

BCCM: status and commissioning plans

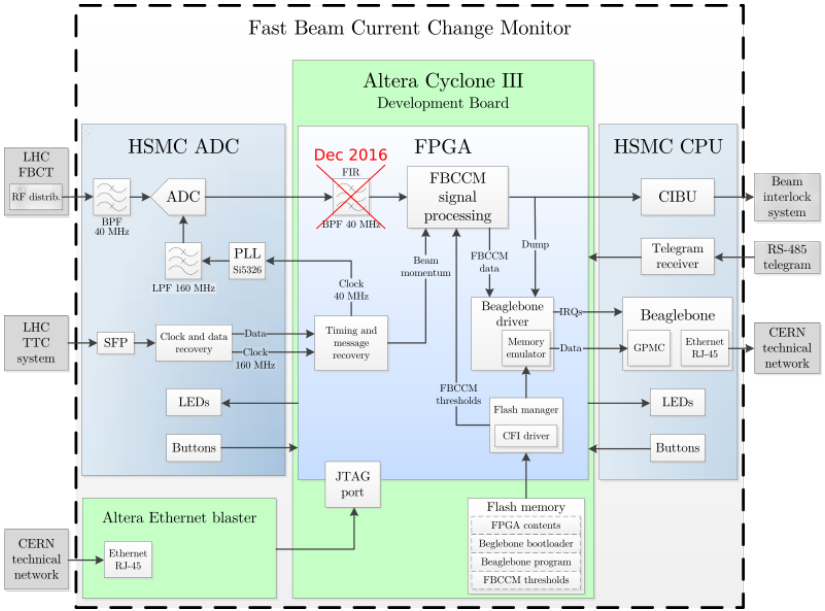
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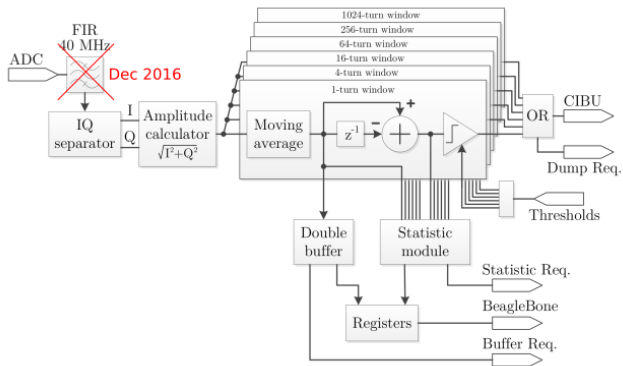
BCCM



Functional description



Algorithm



Changes in BCCM before EYETS

- ▶ system installed and measured during 2016 LHC run with only minor modifications in the firmware
- ▶ **last important algorithm modification:** Beg. December 2016 removed the FIR filter:
 - ▶ the system's response is faster as the FIR latency (108 bunch slots) is not present
 - ▶ algorithm reacts faster on changes during ramp
 - ▶ FIR-less design surprisingly leads to lower system noise when comparing DIFF amplitudes

The effect is still not fully understood.

The used FIR filter is generated by Altera, algorithm is not known as it uses lots of optimisation techniques. Analysis in progress.

Changes during EYETS

- ▶ What concerns the BCCM hardware - no changes
- ▶ Significant changes in the analogue front end:

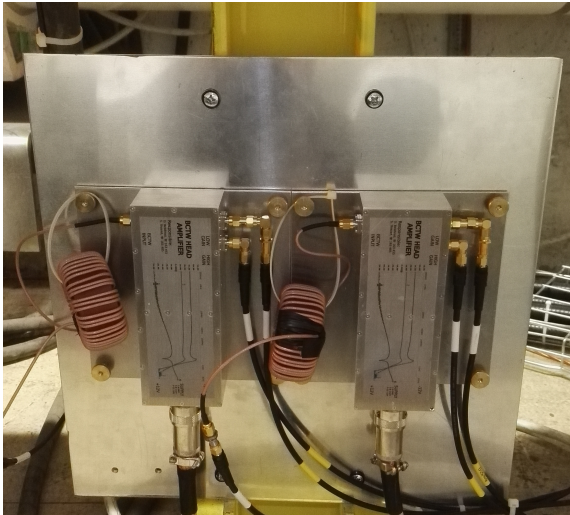
Changes during EYETS

- ▶ What concerns the BCCM hardware - **no changes**
- ▶ Significant changes in the analogue front end:
 - ▶ Installation of the last BCTW to the development beam 1:



Changes during EYETS

- ▶ What concerns the BCCM hardware - no changes
- ▶ Significant changes in the analogue front end:
 - ▶ Installation of the new head amplifiers to all 4 devices:



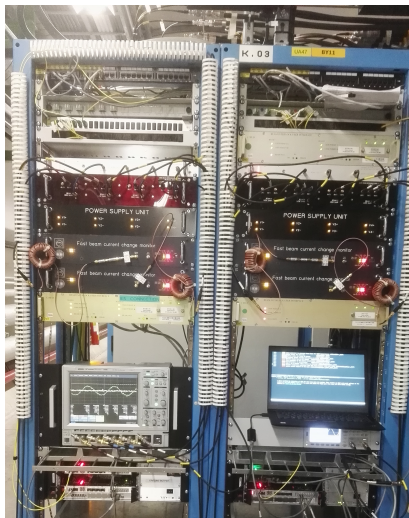
Changes during EYETS

- ▶ What concerns the BCCM hardware - **no changes**
- ▶ Significant changes in the analogue front end:
 - ▶ Verification and replacement of **all** the cables, as it turned out that some of them were not properly done
 - ▶ All cables measured using VNA



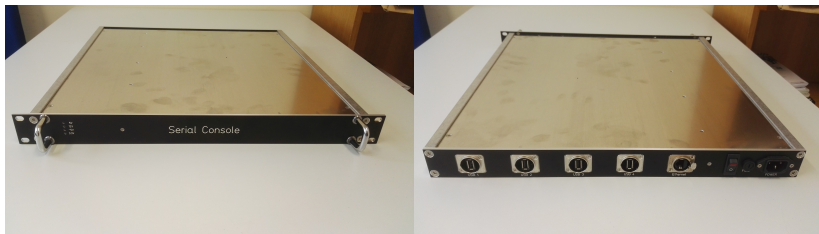
Changes during EYETS

- ▶ What concerns the BCCM hardware - no changes
- ▶ Significant changes in the analogue front end:
 - ▶ Complete removal of the old analogue measurements



Changes during EYETS

- ▶ What concerns the BCCM hardware - **no changes**
- ▶ Significant changes in the analogue front end:
 - ▶ Installation of a serial console to get more BCCM debugging data



Tests already performed

- ▶ All systems were again tested for broken ADC bits
- ▶ Visually verified CIBU links by invoking the BCCM test mode
- ▶ Verified whether the BCCMs noise floor is comparable between BCCMs
- ▶ Injected of 5MHz sine wave into BCTW calibration and observed the results on BCCMs to see whether the calibration propagates through the measurement chain
- ▶ Performed injection-dump tests by injecting the LHC pattern into the head amplifiers
- ▶ Performed dump tests - injection of 5MHz sine wave for 10 seconds and verification whether BCCMs dumped

BCCM dump tests will be again turned on to debug FESA logging

Pre-commissioning phase

The **input signal amplitudes for the BCCMs have to be again set-up**: during EYETS we have completely modified analogue chain and re-shuffled the system gains, hence following scenario will take a place:

- ▶ turn off the thresholds for the start-up
- ▶ when first pilot and nominal is injected: measurement of the system gain, entering machine to remove the attenuators.
 - ▶ pilot already gives decent estimation of required gain
 - ▶ fine tuning with ultimate
- ▶ set again the thresholds using newly measured gains.

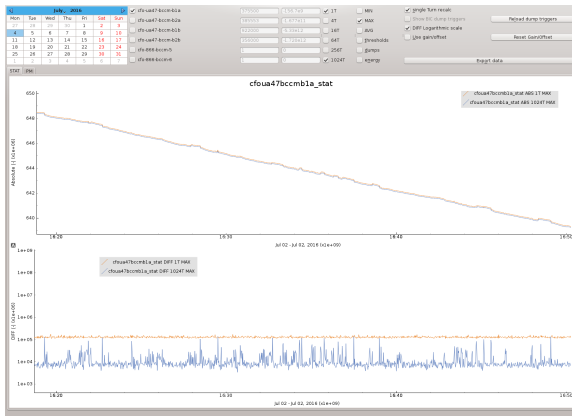
Commissioning

1. bunch amplitudes checks:
 - ▶ single nominal does not saturate ADC.
 - ▶ 5+ nominals do not saturate ADC
2. setting the thresholds, then long-term check of dumping:
 - ▶ each non-scraping dump event must be followed by generation of the dump from given BCCM (automatic script)
3. scraping:
 - ▶ 5 nominals at injection, 5 different loss rates until the beam is gone
 - ▶ 3 nominals at flat-top, 5 different loss rates until the beam is gone
 - ▶ can we do a total loss in in 10 seconds intervals, say 10-60 seconds? (10 seconds creates roughly 7 measurement points)
4. injection of single bunch of various intensities:
 - ▶ can we do 5 different intensities to check the linearity of the system?
5. changing the bunch lengths:
 - ▶ injection of a single nominal, changing its length

Position dependency is not needed as it was already verified

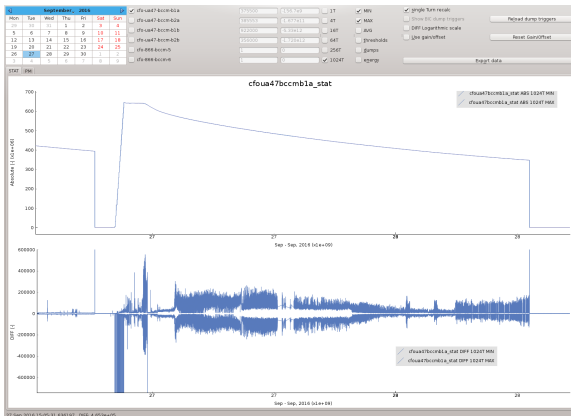
Open issues

- ▶ None of the EYETS works directly affected the BCCMs, but the analogue signal path was completely changed
- ▶ Replacement of the cables could solve the issue of 0.1% jumps, which we have measured the most of the 2016 run



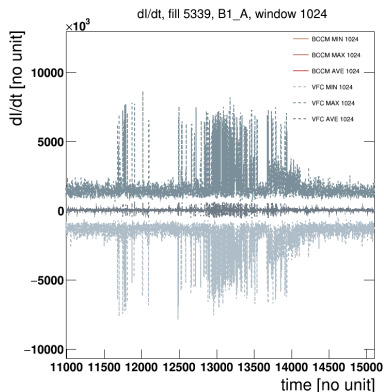
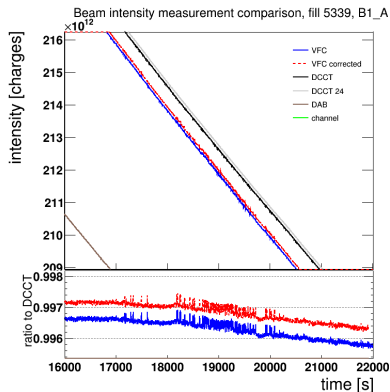
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Open issues

FESA is still not stable - hangs after few days of operation. Works in progress there.

Understanding FIR behaviour

Jumps in the signal amplitude: difficult one, appears during special conditions, during EYETS stability tests nothing revealed

That's it

Thank you for your attention