Update on Spare Preparation -Primary PS and Crate Controller

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Björn Spruck

Primary Power Supplies

- In Phase3, we used two main PS (Genesys/Lambda), one spare in B4
 - \rightarrow 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)
 - \rightarrow 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 brought to top of Belle, how to prevent screws falling down into the detector, etc)



Spare was unprepared (uncabled). Missing components & screws -> bad surpr¹/₂se if we would have needed it bjoern.spruck@belle2 • Define limits and add alarms, x-checks to alarm system

1.01	1.00	1.02	1.04
Status ON/OFF	Status ON/OFF	Status ON/OFF	Status
Set Cur	Sot Cur	Set Cur	Set
Voltage 24 V 24 00 V	Voltago 25 V 24 00 V	Voltago 25 V 24 00 V	Voltage 25 V
	Current 50 A 0.82 A	Current 50 A 0.83 A	Current 50 A
Occurrent OV	Orantian CO		Ourient po A
Operation CV	Operation CC	Operation CC	Operation CC
Loc/Rem REM REM	Loc/Rem REM REM	Loc/Rem REM REM	Loc/Rem REM
OVP 28 V 28.00 V	OVP 28 V 28.00 V	OVP 28 V 28.00 V	OVP 28 V
Trip OK	Trip OK	Trip OK	Trip OK
local modeEnablespareOutput Offfold enableShut Offauto restartOver Voltfault actvFoldbackpo faultOver tempcont currAC failconst voltsparelocal modeInt Comm ErrunusedInt Overflowfold enableInt Overflowauto restartOutput OffunusedShut Offfold enableInt Overflowauto restartOutput OffunusedShut Offover VoltShut OffOver VoltShut OffOver tempOver tempAC failOver tempAC failSum	local modeEnablespareOutput Offfold enableShut Offauto restartOver Voltfault actvFoldbackno faultOver tempcont currAC failconst voltsparelocal modeInt Comm ErrunusedInt Comm Errfold enableInt Overflowauto restartOutput OffunusedOut Enable Fauloutput OffOver Voltfold enableOutput Offoutput OffOver Voltcont currOver tempconst voltAC failsomeAC failisumisum	local modeEnablespareOutput Offfold enableShut Offauto restartOver Voltfault actvFoldbackno faultOver tempcont currAC failconst voltsparelocal modeInt Comm ErrunusedInt Overflowfold enableInt Inp Overflowauto restartOutput Offoutput offOutput Offon faultOver Voltno faultCover Voltcont currAC failoutput offOutput OffOver VoltShut OffOver VoltOver tempAC failOver tempAC failisum	local mode spare fold enable auto restart fault actv no fault cont curr const volt local mode unused fold enable auto restart unused no fault cont curr const volt
Low 22 V 22.00 V	Low 22 V 22.00 V	Low 22 V 22.00 V	Low 22 V
Foldback OFF	Foldback OFF	Foldback OFF	Foldback OFF
Trip OK	Trip OK	Trip OK	Trip OK

		ON/OFF
	Set	Cur
Voltage 2	25 V	23.99 V
Current	50 A	0.79 A
Operatior	CC	
Loc/Rem	REM	REM
OVP	28 V	28.00 V
Trip	OK	
local r	node	Enable
spare		Output Off
fold enable		Shut Off
auto restart		Over volt Foldback
no fault		Over temp
cont curr		AC fail
const volt		spare
	node	Int Comm Err
local r	1000	
local r unus	ed	Int Overflow
local r unus fold er	ed nable	Int Overflow Int Inp Overflow Out Enable Faul
local r unus fold er auto re	ed nable estart	Int Overflow Int Inp Overflow Out Enable Faul Output Off Sbut Off
local r unus fold er auto re unus no fa	ed nable estart ed	Int Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt
local r unus fold er auto re unus no fa cont	ed nable estart ied ault curr	Int Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp
local r unus fold er auto re unus no fa cont	ed nable estart ed ault curr volt	Int Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp AC fail isum
local r unus fold er auto re unus no fa cont const	ed able estart ed ault curr volt	Int Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp AC fail isum
local r unus fold er auto re unus no fa cont const Low 2 Foldbac	eed able estart eed ault curr volt 2 V c OFF	Int Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp AC fail isum
local r unus fold er auto re unus no fa cont const Low 2 Foldbacl	eed able estart eed ault curr volt 2 V c OFF OK	Int Inp Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp AC fail isum 22.00 V
local r unus fold er auto re unus no fa cont const Low 2 Foldbacl Trip	ed able estart ed ault curr volt 2 V C OFF OK	Int Inp Overflow Int Inp Overflow Out Enable Faul Output Off Shut Off Over Volt Foldback Over temp AC fail isum

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!



- 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
 - \rightarrow 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.
 - \rightarrow 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
- \rightarrow retry with only one or two Pis for debugging.

- Location: top of Belle
 - \rightarrow even a power cycle need access (downtime) \rightarrow watchdog installed!
 - \rightarrow At least put the power plugs into read 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. :-(((