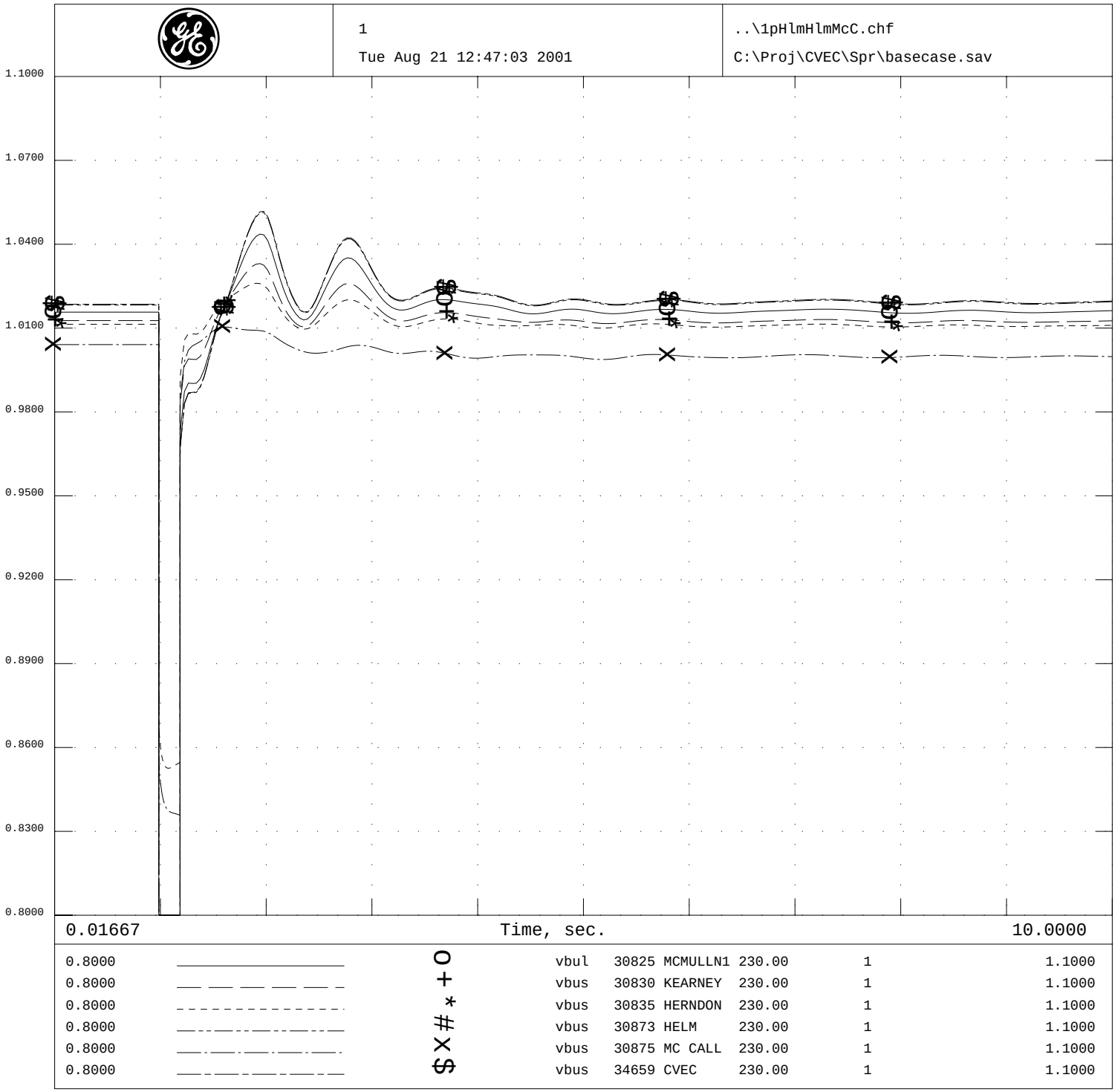
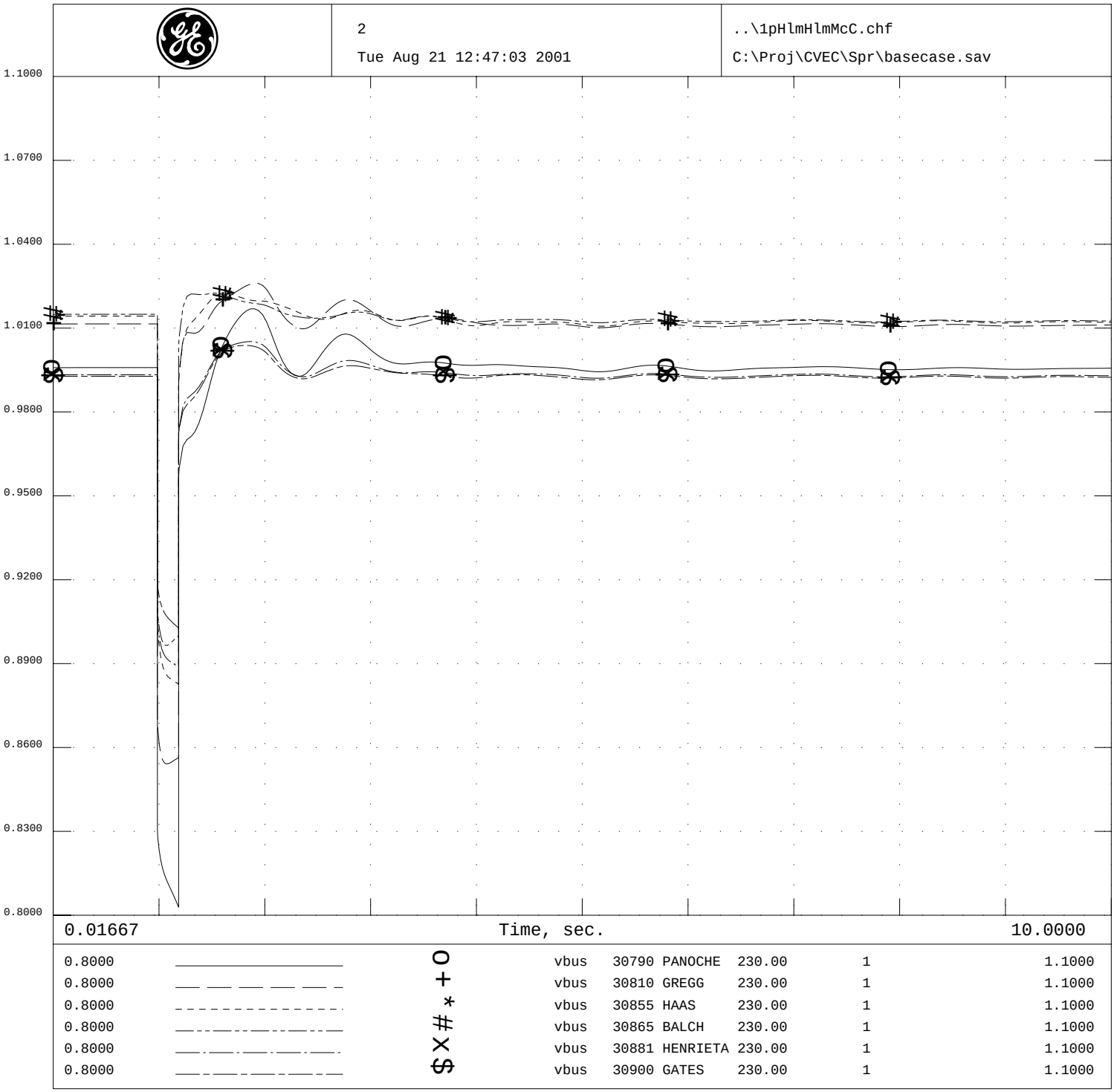


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Helm 230kV Outage
1 phase 12 cycle fault at Helm 230kV bus and trip McCall-Helm line

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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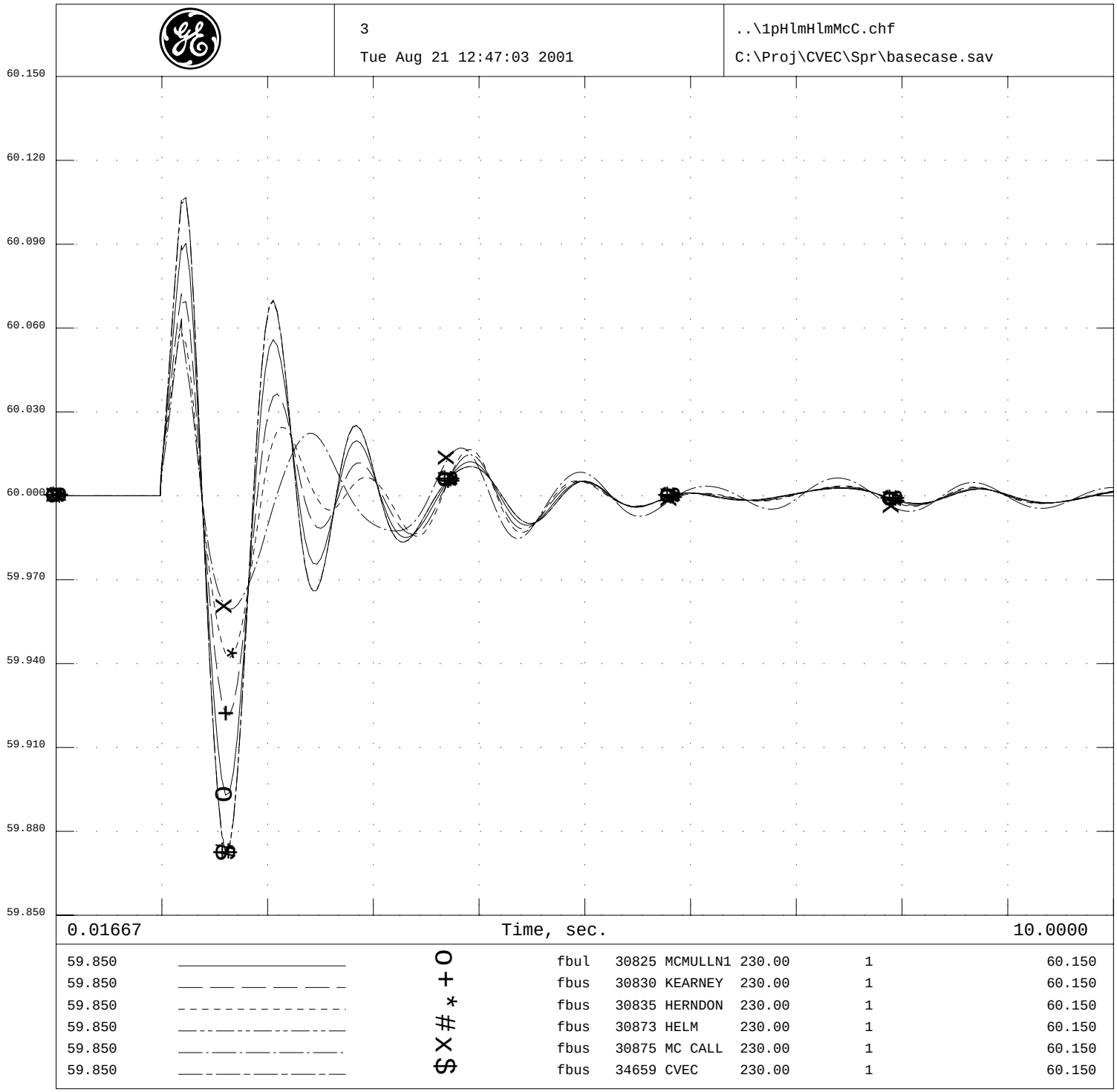

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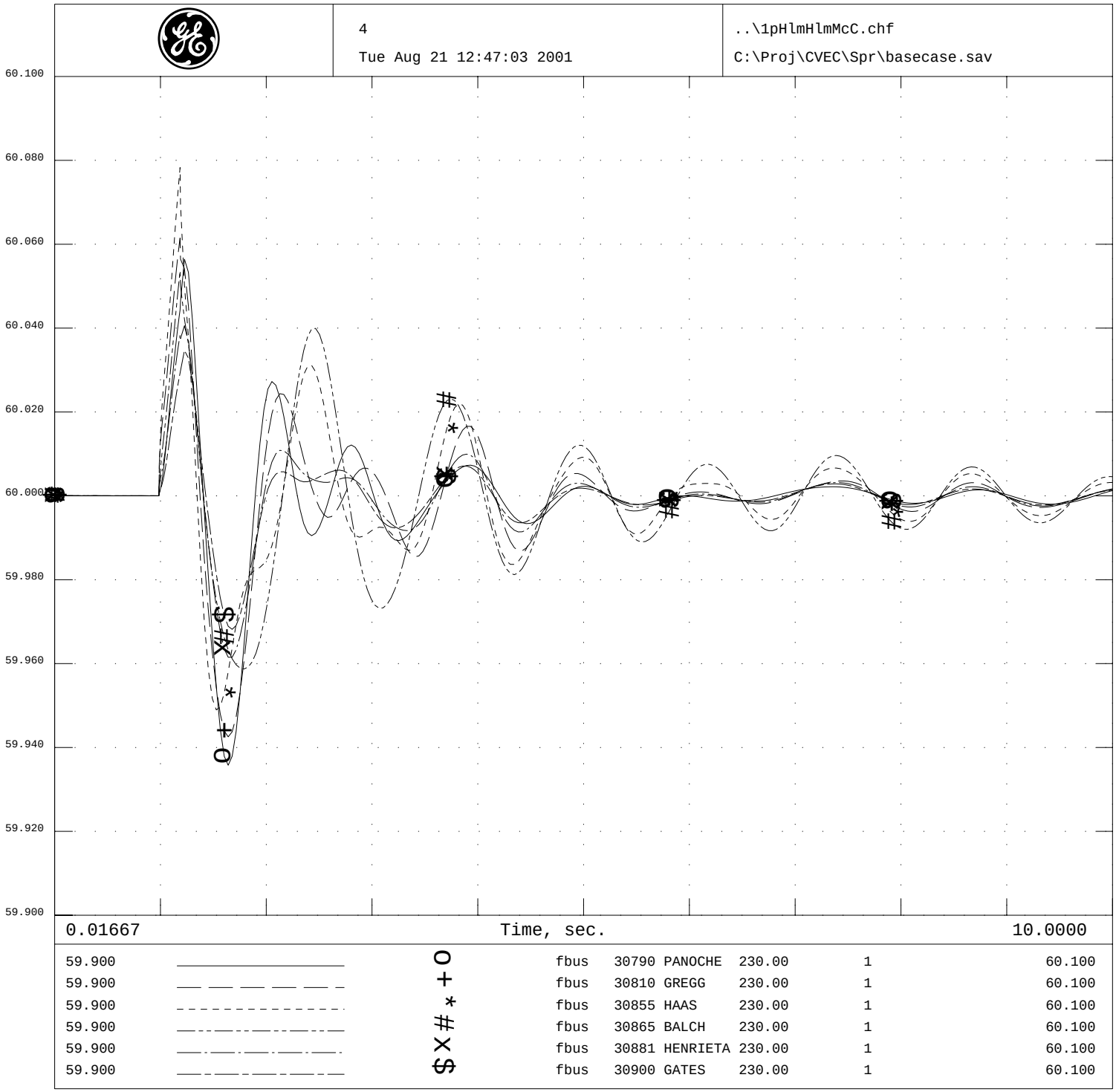

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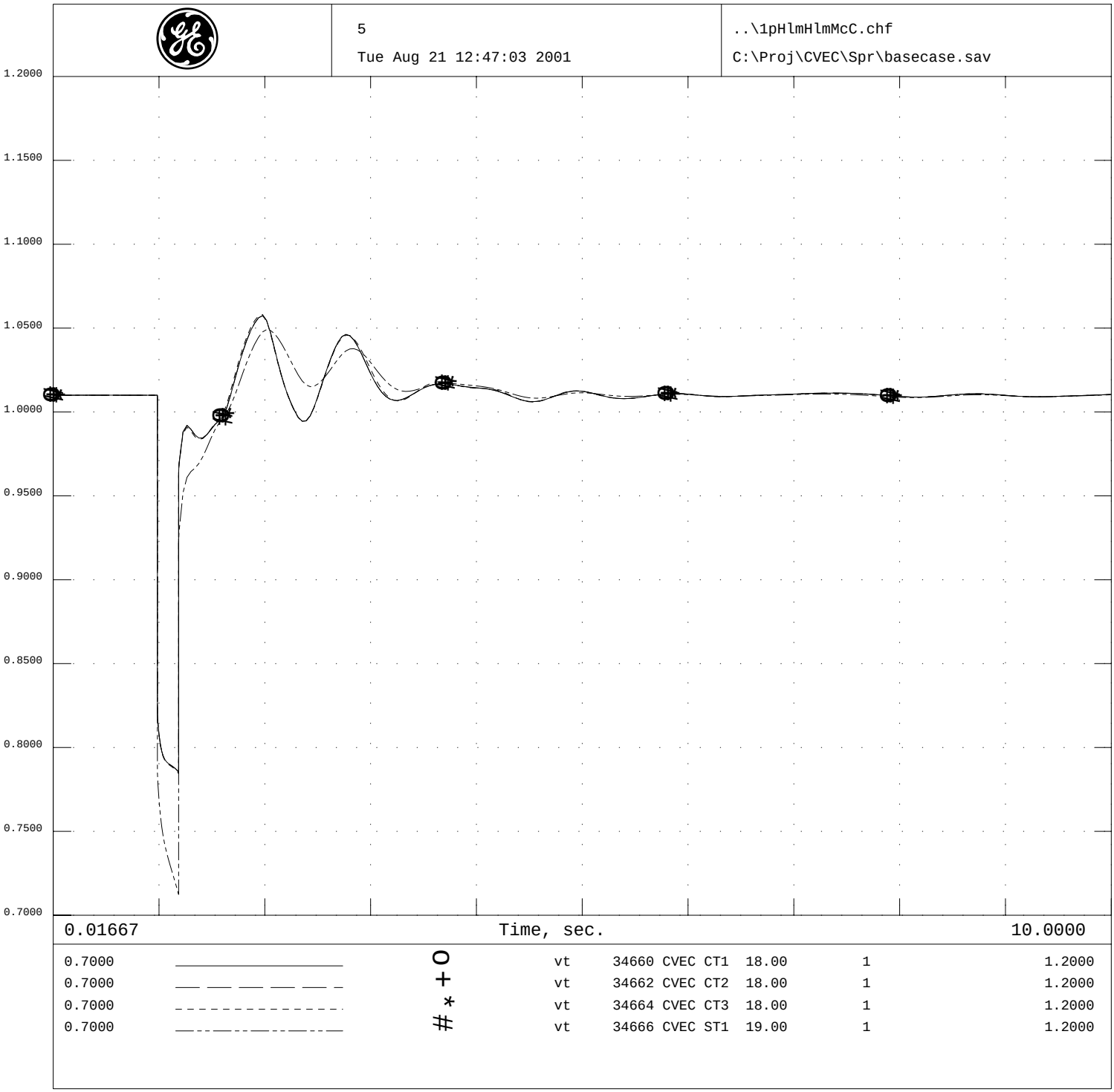

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2004 Heavy Spring Base Case
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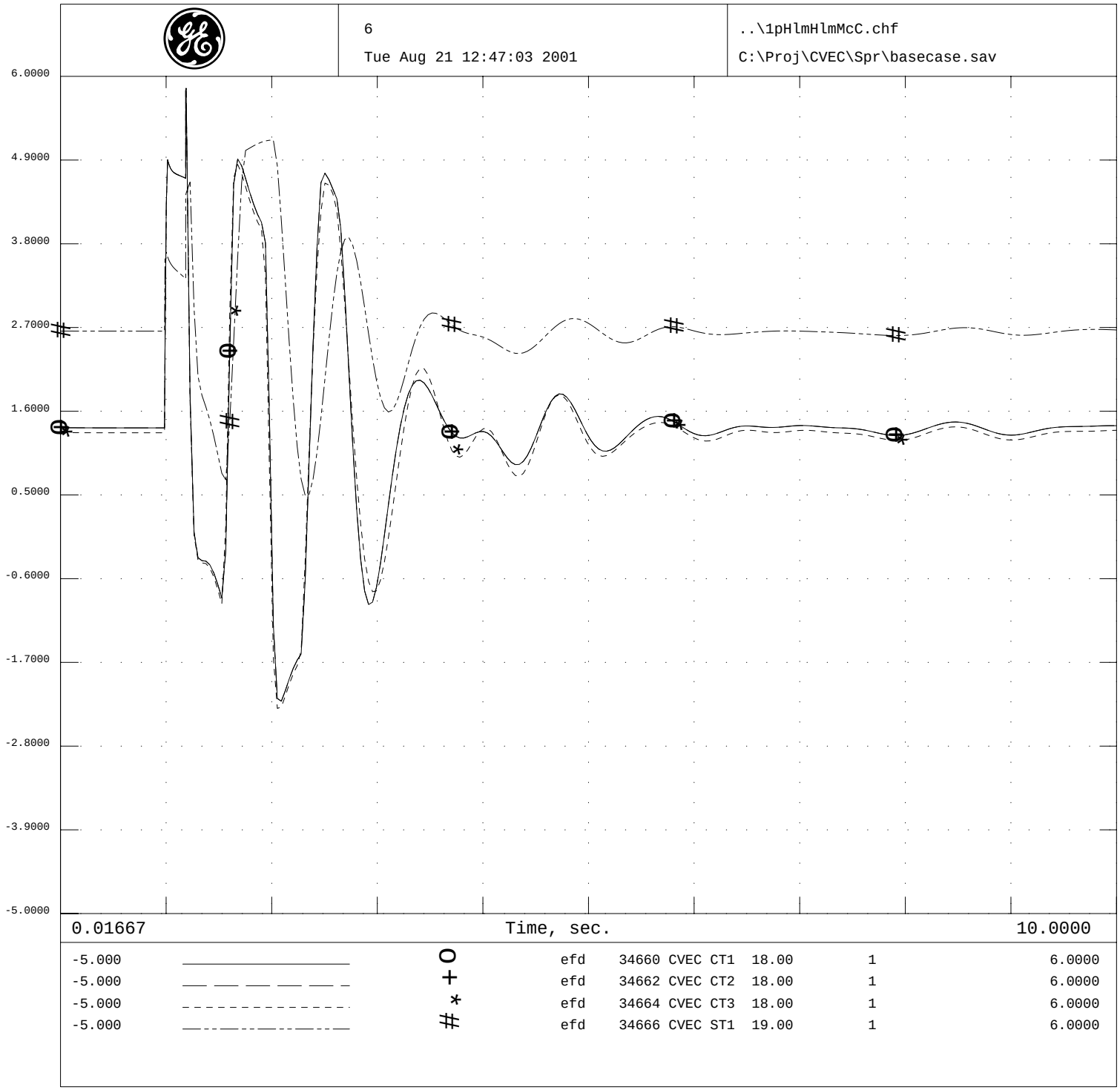
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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Calpine Corporation
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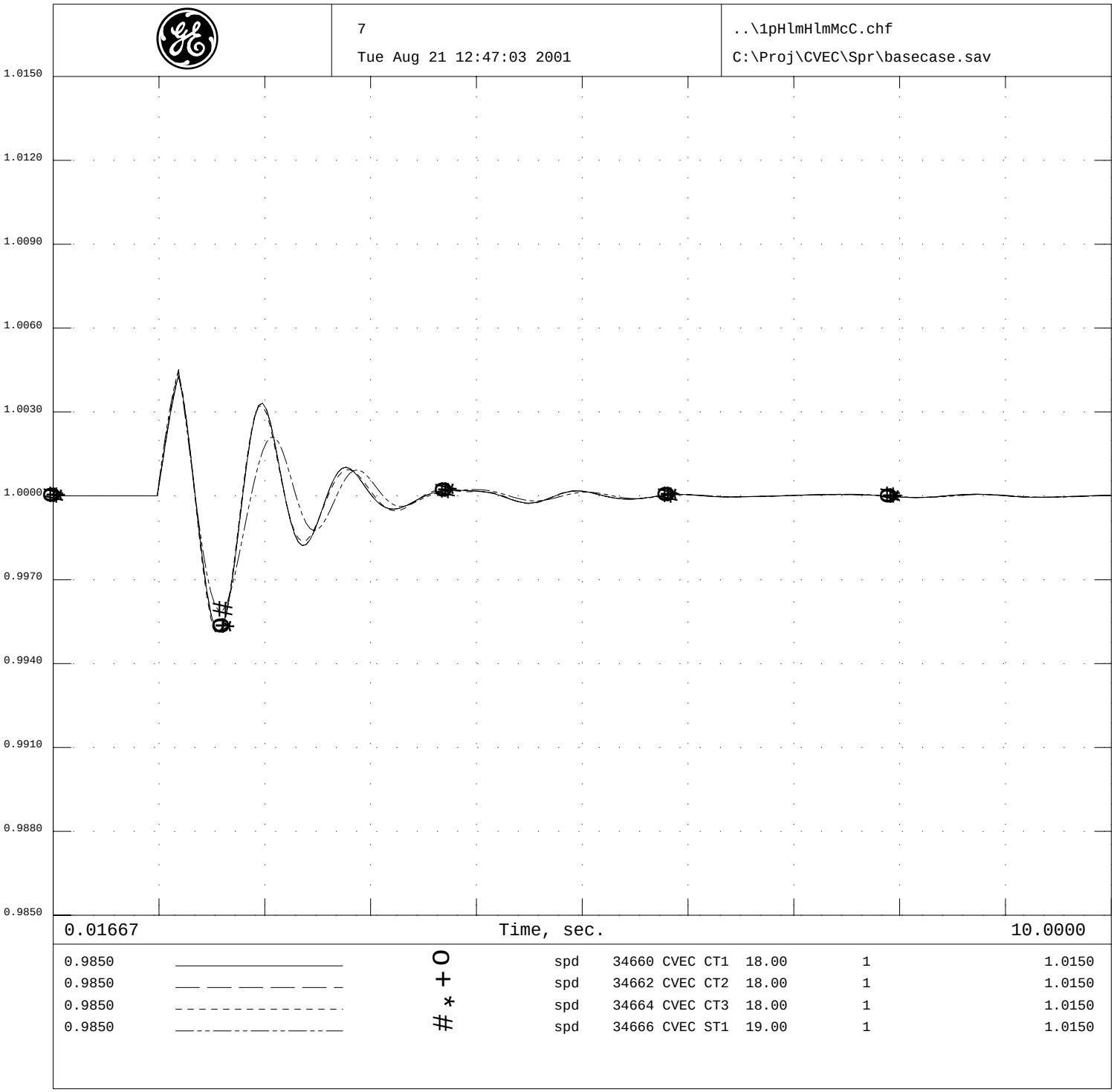

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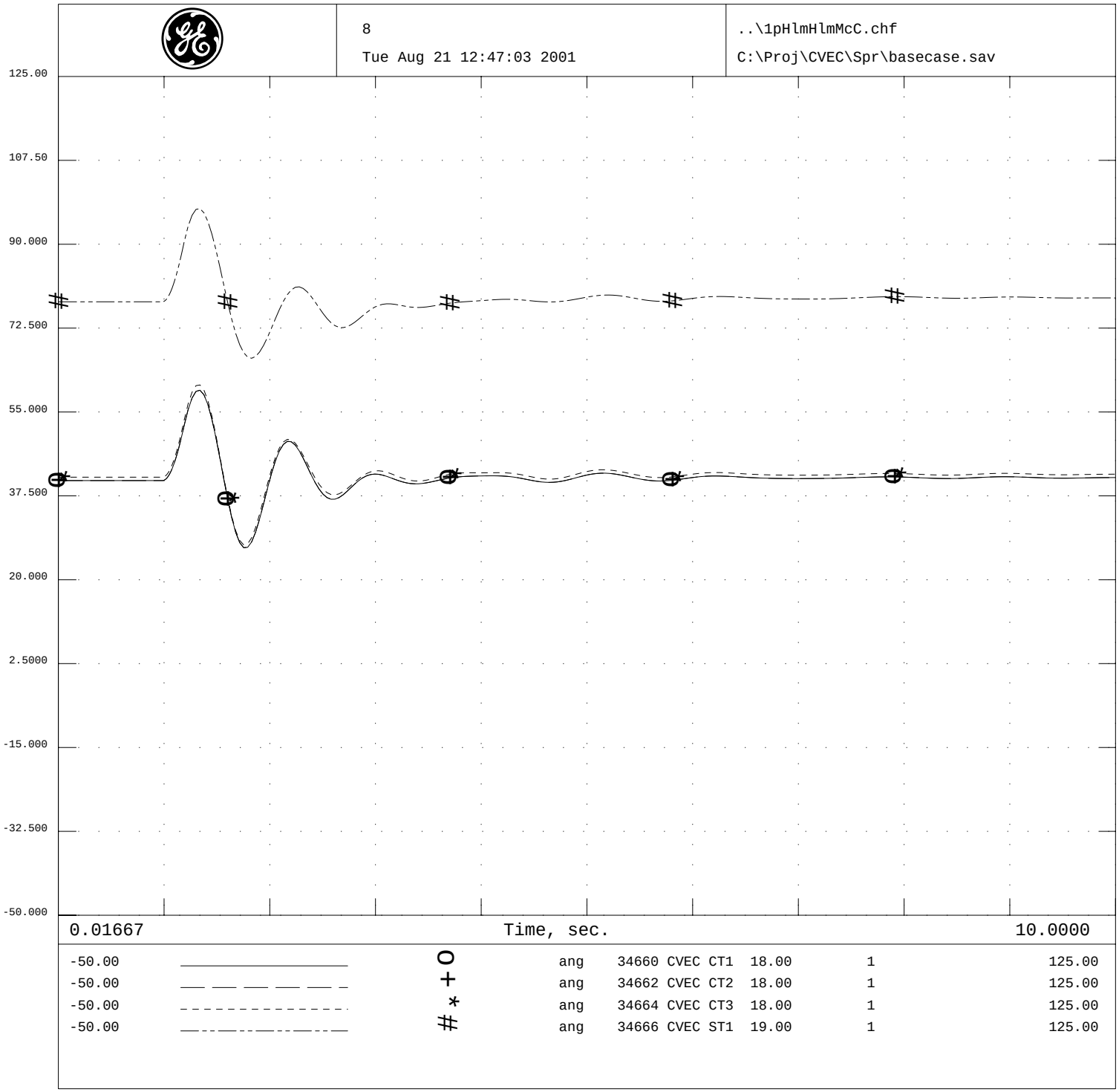
Calpine Corporation
Project Generator Rotor Speed



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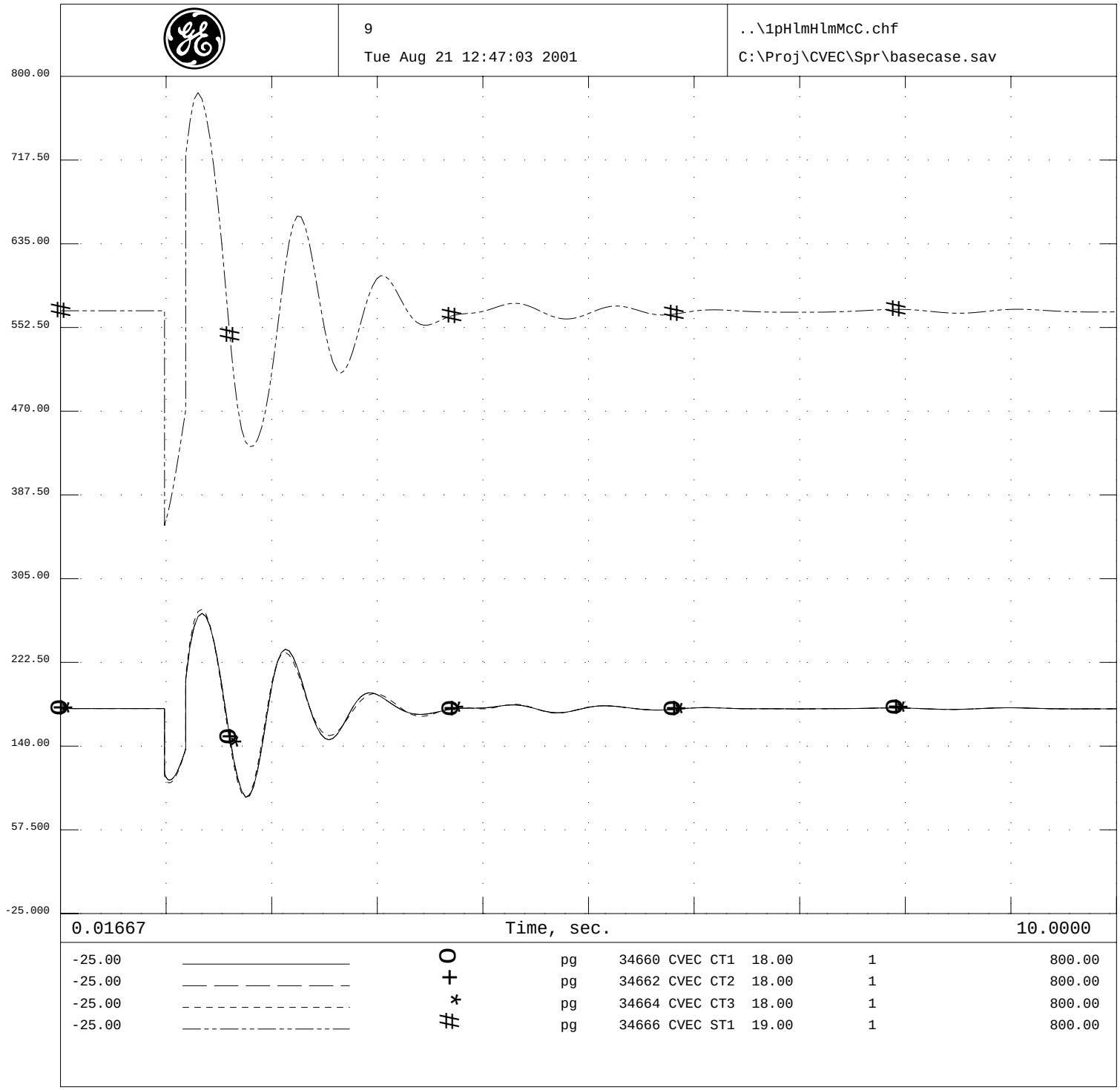
Calpine Corporation
Project Generator Rotor Angle



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Calpine Corporation
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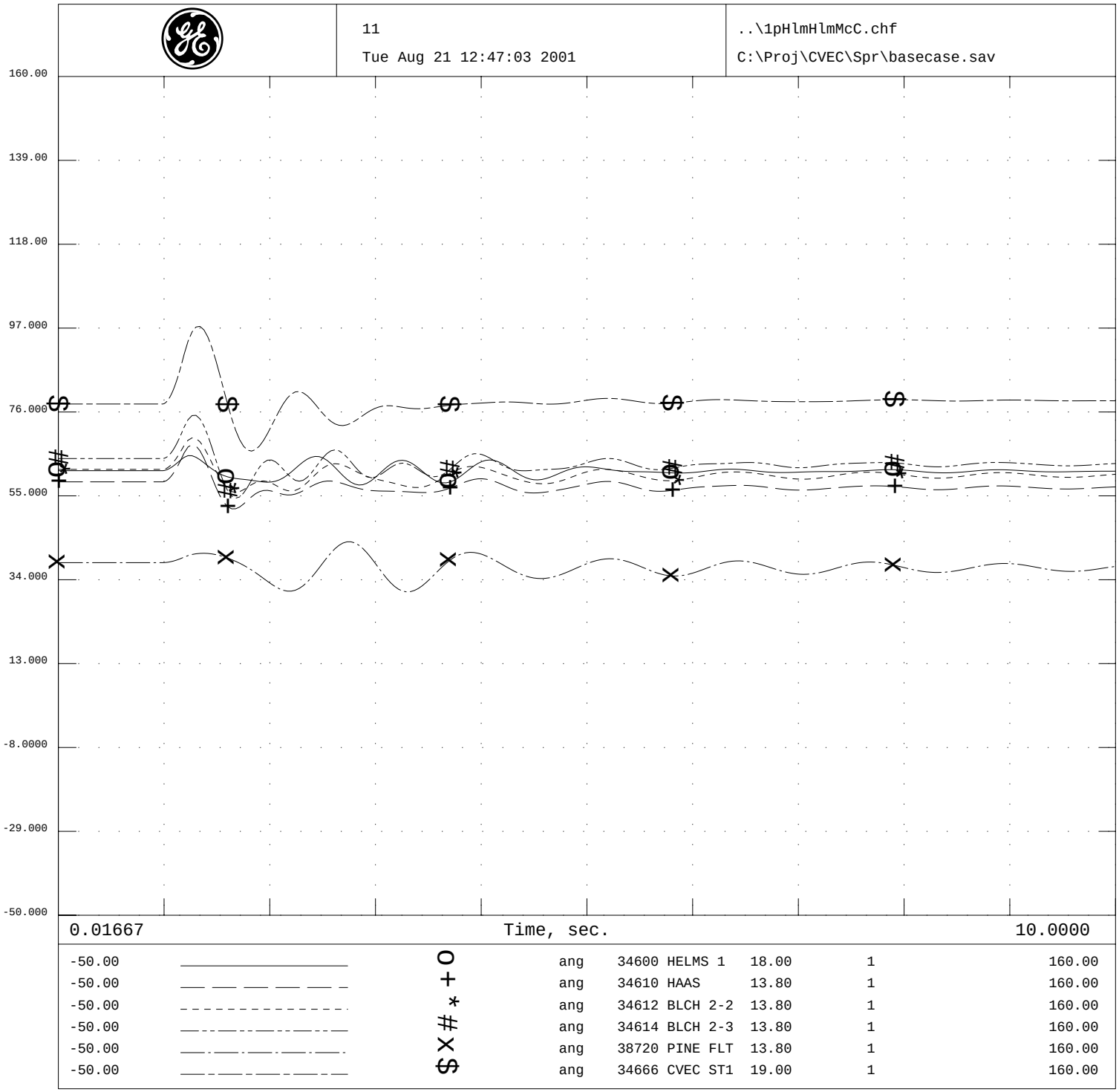

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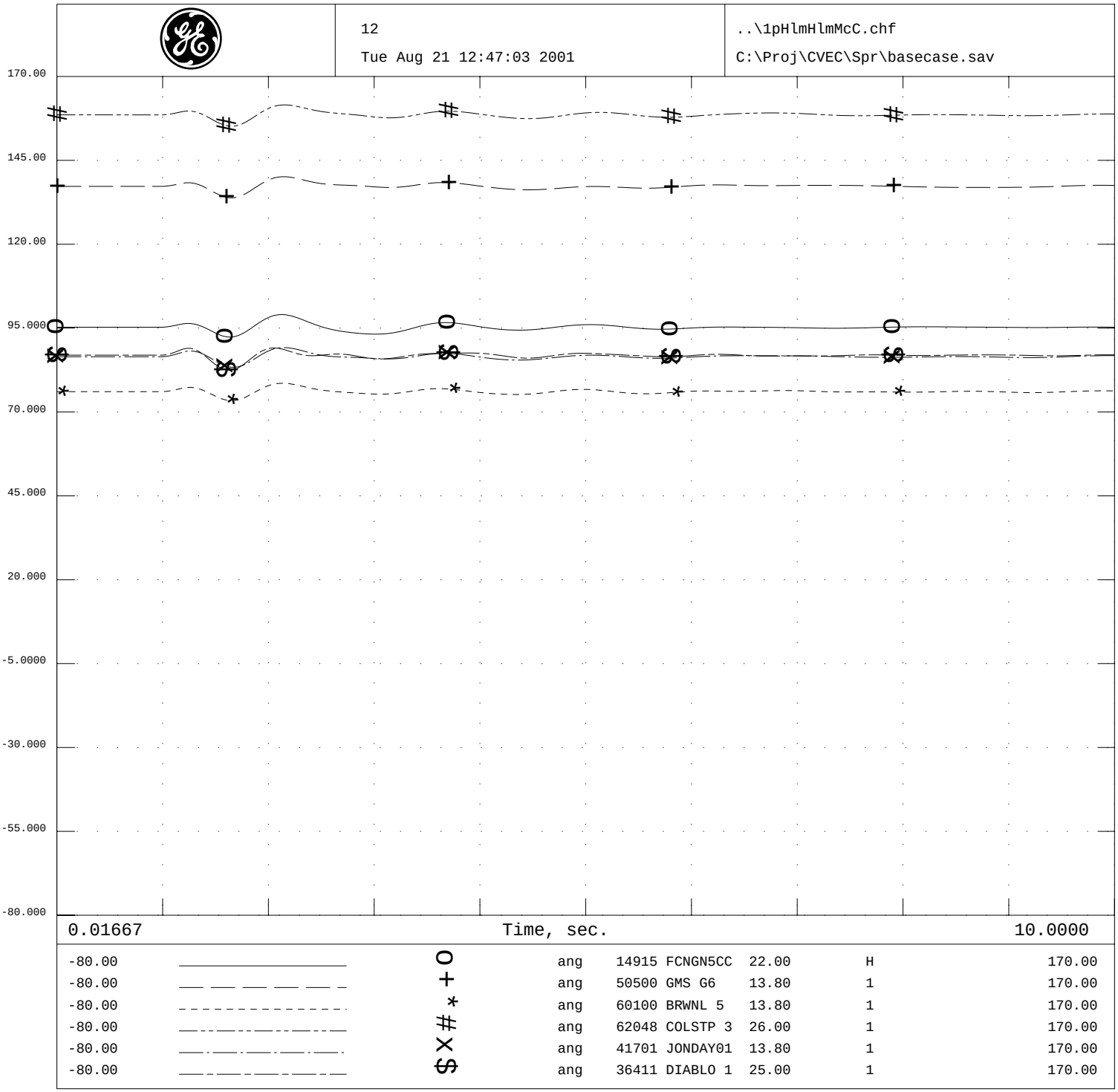
Calpine Corporation
Selected Local Rotor Angle Plots



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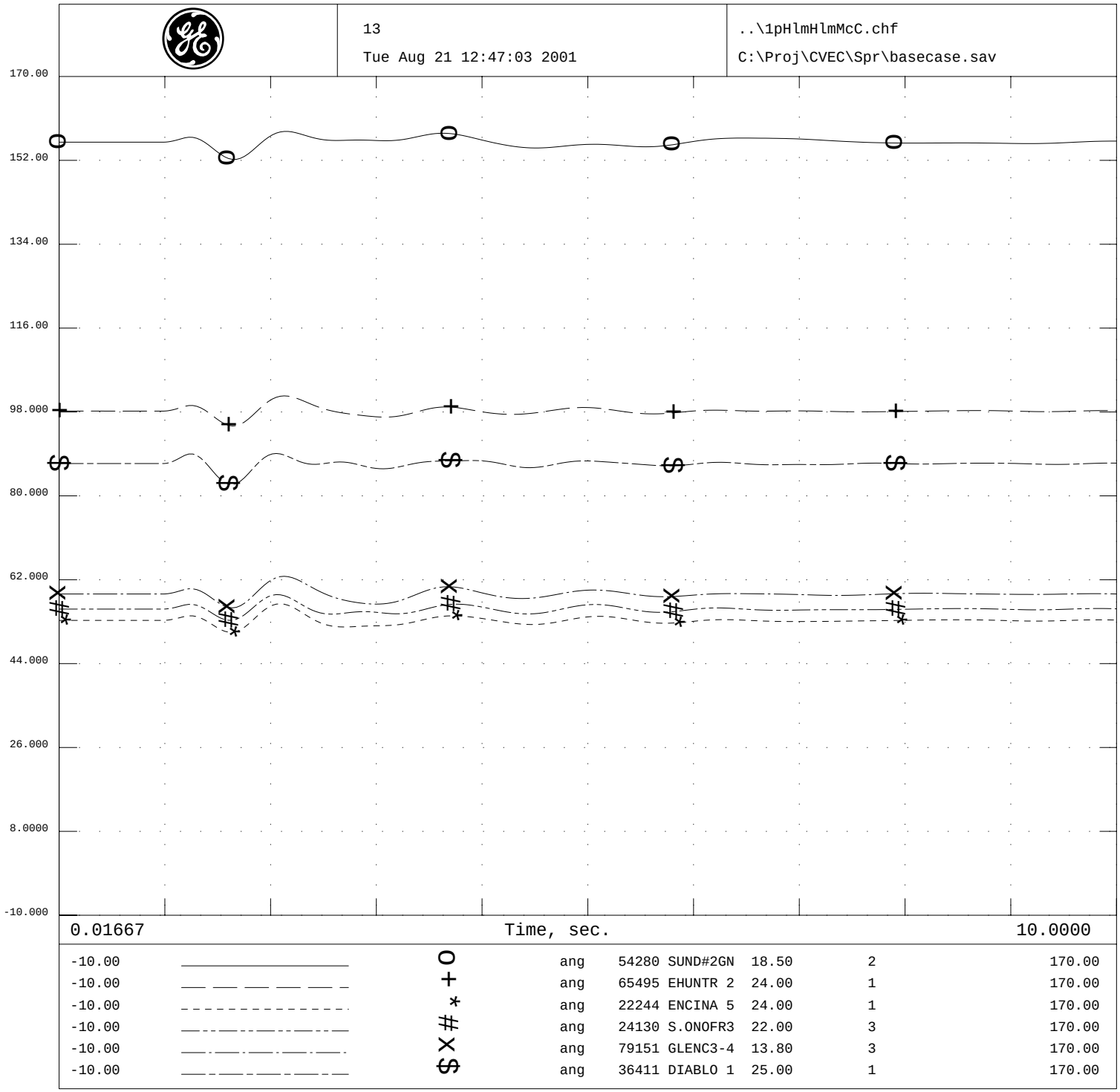
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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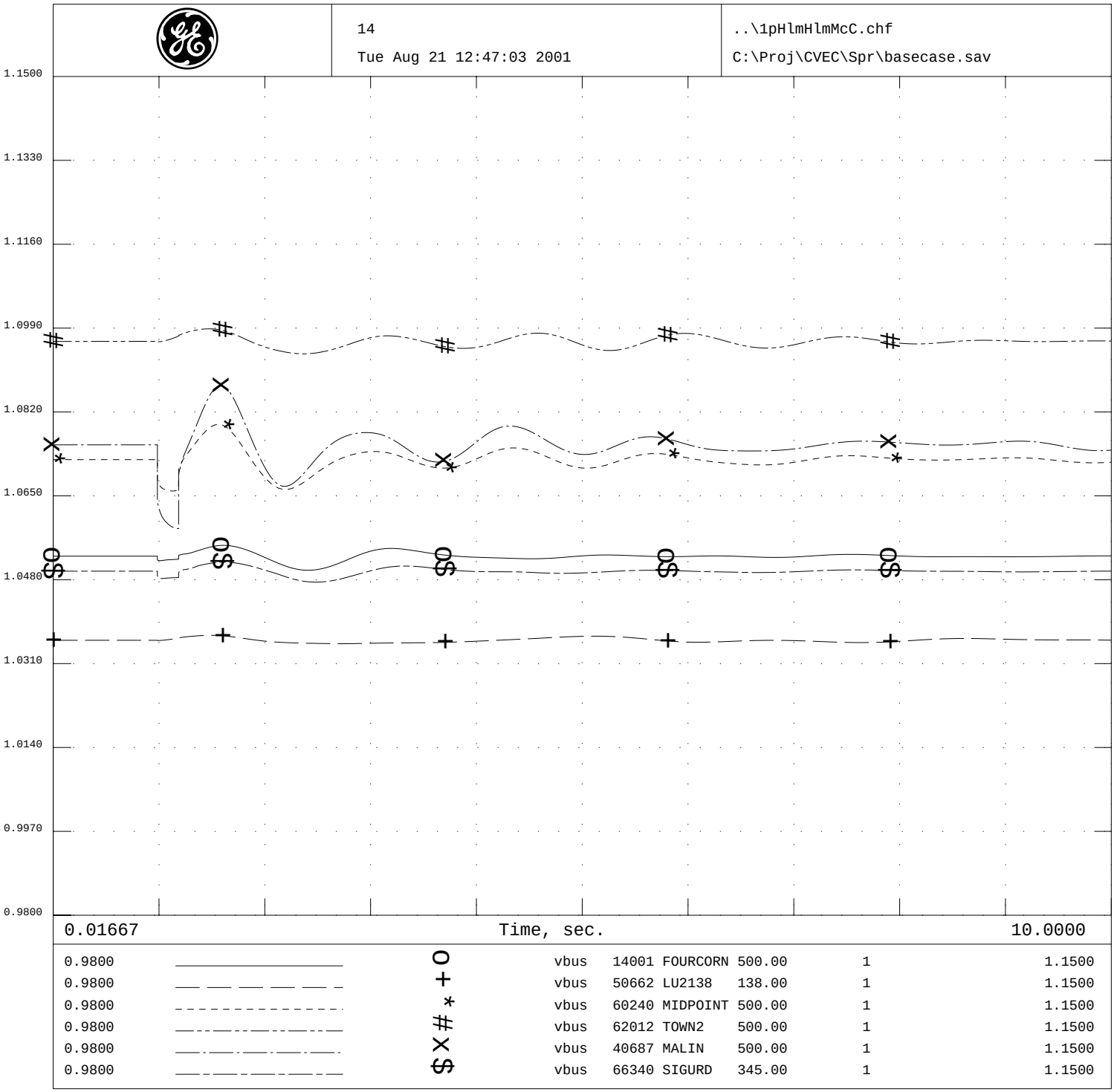

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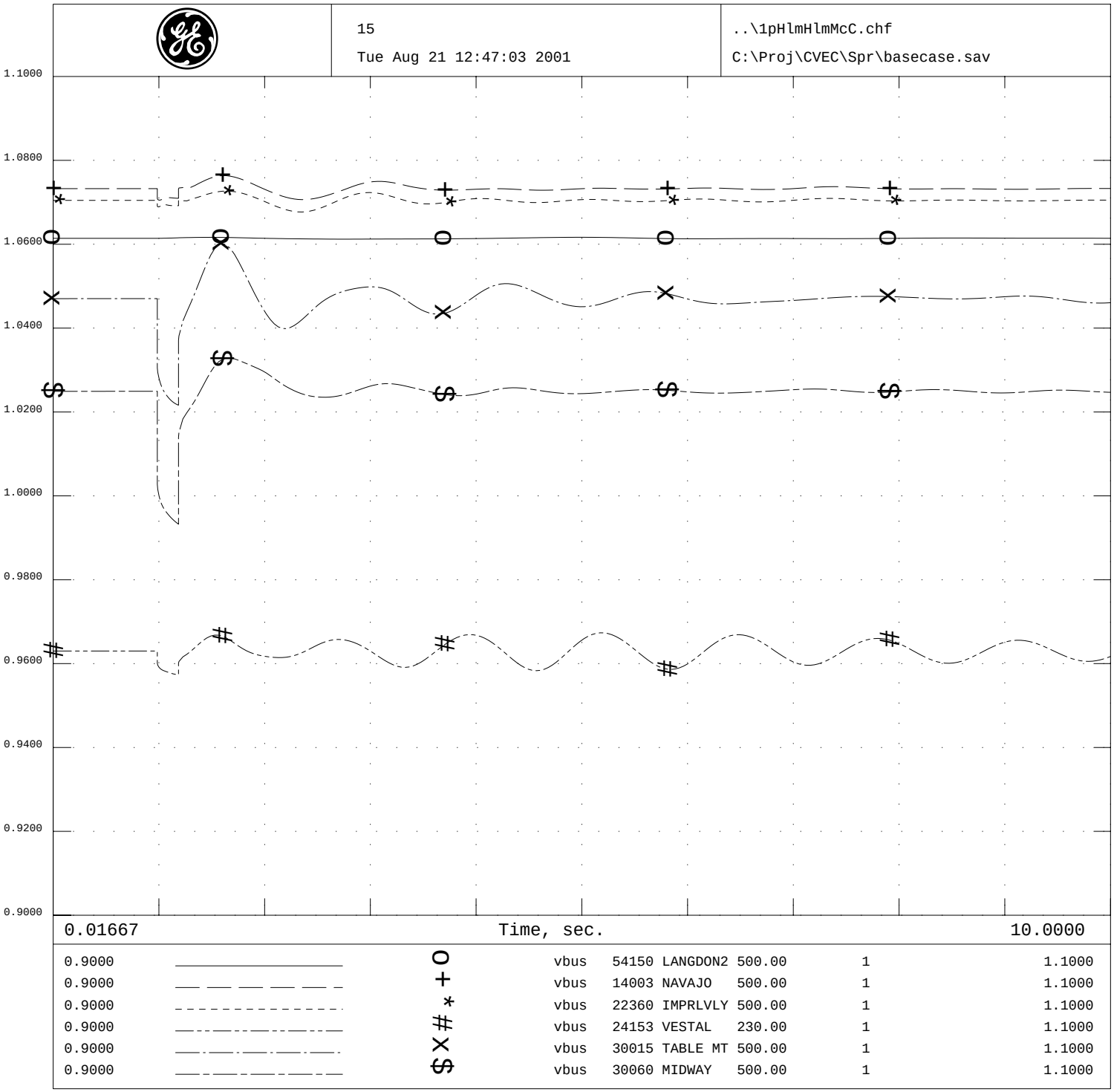
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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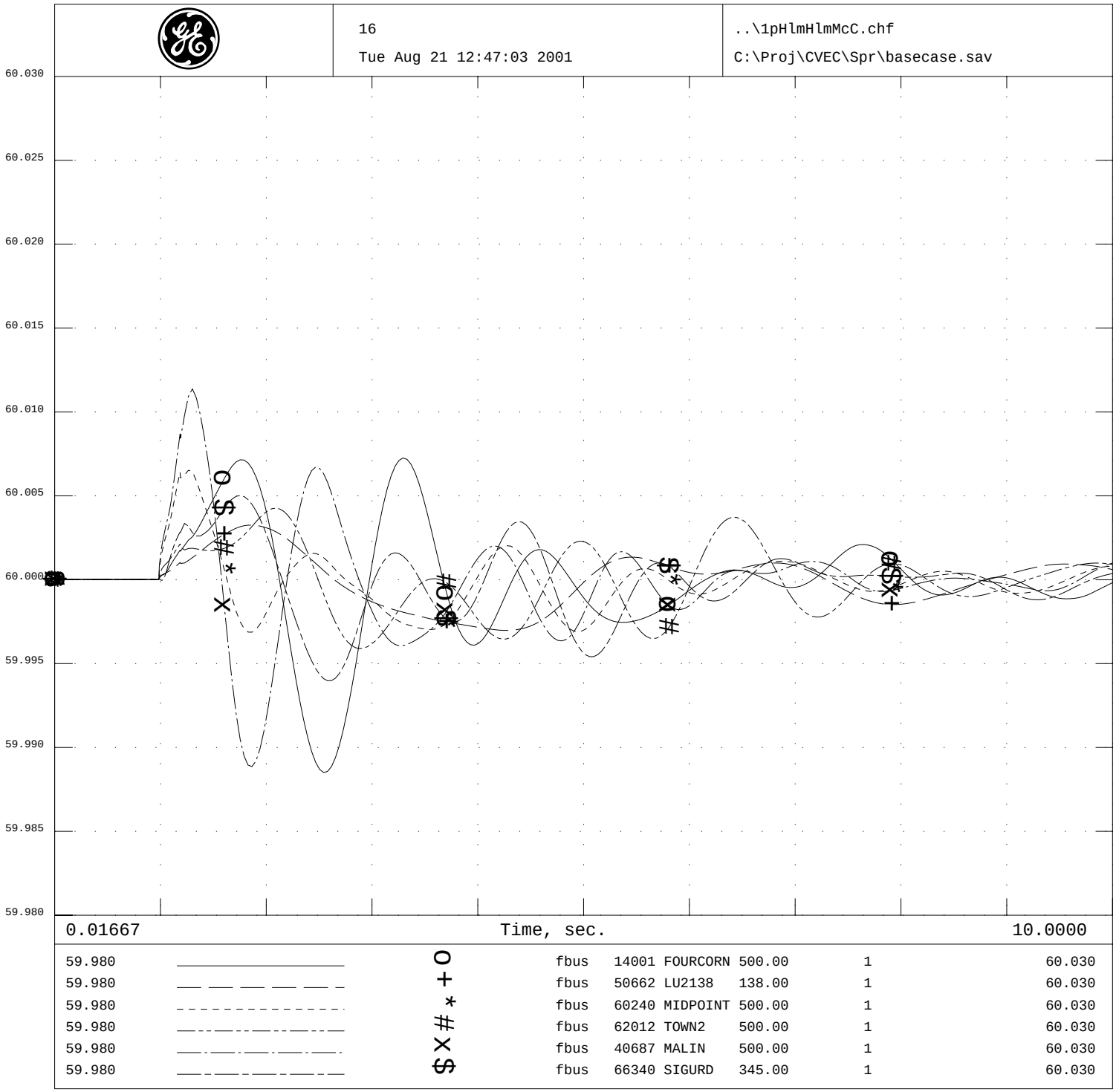

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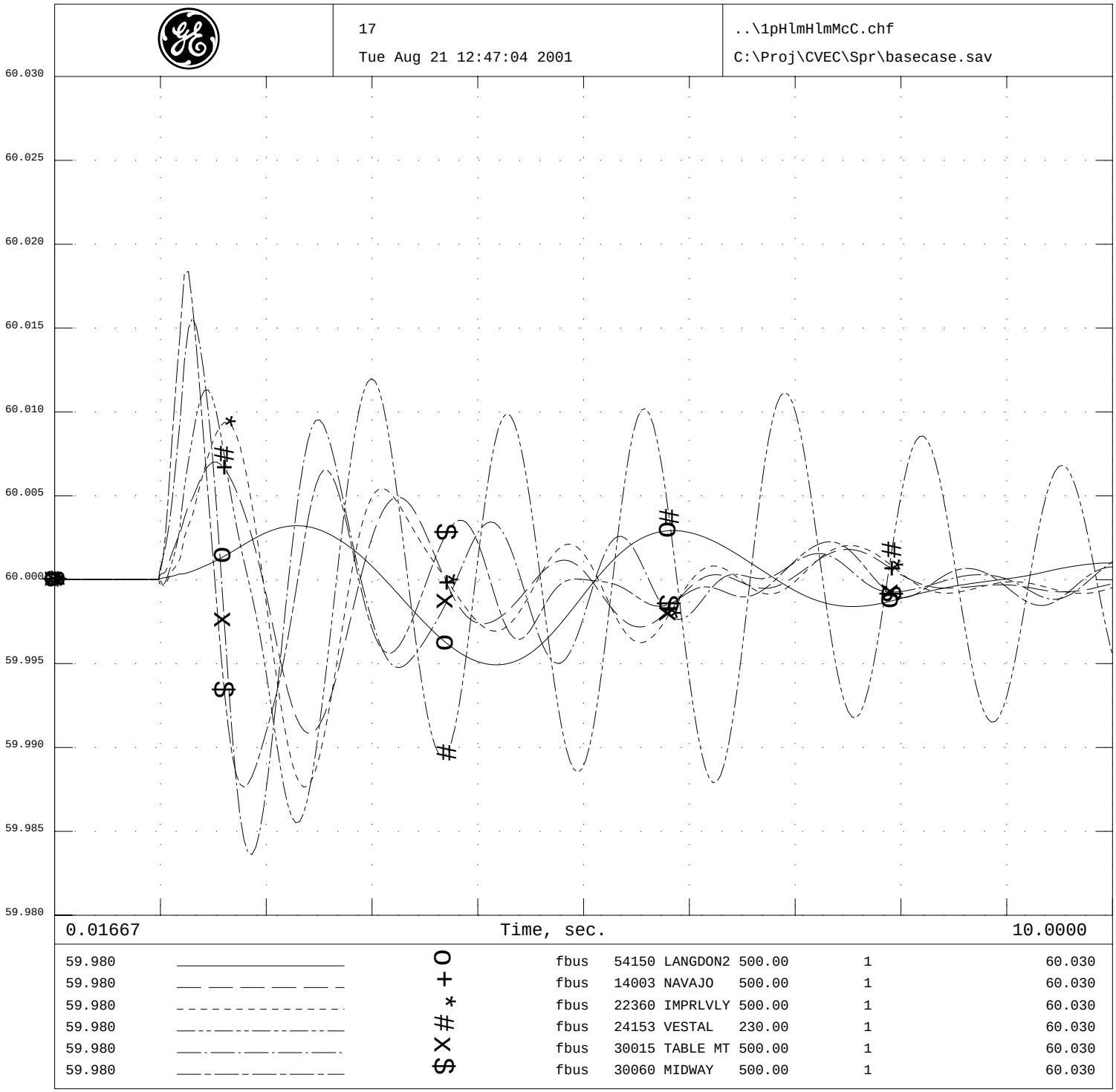

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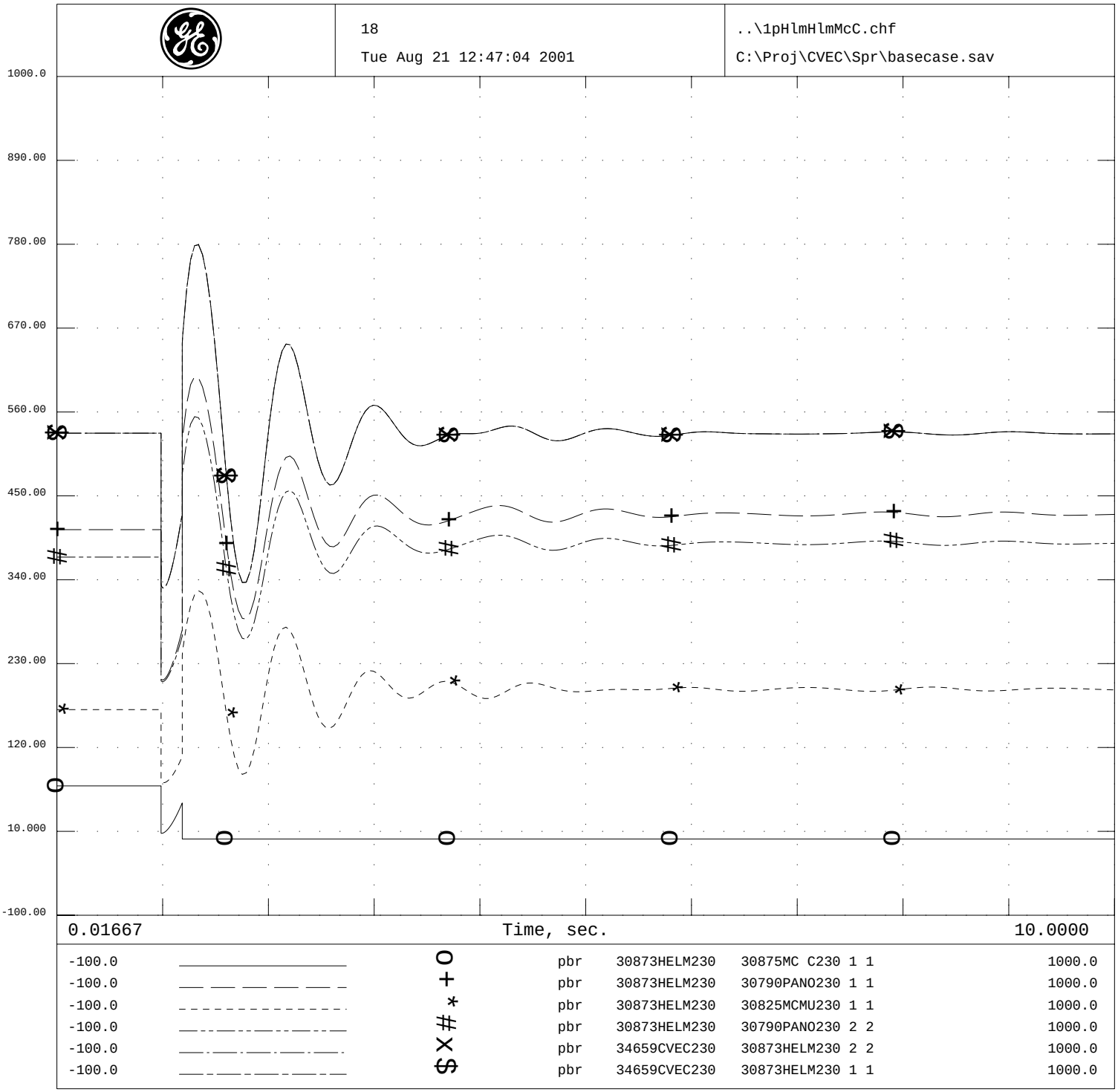

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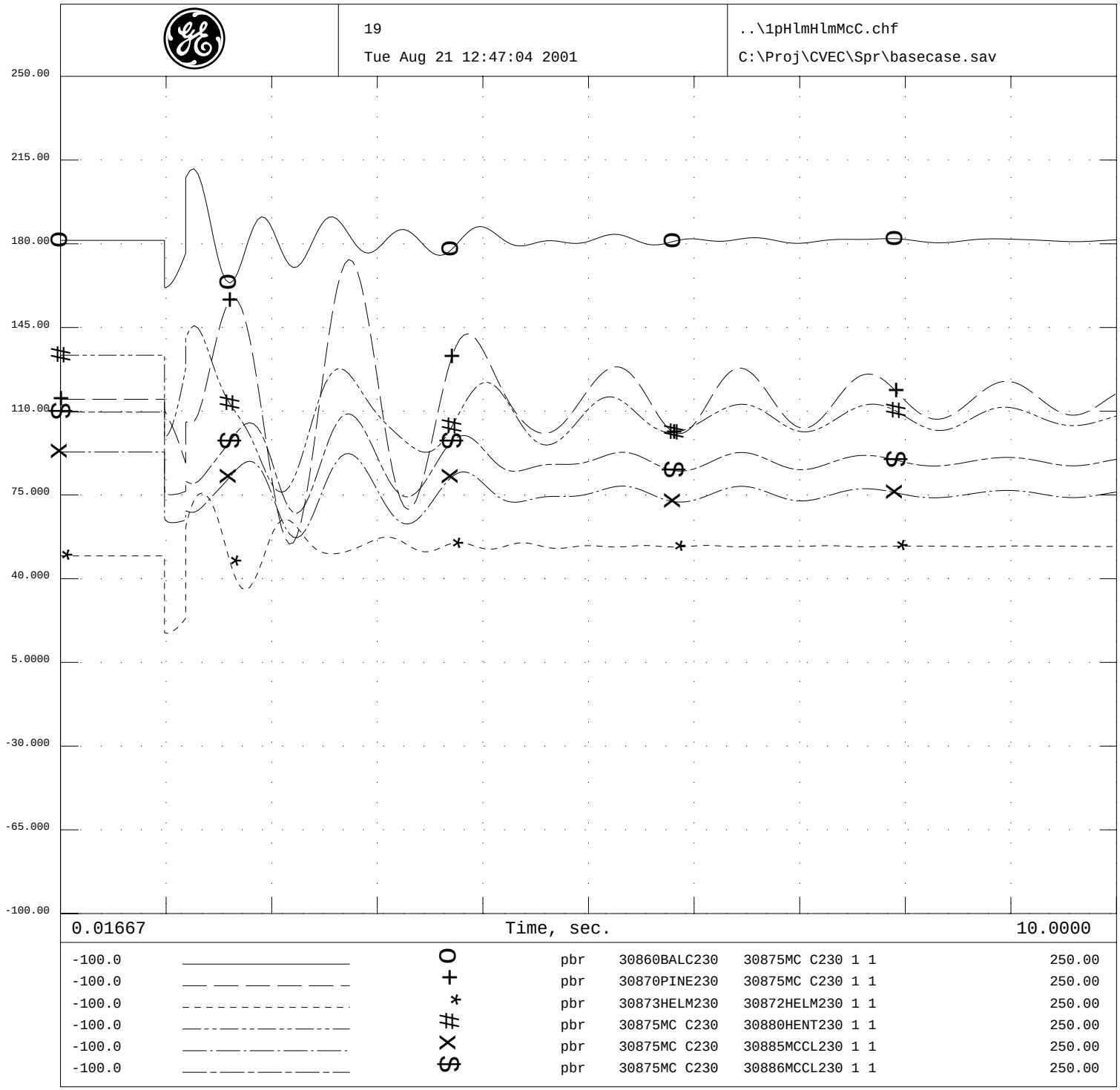
Calpine Corporation
Selected Transmission Line Flows (MW)



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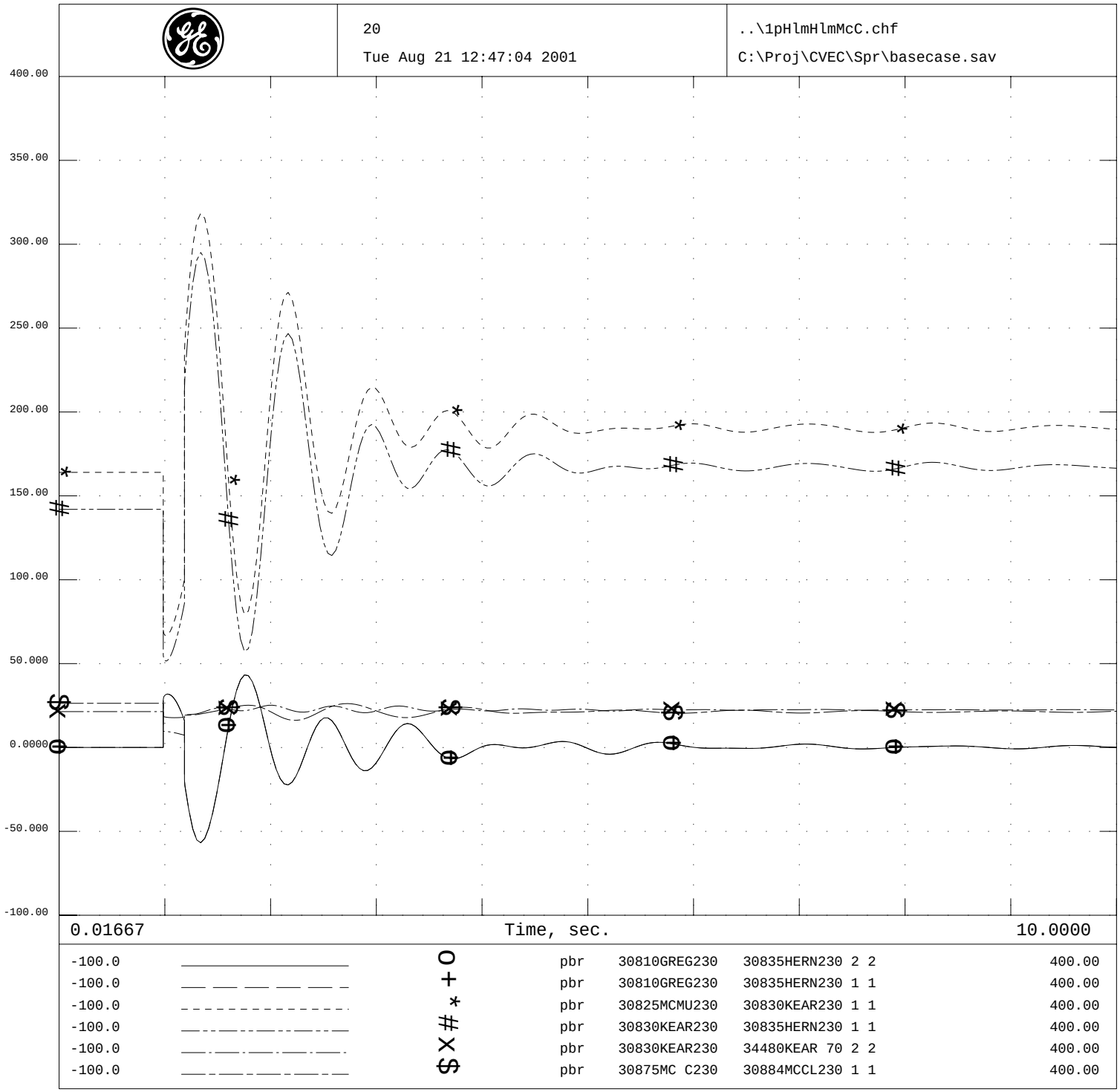

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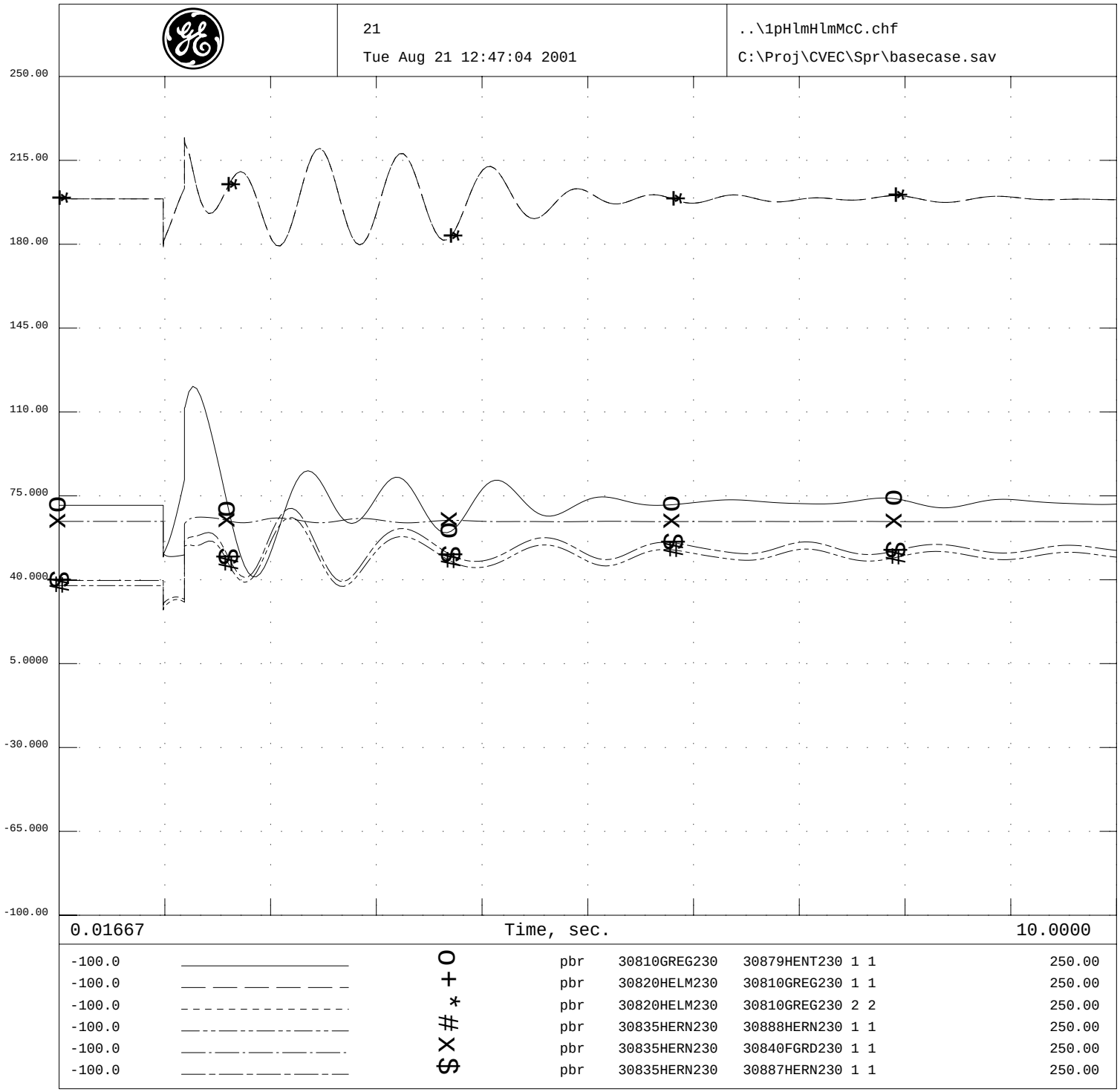

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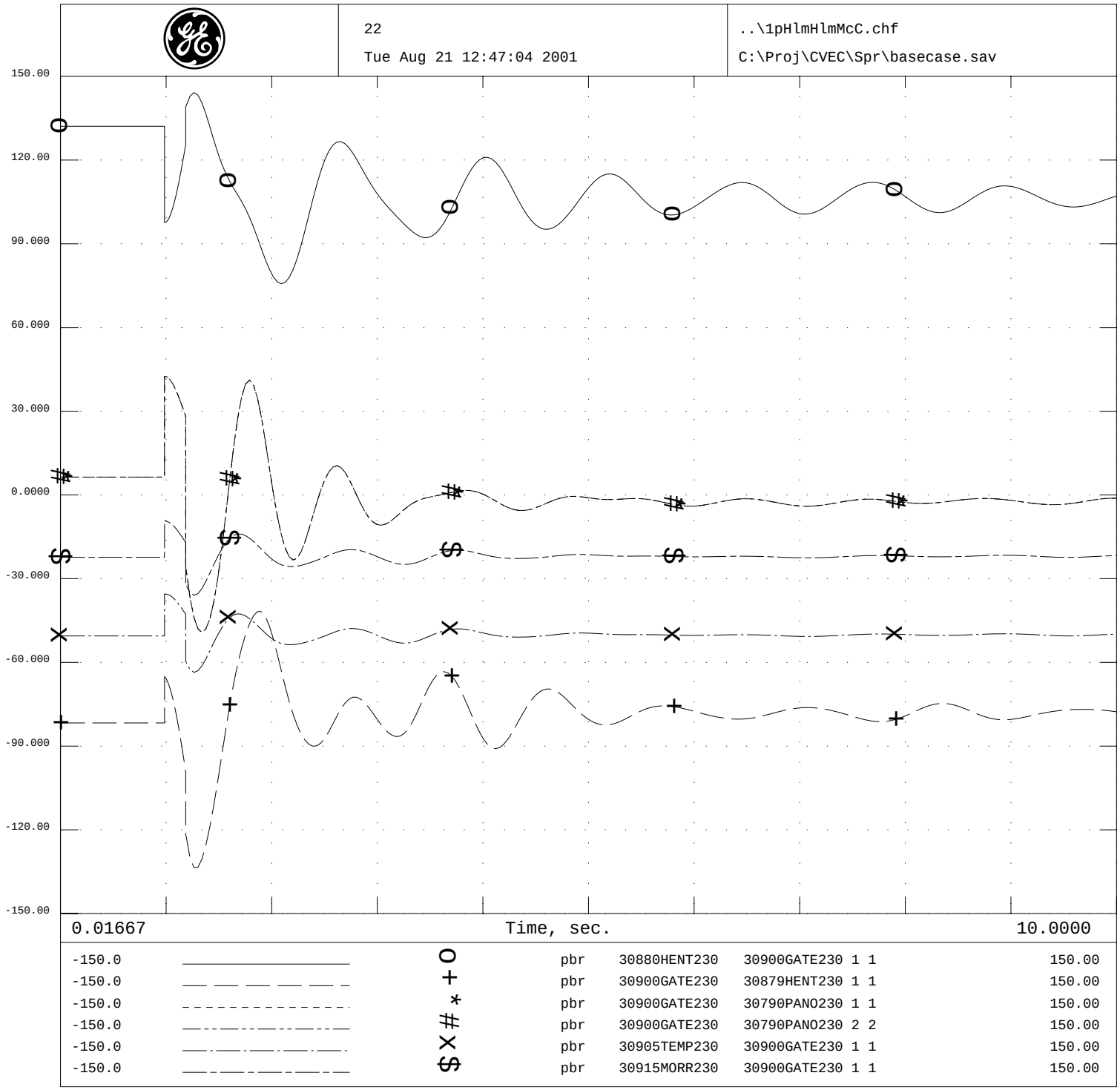

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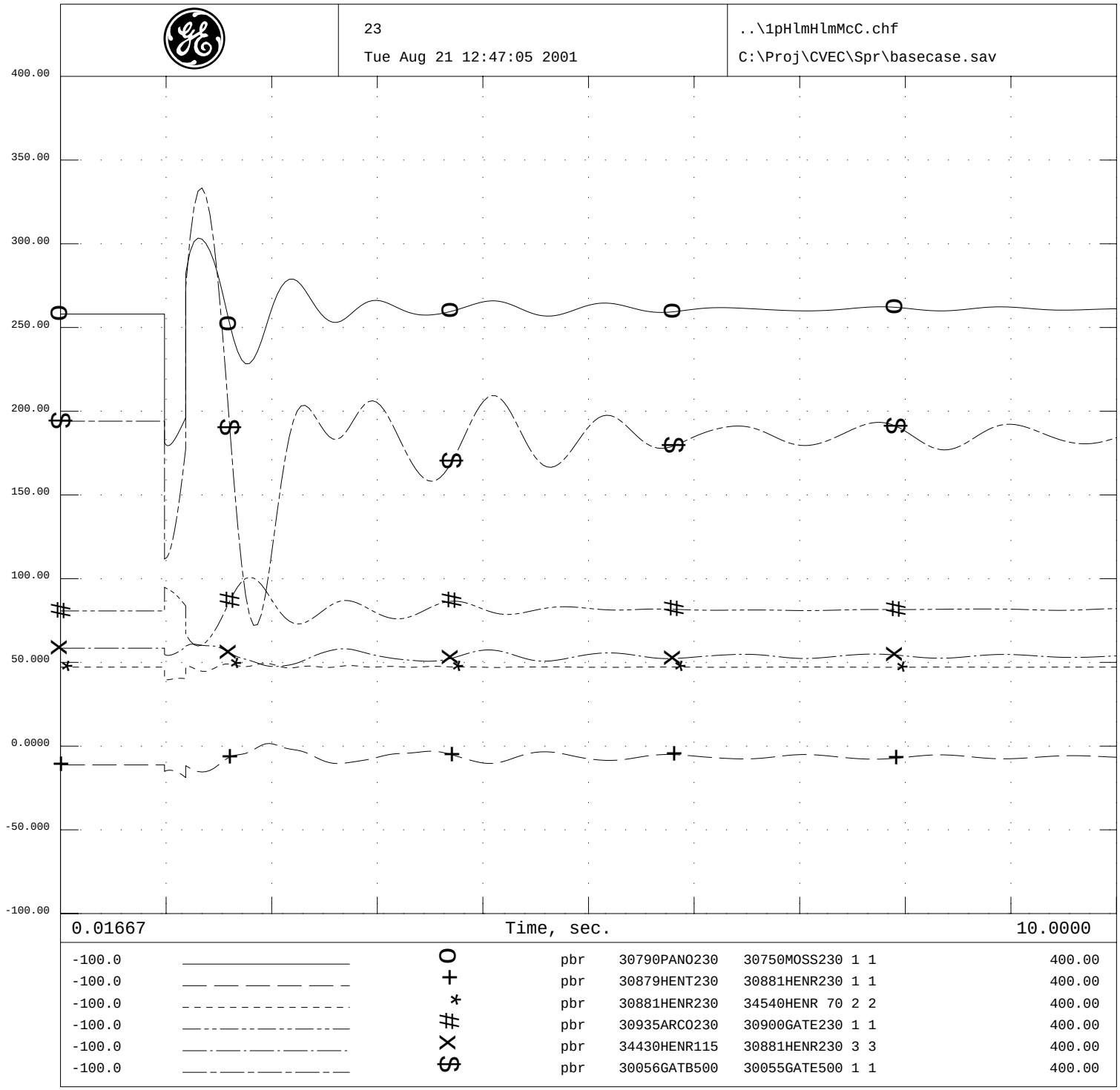

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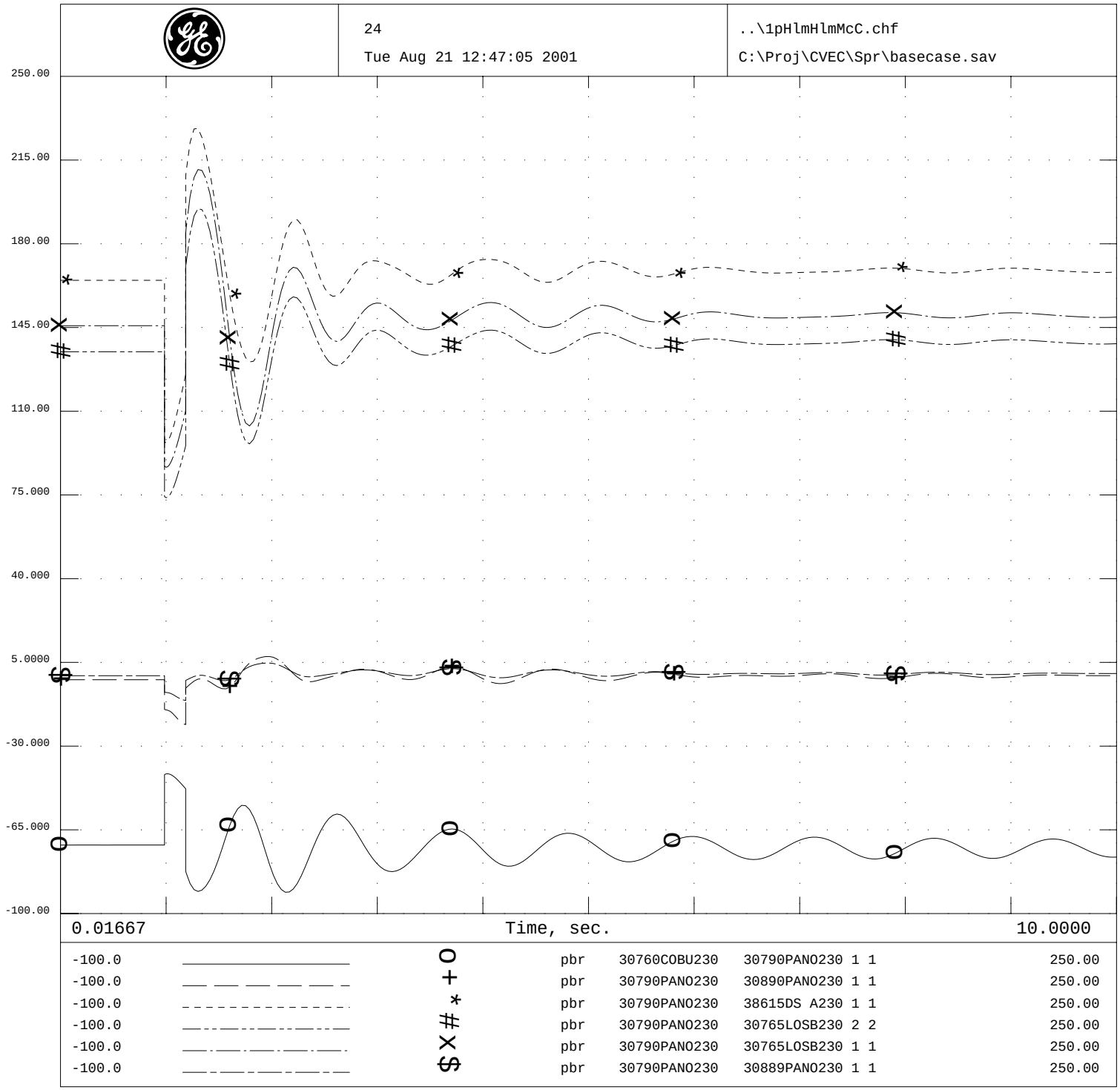

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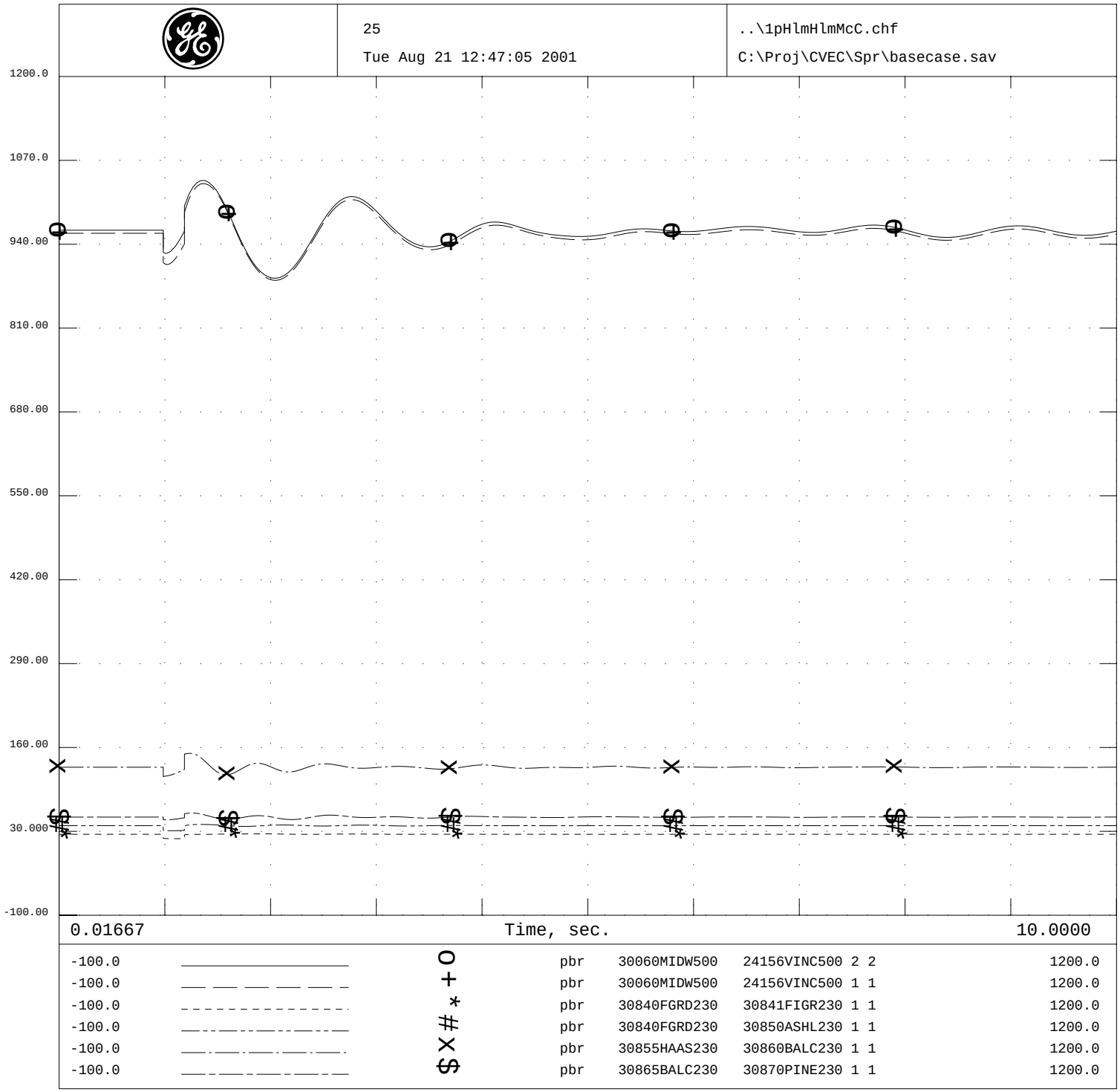

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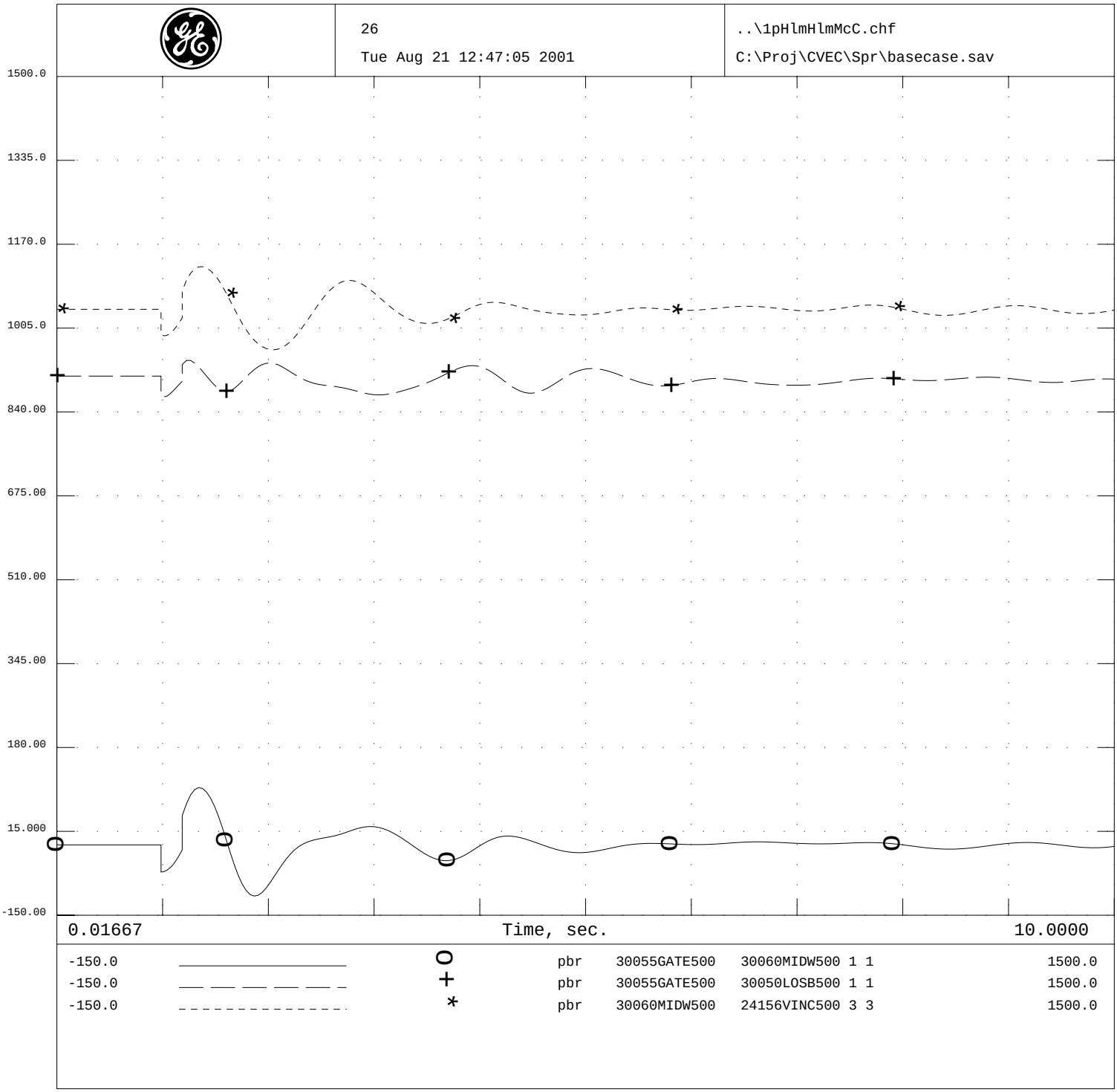

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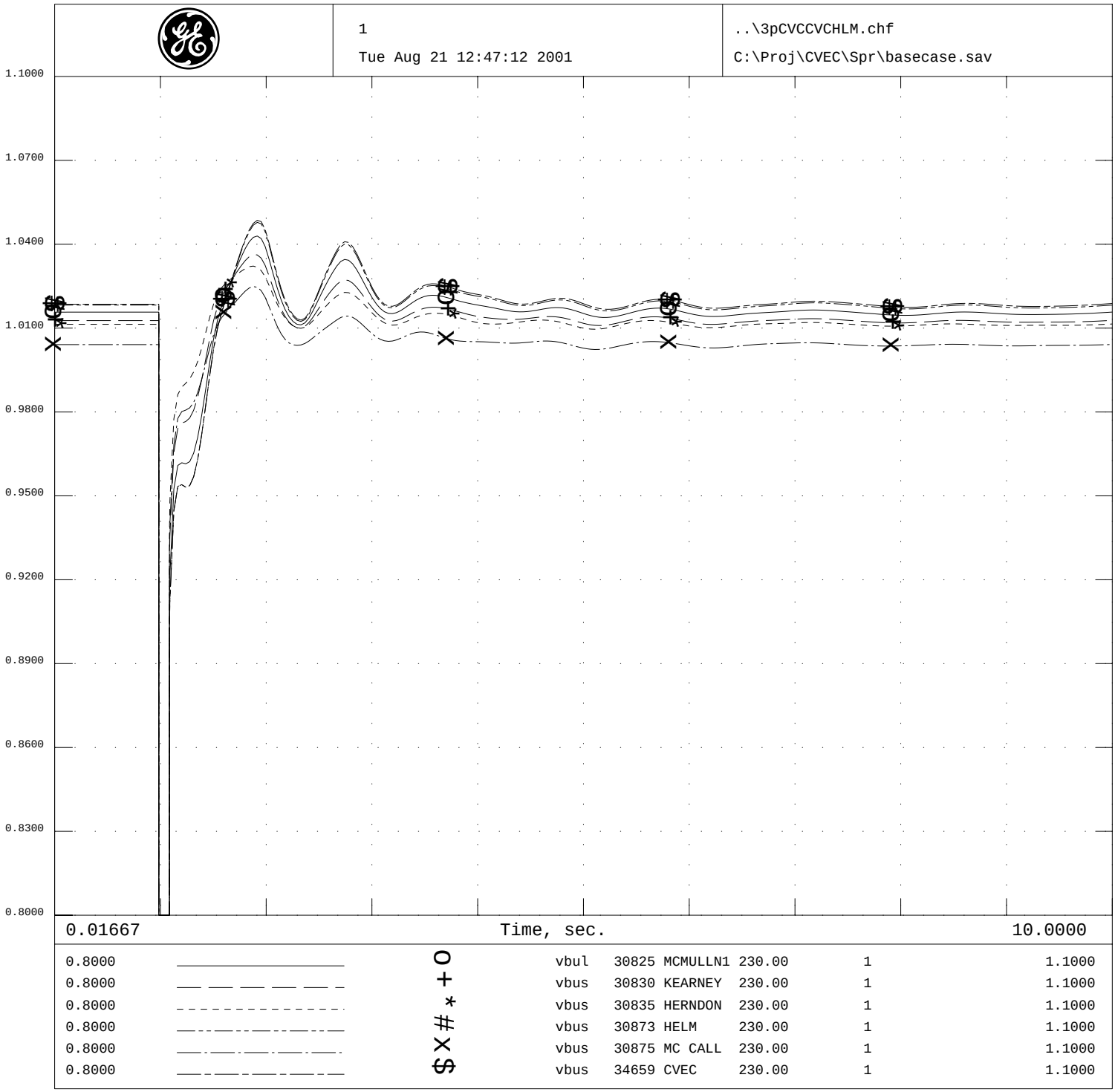

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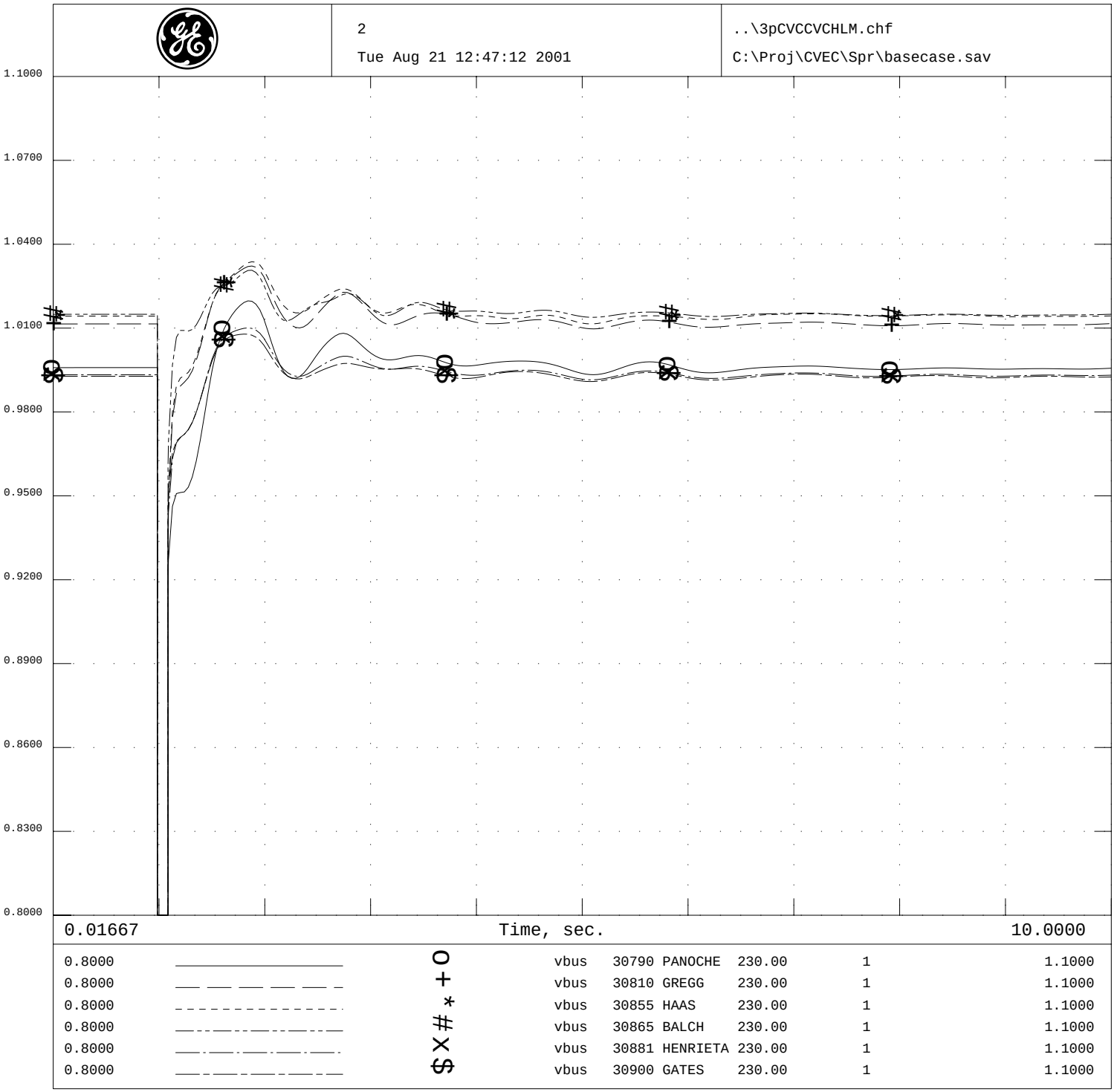
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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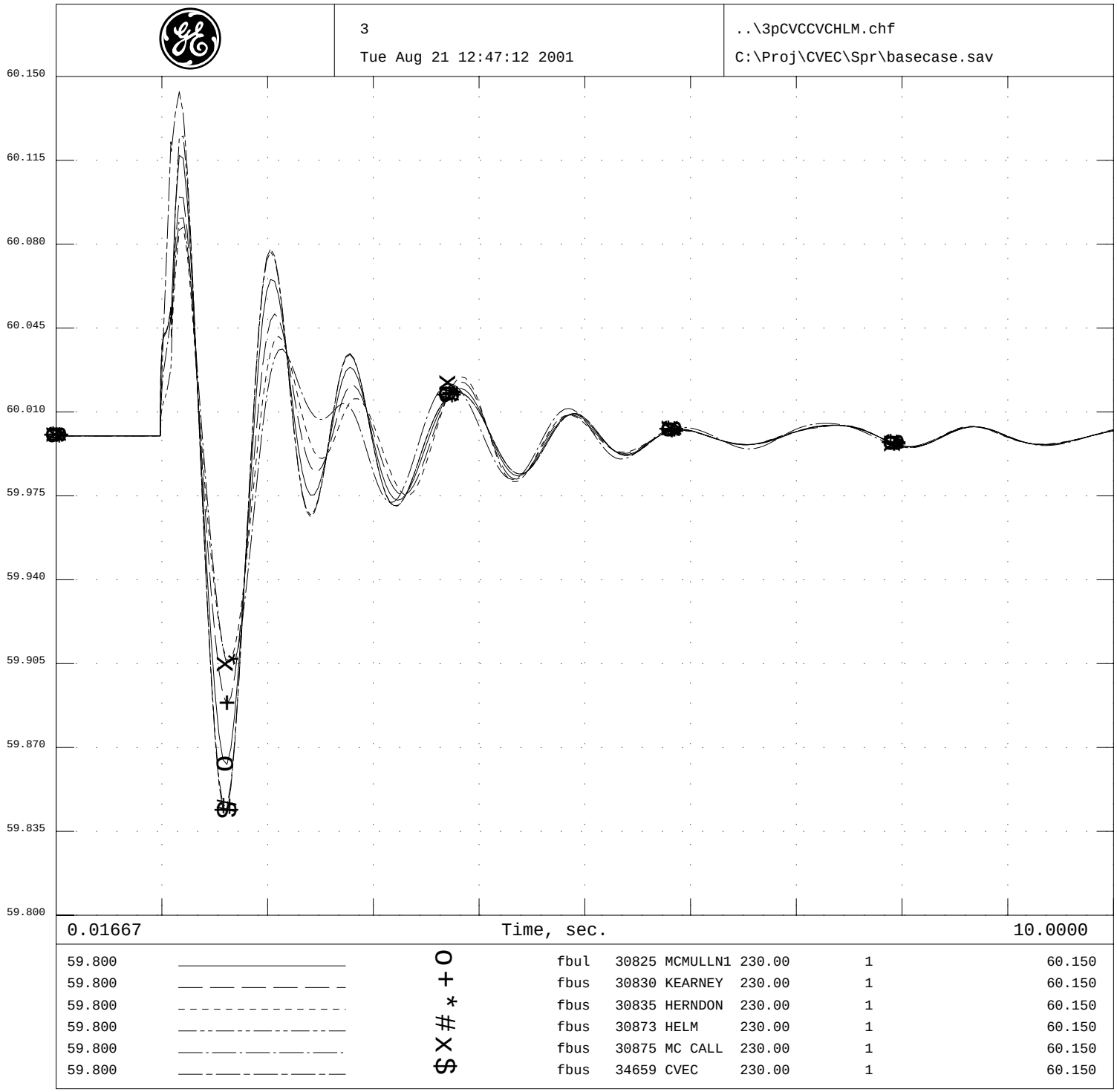

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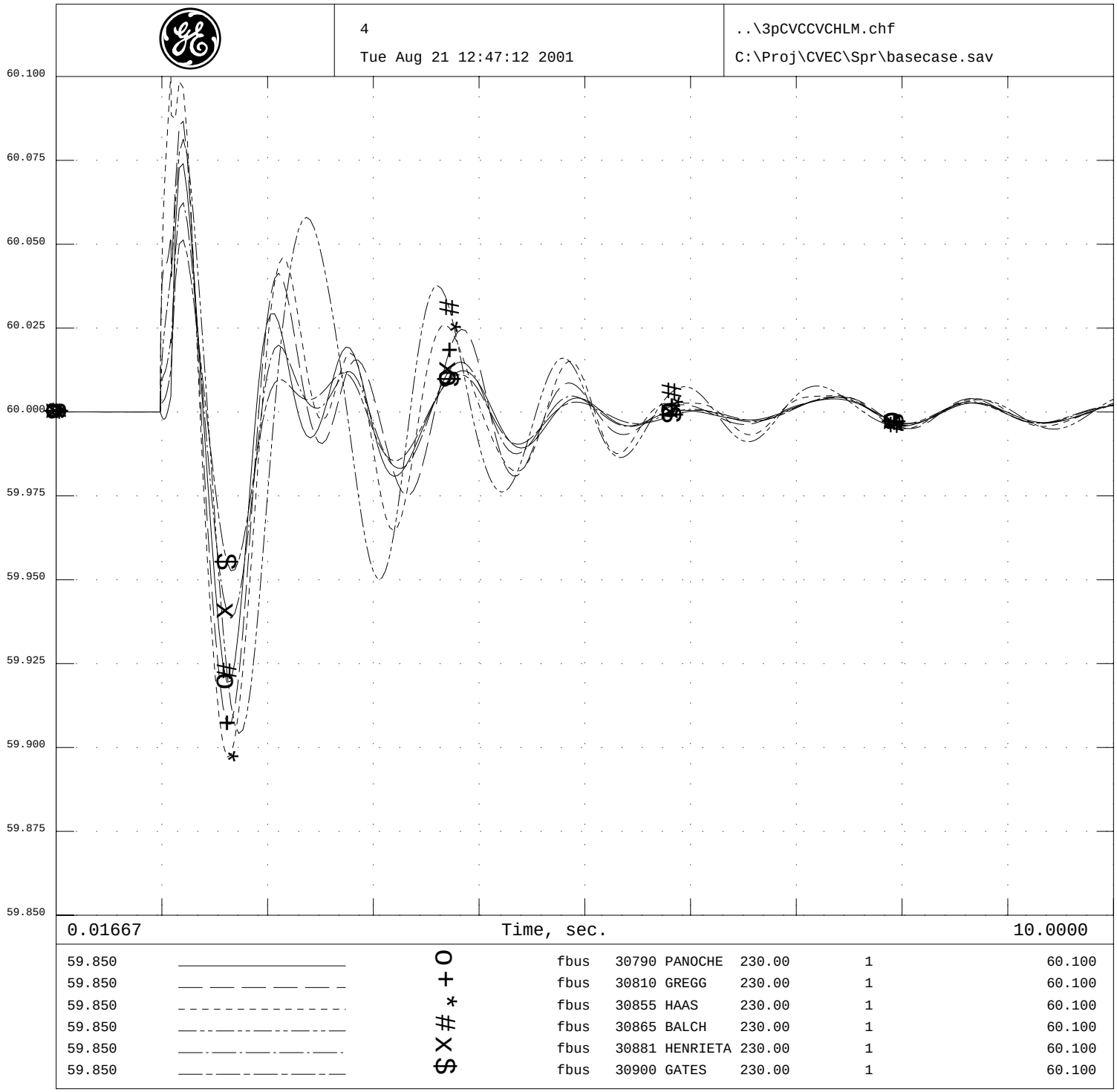

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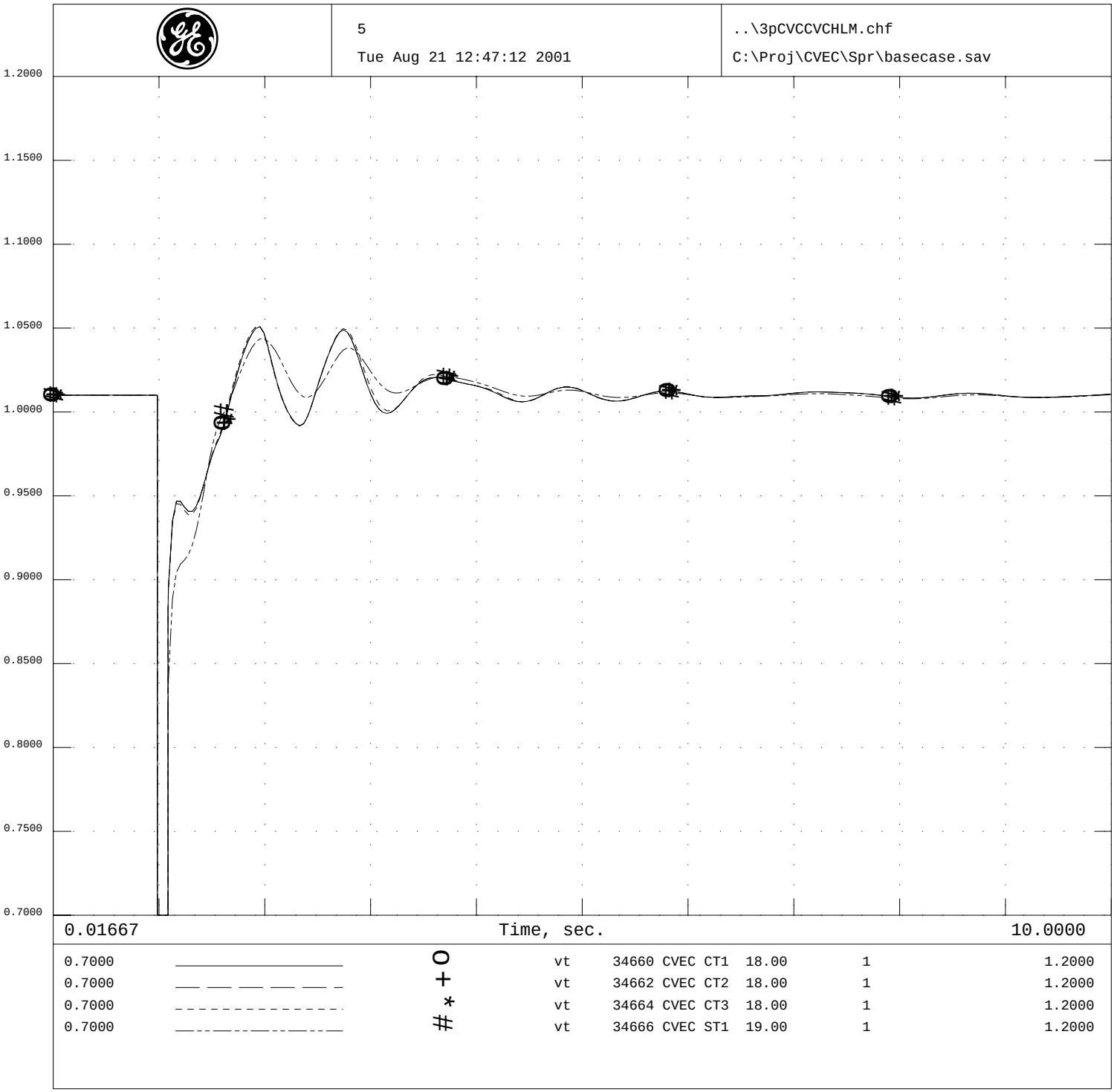

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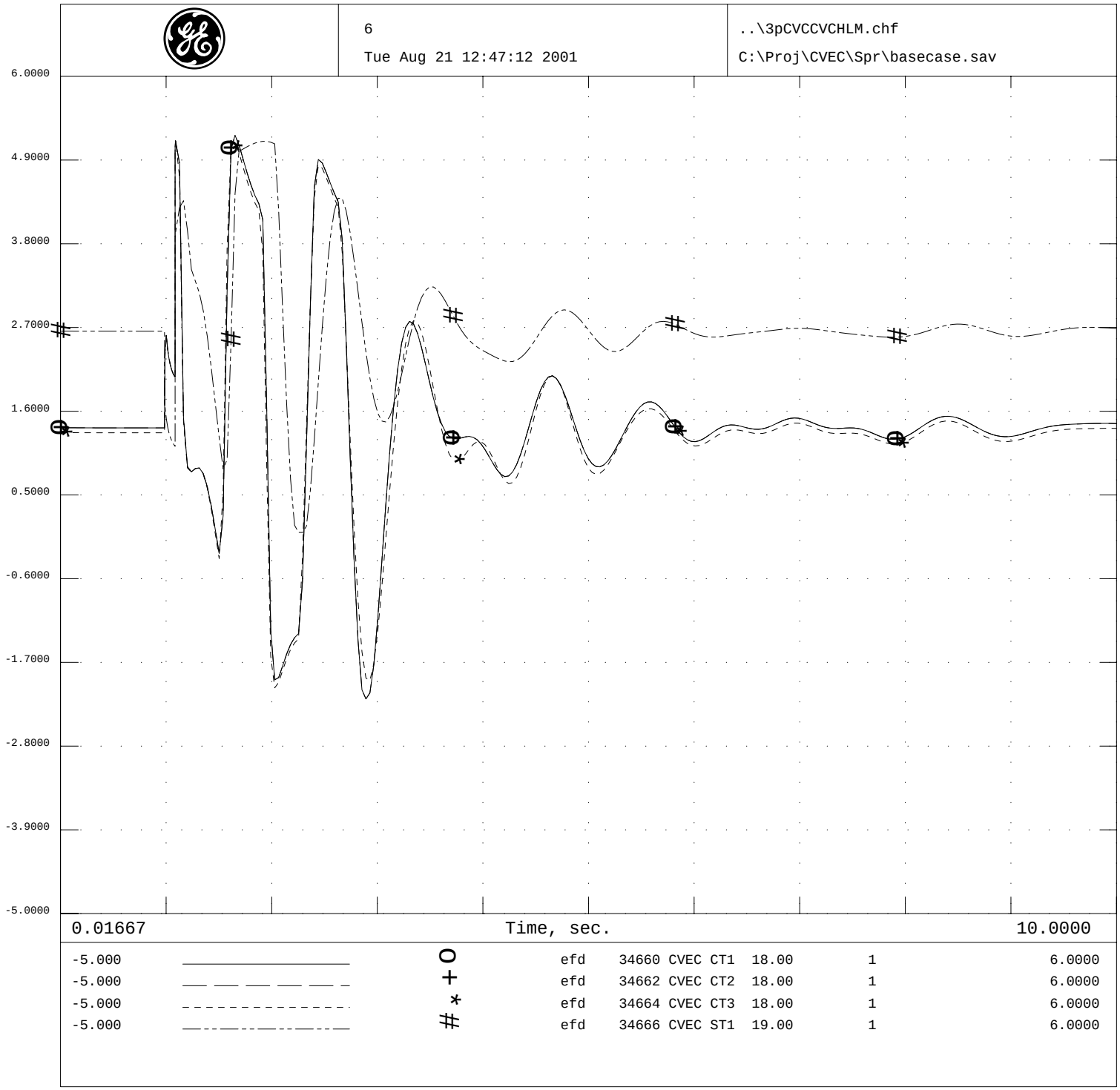
Calpine Corporation
Project Generator Terminal Voltages



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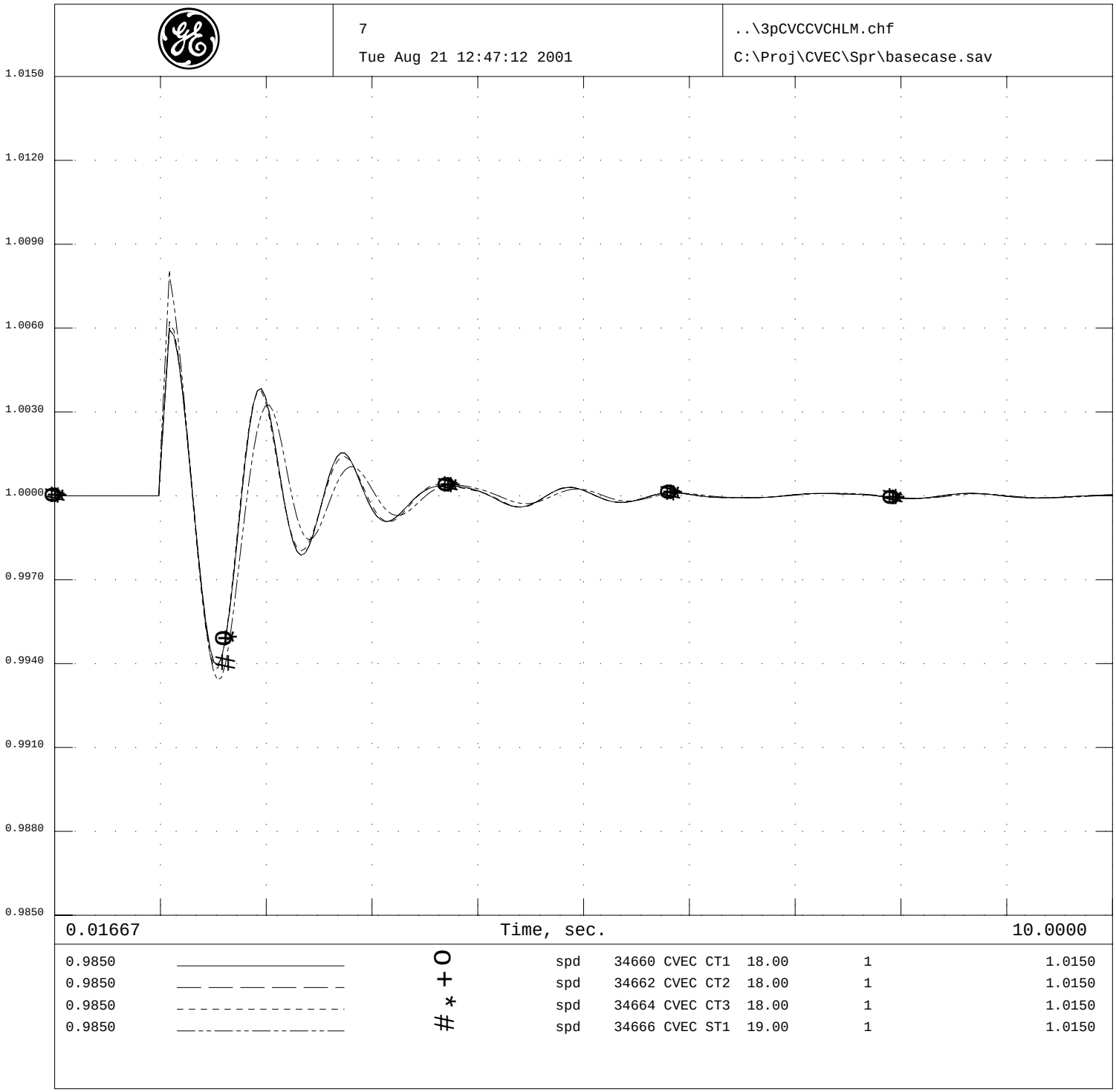

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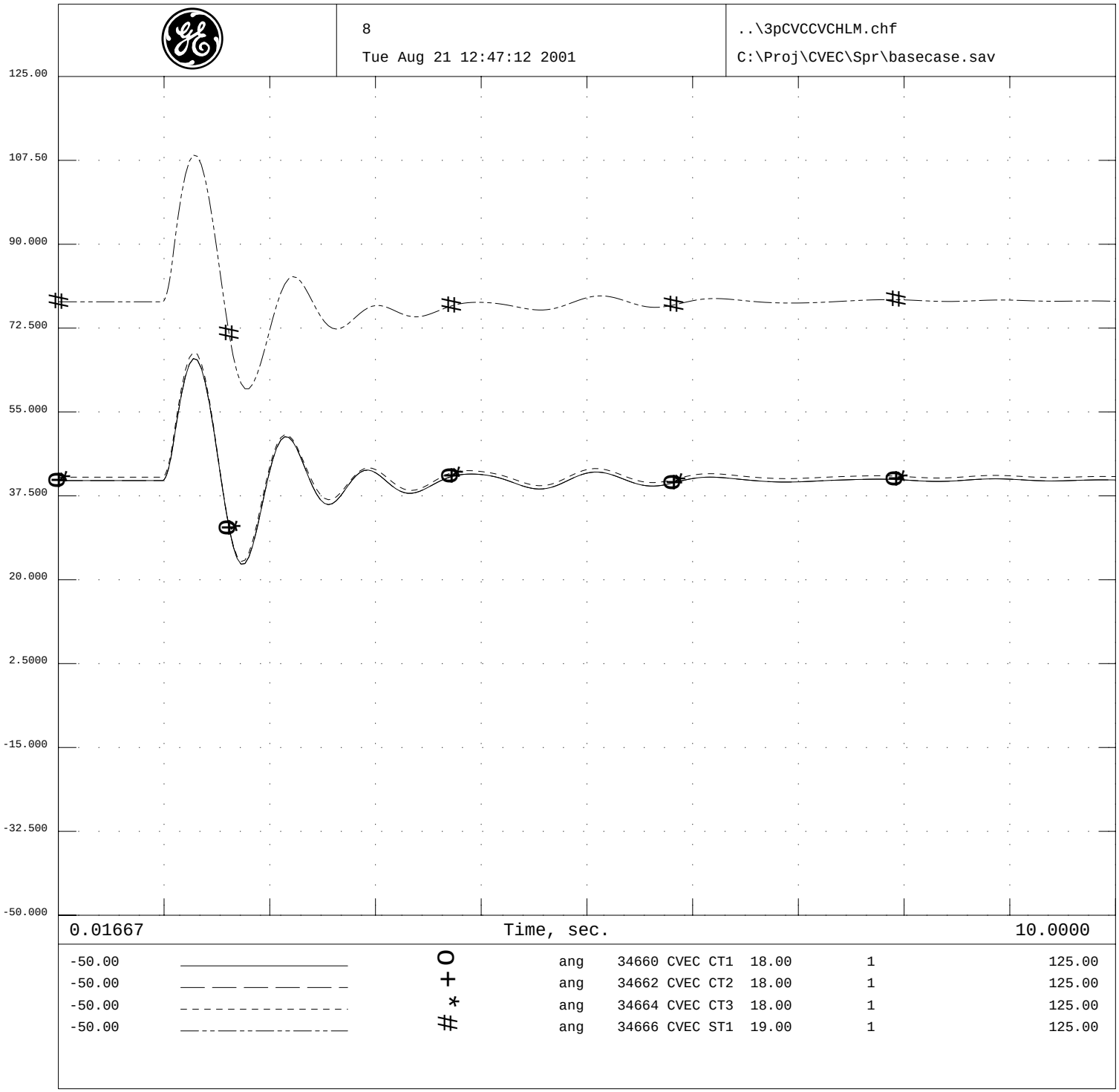
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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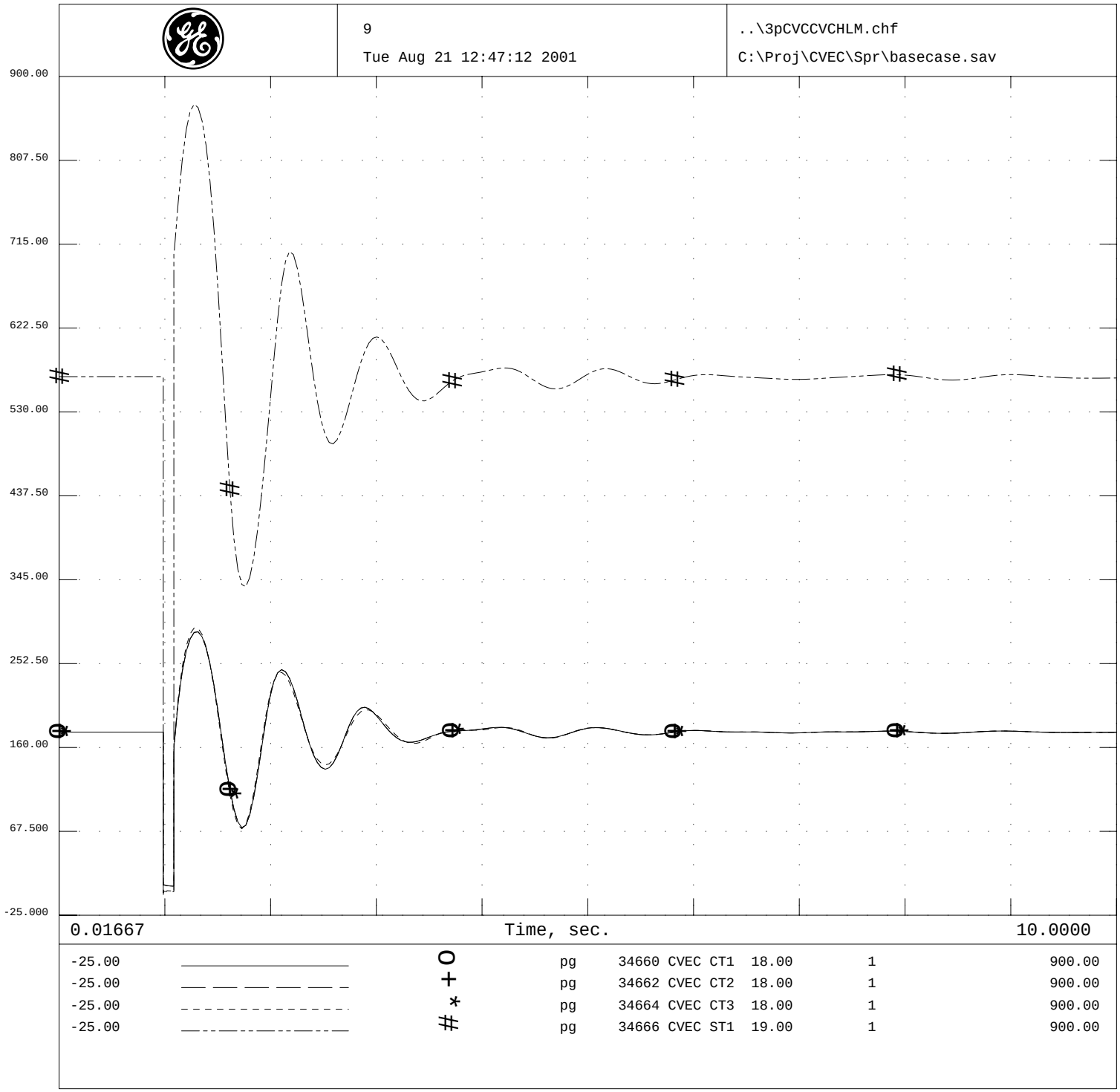
Calpine Corporation
Project Generator Rotor Angle



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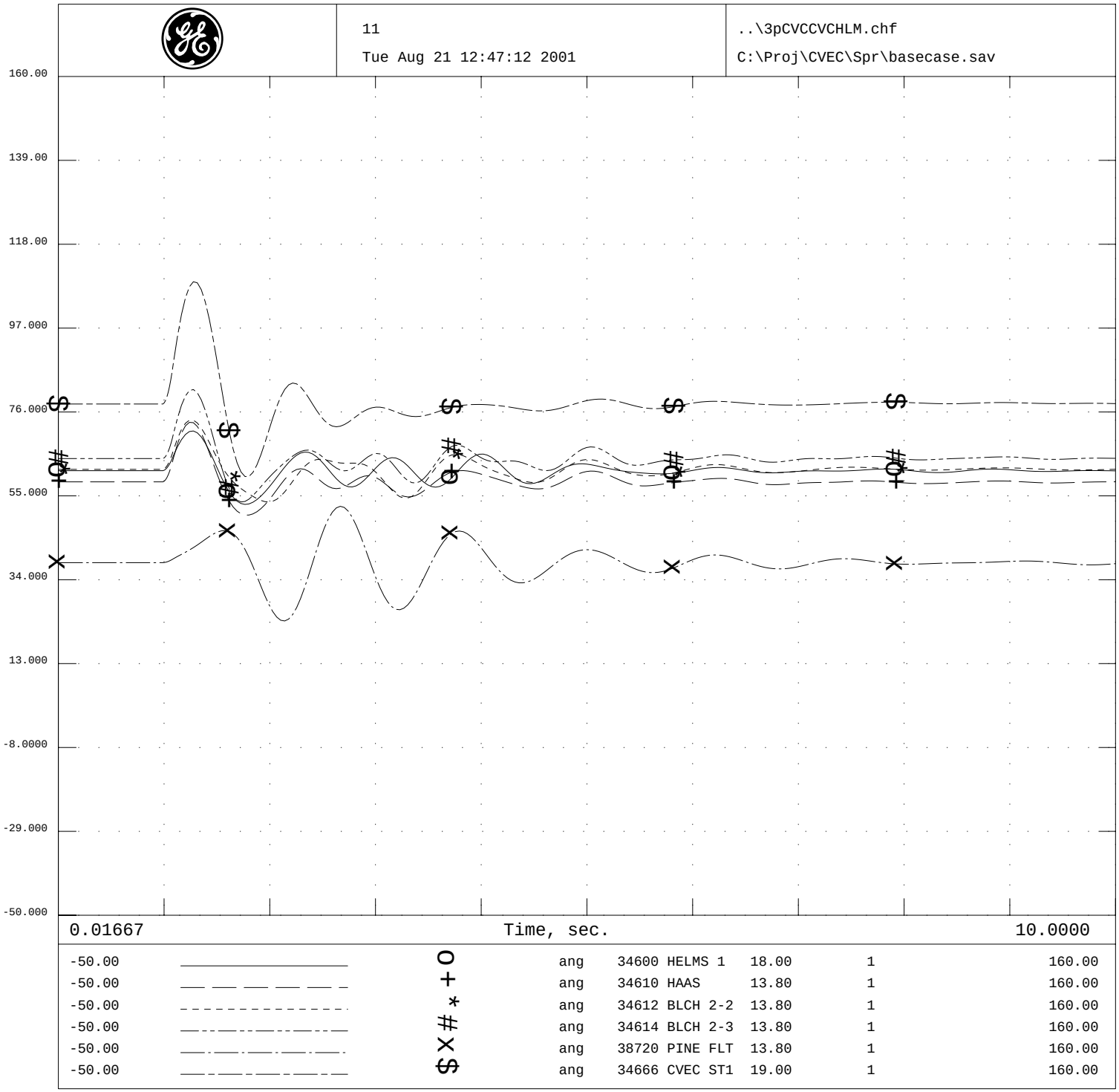
Calpine Corporation
Project Generator Terminal Power



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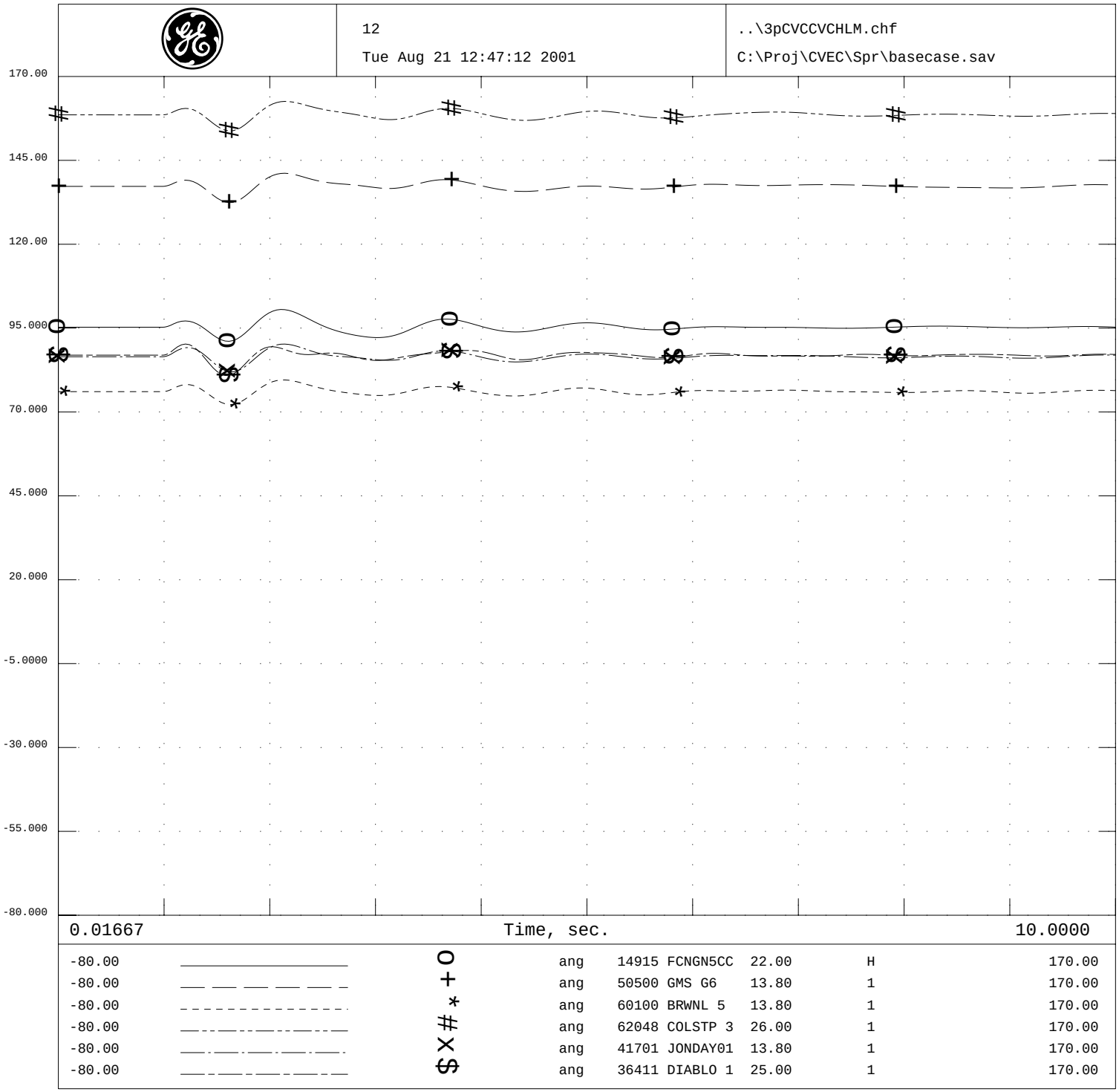

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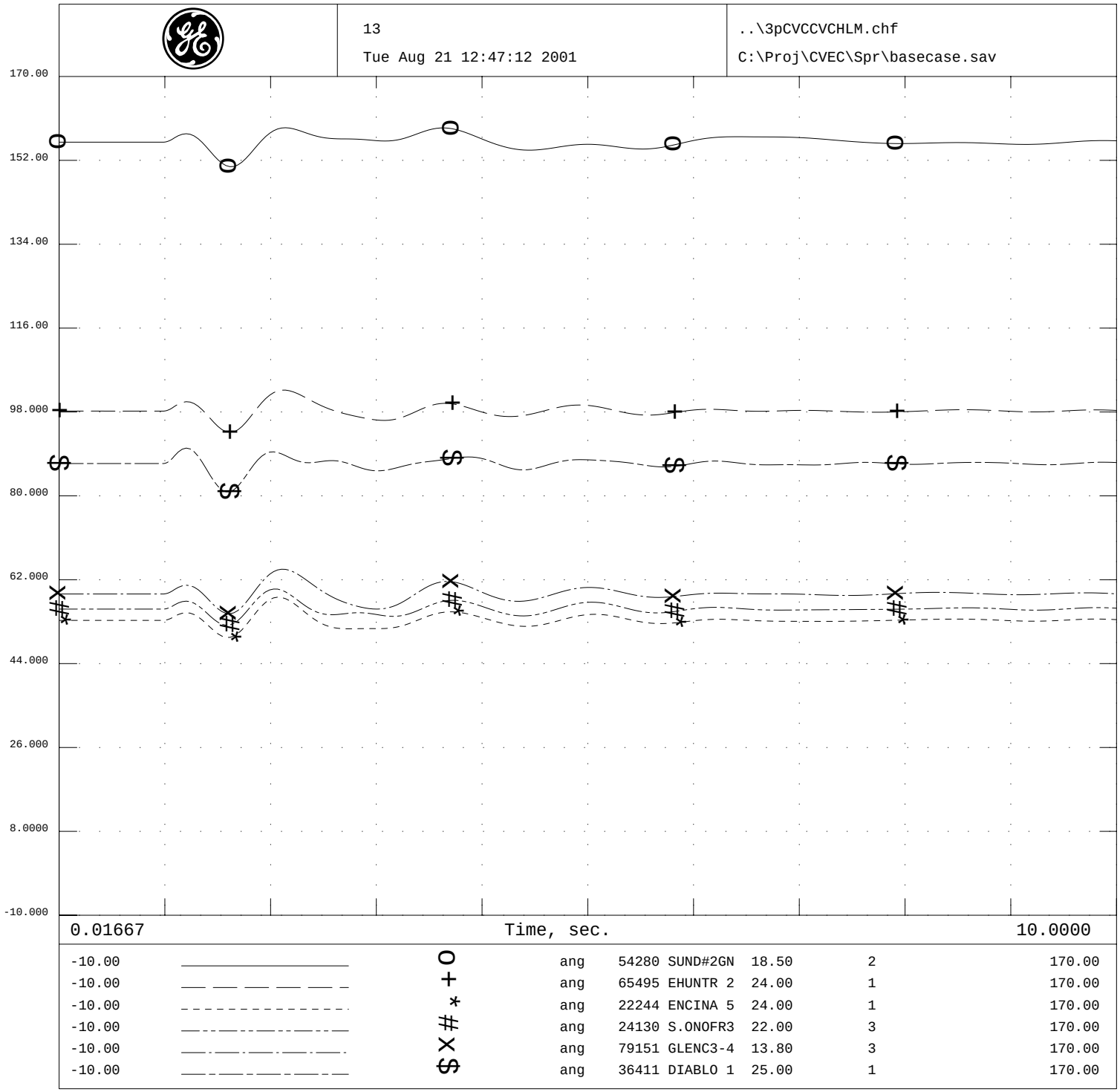

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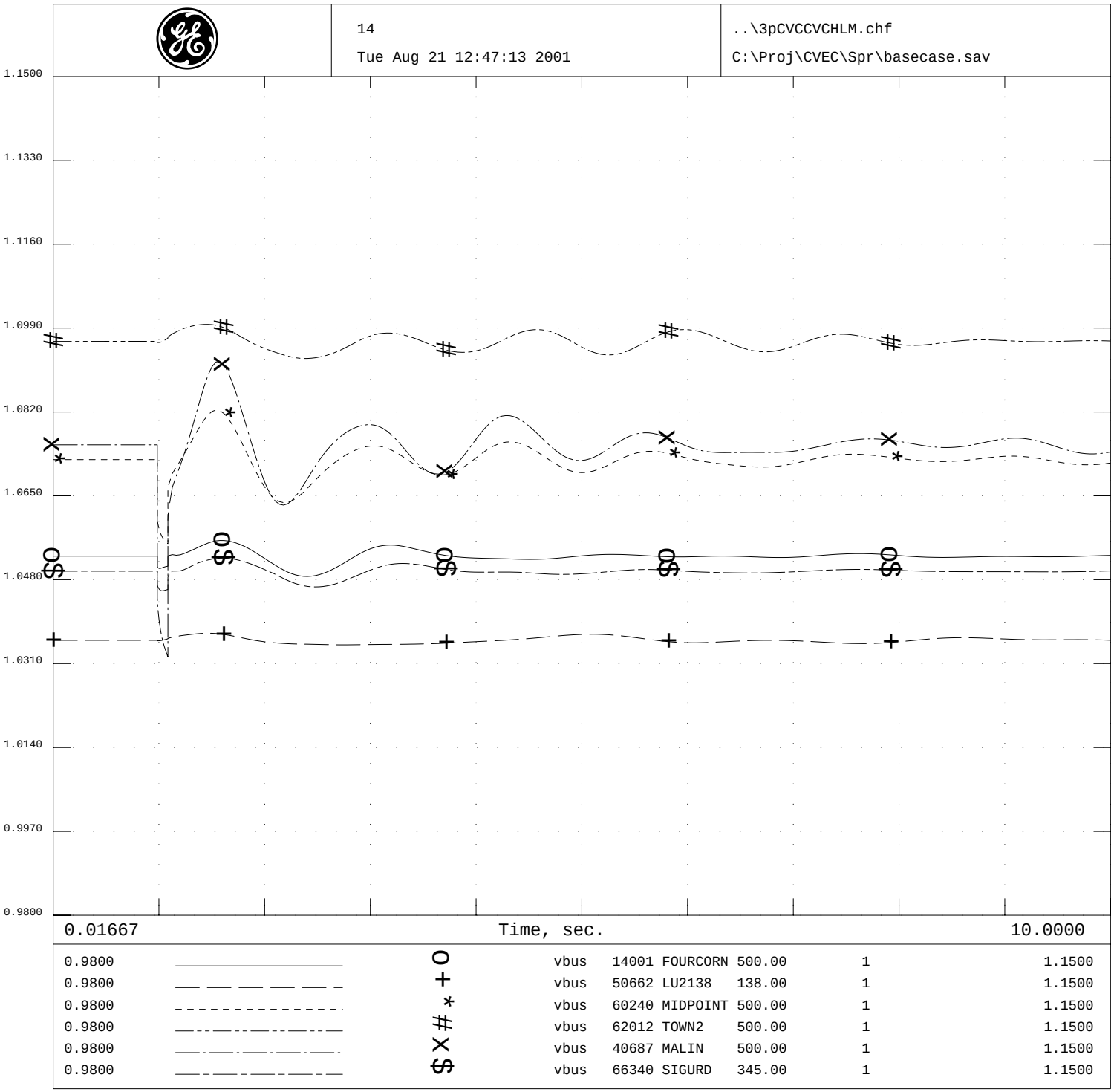

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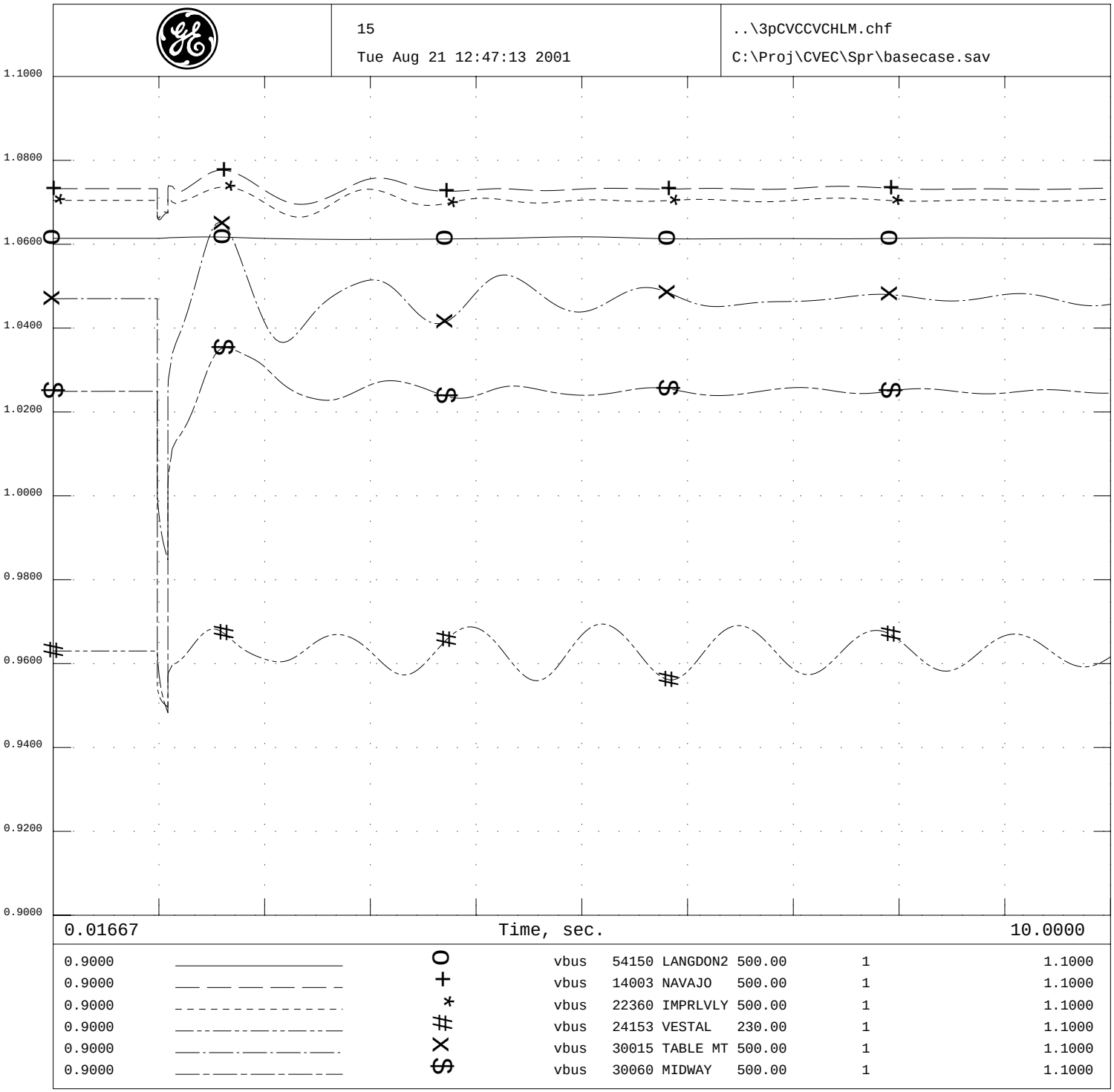
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
CVEC-Helm 230kV #1 Outage
3 phase 6 cycle fault at CVEC 230kV bus and trip CVEC-Helm #1 line

Central Valley Energy Center
Calpine Corporation
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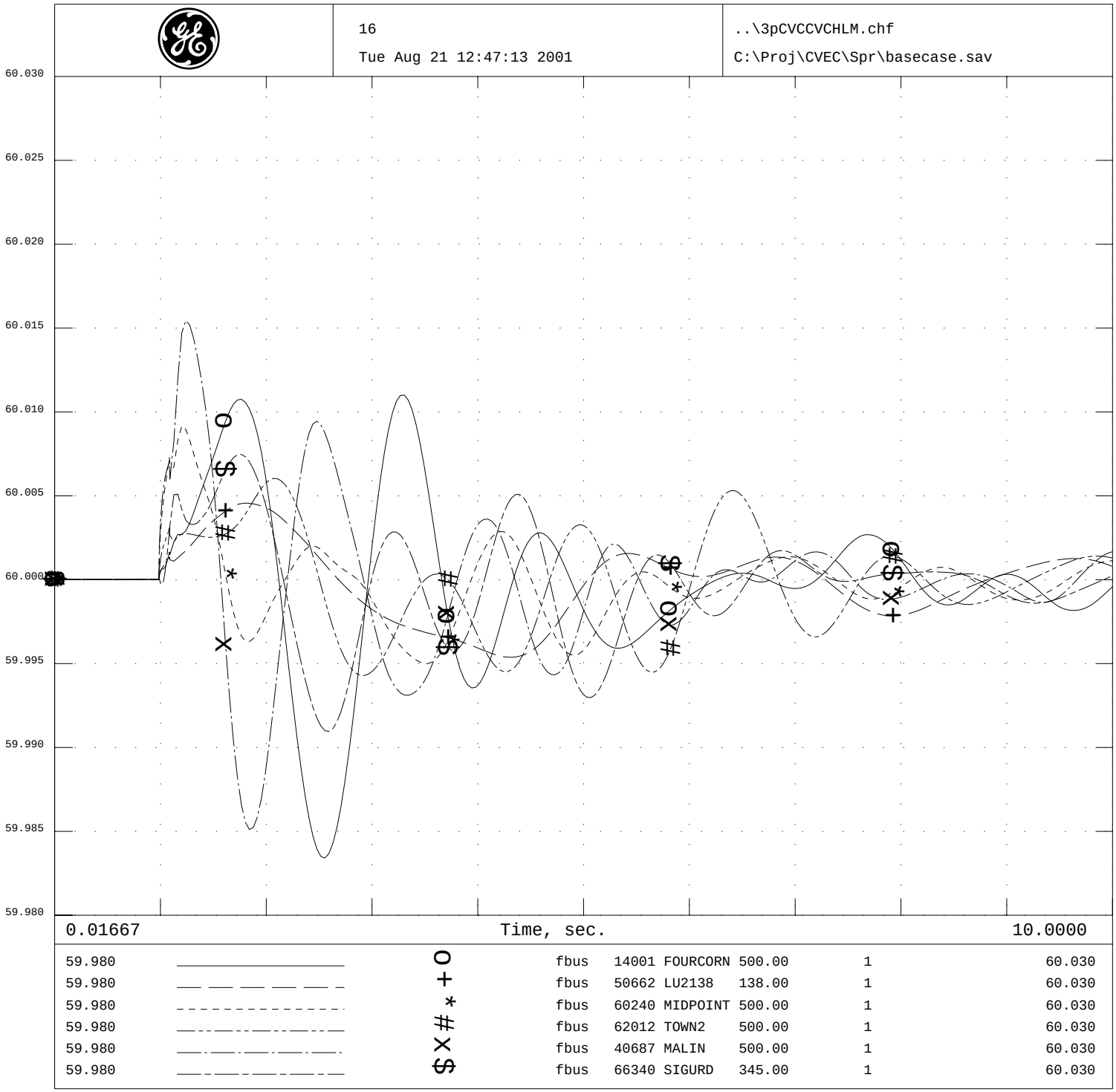

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Central Valley Energy Center
Calpine Corporation
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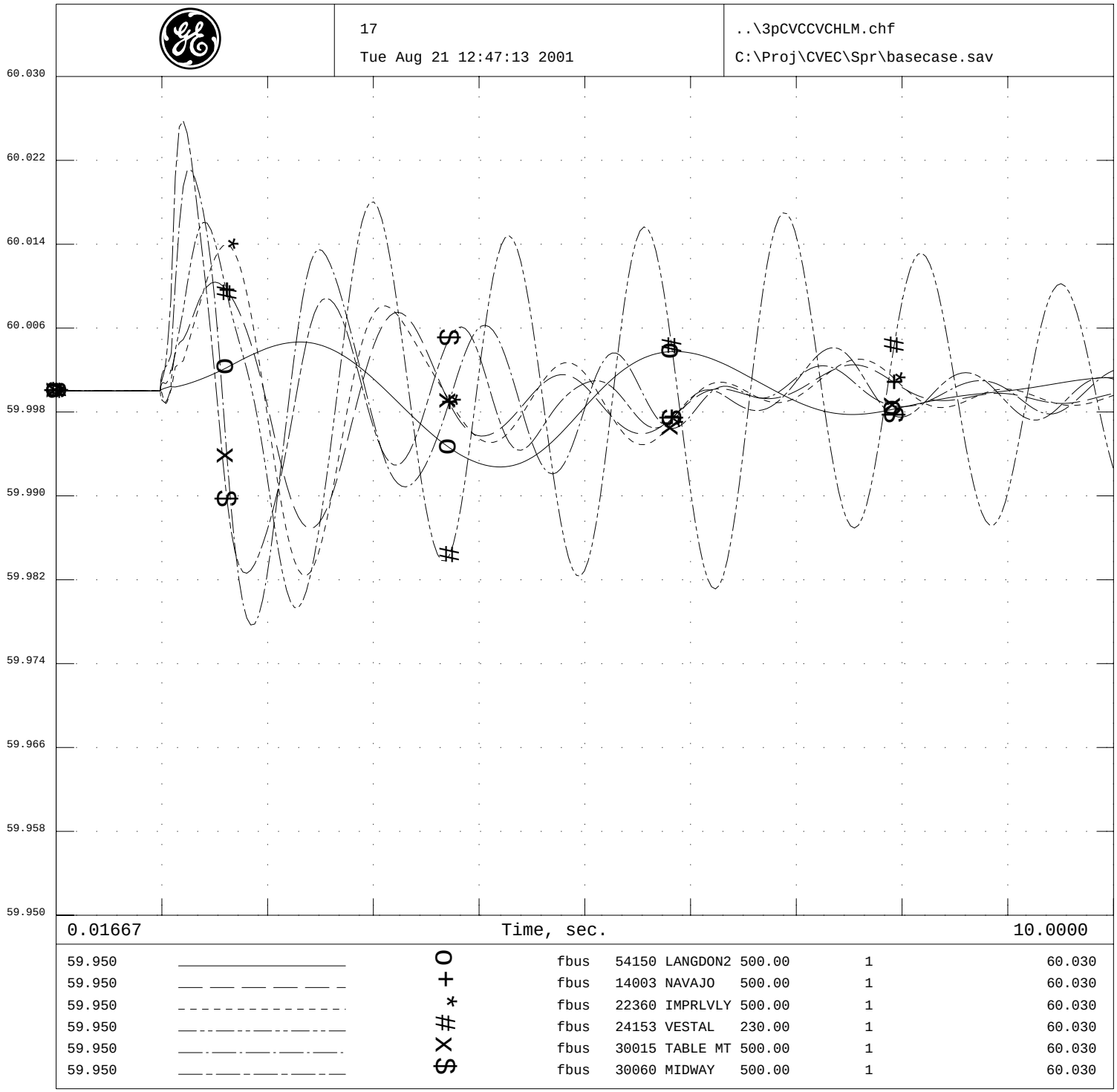

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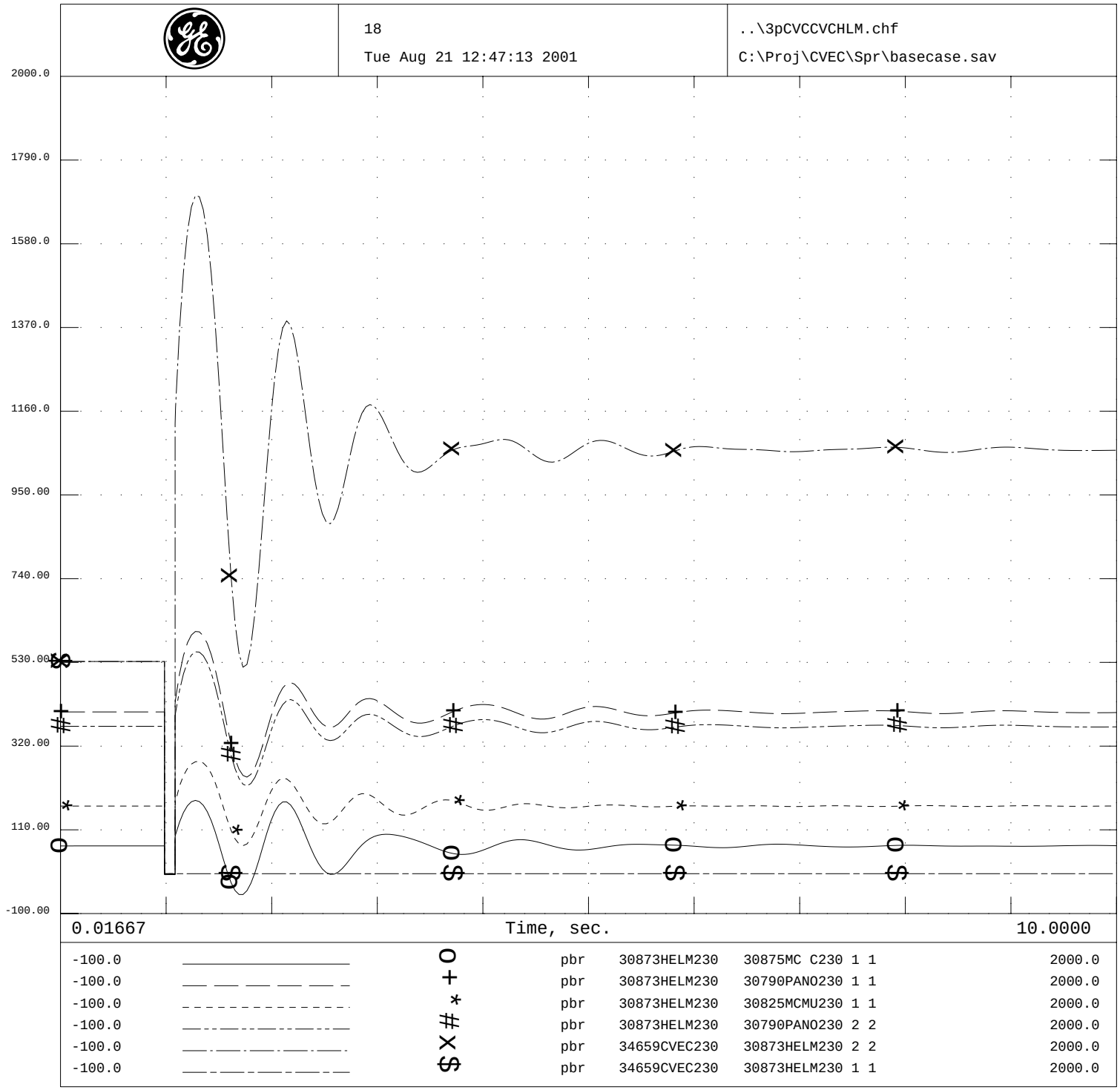

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Central Valley Energy Center
Calpine Corporation
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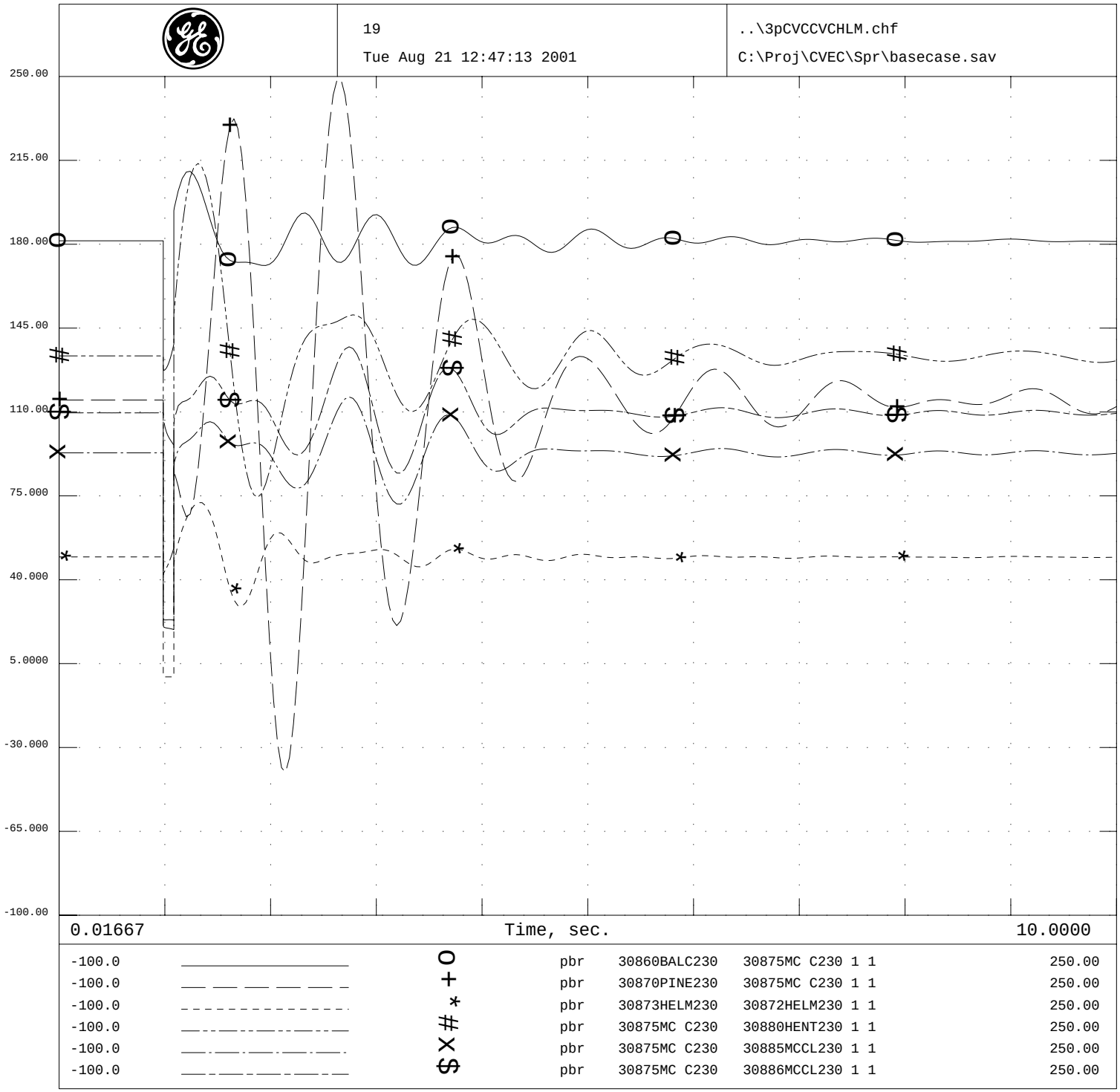

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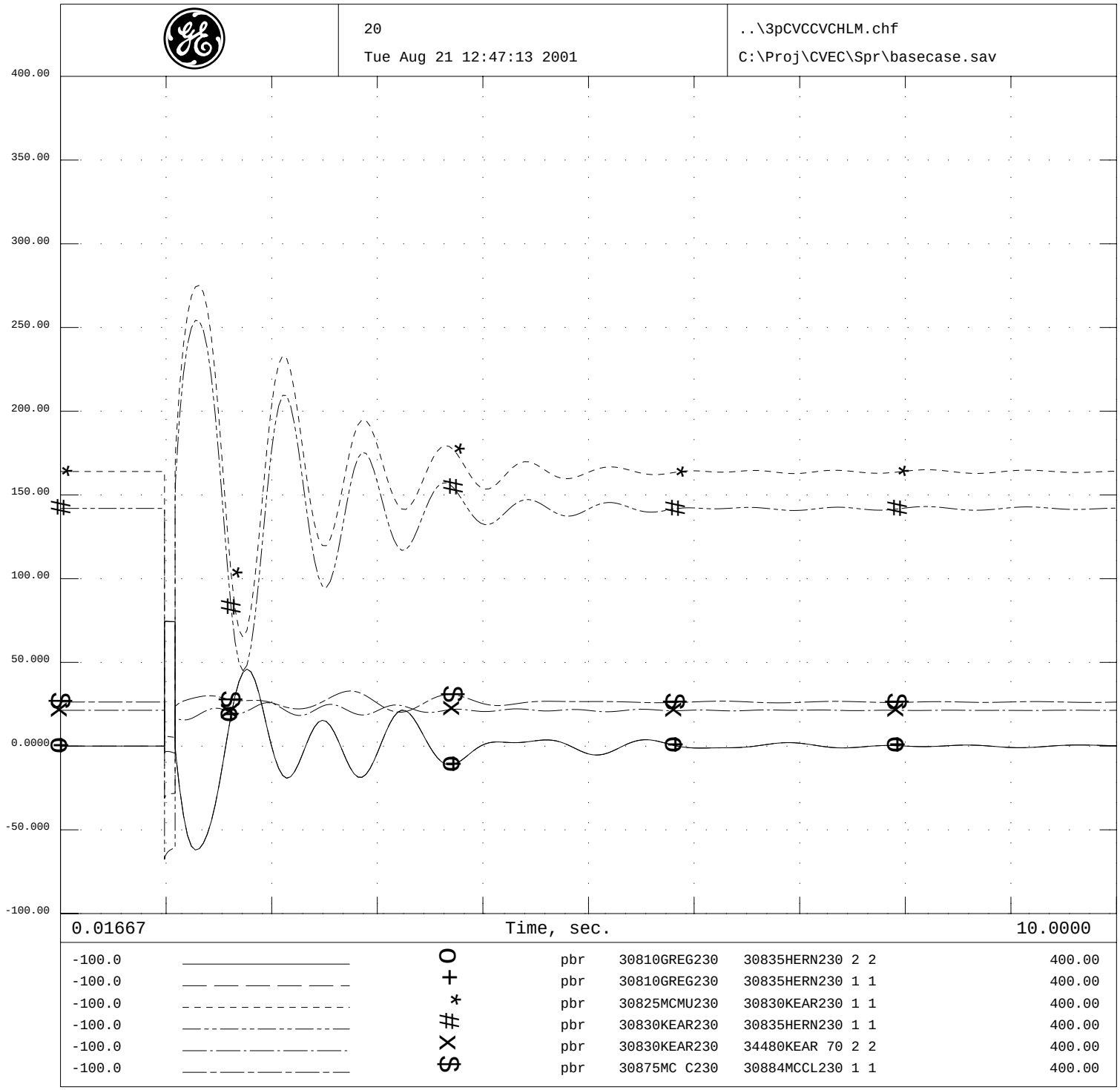

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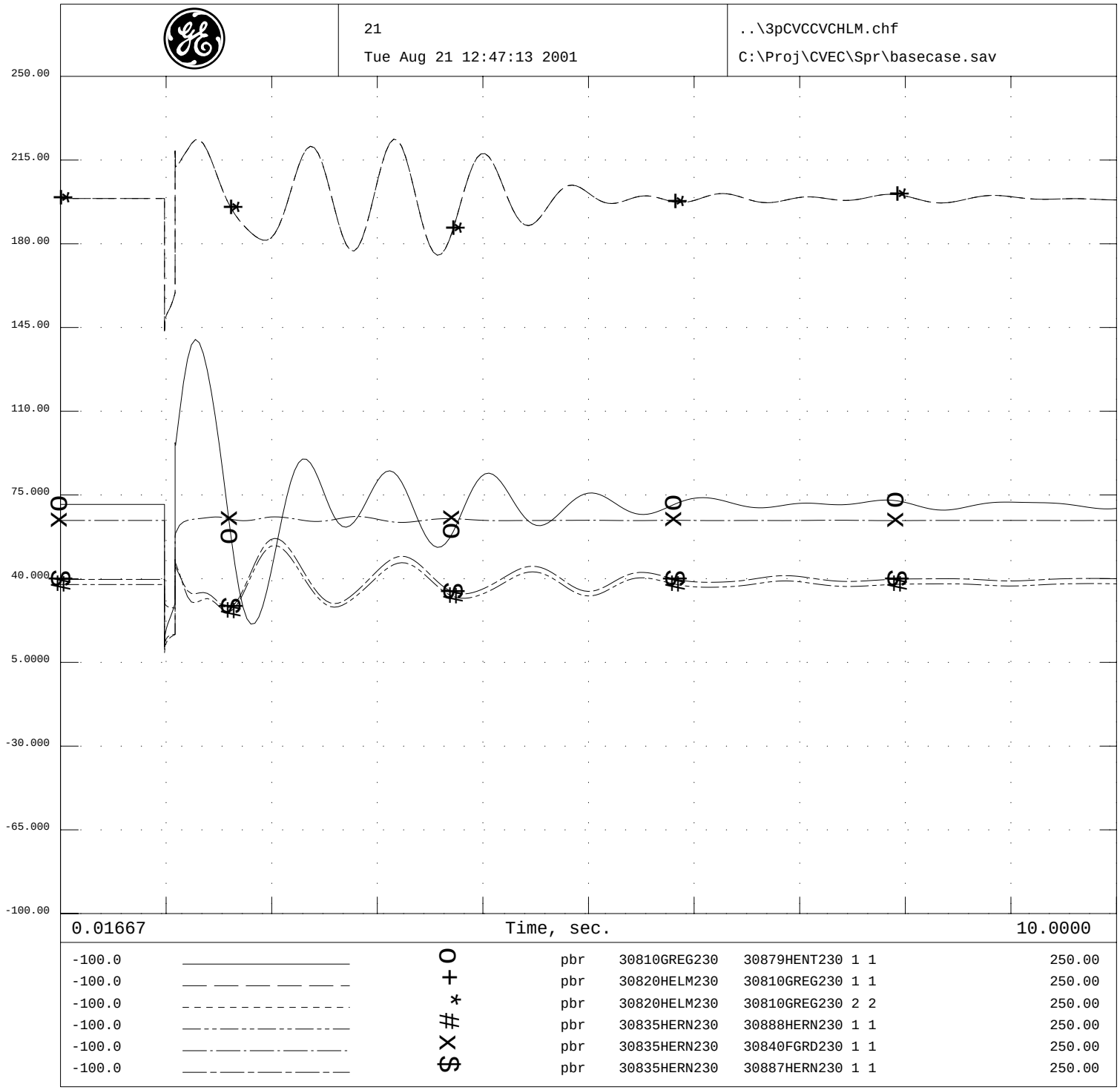

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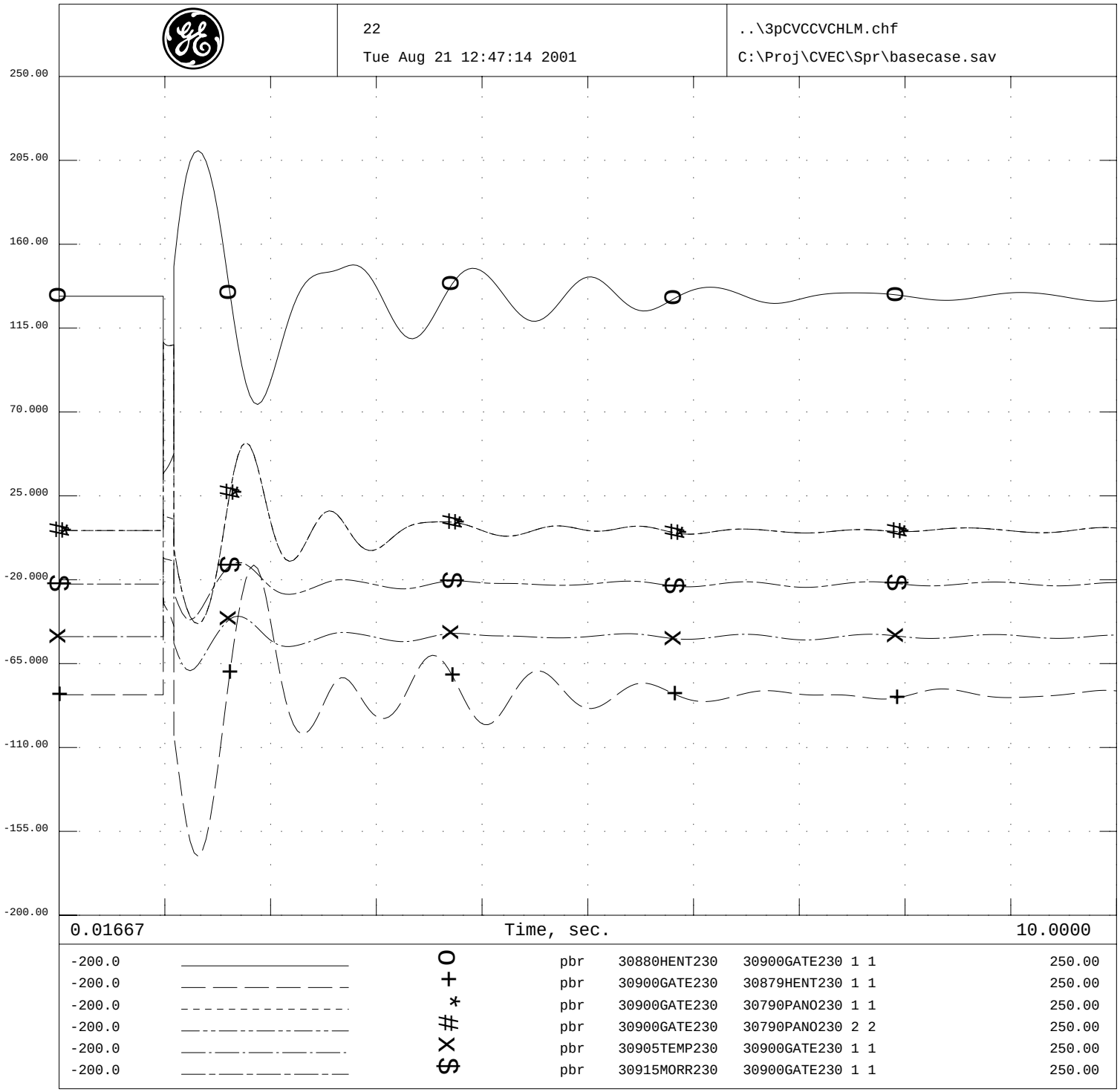

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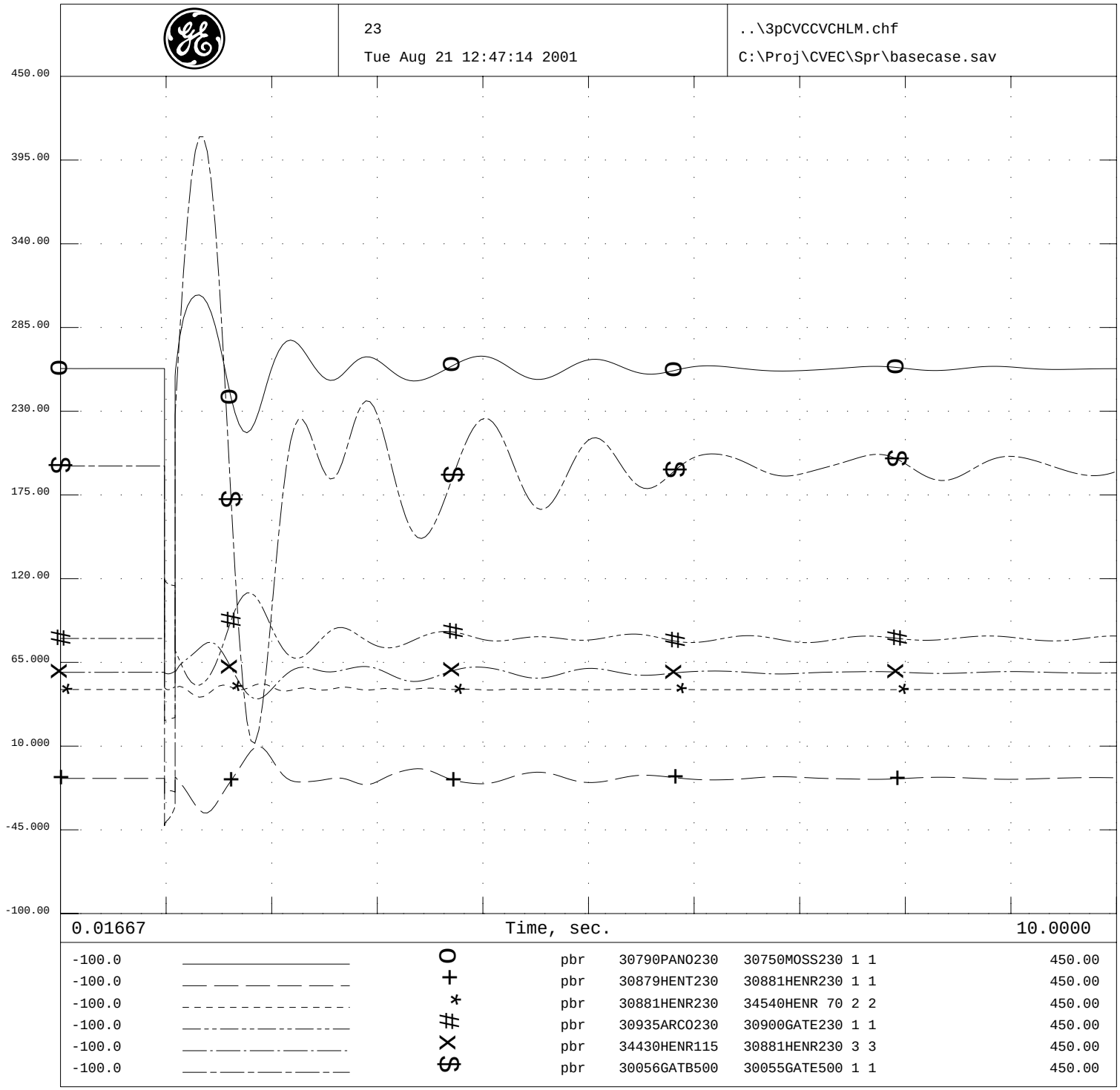

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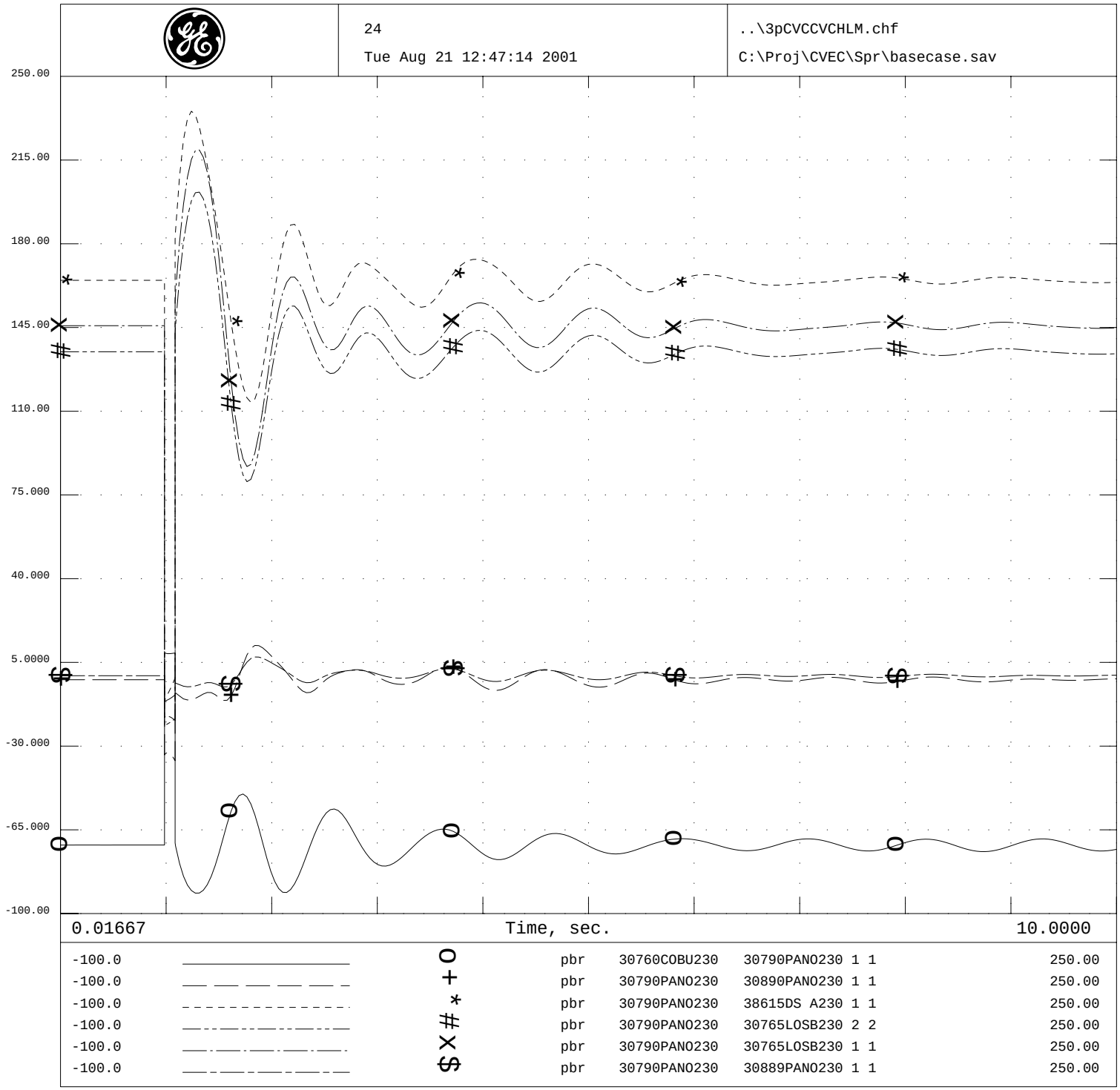

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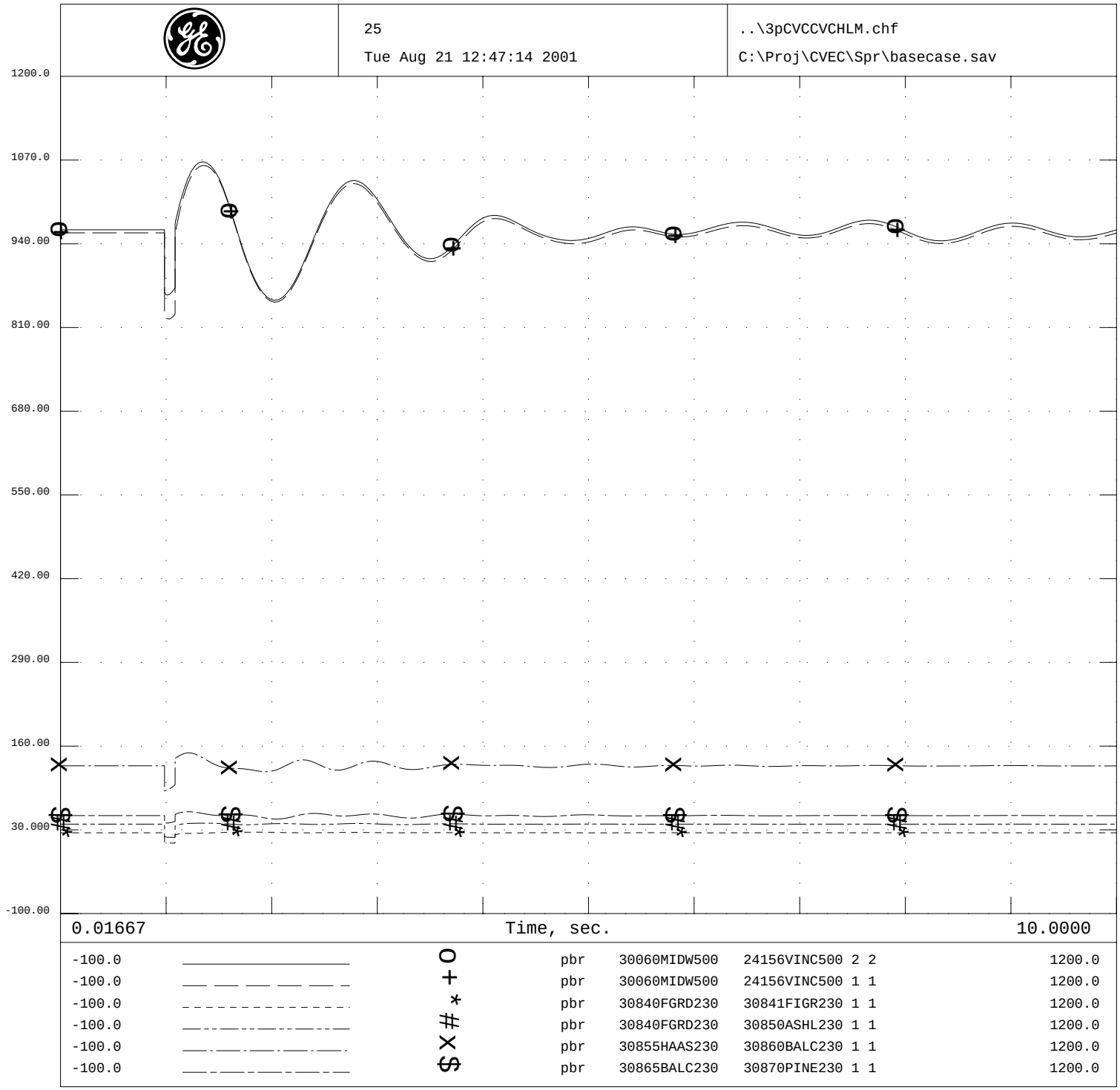

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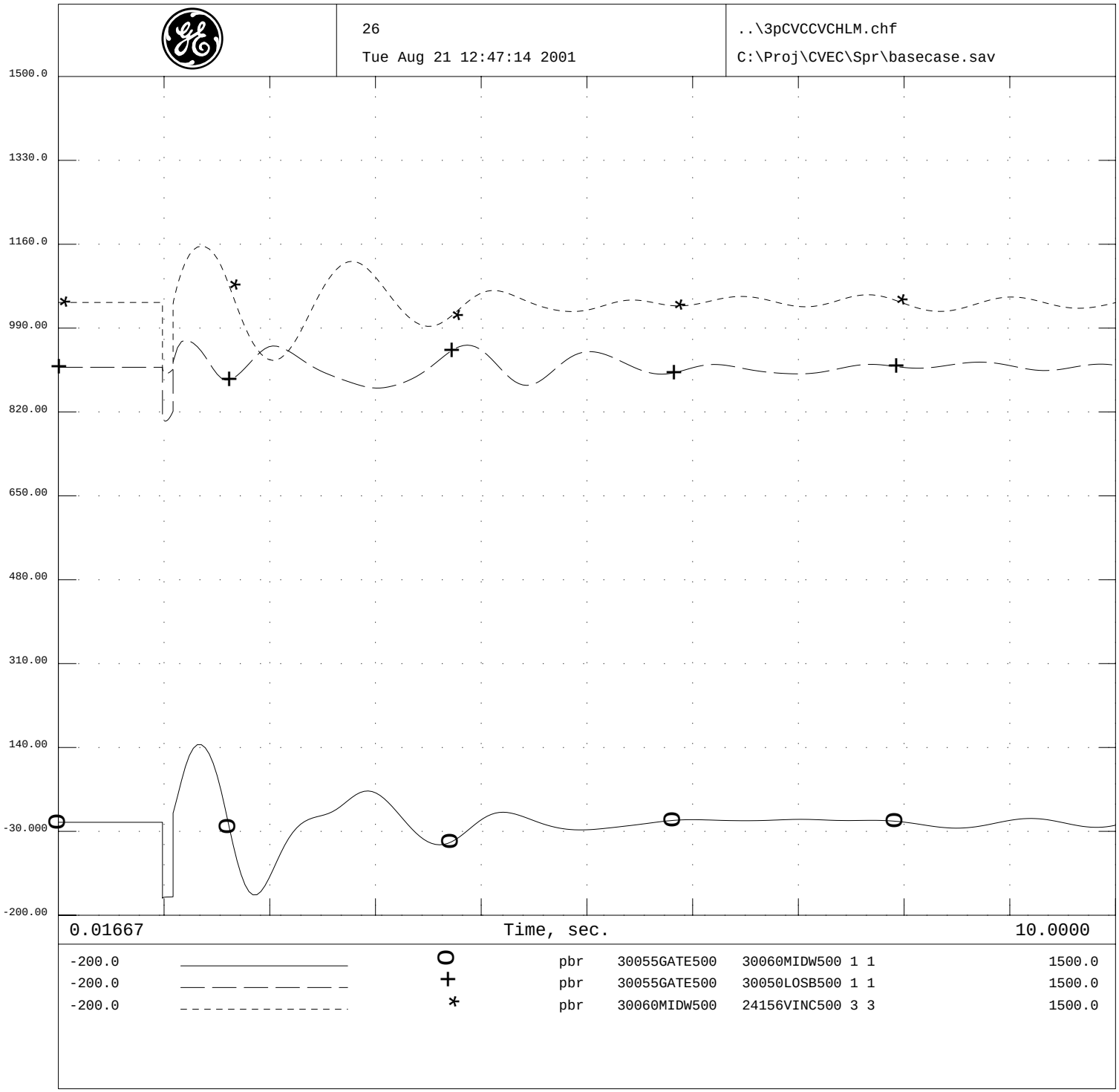

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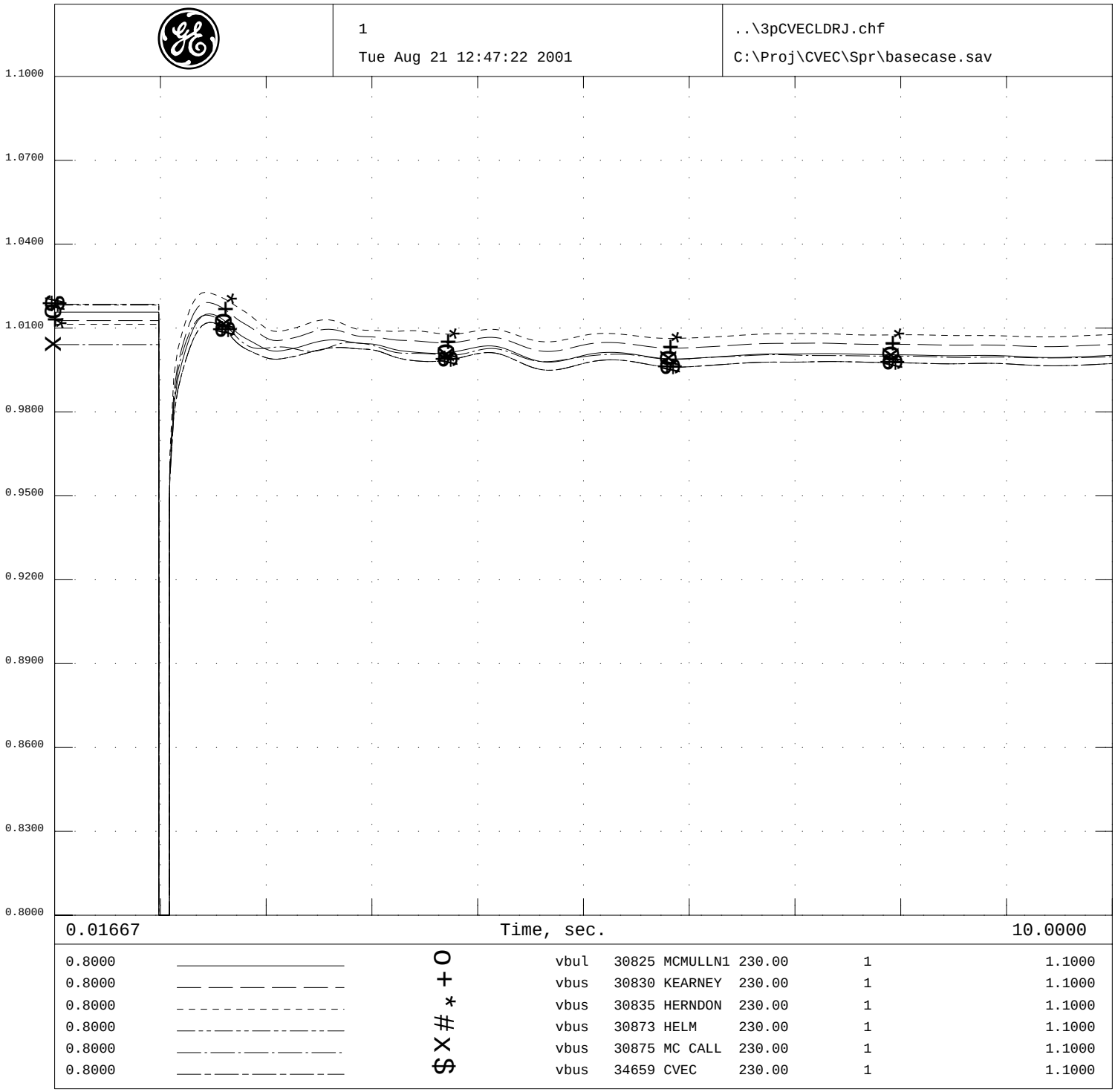

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2004 Heavy Spring Base Case
CVEC @ 1100MW
CVEC Load Rejection
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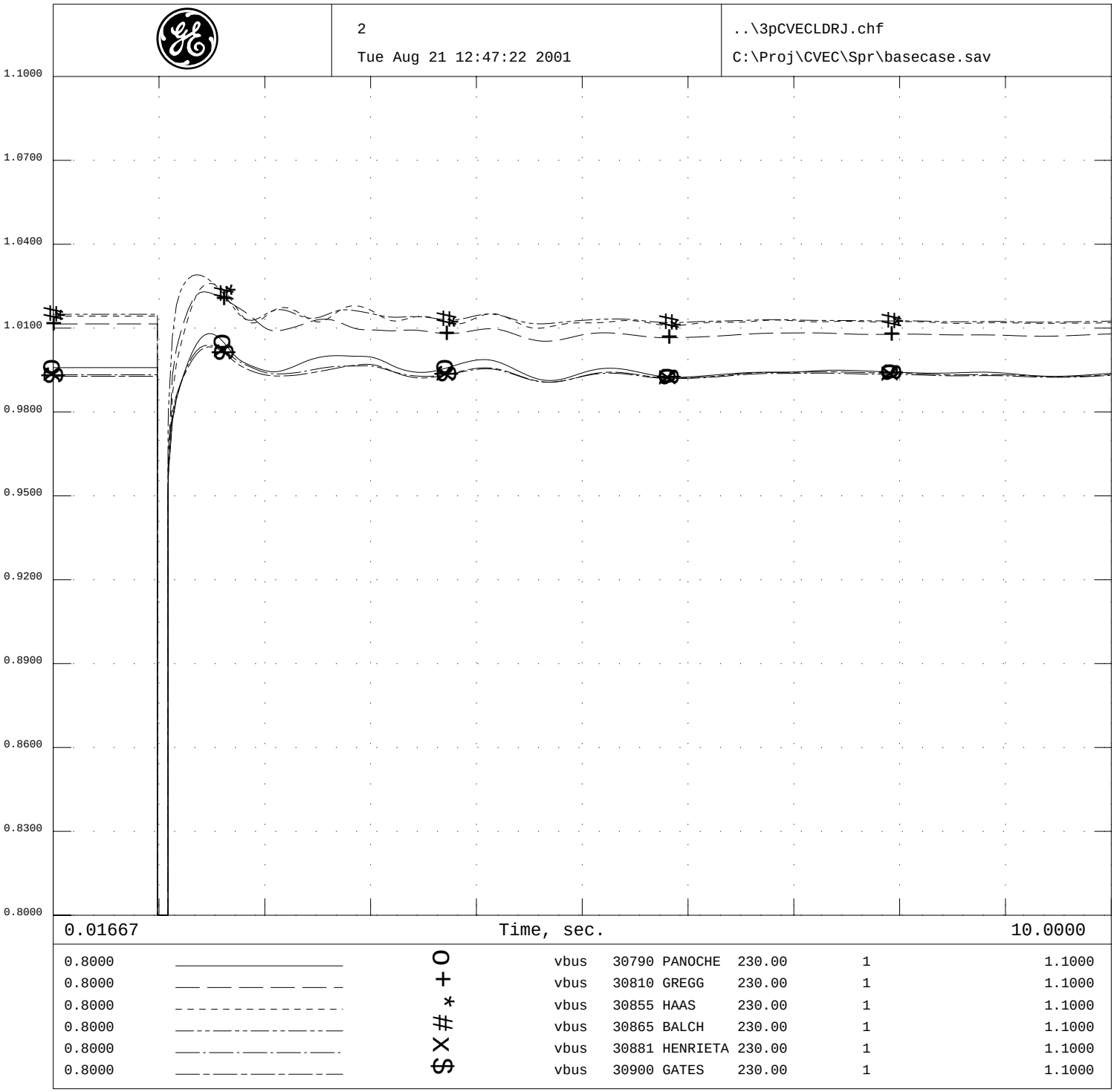
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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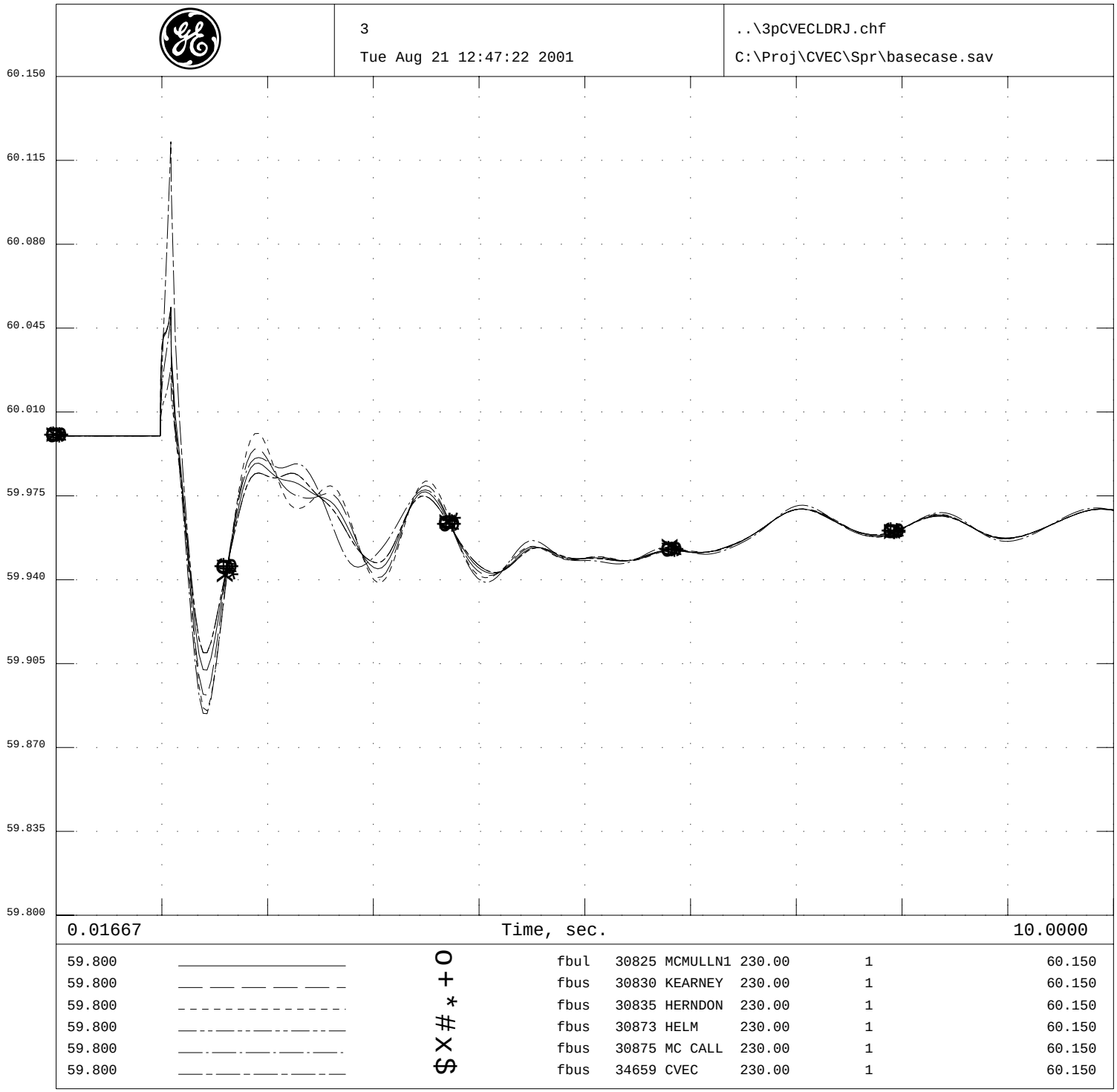

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2004 Heavy Spring Base Case
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Calpine Corporation
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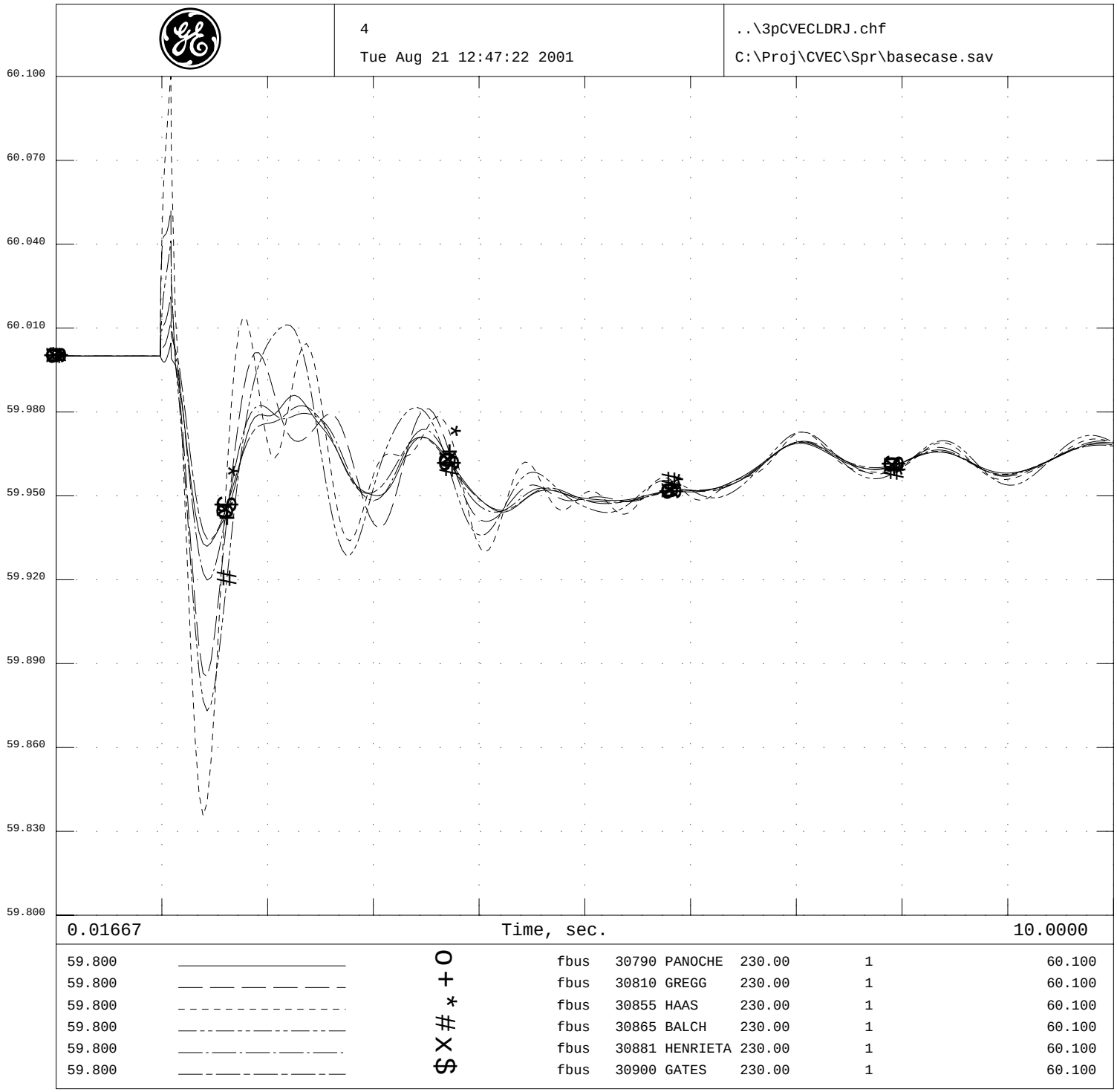

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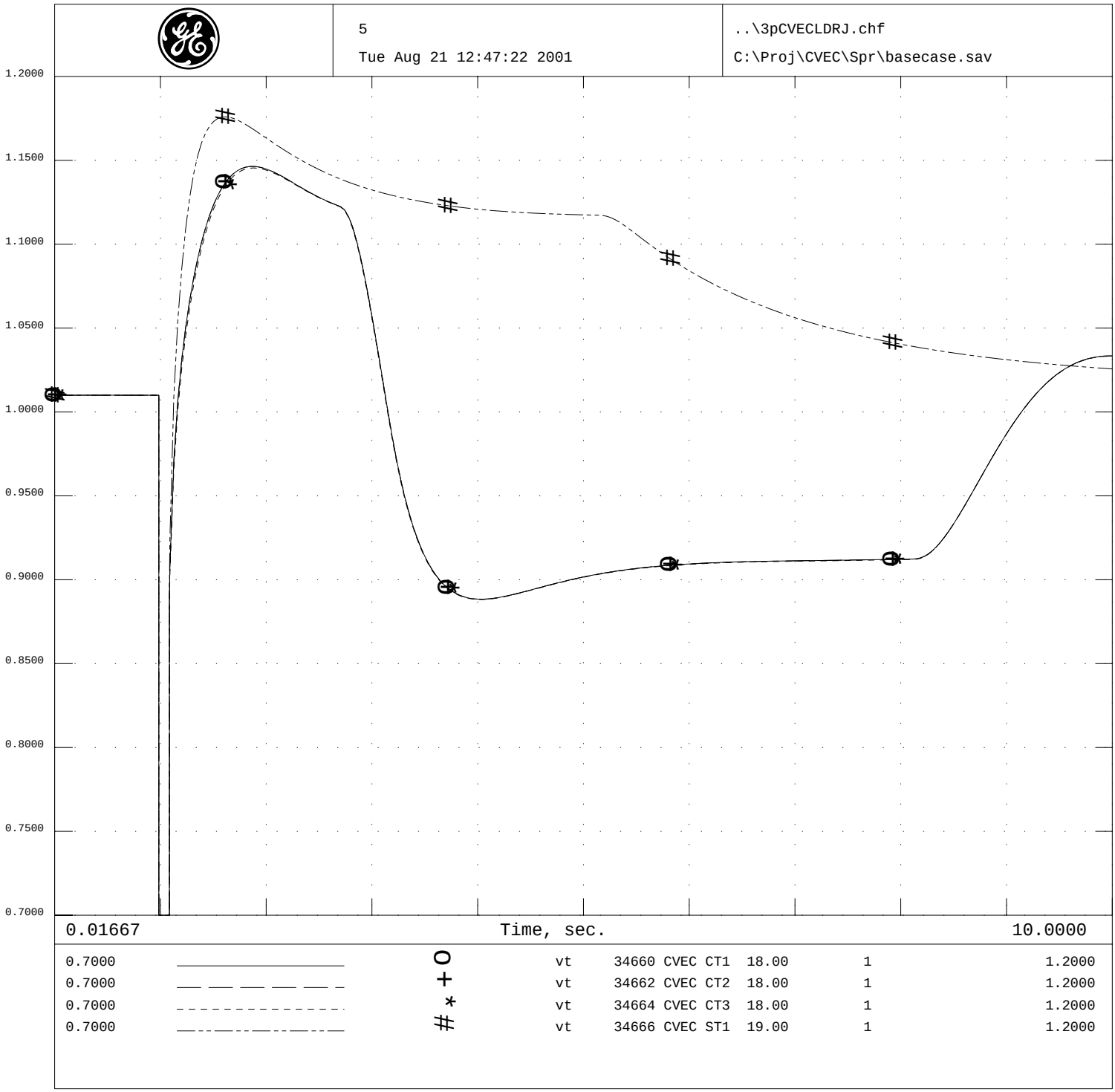

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2004 Heavy Spring Base Case
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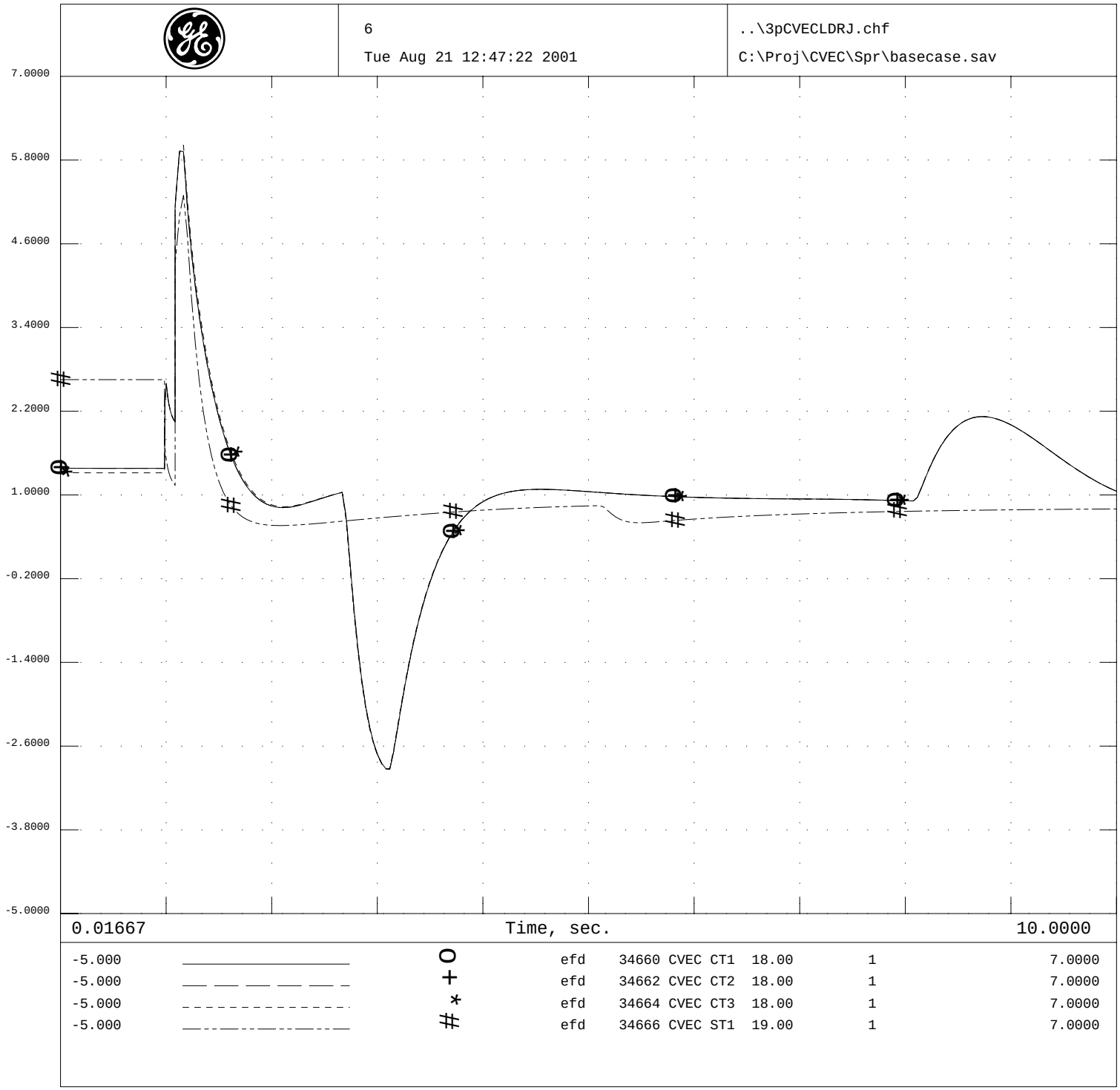
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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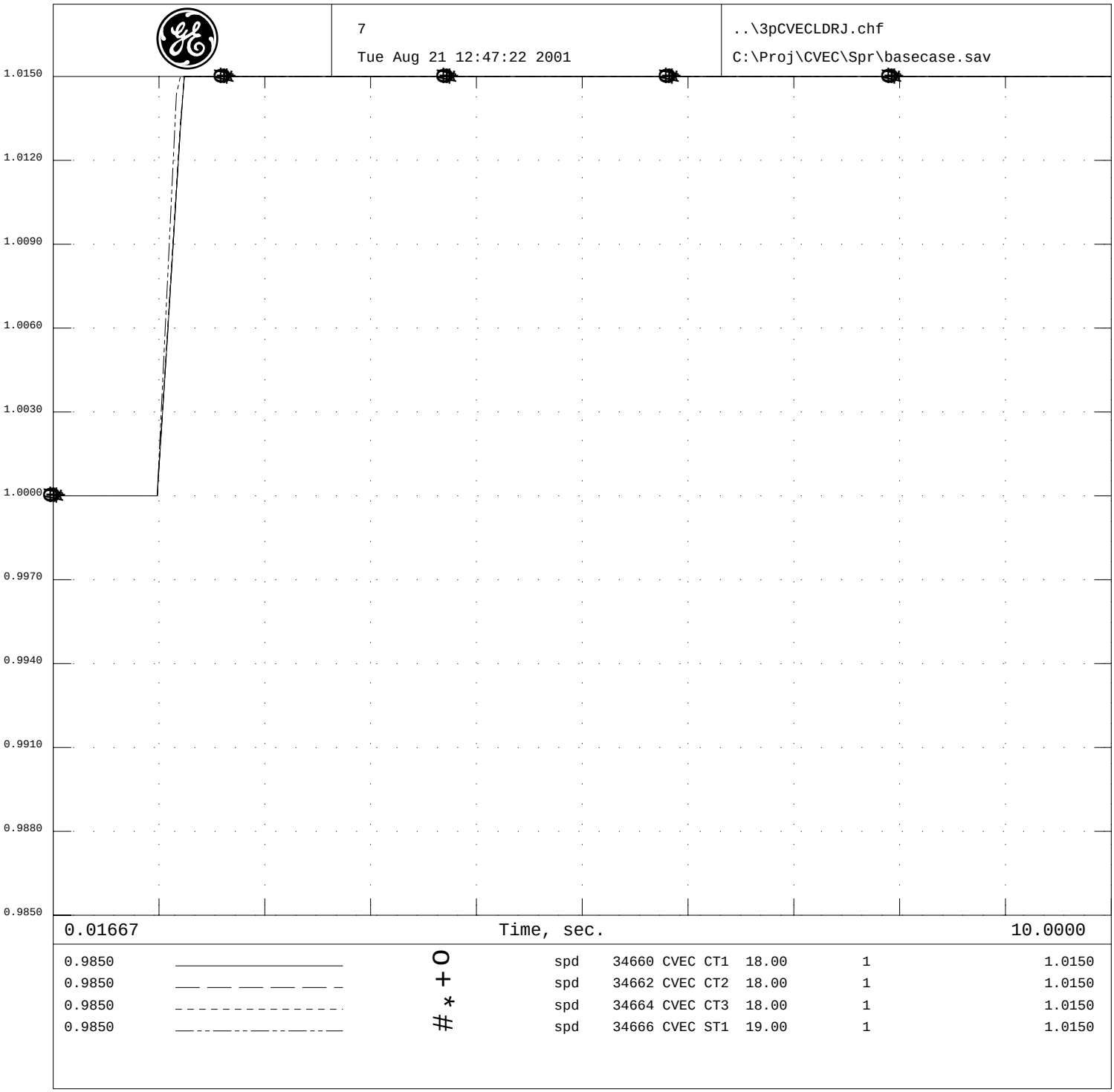
Calpine Corporation
Project Generator Field Voltages



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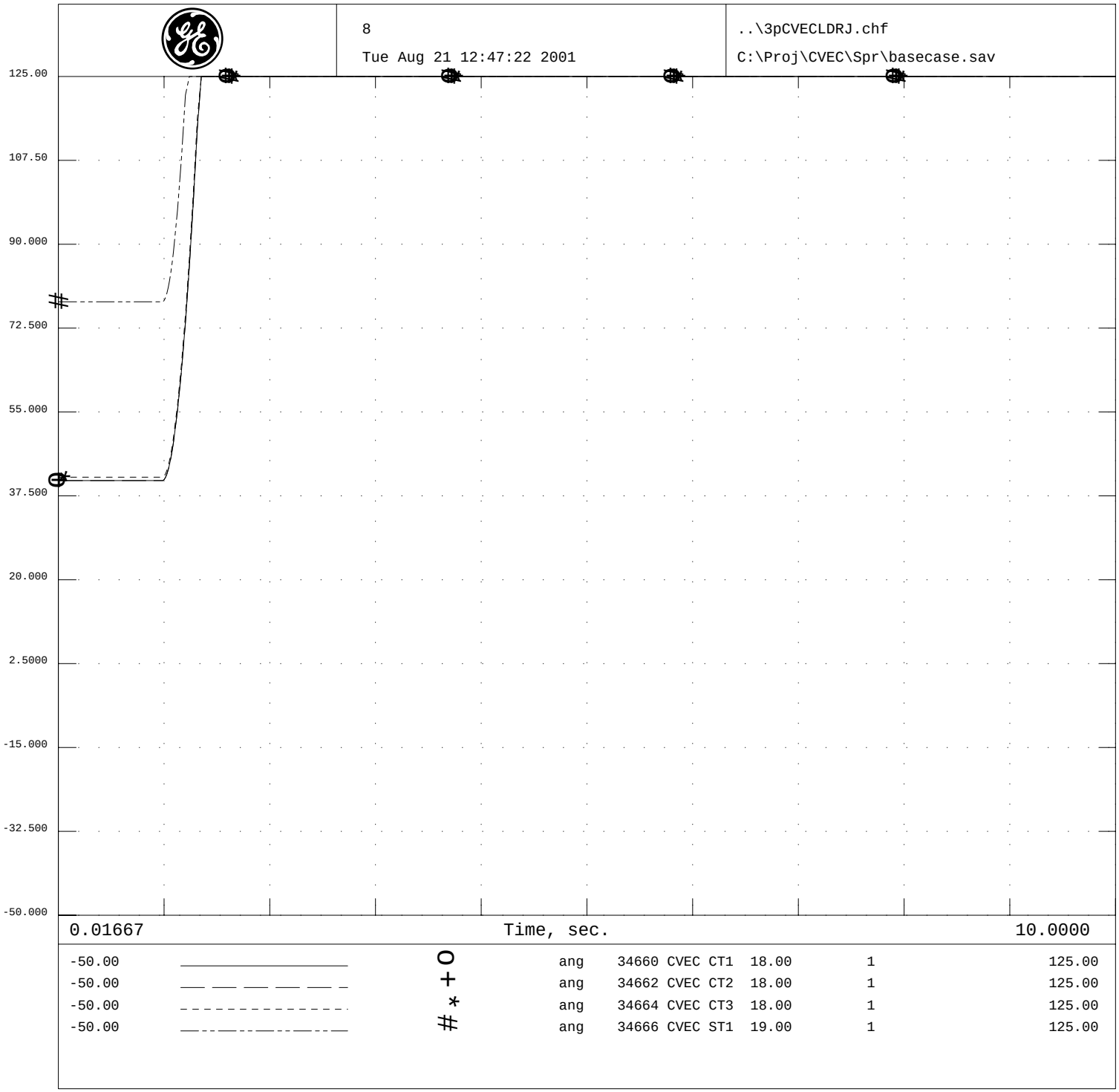
Calpine Corporation
Project Generator Rotor Speed



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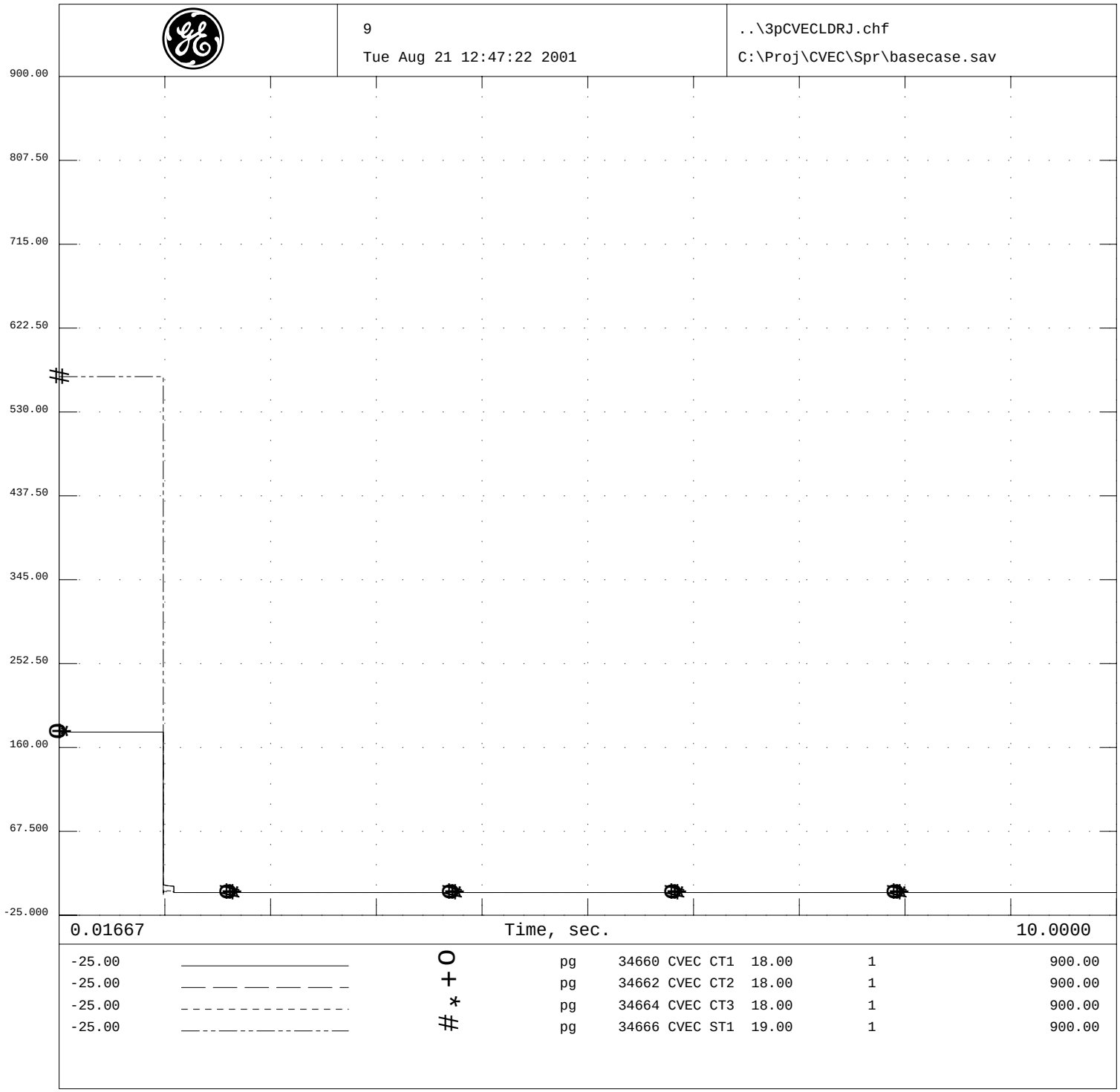
Calpine Corporation
Project Generator Rotor Angle



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Calpine Corporation
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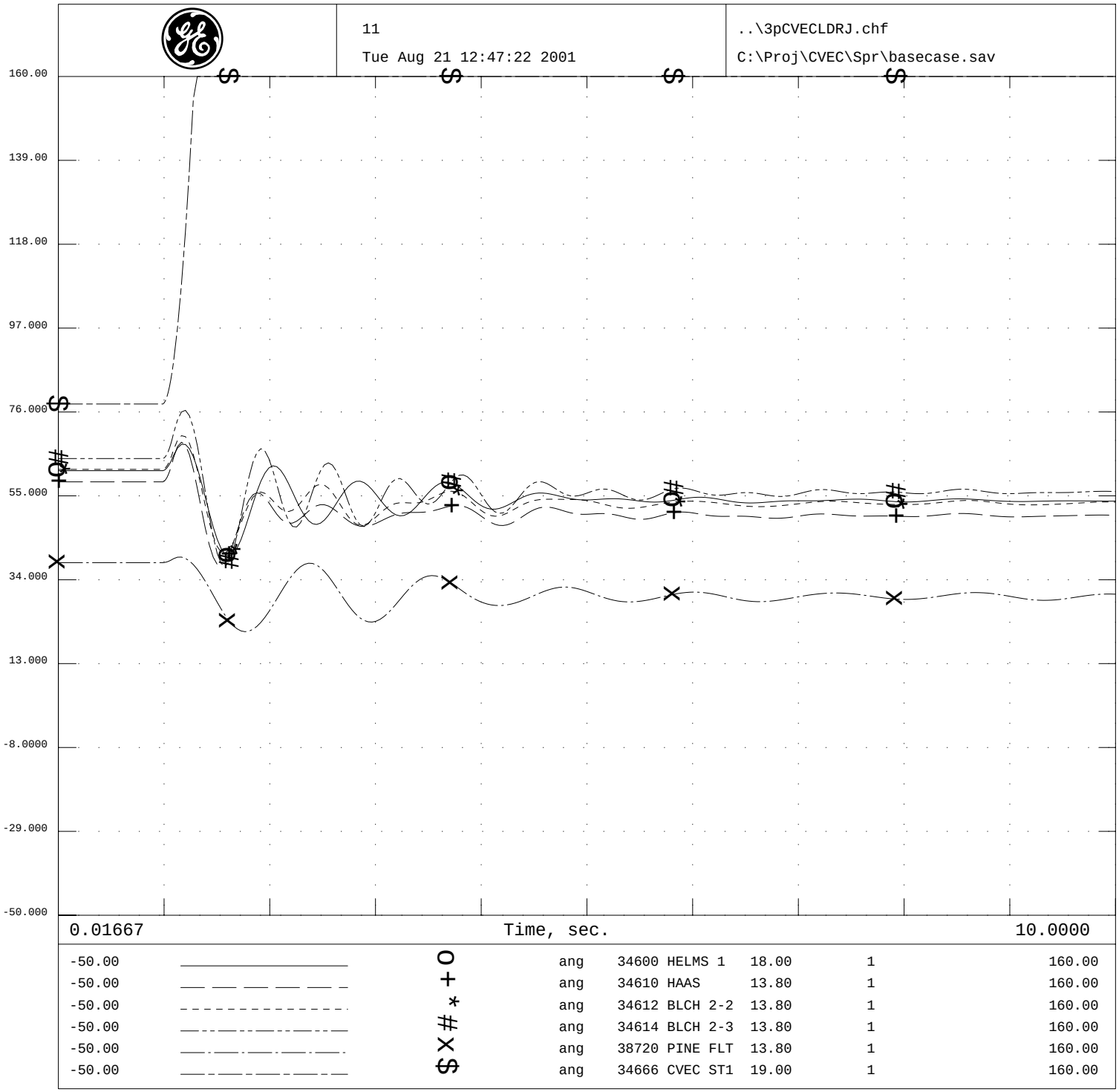

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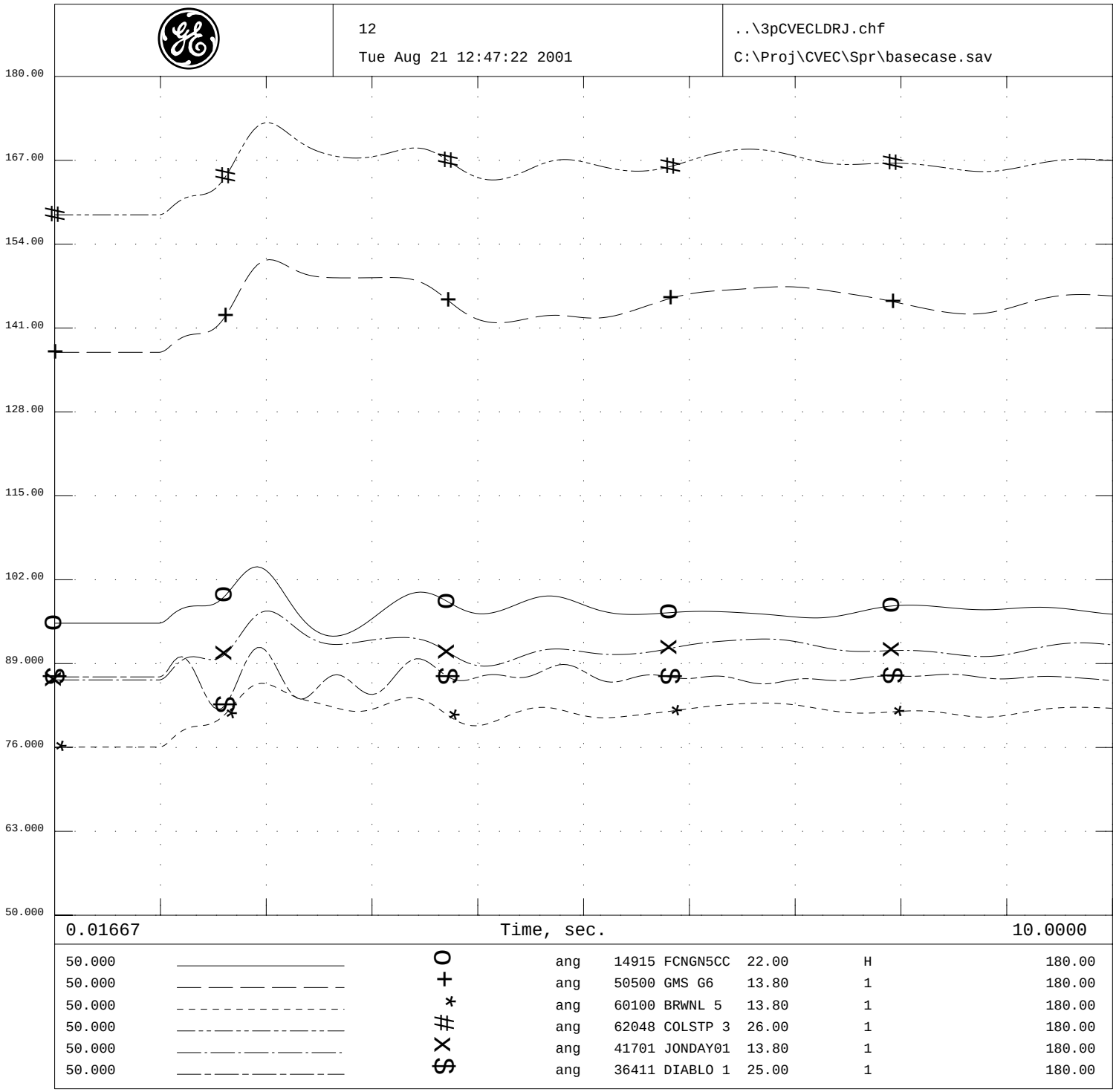
Calpine Corporation
Selected Local Rotor Angle Plots



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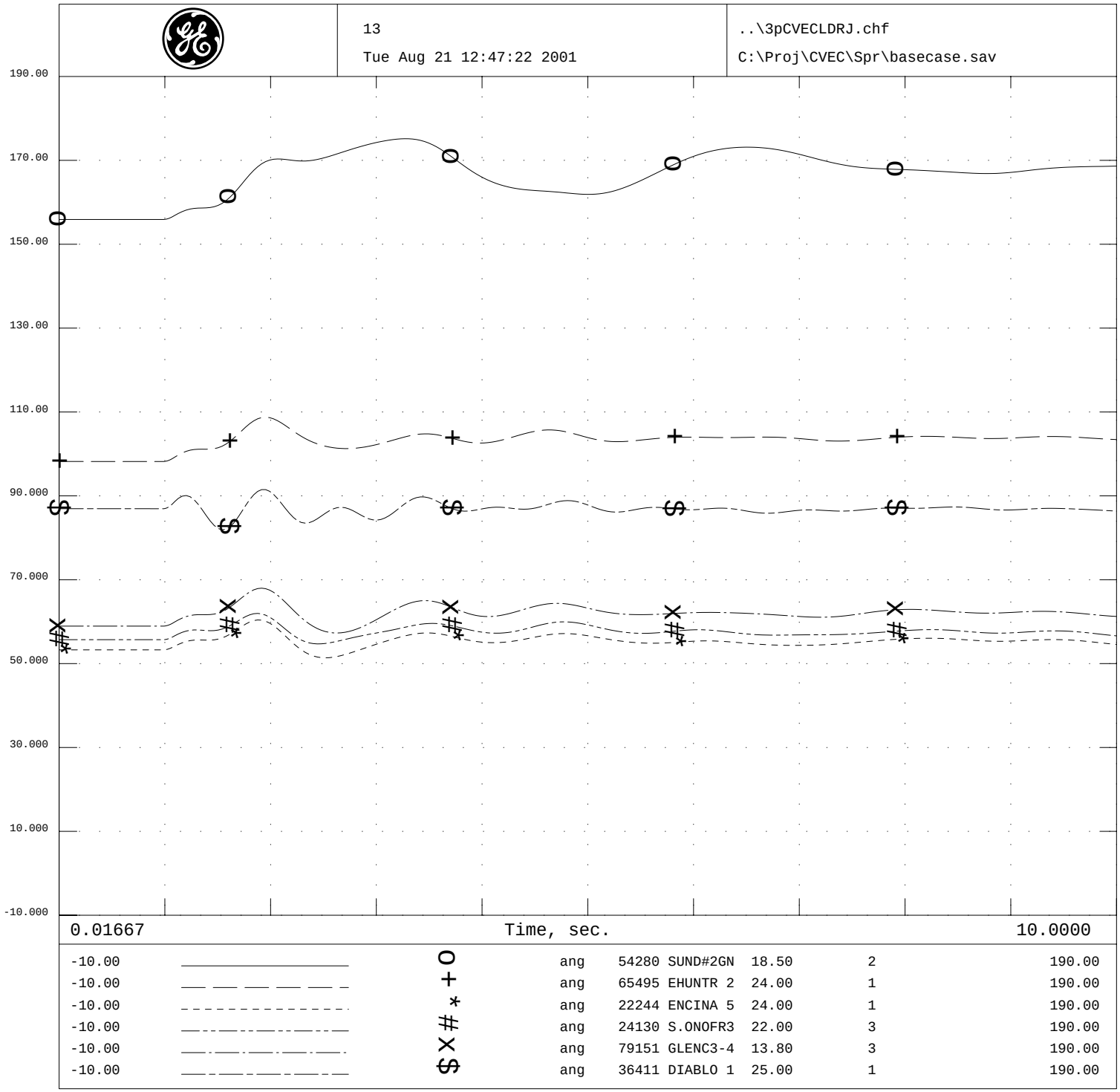

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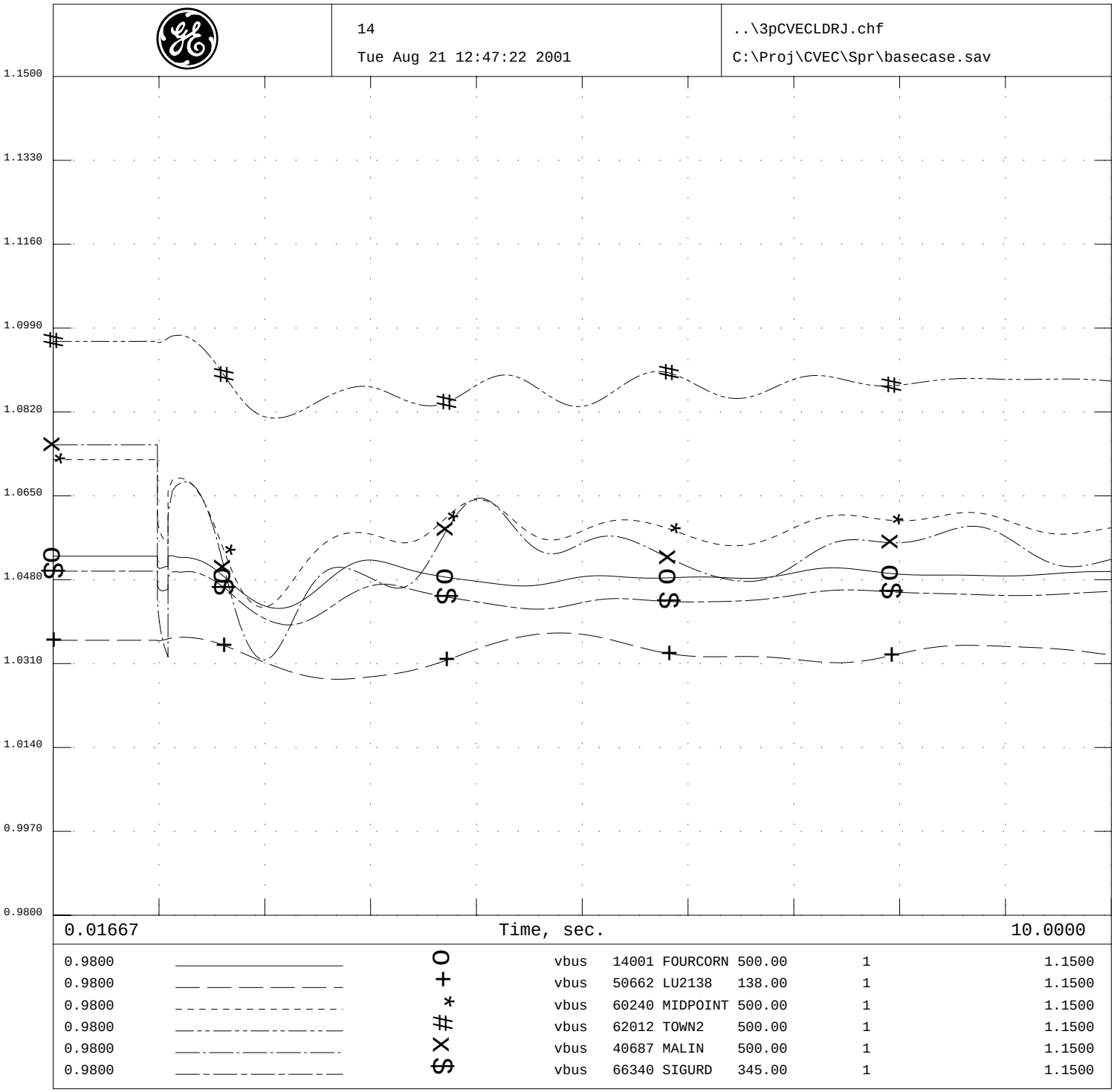

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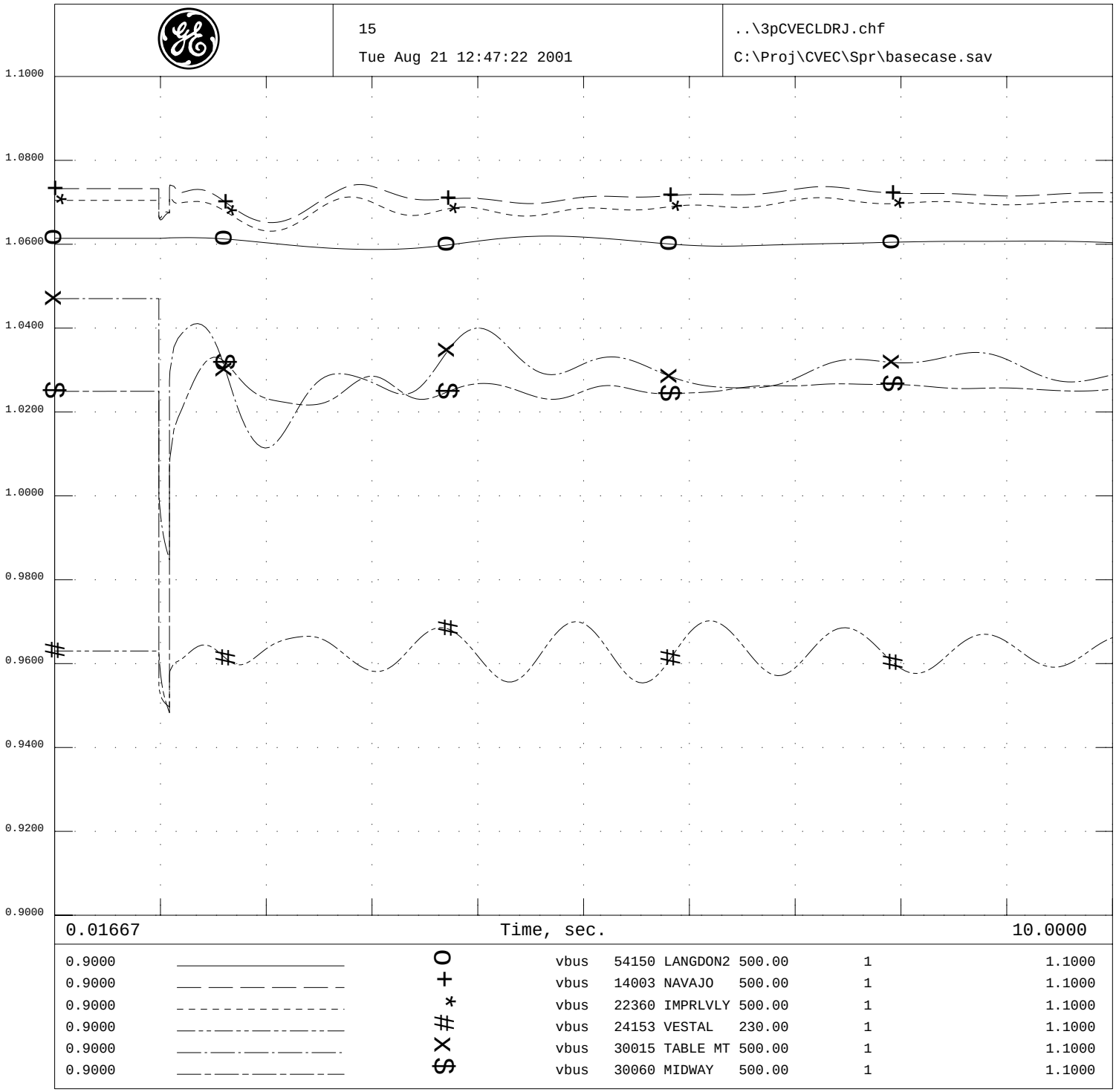

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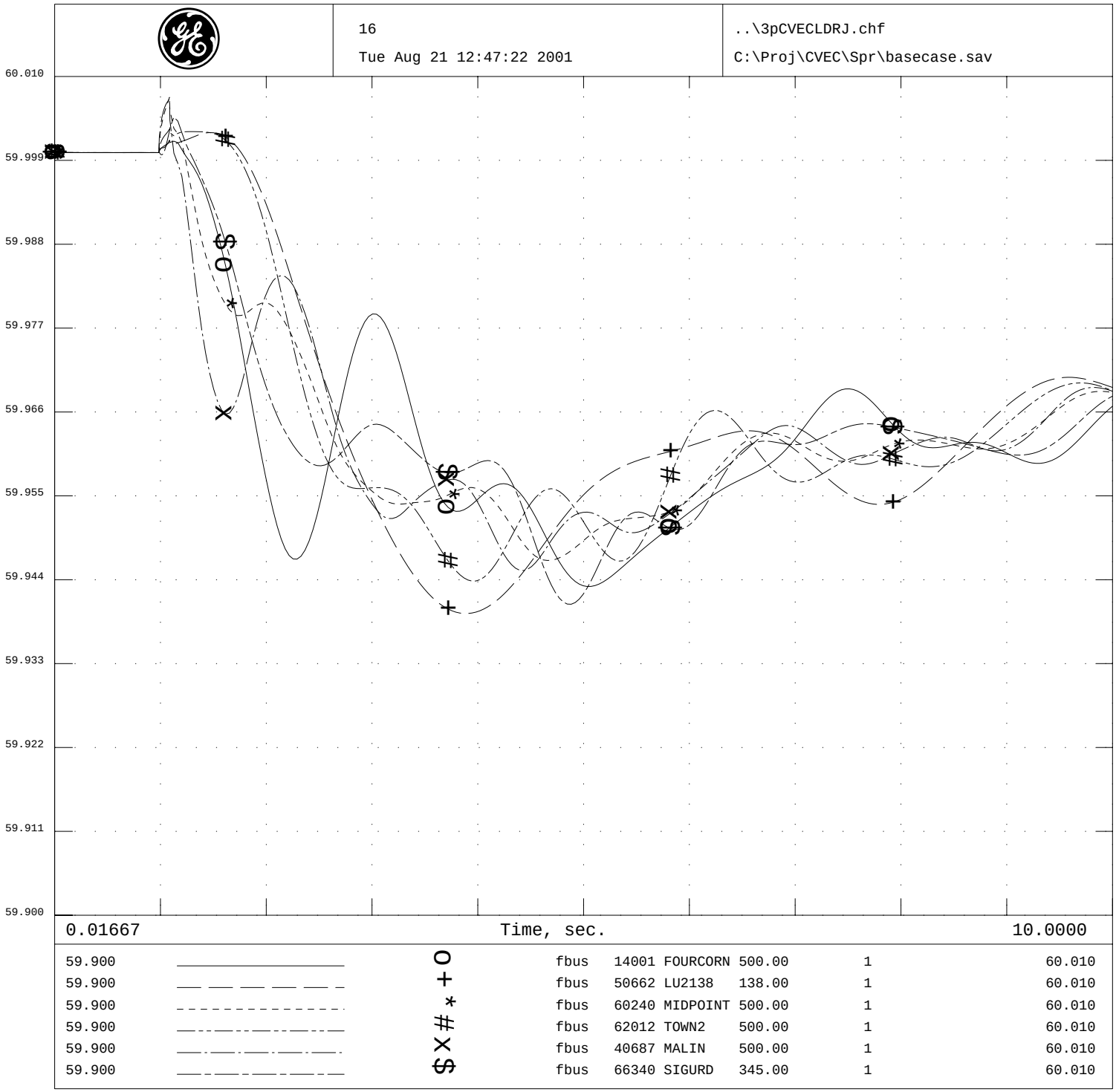

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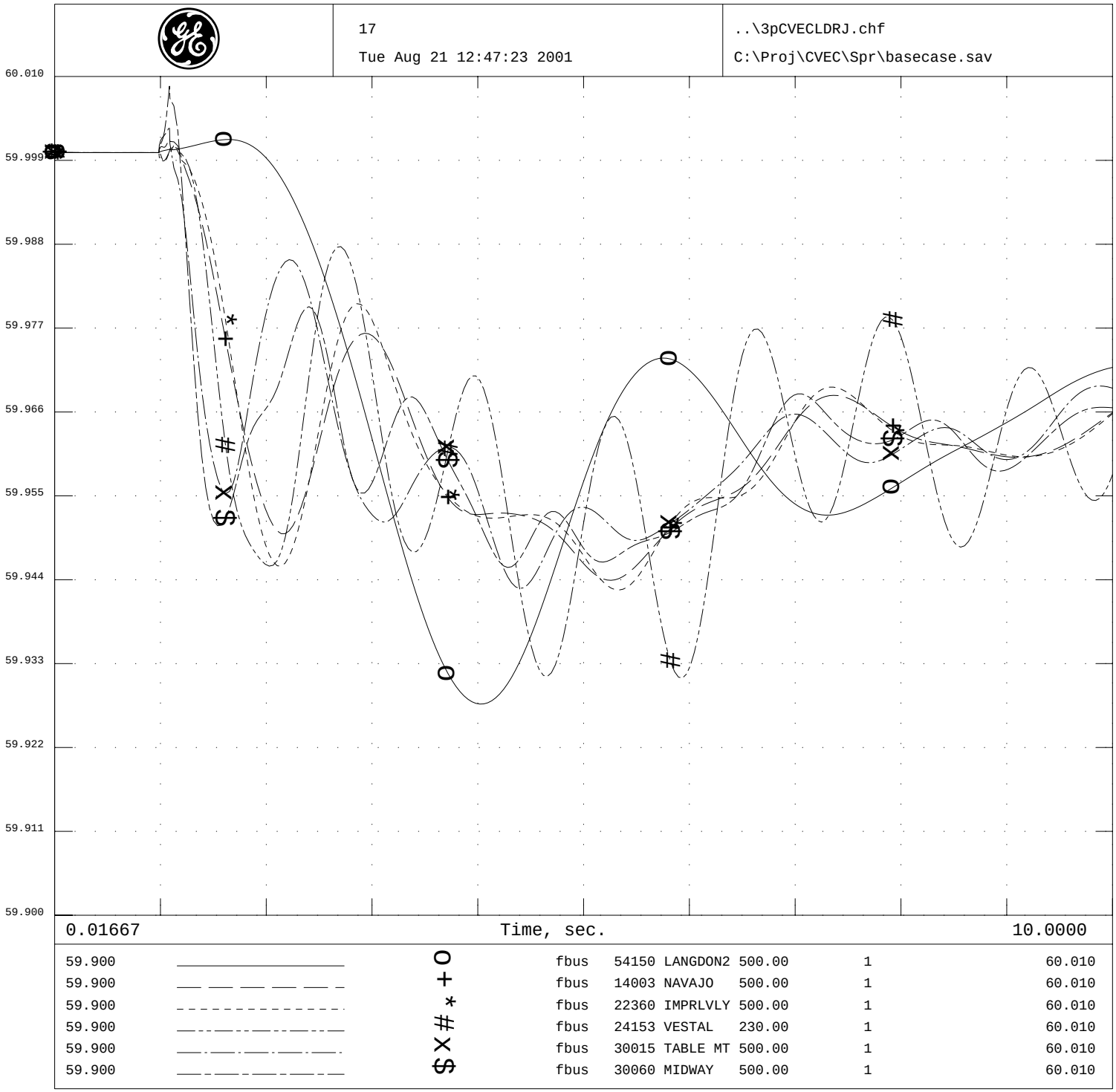

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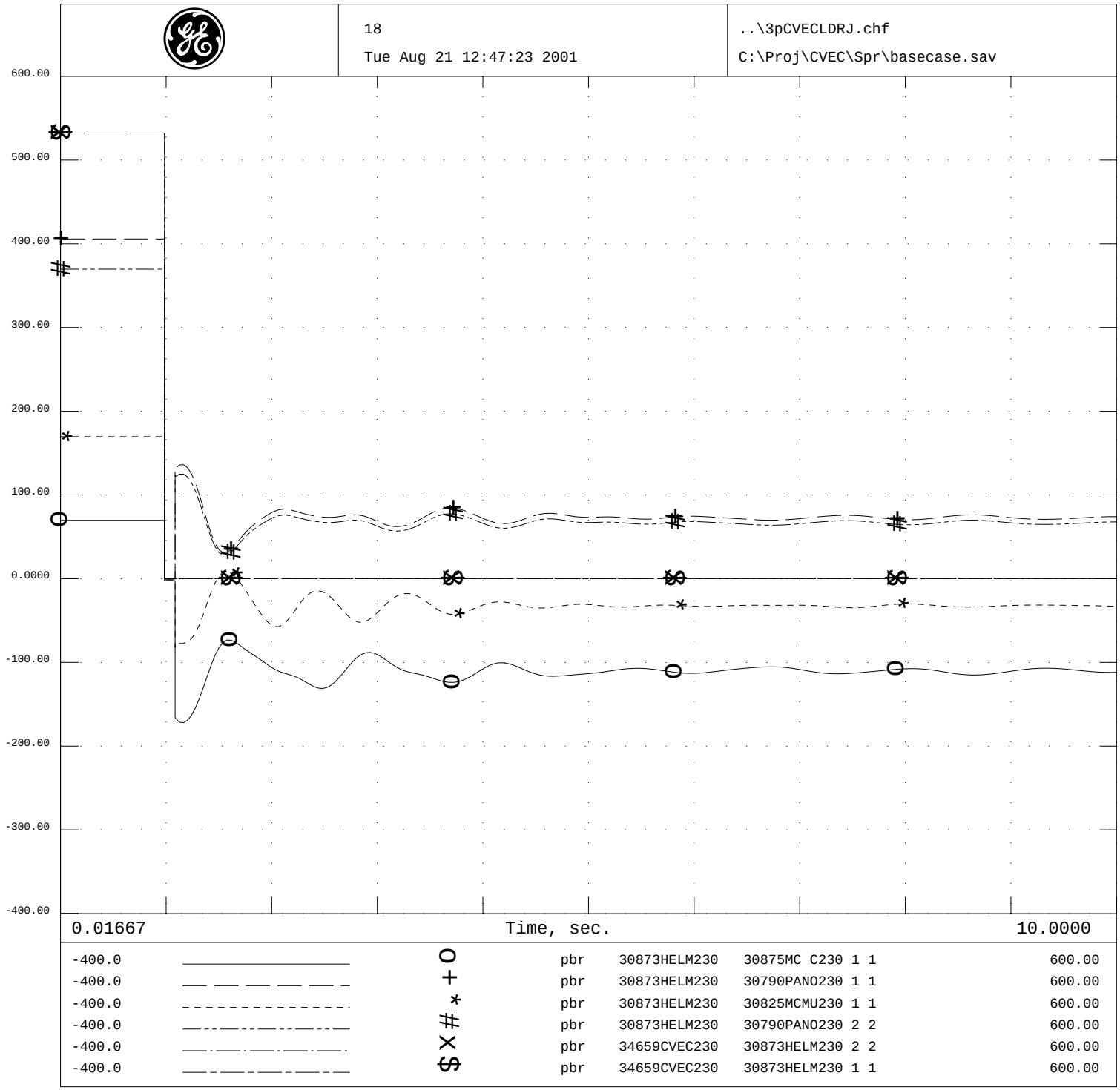

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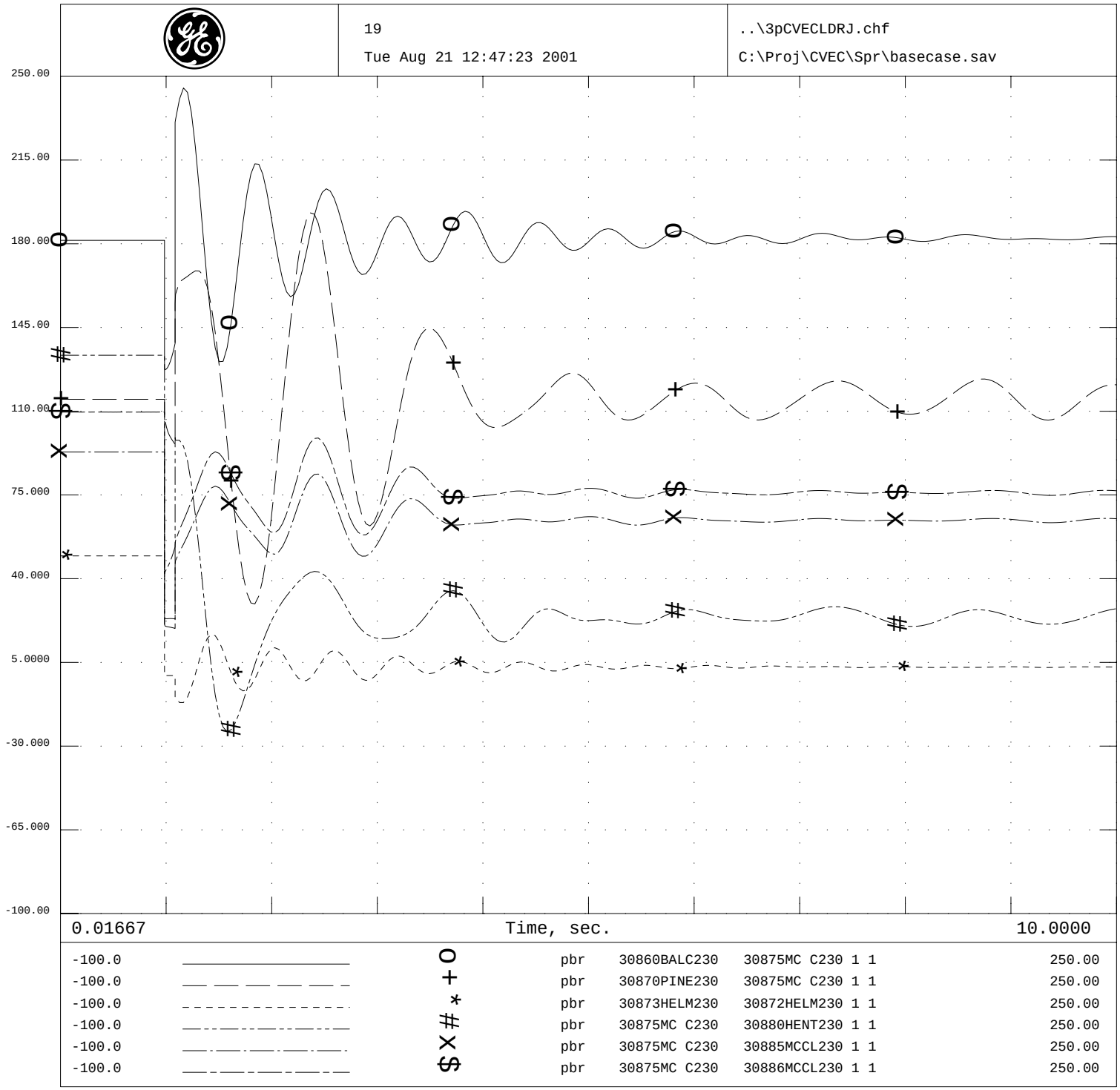

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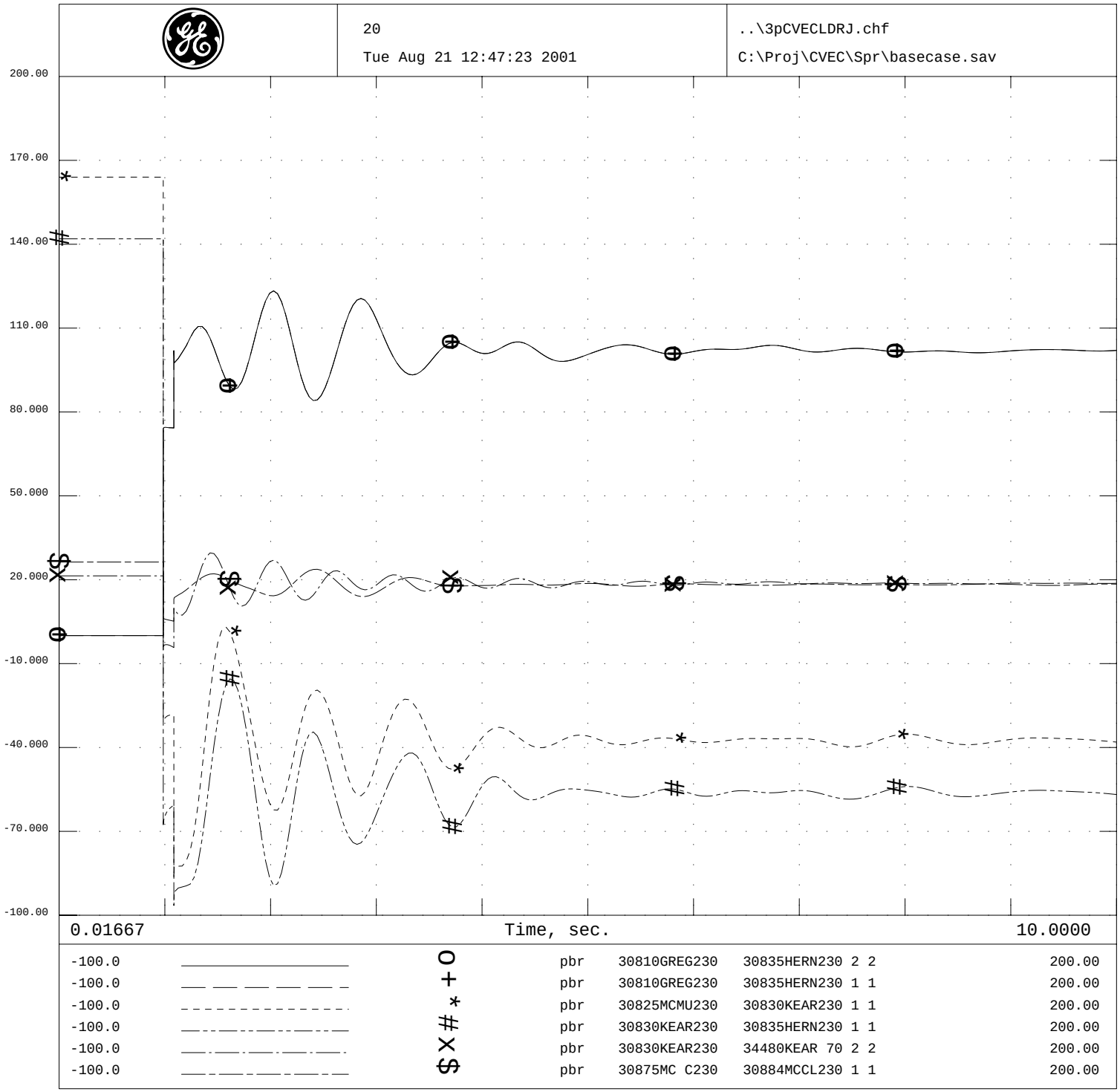

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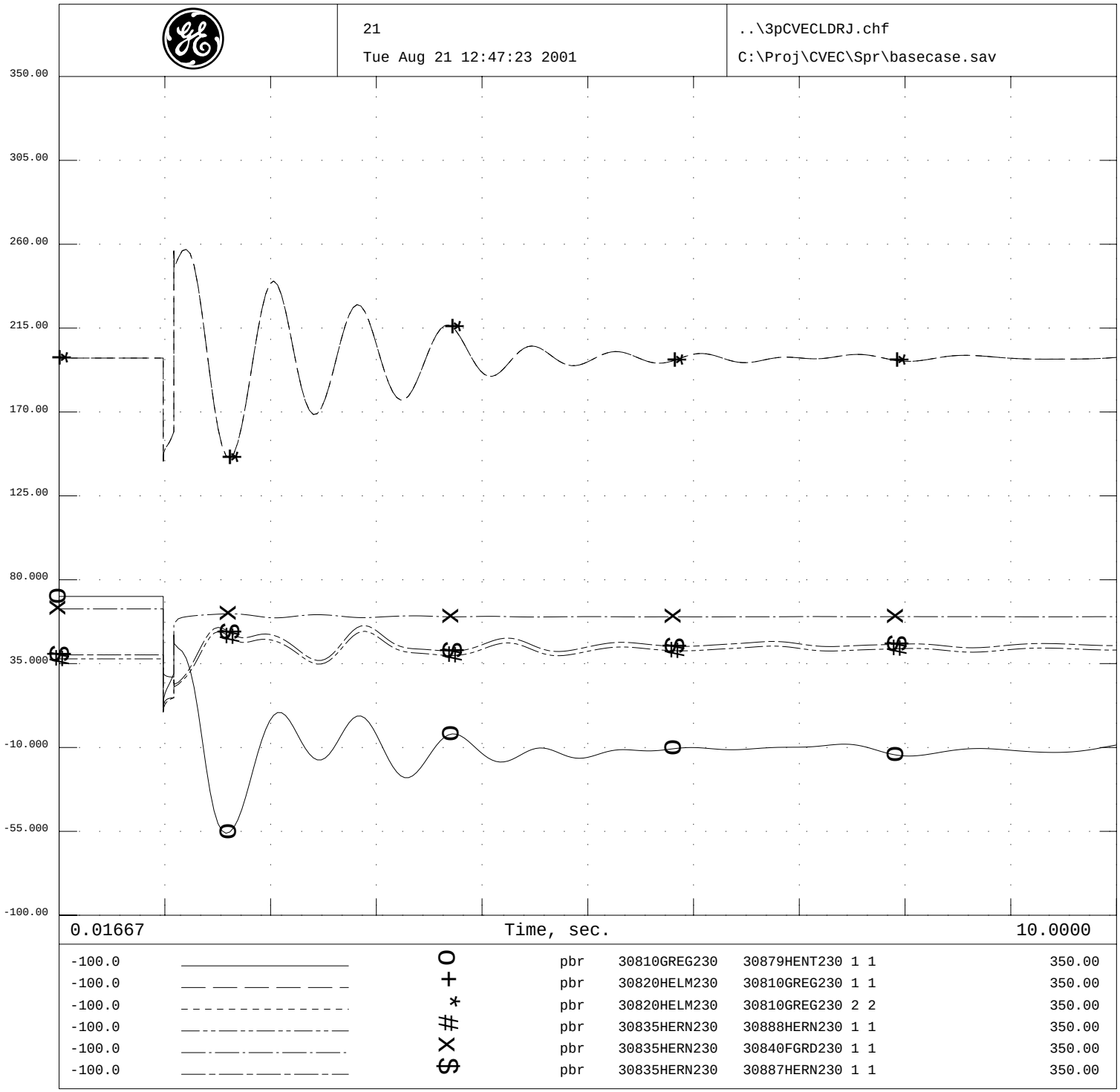

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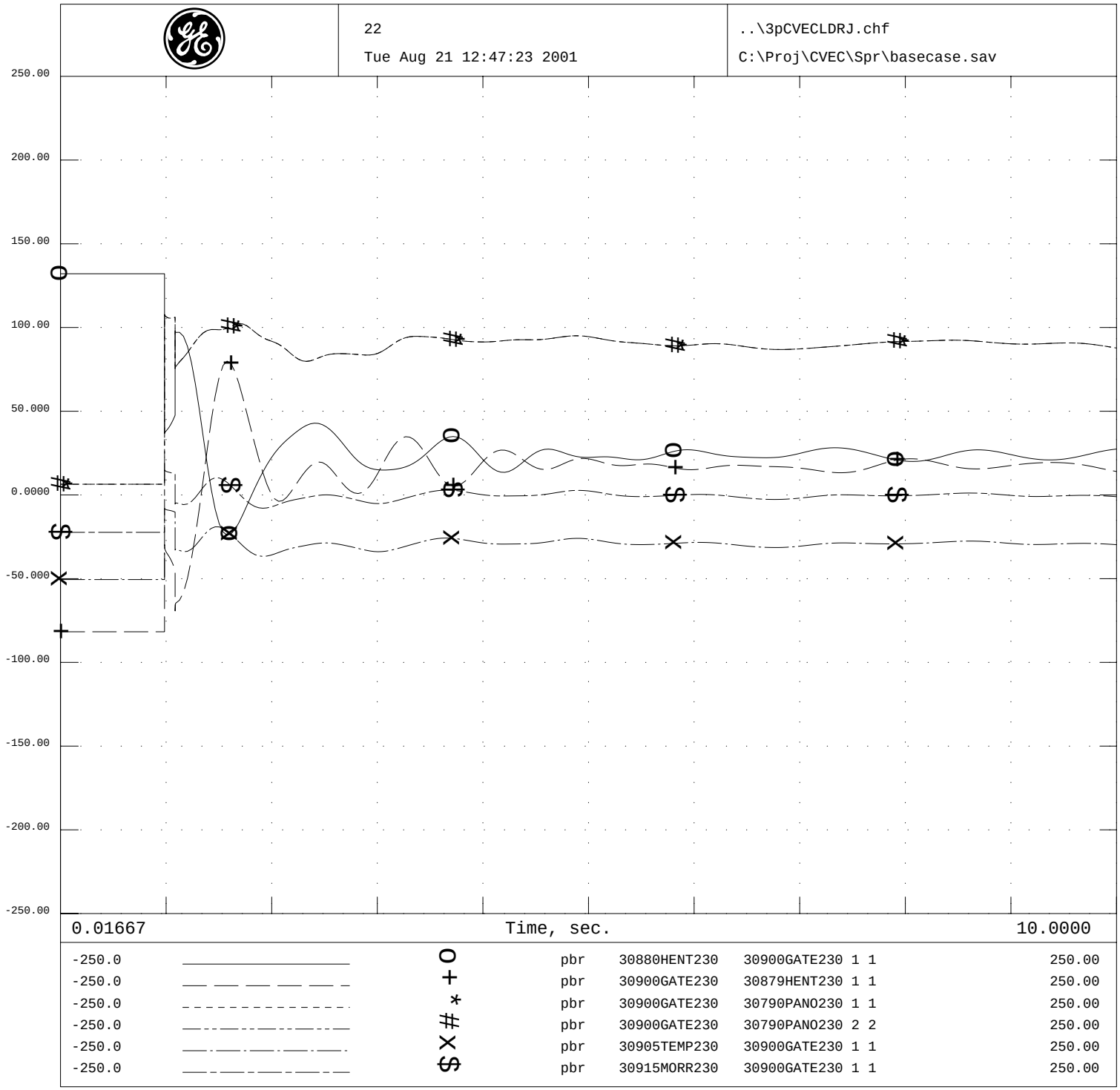

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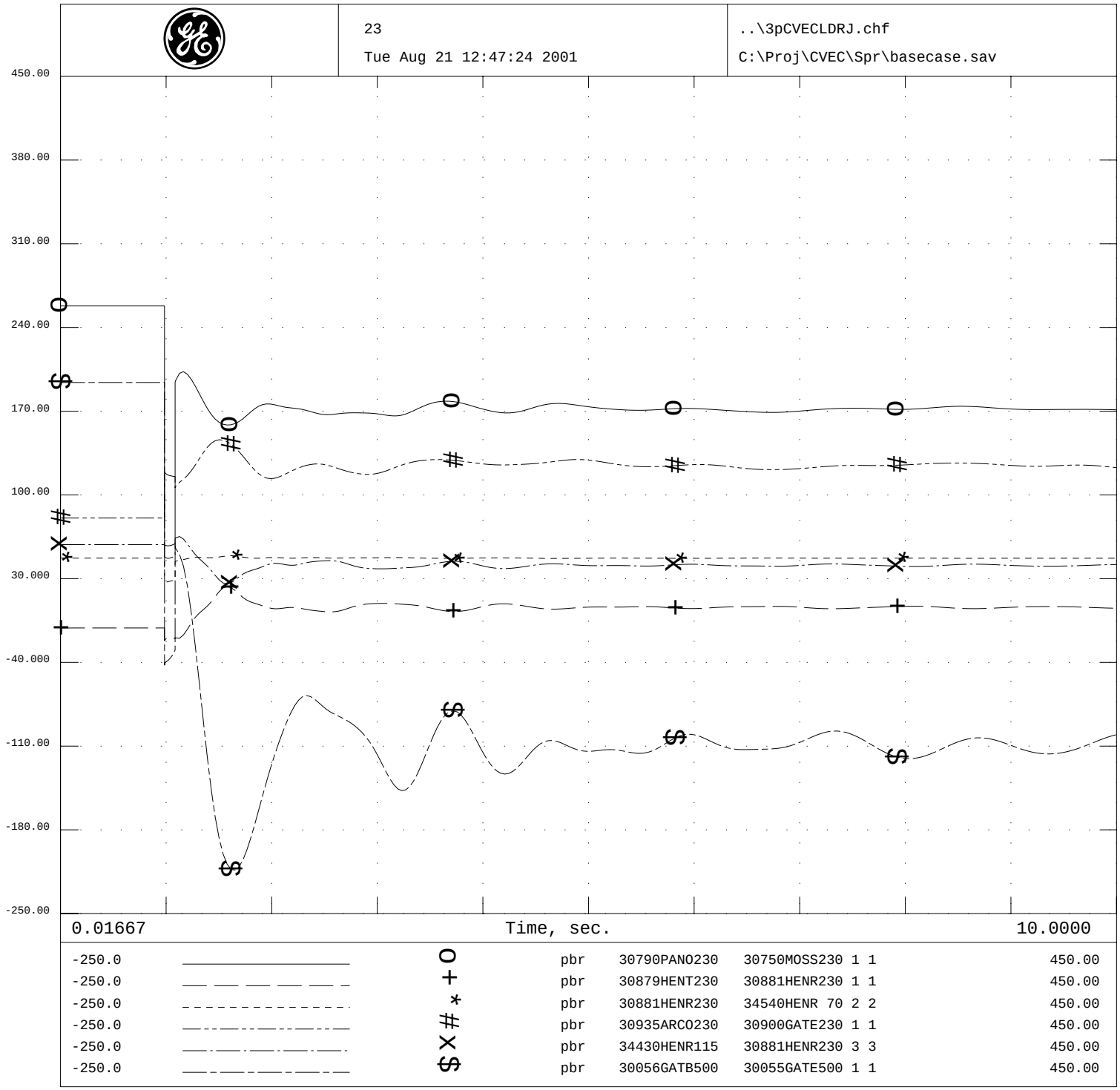

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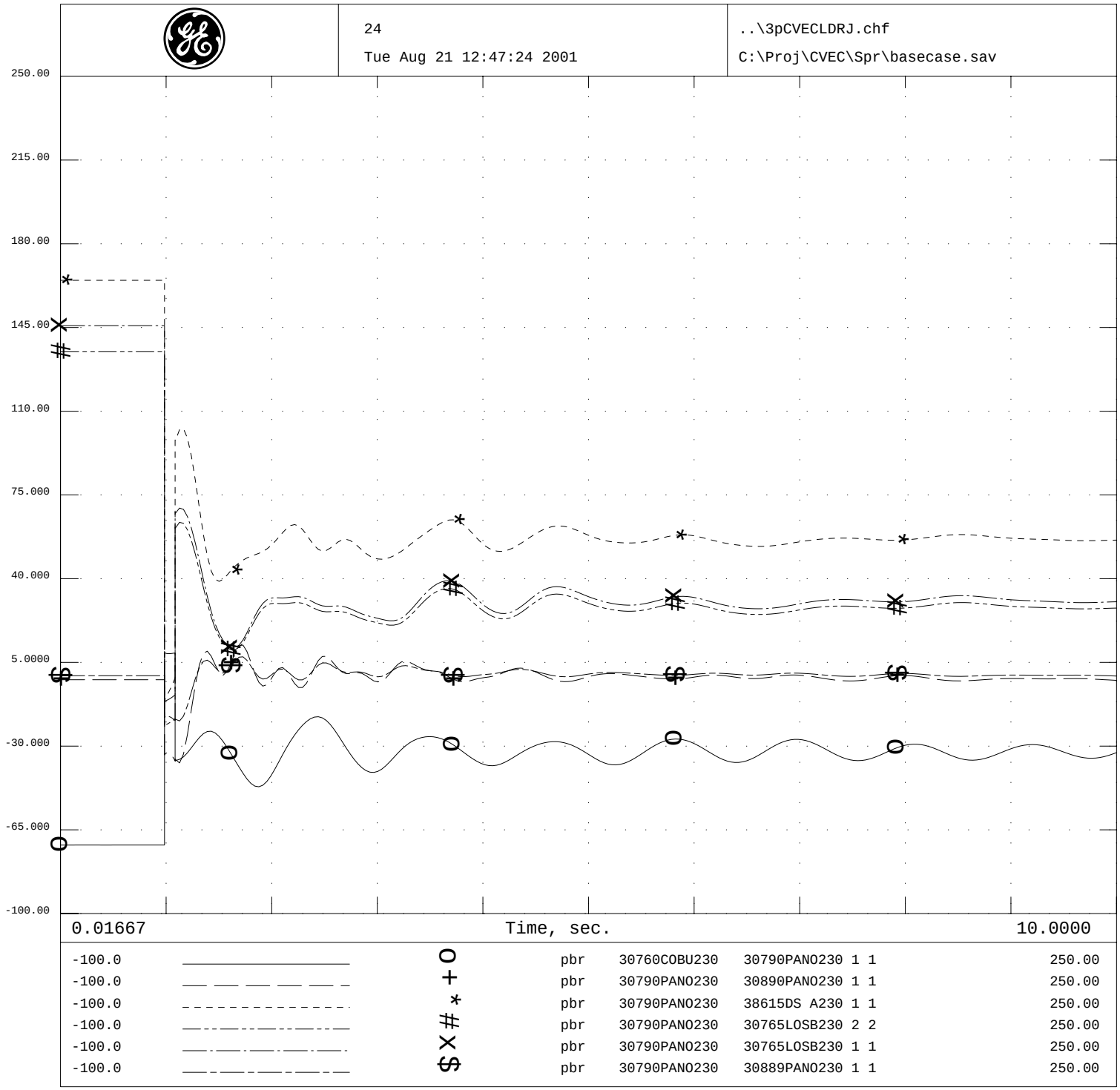

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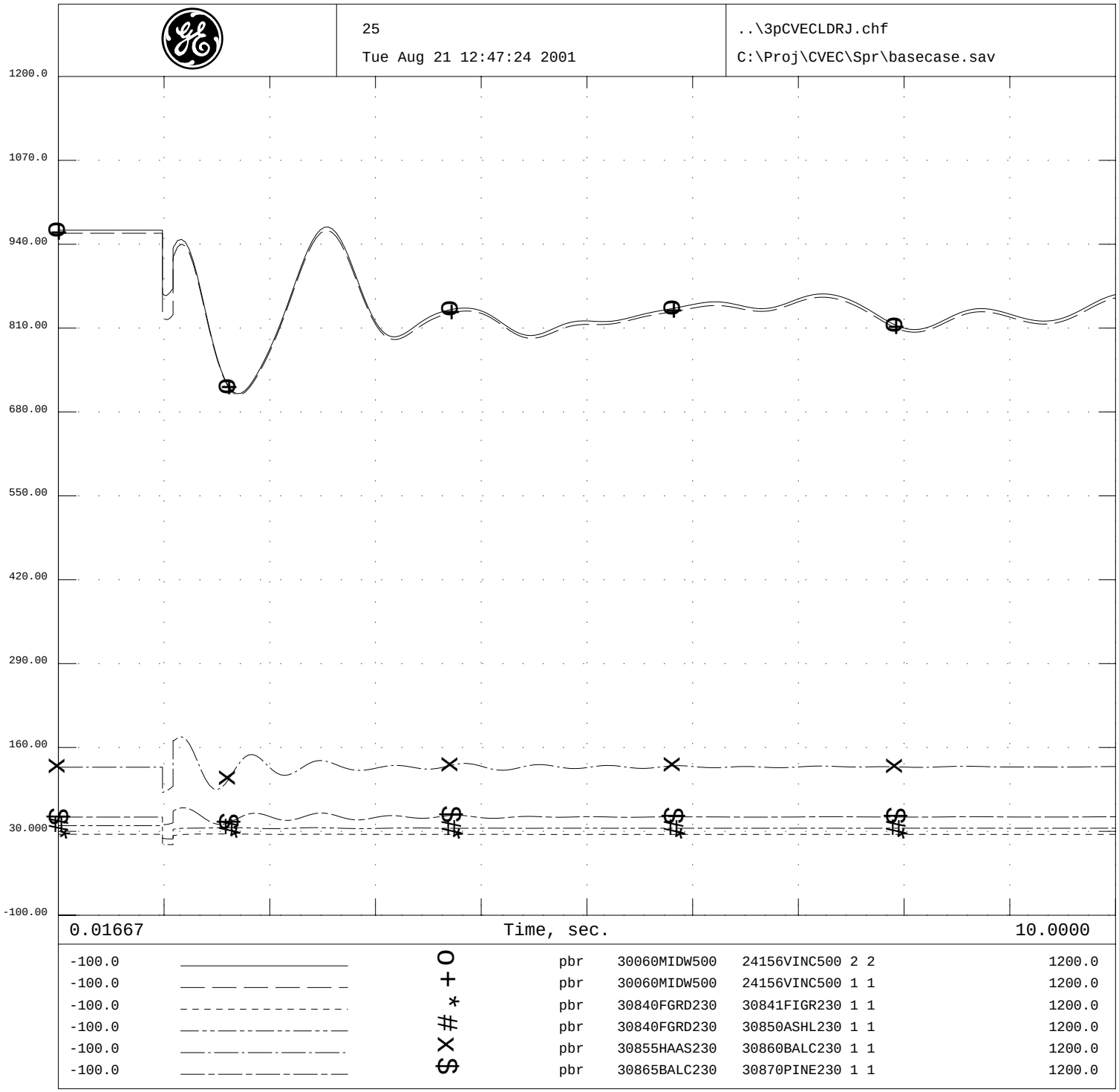

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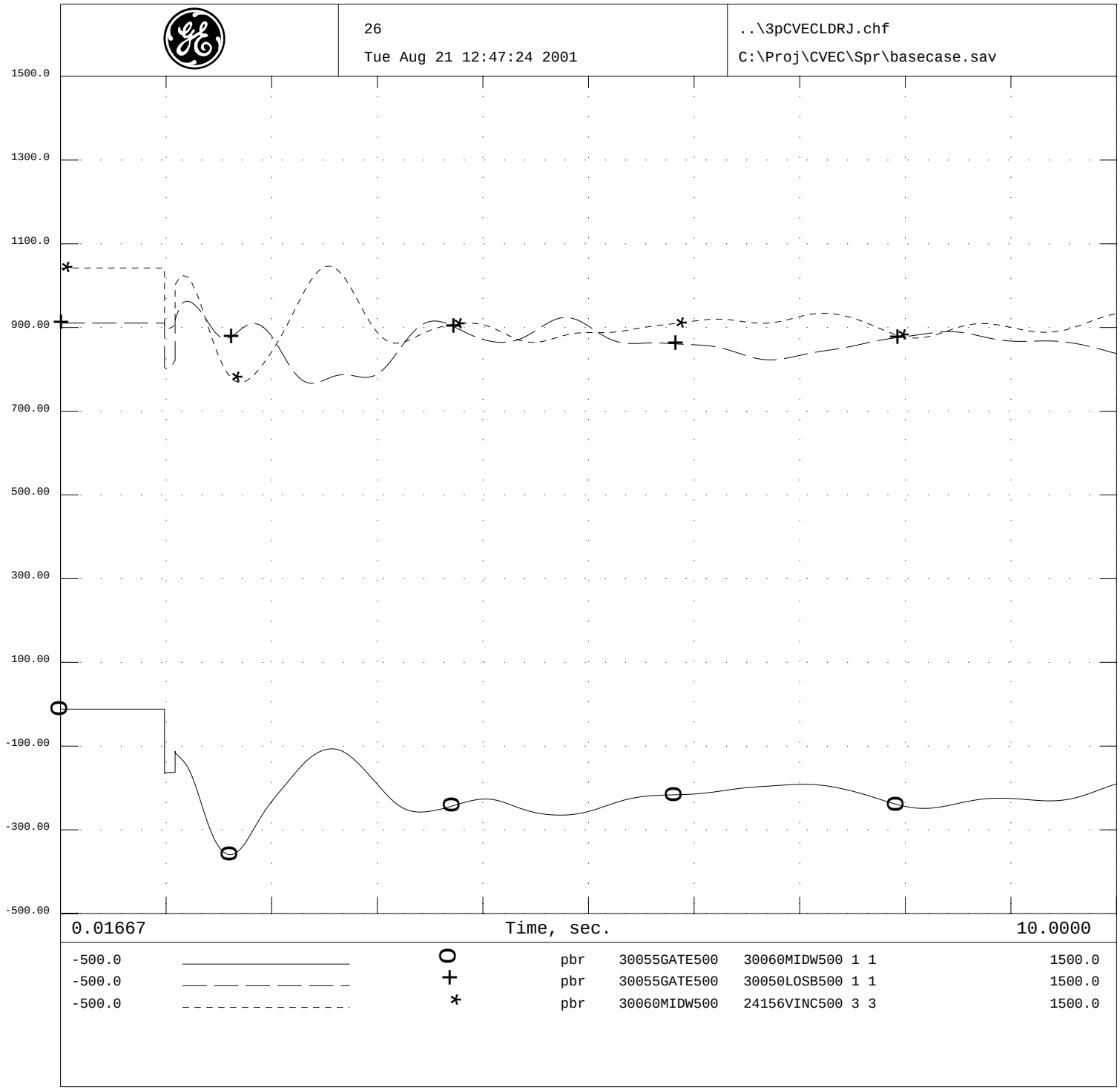

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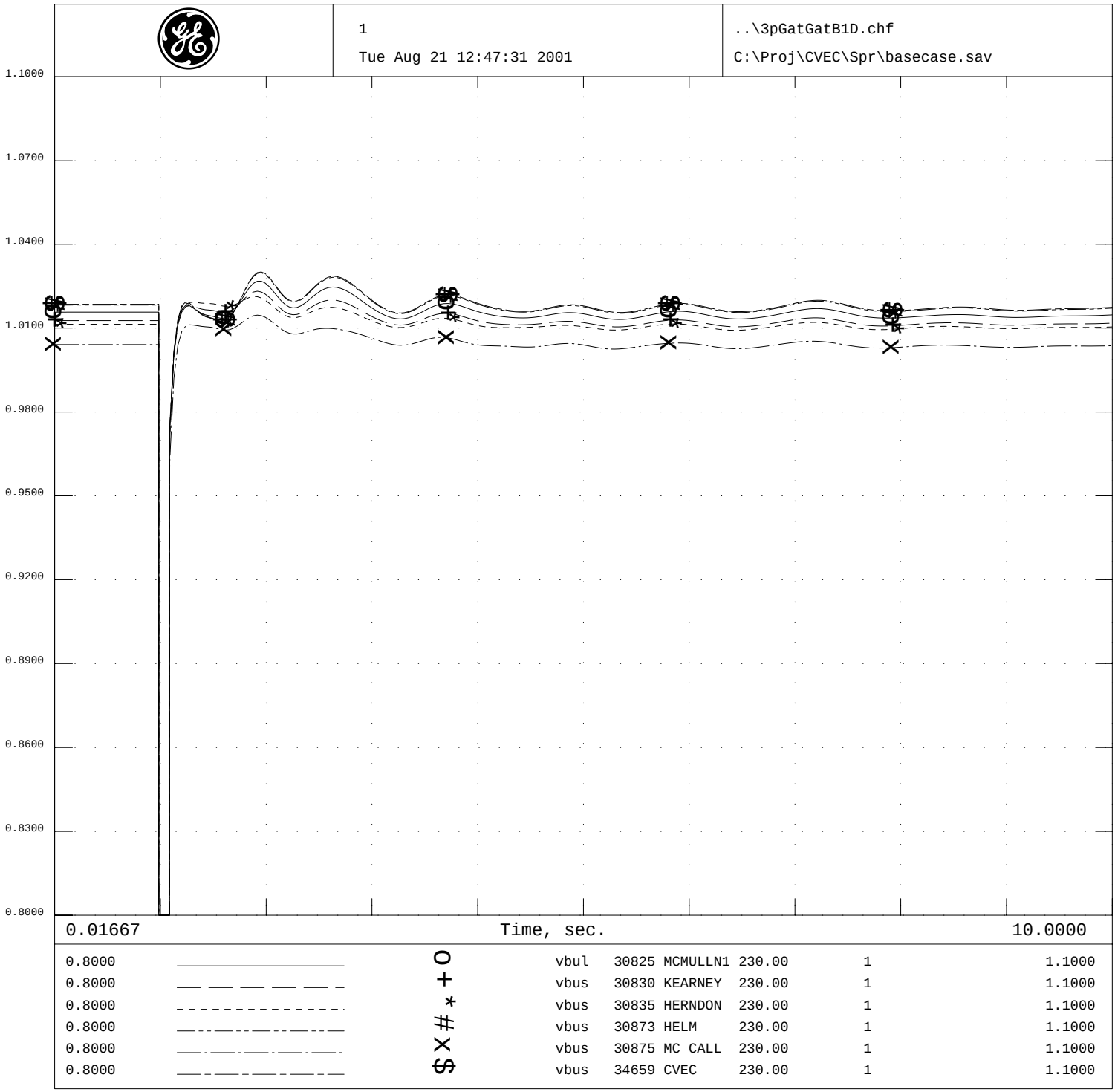

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2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates 230kV Bus 1D Outage
3 phase 6 cycle fault at Gates 230kV bus and clear bus 1D

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Calpine Corporation
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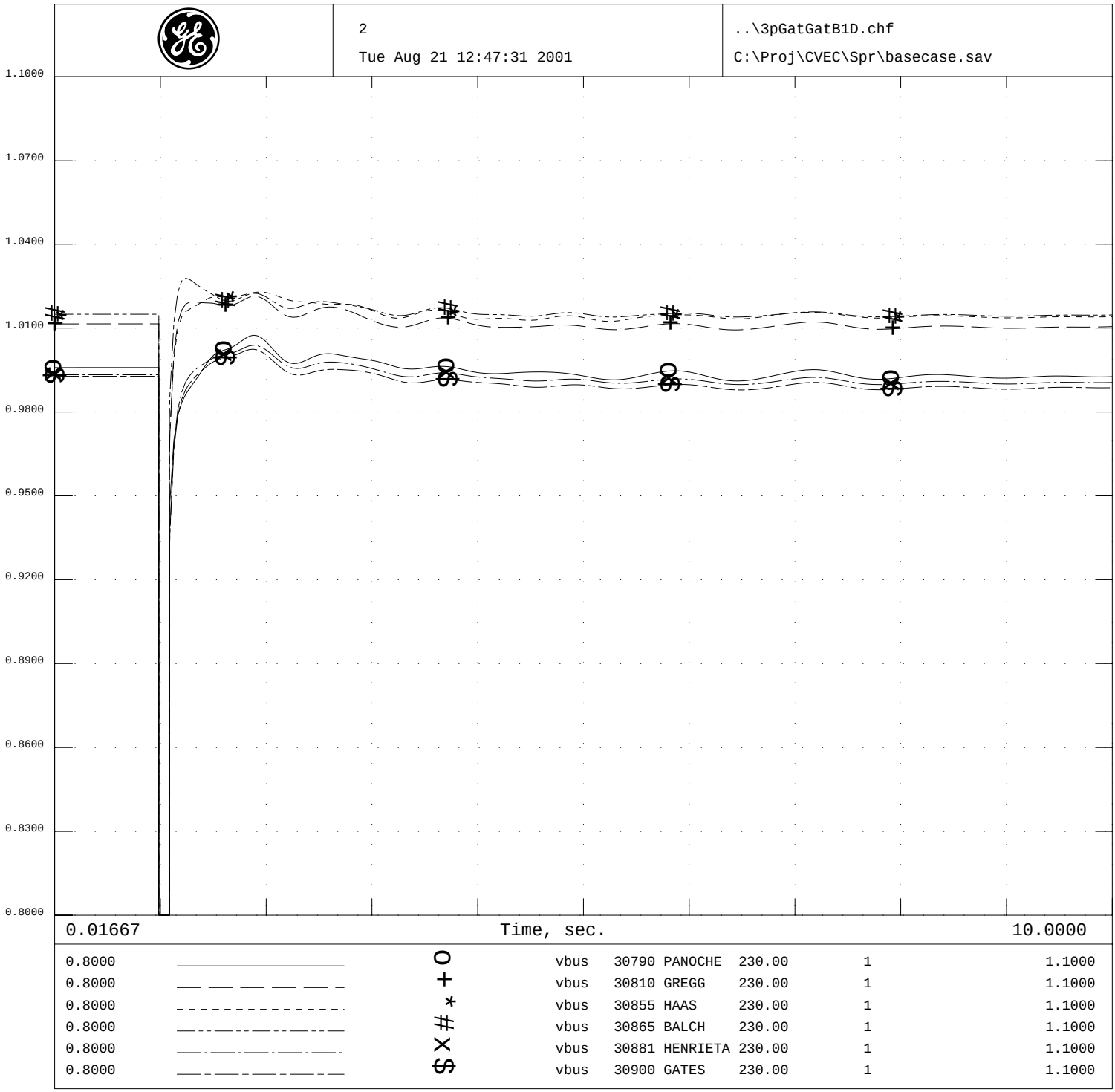

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Calpine Corporation
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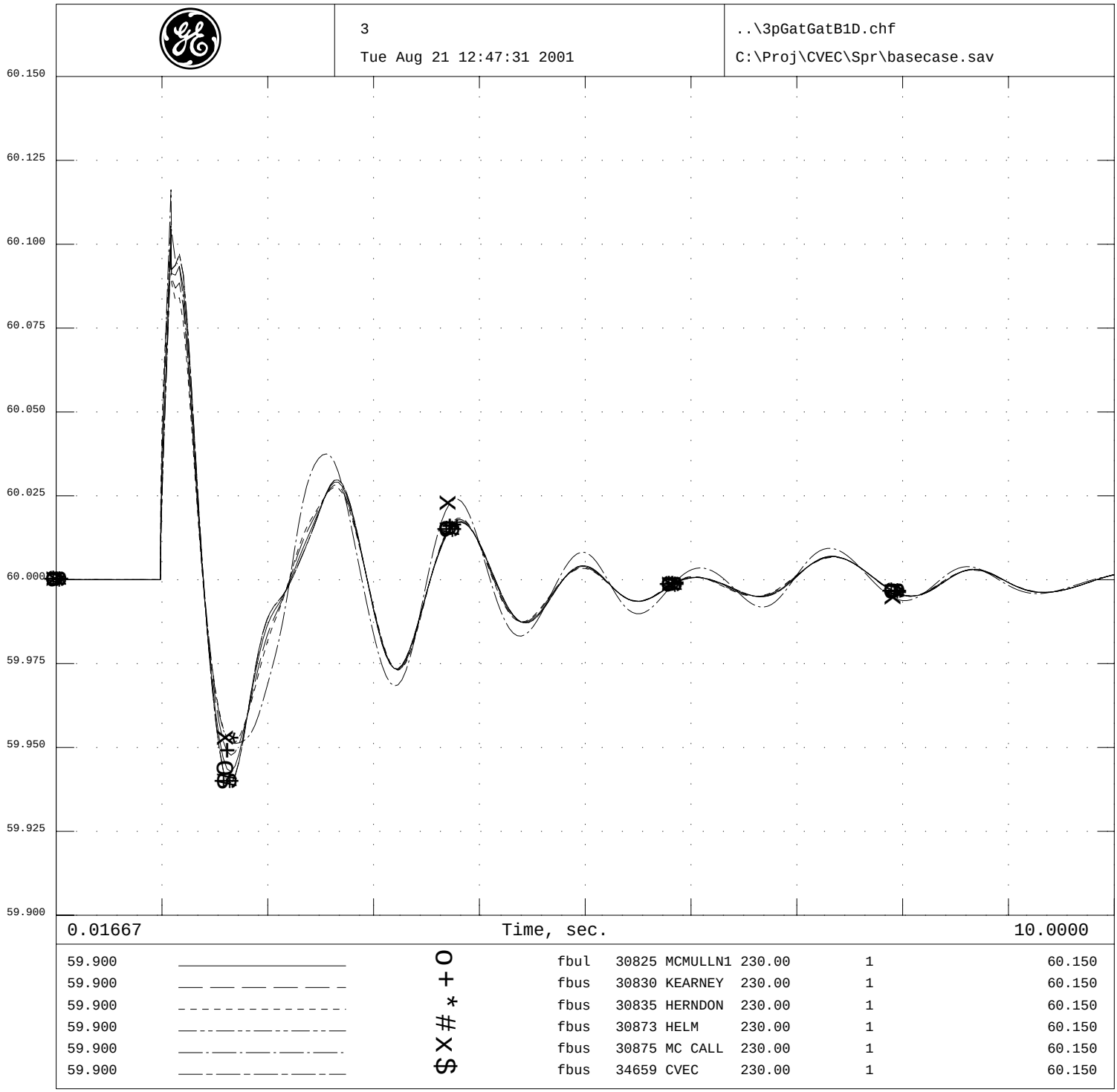
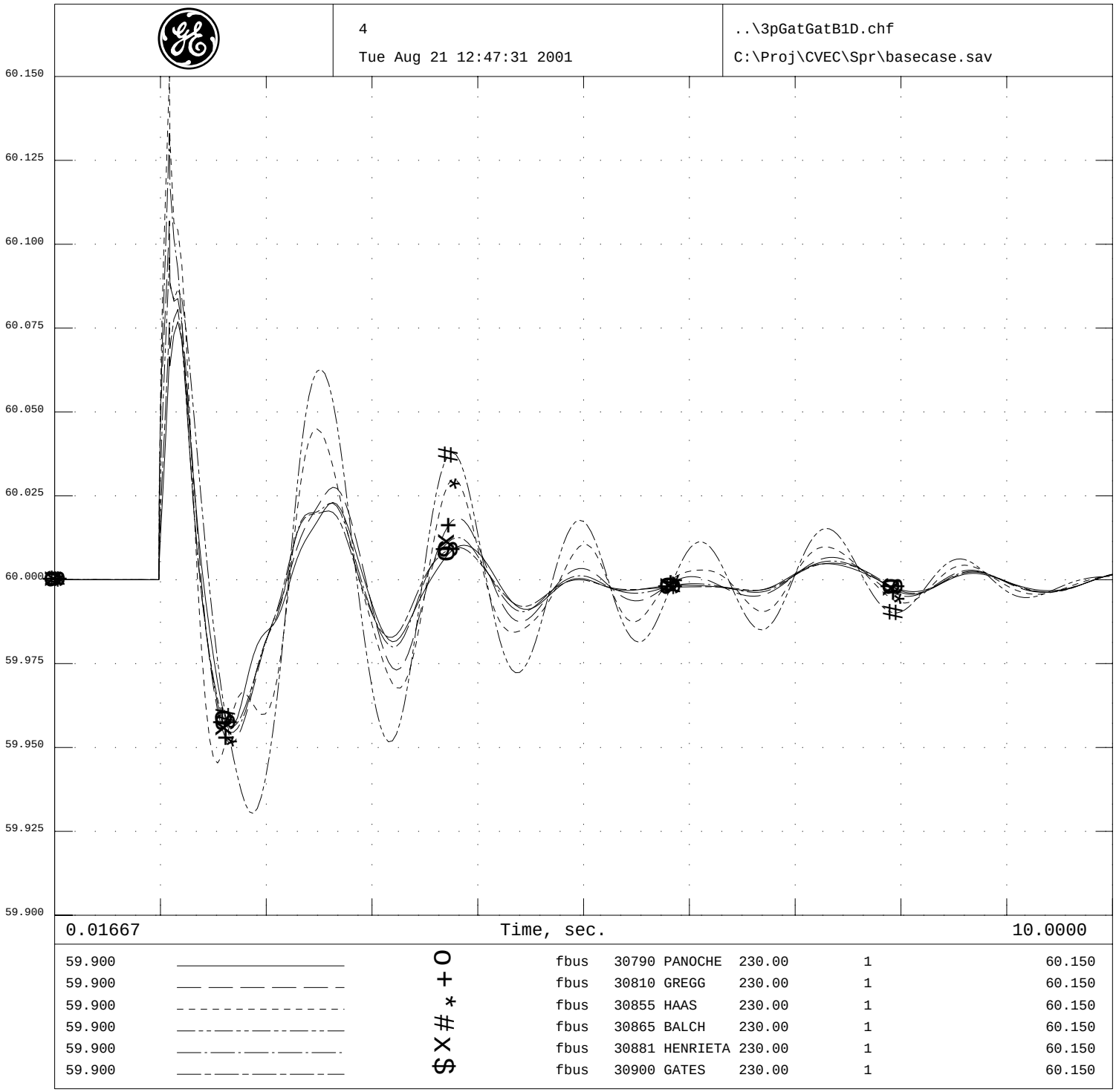


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates 230kV Bus 1D Outage
3 phase 6 cycle fault at Gates 230kV bus and clear bus 1D

Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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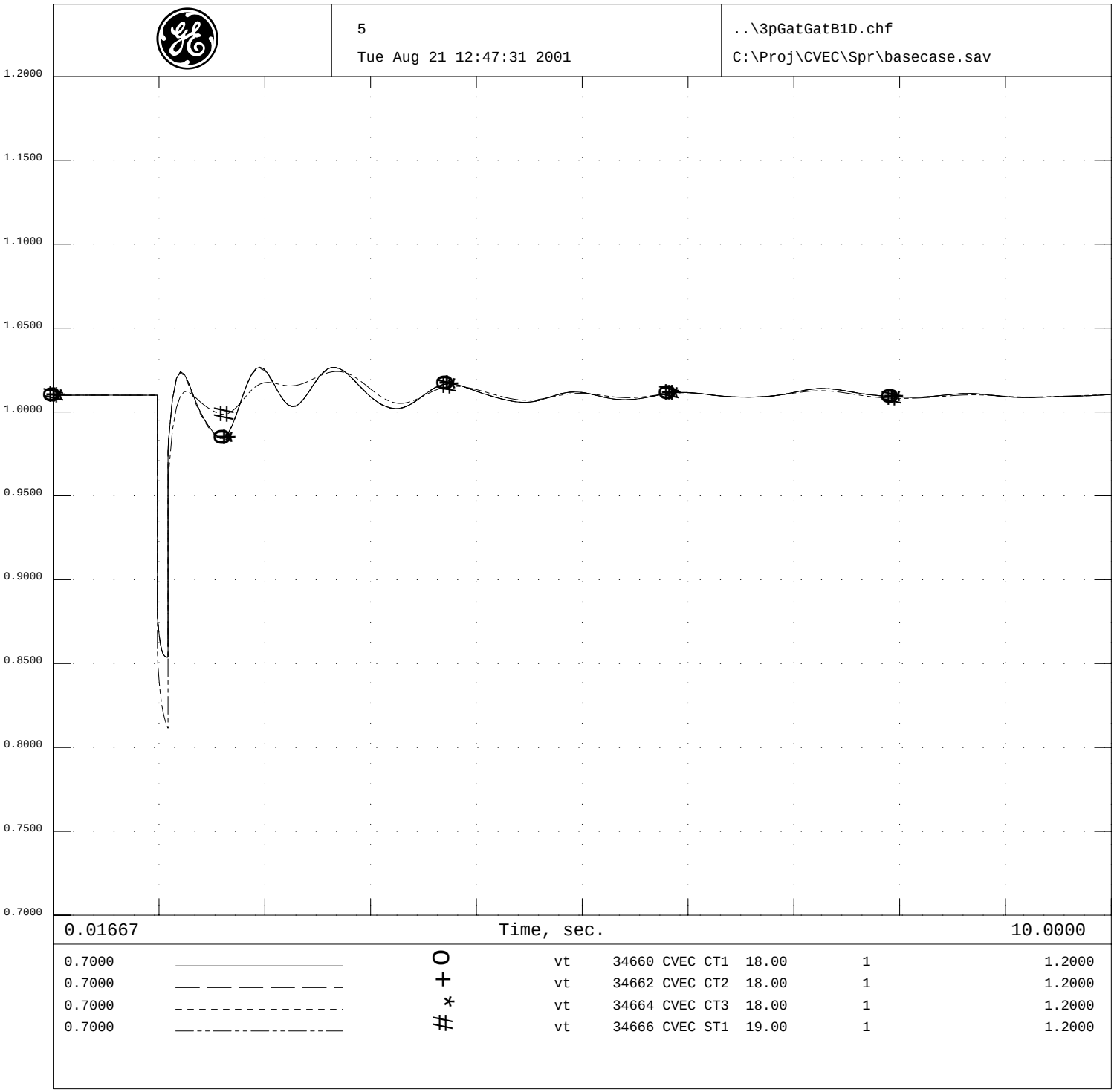

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2004 Heavy Spring Base Case
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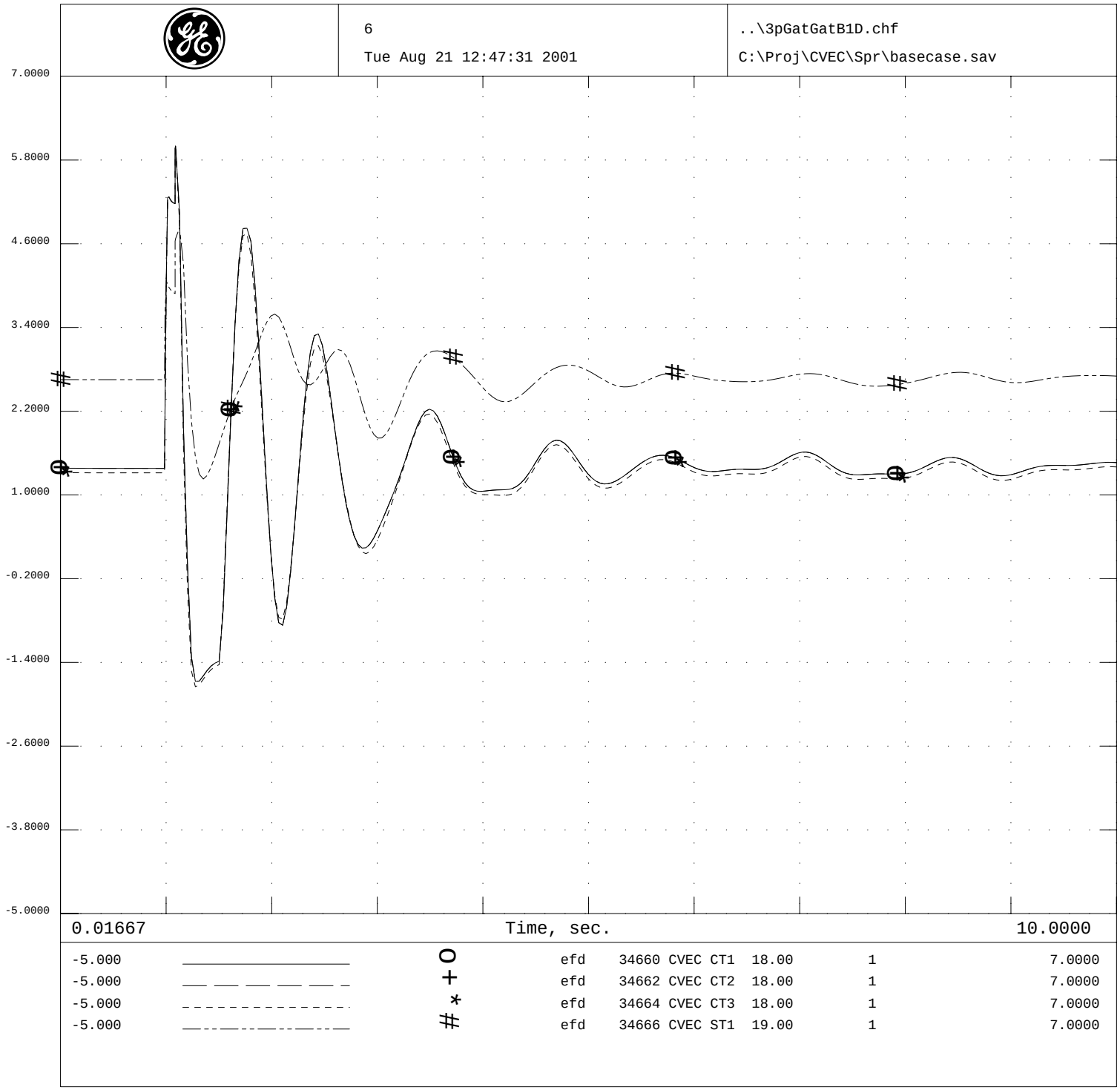
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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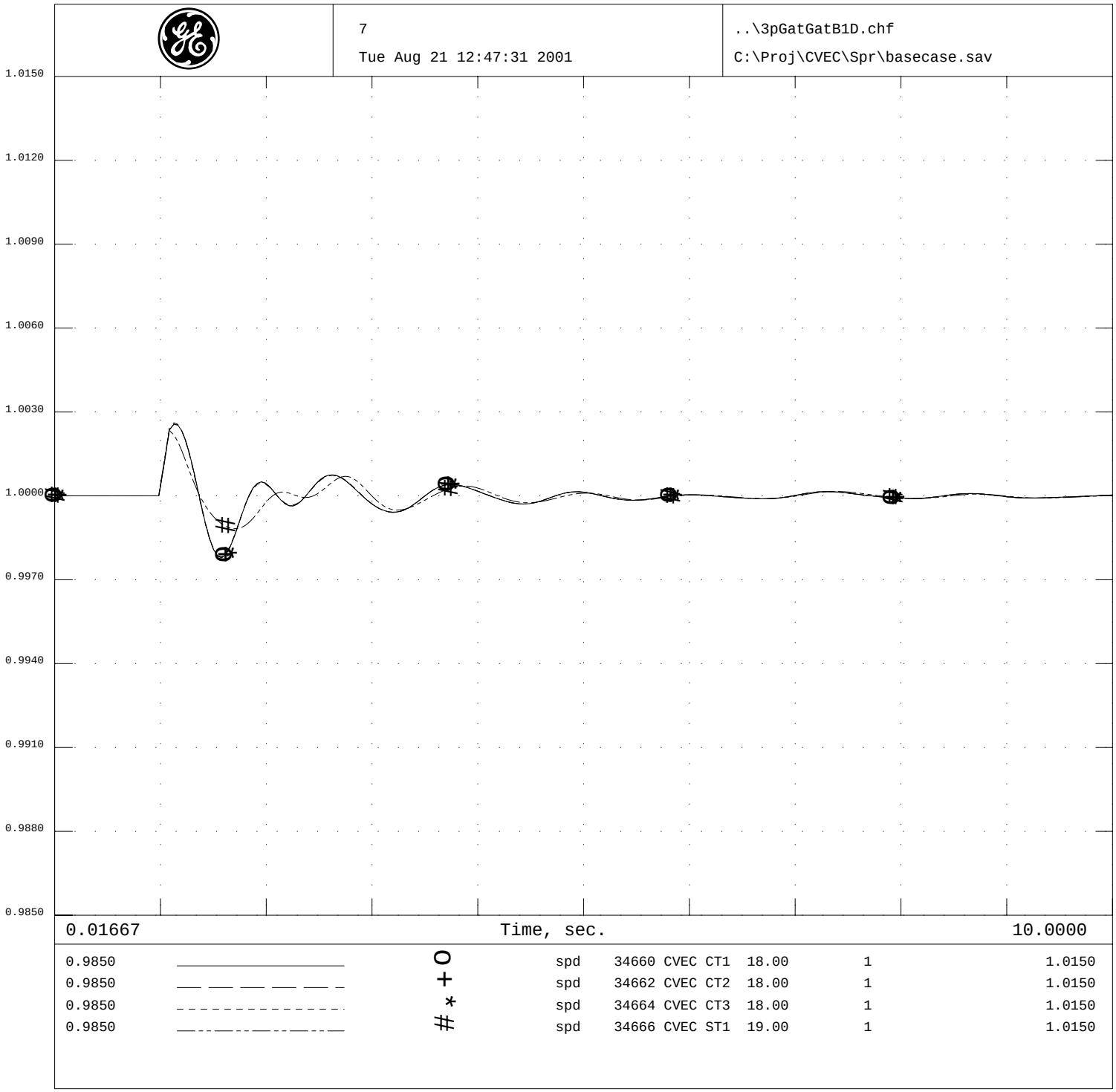
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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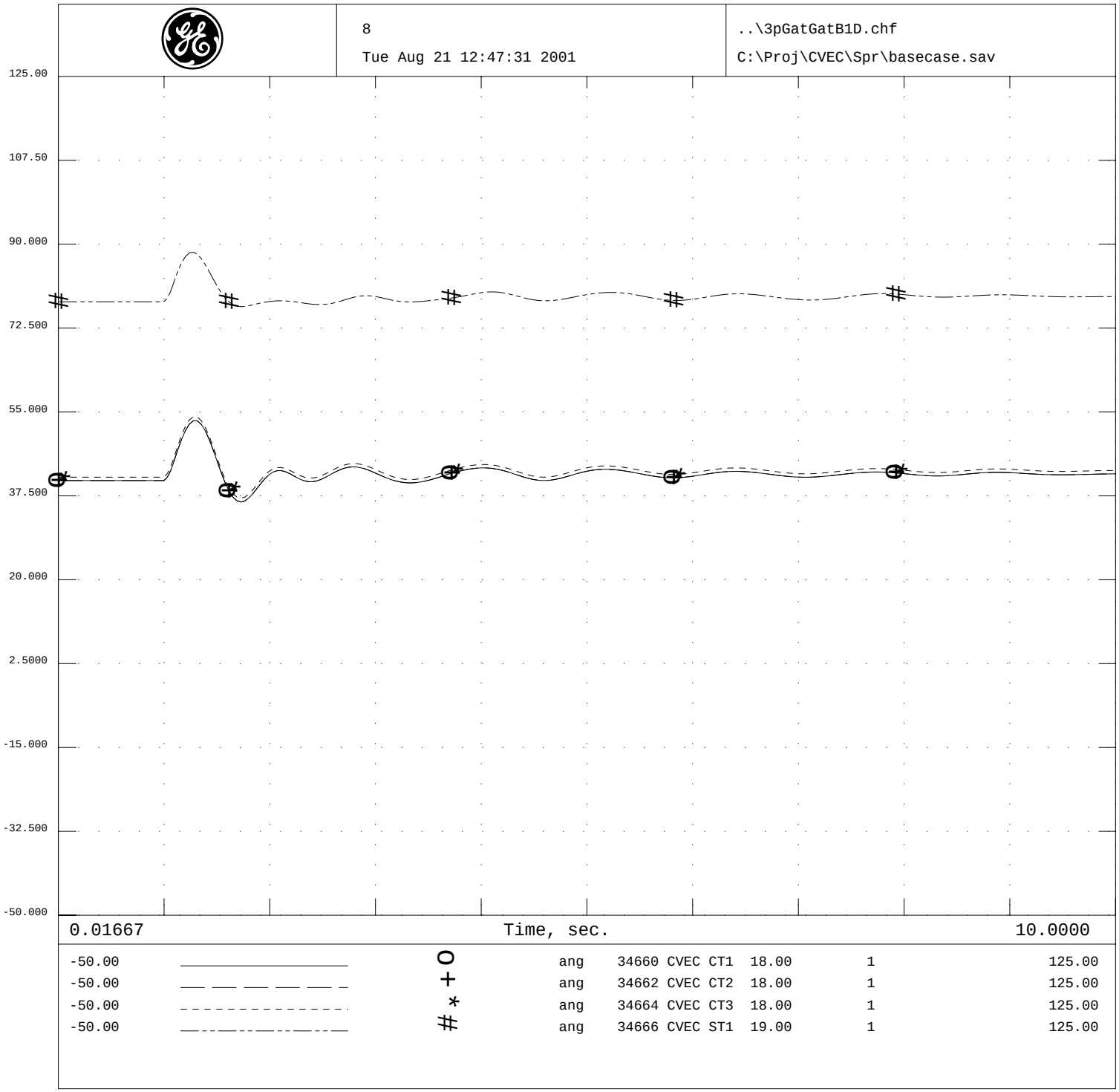
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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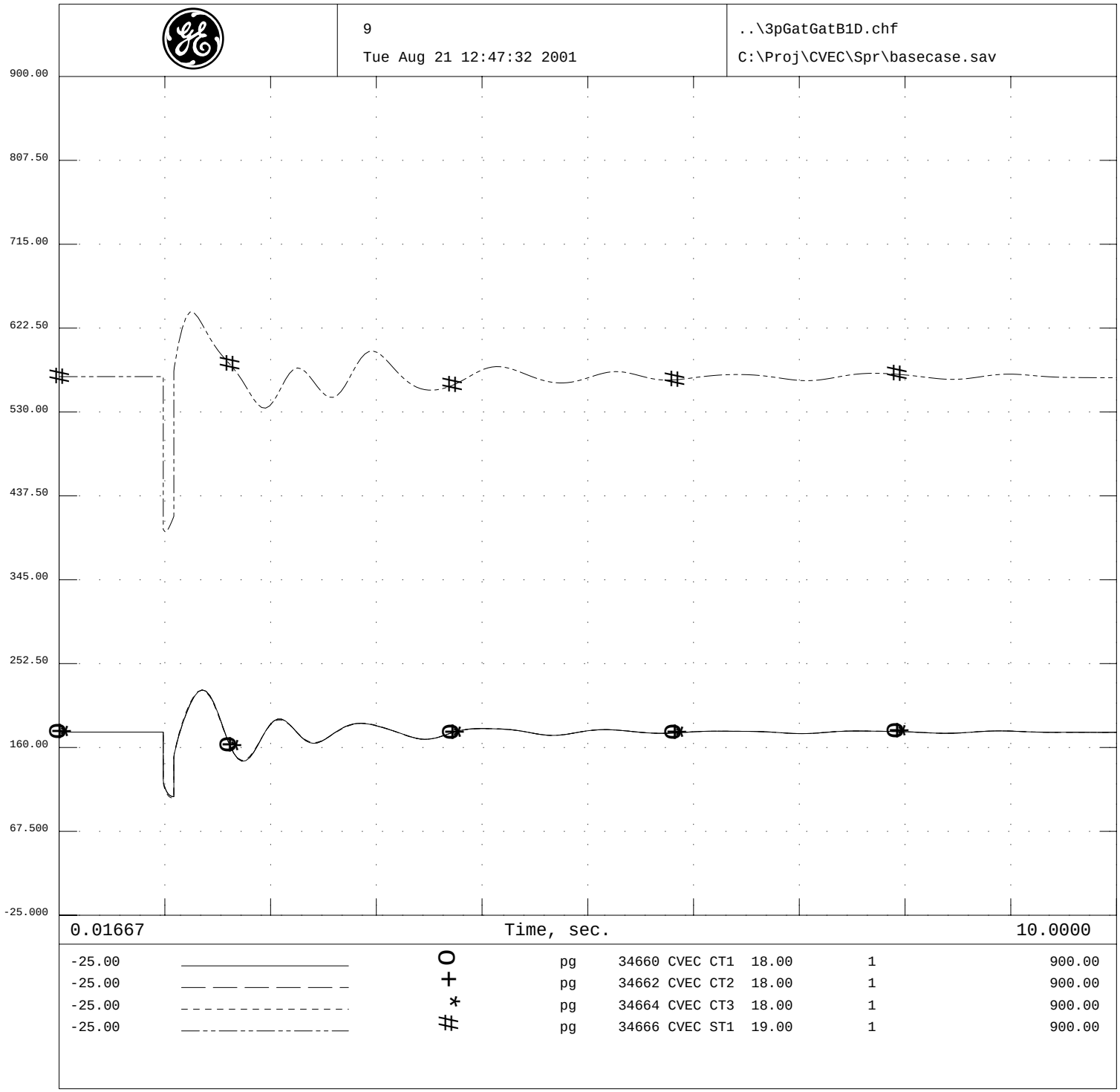
Calpine Corporation
Project Generator Rotor Angle



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2004 Heavy Spring Base Case
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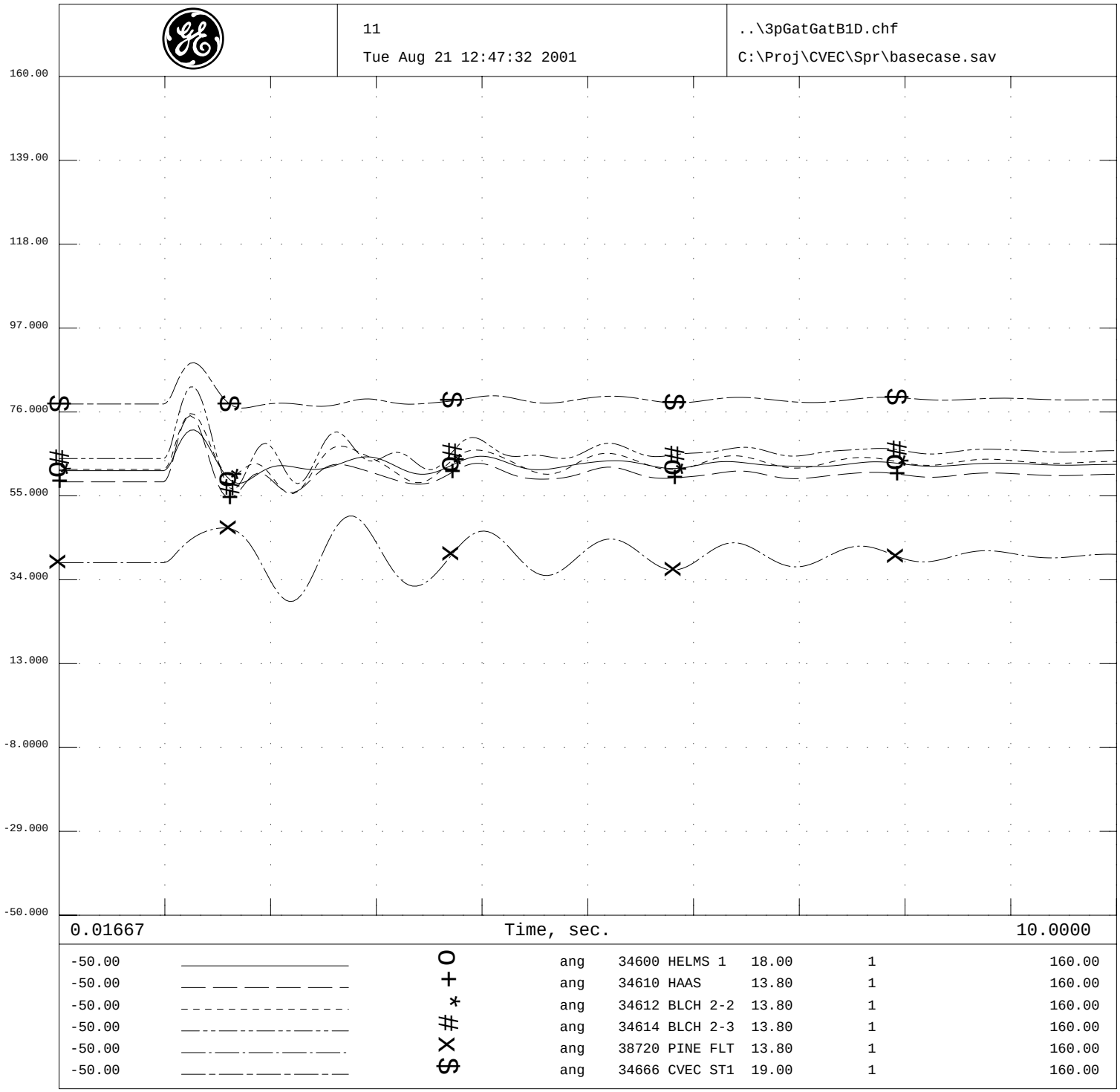
Calpine Corporation
Project Generator Terminal Power



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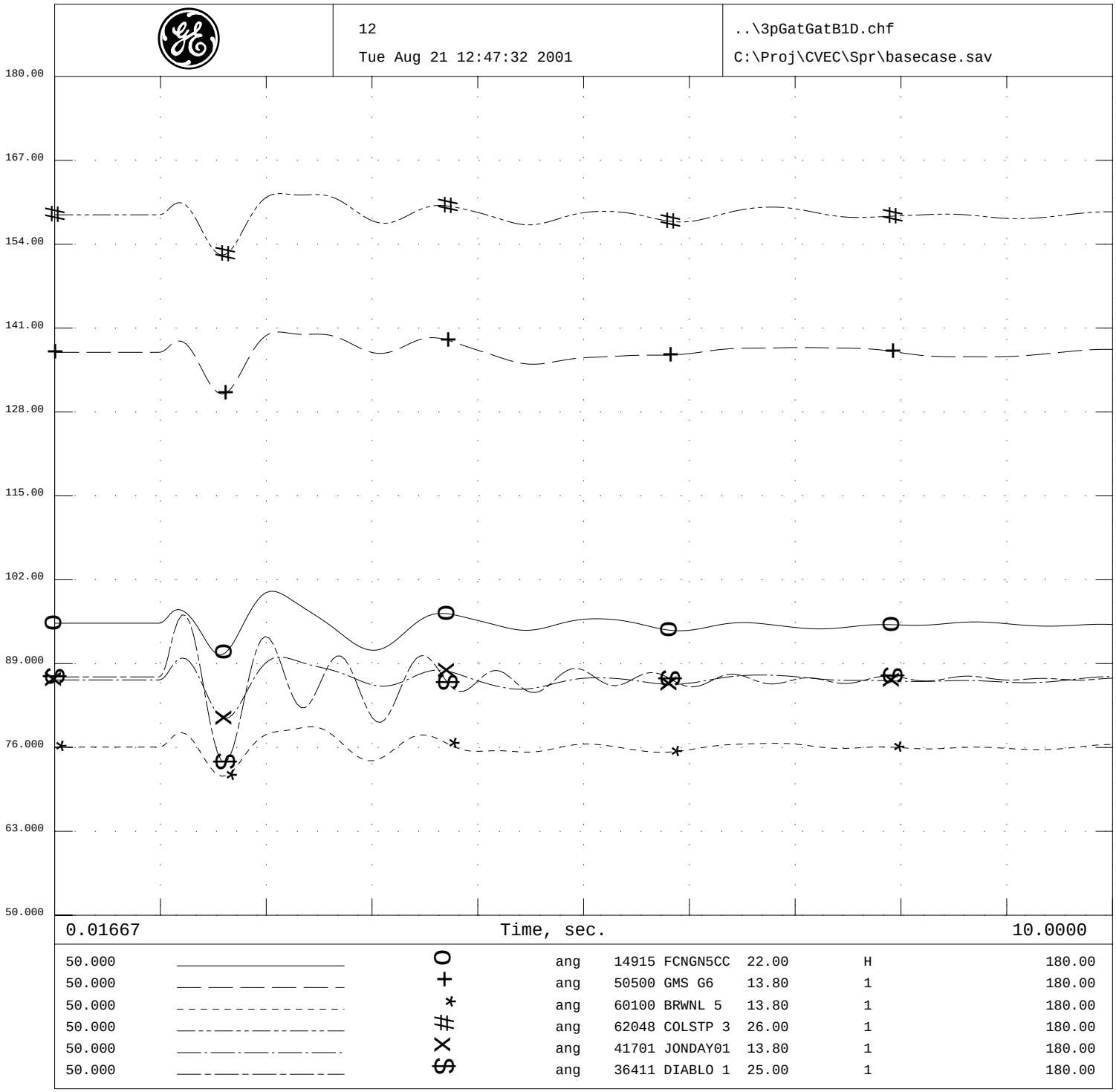
Calpine Corporation
Selected Local Rotor Angle Plots



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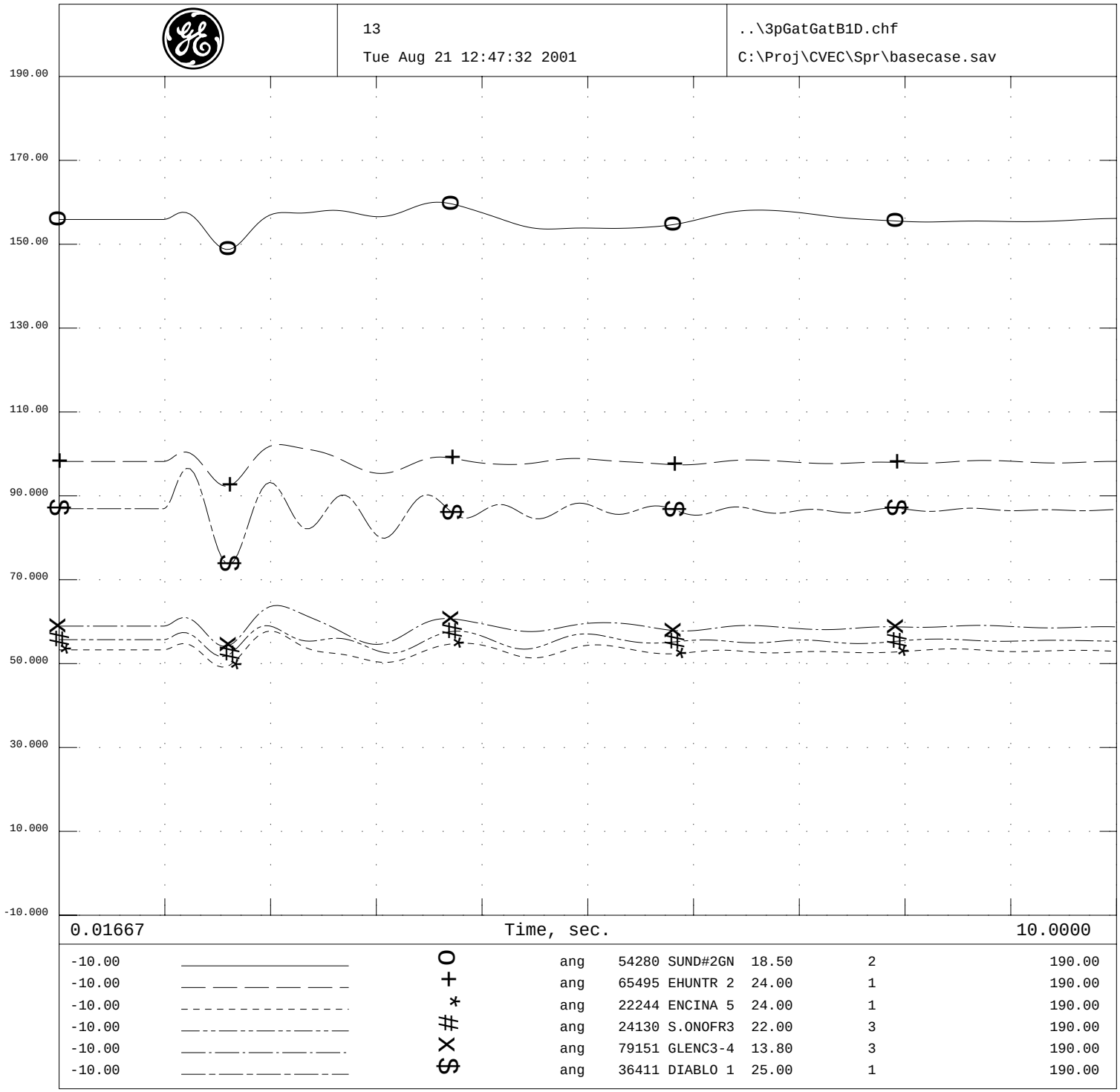
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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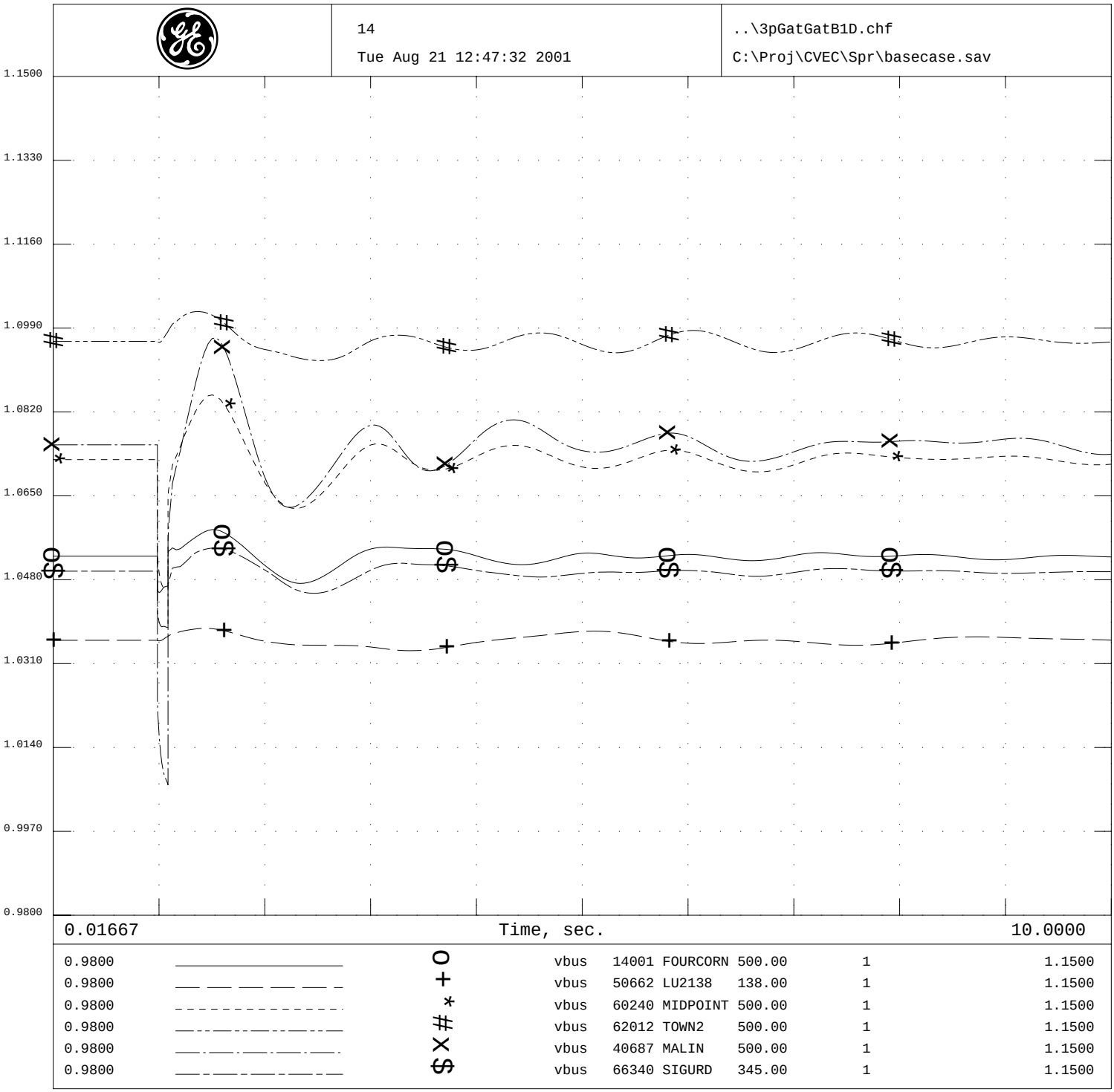

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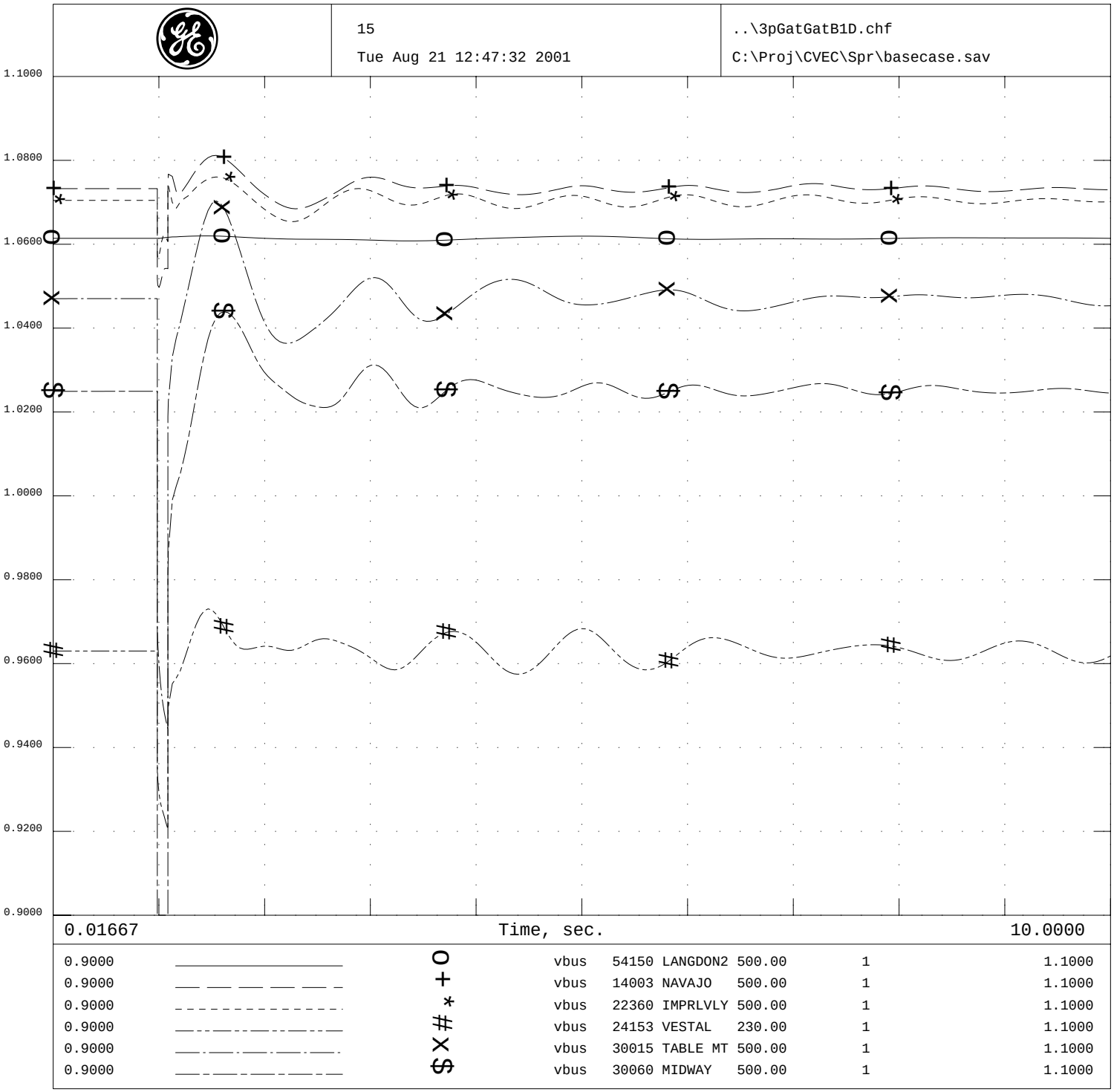
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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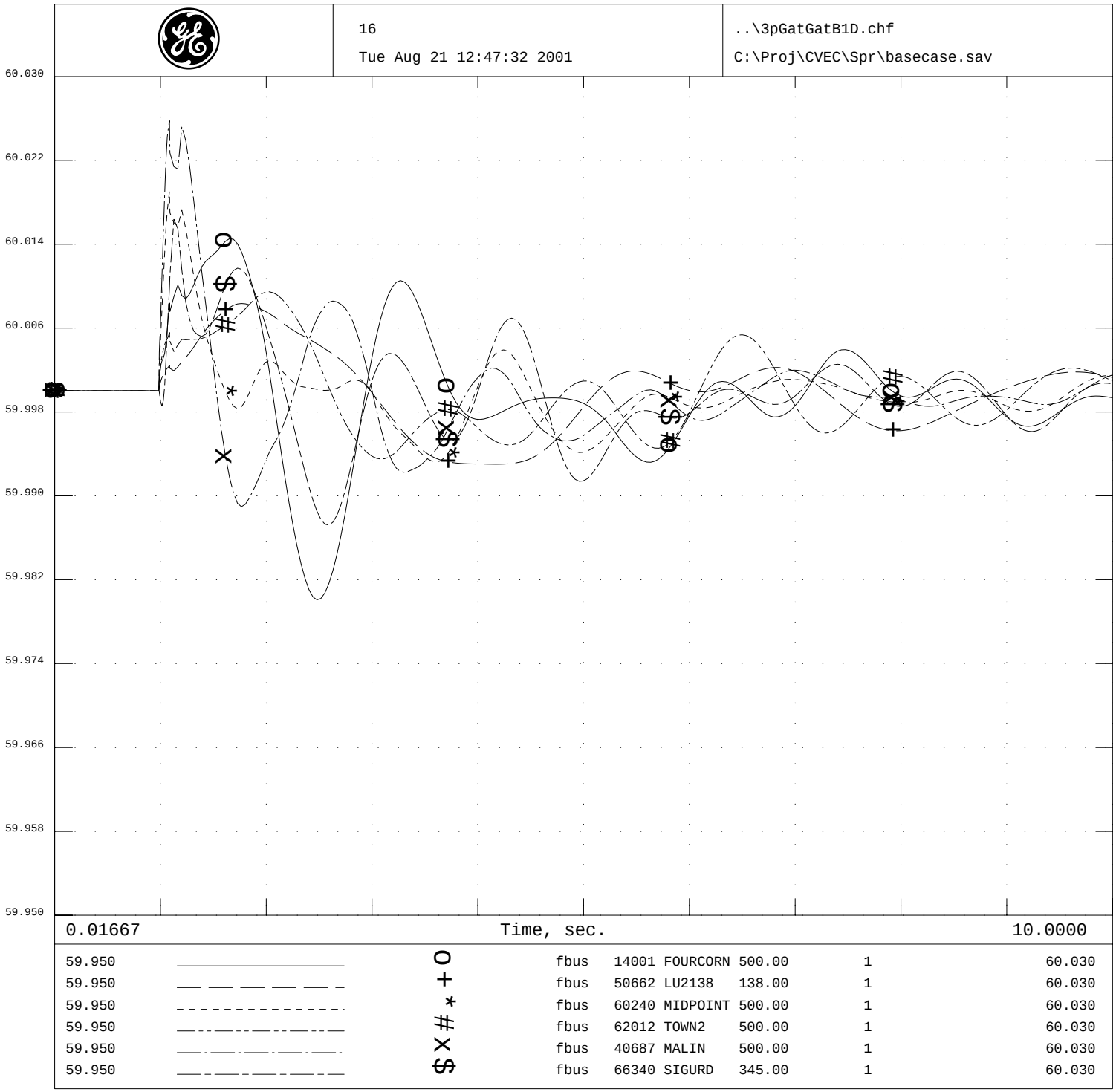

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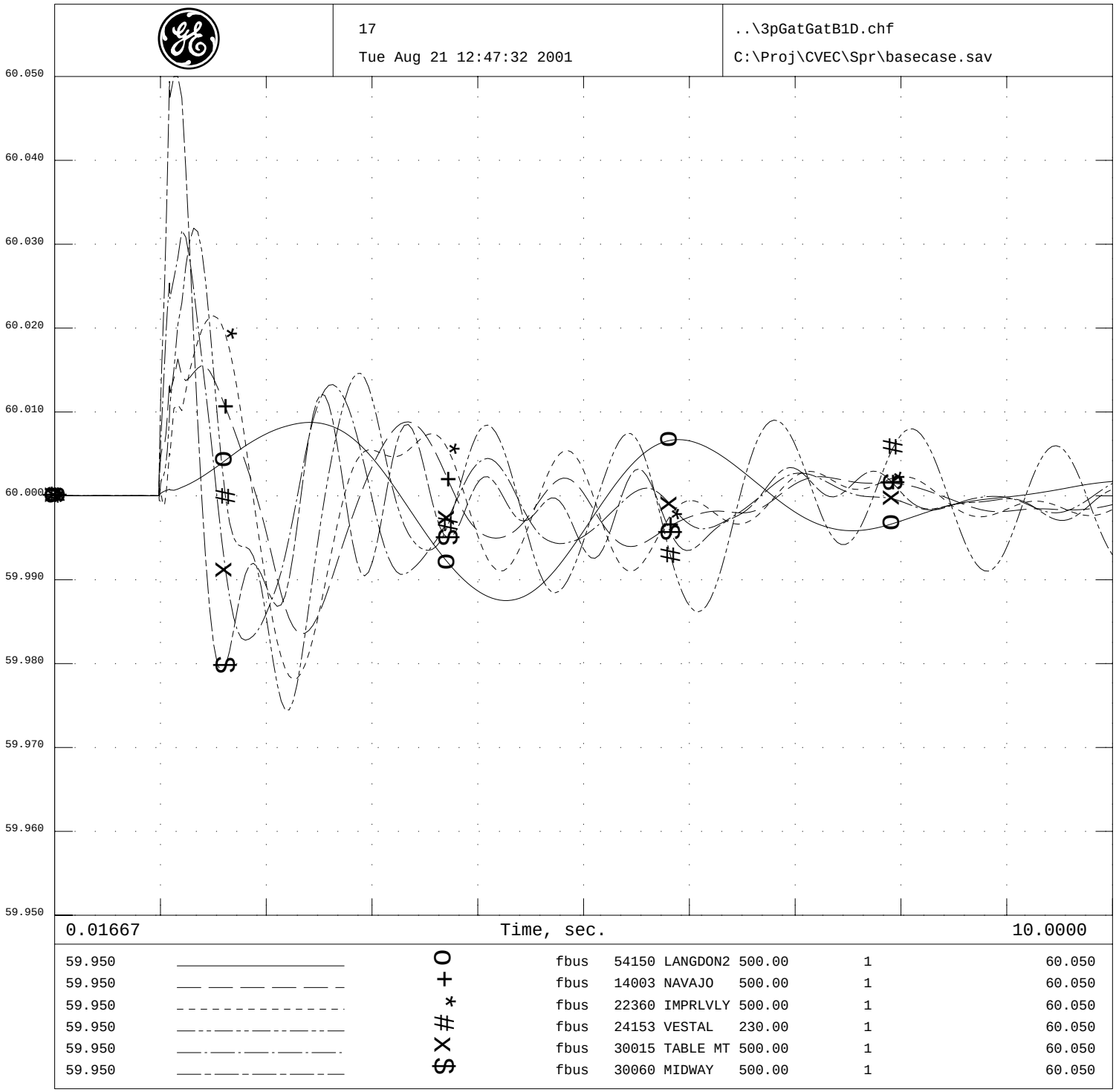
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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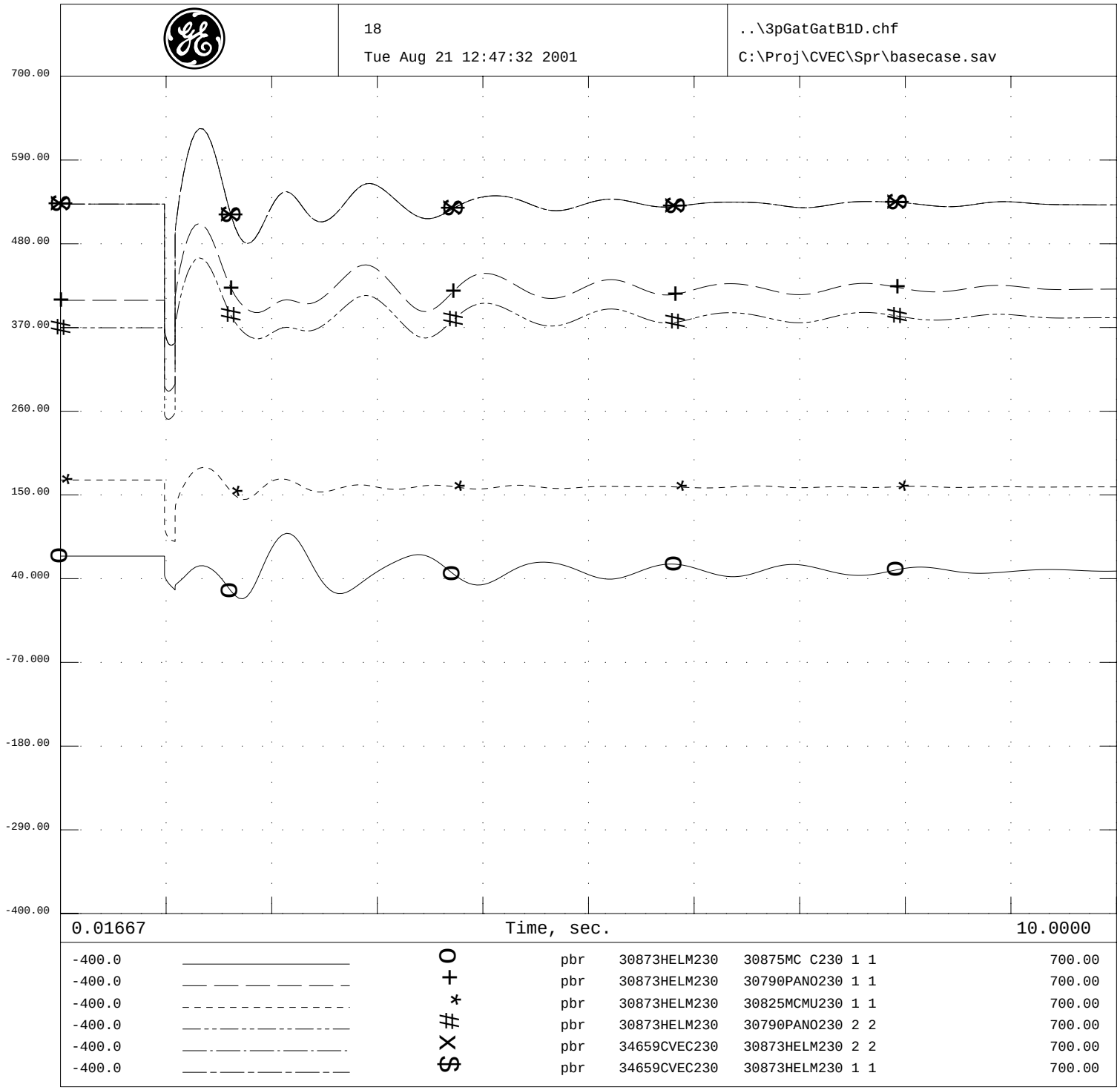

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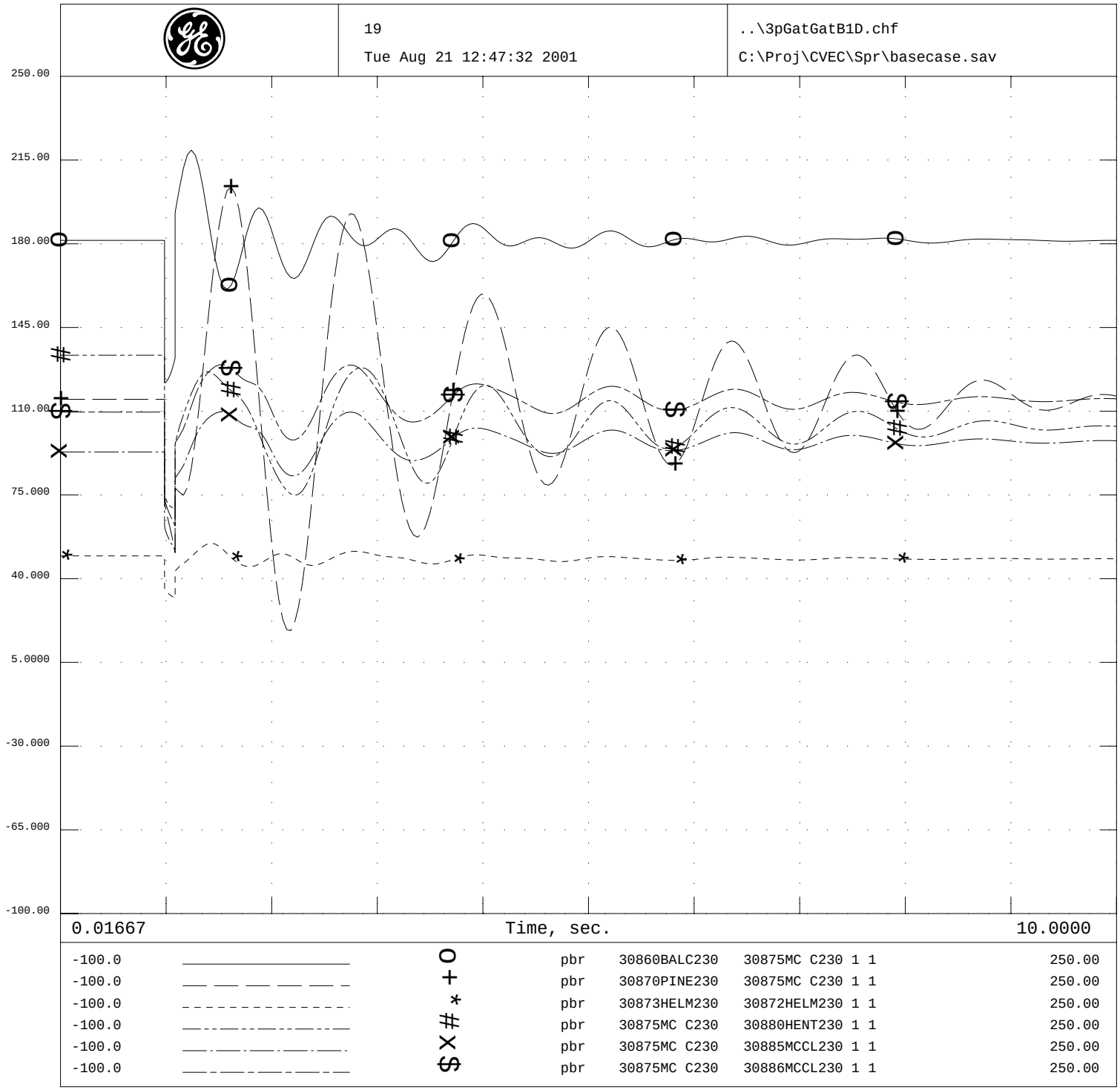
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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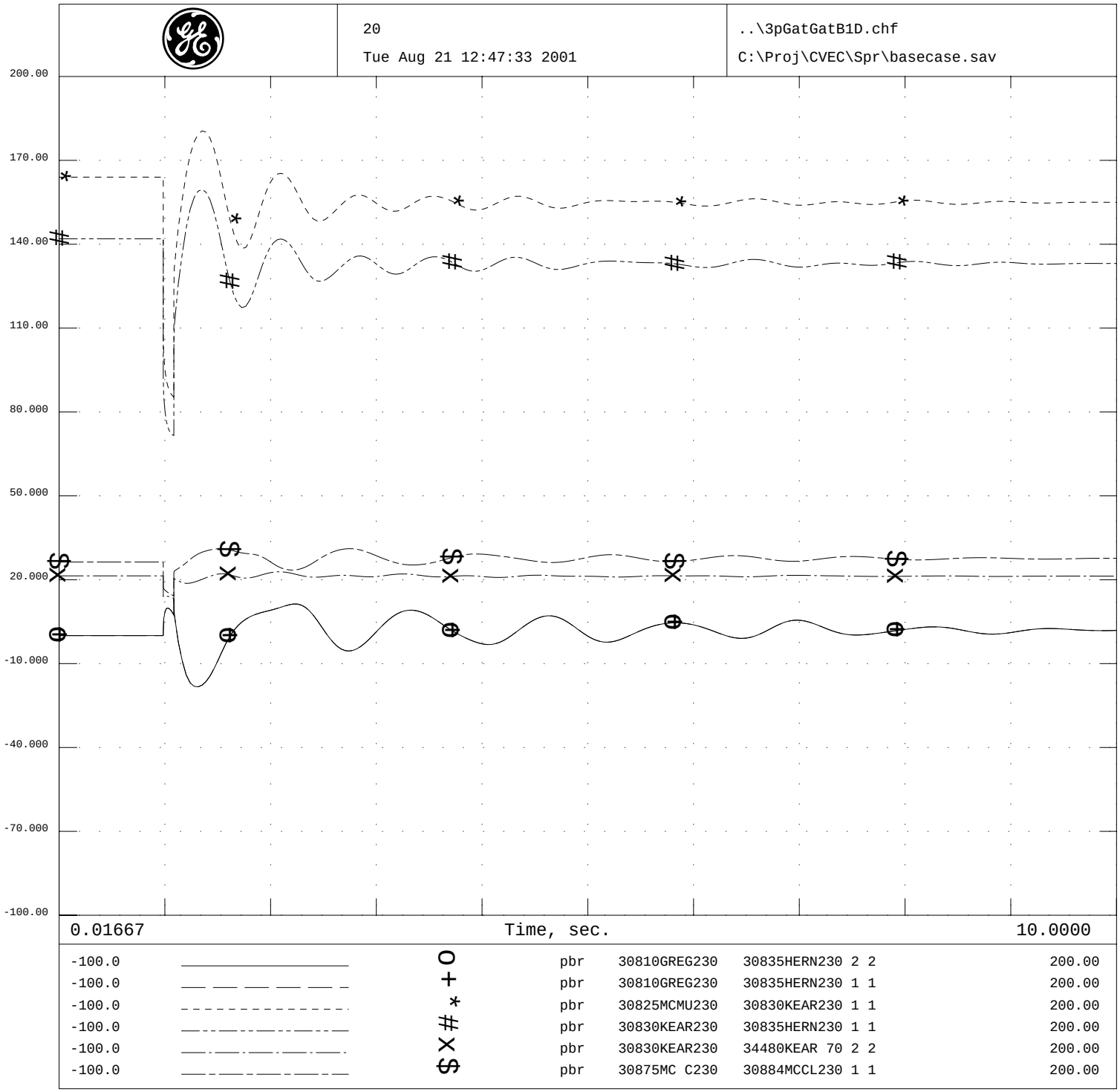

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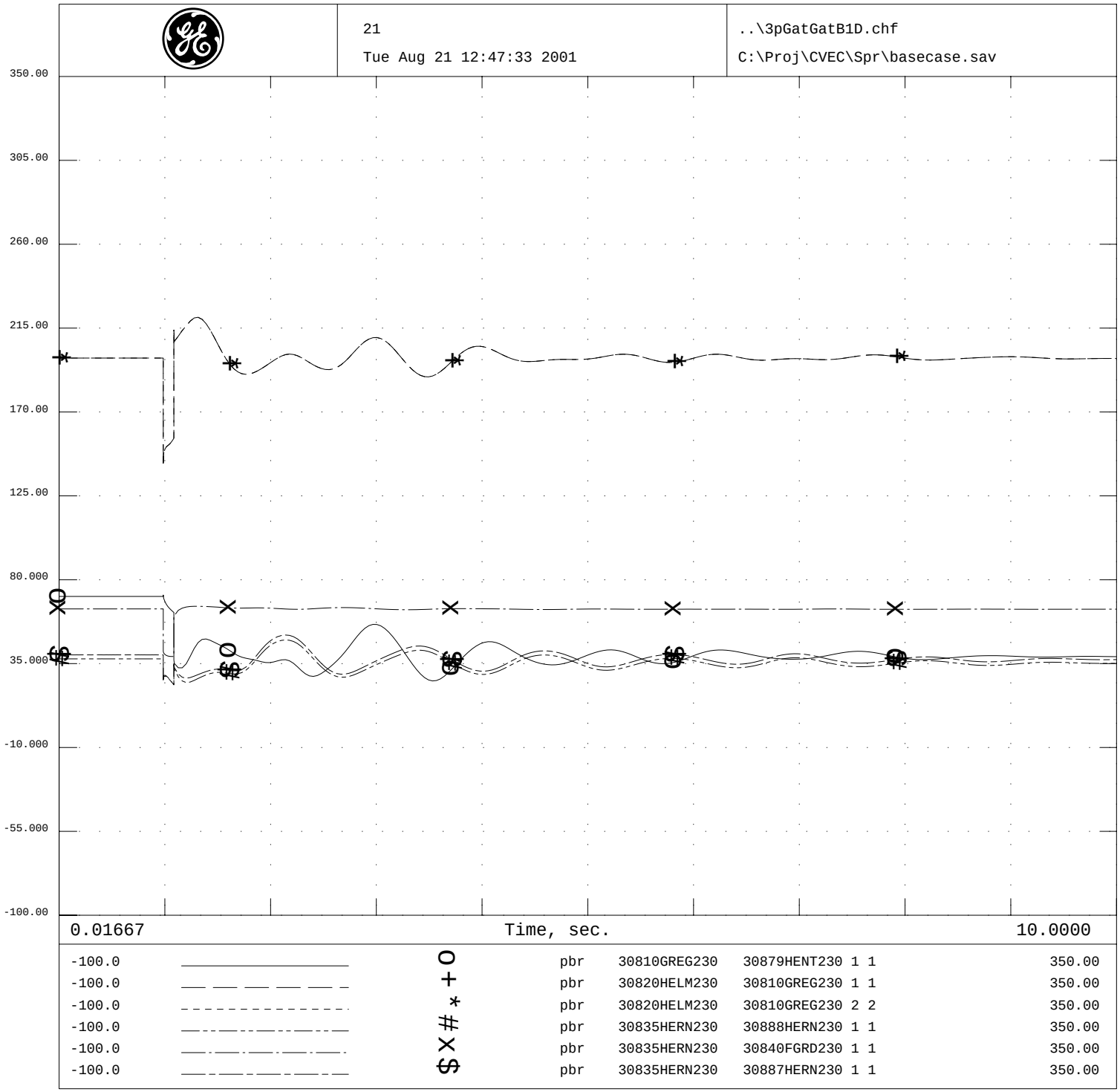

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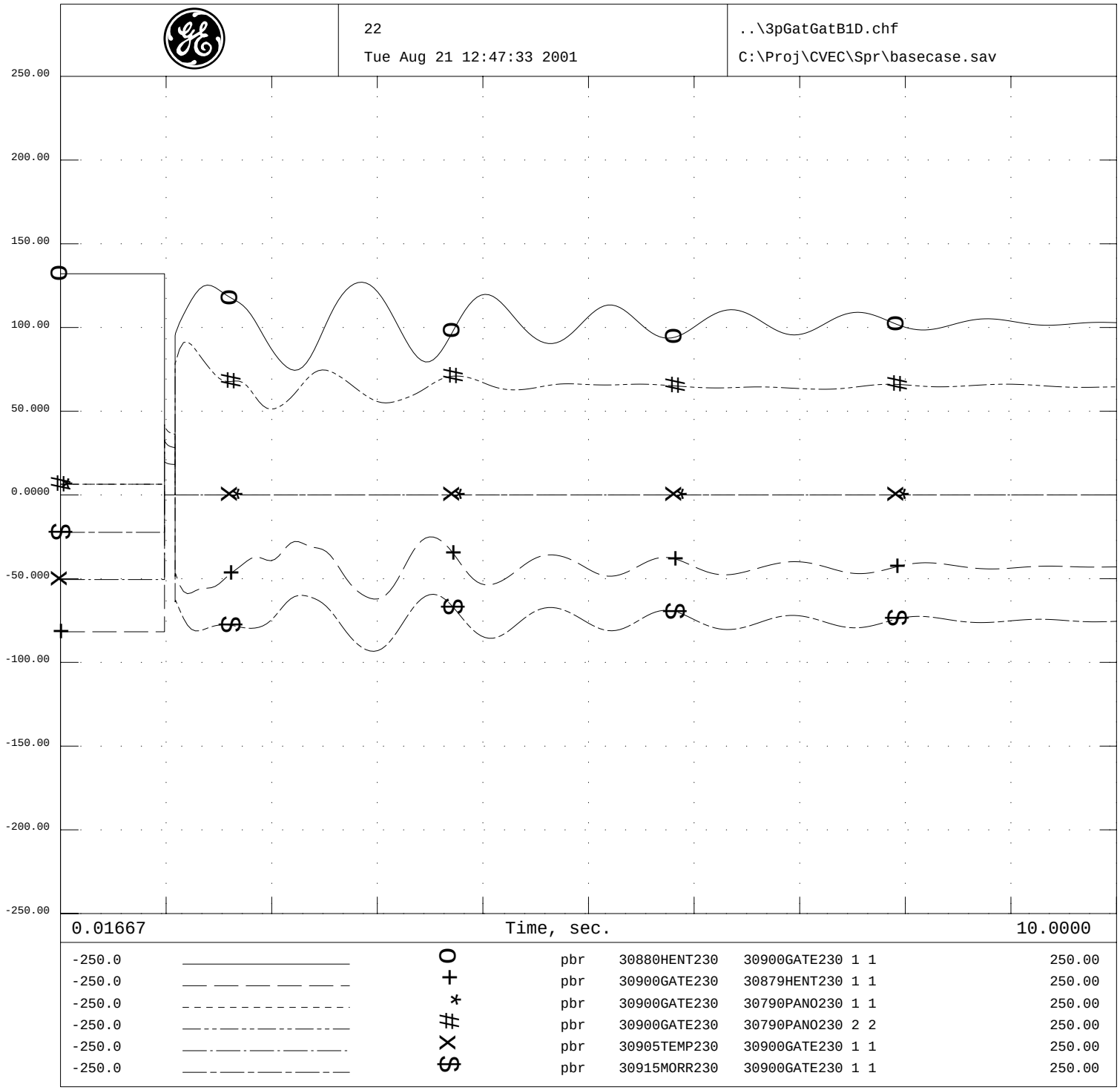

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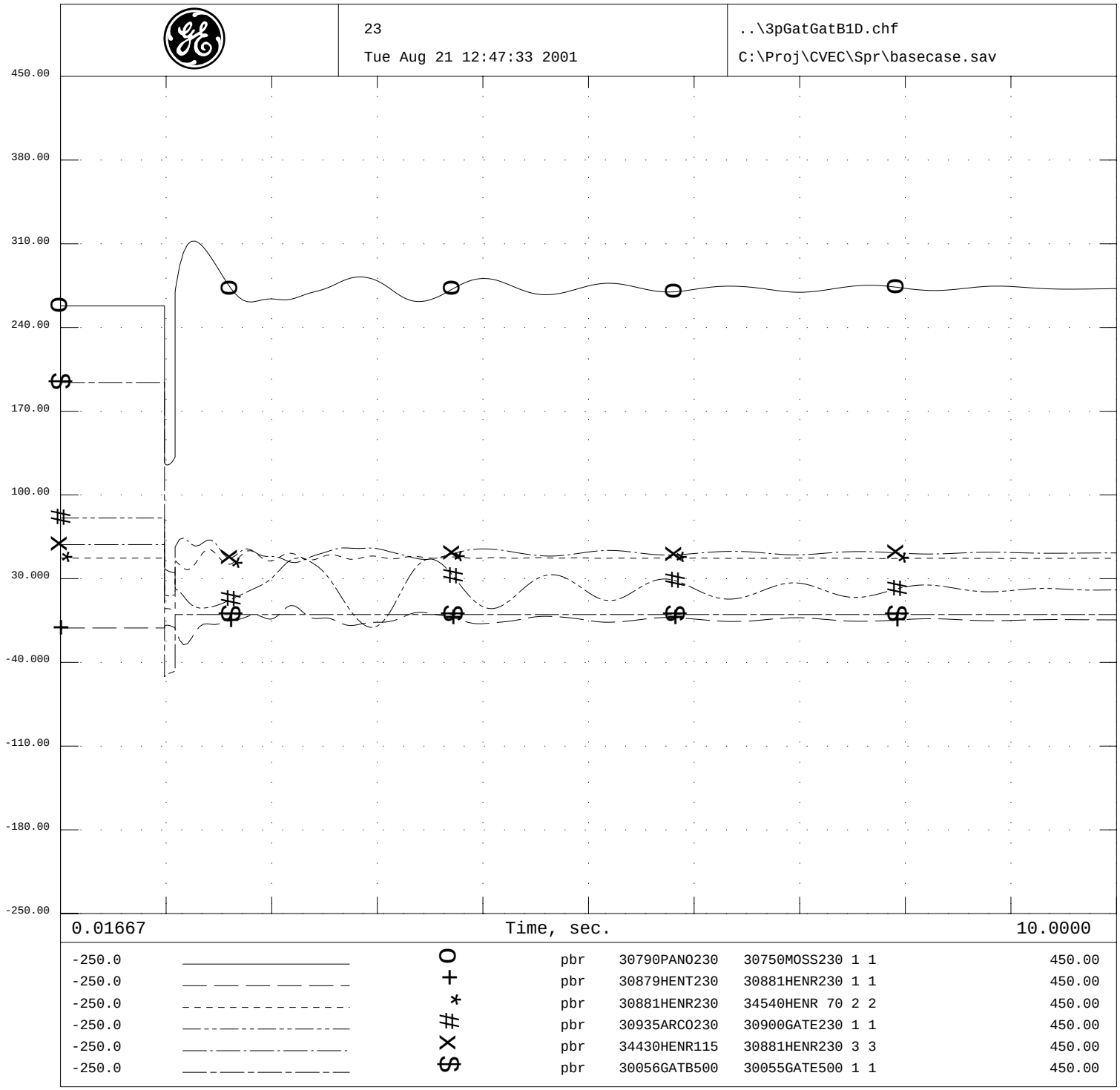

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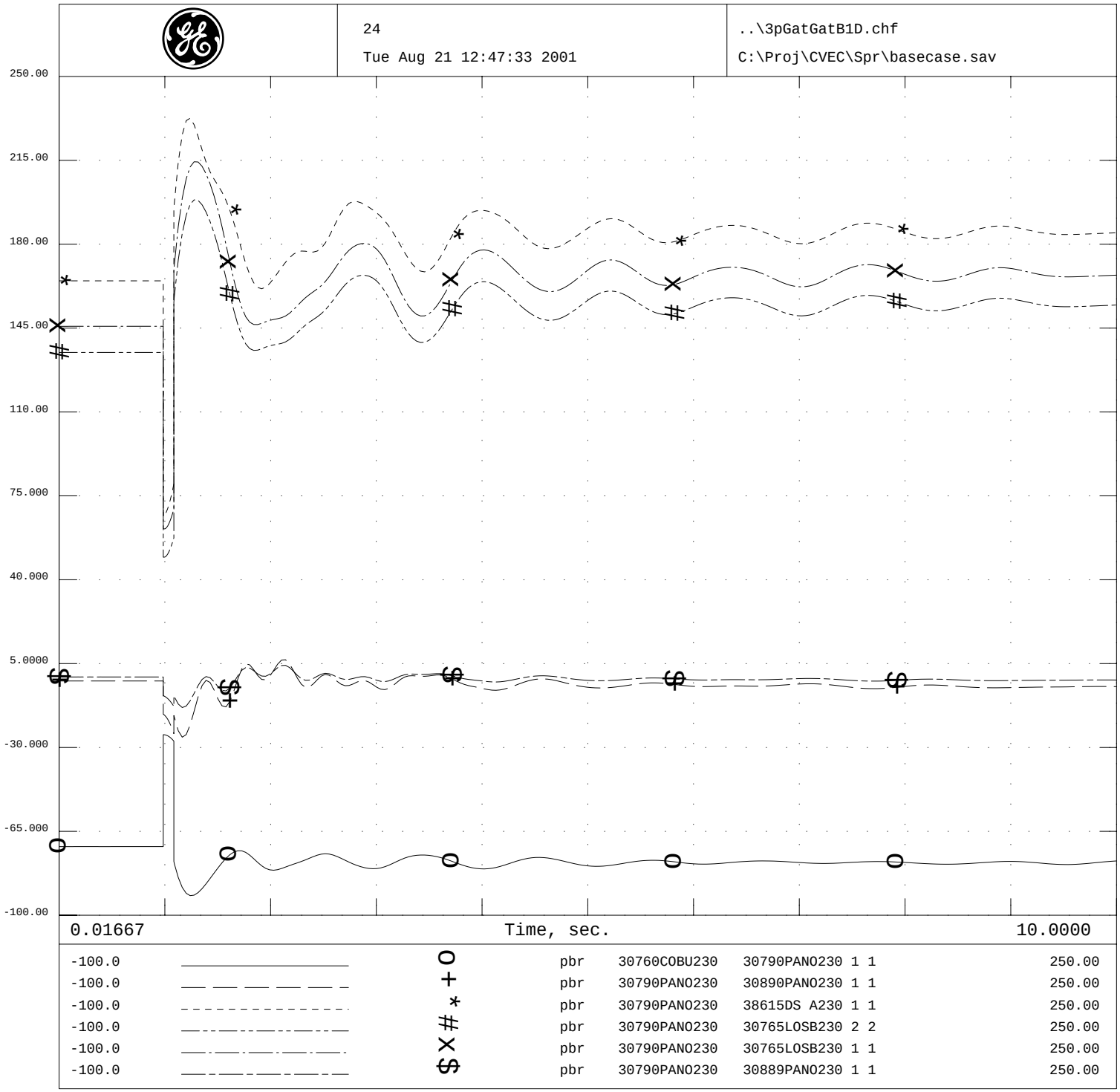

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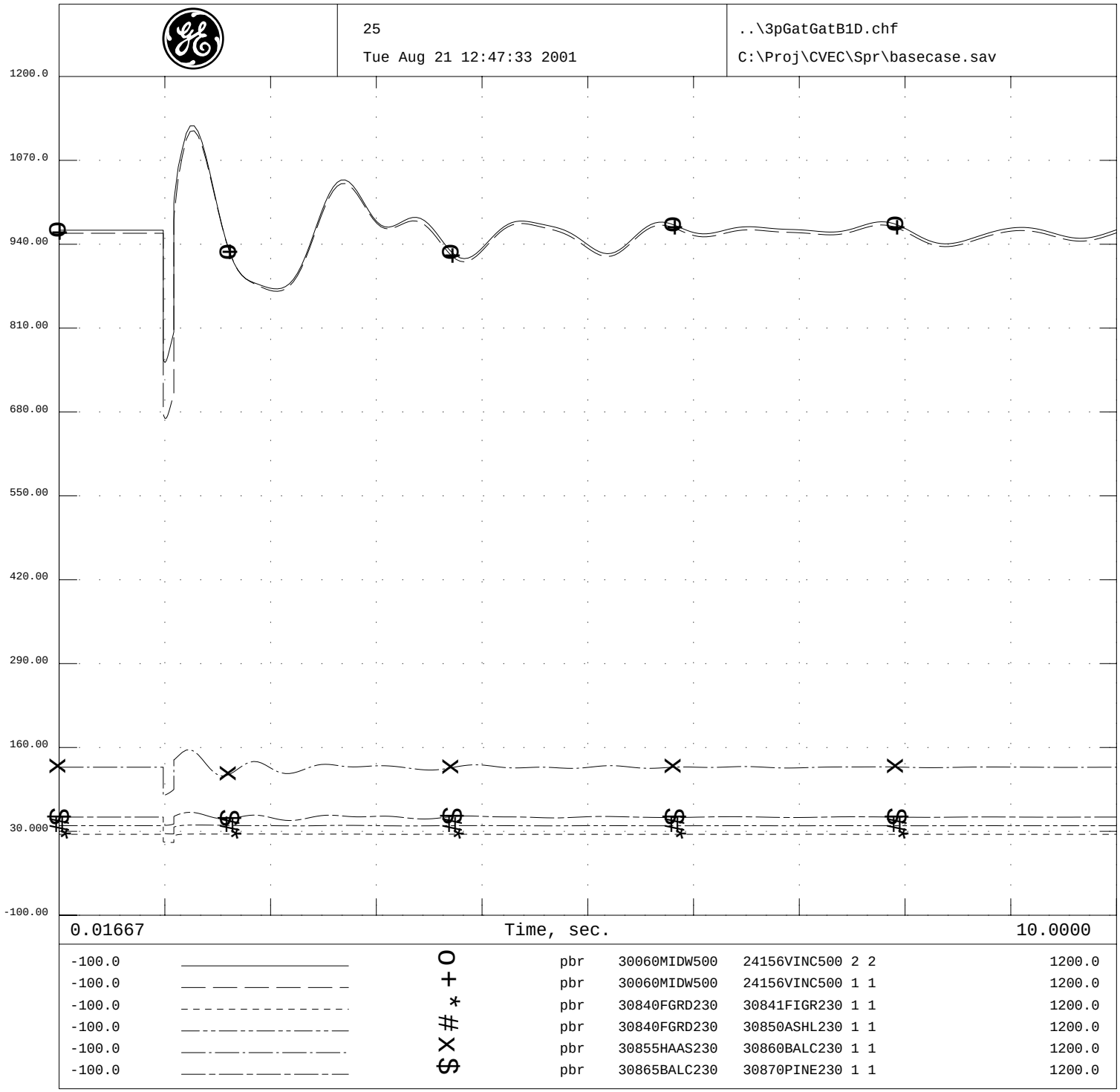

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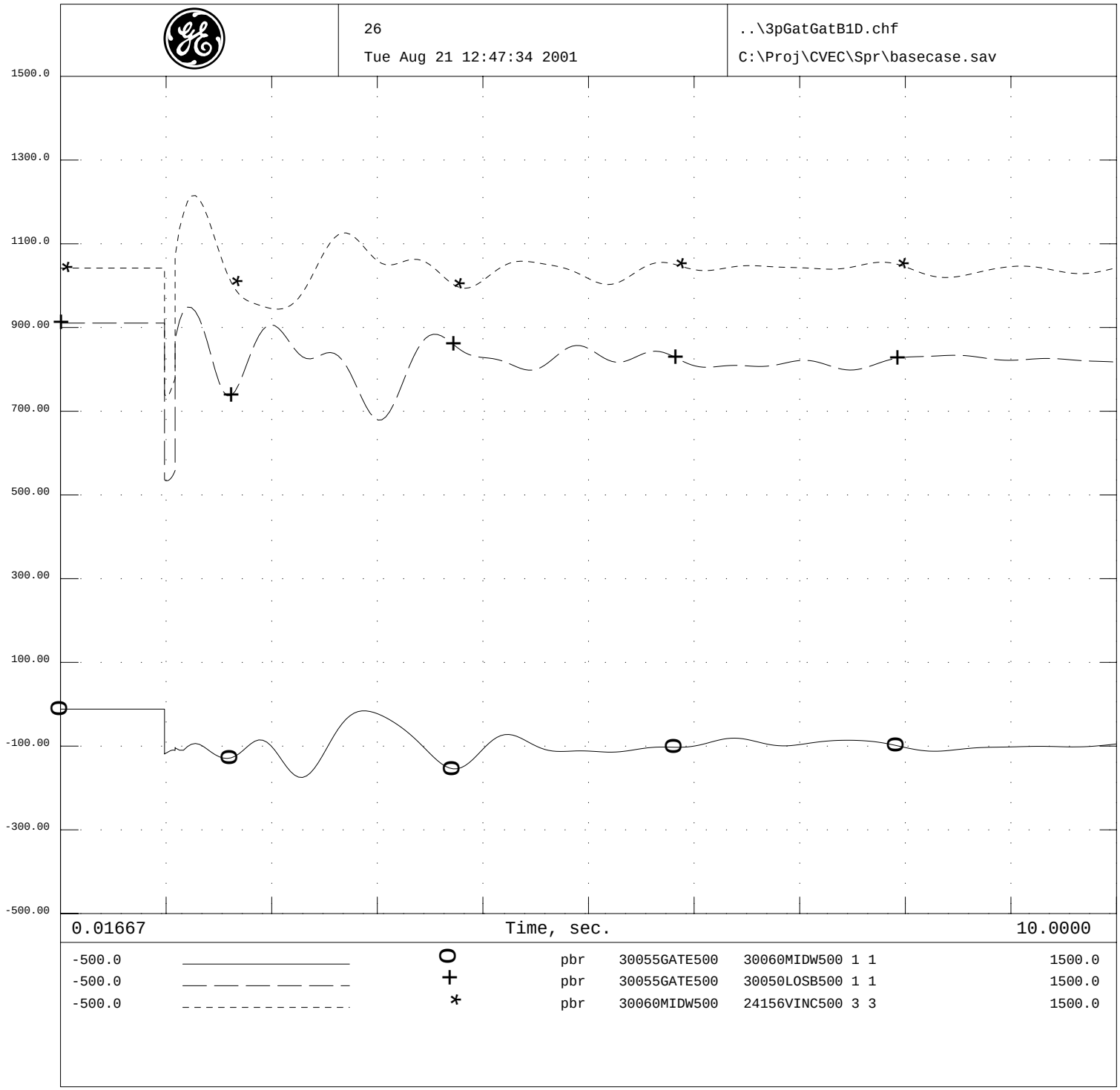

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Calpine Corporation
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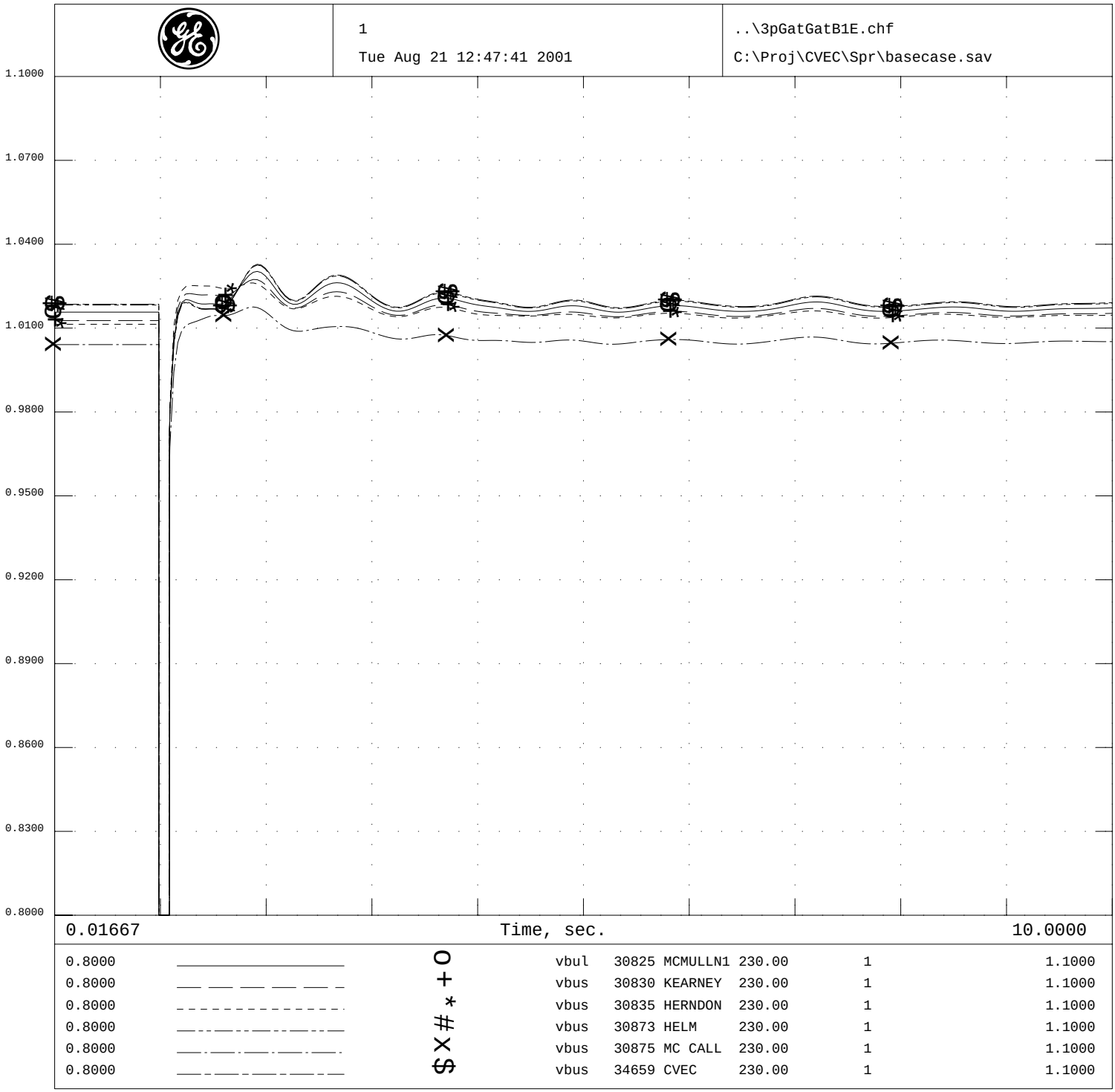

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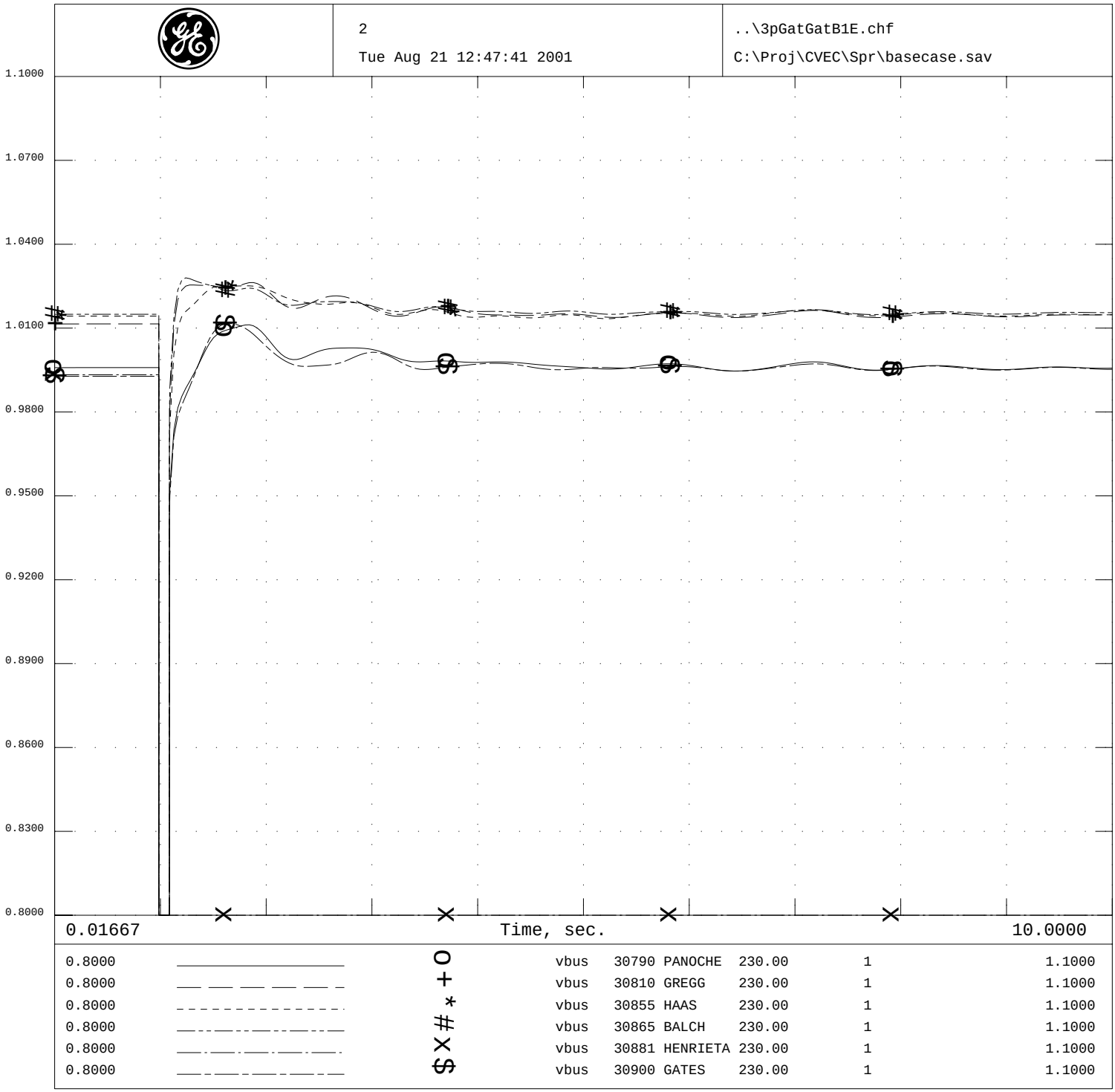
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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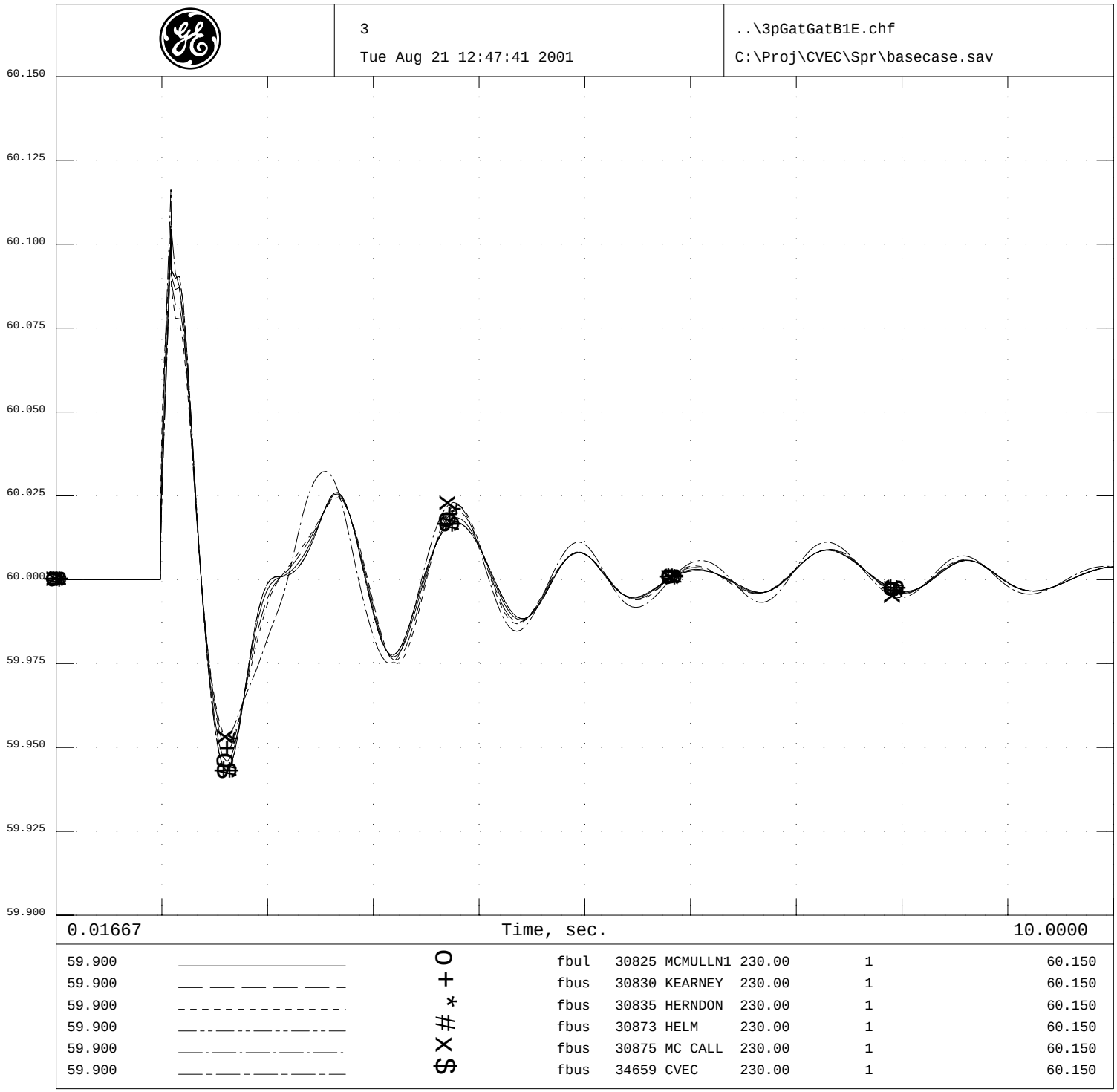

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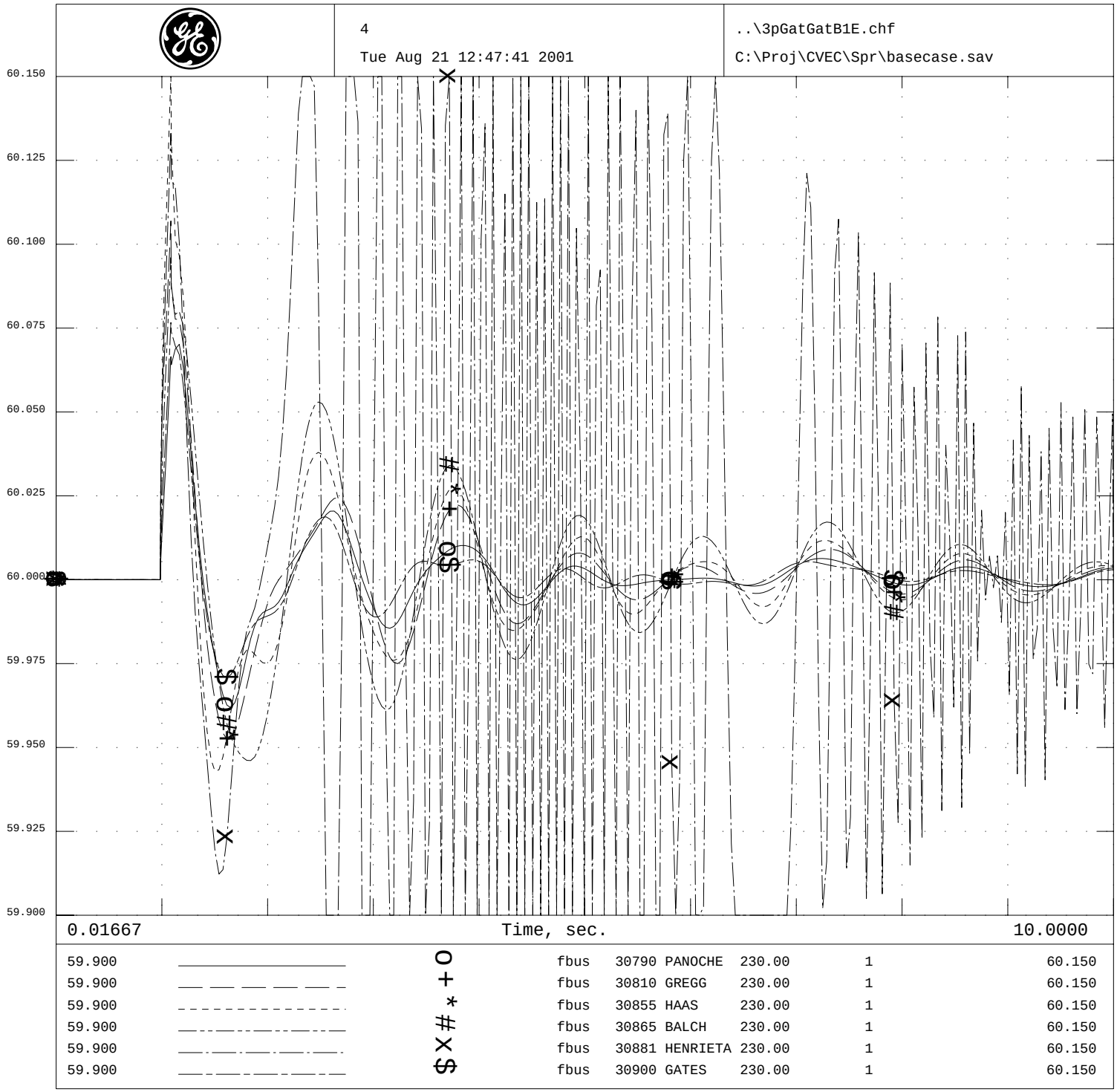

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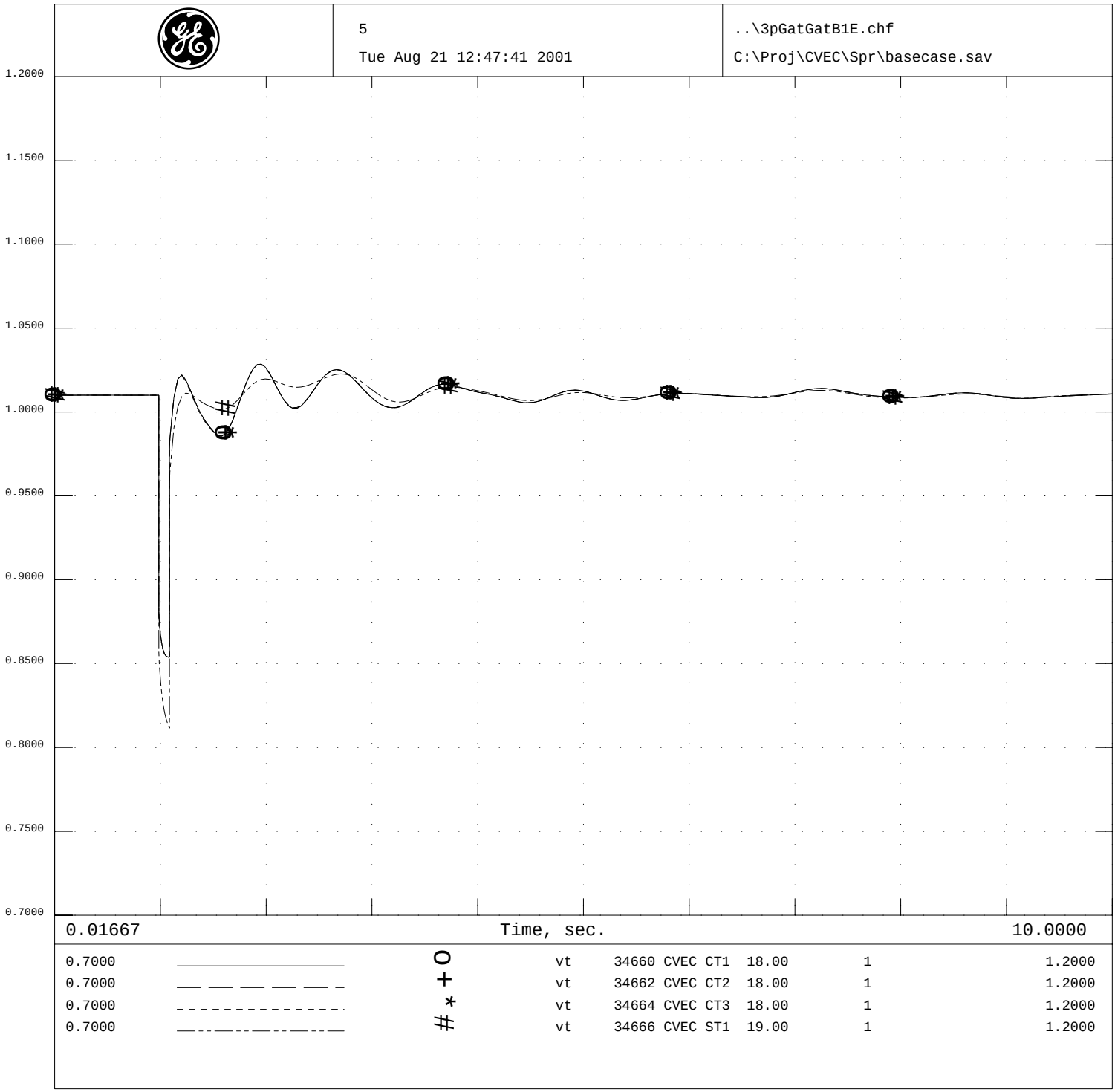

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Central Valley Energy Center
Calpine Corporation
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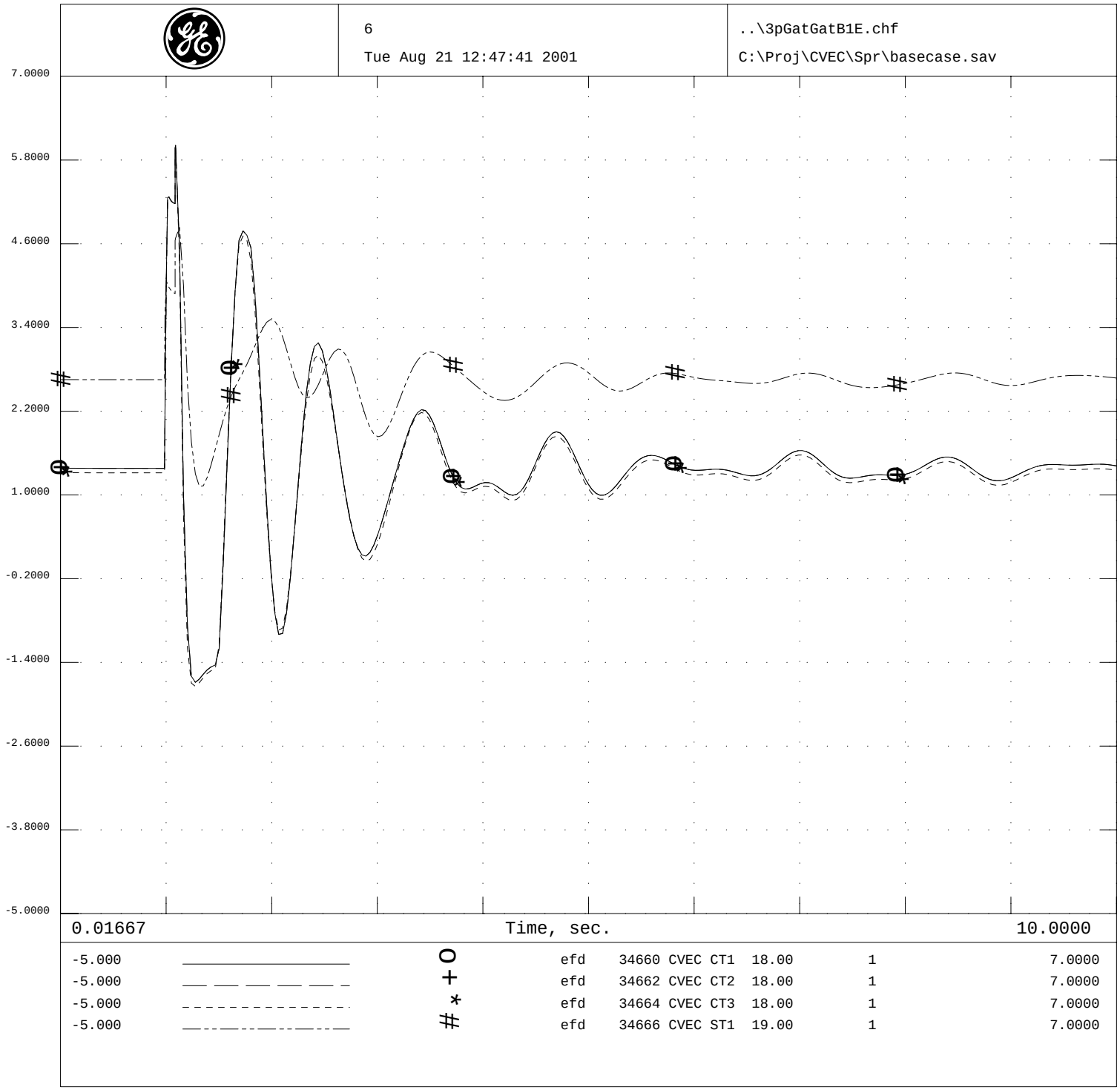

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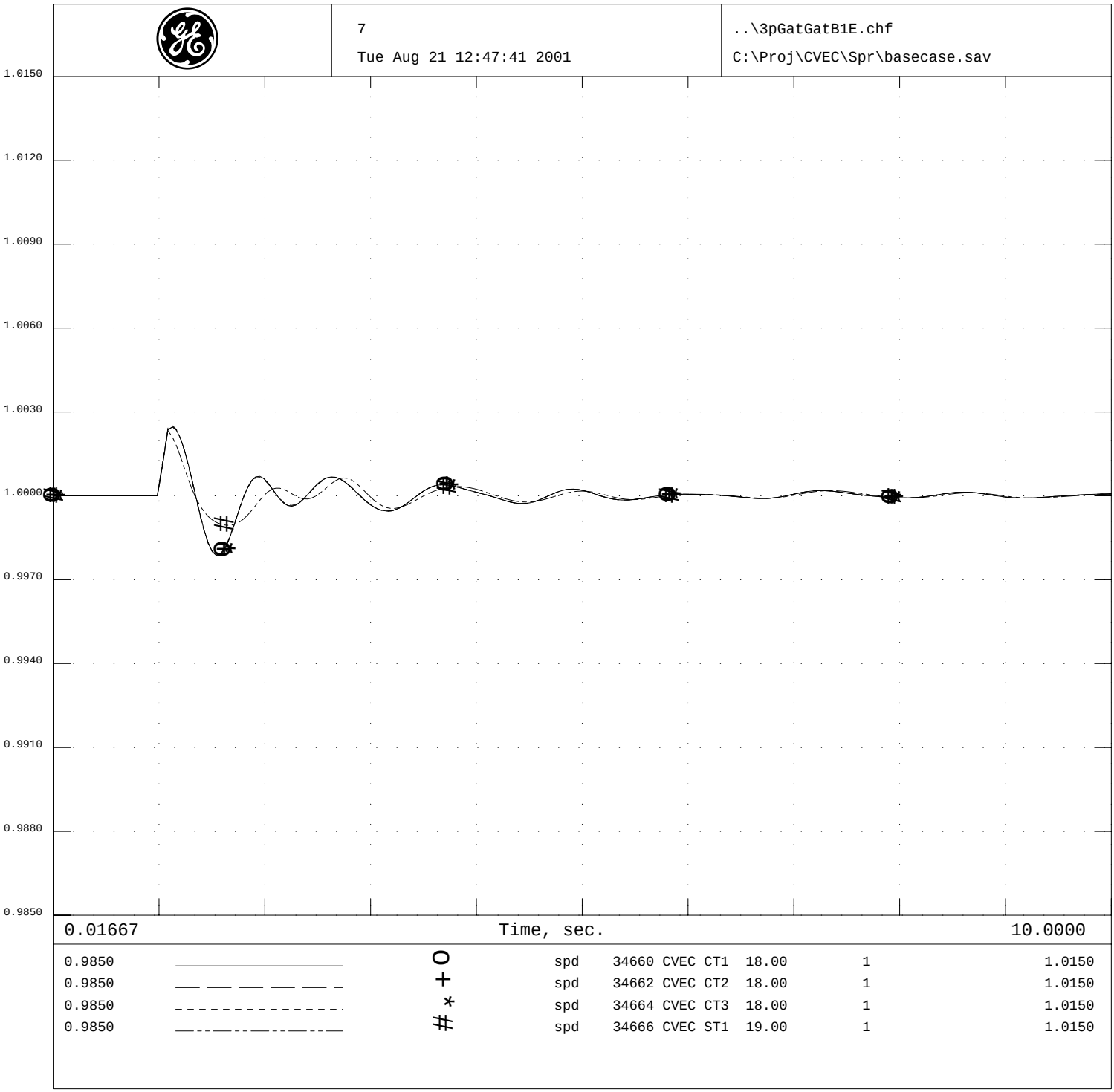

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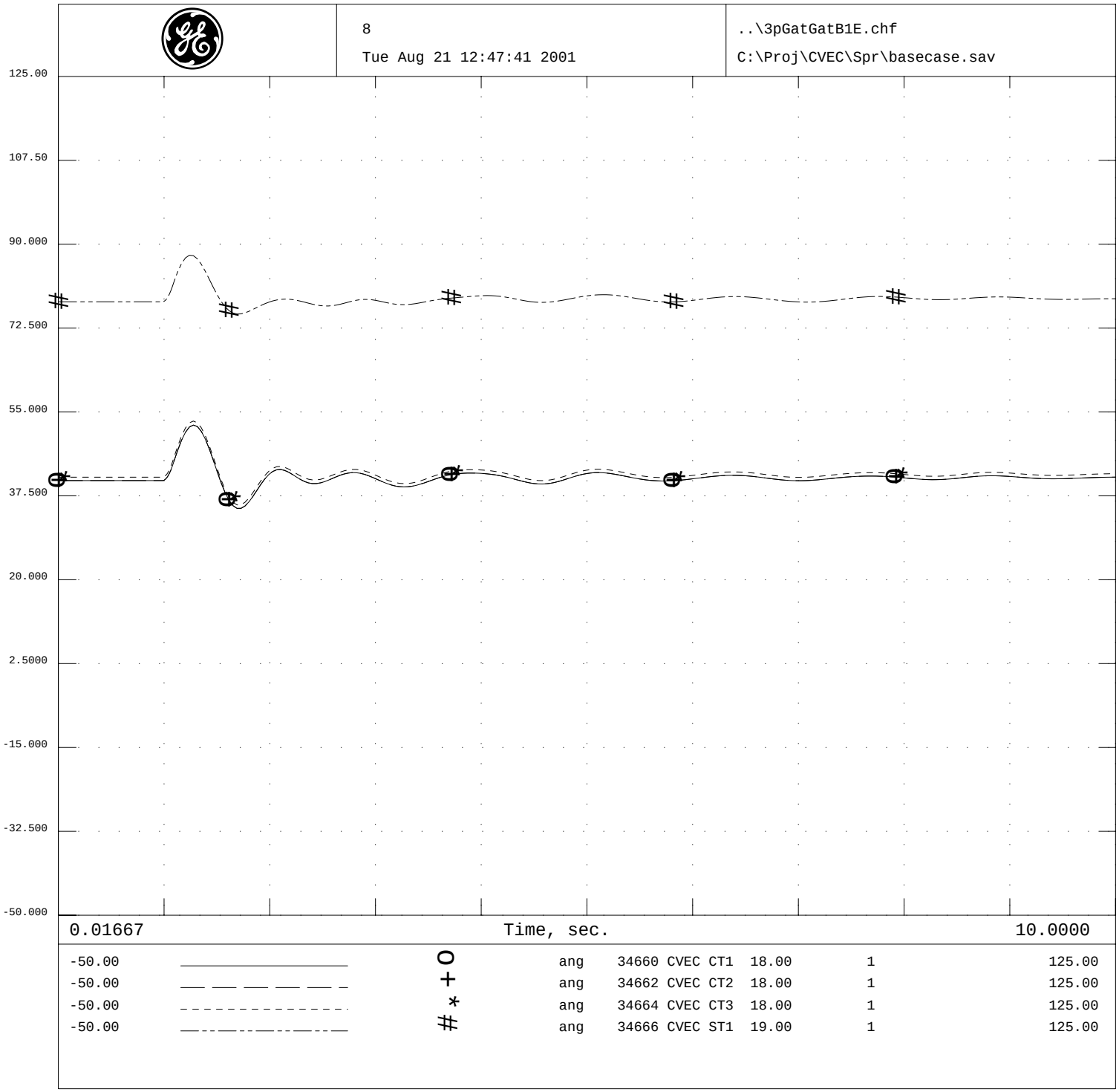
Calpine Corporation
Project Generator Rotor Speed



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Calpine Corporation
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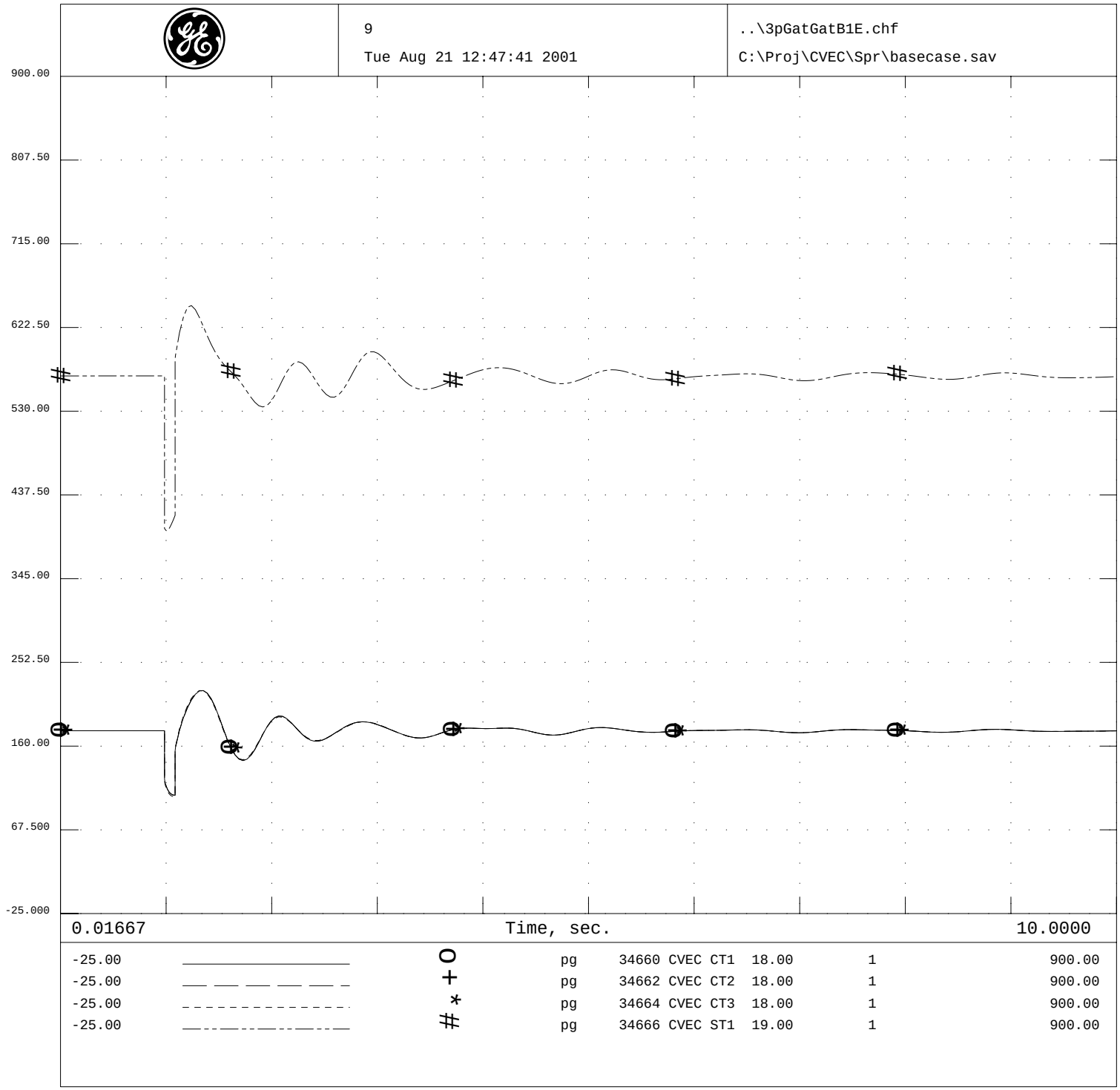

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Calpine Corporation
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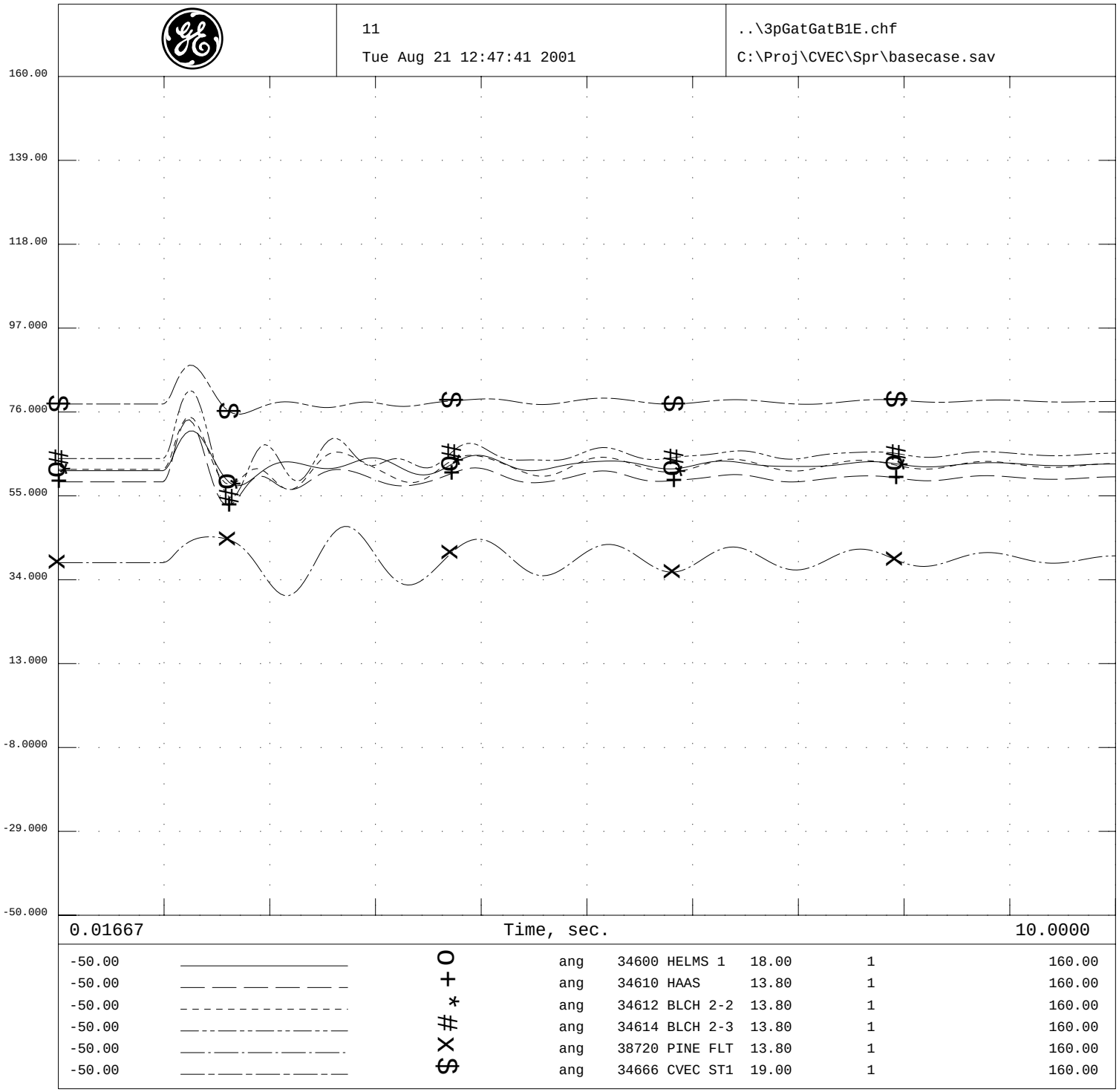

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Calpine Corporation
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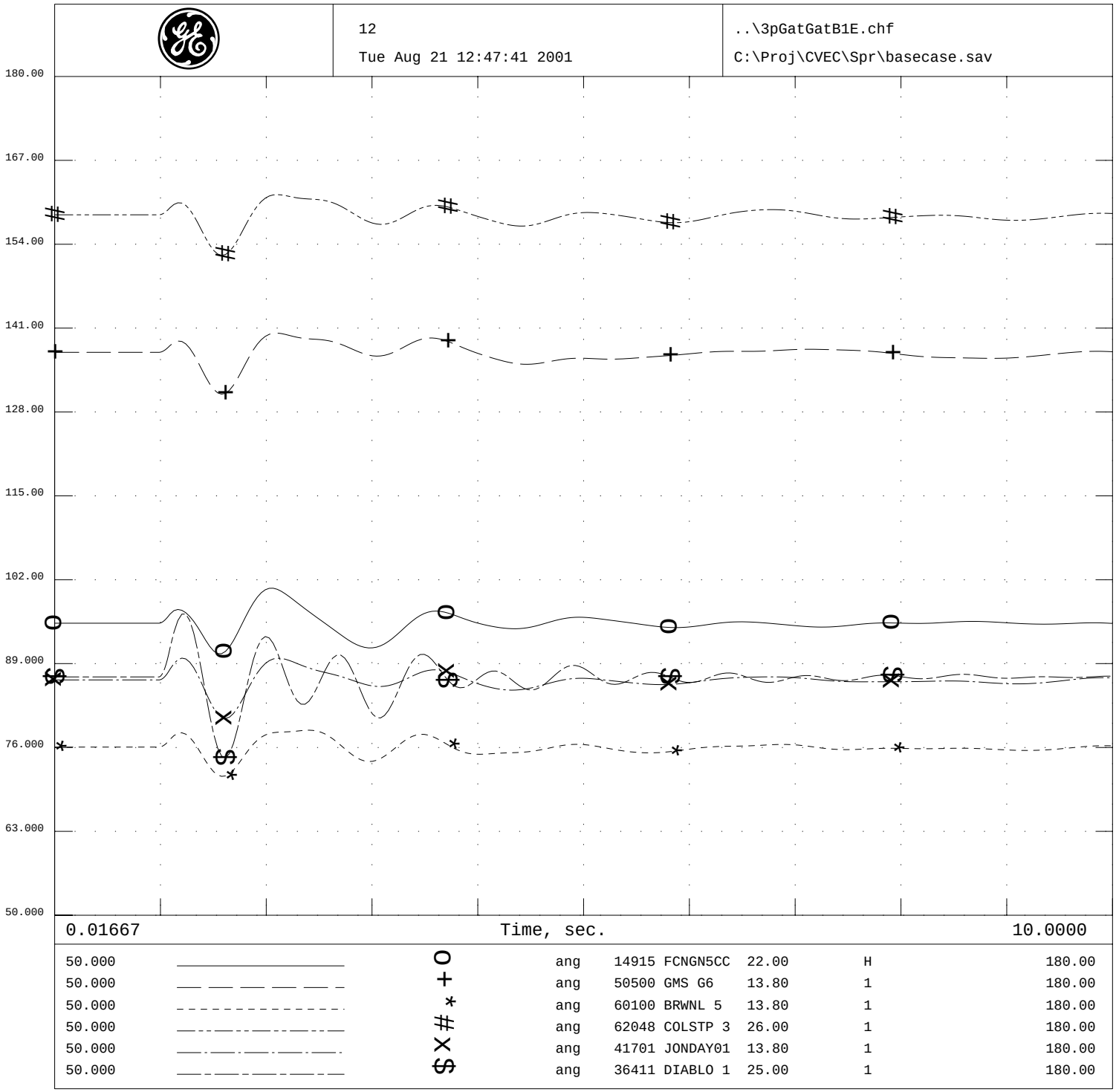

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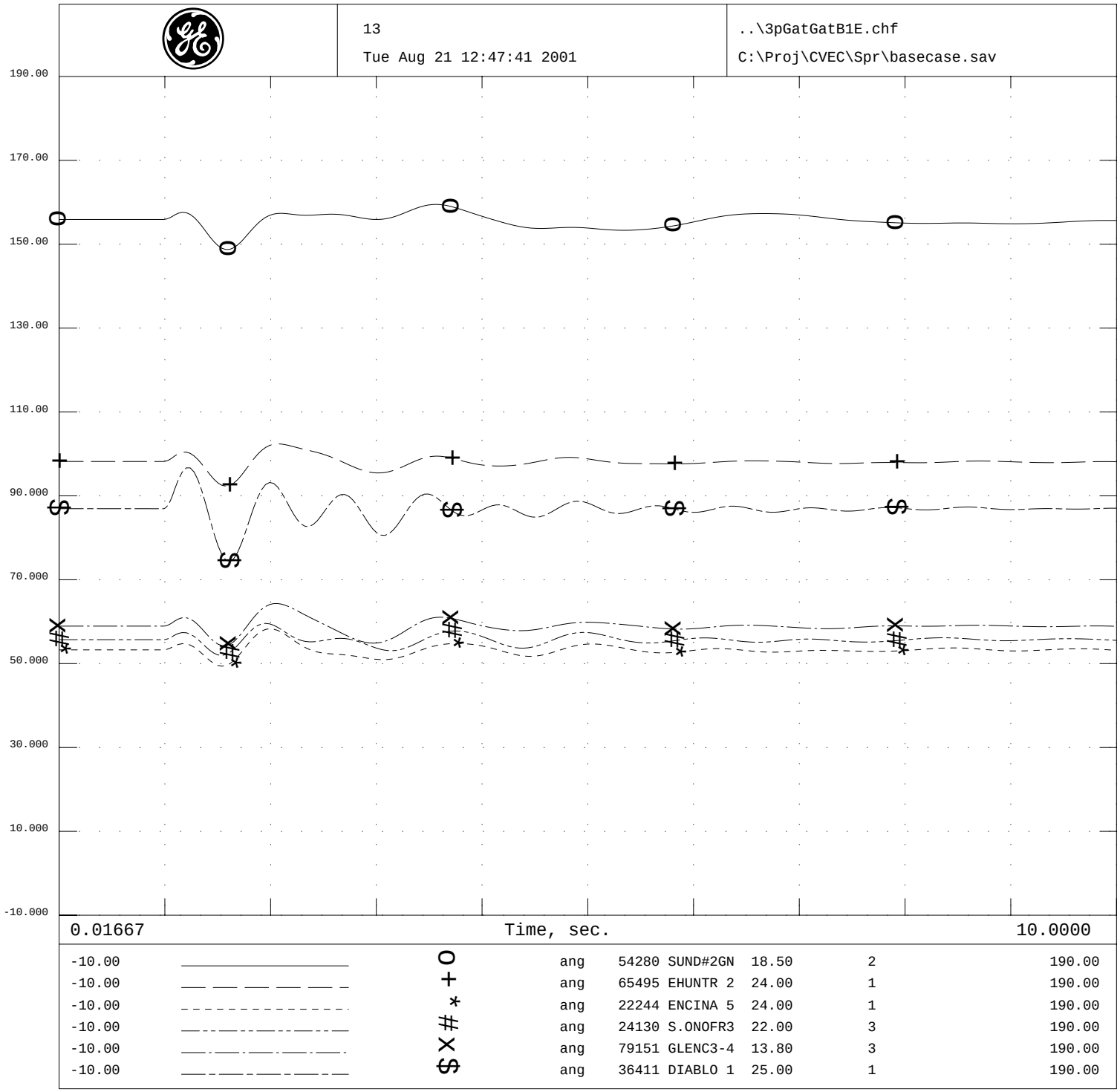

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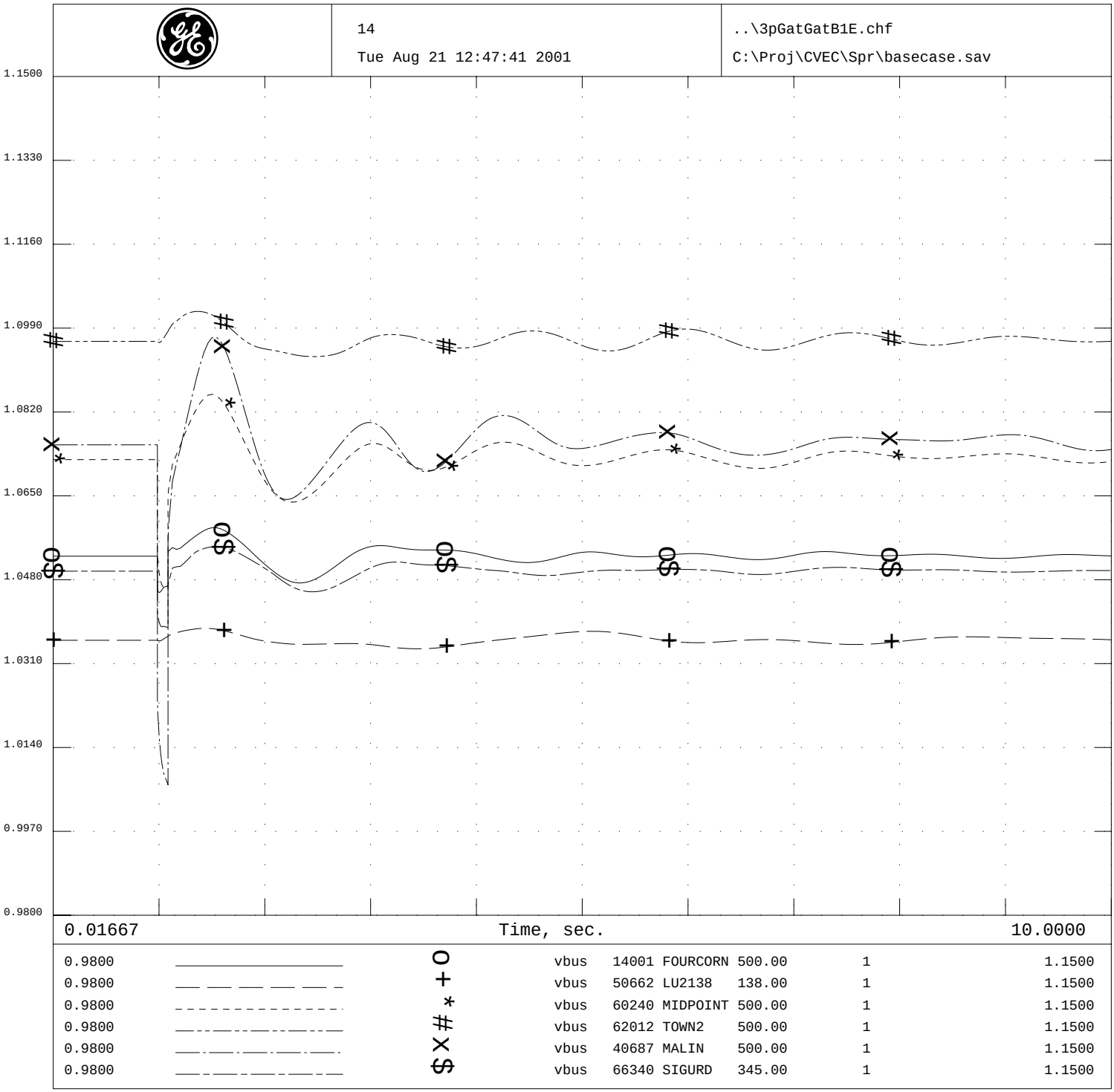

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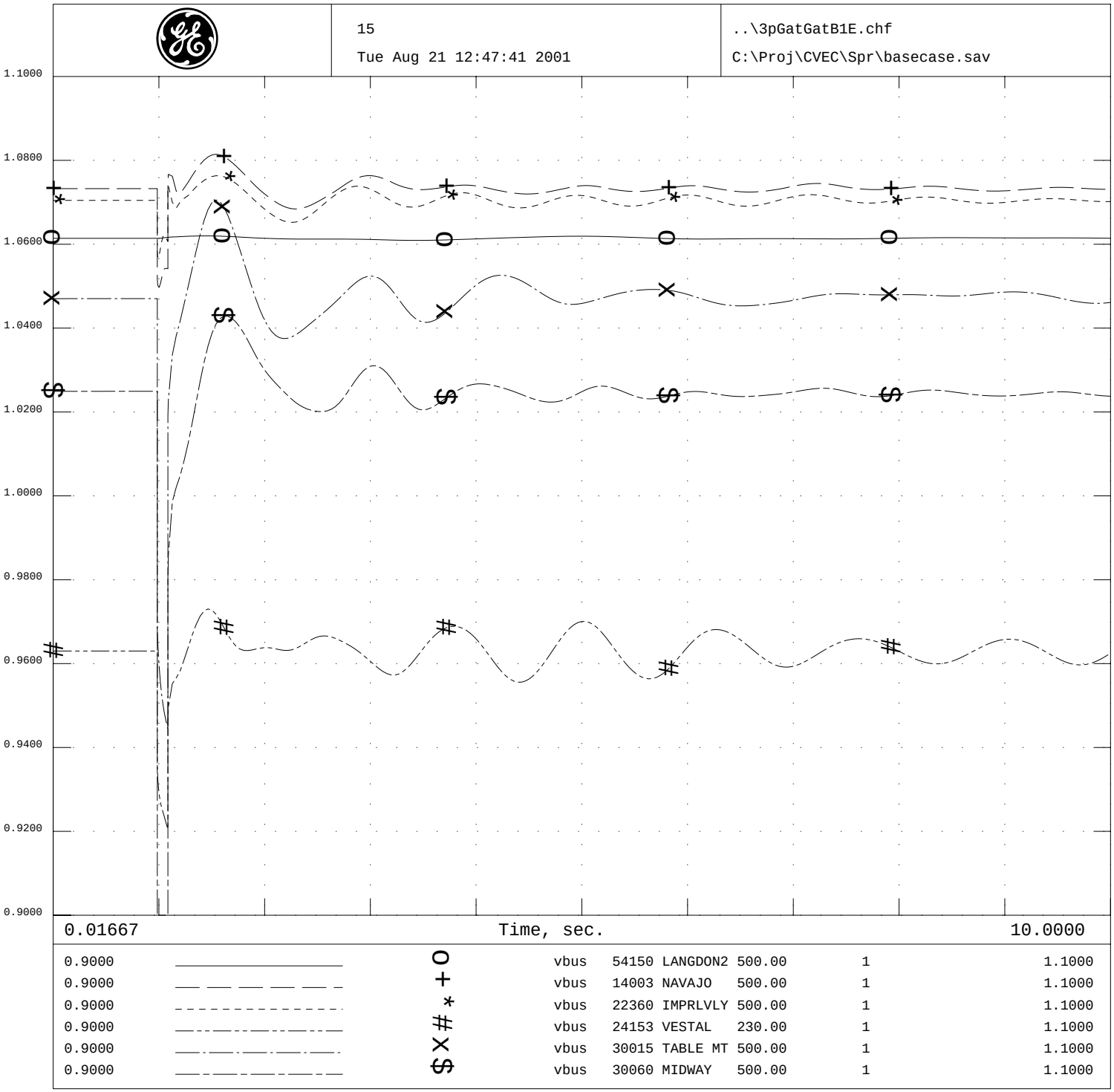

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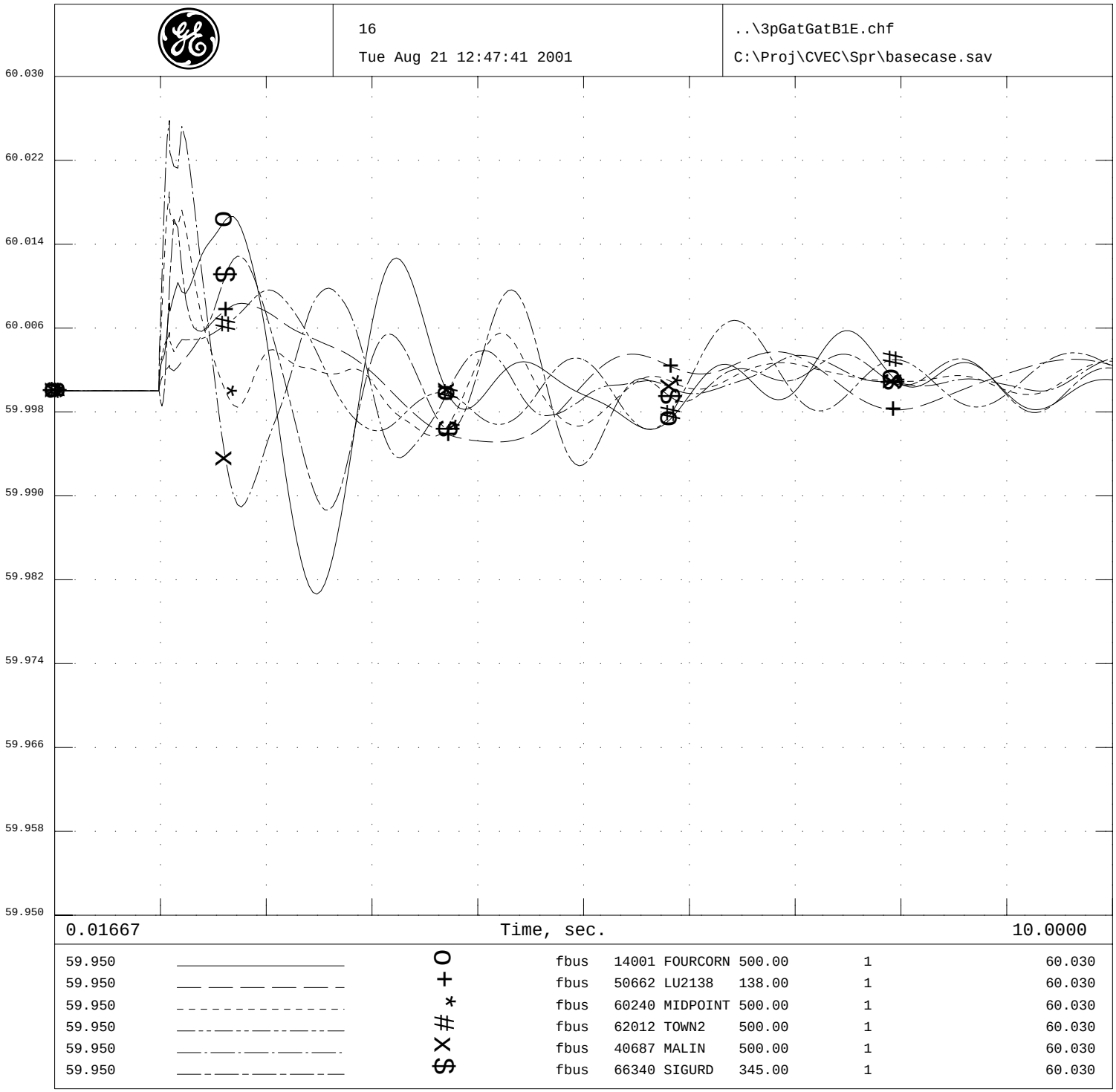

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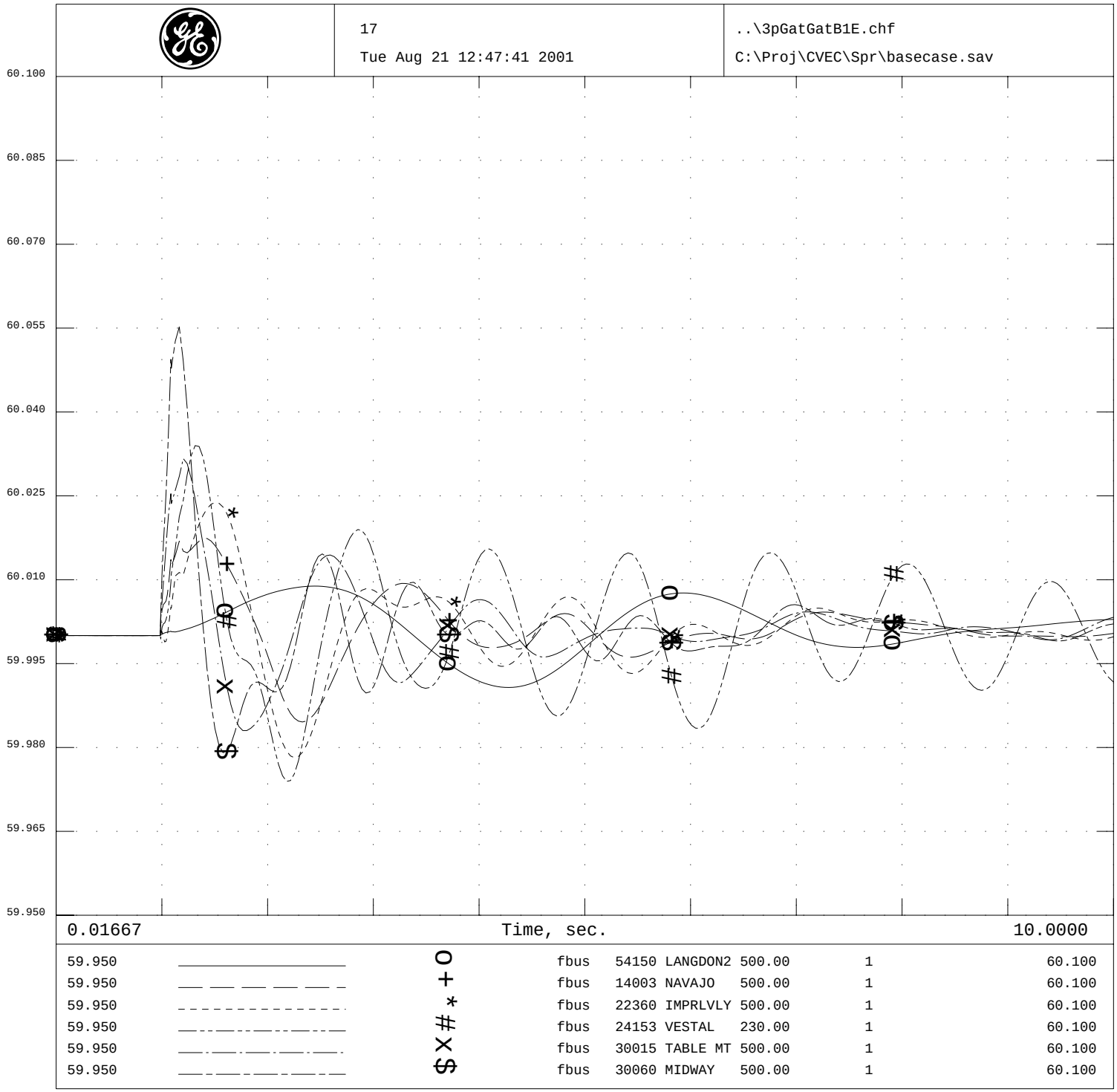

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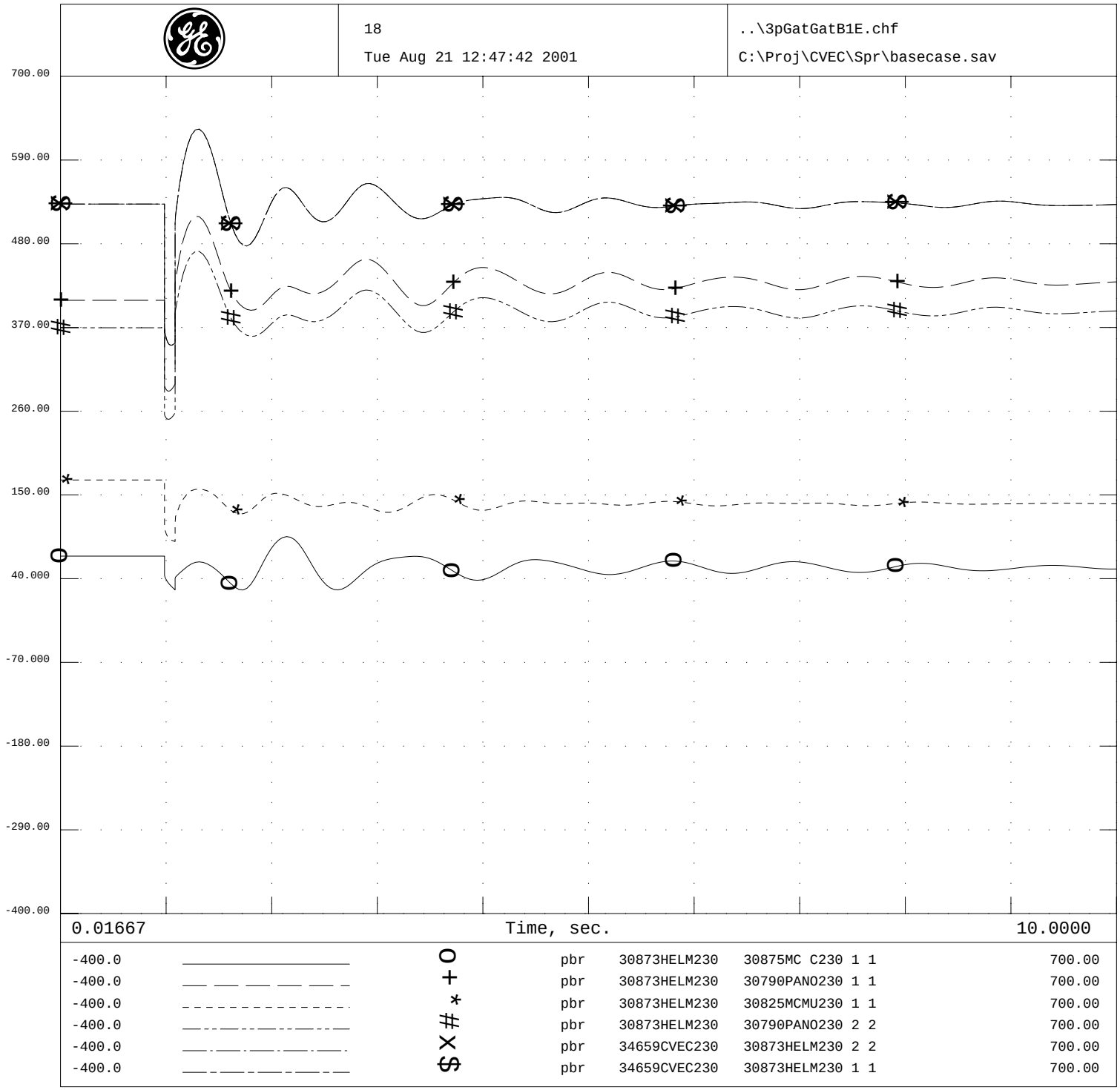
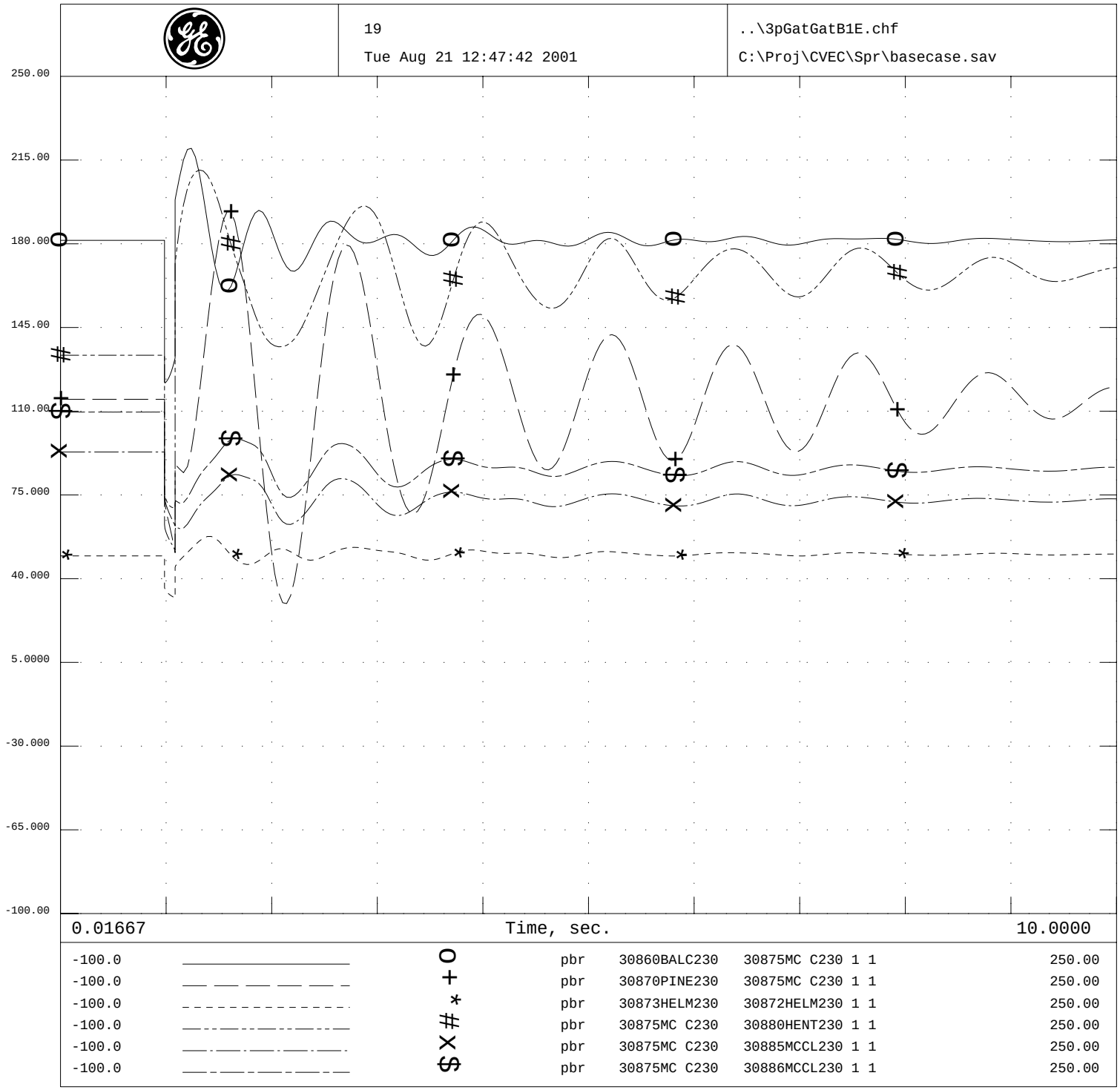


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates 230kV Bus 1E Outage
3 phase 6 cycle fault at Gates 230kV bus and clear bus 1E

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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Calpine Corporation
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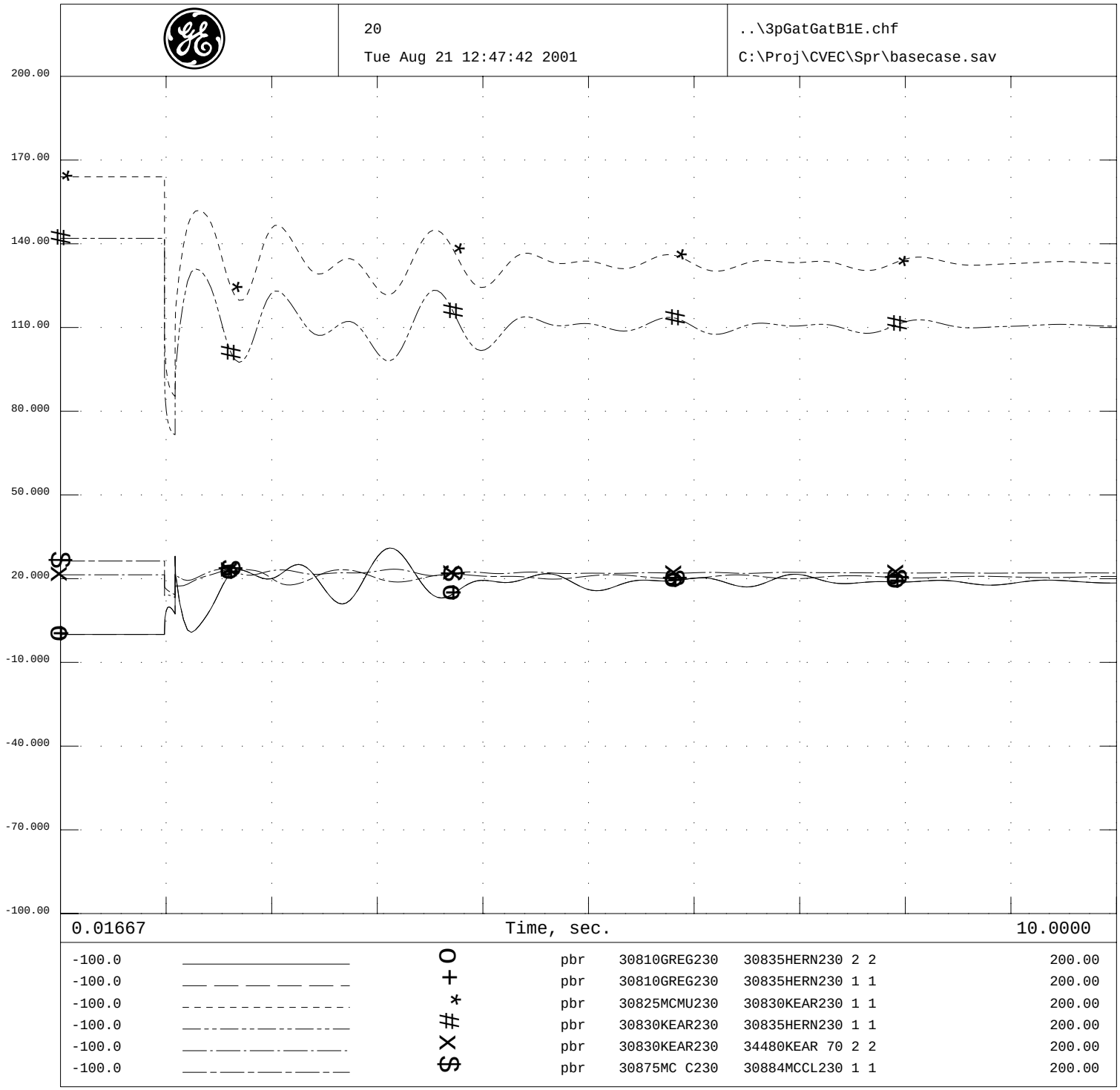

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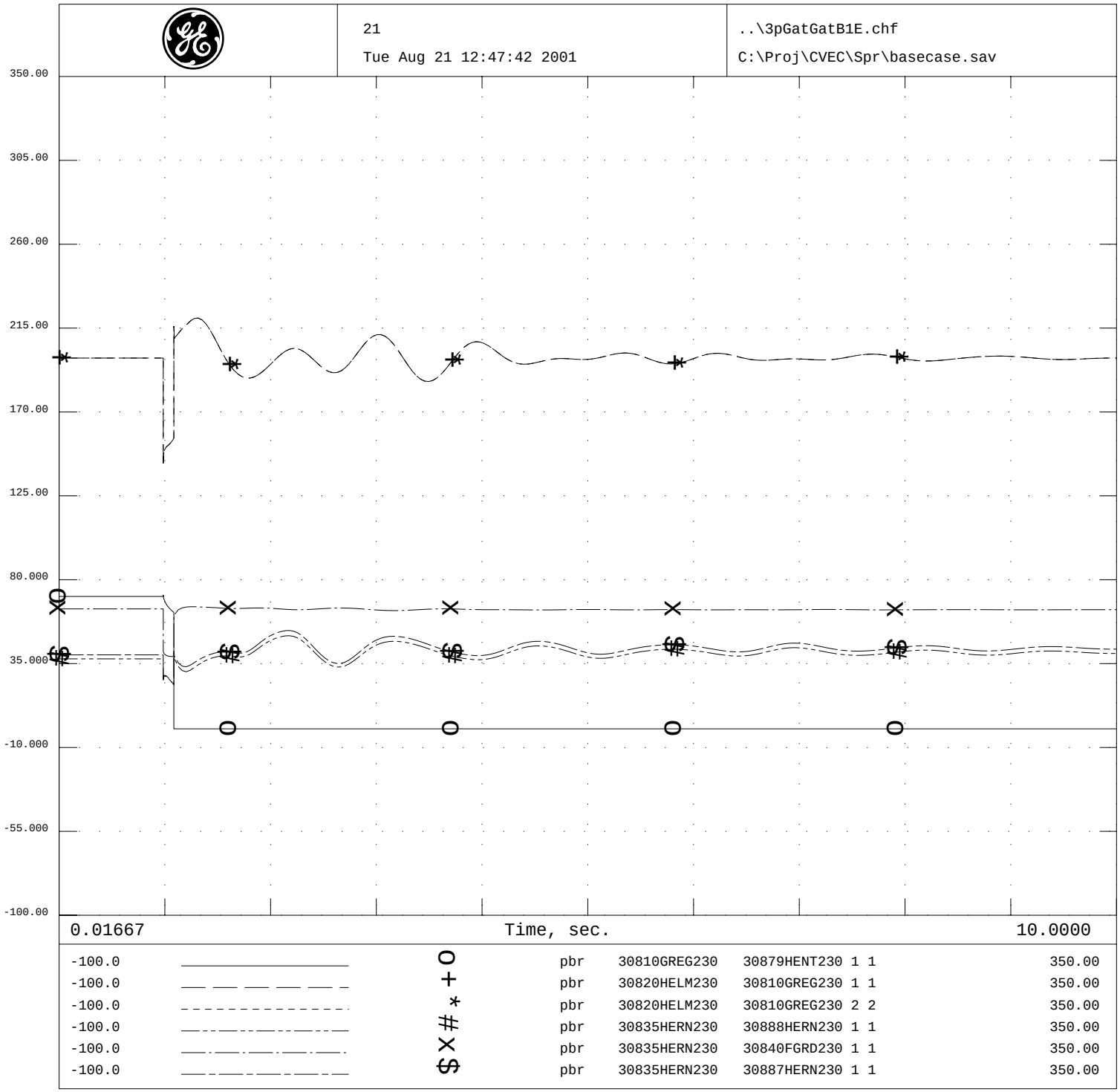

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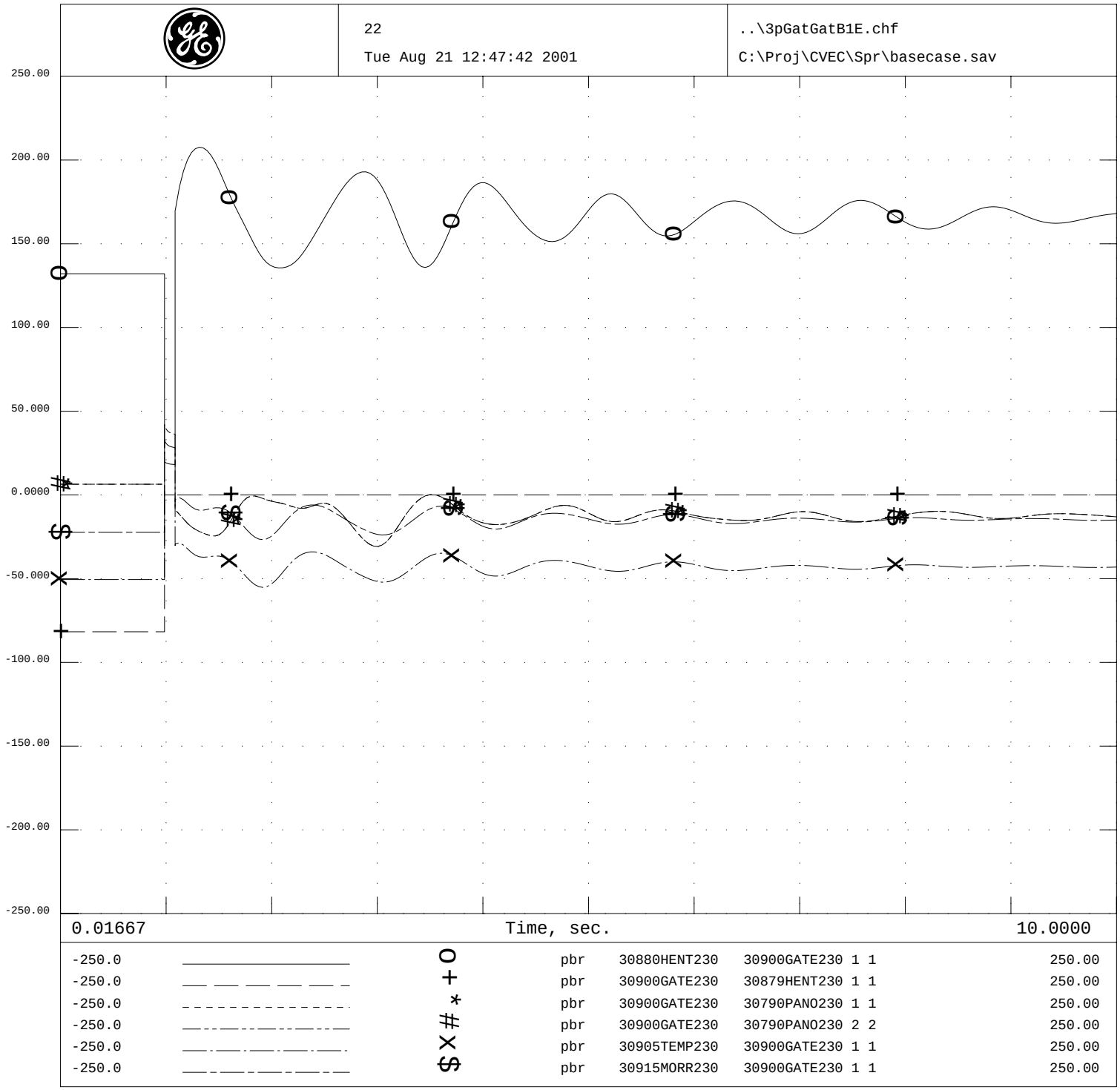

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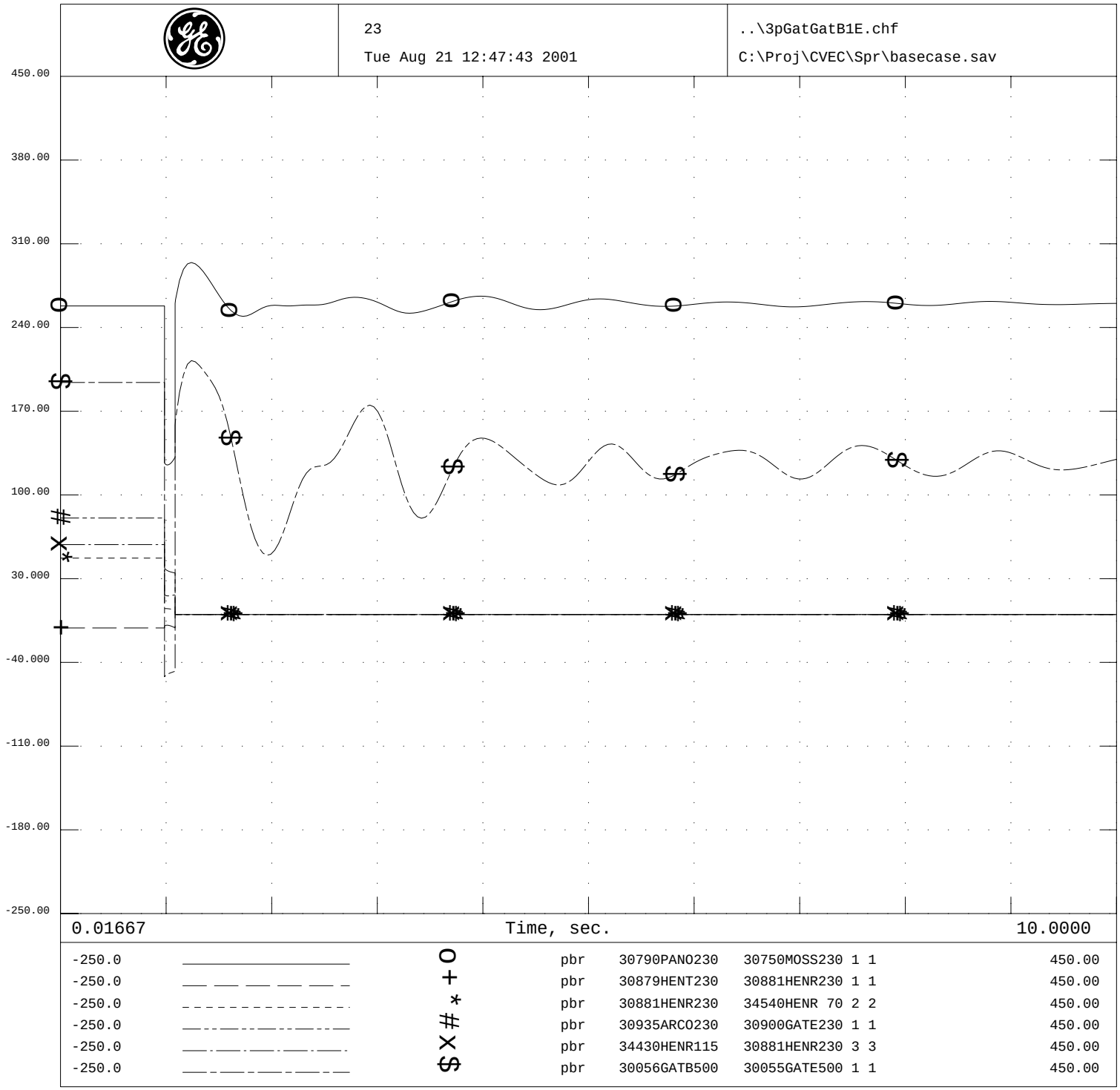

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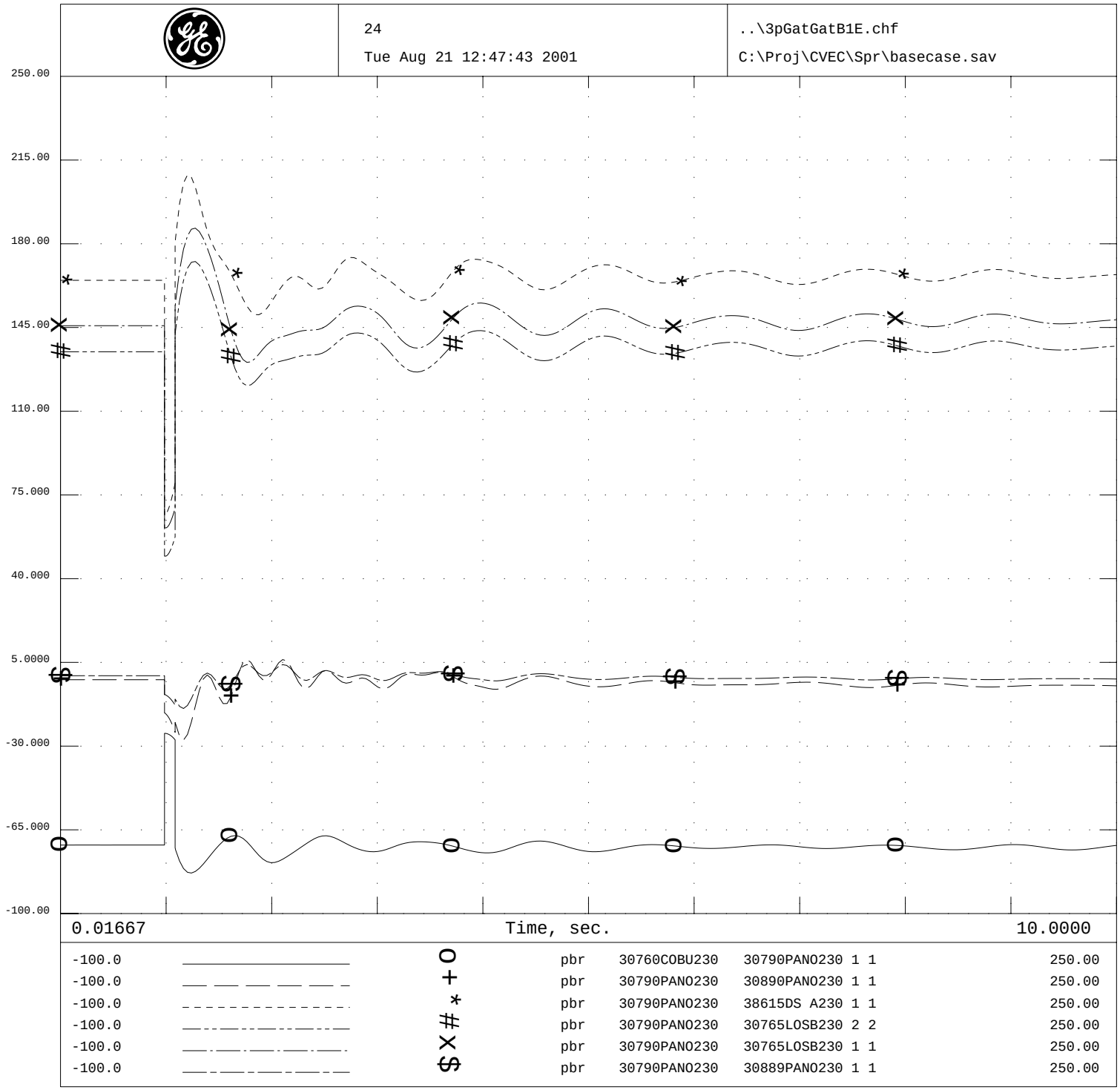

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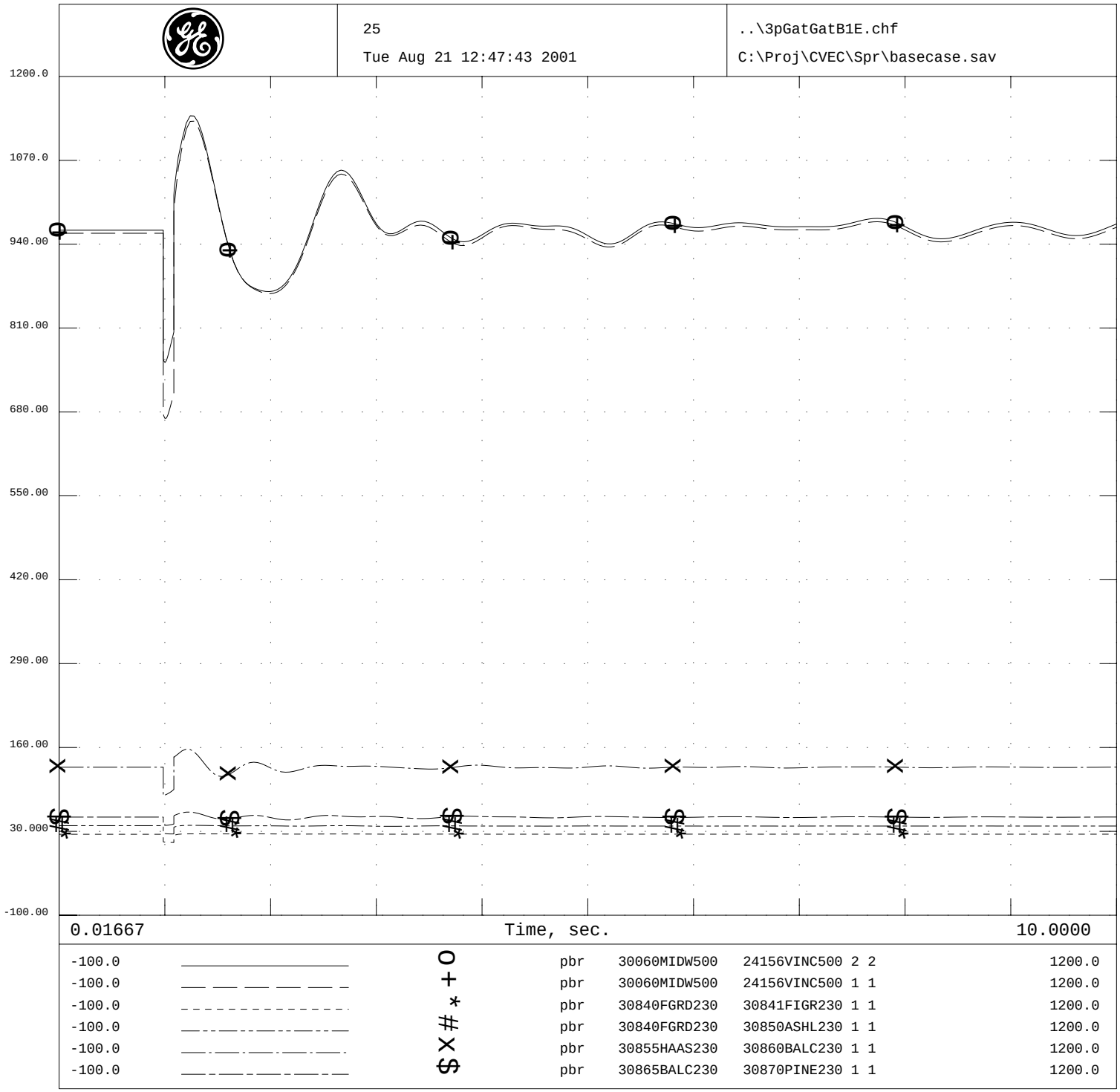

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Calpine Corporation
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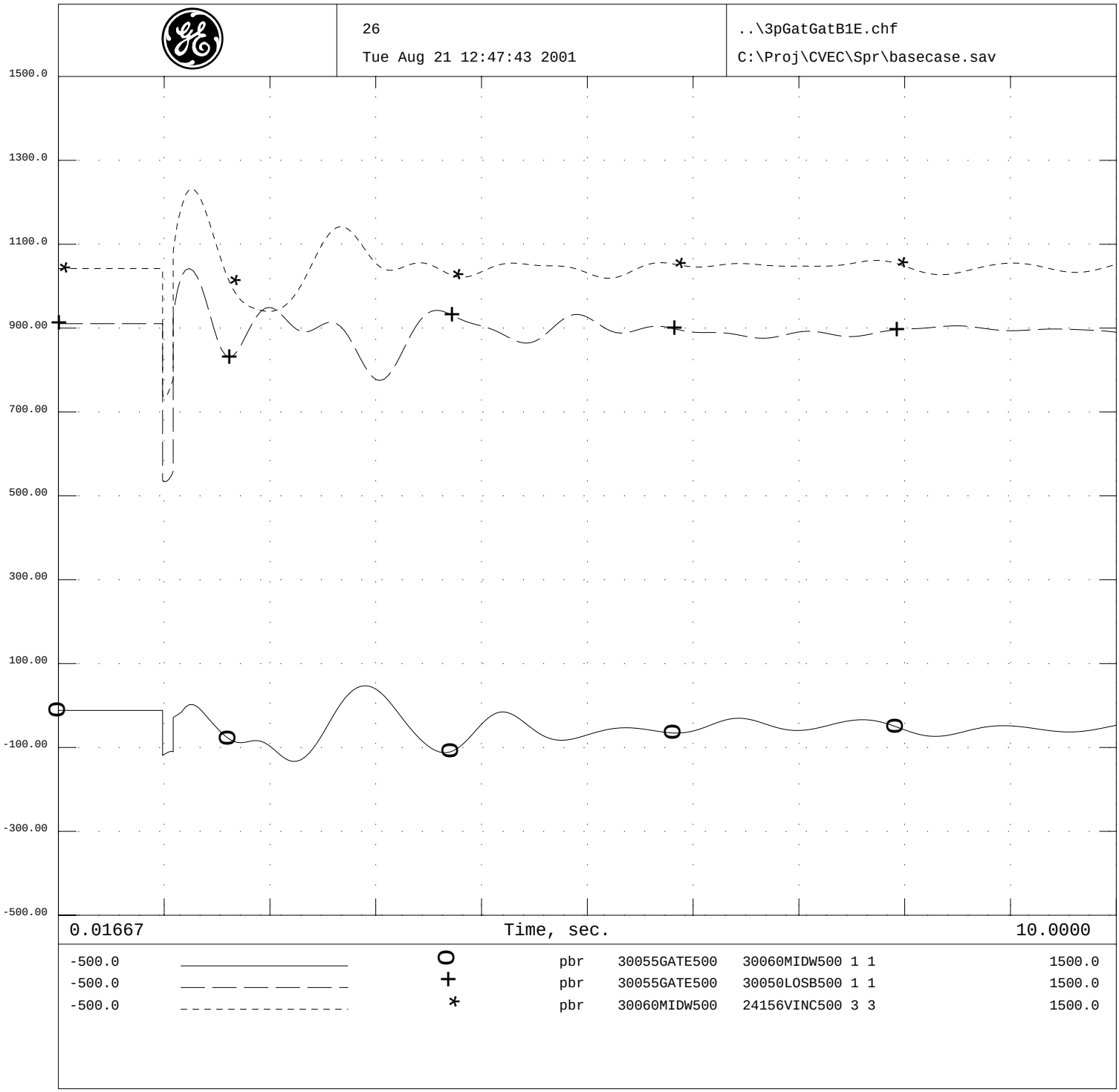

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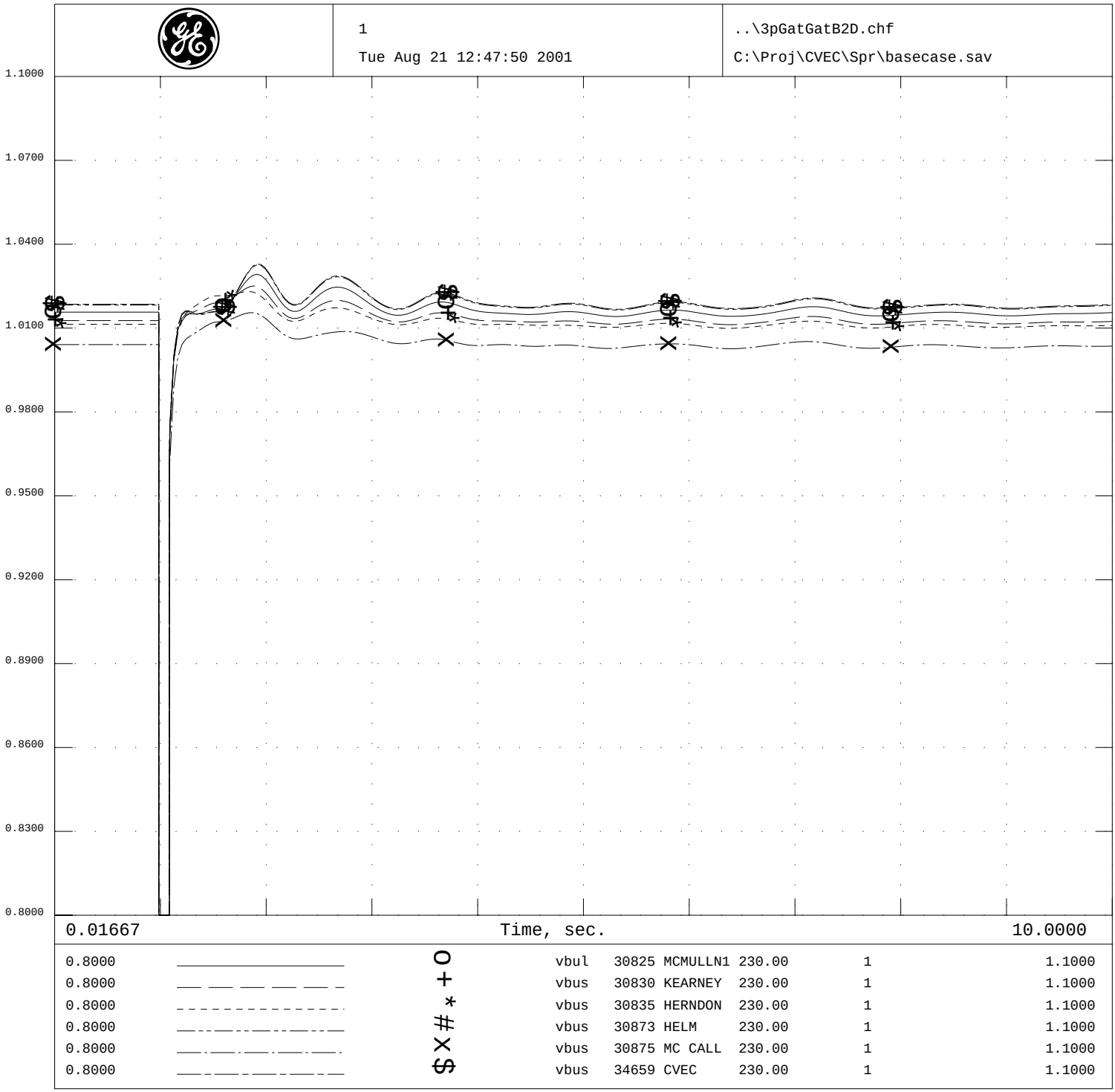

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates 230kV Bus 2D Outage
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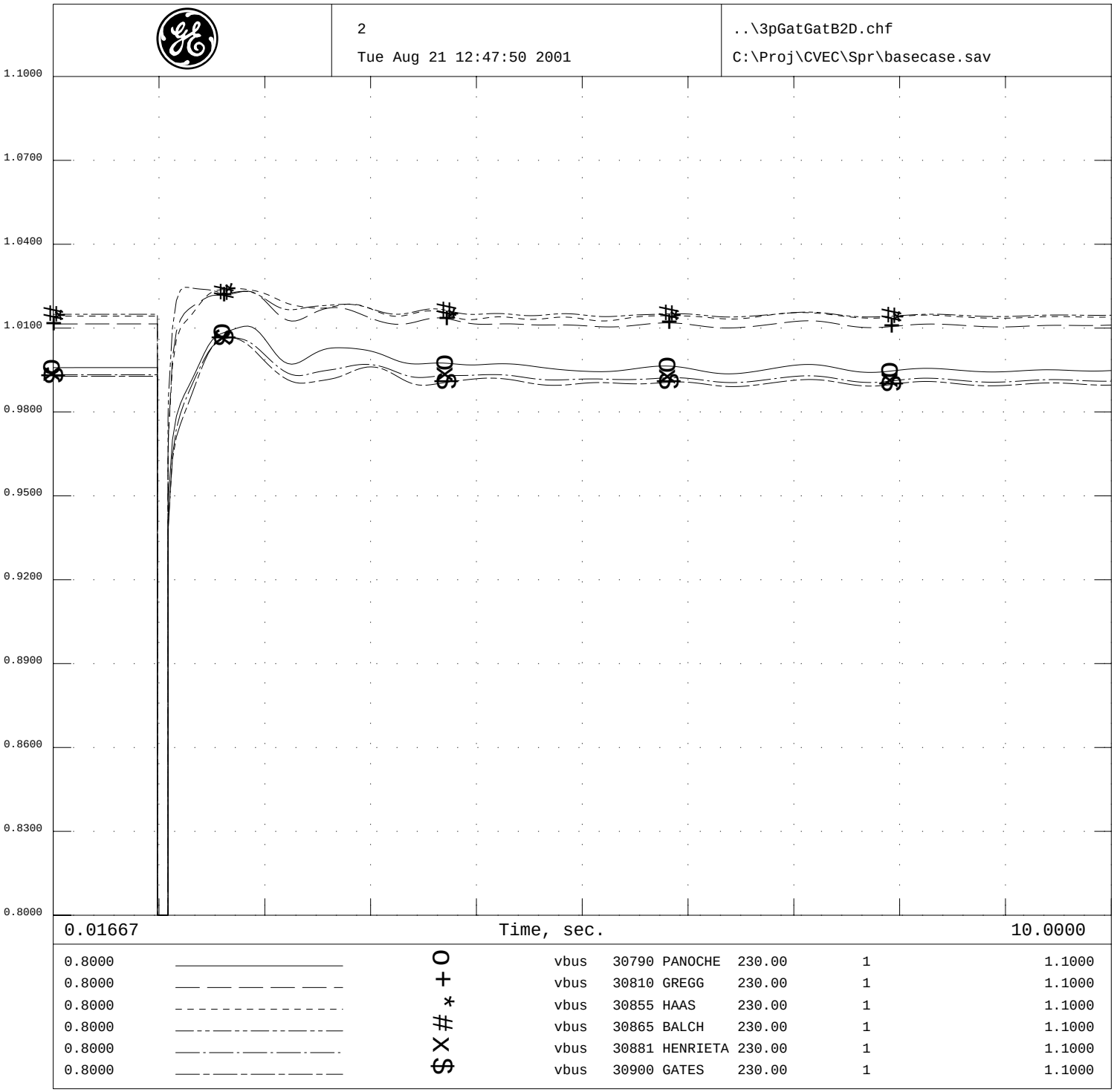
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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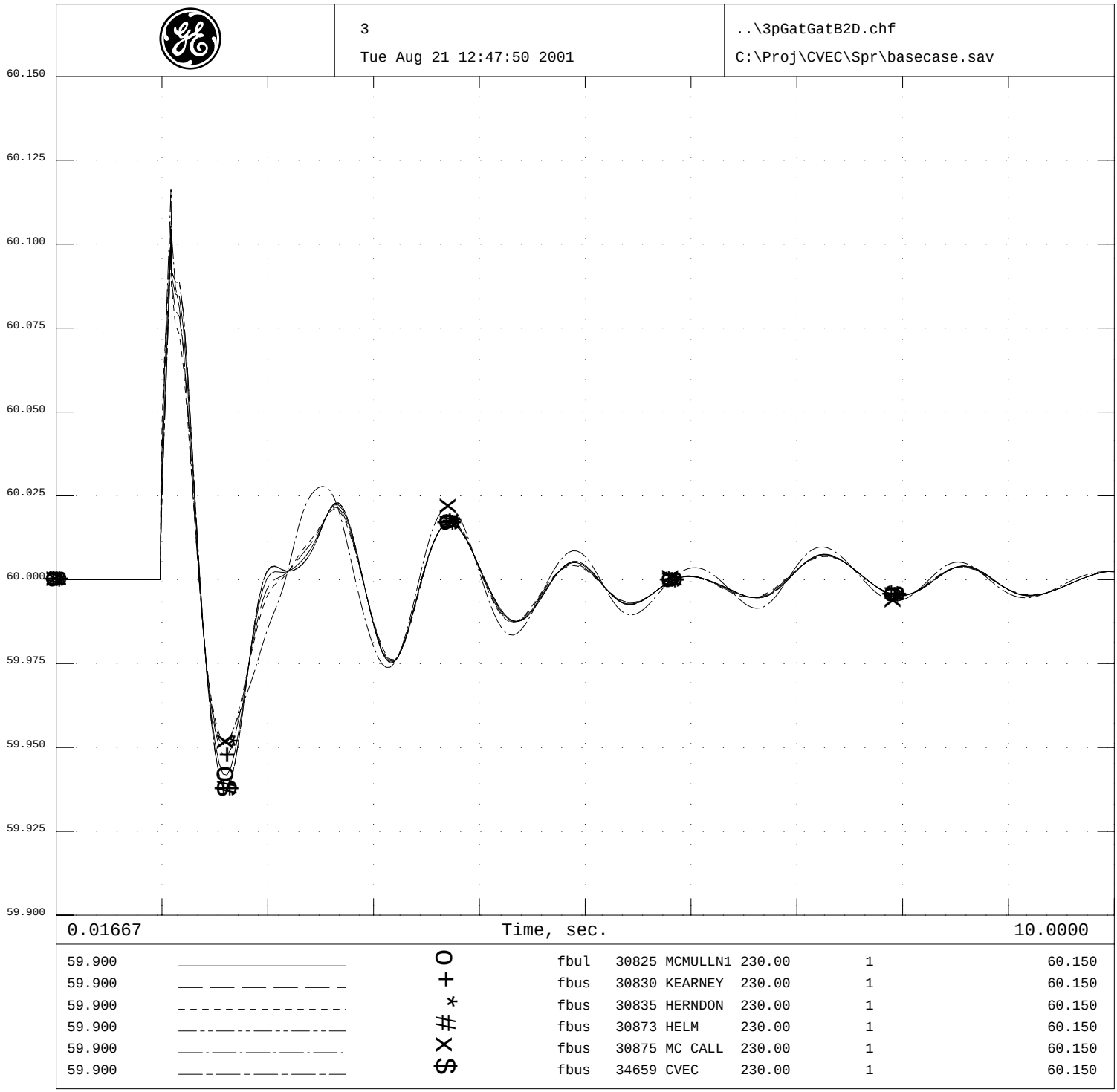

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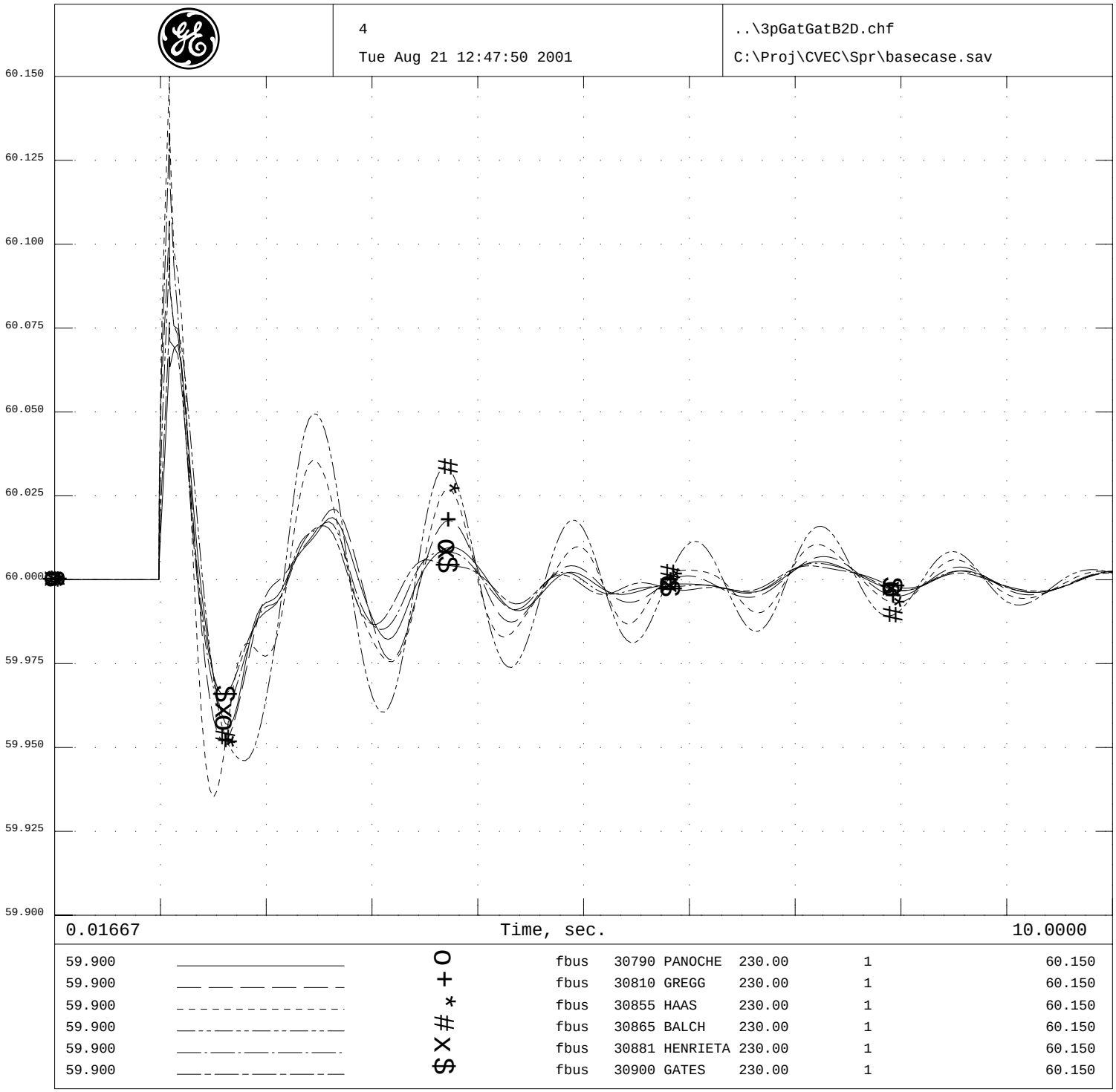
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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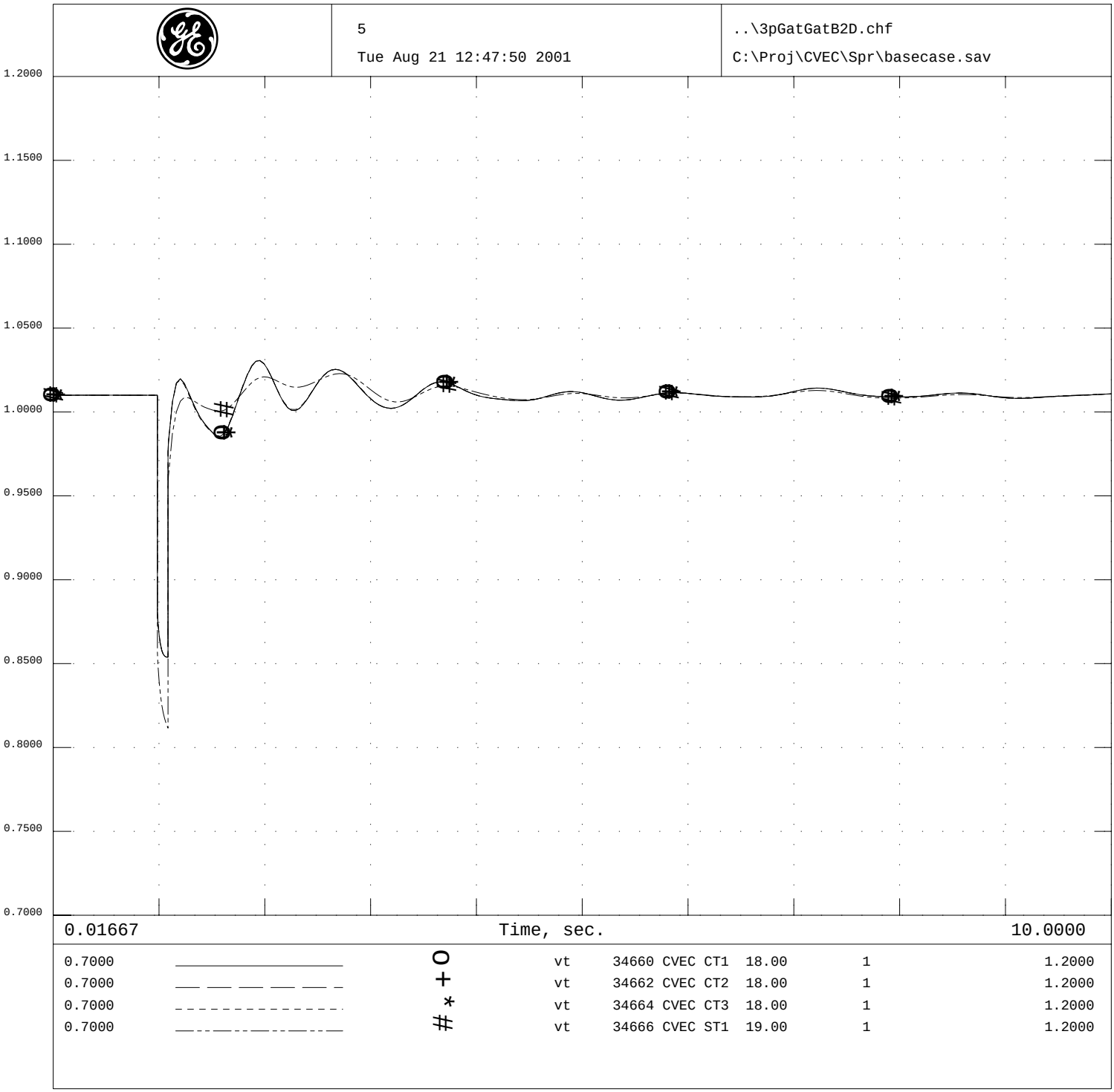

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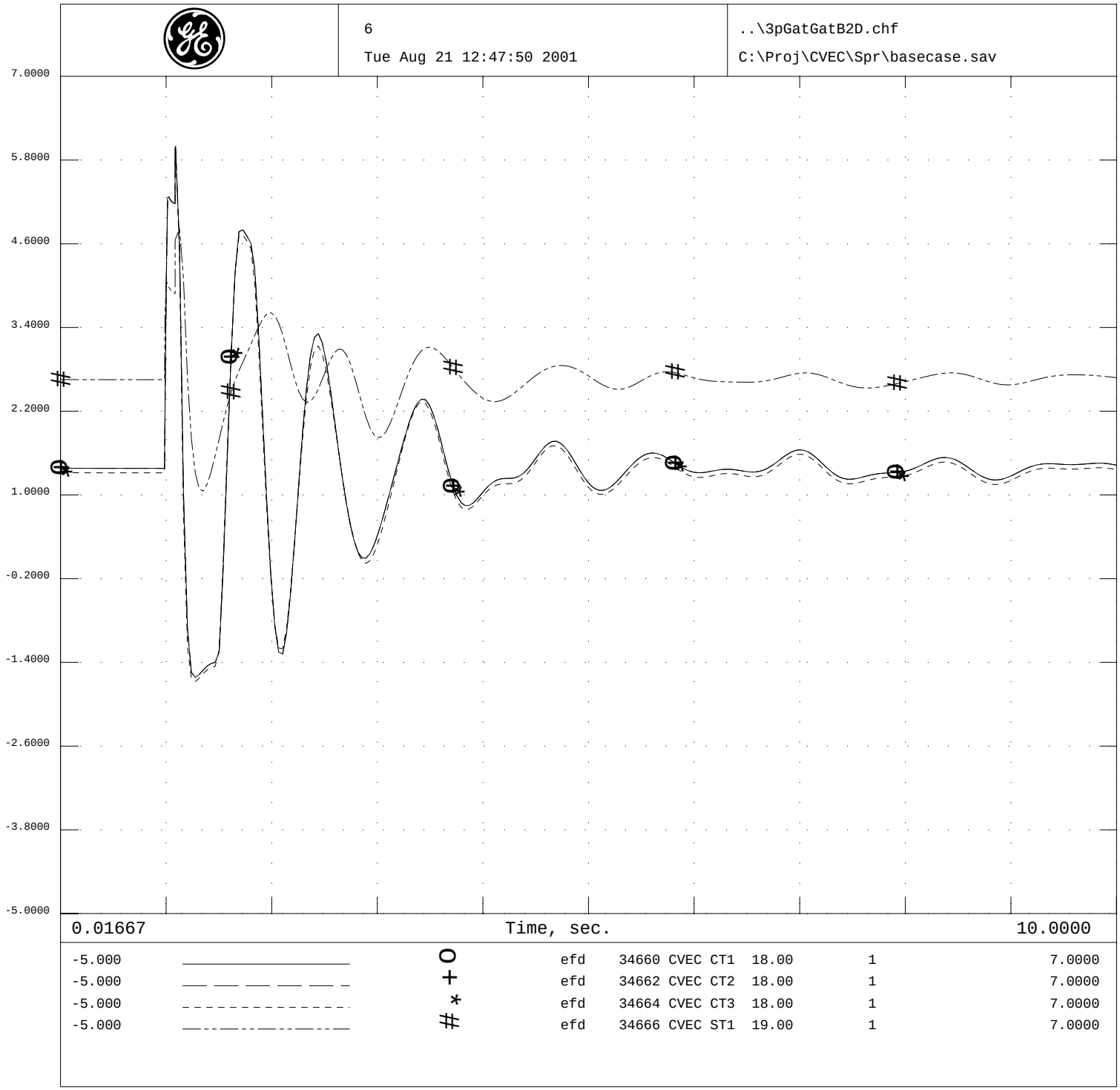
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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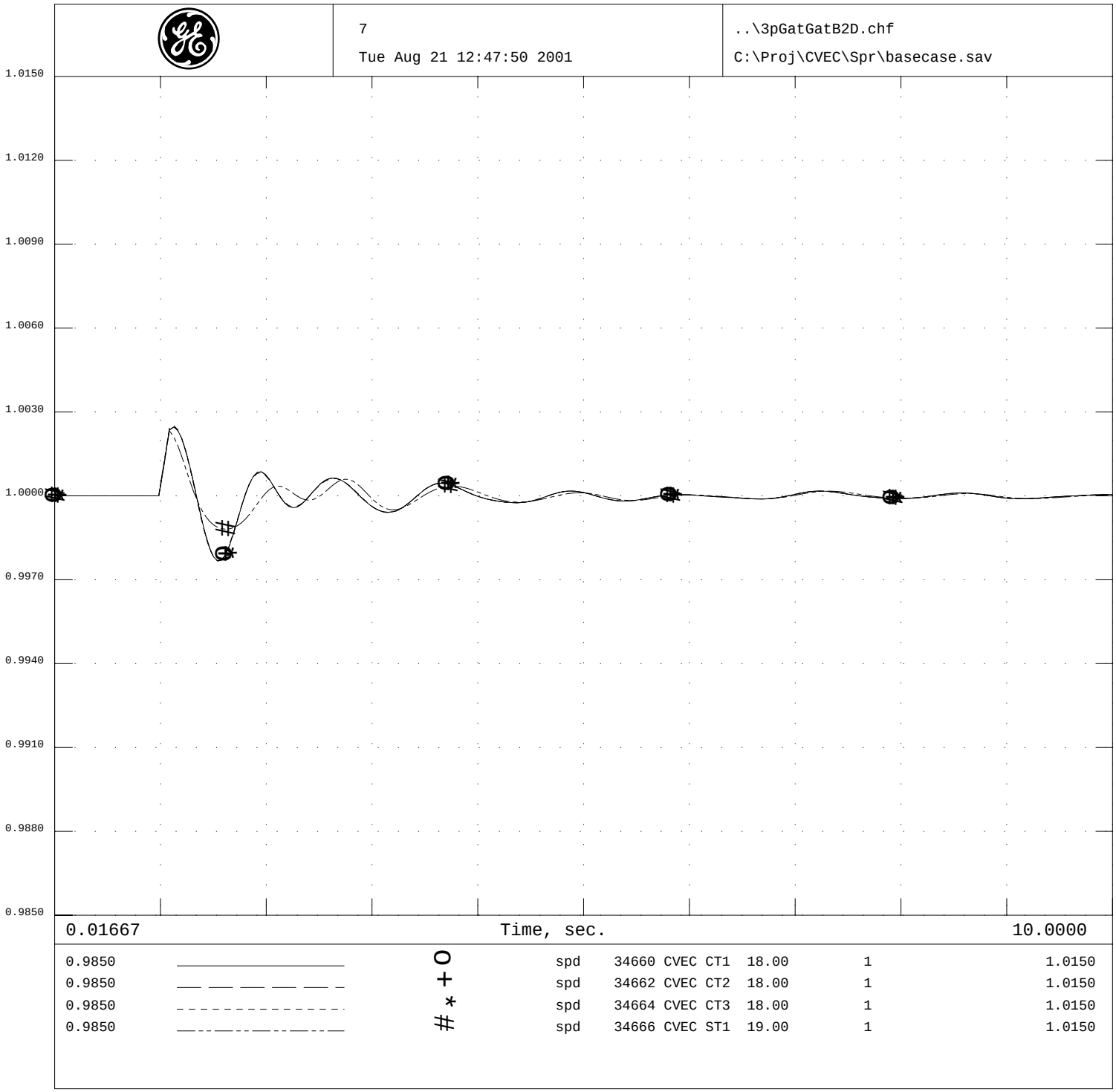
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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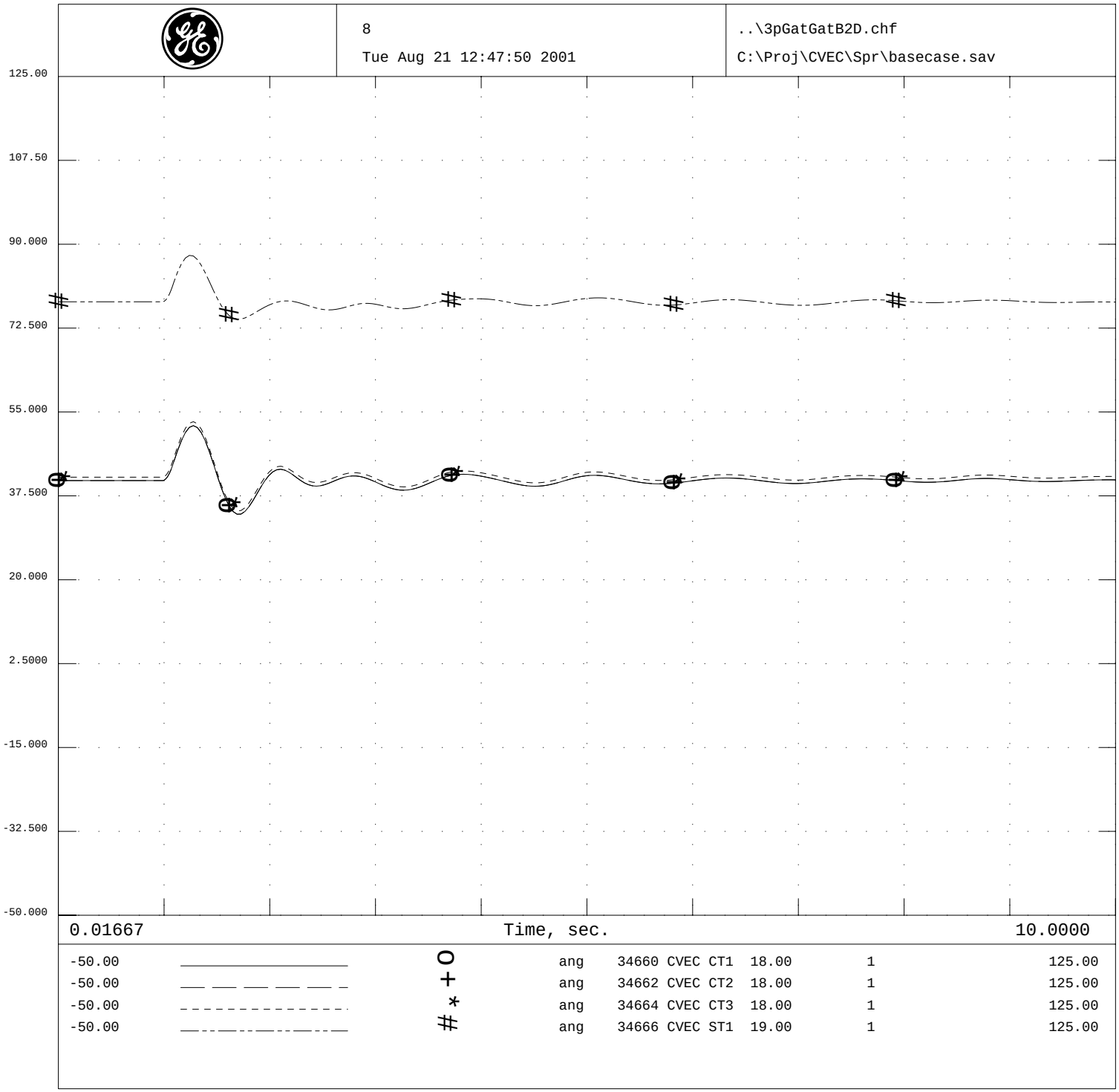
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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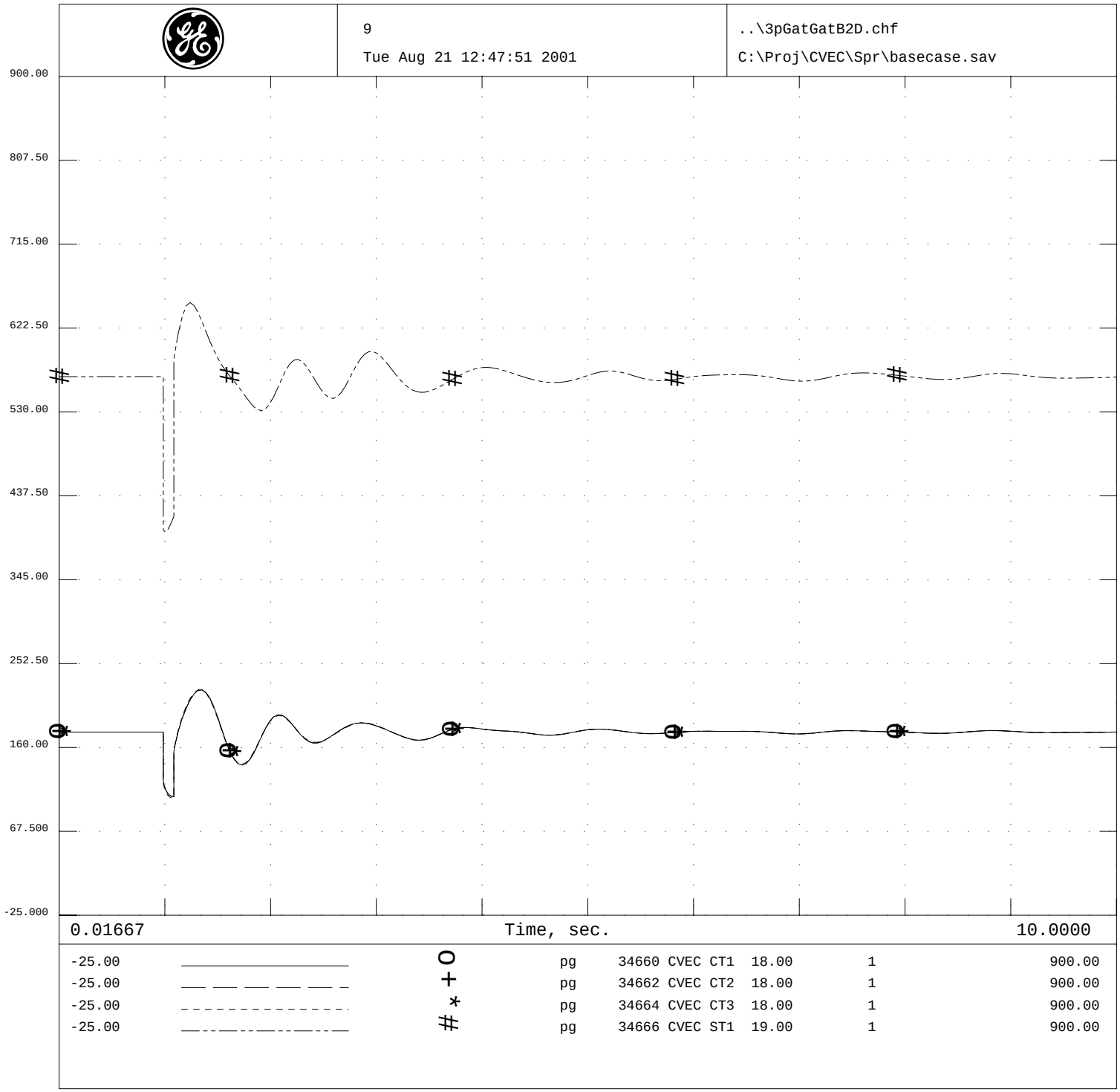
Calpine Corporation
Project Generator Rotor Angle



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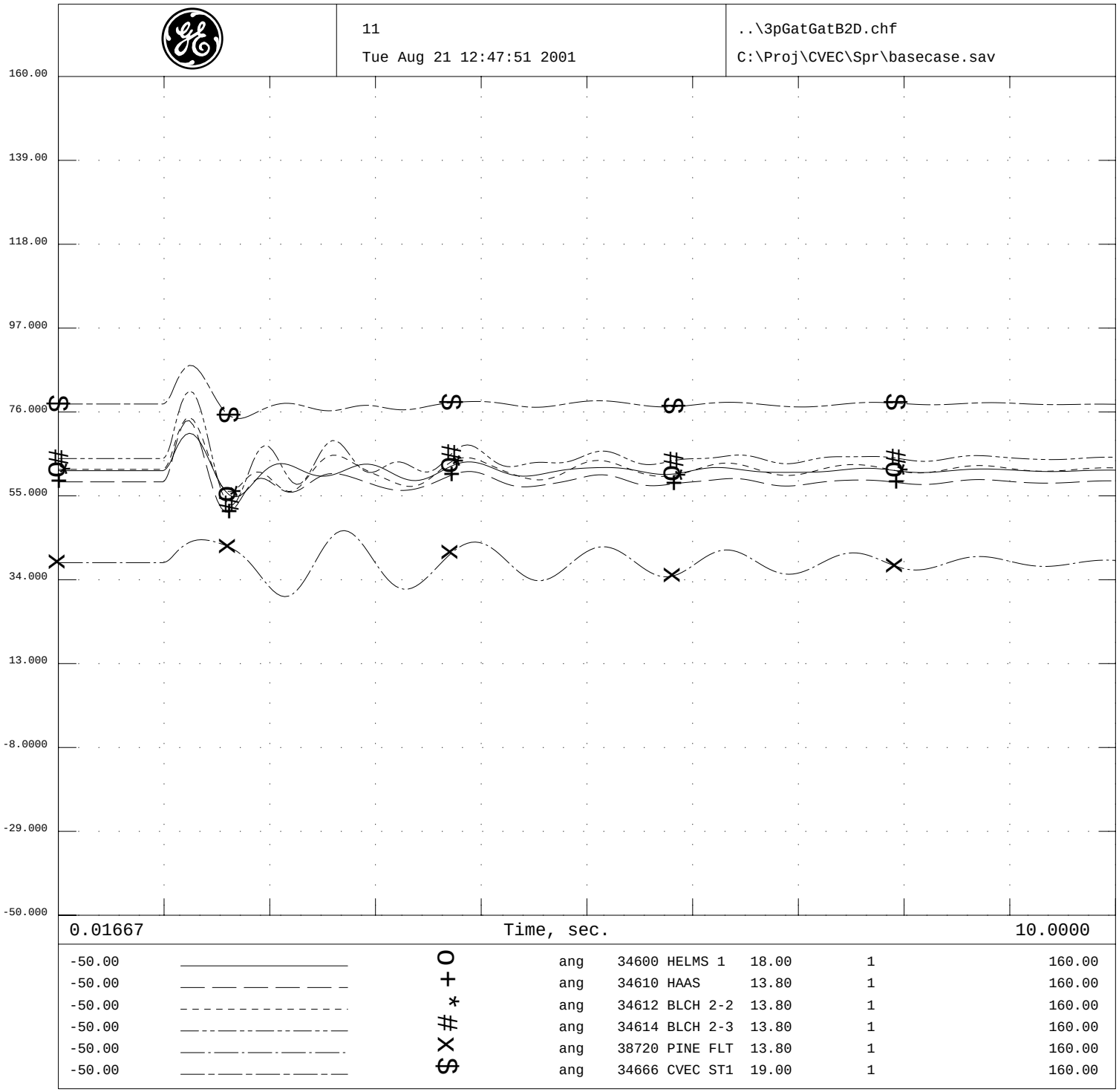
Calpine Corporation
Project Generator Terminal Power



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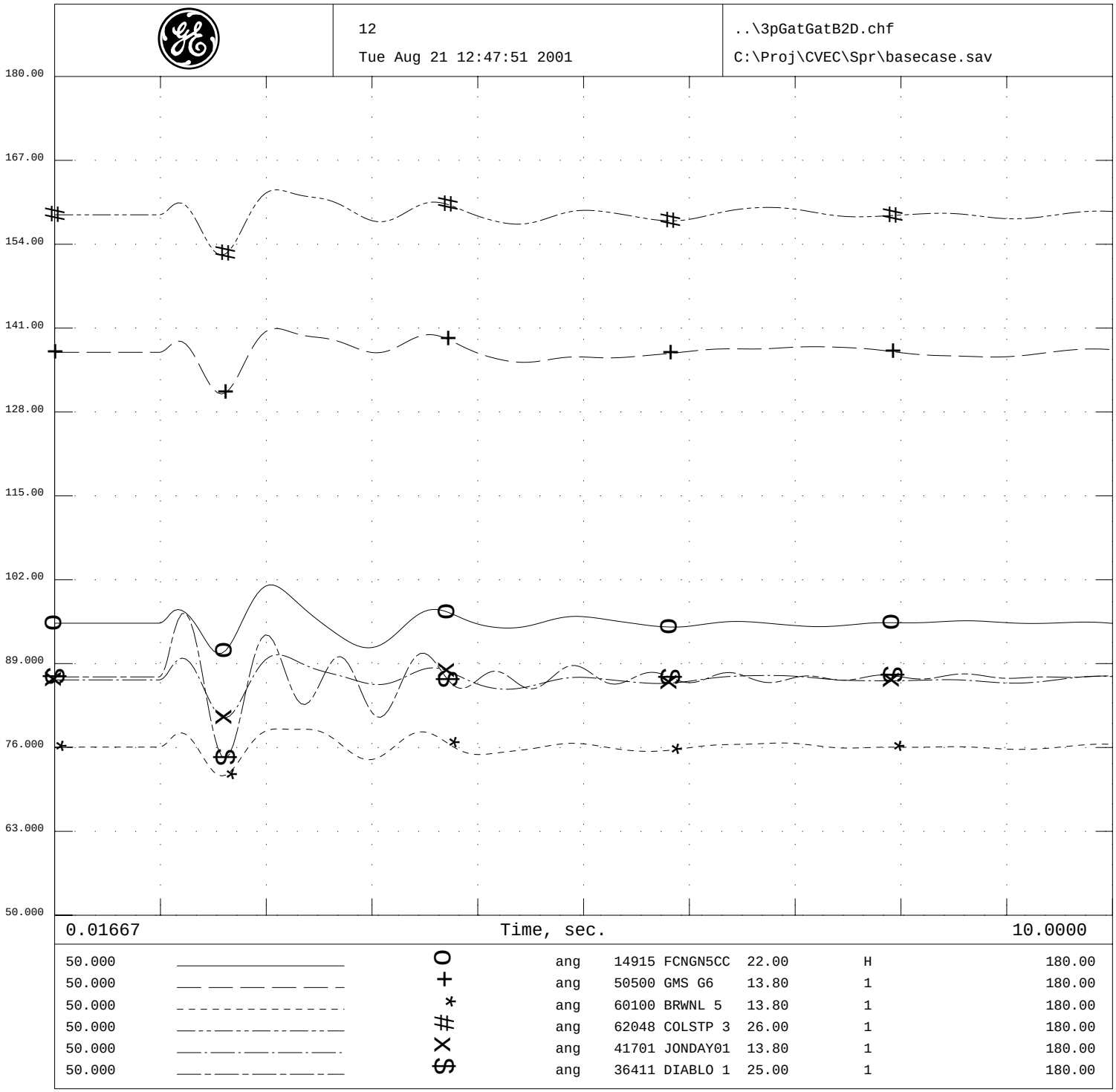
Calpine Corporation
Selected Local Rotor Angle Plots



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Calpine Corporation
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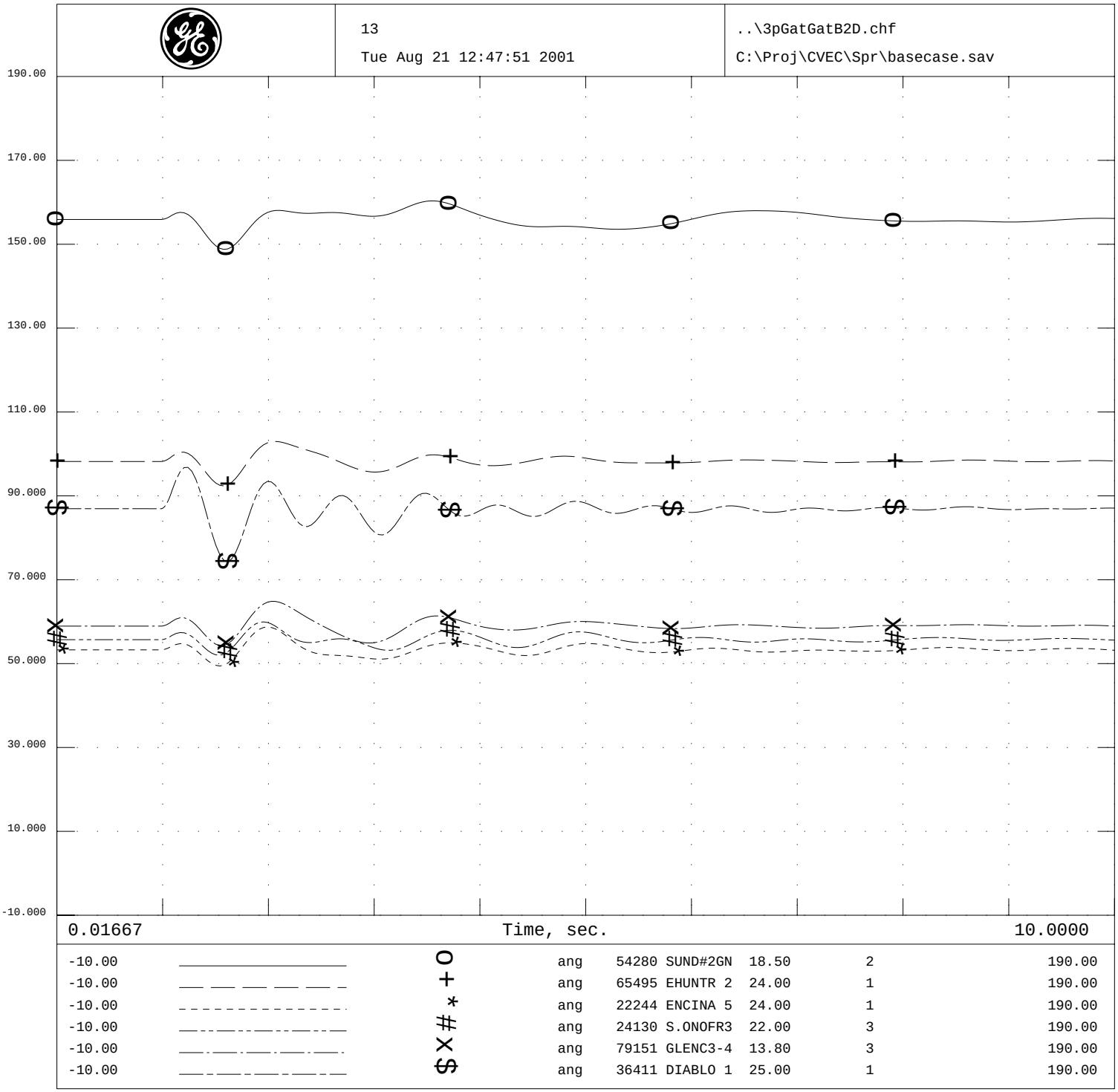

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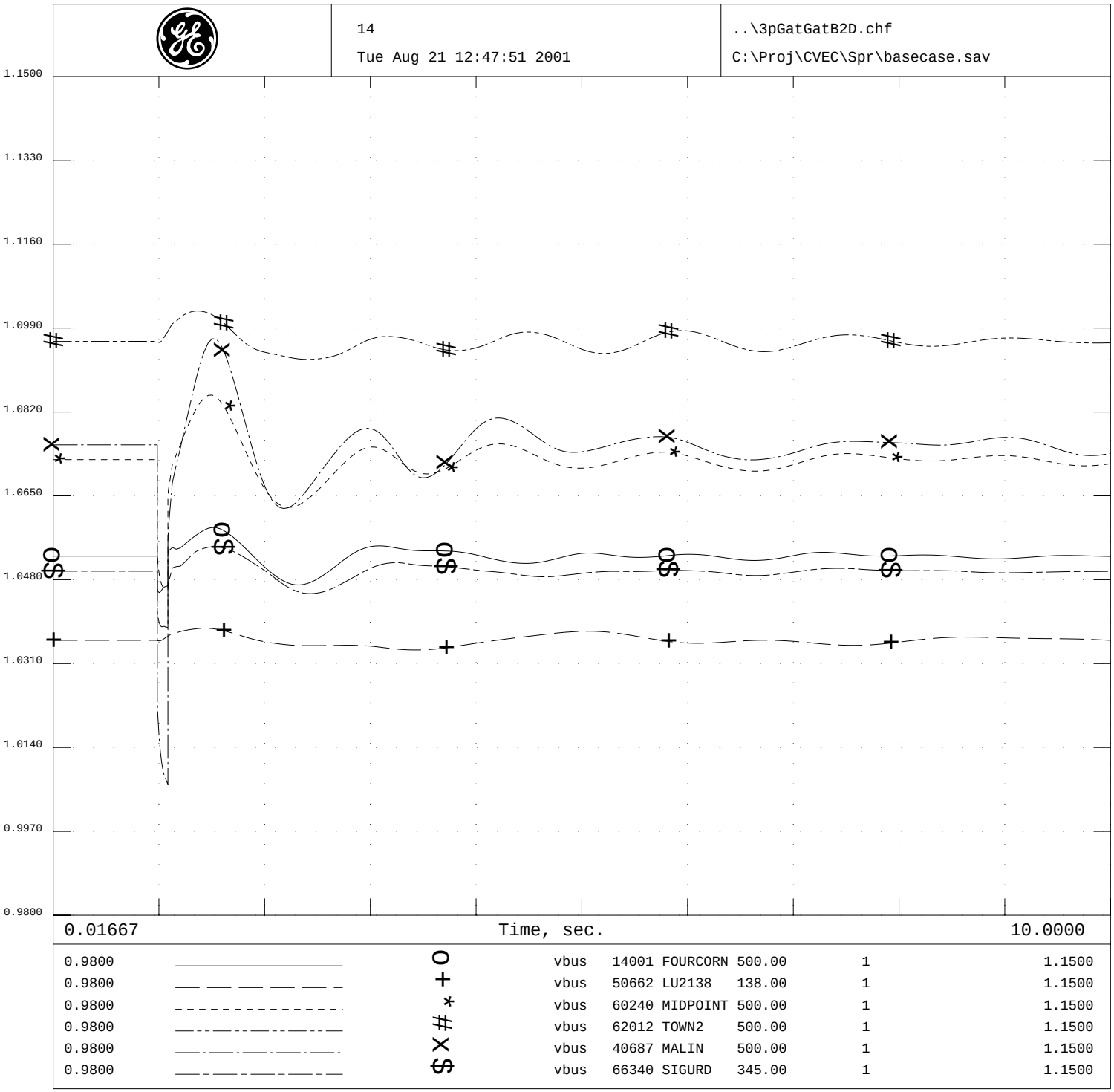

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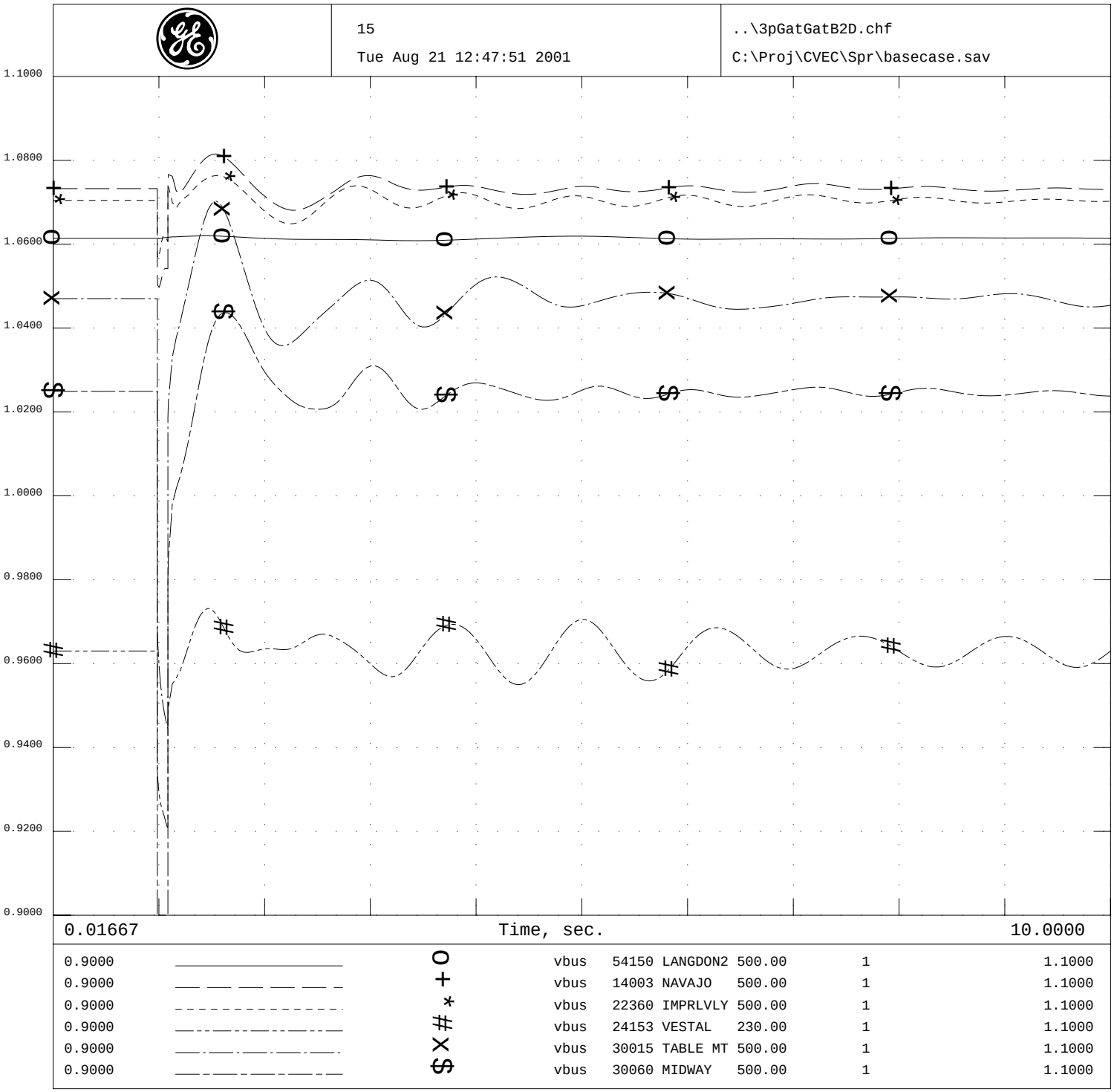

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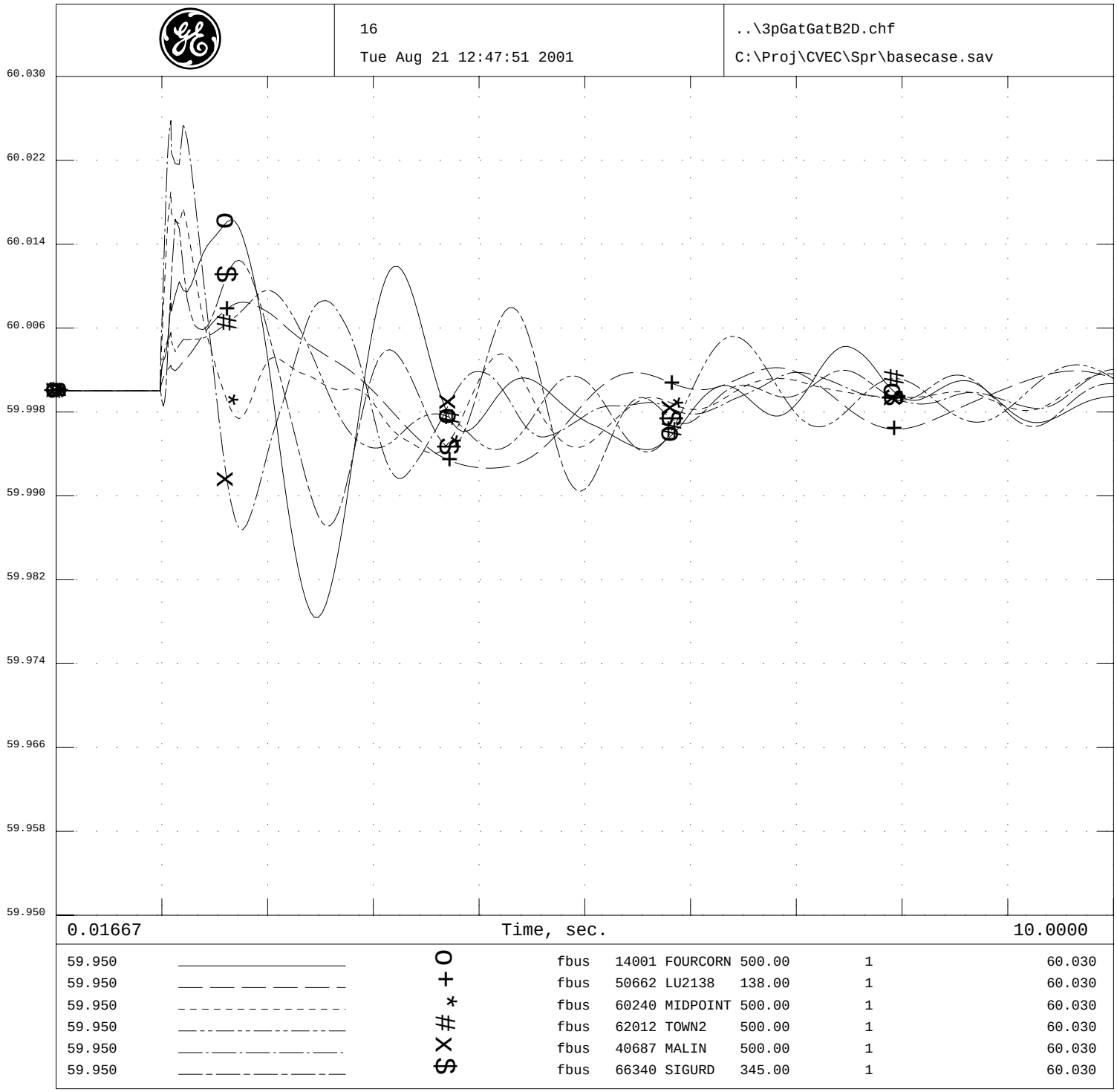

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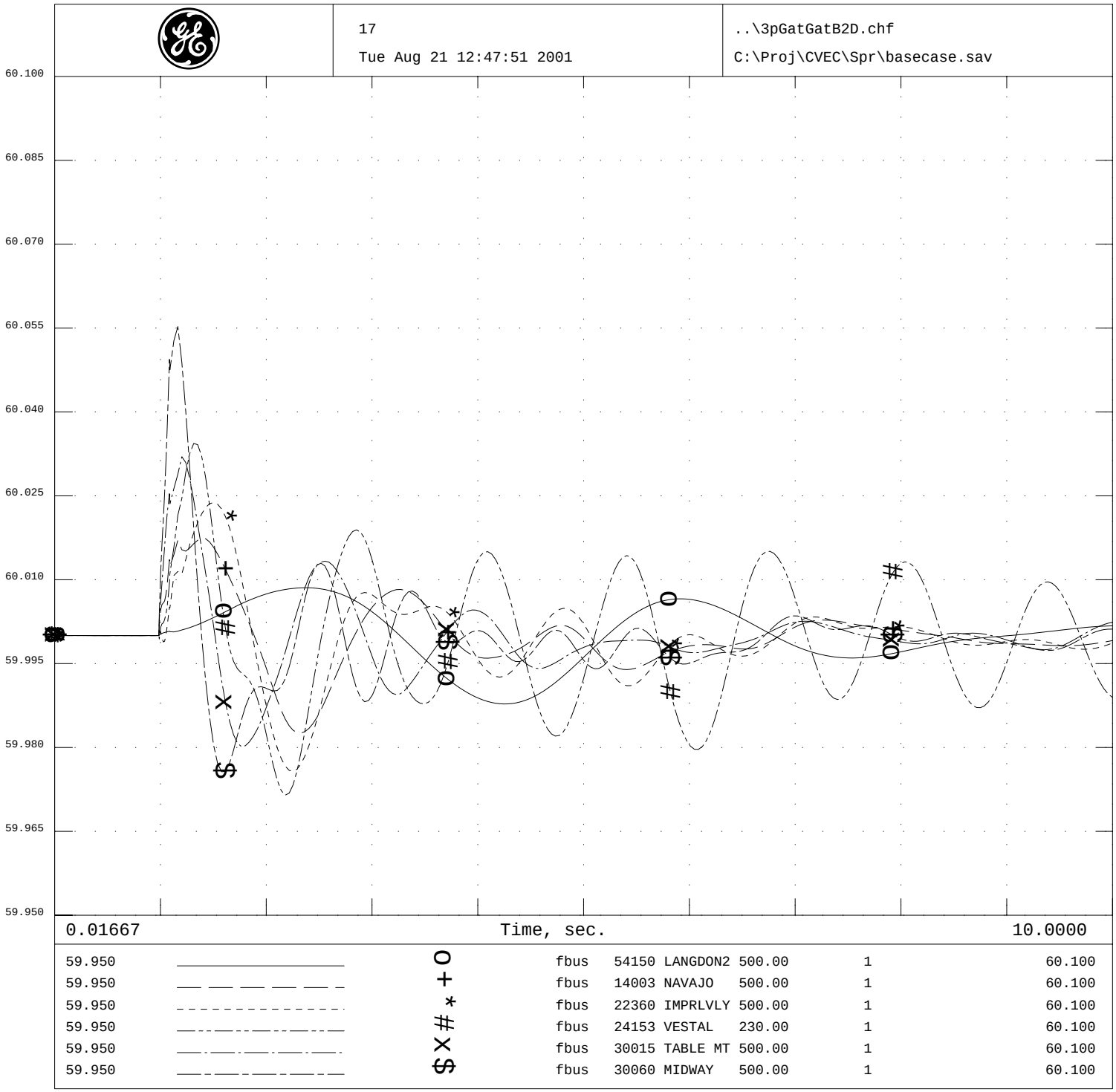

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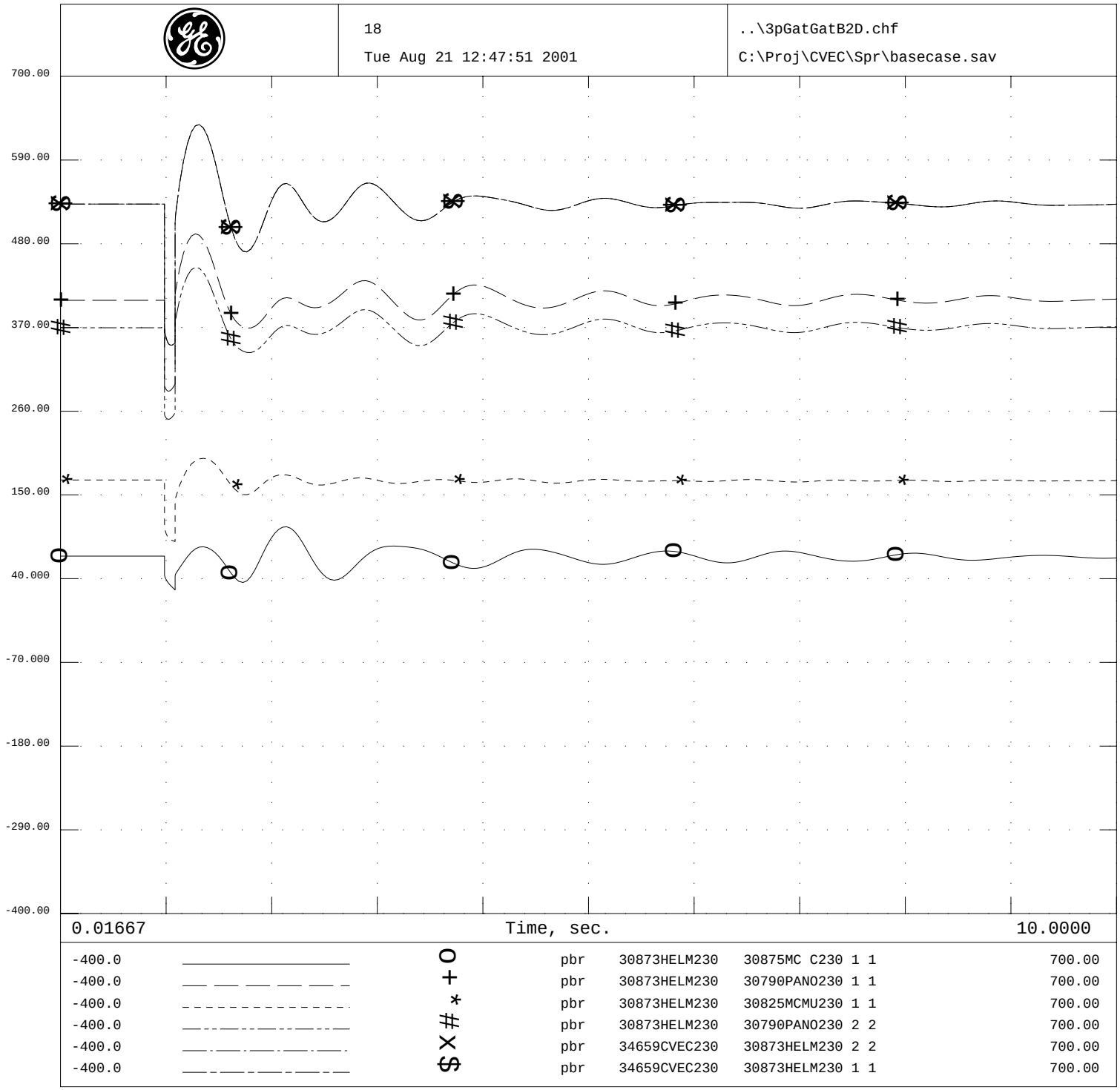

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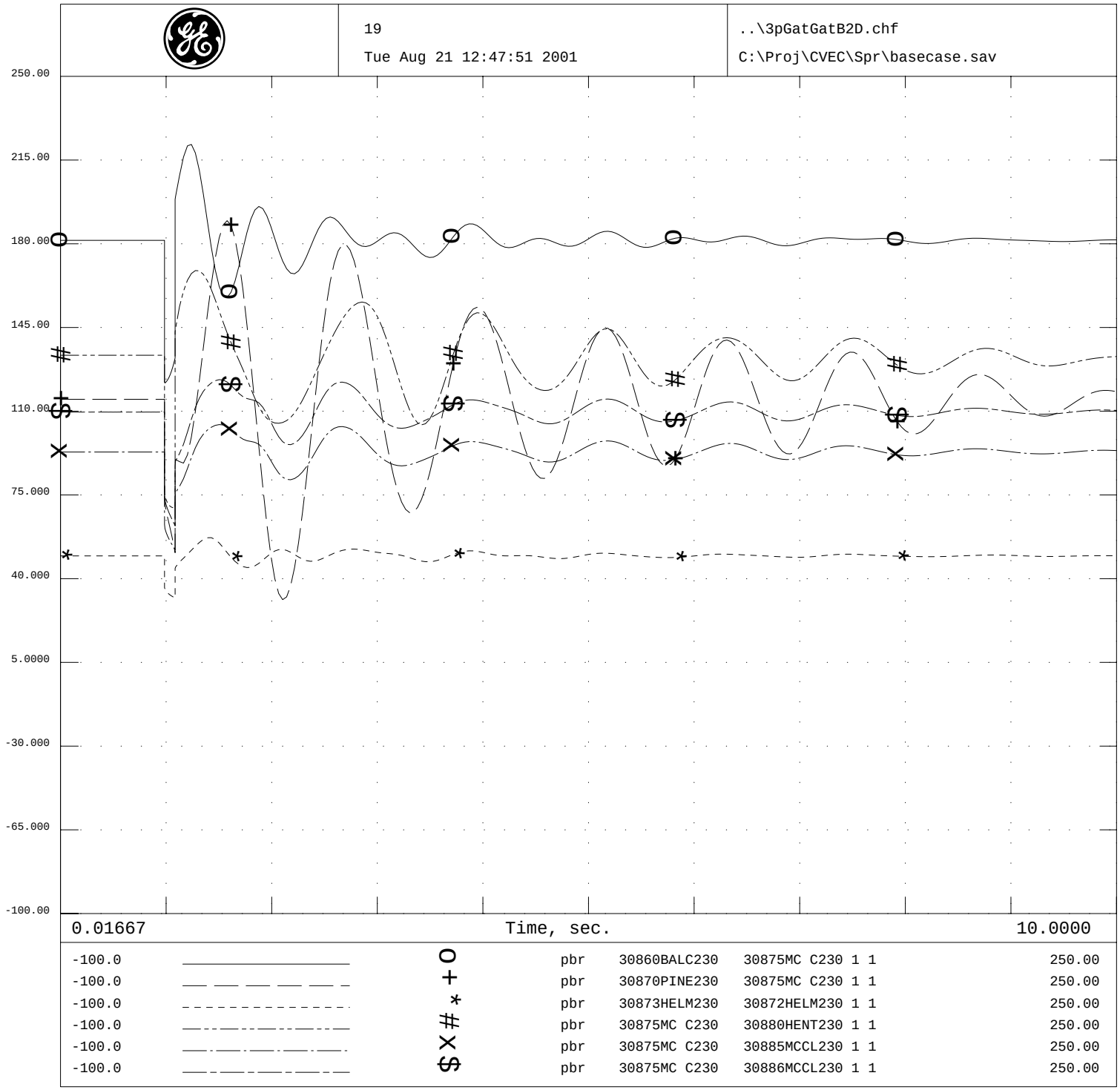

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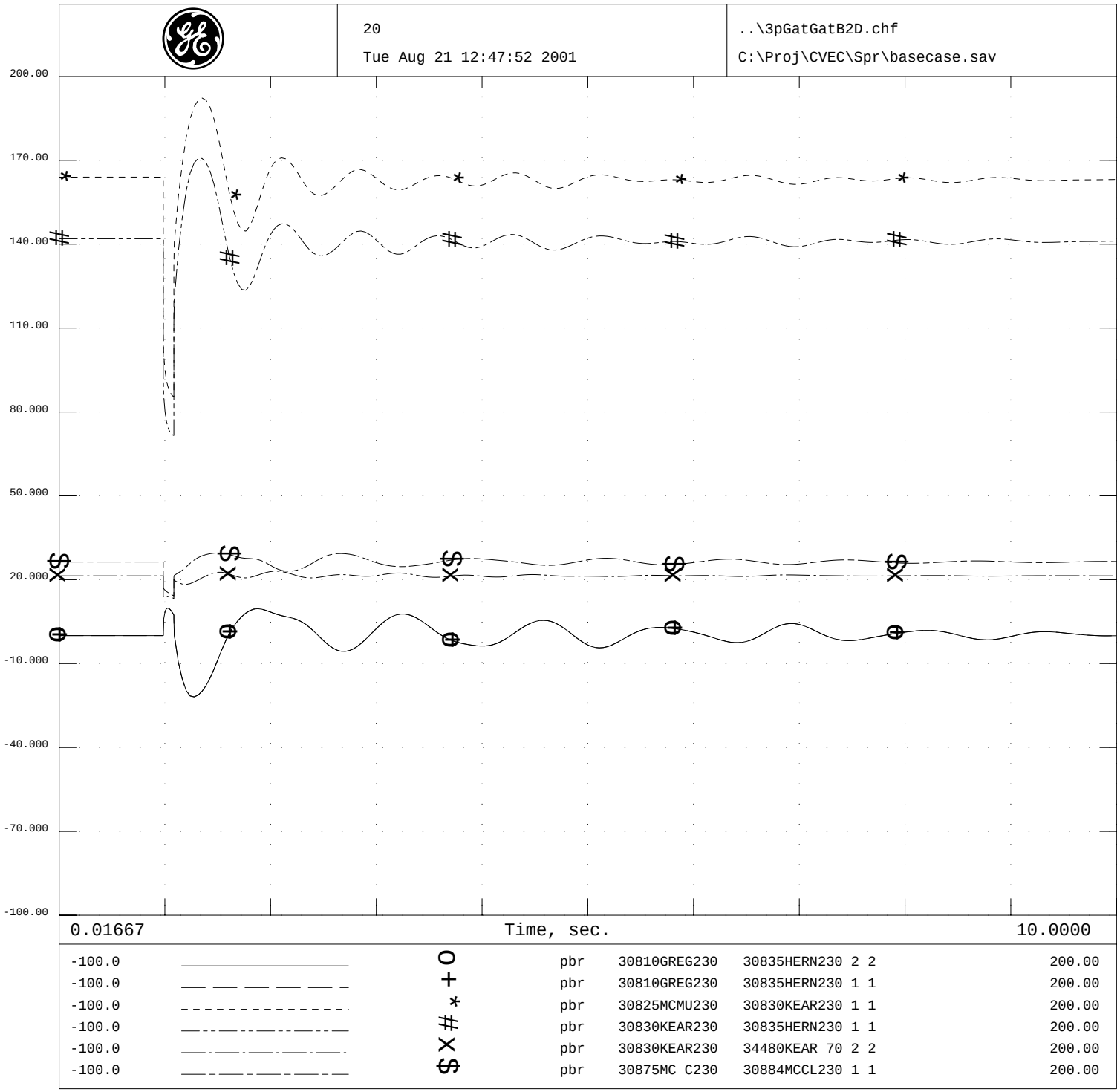

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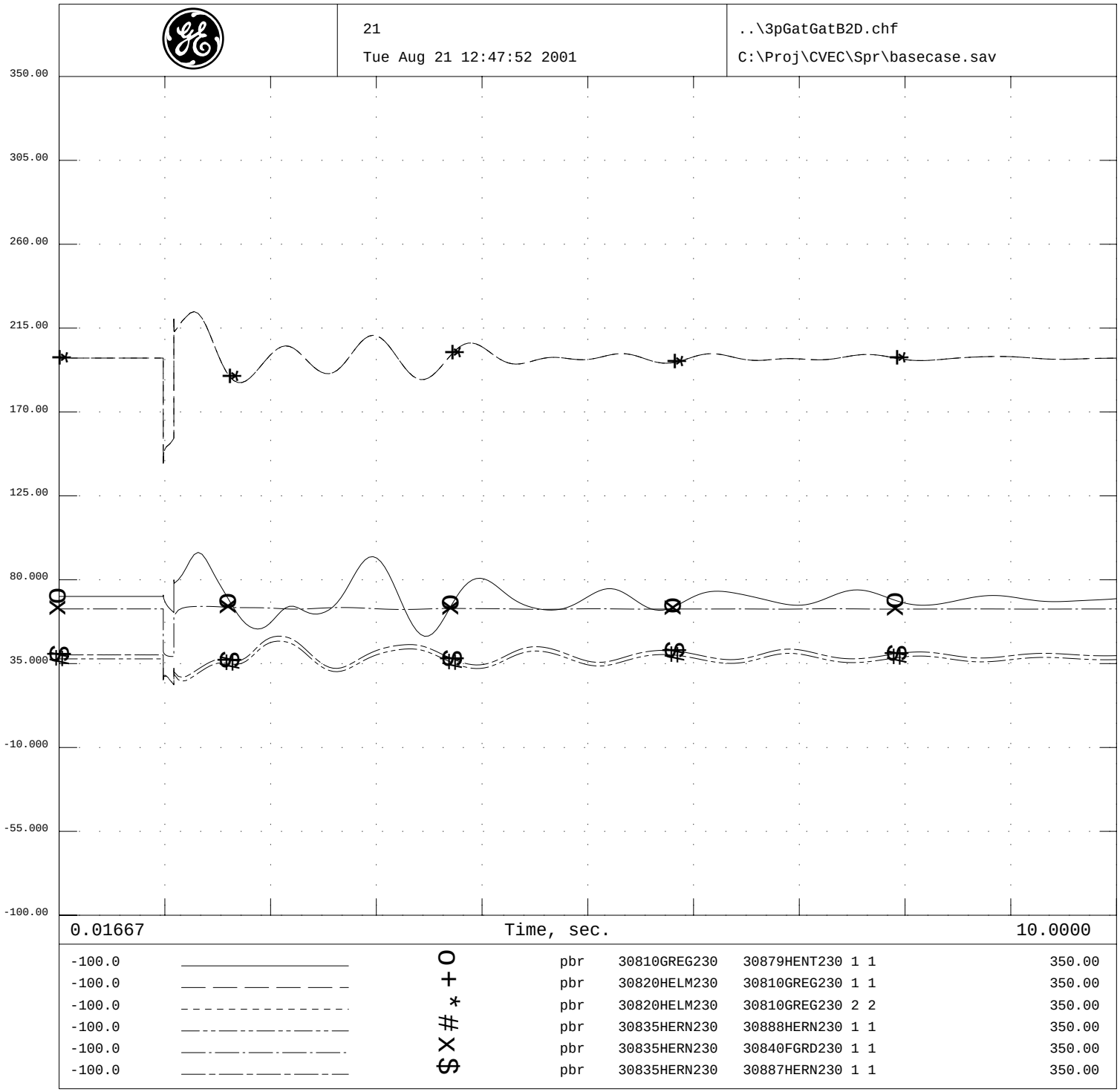

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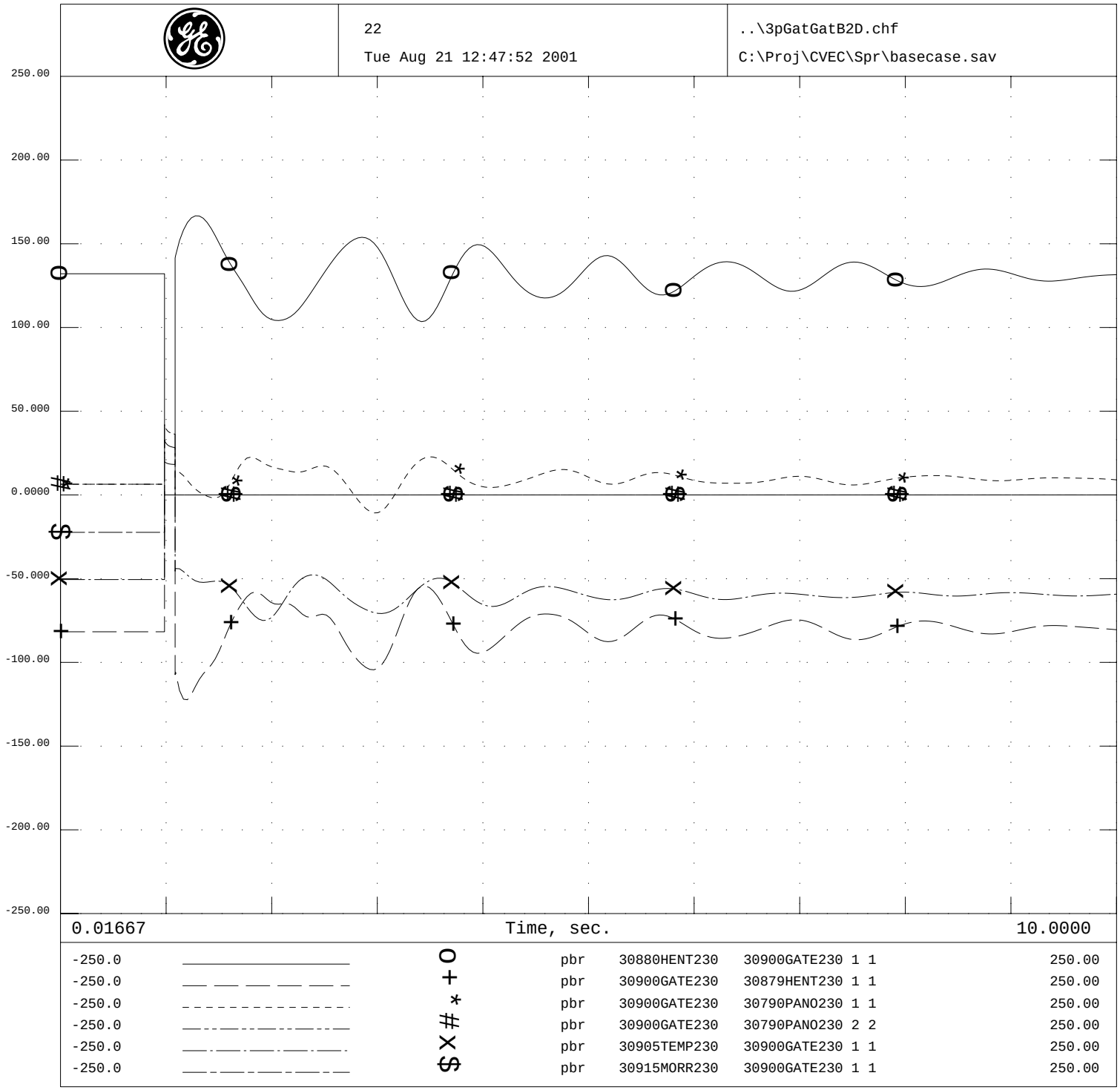

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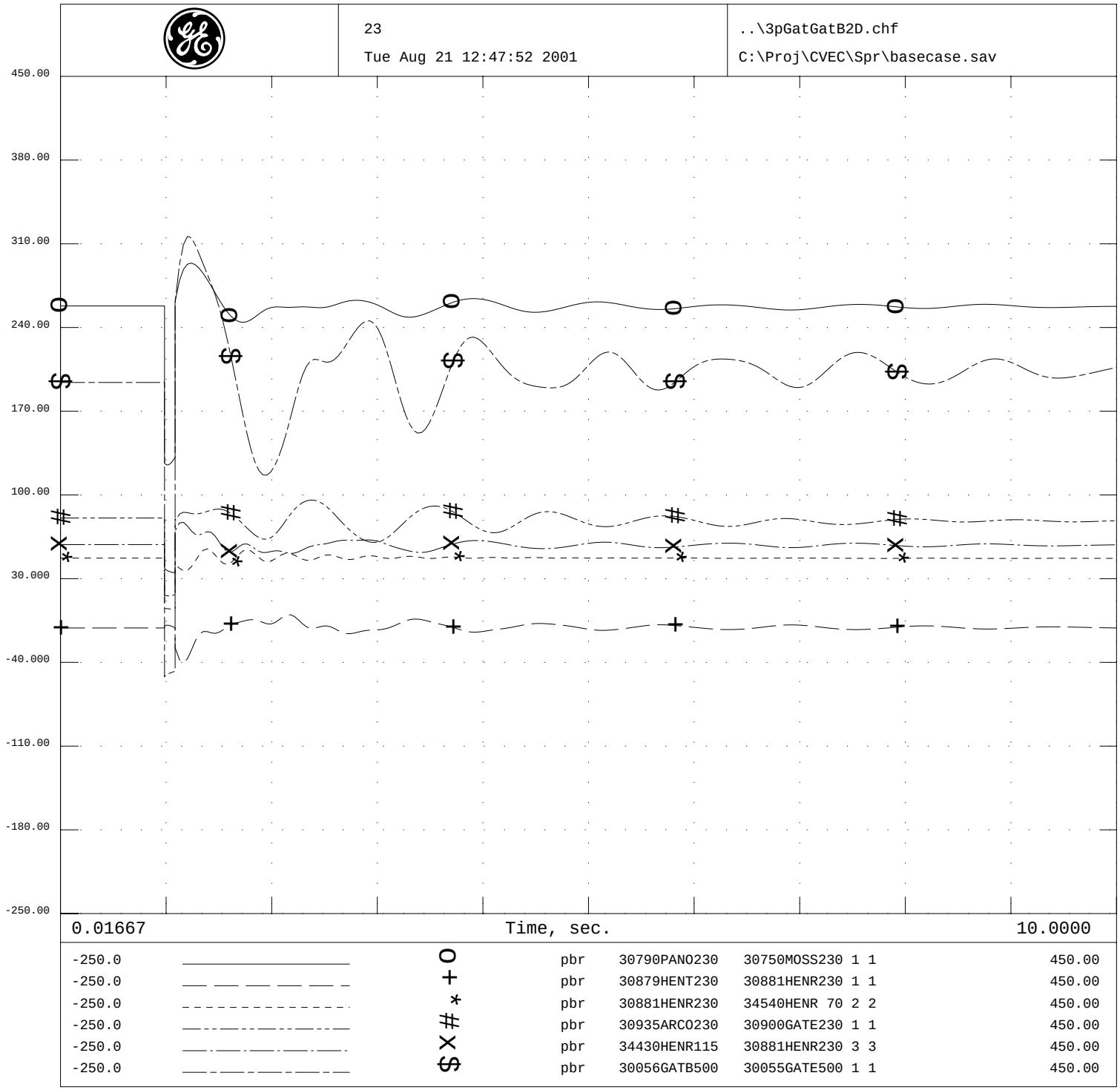

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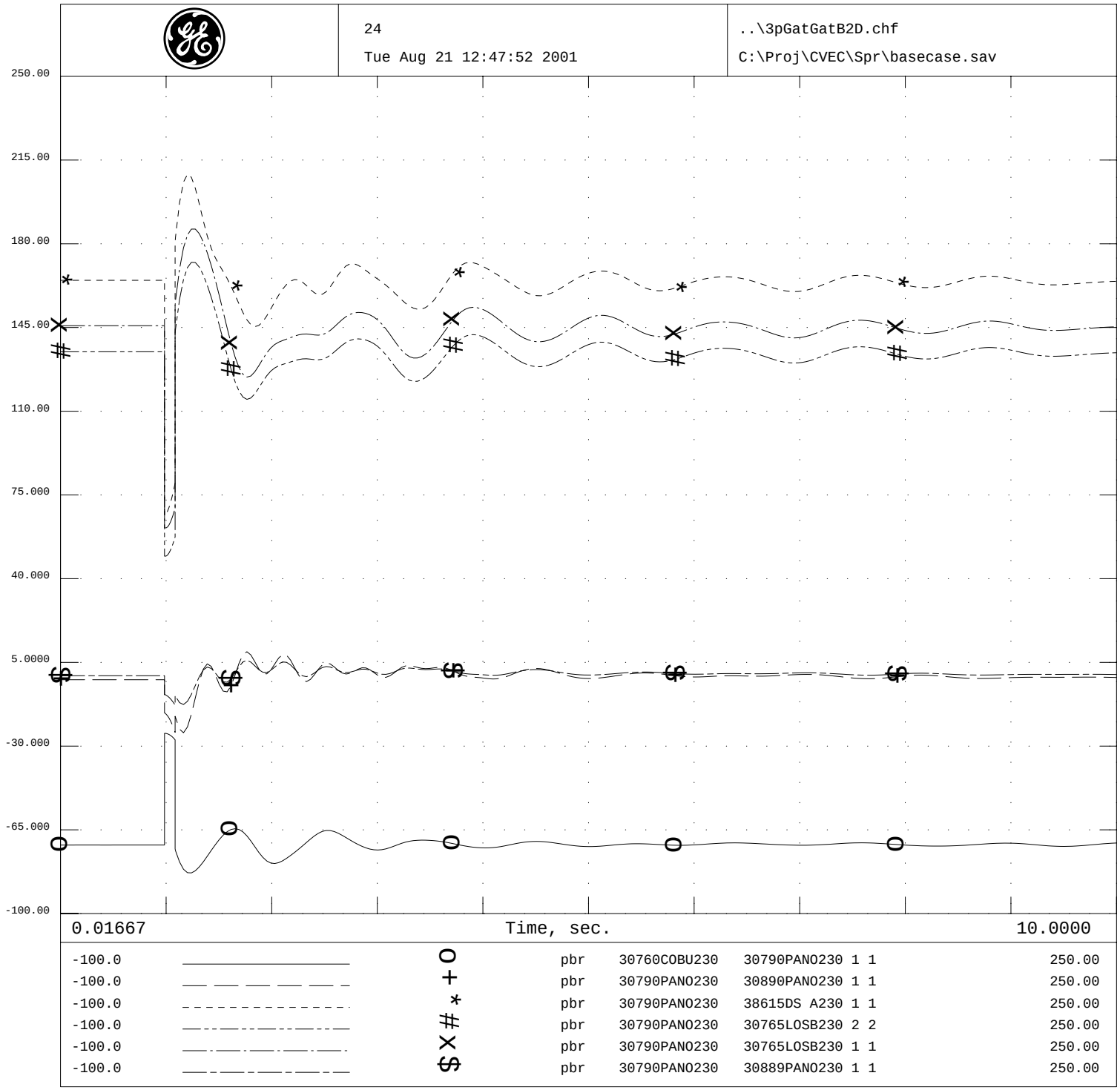

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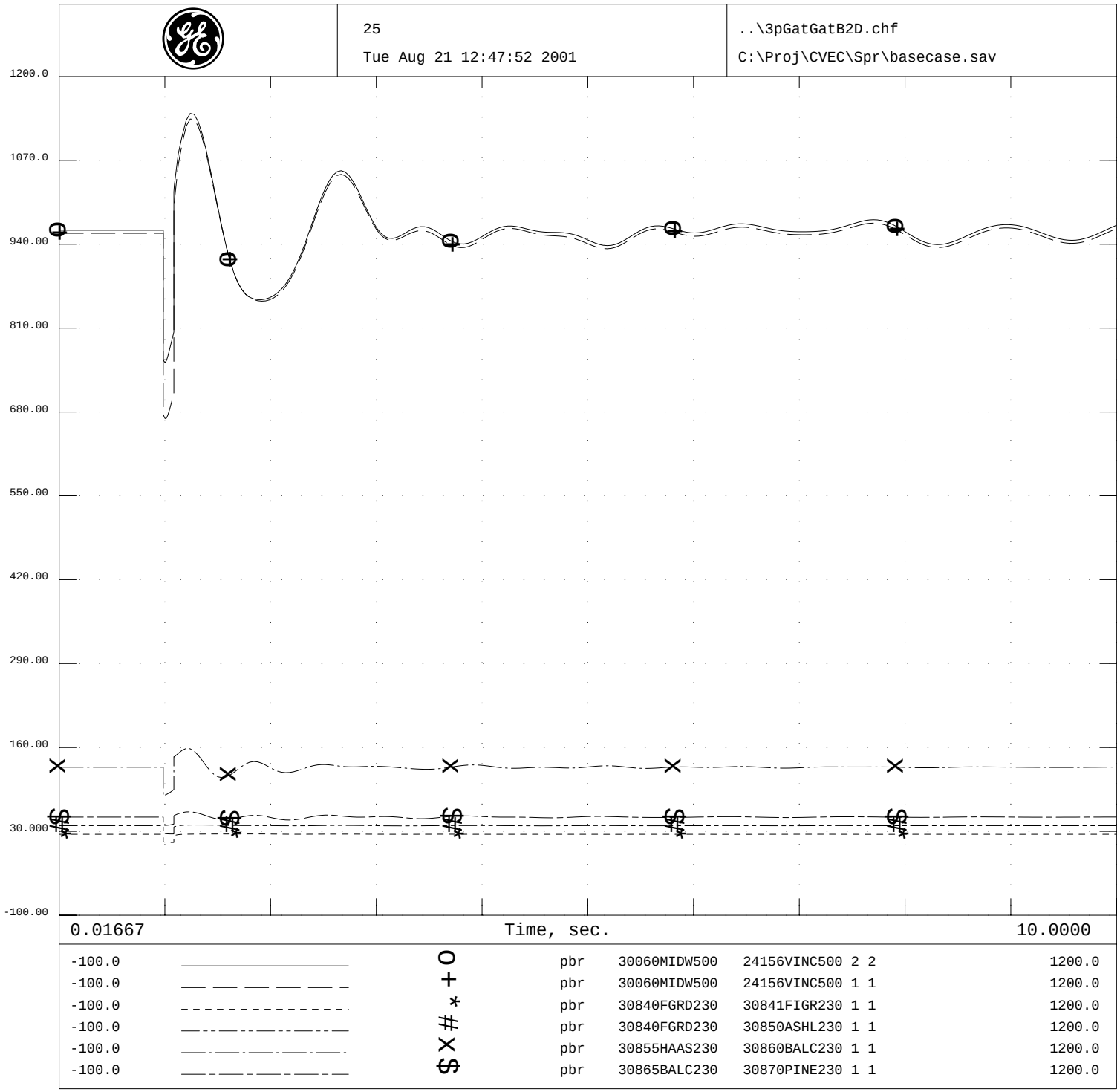

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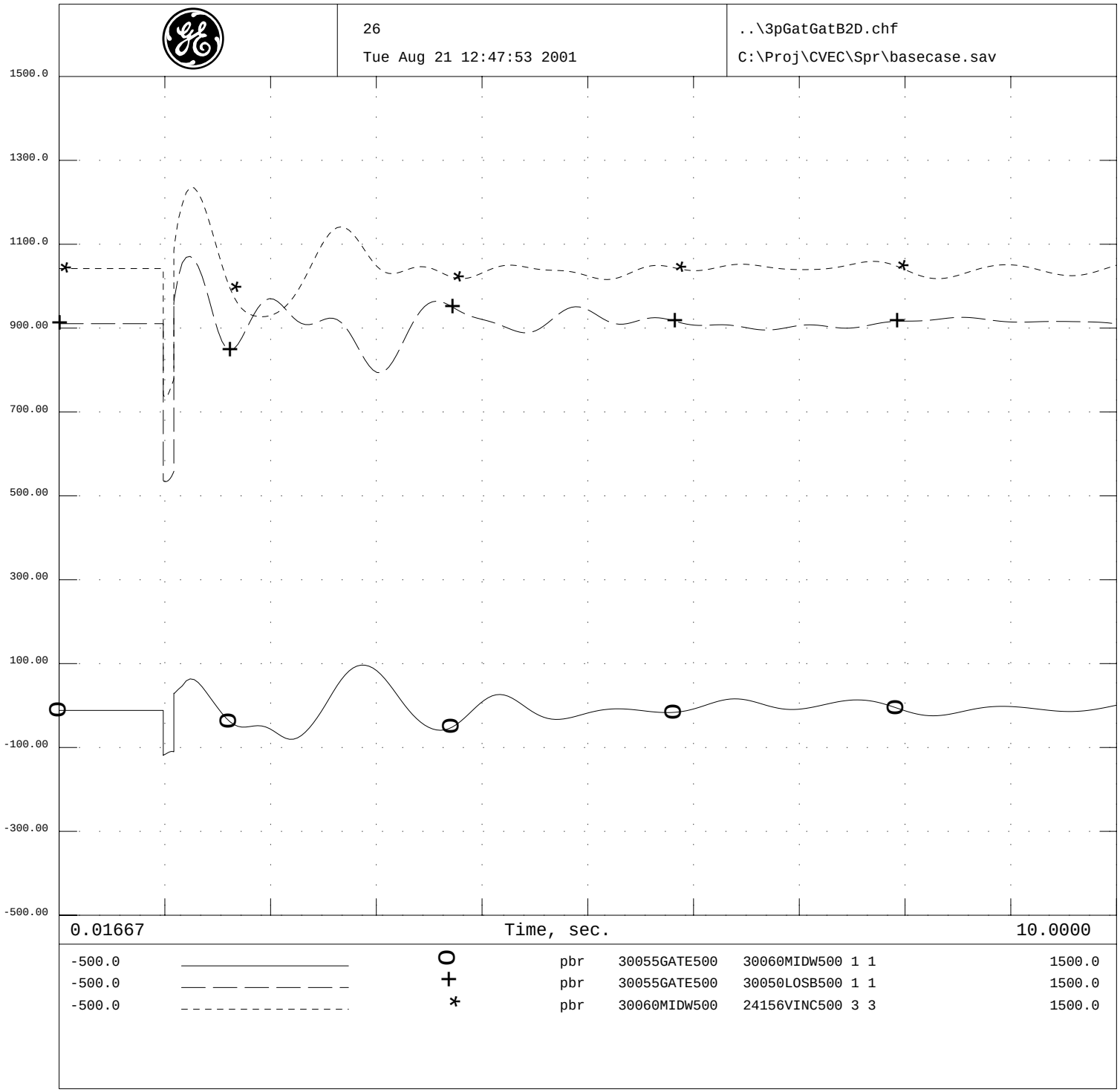

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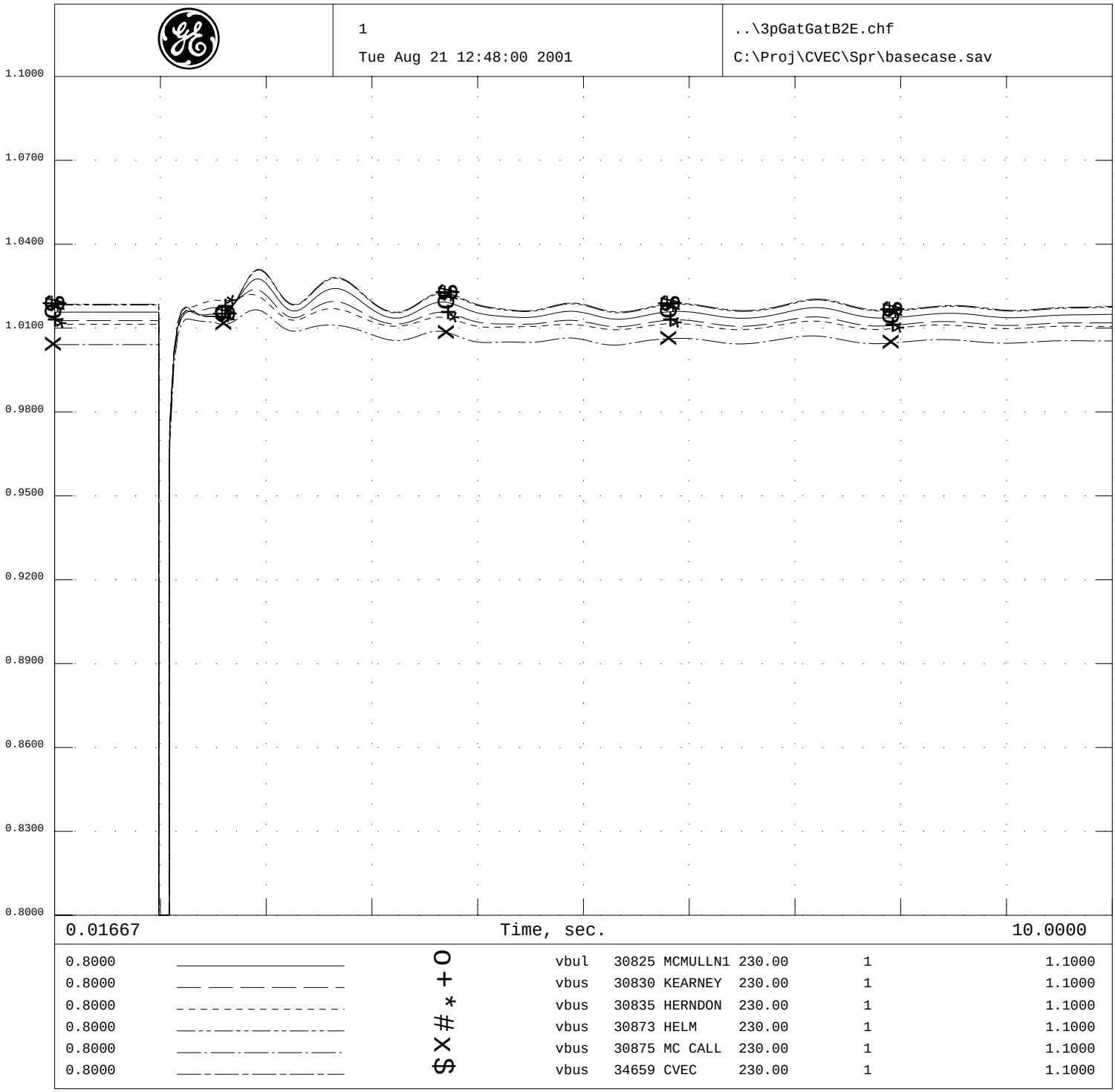

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Calpine Corporation
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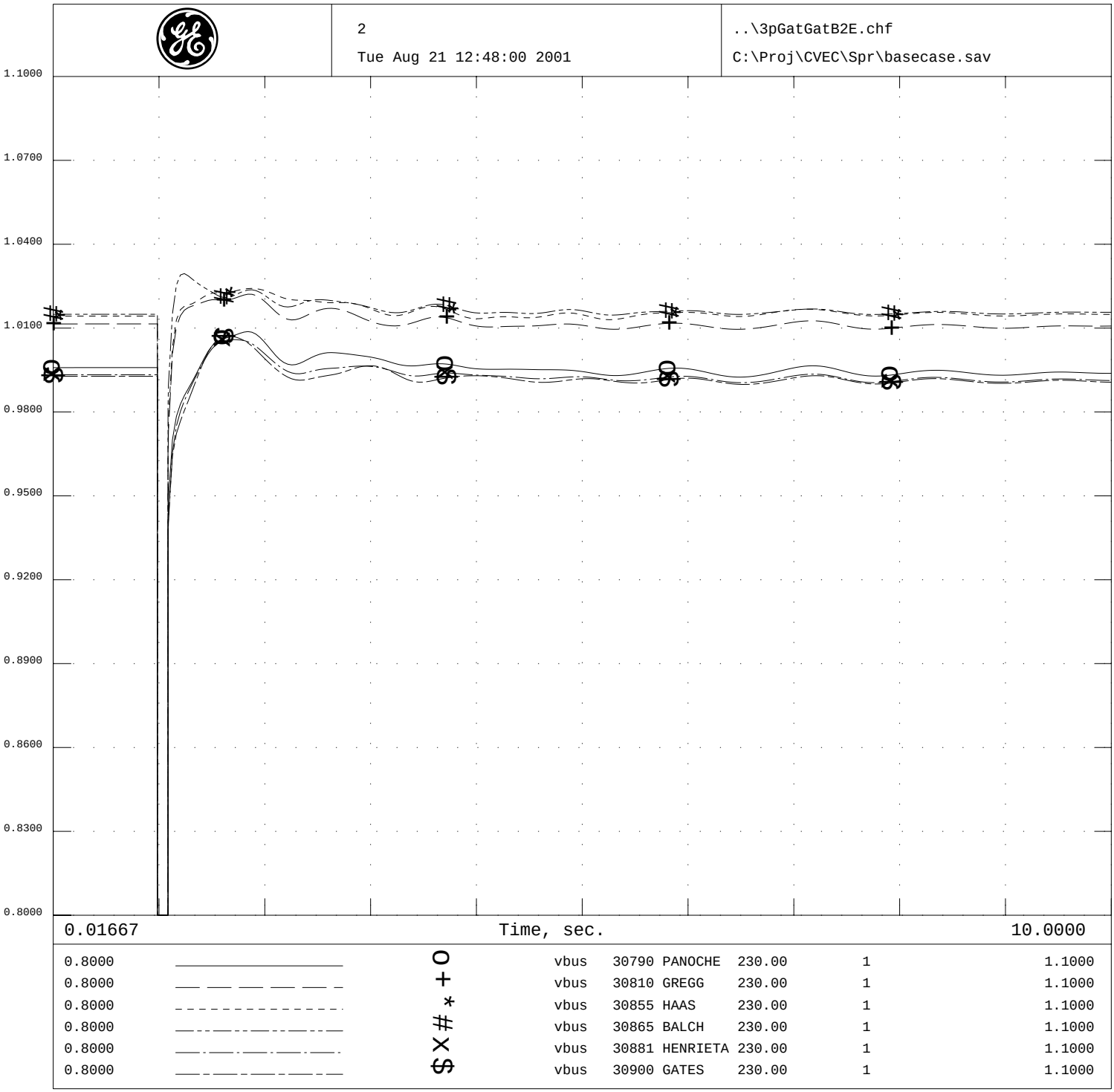

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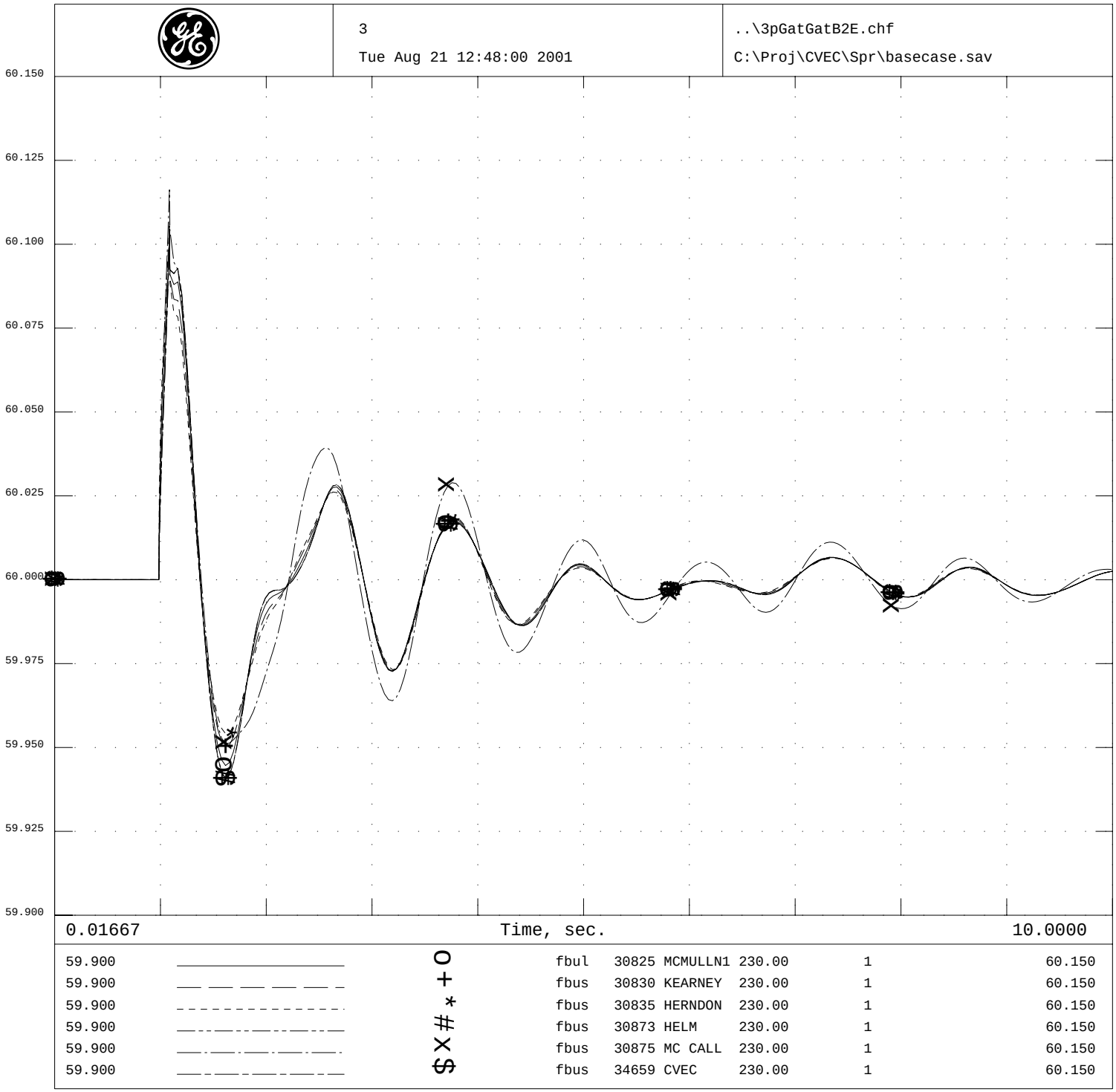

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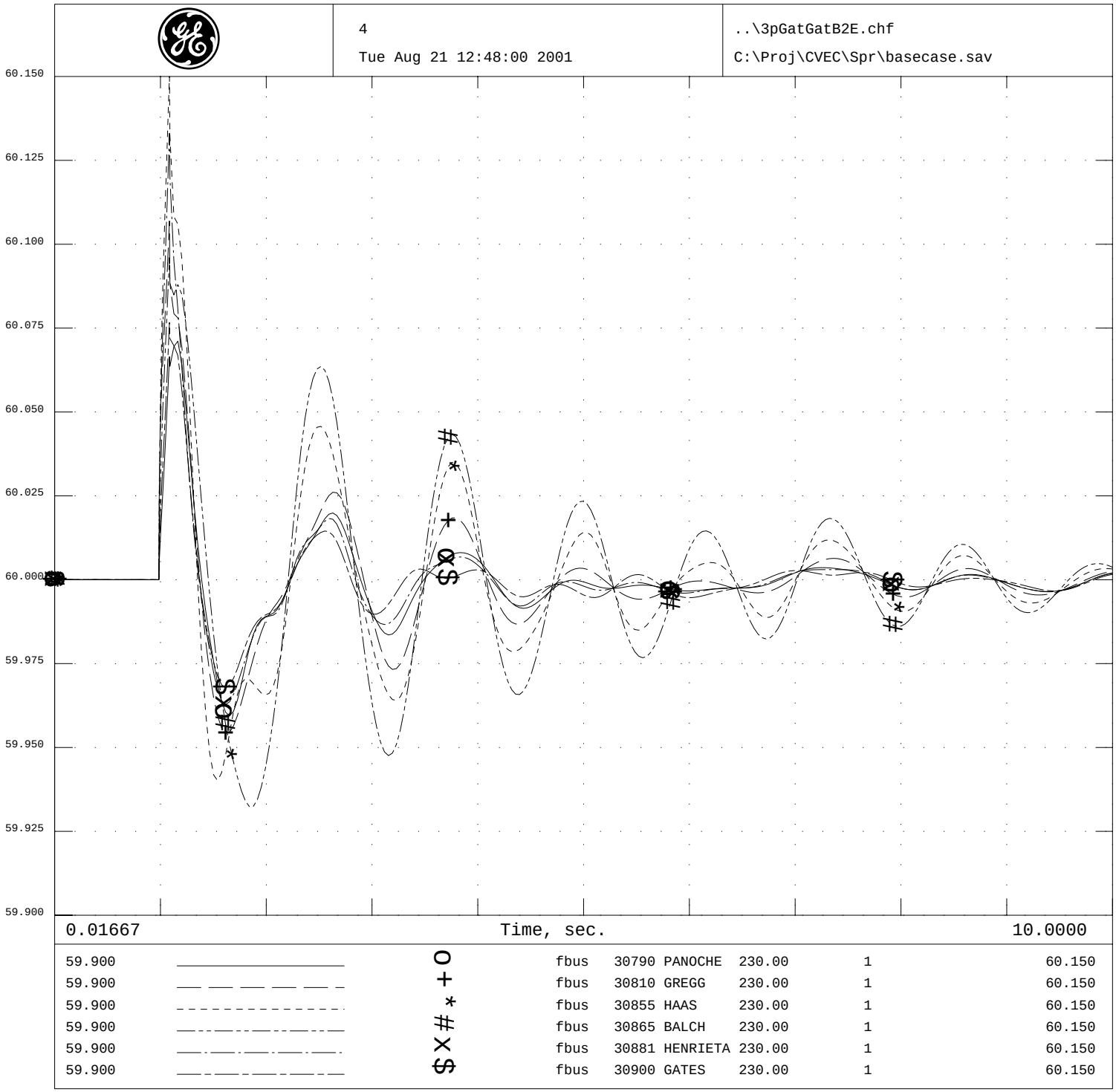

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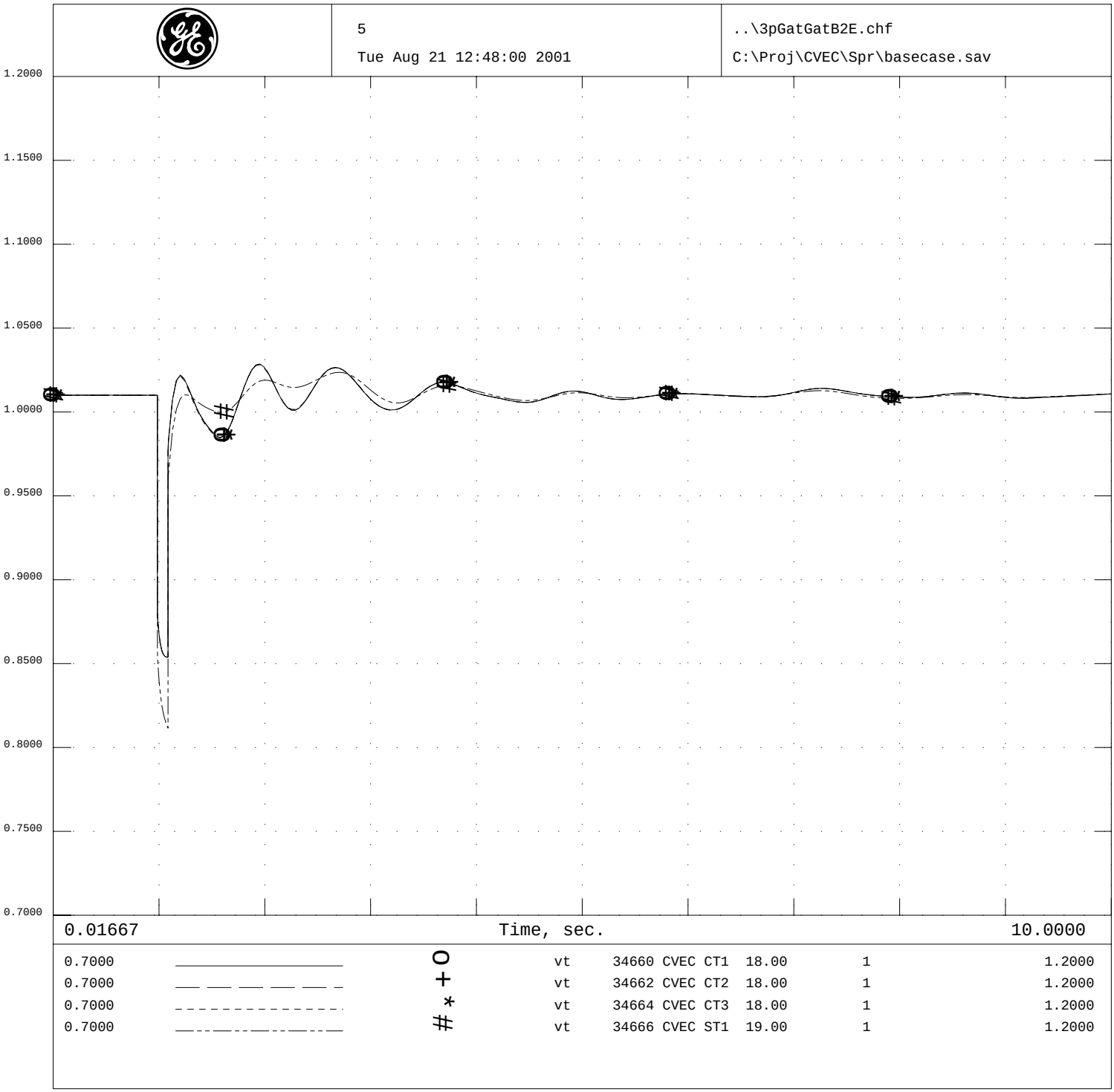

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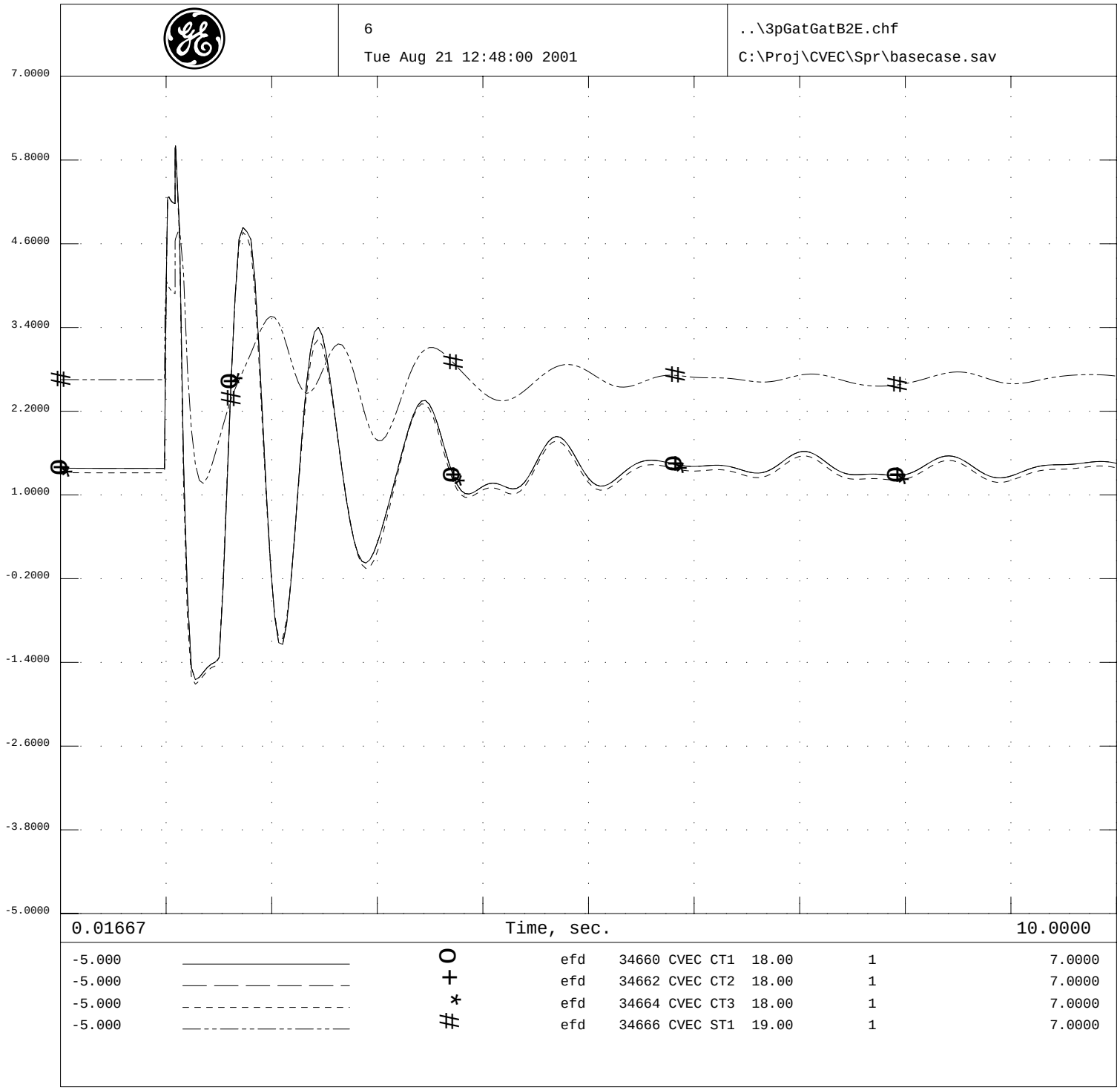
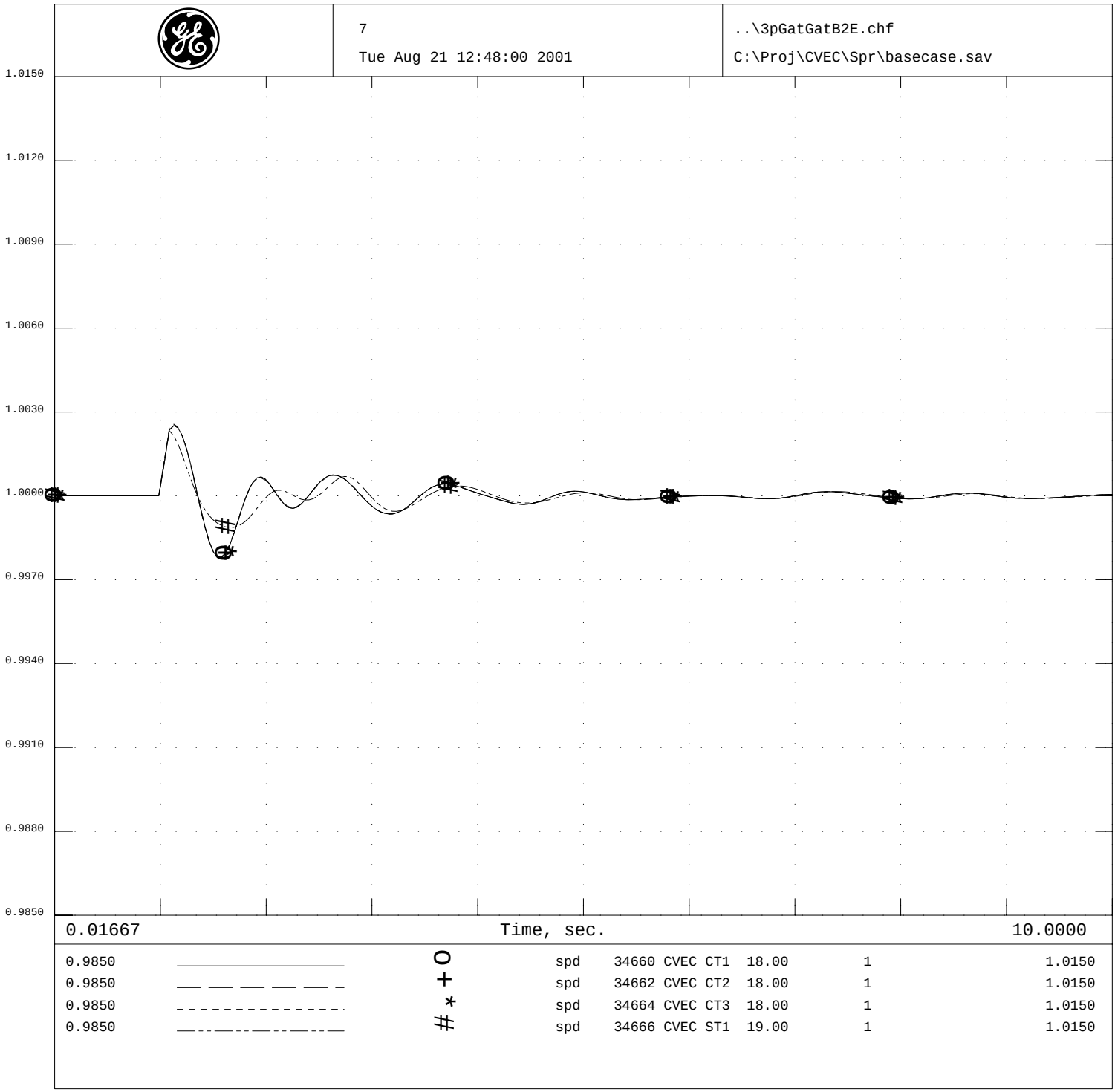
Calpine Corporation
Project Generator Terminal Voltages



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates 230kV Bus 2E Outage
3 phase 6 cycle fault at Gates 230kV bus and clear bus 2E

Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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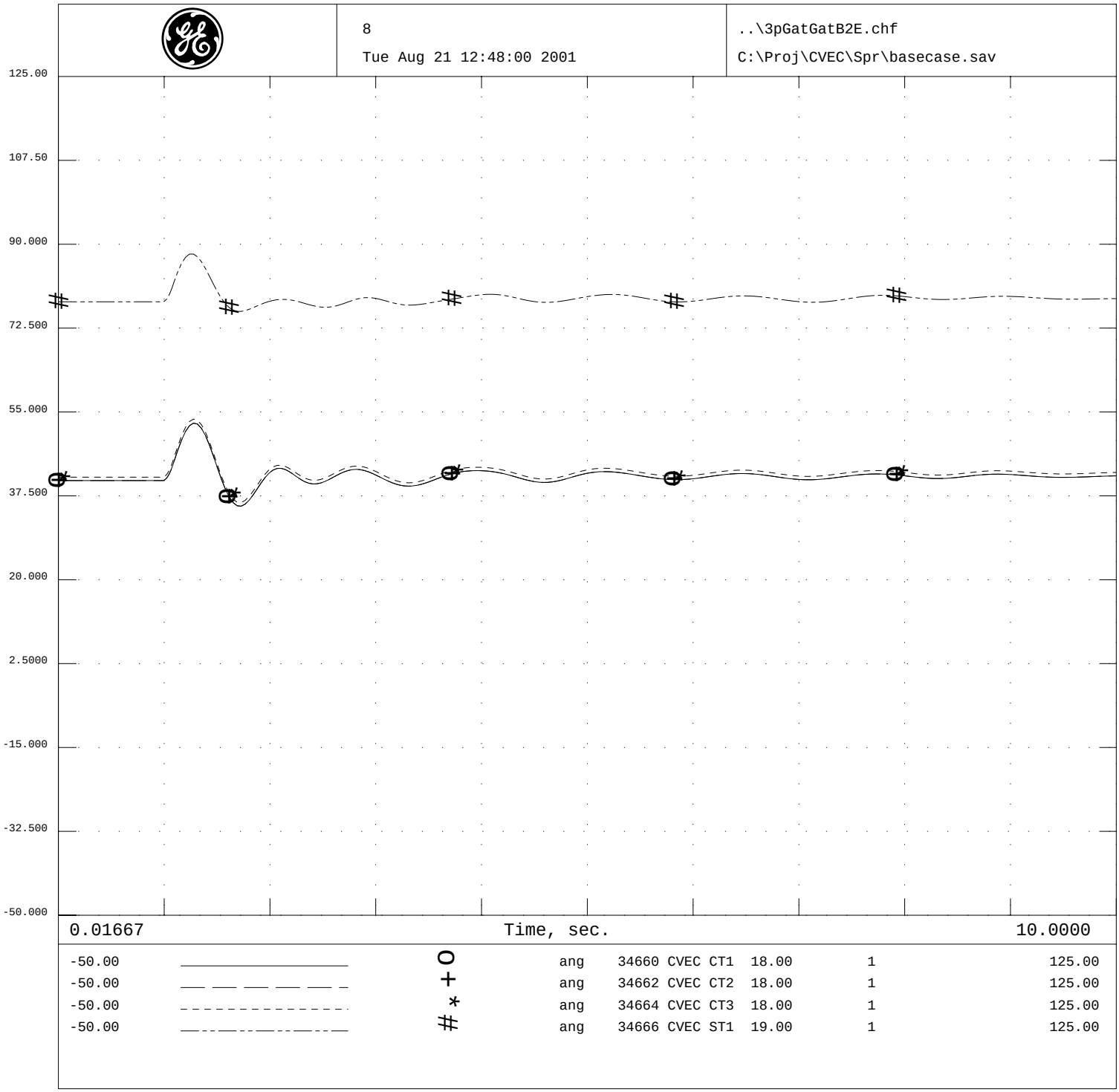
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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2004 Heavy Spring Base Case
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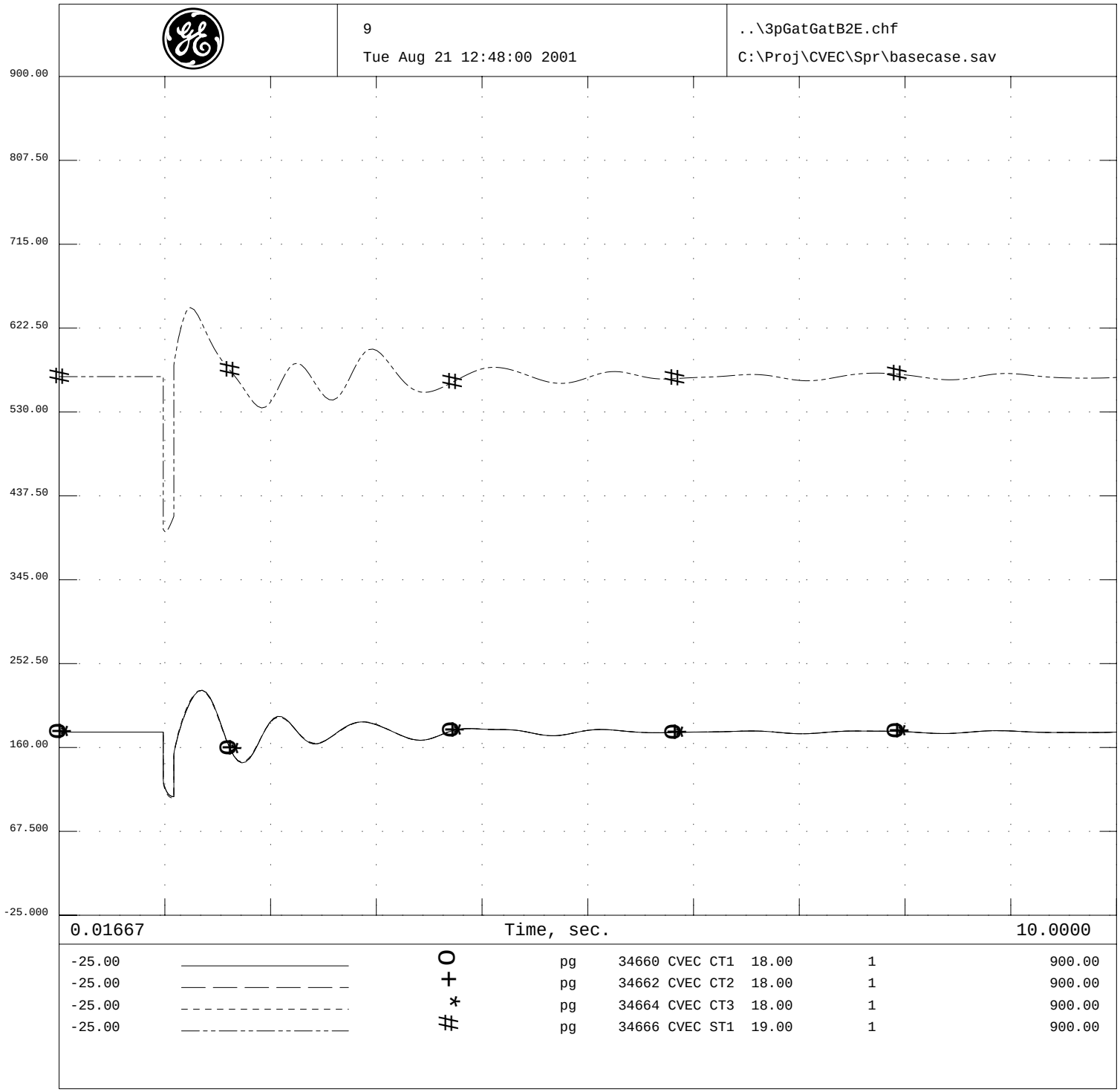
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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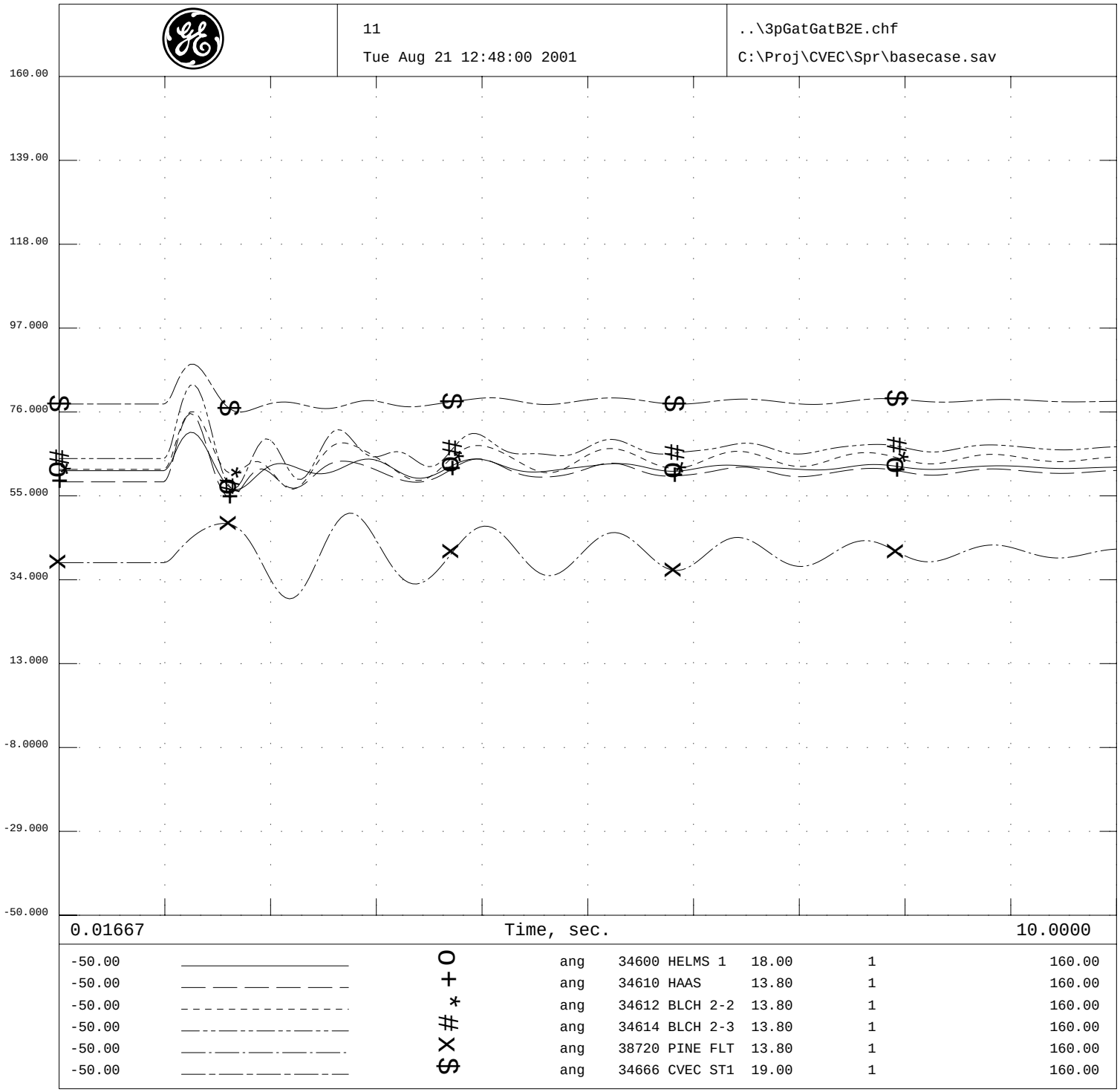
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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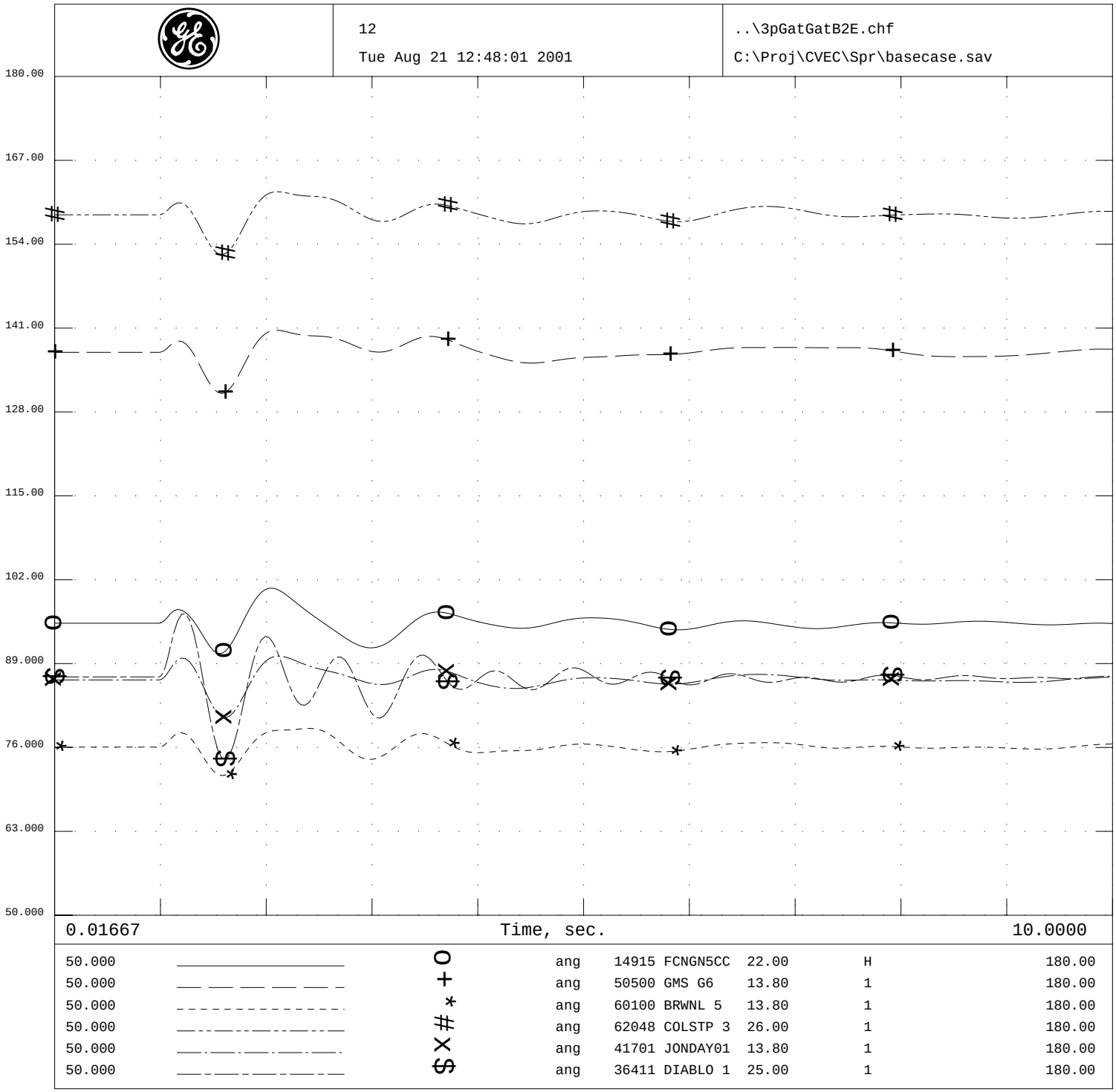
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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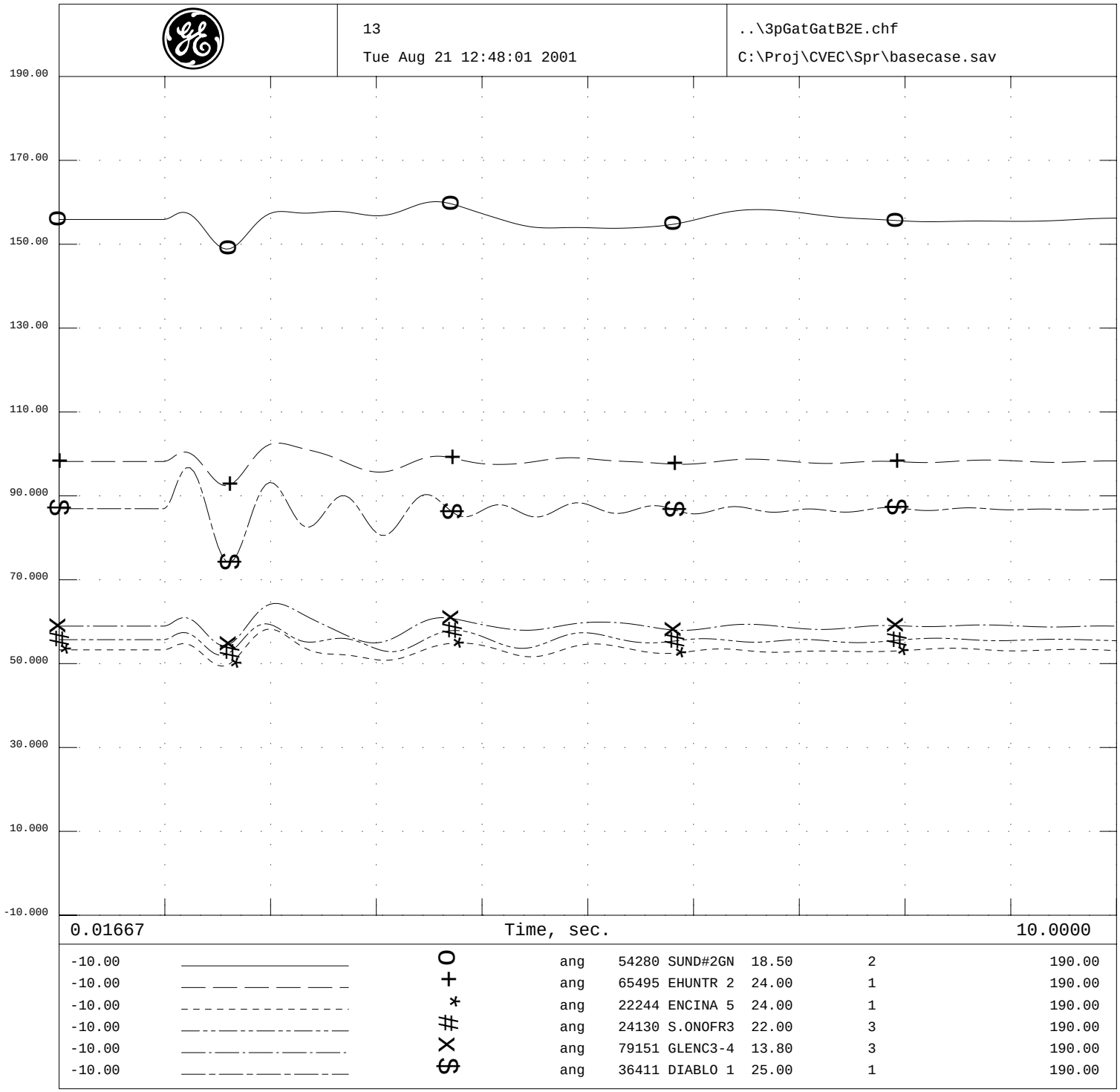
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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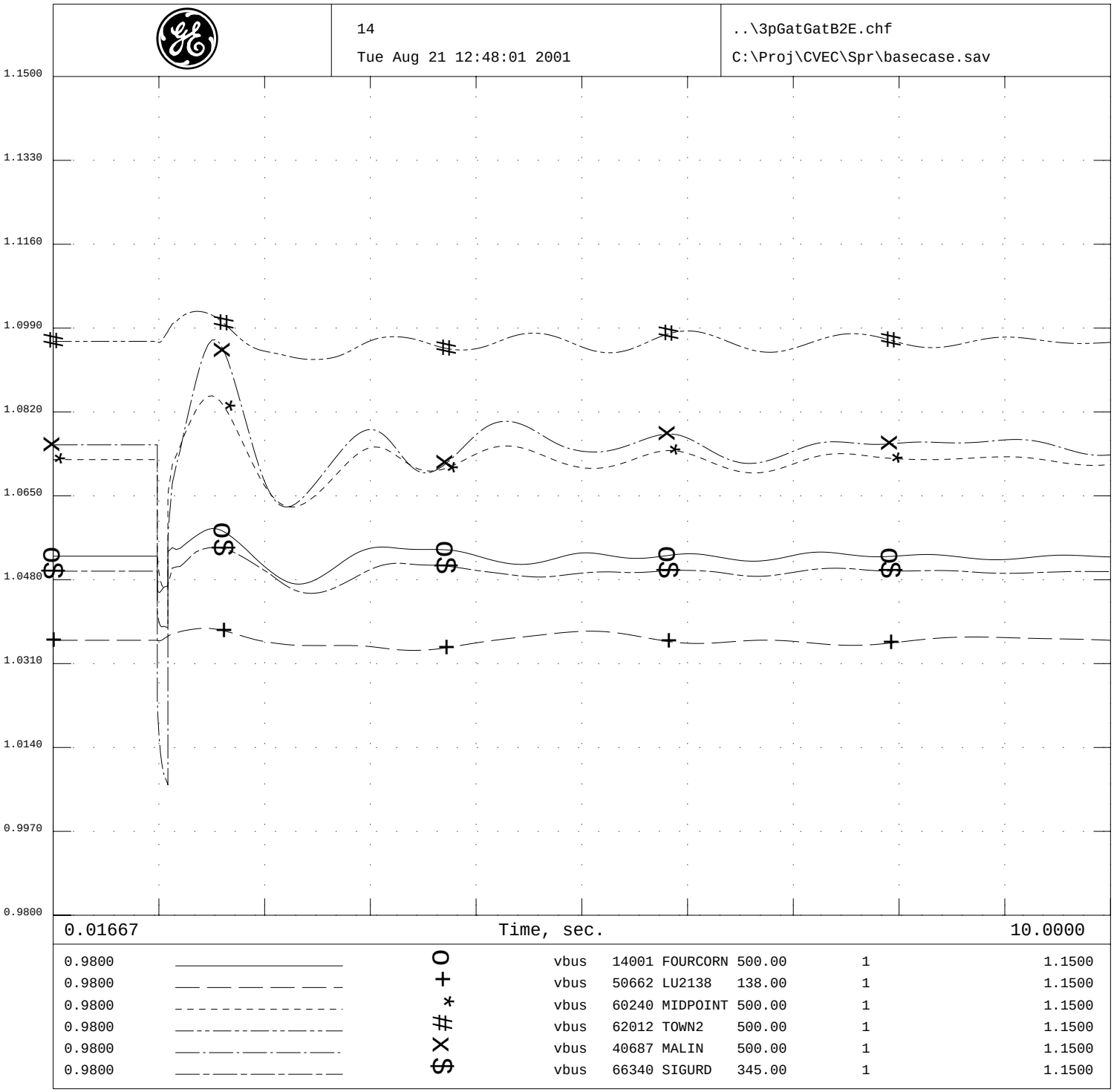

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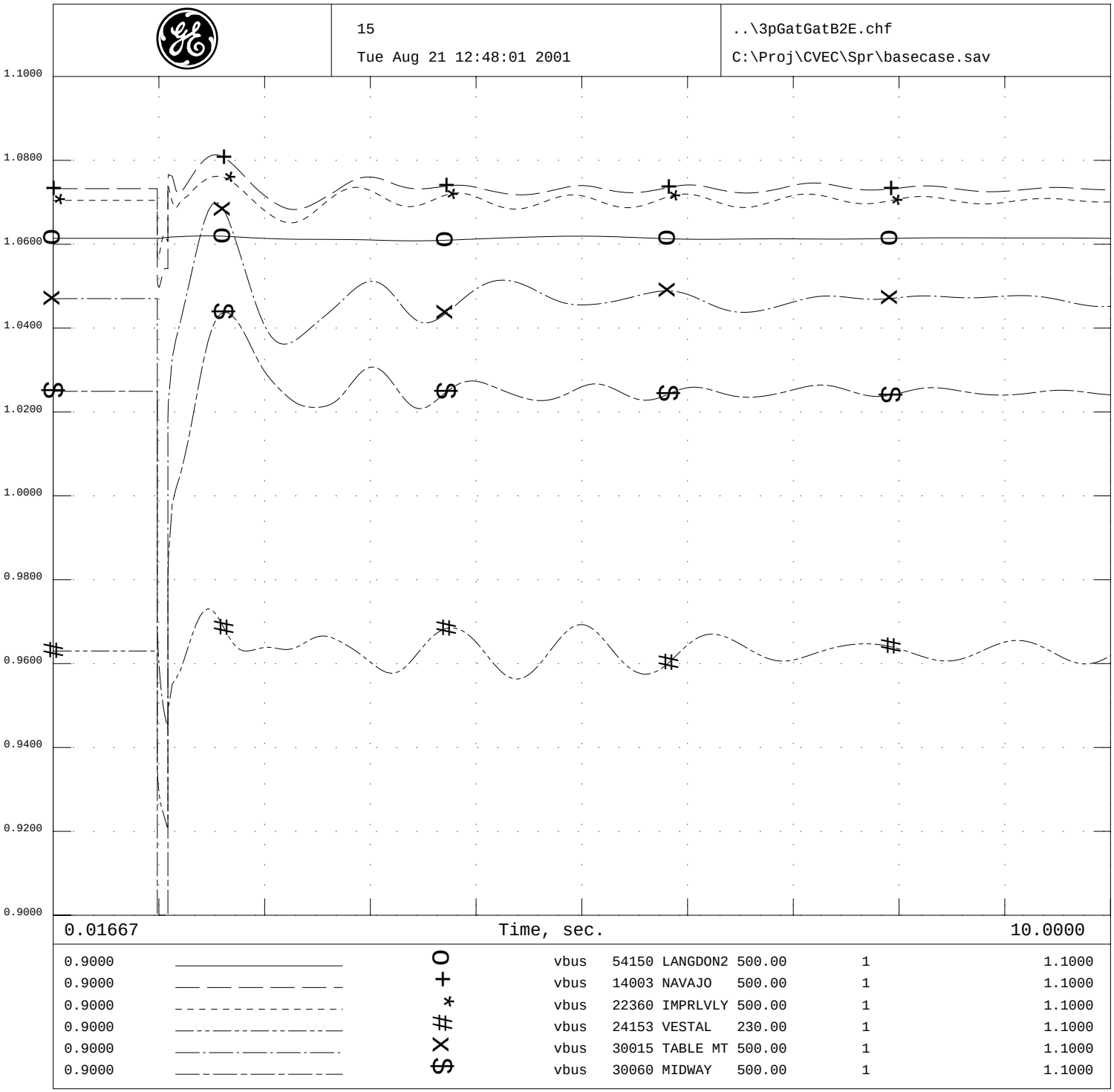
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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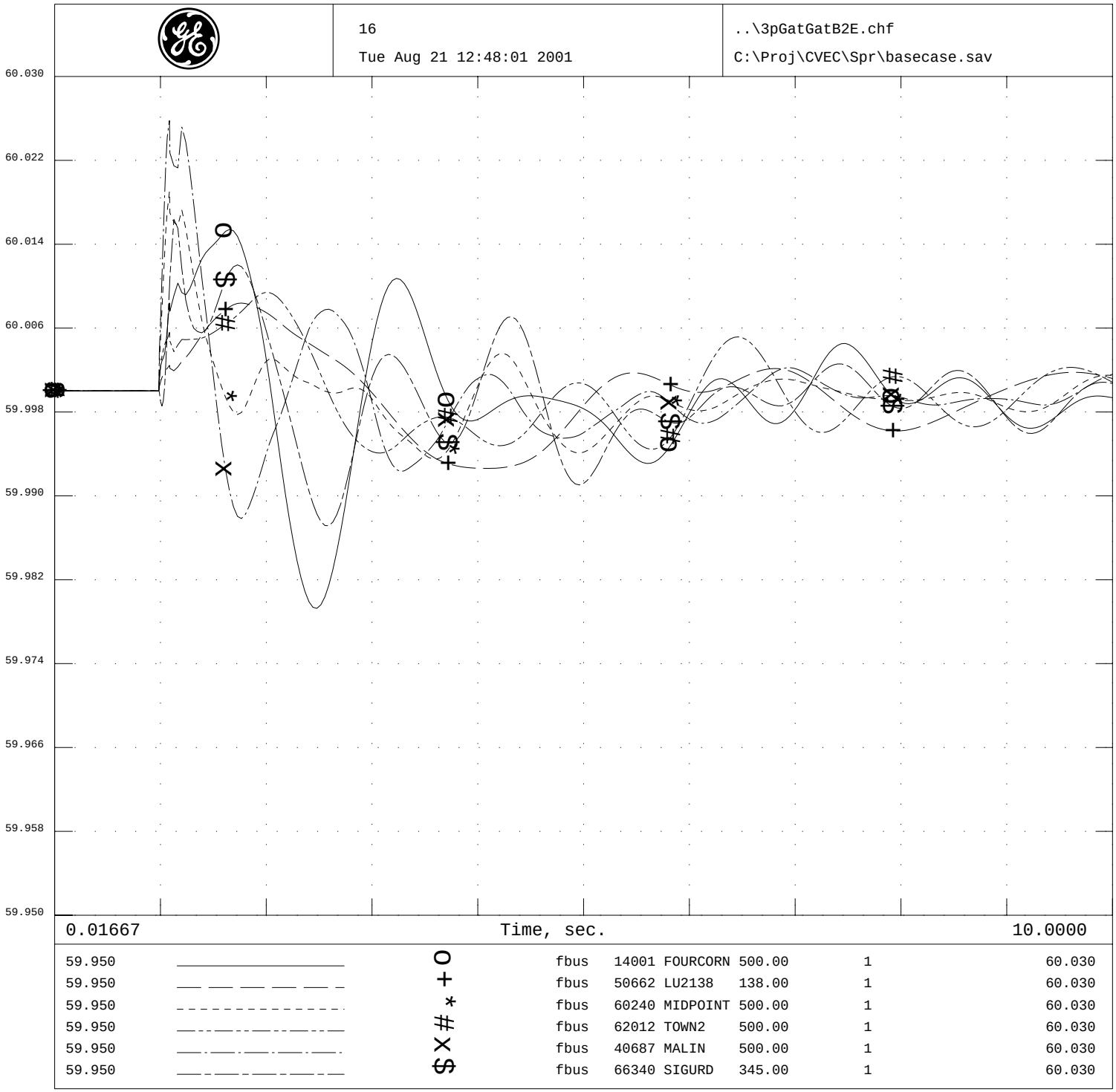

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2004 Heavy Spring Base Case
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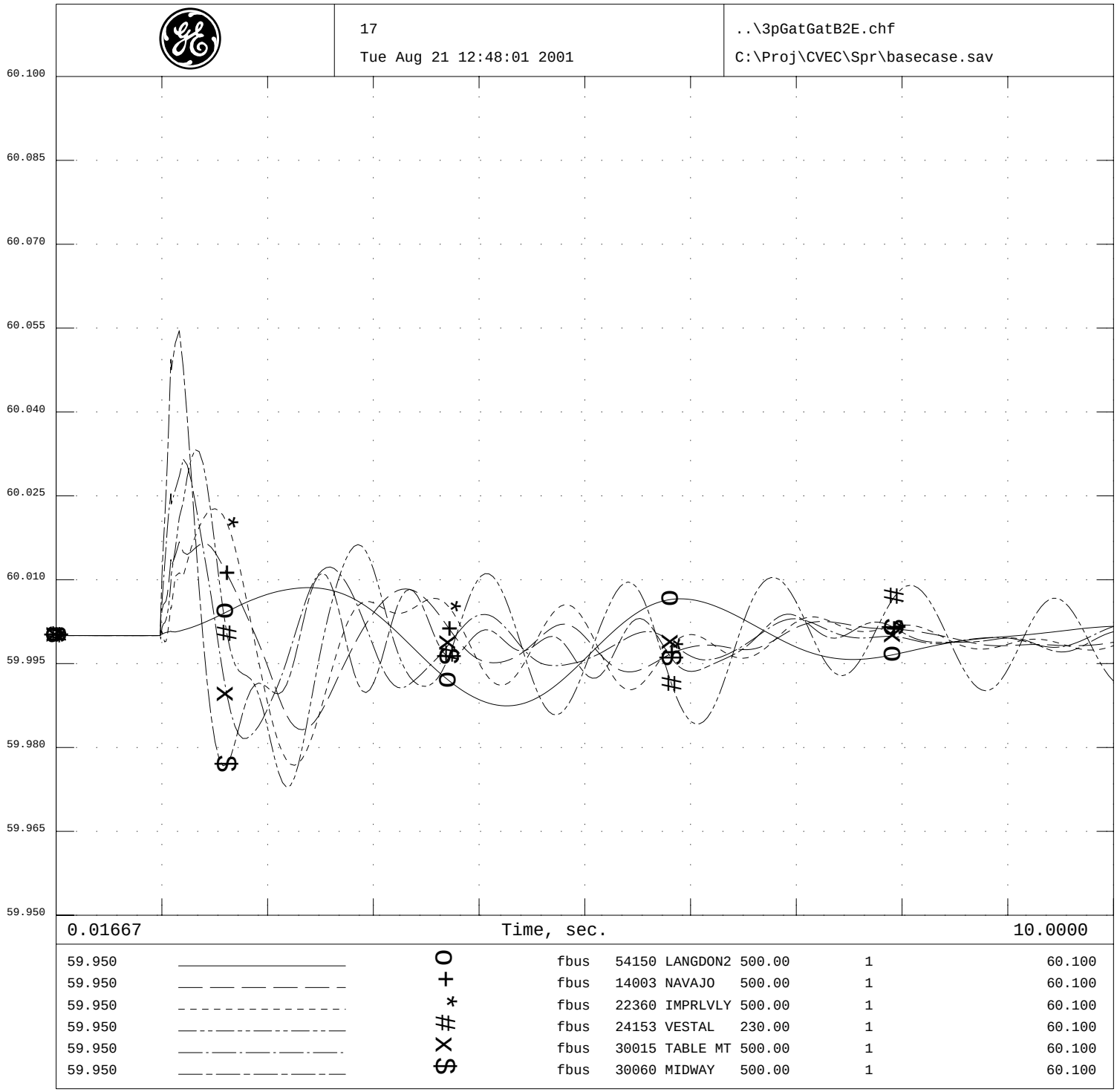
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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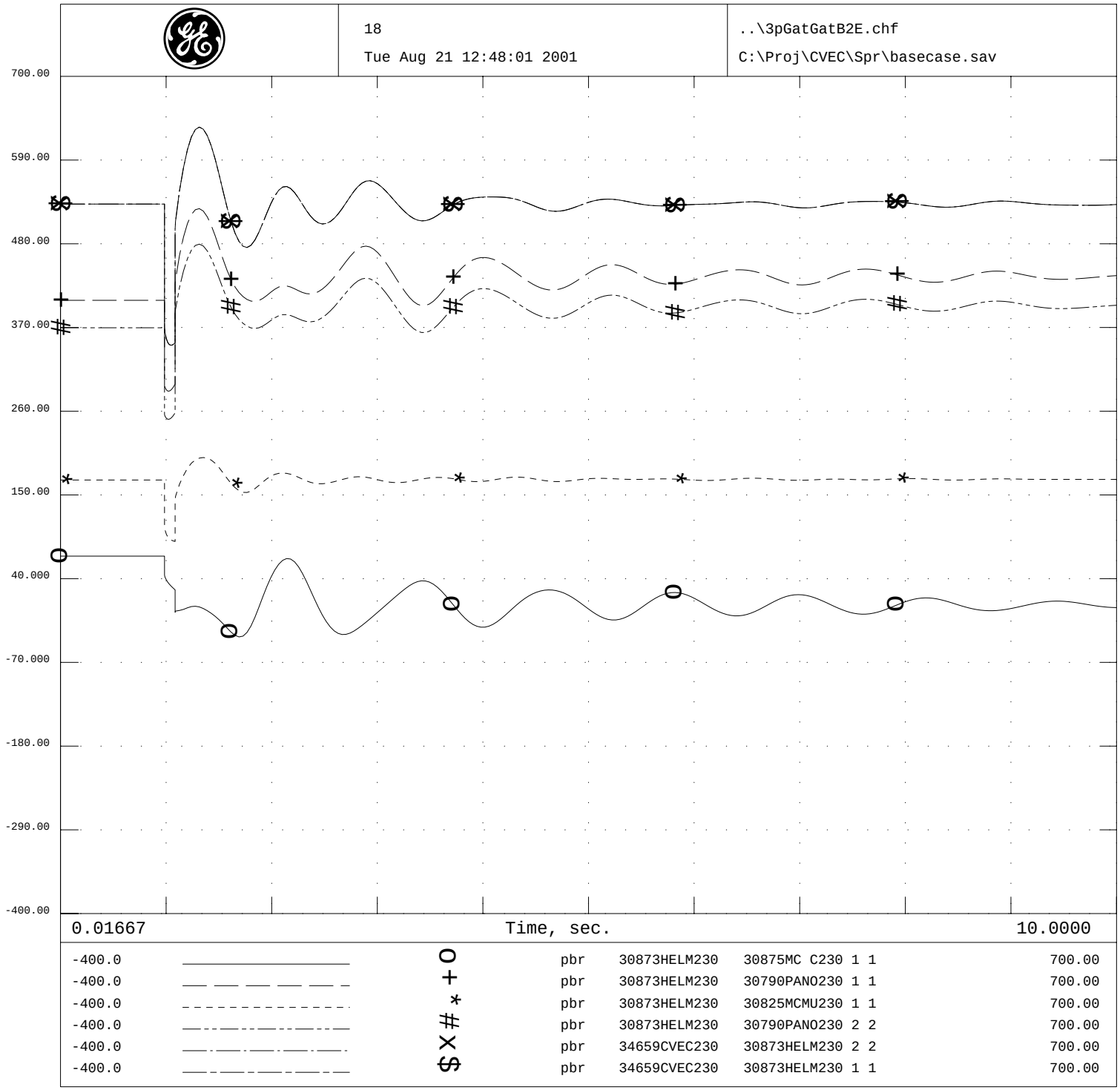

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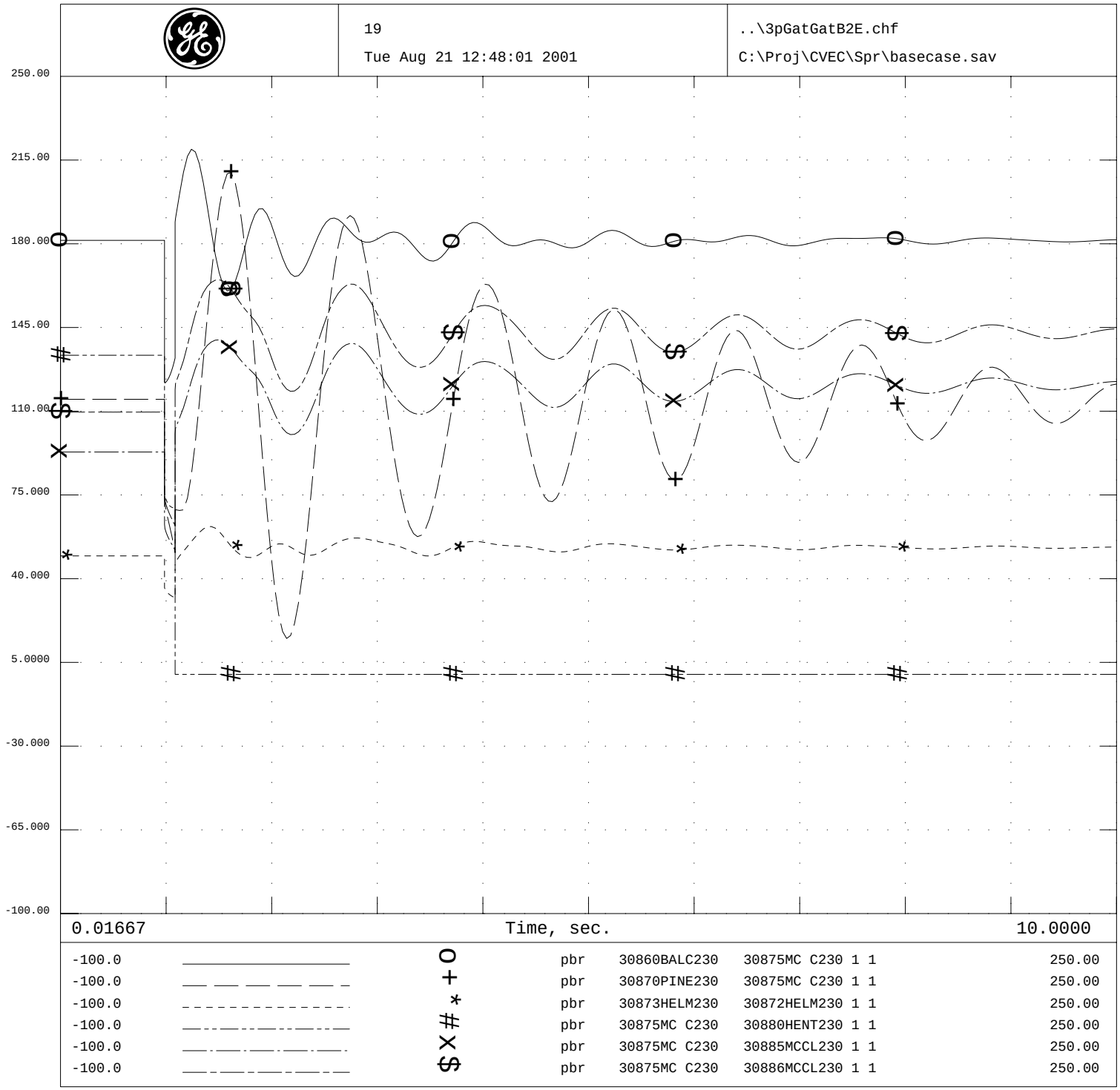
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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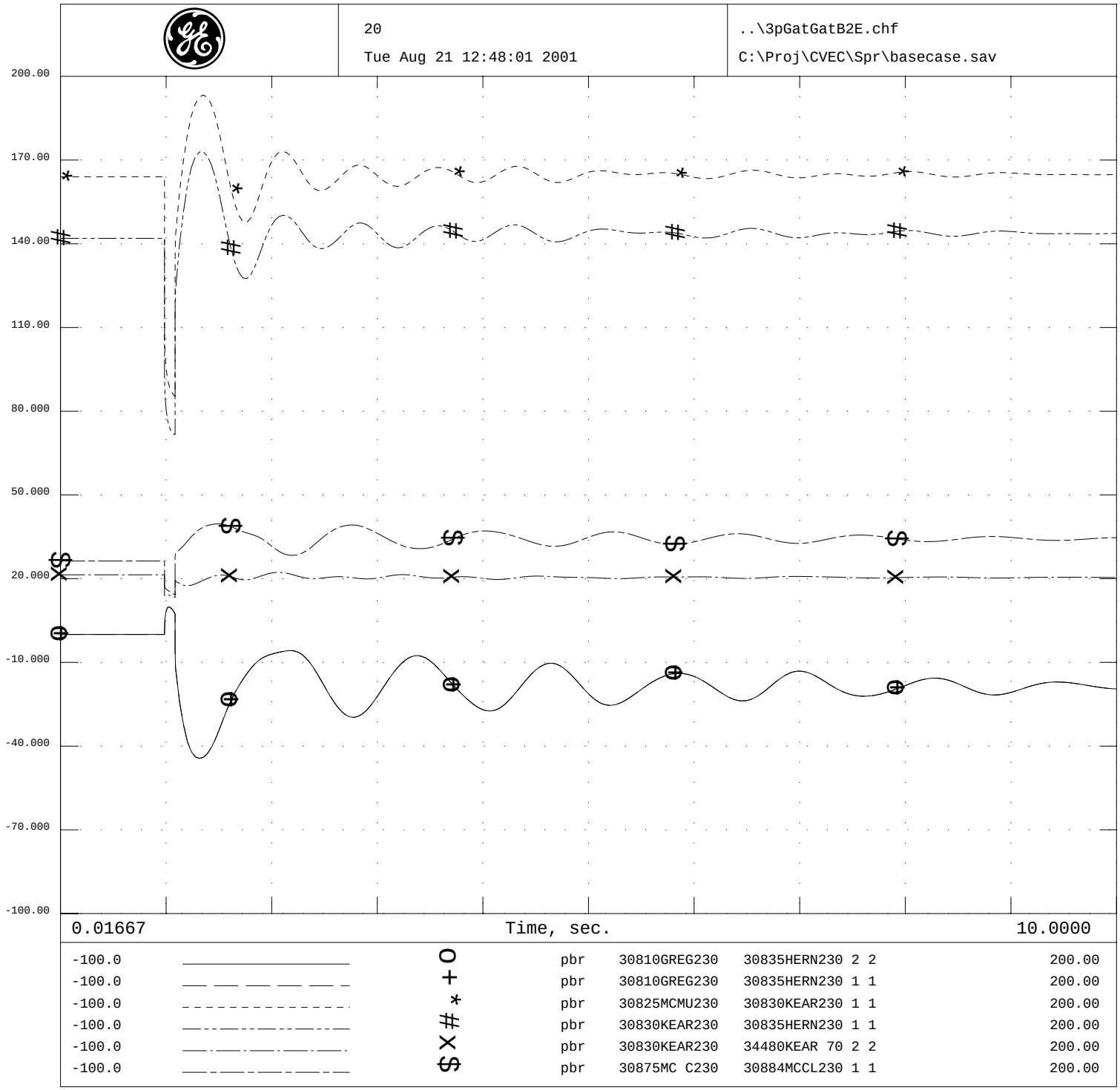

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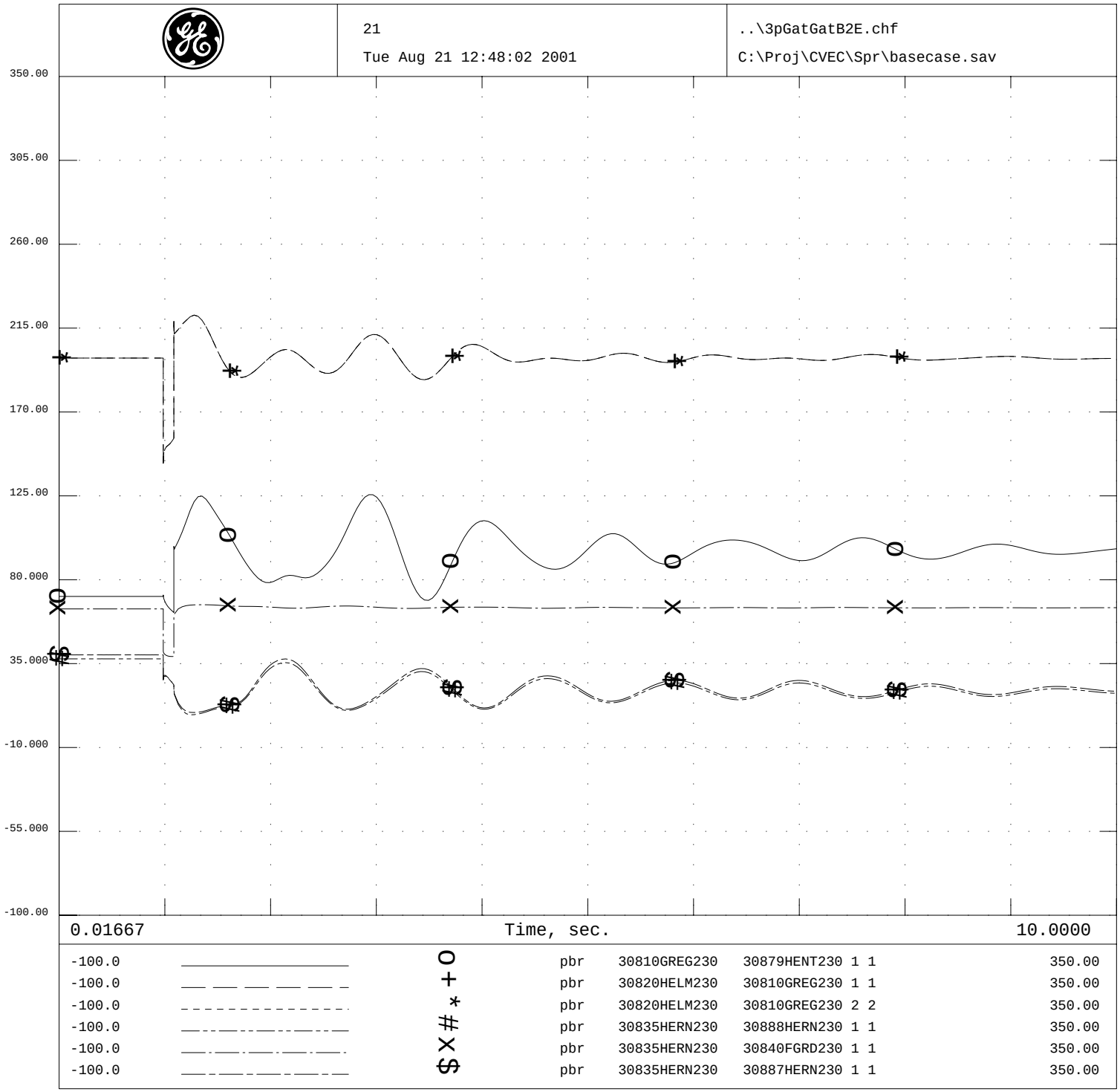

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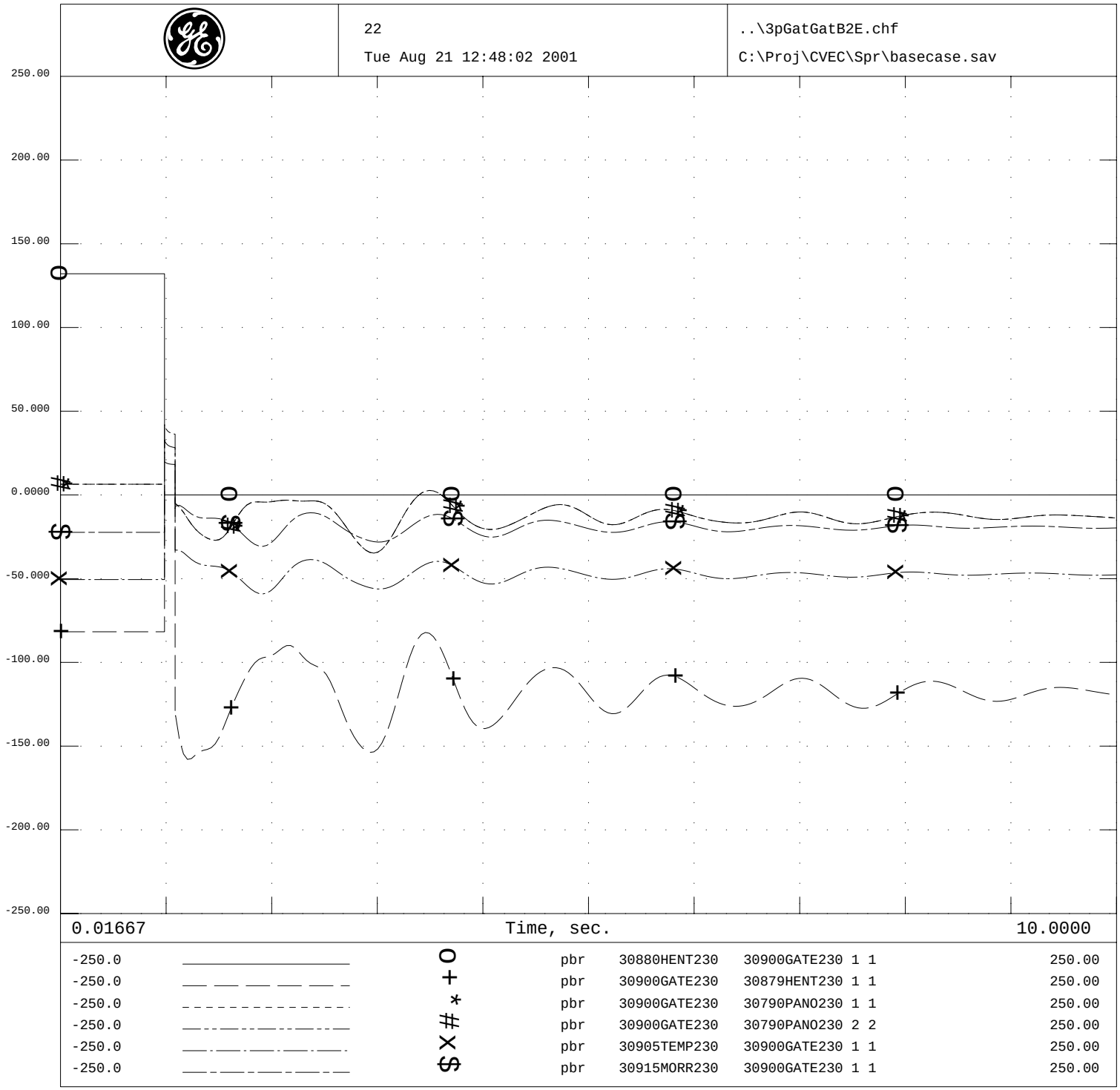

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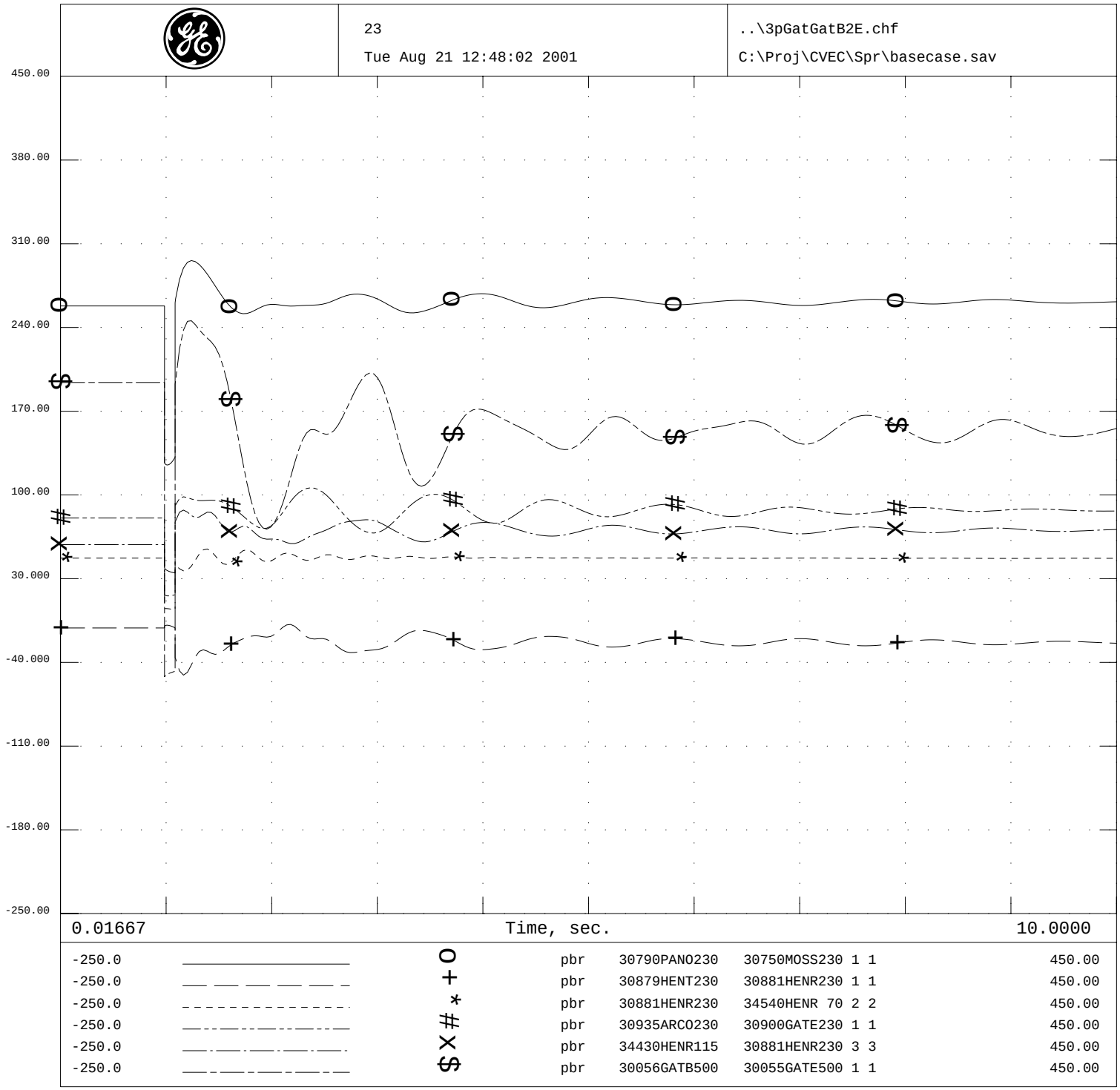

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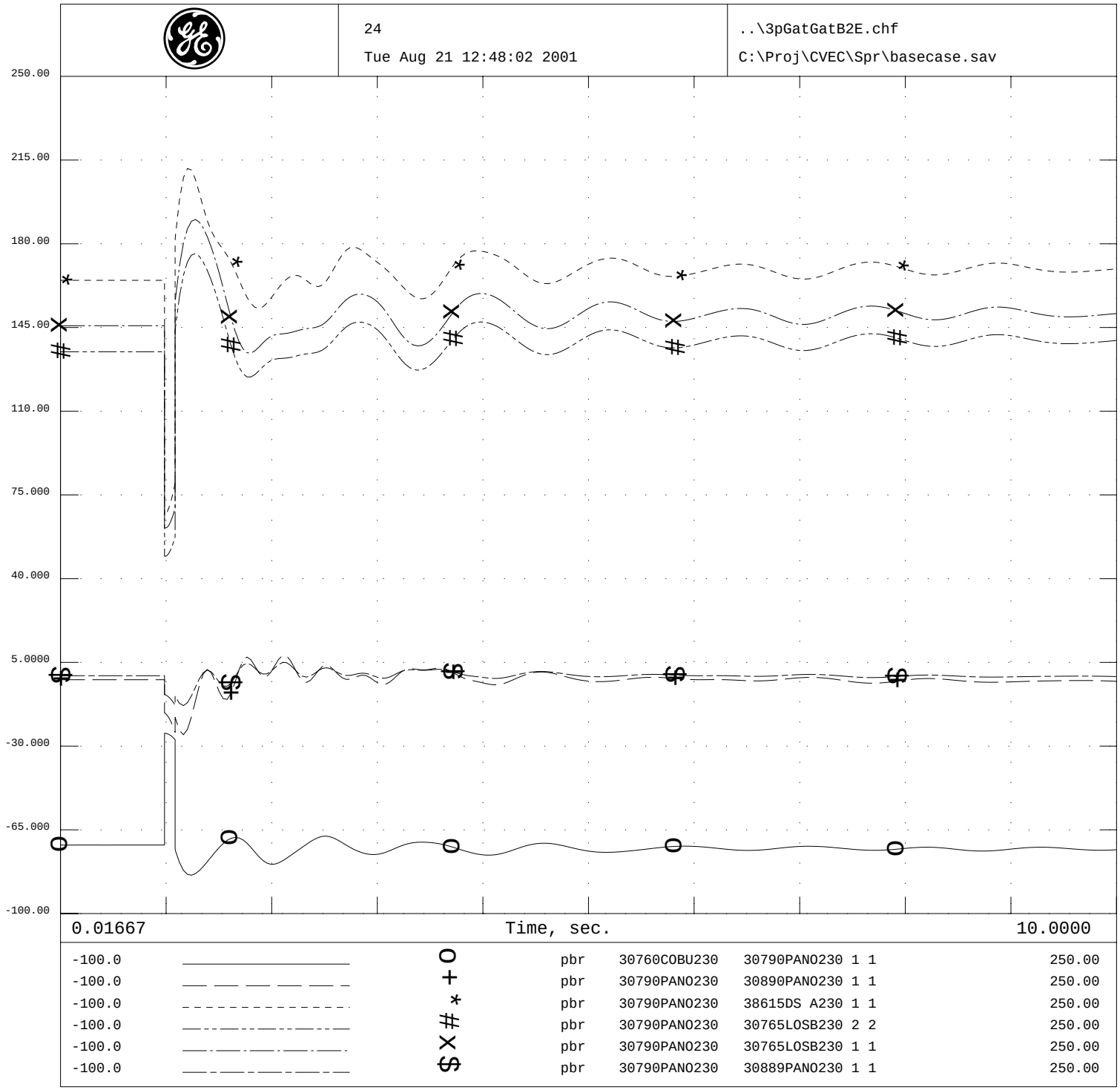

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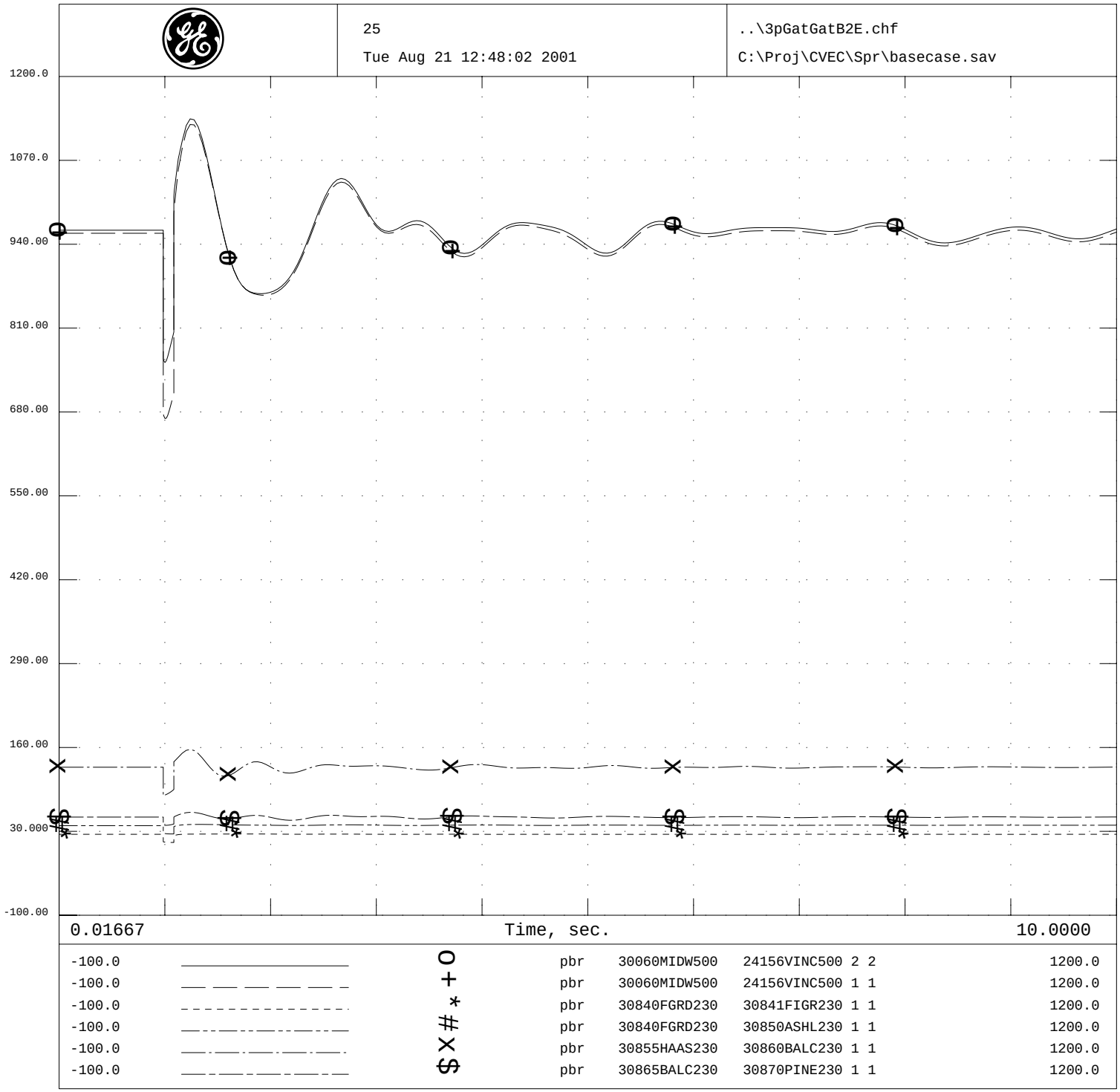

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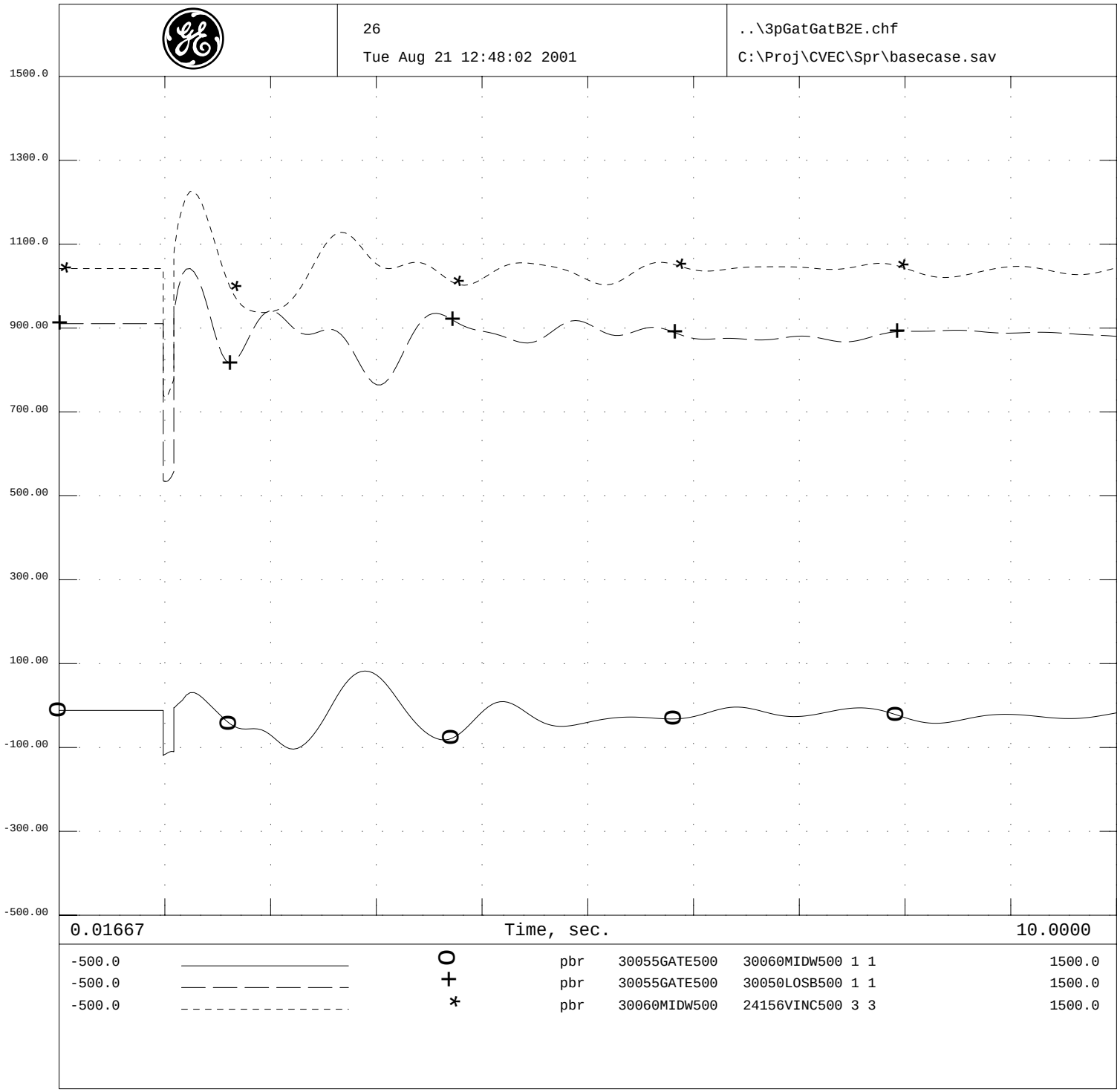

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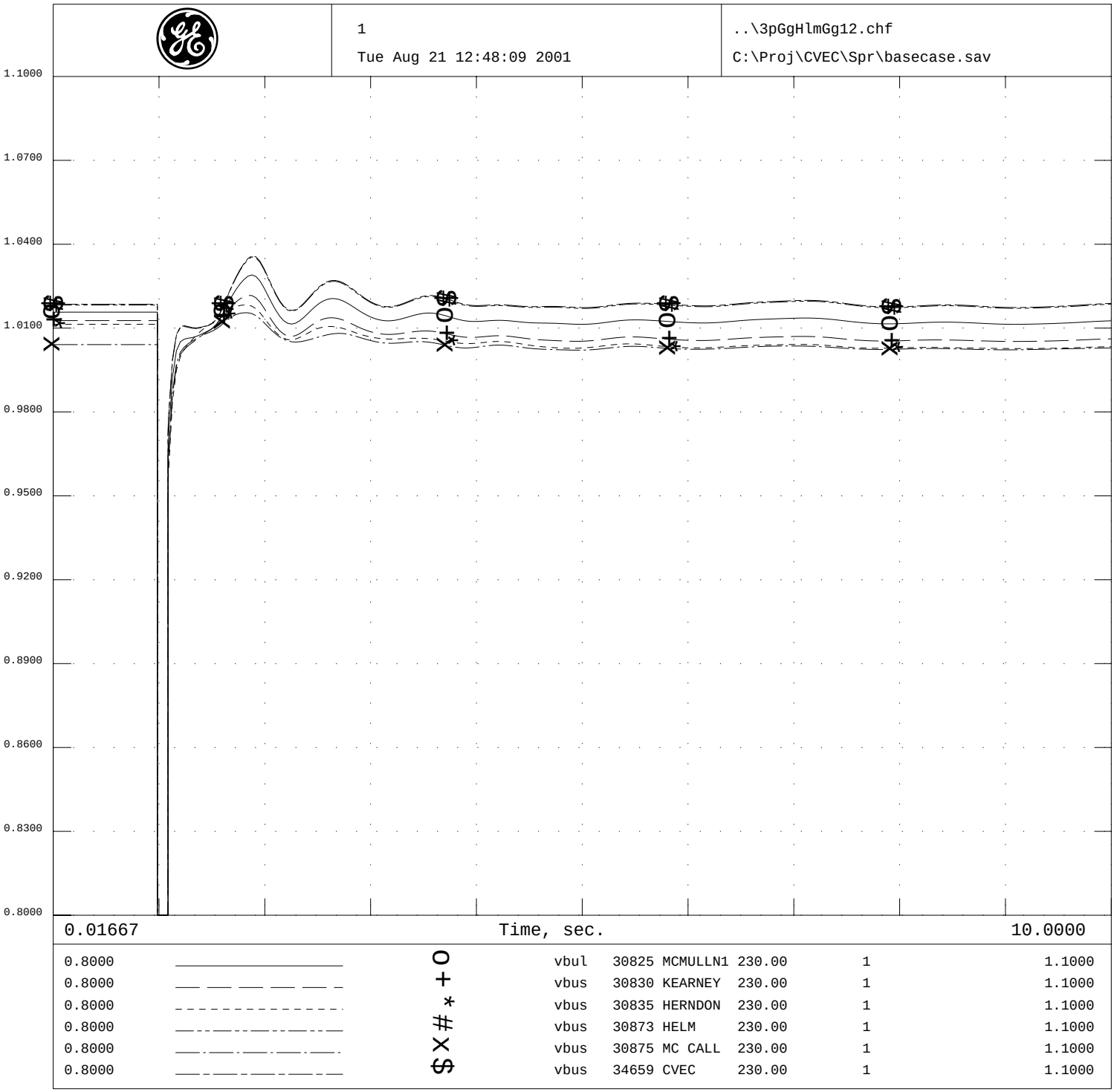

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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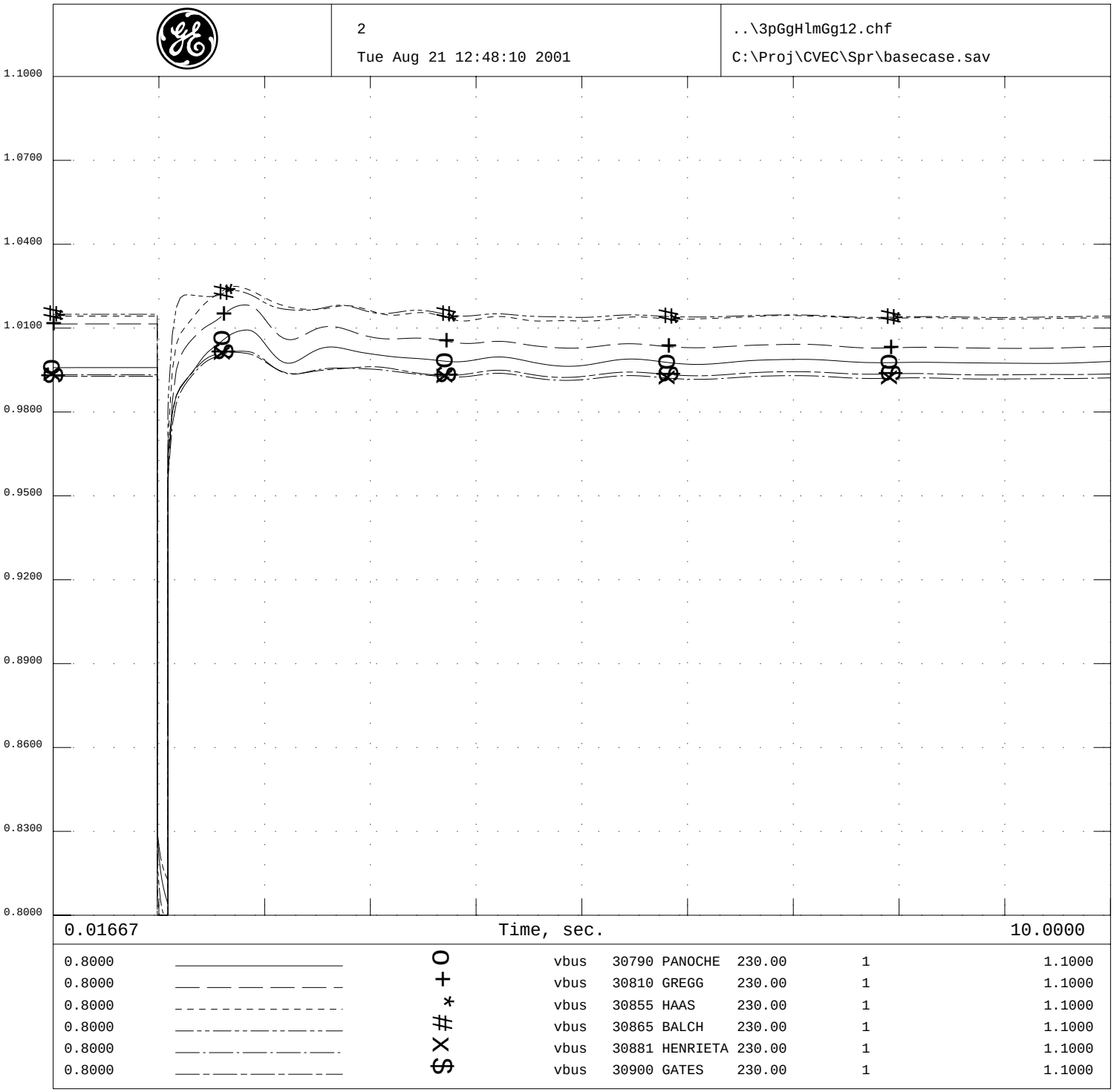
Gregg-Helms #1,2 230kV Double Line Outage
3 phase 6 cycle fault at Gregg 230kV bus and trip both Gregg-Helms 230kV lines

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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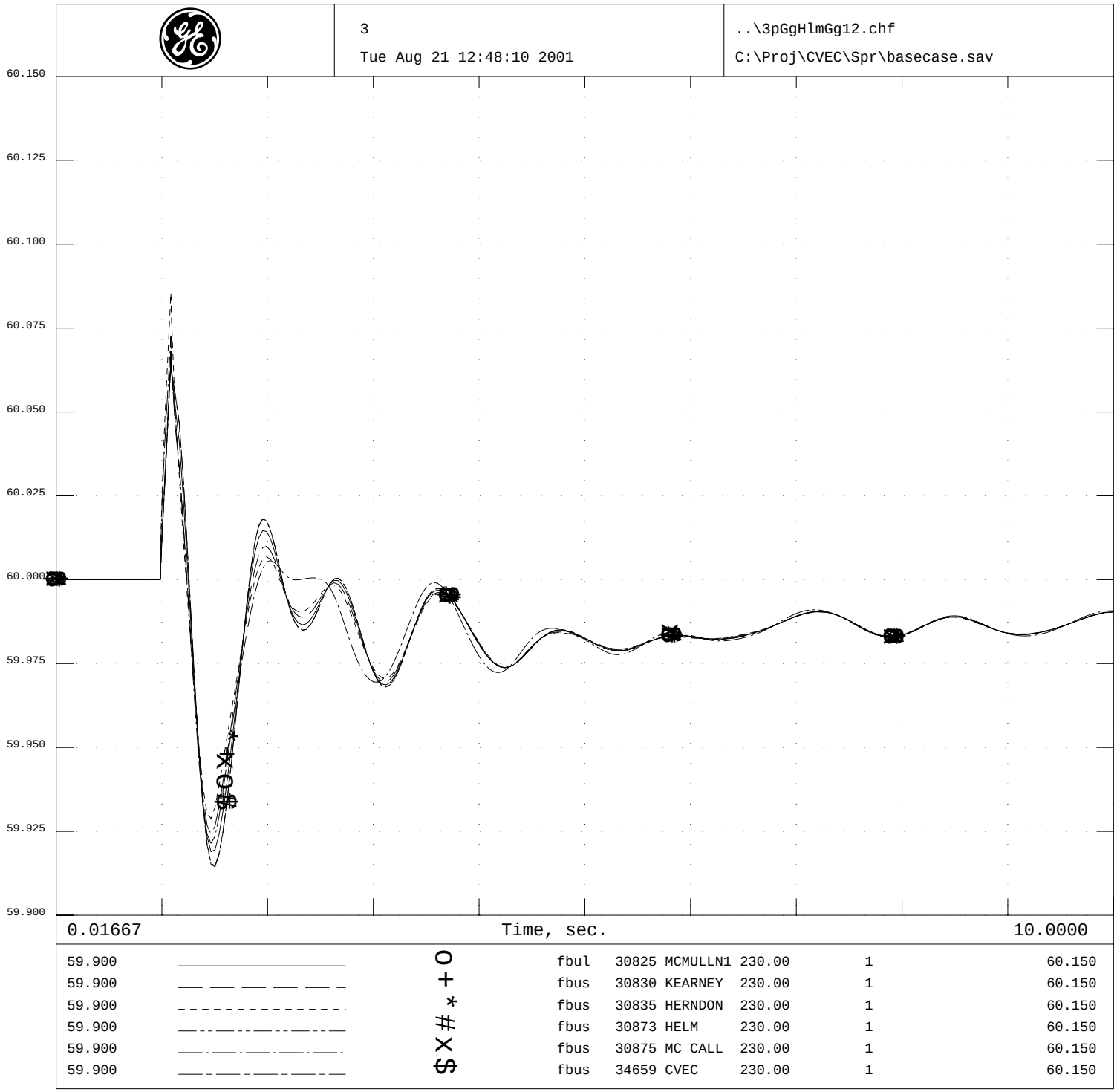

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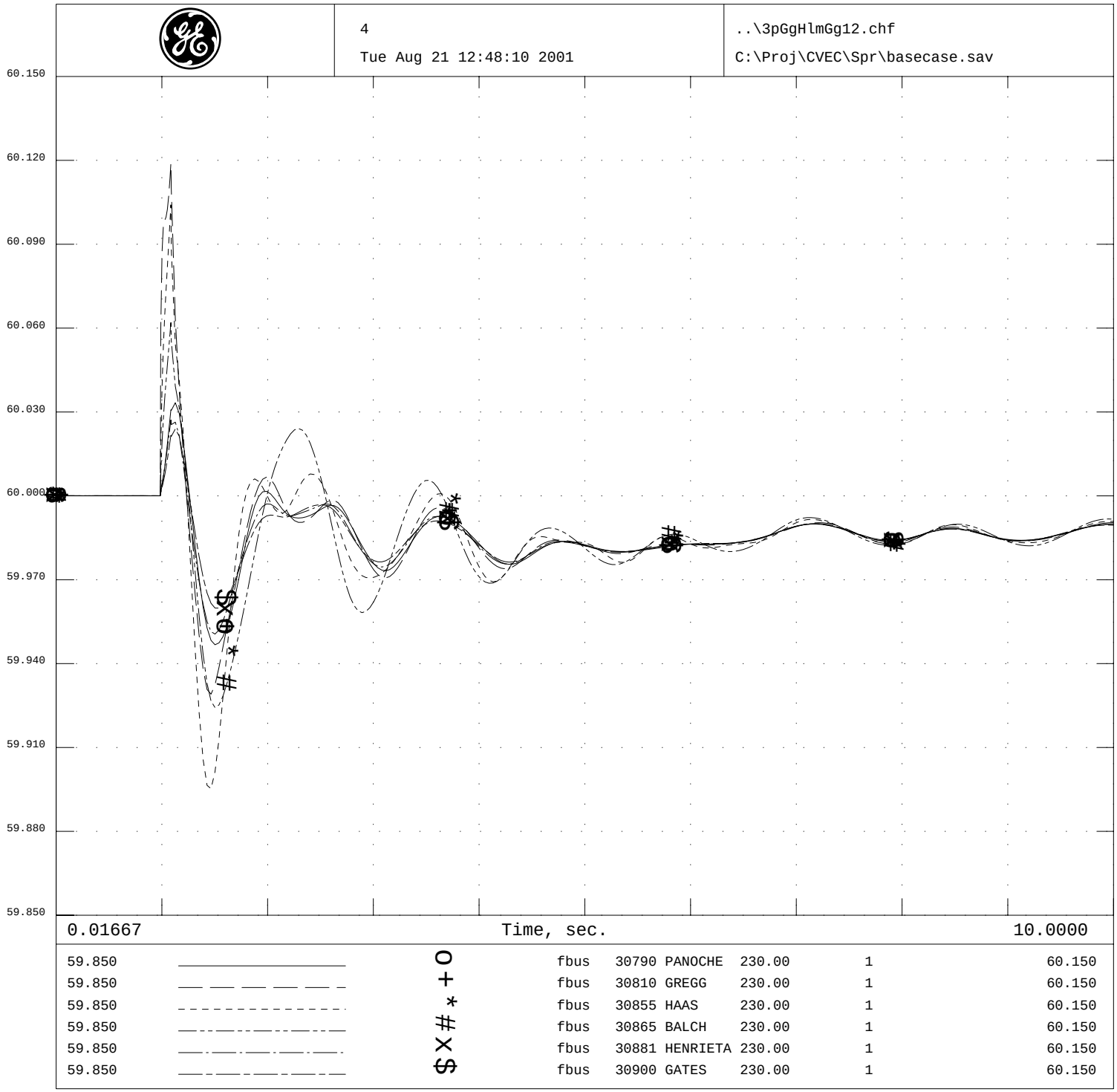
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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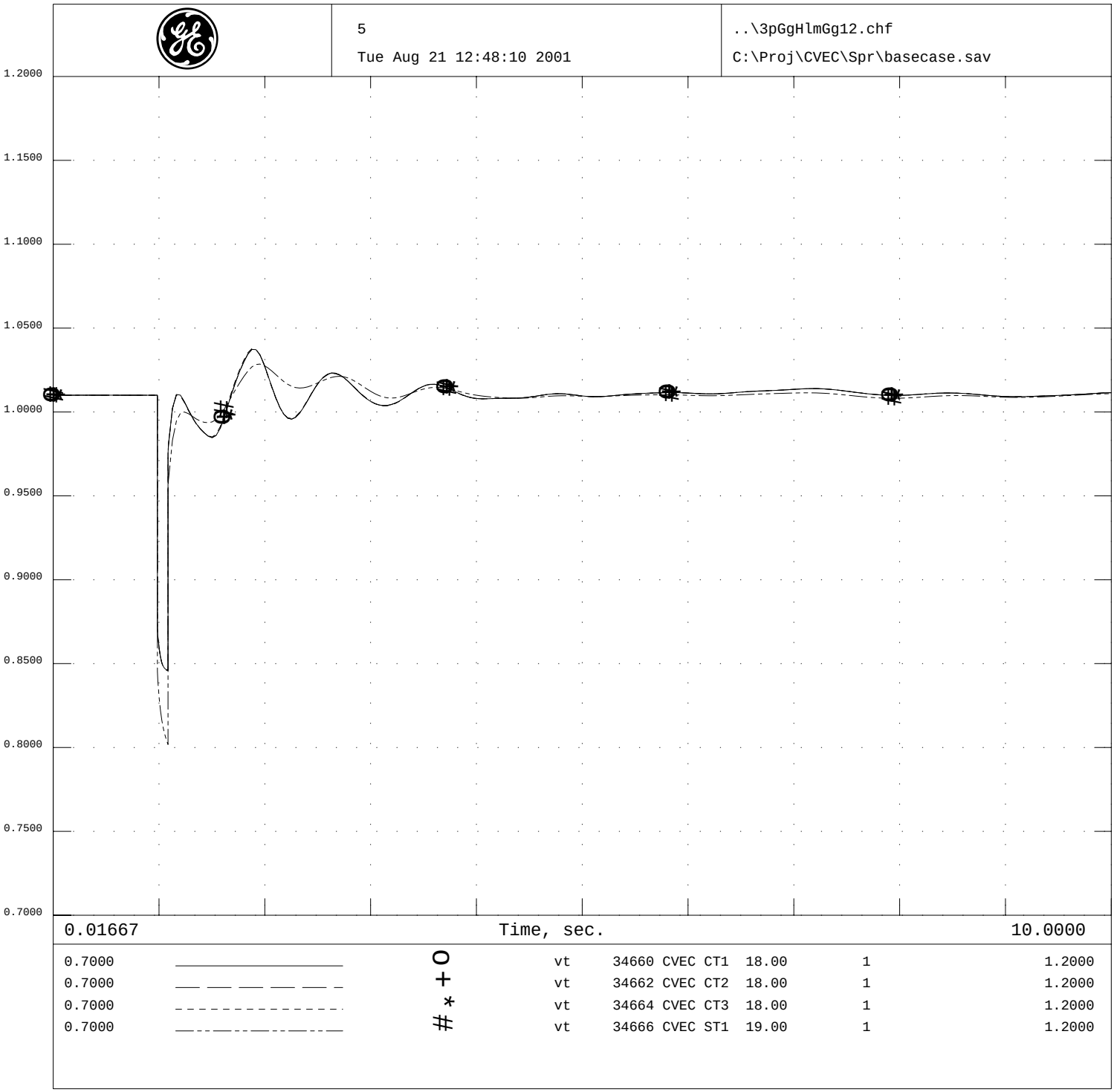

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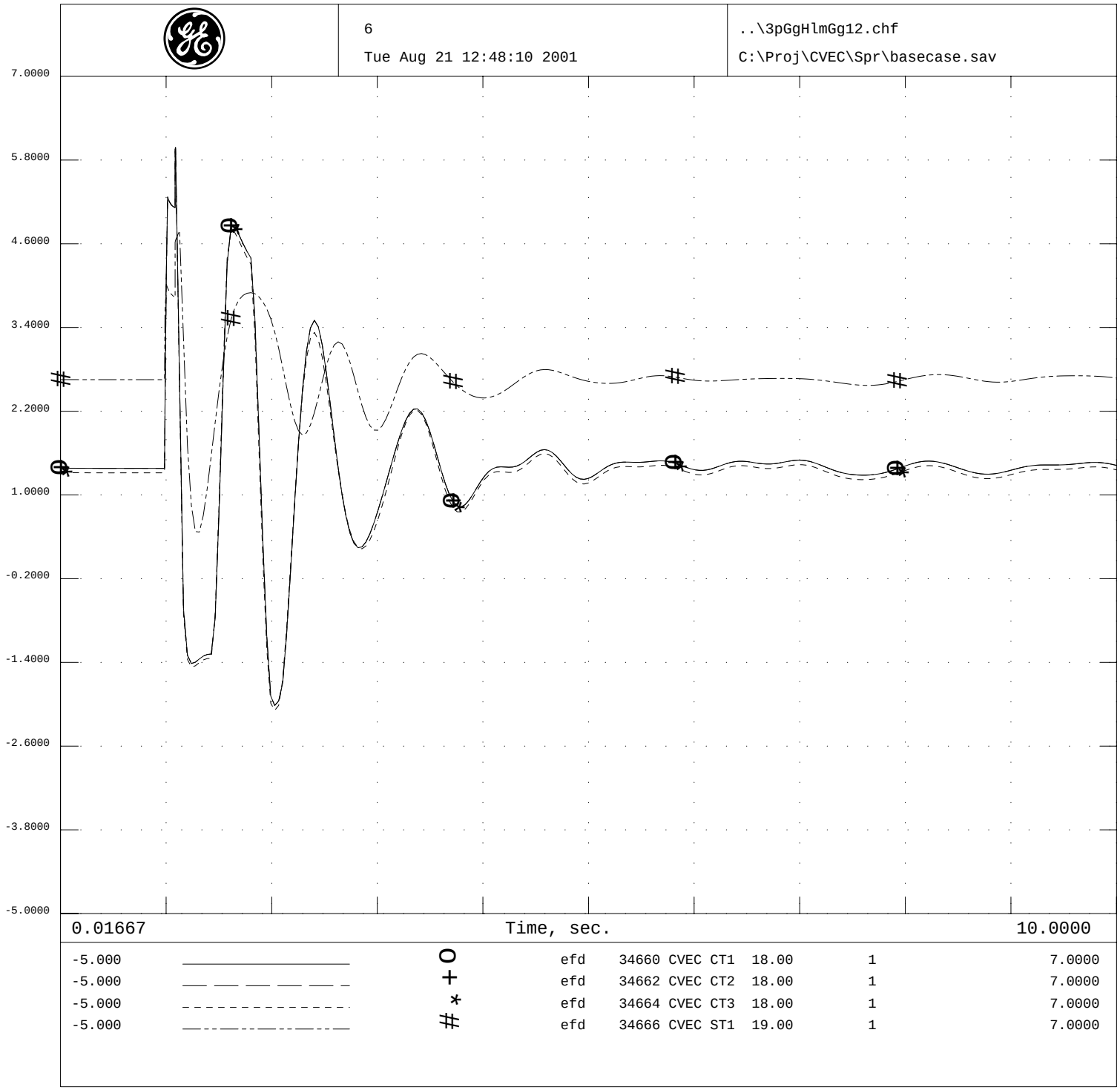
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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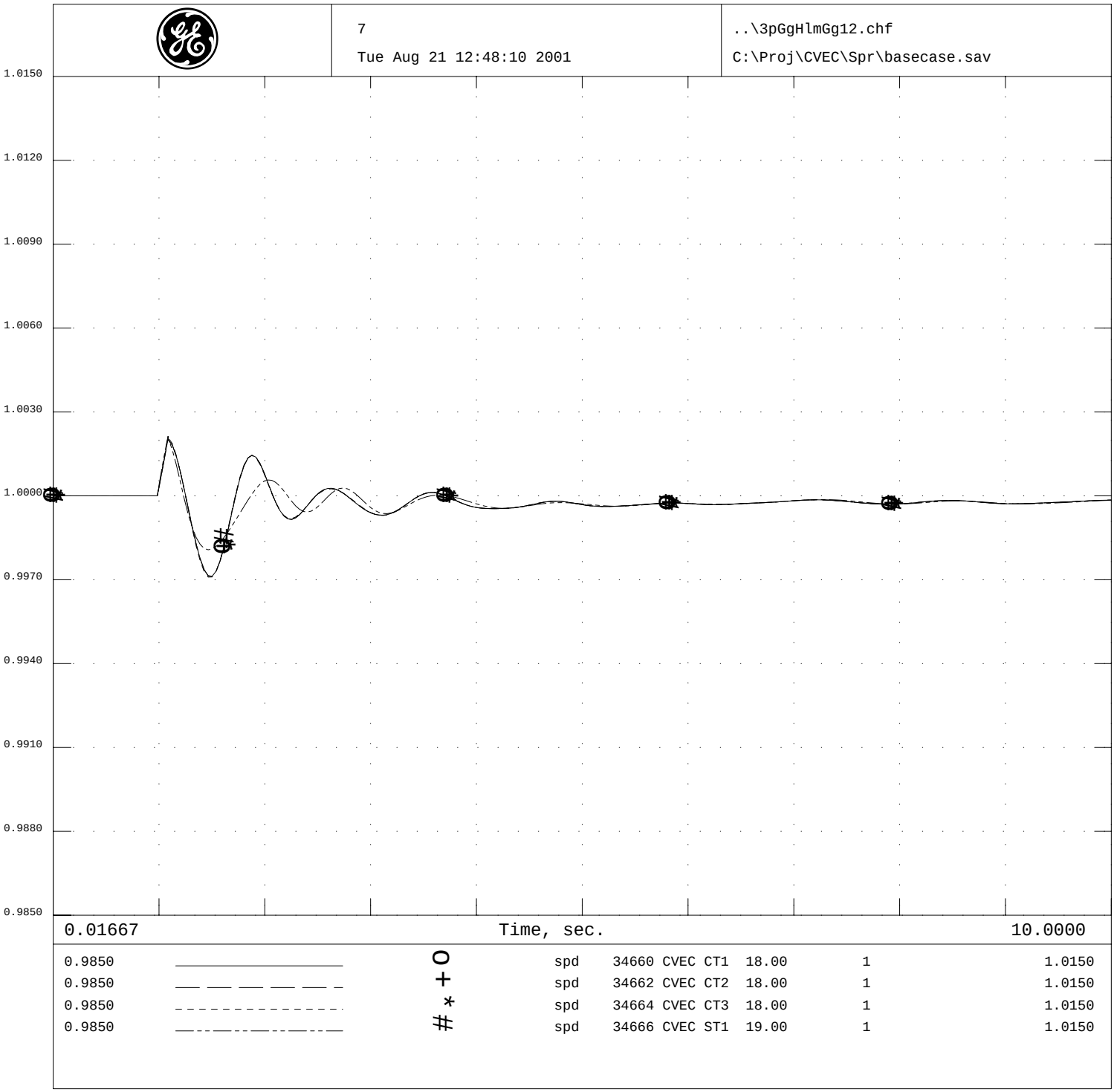
Calpine Corporation
Project Generator Field Voltages



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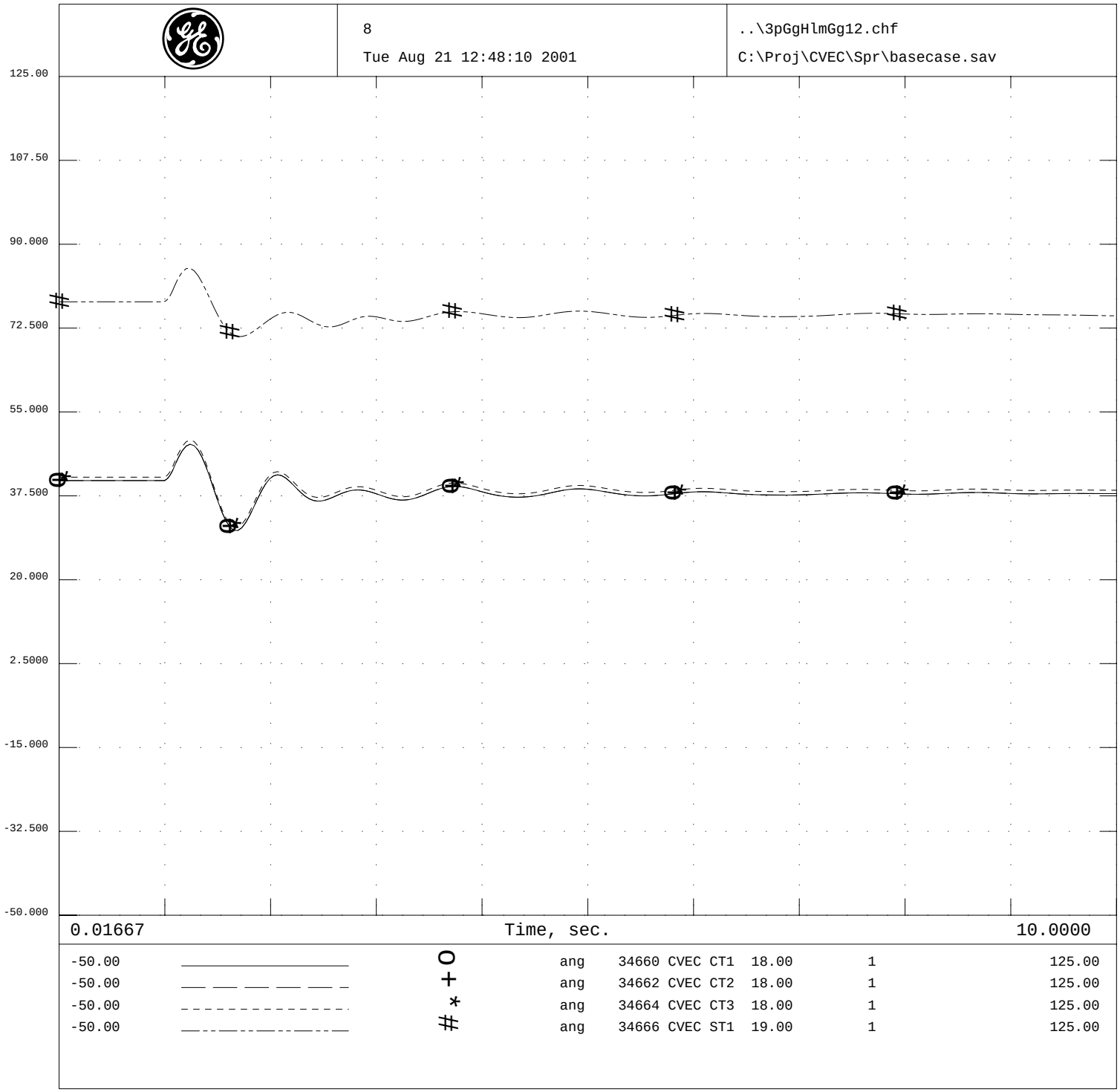
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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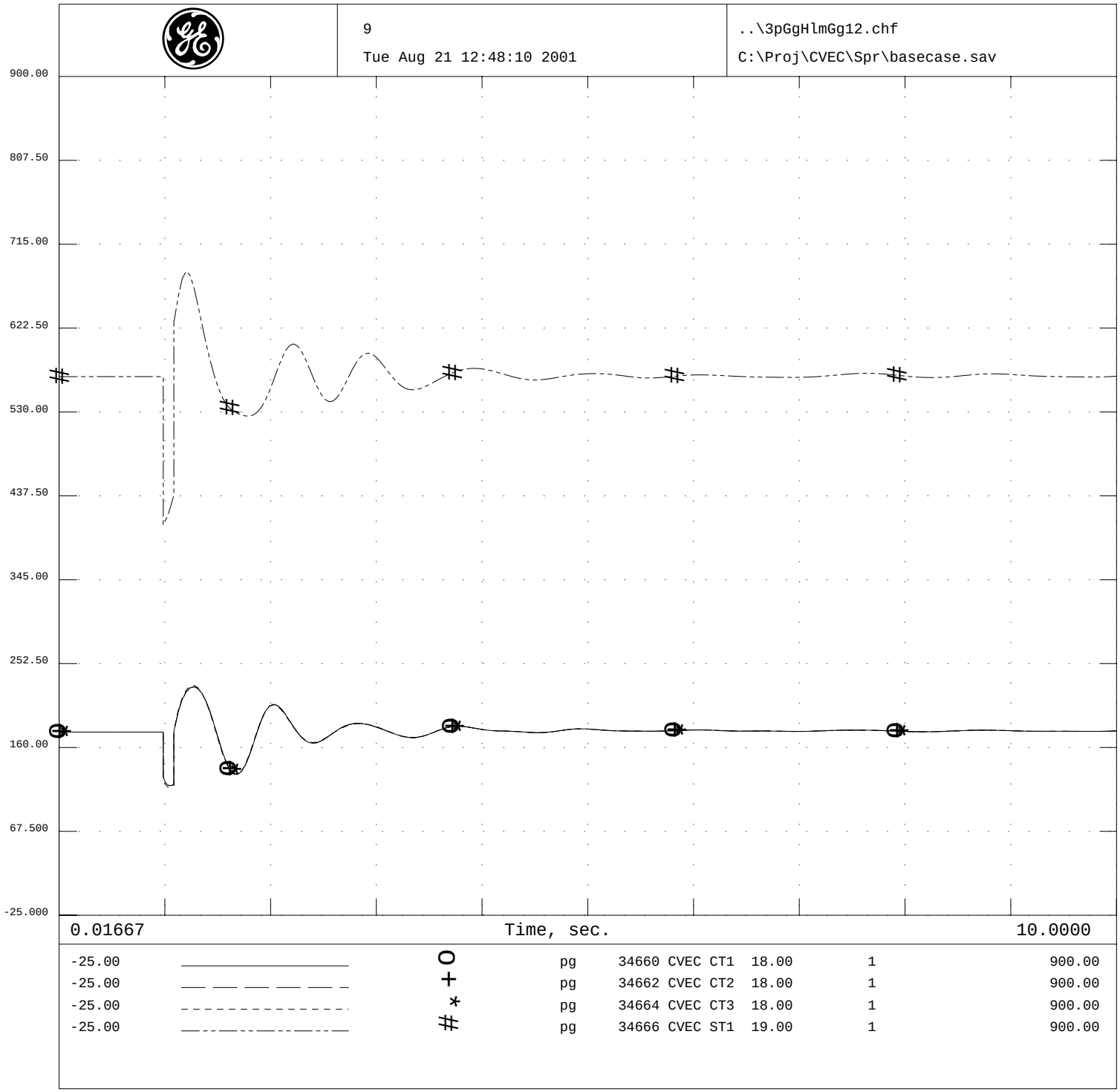
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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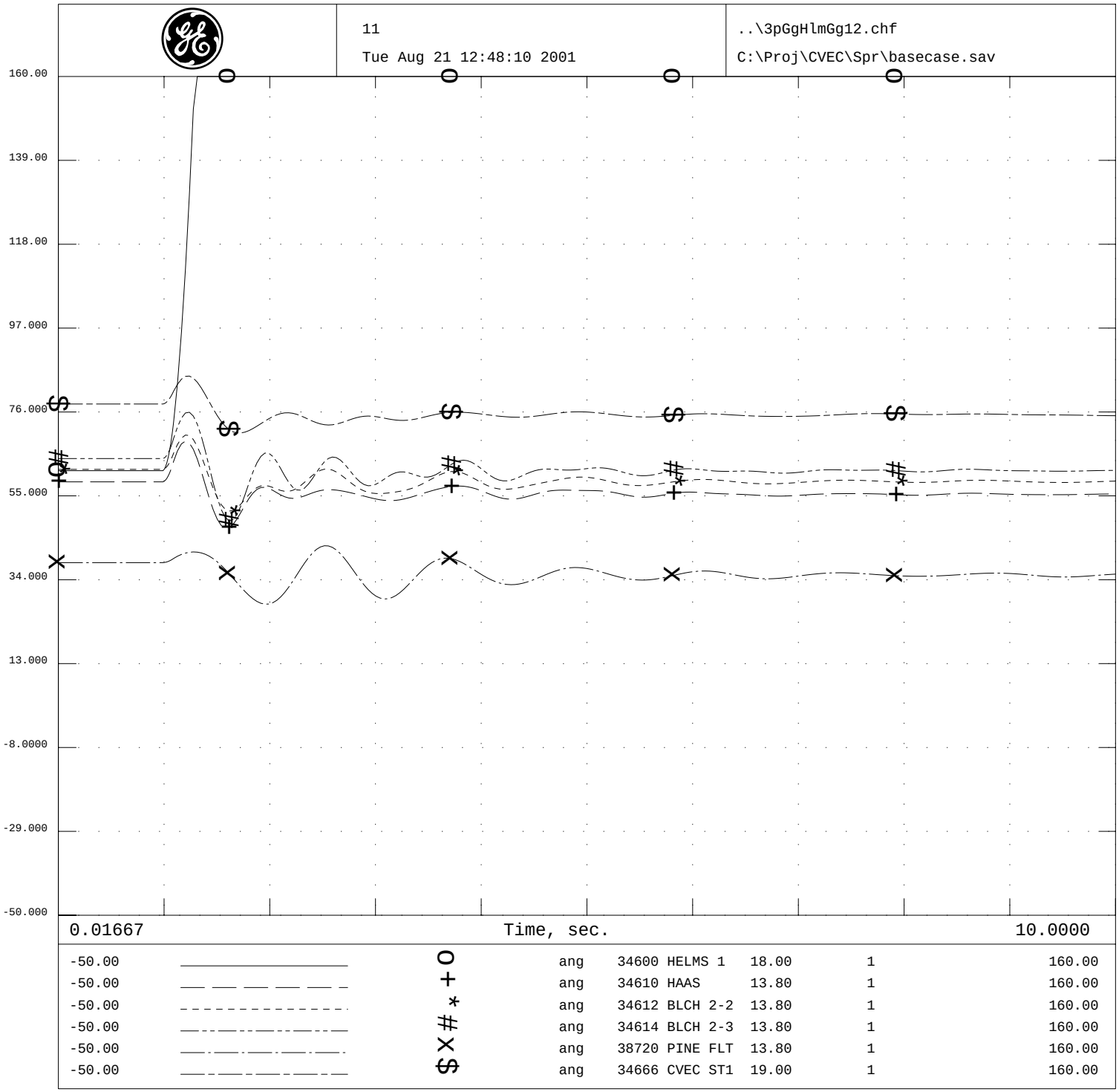
Calpine Corporation
Project Generator Terminal Power



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Calpine Corporation
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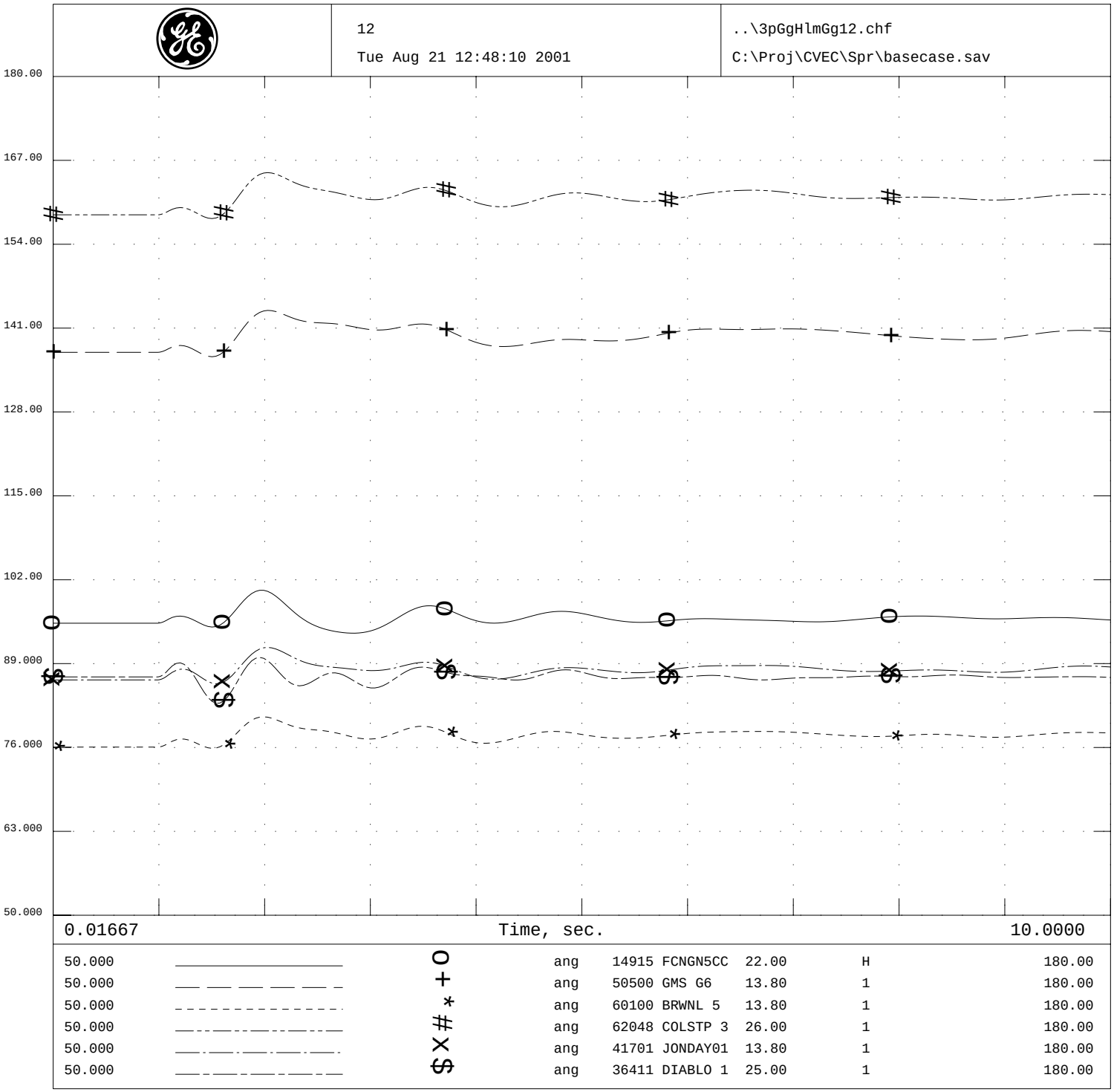

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Calpine Corporation
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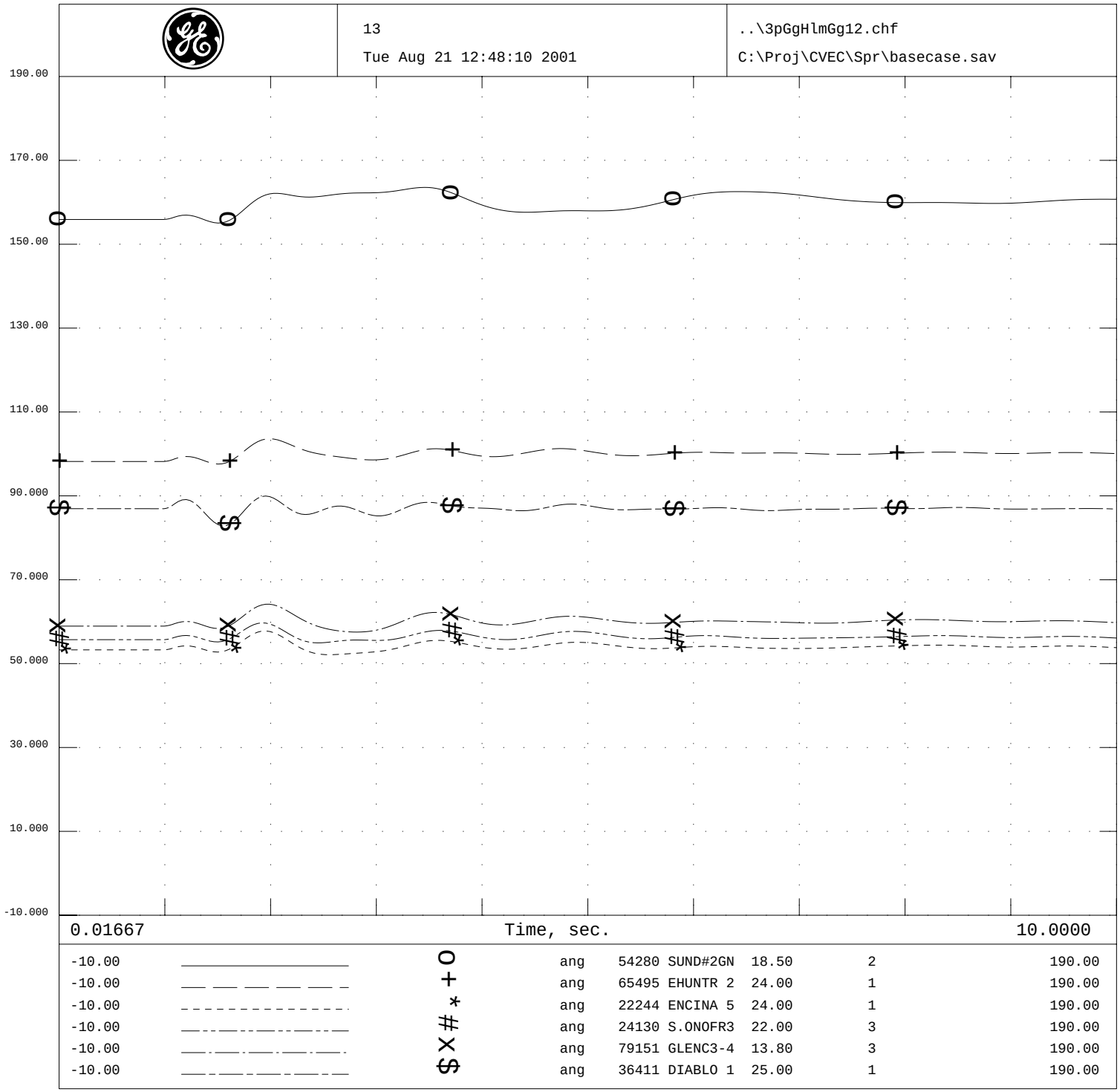

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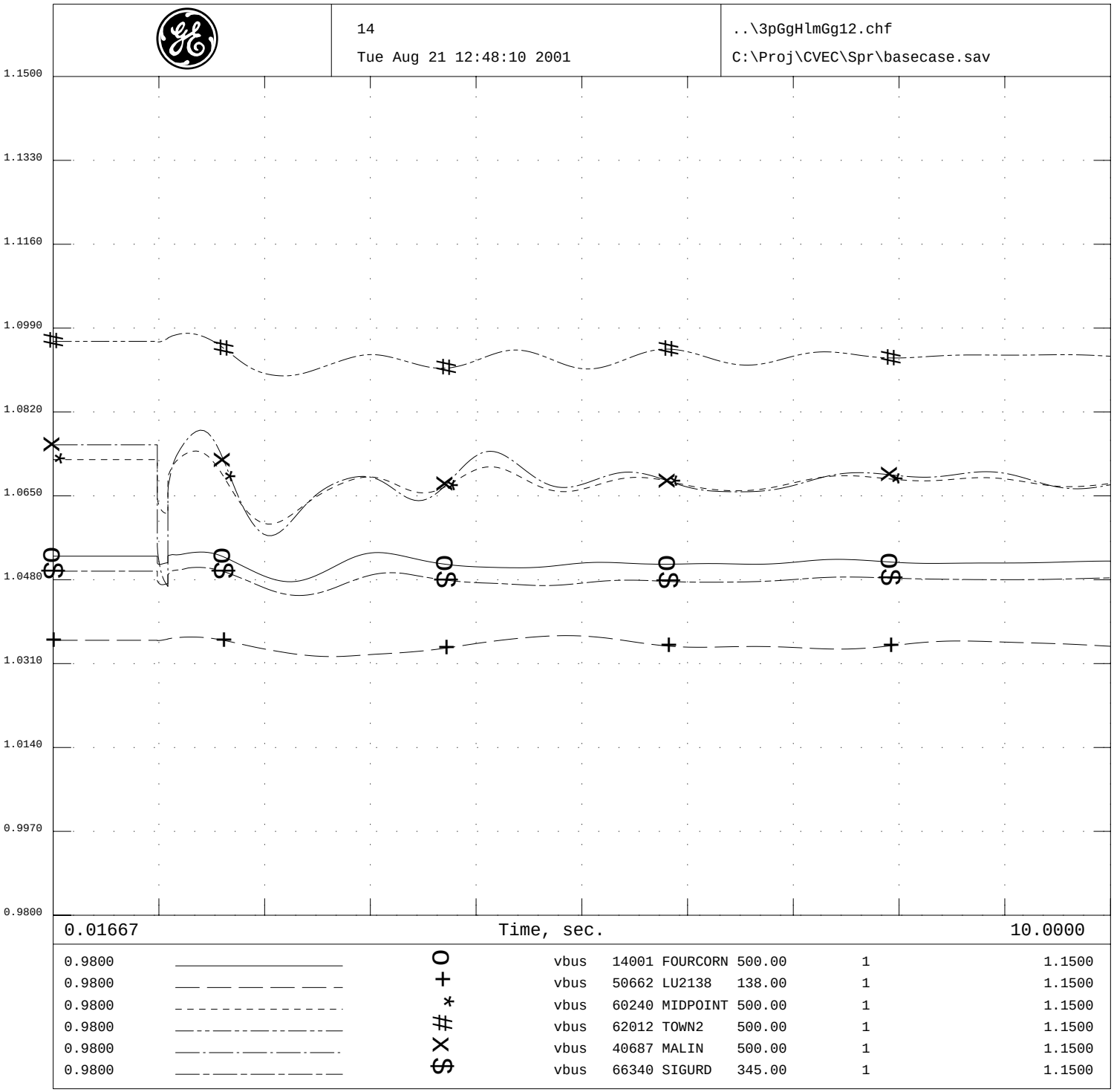

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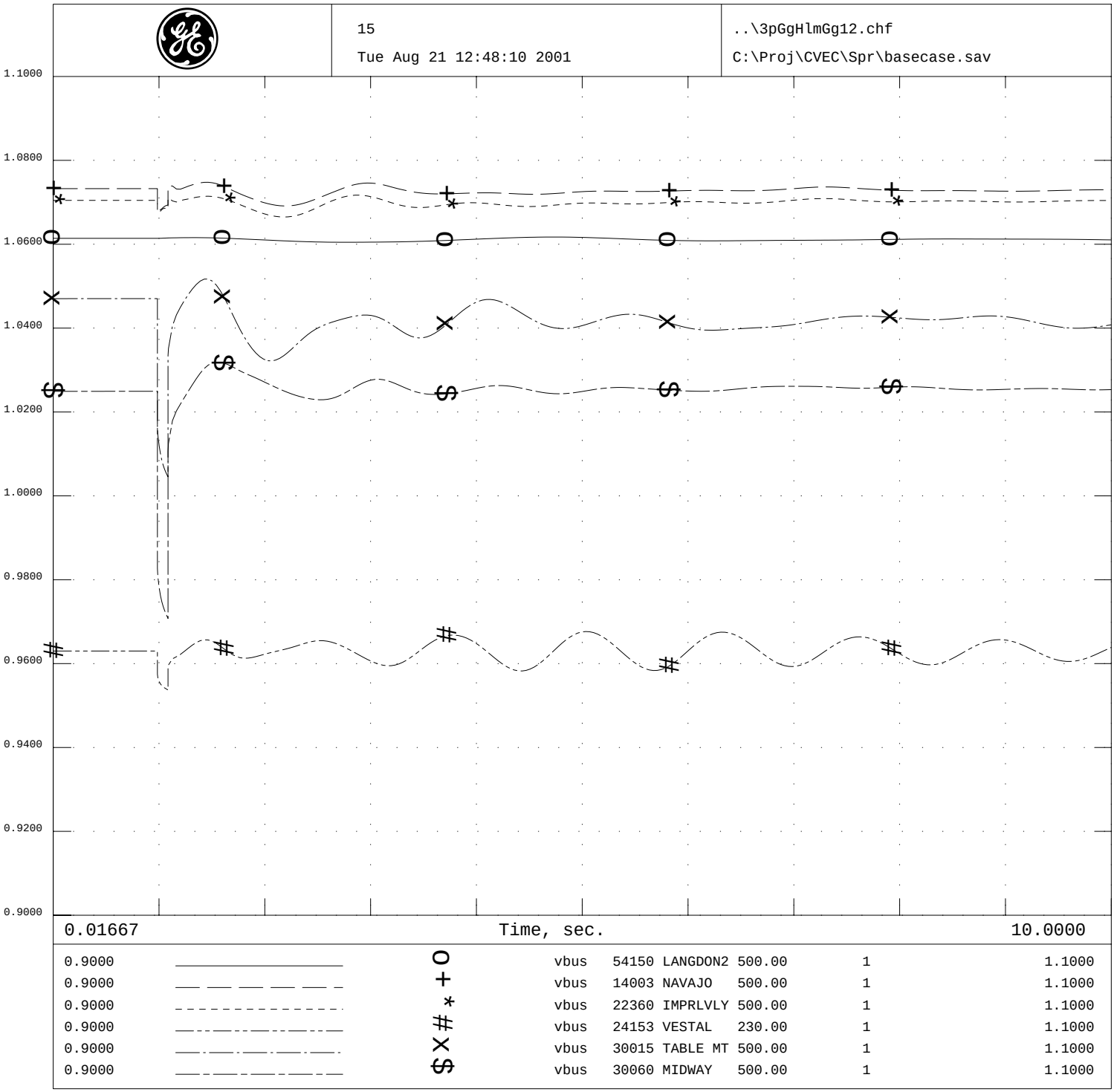

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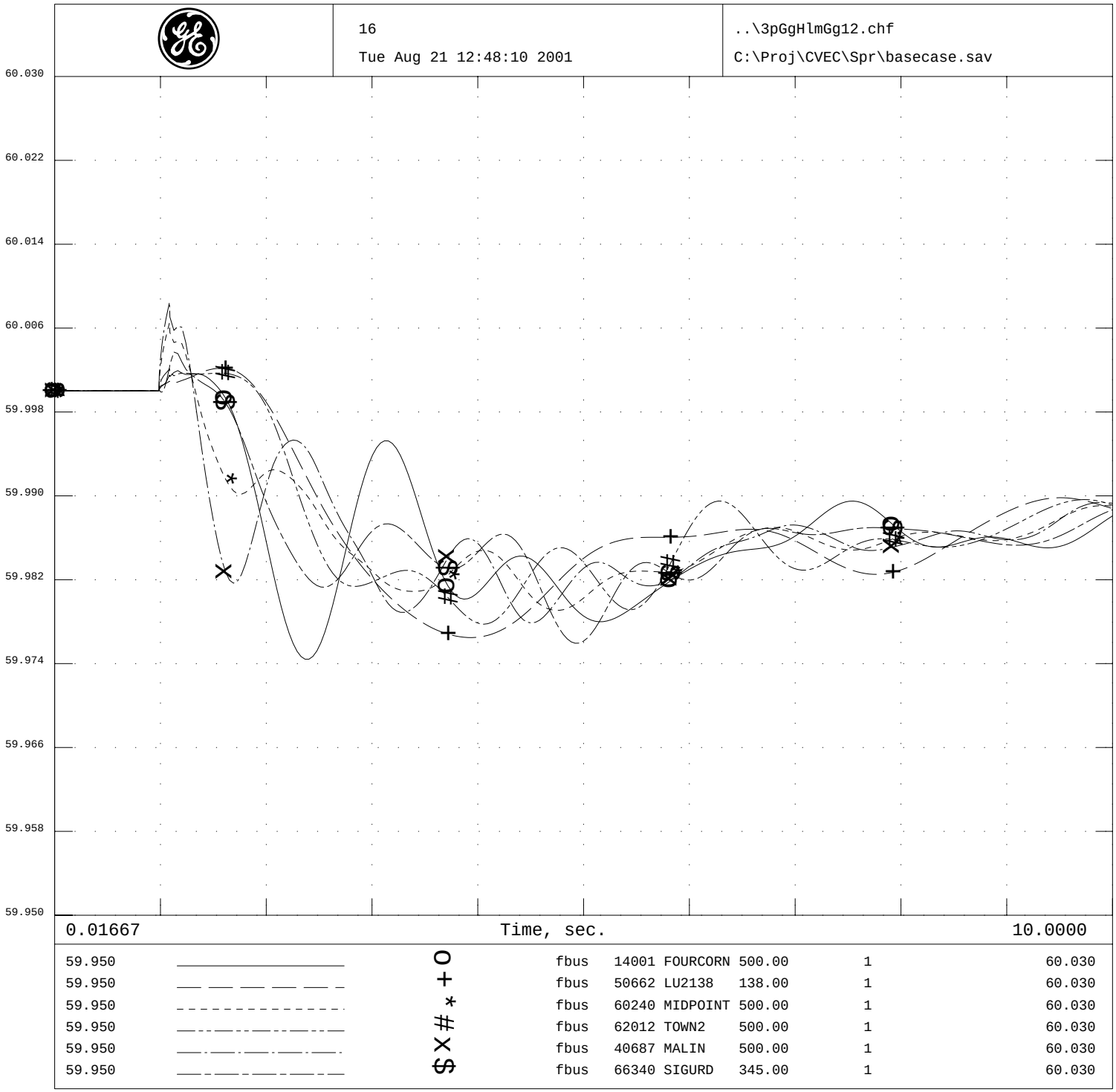

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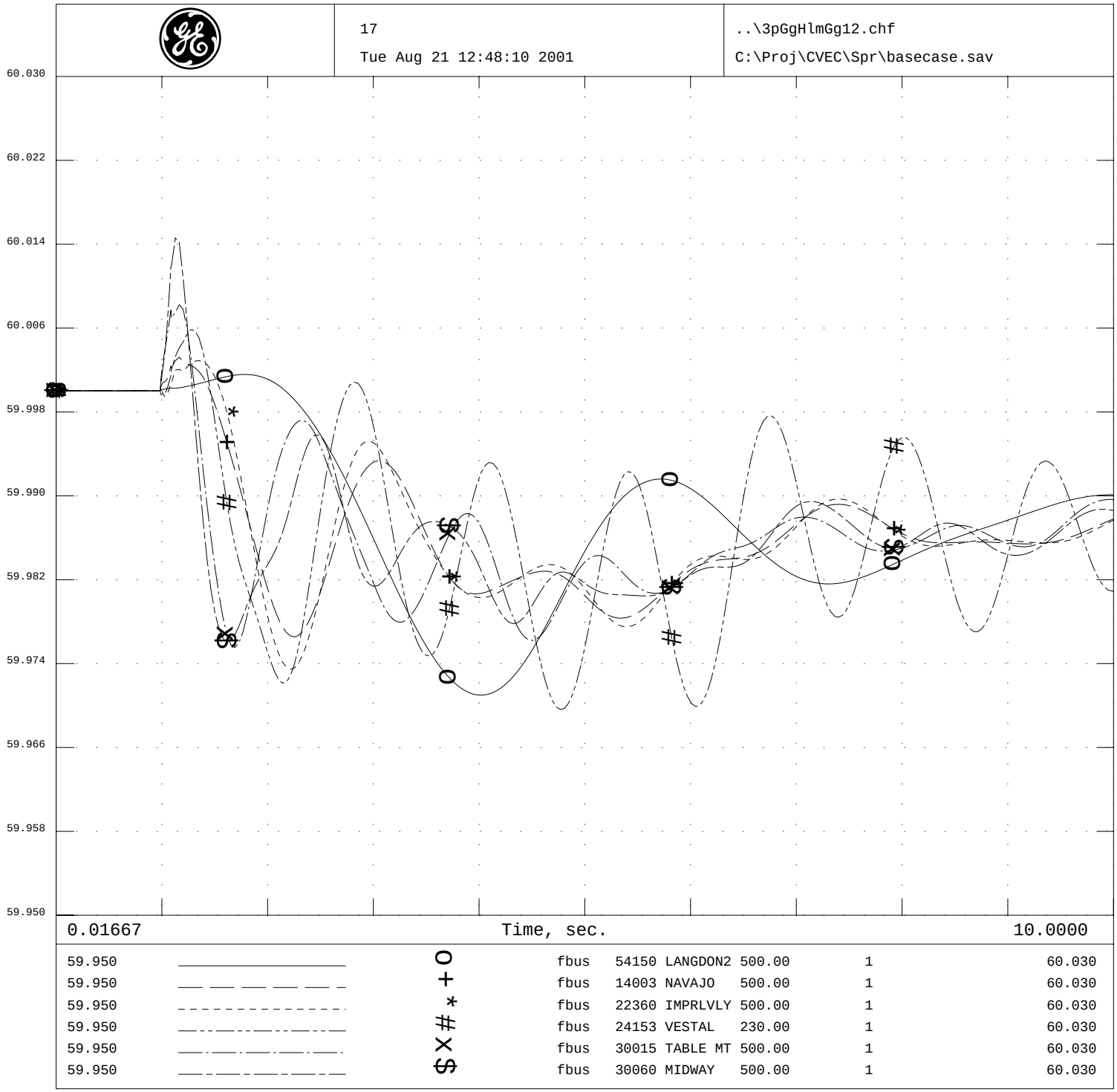

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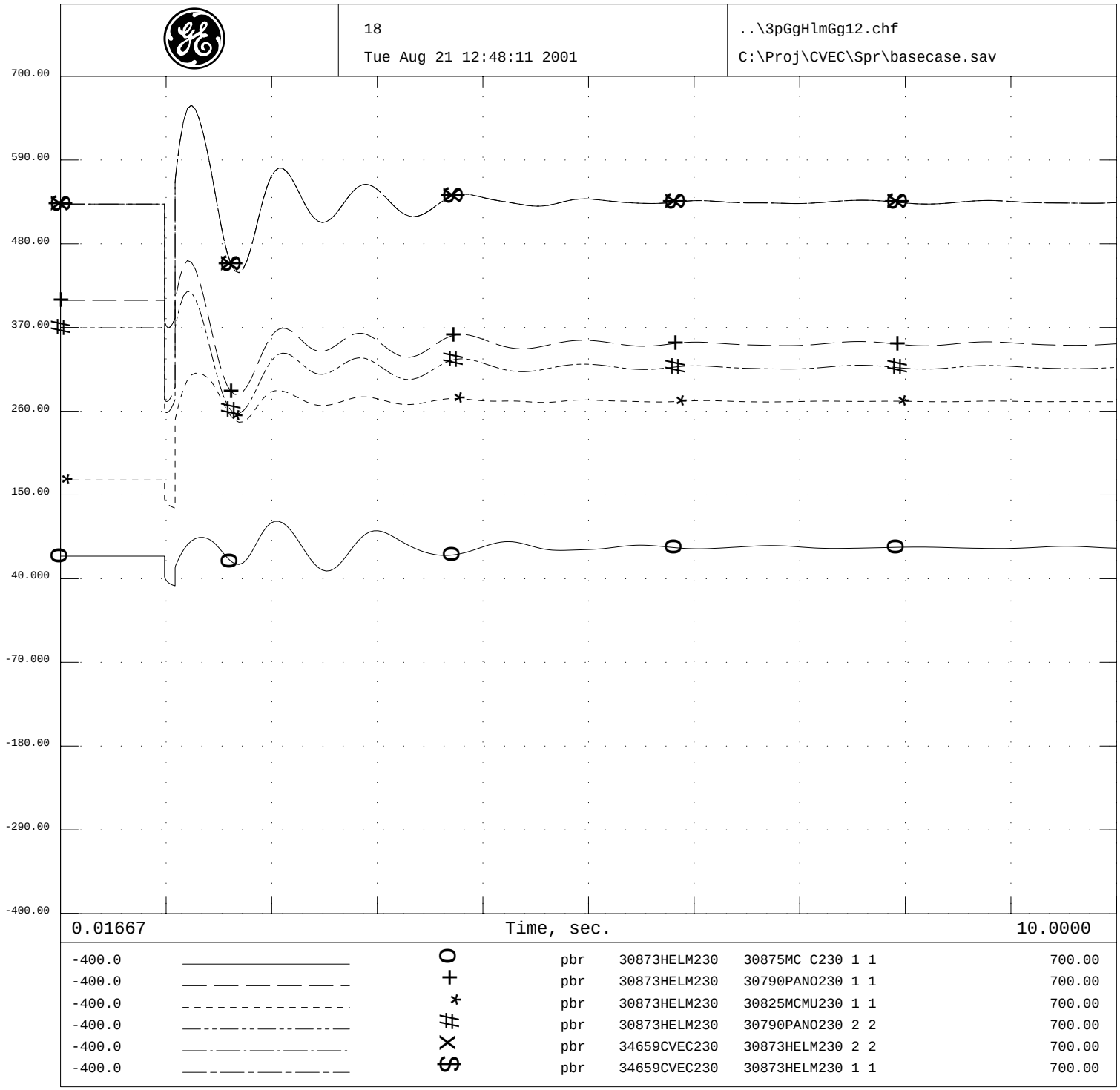

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Calpine Corporation
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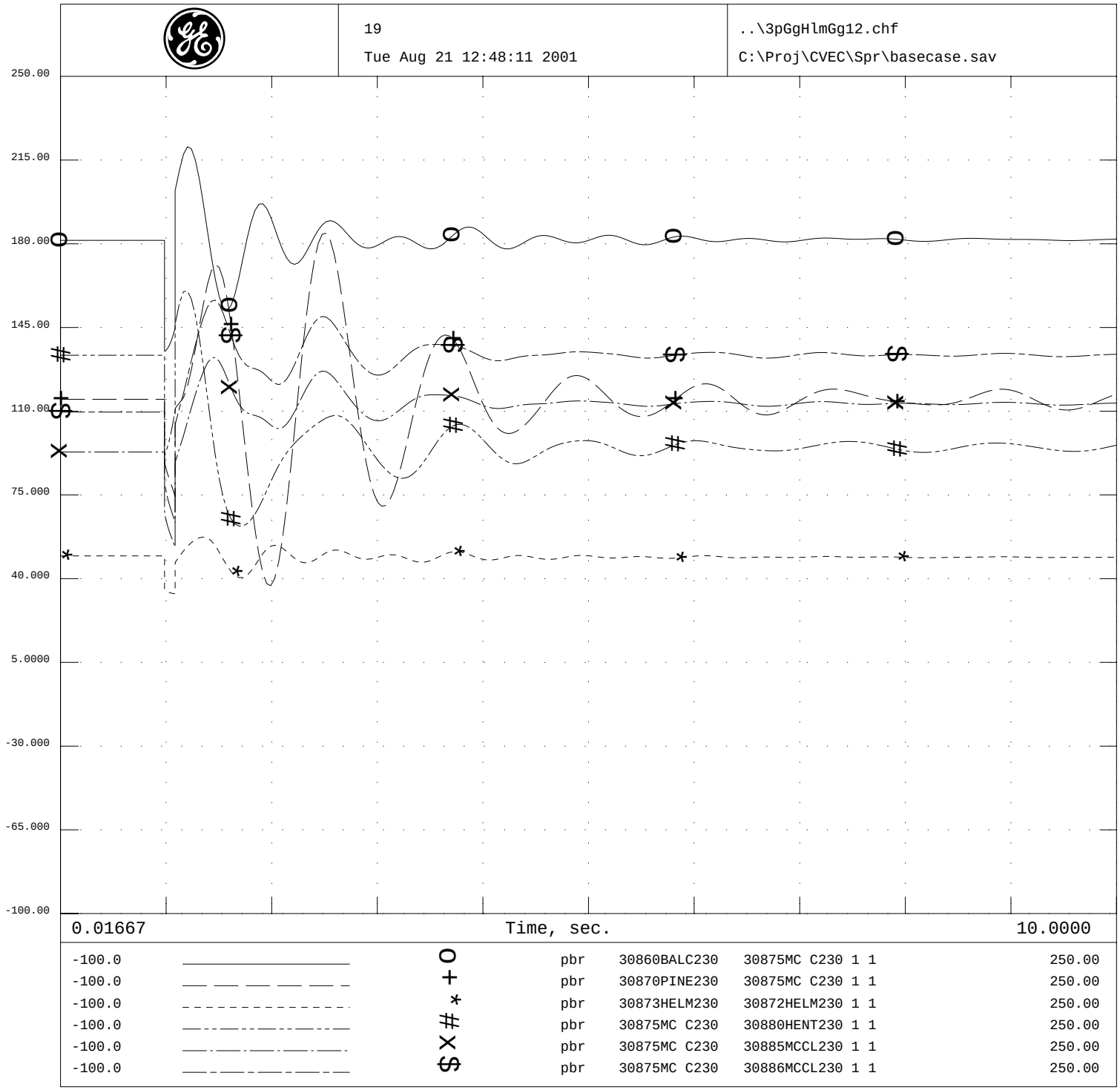

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Calpine Corporation
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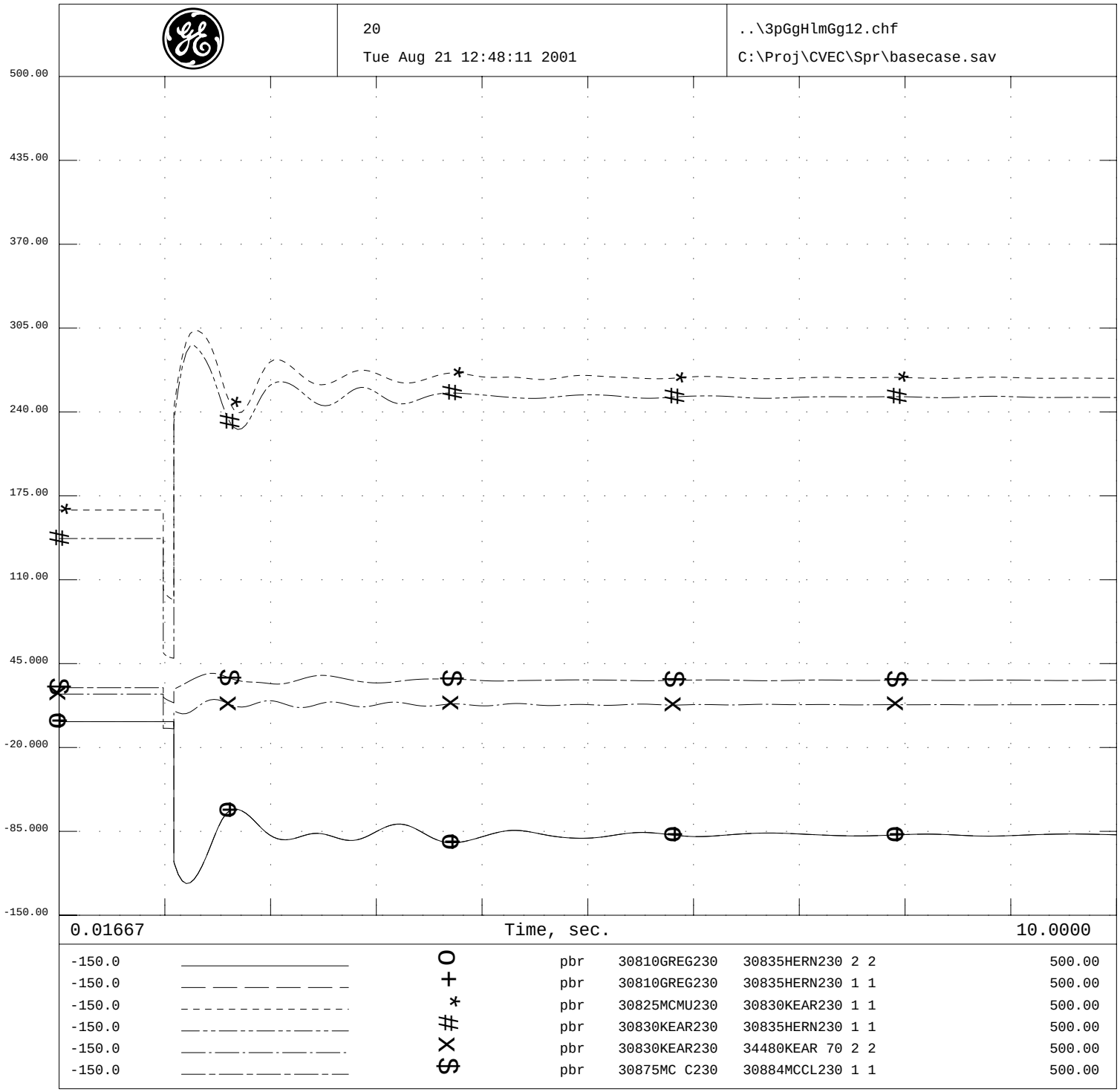
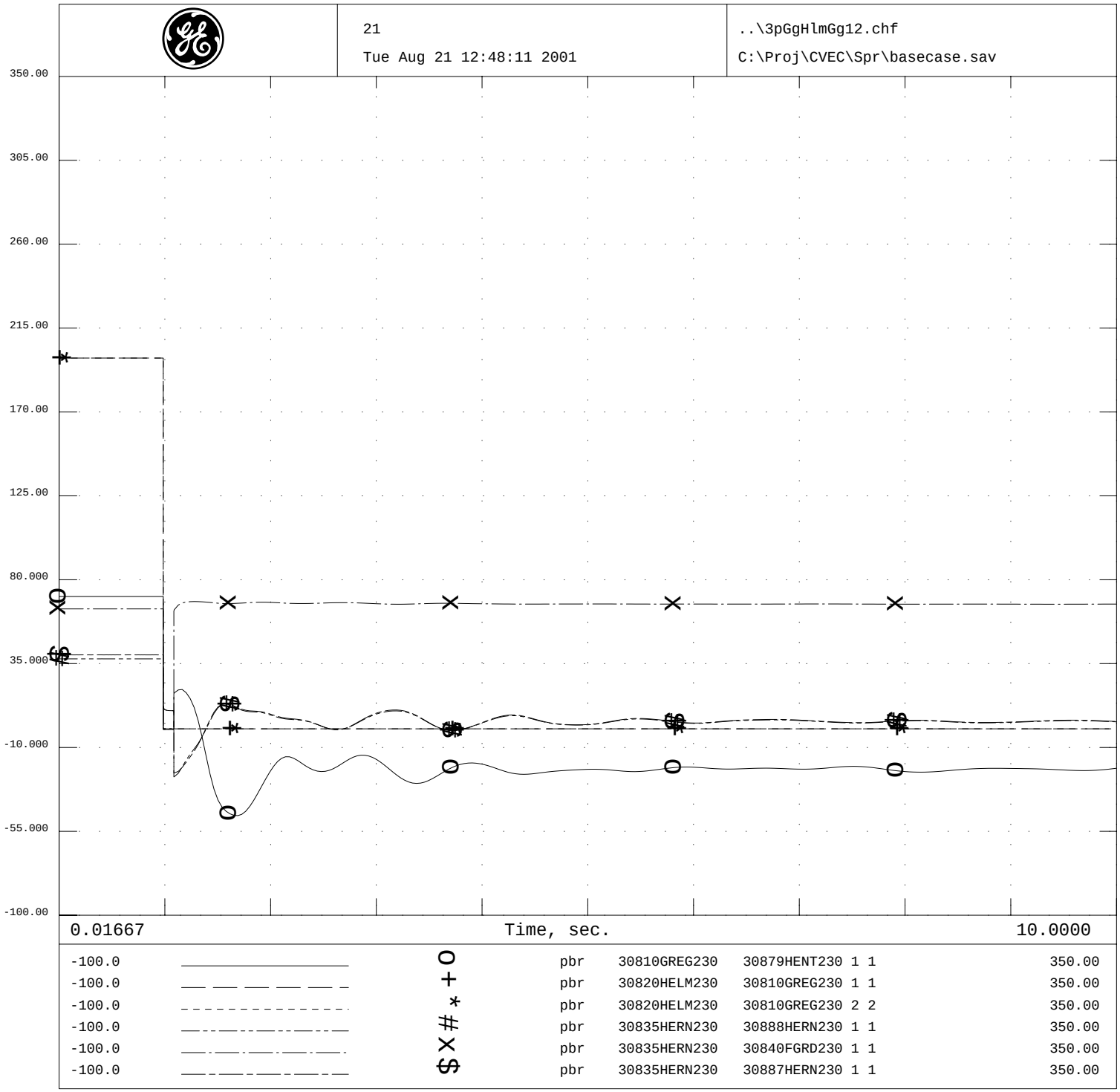


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gregg-Helms #1,2 230kV Double Line Outage
3 phase 6 cycle fault at Gregg 230kV bus and trip both Gregg-Helms 230kV lines

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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2004 Heavy Spring Base Case
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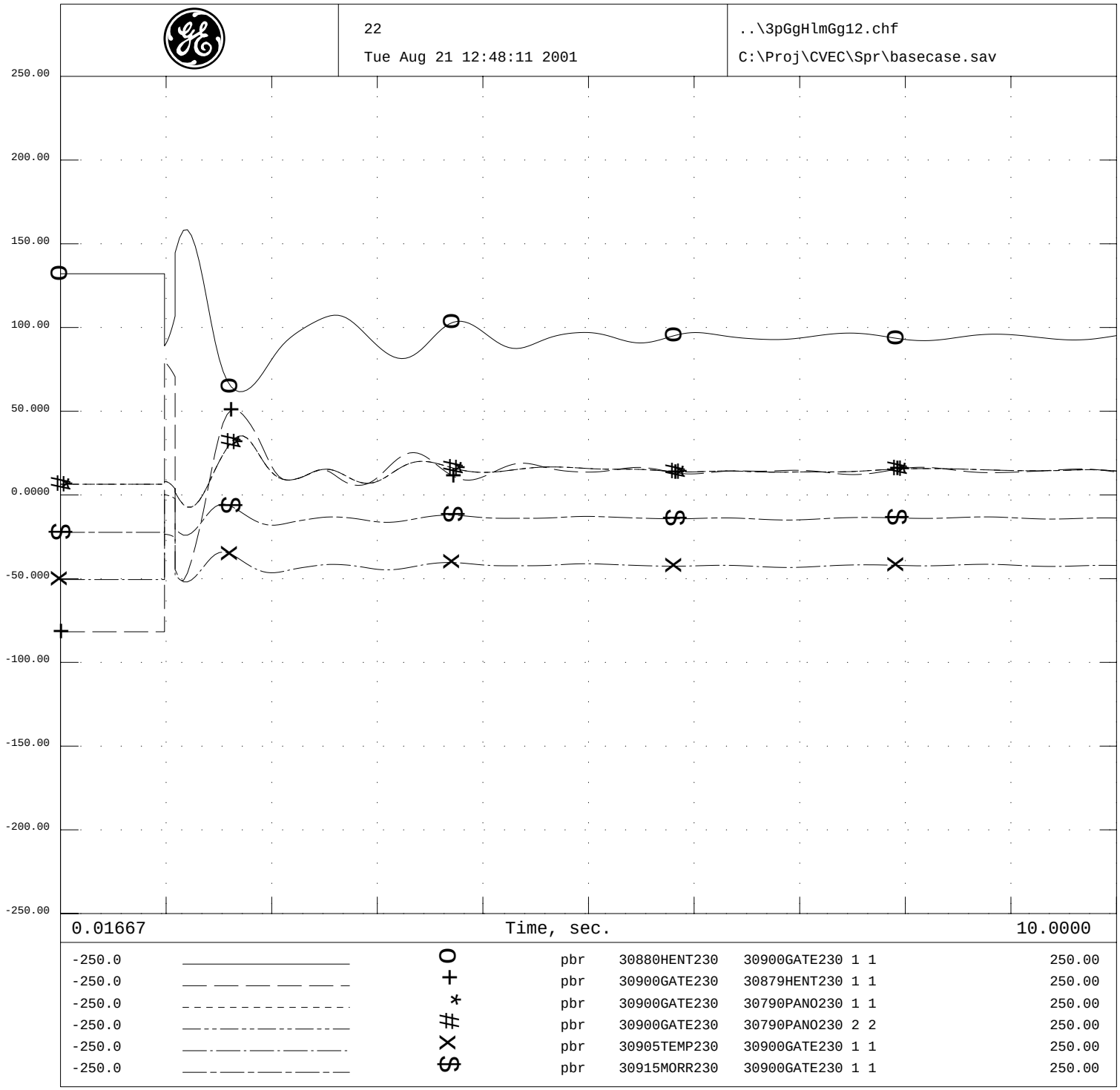

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2004 Heavy Spring Base Case
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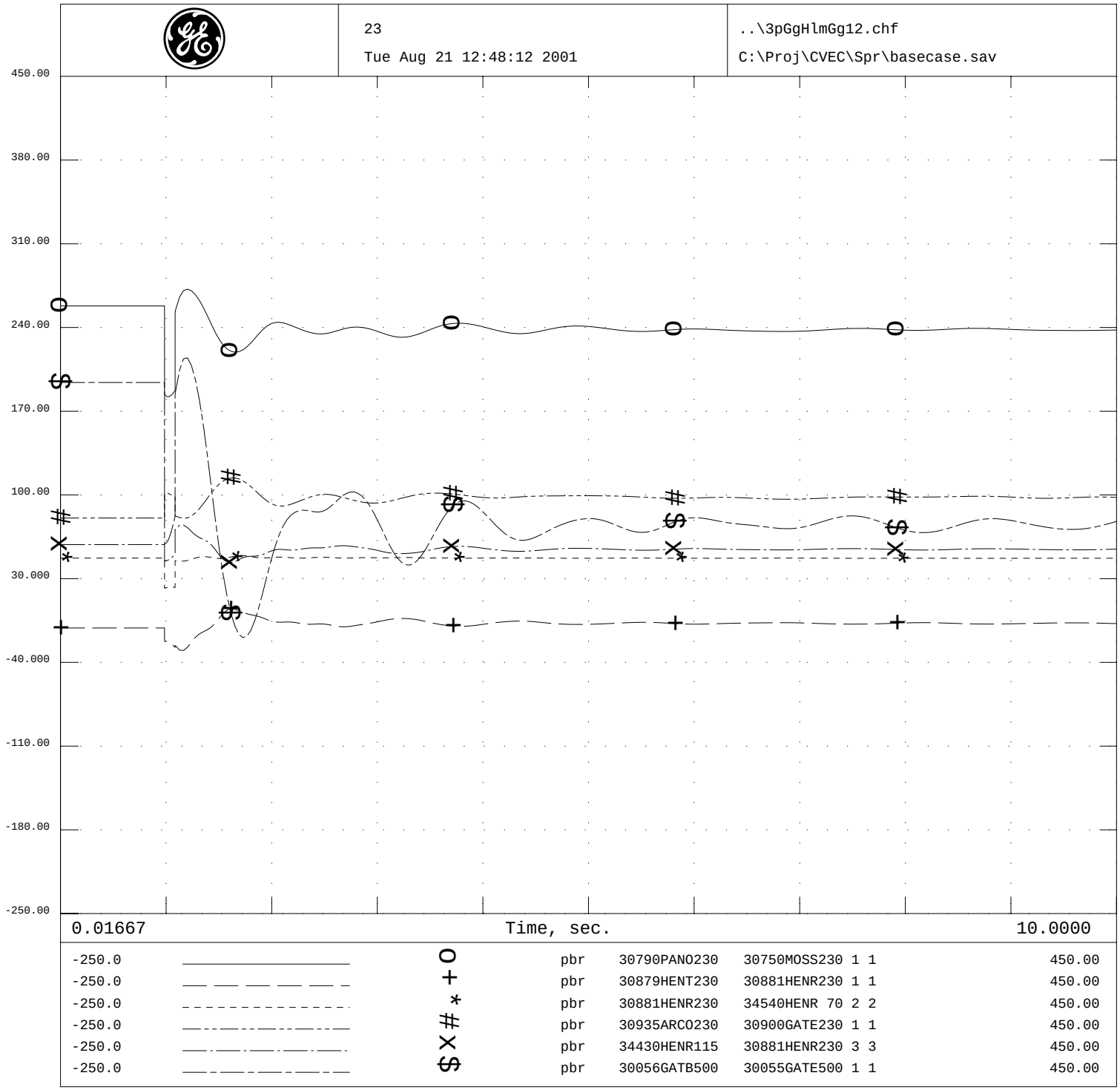

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2004 Heavy Spring Base Case
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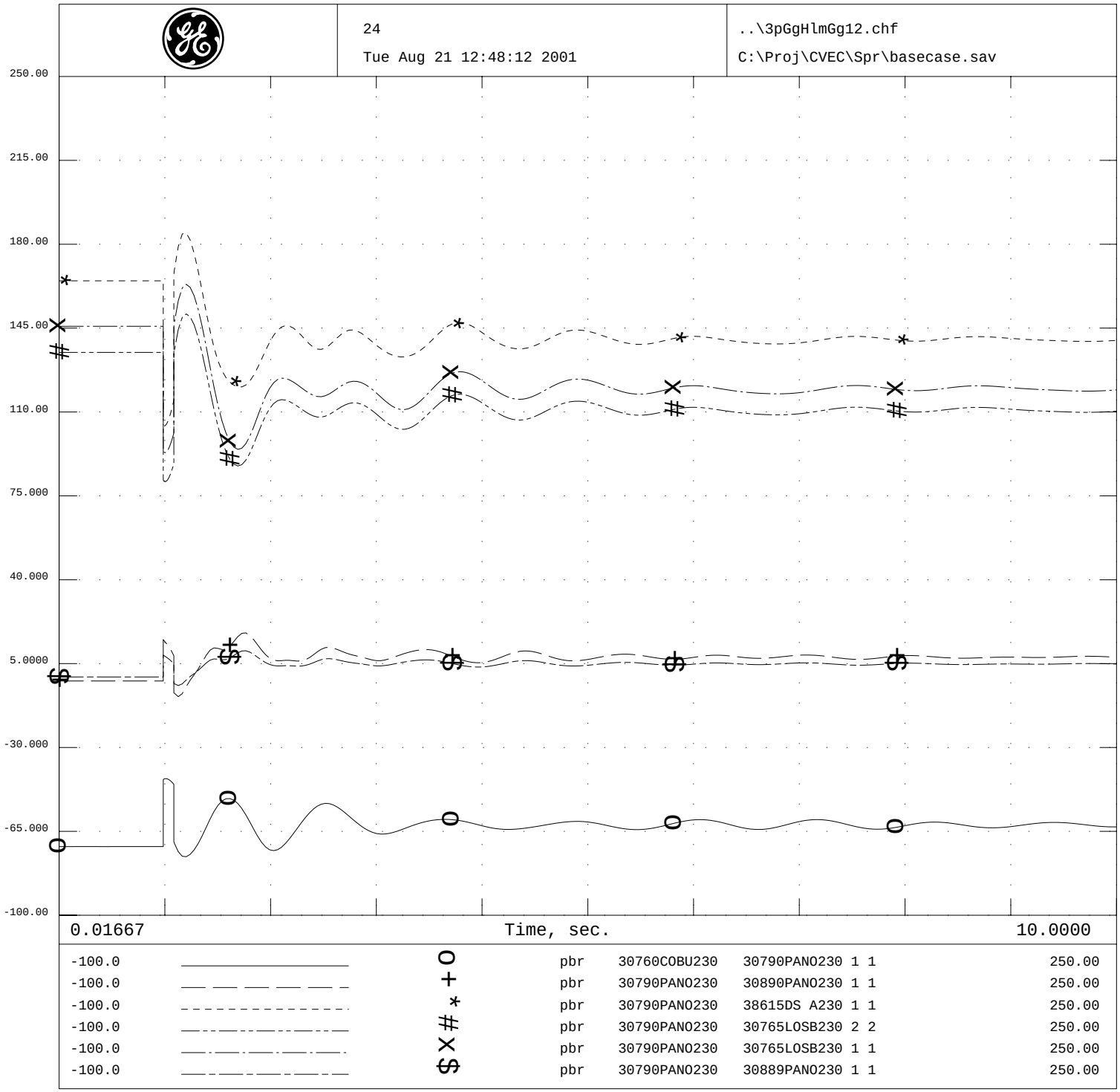

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2004 Heavy Spring Base Case
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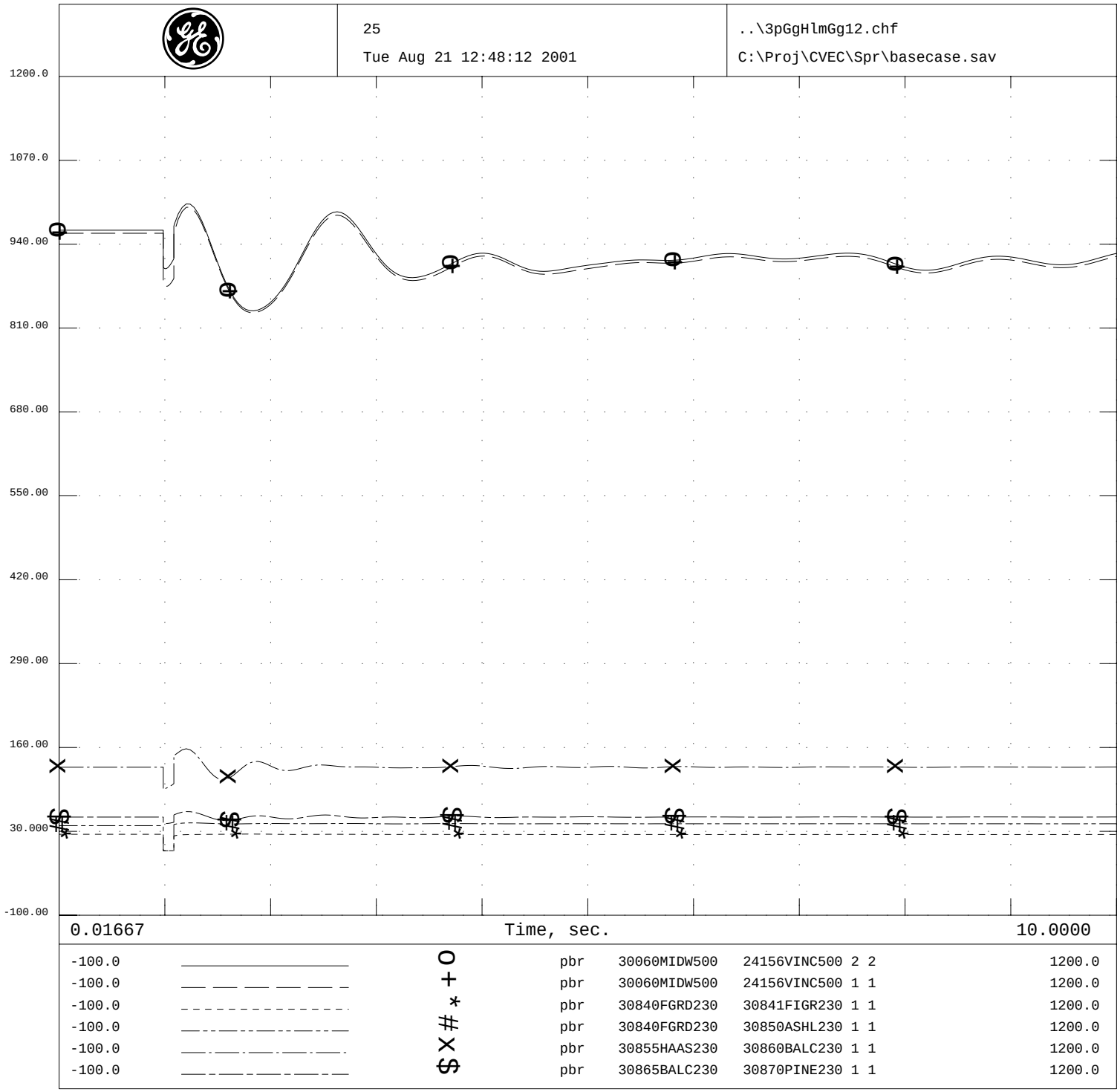

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2004 Heavy Spring Base Case
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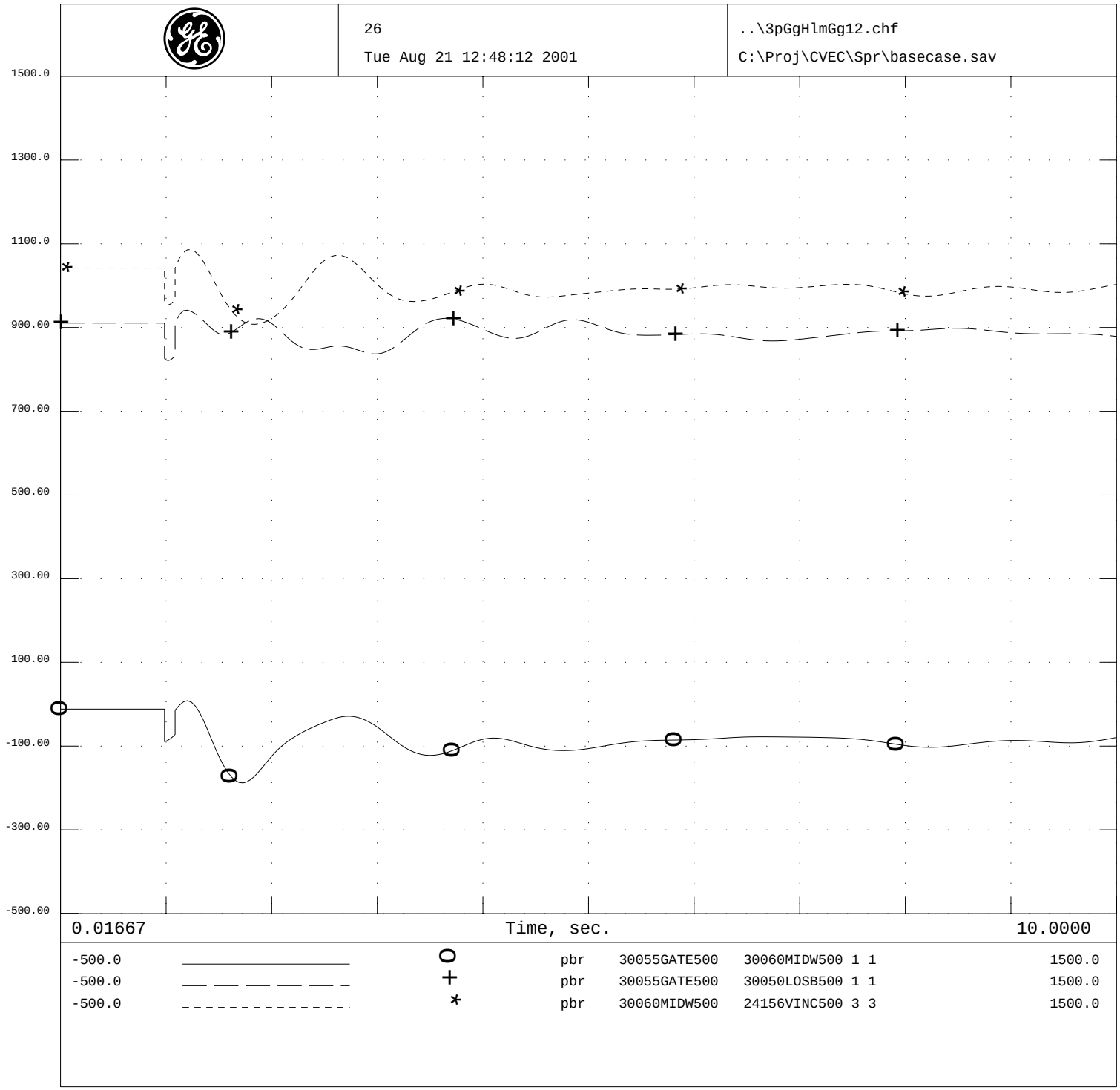

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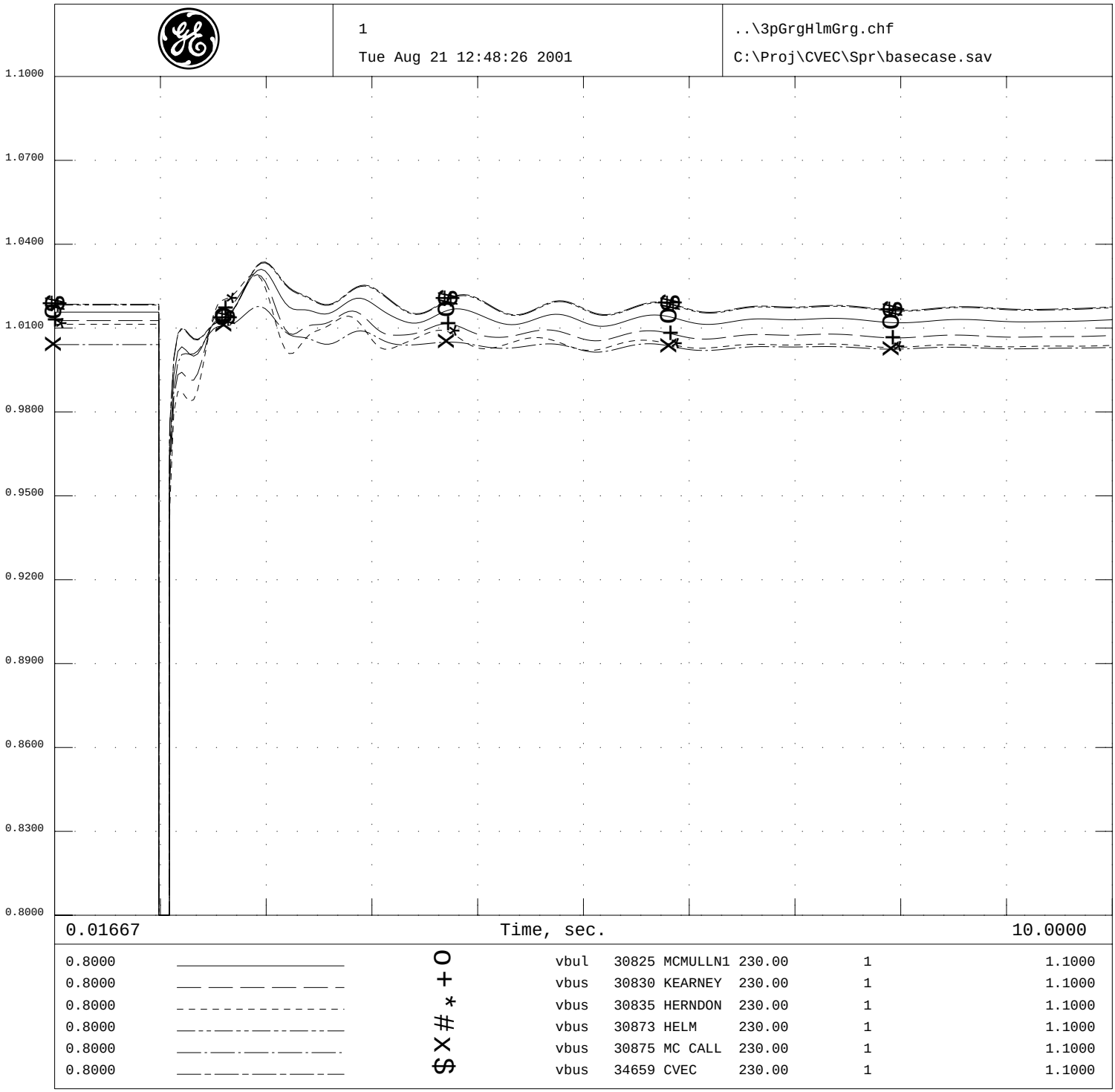

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2004 Heavy Spring Base Case
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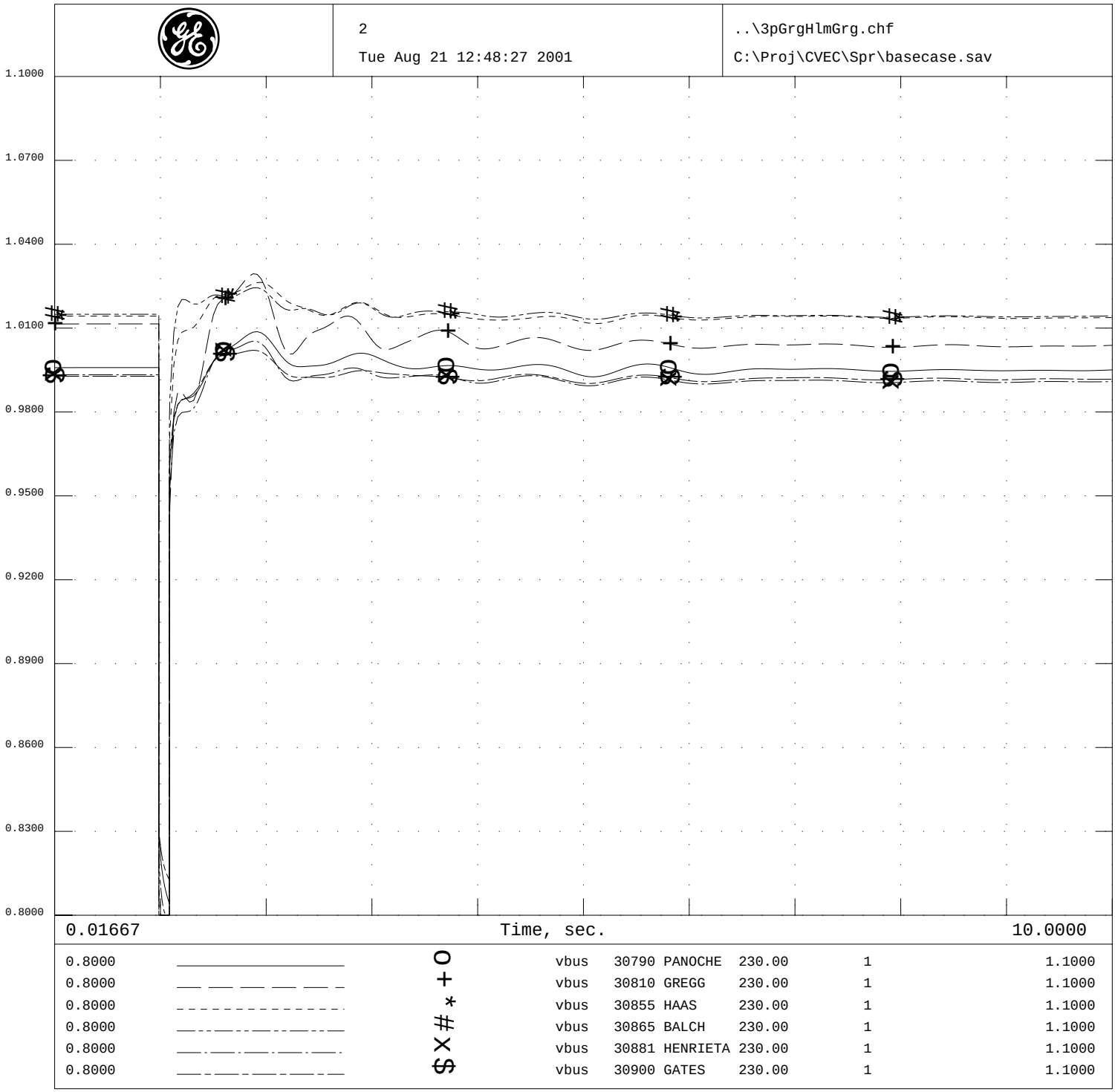
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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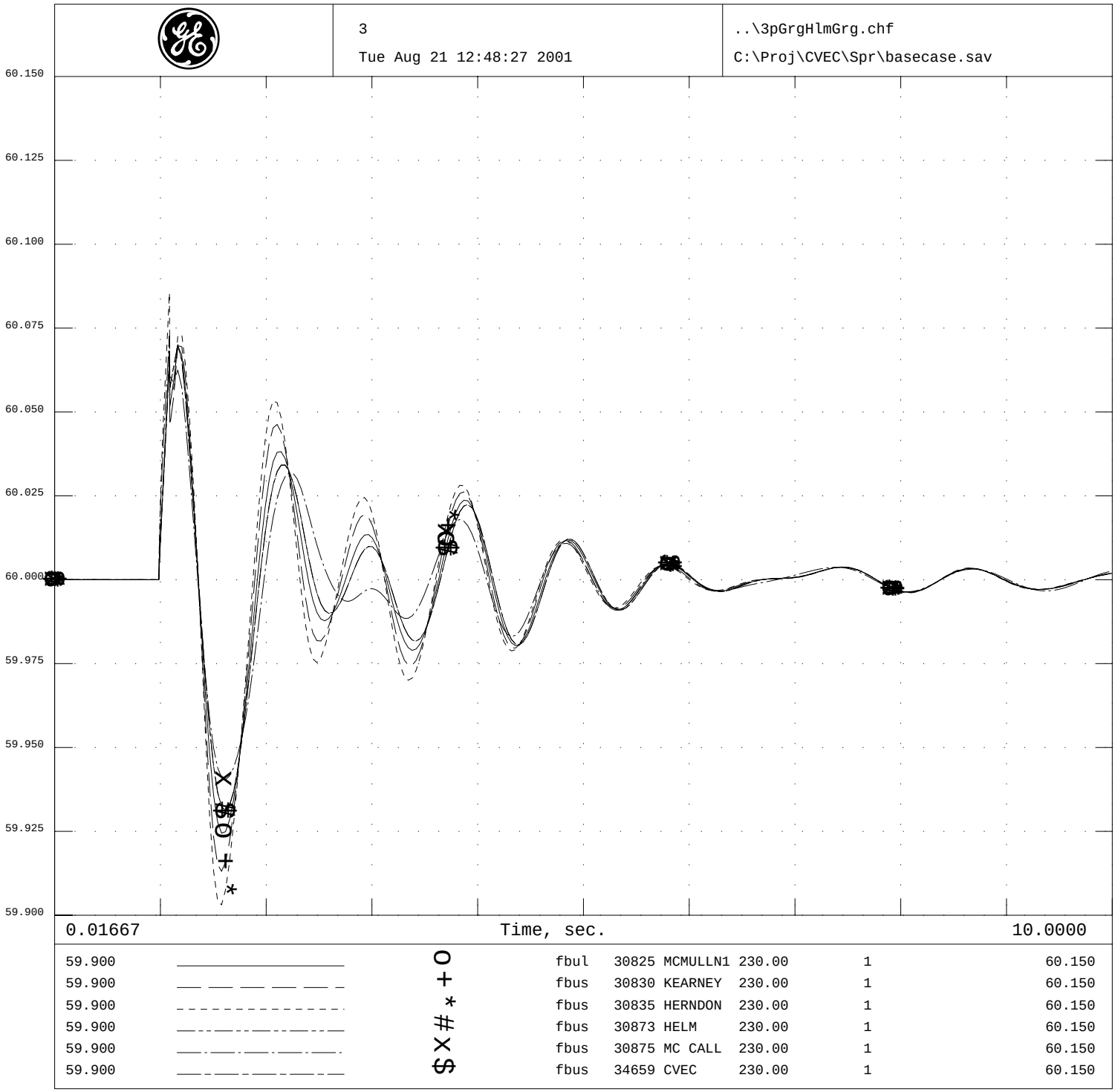

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2004 Heavy Spring Base Case
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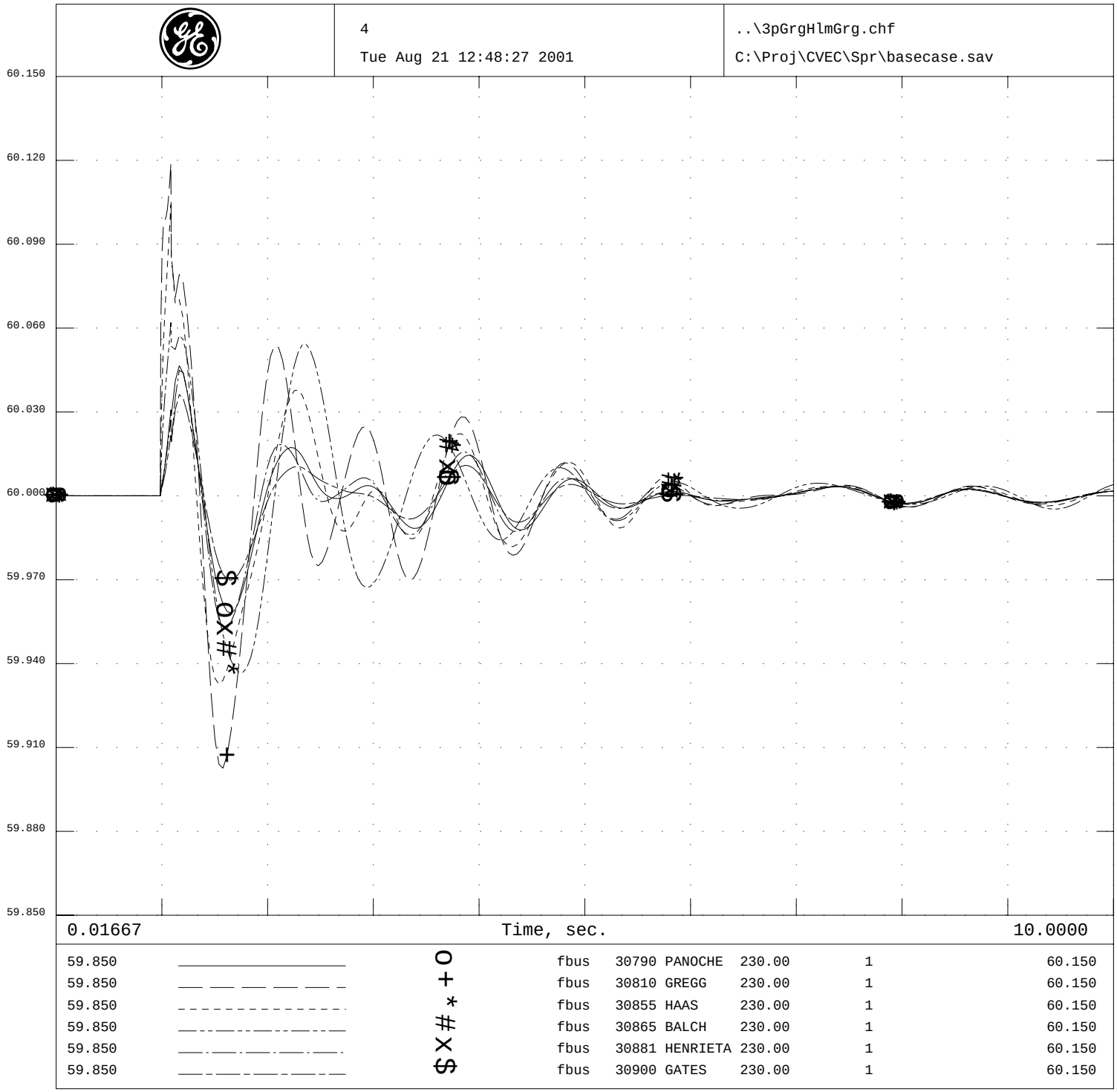
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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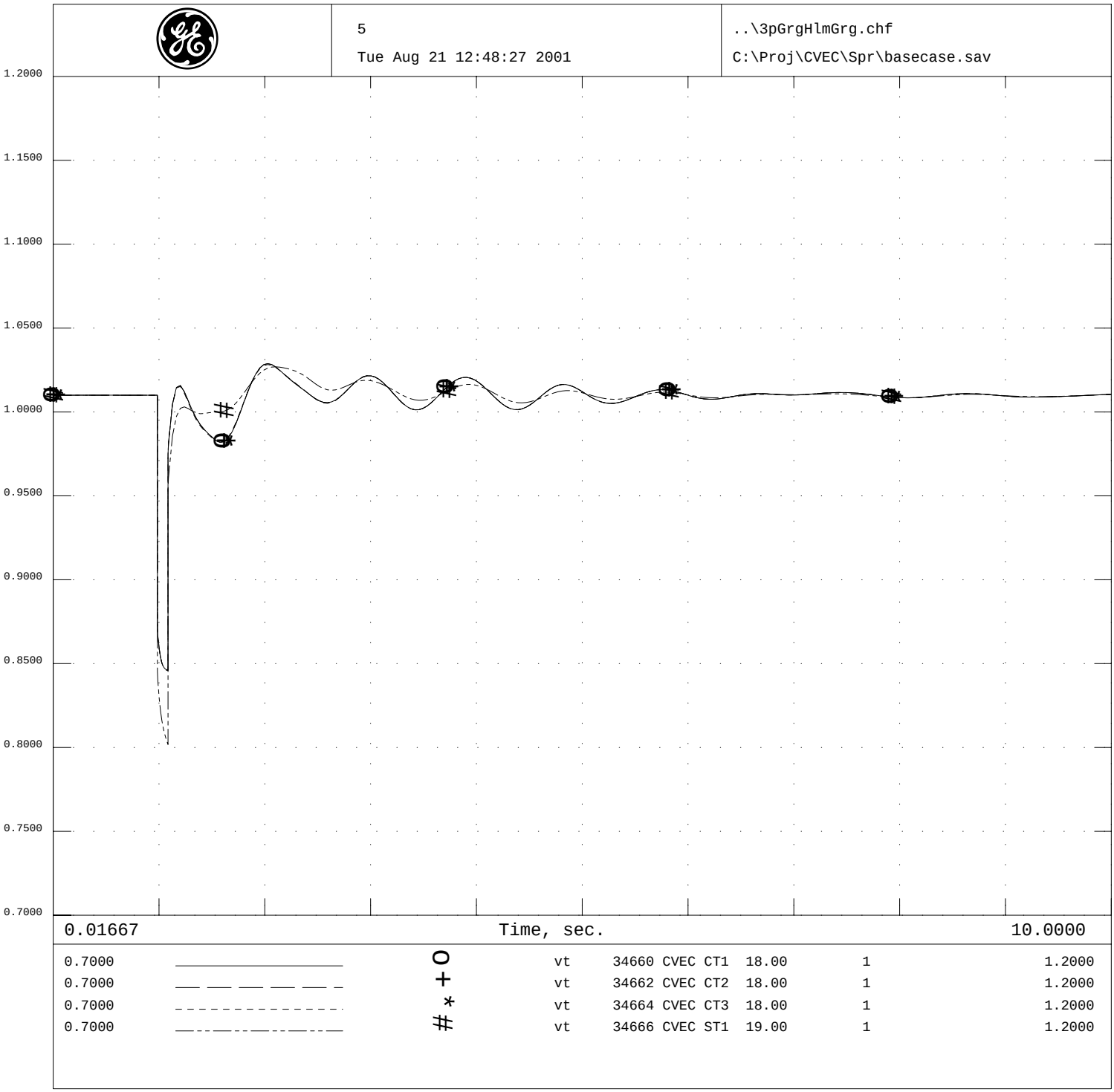

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2004 Heavy Spring Base Case
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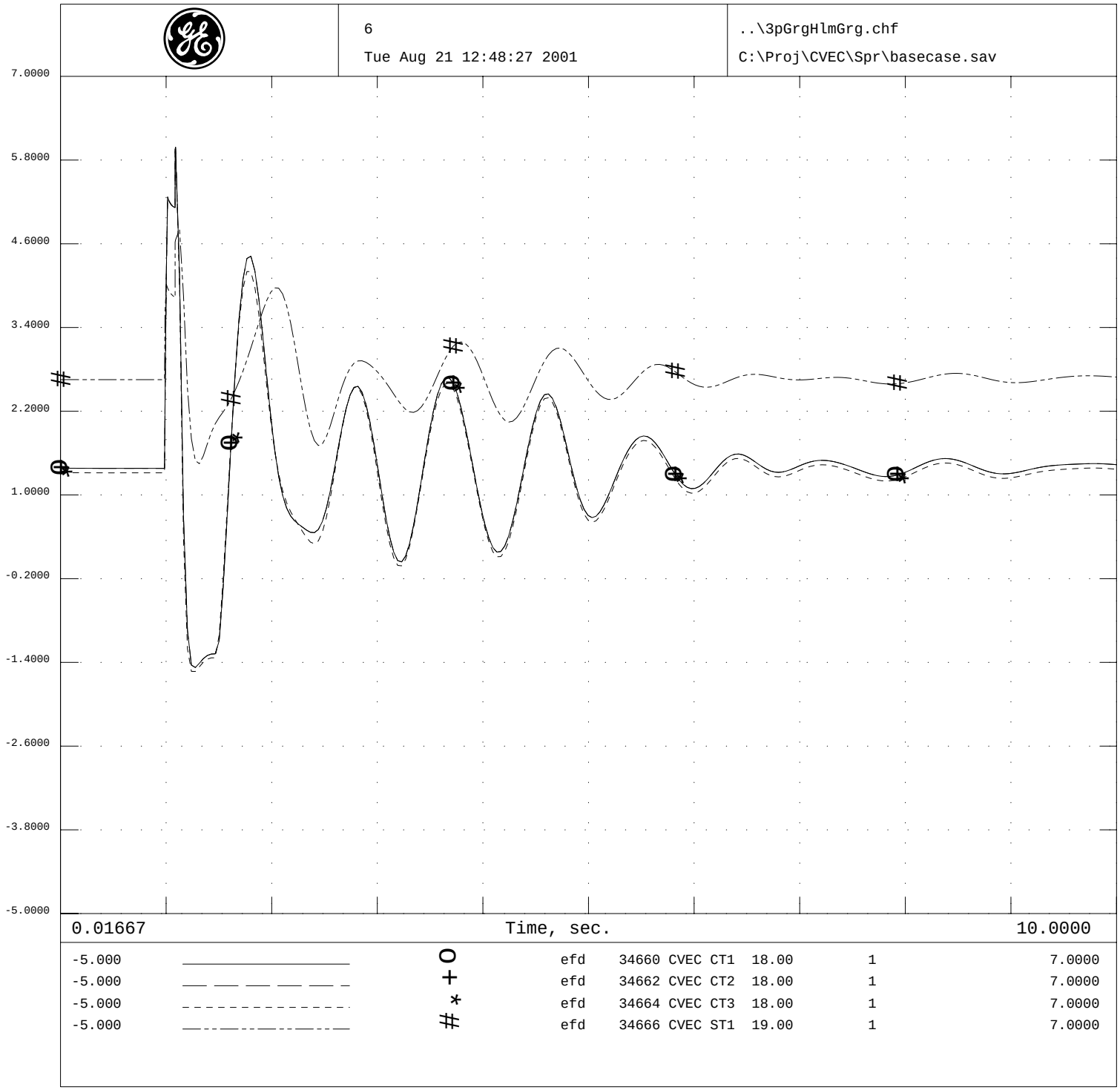
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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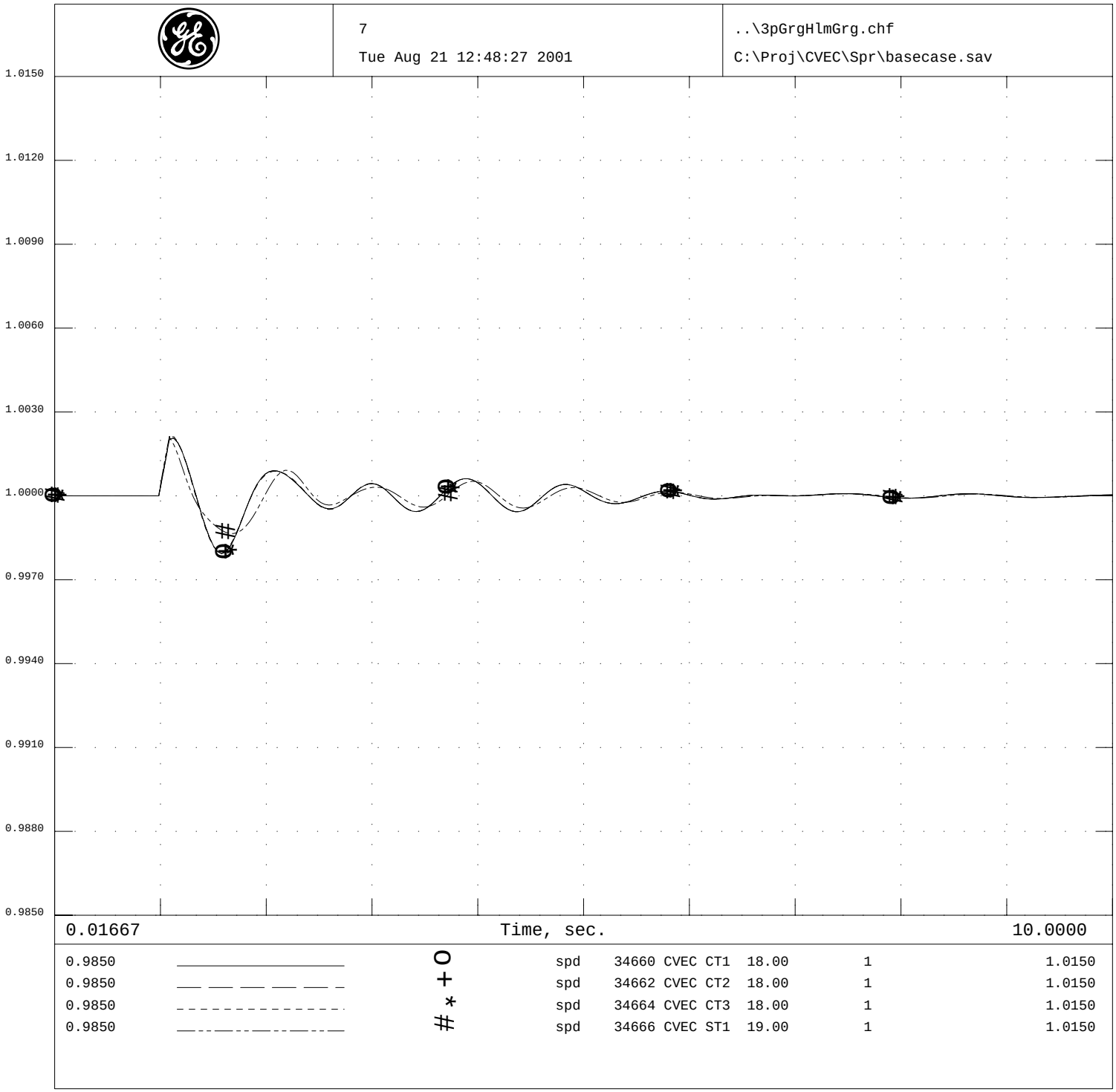
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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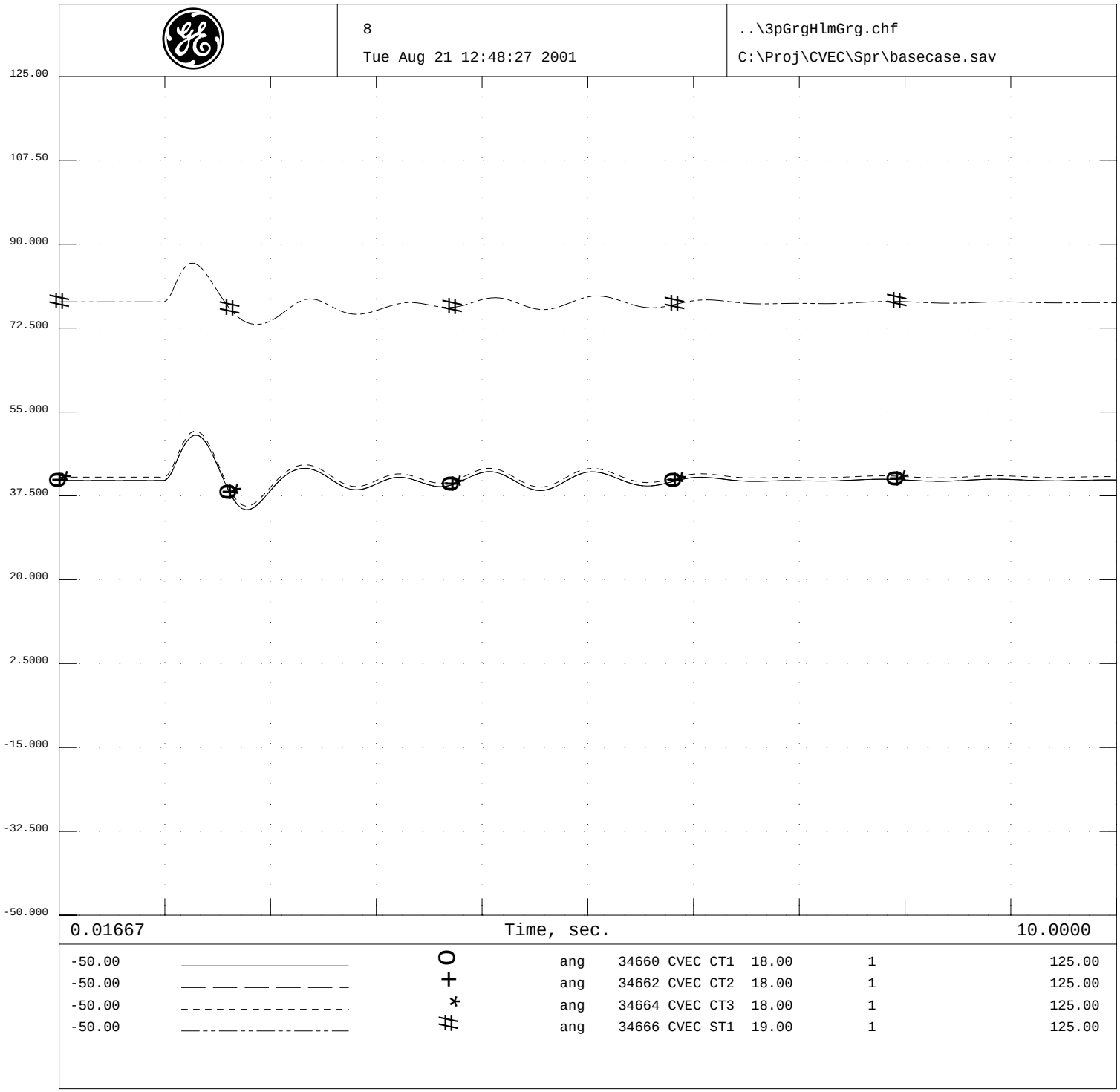
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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2004 Heavy Spring Base Case
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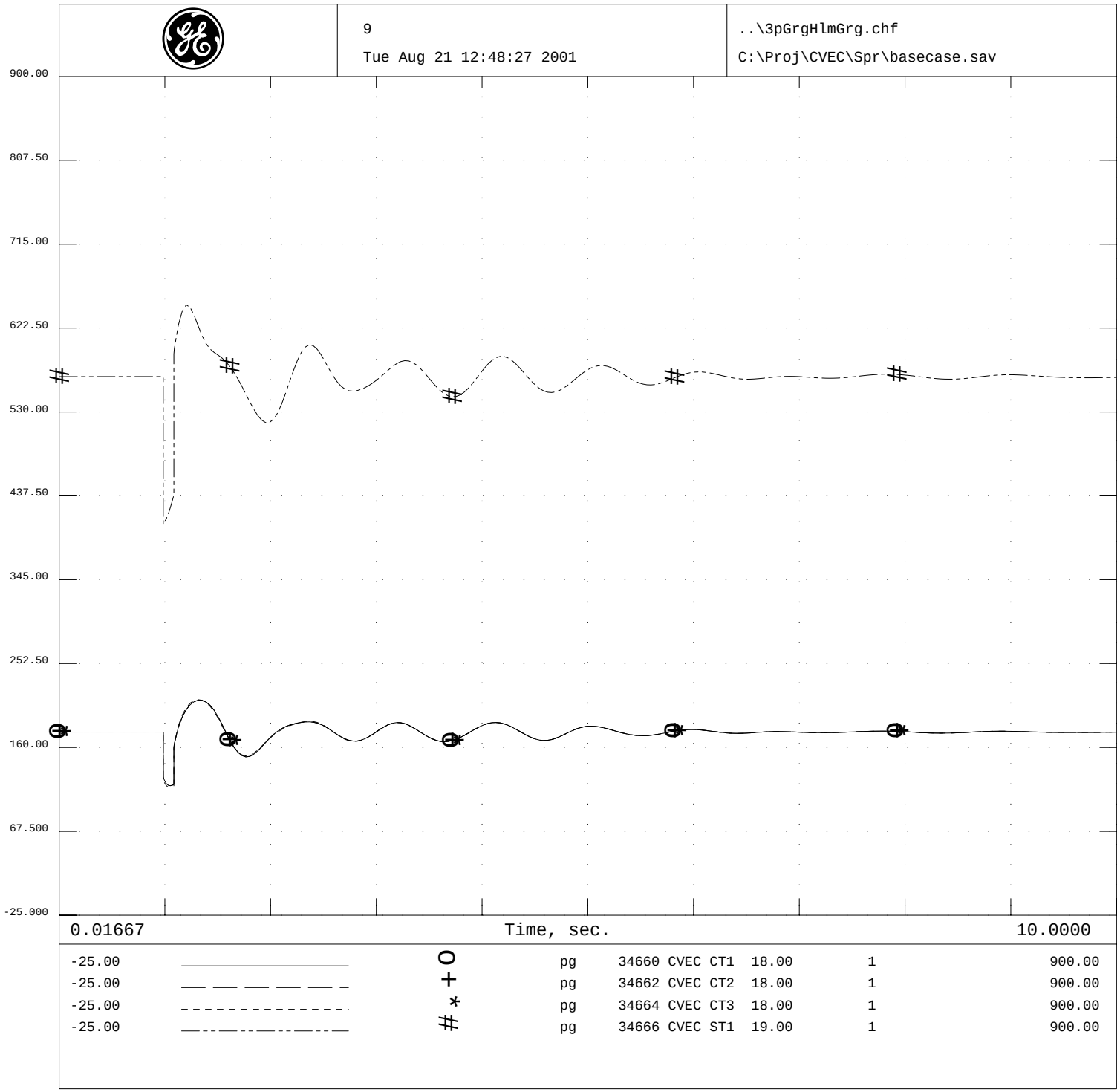
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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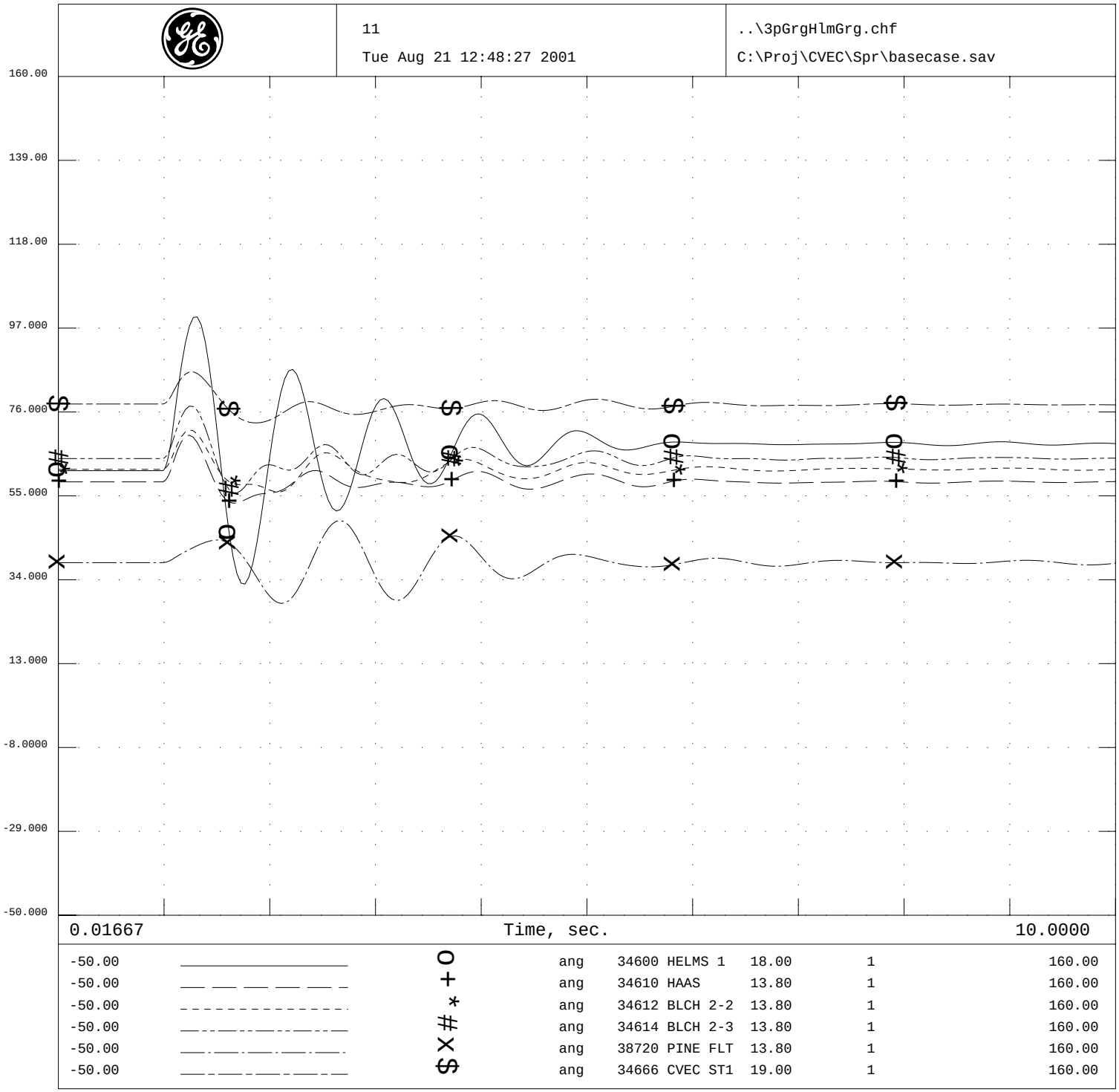
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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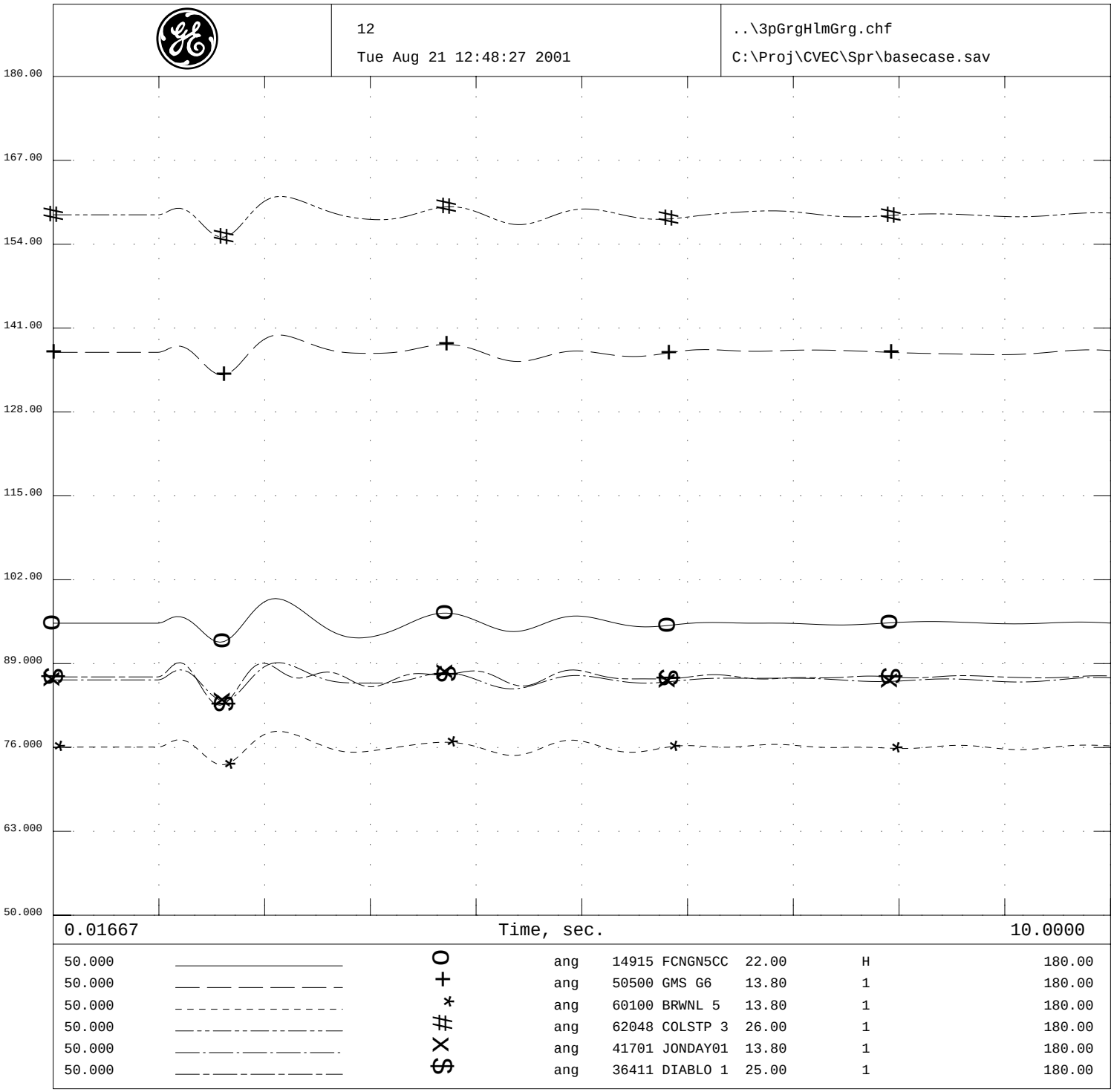
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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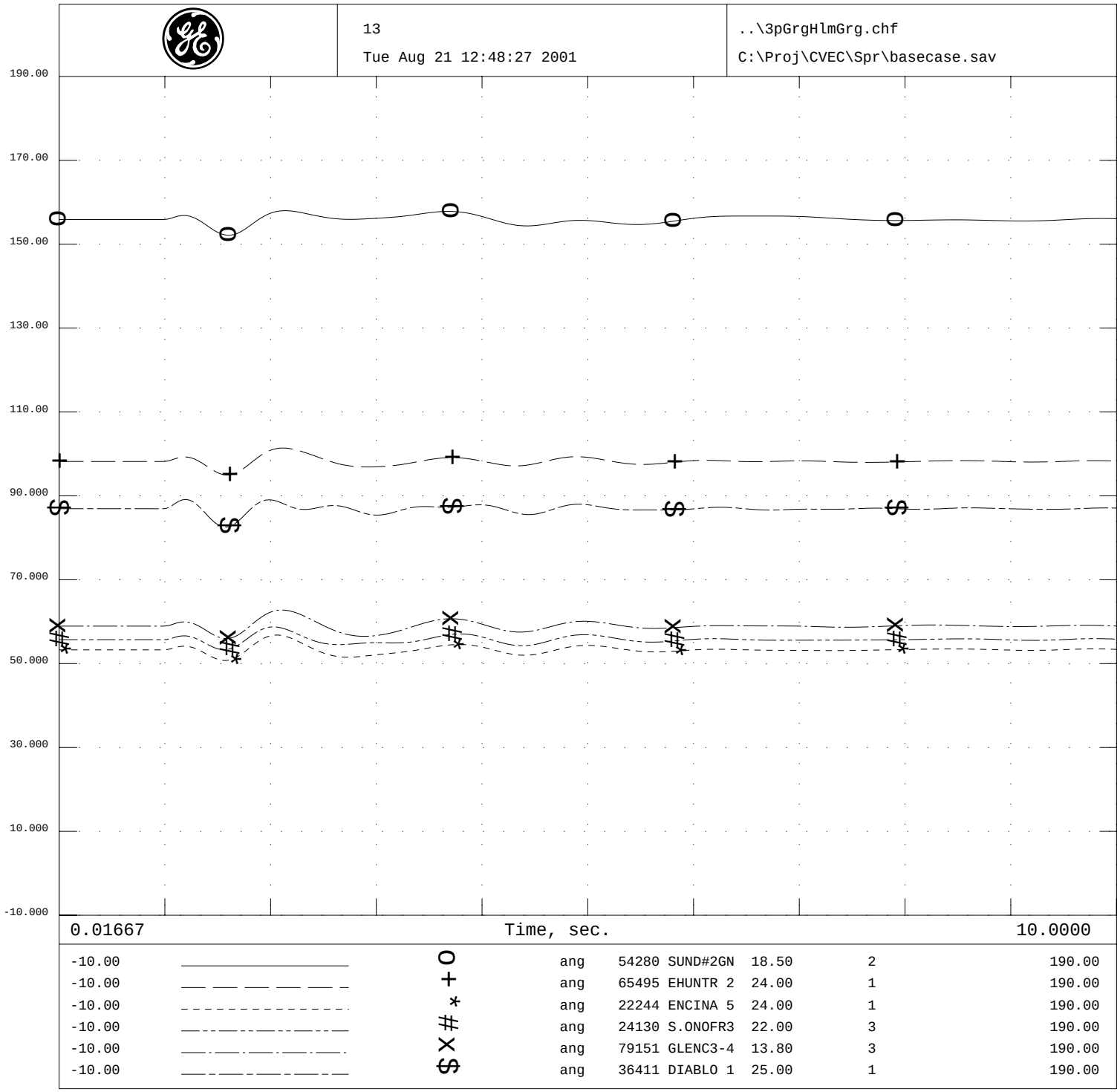
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Calpine Corporation
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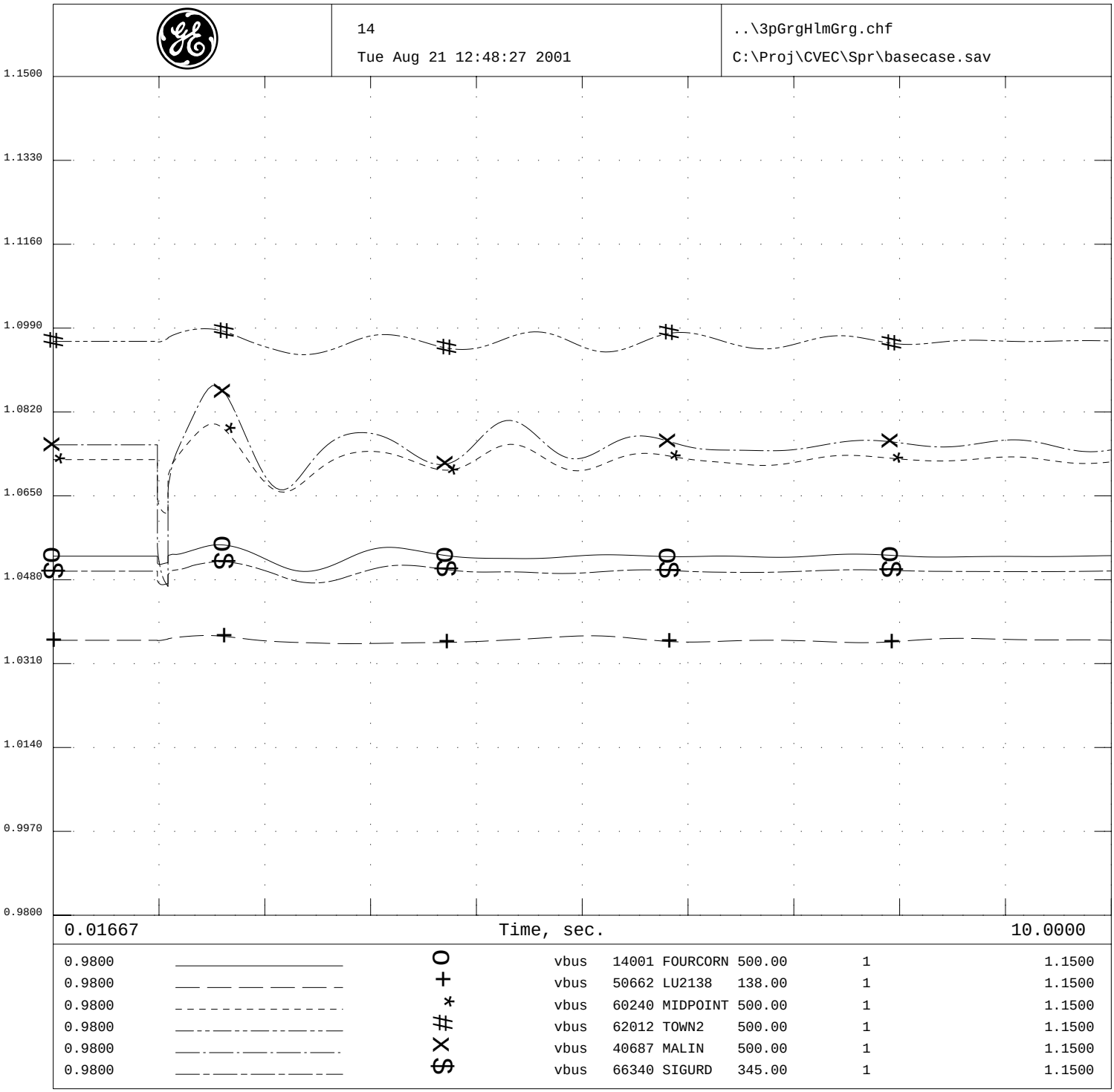

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Calpine Corporation
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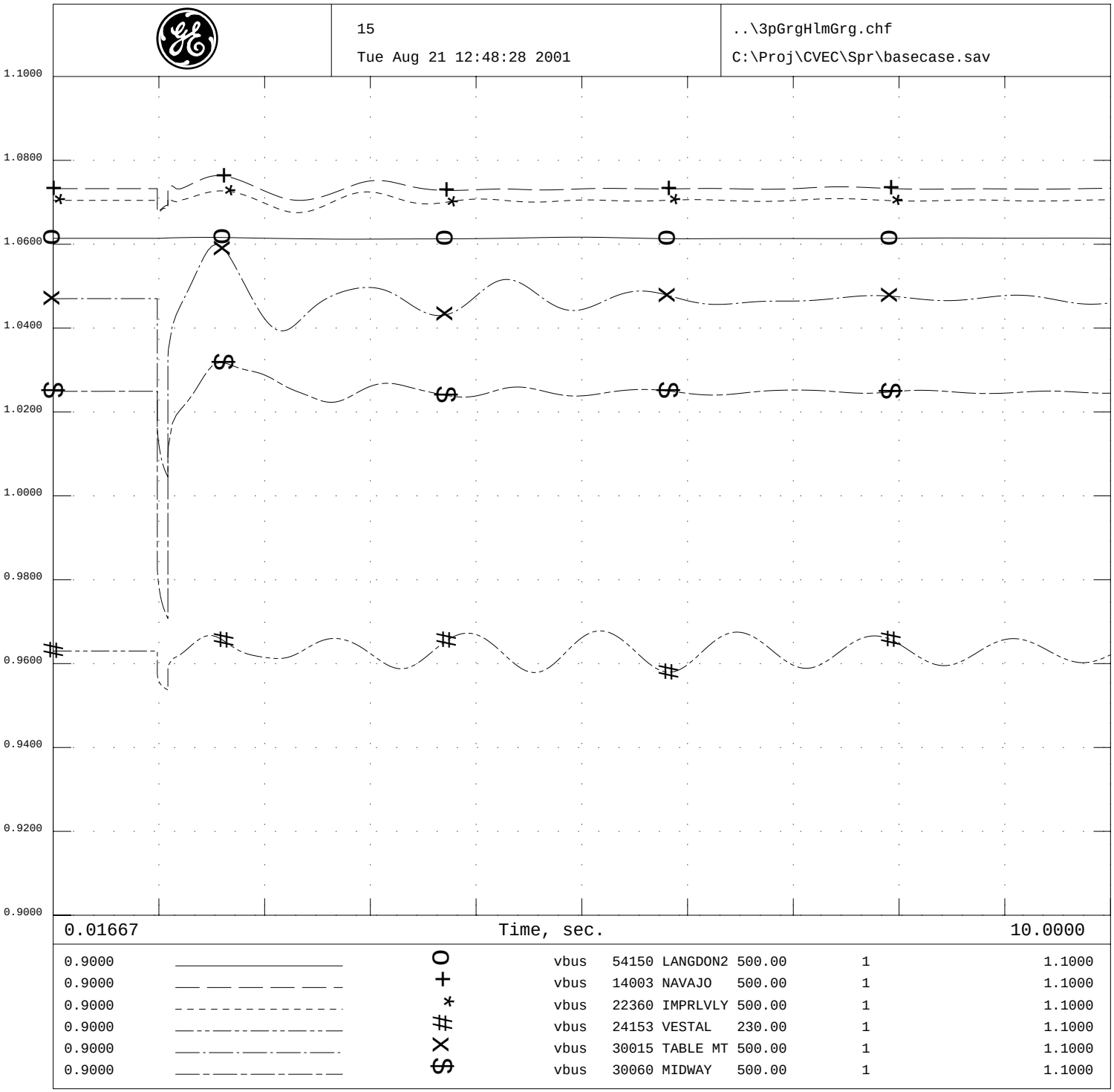

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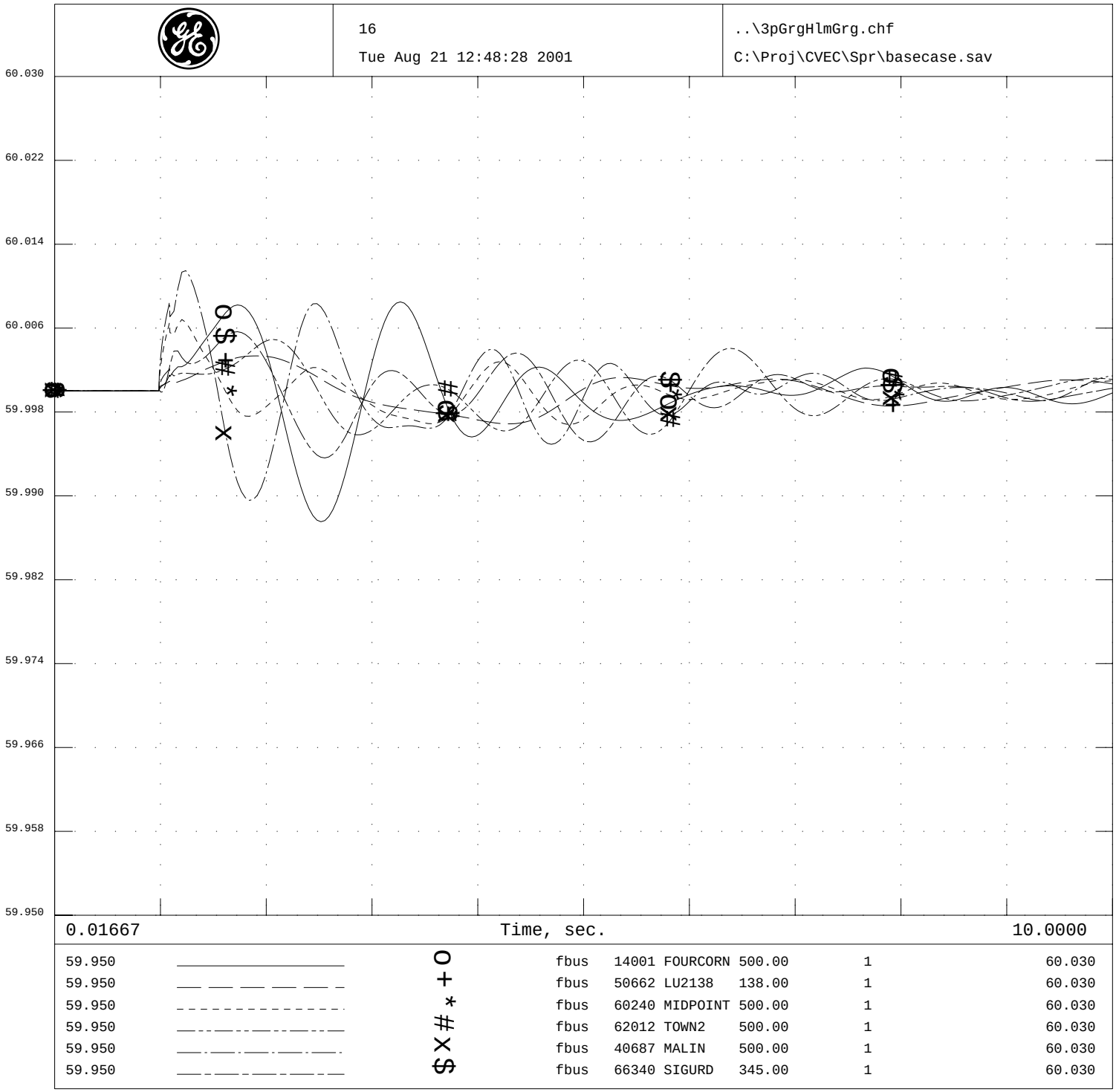

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Calpine Corporation
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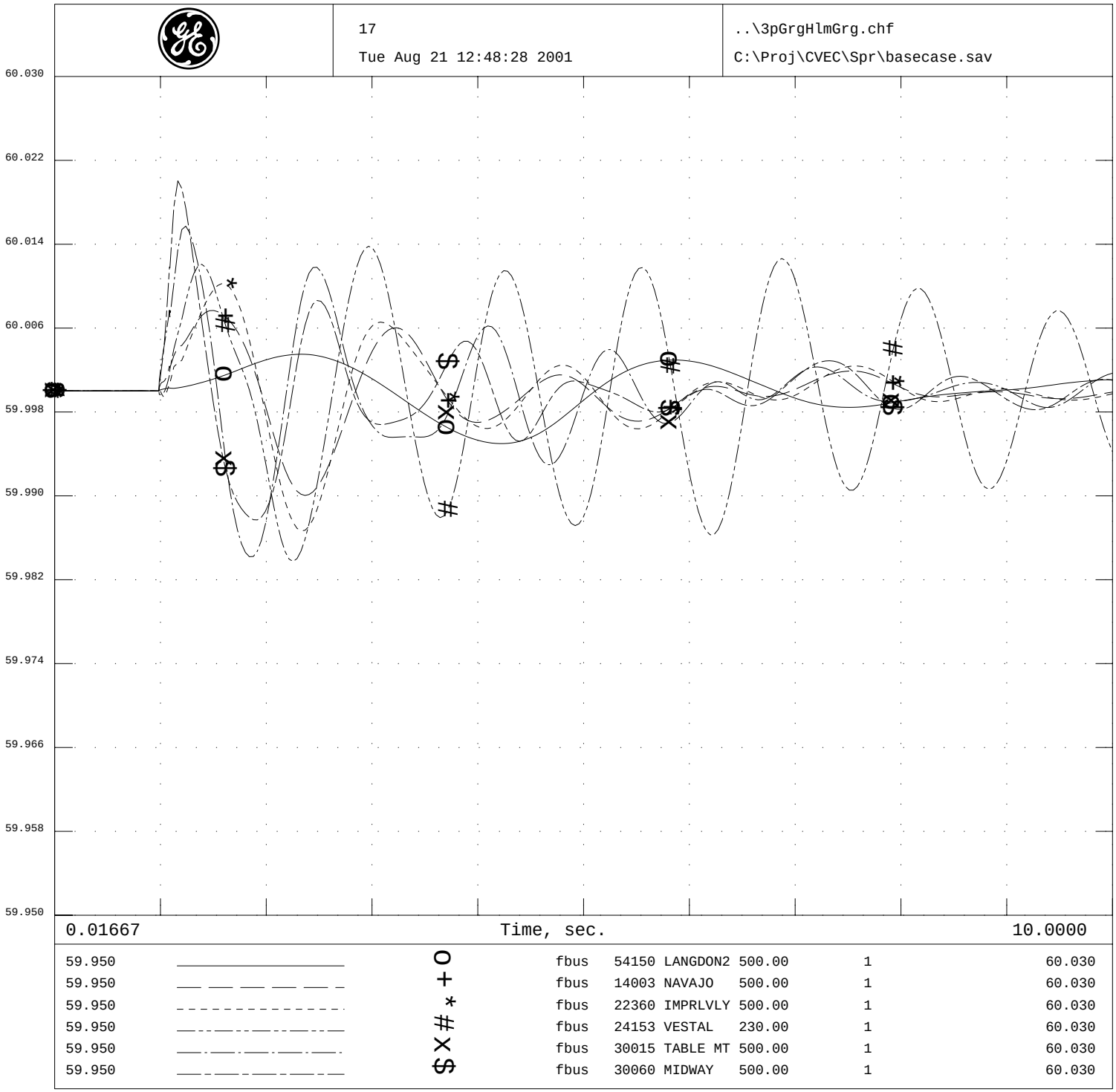

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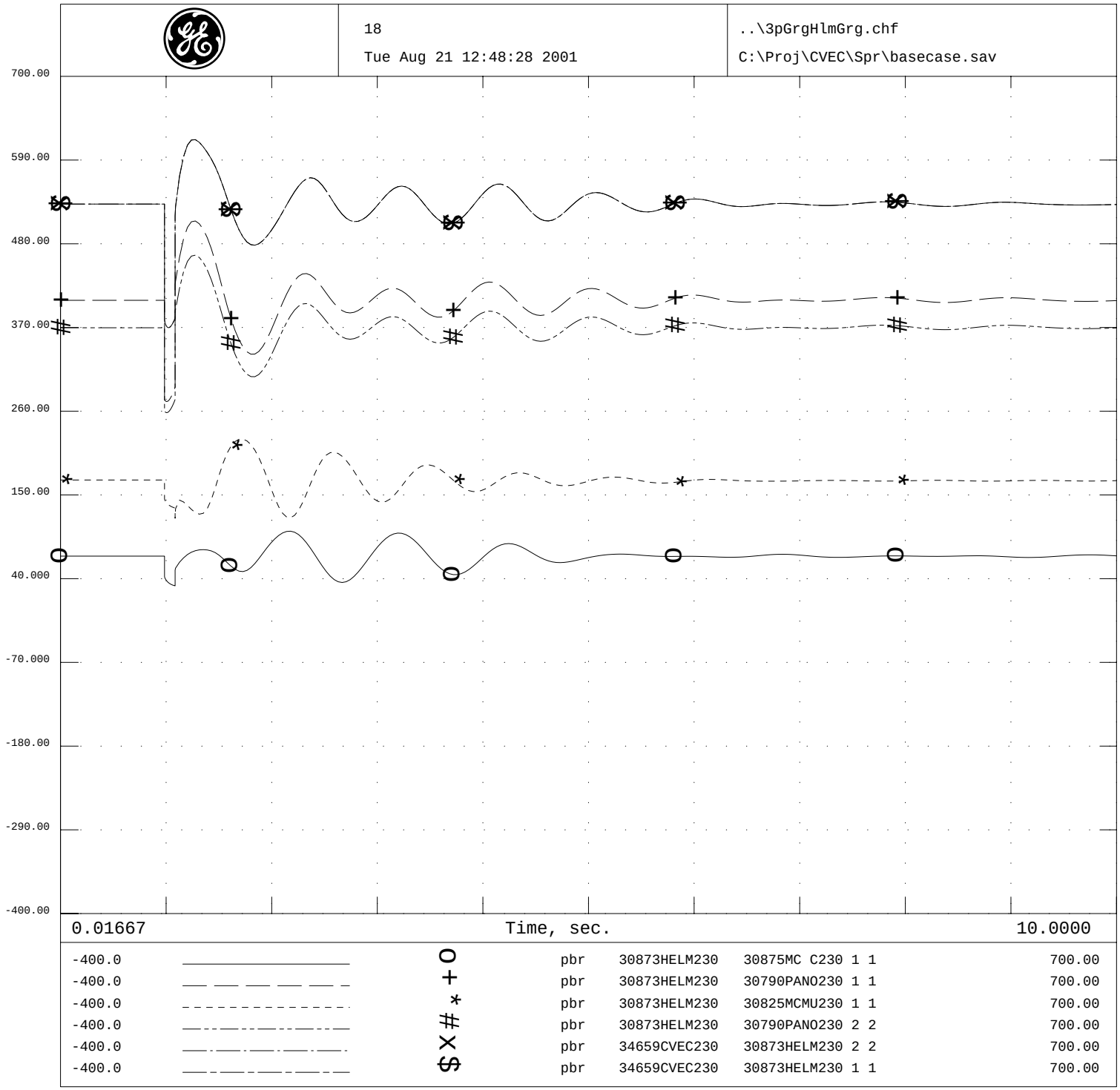

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Central Valley Energy Center
Calpine Corporation
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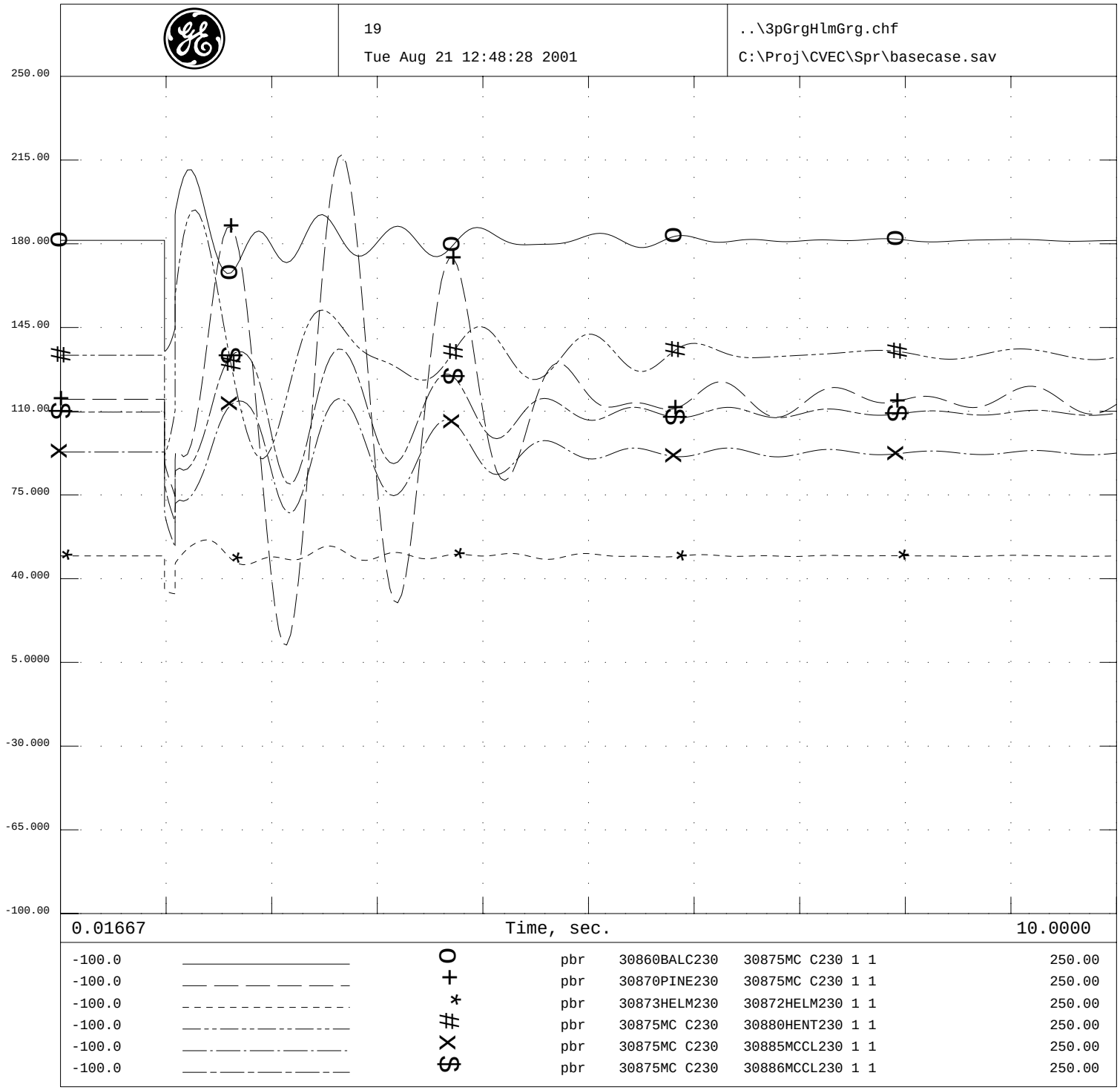

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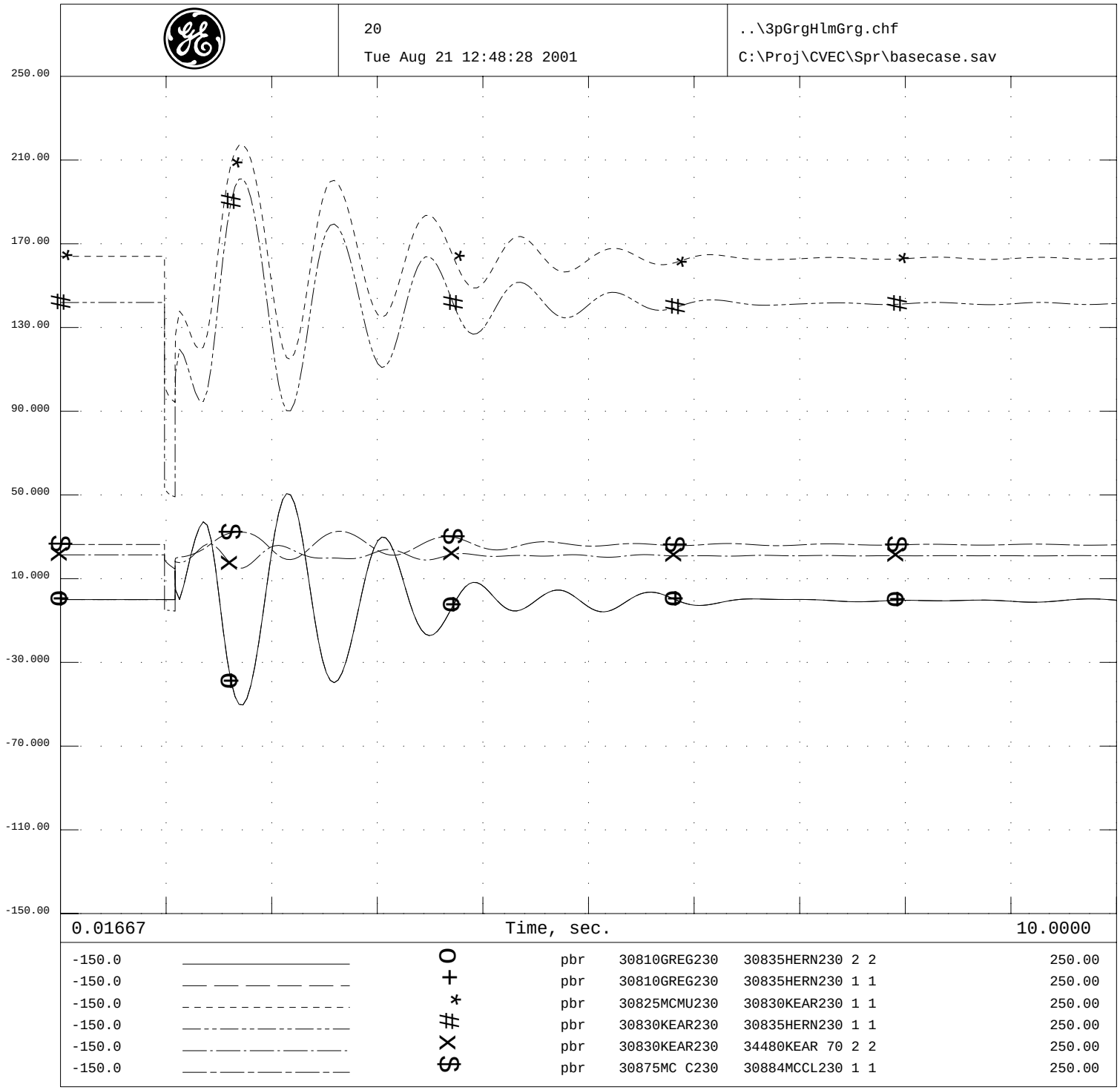

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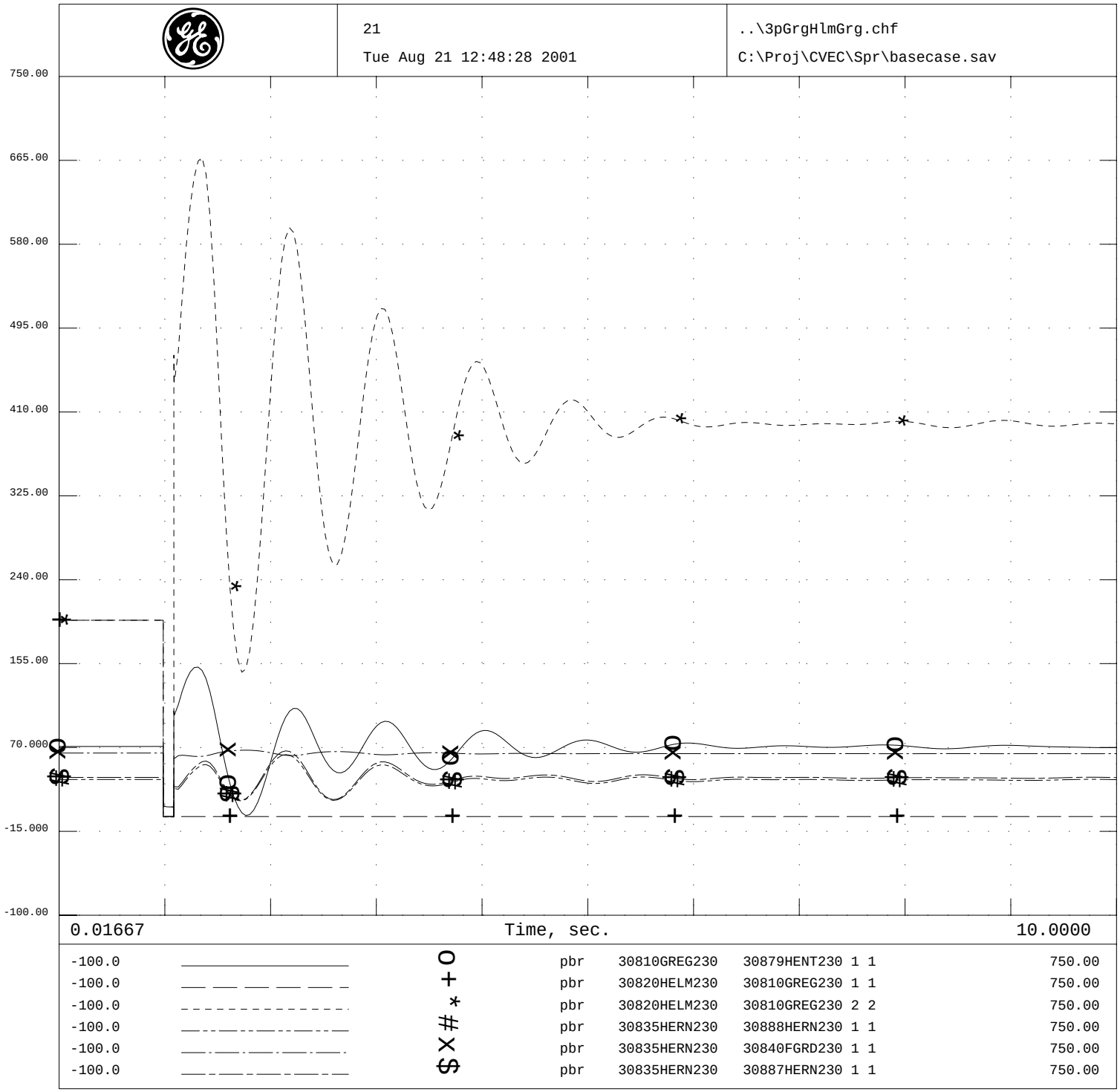

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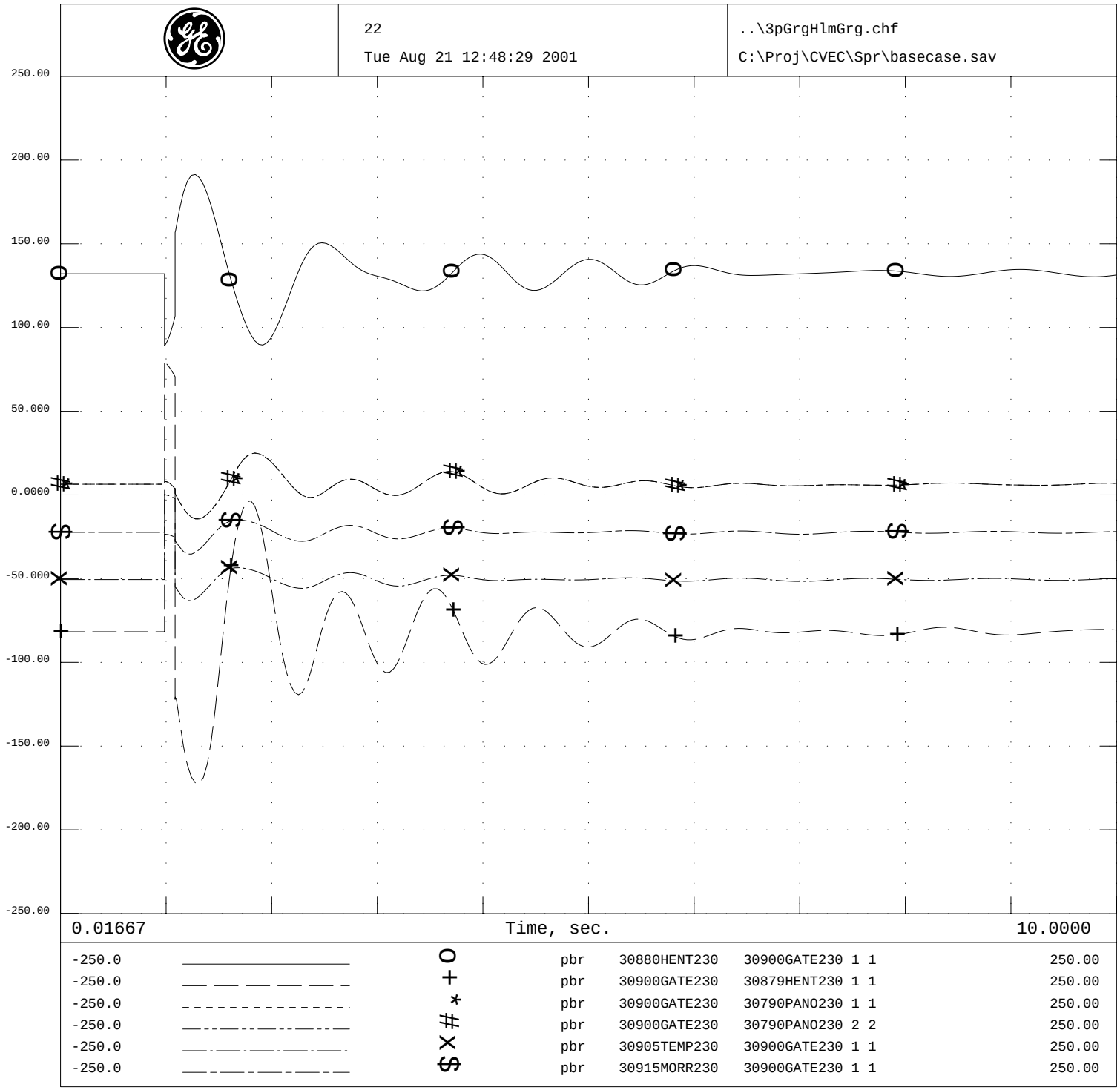

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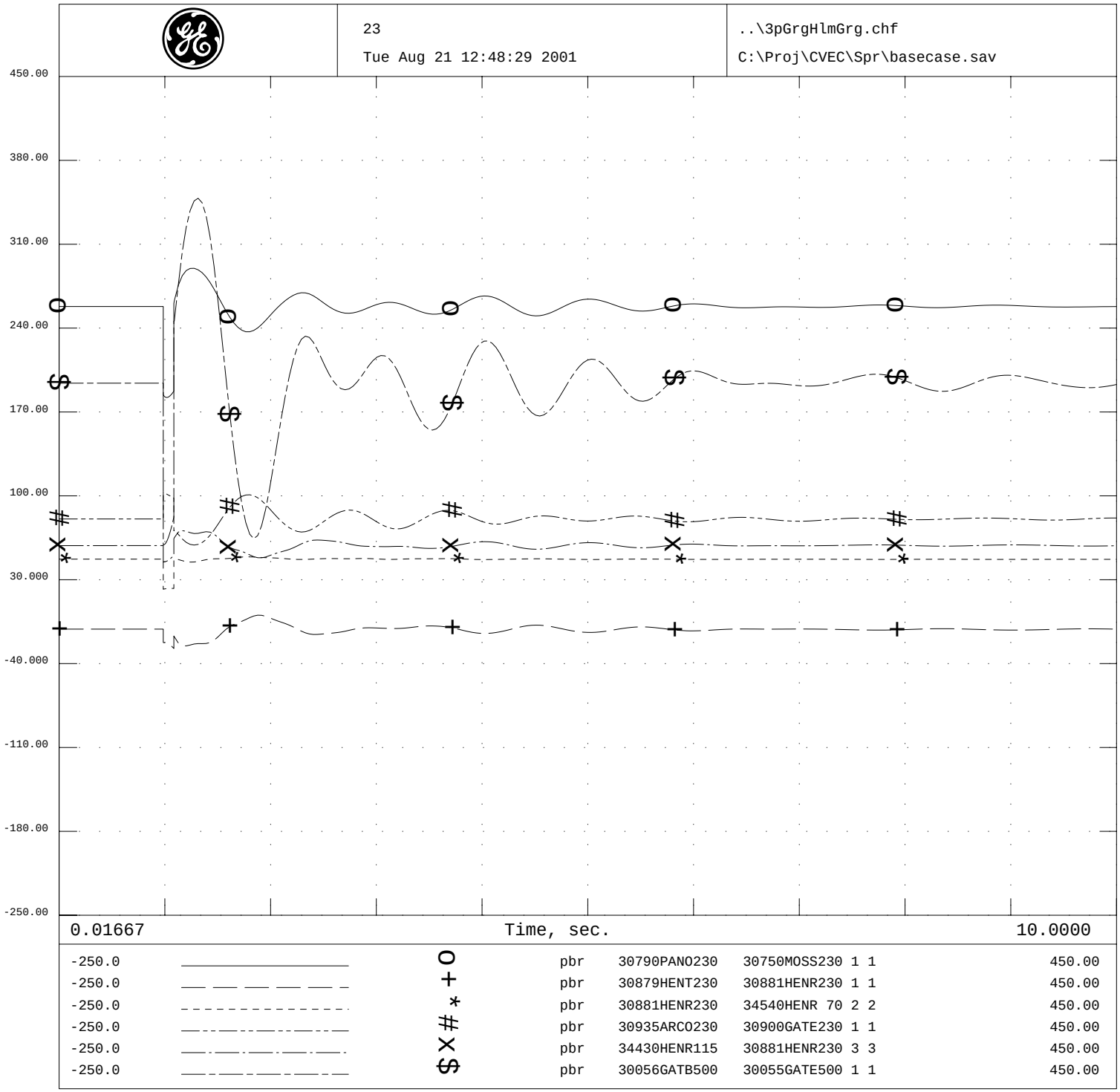

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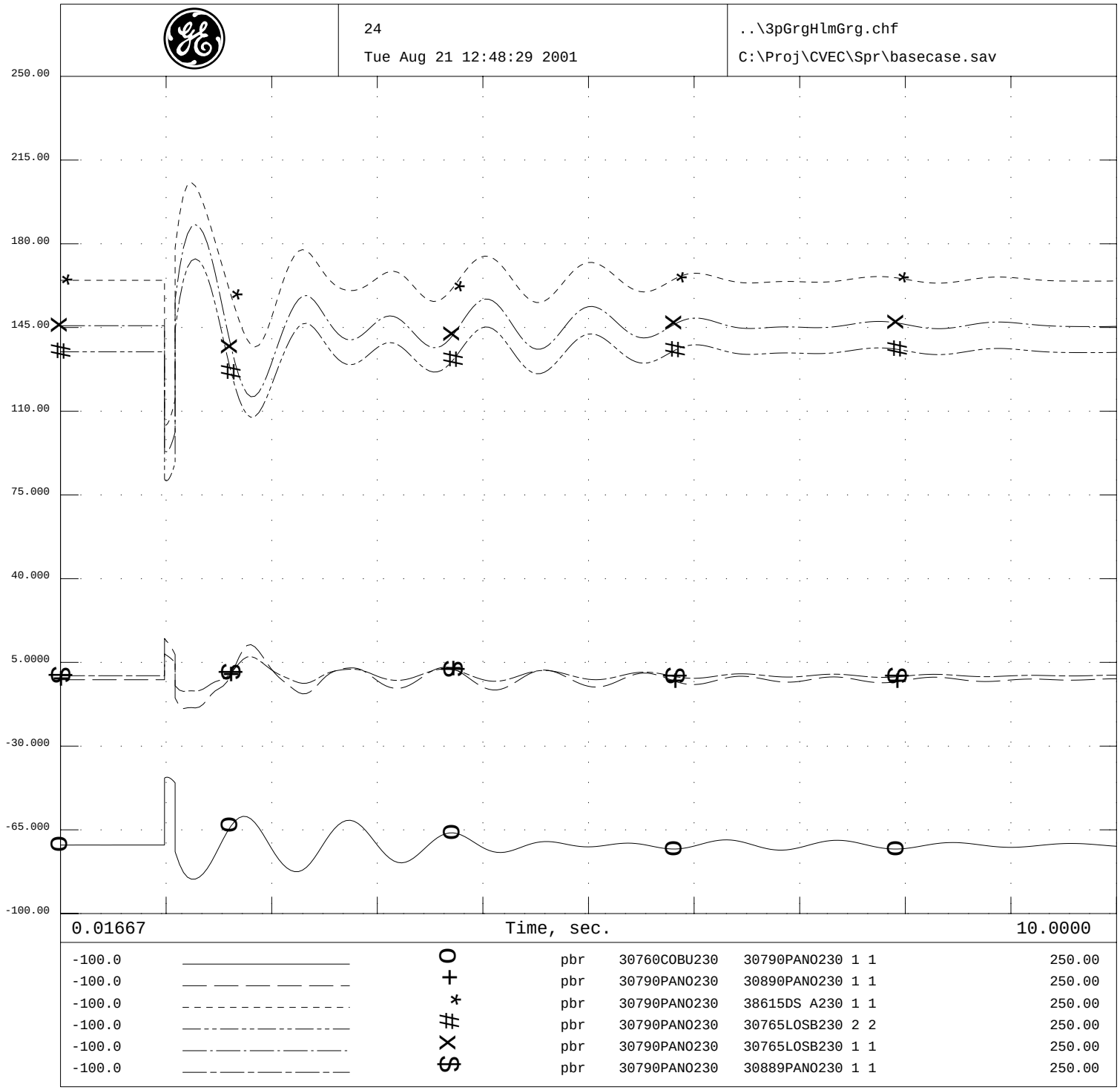

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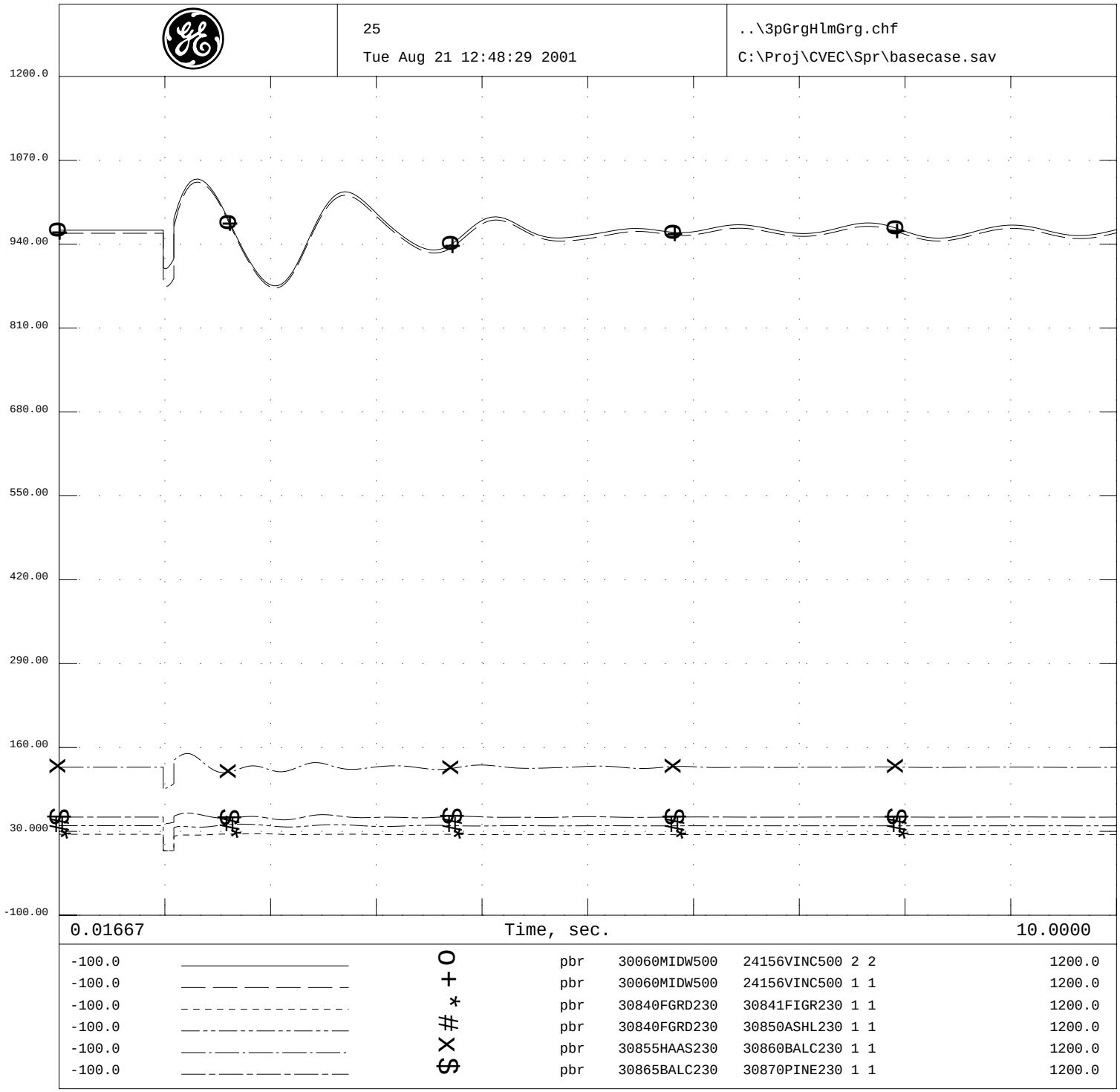

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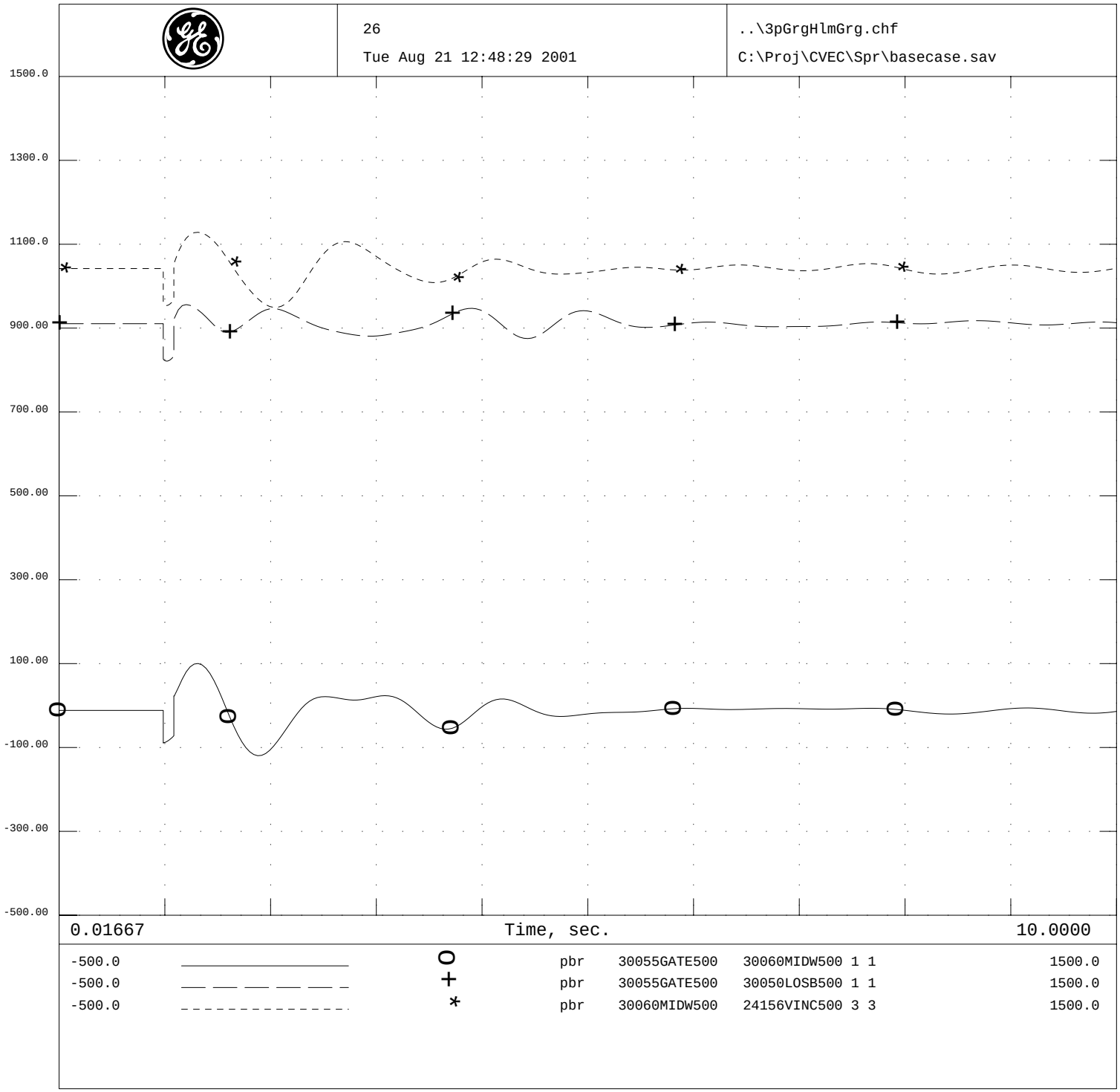

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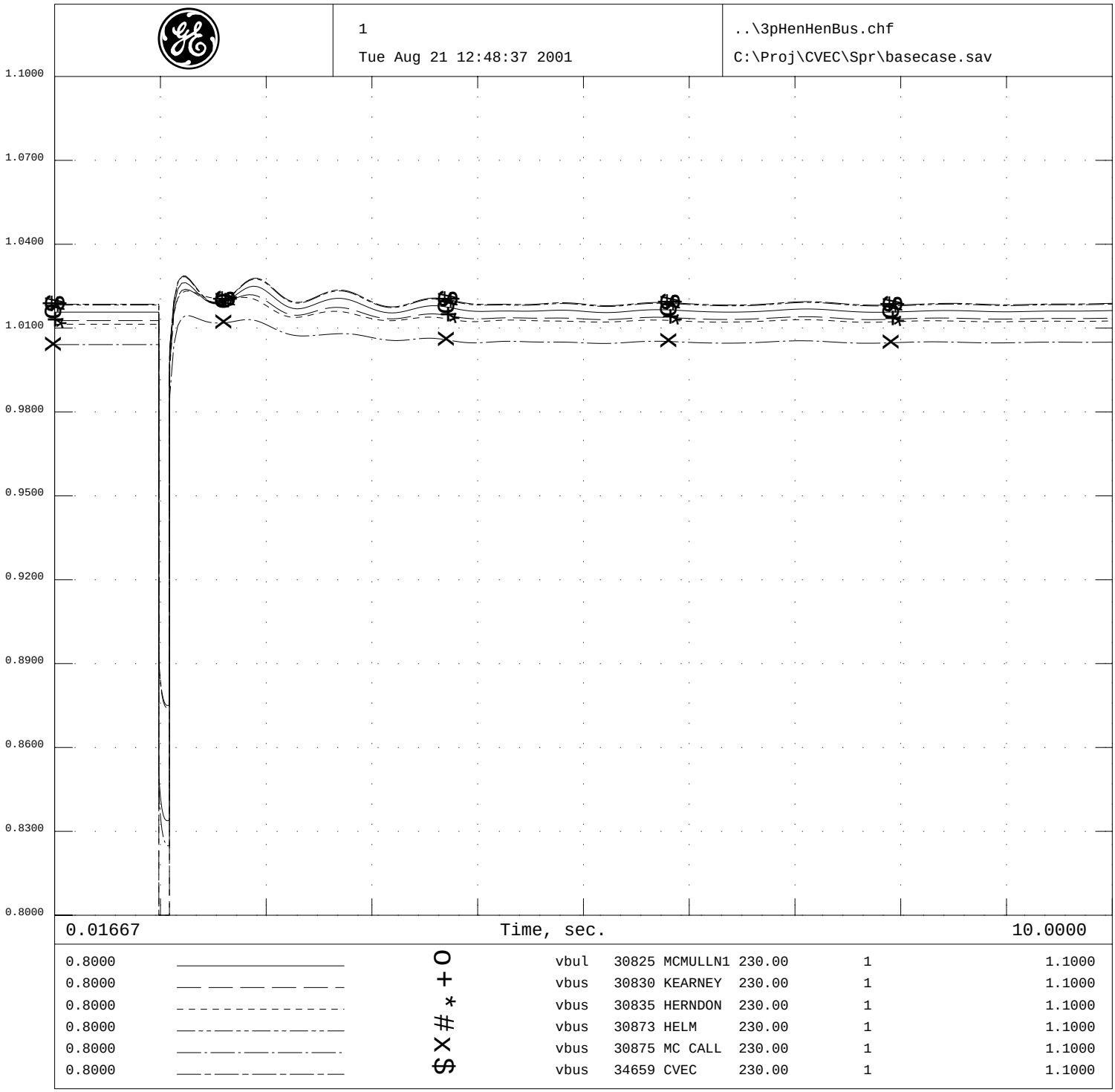
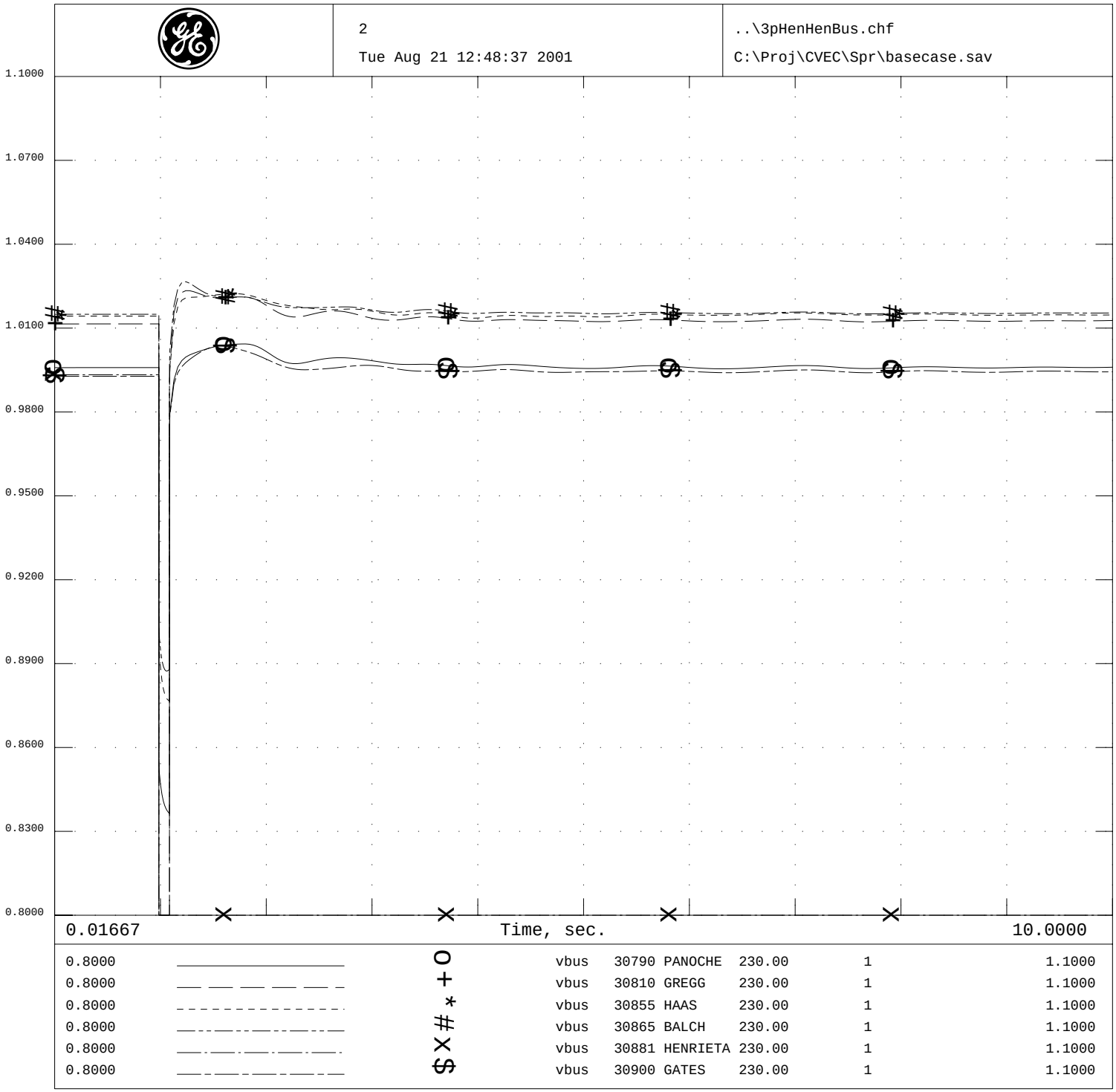


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Henrietta 230kV Bus Outage
3 phase 6 cycle fault at Henrietta 230kV bus and clear bus

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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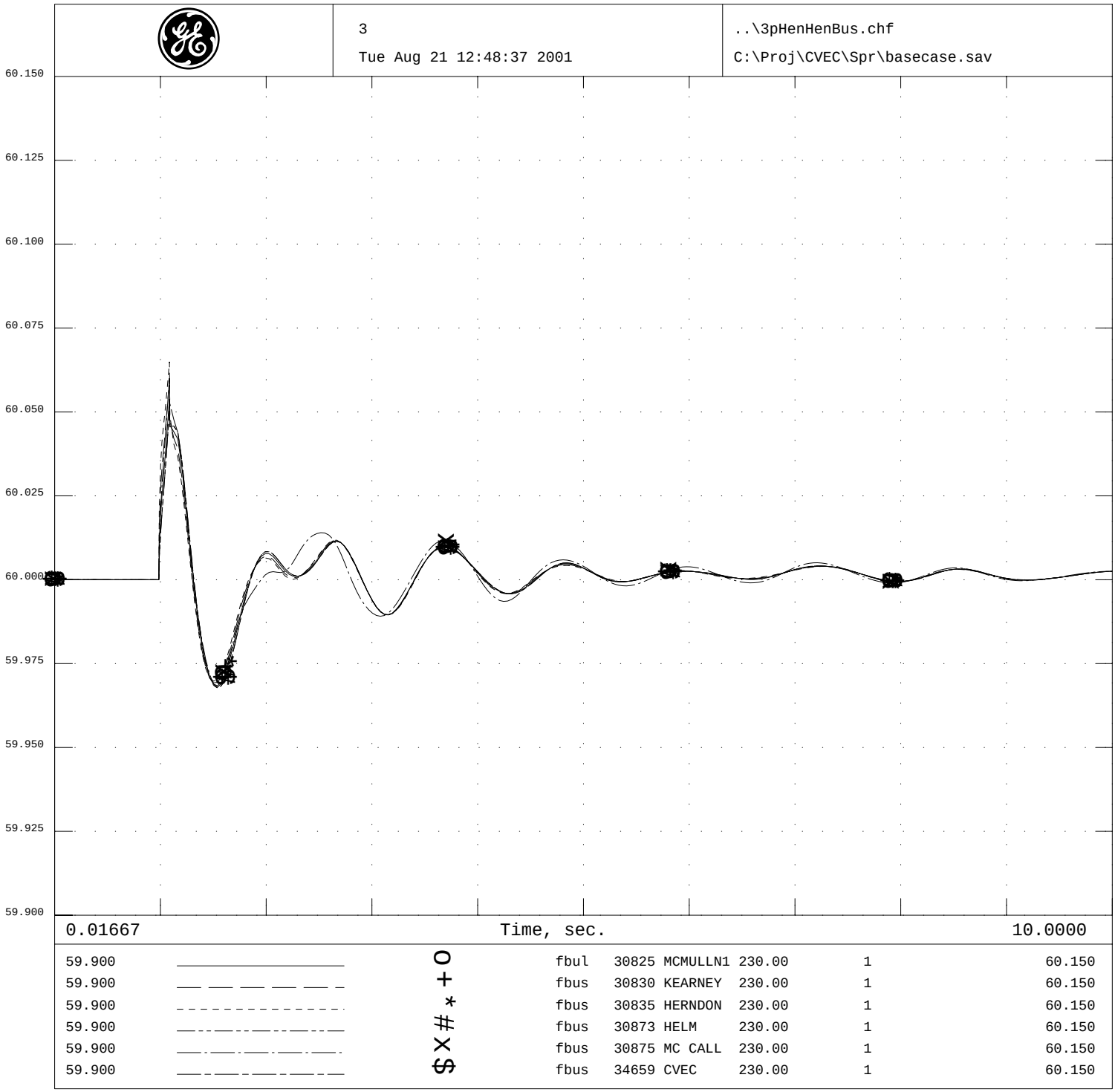

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Calpine Corporation
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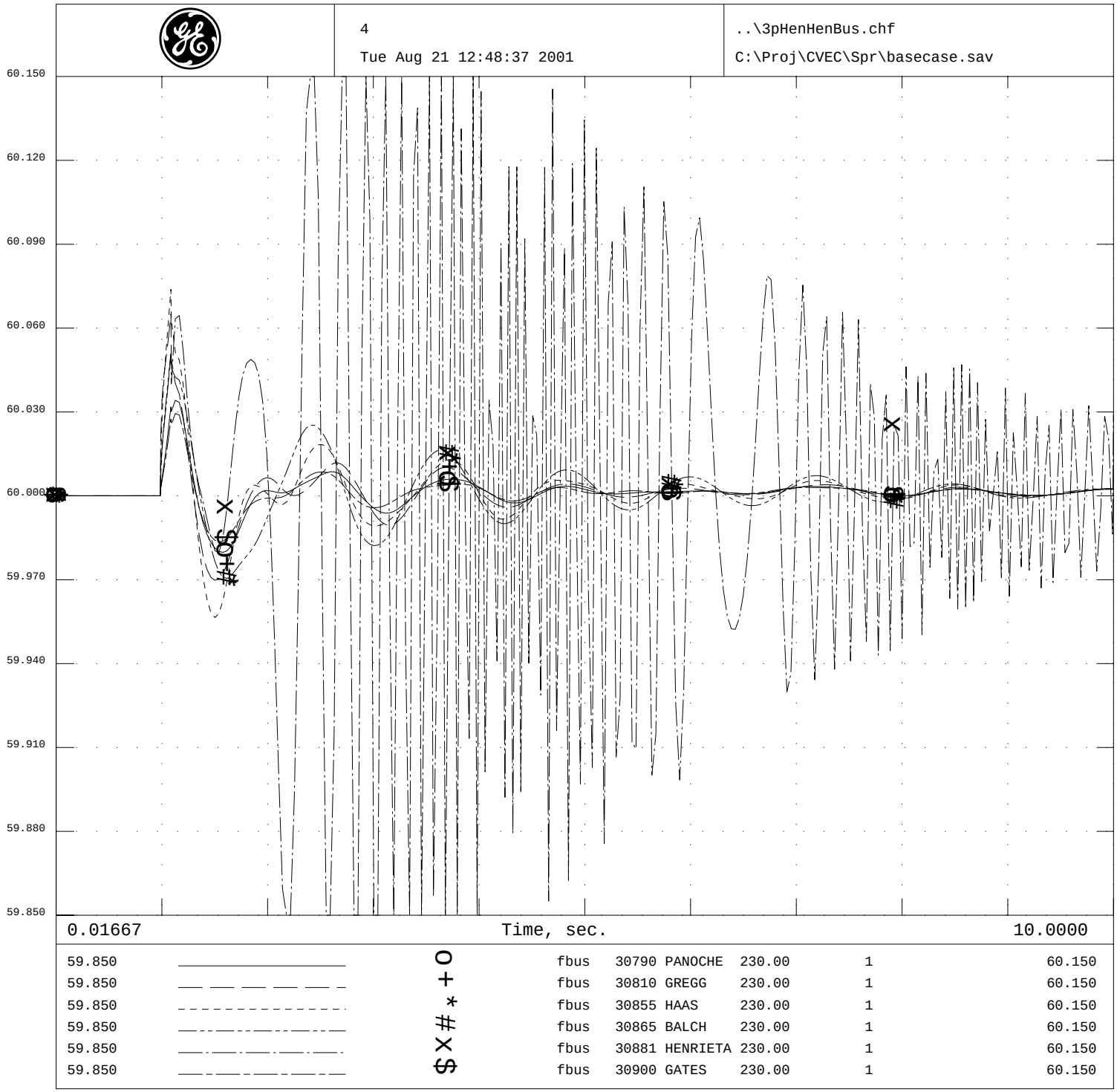

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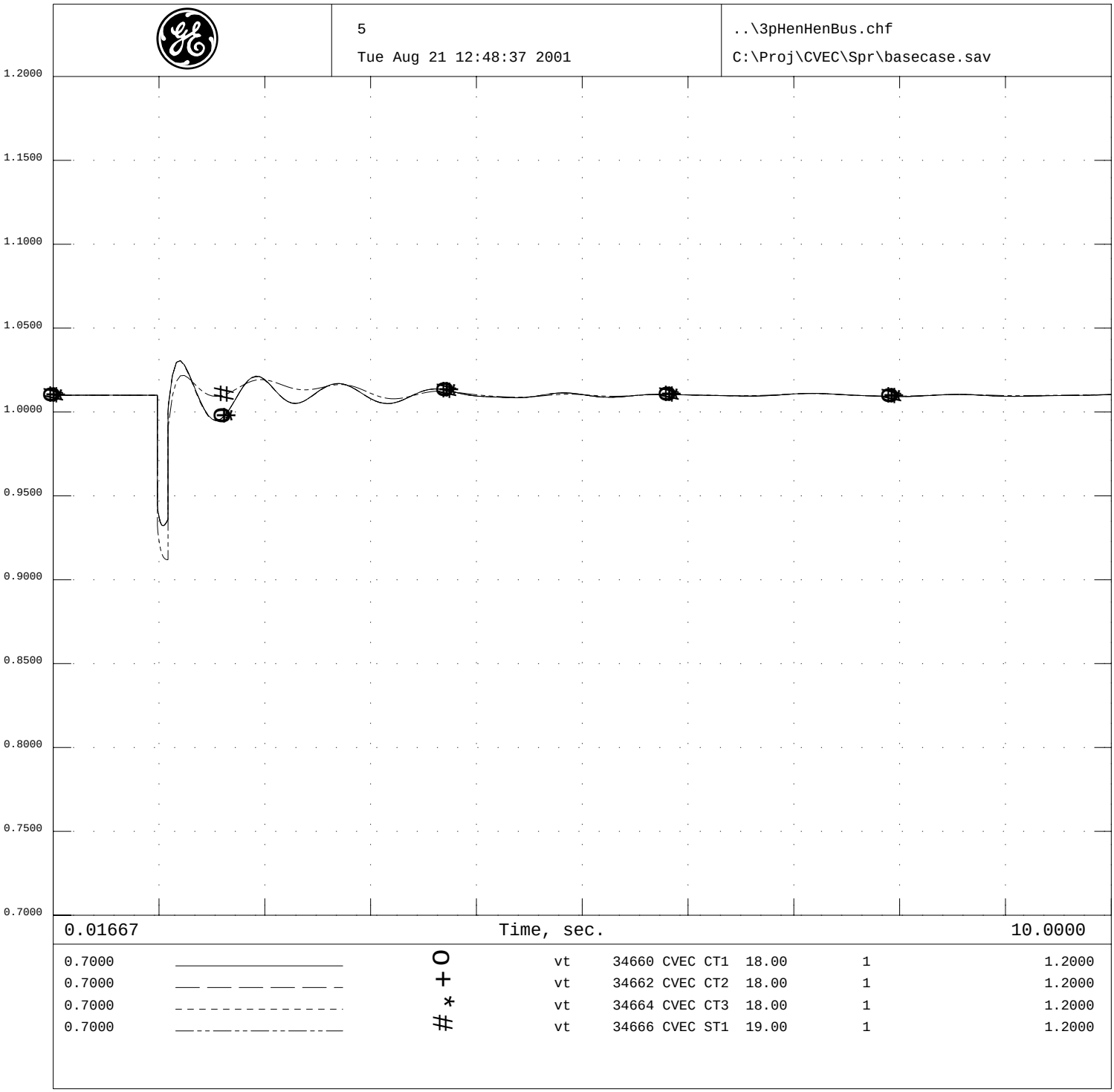

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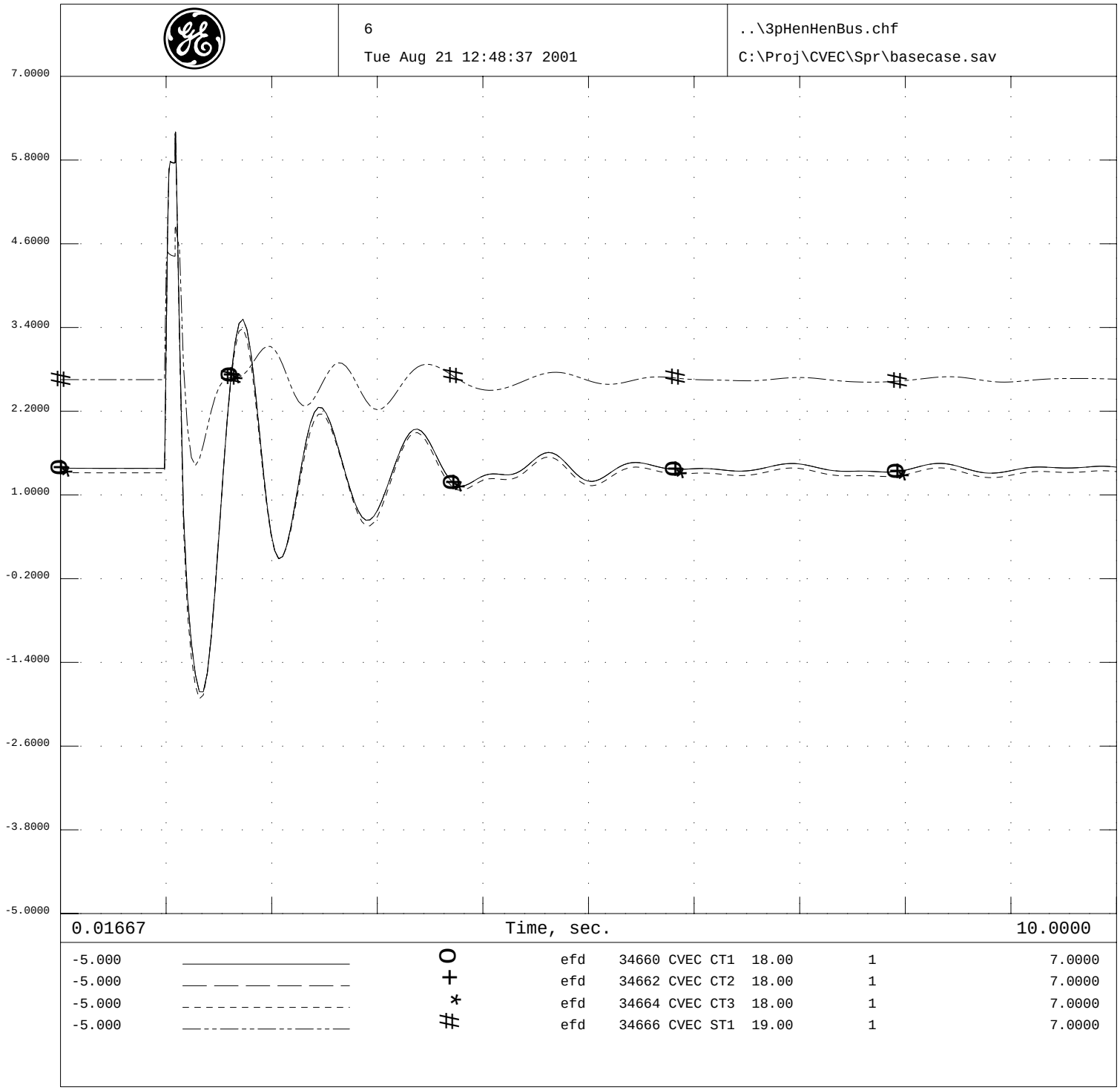
Calpine Corporation
Project Generator Terminal Voltages



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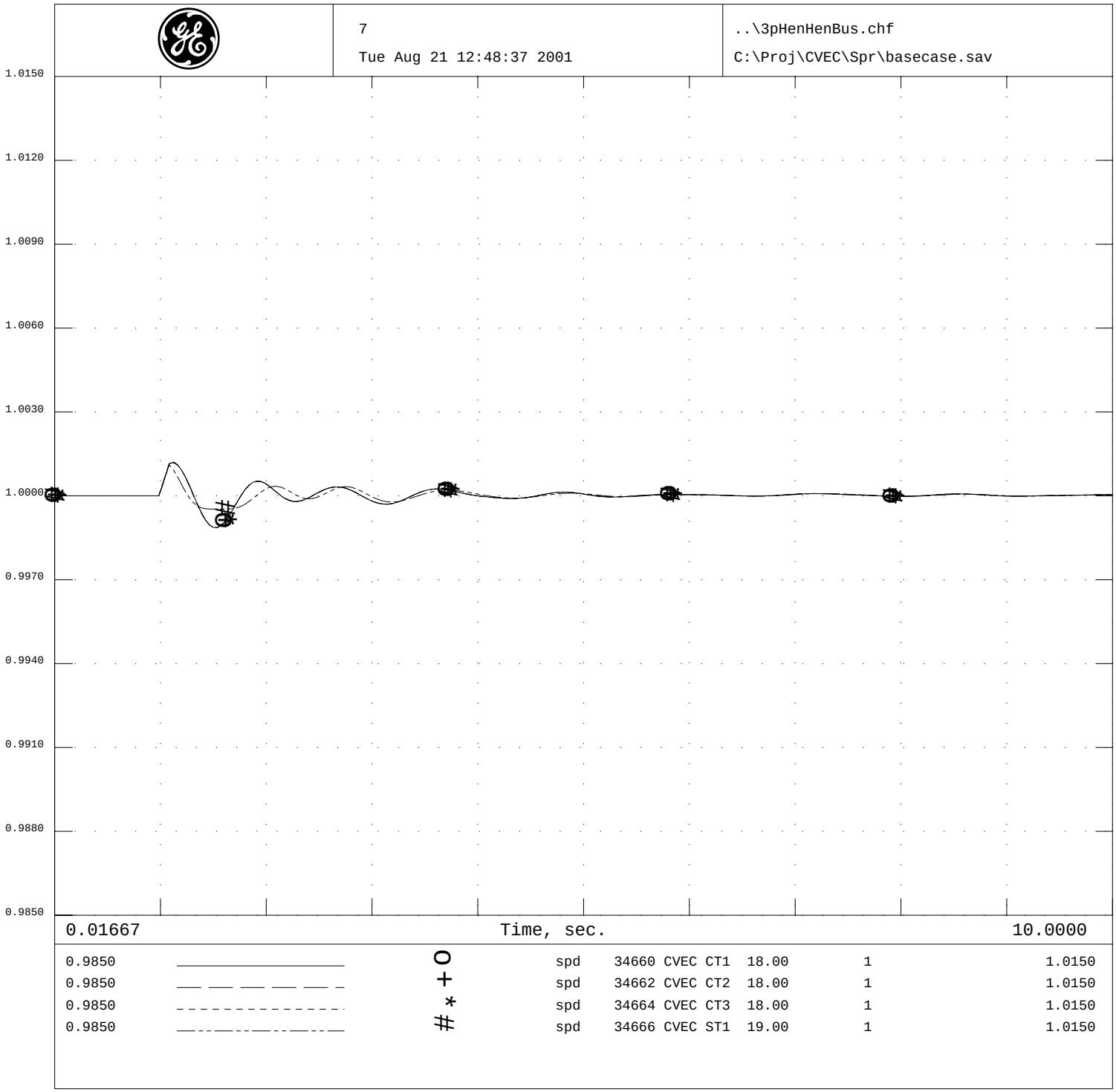
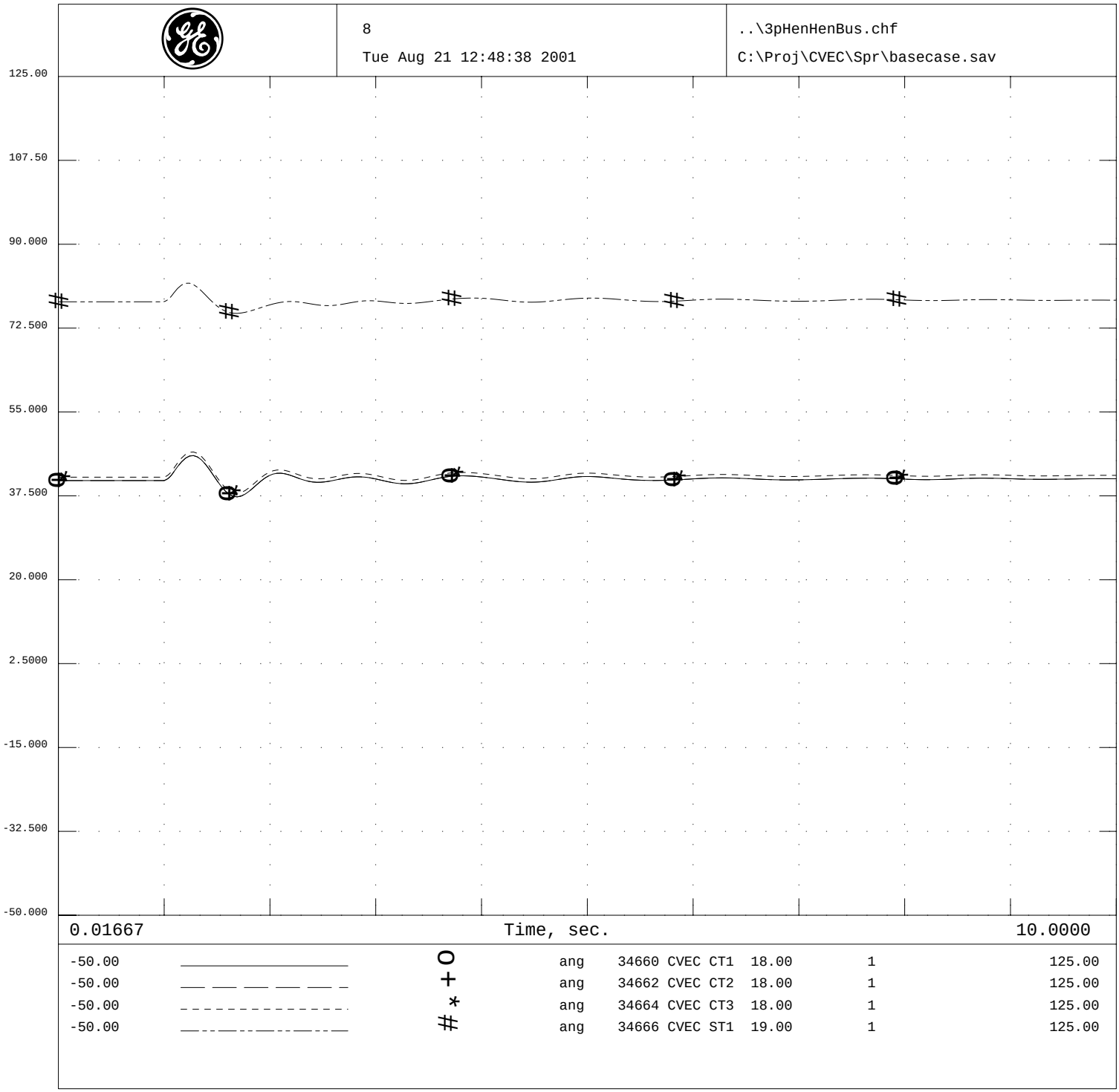
Calpine Corporation
Project Generator Field Voltages



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Henrietta 230kV Bus Outage
3 phase 6 cycle fault at Henrietta 230kV bus and clear bus

Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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2004 Heavy Spring Base Case
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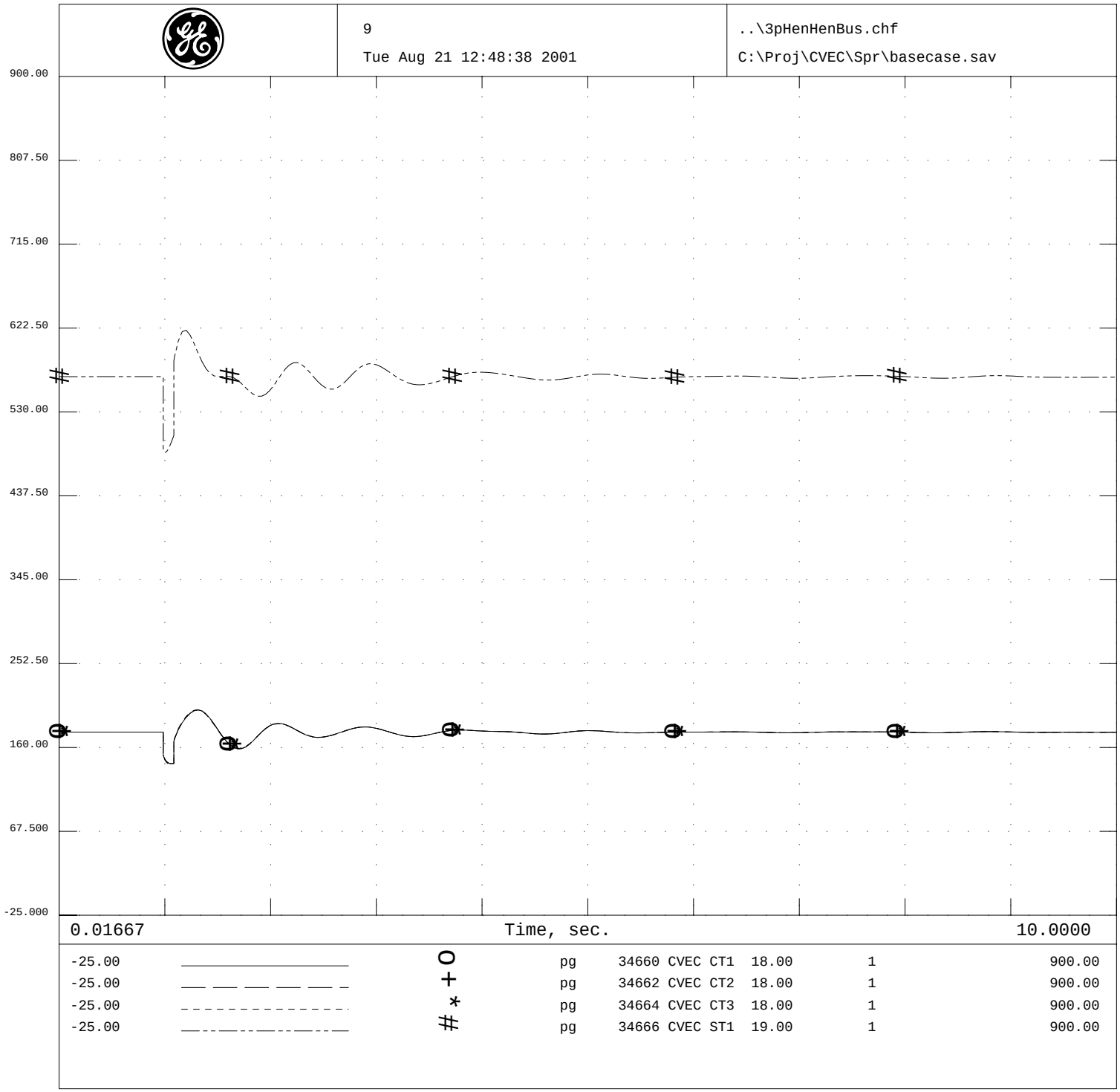
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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2004 Heavy Spring Base Case
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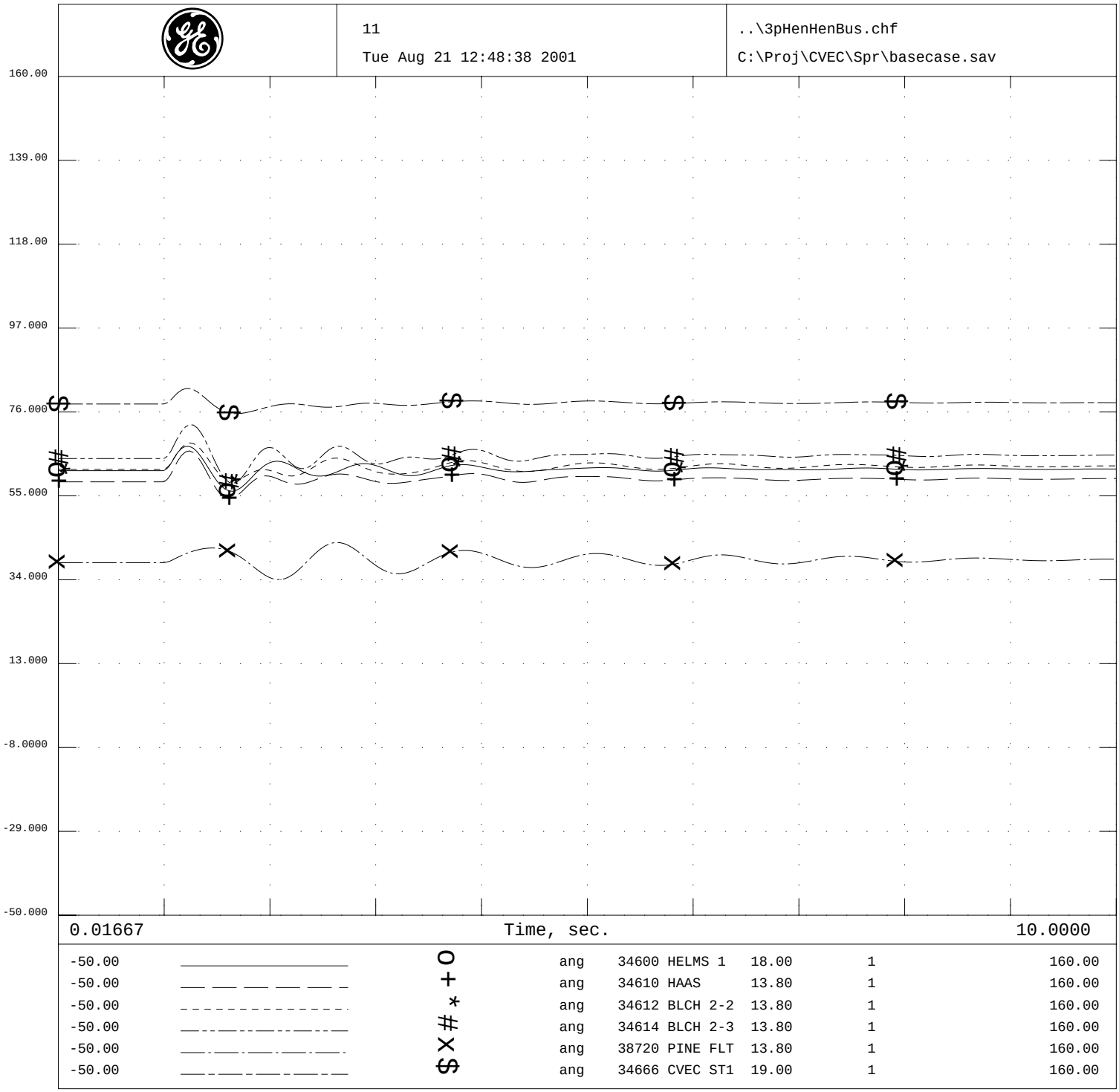
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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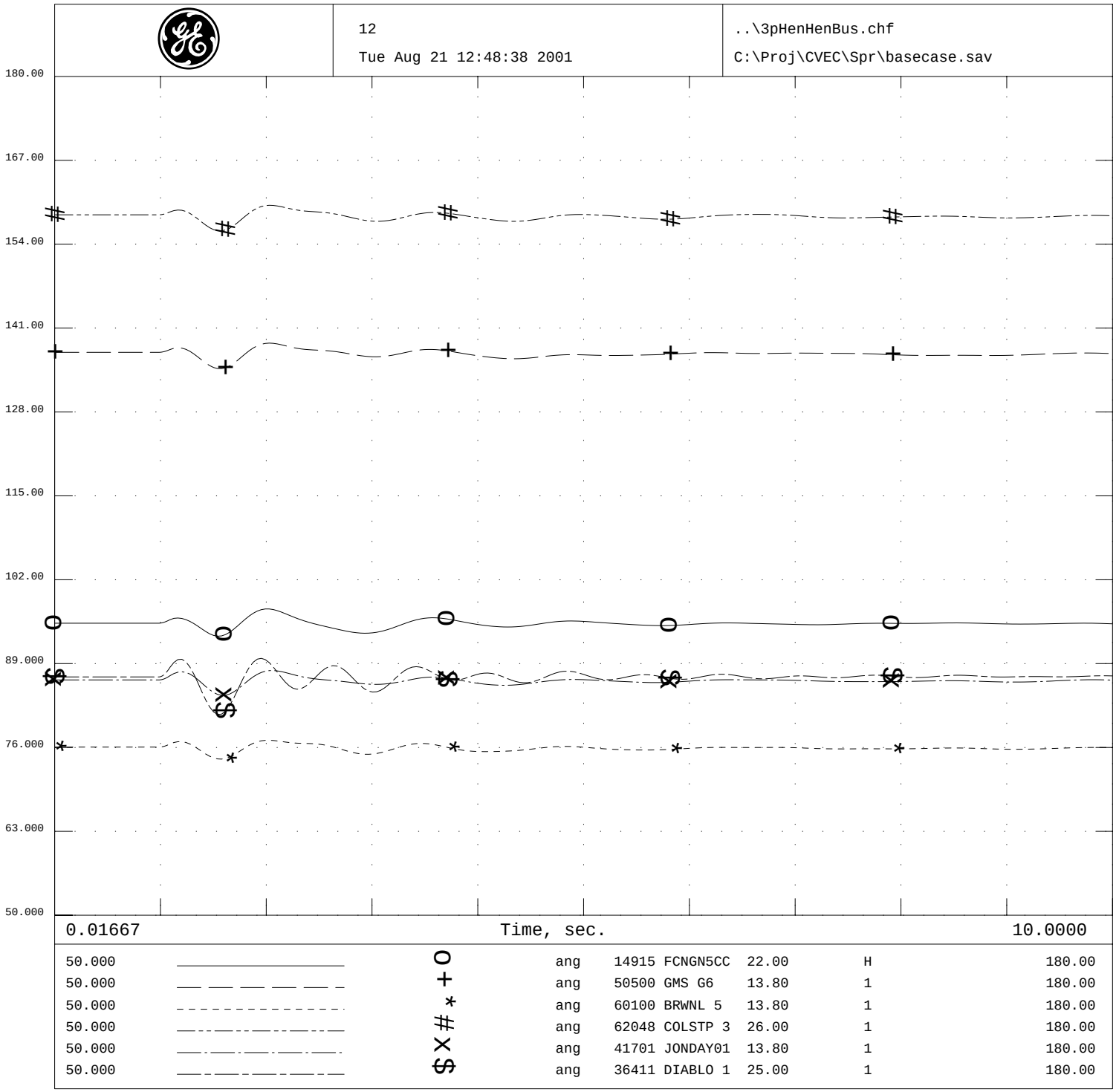
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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2004 Heavy Spring Base Case
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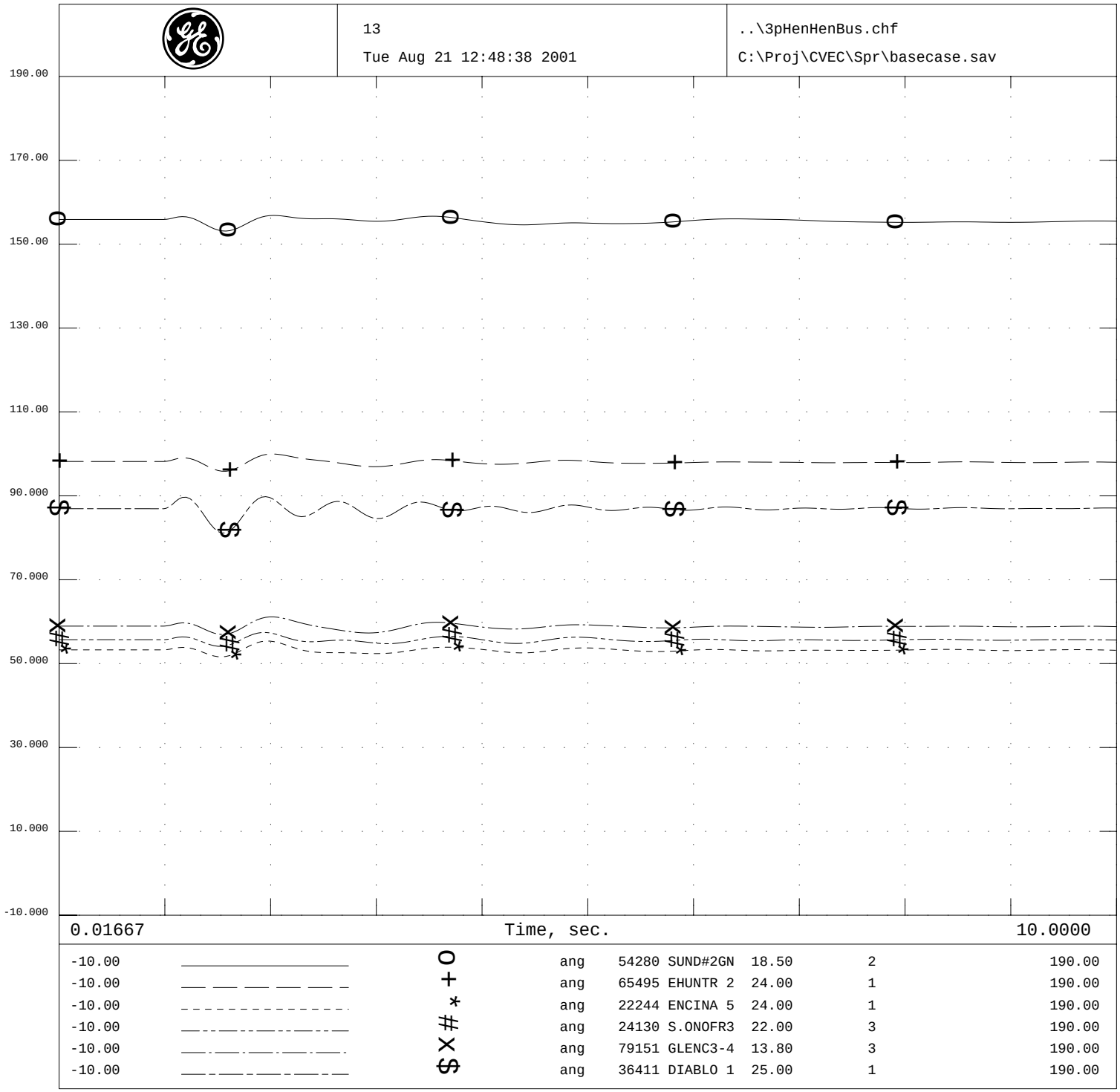
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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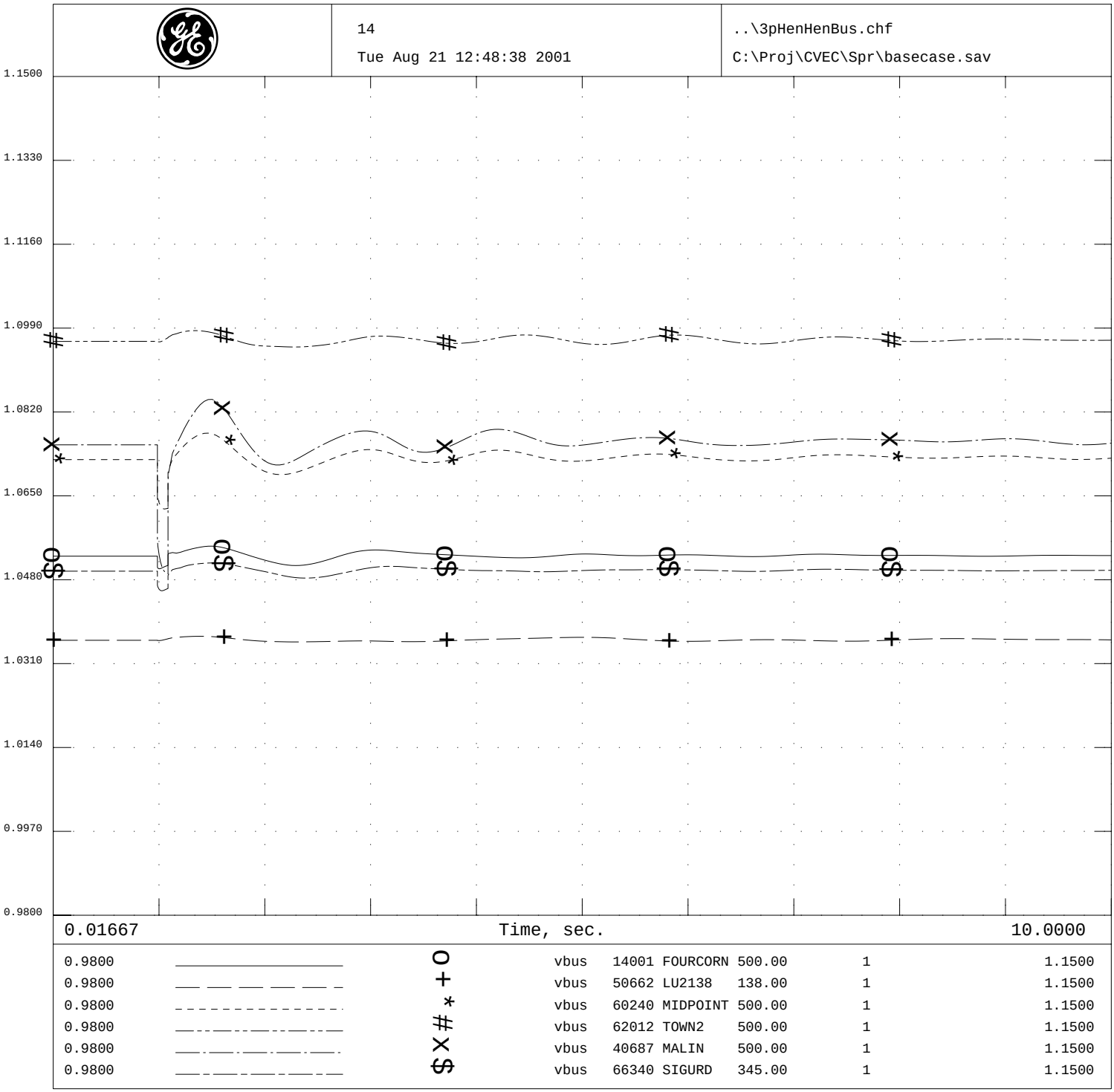

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2004 Heavy Spring Base Case
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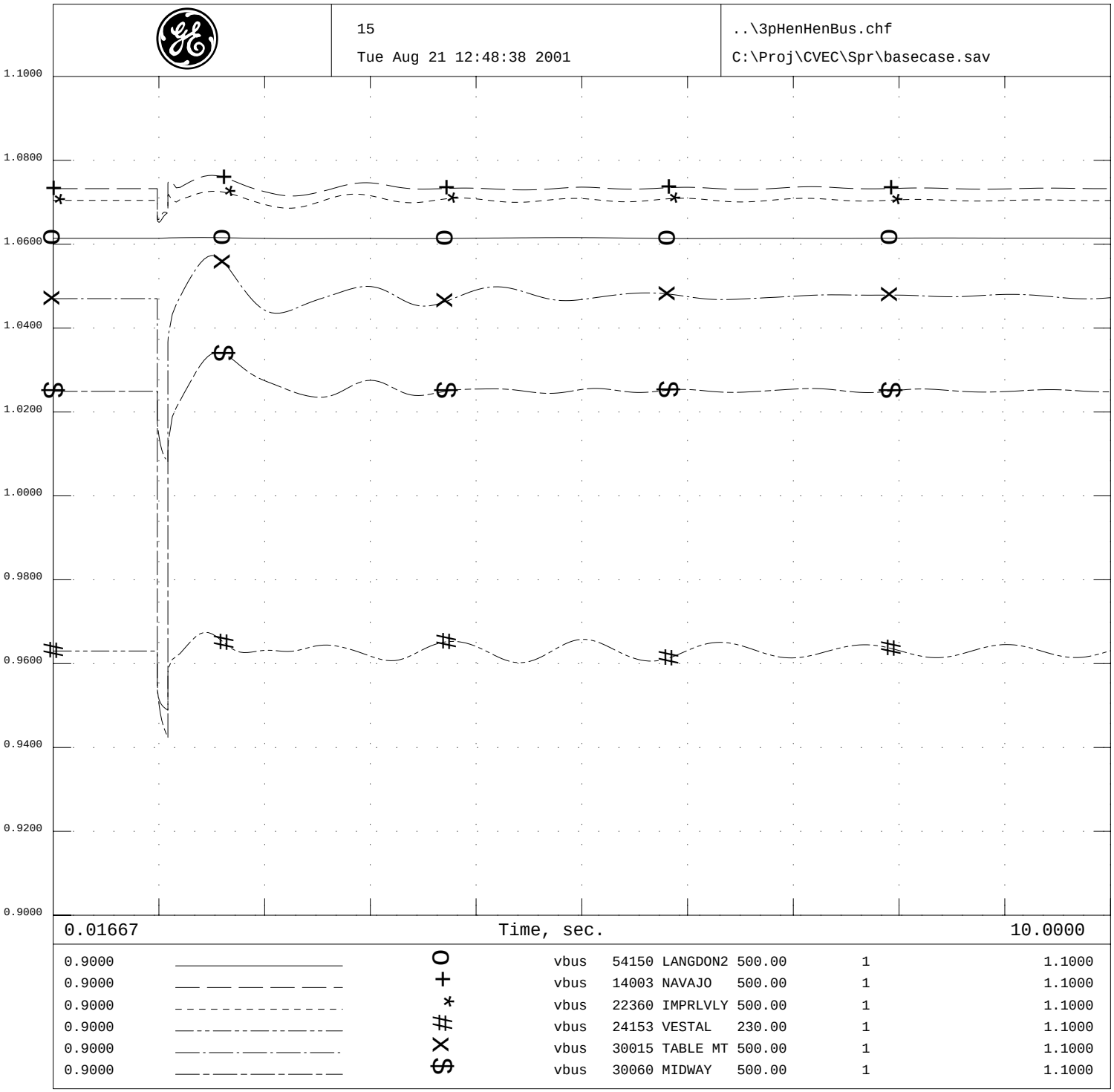
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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Calpine Corporation
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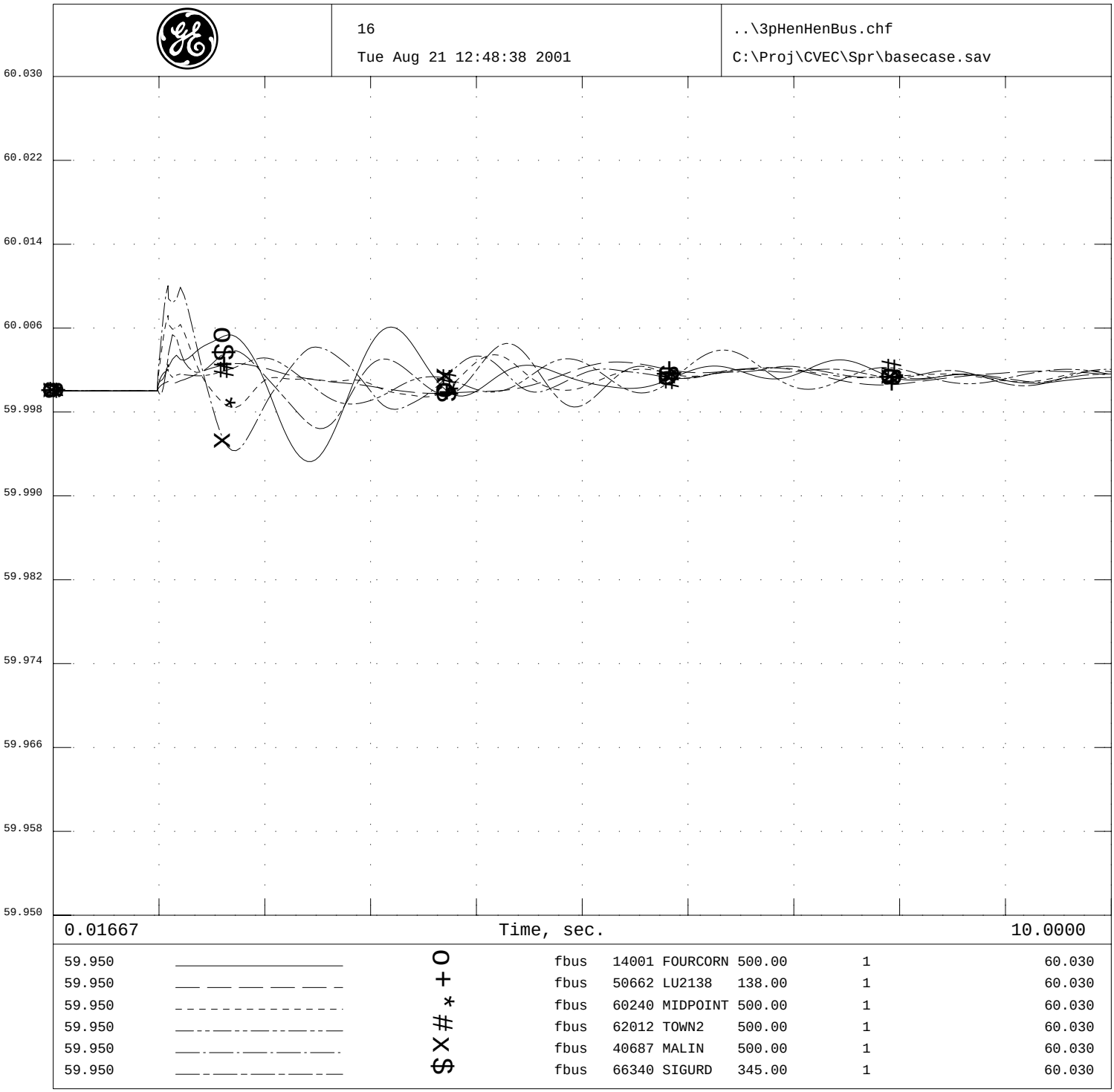

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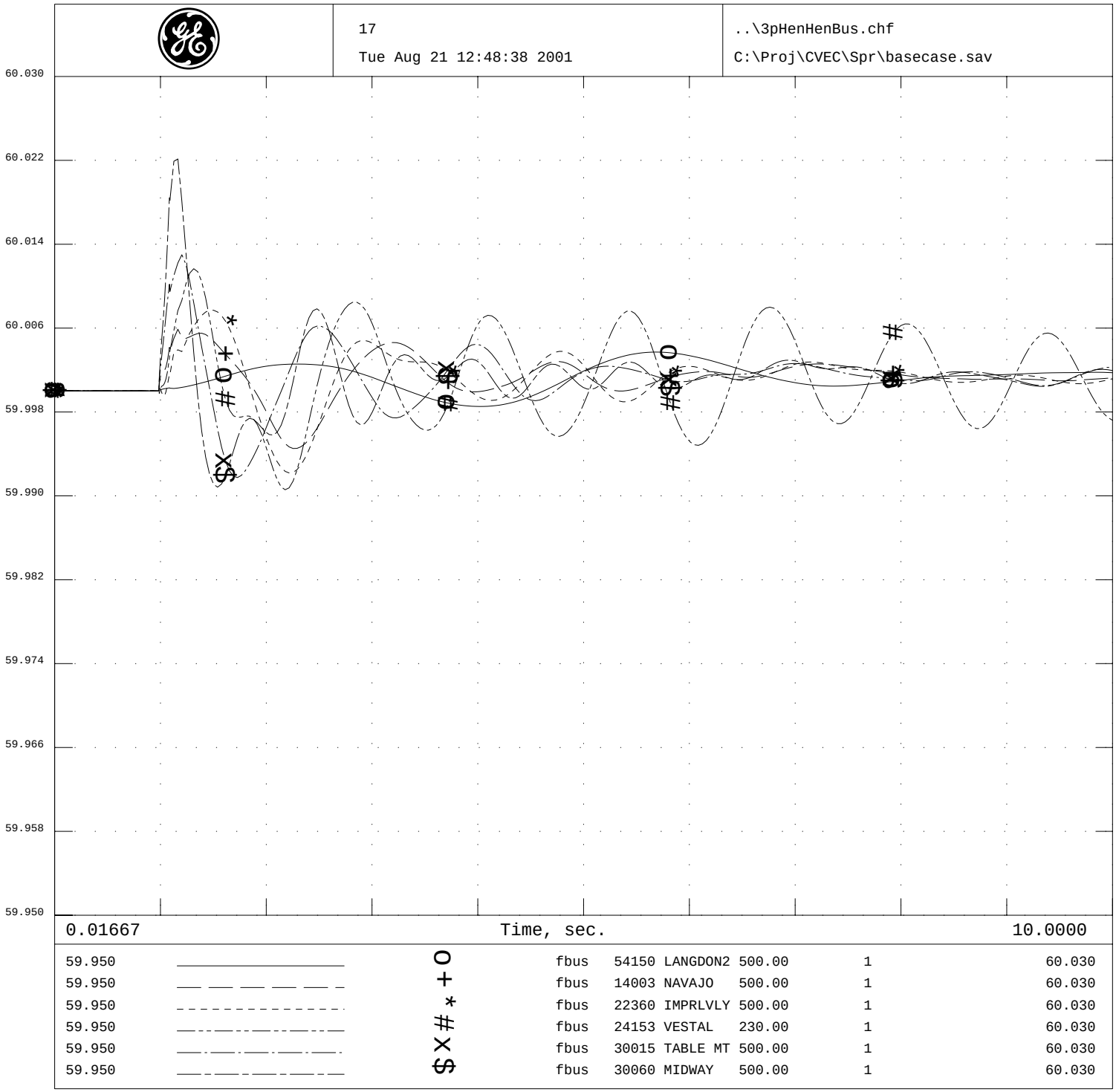
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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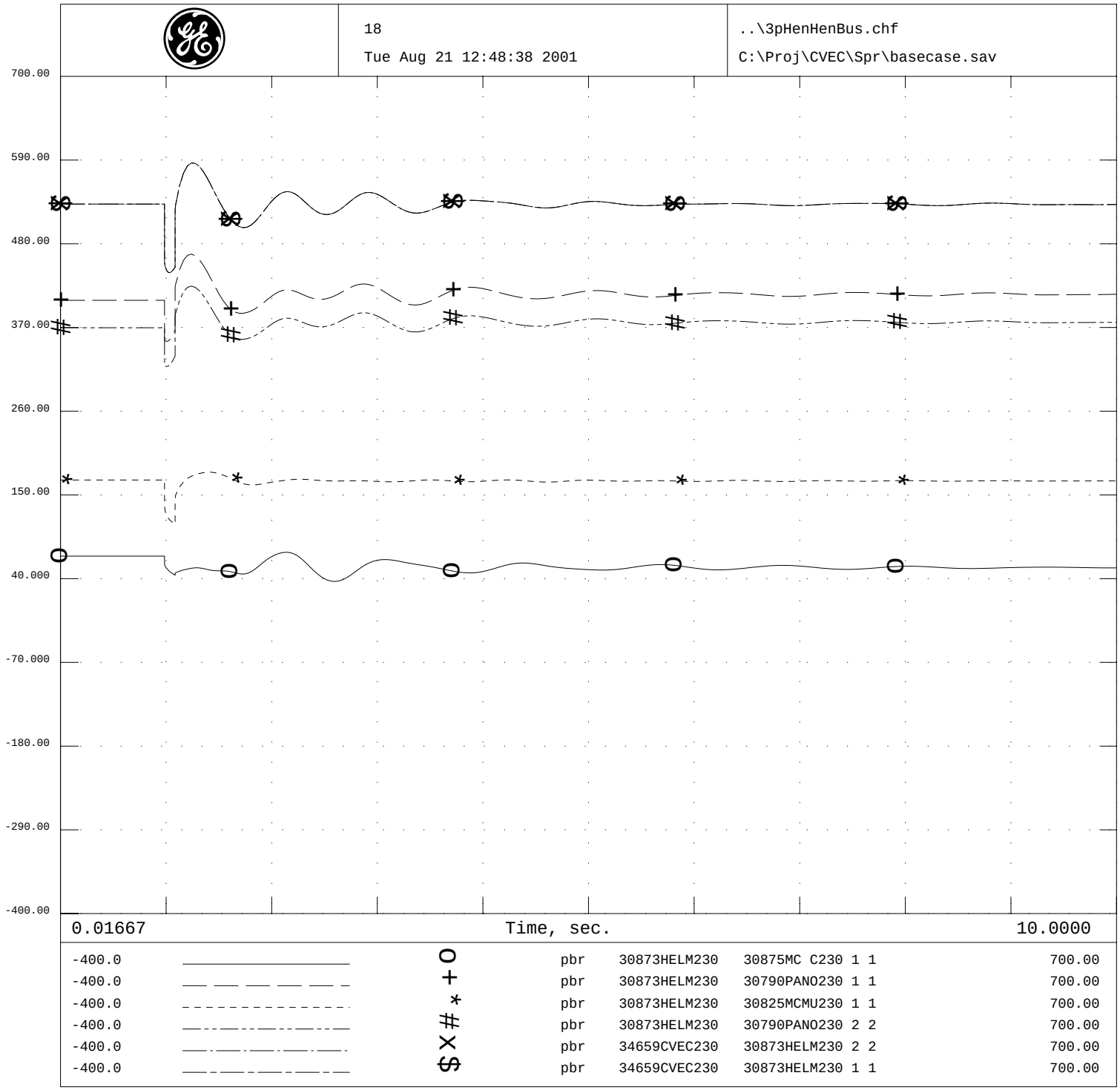

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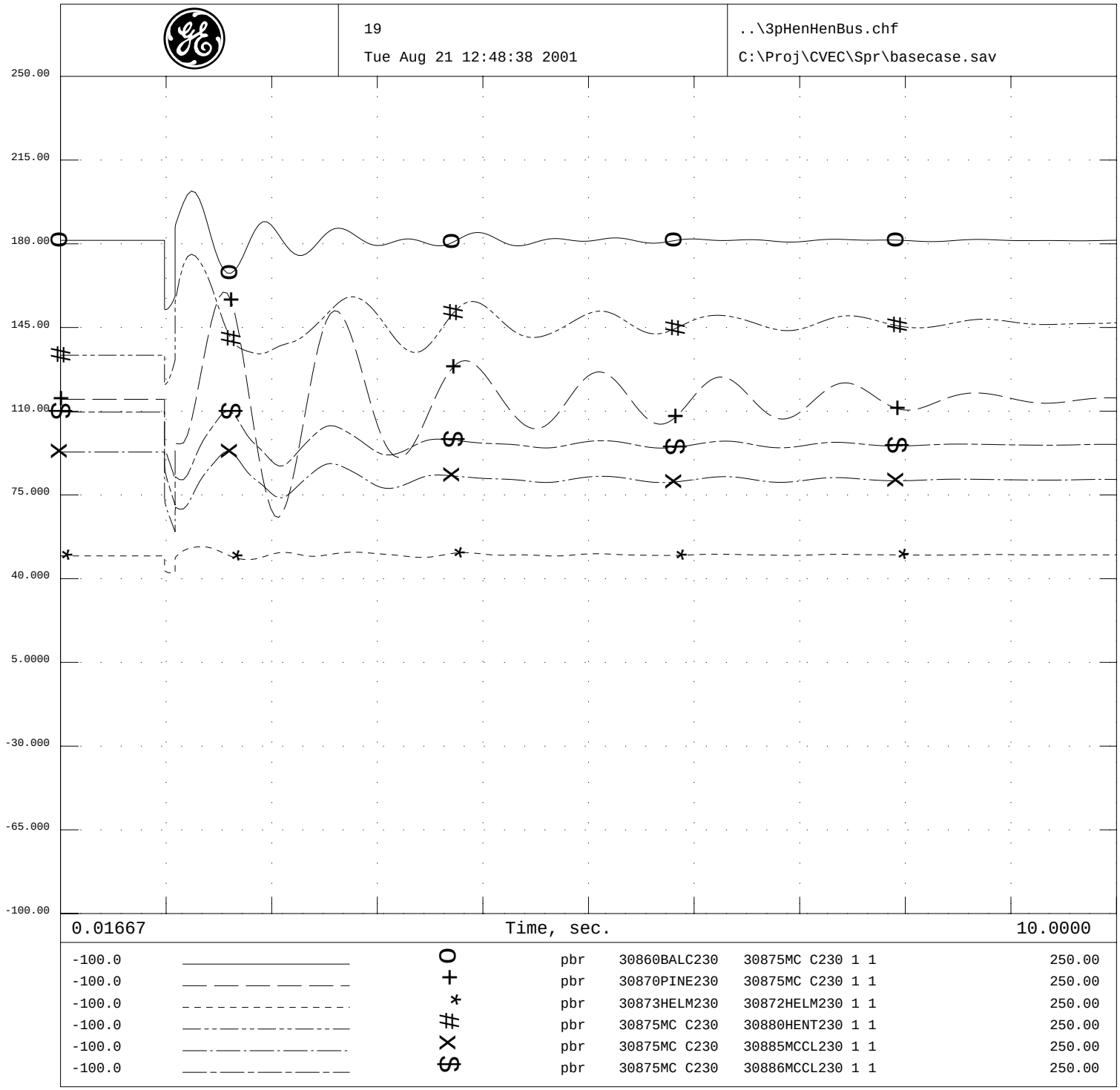
Calpine Corporation
Selected Transmission Line Flows (MW)



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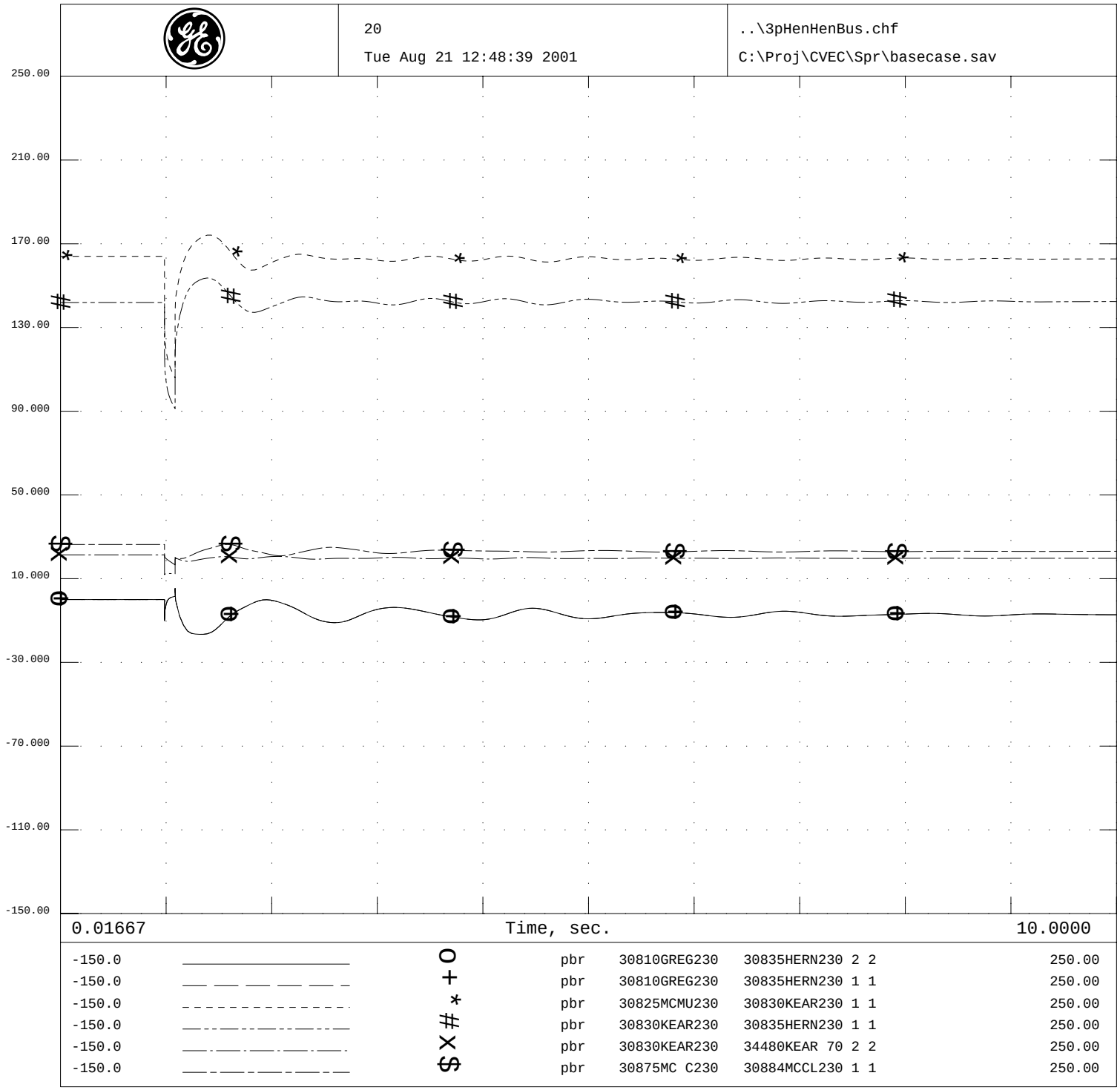

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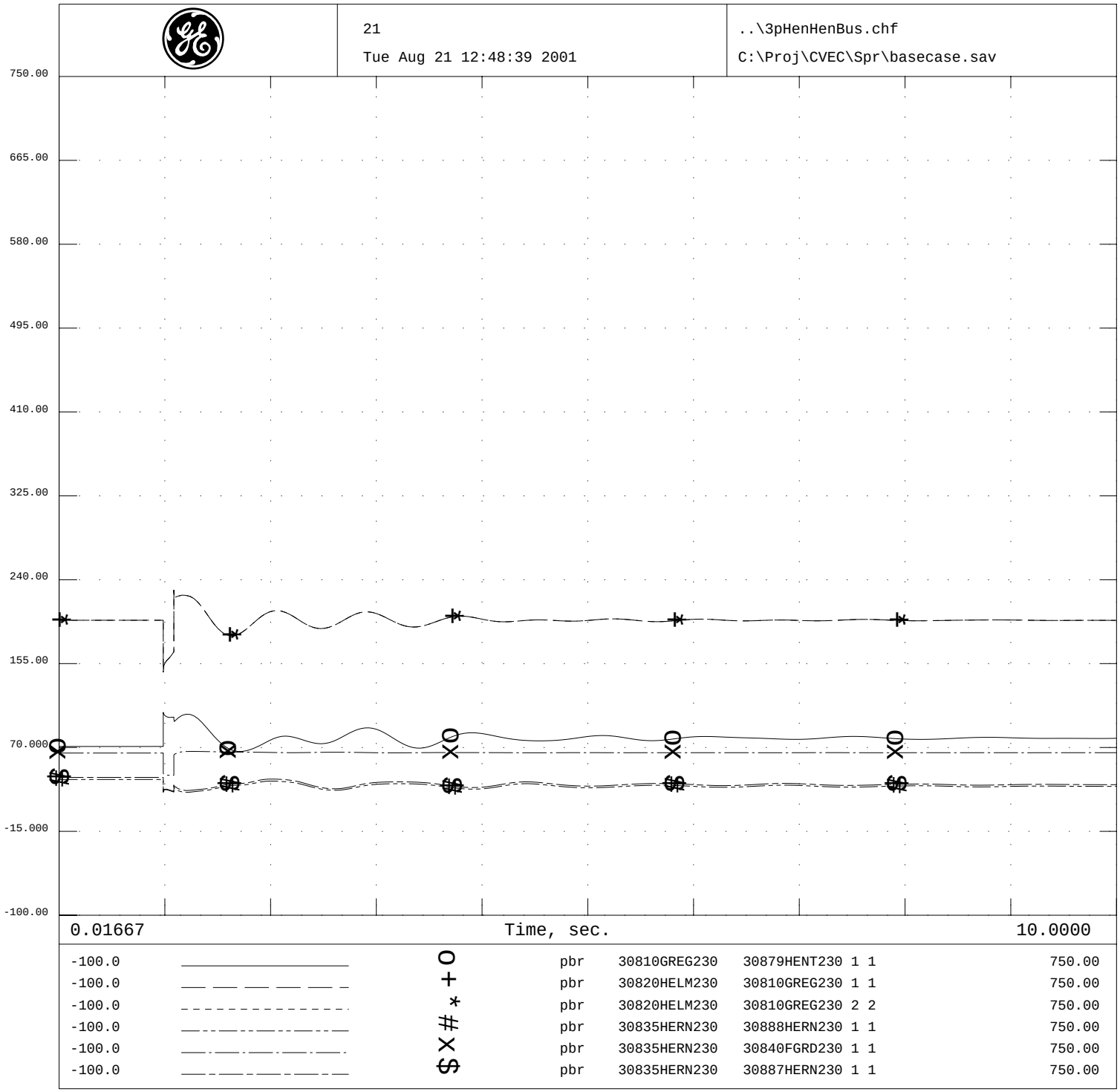

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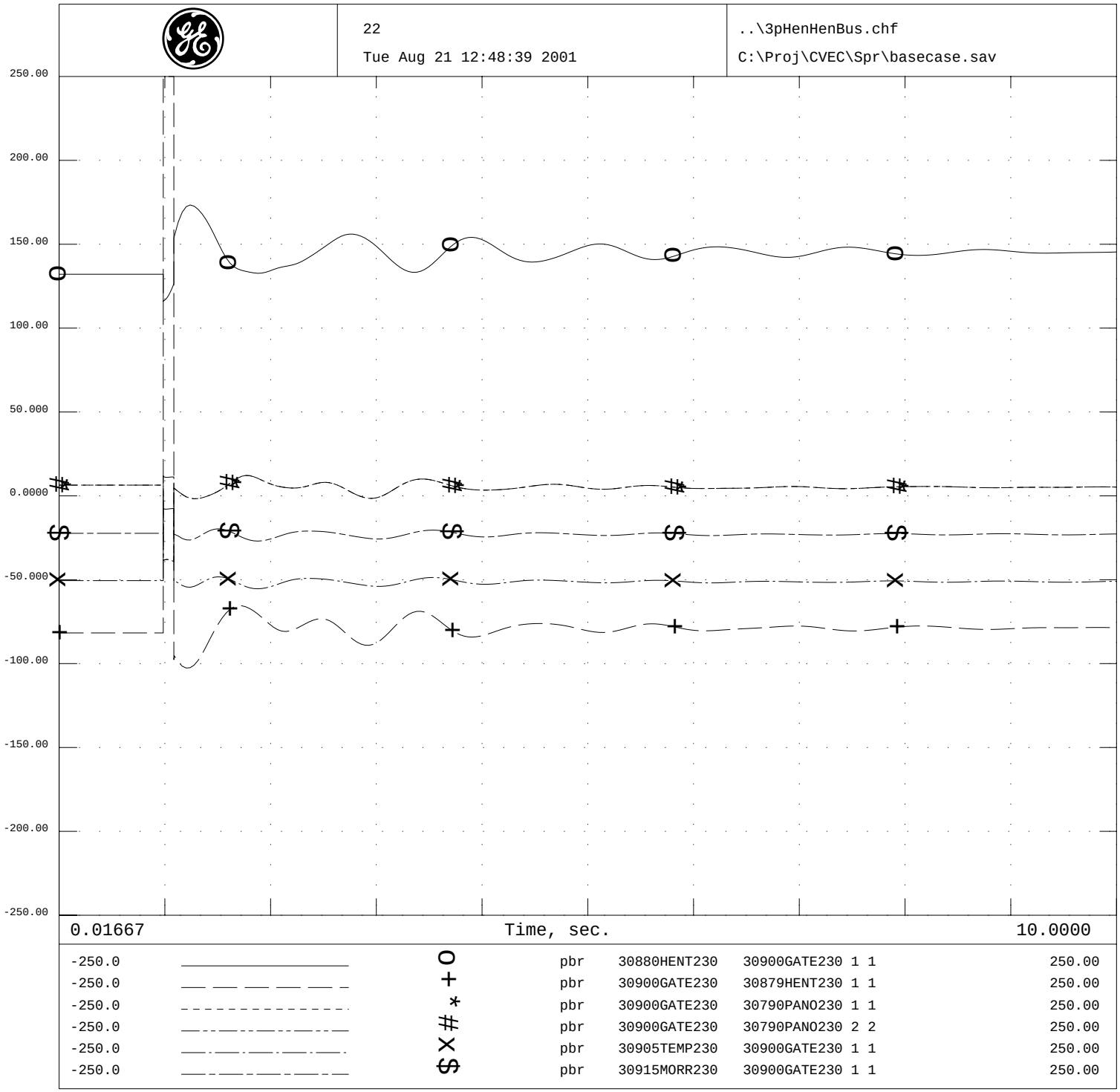

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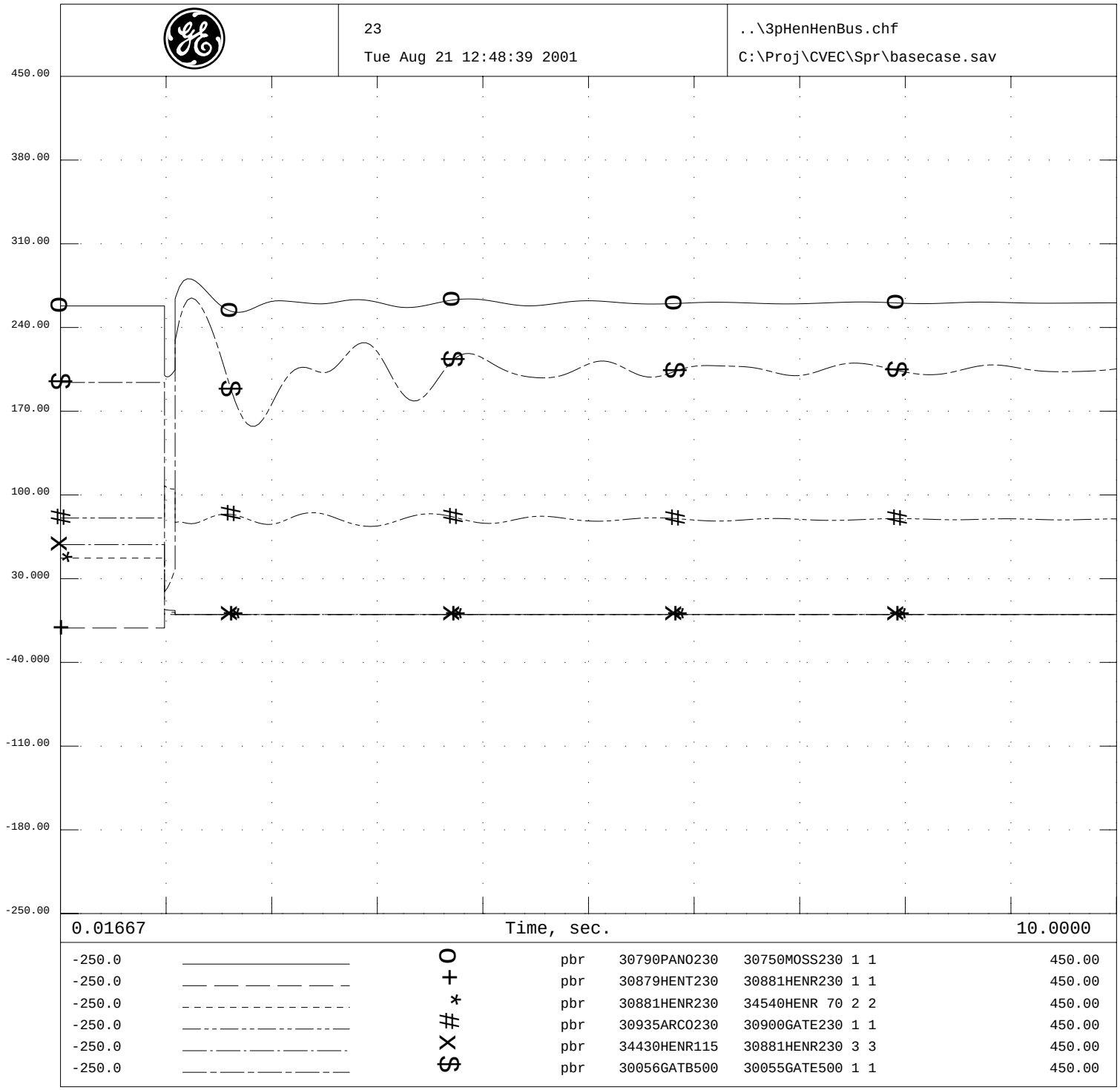

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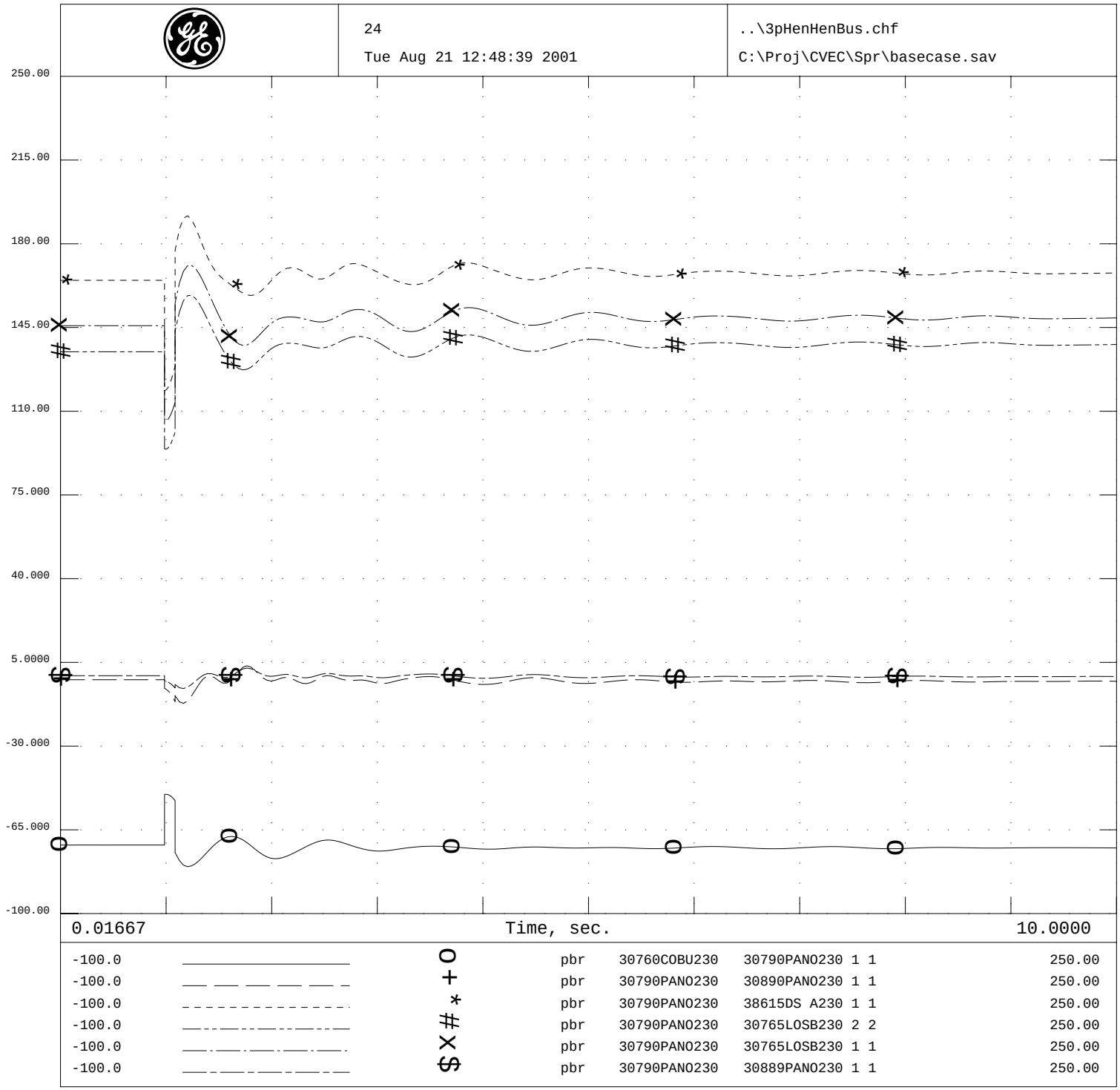

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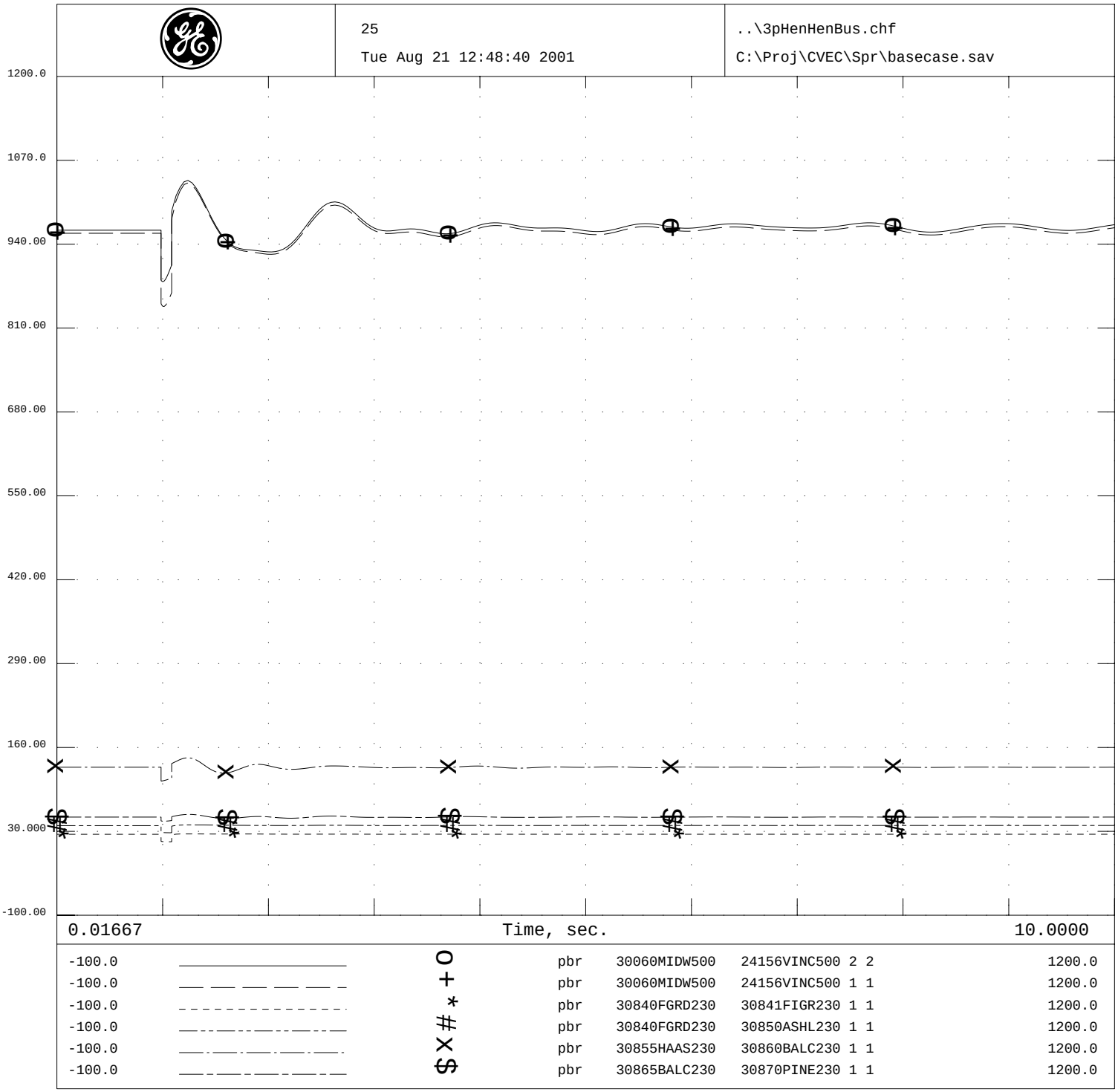

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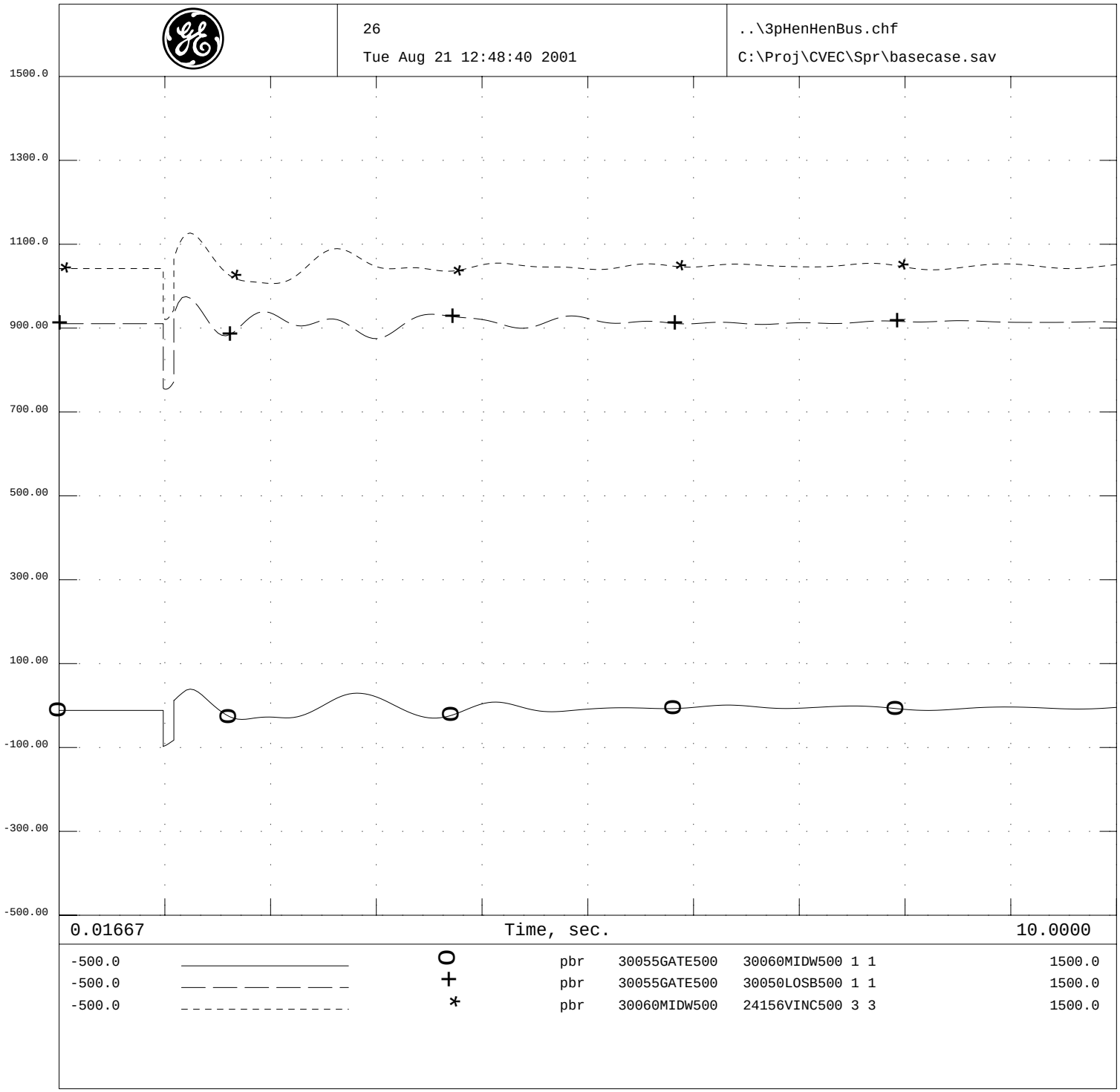

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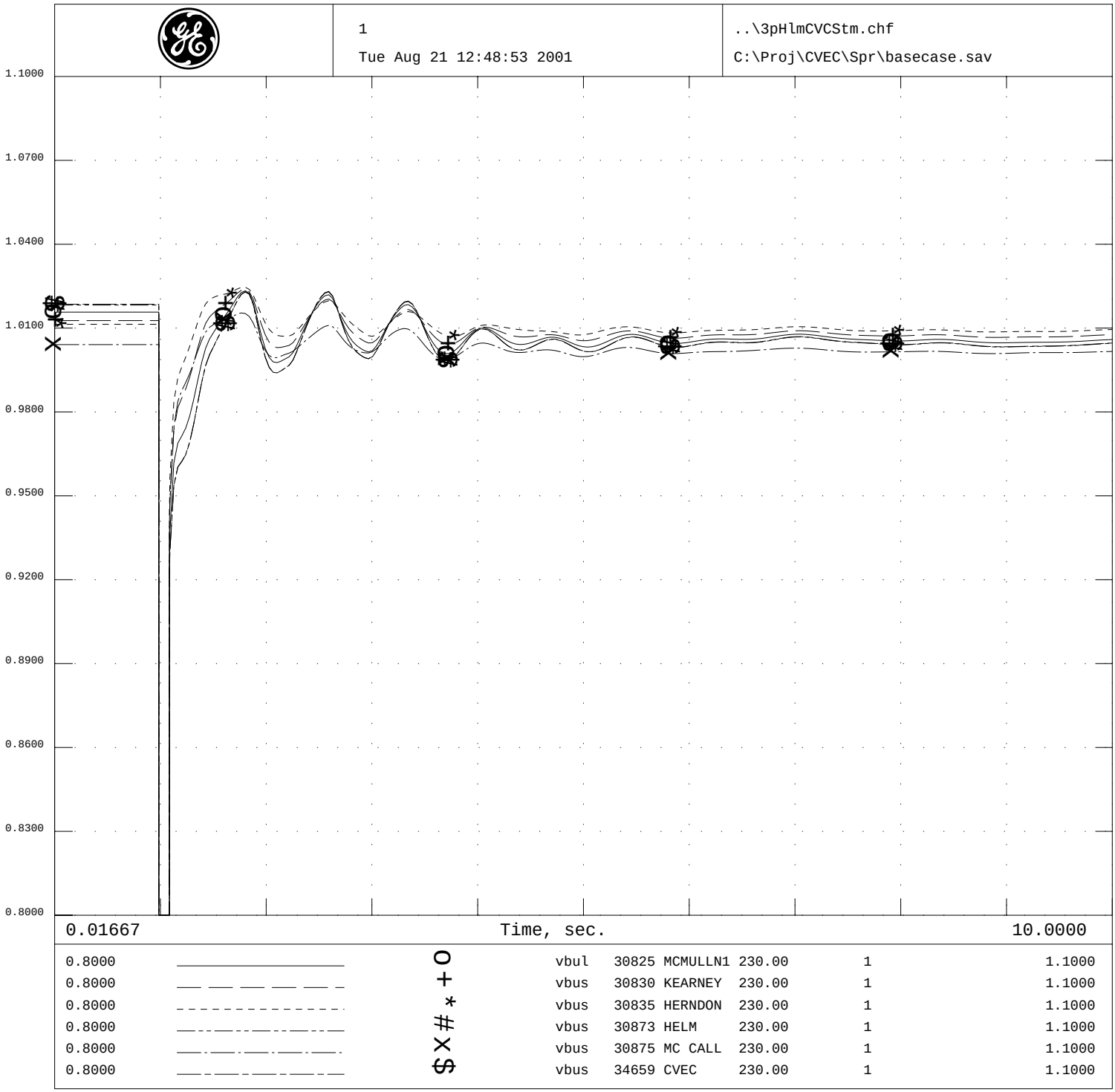
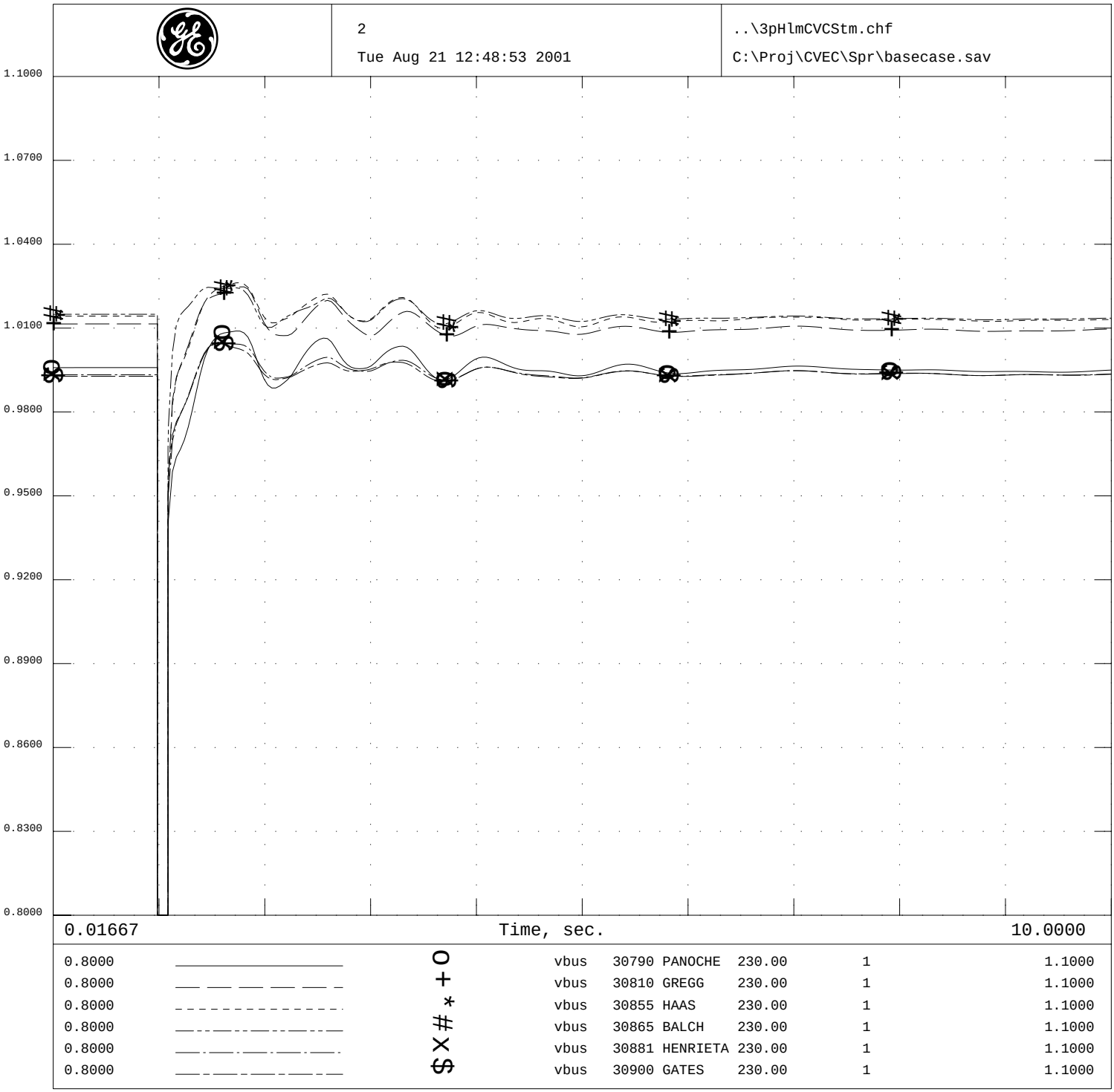


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Trip CVEC Steam Unit
3 phase 6 cycle fault at Helm 230kV bus and trip CVEC Steam Unit

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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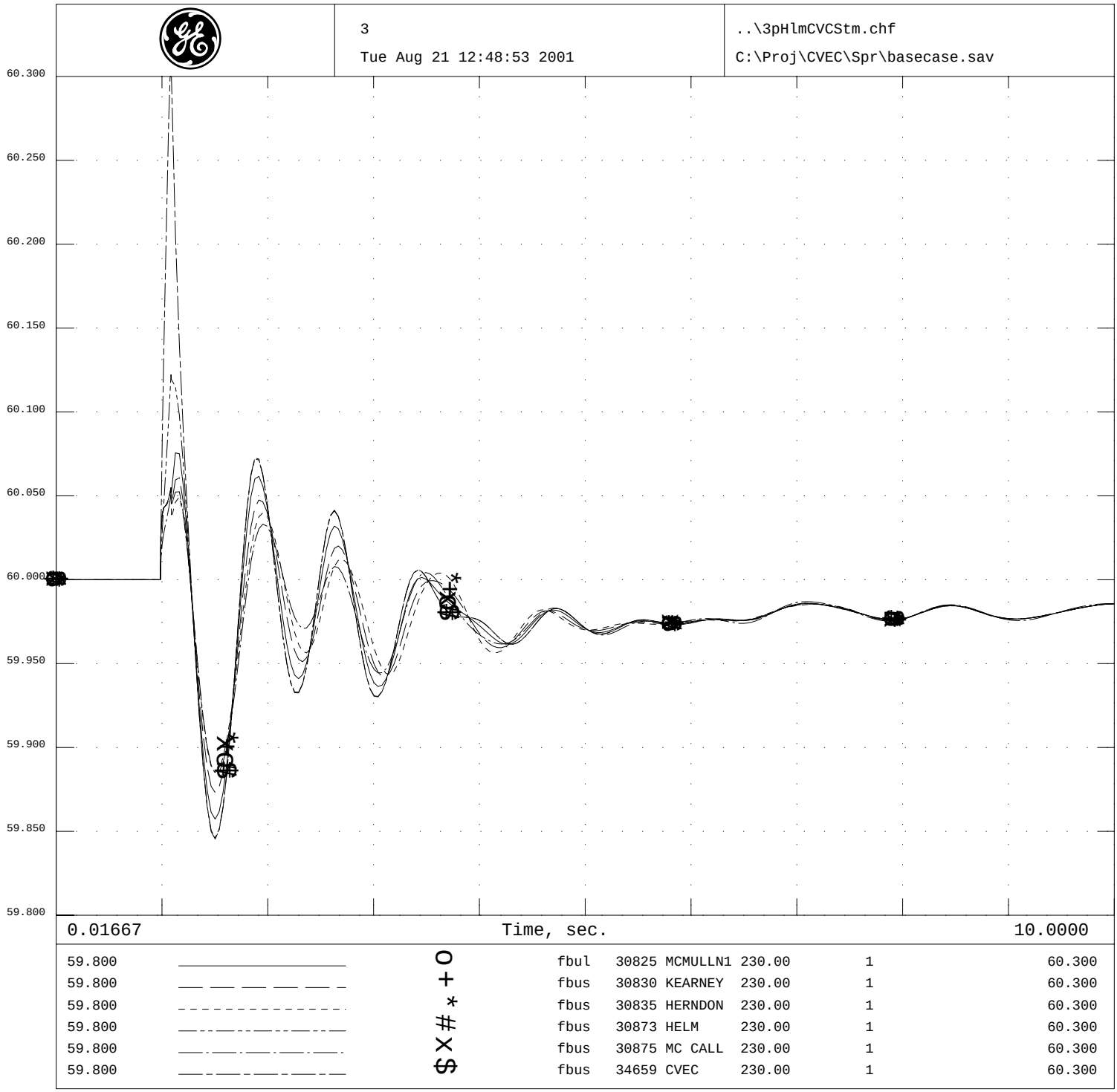

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2004 Heavy Spring Base Case
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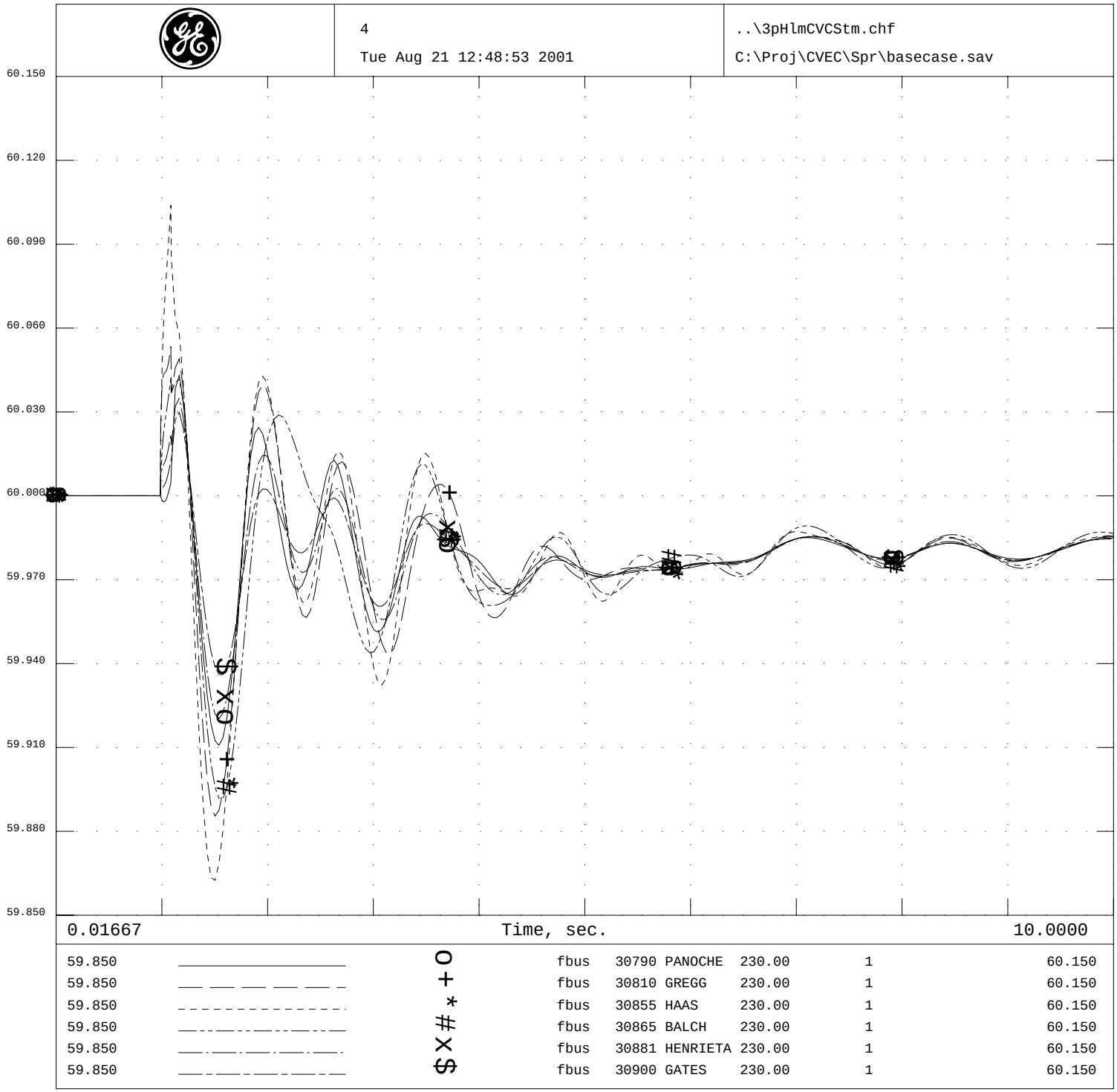
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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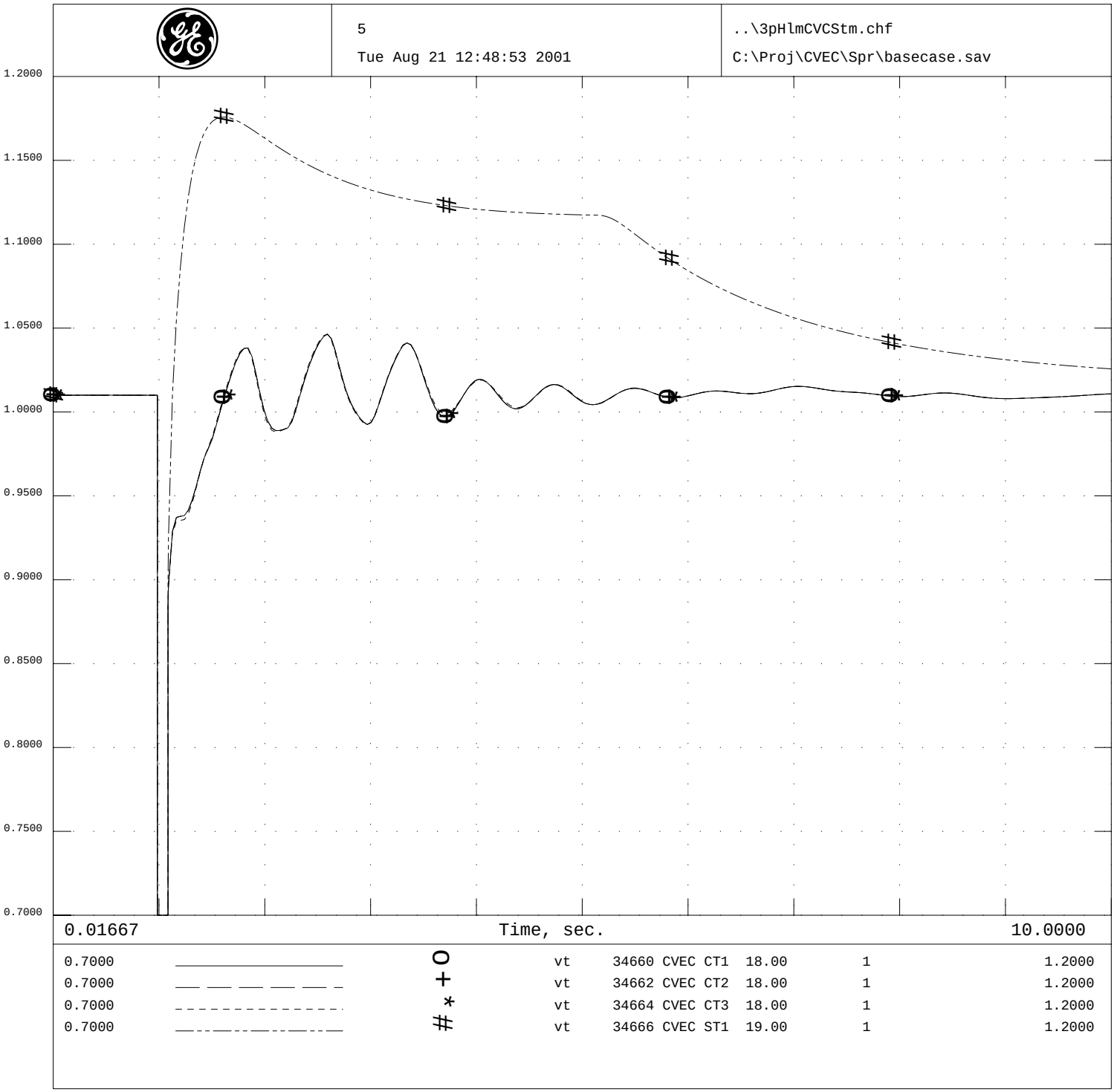

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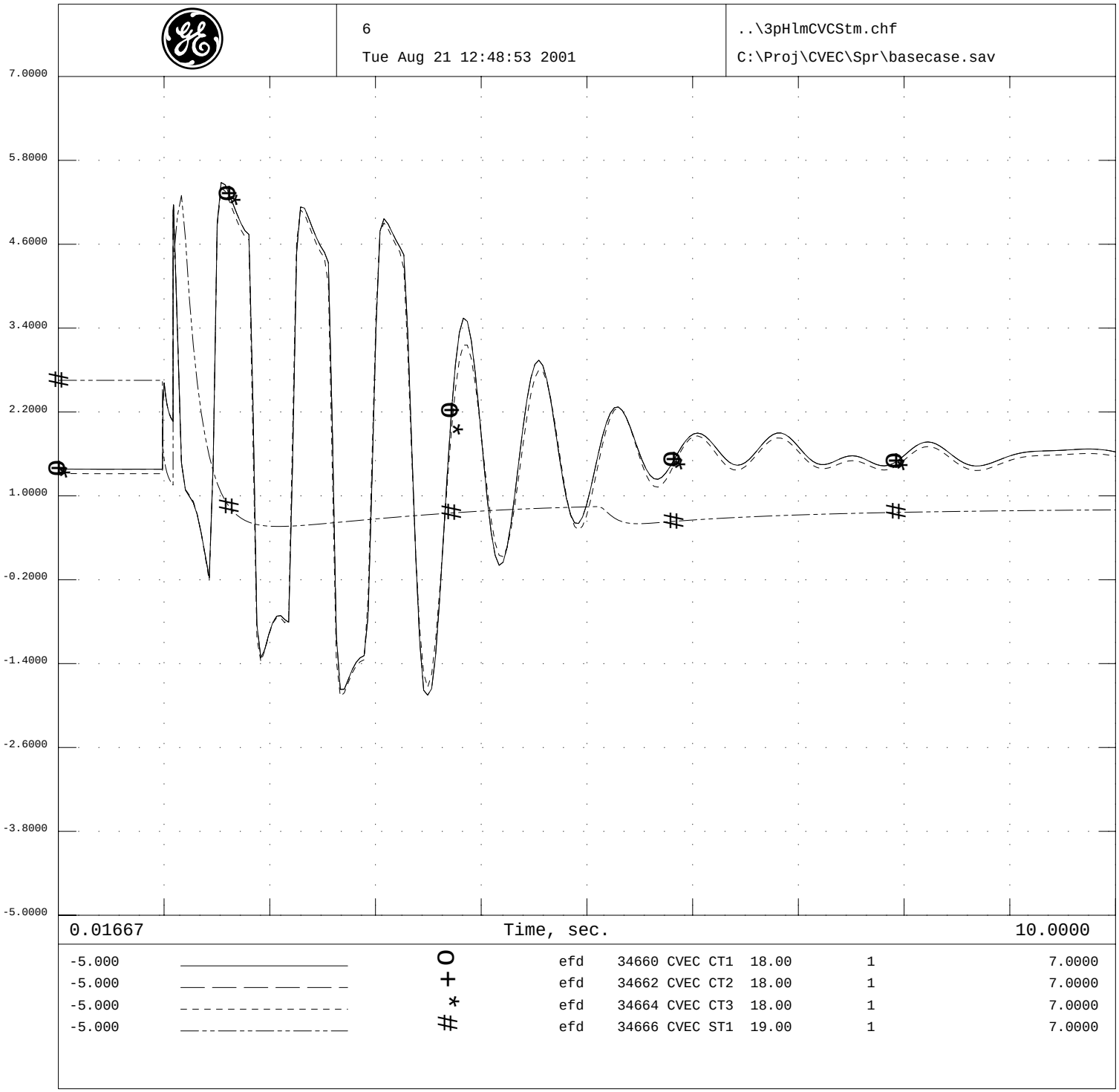
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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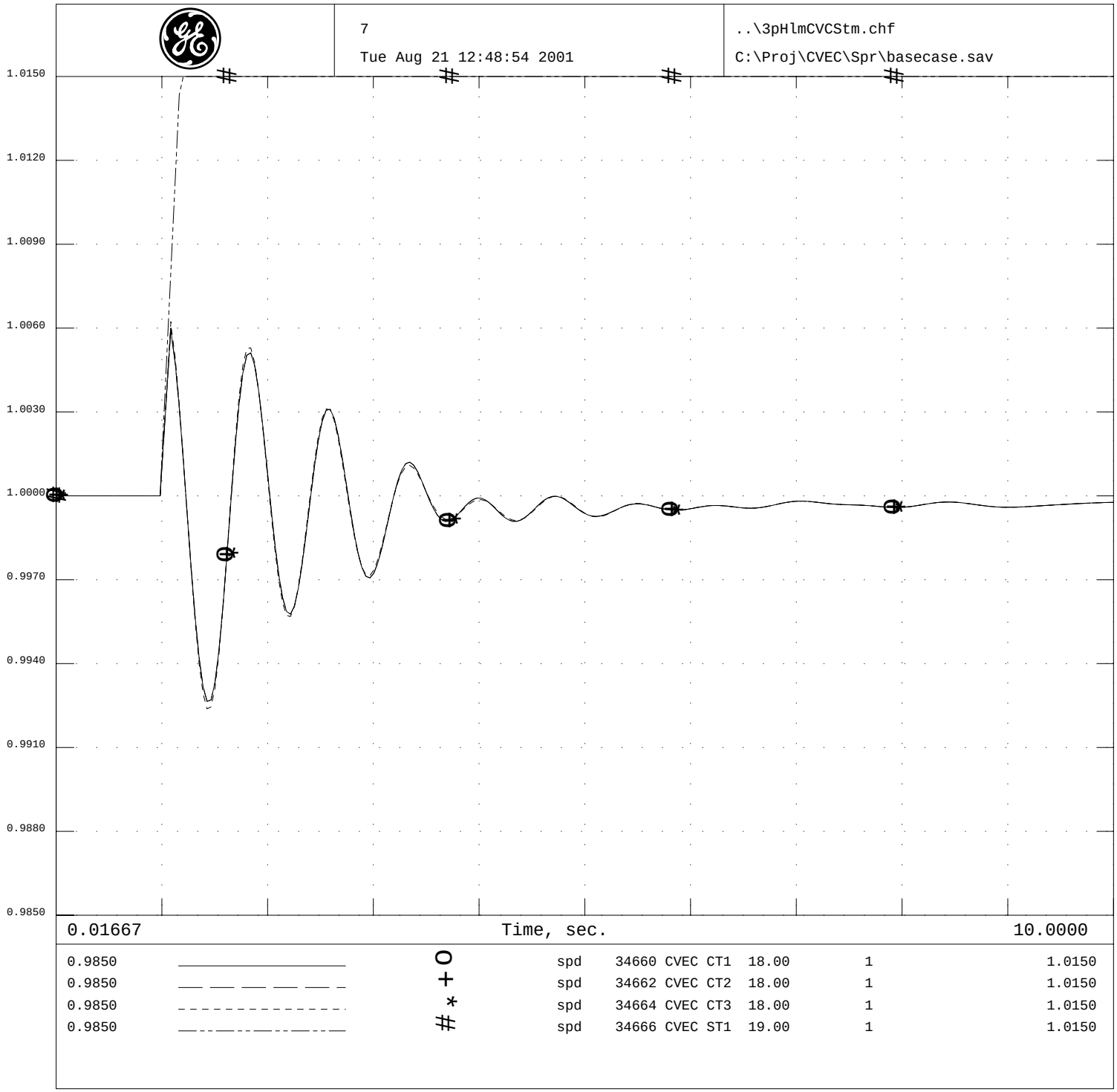

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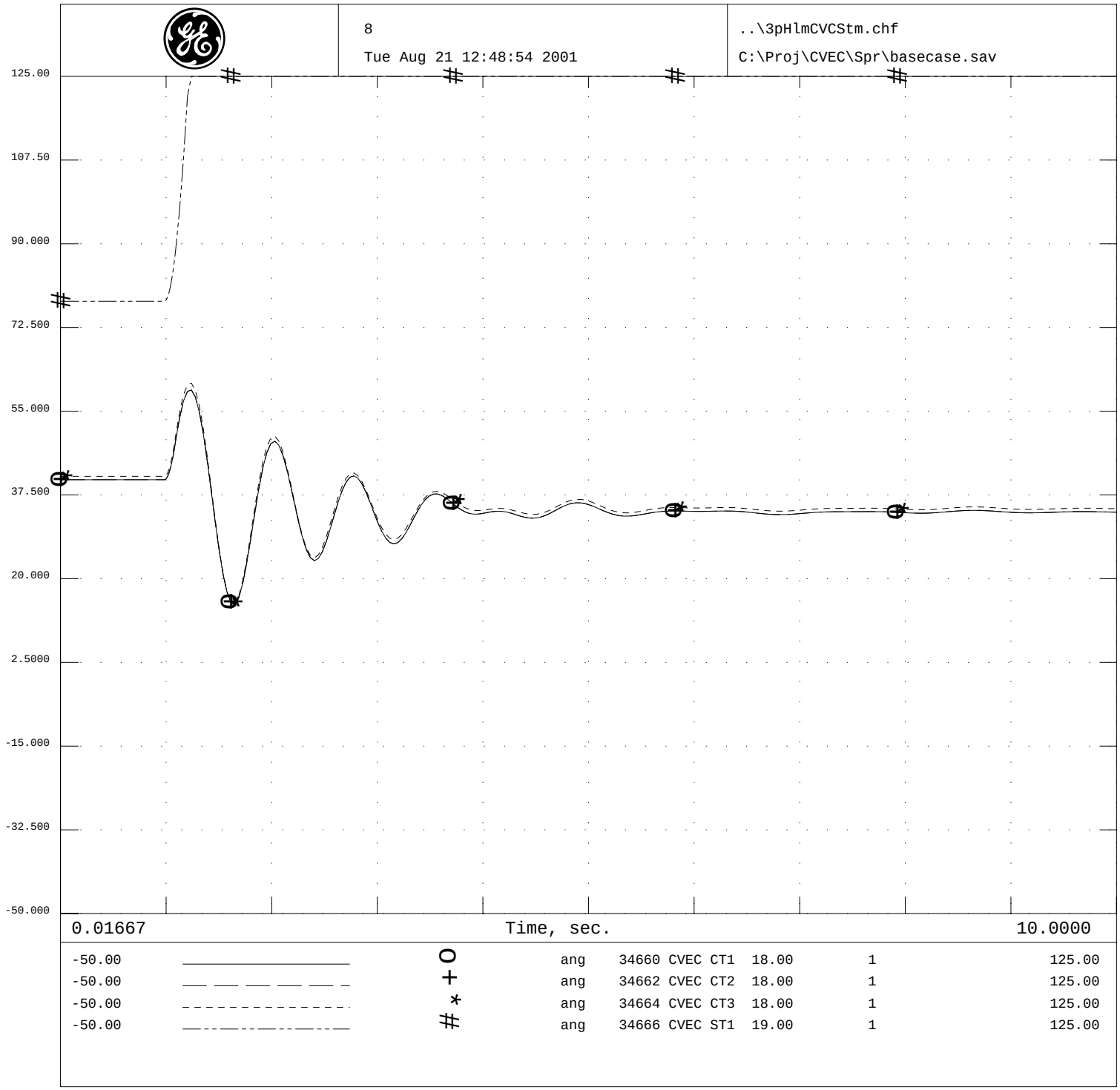
Calpine Corporation
Project Generator Rotor Speed



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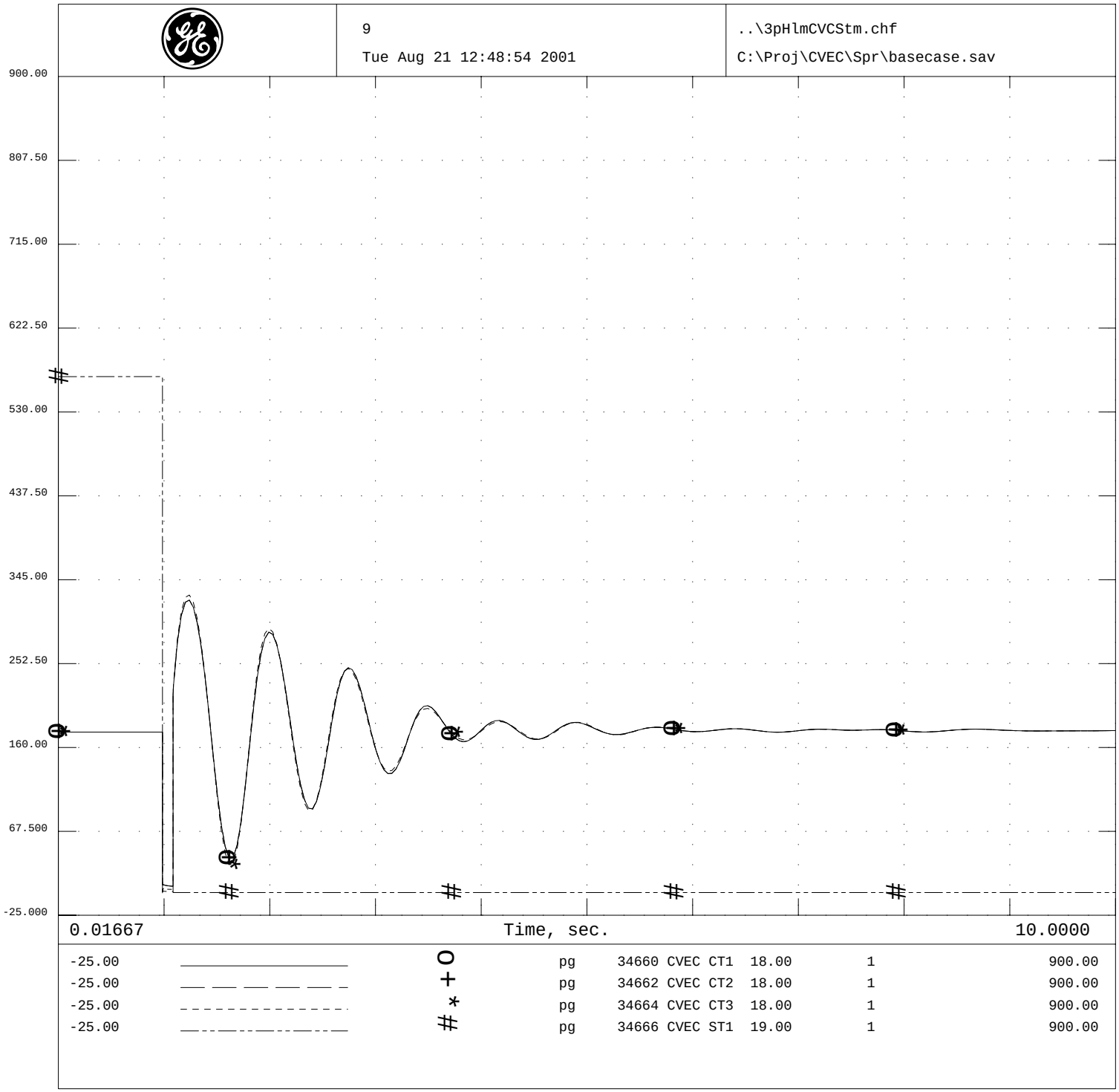
Project Generator Rotor Angle



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Calpine Corporation
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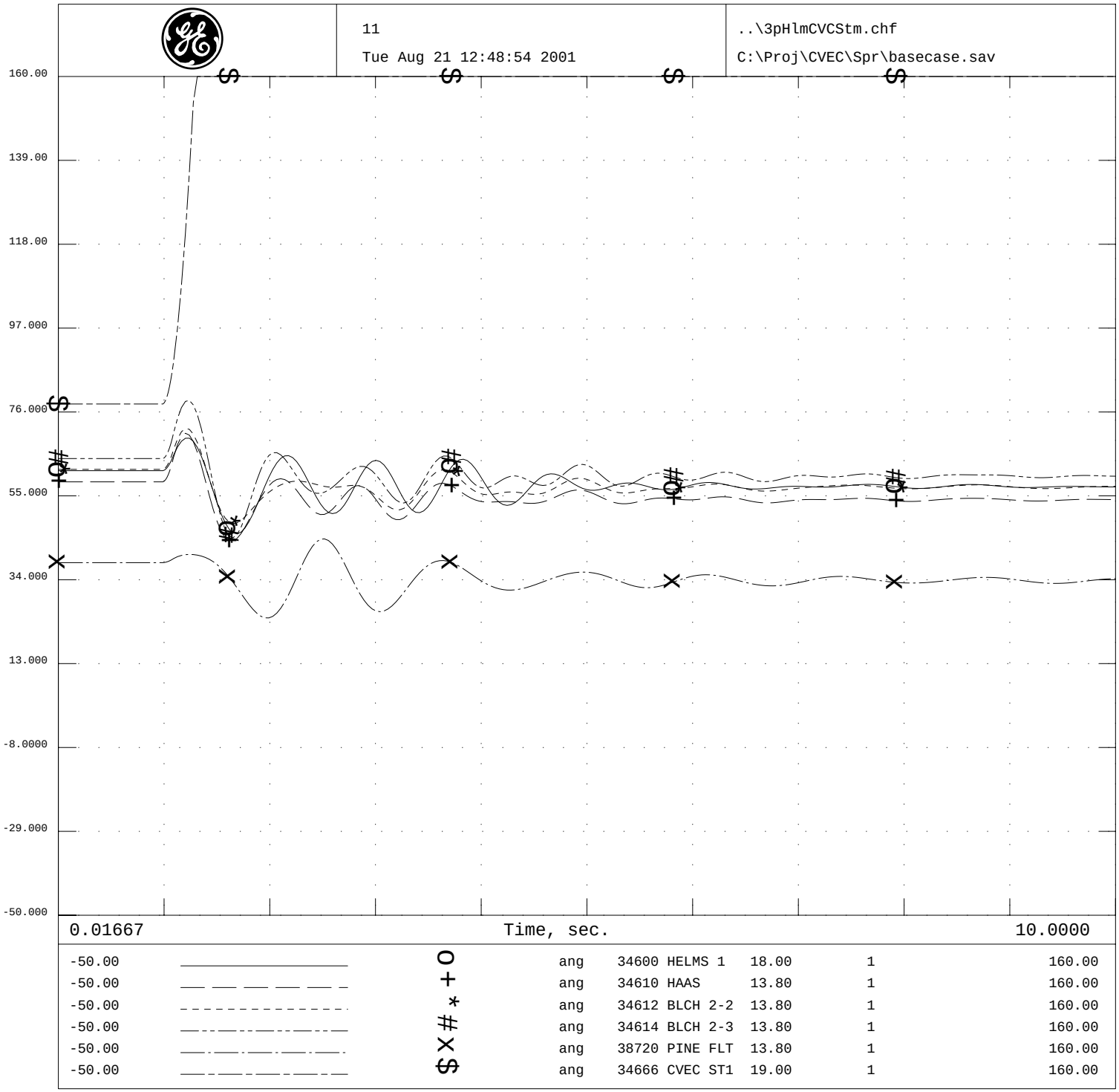

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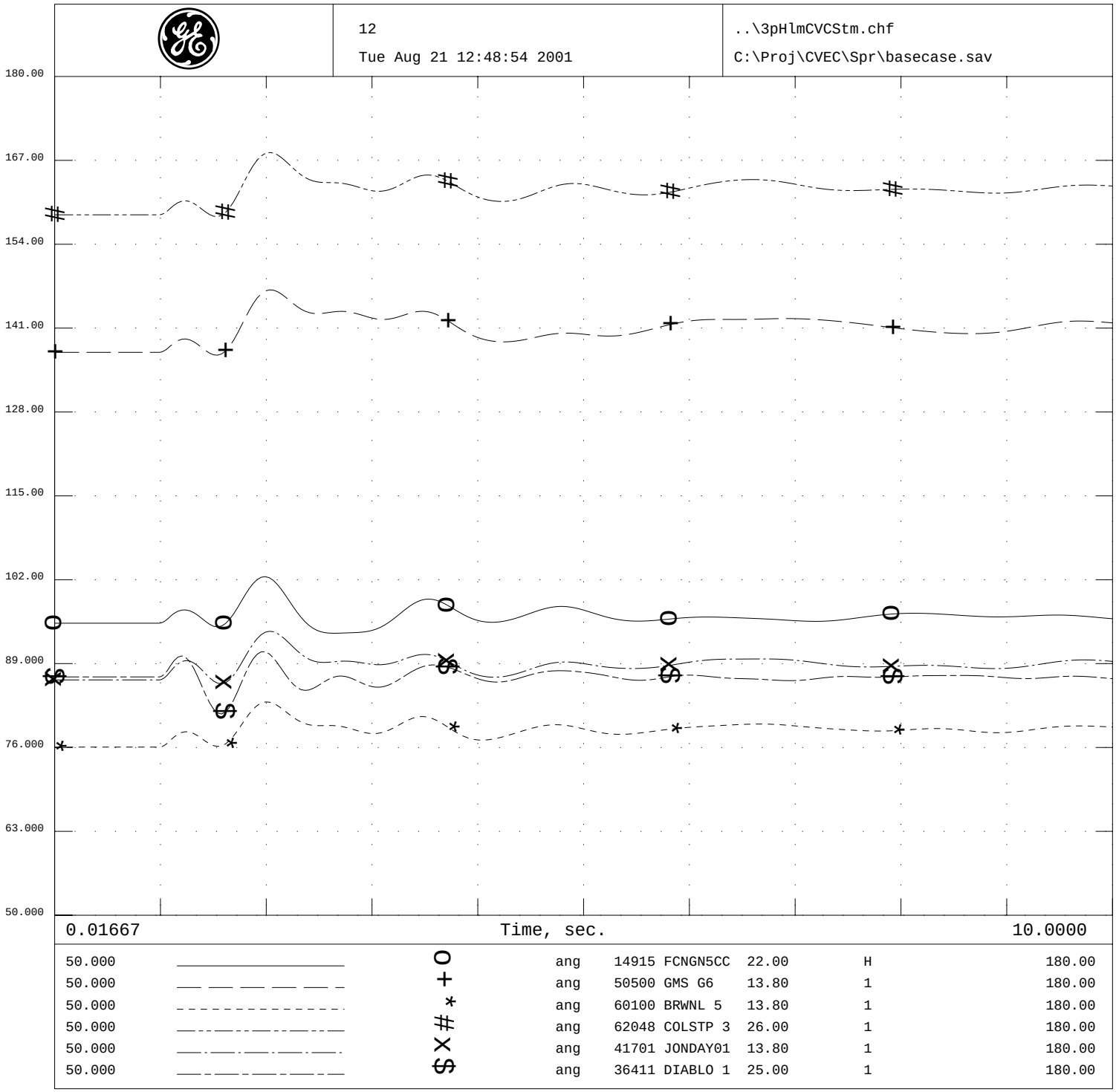

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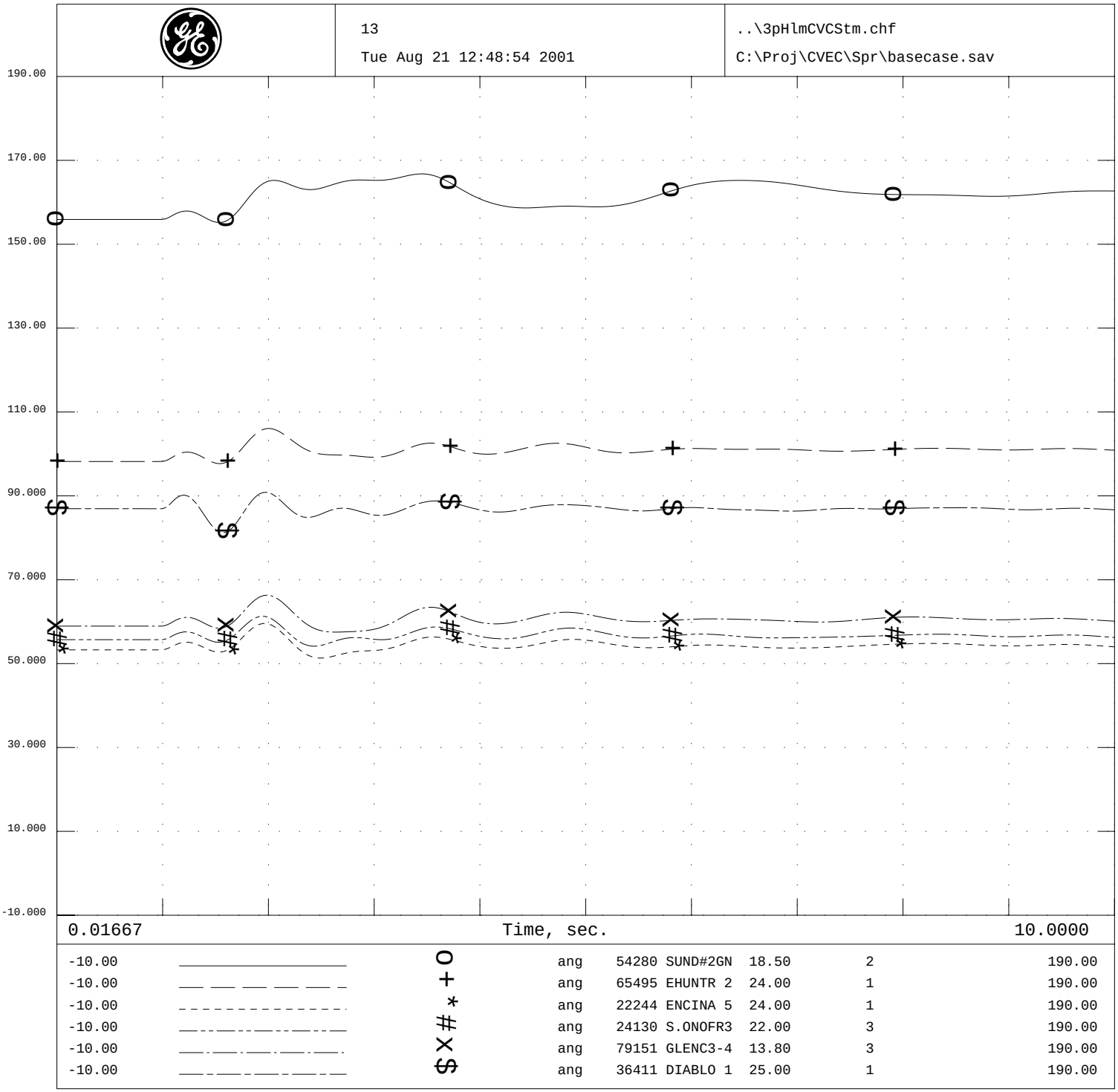

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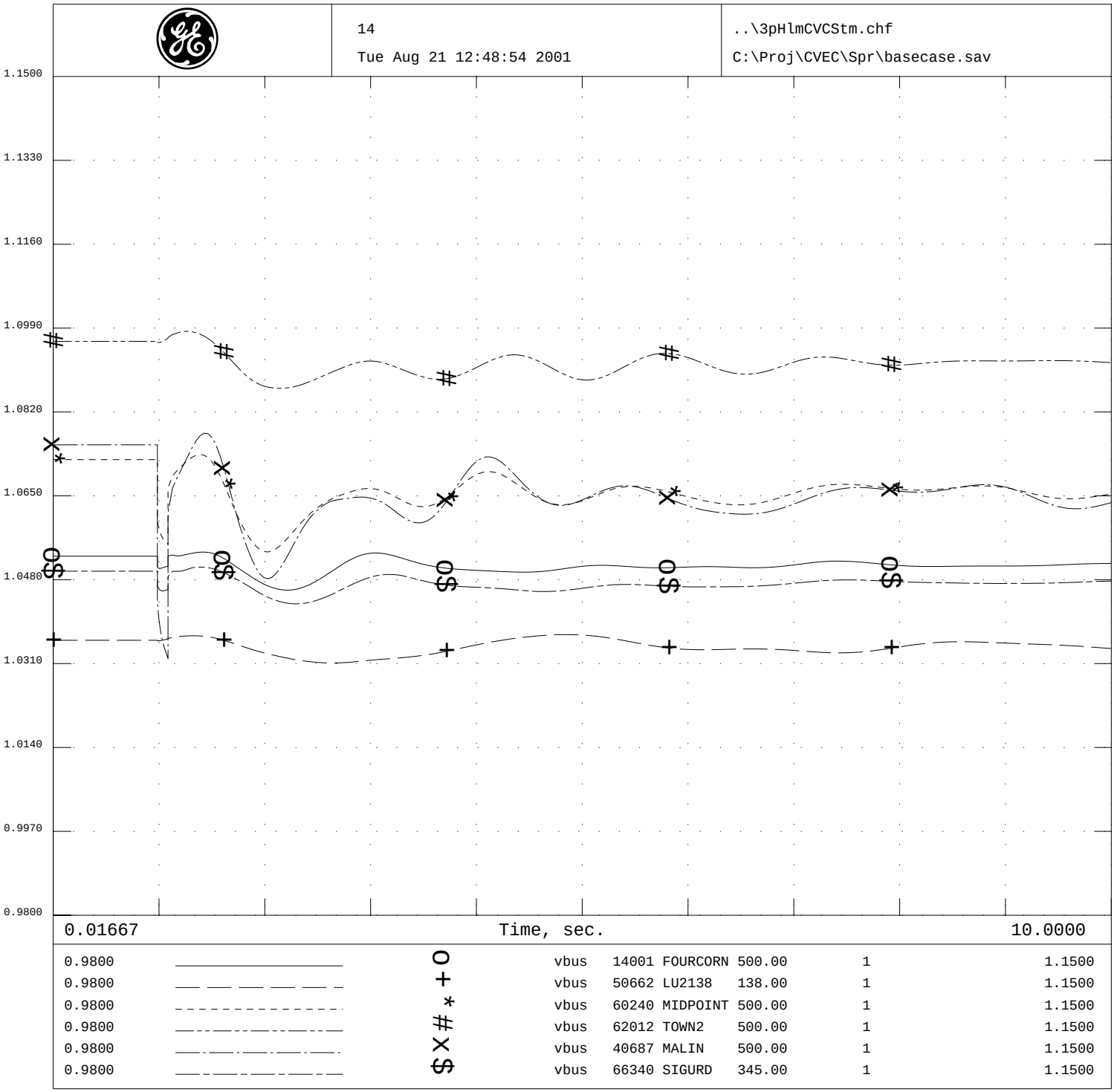

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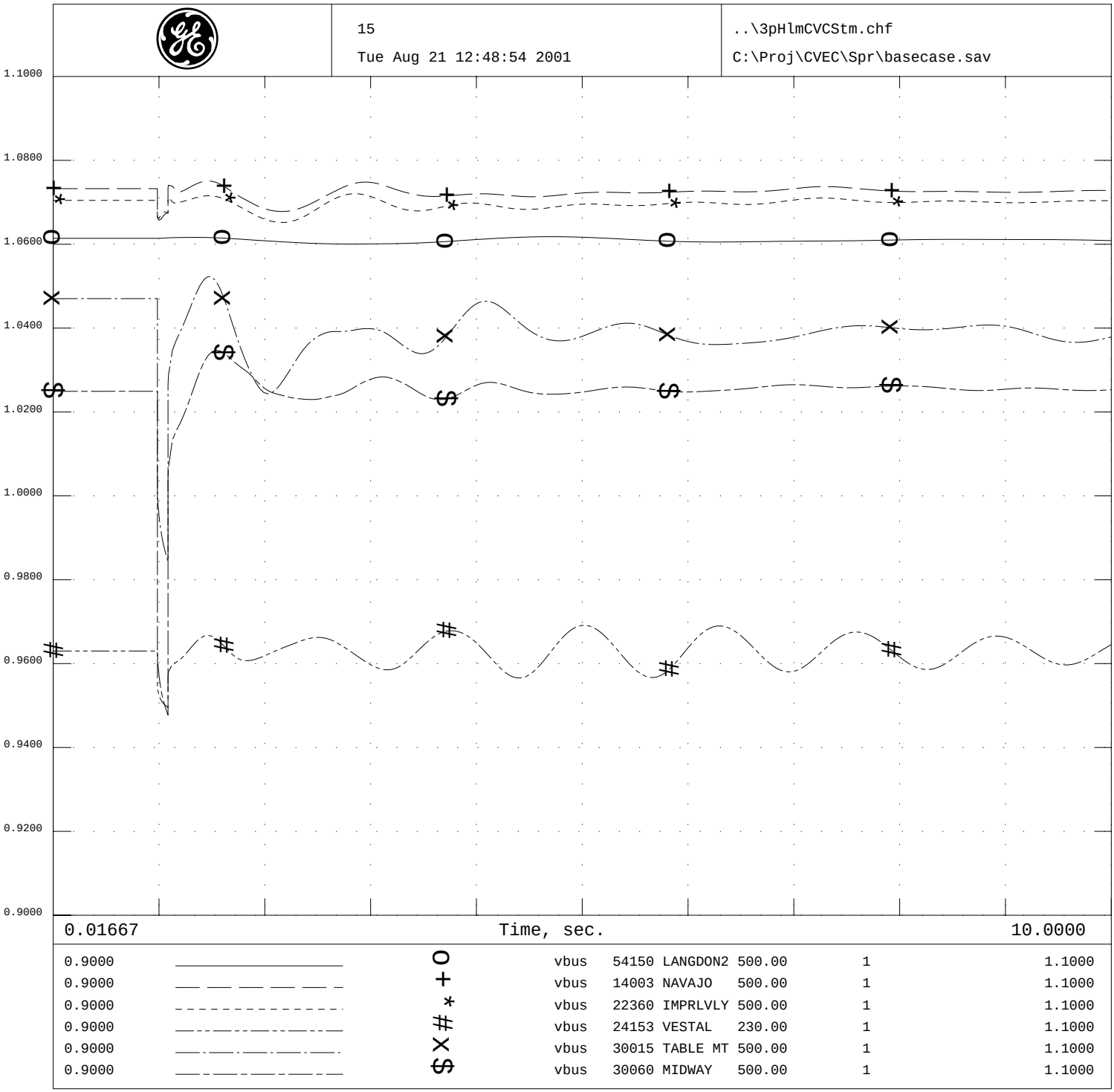

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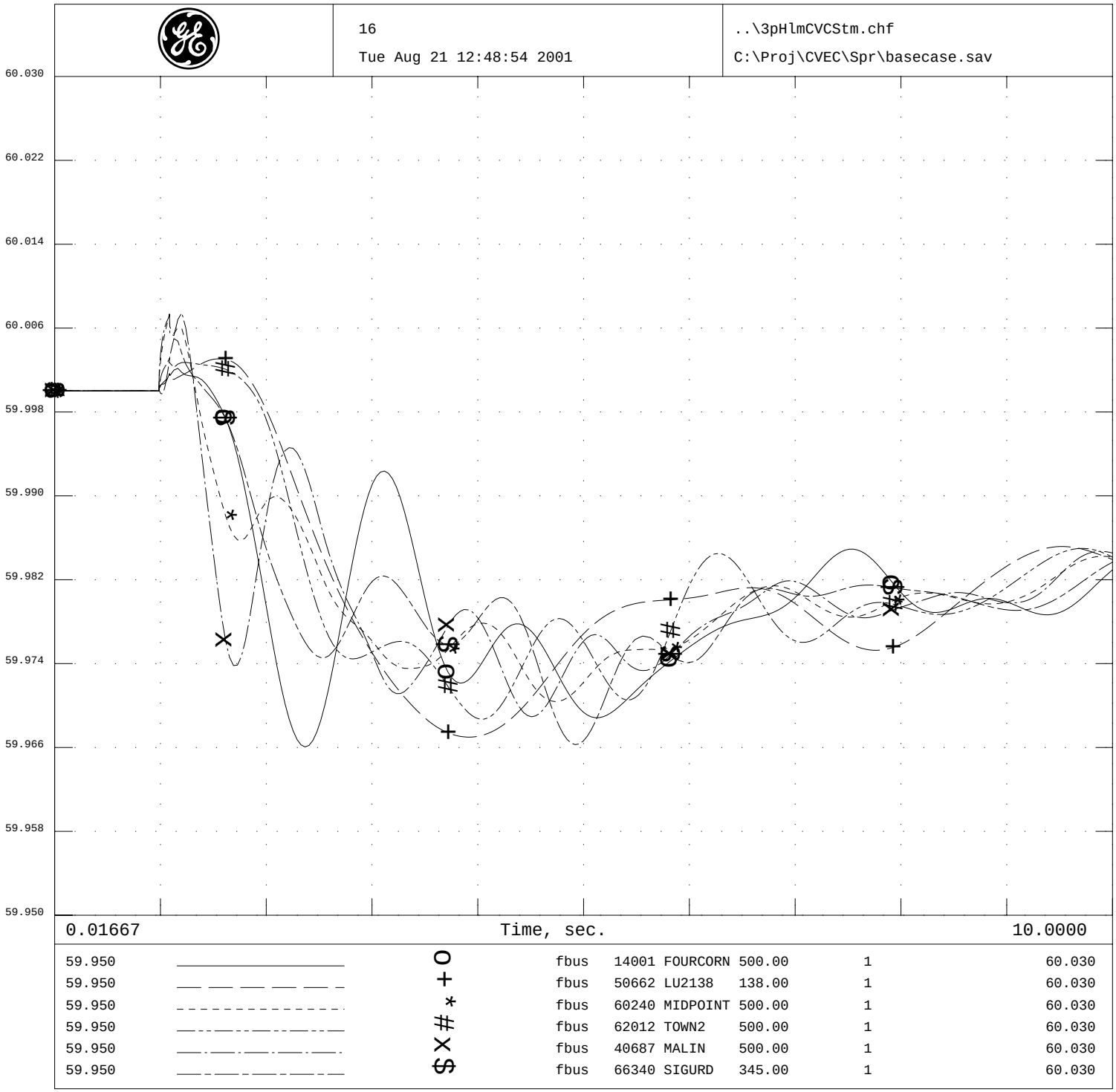

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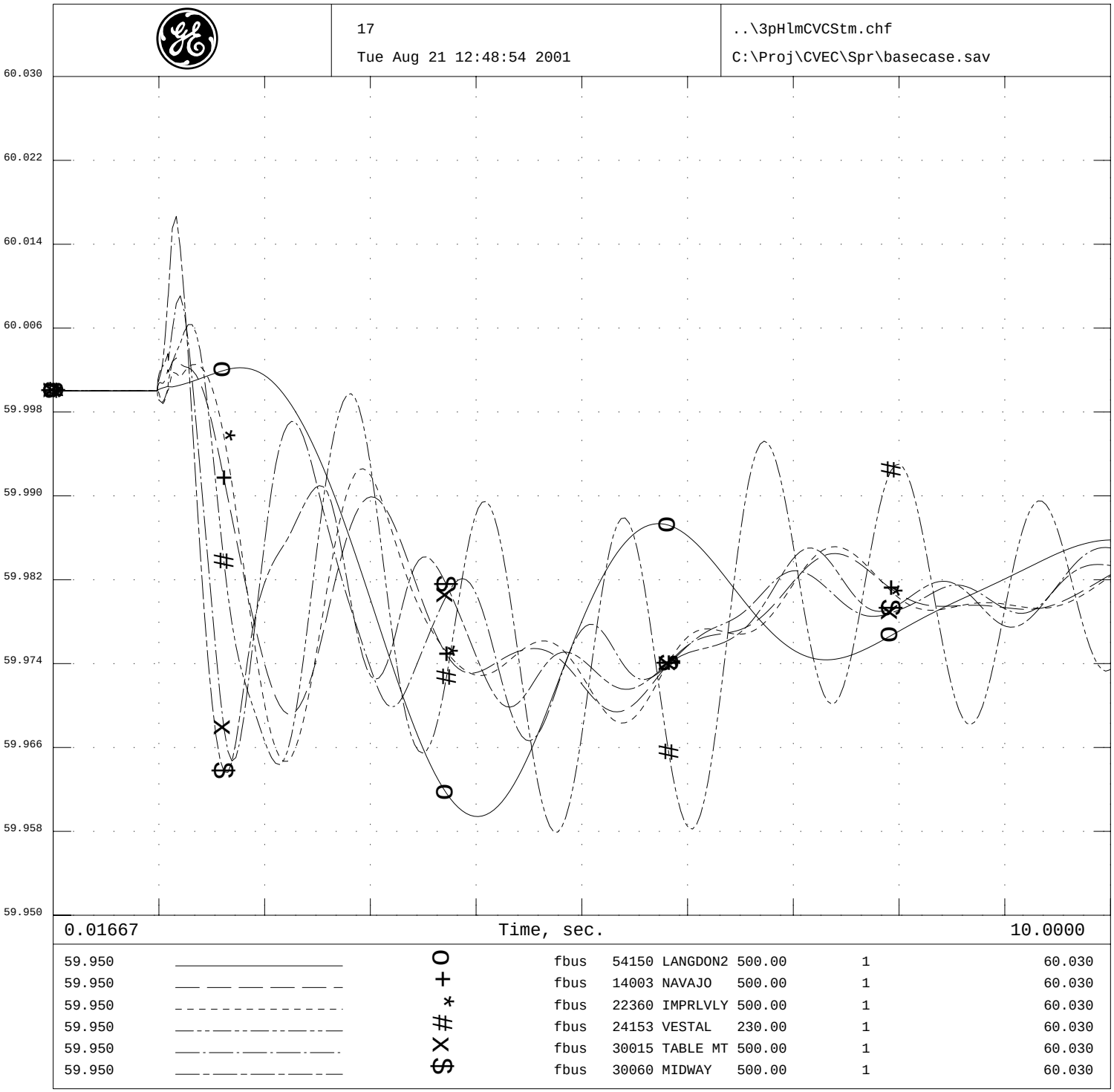

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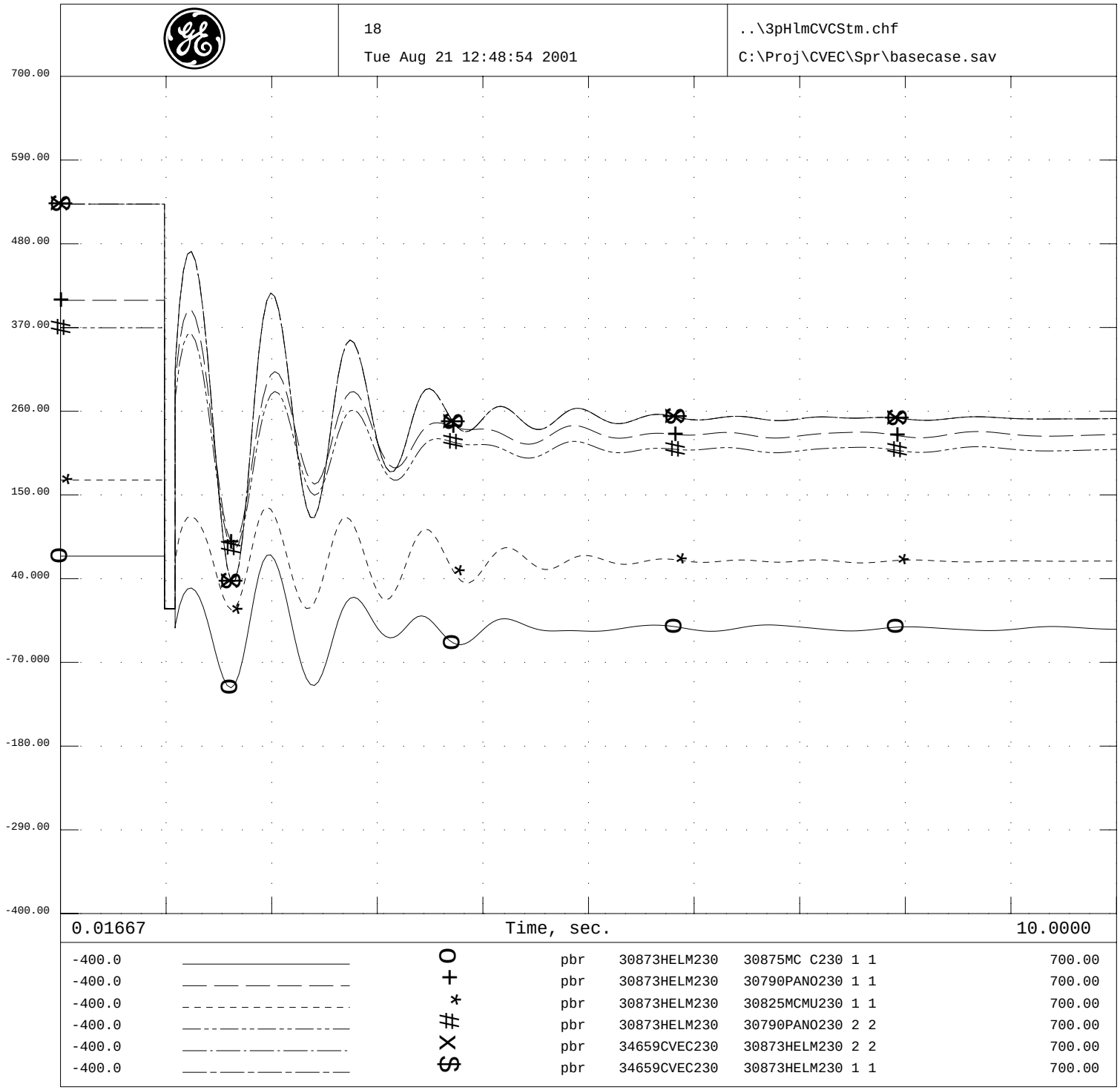

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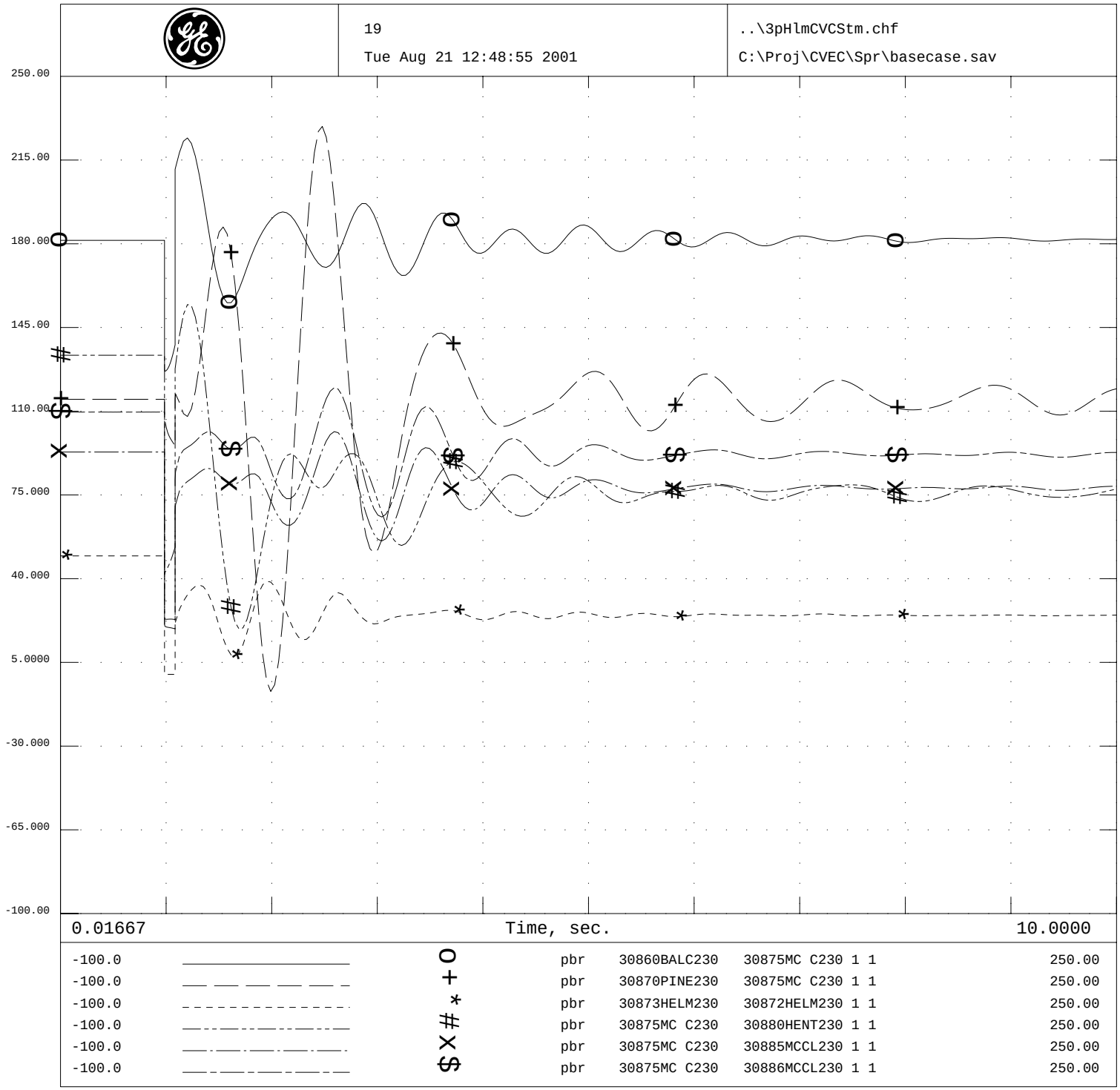

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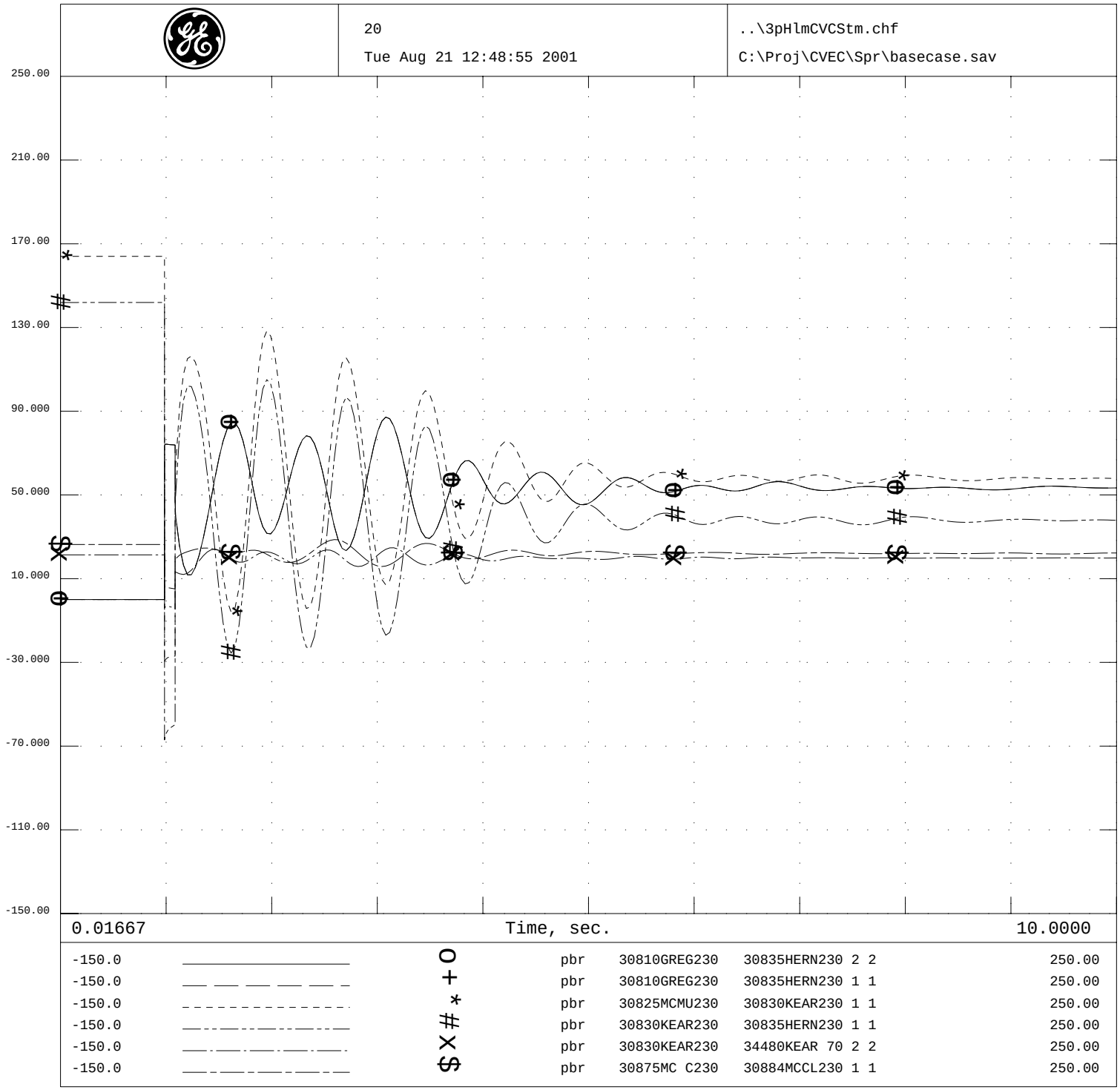

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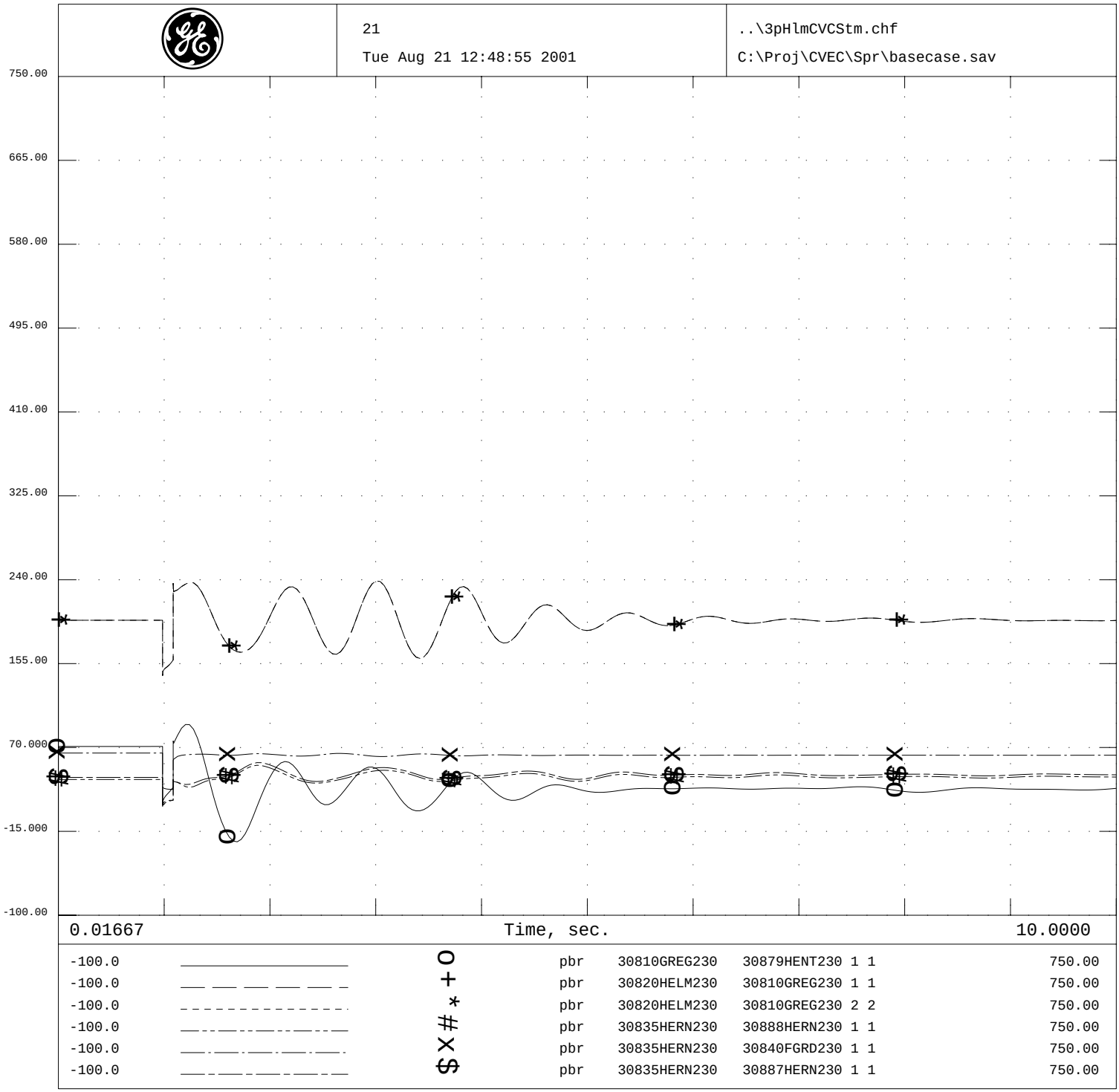

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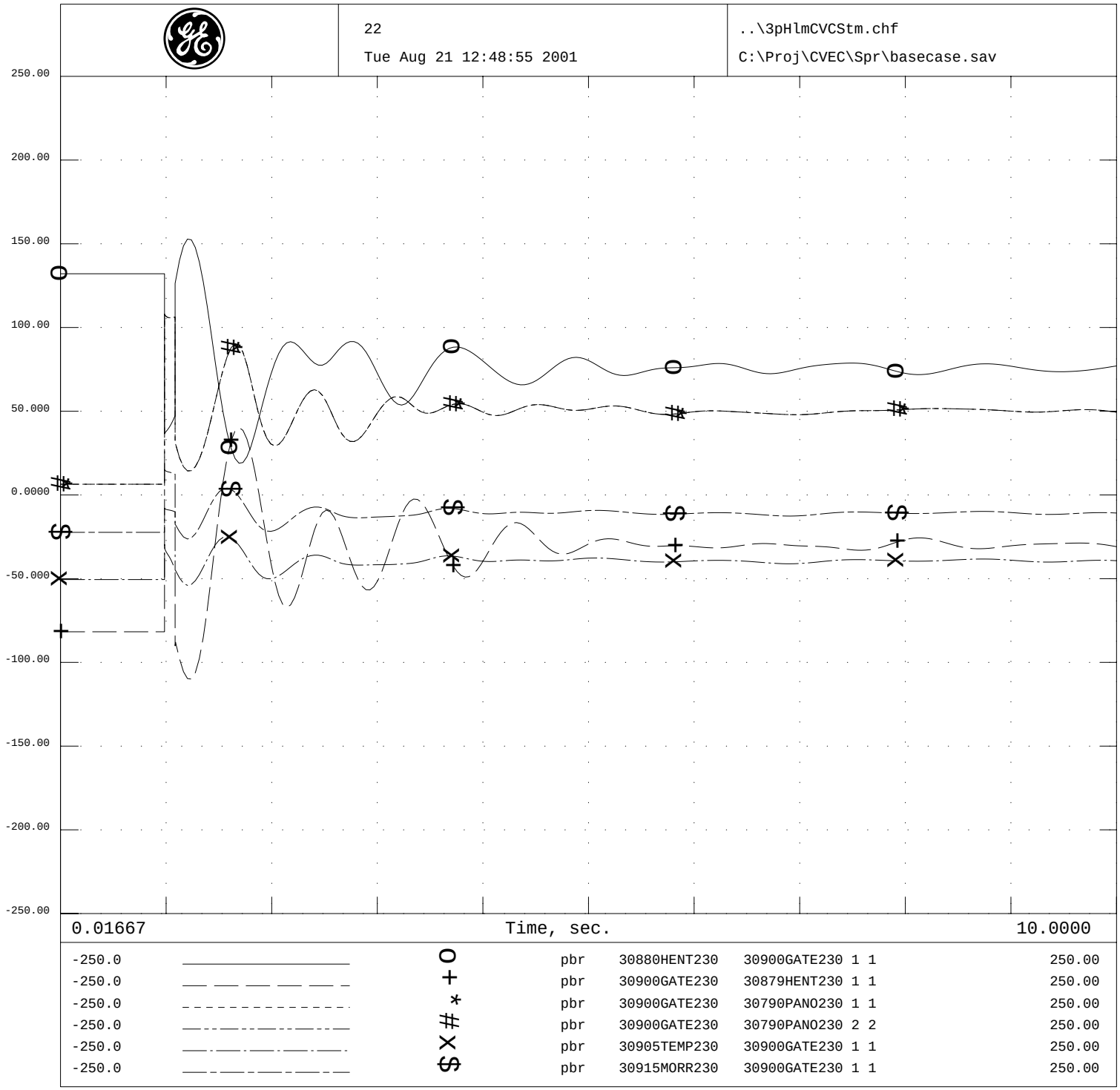
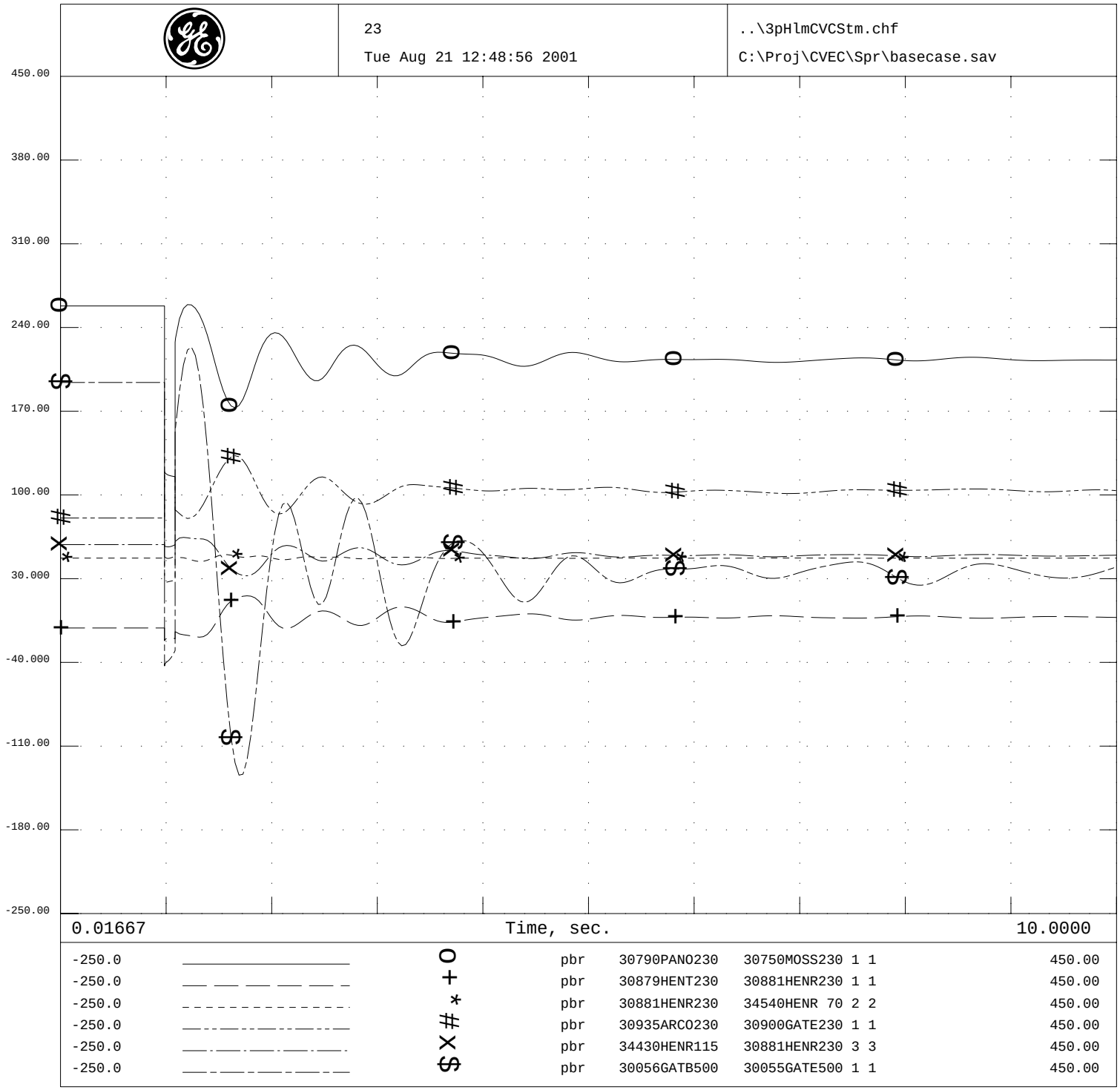


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Trip CVEC Steam Unit
3 phase 6 cycle fault at Helm 230kV bus and trip CVEC Steam Unit

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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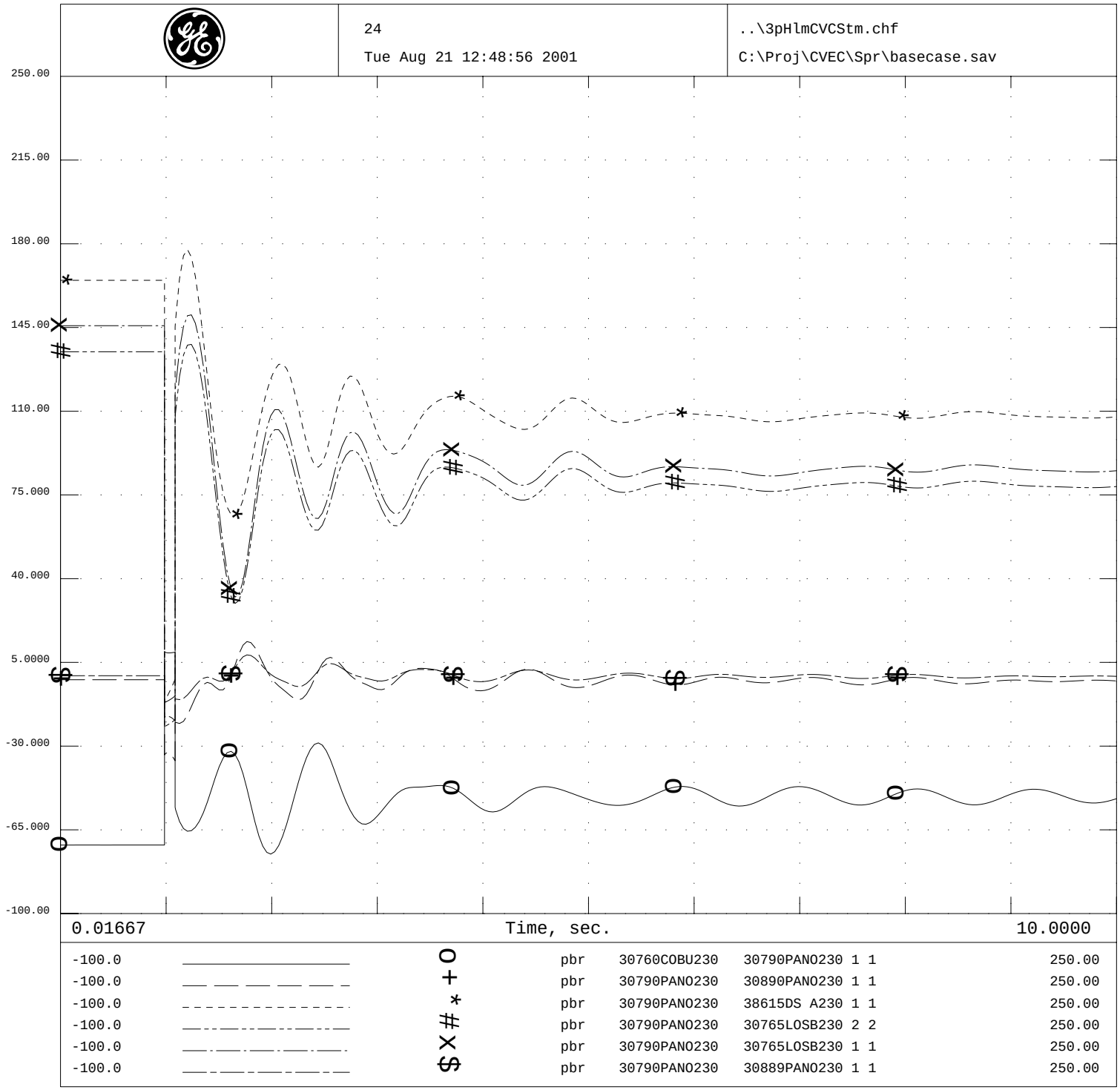

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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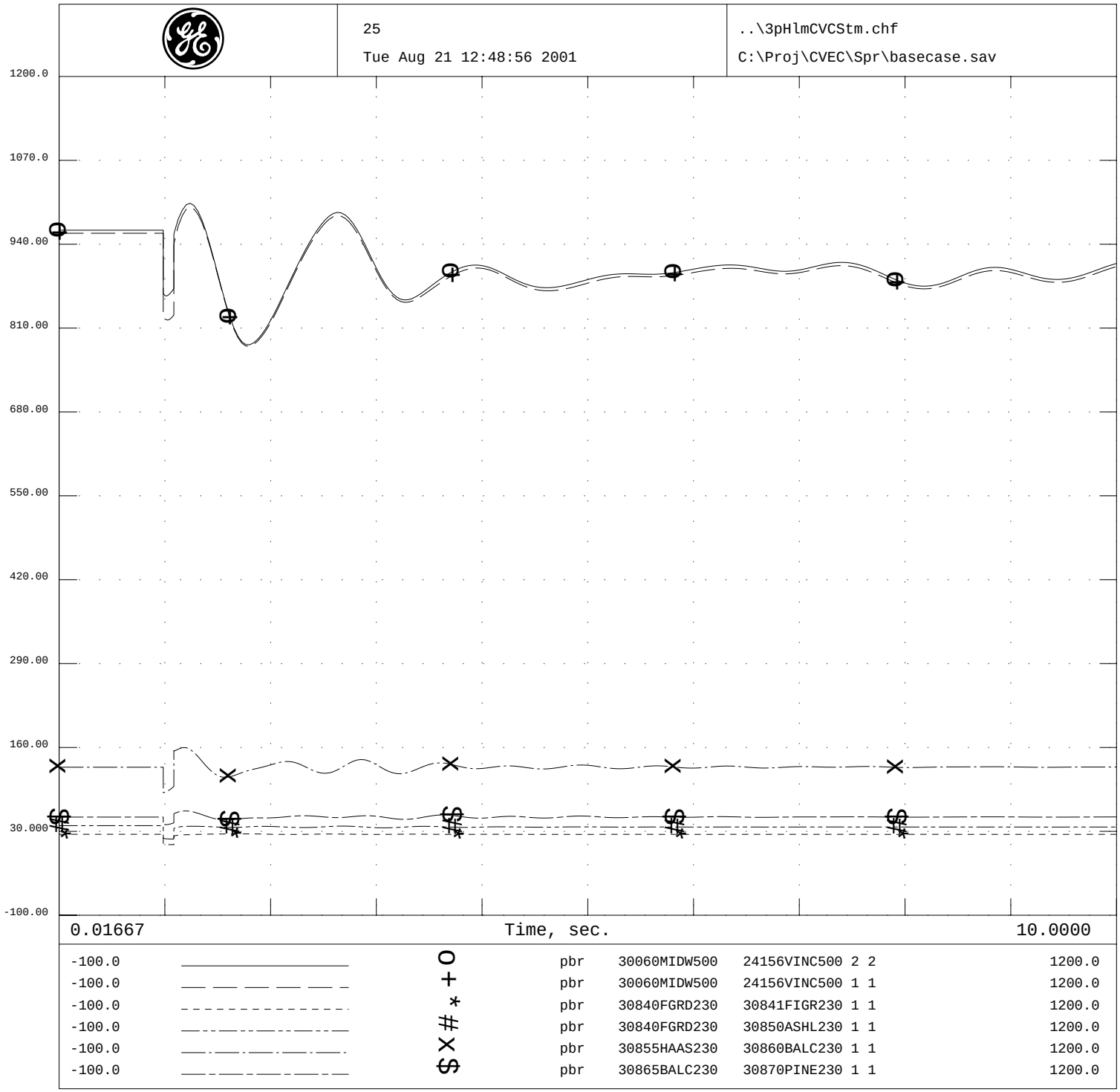

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Calpine Corporation
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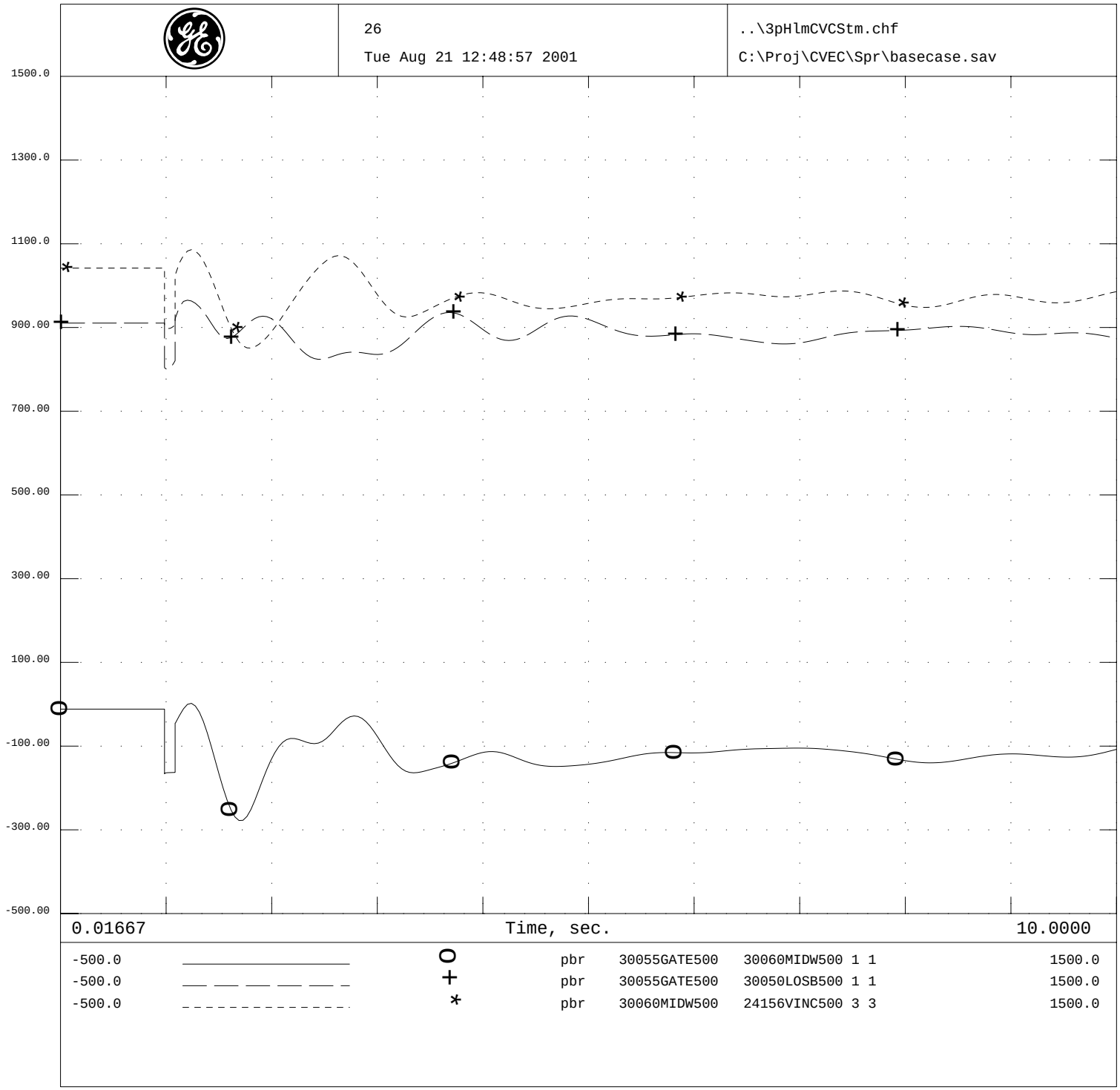

Calpine Corporation - Central Valley Energy Center System Impact Study
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Calpine Corporation
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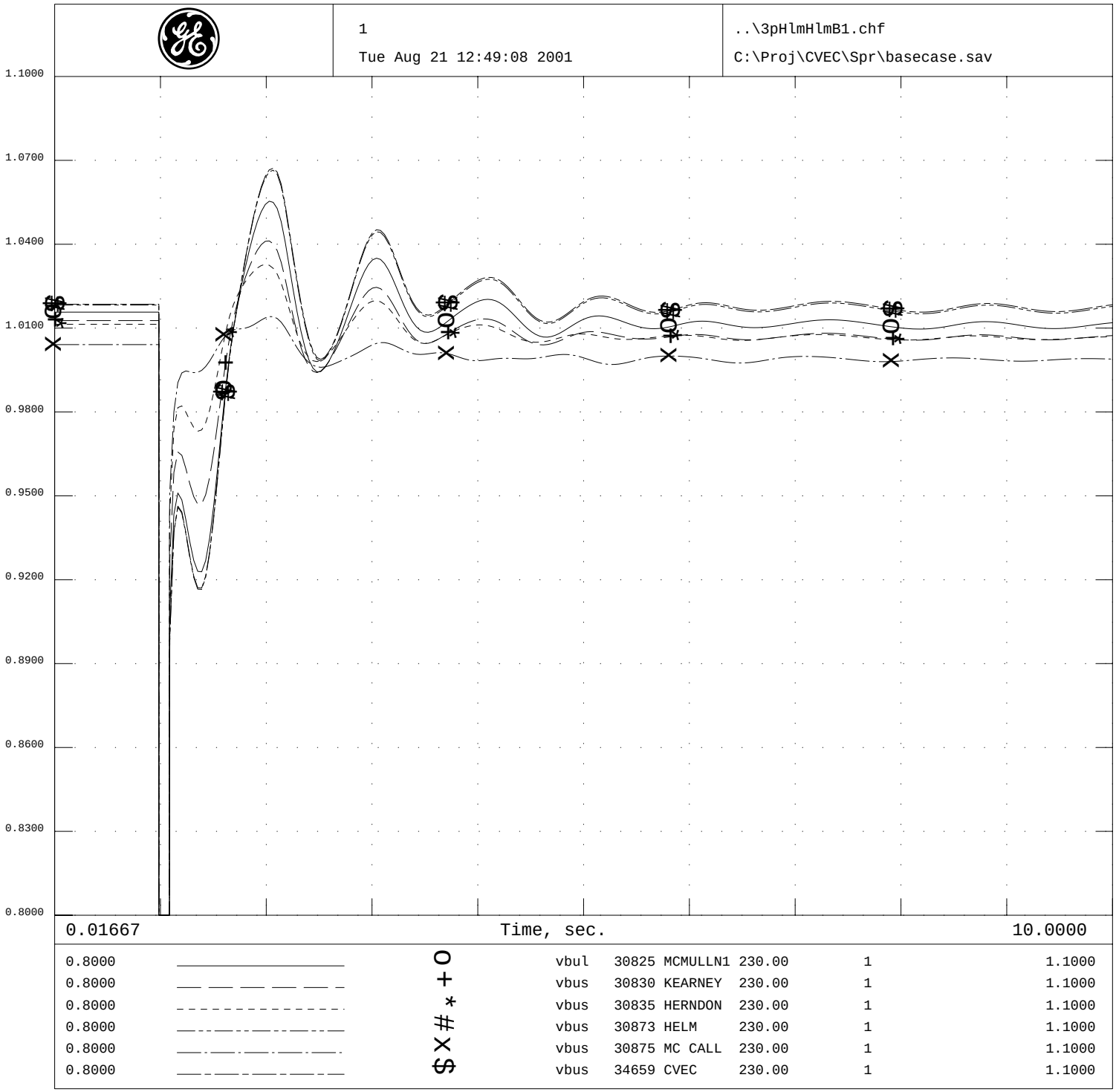
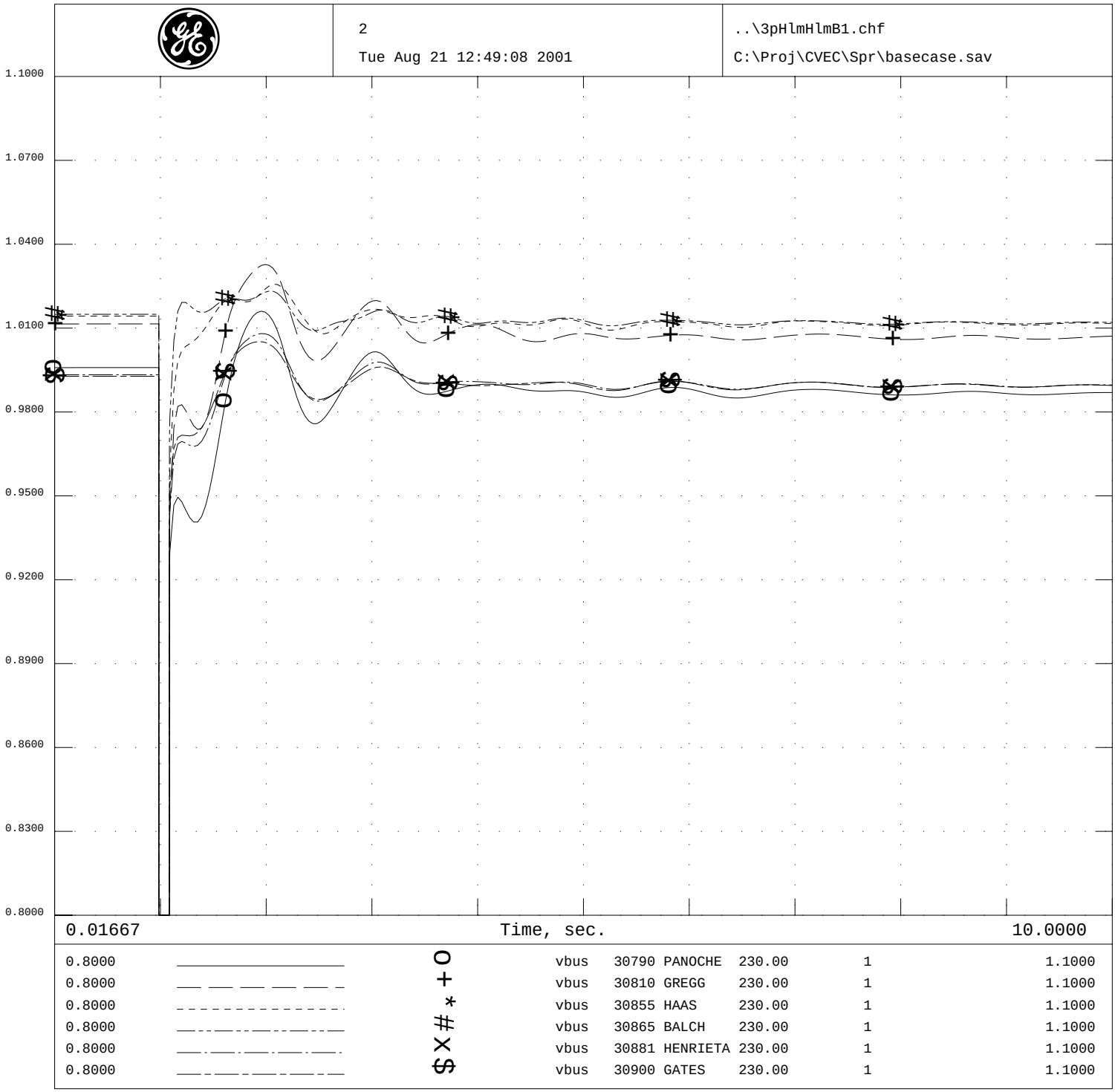


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Helm 230kV Bus #1 Outage
3 phase 6 cycle fault at Helm 230kV bus and clear bus #1

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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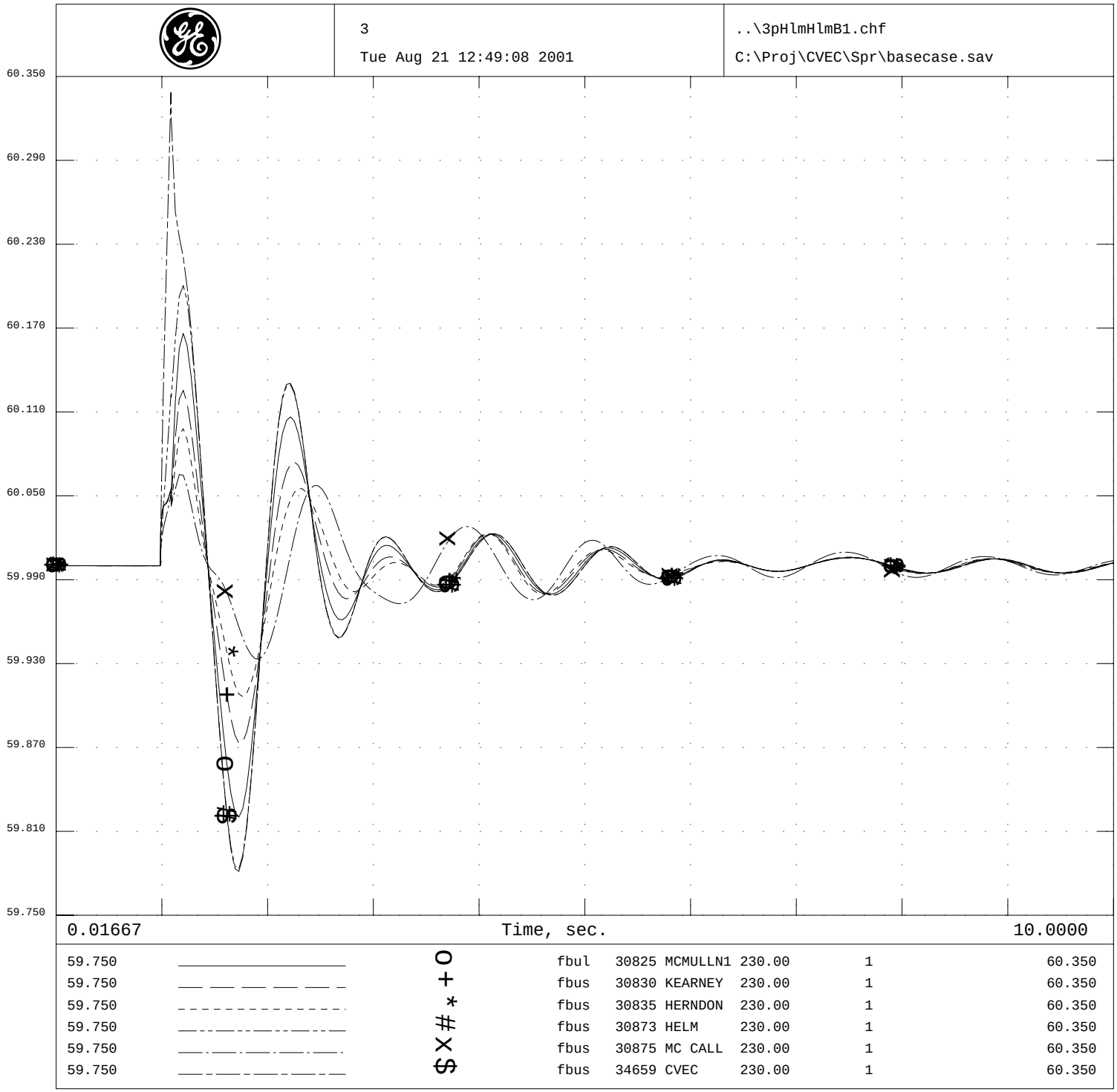

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2004 Heavy Spring Base Case
CVEC @ 1100MW
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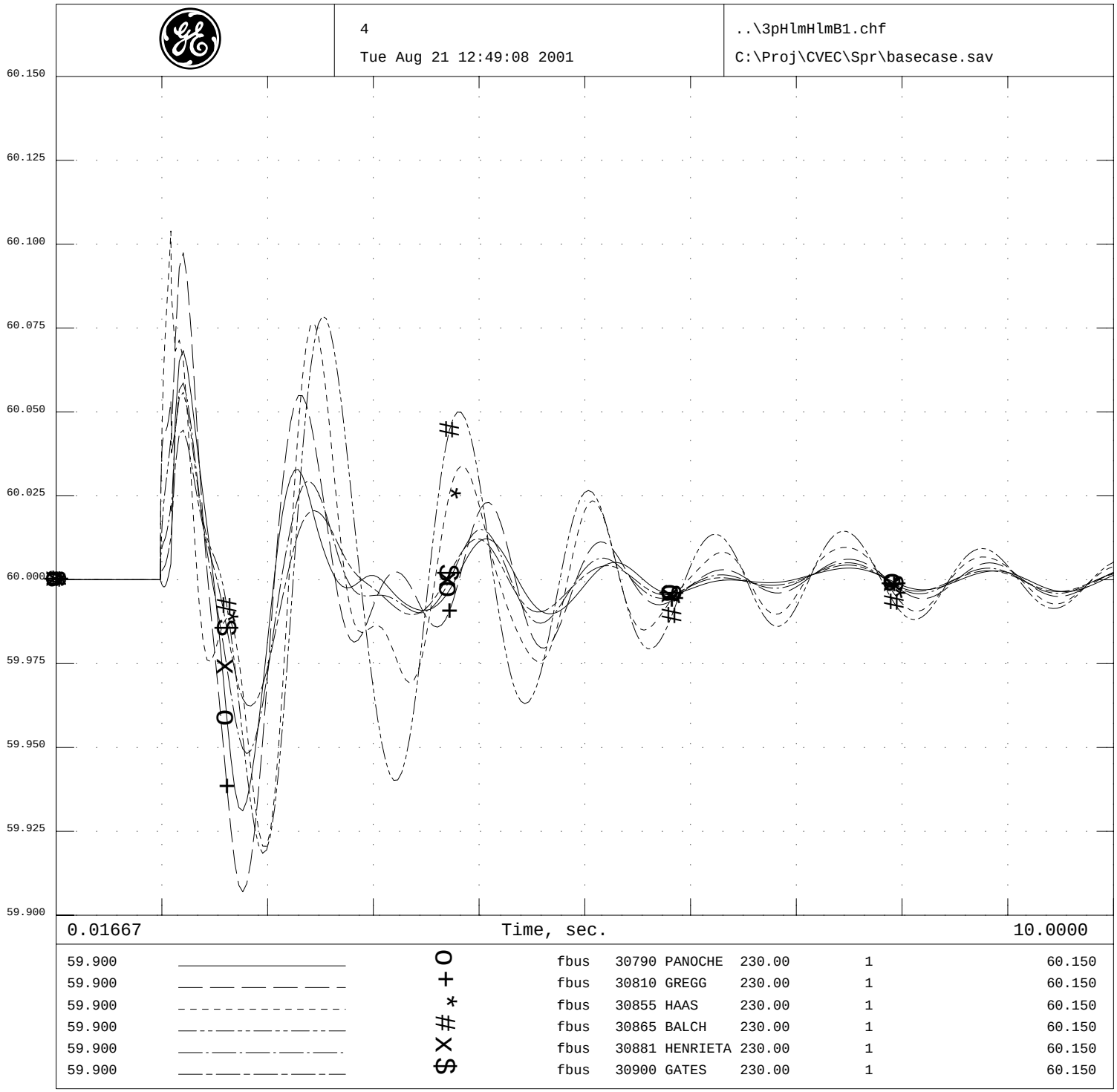
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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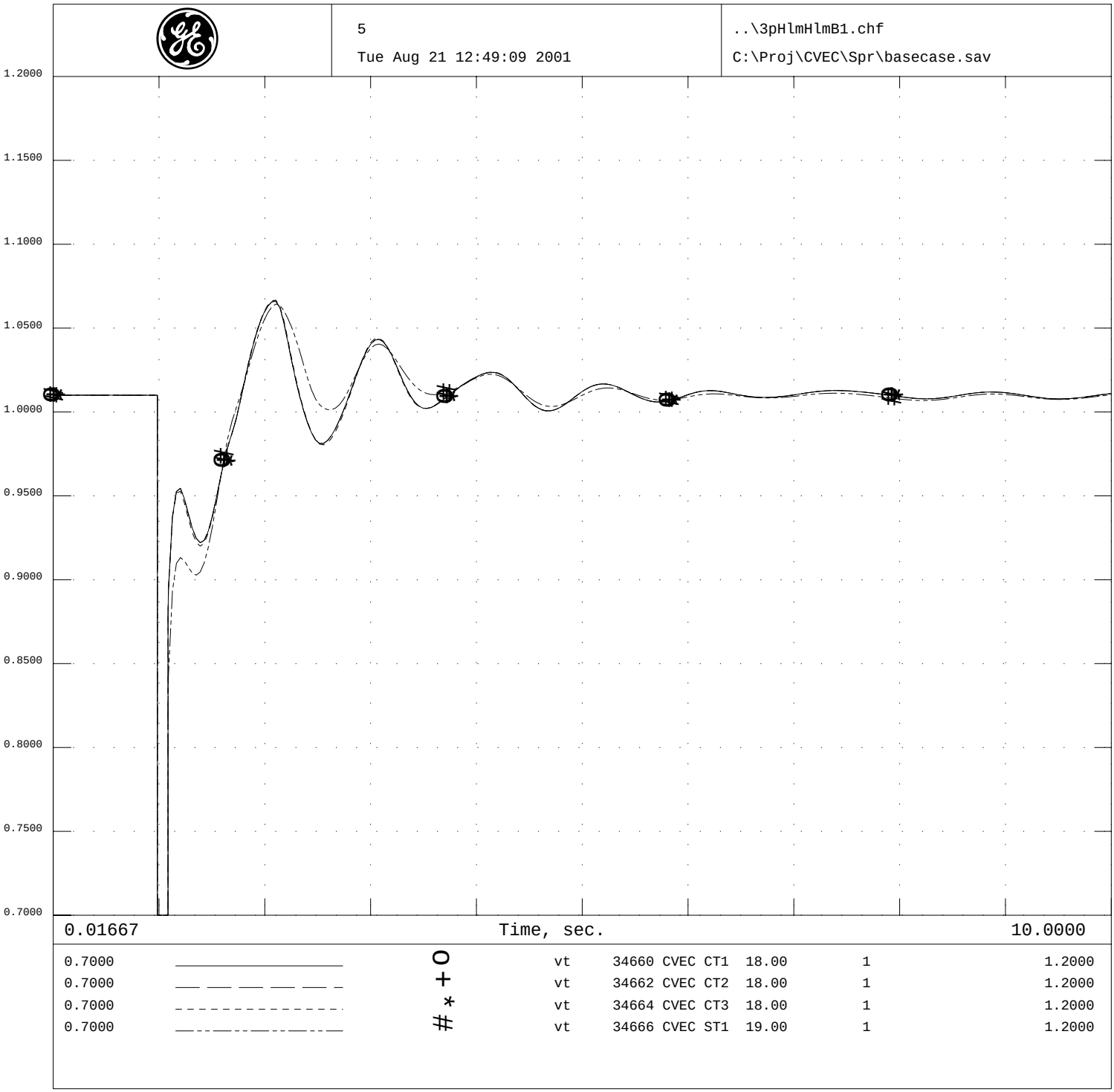

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2004 Heavy Spring Base Case
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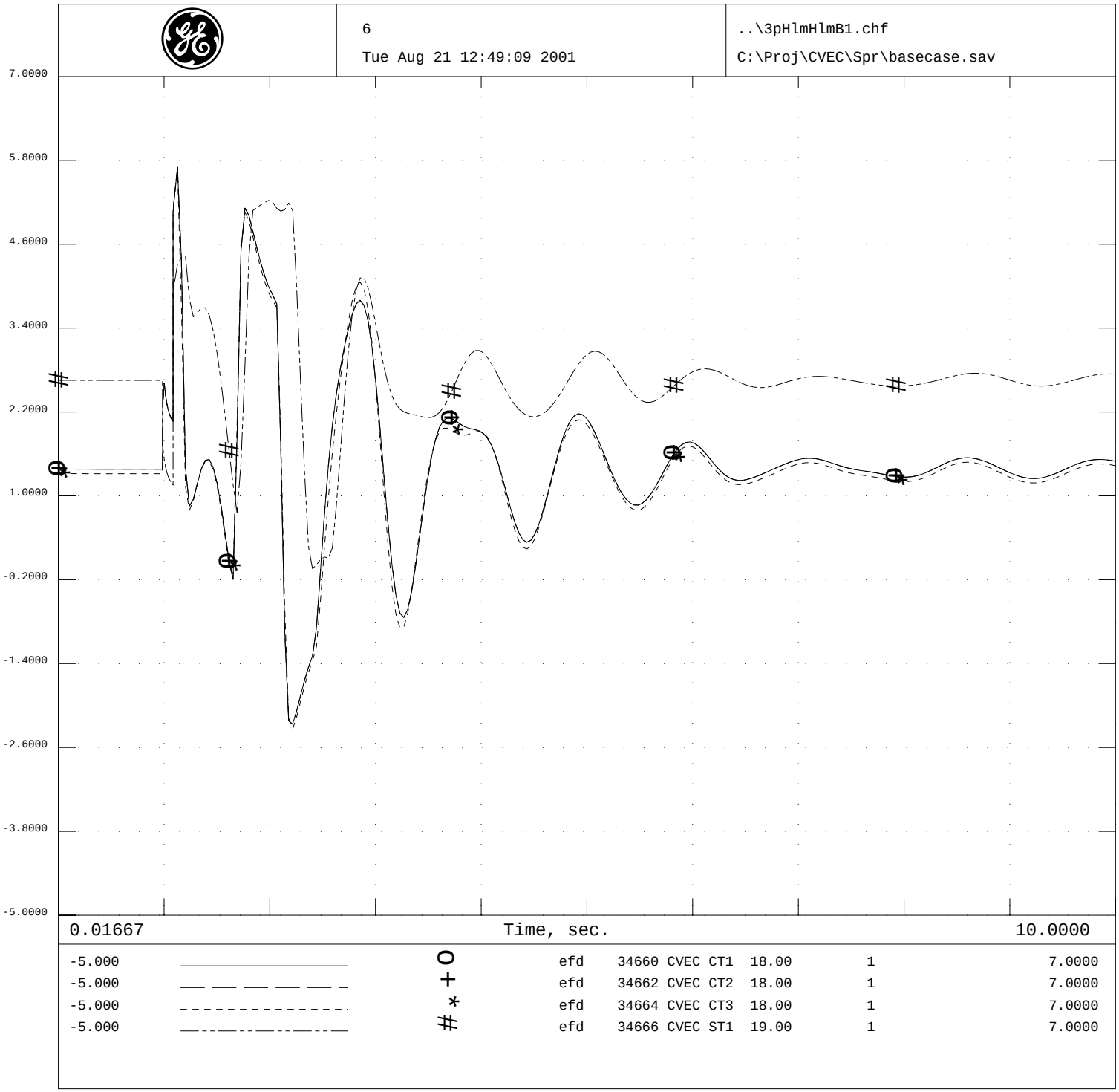
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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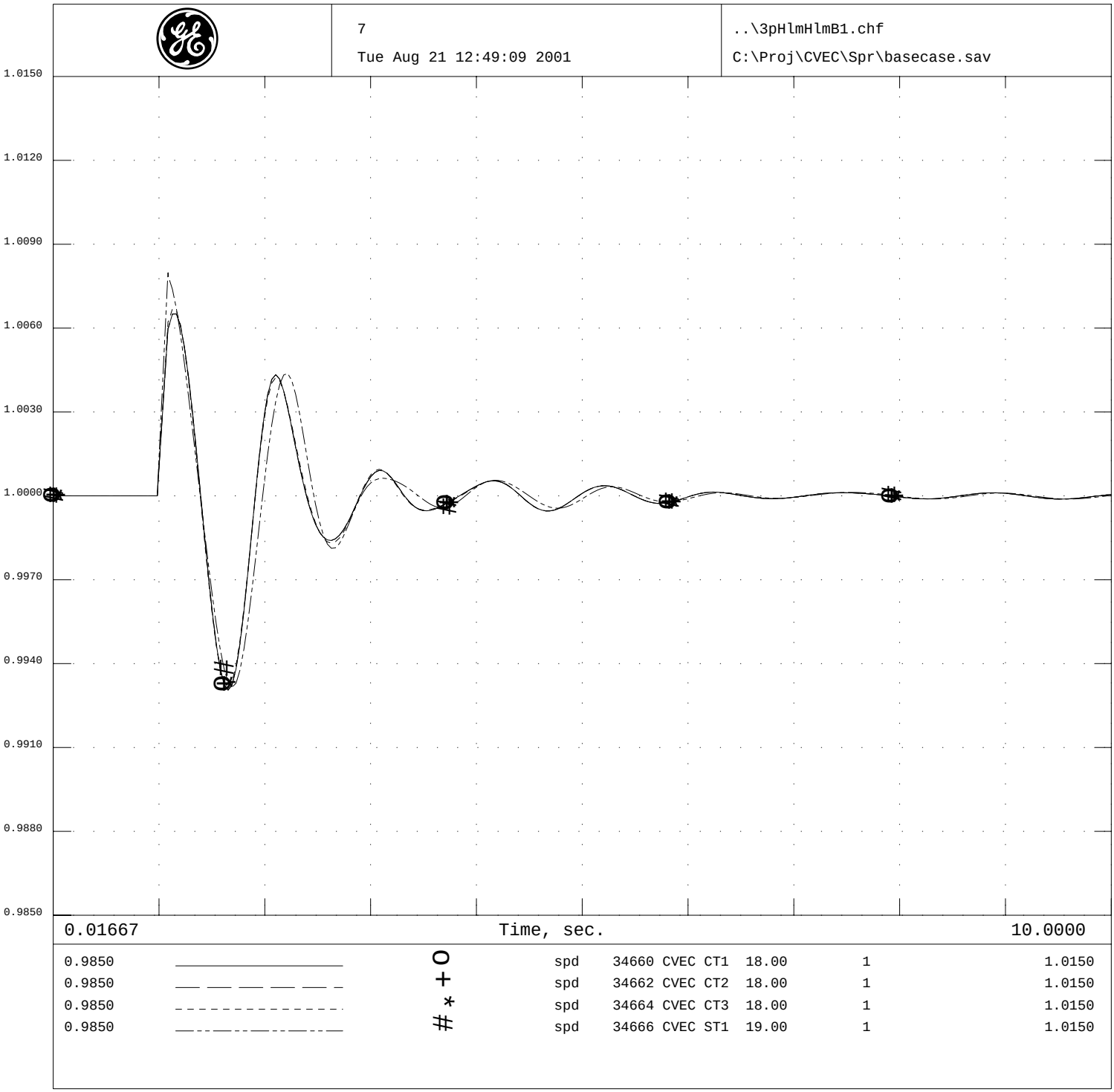
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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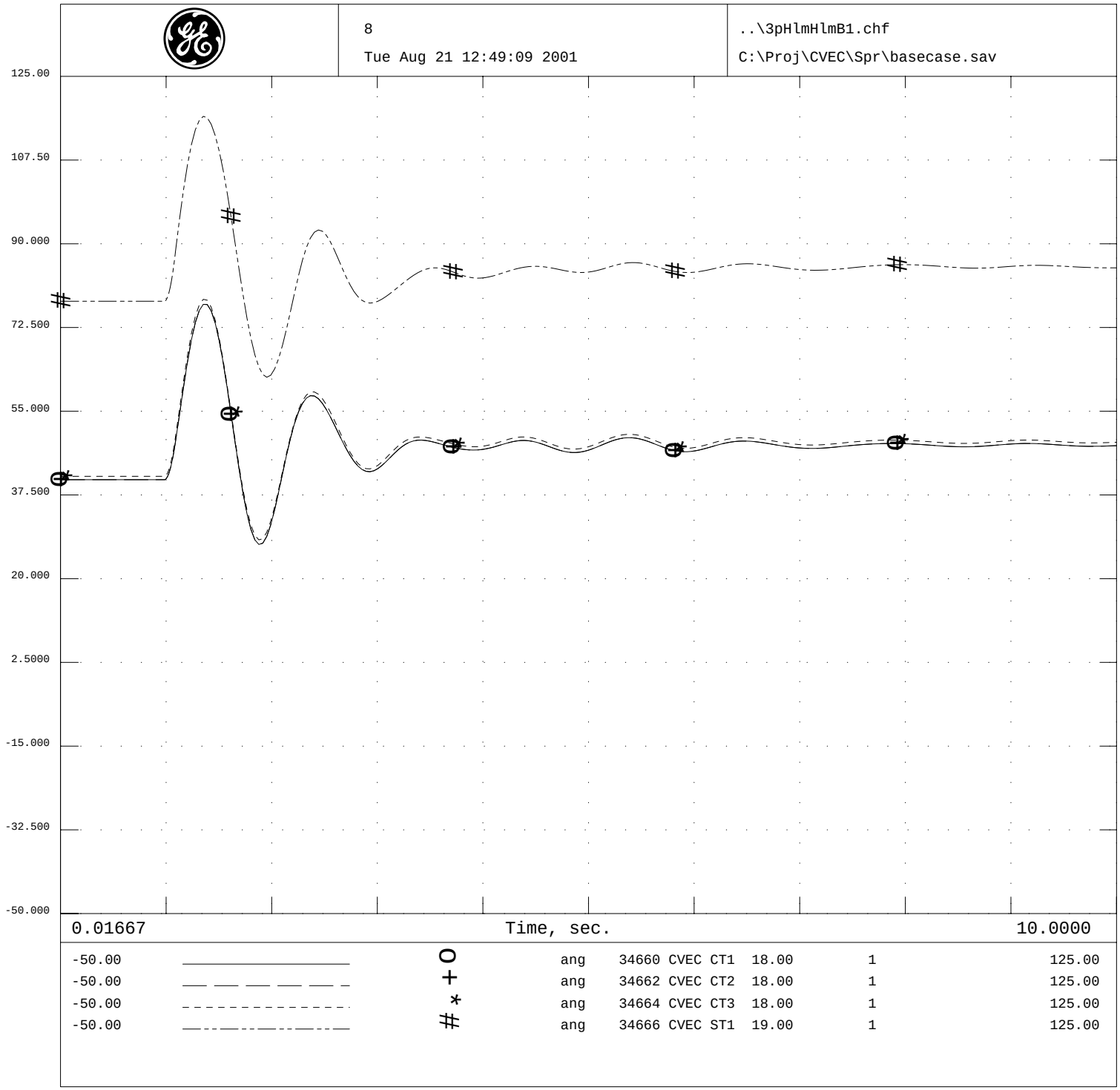
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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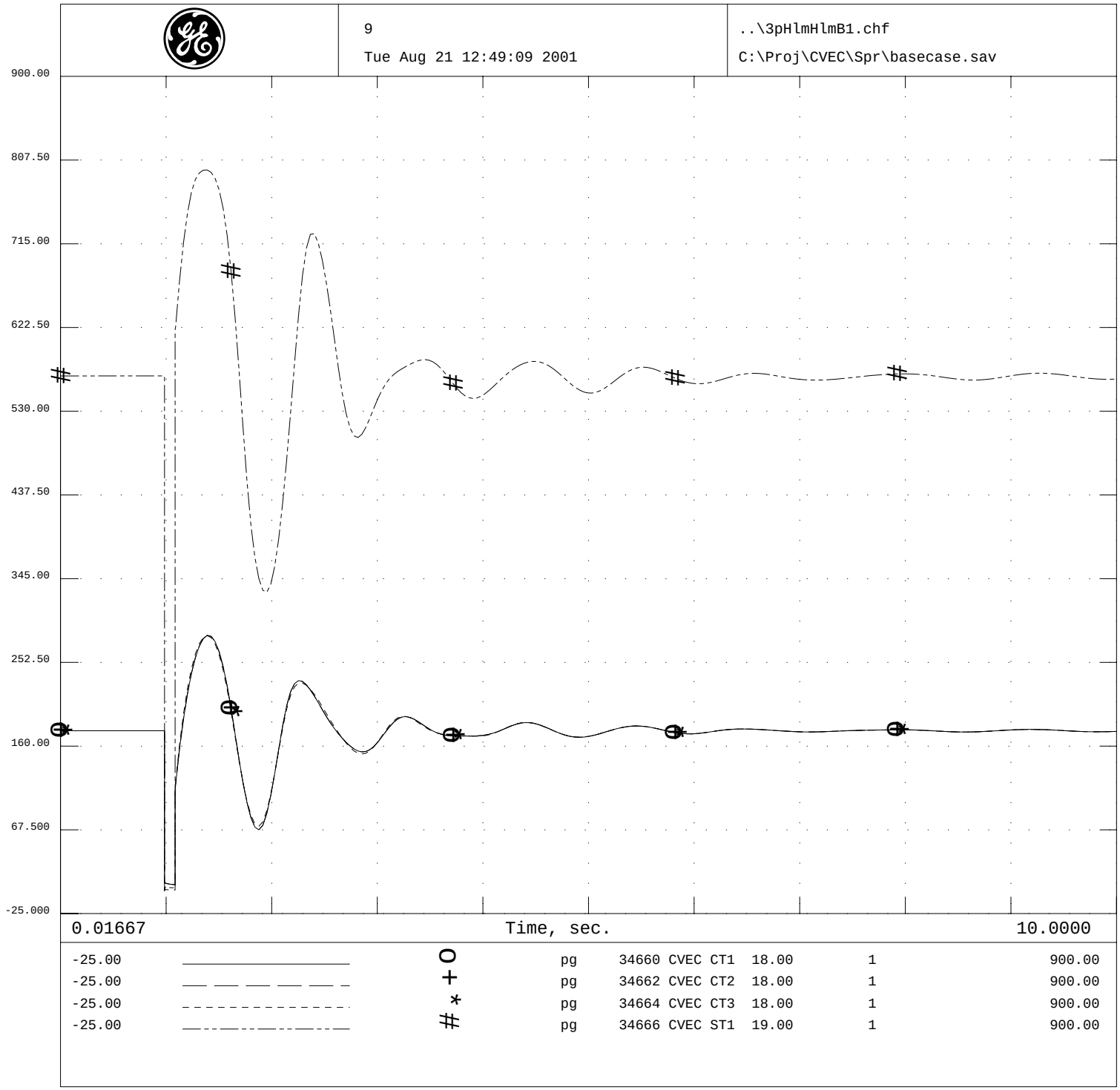
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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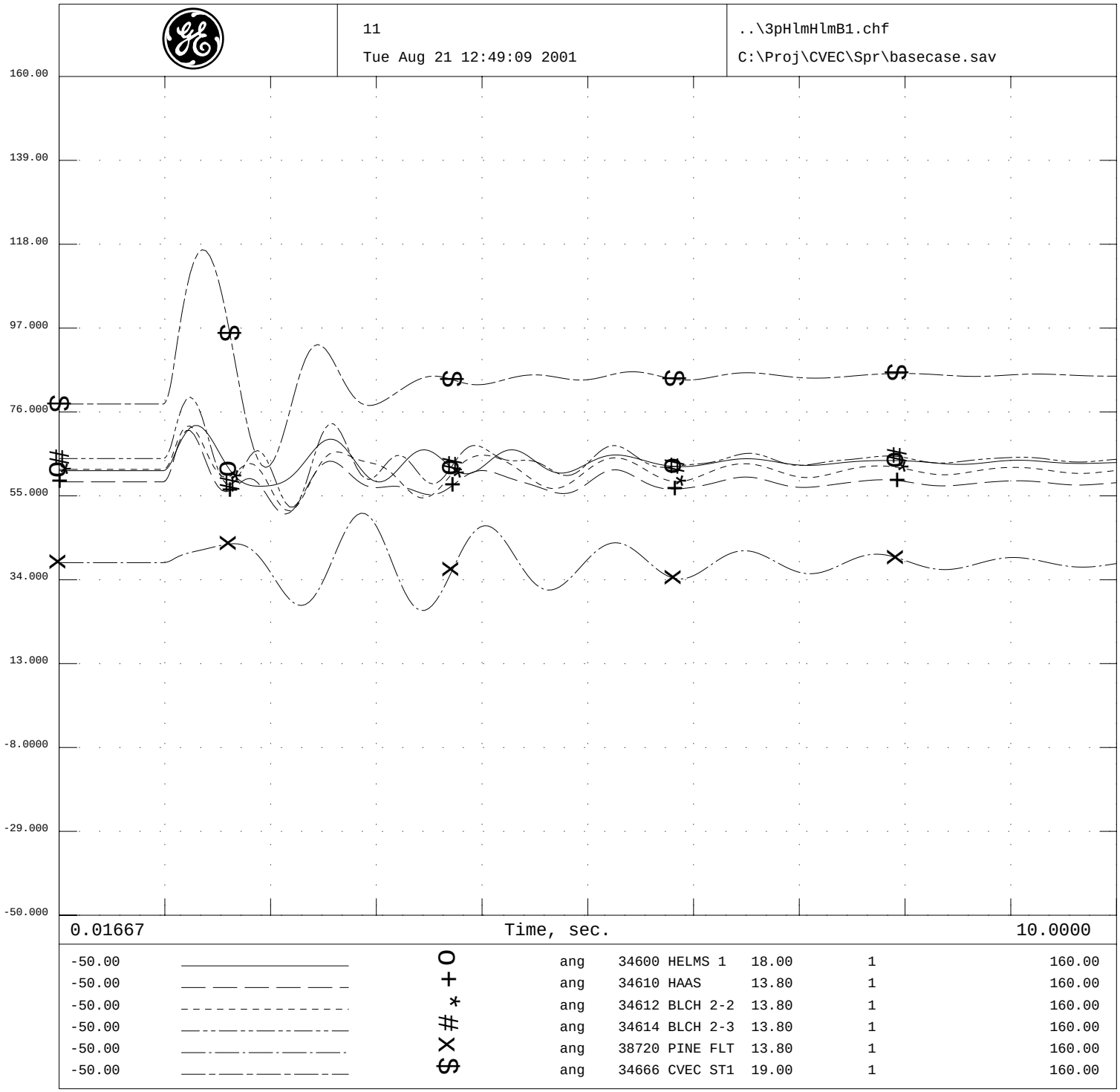
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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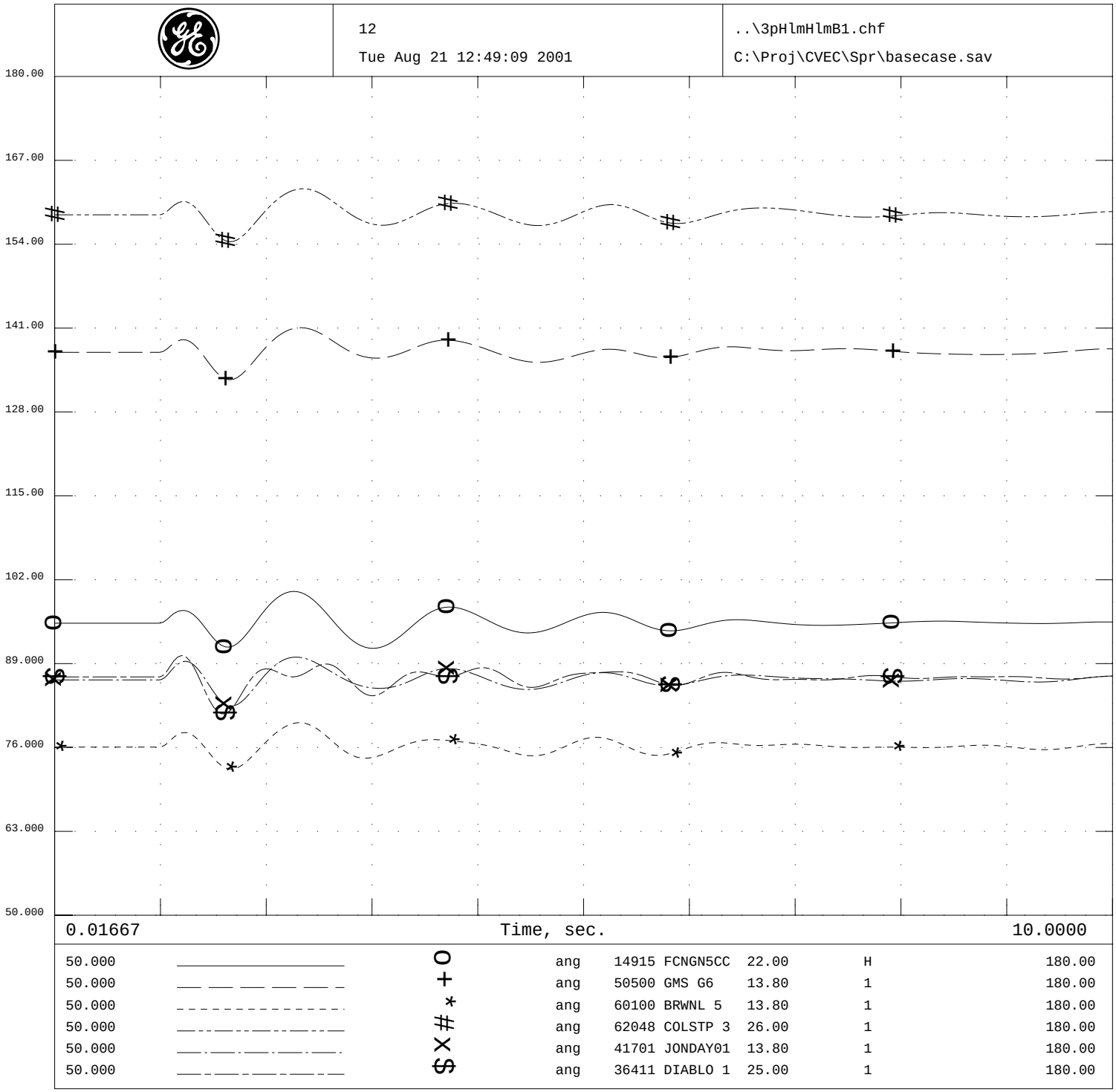
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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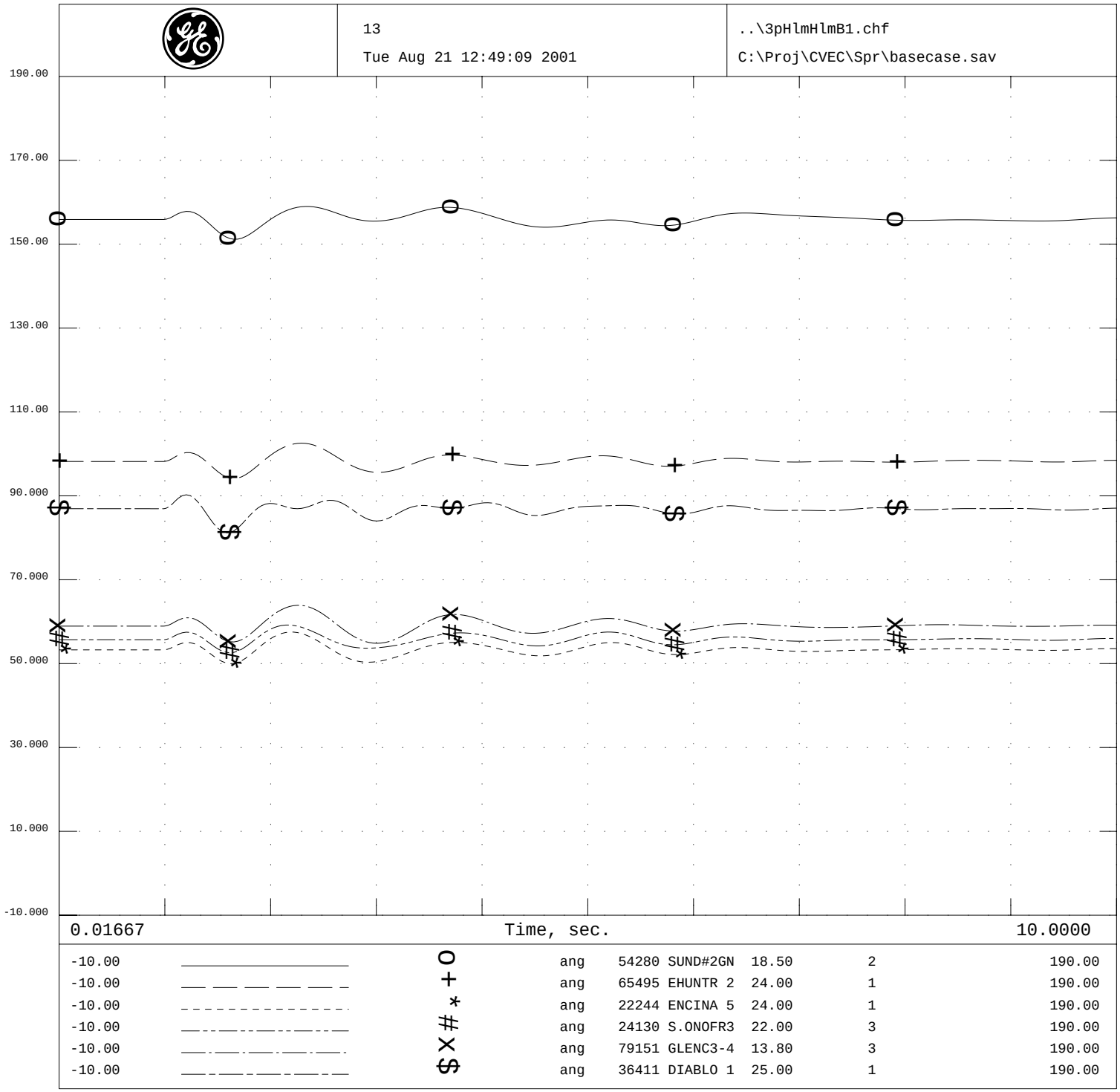
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Central Valley Energy Center
Calpine Corporation
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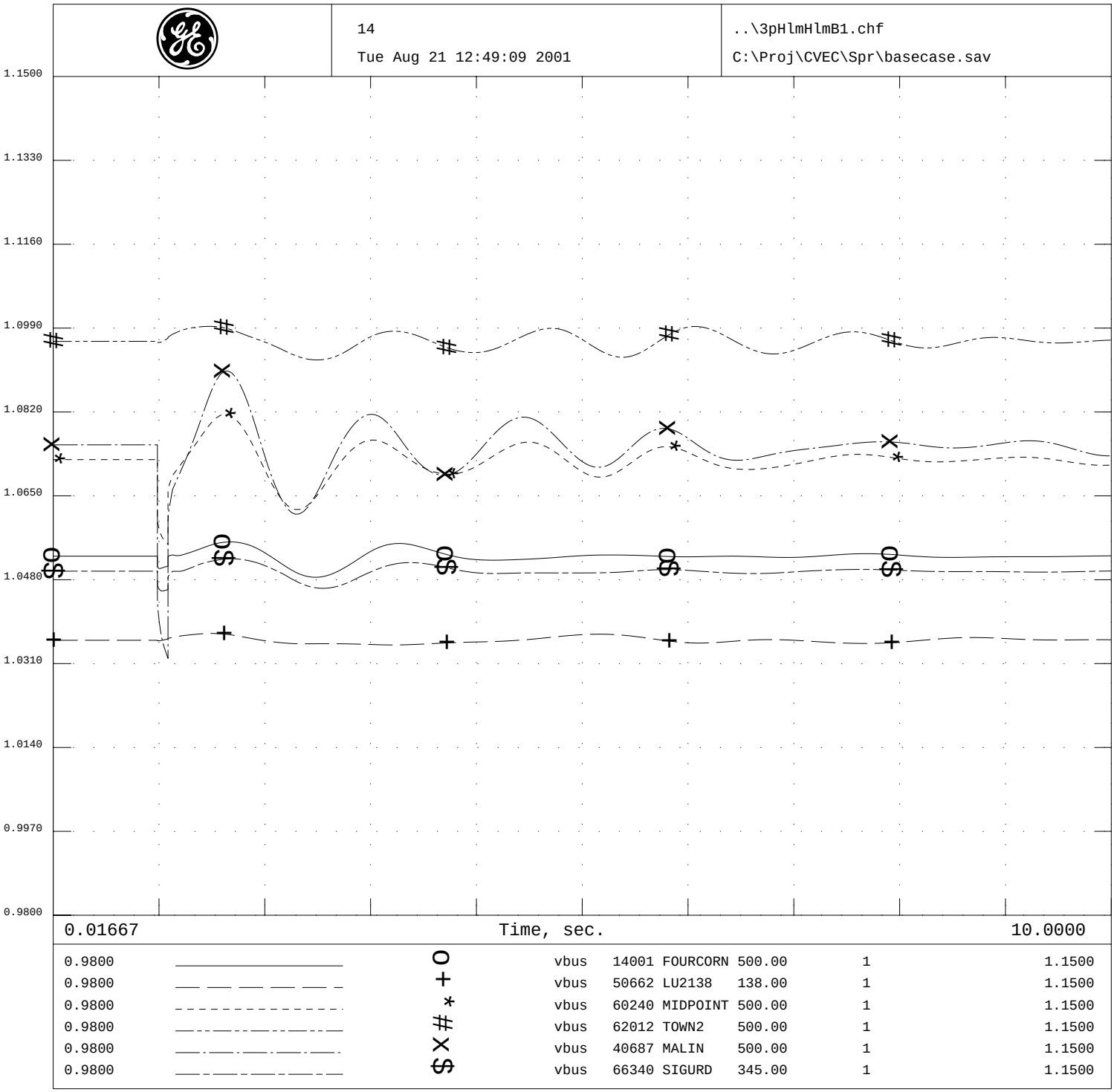

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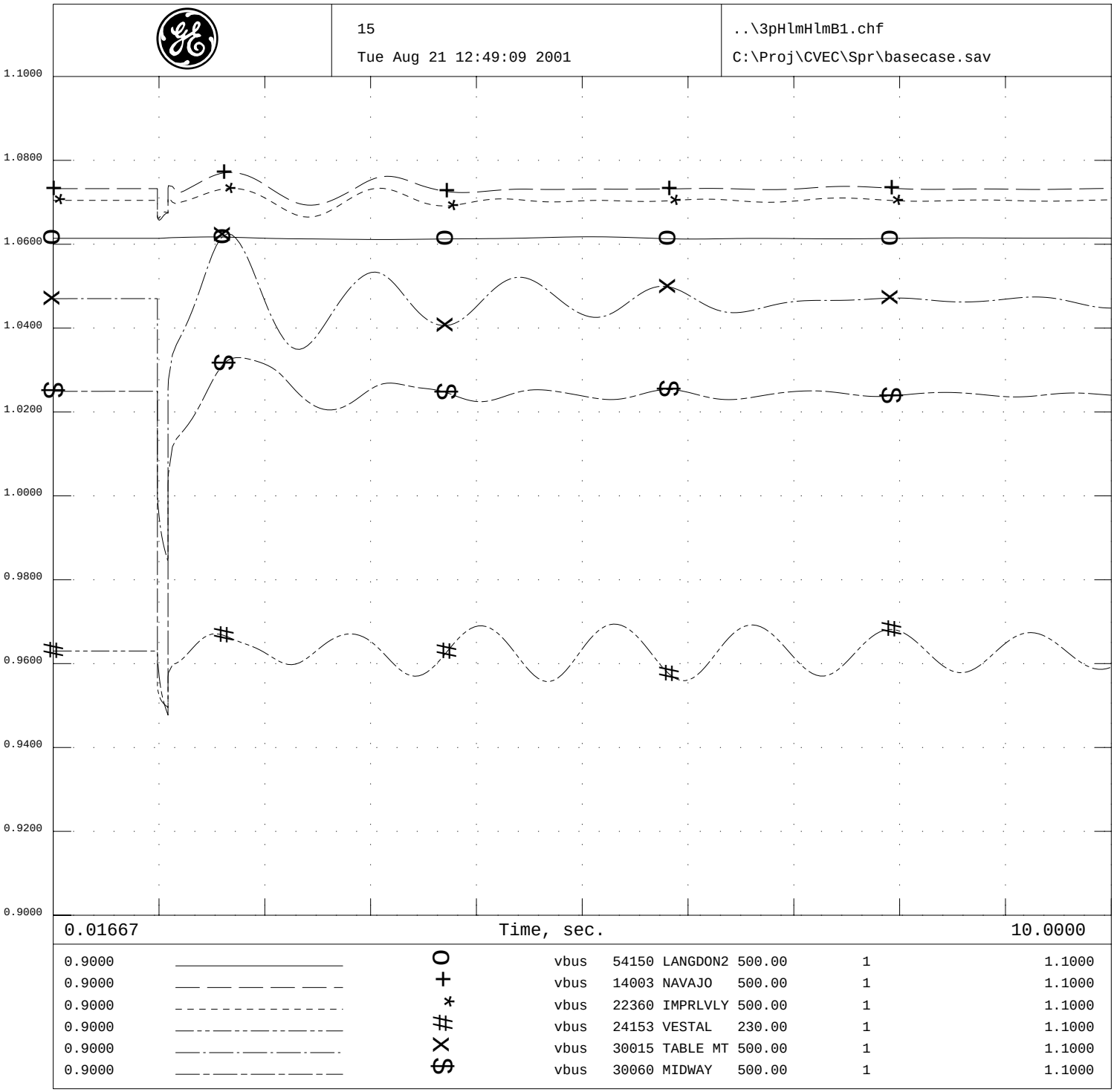
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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Calpine Corporation
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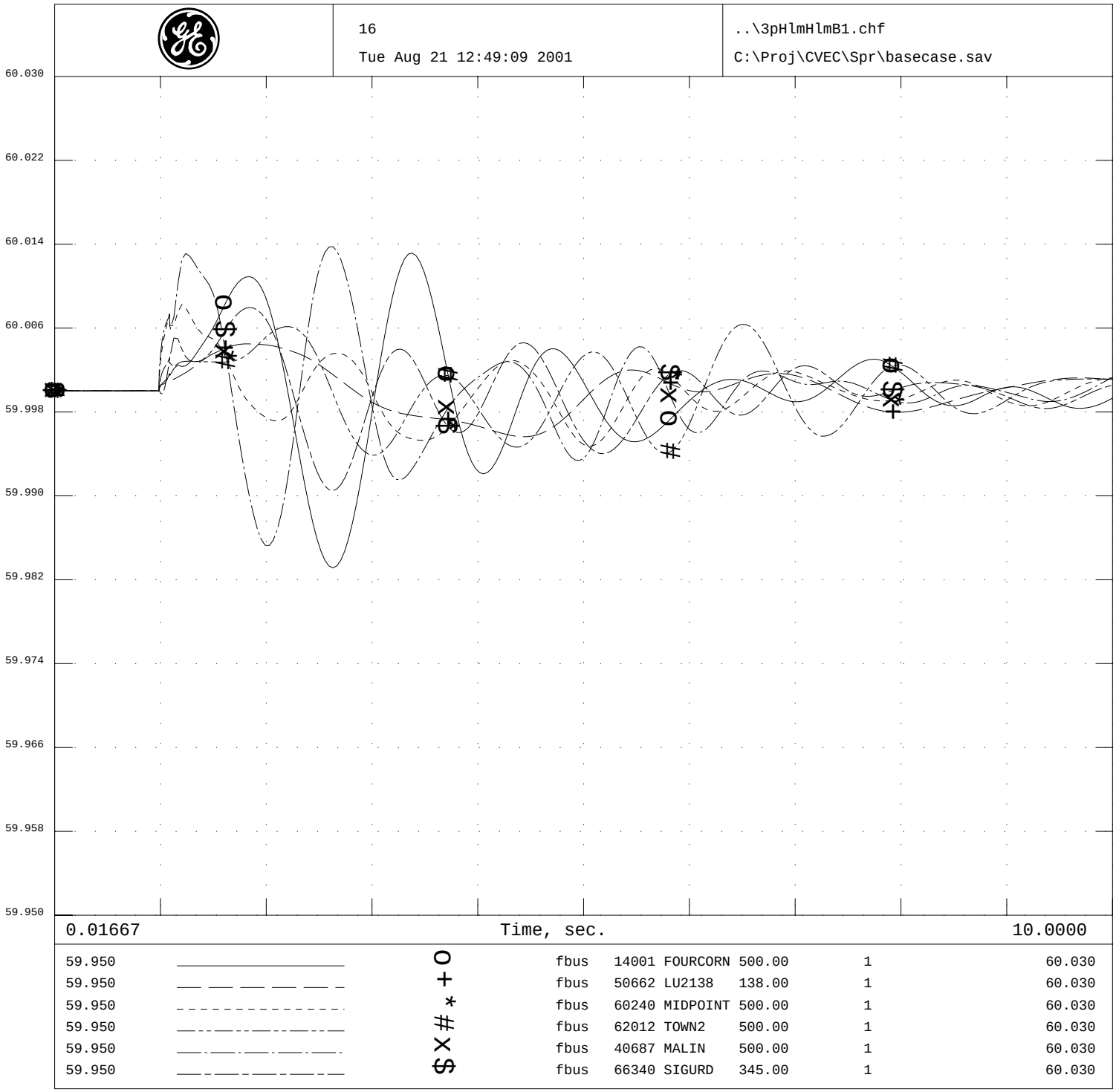

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2004 Heavy Spring Base Case
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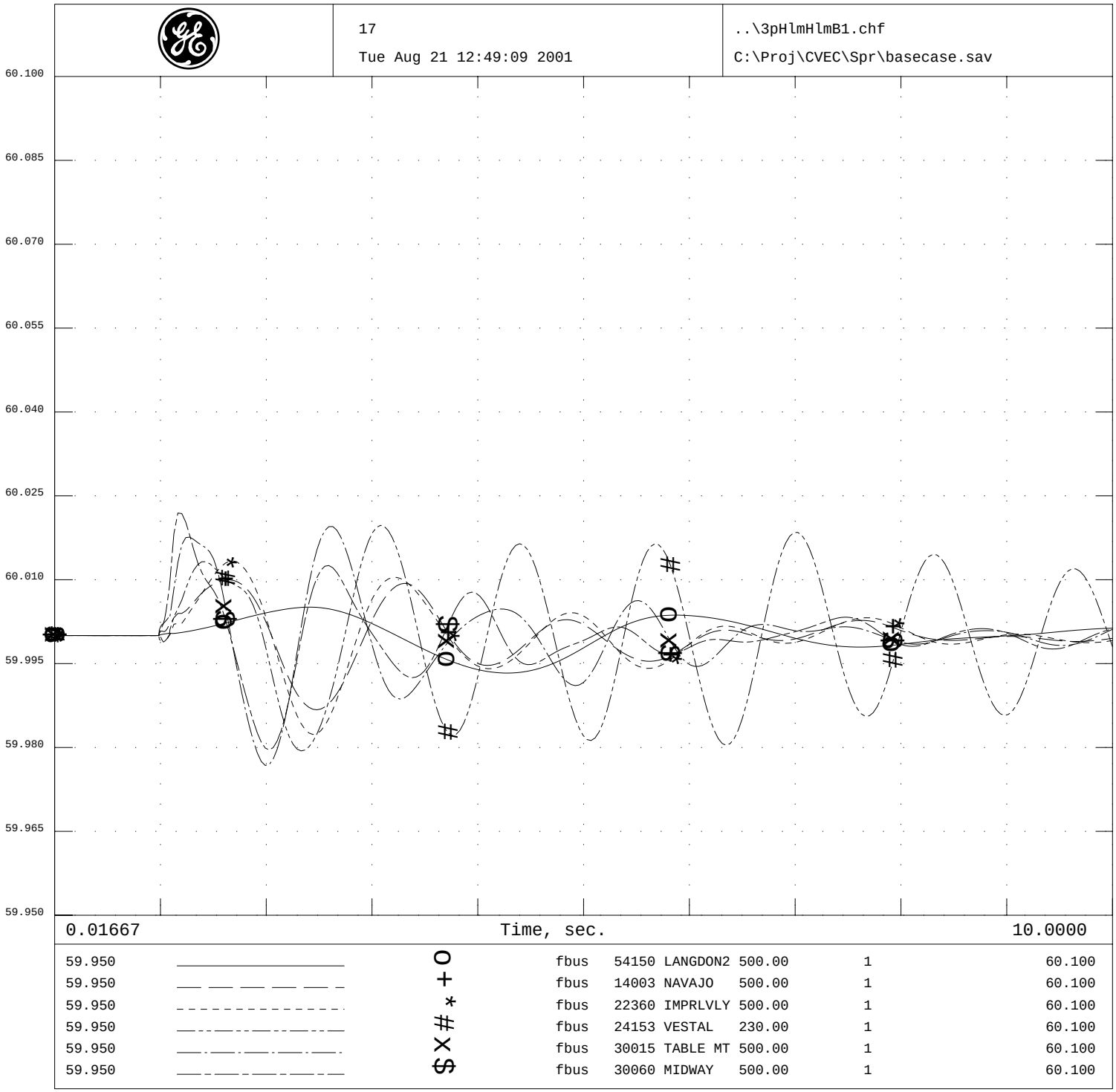
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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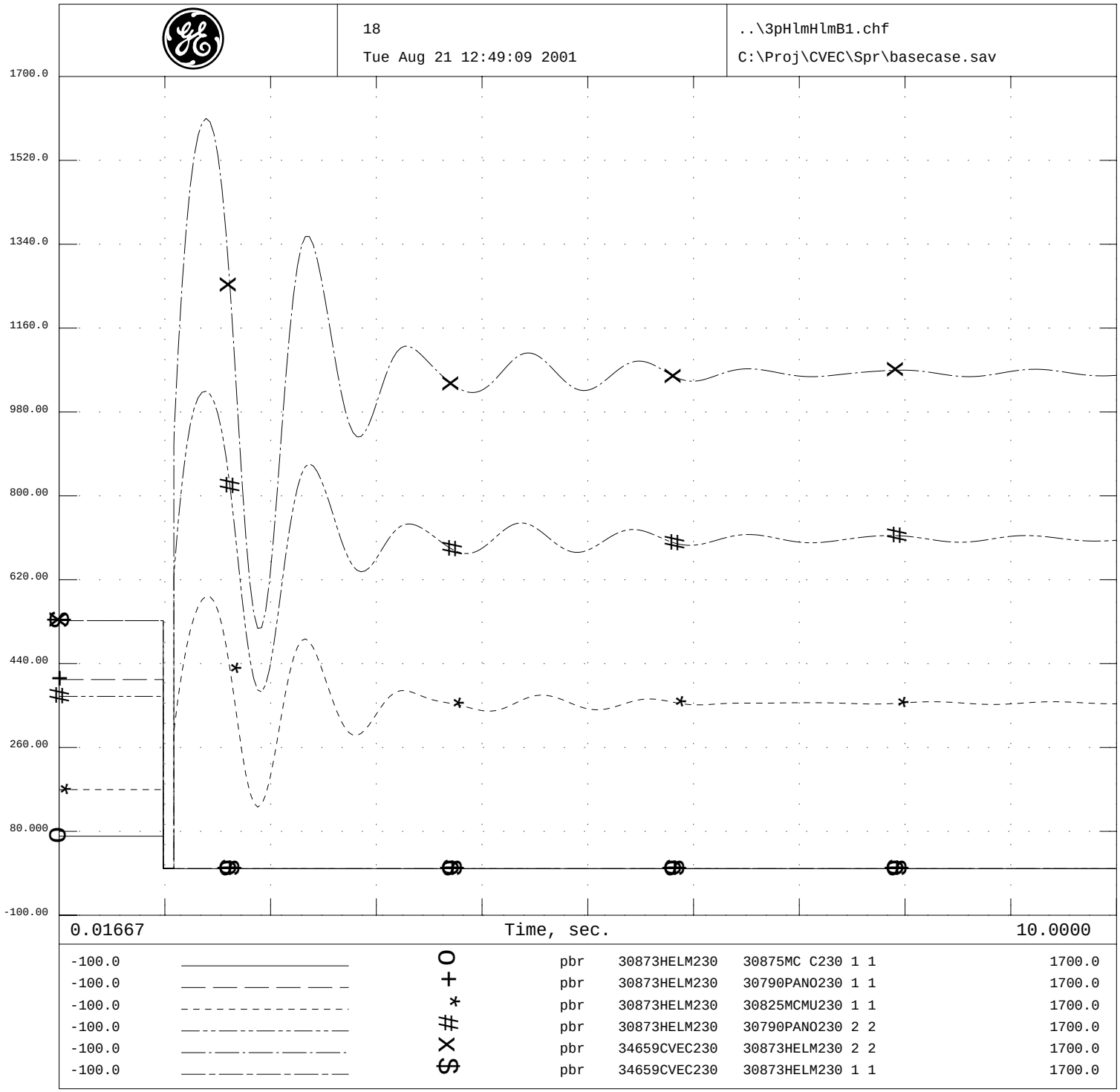

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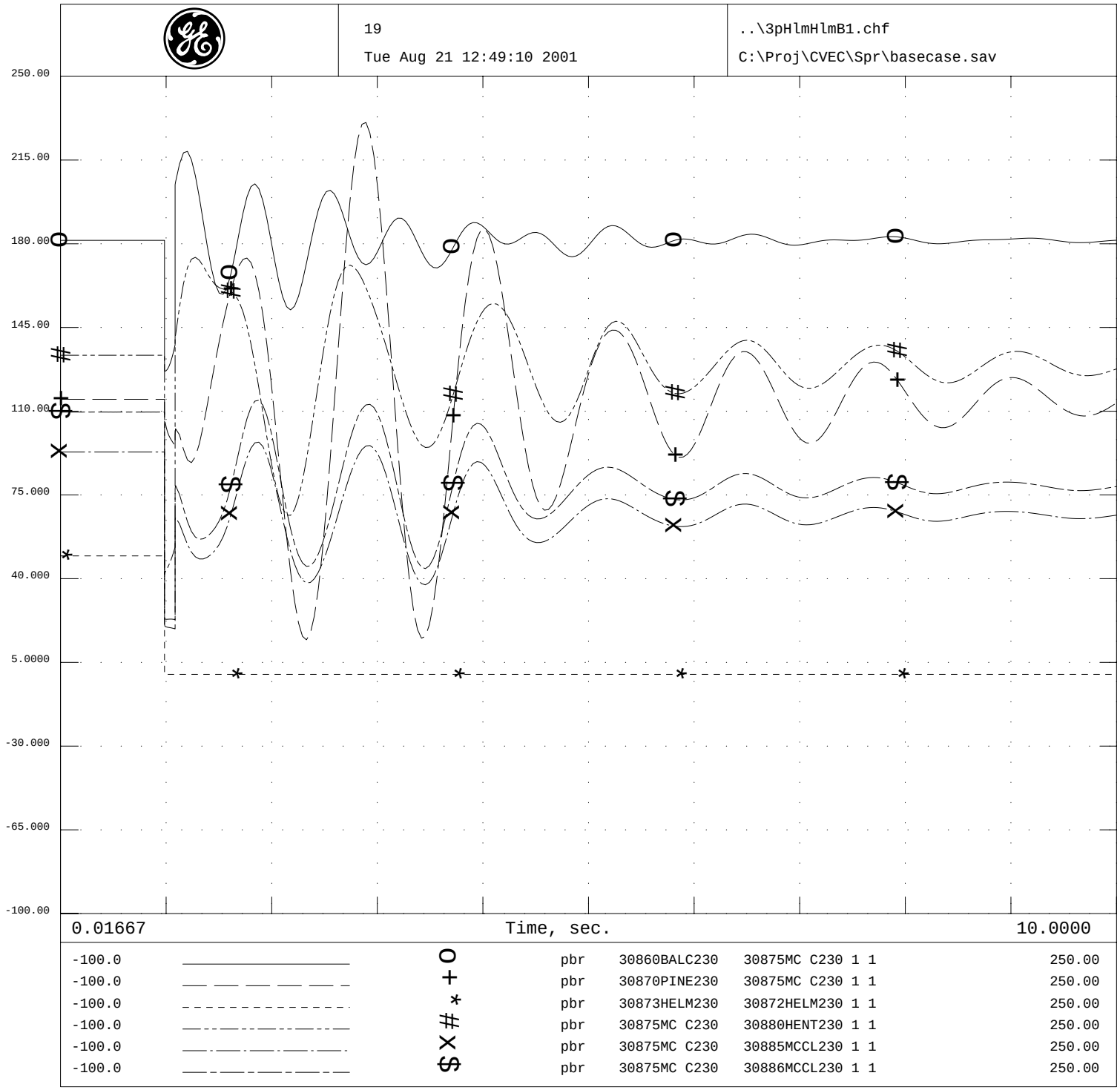
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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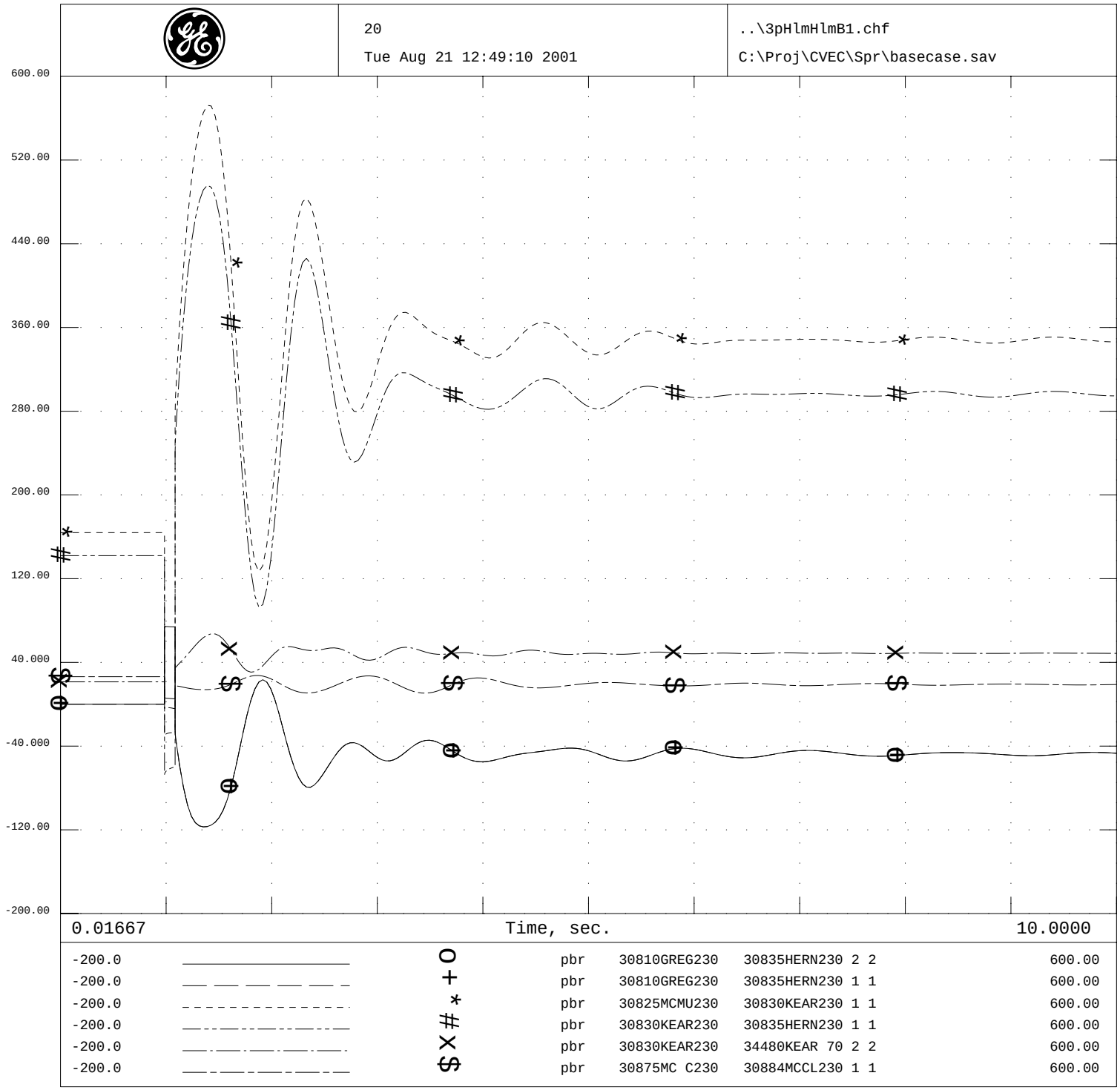

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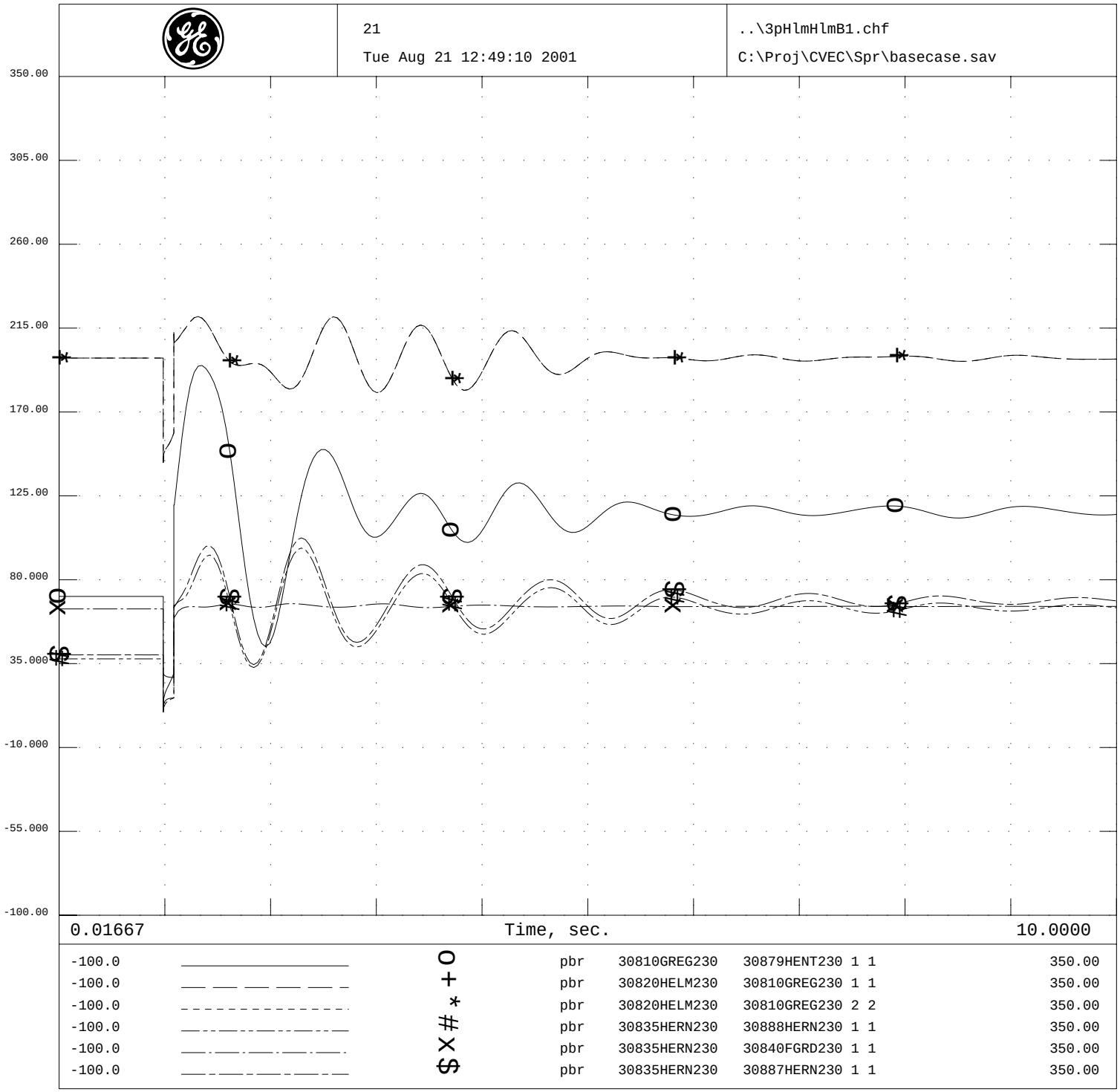

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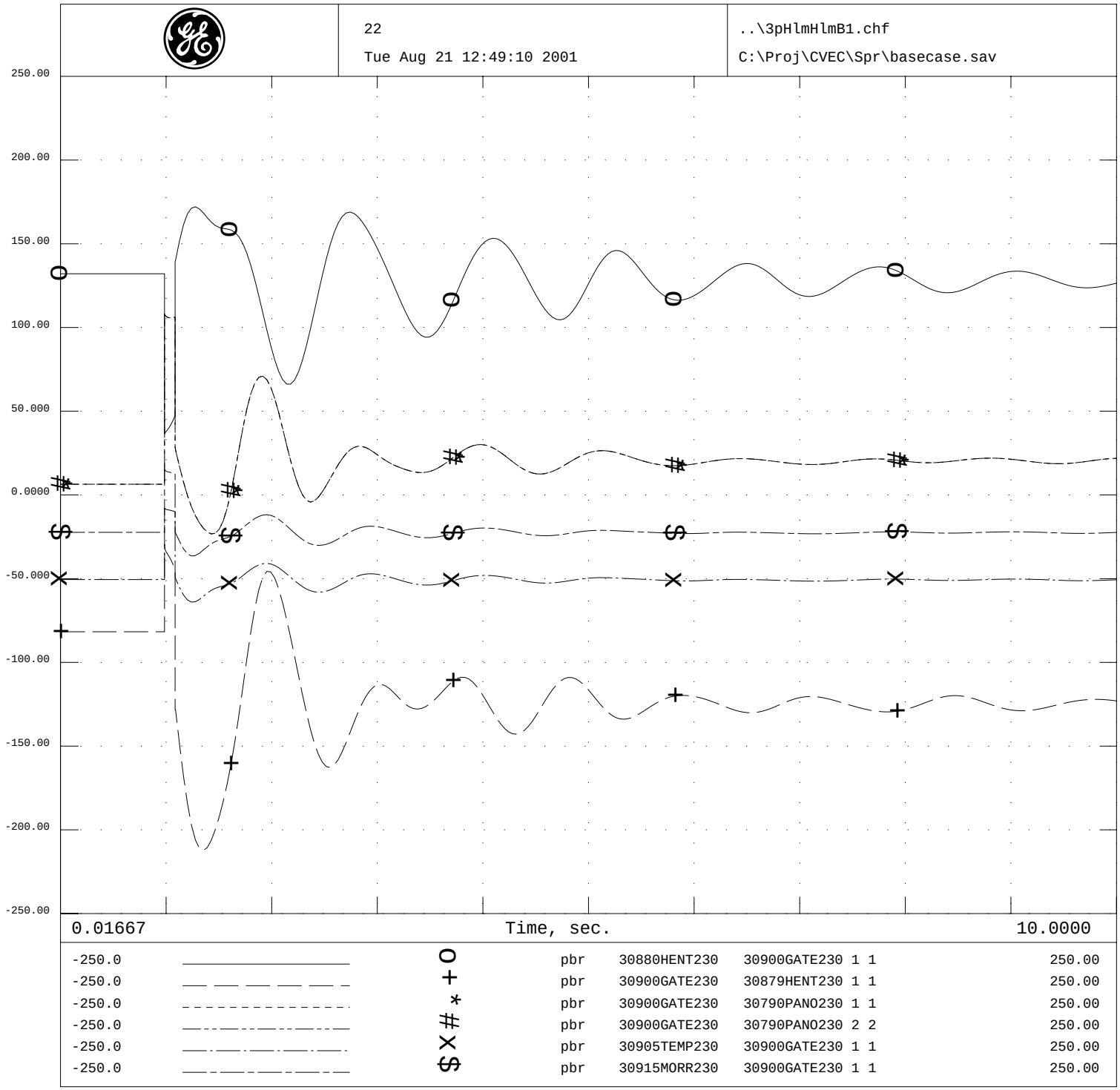

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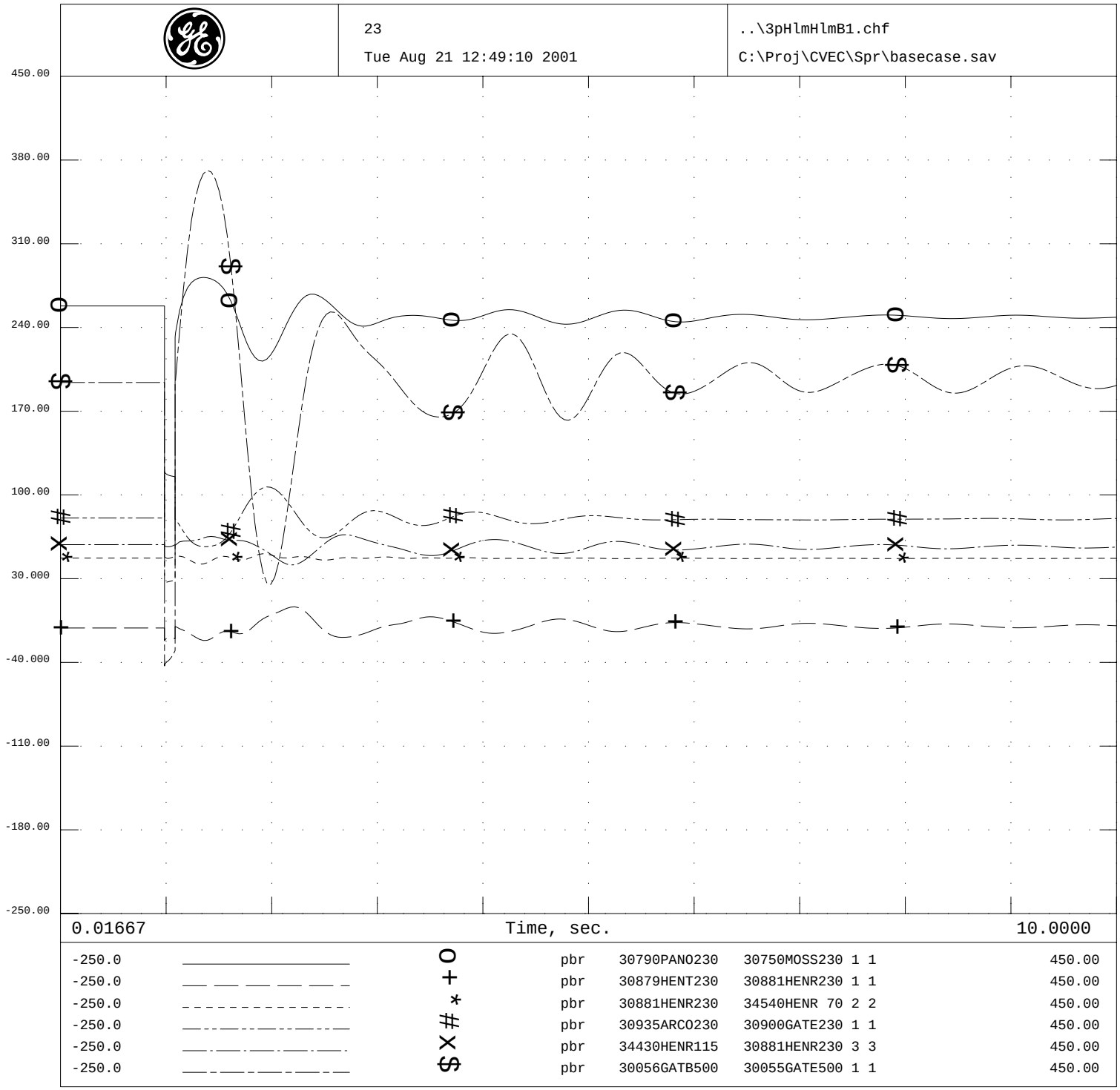

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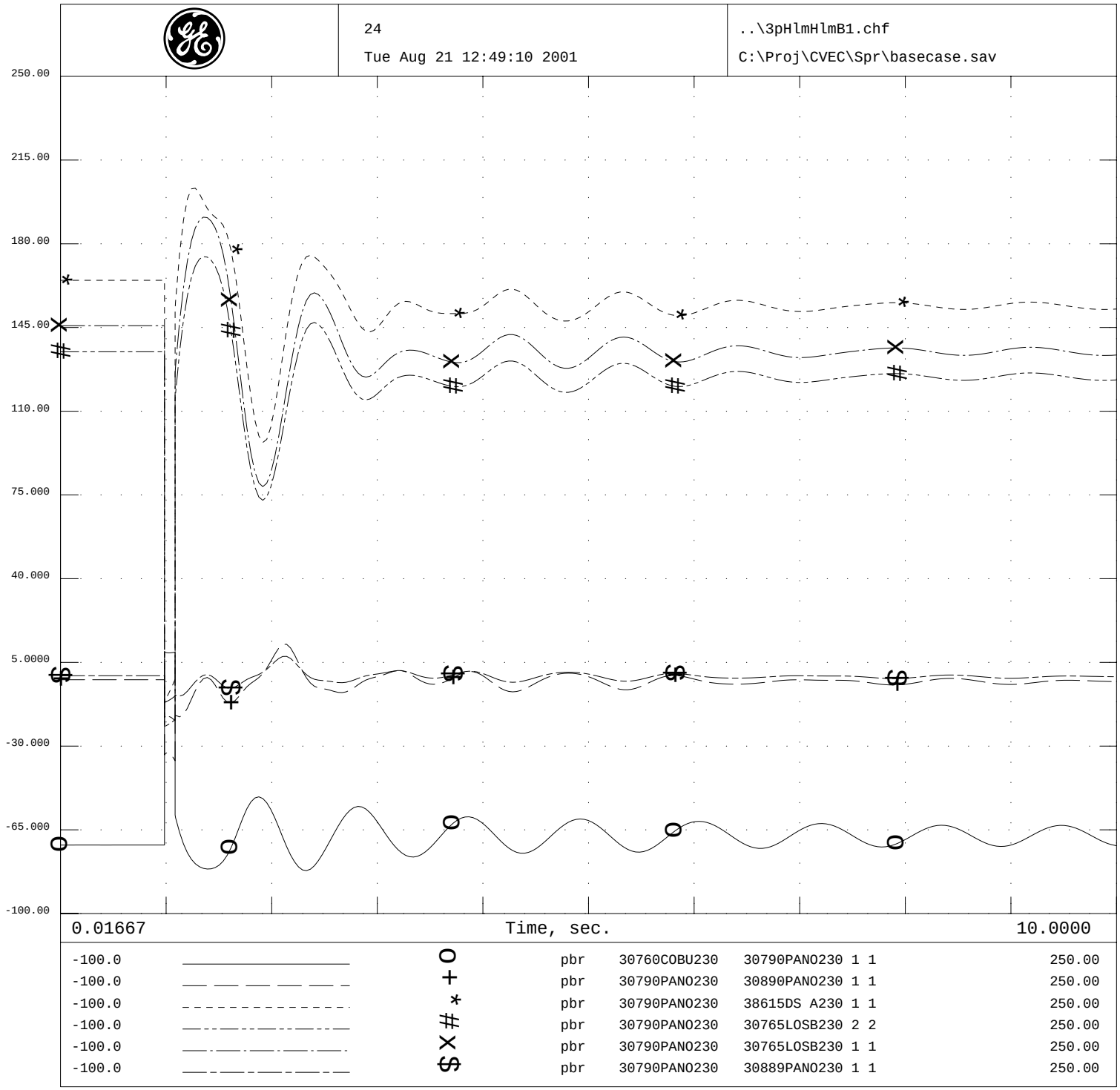

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Calpine Corporation
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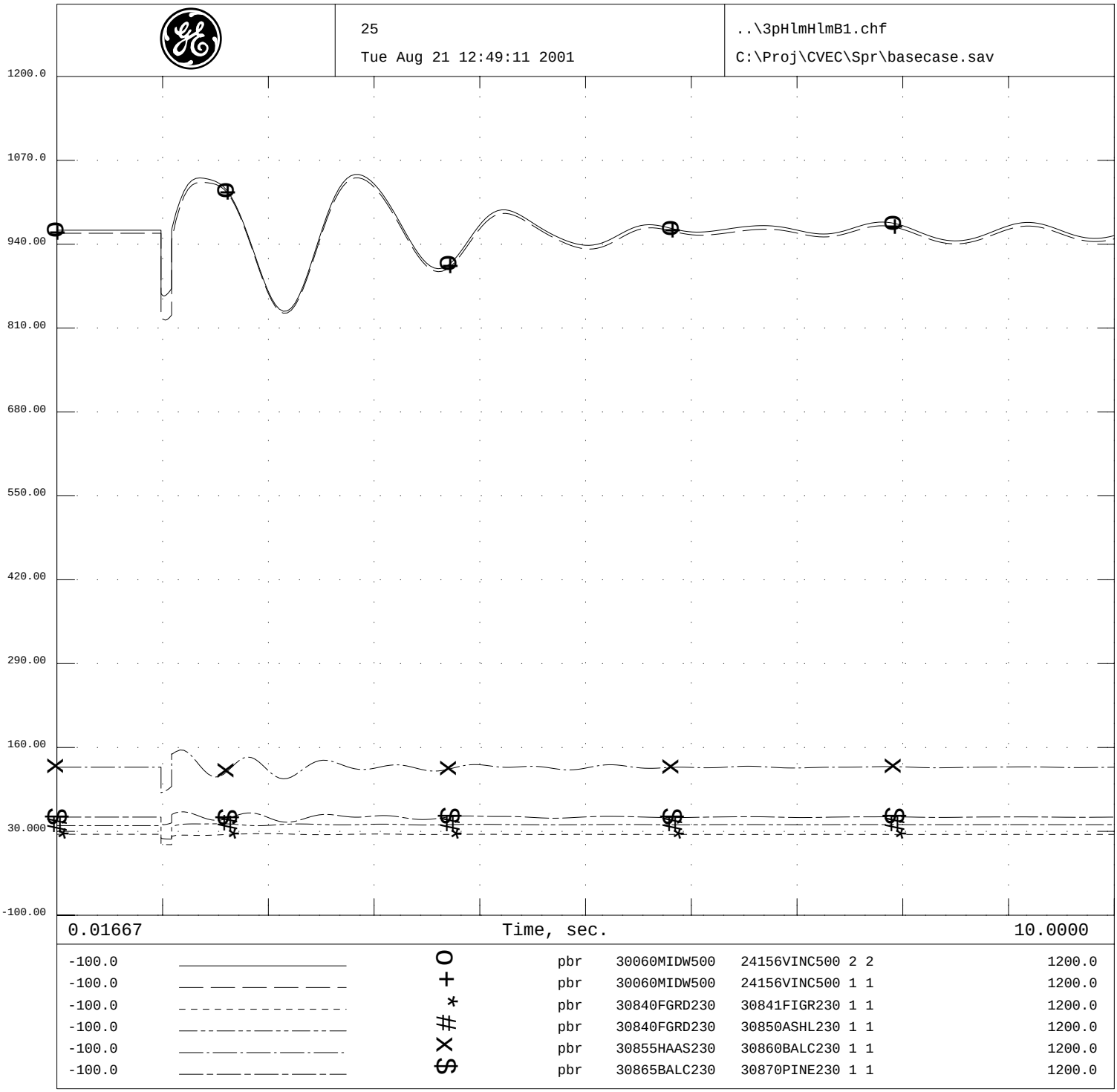

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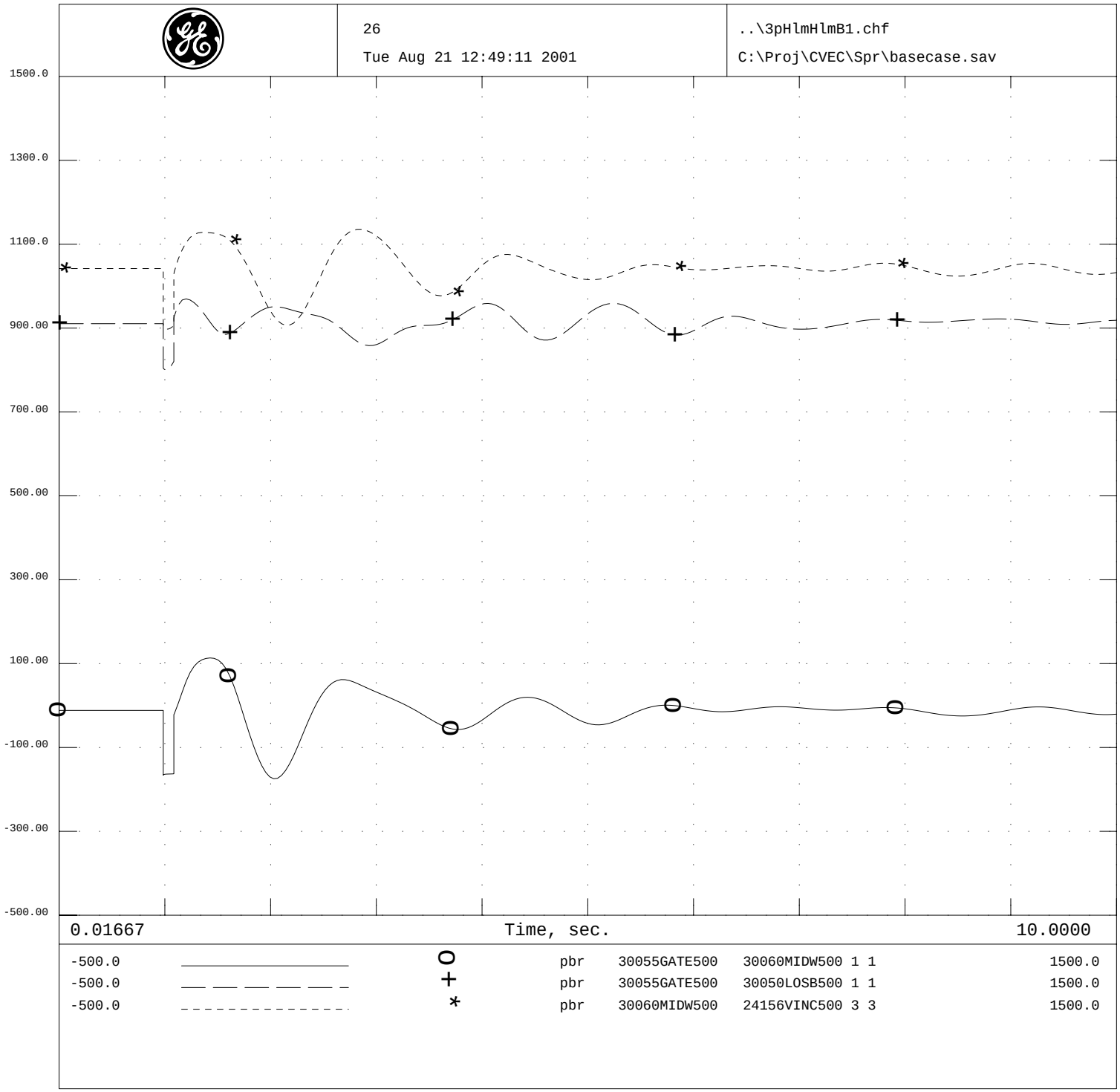

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Calpine Corporation
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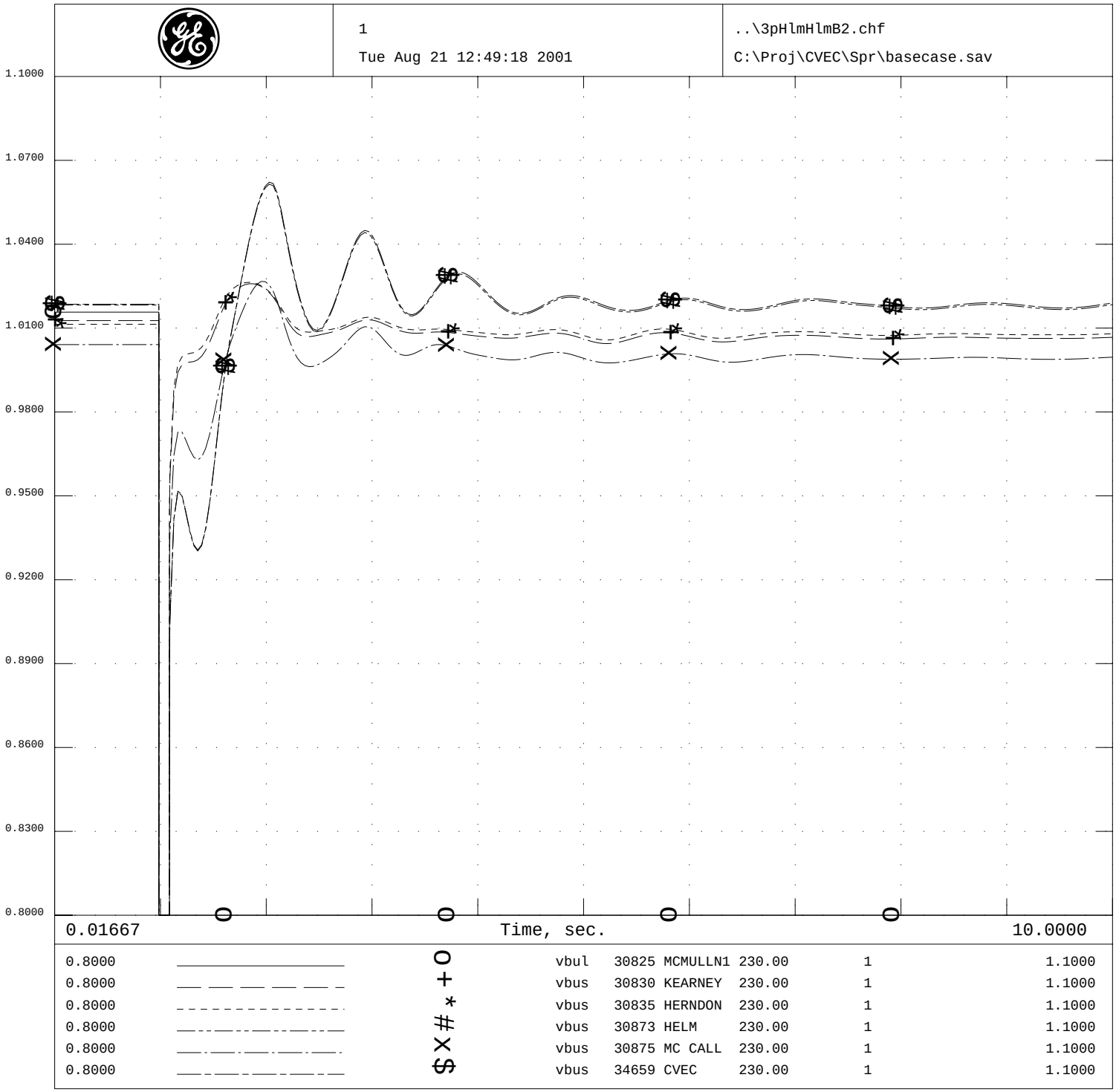

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2004 Heavy Spring Base Case
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Helm 230kV Bus #2 Outage
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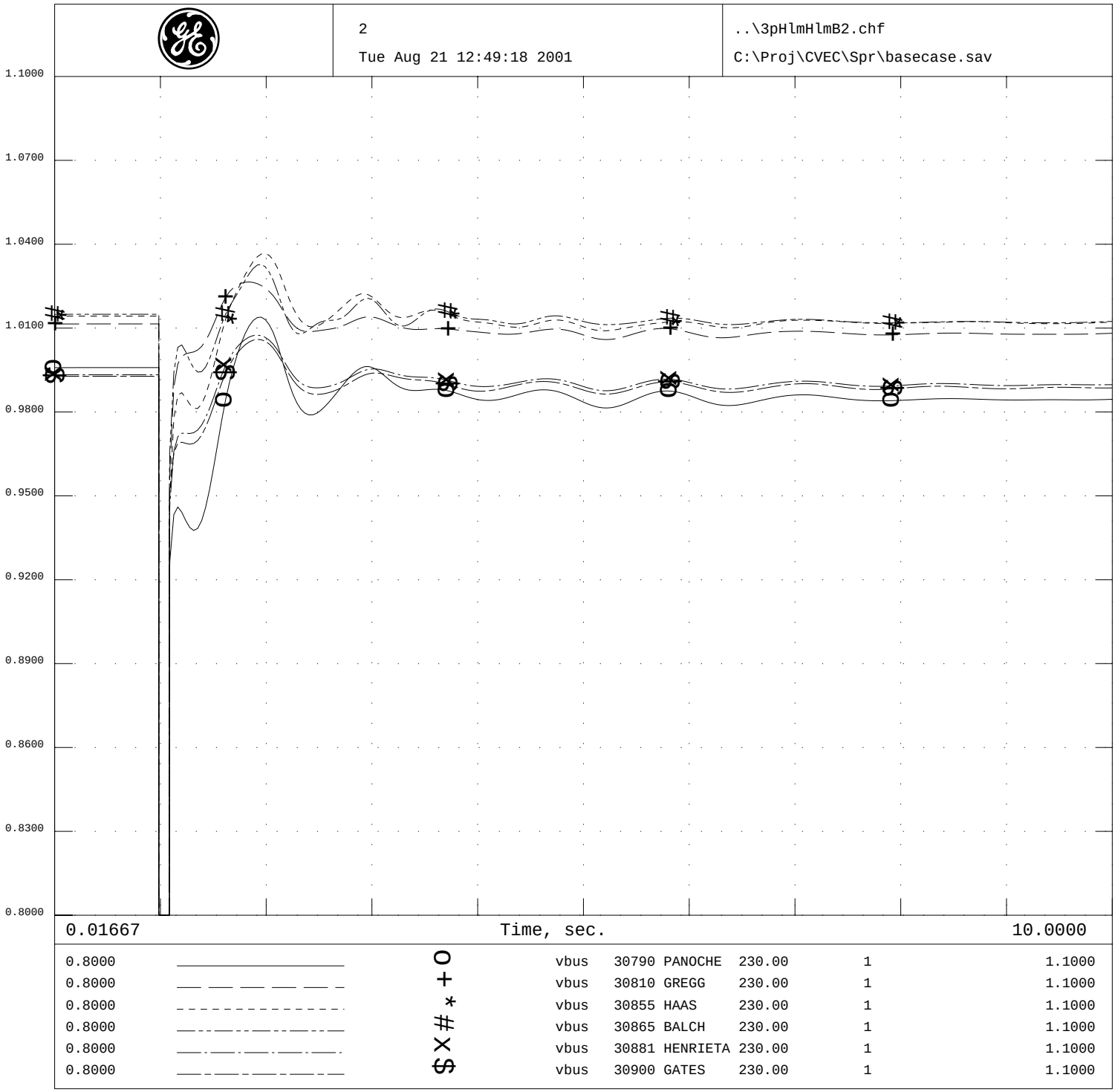
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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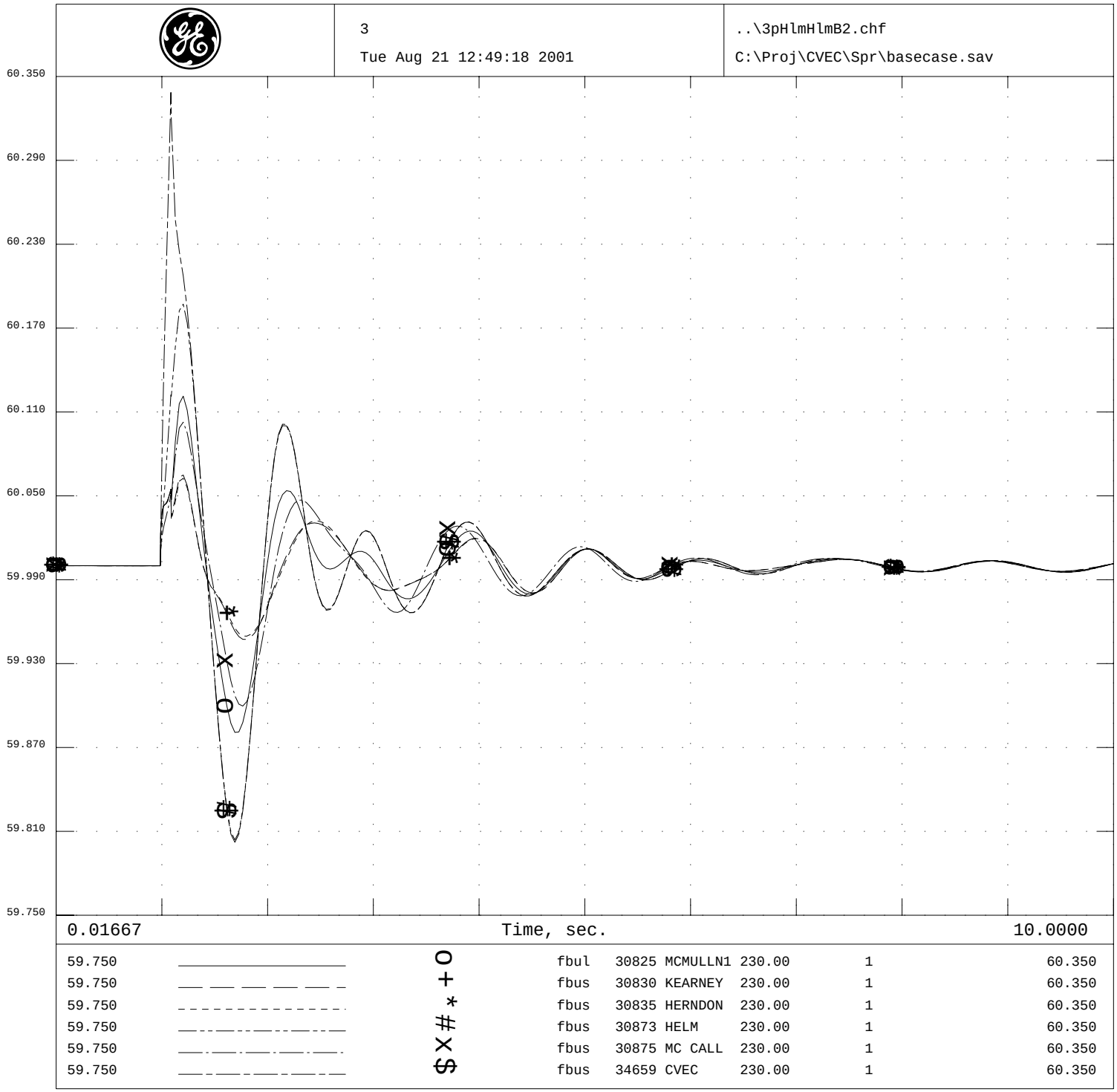

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Central Valley Energy Center
Calpine Corporation
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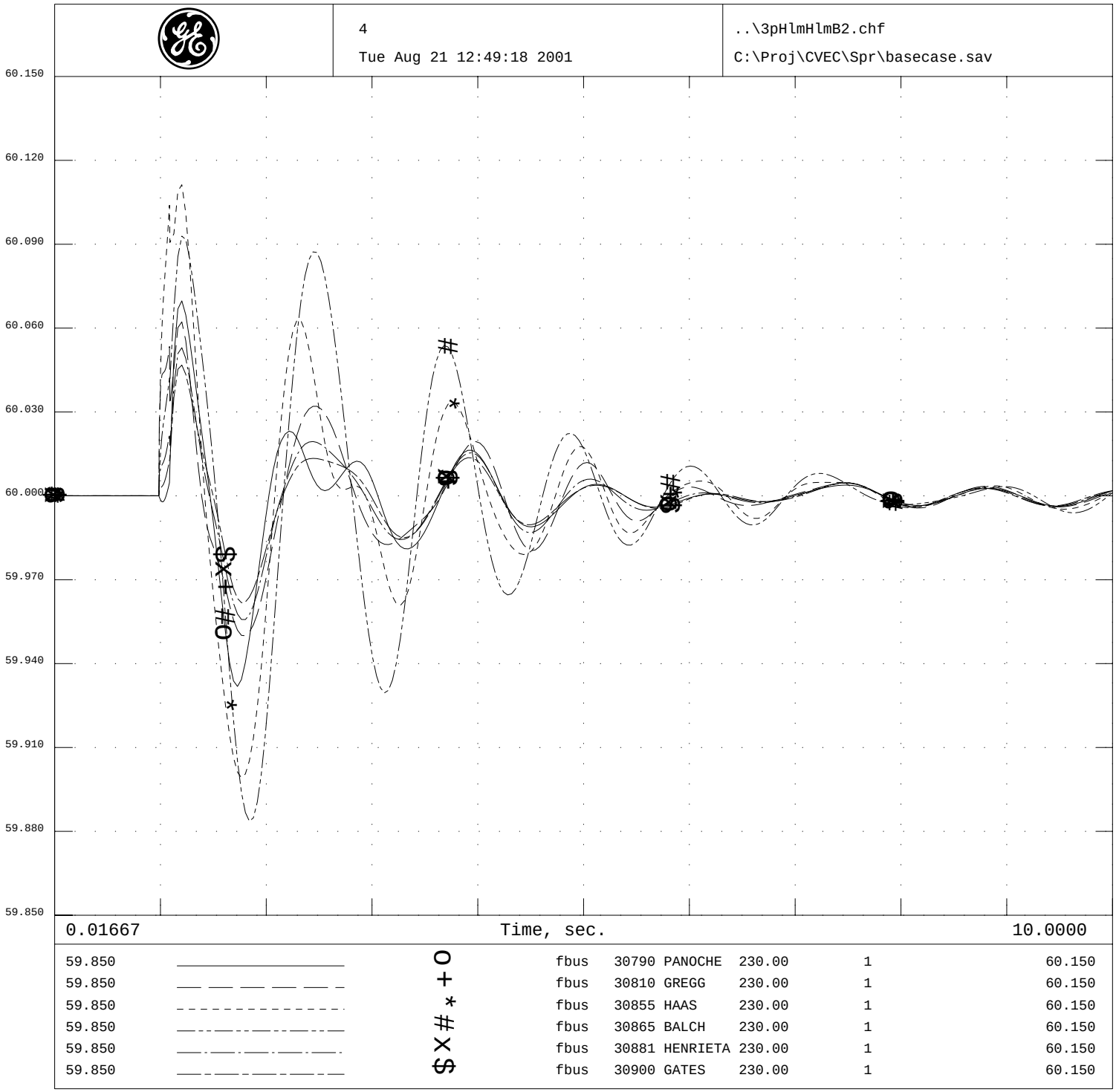

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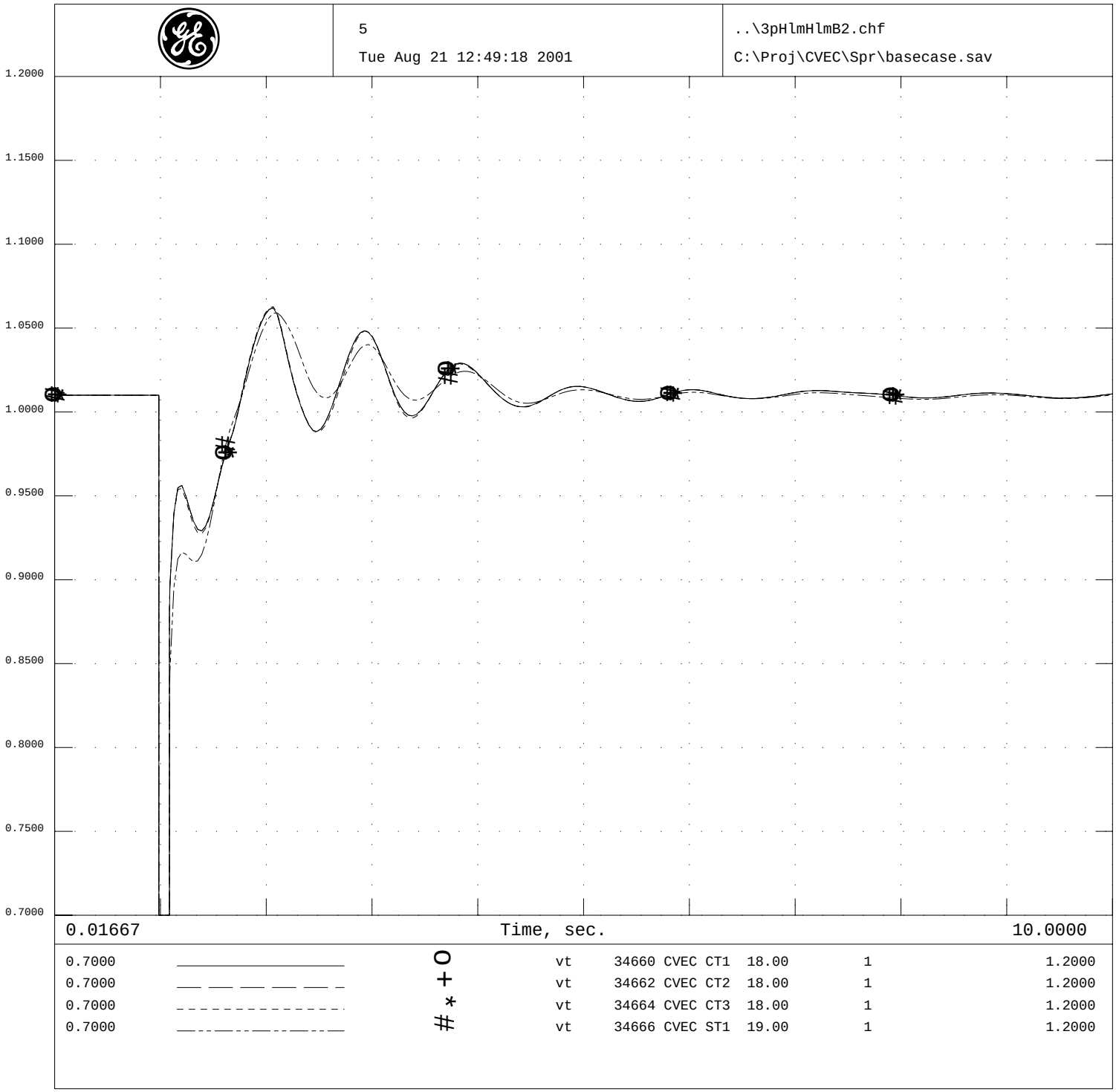

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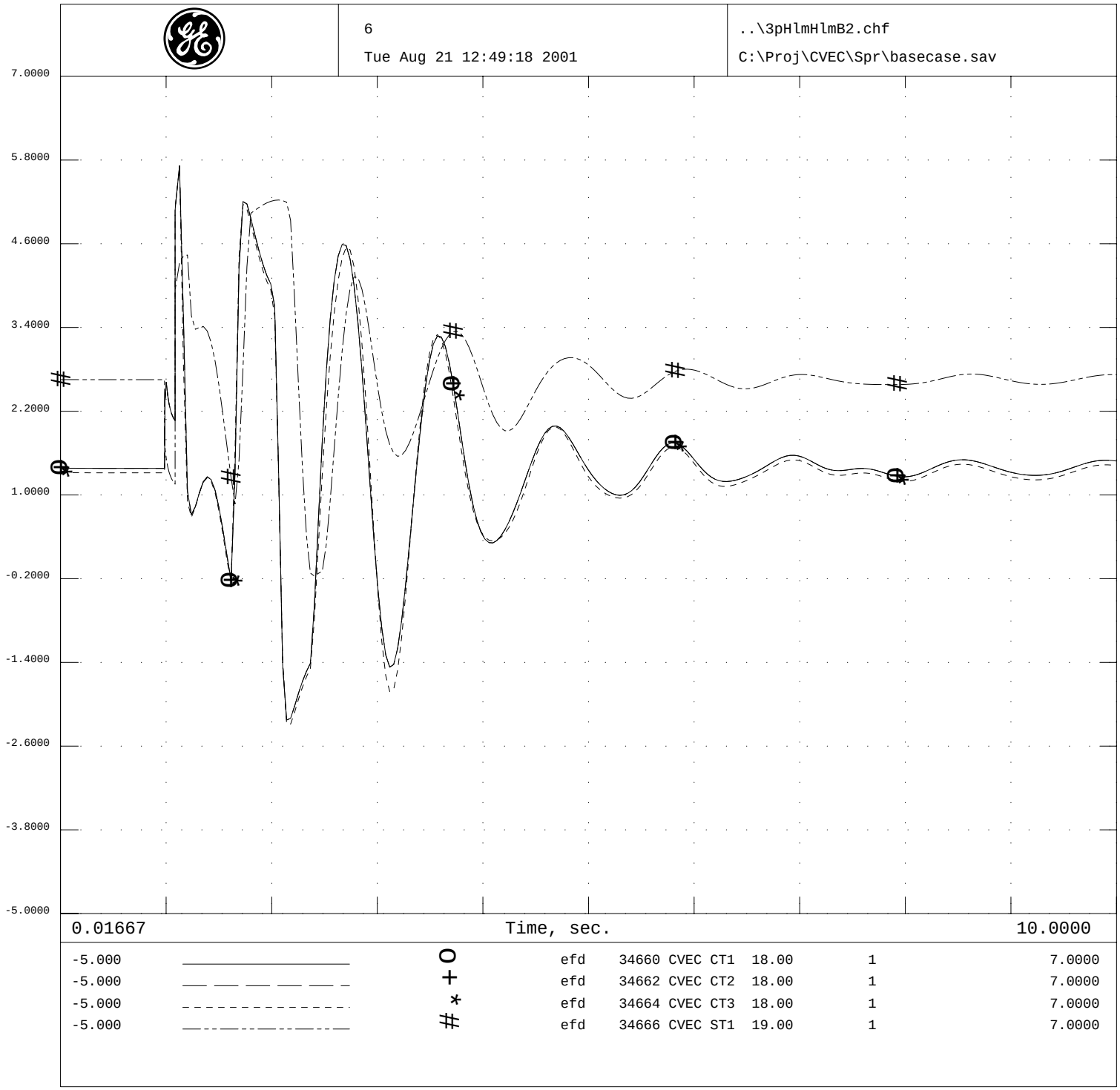
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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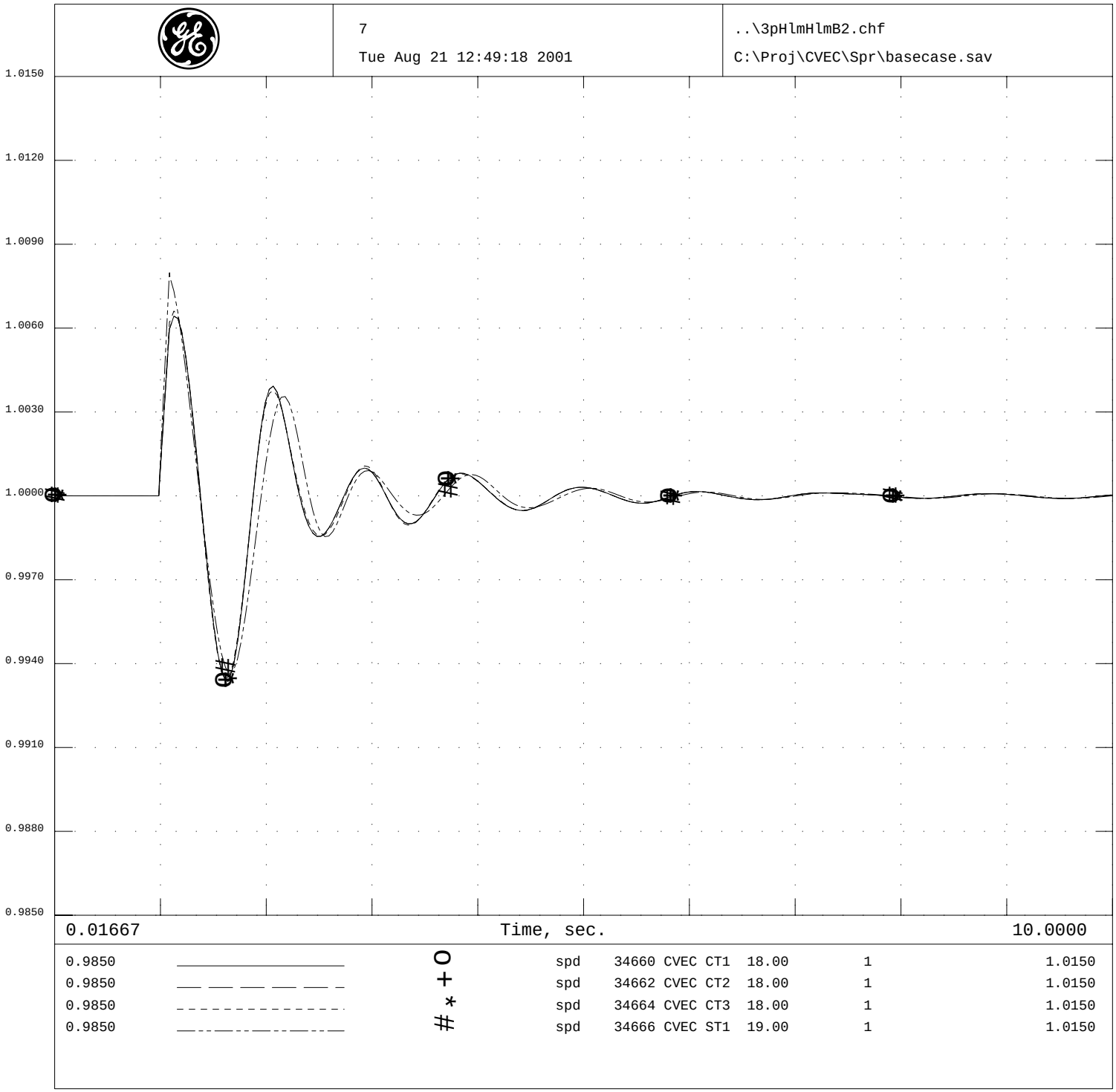
Calpine Corporation
Project Generator Field Voltages



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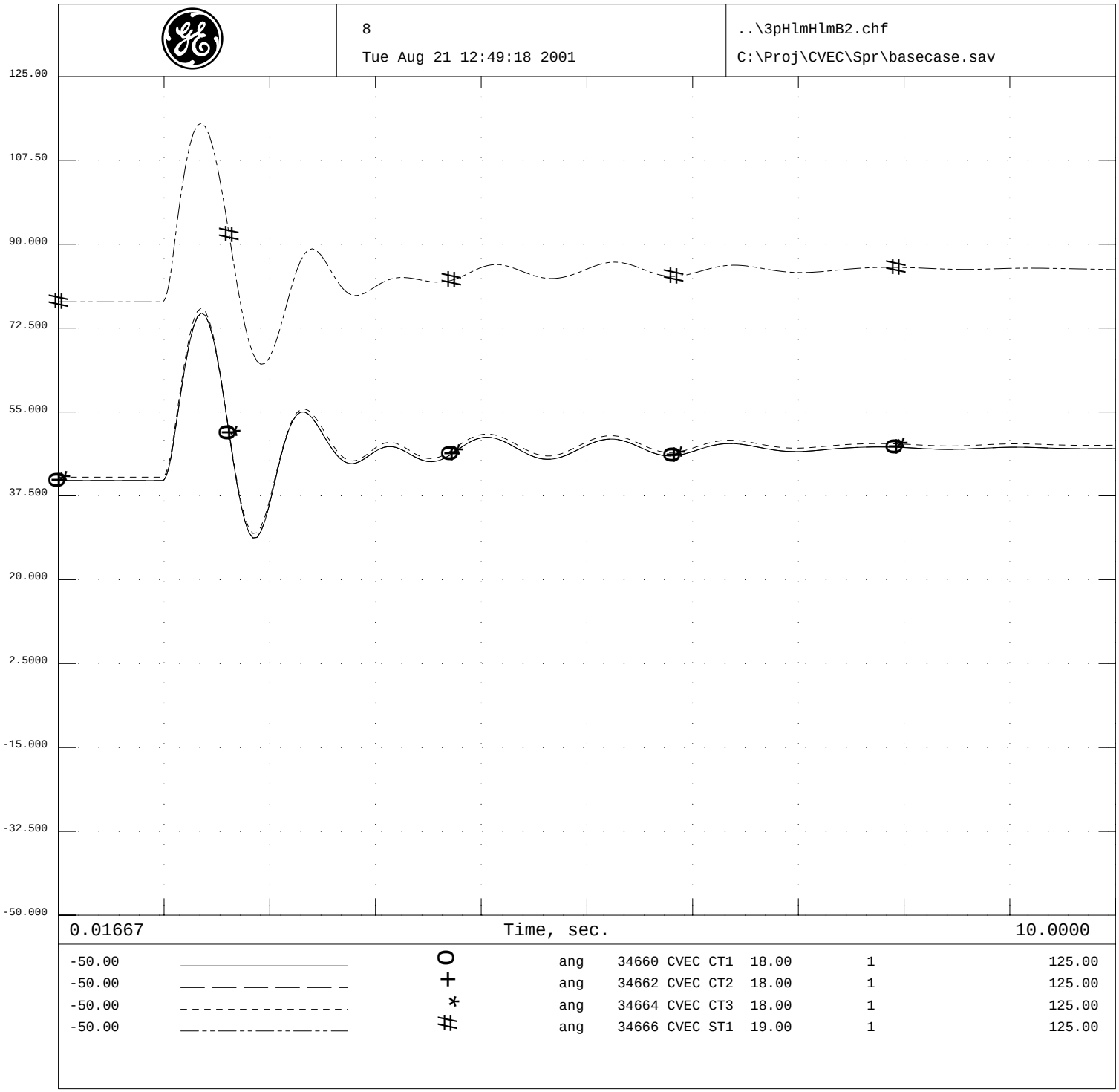
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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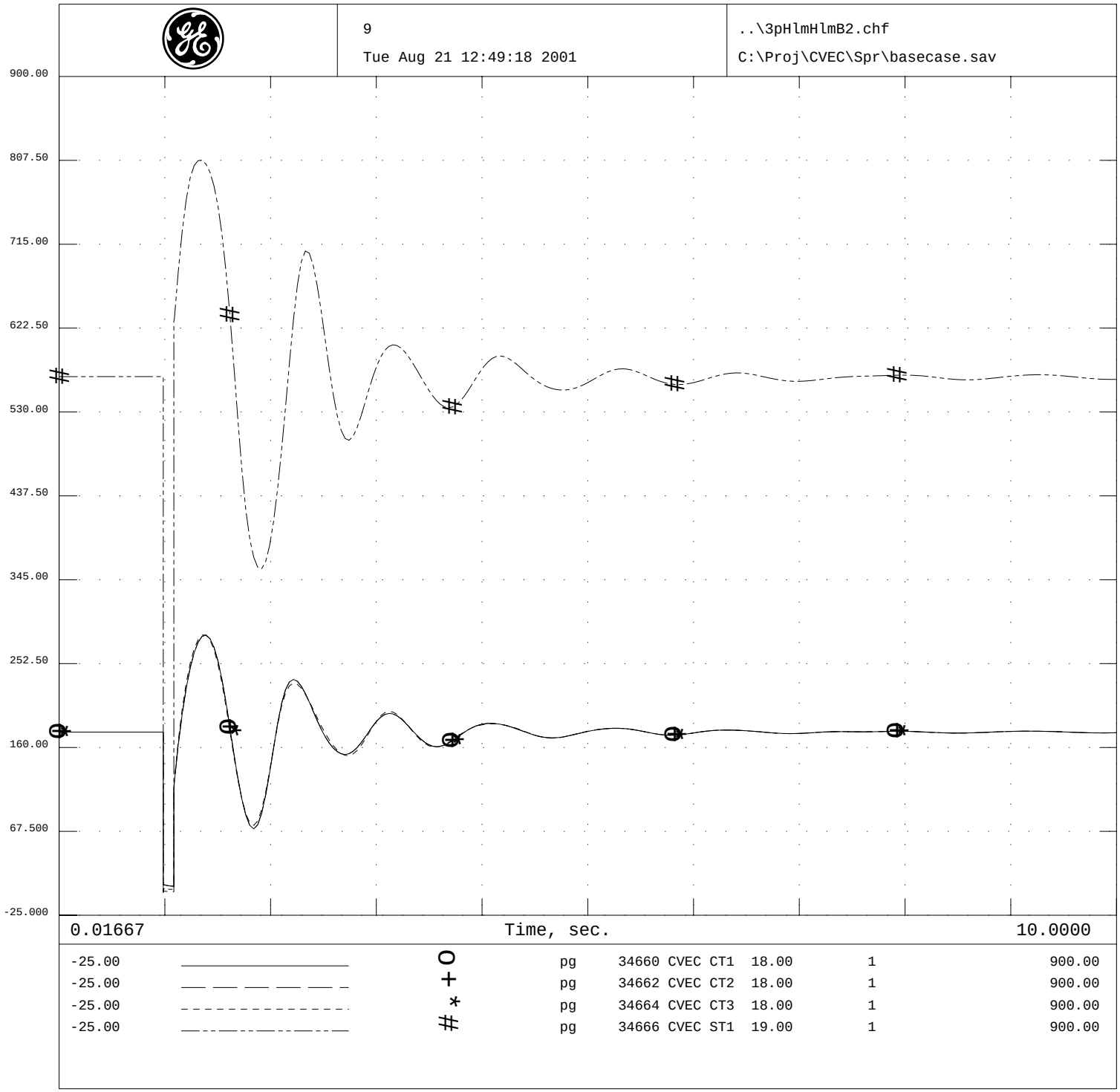
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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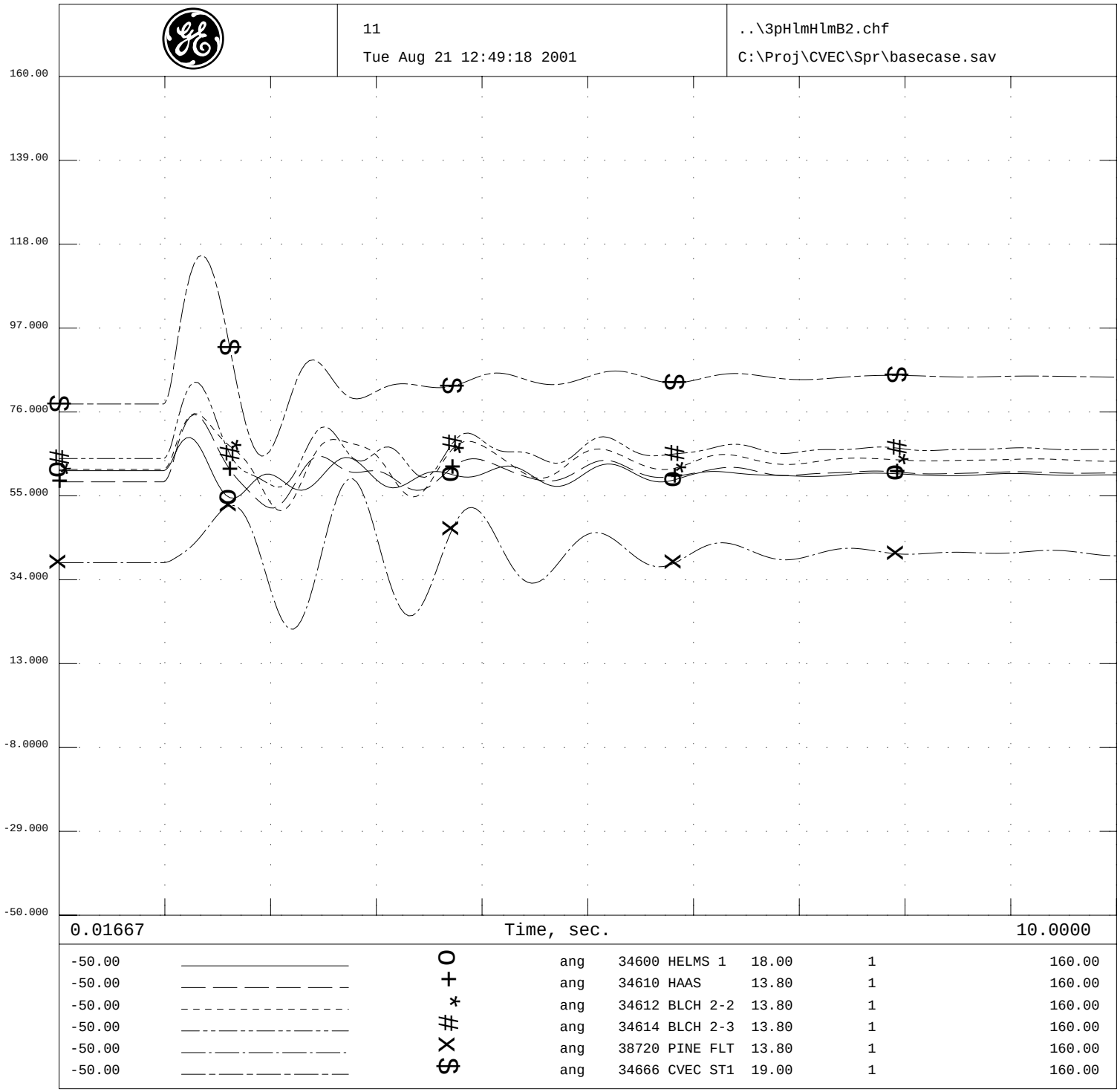
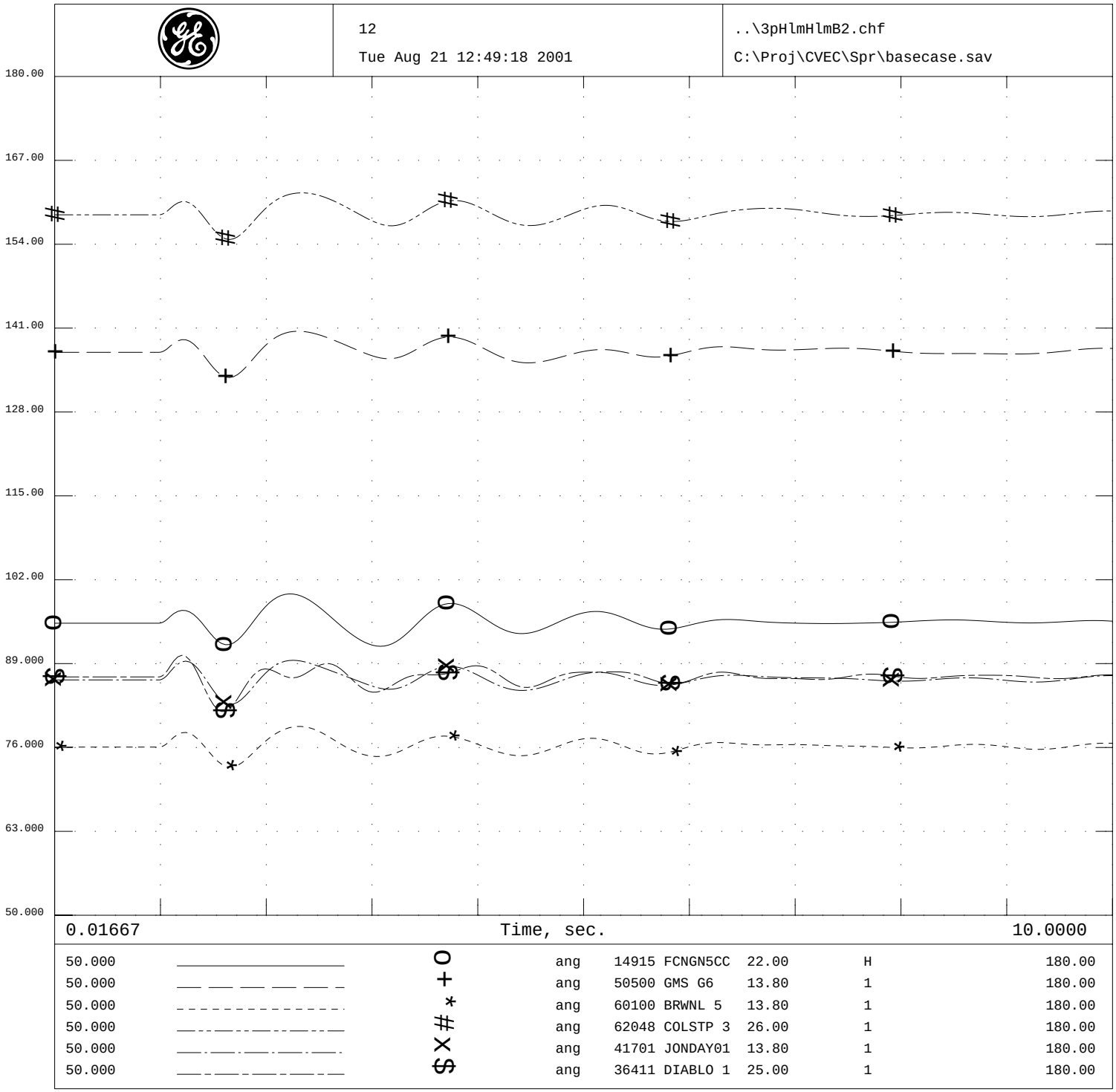
Calpine Corporation
Project Generator Terminal Power



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Helm 230kV Bus #2 Outage
3 phase 6 cycle fault at Helm 230kV bus and clear bus #2

Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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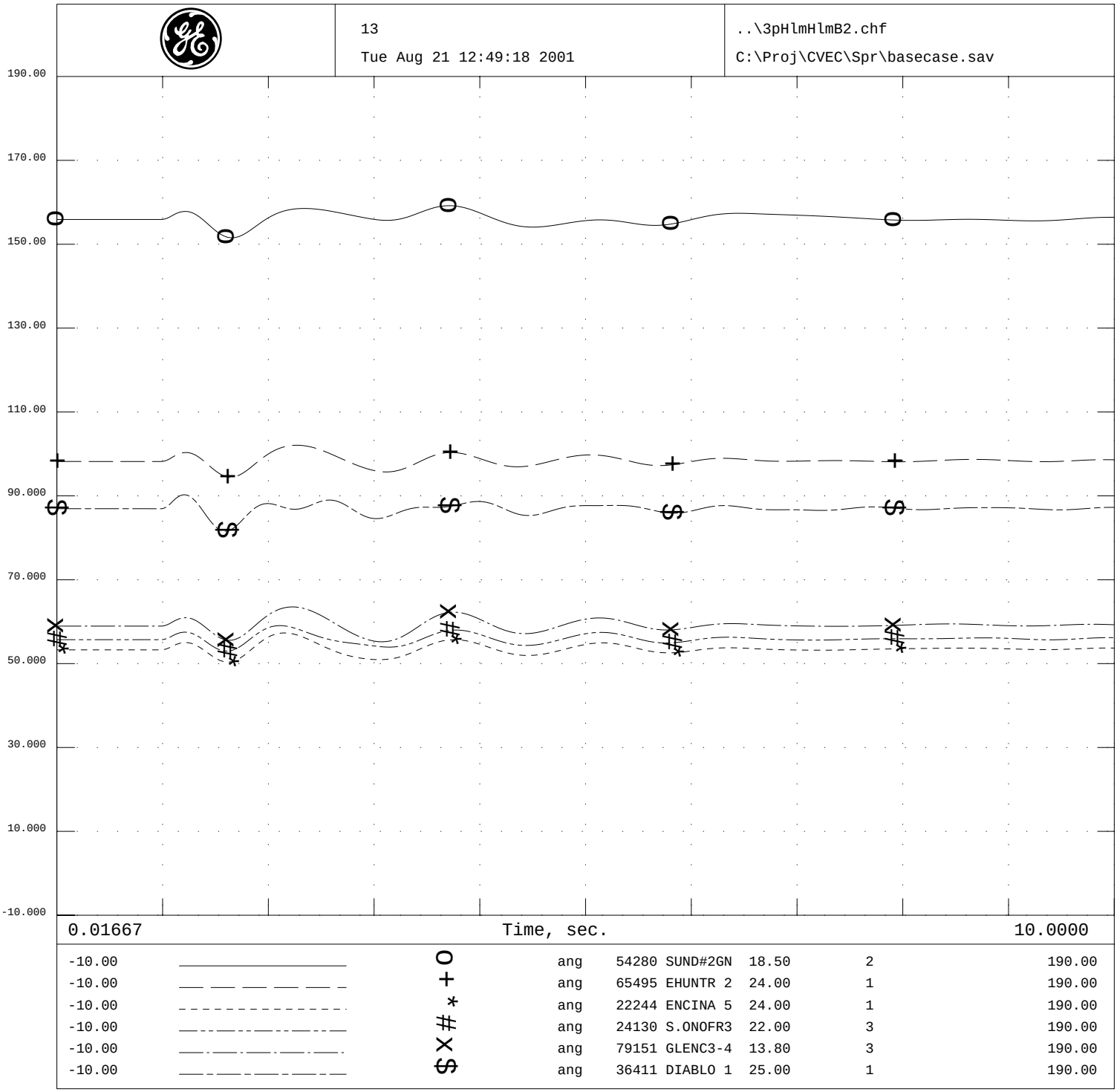
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Calpine Corporation
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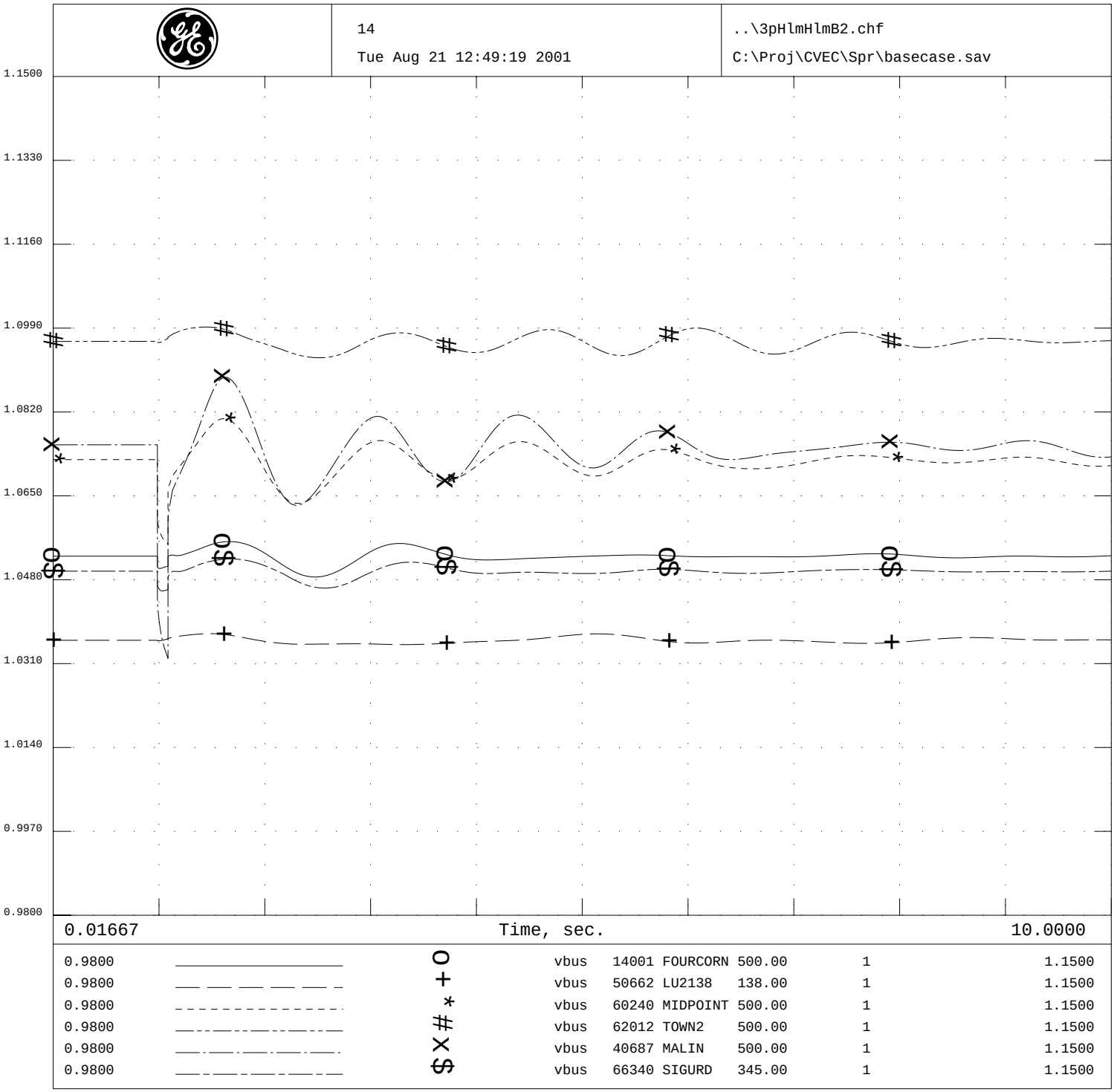

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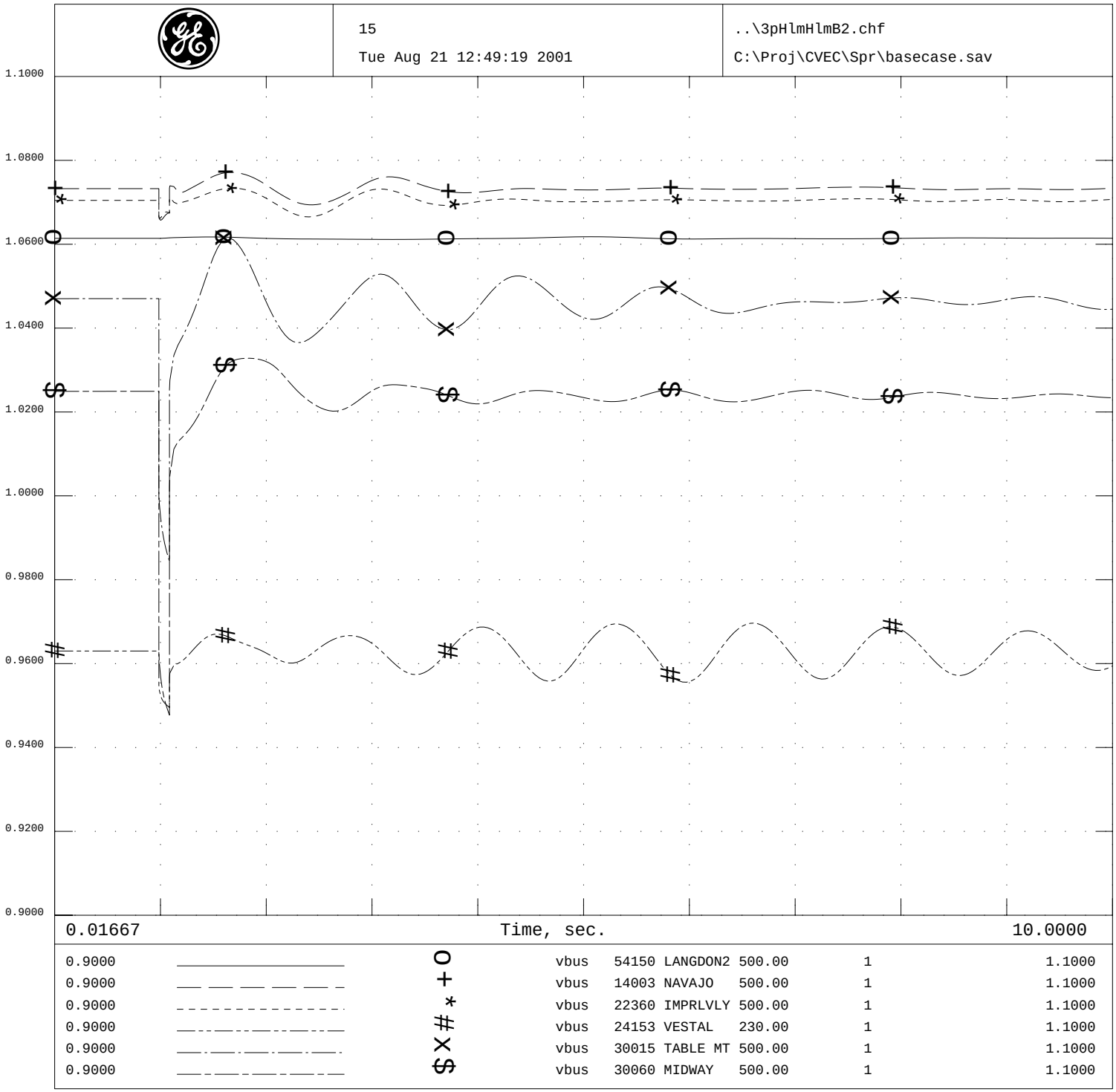
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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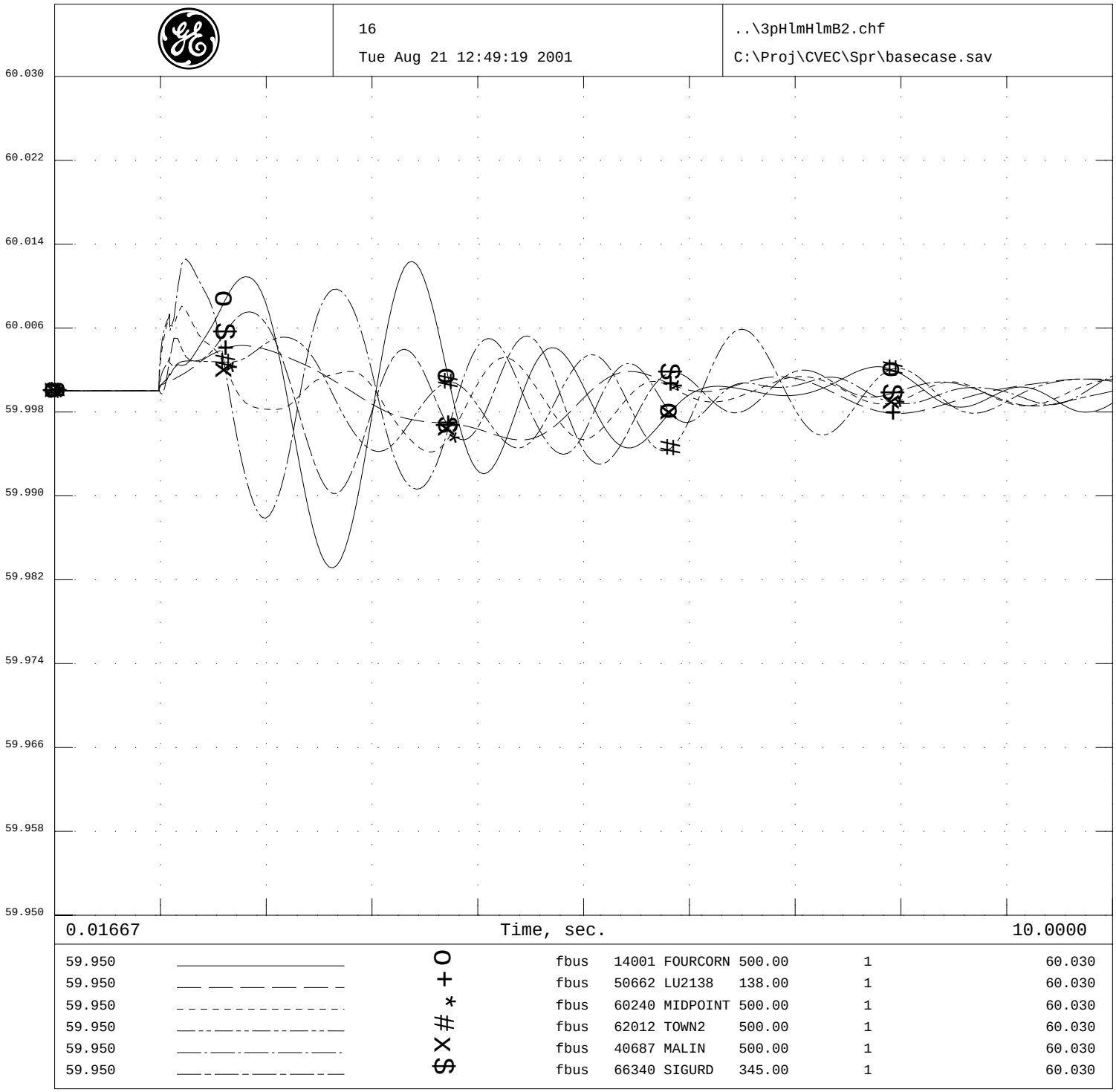

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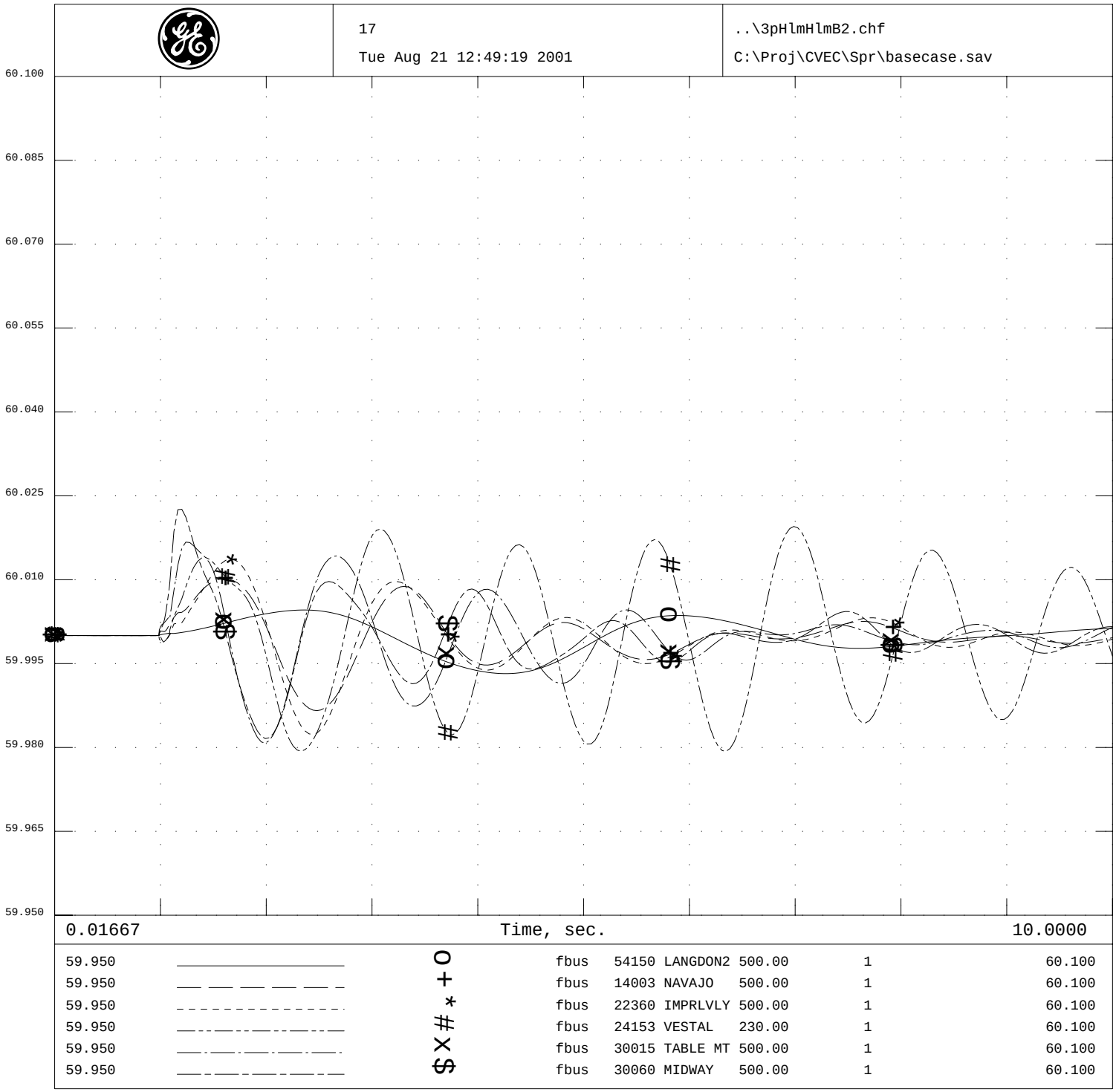
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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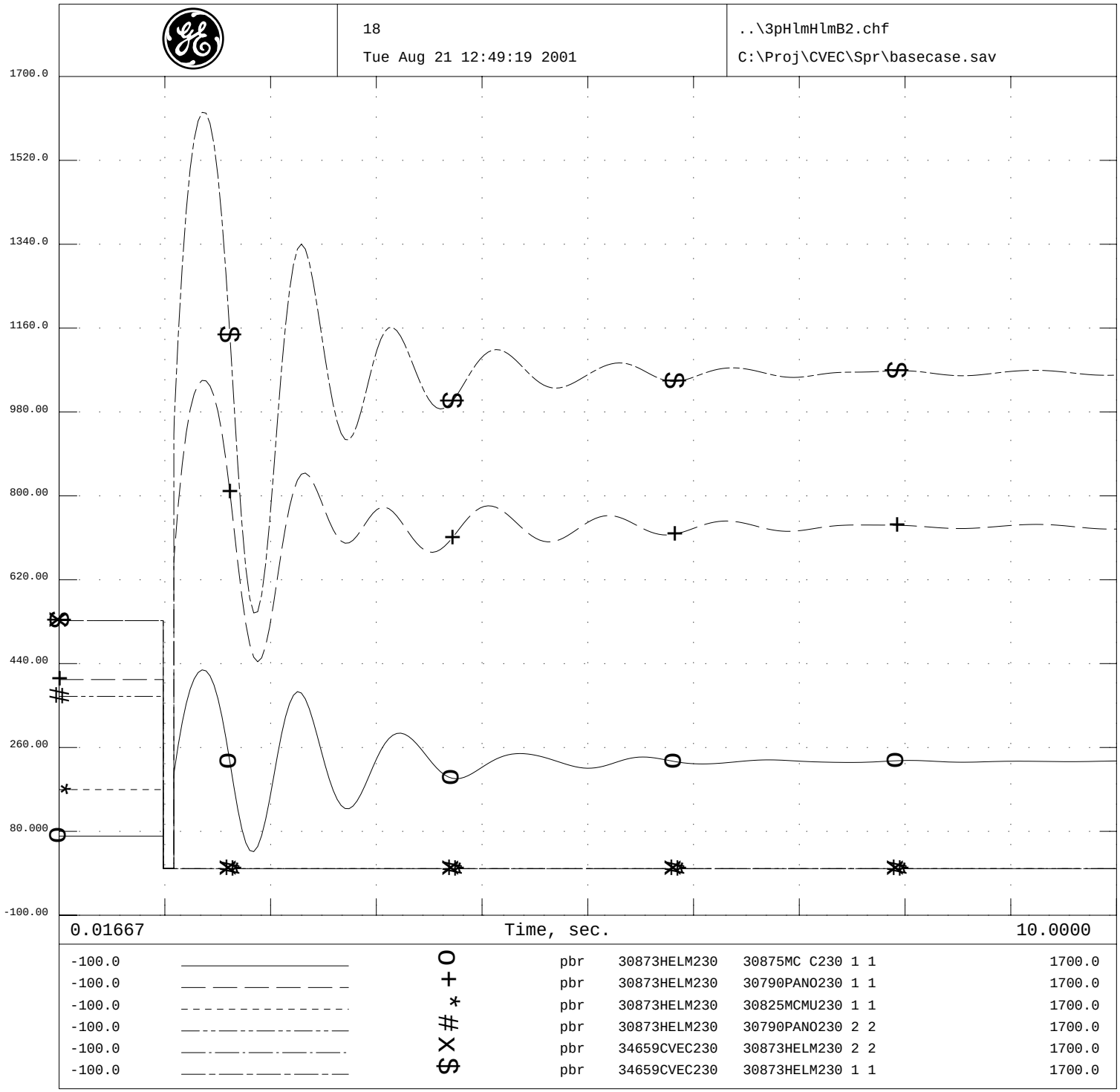

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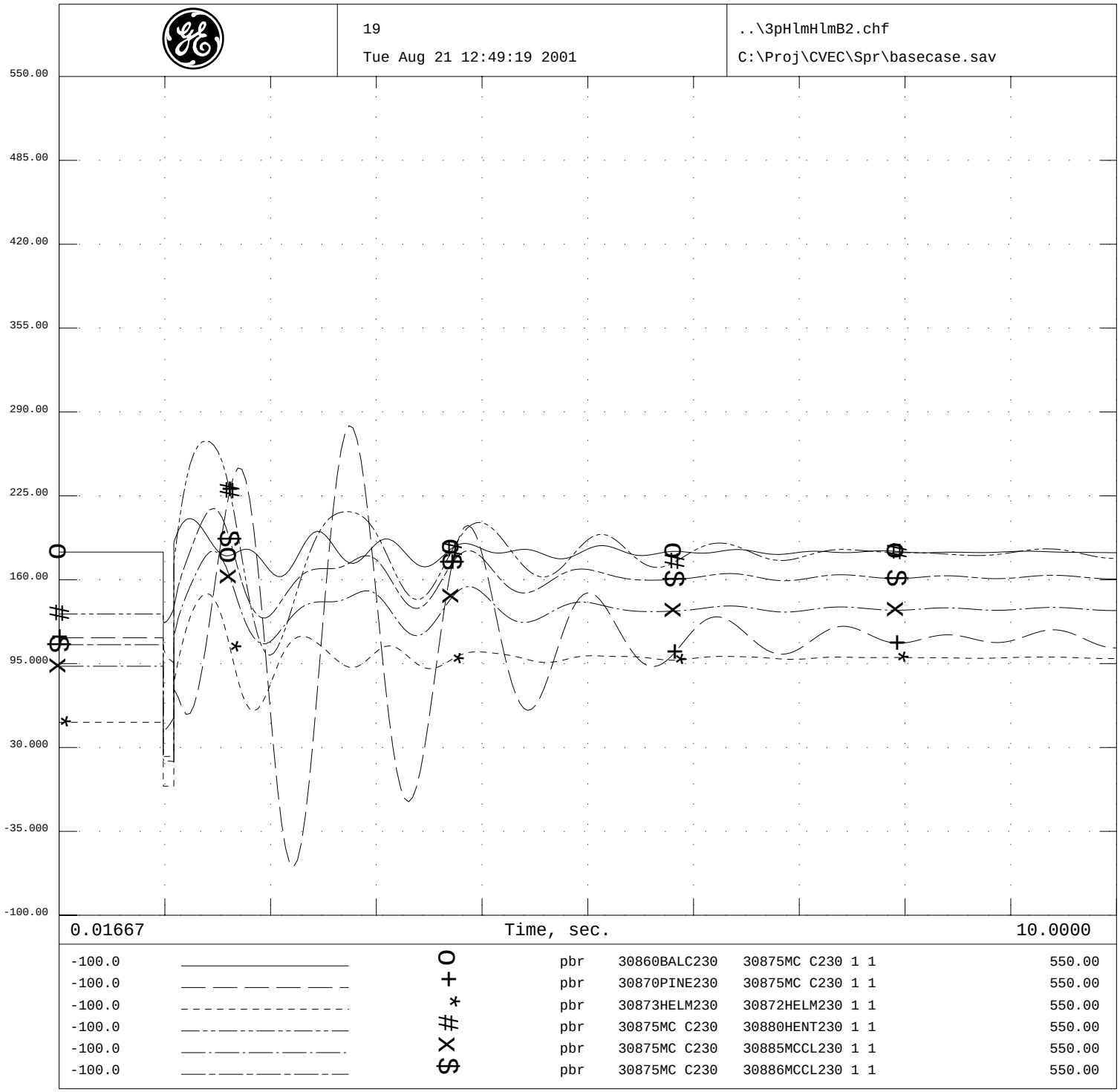
Calpine Corporation
Selected Transmission Line Flows (MW)



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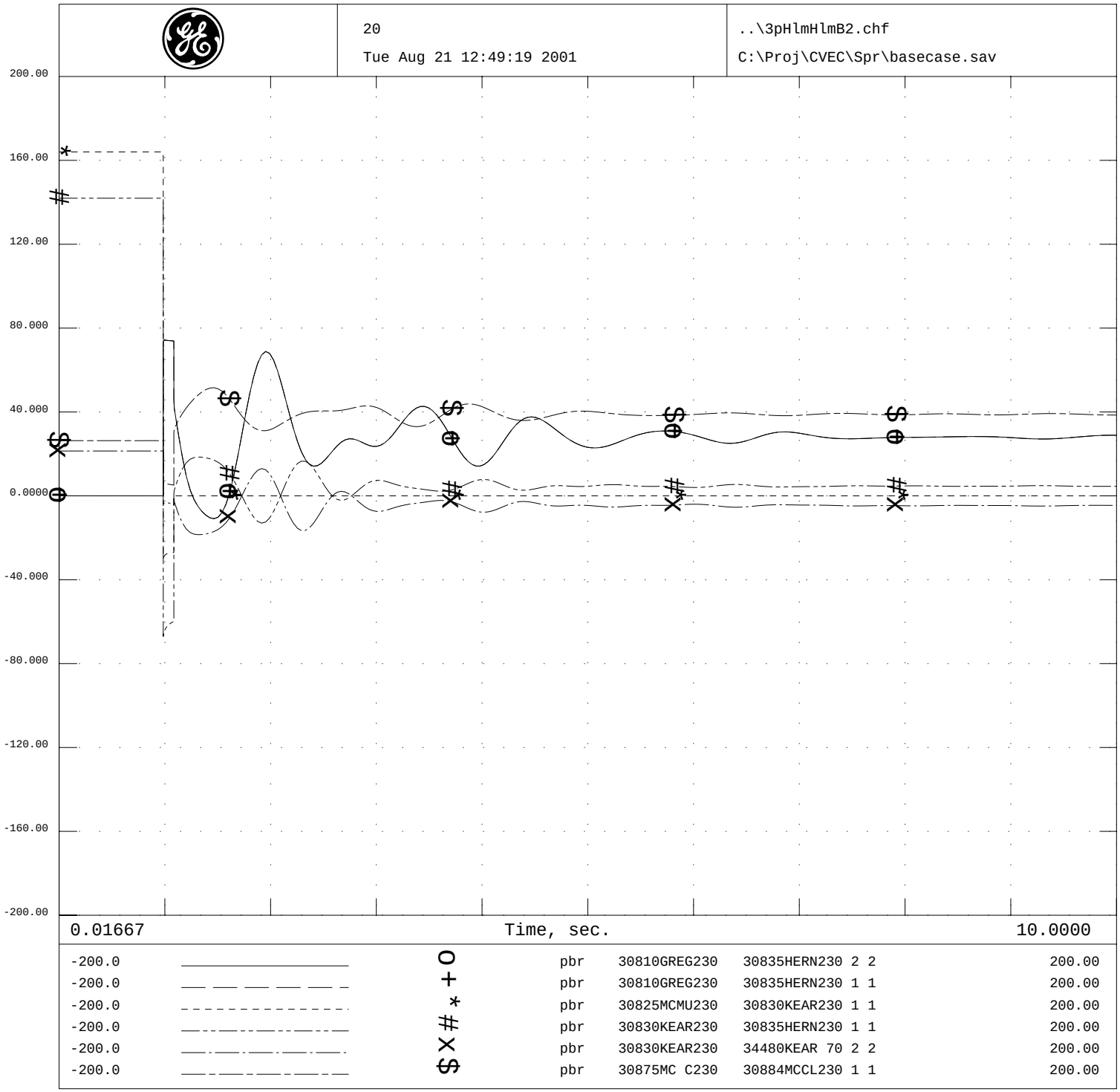

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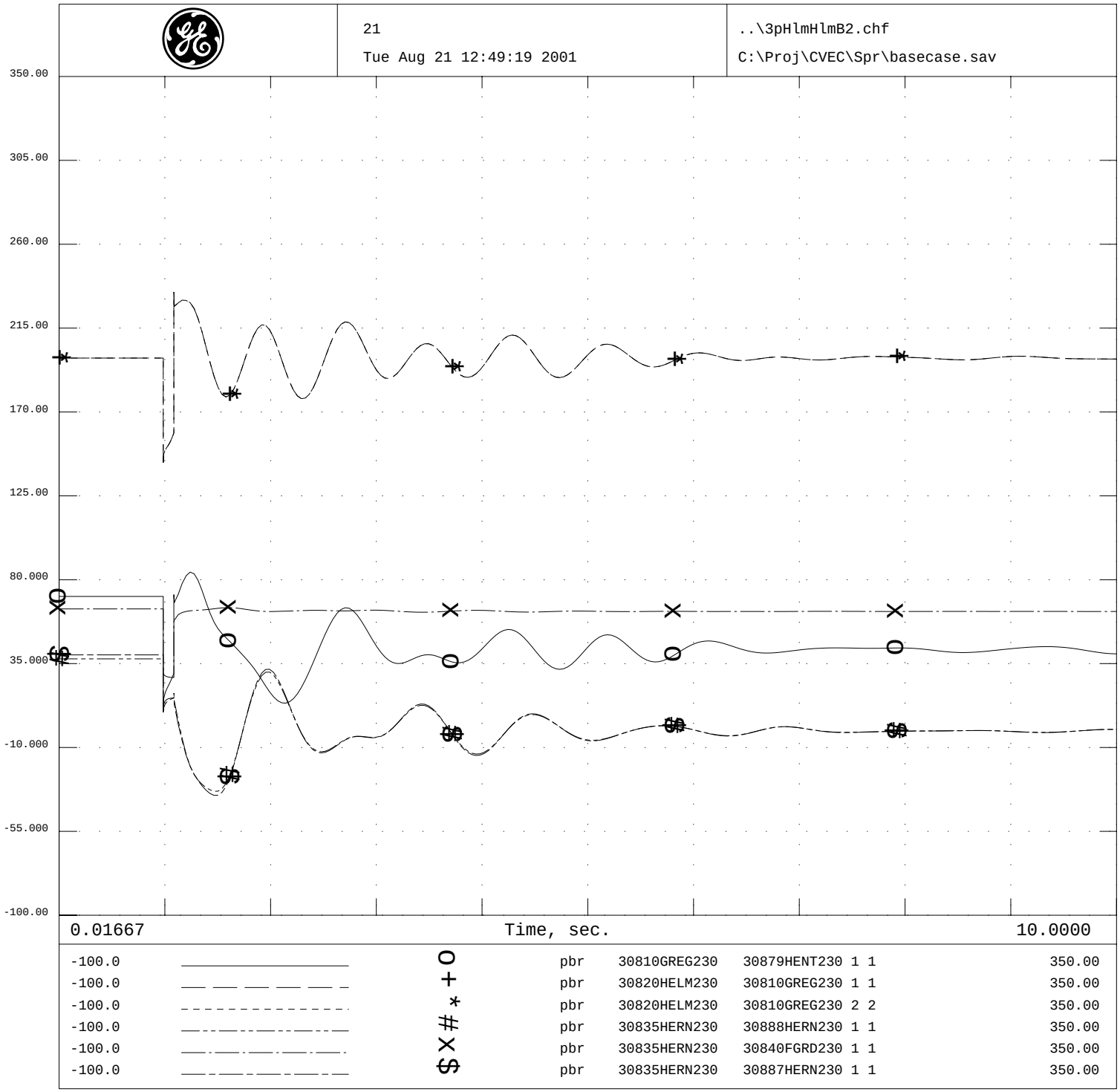

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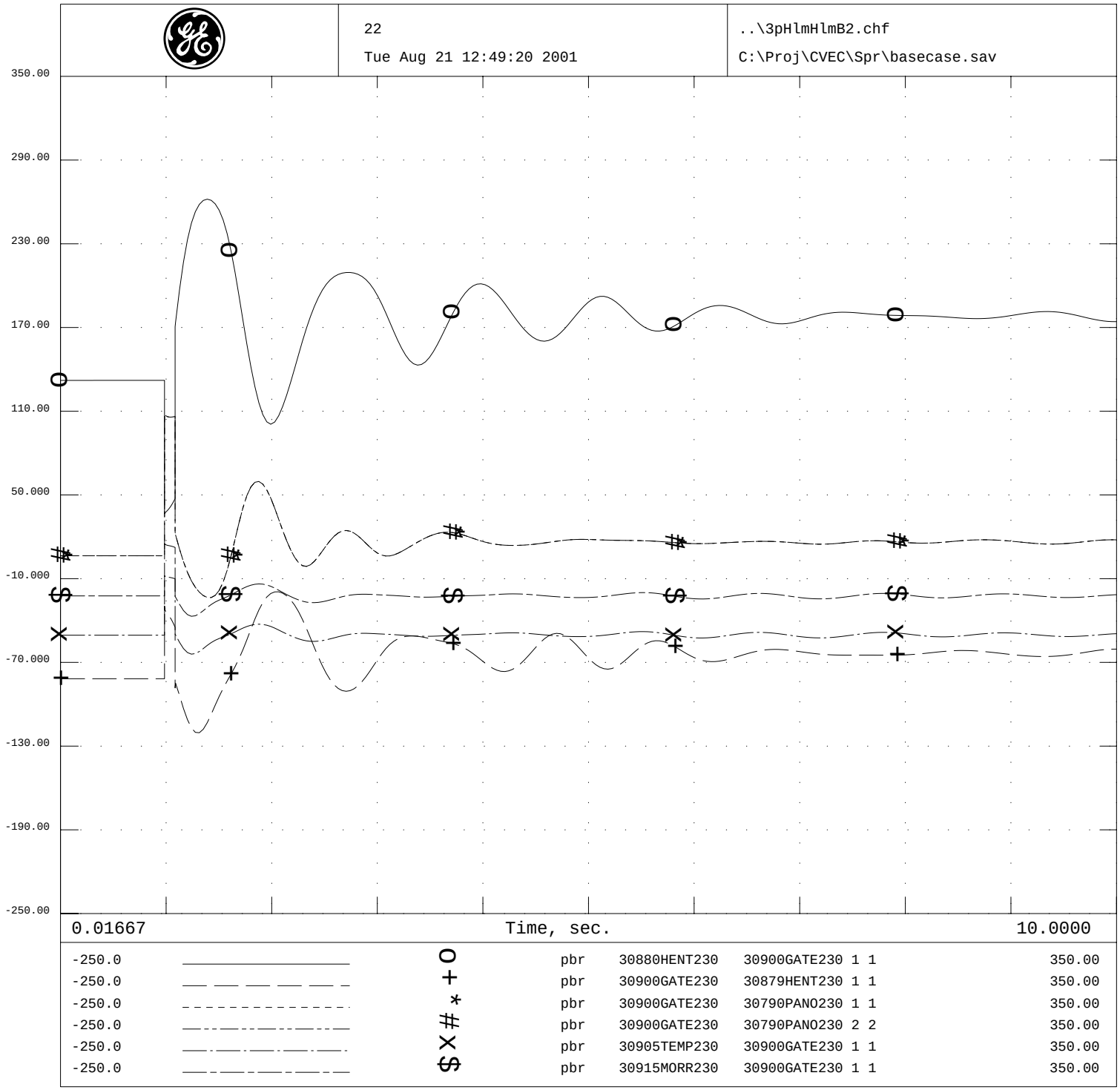

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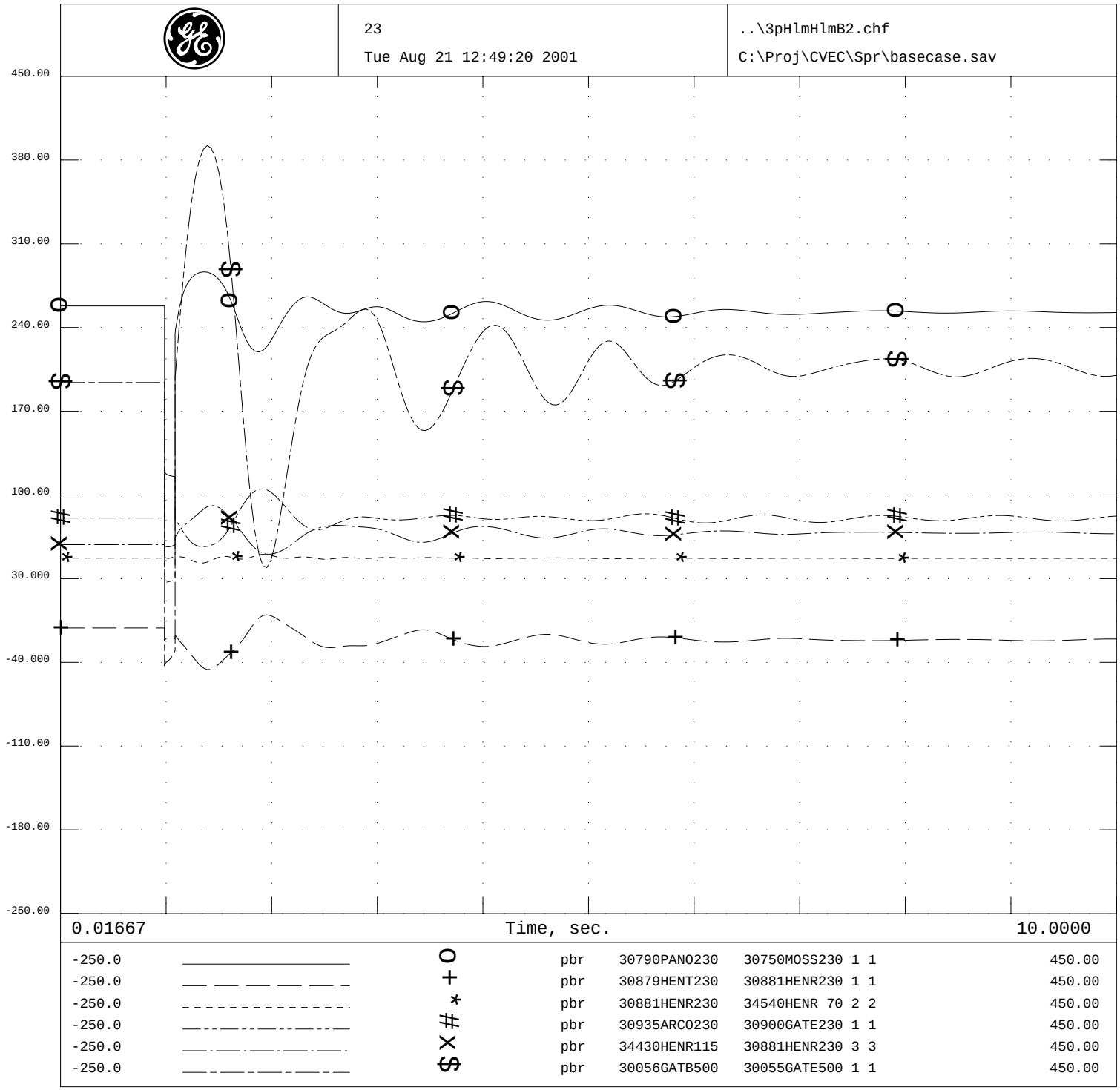

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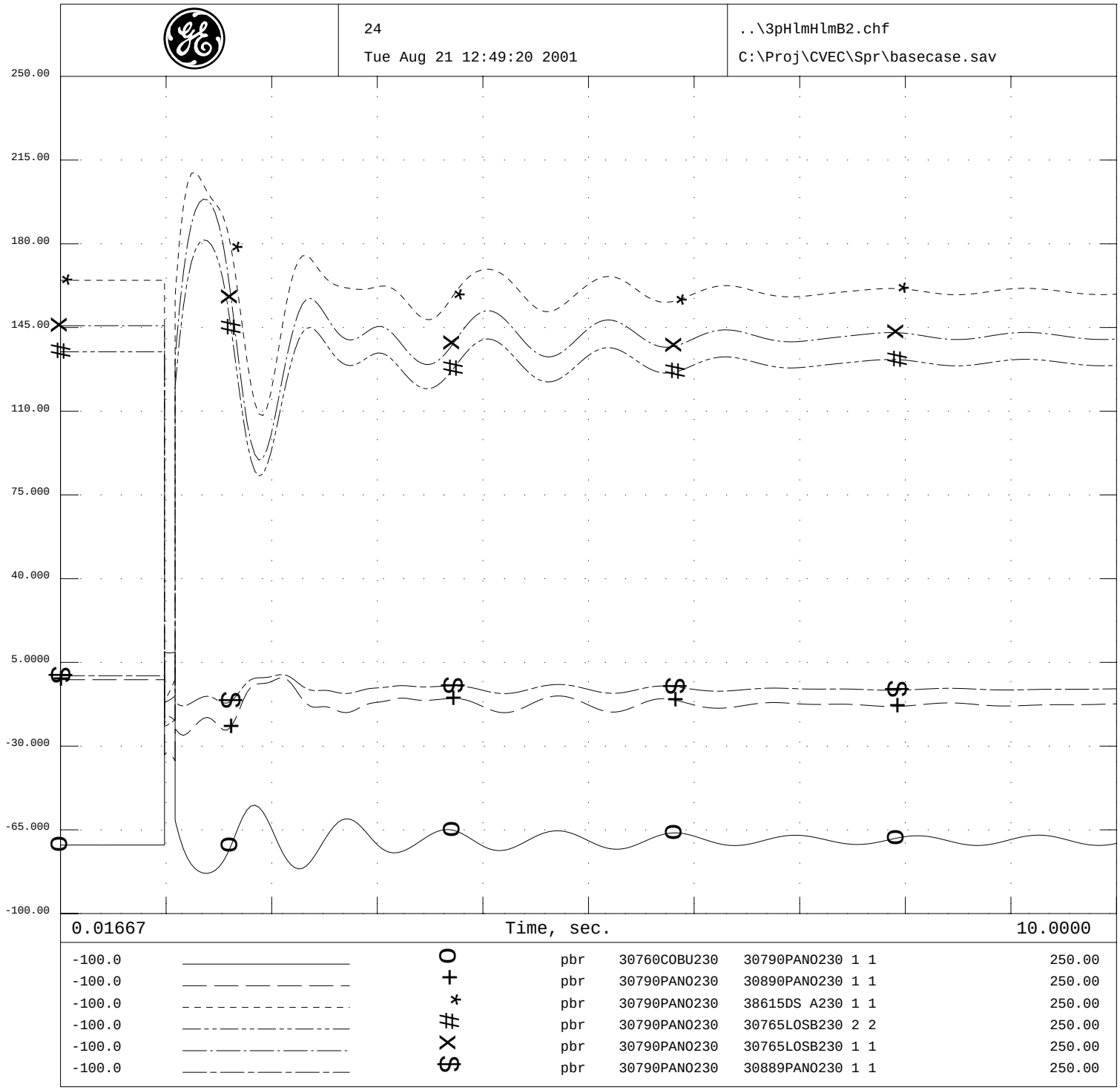

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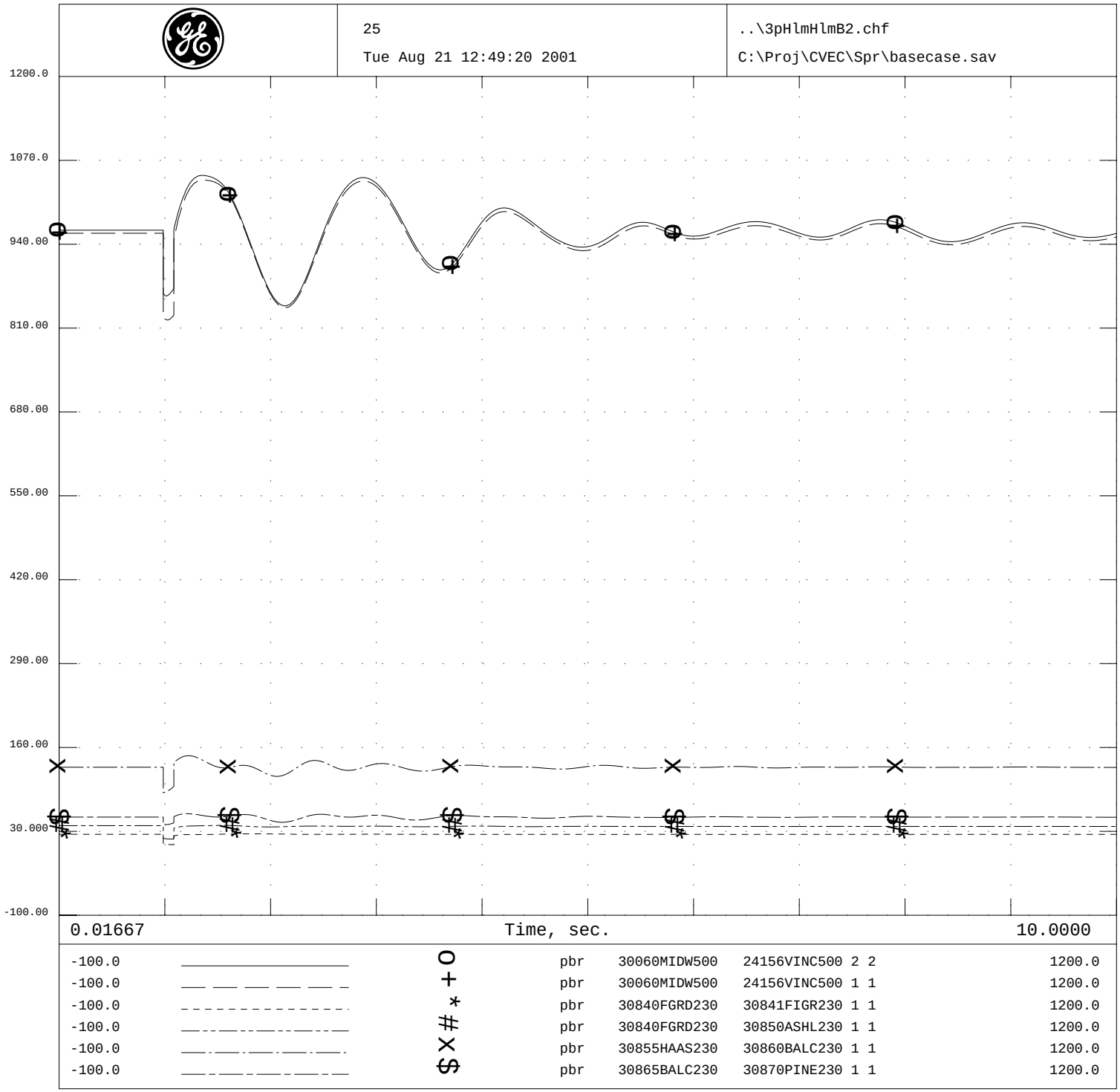

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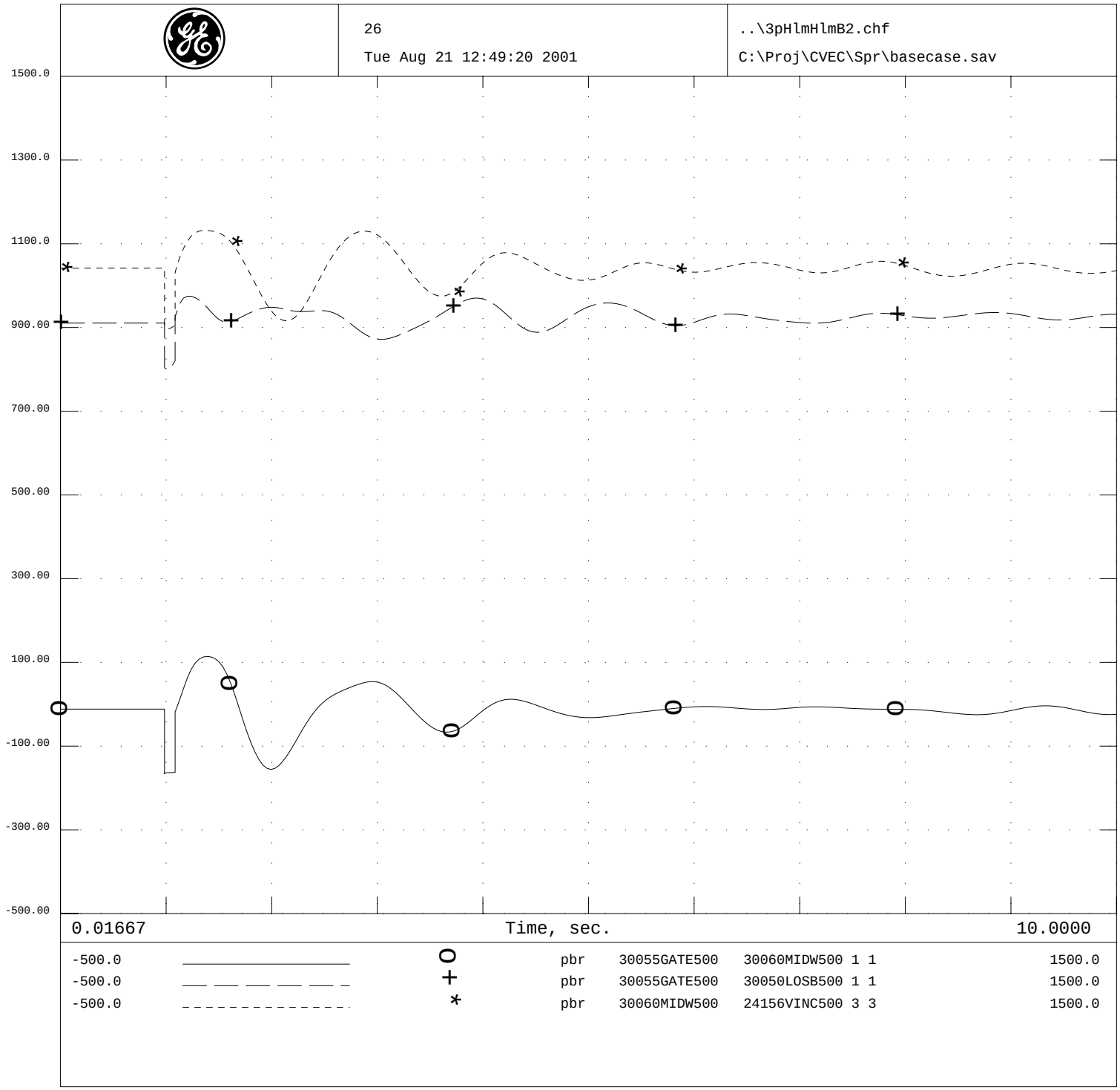

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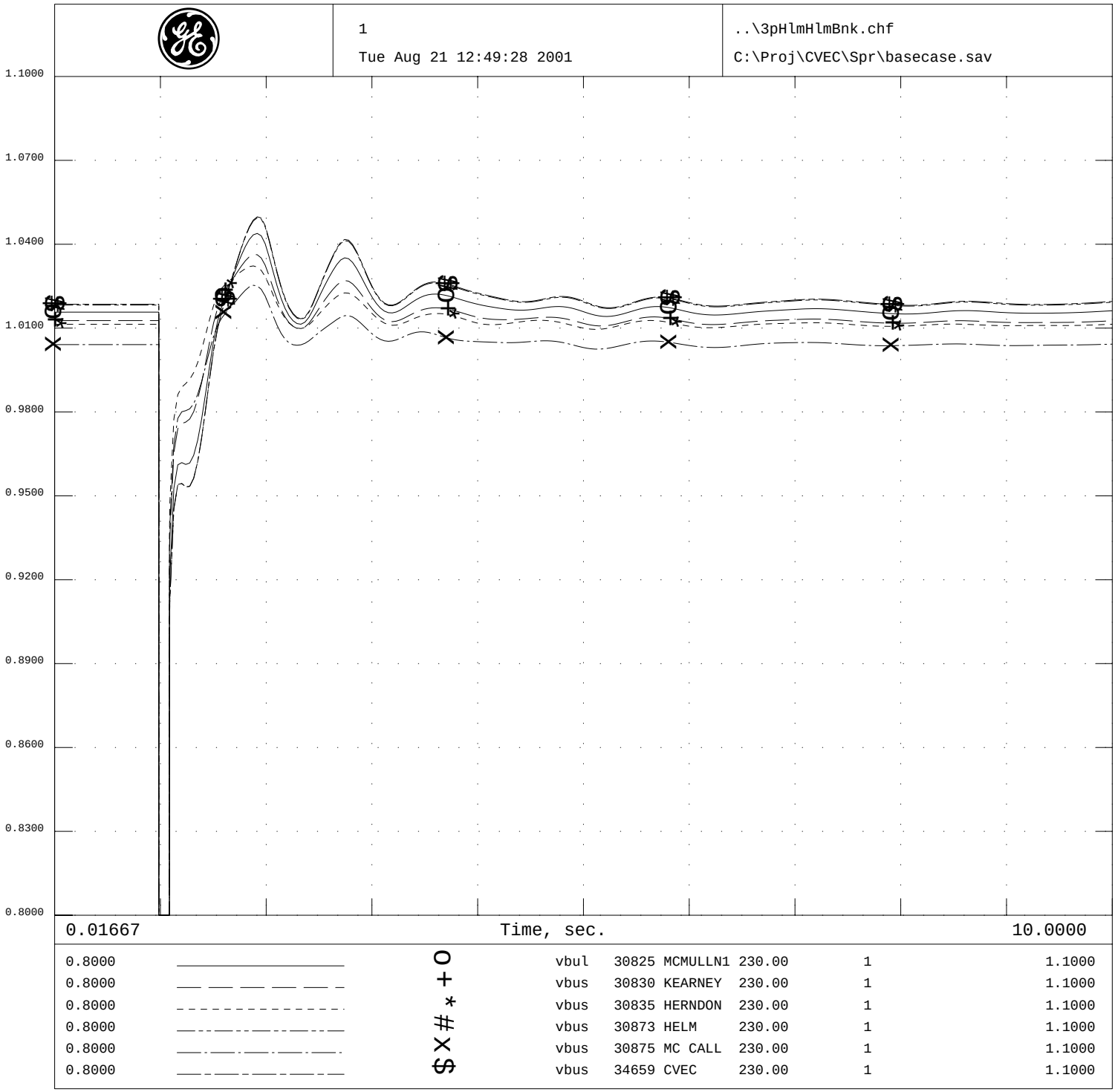

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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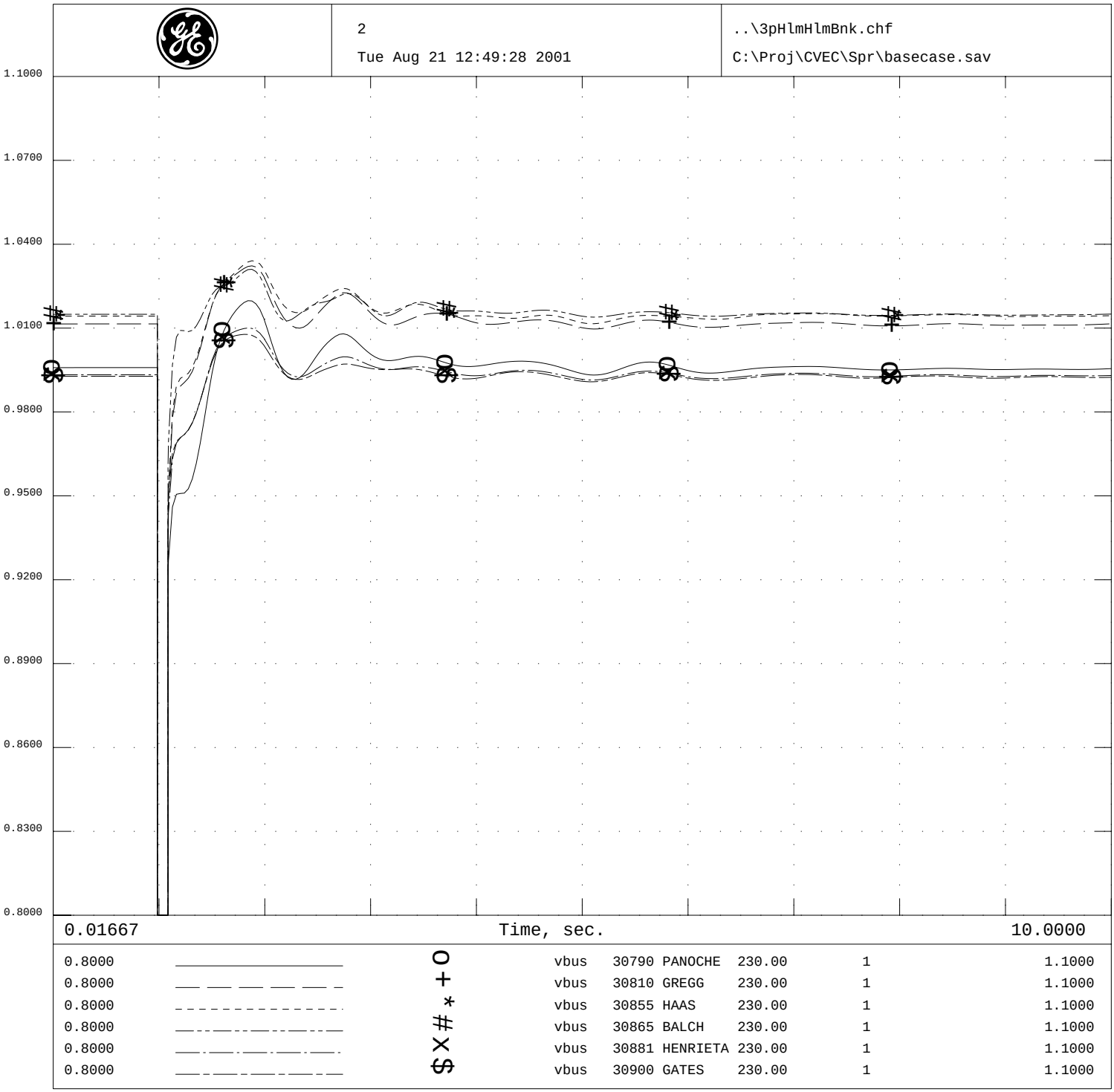
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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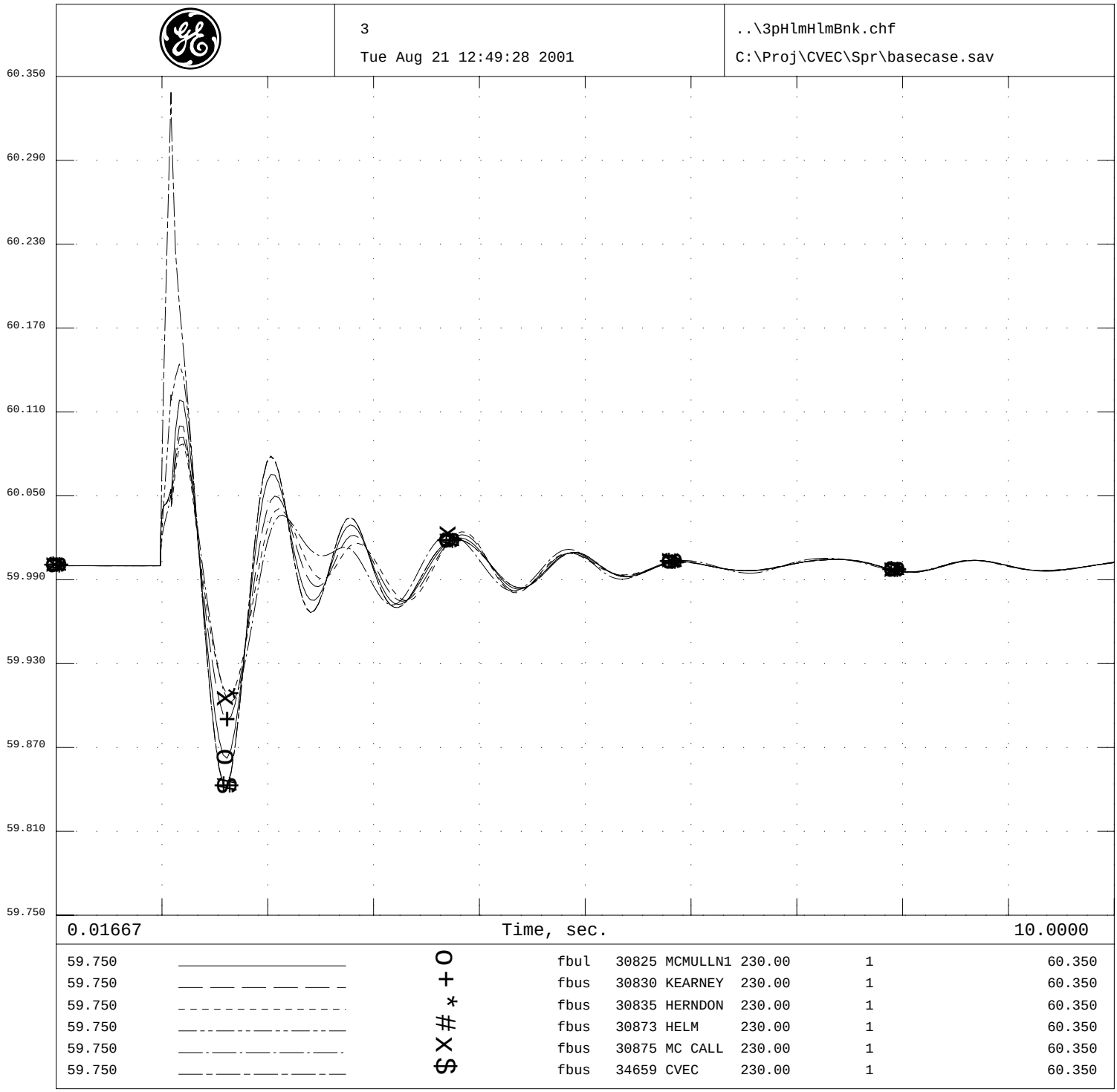

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2004 Heavy Spring Base Case
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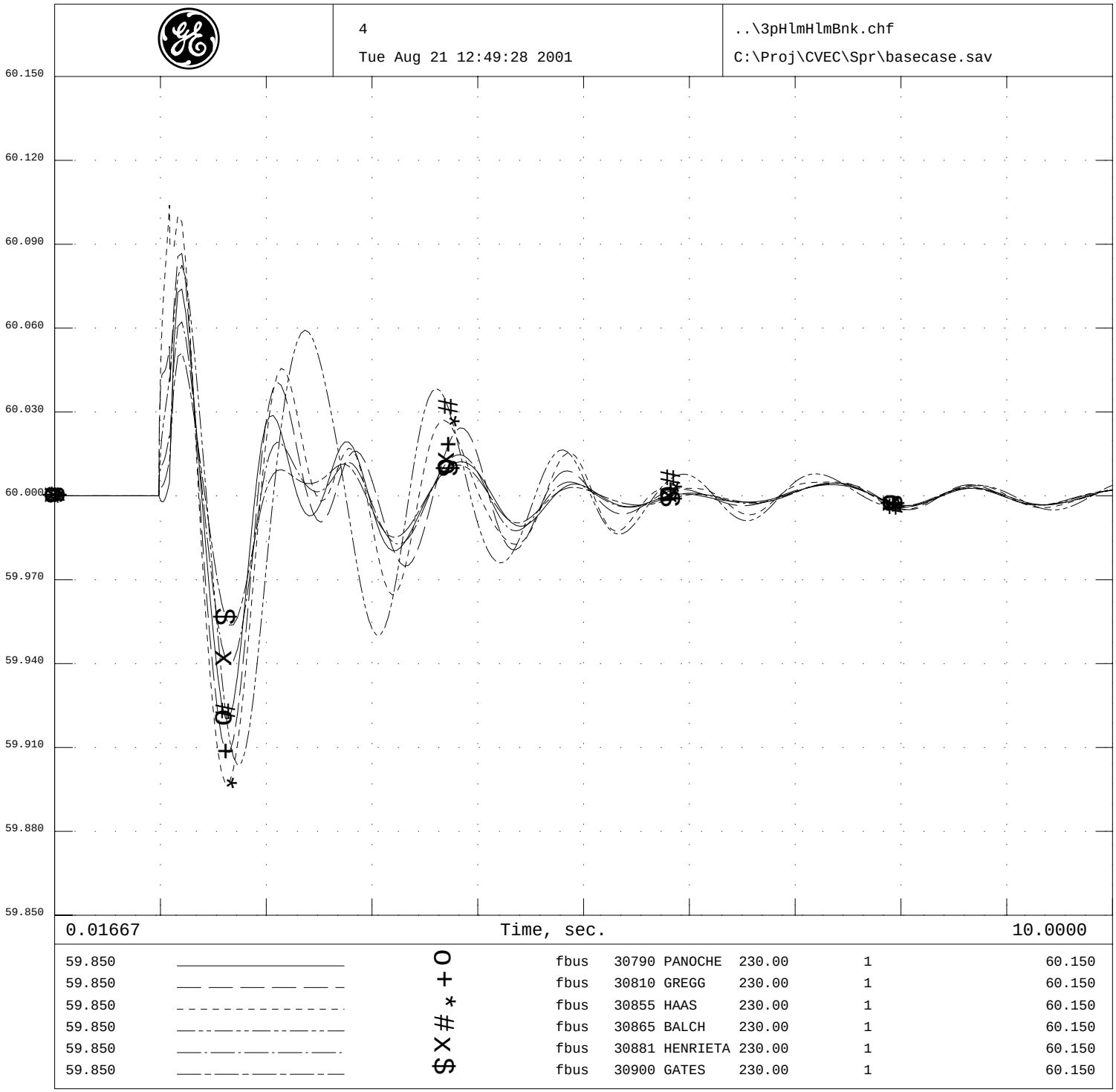
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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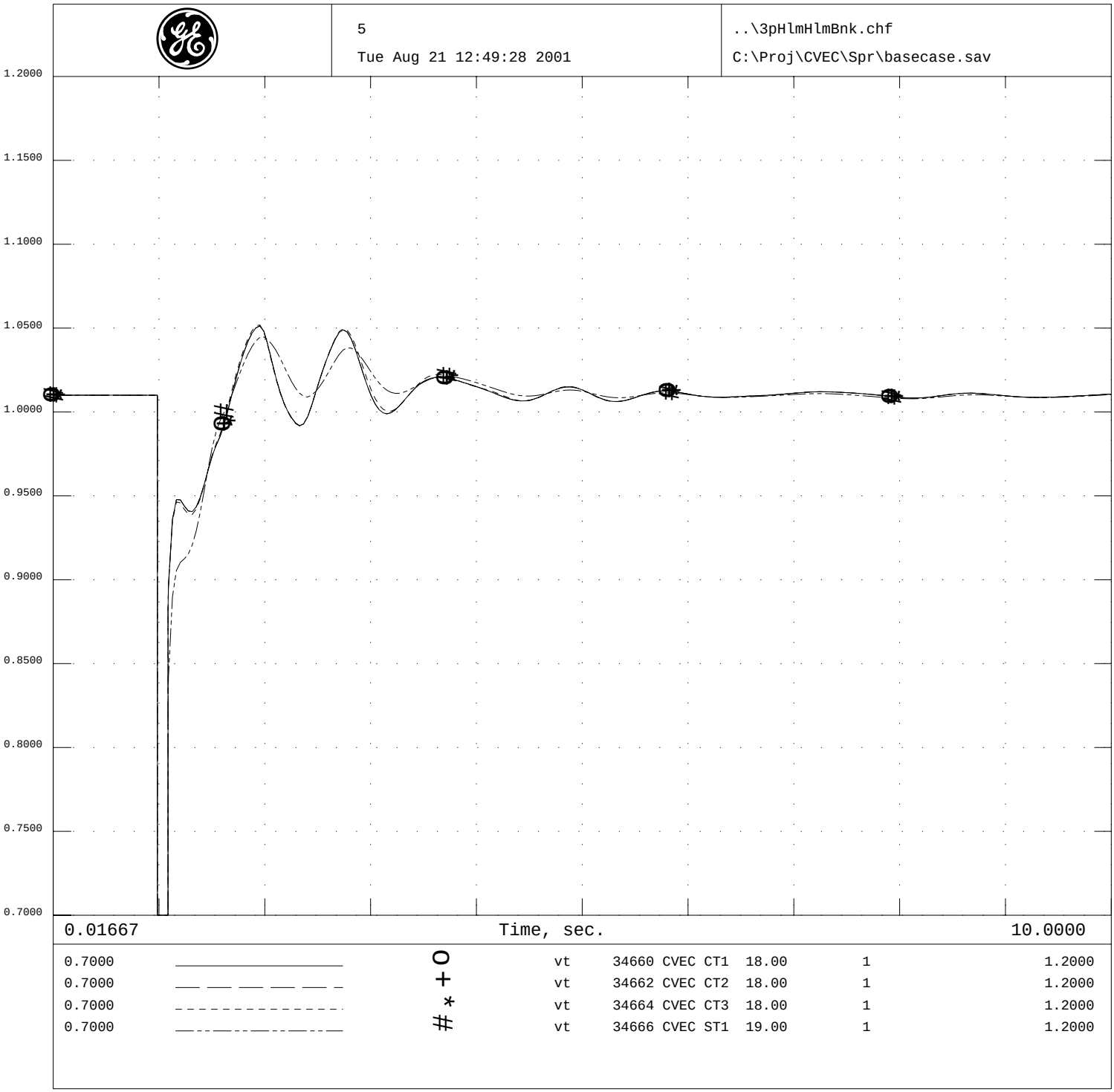

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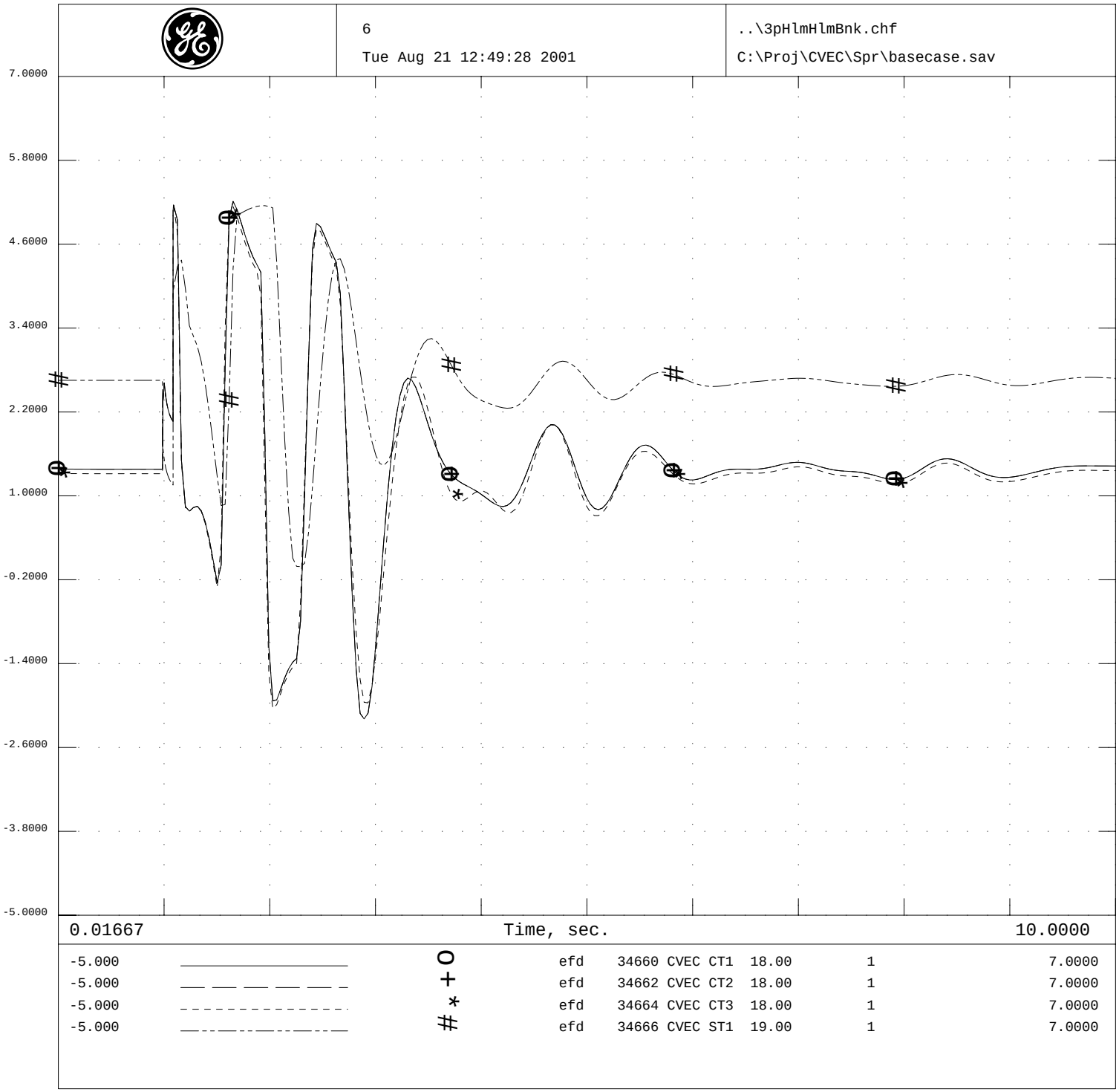
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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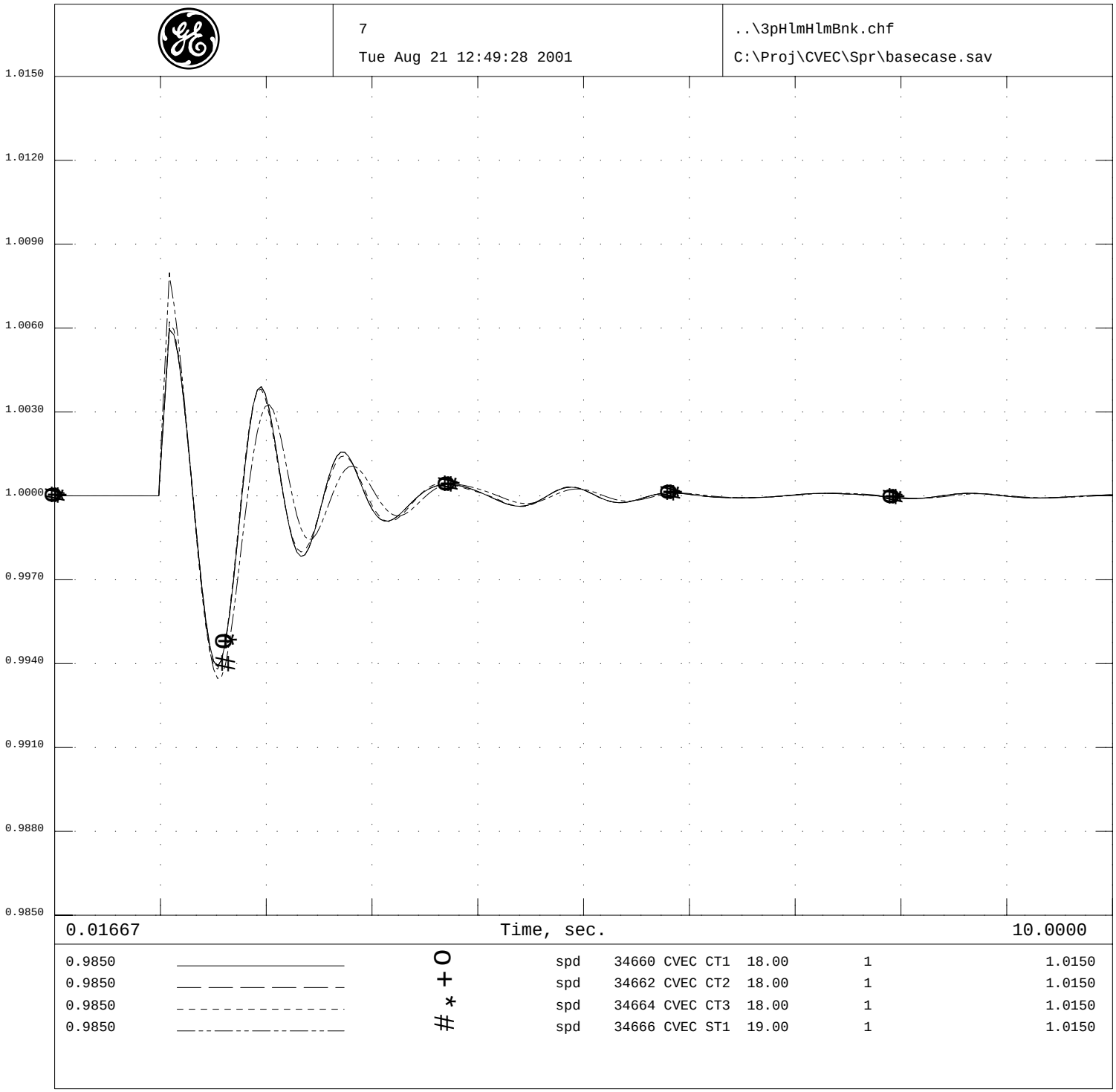
Calpine Corporation
Project Generator Field Voltages



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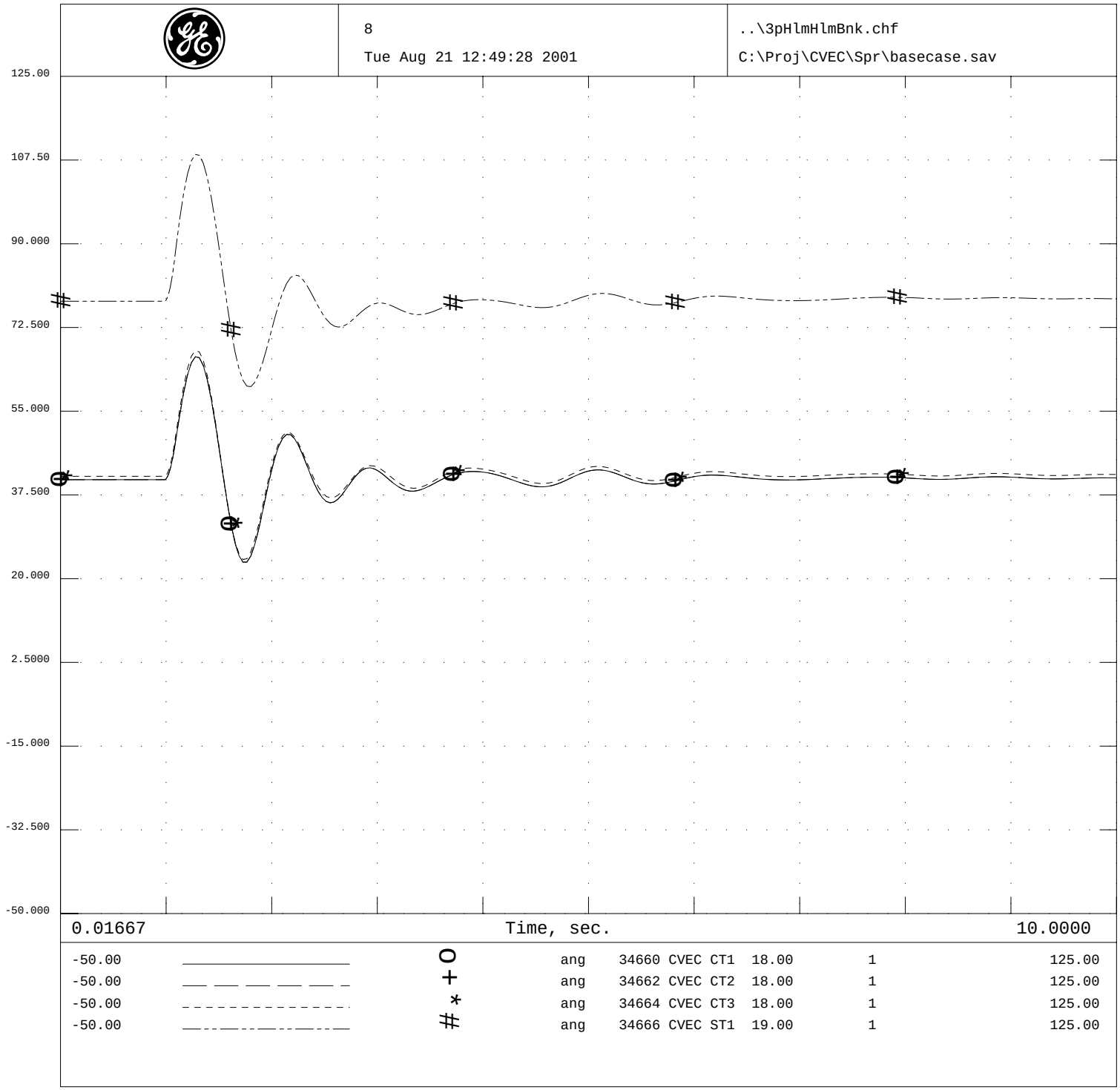
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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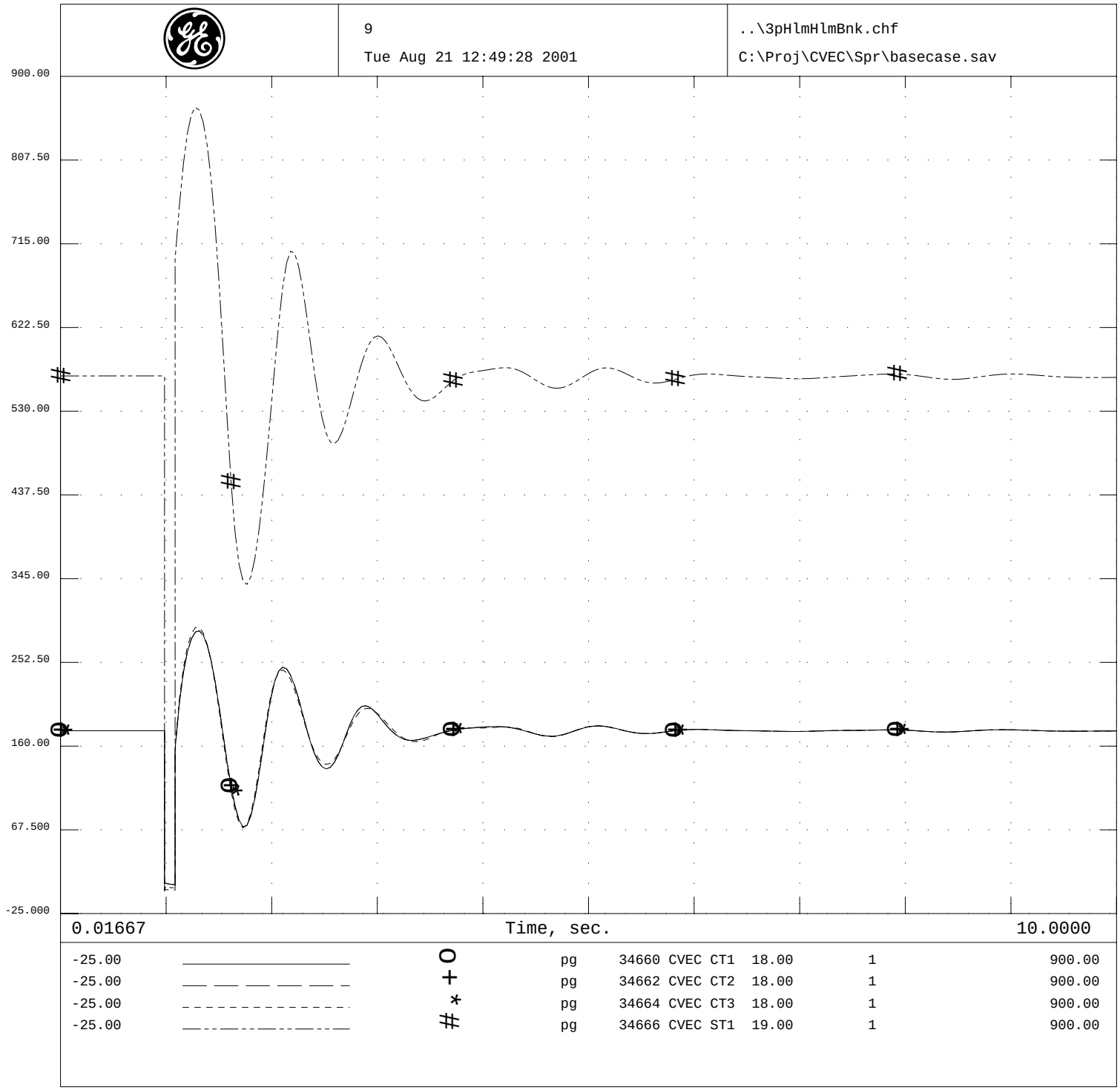
Calpine Corporation
Project Generator Rotor Angle



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Calpine Corporation
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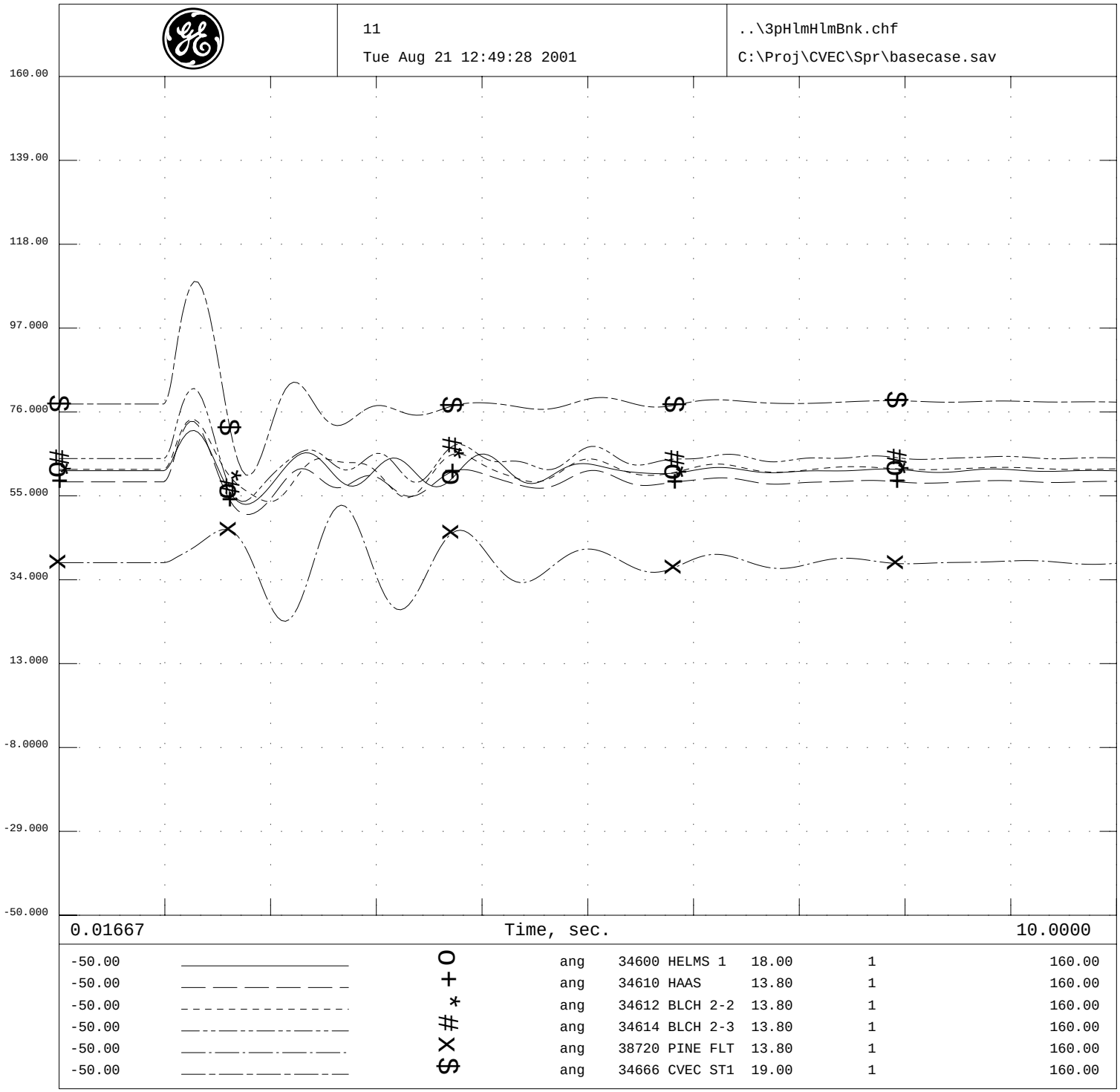

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Calpine Corporation
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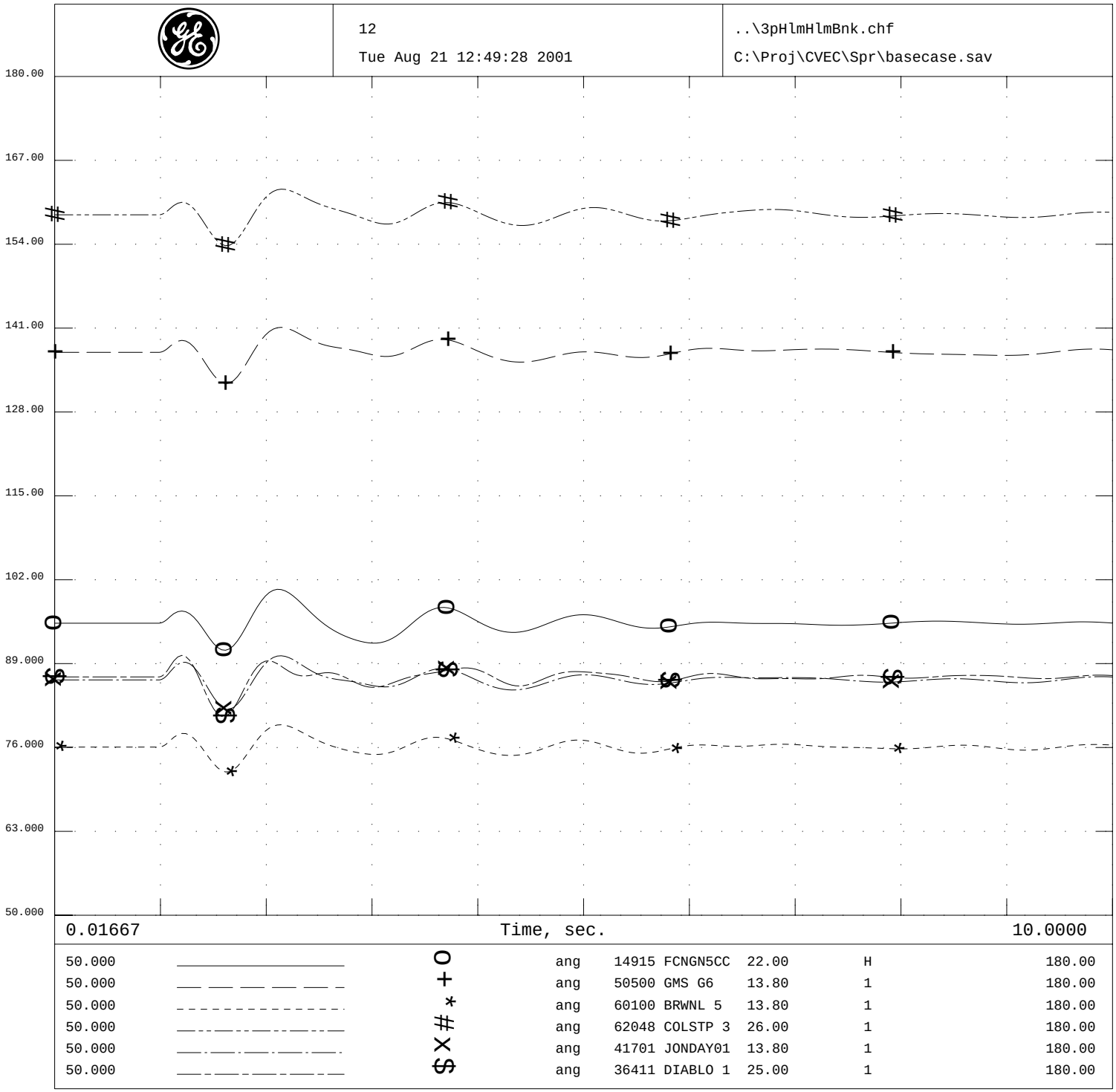

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Calpine Corporation
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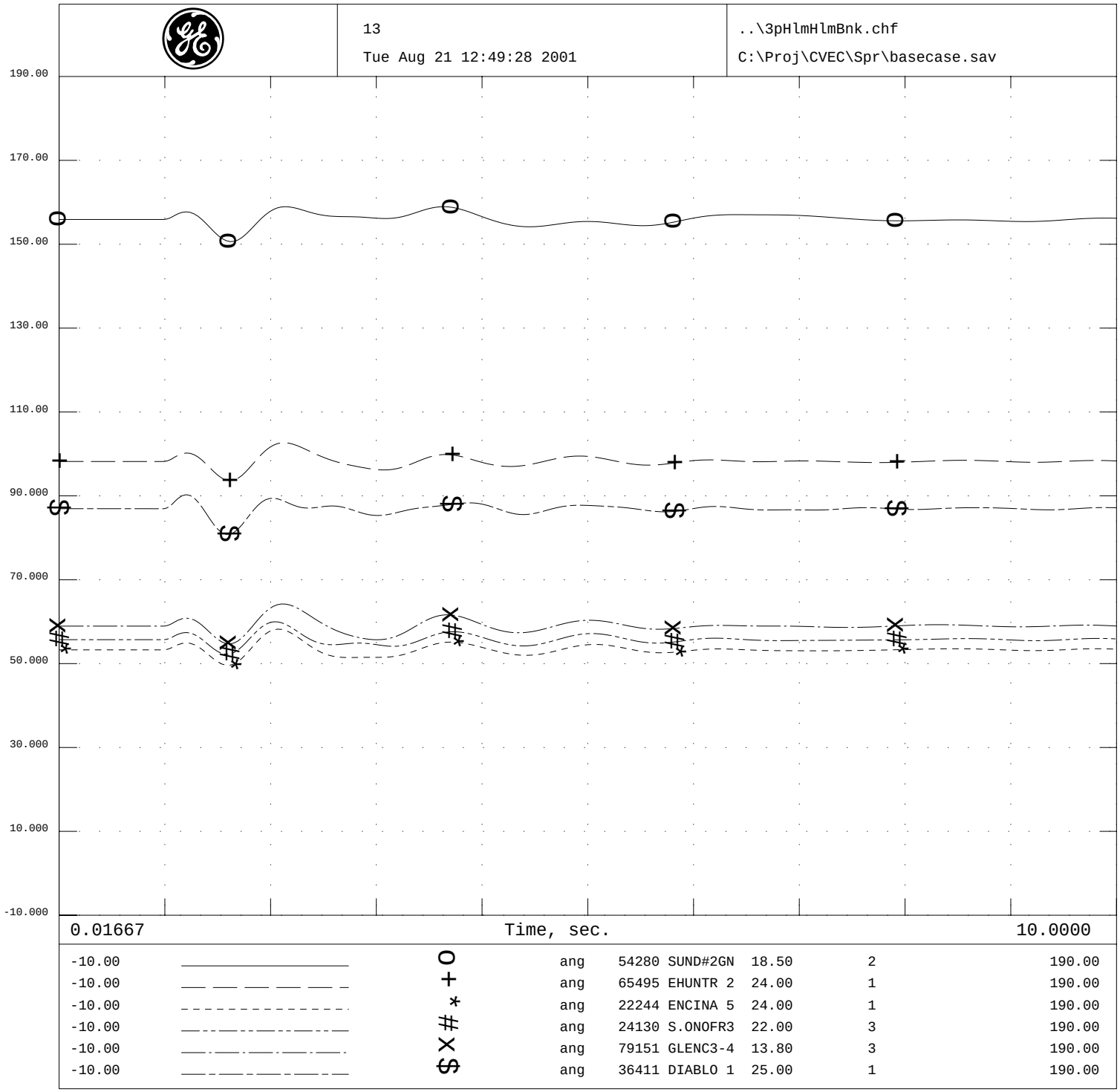

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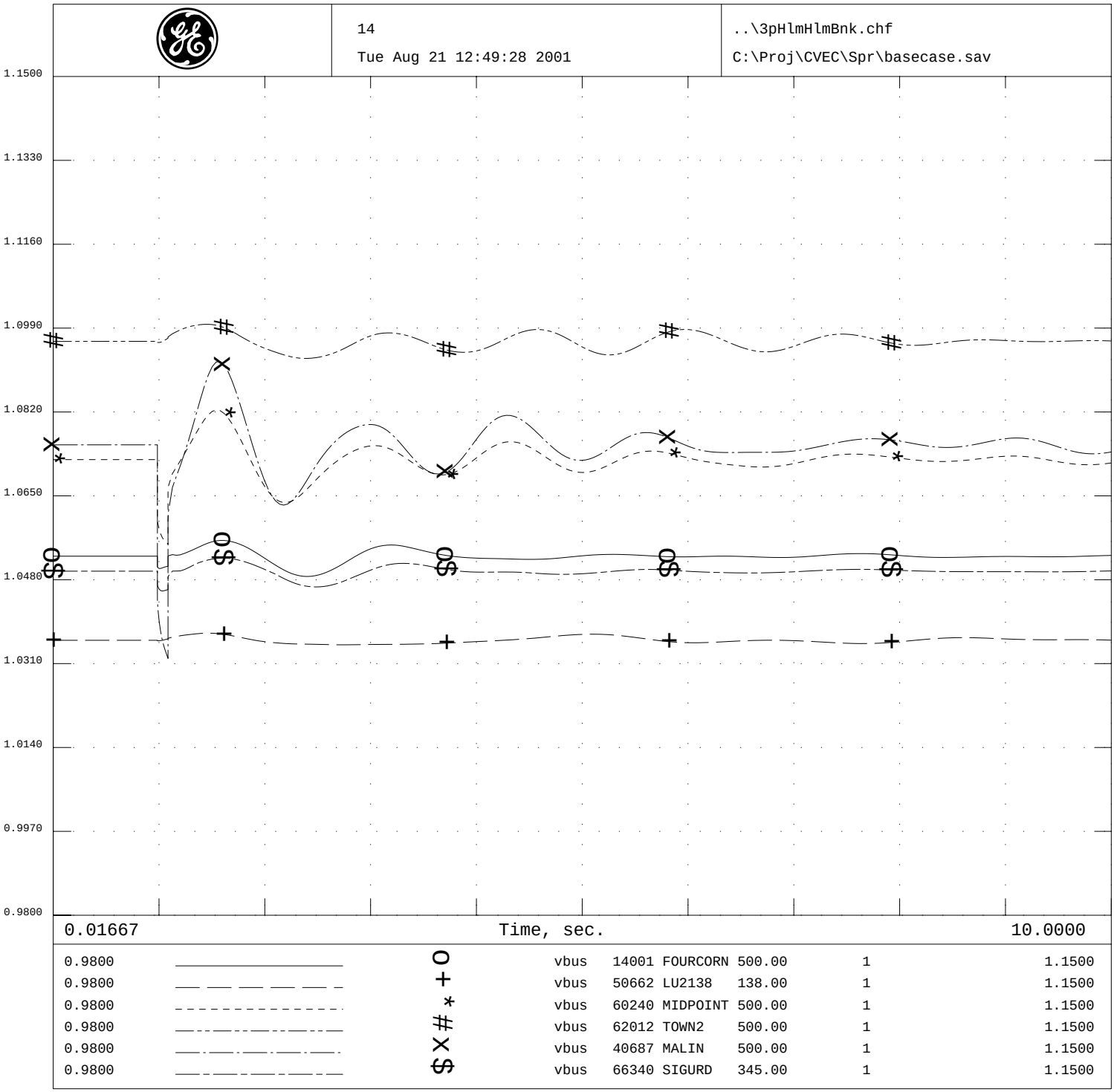

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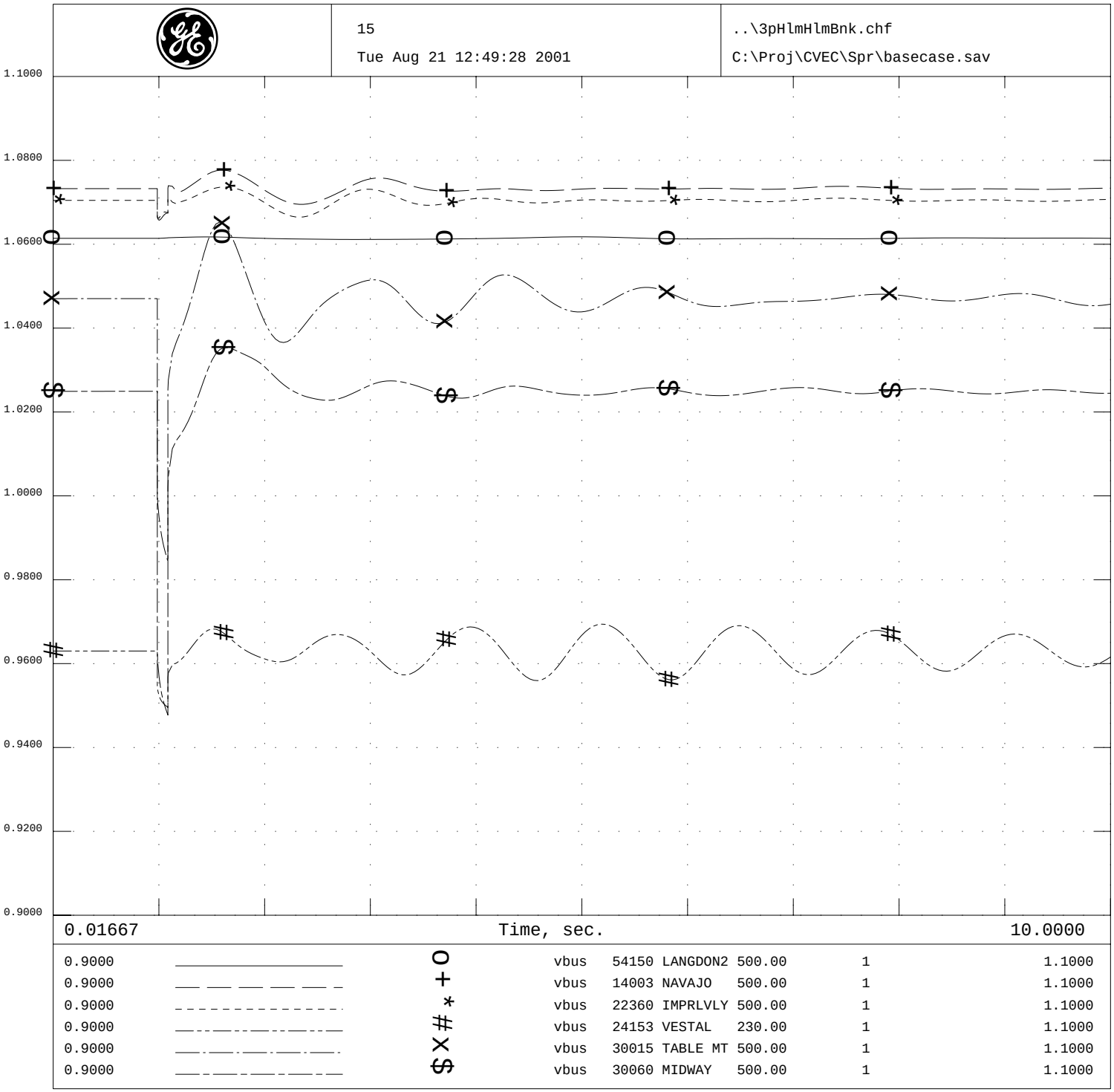

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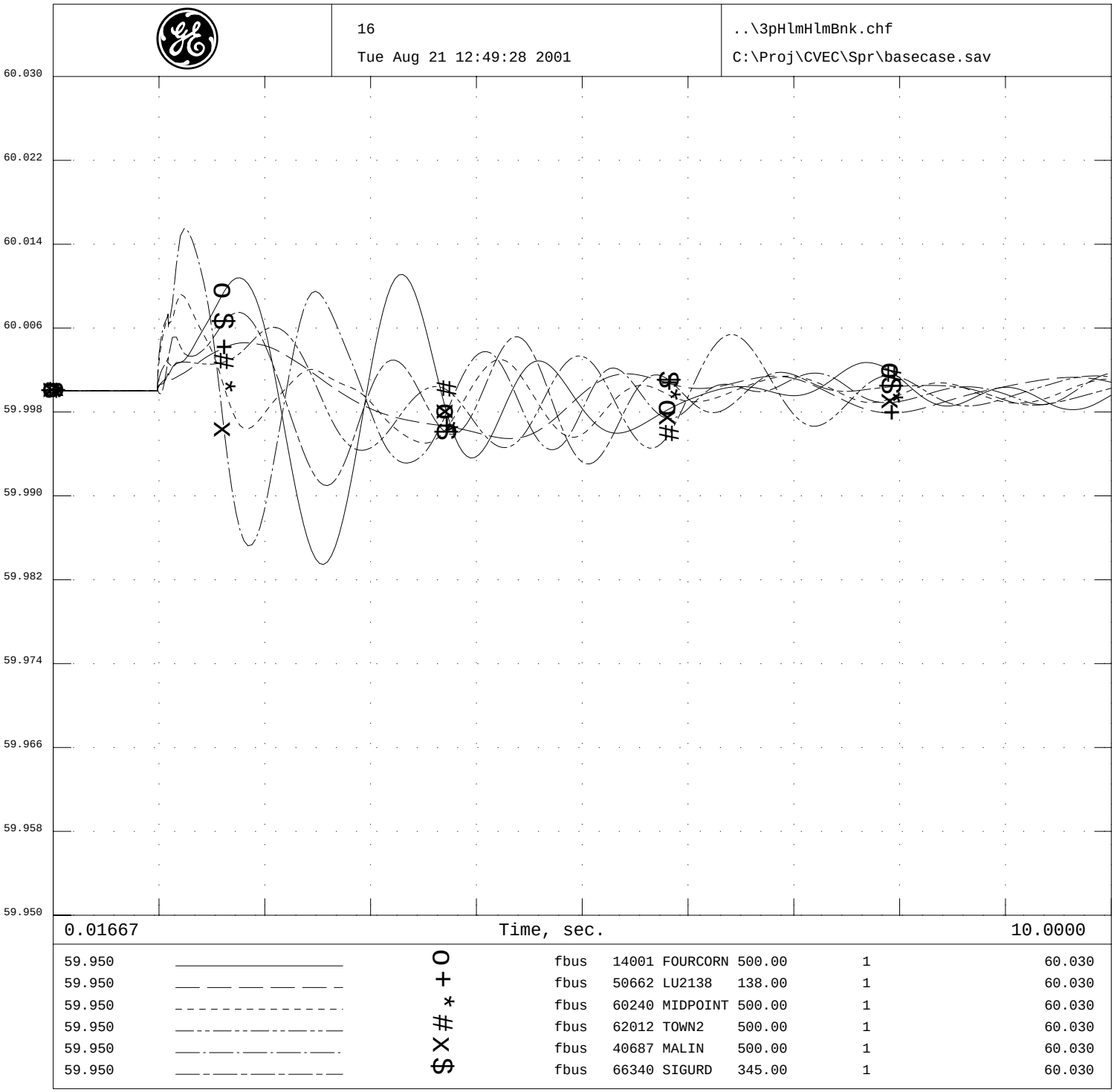

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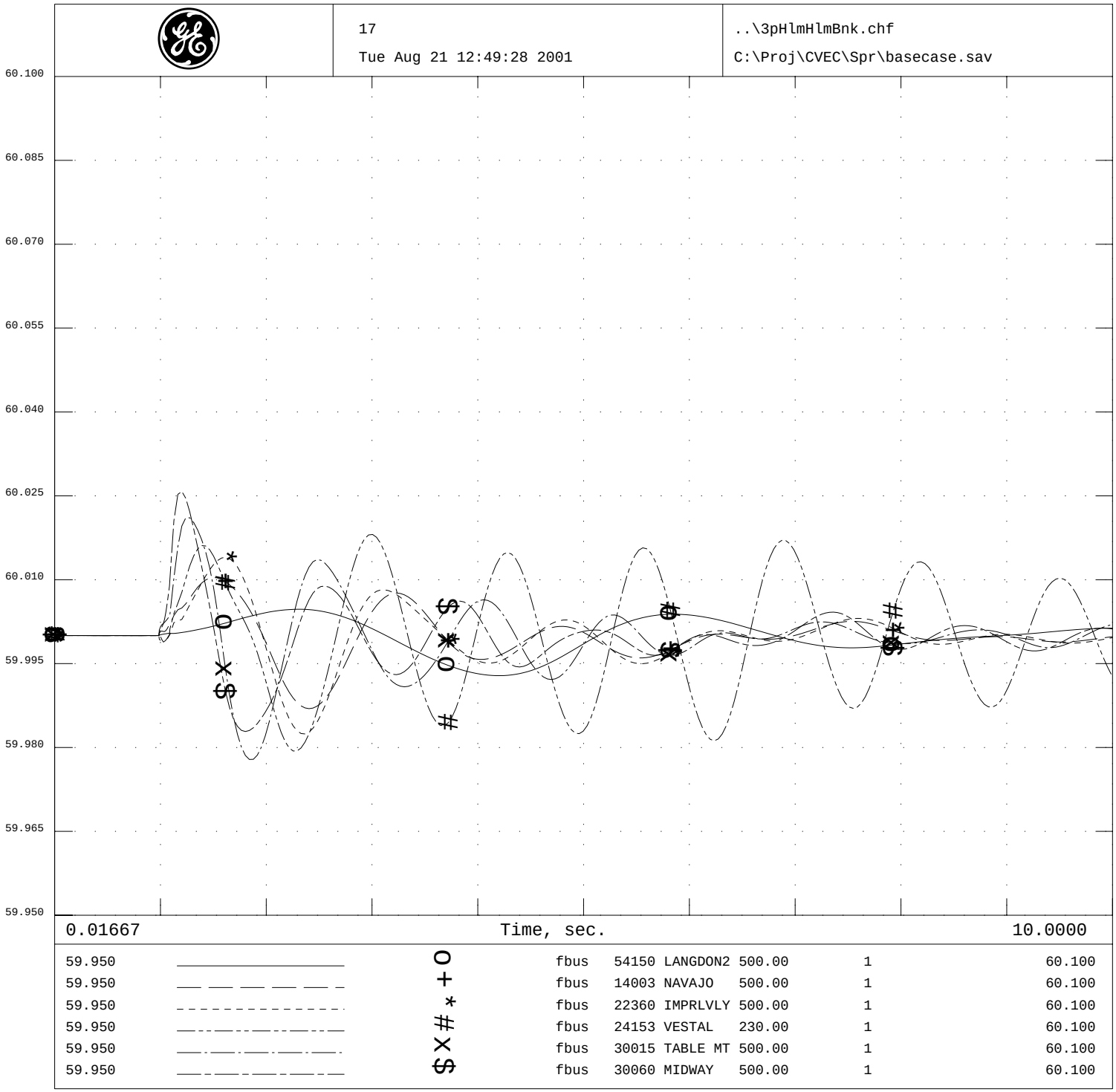

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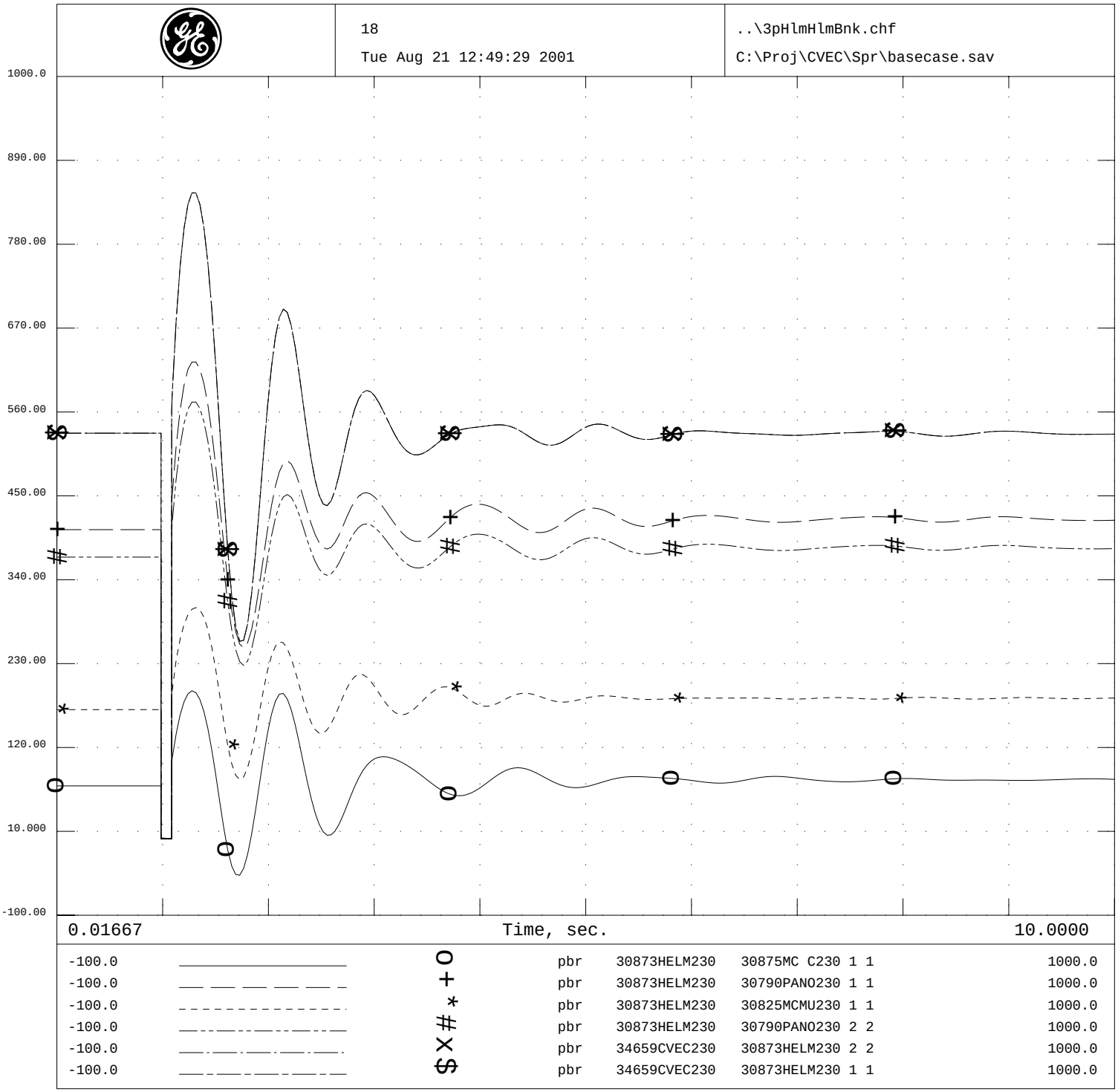

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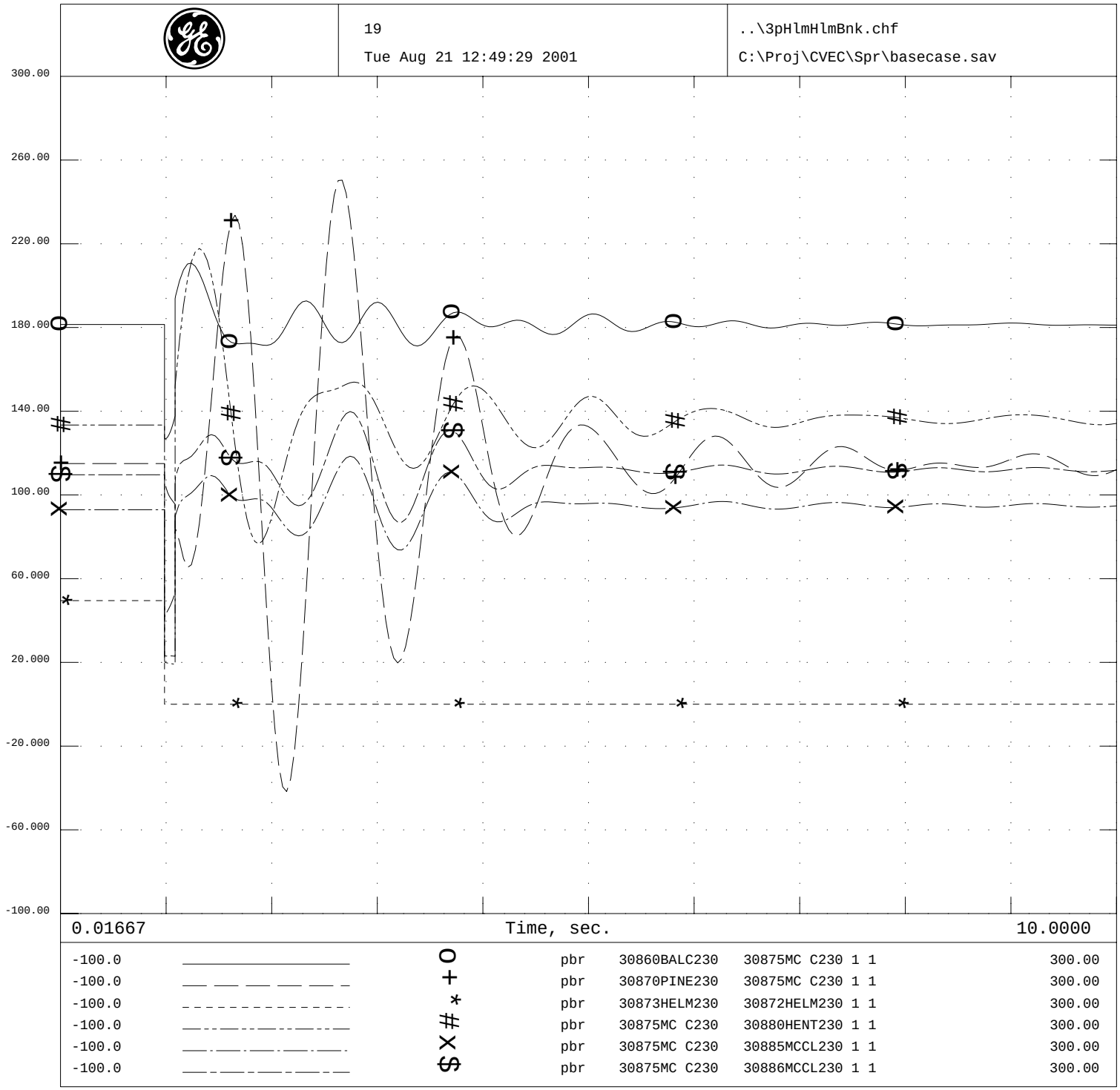

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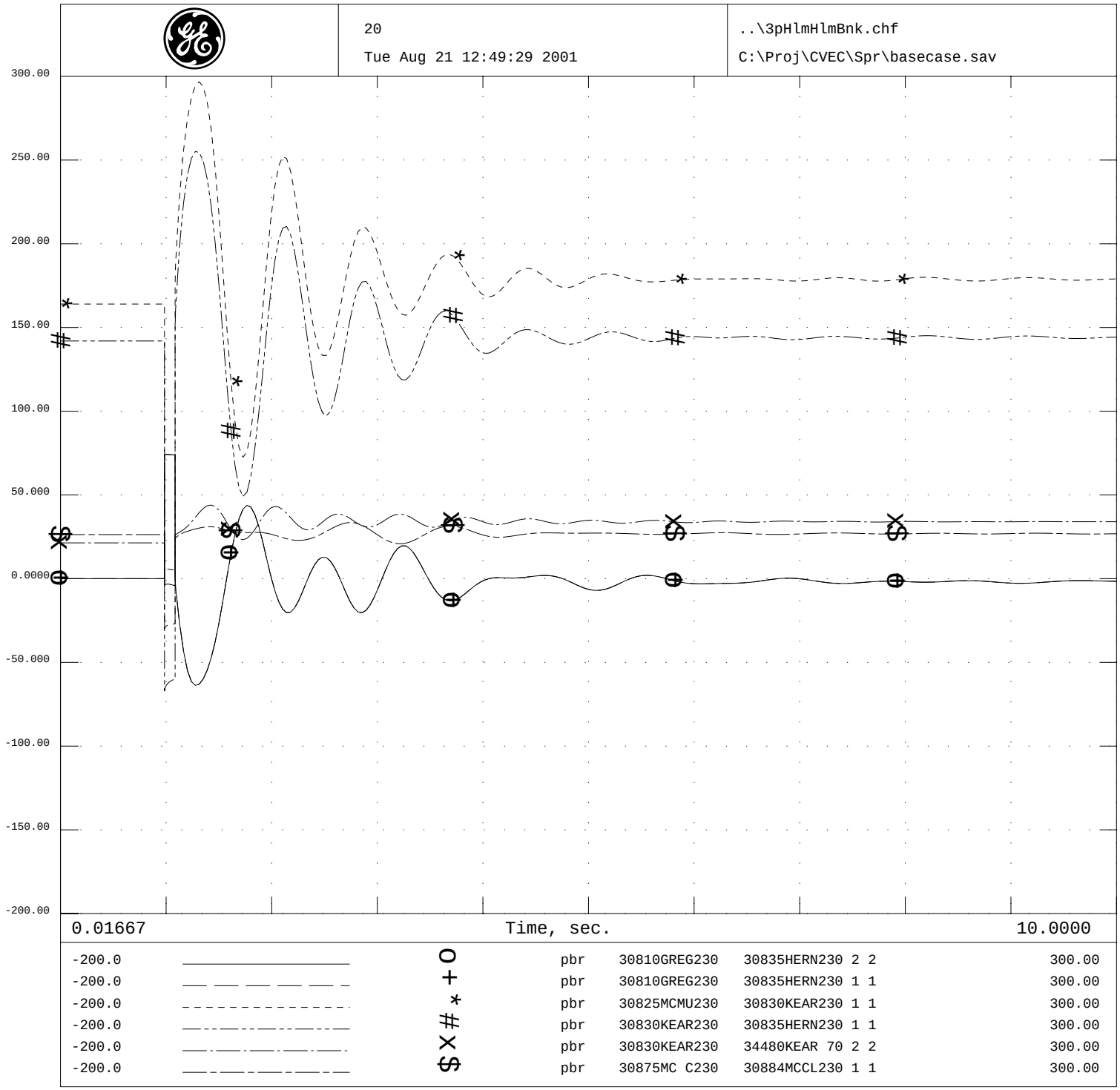

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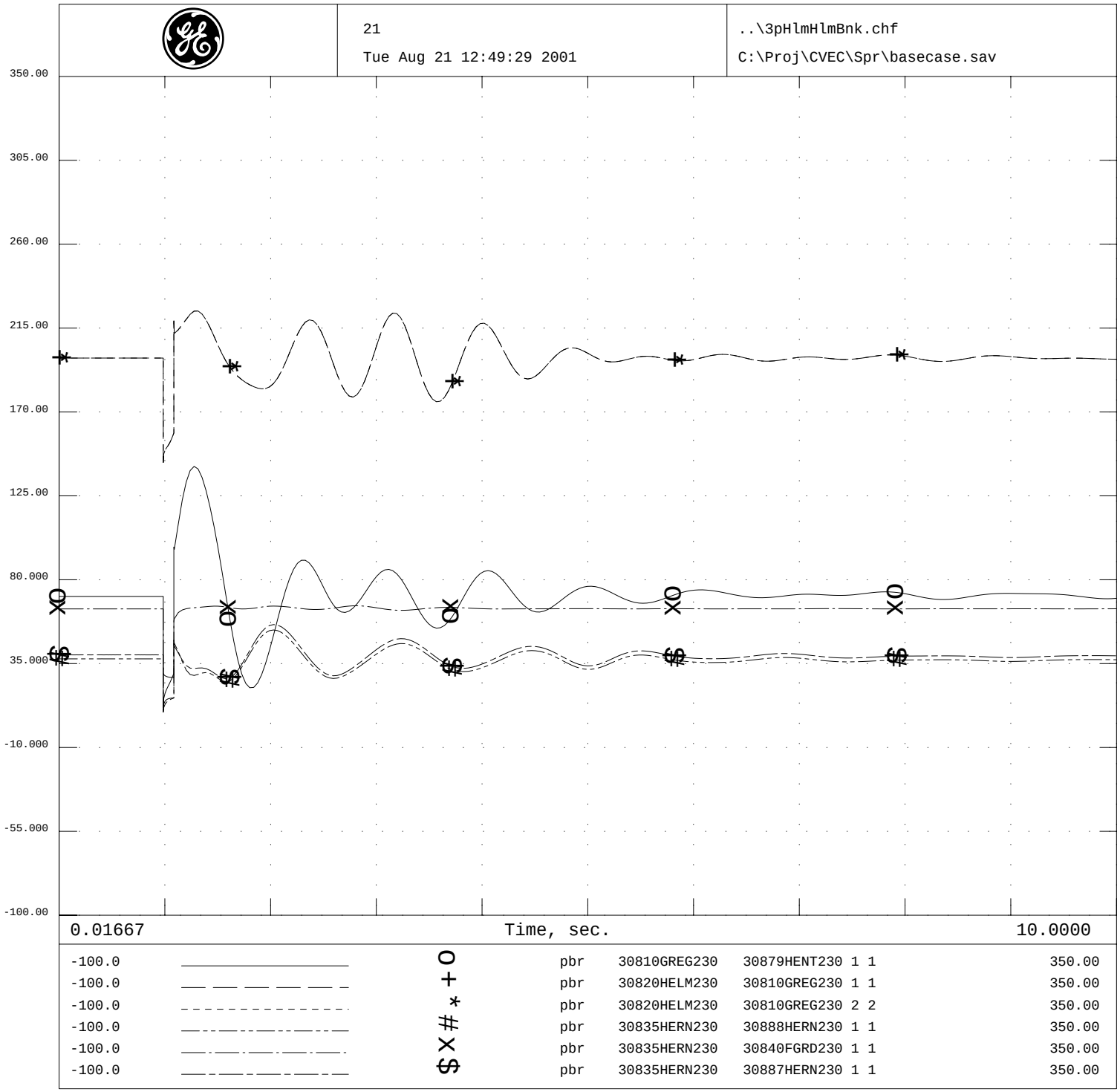

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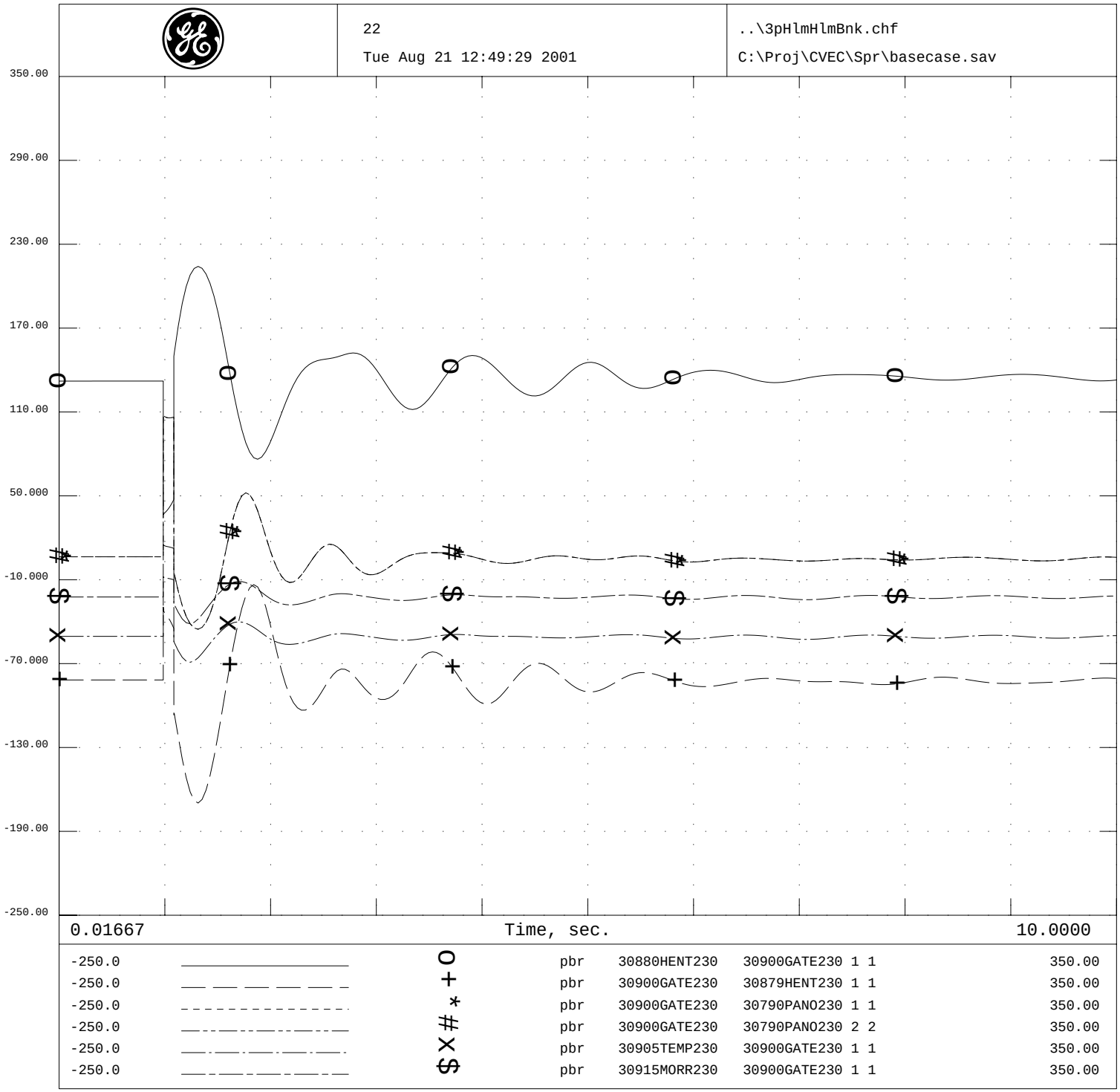

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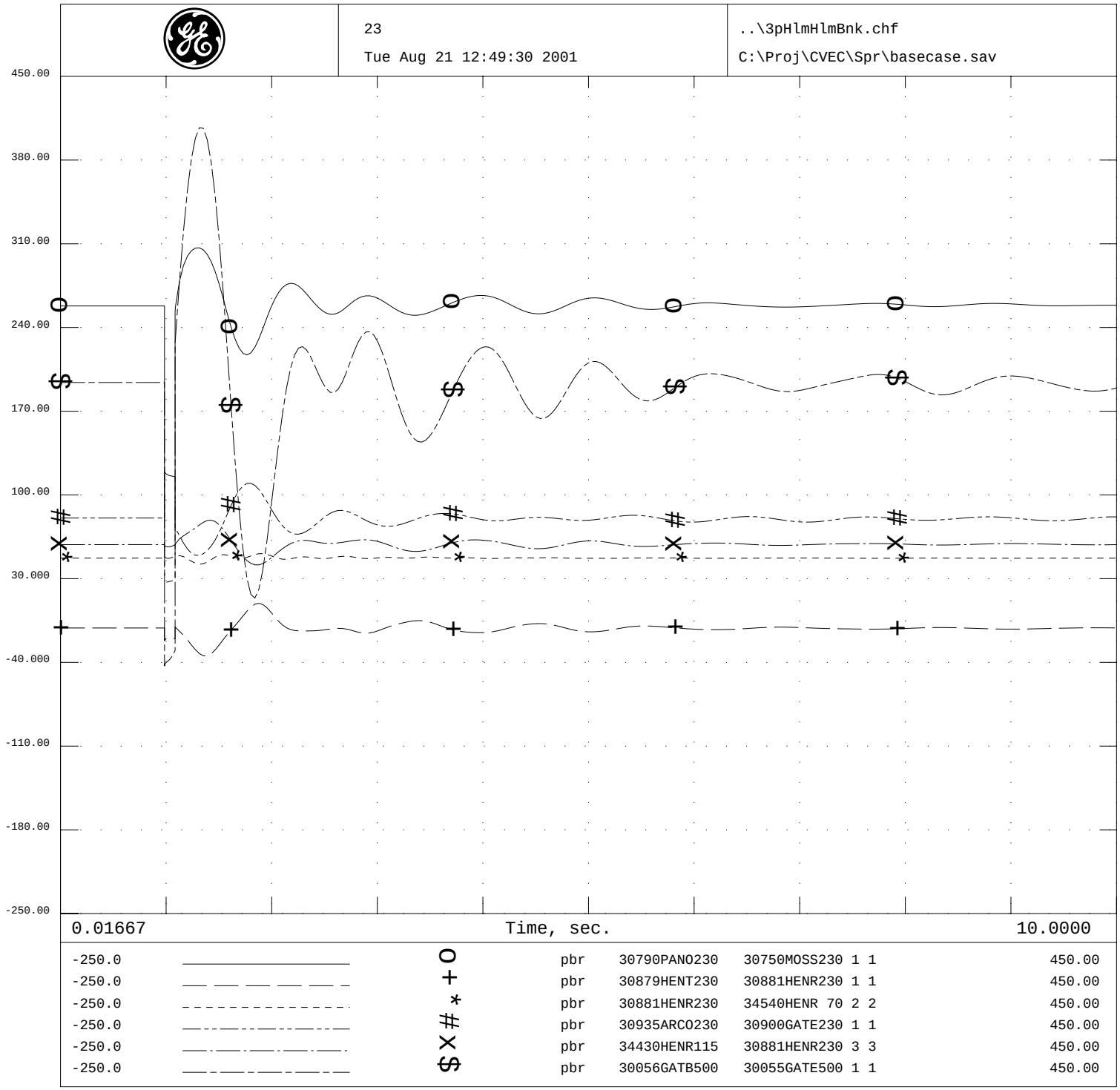

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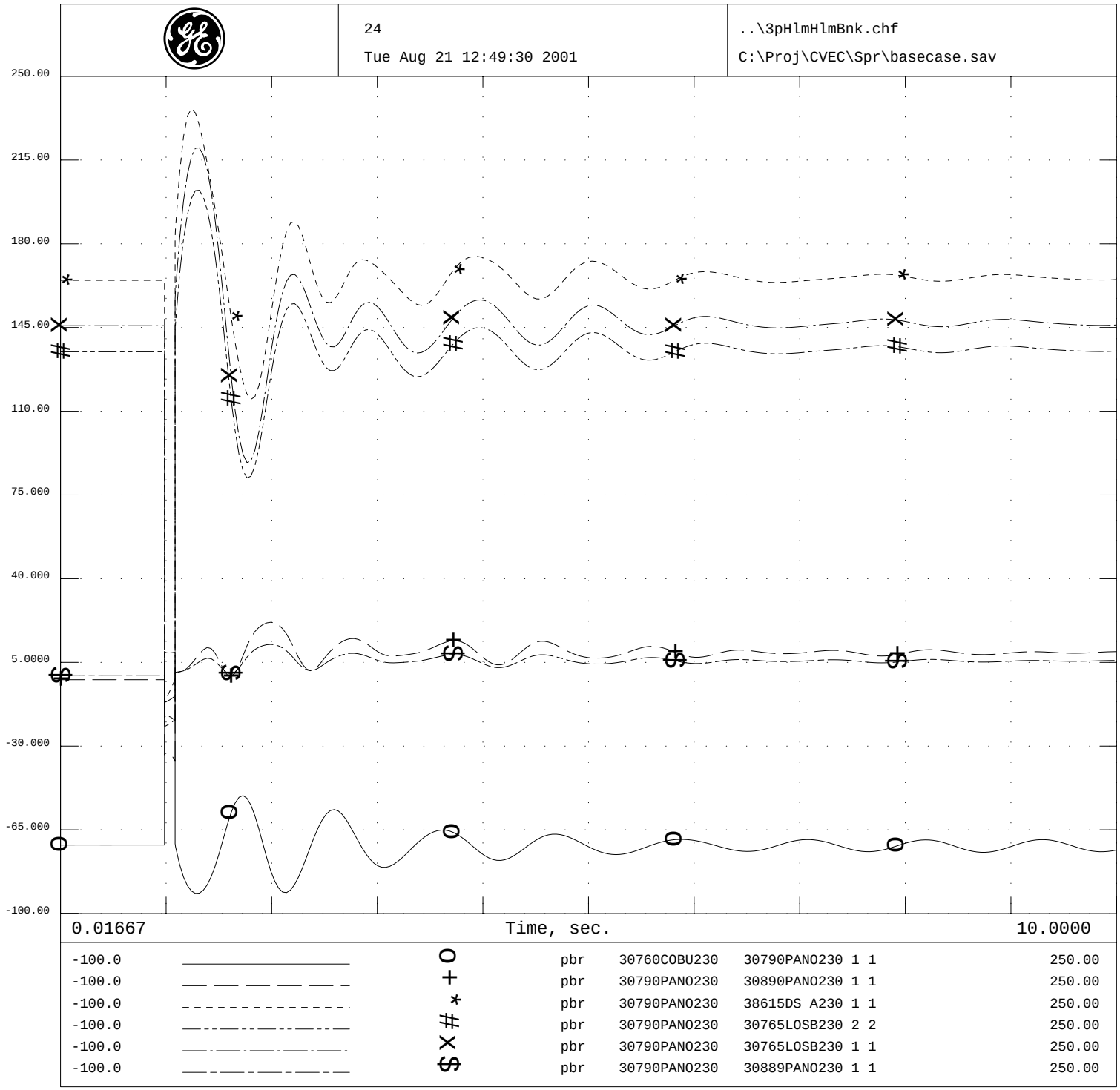
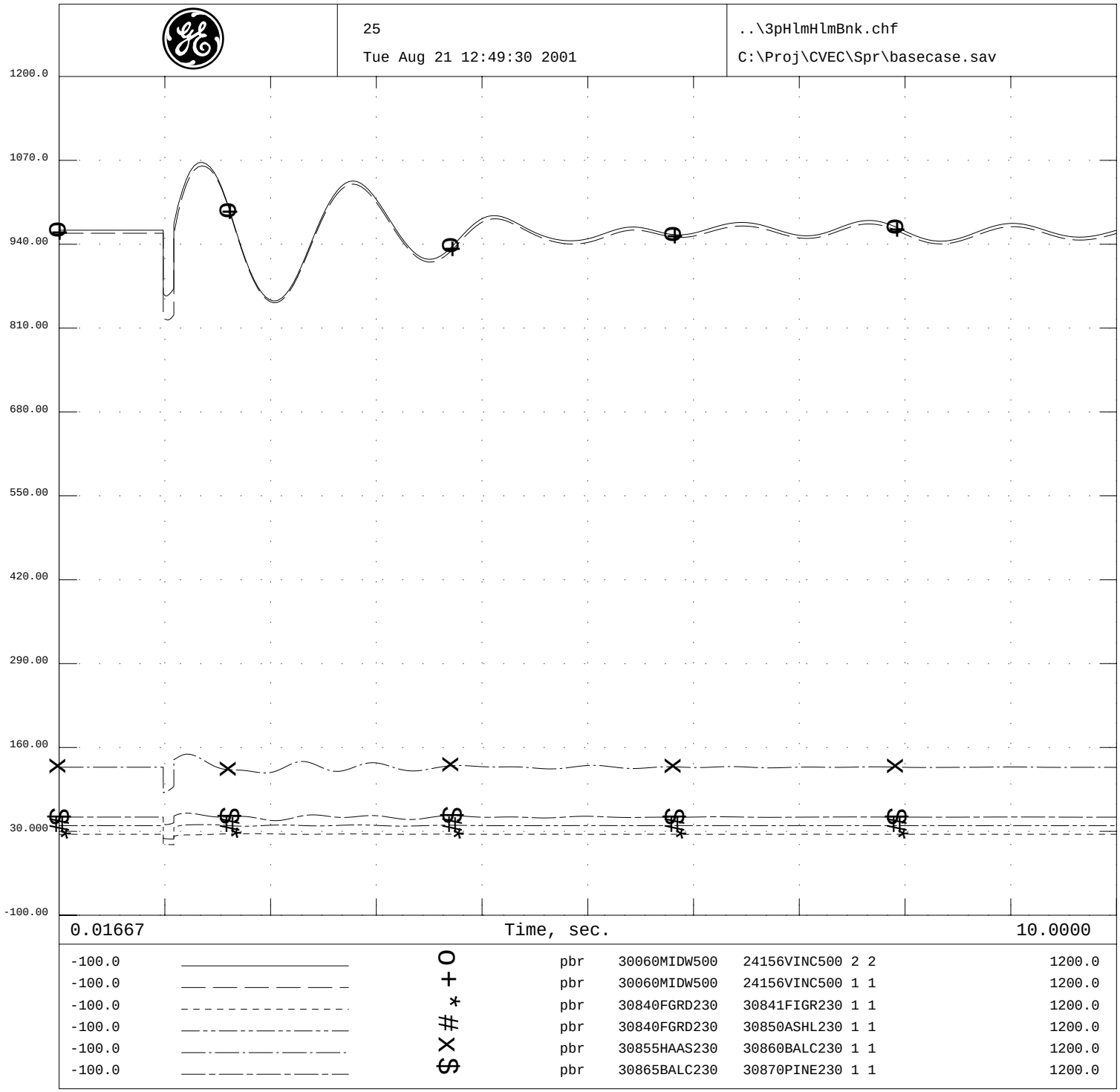


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Helm 230/70kV Bank Outage
3 phase 6 cycle fault at Helm 230kV bus and trip Helm 230/70kV bank

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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Central Valley Energy Center
Calpine Corporation
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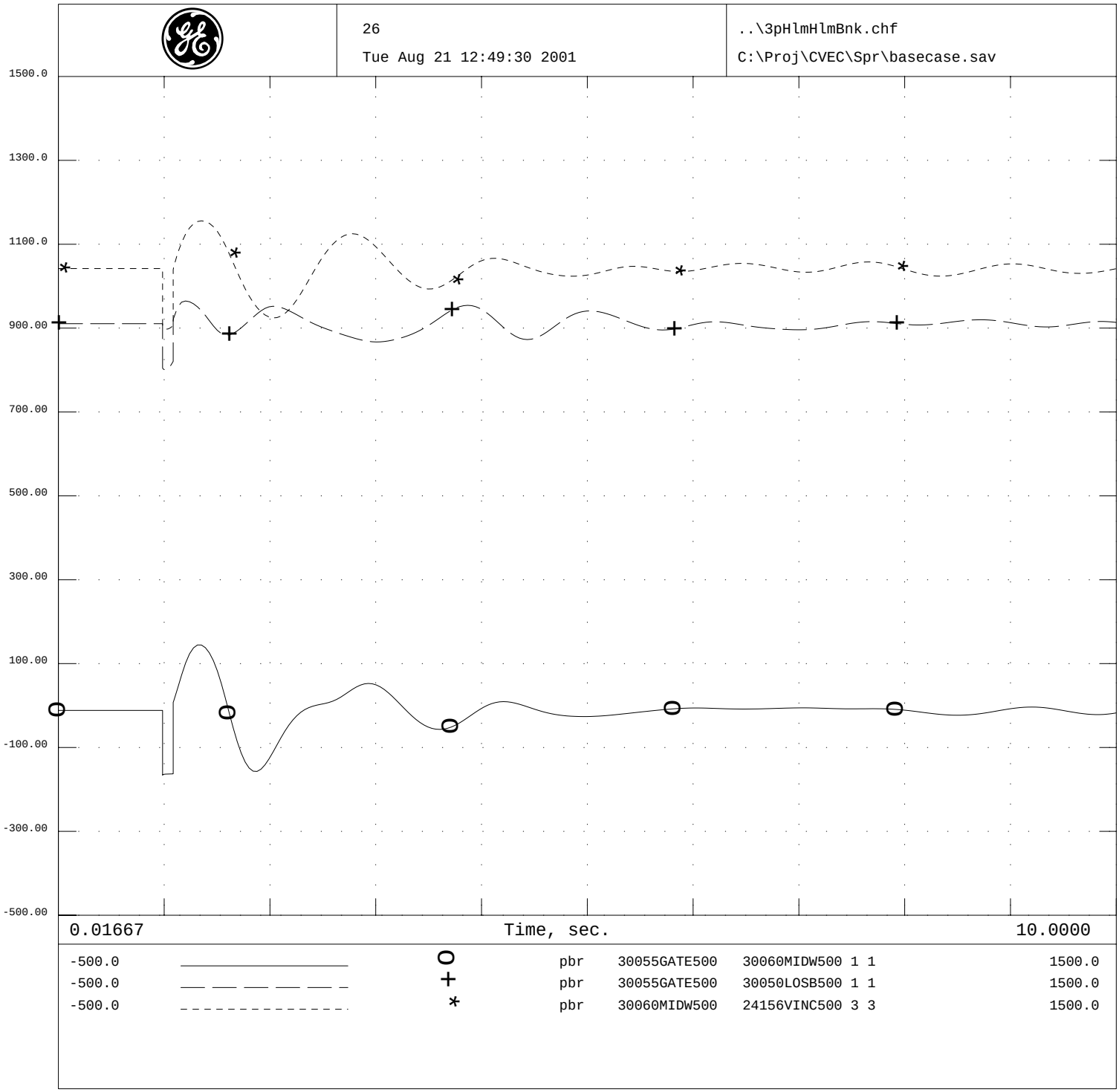

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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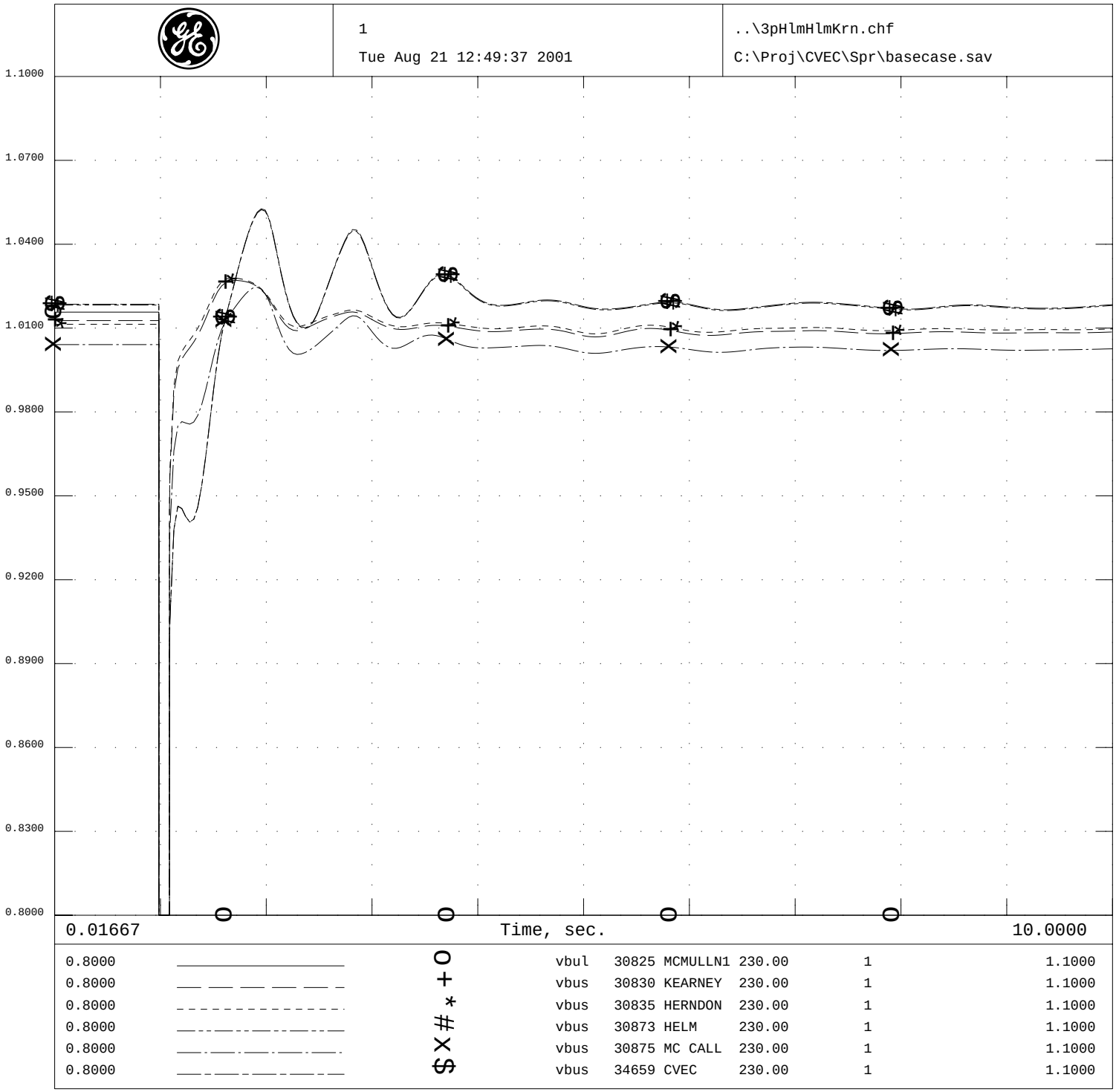
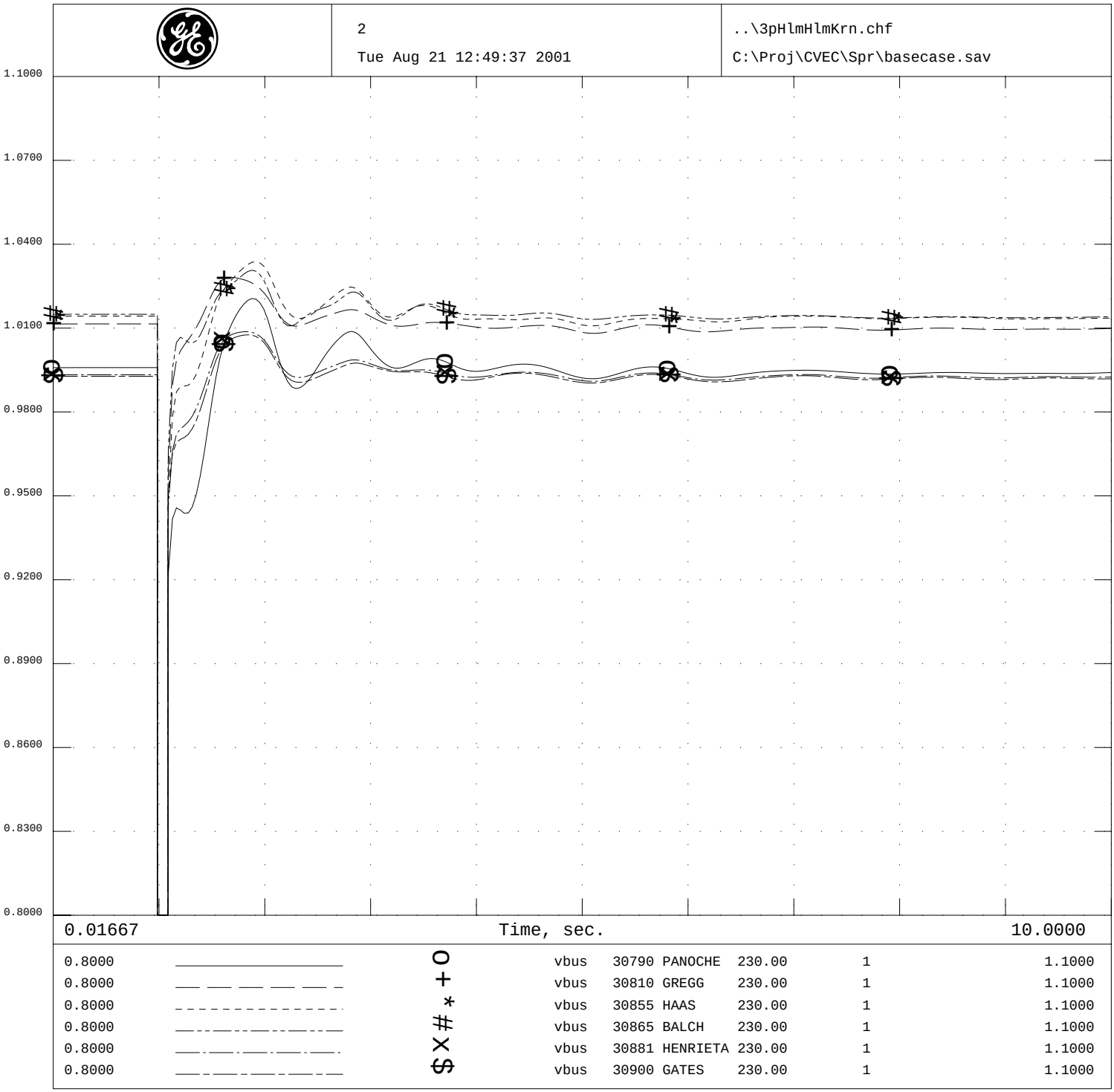


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Kearny-Helm 230kV Line Outage
3 phase 6 cycle fault at Helm 230kV bus and trip Kearny-Helm line

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Calpine Corporation
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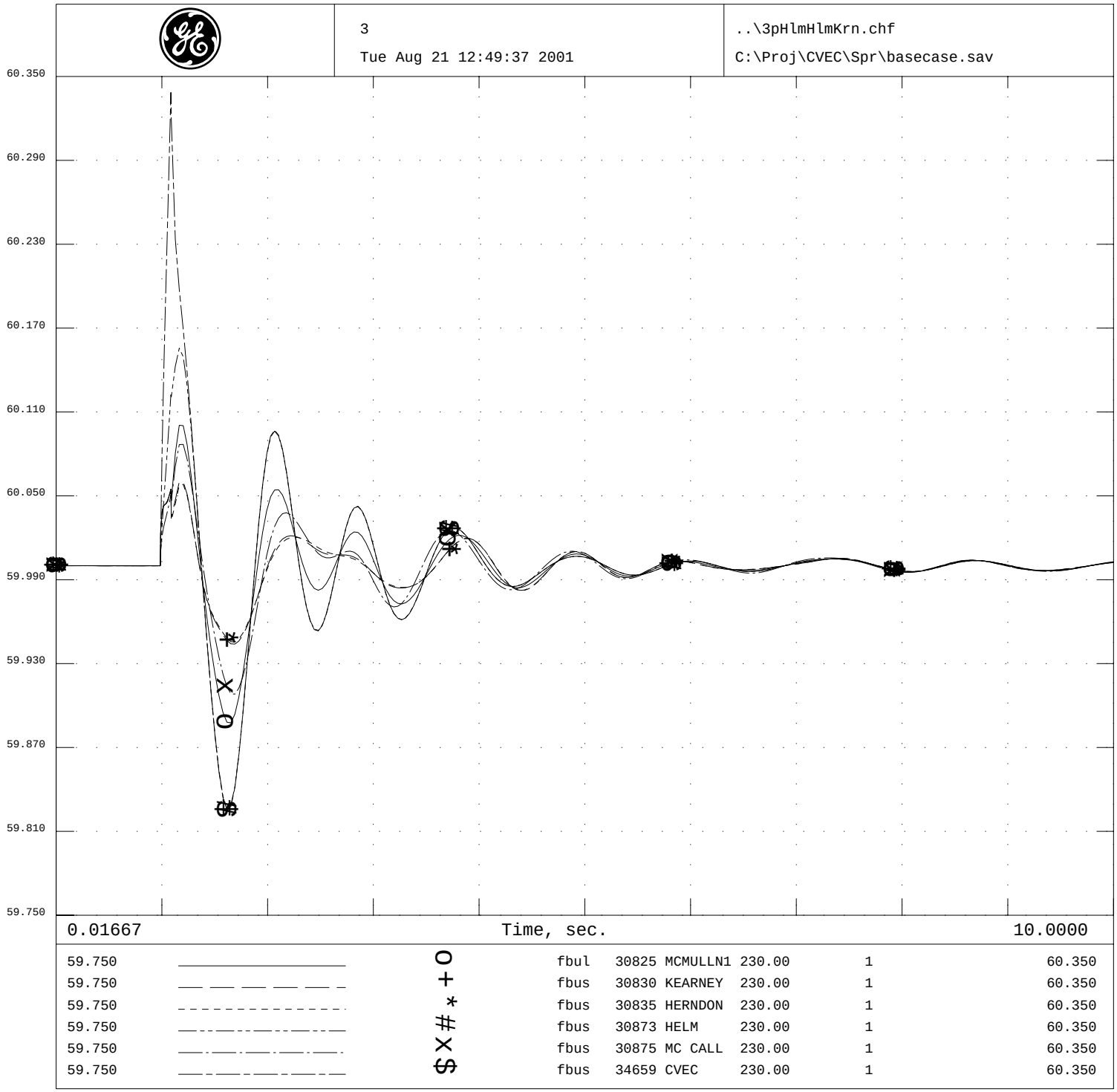

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2004 Heavy Spring Base Case
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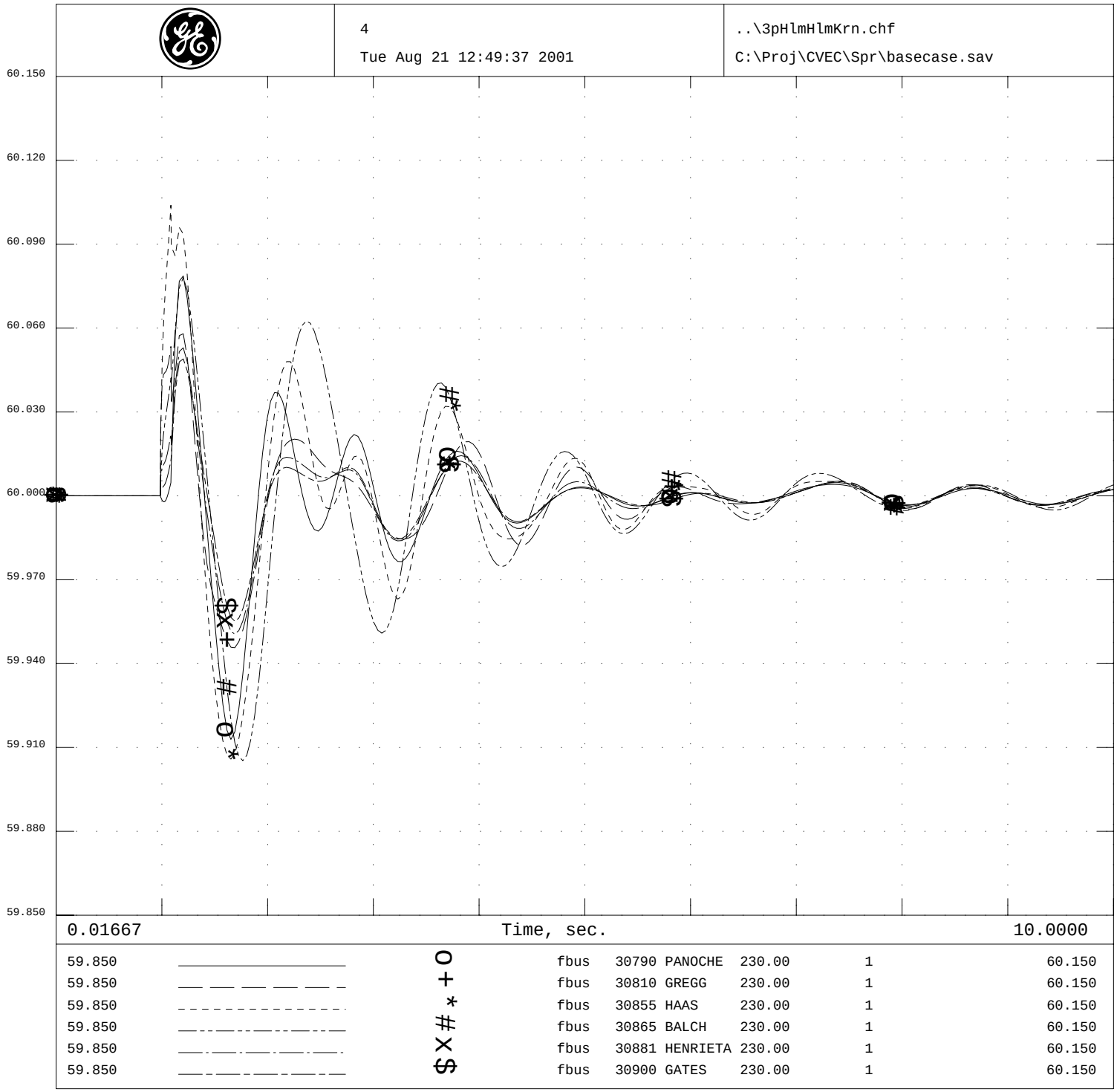
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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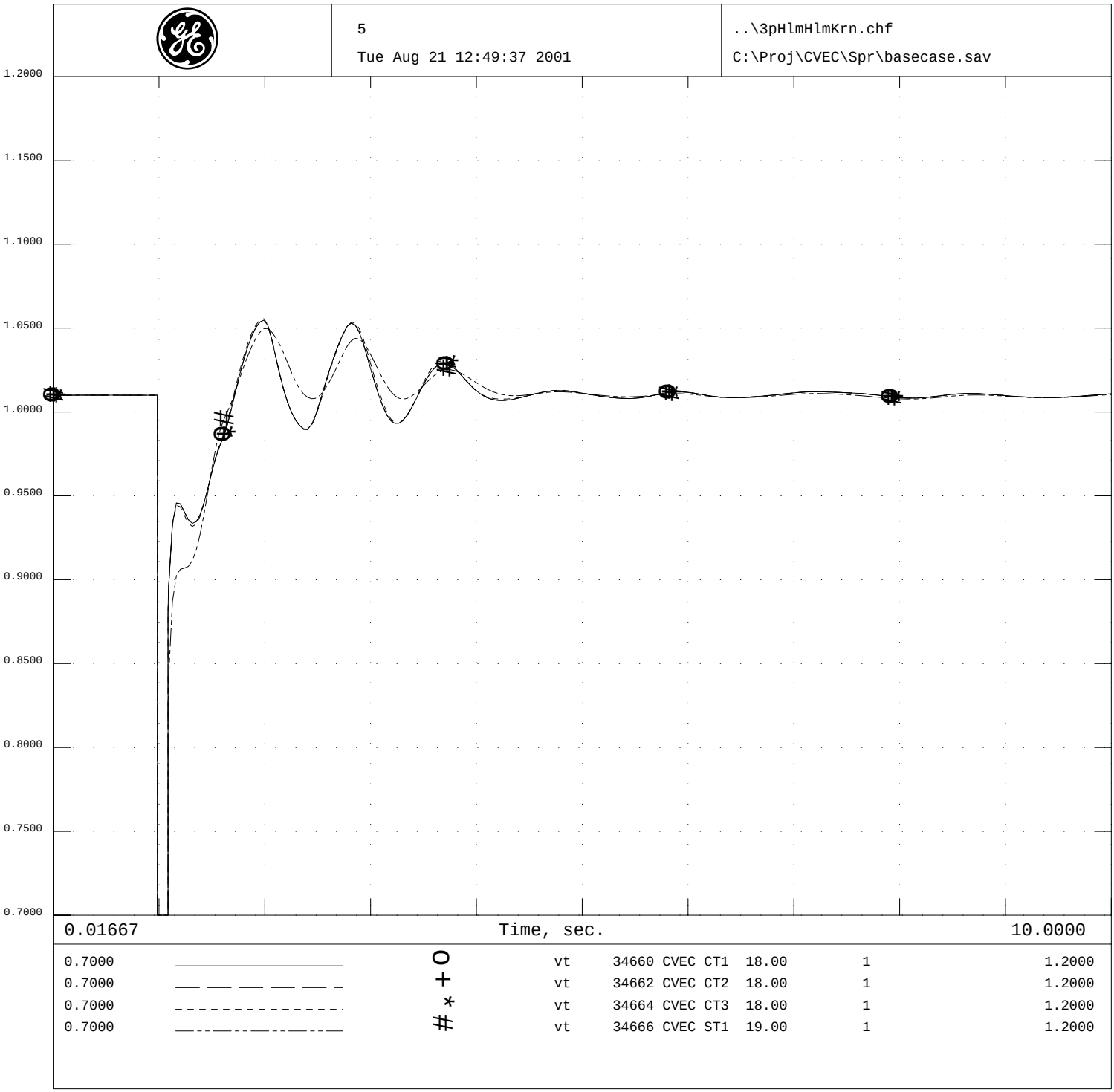

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2004 Heavy Spring Base Case
CVEC @ 1100MW
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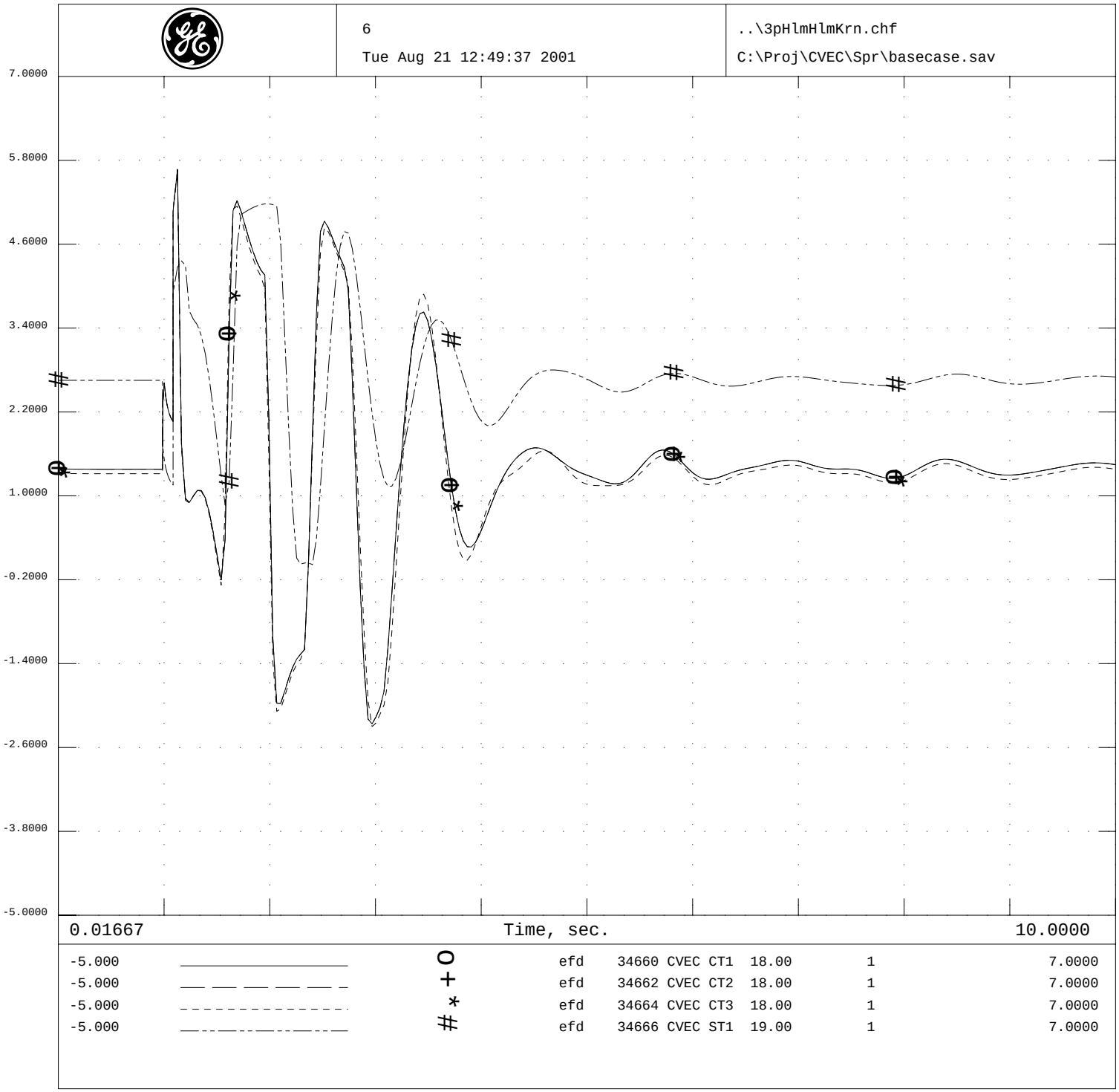
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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2004 Heavy Spring Base Case
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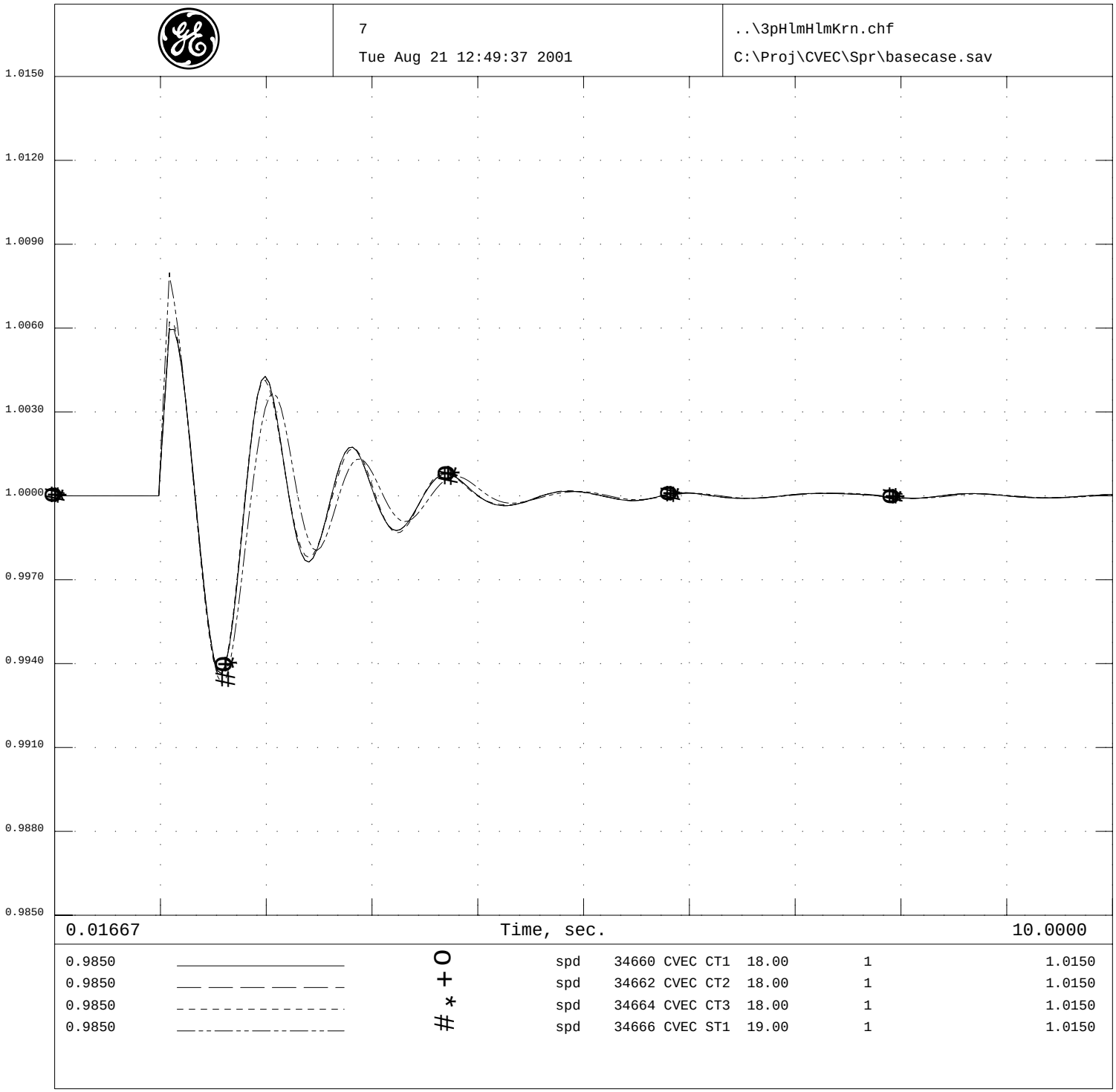
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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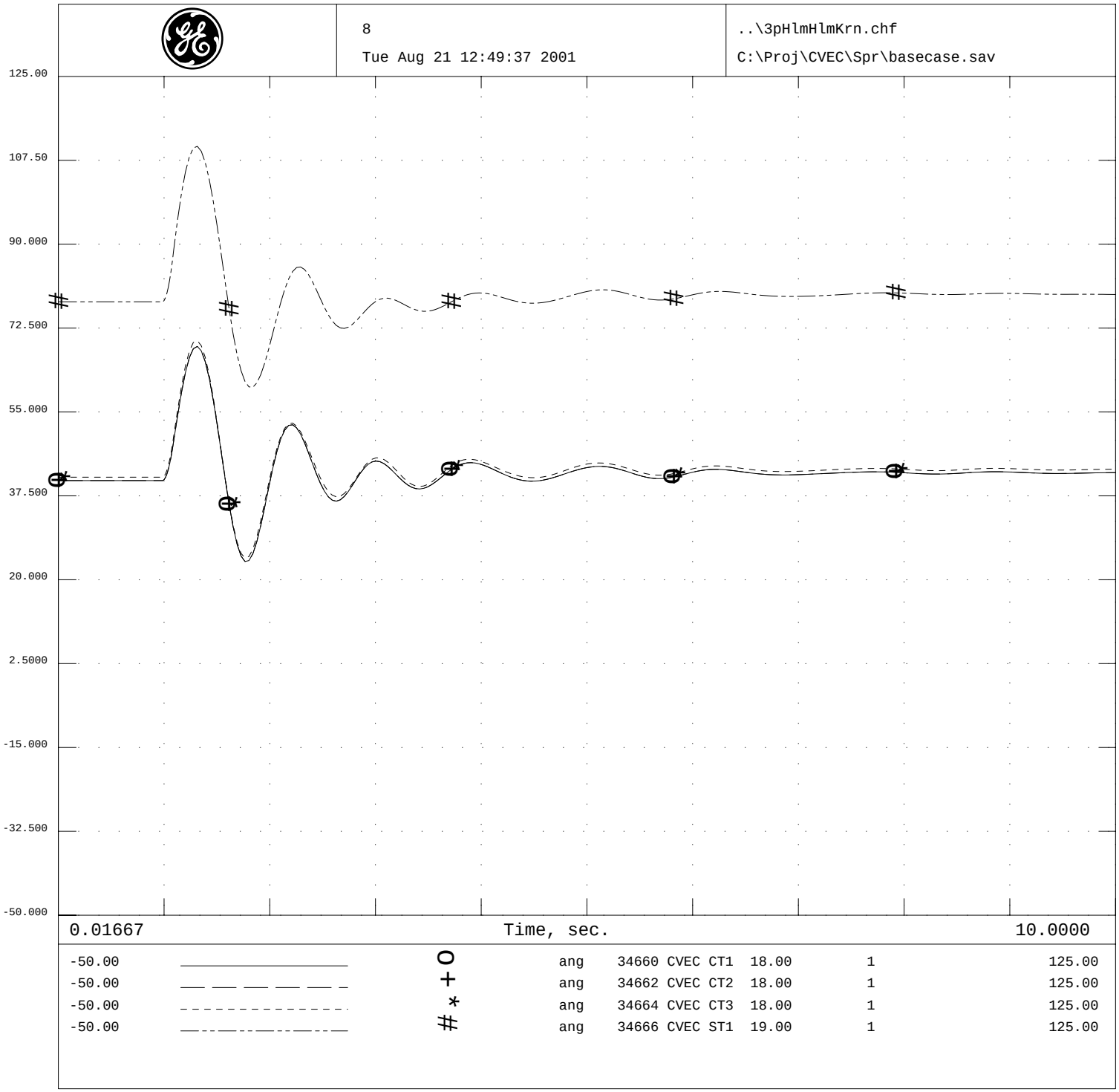
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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2004 Heavy Spring Base Case
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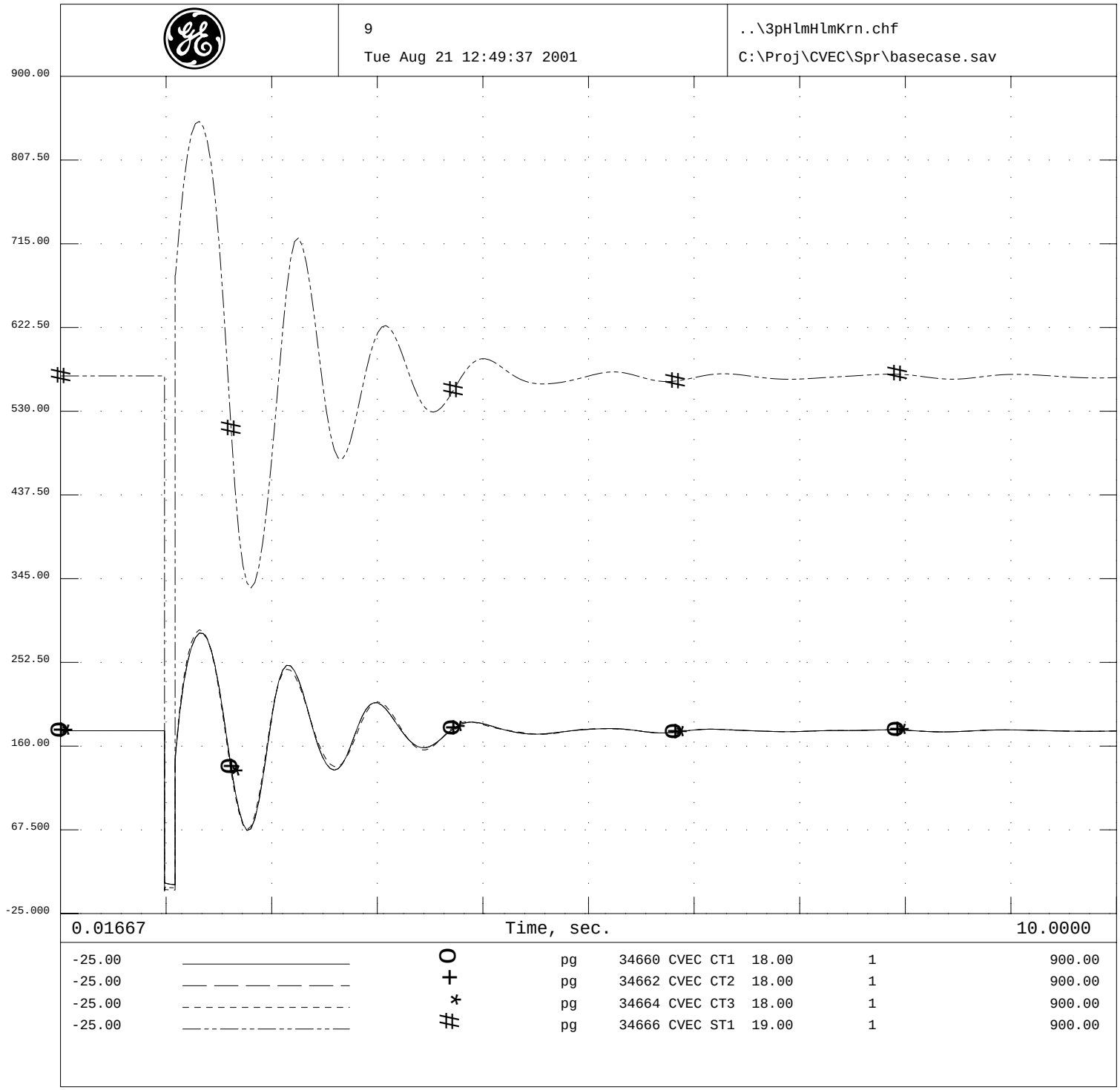
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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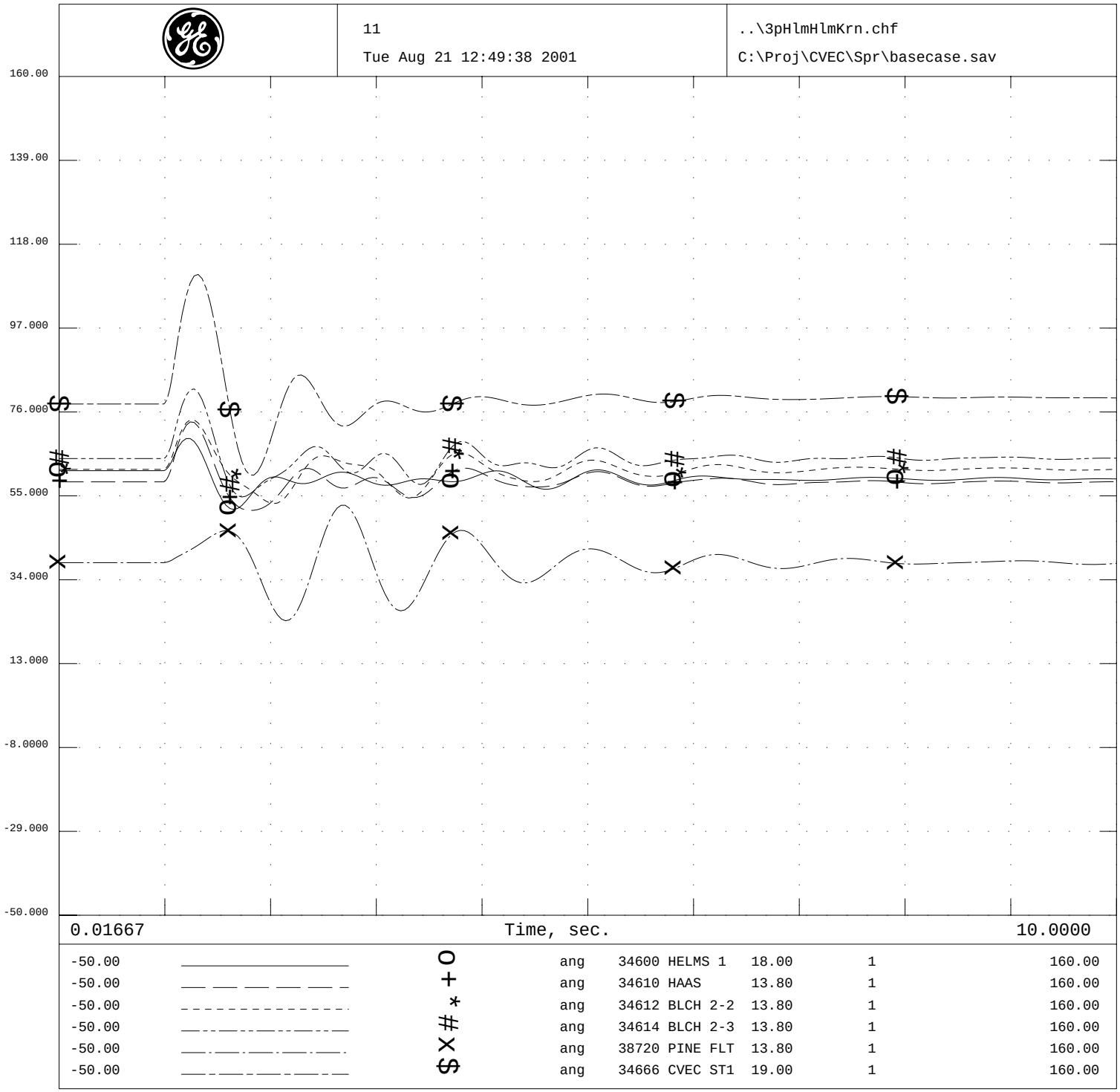
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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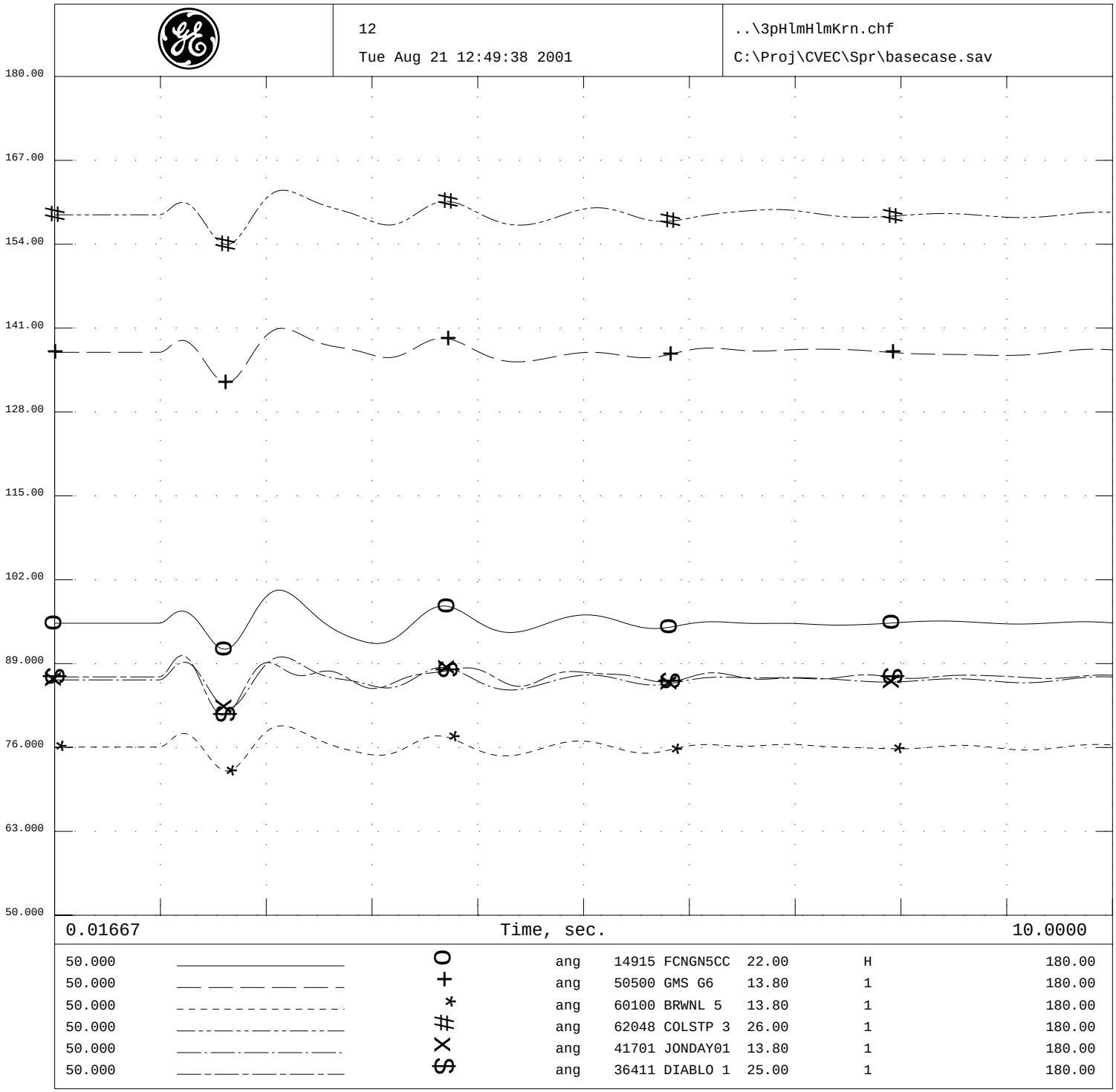
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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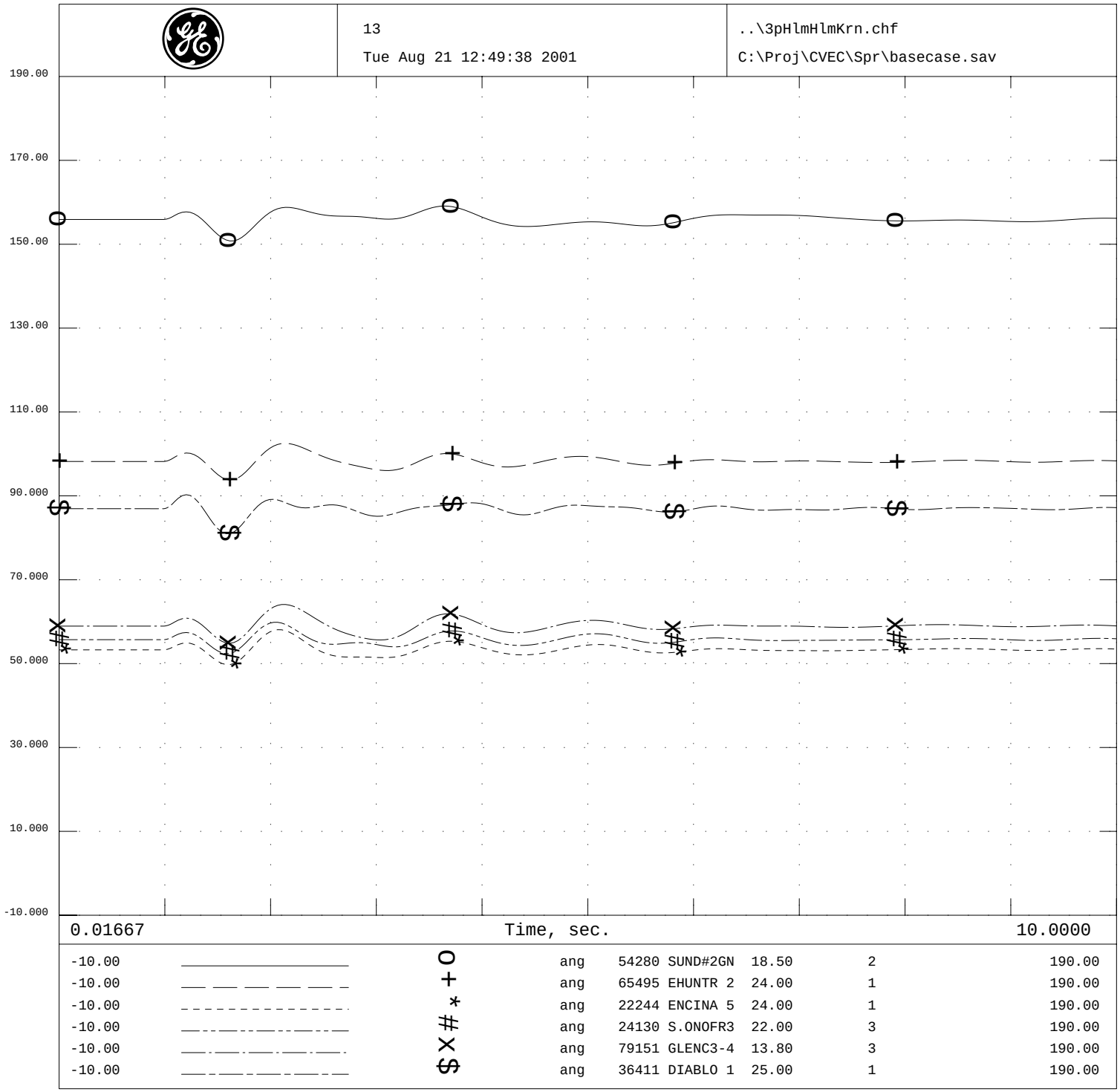
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Calpine Corporation
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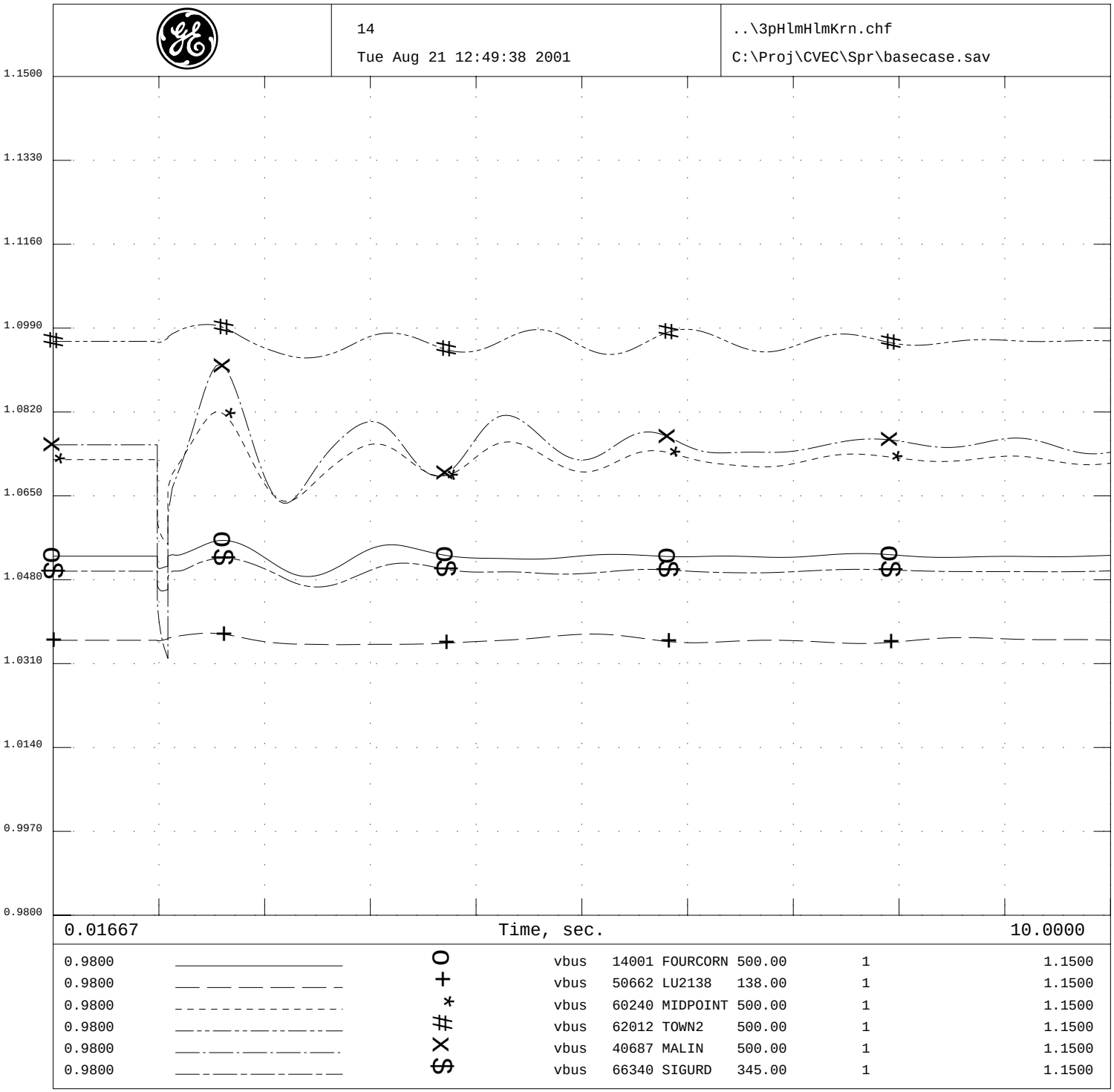

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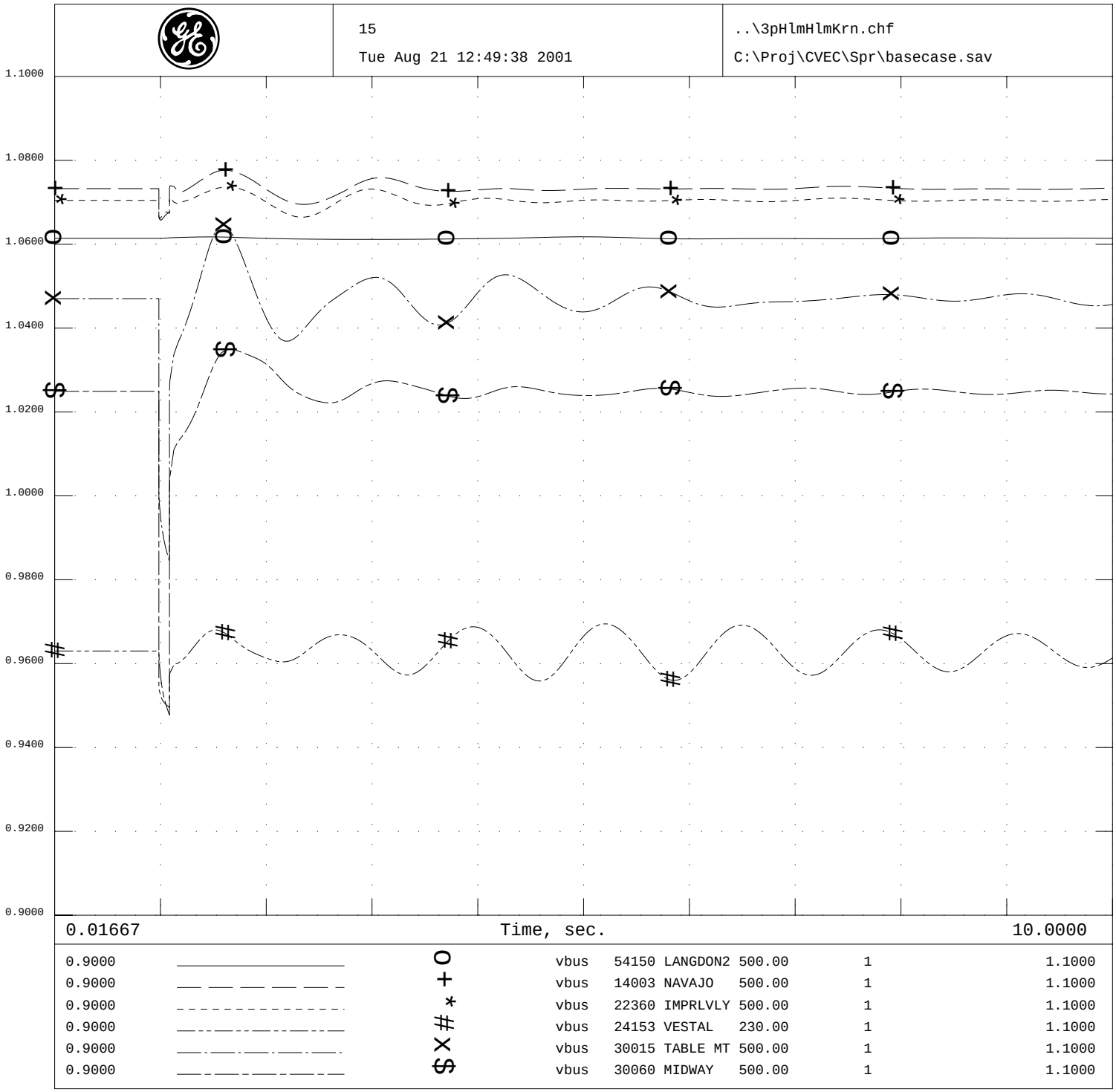
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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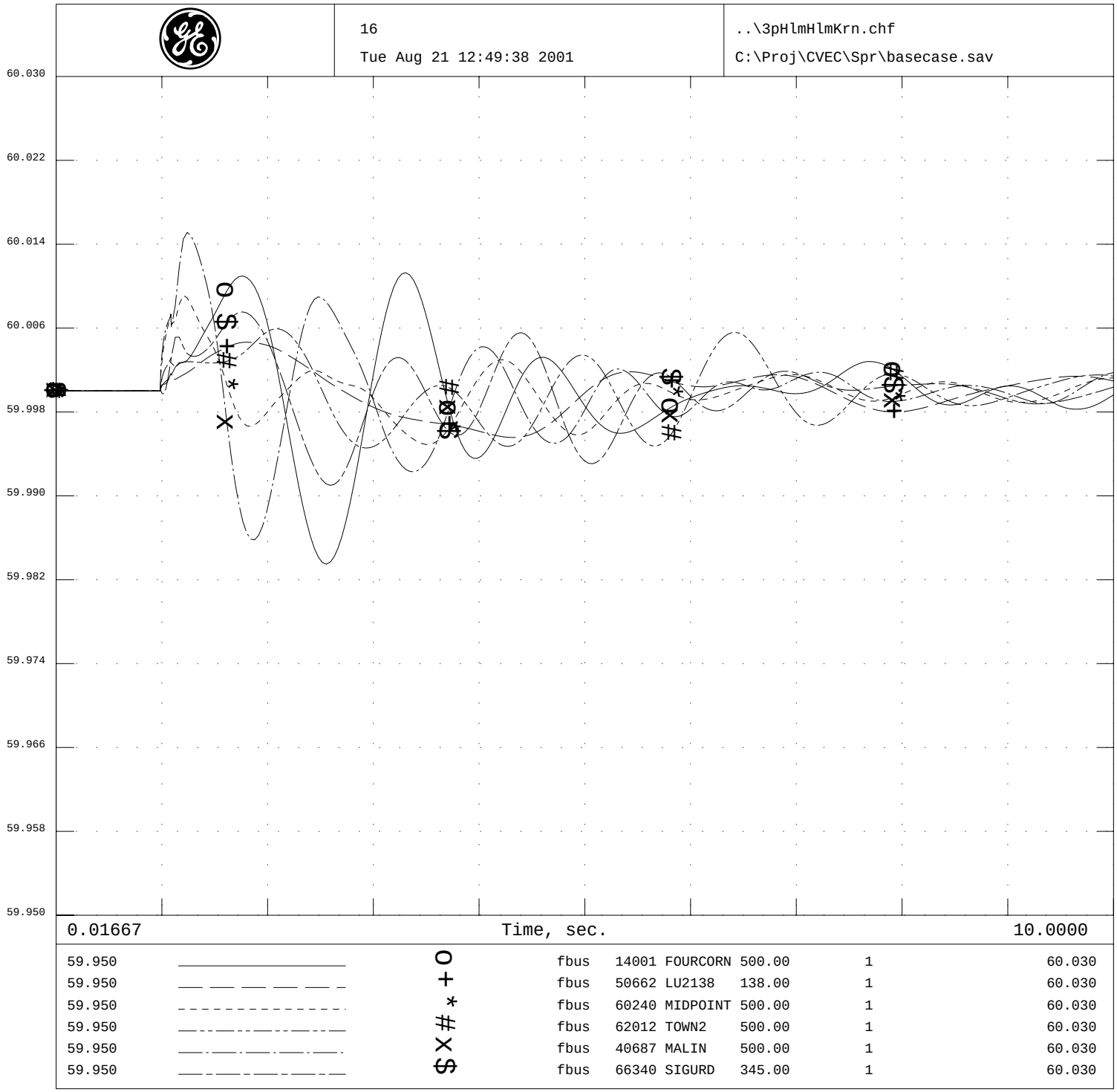

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Central Valley Energy Center
Calpine Corporation
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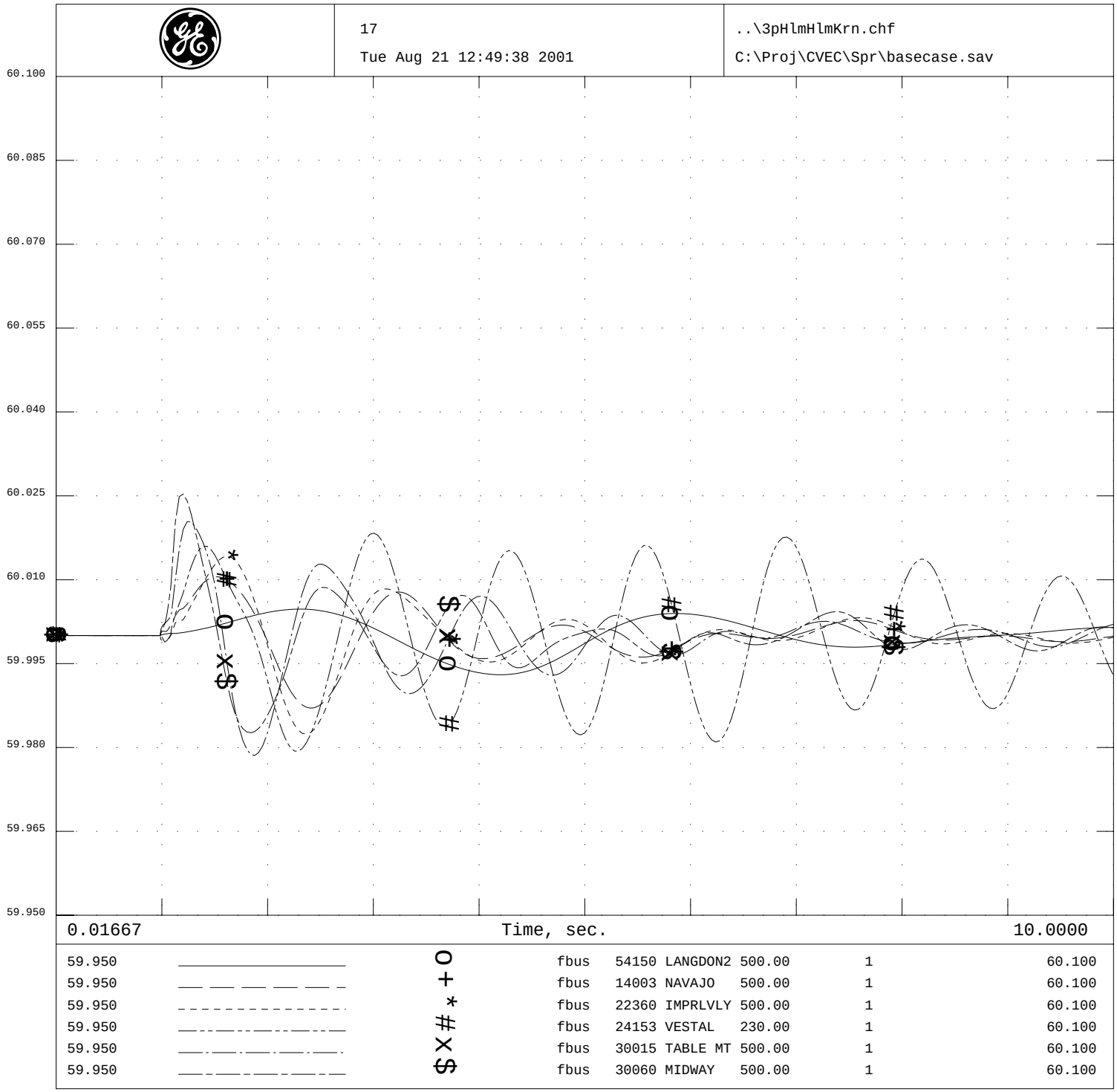

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Calpine Corporation
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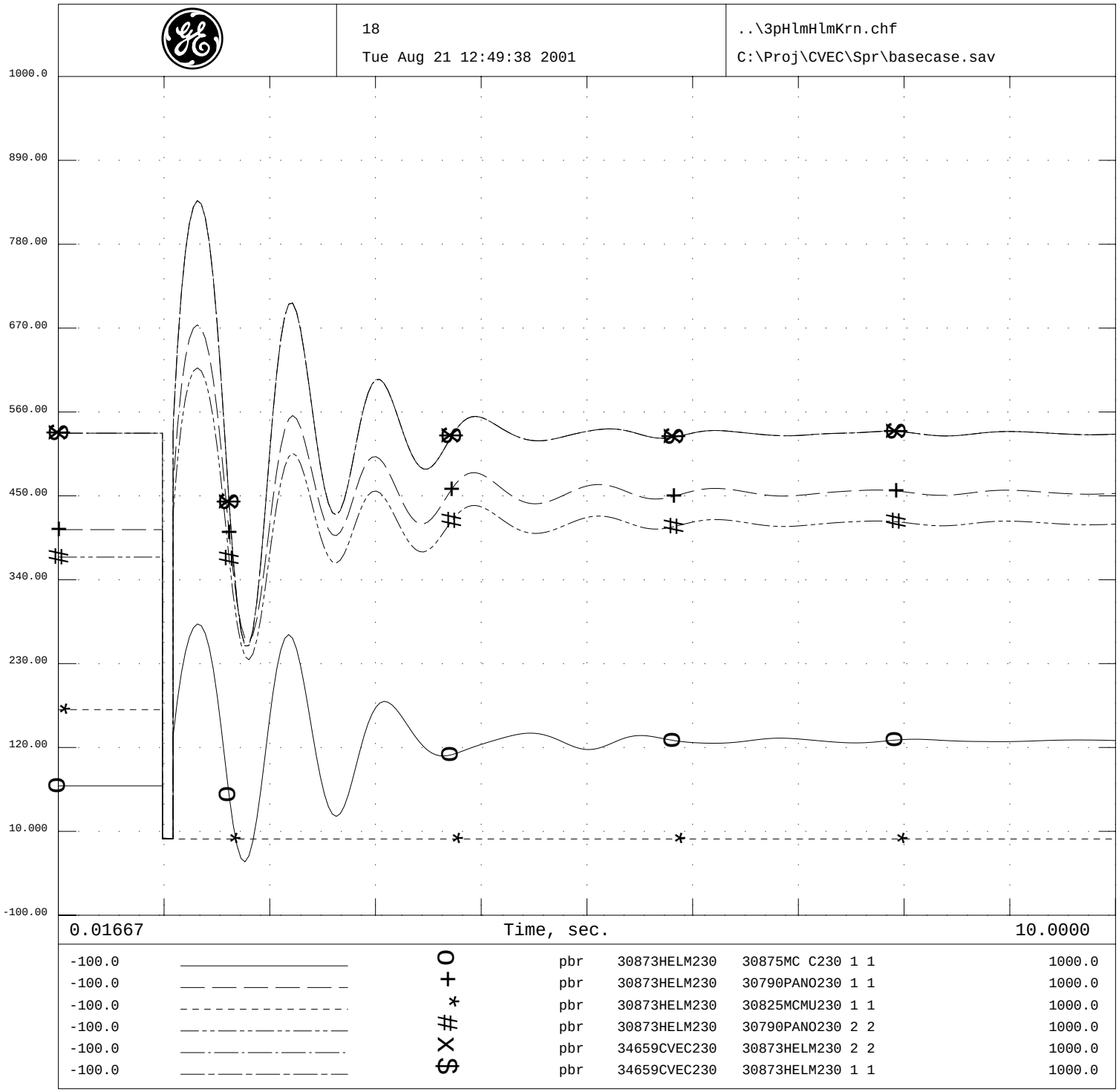

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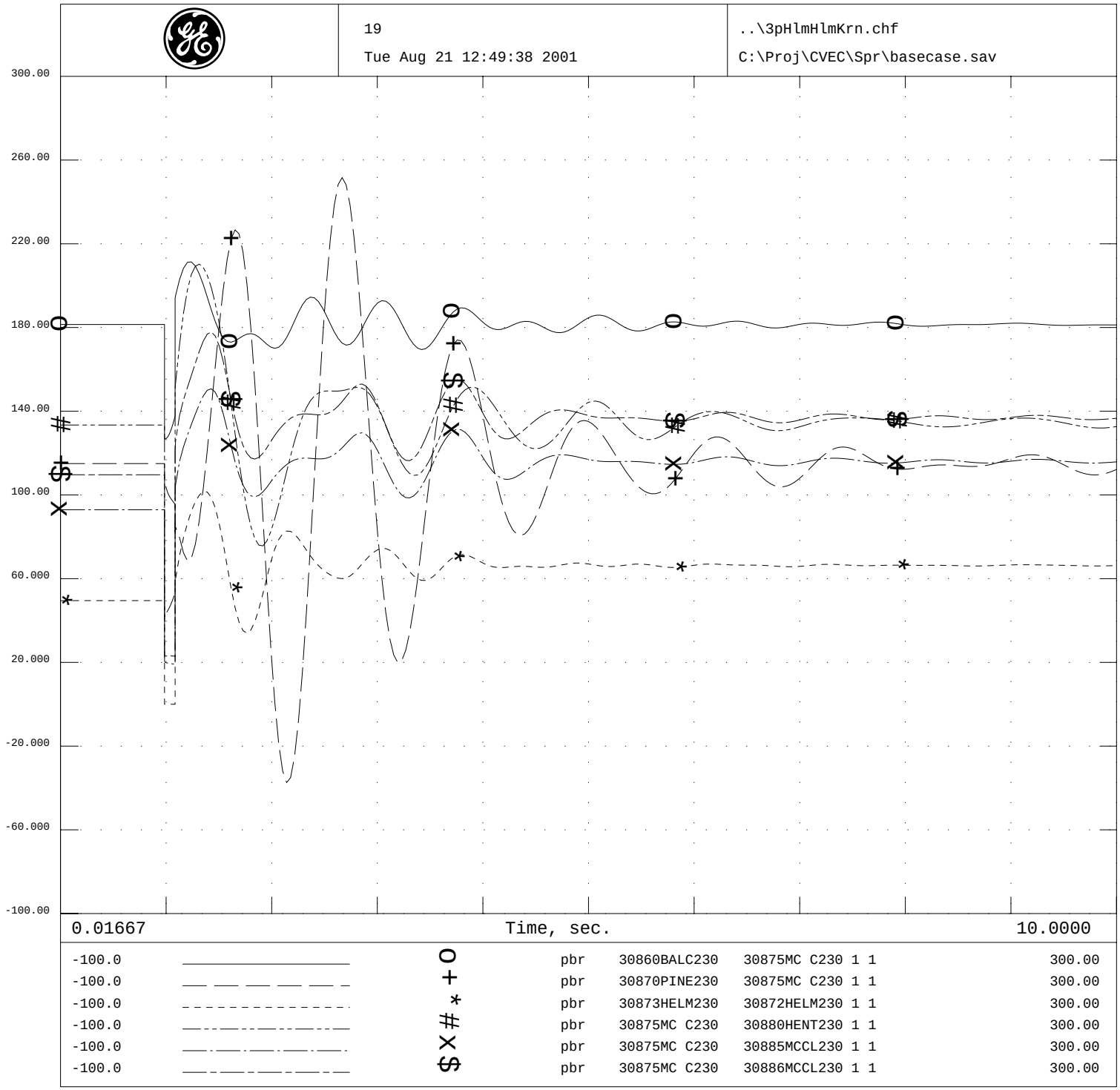
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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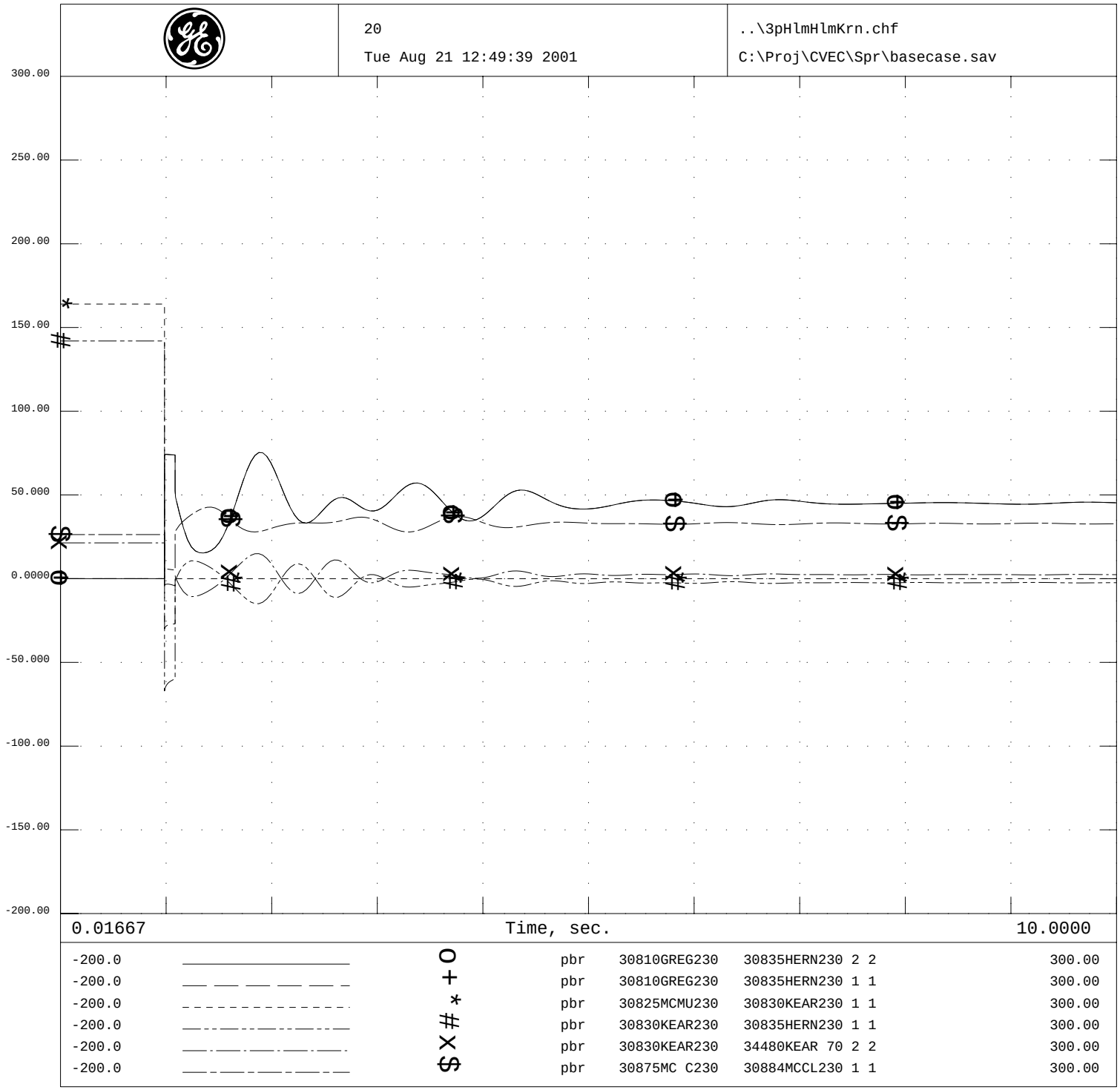

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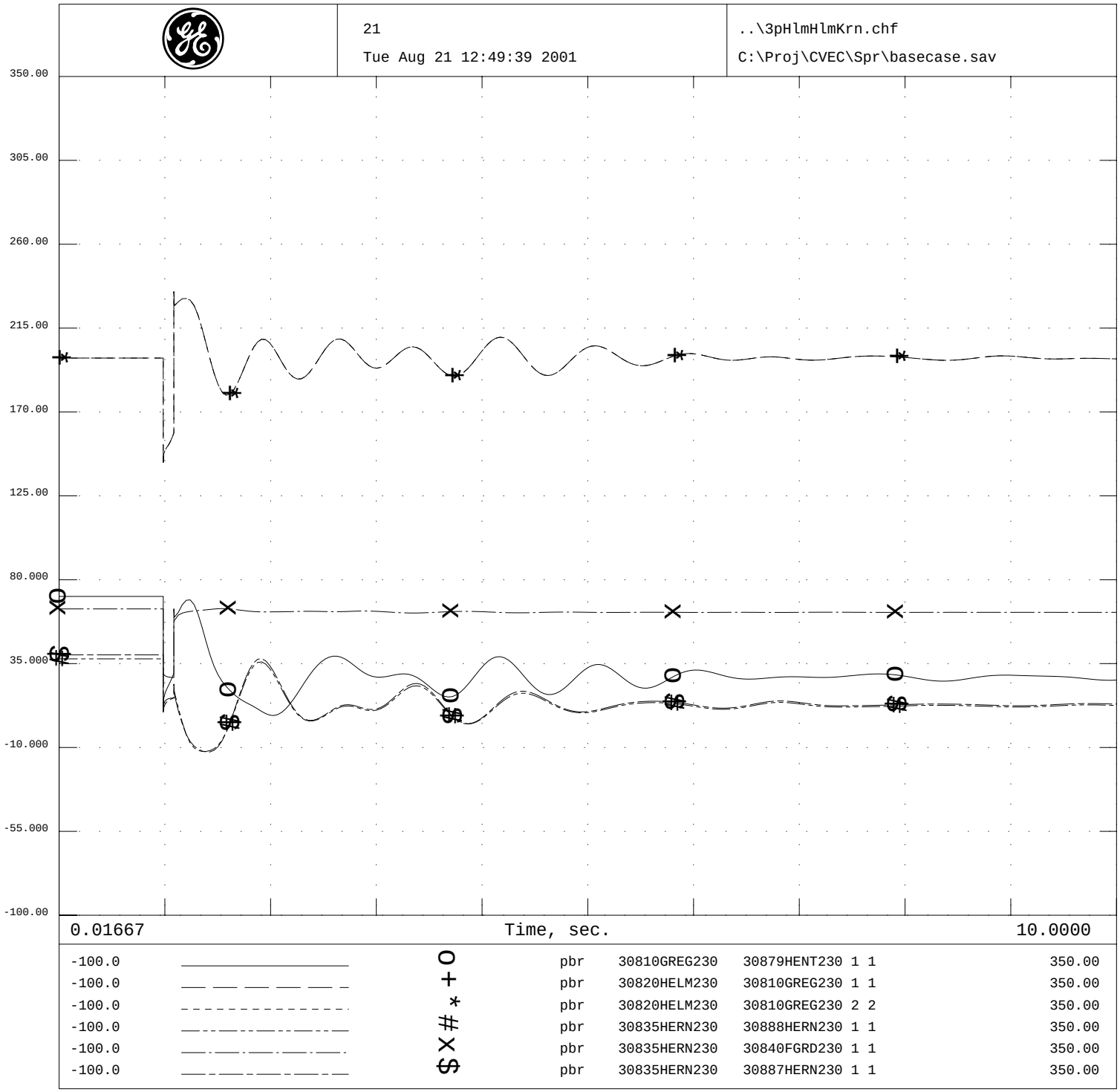

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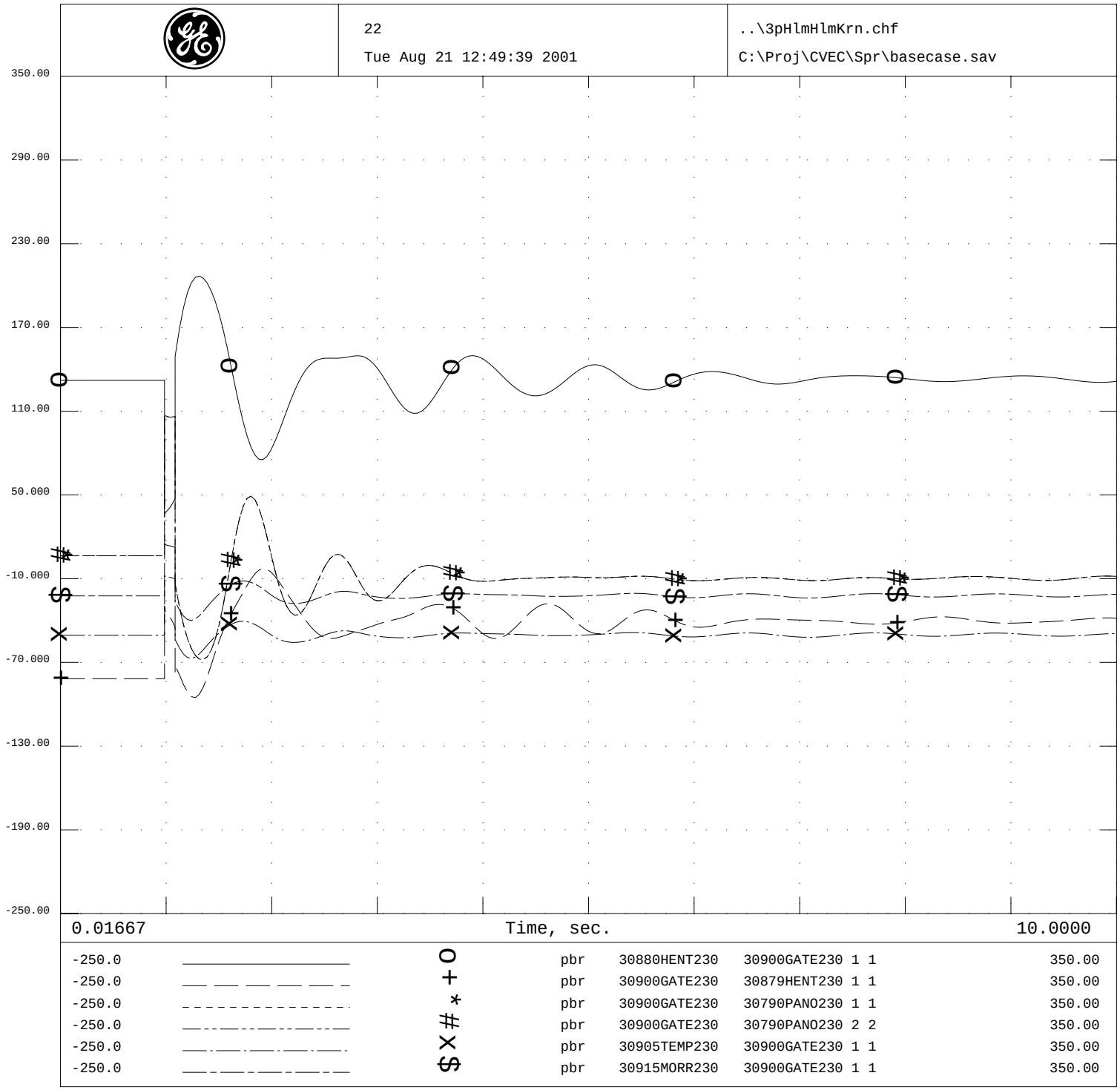

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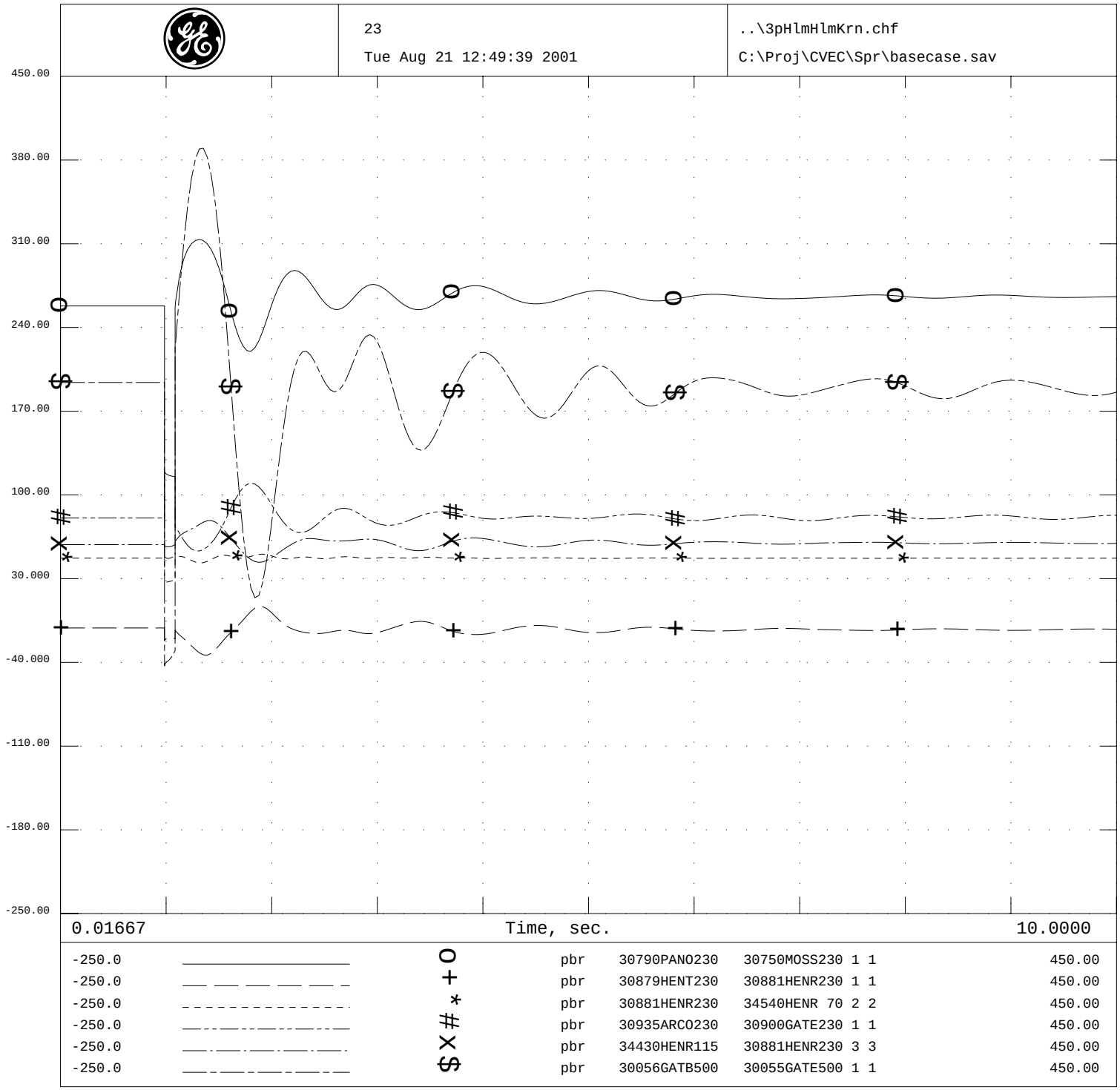

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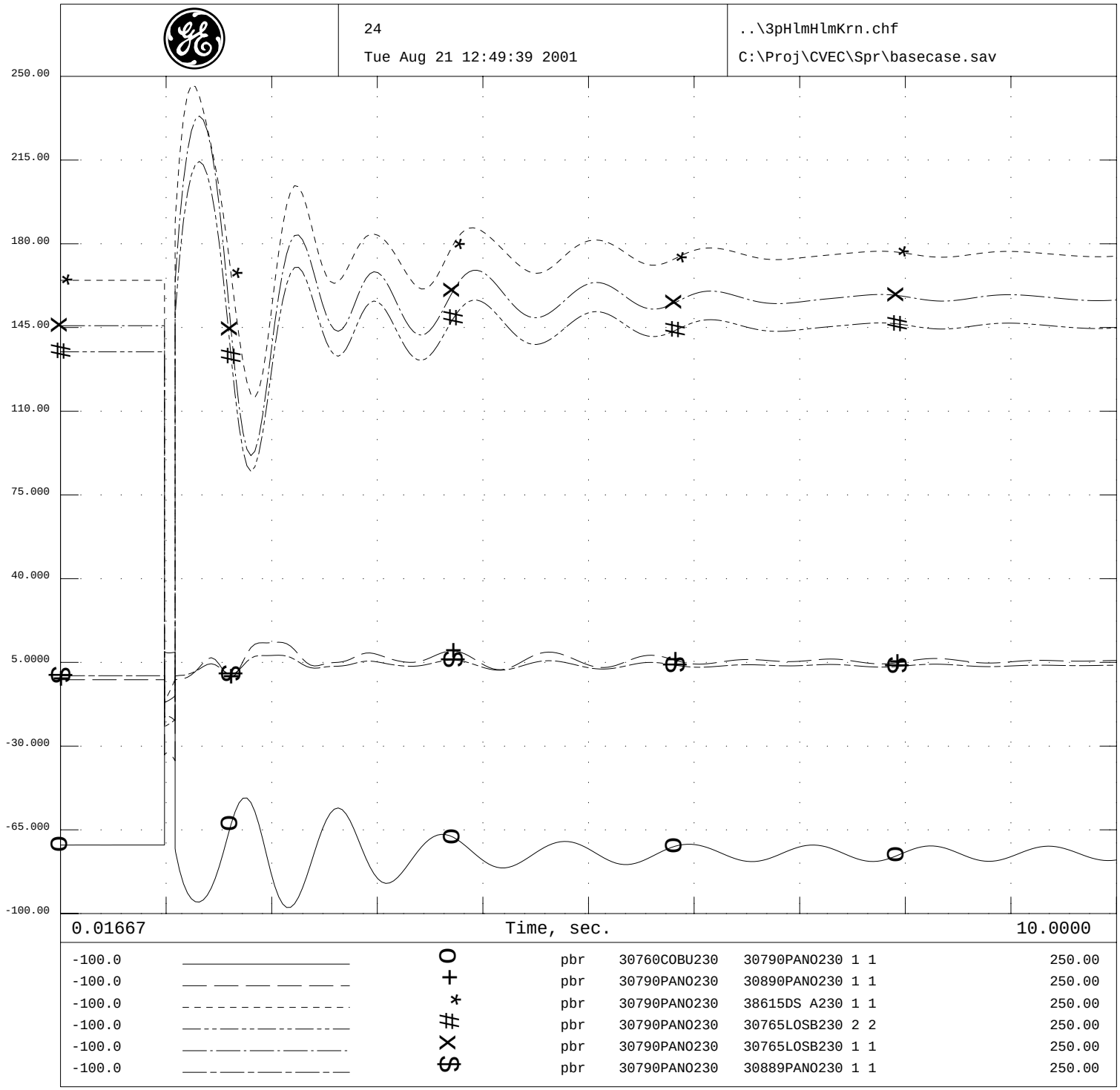

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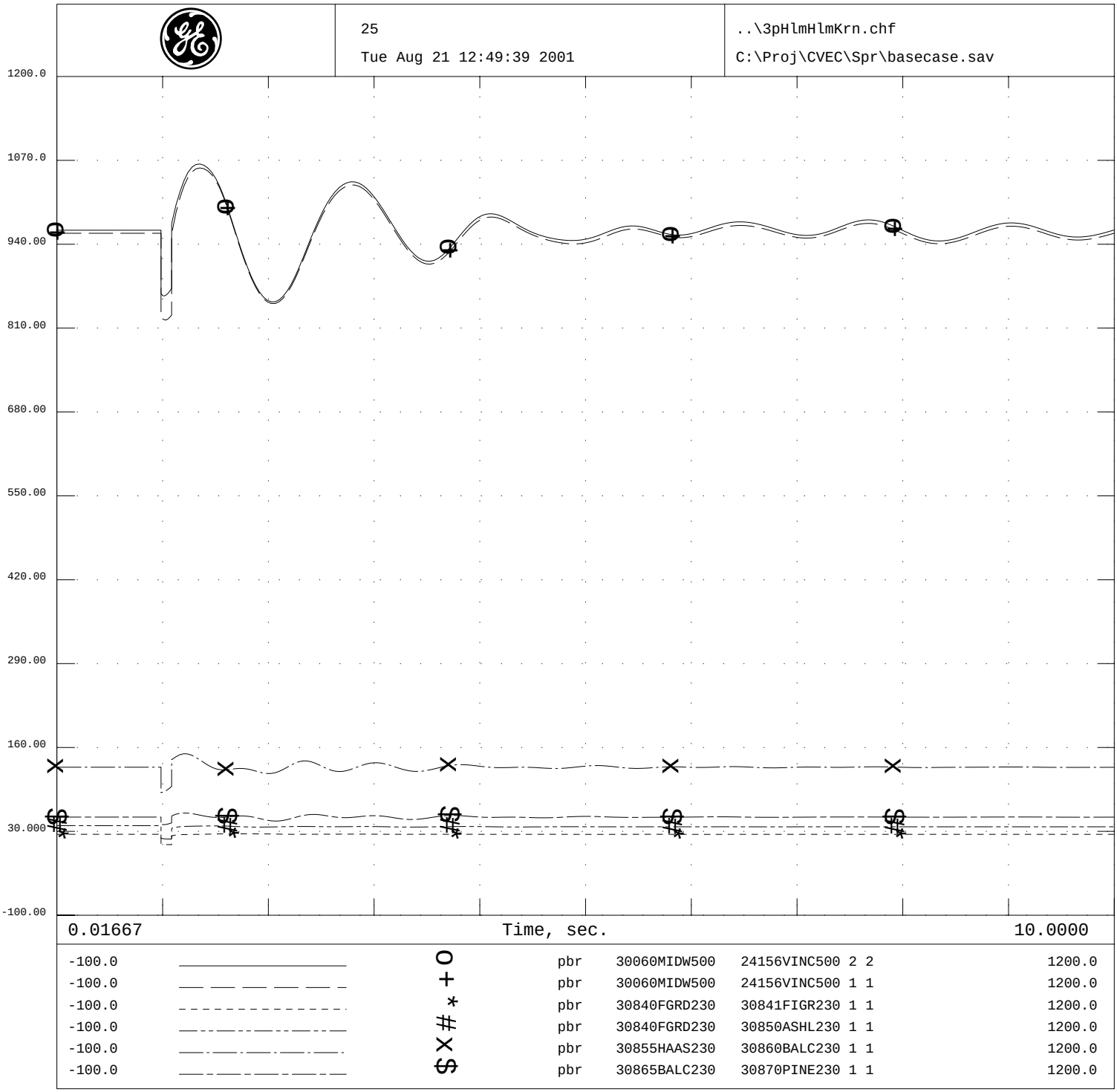

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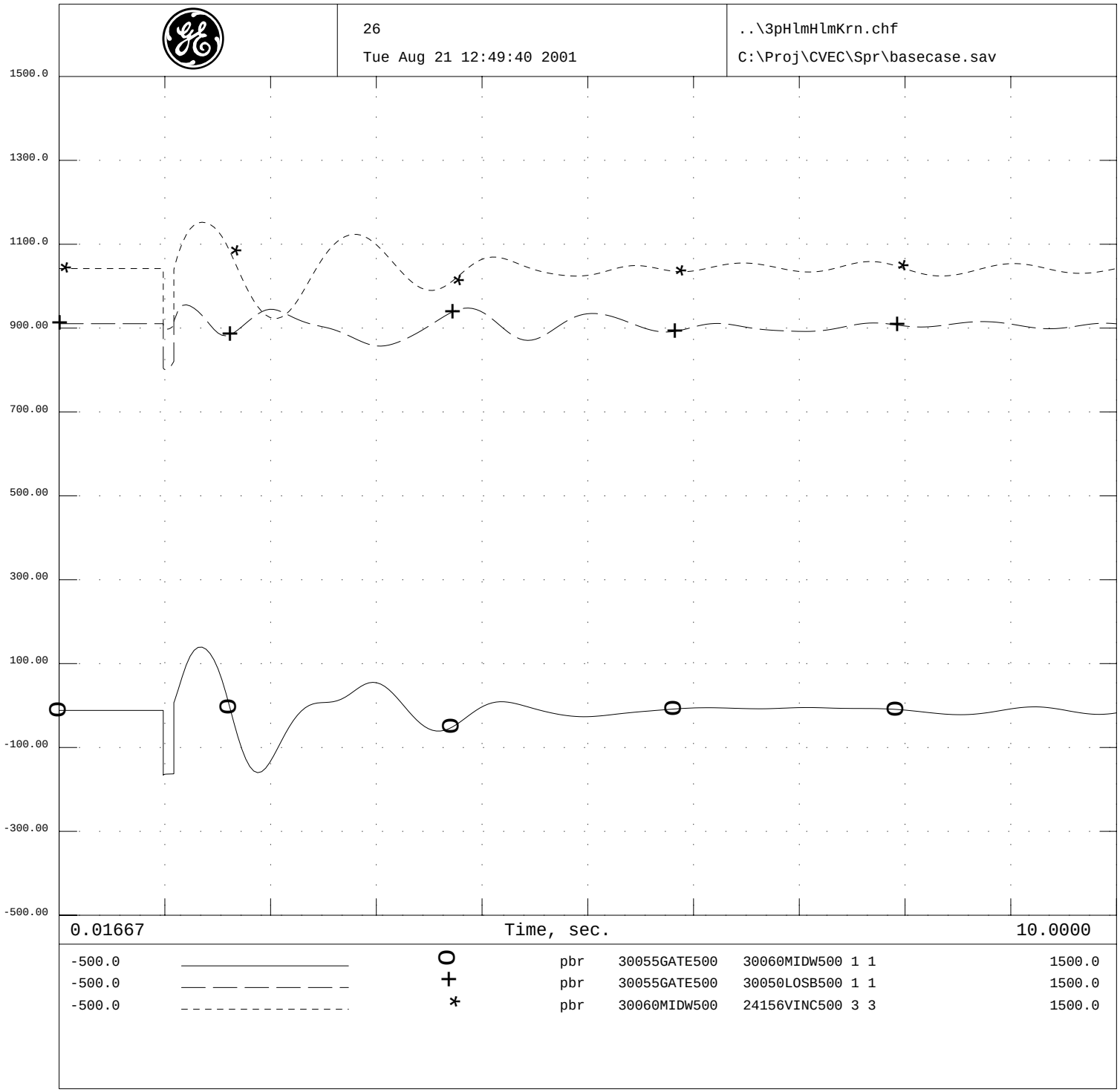

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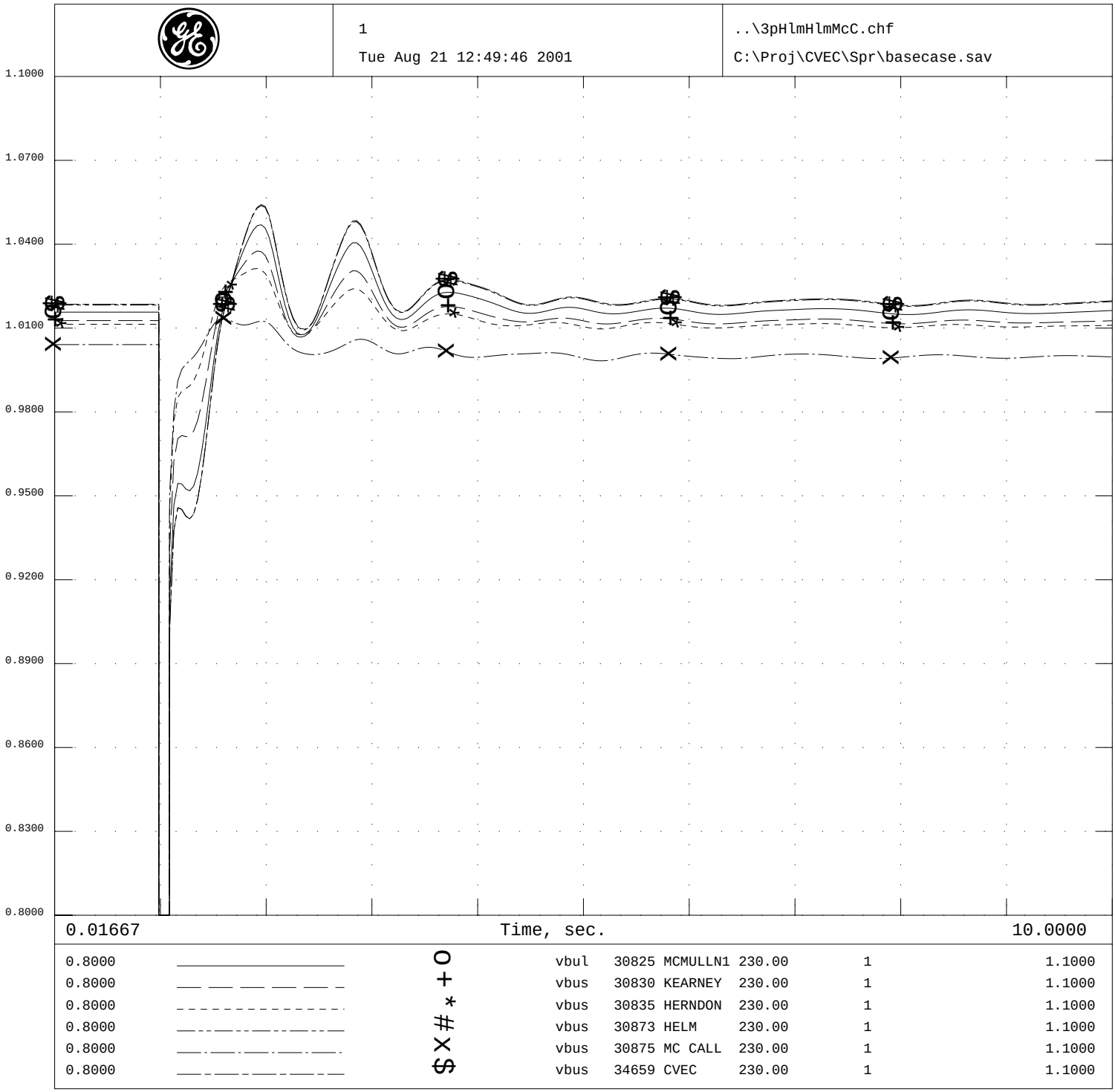

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2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Helm 230kV Line Outage
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Central Valley Energy Center
Calpine Corporation
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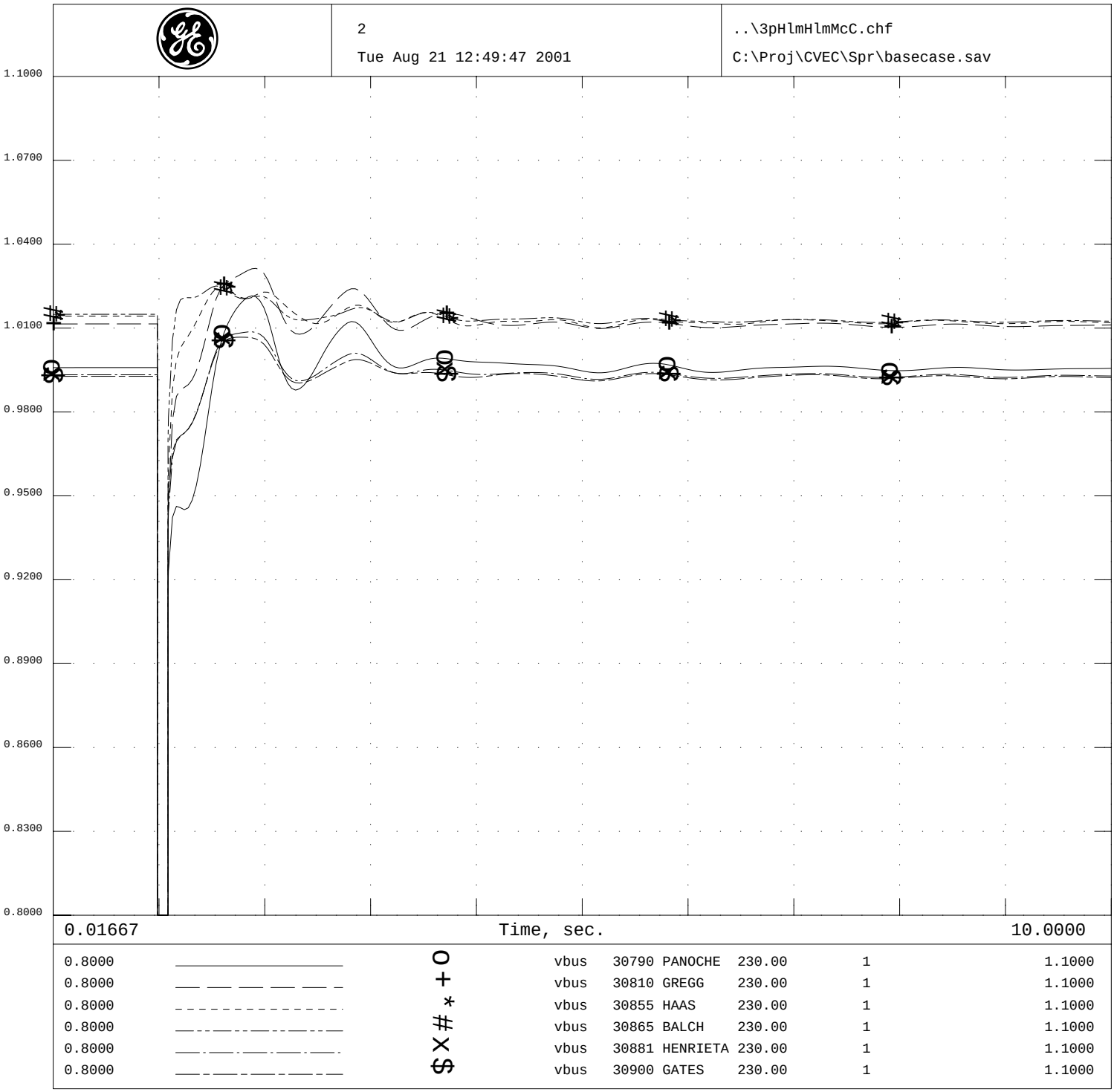

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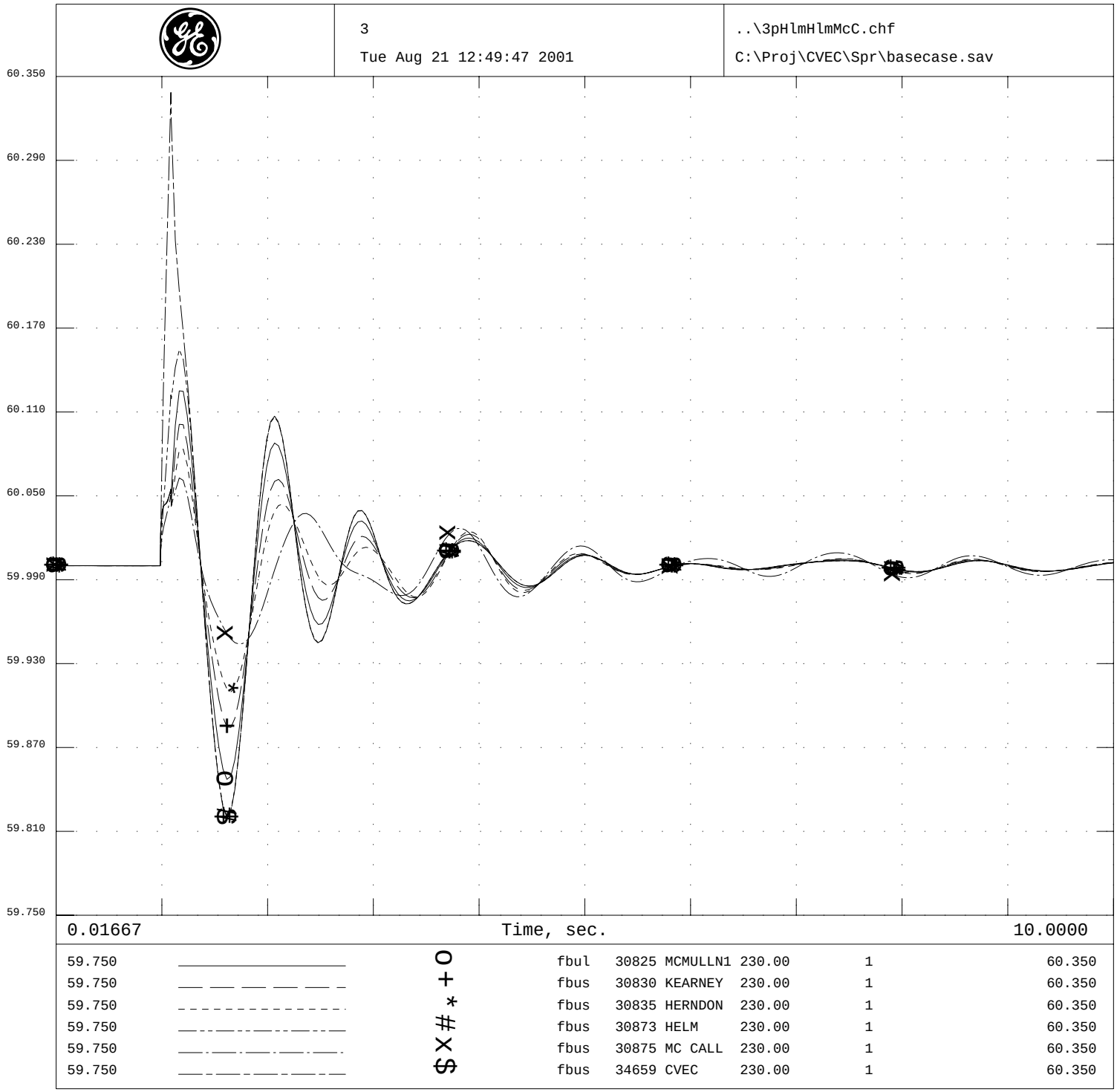

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Central Valley Energy Center
Calpine Corporation
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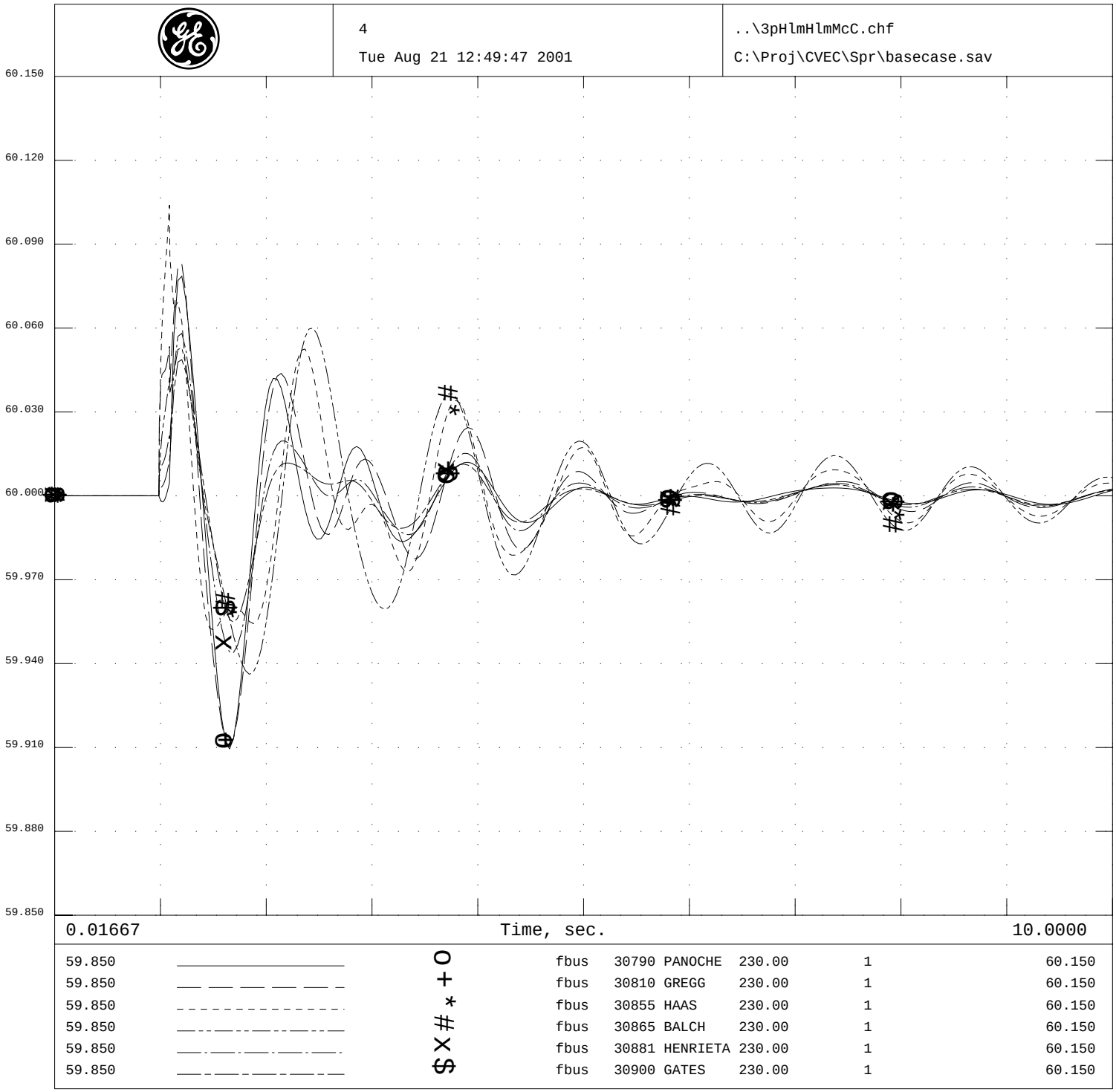

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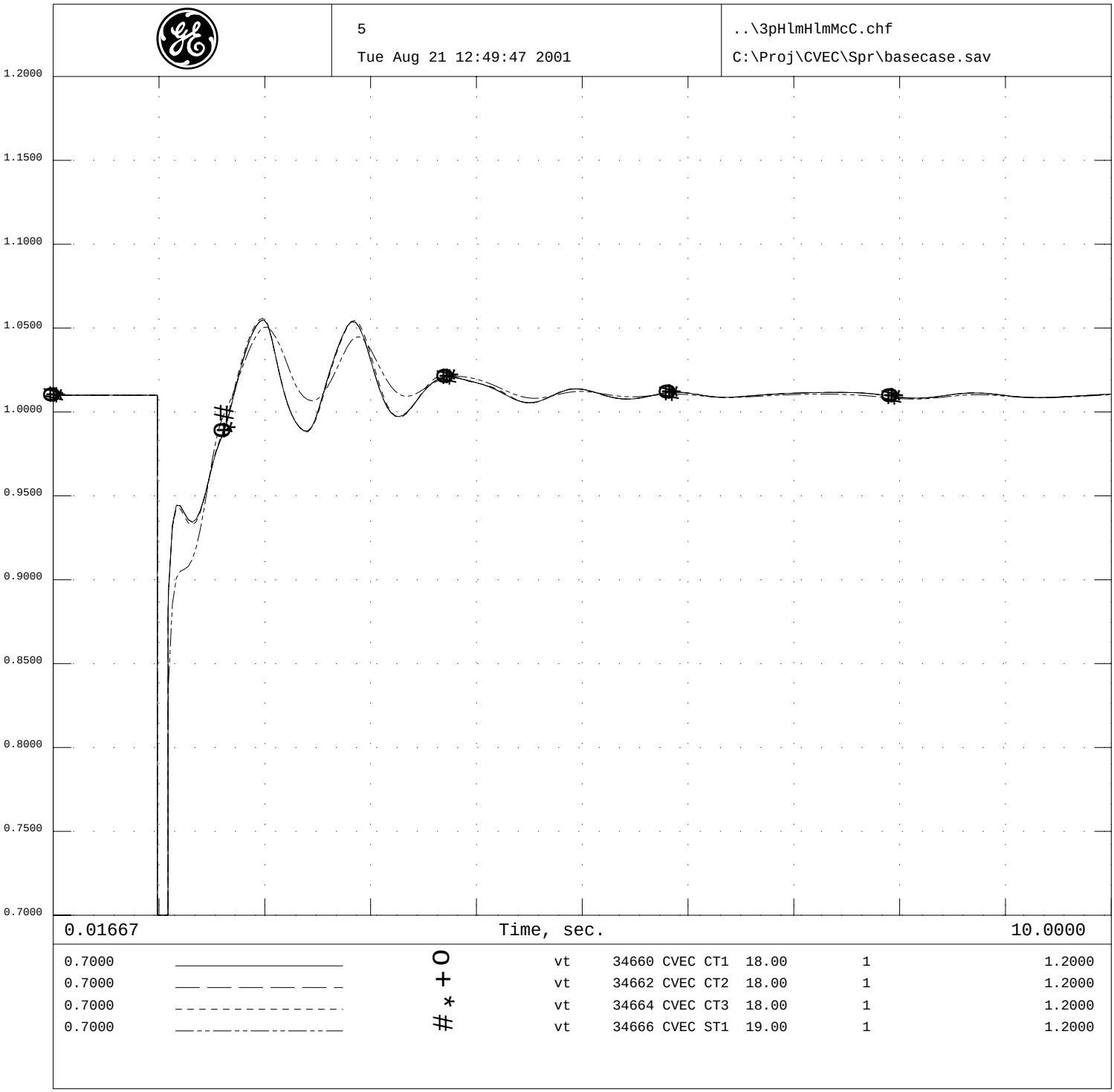

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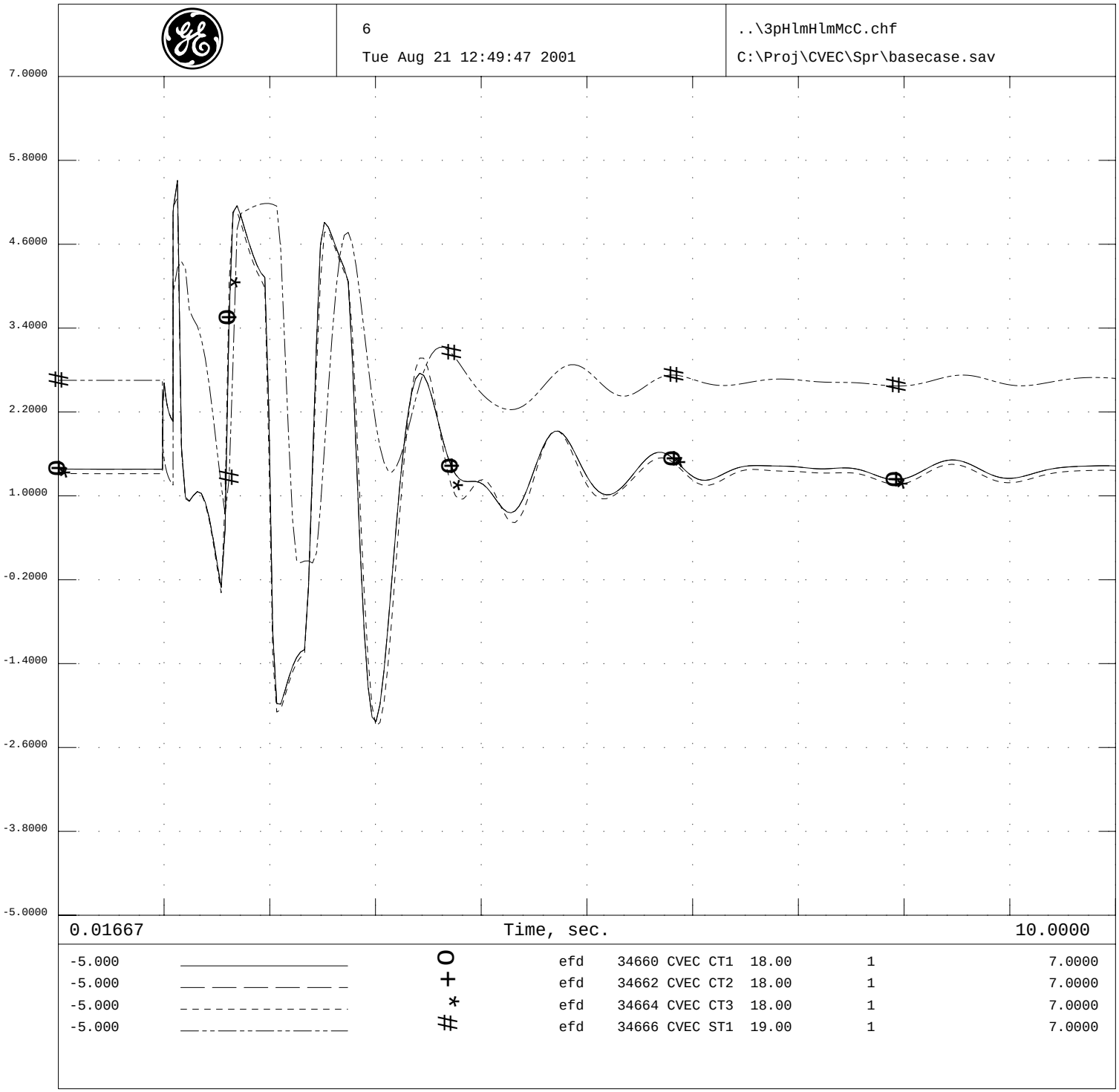
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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Calpine Corporation
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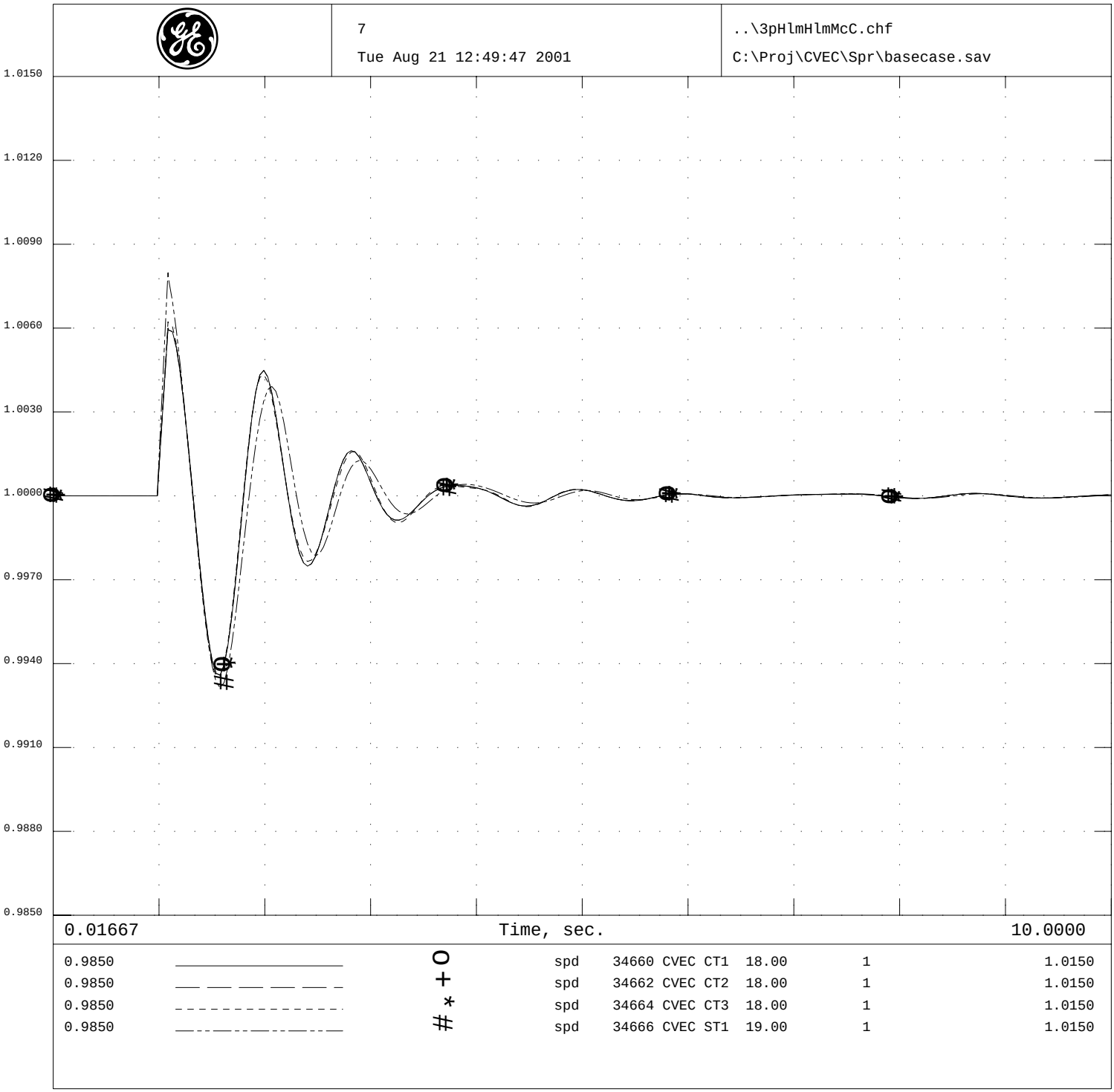

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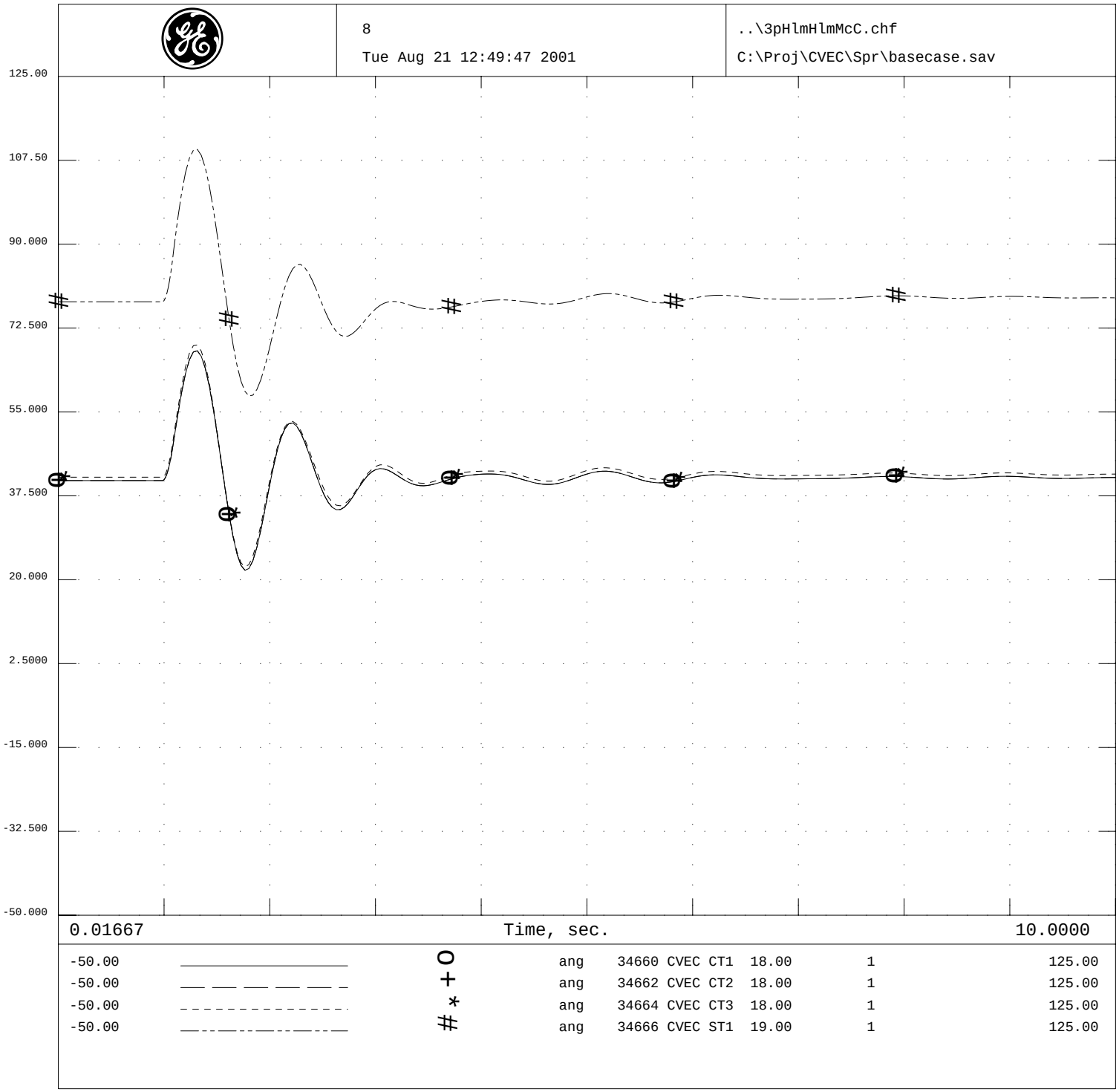
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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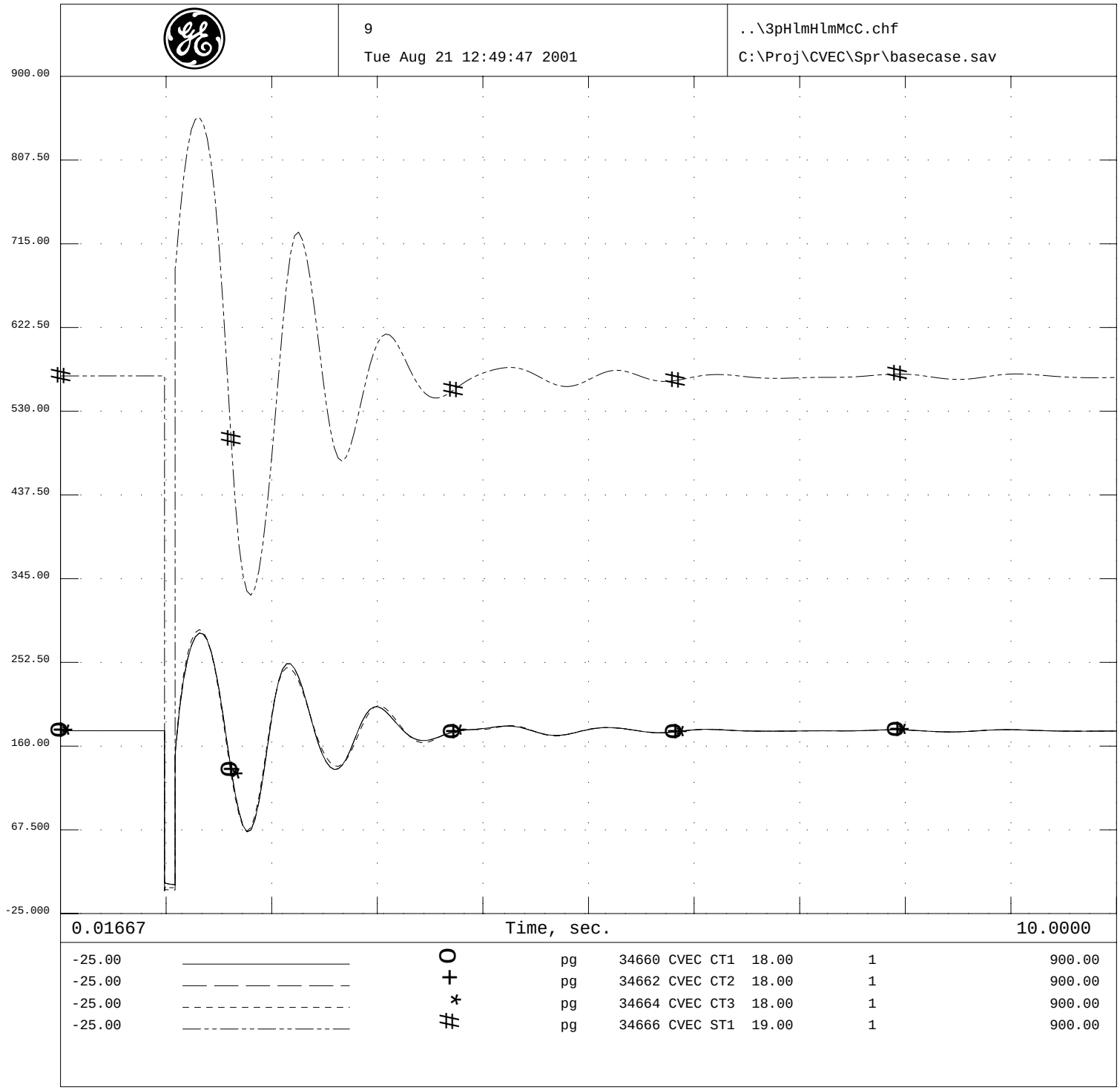
Calpine Corporation
Project Generator Rotor Angle



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Calpine Corporation
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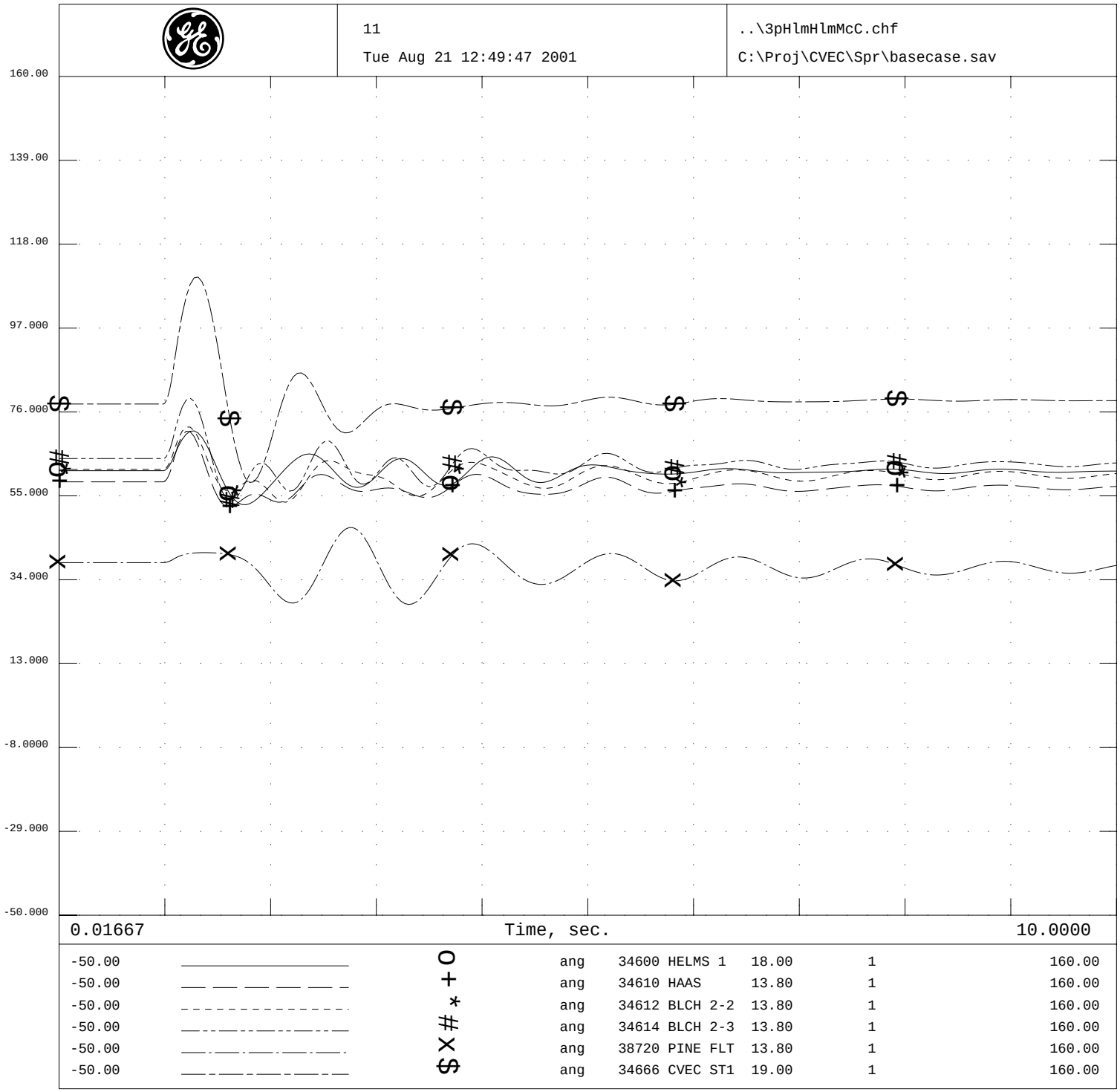

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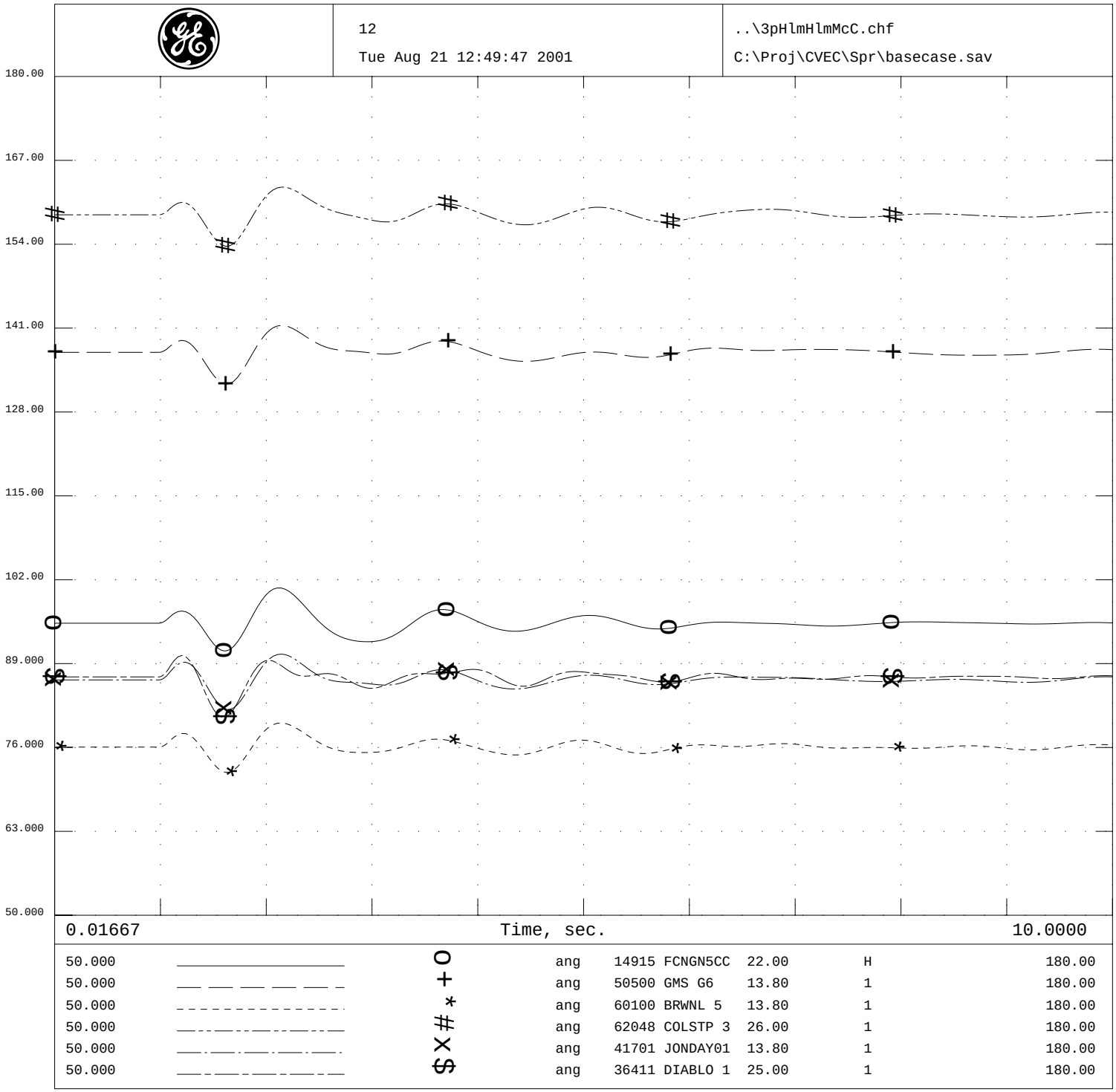
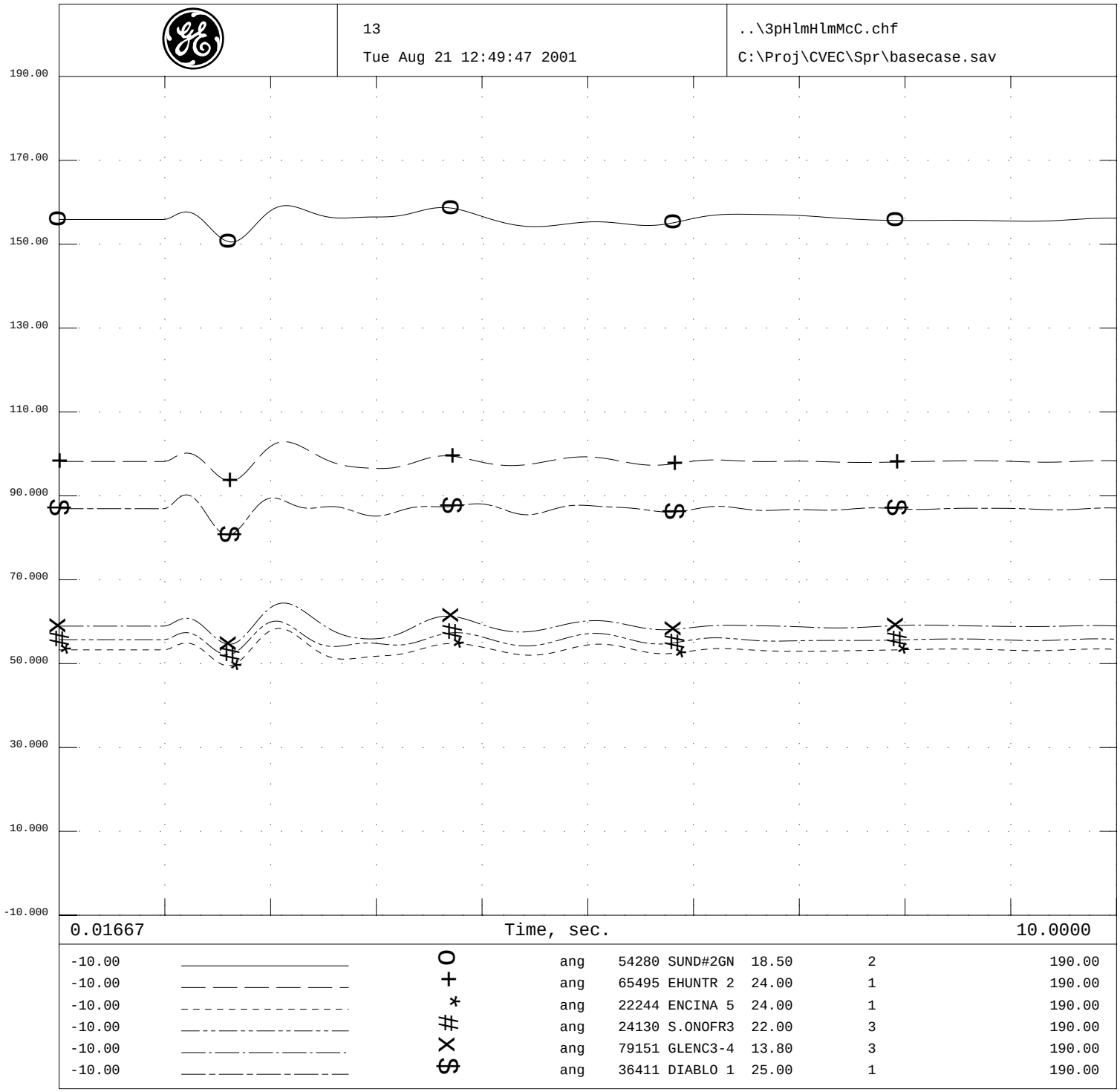
Calpine Corporation
Selected Local Rotor Angle Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Helm 230kV Line Outage
3 phase 6 cycle fault at Helm 230kV bus and trip McCall-Helm line

Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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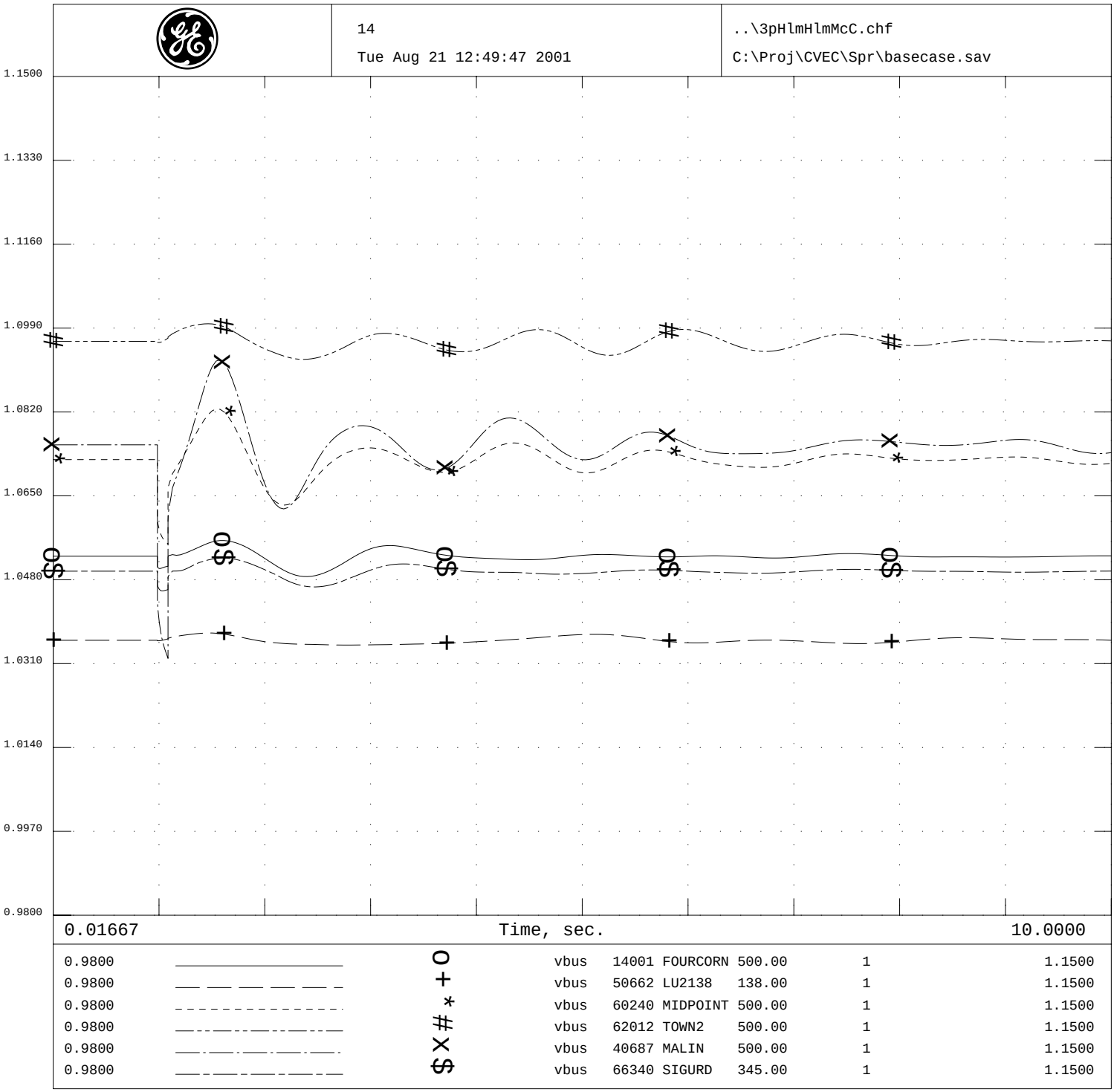

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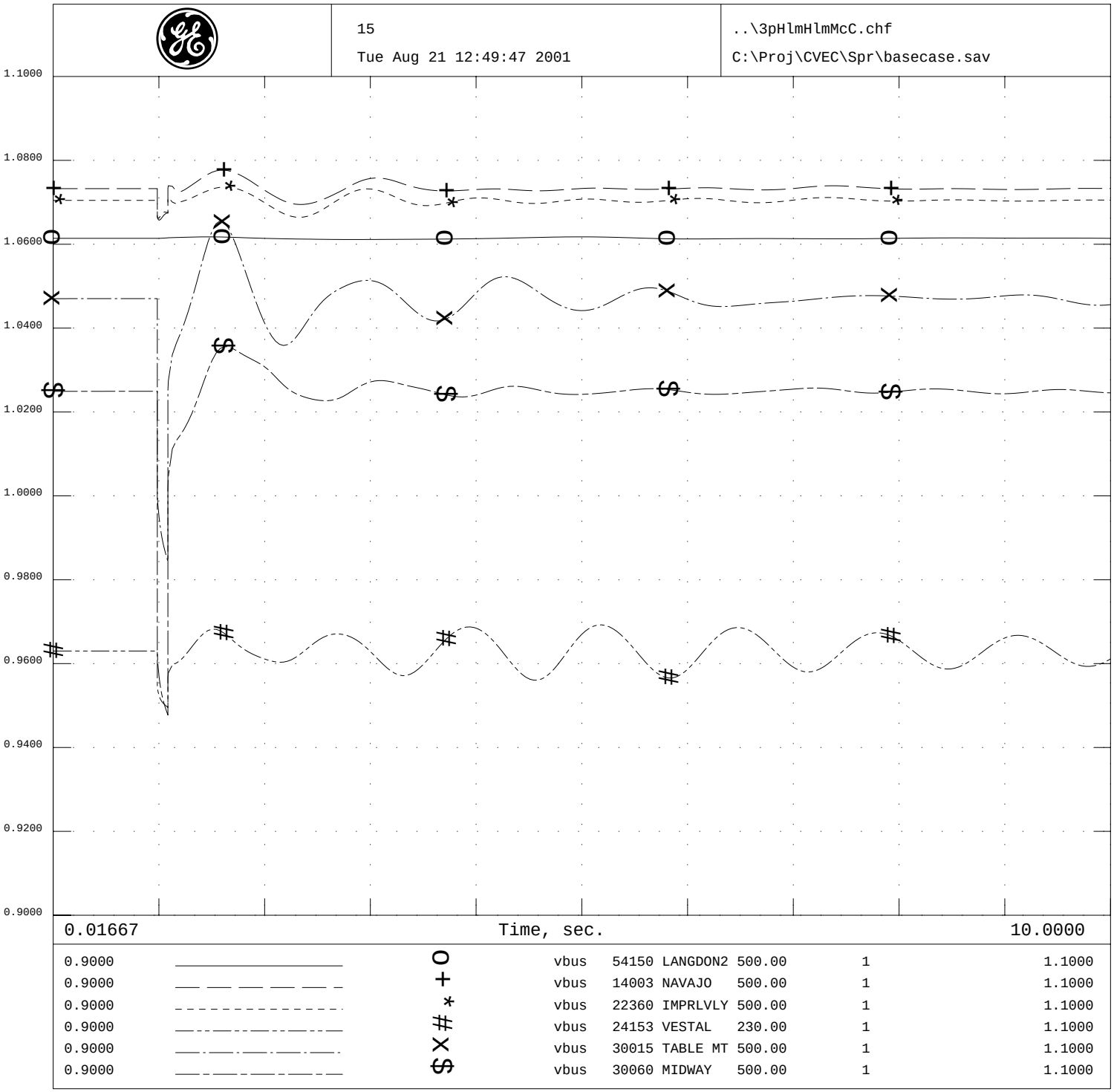

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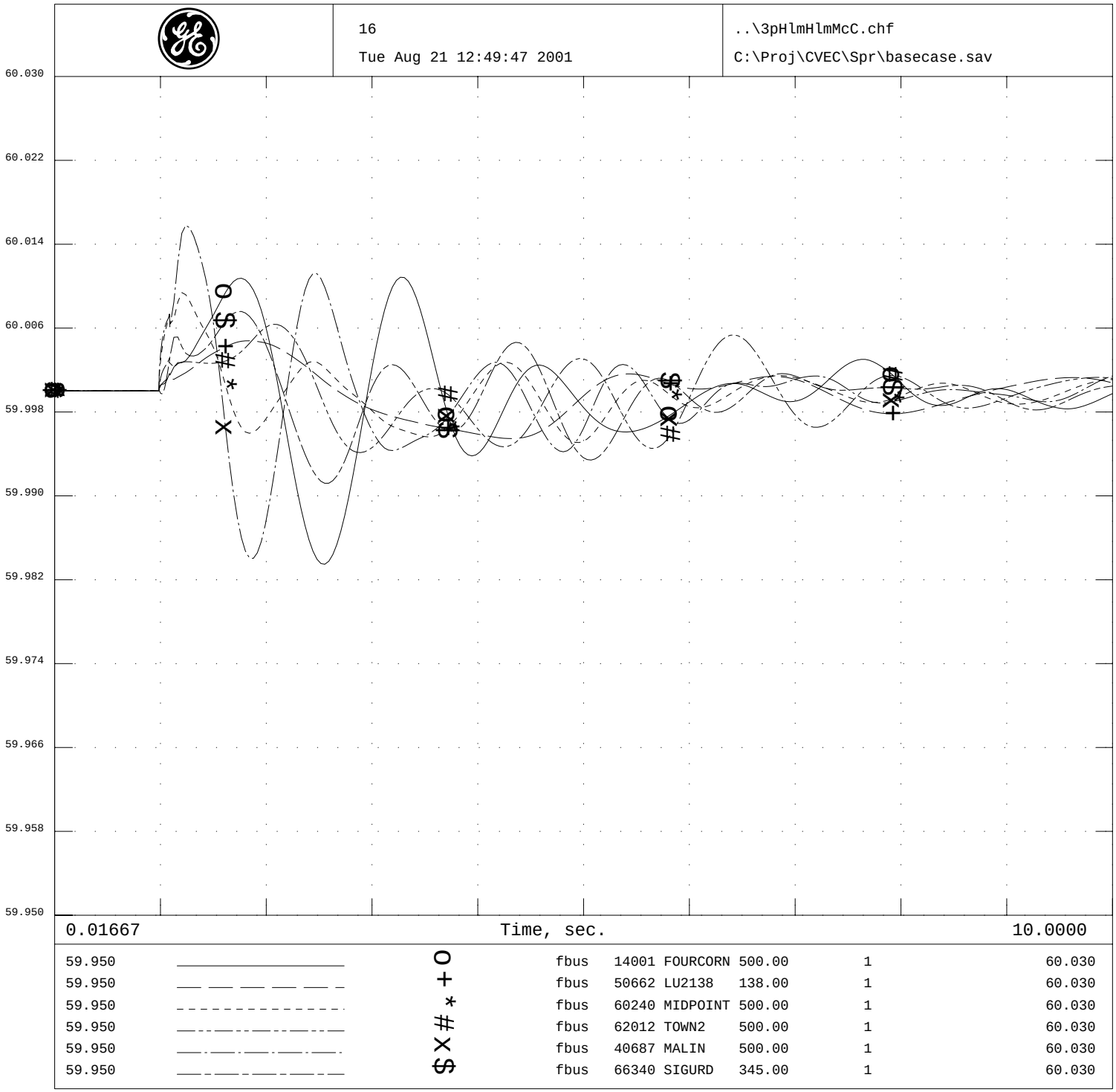

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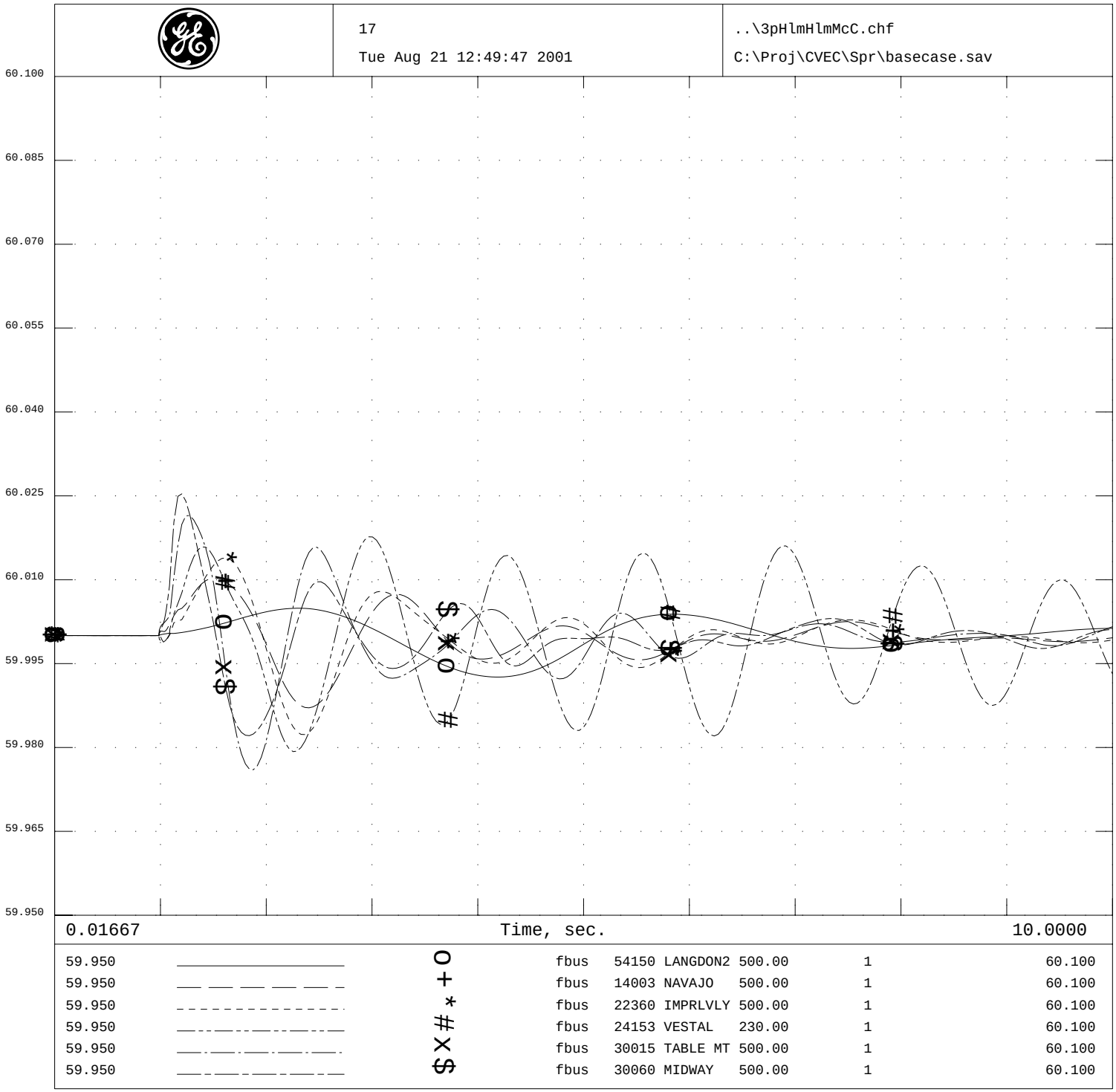

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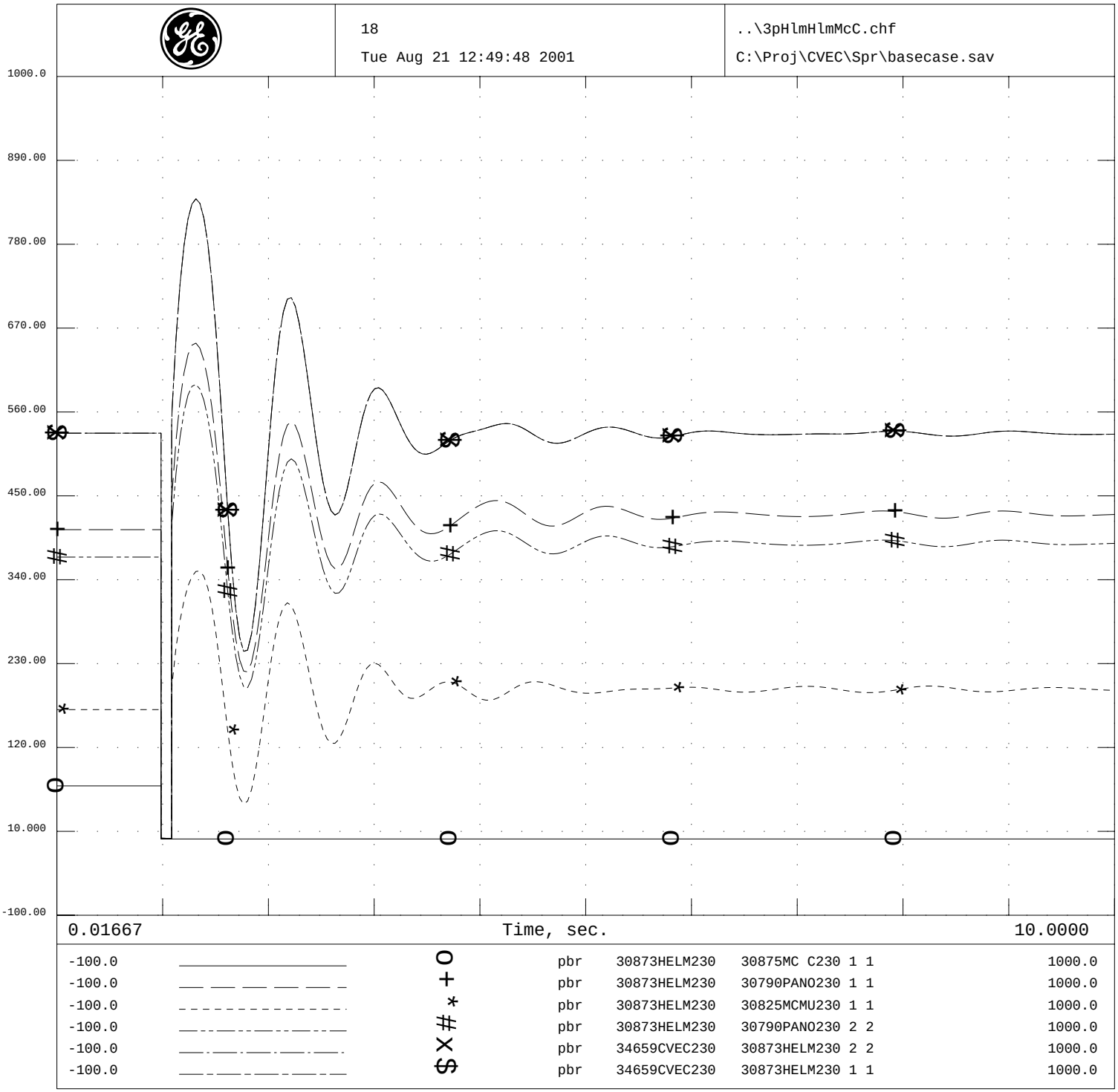

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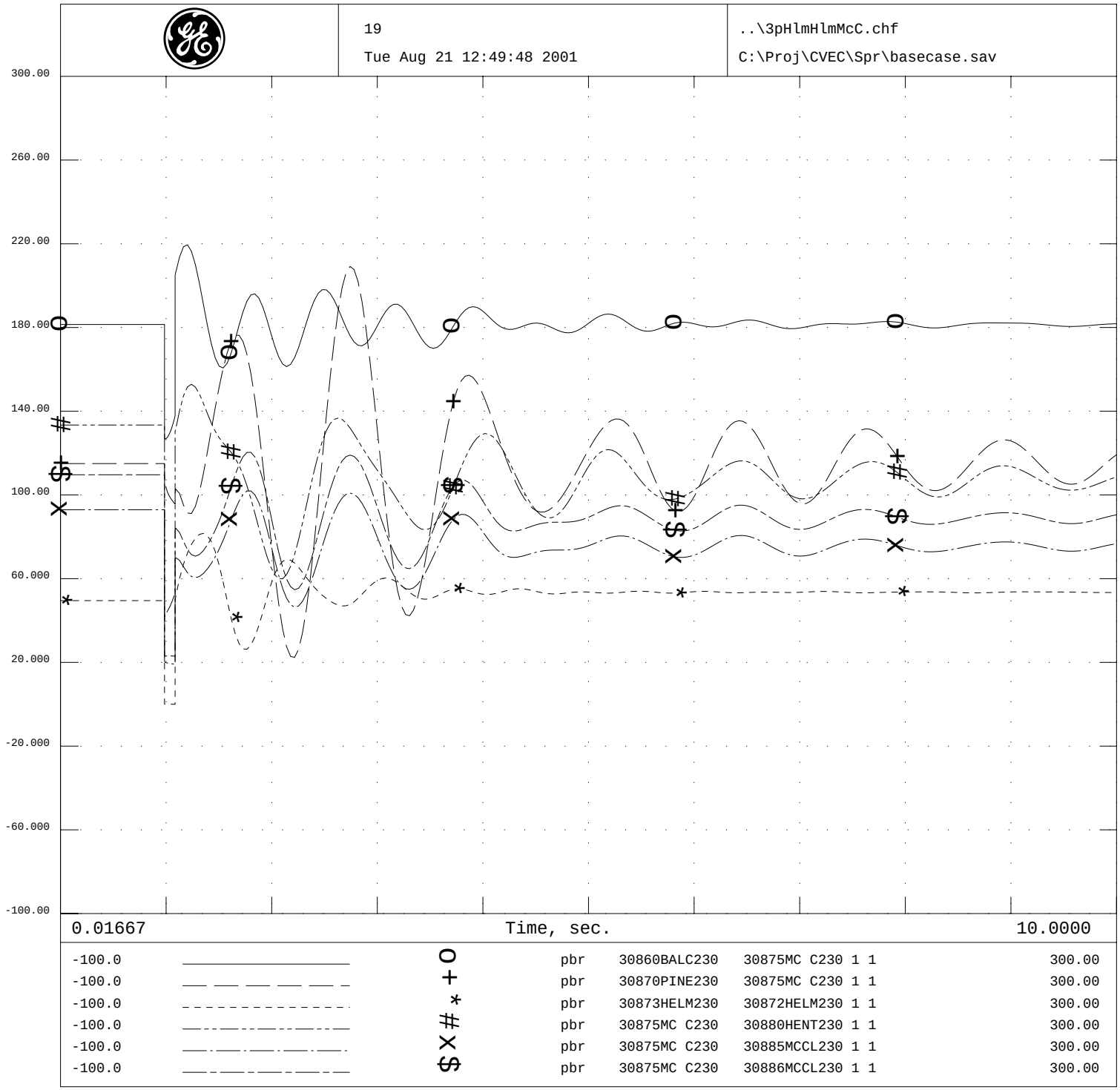

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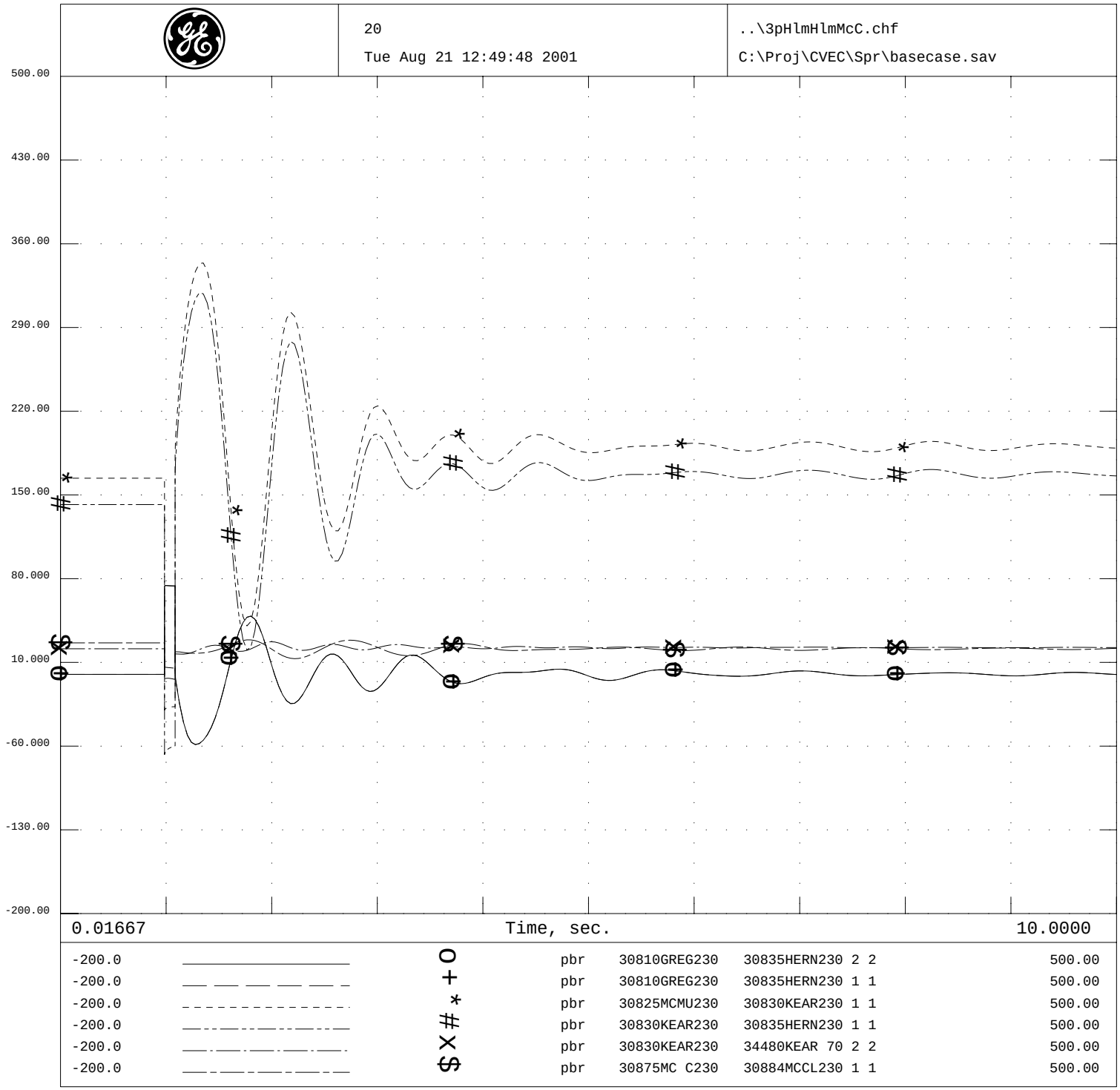

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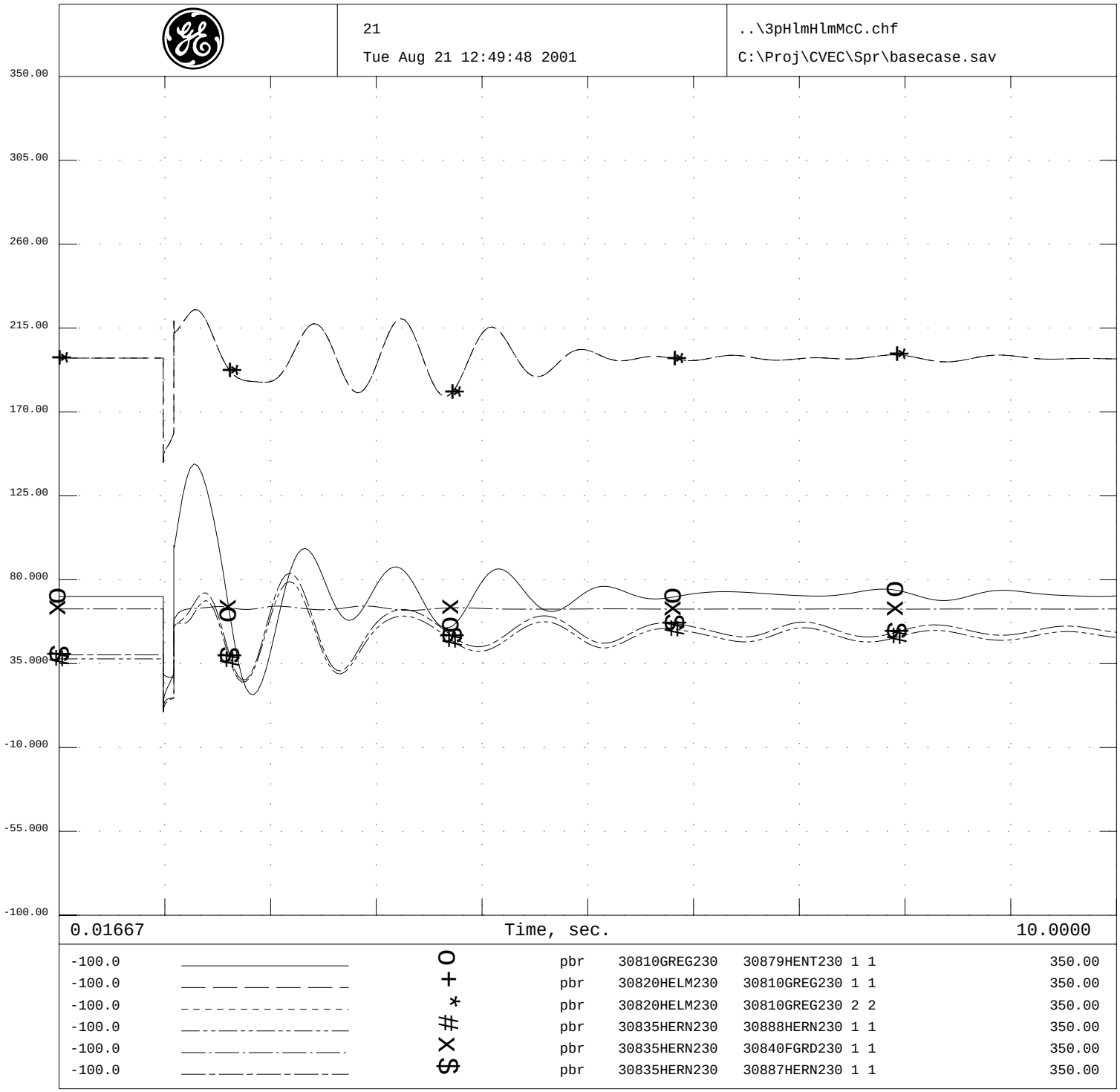

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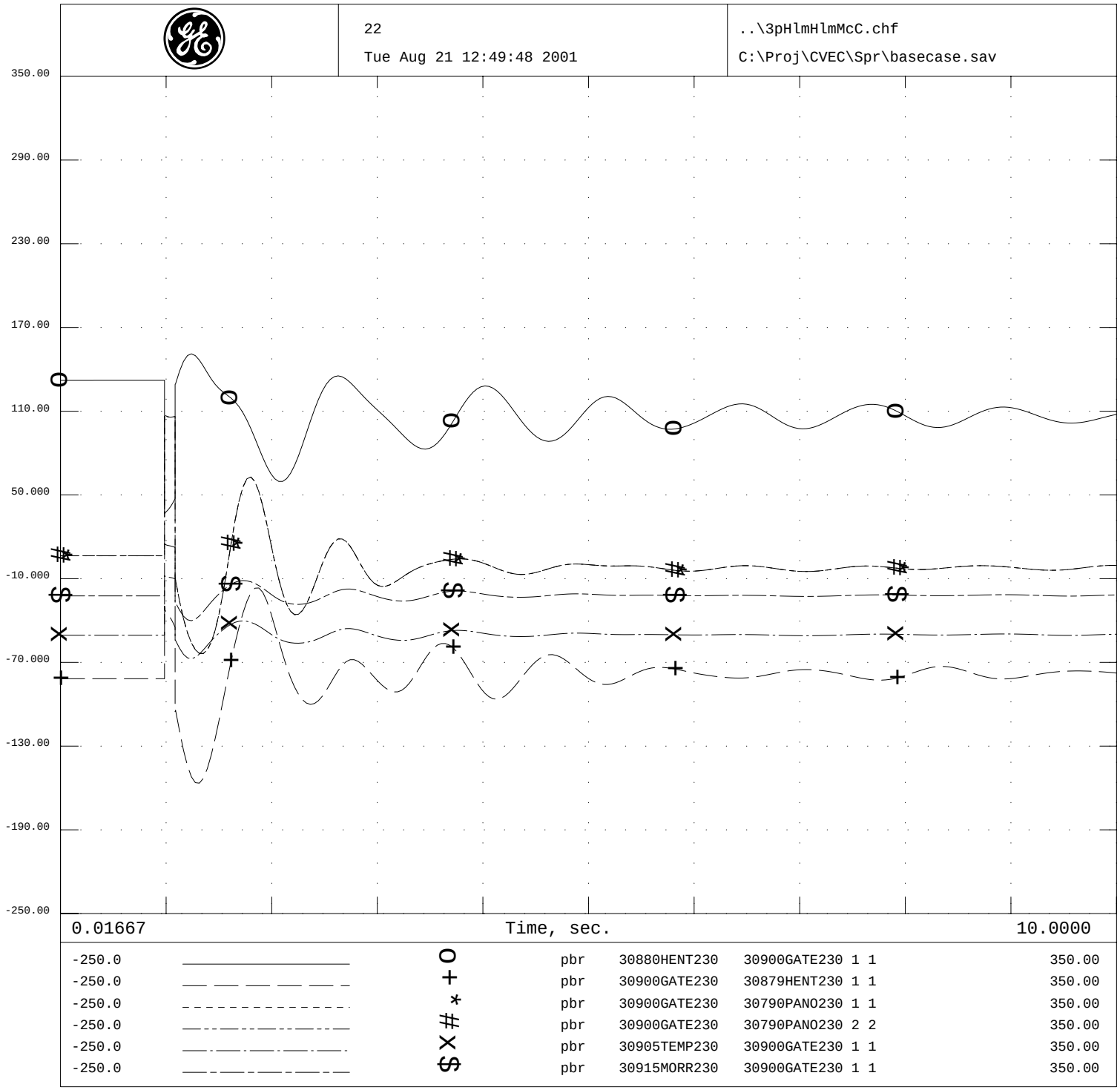

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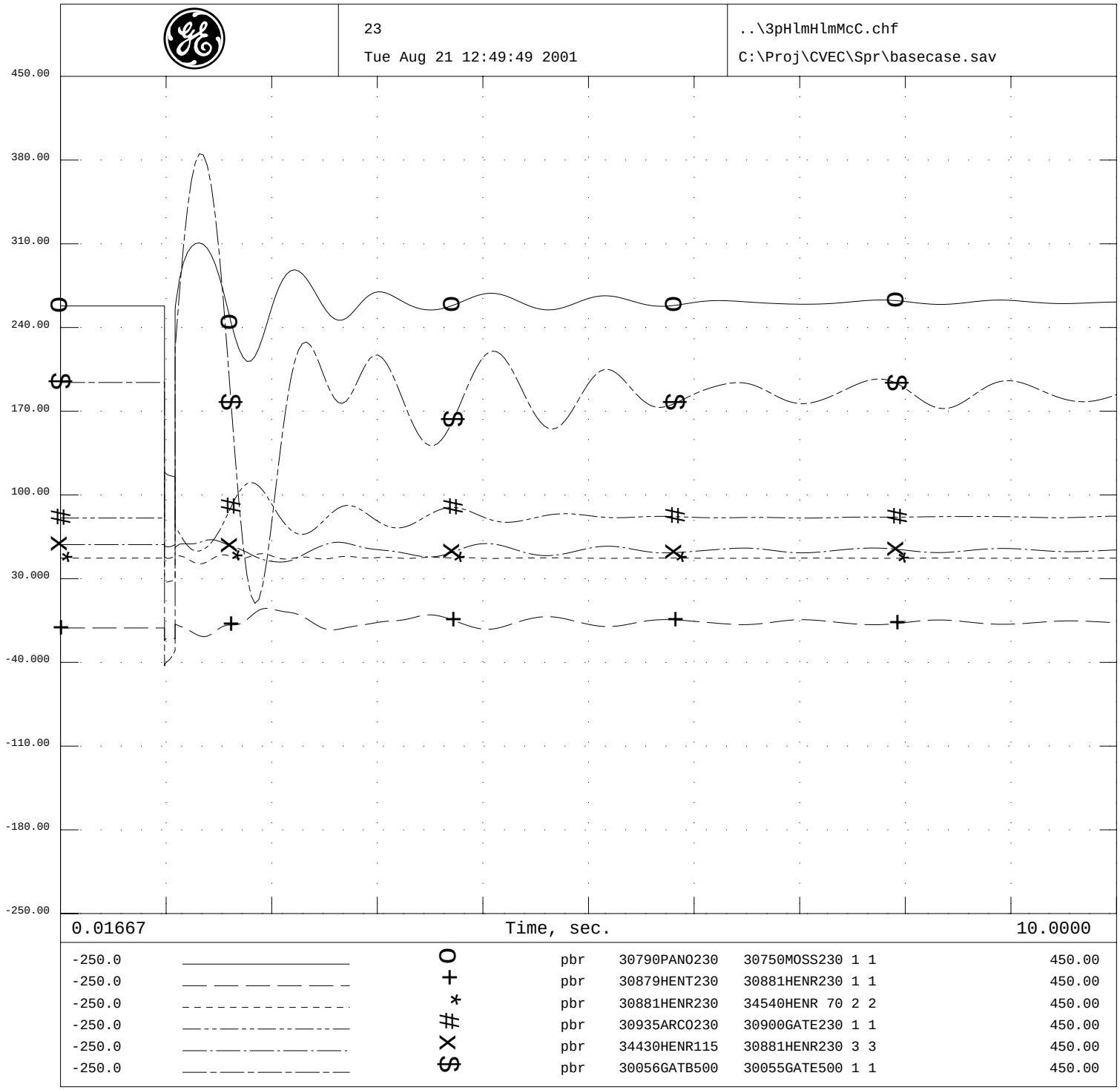

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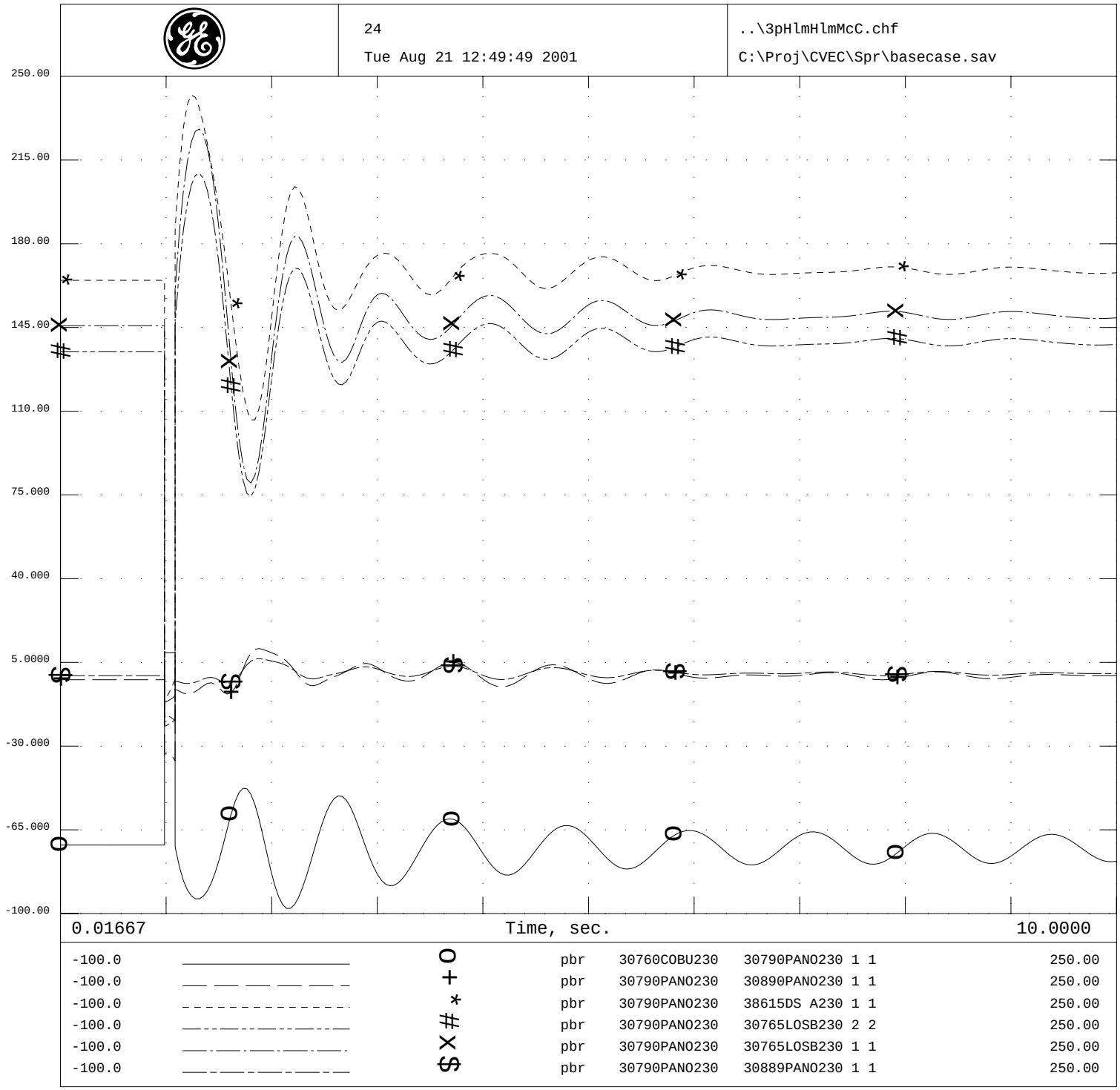

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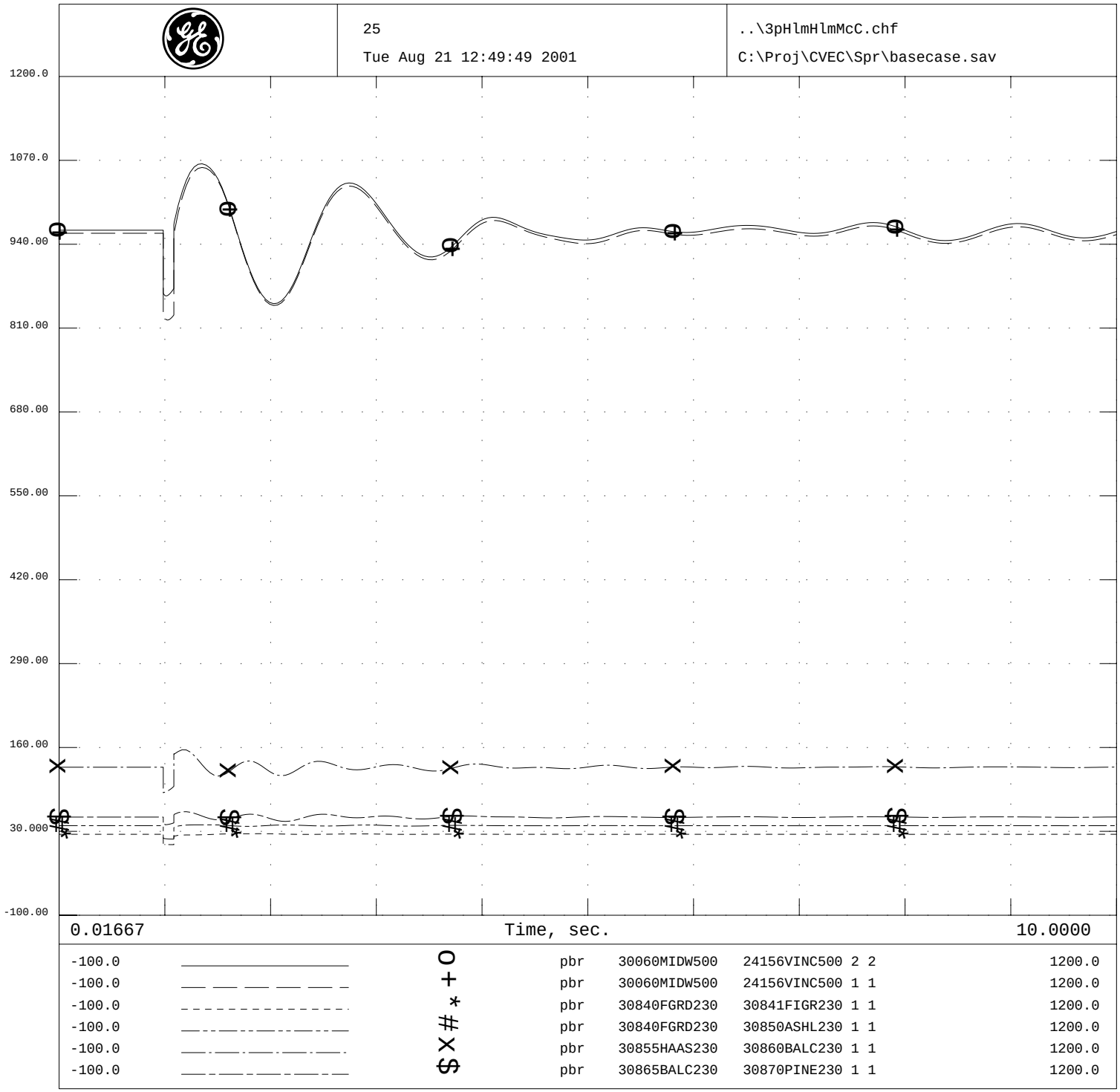

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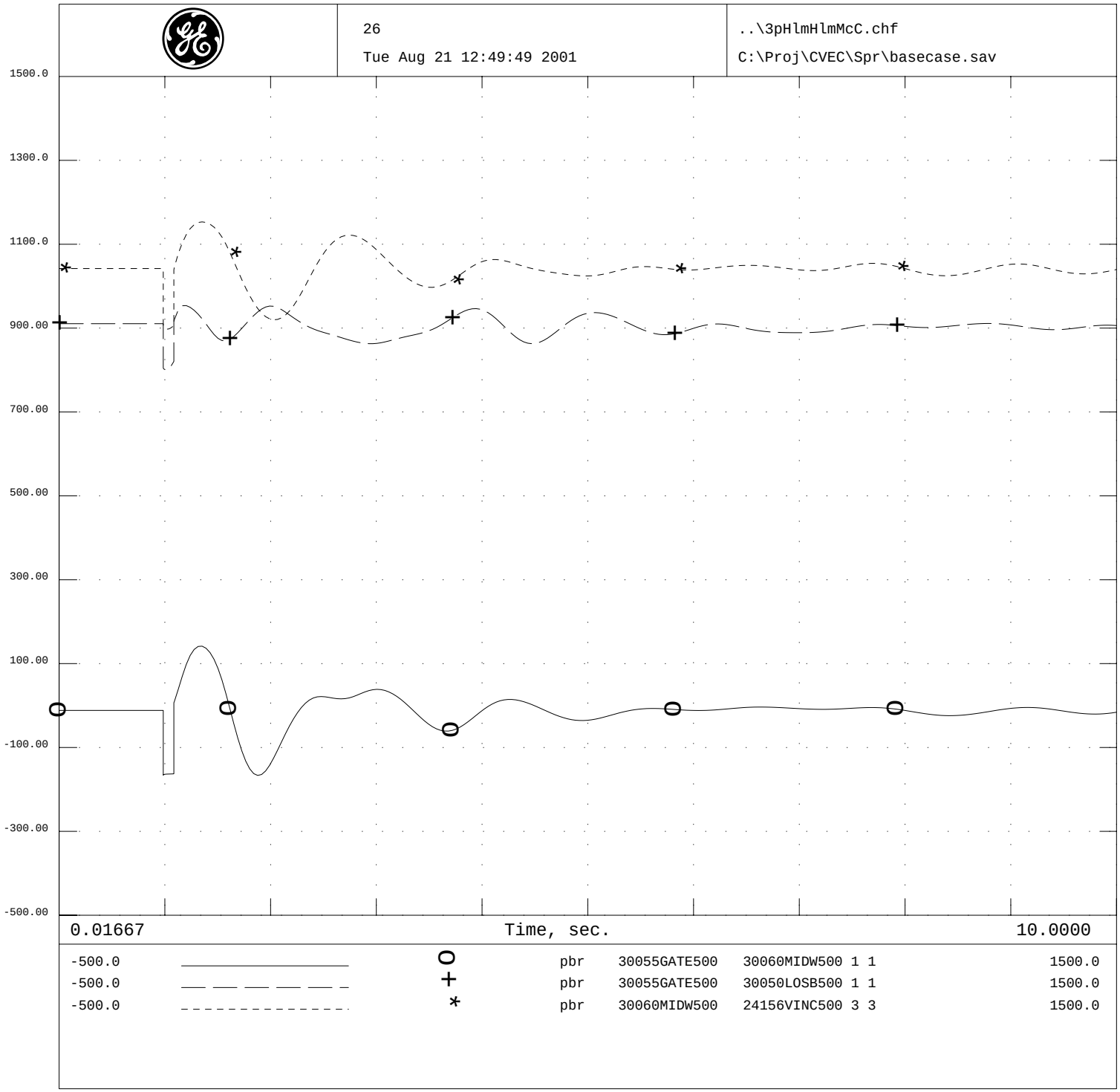

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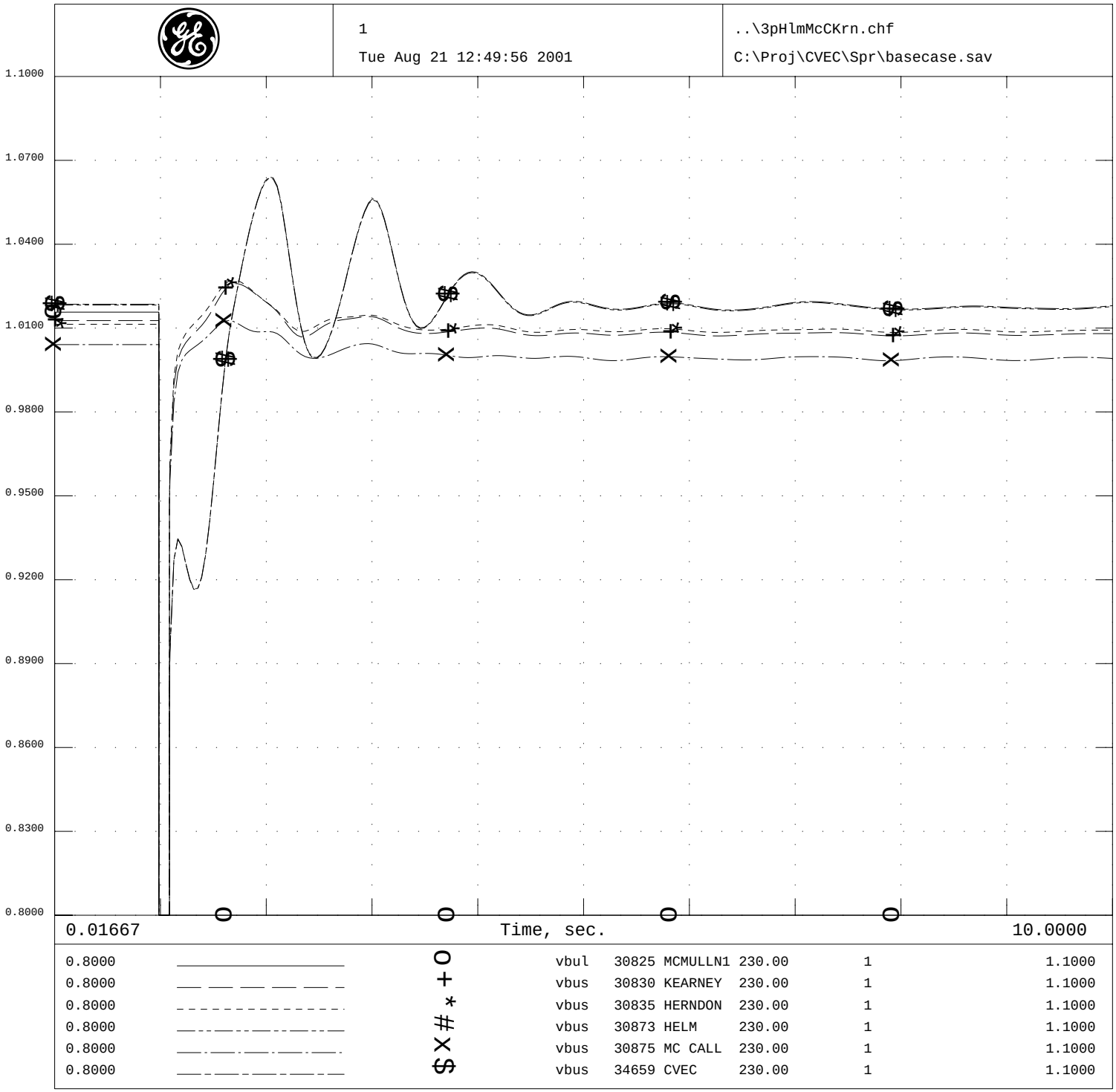

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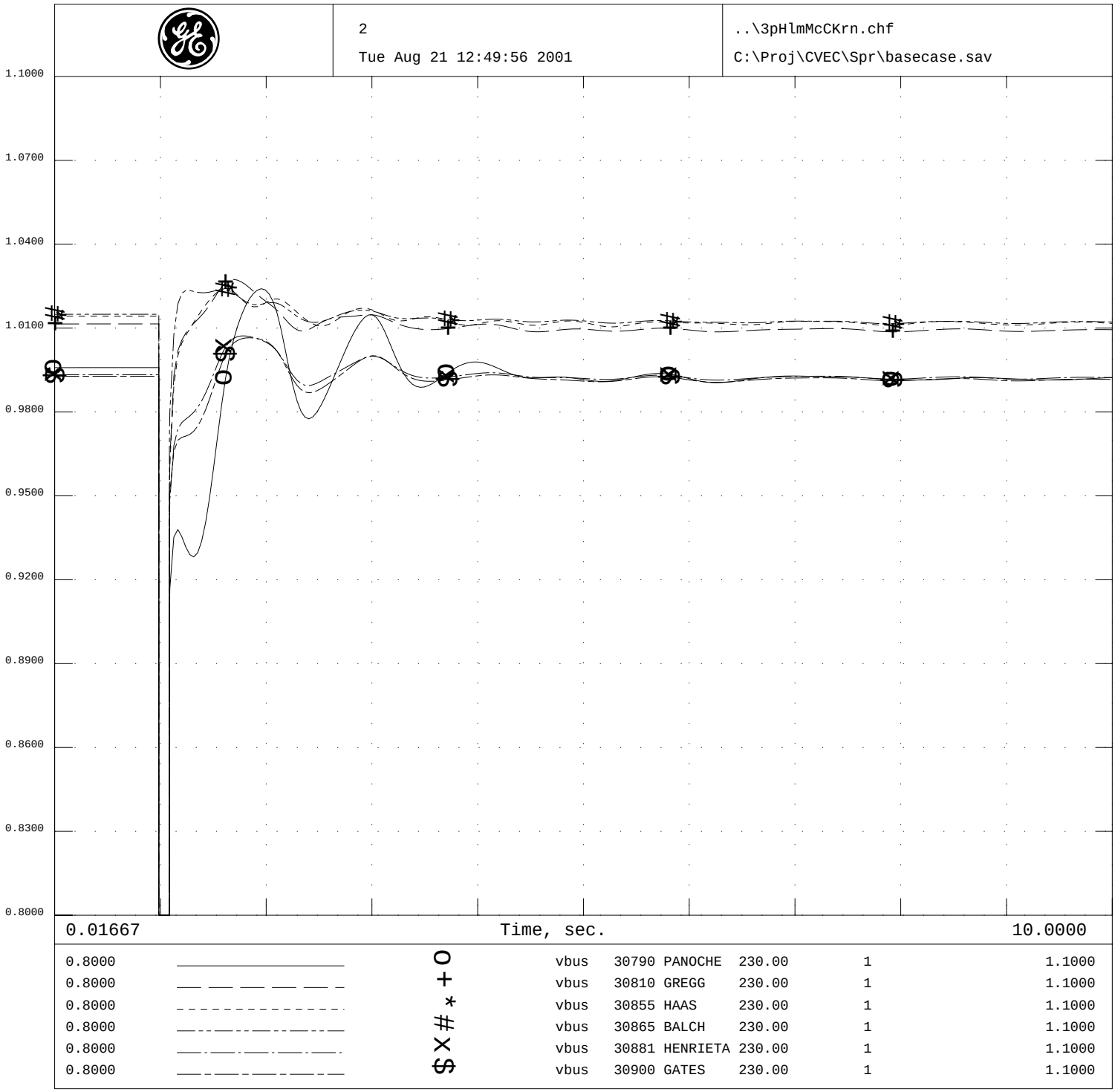
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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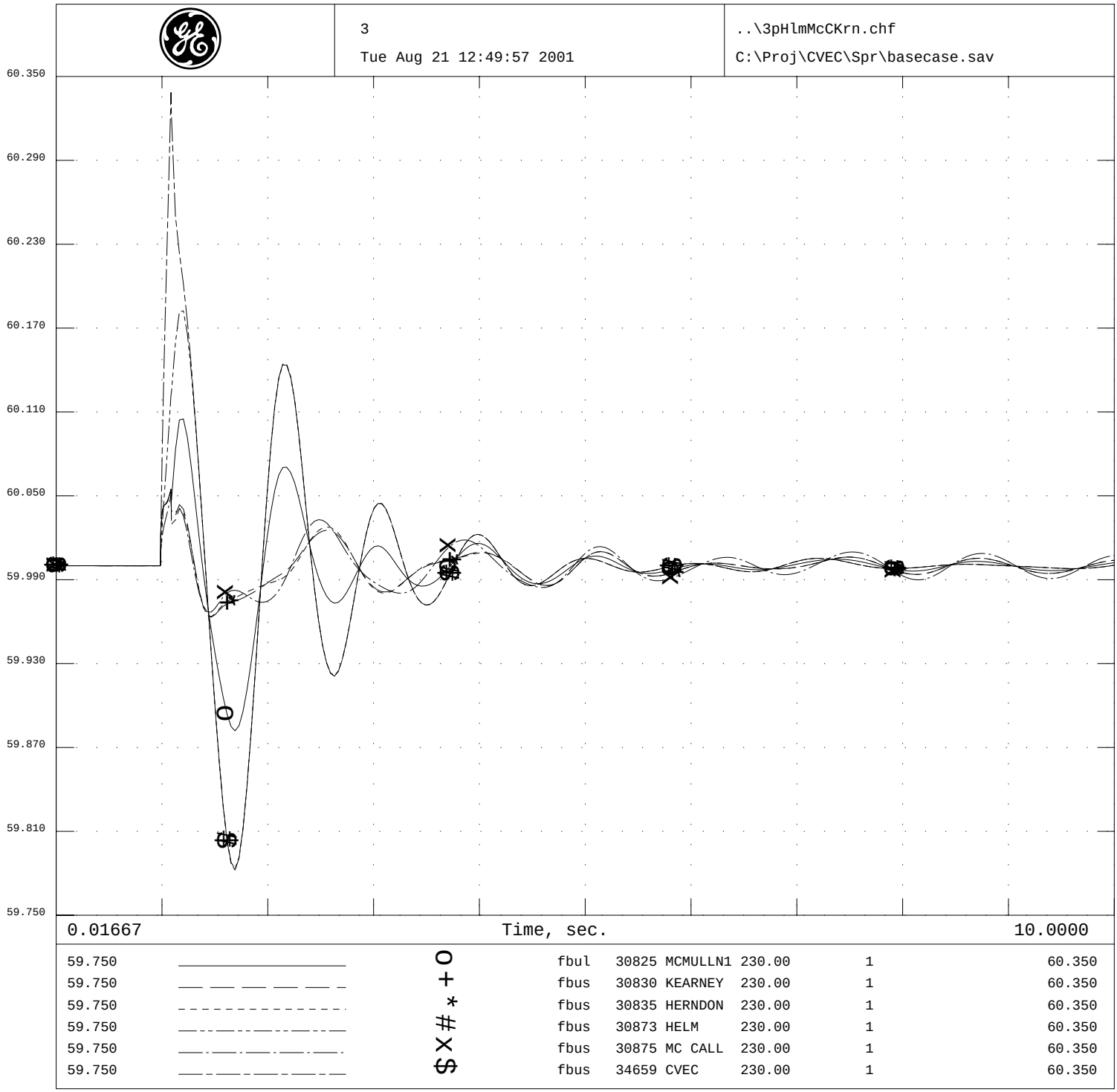

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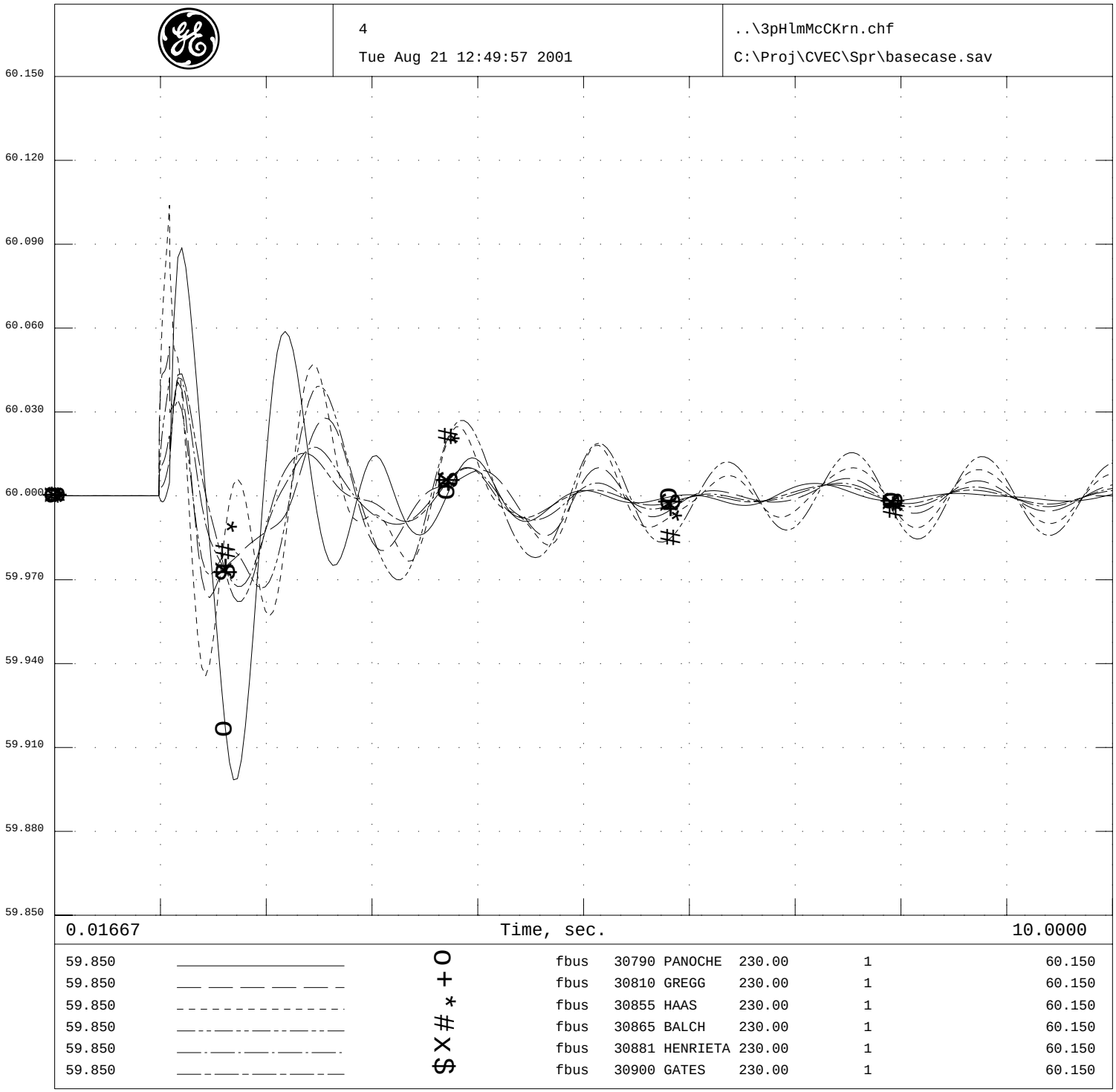
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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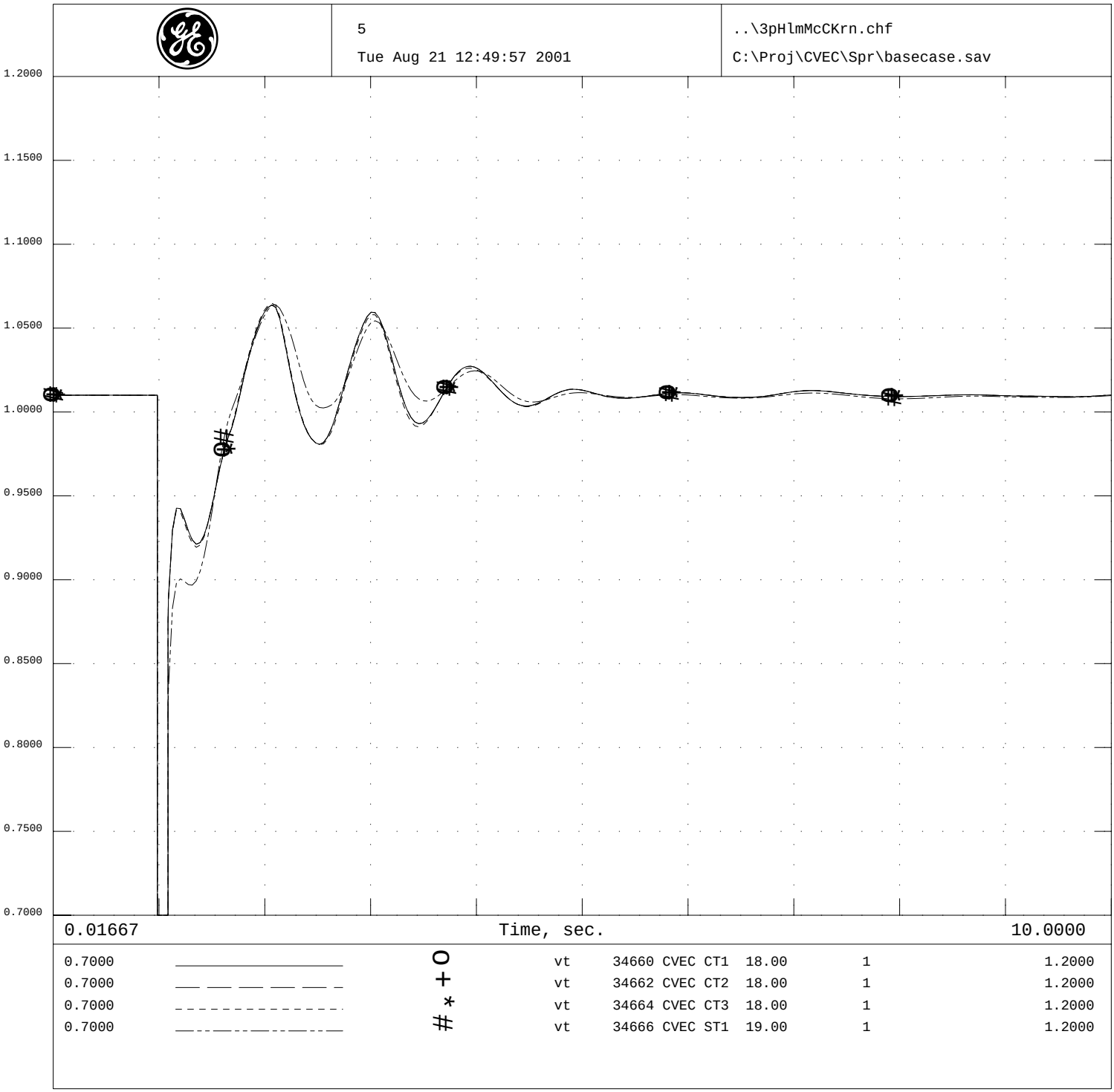

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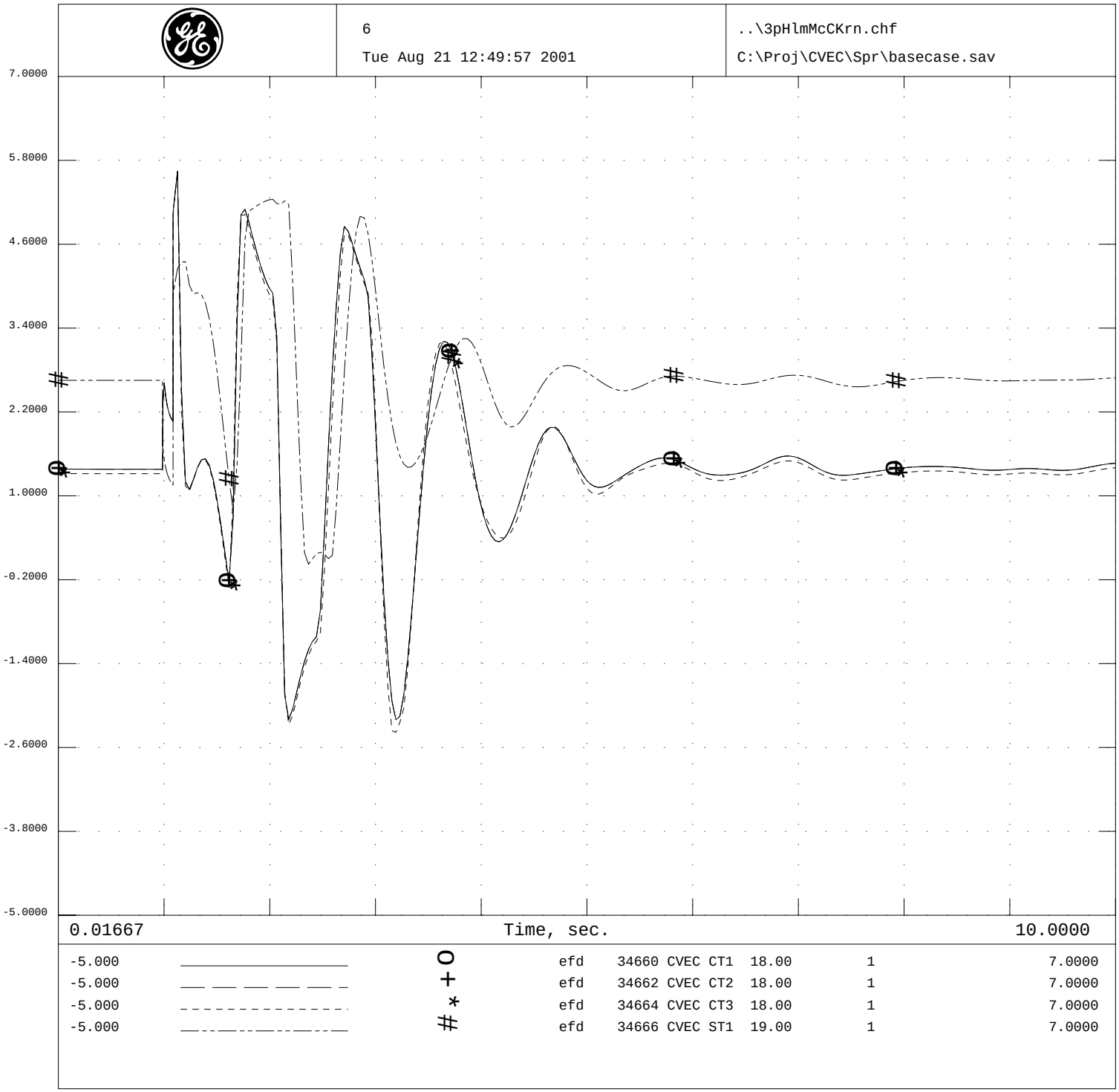
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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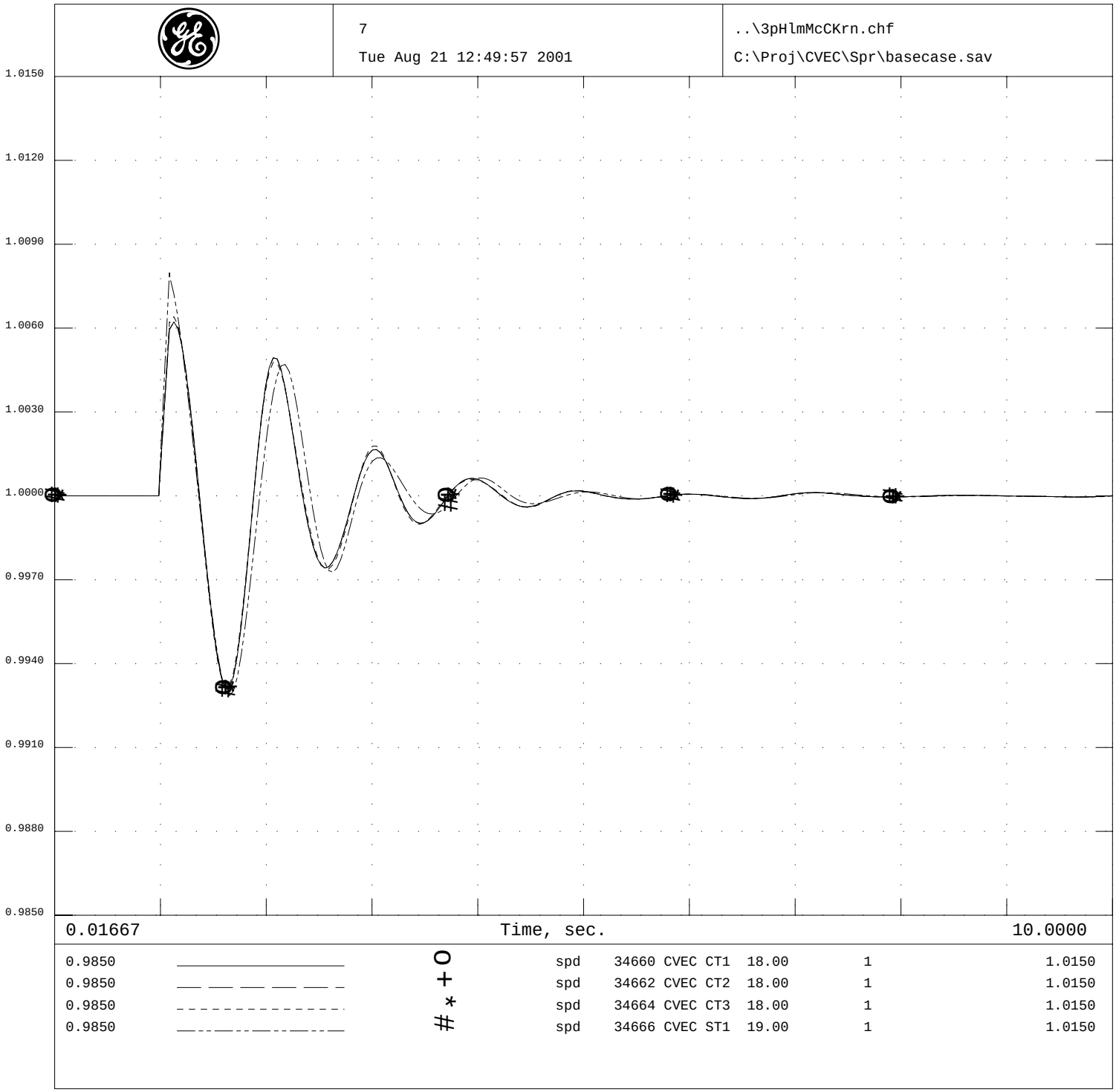
Calpine Corporation
Project Generator Field Voltages



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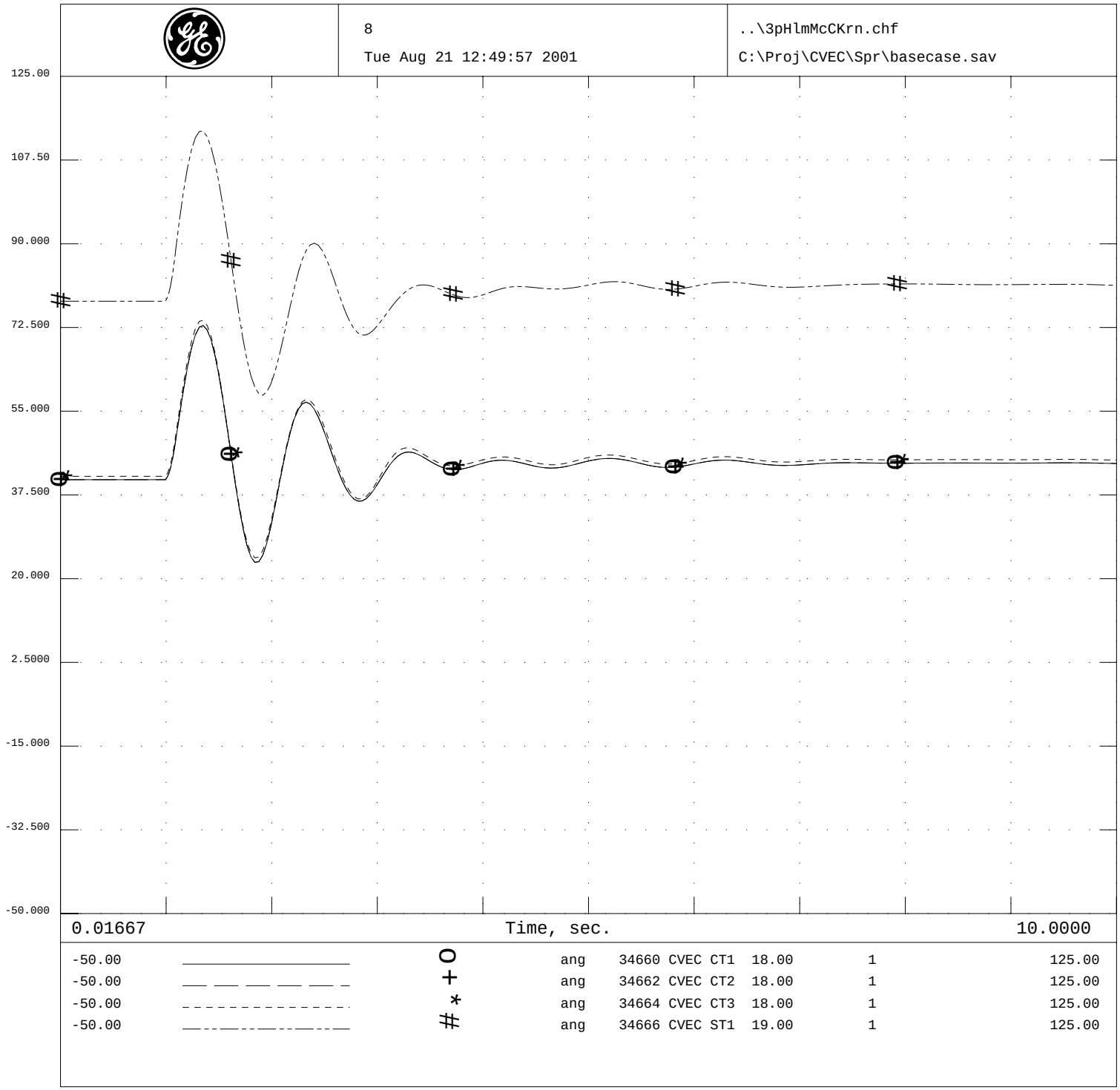
Calpine Corporation
Project Generator Rotor Speed



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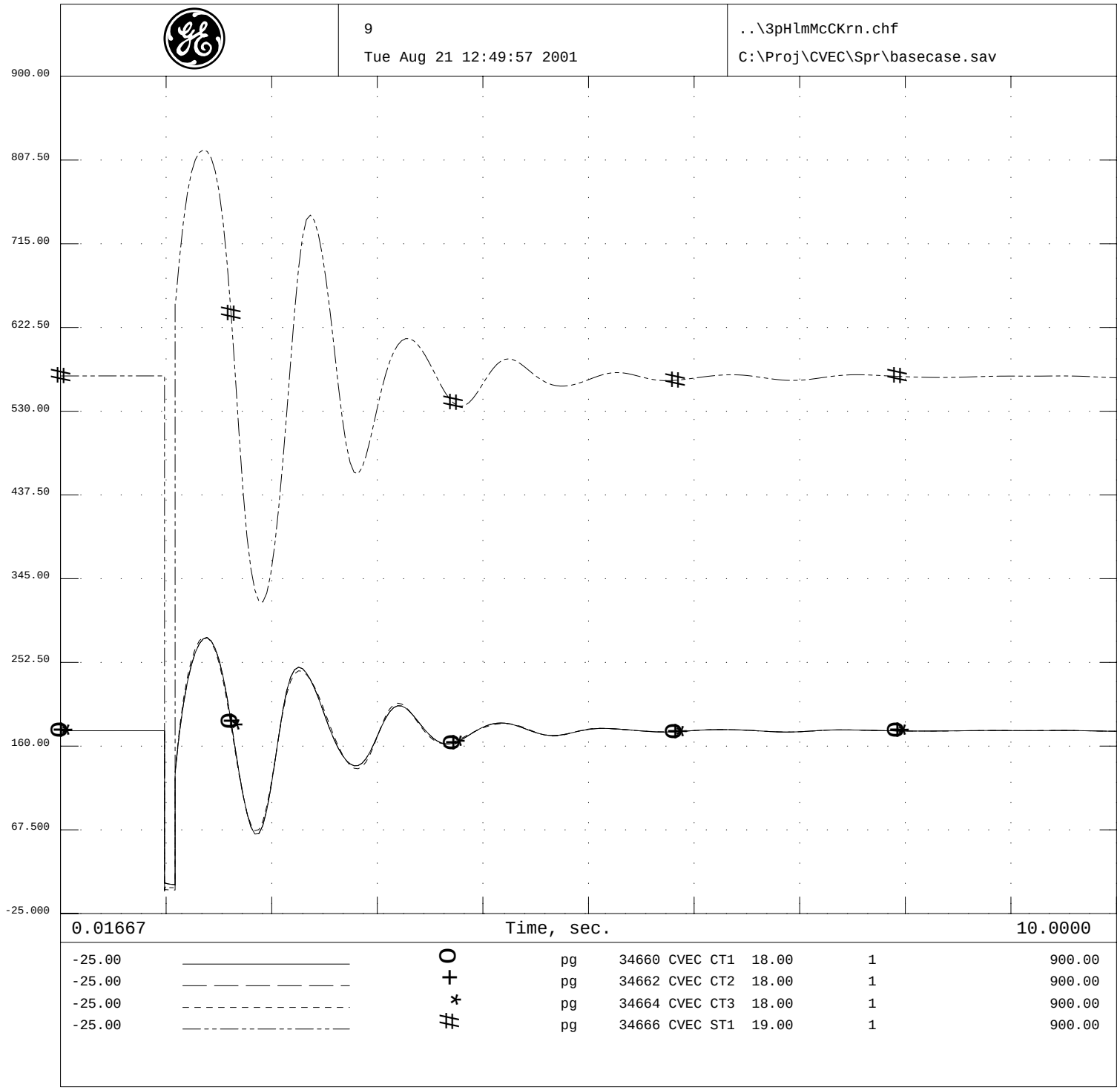
Project Generator Rotor Angle



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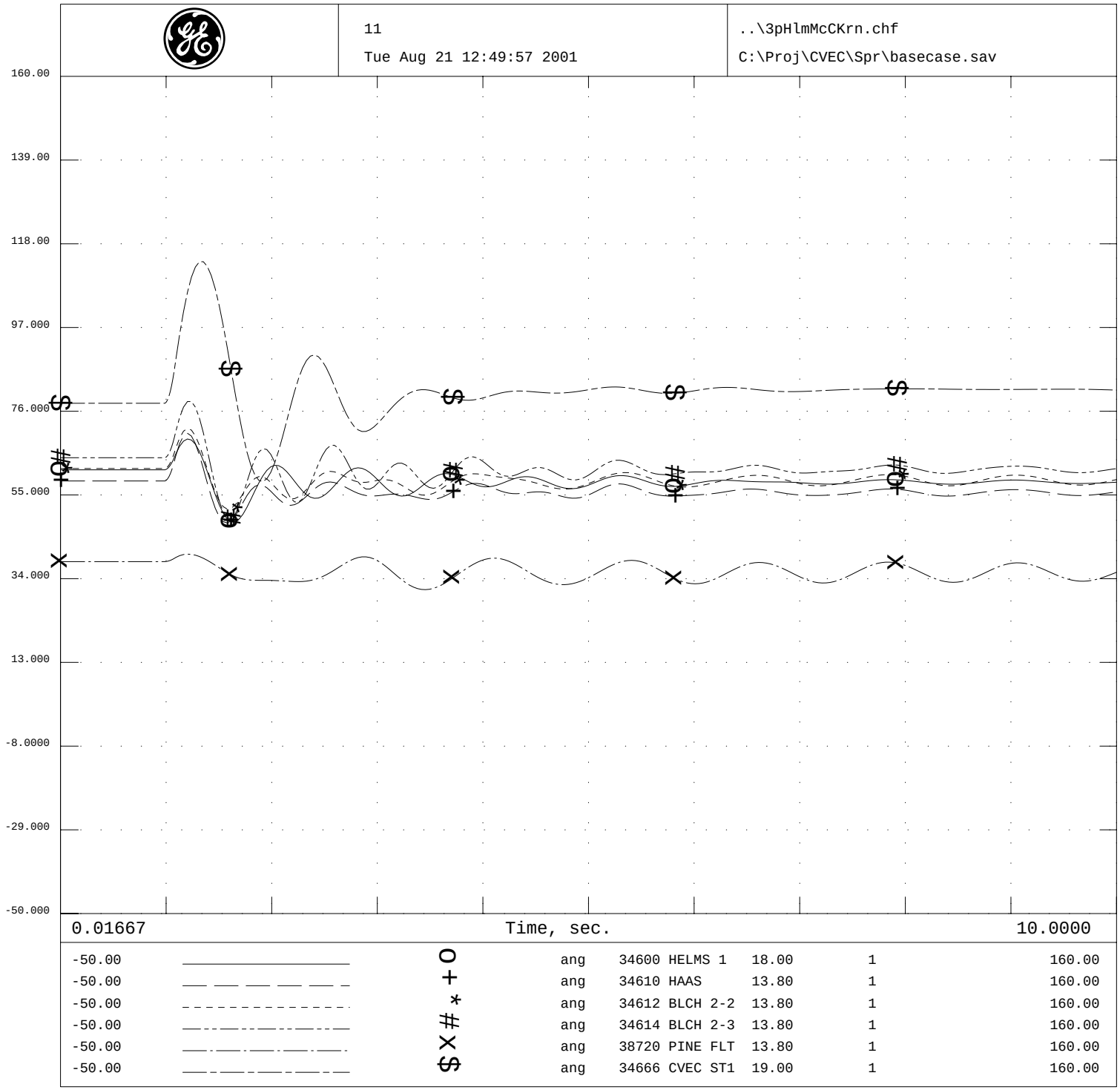

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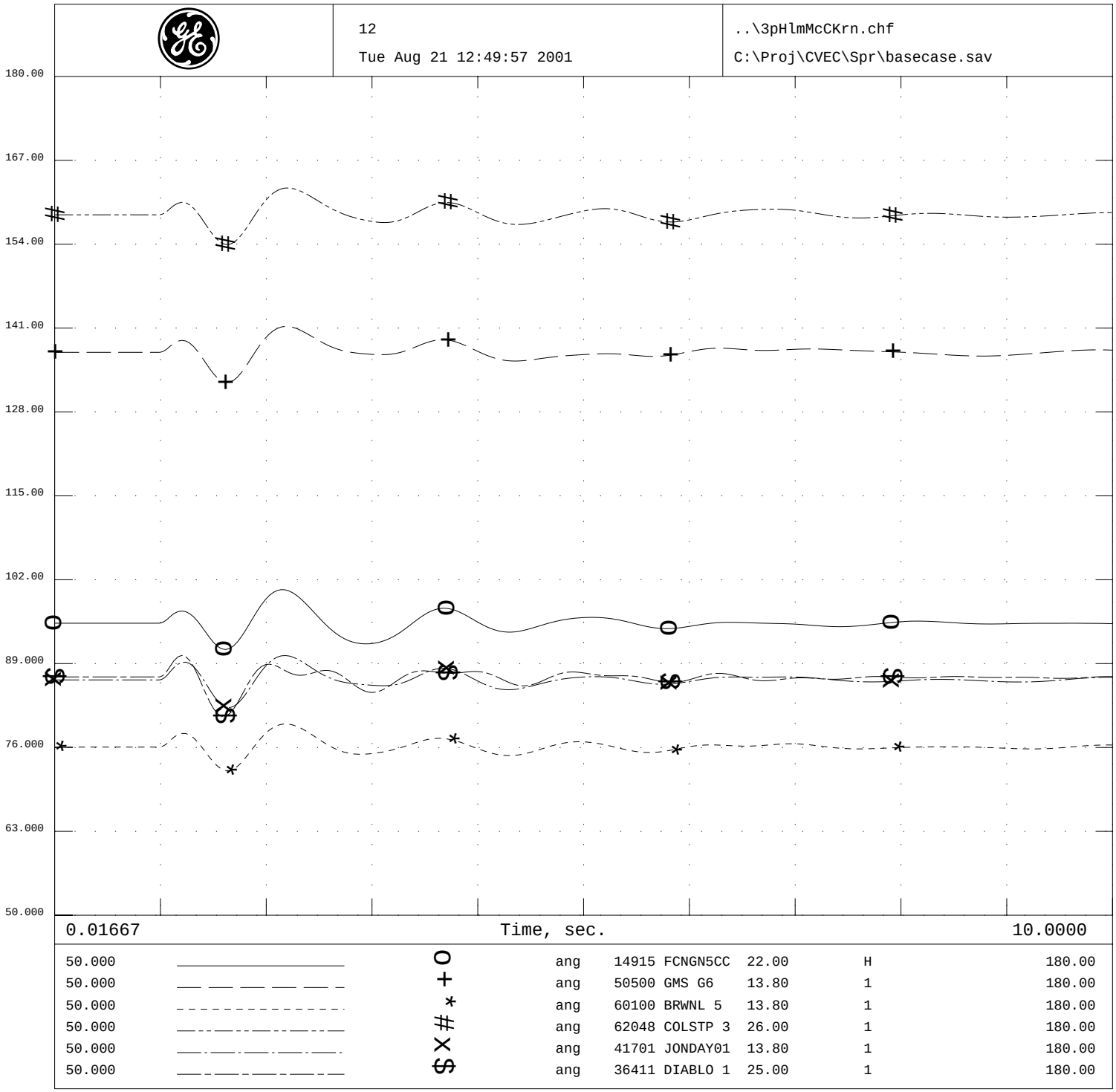

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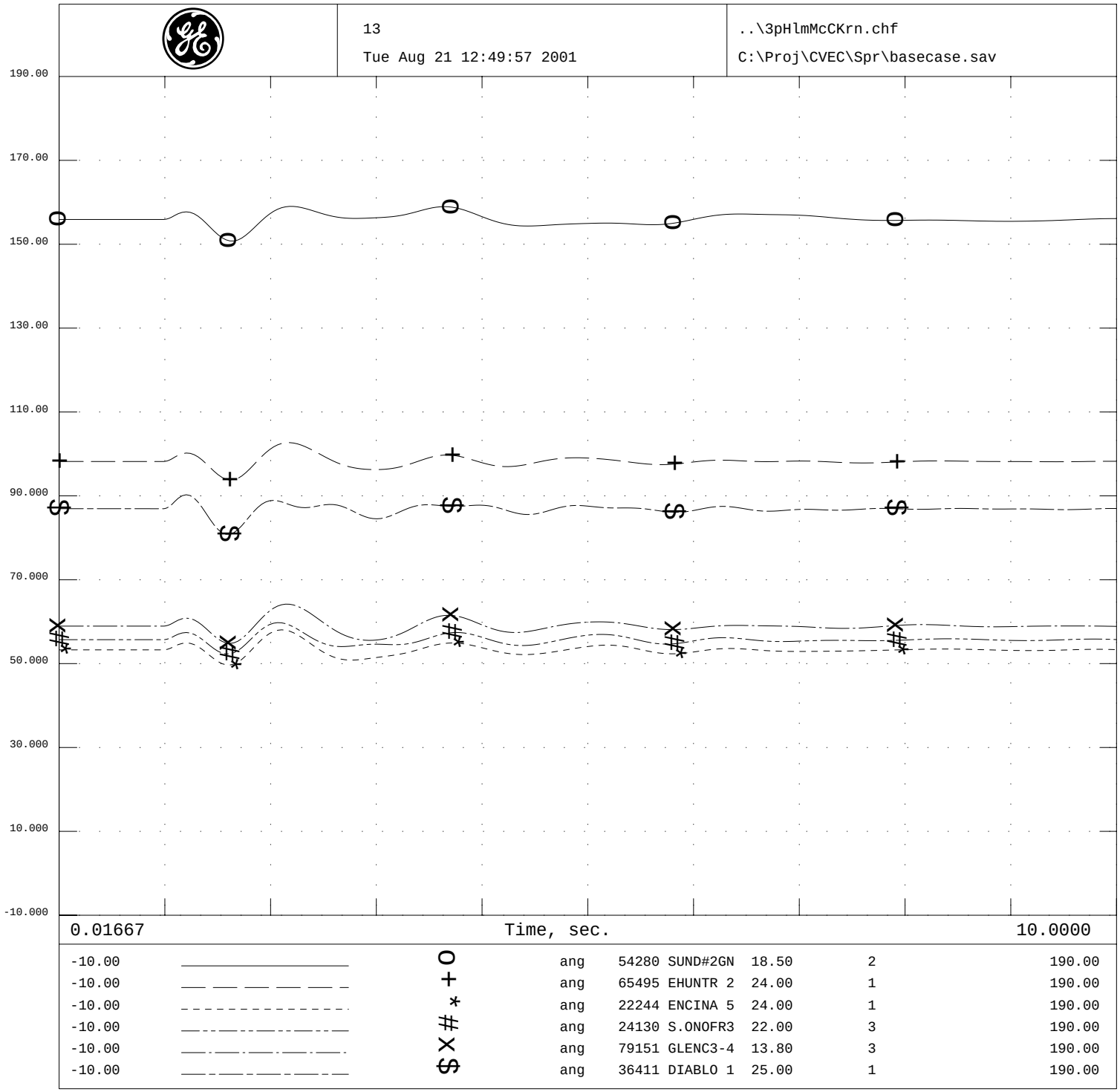

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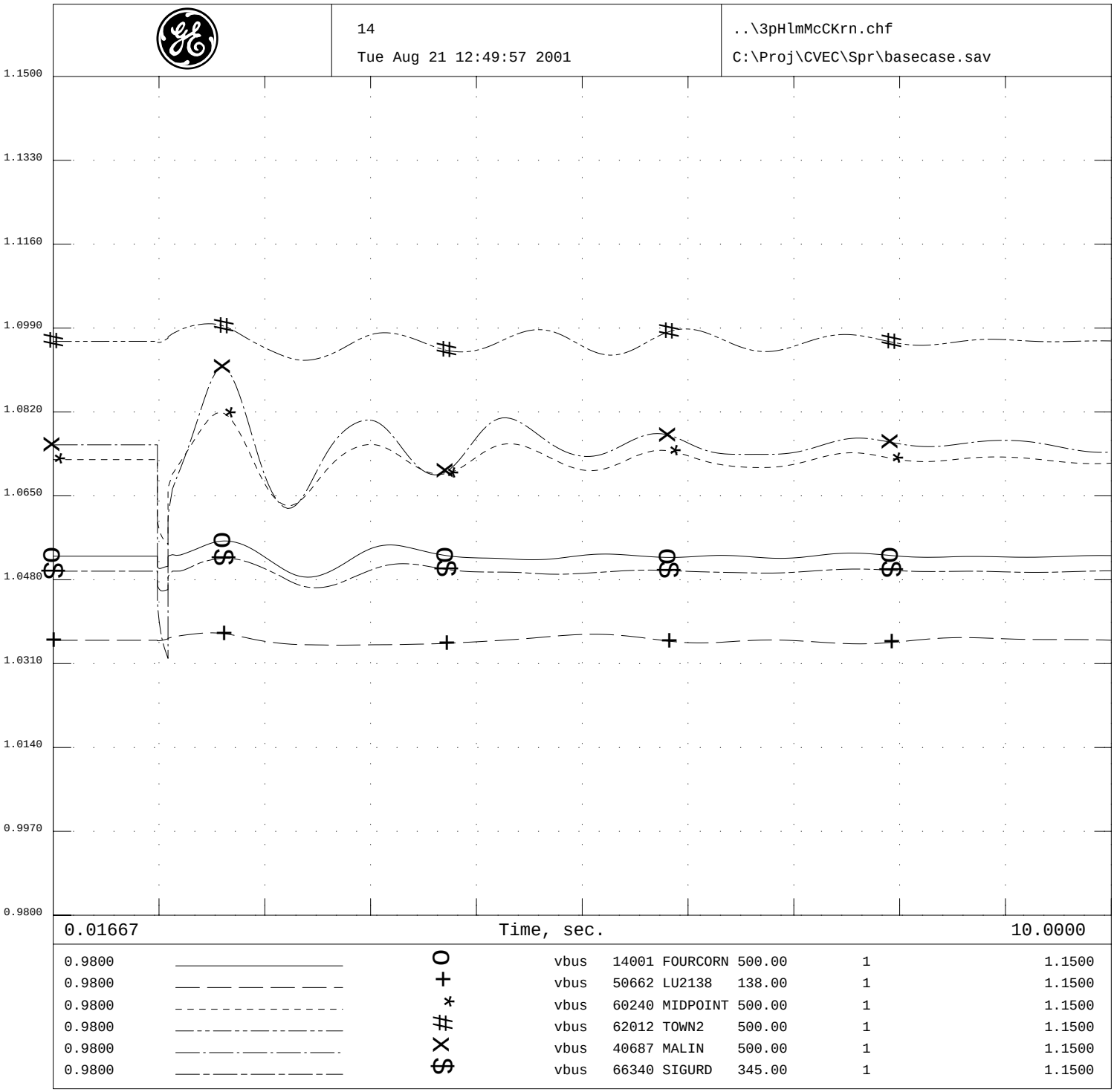

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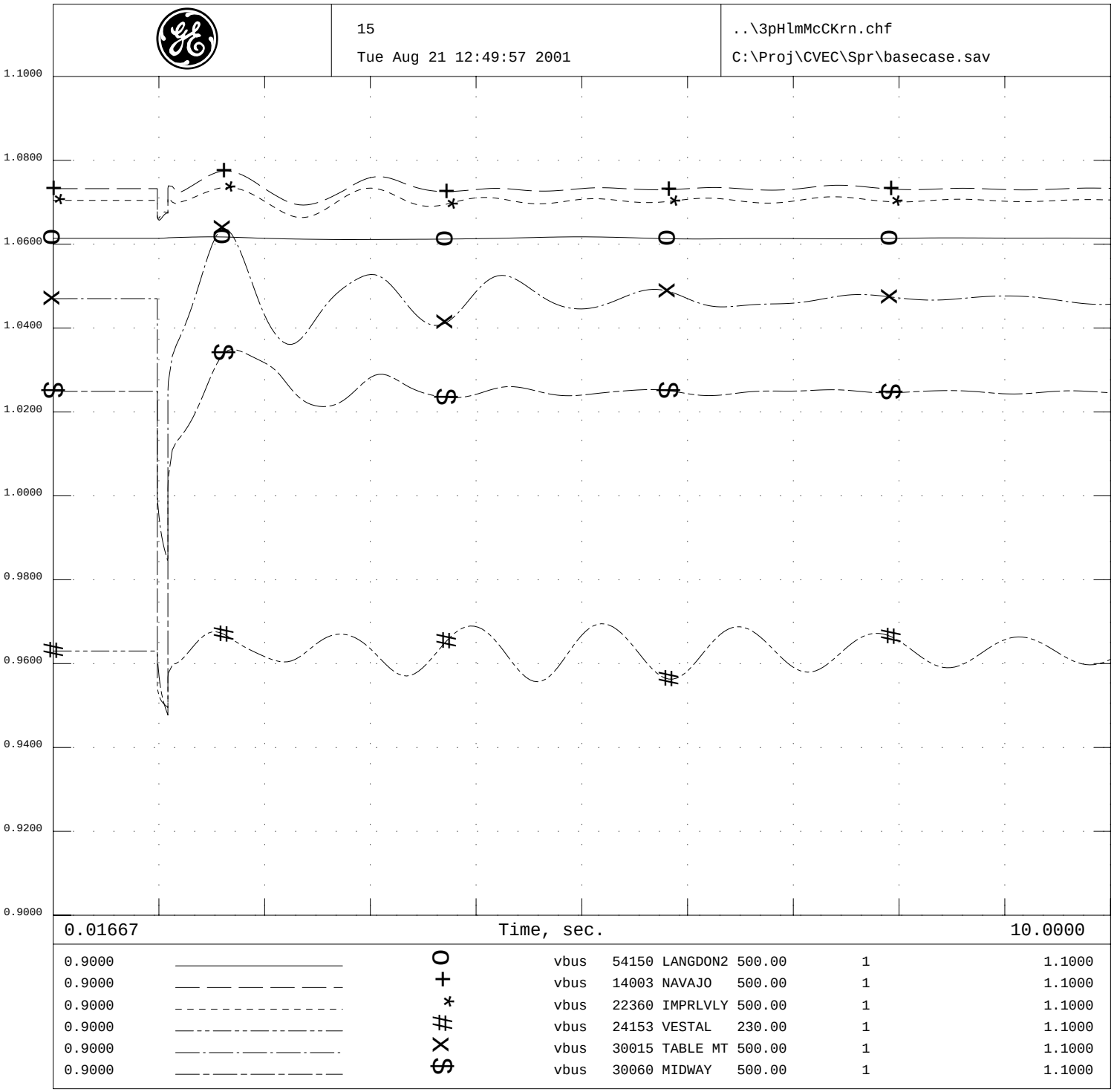

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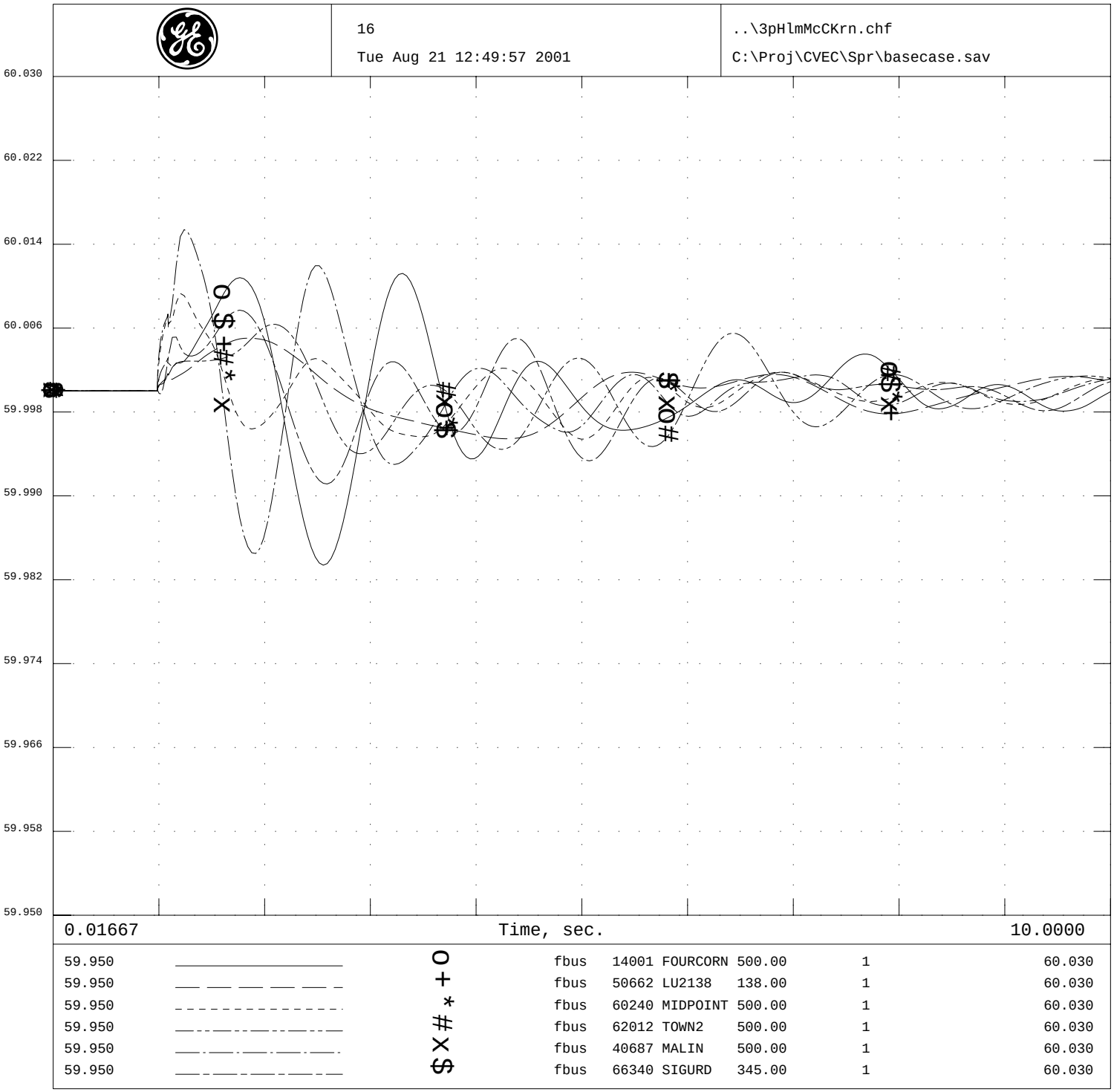

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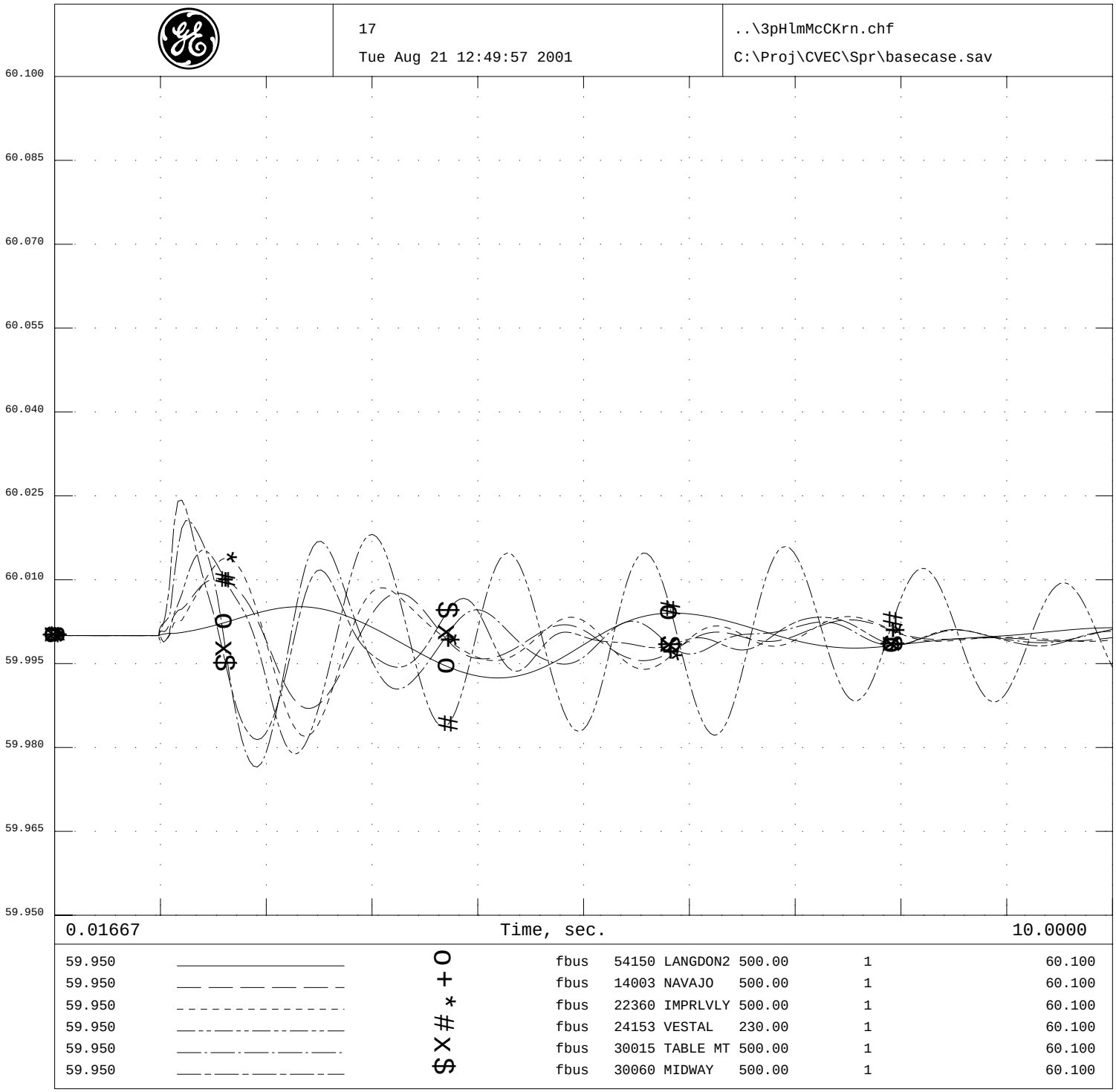

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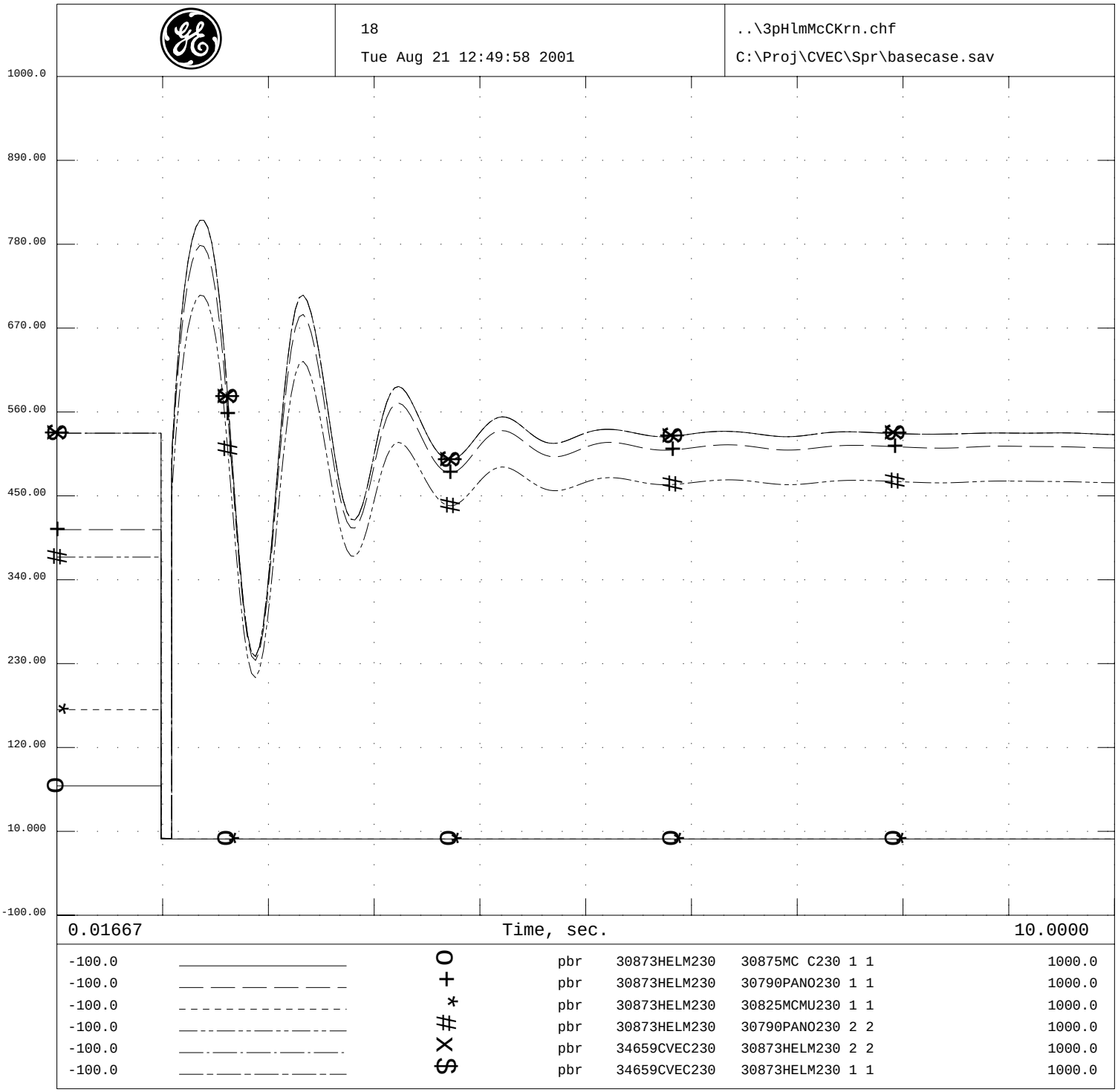

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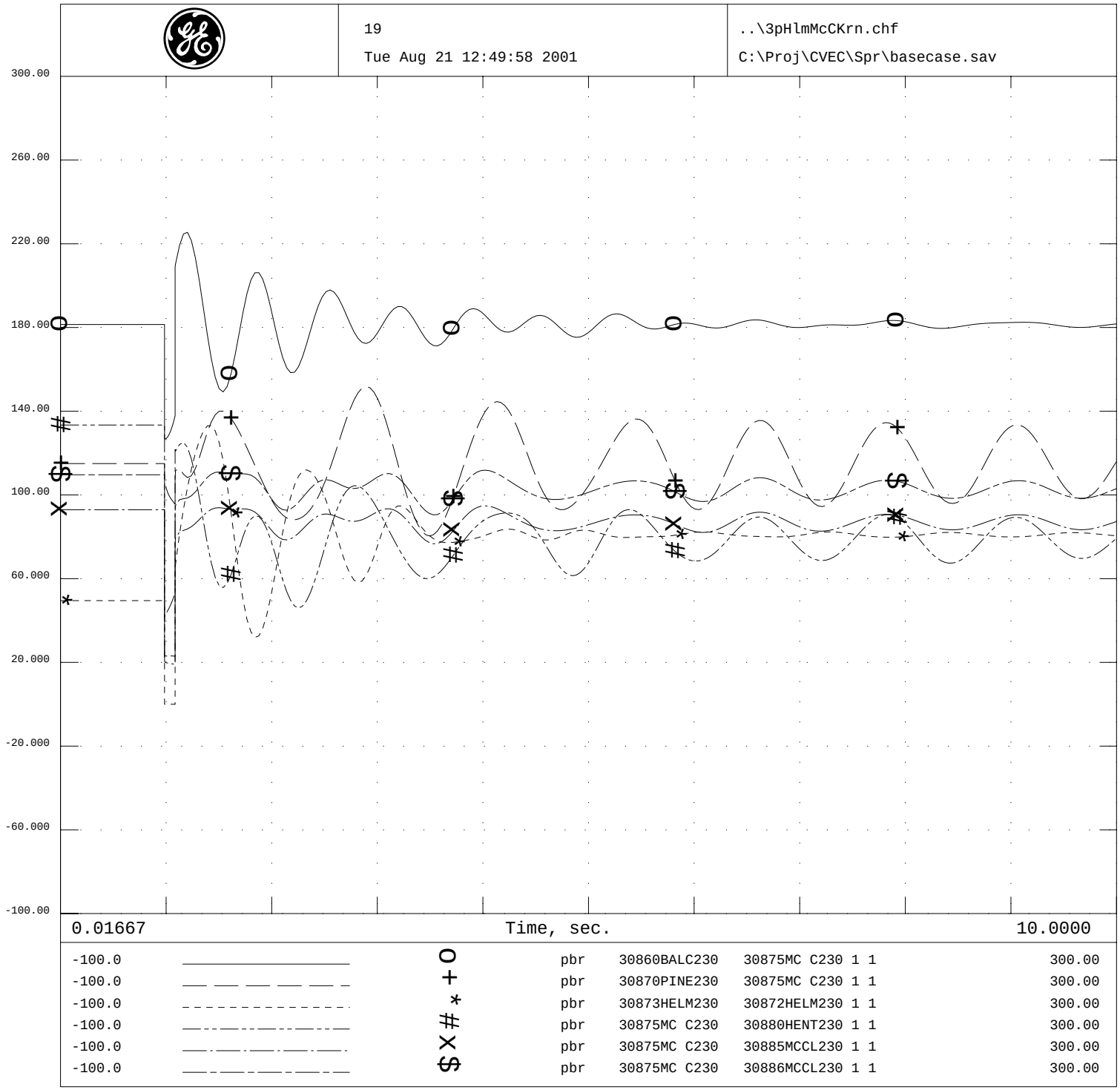

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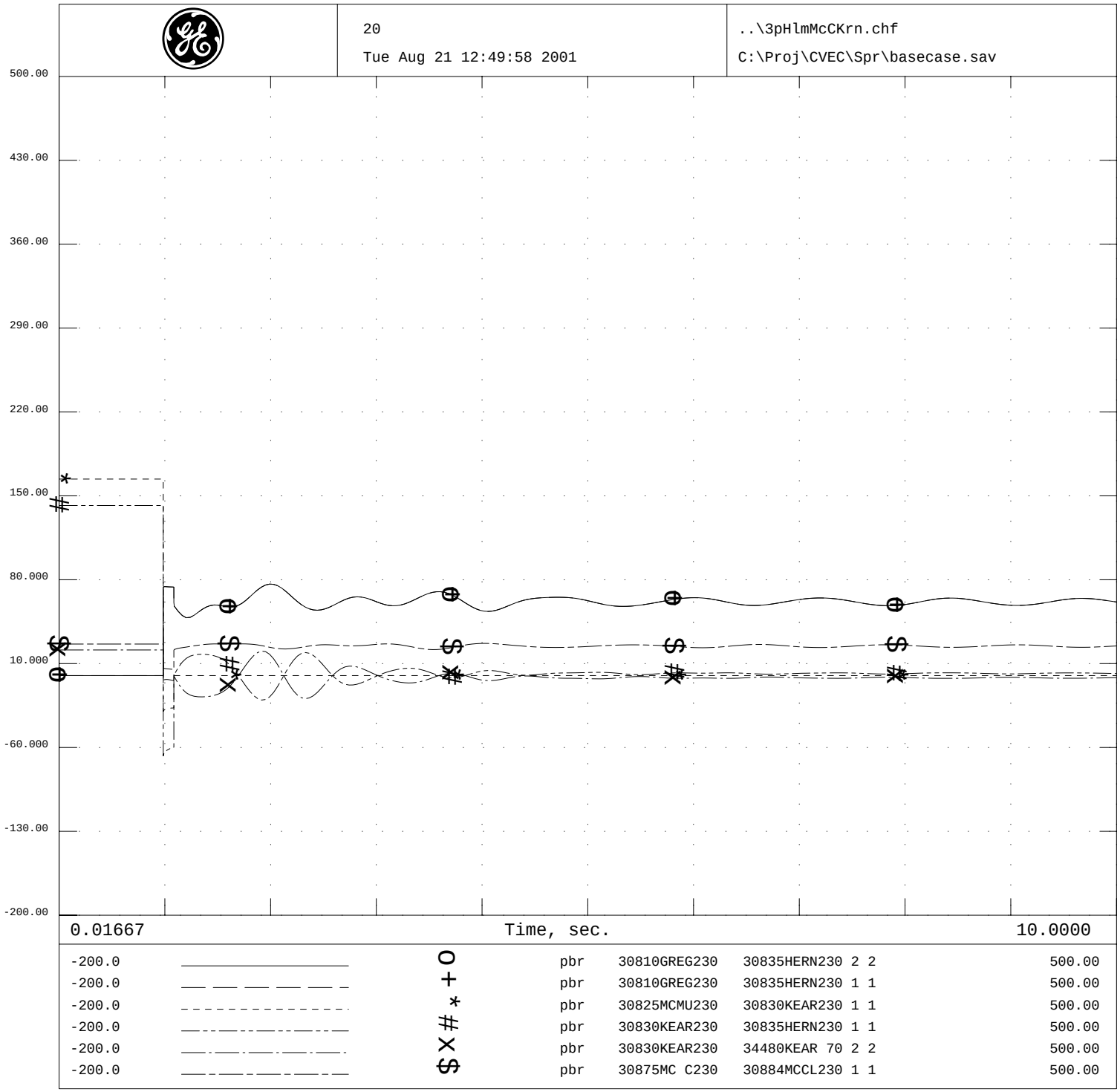

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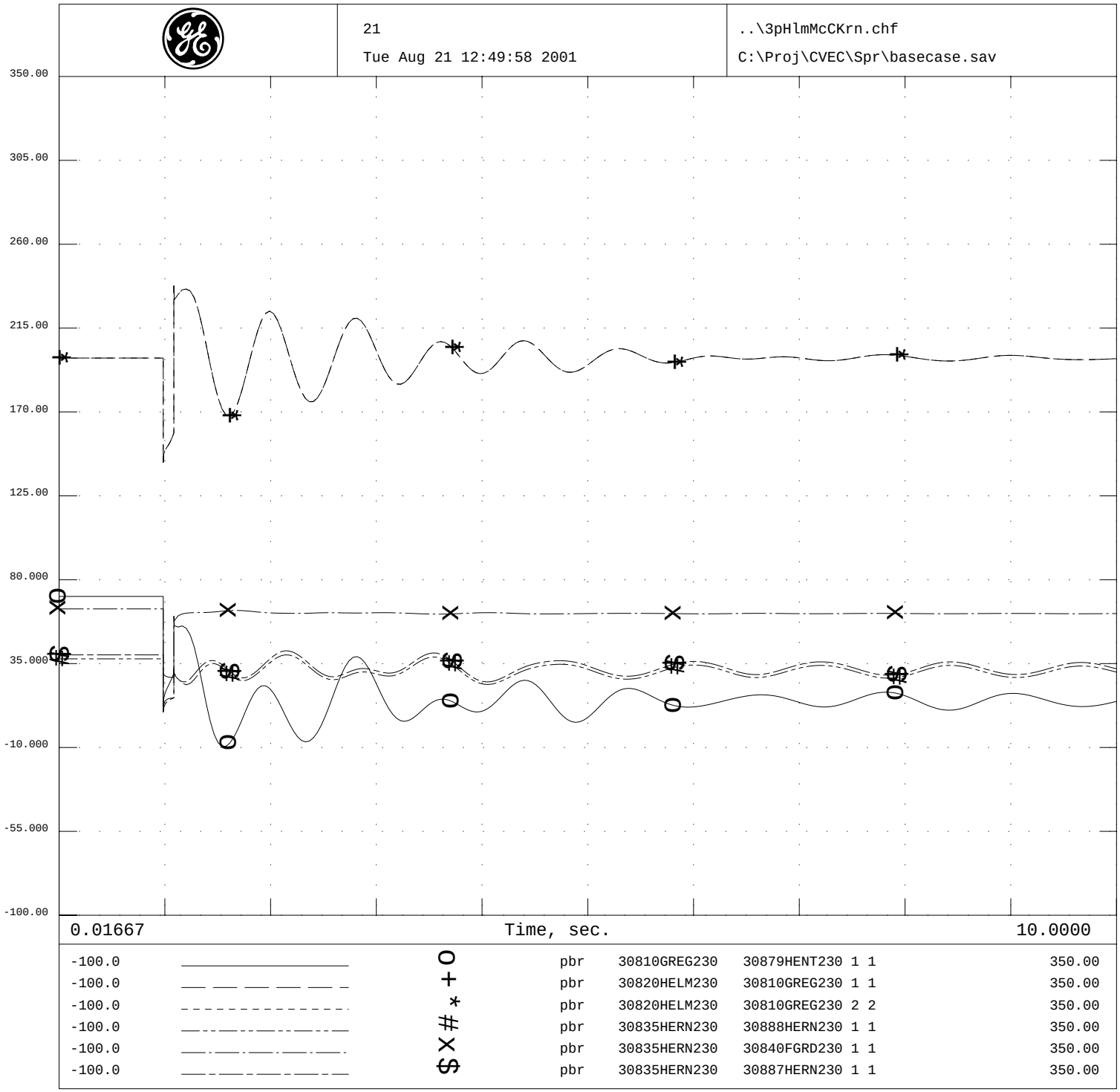

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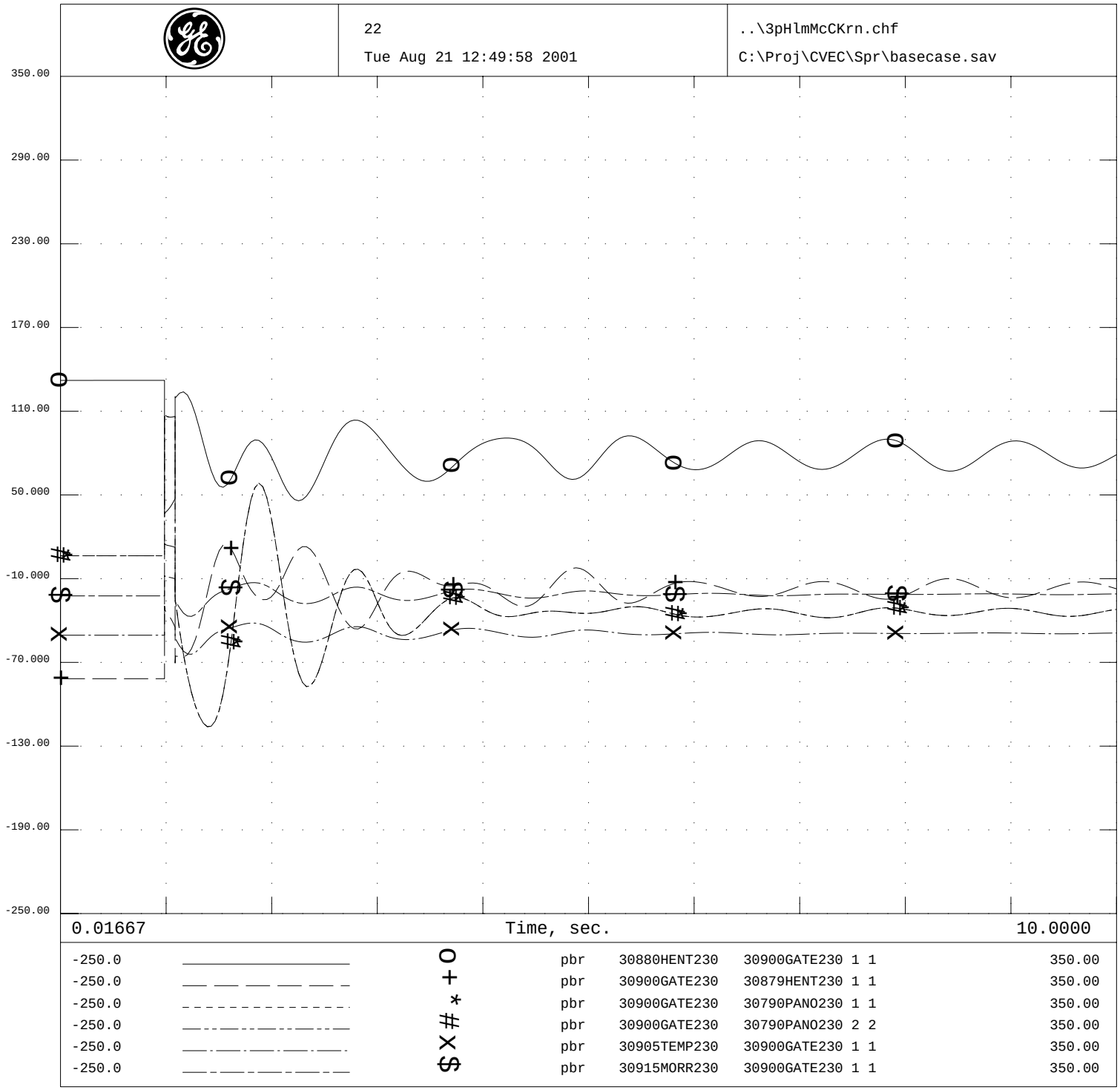

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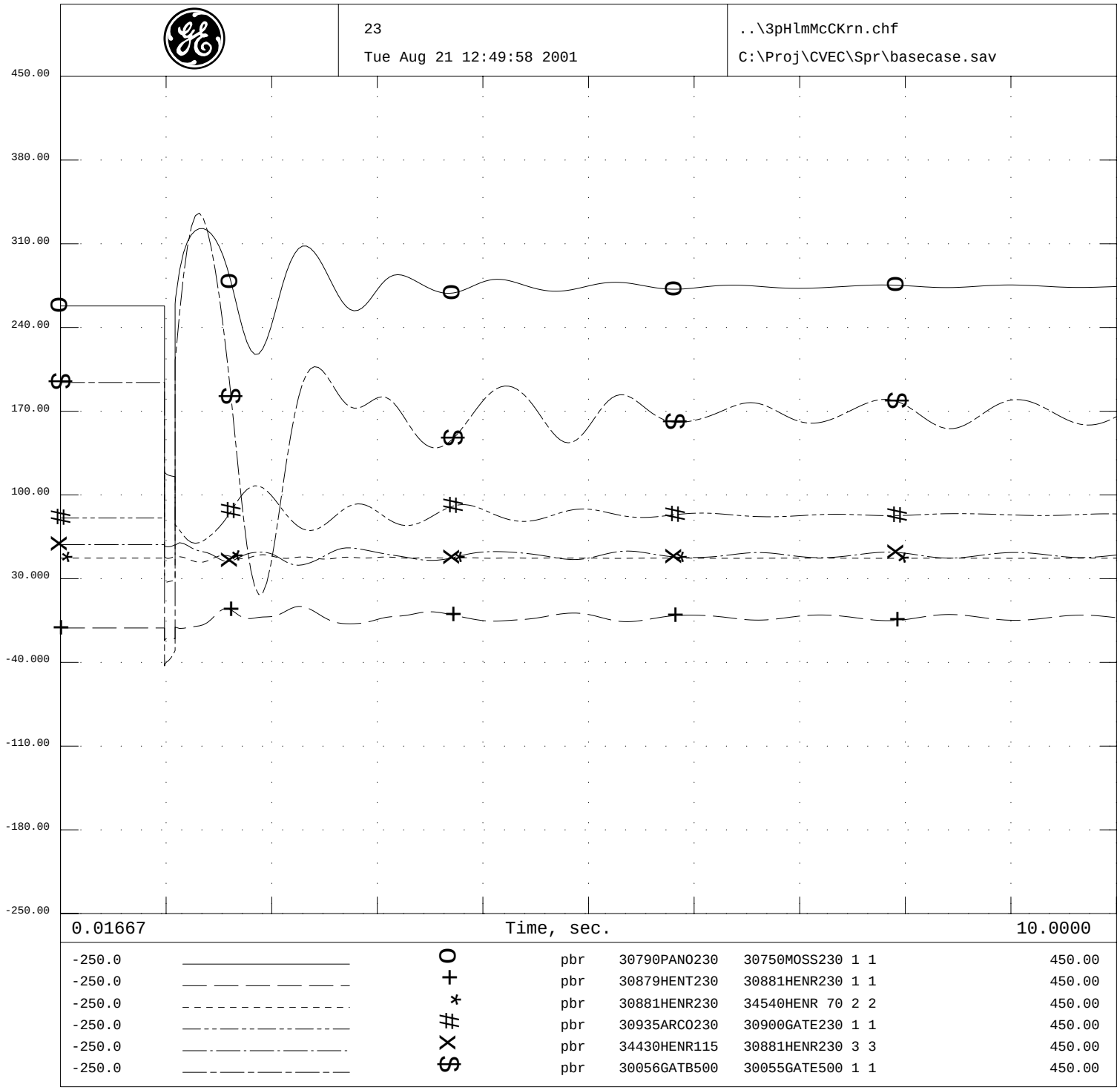

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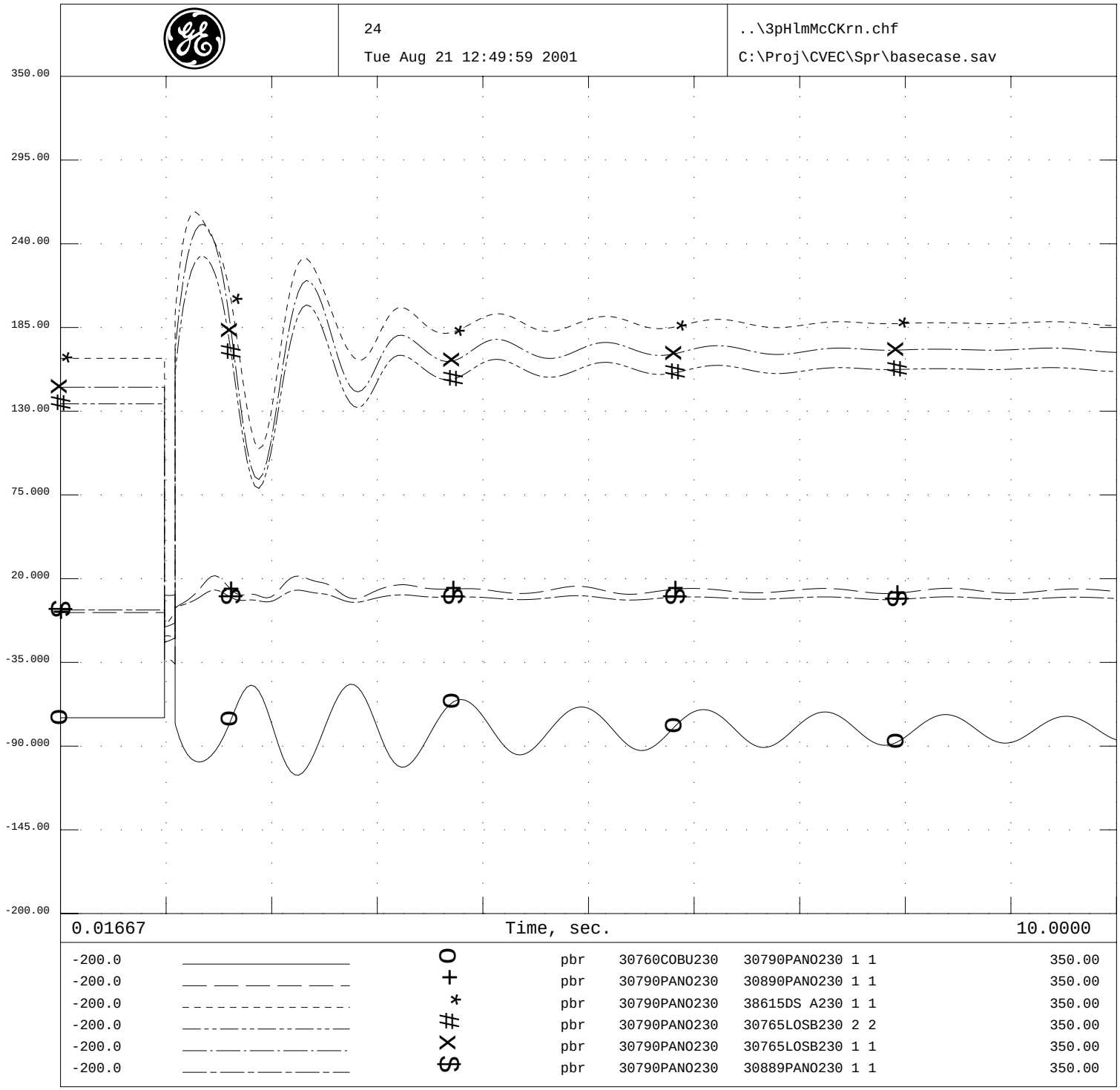
3 phase 6 cycle fault at Helm 230kV bus and trip Helm-McCall, Helm-Kearny lines

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Helm-McCall, Helm-Kearny 230kV Double Line Outage
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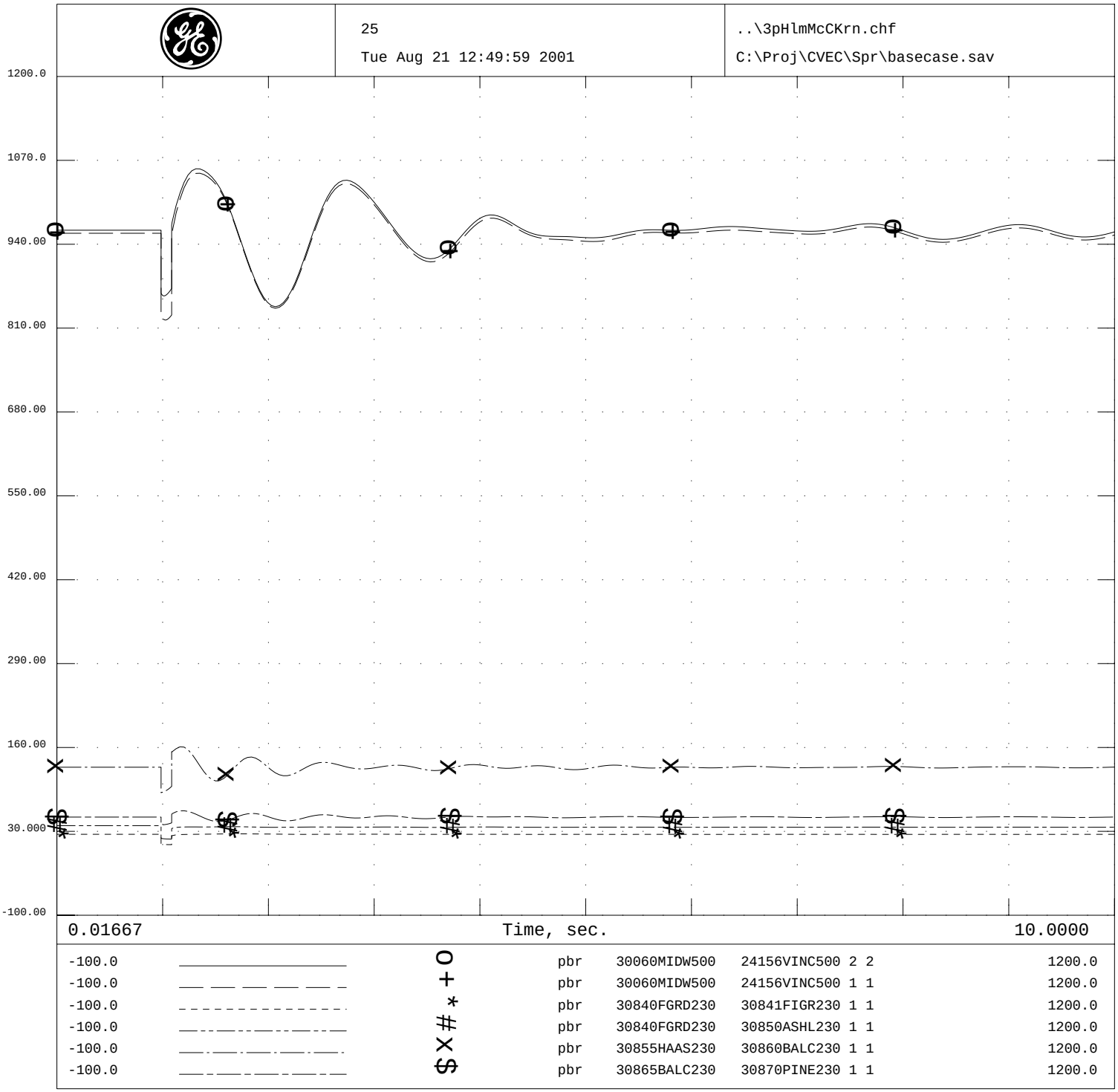

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2004 Heavy Spring Base Case
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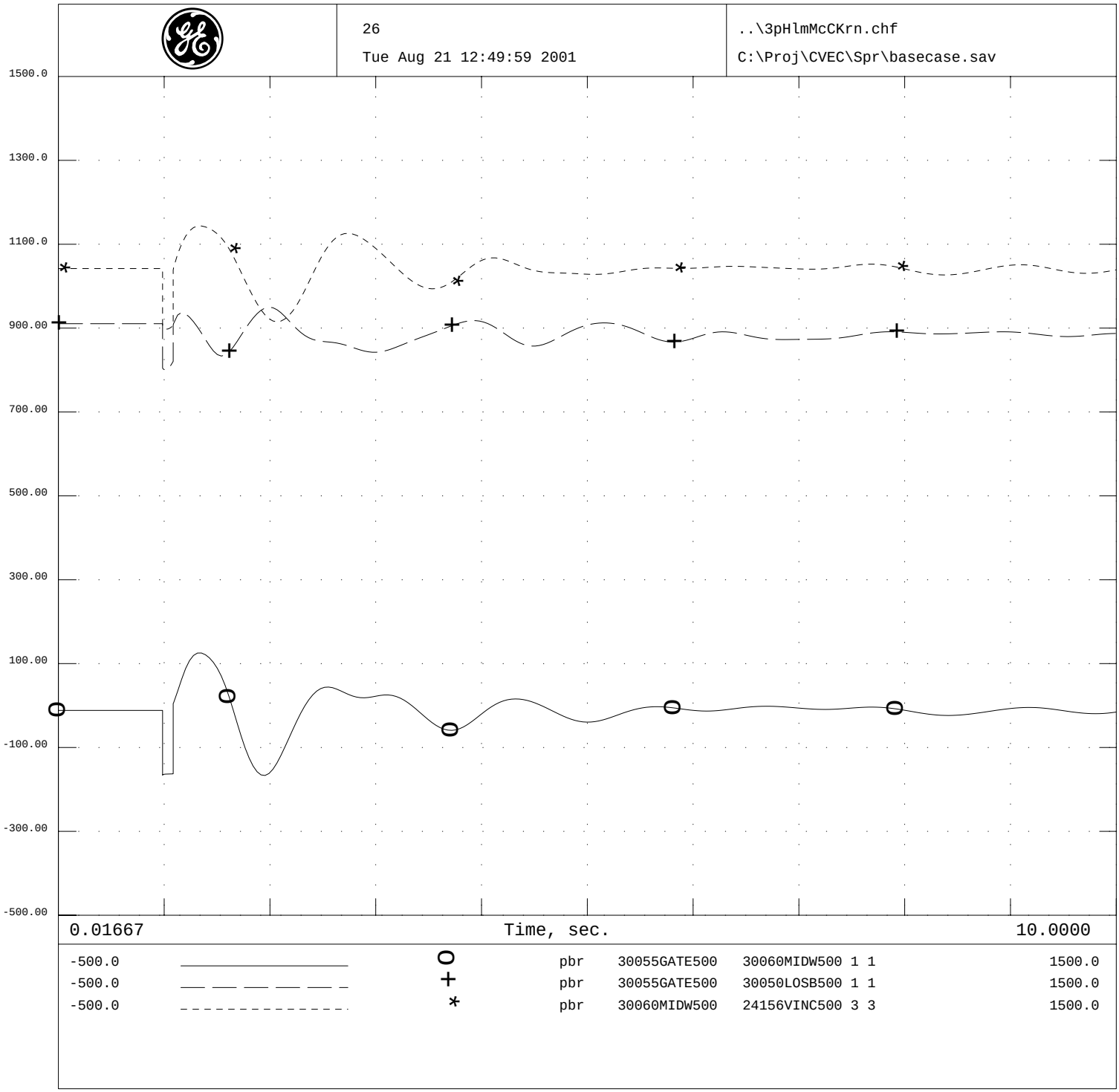

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2004 Heavy Spring Base Case
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Calpine Corporation
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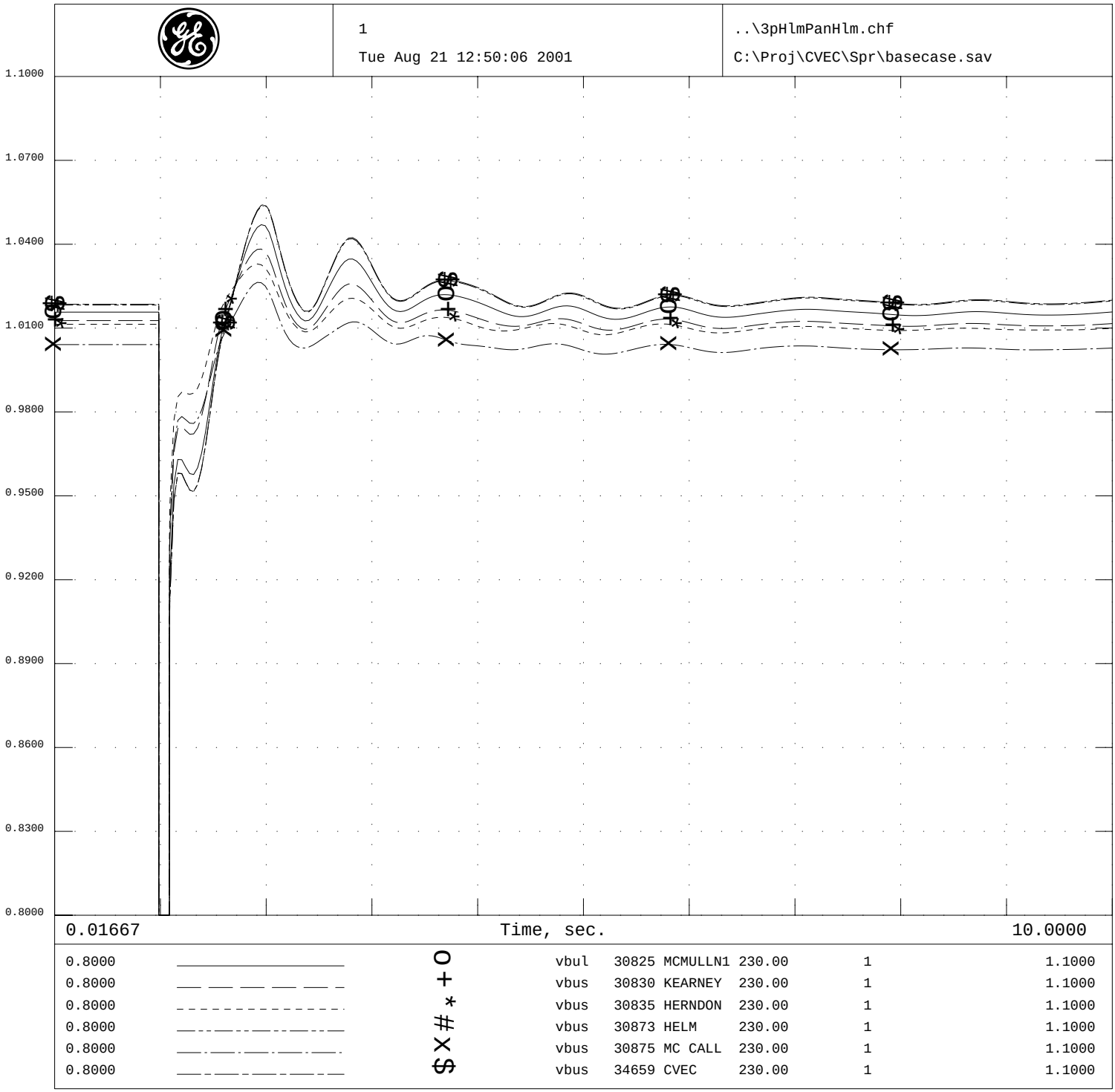

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Panoche-Helm 230kV #2 Outage
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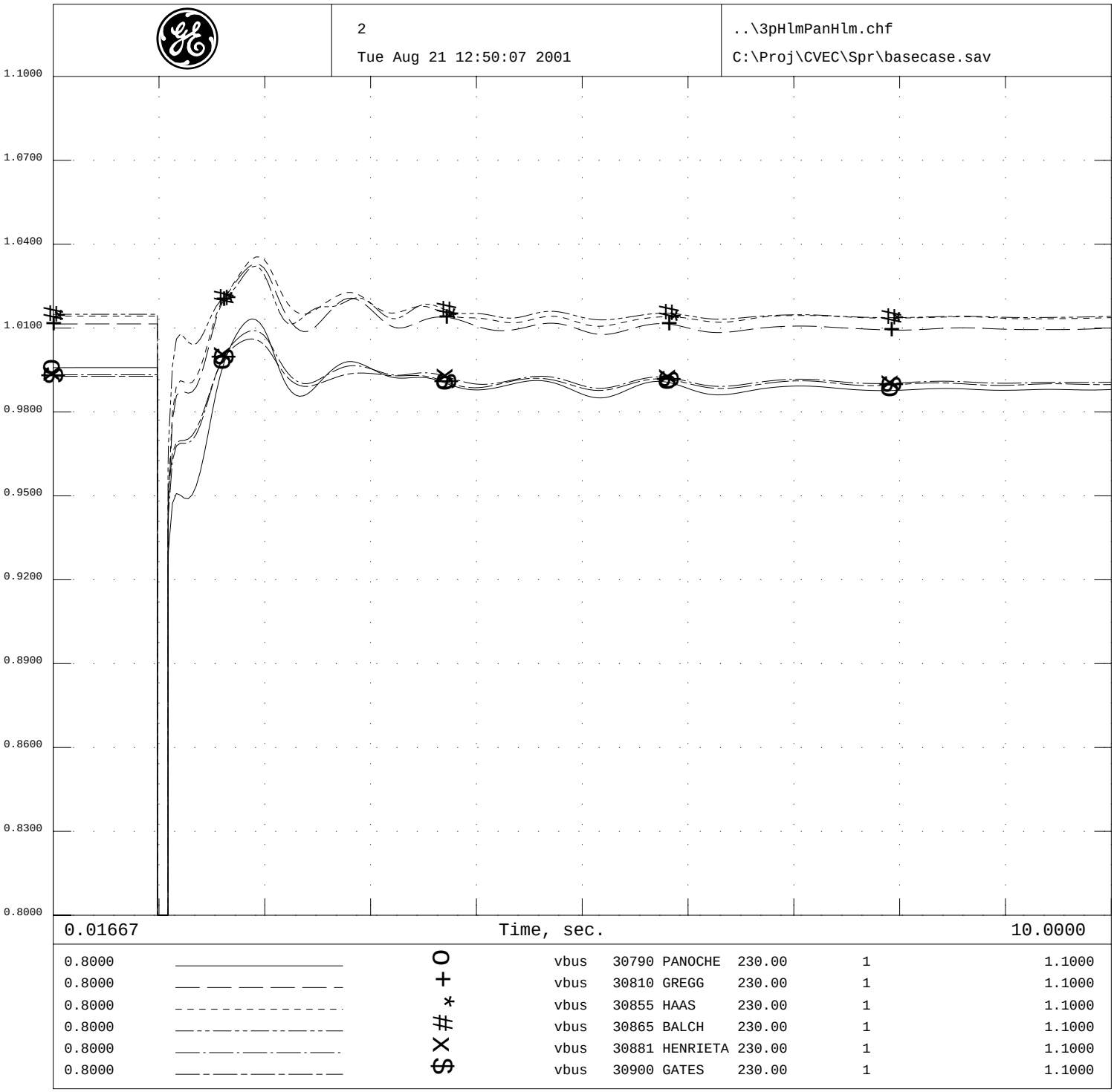
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Calpine Corporation
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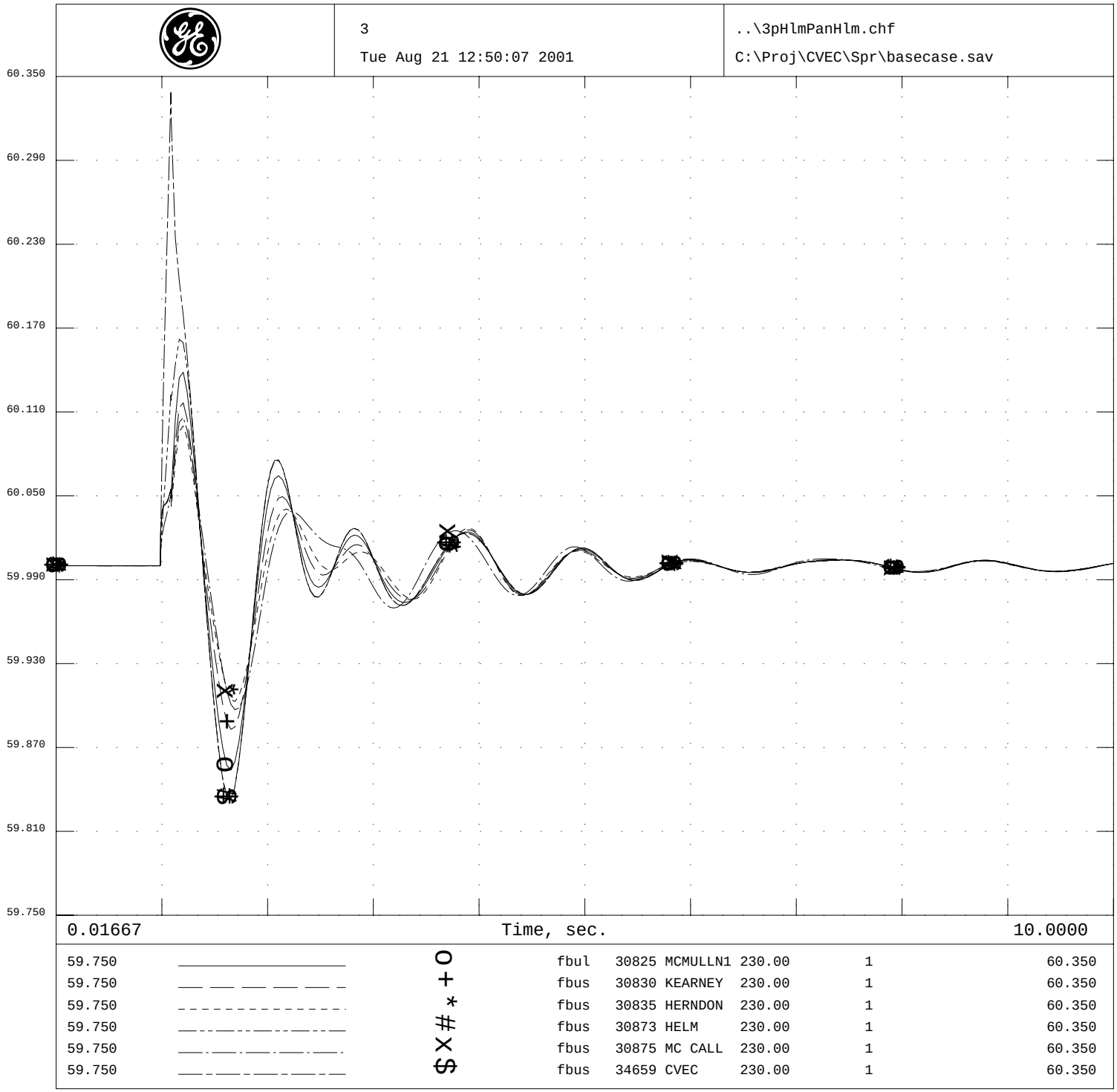

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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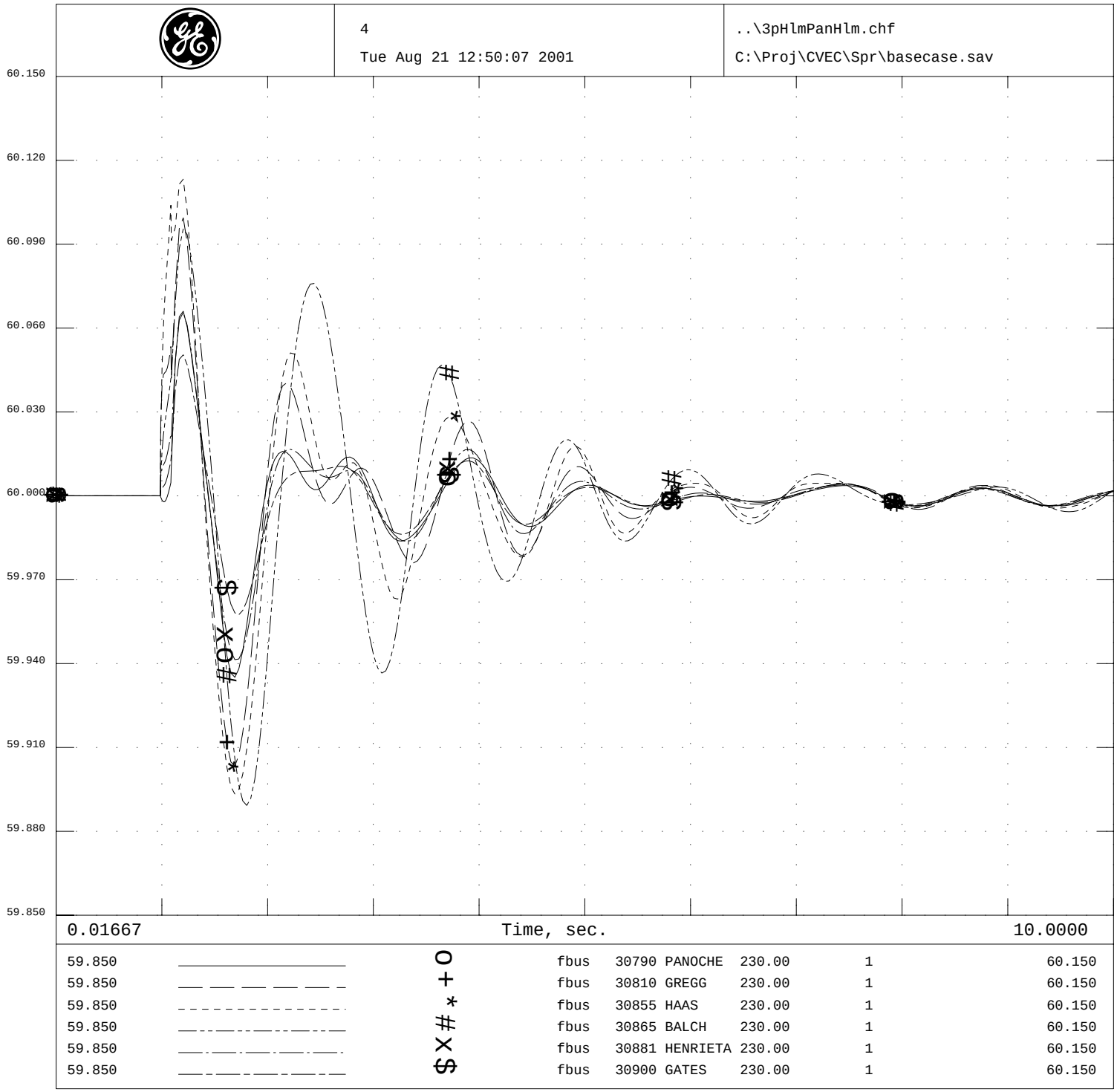
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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2004 Heavy Spring Base Case
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Calpine Corporation
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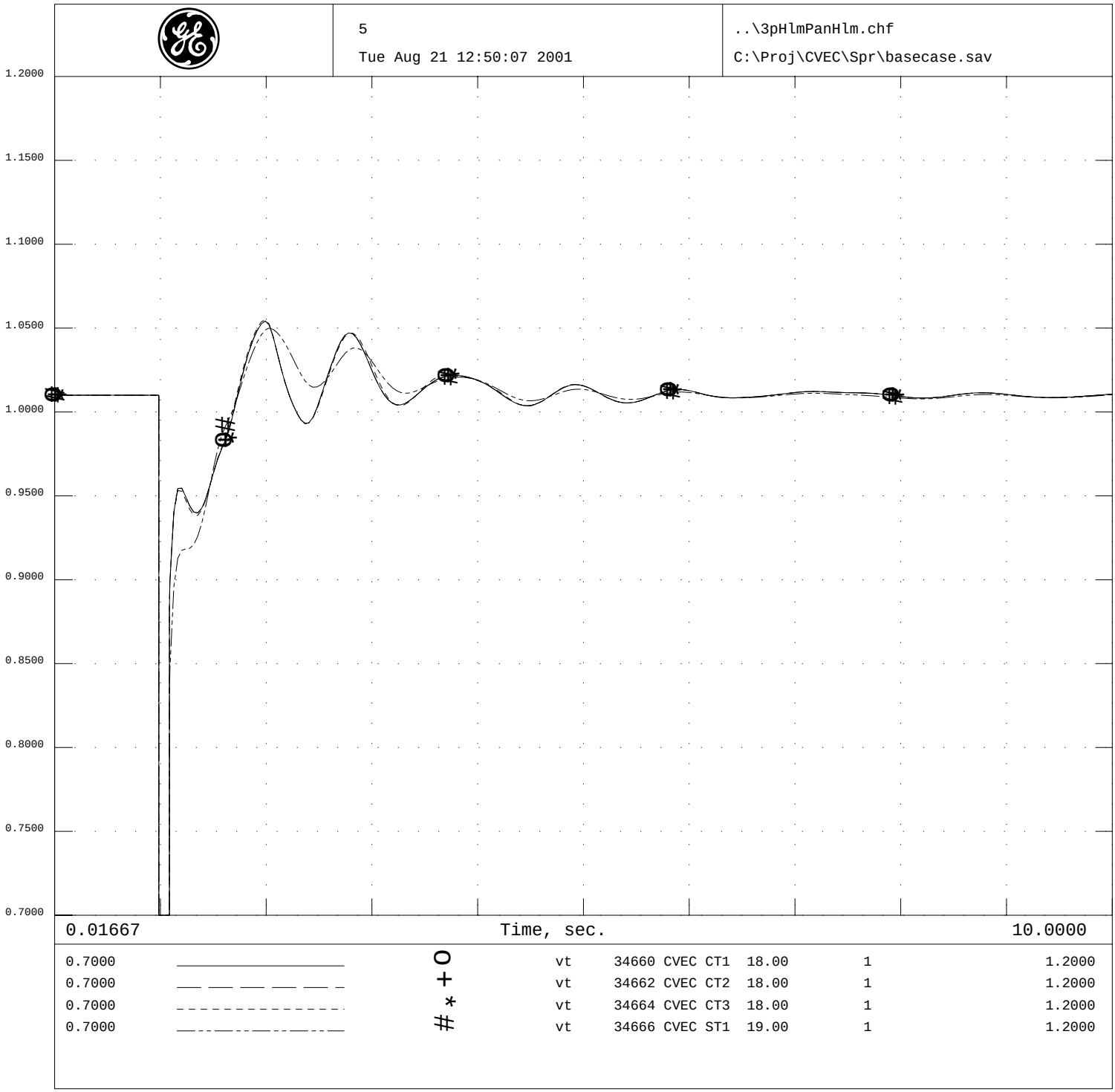

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2004 Heavy Spring Base Case
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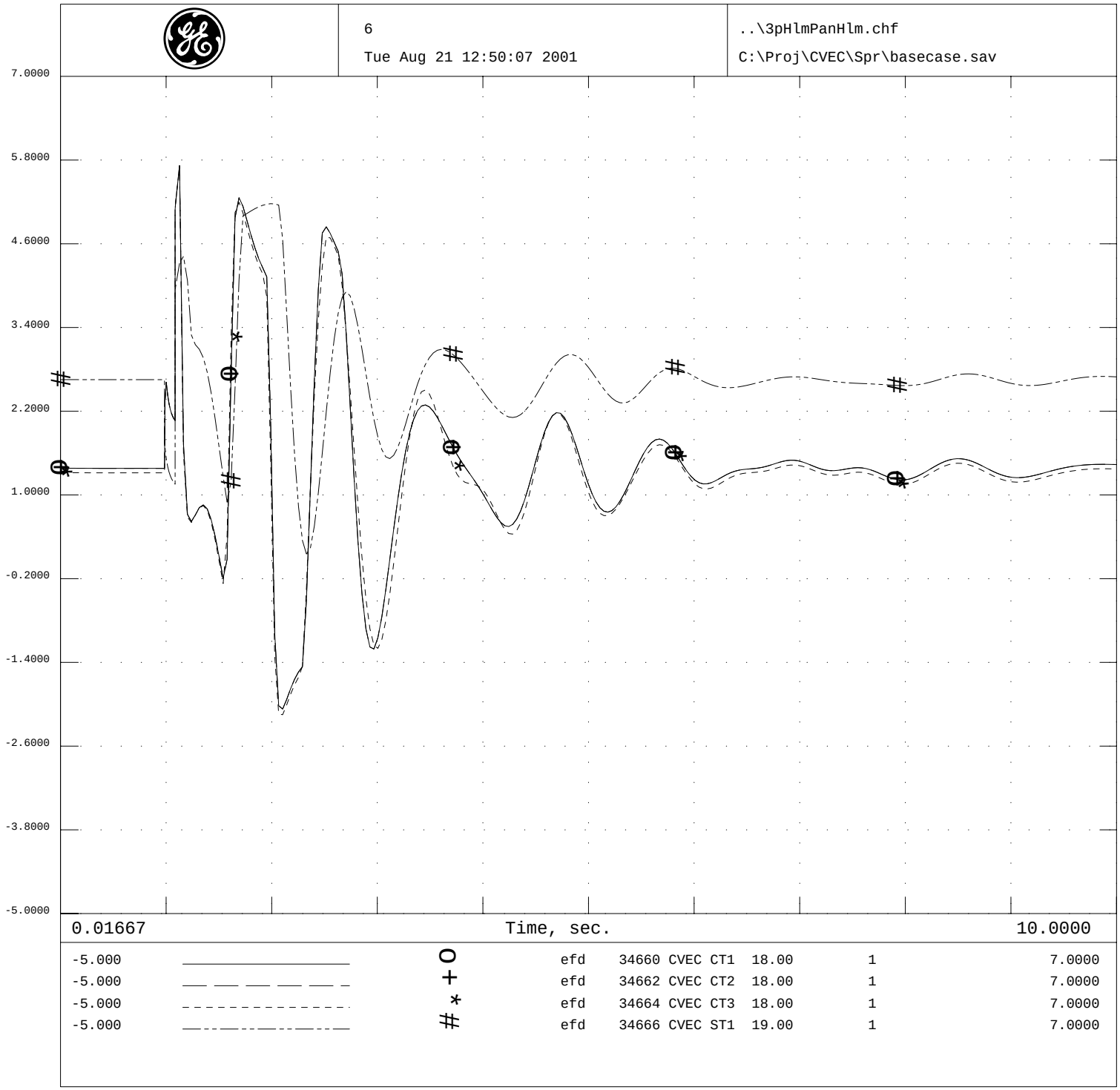
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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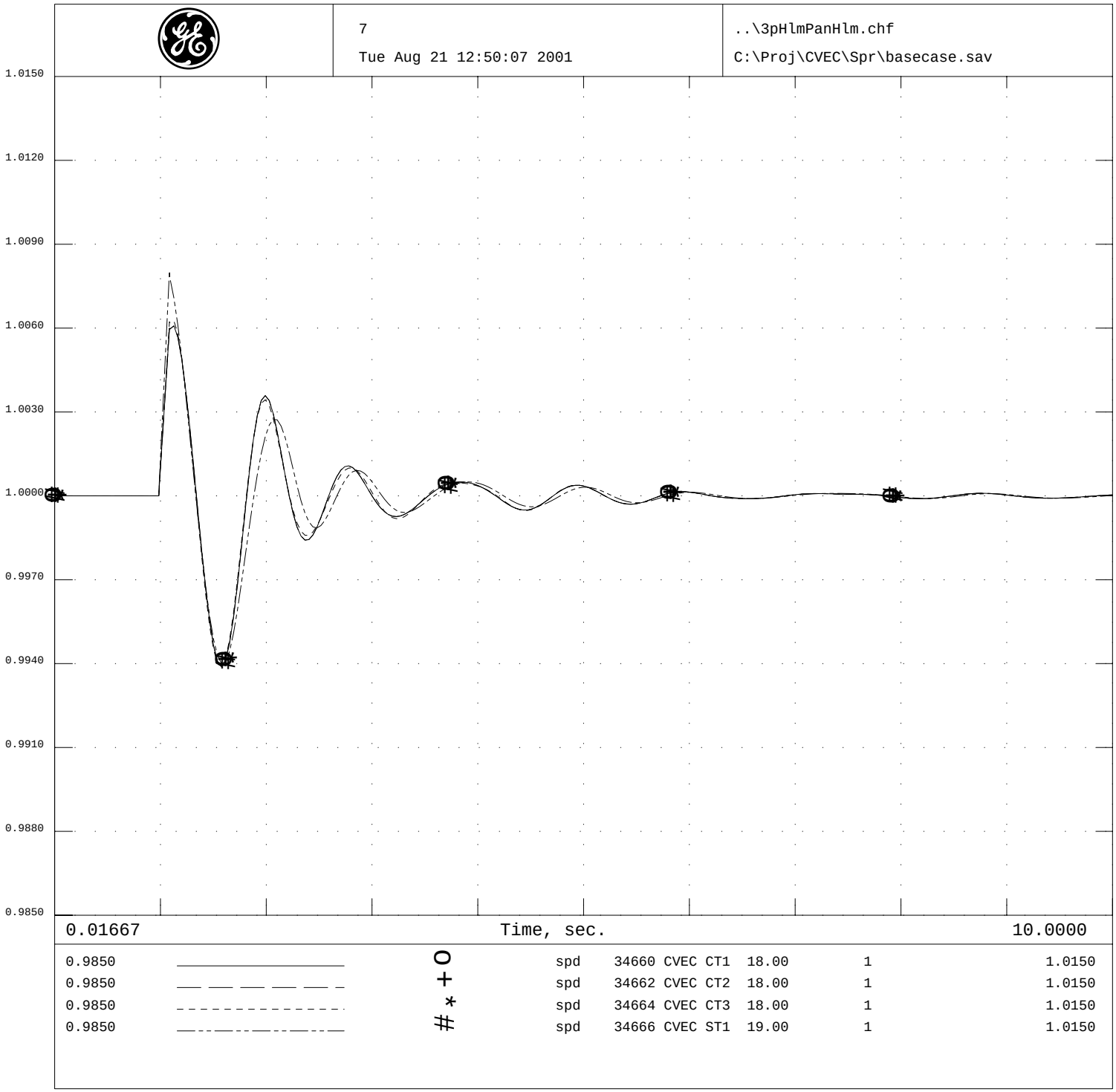
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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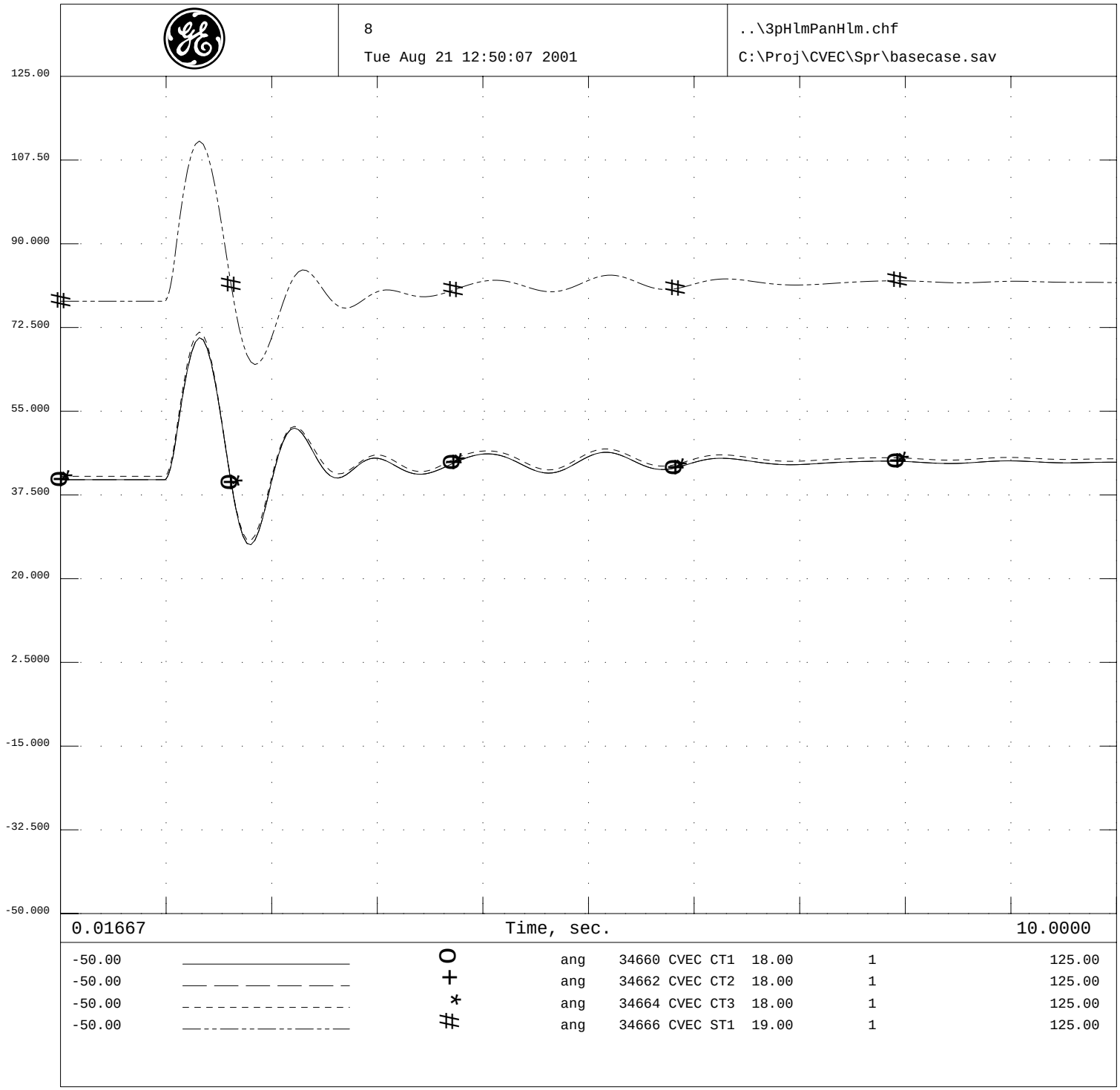
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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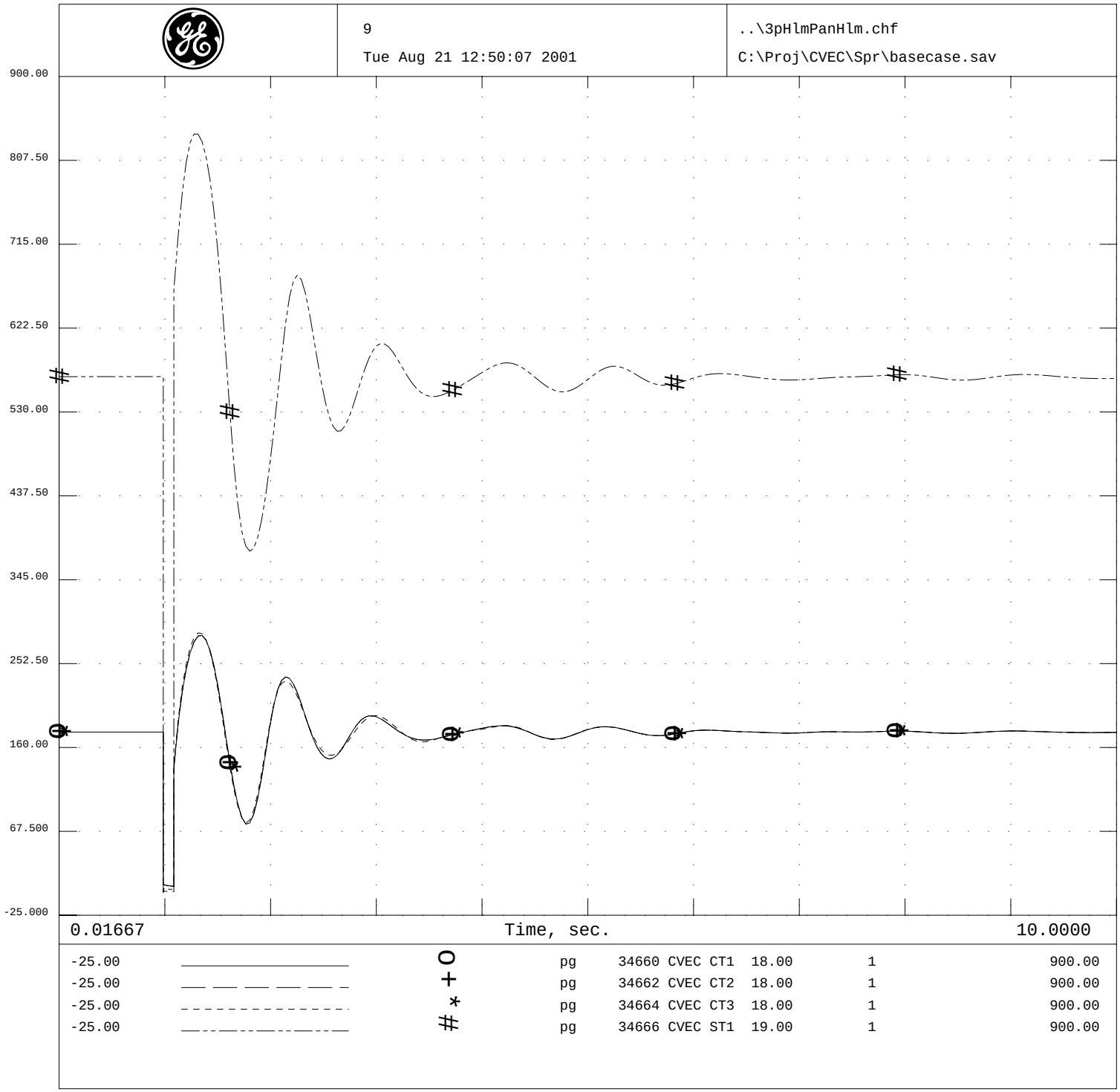
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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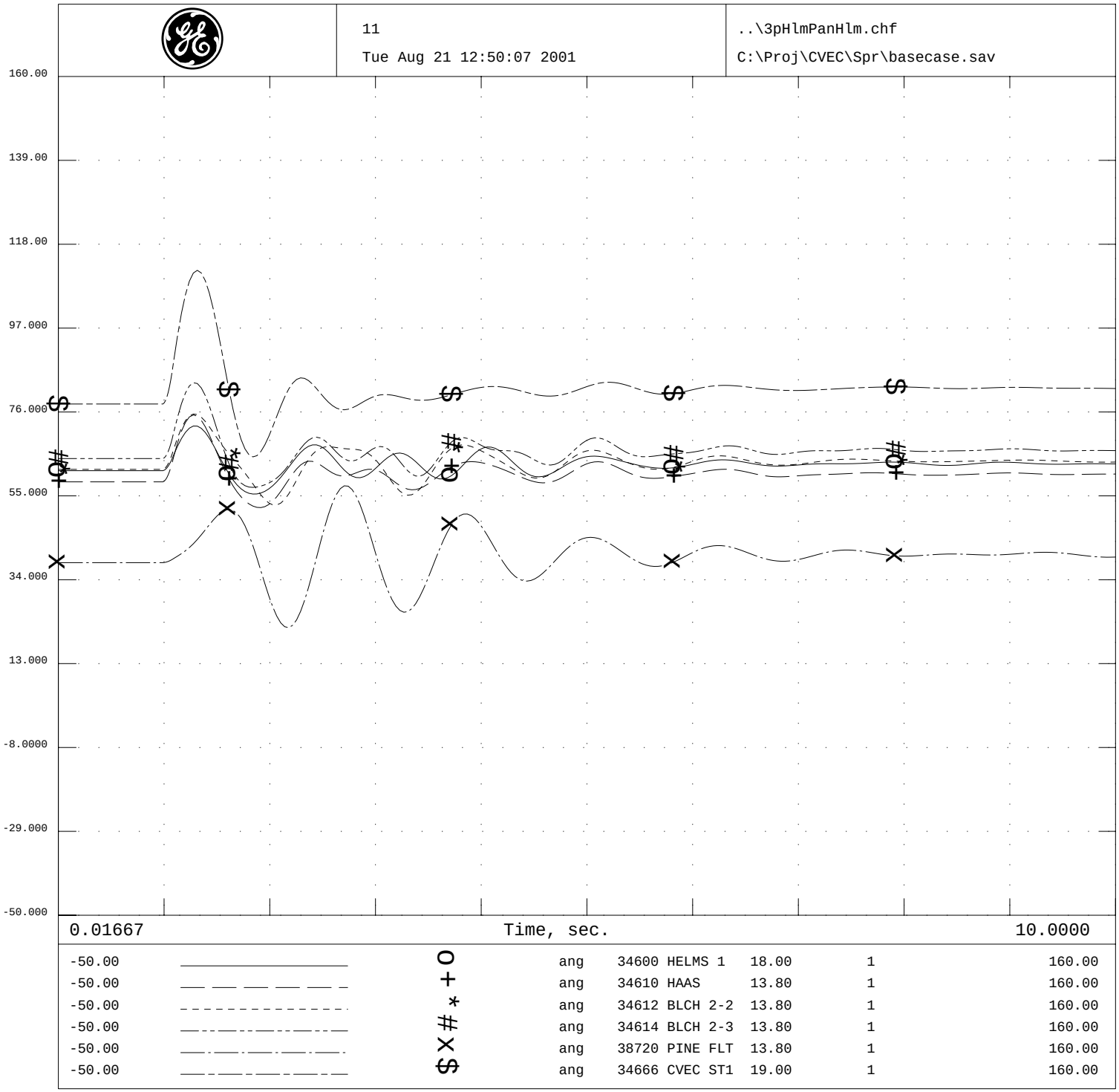
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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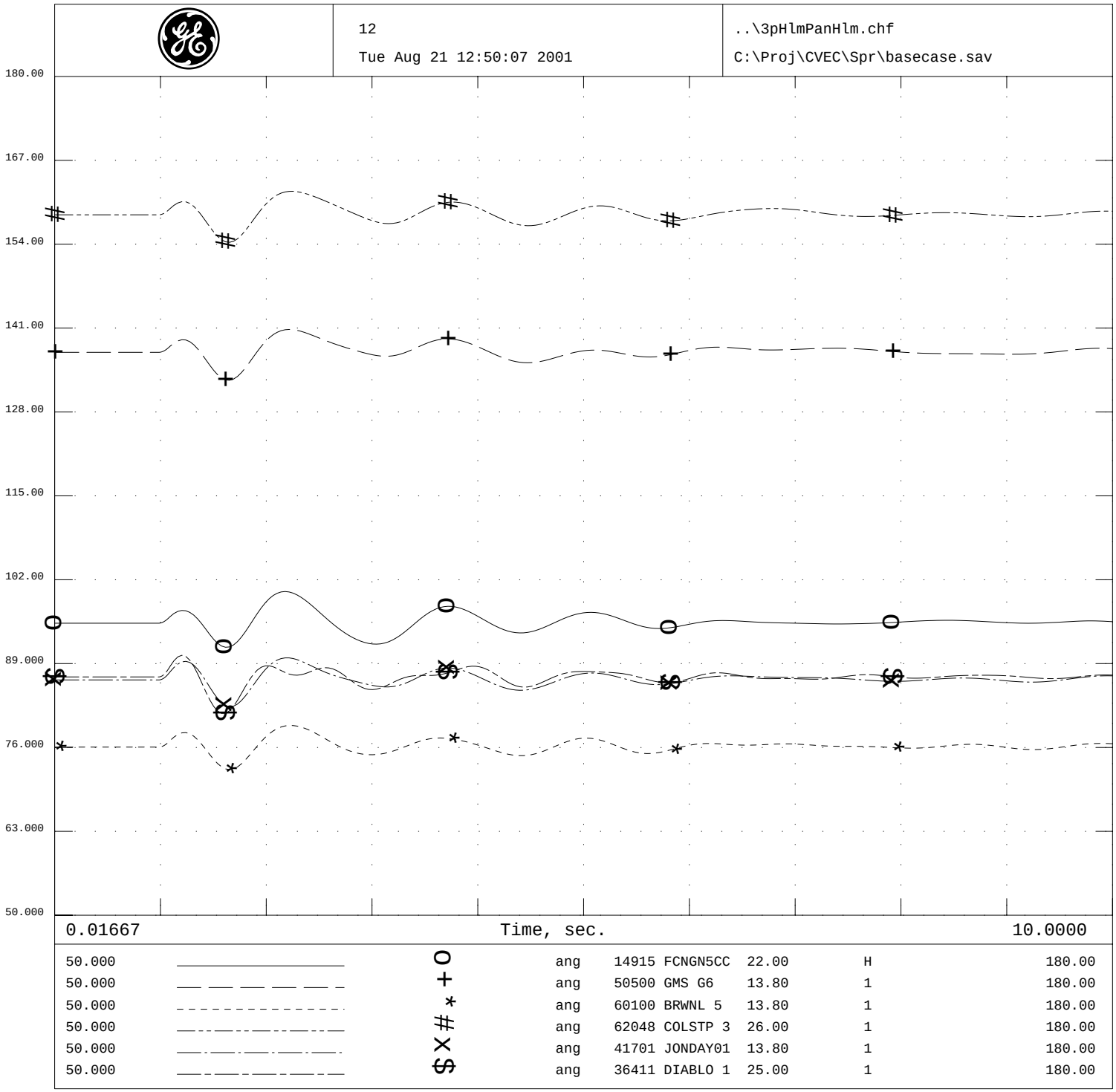
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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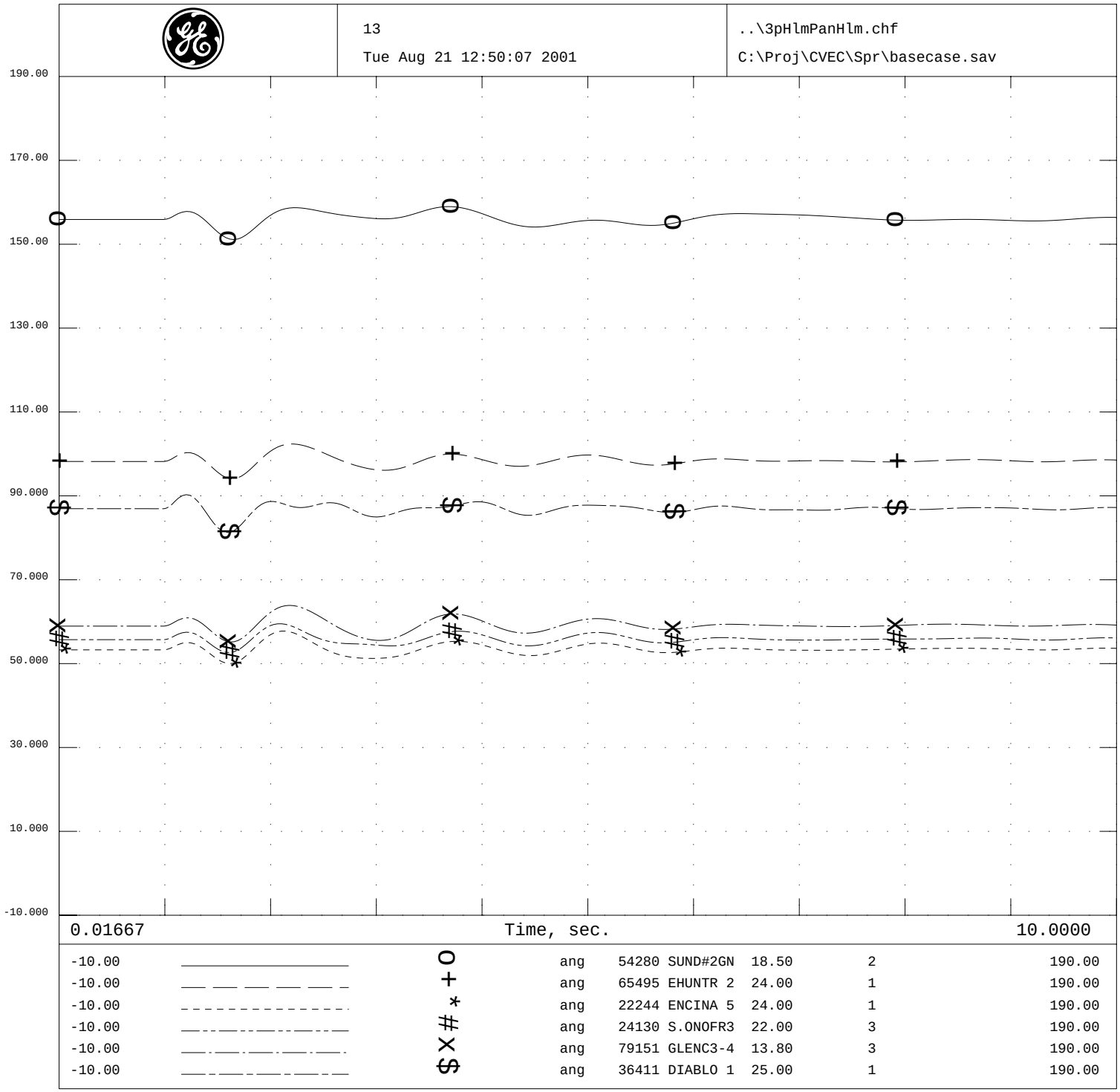
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Central Valley Energy Center
Calpine Corporation
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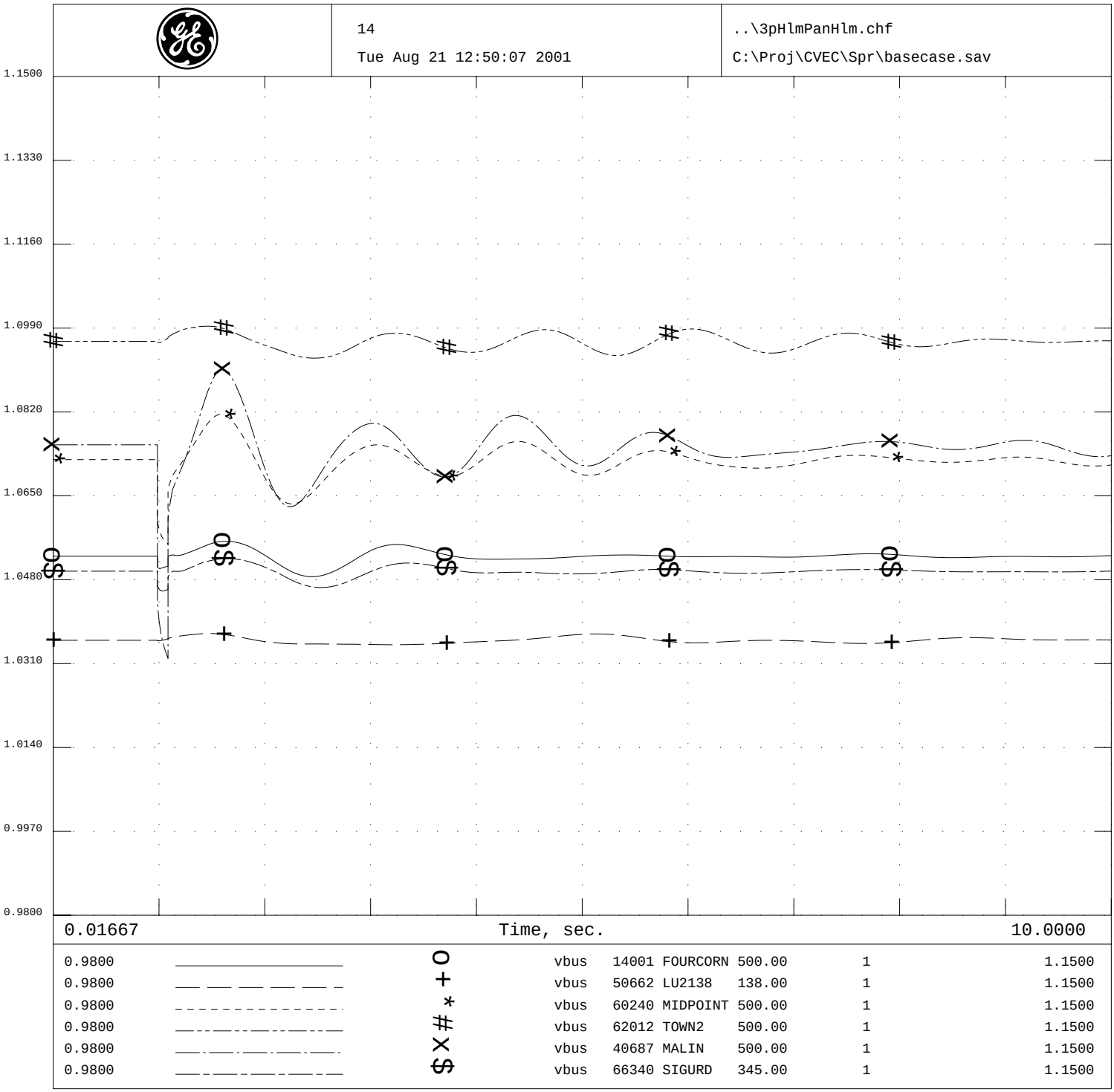

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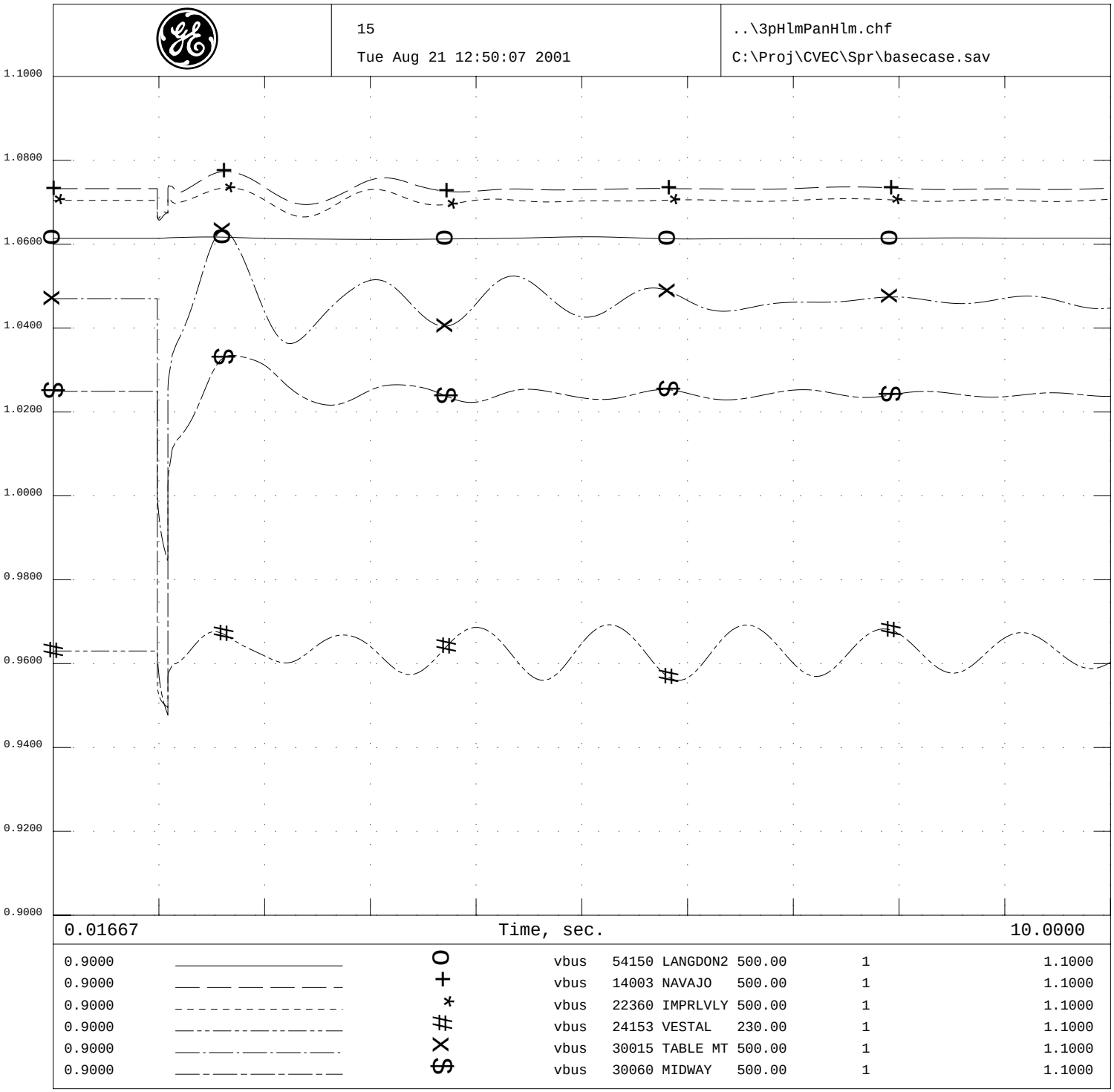
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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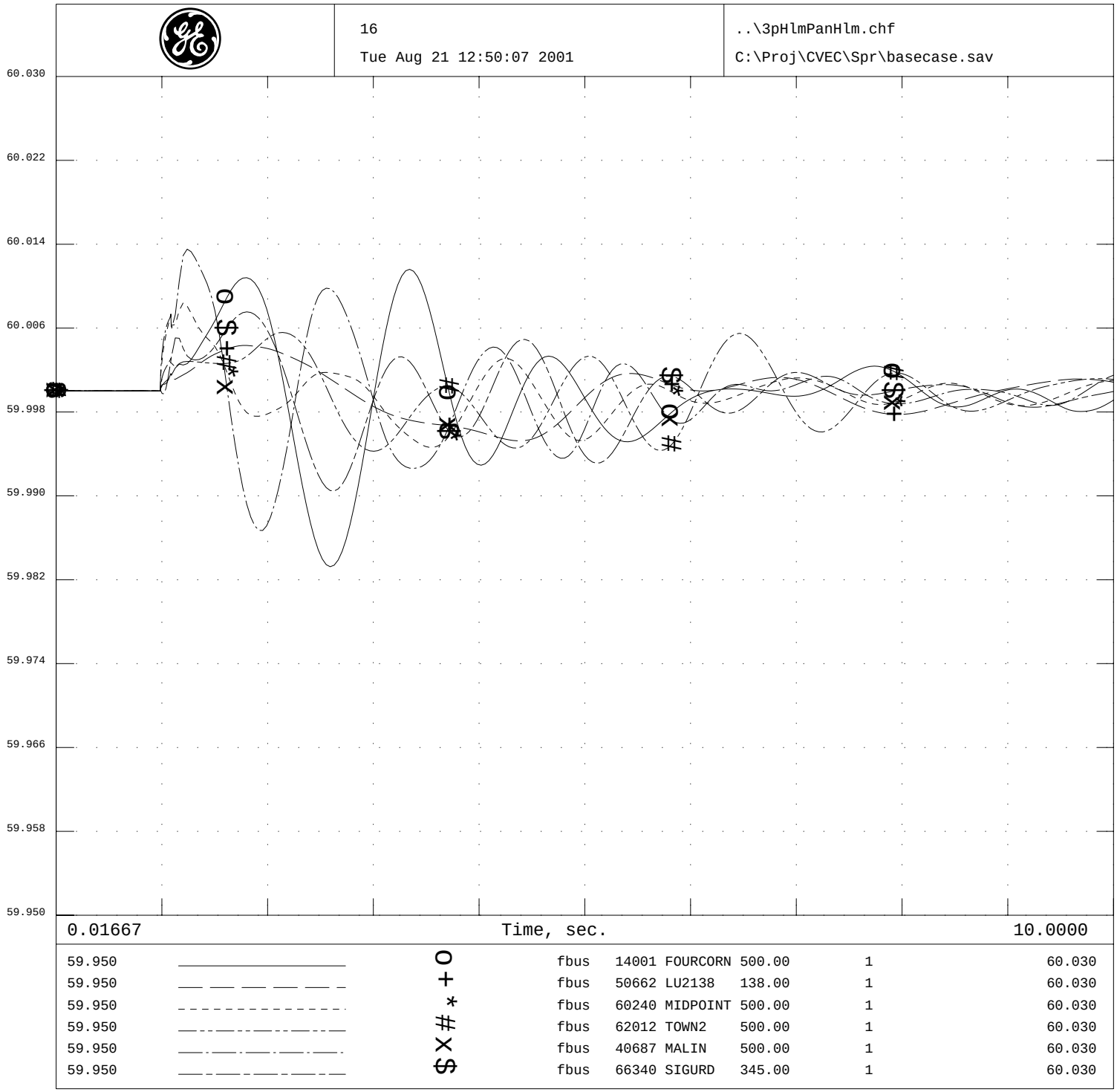

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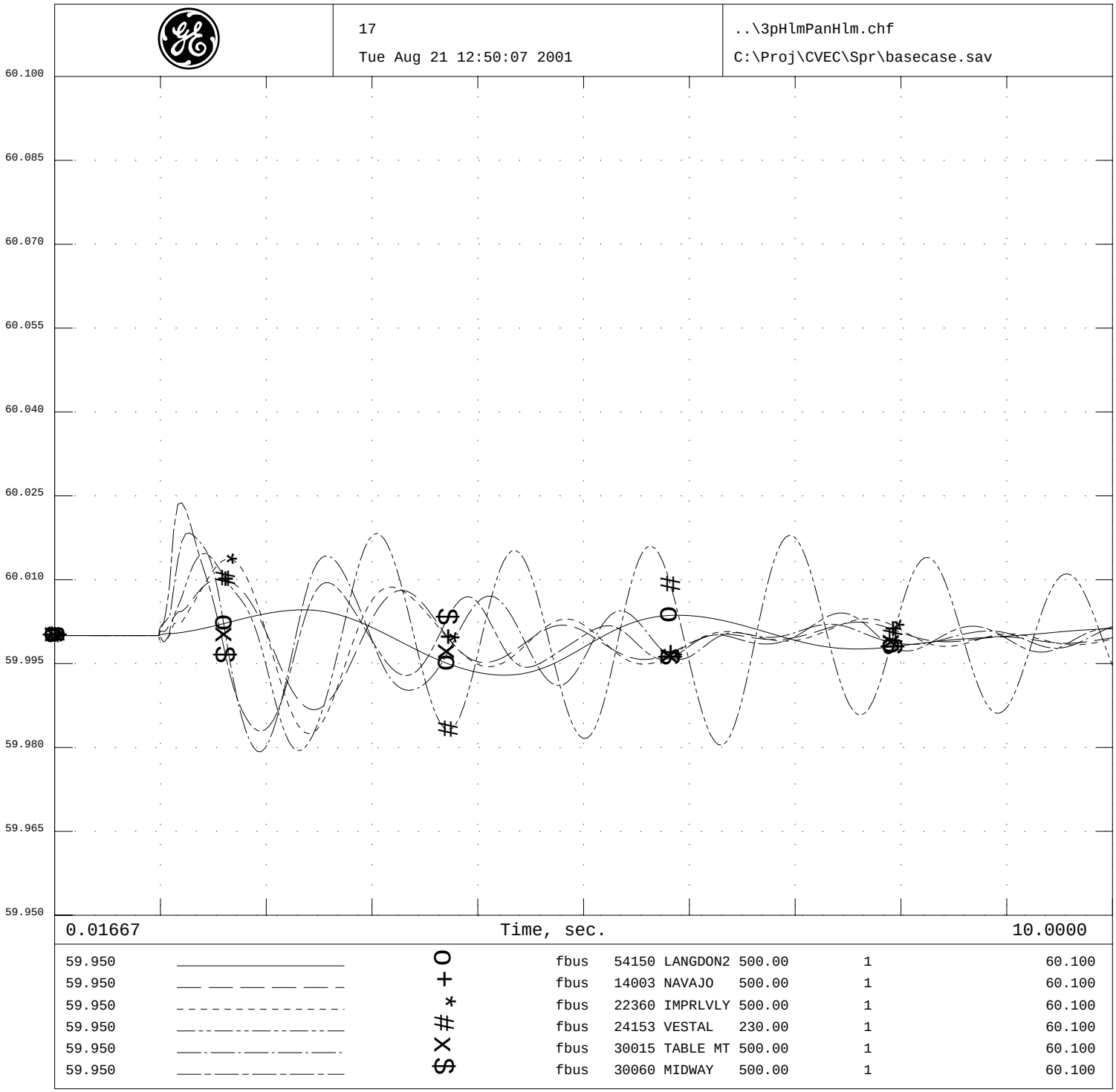
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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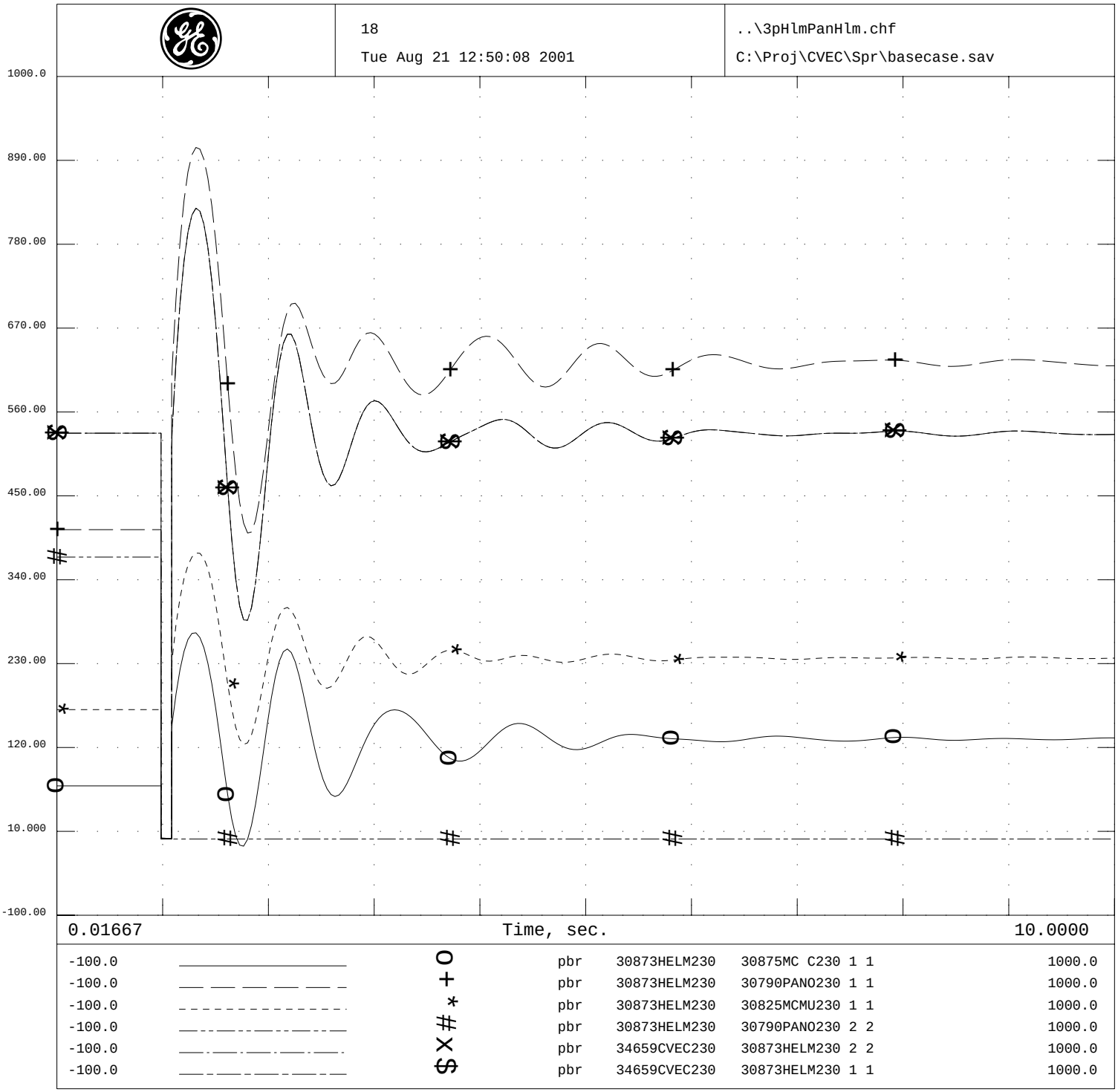

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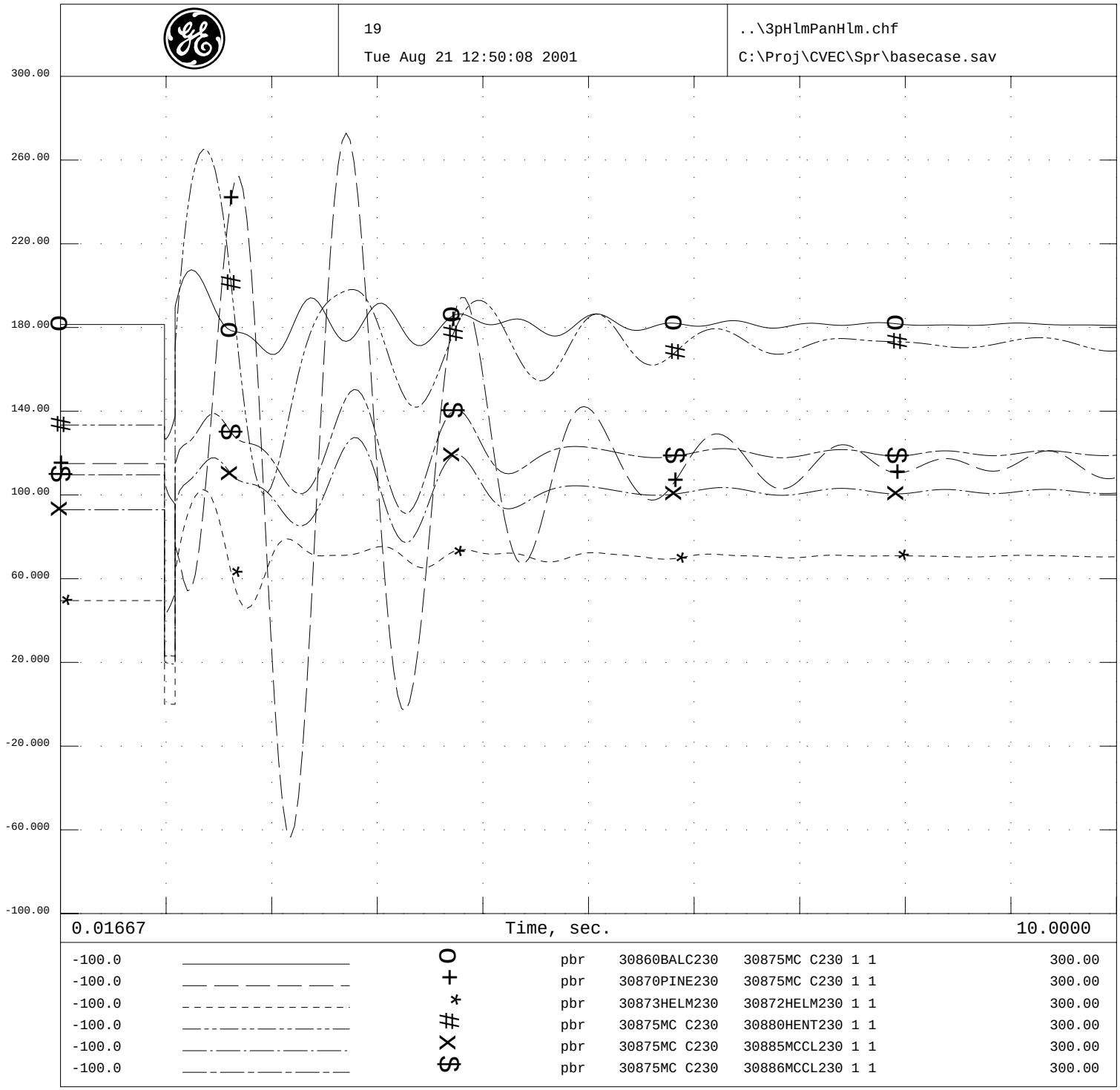
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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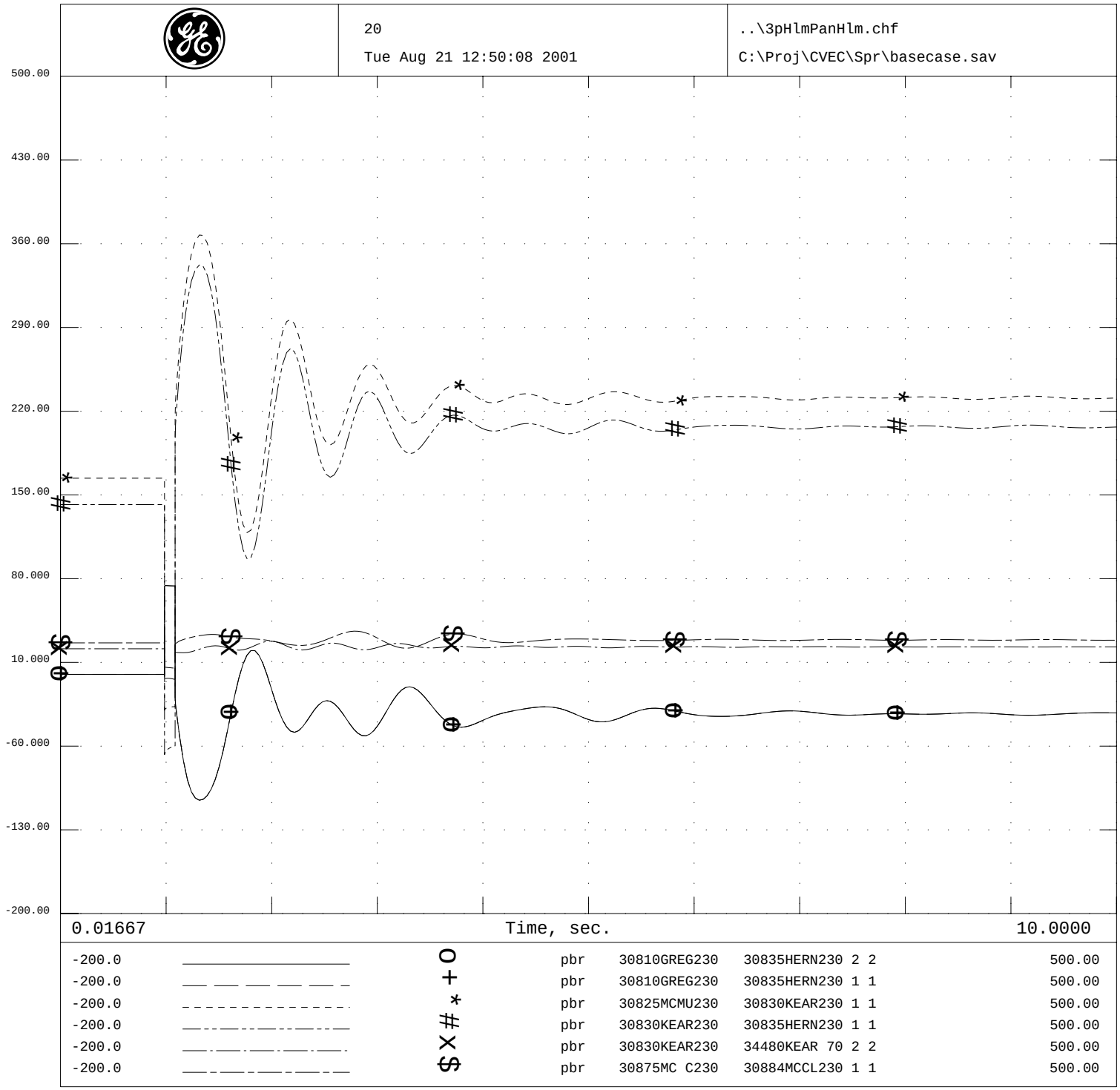

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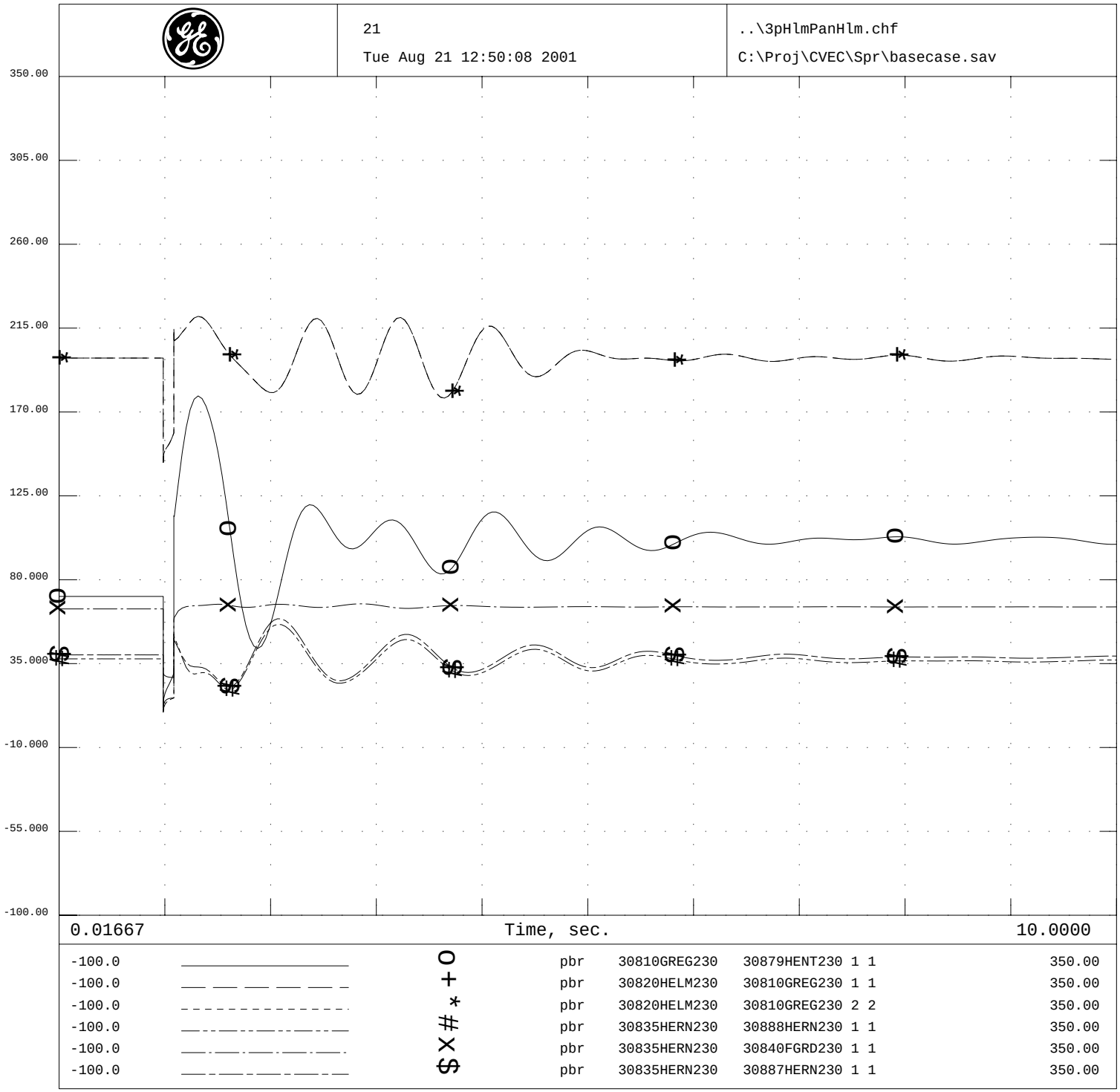

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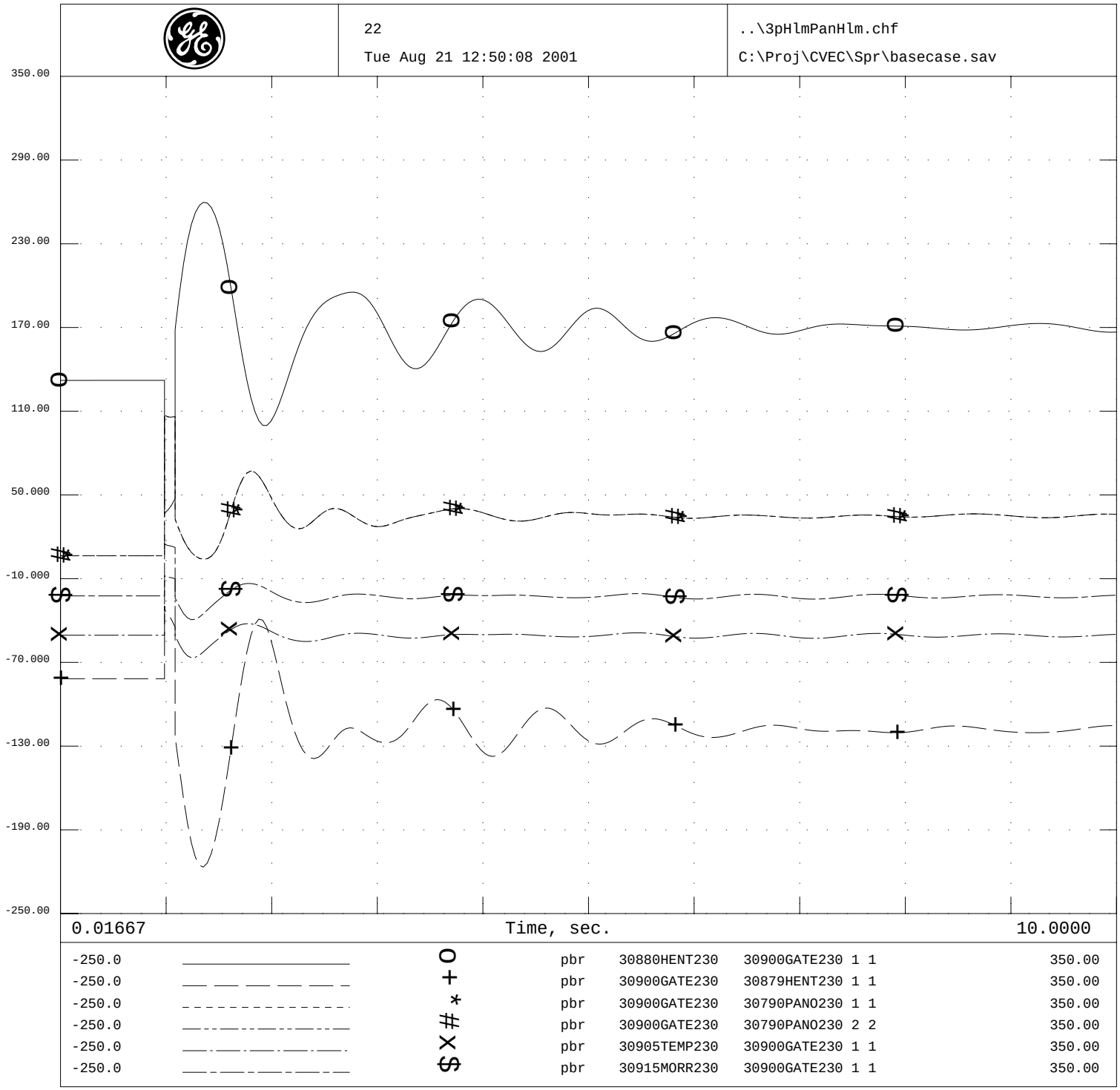

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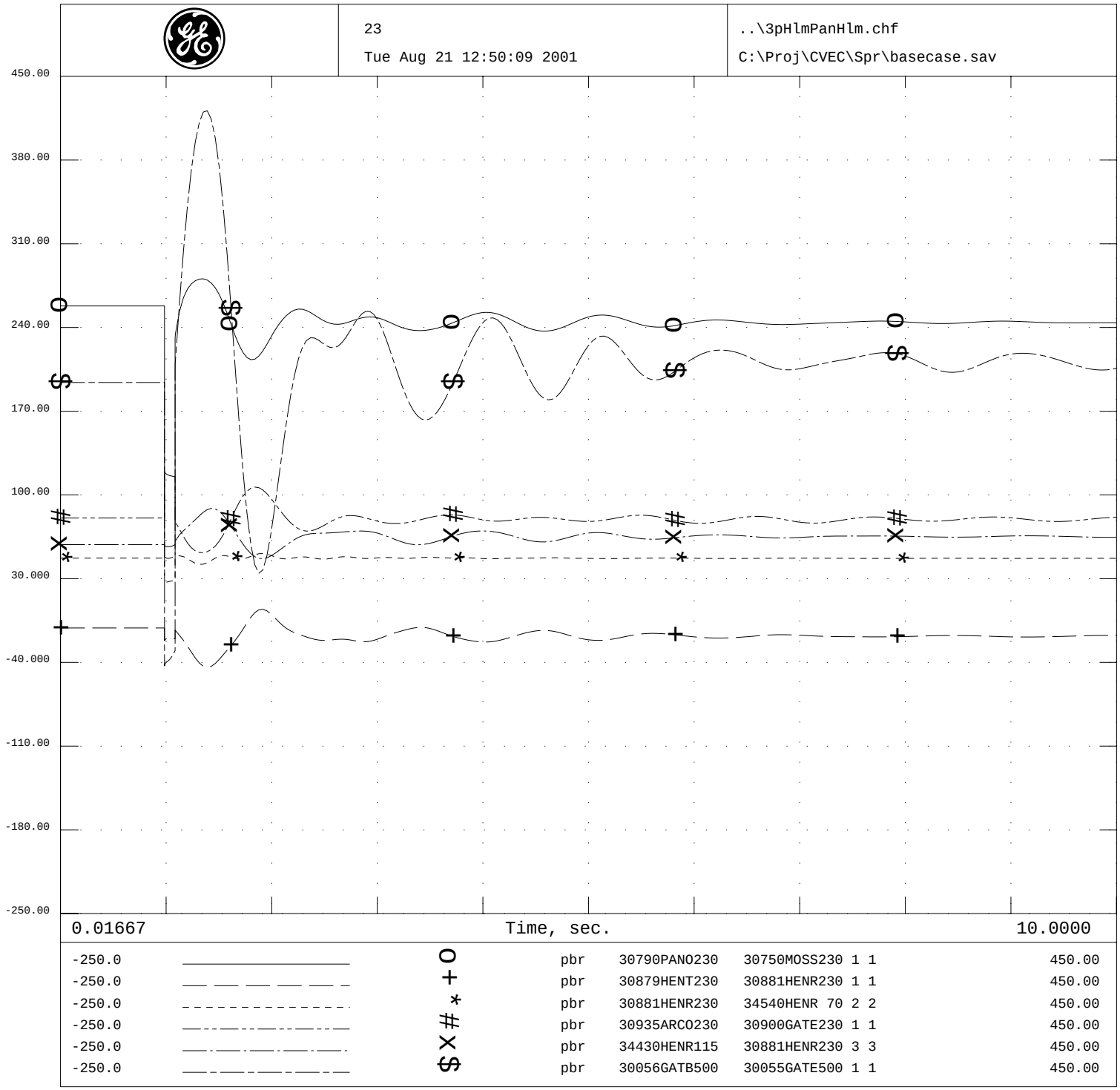

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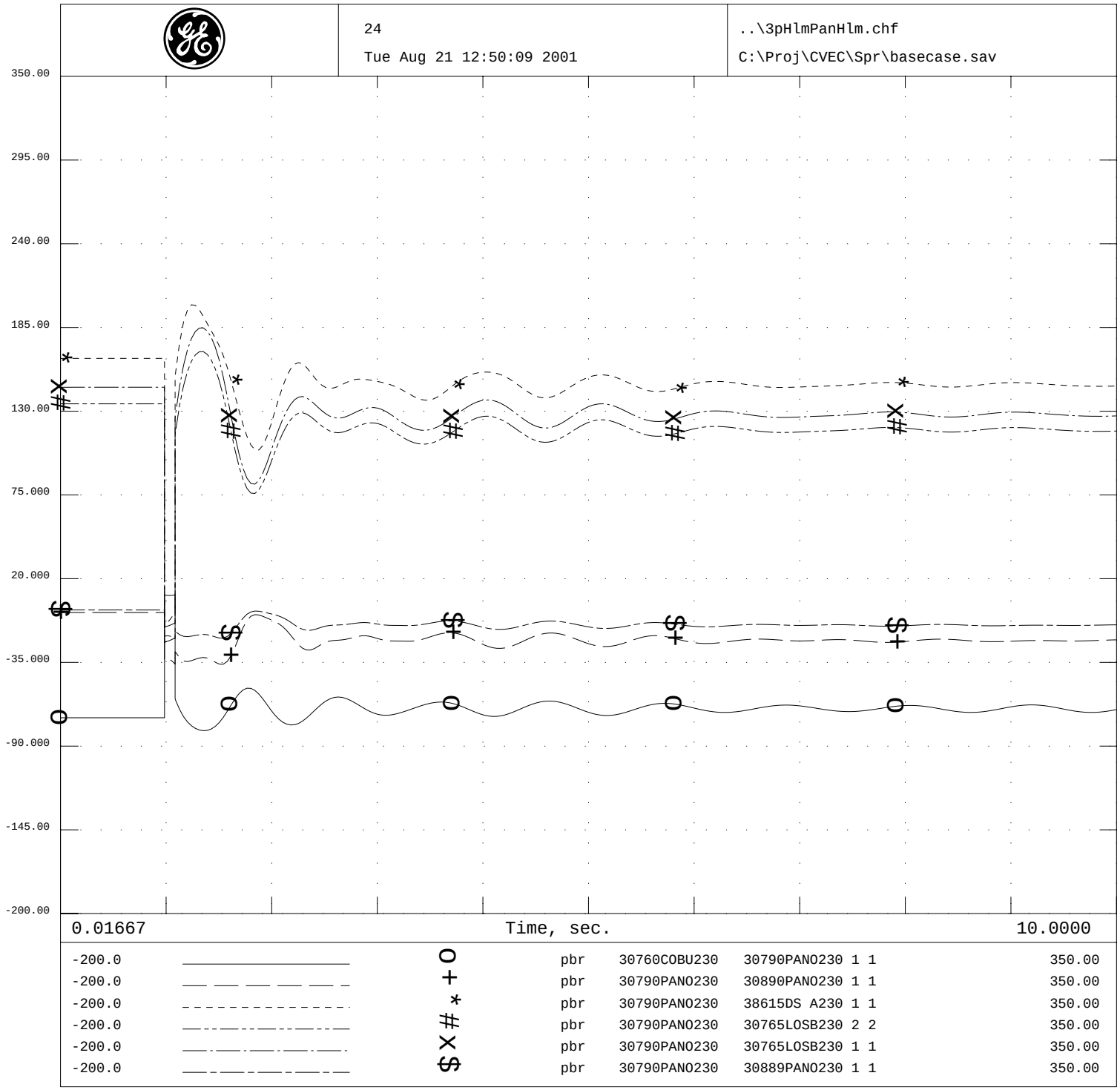

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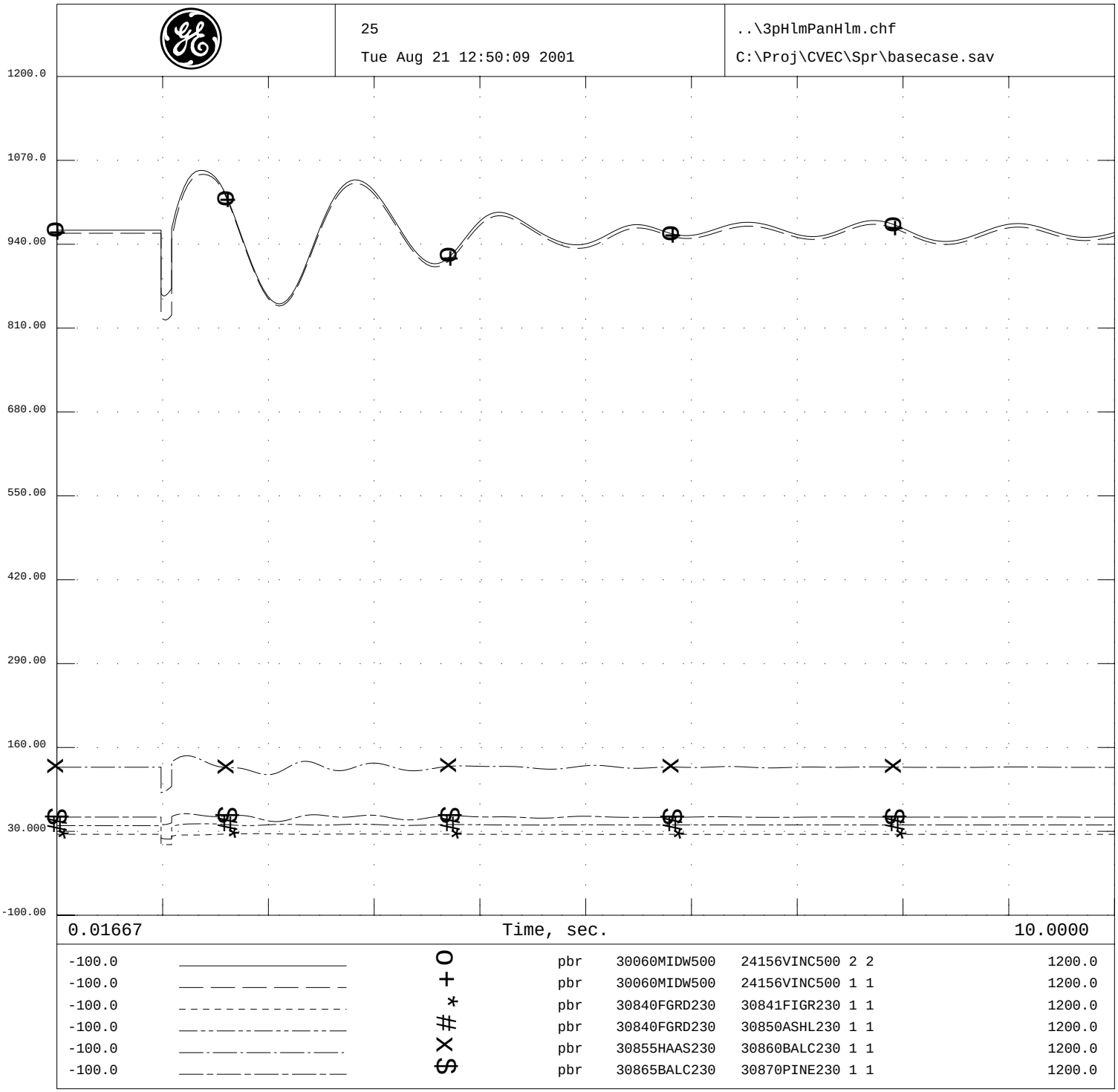

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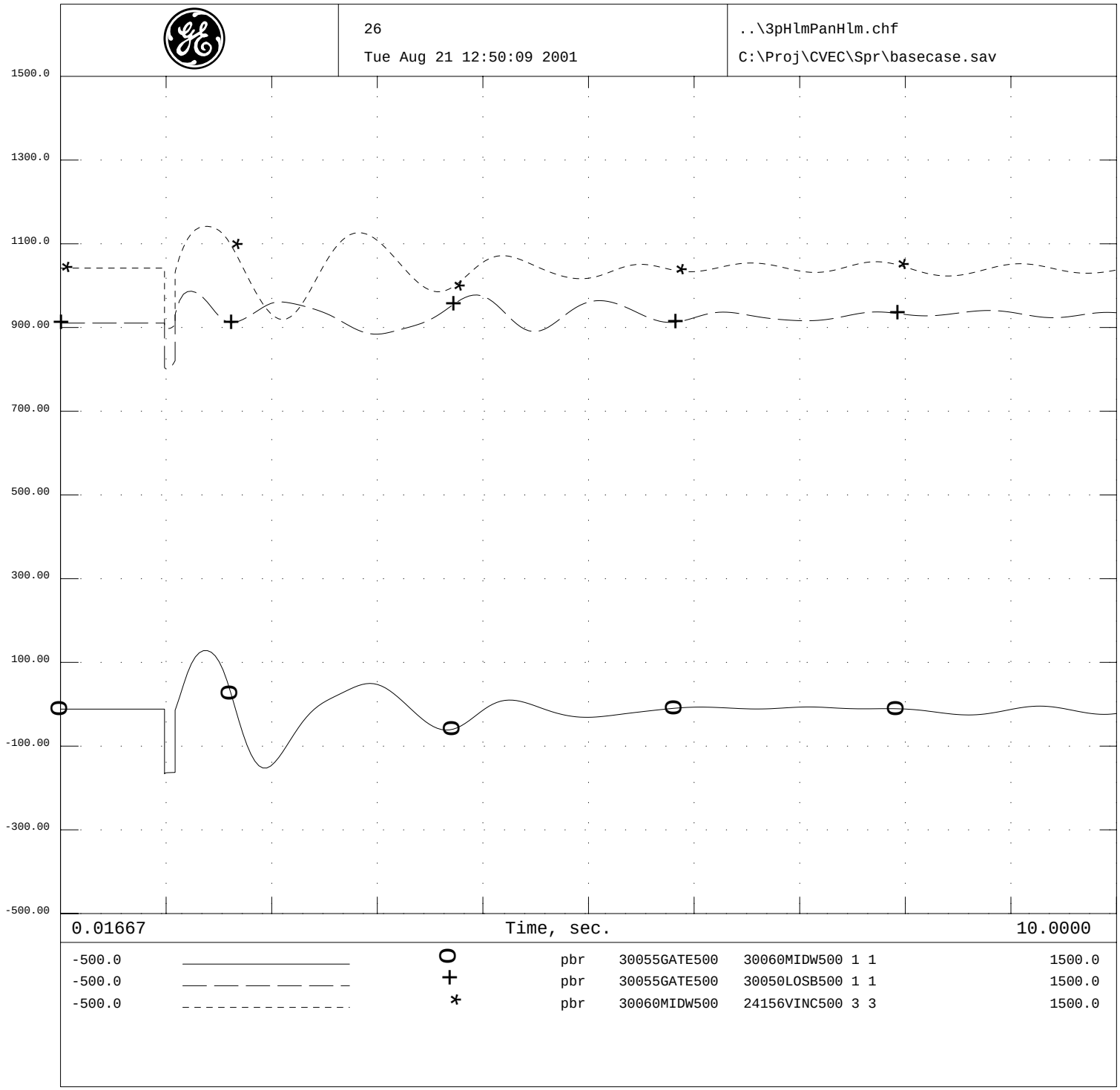

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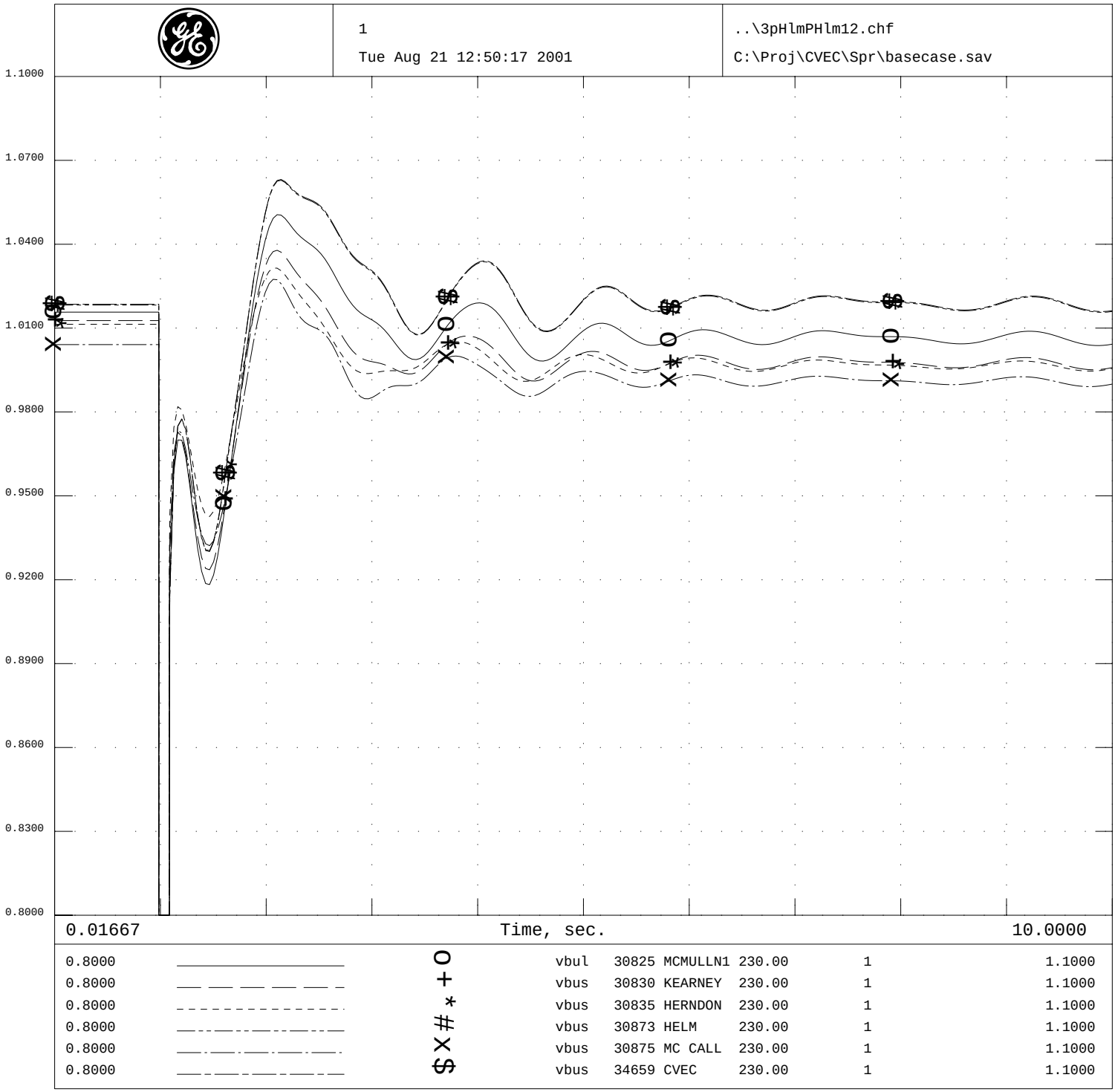

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Helm-Panoche #1,2 230kV Double Outage
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Central Valley Energy Center
Calpine Corporation
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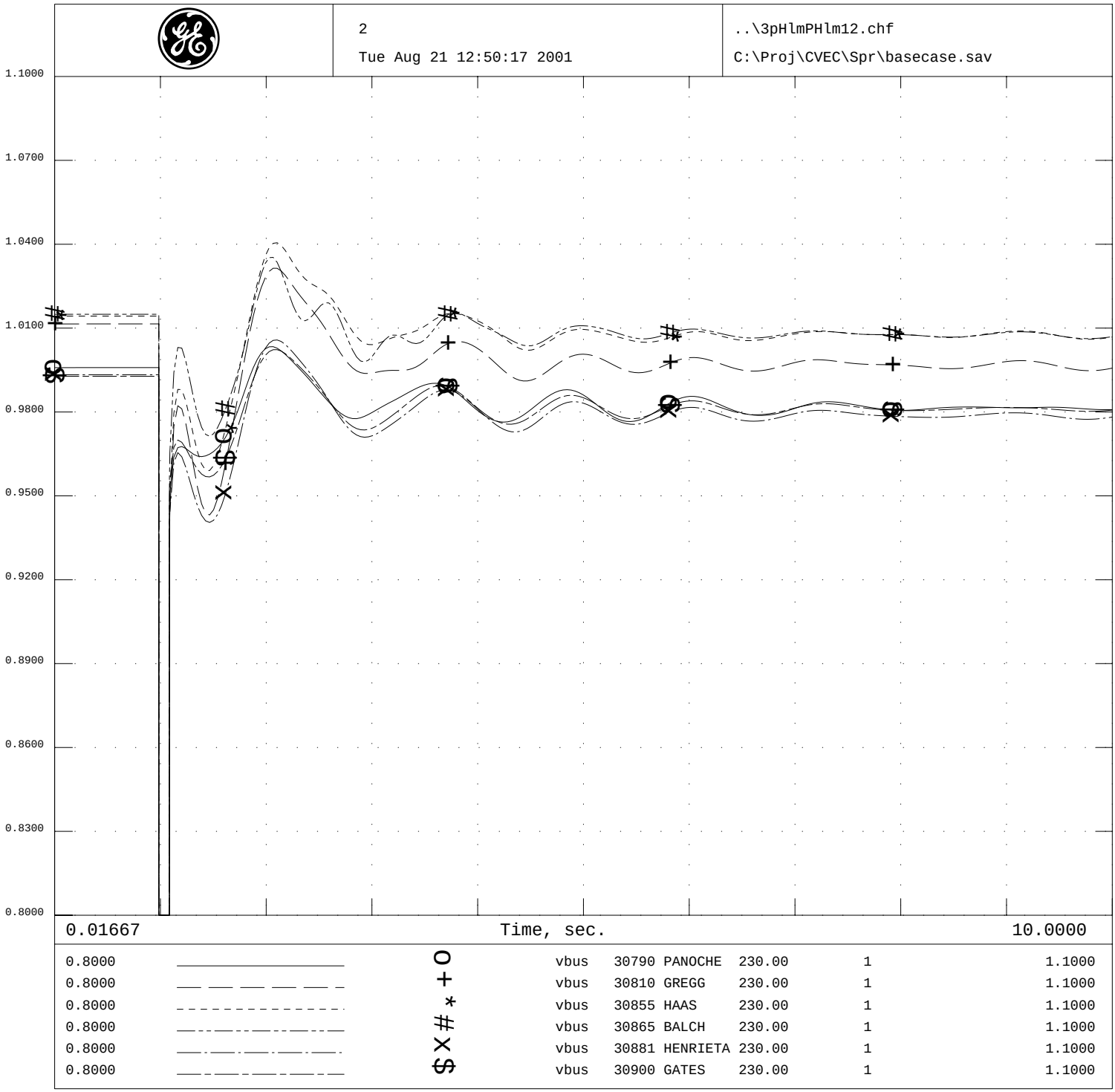

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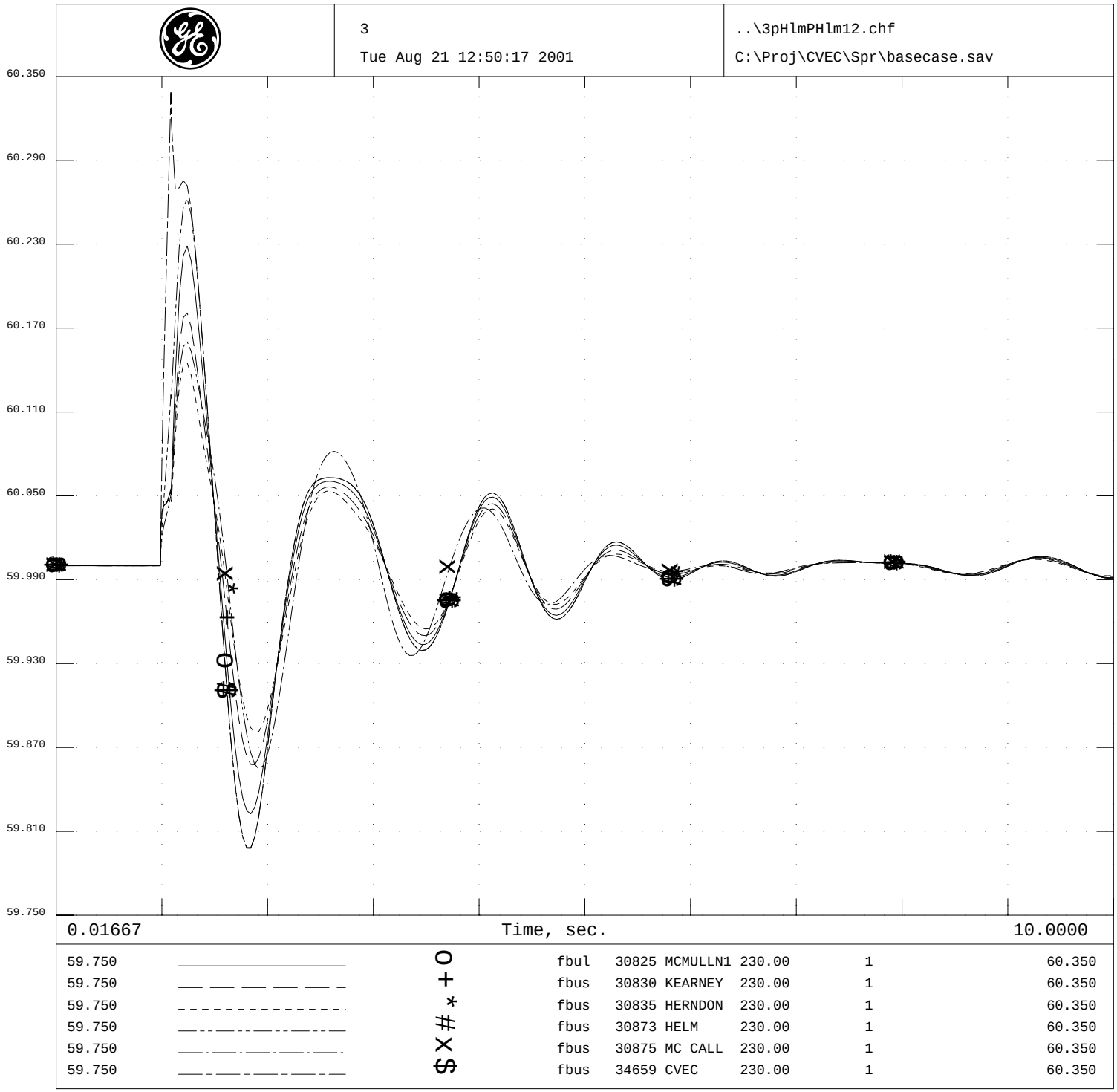

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Calpine Corporation
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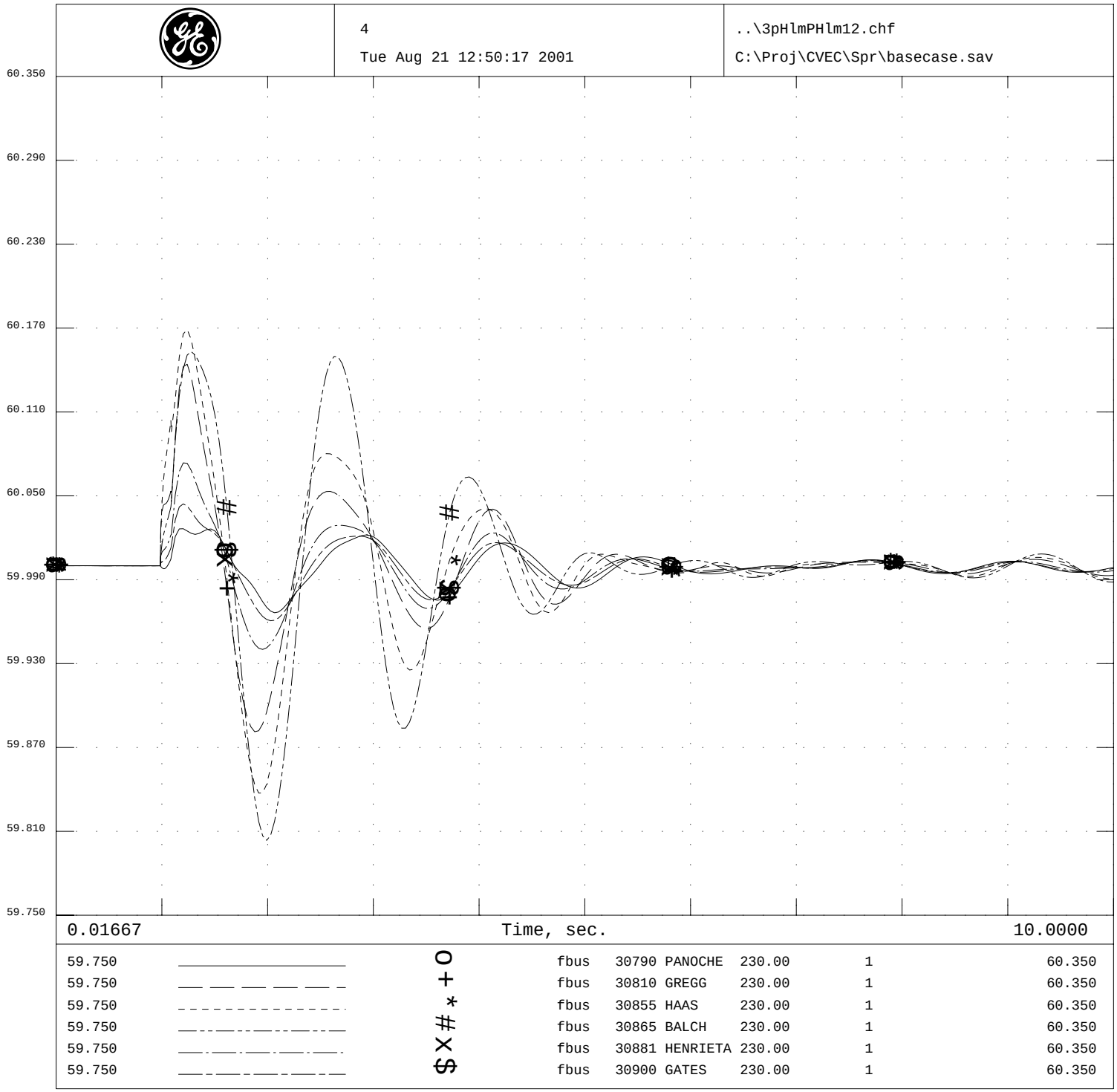

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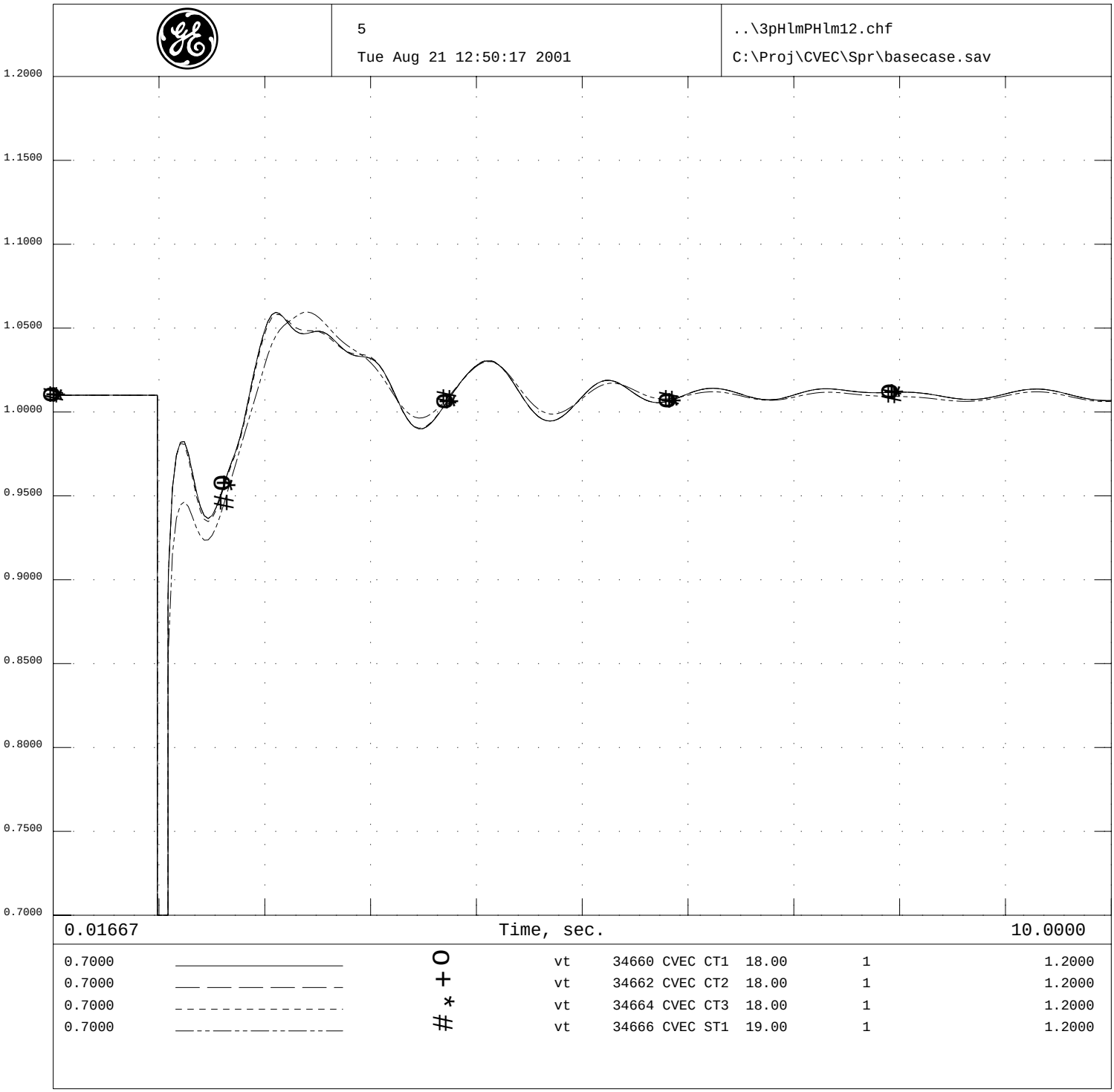

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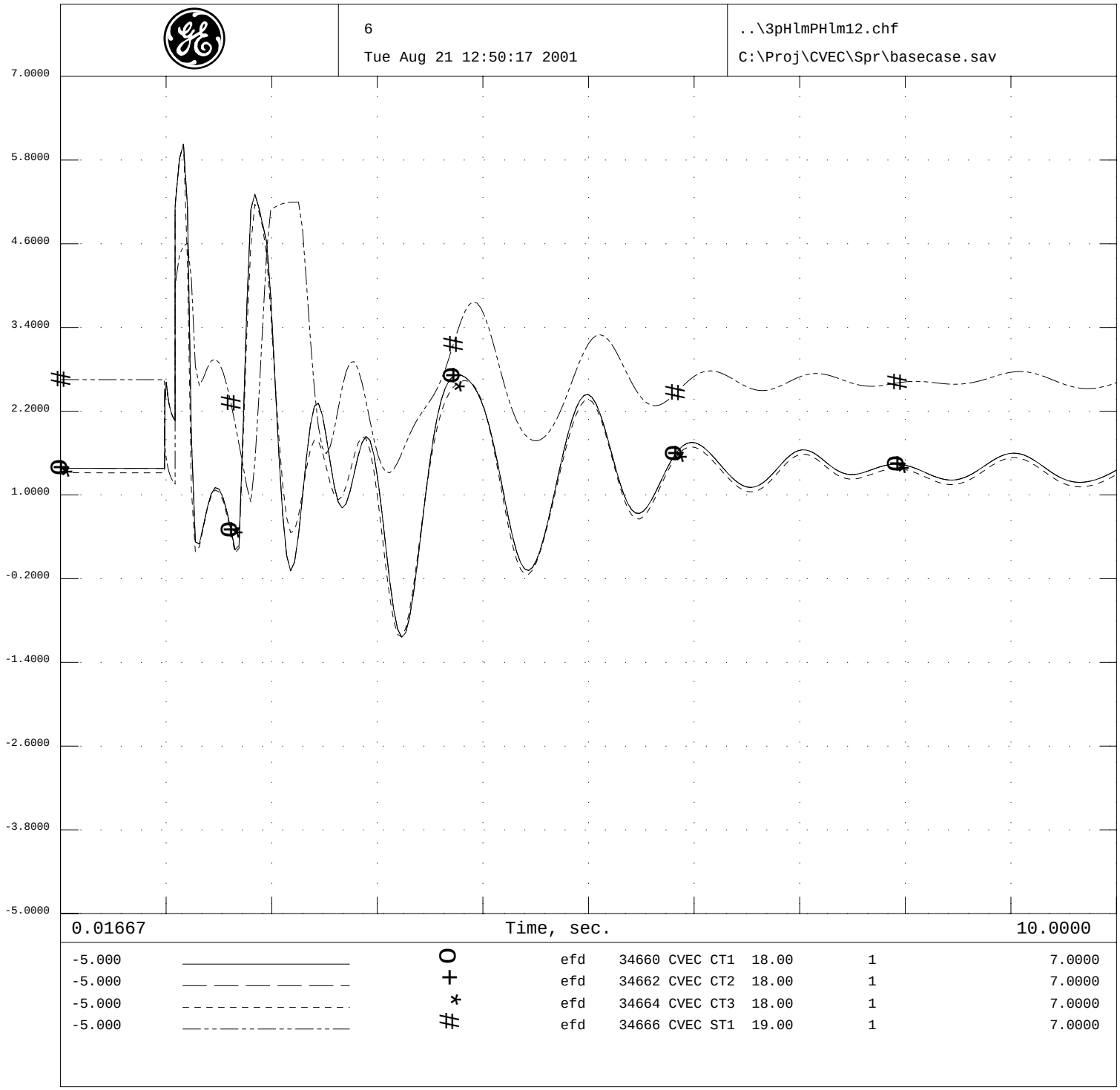
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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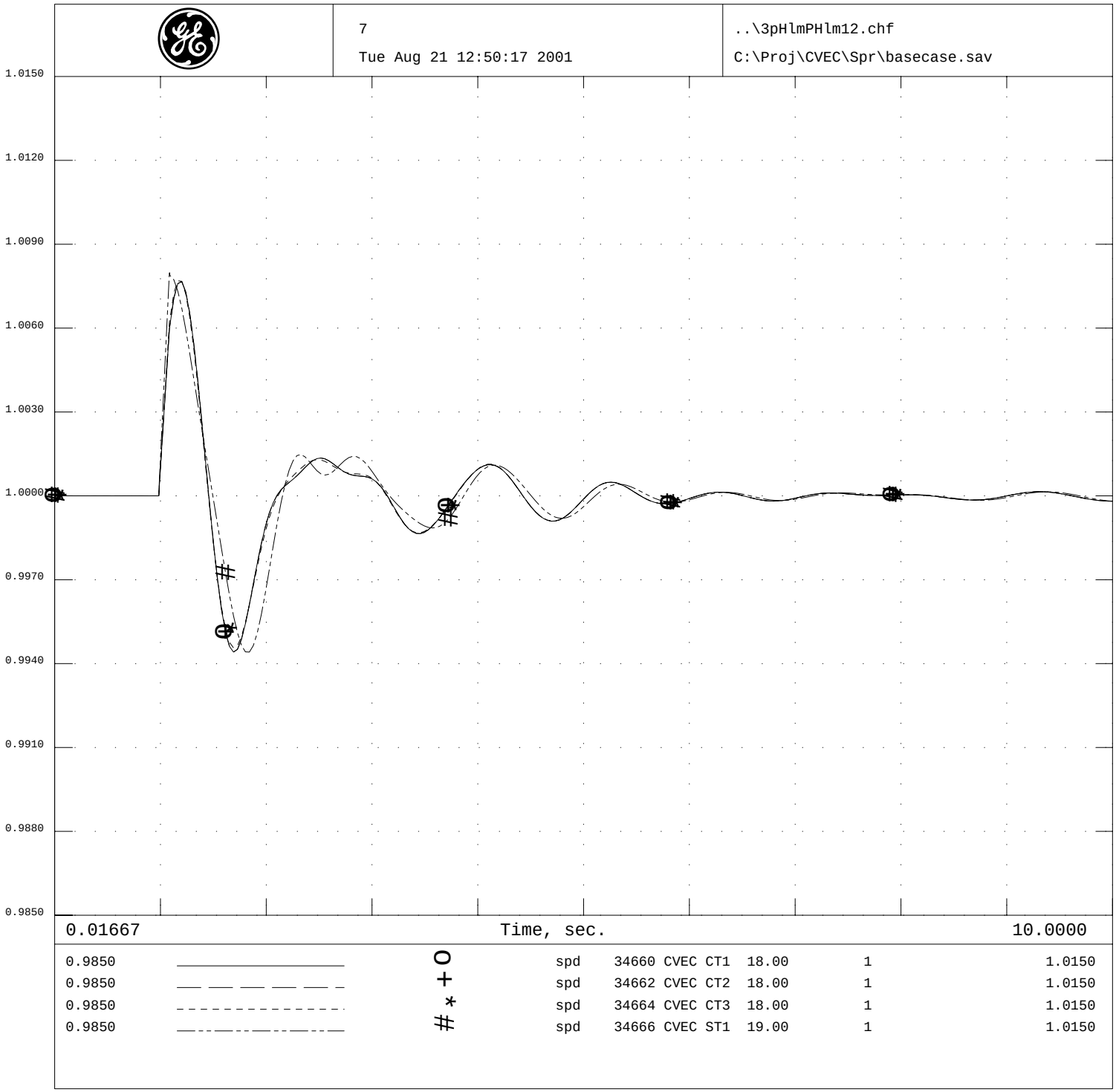

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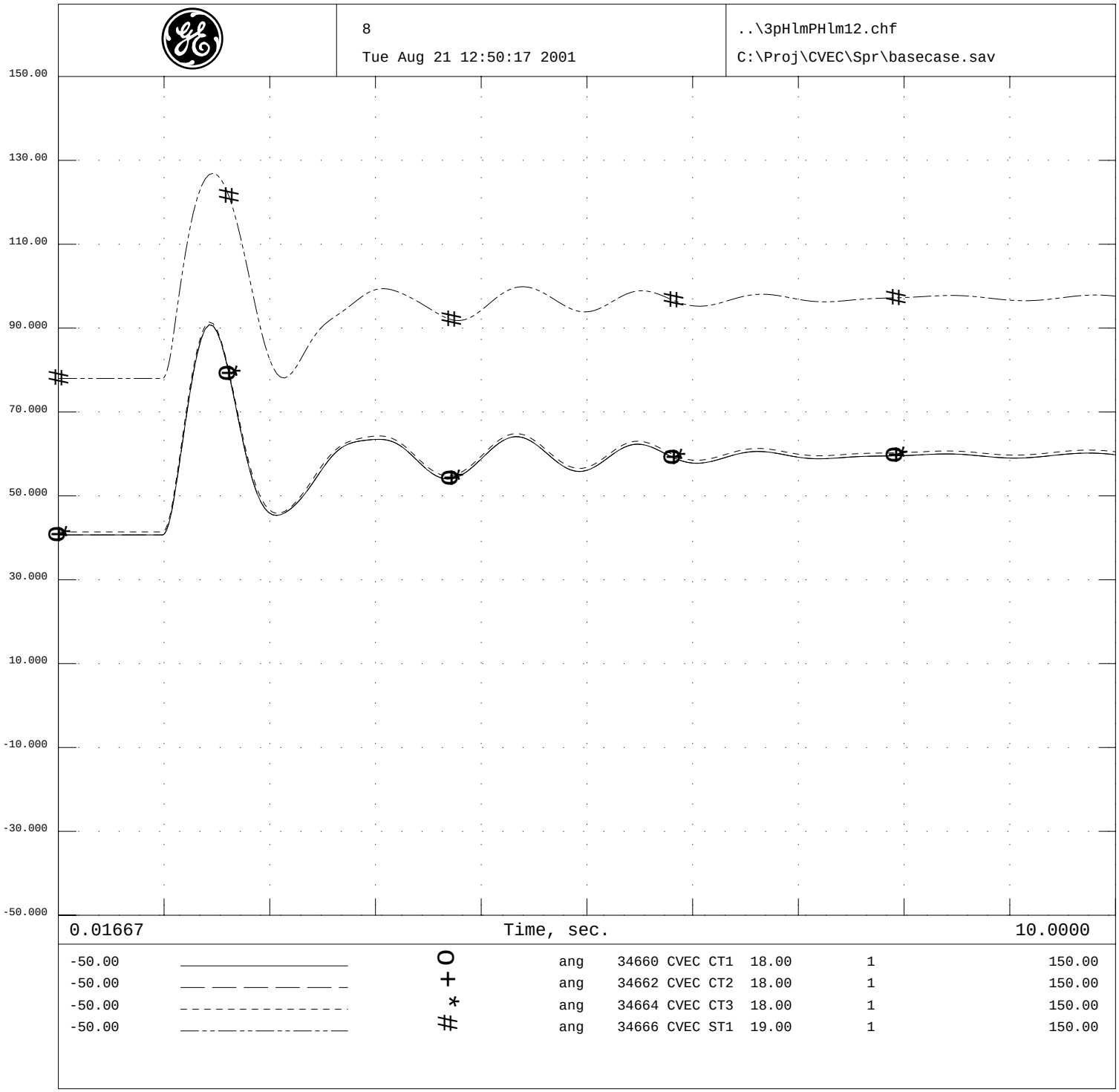
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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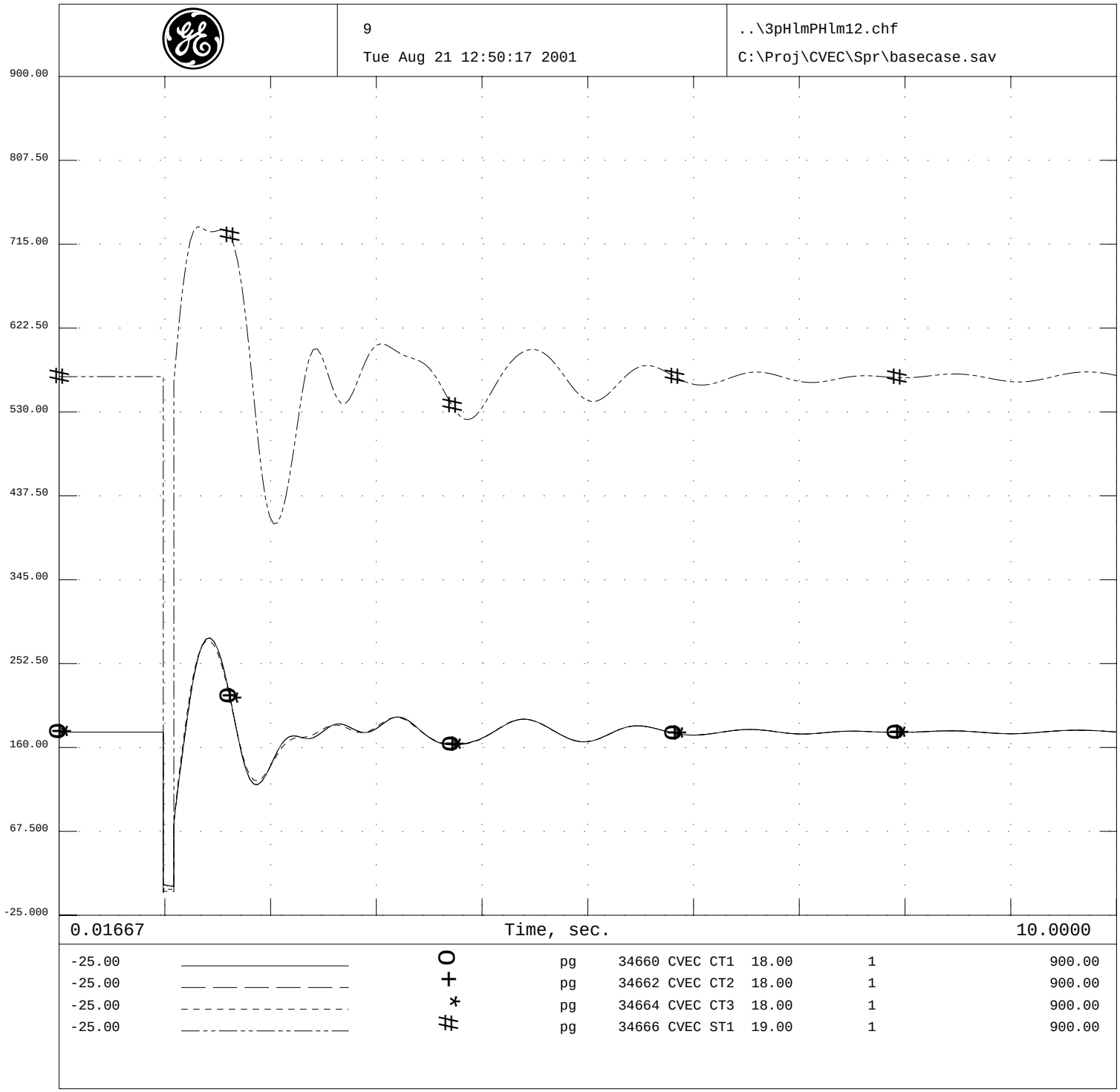
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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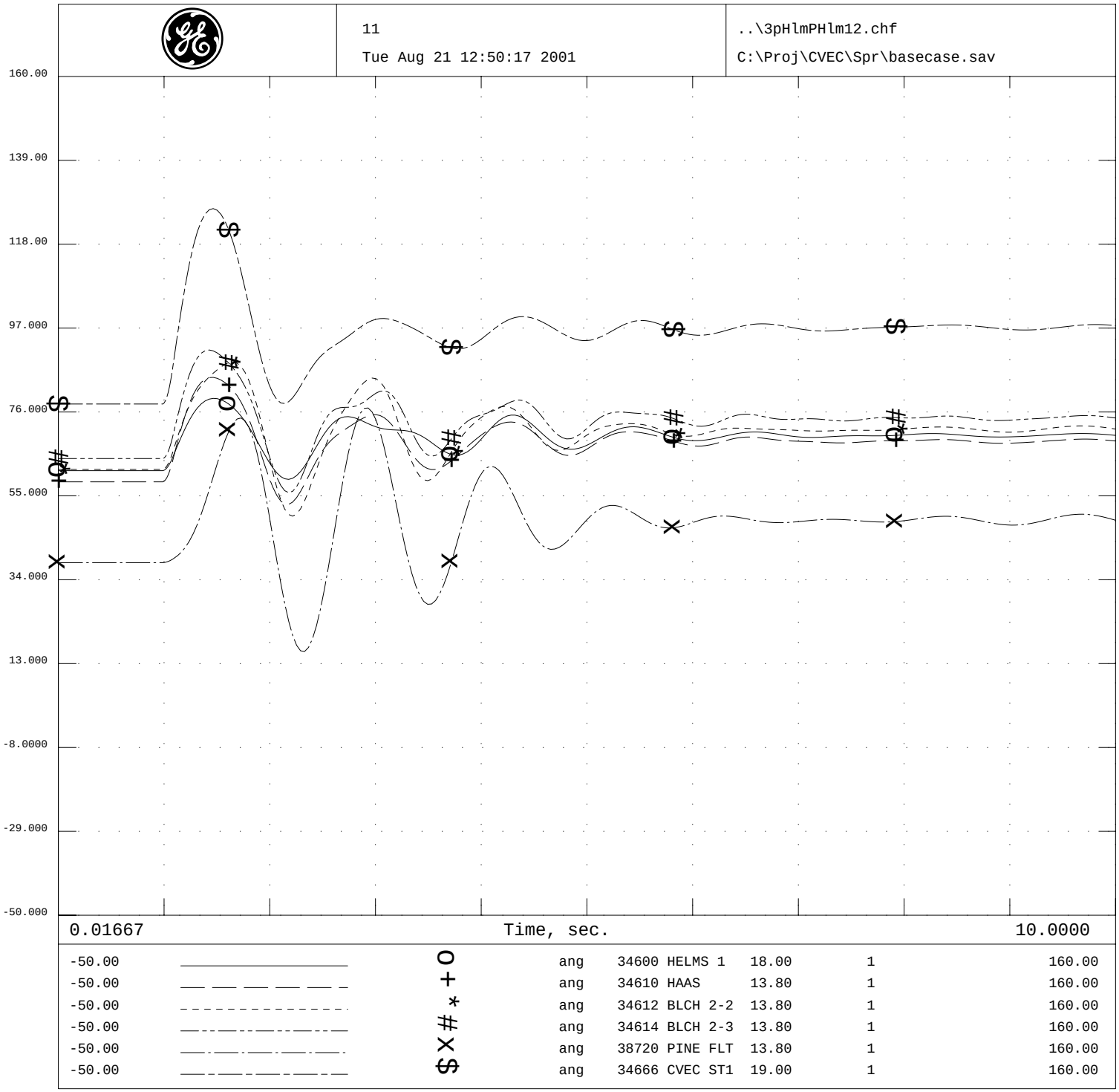
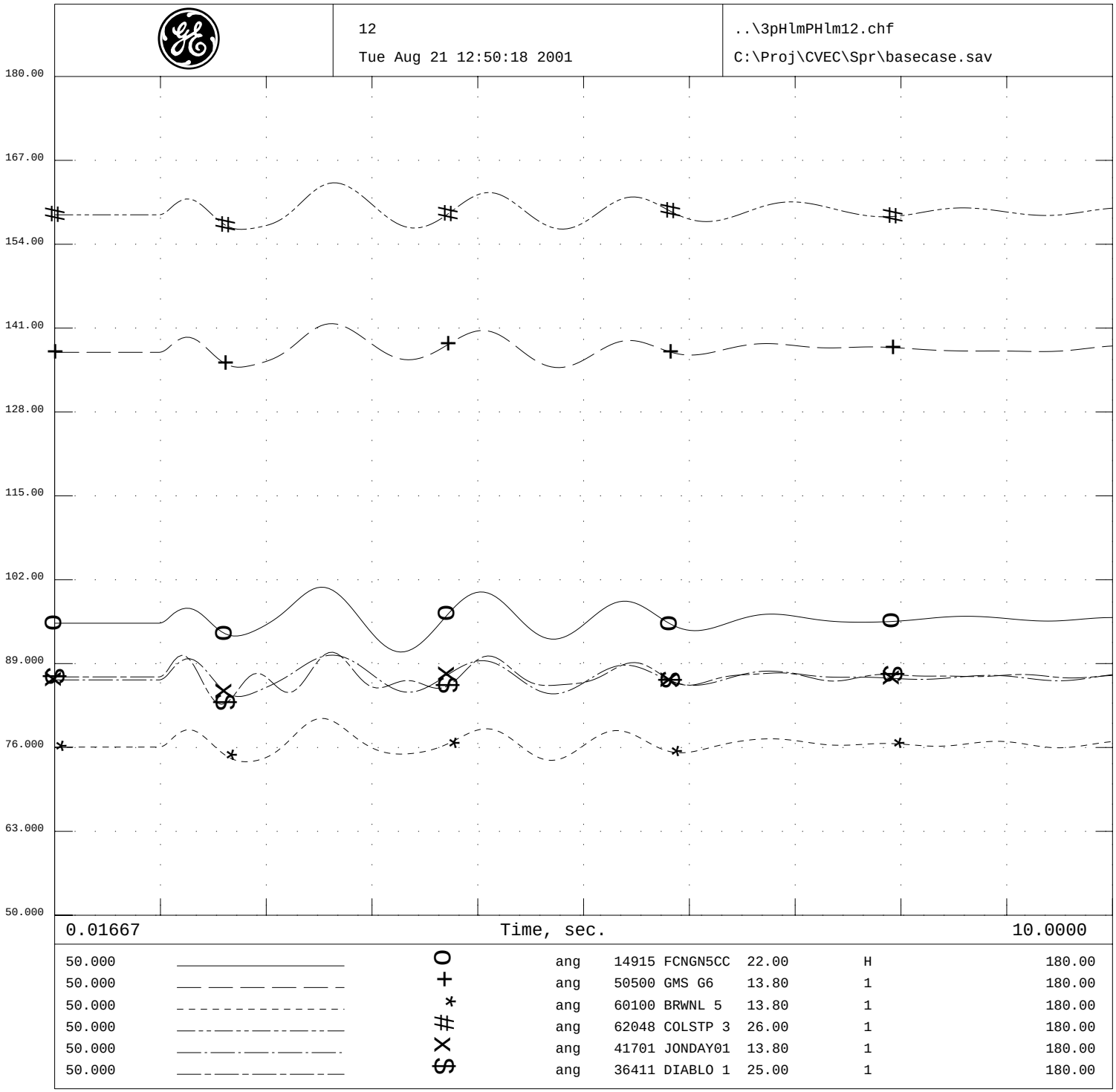
Calpine Corporation
Project Generator Terminal Power



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Helm-Panoche #1,2 230kV Double Outage
3 phase 6 cycle fault at Helm 230kV bus and trip both Panoche-Helm lines

Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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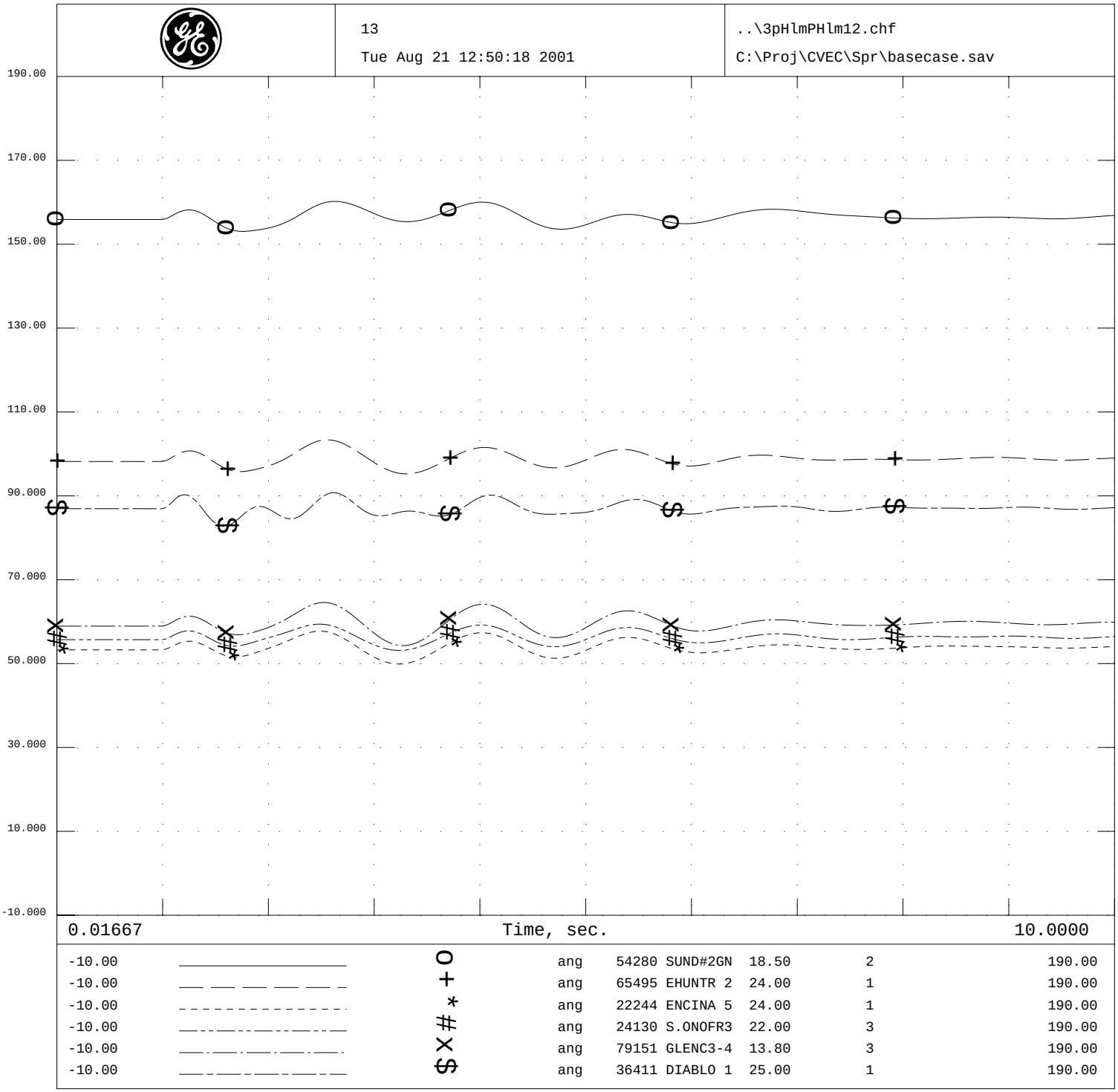
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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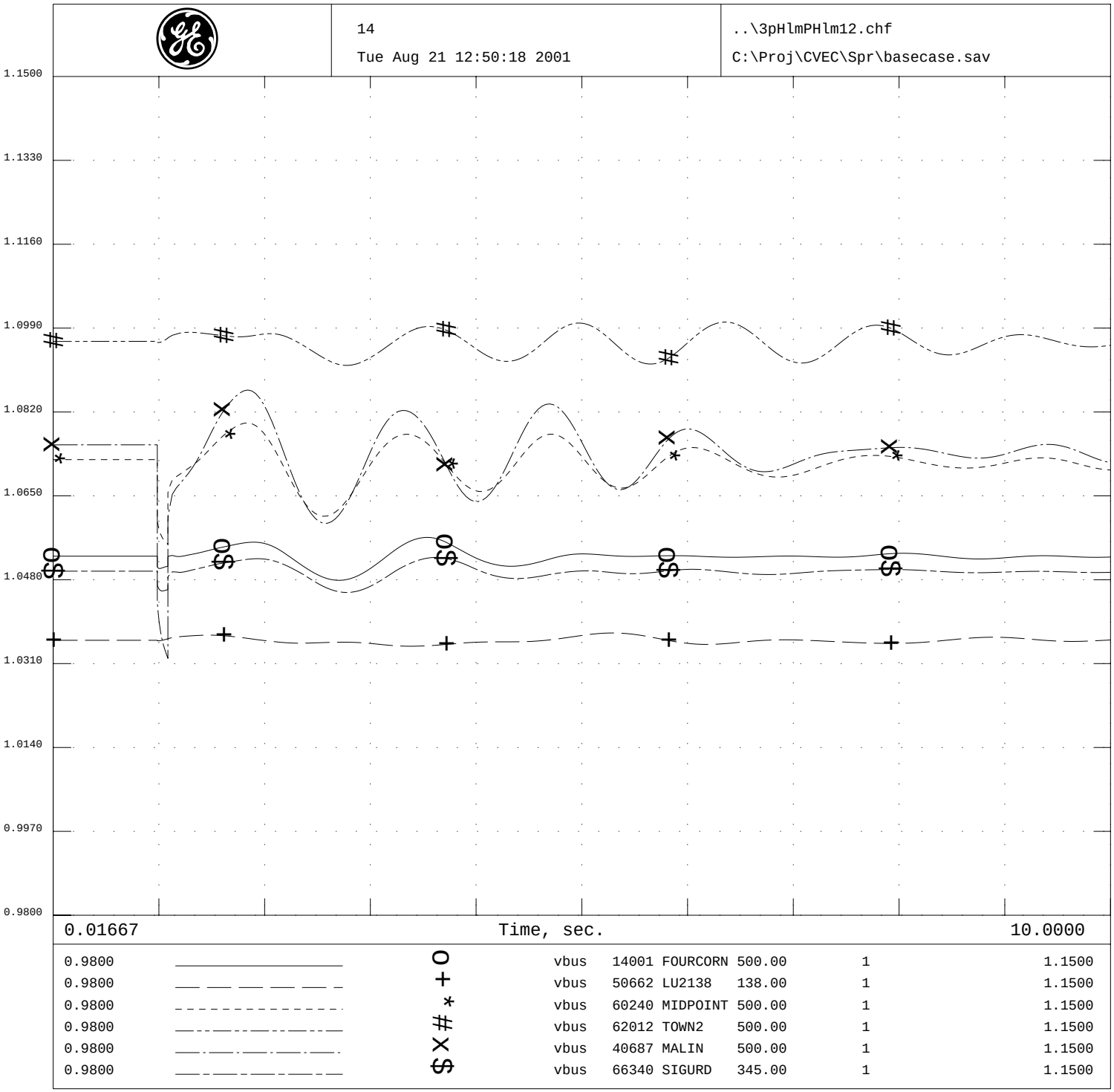

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Calpine Corporation
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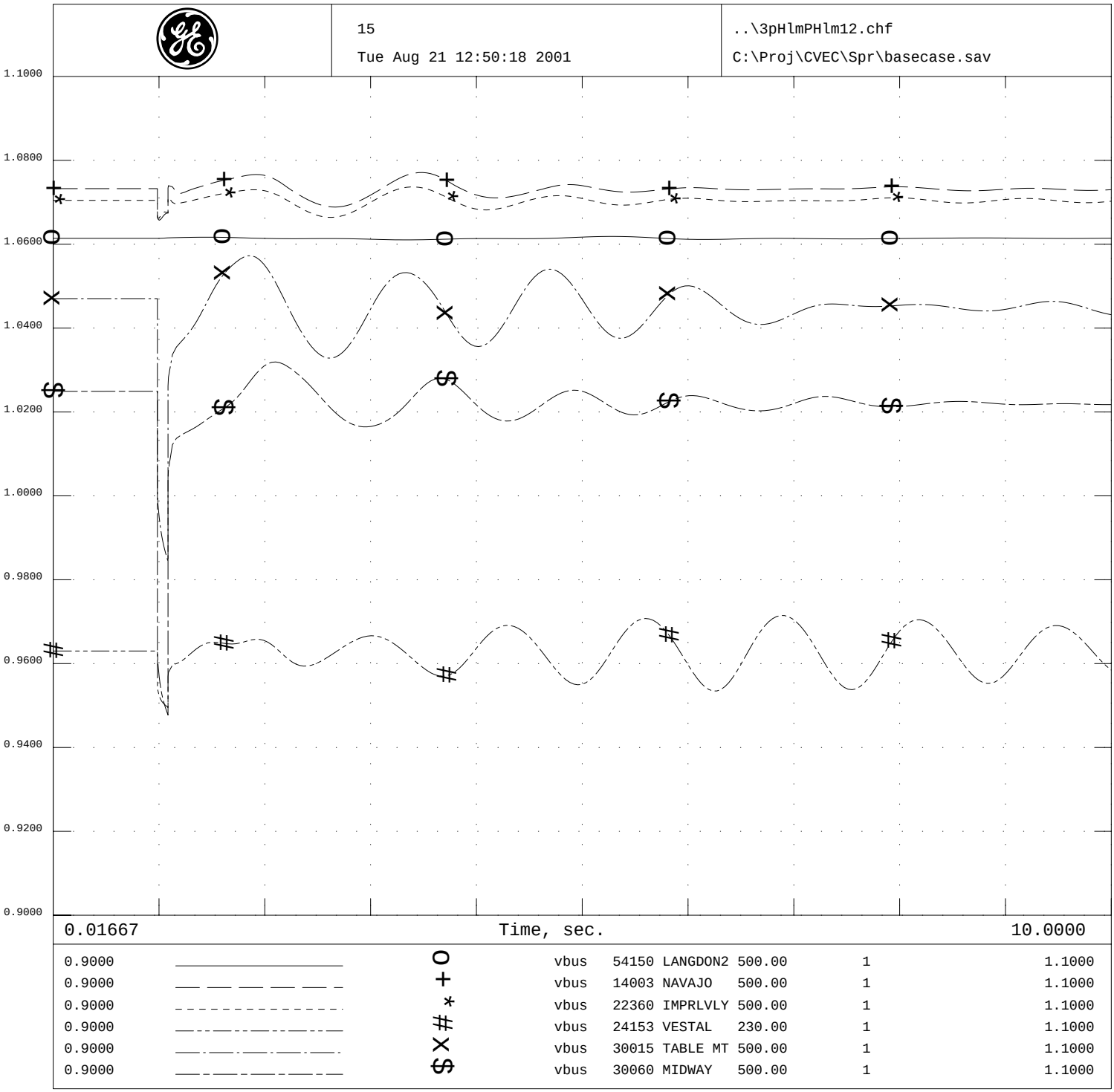

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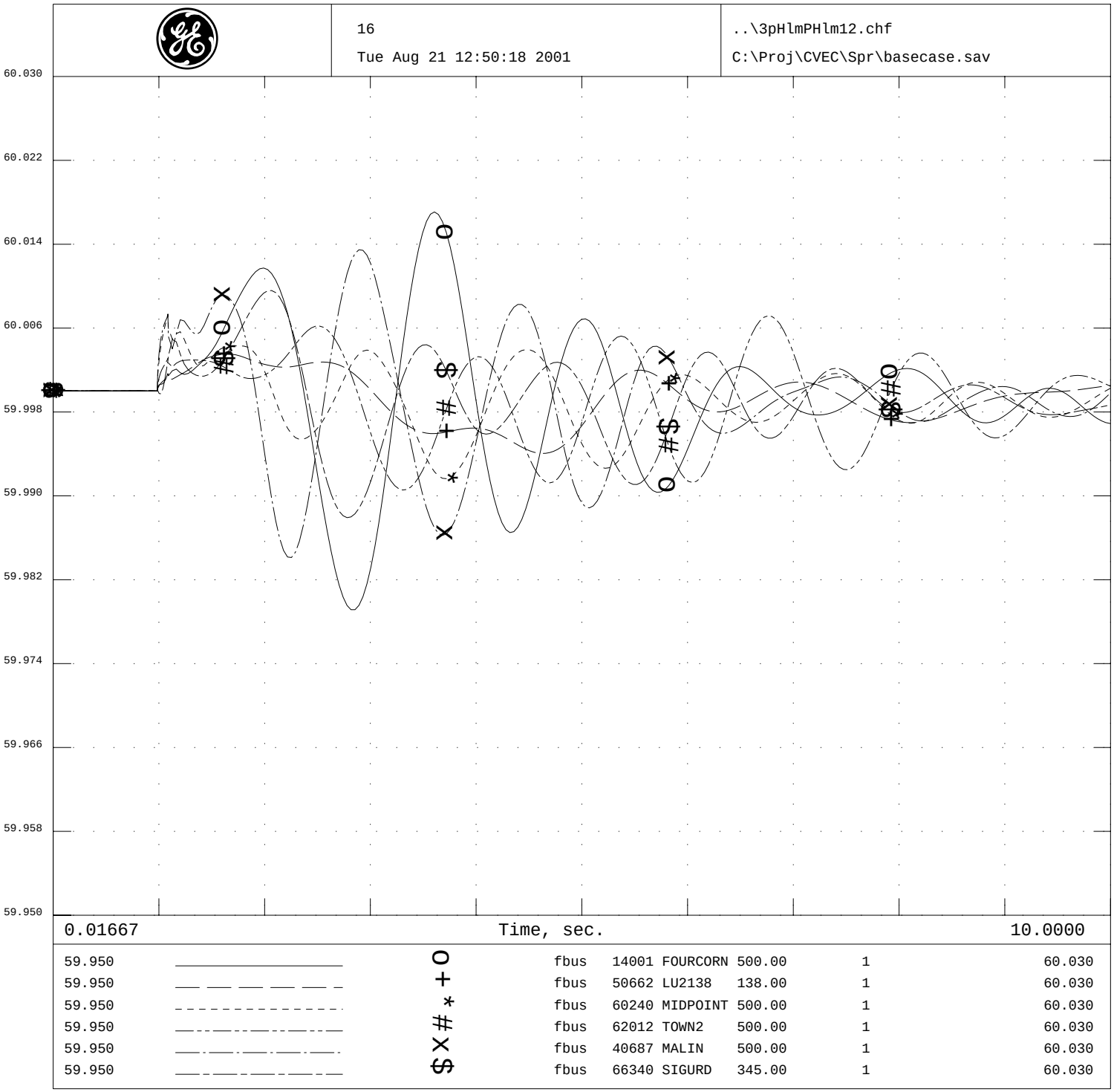

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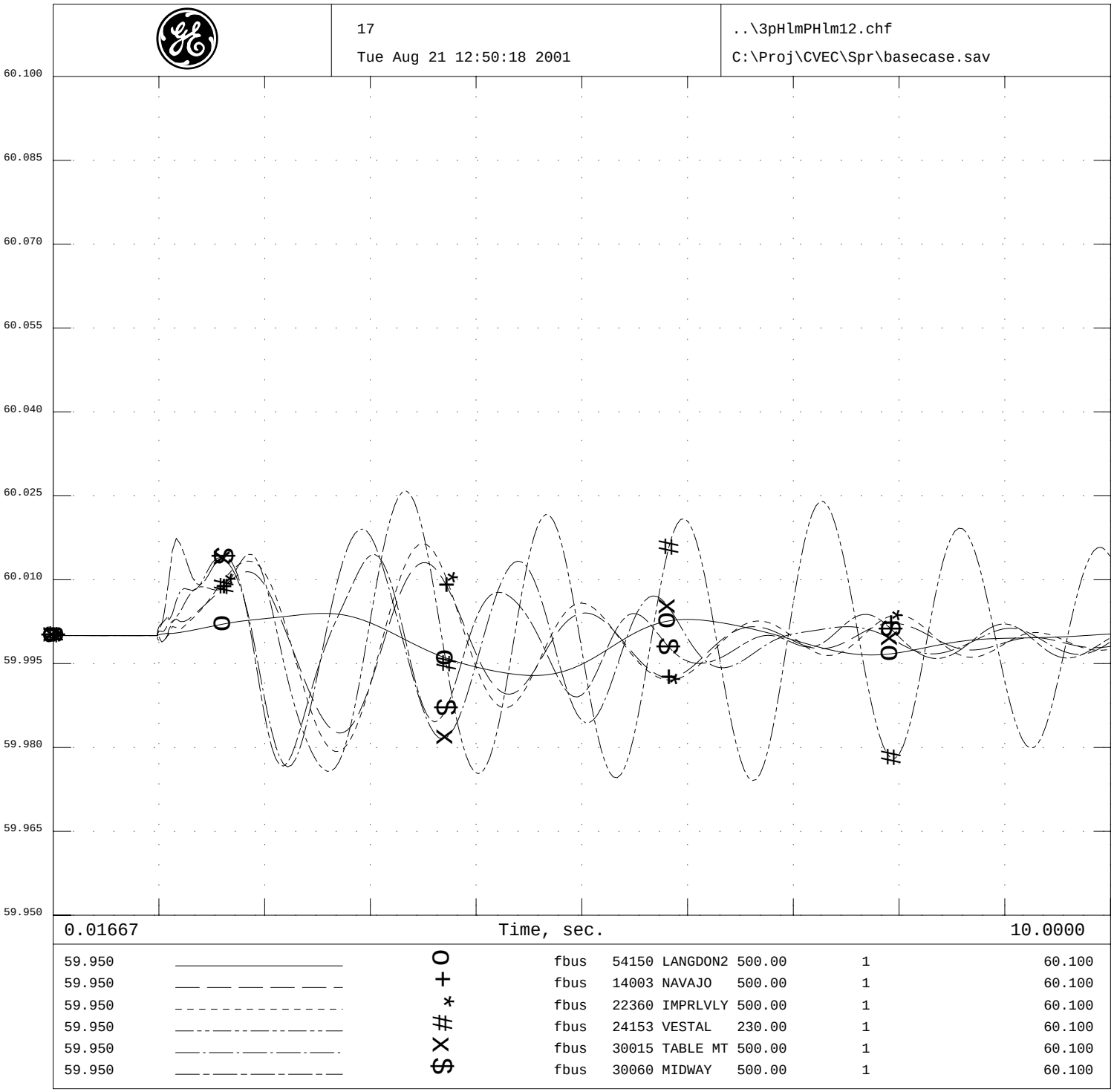
Selected WSCC Transmission Bus Frequency Plots



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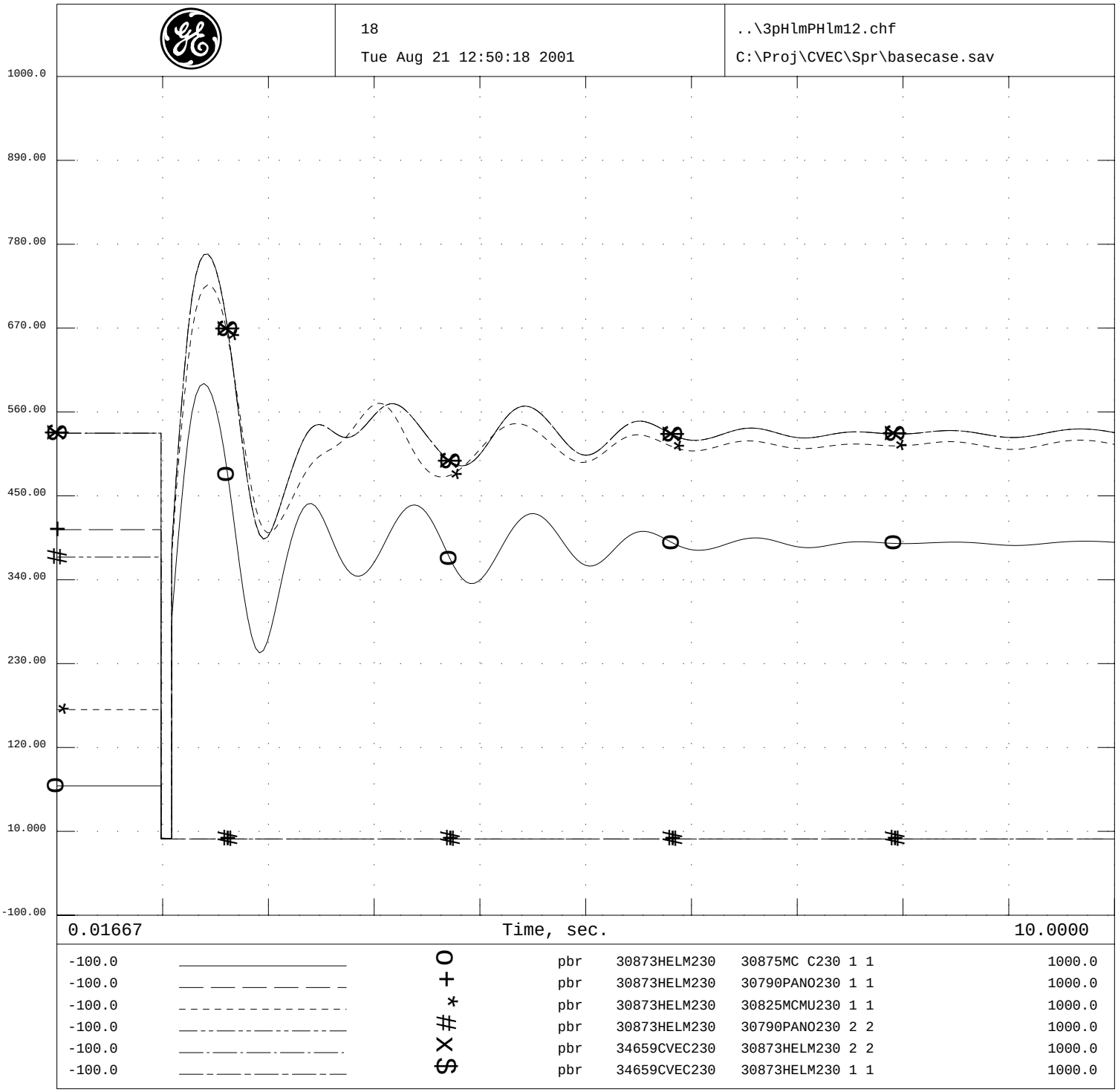

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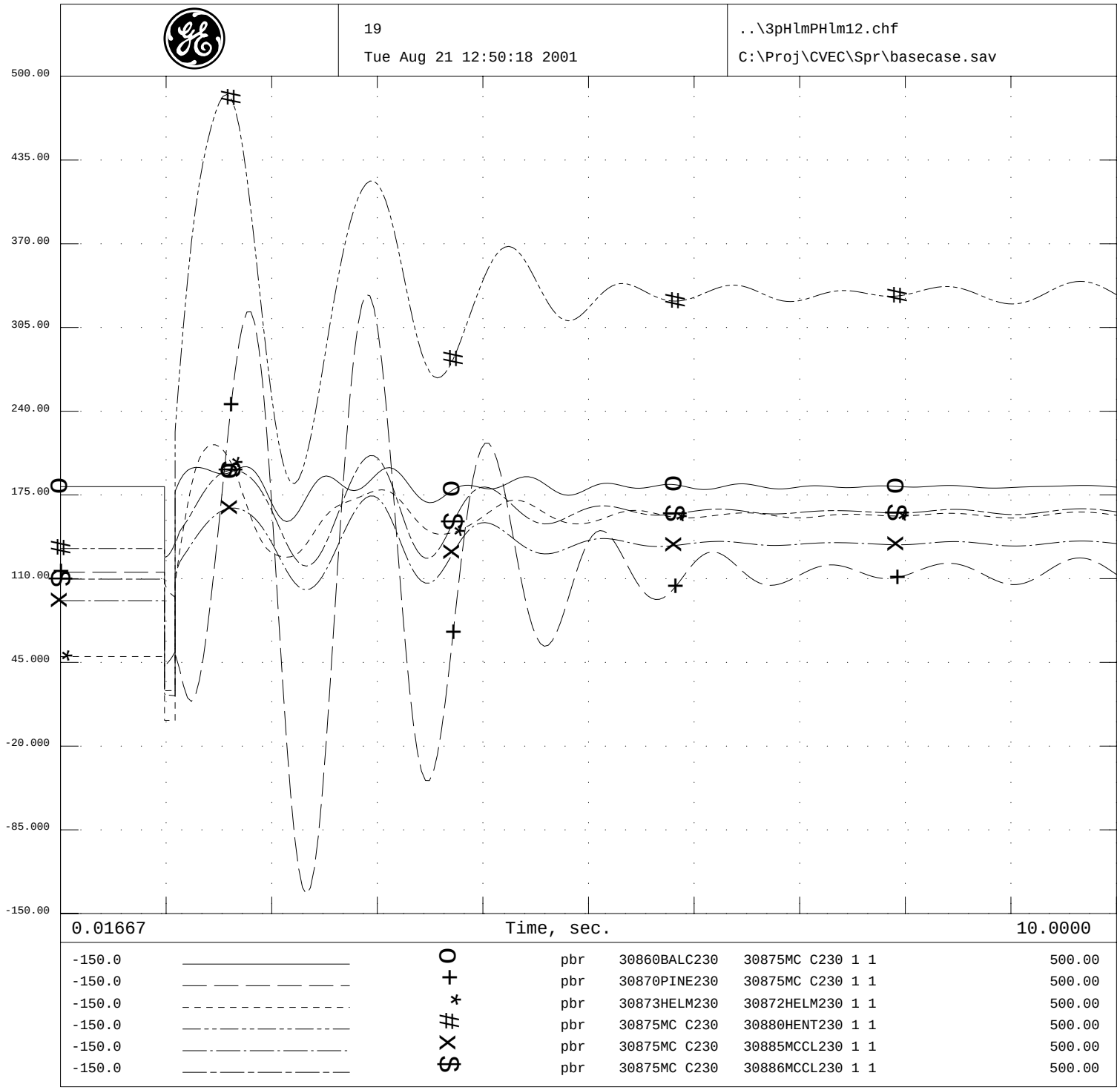
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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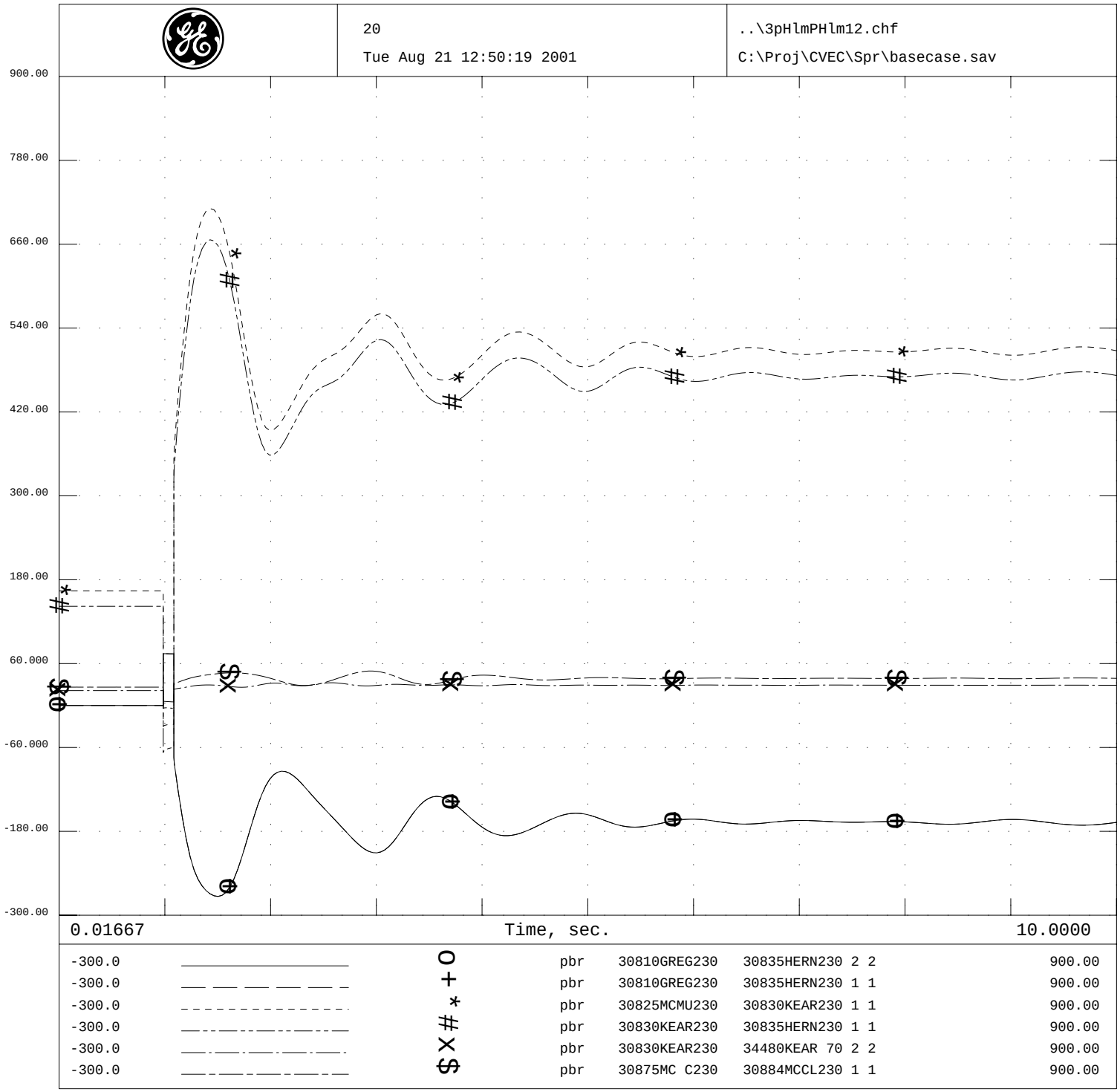

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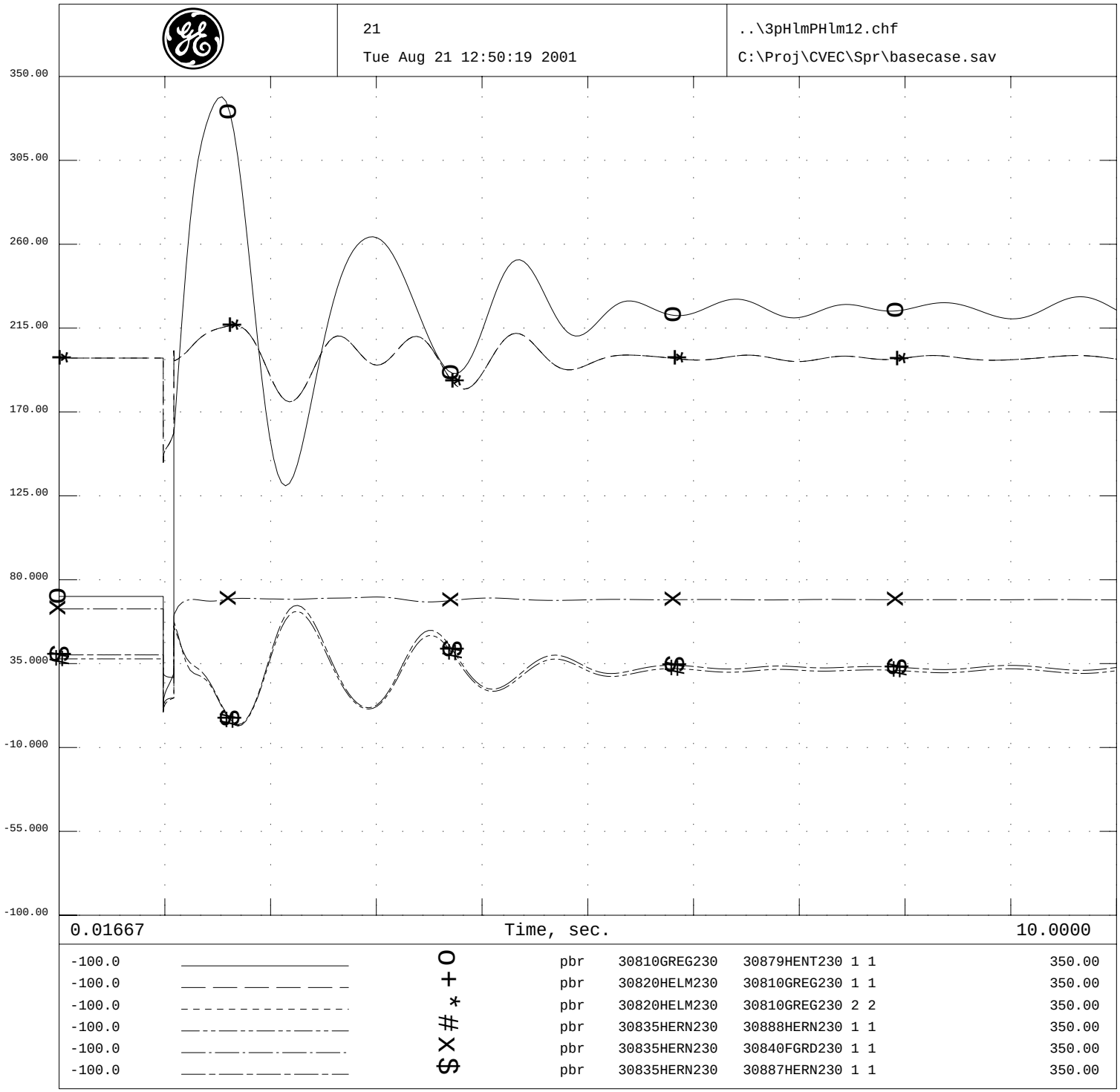

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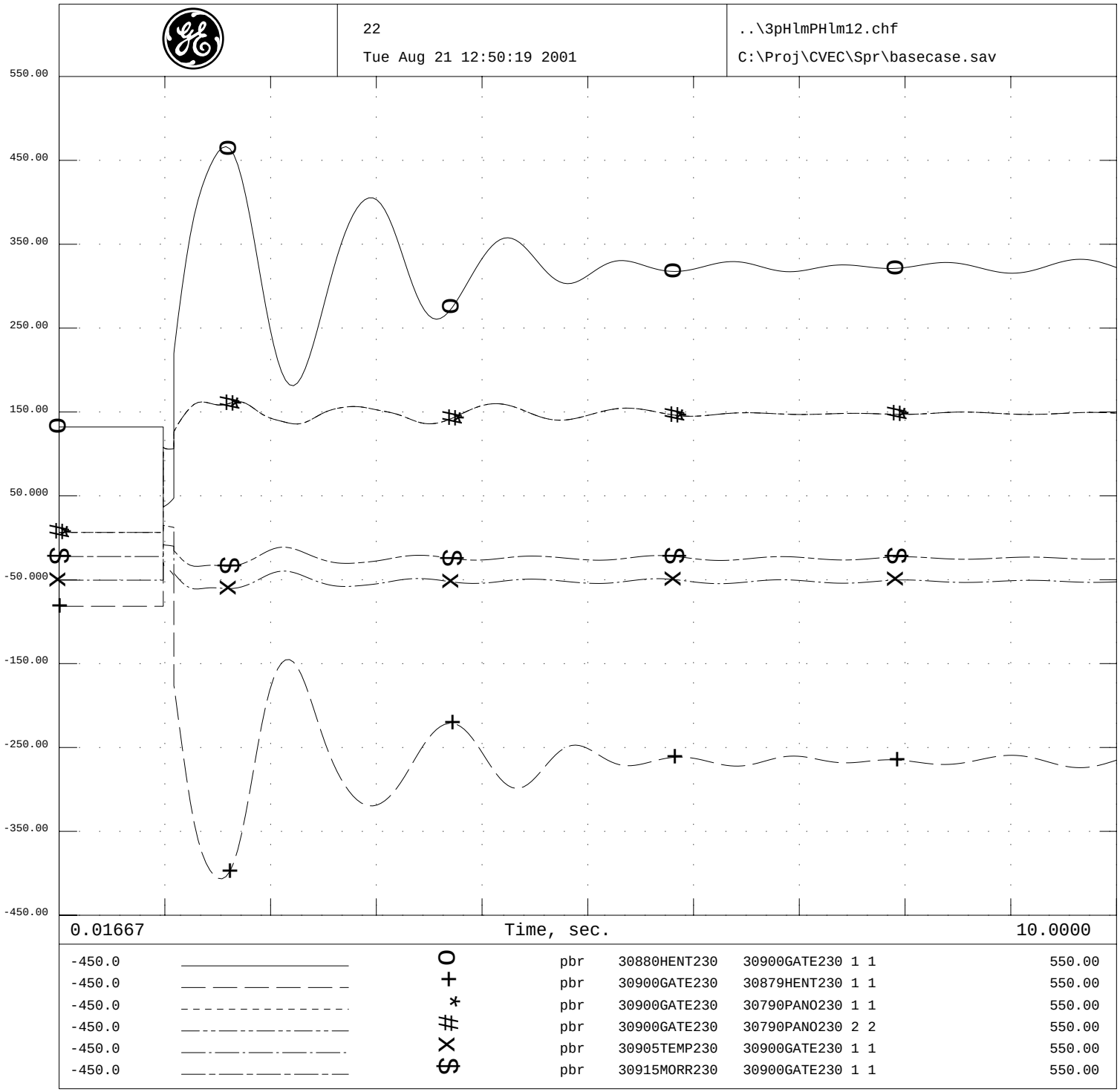

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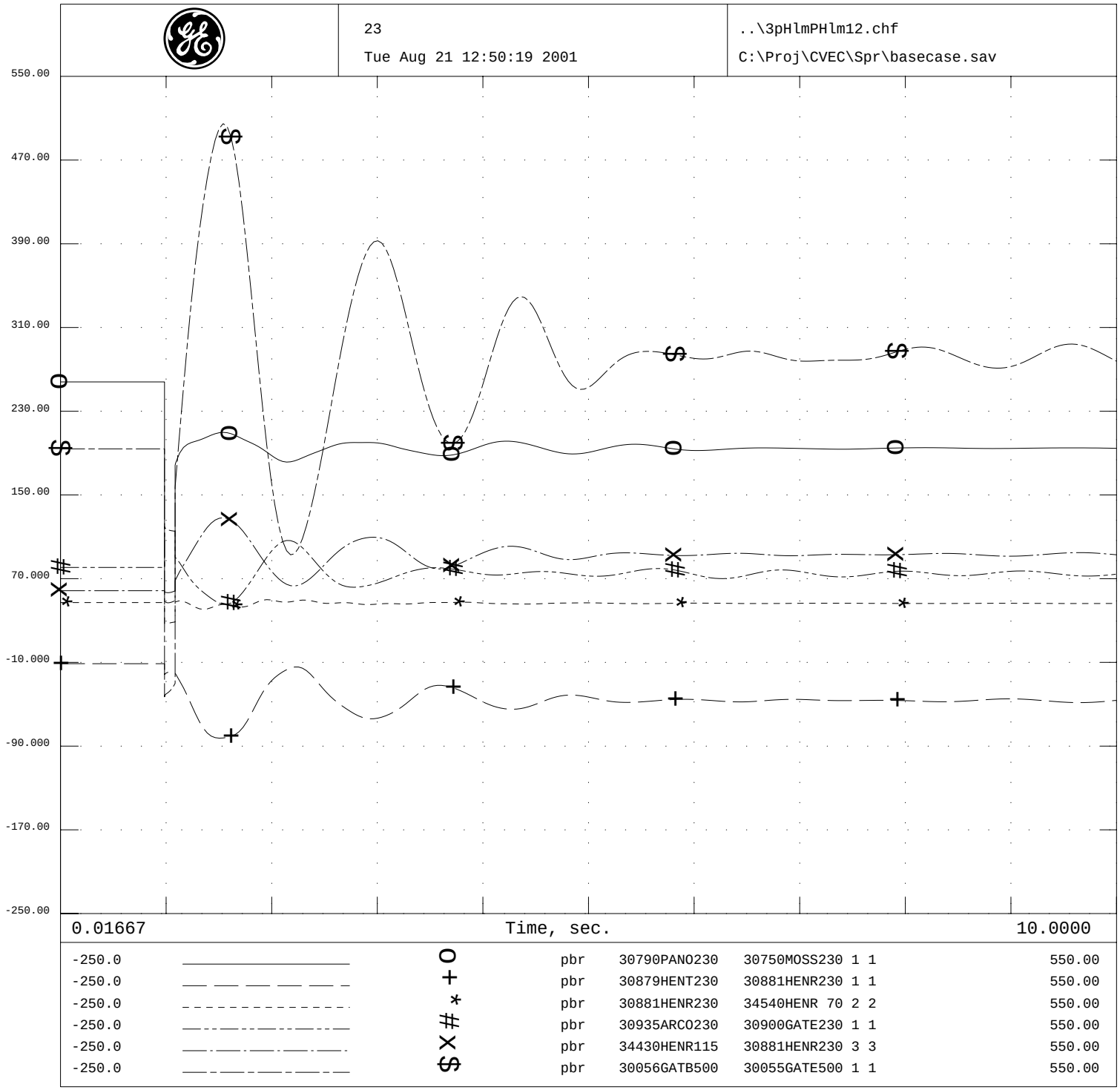

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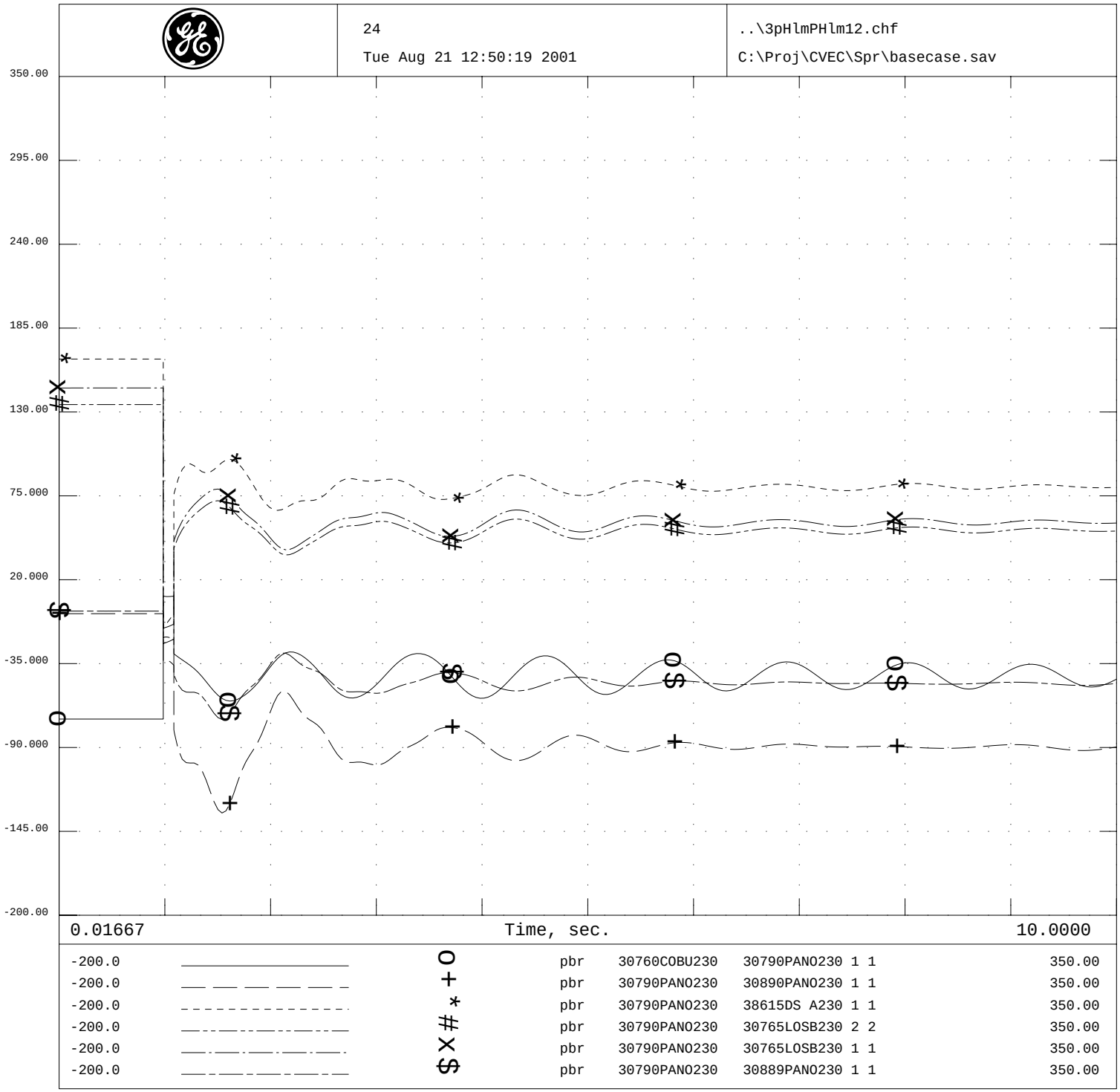

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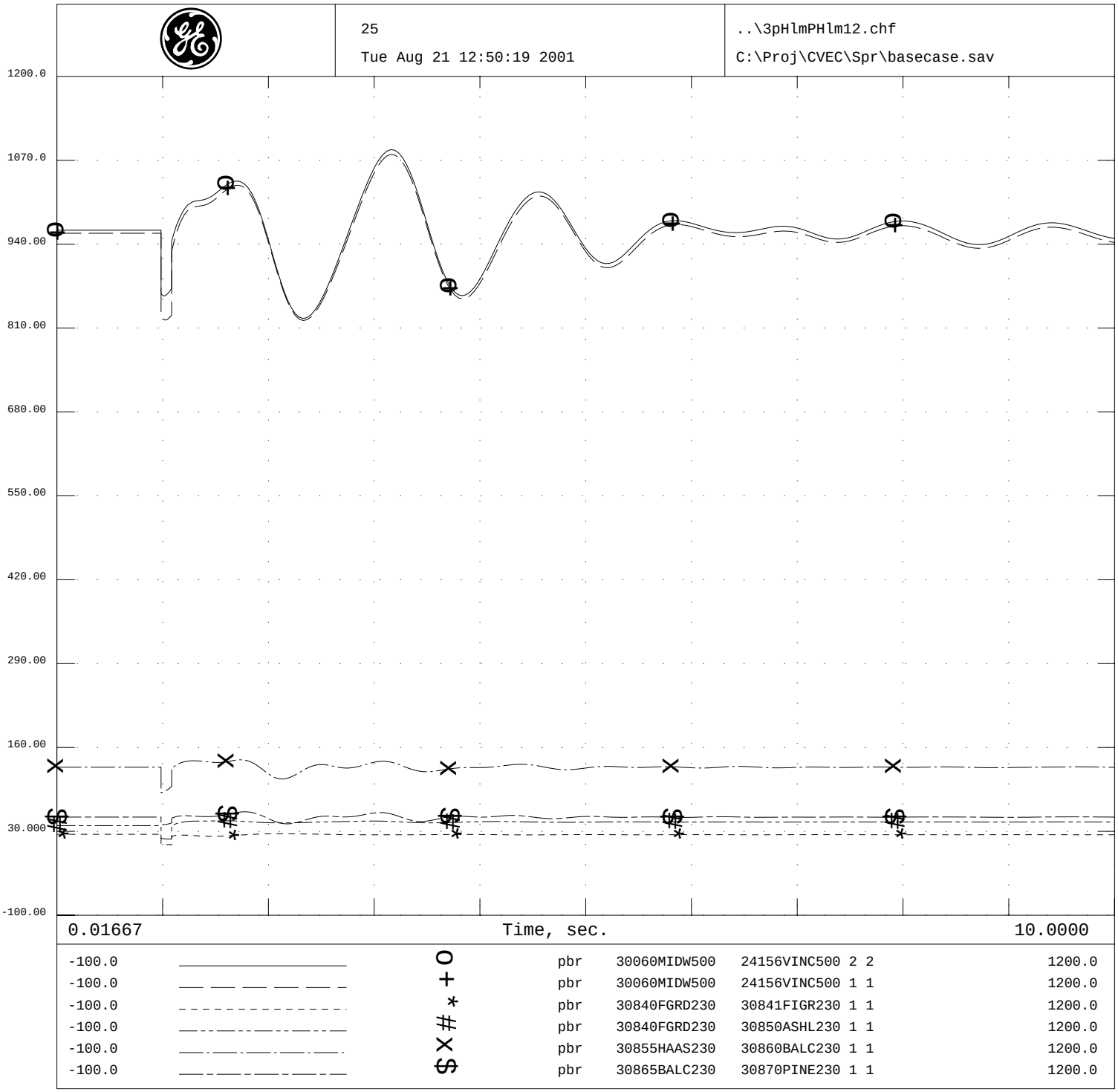

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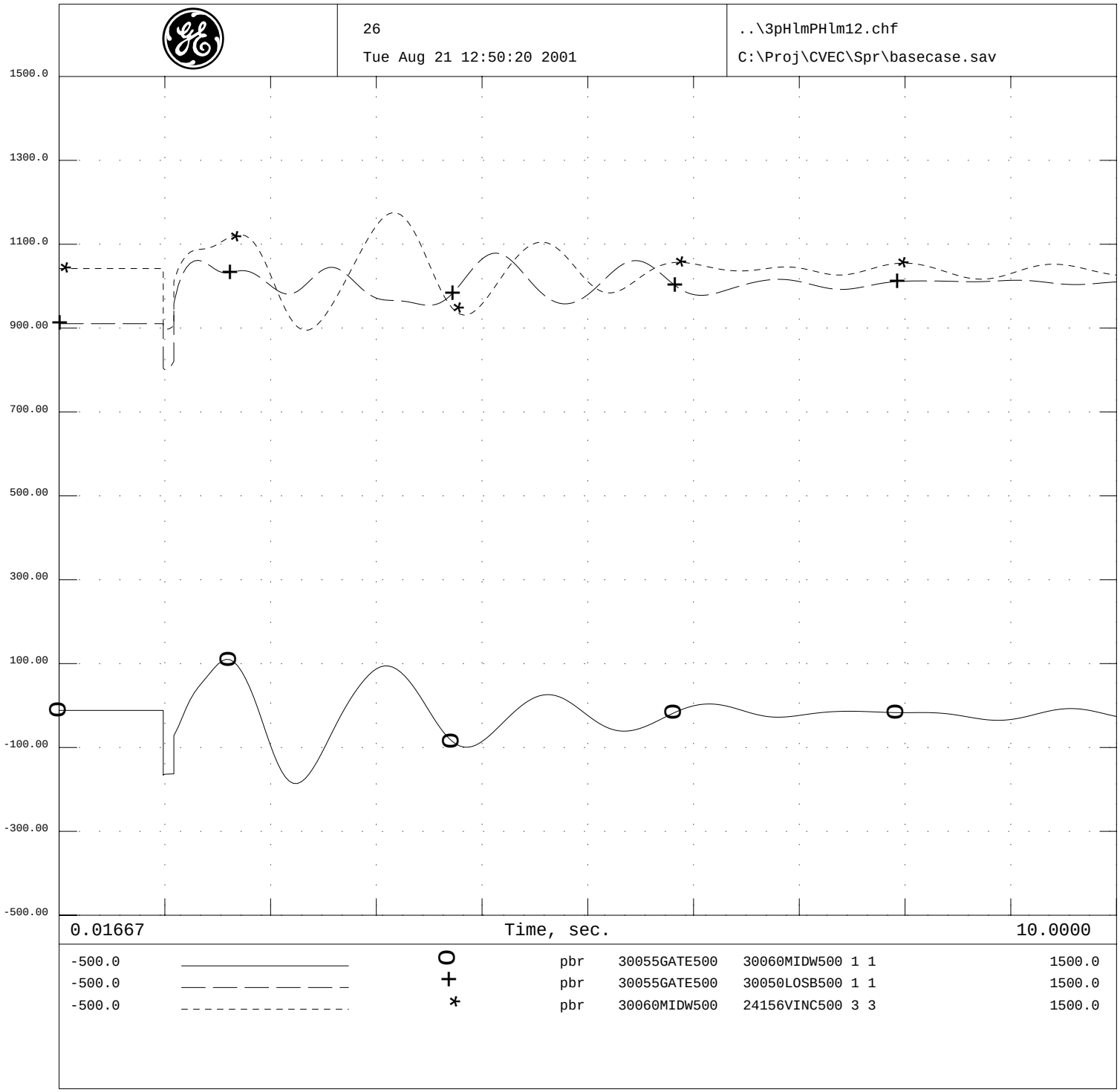

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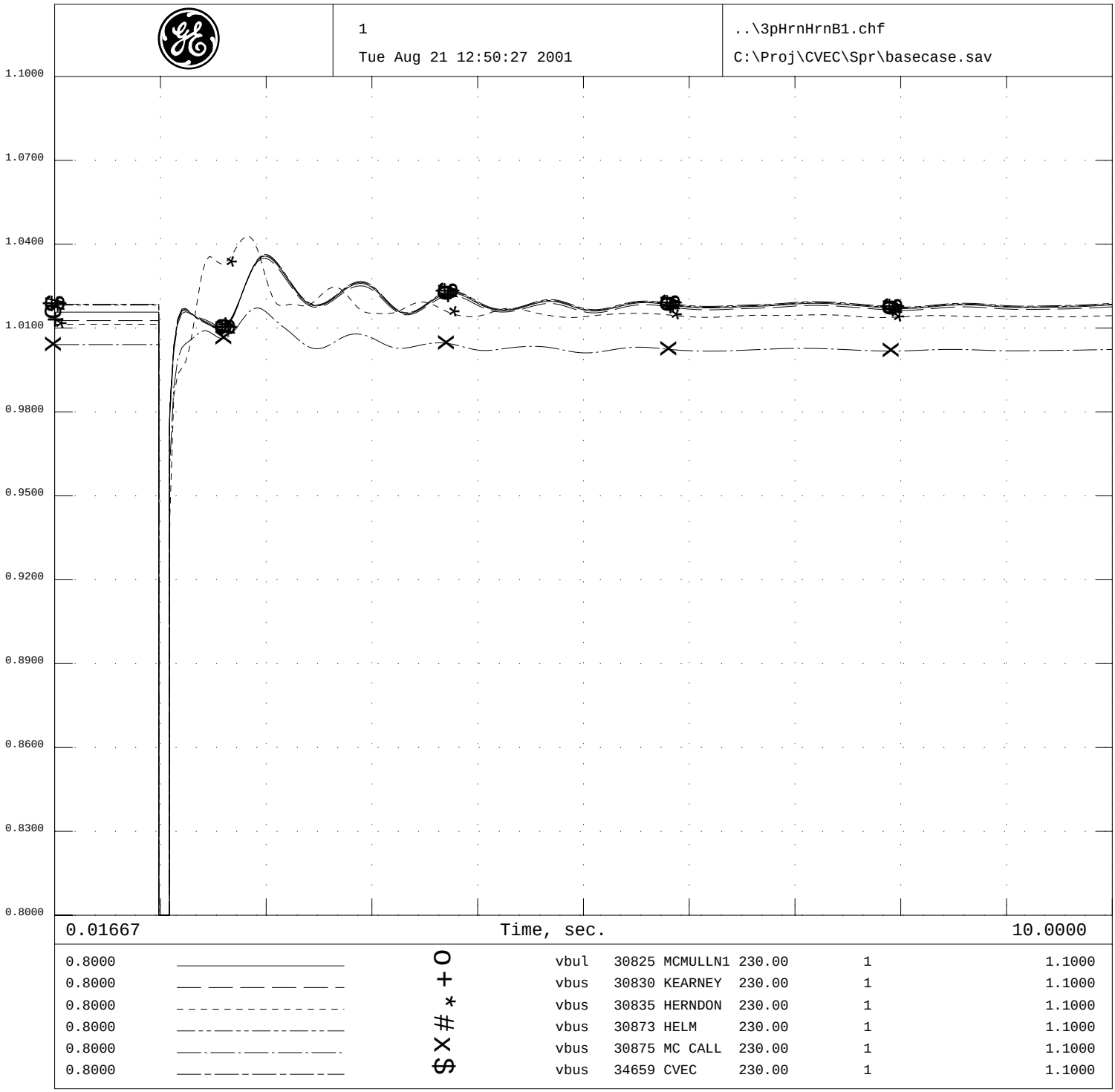

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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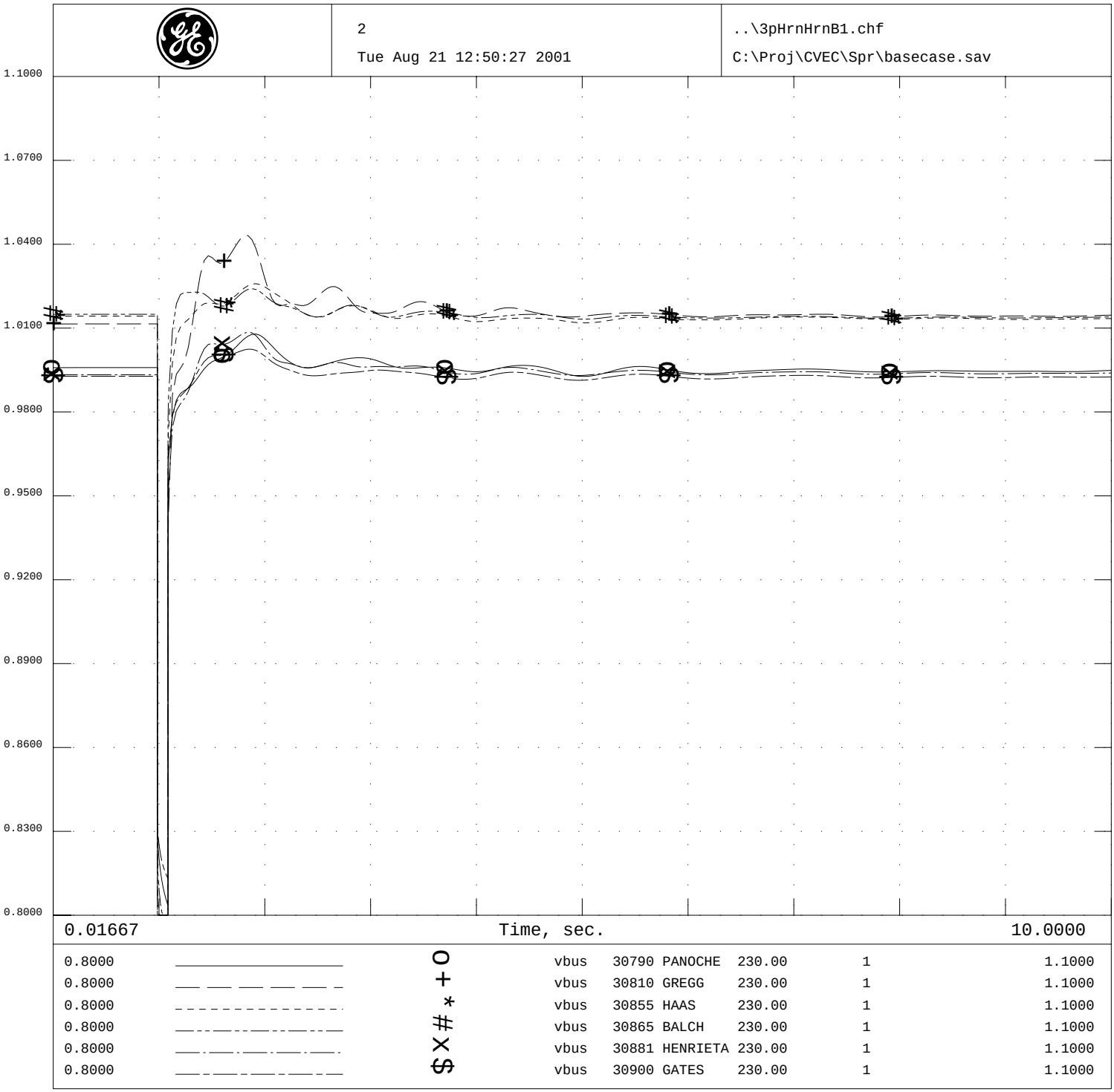
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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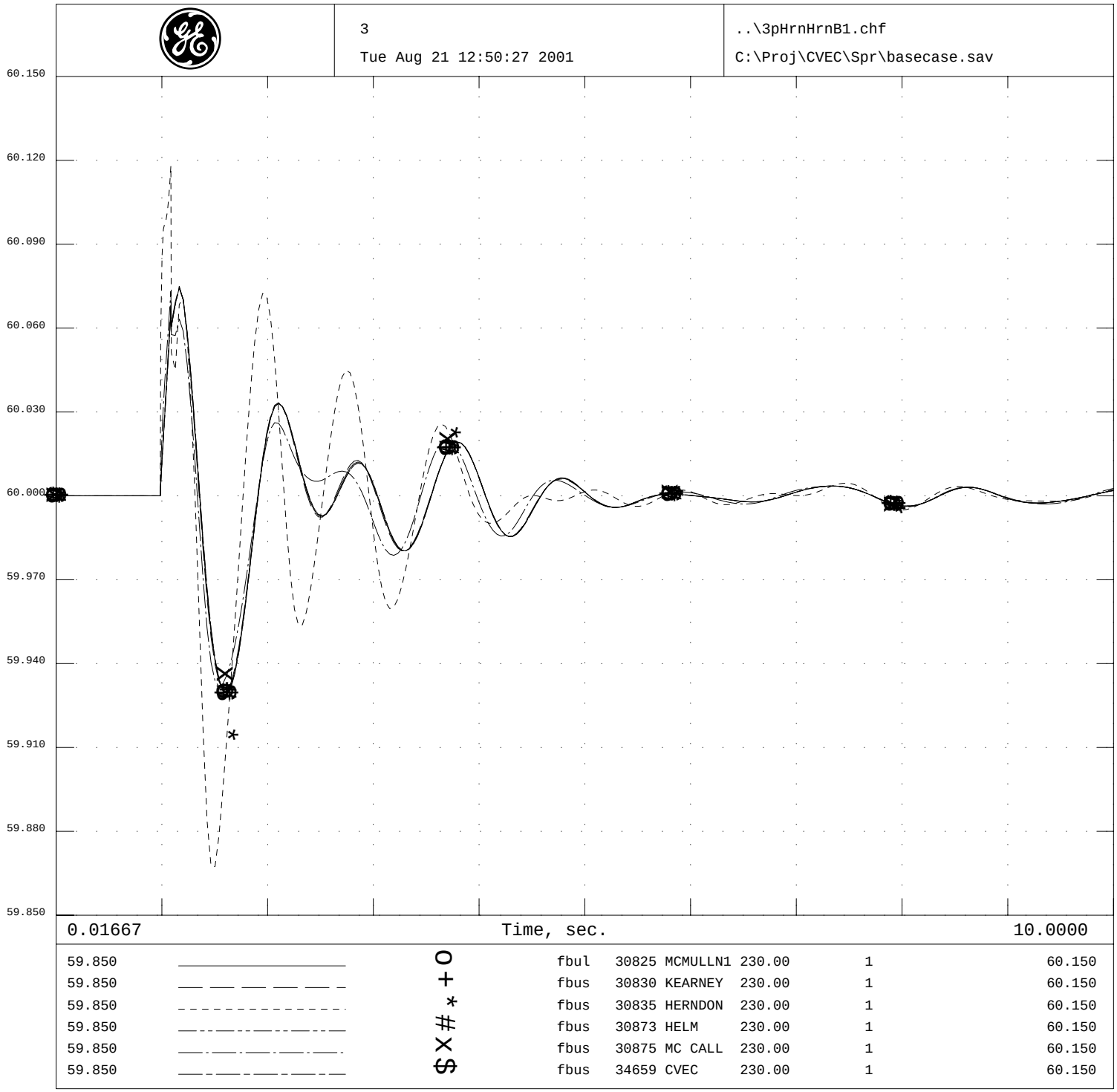

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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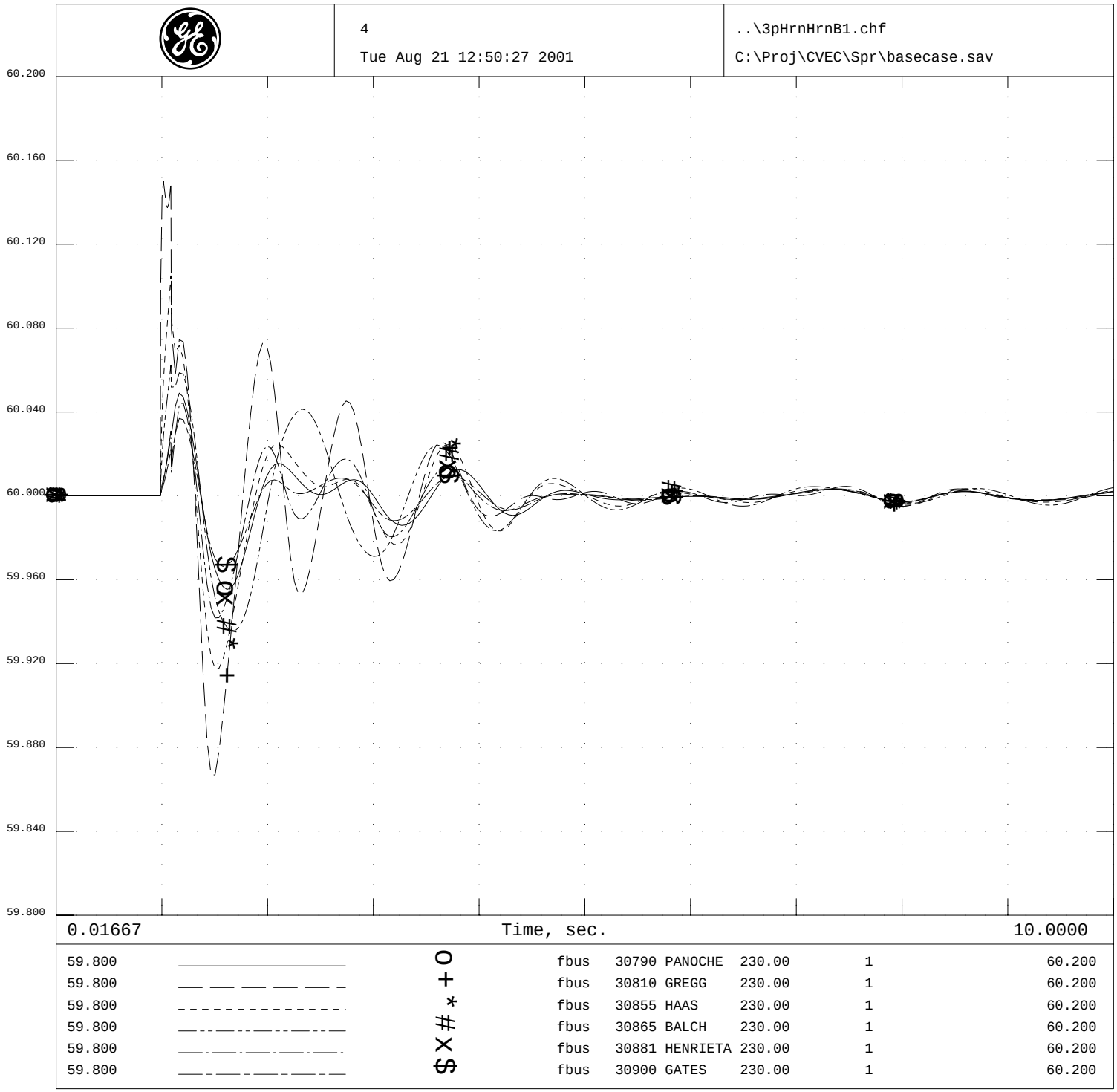
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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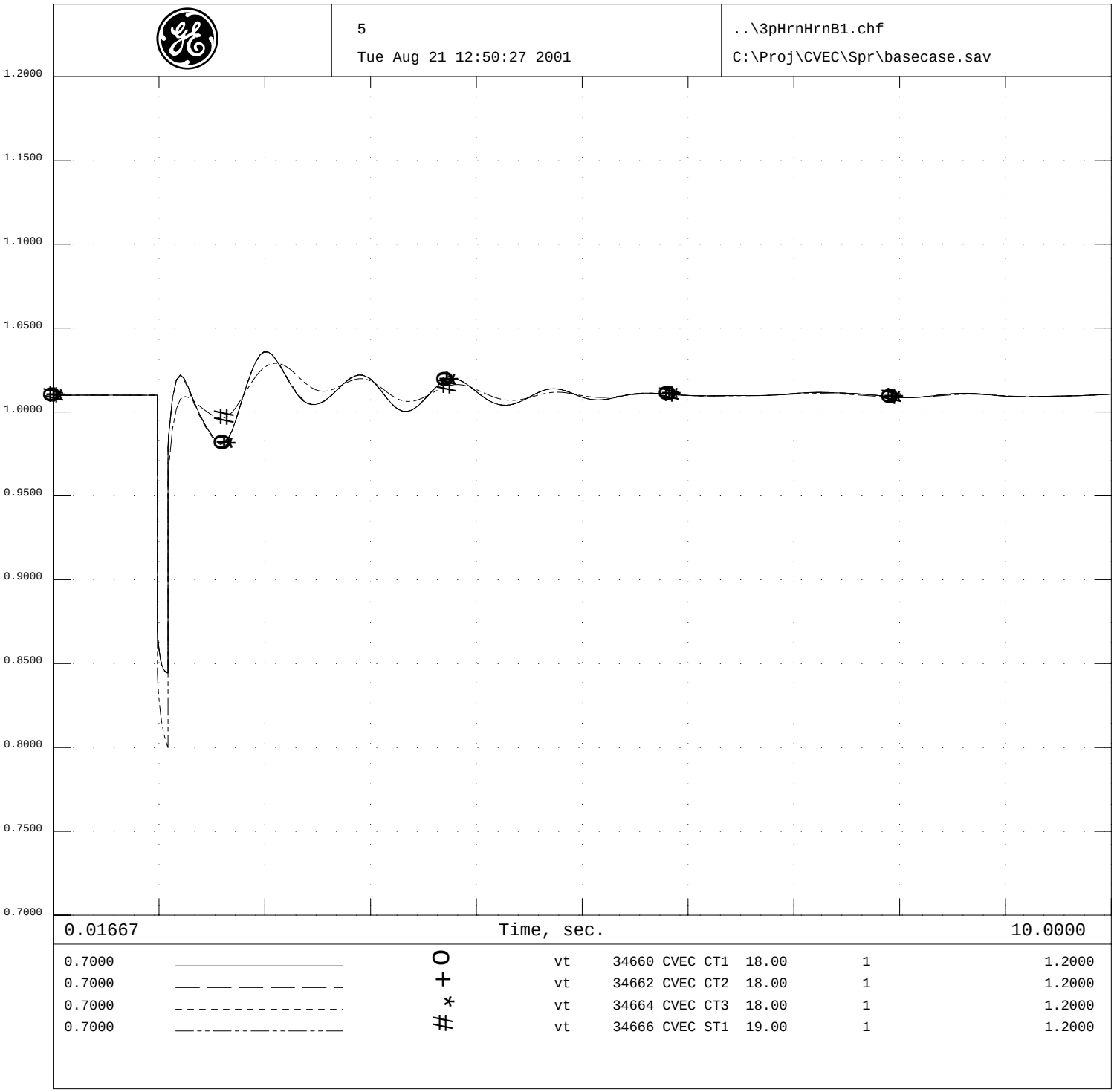

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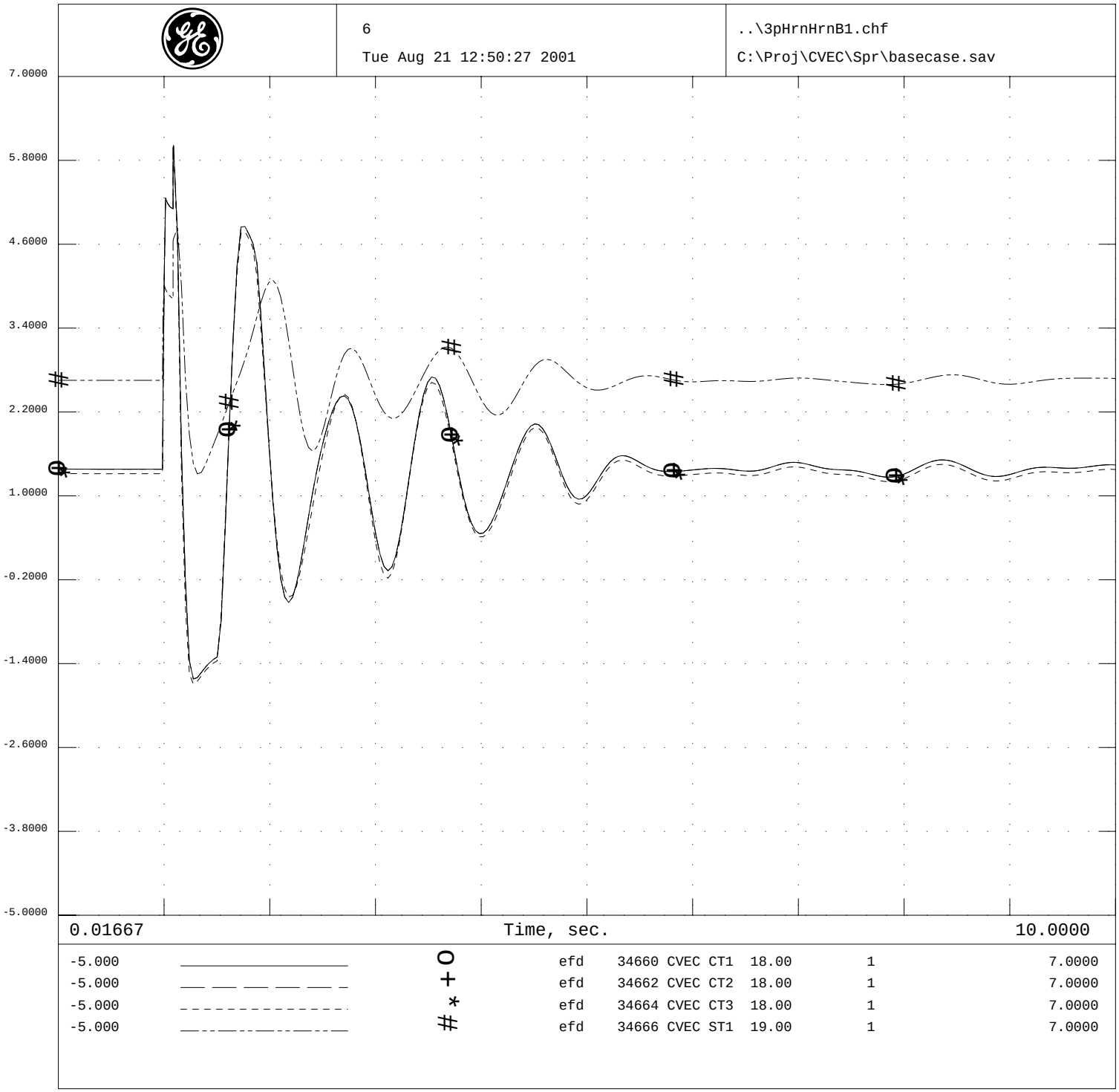
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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2004 Heavy Spring Base Case
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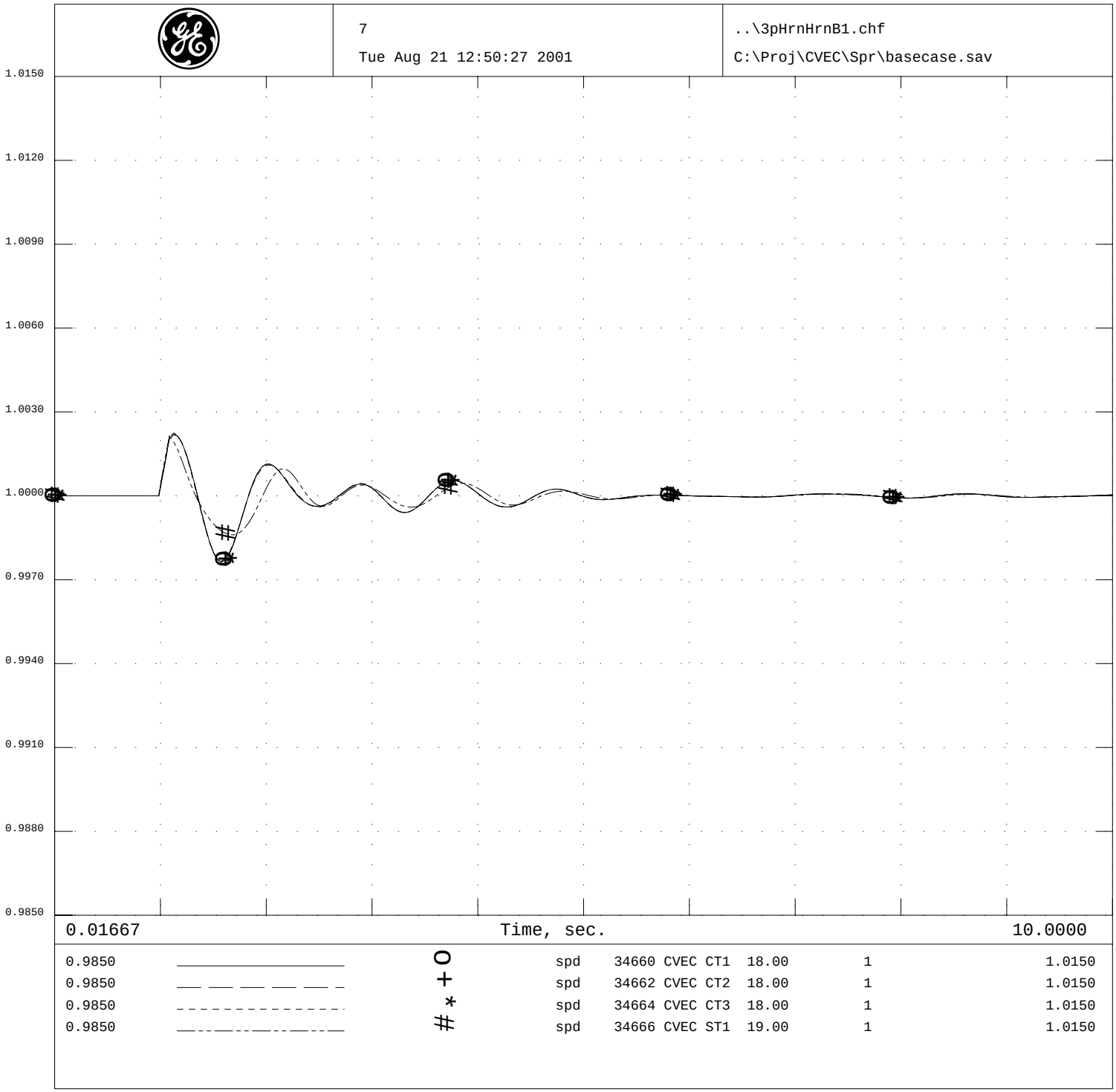
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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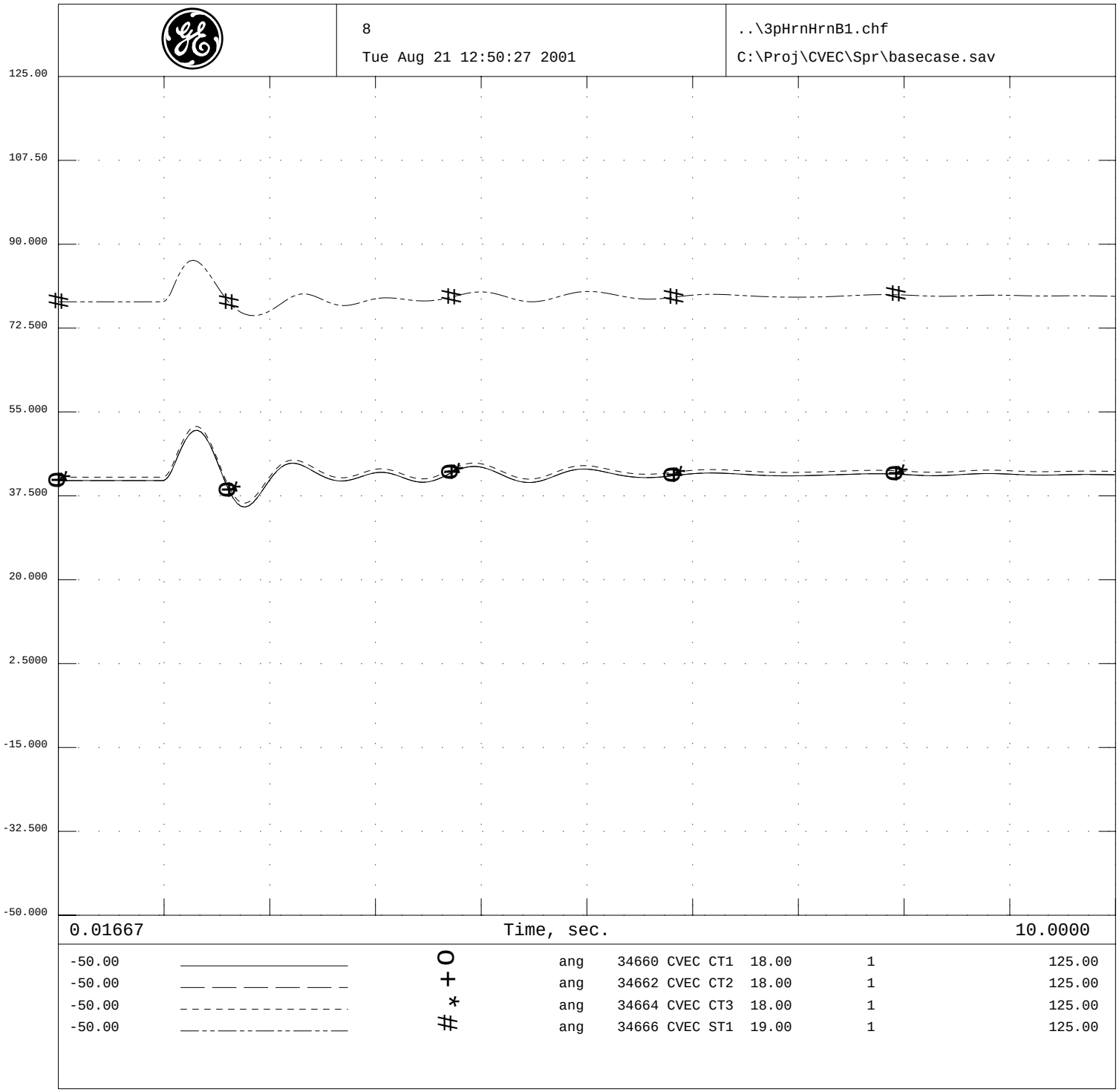
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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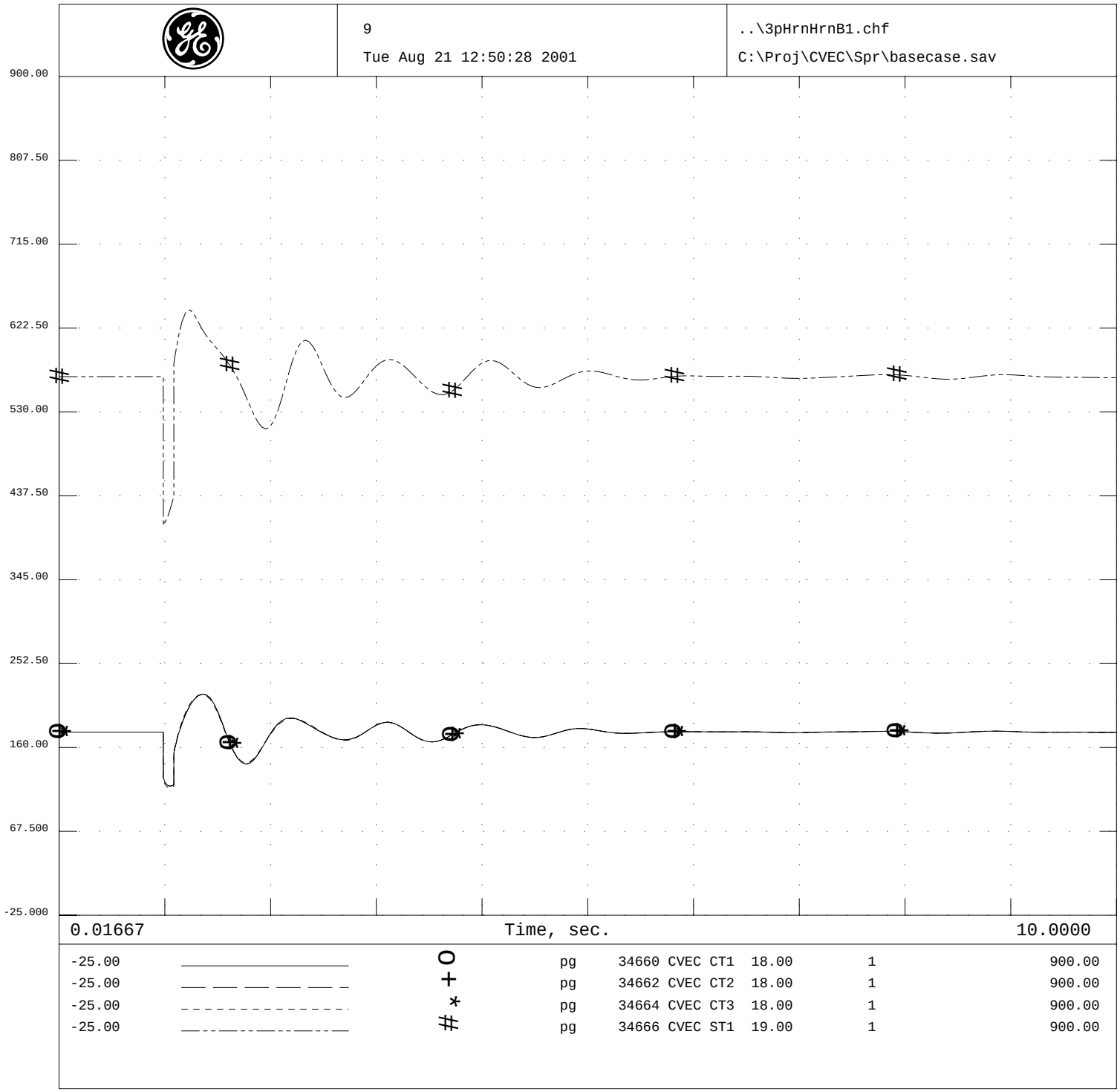
Calpine Corporation
Project Generator Rotor Angle



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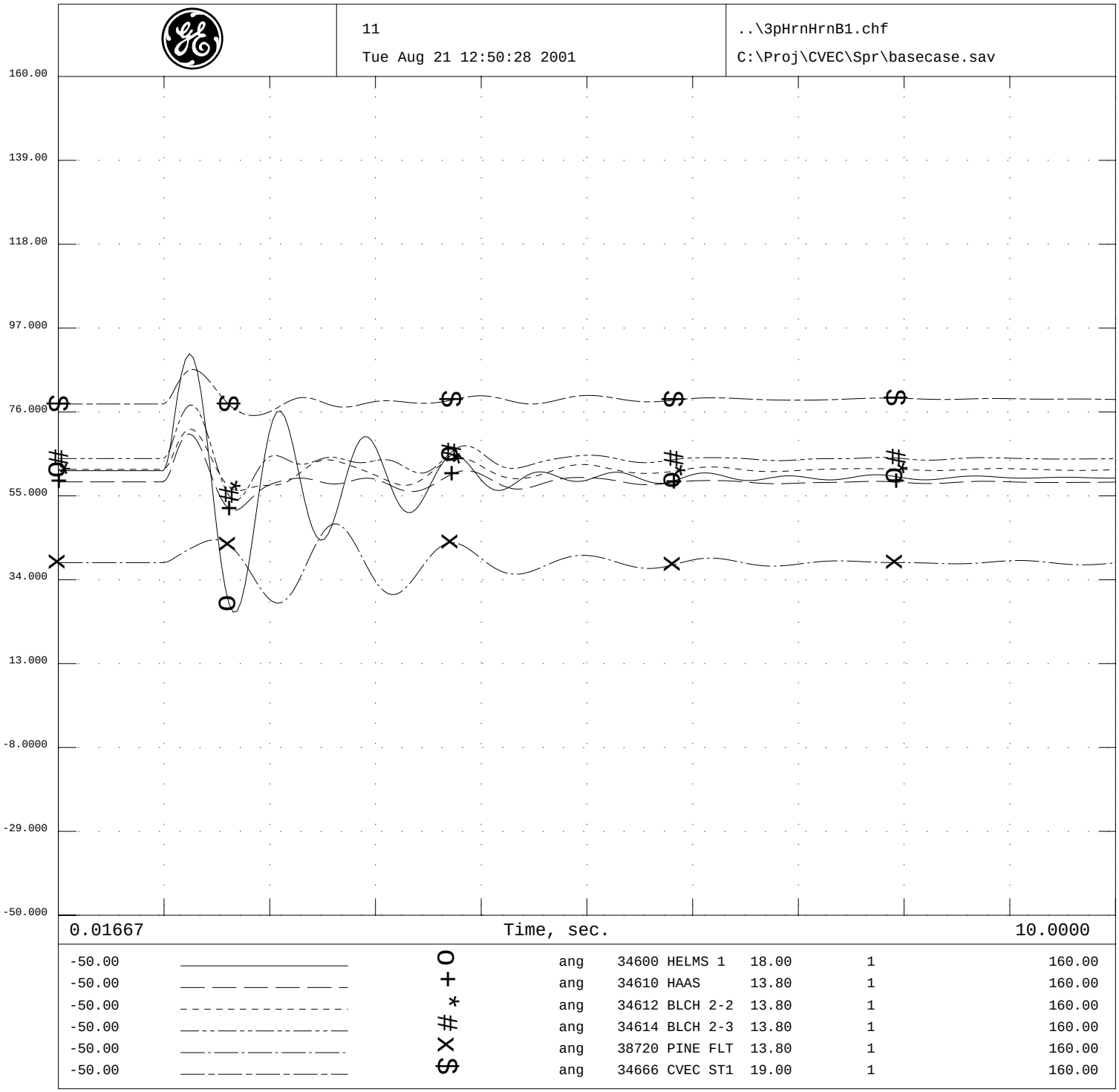

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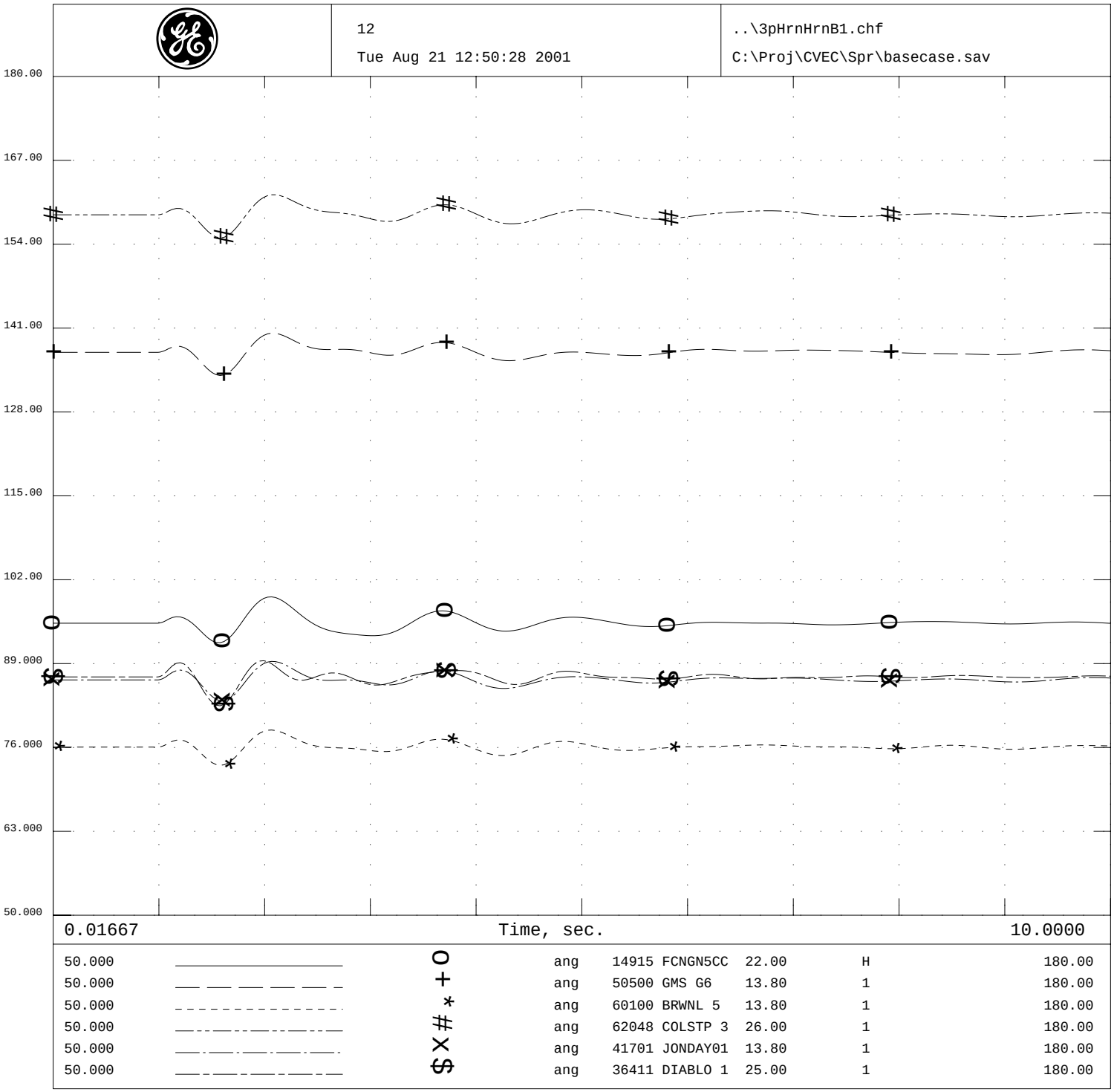

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Calpine Corporation
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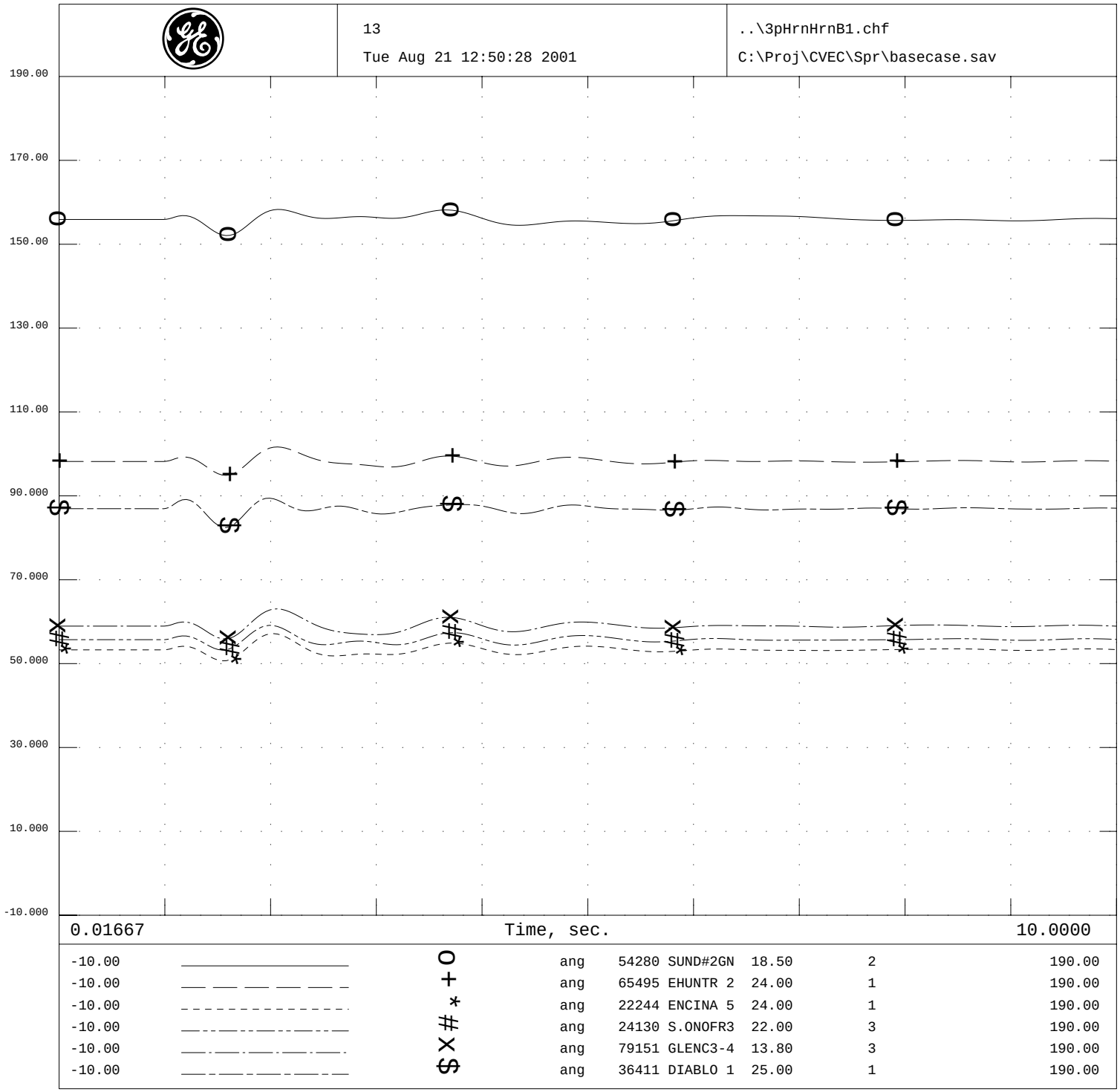

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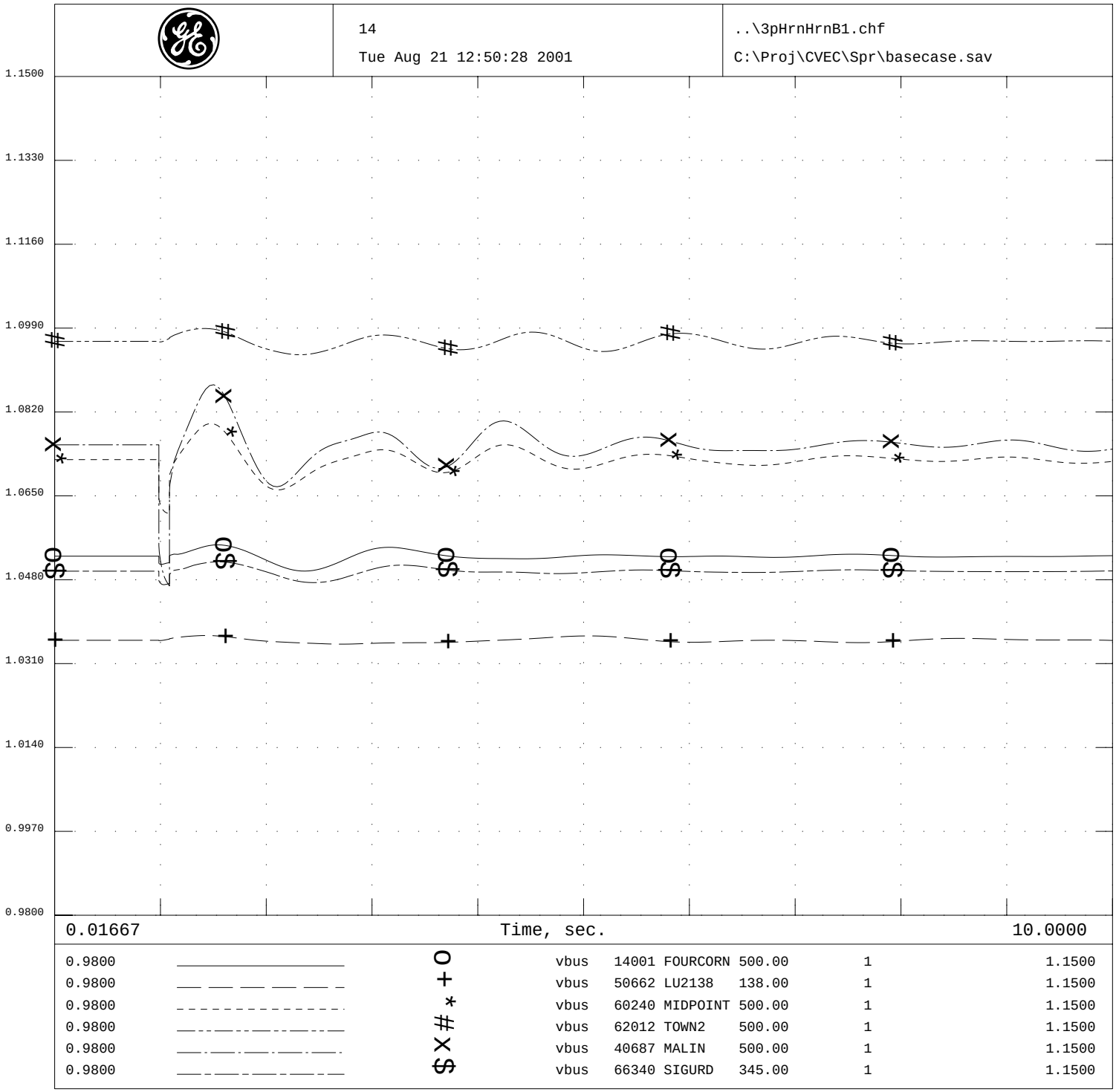

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Calpine Corporation
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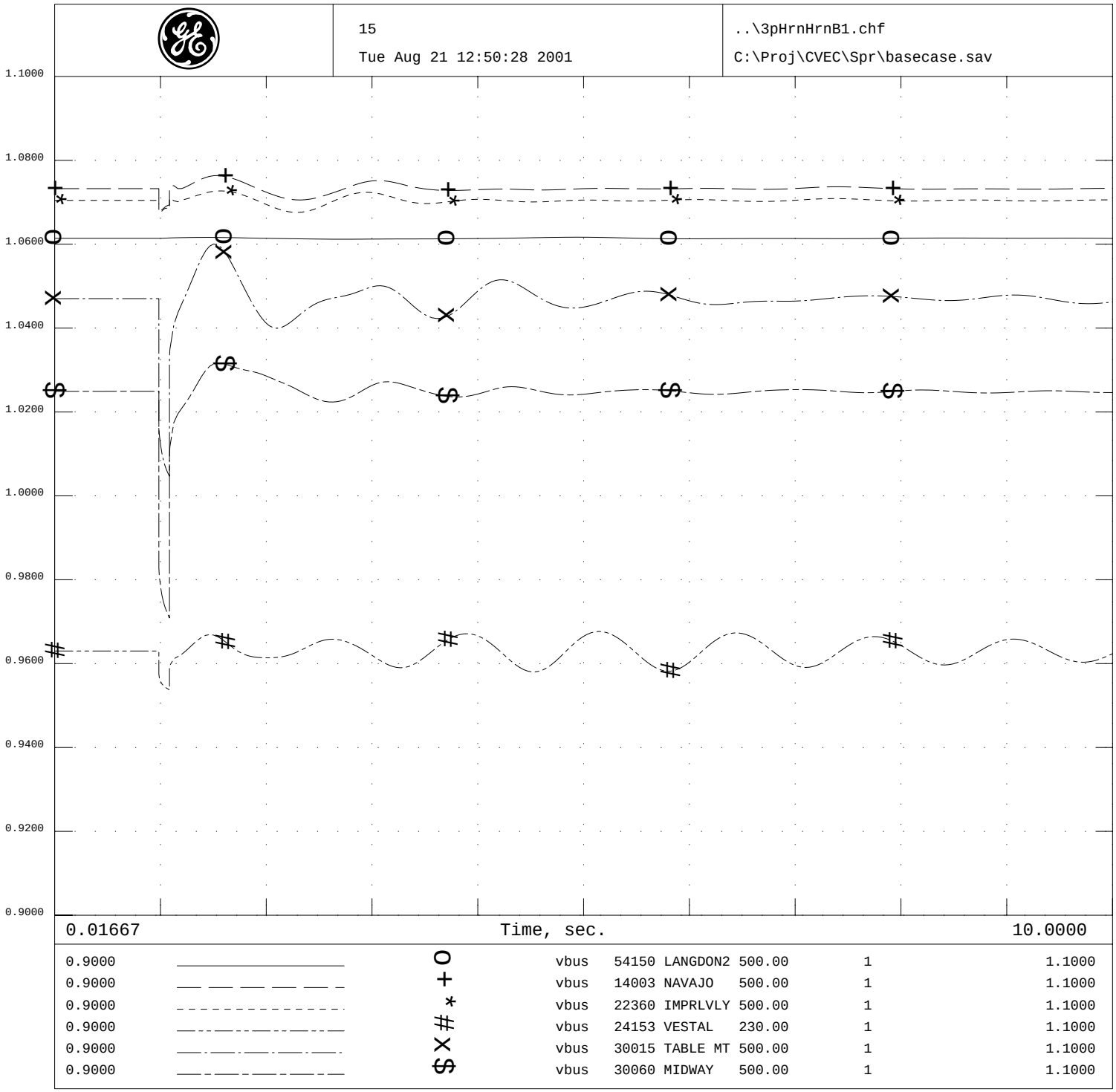

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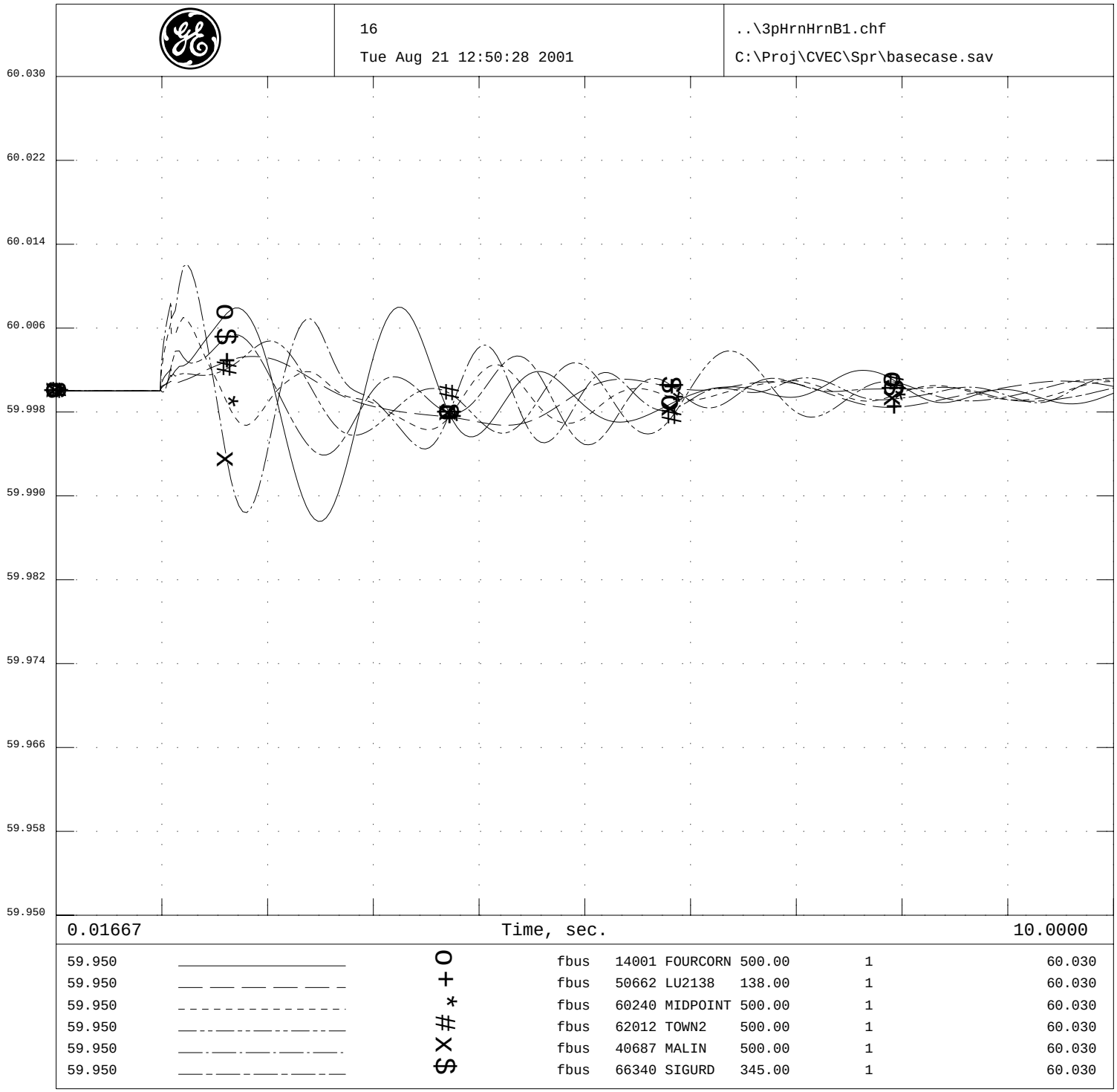

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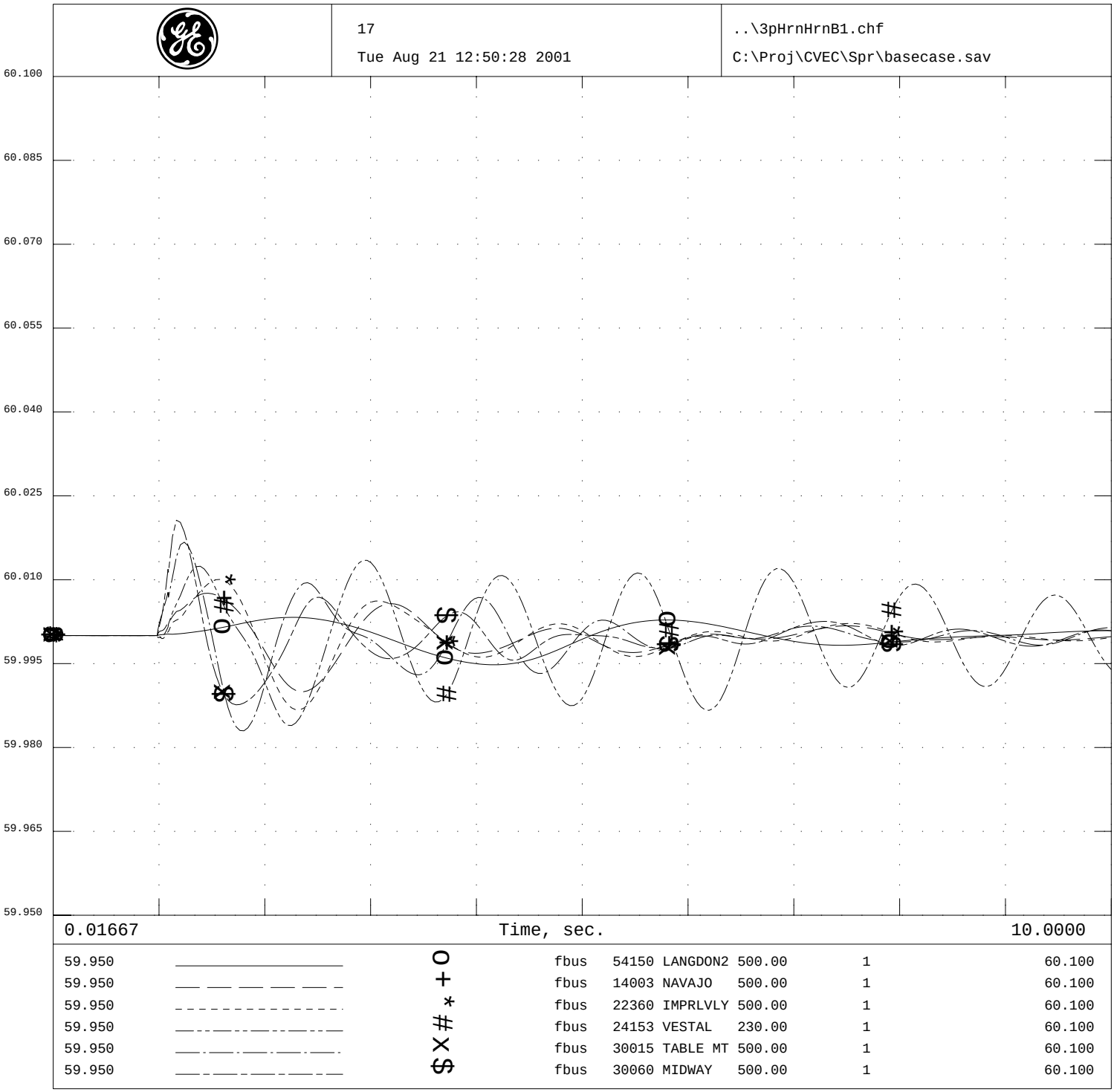

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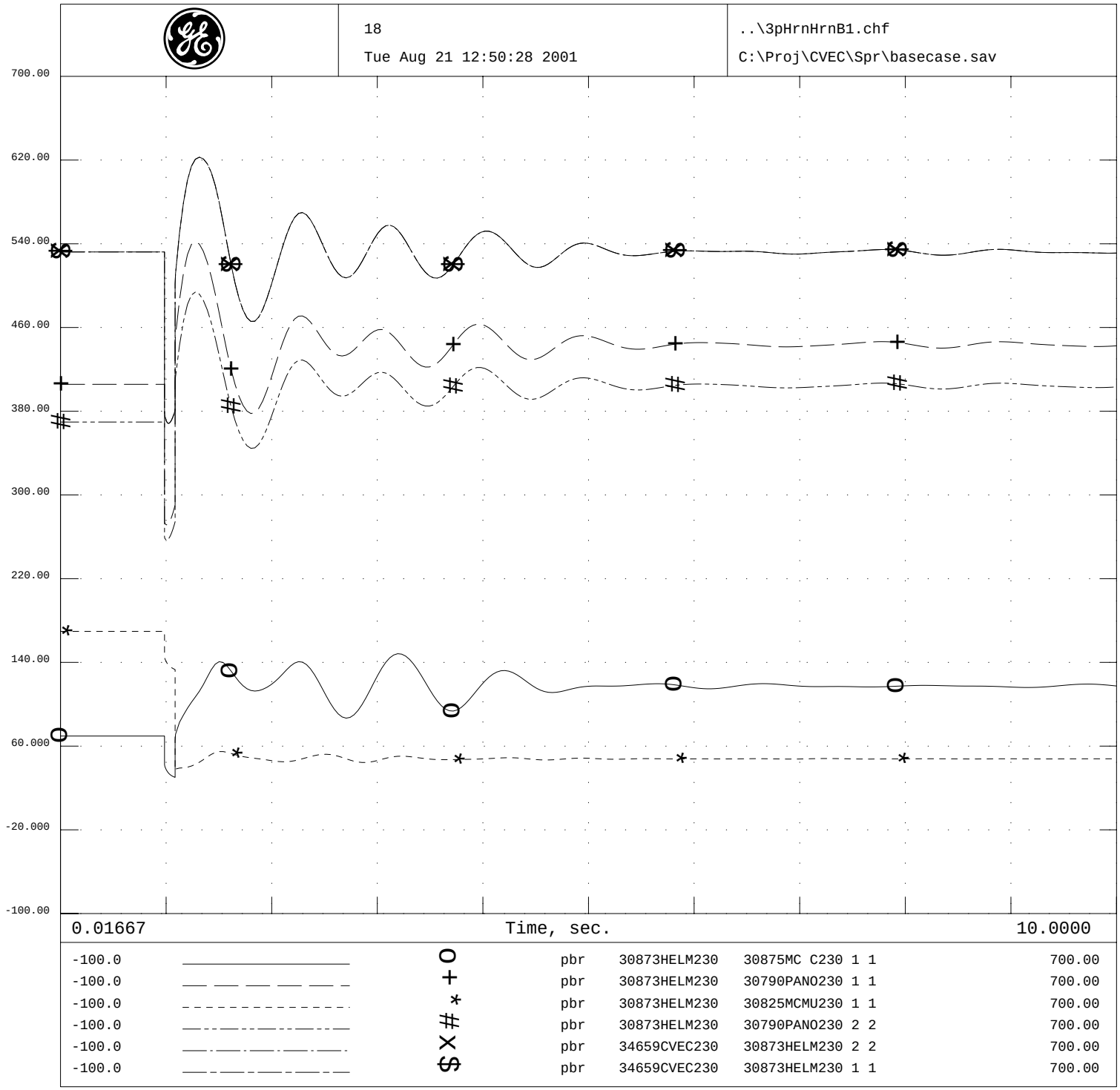

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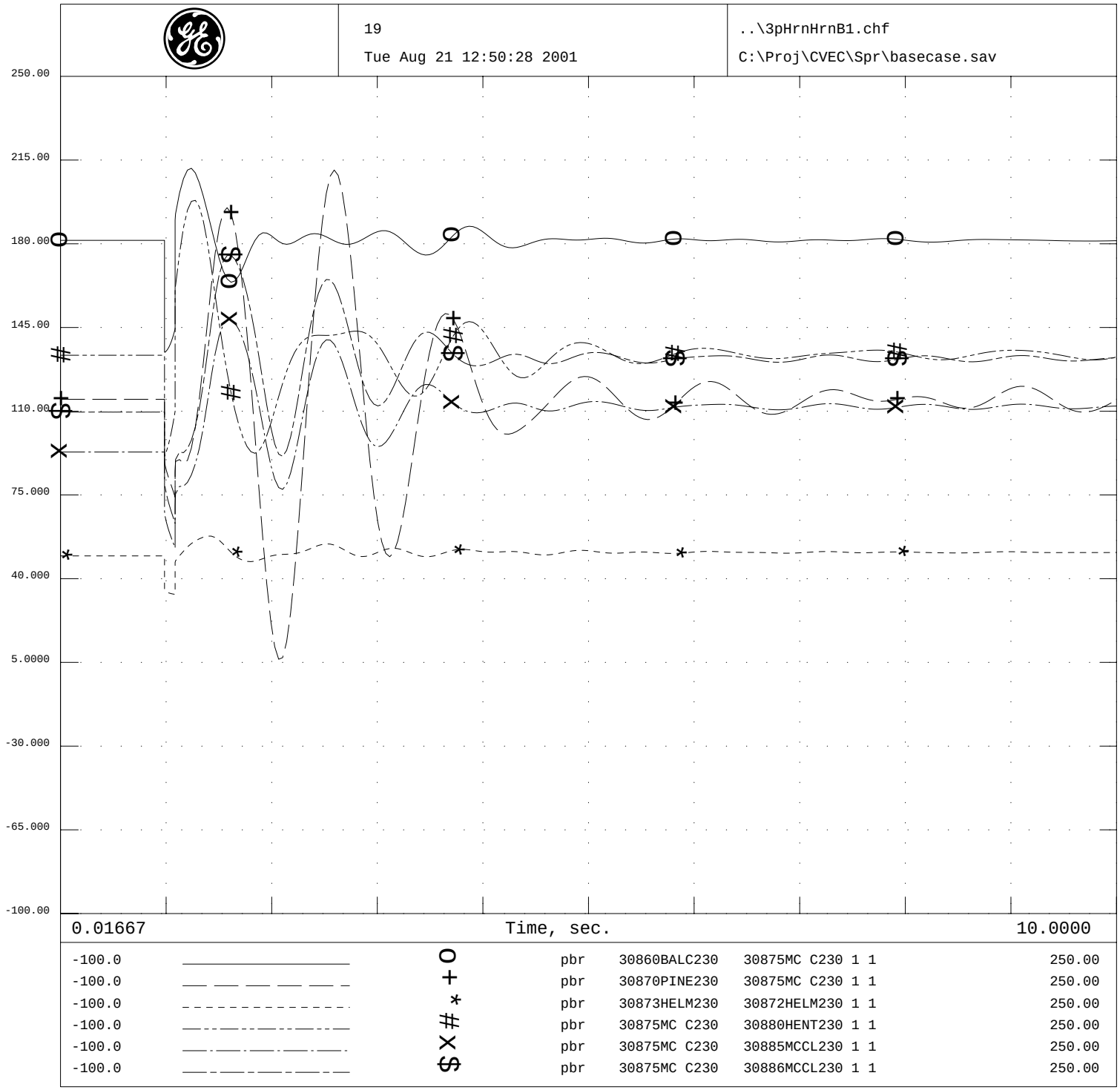

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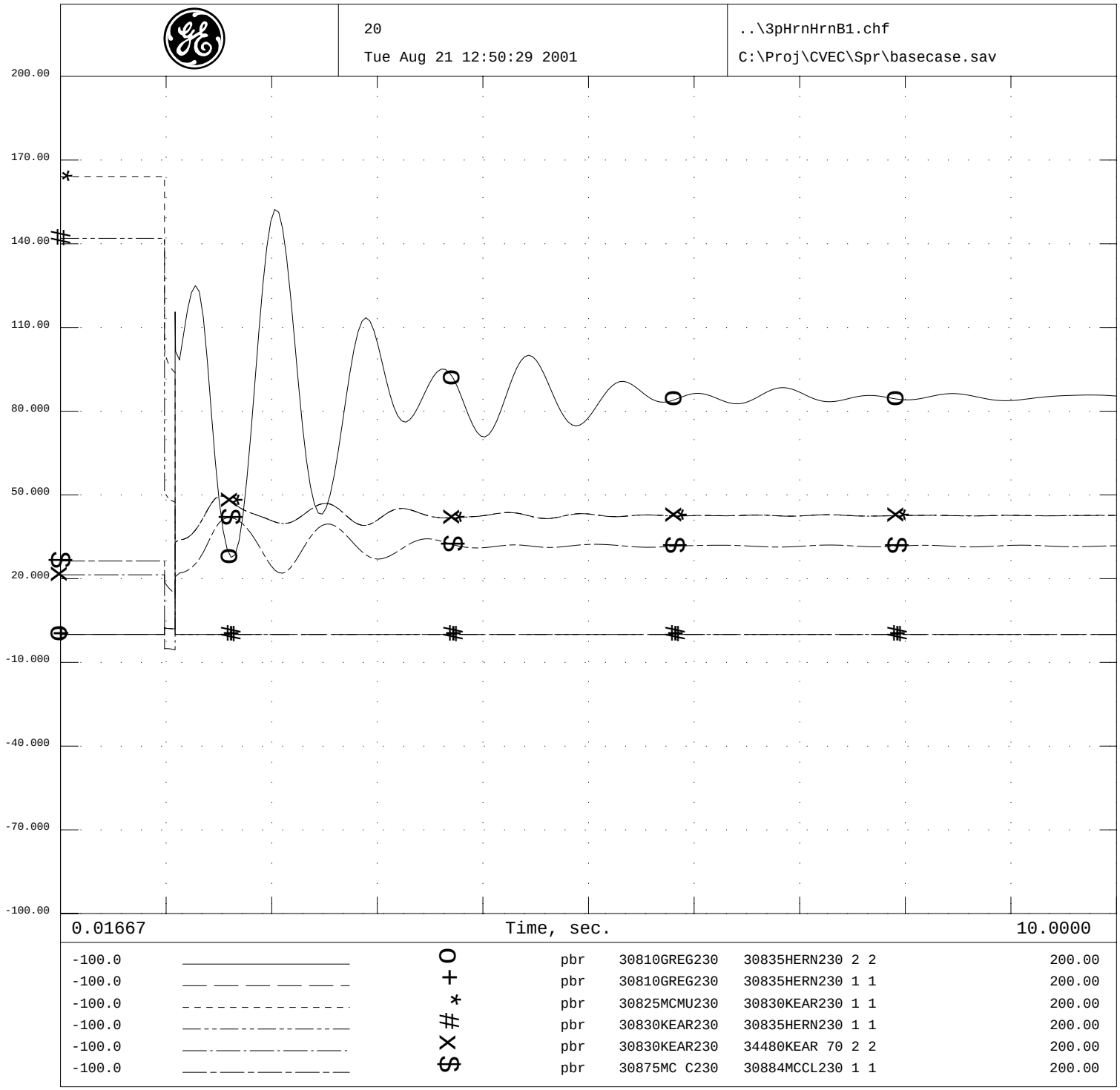

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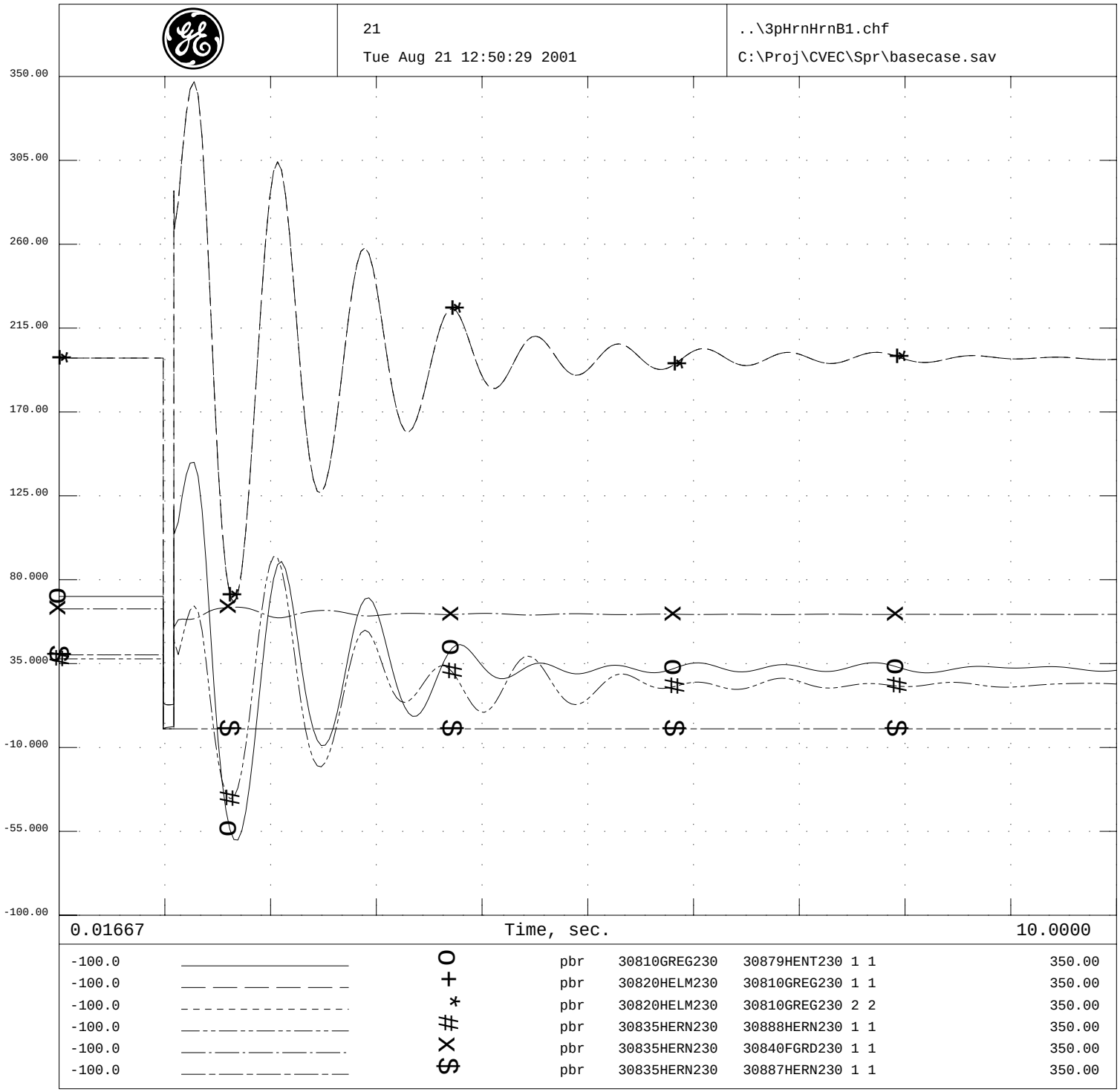

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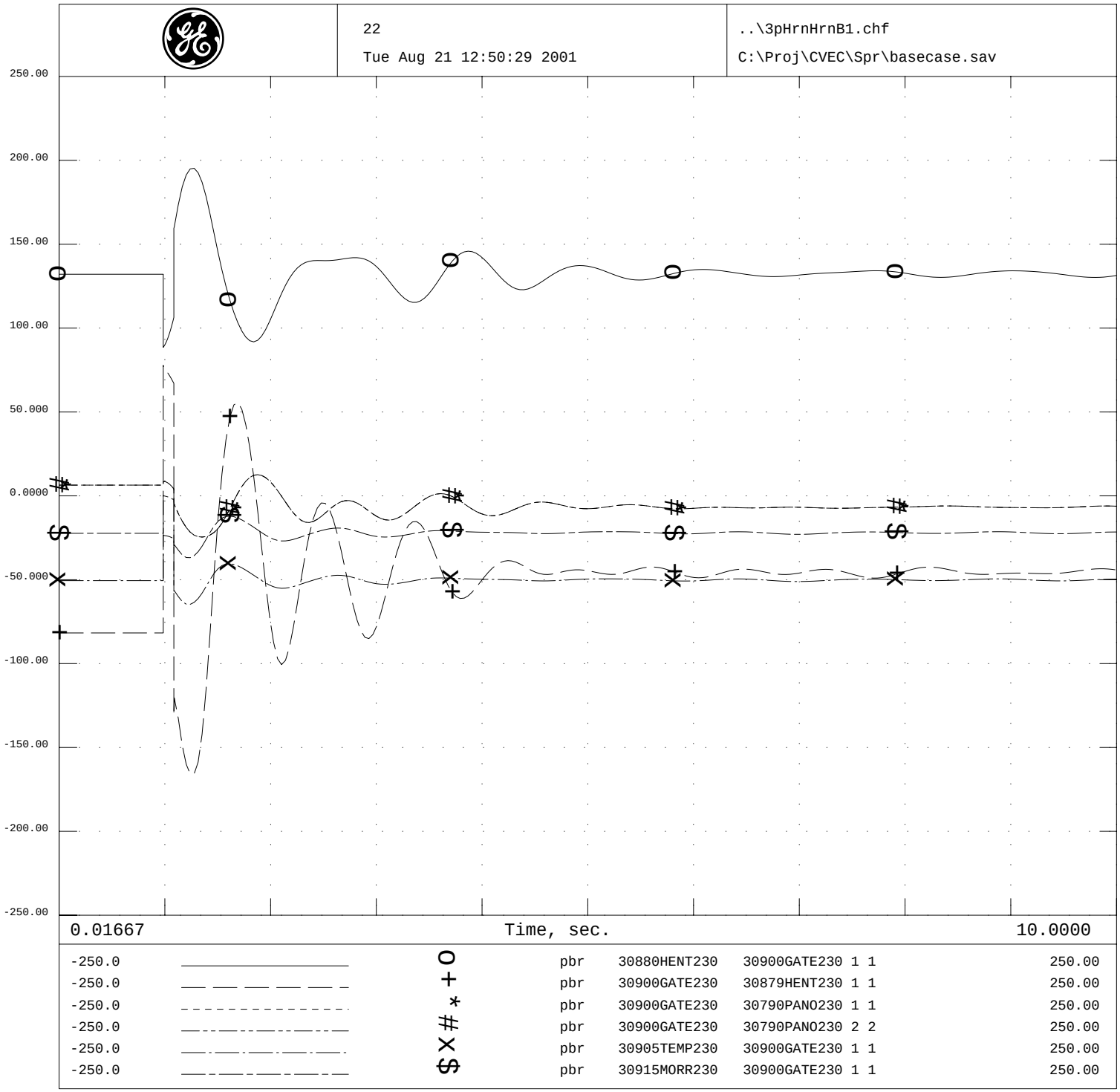

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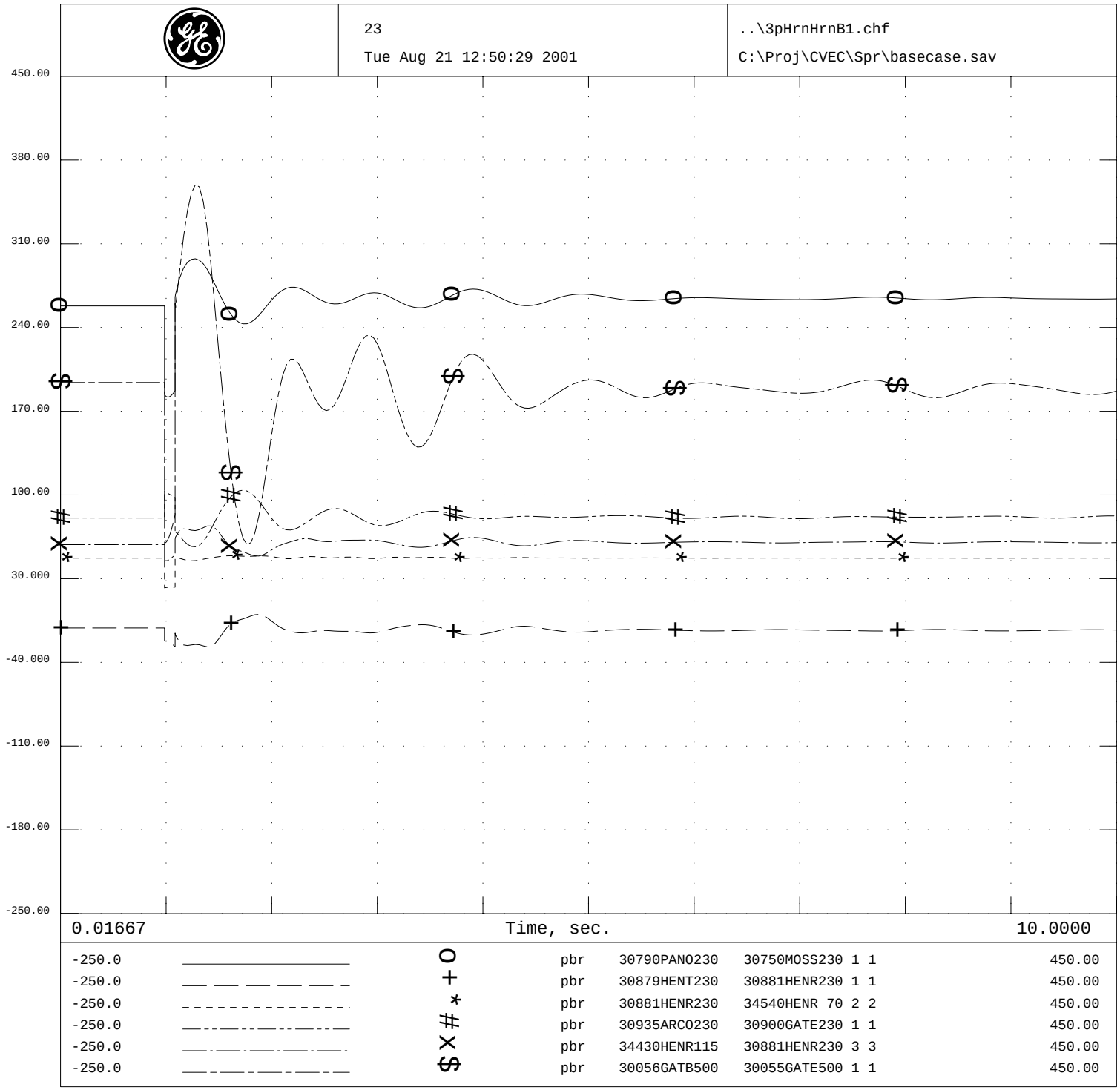

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Calpine Corporation
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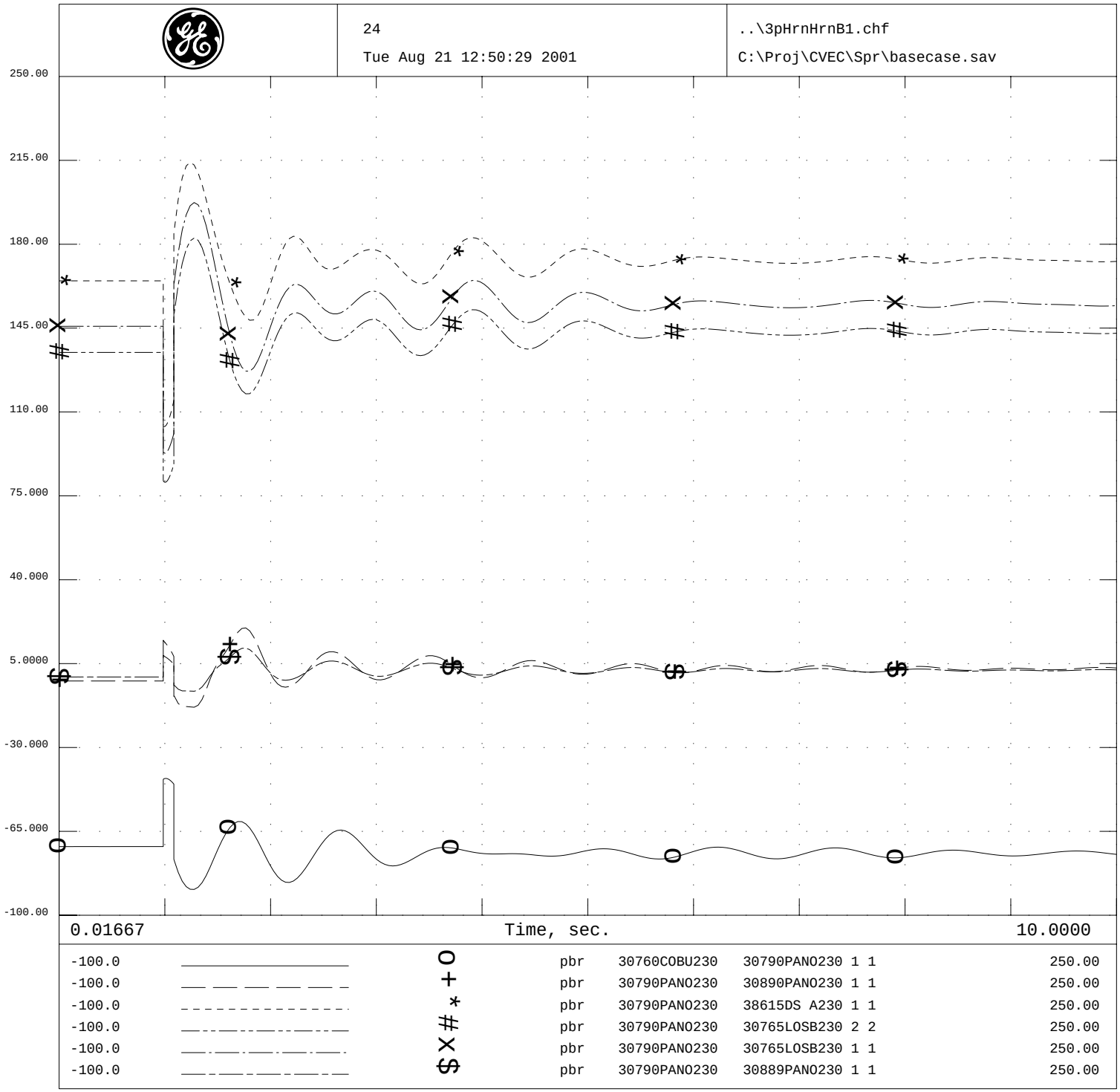
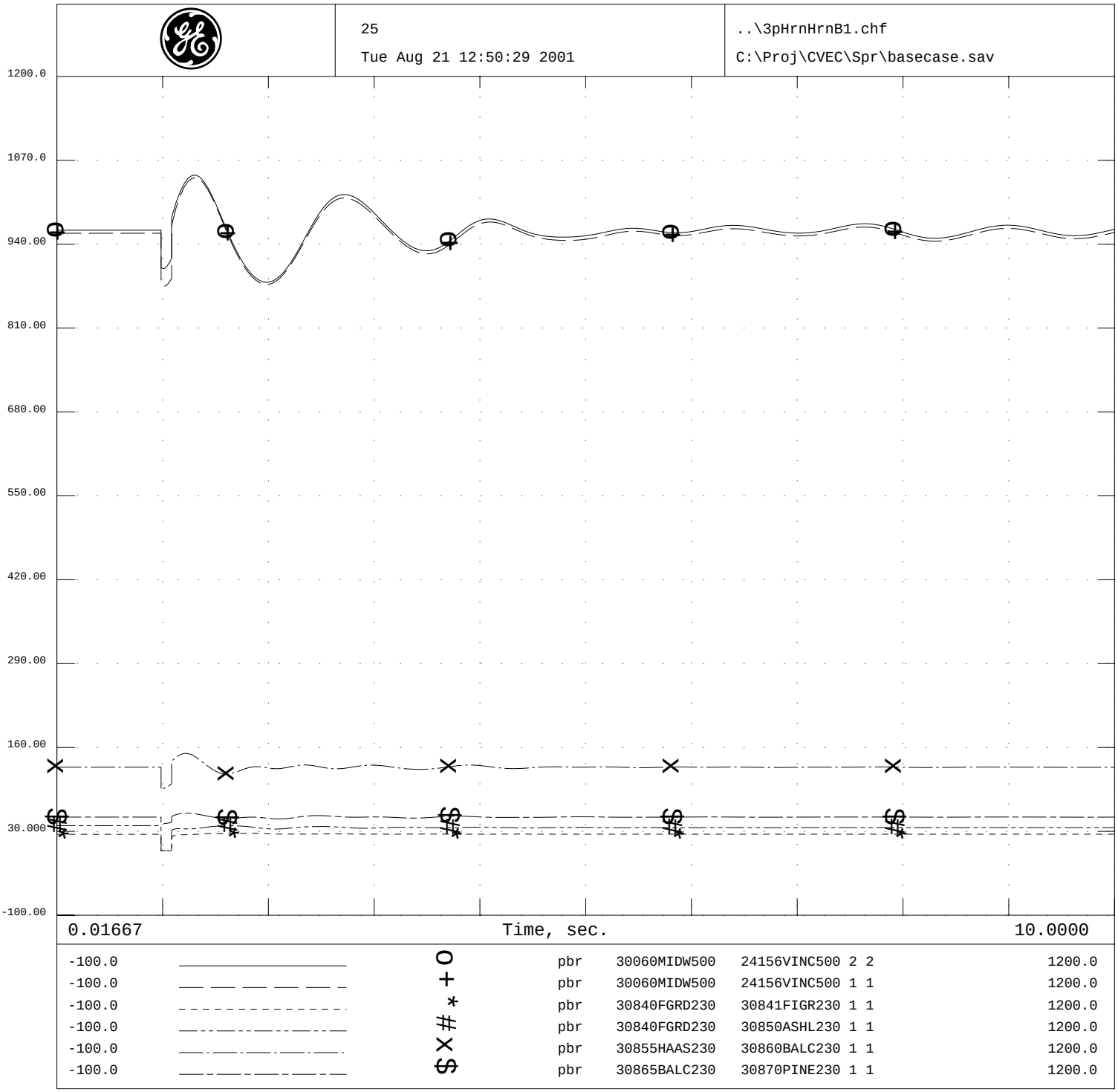


Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #1 Outage
3 phase 6 cycle fault at Herndon 230kV bus and clear bus #1

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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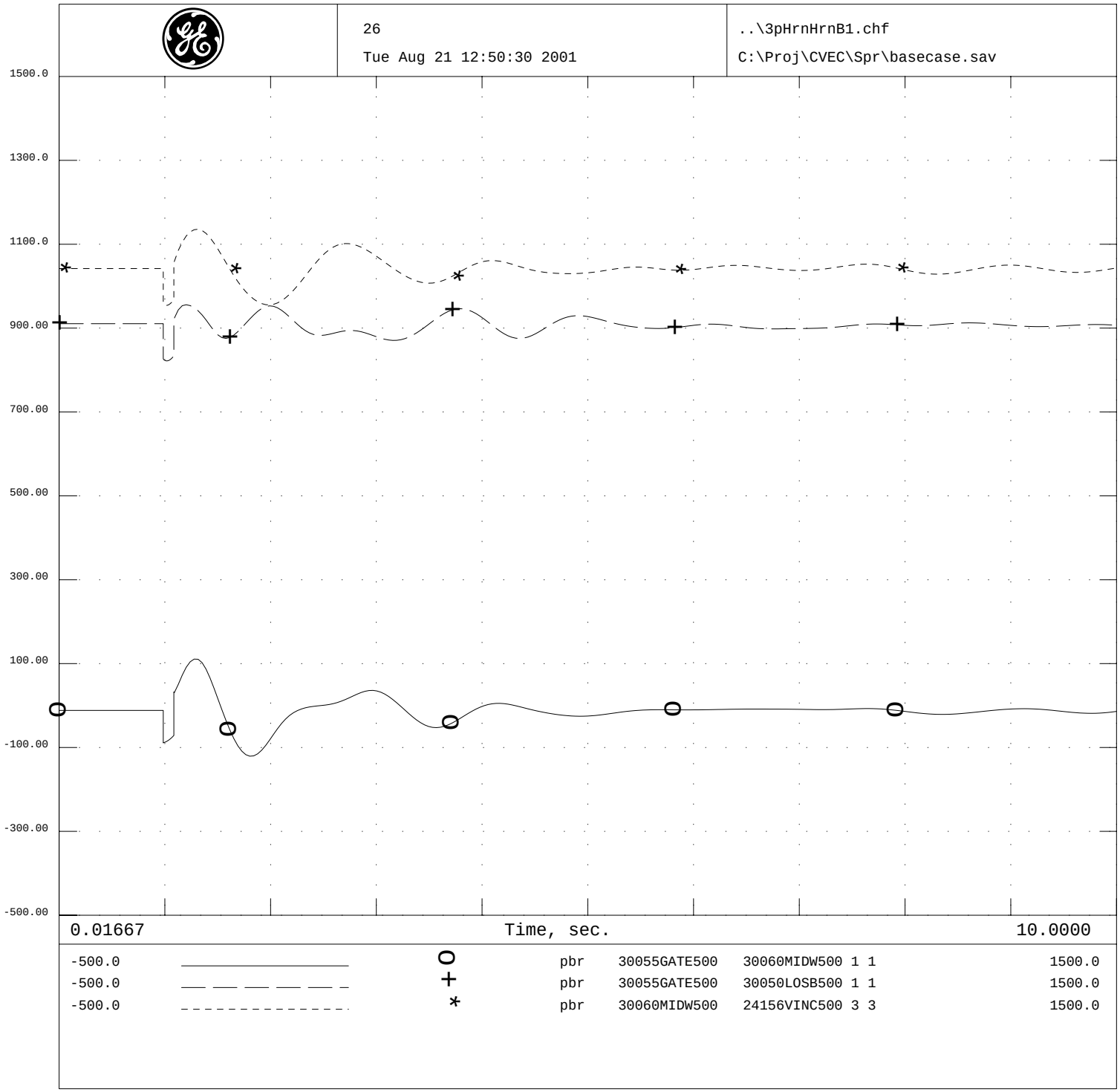
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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Central Valley Energy Center
Calpine Corporation
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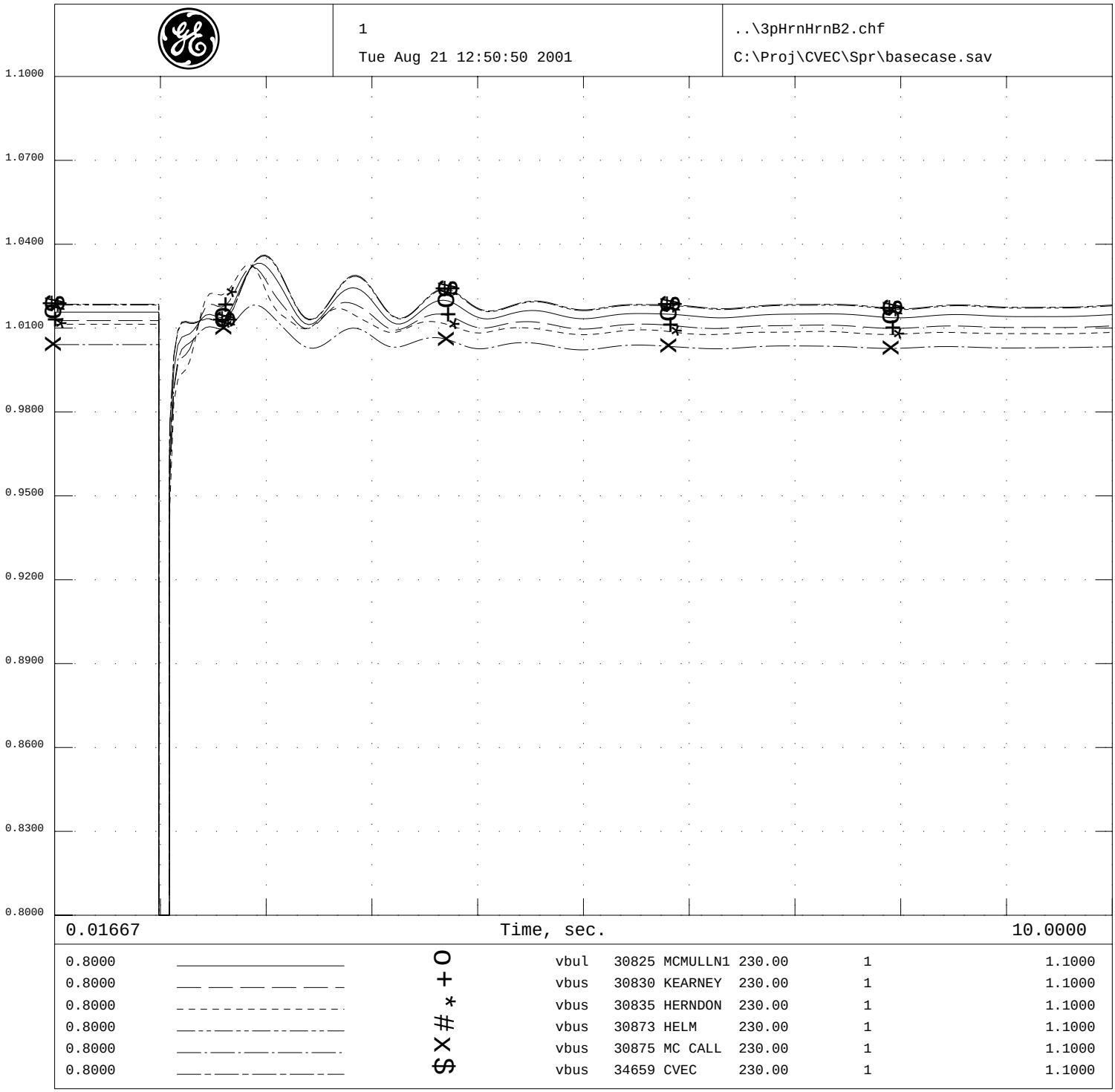
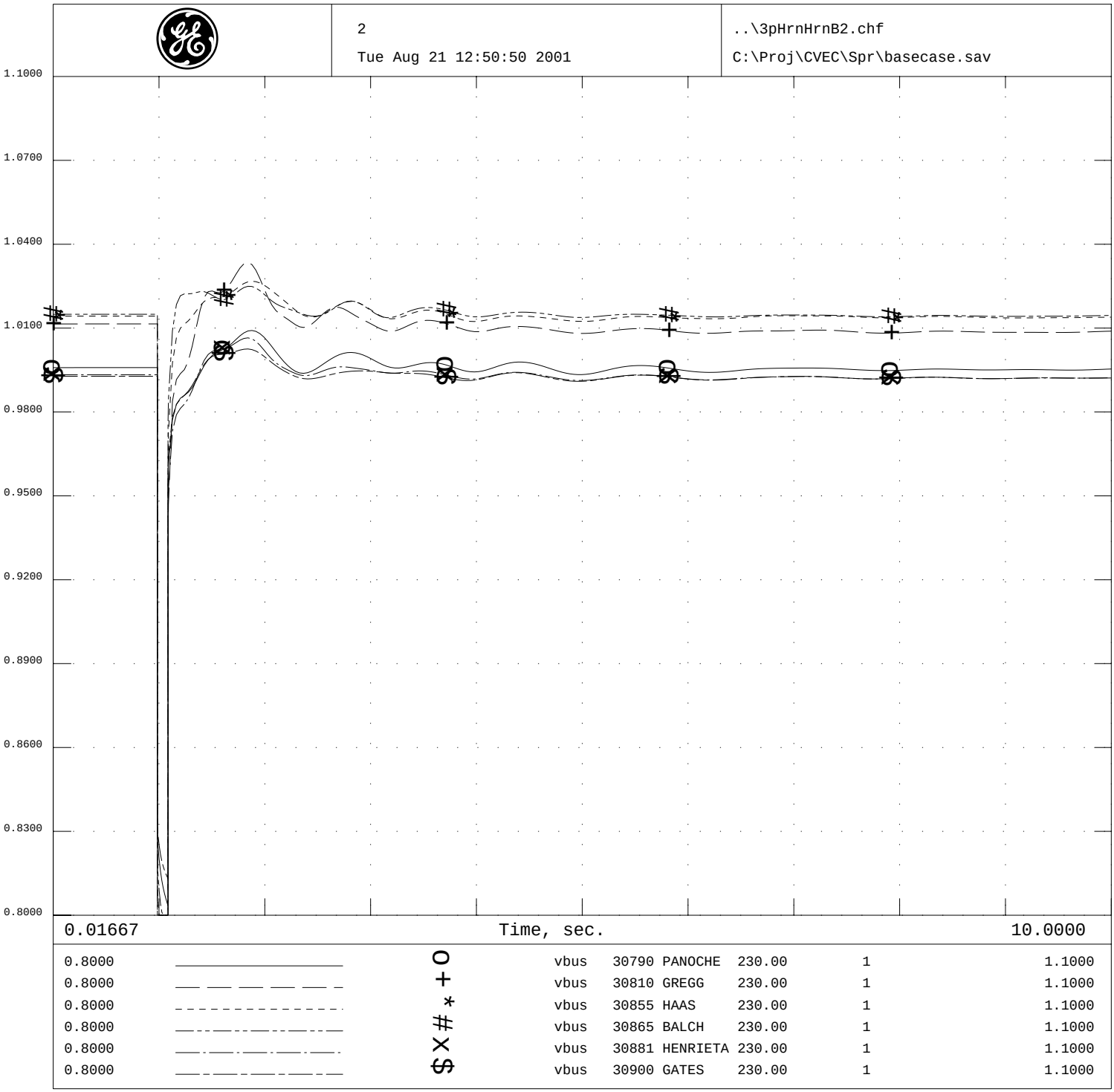


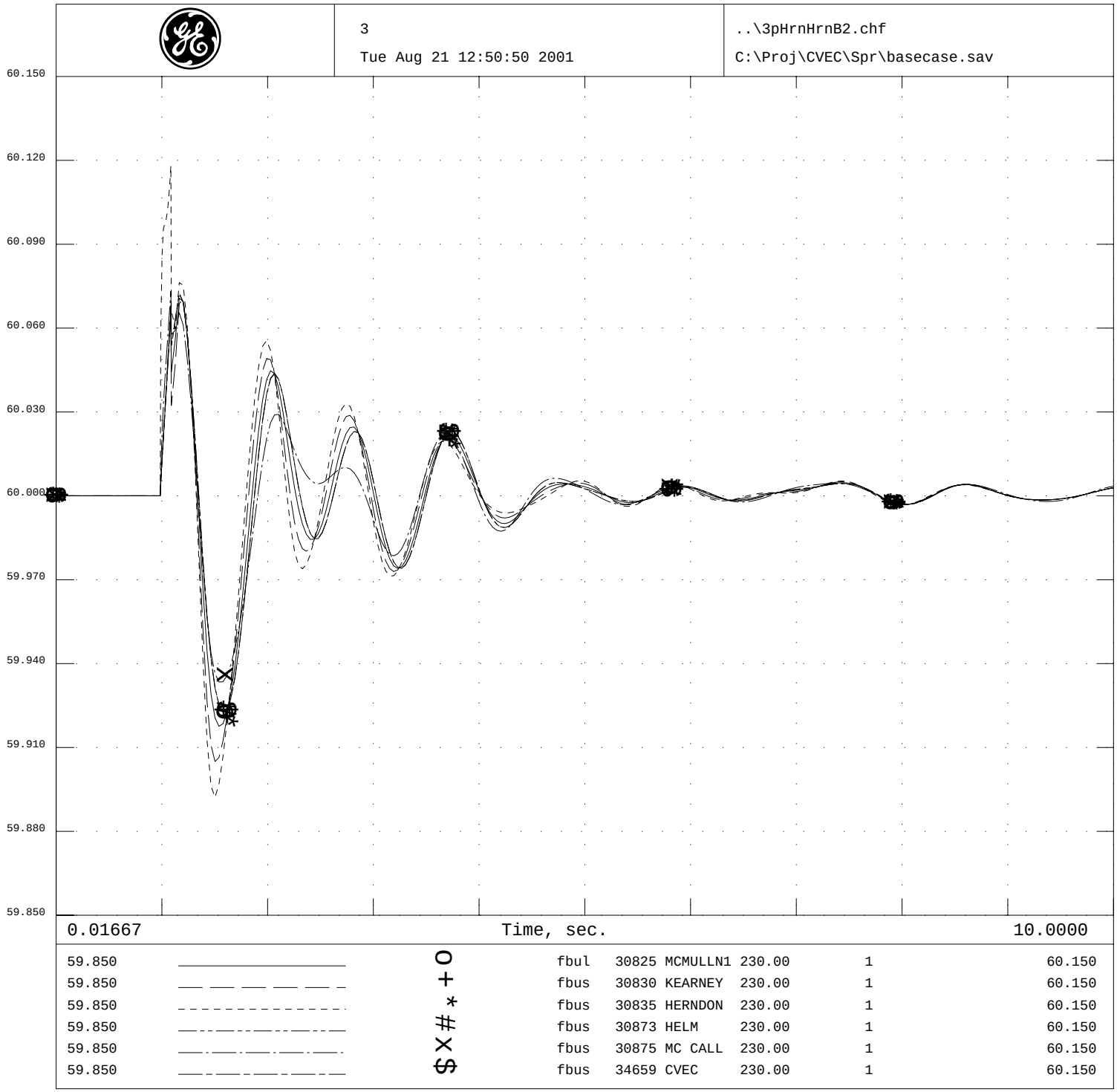
Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
3 phase 6 cycle fault at Herndon 230kV bus and clear bus #2

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



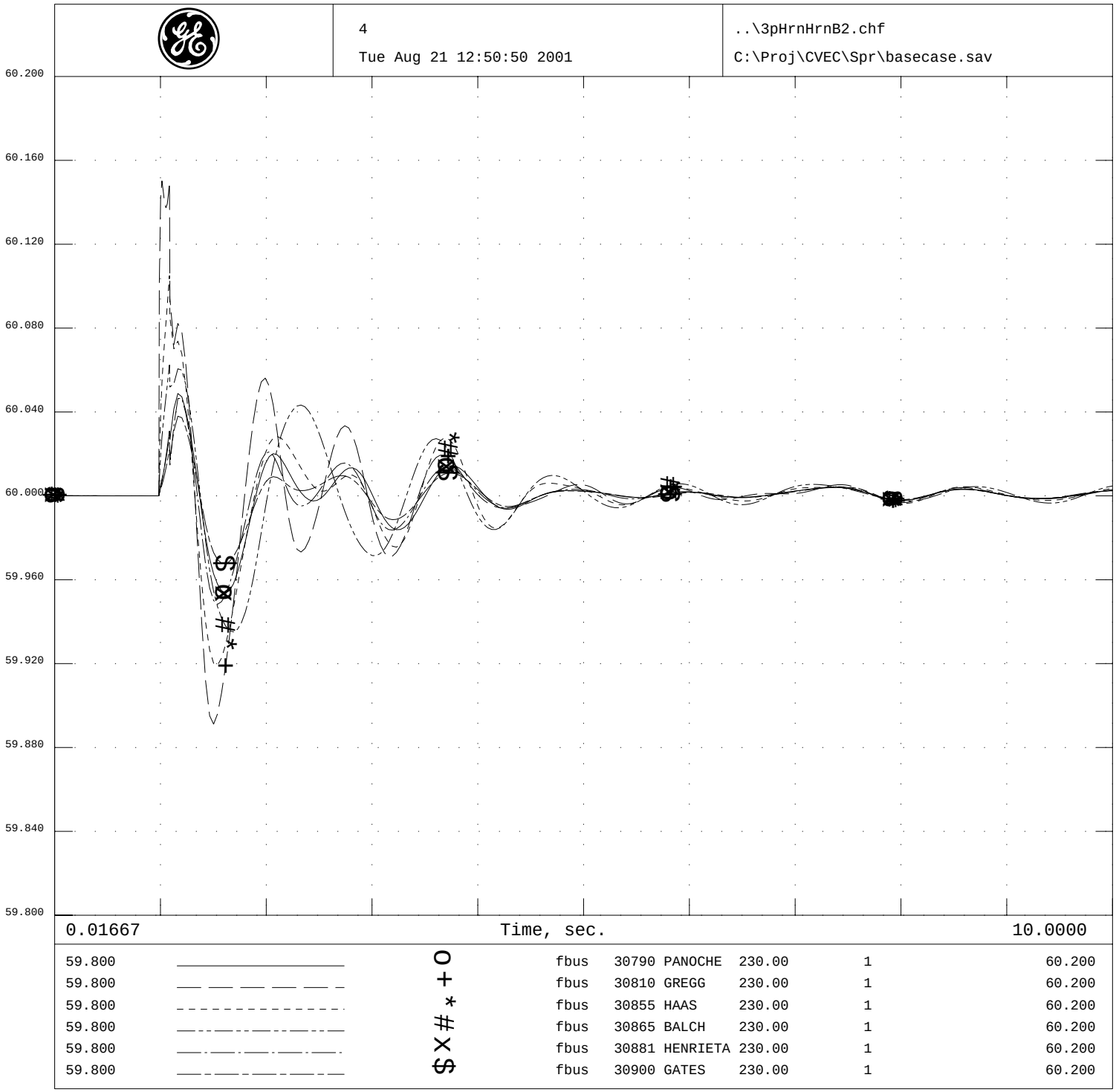
Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
3 phase 6 cycle fault at Herndon 230kV bus and clear bus #2

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
3 phase 6 cycle fault at Herndon 230kV bus and clear bus #2

Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
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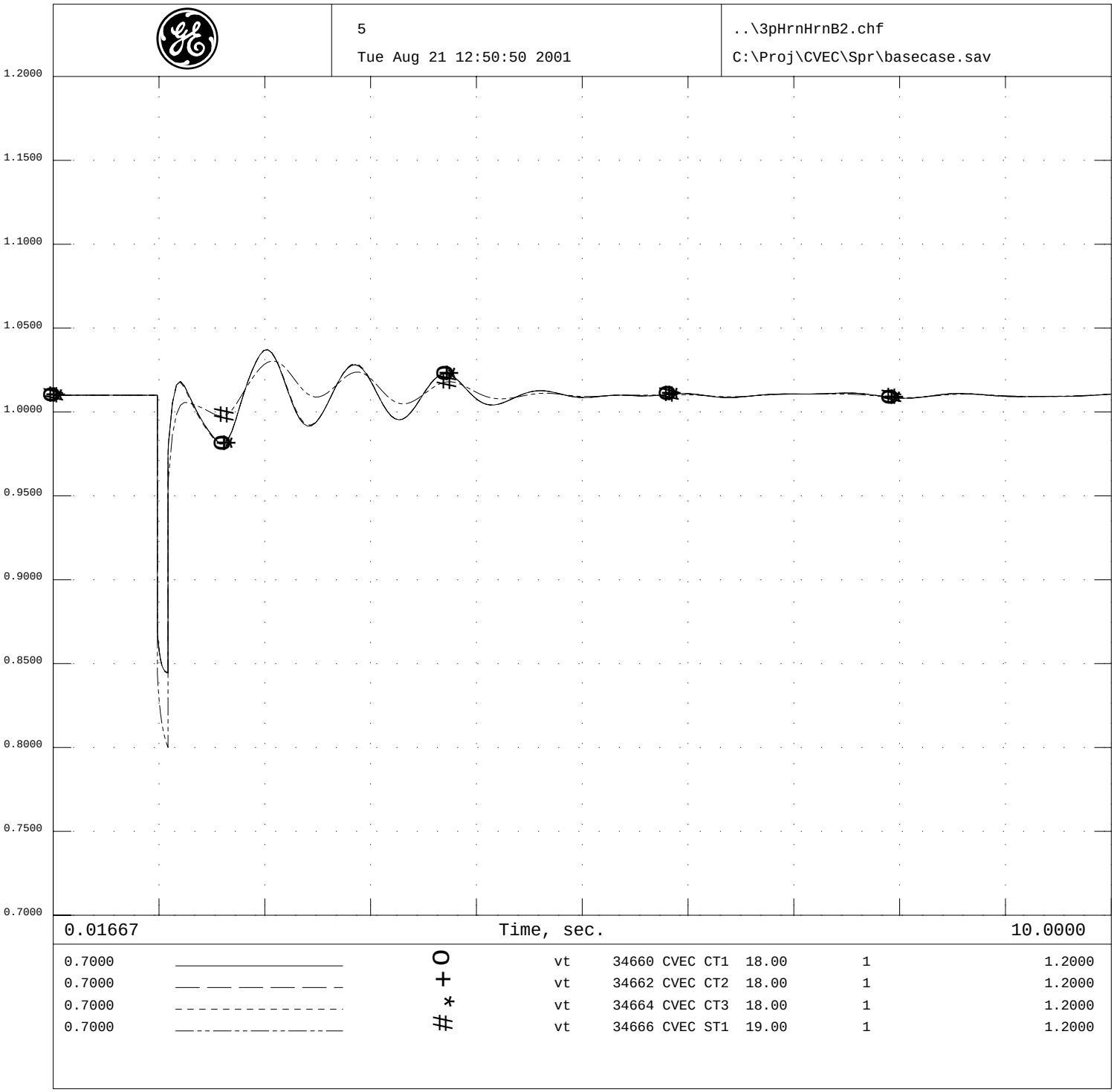
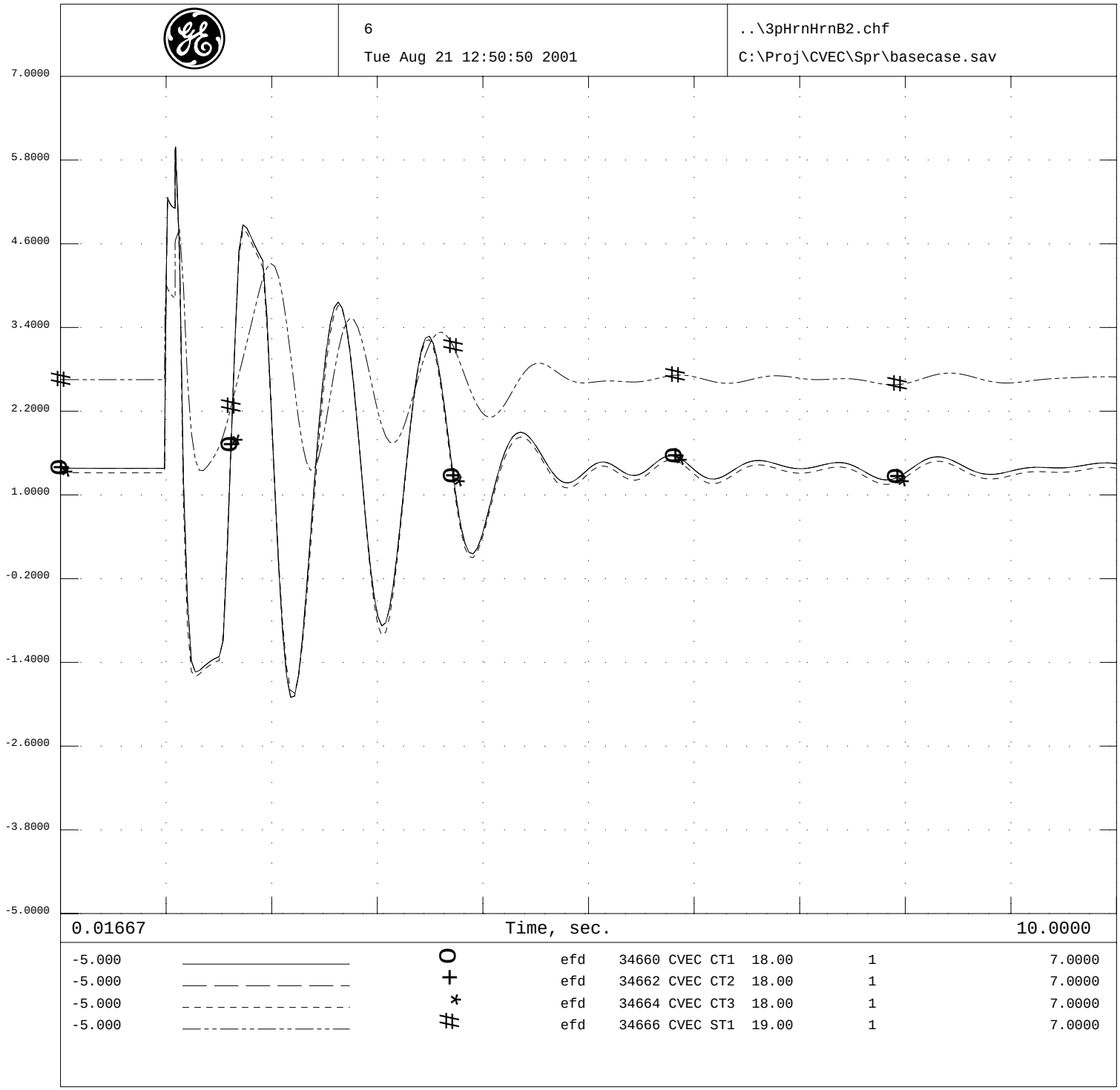
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
3 phase 6 cycle fault at Herndon 230kV bus and clear bus #2

Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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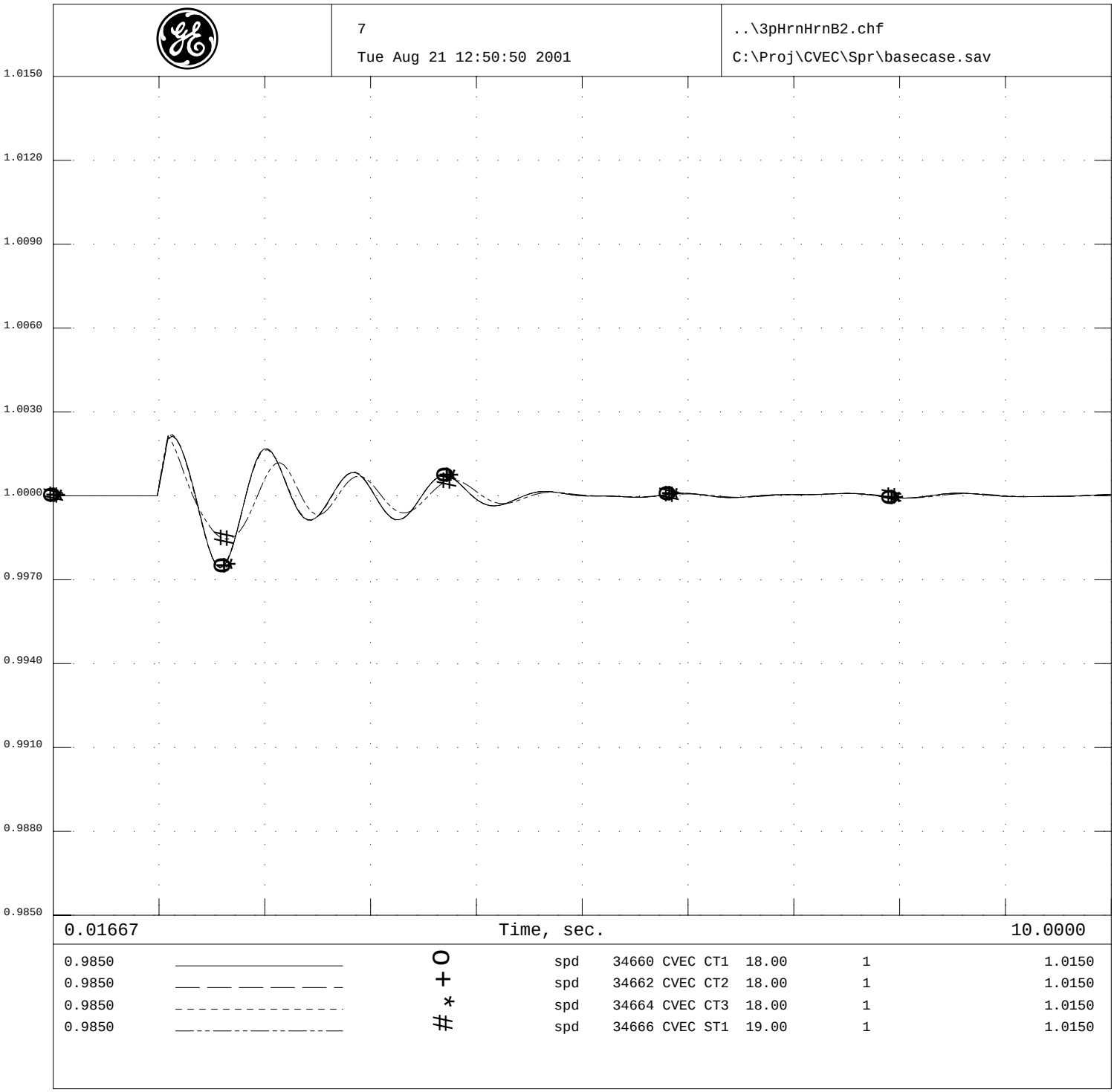
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Herndon 230kV Bus #2 Outage
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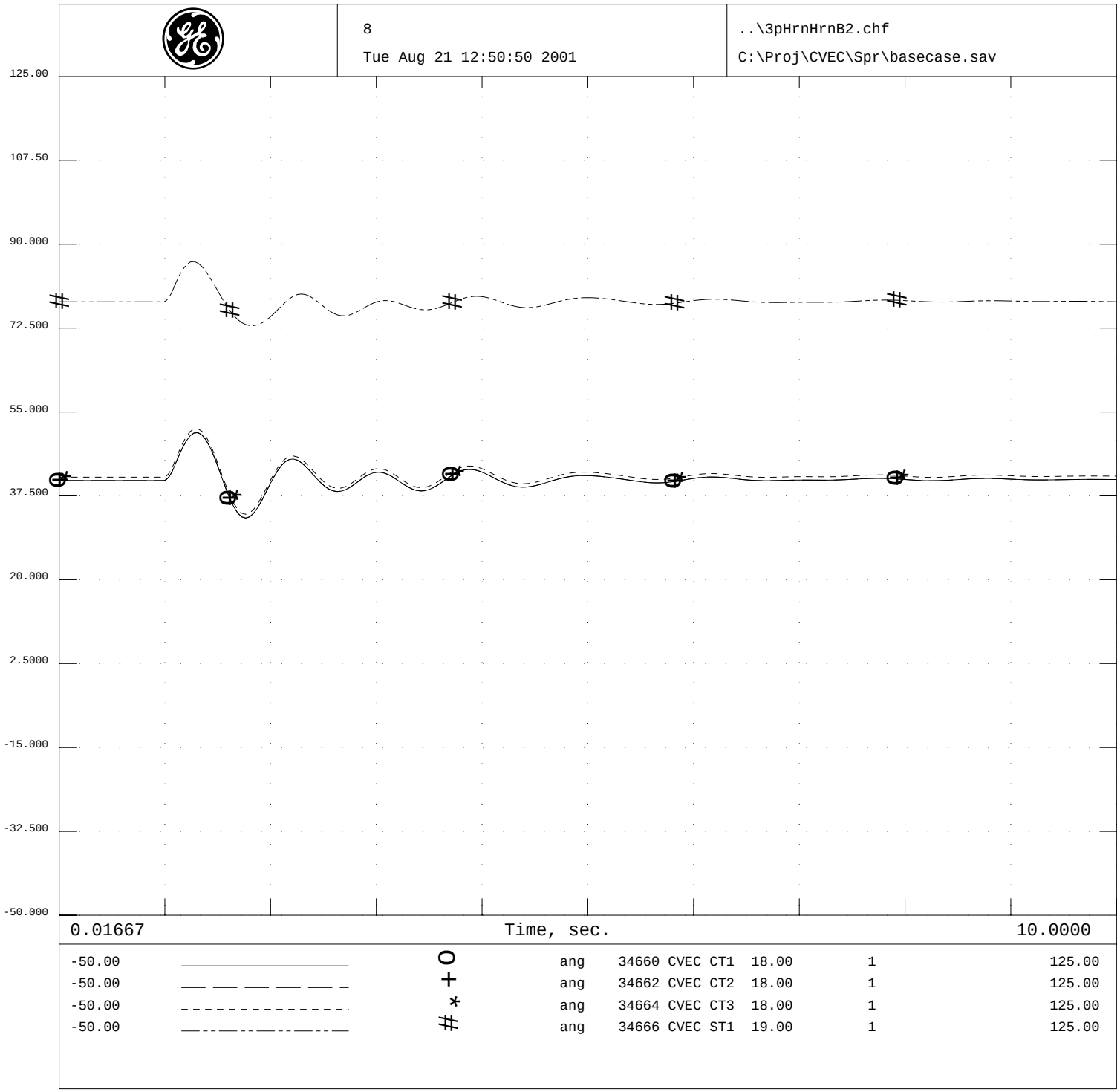
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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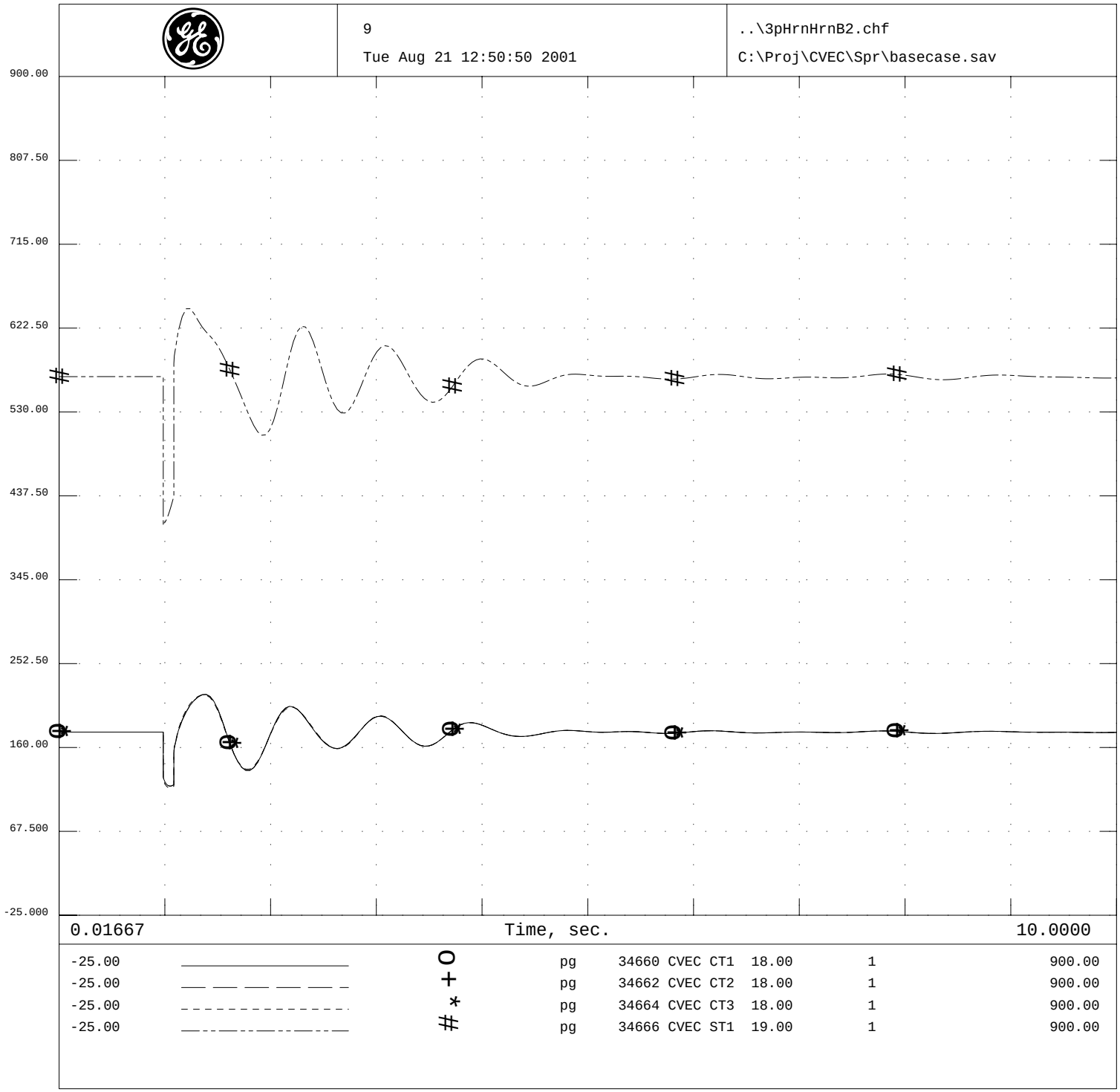
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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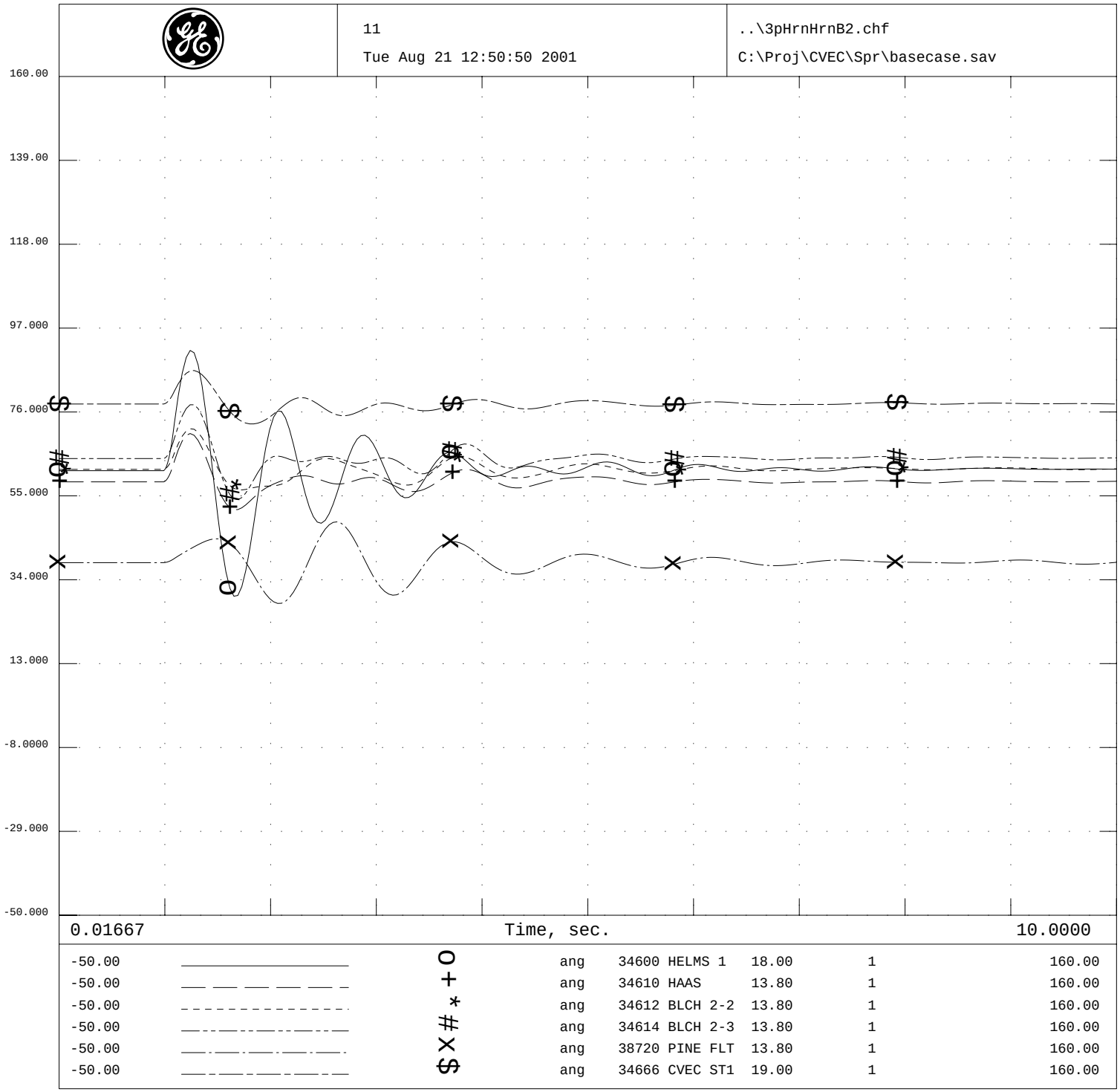
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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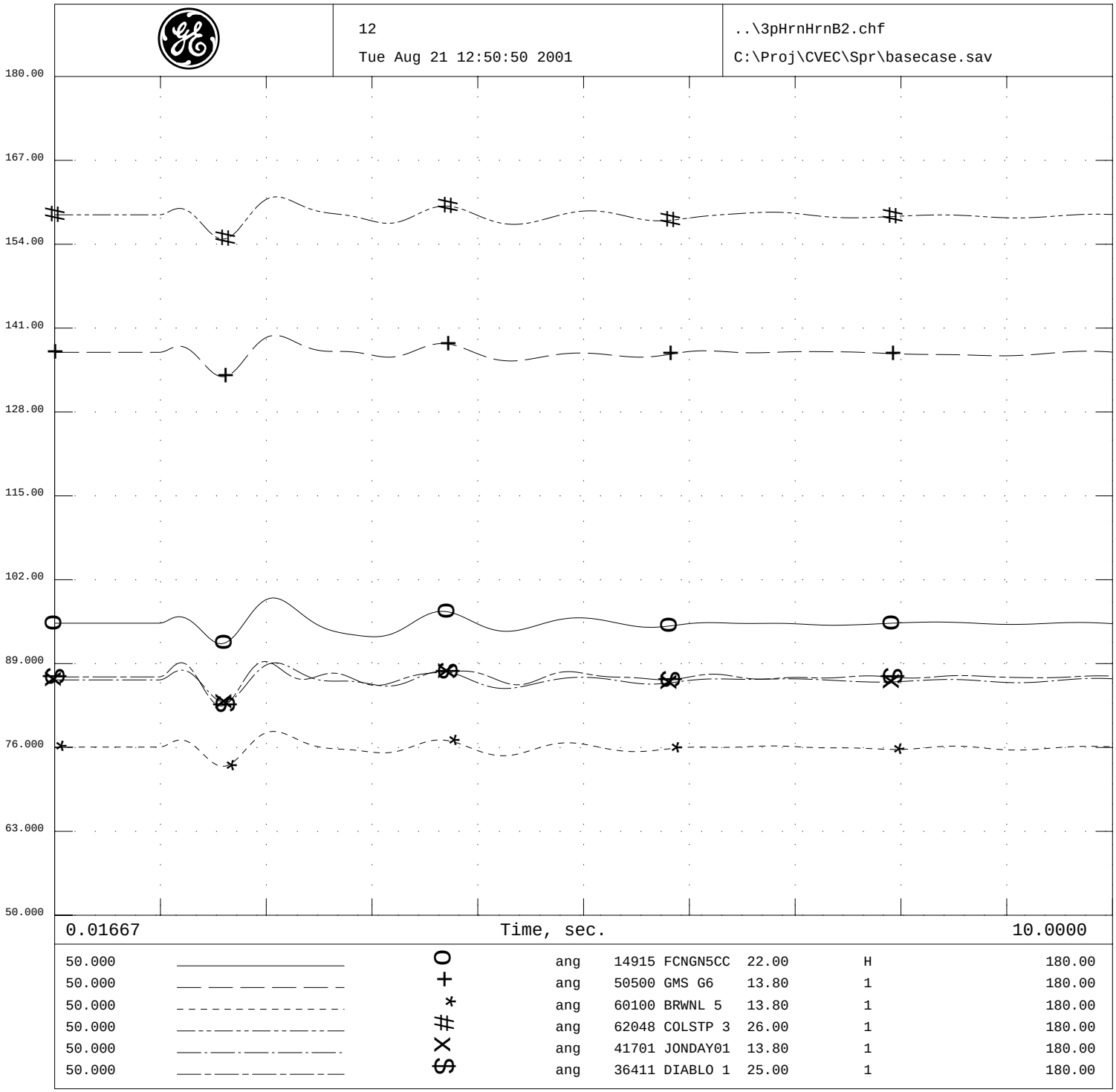
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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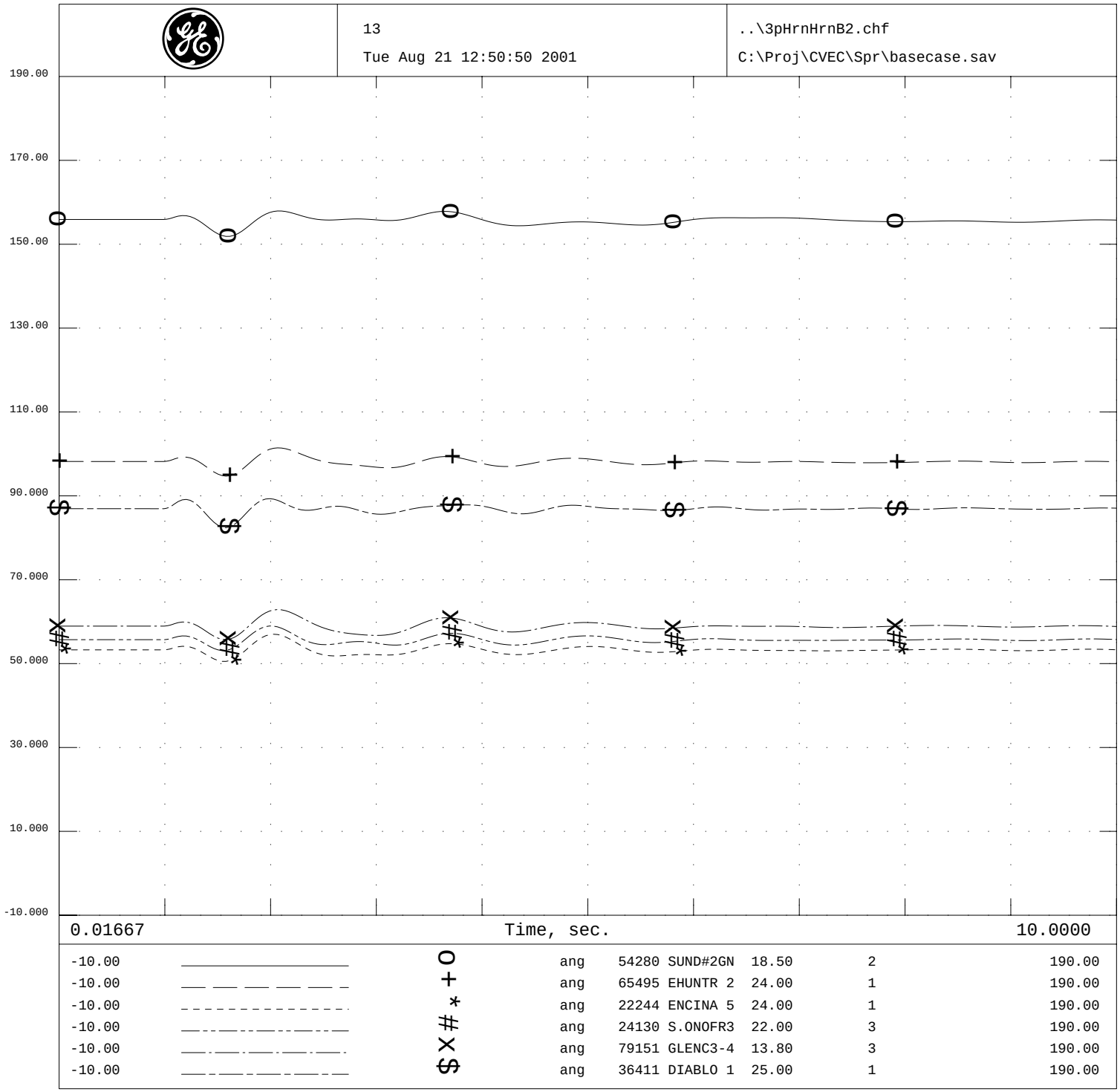
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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2004 Heavy Spring Base Case
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Central Valley Energy Center
Calpine Corporation
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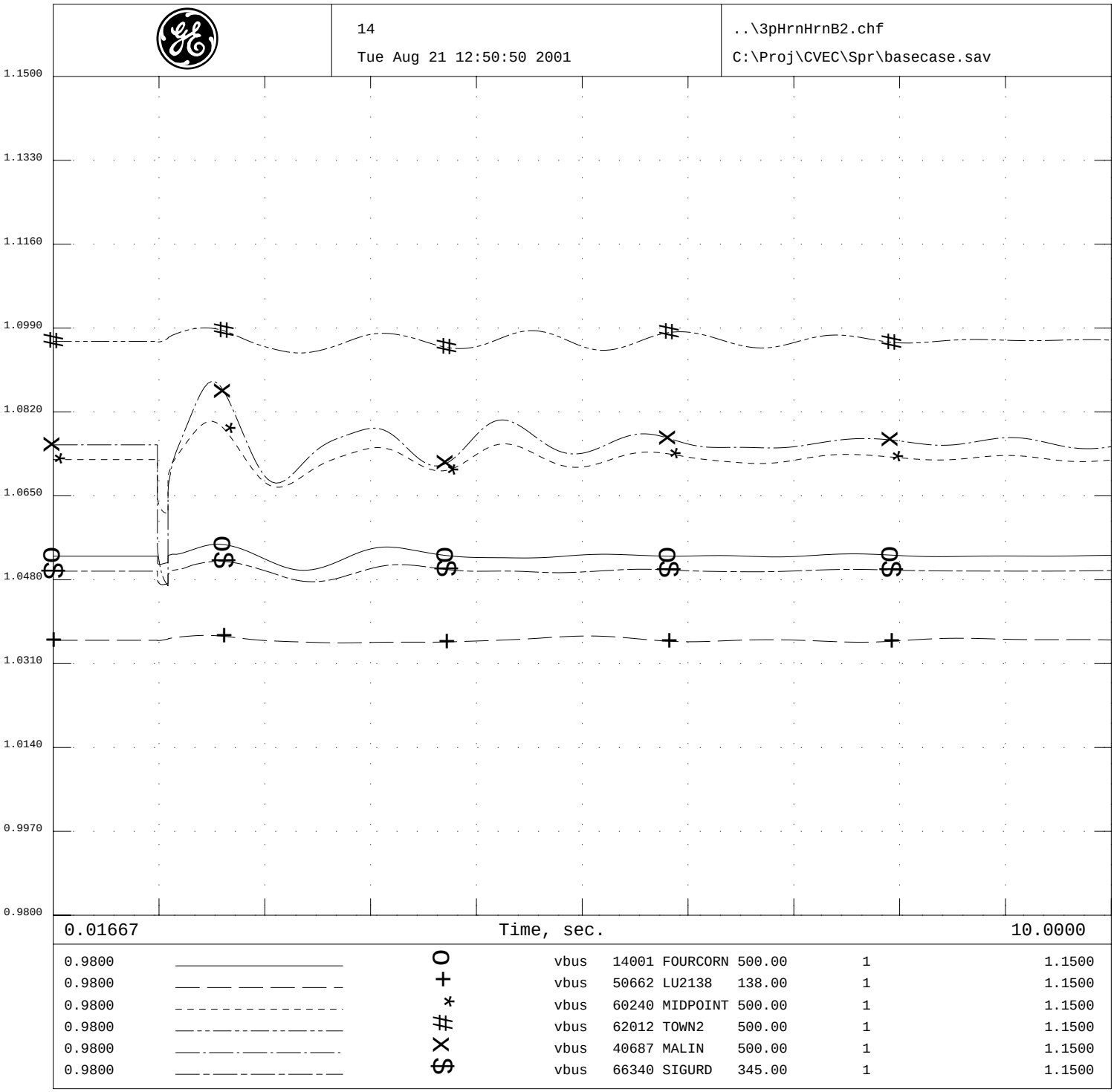

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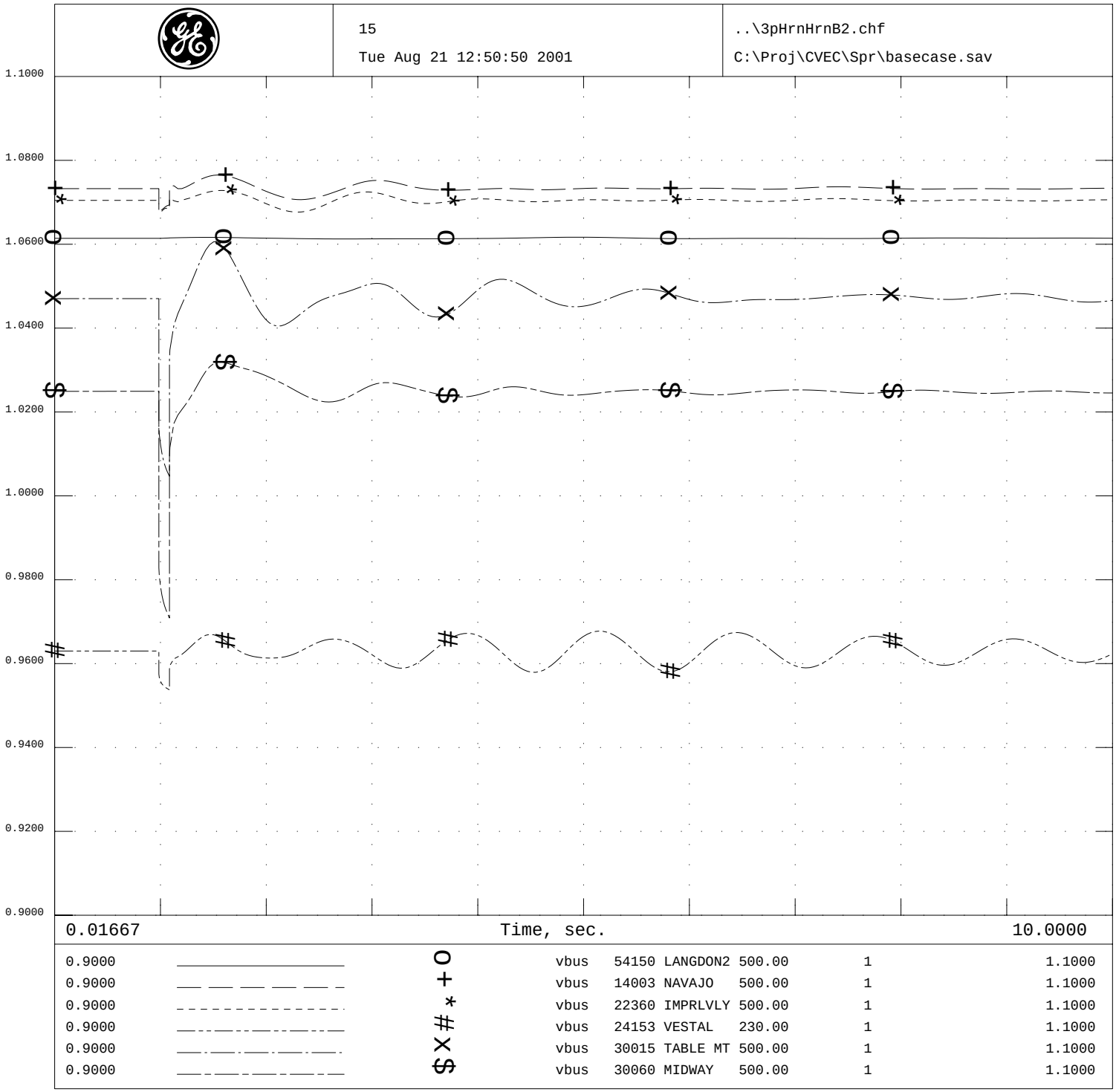
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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Calpine Corporation
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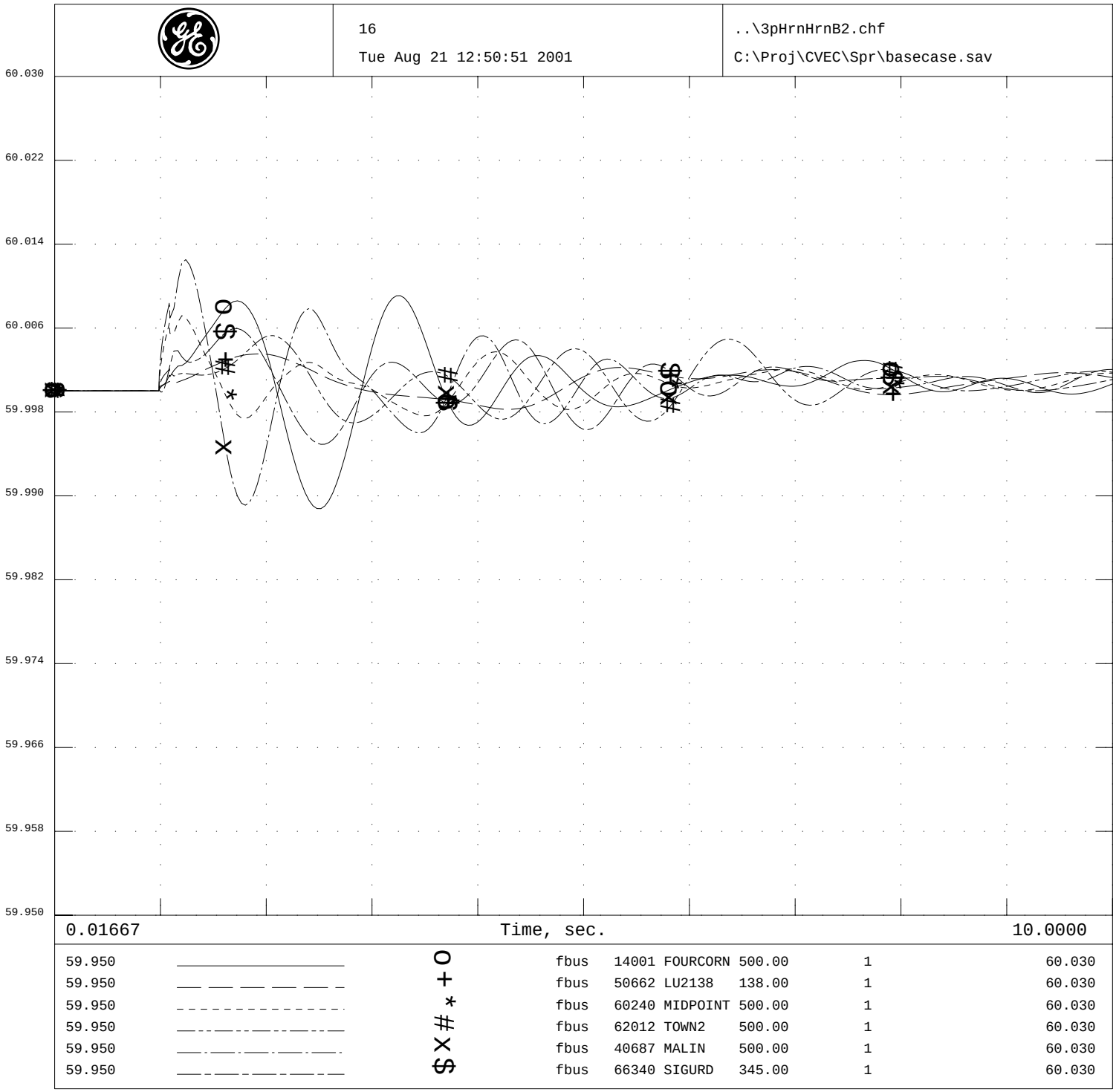

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2004 Heavy Spring Base Case
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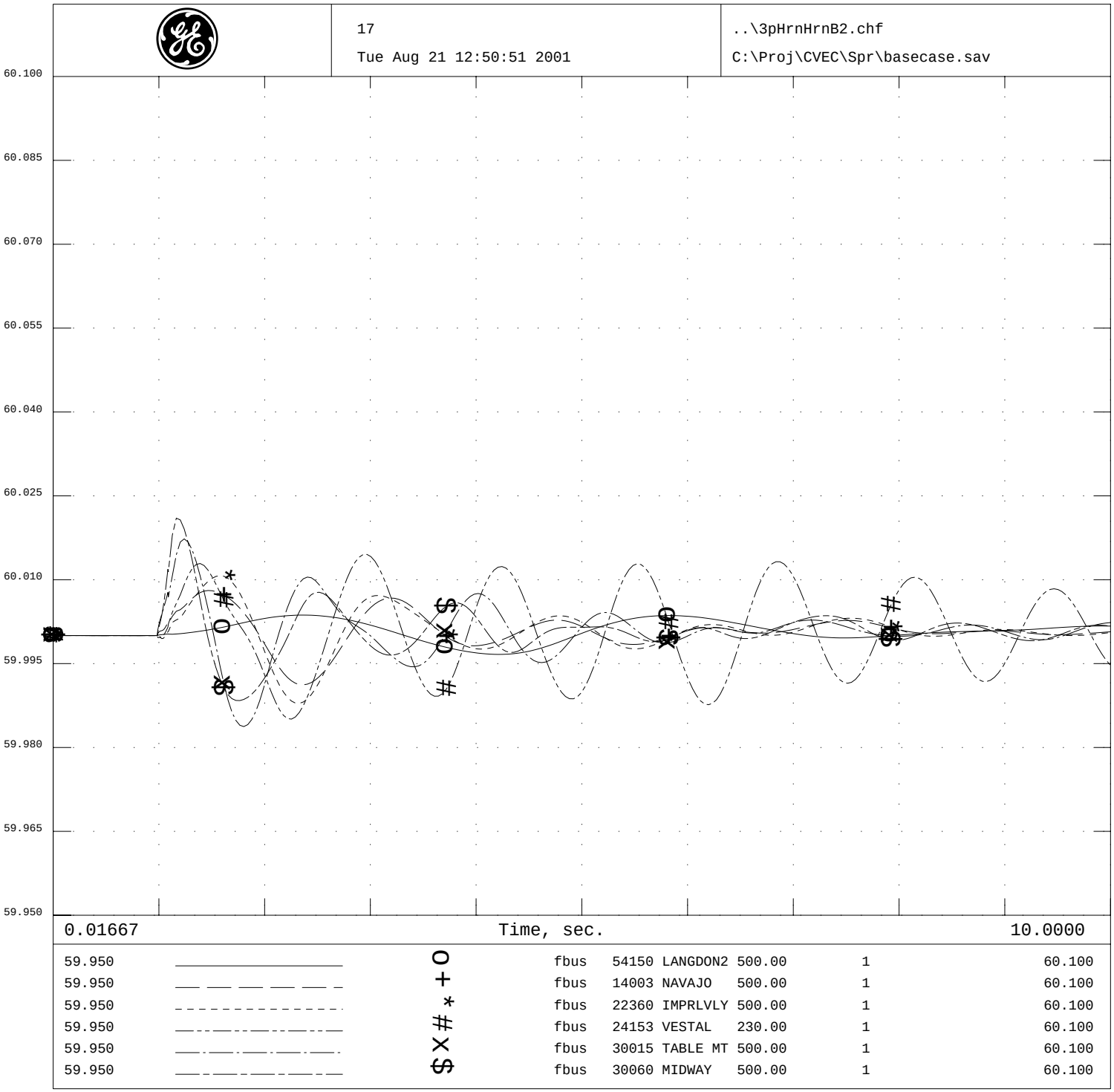
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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Calpine Corporation
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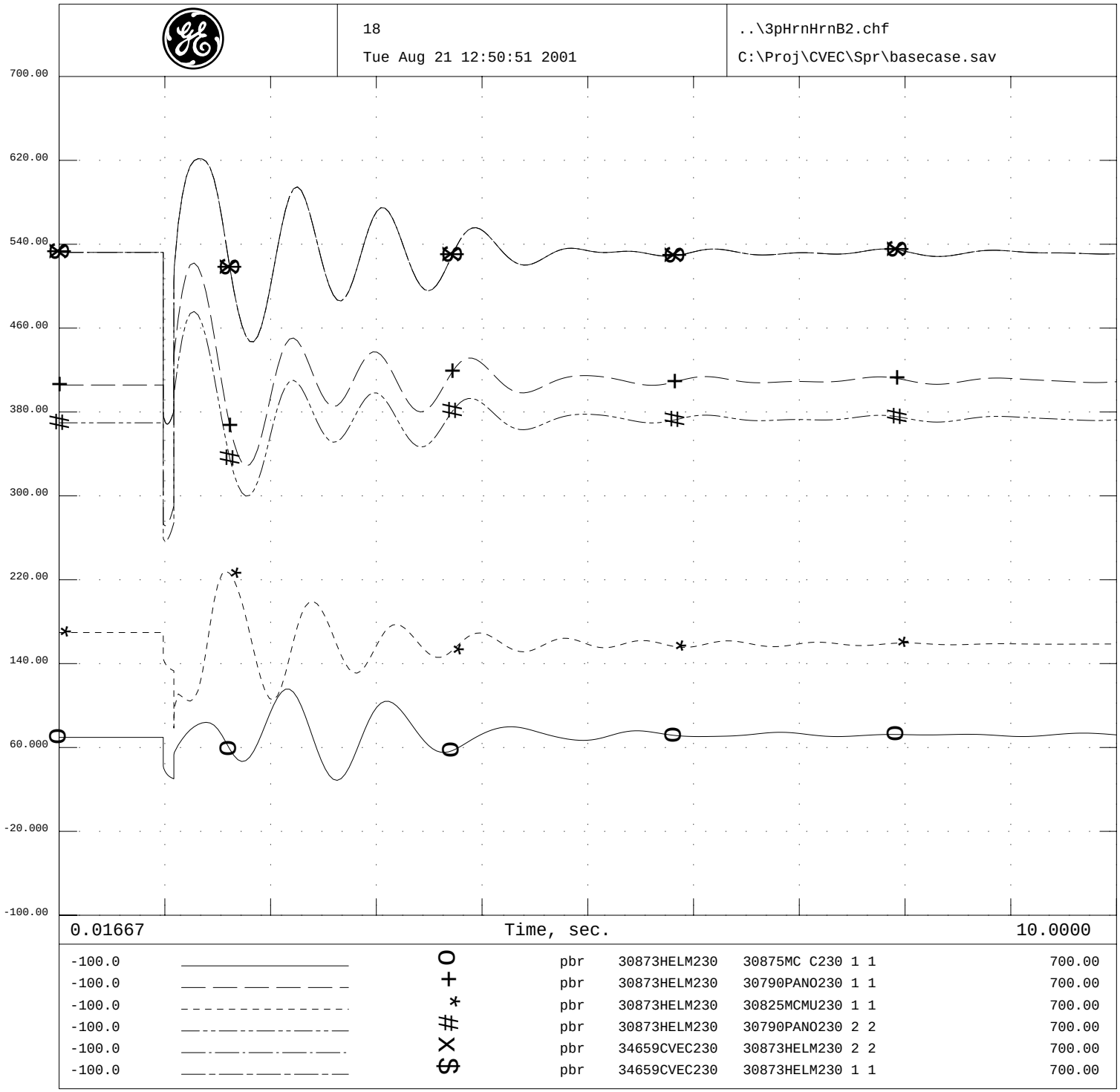

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2004 Heavy Spring Base Case
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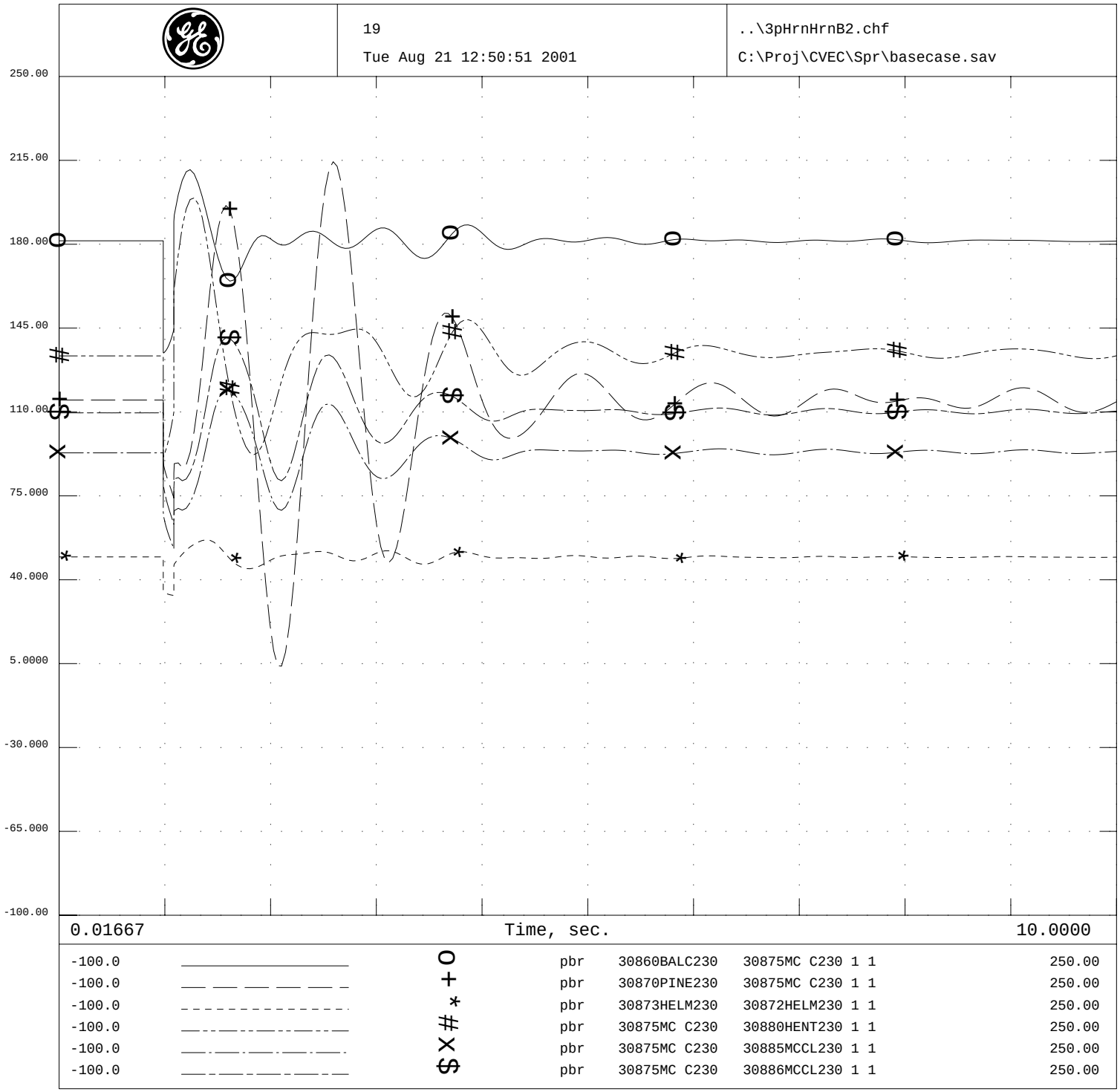
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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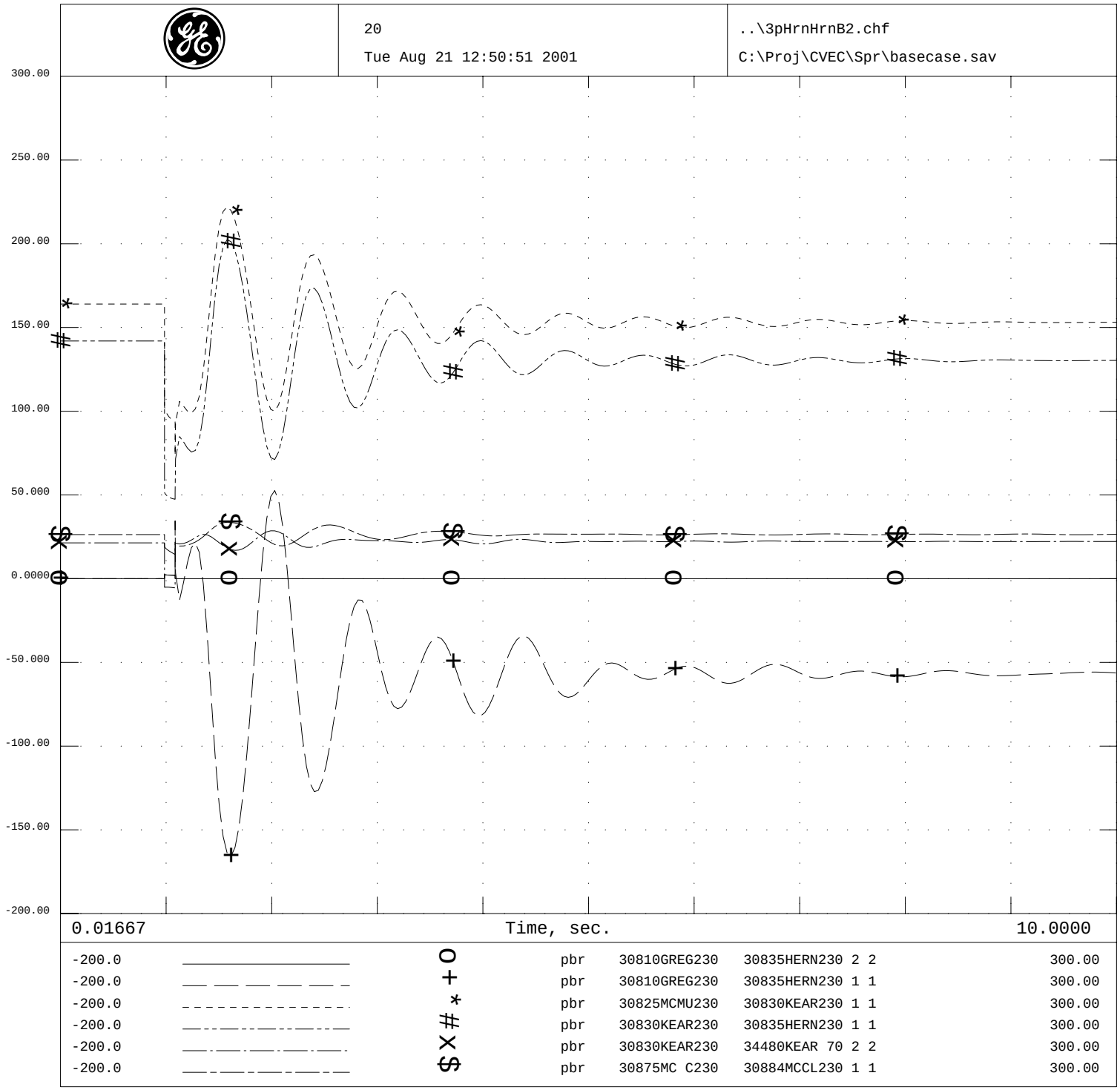

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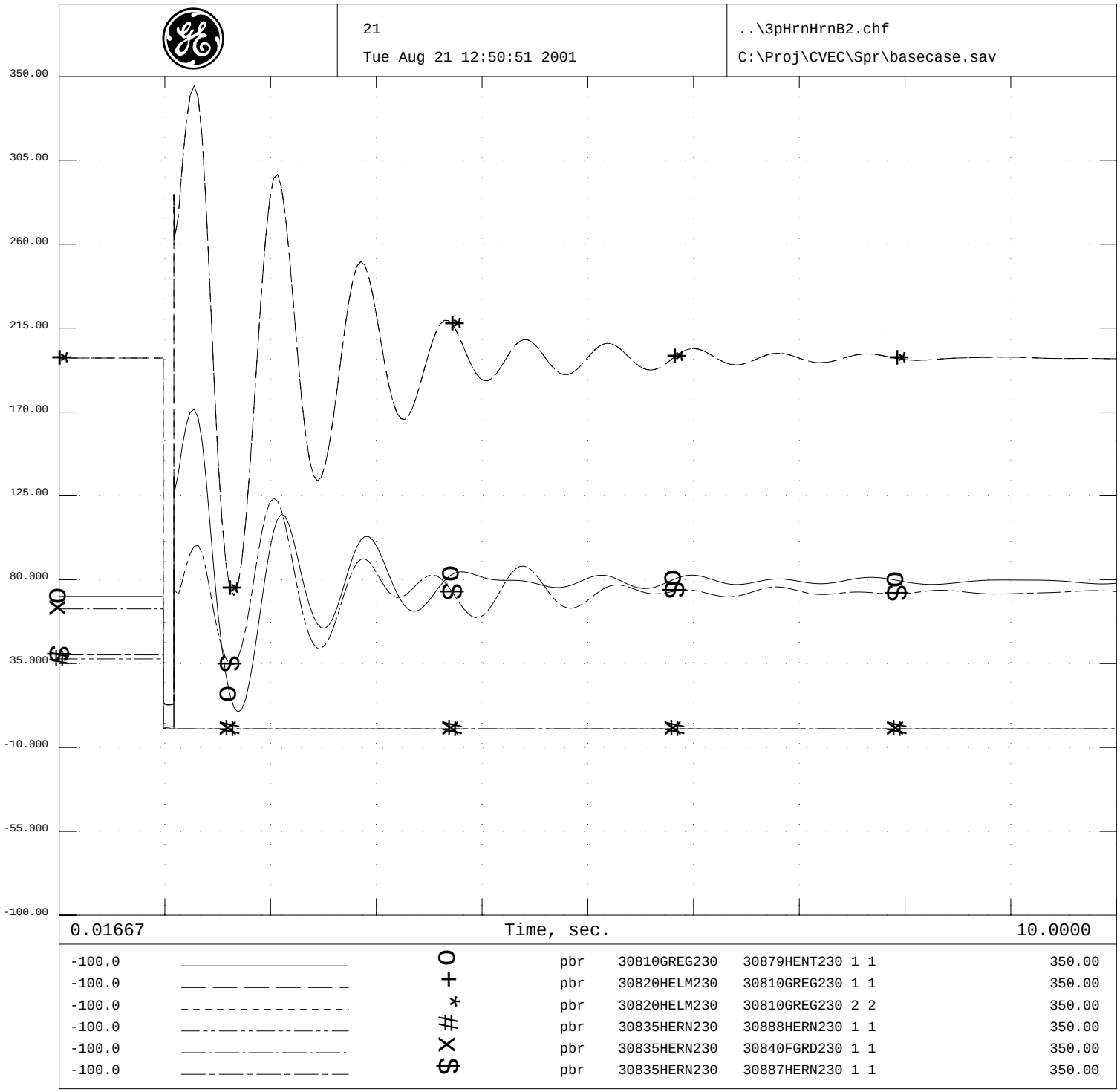

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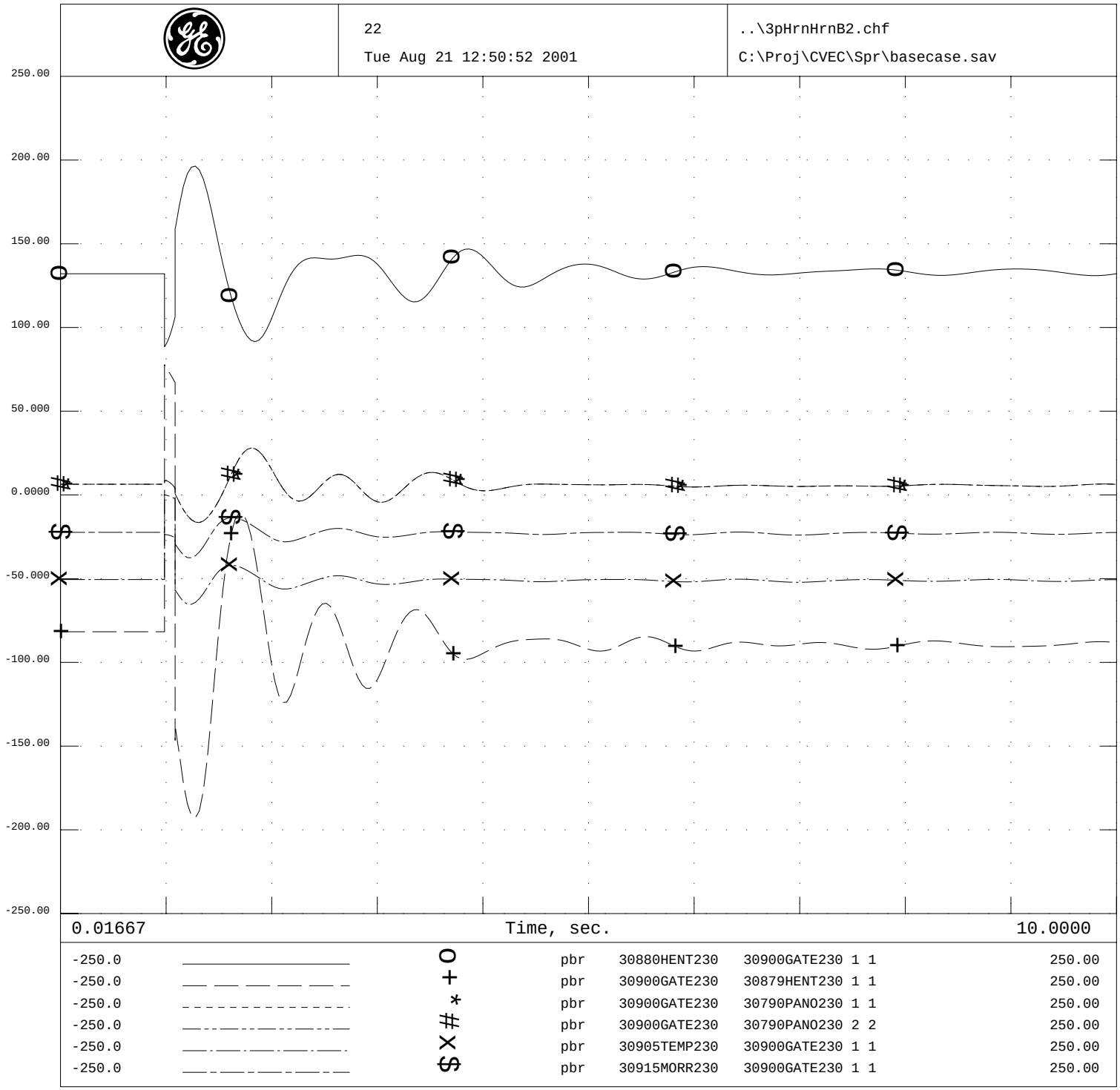

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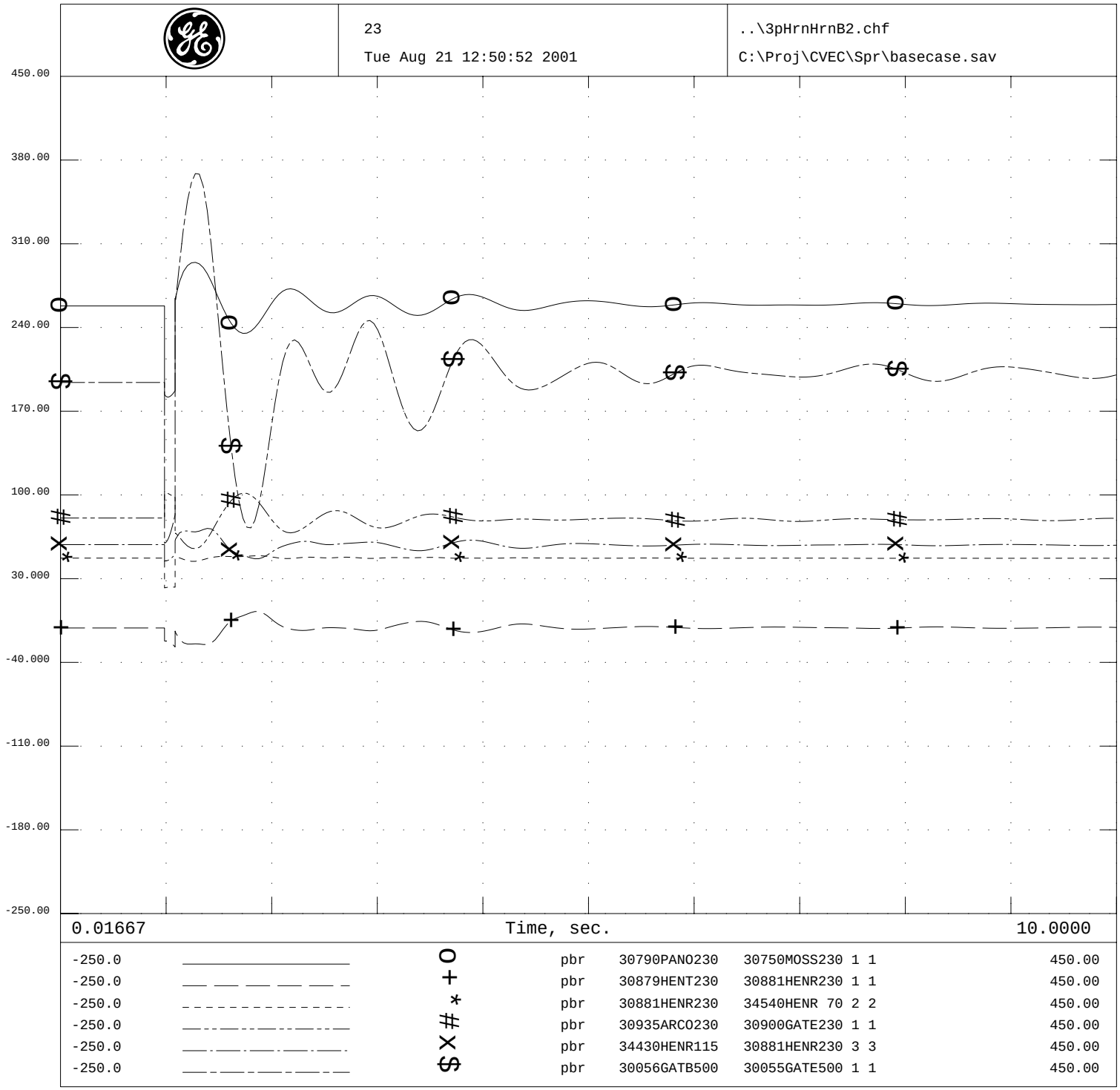

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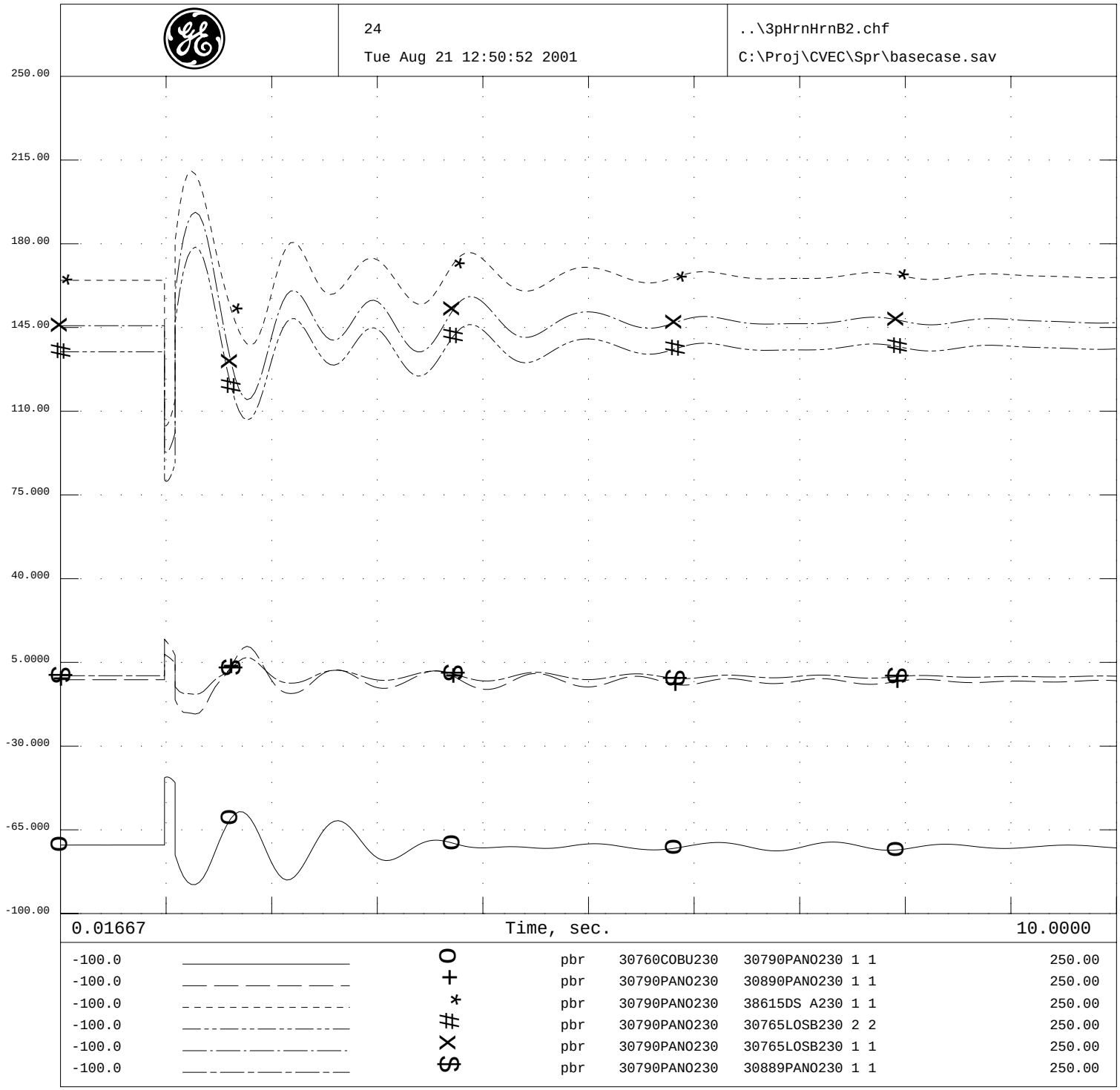

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Calpine Corporation
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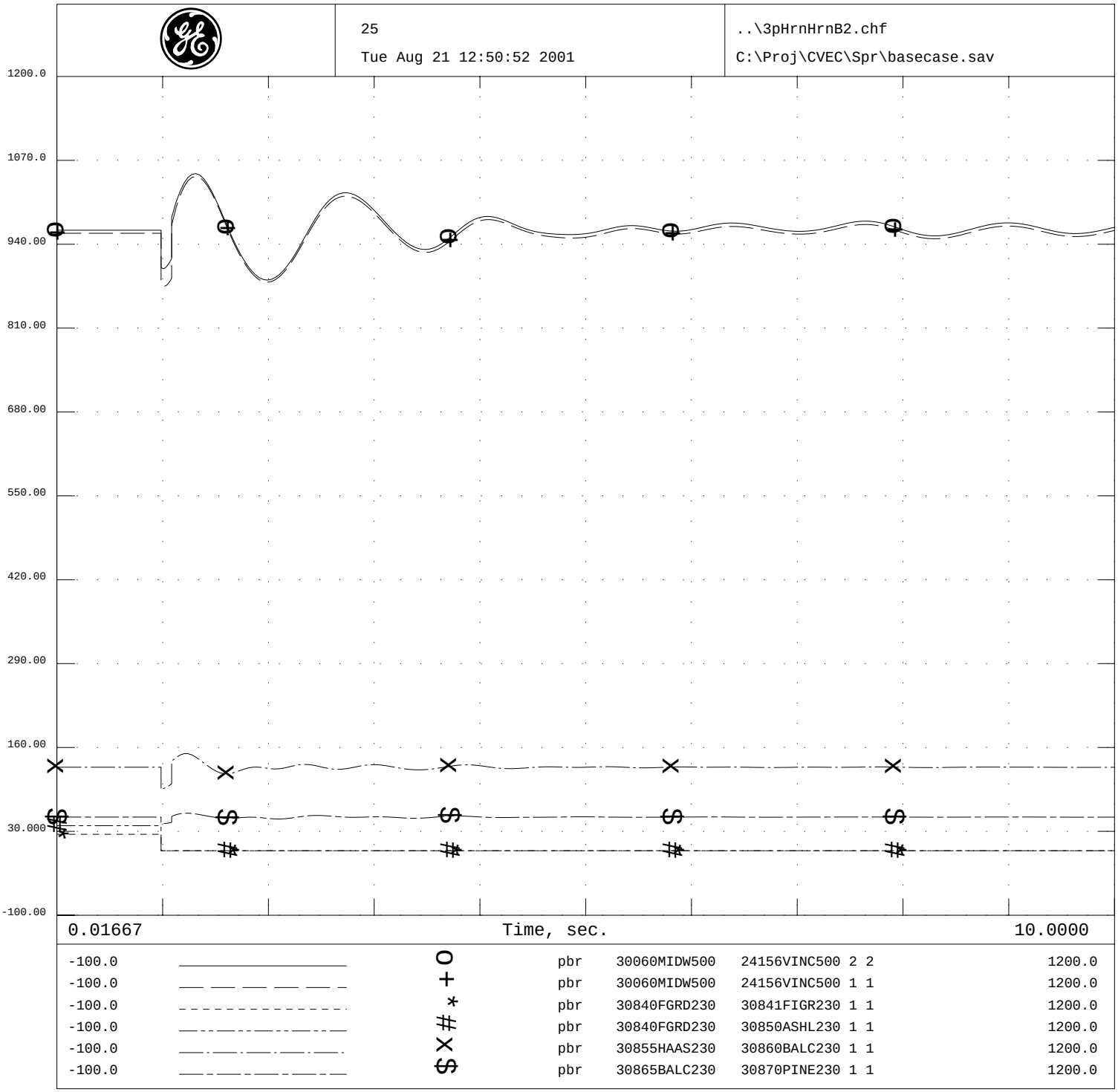

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Calpine Corporation
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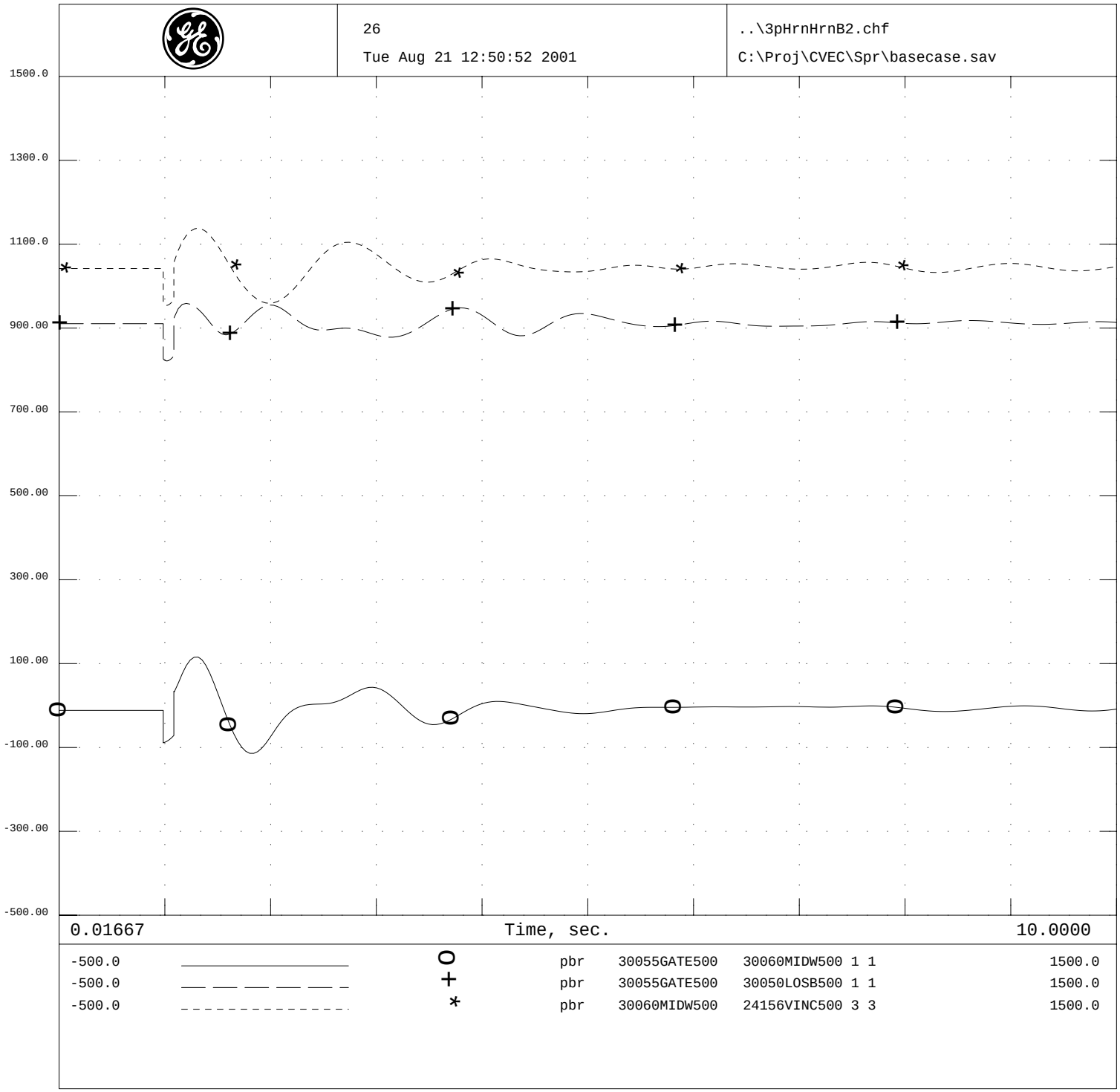

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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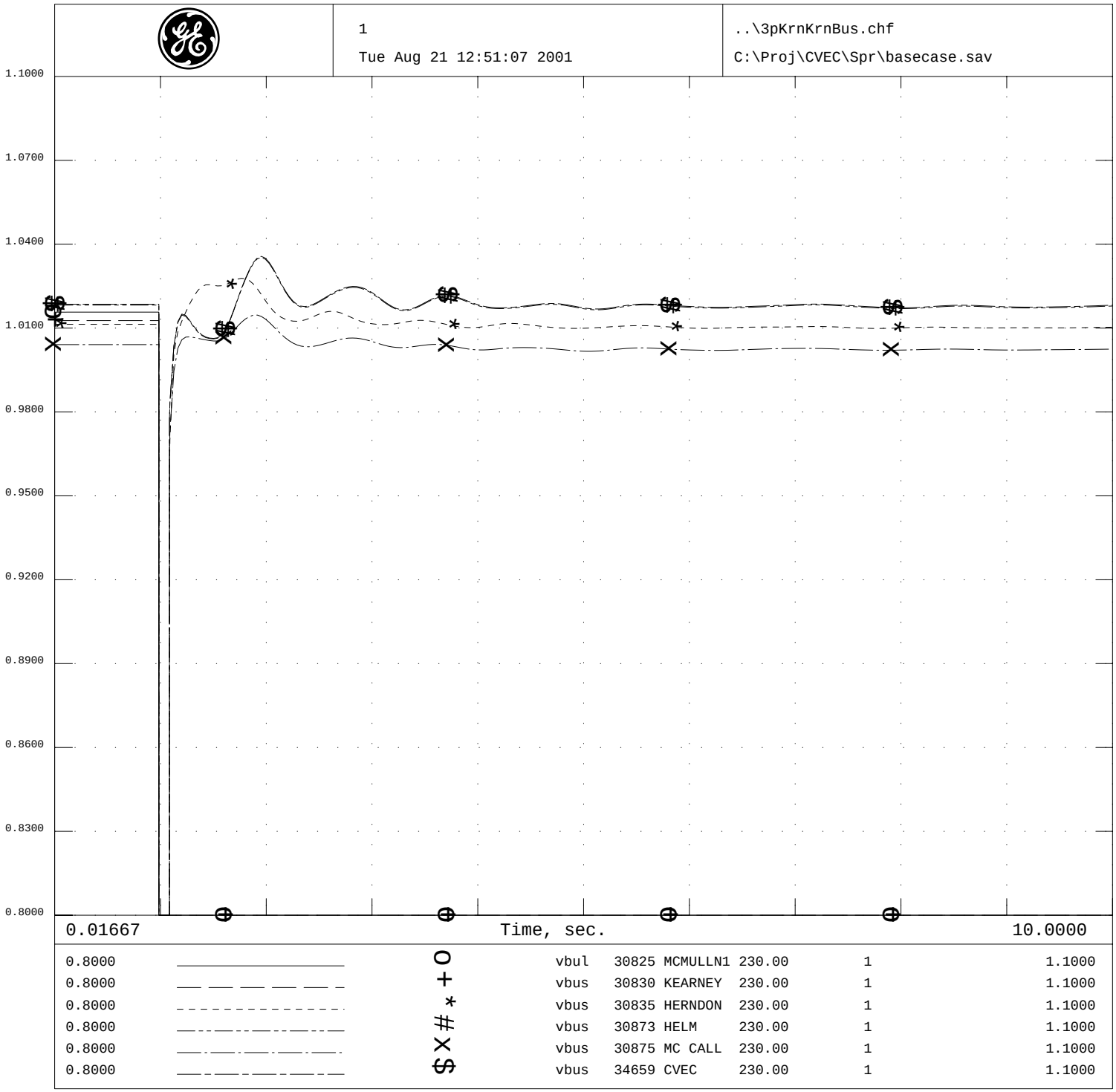
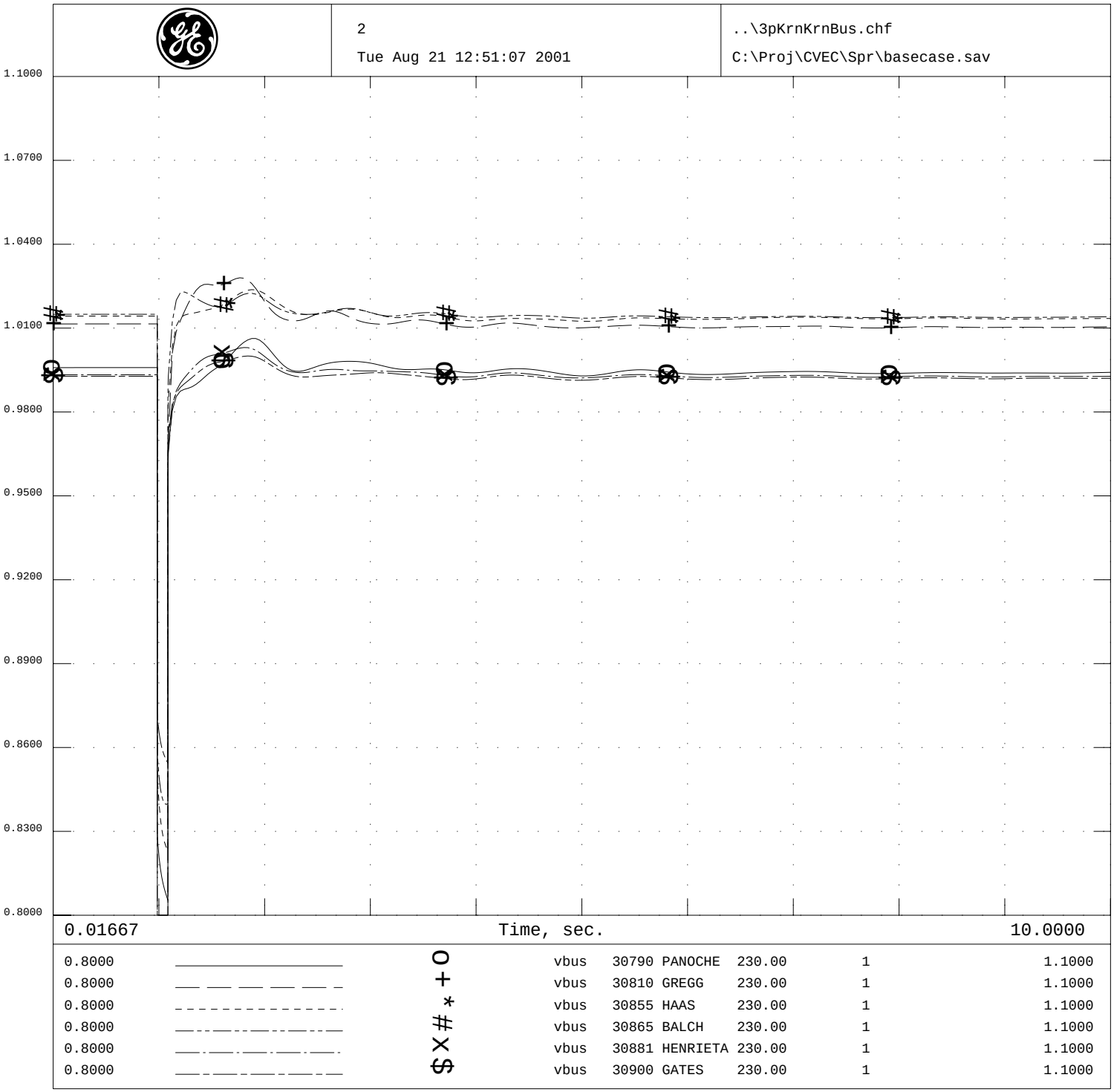
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Kearny 230kV Bus Outage
3 phase 6 cycle fault at Kearny 230kV bus and clear bus

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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2004 Heavy Spring Base Case
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Calpine Corporation
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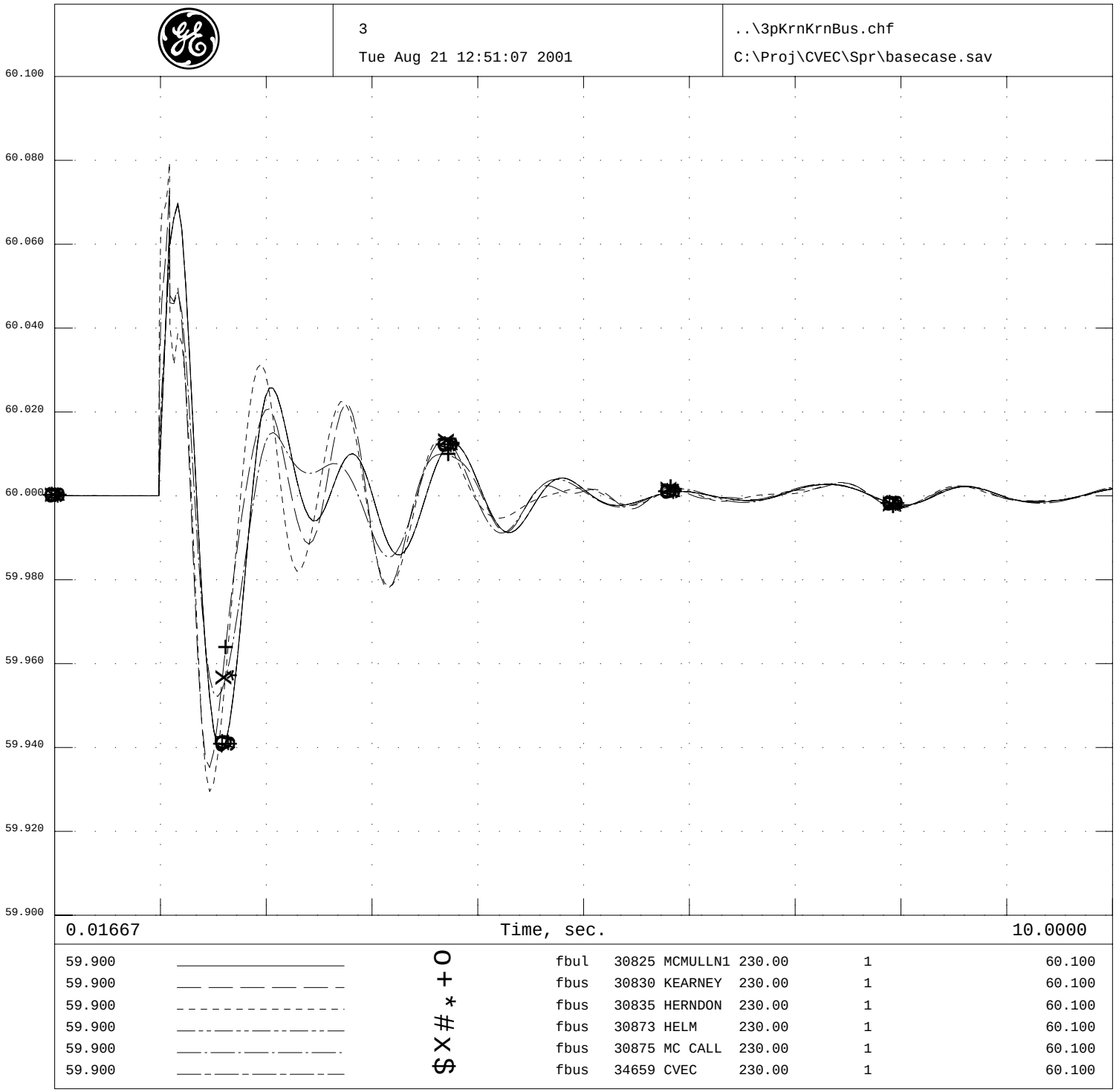

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Central Valley Energy Center
Calpine Corporation
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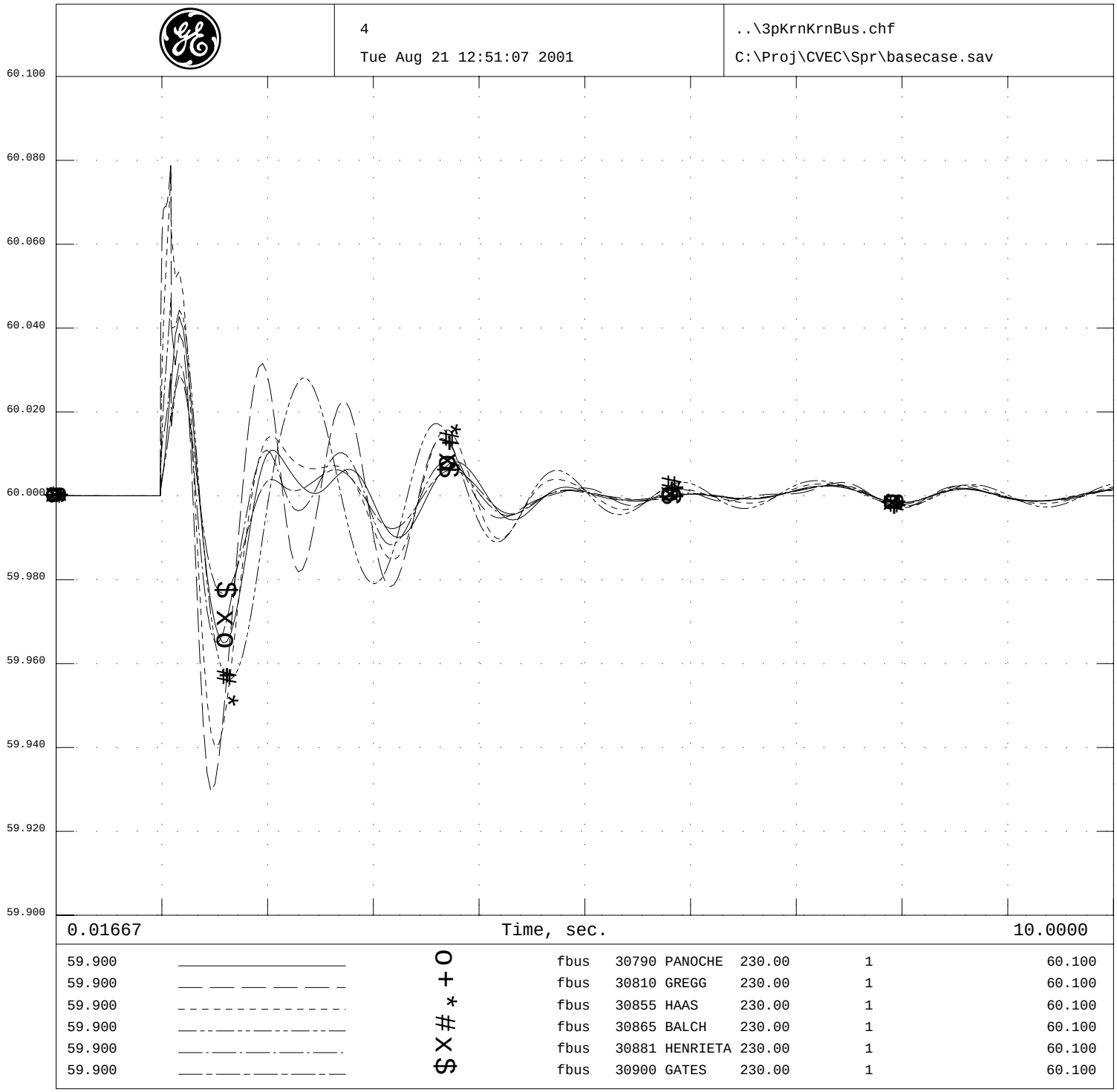

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Calpine Corporation
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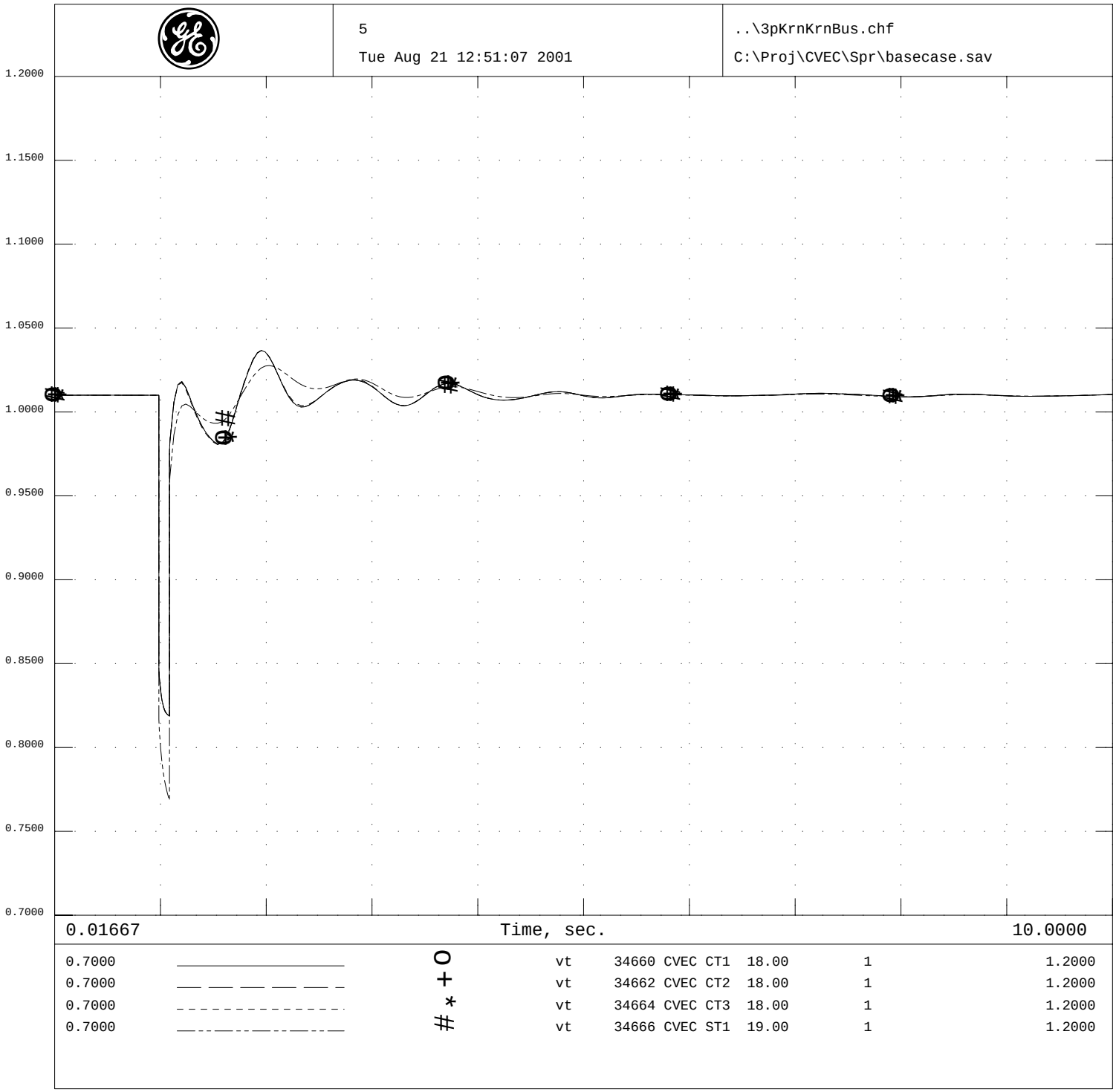

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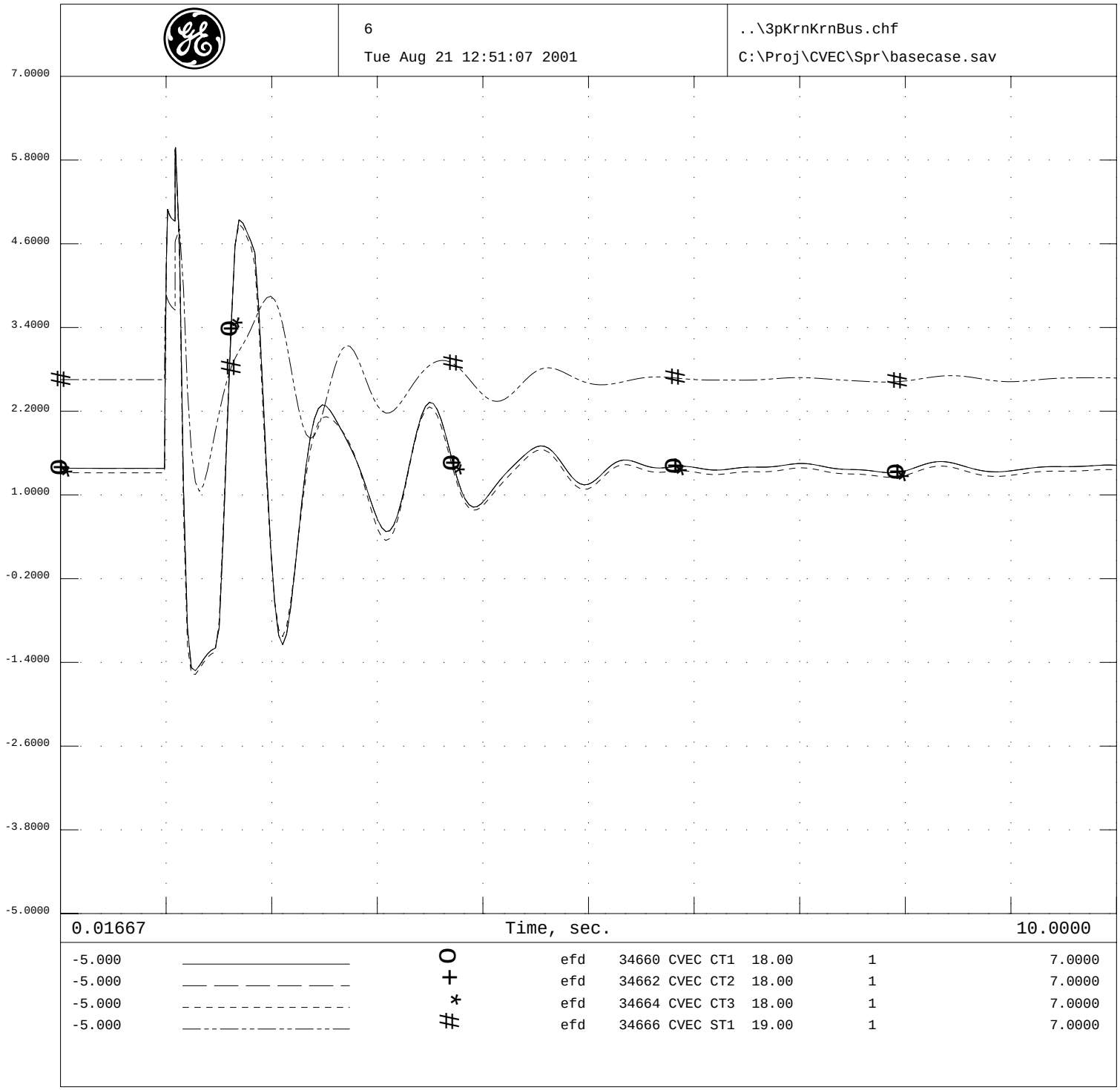
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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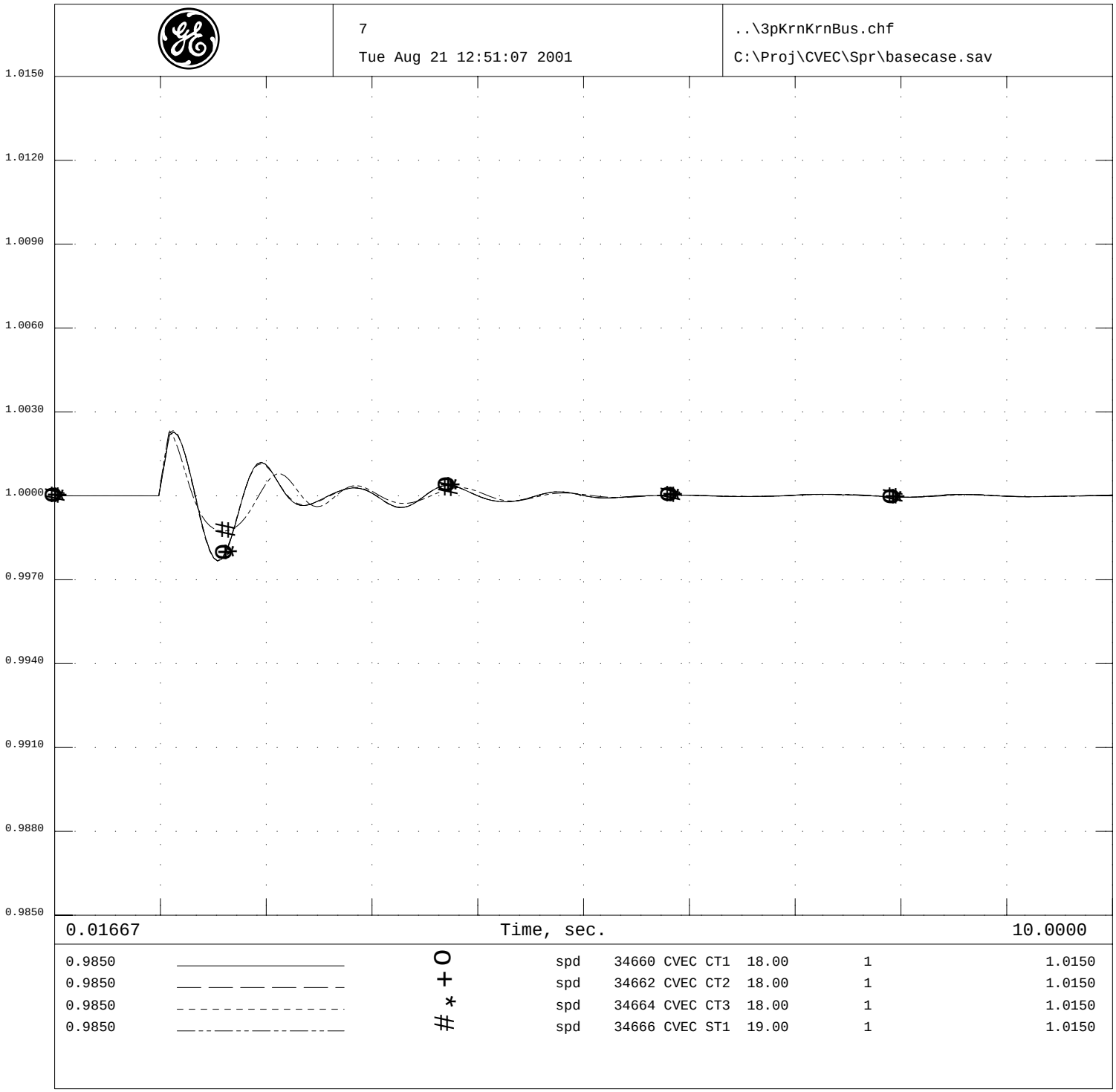
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
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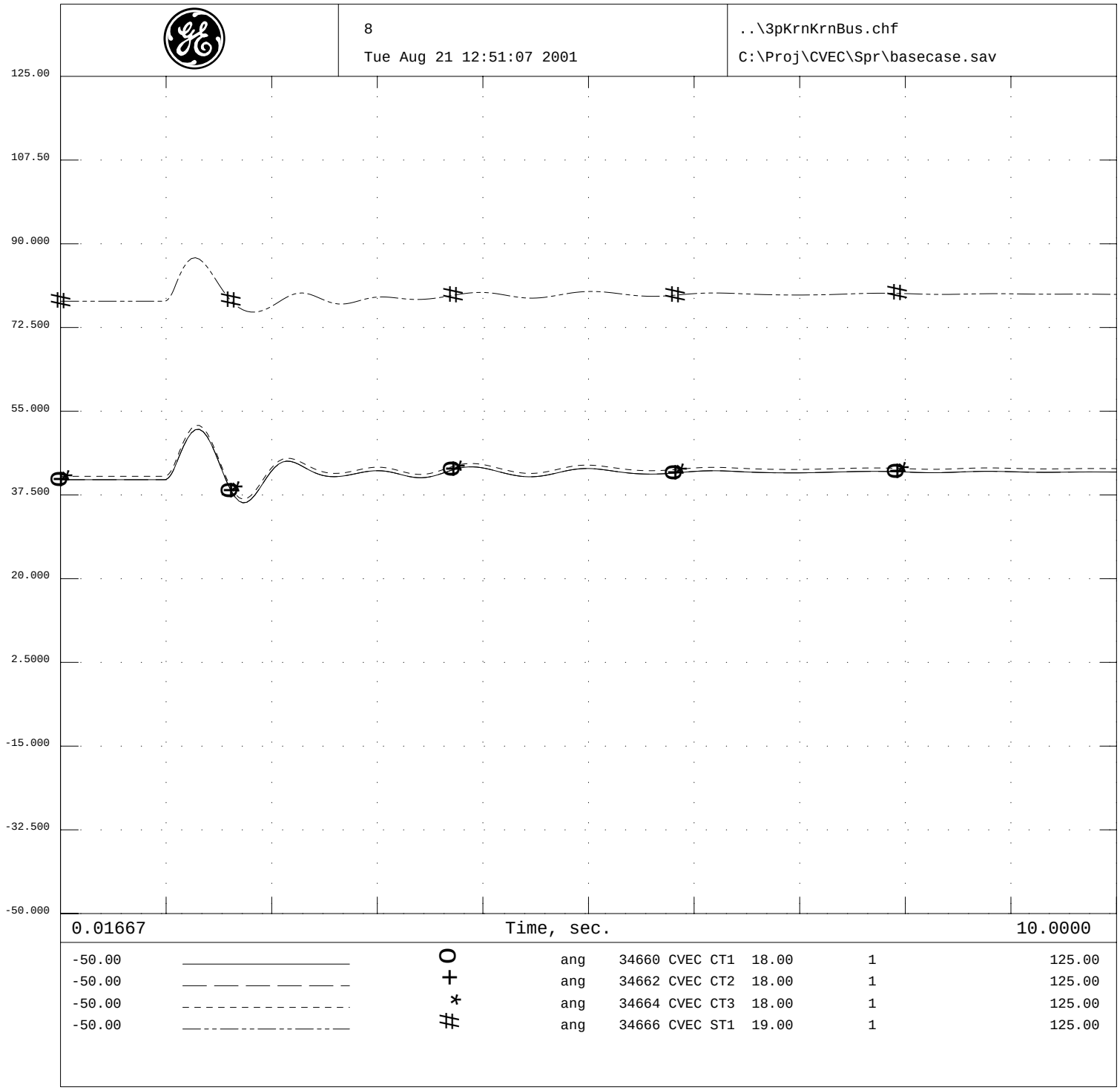
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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2004 Heavy Spring Base Case
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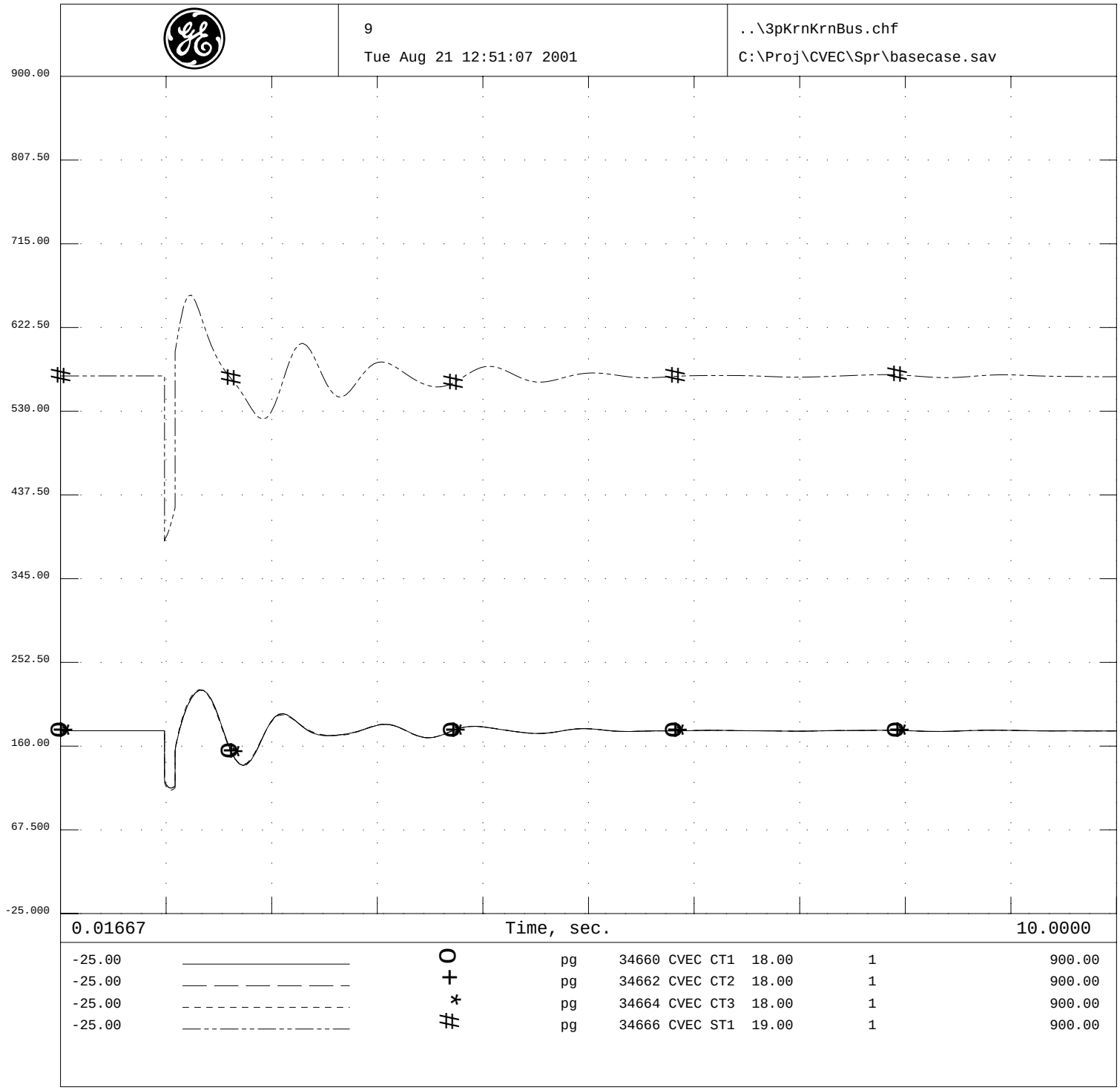
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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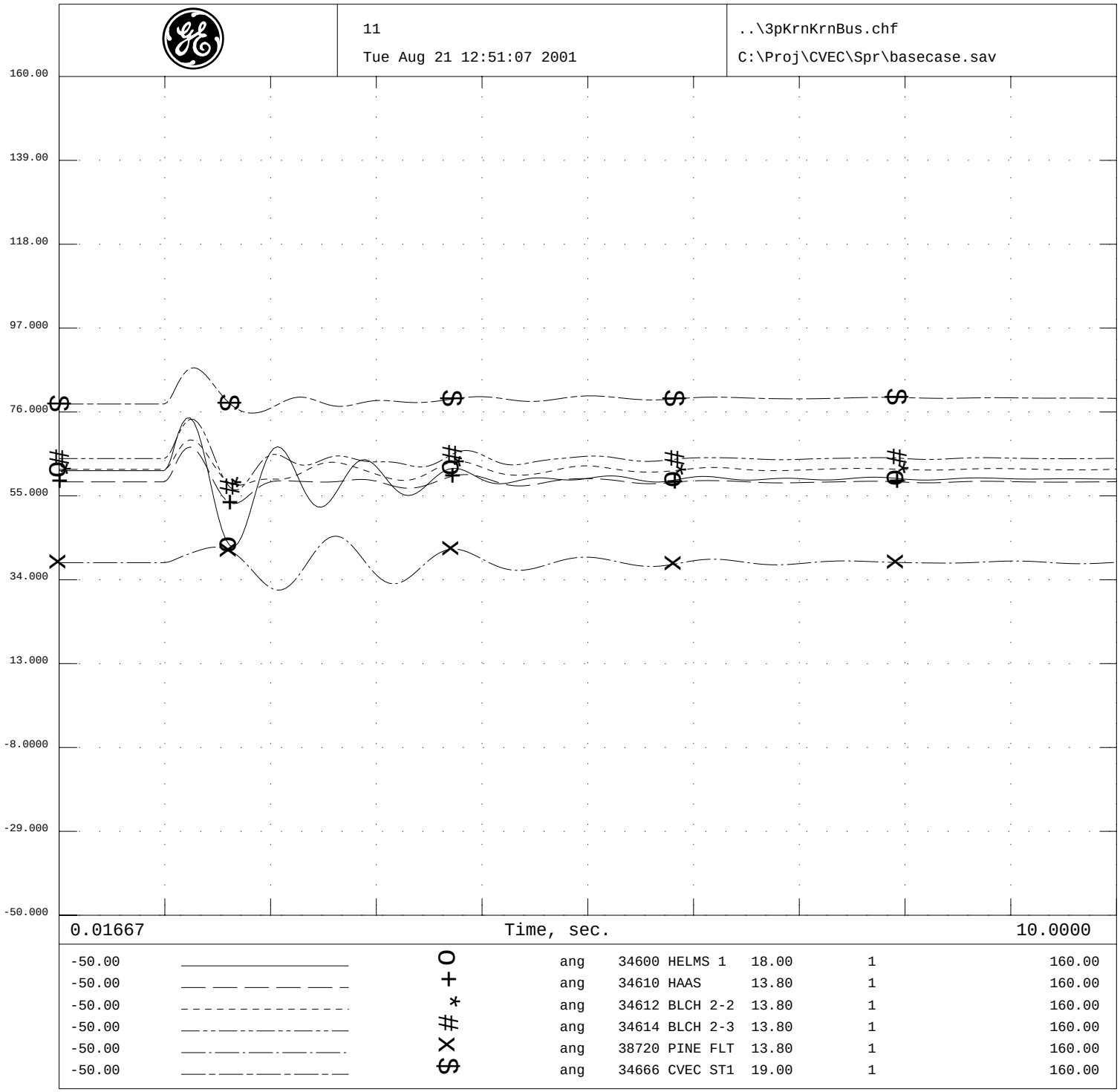
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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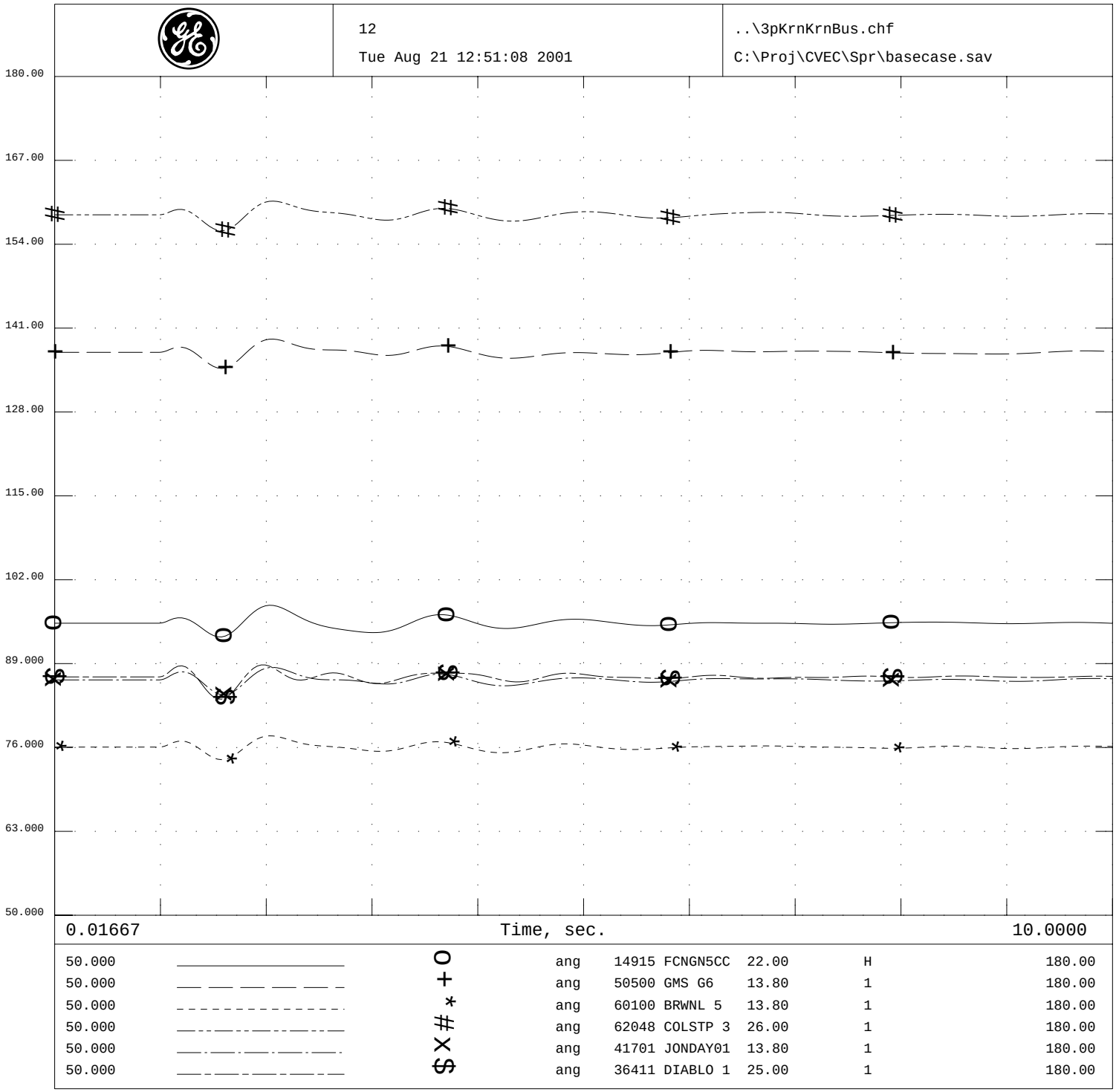
Calpine Corporation
Selected Local Rotor Angle Plots



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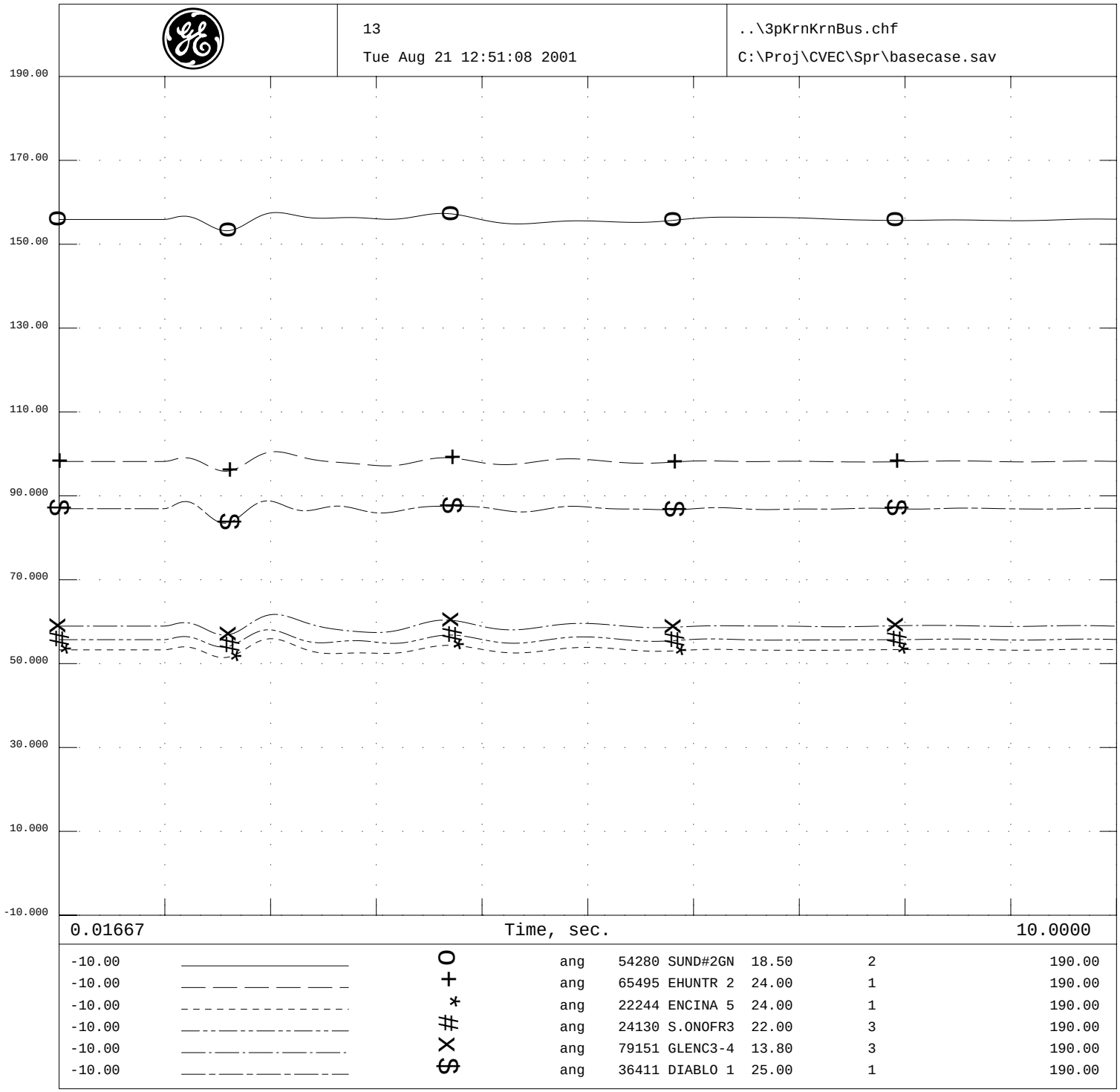
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Kearny 230kV Bus Outage
3 phase 6 cycle fault at Kearny 230kV bus and clear bus

Central Valley Energy Center
Calpine Corporation
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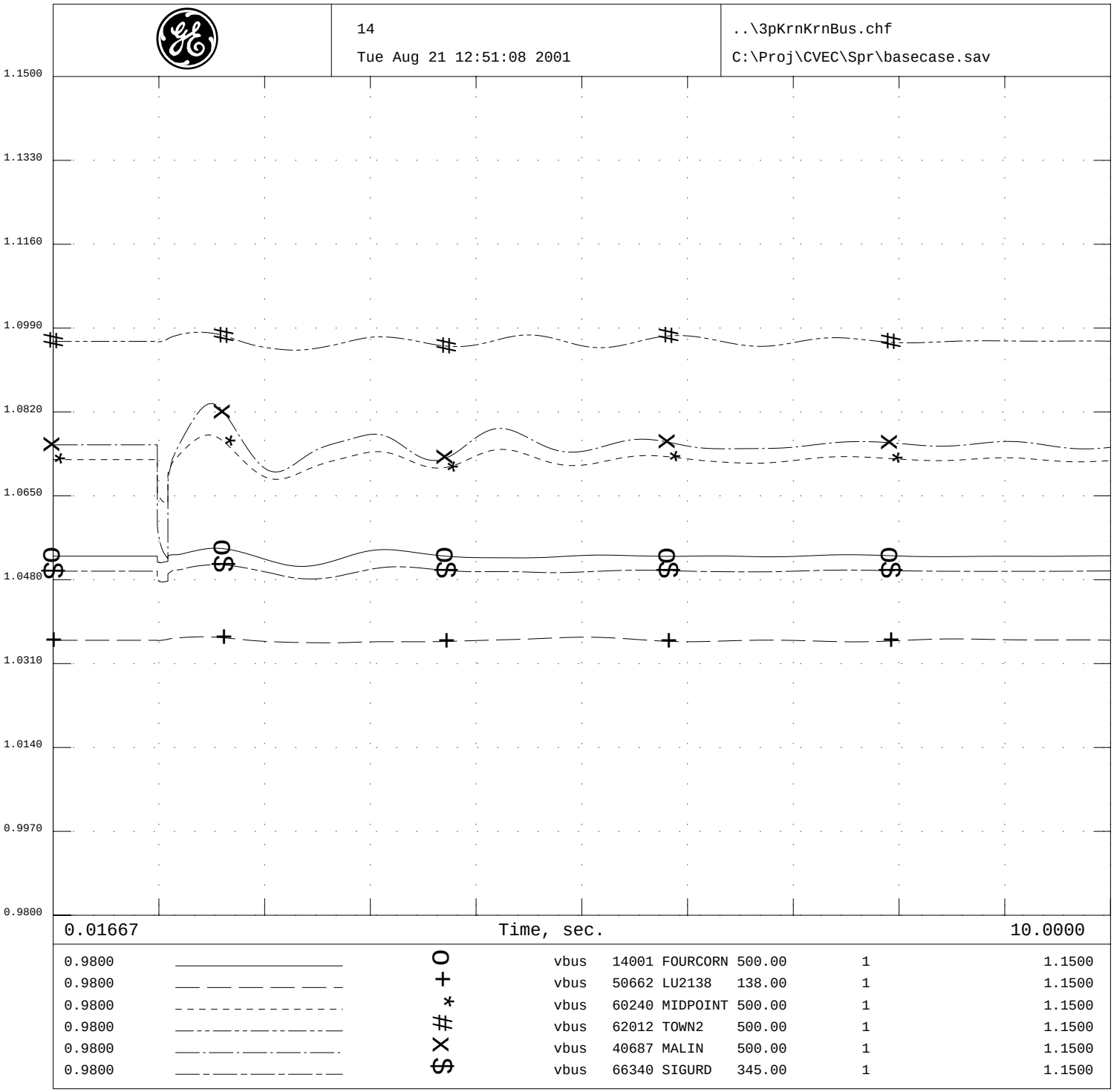

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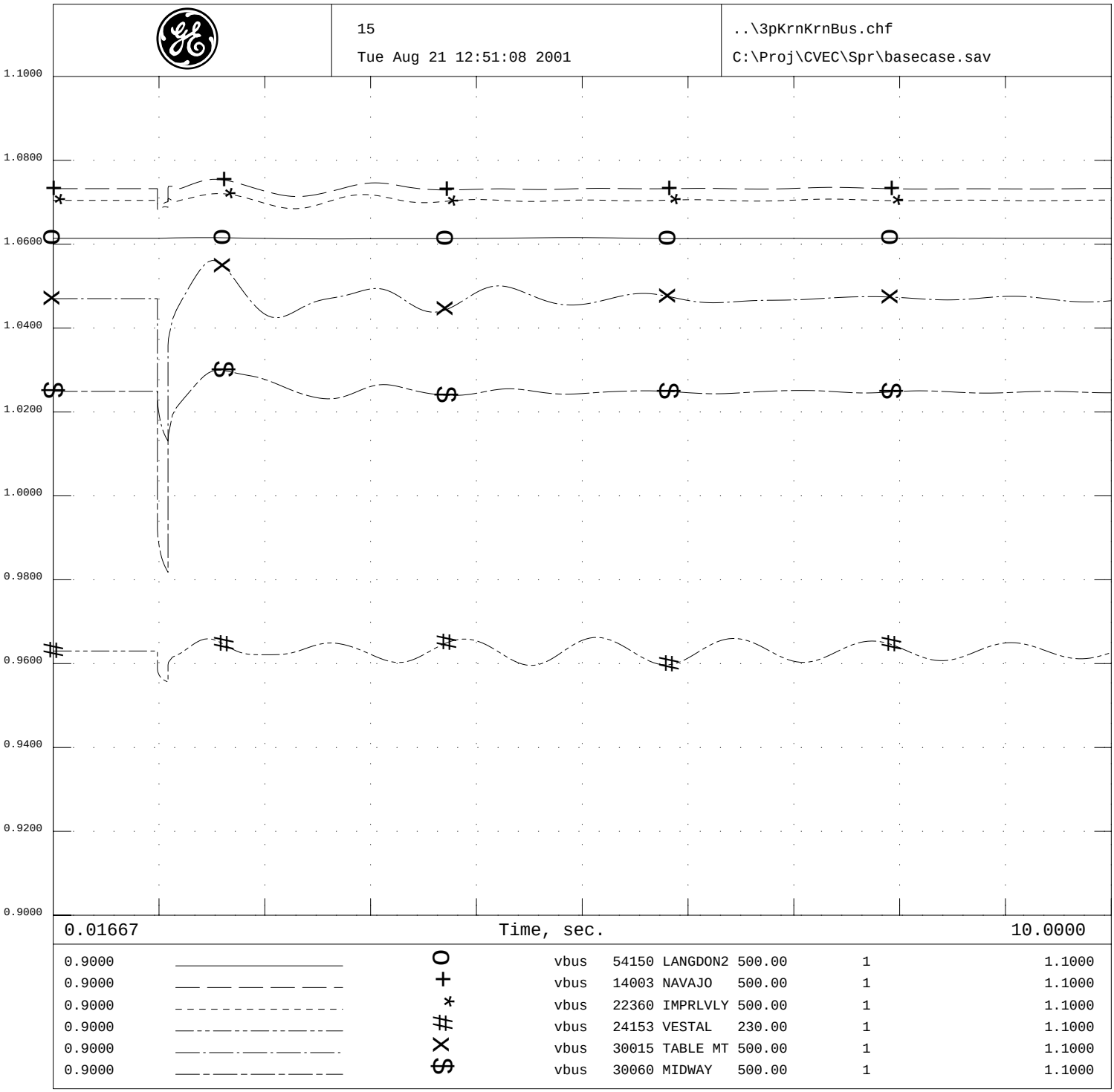

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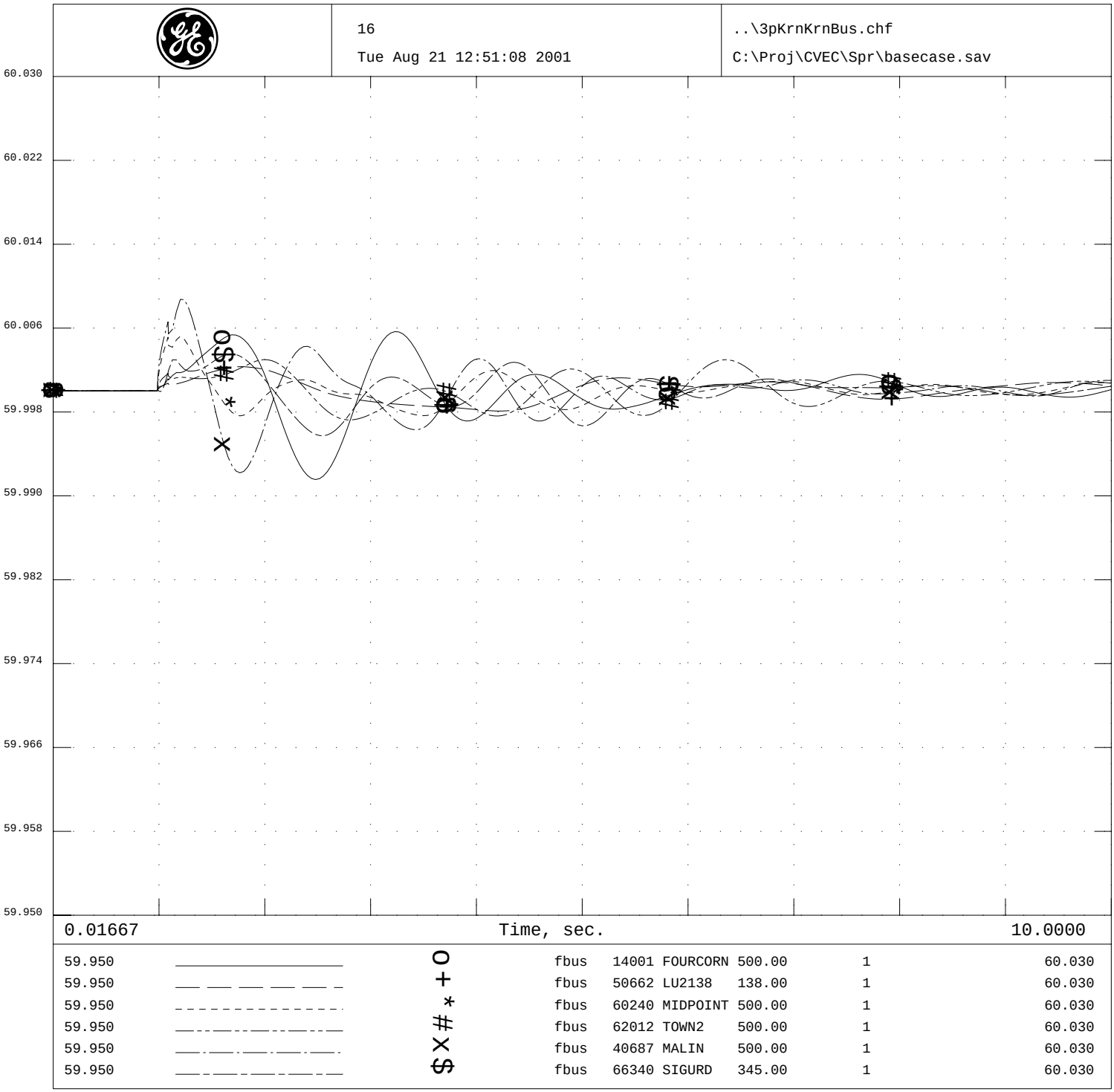

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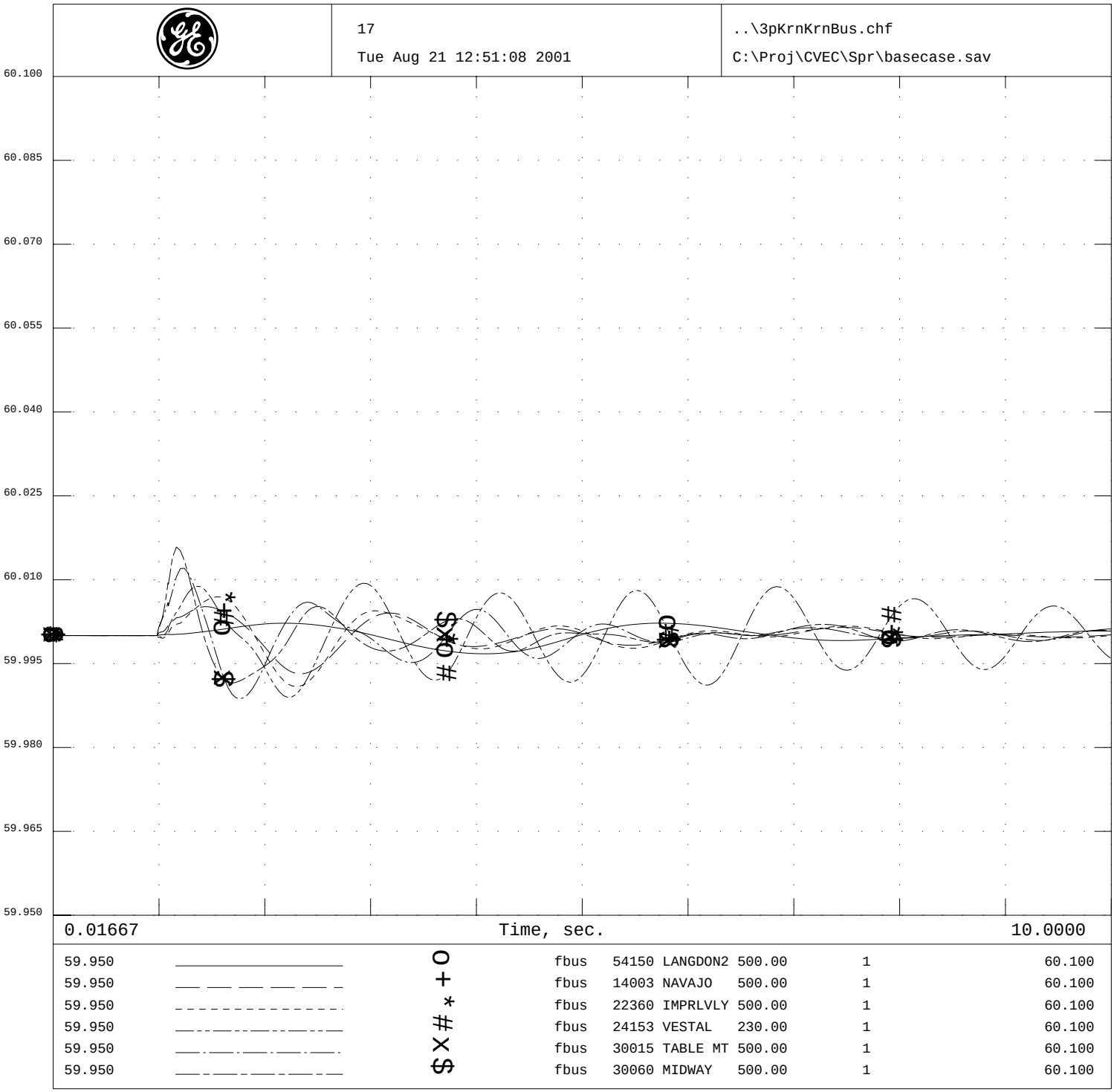

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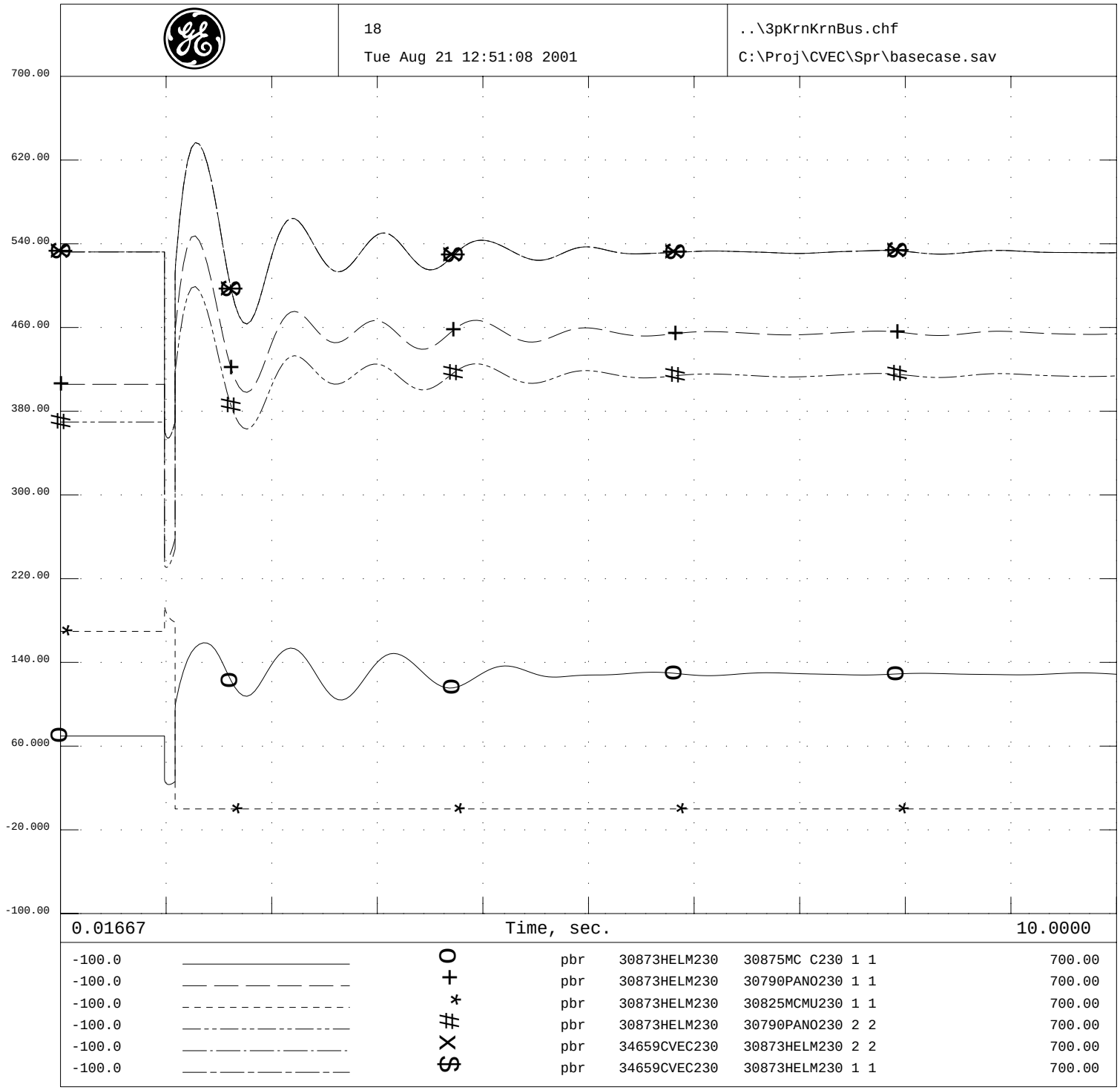

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Central Valley Energy Center
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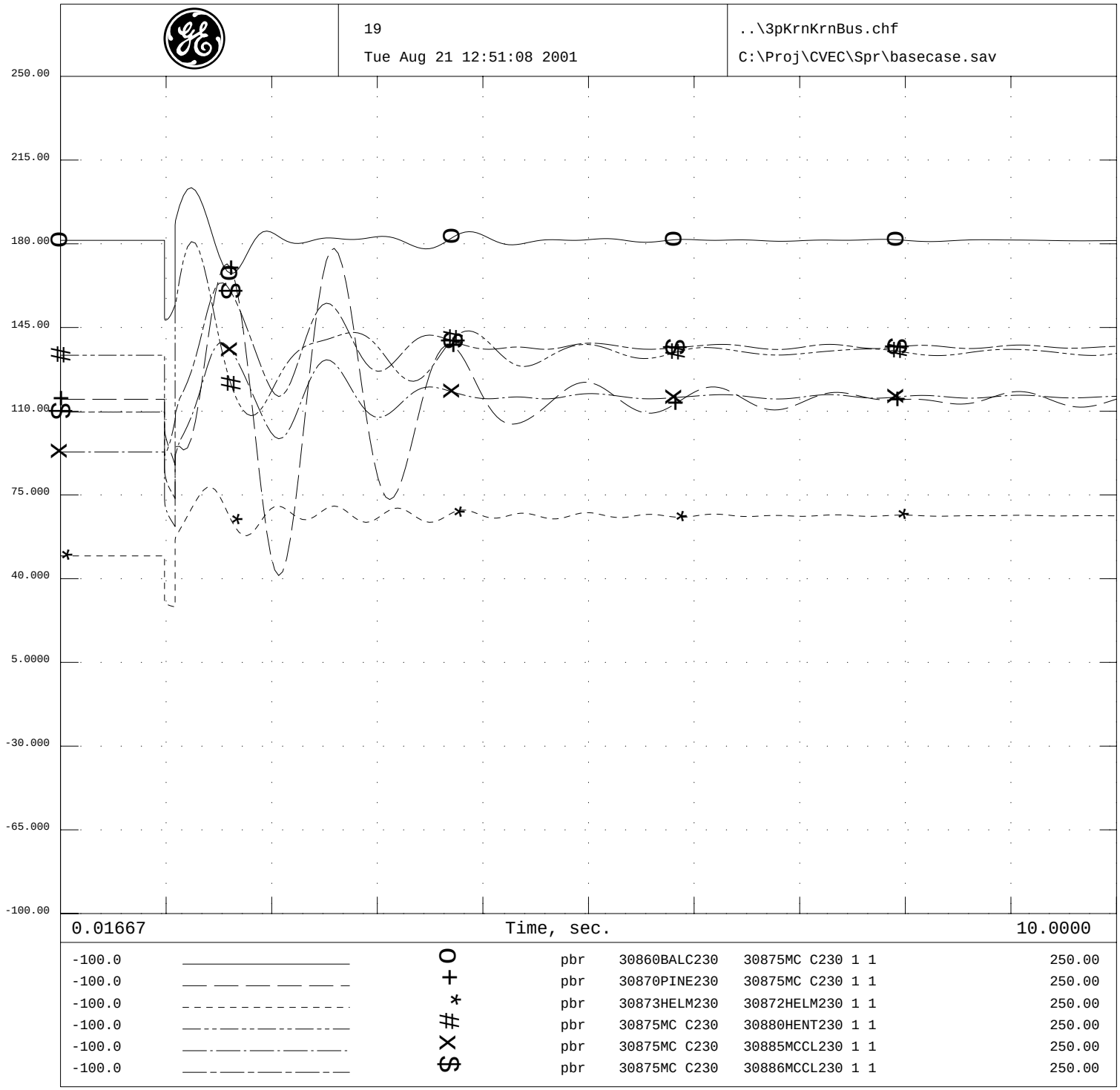

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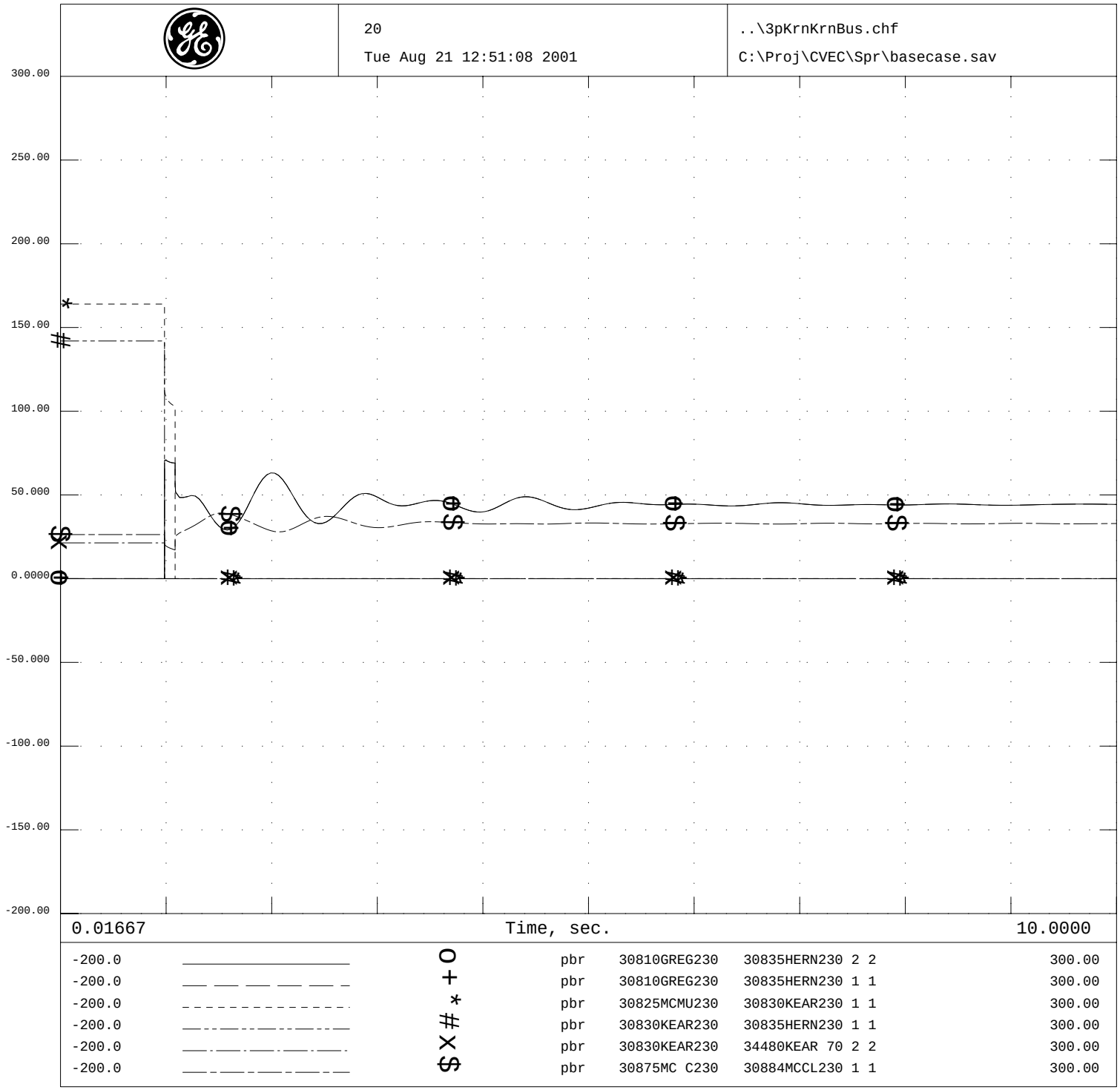

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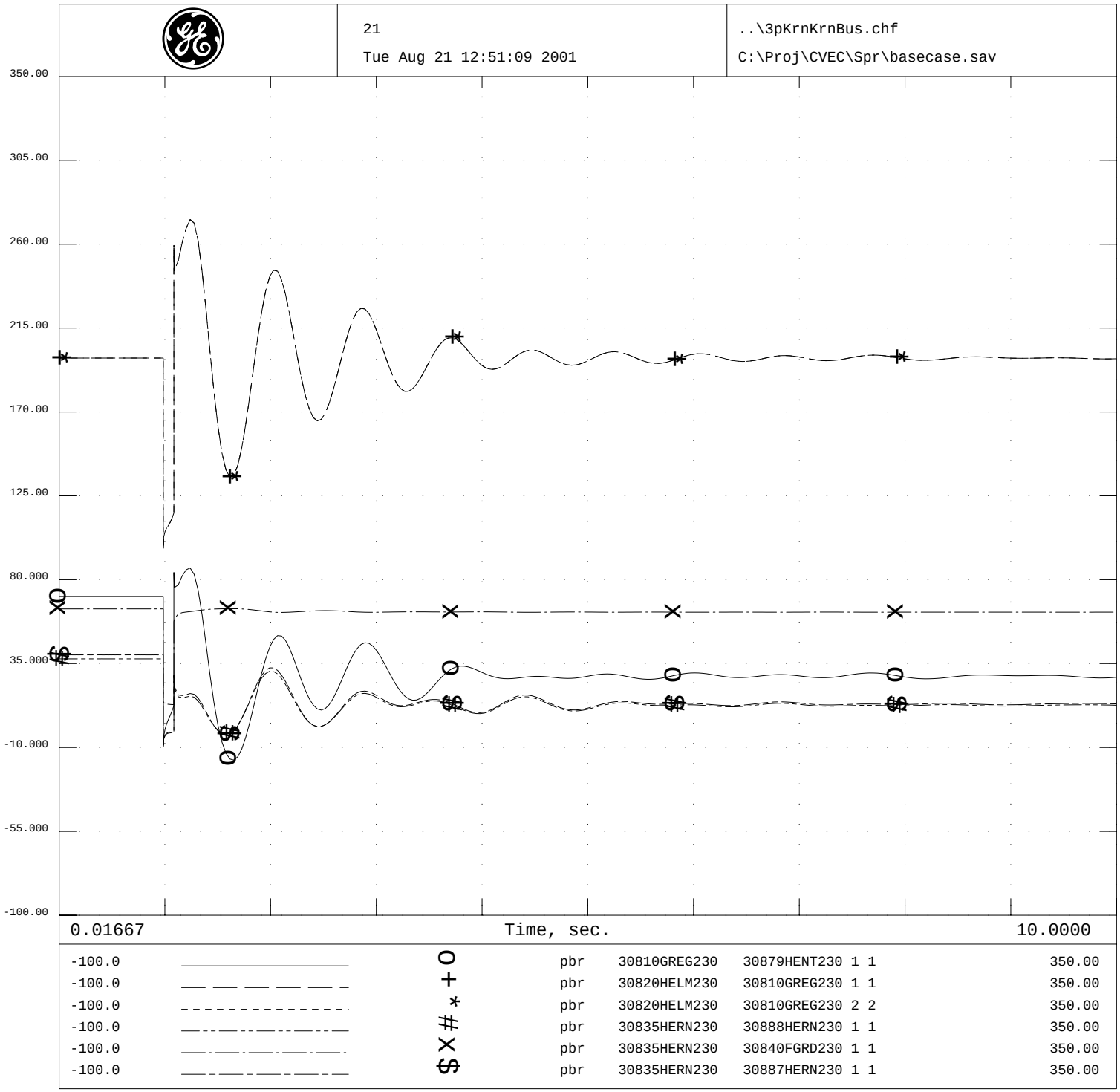

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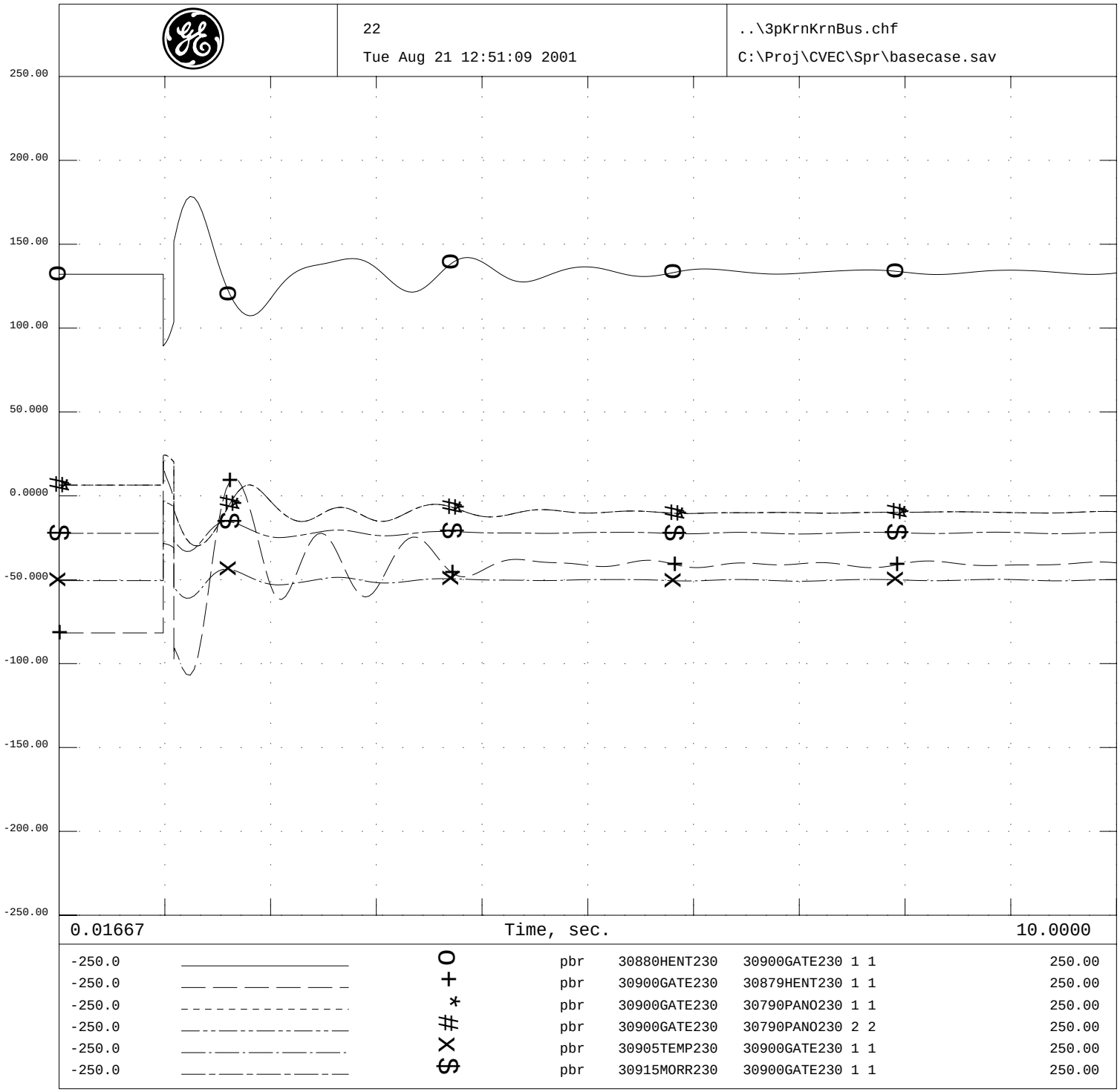

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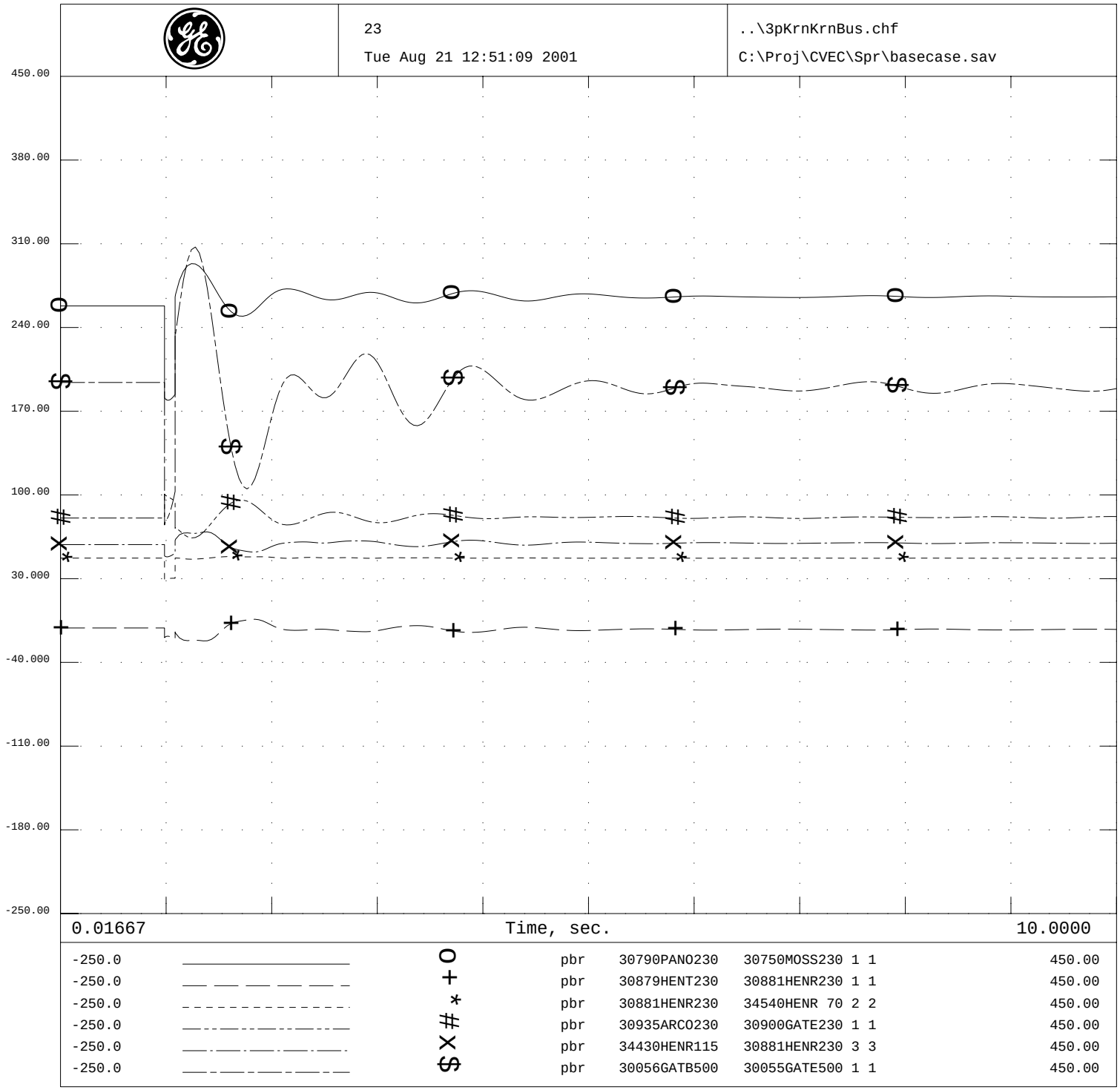

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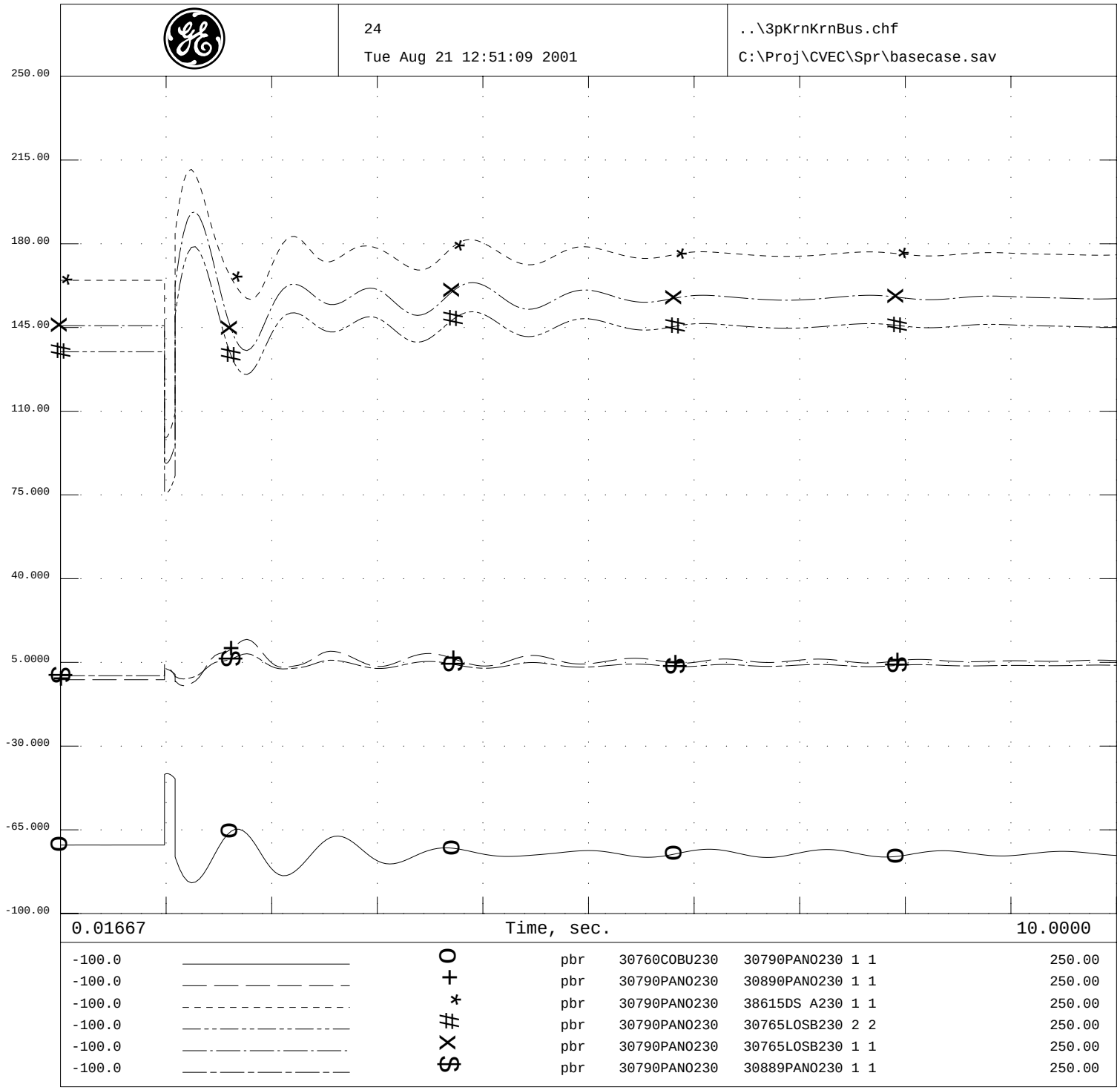

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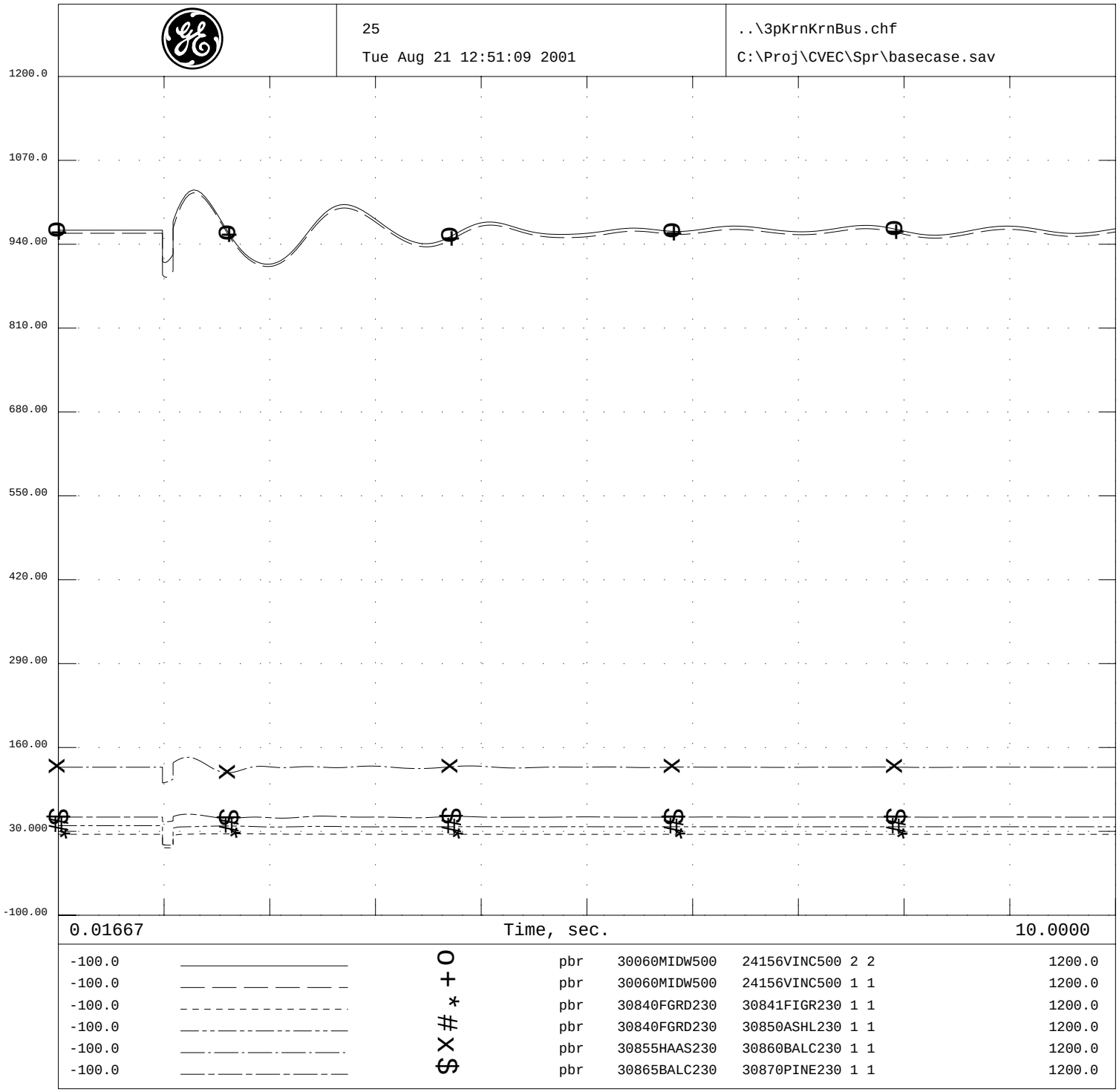

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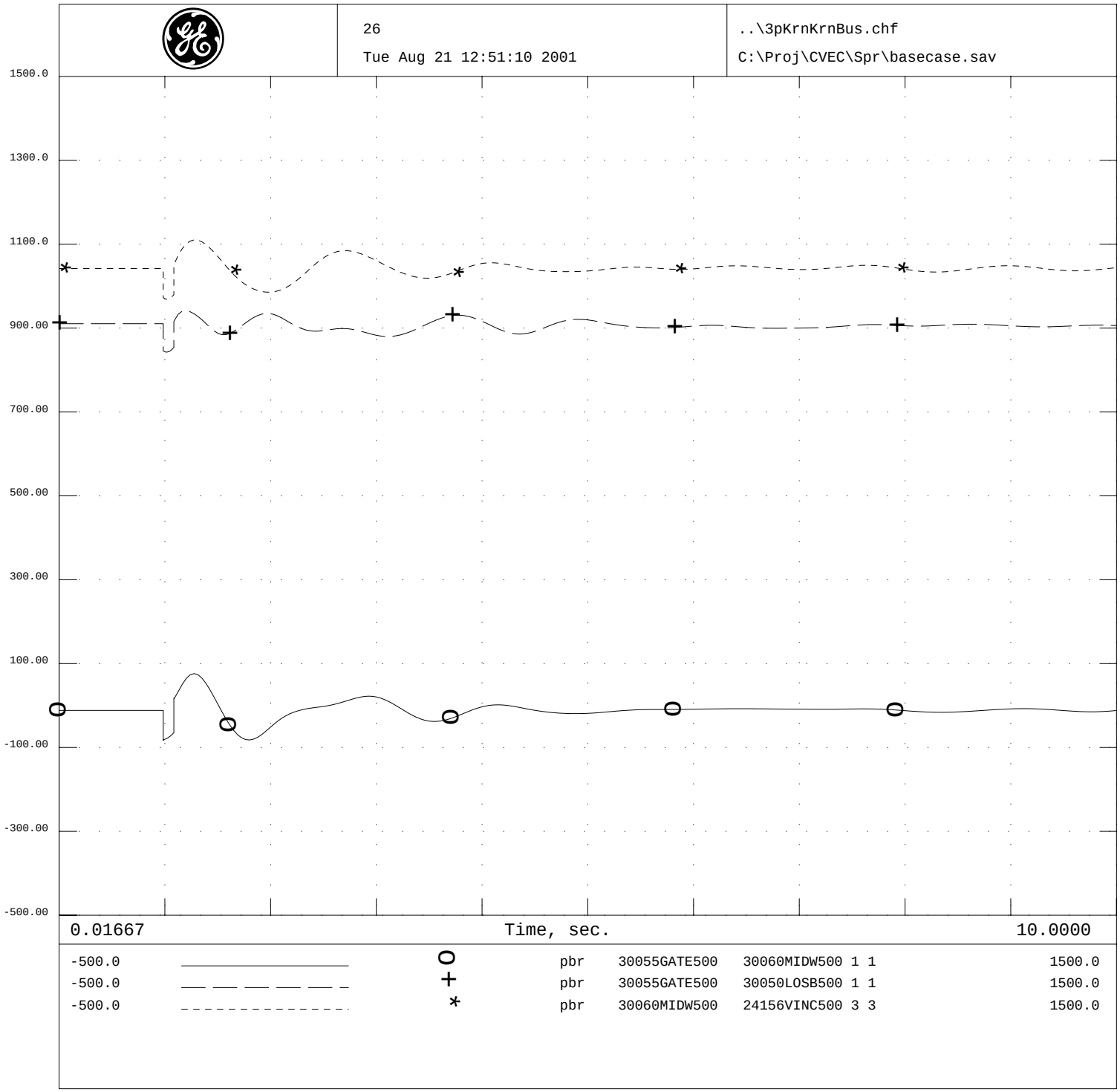

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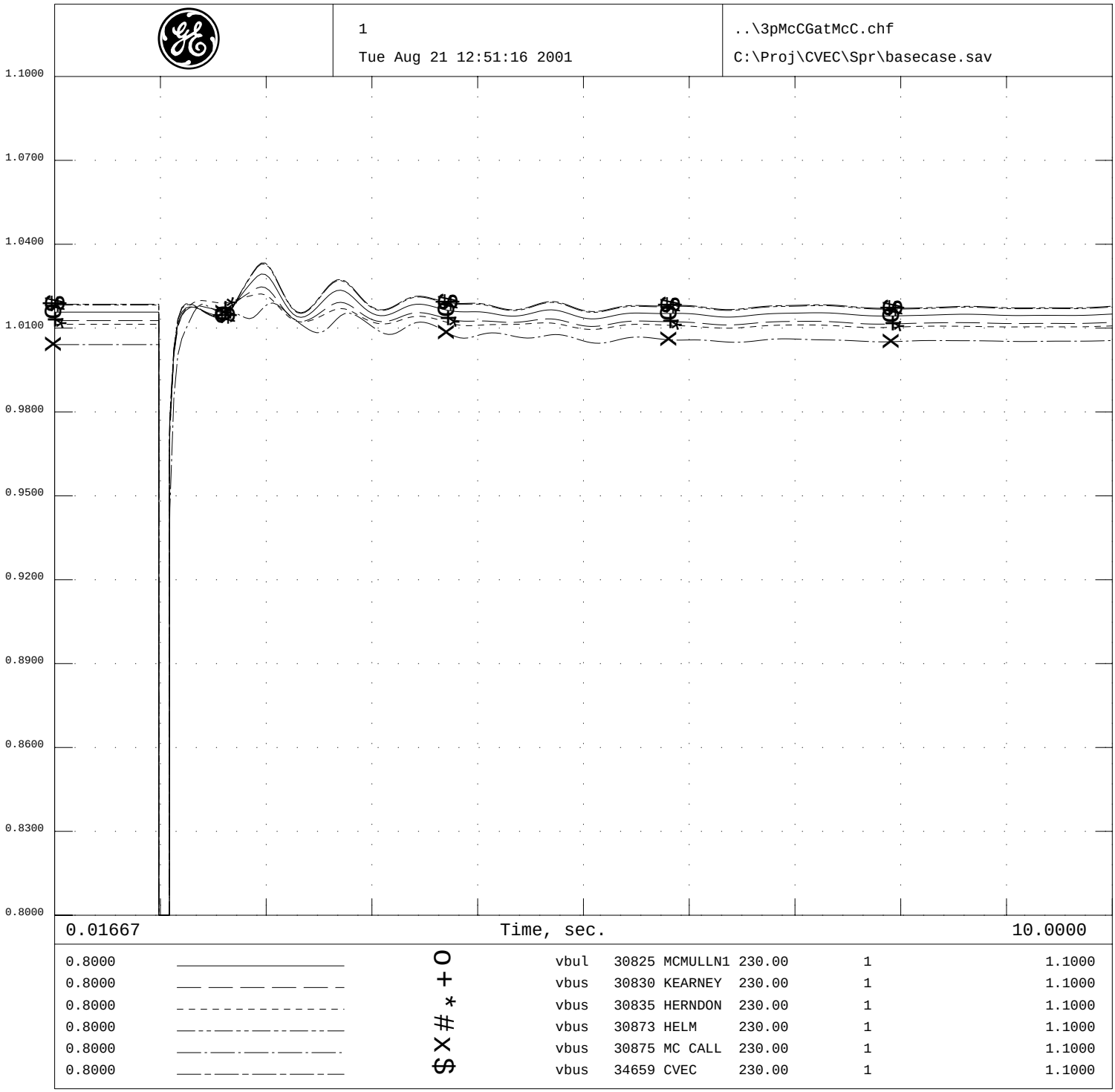

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2004 Heavy Spring Base Case
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Gates-McCall 230kV Line Outage
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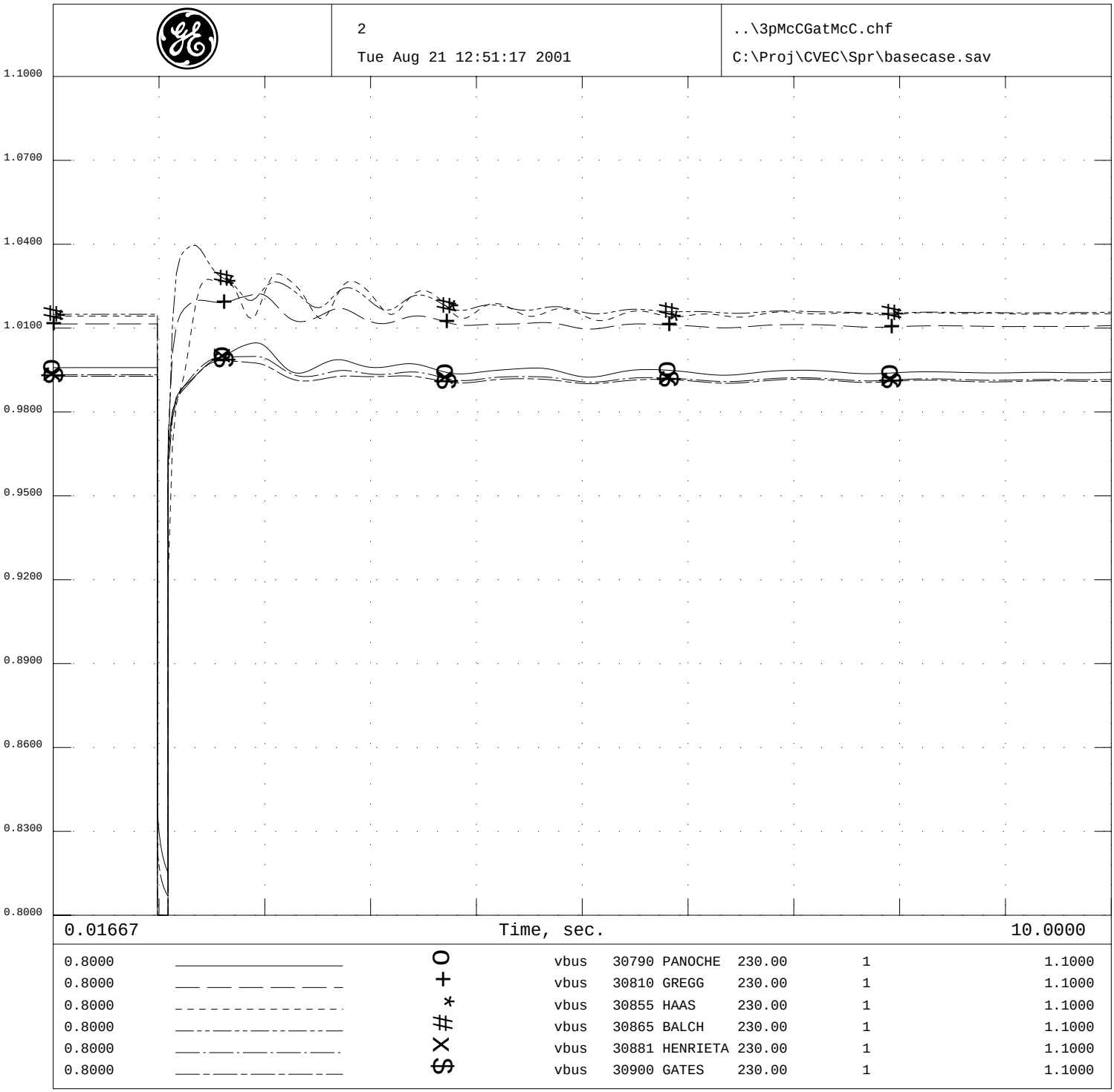
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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Calpine Corporation
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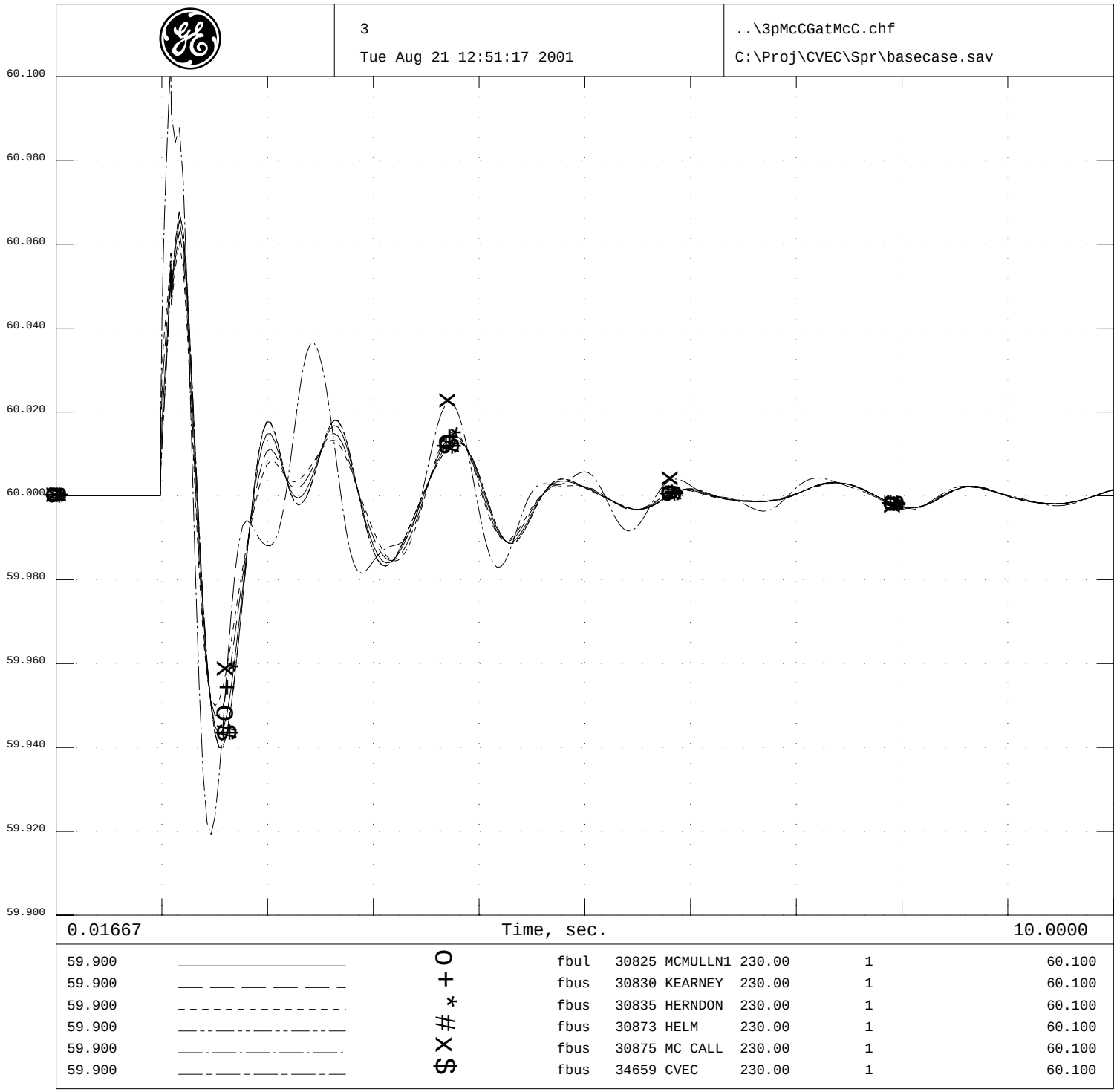

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2004 Heavy Spring Base Case
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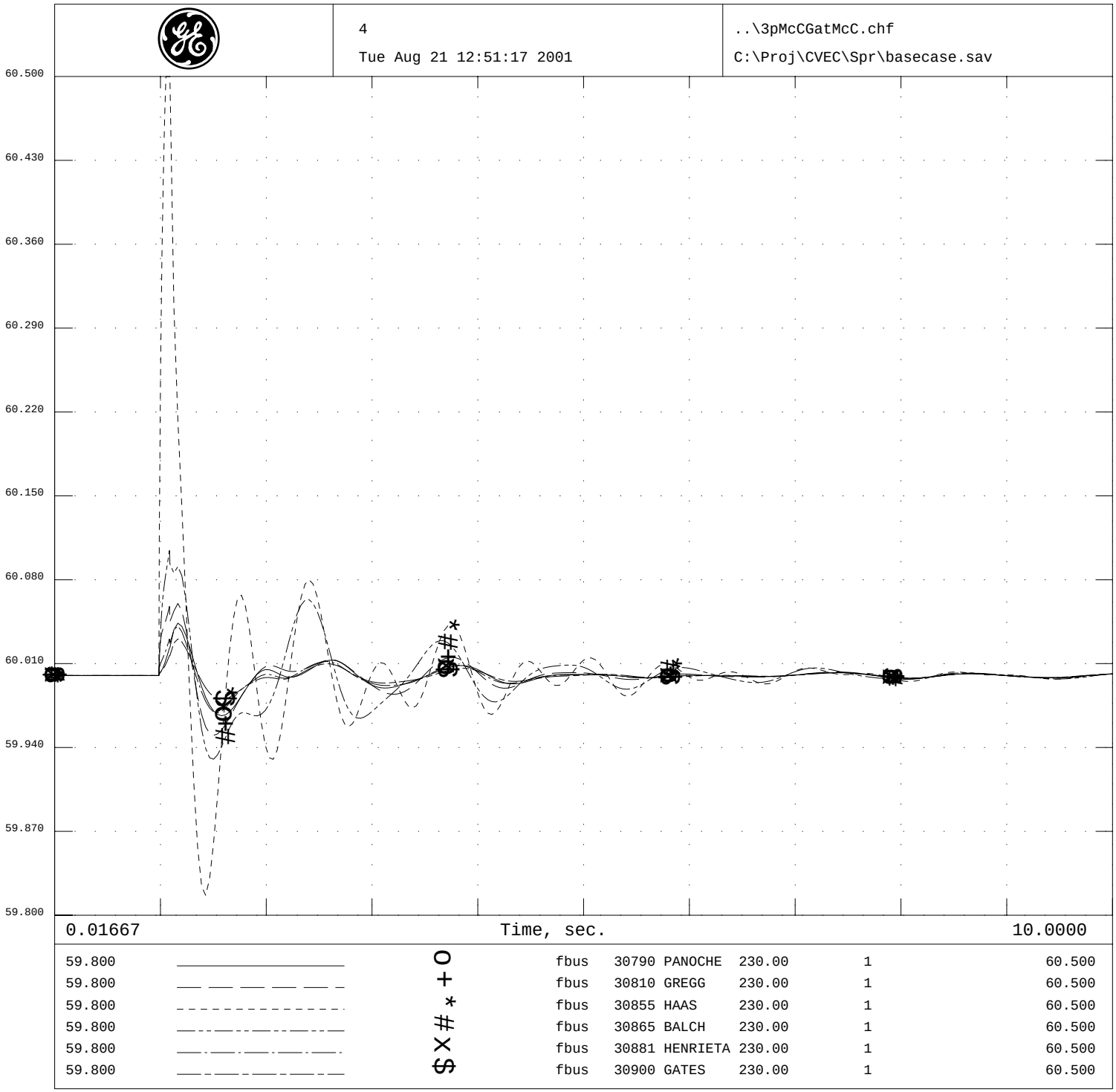
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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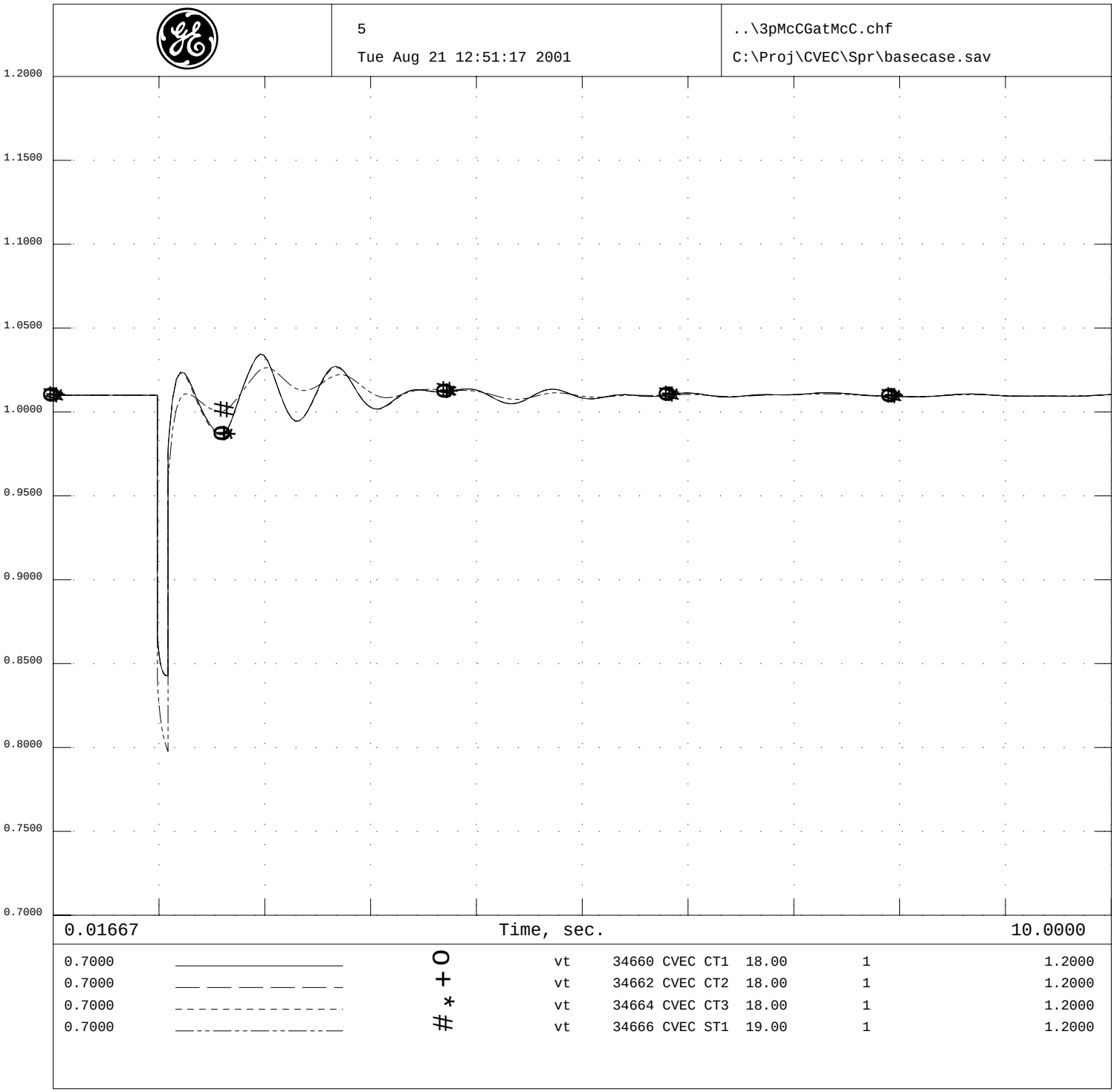

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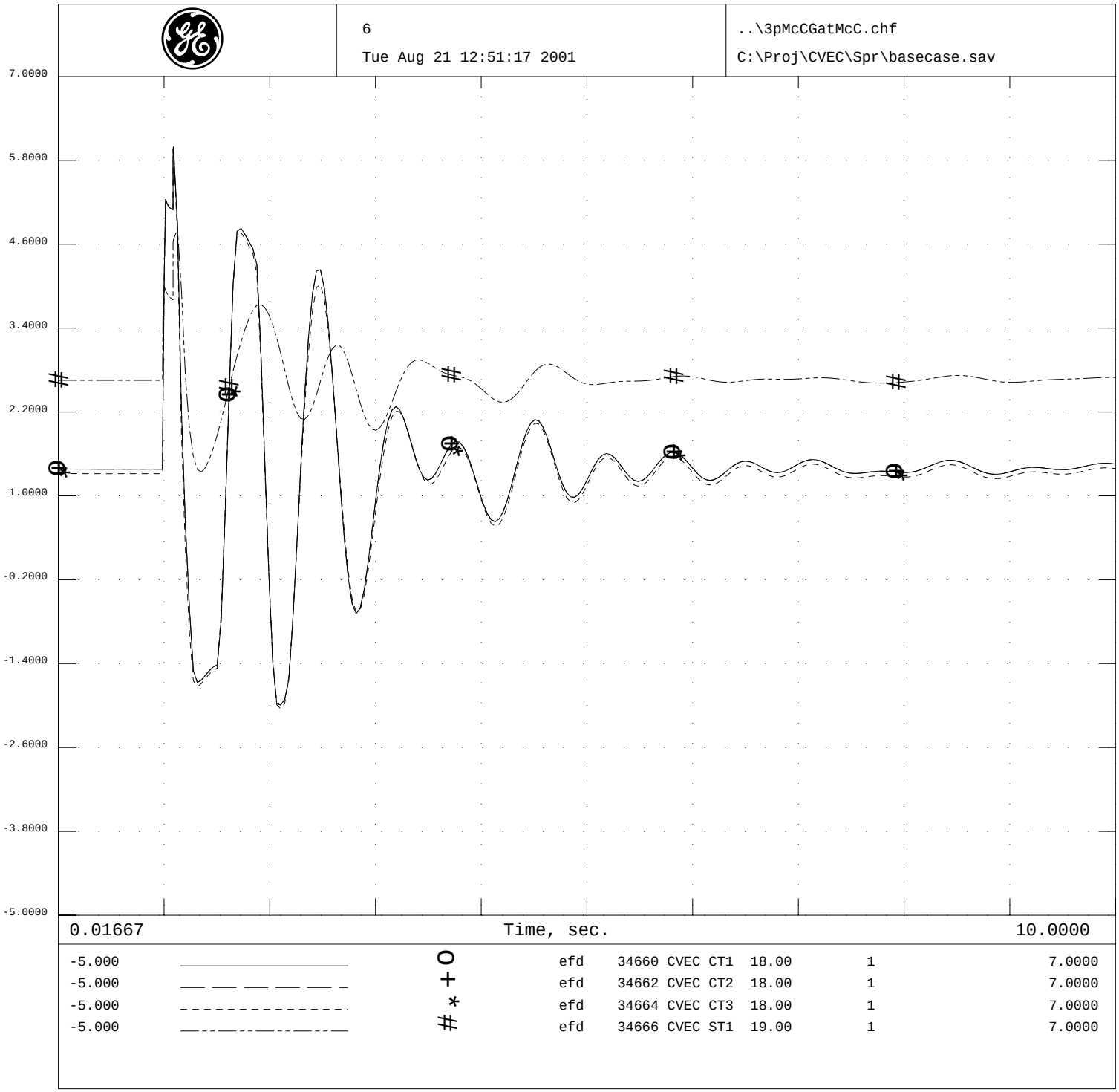
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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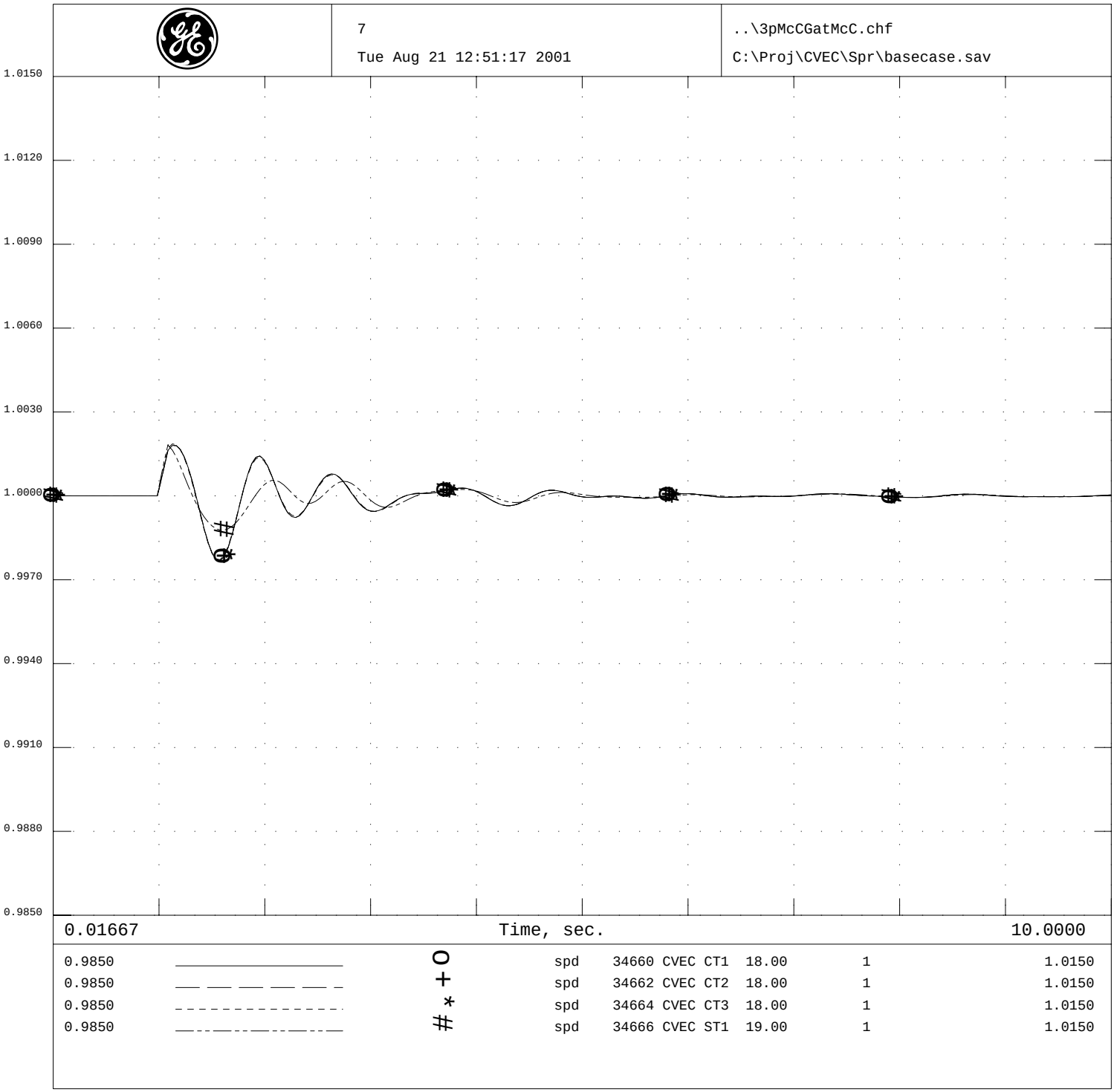
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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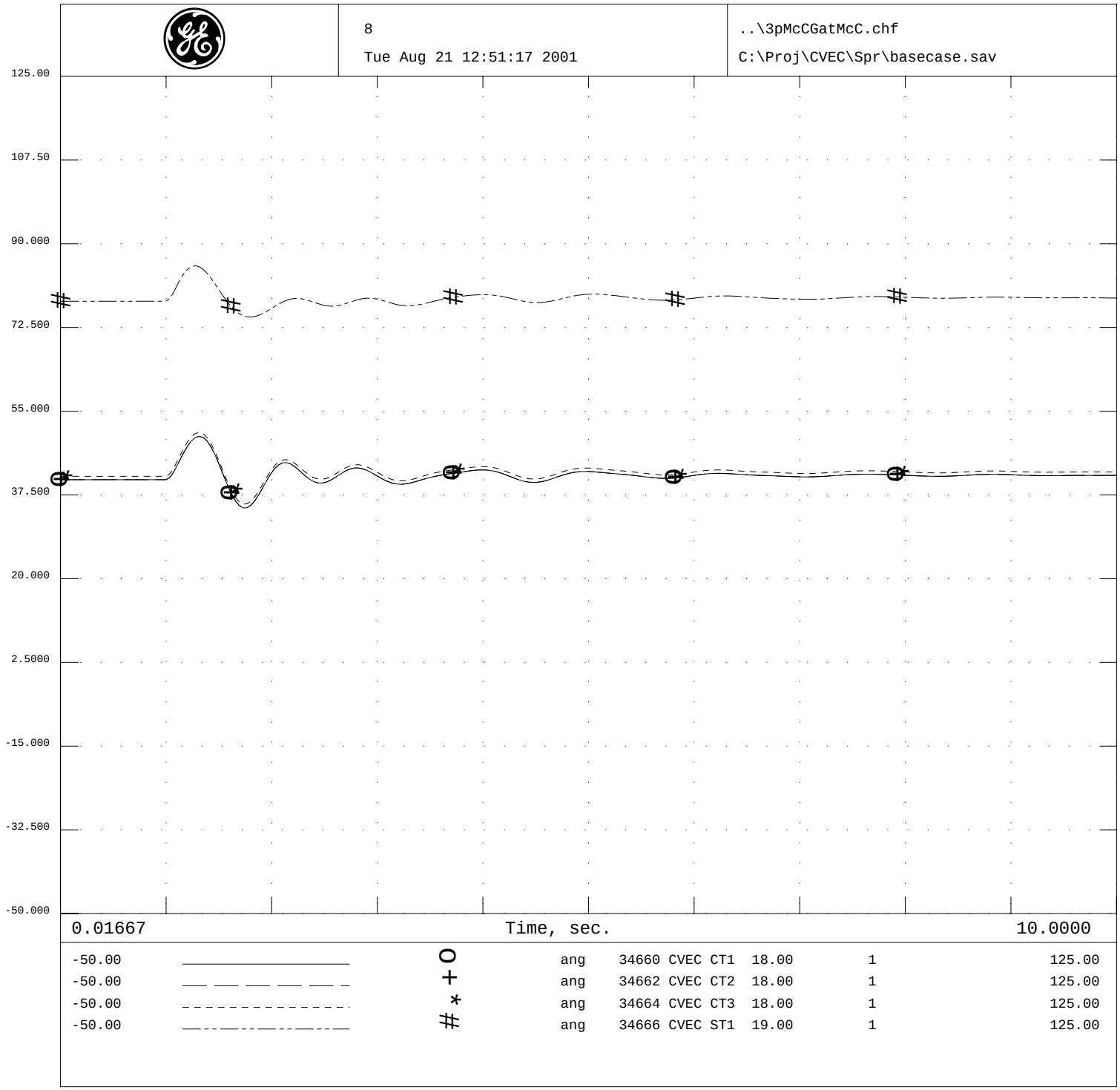
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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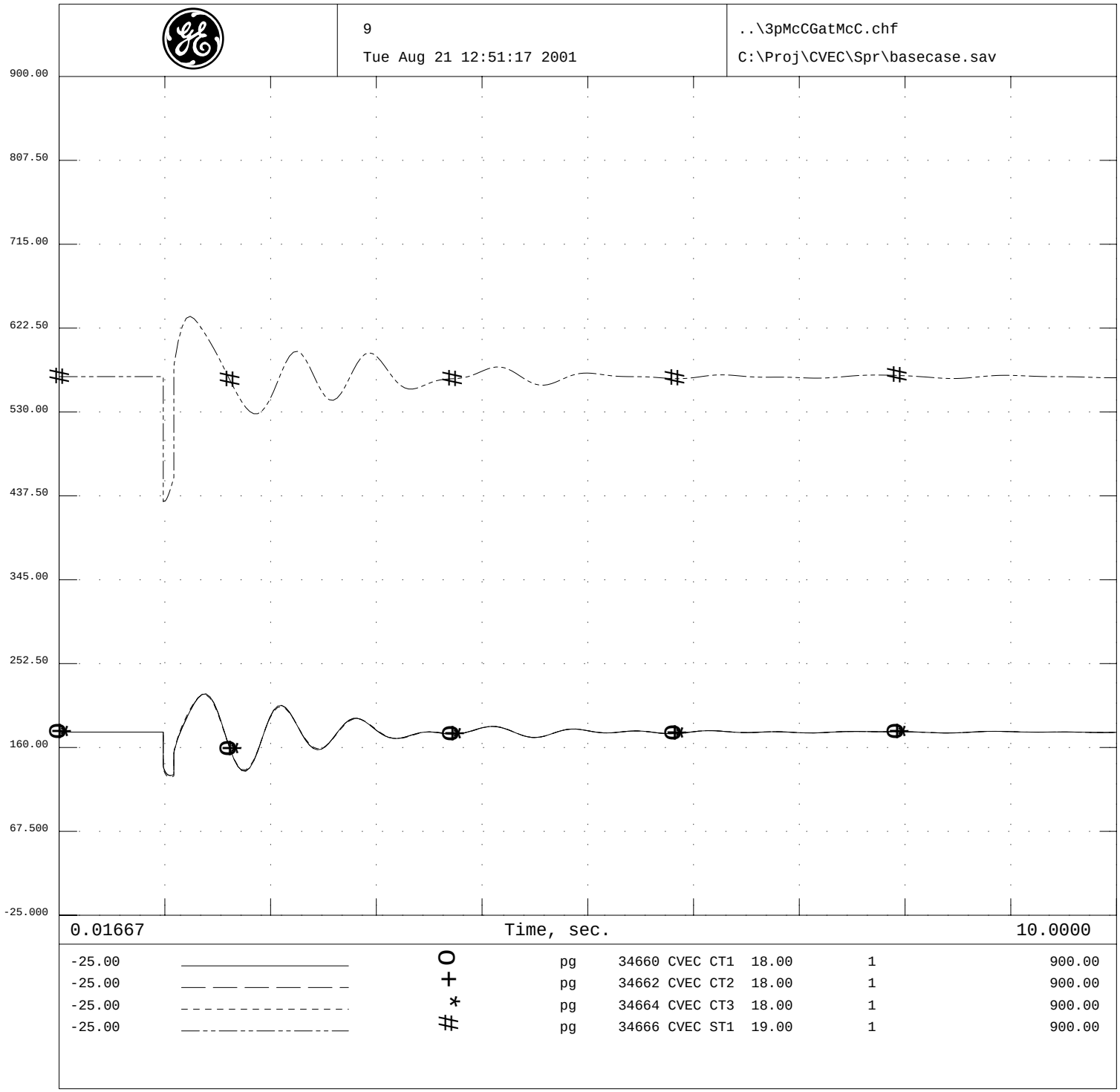
Project Generator Rotor Angle



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Calpine Corporation
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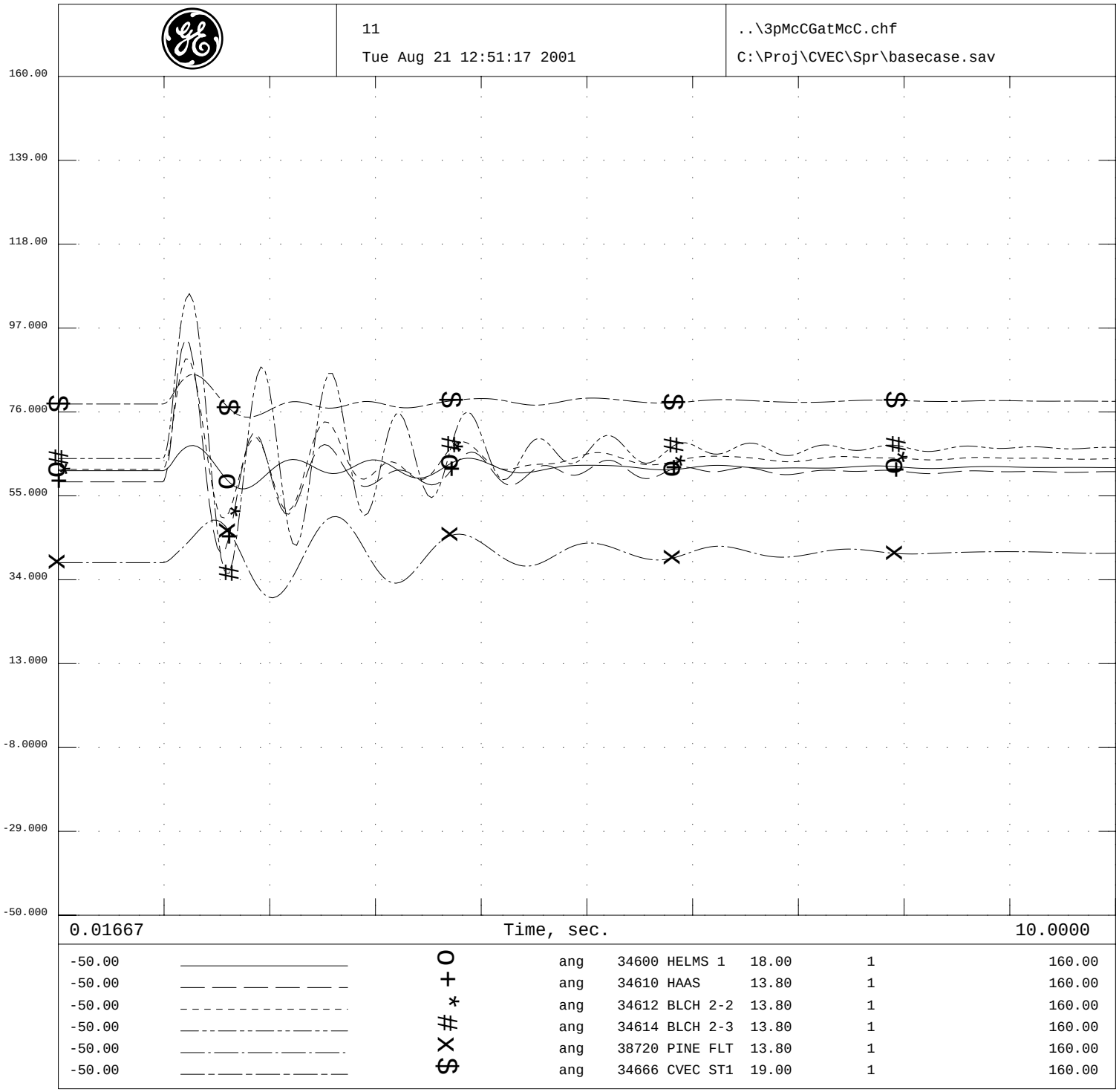

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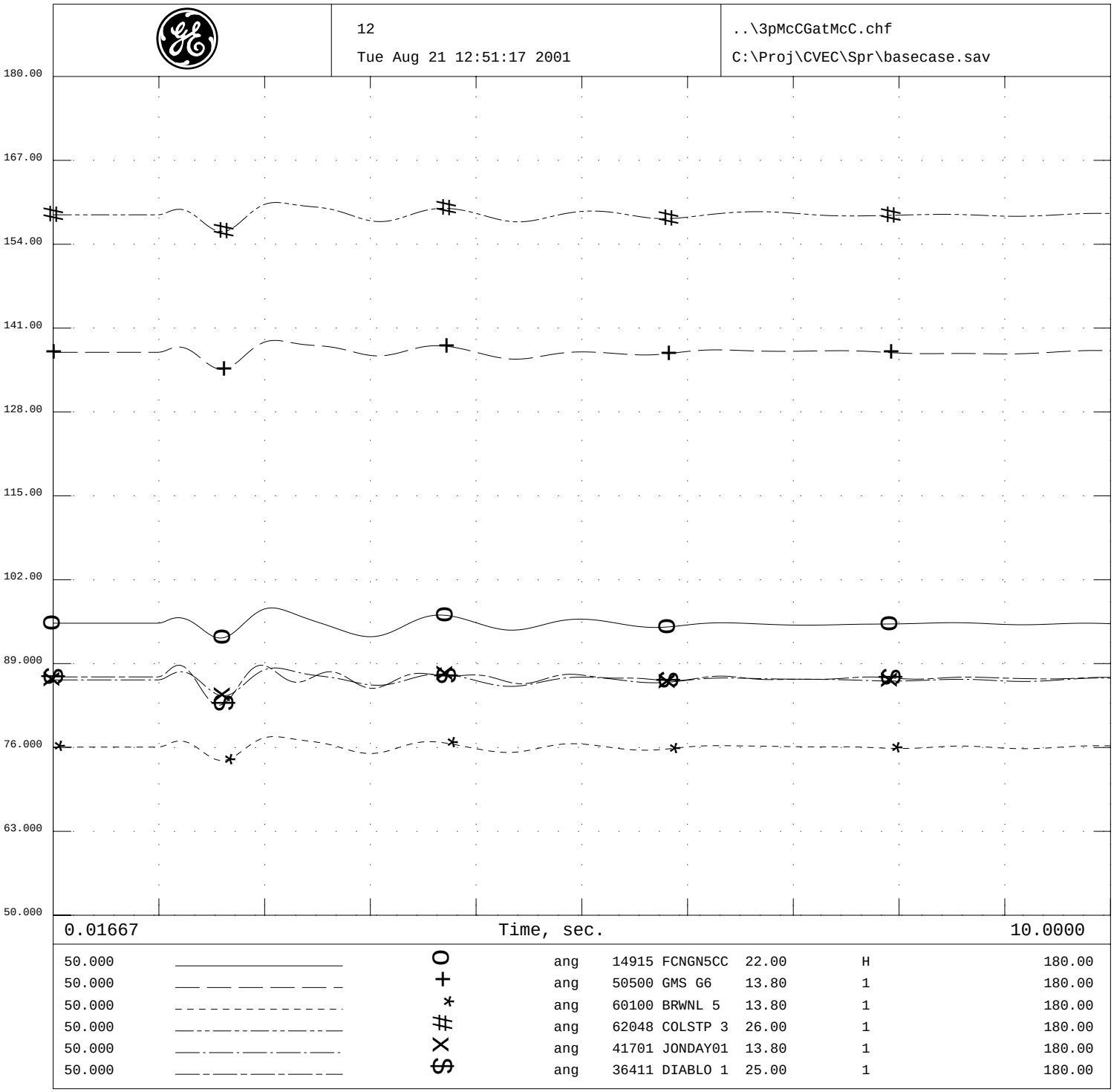
Calpine Corporation
Selected Local Rotor Angle Plots



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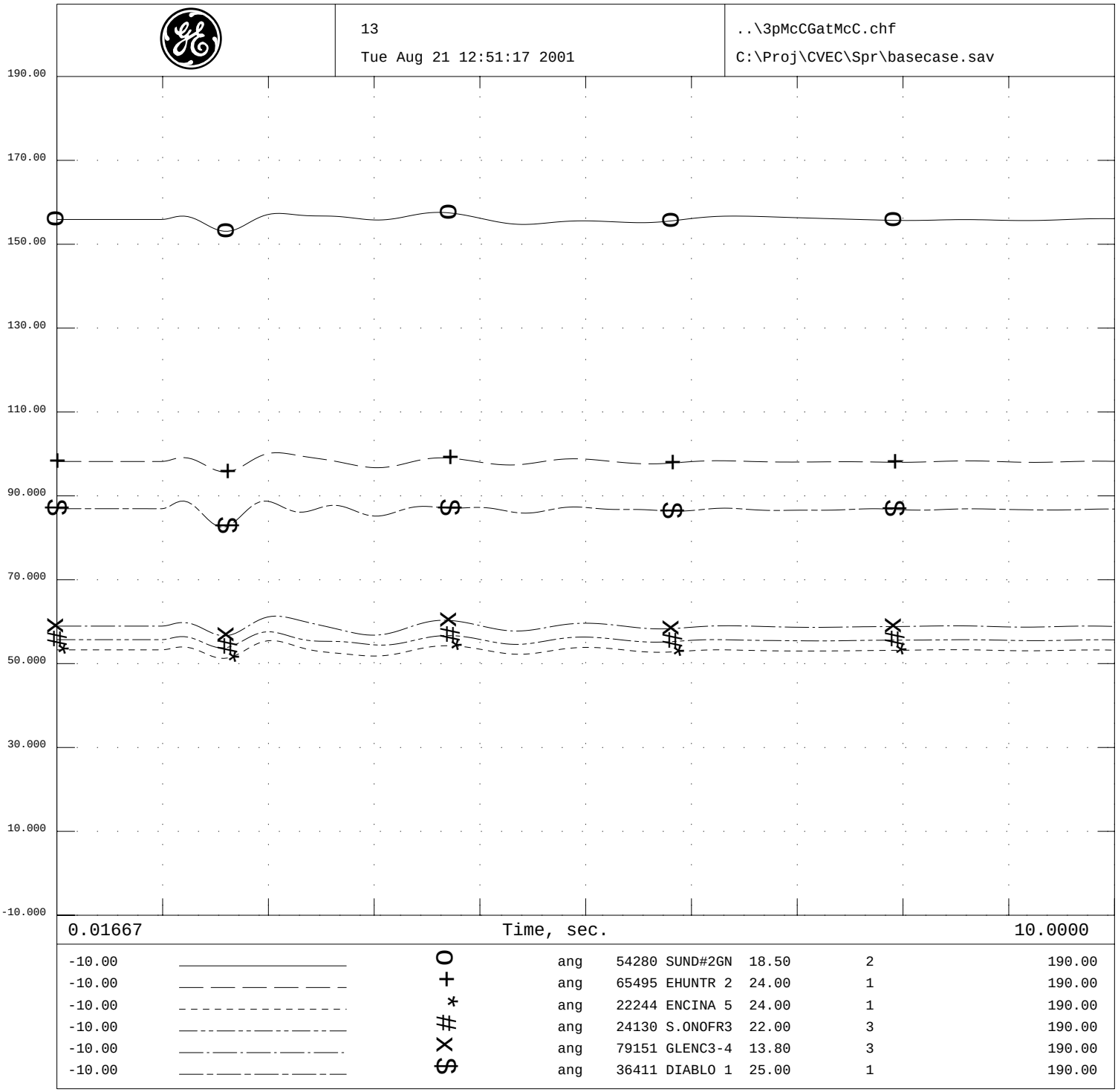

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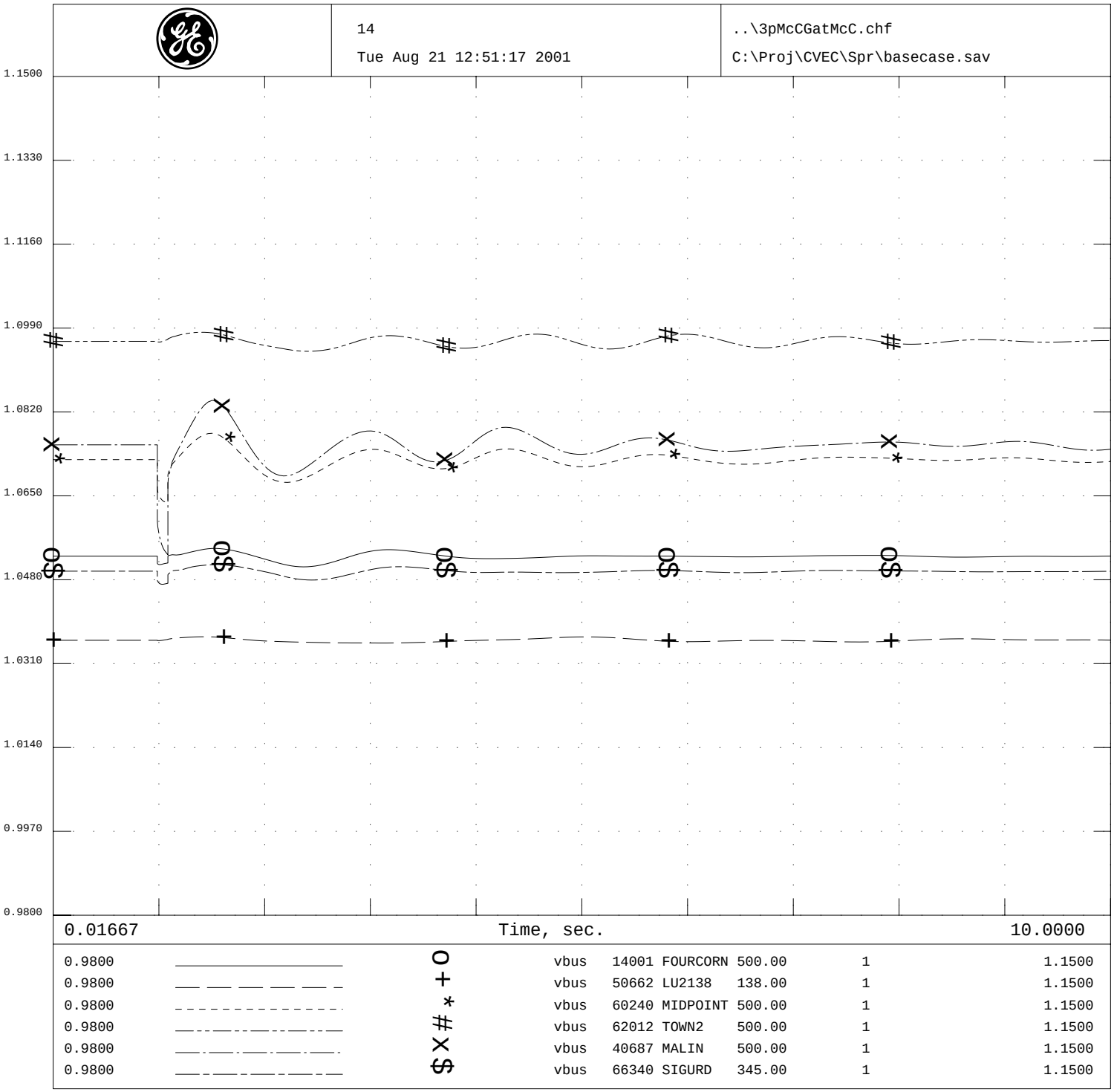

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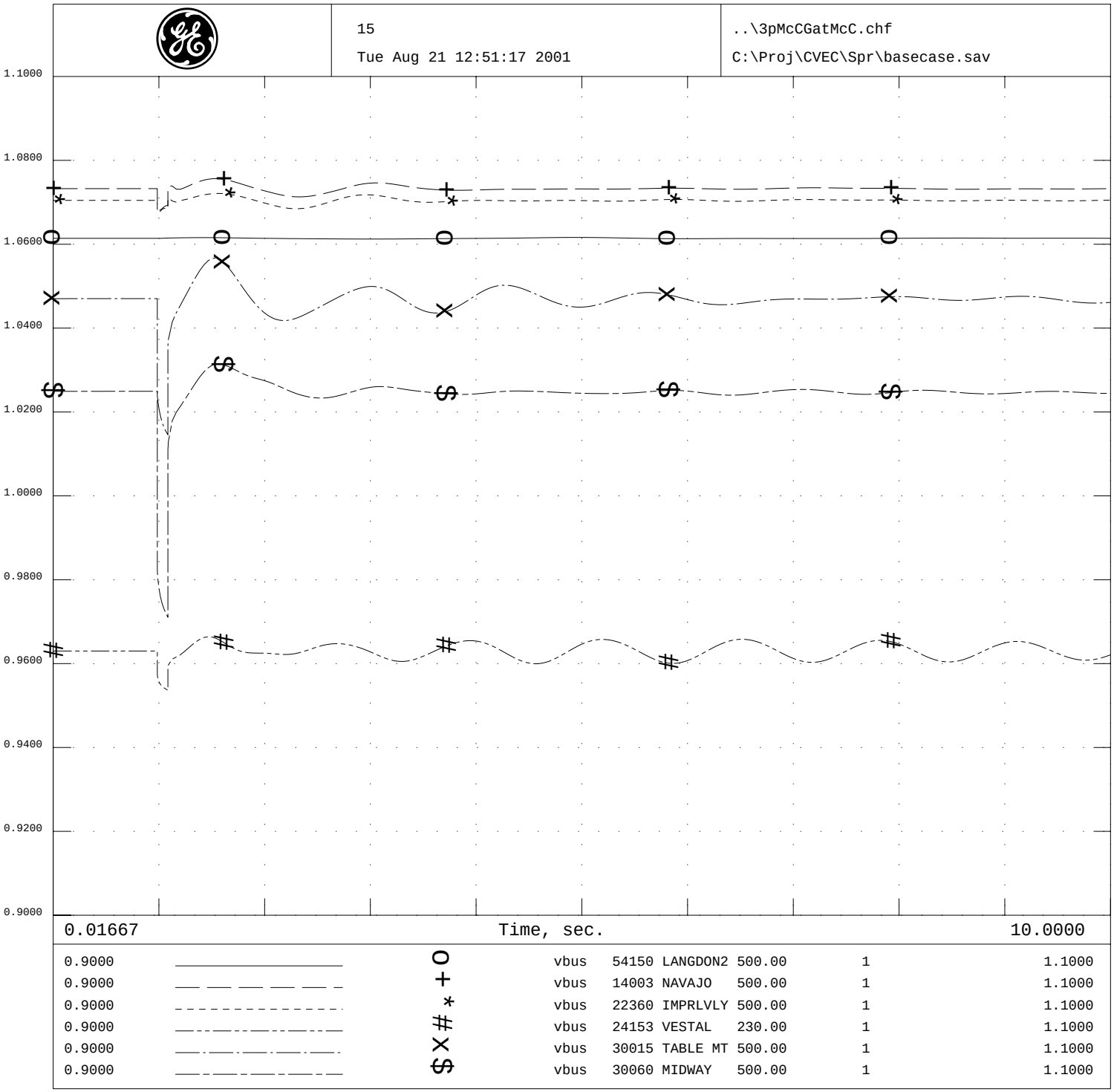

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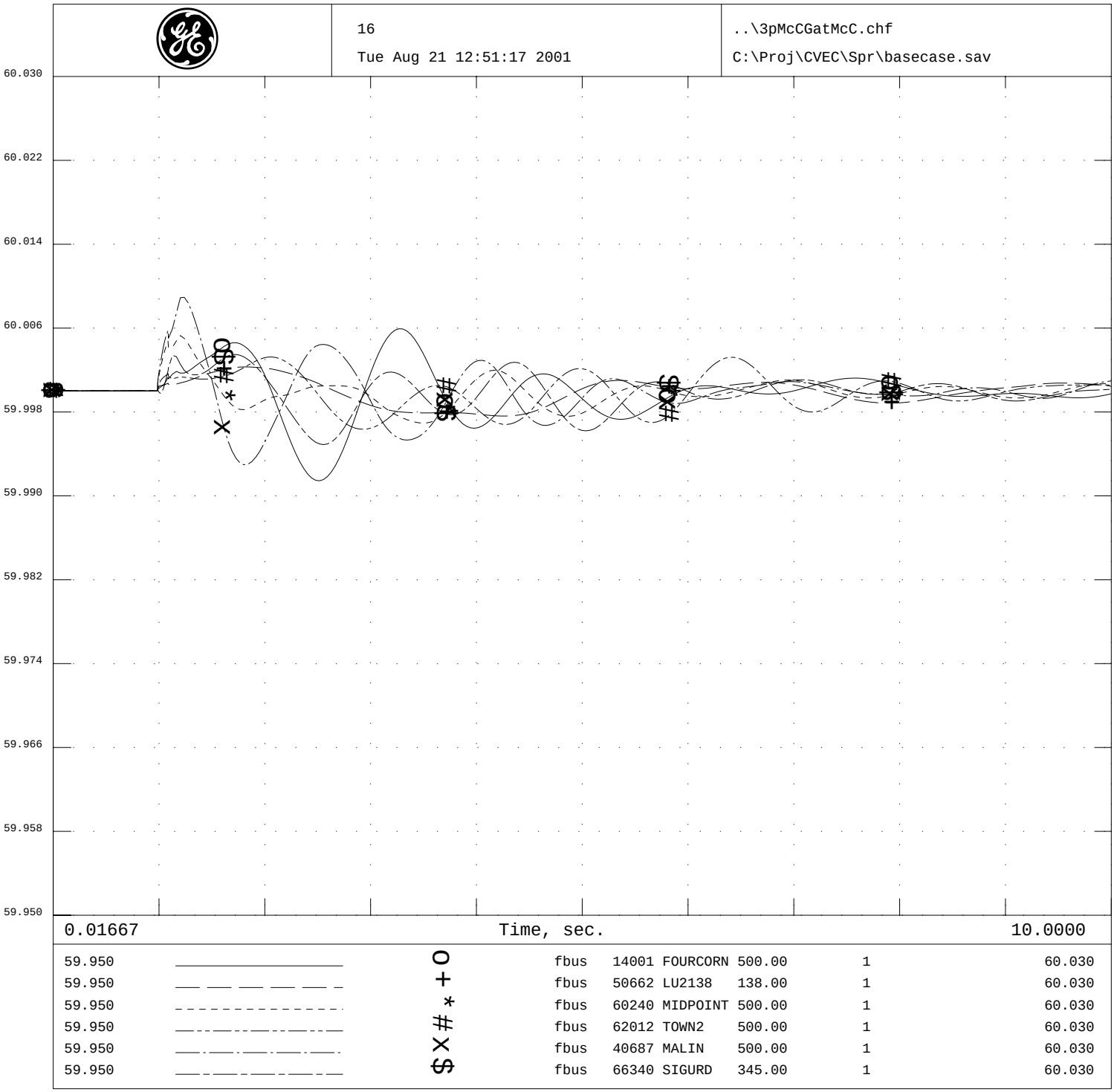

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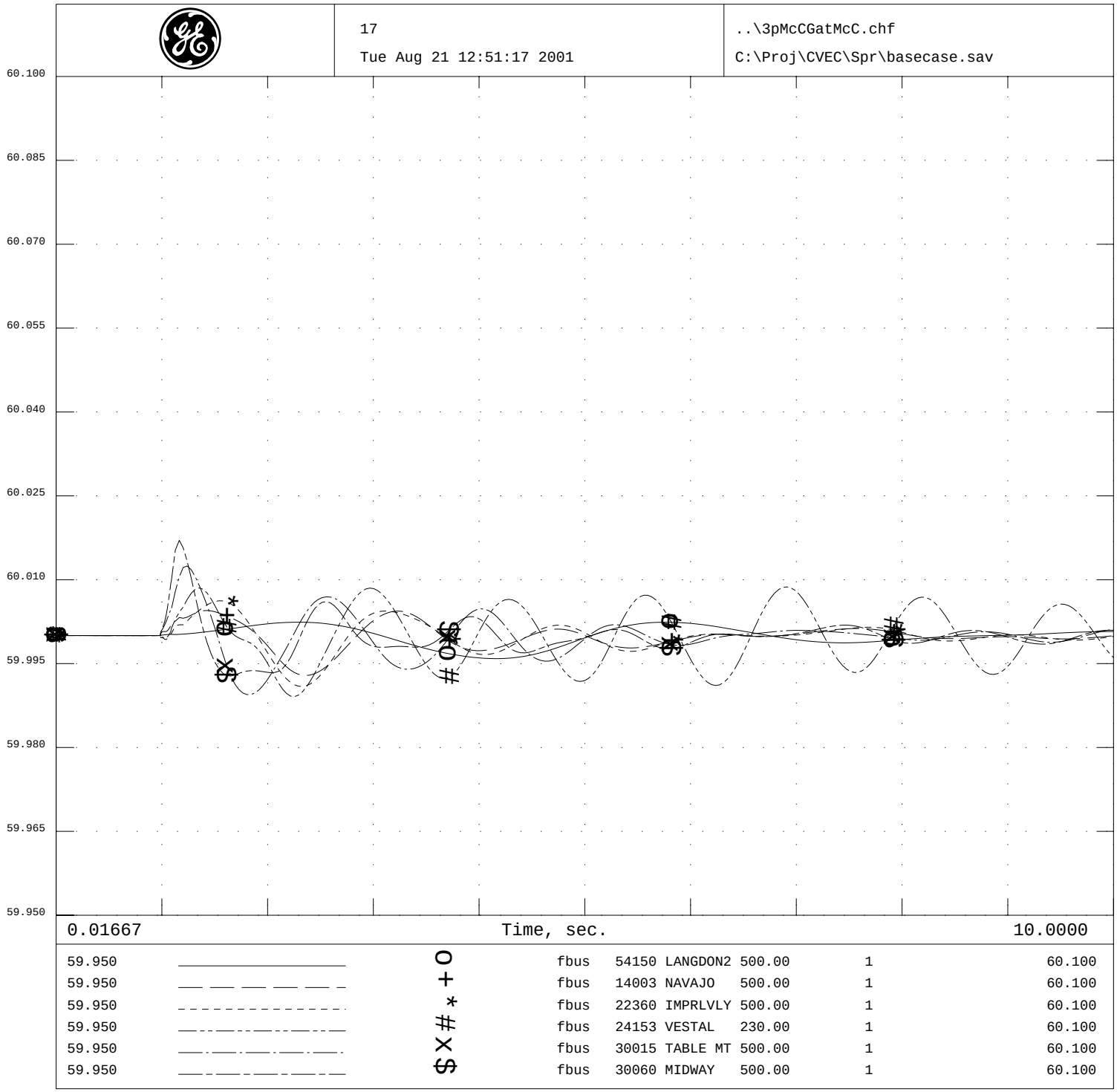

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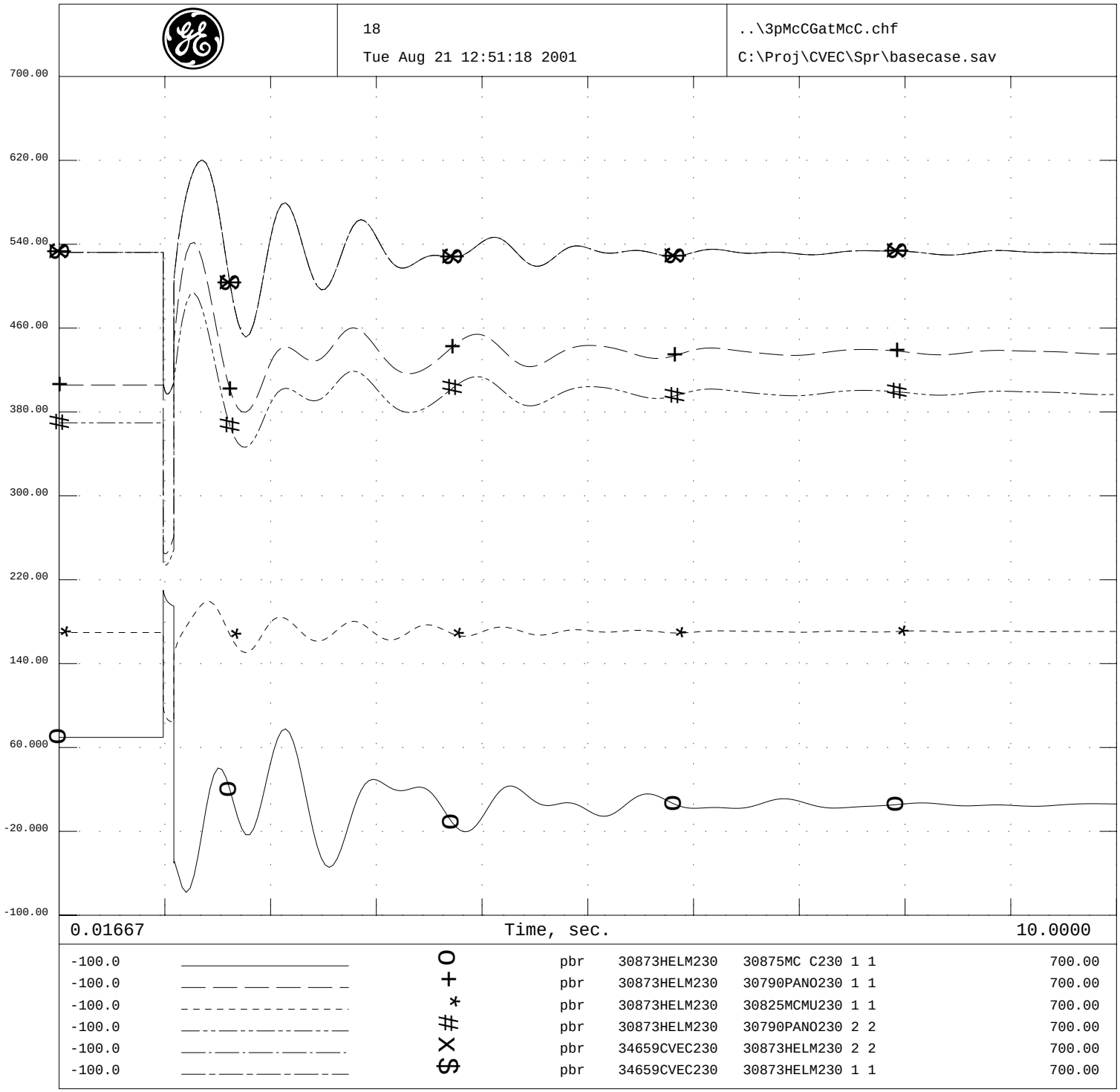

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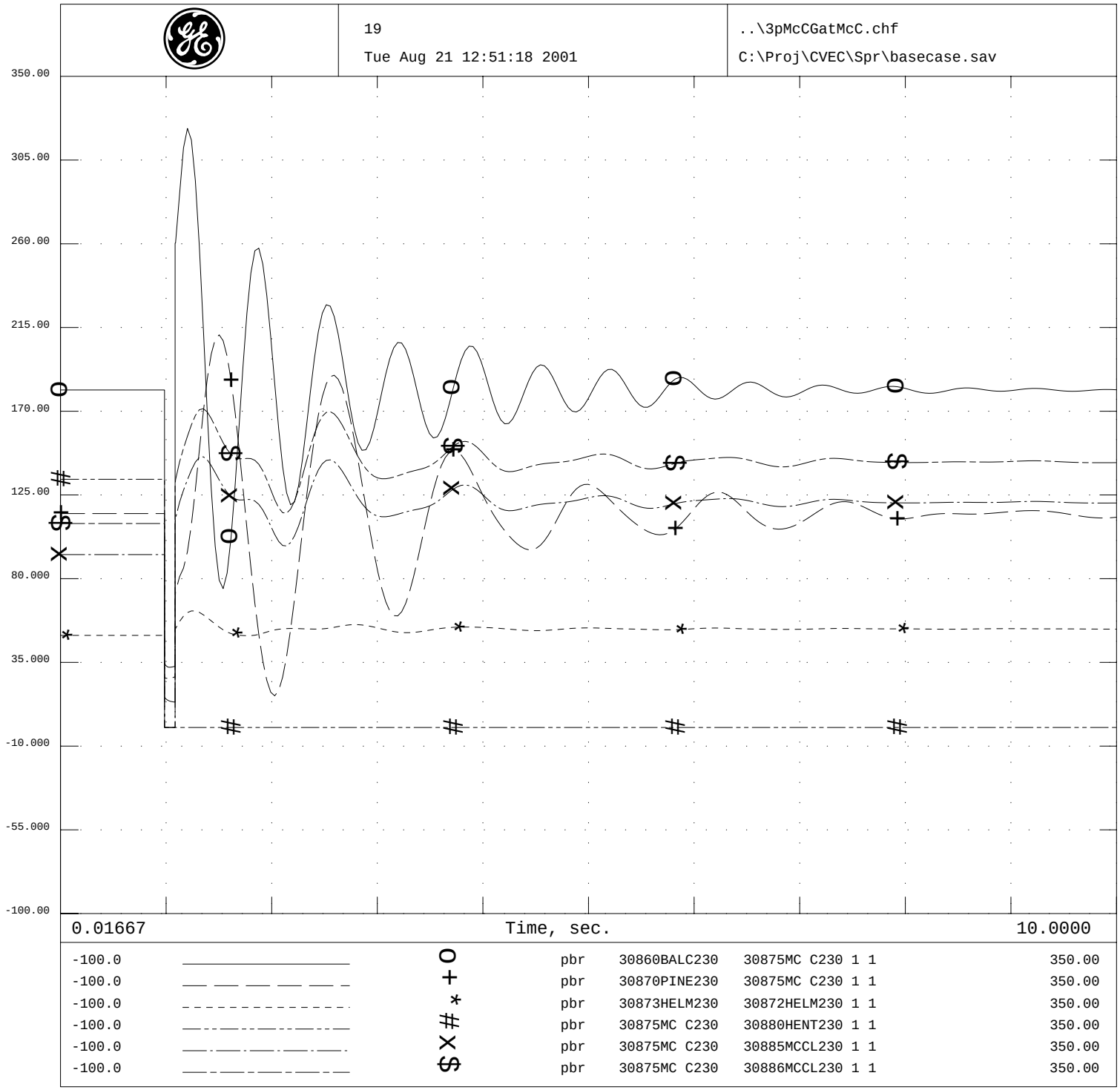

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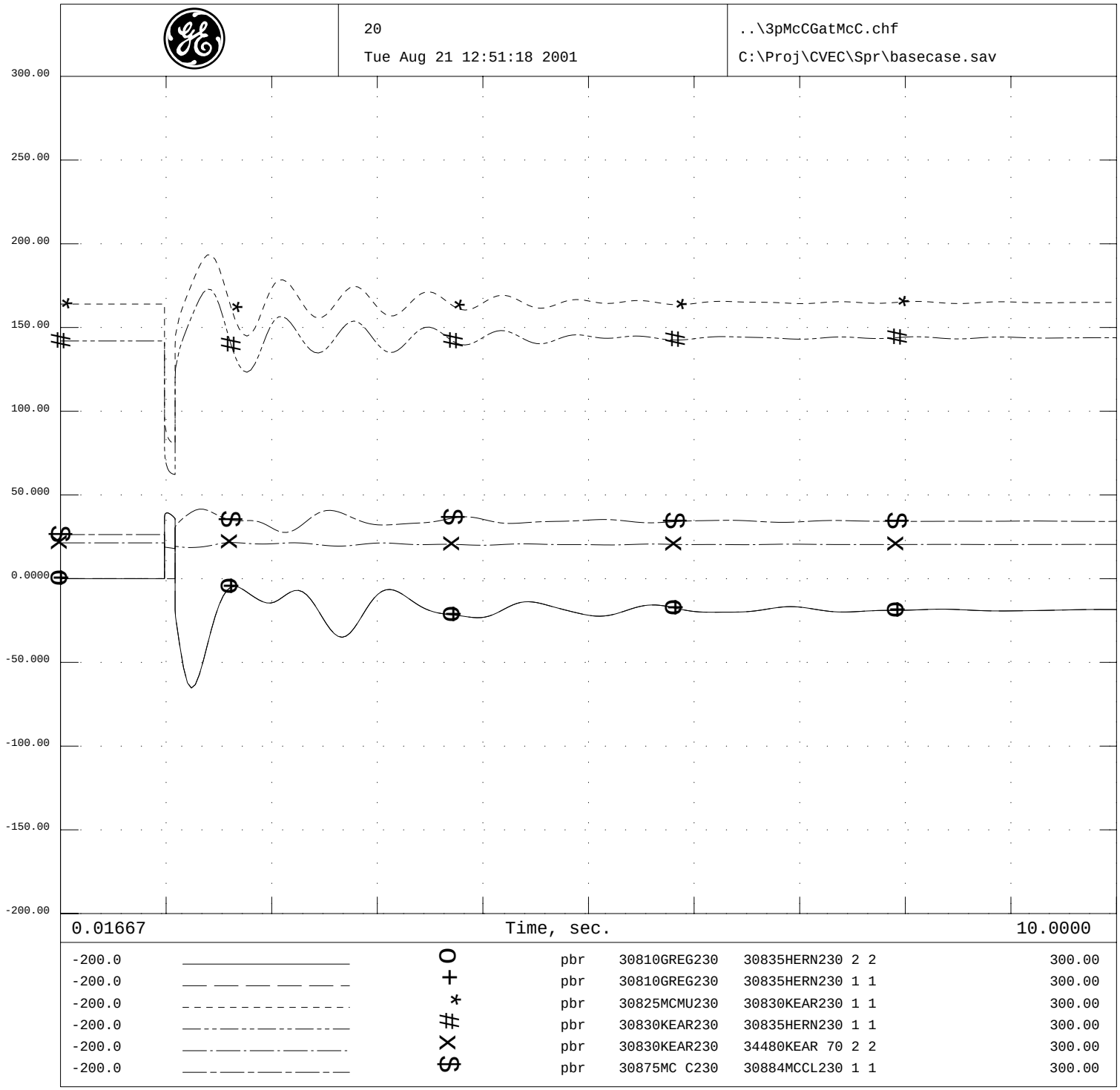

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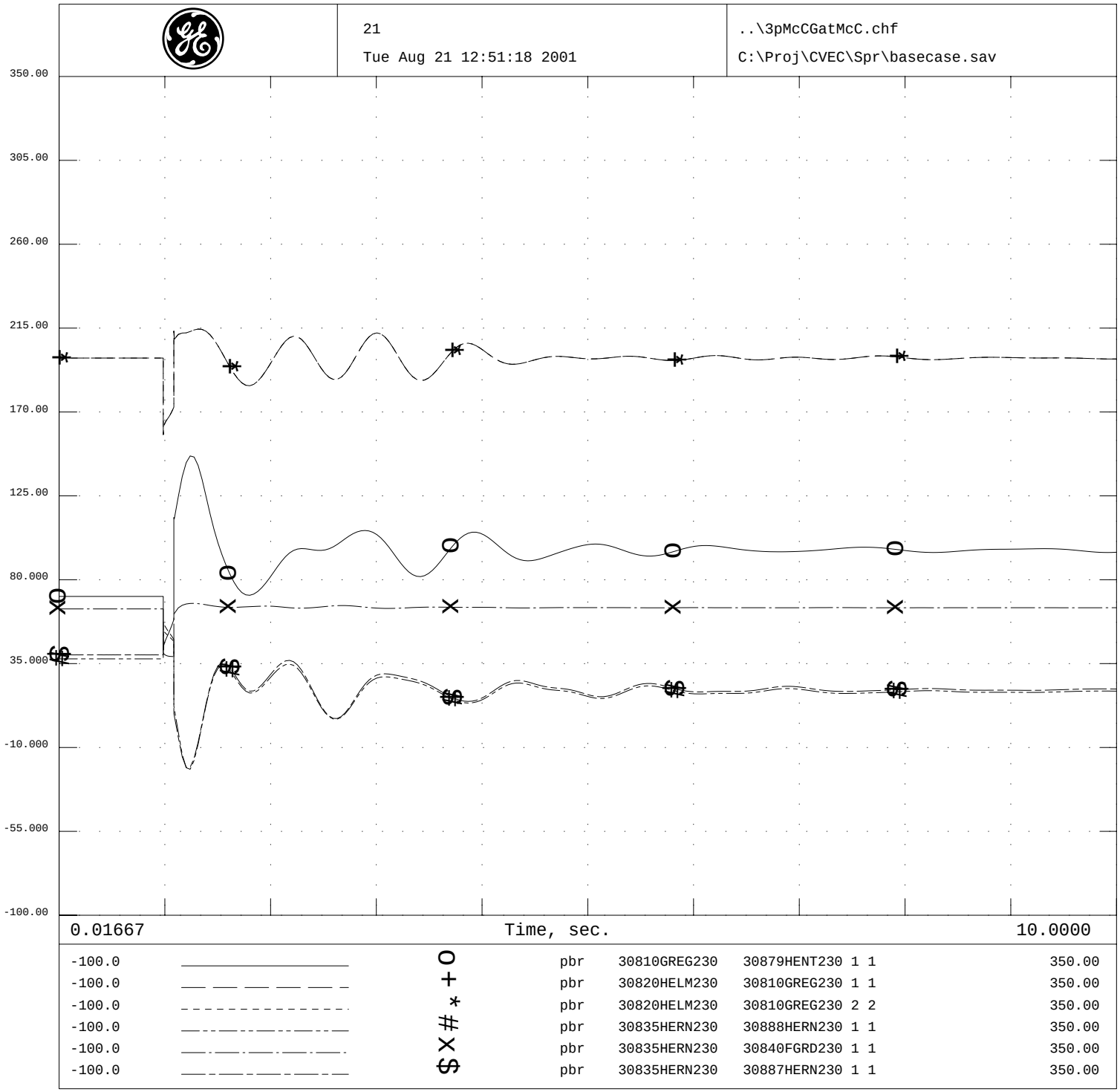

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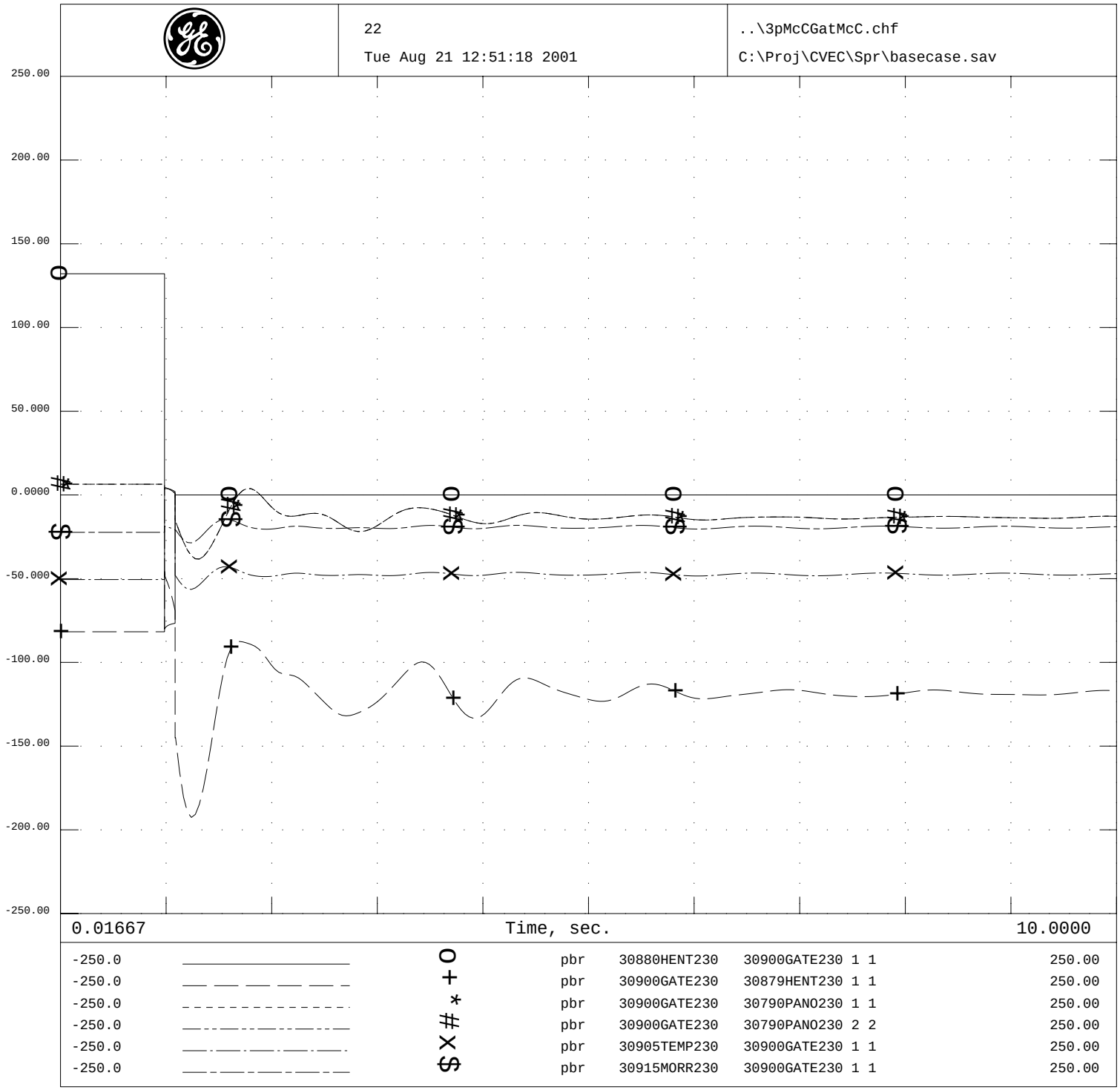

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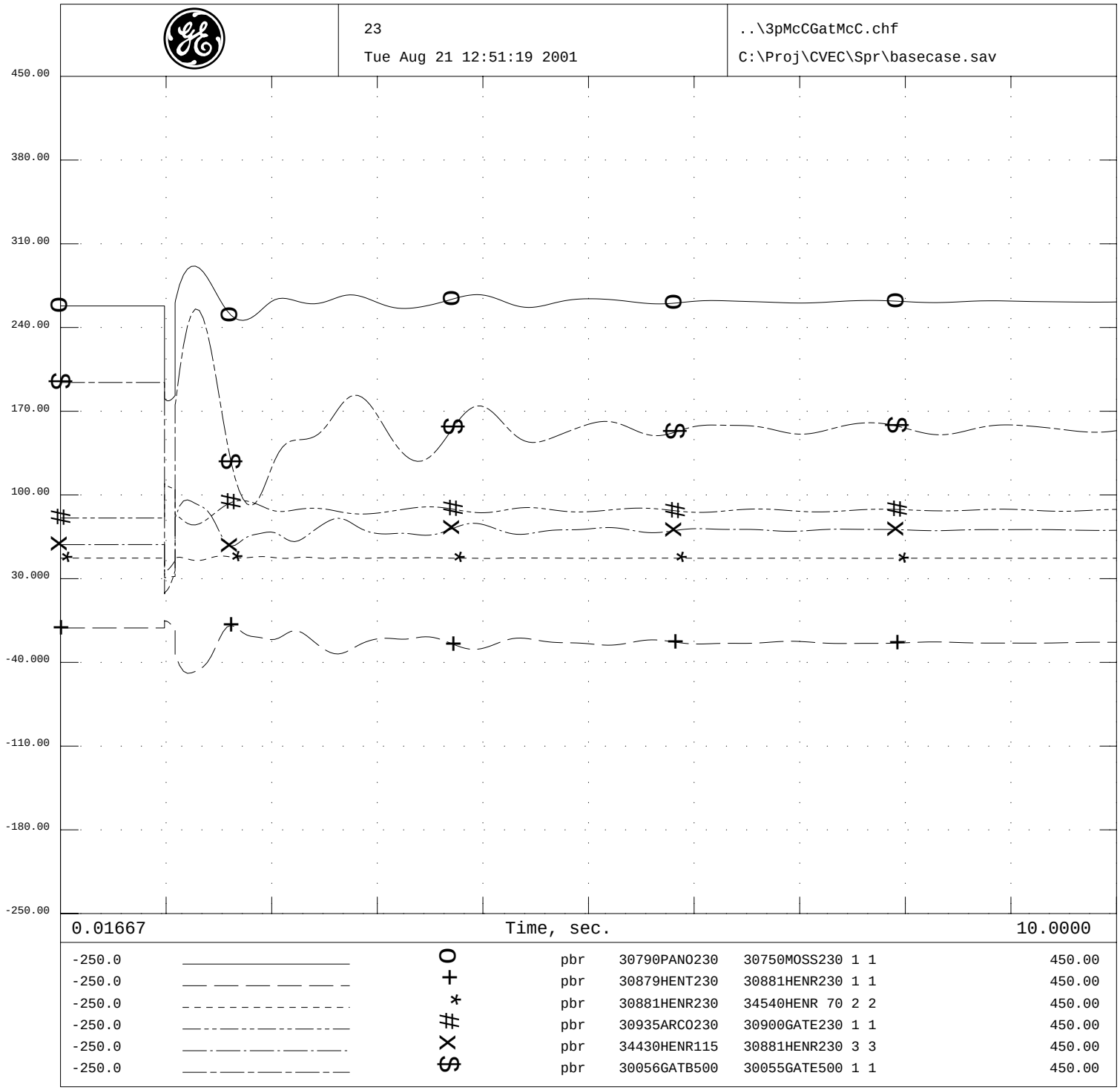

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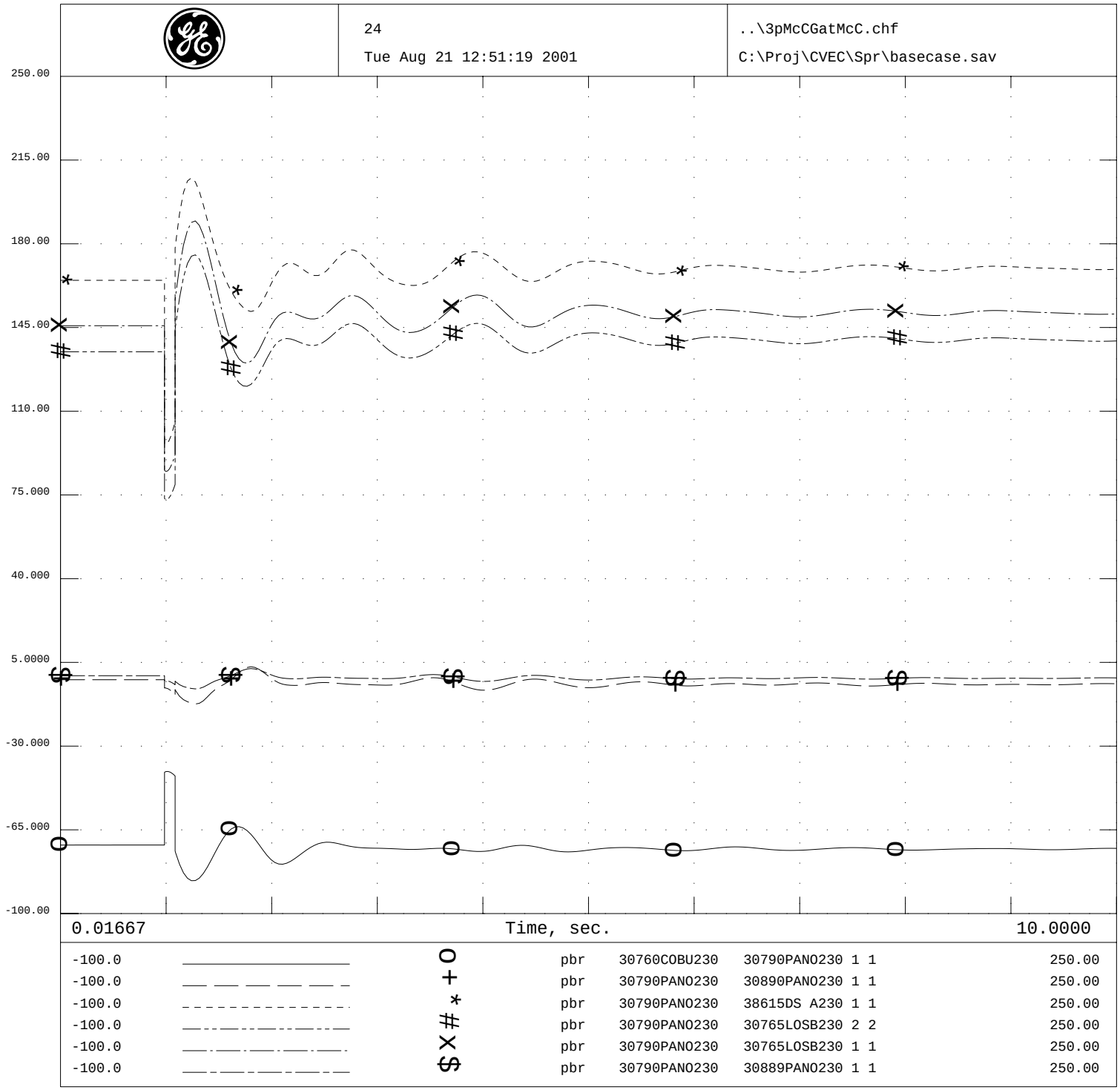

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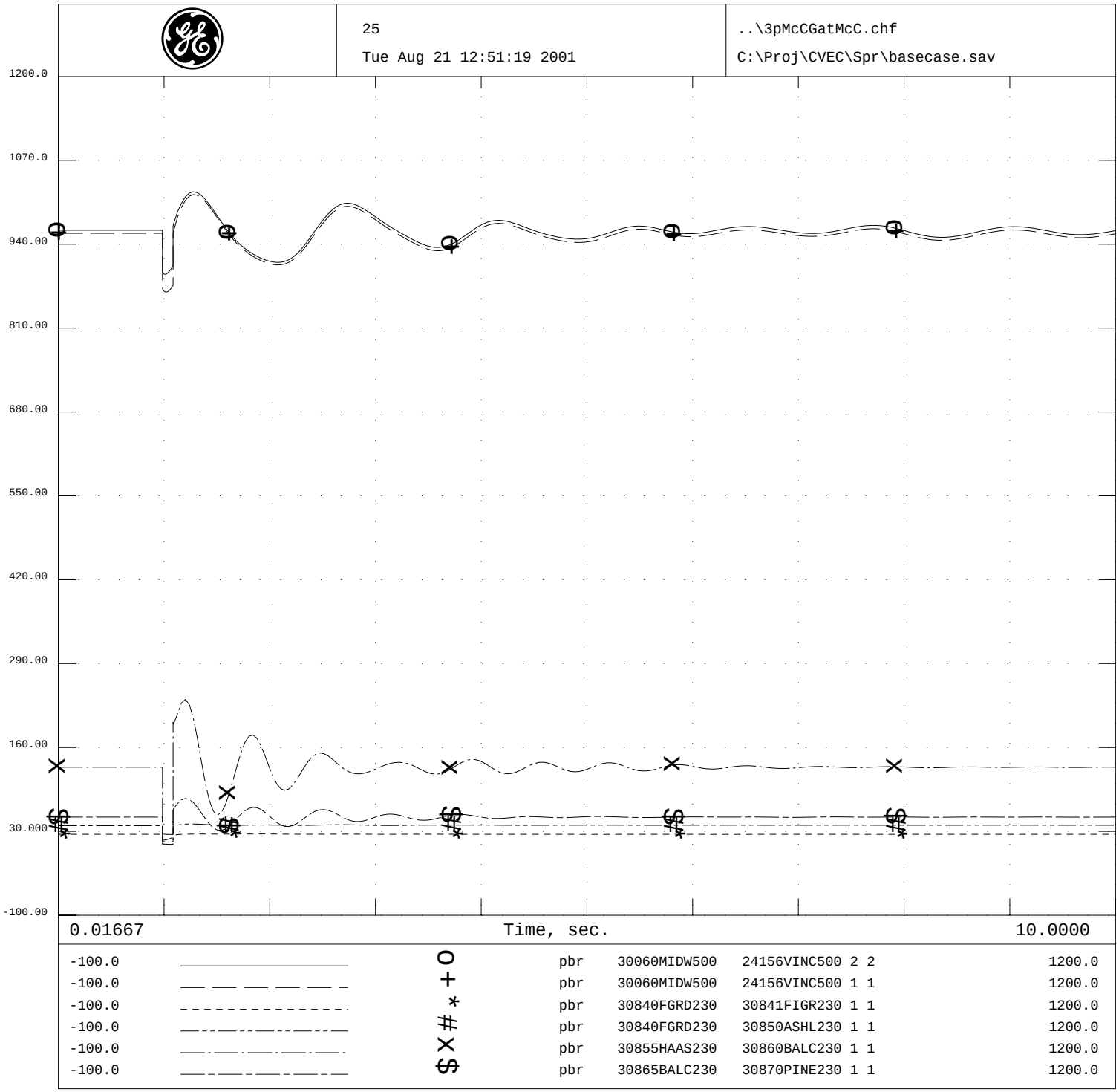

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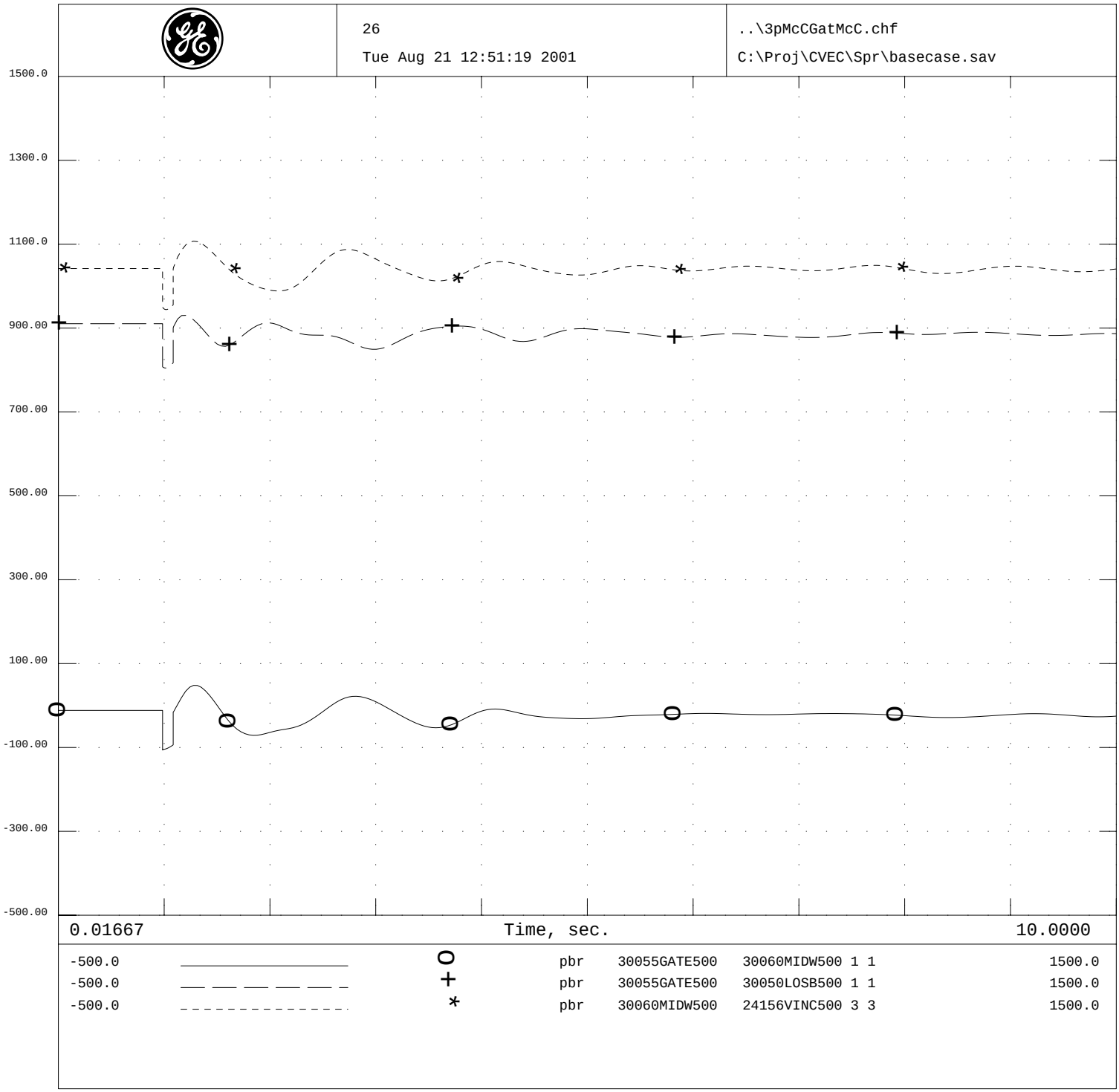
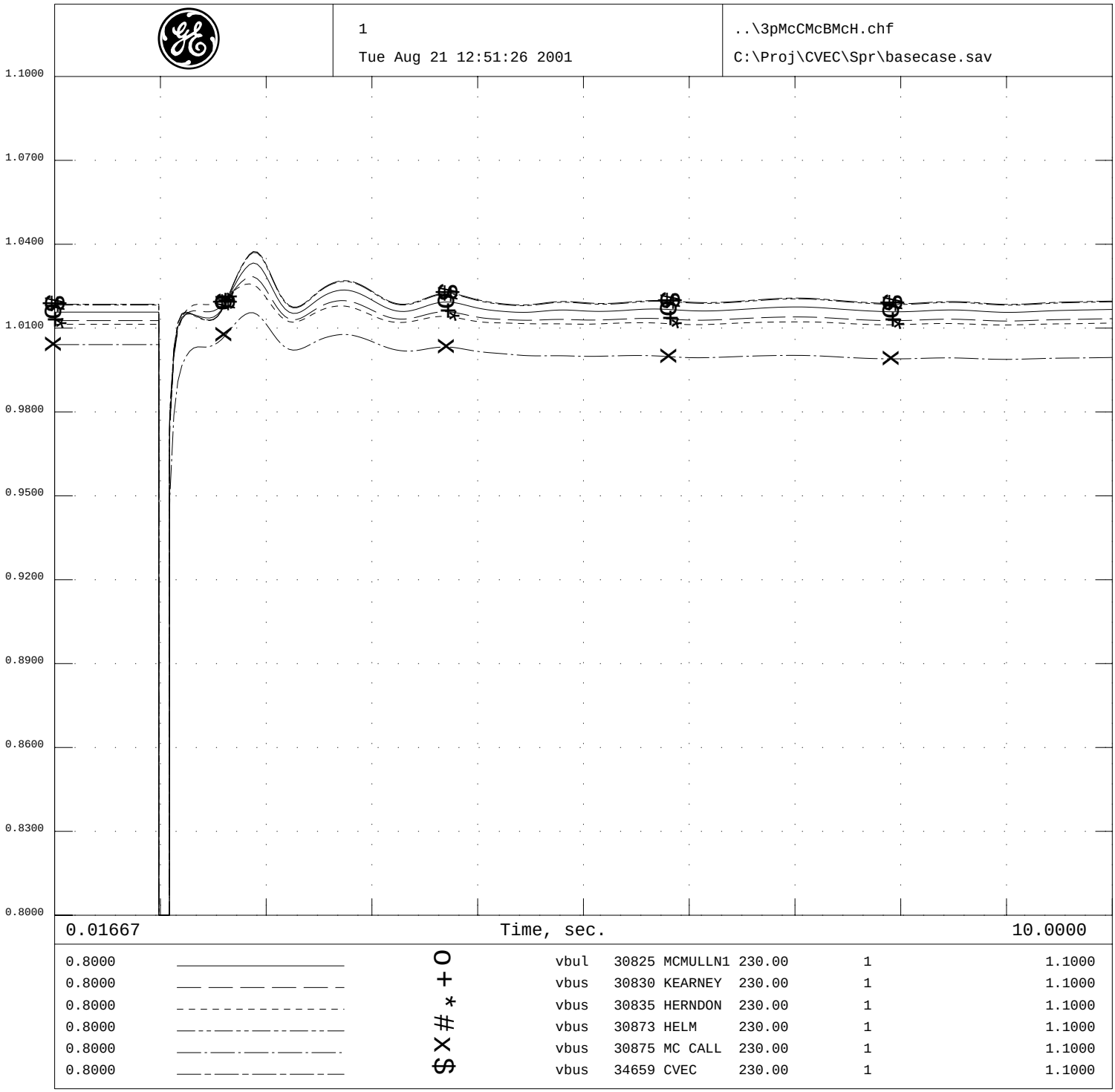


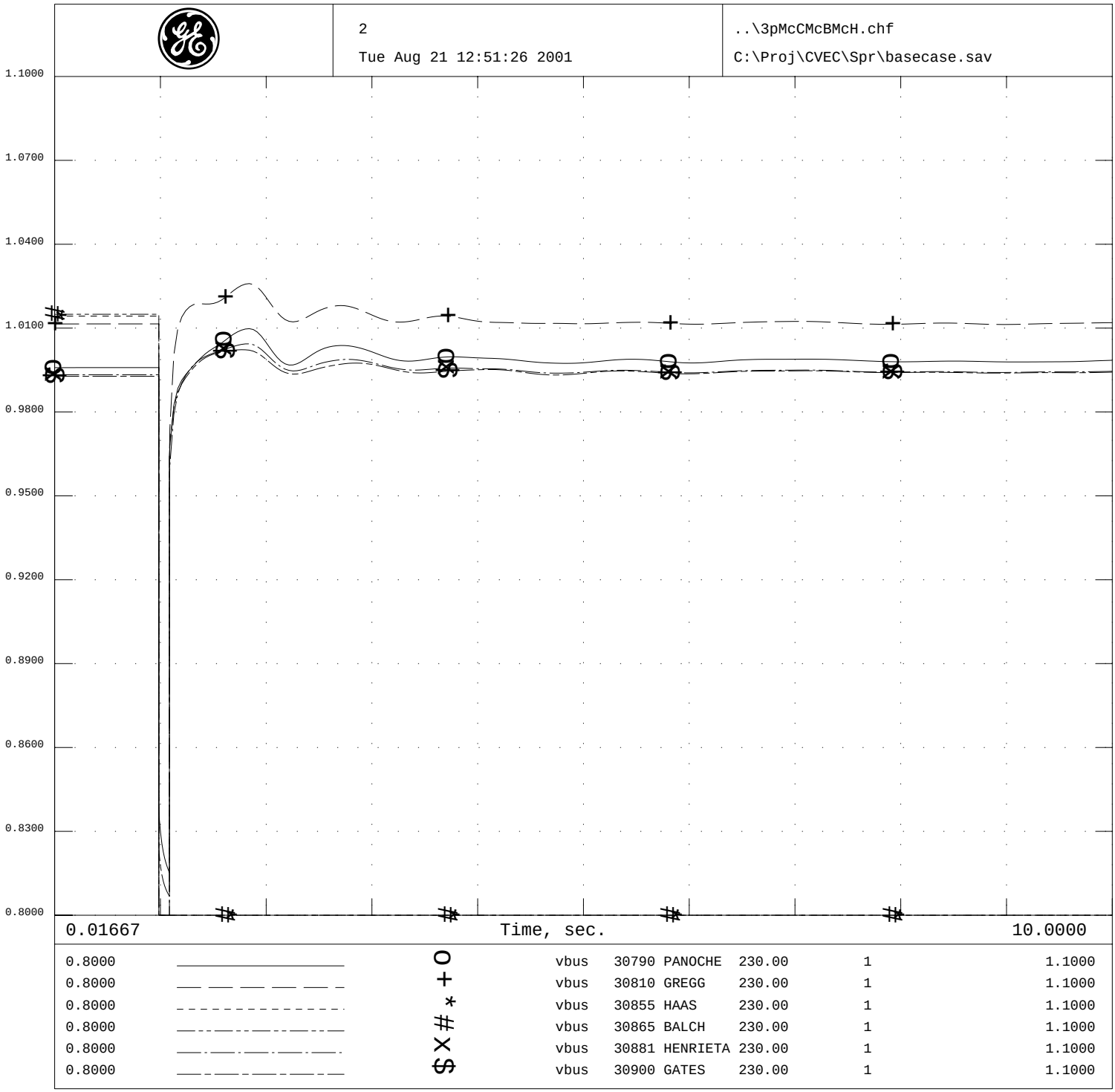
Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Gates-McCall 230kV Line Outage
3 phase 6 cycle fault at McCall 230kV bus and trip Gates-McCall 230kV line

Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Balch, McCall-Haas 230kV Double Line Outage
3 phase 6 cycle fault at McCall 230kV bus and McCall-Balch, McCall-Haas lines

Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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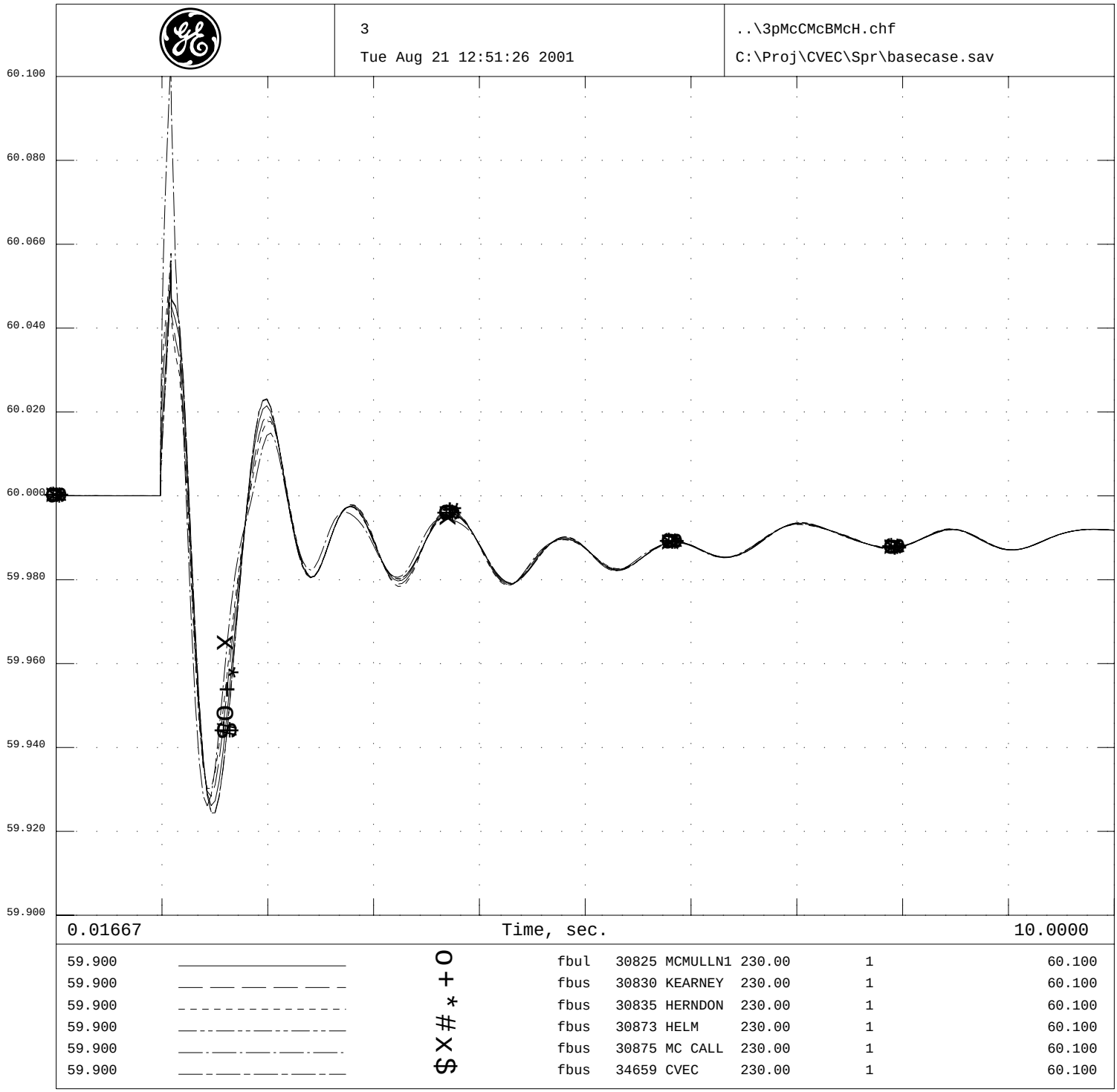
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Balch, McCall-Haas 230kV Double Line Outage
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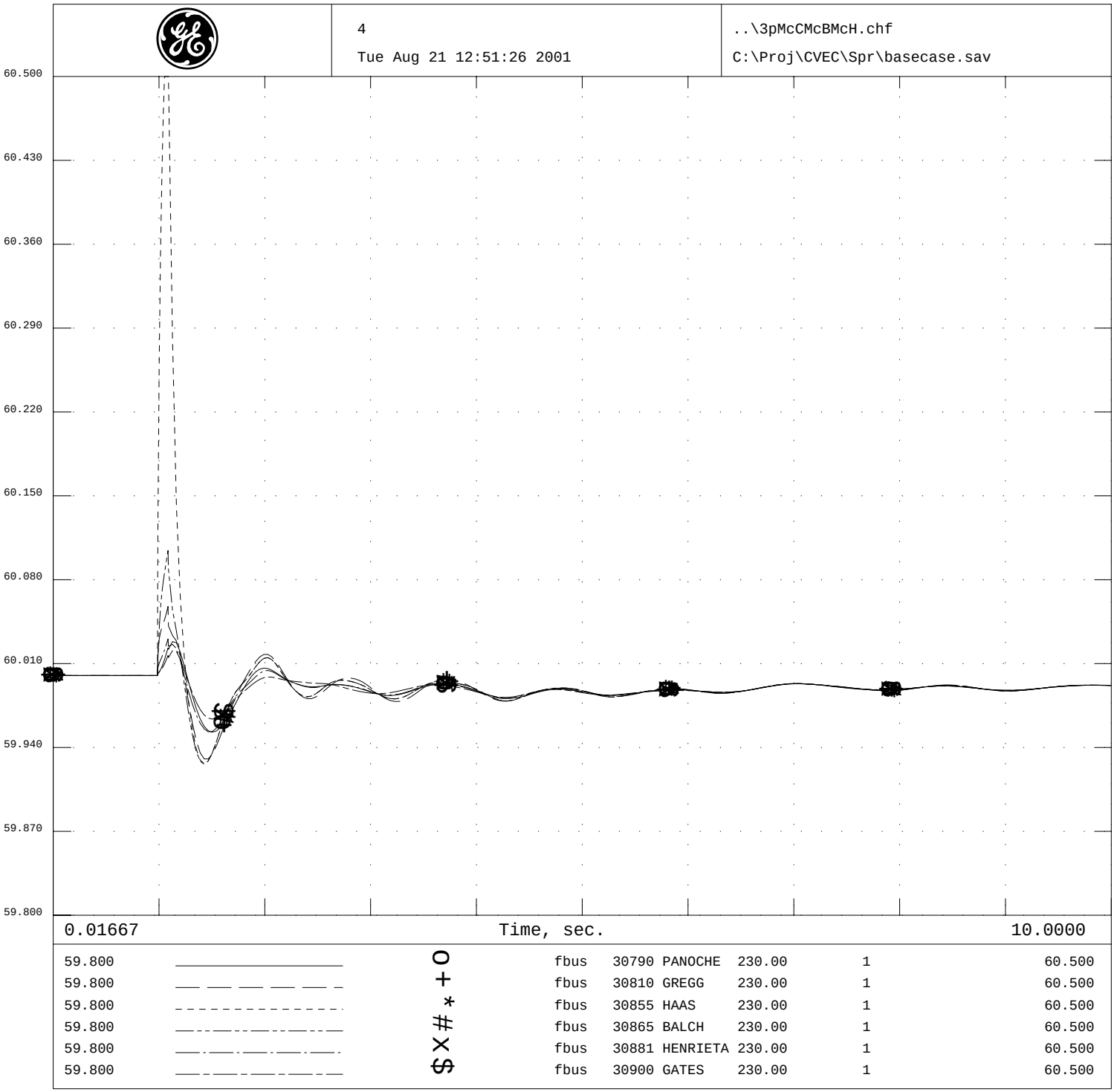
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Balch, McCall-Haas 230kV Double Line Outage
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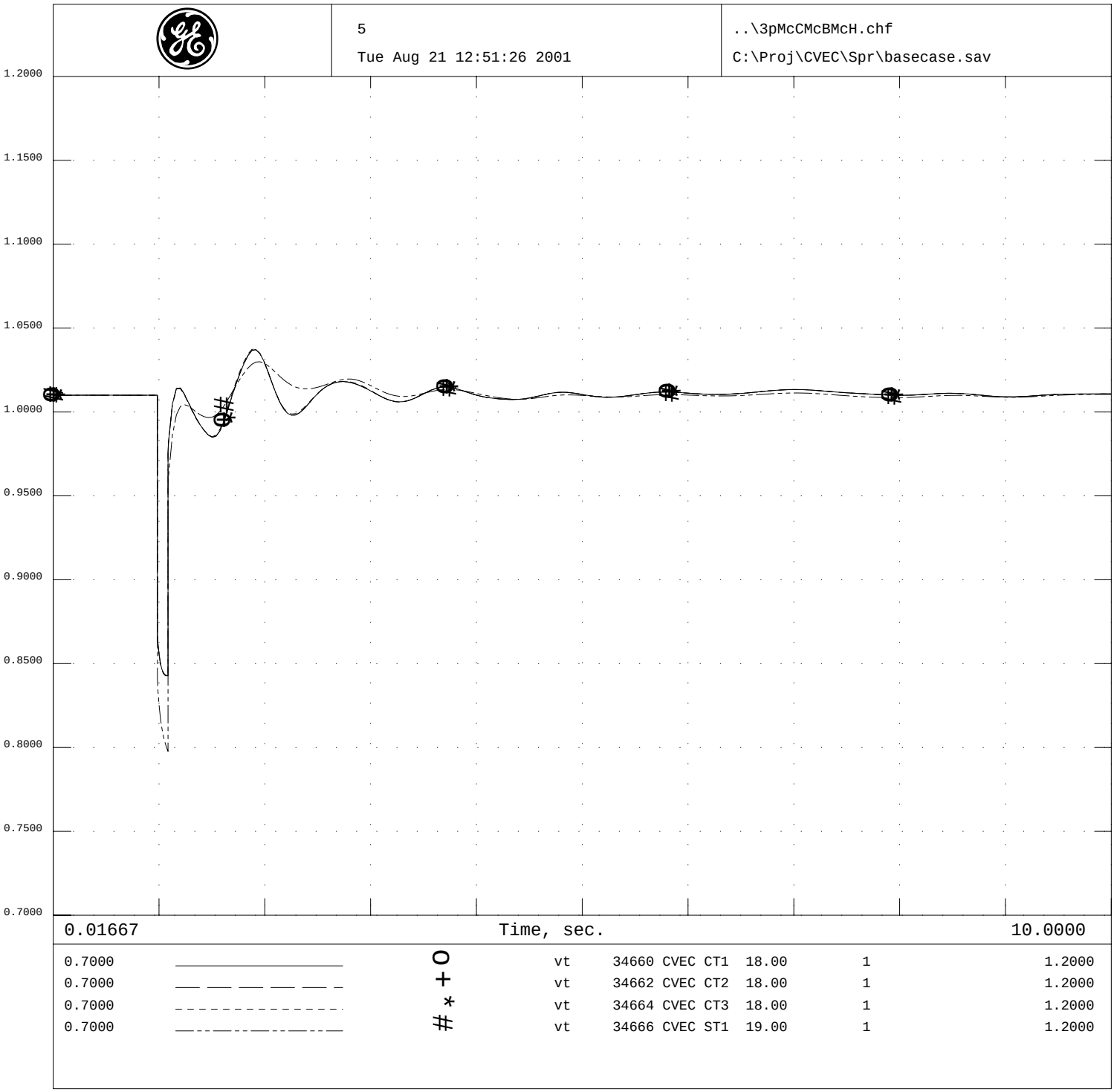
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Balch, McCall-Haas 230kV Double Line Outage
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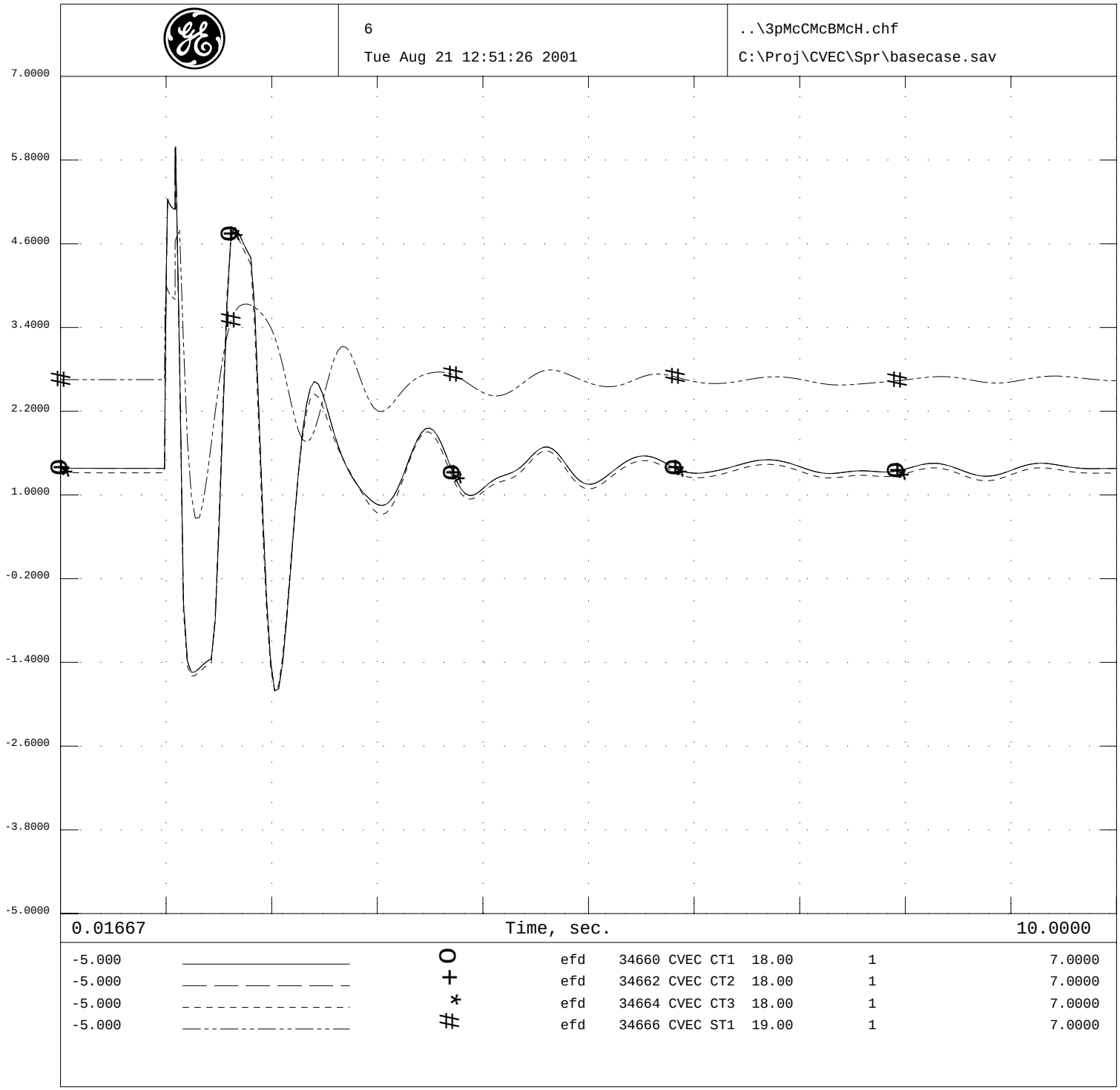
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
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McCall-Balch, McCall-Haas 230kV Double Line Outage
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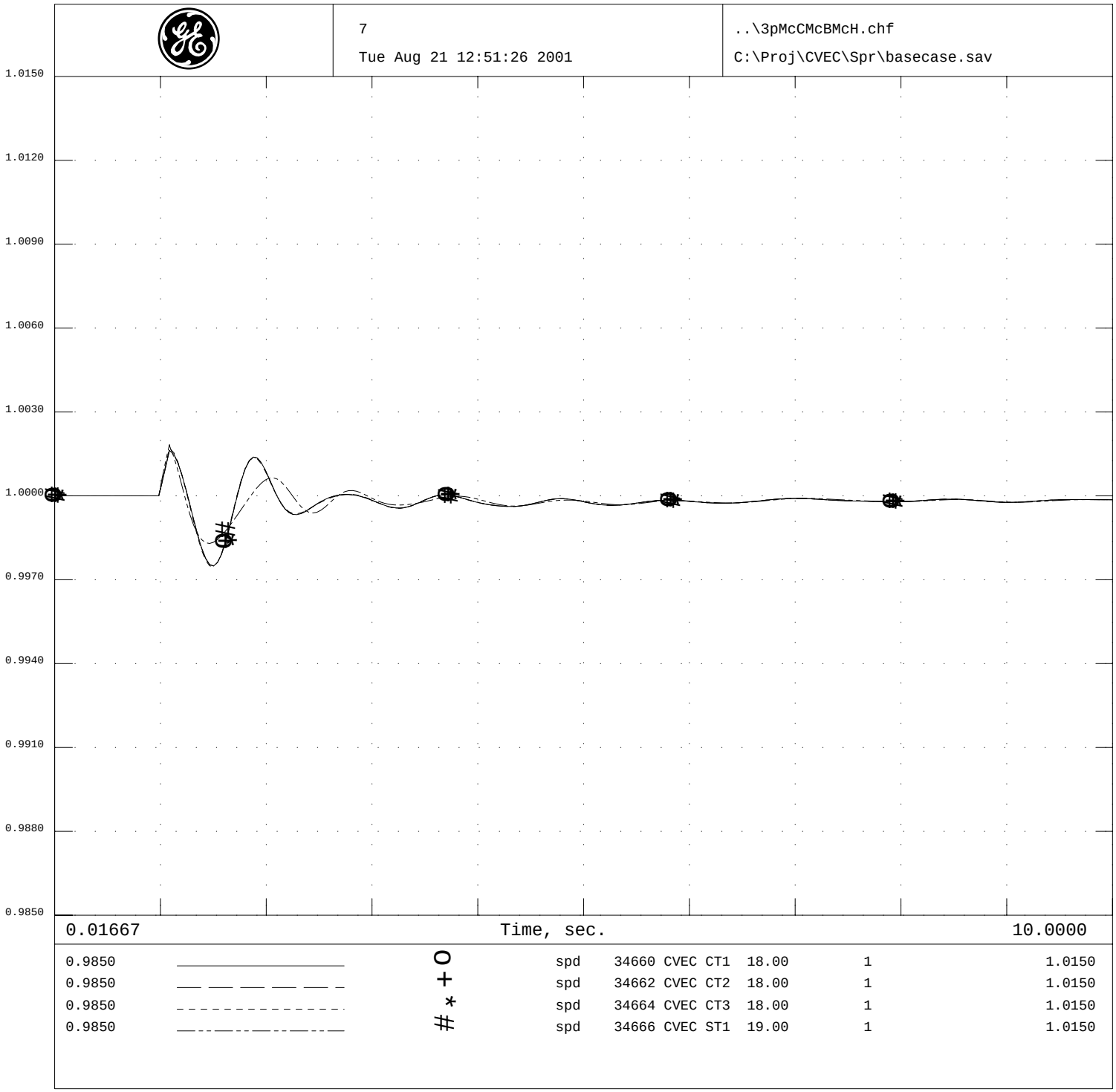
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall-Balch, McCall-Haas 230kV Double Line Outage
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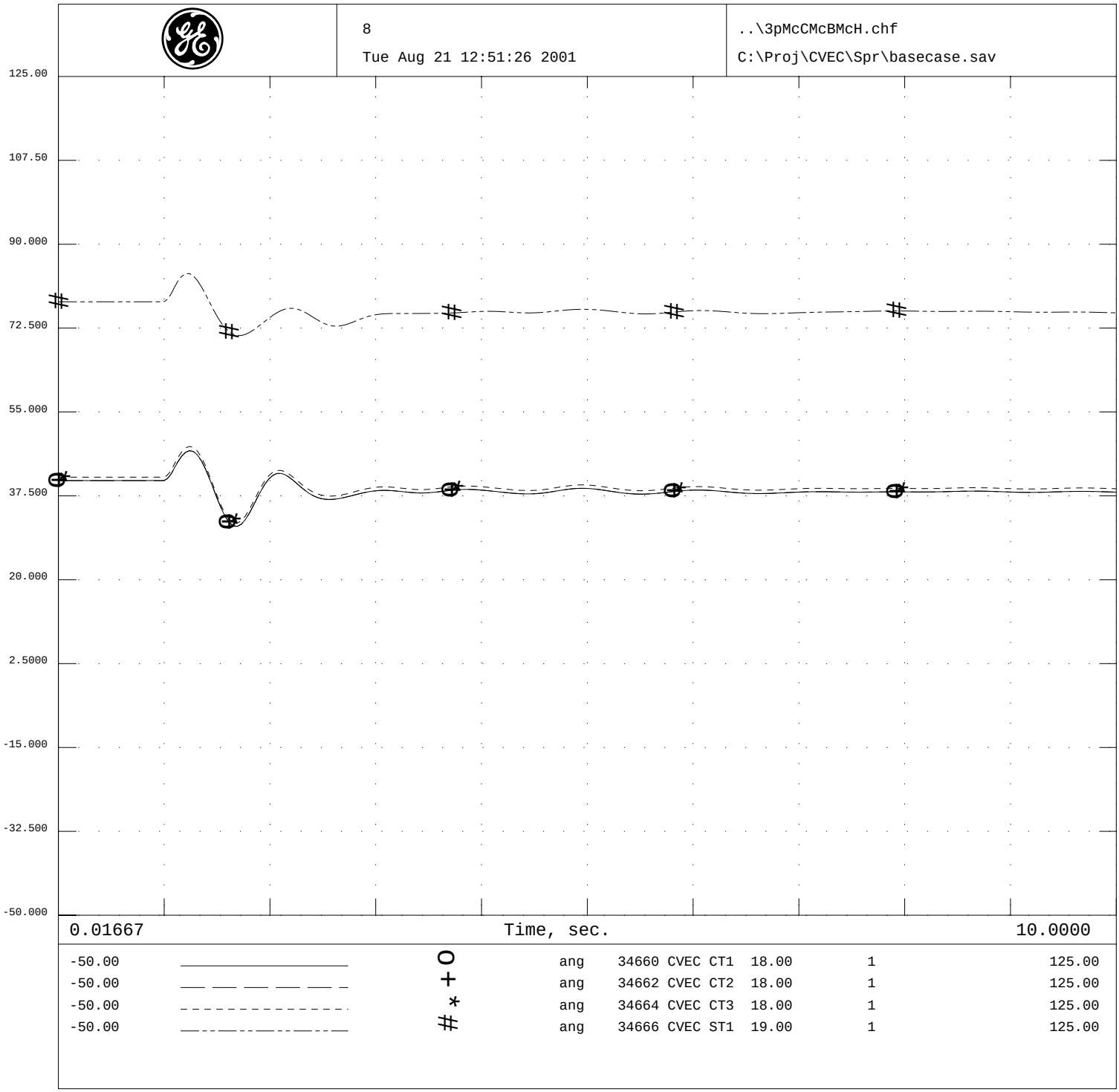
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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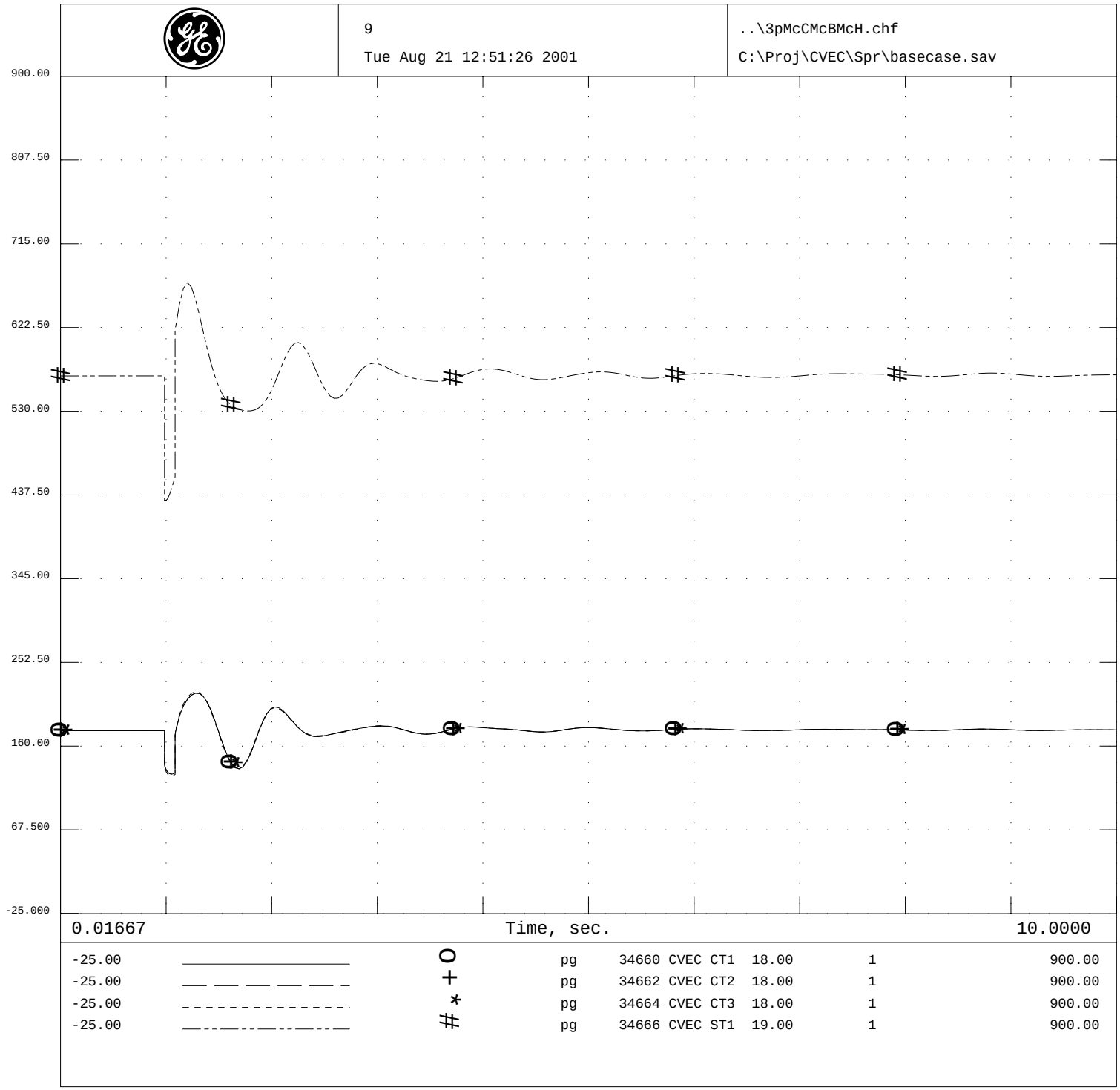
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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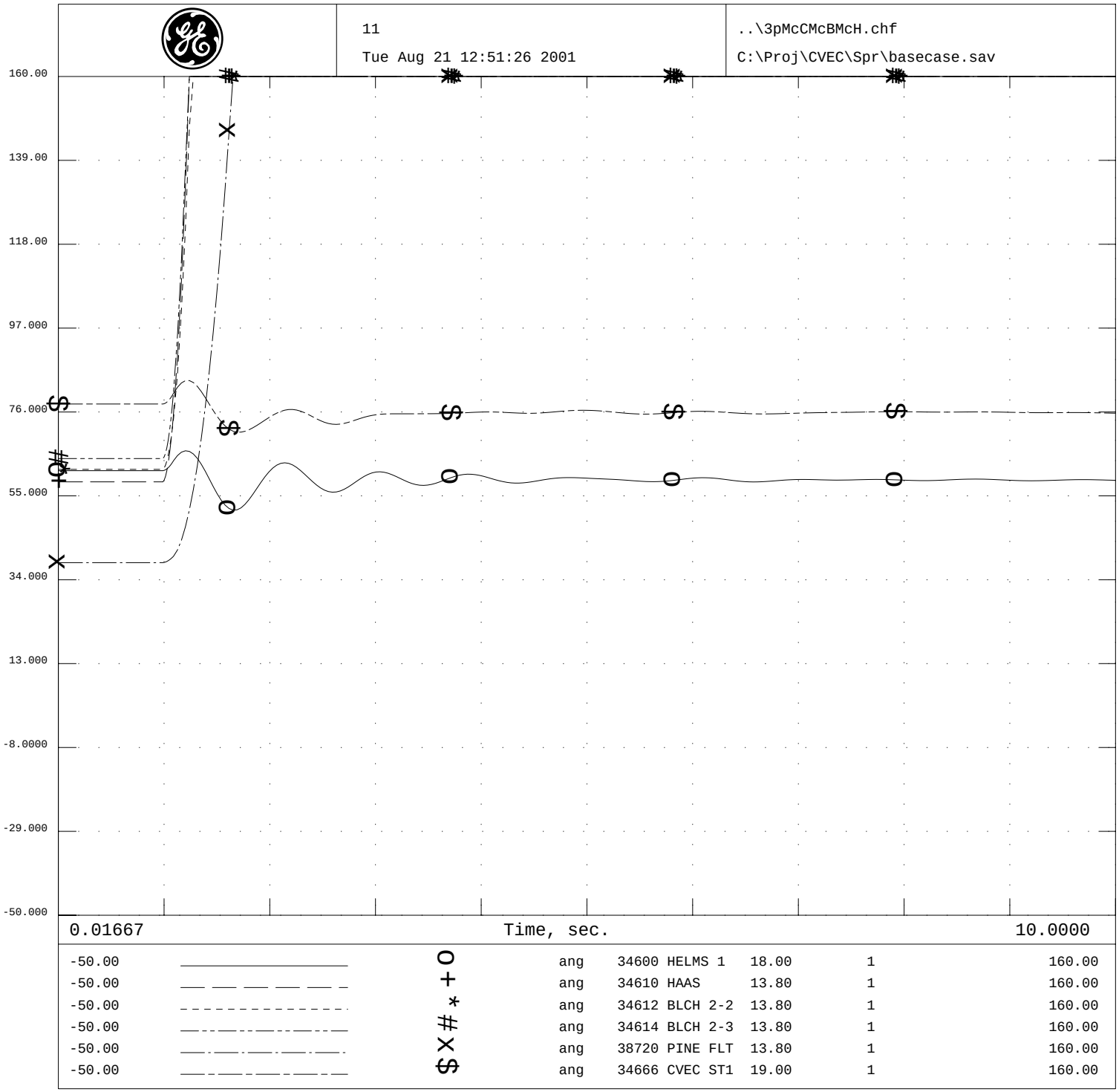
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Power



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McCall-Balch, McCall-Haas 230kV Double Line Outage
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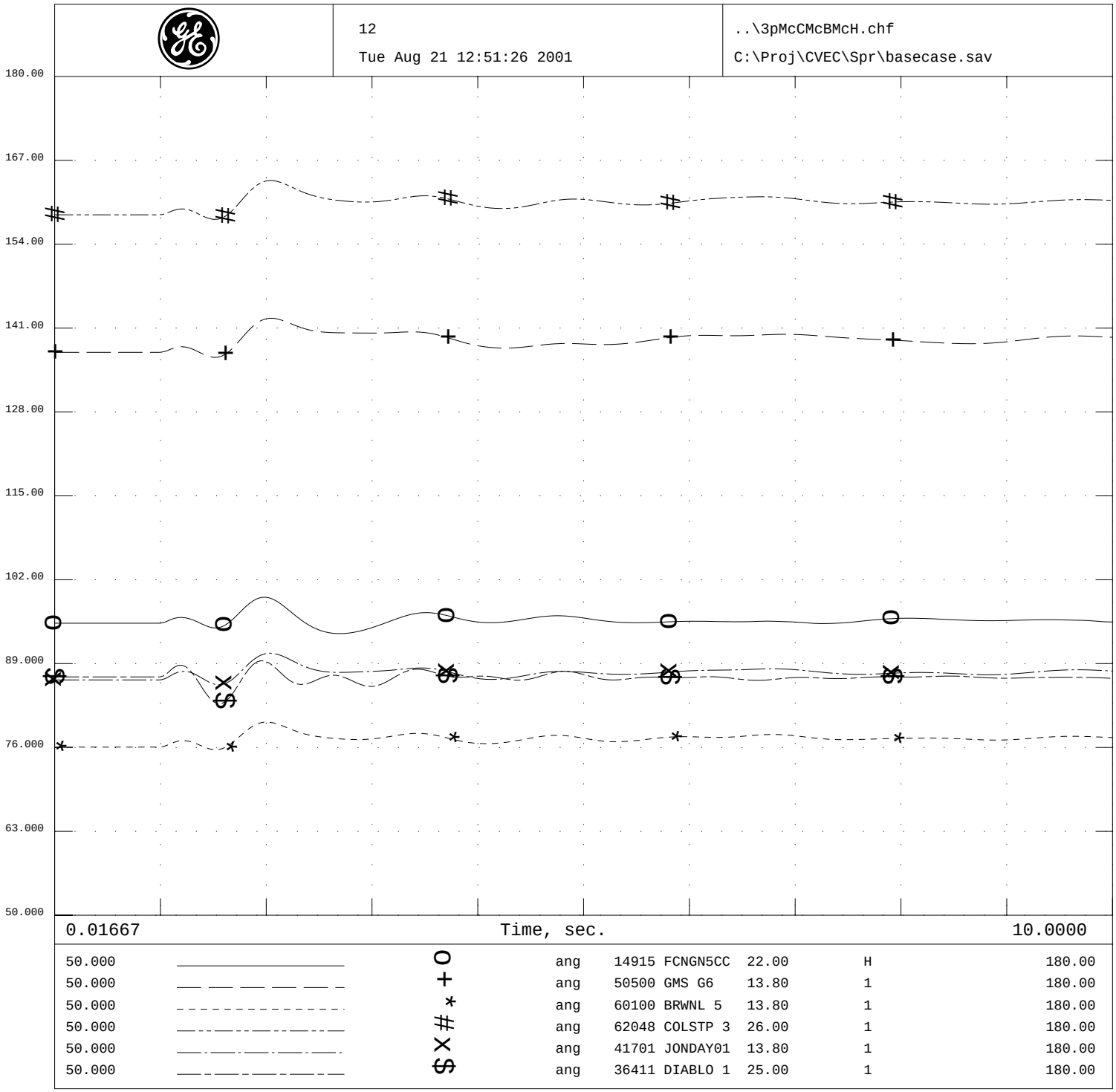
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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2004 Heavy Spring Base Case
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McCall-Balch, McCall-Haas 230kV Double Line Outage
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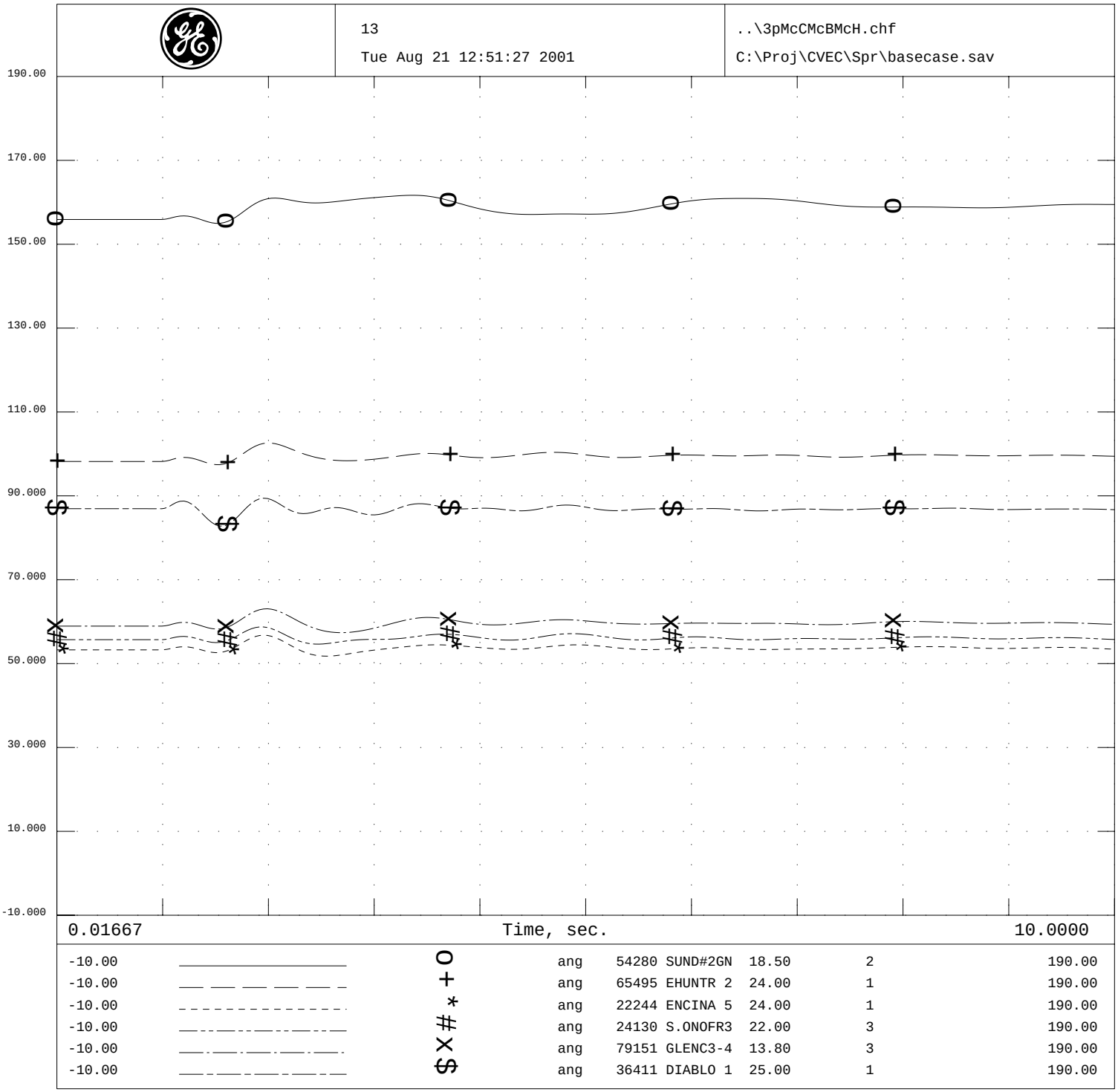
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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Central Valley Energy Center
Calpine Corporation
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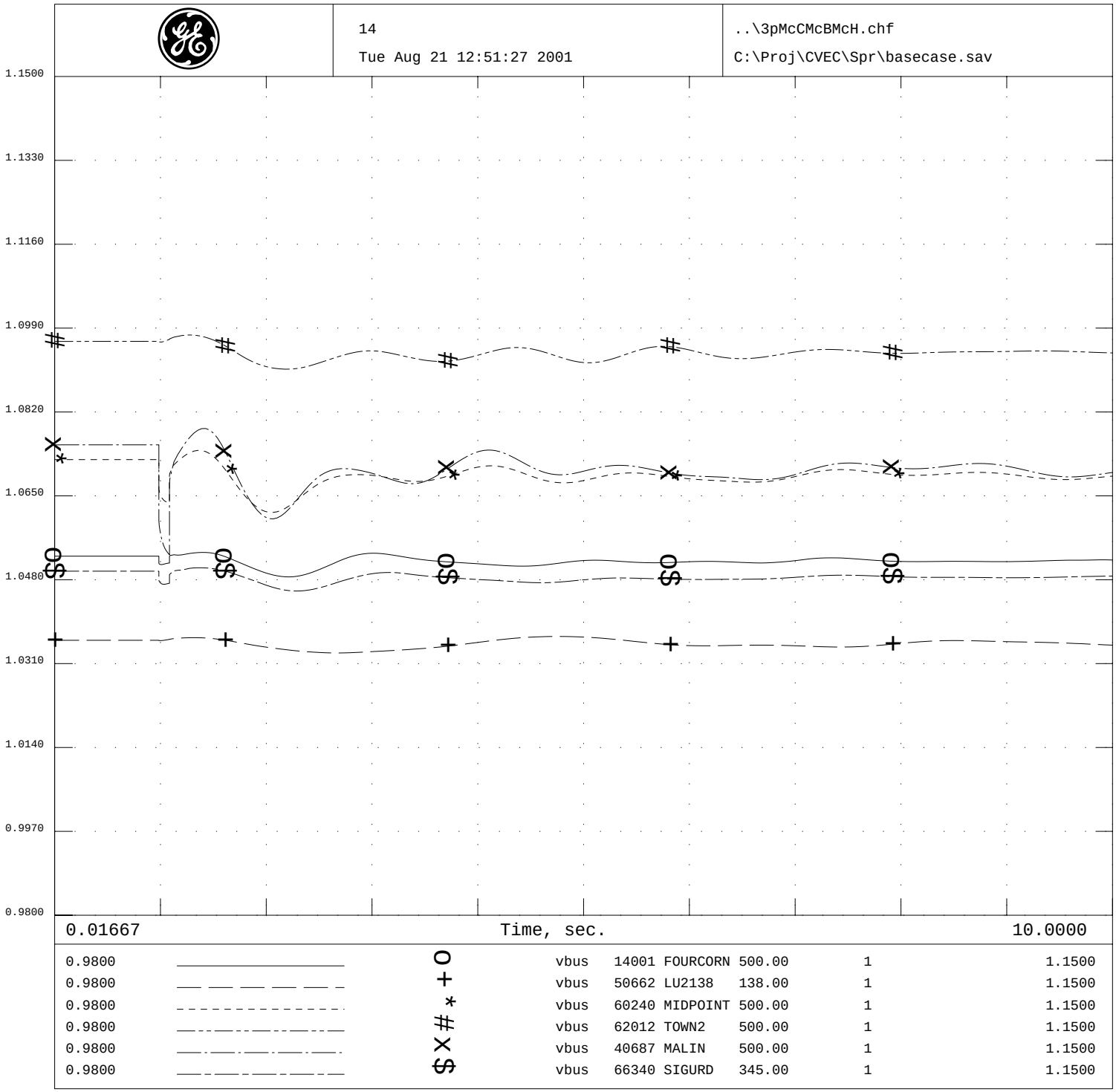

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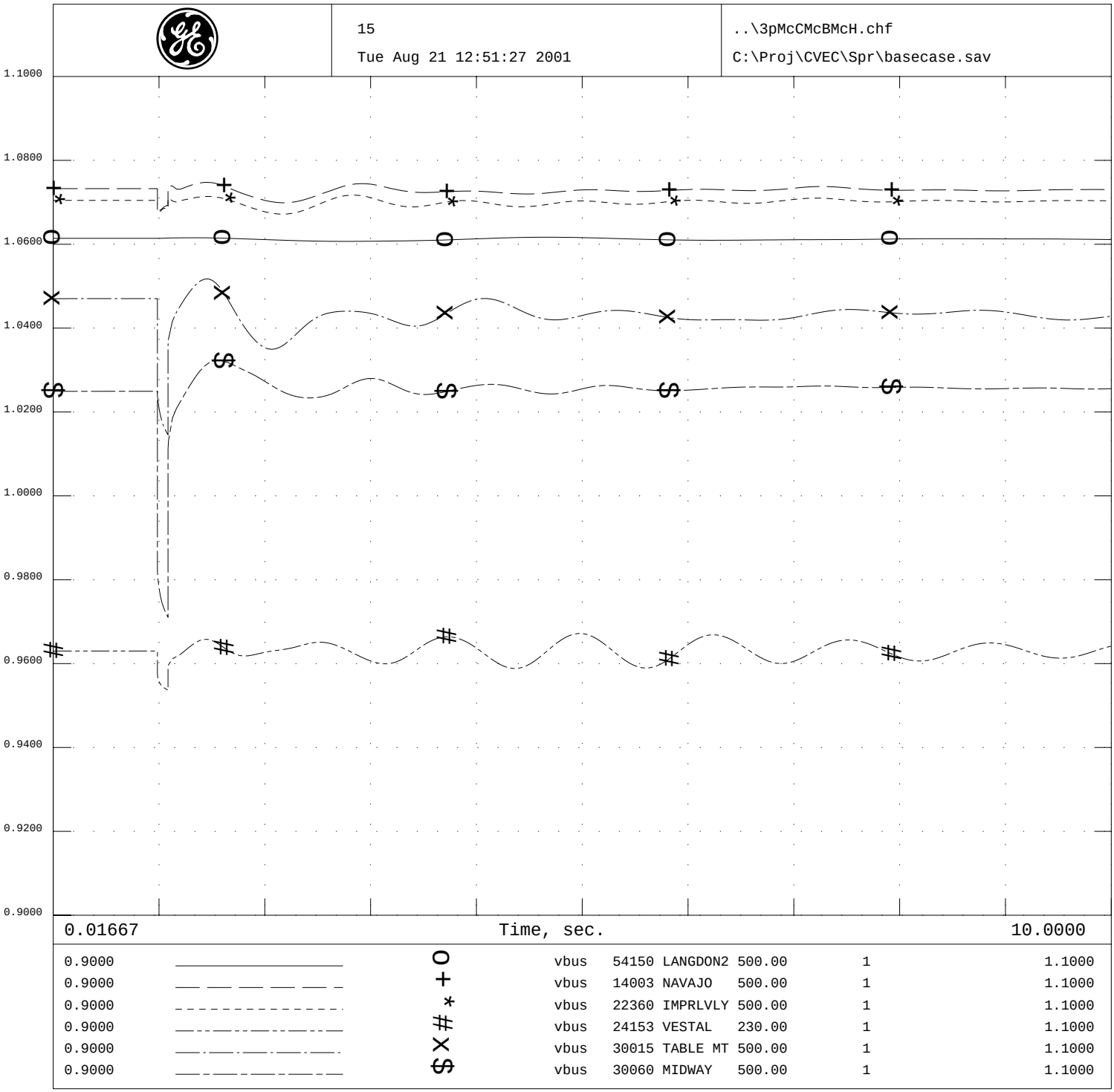
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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Calpine Corporation
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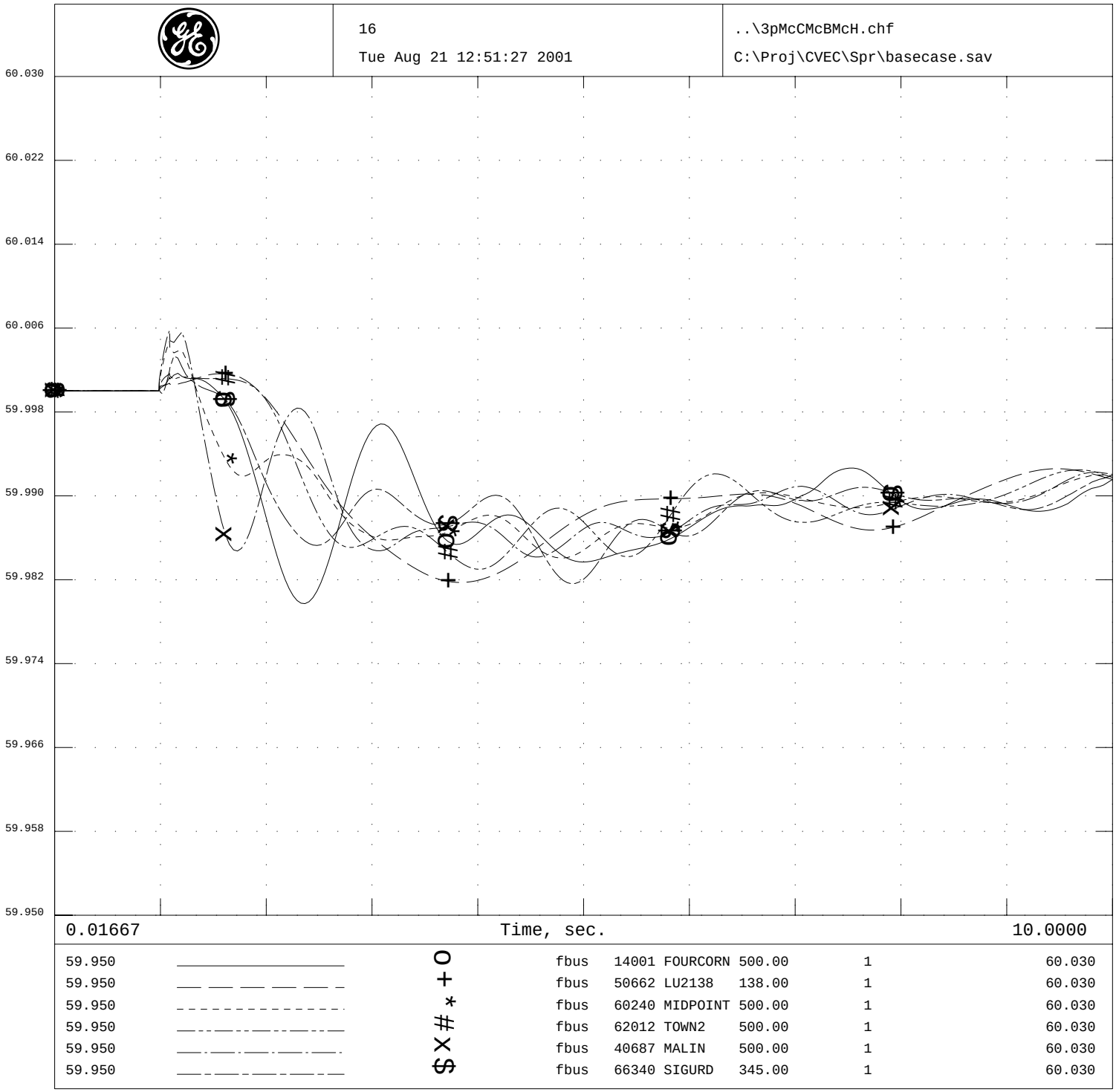

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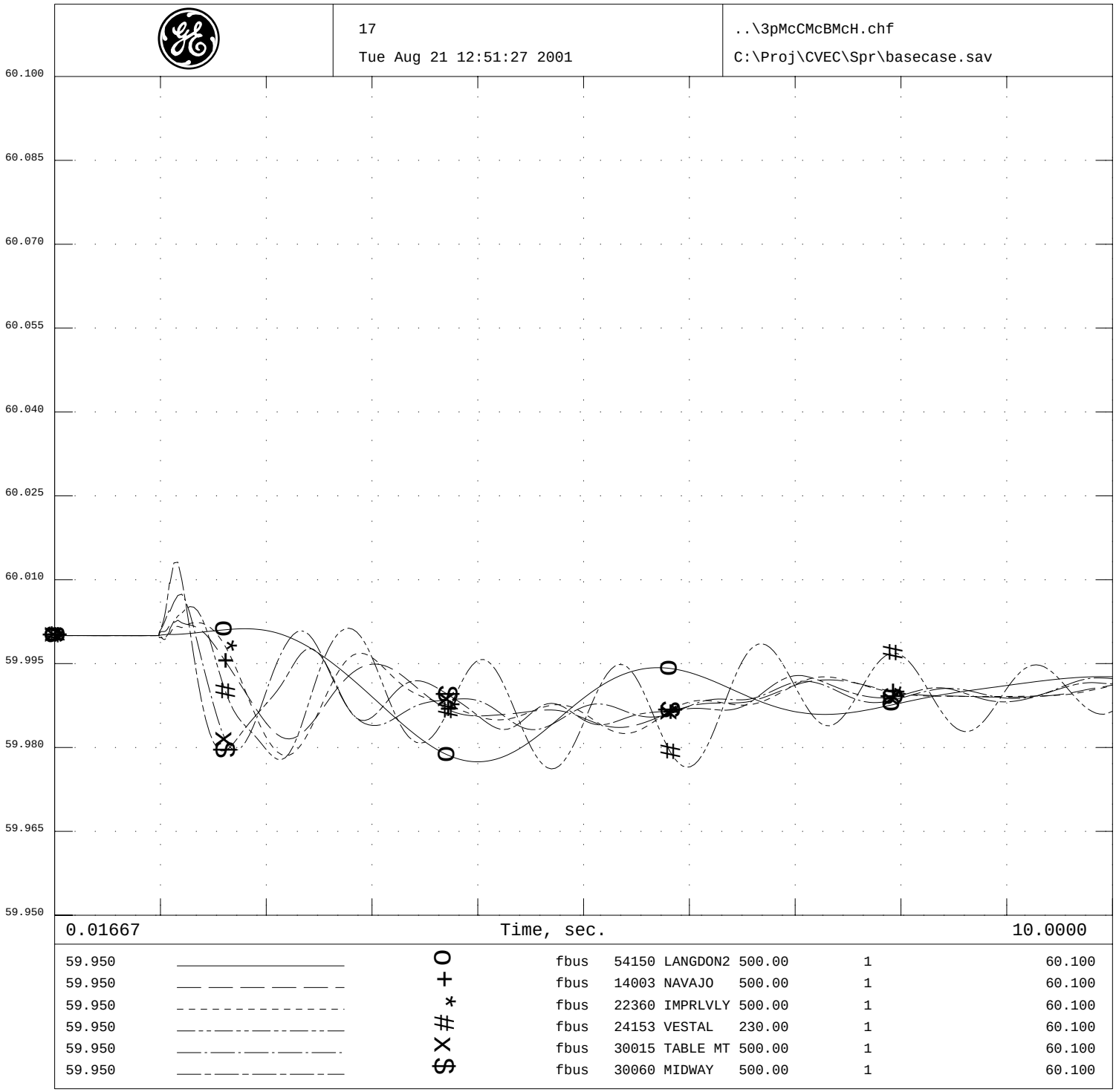
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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Calpine Corporation
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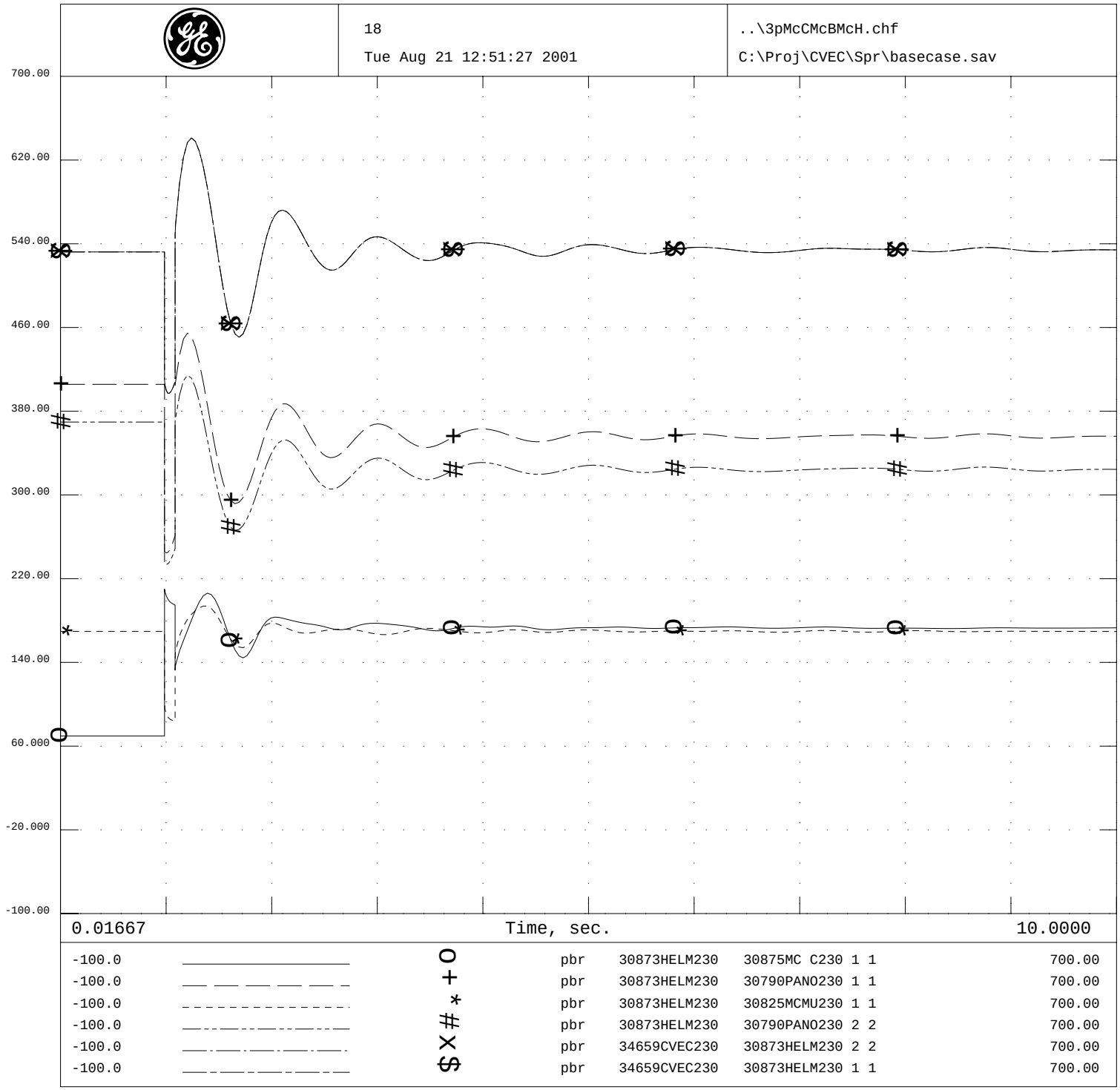

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2004 Heavy Spring Base Case
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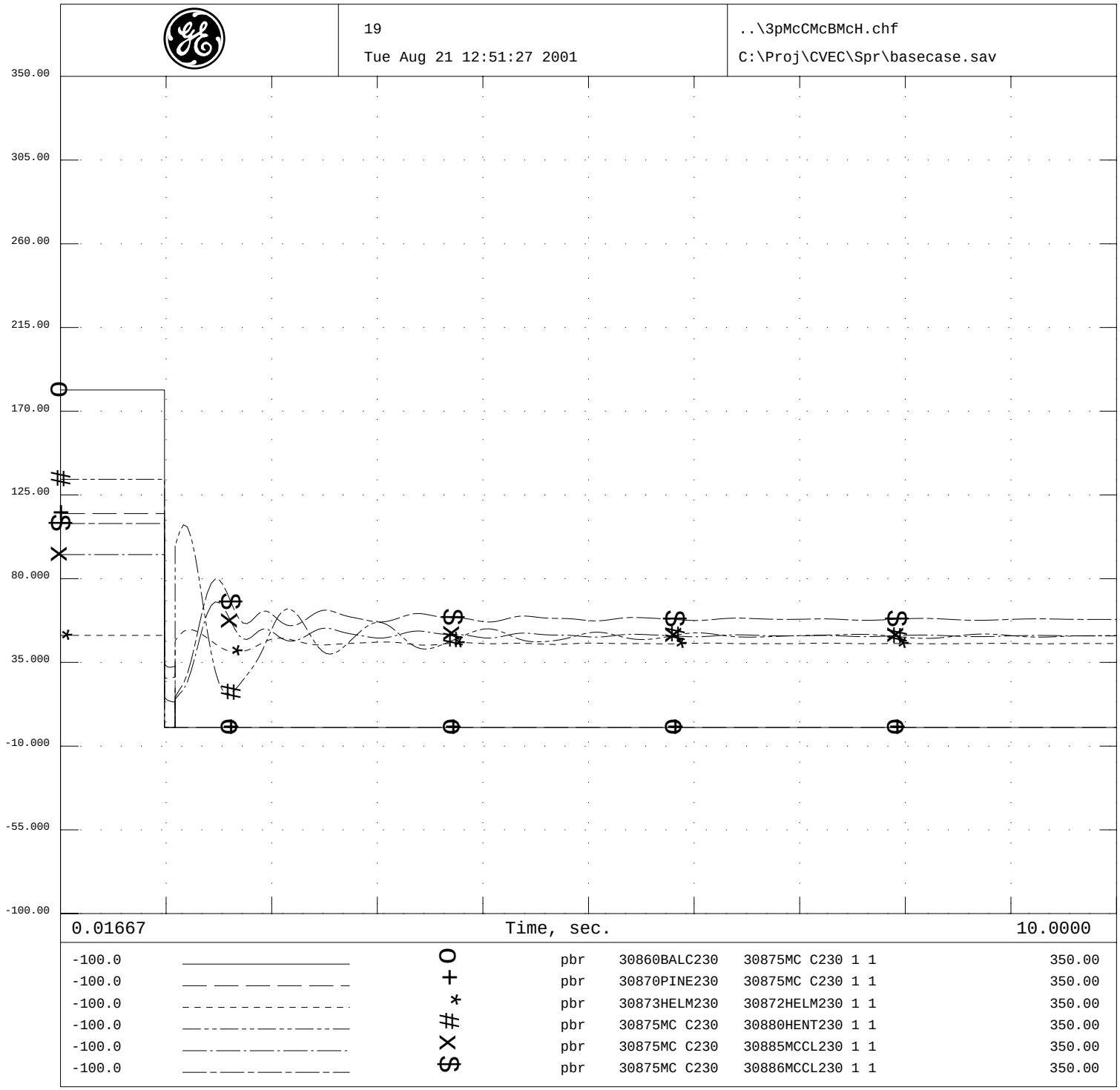
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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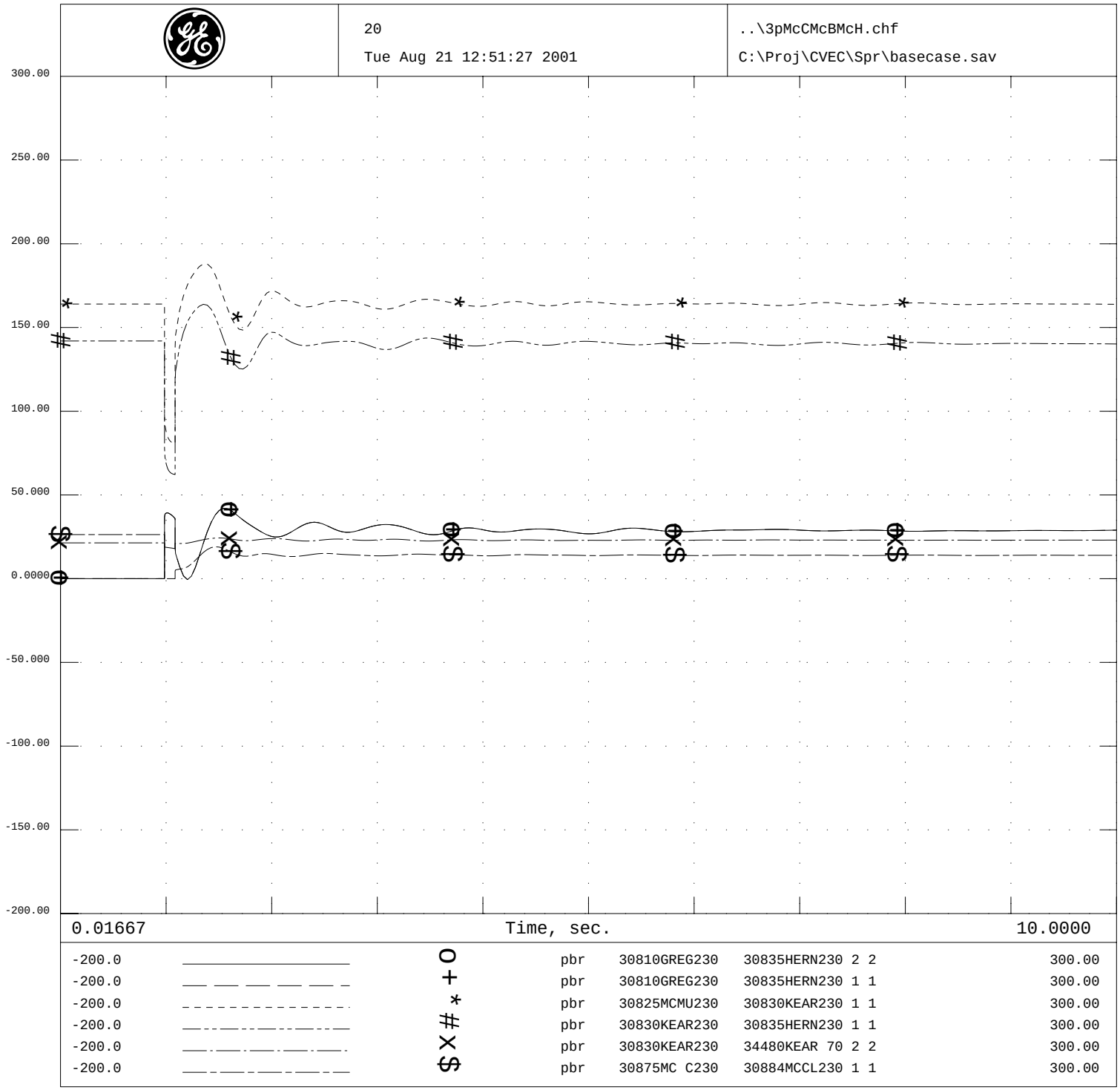

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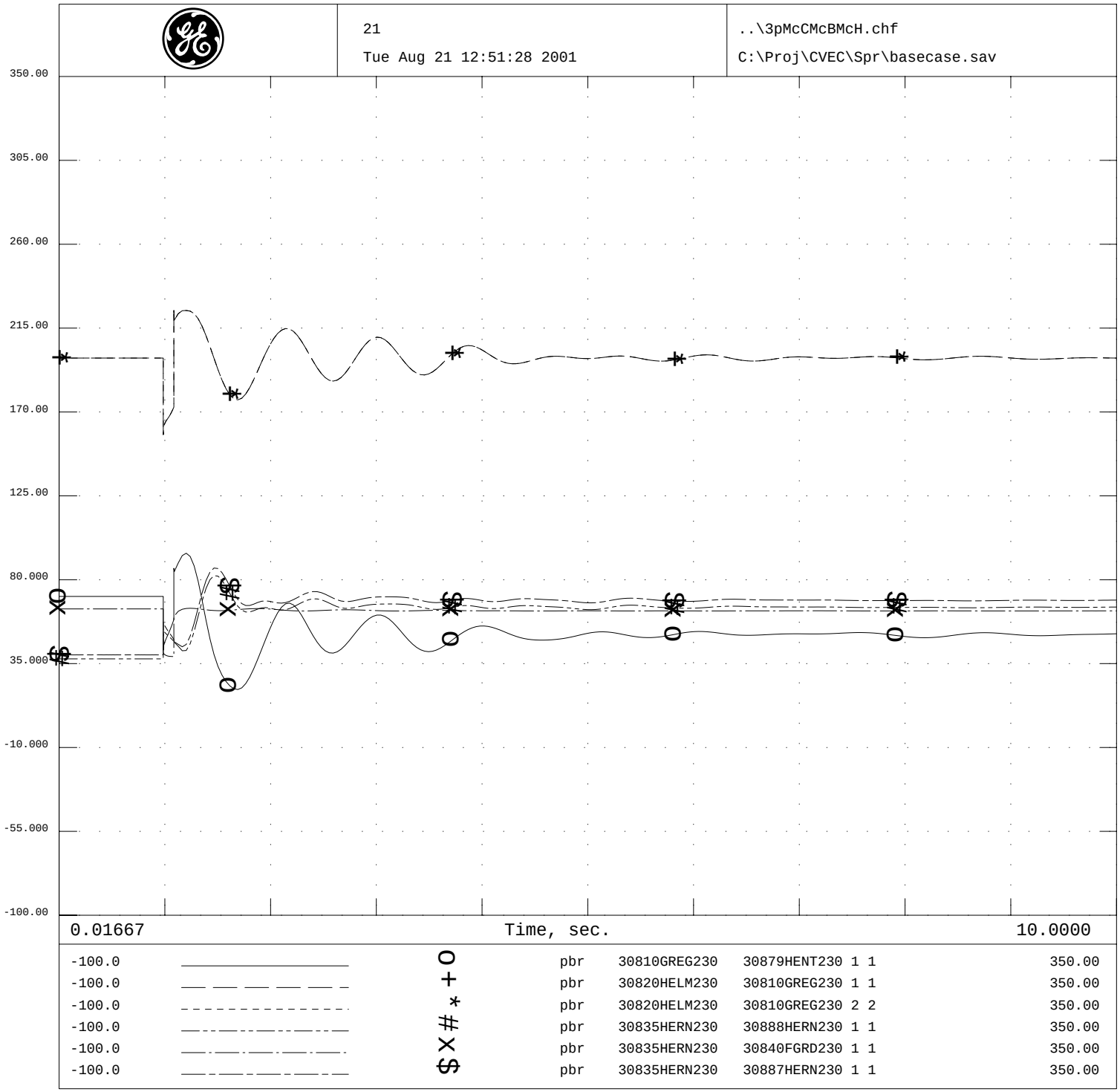

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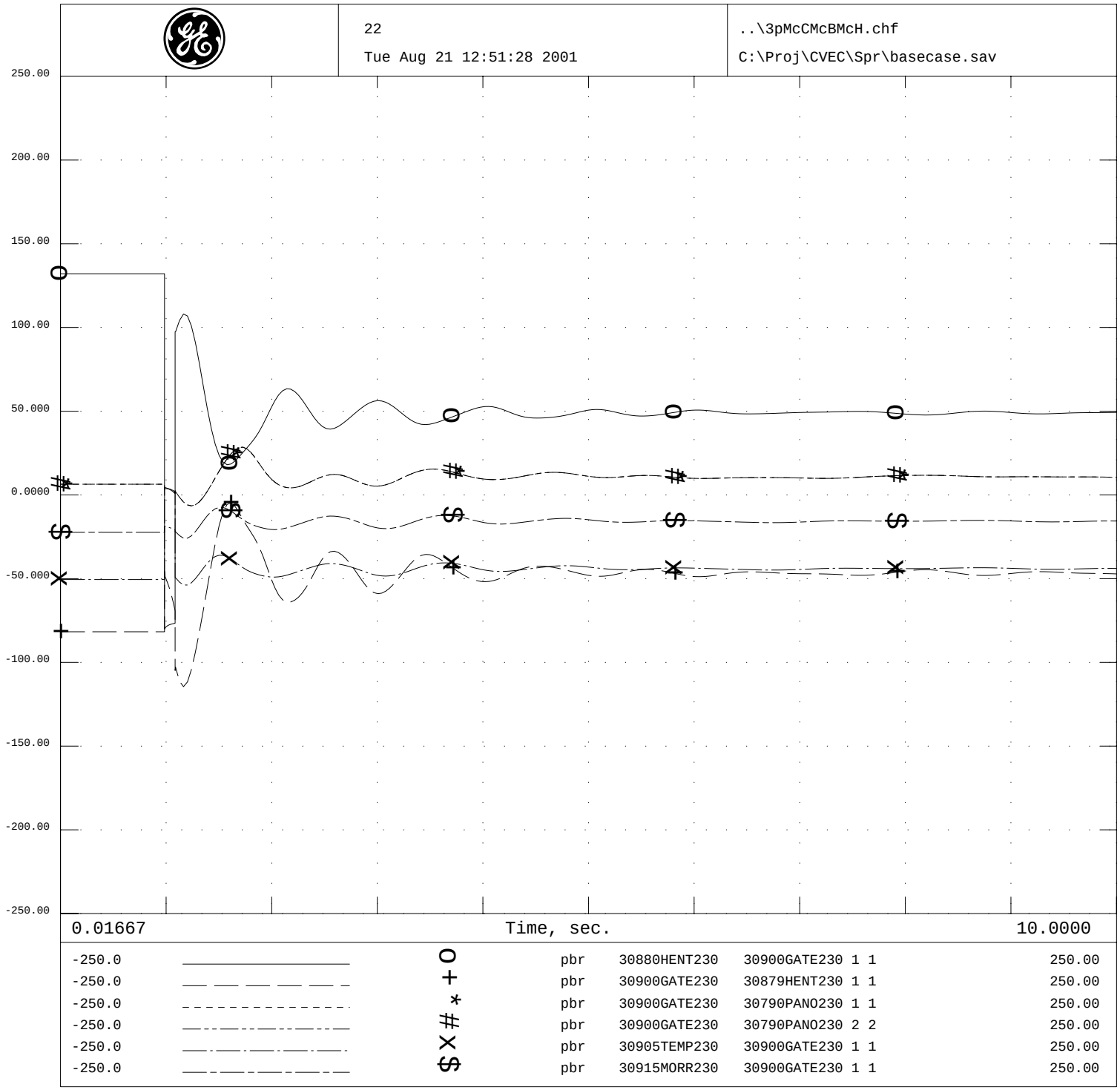

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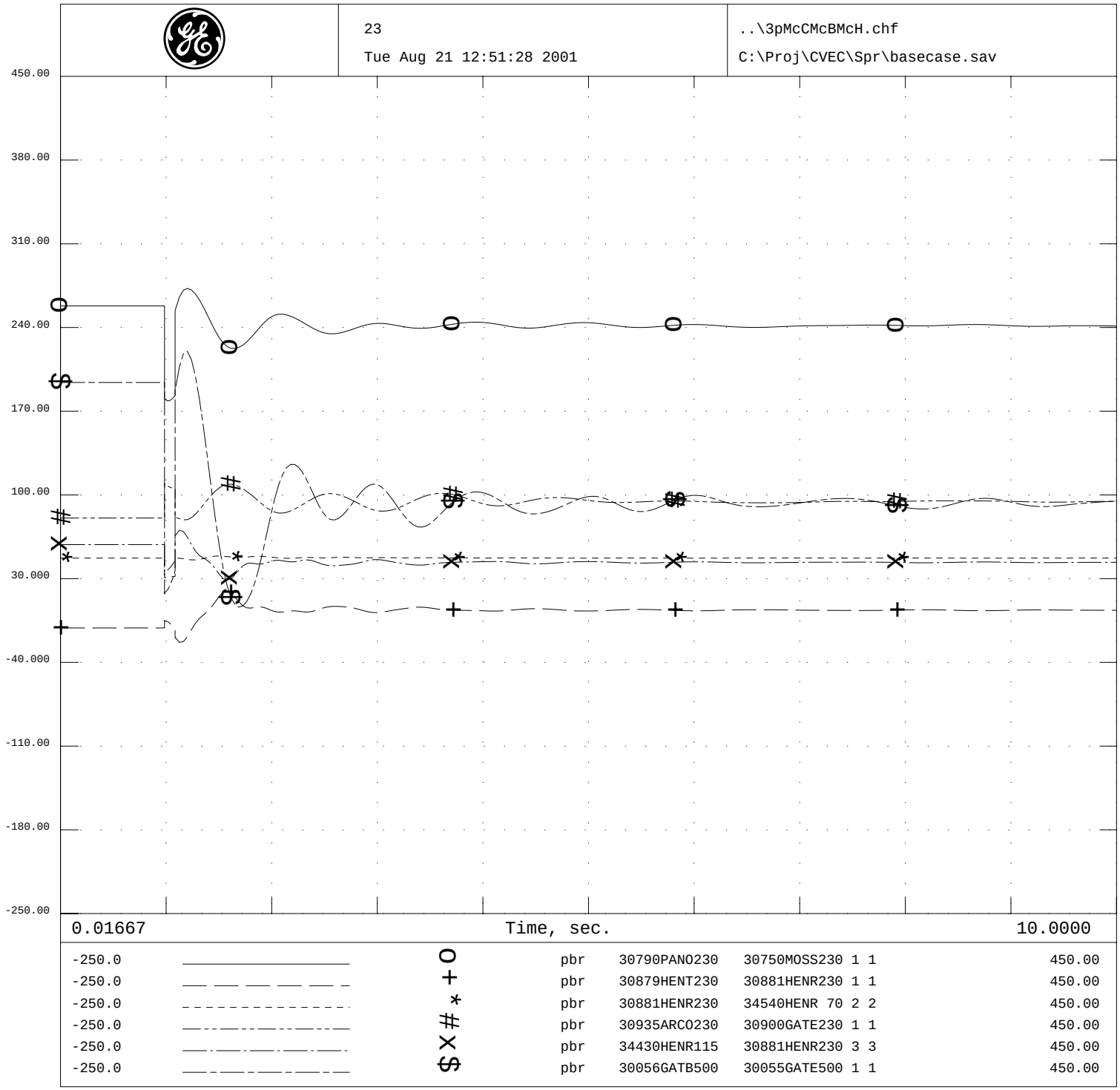

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2004 Heavy Spring Base Case
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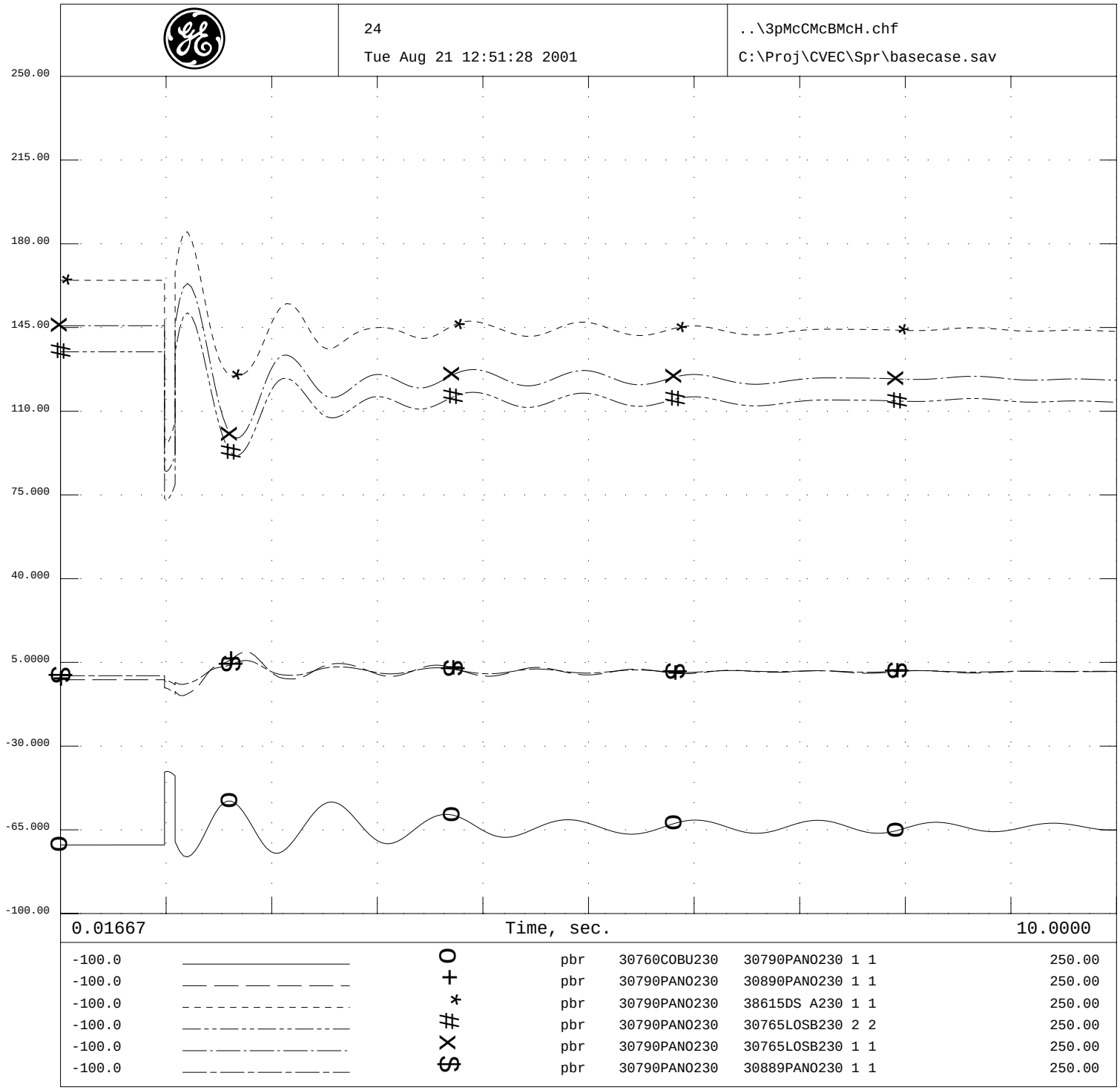

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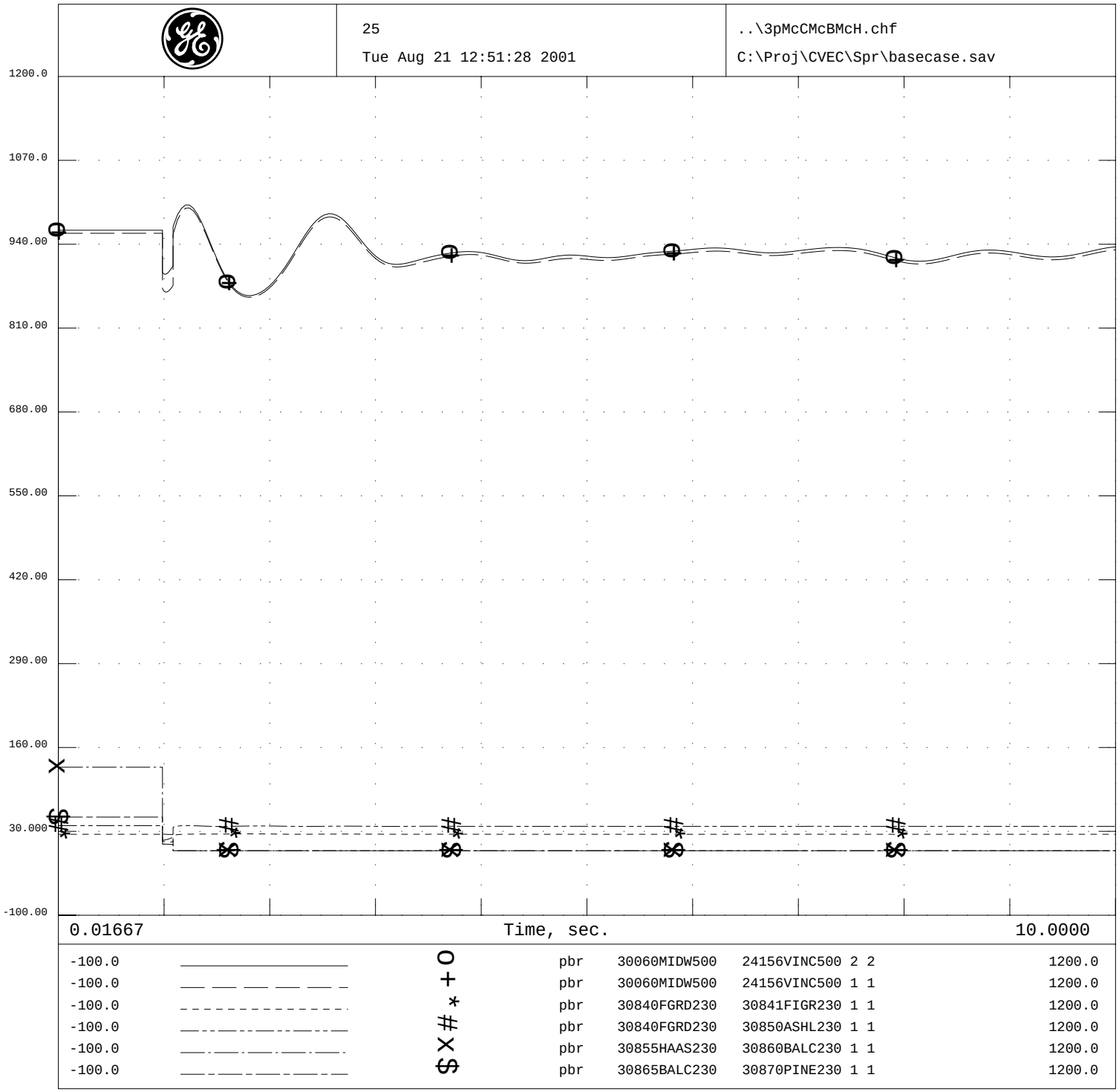

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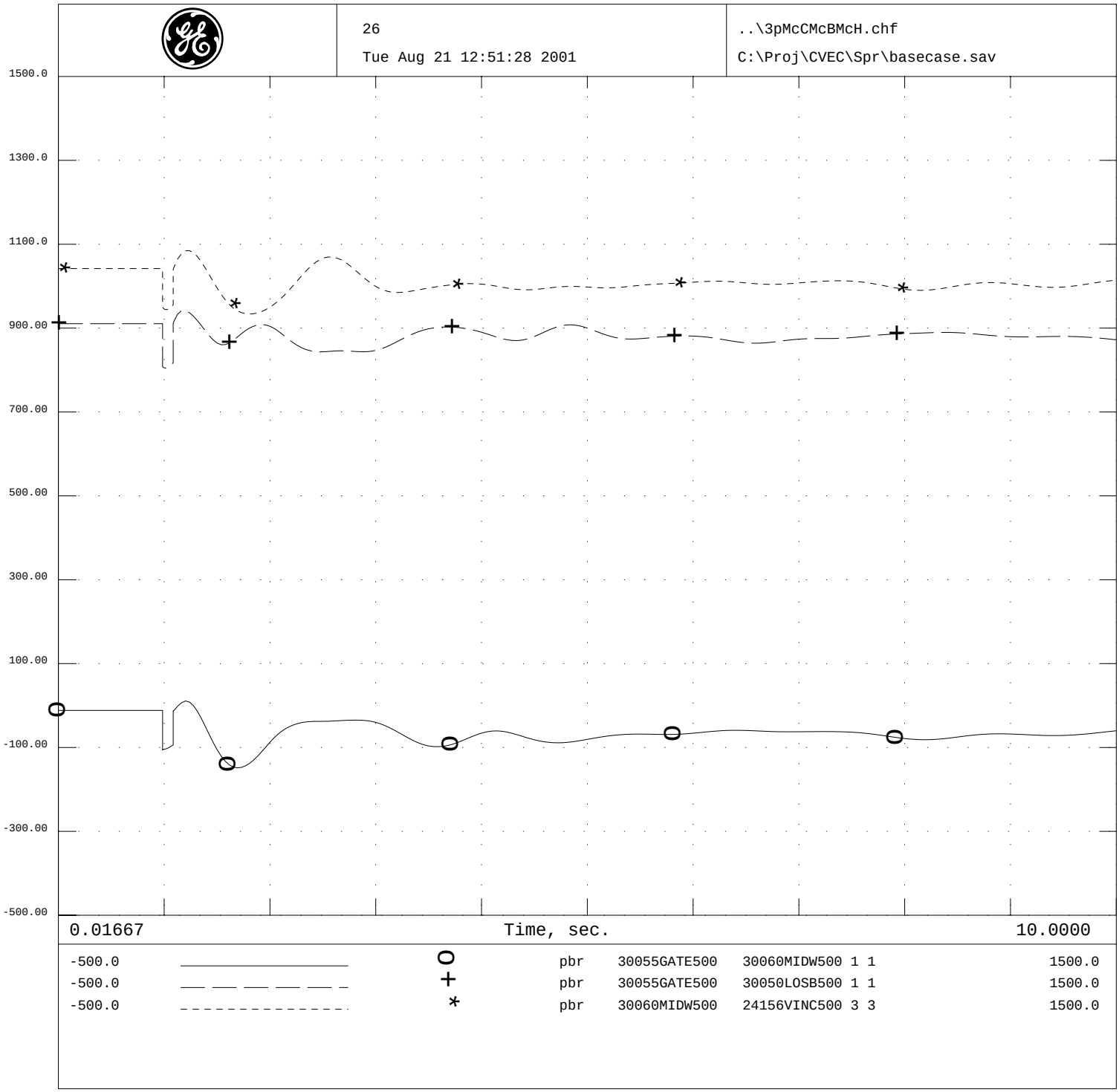

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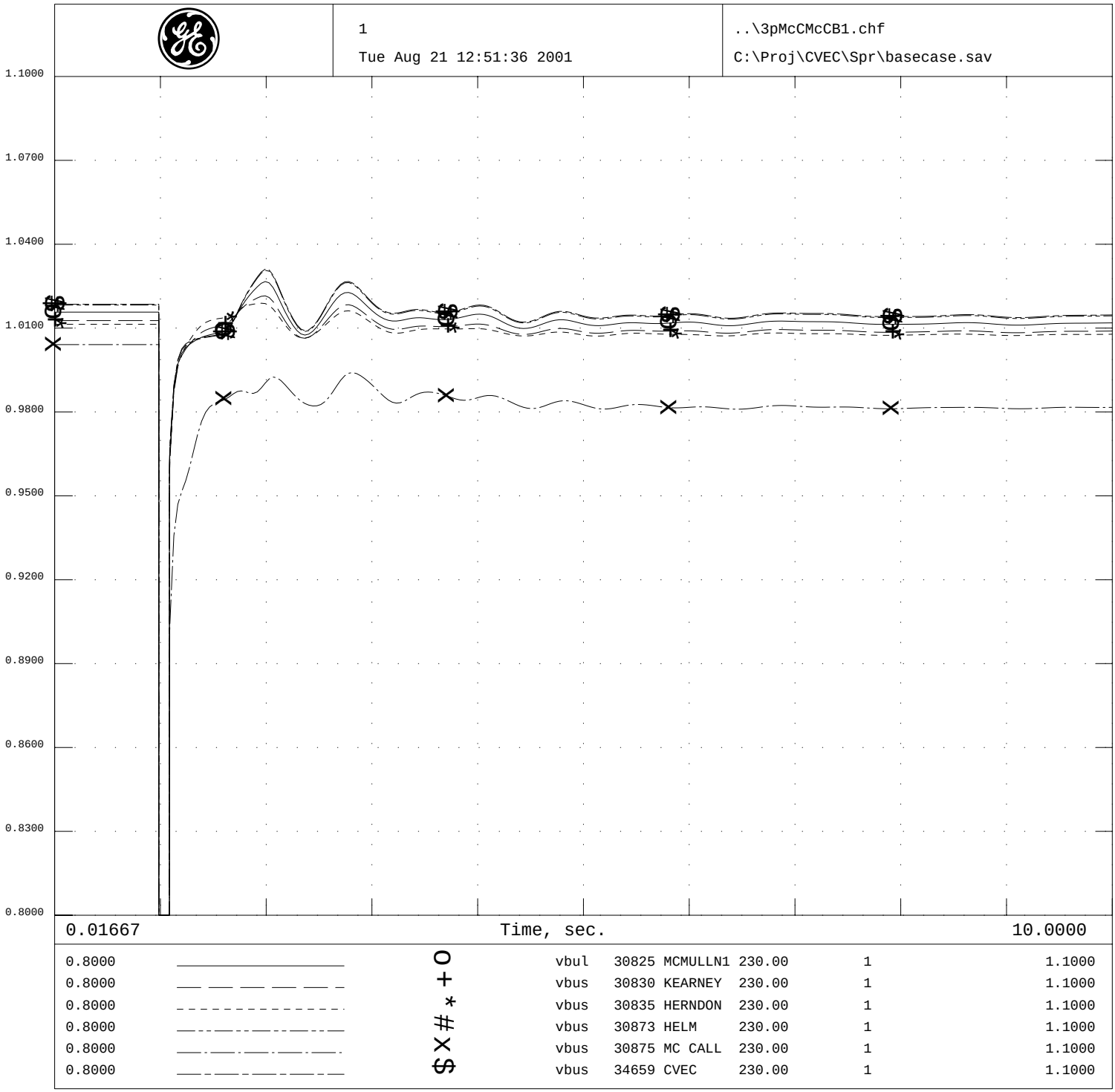

Calpine Corporation - Central Valley Energy Center System Impact Study
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McCall 230kV Bus #1 Outage
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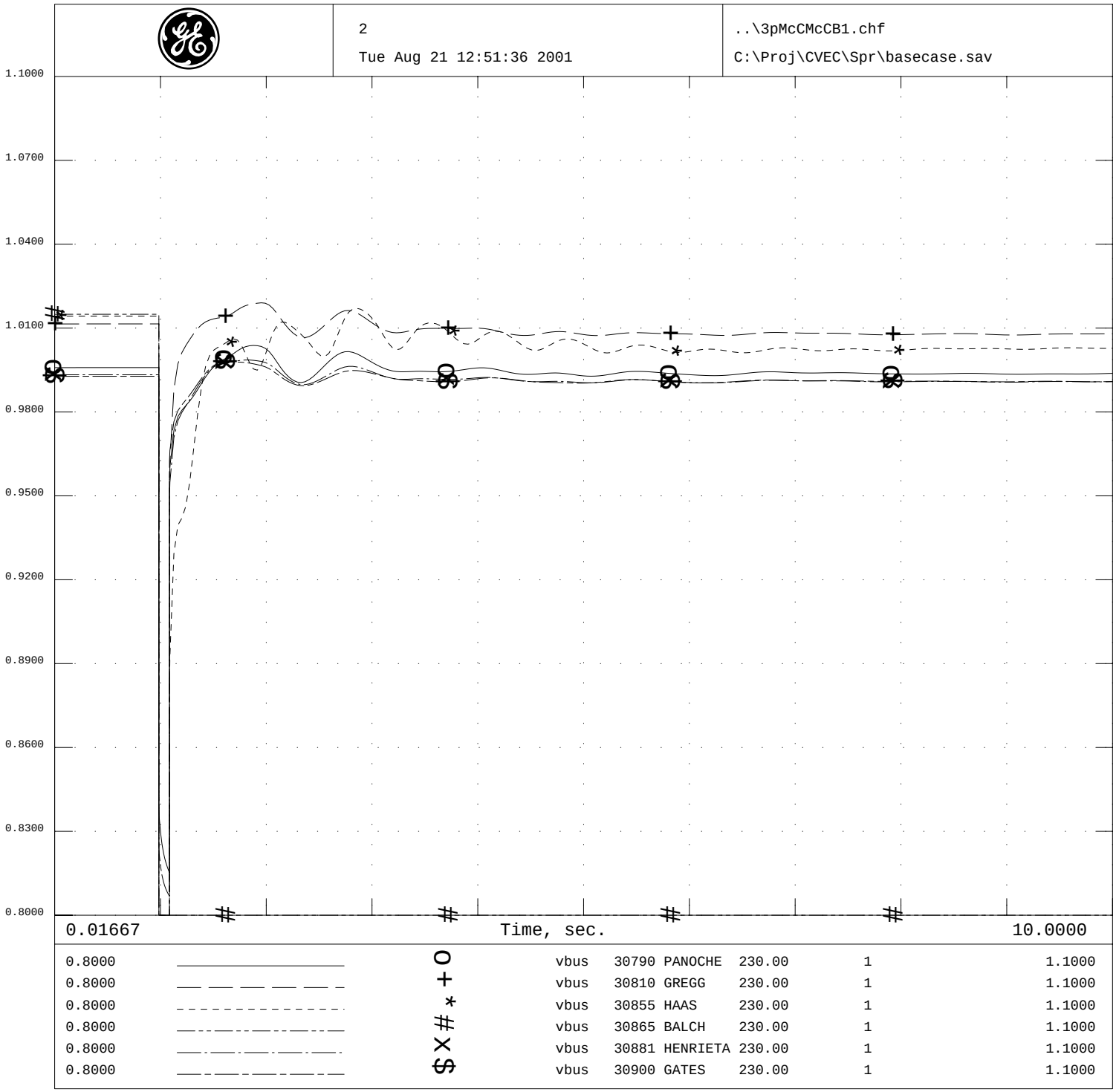
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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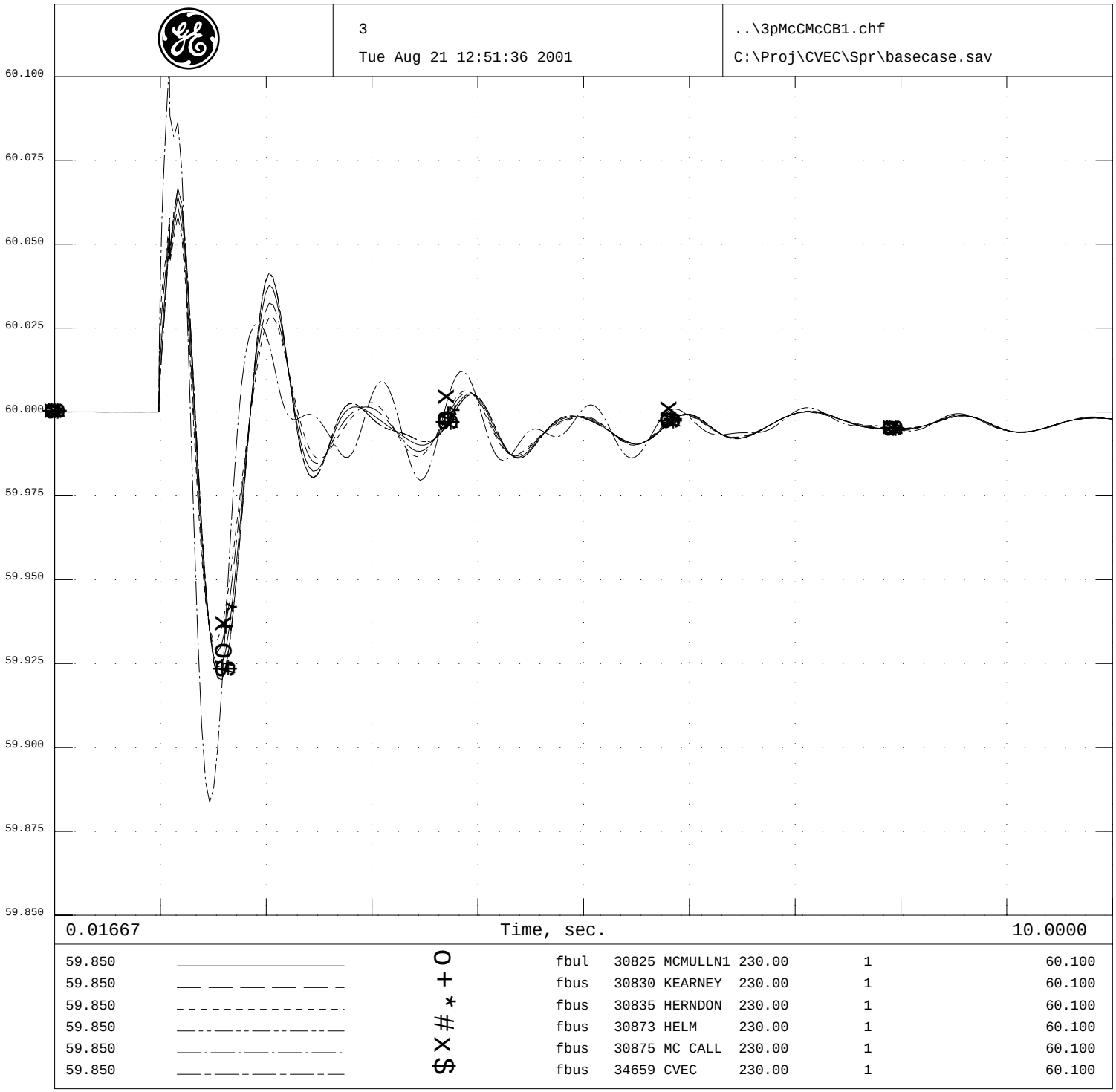

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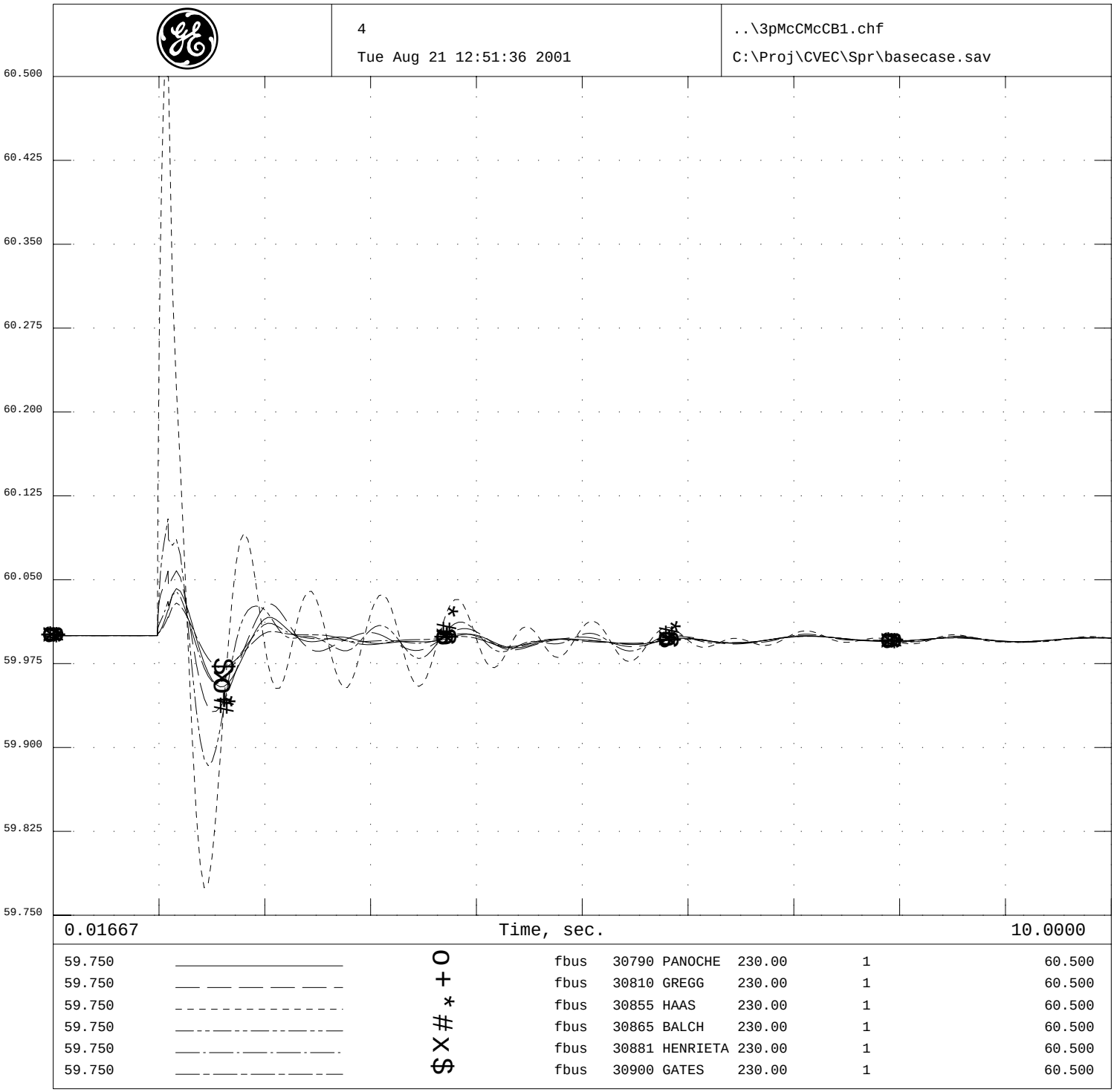
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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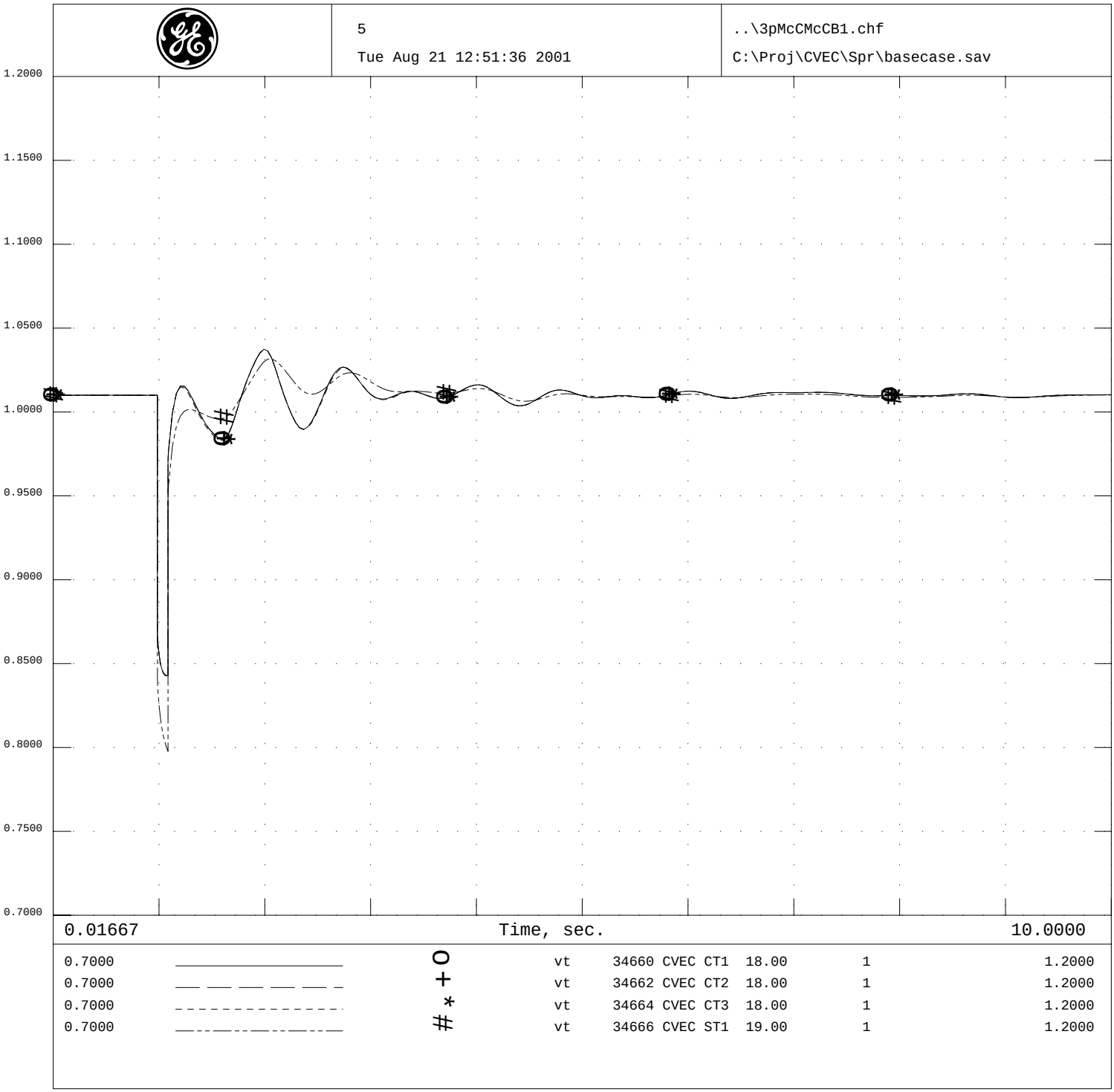

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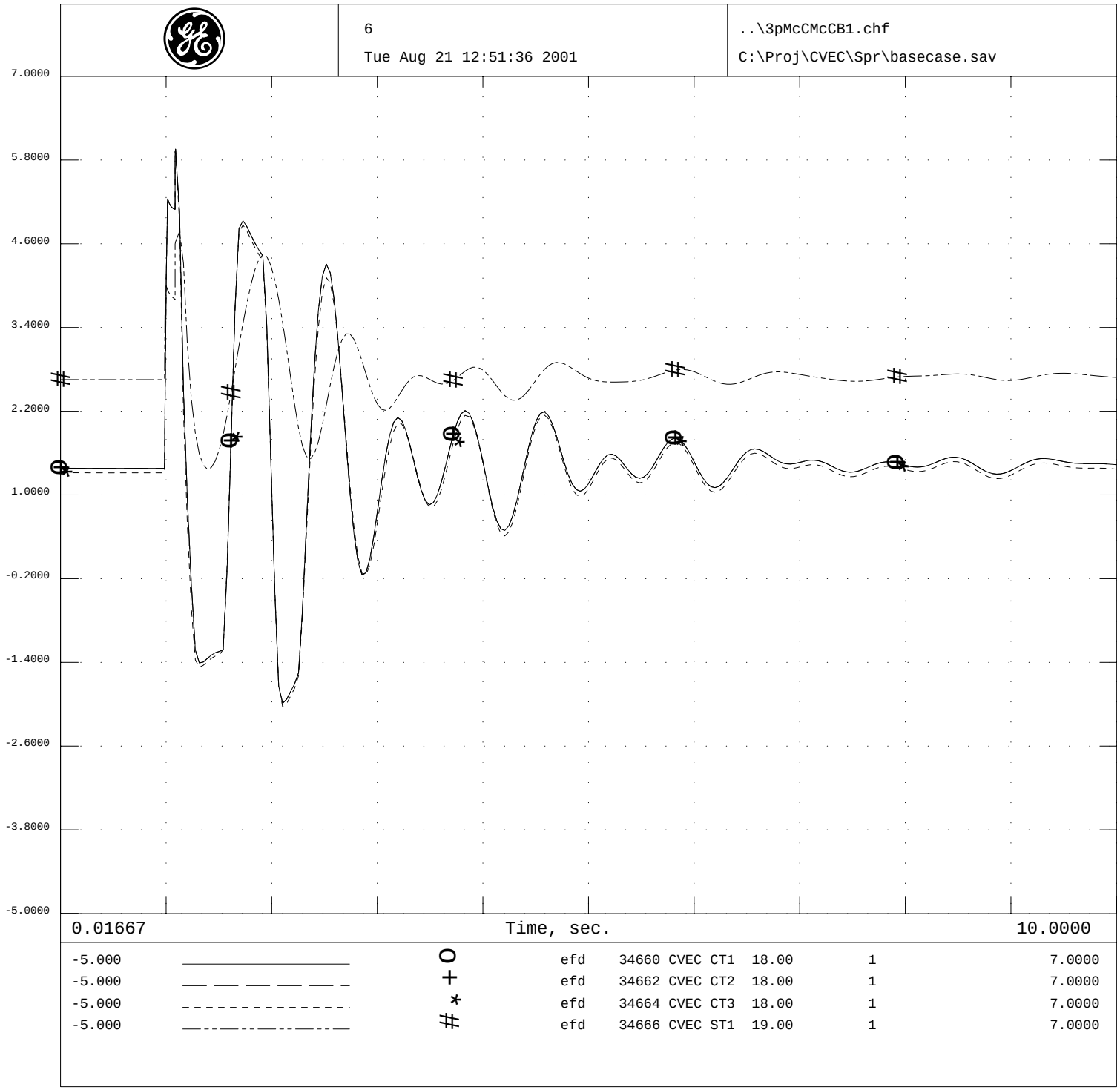
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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Central Valley Energy Center
Calpine Corporation
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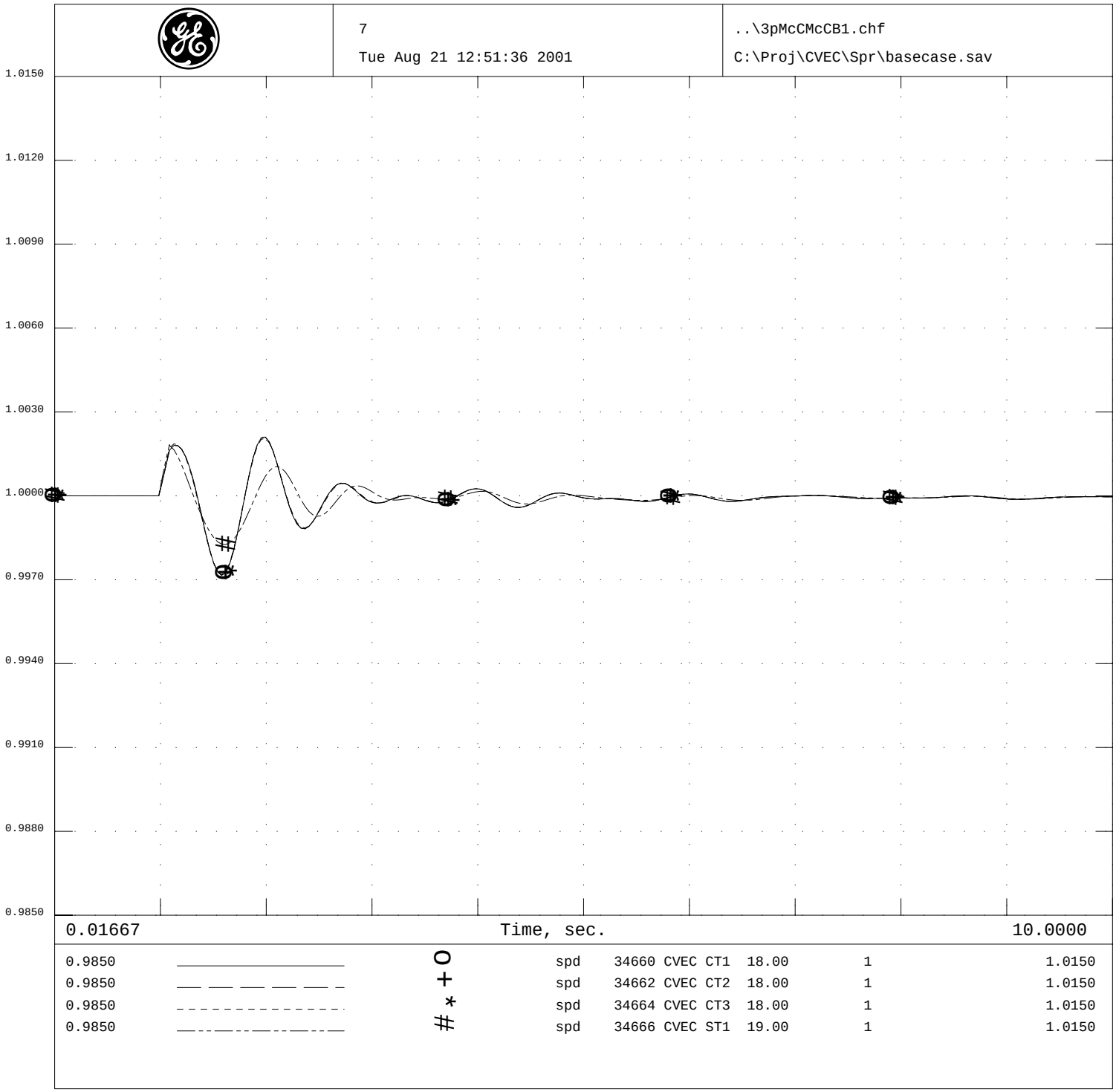

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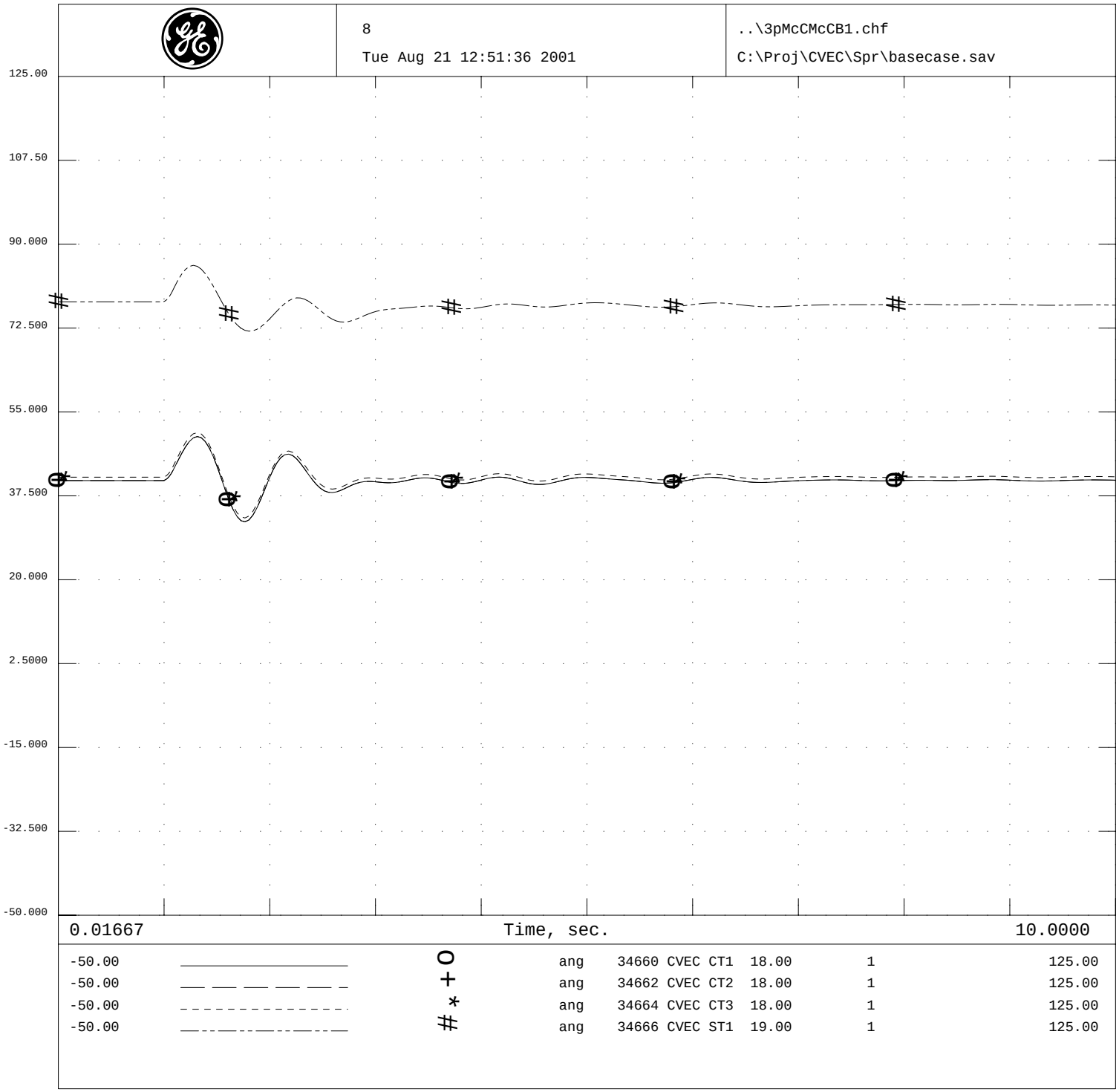
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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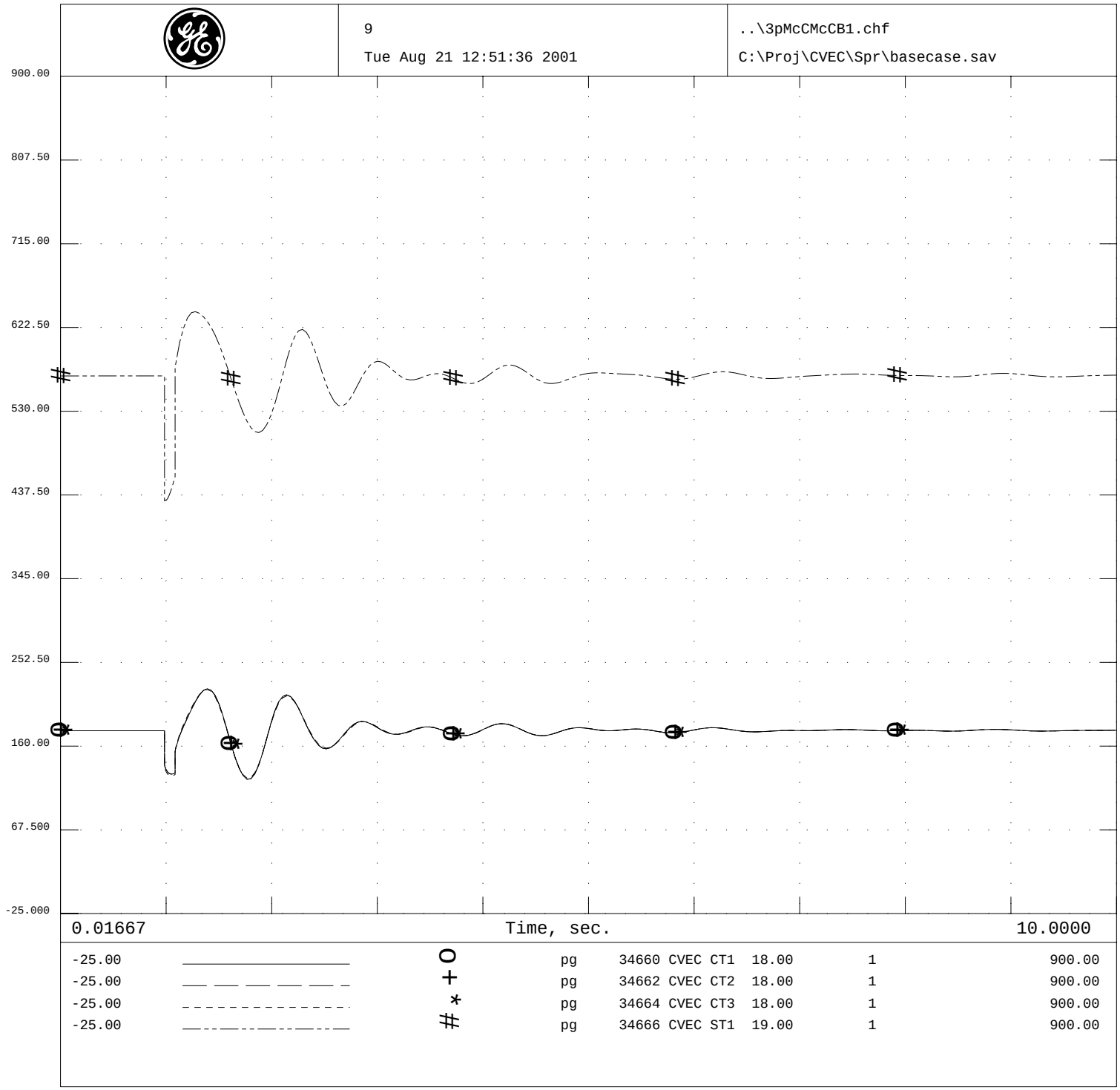
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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Calpine Corporation
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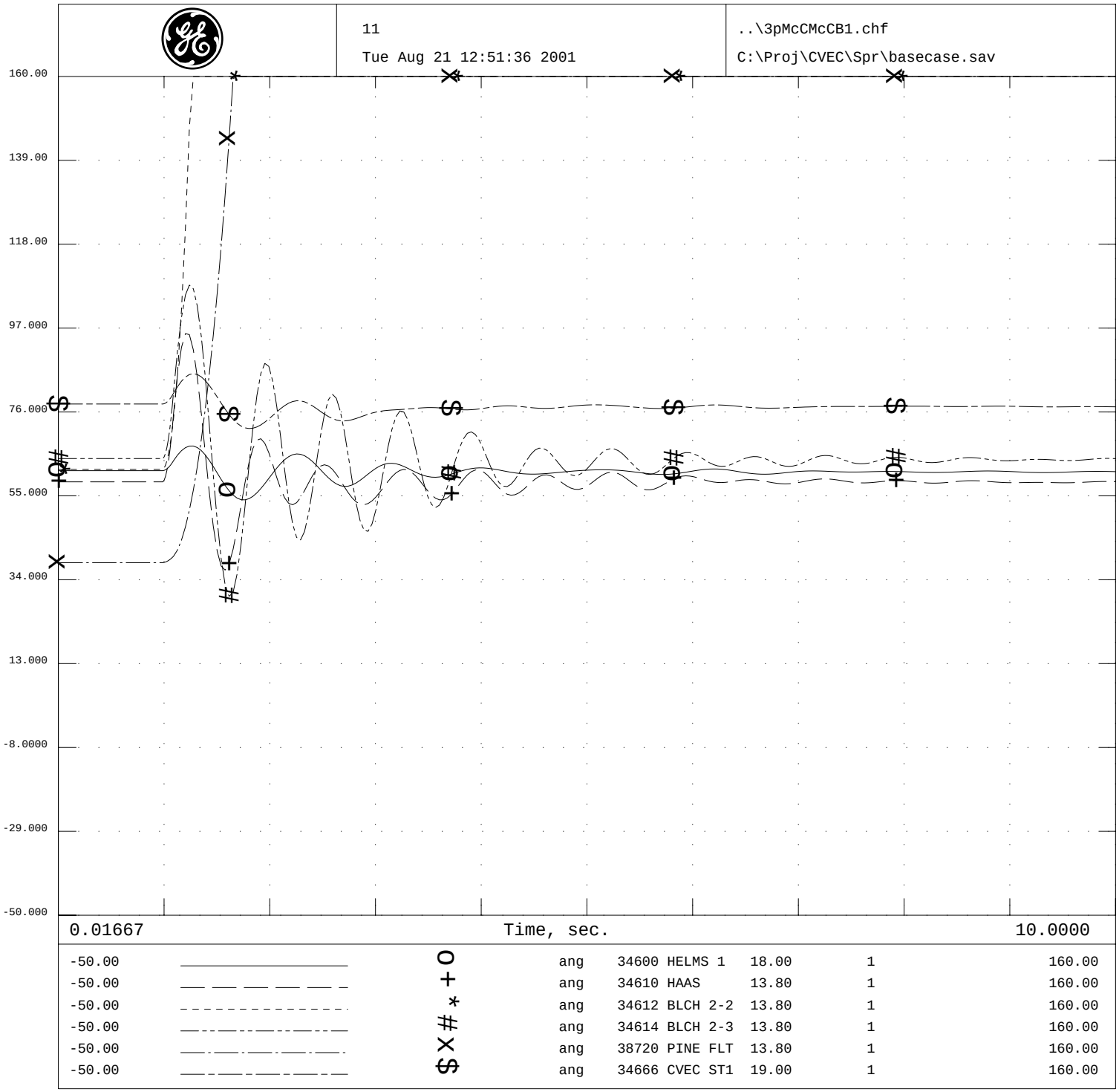

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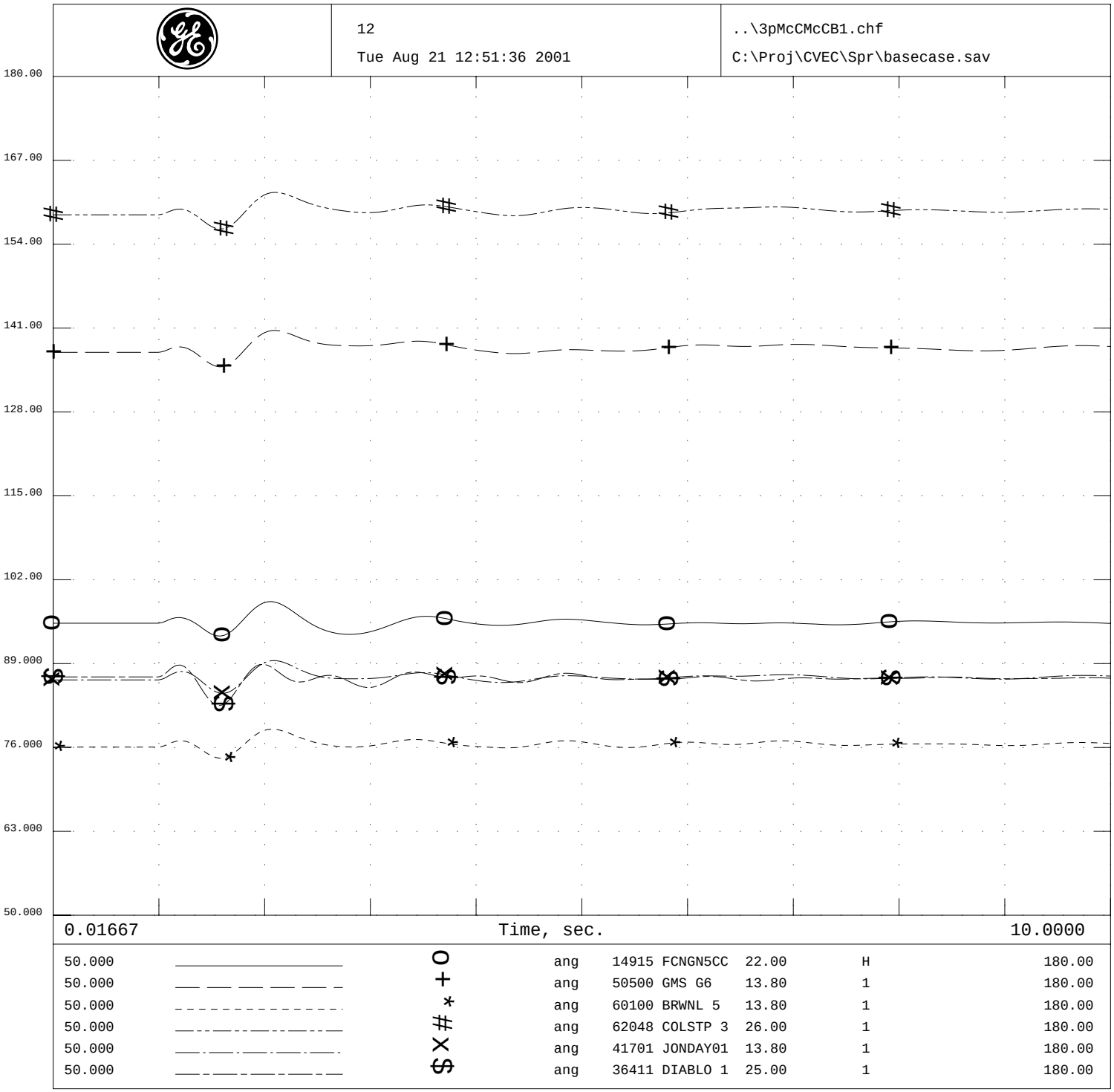
Calpine Corporation
Selected Local Rotor Angle Plots



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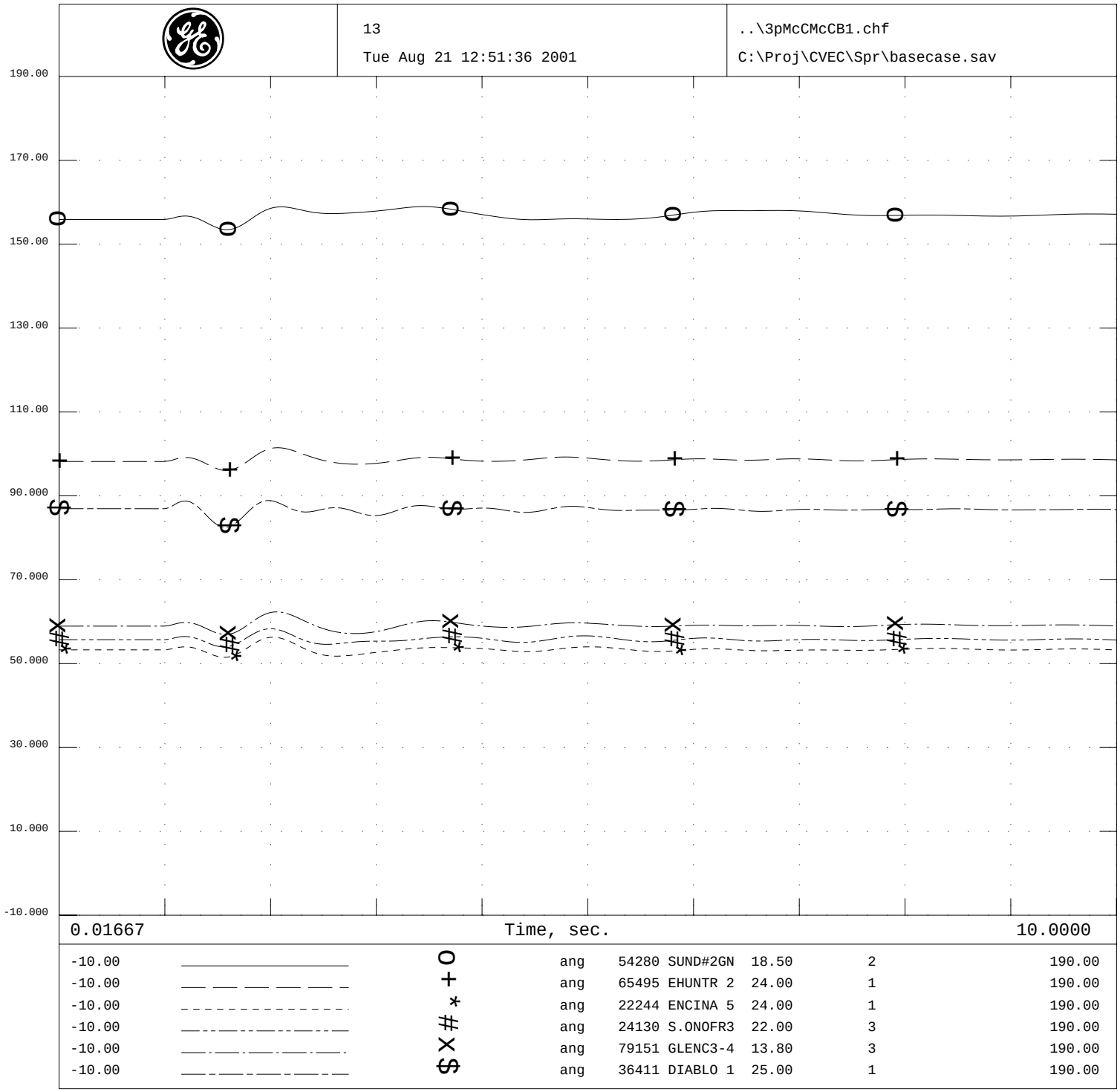
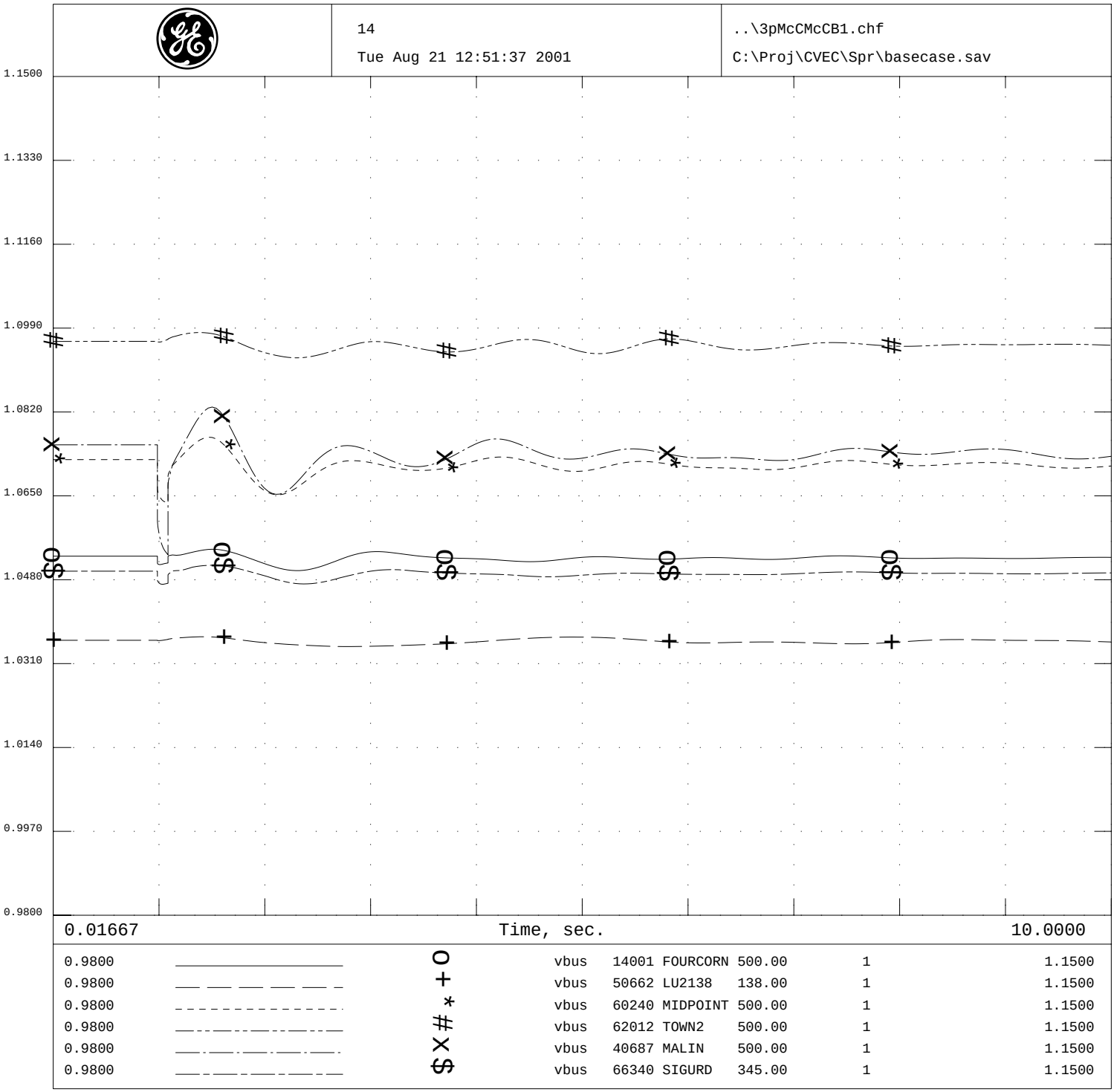
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
McCall 230kV Bus #1 Outage
3 phase 6 cycle fault at McCall 230kV bus and clear bus #1

Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



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2004 Heavy Spring Base Case
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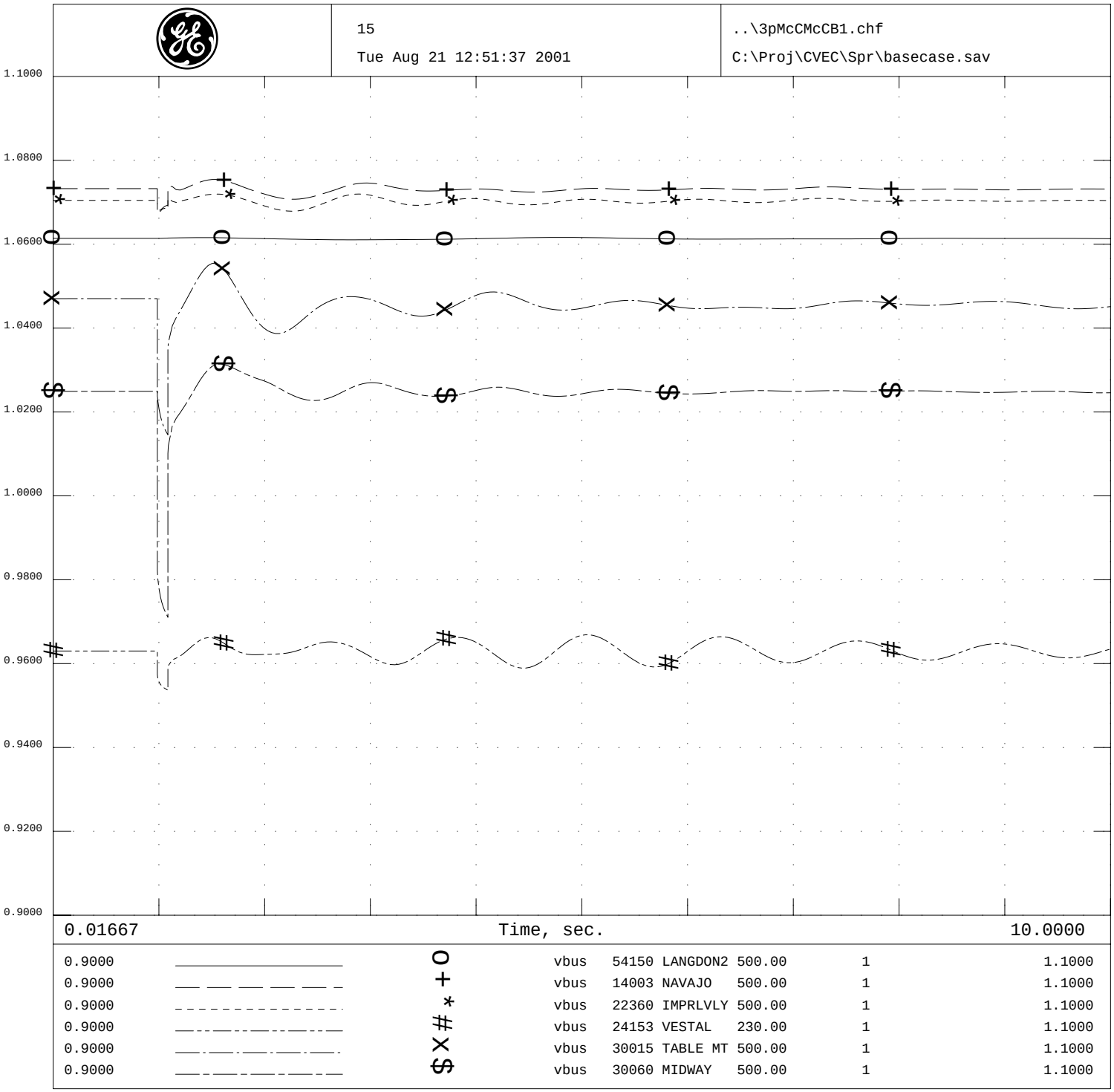
Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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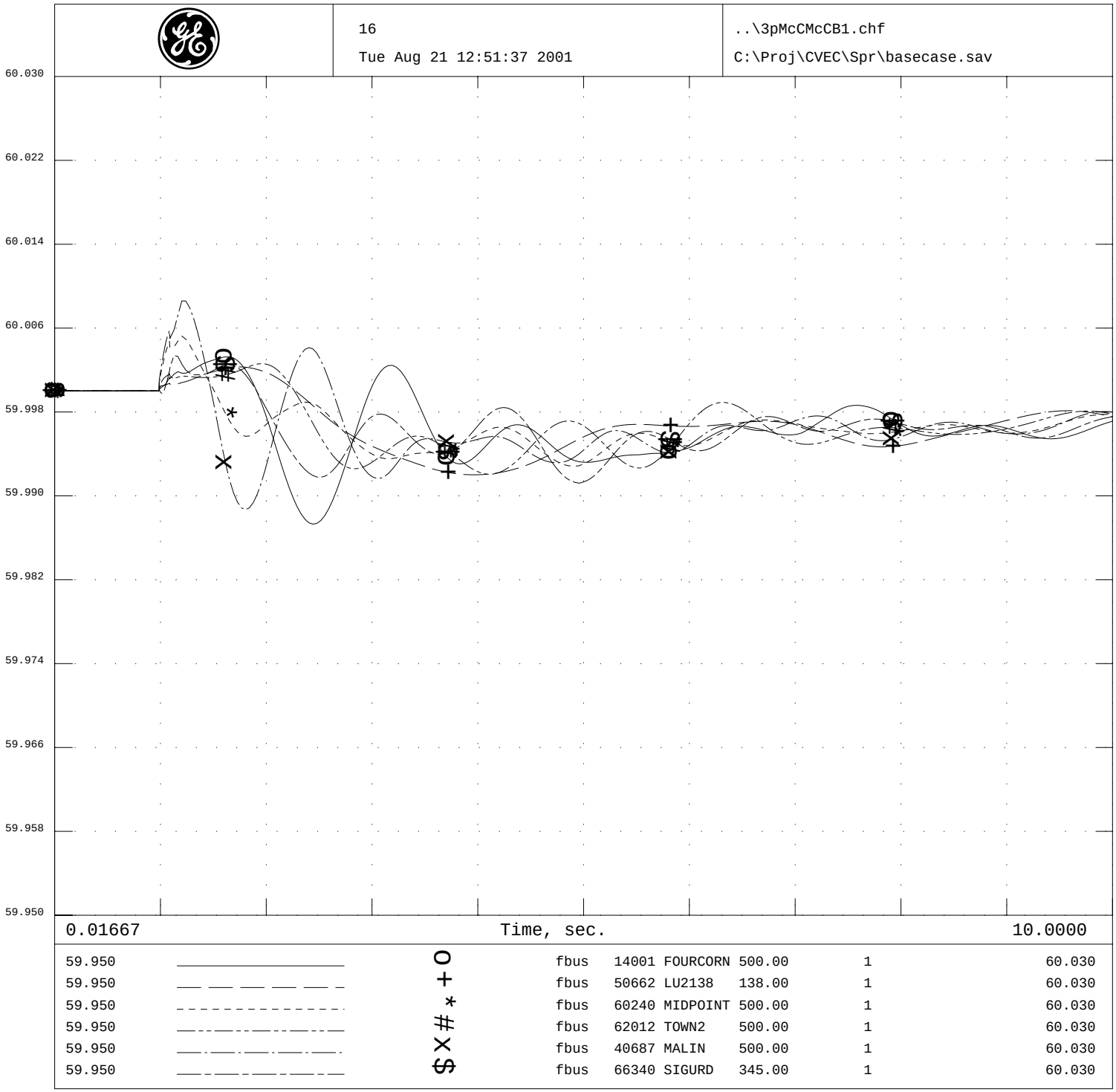

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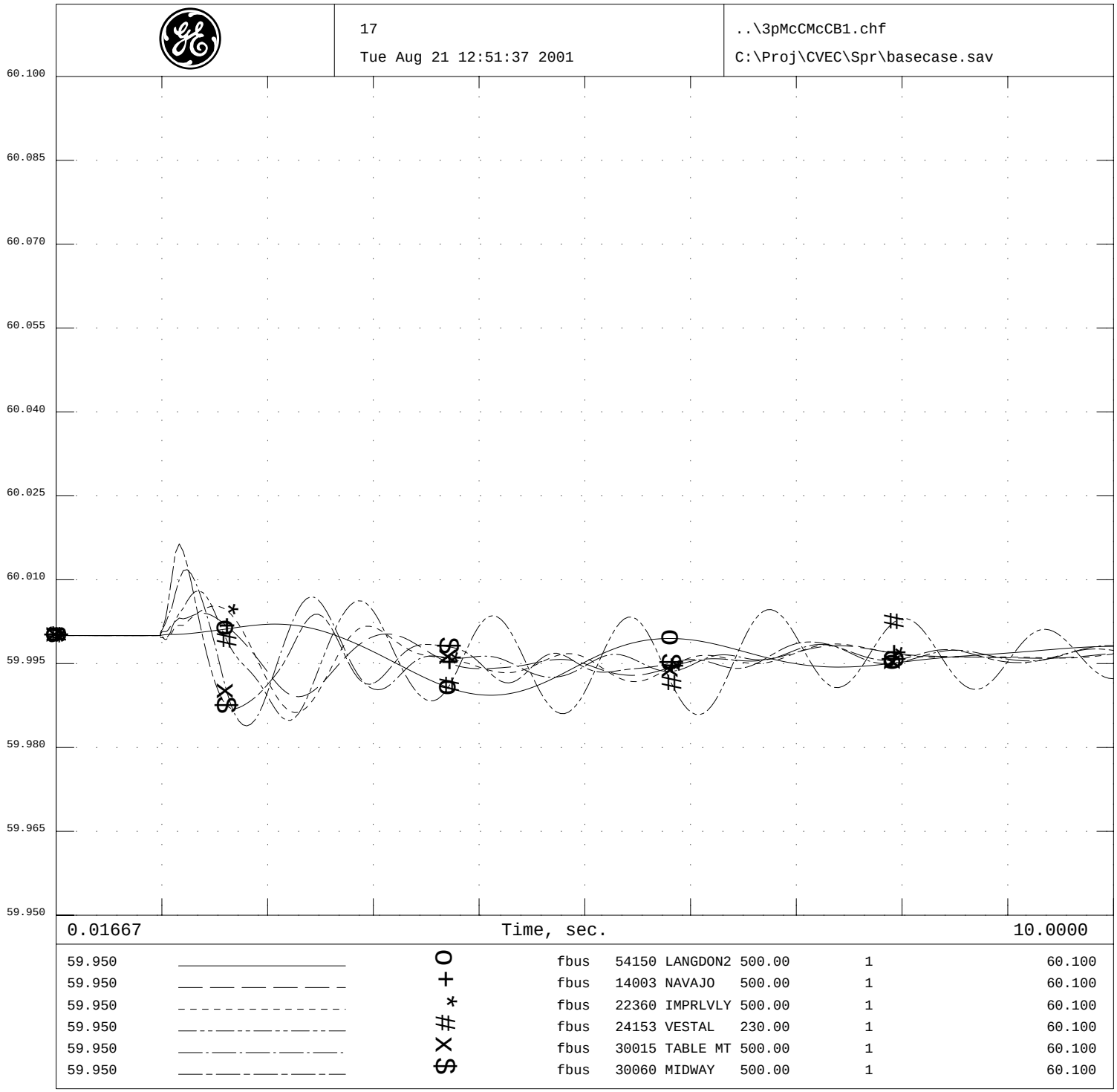

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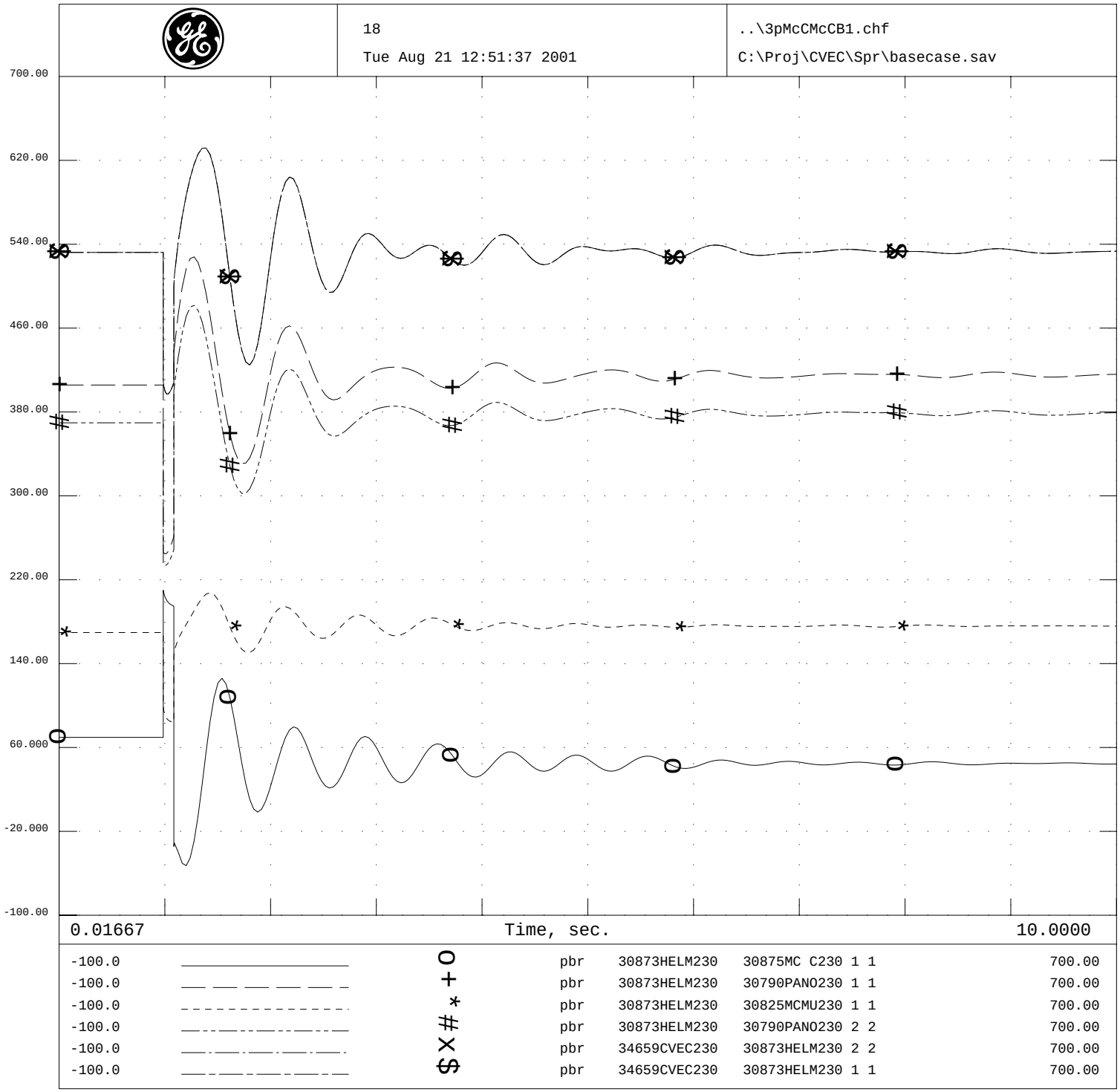

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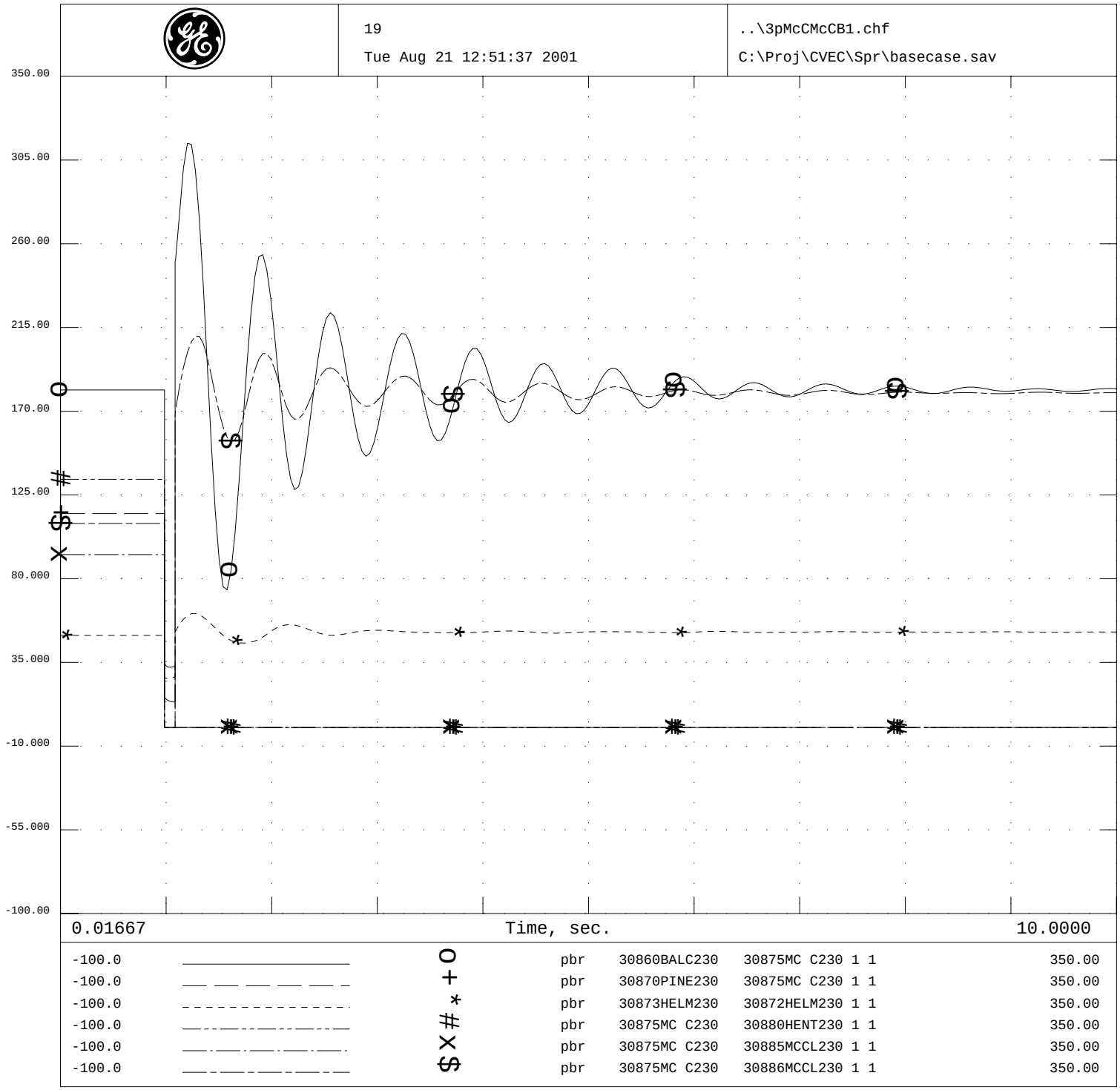
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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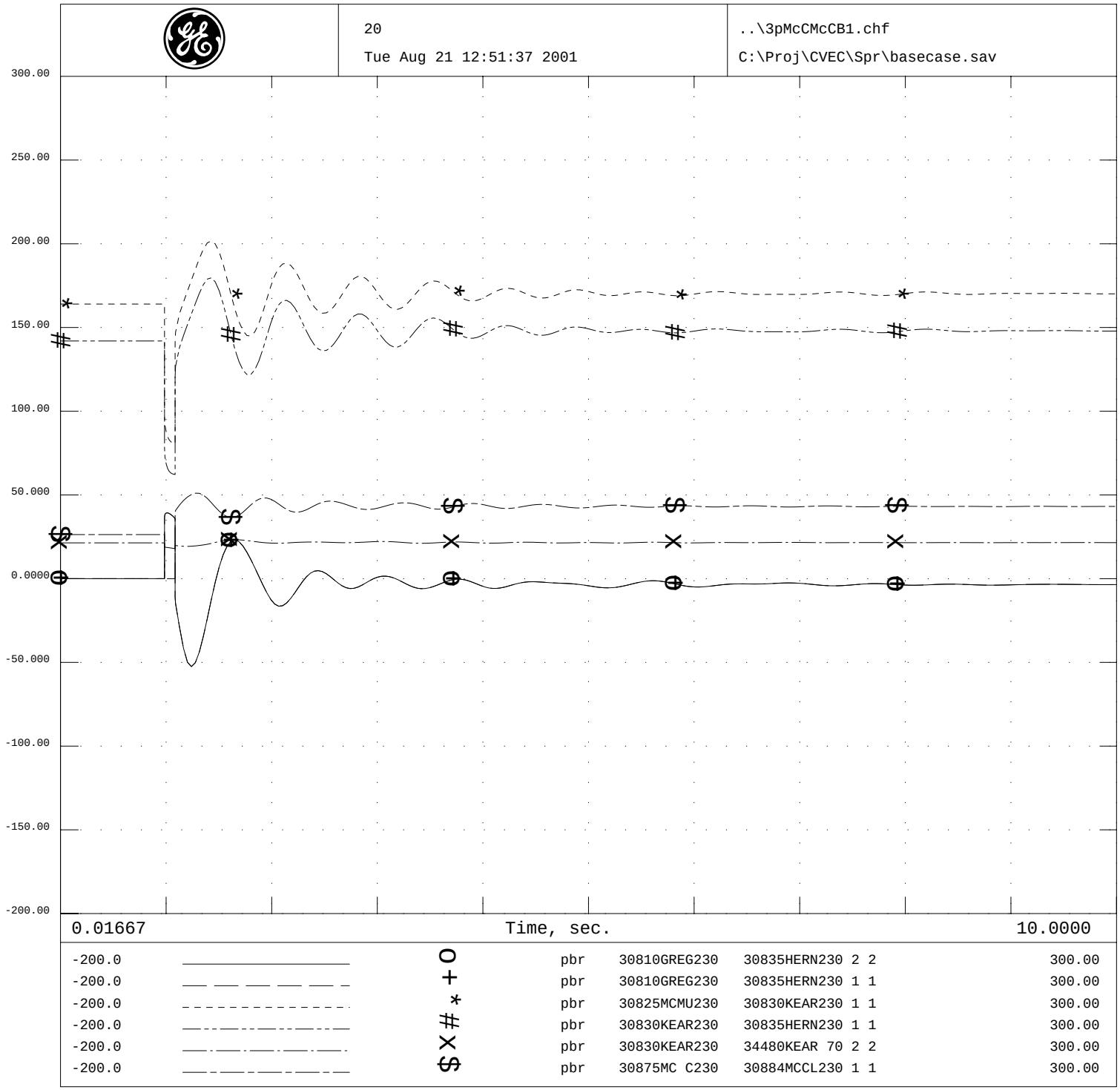

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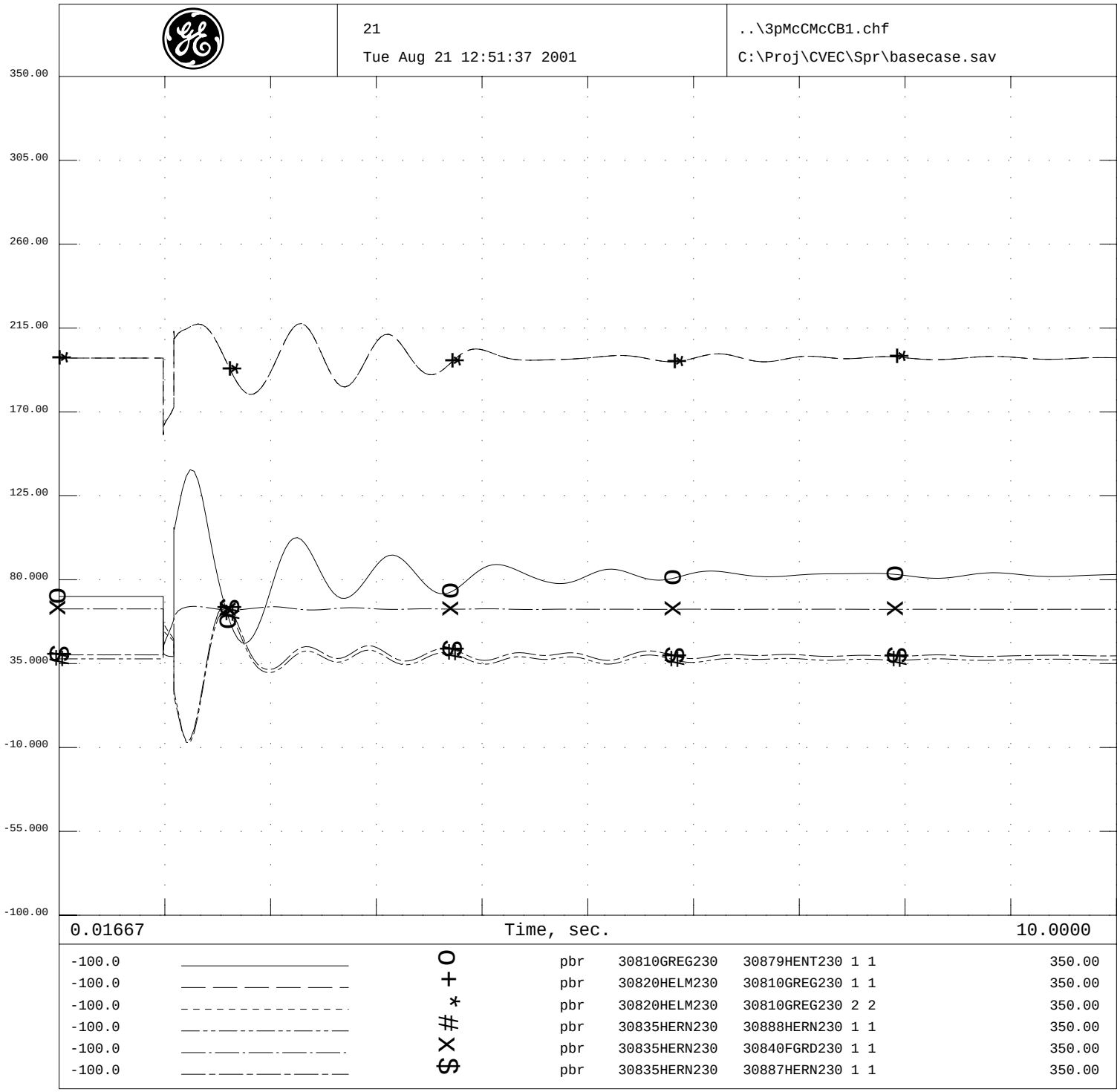

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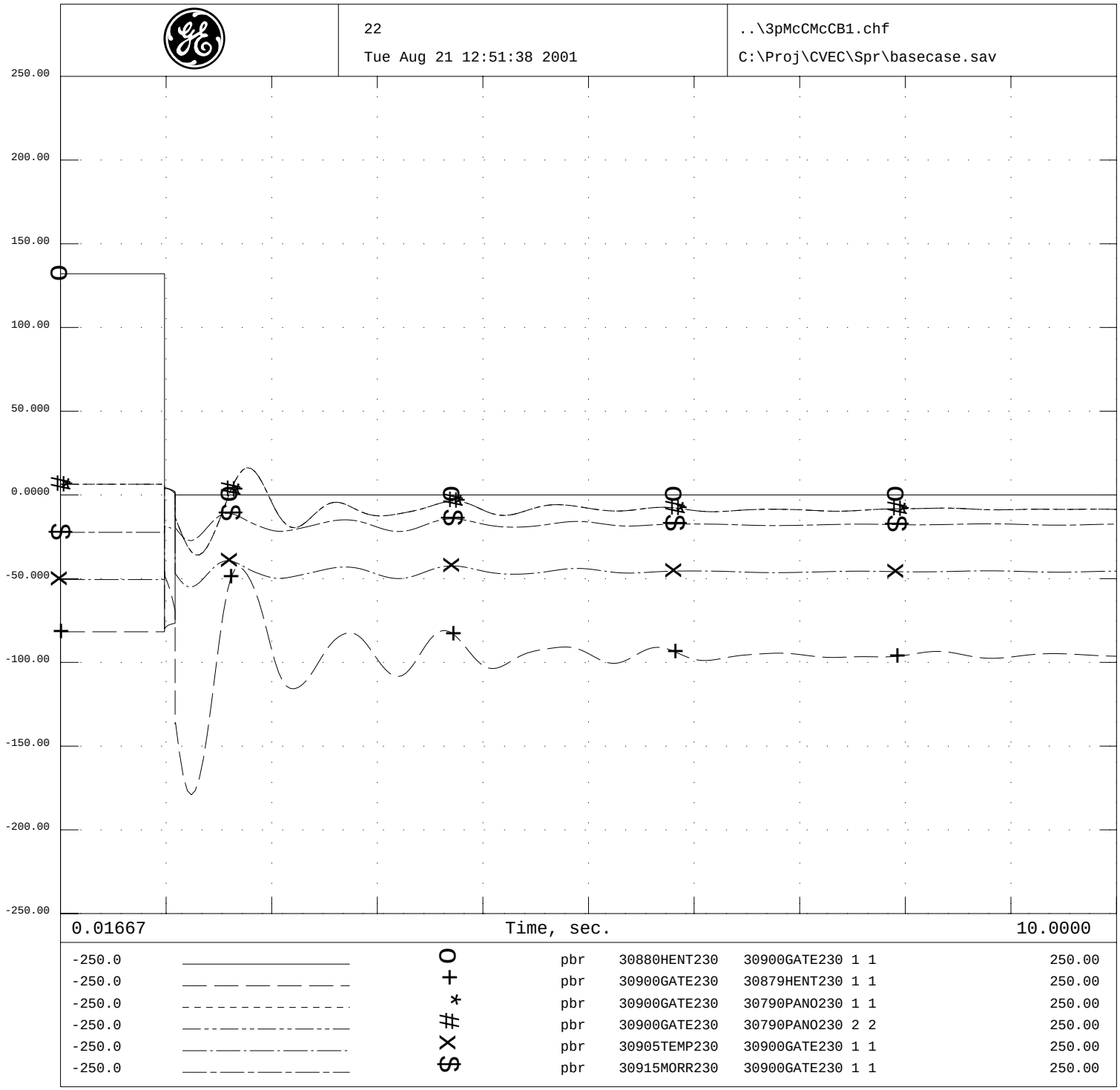

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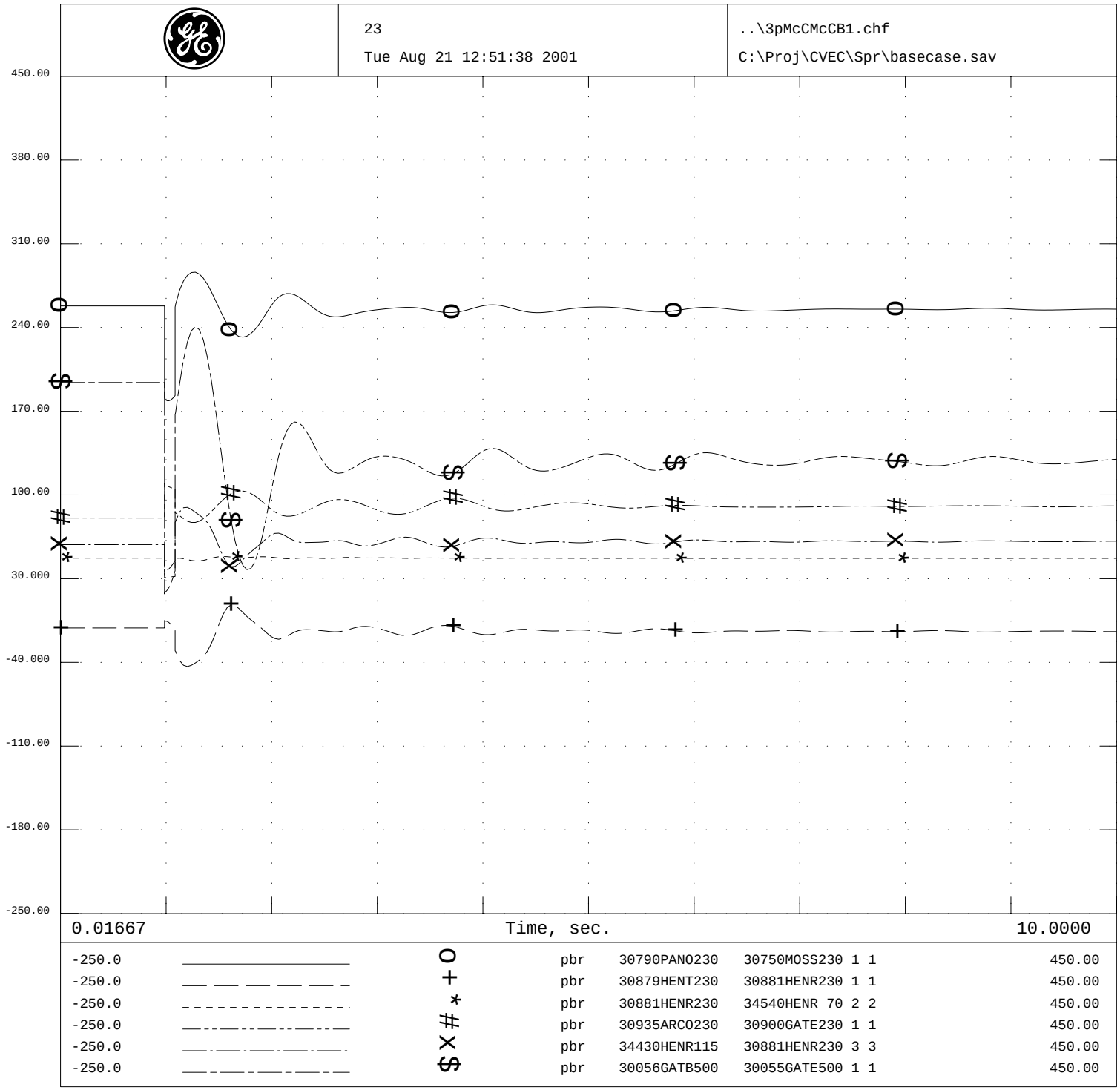

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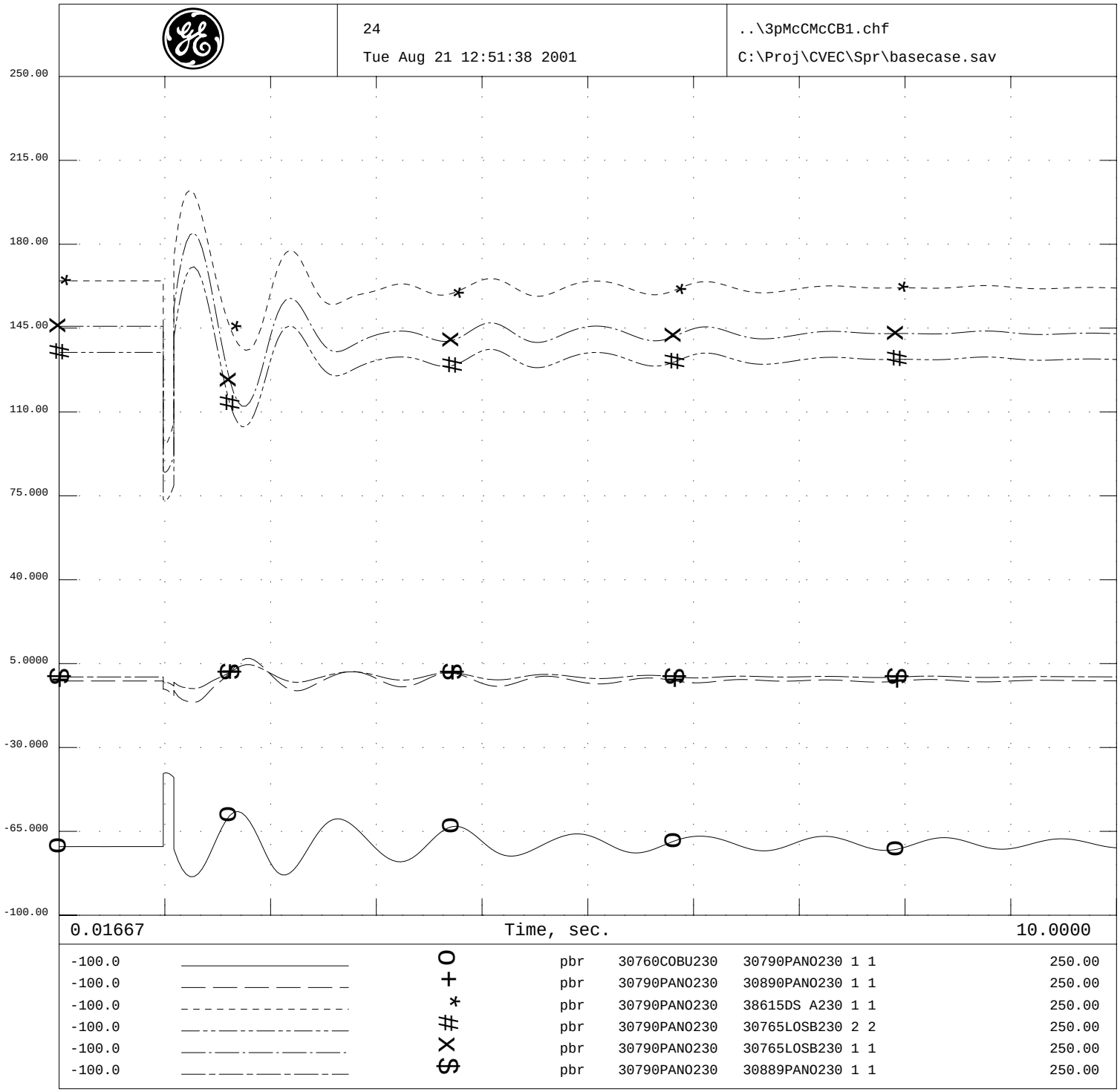

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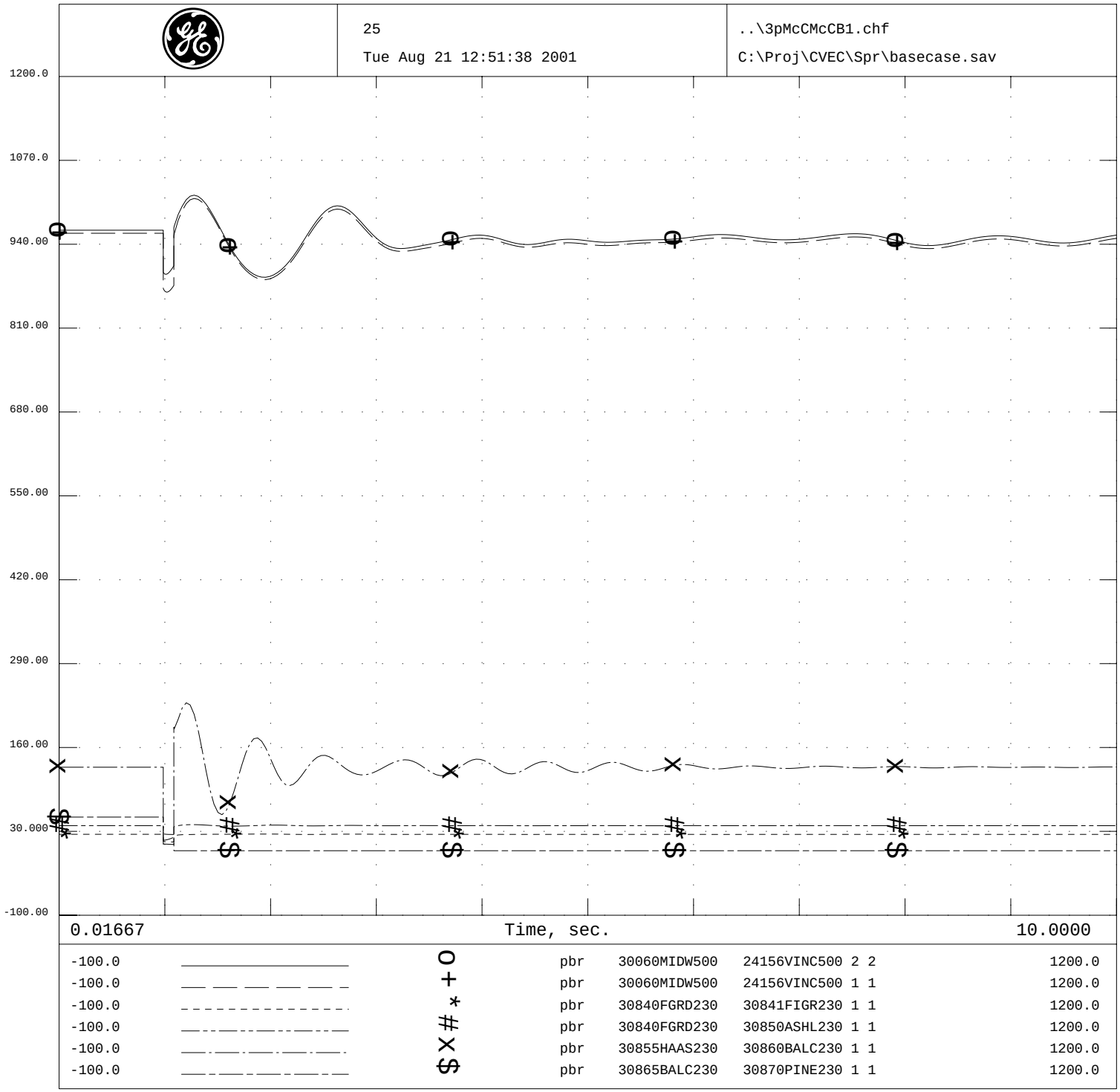

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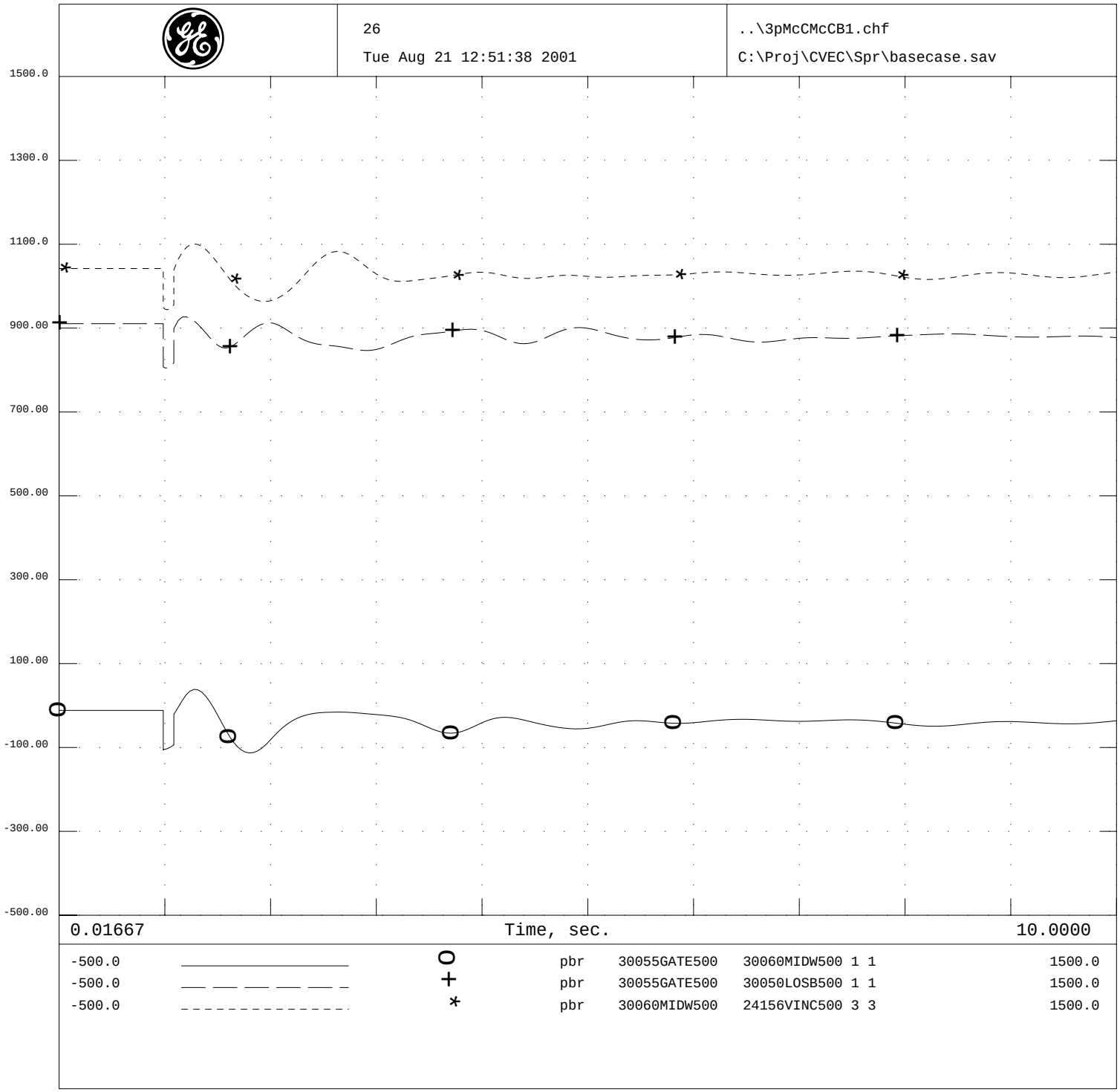

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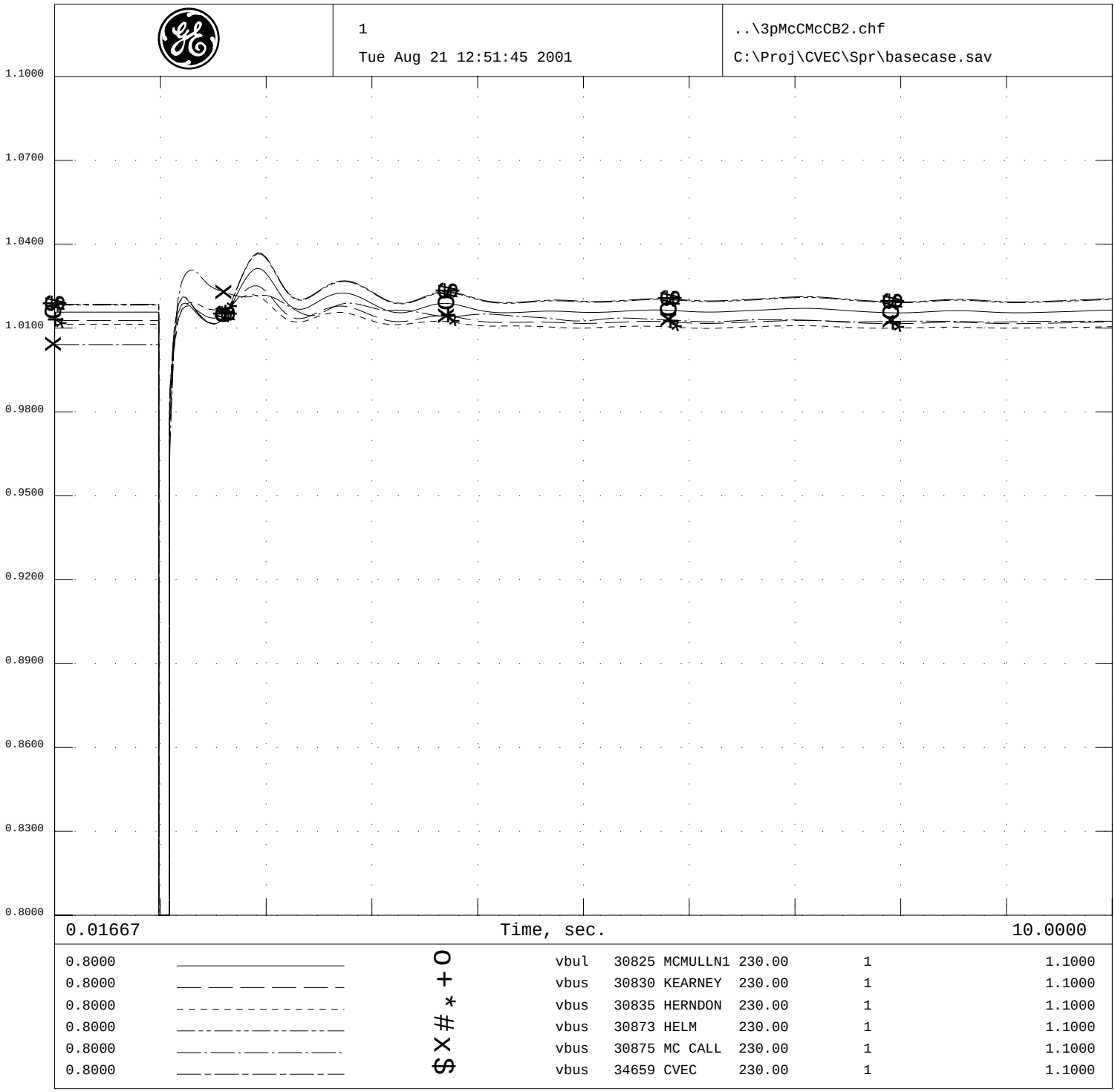

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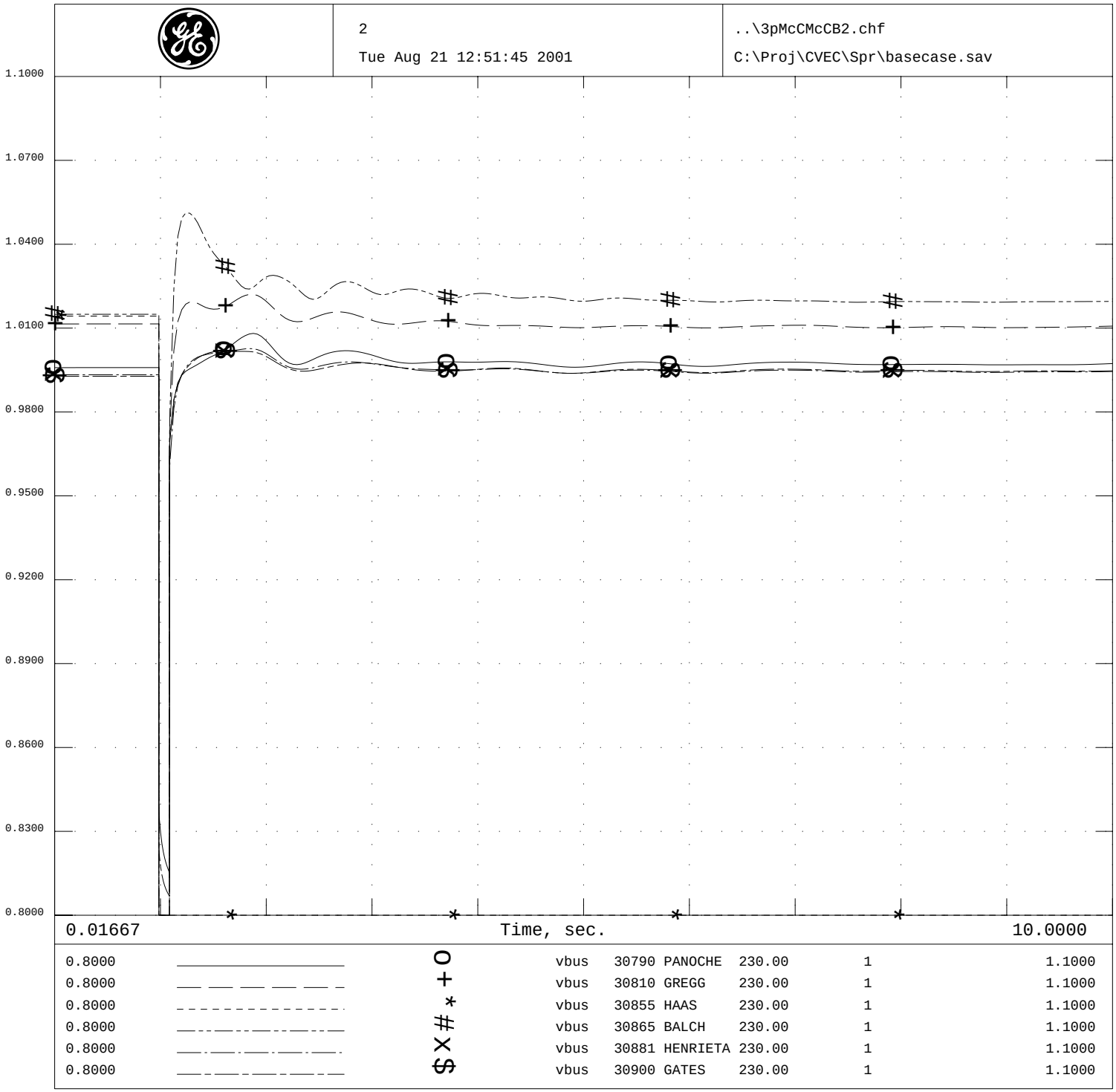
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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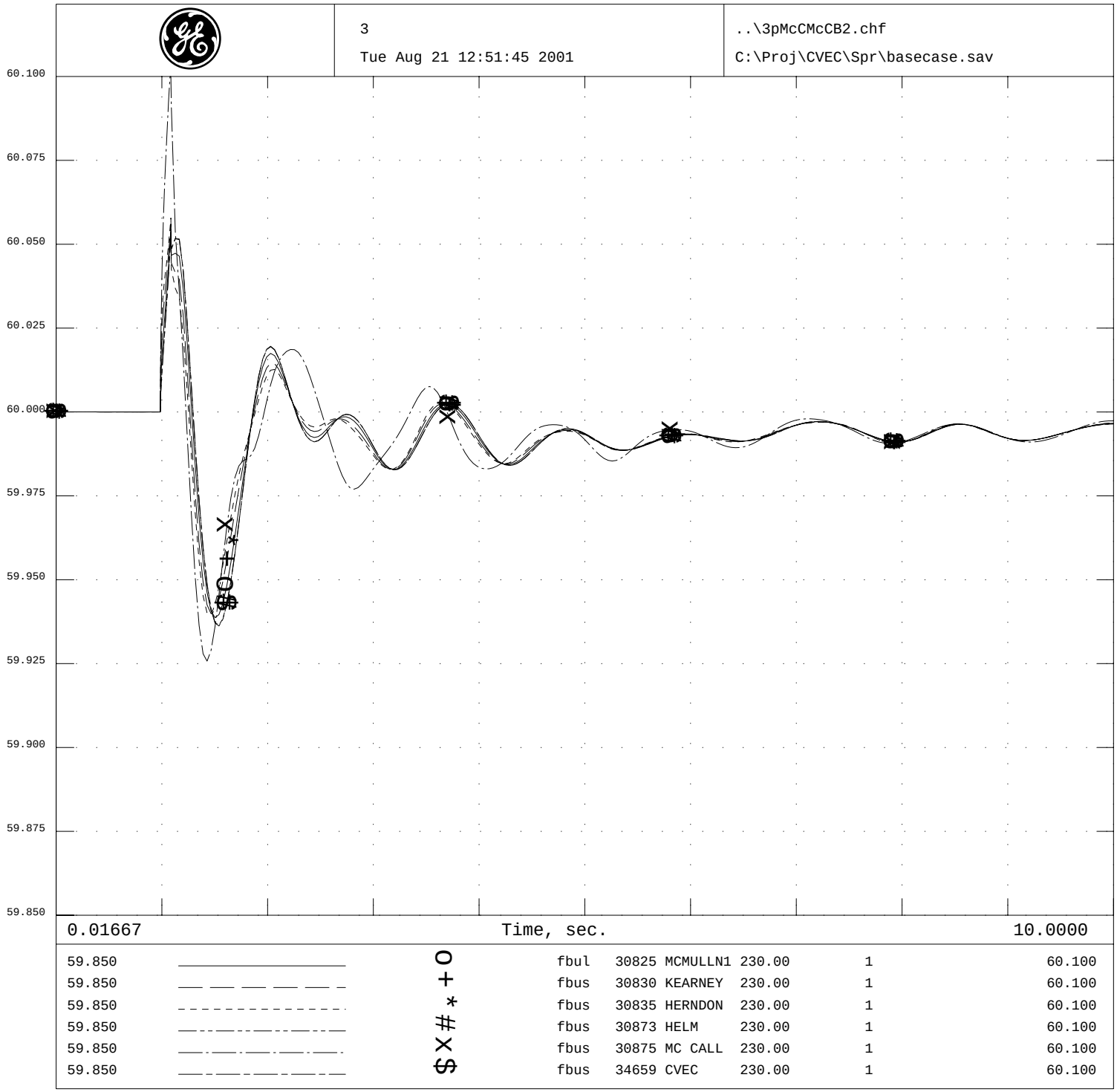

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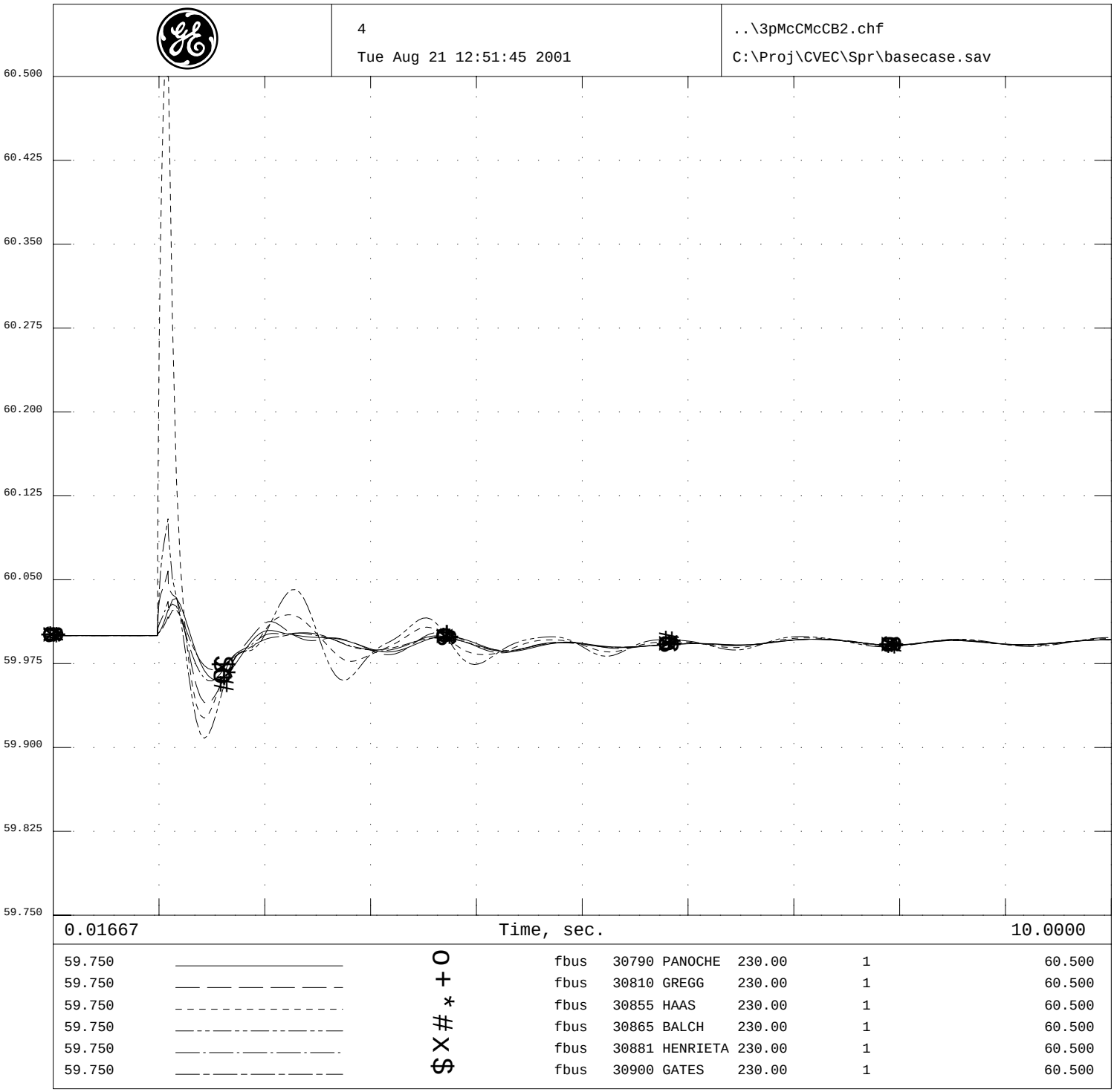
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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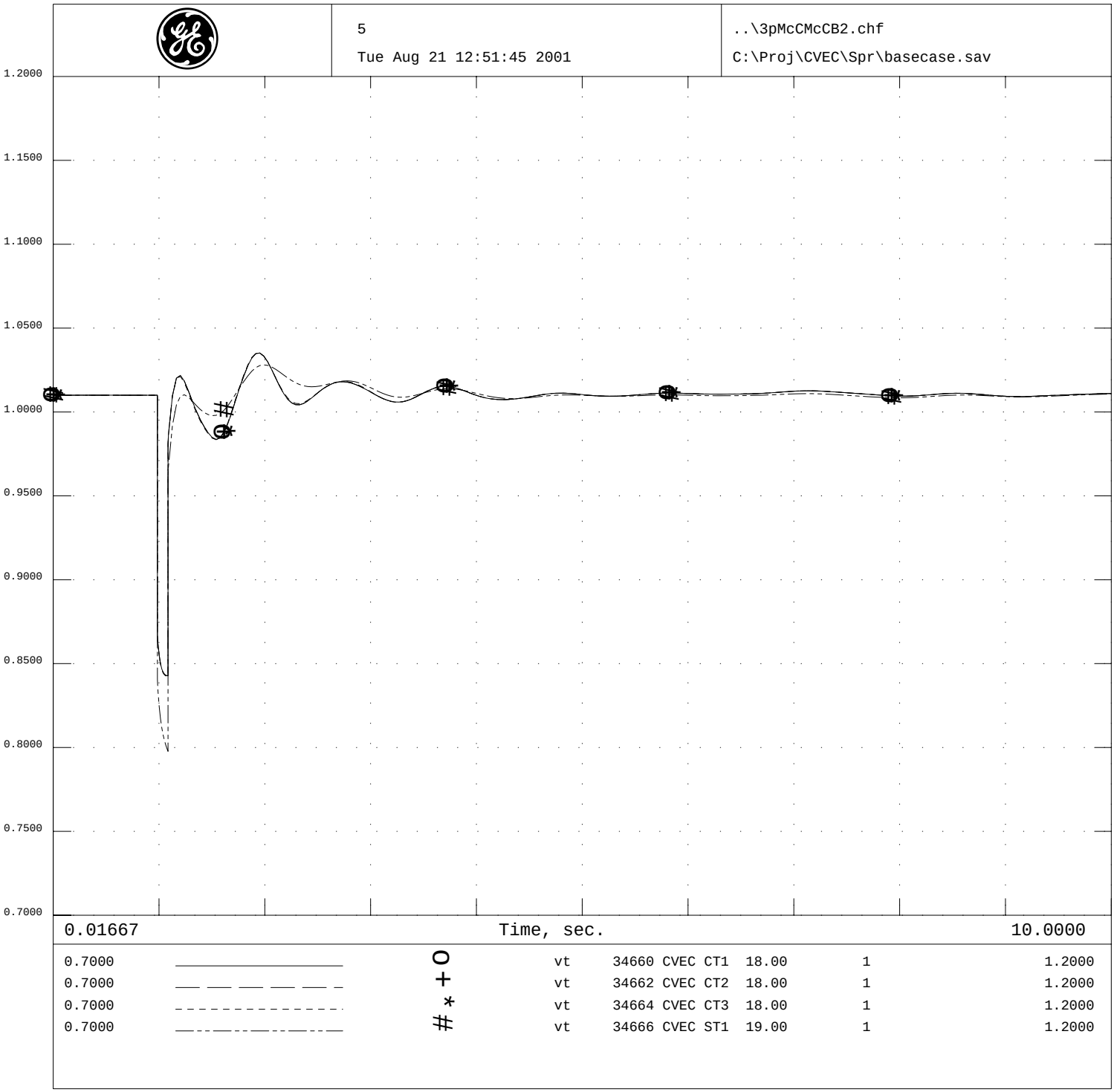

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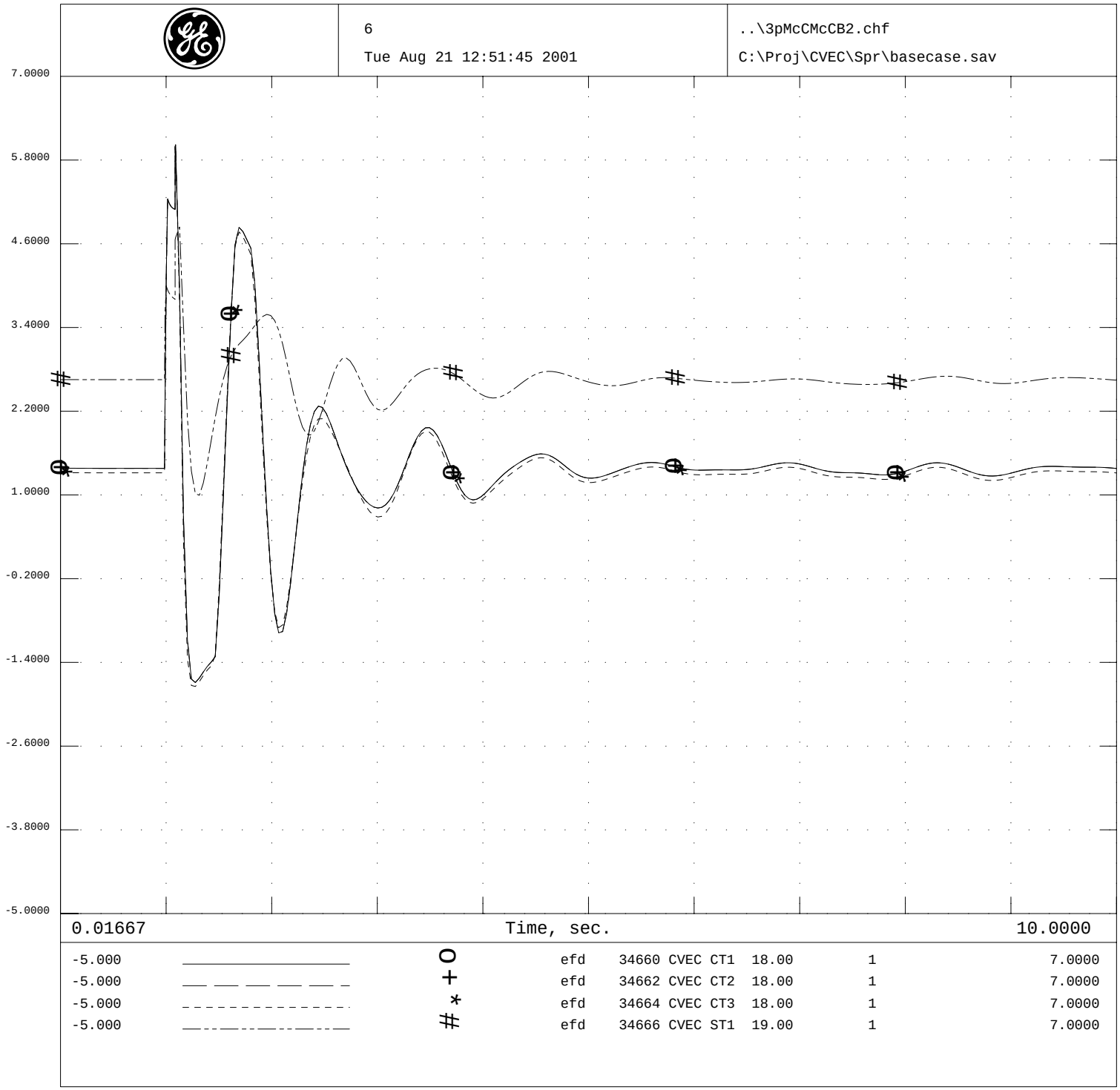
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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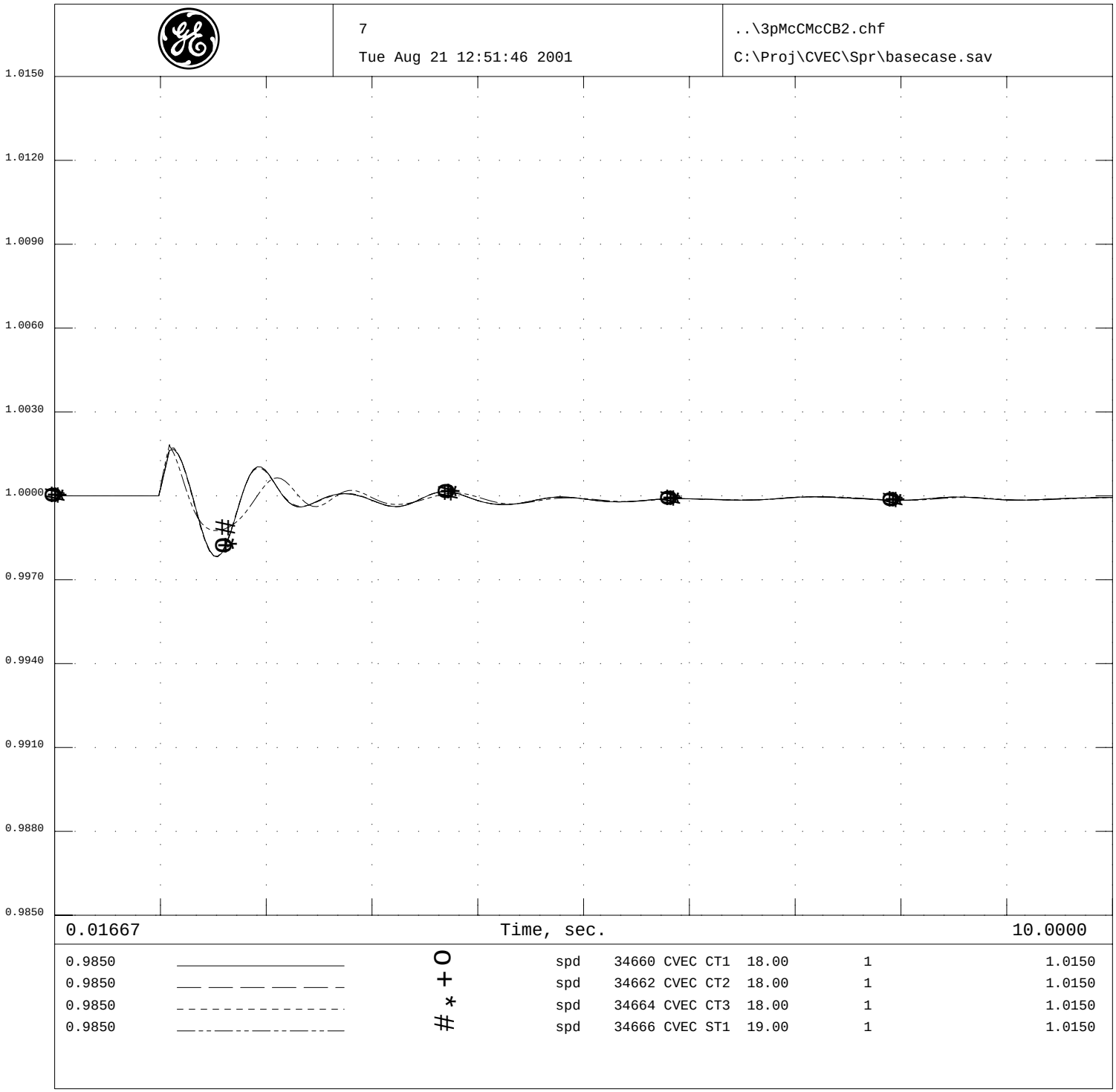
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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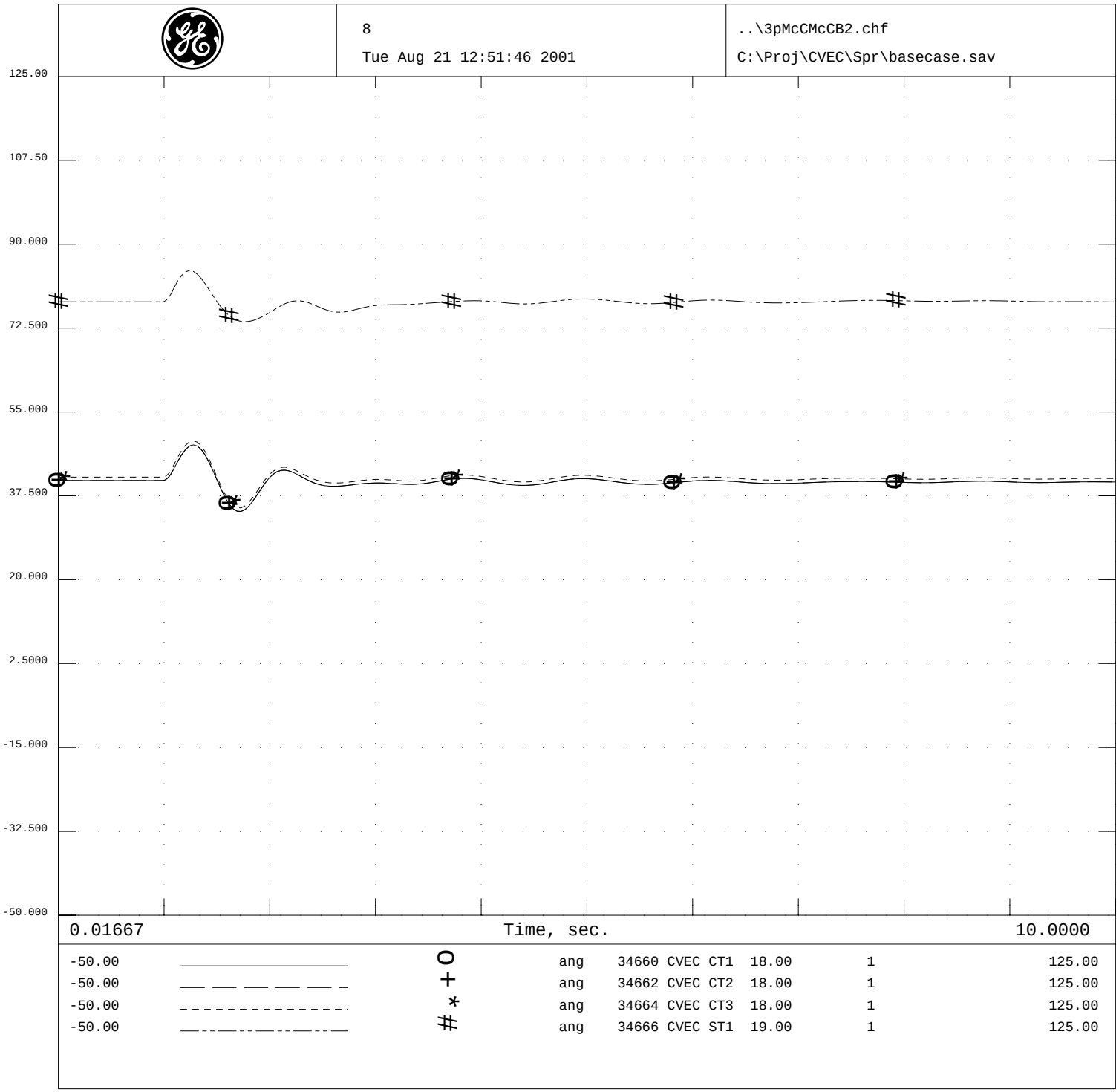
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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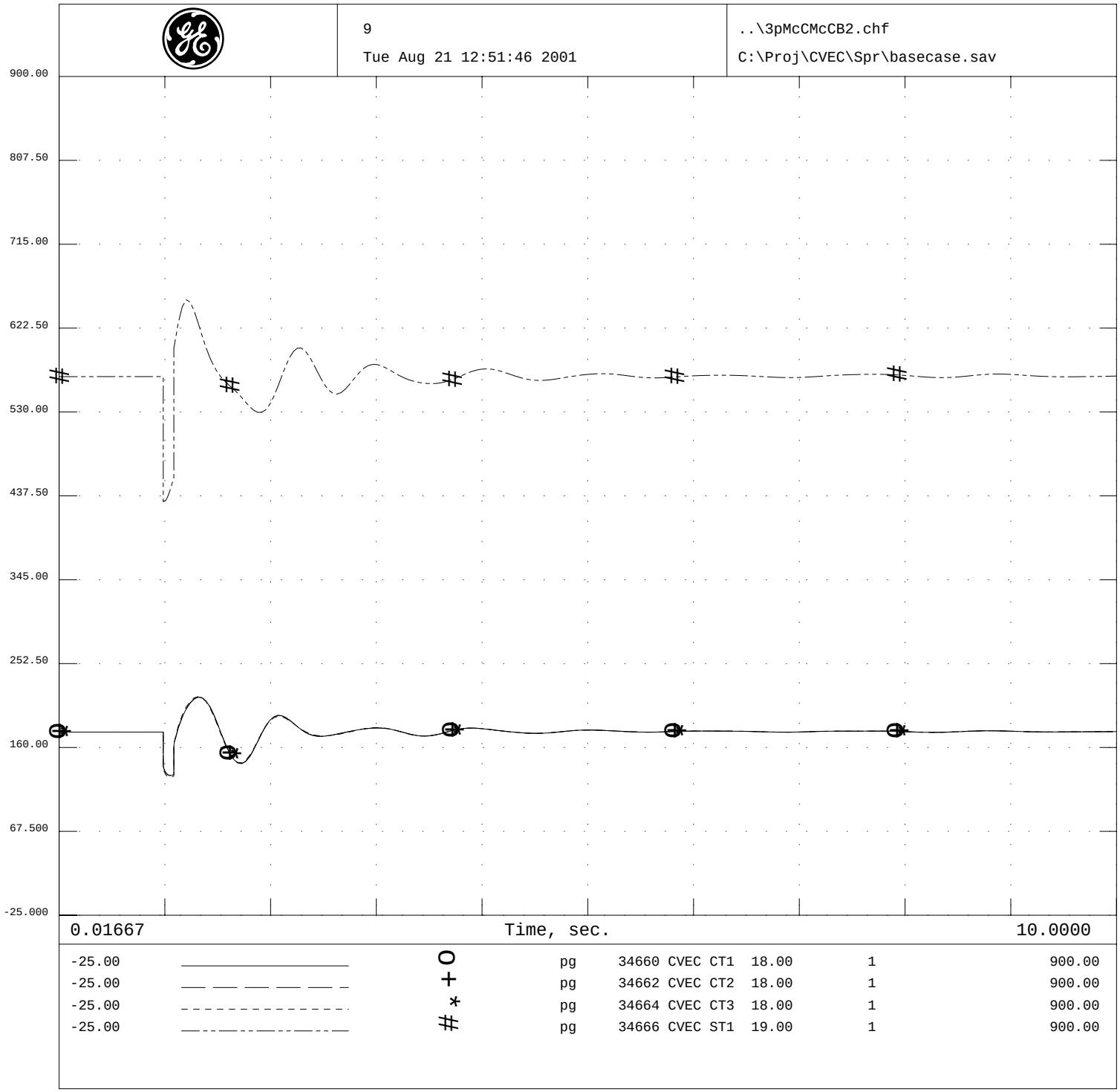
Calpine Corporation
Project Generator Rotor Angle



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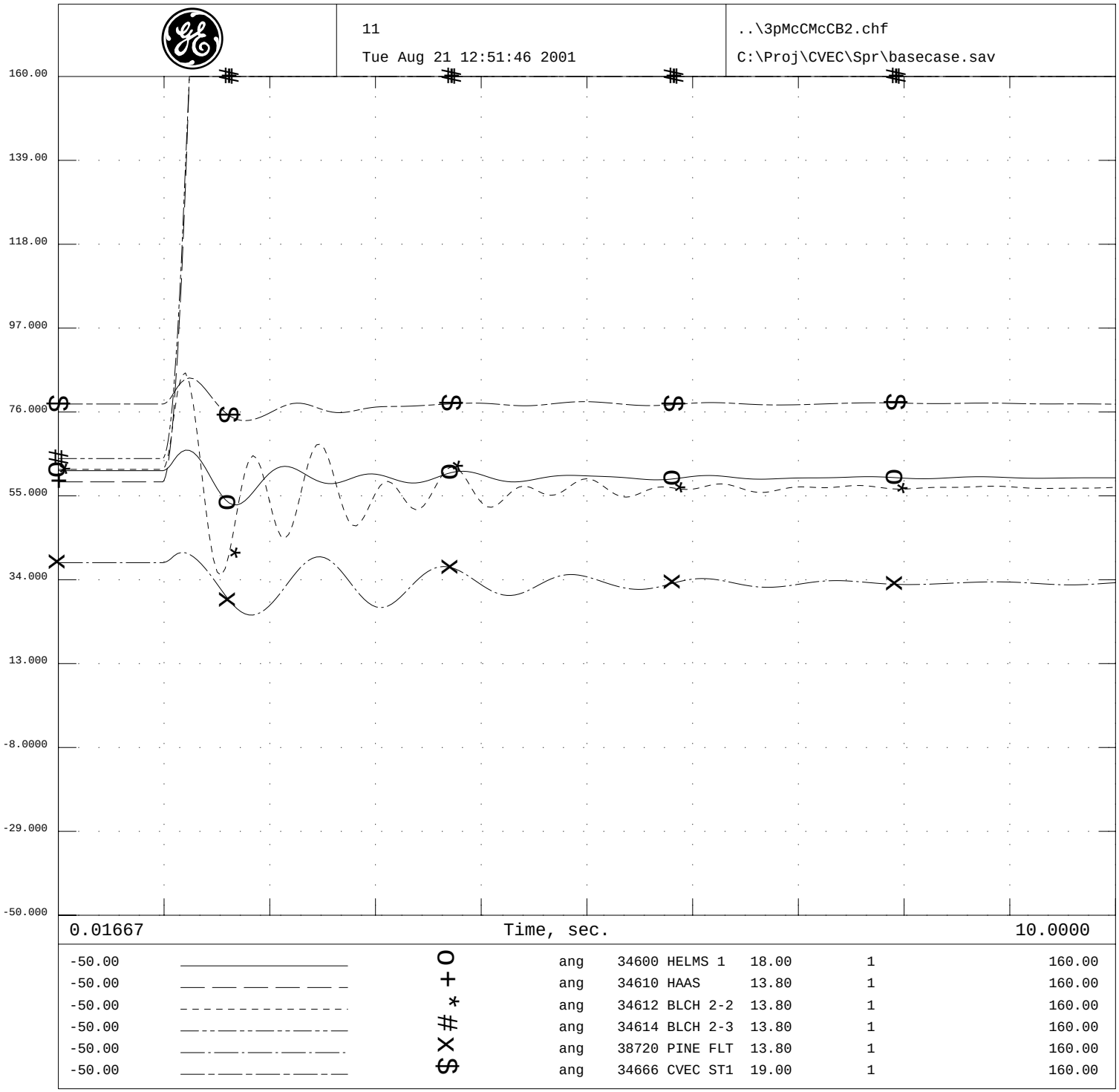
Calpine Corporation
Project Generator Terminal Power



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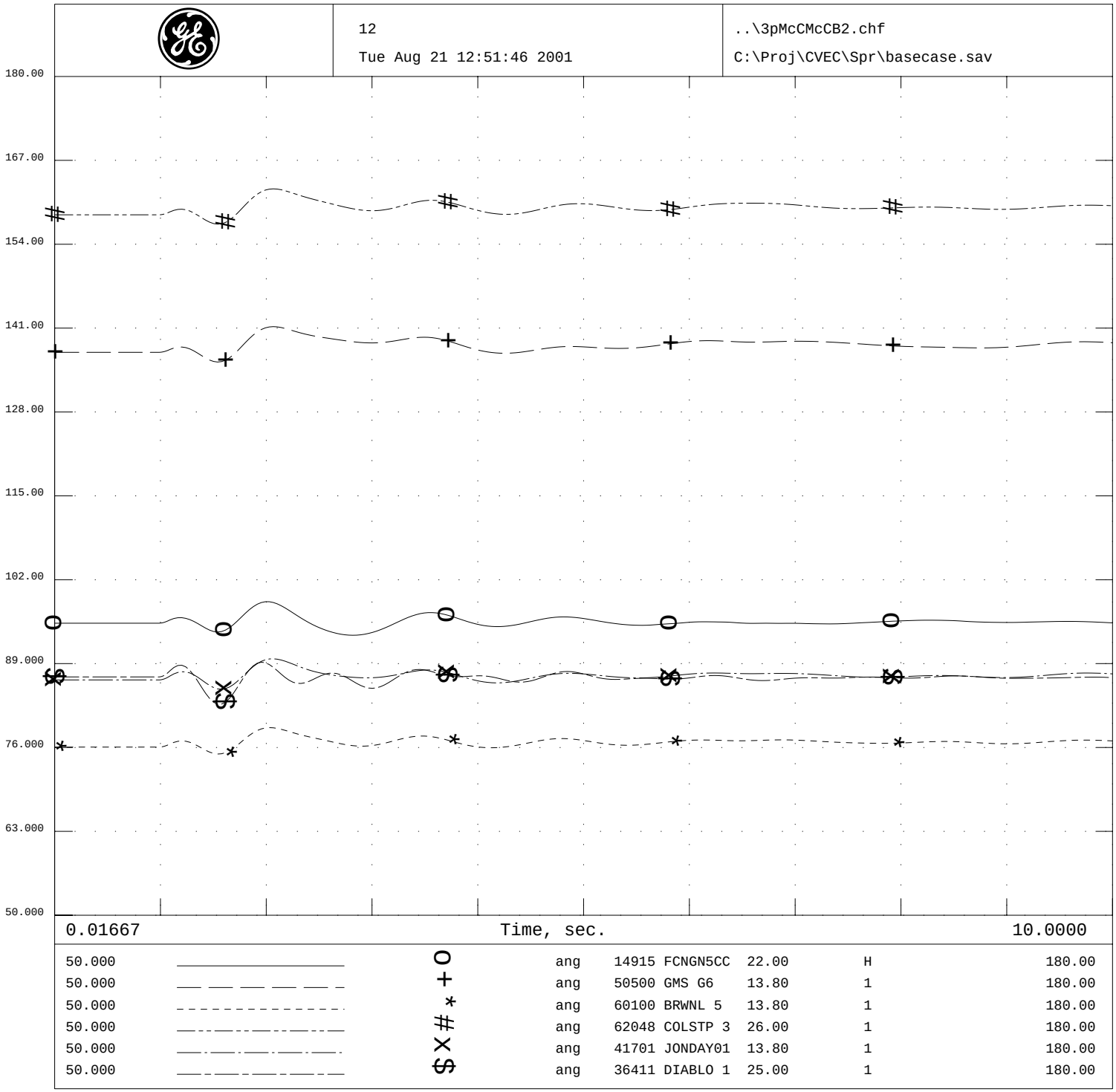
Calpine Corporation
Selected Local Rotor Angle Plots



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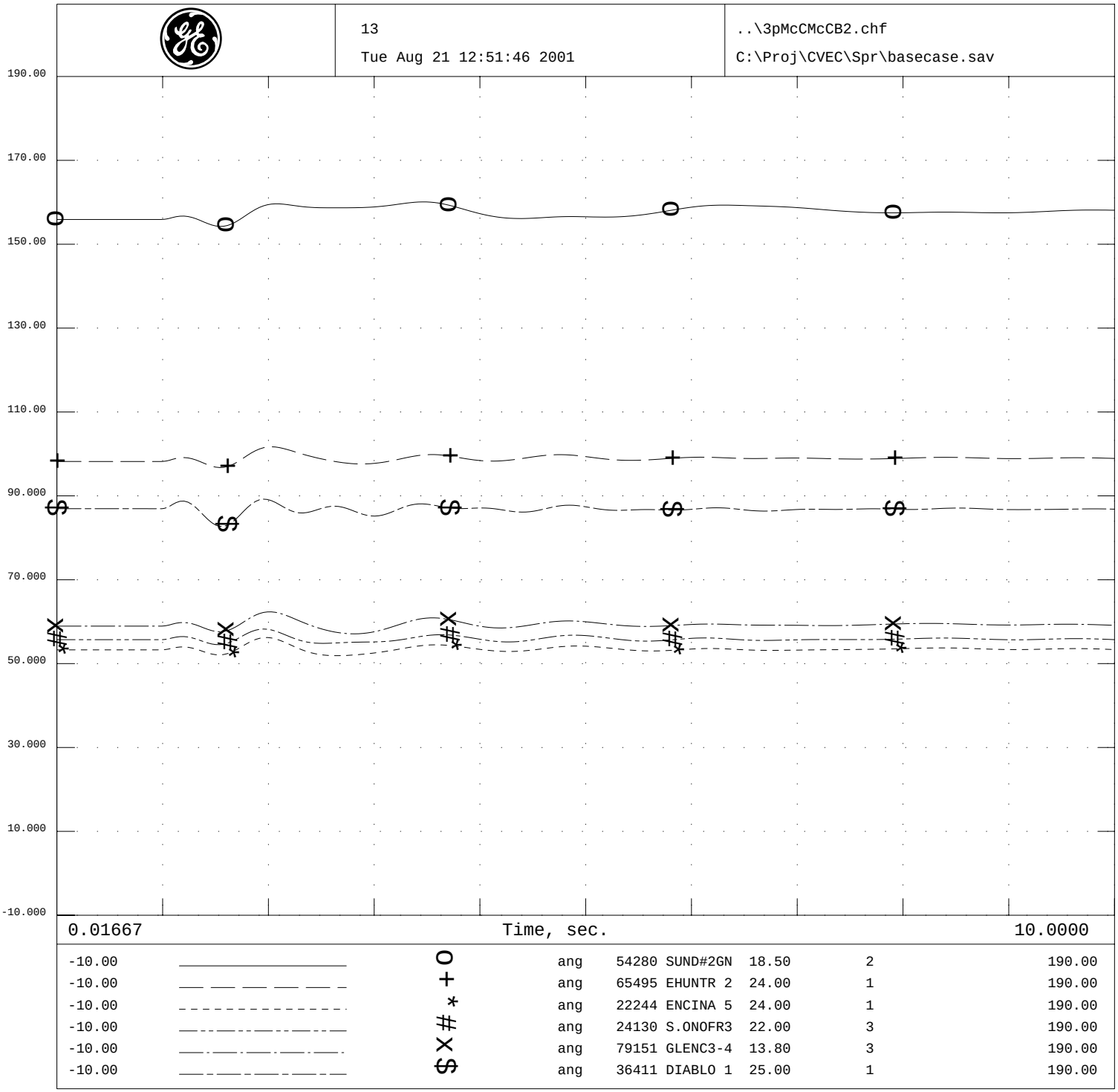

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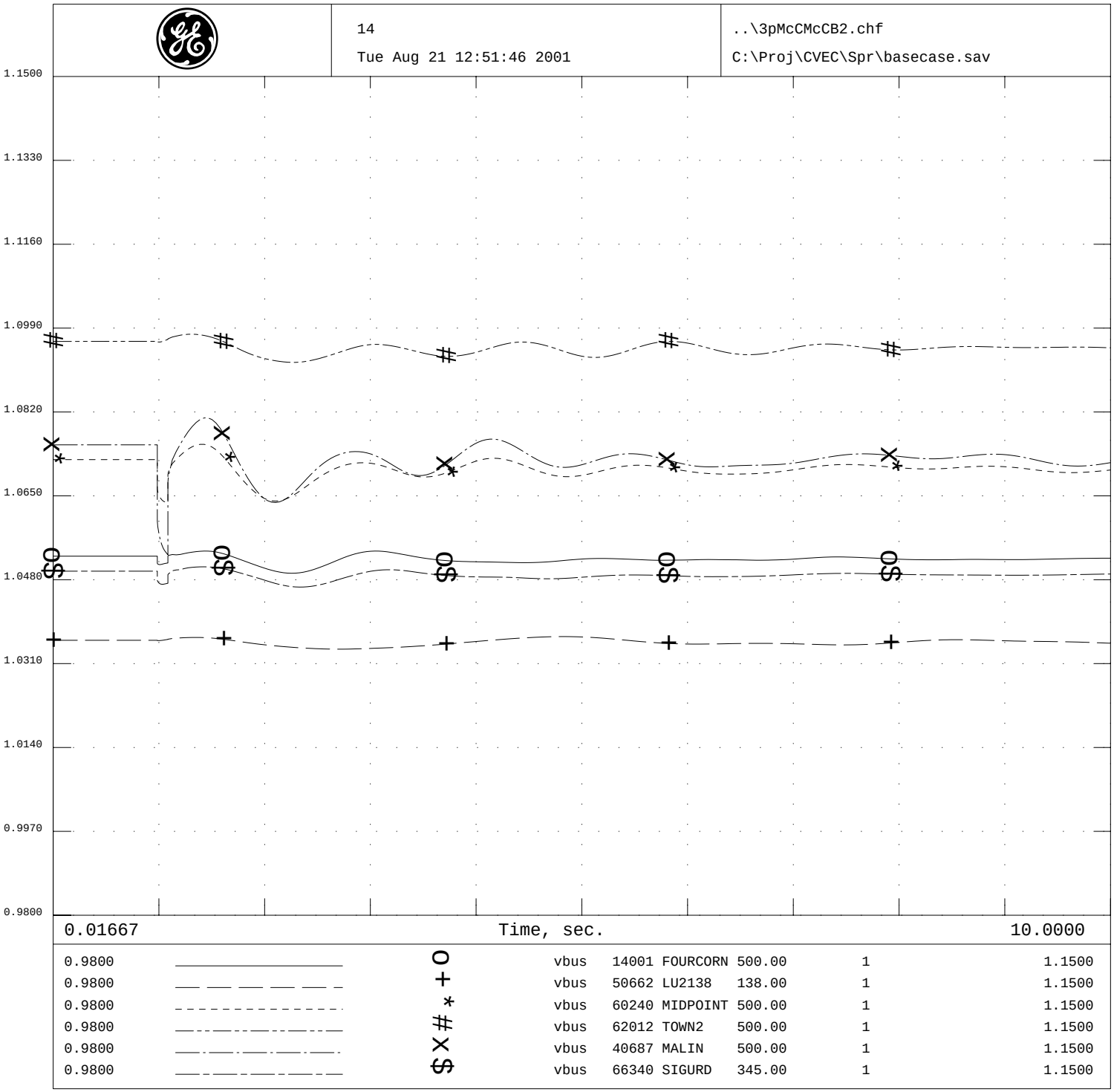

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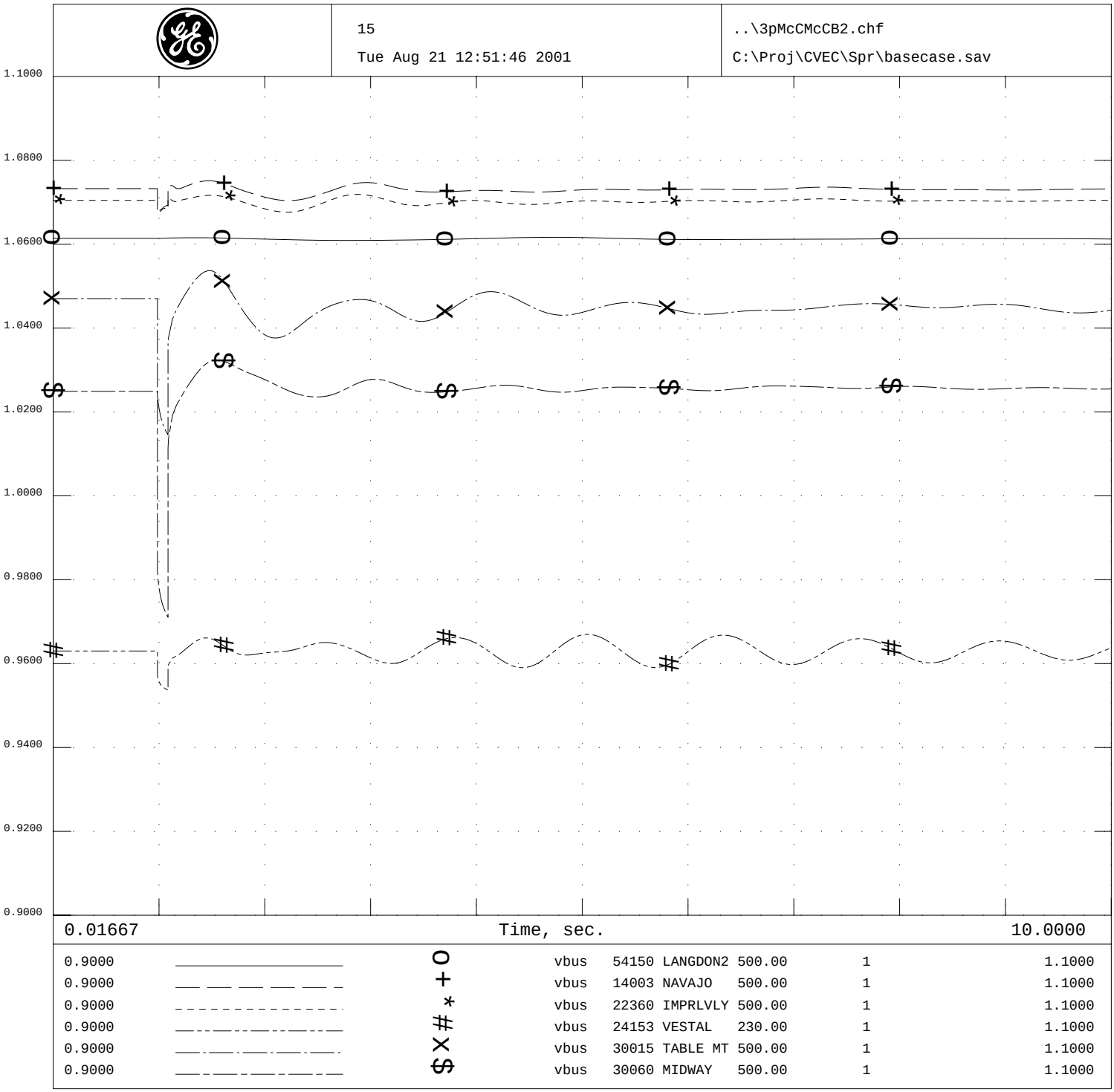

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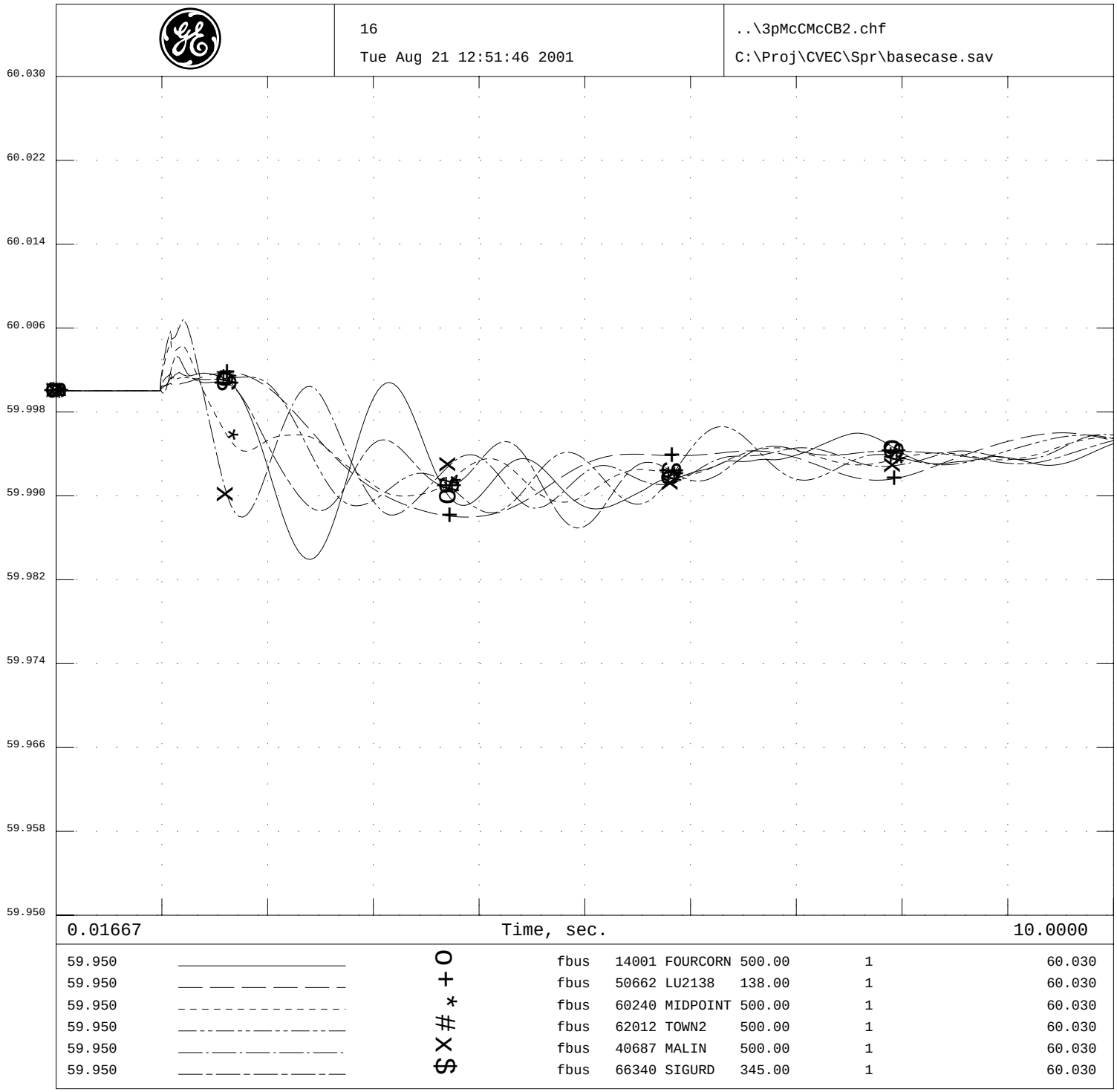

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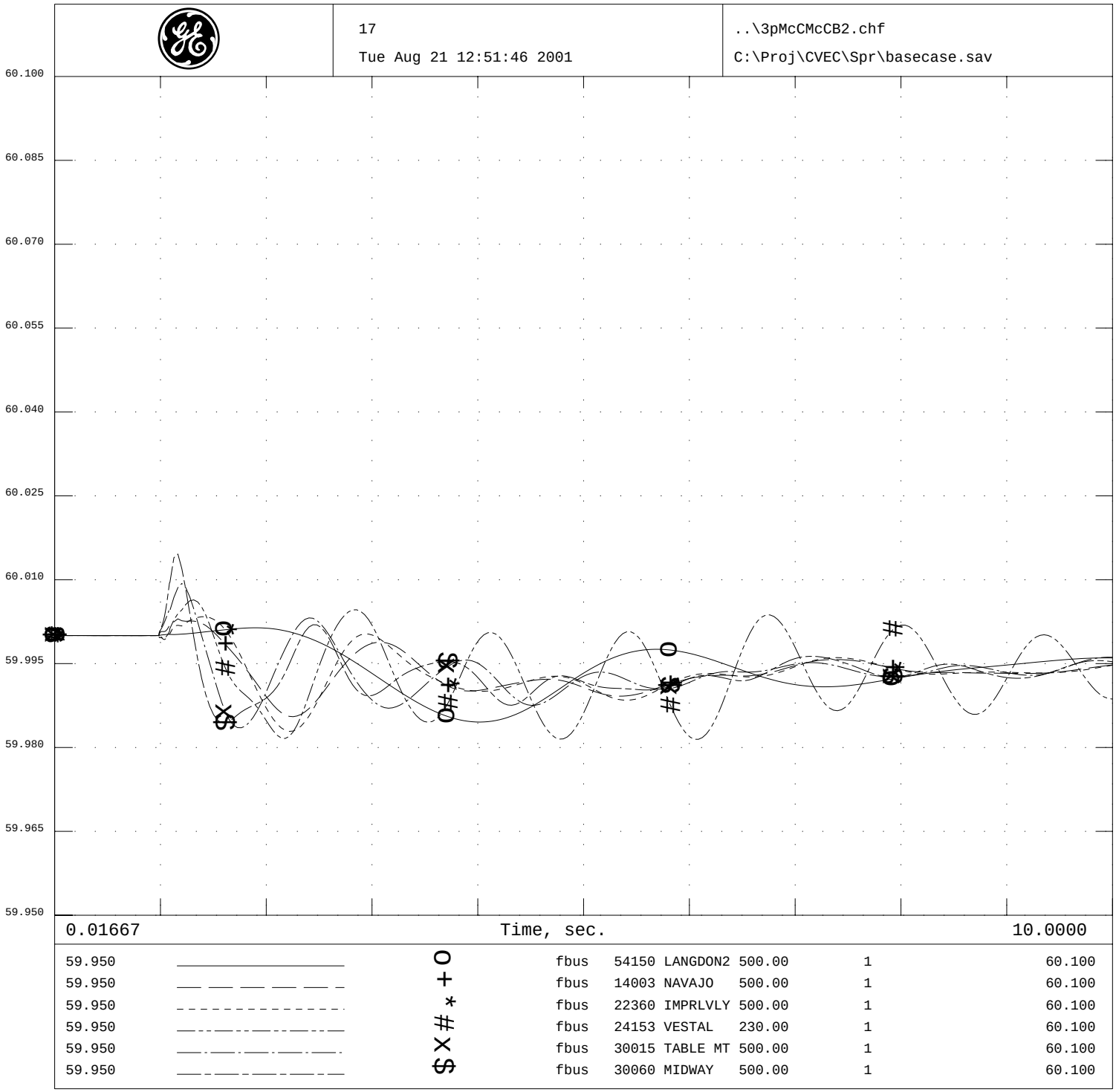

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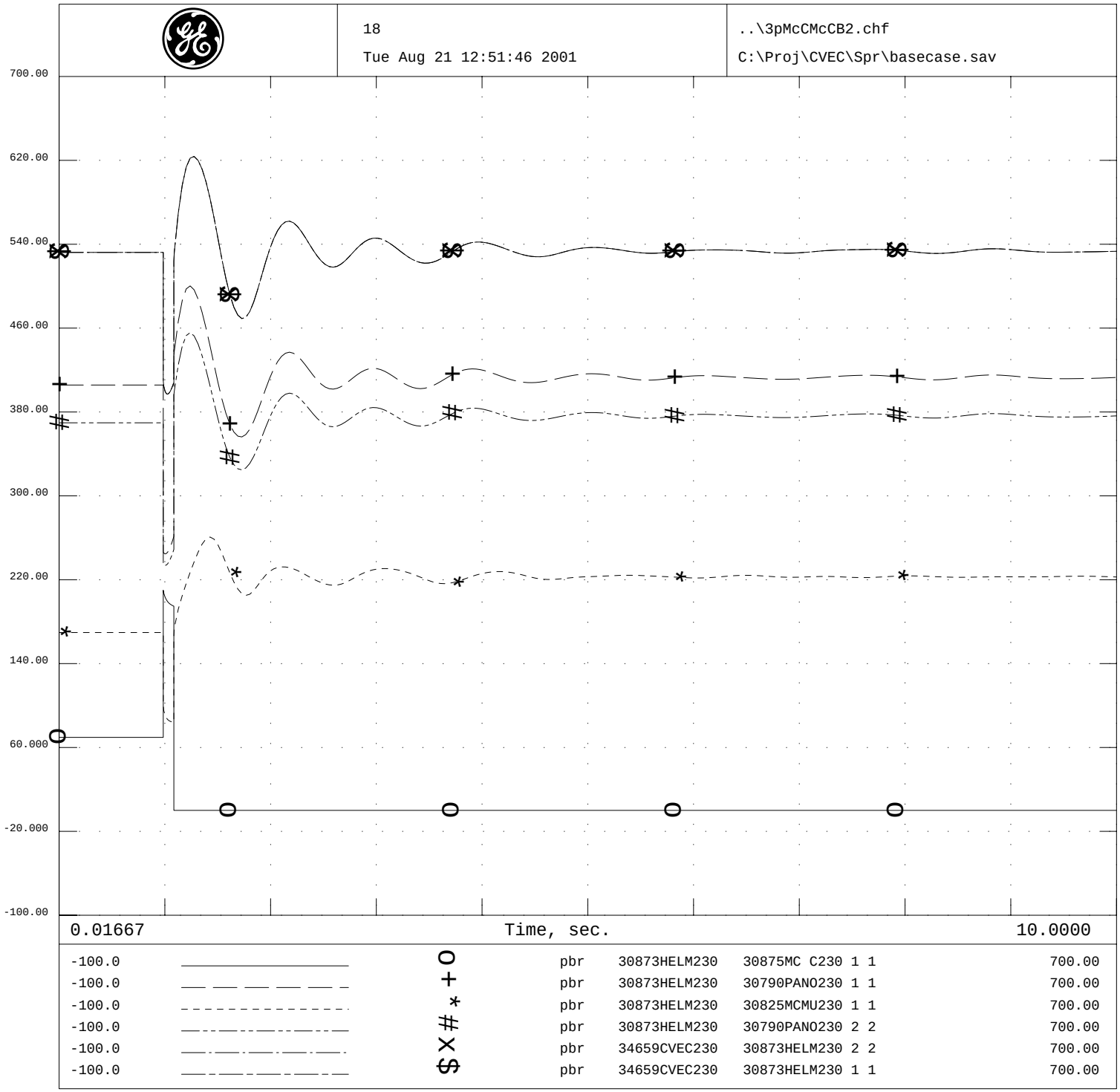

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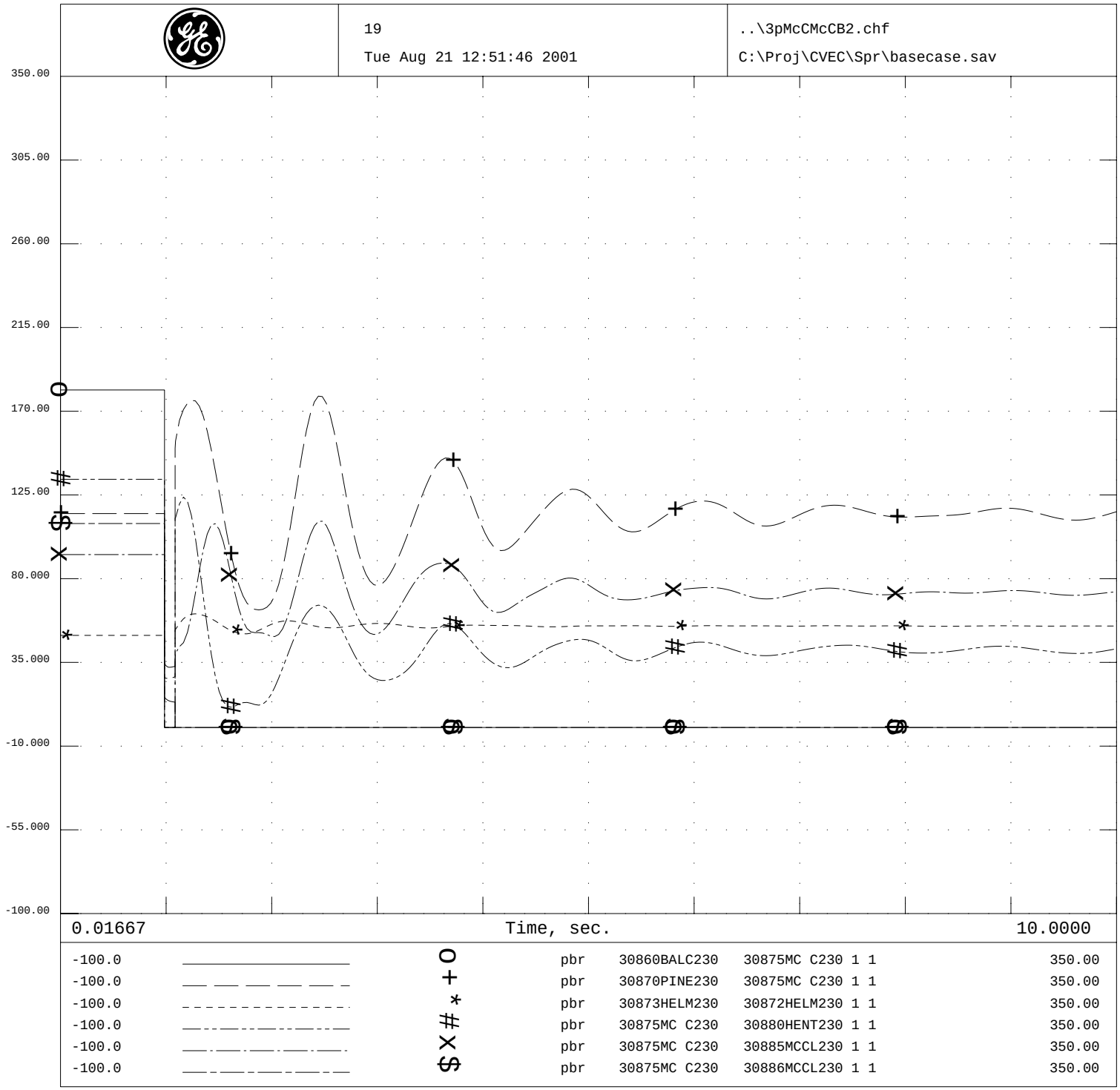

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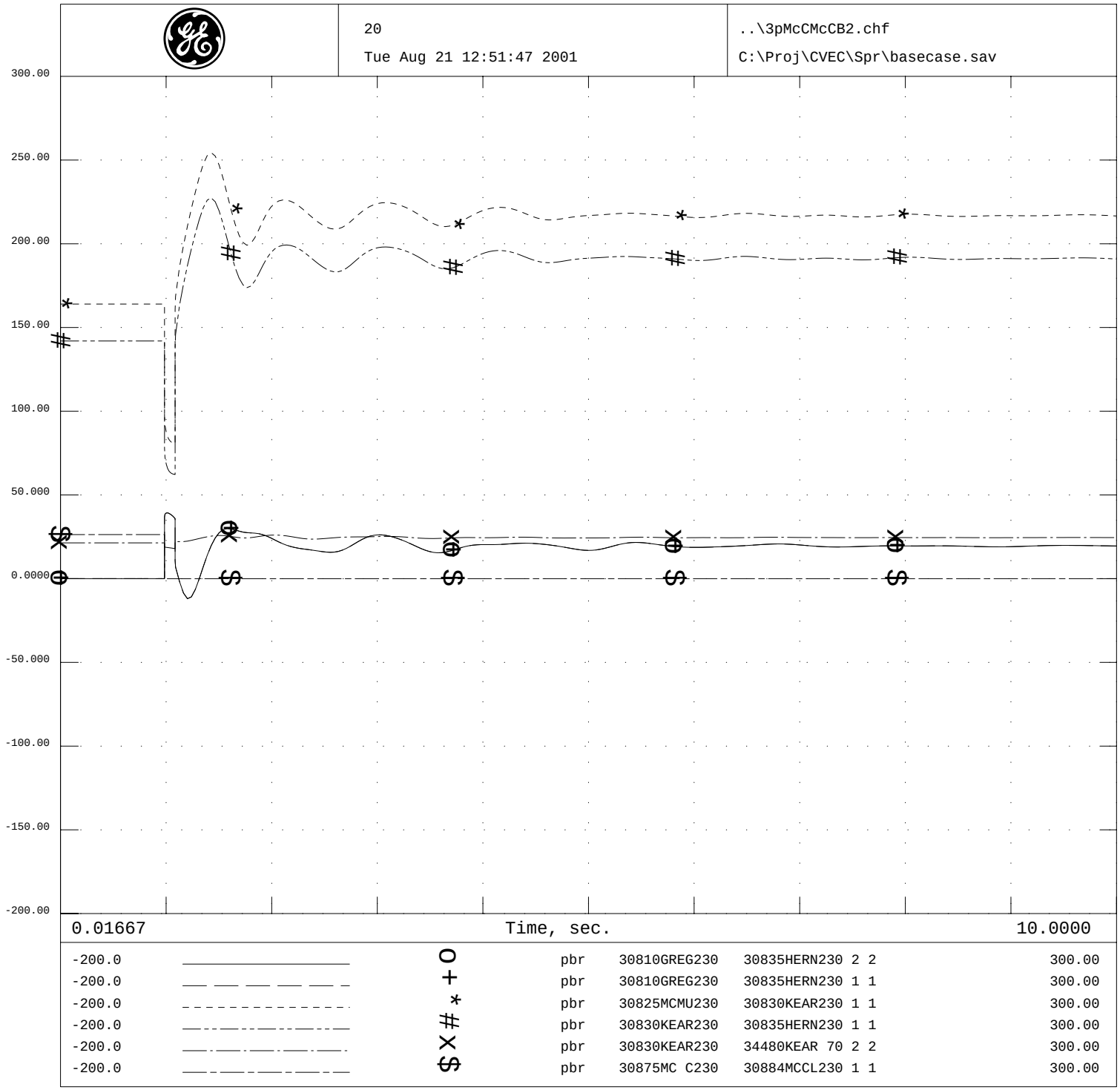

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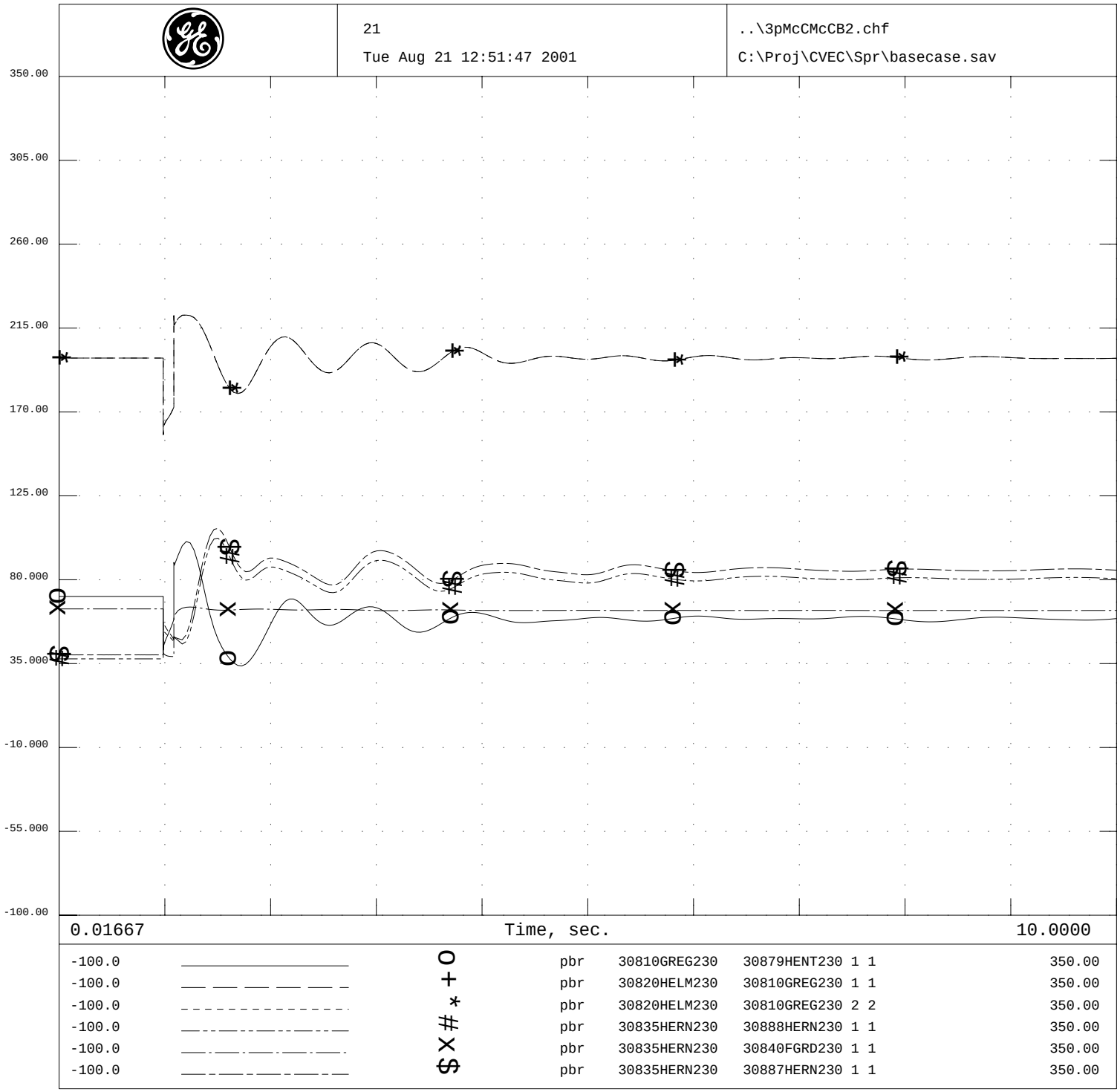

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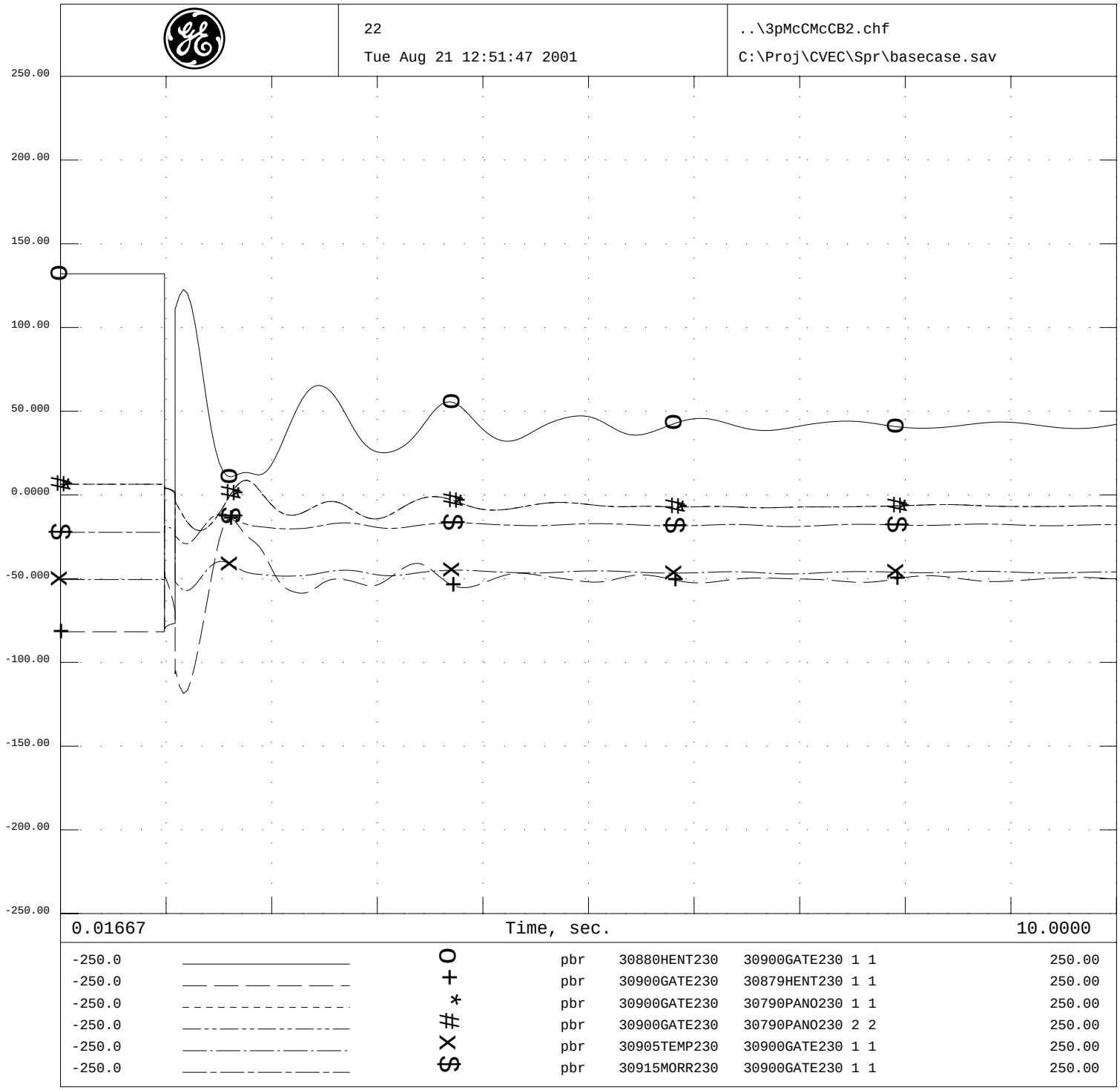

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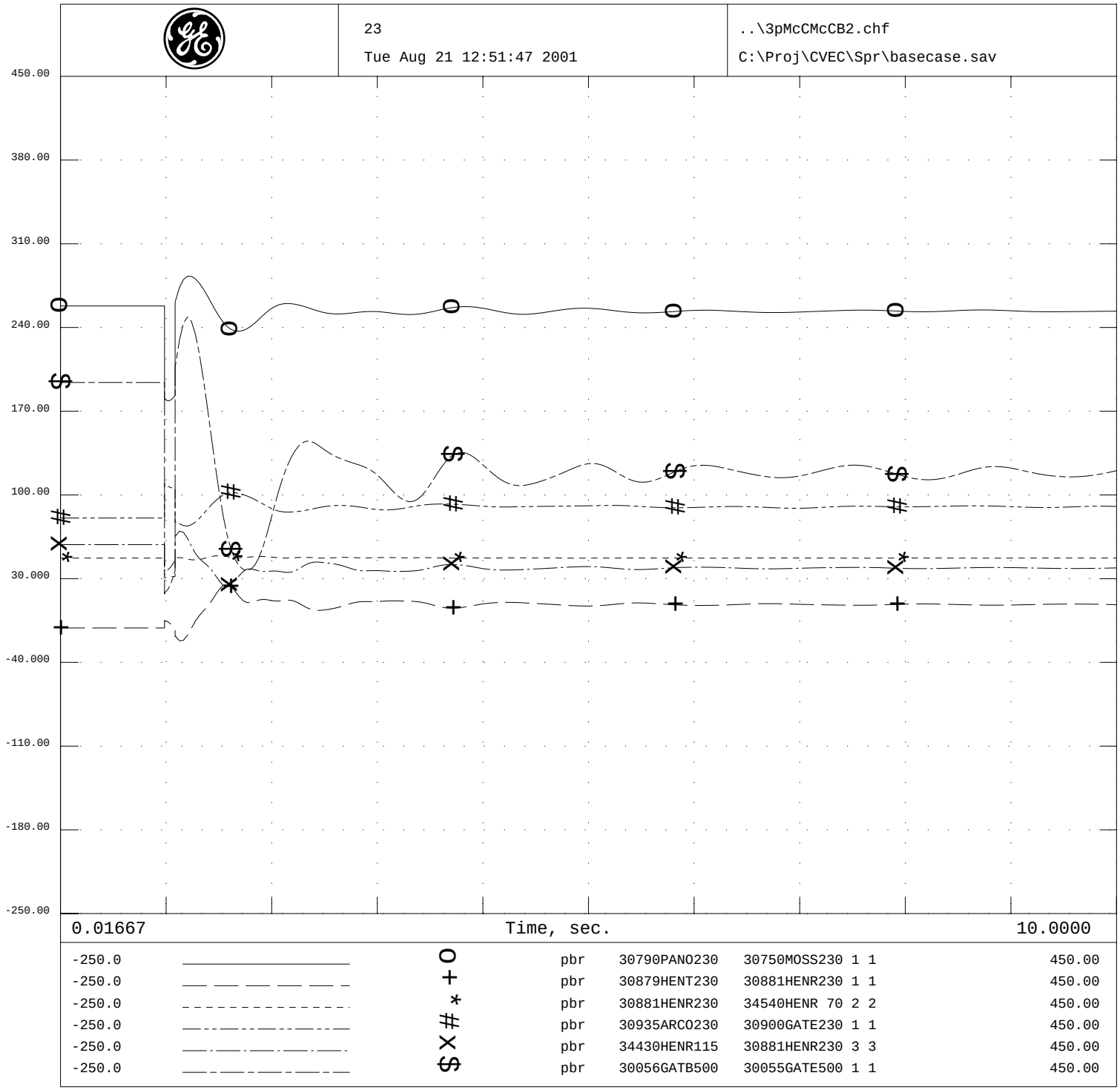

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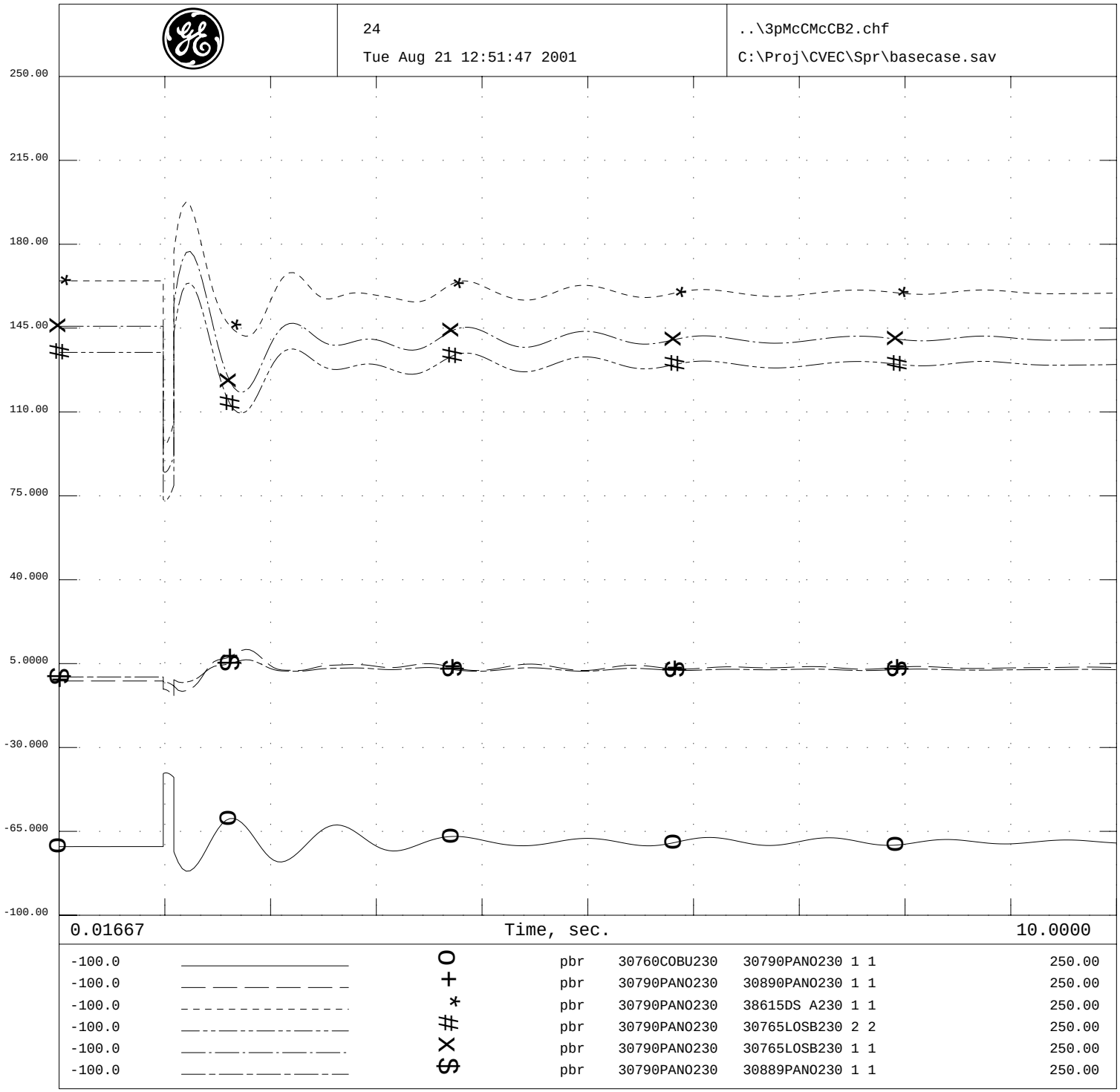

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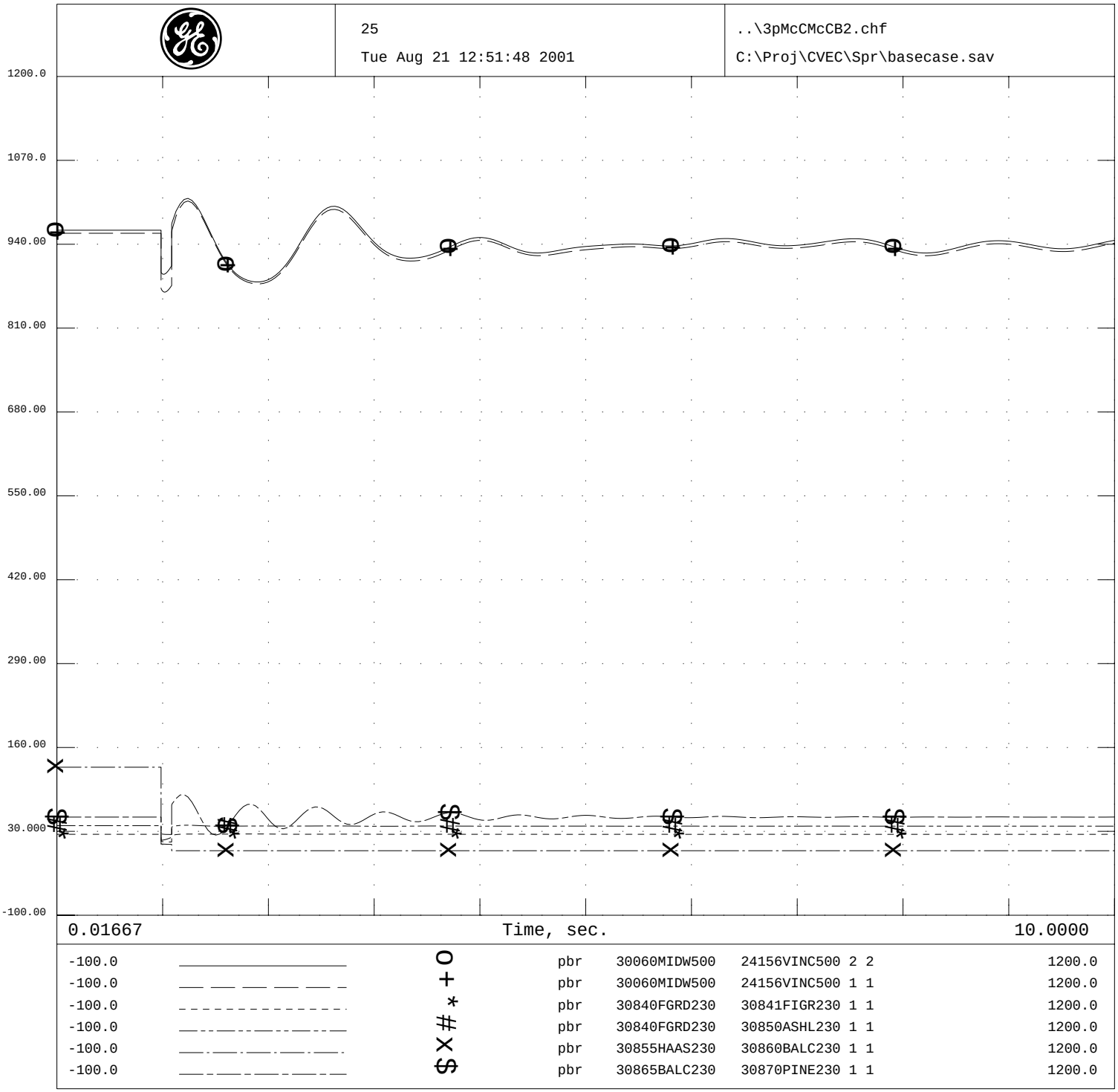

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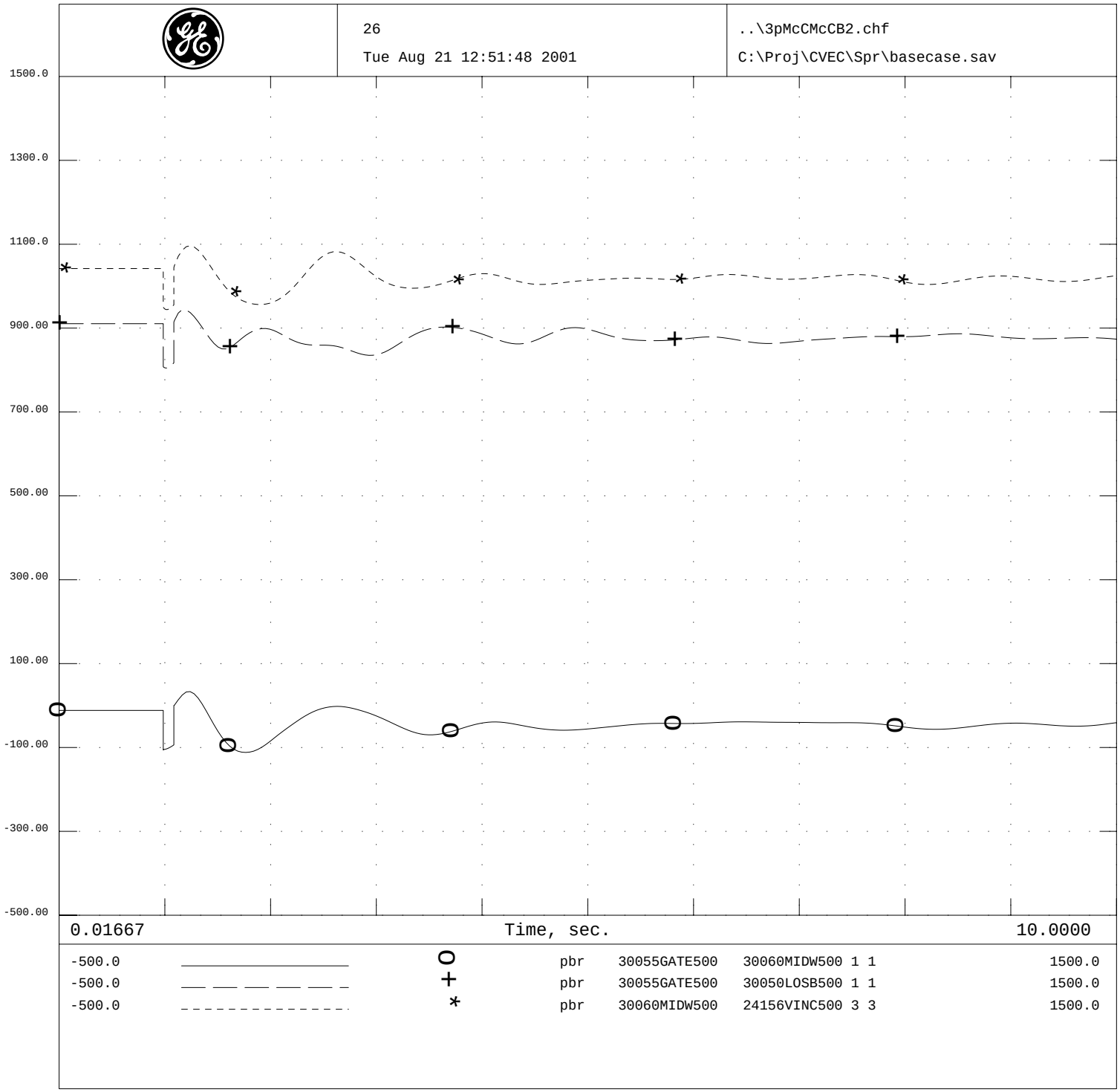

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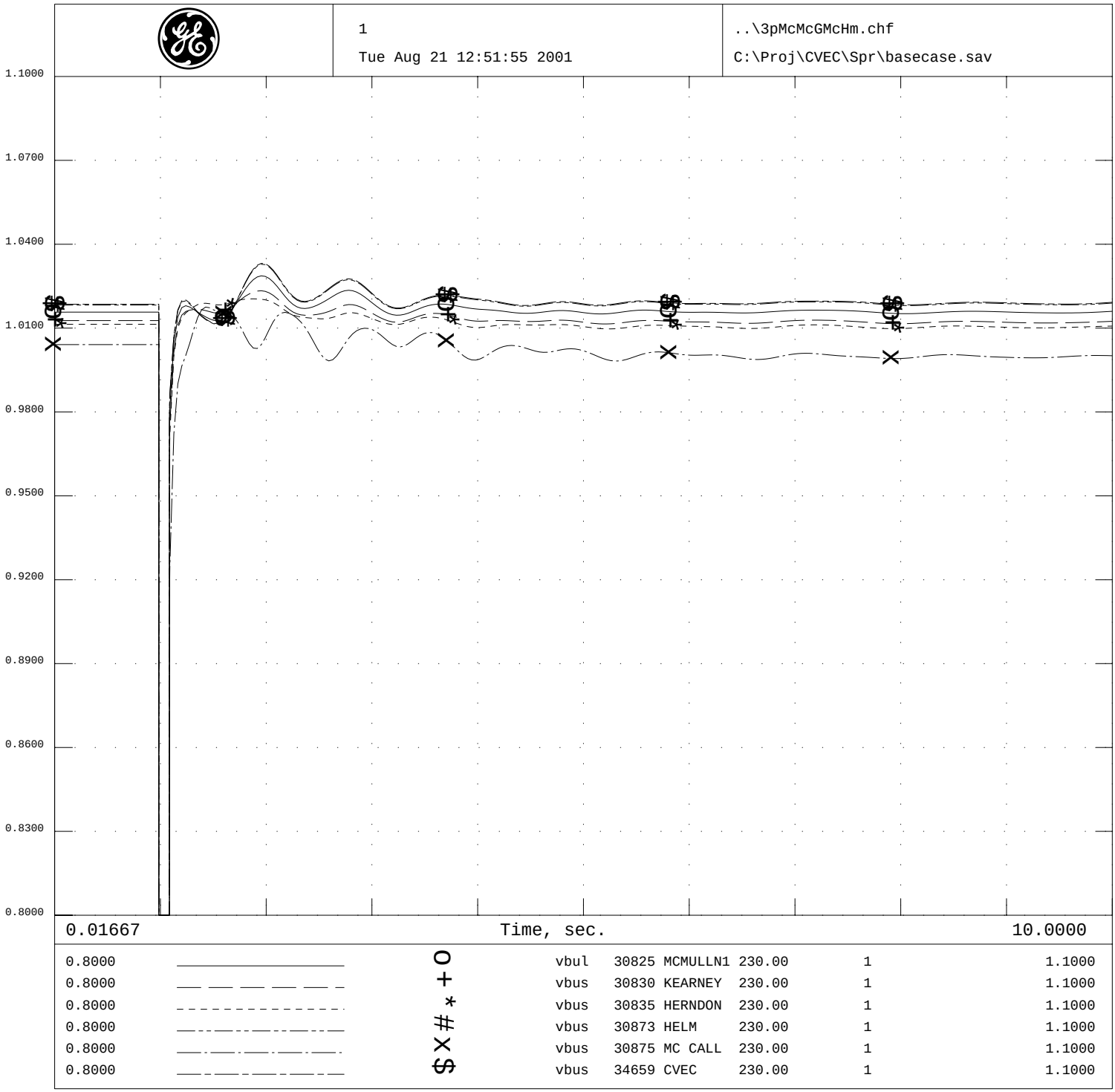

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
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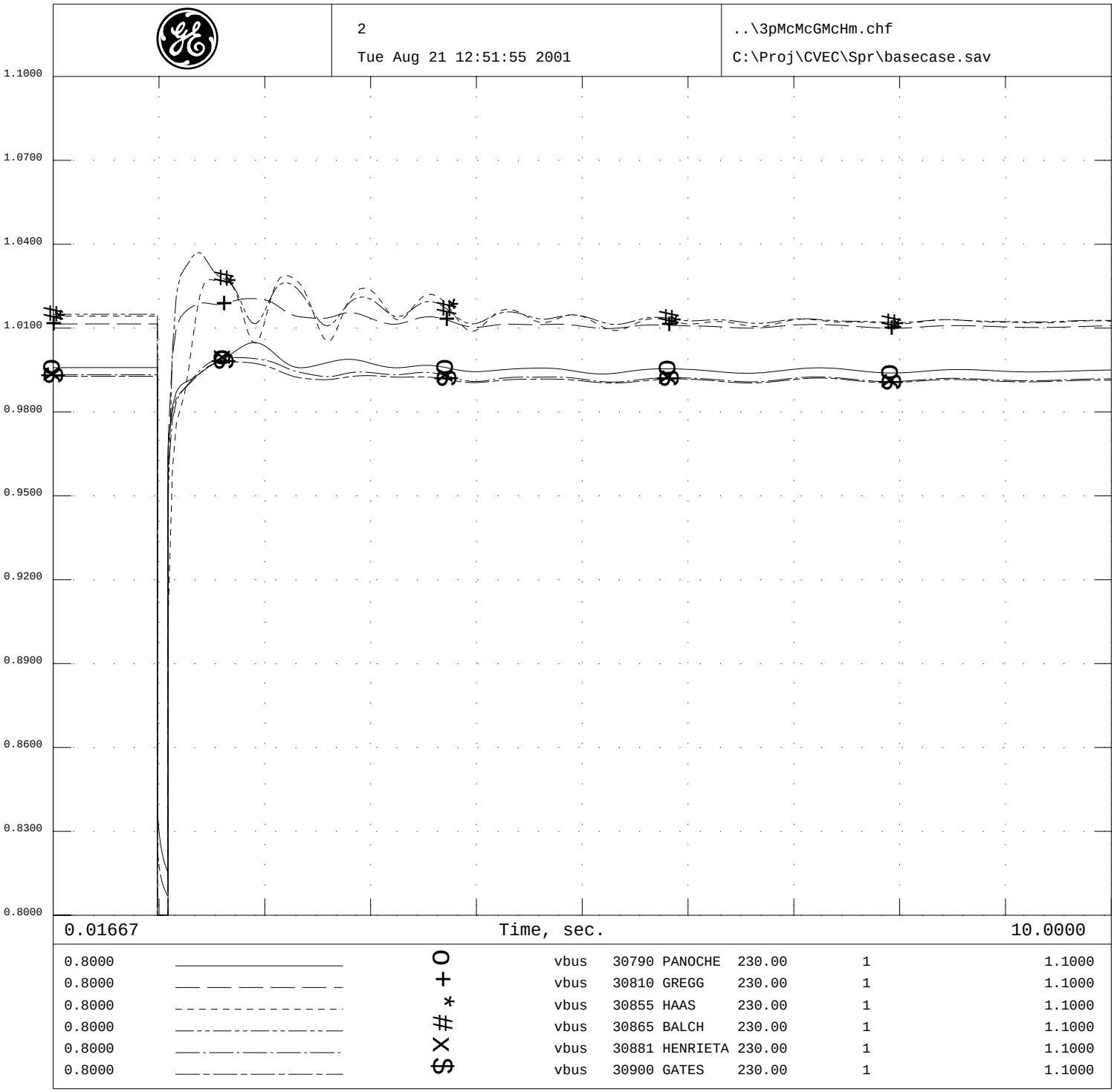
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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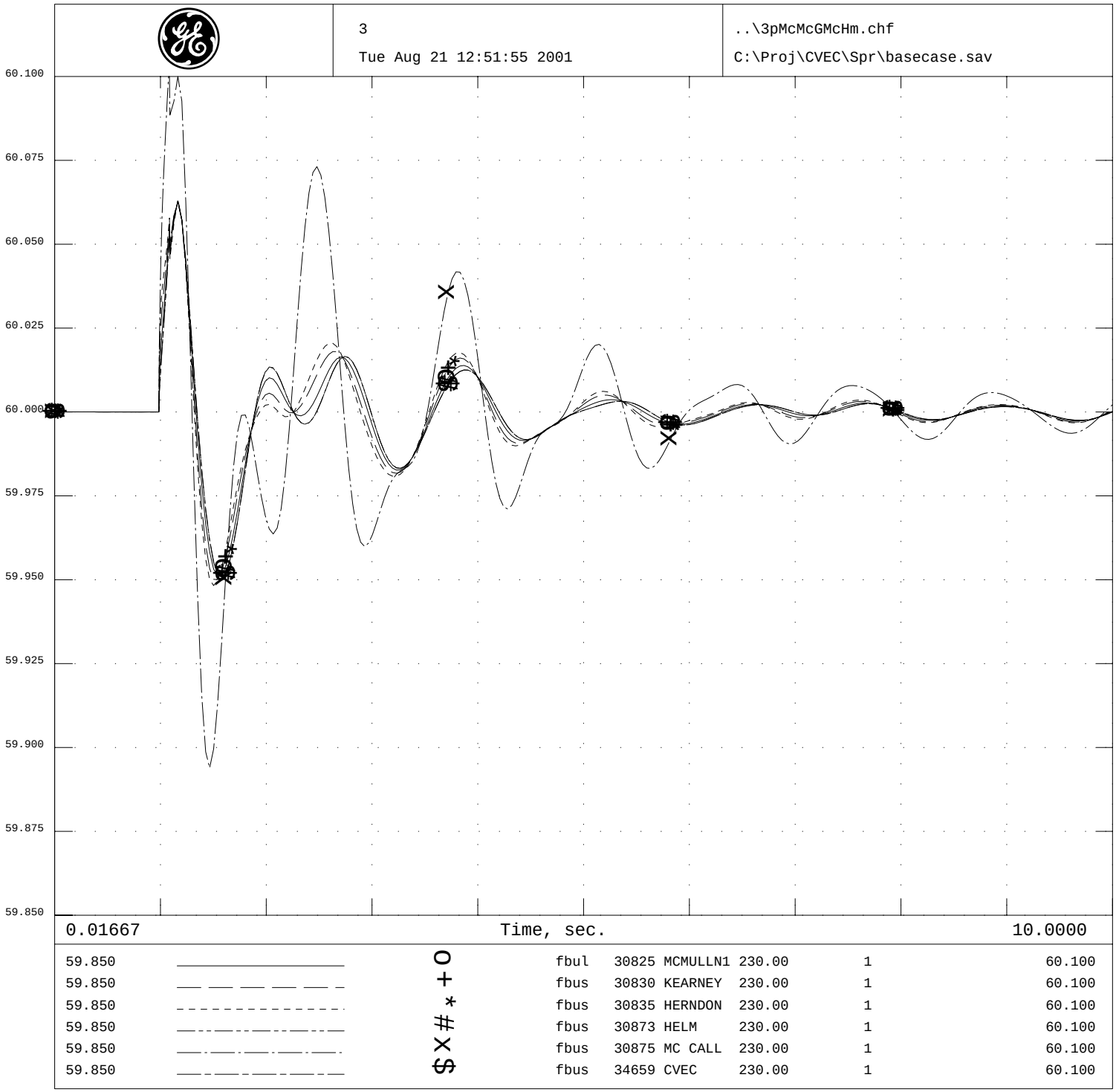

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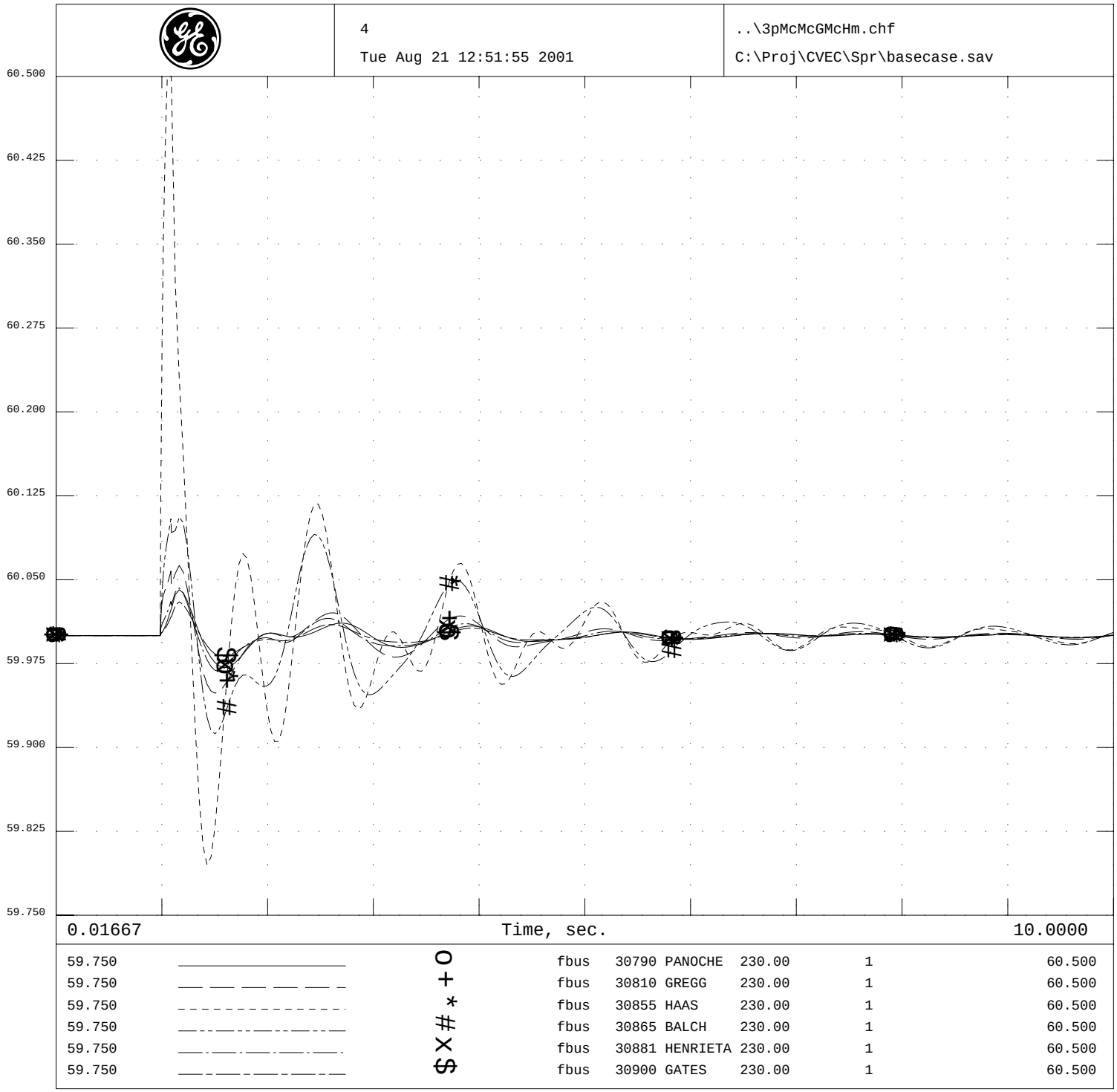

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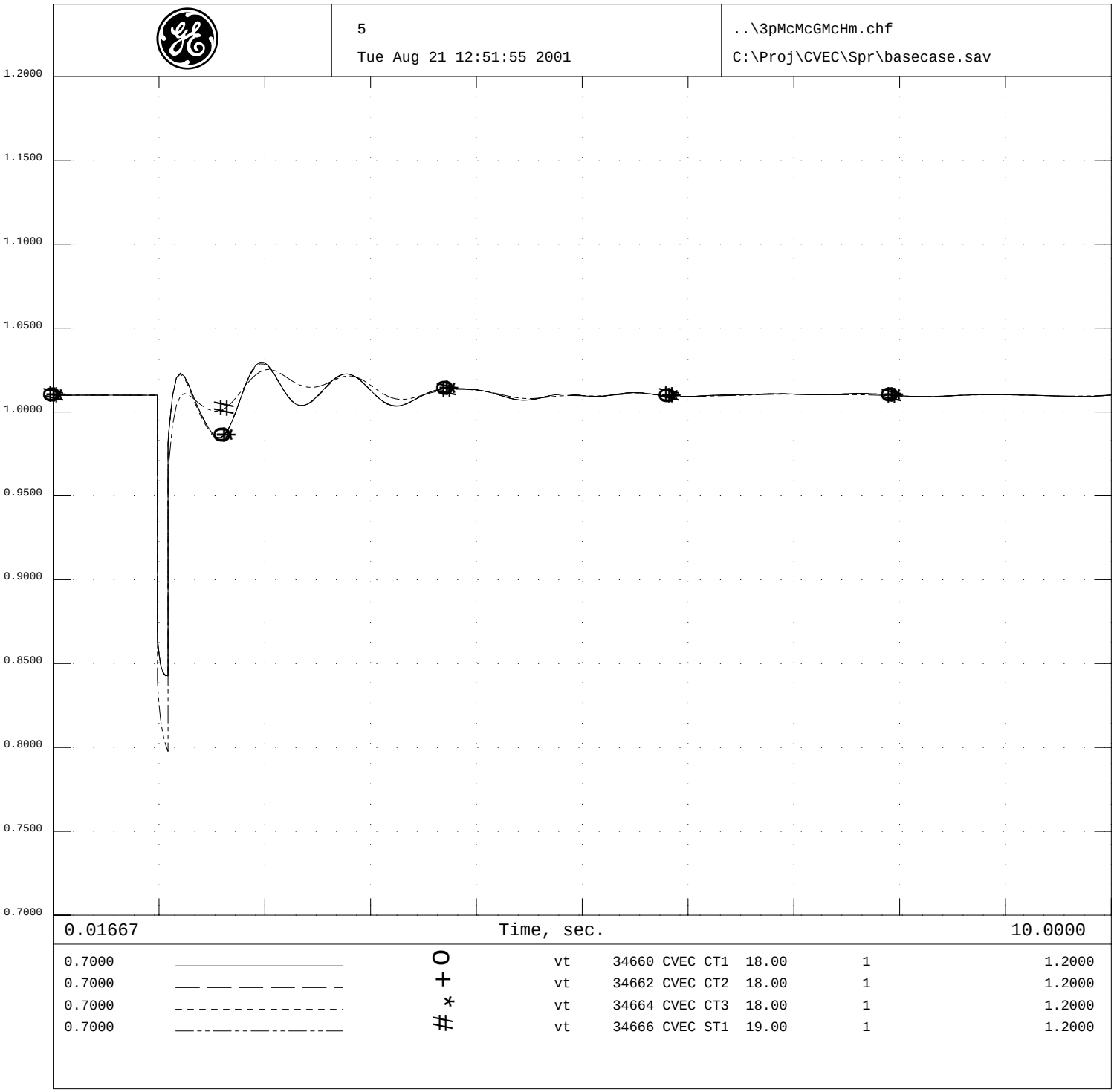

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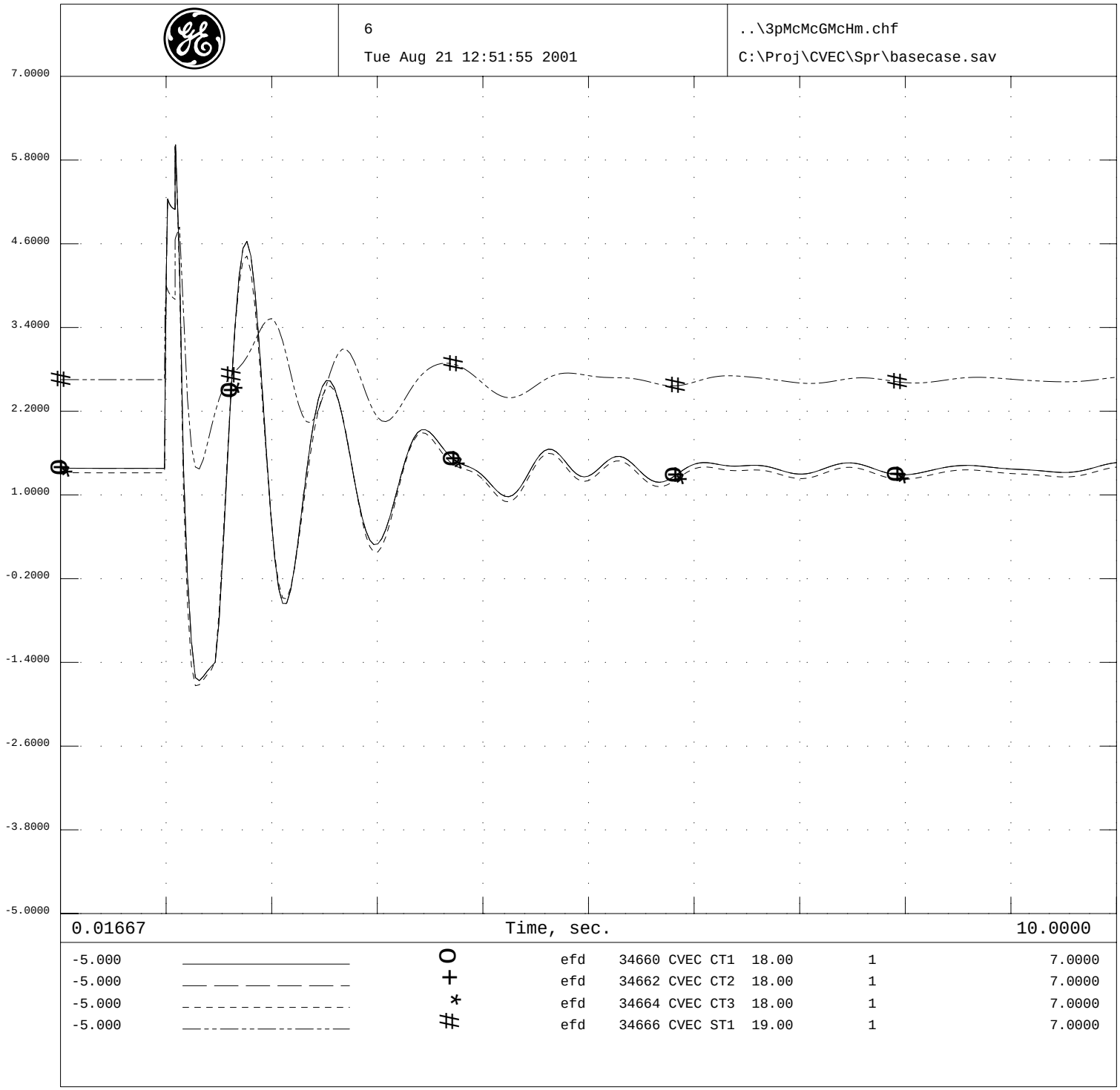
Project Generator Terminal Voltages



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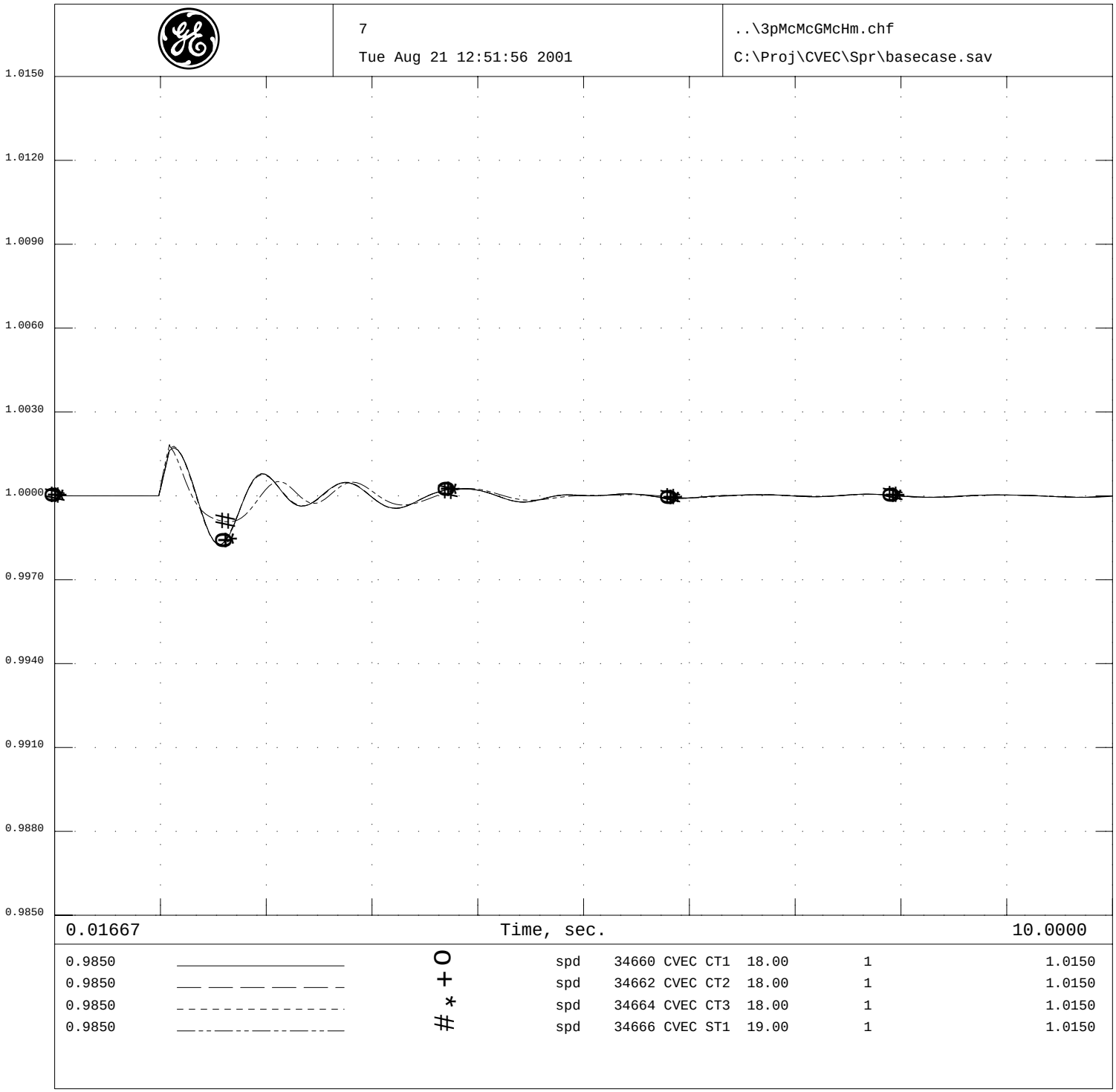

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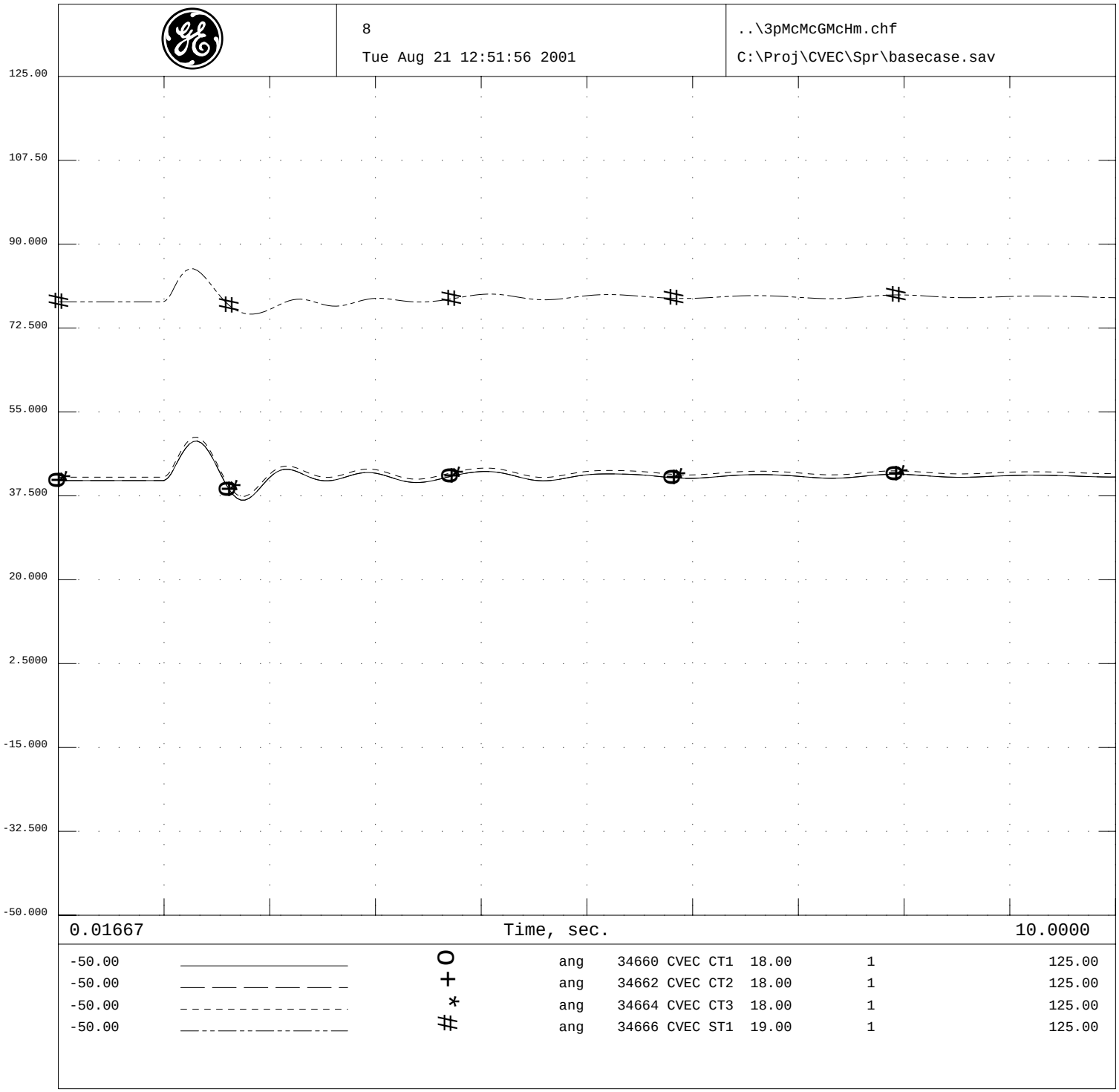
Project Generator Rotor Speed



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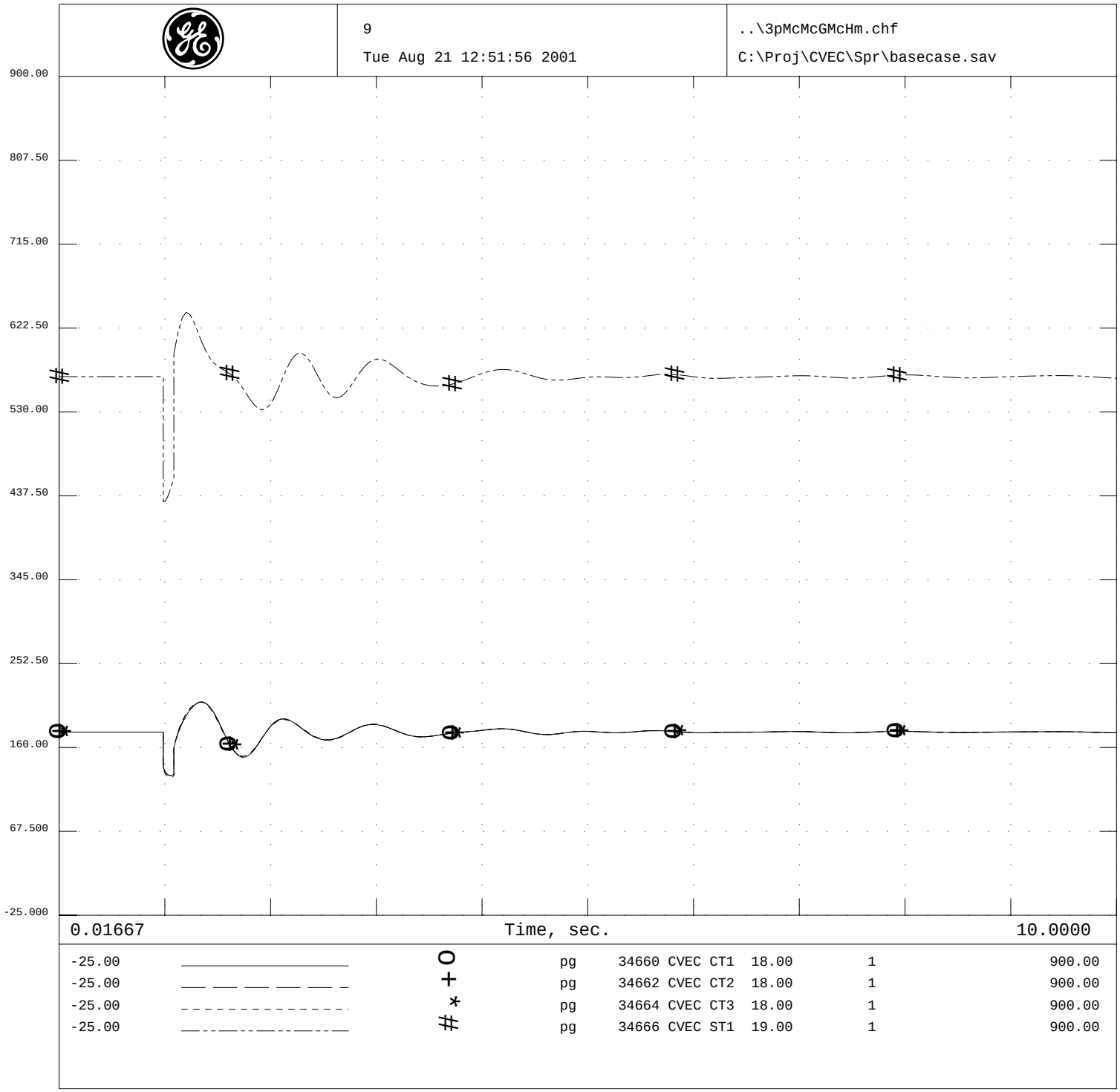
Project Generator Rotor Angle



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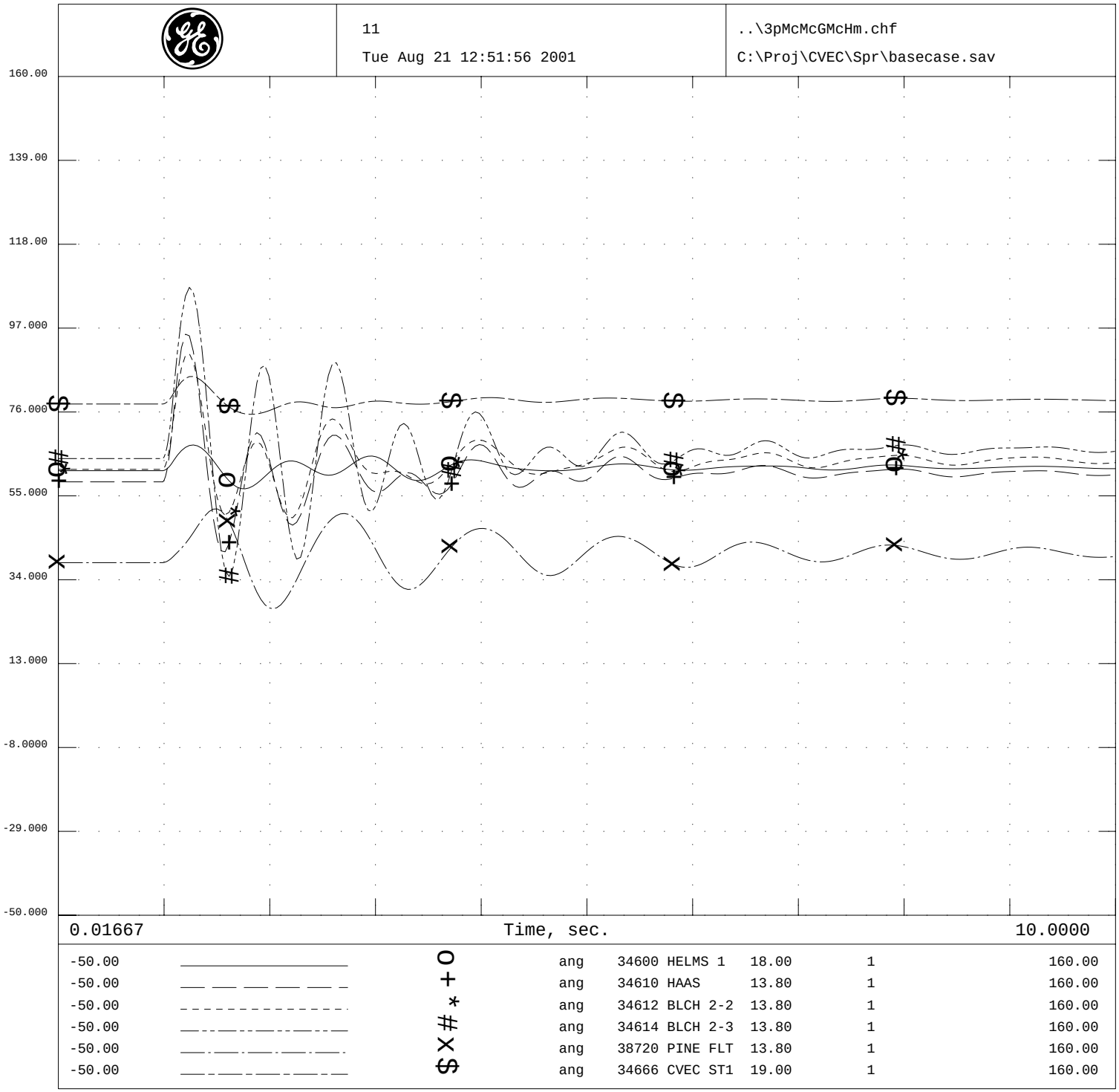

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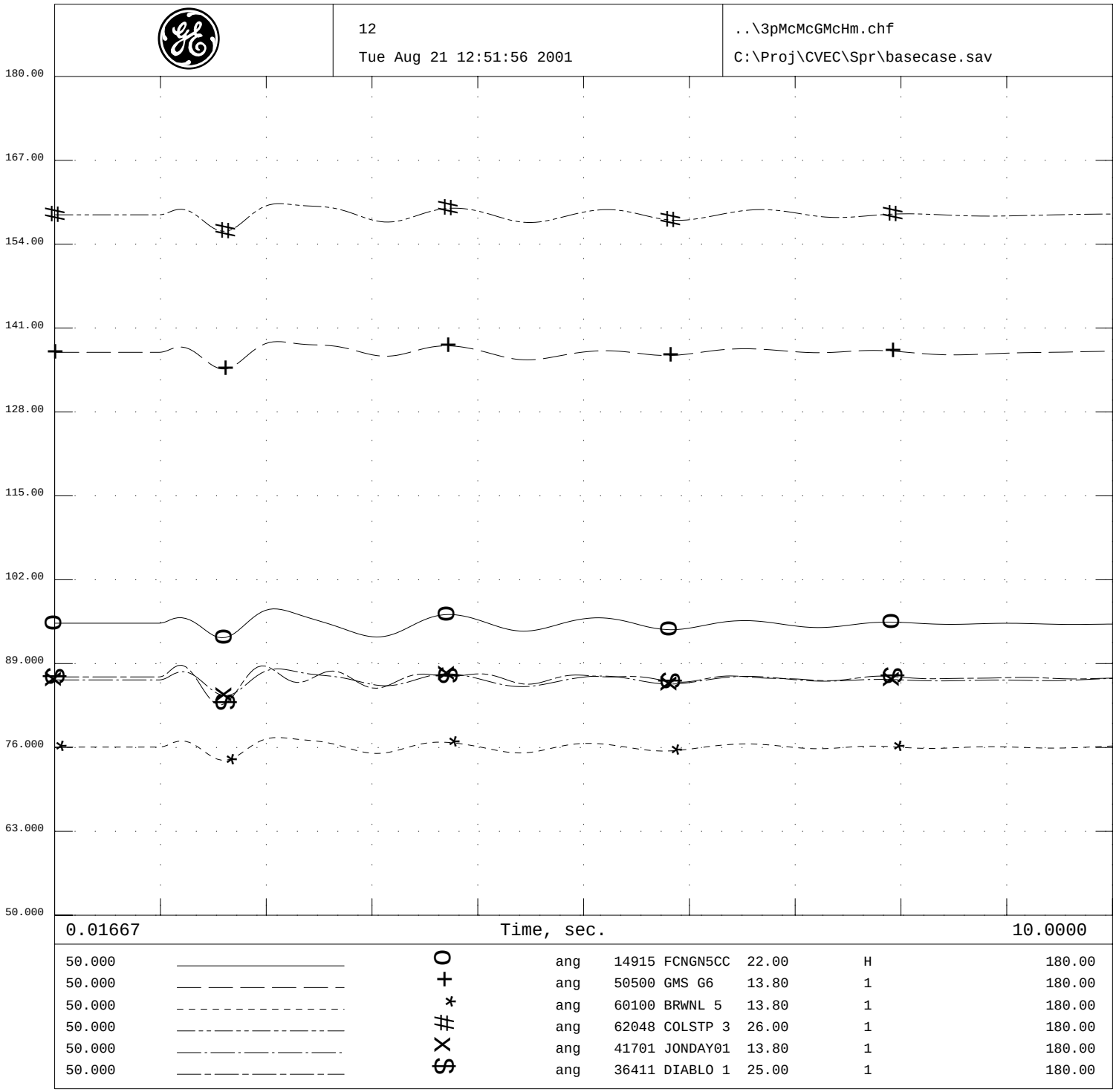
Selected Local Rotor Angle Plots



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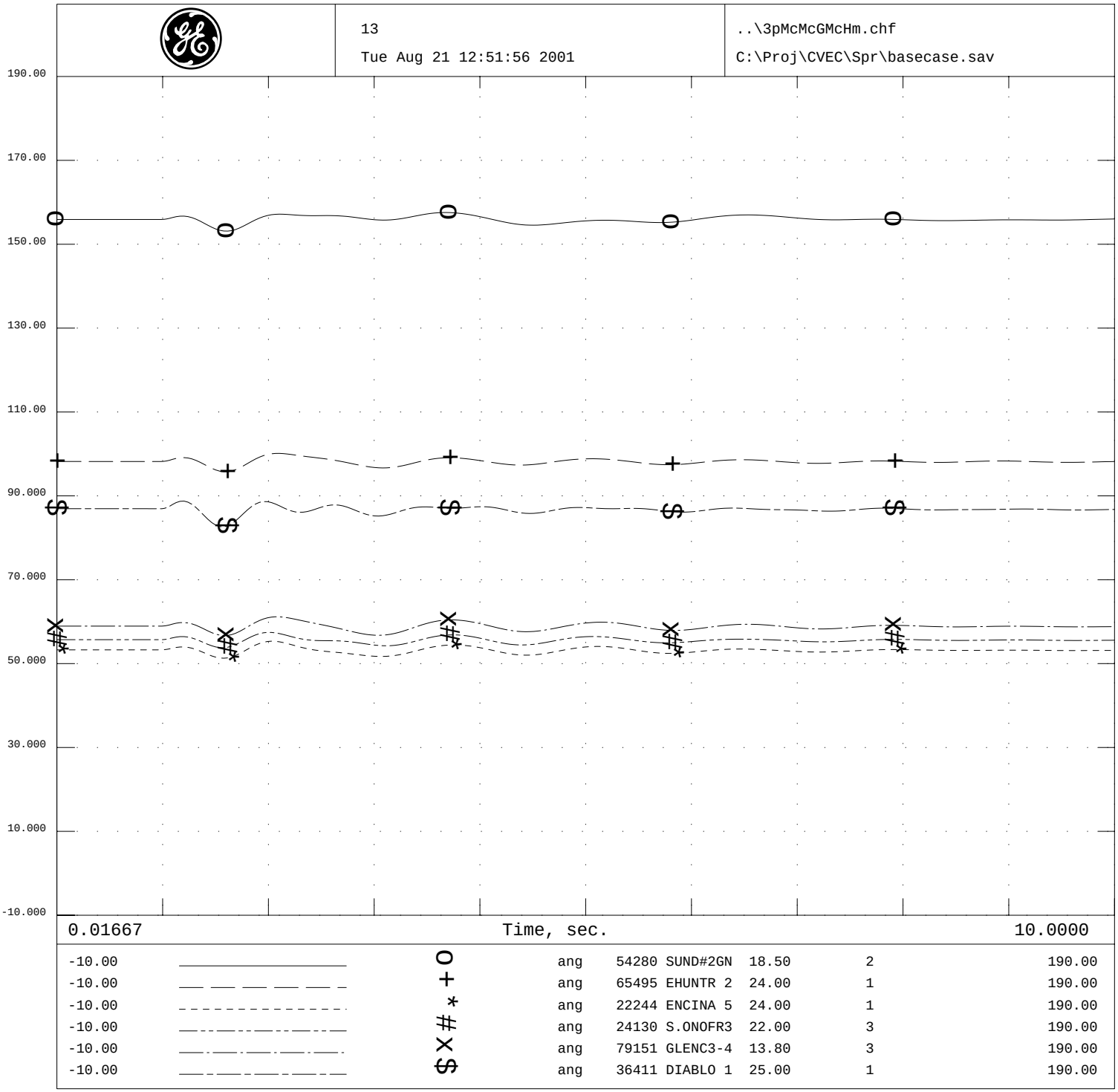
Selected WSCC Transmission Bus Angle Plots



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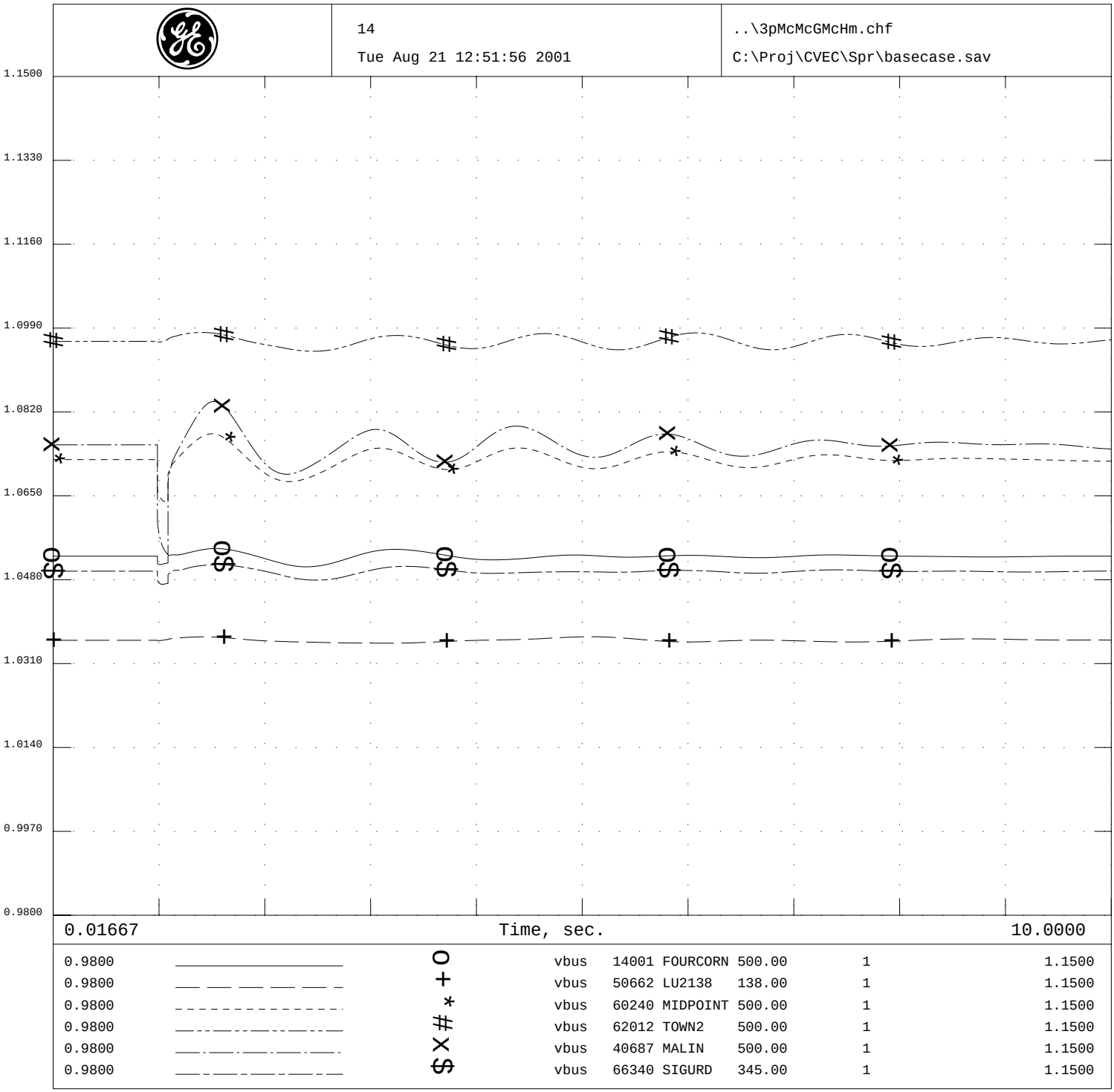

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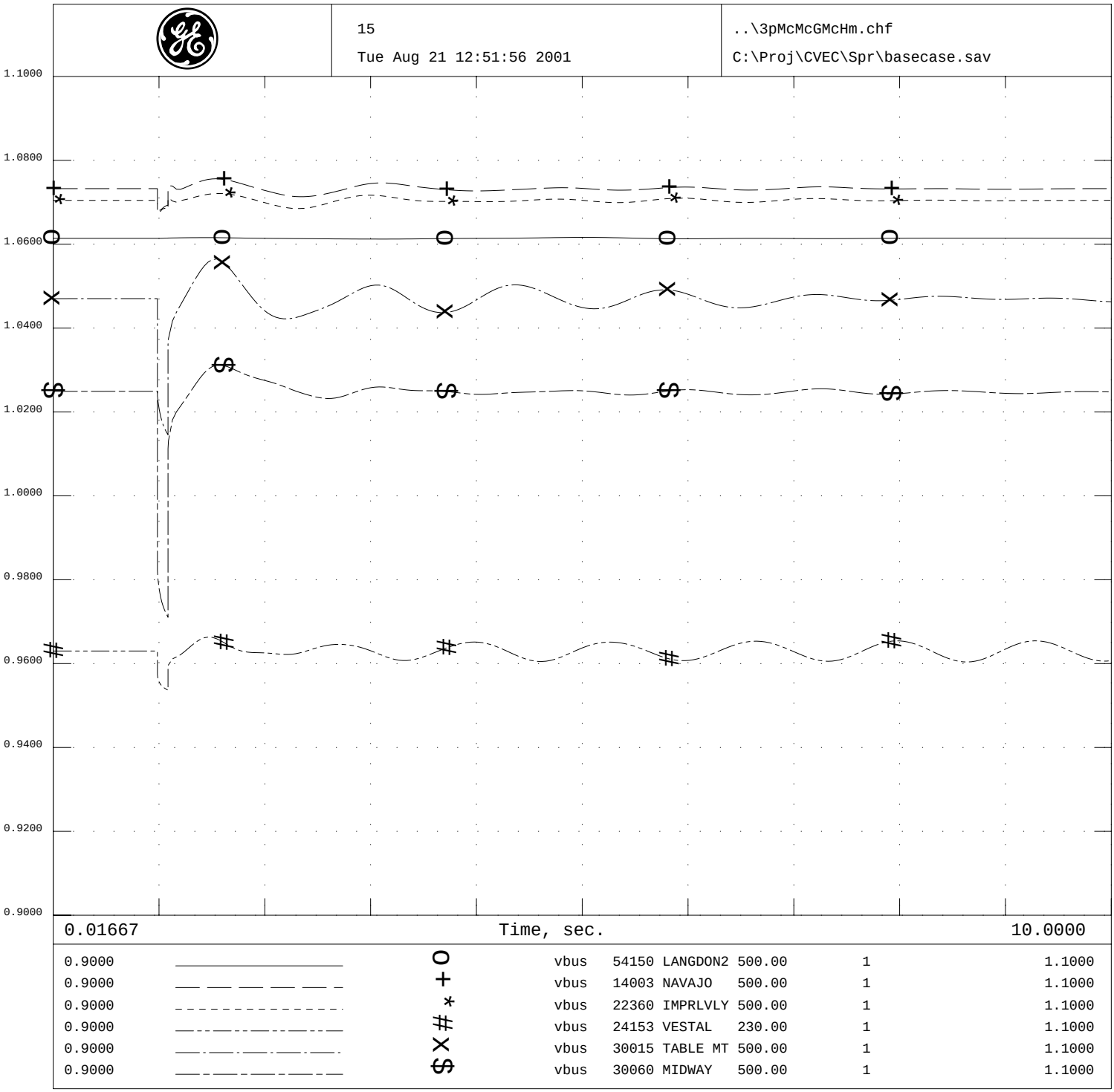

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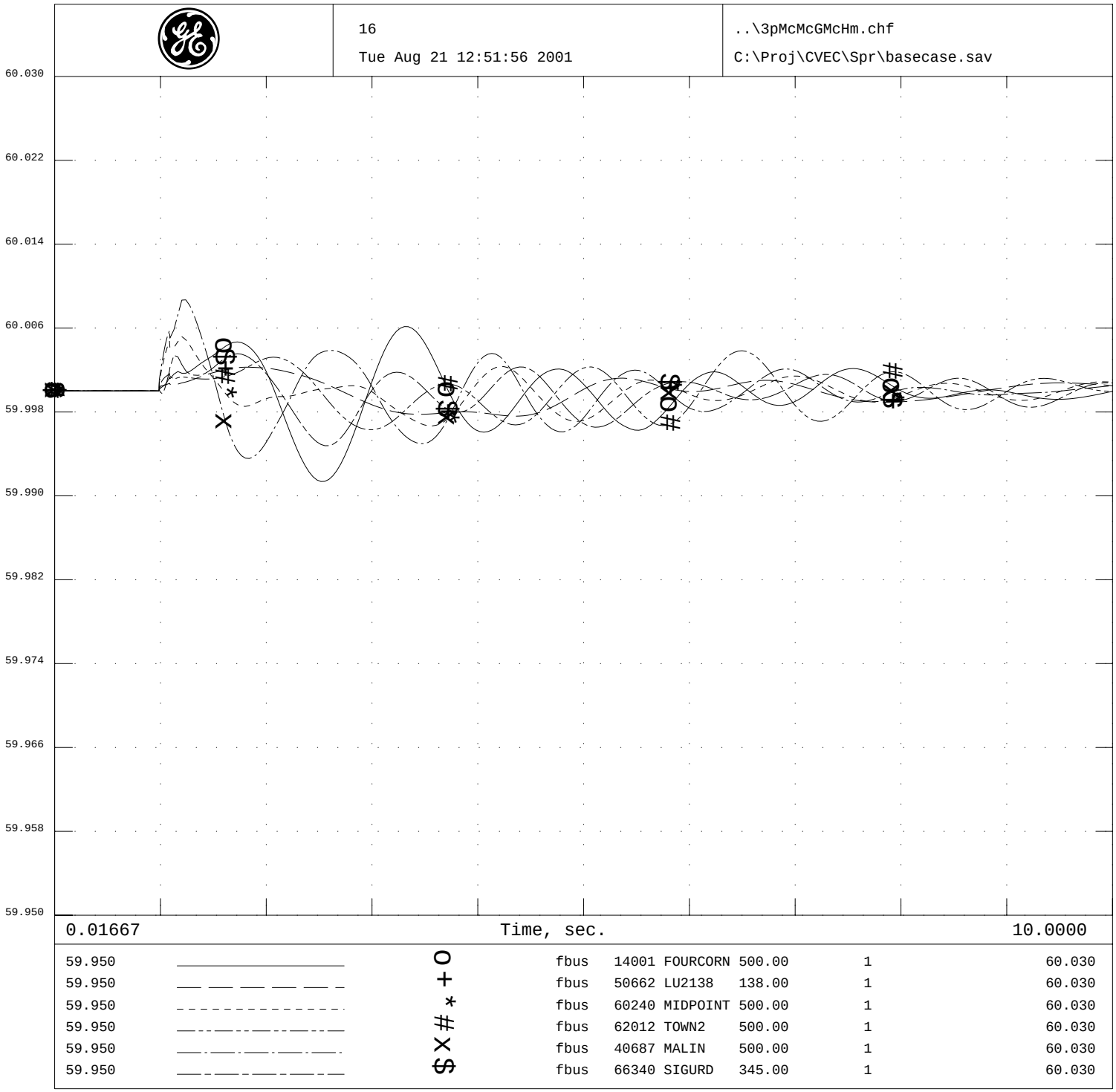

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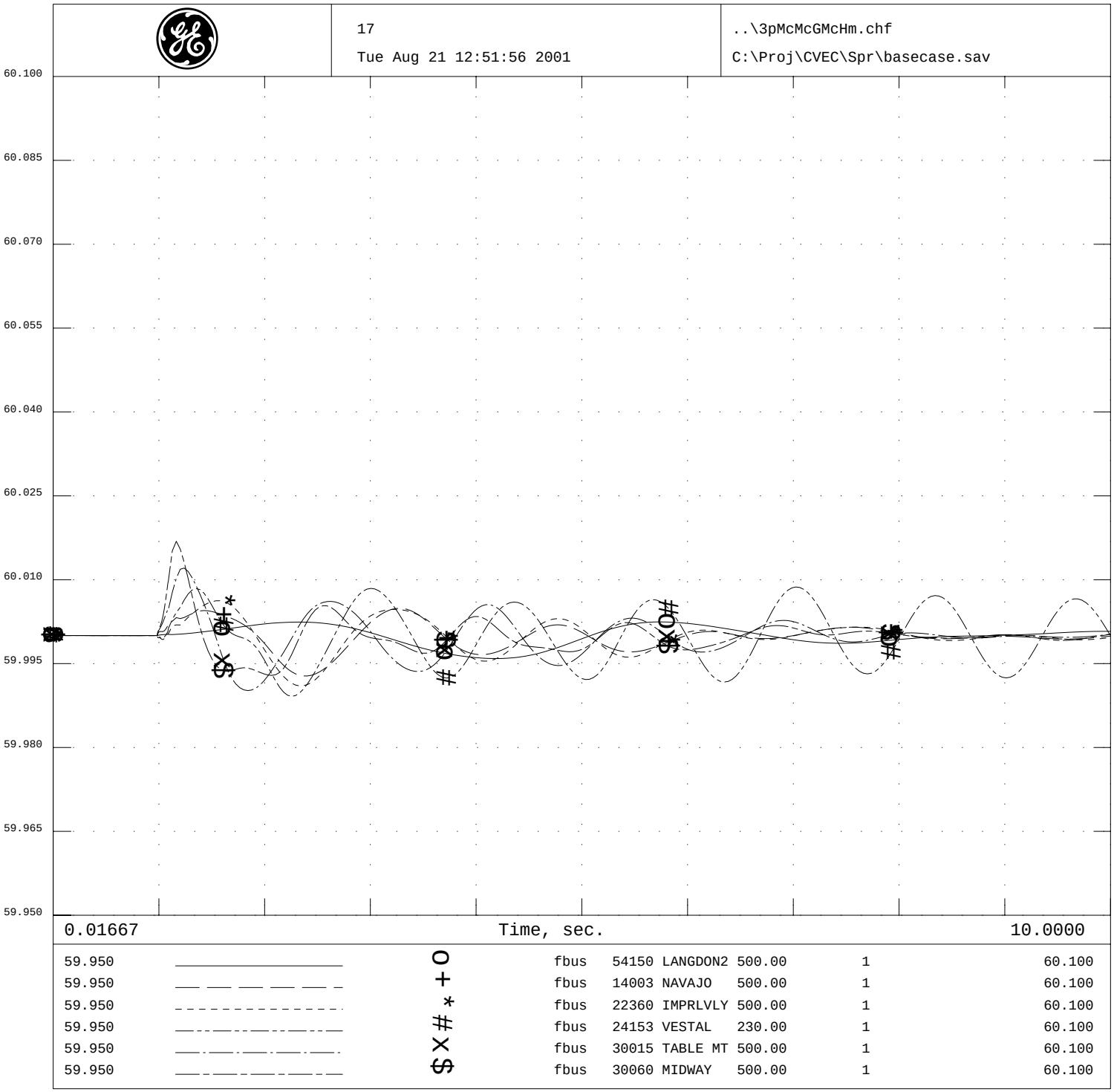

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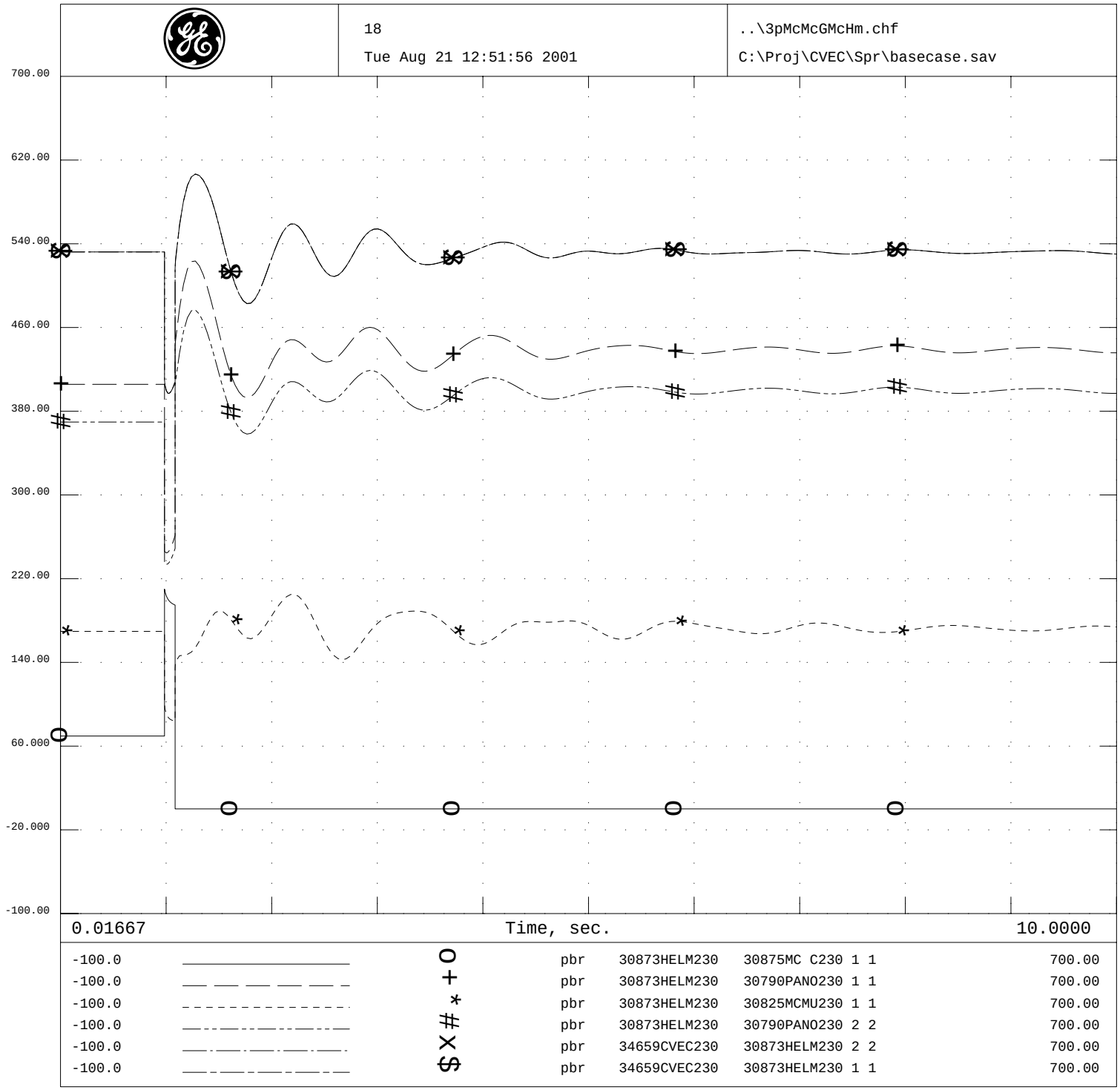

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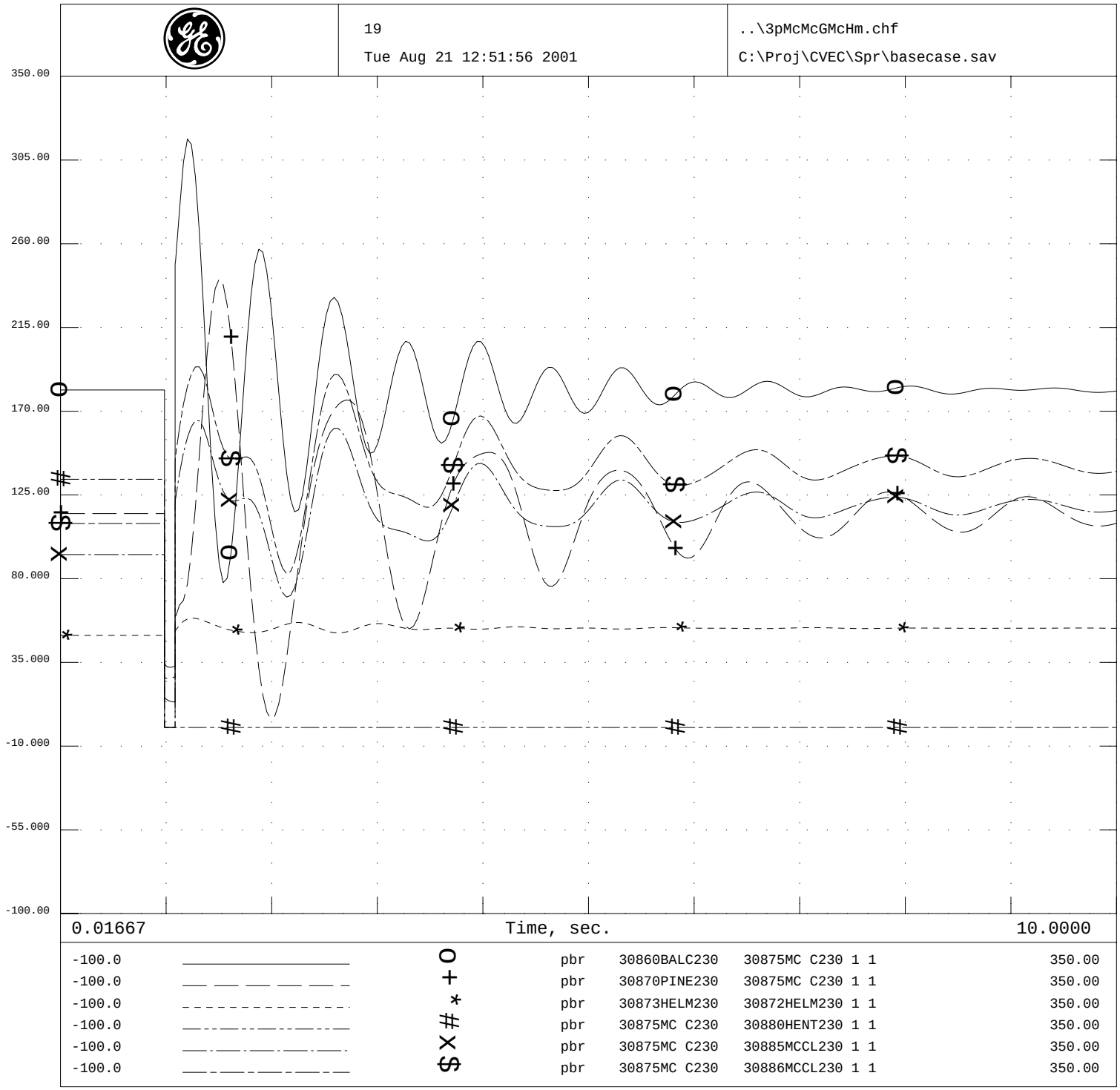

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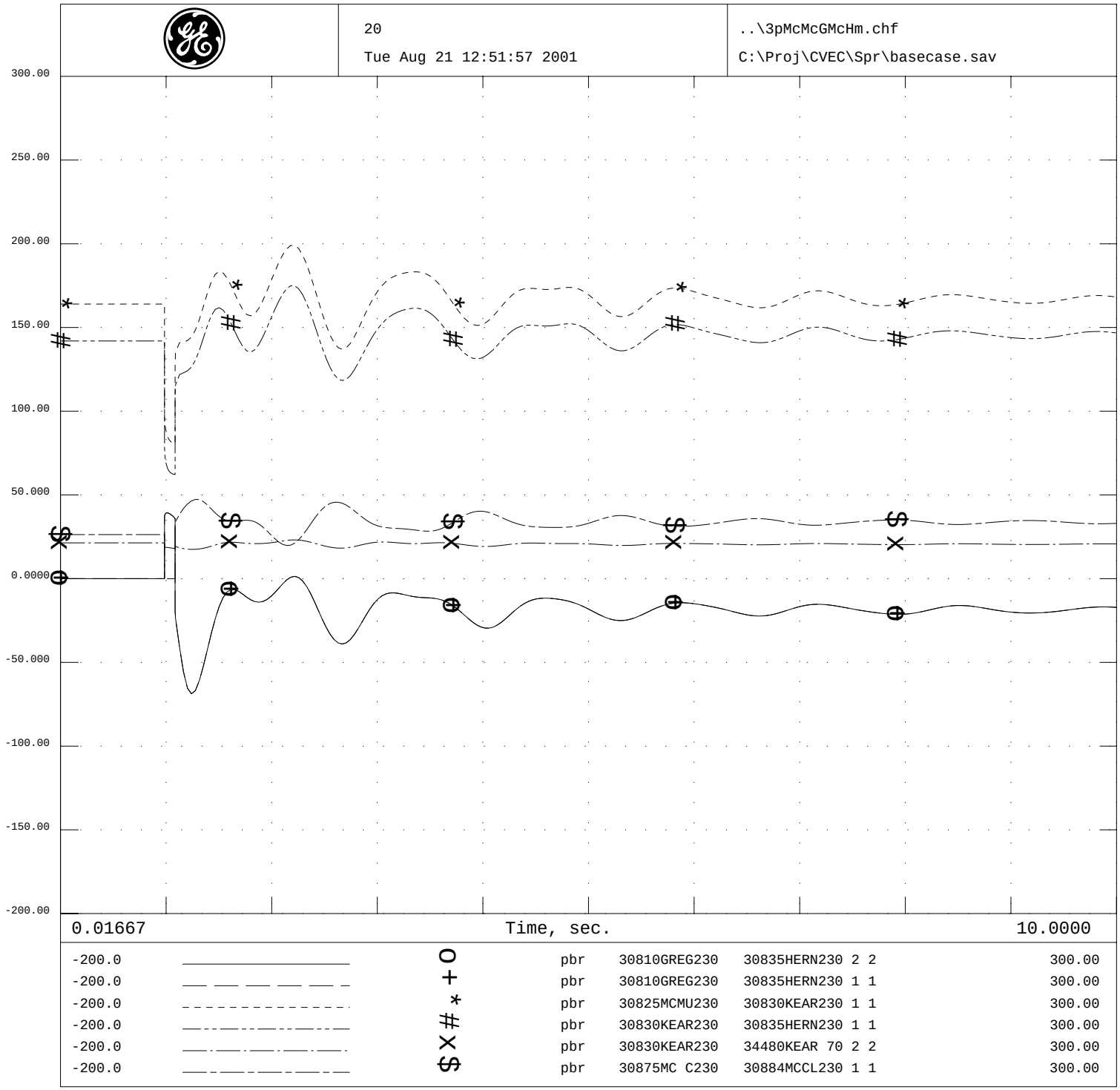

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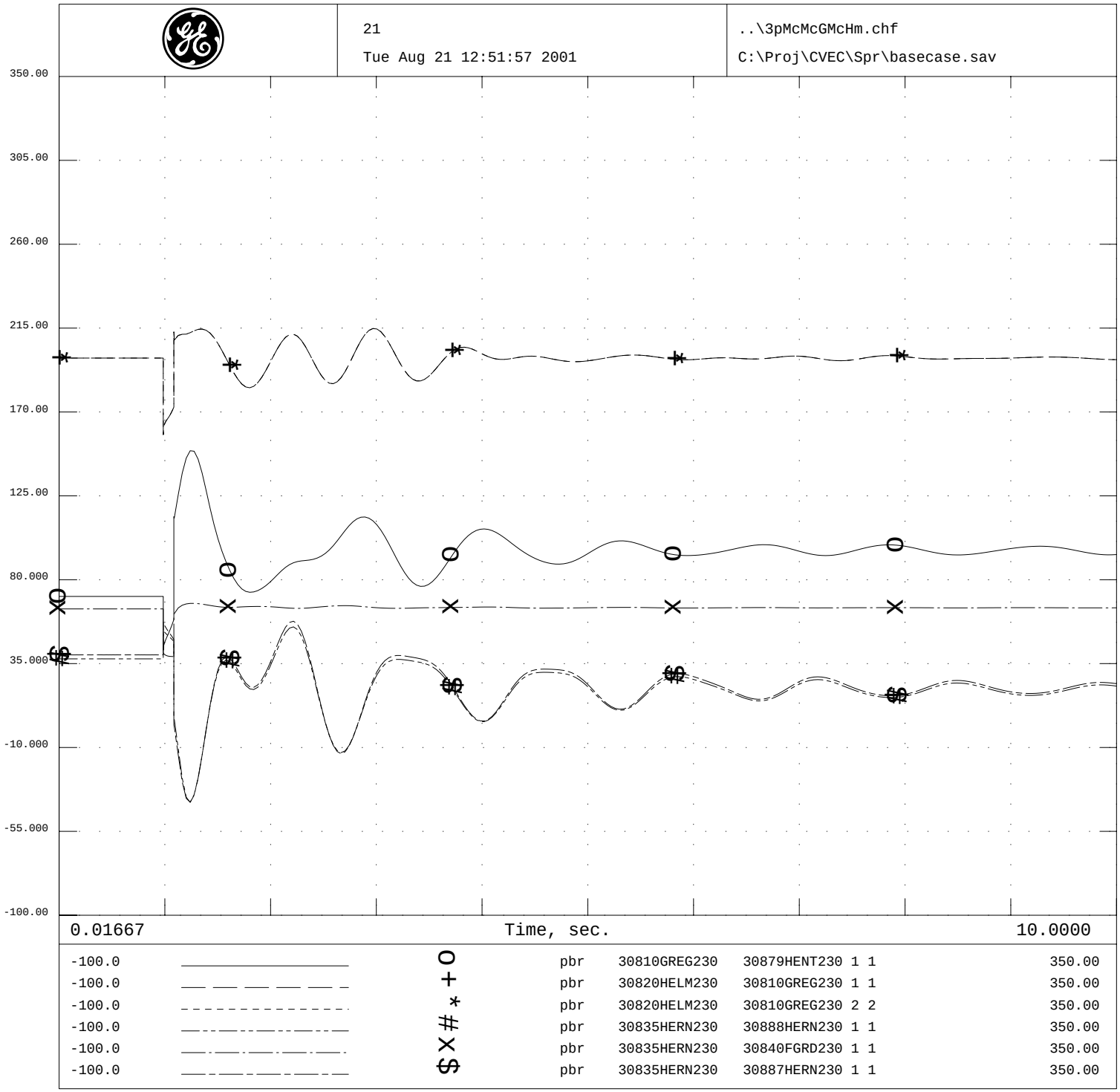

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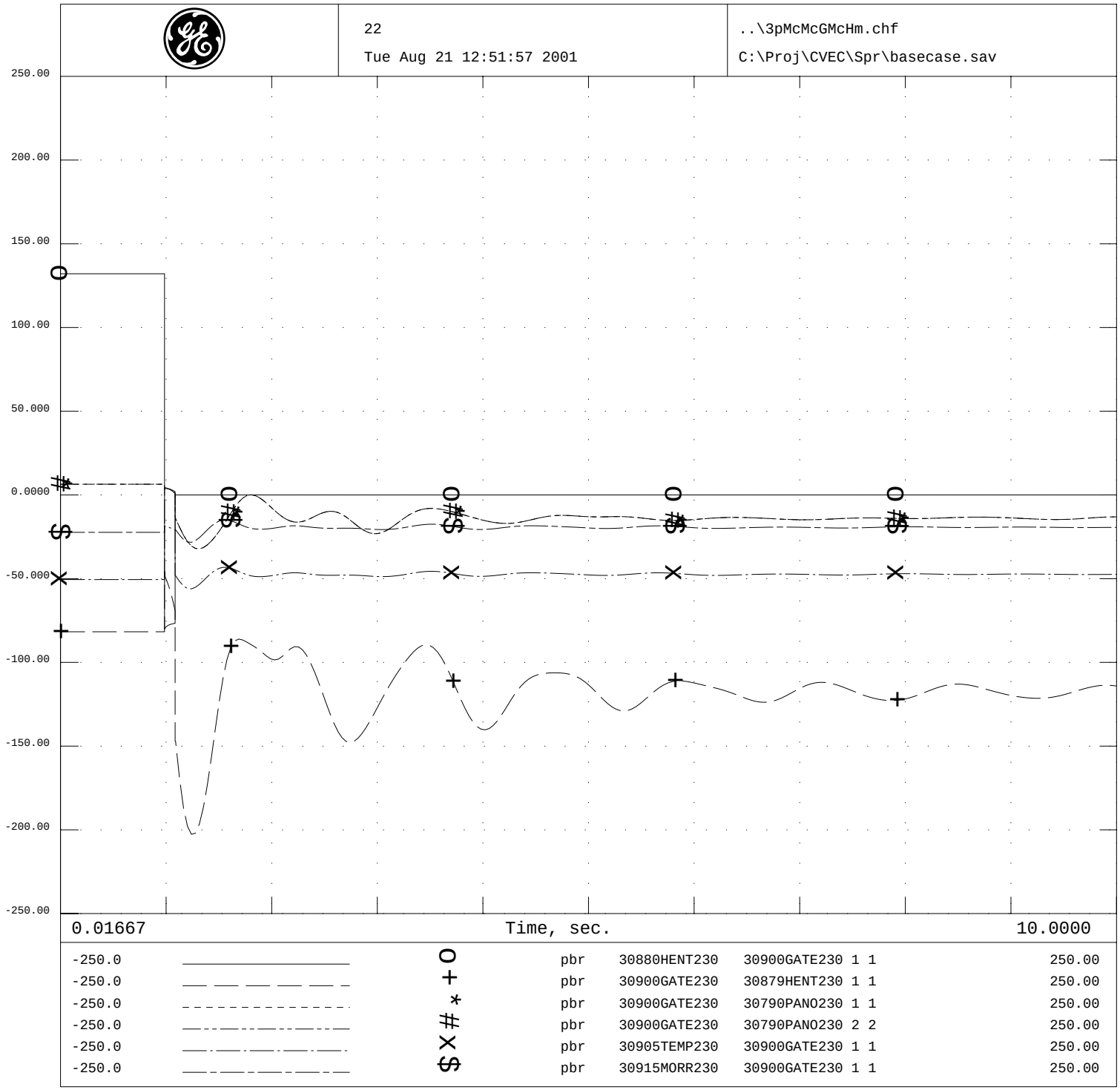

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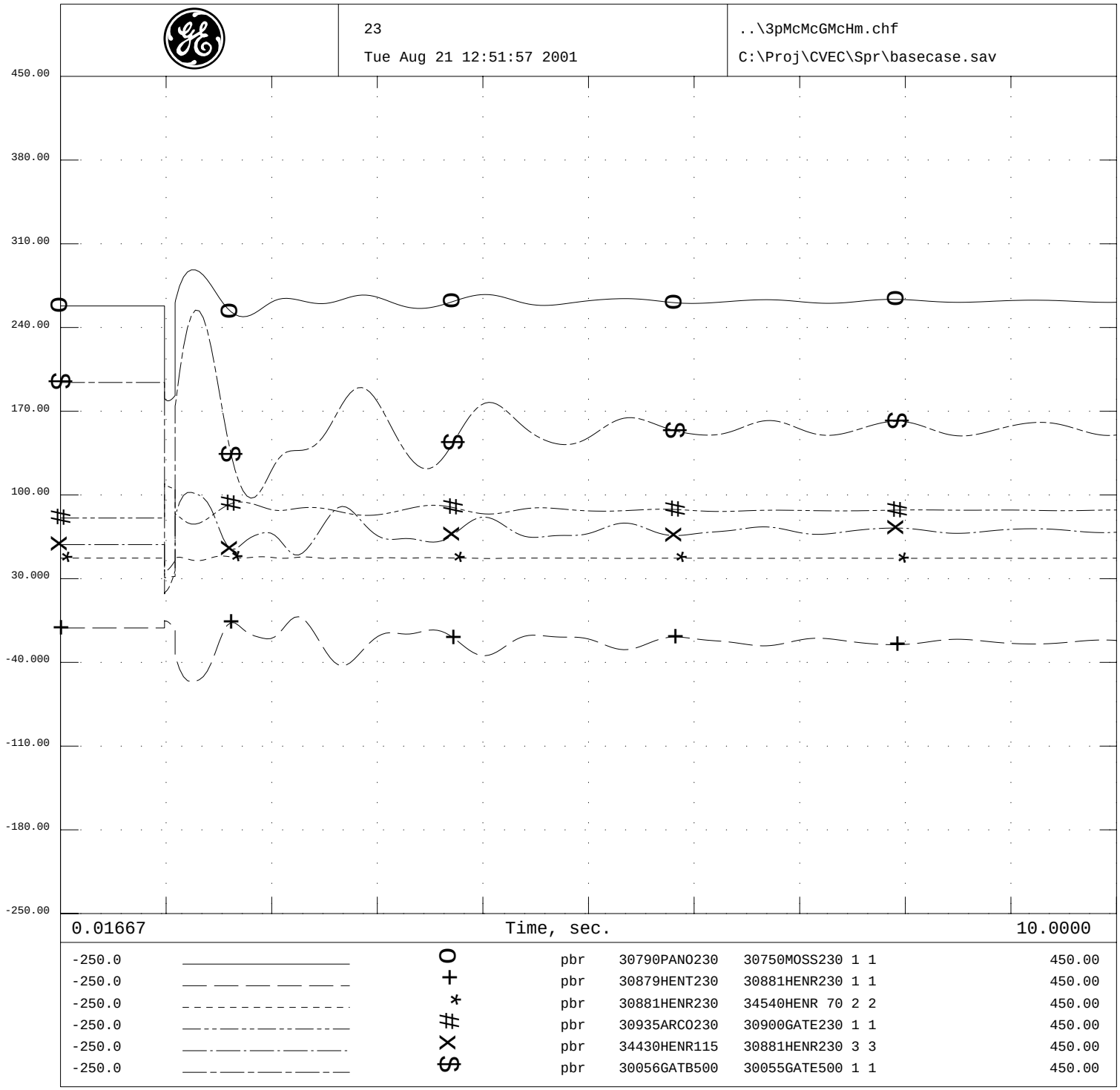

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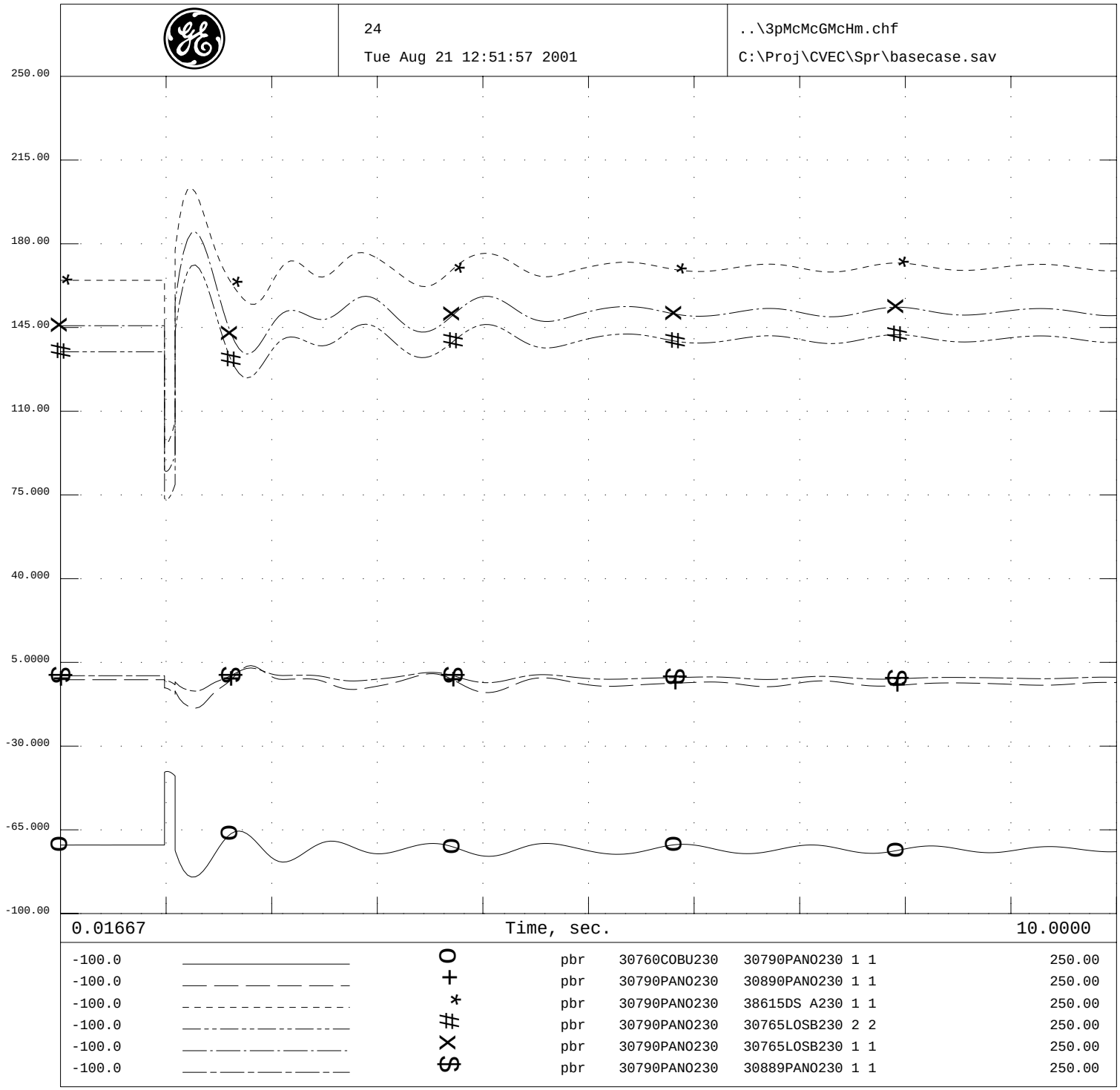

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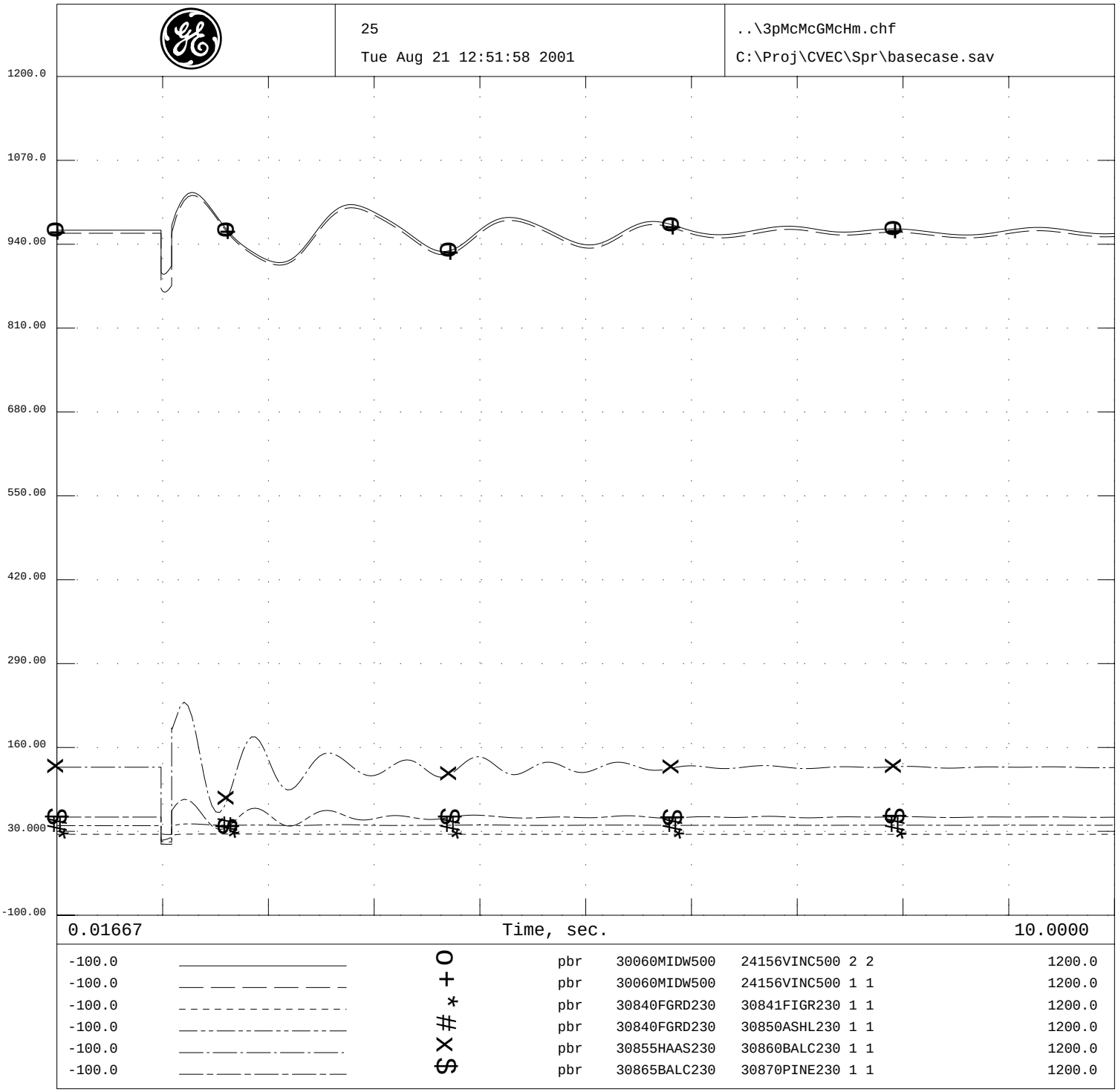

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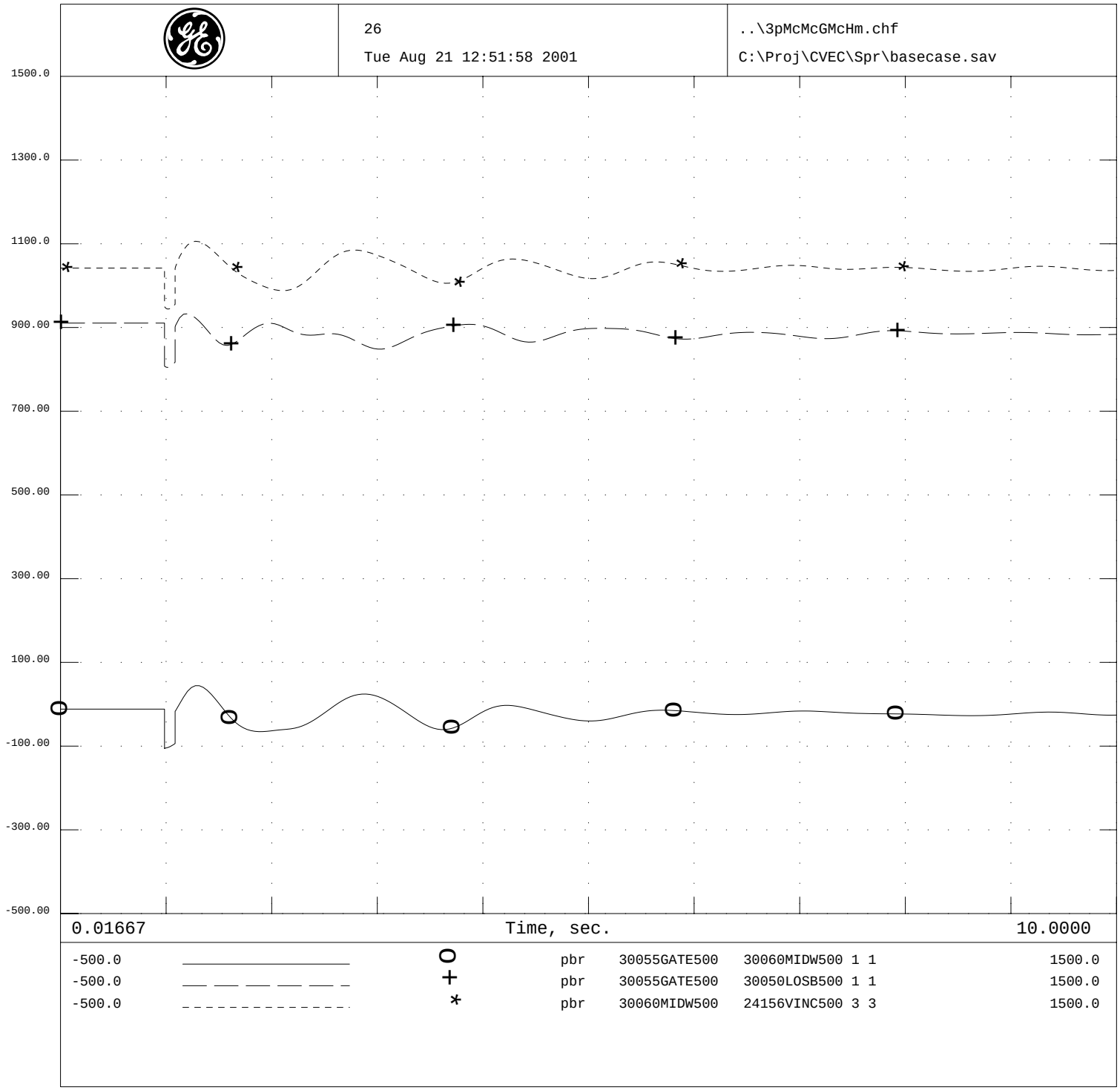

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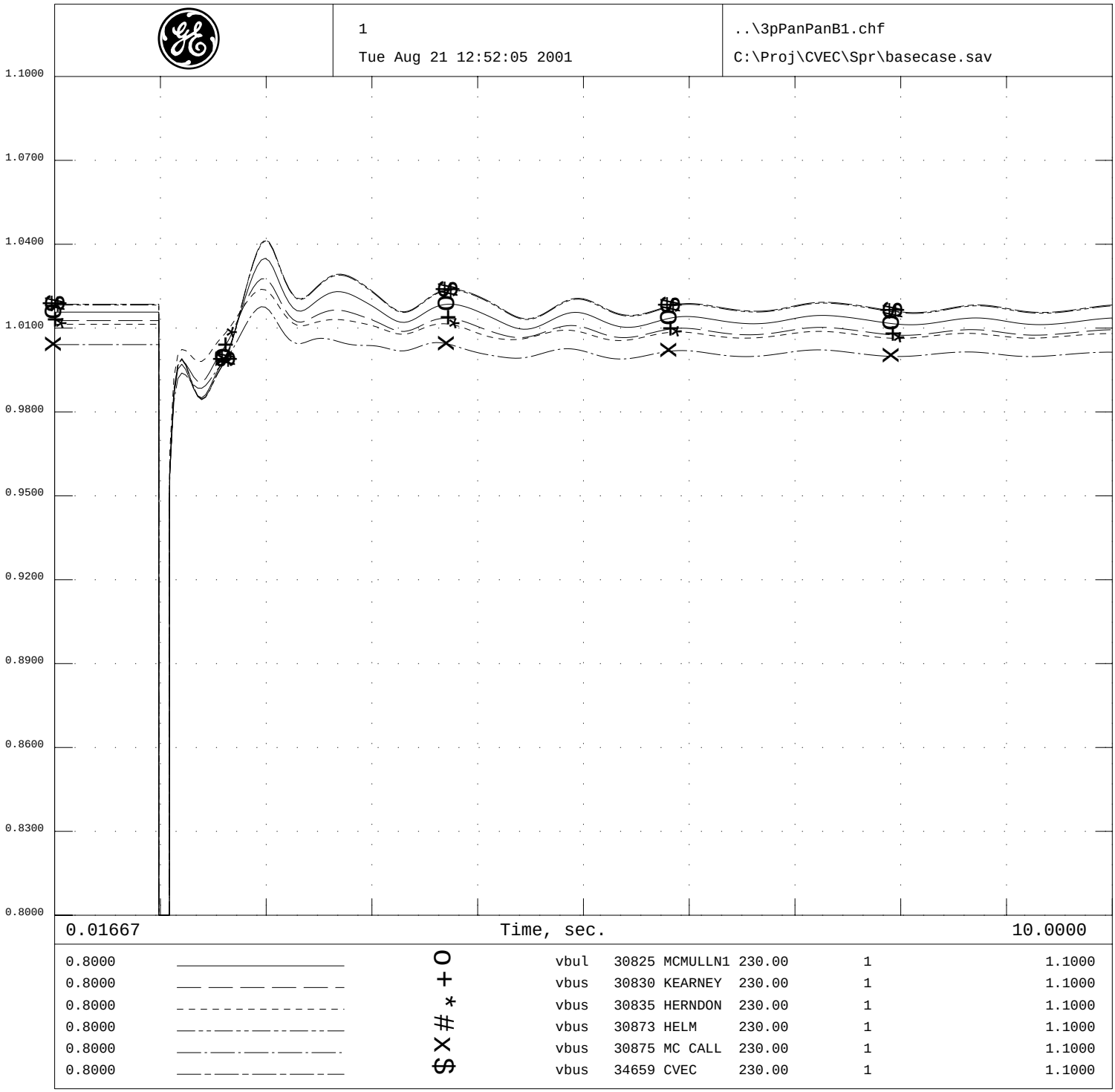

Calpine Corporation - Central Valley Energy Center System Impact Study
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Panoche 230kV Bus #1 Outage
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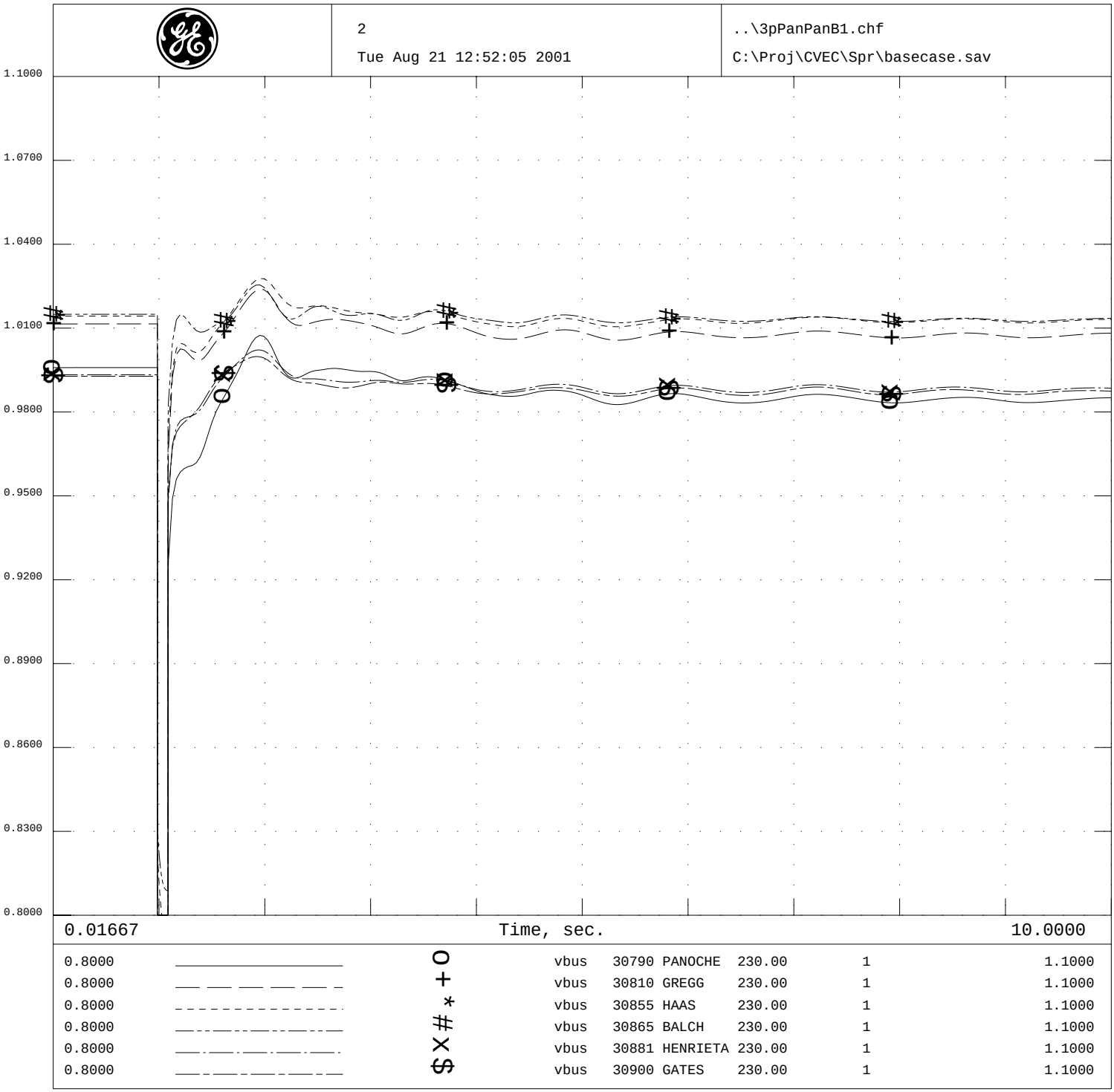
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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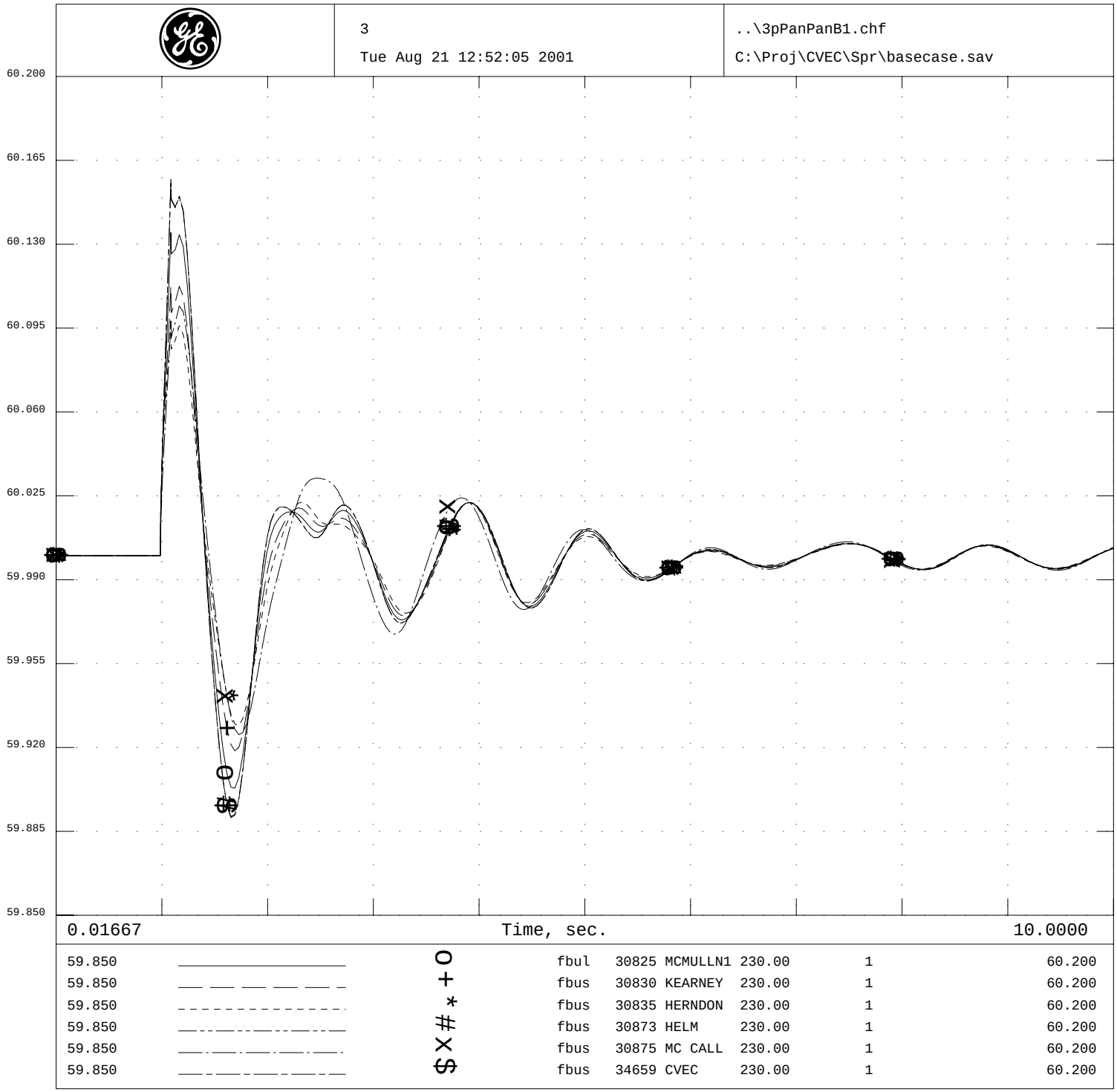

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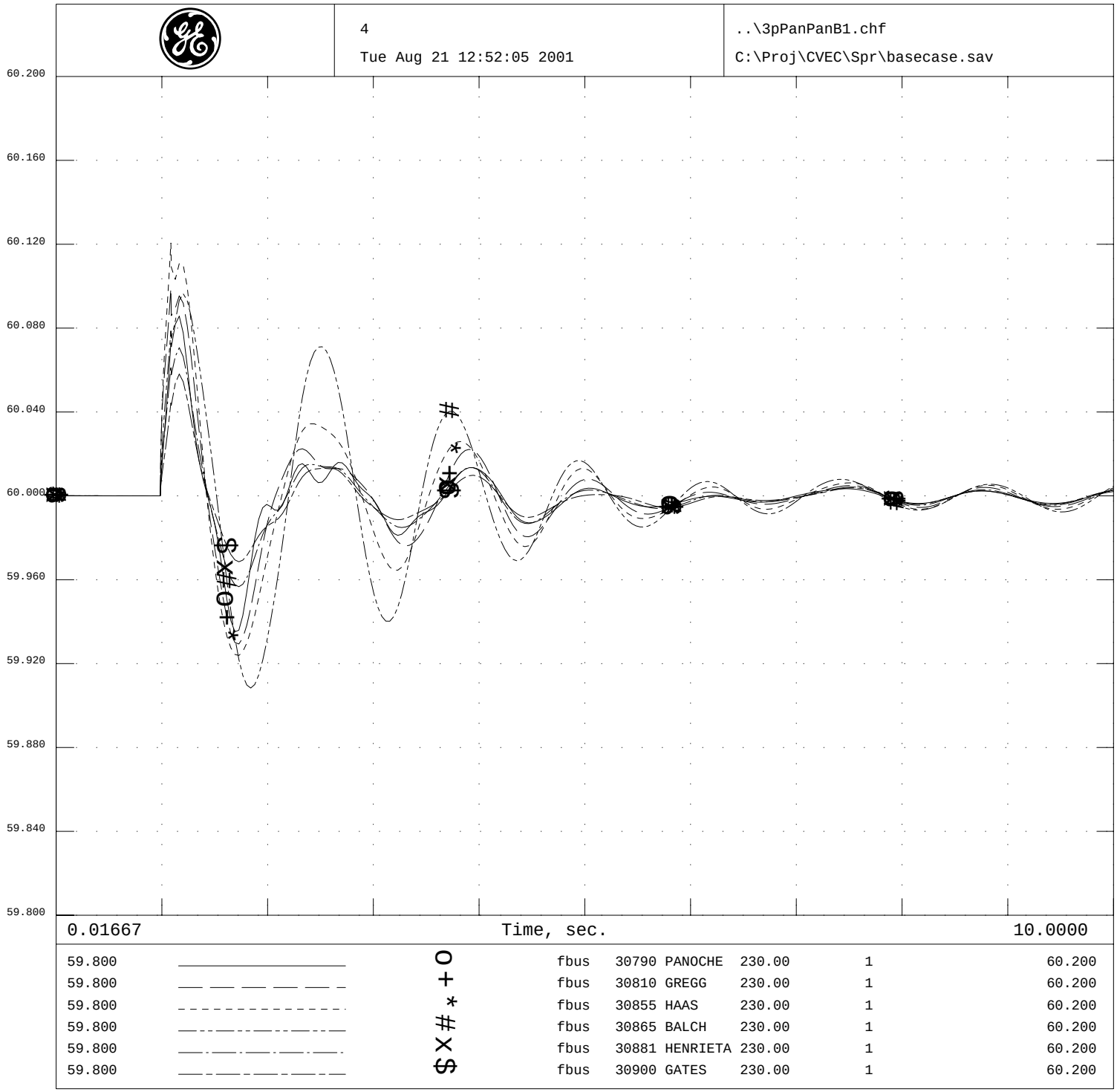

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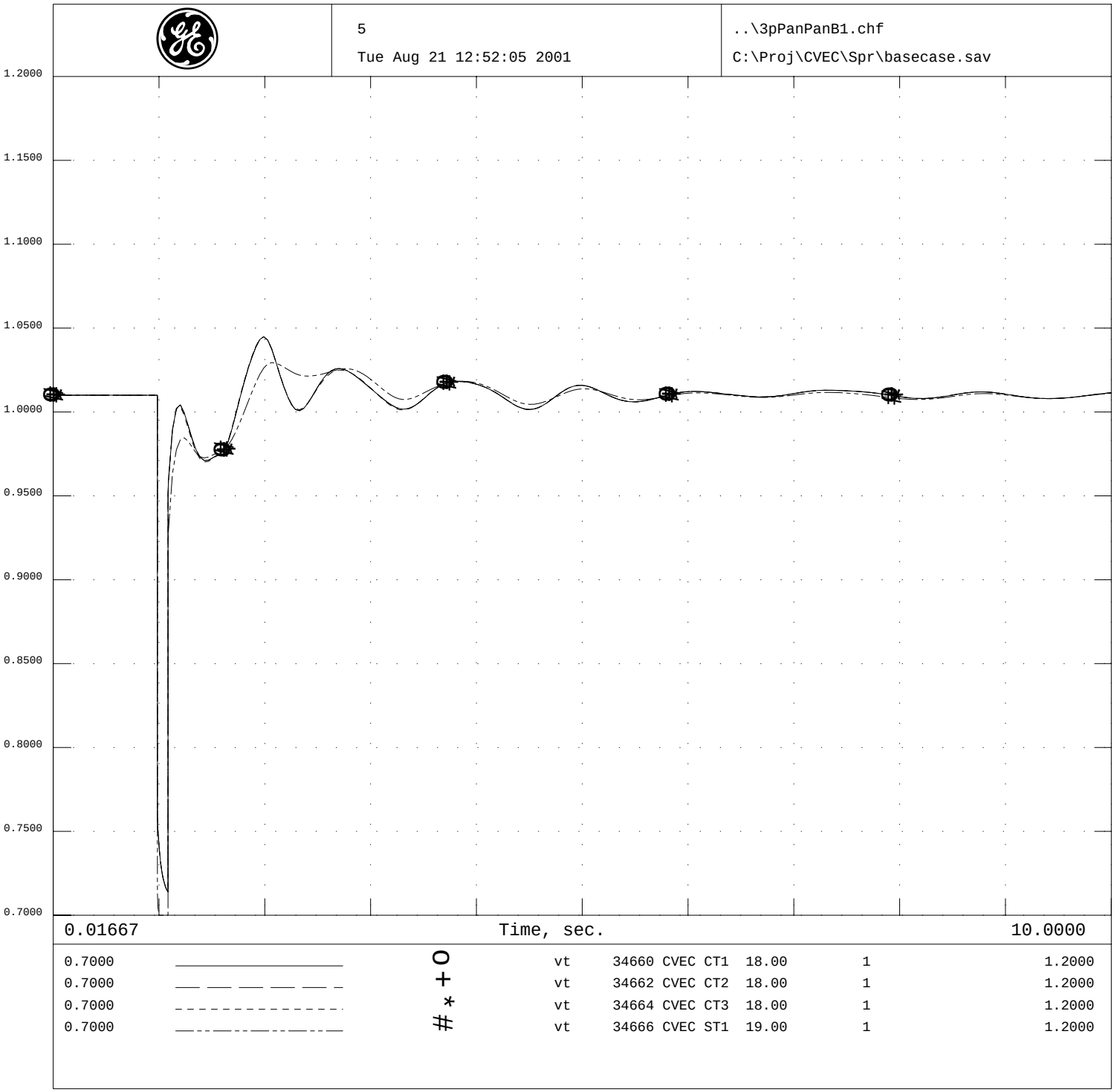

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Calpine Corporation
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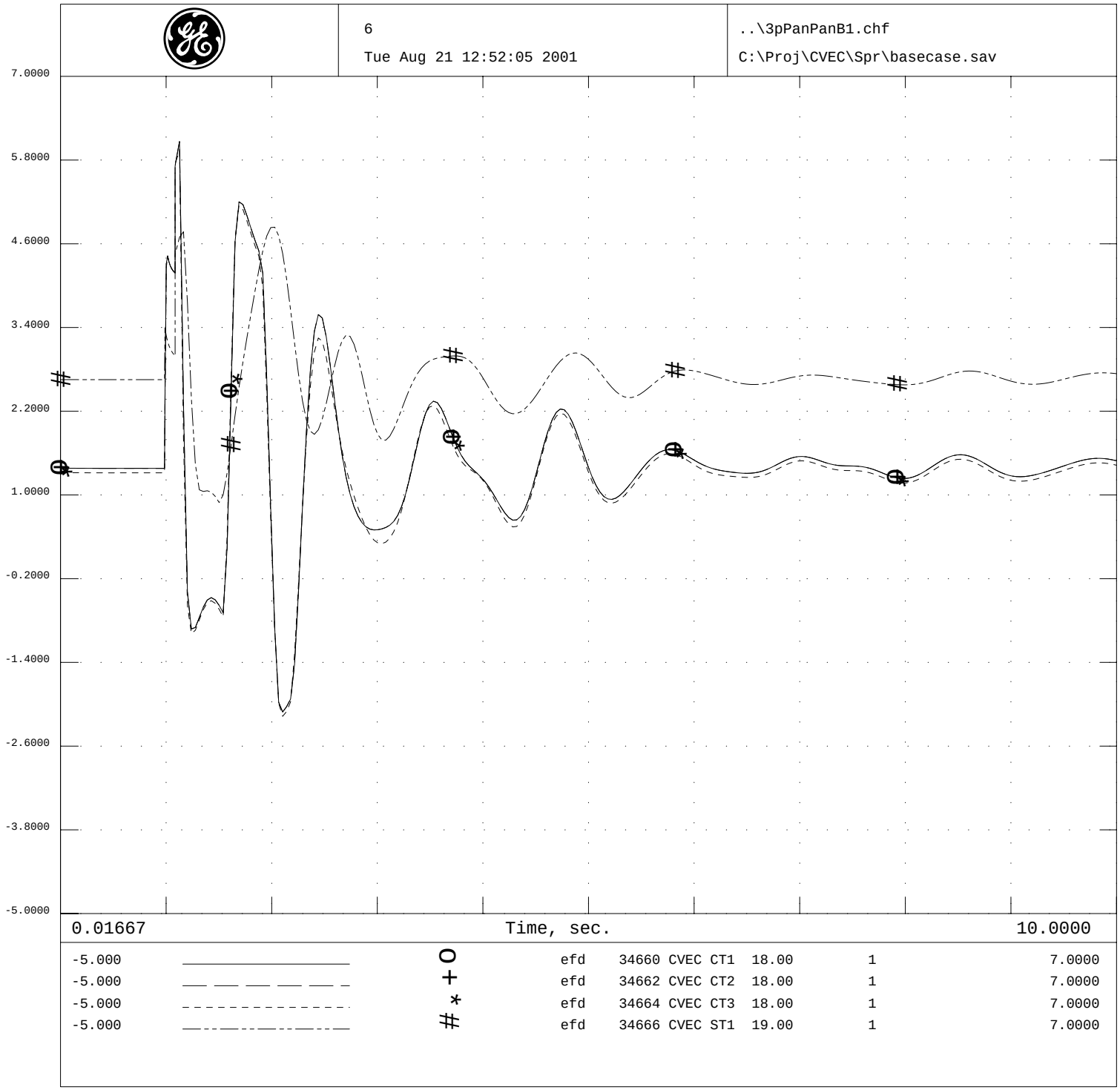

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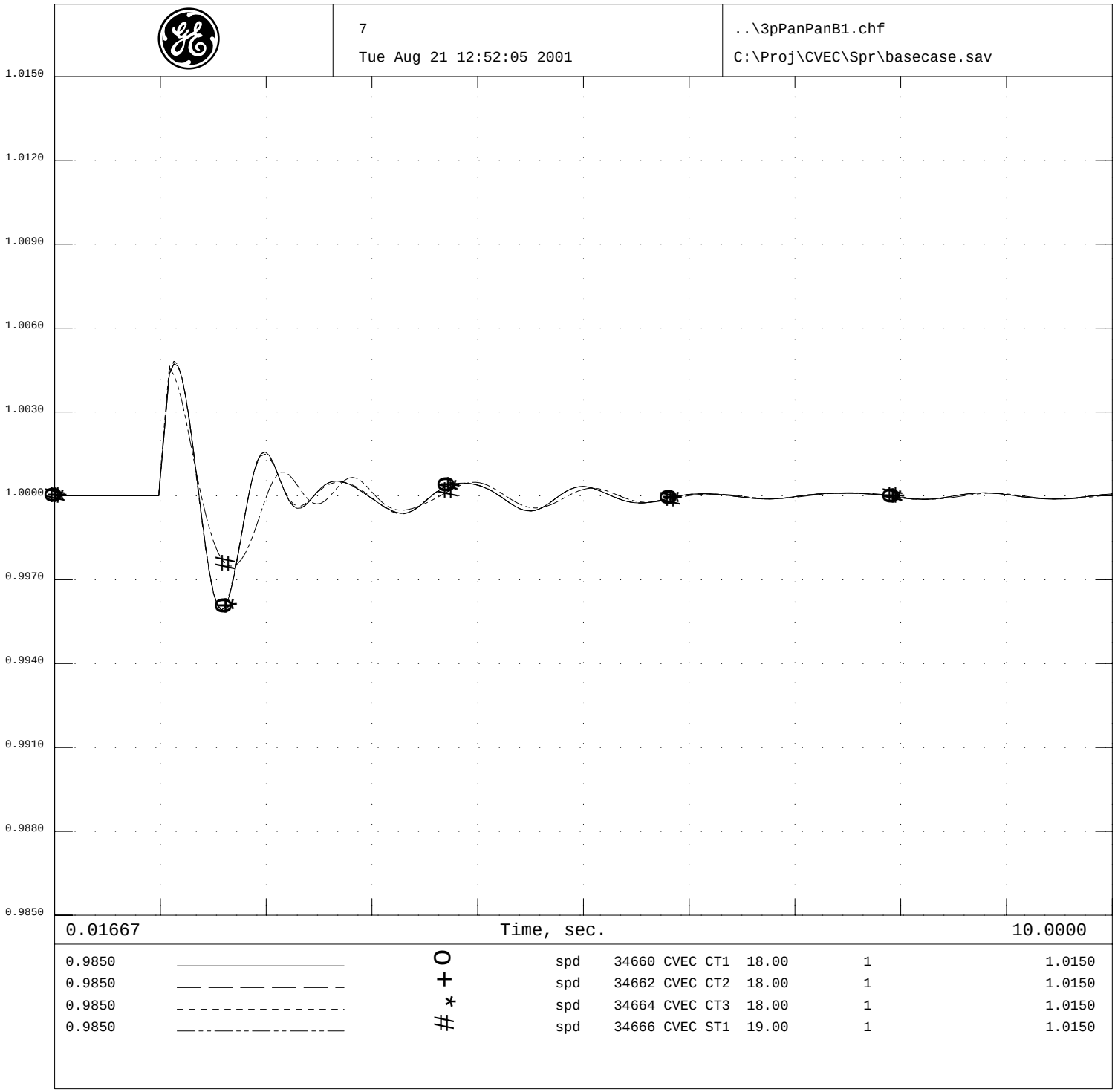

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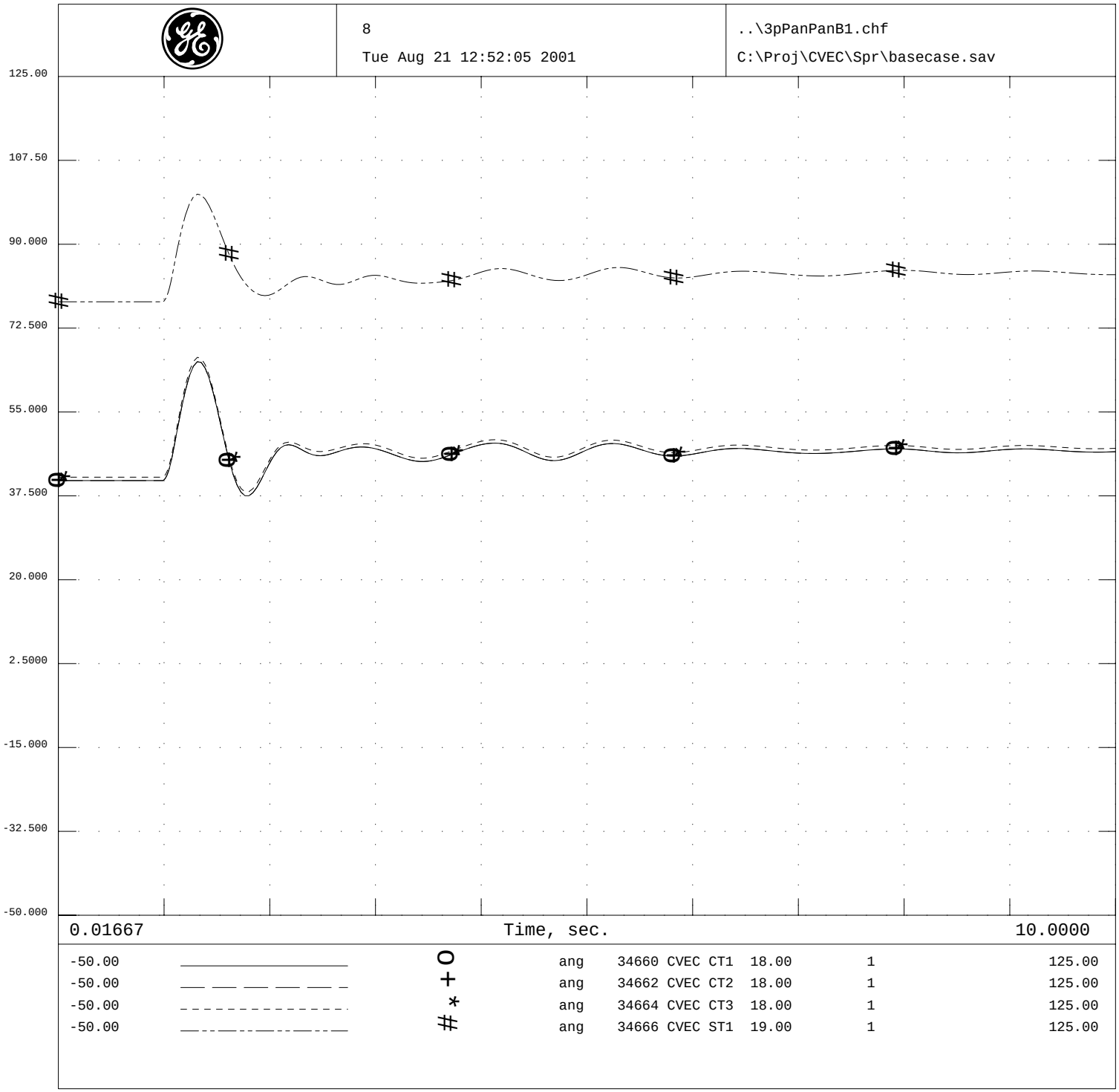
Calpine Corporation
Project Generator Rotor Speed



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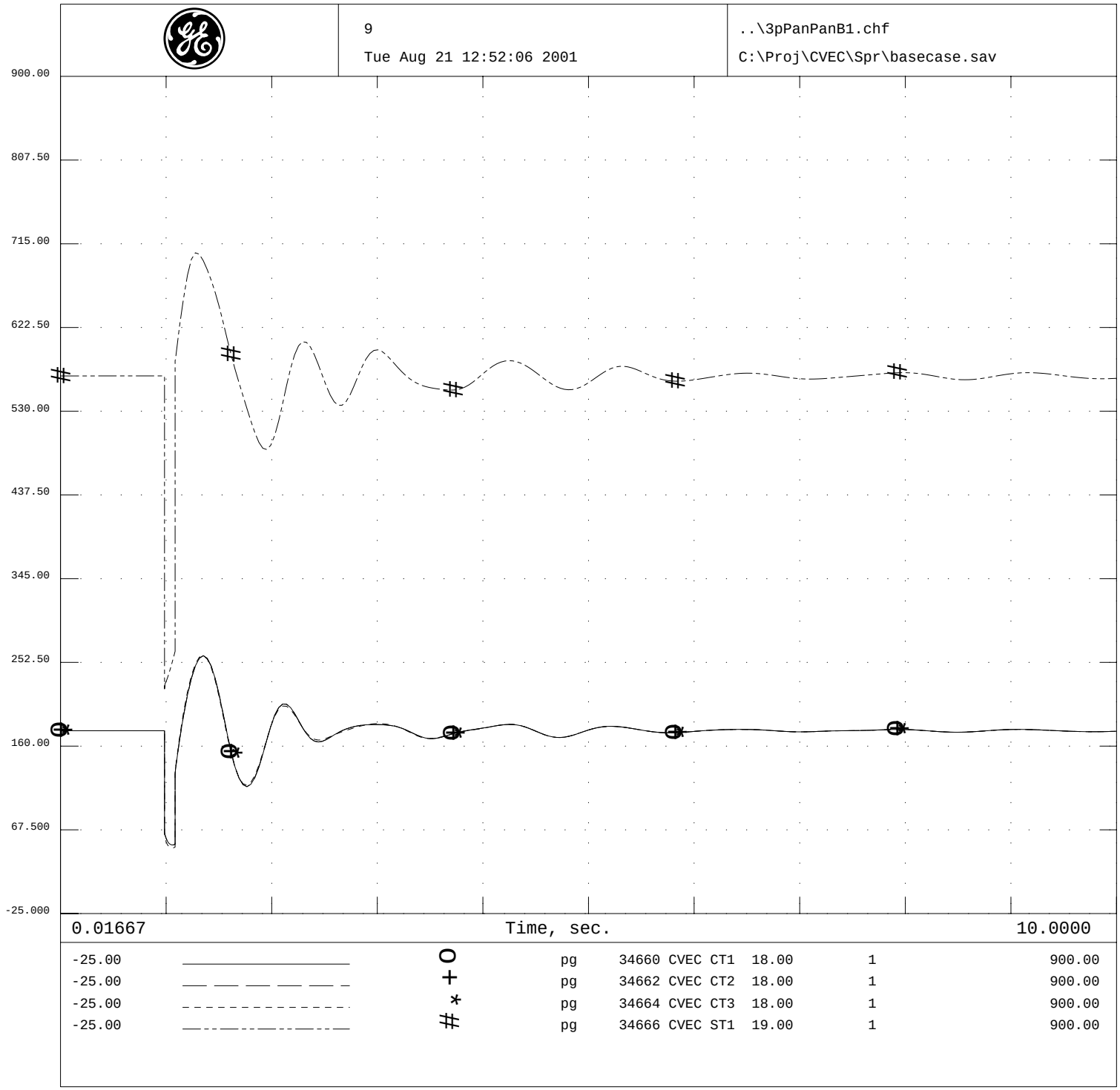

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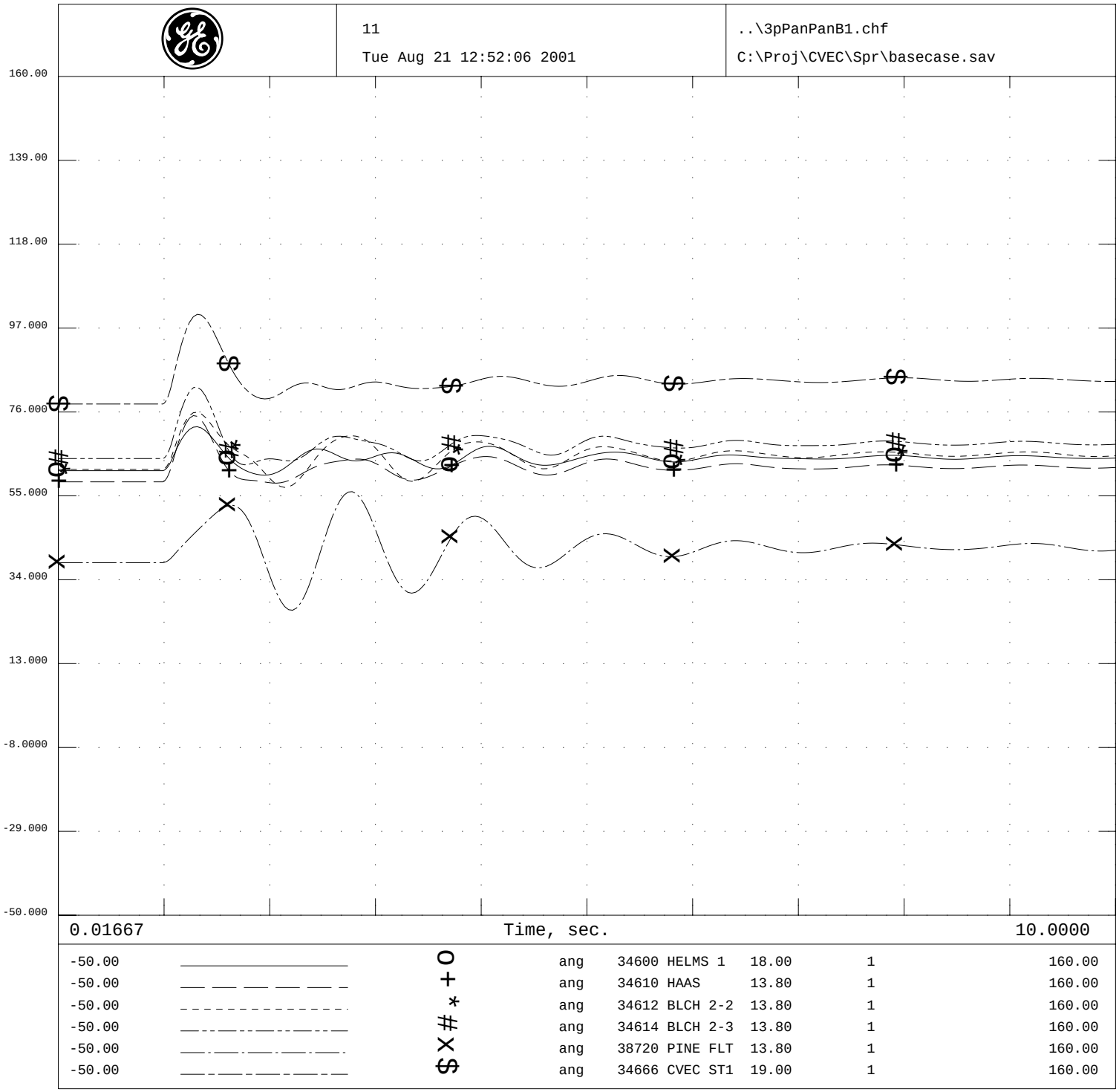

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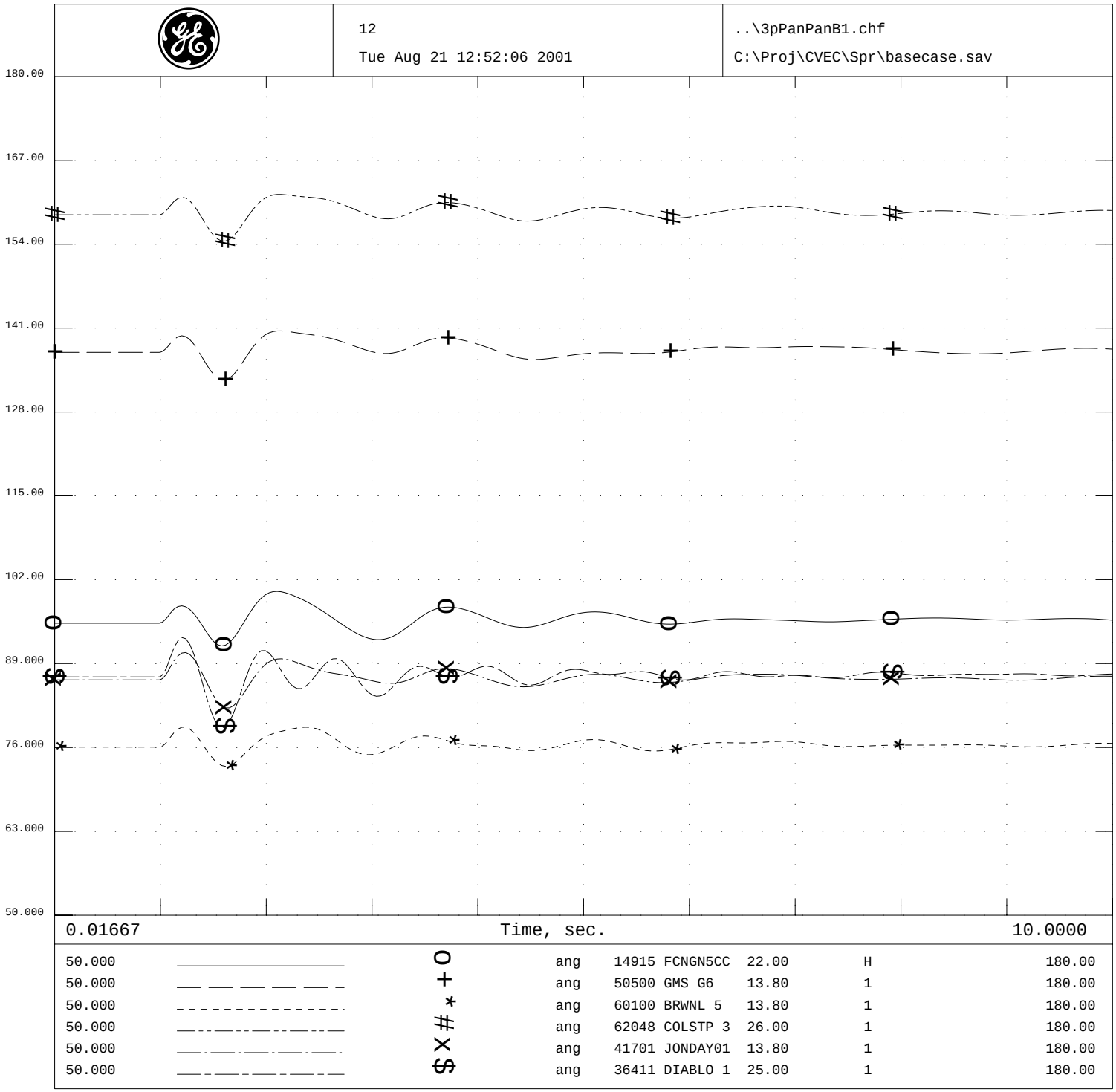

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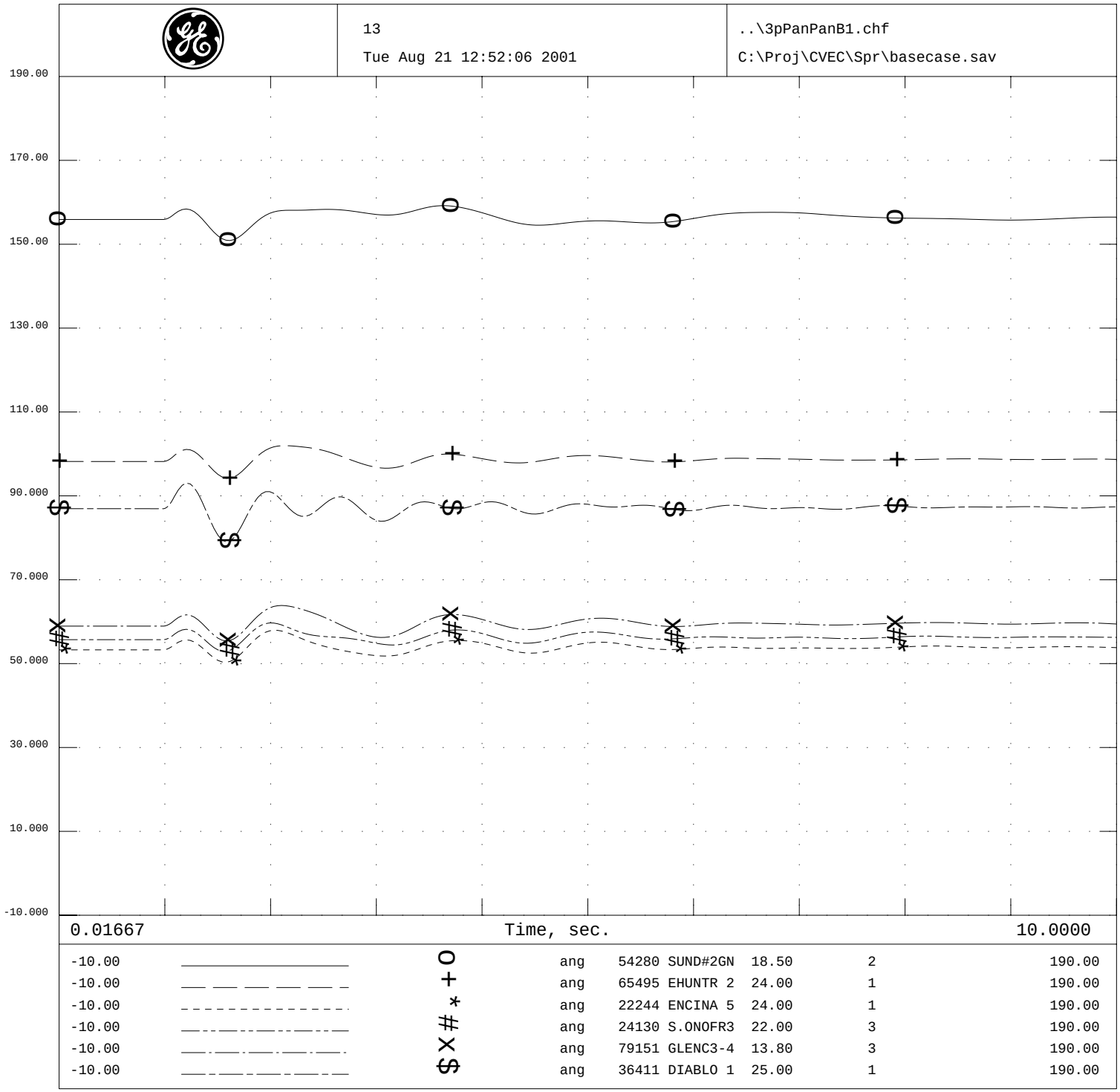

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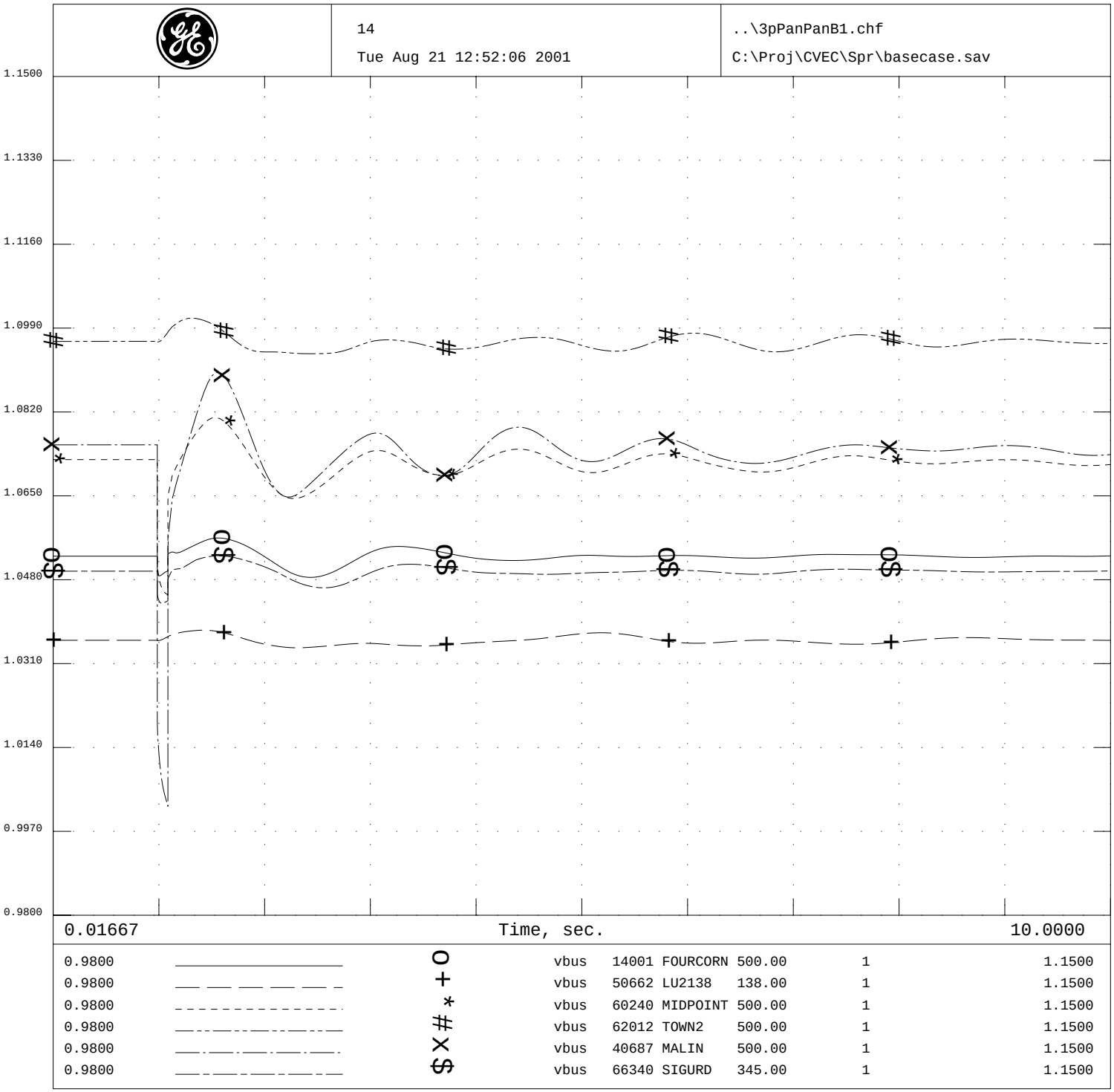
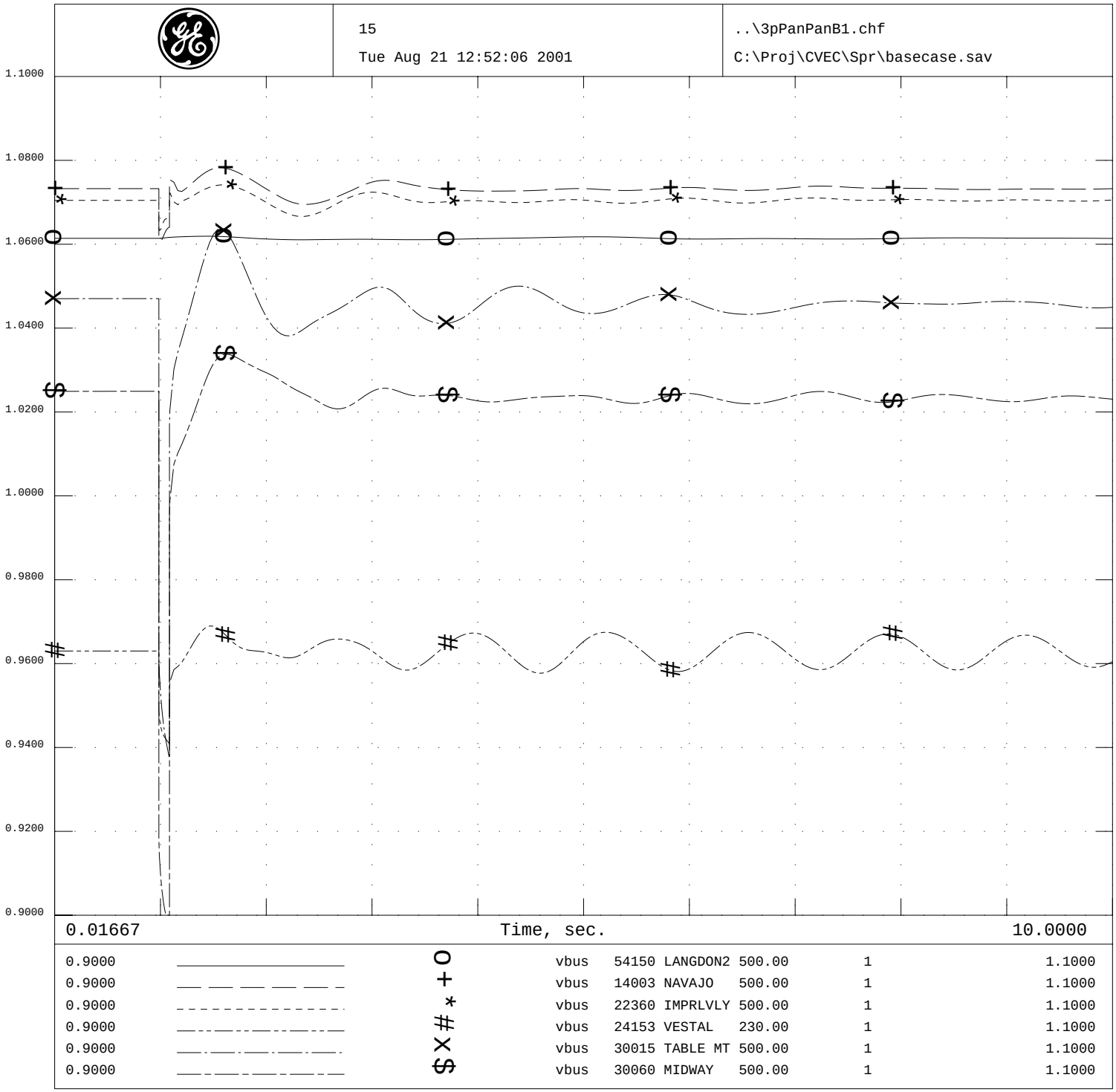
Calpine Corporation
Selected WSCC Transmission Bus Angle Plots



Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Panoche 230kV Bus #1 Outage
3 phase 6 cycle fault at Panoche 230kV bus and clear bus #1

Central Valley Energy Center
Calpine Corporation
Selected WSCC Transmission Bus Voltage Plots



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Calpine Corporation
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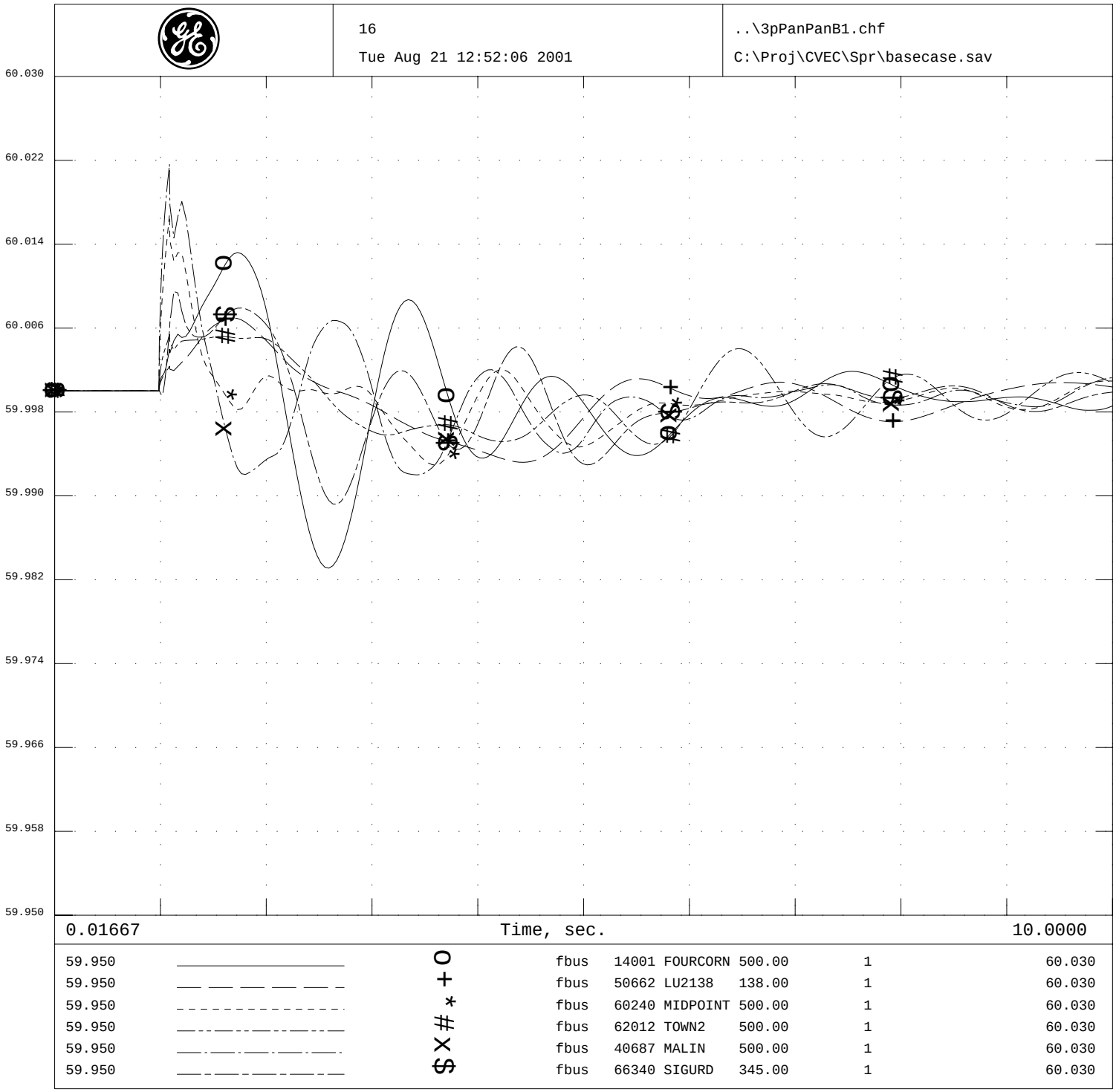

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2004 Heavy Spring Base Case
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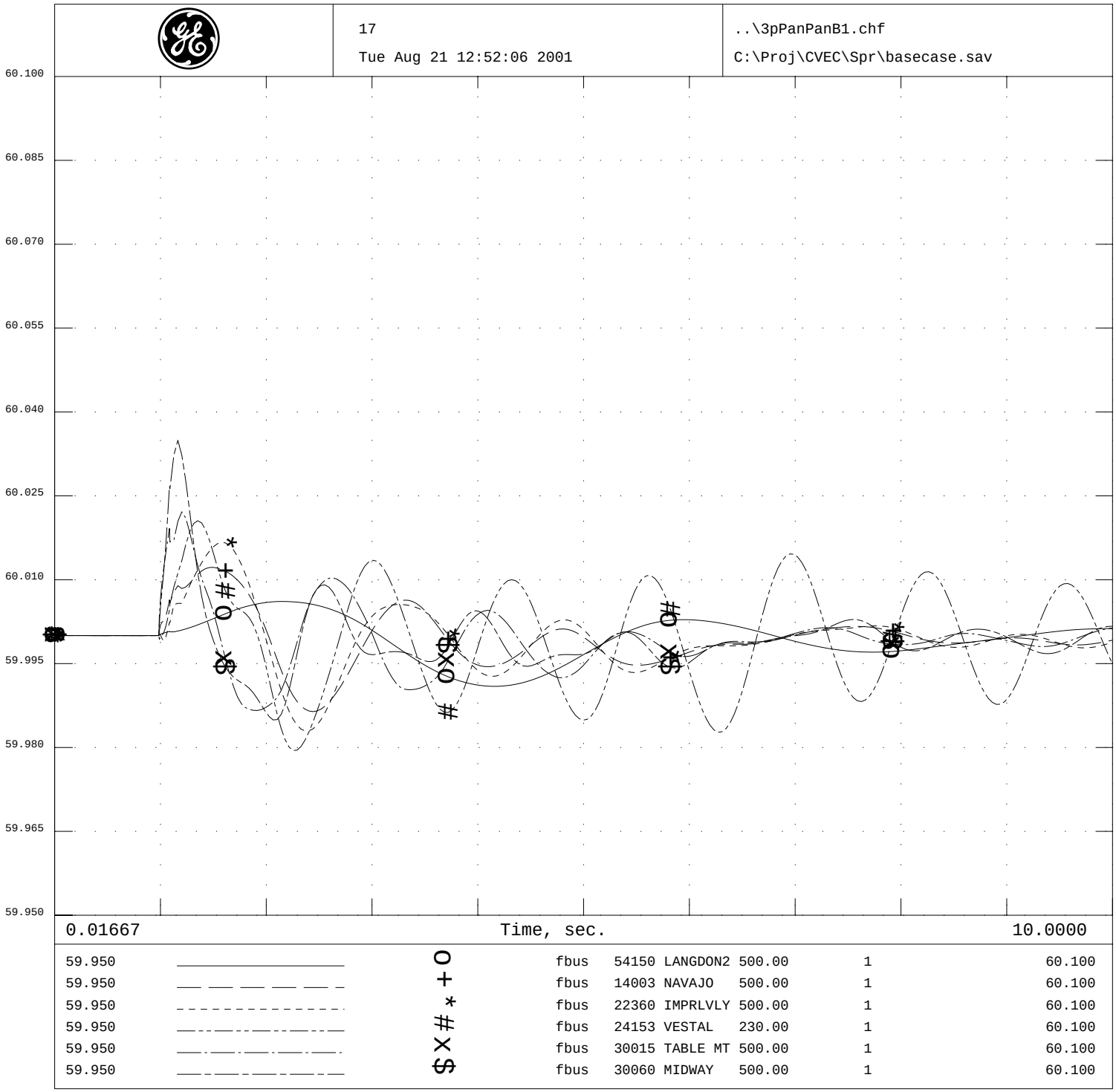
Calpine Corporation
Selected WSCC Transmission Bus Frequency Plots



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Calpine Corporation
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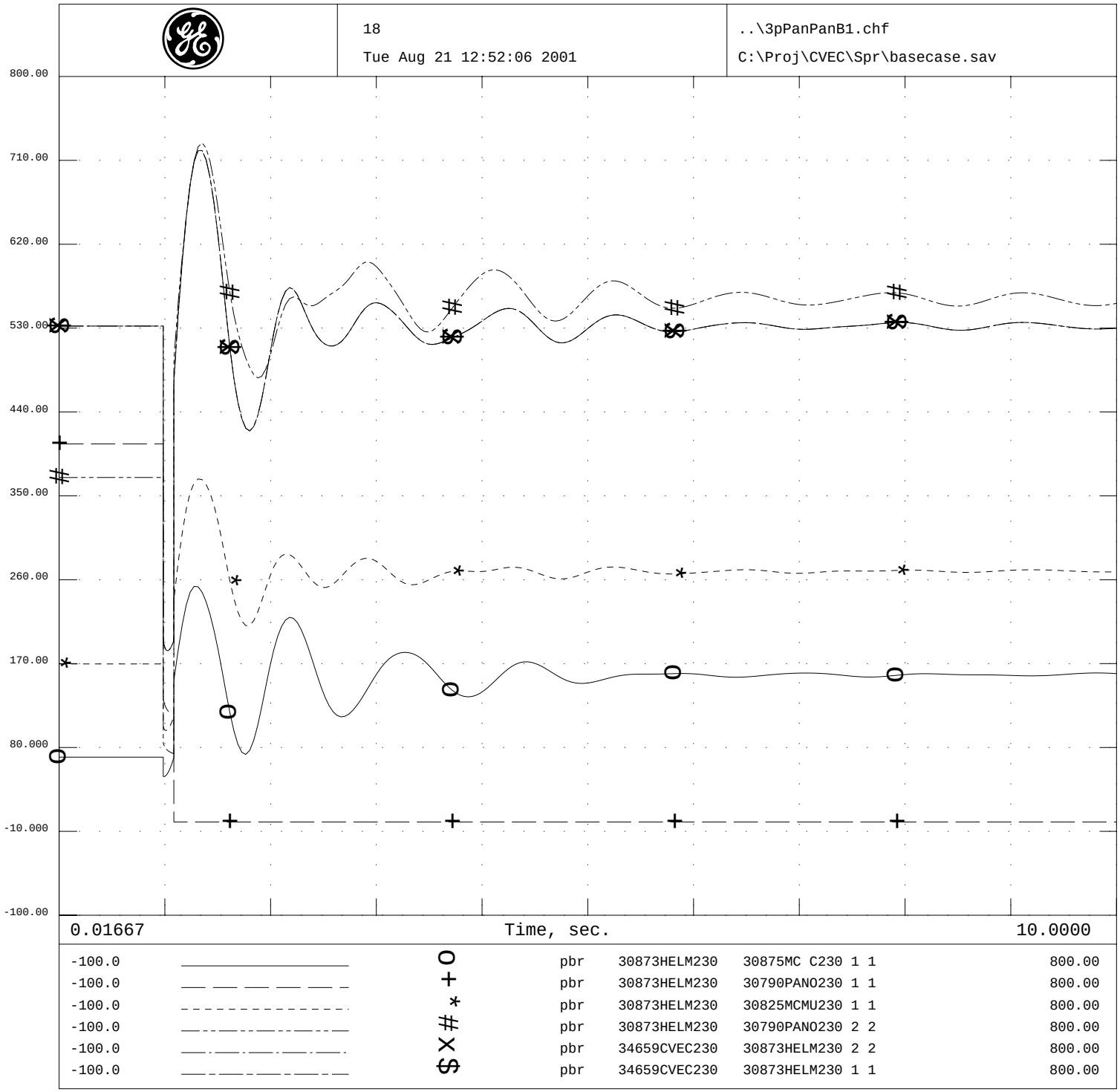

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2004 Heavy Spring Base Case
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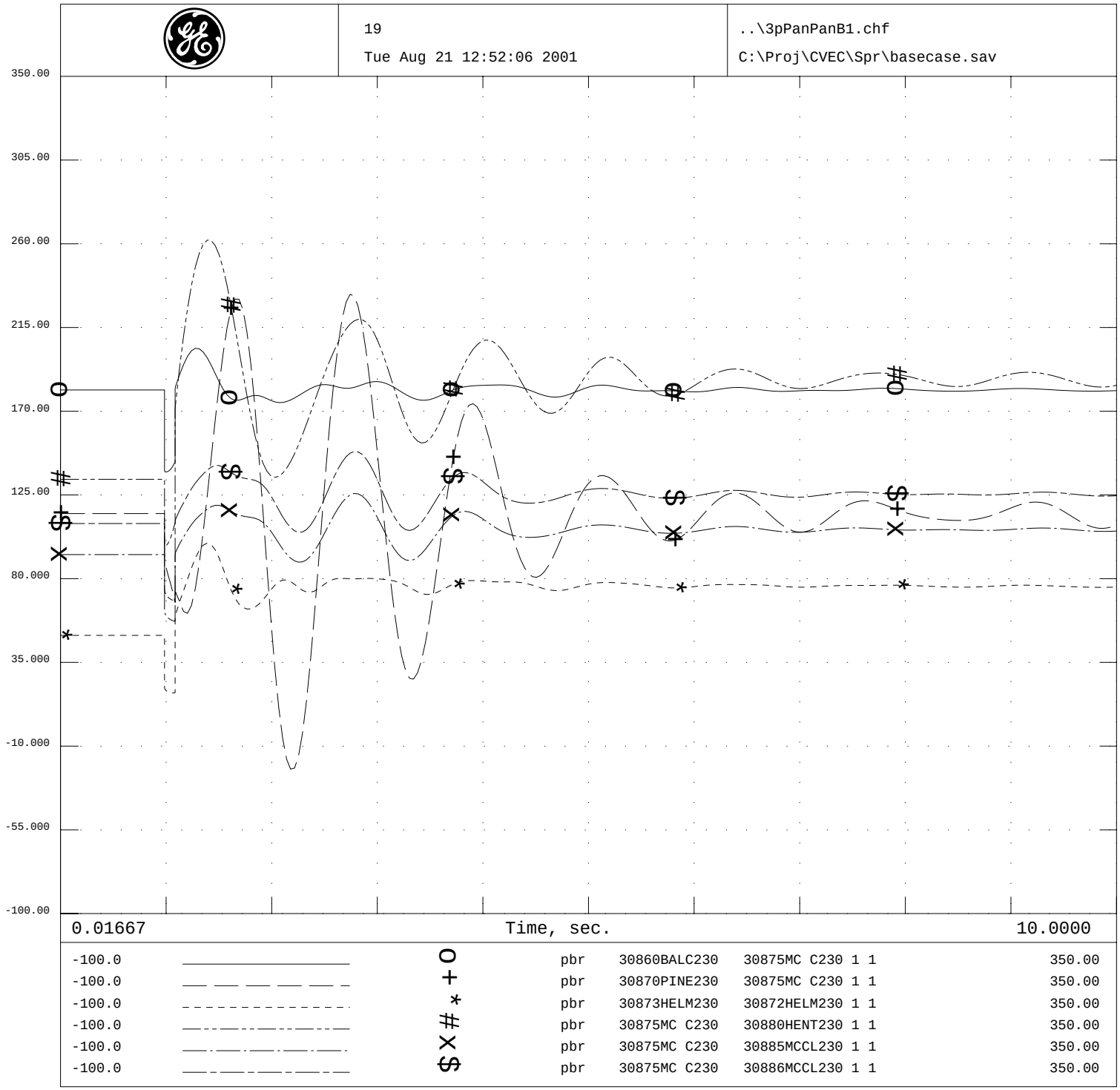
Central Valley Energy Center
Calpine Corporation
Selected Transmission Line Flows (MW)



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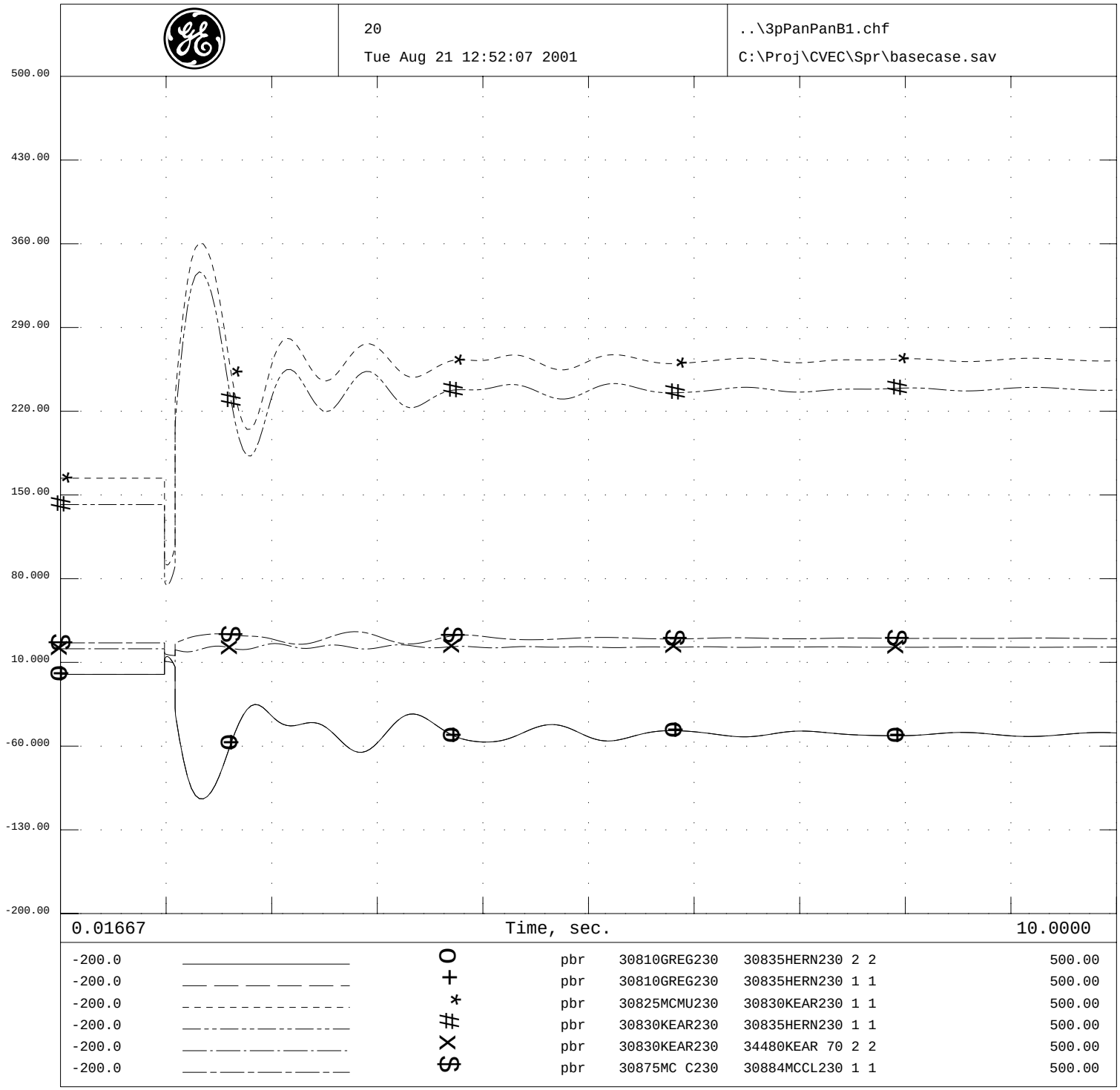

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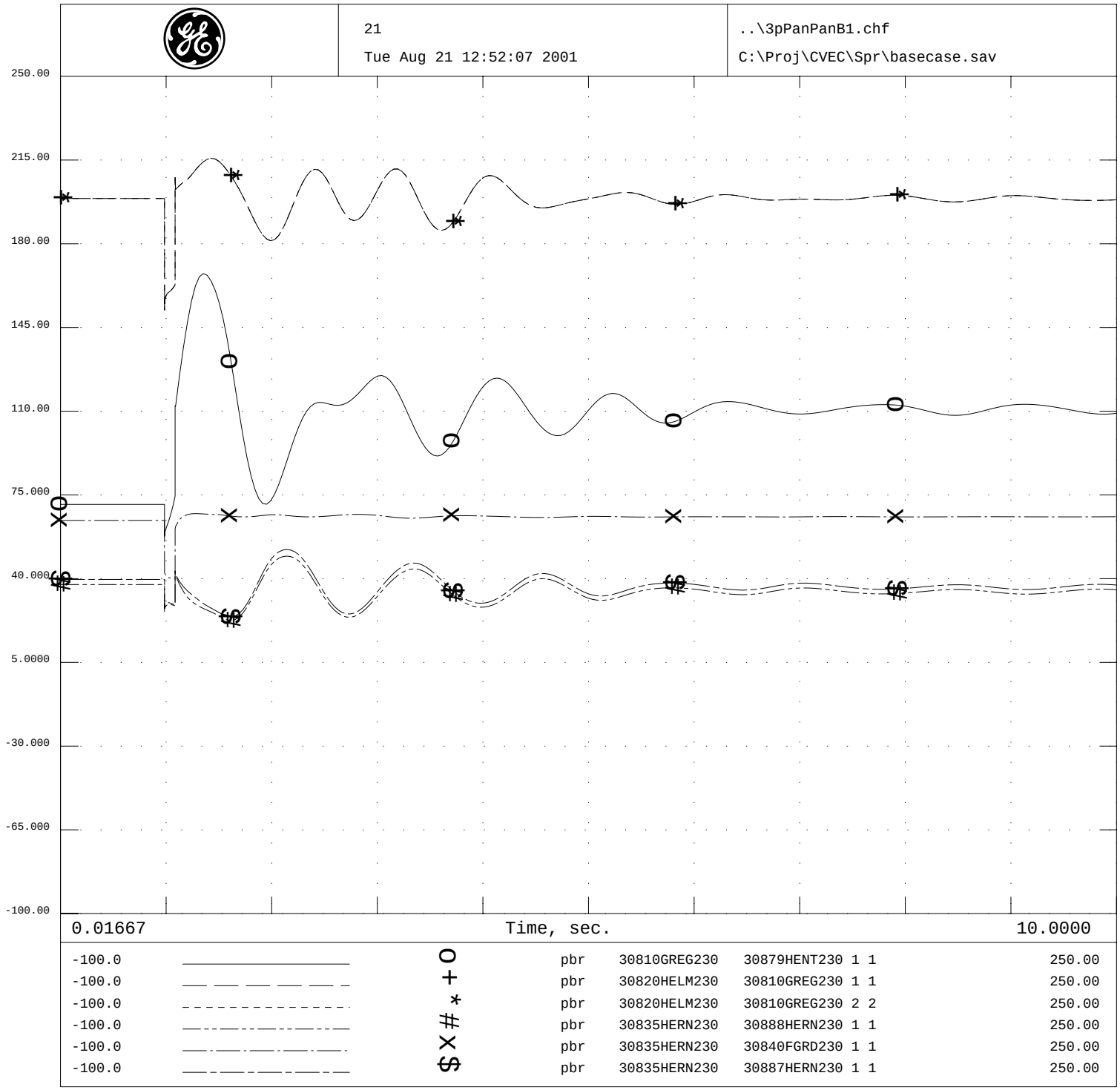

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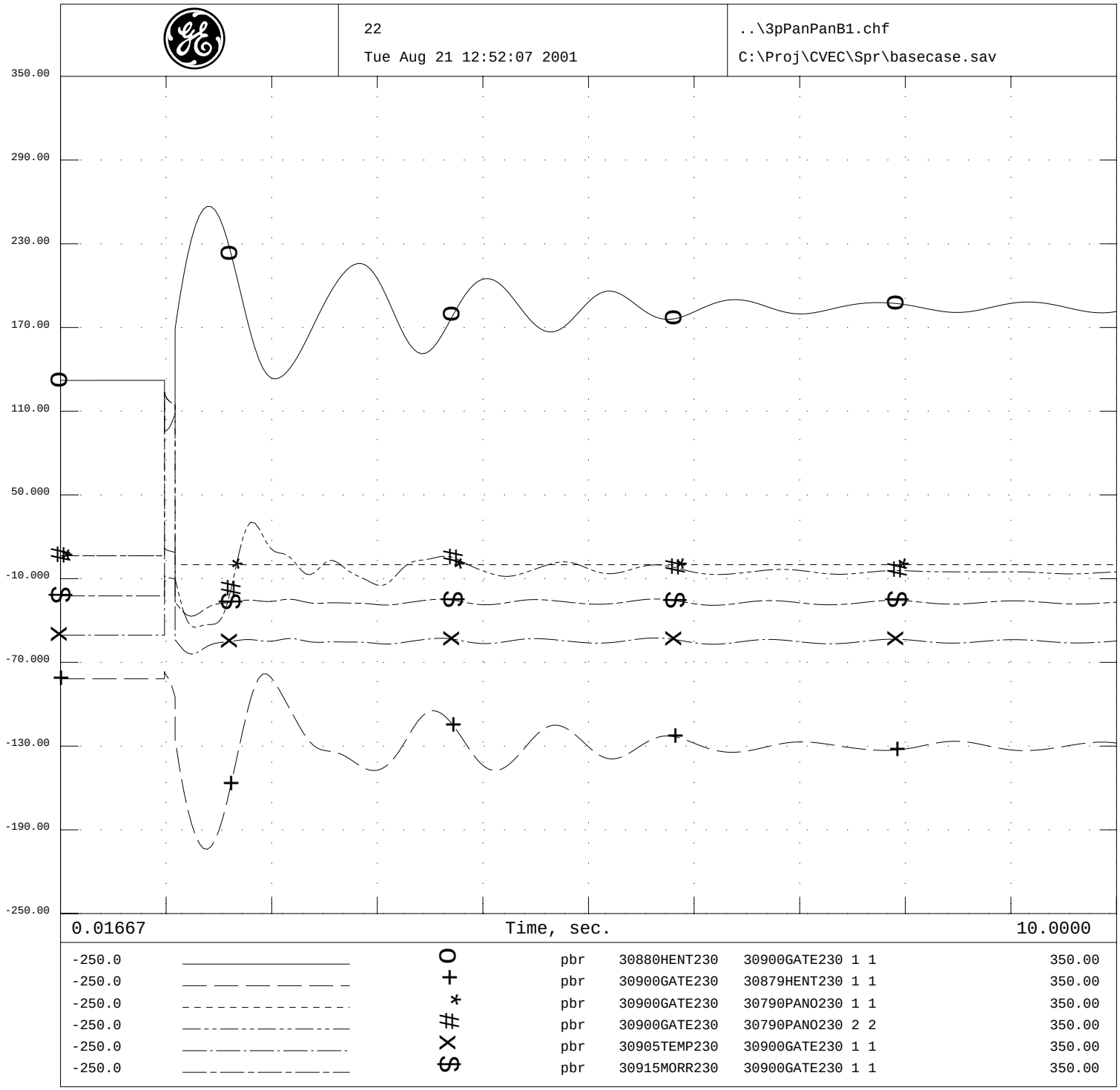

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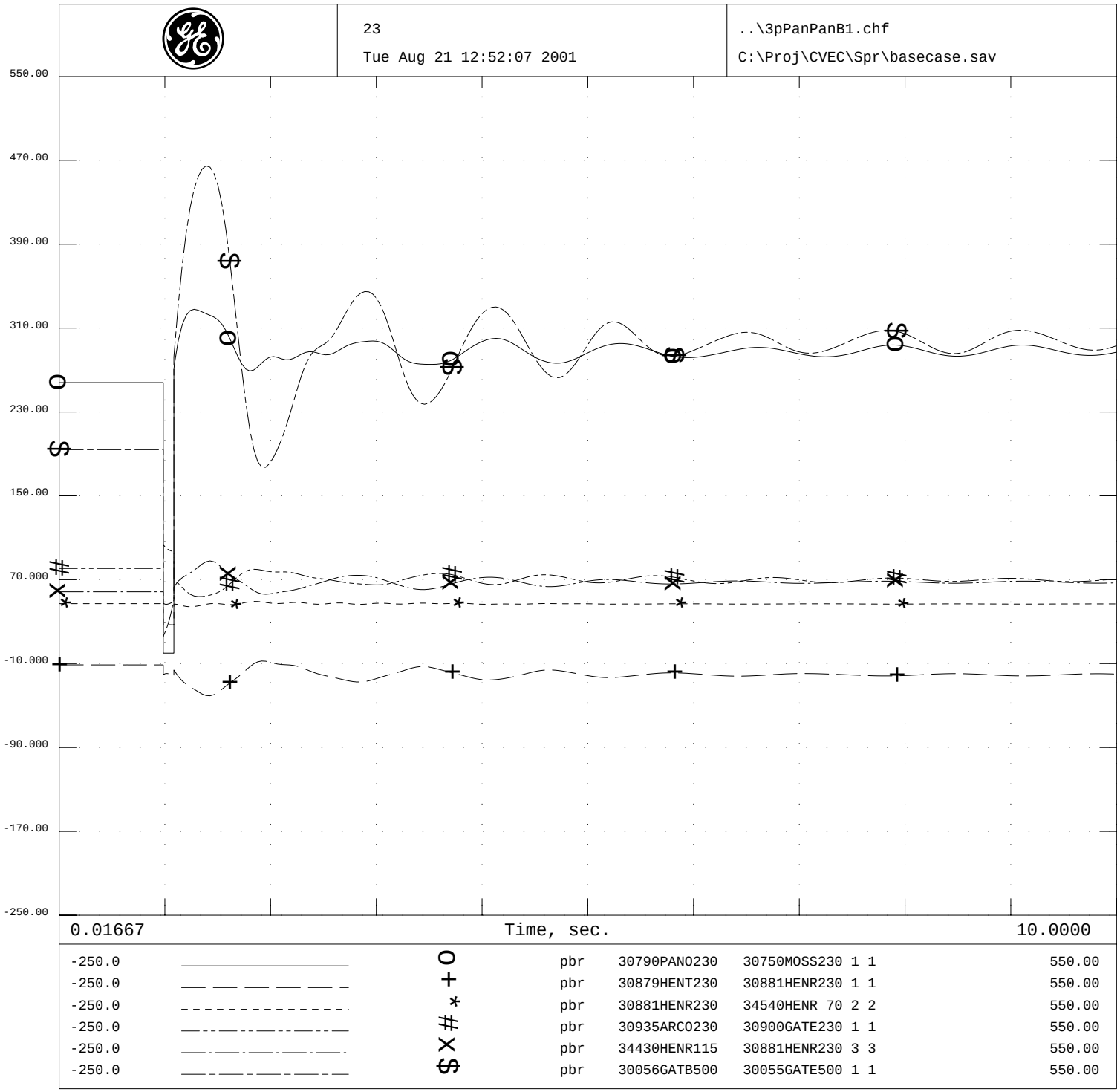

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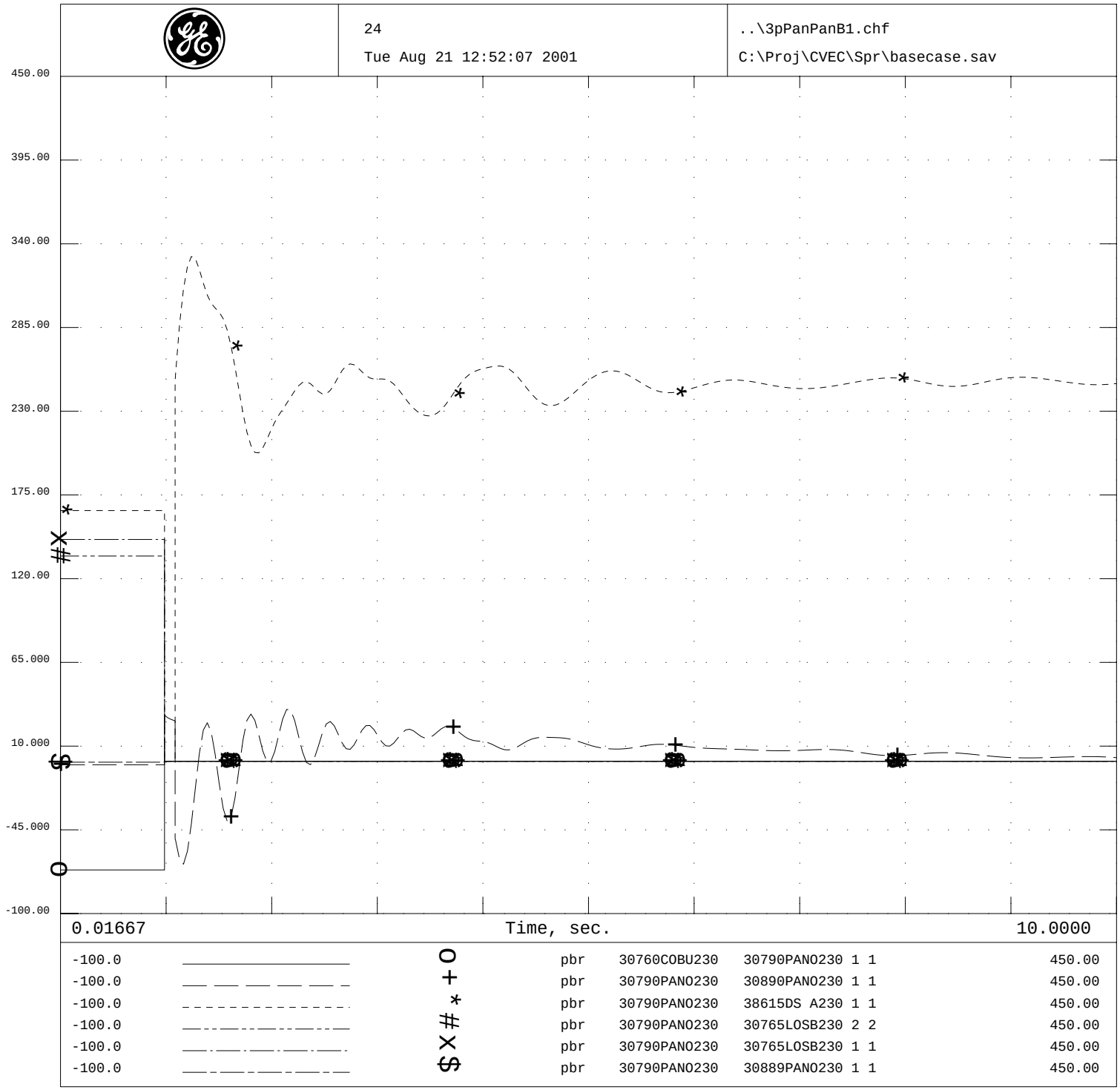

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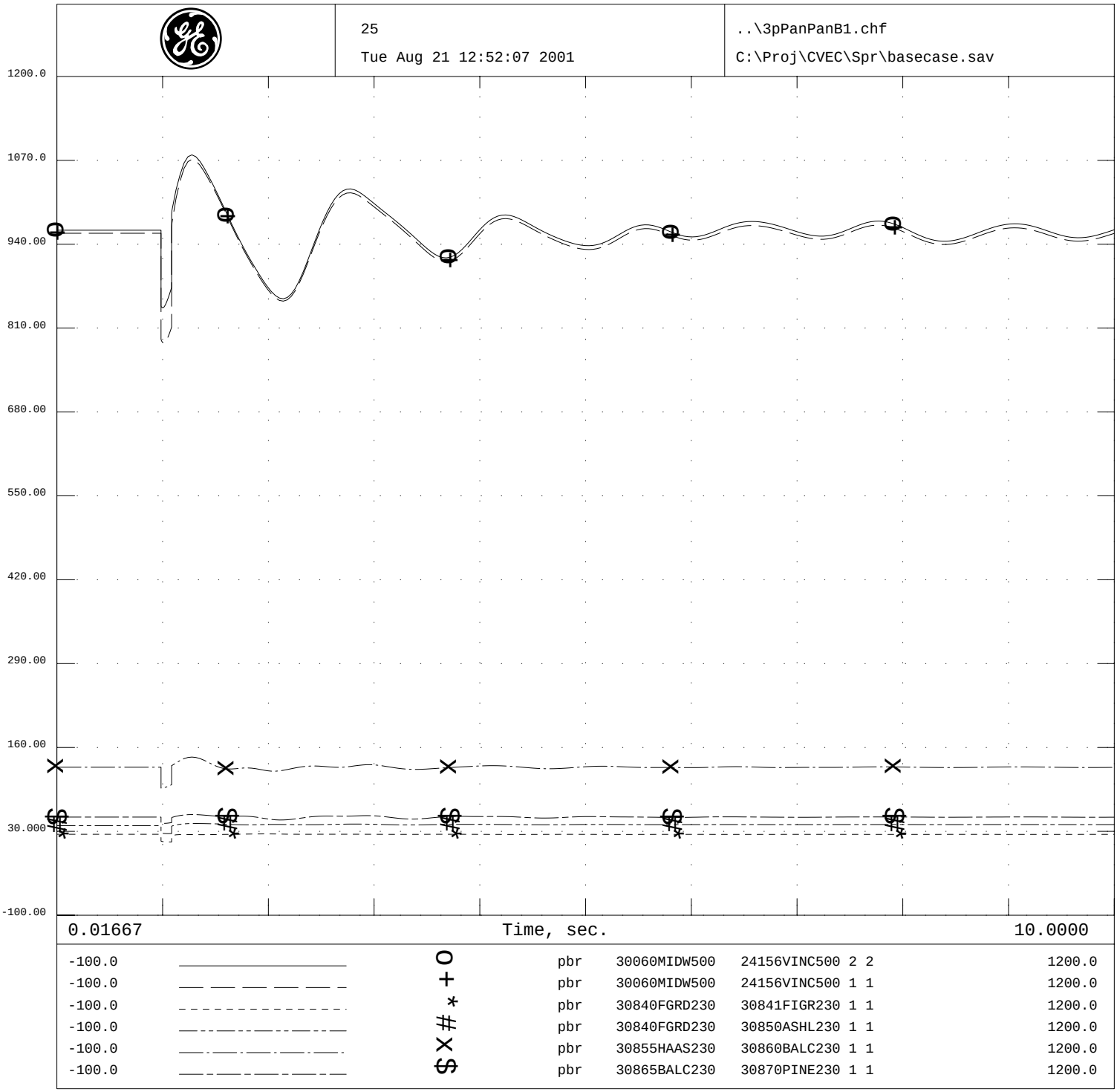

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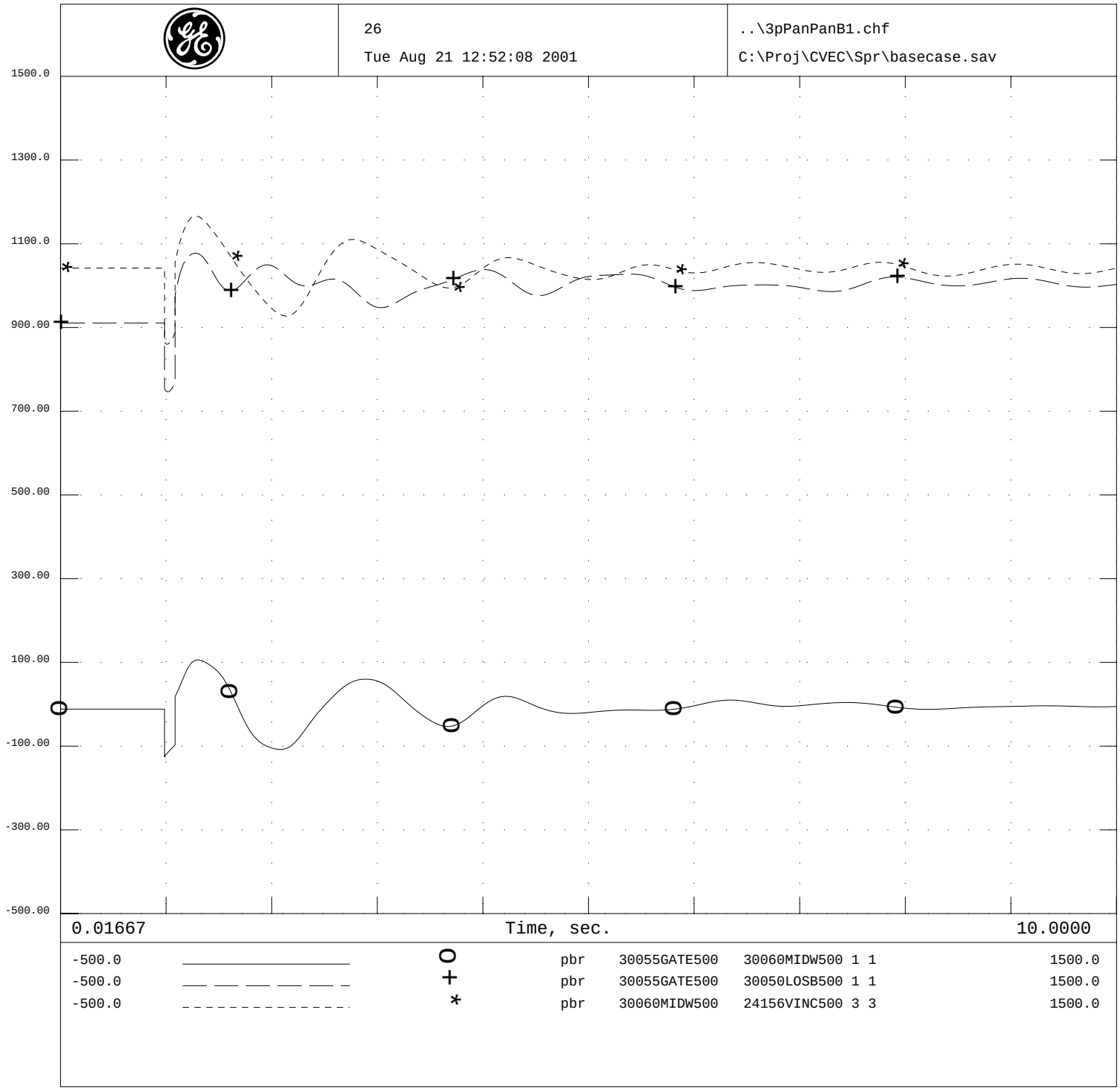

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Calpine Corporation
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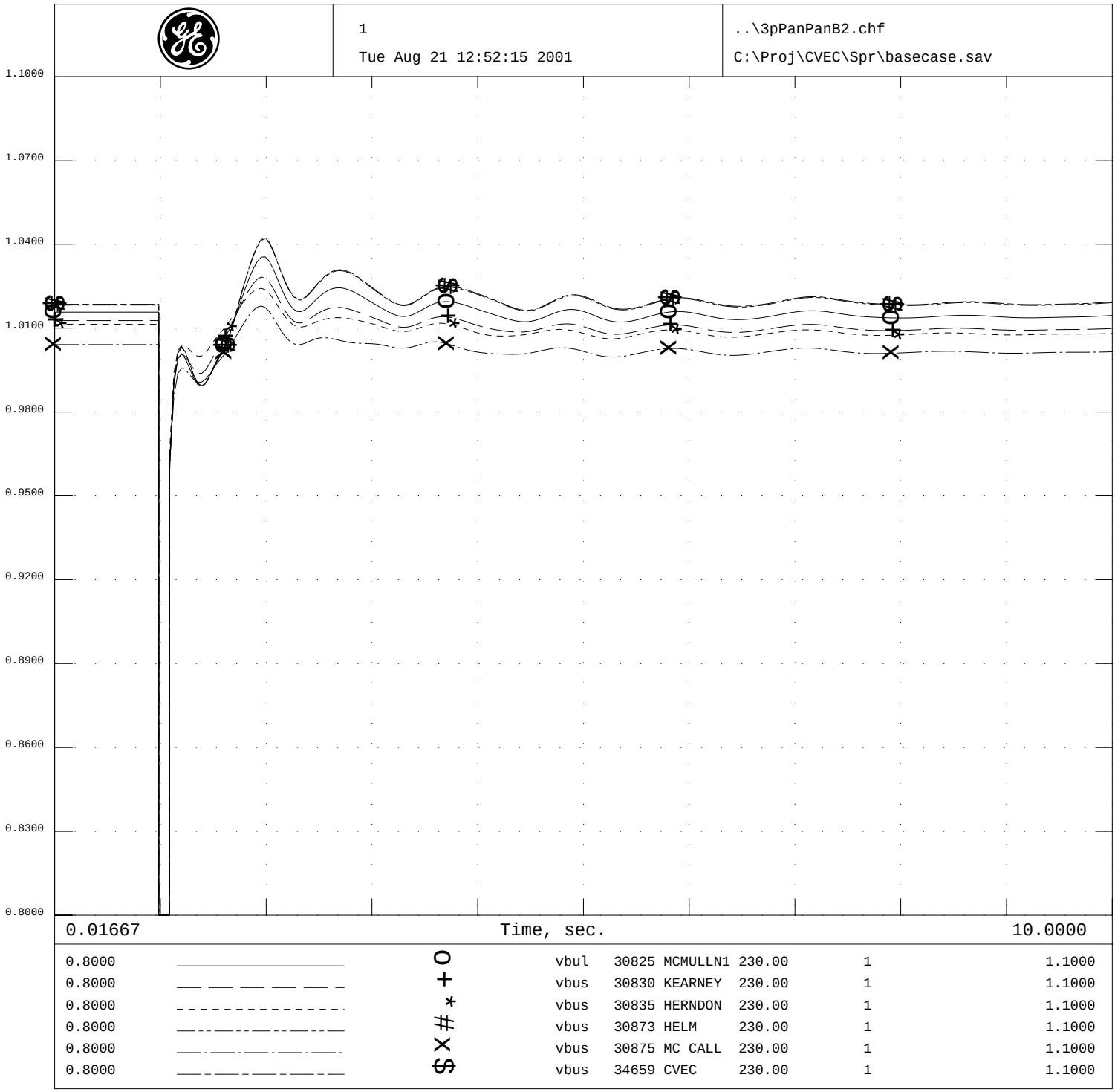

Calpine Corporation - Central Valley Energy Center System Impact Study
2004 Heavy Spring Base Case
CVEC @ 1100MW
Panoche 230kV Bus #2 Outage
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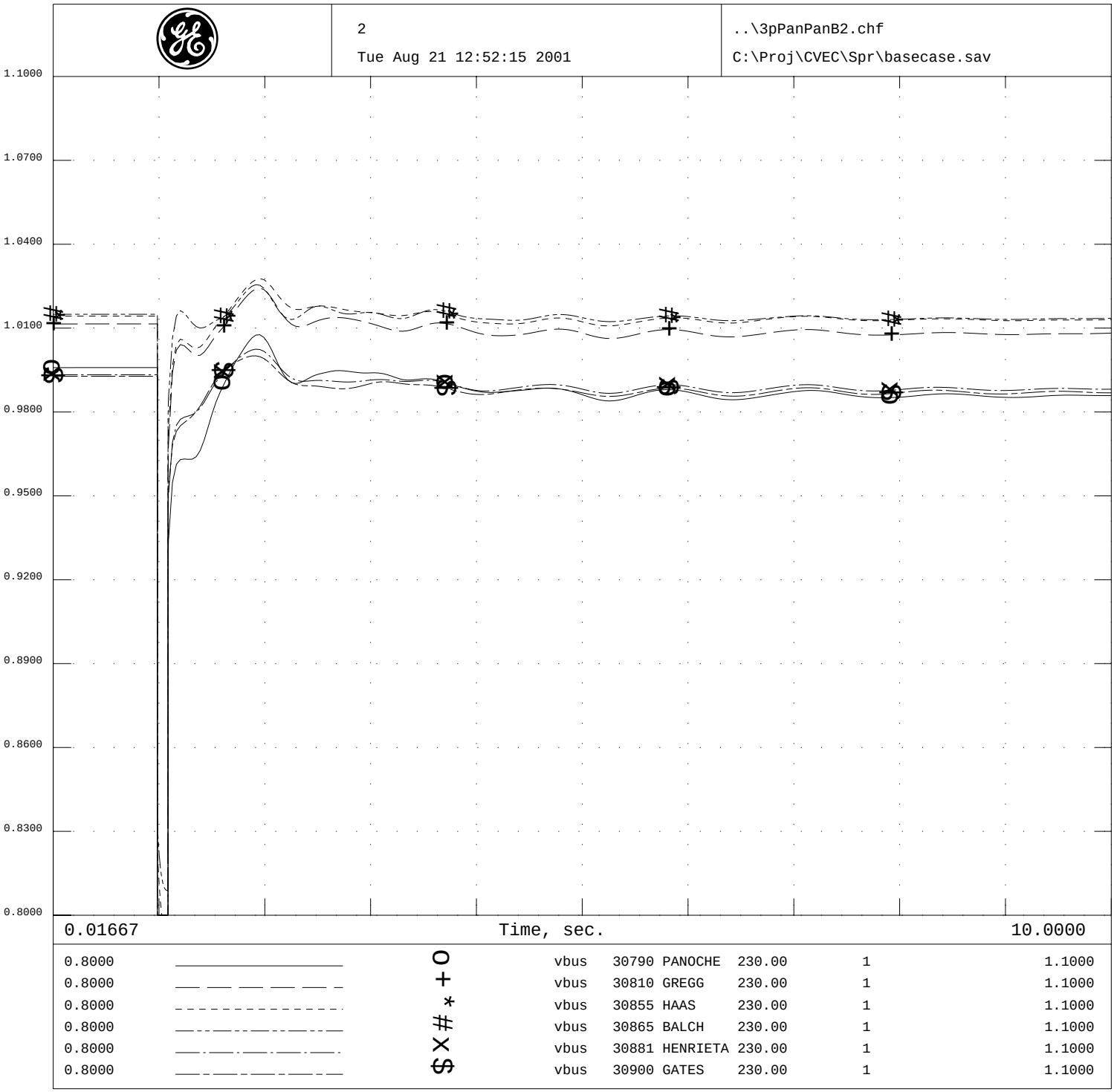
Central Valley Energy Center
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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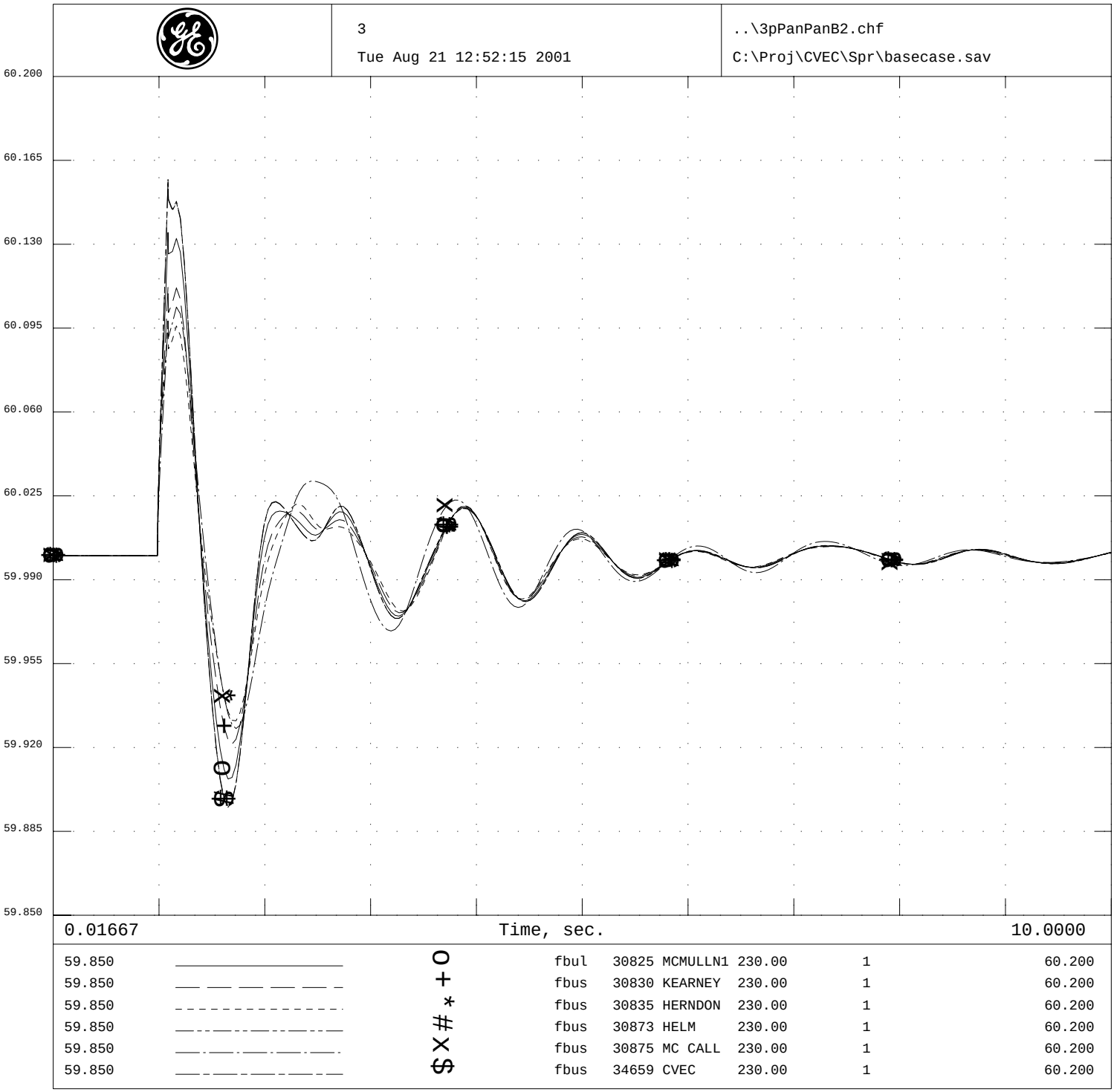
Calpine Corporation
Selected PG&E Transmission Bus Voltage Plots Adjacent to Fault



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2004 Heavy Spring Base Case
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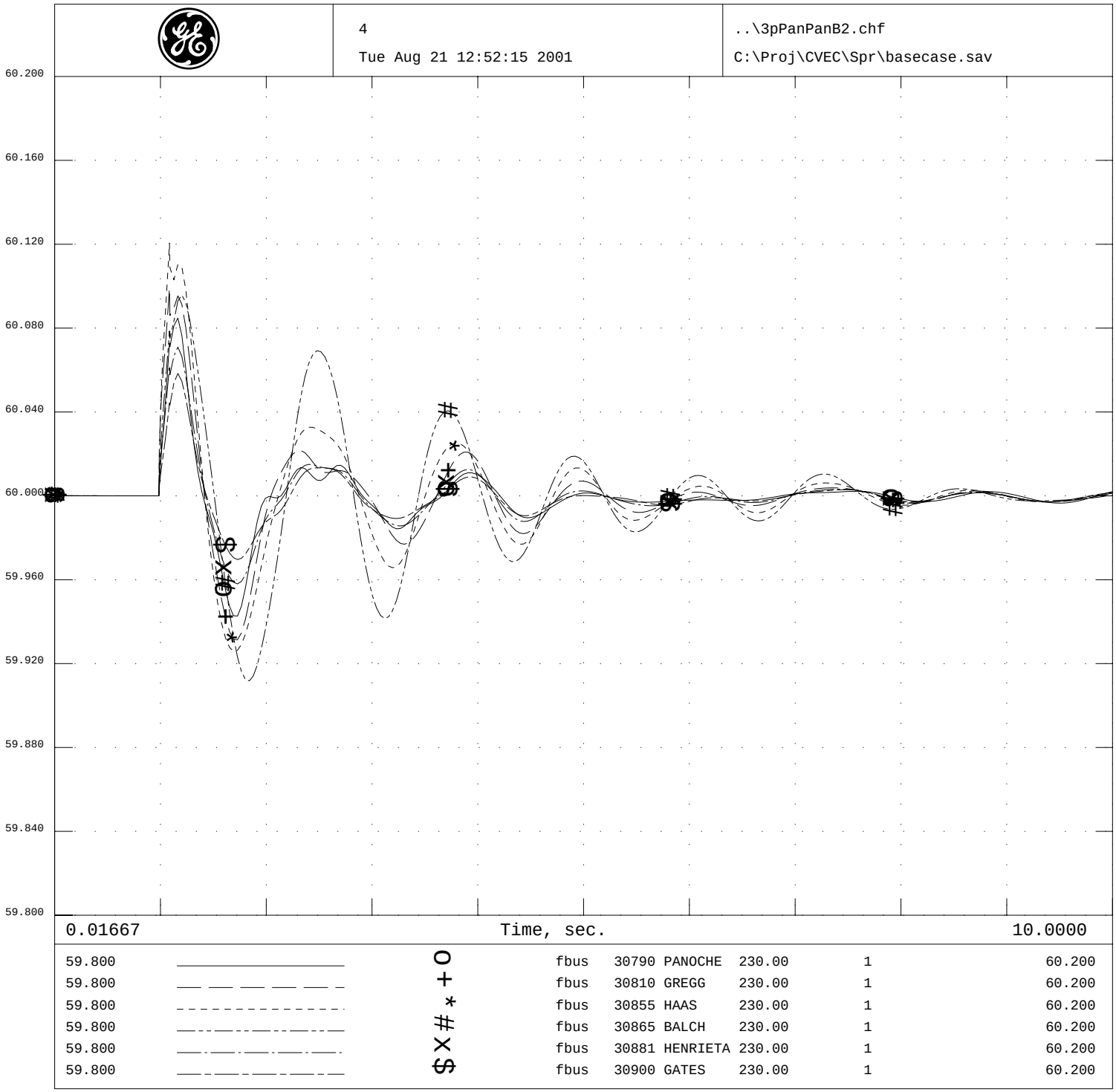
Central Valley Energy Center
Calpine Corporation
Selected Bus Frequency Plots Adjacent to Fault



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Calpine Corporation
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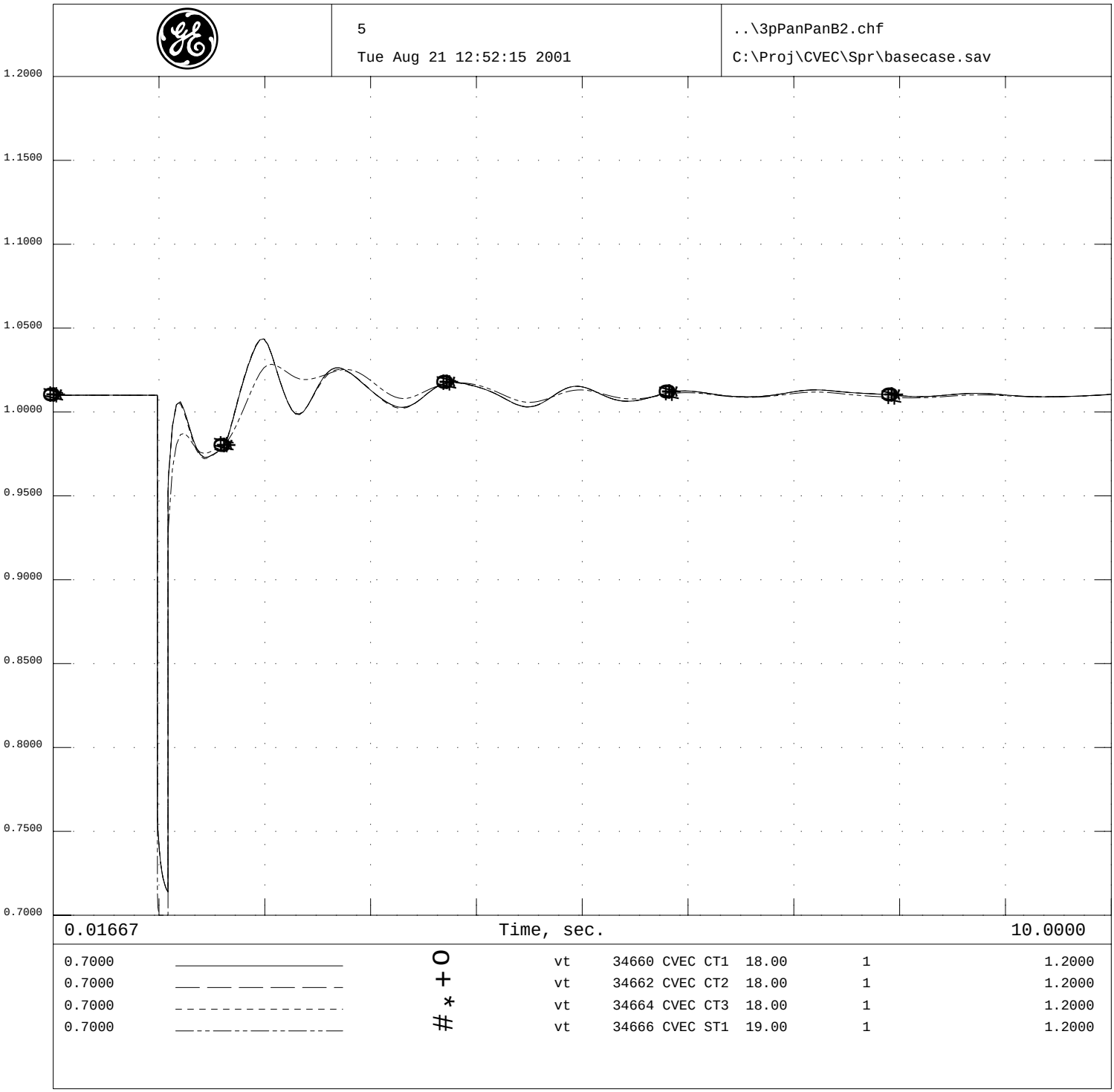

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2004 Heavy Spring Base Case
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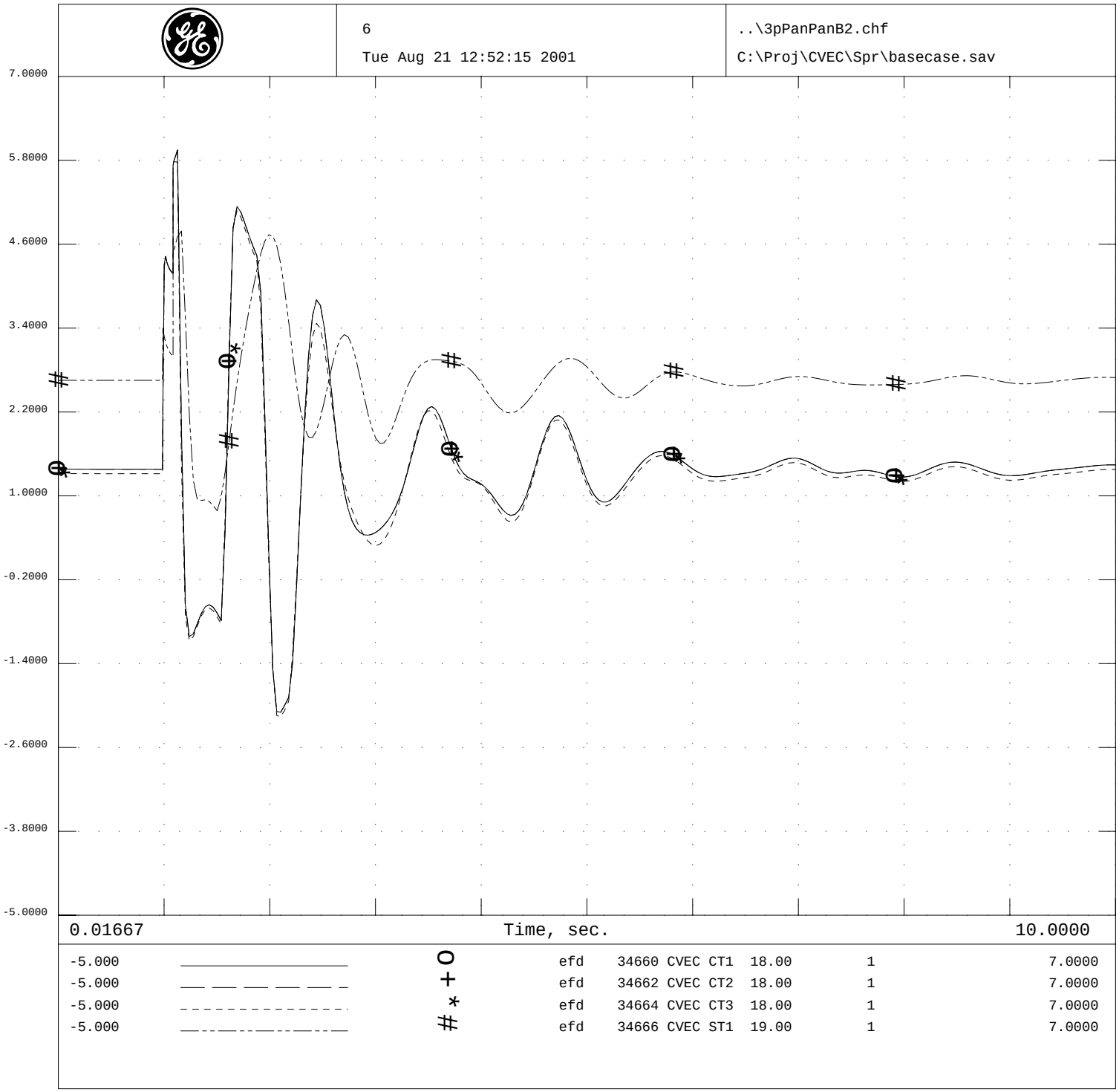
Central Valley Energy Center
Calpine Corporation
Project Generator Terminal Voltages



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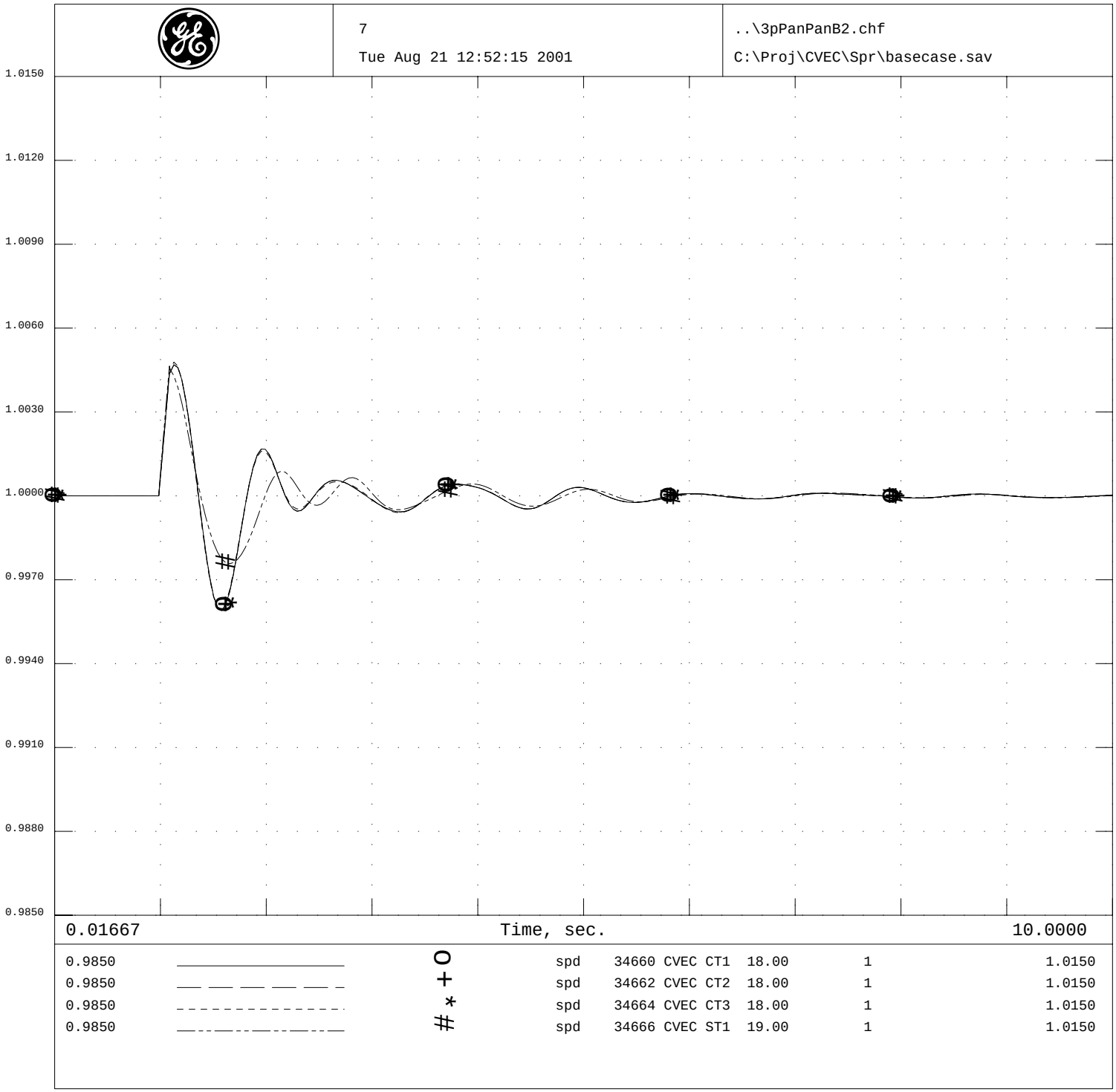
Central Valley Energy Center
Calpine Corporation
Project Generator Field Voltages



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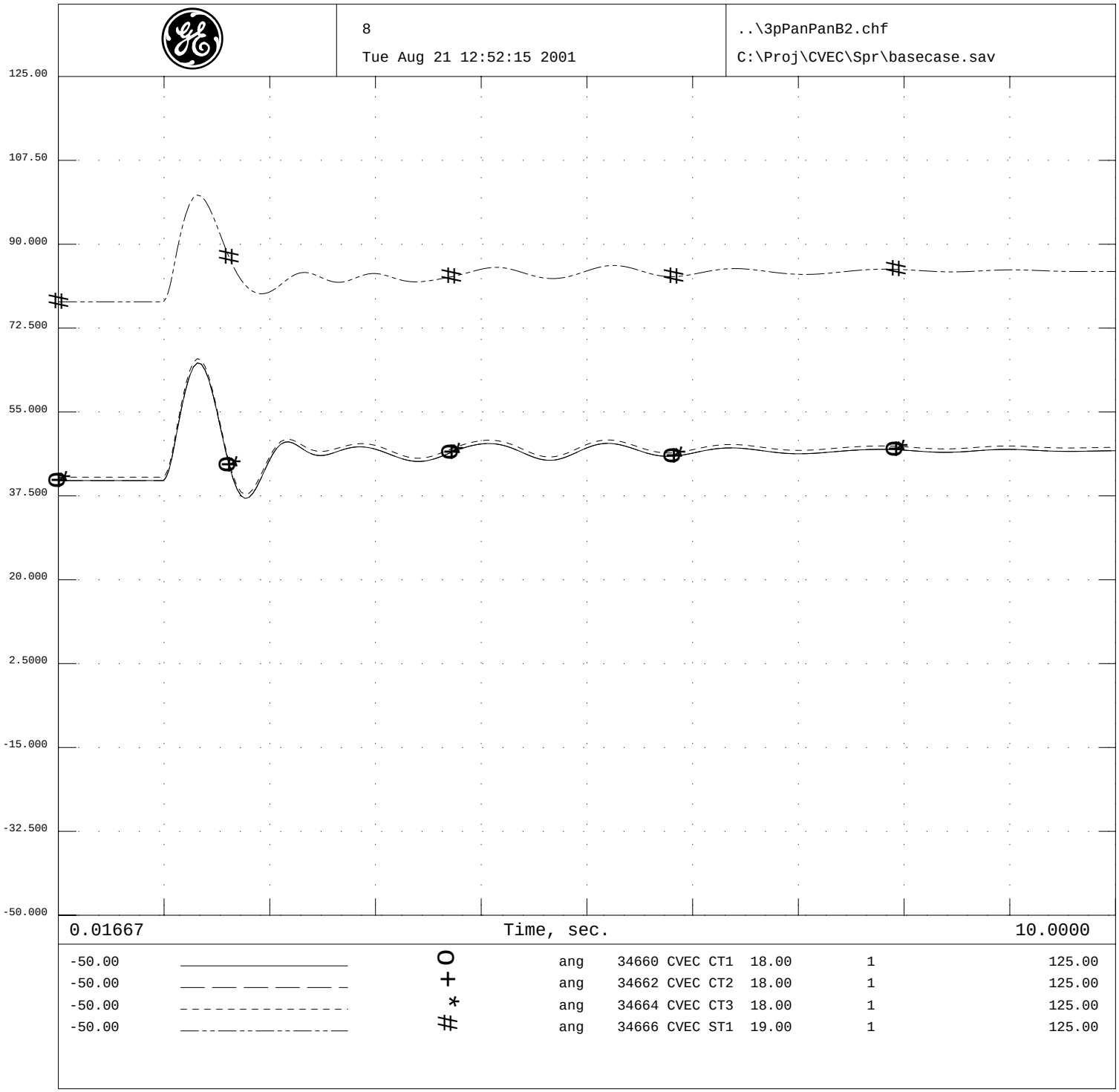
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Speed



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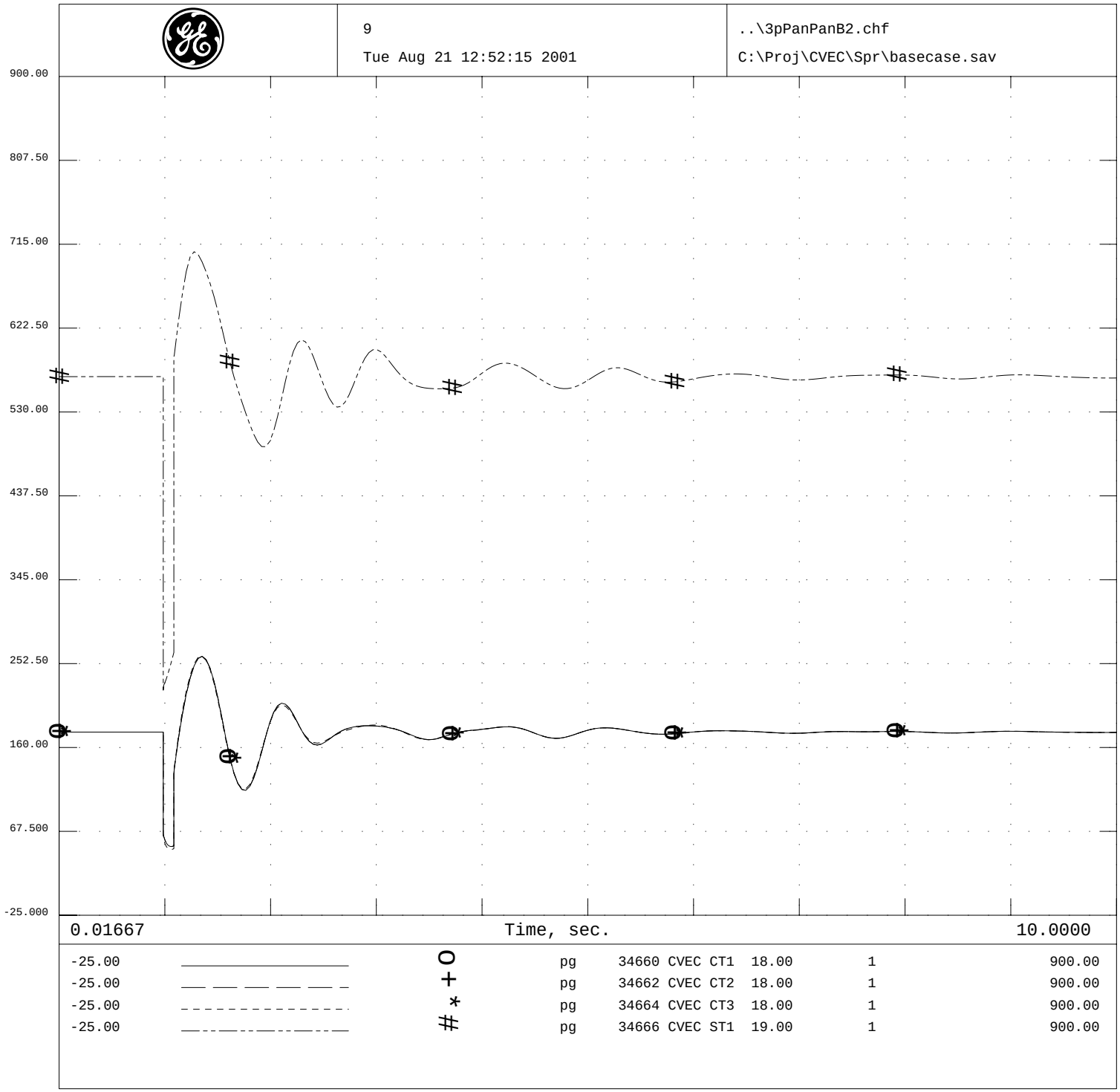
Central Valley Energy Center
Calpine Corporation
Project Generator Rotor Angle



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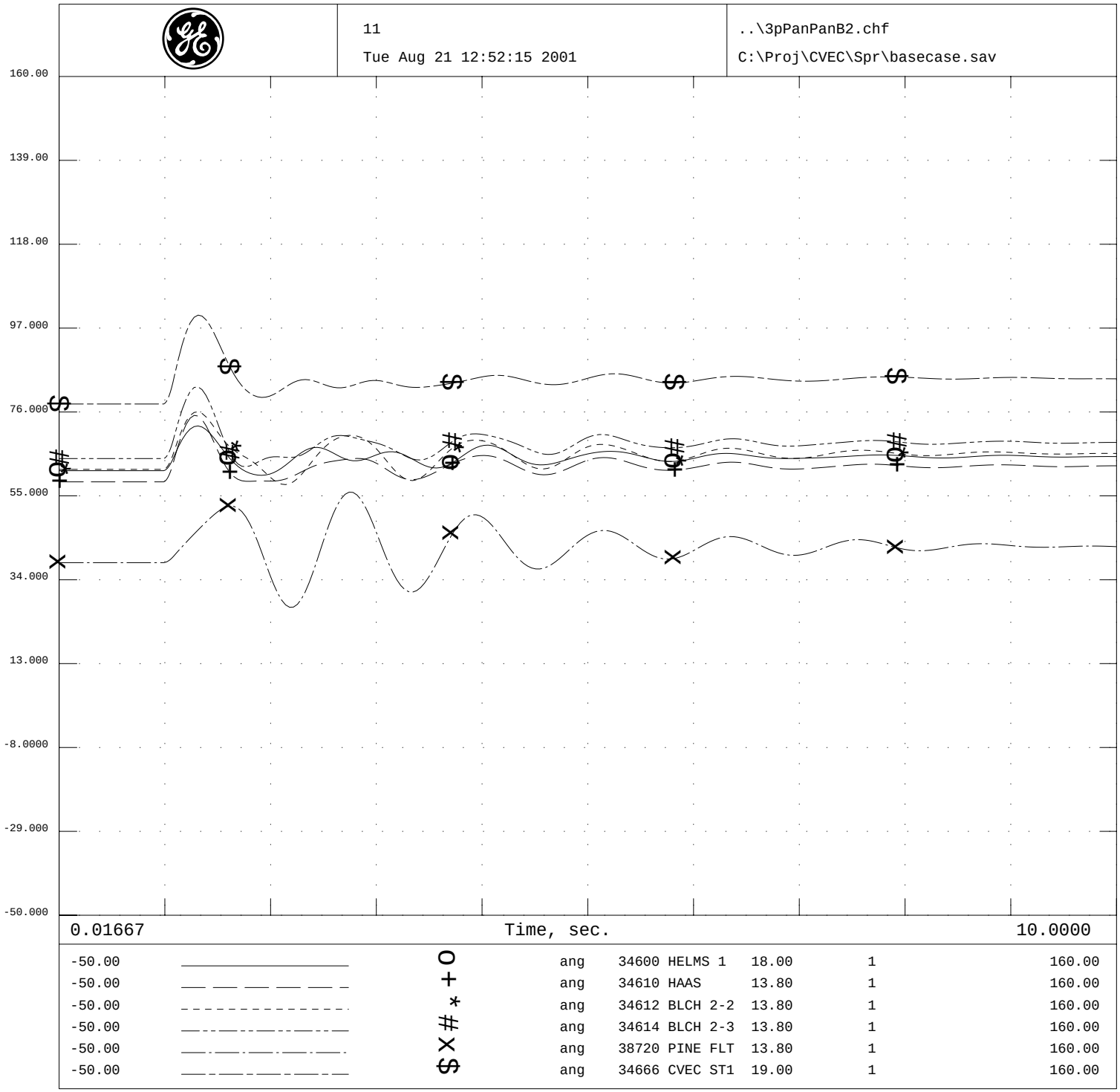
Calpine Corporation
Project Generator Terminal Power



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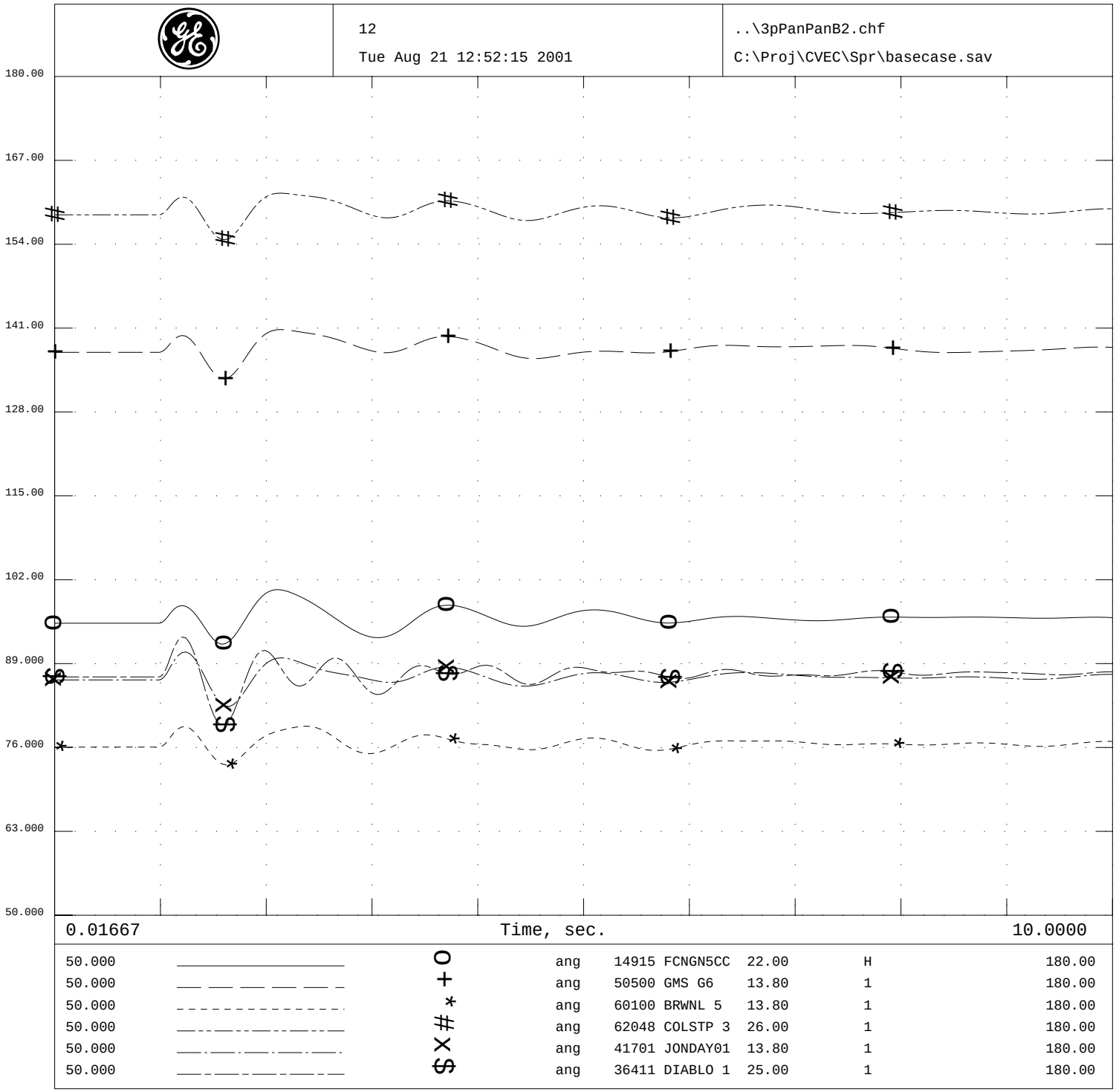
Central Valley Energy Center
Calpine Corporation
Selected Local Rotor Angle Plots



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Central Valley Energy Center
Calpine Corporation
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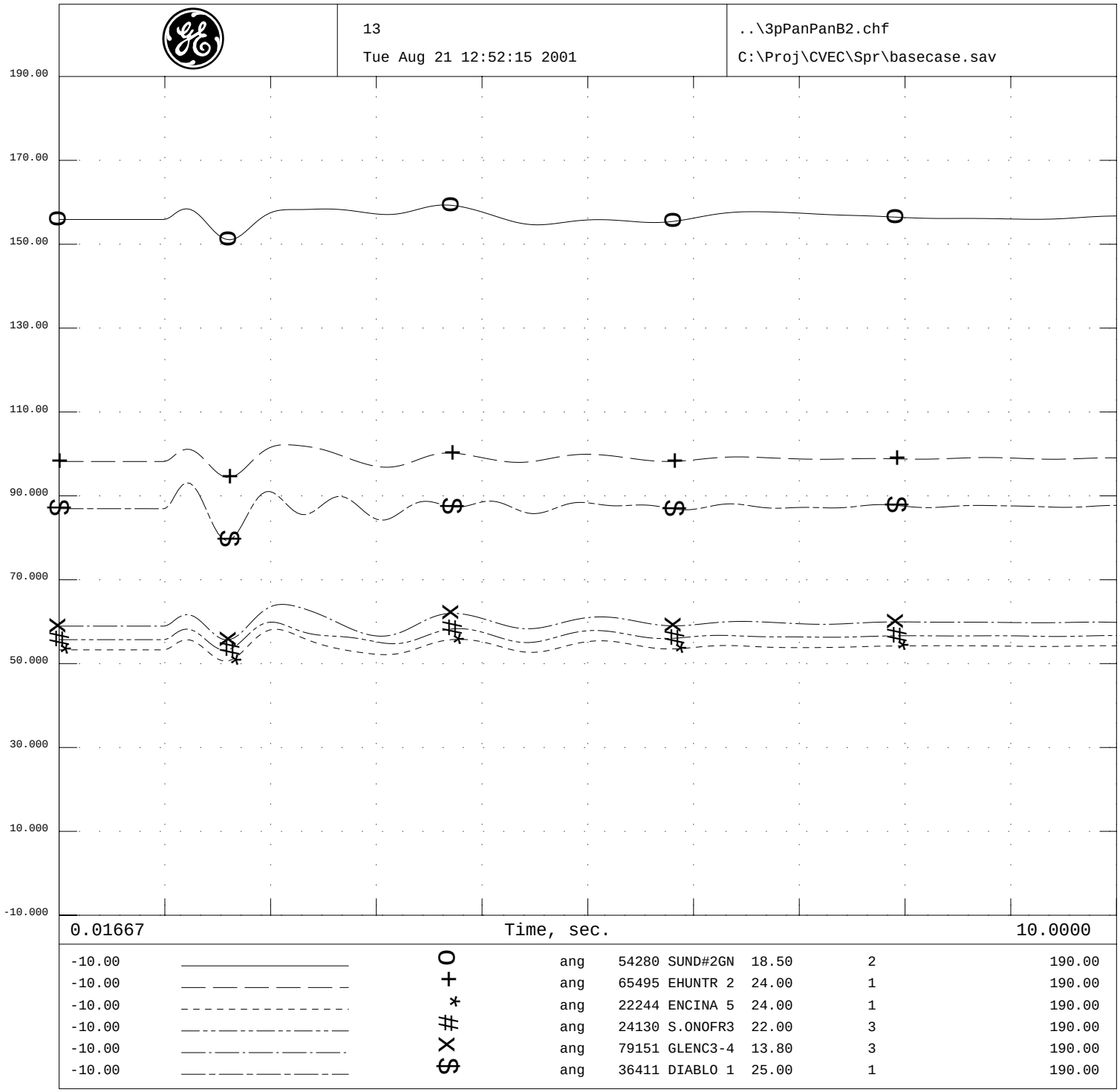

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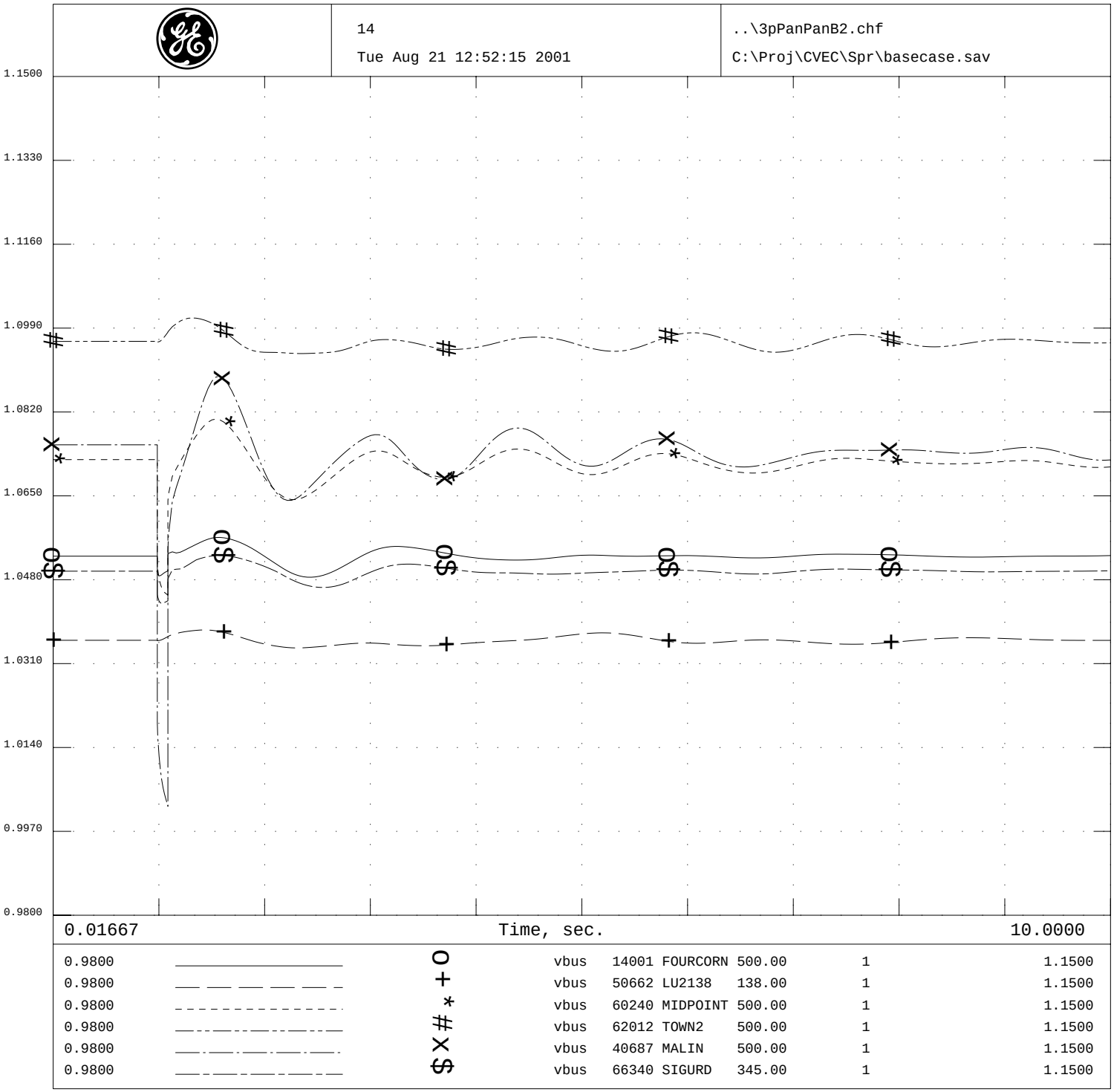

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Calpine Corporation
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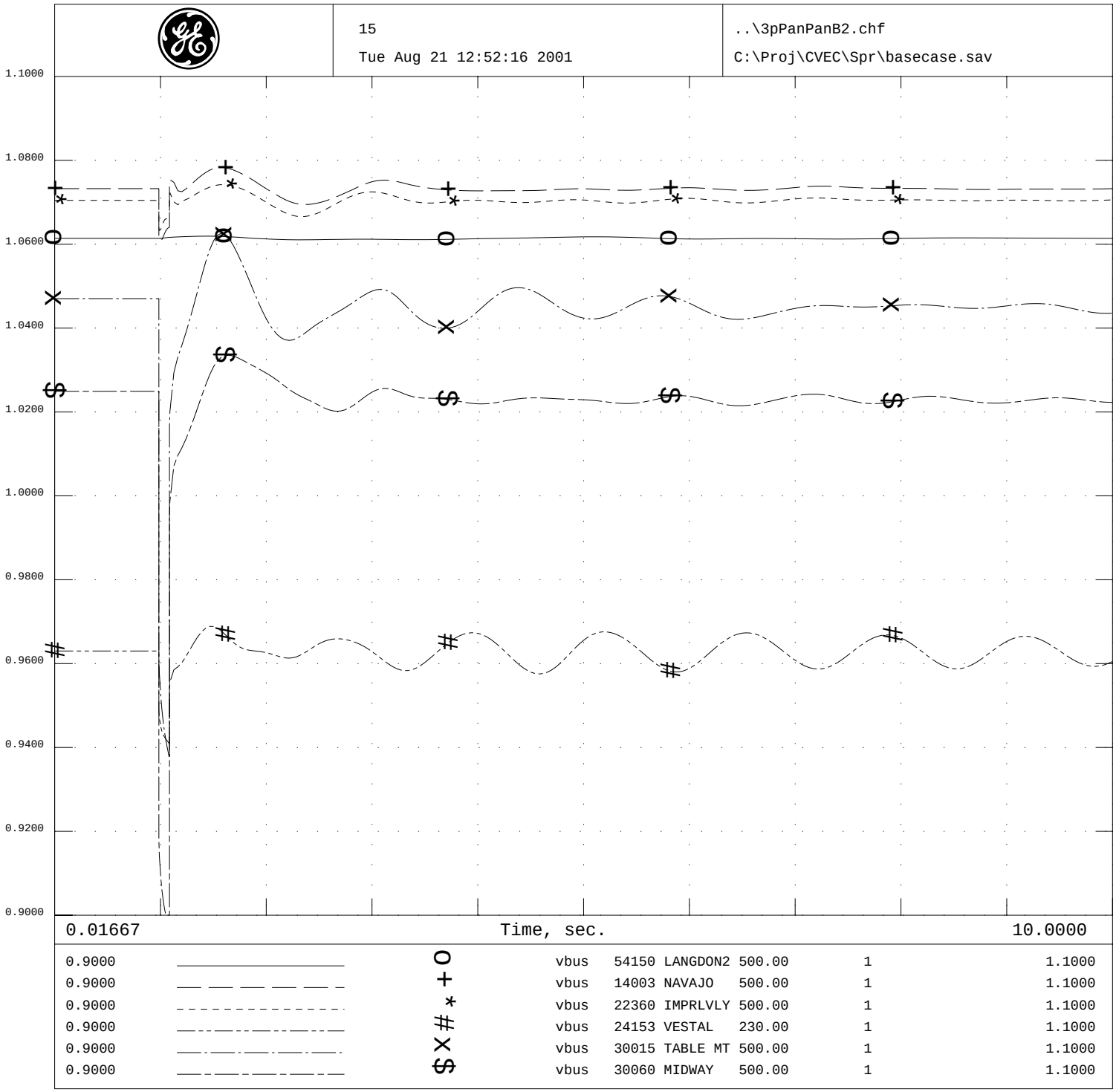

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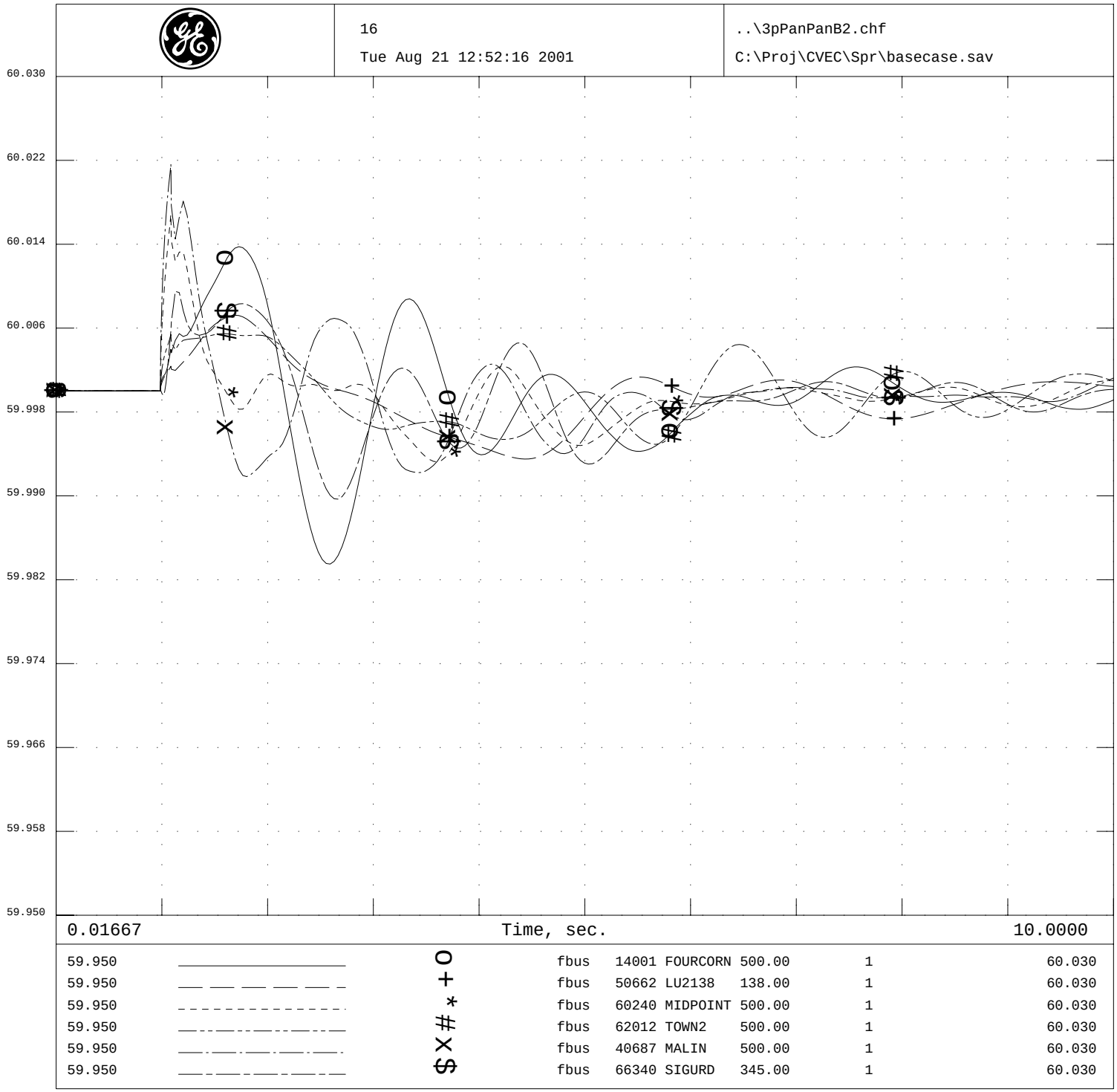

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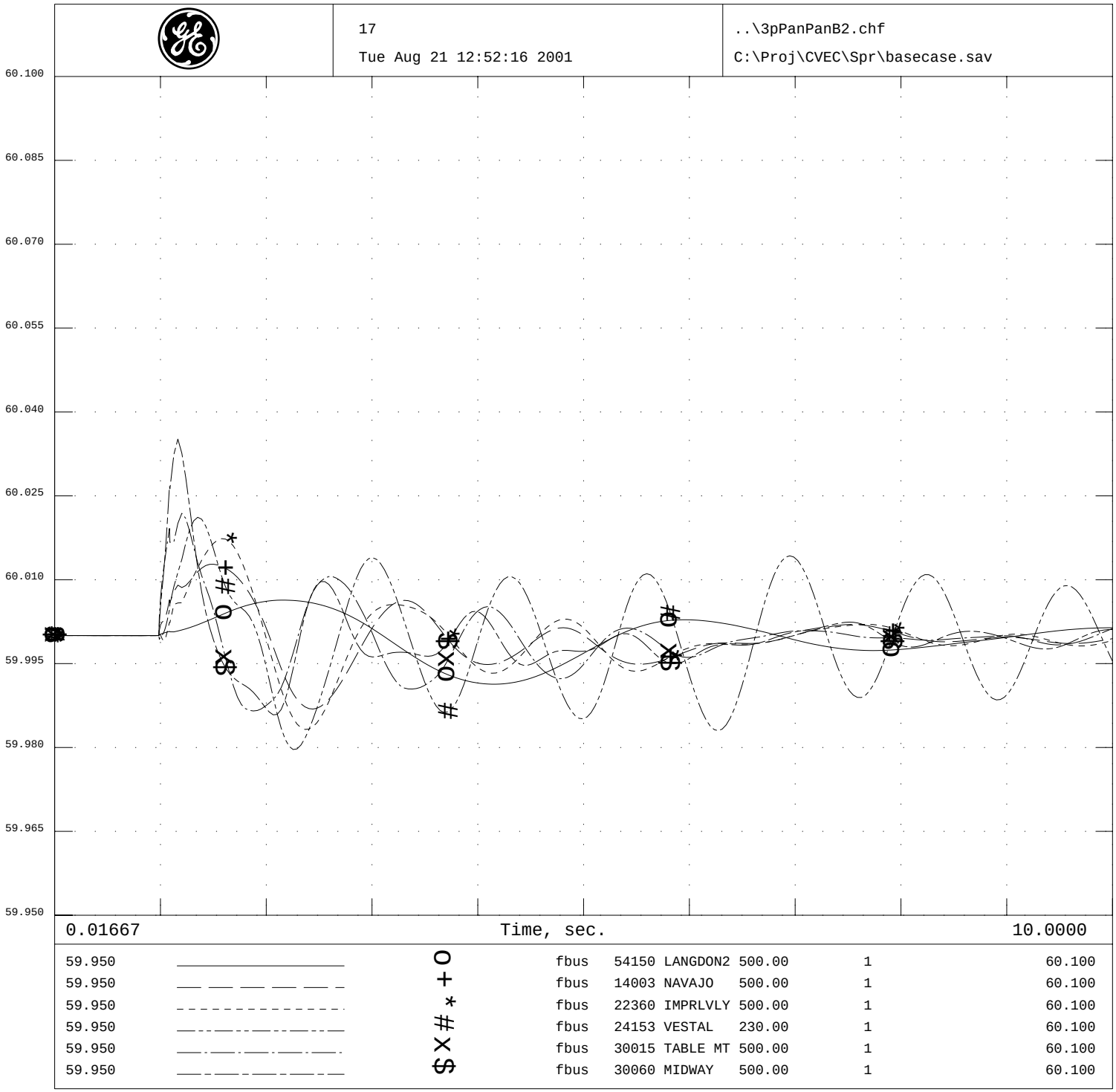

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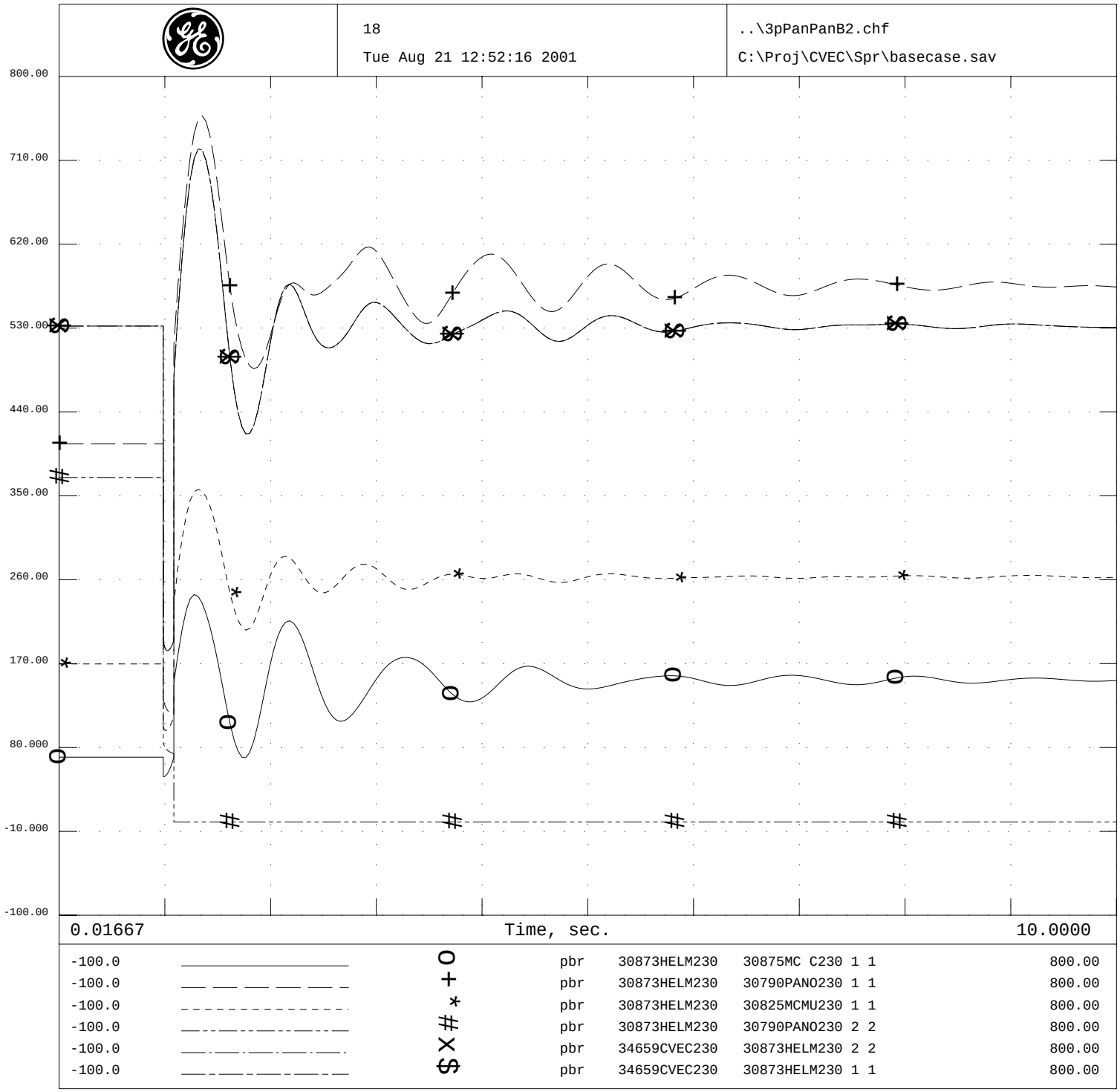

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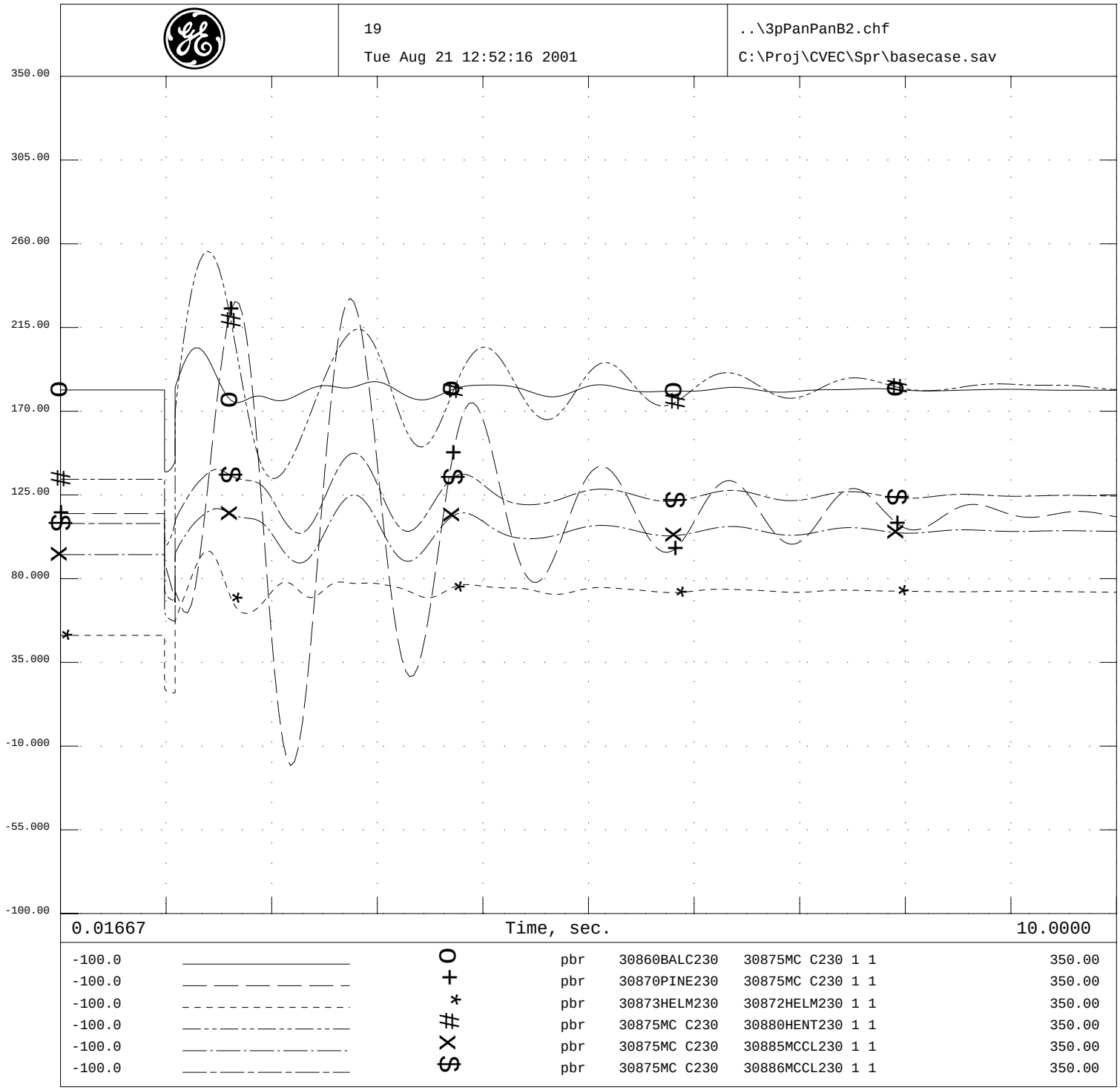

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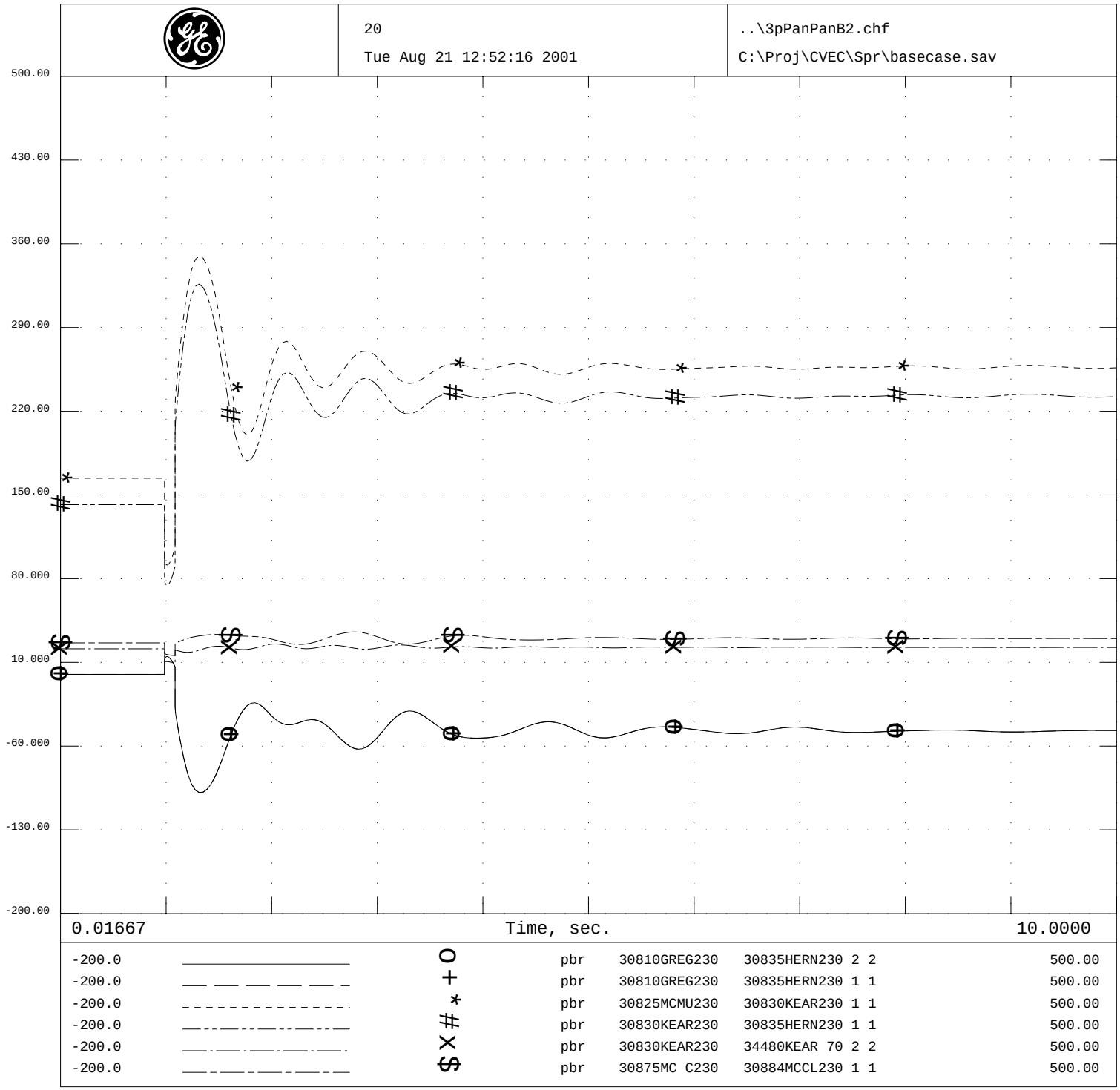

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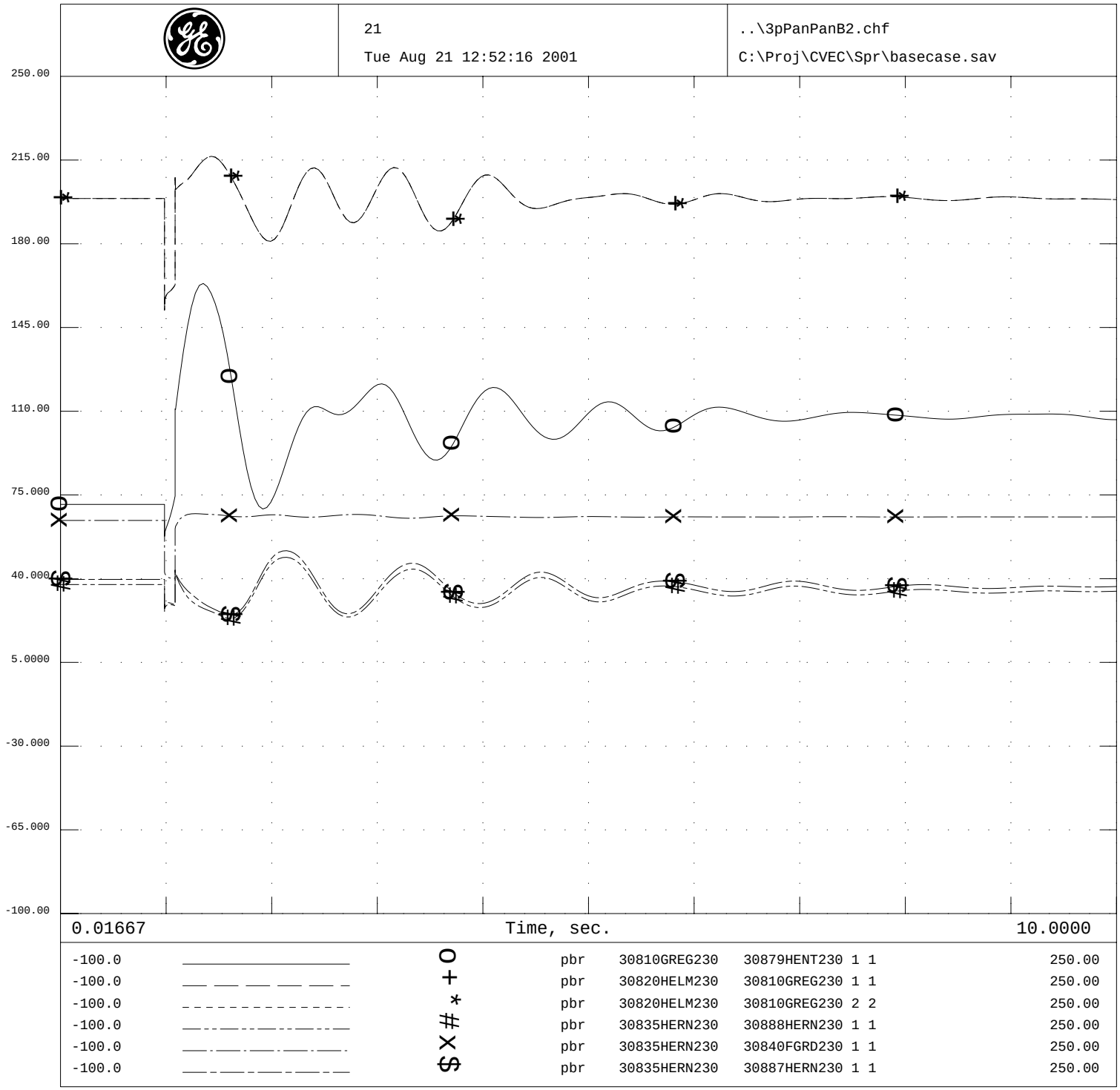

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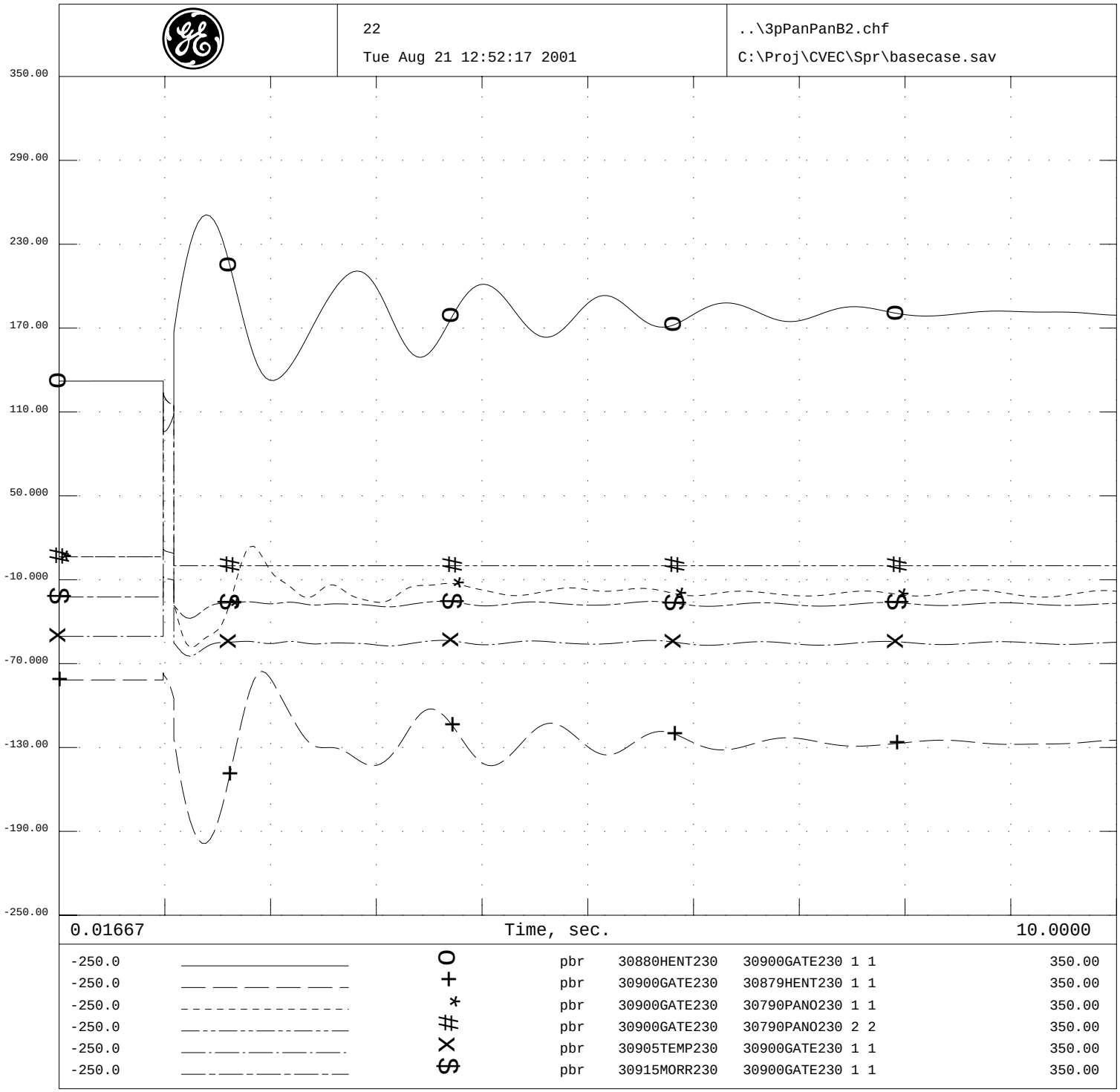

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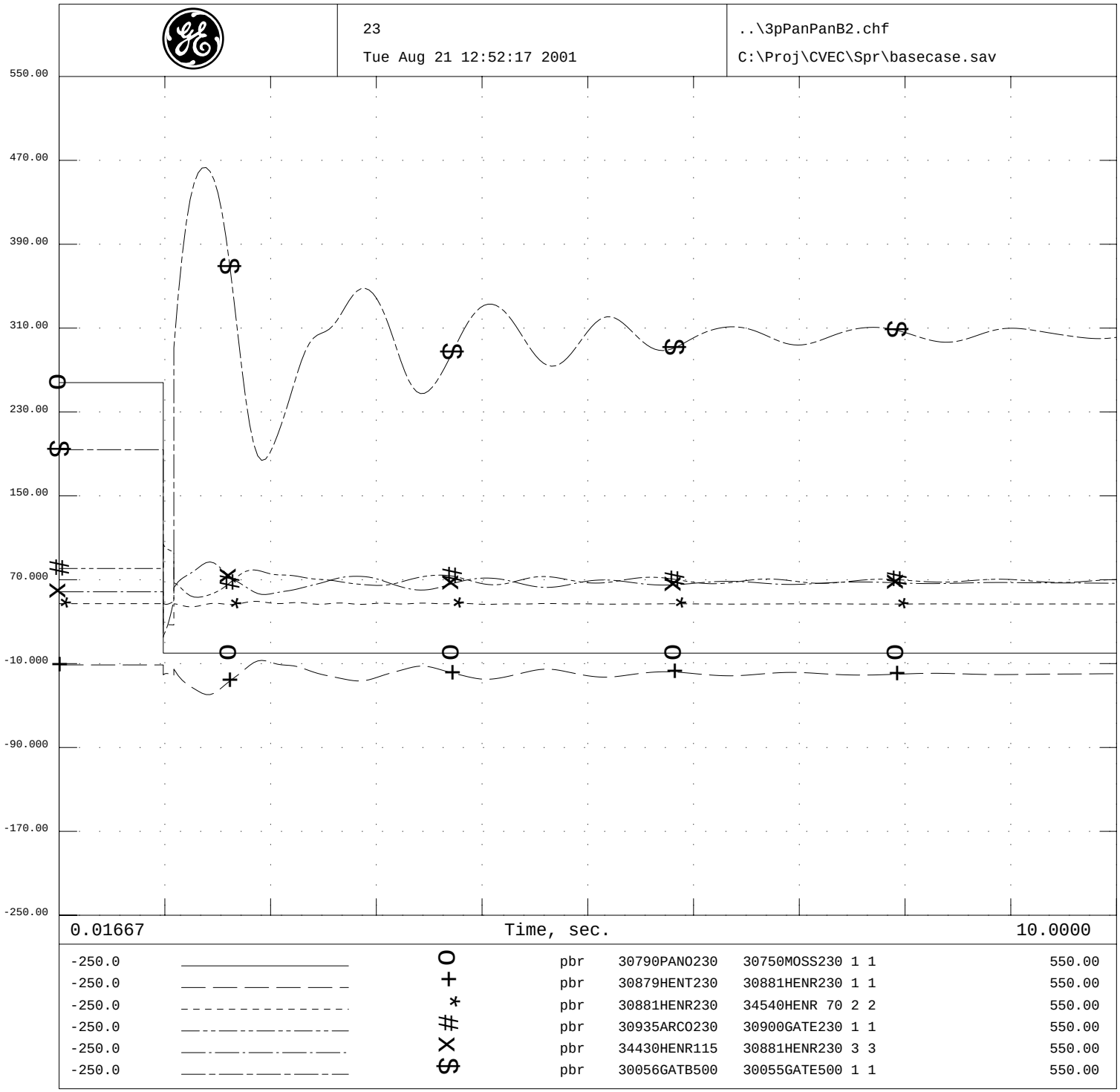

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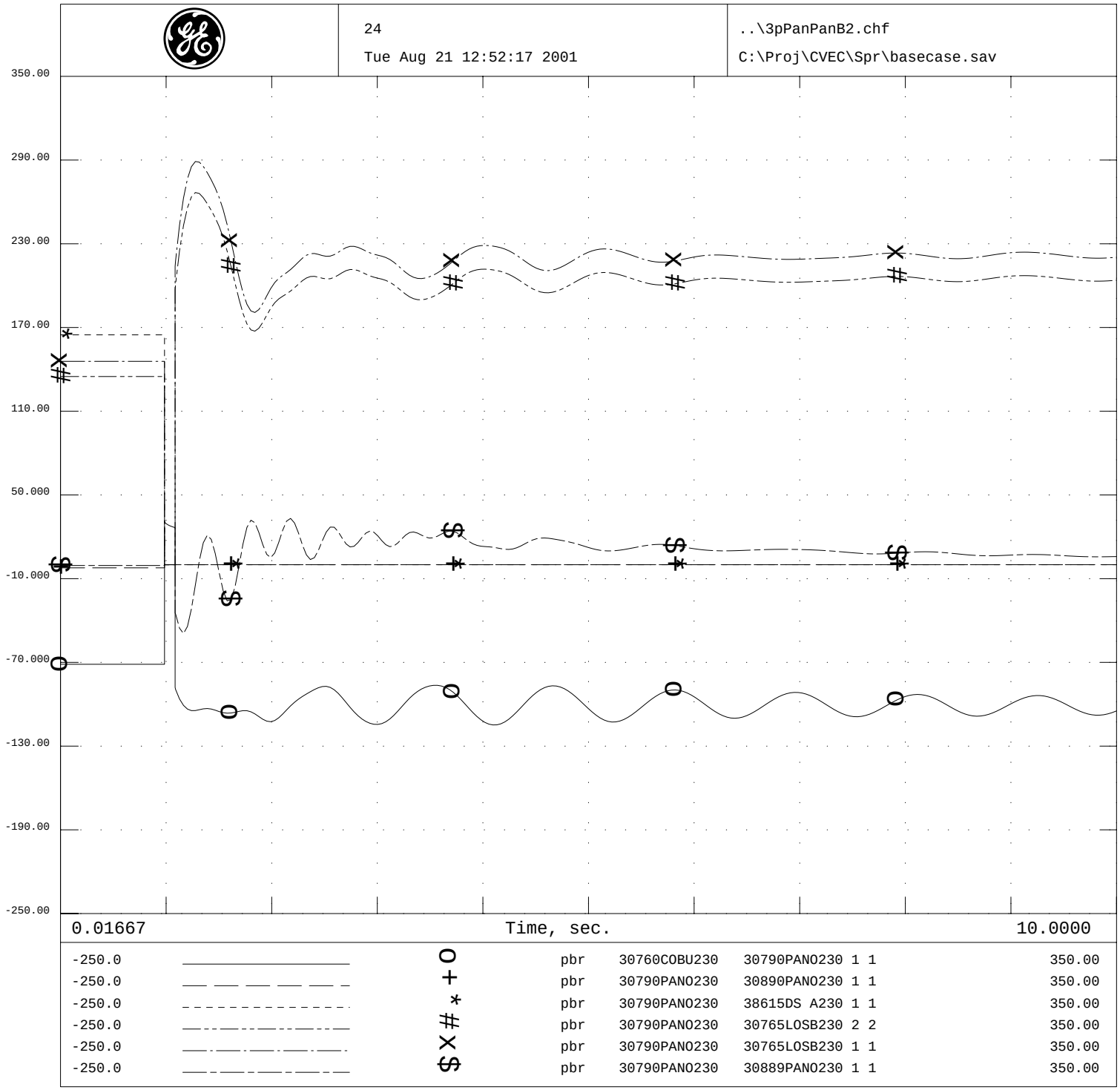

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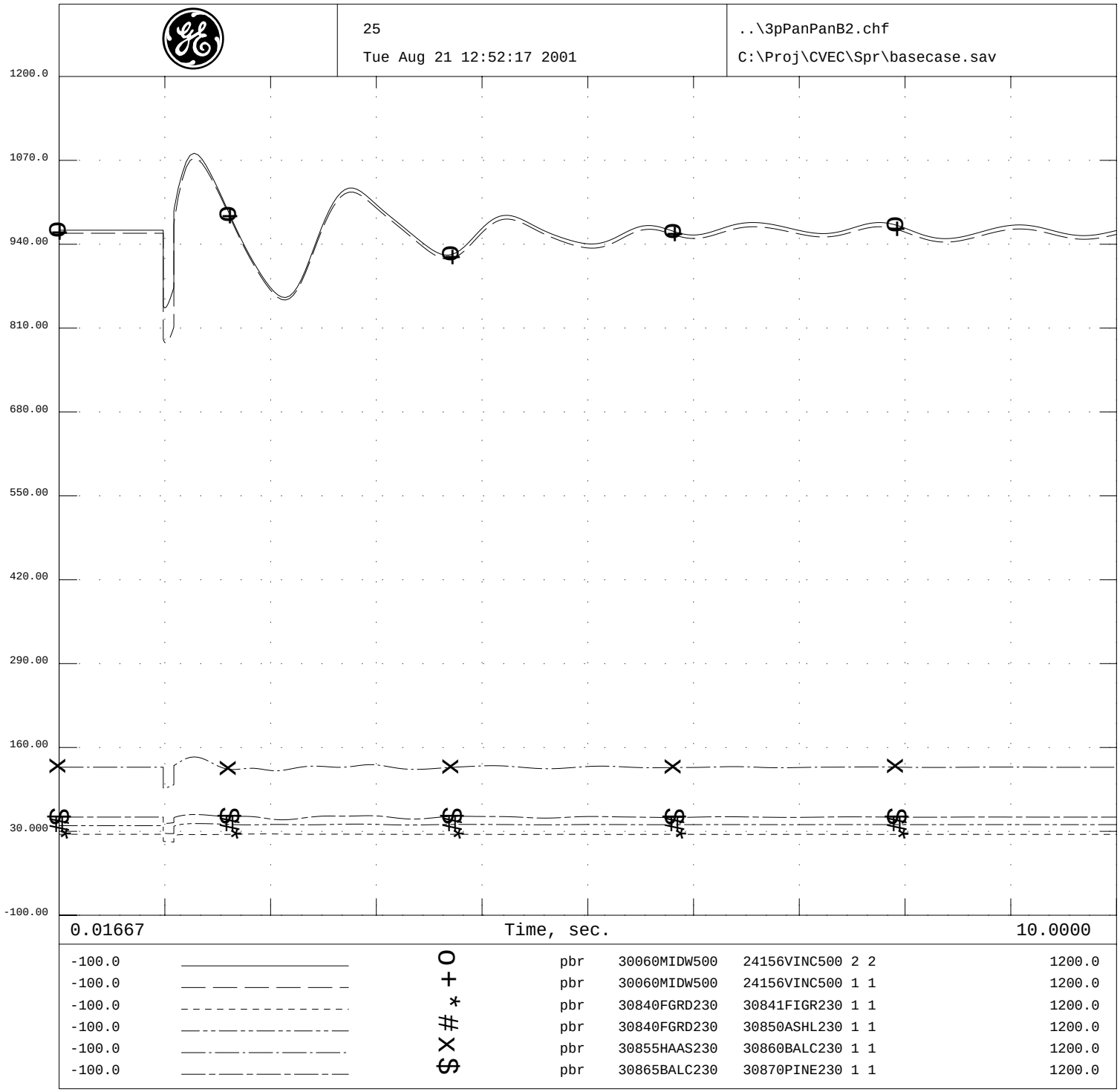

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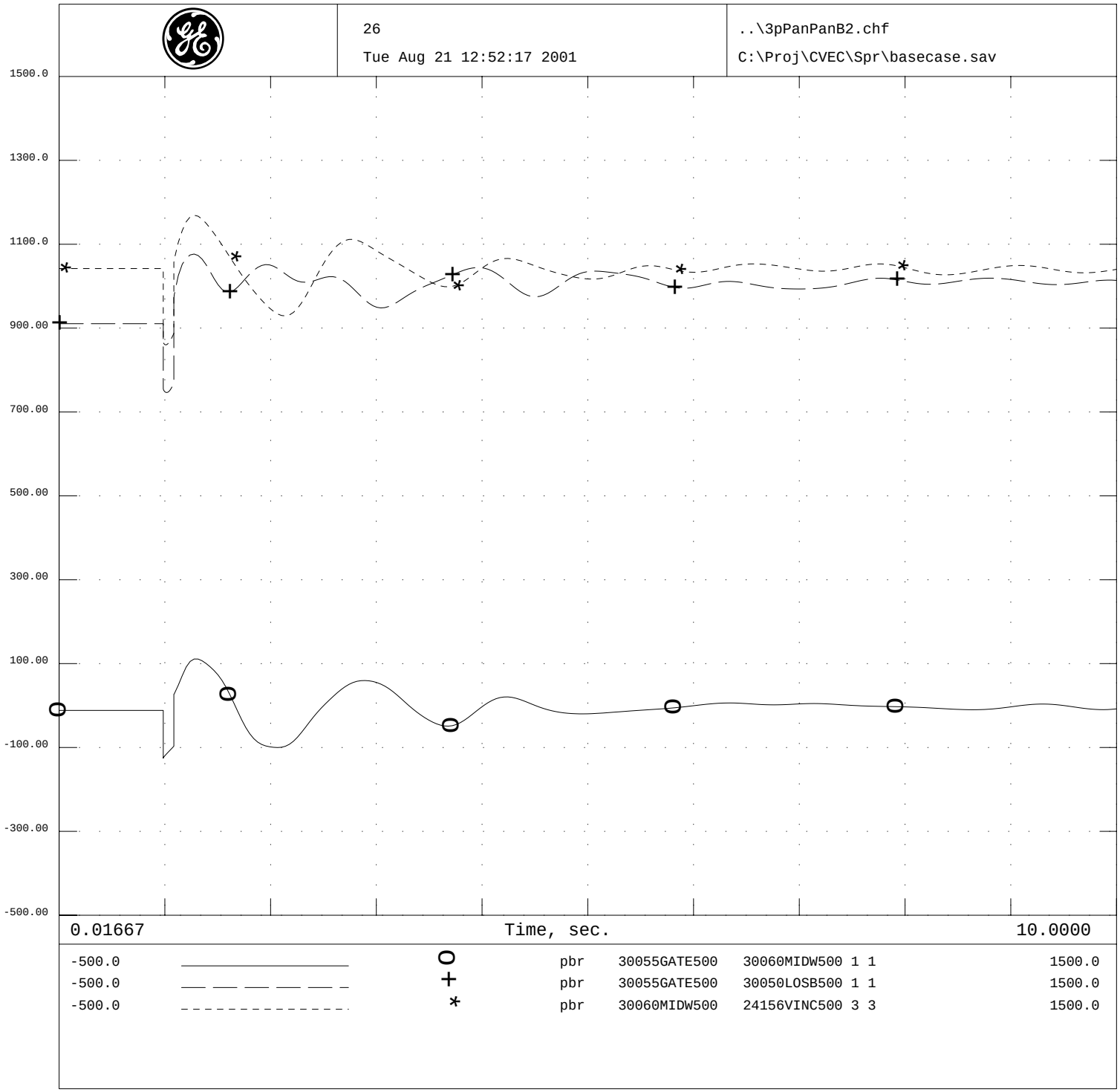

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