

# BCT's for beam protection

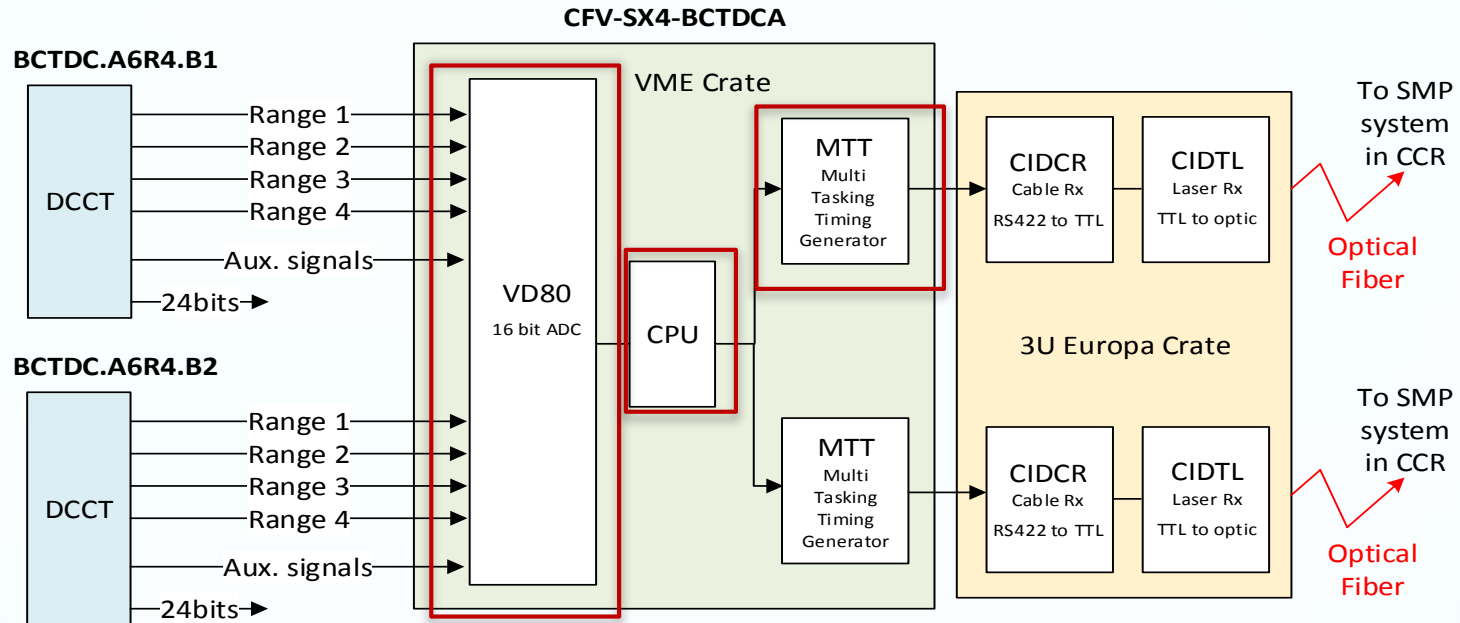
L. Søyby

On behalf of D. Belohrad, L. Jensen and P. Odier

# Outline

- **DCCTs**
  - LS1 upgrades and status
  - SBF
- **BCCM (FBCT)**
  - LS1 installations and present status
  - First results
- **Summary**

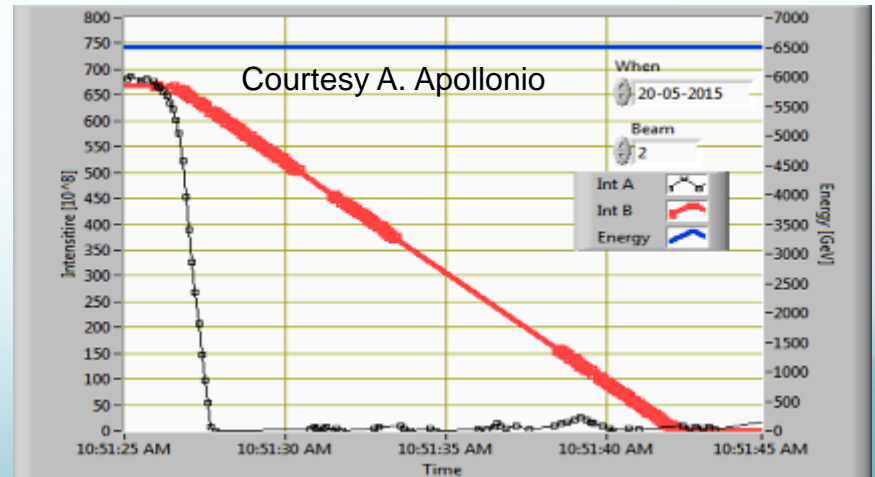
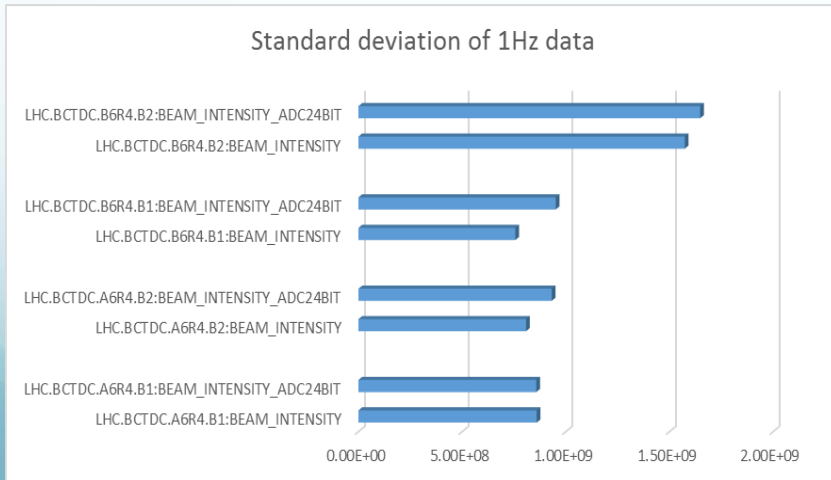
# DCCT upgrades and status



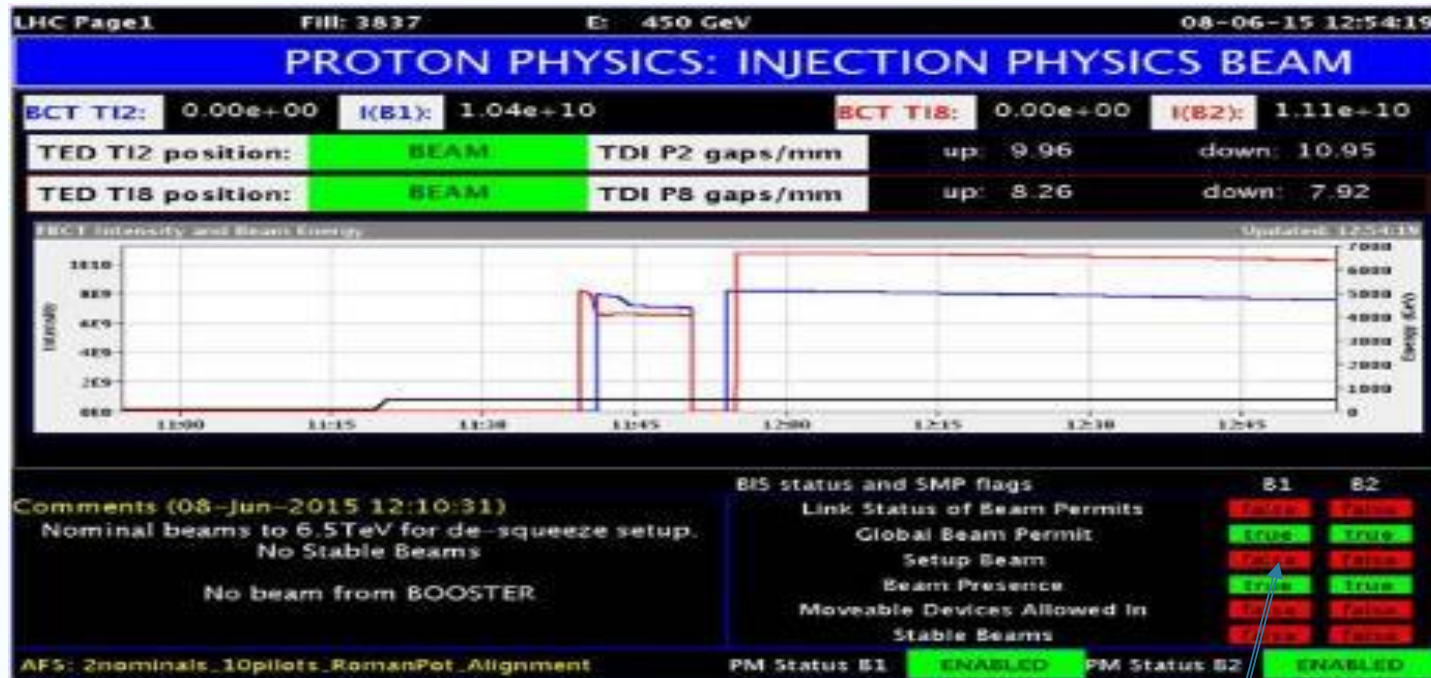
- New CPU and FESA class
- New ADC: VD80
- MTT module driver update by BE-CO
- Fibers to CCR modified
- MPS changes on receiving end as well
- Good collaboration between, CO, MP, and BI to solve all issues.

# DCCT upgrades and status

- System B Beam 2 is twice more noisy than 3 other DCCTs. But still within 1% of one nominal bunch.
- P. Odier will try to improve during TS1.
- But only hysteresis can cure the problem of flickering of the SBF.
- M. Ludwig increased averaging from 1s to e.g.16s from 500GeV, implemented. Only active on system B B2.



# DCCT SBF

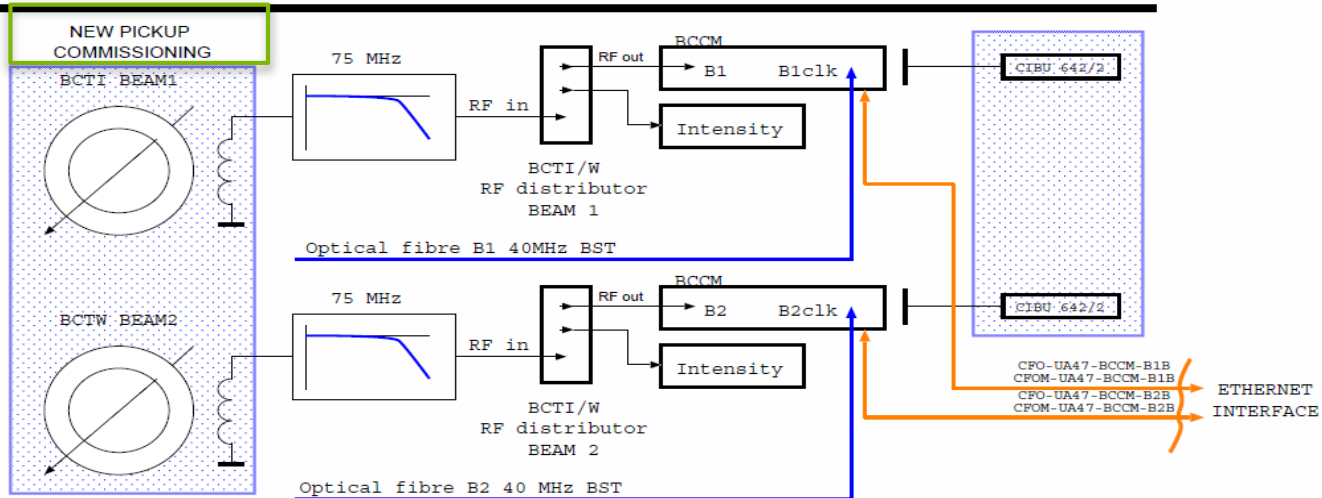
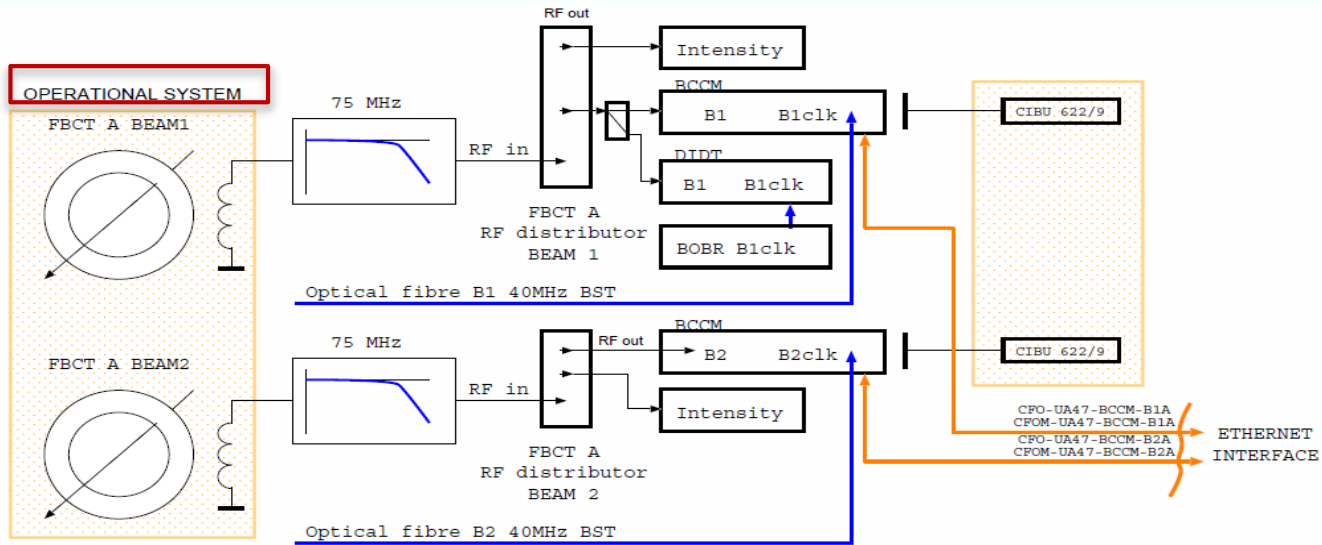


- System operational
- SBF “false” has on some occasions created beam dumps, even though intensity was safe.
- Status on VISTAR “False” with low intensity, not clear to BI why.
- To diagnostic SBF errors, logging in Timber (SBF, mode (e.g. forced), intensity.) is a must. [This is a request](#) 😊

# SBF reliability

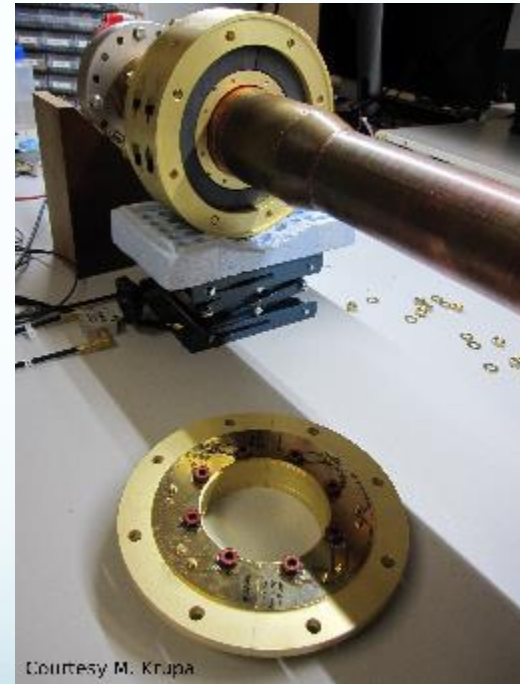
- BI writes intensity (22bits with a few verifications) into MTT driver (CO responsibility). From there on responsibility is unclear for me.
- BUT...Wrong scaling factors (FESA variables) and offset values (sequencer) will give wrong intensity and as consequence a wrong SBF.
- Currently mitigated by use of redundant system – SBF derived from highest intensity from 2 separate DCCT's
- Short term improvement:
  - Scaling factor hard coded in SW, but still need to read and correct offset
- Long term solution (specifications needed!)
  - DCCT 24 bit system (BI VFC) with FPGA and direct fiber link to MPS.
    - Implemented once the 24 bit system has been qualified (front-end in radiation area)
    - Offset variations to be logged during the year ( $\sim 5E9$ ). Can they be hard coded to zero in firmware?
  - Completely different hardware as e.g. beam presence flag?

# BCCM



# BCCM status

- 4 units installed during LS1
- Bunch and orbit clock, energy from BST fiber
- CIBU links commissioned
- Operational system (A)
- Development system (B)
  - ICT, Beam1 and BCTW, Beam2
- New stable firmware
- Realistic thresholds set to since 8/6-2015
- New FESA class, still not 100% operational
  - Data analysis and logging in Timber
- QT based Python scripts used to evaluate performance



Courtesy M. Krupa

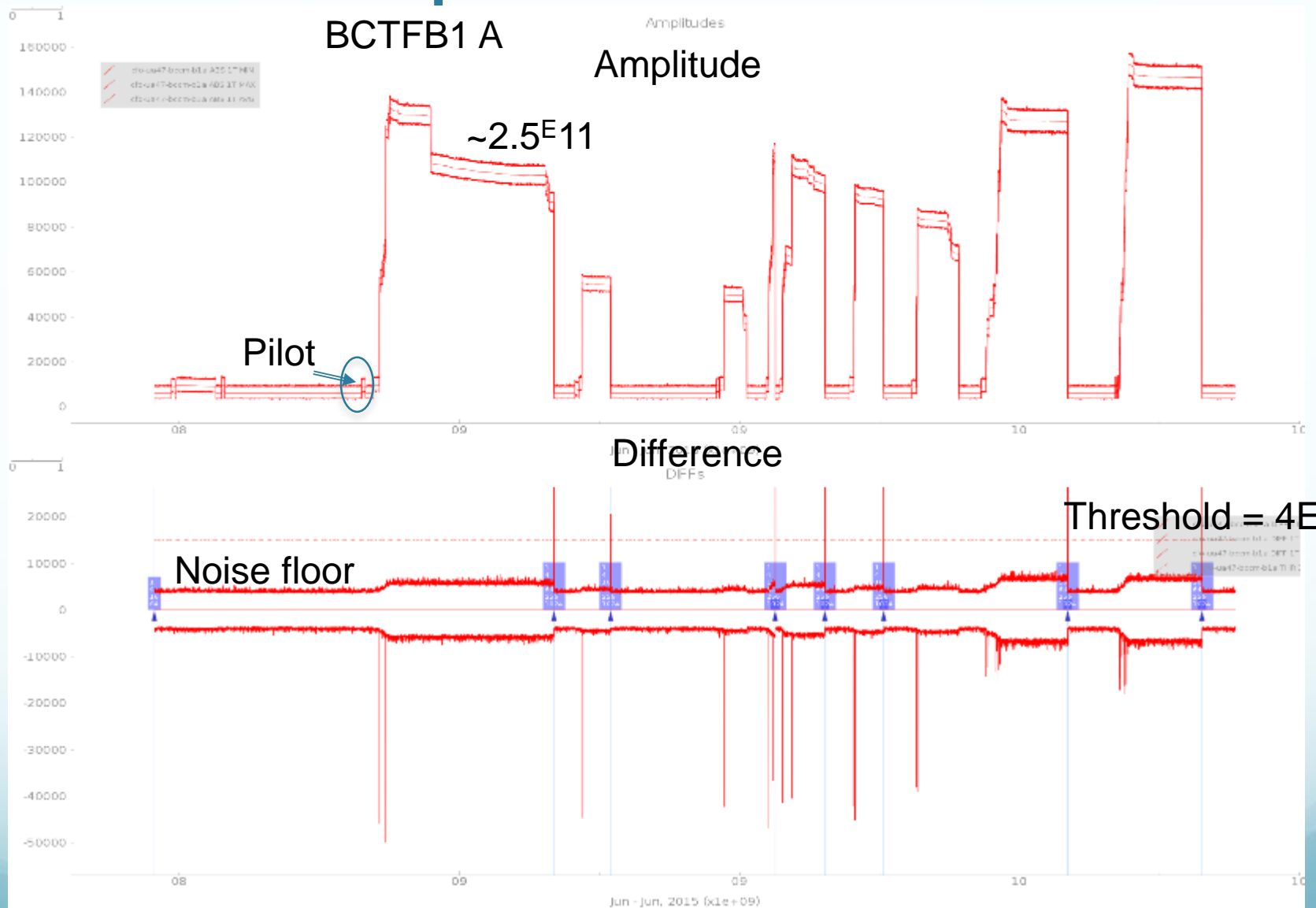


# BCCM status

Since beginning of Run 2 the 6 loss windows were set very high. Since Monday reduced to more realistic values and can be further decreased.

Window [T]	Noise floor [Bits]	Scale [Ch/Bit]	Threshold [Bit]	Threshold [Ch]	WC Threshold [Ch]
1	4000	2.11E6	15000	3.2E10	4E10
4	8000	5.59E5	30000	1.9E10	2.1E10
16	12000	1.46E5	60000	8.8E9	1.1E10
64	25000	3.65E4	100000	3.7E9	4.6E9
256	40000	8.63E3	200000	1.7E9	2.1E9
1024	90000	2.2E3	600000	1.3E9	1.5E9

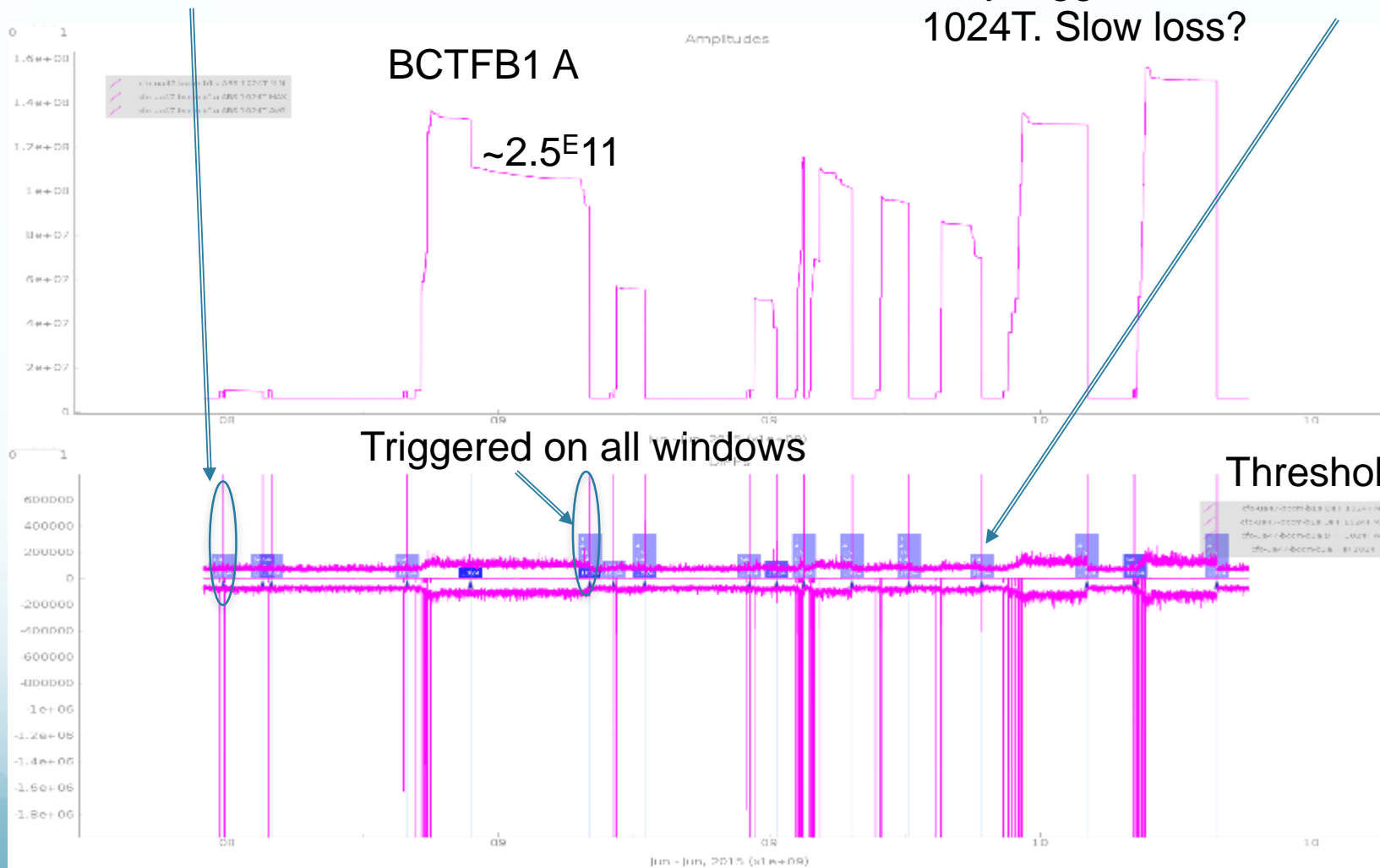
# BCCM performance 1T



# BCCM performance 1024T

Pilot only triggered on 64,256 and 1024T

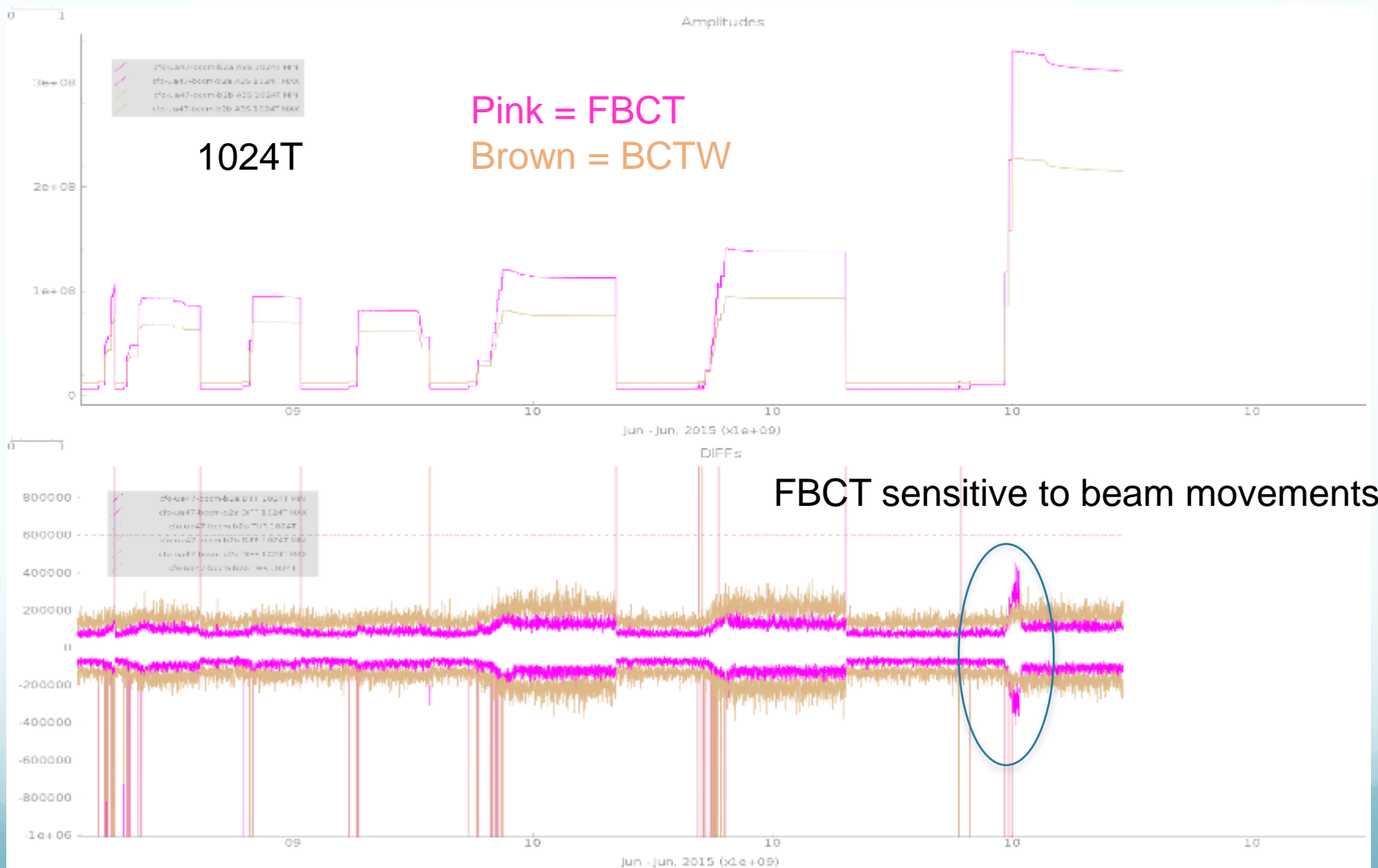
Only triggered on 64,256 and 1024T. Slow loss?



# FBCT / BCTI performance



# FBCT / BCTW performance



# Summary

- **DCCT SBF**

- System B2, 2 times more noisy, P. Odier will try to reduce.
- **SBF: Not clear to BI why it goes unsafe at low intensity.**
- Need diagnostics: SBF, mode, received intensity.
- **SBF SIL level is low: Scaling factors, offsets**
- For new system: specifications are needed.

- **BCCM**

- Thresholds set to reasonable values, can be lowered.
- **System is “stable” and detects beam dumps/losses correctly, TBC.**
- FESA class will be operational after TS1, very important for commissioning.
- **The system will not be “operational” after TS1, but the complete system (FESA + hardware) is in its final configuration.**
- We therefore propose to monitor the system “operationally” but without active interlocks until mid August (return of HW expert).
- **Depending on the results we can then make them active.**