

Update on Spare Preparation - Primary PS and Crate Controller

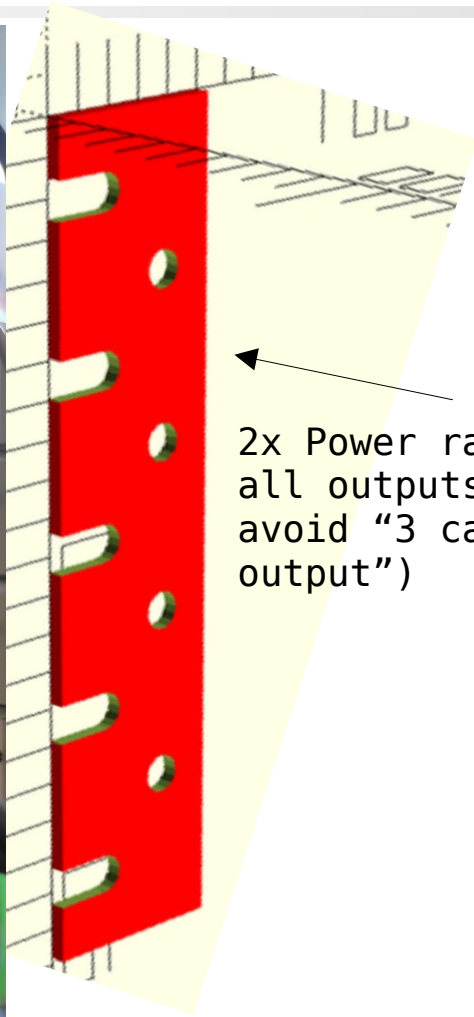
22.5.2023

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Primary Power Supplies

- In Phase3, we used two main PS (Genesys/Lambda), one spare in B4
 - → double: four main PS
- Improvements:
 - Additional Monitoring (status, failures)
 - Use a parallel powering scheme
 - One PS steers the other three
 - Redundancy: Three PS may be enough for full system
 - Put configured spare already in place (but keep off)
 - → Avoid as much as possible any mechanical work on top of Belle (backside of rack!)
 - Allow simple exchange by non-expert (with proper step-by-step document)
 - Todo: Connect common output by metal rail instead of cables
- Documentation
 - Go through possible scenarios and describe procedures in detail (e.g. which tools need to be brought to top of Belle, how to prevent screws falling down into the detector, etc)

<https://gitlab.desy.de/belle2/detector/pxd/commissioning/-/issues/217>



2x Power rail to connect all outputs securely, avoid "3 cables on one output")

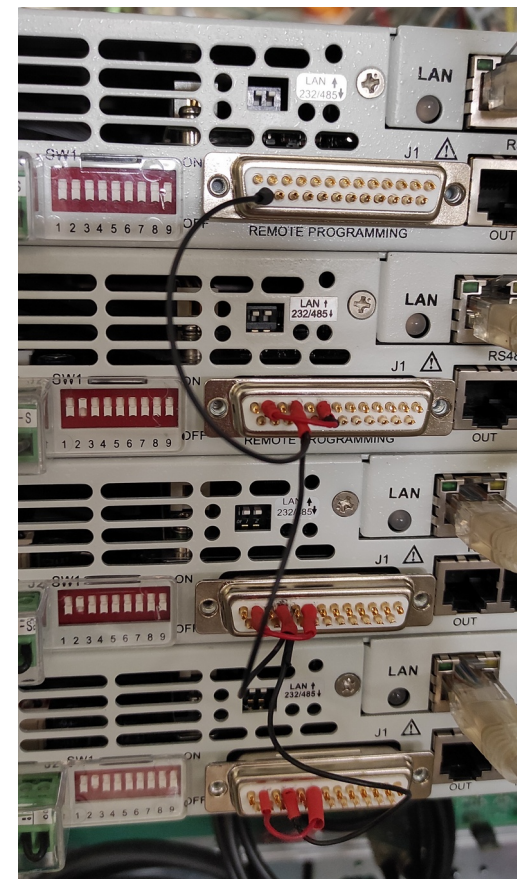
PS 1

PS 2

PS 3

PS 4

PS 5 → should go here



Spare was unprepared (uncabled). Missing components & screws -> bad surprise if we would have needed it

- Define limits and add alarms, x-checks to alarm system

L01

Status █ ON/OFF

Set Cur

Voltage 24 V 24.00 V

Current 50 A 0.80 A

Operation CV

Loc/Rem REM REM

OVP 28 V 28.00 V

Trip OK

local mode	Enable
spare	Output Off
fold enable	Shut Off
auto restart	Over Volt
fault actv	Foldback
no fault	Over temp
cont curr	AC fail
const volt	spare

local mode	Int Comm Err
unused	Int Timeout
fold enable	Int Overflow
auto restart	Int Inp Overflow
unused	Out Enable Faul
unused	Output Off
unused	Shut Off
no fault	Over Volt
cont curr	Foldback
const volt	Over temp
	AC fail
	isum

Low 22 V 22.00 V

Foldback OFF

Trip OK

L02

Status █ ON/OFF

Set Cur

Voltage 25 V 24.00 V

Current 50 A 0.82 A

Operation CC

Loc/Rem REM REM

OVP 28 V 28.00 V

Trip OK

local mode	Enable
spare	Output Off
fold enable	Shut Off
auto restart	Over Volt
fault actv	Foldback
no fault	Over temp
cont curr	AC fail
const volt	spare

local mode	Int Comm Err
unused	Int Timeout
fold enable	Int Overflow
auto restart	Int Inp Overflow
unused	Out Enable Faul
unused	Output Off
unused	Shut Off
no fault	Over Volt
cont curr	Foldback
const volt	Over temp
	AC fail
	isum

Low 22 V 22.00 V

Foldback OFF

Trip OK

L03

Status █ ON/OFF

Set Cur

Voltage 25 V 24.00 V

Current 50 A 0.83 A

Operation CC

Loc/Rem REM REM

OVP 28 V 28.00 V

Trip OK

local mode	Enable
spare	Output Off
fold enable	Shut Off
auto restart	Over Volt
fault actv	Foldback
no fault	Over temp
cont curr	AC fail
const volt	spare

local mode	Int Comm Err
unused	Int Timeout
fold enable	Int Overflow
auto restart	Int Inp Overflow
unused	Out Enable Faul
unused	Output Off
unused	Shut Off
no fault	Over Volt
cont curr	Foldback
const volt	Over temp
	AC fail
	isum

Low 22 V 22.00 V

Foldback OFF

Trip OK

L04

Status █ ON/OFF

Set Cur

Voltage 25 V 23.99 V

Current 50 A 0.79 A

Operation CC

Loc/Rem REM REM

OVP 28 V 28.00 V

Trip OK

local mode	Enable
spare	Output Off
fold enable	Shut Off
auto restart	Over Volt
fault actv	Foldback
no fault	Over temp
cont curr	AC fail
const volt	spare

local mode	Int Comm Err
unused	Int Timeout
fold enable	Int Overflow
auto restart	Int Inp Overflow
unused	Out Enable Faul
unused	Output Off
unused	Shut Off
no fault	Over Volt
cont curr	Foldback
const volt	Over temp
	AC fail
	isum

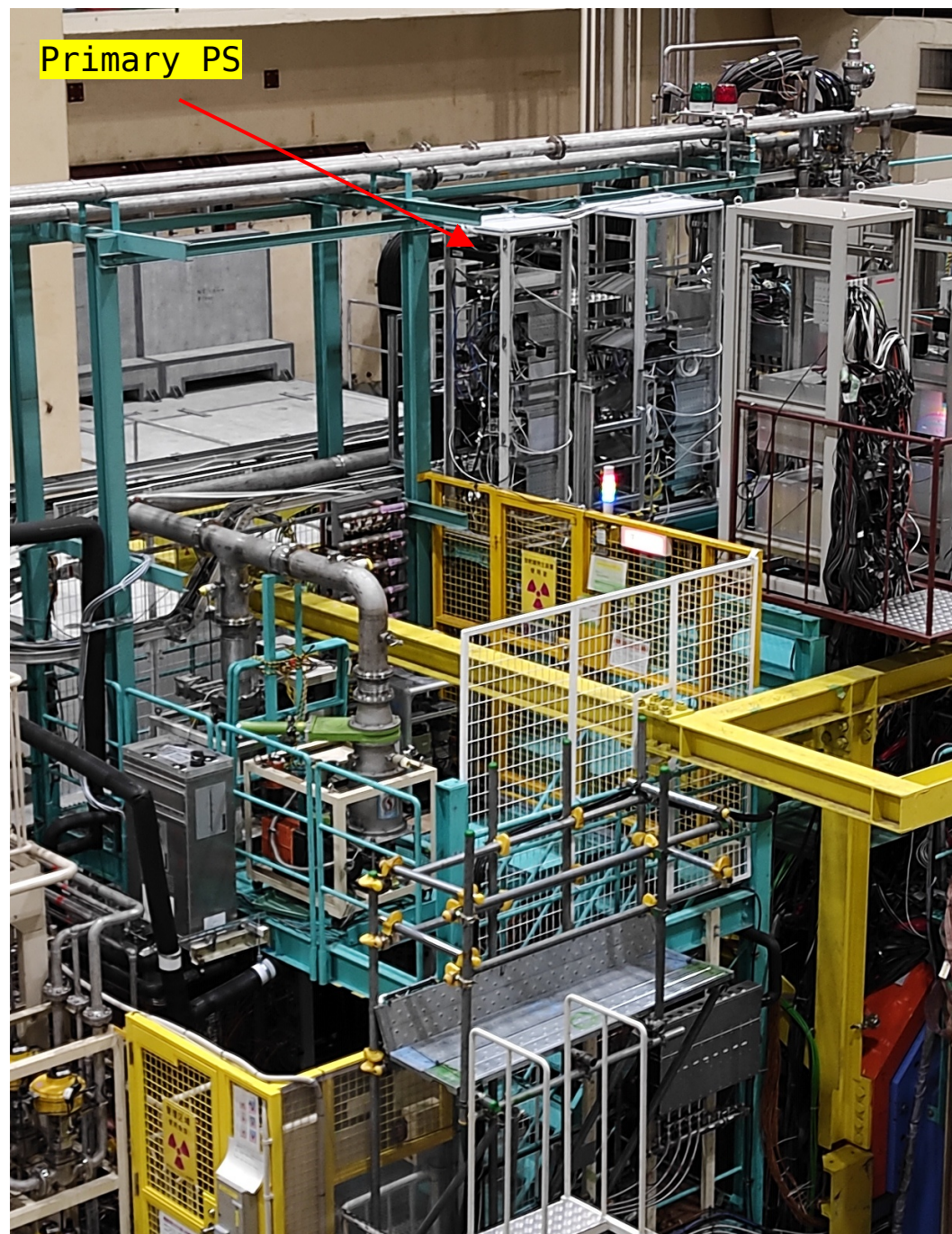
Low 22 V 22.00 V

Foldback OFF

Trip OK

Location & Access

- Unpleasant access, possible only from the side
- Even in B4 spring rings and screws fell down several times when cabling outputs.
- IP area: any action need “Access request” with safety shifter company → large downtime
- We have 4 fuses for main PS. Spare would not be connected. Euro or Japanese plugs (100V), currently we have 3E/2J cables, adapters need to be safe for required current or cables modified!



Crate Controller “Pi”s

- Phase3:
 - One crate controller RPi with two I2C branches controlled 7 crates (=21 PSUs)
- B4: Troubles with getting stable connection for known and unknown reasons
 - → using 3 RPi with extra multiplexer board (6 branches) to control 14 crates
- All Pis now use the very same system (clone of one sd card), differ only by name, network IP and the epics ioc start script (configuration).
- Fully interchangeable, only other ioc script need to be soft-linked if controllers are swapped
- A fourth Pi + multiplexer board has been set up identical as drop-in replacement.
 - → Keep as it is. How to ensure it is kept up to date if we put it into a spare box?
- We still don't fully understand the instabilities (software/IOC? Messed up I2C multiplexer config?) → prefer to investigate further
 - → retry with only one or two Pis for debugging.

<https://gitlab.desy.de/belle2/detector/pxd/commissioning/-/issues/274>

Setup, Exchange Procedure

- Location: top of Belle
 - → even a power cycle need access (downtime) → watchdog installed!
 - → At least put the power plugs into reach from outside (stair case area) as we did with the interlock box.
- Exchange: mechanical trivial, setup easy
 - Problem: the issues which we observed (recently) were not resolved by exchanging the pi + multiplexer board. :-(((