

A Users Perspective

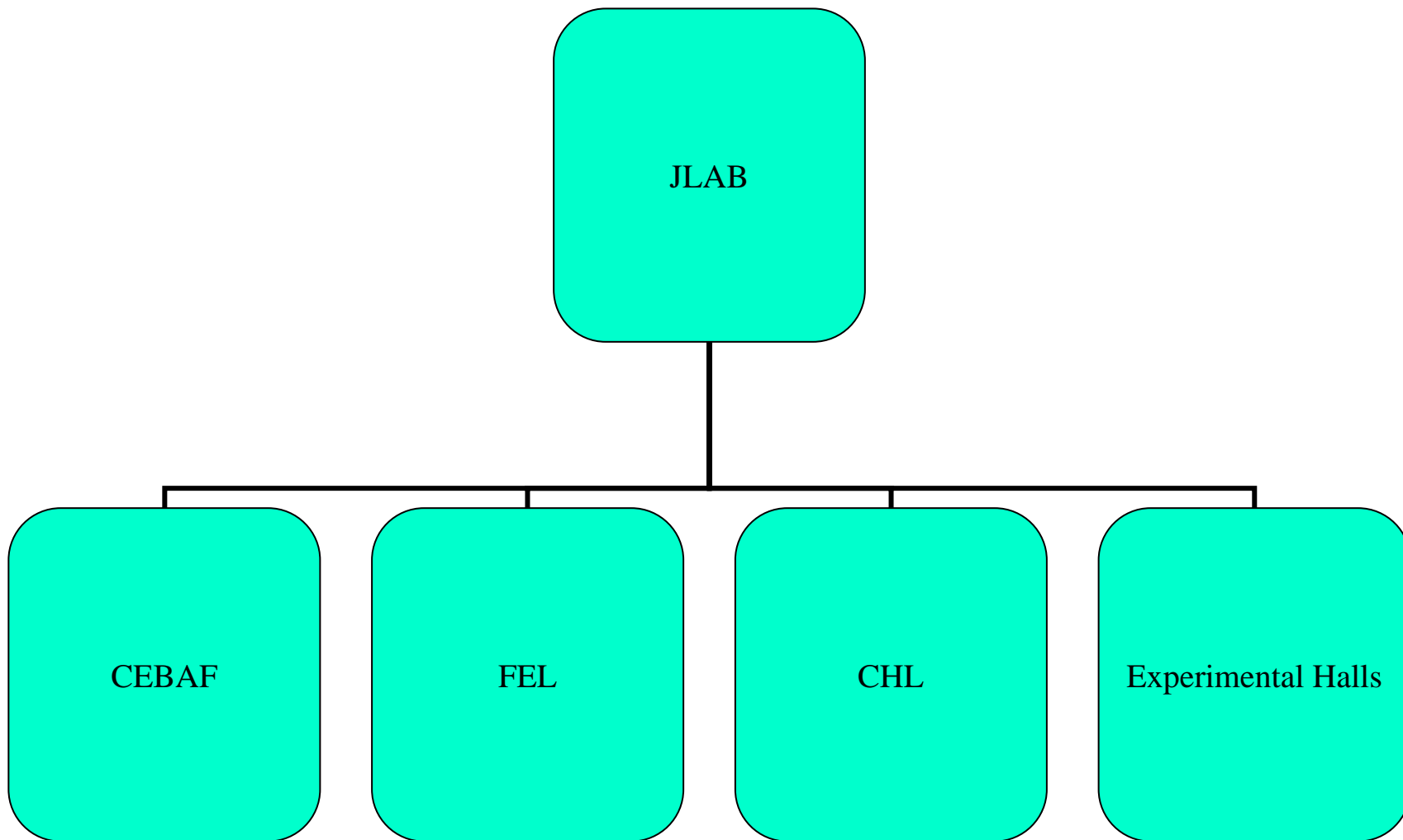
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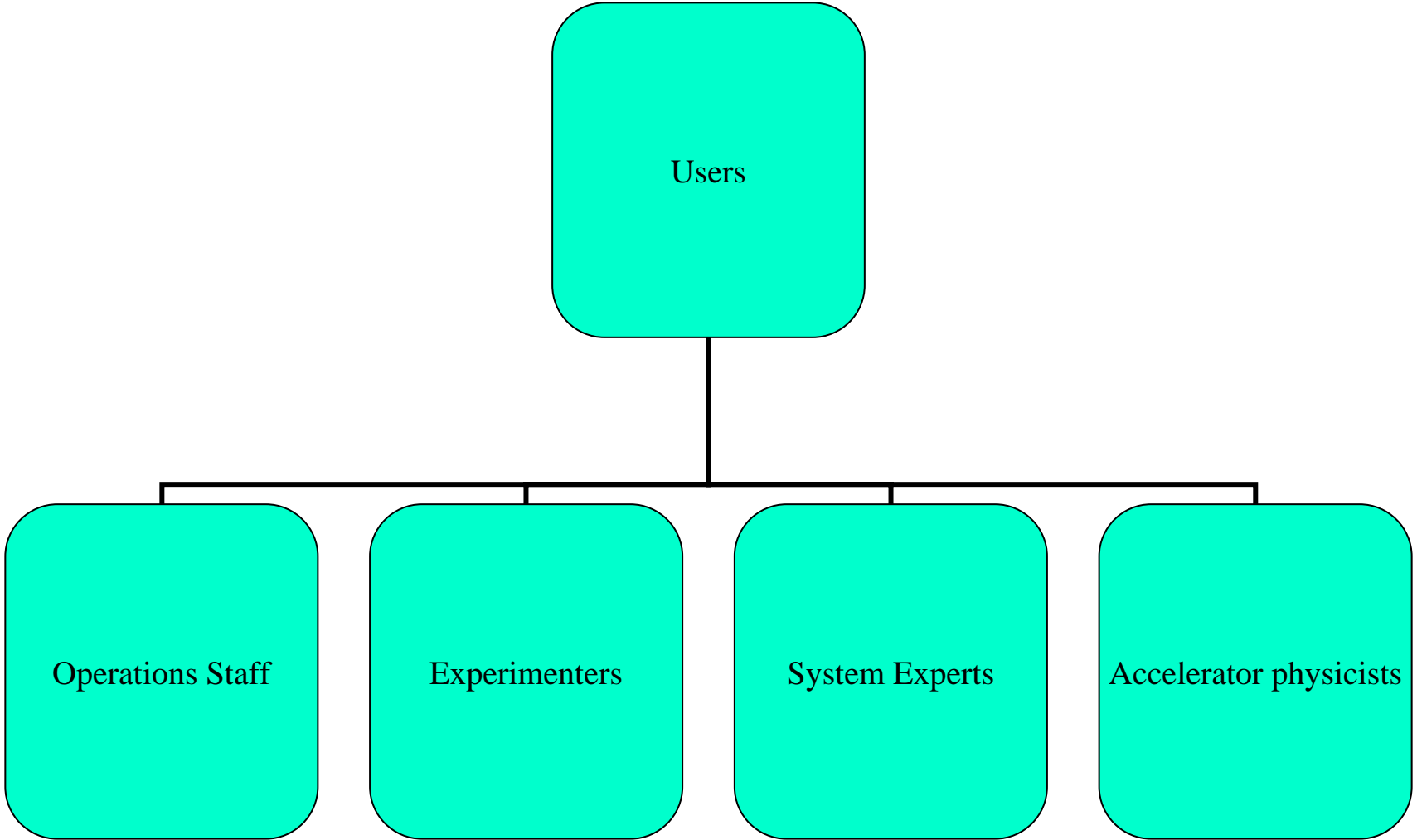


Introduction

- Industrial design
 - Widely used in analog system design
- Analog controls
 - Long history
 - Not used so much anymore
- Digital controls
 - Less constraints than analog controls
 - Analog limits still apply

Jefferson Lab Overview





Limitations

- Analog
 - Positive cues
 - Sound
 - Position
- Digital
 - All feedback a deliberate implementation

Perspectives

- Colored by environment
- Control room
 - Complex
 - Large number of systems
 - Multitasking
- Operations user
 - Jack-of-all-trades
 - Greater cross system knowledge
 - Do not know as much about systems

Perspectives

- Tool paradigm
 - Limited operational envelope
 - Only a subset of expert tools needed
 - Tools determined by beam state
 - Tools determined by program
- Tool implementation:
Various languages:
 - C, C++,
 - Java,
 - tcl/tk, Perl/tk,
 - EPICS, SNL, etc.

Perspectives

- From the User's perspective the language/system of the implementation is irrelevant.



Human Machine Interface

- 8,000 EDM screens
- 3,000 EDM screens easily accessible
- Typically used?
- A few dozen!



Human Machine Interface

- Colors
- Layout
- Design
- Limiting factors
 - Startup/shutdown
 - Shiftwork
 - Staffing

Colors, Layout, Design

Frequency Generator System

Injector

Cancel

0x0

Cavities at 0L04

5,6 Off On

7,8 Off On

1S - Region

Cancel

0x0

Cavities at 1L21

1,2 Off On

5,6 Off On

3,4 Off On

7,8 Off On

Setup

Drive Level

30 Hz VAC (pk)

30 Hz

0.000 0.000

VDC (Offset)

0.459 0.459

Suggested values

Variable	Value	Fopt	30 Hz
AC Ampl.	0.000	0V	1.5V
Frequency	30.0	30Hz	30Hz
DC Offset	0.459	0.459V	0V
N	0.00	0	0

MAGNET Readbacks	Current	Voltage
MHF0L07HM	0.000	-0.000
MHF0L09VM	0.000	0.000
MHF0L10HM	0.000	-0.000
MHF0L06HM	0.000	-0.000
MHF1S09VM	0.004	-0.394
MHF1E01VM	0.000	-0.000
MHF1E01HM	-0.011	0.013
MHF1S08HM	0.004	0.020

RF Readbacks	DRVH	GMFS	DRVH
0L04 5,6	8.50	6.15	3.01 8.60
0L04 7,8	7.58	5.26	8.26 13.00
1L21 1,2	8.30	7.33	8.34 9.50
1L21 3,4	9.00	7.91	7.01 7.90
1L21 5,6	7.00	6.27	5.79 6.45
1L21 7,8	7.56	6.71	6.26 6.99

- Control widget
- Readback widget
- Alarm colors (with text)
- Special devices

Colors, Layout, Design

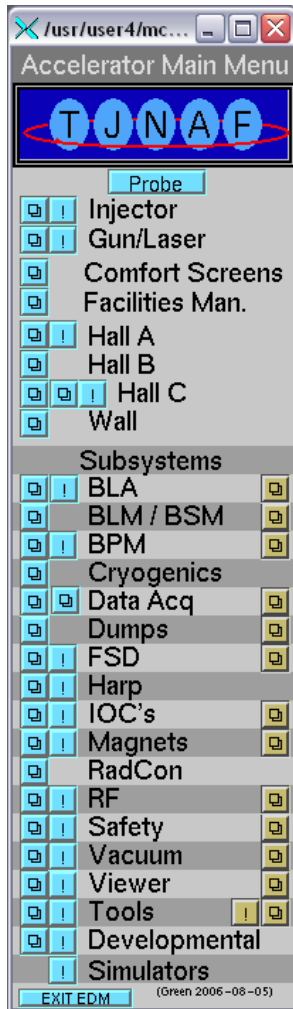
- Tcl/TK tools follow standard pattern.

Current and Asymmetry Lock Control

Current Locks | Asym Locks | PosAsym Locks | Other Locks | Orbit Locks

HALL A				HALL B							
Lock OFF	Setpoint(uA)	5.0	Atten Mode	Lock OFF	Setpoint(nA)	1.0	Atten Mode				
Interval(s)	2.0	Current(uA)	0.0	AttnMin	90	Interval(s)	1.0	Current(nA)	0.0	AttnMin	120
Attn A	70	Current Ramp	0.0	Slit A	-1.003	Attn B	100	Current Ramp	0.0	Slit B	-0.994
Ramp ON	Ramp Rate (uA)/sec	1.0	Atten Ramp	Ramp OFF							

Screen Sets



- Central source
- Gold buttons
- Area
- Functions

Screen Sets

The screenshot shows a control interface for Hall A Cryo Target Cool Down / Warm Up. The interface is titled "Target Isolation Valves" and "Cool Down". It displays various valves and their status, including CPV6614, CEV6731-A, CEV6741-A, and CEV6781-A. The interface also shows temperature targets and current values for various components.

Component	Set Val	Cur Pos	min	max
CPI6614	12.000	8.935	-6.000	70.000
CTD6614	13.29			
CTD6614	17.00	-6.41	-20.00	-20.00
CTD7541	26.00	-6.41	-20.00	-20.00
CEV6781A	15.00	-6.41	-20.00	-20.00
CTD7541	66.23			
CPI7541	2.77			

- Procedure driven
- Devices in logical order
- Related screen buttons
- Scripts
- Link to procedure
- Only required controls

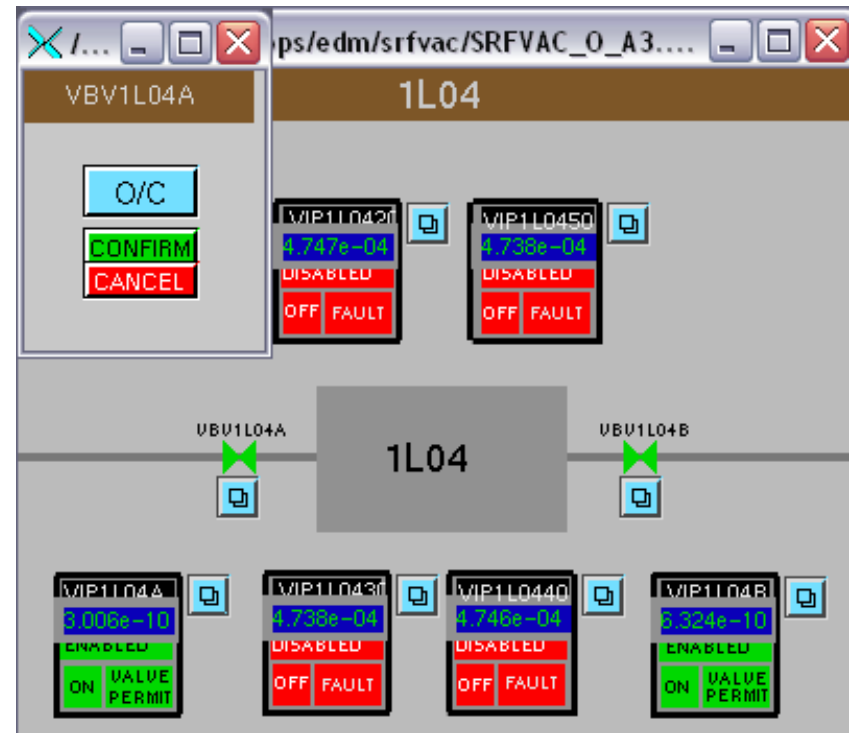
Widgets

- Correspond to device operation
- Example: RF Cavity Gradients
 - Typically operate @ fixed setting
 - Text control field
 - Cavity SOS'ing – step down
 - Slider



Widgets

- Complications limited to high penalty operations
- Example: Beamline Vacuum
 - Potential vacuum loss
 - Confirmation required
- Combination control
 - Individual controls onerous
 - Dozens of valves normally opened



CEBAF MCC



Screen Displays

- Different users have different display environments
- Operators
 - Triple-headed displays
 - 4 x 2 ft. status monitors
 - 16 x 6 display wall
- Other users
 - 19 “ LCD monitor
 - 21” CRT monitor

Alarm Handling

- Standard EPICS Alarm Handler
- Safety Alarms ODH, Fire, Radiaton
 - PLC driven
 - Audible alarm
 - Flashing LED
- Additional Fire Alarms annunciators
 - Visual flashing strobes
 - Geographically based computer display

Expert Systems

The screenshot shows a software window titled "Injector Startup Procedure 1-4". At the top, it displays user information: "User: Carlino", "Date: 10-02-06", and "Time: 14:34". Below this are buttons for "Expert", "View Steps", "GUI Help", "Procedure Help", and "Quit". A red banner indicates "Injector Parameters Last Reviewed by Erb on 10/02/06 at 10:01:14". The main interface has four tabs: "Pre-beam Checks", "Injector Optimization", "Injector Verification", and "Current Program Setup". Under "Pre-beam Checks", there are several "Explain" buttons and checkboxes for tasks like "Perform initial checks", "Transport ~8 to 10 uA tune mode beam from Laser A to the Pol. Src. FCup.", "Transport ~8 to 10 uA tune mode beam from Laser A to FCup 2.", "Transport ~8-10 uA tune beam to the inline dump", and "Transport ~5uA CW beam from Laser A to FCup 2.". There are also buttons for "Initial Checks", "Injector Absolutes", and "StepNGraph". A table shows phase values: "Original phase values: A 135 B 135 C 132" and "New phase values: A 146.0 B 146.0 C 135.4". Other tasks include "Verify that de-chopping is correct", "Turn on the prebuncher at .4 keV", and "Optimize the prebuncher phase with .60 uA CW". A "Special Concerns" section is at the bottom with an "Add Comment" button and a "Submit to Elog" button.

- Application encapsulates experts' knowledge
- Injector Setup
 - Logical progression
 - Embedded help
 - Links to tools
 - Automatic elog entries

Summery

- The user is often the most overlooked component of the control system.
- Consistency is key.
- Language/System is irrelevant to user.
- Usability is most important factor to user.