Hcal phase I upgrade irradiation test



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DESY CMS uTCA Meeting – Oct 27th 2015



The CHARM facility

Beam Parameters

Parameter	Value
Proton beam momentum [GeV/c]	24
Maximum flux per PS spill	5 10 ¹¹
Maximum # spills per super-cycle	6
Duration of super-cycle [s]	45.6
Maximum # protons per second	6.7 10 ¹⁰
Maximum number of days per year	200
Assumed efficiency	90%
Maximum number of super-cycles per year	340,000
Maximum number of protons per year	1.0 10 ¹⁸
Minimum spot size [mm RMS]	~5 x 5

Charm is located on the beam line T8 @CERN East Hall in bld. 157 It uses the 24GeV proton beam from the PS

3 different targets to have different radiation levels: Aluminum with holes, Aluminum, copper.







The Charm Facility







Charm irradiation test: dry run

- On Wed 14th Tugba had the chance to see the irradiation area while the previous group was mounting its equipment.
- On Wed 14th and Thu 15th Ozgur, Tugba and Tullio configured most of the HF teststand for the dry run (no radiation).
- ✓ QIE cards arrived at CERN on Thu 15th and they were tested in 904.
- On Friday 16th Ozgur explained me what was done till that moment and in the afternoon he left.
- Tugba and I tested the system for the whole weekend.
- Don and Nadja arrived on Sunday.
- We got QIE cards on Monday and we had one day to understand how to use the uHTR and finalize the setup.
- By 8pm on Tue 20th the whole system was tested and at that time we unplugged all cables and we left the cable-holder chain in the buffer zone for the facility staff to bring it in the radiation area the day after.

Yanchu and I configured scripts for initialization, logging and monitoring of the HF system TANZA | Hcal Phase I upgrade irradiation test – DESY CMS uTCA Meeting | Oct 27th 2015 | Page 4



Power supplies

computer used for configuration and monitoring

Backend crate:1 FC7, 2 uHTR, 1 Fast control emulator board



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Cable-holder chain

Patch pannel





HE Readout box



HE backplane





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Rack in its final position





Radiation dose, neutron and charged hadrons fluence

- Don and I were in charge for planning the target changes, hence deciding the dose and fluence profiles
 - We reached 1.5Gy, estimated integrated dose for HF when 3000fb⁻¹ will be collected with one day of running without target
 - Few Cycles mede of 2 hours Cu and 1 hour AI with holes were used to stress the system and then check it (1 hour of Cu gives ~ 2.5Gy)
 - Operation at night and during the weekend with AI with holes
 - From Mon 25th we are running only with Cu, to bring the system to the maximum radiation dose it can bare, which is a valuable information for the upcoming design of HB electronics (No beam since Tue 27th 4:18 due to a problem at LINAC)



Short report of the observations we made

- ✓ FC7 → ngCCM communication always reliable, prbs error counters increased few (1 or 2) times per day with bursts
- From Sunday afternoon until Monday morning (in a run with Al with holes target), ngCCM gave some IPBUS errors that were not understood. Eg. get HF1-VIN_voltage_f -> ERROR!! I2C: IPBUSBAD Power cycling (turning off and on HF power supply) did not solve the problem immediately. The problem was solved with a power cycle on Monday morning while there was no target (almost no radiation)
- Issue related to bad data and BC0 bad align of QIEs were solved
 - Reinitialization of the data links: few times (~5) per day
 - FE Backplane reset: 1 or 2 times per day
 - FE Backplane power enable $1 \rightarrow 0 \rightarrow 1$: 1 or 2 times per day
- HF power supply had to be reset once, it is not clear what happened





- The irradiation test has been very successful so far.
- Only minor and transient issues showed up, which were recovered with a simple reinitialization, a reset or, in the most sever cases, a power cycle.
- HF and HE electronics were proved to reliably work far beyond their expected operational range.
- Yesterday's and today's data collected with copper target (the highest radiation dose) are going to give valuable information for the design of HB electronics.
- On site and remote support from DESY was well visible and I think highly appreciated.
- We are currently preparing a report of the irradiation test in which we will be have more quantitative observations and we will interpret data.



