



Backward EMC Update



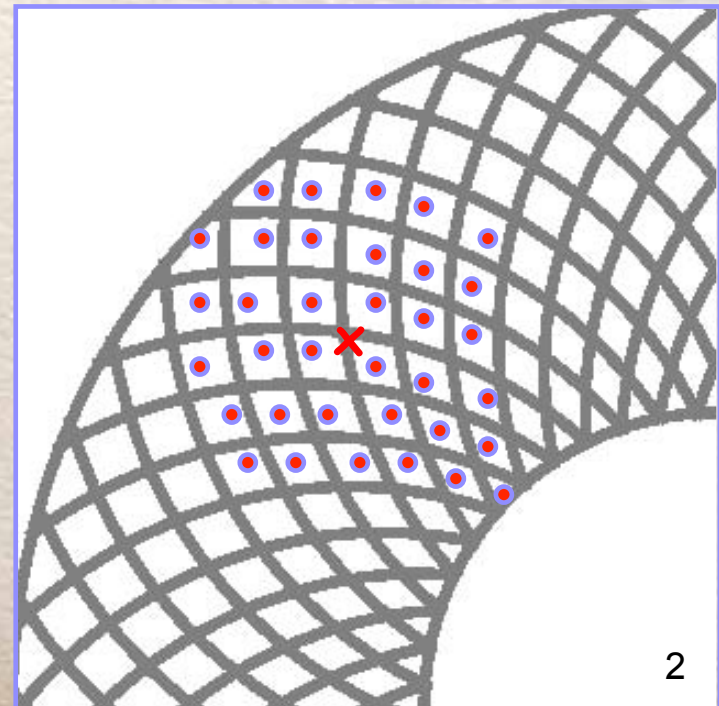
G. Eigen, Bergen

SuperB meeting, Frascati 21-03 2012

Introduction



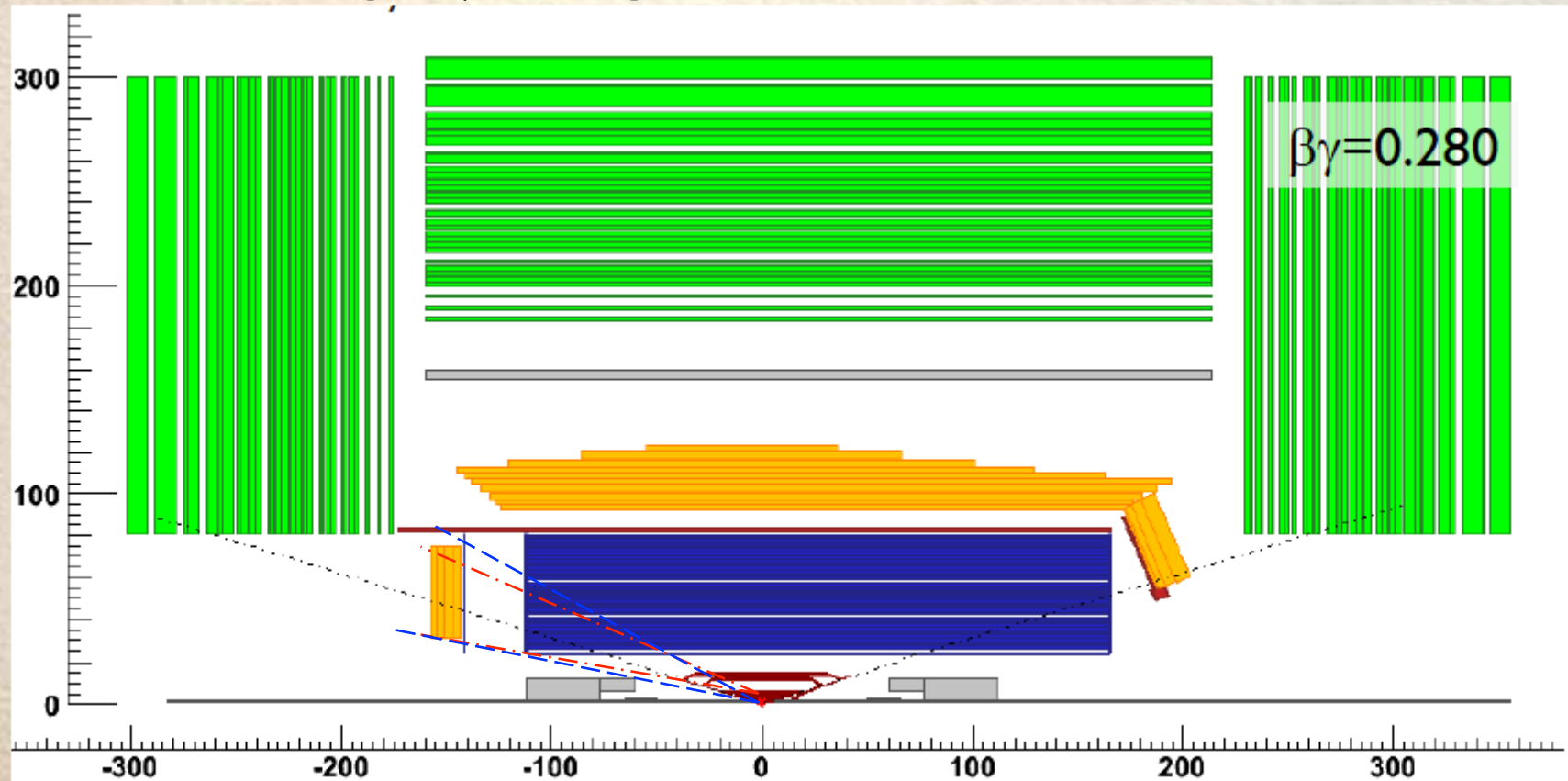
- The backward EMC prototype consists of 24-layers of Pb plates and scintillator strips → full depth is $12 X_0$
- Pb plates are 2.8 mm thick ring segments
- Scintillator strips are 3 mm thick left-handed spirals, right-handed spirals radial segments that alternate eight times
- 6 strips per layer will be read out
strip sizes vary from 4.1 cm at the inner rim to 9.8 cm at the outer rim
→ total of 144 readout channels
- Each scintillator strip is read out with a Y11 WLS fiber positioned in a groove in the center of the strip and coupled to an MPPC at the outer rim



Angular Coverage



- Full coverage in lab (CM) frame: 231 (218) mr to 463 (432) mr
- Partial coverage in lab (CM) frame: 204 (190) mr to 517 (482) mr
- Gap to barrel in lab frame: 517 mr to 694 mr
→ increase coverage by moving closer towards drift chamber



Status of Spiral Strip Production



- While the 48 radial strips are being tested, the saga with the production of the 96 spiral strips continues
- The DESY option is complicated and expensive → looks not feasible
- My application for the prototype work (€20k) from the Meltzer fond of the University was rejected, → I have no resources to outsource the strip production in Bergen
- Discussions with a CERN engineer recommended by Lucie Linssen
 - His machine is too small to do the job
 - Big CERN machine shops charge (\$\$\$)
- The best option still is to the job in the machine shop in Bergen
 - Thus, I have discussed the issue again with the chief engineer who suggested that this job could serve as a pilot project to learn how to operate the computer-controlled milling machine
- I hope this is the final word on strip production now



Manpower Issues



- We just received our next 4-year contract (3 months late)
- We suffered a severe cut, so at the moment is not clear how to hire the postdoc and to operate non CERN activities
 - this is the reason why I had to cancel my trip to Frascati
- Steinar Stapnes still considers to hire the postdoc for 2 years via CERN, paid by $\frac{1}{4}$ from NFR, $\frac{1}{4}$ from EU and $\frac{1}{2}$ from CERN
 - postdoc has to work $\frac{1}{2}$ time at CERN
 - position needs to be advertised in Norway with selection committee
 - try to find a qualified person in SuperB as Marcello suggested
- Hire technical PhD student jointly with CERN this year
 - need to find other candidates as Justas wants to remain in Bergen
- Justas is good candidate for PhD position I am promised from university later this year



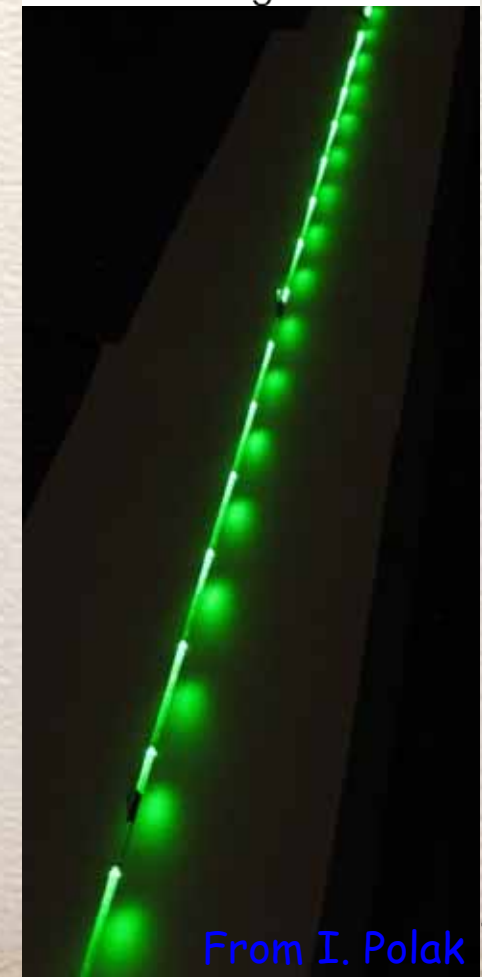
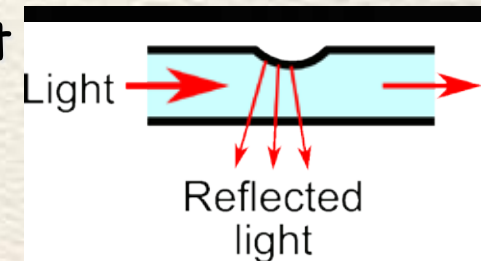
Near-term Activities

- My Chinese master student, Zhou Zhuo, built a couple of preamps and learned to operate LabView
- We plan to test the preamps Thursday, due to EMC meetings today
- Next, we retrieve the test station and characterize all 48 radial strips covering top and bottom faces with Tyvec sheets, sides with Teflon, leave air gap between fiber and MPPC
 - measure absolute light of MIP with a ^{90}Sr
 - measure light uniformity vs length with an LED
 - measure light uniformity vs width with an LED
 - measure light yield with MPPC glues to fiber
 - test performance w/wo preamp to decide if we should produce 144 preamps
- Once first spiral strip is produced we will test it

Calibration System



- In the last SuperB meeting I presented a new concept for the calibration system using notched fibers
- This concept looks very promising (see results)
 - it has advanced to one of the baseline designs for the calibration system of the AHCAL
- For the backward EMC, we can illuminate all strips in one row with 2 fibers each having 13 notches
 - use notch spacing of 12 mm
- Couple 4 fibers to one LED to illuminate 2 rows
 - need 96 ~20cm long fibers,
 - need 24 LEDs and 24 PIN photodiode
- Fibers are routed at outer EMC radius
 - fibers can be nearly straight
 - four fibers can be closely mounted
 - calibration boards are mounted on back plate



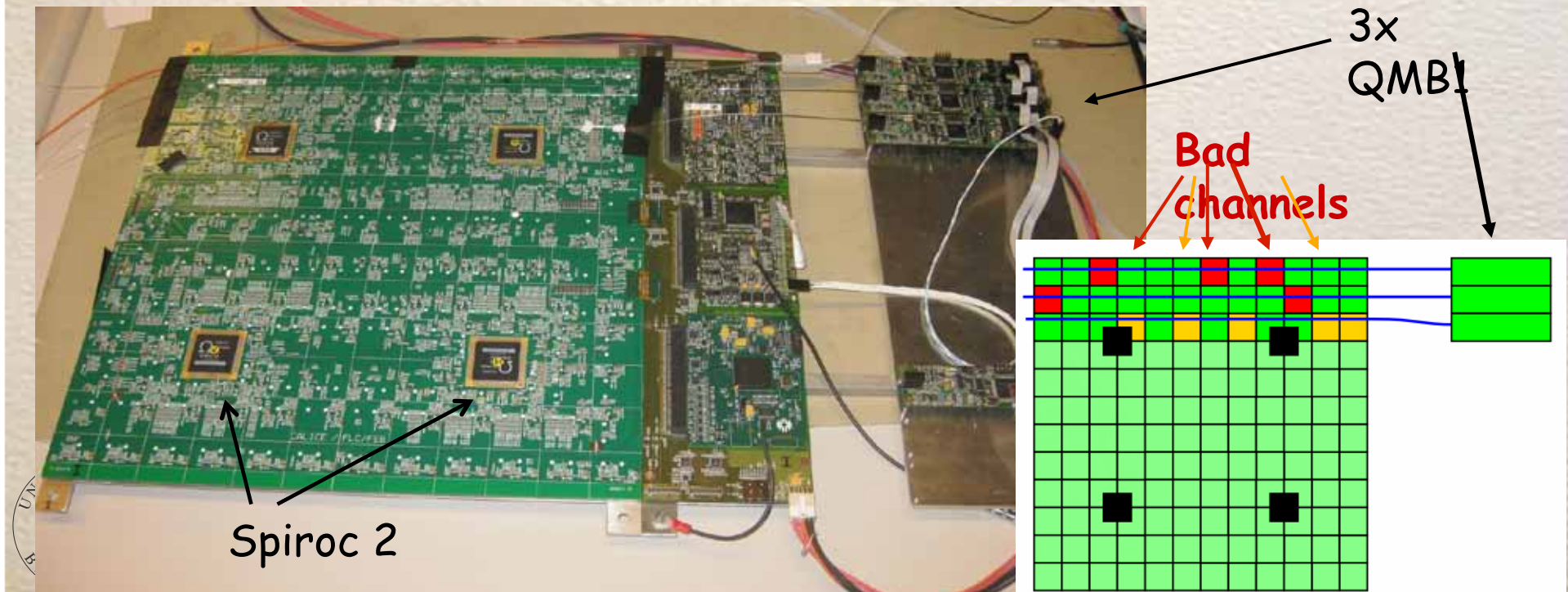
From I. Polak



Test of Notched Fibers



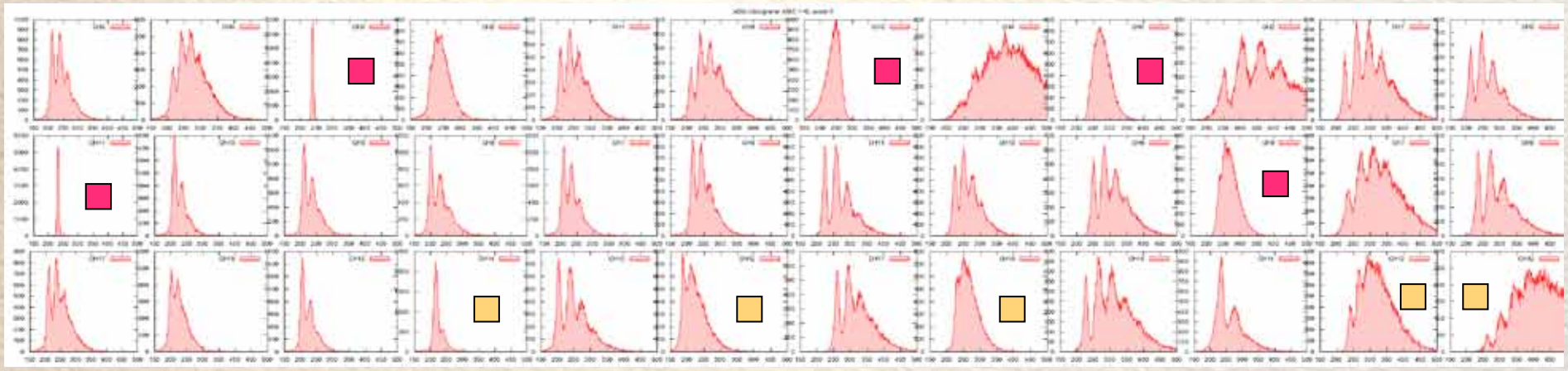
- Prague colleagues tested concept of notched fibers using technical AHCAL prototype
- Place 3 fibers with 12 notches on 3 rows of 12 tiles read out with SiPM
- Use 3 especially designed boards (quasi-resonant main boards) that contain LED, PIN photodiode, trigger electronics, T&V monitoring (size: 3 cm x 14 cm)



Notched Fiber Test Results

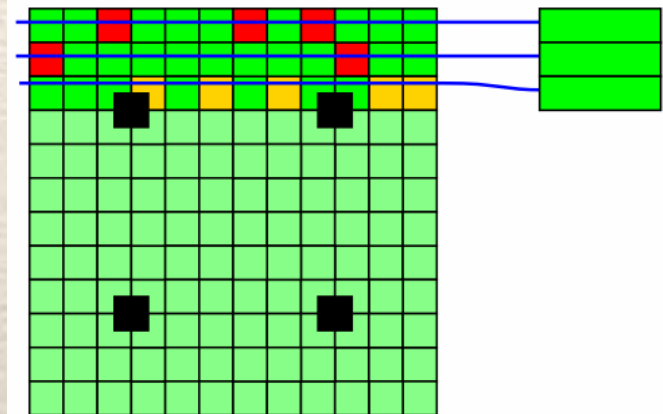
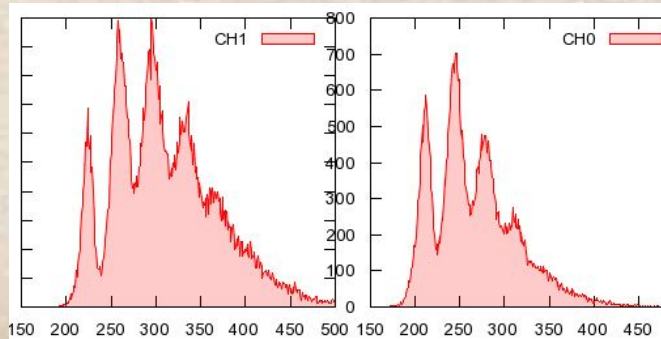


- Measure single photoelectron spectra



- Encounter 10 bad channels out of 36 (problem with new 2011 batch of Russian scintillators)

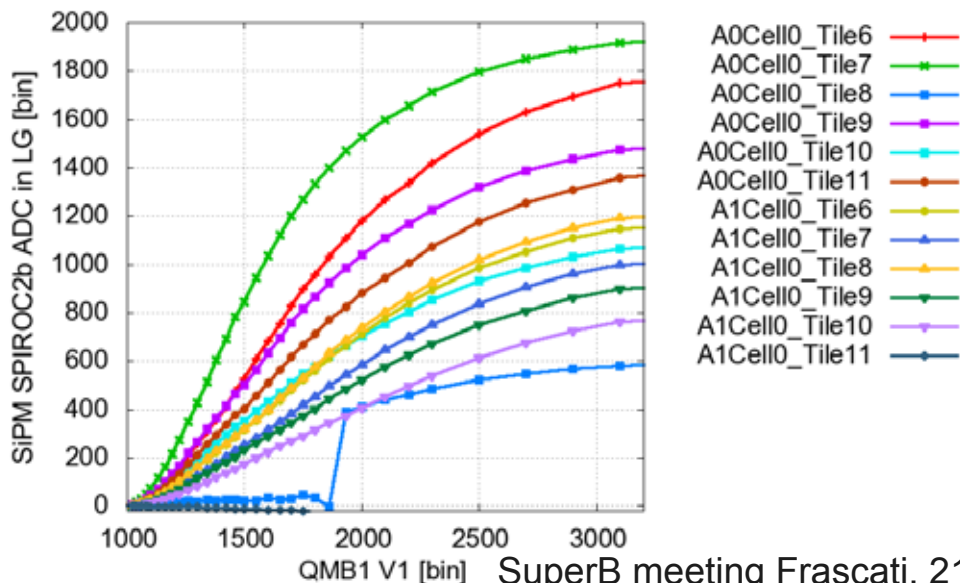
- Two best spectra from 2011 batch of scintillators



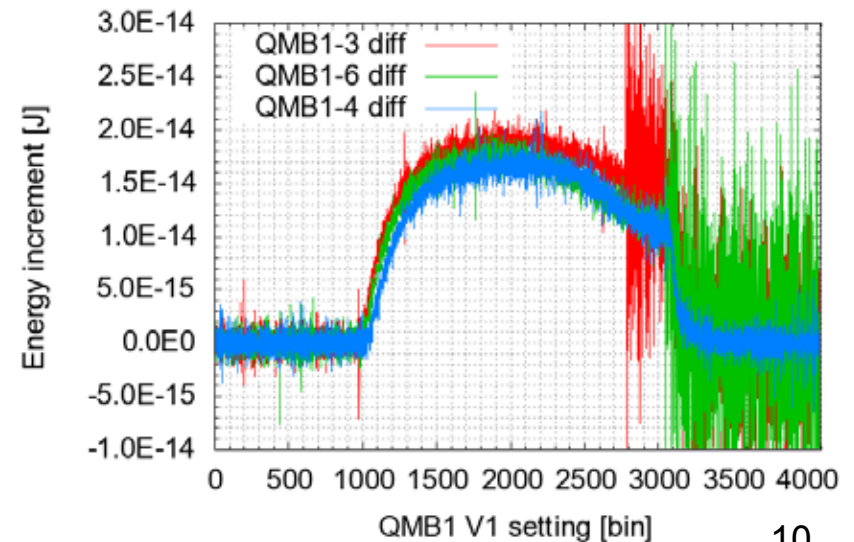
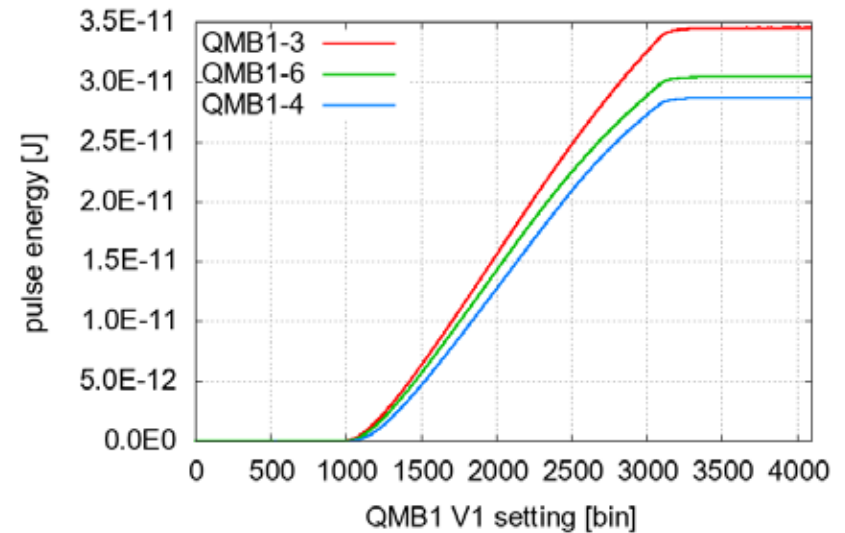
QMB Linearity and Uniformity Test



- QMBs operated with fiber are linear
 - Nonlinearity is $< 0.1\%$
- Perform linear scan of 12 SiPMs
- See one bad response curve \rightarrow fixing
- 6 QMBs are produced so far
- Try to implement this concept into prototype (need 3 QMBs for 6 strips)



Output optical power vs V1 setting, QMB1, optical fibre 7m in length, 1mm in diameter,



TDR Status

- The backward EMC part in the TDR is nearly 100% complete
- Since December meeting basically all sections have been completed
 - Improvements on physics results
 - Solid angle, transition to barrel
 - Calorimeter construction
 - Supply and services
 - Backward simulation
 - Performance in simulations
 - Use for particle identification
- Only missing section: "discussion of task force conclusions"
- All sections have been edited for coherent text
- Missing figures and references were added
 - May need additional references
 - Signal/background ratio for sl tags in $B \rightarrow K \nu \bar{\nu}$ is missing



Missing Components

- Reflector sheets for strip top and bottom faces
- White reflector for strip sides
- 30m Y11 fiber
- Thermo sensors
- 2 new calibration boards (QRB) from Prague
- 3 boards with SPIROC 2 ASICs from Orsay
- Produce the preamps (?)

Conclusions

- The radial strip production hopefully is done in Bergen starting soon
- Master student starts to do useful measurements
- Still deal with man power issues
 - The postdoc hiring is still up in the air
 - aim to hire SuperB physicist
 - Lucie Linssen still promises to hire a technical PhD student jointly with Bergen
 - Urgently need new collaborators
- Concept of notched fibers looks very promising
 - simplifies the calibration system tremendously
- Backward EMC part in the TDR is nearly complete
 - Last touches will be done in the next few days