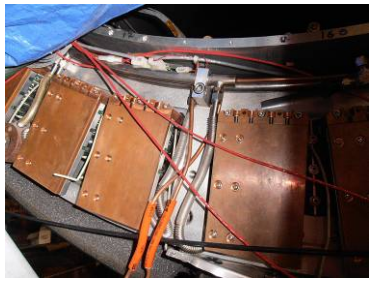
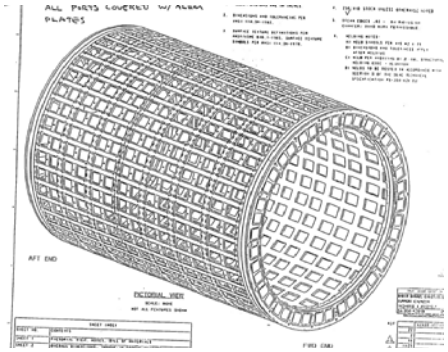
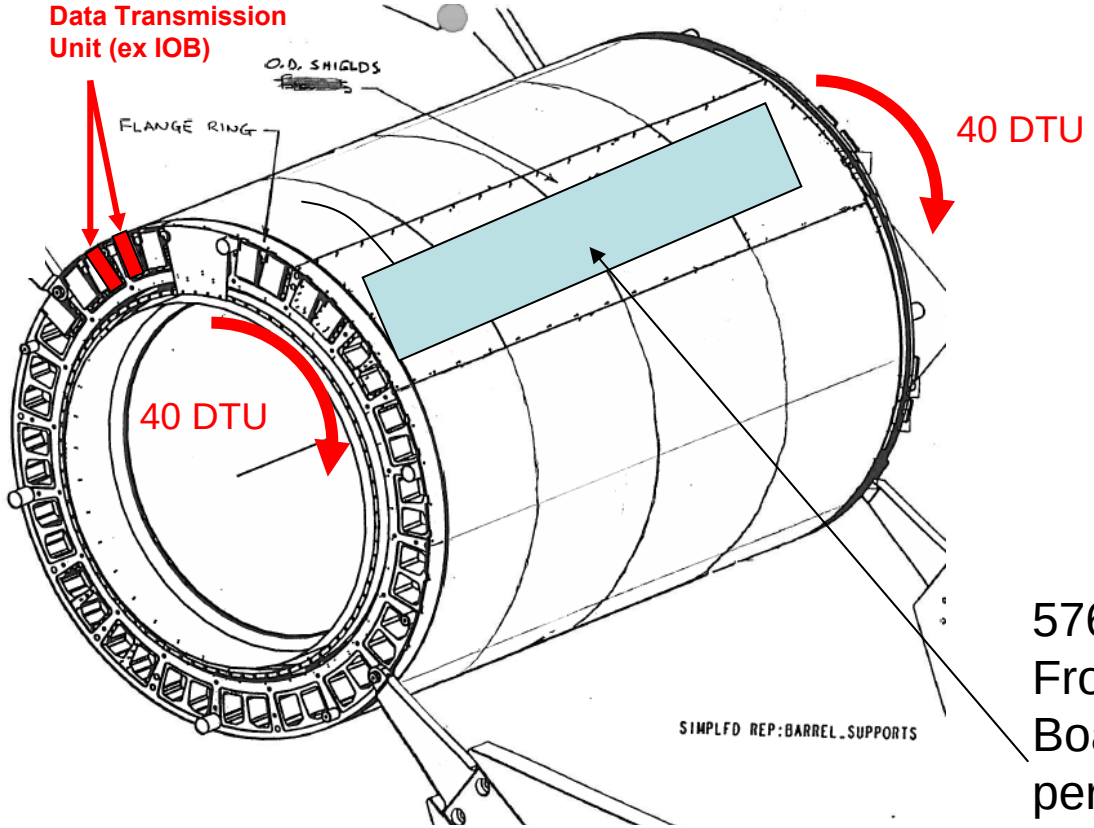
EMC Electronics Updates

Valerio Bocci INFN Roma

Location of the Front End electronics in the EMC barrel

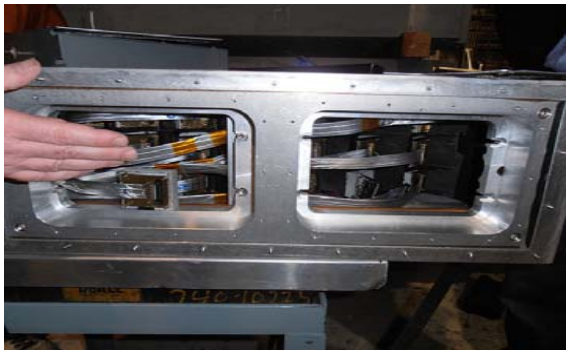


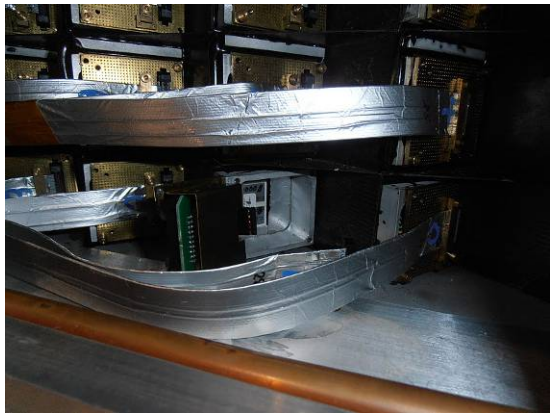


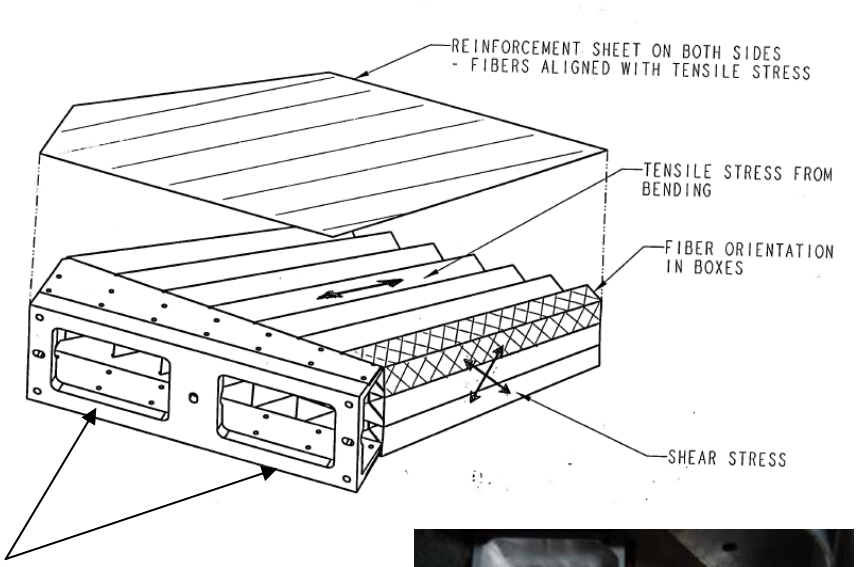


5760 Front Ends Boards one per crystal

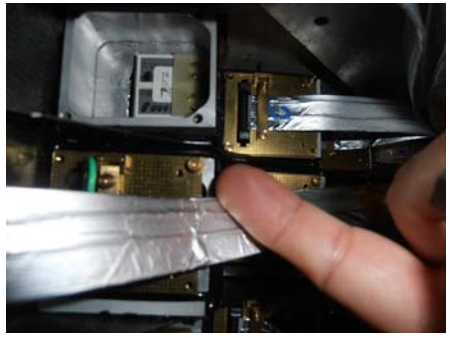
21 Crystals Calorimeter Module
(40 (phi) x (4+4) (theta) = 320 modules)



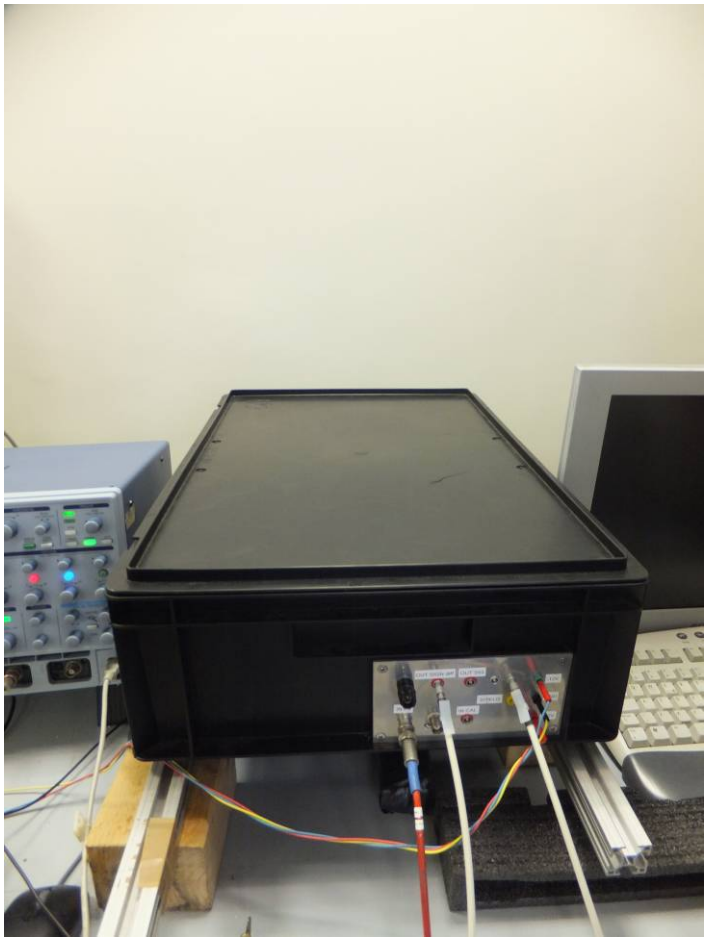


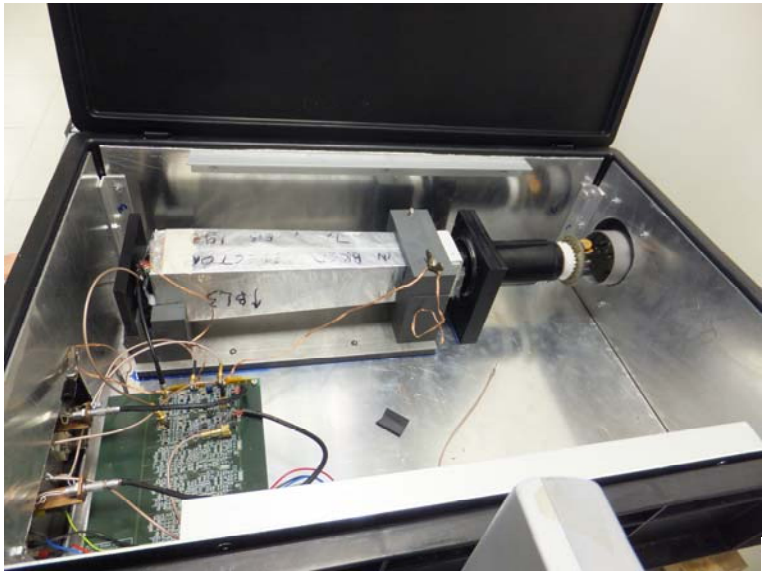


21 Front End Boards



Crystals Test Box



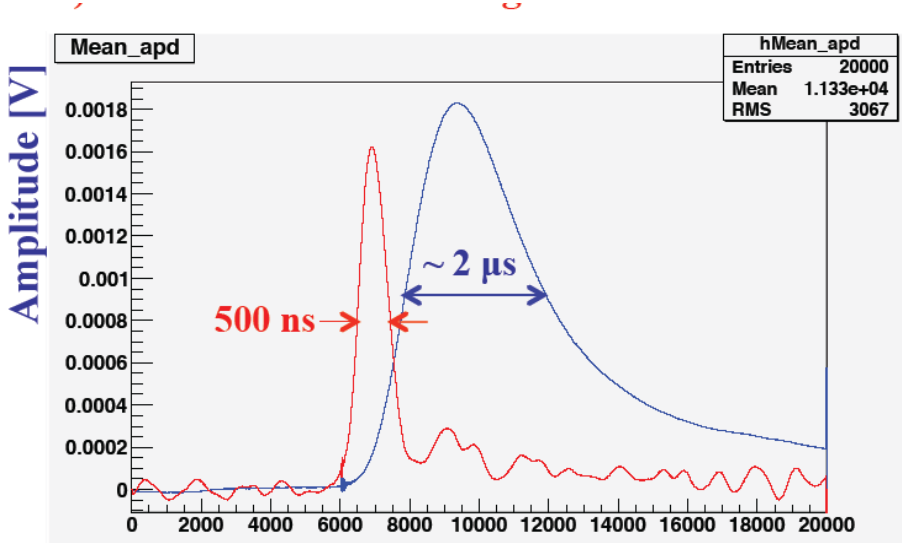


CsI (Tl) test bench with different Integration time and shaping time

CsI:

CSP Cremat integr. time = 140 µs shaping time = 500 ns

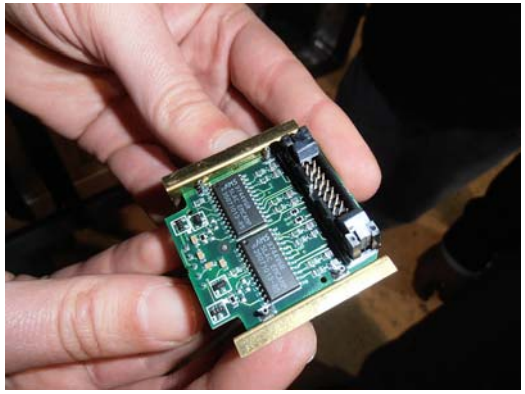
CSP Hamamatsu integr.time = 100 ns + shaping time = 100 ns



From Paolo Gauzzi

We use a modified version of our VFE shaper design for LYSO With different hybrid CSP Cremat (fixed integration time) Hamamatsu(flexible integration time) And different shaping time.

Barrel Front End Replacemet



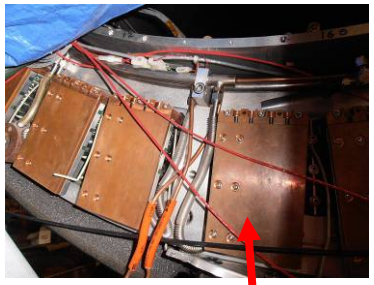
2 Pin Diode readout
2 Channel
2 different Gain x1 x32

We have done a meeting with Italian
Texas Instruments Field Application Engineer
to create a grid of possible components candidate for a new
Front Ends design with shorter integration time
(hundreds of ns instead of microseconds) and shorter shaping time.

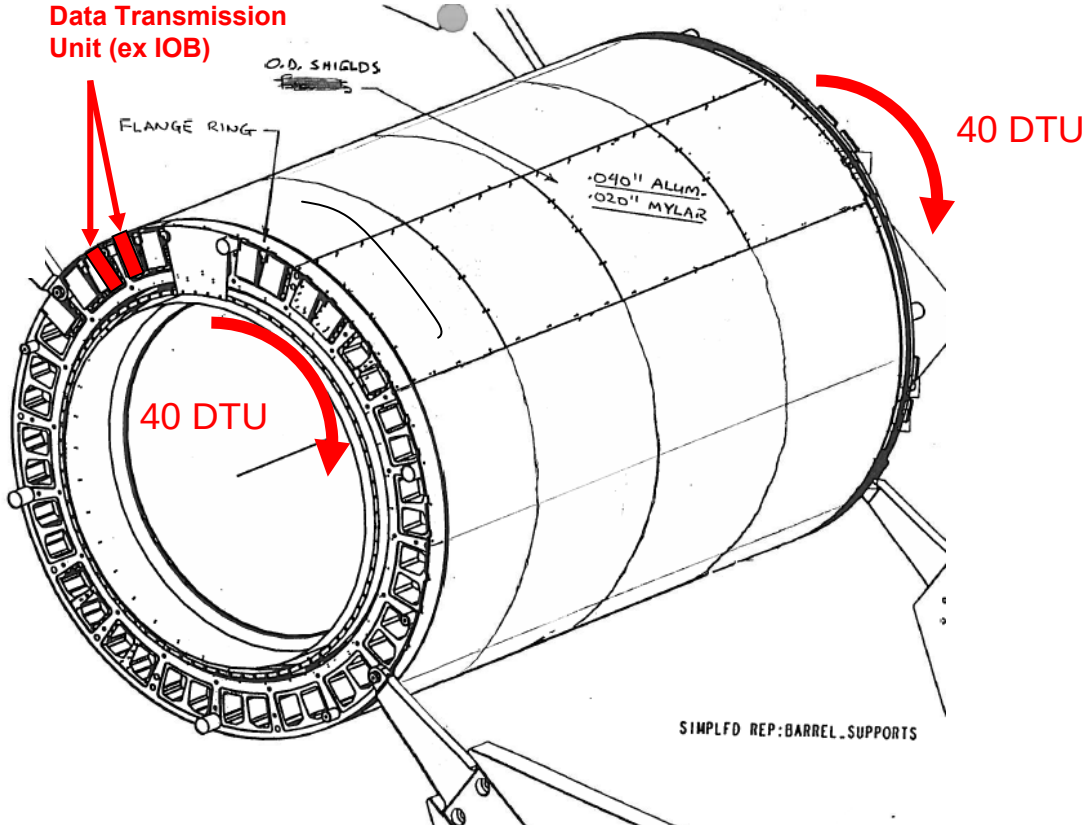
- LDO(TPS7A49) to filter and regulate voltage
- Input FET (BF862)
- CSP OPAMP (LMH6624 100mW alone under decision)
- Shaper OPAMP (OPA836)
- Differential driver (THS4521)

Using off the shelf components give the possibilty
to have access to best professional design but general purpose
meaning more functionality -> more power consumption.
With the components proposed we have 170 mW/Crystal instead of
100 mW/Crystal of Babar design.

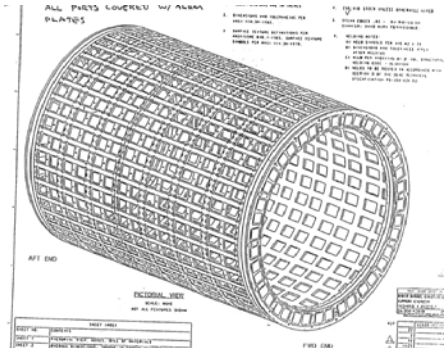
Location of the DTU mini crate in the EMC barrel



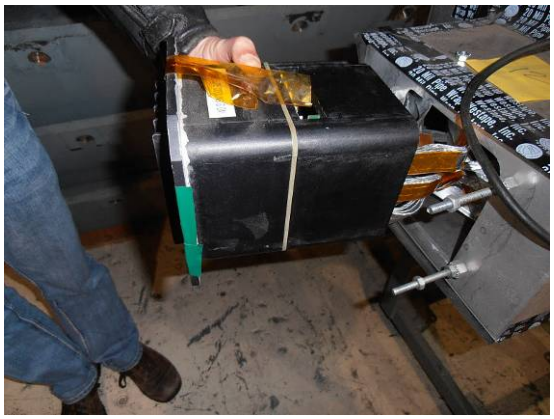
Data Transmission Unit (ex IOB)

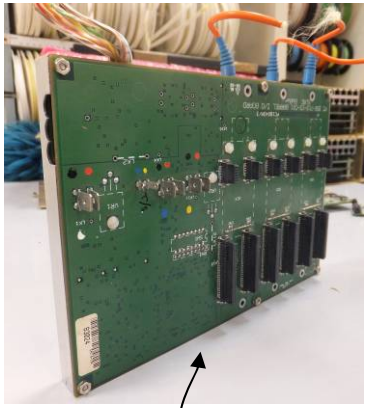


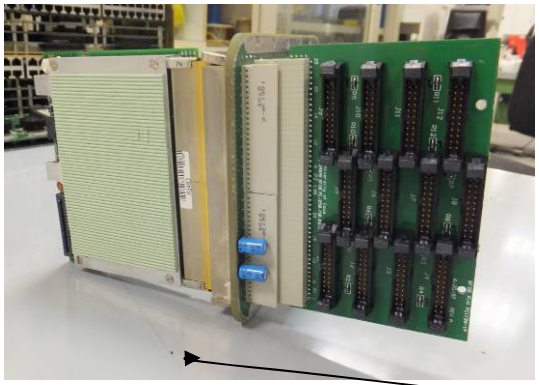
DTU mini crate

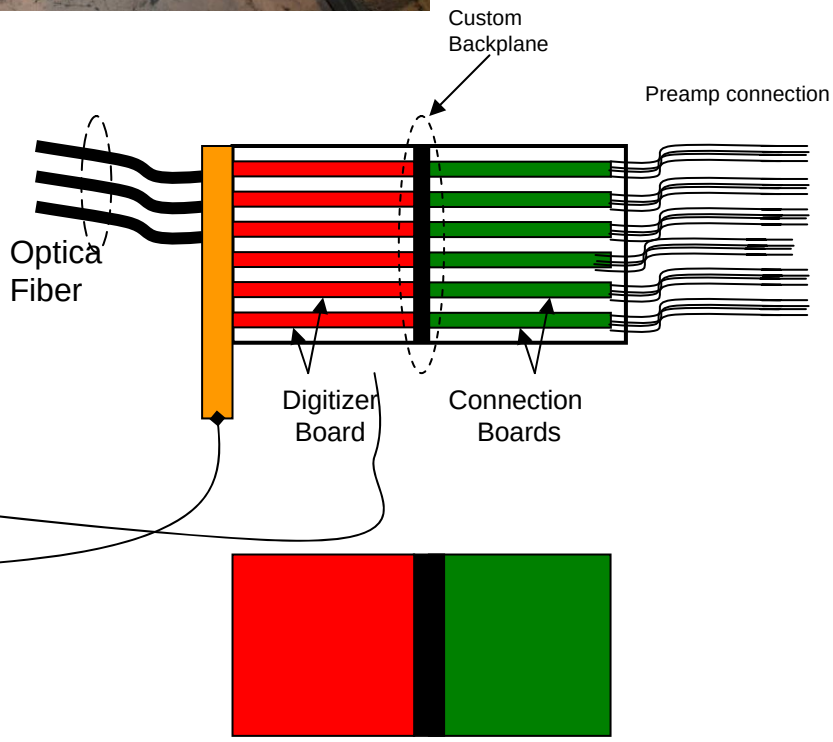


Mini Crate structure

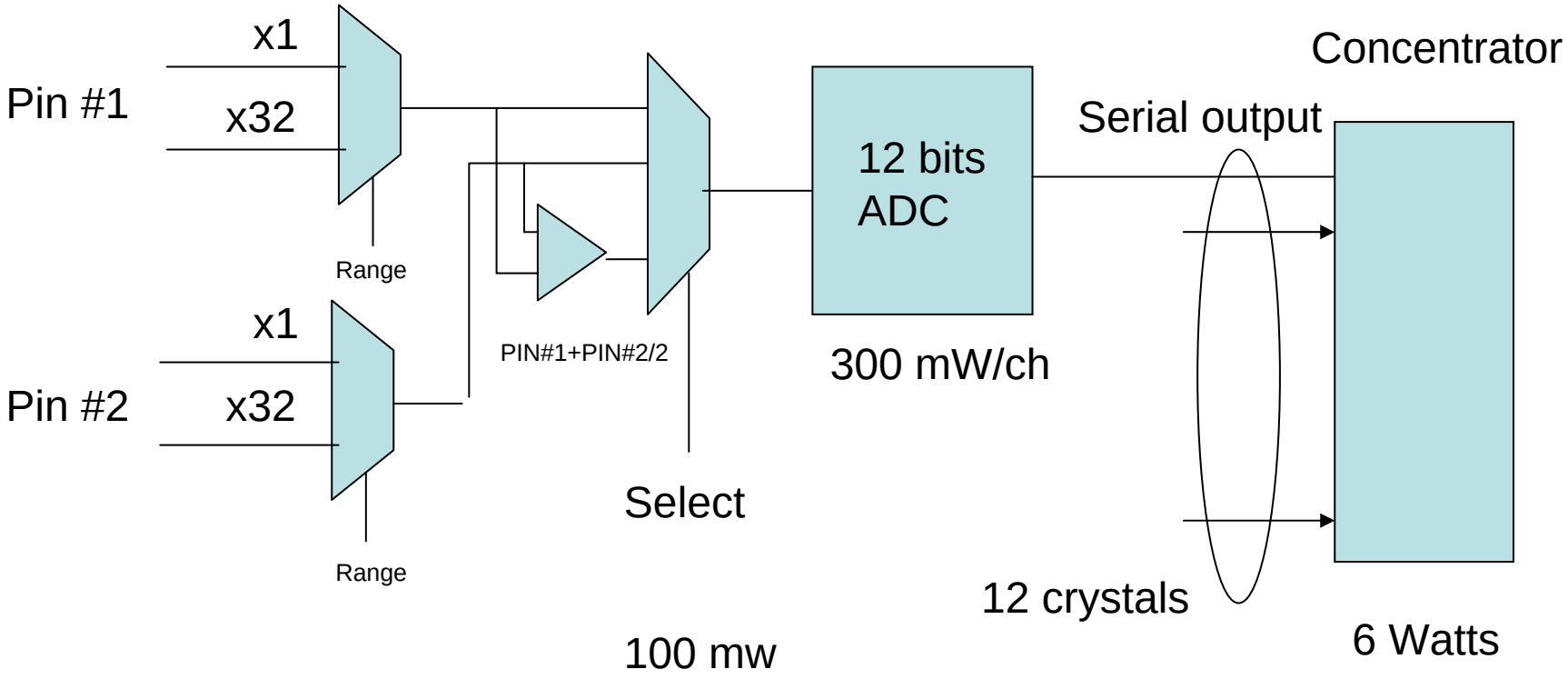


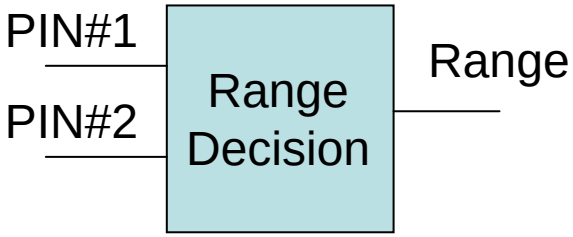






Digitizer Board





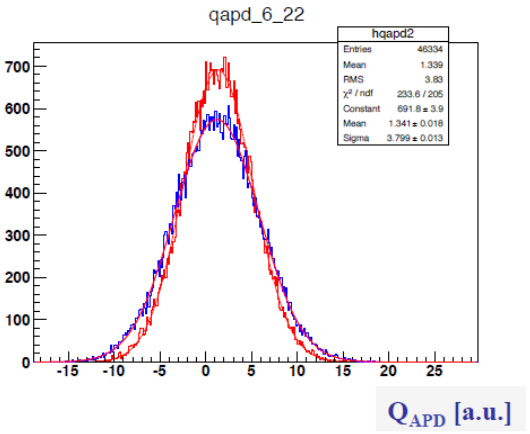
We start to discuss this block diagrams with Texas field Apllication we found some solution for ADC.

Forward Calorimeter BGO Study

Same setup using the Crystal test box.
Comparison of two CSP (Cremat and Hamamatsu using the same integration time)

BGO with ^{137}Cs source

Comparison with source: Hamamatsu vs Cremat

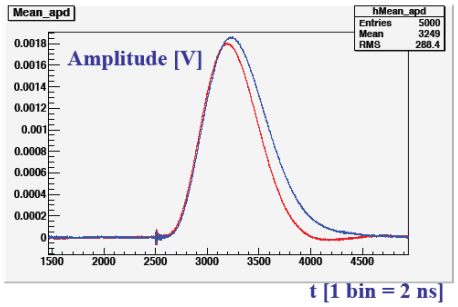


Analysis from P. Gauzzi

BGO - APD signal

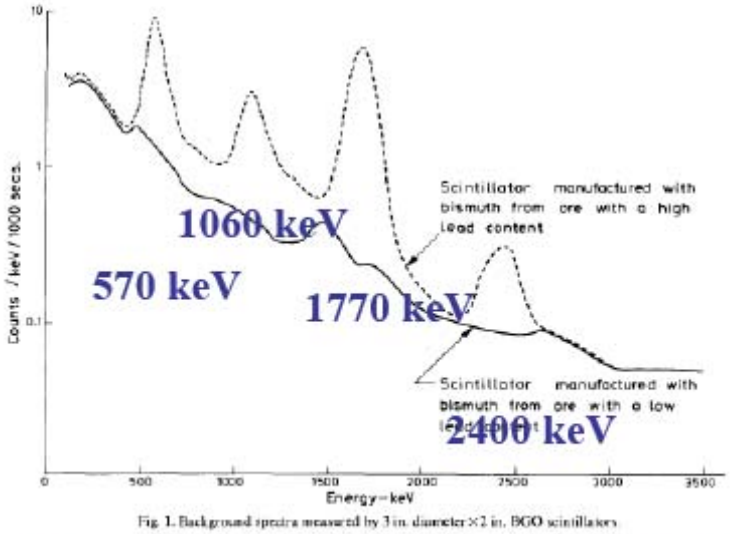
- CSP Hamamatsu i.t.= 1 μs
  s.t. = 500 ns
  FWHM =1.2 μs
- CSP Cremat i.t. = 140 μs
  s.t. = 500 ns
  FWHM = 1.4 μs

Bin by bin average over 50000 waveforms

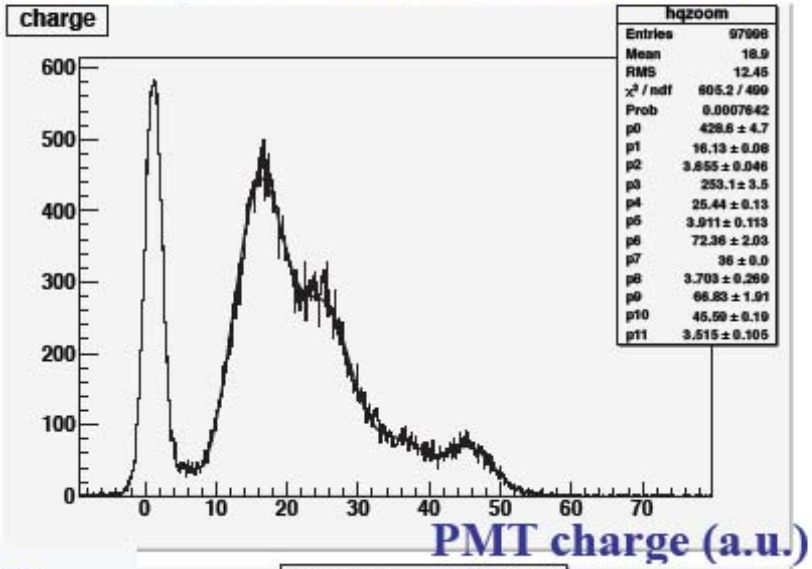


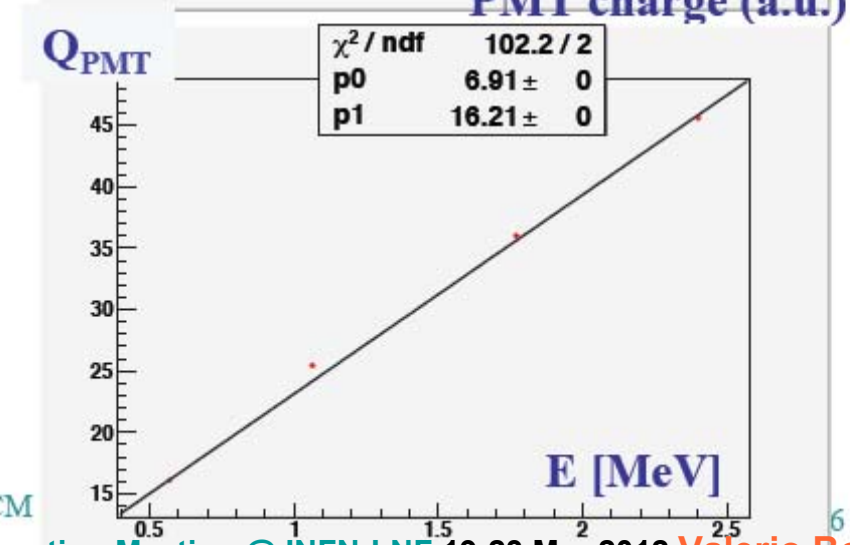
BGO - Setting the energy scale

- BGO activity due to ^{207}Bi contamination (decays to ^{207}Pb, with 4 γ lines)



[from Lewis, NIMA264(1988)534]





Comparison S/N ratio BGO(crystal test box) vs LYSO (BTF tests)

Electronic noise

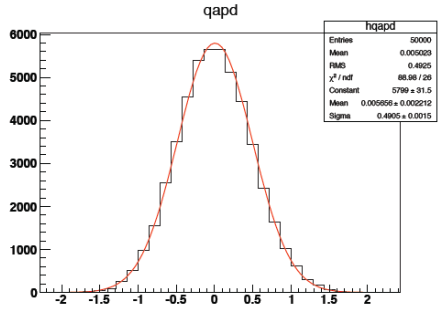
- **BTF test with LYSO crystal ⇒ electronic noise was ~ 250 keV**
- **Lab test of BGO ⇒ 1.5 – 2 MeV**

$$\frac{Noise(BGO)}{Noise(BTF)} = \frac{LY_{LYSO}}{LY_{BGO}} \frac{G_{APD}(BGO)}{G_{APD}(BTF)} \frac{1}{Atten_{BTF}} =$$

$$= \frac{75}{9} \quad \frac{1}{4} \quad \frac{1}{0.175} \simeq 10$$

Oscilloscope noise

- **Random trigger**



σ = 0.49 ⇒ ~ 300 keV

LYSO signal is better
BGO needs better electronics noise

Conclusions

•The Mechanical structure of the Barrel give some strong physical constraint to electronics design.

•The Integration time and shaping time is under study with physics simulation and on field measuraments using our Crystal test box.

•The Front-END CSP preaplifier design study was started using COTS components strong interaction with TI FAI.

•The new power dissipation budget seems higher respesct to Babar

•Digitizer board starting to found COTS (first interaction with TI FAI)

•Forward crystal evaluation (BGO,LYSO) proceed with interesting results

•Power Supply request questionaire can be started to fill using some infomation above