



Beam dump due to BEM problem

N.Magnin - MPP 01.09.2017

Dump due to LBDS

XPOC PRO GUI: 2.5.0

File Session Help

RBA: nmagnin

XPOC: XPOC_B1: 30.08.2017 00:28:01 (150404568150900000) - ONLINE

Final analysis is confirmed

XPOC Modules graph Results

BEAM 1 - PROTON (PROTPHYS) E: 1935.00 GeV I: 1.65E14 p+ #b: 1550 30.08.2017 - 00:28:01.509185900

Module results Module journal

Module: SCSS Analysis: OK Check: ERROR

| Source | Statuses |
|--------------------|----------|
| MRBH UA67 SCSS,DB1 | ON |
| MRBH UA67 SCSS,CB1 | REMOTE |
| MRBH UA67 SCSS,DB1 | 1939.29 |
| MRBH UA67 SCSS,DB1 | 3070 |
| MRBV UA67 SCSS,AB1 | OK |
| MRBV UA67 SCSS,BB1 | OK |
| MRBV UA67 SCSS,CB1 | OK |
| MRBV UA67 SCSS,DB1 | OK |
| MKDV UA67 SCSS,DB1 | OK |
| MKD UA63 SCSS,AB1 | OK |
| MKD UA63 SCSS,BB1 | OK |
| MKD UA63 SCSS,CB1 | OK |
| MKD UA63 SCSS,DB1 | OK |
| MKD UA63 SCSS,EB1 | OK |
| MKD UA63 SCSS,FB1 | OK |
| MKD UA63 SCSS,GB1 | OK |
| MKD UA63 SCSS,HB1 | OK |
| MKD UA63 SCSS,IB1 | OK |
| MKD UA63 SCSS,JB1 | OK |
| MKD UA63 SCSS,KB1 | OK |
| MKD UA63 SCSS,LB1 | OK |
| MKD UA63 SCSS,MB1 | OK |
| MKD UA63 SCSS,NB1 | OK |
| MKD UA63 SCSS,OB1 | OK |

| Interlocks | Stage | State | Interlock | Masked |
|-------------------|--------|--------|-----------|--------|
| ALIVE | OK | OK | OK | NO |
| Bains | OK | OK | NO | NO |
| Earthing Switches | OK | OK | NO | NO |
| Power Supplies | OK | OK | NO | NO |
| Timing | OK | OK | NO | NO |
| Tracking | FAULTY | FAULTY | NO | NO |
| Triggering | FAULTY | OK | NO | NO |
| Ready | FAULTY | OK | NO | NO |

| DC Power Supplies | Parameter | Monitoring | Reference |
|-------------------|-----------|------------|-----------|
| Up [M] | 434.74 | 7491.78 | |
| Ip [mA] | 9.72 | 9 | |
| Uptu [M] | 3468.75 | 3500 | |

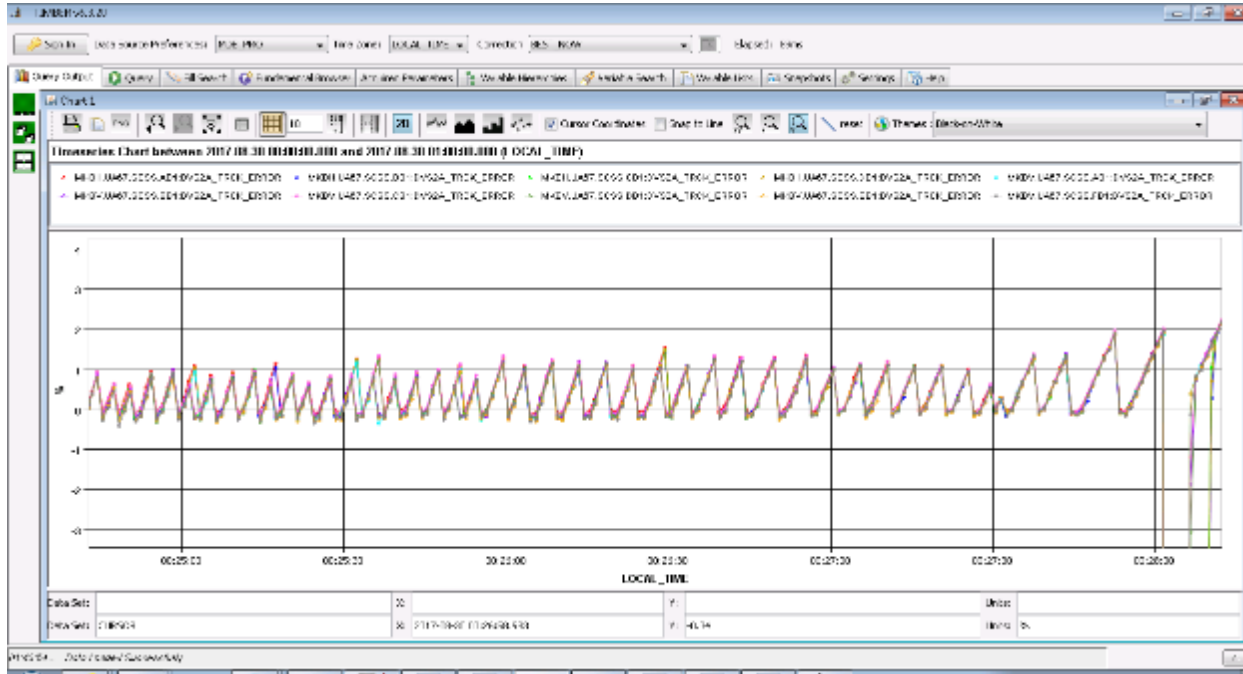
| Tracking | Parameter | Monitoring | Reference | Error | Mode |
|-----------|-----------|------------|-----------|-------|-------------|
| DVs1A [M] | 76.29 | | | | NO TRACKING |
| DVs2A [M] | 7487.88 | 7337.12 | | 2.05 | INHIBIT |
| PTU [M] | 3468.75 | 3472.16 | | -0.1 | INHIBIT |

01:19:39 - session confirmed by : RMXPOC-ONLINE-PRO

01:19:22 - server up.

- XPOC error: 3 MKB tracking error on SCSS
- XPOC&IPOC MKD/MKB waveform analysis is OK
- TSU dumped on SCSS request
- No BETS tracking error

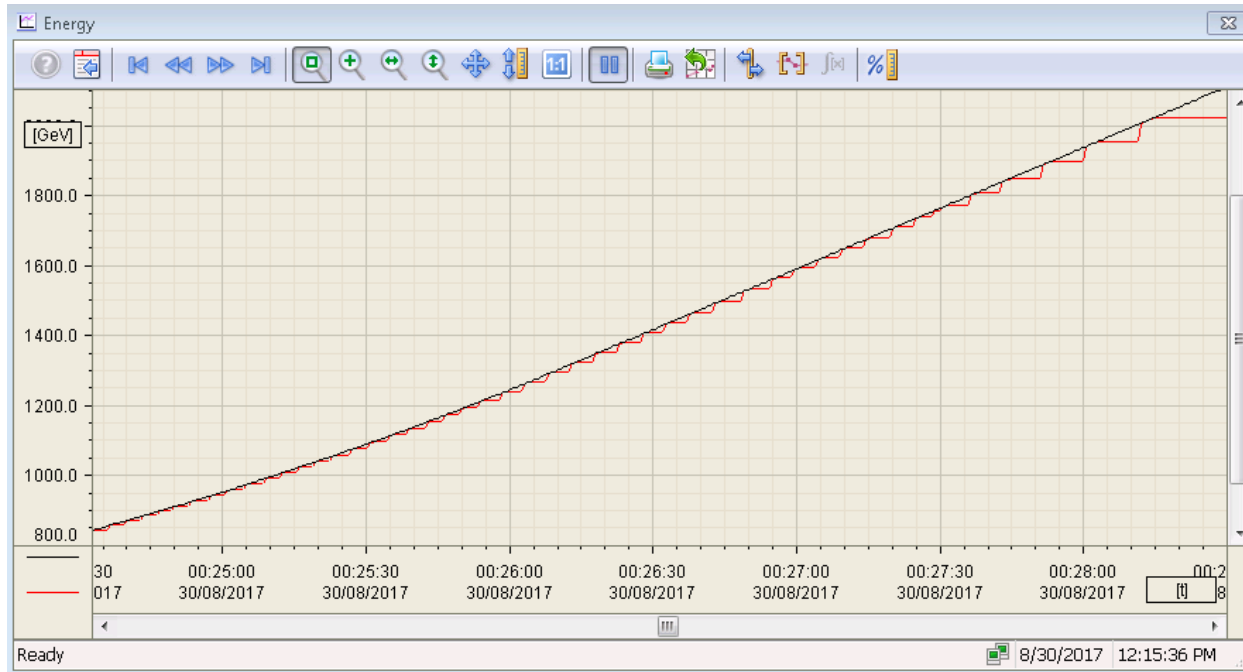
SCSS tracking error



ALL MKD and MKB generator showed big 'saw shape' tracking error during ramp

Dump after 2% error:
3 MKB gen interlocked

SCSS energy Reference/Interlock



Reference energy OK

Interlock energy
'frozen' for increasing
time up to minutes !

⇒ Communication
problem with the
BEM-Interlock card

BEM-Interlock problem scenario

- BEM Reference send the energy to SCSS
 - ⇒ SCSS set voltage to HV generators
- BEM Interlock send the energy to SCSS:
 - ⇒ SCSS check voltage on HV generators (V/E tracking tables)

BEM Interlock energy 'frozen' during ramp:

- ⇒ HV Generators voltage is correct wrt beam energy
- ⇒ SCSS detects a tracking error on all generators => Dump request.

This problem already occurred once in 2012 operation.

BEM-Reference problem scenario

- BEM Reference send the energy to SCSS
 - ⇒ SCSS set voltage to HV generators
- BEM Interlock send the energy to SCSS:
 - ⇒ SCSS check voltage on HV generators (V/E tracking tables)

BEM Reference energy 'frozen' during ramp:

- ⇒ HV Generators voltage is **NOT** correct wrt beam energy
- ⇒ **BETS** detects a tracking error on all generators => Dump request.

This problem never occurred in operation.

BEM Diagnosis problem

- BEM cards have an 'AnyBus error' interlock, which was not visible.
 - ⇒ BEM card send energy to SCSS through AnyBus card
 - ⇒ SCSS receives the energy and send it back to BEM
 - ⇒ BEM card receives the energy from SCSS and check wrt to sent value.
- This interlock did not work !
- Problem understood after investigation:
 - The BEM card only check the receive value wrt to sent value WHEN A VALUE IS RECEIVED FROM SCSS.
 - In this case the AnyBus card was frozen, no data received => no check, no interlock !

Summary

- Dump due to AnyBus communication problem between BEM-Interlock and SCSS
- This is a known failure mode, taken into account in design
- System protections worked properly
- Beam dumped synchronously, clean dump
- AnyBus communication diagnosis problem identified.
 - Could be fixed with a new firmware deployed during YETS.
 - Validation during reliability run with local BIS loops.