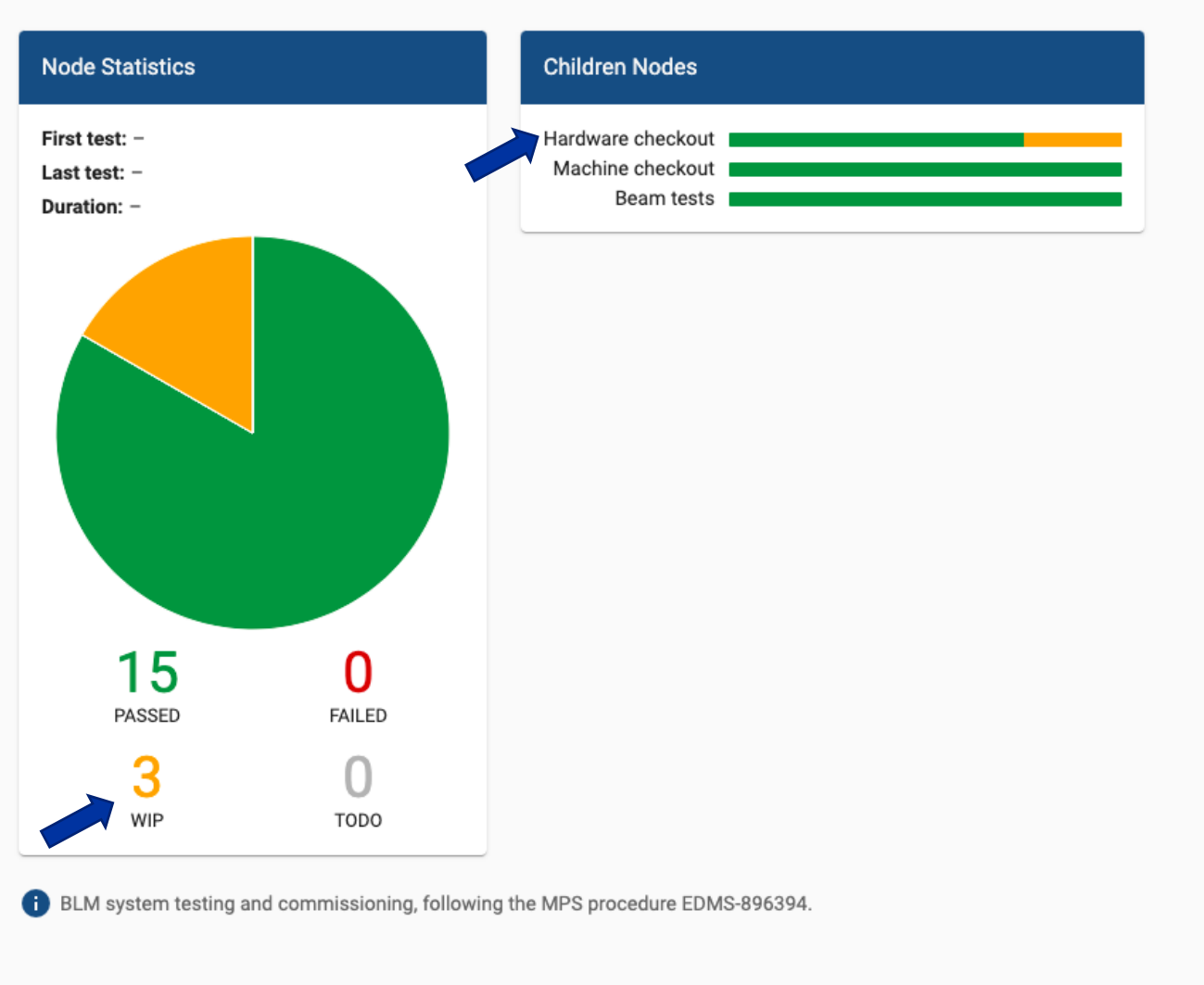# Status of MPS aspects of the BLM system commissioning

S.Morales on behalf of the BLM team – SY-BI-BL

22/10/2021 – 214th Machine Protection Panel (MPP)

Status on MPP checklist

Hardware (WIP):

- Changes in LSA database
- ~10 optical links show few errors
- BLETC & BLECS vs database tests to be repeated after the changes

One noisy optical link fixed during access yesterday!

-> OK and verified for Pilot Run!

Hardware checkout

High voltage modulation test:

- Ensure the integrity of the cabling and system components

- Harmonic modulation added on the HV supply -> Signal modulation on the detectors

- Amplitude and phase compared to predetermined limits
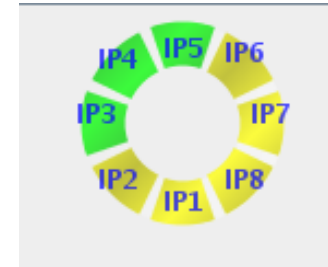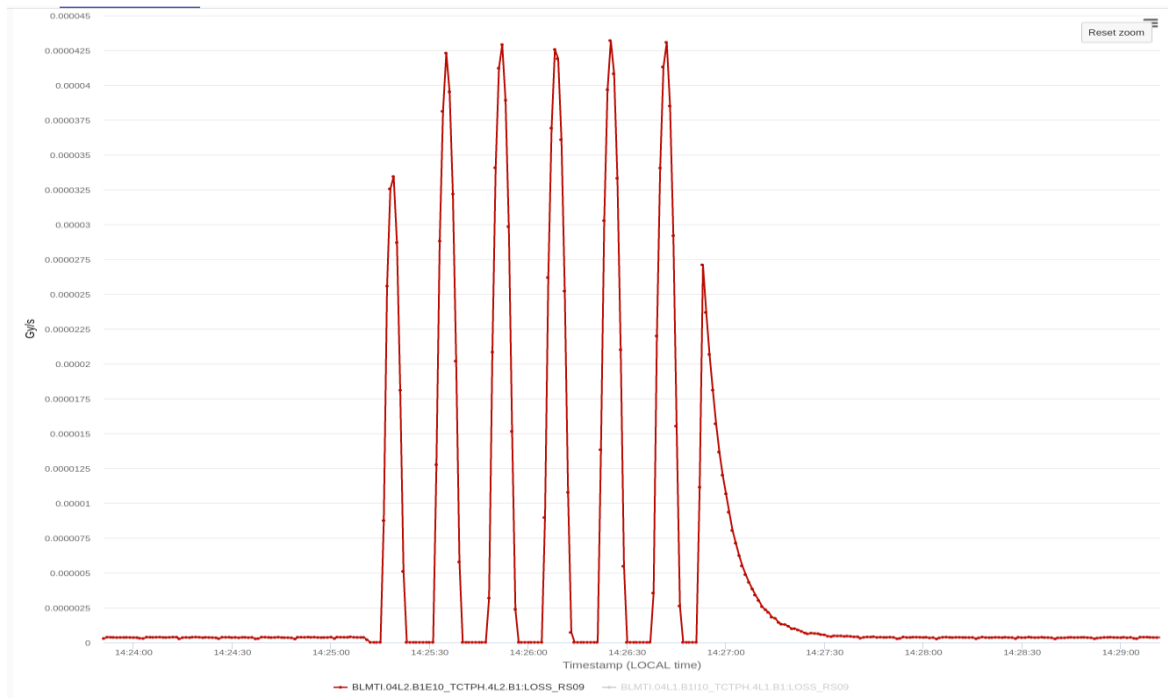
All detectors OK and modulating within limits!

Modulation test 18/09

Hardware checkout

Radioactive source test:

- Test of the full acquisition chain on all detectors

- TIM robot and "battery tests" -> Tests on a set (30%) of high/medium priority detectors for Pilot Run

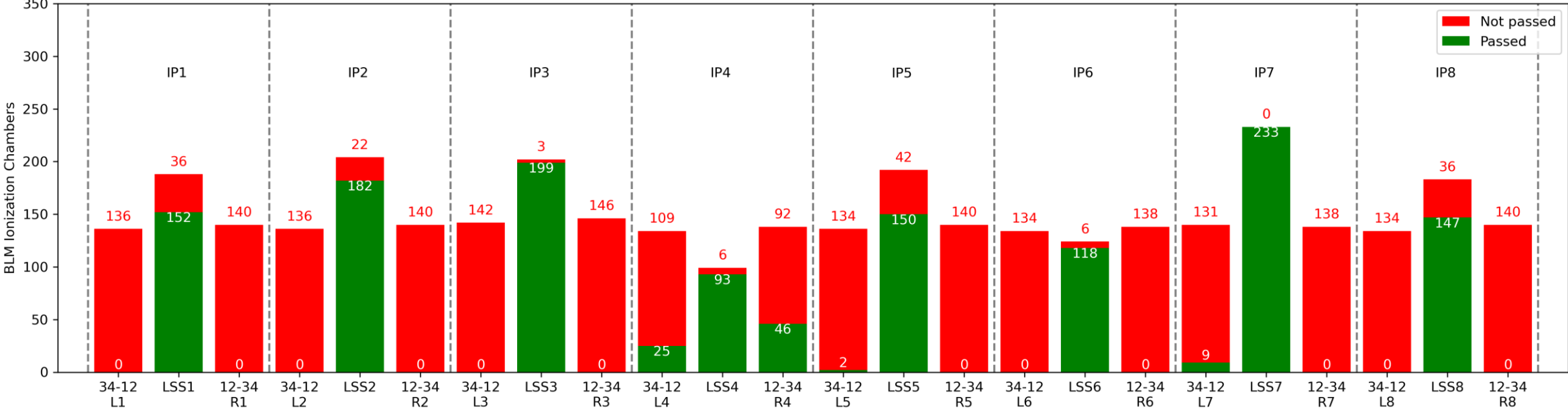- **All tested and OK** except for not accessible monitors (not tested)
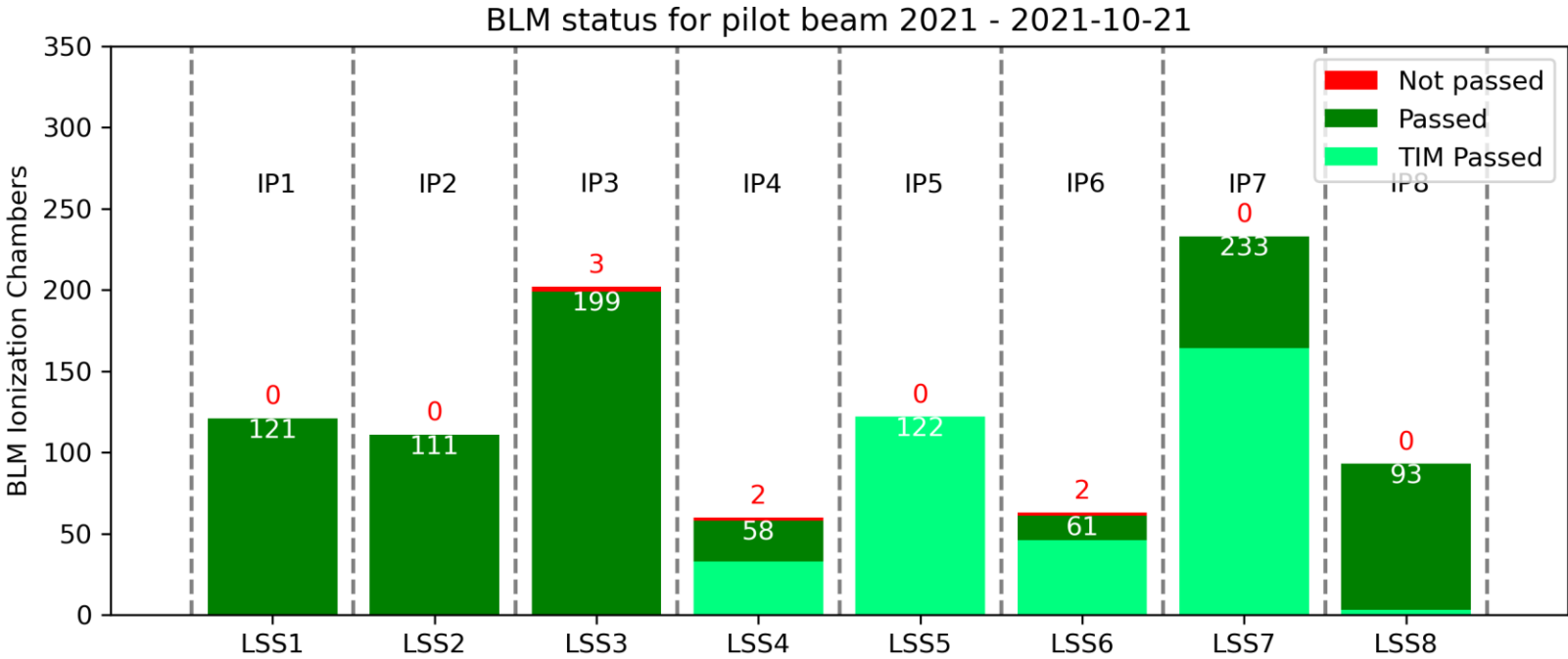
Hardware checkout

Radioactive source test:

• Test of the full acquisition chain on all detectors

• Still a large amount of detectors to be checked in the arcs for Run 3 -> Will be done during YETS, planning prepared with Coordination and OP

BLM status for Run 3 - 2021-10-21
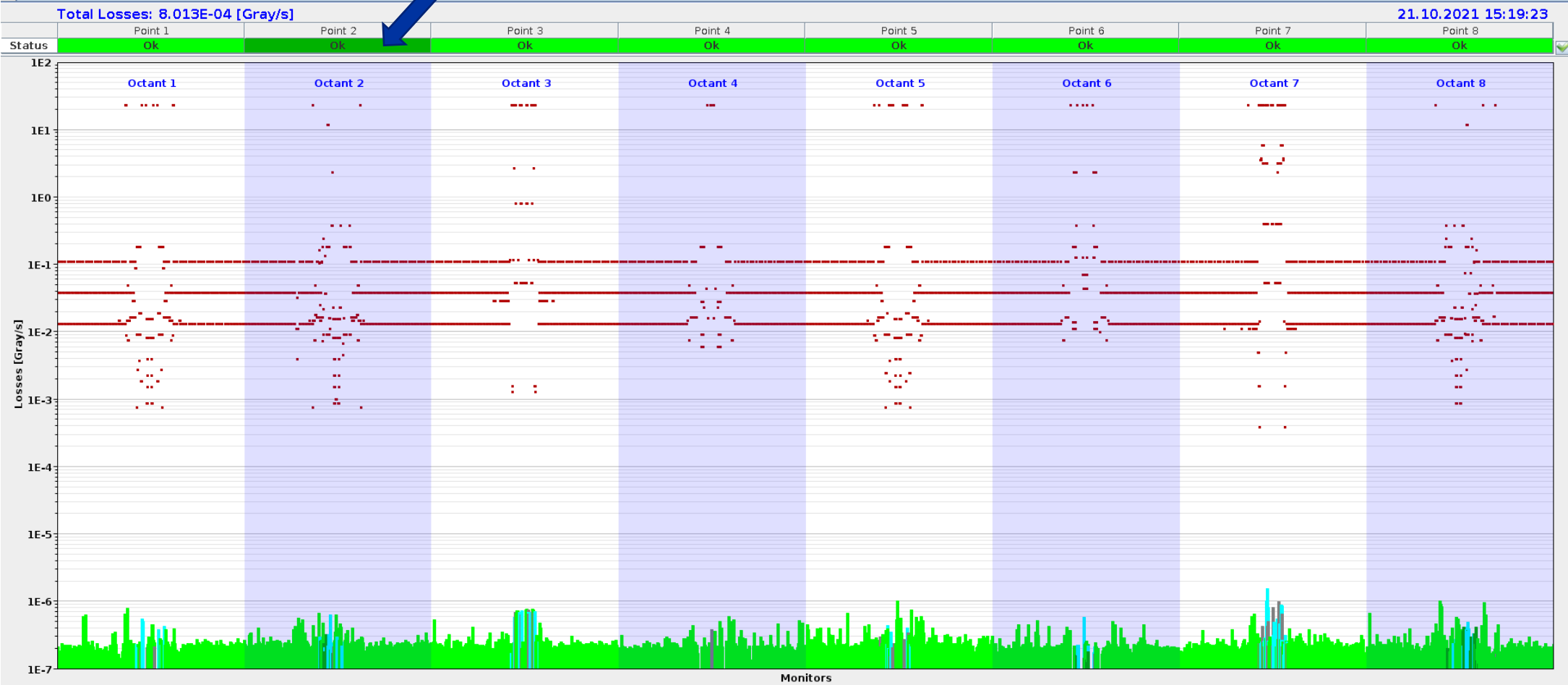
Hardware checkout

Beam energy reception test:

- Energy ramp during pre-cycle night **18th-19th October 2021** followed -> **OK**

Rest of tests performed before Pilot Run -> All OK
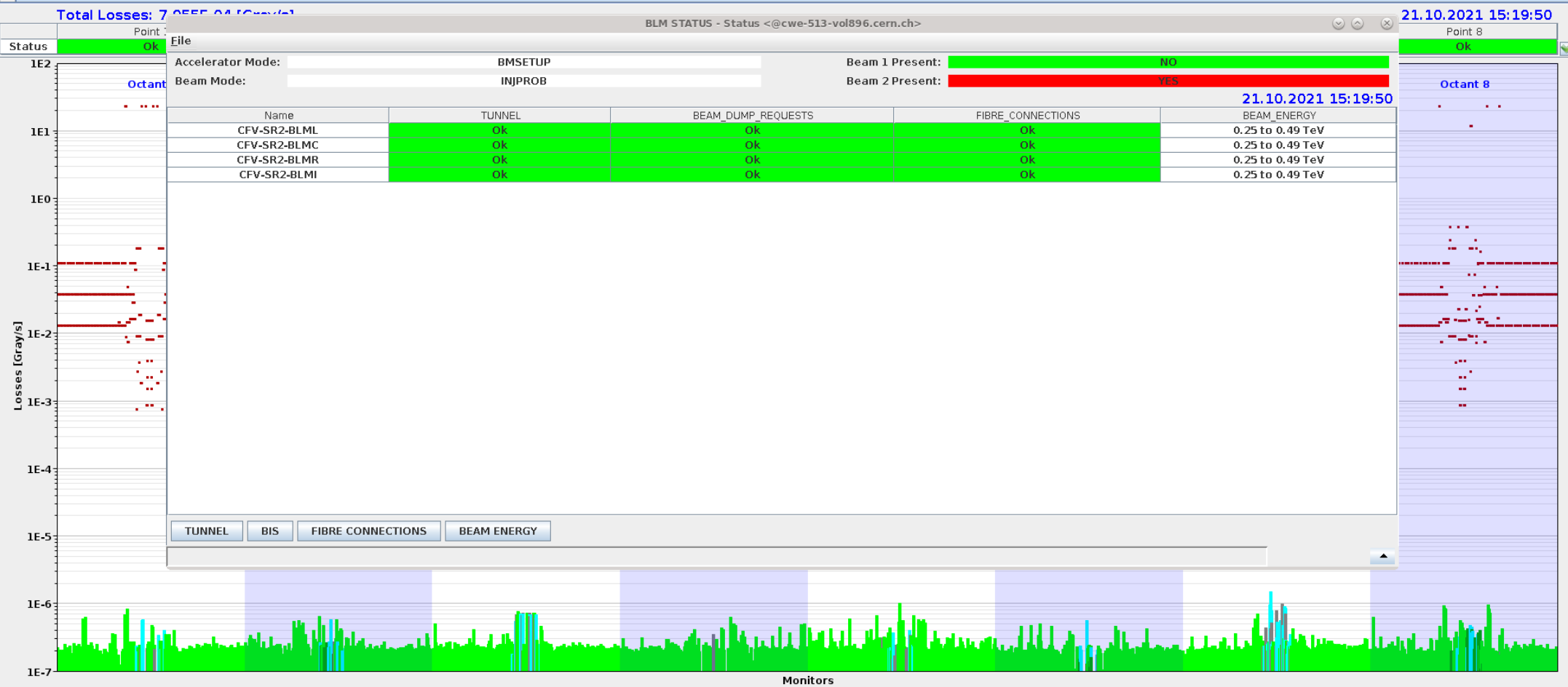
Hardware checkout

Continuous monitoring of the status of the system:
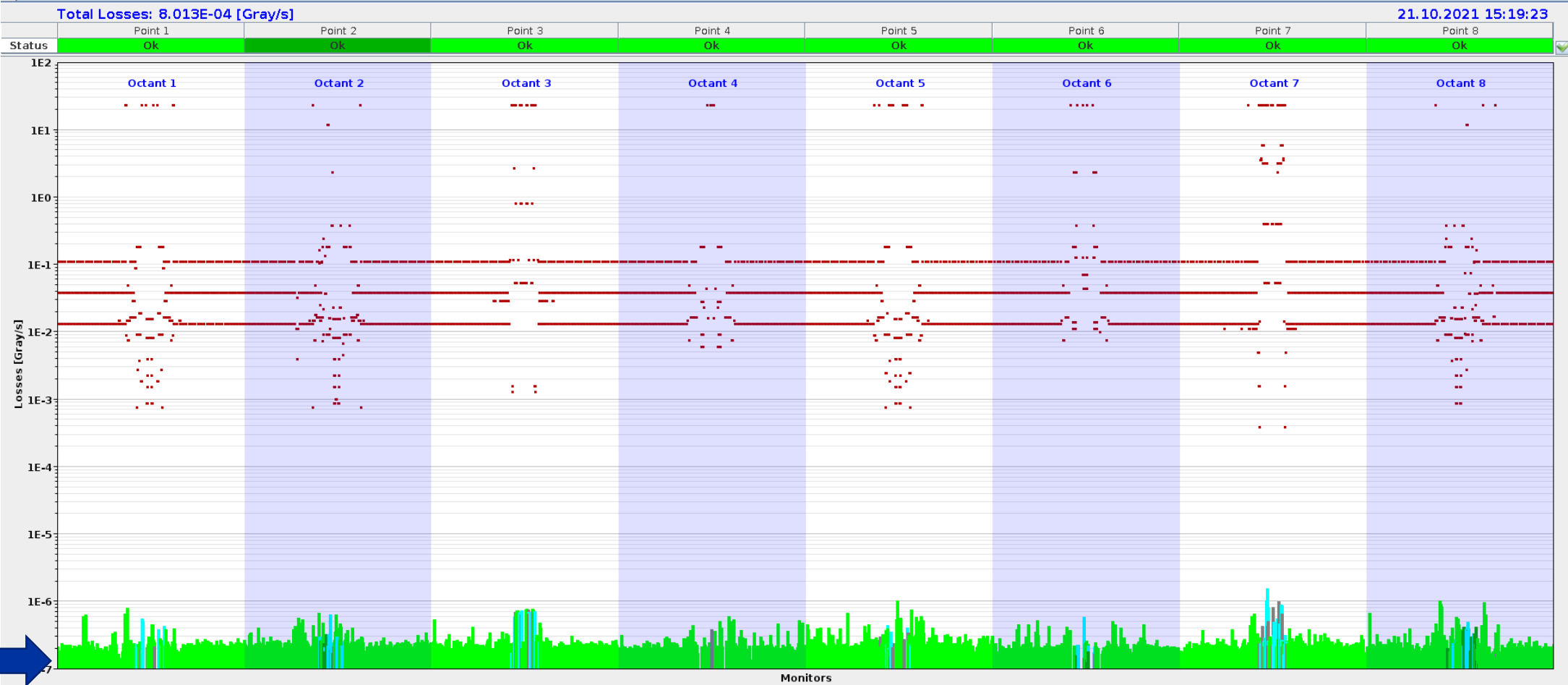

LHC BLM Fixed Display

Hardware checkout

Continuous monitoring of the status of the system:

LHC BLM Fixed Display – Not detailed information, Expert applications used for analysis

Hardware checkout

Continuous monitoring of the status of the system:

LHC BLM Fixed Display – DAC reset on all cards, lower offset levels -> Will perform noise analysis

Machine checkout

User permit transmission test:

- Done manually in the lab and in one crate without beam -> **OK**

- Majority of CIBUs checked with beam during **Beam Tests on 19th October 2021** (next slide)

Threshold values change with energy test:

- Followed energy ramp during pre-cycle night **18th-19th October 2021** -> **OK**
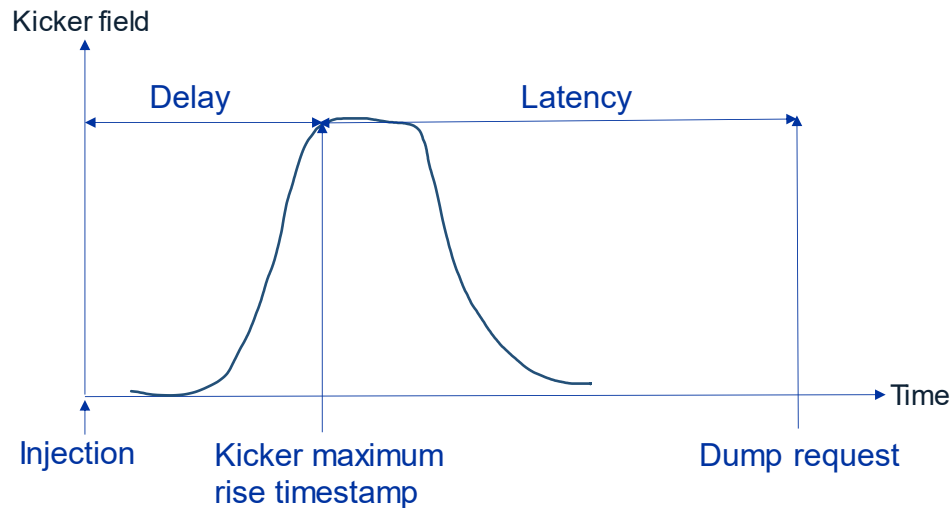
Missing HV detection and propagation to the SIS test:

- Not tested in all locations, but **OK for Pilot Run** -> Aparent HV fault in SR5.R caused some beam dumps!

- To be completed for all crates before Run 3

Beam tests

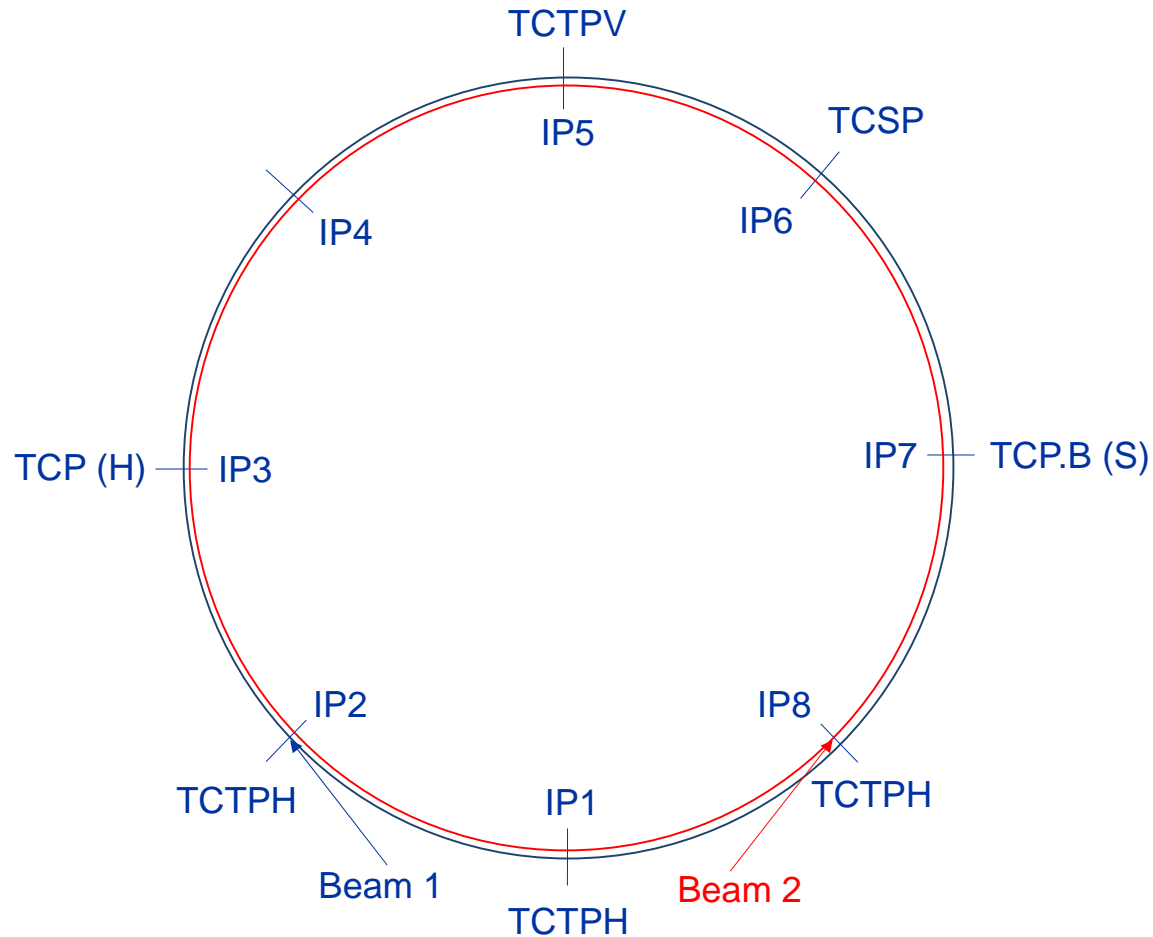Two tests performed in paralell during the **evening of 19th of October 2021**:

- **Test 1: Interlock request functionality of the BLM crates**

  - Aim to trigger all possible BLM crates

  - Collimators closed initially and opened using threading sequence by D.Mirarchi

  - Injection of pilot bunch

- **Test 2: Interlock request system latency**

Kicker field

Delay   Latency

Injection

Kicker maximum
rise timestamp

Dump request

Time

Possible to perform both tests in paralell-> Latency calculated for each triggered crate

Latency has to be below 3 LHC turns (89 μs each)

Beam tests

- Selection of collimator orientation arbitrary

- Same collimator type per point for B1 and B2

- Most dumps from central crate, maskable channels

Triggering beam dump in IP5 with B1

Beam tests

- Selection of collimator orientation arbitrary

- Same collimator type per point for B1 and B2

- Most dumps from central crate, maskable channels

Triggering beam dump in IP1 with B2

Beam tests
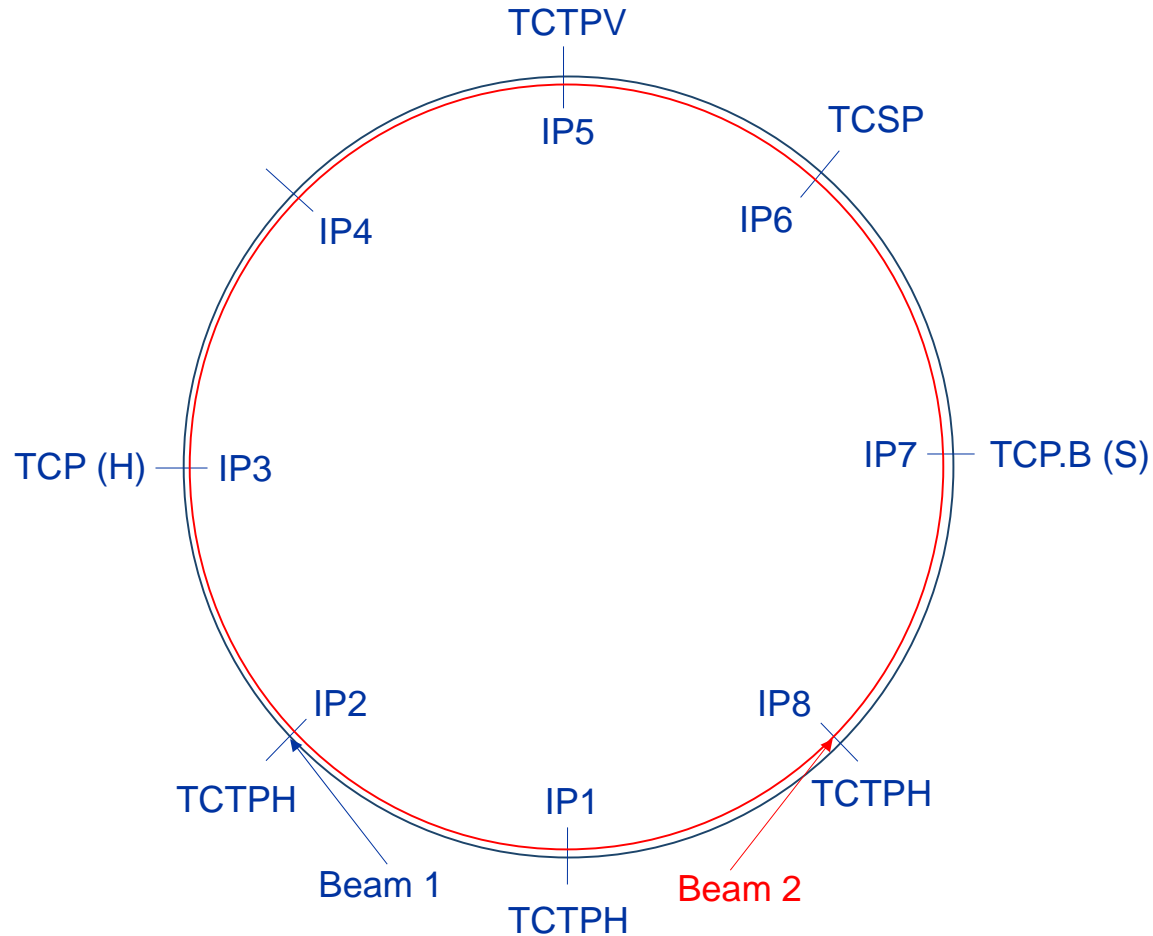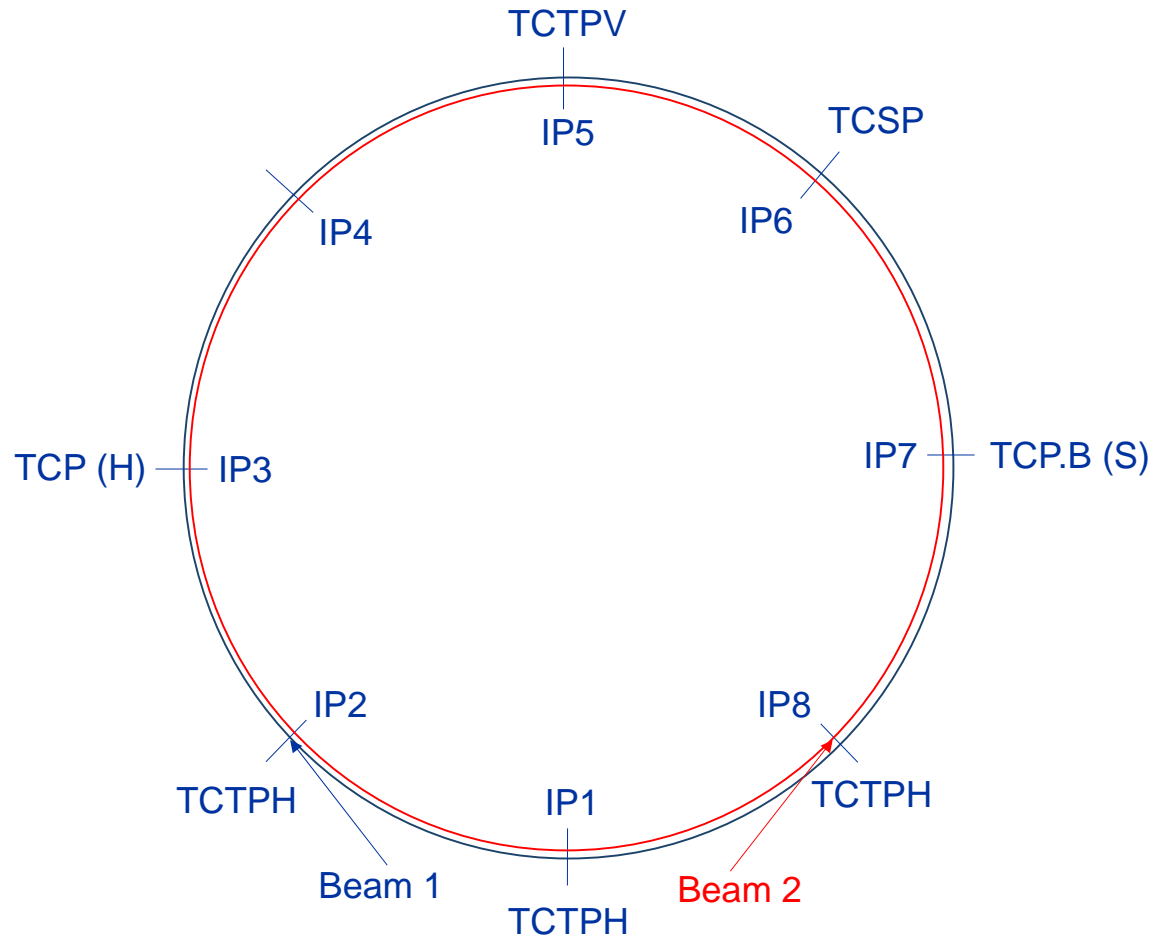

- Selection of collimator orientation arbitrary

- Same collimator type per point for B1 and B2

- Most dumps from central crate, maskable channels

BLM system latency (µs)	B1	B2	Combined
IP1	142	132	✅
IP2	74	100	✅
IP3	96	-	✅
IP4	-	-	
IP5	82	86	✅
IP6	80	69	✅
IP7	143	123	✅
IP8	105	-	✅

Includes transmission time of the signal through cabling from detectors to CIBUS -> Some km

Beam tests – To be done

Interlock request functionality of the BLETC test:

- Aims to trigger the BLM crates on longer RS by creating a local bump or approaching the beam slowly towards a collimator

- Verified that longer RS trigger a dump together with the shorter RS during Beam Tests-> **OK for Pilot Run**

- **Would like to verify that only RS > 1.3 s trigger the beam dump with an orbit bump test, as described in the procedure**
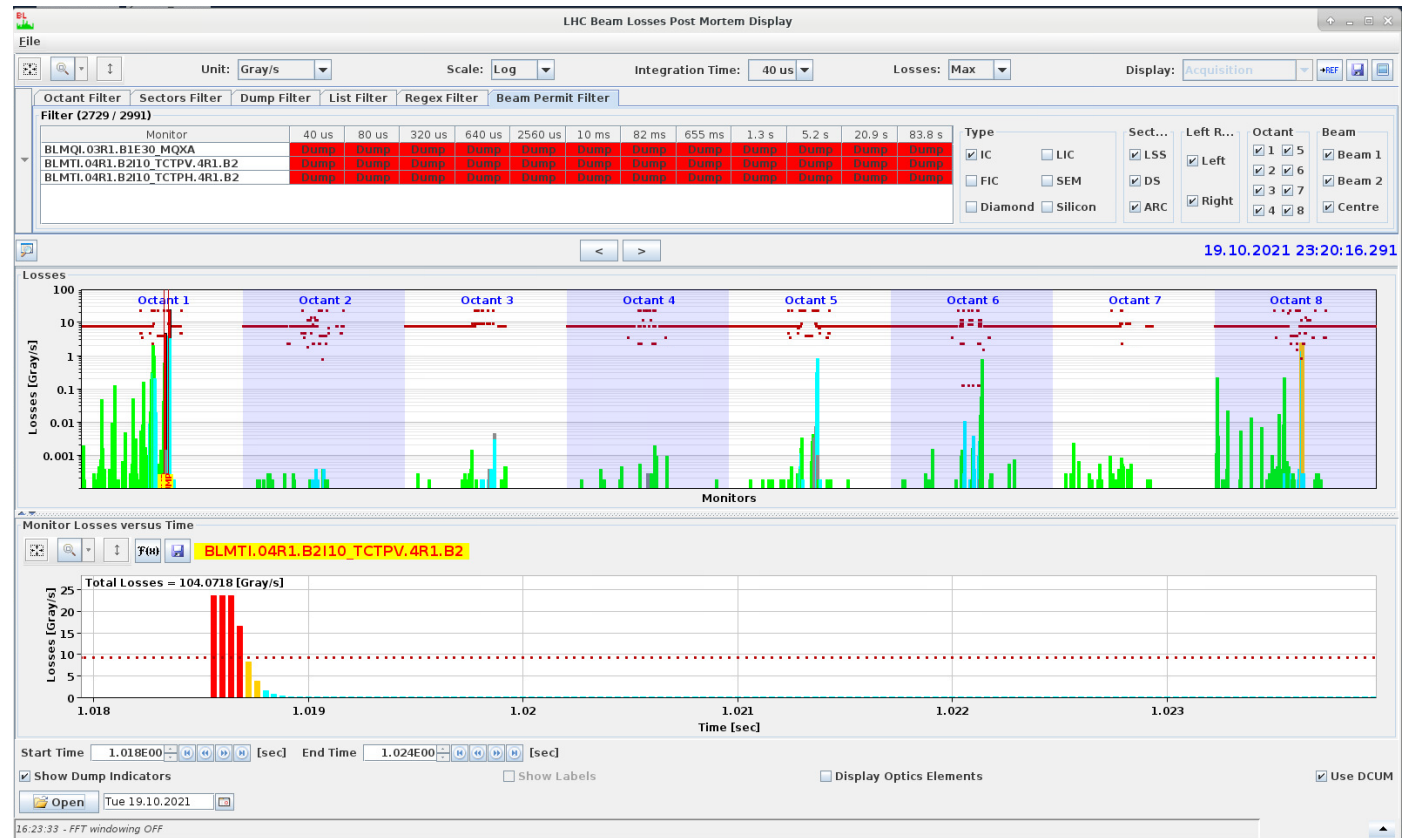
Beam tests – To be done

It was decided not to perform two beam tests before the Pilot Run:

1. **Test the interface of direct BLMs with the beam dumping system**

2. **Test the Injection Interlock Inhibit functionality**

To be done before Run 3

Issues encountered during Pilot Run

- **Noisy channels in 11R1** -> Not passing HV modulation tests, **fixed yesterday** during access

- **SR5.R crate sending SIS interlocks on HV** -> Crate seems a bit faulty, not limiting operation, but will need to be investigated and repaired **after the Pilot Run**

- **Beam dump request from all crates and both M&U outputs while beam circulates:**
  1. Device to bypass the beam info installed during LS2 in all LHC points to run tests on the system
  2. Device forgotten in IP1 and IP8 before the Pilot Run, consequences:
     1. Sanity checks expire after 24h
     2. IP1 and IP8 reading fake beam info (no beam) -> Remove the beam permit -> Dump the beam
     3. Rest of crates read updated beam info (no beam) -> Remove the beam permit

-> **Device removed from IP8, switched off in IP1 as original plug was not found -> To be done in YETS**

-> **Test to be added in the procedure to check all devices are removed before operation**