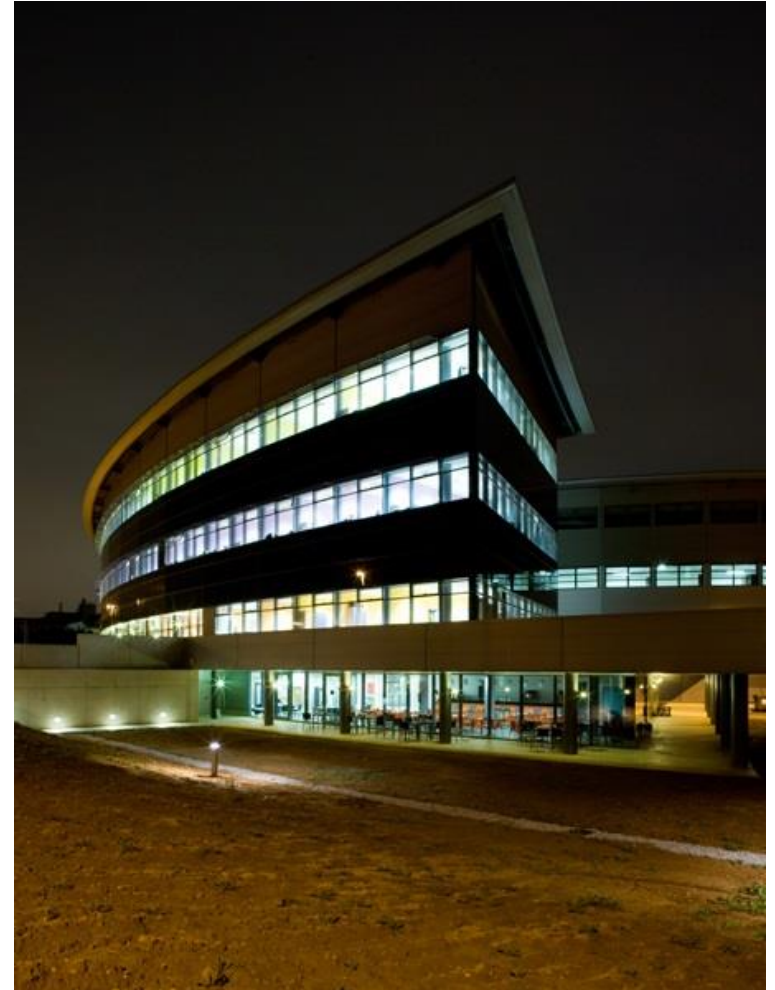


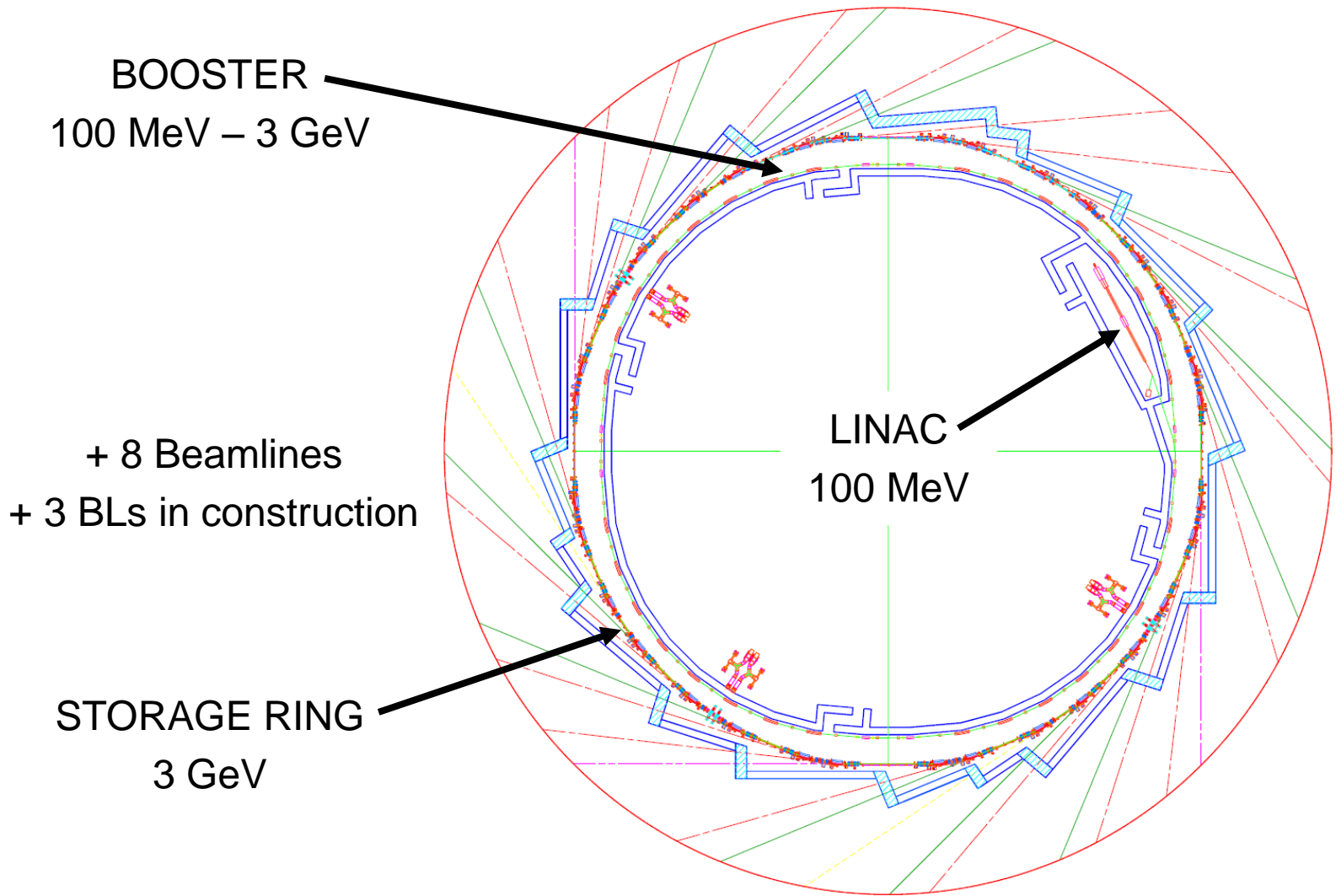


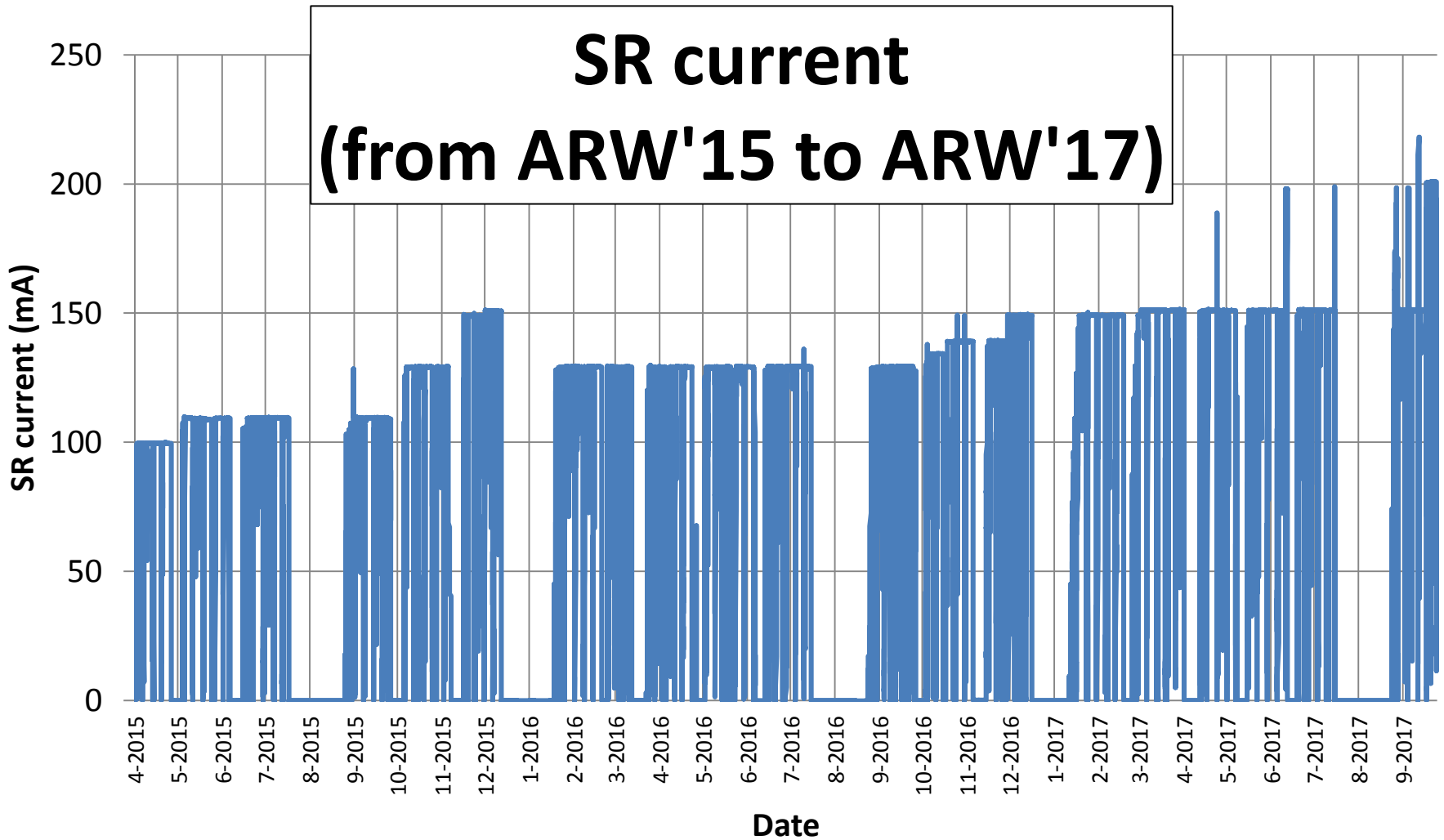
# The Use of PANIC Alarm System at ALBA

*Ferran Fernandez*  
*ARW2017*

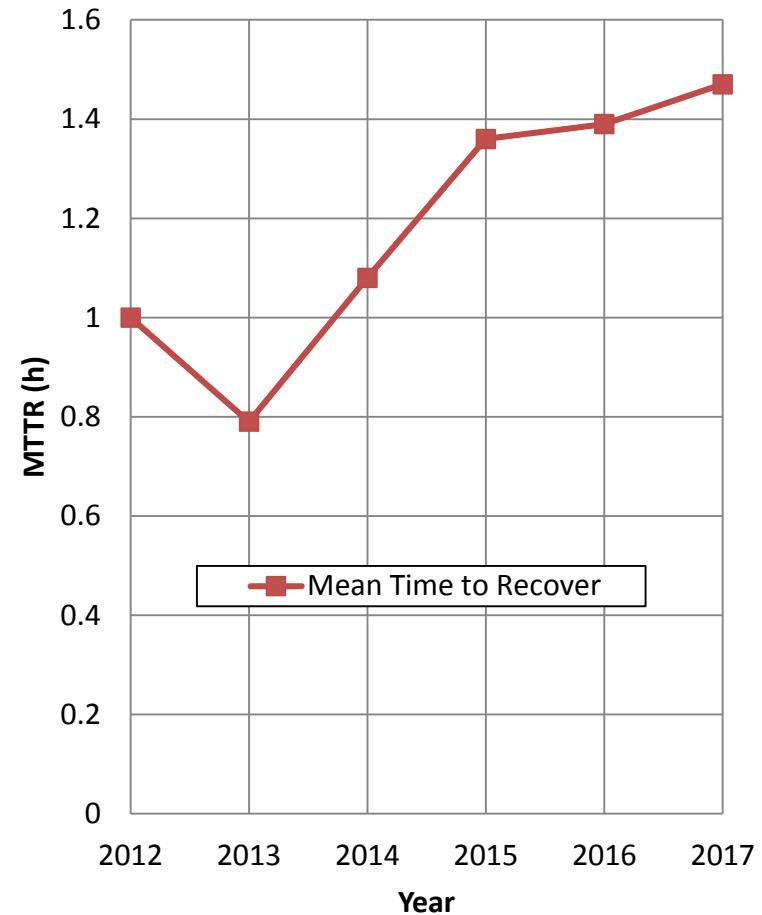
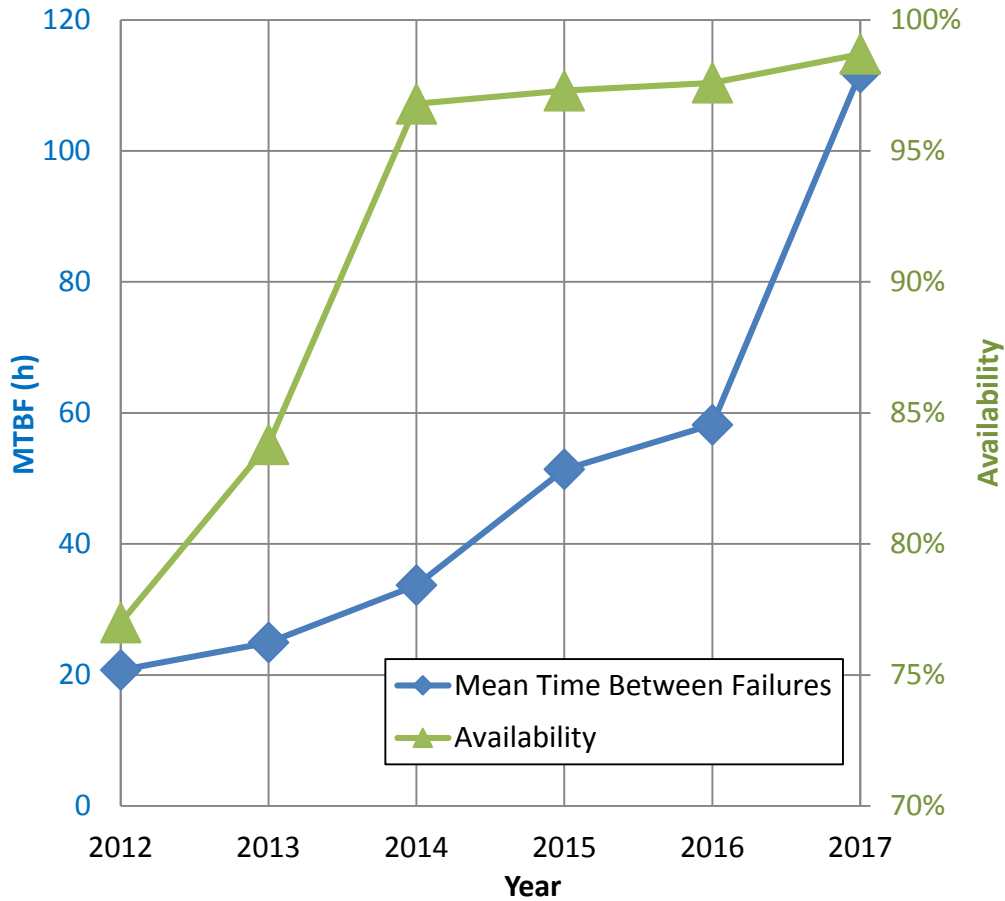


- *Introduction to the ALBA synchrotron light source*
- *The PANIC alarm system*
- *The use of PANIC at ALBA*





- *Started with users 2012 (Top-up summer 2014)*



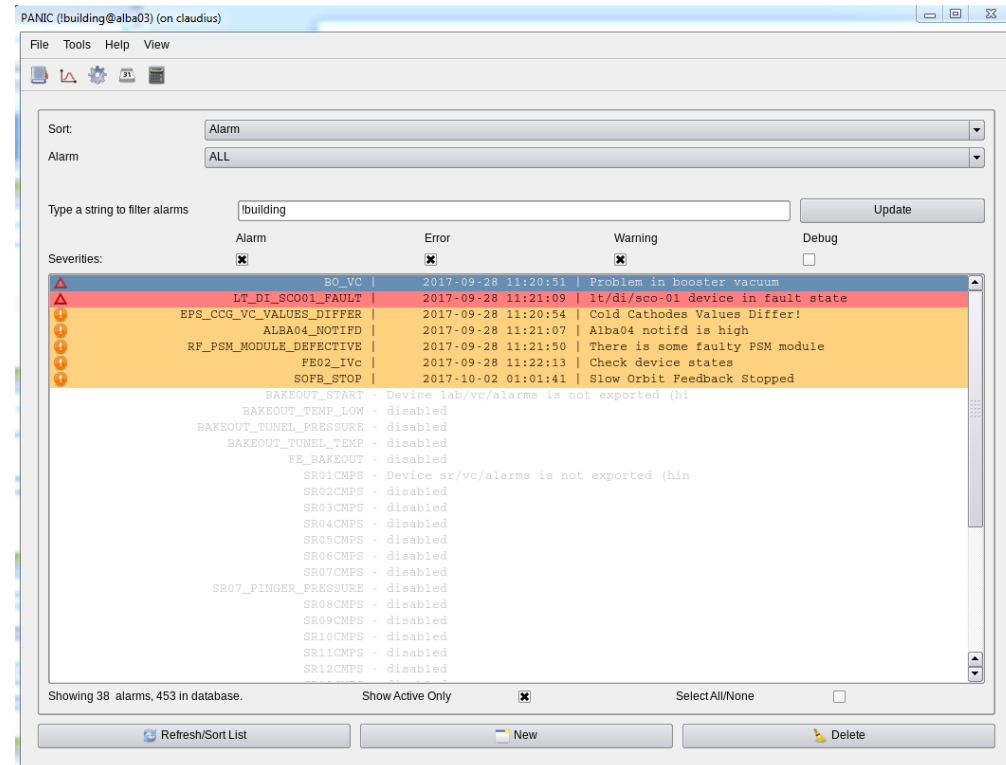
- The ALBA Accelerator Operators
    - 7 operators
    - 50% On Shift // 50% “office”
    - 20% Machine days // 80% Beamlines days
    - Operation tasks: eLog, new procedures development, programming new GUIs and scripts,...
- Check O.Serres poster --> 31. Operation Scripts*
- Each operator is also assigned to a subsystem to provide support and to obtain a higher degree of specialization from which the operation also benefits

- *Programable Alarms and Notifications Incidences*
- PANIC is an **alarm handler developed at ALBA** under the **Tango** Control System framework based on the PyAlarm engine
- It was developed during the construction and installation phase (2007-2010) to provide remote control of the equipments on site; mainly Vacuum and Linac
- It is being adopted by other members of the Tango collaboration like MaxLab, Solaris or SKA

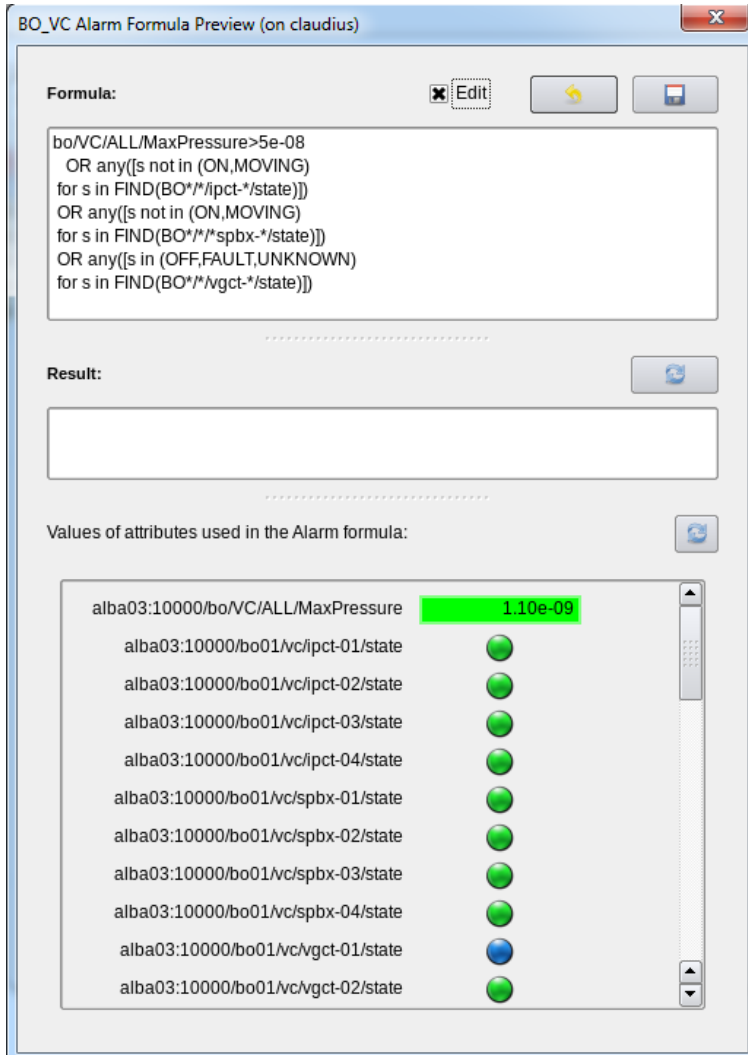


# The PANIC alarm system

- PANIC notifies of abnormal process conditions or equipment malfunction
- Each alarm evaluates a formula using the Tango Database
- Once the alarm is activated, PANIC performs the programmed action
- The management of all the alarms is centralized with PANIC, but alarms run in the different device servers







The screenshot shows a software window titled "BO\_VC Alarm Formula Preview (on claudius)". It contains a "Formula:" field with the following text:

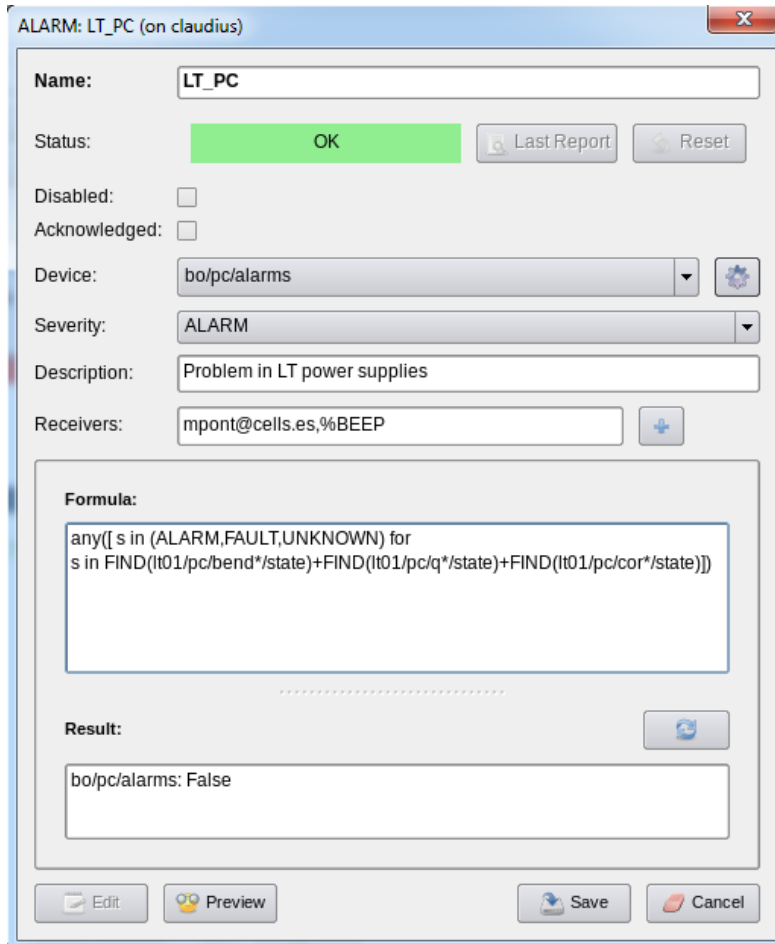
```
bo/VC/ALL/MaxPressure>5e-08
OR any([s not in (ON,MOVING)
for s in FIND(BO*/*/ipct-*/state)])
OR any([s not in (ON,MOVING)
for s in FIND(BO*/*/spbx-*/state)])
OR any([s in (OFF,FAULT,UNKNOWN)
for s in FIND(BO*/*/vgct-*/state)])
```

Below the formula is a "Result:" field which is currently empty. At the bottom, there is a section titled "Values of attributes used in the Alarm formula:" which lists several attributes and their corresponding values, represented by colored circles:

Attribute	Value
alba03:10000/bo/VC/ALL/MaxPressure	1.10e-09
alba03:10000/bo01/vc/ipct-01/state	●
alba03:10000/bo01/vc/ipct-02/state	●
alba03:10000/bo01/vc/ipct-03/state	●
alba03:10000/bo01/vc/ipct-04/state	●
alba03:10000/bo01/vc/spbx-01/state	●
alba03:10000/bo01/vc/spbx-02/state	●
alba03:10000/bo01/vc/spbx-03/state	●
alba03:10000/bo01/vc/spbx-04/state	●
alba03:10000/bo01/vc/vgct-01/state	●
alba03:10000/bo01/vc/vgct-02/state	●

## Easily configurable by users

- **Flexible Formulas** syntax:
  - Strings (States), Booleans, float (analog)
  - Can combine them
  - Can use “FIND” within all the Tango Database attributes
- **“Preview”** functionality:
  - Formulas can be quickly evaluated
  - Involved devices can be checked



ALARM: LT\_PC (on claudius)

Name:

Status: OK

Disabled:

Acknowledged:

Device:

Severity:

Description:

Receivers:

Formula:

```
any([ s in (ALARM,FAULT,UNKNOWN) for
s in FIND(/t01/pc/bend*/state)+FIND(/t01/pc/q*/state)+FIND(/t01/pc/cor*/state)])
```

Result:

- **Different actions** can be defined:
  - Notification: email, SMS or Telegram
  - Control Room loudspeaker (VERY USEFUL!!!)
  - Database insertions
  - Tango commands
  - Run python scripts
- **“Password required”** can be set to create/edit/delete alarms

- Parameters of the alarm can be configured:
  - Pooling period
  - Alarm threshold
  - Autoreset
  - Eval Timeout
  - Reminder
- Import/Export alarms

PyAlarm Device Configuration (on claudius)

bo/pc/alarms

	Attribute Name	Attribute Value
1	AlarmThreshold	3
2	AlertOnRecovery	false
3	AutoReset	600
4	CreateNewContexts	False
5	Enabled	120
6	EvalTimeout	500
7	FlagFile	/tmp/alarm_ds.nagios
8	FromAddress	oncall
9	HtmlFolder	htmlreports
10	IgnoreExceptions	True
11	LogFile	/dev/null
12	LogLevel	INFO
13	MaxMessagesPerAlarm	0
14	PollingPeriod	5
15	Reminder	0
16	RethrowAttribute	False
17	RethrowState	True
18	SMSConfig	cells:cells.cells
19	StartupDelay	60
20	UseProcess	False
21	UseSnap	True
22	UseTaurus	False

Refresh

Create New

## *SPOILER ALERT: CONCLUSION*

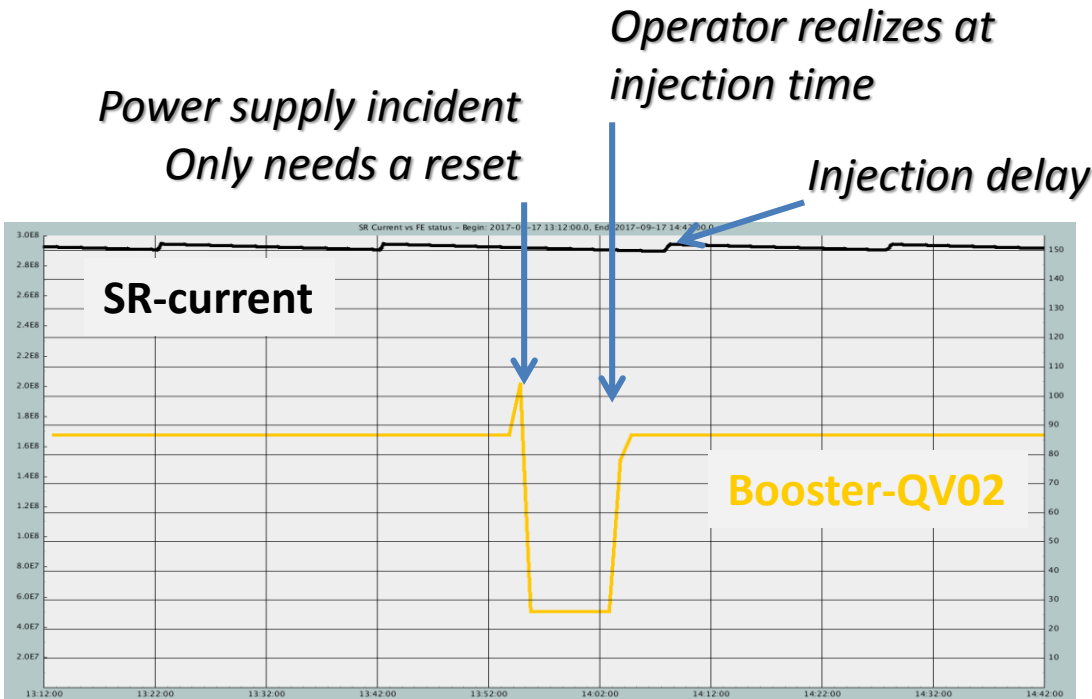
- A good alarm system is **very useful**...
  - Loudspeaker in the Control Room
  - OnCall alarms for subsystem responsible
  - Automatic actions on the machine

...if the final **user can easily edit** the alarms



- As said, the PANIC project was initiated during the construction/installation phase to provide remote control of the installed equipment on site; mainly Vacuum and Linac
- During commissioning not much used by Accelerators because “many eyes were on the screens”
- From 2012 (start with users) and mainly from 2014 (start top-up) the use of PANIC has grown a lot in the Control Room

- Four types of alarms (from the user's point of view)
  1. Problem in the Injector
  2. Abnormal condition in the Storage Ring
  3. Subsystem notification to experts
  4. *Bonus track*: automatic actions


- Injector problem
  - LTB, Booster, BT power supplies
  - Pulsed magnets




LT\_PC Alarm Formula Preview (on claudius)













**Formula:**  Edit  

```
any([ s in (ALARM,FAULT,UNKNOWN)
for
s
in
in
FIND(/t01/pc/bend*/state)+FIND(/t01/pc/q*/state)+FIND(/t01/pc/cor*/state)])
```

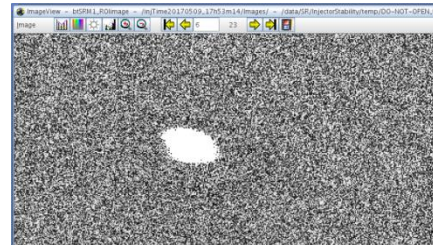
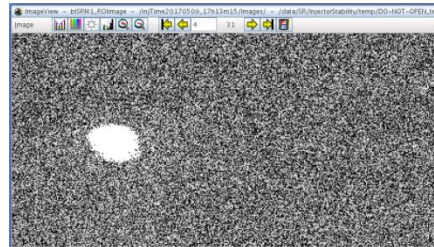
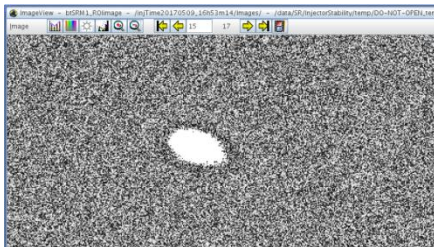
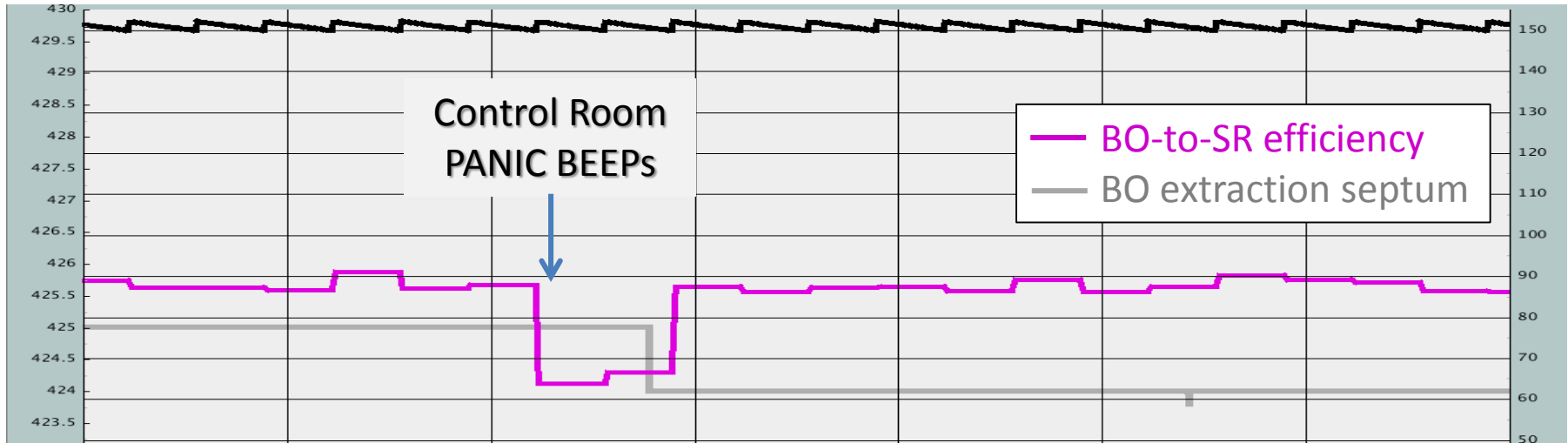
**Result:** 

bo/pc/alarms: False

Values of attributes used in the Alarm formula: 

alba03:10000/t01/pc/bend-01/state	
alba03:10000/t01/pc/bend-02/state	
alba03:10000/t01/pc/corh-01/state	
alba03:10000/t01/pc/corh-02/state	
alba03:10000/t01/pc/corh-03/state	
alba03:10000/t01/pc/corh-04/state	
alba03:10000/t01/pc/corv-01/state	
alba03:10000/t01/pc/corv-02/state	
alba03:10000/t01/pc/corv-03/state	
alba03:10000/t01/pc/corv-04/state	
alba03:10000/t01/pc/q-01/state	
alba03:10000/t01/pc/q-02/state	

- Abnormal condition in the Storage Ring
  - Injection efficiency

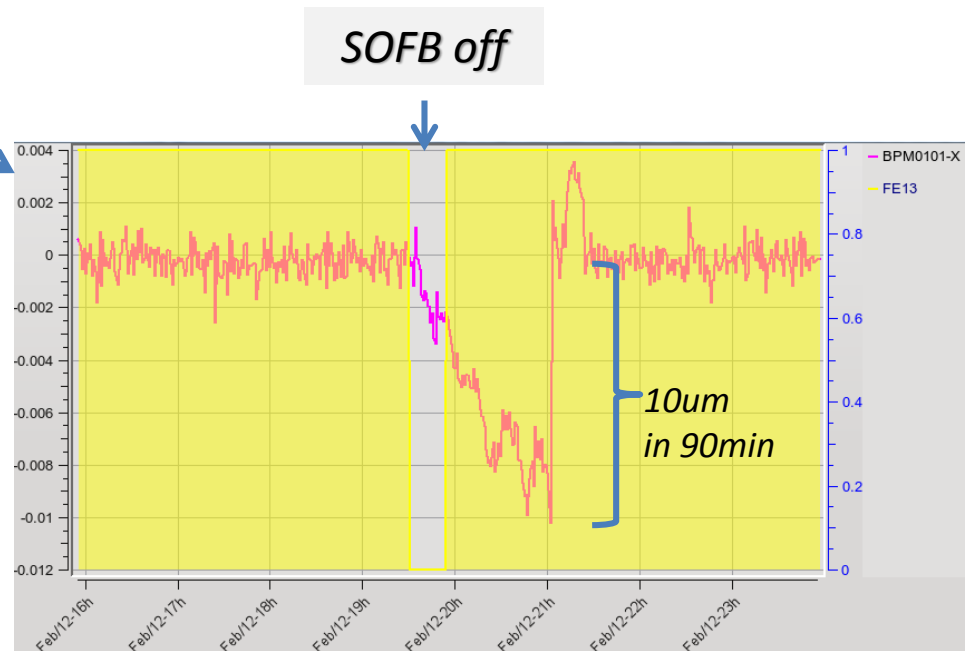


BO-to-SR synchrotron radiation monitor



- Abnormal conditions in the Storage Ring

- Orbit distortion
- Low/high lifetime
- Beam size
- Radiation monitors
- SR temperatures
- Cooling water flow, pressure and temperature
- SCW quench
- ...



- Subsystem notifications to experts

- Linac

- Radiofrequency

From Accelerators

---

- Timing

From other Divisions

- Controls servers

- Vacuum lab. Bakeouts

- Civil engineering

- Cooling water

- Electrical supply

- Accelerator subsystem --> Linac

ALARM: LI\_ALARM\_SF6 (on gordianus)

Tag:

State: NORM

Disabled:

Acknowledged:

Device:

Priority:

Description:

Annunciators:

**Formula:**

```
( LI/CT/PLC1/SF6_P1 <= 2.8
OR LI/CT/PLC1/SF6_P1 >= 3.05 )
OR ( LI/CT/PLC1/SF6_P2 <= 2.8
OR LI/CT/PLC1/SF6_P2 >= 3.05 )
```

## What to do if a Linac Alarm beeps in the control room

Created by Malysa Martin, last modified by Marc Sos Cambras on Oct 02, 2017

*The aim of this procedure is to give a very brief explanation of why one linac alarm beeps and how to solve it*

- SF6 Alarm
- Cooling Loops Power Drive
- Cooling Loops Heater Resistor Temperature
- Vacuum
- Bunker temperature
- Pulse Klystron for KA1 and KA2
- Linac Klystron Alarm
- Linac Magnet Interlock
- Linac Electron Gun
- Klystron UV Fire Detector

### SF6 Alarm

- **Panic Alarm:** LI\_ALARM\_SF6
- **Description:** This alarm beeps when pressure of the gas circuit is below 2.86 bar or above 3.05 bar.
- **TODD:** Contact Linac group to fill the circuit to 2.98 bar. Never exceed the value of 3 bar, it could break the RF window.
- **Attributes to check:** li/ct/plc2/SF6\_pressure
- **Procedures:** SF6 refill procedure and Empty the SF6 gas (for EXPERTS)

### Cooling Loops Power Drive

- **Panic Alarm:** LI\_COOLING and LI\_COOLING\_PWR
- **Description:** These alarm beeps when one of the 3 cooling loops power drive is out of range and when the cooling loop stops for some reason.
- **TODD:** Check on taurustrend the cooling loop behaviour. Look for pressure and temperature variation. Apply this procedure.
- **Attributes to check:** li/ct/plc2/ci\_temperature, ci\_pwd, ci\_pressure
- **Procedures:** Linac cooling loop trouble shooting

### Cooling Loops Heater Resistor Temperature

- **Panic Alarm:** LI\_COOLING\_RES\_TEMP
- **Description:** This alarms beeps when one of the 3 cooling loop heater resistor temperature exceeds the 110 degrees. Before this alarm ring, probably the cooling loop power drive alarm also beeped.
- **TODD:** Check on a taurustrend the cooling loop behaviour. Look for temperature and power-drive variations. Contact linac group.
- **Attributes to check:** li/ct/plc2/ci\_temperature, ci\_pwd

- Subsystems from other Divisions

## CONTROLS

ALARM: ALBA03\_CPU (on gordianus)

Tag: ALBA03\_CPU

State: SHLVD

Disabled:

Acknowledged:

Device: mach/ct/alarms-servers

Priority: WARNING

Description: alba03 usage is high

Annunciators: srubio@cells.es,%LOG

Formula:

```
0.5<max(sys/profile/alba03/loadaverage)
```

## VACUUM

ALARM: FE13\_VGCT (on gordianus)

Tag: FE13\_VGCT

State: NORM

Disabled:

Acknowledged:

Device: fe/vc/alarms

Priority: WARNING

Description: Check device states

Annunciators: %VACUUM,%FRONTENDS

Formula:

```
tango/admin/life1301/state=>=0  
and any([s in (OFF,FAULT,UNKNOWN)  
for s in FIND(FE13/*vgct-*/state)])
```

## COOLING

ALARM: CW\_TUN\_P12\_A\_STATUS\_WARNING (on gordianus)

Tag: CW\_TUN\_P12\_A\_STATUS\_WARNING

State: UNACK

Disabled:

Acknowledged:

Device: building/ct/alarms-clima\_tunel

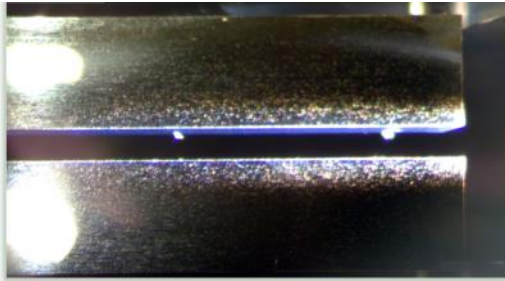
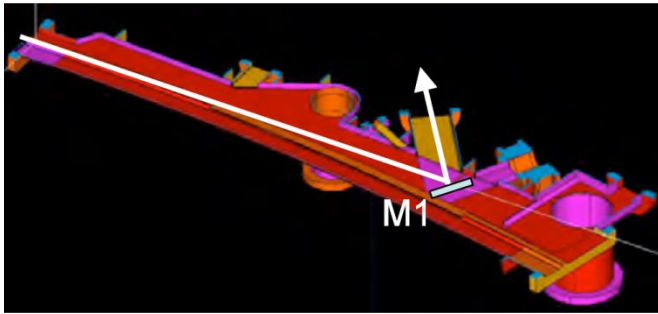
Priority: WARNING

Description: CW.TUN.P12\_A.VAL.STATUS goes OFF Bombas de agua en CW en

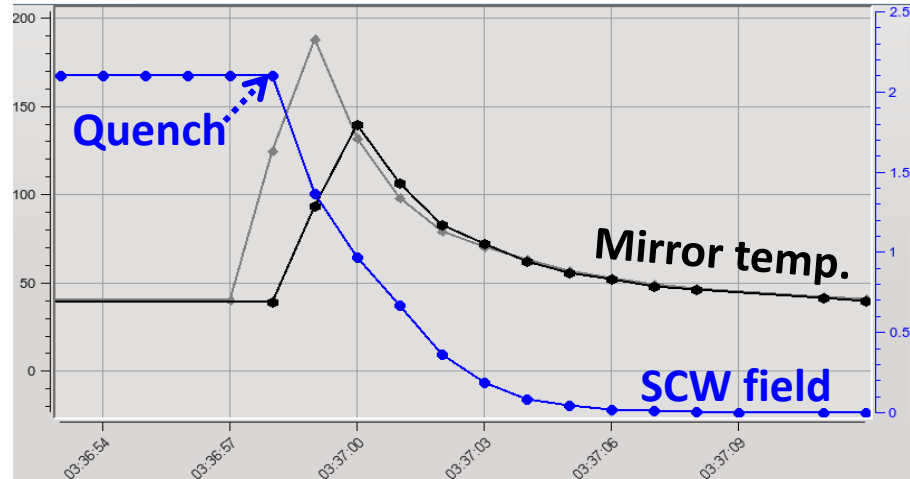
Annunciators: %BUILDING,%SMSENG

Formula:

```
BUILDING/CT/SQLServer/SERVER_UP  
and BUILDING/CT/SQLSERVER/CW_TUN_P12_A_STATUS <2
```



## Infrared Beamline mirror



- ✓ Small orbit distortions “hit/heat” the mirror
- ✓ Insert mirror only if  $SR < 2\text{mA}$  and orbit ok
- Automatic actions
  - Beam Lost → Remove IR beamline mirror

- Automatic actions
  - SR current limit → stops Linac (Tango command)
  - Save bunch intensity after injections (launches script)

ALARM: SR\_CURRENT\_LIMIT (on gordianus)

Tag:

State: **NORM**

Disabled:

Acknowledged:

Device:

Priority:

Description:

Annunciators:

Formula:

```
SR/DI/DCCT/AverageCurrent>225
```

ALARM: BUNCH\_INTENSITY\_LOG (on gordianus)

Tag:

State: **NORM**

Disabled:

Acknowledged:

Device:

Priority:

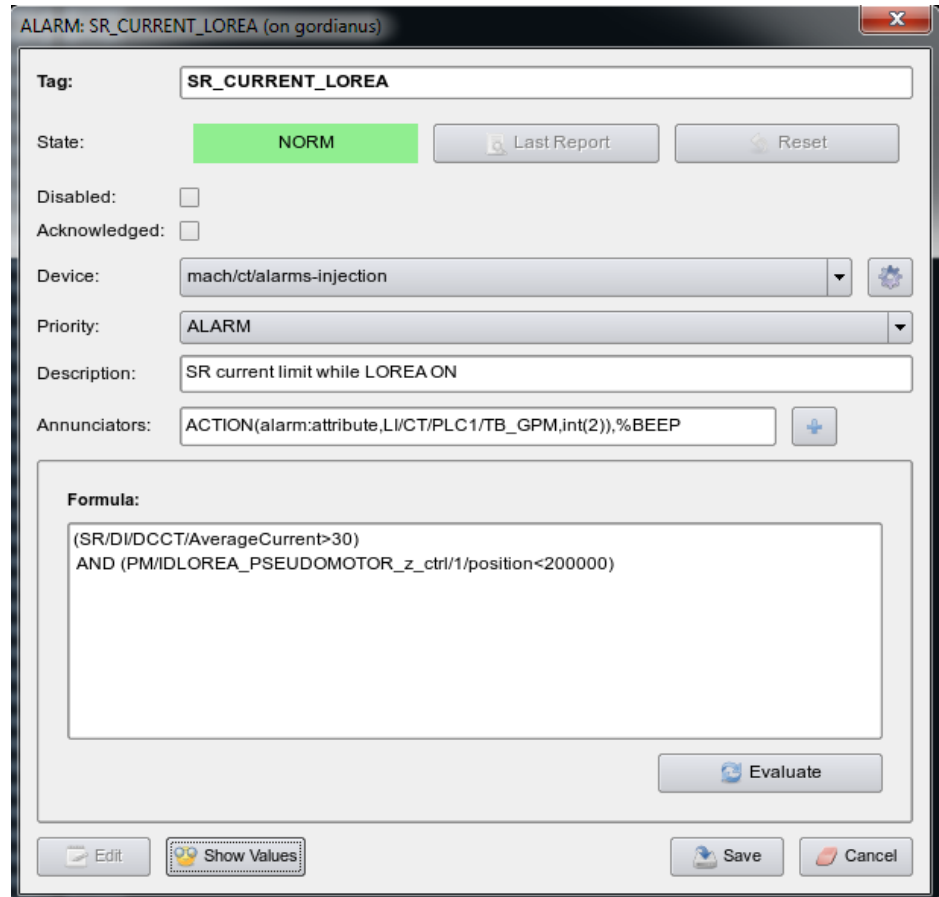
Description:

Annunciators:

Formula:

```
sr/di/dcct/averagecurrent>151.95  
AND sr/ti/fill/SBBSEnabled
```

- Automatic actions: example of flexibility and “other” use
  - New Insertion Device commissioning
  - FE not yet ready
  - Limit SR current while gap closed



ALARM: SR\_CURRENT\_LOREA (on gordianus)

Tag: SR\_CURRENT\_LOREA

State: NORM [Last Report] [Reset]

Disabled:

Acknowledged:

Device: mach/ct/alarms-injection [Settings]

Priority: ALARM

Description: SR current limit while LOREA ON

Annunciators: ACTION(alarm:attribute,LI/CT/PLC1/TB\_GPM,int(2)),%BEEP [+]

Formula:

```
(SR/DI/DCCT/AverageCurrent>30)
AND (PM/IDLOREA_PSEUDOMOTOR_z_ctrl/1/position<200000)
```

[Evaluate]

[Edit] [Show Values] [Save] [Cancel]

# Questions?

*Acknowledgments*

Thanks to Operators and to S.Rubio