

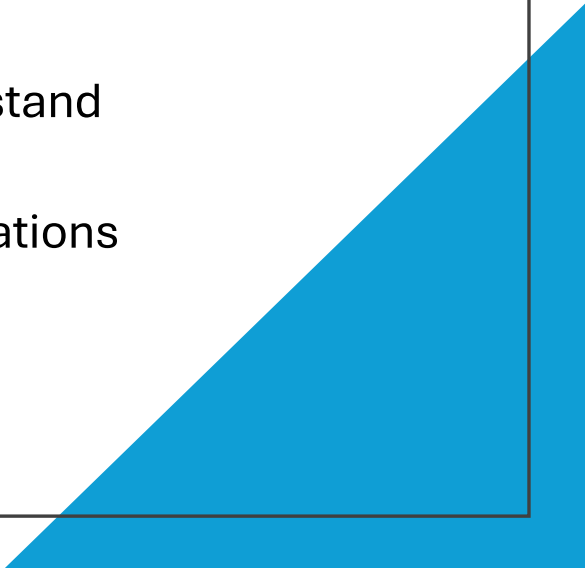
EPIK8s at BTF

From Process Variables to Operational Interfaces

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Doctoral Lab 2026, 04/15-16/2026



Why this matters?

- BTF systems expose a large amount of real-time data through EPICS PVs
 - Operators and beam line scientists need to quickly understand system state and react accordingly
 - Raw data alone is not sufficient for safe and efficient operations
 - Interfaces must support fast decision-making under time pressure
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The problem

- EPICS exposes many PVs, often without structure from a user perspective
- Interfaces can become cluttered with too many values and no clear hierarchy
- Different systems may use inconsistent conventions and layouts
- Users are forced to interpret raw values instead of meaningful states

Instance Name	Status	PV Count	Connected	Event Rate	Data Rate (GB/day)	Engine write thread(s)	Max ETL(%)
appliance0	Working	1459	563	131.2	0.2	0.02	0.02

Mental model



MONITORING

Real Hardware

(power supply, diagnostic system, motors...)

- Produces physical signals and responds to control actions
- Not directly accessible to users or applications
- Requires a control layer to interface with software

IOCs

- Software layer interfacing with the hardware
- Read data and sends commands to the device
- Run inside a container managed by EPIC8s
- Translate hw-level signals into PVs
- Ensure safe and controlled interaction with the system

PVs

- EPICS abstraction presenting data and control points
- Expose system information (RB, states, alarms, ...)
- Allow control action (setpoints, commands)
- Contact between Control System and application

GUI

- Application used by operator and users
- Reads PV to display system state and values
- Write to PV to send commands and setpoints
- Transform raw data in meaning full info
- Ensure clarity and usability



CONTROL

Recap on Pv types

- **Readback (RBV):** represents measured or actual values (ai, bi, waveform records)
- **Setpoint (SET):** represents desired or commanded values (ao, bo, stringout)
- **State (STATE):** indicates system status - e.g. ON/OFF (bi, mbbi)
- **Mode (MODE):** defines operational mode - e.g. LOCAL/REMOTE (mbbo, mbbi)
- **Alarm (ALARM):** indicates severity or abnormal conditions (**NOT separate PVs by default**)

A real BTF example

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PV Name	Status	Appliance	Connected?	Monitored?	Sampling period	Last event	Details	Quick chart
BTF2:daq:DAQ_BTF2:gun_status	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:34:55 UTC		
BTF2:daq:DAQ_BTF2:mod_status	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:34:55 UTC		
BTF2:daq:DAQ_BTF2:particle_status	Being archived	appliance0	true	true	1.0	Mar/24/2026 06:37:41 UTC		
BTF2:slow:CaloV:value	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:09:16 UTC		
BTF2:slow:EH1_CaloV:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:01 UTC		
BTF2:slow:EH1_calor_autotrack:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:36:49 UTC		
BTF2:slow:EH2_ele_instant:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:36:59 UTC		
BTF2:slow:EH2_CaloV:value	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:30:17 UTC		
BTF2:slow:EH2_N_ele_tot:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:01 UTC		
BTF2:slow:EH2_calor_autotrack:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:07 UTC		
BTF2:slow:FITPIX:XCenter	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:FITPIX:XSTD	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:FITPIX:YCenter	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:FITPIX:YSTD	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:FITPIX:mean_hit	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:FITPIX:mean_sum	Being archived	appliance0	true	true	1.0	Mar/24/2026 09:56:37 UTC		
BTF2:slow:GaussProbe:DHRTB102:Error_source	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:06 UTC		
BTF2:slow:GaussProbe:DHRTB102:GPBIP	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:GaussProbe:DHRTB102:value	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:GaussProbe:DHSTB001:Error_source	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:03 UTC		
BTF2:slow:GaussProbe:DHSTB001:GPBIP	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:10 UTC		
BTF2:slow:GaussProbe:DHSTB001:value	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:10:54 UTC		
BTF2:slow:GaussProbe:DHSTB002:Error_source	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:36:51 UTC		
BTF2:slow:GaussProbe:DHSTB002:GPBIP	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:09 UTC		
BTF2:slow:GaussProbe:DHSTB002:value	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:36:50 UTC		

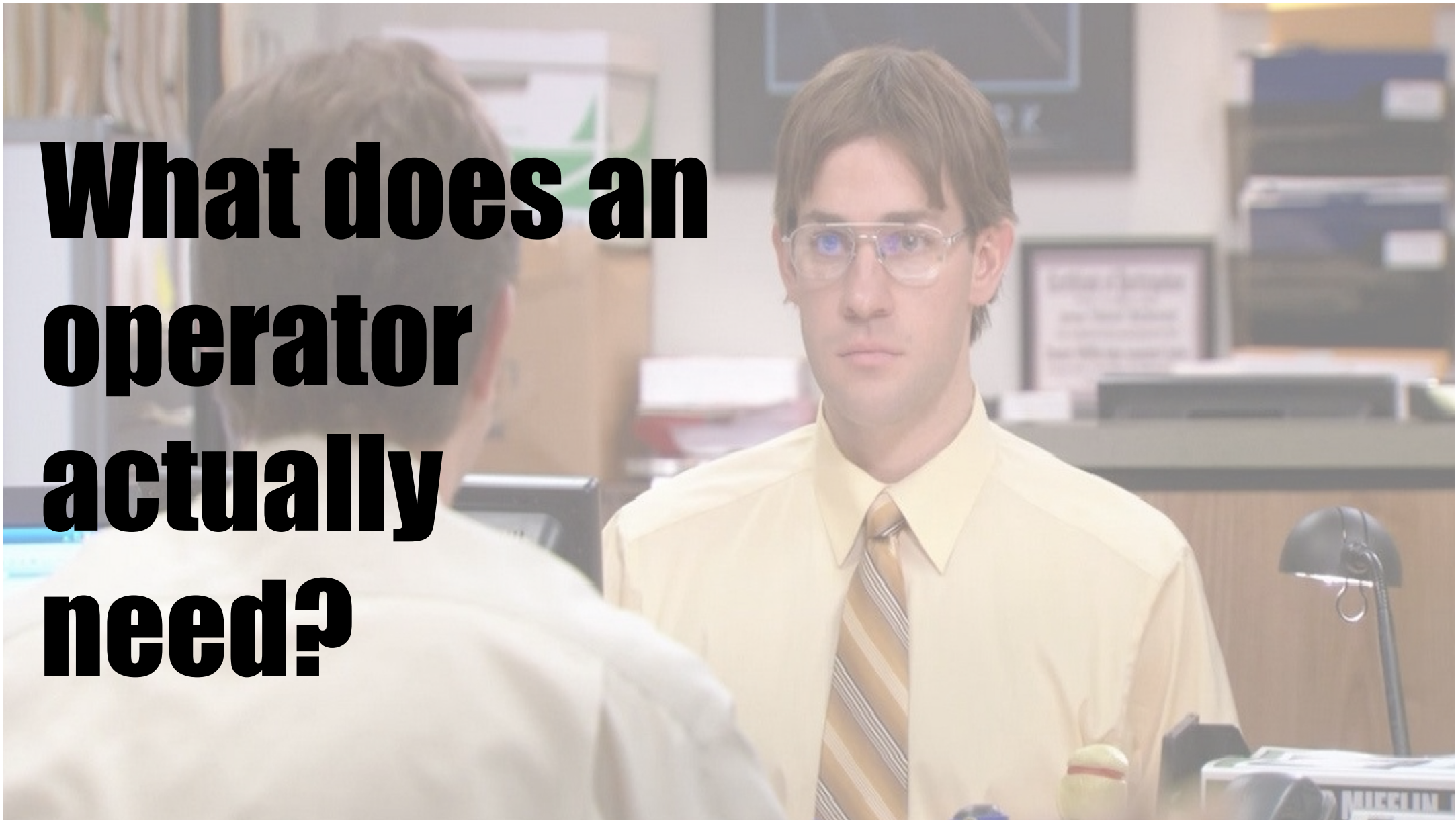
EPICS Archiver Appliance Version 2.1.2

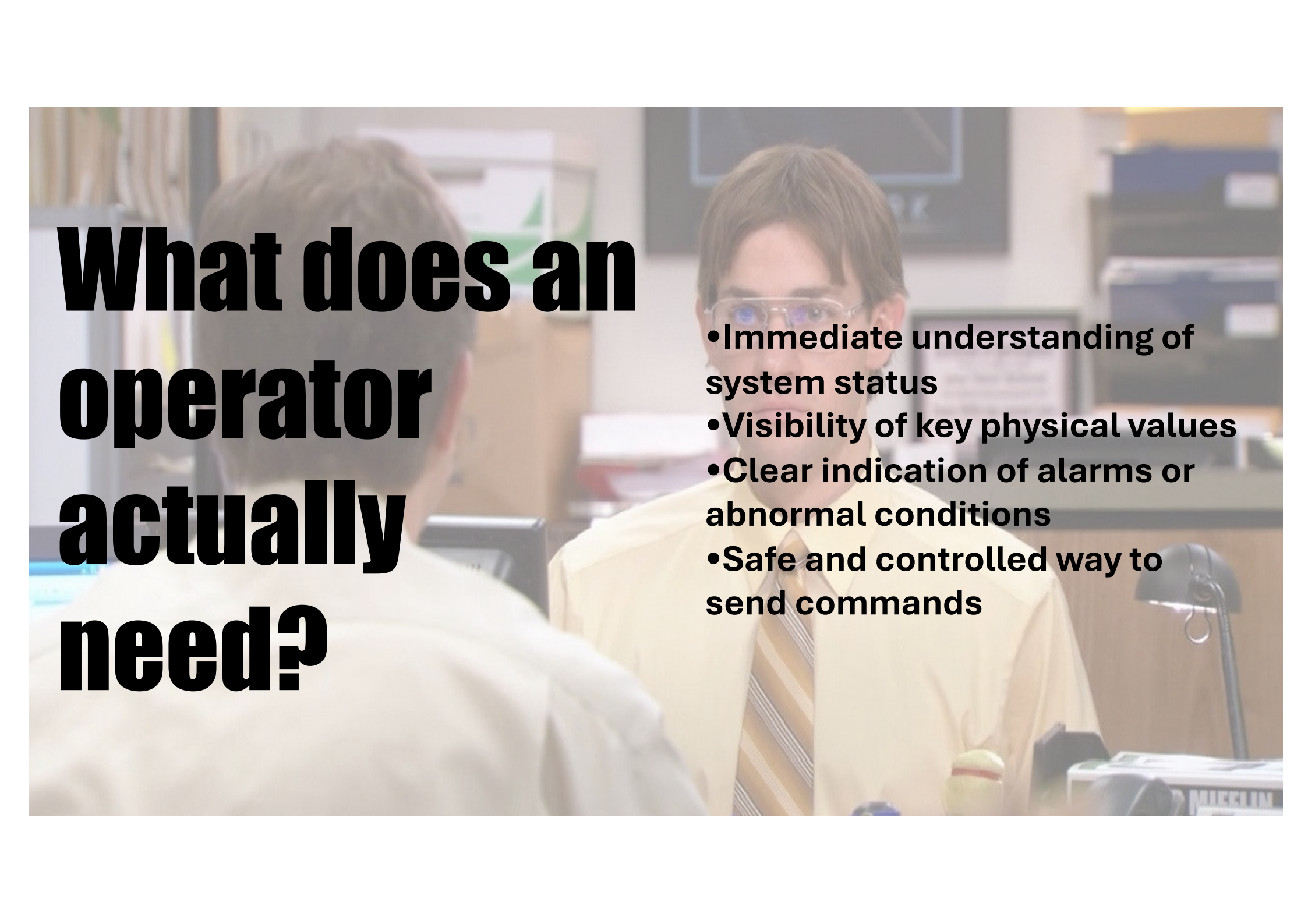
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PV Name	Status	Appliance	Connected?	Monitored?	Sampling period	Last event	Details	Quick chart
BTF2:slow:VUGPADME:value	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:10:53 UTC		
BTF2:slow:VUGTB003:error_code	Being archived	appliance0	true	true	1.0	Mar/23/2026 08:54:26 UTC		
BTF2:slow:VUGTB003:error_status	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:VUGTB003:status	Being archived	appliance0	true	true	1.0	Mar/23/2026 08:54:26 UTC		
BTF2:slow:VUGTB003:timestamp	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:10:53 UTC		
BTF2:slow:VUGTB003:value	Being archived	appliance0	true	true	1.0	Mar/23/2026 08:54:26 UTC		
BTF2:slow:VUGTB004:error_code	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:11 UTC		
BTF2:slow:VUGTB004:error_status	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:VUGTB004:status	Being archived	appliance0	true	true	1.0	Mar/23/2026 05:50:17 UTC		
BTF2:slow:VUGTB004:timestamp	Being archived	appliance0	true	true	1.0	Mar/23/2026 17:10:53 UTC		
BTF2:slow:VUGTB004:value	Being archived	appliance0	true	true	1.0	Mar/23/2026 05:50:17 UTC		
BTF2:slow:VUGTB201:error_code	Being archived	appliance0	true	true	1.0	Mar/18/2026 07:37:13 UTC		
BTF2:slow:VUGTB201:error_status	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:VUGTB201:status	Being archived	appliance0	true	true	1.0	Mar/23/2026 08:39:06 UTC		
BTF2:slow:VUGTB201:timestamp	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:10:53 UTC		
BTF2:slow:VUGTB201:value	Being archived	appliance0	true	true	1.0	Mar/23/2026 08:39:06 UTC		
BTF2:slow:VUGTB202:error_code	Being archived	appliance0	true	true	1.0	Mar/23/2026 09:07:12 UTC		
BTF2:slow:VUGTB202:error_status	Being archived	appliance0	true	true	1.0	Never		
BTF2:slow:VUGTB202:status	Being archived	appliance0	true	true	1.0	Mar/23/2026 09:07:12 UTC		
BTF2:slow:VUGTB202:timestamp	Being archived	appliance0	true	true	1.0	Mar/26/2026 17:10:53 UTC		
BTF2:slow:VUGTB202:value	Being archived	appliance0	true	true	1.0	Mar/23/2026 09:07:12 UTC		
BTF:MAG:FAST:PS:OutputCurrent	Being archived	appliance0	true	true	1.0	Mar/26/2026 09:44:27 UTC		
BTF:MAG:FAST:PS:OutputVoltage	Being archived	appliance0	true	true	1.0	Mar/26/2026 09:44:27 UTC		
BTF:MAG:FAST:PS:STATE_RB	Being archived	appliance0	true	true	1.0	Mar/26/2026 09:44:29 UTC		
BTF:TML:SLTTB001D:ACCL_RB	Being archived	appliance0	false	true	1.0	Never		

EPICS Archiver Appliance Version 2.1.2

**What does an
operator
actually
need?**





What does an operator actually need?

- Immediate understanding of system status
- Visibility of key physical values
- Clear indication of alarms or abnormal conditions
- Safe and controlled way to send commands

Control Interface Design Principles

Fast Interpretation

Understandable in < 1 sec

Focus on Decisions

Show what matters

Reusable patterns

Same PV → same behavior

Standardized Structure

Predictable layout

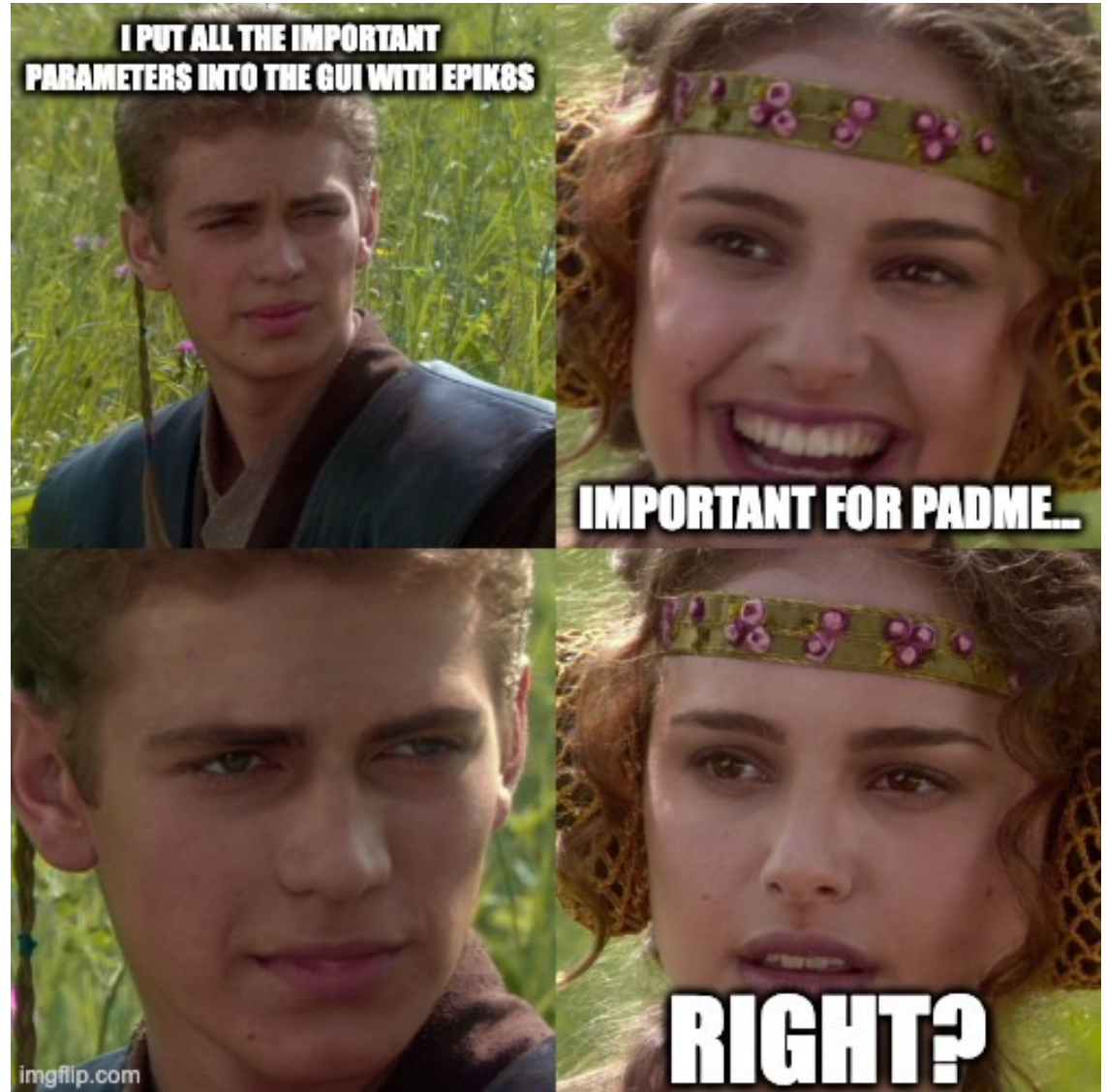
Some ideas...

- Monitor the Humidity, Pressure and Temperature of the EH1 and EH2
 - BTF2:slow:PTUBTFEH1_Temp:value, BTF2:slow:PTUBTFEH1_Press:value, BTF2:slow:PTUBTFEH1_RH:value
 - BTF2:slow:PTUBTFEH2_Temp:value, BTF2:slow:PTUBTFEH2_Press:value, BTF2:slow:PTUBTFEH2_RH:value
- Monitor the values of the Hall probes installed on the magnet
 - BTF2:slow:GaussProbe:DHSTB001:value, BTF2:slow:GaussProbe:DHSTB201:value, BTF2:slow:GaussProbe:DHSTB202:value
- Monitor the vacuum level
 - BTF2:slow:VUGTB003:value, BTF2:slow:VUGTB004:value, BTF2:slow:VUGTB201:value, BTF2:slow:VUGTB202:value, BTF2:slow:VUGPADME:value
- Monitor the current of the the magnets
 - DAFNE:BTF:QUATB101:current_rb, DAFNE:BTF:QUATB102:current_rb, (...)
 - DAFNE:BTF:DHSTB001:current_rb, DAFNE:BTF:DHPTB101:current_rb, (...)
 - DAFNE:BTF:CHHTB001:current_rb, DAFNE:BTF:CVVTB001:current_rb, (...)

The final task...

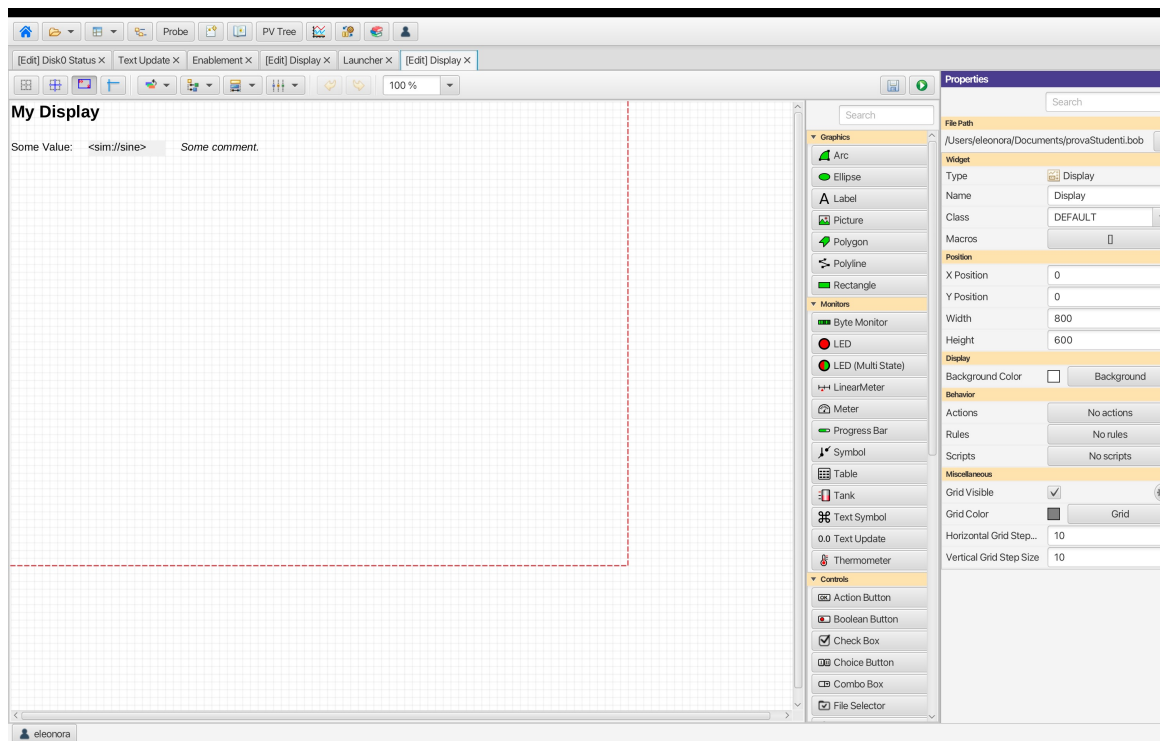
Let's realize together a GUI to show all the pivotal PV needed by PADME

**THINK ABOUT WHAT
USER WANT TO SEE**



The exercise...

1. Check if the PV is archived on the [EPICS archiver](#)
2. Check the graph to understand the range of the PV
3. Open a new Display on Phoebus



- Use text update to see the value of a given PV changing (eventually) over the time
- Use LED, Stripcharts, ... to give a graphical representation of the PV
- Open the terminal phoebus -settings settings.ini –resource DoctoLab.bob