



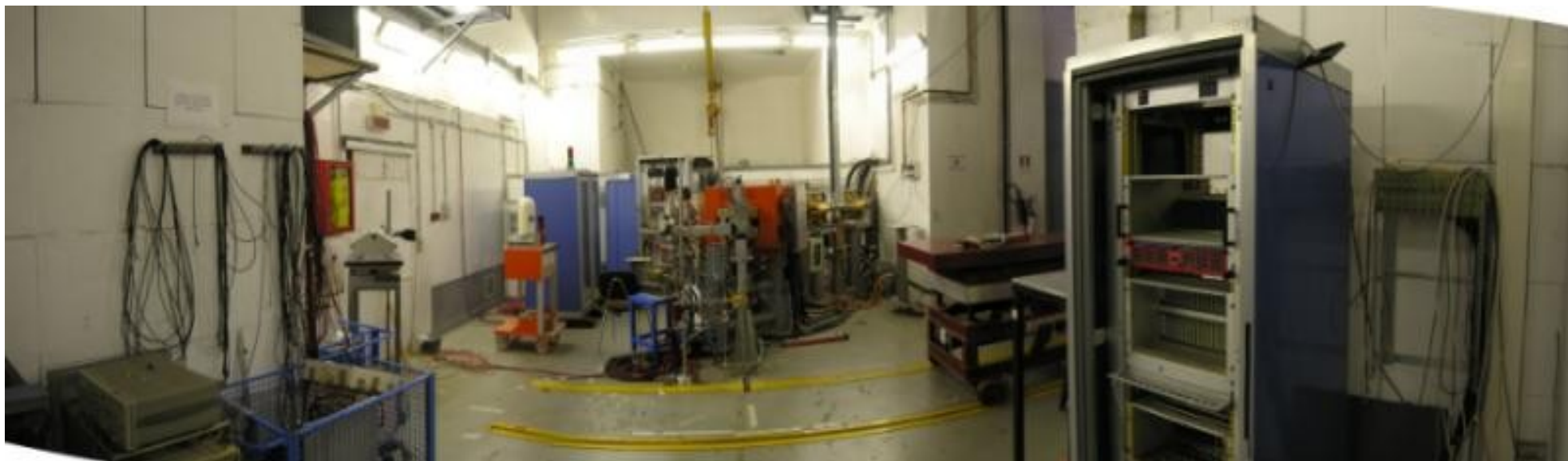
LNF Test Beam (Very) Preliminary Results

Alessandro Rossi
Università di Perugia & INFN Perugia

The Plan

- Beam Test Facility at Frascati
- Beam Test Read Out and Data Acquisition
- Energy Scan with PiN and APD

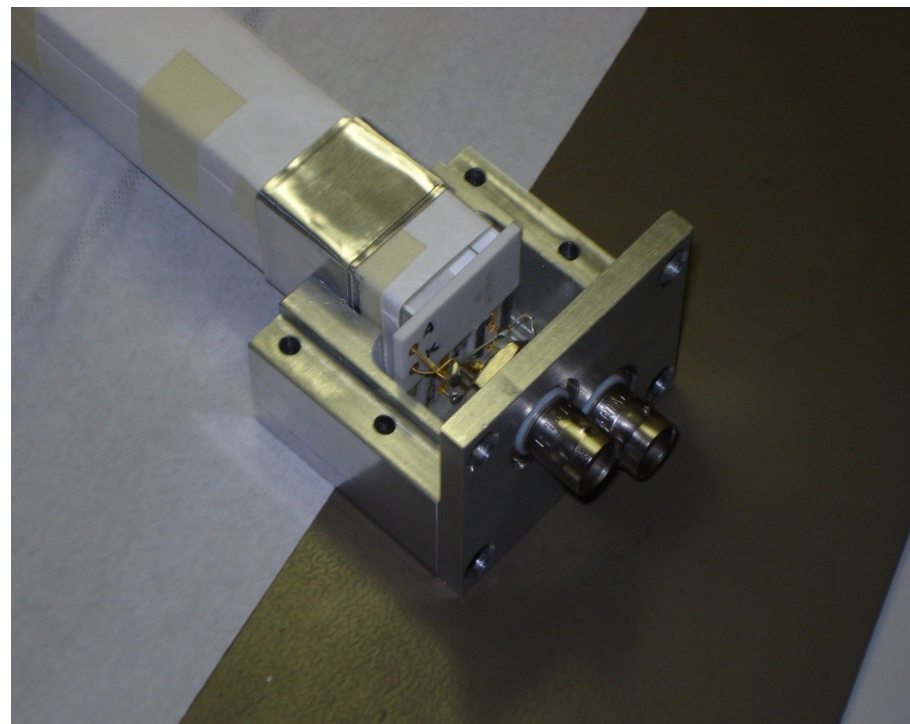
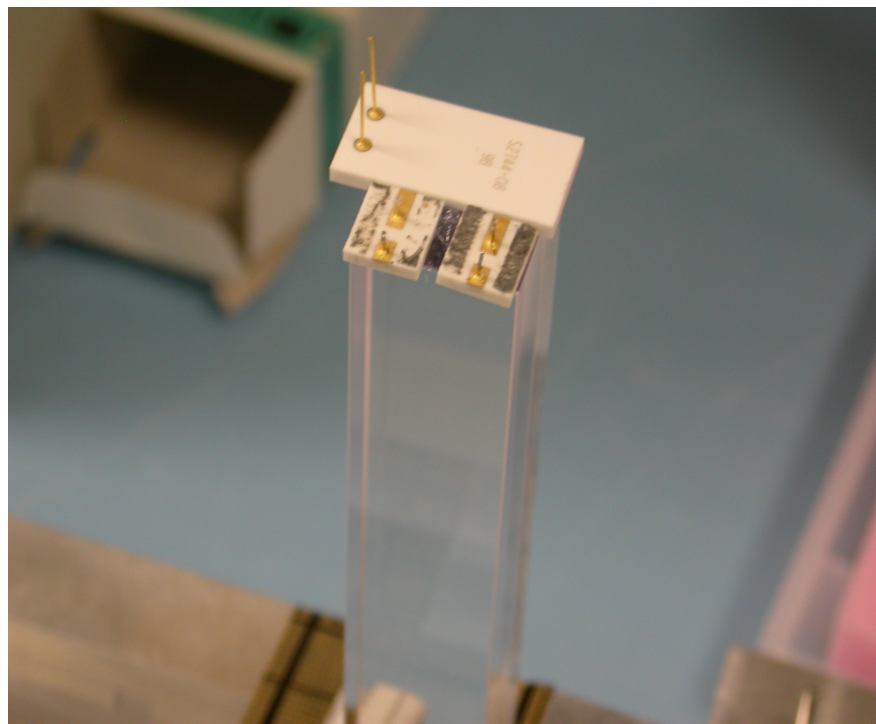
Beam Test Facility



Energy Range	50-500 MeV e-/e+
Max. Repetition Rate	50 Hz
Pulse Duration	1-10 ns
Particles/Pulse	1 to 10 ¹⁰ particles

Read Out

- one LYSO Crystal (2x2x20cm) is read by two different sensors
 - 1 S2744-08 PiN Photodiode (1x2cm)
 - 2 S8664-55 APD (0.5x0.5cm each)
- DOW CORNING RTV-3145 glue is used (CMS)



Read Out

PiN is read by

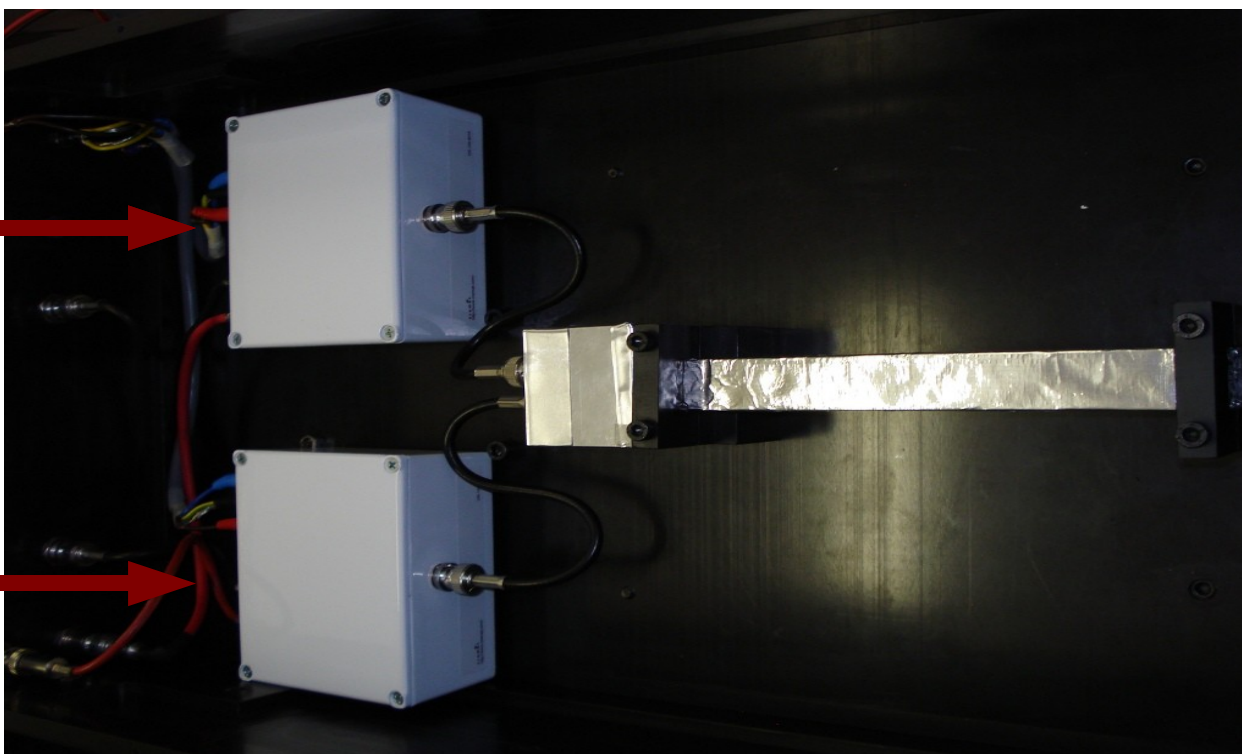
- CREMAT Charge Sensitive Preamplifier CR110 (gain 1.4V/pC)
- CREMAT Shaper CR200-250ns shaping time

APDs are read in parallel by

- CREMAT Charge Sensitive Preamplifier CR111 (gain 0.15V/pC)
- CREMAT Shaper CR200-250ns shaping time

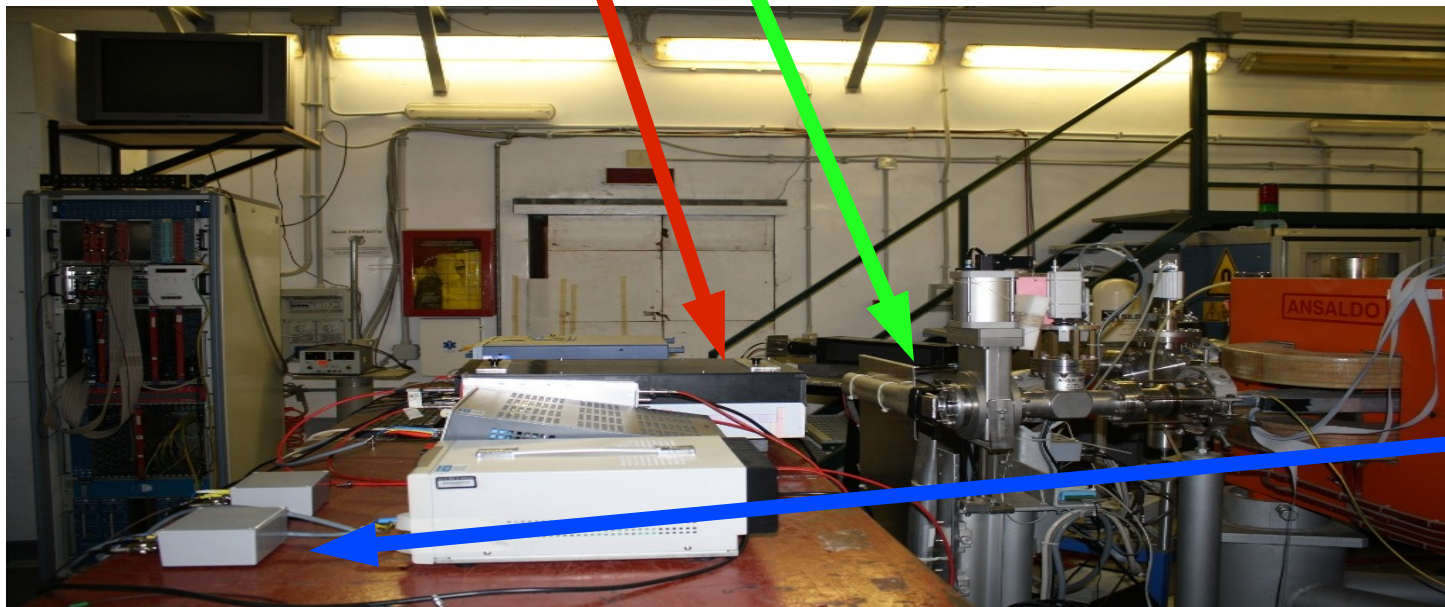
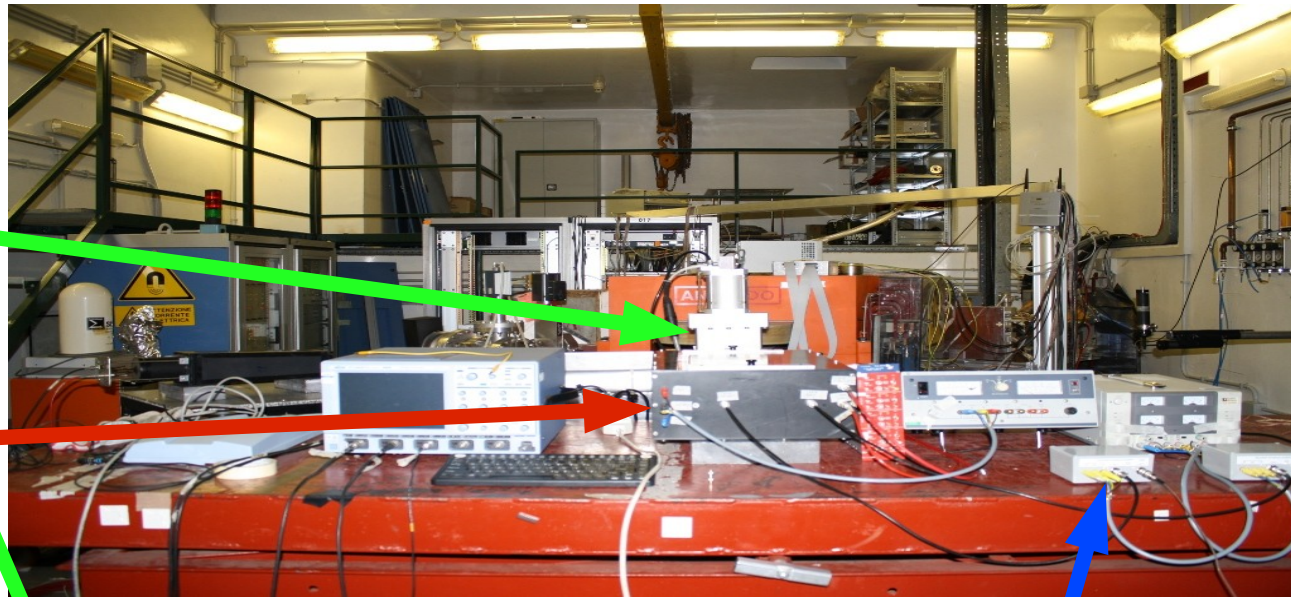
APDs CSP

PiN CSP

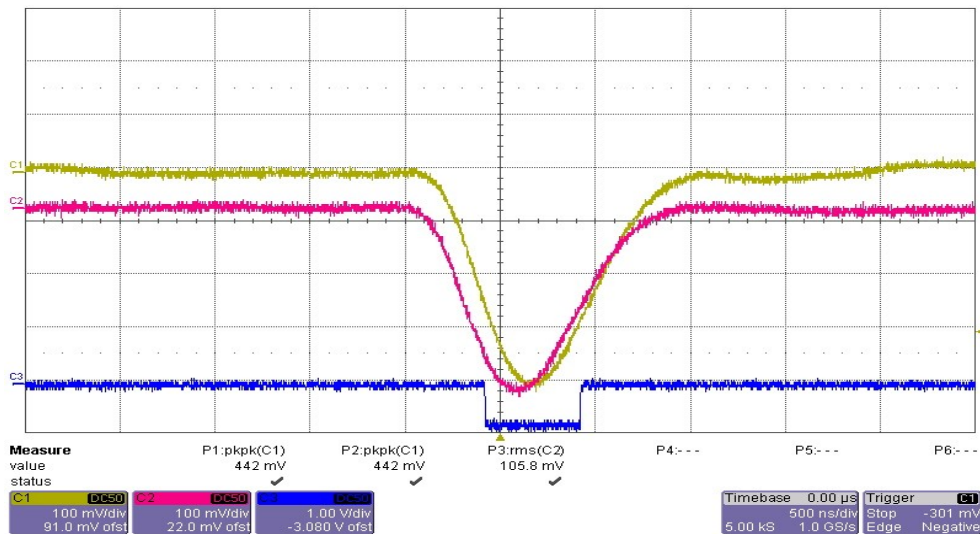


Beam

Crystal Black Box



Shapers

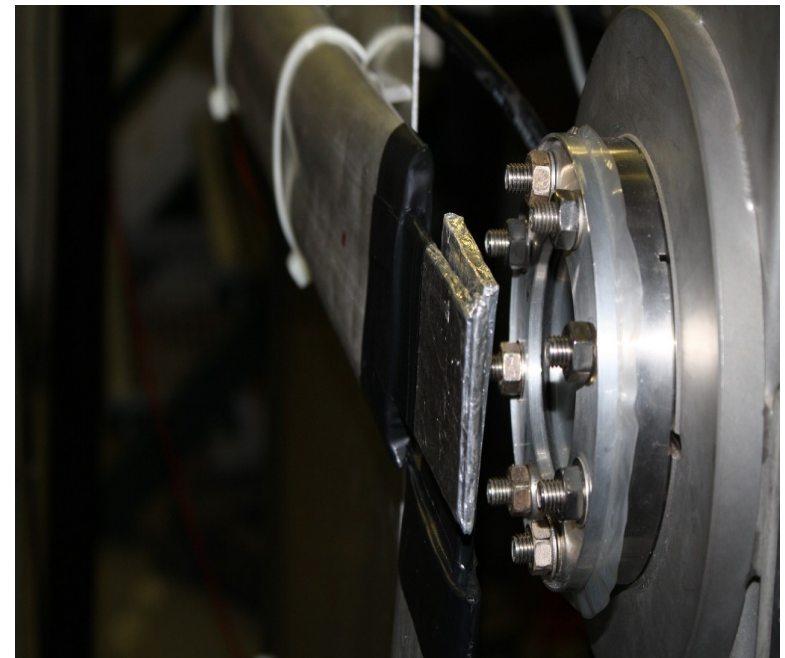


Signals from PiN (yellow) and APDs (red)

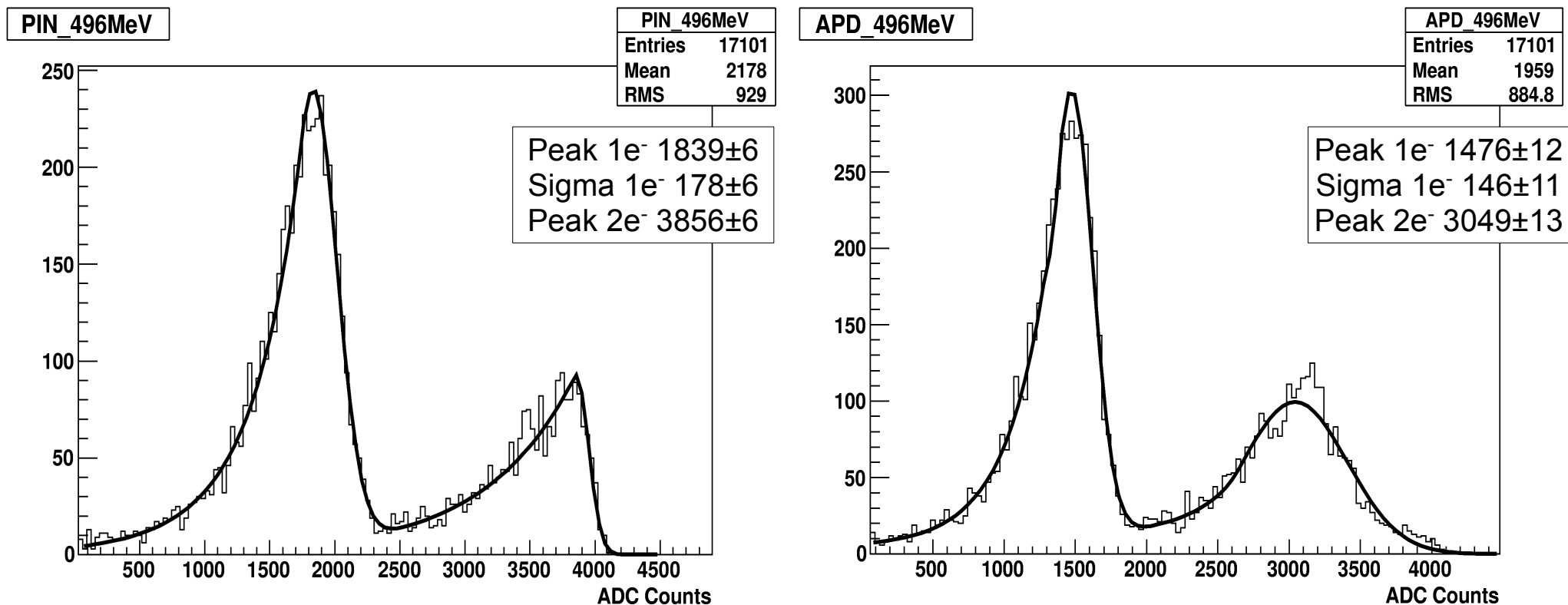
Data from a fibrometer (close to beam extraction) are also acquire

→ scintillating fiber, resolution ~3mm

These can be used to reject 0 electron events



- Data are acquired at 5 different energy from 496MeV to 99MeV



- one e- and two e- peaks are evident

- fits are made with the sum of two CrystalBall function

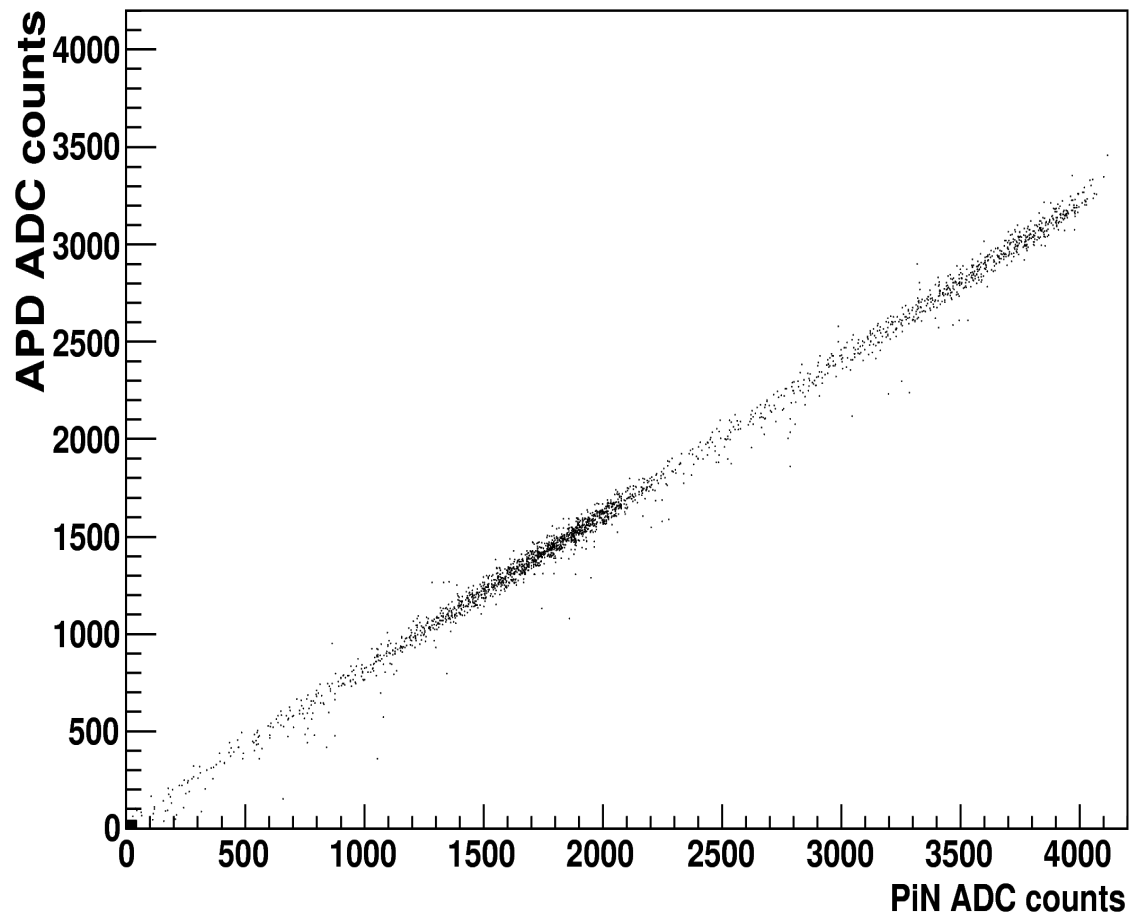
$$f(x; \alpha, n, \bar{x}, \sigma) = N \cdot \begin{cases} \exp\left(-\frac{(x-\bar{x})^2}{2\sigma^2}\right), & \text{for } \frac{x-\bar{x}}{\sigma} > -\alpha \\ A \cdot \left(B - \frac{x-\bar{x}}{\sigma}\right)^{-n}, & \text{for } \frac{x-\bar{x}}{\sigma} \leq -\alpha \end{cases}$$

$$A = \left(\frac{n}{|\alpha|}\right)^n \cdot \exp\left(-\frac{|\alpha|^2}{2}\right)$$

$$B = \frac{n}{|\alpha|} - |\alpha|$$

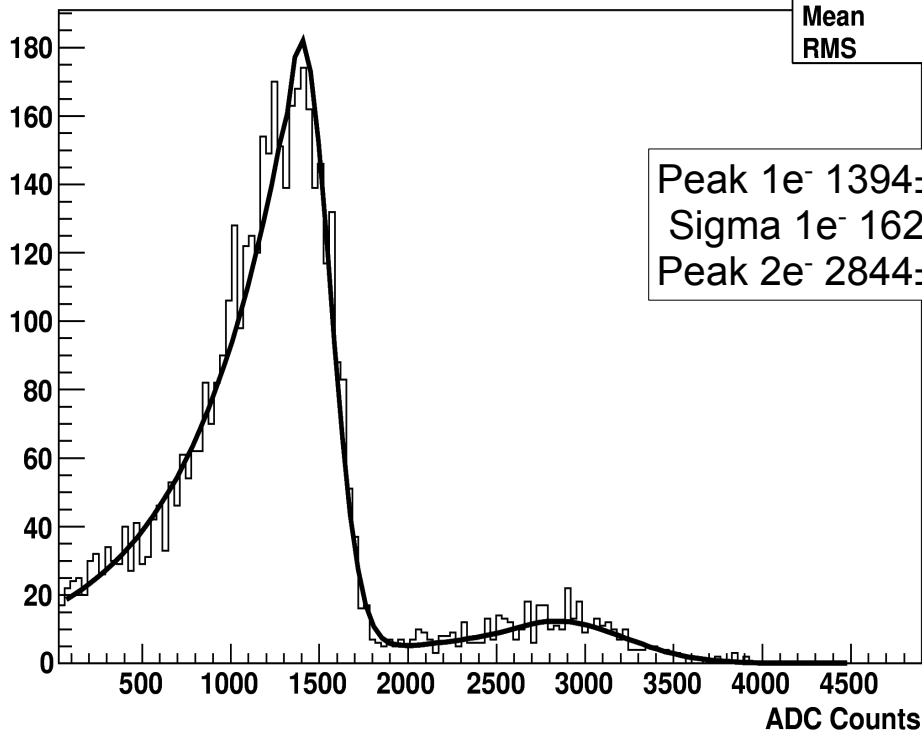
Energy Scan

PiN vs APD 496MeV

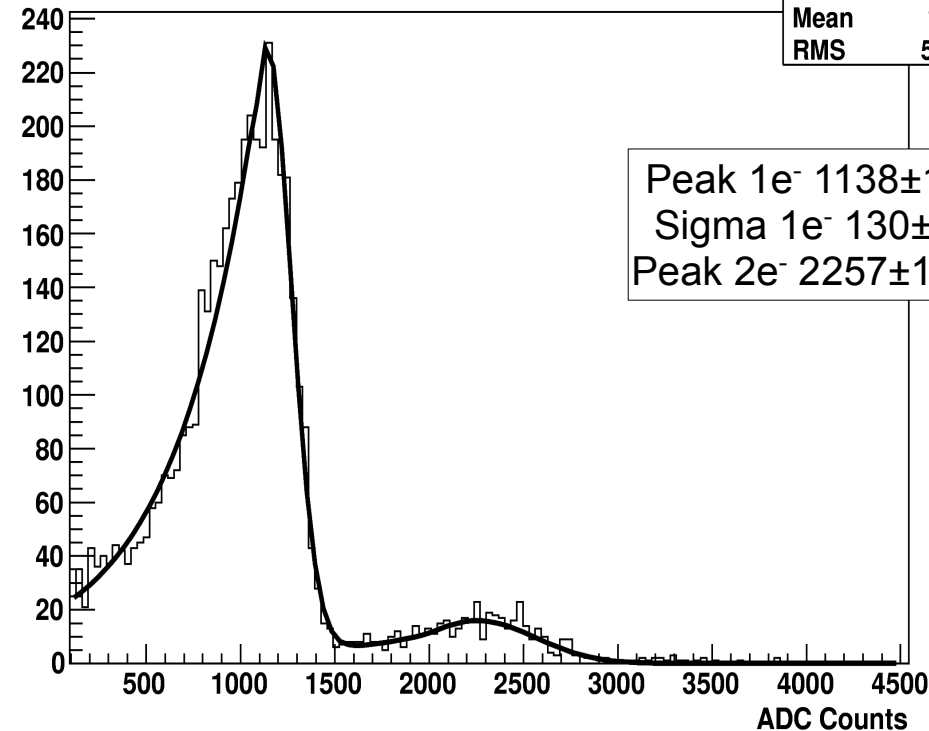


There is a perfect correlation
between PiN and APDs response

PIN_397MeV



APD_397MeV

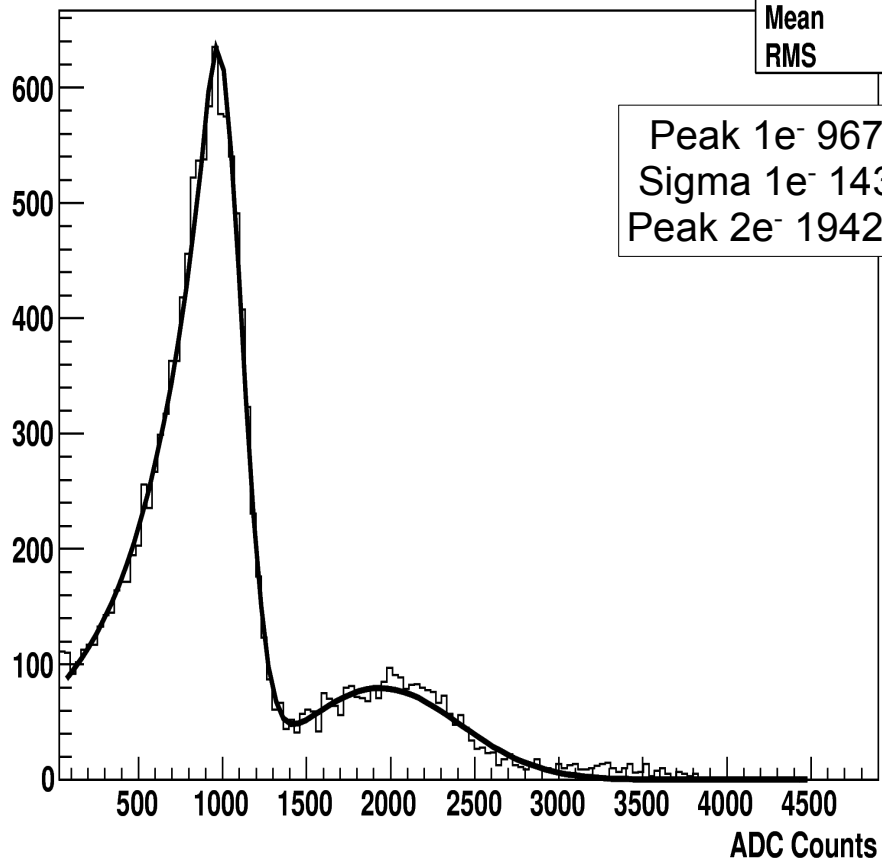


- At different energy there is a different beam composition (1e-/2e- ratio change with energy)

- 1e- peak is used to evaluate crystal response linearity

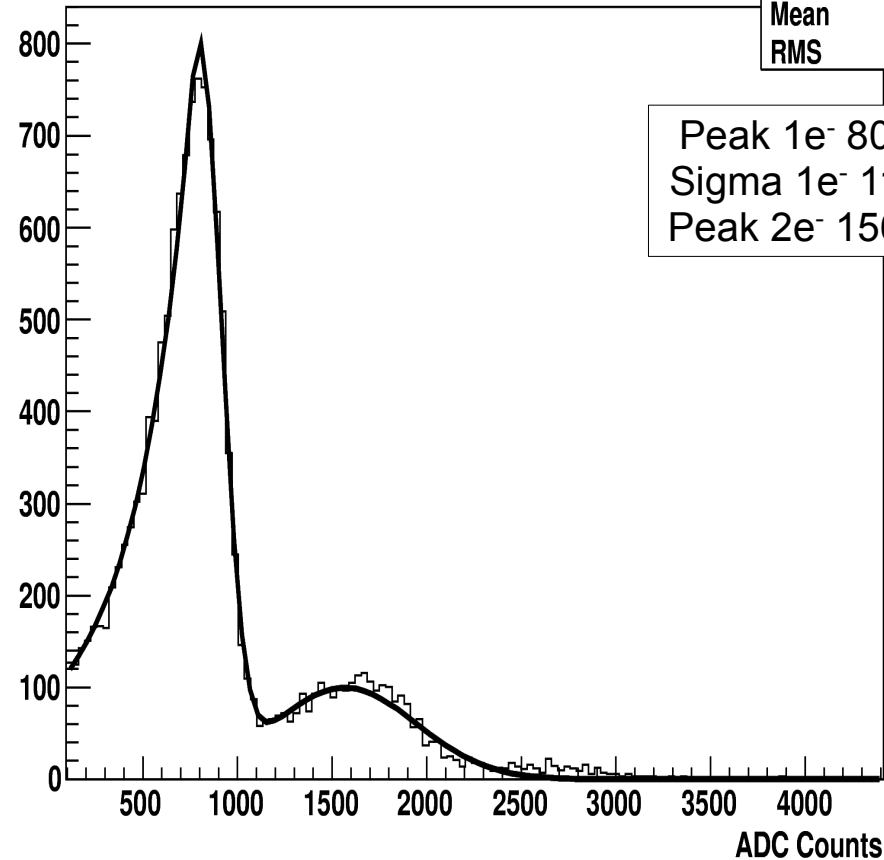
- CrystalBall function's sigma (which describes the gaussian shape on the right side of peak) is used to value crystal resolution

PIN_297MeV



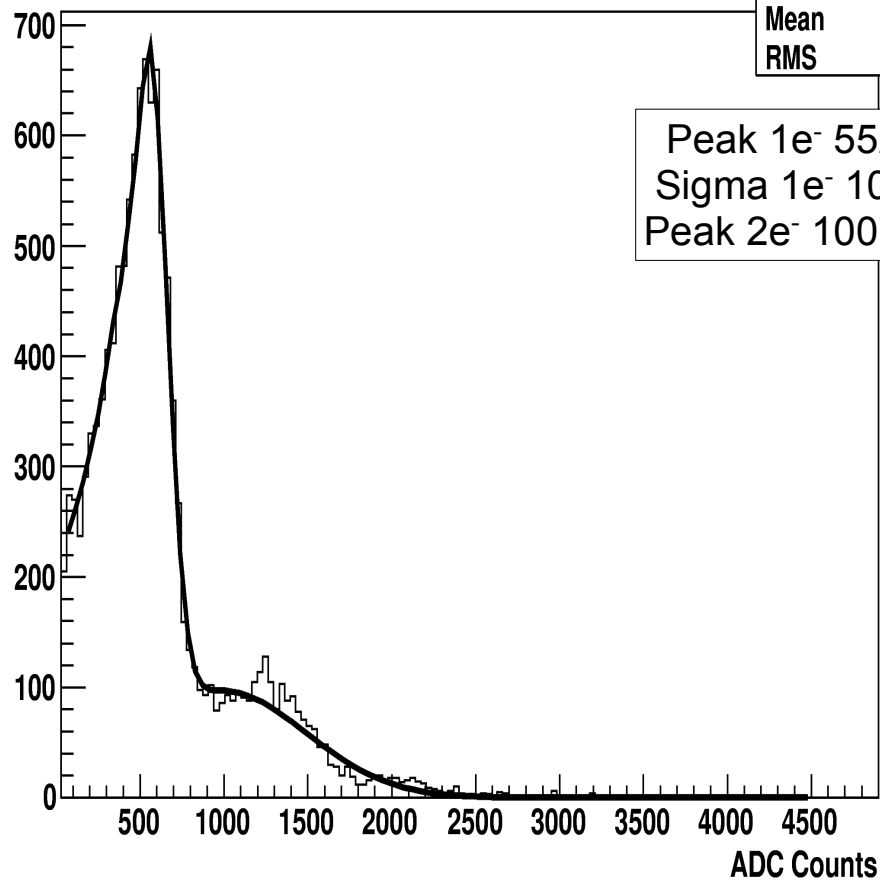
PIN_297MeV	
Entries	24838
Mean	1059
RMS	634

APD_297MeV

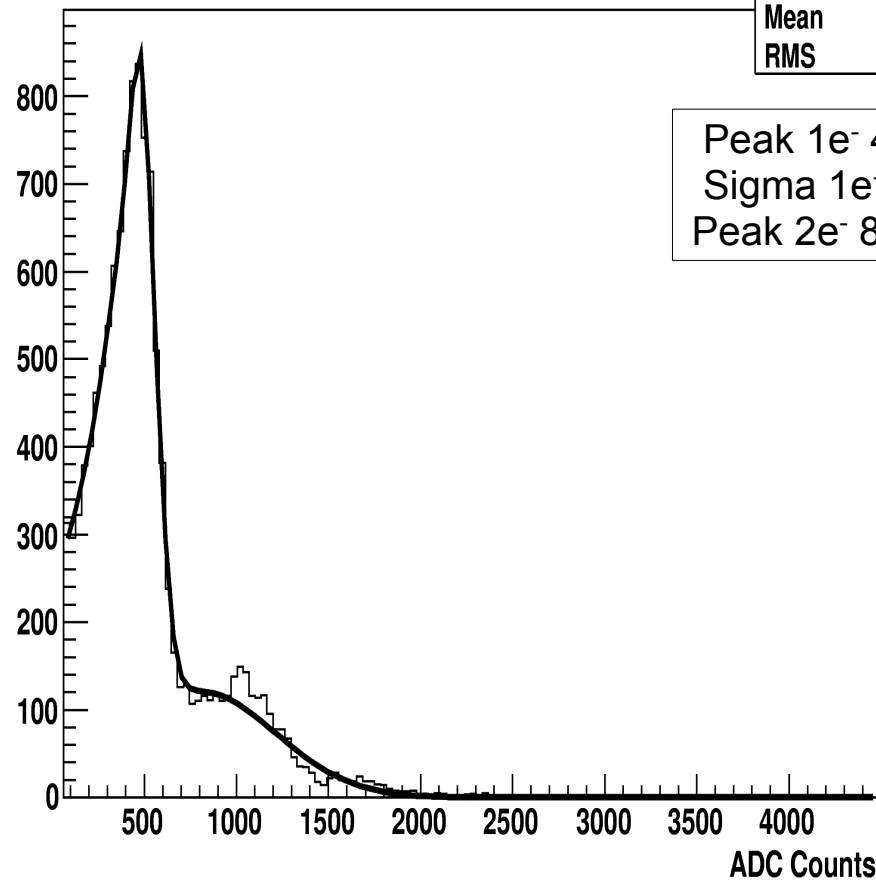


APD_297MeV	
Entries	24838
Mean	890.1
RMS	516

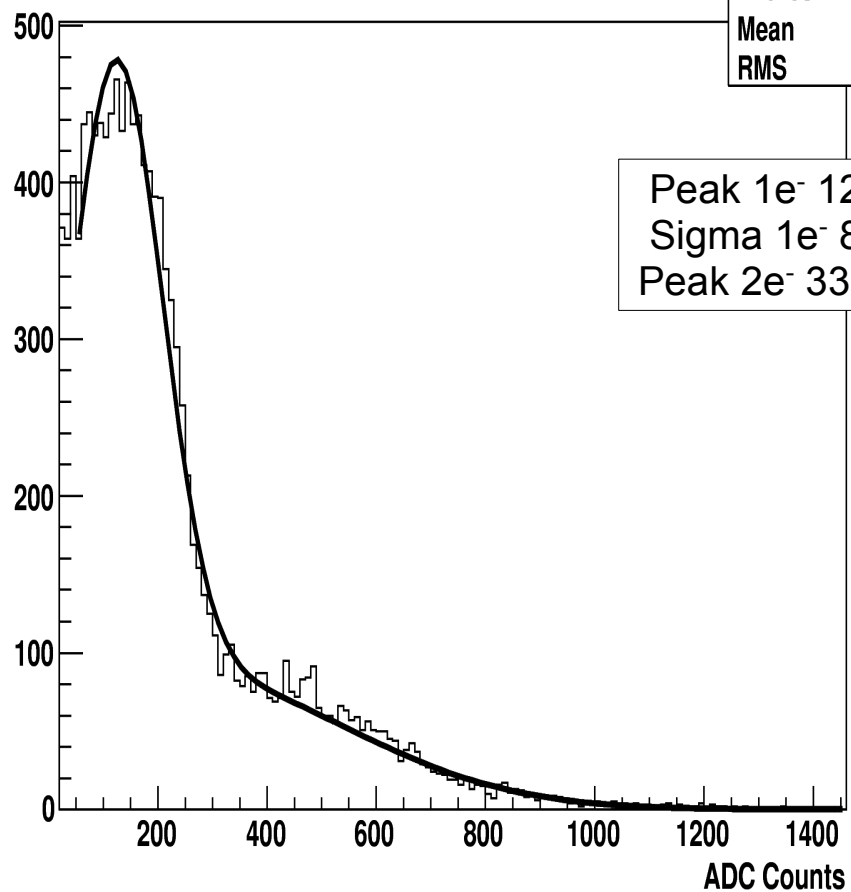
PIN_198MeV



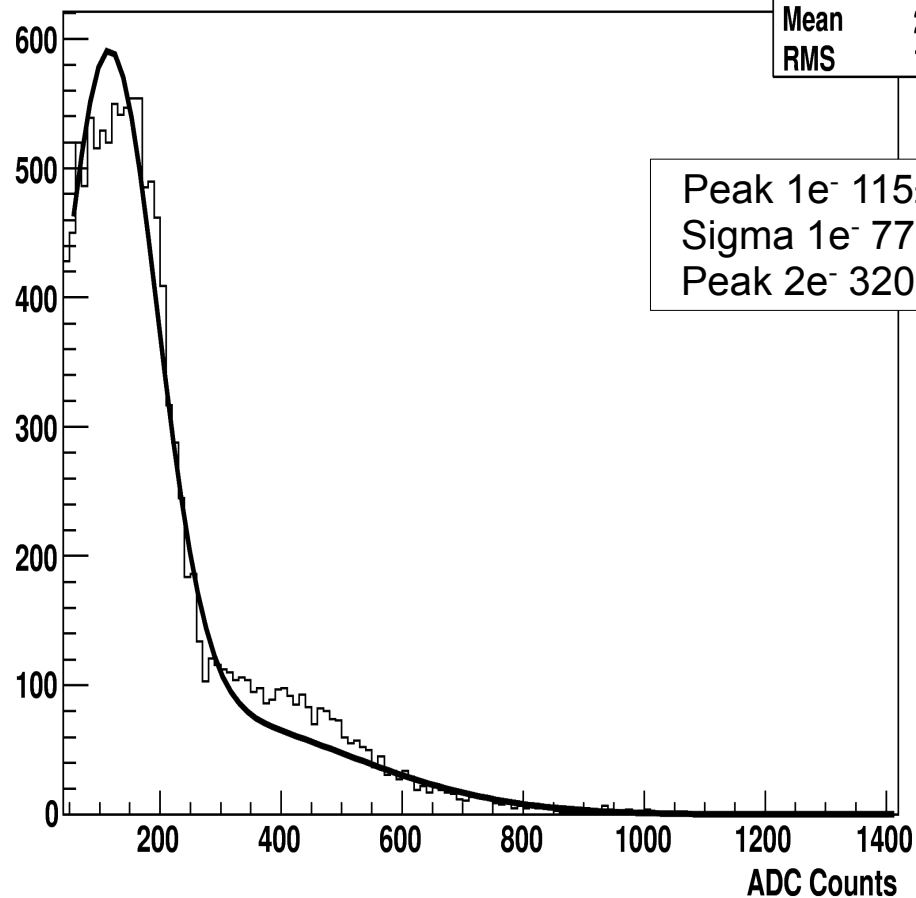
APD_198MeV



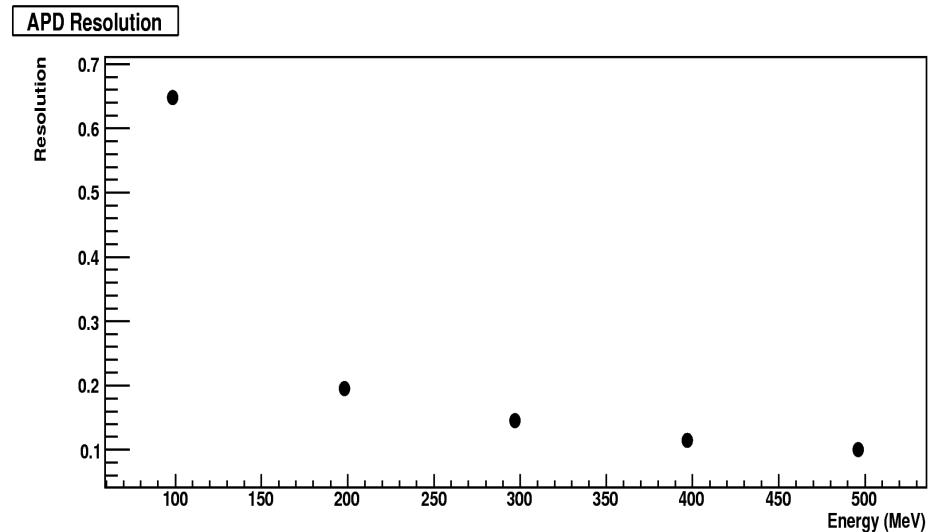
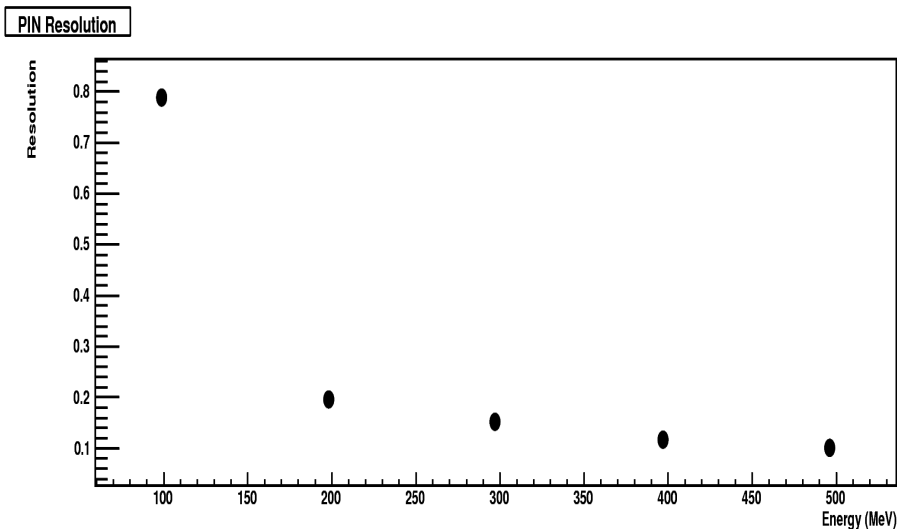
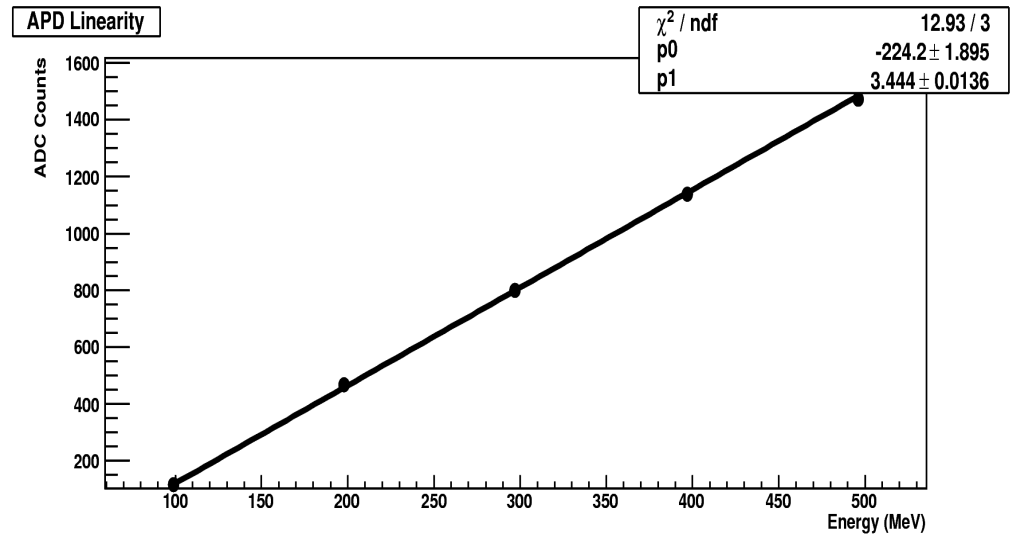
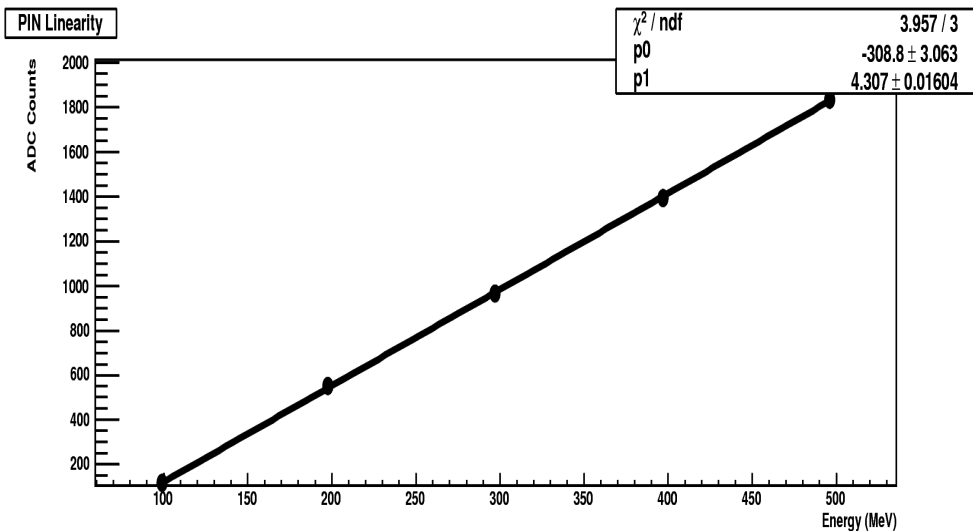
PIN_99MeV



APD_99MeV



- Here 1e⁻ and 2e⁻ peaks are partially overlapped



→ Resolution at 99MeV is affected by 1e-/2e- peaks overlapping and an increase of beam size

Conclusions

- All works very good for both PiN and APD
- What has been presented is only preliminary, a more detailed results will be communicated soon