

# Multiple Control Systems At Fermilab

Why can't we all just get along?

Dennis Nicklaus, ICALEPCS 2009

# Multiple Control Systems: Why?

- Encourage collaboration
- Some systems better for remote development
- Fermilab traditionally single Acnet environment for accelerators
- Even at Fermilab: Labview is used in many applications or instruments, just not usually for main control room usage

# Multiple Control Systems: “We”?

- ACNET
- EPICS
- DOOCS
- Labview
- SNMP

# Fermilab Experiments

- Photoinjector --- DOOCS
- Horizontal Test Stand --- EPICS
- HTS Cryogenics --- EPICS
- High Intensity Neutrino Source --- EPICS
- NML Cryomodule Test --- Some EPICS
- LLRF Controls with DOOCS



# Getting Data from a Foreign Control System: Approaches

- Higher Level: User Interface tools adapt and include alternate protocol
- Lower Level: Bridge between the two systems. Higher level tools only know their same native devices.

# E is for extensible 😊

- EDM extended to access ACNET devices
- Great for monitoring one or two ACNET readings on an EDM screen
- Not all EDM widgets supported

# ACNET Parameter Pages

```
X PA F73 REFRIG MADC'S <NoSets>
F73 ENGINE CHANNELS 0 TOSET D/A A/D Com-U ♦PTools♦
-<FTP>+ *SA♦ X-A/D X=TIME Y=N:C2KFP ,E NHLS1B,8 ,D IC728N
COMMAND .... Eng-U I= 0 I= 0 , 0 , 0 , 0
-<B1>+ One+ AUTO F= 10 F= .01 , 400 , 10 , 2
AEFV ac00_17 ac18_34 lp 1_19 lp20_25 ENG_ADC ..... filters vac
-T:B1SPDE DRY ENGINE SPEED 0 * 12.7 RPM *TL
T:B1PWDE DRY ENGINE POWER * 18.21 WATT
-T:B1SPWE WET ENGINE MOTOR SP 813.6 826.8 823.3 RPM ...
T:B1IAWE WET ENGINE INVERTER AMPS 6.971 AMPS
-T:B1SPCC COLD COMP MOTOR SPEED 0 * 0 KRPM *TLO
T:B1IPCC COLD COMP PHASE RMS AMPS * 0 AMPS
-T:B1CVHR DEWAR HEATER CONTRL VOLT 0 0 VOLT ...
T:B1PWHR DEWAR HEATER POWER 2.442 WATT
-T:B1SPRC RECIP COLD COMP MOT 1350 1341 1334 RPM ...
T:B1PWRC RECIP COLD COMP POWER .559 KW
T:B1EC10 Cryogenic ENG Channel 10 * 27 -84 27 -84
T:B1EC11 Cryogenic ENG Channel 11 * 27 -84
! COMMENTS ARE ALSO ALLOWED
```

# EPICS on Parameter Pages

- Secure Framework for Controls amended to include Channel Access
- Parameter Pages still somewhat inflexible about different PV types



# Getting Along -- Bridges

- Simplest way to work together
  - DOOCS to ACNET Classic
  - DOOCS to EPICS (DESY)
  - EPICS to HRM
  - ACNET Front-end to EPICS

# ACNET to EPICS Bridge

- 2009 Work by Duane Voy
- Channel Access from Fermi std. controls front-end
- Translation table supplying ACNET to EPICS name correlation
- PVs are *CA Monitored*
- CA Handles broken connections
- ACNET sampling rate independent of EPICS

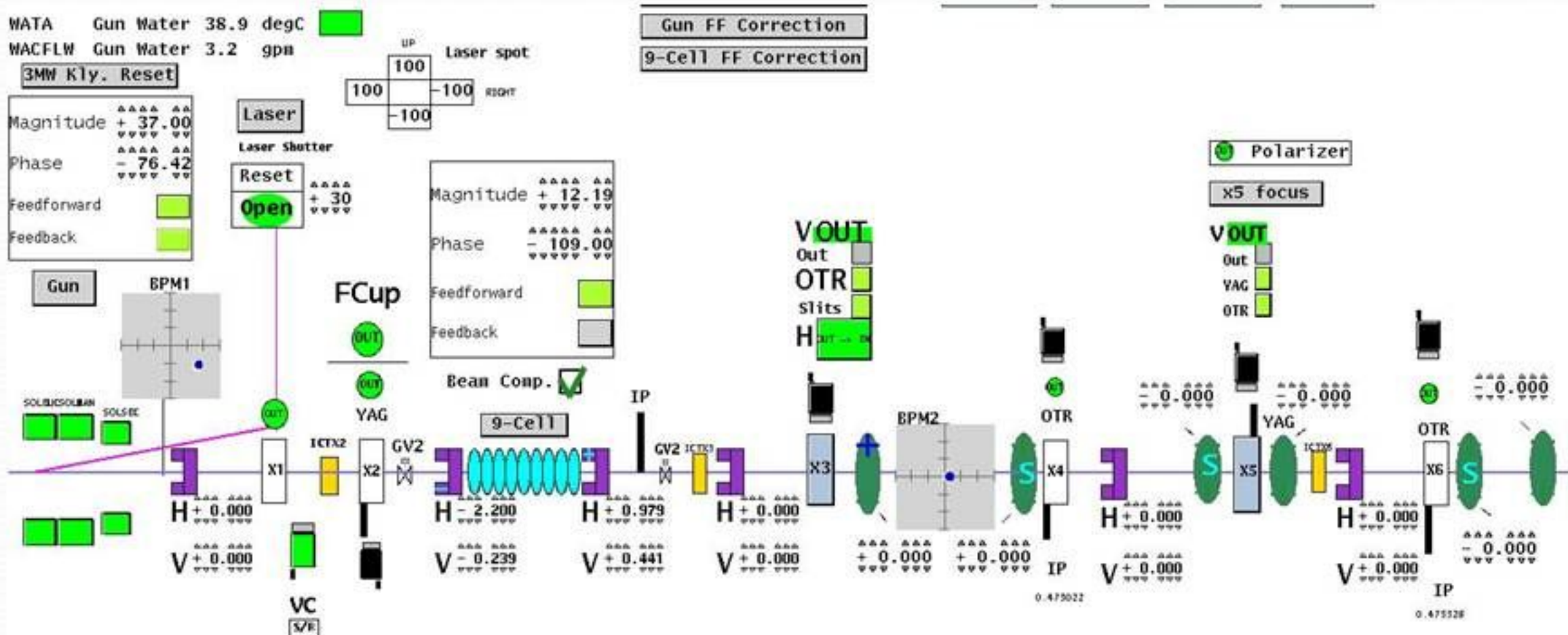
# Fermilab Accelerator Operations



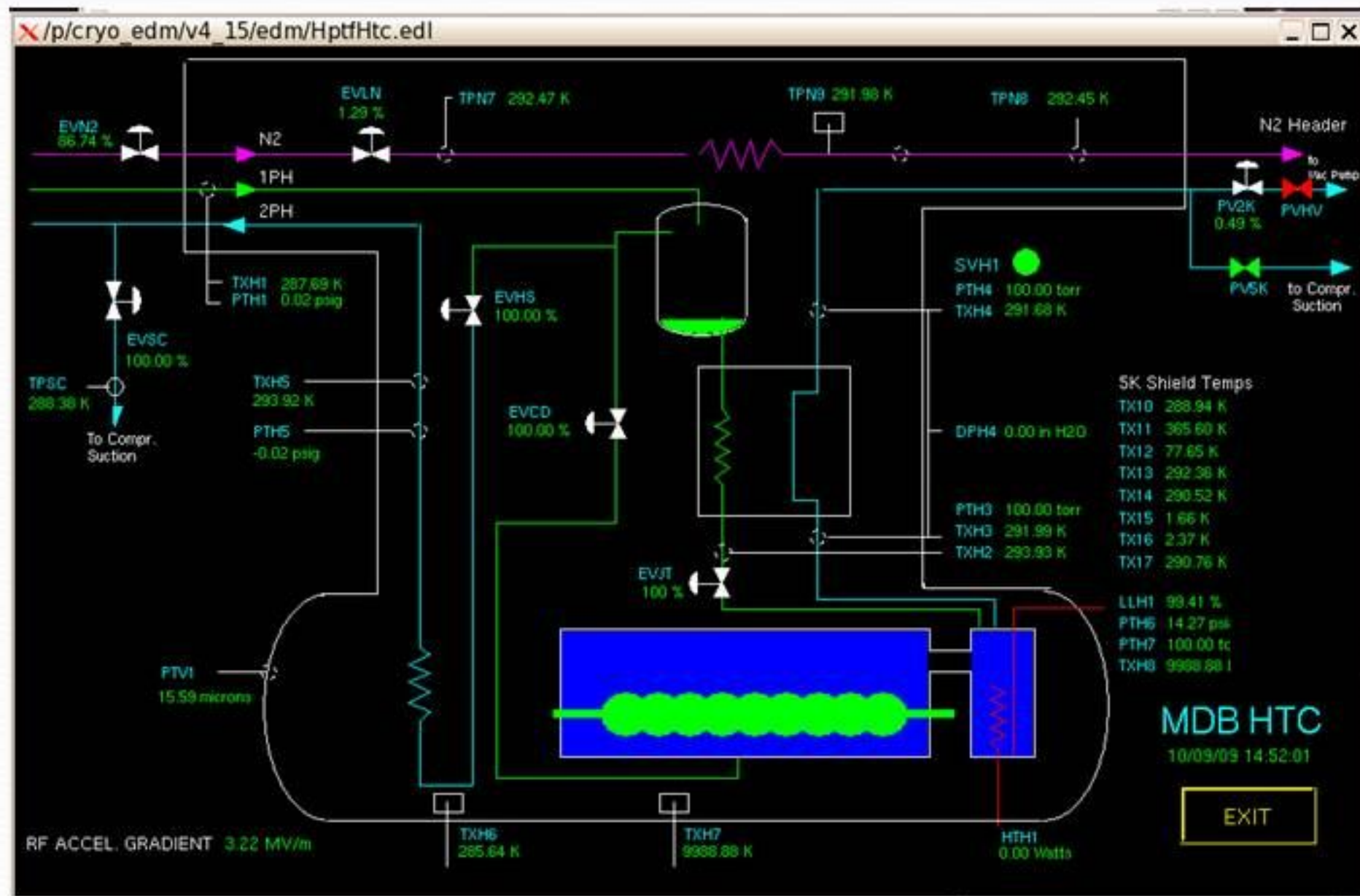
# ACNET Index Pages

```
PA:T <INDEX> Class: <AccelPrgmmer>
T   Tevatron Index Page
      TEV LLRF
2  AUTOMATE BLT
3
4  TeV D LLRF Params
5  TeV LLRF Params
6  LLRF VXI Control
      TEV HLRF
8  HLRF Status/Cntrl
9  RF PARAMETERS
10
      UTILITIES
12 TEV LCW SYSTEM
13 UTILITIES PARAMS
14 TEMP/HUM SAVE FILE
15 TEMP & HUMID PARAM
16 Tev Compressors
17
18 Tevatron Vacuum
19 VAC & TEMP LOGGER
      TEV POWER SUPPLIES
21 POWER SUPPLY STAT
22 VOLTS TO GROUND
23 POWER SUPPLY PARAM
      QUENCH PROTECTION
25 QPM STATUS
26 QPM LINK CONTROL
27 HFU & HWL TESTS
28 QPM MISC - RPC
29 QBS TEST USING RPC
30 QPM PARAMS
31 SCALRS CALIBRATION
32 QPM HOUSE DATA
33 POWER LEADS MONITR
34 MISC P.S. STATUS
35 QPM CIRCULAR BUFFER
      INSTRUMENTATION
37
38
39 BPM/BLM Plots/List
40 BLM PLOT & CONTROL
41 BPM BEAM DIAGNOSTC
42 TEV TBT
43 INSTRUMT PARAMS
44
45 TEV BLT PLOTS
46 TEV FLYING WIRES
      Messages
      Ccmds Pgm_Tools
      BEAM CONTROL
48 Sequencer
49 TeV Ramp Build
50 TeV Orbit Pgm(TOP)
51 TEV SCHOTTKY
52 Auto Chromaticity
53 Tev IPM Params
54 TeV IPM Controls
55 Tevatron Tuning
56 Schottky Params
57 E17 TEK3045 SCOPE
58 E17 SCHOTTKY MUX
      TIMING
60 TEV CLOCK 70's
61 TEVATRON CLOCK
62
63 BEAM SYNC CLOCKS
64 Timer Cards Cntrl
      ABORT
66
67 ABORT LINK STATUS
68 ABORT PARAMETERS
69 Transient Recorder
```

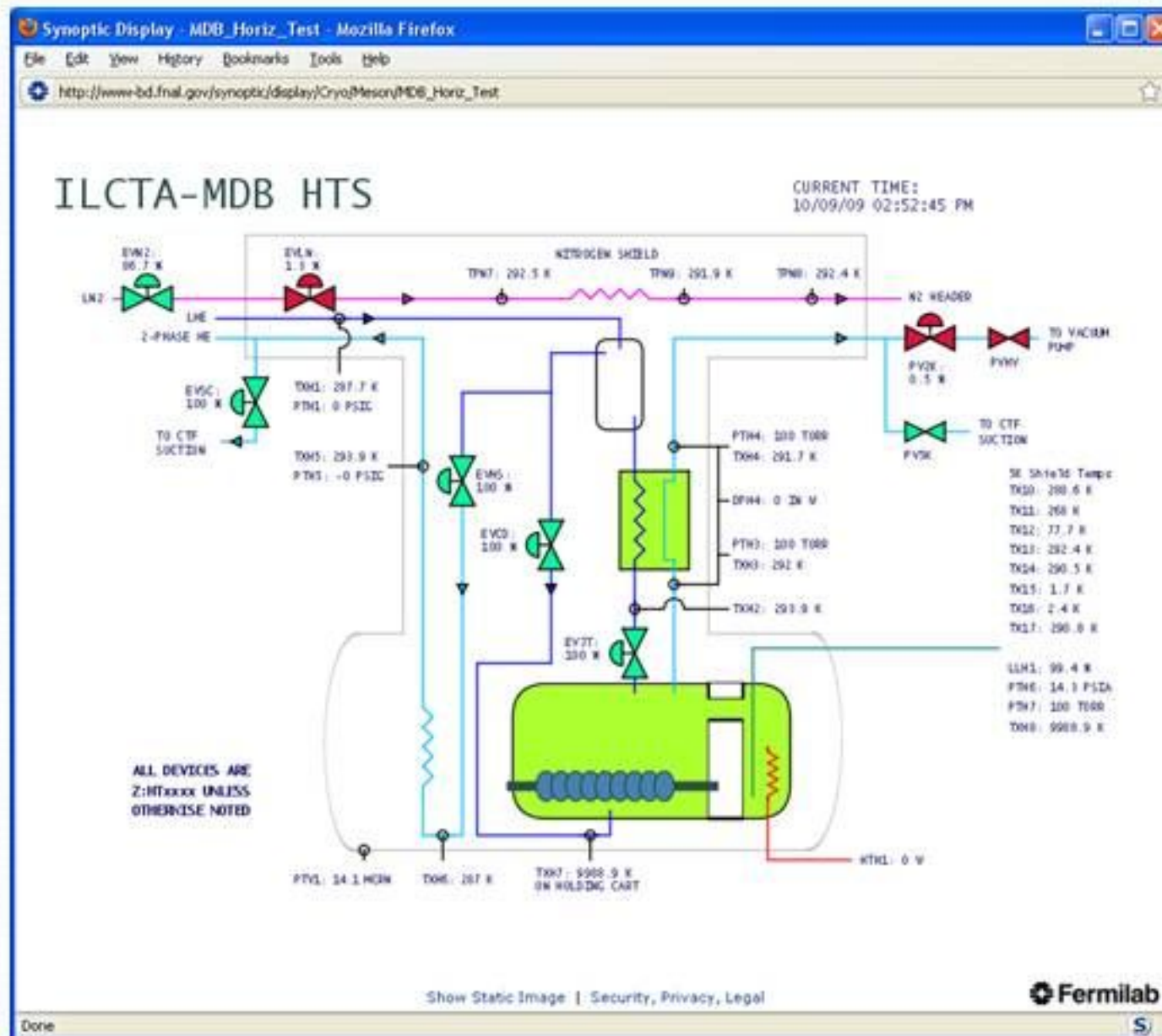
# Photoinjector DOOCS DDD



# Cryo Display: EDM



# Cryo Display: ACNET Synoptic



# Integrating EPICS Into Operations

- Simple enough to add an EDM command to one of our Index Pages
- What about all the other supporting data files, configurations, scripts, file permissions,...?
- Hard to enforce environment standards on external developers
- Access Security





# Why We Like ACNET

- No CA Gateways (don't need to know network topology)
- Central Device Database is very useful
- Reading/setting parts of an array
- The ability to acquire or trigger the same device at multiple frequencies or events

# What We're Learning From Others

- Some People Really Like GUIs instead of text (but some operators at Fermilab really like textual parameter pages). We need to enhance and advertise our GUI builders.
- Longer\_Device:Names:helpful (sometimes)
- Intuitive seamless plotting packages
- Support of collaborators contributions

# Why *Can't* We Just All Get Along

- If there are two controlling points, who's really in charge?
- Security headaches double
- System Administration/Configuration
- Staffing-limited
- Danger of orphaned or one-expert systems.

# Summary

- Most technical hurdles can be overcome
- The “big picture” integration is harder than spanning different network protocols
- Limits on the availability of personnel
- We can learn from each other

**THANK YOU!**