UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001
April 20, 2001

LICENSEE: Tennessee Valley Authority

FACILITY: Sequoyah Nuclear Plant, Unit 1

SUBJECT: SUMMARY - APRIL 11, 2001, MEETING REGARDING SEQUOYAH UNIT 1 STEAM GENERATOR INSPECTION PLAN FOR CYCLE 11 REFUELING OUTAGE

On April 11, 2001 representatives of the Tennessee Valley Authority (TVA), the licensee for the Sequoyah Nuclear Plant, met in a public meeting with members of the U.S. Nuclear Regulatory Commission (NRC) staff at NRC Headquarters in Rockville, Maryland. TVA requested this meeting to brief the staff regarding the methods and criteria to be used during the Sequoyah (SQN) Unit 1 fall 2001 refueling outage for inspection of the steam generator (SG) tubes. This meeting was a followup to a meeting on the same issues on May 15, 2000.

Background

The NRC issued Amendment No. 252 to SQN Unit 1 on March 8, 2000, to provide alternate repair criteria (ARC) for primary water stress corrosion cracking (PWSCC). During the month of March 2000, TVA conducted a total of 36,294 nondestructive examinations on the tubes in the four SQN Unit 1 SGs. These exams included a 100% bobbin-coil inspection of all tubes and 100% "Plus Point" (+Point) inspections of hot leg dented tube support plate intersections having eddy current instrument indications greater than or equal to (≥) 2 volts. The +Point probe was also used as a diagnostic tool for 1647 bobbin coil indications in less-than (<) 2-volt dented intersections detected by bobbin coil inspections. Three circumferential stress corrosion cracks (two inner diameter, one outer diameter) were identified during these < 2-volt inspections and the tubes were removed from service by plugging. Approximately 200 other tubes were plugged for other reasons during the March 2000 outage.

At the meeting on May 15, 2001, the NRC staff stated that it believes that more extensive +Point inspections should have been conducted during the March 2000 inspections at the < 2-volt dented intersections. The staff believes that TVA had clearly committed to do so in a letter to the NRC dated March 12, 1997, that was provided by TVA to support approval of an April 9, 1997 amendment for voltage-based ARC for outside diameter stress corrosion cracking (ODSCC). TVA discussed their commitment in the letter to sample all dents < 5 volts with a rotating pancake coil probe (RPC), such as +Point. This was not done during the March 2000 inspections. At the May 15, 2000, meeting, the NRC staff suggested that both Pacific Gas and Electric Company and TVA should develop appropriate sampling strategies for dented intersections < 2 volts. It is more likely that circumferential cracks will be detected in the 1 - 2-volt range than in the < 1-volt range, so a future sampling strategy may consider splitting the range into sections where detection would be most likely.

Meeting Summary

TVA stated that the commitment in the March 12 1997, letter was never intended to apply to dented intersections in the < 2-volt range. Because two different license amendments for two

NRC-001

different types of SG degradation mechanisms (ODSCC and PWSCC) had been issued during the past several years that treated dents in the < 2-volt range slightly differently, TVA stated that there had been some confusion regarding the extent of inspection of these tubes and this issue was entered into the SQN Corrective Action Program for resolution. TVA then defined a population of dents below 2 volts.

During the meeting, a number of Lissajous scans with voltage amplitudes ranging from 0.37 volts to 3.74 volts from the most recent SQN Unit 1 SG tube inspections were displayed and discussed by TVA. These scans demonstrated that Lissajous patterns < 1.0 volts are very hard to interpret as to whether an actual SG tube dent is indicated, because they were inconclusive and subjective. Therefore, TVA has proposed a threshold of ≥ 1.0 volts for +point inspections. This will increase the number of +point inspections from 8,360 after Cycle 10 to 15,774 during the Fall 2001 inspections. Bobbin calls will continue to be inspected with +point (1,647 were inspected after Cycle 10).

TVA also stated that approximately 5,000 additional intersections will be inspected to validate the Cycle 10 operational assessment methodology, assumptions, and conclusions. TVA concluded that no indications are predicted to have "percent degraded areas" large enough to challenge structural integrity. If the operational assessment is invalidated by structural or leakage concerns, the scope of this inspection will be expanded and the NRC will be informed.

TVA plans to submit a license amendment request by June 29, 2001, to revise SQN Unit 1 License Condition 2.C.(9)(d) to reflect the new 1.0-volt threshold and to document the Cycle 11 inspection plan. The submittal will supersede the commitment to inspect all dents less than 5 volts with an RPC.

The NRC staff concluded that the SQN Unit 1 planned inspection program, including the revised threshold, was reasonable. The staff stated that there are a number of potential complications, however. One is the need to expand the validation inspection sample size if necessary, as stated above. The staff also stated that TVA should pursue sizing capability of outside-diameter cracks and should consider in situ pressure testing in certain cases.

for

Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-327

Enclosures: 1. Attendance List
2. TVA Handout

cc w/enclosures: See next page

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/RA by M.Padovan Acting for/
Ronald W. Hernan, Senior Project Manager, Section 2
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DATE	4/19/01	4/ /01	4/19/01

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Region II - P. Fredrickson

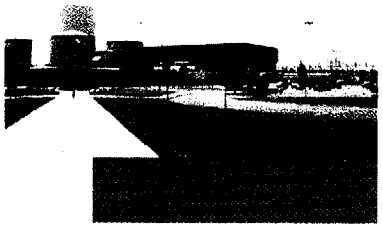
NRC/TVA MEETING ON SEQUOYAH UNIT 1 STEAM GENERATOR TUBE INSPECTIONS
WEDNESDAY, APRIL 11, 2001

ATTENDEES

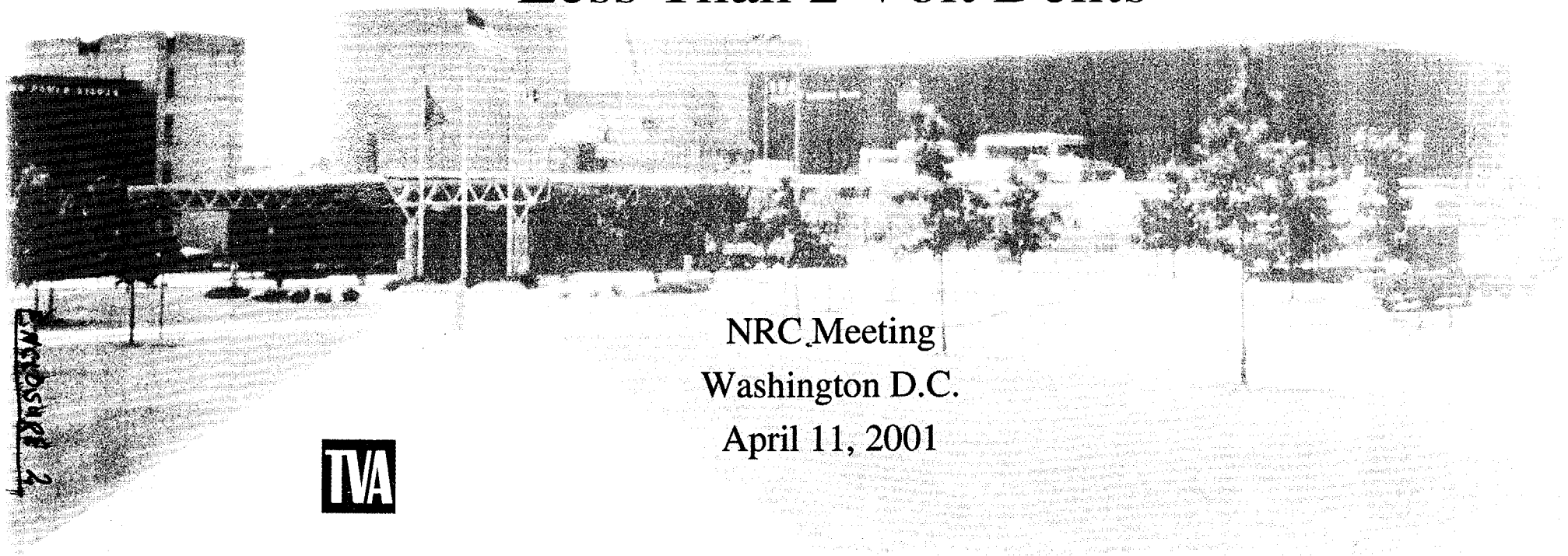
Name	Affiliation
Ronald Hernan	NRC
Herb Berkow	NRC
Richard P. Correia	NRC
Ted Sullivan	NRC
Louise Lund	NRC
Emmett Murphy	NRC
Cheryl Kahn	NRC
U. Bhachu	NRC
Pedro Salas	TVA
Joe Valente	TVA
David Goetcheus	TVA
Helen Cothron	TVA
Dan Salter	HGP, Inc.

ENCLOSURE 1

Sequoyah Nuclear Plant



Steam Generator Inspection
Unit 1 End of Cycle 11
Less Than 2 Volt Dents



NRC Meeting
Washington D.C.
April 11, 2001

TVA

Agenda

• Opening Remarks	Joe Valente
• Introduction	David Goetcheus
• Licensing Basis	David Goetcheus
• Unit 1 Cycle 11 Dent Inspection Plan	Helen Cothron
• Conclusions	Helen Cothron

Introduction

- **During the Sequoyah Unit 1 end of Cycle 10 steam generator inspection, 3 circumferential cracks were identified in less than 2-volt dented intersections**
  - Operational assessment was successfully performed without a dent inspection expansion
  - On May 15, 2000, TVA and NRC met to discuss the condition monitoring and operational assessment
    - *No safety concerns were identified during the meeting*
    - *At that meeting, TVA agreed to meet again with the NRC to present the end of Cycle 11 inspection plan for less than 2-volt dented intersections*

Licensing Basis

- **In a March 12, 1997 RAI response on dent inspections, TVA committed to test all dented intersections less than 5 volts**
  - TVA's intent was dents less than 5 volts, but greater than or equal to the dent calling threshold
    - *Dent thresholds were and still are standard in the industry*
  - It was not intended to apply to the range of 0 - 2.0 volts

Licensing Basis

- **WCAP 15128, Revision 2 approved for use by SQN's Technical Specification Change on March 8, 2000, defines the dent inspection plan for SQN on page 2-3**
  - 100% bobbin coil inspection of all TSP intersections
  - Plus point coil inspection of all bobbin coil indications at dented TSP intersections
  - Plus point coil inspection of all prior PWSCC indications left in service
  - On a SG basis, Plus point coil inspection of all TSP intersections having greater than 2.0-volt dents up to the highest TSP for which PWSCC has been detected in the prior and current inspections and 20% of dents greater than 2.0 volts at the next highest TSP

Licensing Basis

- **TVA realizes that the two statements seem contradictory and need clarification**
  - This issue was entered into Sequoyah's Corrective Action Program
    - *TVA will develop a new inspection strategy for less than 2-volt dented intersections for the Unit 1 Cycle 11 inspection. The new strategy will be documented in a future submittal*
  - This meeting serves to define Sequoyah Unit 1 inspection for dented intersections less than 2 volts for end of Cycle 11 and a new dent calling threshold
    - *Sequoyah will submit the inspection plan and change procedures accordingly*
    - *The inspection plan will be contained in a License Ammendment change request to Unit 1 License Condition 2.C.(9)(d)*
    - *Ammemdment request expected to be submitted by June 29 in support of NRC approval for the Unit 1 Cycle 11 refueling outage*

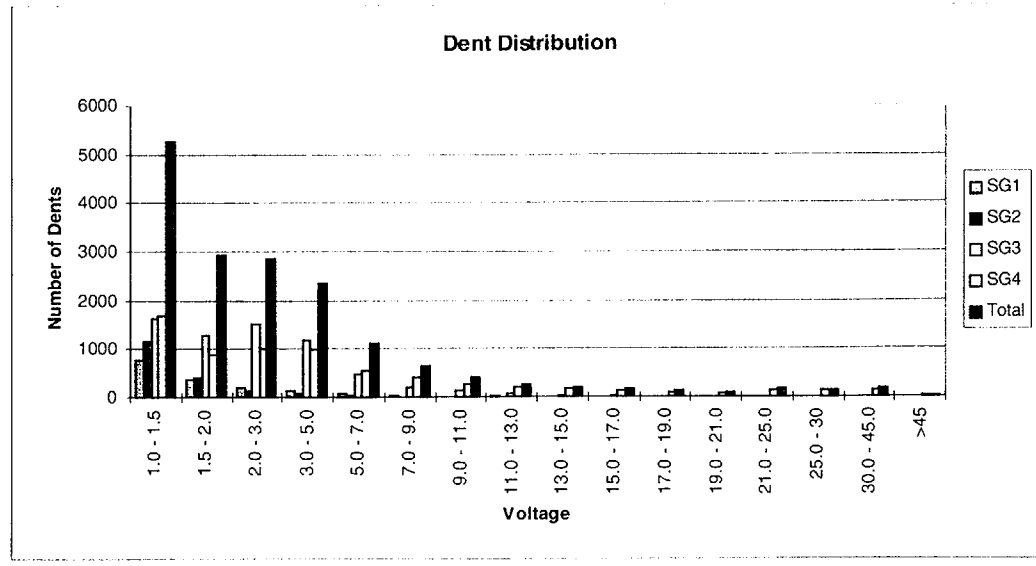
Dented Intersection Calling Threshold

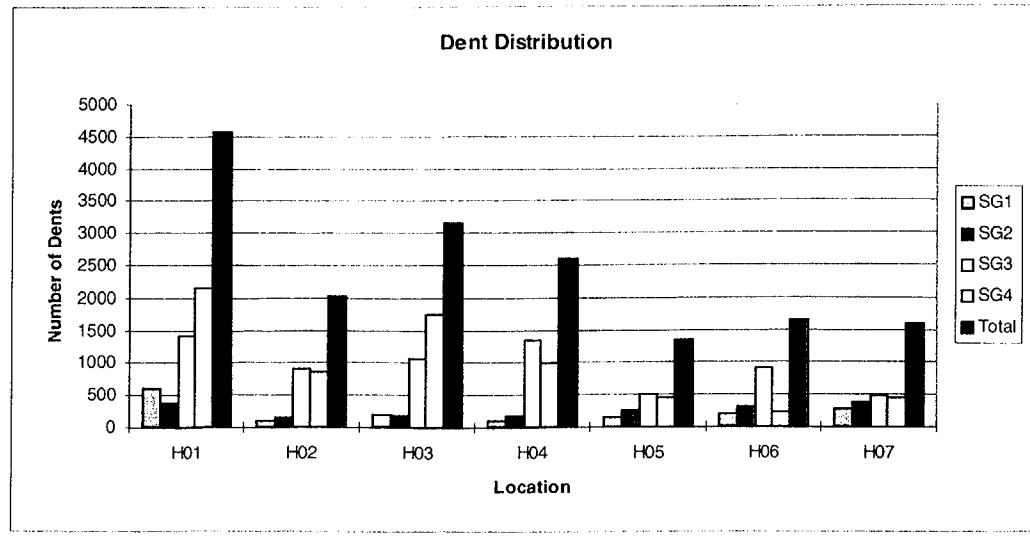
- **After the U1C10 inspection, the population of dents below 2 volts were evaluated**
  - Due to NRC's concerns, a population of dents below 2 volts was defined
  - The population below 1 volt is inconclusive and subjective as to whether a dent exists or not

Dented Intersection Calling Threshold

- **The new threshold for Sequoyah Unit 1 will be 1 volt**
  - Dented intersections greater than or equal to 1 volt will be inspected in all 4 steam generators
    - *15,774 dent inspections with plus point compared to base scope of 8,360 at end of Cycle 10*
  - No circumferential crack has been identified in a dent less than 1.5 volt
- **Bobbin calls will continue to be plus point inspected regardless of dent voltage**
  - 1,647 additional plus point exams were performed end of Cycle 10

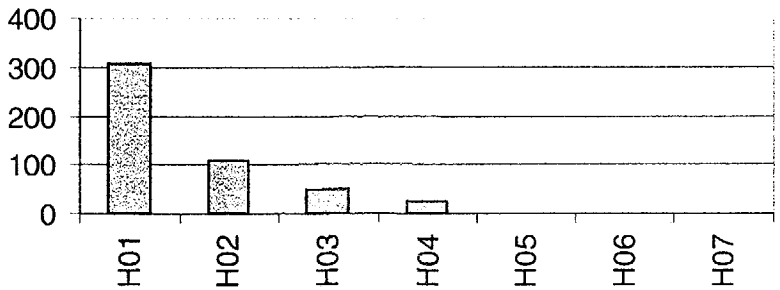
Population of Dented Intersections



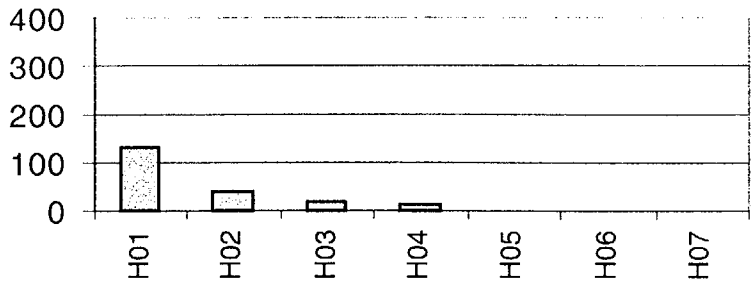


Cracking at Dented Intersections

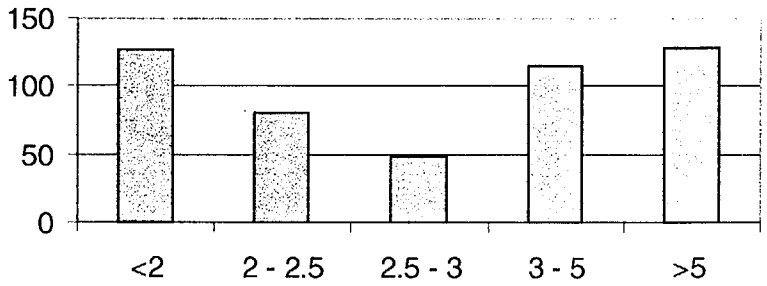
Cycle 7 - Cycle 10 ID Axial Indications vs Location



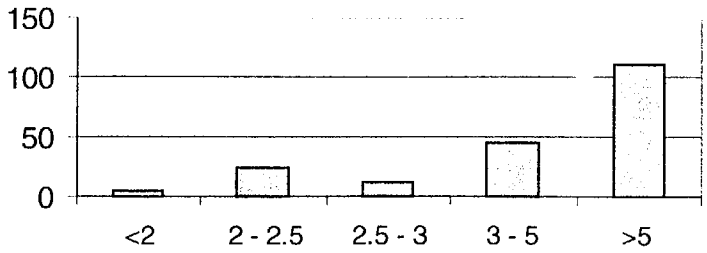
Cycle 7 - Cycle 10 Circ Indications vs Location



Cycle 7 - Cycle 10 ID Axial Indications vs Dent Voltage

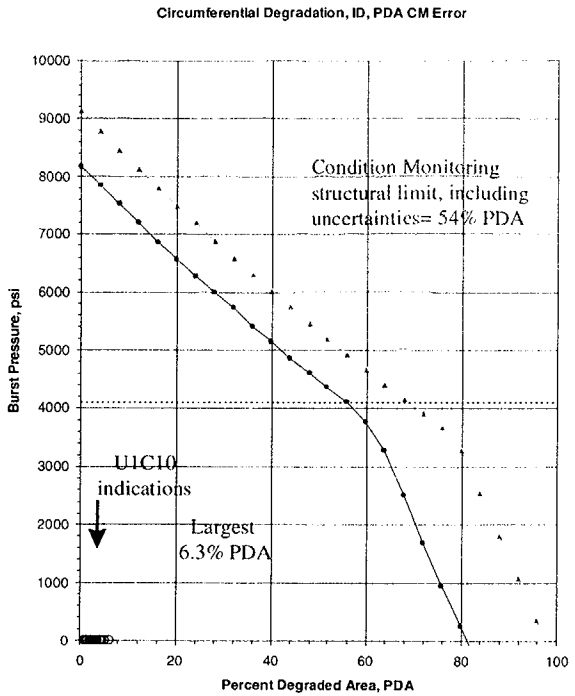


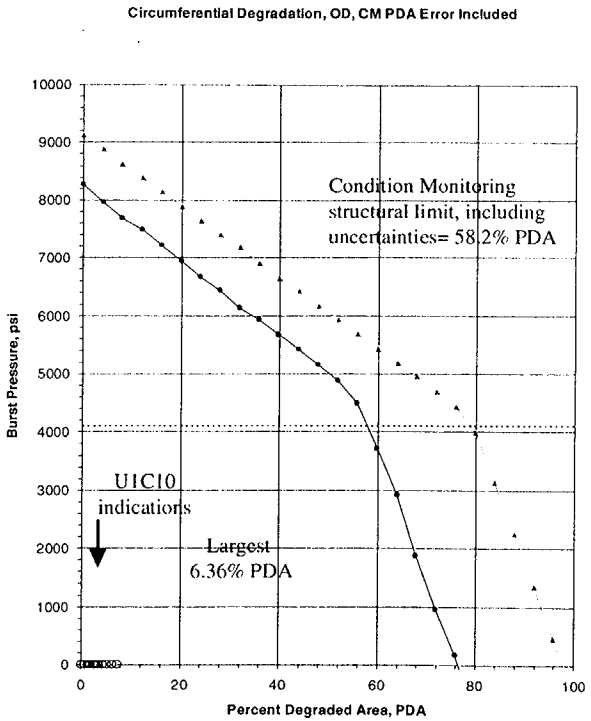
Cycle 7 - Cycle 10 Circ Indications vs Dent Voltage



Objective of Larger Inspection

- **Approximately 5,000 additional intersections will be inspected to validate end of Cycle 10 operational assessment methodology, assumptions, and conclusions**
  - No indications are predicted to have PDAs large enough to challenge structural integrity



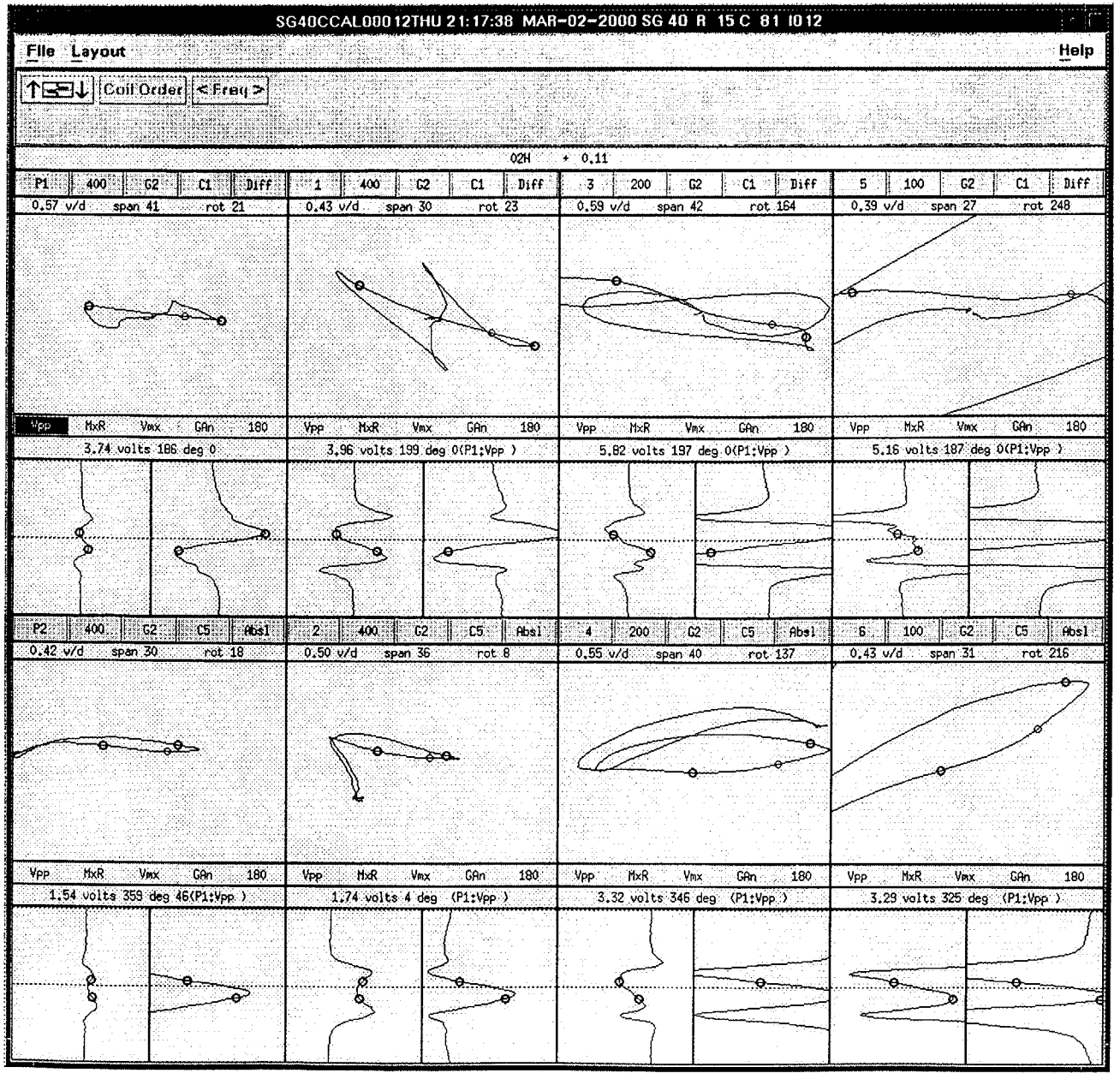


Objective of Larger Inspection

- **Approximately 5,000 additional intersections will be inspected to validate end of Cycle 10 operational assessment methodology, assumptions, and conclusions**
  - Between 100 and 150 indications were assumed unidentified during the end of Cycle 10 inspection
    - ☛ *Calculated accident-induced leakage remained well below allowable 1 gpm*
- **Expansion will be necessary if operational assessment is invalidated by structural or leakage concerns**
  - Plan will be developed when data is compiled
  - NRR will be informed of the expansion decision

Conclusions

- **Sequoyah Unit 1 dent calling threshold will be established at 1 volt**
- **Dented intersections greater than or equal to 1 volt will be inspected end of Cycle 11 with plus point**
- **If end of Cycle 10 operational assessment conclusions are validated, no expansion will be necessary**
  - The same operational assessment methodology will be applied end of Cycle 11 to determine cycle length for Cycle 12
  - NRR will be informed of expansion plans
- **This strategy will be submitted to the NRC and procedures will be changed accordingly**
- **Unit 1 SG replacement is on schedule for the next outage, Spring 2003**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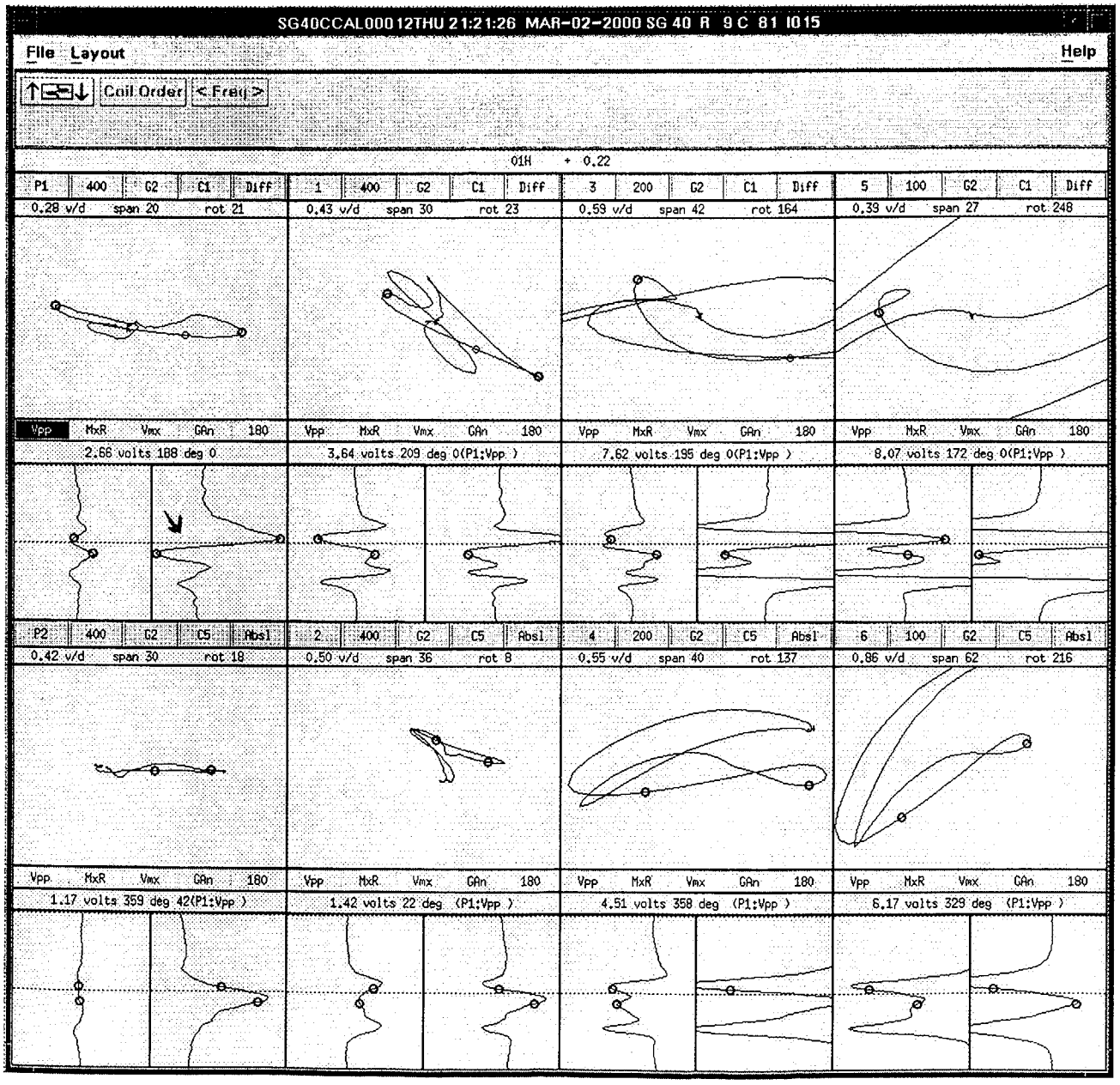
02H + 0.11
P1 400 G2 C1 Diff
0.57 v/d span 41 rot 21
1 400 G2 C1 Diff
0.43 v/d span 30 rot 23
3 200 G2 C1 Diff
0.59 v/d span 42 rot 164
5 100 G2 C1 Diff
0.39 v/d span 27 rot 248
Vpp MxR Vmx GAn 180
3.74 volts 186 deg 0
3.96 volts 199 deg 0(P1:Vpp)
5.82 volts 197 deg 0(P1:Vpp)
5.16 volts 187 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.42 v/d span 30 rot 18
2 400 G2 C5 Absl
0.50 v/d span 36 rot 8
4 200 G2 C5 Absl
0.55 v/d span 40 rot 137
6 100 G2 C5 Absl
0.43 v/d span 31 rot 216
1.54 volts 359 deg 46(P1:Vpp)
1.74 volts 4 deg (P1:Vpp)
3.32 volts 346 deg (P1:Vpp)
3.29 volts 325 deg (P1:Vpp)

Phase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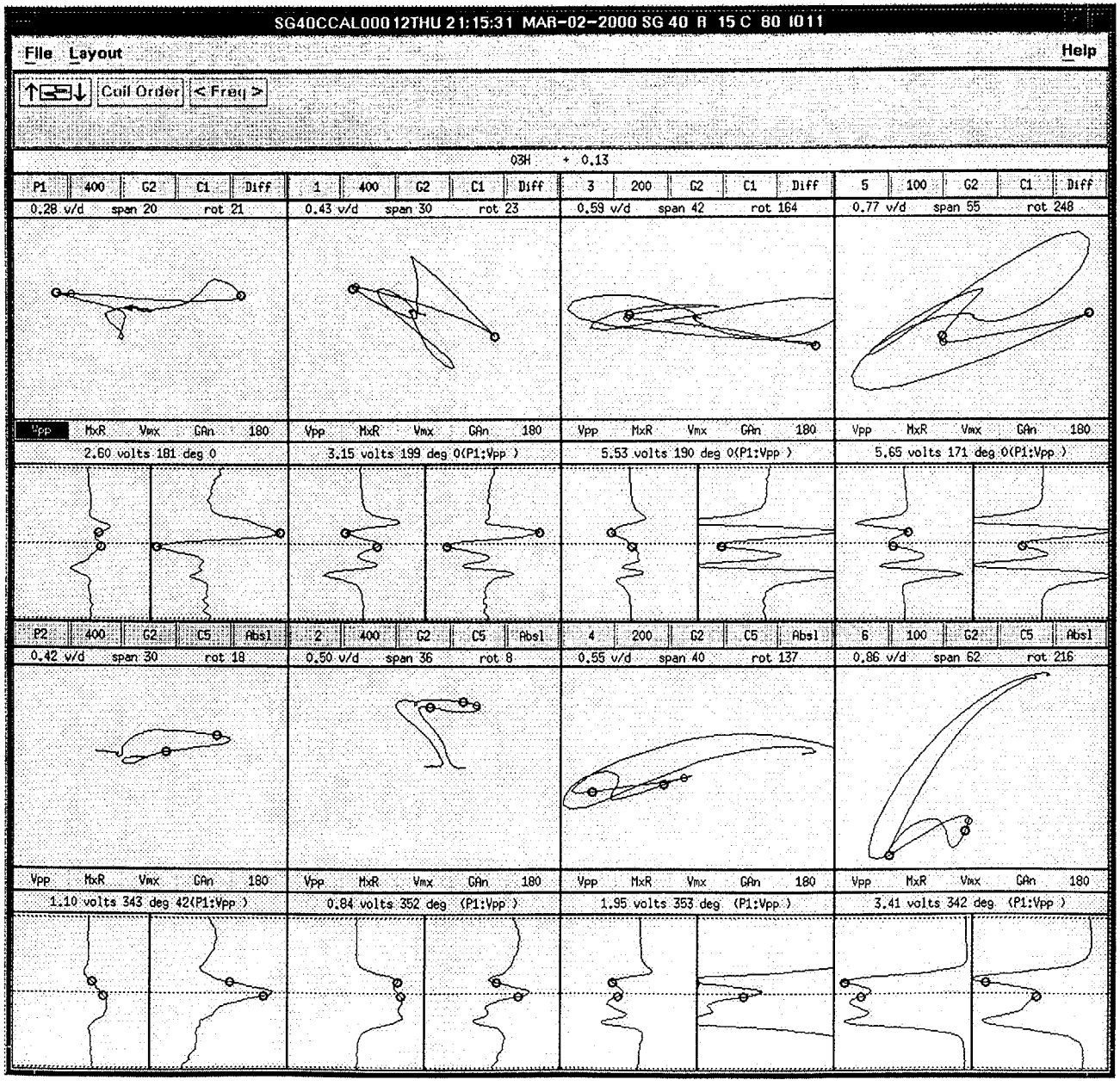
01H + 0.22
P1 400 G2 C1 Diff
0.28 v/d span 20 rot 21
1 400 G2 C1 Diff
0.43 v/d span 30 rot 23
3 200 G2 C1 Diff
0.59 v/d span 42 rot 164
5 100 G2 C1 Diff
0.39 v/d span 27 rot 248
Vpp MxR Vmx GAn 180
2.66 volts 188 deg 0
3.64 volts 209 deg 0(P1:Vpp)
7.62 volts 195 deg 0(P1:Vpp)
8.07 volts 172 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.42 v/d span 30 rot 18
2 400 G2 C5 Absl
0.50 v/d span 36 rot 8
4 200 G2 C5 Absl
0.55 v/d span 40 rot 137
6 100 G2 C5 Absl
0.86 v/d span 62 rot 216
1.17 volts 359 deg 42(P1:Vpp)
1.42 volts 22 deg (P1:Vpp)
4.51 volts 358 deg (P1:Vpp)
6.17 volts 329 deg (P1:Vpp)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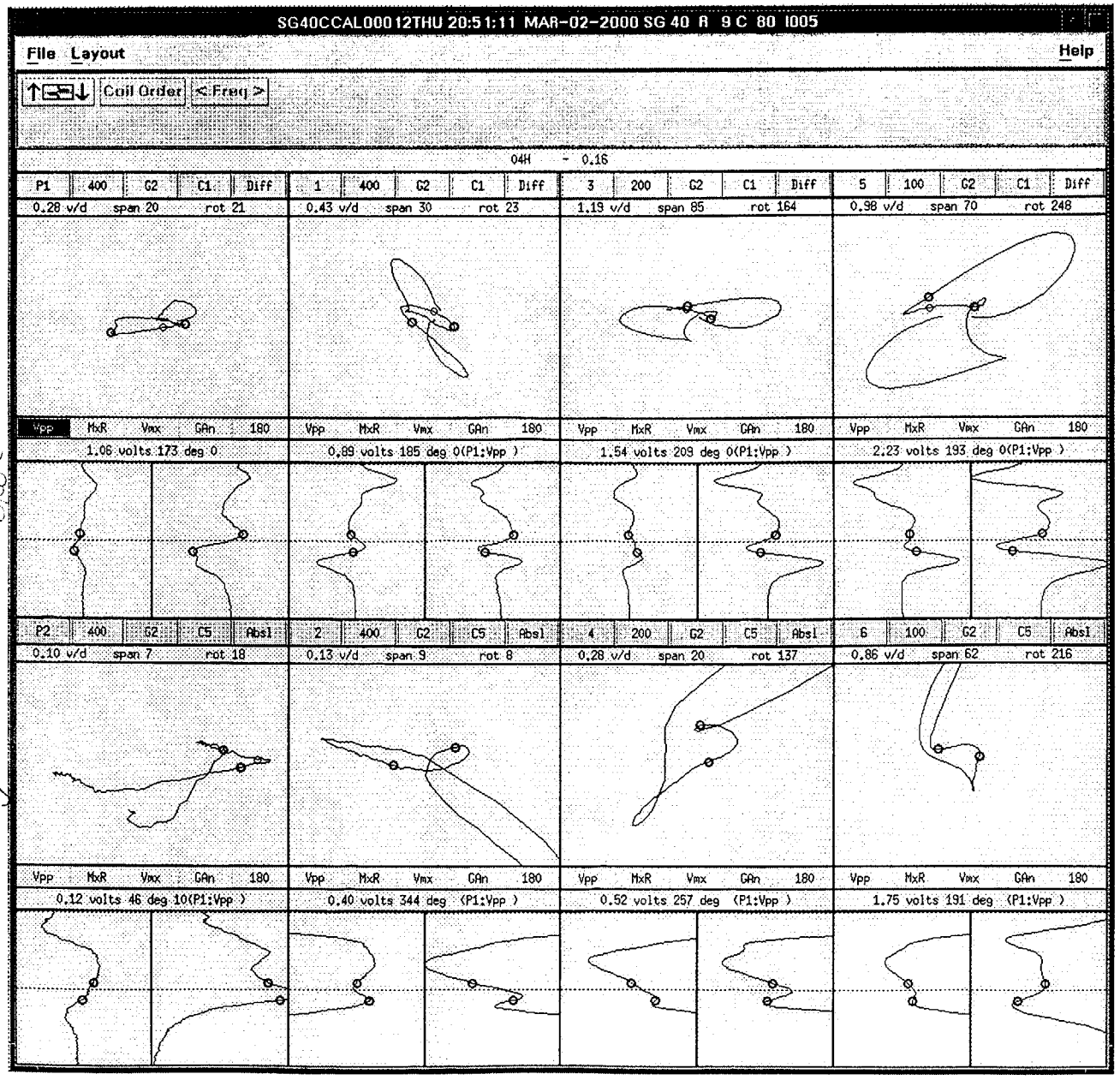
03H + 0.13
P1 400 G2 C1 Diff
0.28 v/d span 20 rot 21
1 400 G2 C1 Diff
0.43 v/d span 30 rot 23
3 200 G2 C1 Diff
0.59 v/d span 42 rot 164
5 100 G2 C1 Diff
0.77 v/d span 55 rot 248
Vpp MxR Vmx GAn 180
2.60 volts 181 deg 0
3.15 volts 199 deg 0(P1:Vpp)
5.53 volts 190 deg 0(P1:Vpp)
5.65 volts 171 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.42 v/d span 30 rot 18
2 400 G2 C5 Absl
0.50 v/d span 36 rot 8
4 200 G2 C5 Absl
0.55 v/d span 40 rot 137
6 100 G2 C5 Absl
0.86 v/d span 62 rot 216
1.10 volts 343 deg 42(P1:Vpp)
0.84 volts 352 deg (P1:Vpp)
1.95 volts 353 deg (P1:Vpp)
3.41 volts 342 deg (P1:Vpp)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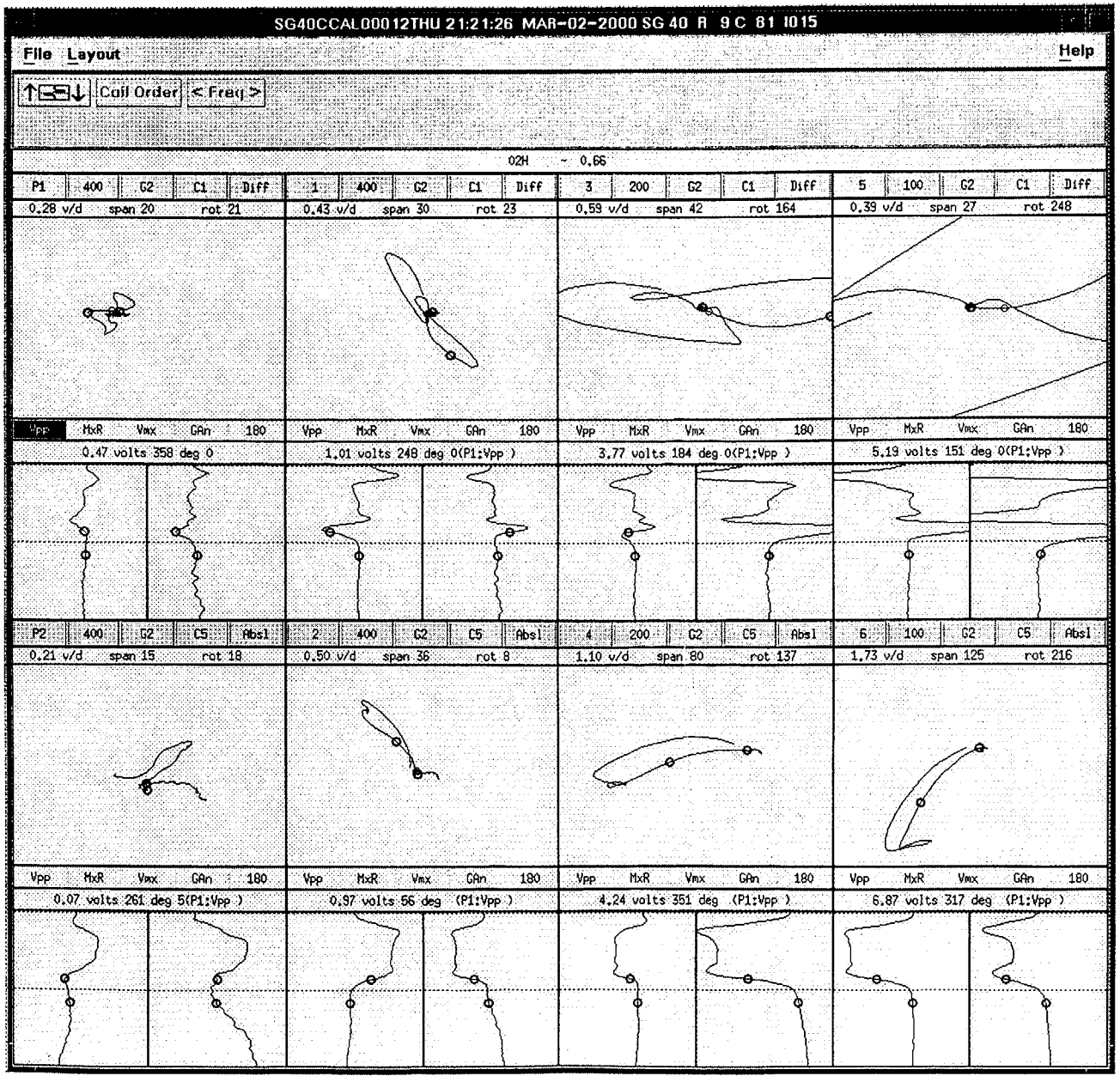
1 400 G2 C1 Diff
0.43 v/d span 30 rot 23
3 200 G2 C1 Diff
1.19 v/d span 85 rot 164
5 100 G2 C1 Diff
0.98 v/d span 70 rot 248
Vpp MxR Vmx GAn 180
1.06 volts 173 deg 0
Vpp MxR Vmx GAn 180
0.89 volts 185 deg 0(P1:Vpp)
Vpp MxR Vmx GAn 180
1.54 volts 209 deg 0(P1:Vpp)
Vpp MxR Vmx GAn 180
2.23 volts 193 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.10 v/d span 7 rot 18
2 400 G2 C5 Absl
0.13 v/d span 9 rot 8
4 200 G2 C5 Absl
0.28 v/d span 20 rot 137
6 100 G2 C5 Absl
0.86 v/d span 62 rot 216
Vpp MxR Vmx GAn 180
0.12 volts 46 deg 10(P1:Vpp)
Vpp MxR Vmx GAn 180
0.40 volts 344 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
0.52 volts 257 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
1.75 volts 191 deg (P1:Vpp)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02H ~ 0.66
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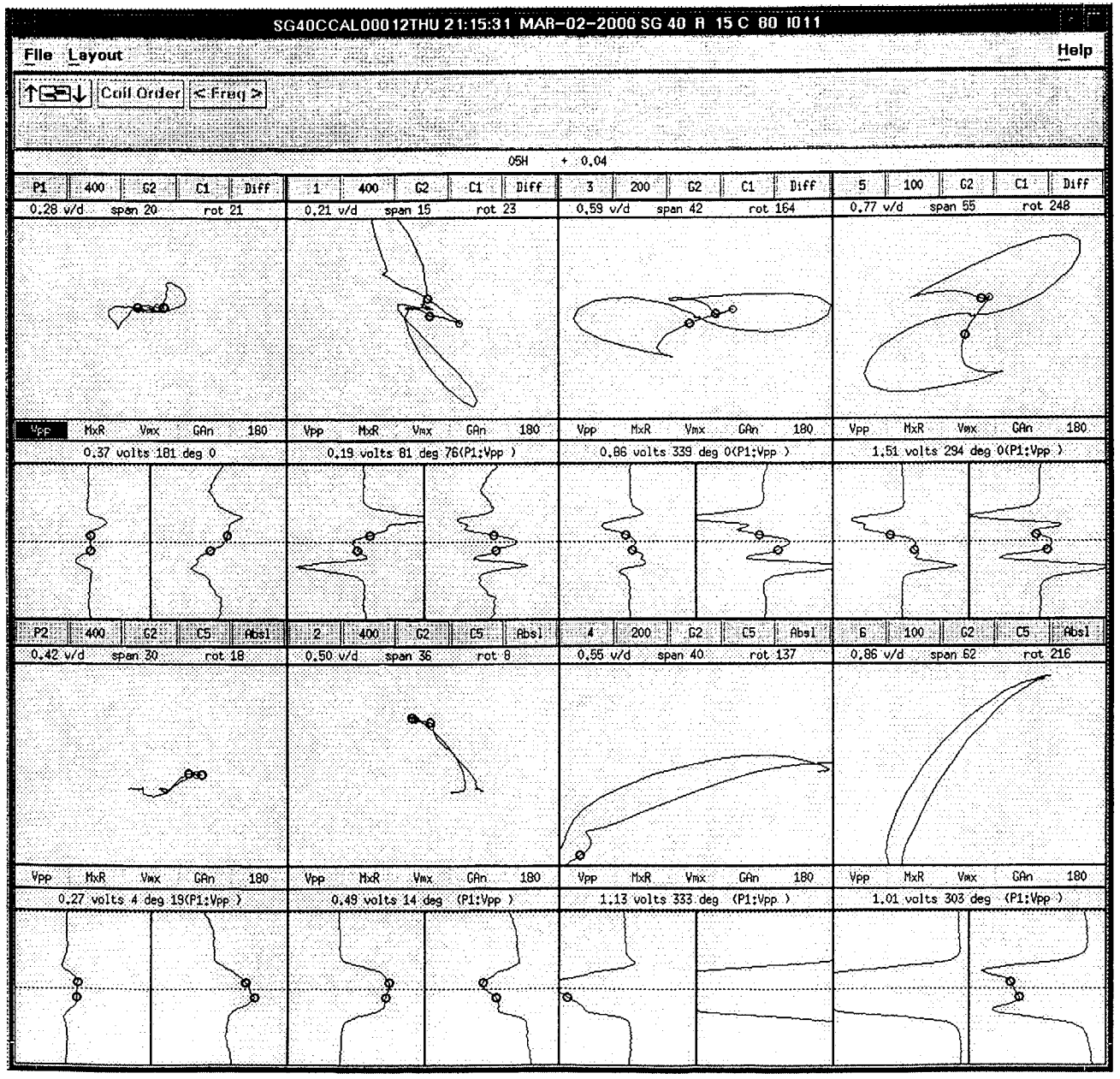
0.28 v/d span 20 rot 21
1 400 G2 C1 Diff
0.43 v/d span 30 rot 23
3 200 G2 C1 Diff
0.59 v/d span 42 rot 164
5 100 G2 C1 Diff
0.39 v/d span 27 rot 248
Vpp MxR Vmx GAn 180
0.47 volts 358 deg 0
Vpp MxR Vmx GAn 180
1.01 volts 248 deg 0(P1:Vpp)
Vpp MxR Vmx GAn 180
3.77 volts 184 deg 0(P1:Vpp)
Vpp MxR Vmx GAn 180
5.19 volts 151 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.21 v/d span 15 rot 18
2 400 G2 C5 Absl
0.50 v/d span 36 rot 8
4 200 G2 C5 Absl
1.10 v/d span 80 rot 137
6 100 G2 C5 Absl
1.73 v/d span 125 rot 216
Vpp MxR Vmx GAn 180
0.07 volts 261 deg 5(P1:Vpp)
Vpp MxR Vmx GAn 180
0.97 volts 56 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
4.24 volts 351 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
6.87 volts 317 deg (P1:Vpp)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0.28 v/d span 20 rot 21
1 400 G2 C1 Diff
0.21 v/d span 15 rot 23
3 200 G2 C1 Diff
0.59 v/d span 42 rot 164
5 100 G2 C1 Diff
0.77 v/d span 55 rot 248
Vpp MxR Vmx GAn 180
0.37 volts 181 deg 0
Vpp MxR Vmx GAn 180
0.19 volts 81 deg 76(P1:Vpp)
Vpp MxR Vmx GAn 180
0.86 volts 339 deg 0(P1:Vpp)
Vpp MxR Vmx GAn 180
1.51 volts 294 deg 0(P1:Vpp)
P2 400 G2 C5 Absl
0.42 v/d span 30 rot 18
2 400 G2 C5 Absl
0.50 v/d span 36 rot 8
4 200 G2 C5 Absl
0.55 v/d span 40 rot 137
6 100 G2 C5 Absl
0.86 v/d span 62 rot 216
Vpp MxR Vmx GAn 180
0.27 volts 4 deg 19(P1:Vpp)
Vpp MxR Vmx GAn 180
0.49 volts 14 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
1.13 volts 333 deg (P1:Vpp)
Vpp MxR Vmx GAn 180
1.01 volts 303 deg (P1:Vpp)

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