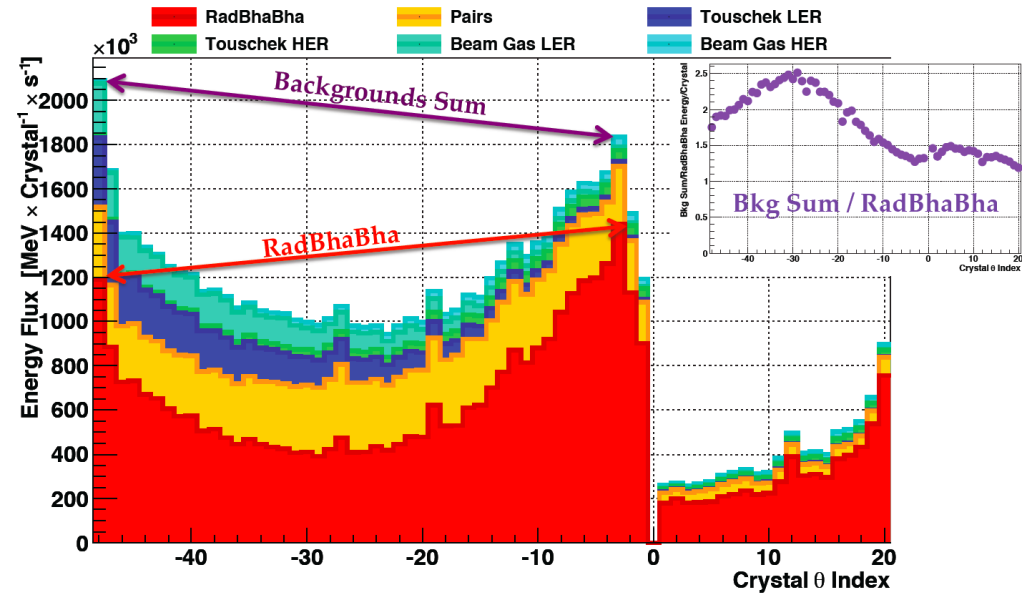
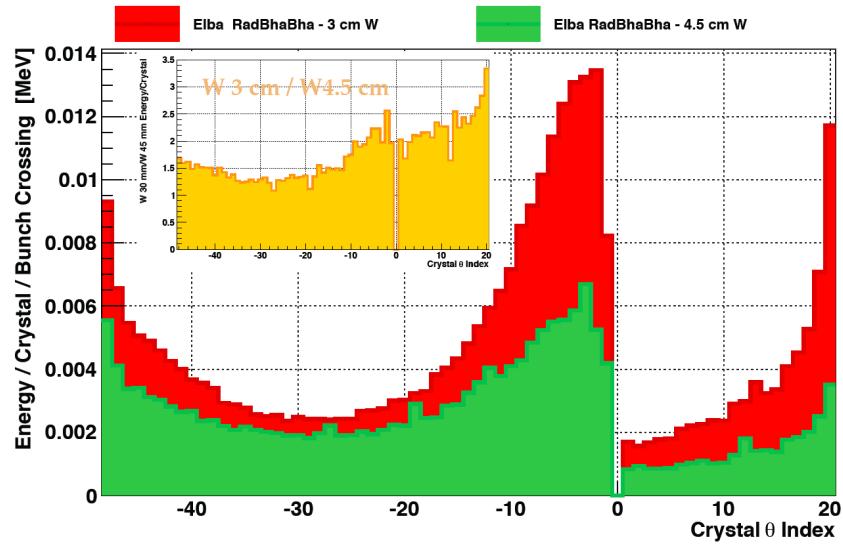




EMC SUMMARY

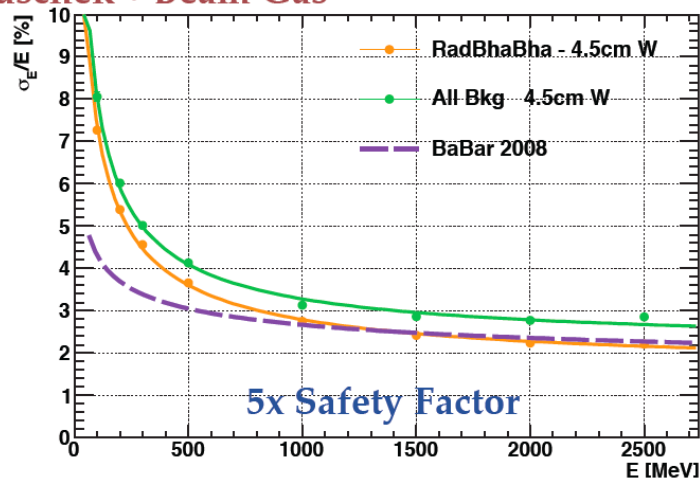
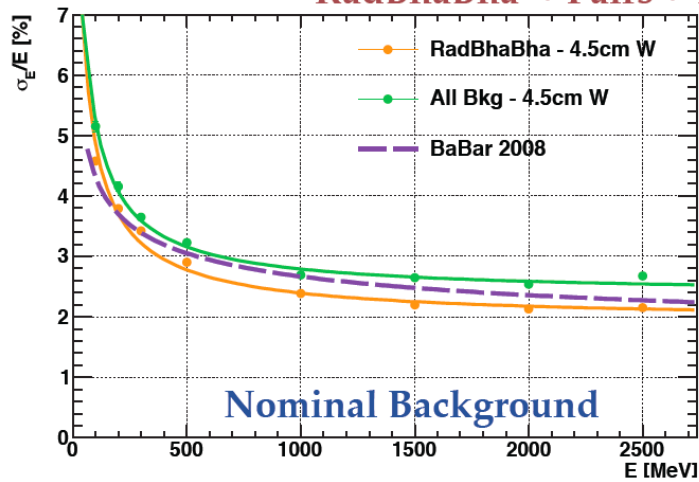
**Claudia Cecchi & Frank Porter
FOR THE EMC GROUP**

June 4th 2011



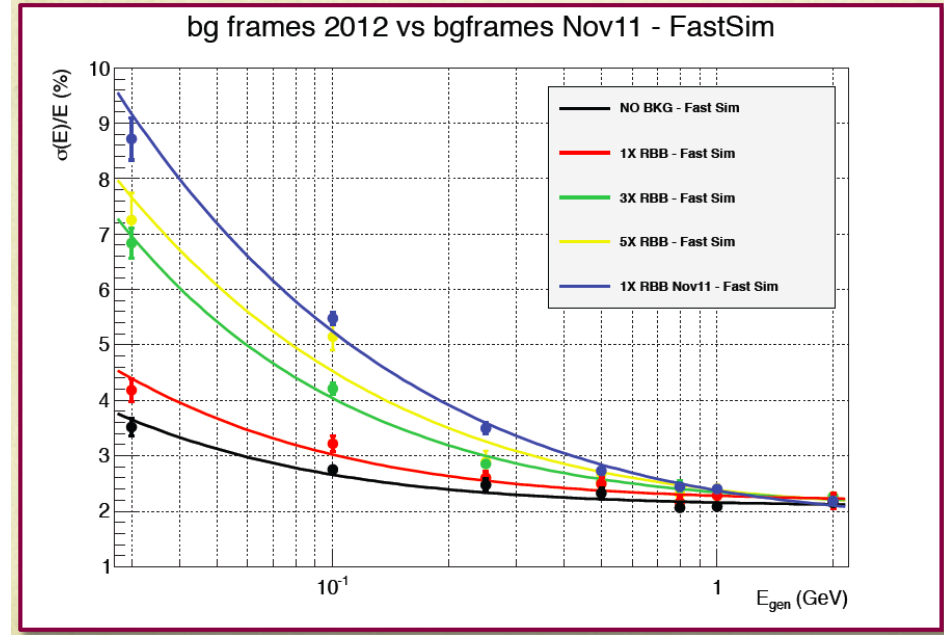
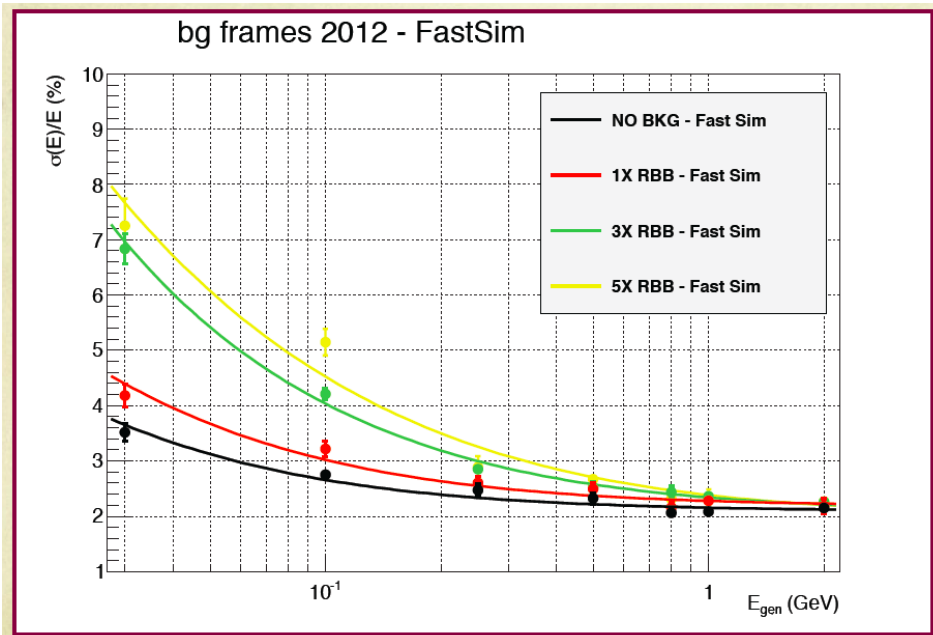
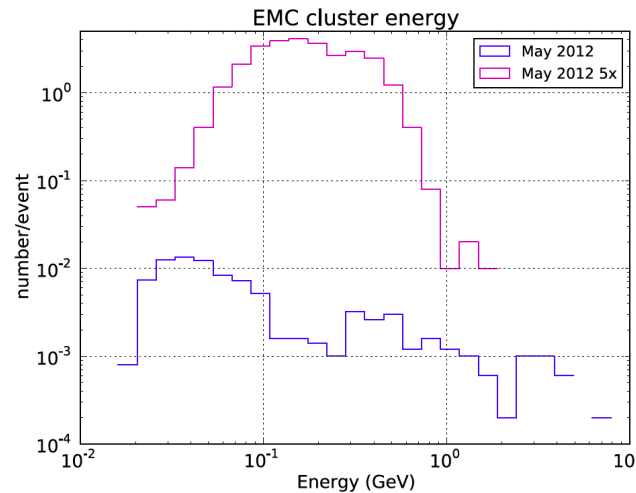
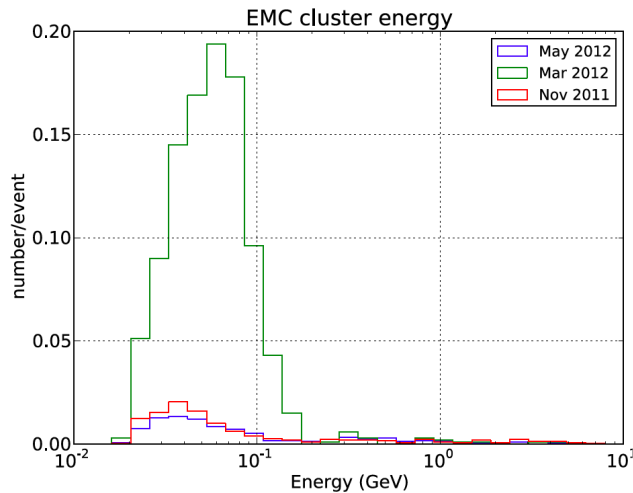
Barrel vs Bkg

RadBhaBha + Pairs + Touschek + Beam Gas

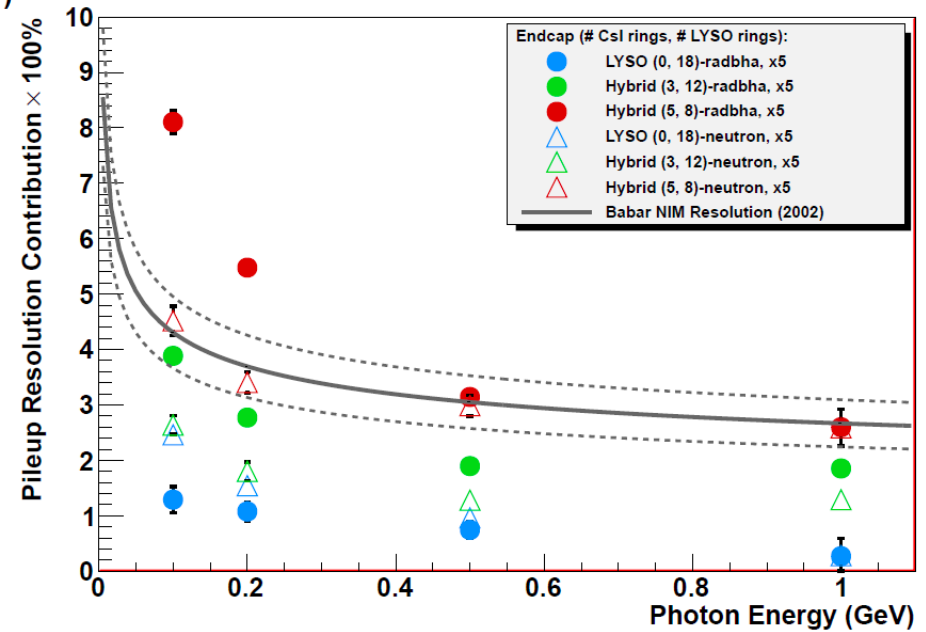
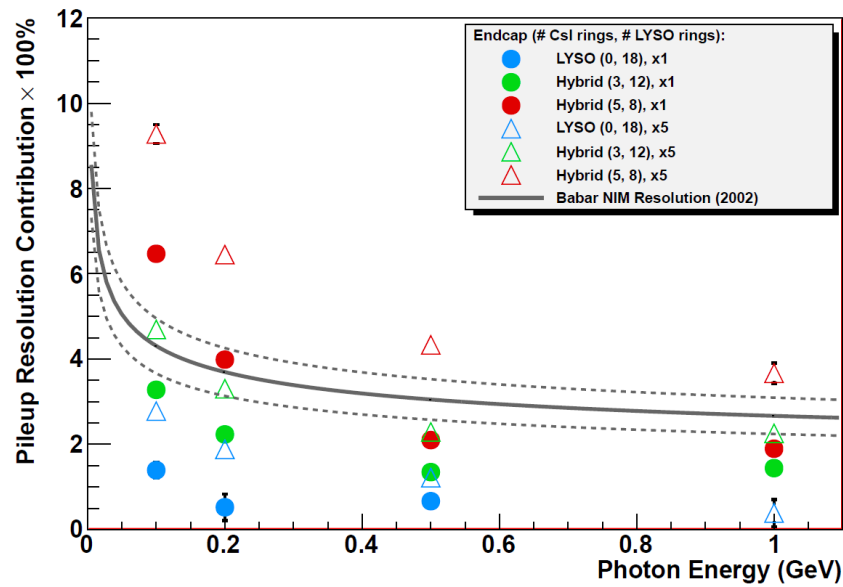
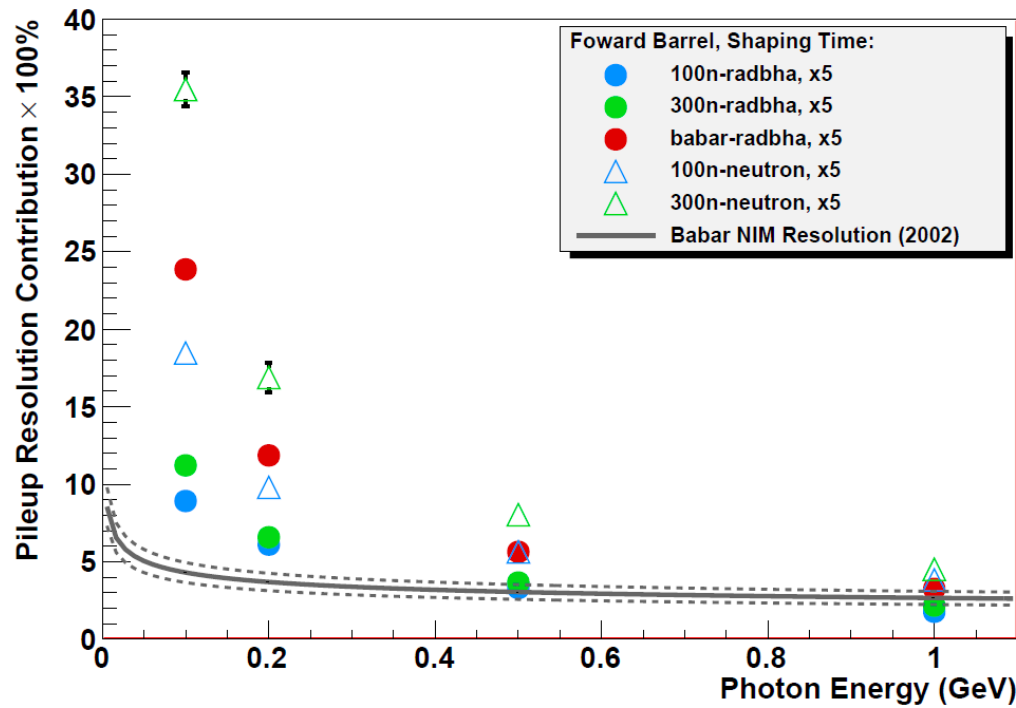


- Shoot neutrinos; count EMC clusters. There is less than 1 cluster (above 20 MeV) per event at nominal bkg, but more than 100x higher at 5x background.

New shielding reduced photon energy flux by $\sim 4x$; neutron flux by $\sim 30\%$ in barrel and $\sim 20\%$ in forward. Background clusters that pass physics selection ($>20\text{MeV}$) are rare at nominal background ($\ll 1$ per event), but grows non-linearly at higher background; more than 2 orders of magnitude at 5x background.



BARREL: dominant contribution from neutrons



A lot of work is going on at SLAC for D&D activities

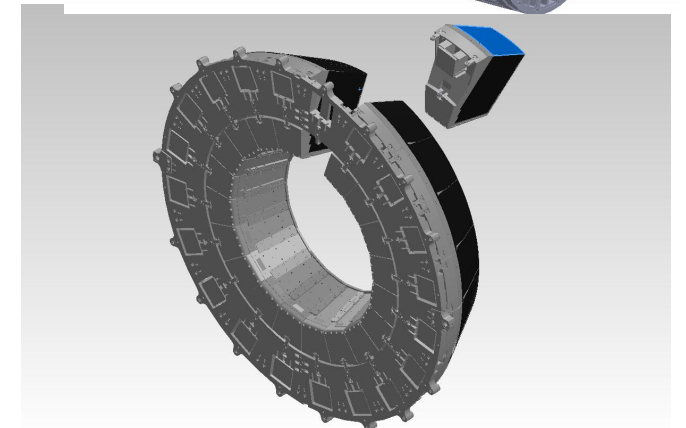
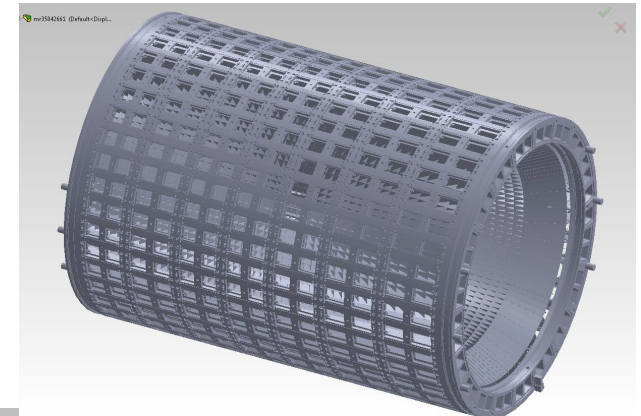
- Request was made by KF (Kevin Flood) on 26 May 2012 to WJW for two spare Endcap modules currently stored at SLAC
- **Module 21**: a reserve module in perfect condition, but without crystals + preamp package
- **Module 23**: a damaged module, with several crystal cells compromised by a missing corner of the carbon fiber honeycomb

WILL BE SENT to CALTECH and then to ITALY for MECHANICS study

BARREL 3D model: SO (Shawn Osier) is going through the ED model piece-by-piece, matching all pre-existing pieces to drawings, and refining/replacing existing pieces where applicable, and creating new pieces where there are gaps

Endcap 3d model is also available

- This model, also originally by ED, seems complete but has not been systematically matched item-by-item to the drawings
- Spot checks reveal no anomalies
- SO has recently added carbon fiber honeycomb structures
- Sent to Roma1 team several weeks ago





KF is currently providing close liasion with SLAC



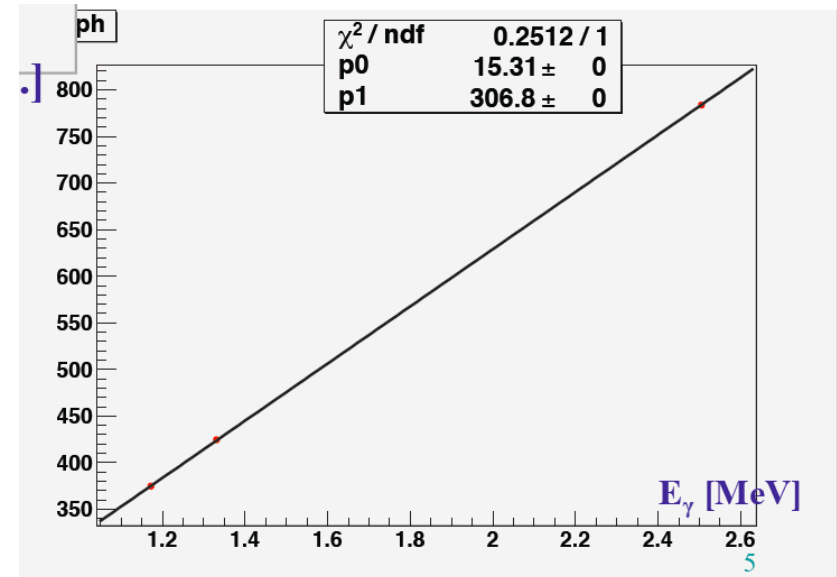
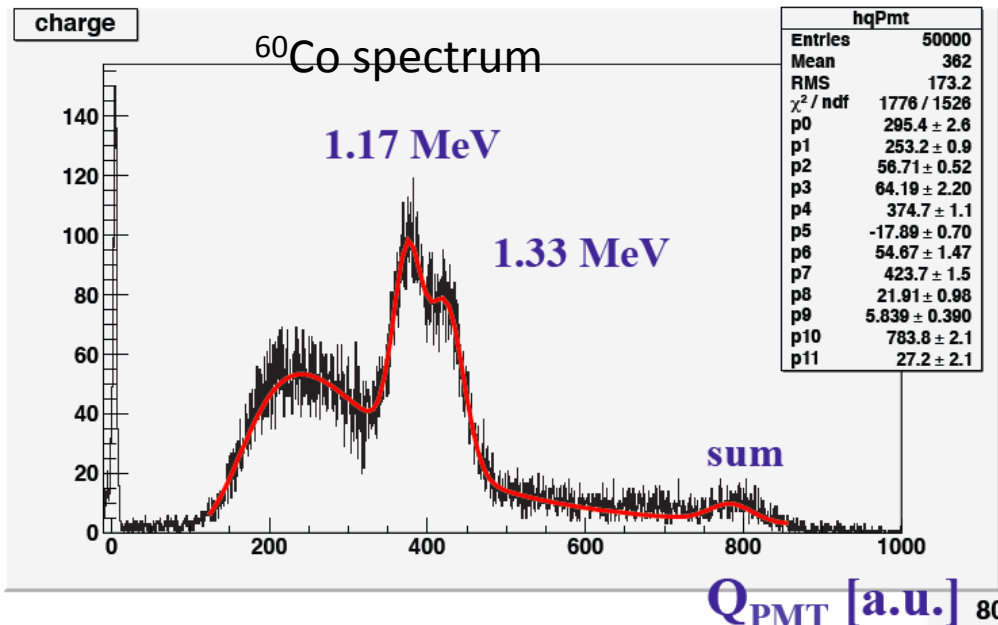
- **SO will continue to provide strong support for the Barrel de-integration and modules transfer**
- **SO will also participate in issues related to Endcap, but Endcap already has a strong team in place so lesser SLAC effort here**
- **Plan is to institute bi-weekly meetings with SO and others (maybe including WJW, SM) and regularly communicate documents, findings, etc. either to Roma1 EMC docs repository or to the EMC SuperB mailing list**
- **KF will be withdrawing from the SuperB project after the 2-3 July trip to SLAC**

Given that it has been more efficient to have a single SuperB contact with SLAC, a new liasion person should be found

BARREL NOISE STUDY

- 1) APD + CSP: Cremat i.t. 140 μ s + shaper 500 ns
- 2) APD + CSP: Hamamatsu H4083, i.t. 100 ns + shaper 500 ns
- 3) APD + CSP: Hamamatsu H4083 i.t. 100 ns + shaper 250 ns
- 4) APD + CSP: Hamamatsu H4083 i.t. 100 ns + shaper 100 ns
- 5) APD + CSP: LABE Rome-1 prototype (LNA02V0) i.t. 100 ns + shaper 500 ns
- 6) PIN + CSP: Hamamatsu H4083 i.t. 100 ns + shaper 500 ns
- 7) PIN + CSP: Cremat i.t. 140 μ s + shaper 500 ns

- APD: 0.5 x 0.5 cm² size, operated at 340 V and 380 V
- PIN diode from BaBar: 1 x 2 cm² size (only one of the two is readout), operated at 60 V





Noise [MeV]

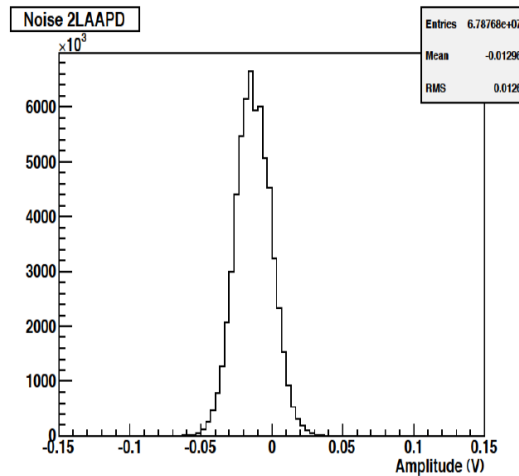
Config.	$V_{APD} = 340 \text{ V}$	$V_{APD} = 380 \text{ V}$	PIN
Cremat + sh. 500 ns	1.3	0.62	0.56
Hamamatsu + sh. 500 ns	1.3	0.85	2.3
Hamamatsu + sh. 250 ns	3.4	1.3	
Hamamatsu + sh. 100 ns	4.4	1.5	
proto. LNA02V0 + sh. 500 ns		0.57	

- **APD: electronic noise (in mV) is increasing from 340 V to 380 V, but signal/noise ratio is improving**
- **PIN: by reading both sensors we expect that signal/noise ratio decreases by a factor of $\sqrt{2}$ (0.4 and 1.5 MeV)**

Simulation shows that to have good performance noise has to be $< 1 \text{ MeV}$

Test with 2 LAAPD

- Two 2 LAAPD glued to the crystal

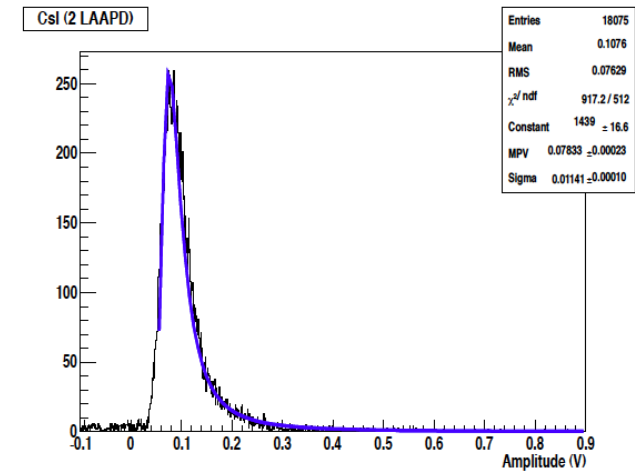


~ same level of
1LAAPD noise

- 11.4 mV (1LAAPD)
- 12.6 mV (2LAAPD)

- MVP : 78 mV1
- x2.1 LAAPD1
- Noise = $2.6\text{mV} * 1.09/21$
- .1= 6.6MeV1
- Still too high1

Test with 2LAAPDV1

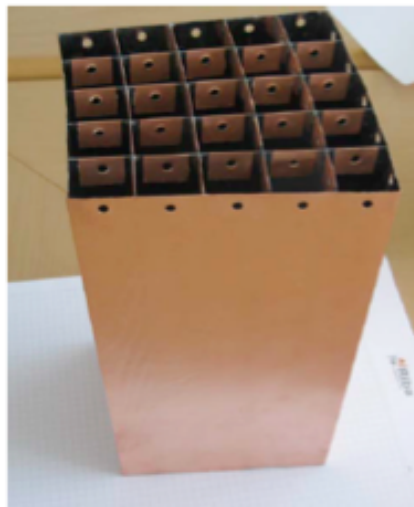
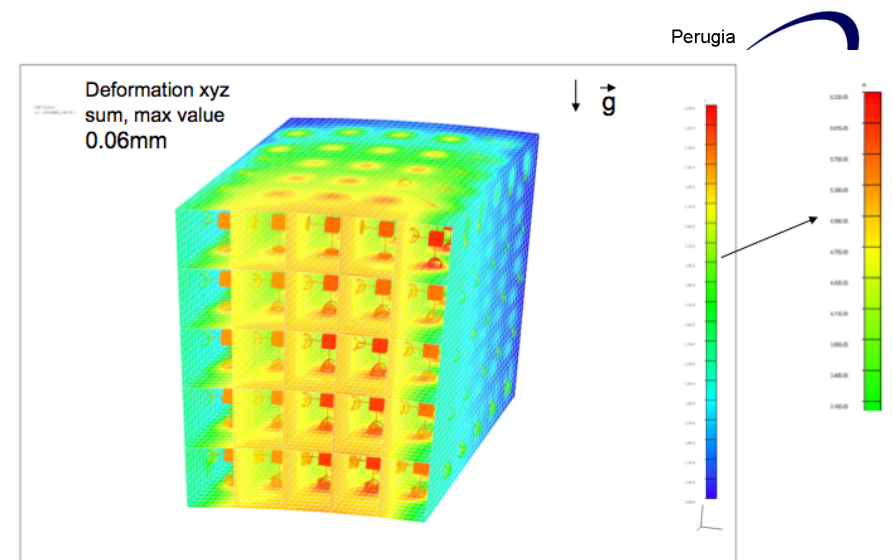


- Oscilloscope ADC only 8bit
- In this case Osc. Resolution $\sim 2\text{mV}$
- Need to check the effect by change the dynamic range

- Noise level of the order of 12 MeV with 1LAAPD and 6.6MeV with 2LAAPD
- Need to check the effect of limited oscilloscope resolution on the noise evaluation

The material used for the fem analysis are laminae of 0.1mm thick. For external wall the orientation is one 0° and the other one at 90°, the total ply thickness is 0.2mm, while internal walls have a double adjacent walls of 2 cells and ply thickness is 0.4mm. For the bottom plate was used Aluminium of 6mm equivalent to CFRP material

The FEA model and results need to be validate with PROTO 2 test



Proto 2

- The mathematical model allows for a reduced set of variables which describe the stress and strain in a macro-element;
- The parameters which describes the stiffness of the material and the local and global geometry of the shell can be measured by means of “ad-hoc” mechanical tests.

2 hypotheses

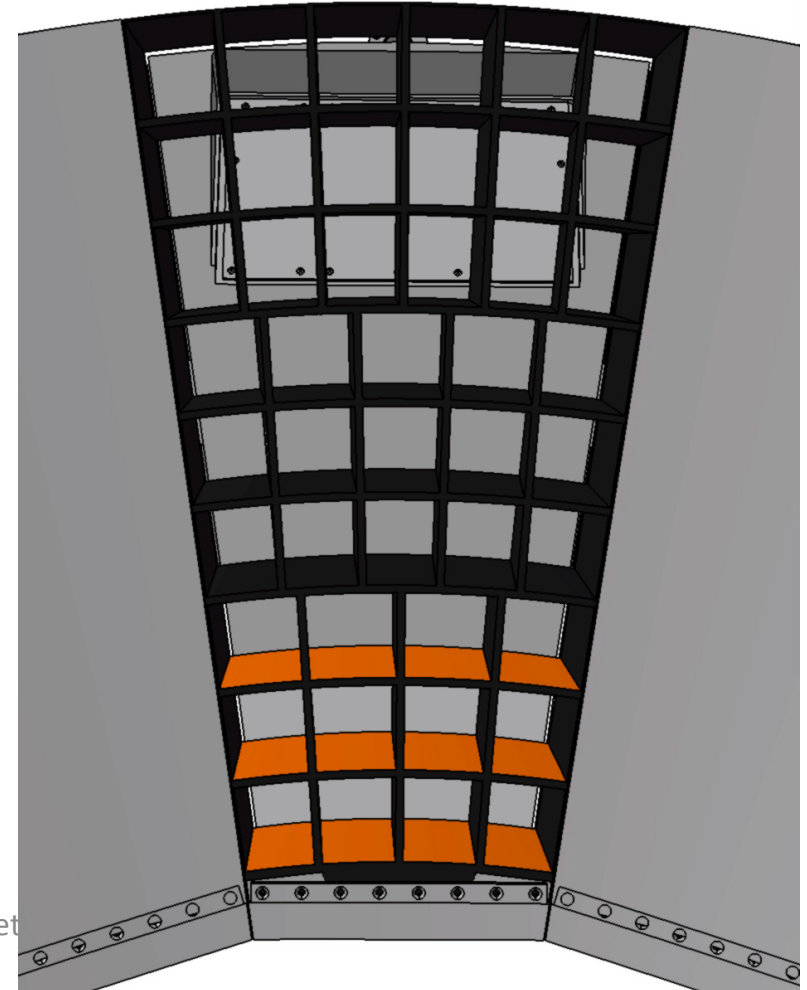
A. The hybrid solution: to keep the original outer 3 rings, with CsI(Tl) crystals and replace the Inner ring crystals, filling the cells with lyso.

4 Lyso crystals to fit the original inner cells

B) Replacement of all original crystals with pure CsI crystals

A) Hypothesis is more complex due to the lyso crystals presence and to the reuse of the original outer crystals

- Spare modules important in order to define the optimal procedure for crystals replacement
- After observation and measurements of this module → definition of the LYSO inserting procedure





TDR status



Writing is well advanced

Few parts needs to be integrated

Editing is still to be done

COST and SCHEDULE in the next future



Conclusions



Background studies (FULL AND FAST SIM):

- improve barrel performance
 - electronics (shaping time)
 - shielding (neutrons seems to have more impact in this region)

FWD performance:

- First study with hybrid solution in fast sim is now available
- good performance are observed with 3 CsI(Tl) rings and 12 (LYSO)

A lot of work from D&D group at SLAC, CAD designs are available

2 endcaps spare modules will be shipped to Italy

→ Mechanics investigation will start and definition of the replacement of the crystals with LYSO.

Pure CsI crystals R&D is ongoing, first lab results with 2 LAAPD readout → improvement in the noise level is mandatory.