



JAGIELLONIAN UNIVERSITY
IN KRAKOW



SOLARIS
NATIONAL SYNCHROTRON
RADIATION CENTRE



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Synoptic GUIs in NSRC SOLARIS for Beamlines and Accelerators Visualization and Control

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M. Fałowski, M. Zając, N. Olszowska, T. Noga

National Synchrotron Radiation Centre SOLARIS

**SCADA systems play very
important role in control systems**

What should synoptic do?

- Show control system clearly.
- Be reliable and stable.
- Show exactly what we need to see.
- And it should be intuitive.
- Or even allow to interact with devices and control them in easy way.

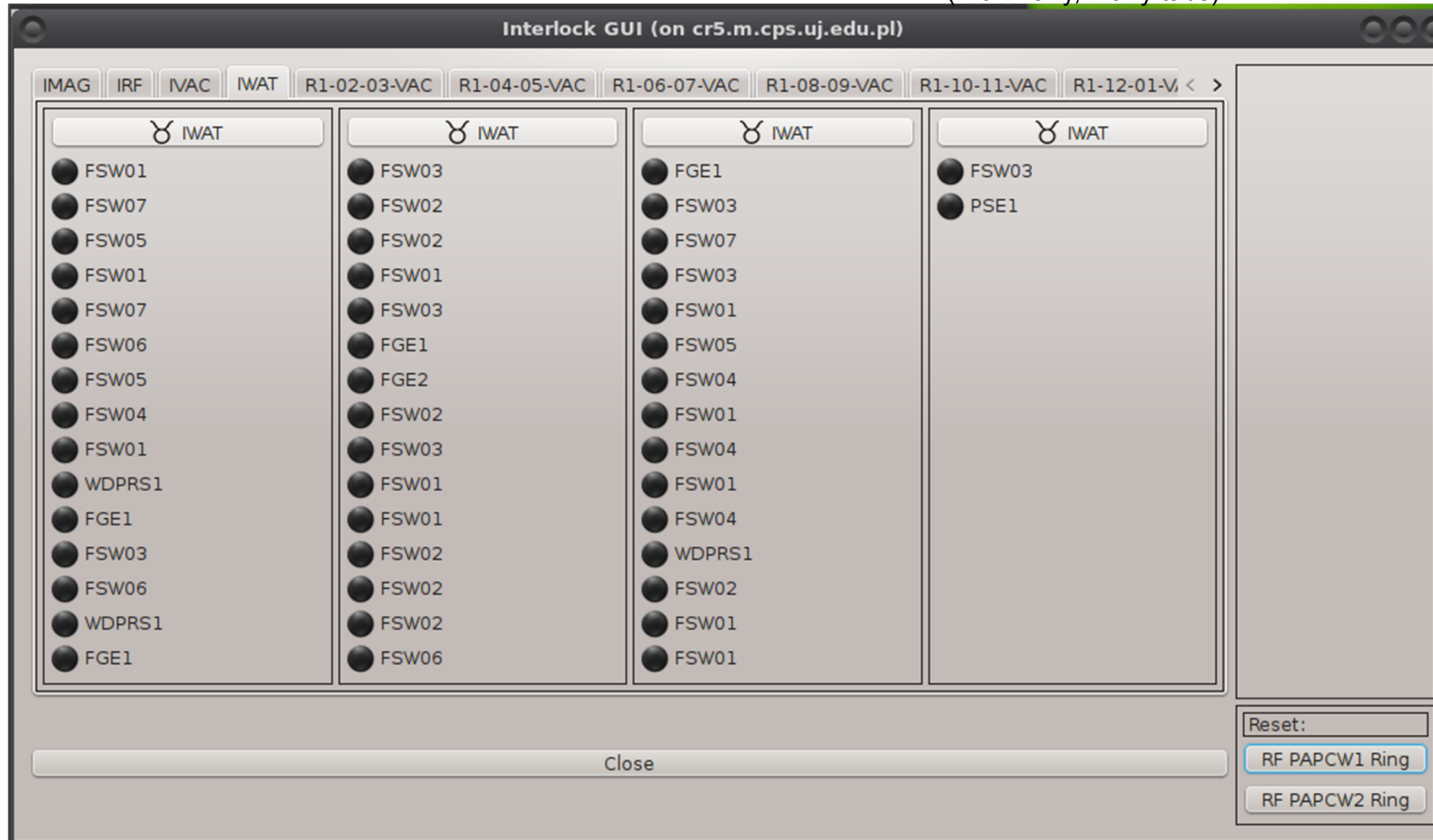
First there was a simple panel to control a beamline...



(actually there were few of them for one BL)

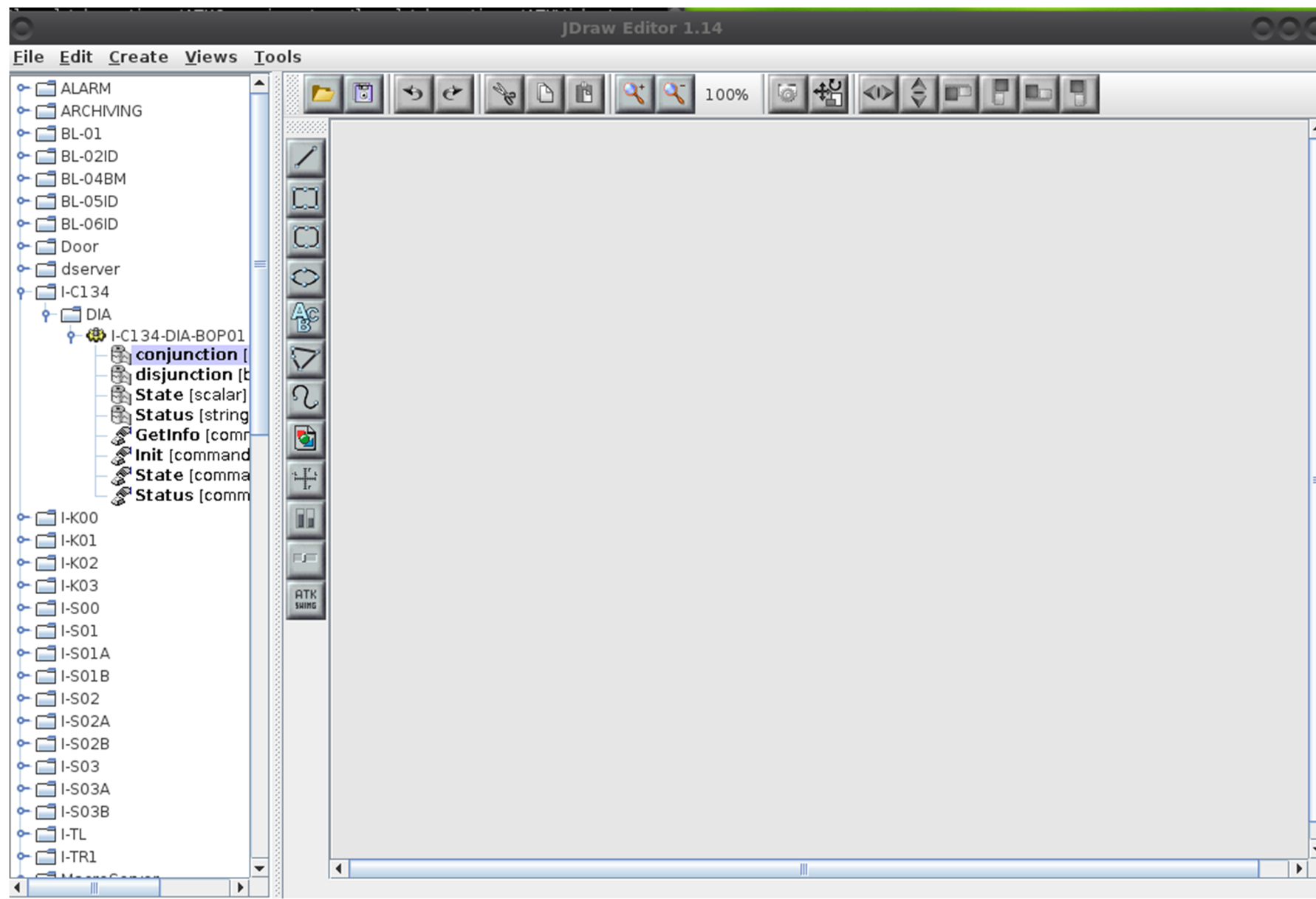
...and a simple panel to watch interlocks

(with many, many tabs)

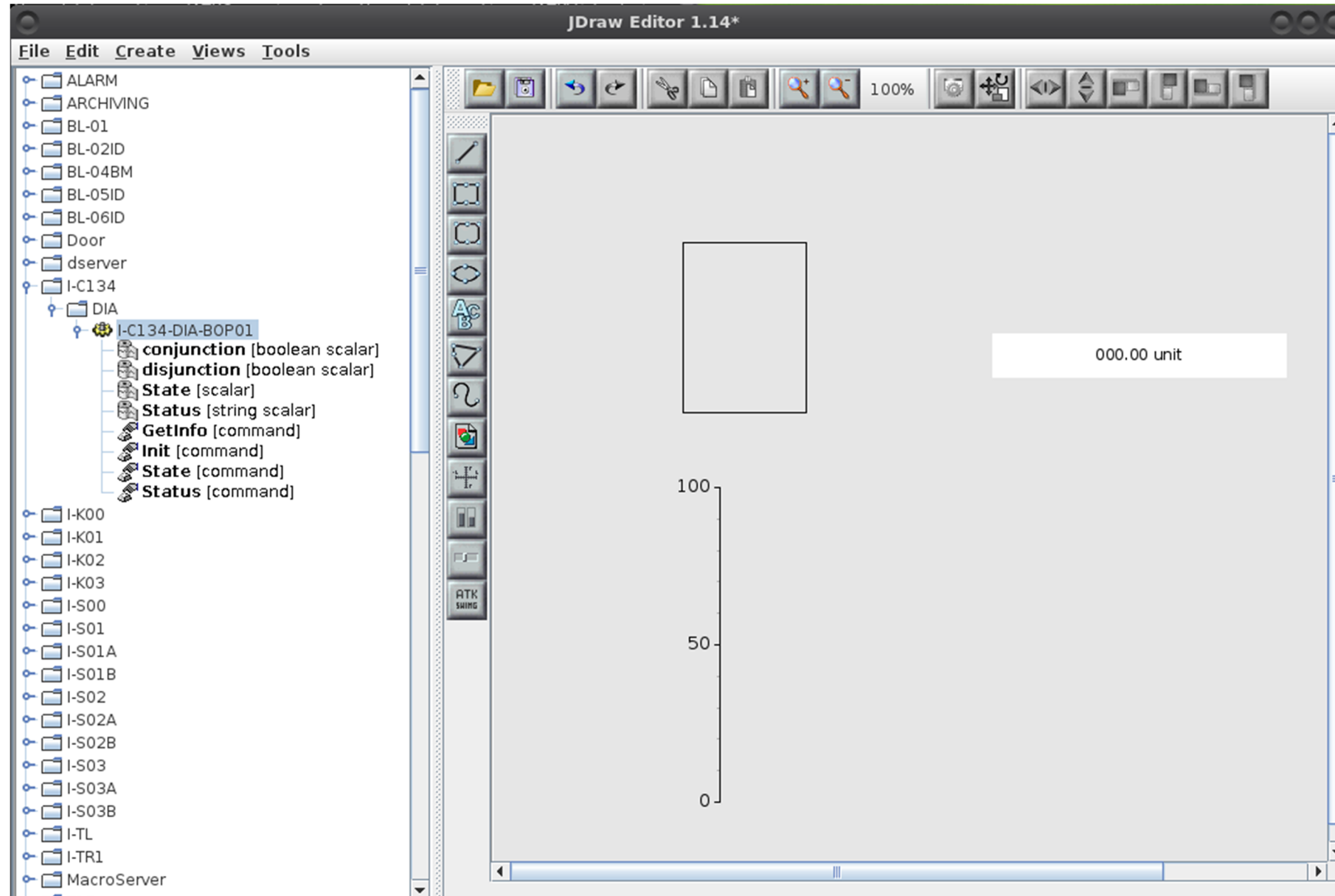


**Conclusion was simple:
we need synoptics**

So we tried JDraw



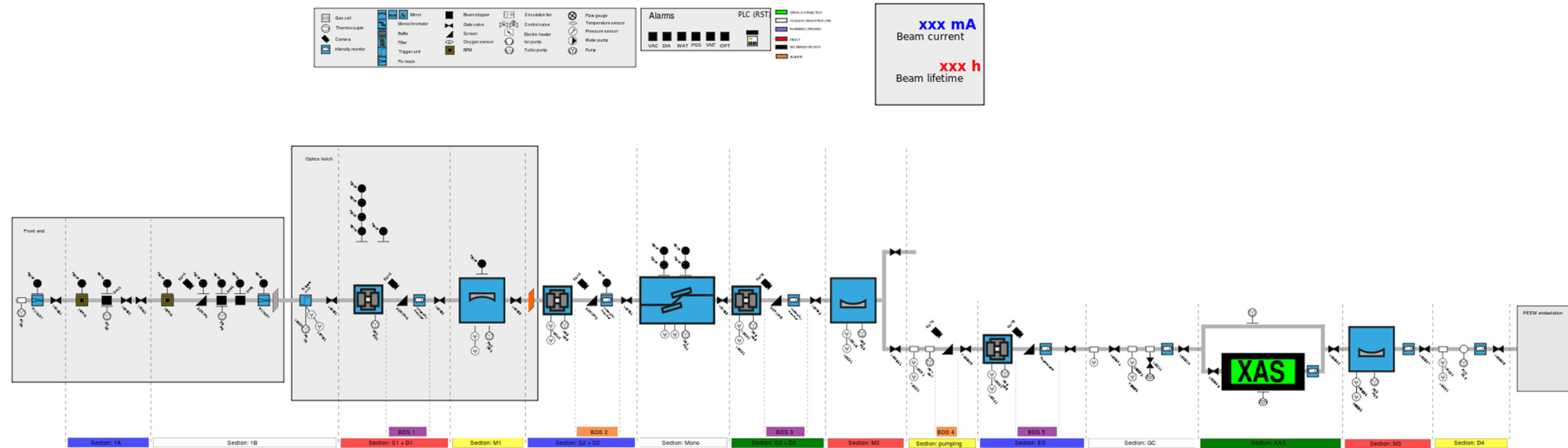
And after some time we got



But then MAX IV came with help

svgsynoptic2

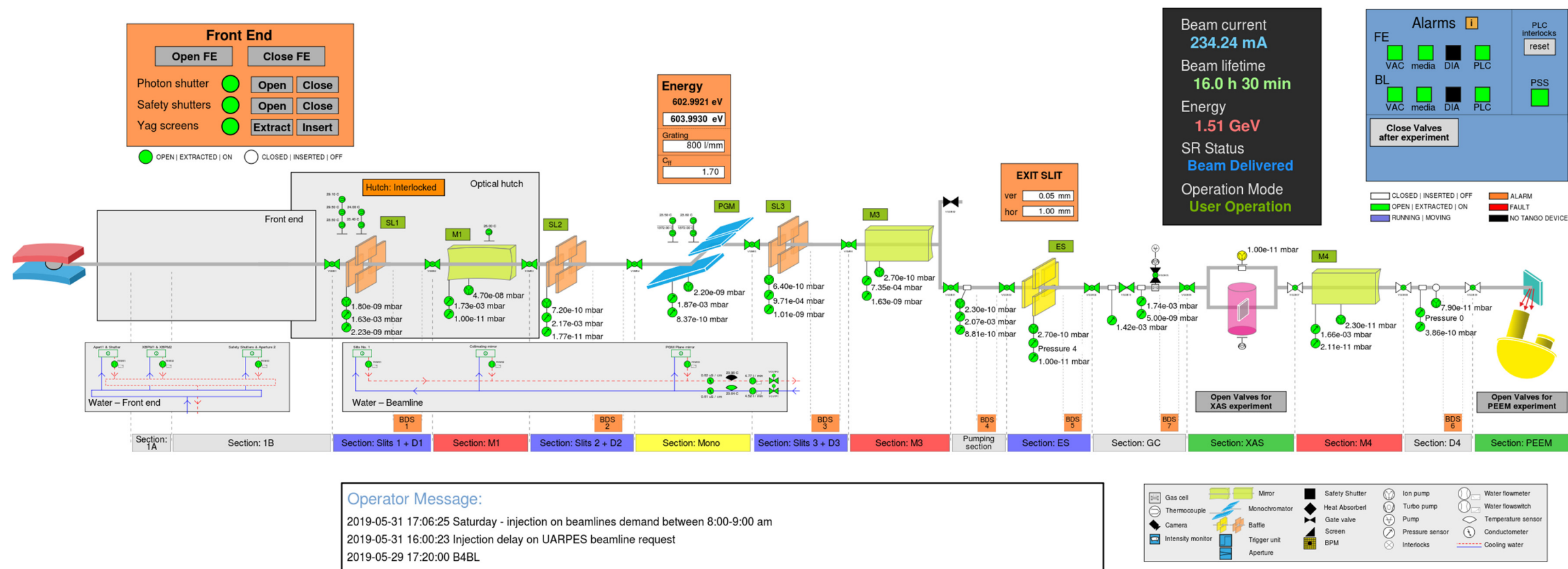
With svgsynoptic we created this:



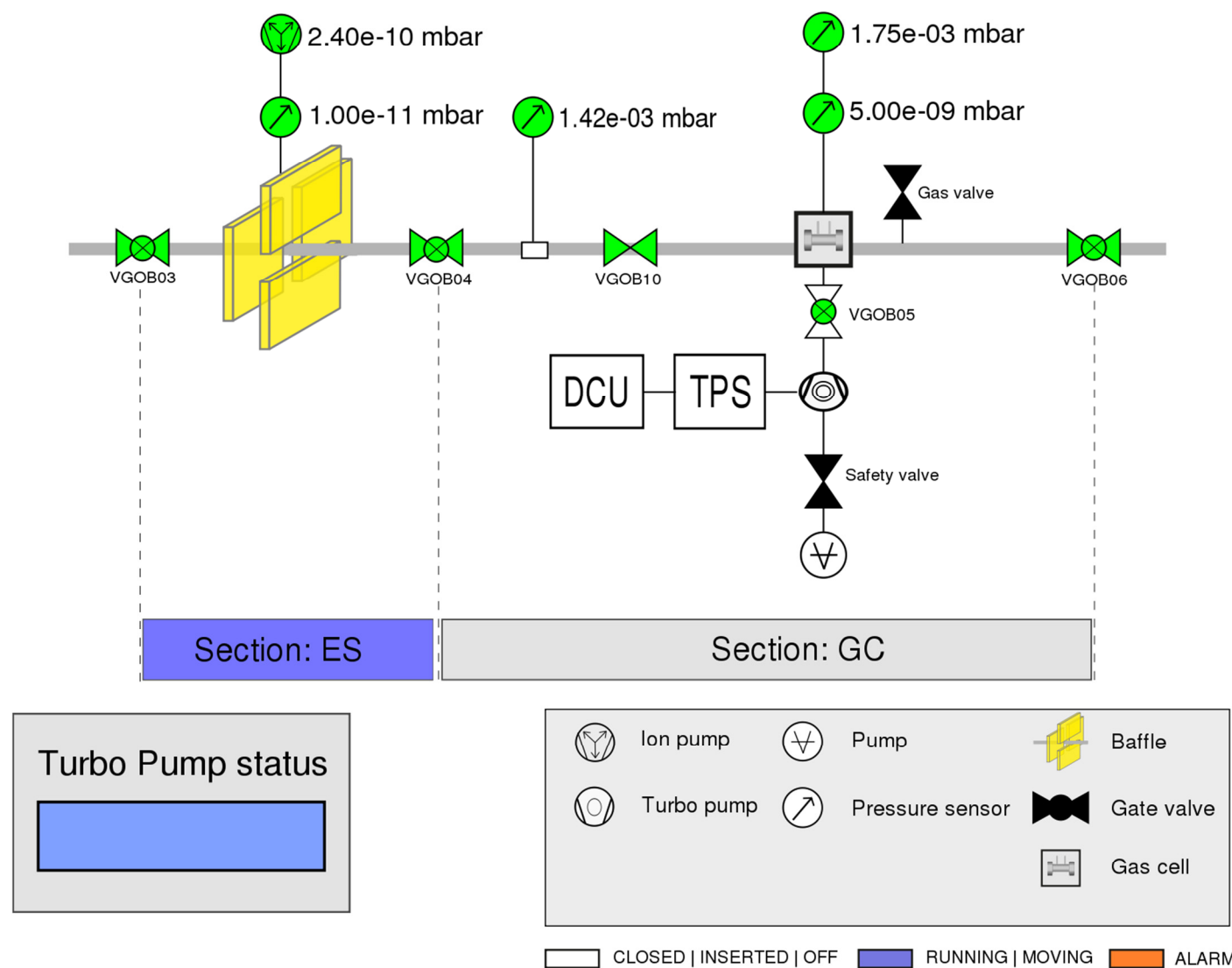
But that wasn't enough

- It's too small.
- Elements are too archaic.
- We need more stuff there (like buttons, indicators etc).

We have improved

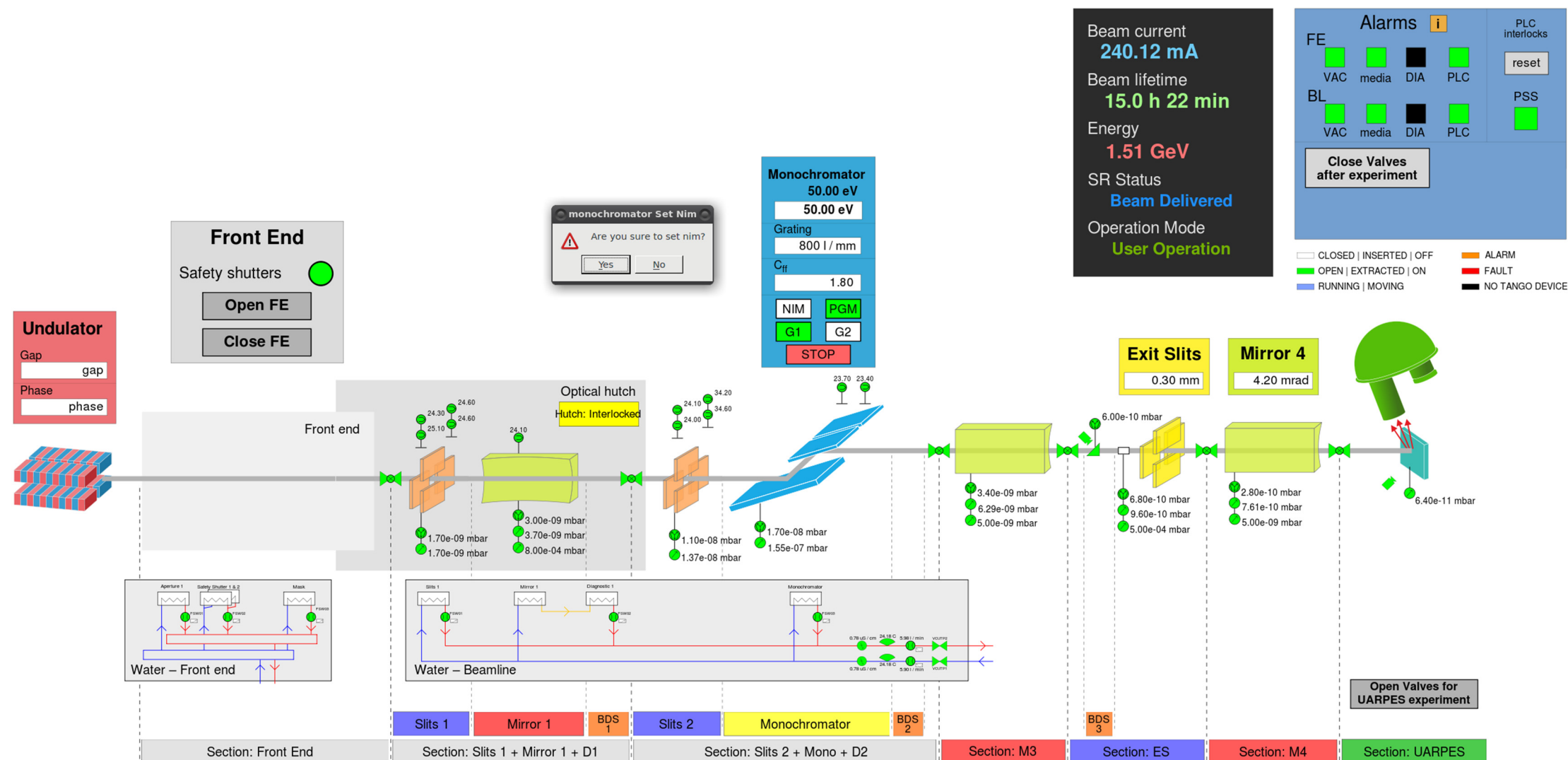


And created more of them

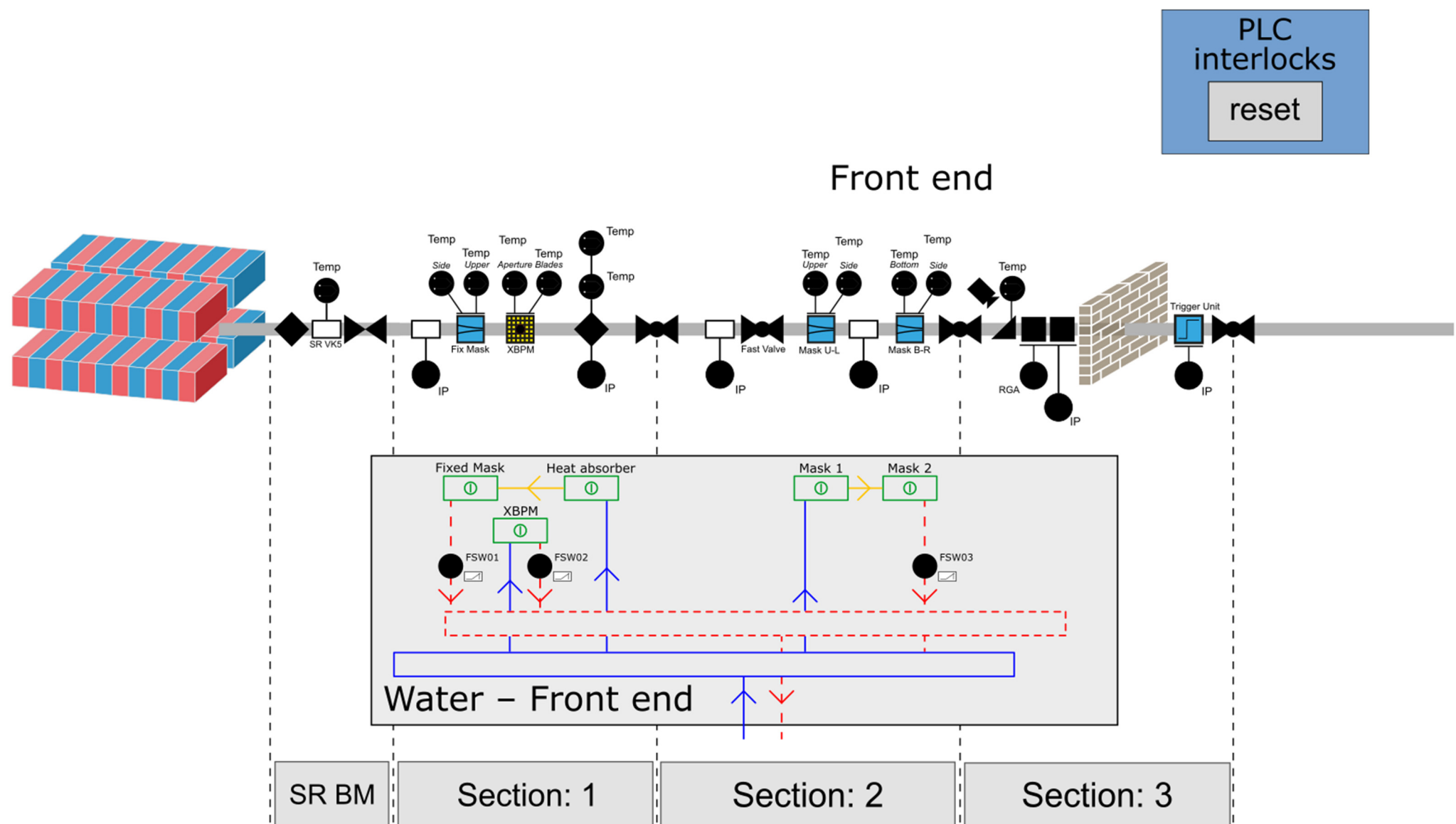


Gas Cell on
PEEM/XAS beamline

It was quite simple



And fast

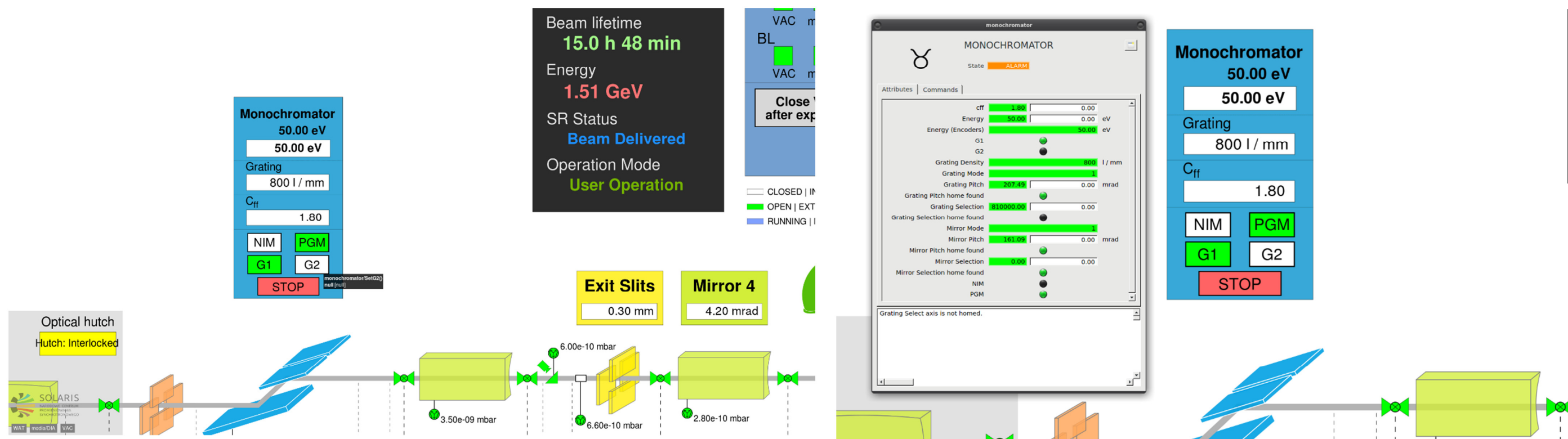


PHELIX beamline frontend

They have some nice functions

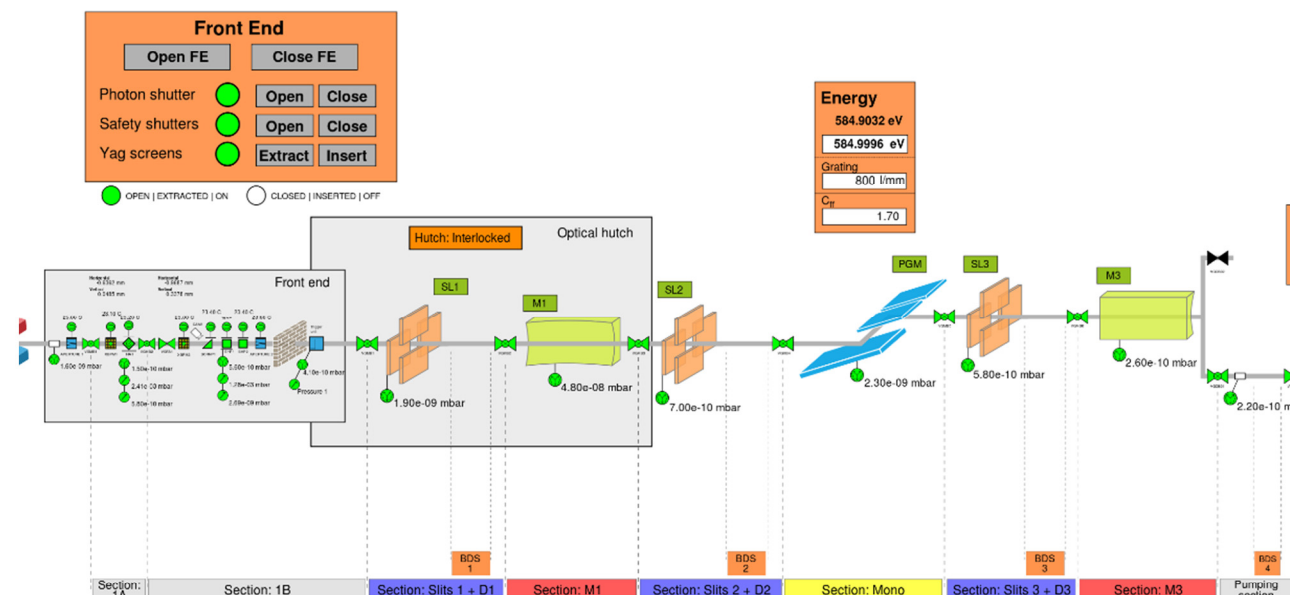
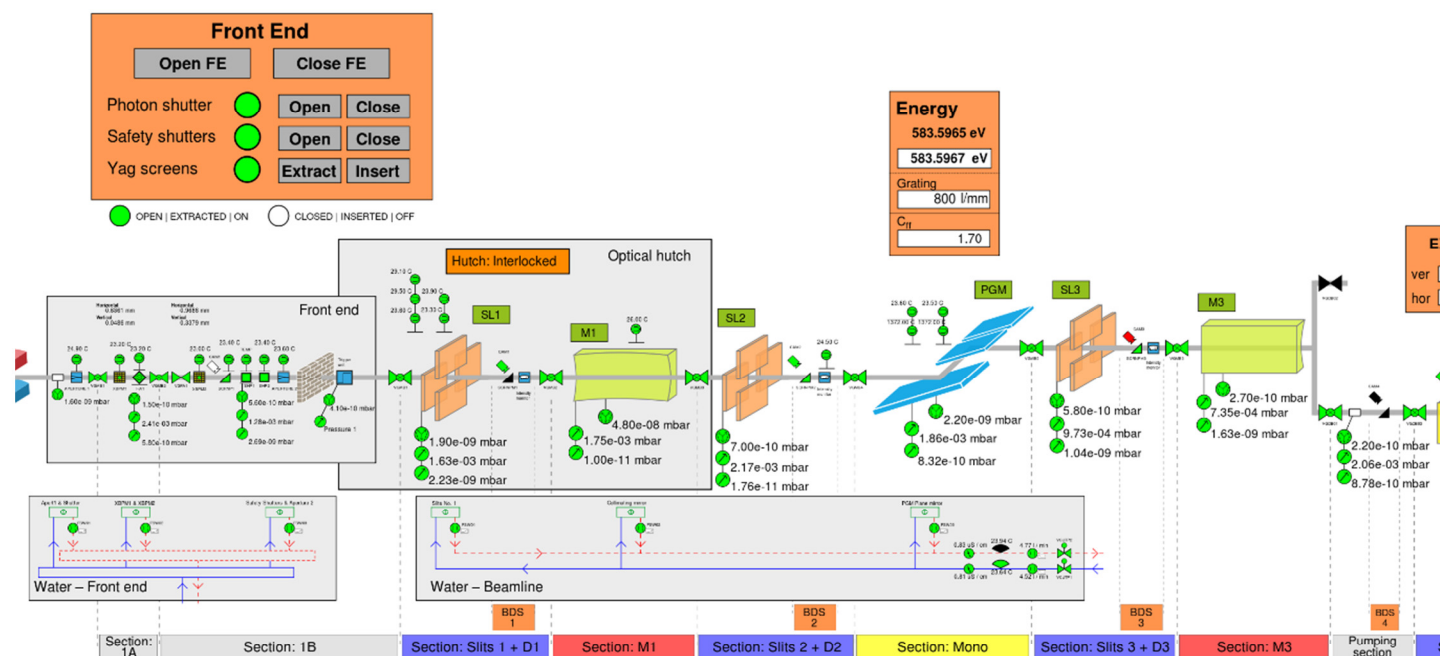
Moving and zooming to sections

Opening Device Widgets (Taurus Device Panels)



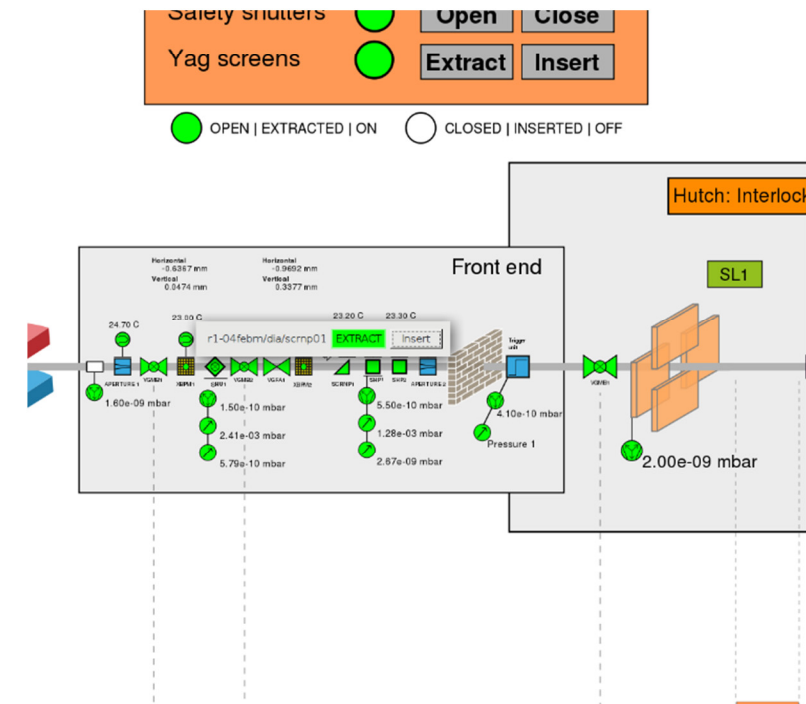
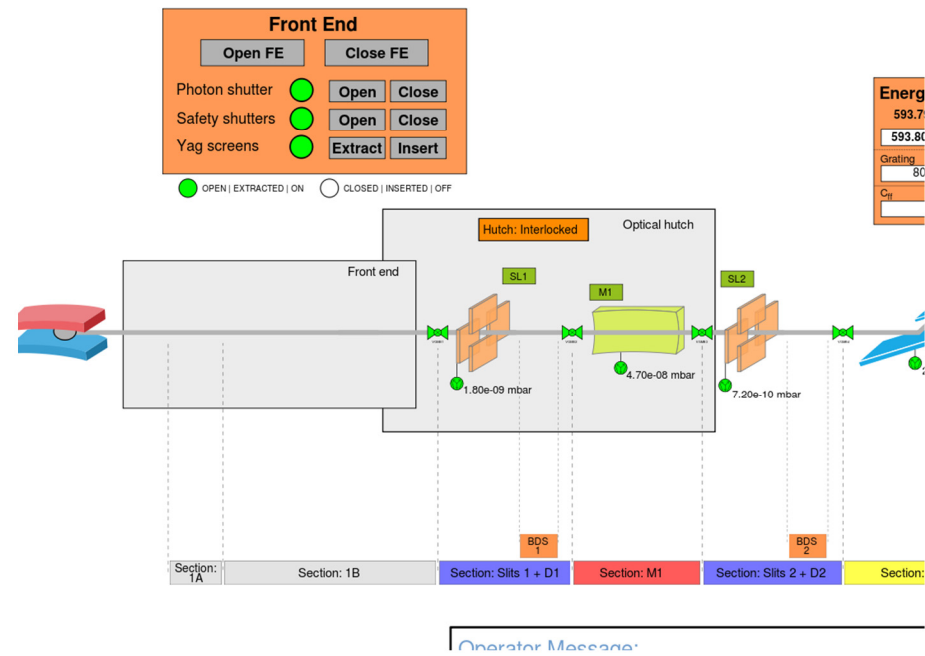
They have some nice functions

Hiding some layers



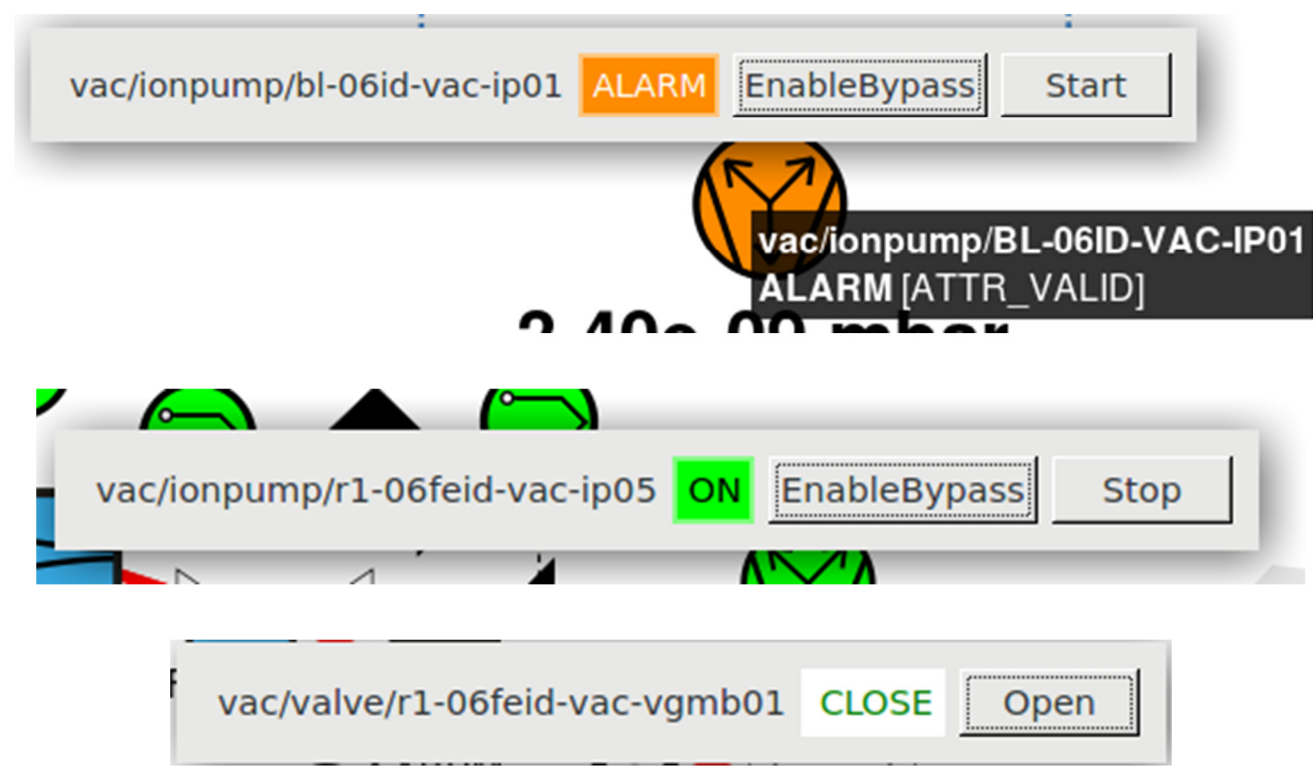
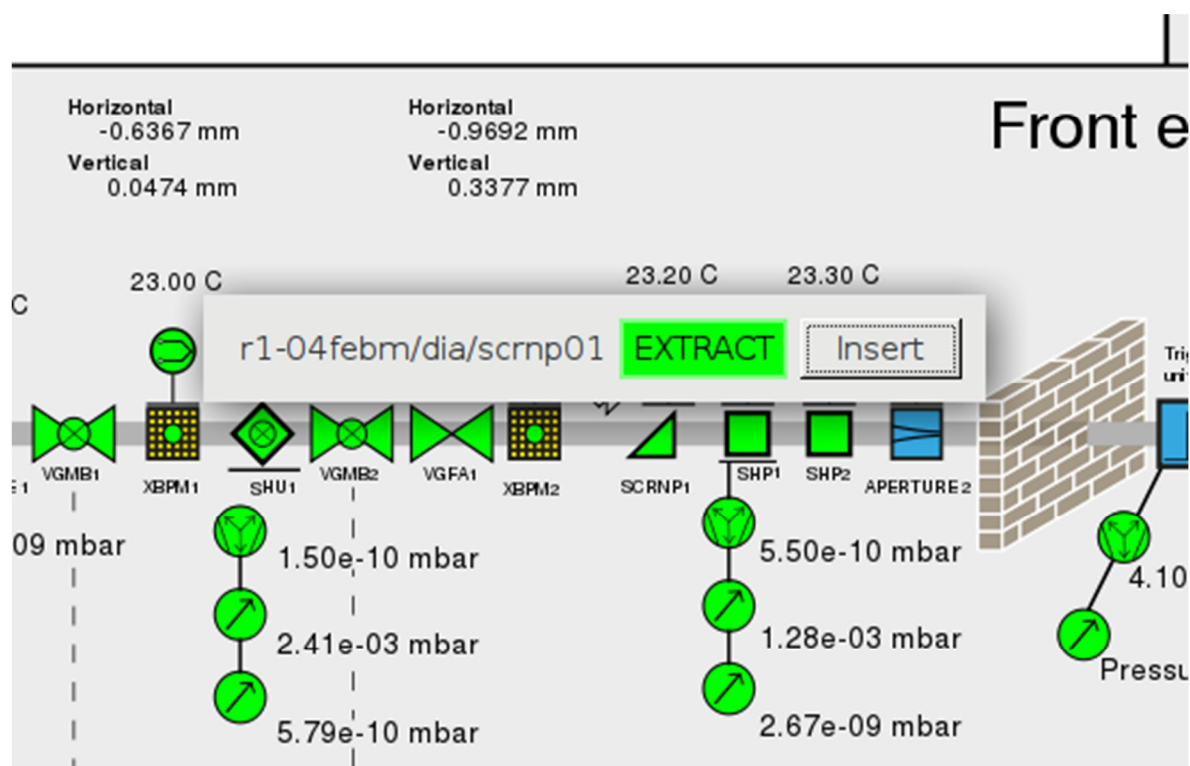
They have some nice functions

Zoom levels



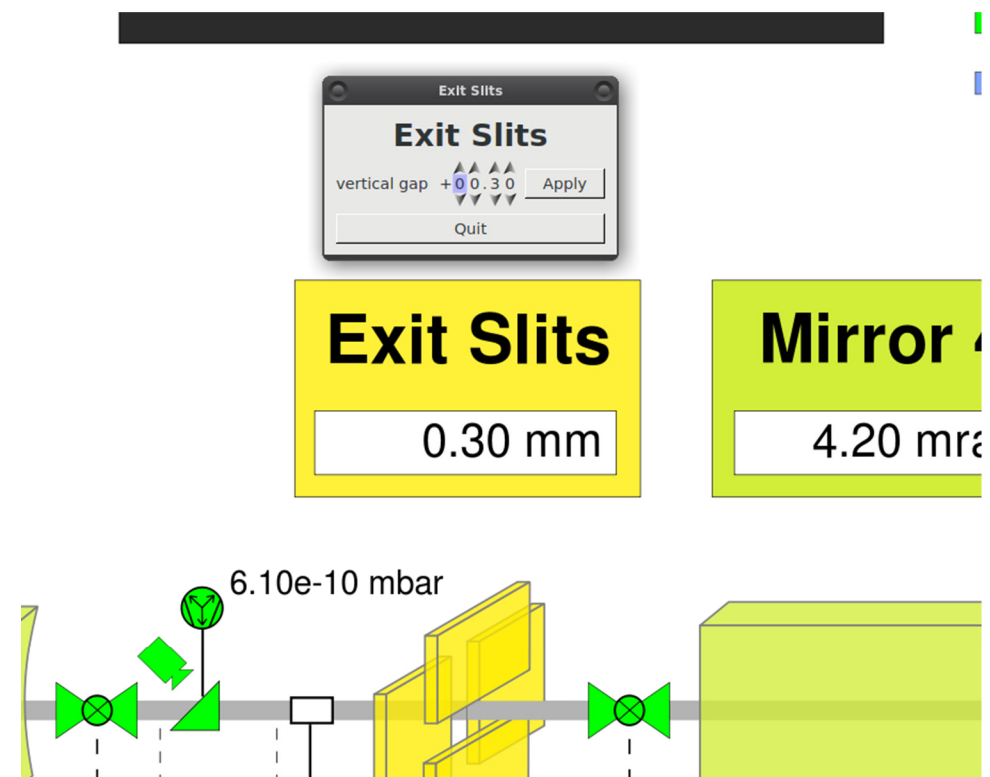
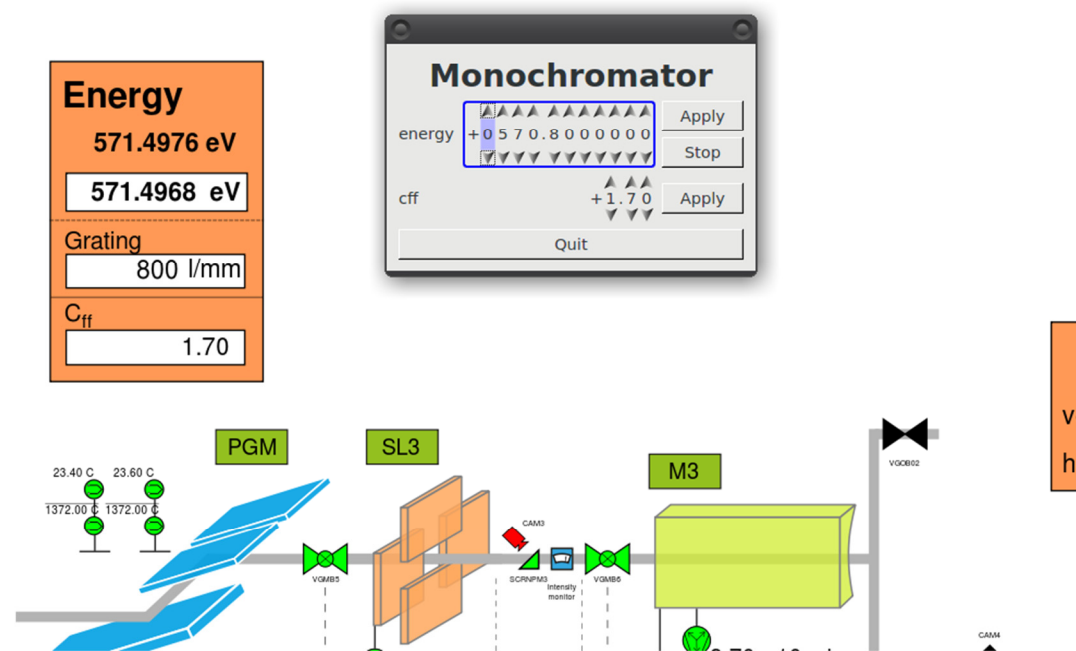
We added more through our common library (some function based on MAX IV code)

Specific commands for classes



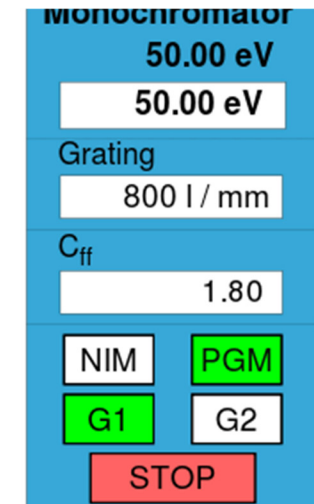
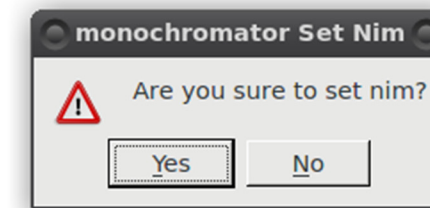
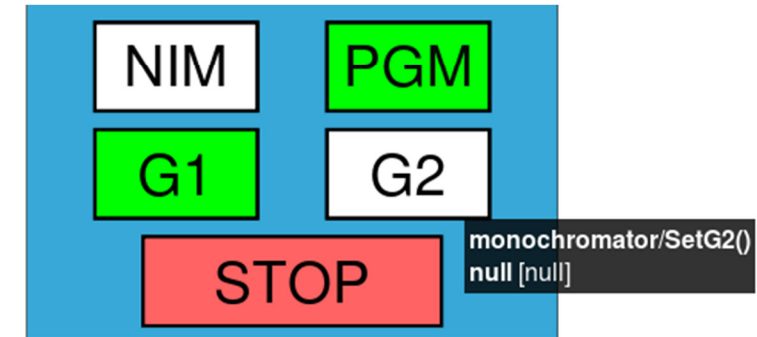
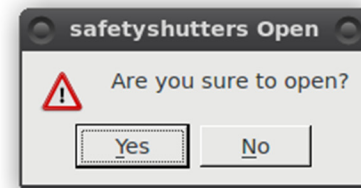
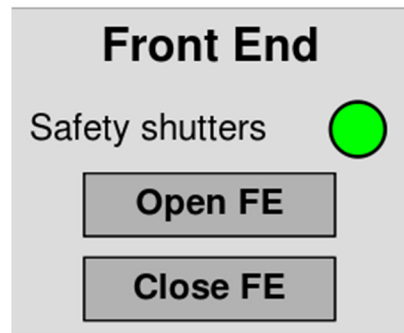
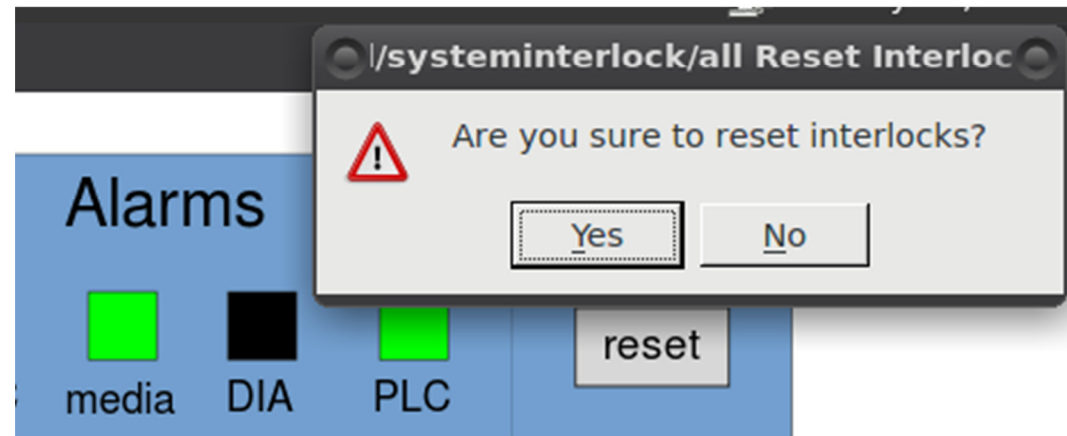
We added more through our common library

Opening panels for sets of attributes



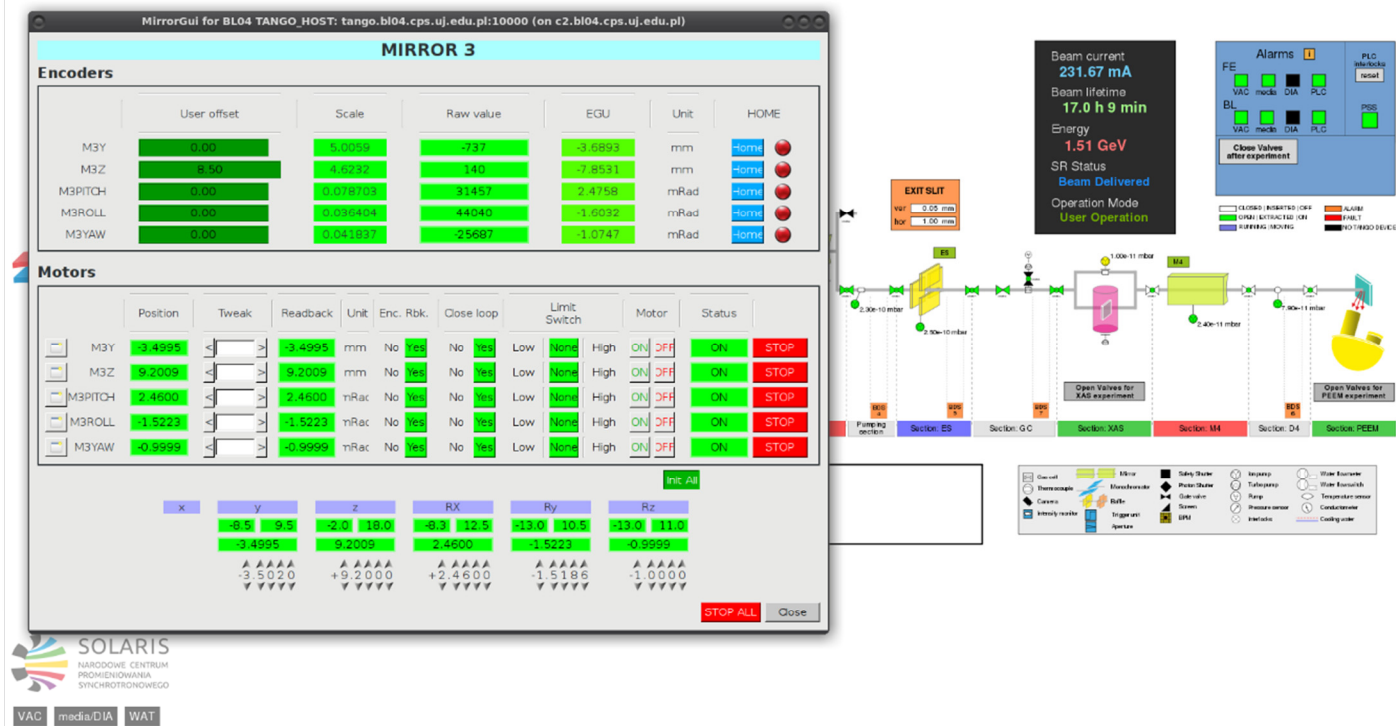
We added more through our common library

Run specific command for device



We can also

Open different applications



MIRROR 3

Encoders	User offset	Scale	Raw value	EGU	Unit	HOME
M3Y	0.00	0.0039	-737	-3.6893	mm	Home
M3Z	0.00	0.0039	140	-7.8531	mm	Home
M3PITCH	0.00	0.078703	31457	2.4758	mRad	Home
M3ROLL	0.00	0.036404	44040	-1.6032	mRad	Home
M3YAW	0.00	0.041837	25687	-1.0747	mRad	Home

Motors	Position	Tweak	Readback	Unit	Enc. Rbk.	Close loop	Limit Switch	Motor	Status
M3Y	3.4995	0.00	3.4995	mm	No	Yes	Low	ON	STOP
M3Z	9.2009	0.00	9.2009	mm	No	Yes	Low	ON	STOP
M3PITCH	2.4600	0.00	2.4600	mRad	No	Yes	Low	ON	STOP
M3ROLL	-1.5223	0.00	-1.5223	mRad	No	Yes	Low	ON	STOP
M3YAW	-0.9999	0.00	-0.9999	mRad	No	Yes	Low	ON	STOP

Beamline Diagram: Shows sections ES, GC, XAS, M4, D4, PEB. Legend: CLOSED | INSERTED | OFF (white), OPEN | EXTRACTED | ON (green), ALARM (red), FAULT (black), NO TANGO DEVICE (grey).

Status Panel: Beam current: 231.67 mA, Beam lifetime: 17.0 h 9 min, Energy: 1.51 GeV, SR Status: Beam Delivered, Operation Mode: User Operation.

Legend: CLOSED | INSERTED | OFF (white), OPEN | EXTRACTED | ON (green), ALARM (red), FAULT (black), NO TANGO DEVICE (grey).



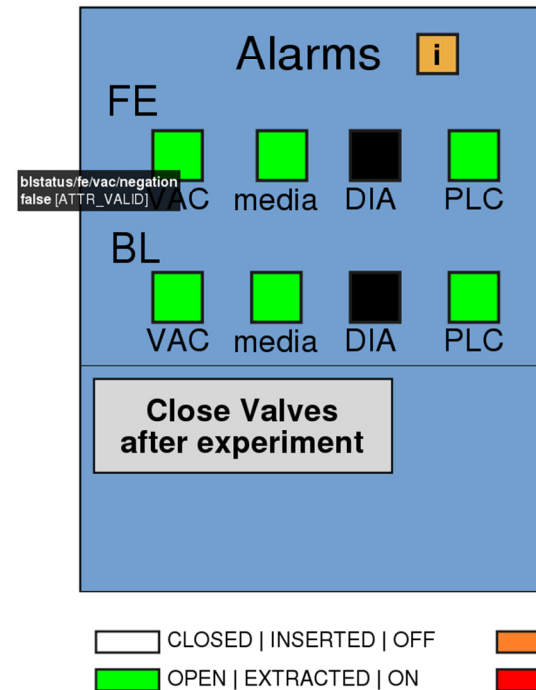
BL04BM MPS FRONT-END-VAC Information (na c2...)

Front-end summary vacuum status

- Vacuum pressure alarm IPCU01
- Vacuum pressure alarm IPCU02
- Vacuum pressure alarm IPCU03
- Vacuum pressure alarm IPCU04
- Vacuum pressure alarm VGC1
- Vacuum pressure alarm VGC2
- Vacuum pressure alarm VGP1
- Vacuum pressure alarm VGP2
- Vacuum valve is open VGMB1
- Vacuum valve is open VGMD2
- Fast valve is open VGF1

Loading: 73% OK

Operation Mode: User Operation



Alarms

FE: VAC, media, DIA, PLC

BL: VAC, media, DIA, PLC

Close Valves after experiment

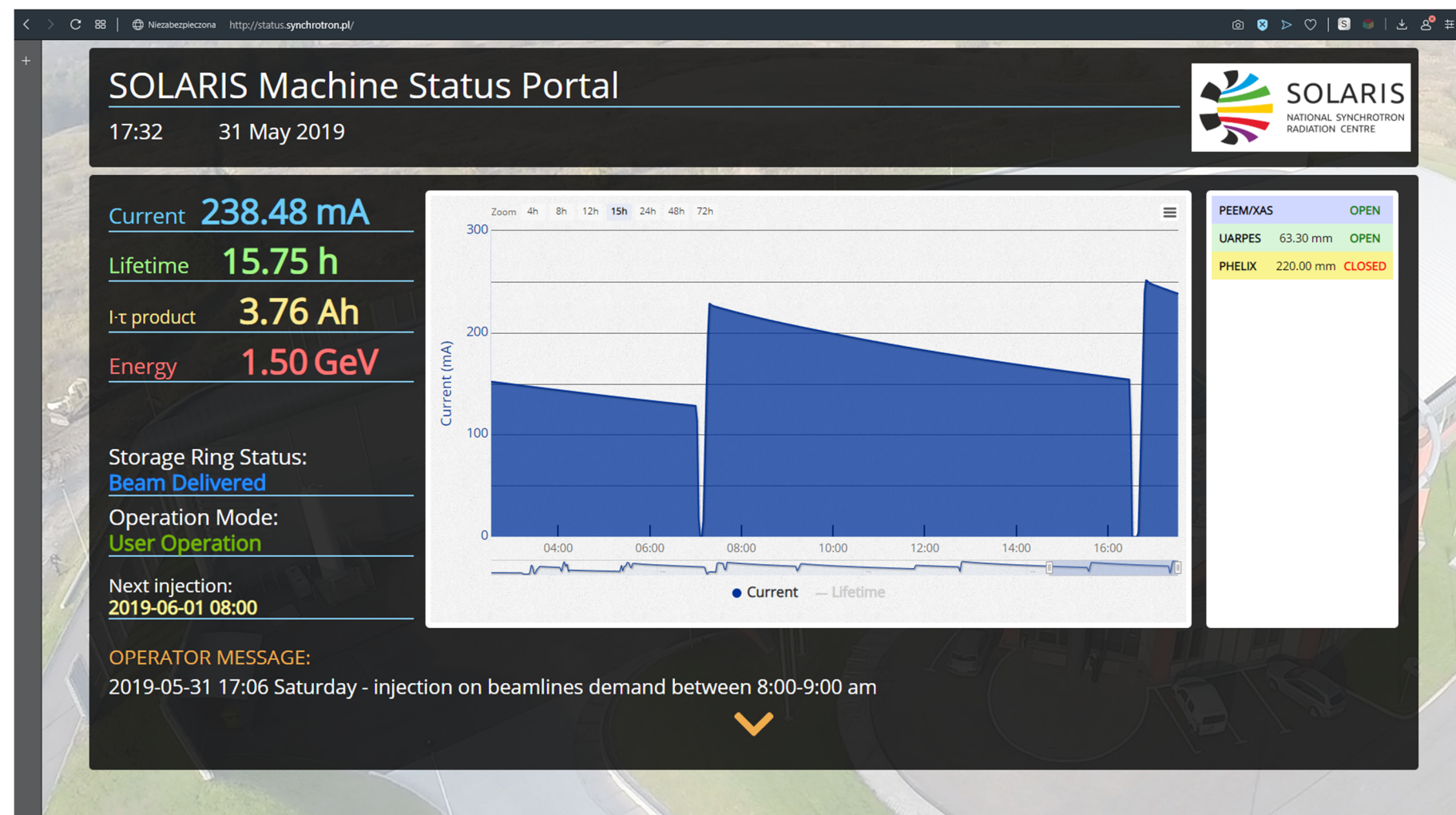
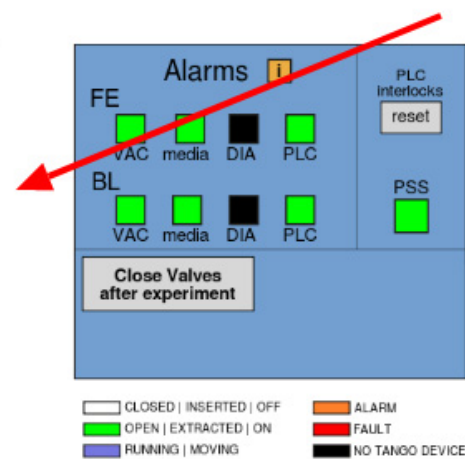
Legend: CLOSED | INSERTED | OFF (white), OPEN | EXTRACTED | ON (green), ALARM (red), FAULT (black), NO TANGO DEVICE (grey).

Unfortunately, it can't be too easy

- Every scientist wants different functions.
- And different symbols.
- And different colours.
- And panels similar with other applications

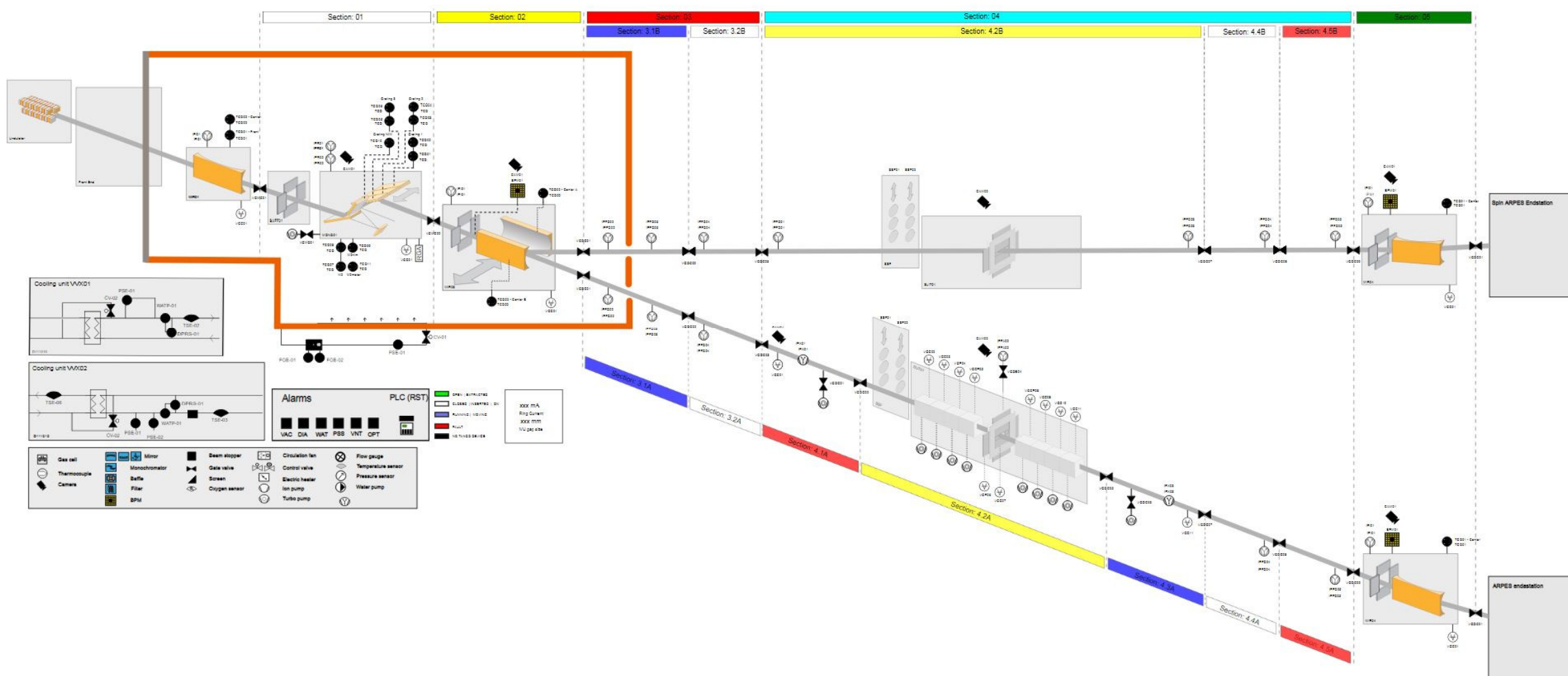
Like this

Beam current
234.24 mA
Beam lifetime
16.0 h 30 min
Energy
1.51 GeV
SR Status
Beam Delivered
Operation Mode
User Operation



And for the scientists the role model was

MAX IV's Bloch beamline



We decided with scientists and technical department to set standard for

- colours,
- basic functions,
- mouse actions,
- main panels and view schemes
- similarities between other applications,
- symbols and elements also used in technical drawings.

It's all for users and scientists, so they can be more familiar, especially if they will work on many beamlines. In addition, it allows technical department to use them easily.

Frontend small button layout

Undulator
Gap: gap
Phase: phase

Front End
Safety shutters
Open FE
Close FE

Monochromator
energy: energy
Grating: grating
C_{ff}: C_{ff}
STOP

Alarms
FE: VAC, media, DIA, PLC
BL: VAC, media, DIA, PLC
Close Valves after experiment
Open Valves for experiment

Storage Ring Status
machine status
operation status

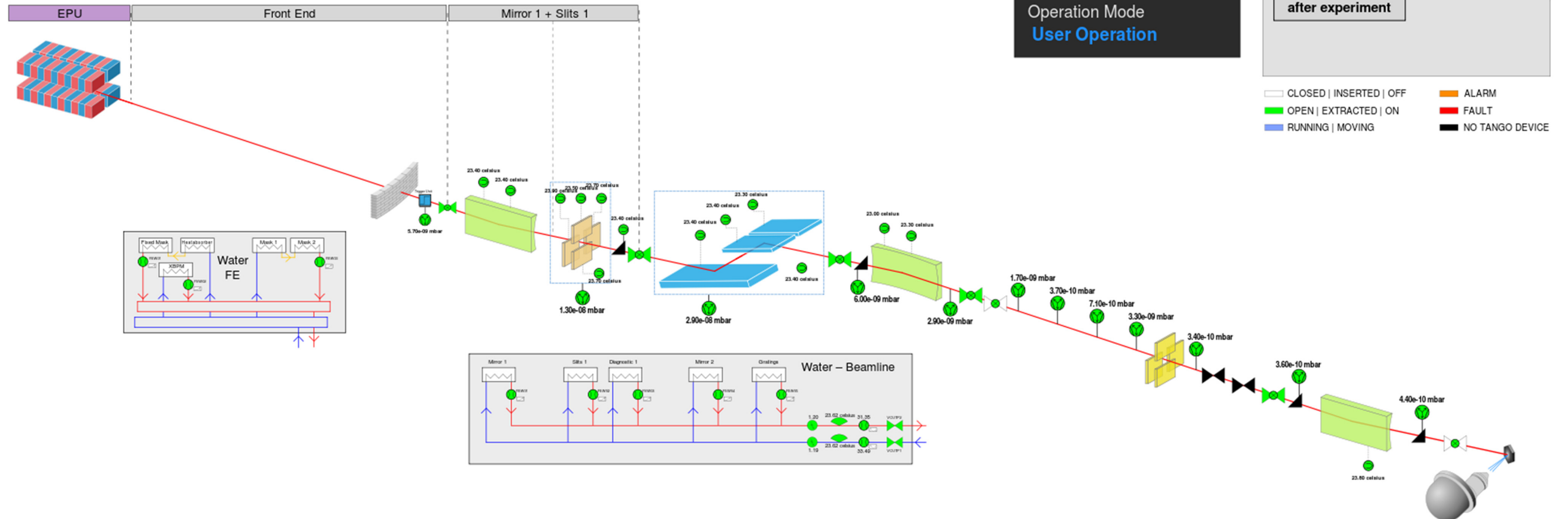
Legend
CLOSED | INSERTED | OFF
OPEN | EXTRACTED | ON
RUNNING | MOVING
ALARM
FAULT
NO TANGO DEVICE

Components
Gas cell
Thermocouple
Camera
Intensity monitor
Mirror
Monochromator
Baffle
Trigger unit
Aperture
Safety Shutter
Photon Shutter
Gate valve
Screen
BPM
Ion pump
Turbo pump
Pump
Pressure sensor
Interlocks
Water flowmeter
Water flowswitch
Temperature sensor
Conductometer
Cooling water

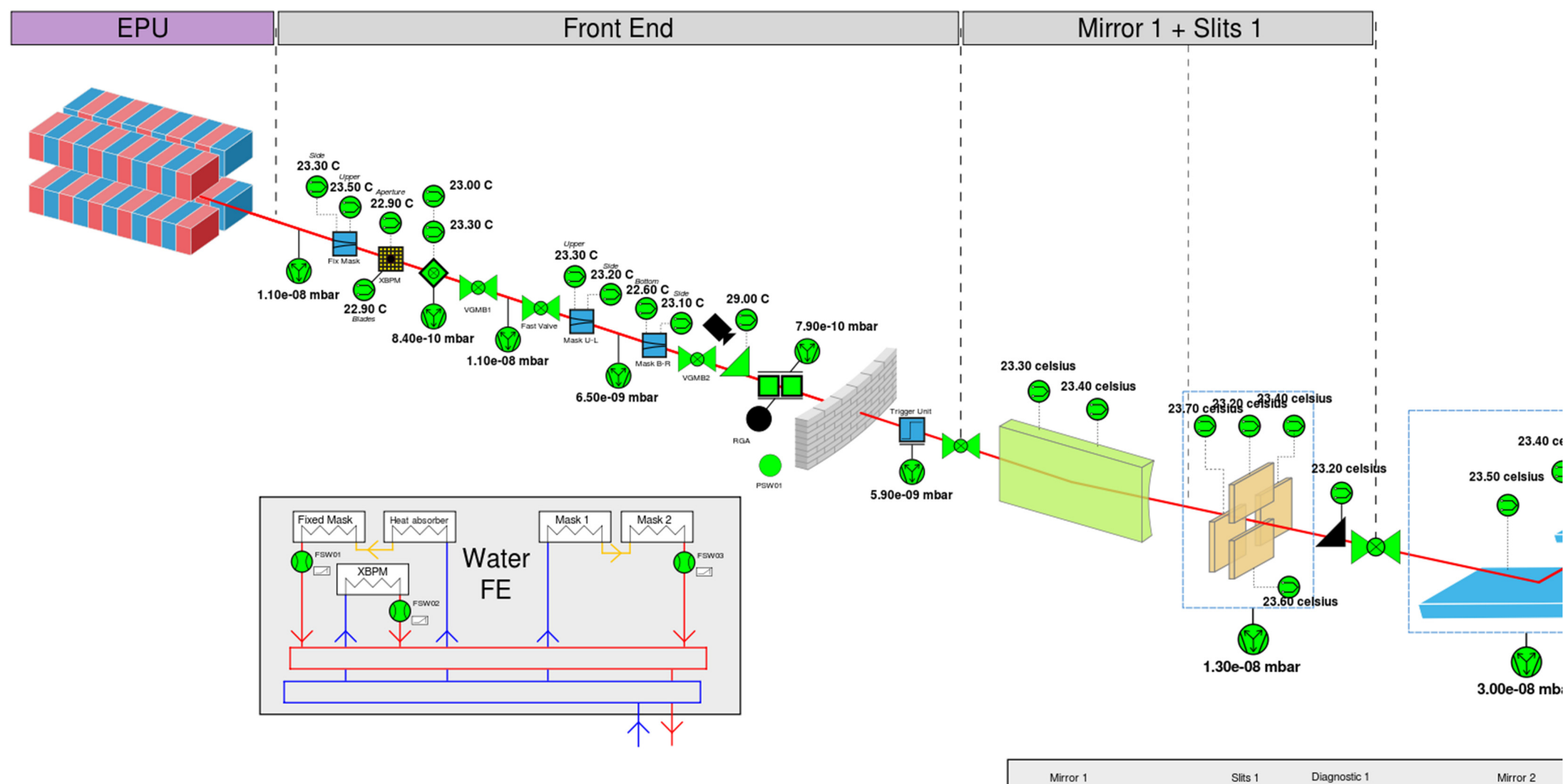
Diagram Labels
Front end
Optical hutch
Exit Slits
Mirror 4
Slits 1
Mirror 1
BDS 1
Slits 2
Monochromator
BDS 2
BDS 3
Section: Front End
Section: Slits 1 + Mirror 1 + D1
Section: M3
Section: ES
Section: M4
Section: UARPES
Water - Front end
Water - Beamline
Open Valves for UARPES experiment

Operator Message:

New beamline in new standard (under construction)



New beamline in new standard (under construction)



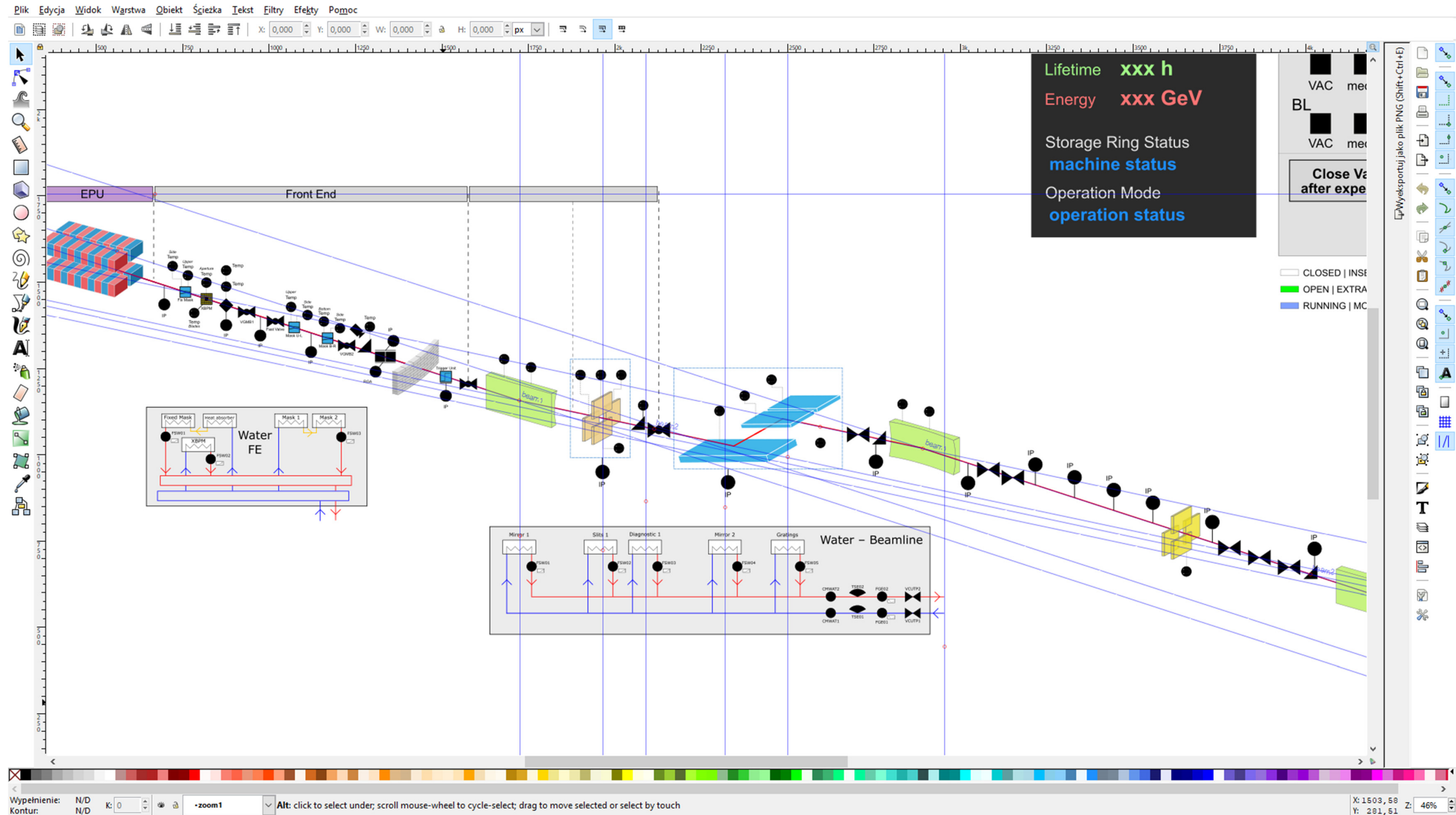
What are we using?

Tools

- svgsynoptic2,
- Taurus,
- TANGO controls,
- facadedevice (very useful for creating high level devices used for better views),
- some basic javascript,
- Inkscape.

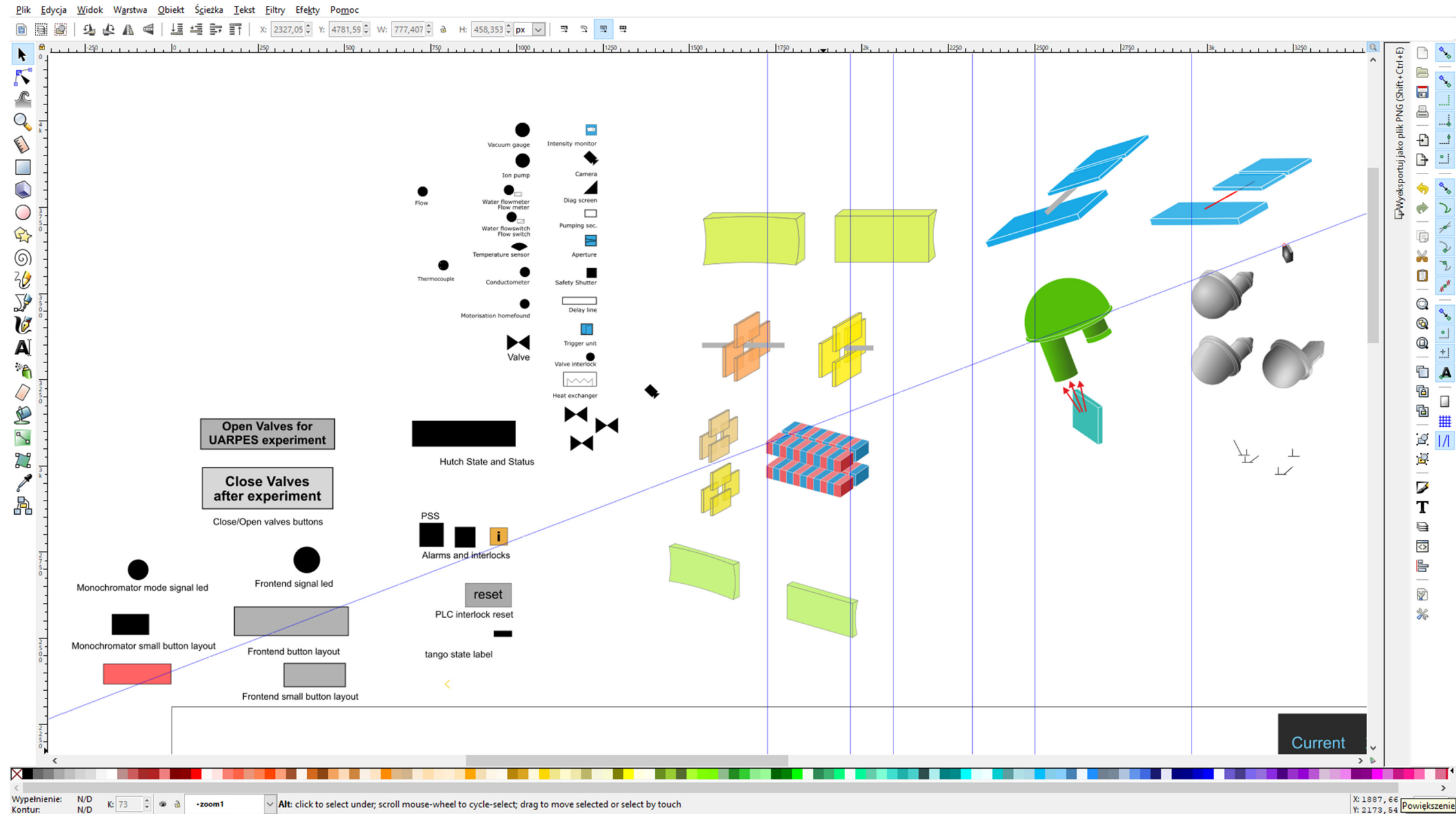


Inkscape workflow



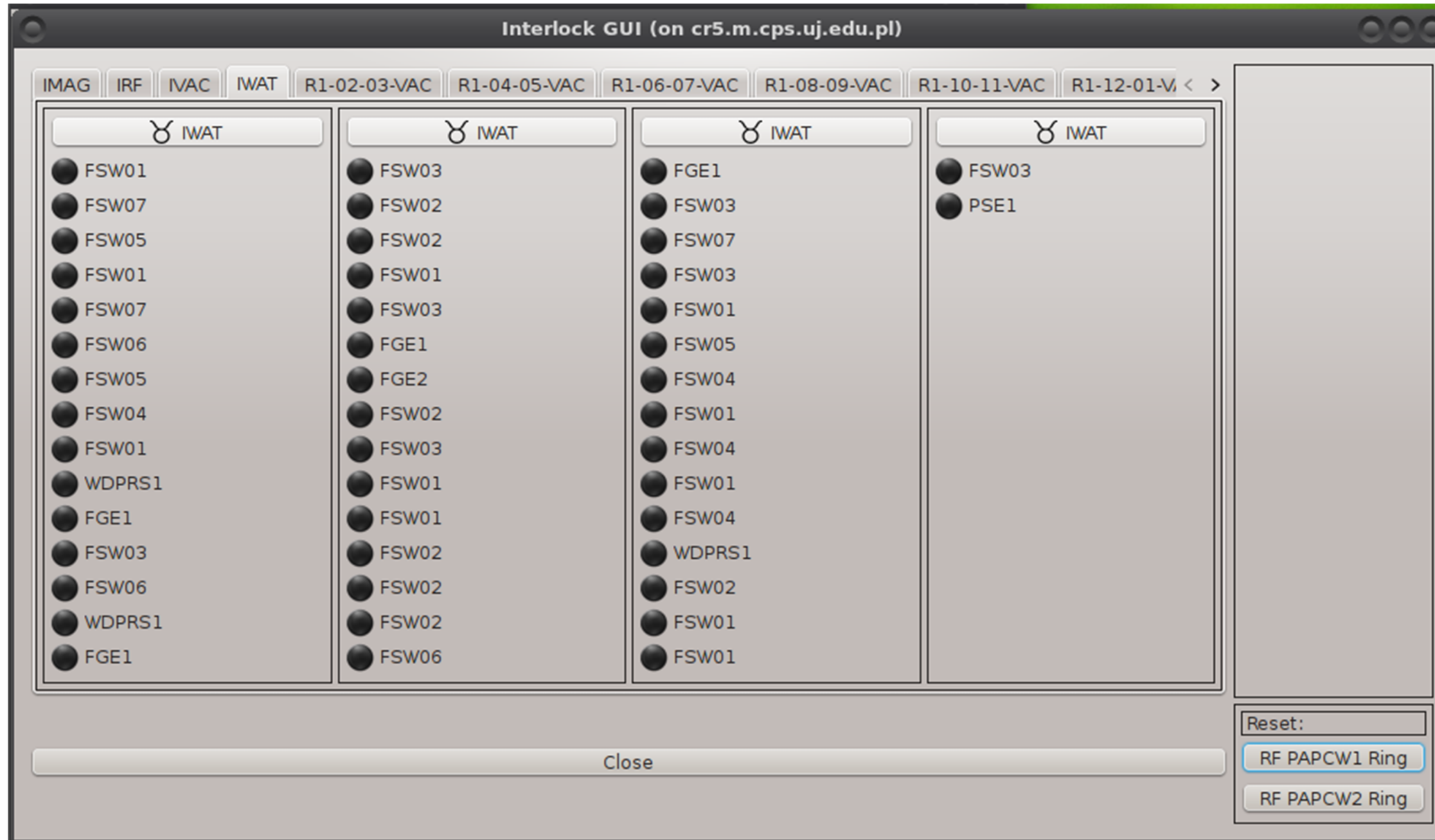


Inkscape workflow (symbols)

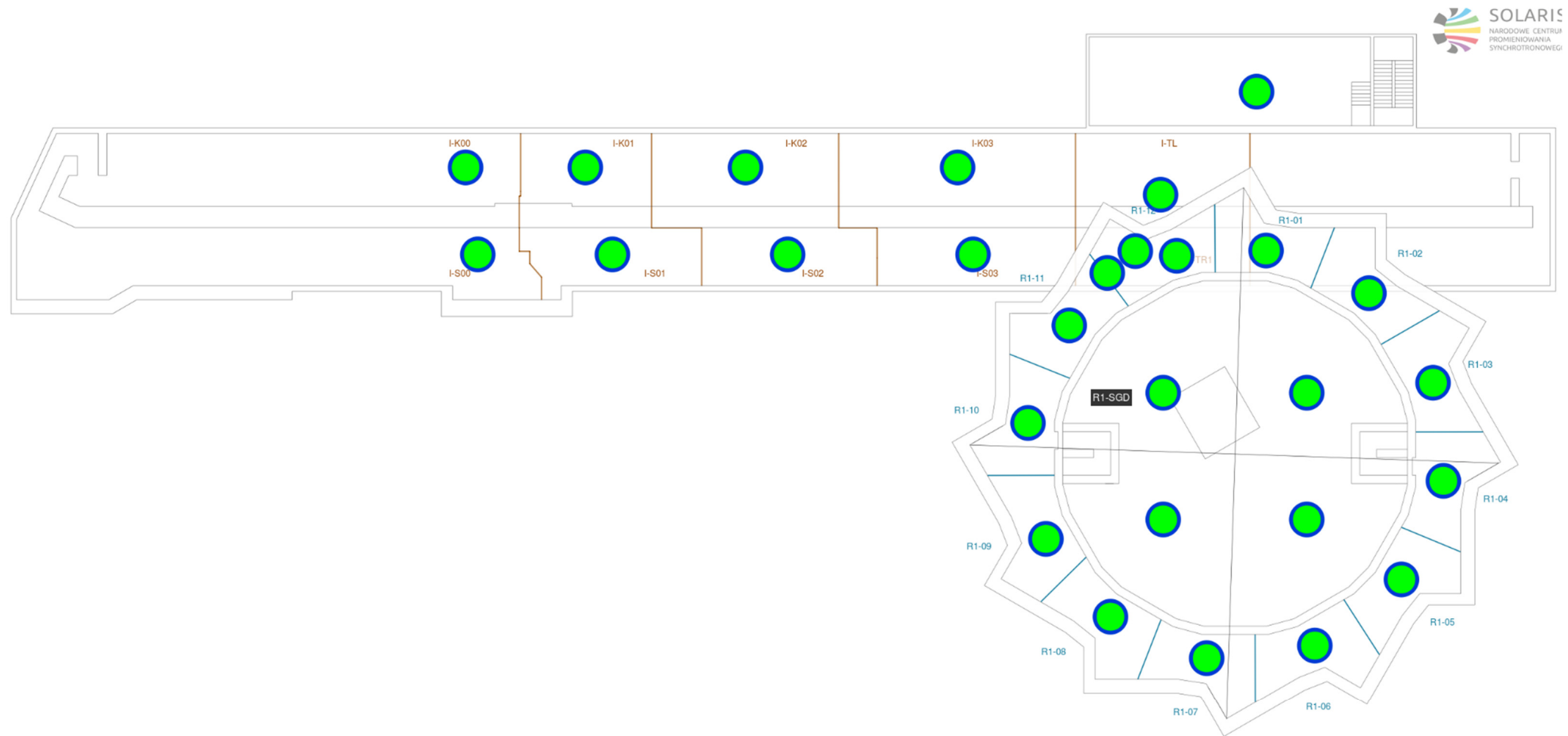


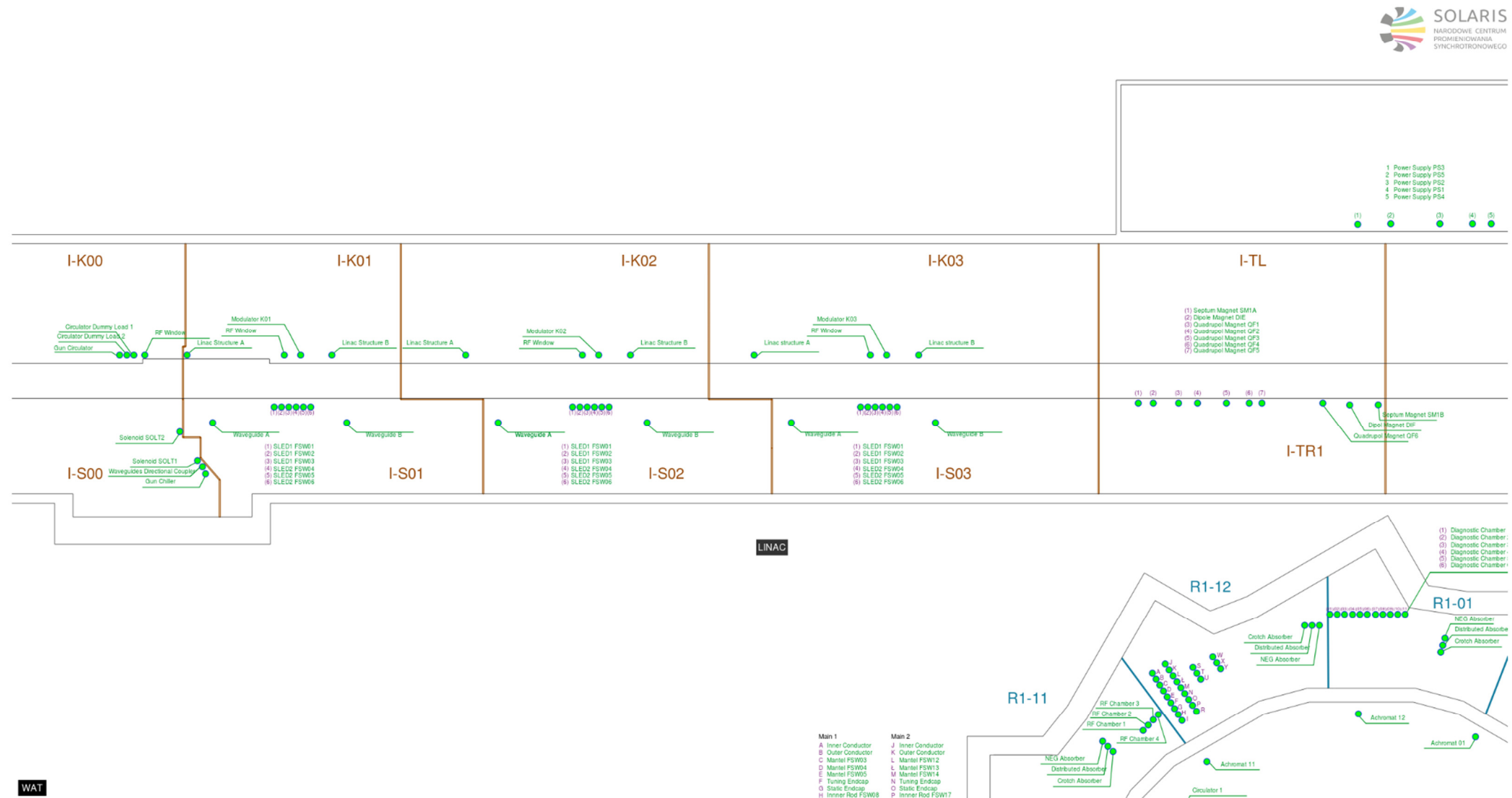
Bonus synoptic

What happened to this?



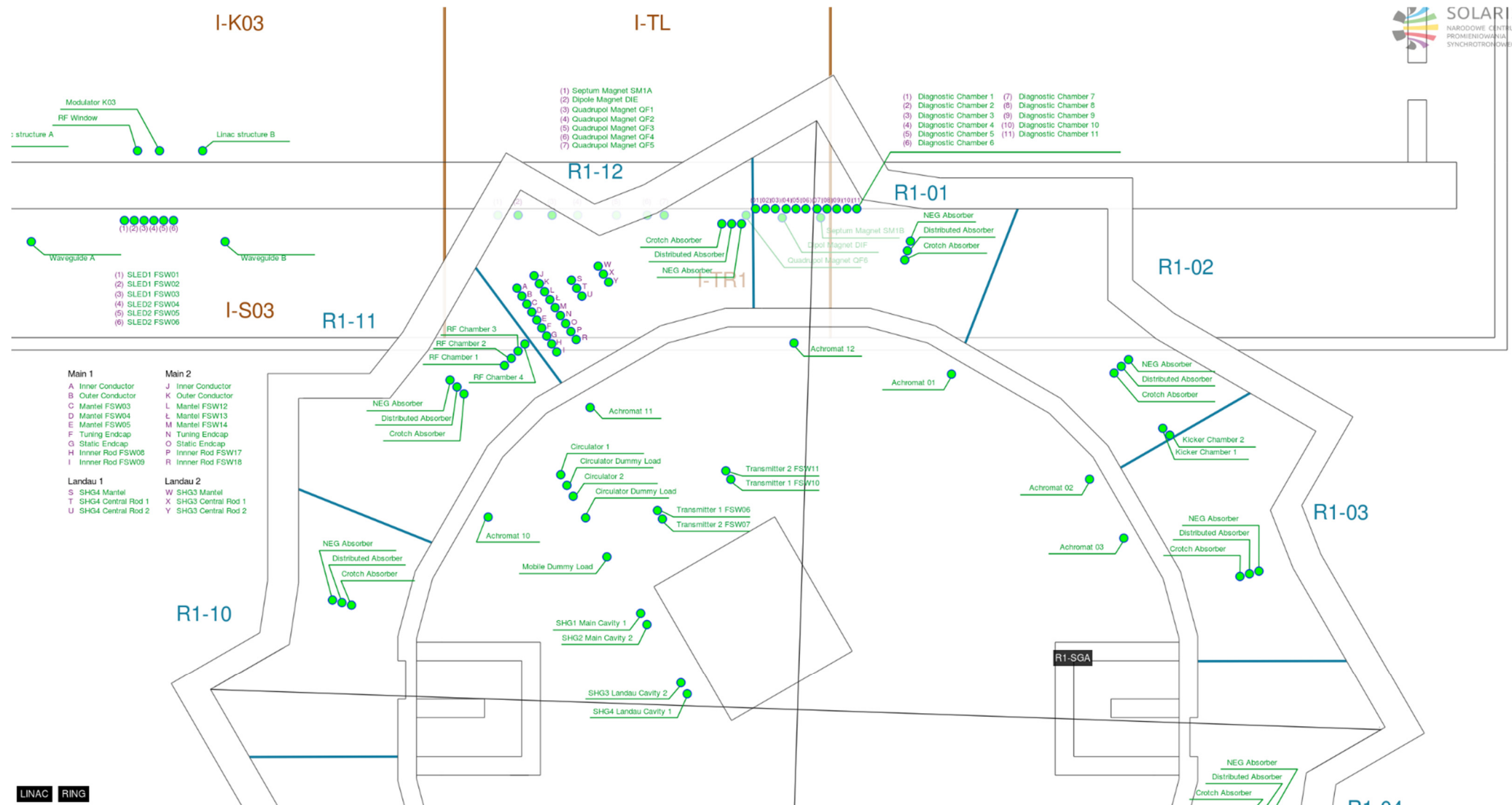
We created this panel (there are only water interlocks)





Water interlocks

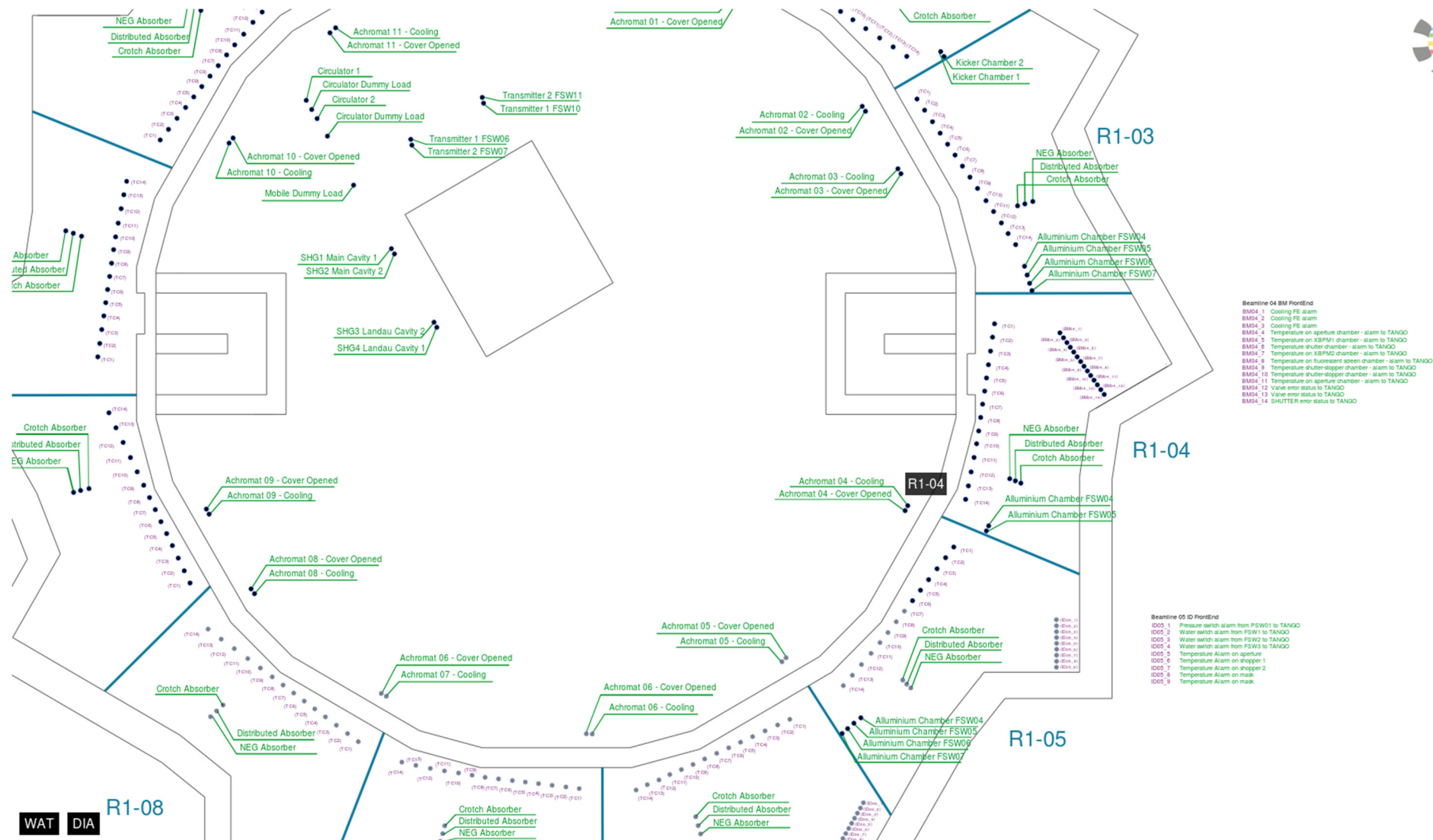
We created this panel (there are only water interlocks)



Water interlocks

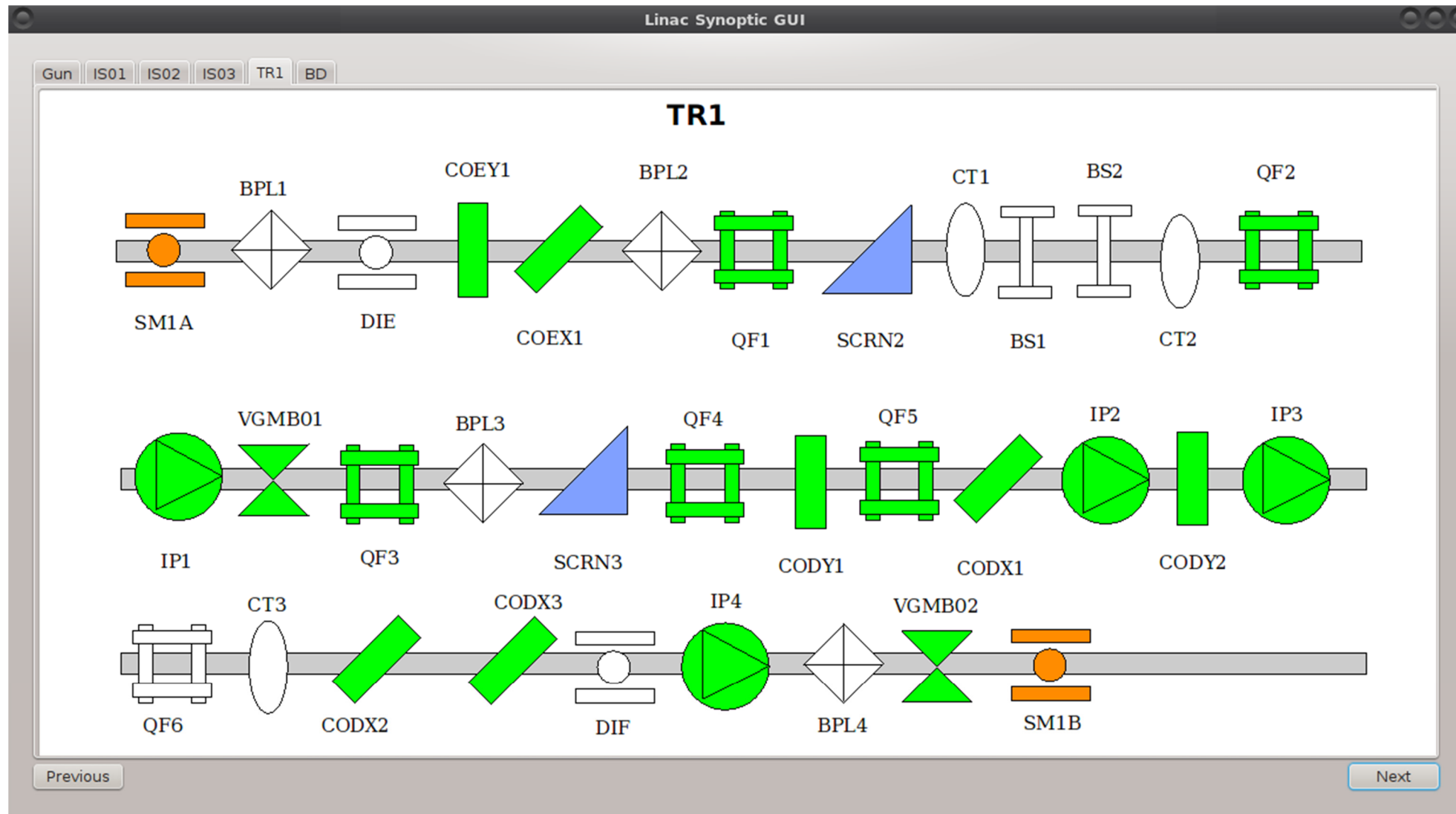


After adding additional elements



Machine interlocks (partial)

We also have this



LINAC

And this is our try to replace it



LINAC

Conclusion

- Now we can quickly create clear synoptics.
- And create more of them.
- Allowing scientists and operators to react quickly.
- And control the accelerators and the beamlines directly.
- It's very helpful to meet with users and decide on standards and vision we want to follow.

It is still a lot to do

It is still a lot to do

- We still need to visualize entire system and its subsystems.
- We should allow to directly modify values, not through popup widgets.
- Adding animation would improve visibility.
- Scientists want to have more control and more things on their synoptics.
- Display synoptics in web browser (MAX IV is close)