SMS Monitoring

- The G0 SMS Control System
  - Introduction (see OSP hardware description)
  - Navigation
  - Summary Pages
- Monitoring with no field (magnet current = 0)
  - LHe Level
  - LN2 Level
  - Vacuum
  - Temperatures
- Monitoring with field
  - Power Supply
  - DQP
  - AQP
  - Lead Flow
  - Lead Temperature
- Emergency procedures

The Console and PLC

- Console
  - Development station for PLC
  - LookoutDirect HMI
  - Temperature pass-through process

Ethernet

- PLC
  - DirectLogic DL405 PLC
  - Relay Ladder Logic
  - Independent of Con-sole (except for tem-peratures)
  - Built in PID loop “black boxes”
  - 25 ms loop time
  - Serial port Modbus to EPICS

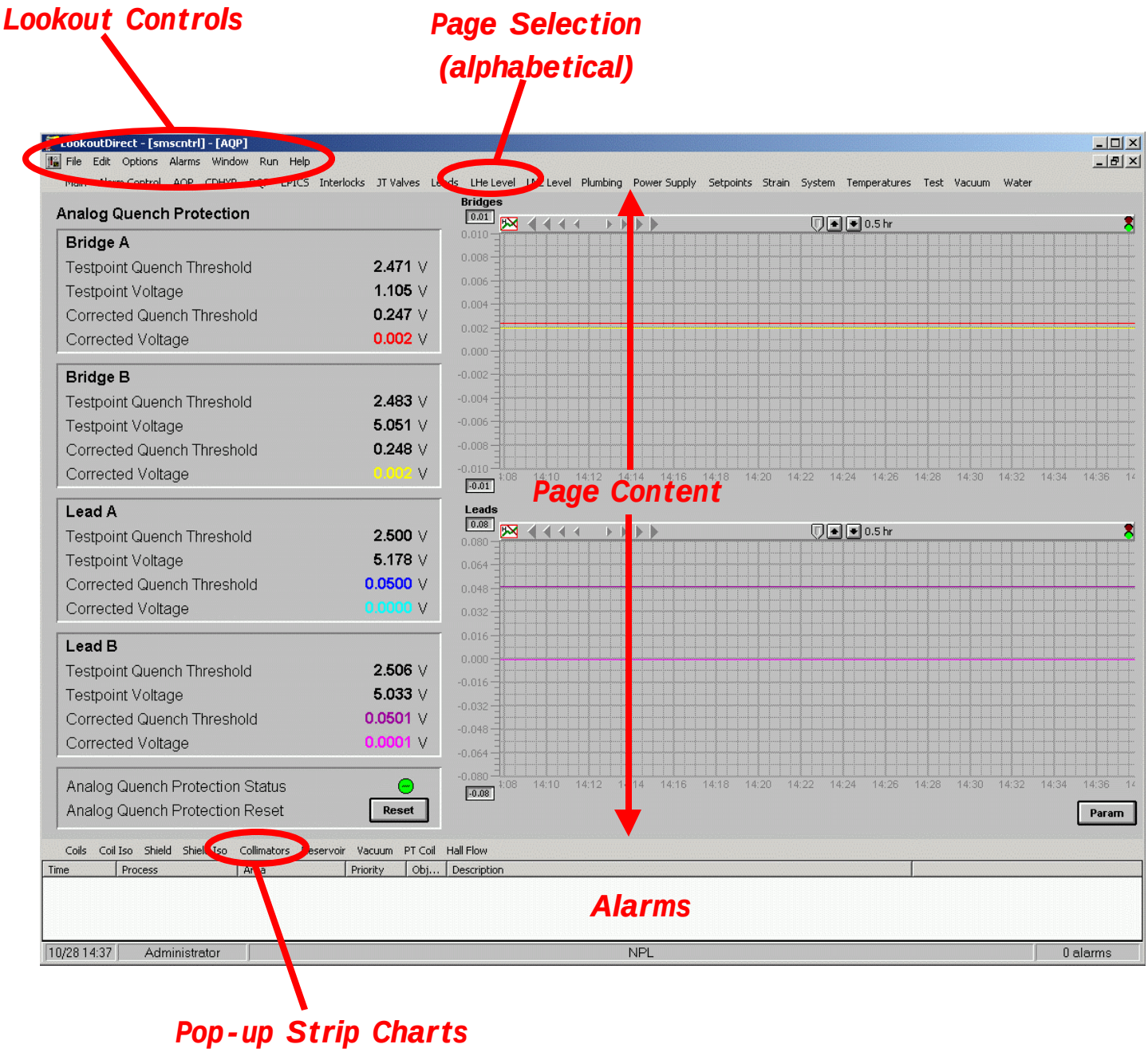
Lookout Program Functions

- Monitor digital and analog signals
- Alter user-setable parameters
- Command the PLC to perform procedures
- Display data in historical (strip charts)
- Screens have been created for
  - Alarm control
  - Cool-down PID Loop
  - Interlocks
  - JT Valve Control
  - VCL control
  - LHe Level PID loop (under construction)
  - LN2 Level PID Loop
  - LN2/LHe cryogen circuit status
  - Power supply control
  - Quench Protection
  - Setponts and levels, Strain monitoring
  - Temperatures
  - Vacuum Monitoring
  - LCW Monitoring
- Data logged to compressed “citadel” data base
  - Available through MS Query (Excel, Access,...)
- The program is still being improved and enhanced.

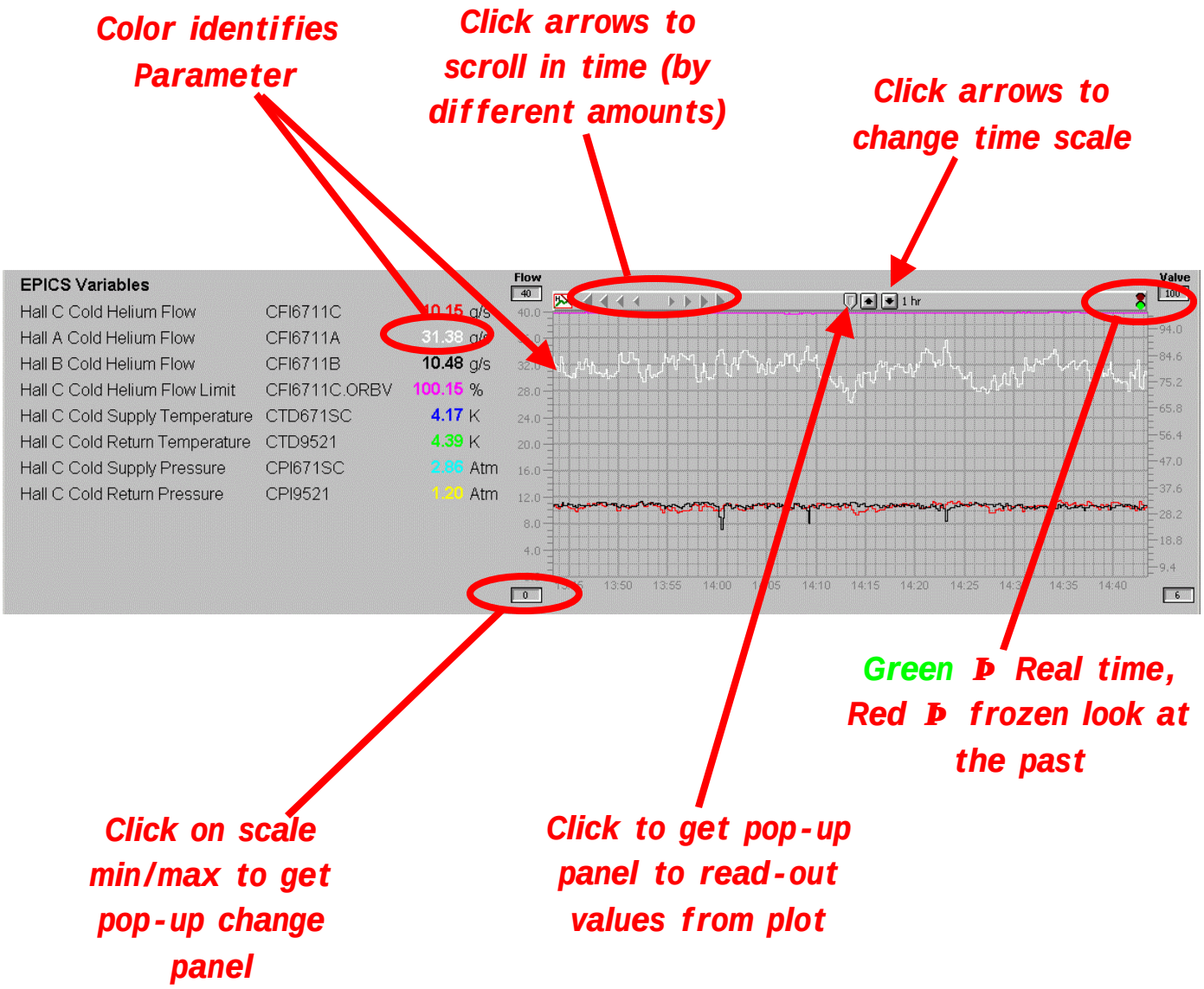
The PLC Program

- Initialize (first cycle only)
- Process analog input
  - Read multiplexed ADCs.
  - Scale analog inputs to “Engineering Units”.
- Read digital inputs
- Move cryogenic valves based on user (or PID) target
- Ramp power based on user (or slow dump) target
- Set VCL flow based on user (or current derived) target
- Derive new analog quantities (e.g. coil imbalance)
- Alarm checks
  - Compare raw and derived analog values to levels
  - Latch alarm “contacts” if some condition is true
  - For some, only alarm if condition true for ΔT
- Power supply polarity logic
- Evaluate interlock chains of alarms and digital inputs
- Set dump switch position, supply “ON/OFF”
- Manage PID Loops
- Write multiplexed analog outputs
- Write digital outputs

Navigation

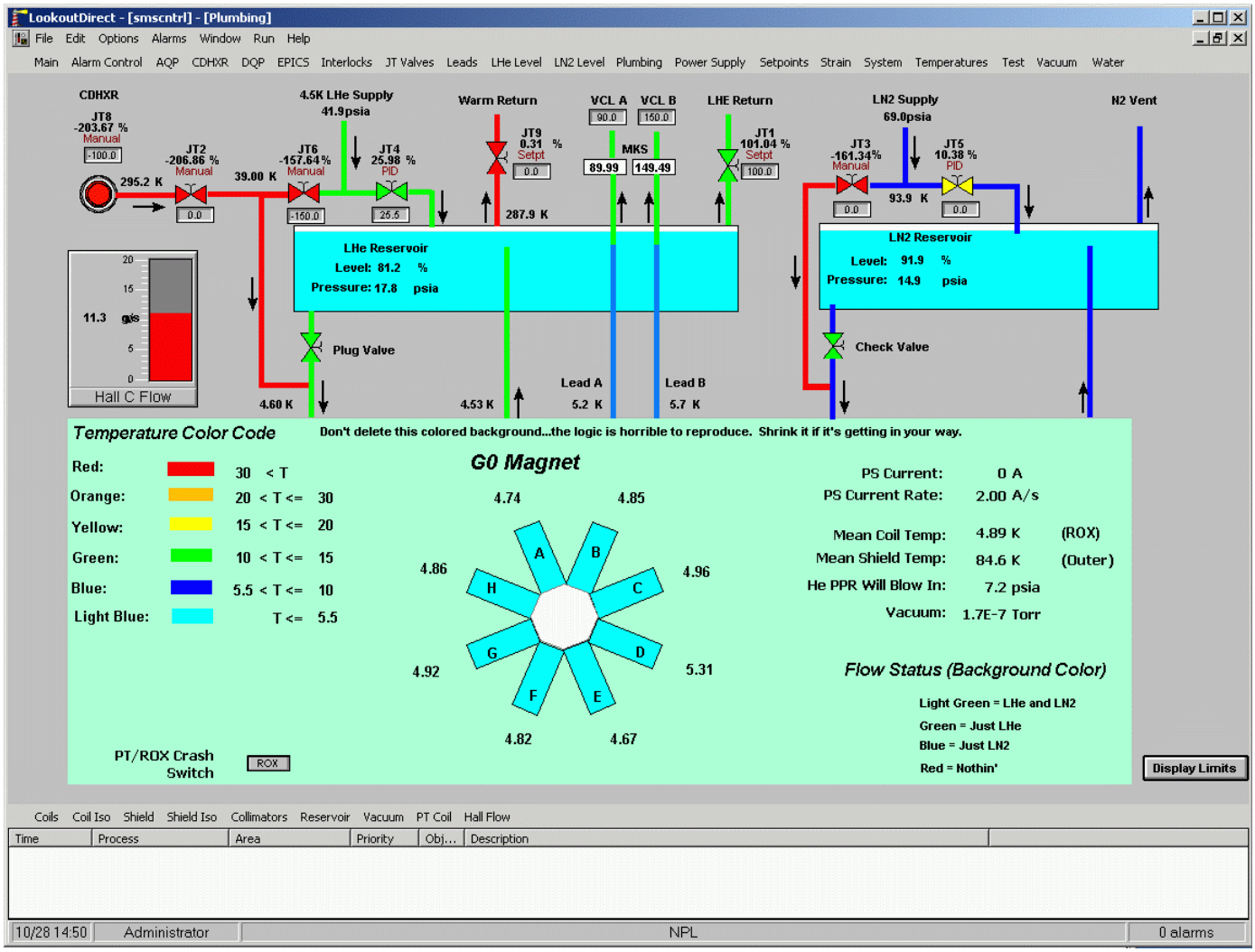

Lookout Controls
Page Selection (alphabetical)
LookoutDirect - [smscntrl] - [AQP]
File Edit Options Alarms Window Run Help
Interlocks JT Valves LHe Level Plumbing Power Supply Setpoints Strain System Temperatures Test Vacuum Water
Analog Quench Protection
Bridge A
Testpoint Quench Threshold 2.471 V
Testpoint Voltage 1.105 V
Corrected Quench Threshold 0.247 V
Corrected Voltage 0.002 V
Bridge B
Testpoint Quench Threshold 2.483 V
Testpoint Voltage 5.051 V
Corrected Quench Threshold 0.248 V
Corrected Voltage 0.002 V
Lead A
Testpoint Quench Threshold 2.500 V
Testpoint Voltage 5.178 V
Corrected Quench Threshold 0.0500 V
Corrected Voltage 0.0000 V
Lead B
Testpoint Quench Threshold 2.506 V
Testpoint Voltage 5.033 V
Corrected Quench Threshold 0.0501 V
Corrected Voltage 0.0001 V
Analog Quench Protection Status
Analog Quench Protection Reset
Reset
Bridges
Leads
0.5 hr
Page Content
Param
Coils Coil Iso Shield Collimators Vacuum PT Coil Hall Flow
Time Process Priority Obj... Description
Alarms
10/28 14:37 Administrator NPL 0 alarms
Pop-up Strip Charts

Strip-charts



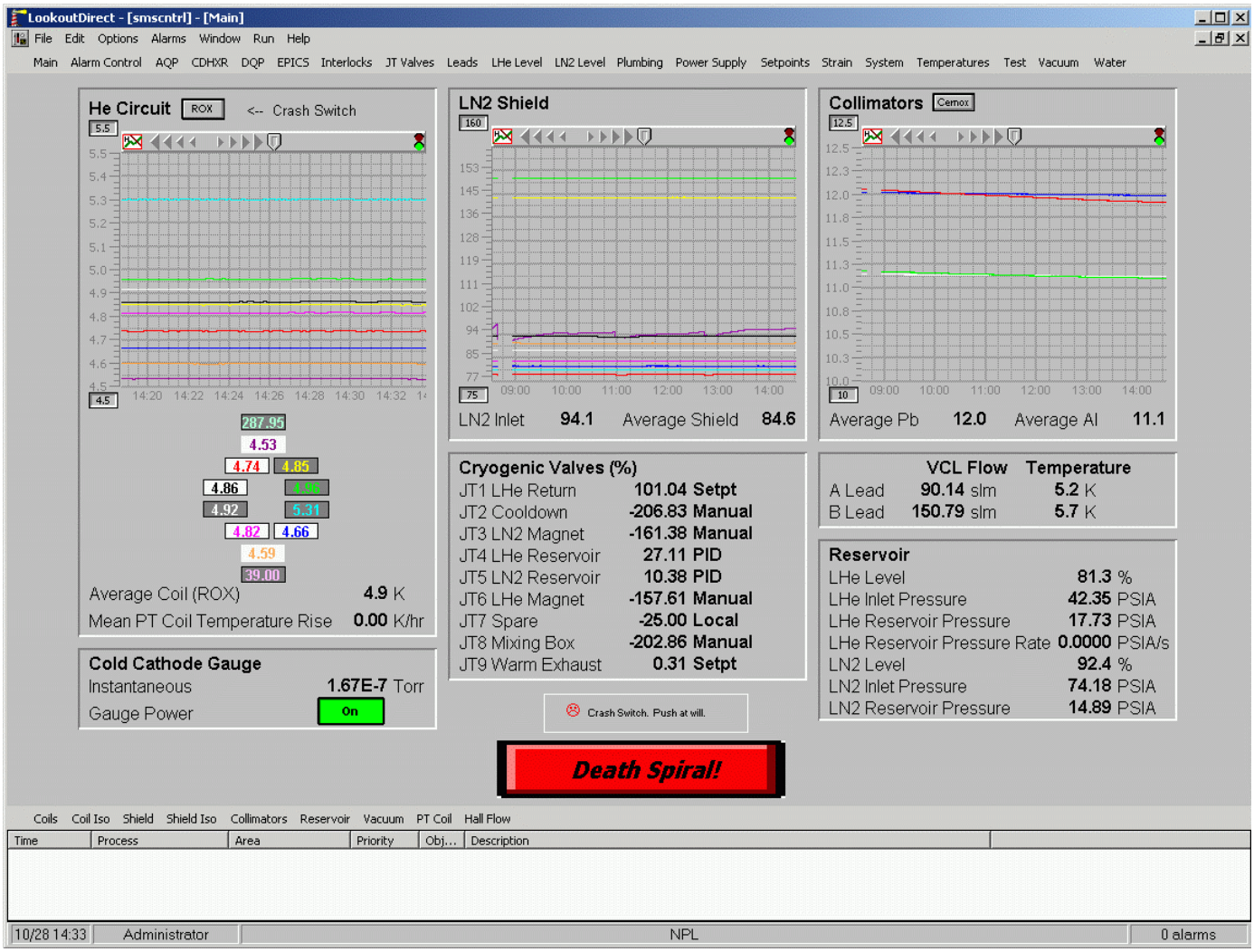
General Monitoring

- "Plumbing Page" shows most important parameters
- Look here for shift check-list values



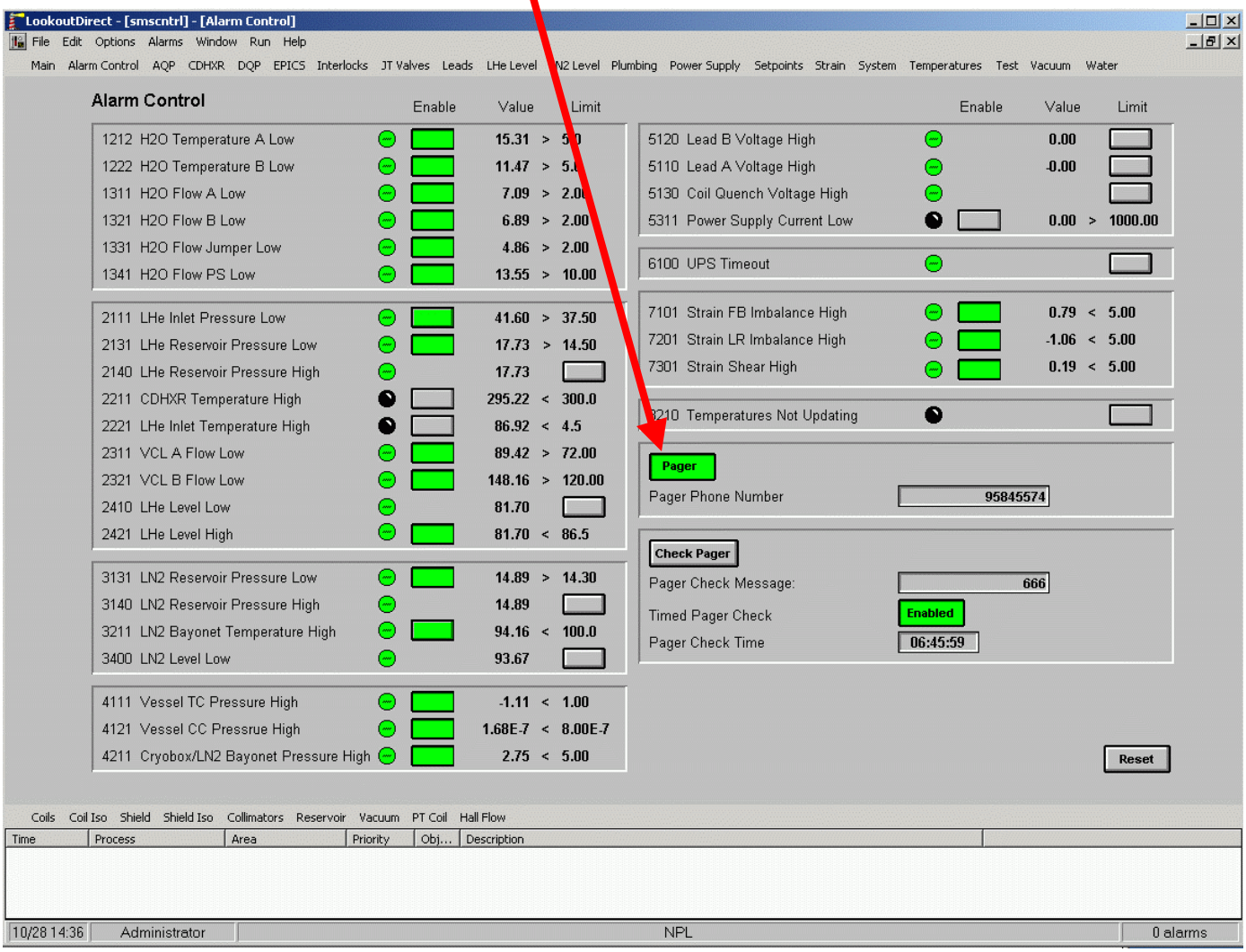
General Monitoring

- "Main" page gives quick look at temperatures
- Due to a bug in lookout (which we are still trying to re-solve), a couple of the buttons cause the program to crash. DO NOT PRESS THEM



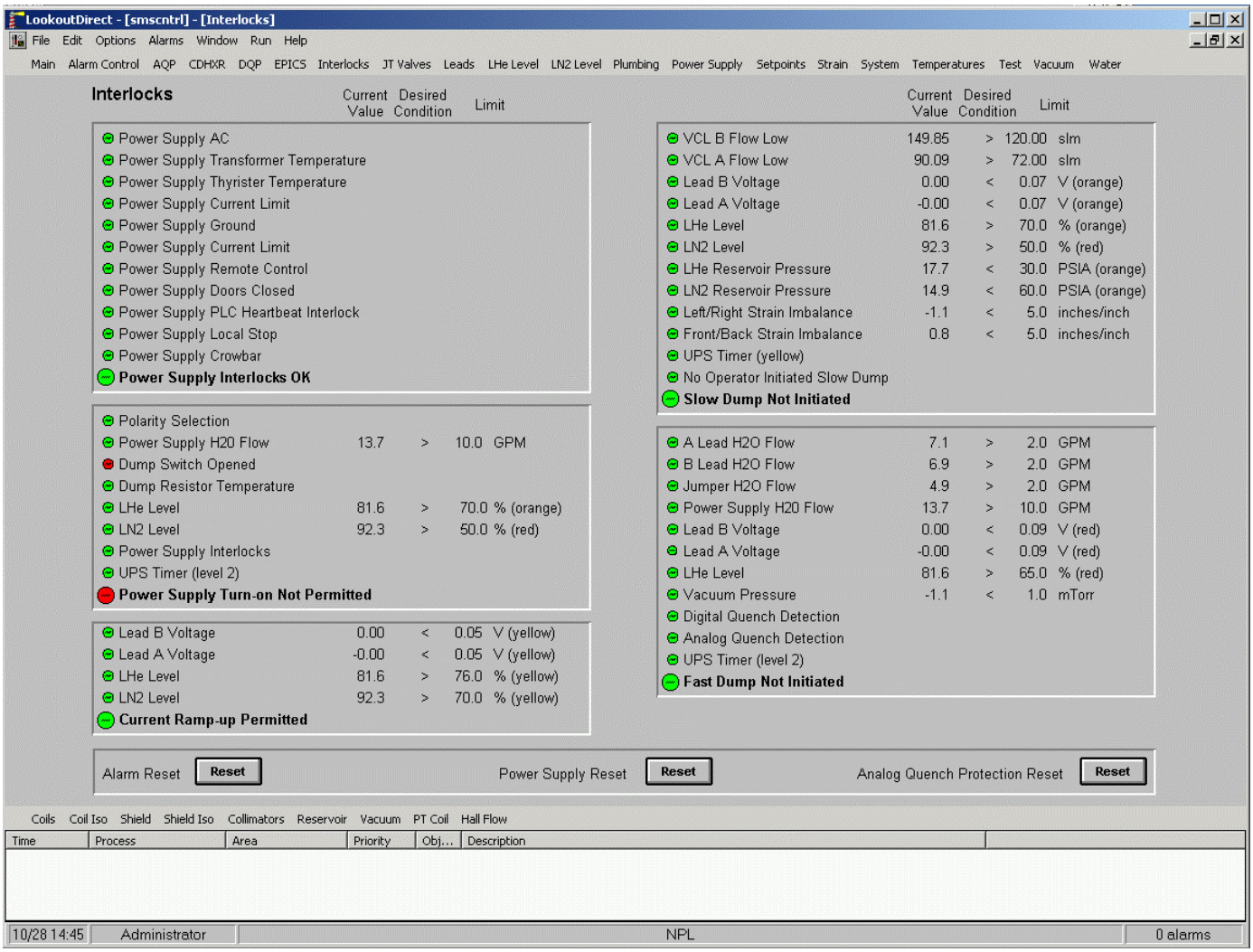
General Monitoring

- Alarm control page provides a quick look at alarm conditions
- Be sure that no important alarms have been disabled.
- Be sure that the “Pager” switch is Green.



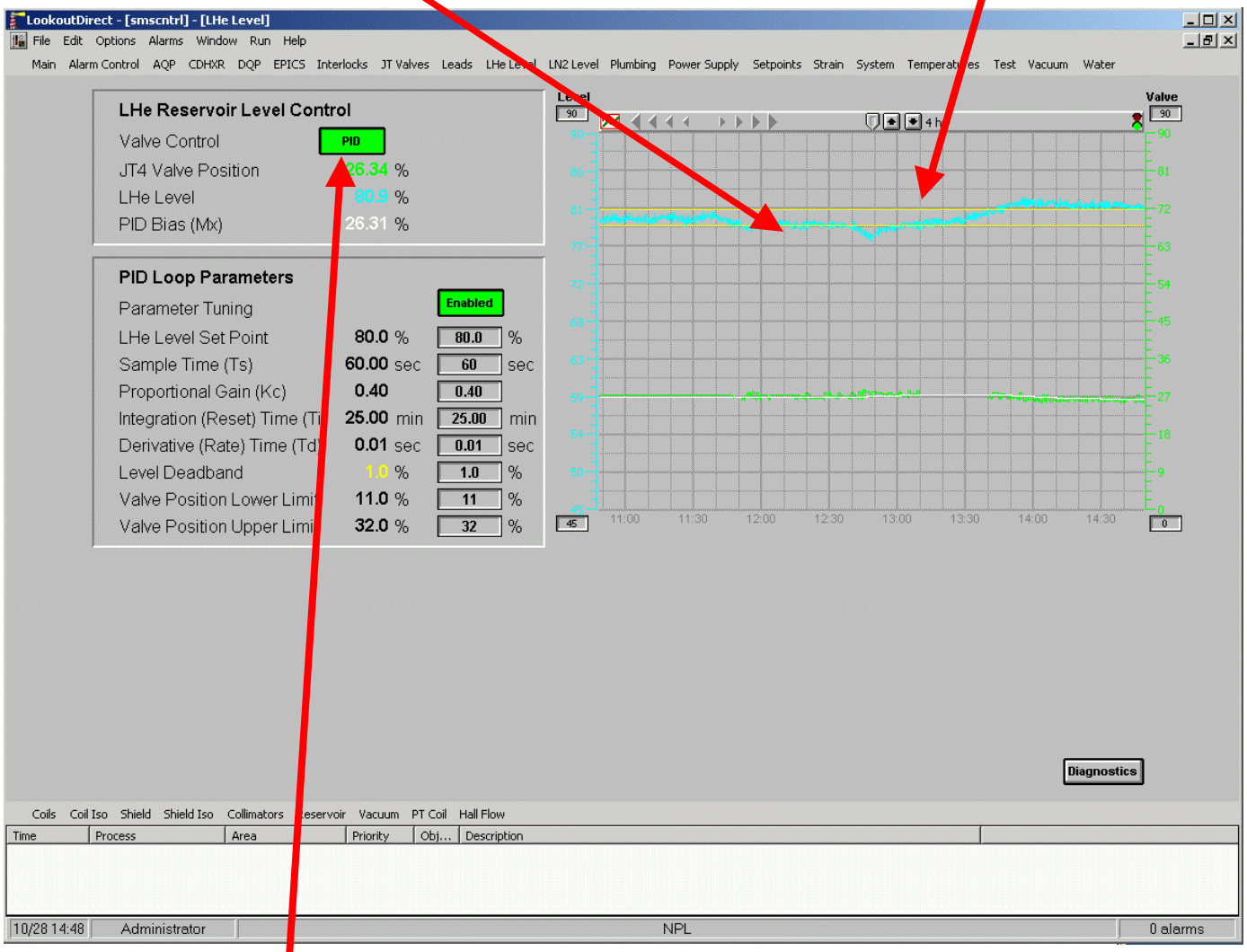
General Monitoring

- Interlocks page shows the status of interlock chains.
- Broken interlock chains cause something to happen.



No-field Monitoring - LHe

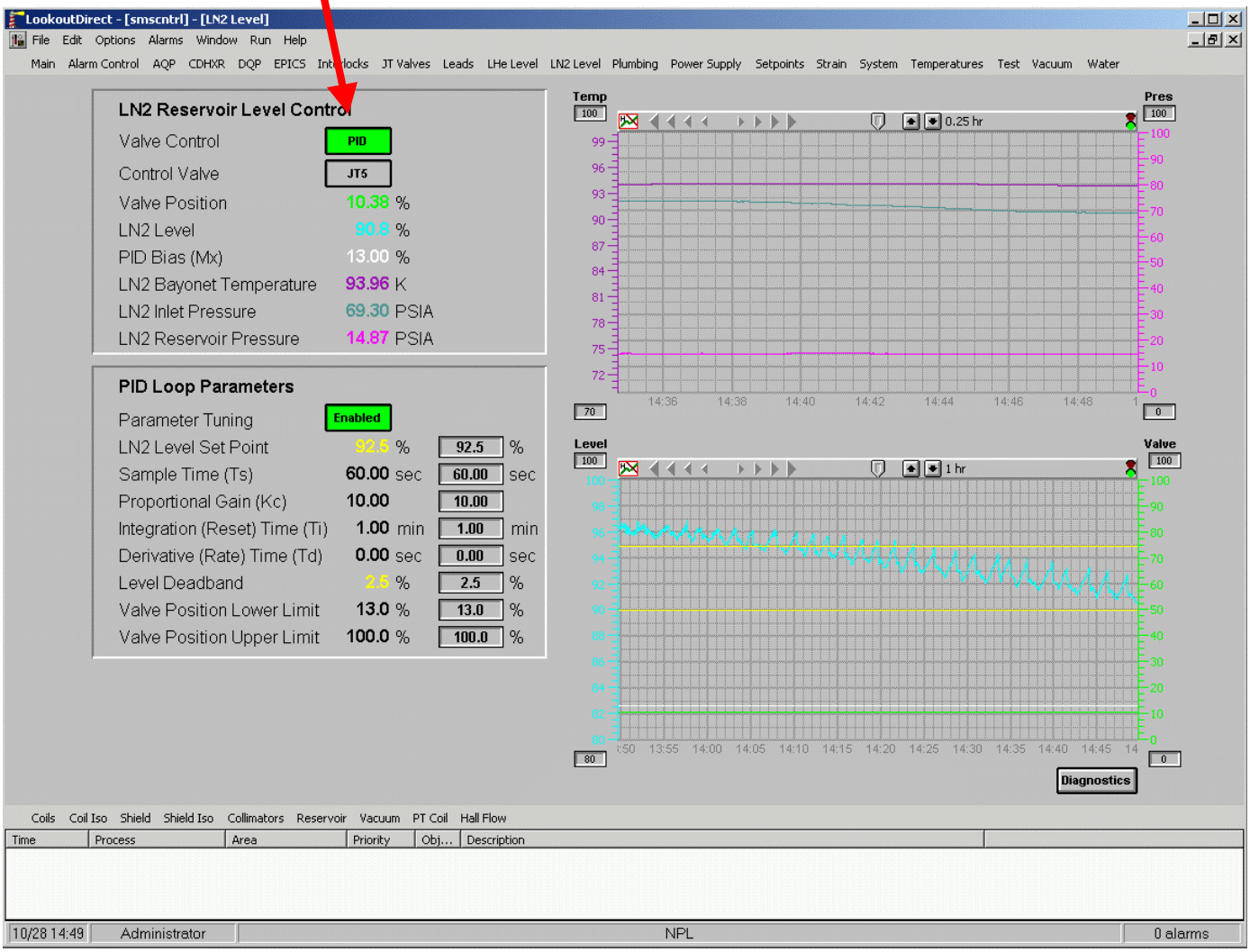
- LHe Level should be within (or near) the “dead band”.



- Be sure PID is Green

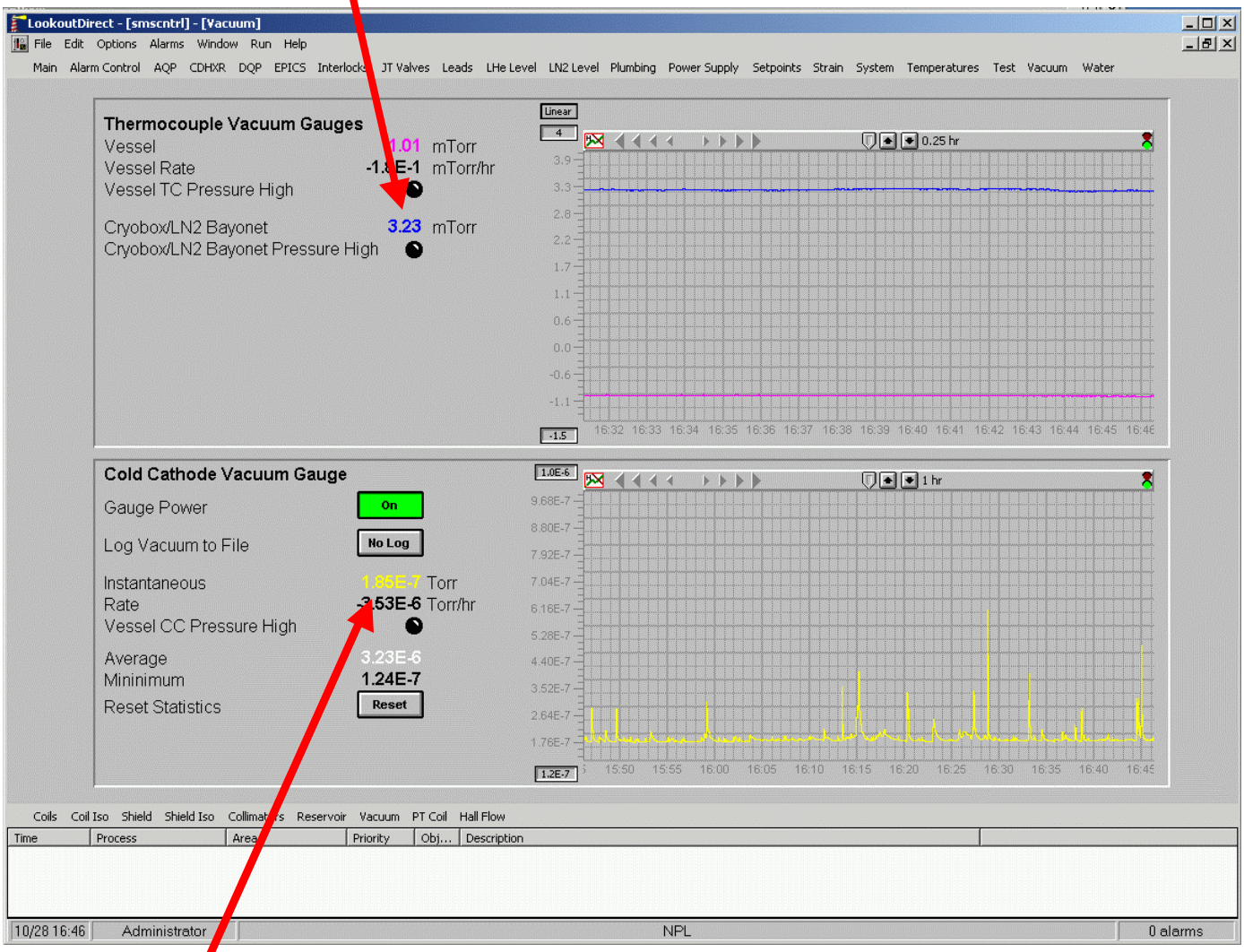
No-field Monitoring – LN2

- LN2 Level should be near or within dead band
- Generally more variation in level than LHe
- Typically has a “saw-tooth” pattern (on longer time scale).
- Be sure PID is Green



No-field Monitoring – Vacuum

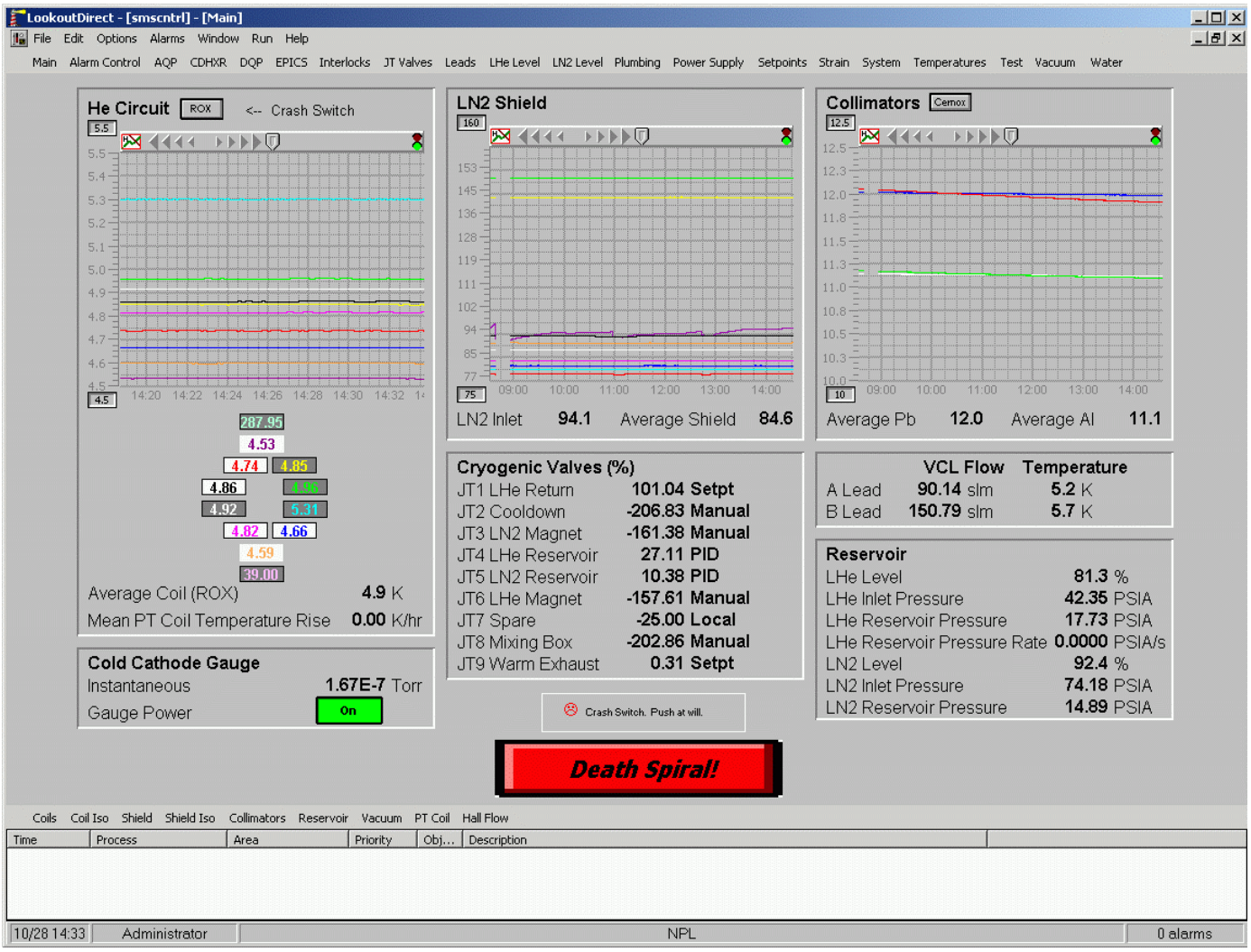
- Bayonet pressure should be a few mTorr.



- Cold cathode vessel pressure should be a few $\times 10^{-7}$ Torr

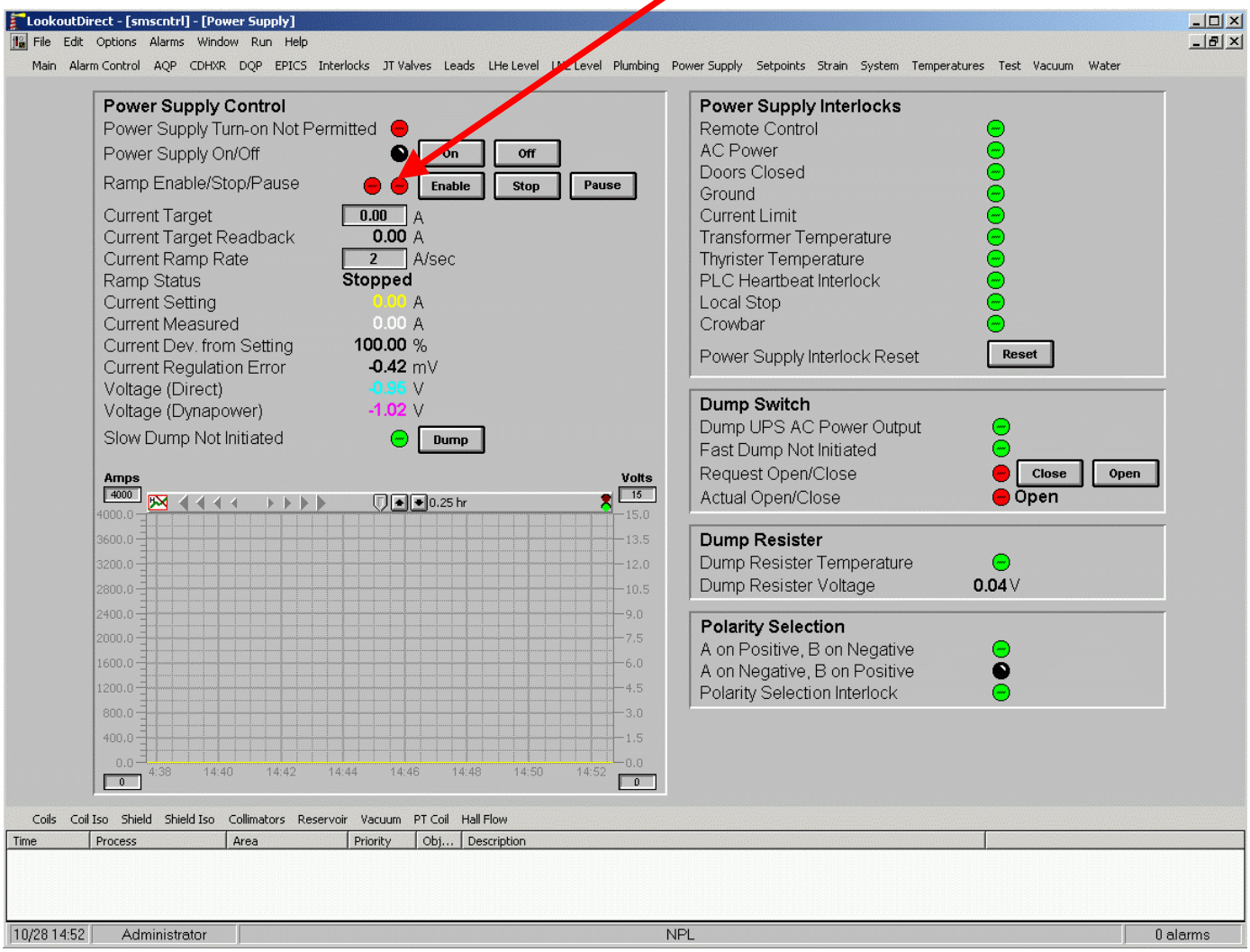
No-field Monitoring – Temperatures

- Temperatures should be flat (or going down).
- But not too flat (Temperature monitor may have crashed).



Monitoring with field – Power Supply

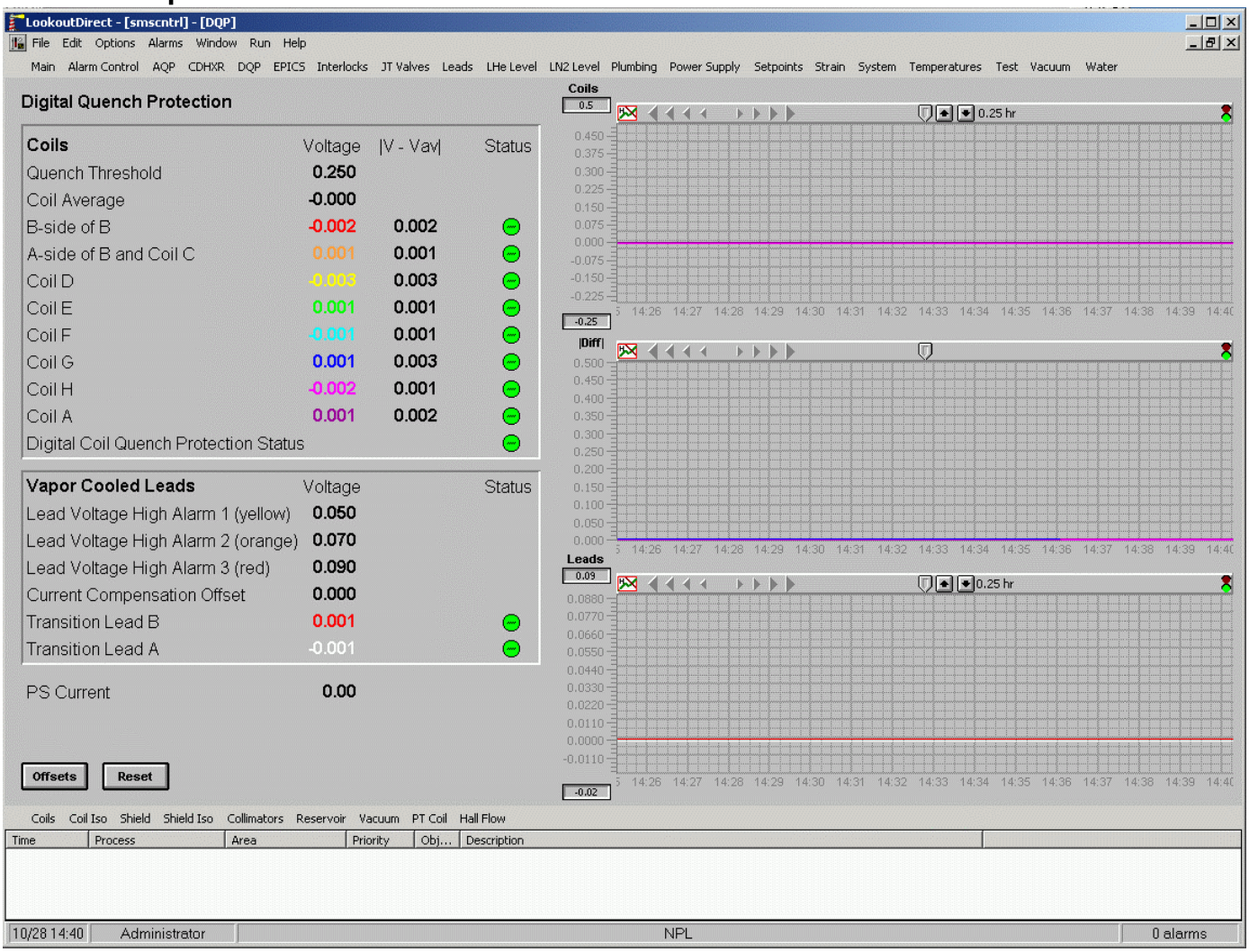
- All lights green except Ramp Enable



- Current and voltage plot should be flat at the set values

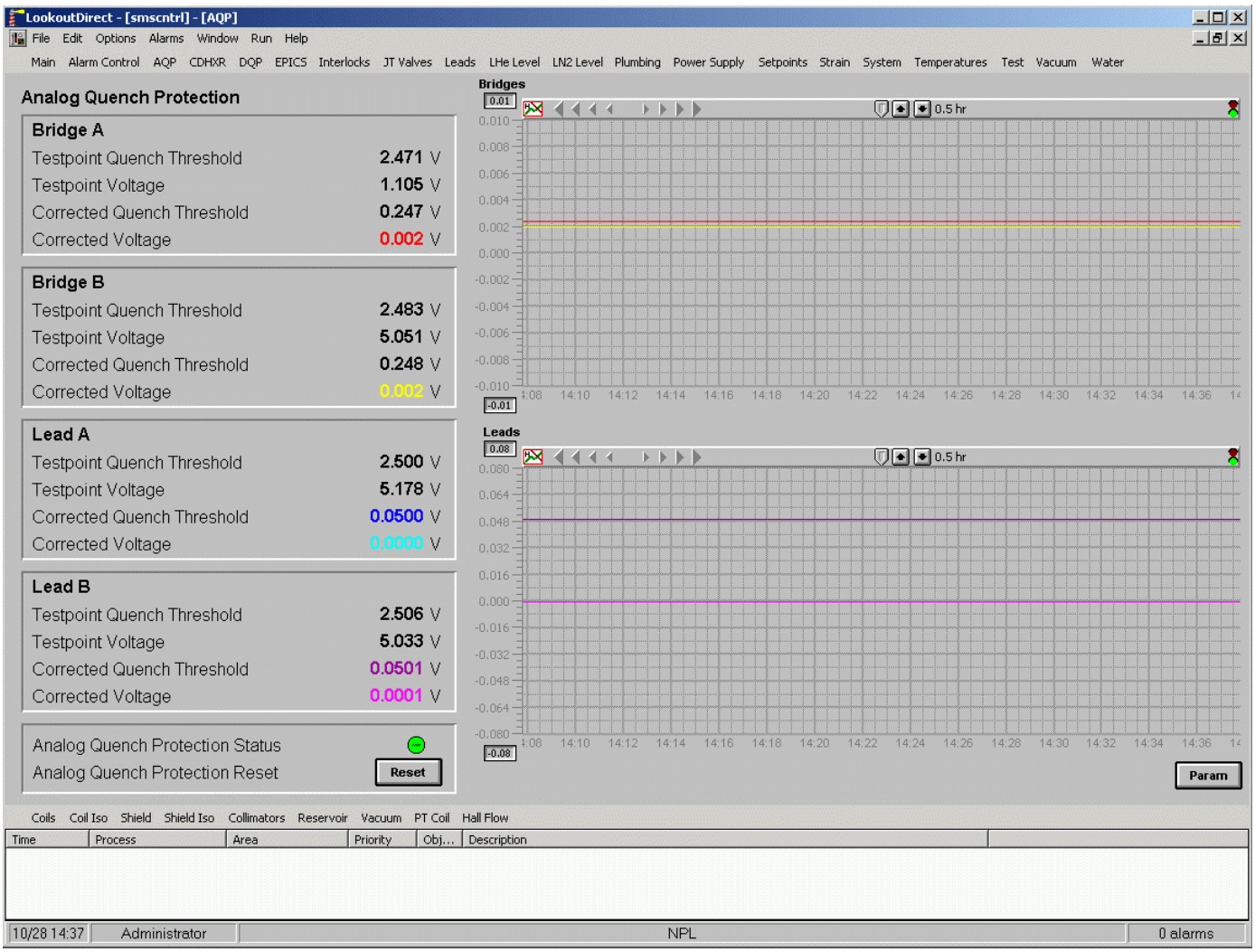
Monitoring with field - Digital Quench Detection

- All coil and lead voltages should be a few (< 10) mV
- Strip charts should be flat at the few mV level



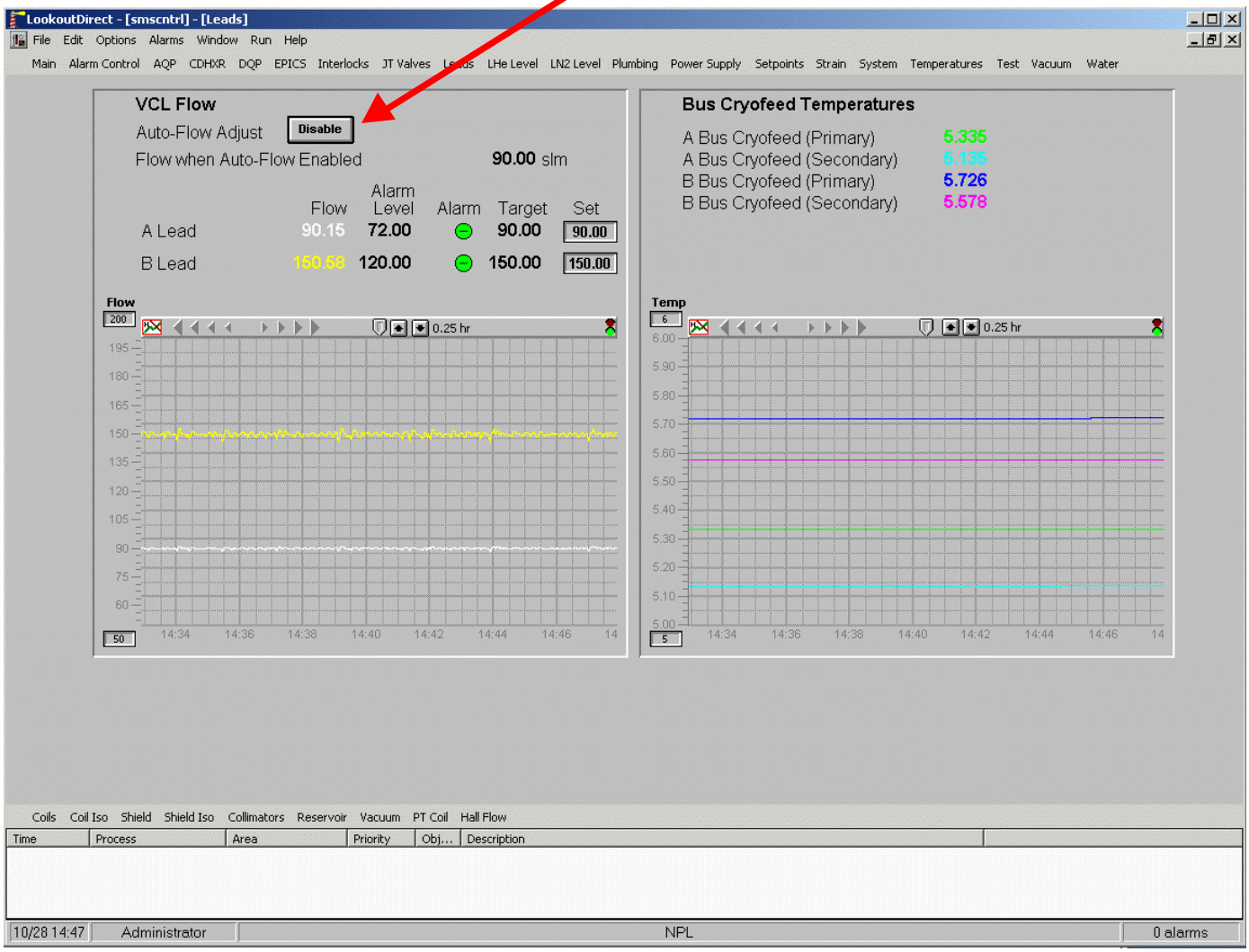
Monitoring with Field Analog Quench Protection

- “Corrected” bridge voltages should near 0 (a few mV)
- “Corrected” lead voltages should be “below” corre-sponding corrected threshold by at least 50 mV.
- Strip charts should be flat.



Monitoring with field Lead Flow

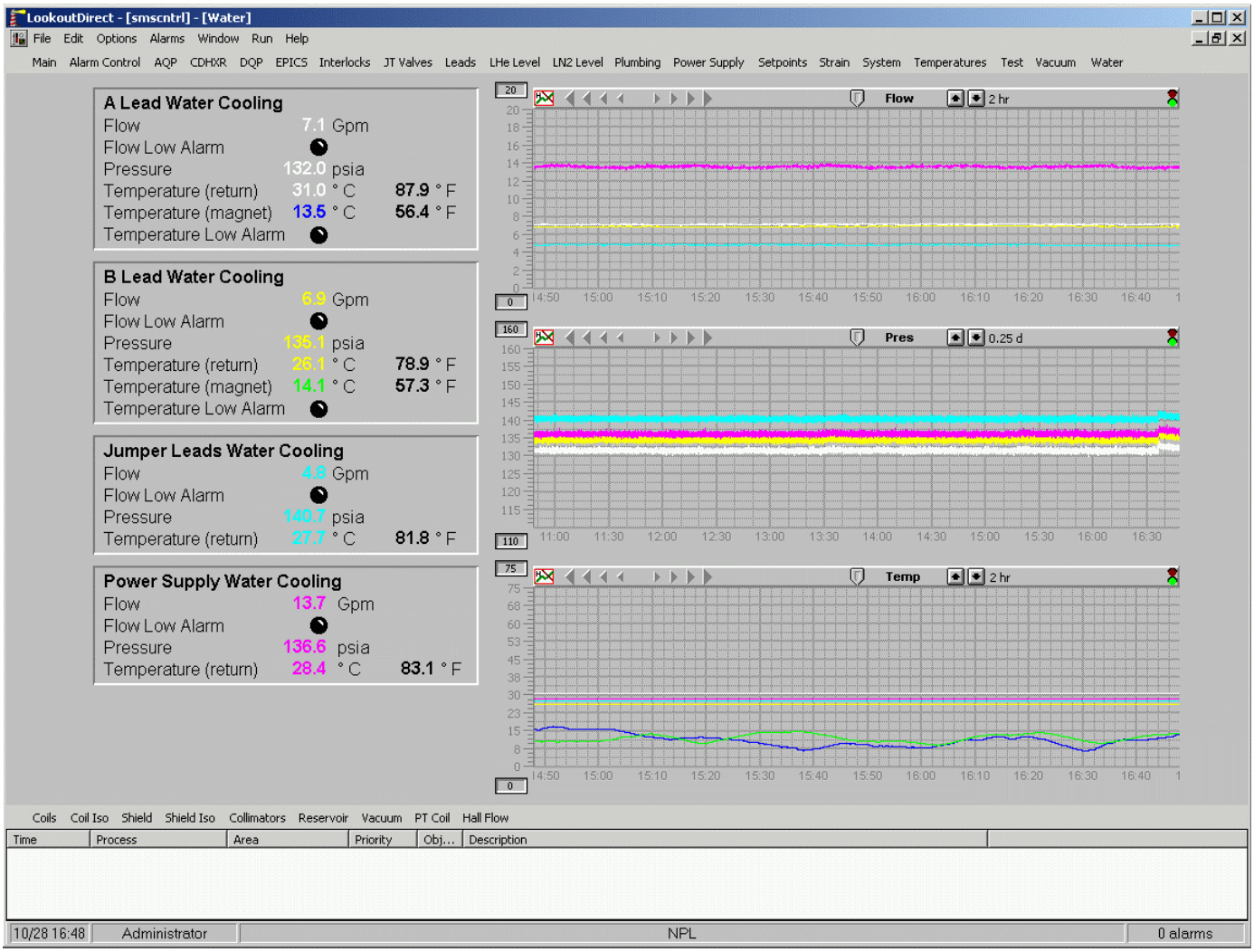
- Auto-flow adjust should be Green



- Flow and temperature strip charts should be flat

Monitoring with field - Water

- Flow and temperature should be flat.



Emergency Procedures

- Call the Magnet Expert on call.
- SMS How-To
- Emergency procedures are in the OSP
  - Loss of cryogens (fast dump, ESR down)
  - Loss of power
  - Should be done by magnet expert on call but....