# SC Status

Michael Ritzert
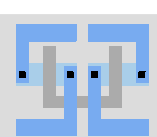
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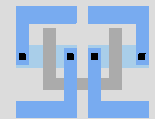
# Contents

- Alarms

- GUI

- PS Firmware

- PSC

Some clarifications:

- Sole addressee of alarms is the shifter.
  ⇒ Only objective: Keep the system producing good data.

- It's not a reminder tool for experts.

- Two well-defined alarm levels:

  - **MAJOR**: System is broken.

  - **MINOR**: Do something *now* to prevent MAJOR.

⇒ no MINOR without MAJOR possible.
  We might not have many MINOR alarms.

- DQM will provide valuable inputs:

  - PXD operation is judged by the data that come out.

  - If in doubt: If data are fine, all is well.

  - Unfortunately, this means there's a delay between failure and alarm.
    ⇒ get from BonnDAQ what's also available there?

- Sound Notification in the Control Room.
  - Obviously requires speakers.
- Alarm visible in the respective views.
- Action guidelines for the shifter available in the context menu.
  - List of things to try. Last item usually „Call … expert.“
- Only one possible action: Let the IOC do it automatically.
  - Unless the state of the system should not be changed for inspection by the experts. Use sparingly.
  - Log entry as „FYI“ to the shifter. Shown on PXD top panel.

- Probably no upstream integration (to Belle 2):
  No compatible system used.

Could add actual instructions directly here.
But long instructions could be misinterpreted.

- First draft of shifer-overview panel and a few levels of hierarchy in PSC.
  - Inspired by outcome of discussion with Botho.
  - Next level: (Half-)expert panels for more detailled overview and task-oriented view, i.e. all information/buttons required to perform a task.

- Widely accessible, no expert-only information.

- It's not possible to run 40 units manually.
  No provisions for that are foreseen.


- To be hosted on pxdgw1.
  - Check into one repository, get precompiled output in another repository.
  - git ⇒ mirroring to outside of KEK possible.
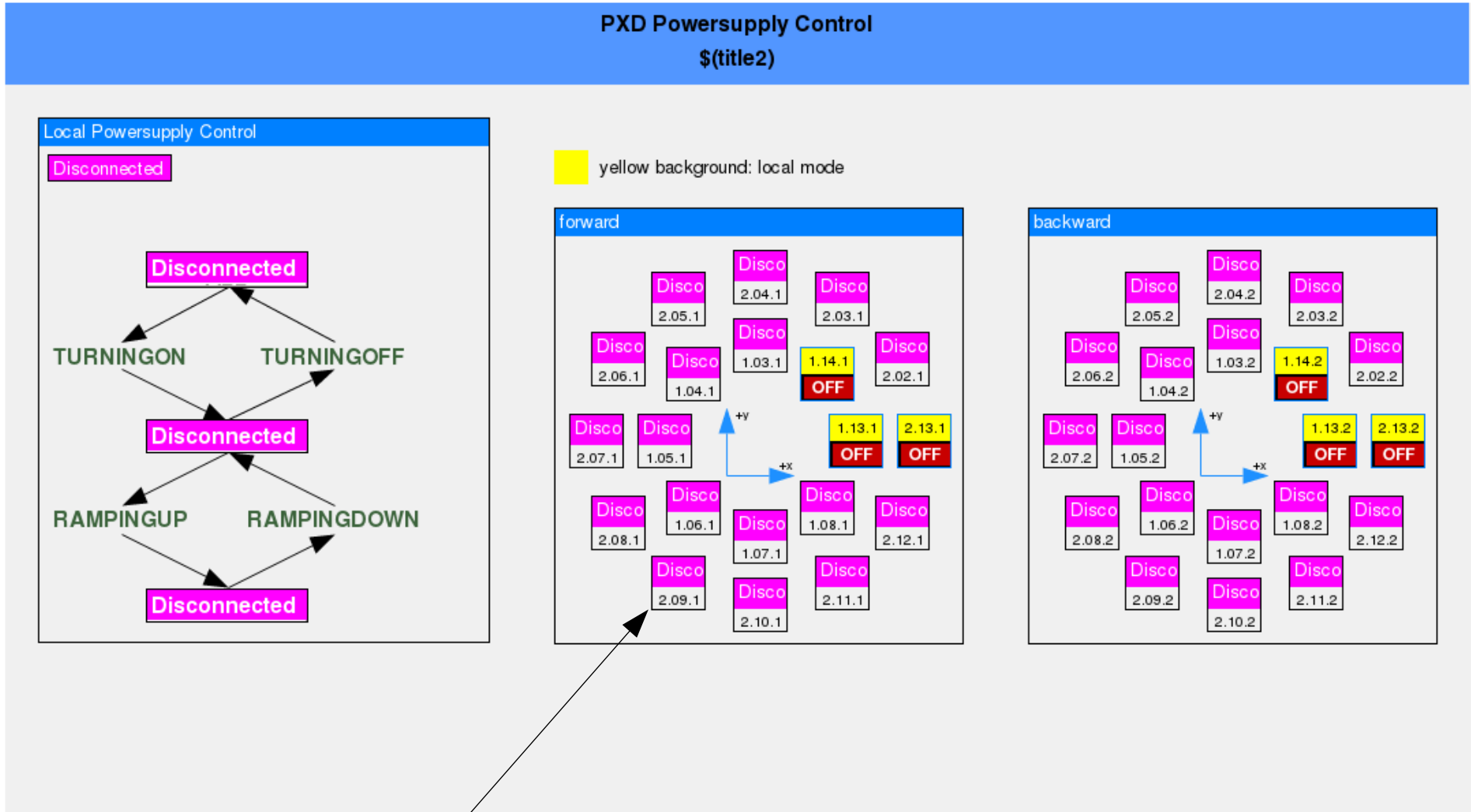    Read-only copy in stash @ DESY if required.

Log entries ≥ warning level ⇒ awareness of what's happening when things fail.
E.g. automated action by the alarm system triggered an error state.

left-click: descend.
right-click: go local, emergency shutdown.

# Single Module GUI



**PXD Module 1131**
$(title2)

**Local Powersupply Control**
- Global Run — Unit is disabled.
- OFF
- TURNINGON — TURNINGOFF
- STANDBY
- RAMPINGUP — RAMPINGDOWN
- PEAK
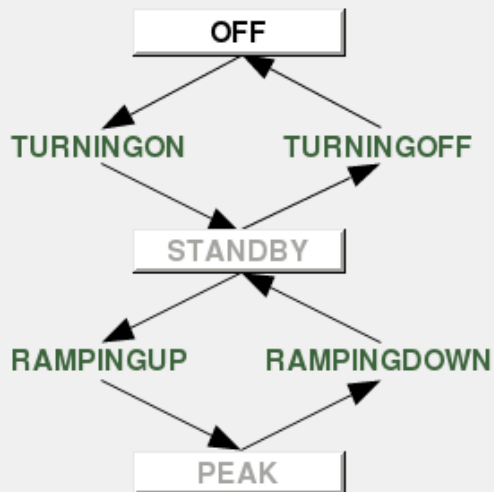
**Power Chain**
- module powered
- PS interlock
- PS OVP
- PS connected
- PS powered — 0.85 A
  - power — Reset
- primary power
- Details...
- Voltages & Currents...
- Emergency Shutdown

**Data Path**
- DHP Links
- DHC Link
- 0 — trigger rate

00:00 — 00:
2018-04-07
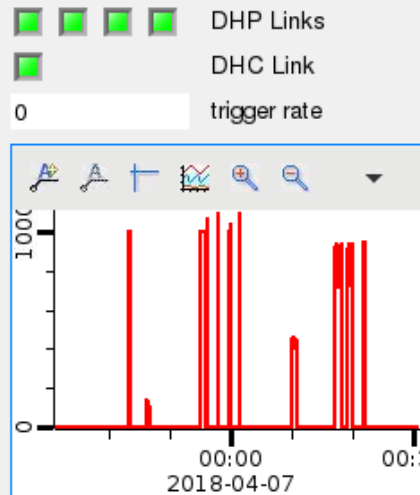
**Temperatures**
- PS Unit — Disconn
- DHH — 38 C
- DHP2 — -6.1 °C
- DHP3 — 1.3 °C
- DHP4 — -4.2 °C

remove ?

OFF — OFF

DQM?
BonnDAQ data?

Sequence Detail... — Pedestals... — do something...

to GUIs for DHH, PS, special tasks

- PS connected
- PS powered — 0.85 A
  - power — Reset
- primary power

PS current consumption (from Crate Controller).
VDouble[0.8502538800239563, 2018/04/06 23:53:3

At first: Everything according to plan with first real tests:

- Firmware successfully tested with two units (no modules) at KEK.
    - Parallel ramp-up/-down without problems.
- Several units flashed at DESY.
    - Flashing now really easy.
    - Routine power on/off cycles without problems.
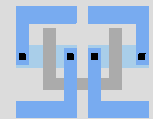
**BUT**

- Frequent disconnections between firmware and IOC at KEK.
- Immediately visible symptoms:
    - Some ‰ of monitoring packets are not received by the IOC.
- Happens many times a day at KEK, not a single time in weeks in Heidelberg.
- At DESY, I do see „something" once every couple of *days*.
    - Events involving both units within a few seconds, longer that at KEK.

- TCP connection for commands IOC ⇒ PS.
  - Effectively unidirectional communication.
  - ACK gets lost
    ⇒ IOC retransmits the frame.
  - PS ignores the duplicate frame ⇒ no problem?
    (Commands carry a sequence number, no discontinuity is detected.)

- UDP „connection" PS ⇒ IOC.
  - Monitoring packets (voltage/current data).
  - No retransmission of lost packets
    ⇒ IOC **drops the connection** on timeout.
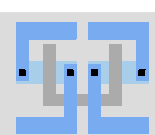
# Is It Very Bad?

- In principle: No.

- A patched IOC accepts three or four lost packets in a row.
  - ~800 ms monitoring period, timout increased to 4 s.
  - Two lost packets in a row are a frequent event, more is very rare (at KEK).
  - The old firmware/PS has a 5 s timeout.
  - **RISK:** At DESY, events are much less frequent, but more destructive.

- Are there more implication I don't see, yet?
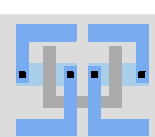
- Narrowed down to: An Ethernet frame is handed to the DMA engine for transfer to the MAC. It never shows up on the Ethernet.
- On the switch side, I see „FCS errors" (Frame check sequence). ⇒ the problem is between PS unit and switch!
    - Rate of occurences depends strongly on switch type used.
    - Wrong checksum, etc. can be ruled out: Any receiver would reject that. ⇒ the problem must be more „analog".
- The old units do not show this behavior ⇒ Now I know where to look for differences in the code.
    - But reading the old code is a nightmare.
    - And interpreting it then is yet another one.
- My personal favourite right now: Different configuration of the μC-internal clock tree yields a slightly better PHY frequency output.
    - There a hardly any other settings that are not black/white good/bad.
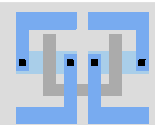
- <u>Option a)</u> Ignore for now, use the patched IOC.
  - Accept the risk of occassional errors.
  - A fix can be developed without time pressure.
- <u>Option b)</u> Do not continue like this.
  - Safest way.
  - Totally unpredictable delay: Zero to „forever". A fix might be one line of code found tomorrow or require fixes in the PS hardware.

- If the situation at DESY **with the new switch** is as at KEK, I'd probably go for a).
  - These are the units we will use in phase 3.
  - The entire rack will travel to KEK, including the switch.
  - ⇒ We know beforehand, what we'll get.
- Hardware for flashing is available at KEK.
  - Needs access to top of belle for ~2 minutes per unit.
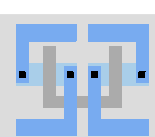
- PXD is not yet connected to PSC. Waiting for
  - New PS firmware.
  - Full PSC interface spec from Belle 2 SC team.
- It has been proposed to participate at first by only reporting the state of PXD.
- The mapping from state to allowed type of injection is as below.
- We designed our PSC (i.e. power-up sequence) this way, so this could be a way forward.
- But merging the states from several PS needs some thought.

## HV state mapping (from Konno-san)

| HV state | HV master | Continuous injection | Normal Injection |
|----------|-----------|----------------------|------------------|
| OFF | OFF | Allowed | Allowed |
| STANDBY | STANDBY | Allowed | Allowed |
| PEAK | PEAK | Allowed | Inhibited |

Thank you!

- Quite unlike the events at KEK:
  - much less frequent than at KEK. Once every two days vs. once every hour.
  - two units almost(!) simultaneously
  - lasts for more than 4 seconds

```
2018-04-06 21:06:31.389 [warning] [active_u] Unit 53: monitoring delta 2612ms.
2018-04-06 21:06:32.389 [warning] [active_u] Unit 53: monitoring delta 3612ms.
2018-04-06 21:06:33.390 [warning] [active_u] Unit 53: Marked as dead.
2018-04-06 21:06:33.390 [warning] [communic] Unit 53: Dropping TCP connection
2018-04-06 21:06:33.390 [severe ] [LogRecei] Unit 53: Error in recv() : 0, 107
2018-04-06 21:06:33.391 [warning] [LogRecei] Unit 53: emergency_shutdown
2018-04-06 21:06:33.391 [warning] [LogRecei] Unit 53: SC connection lost.
2018-04-06 21:06:37.390 [warning] [active_u] Unit 60: monitoring delta 2493ms.
2018-04-06 21:06:38.390 [warning] [active_u] Unit 60: monitoring delta 3493ms.
2018-04-06 21:06:38.390 [info    ] [communic] Unit 53: TCP connected.
2018-04-06 21:06:38.391 [info    ] [LogRecei] Unit 53: TCP connection accepted.
2018-04-06 21:06:38.391 [config ] [communic] Unit 53: firmware version 'afe2128-dirty @ 2018-04-05T13:05'.
2018-04-06 21:06:39.390 [warning] [active_u] Unit 60: Marked as dead.
2018-04-06 21:06:39.390 [warning] [communic] Unit 60: Dropping TCP connection
2018-04-06 21:06:39.391 [severe ] [LogRecei] Unit 60: Error in recv() : 0, 107
2018-04-06 21:06:39.391 [warning] [LogRecei] Unit 60: emergency_shutdown
2018-04-06 21:06:39.392 [warning] [LogRecei] Unit 60: SC connection lost.
2018-04-06 21:06:44.391 [info    ] [communic] Unit 60: TCP connected.
2018-04-06 21:06:44.392 [info    ] [LogRecei] Unit 60: TCP connection accepted.
2018-04-06 21:06:44.392 [config ] [communic] Unit 60: firmware version 'afe2128-dirty @ 2018-04-05T13:04'.
```