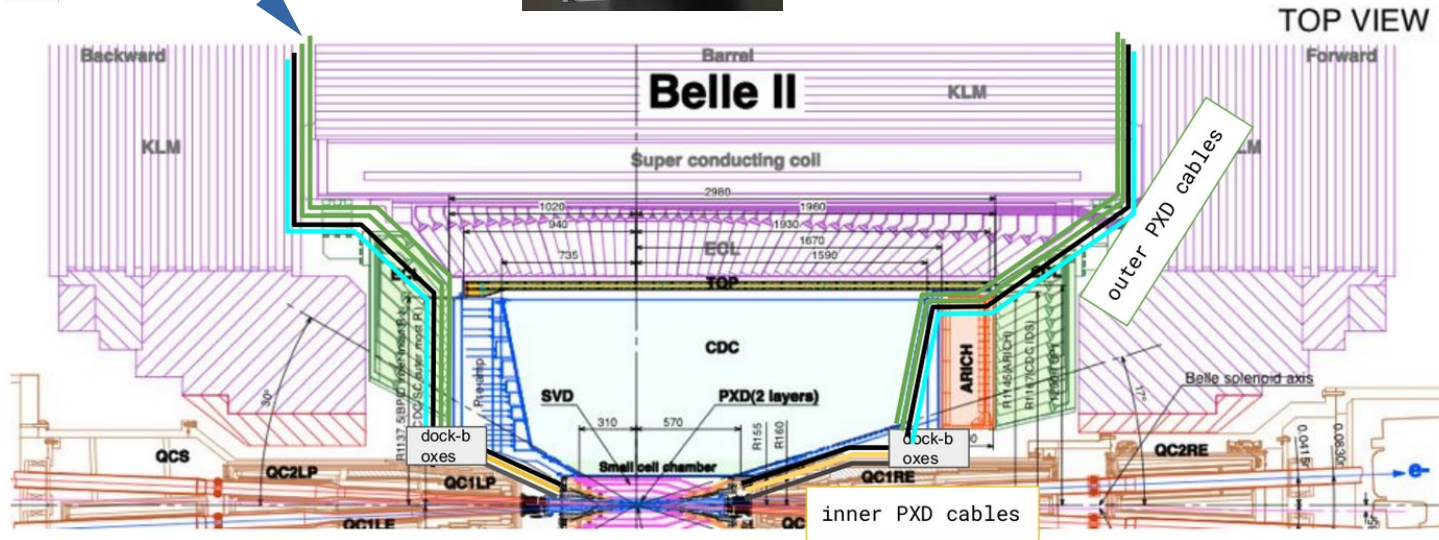
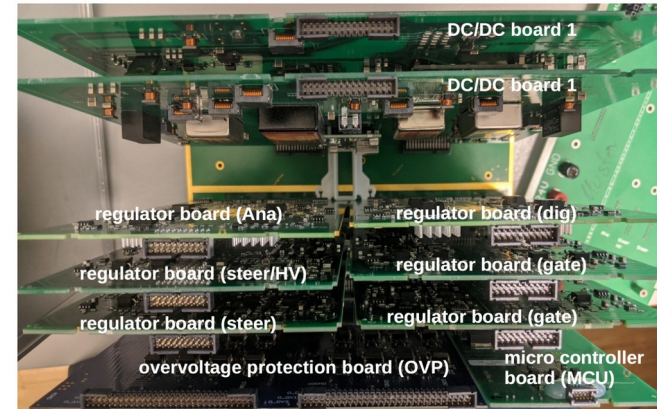


PXD PS COMMISSIONING

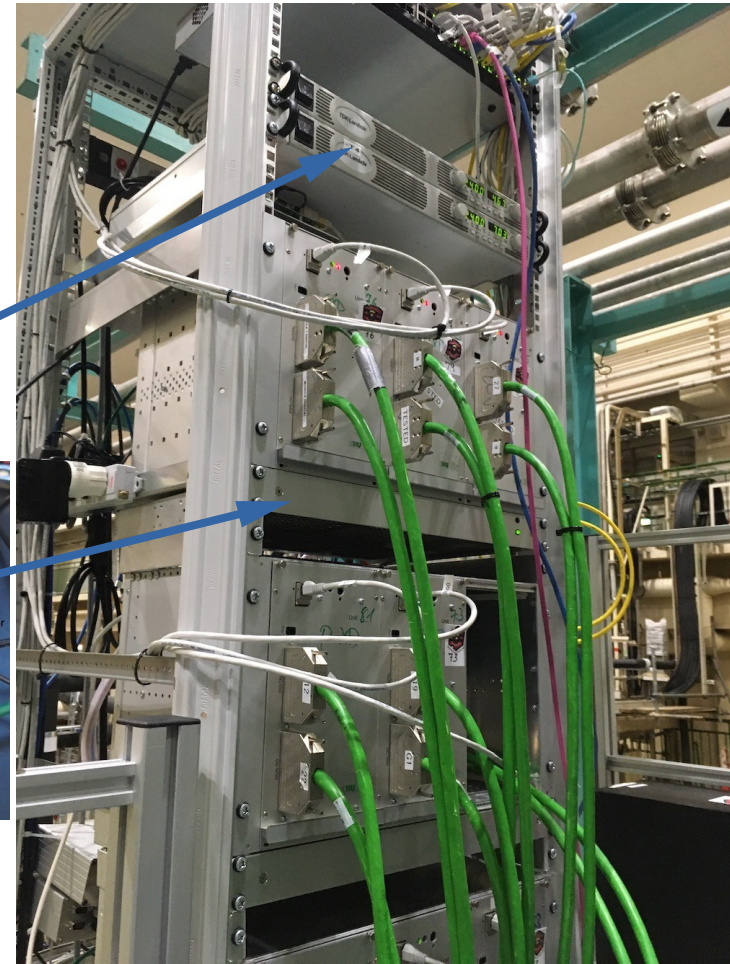
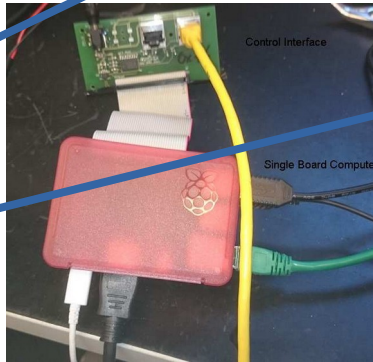
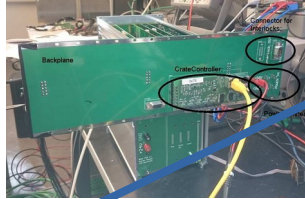
PXD PS

- Custom made 23 voltages for powering PXD module via ~16 m long cables



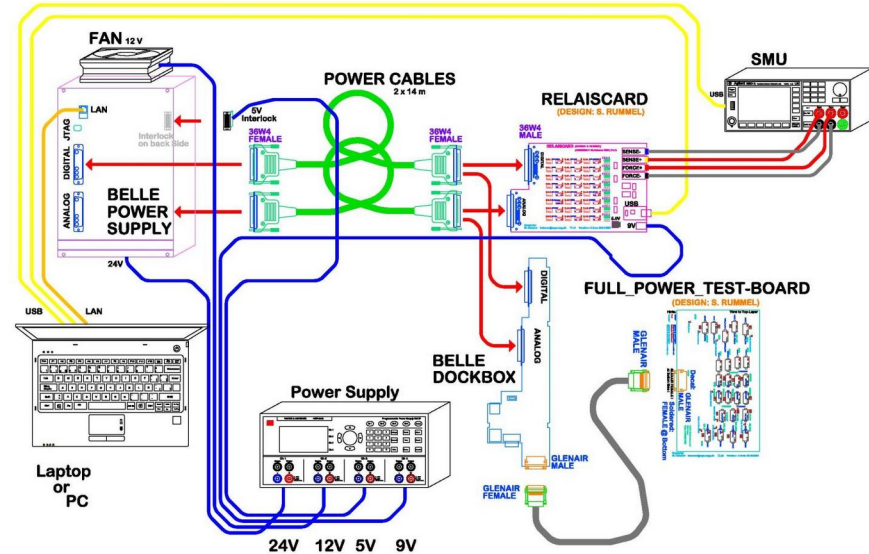
PXD PS SYSTEM

- Individual PS Unit
 - One per PXD module (40)
- Backplane/Crate Controller
 - One per 3 PS units (14)
- Single Board Computer
 - One per 16 crater controllers (1)
 - Raspi + interface board
- Genesys 24 V main supply
 - One per 10 PS (4)
- Fan Units
 - One per crate (14)



PXD PS SYSTEM

- Interlock Box
 - Fast diamond and CLAWS signals
- Control software
 - IOCs on PXD server
 - PS IOC
 - PS Sequence
 - PS control (main PXD sequence)
 - Genesys IOC
 - IOCs on Control Raspis
 - Interlock Box IOC
 - Crate Controller IOC
 - Fan Controller IOC
- PS Firmware
- Calibration Setup and Software



"MPI BELLE II-PS Test"

Drawn by: W. Haberer haberer@mpp.mpg.de 1.1.21

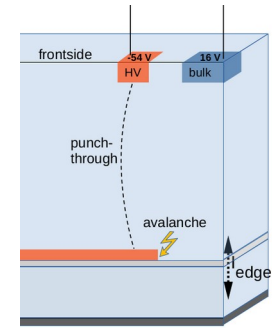
Version : A from 06.10.2021

PXD2 PRE-COMMISSIONING

- Status 2020: only 21 PS at KEK, ~hand-full working PS plus several broken ones in Germany
 - **Need 40+** for PXD plus spares and lab systems
 - kicked off production preparations for 24 (+5) new power supplies summer 2020
- Status fall 2022: still **21 PS at KEK, 11 PS at DESY** for commissioning (= half halfshell), lab PS strewn over Germany
 - All PS in Germany needed several modifications to be ready for PXD operation at KEK
- Scraped together all available PS in Germany and set out for modification and repair (5 from new production)
 - 27 PS went through full modification, calibration, testing and repair in Bonn in ~3 months
 - 26 passed and delivered via DESY to KEK
- **Now: 44 PXD2 ready PS at KEK**, 1 not re-calibrated, 4 unmodified, 3 with issues
- Huge thanks to
 - Jannes Schmitz
 - Electronics workshop: Candas Tezel, Katharina Rosenthal, Walter Honerbacher
 - Bachelor students: Theresa Goldschmidt, Frederik Lange

PS MODIFICATIONS

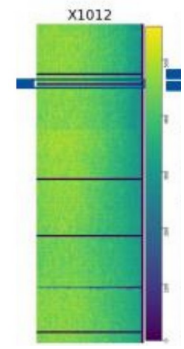
- HV modification on DCDC + regulator board to increase max. current 1.4 mA \rightarrow 28 mA



- AVDD modification to increase regulator voltage to at ~ 6 V
 - $U_{load} = 1.8$ V, $I = 3$ A, up to 4 V drop over cables plus Kapton

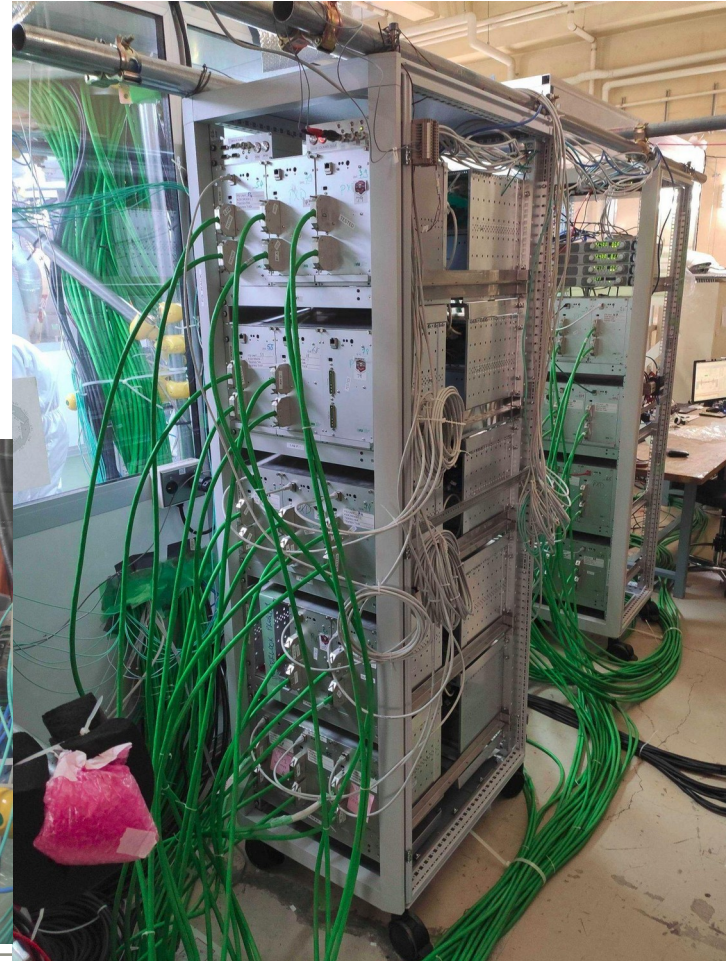


- Interlock path modification on MCU board \rightarrow remove delays



COMMISSIONING AT KEK

- Team PS: Jannes Schmitz + Munira Khan (+ Björn Spruck)
- Set up and test 40 PS
 - Move hardware
 - Sweat in cleanroom
 - Dockbox mechanics
 - I2C Horror

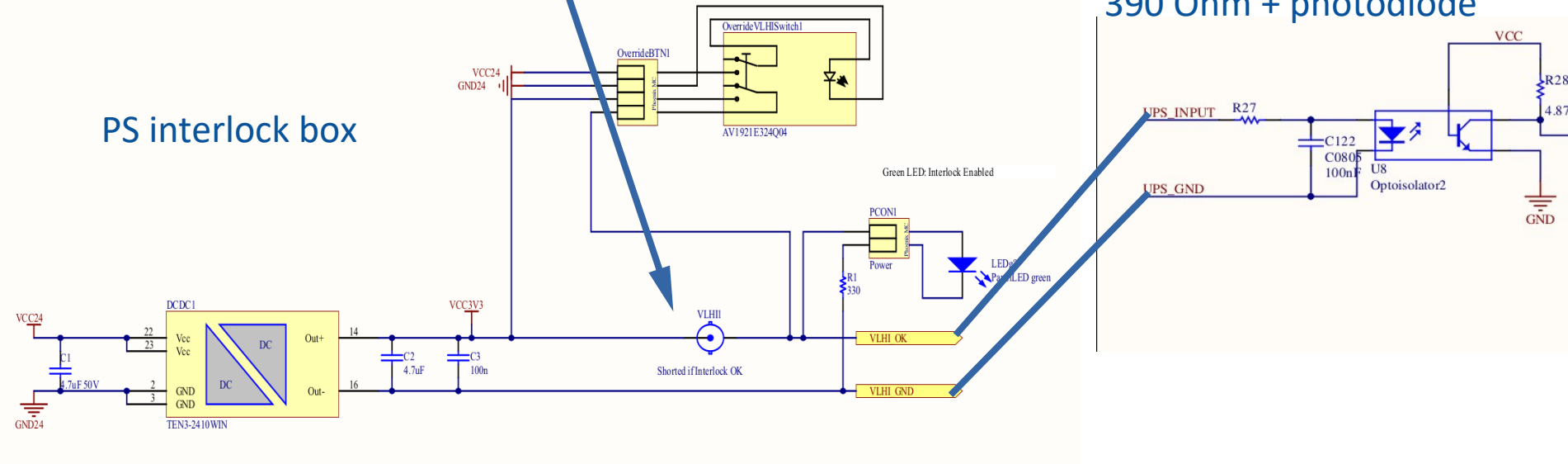


COMMISSIONING TROUBLES

- IBelle interlock cable resistance too high
→ bad interlock signal
- 3.3 V over long cable has to trigger optocoupler

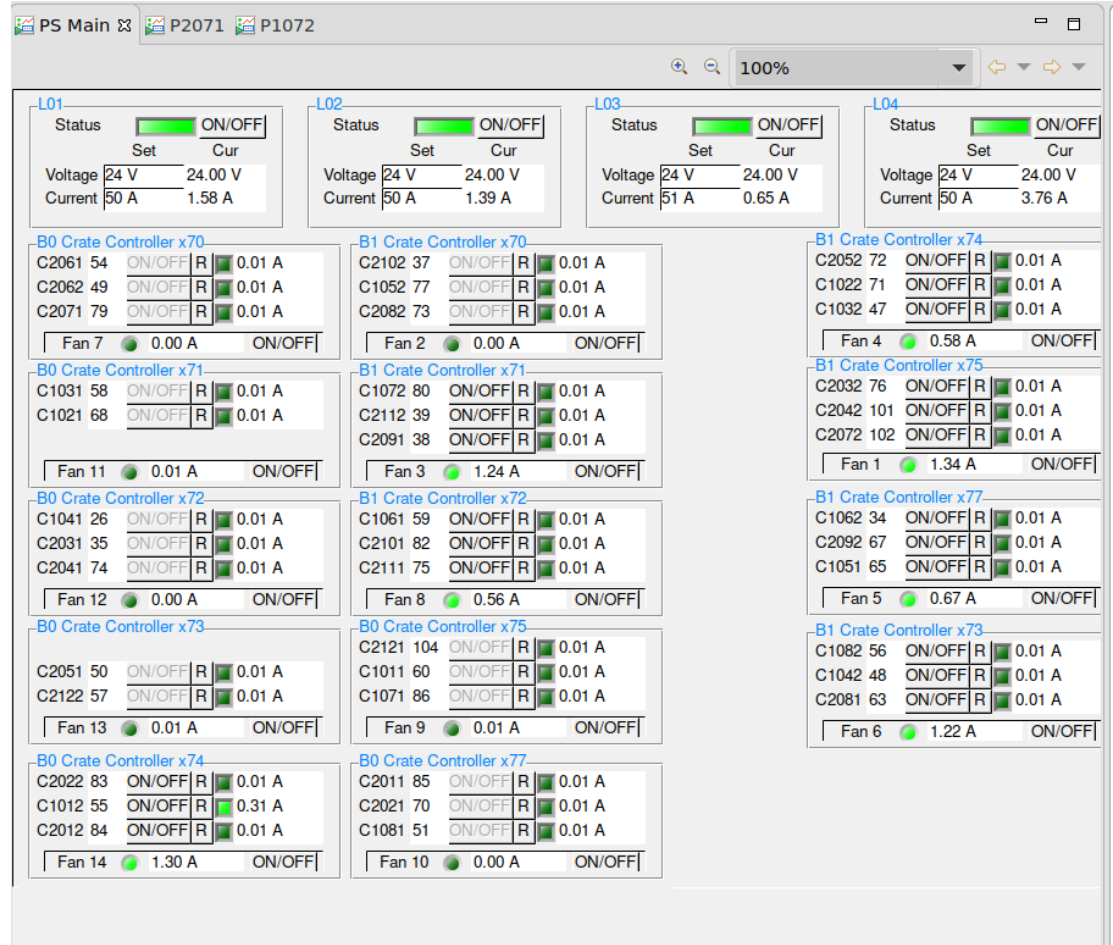
PS Interlock input
40x in parallel
390 Ohm + photodiode

PS interlock box



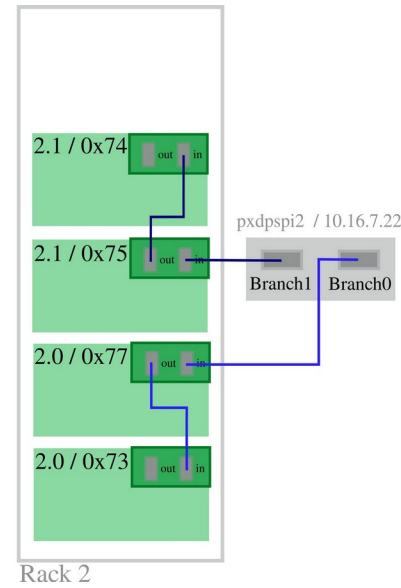
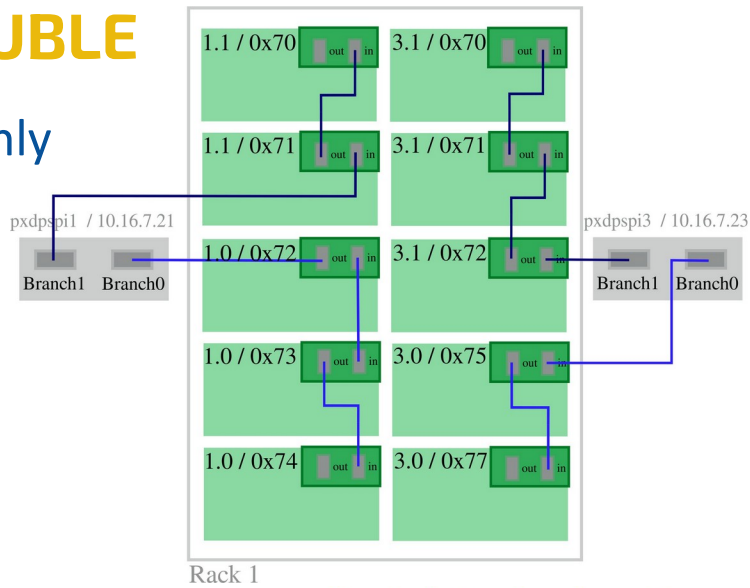
PS BACKPLANE CONTROL ISSUES

- PS and Fan power controlled via I2C
- Current readout

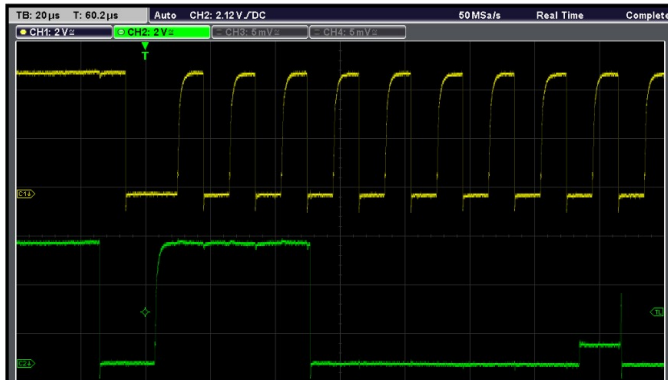


I2C TROUBLE

- I2C specified for few meters only
- PS connection spanned several meters initially
- Changed to multiple shorter chains



Old config, all CC, last in chain



New config, 3rdCC of pxdpspi3



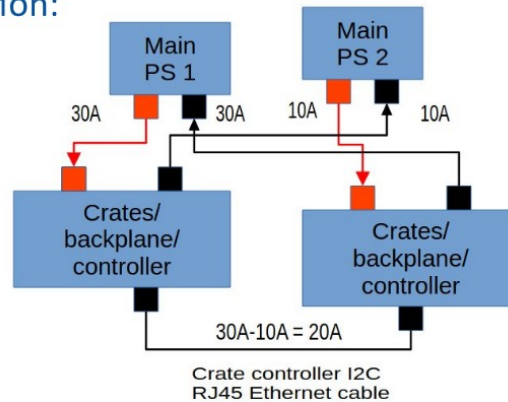
I2C TROUBLE

GROUNDING SITUATION

- Did mistake during cabling of primary PS cables

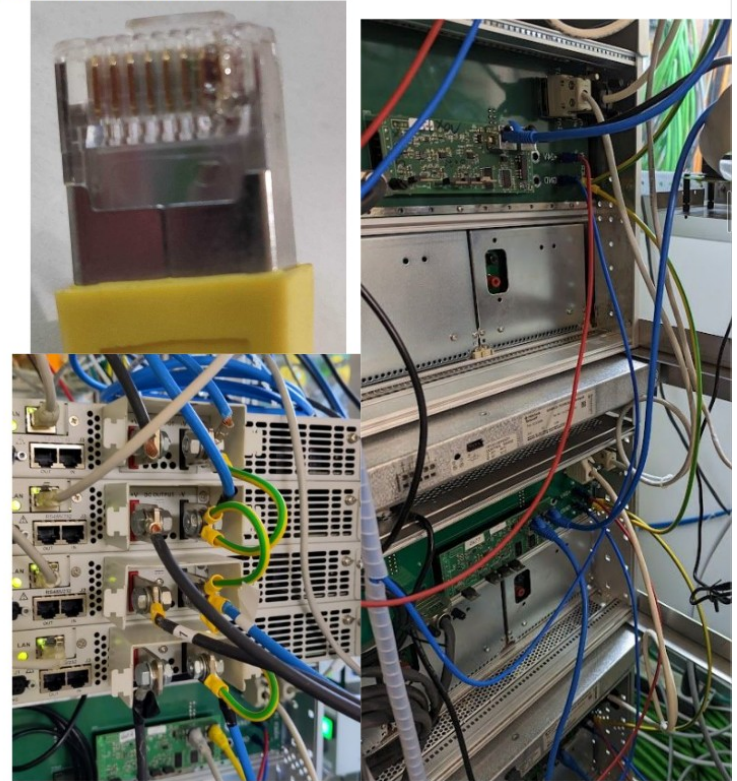
- Leading to following situation:

→ High current flowing through Ethernet cables



- Countermeasures:

- Fixed cabling
- Connected all “-V” ports of GEN Pss
- Connected GNDs of all backplanes within a rack
- “-V” is still floating, should we properly define it?
- Could also connect all “+V” in parallel mode



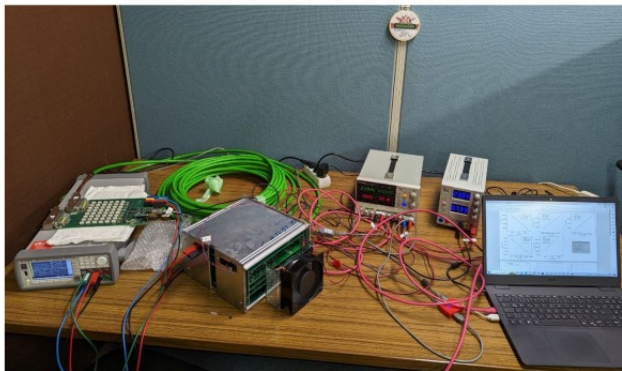
CALIBRATION

- PS-Recalibration
 - HV channel modification changes current monitor
 - Aging of components could cause drifts

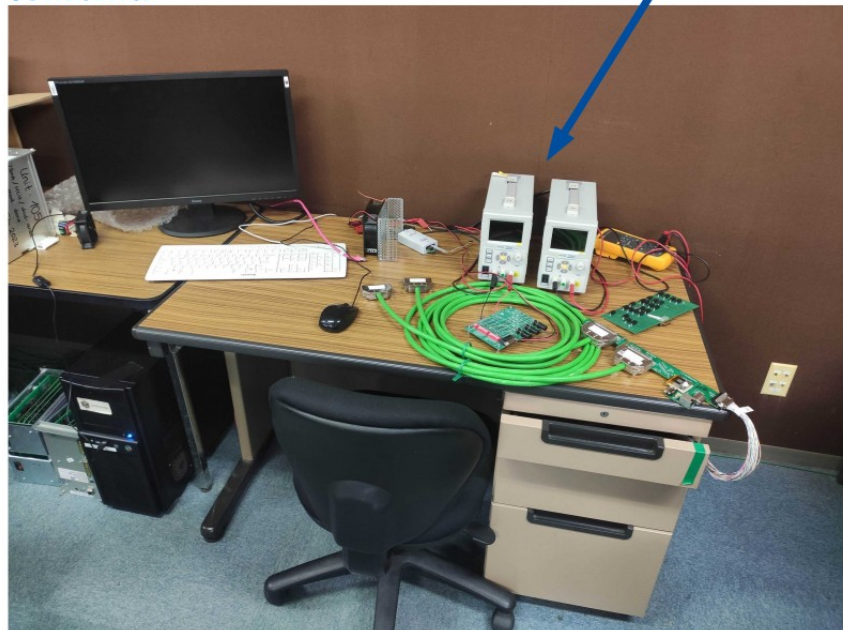
- KEK Calibration setup set up and improved in Bonn, two Bachelor theses
 - pass/fail with standard constant ranges
 - no significant drift over ~5 years without operation
 - now data-set for drift under operation available → to be analyzed

- All PXD2 backup PS calibrated, all KEK PS calibrated (except one)
 - 28 PS calibrated in Bonn
 - 20 PS calibrated at KEK by Haolin Yang, Zhaoling Zhang from Weimin Song group at JLU

- Calibration at KEK went smooth
 - Haolin and Zhaoling did great job calibrating and testing the modified KEK units
→ Have nice dataset to study long-term drift of calibration constants



Not our PSs



- Primary PSs of testing setup only borrowed → get own one?
- Pxdbonndaq in F2
 - Can it stay there?
 - Need to test PSs, once calibration is done
 - Need access to internet for documentation

SPARES AND NEEDS

- Production of replacement PS: see Thomas' Talk
- Spare status details: <https://indico.belle2.org/event/9312/>
- Have now at KEK
 - 44 PXD2 ready PS (only short run-time so far)
 - main PS (genesys): 1 spare
 - shelves: 2 spare
 - crate-controller: 1 spare + 3 broken and 3 unknown assemblies
 - backplanes: 2 spare + 1 broken
 - Rpi: 1 spare with adapter board
- Need
 - 1 spare fan unit and 9 temperature sensors
 - Rack fuses
 - Repair crate-controllers
 - RPi Japanese plugs + Main PS Japanese plug modification (3 units)

CONCLUSION

- Full PXD2 PS system working currently
- Modification needed when moving to top of Belle (Japanese plugs)
- Repair and improvements
 - Spares
 - General issues, see Björn's slides
- Topic made very hard by missing documentation from designer
- Great effort by all involved people! Thank you!