

LNF Test Beam data analysis

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EMC Parallel Session, Elba Meeting, 29/05/2011

Outline

- Dataset
- Selection
- Deposited energy fits
- Resolution & silicon selection
- Resolution vs energy

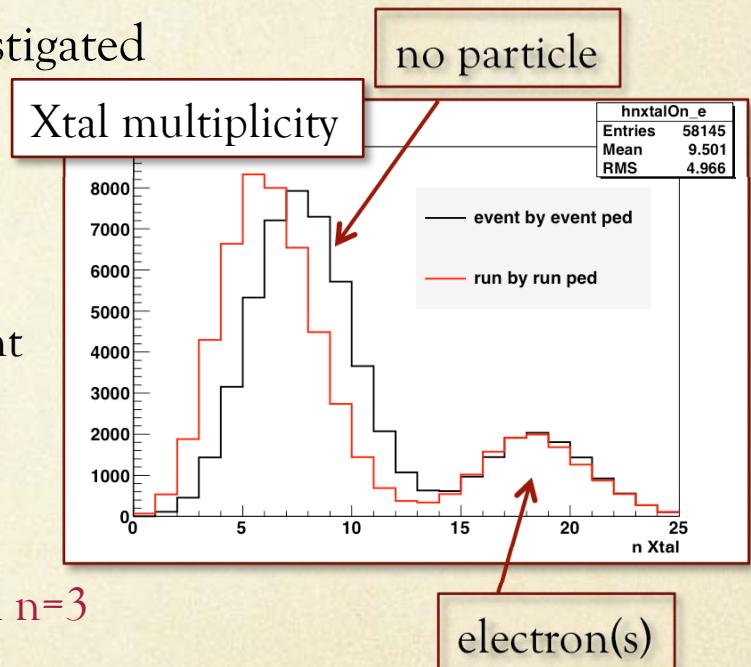
Dataset & Intercalibration

- Beam centered on **xtal 12**
- Runs taken after xtal 18 recovery
- APD Vbias = 380 V (high gain)
- **Xtal intercalibration** from electrons (Ric)

Energy (MeV)	Run
487	804
397	805
297	806
198	807
99	808

Intercalibration and energy threshold

- Details on **energy threshold**, **silicon selection** and **pedestal optimization** on Matteo's talk
- **Pedestal computation:** several methods investigated
 - event-by-event pedestal = mean of countings in the first 60 sampling
 - run-by-run pedestal = mean of event-by-event pedestal in a single runs → account for wider range of noise component frequencies
- **Deposited energy threshold**
 - xtal on if its deposited energy > n RMS with **n=3**
 - RMS from pedestal **RUN (712)**



Silicon Selection (I)

- Signal box determine by **minimizing resolution** (x-y region where the **total reconstructed energy \sim constant**)

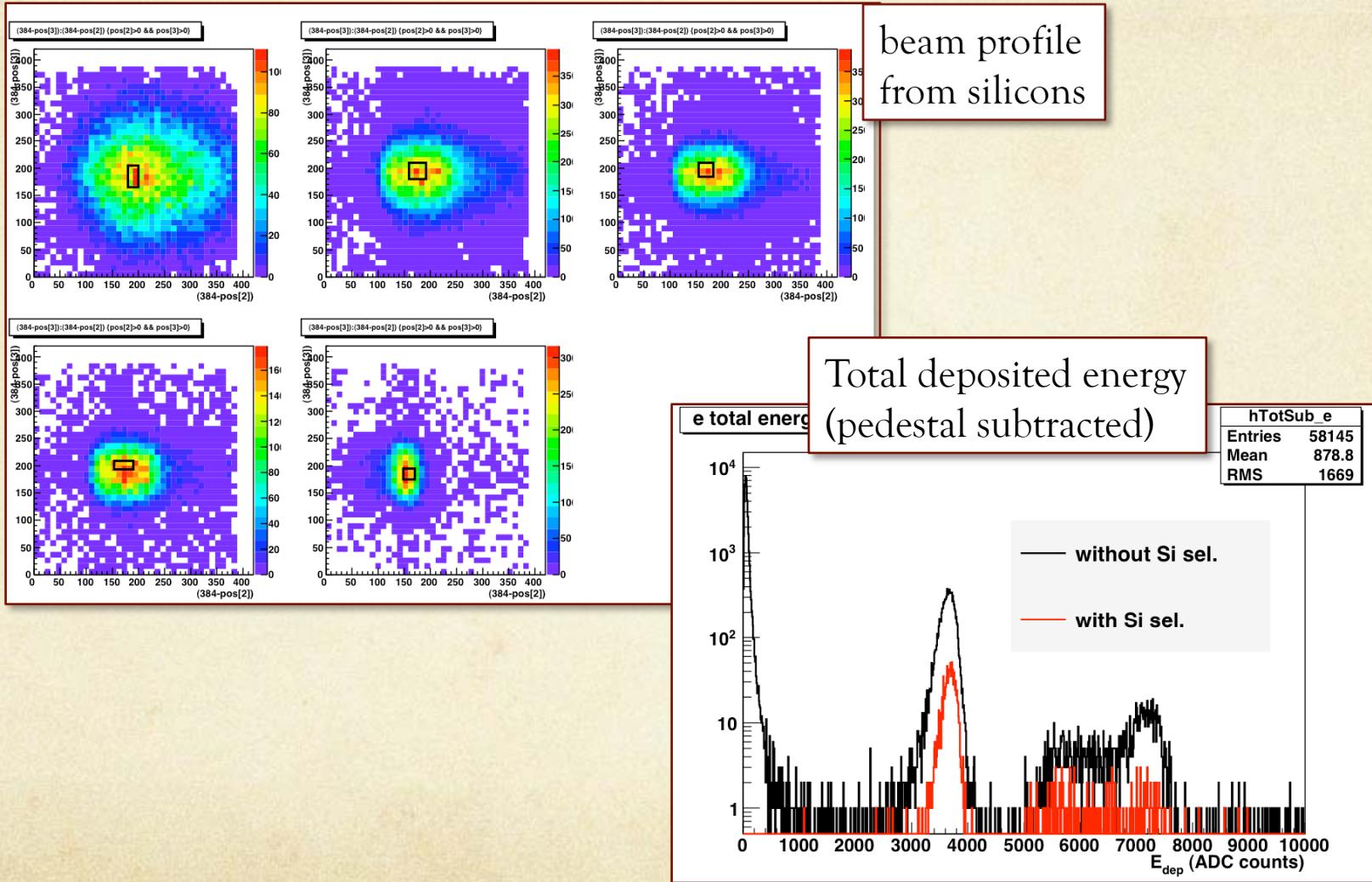
Energy (MeV)	x range (strips)	y range (strips)	Signal box (cmxcm)
487	148-170	175-195	0.50 x 0.46
397	153-190	193-209	0.85 x 0.36
297	155-183	184-210	0.64 x 0.59
198	159-192	180-210	0.75 x 0.69
99	180-220	165-205	0.91 x 0.91

n.b.:

$$x = 384 - pos[2]$$

$$y = 384 - pos[3]$$

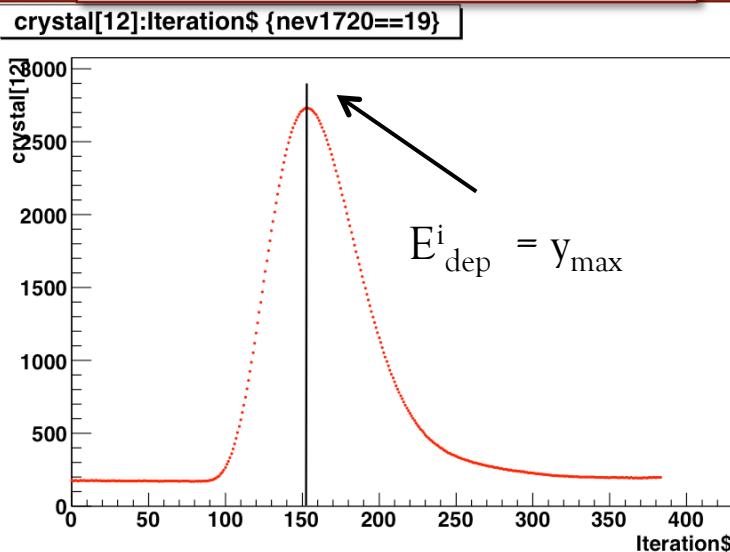
Silicon Selection (II)



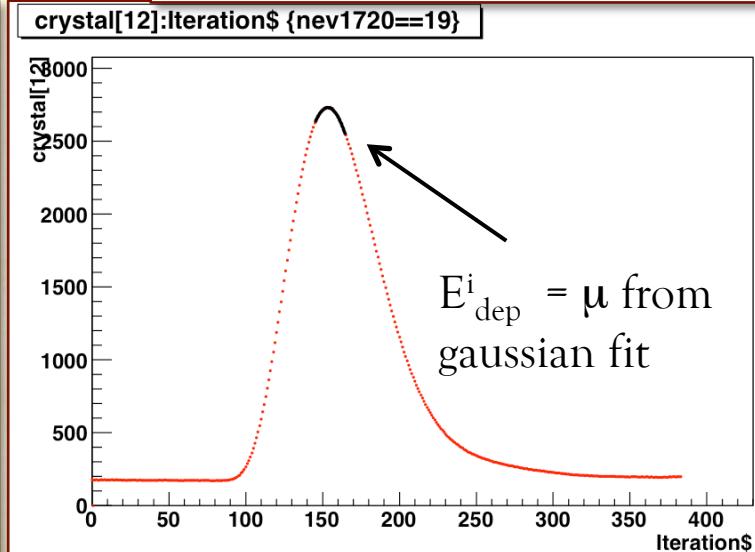
Deposited Energy computation

- METHOD 1 : i^{th} xtal deposited energy = **max value** over 384 samplings – pedestal
- METHOD 2 : i^{th} xtal deposited energy = **mean for gaussian fits** around max position – pedestal

Xtal multiplicity, METHOD 1

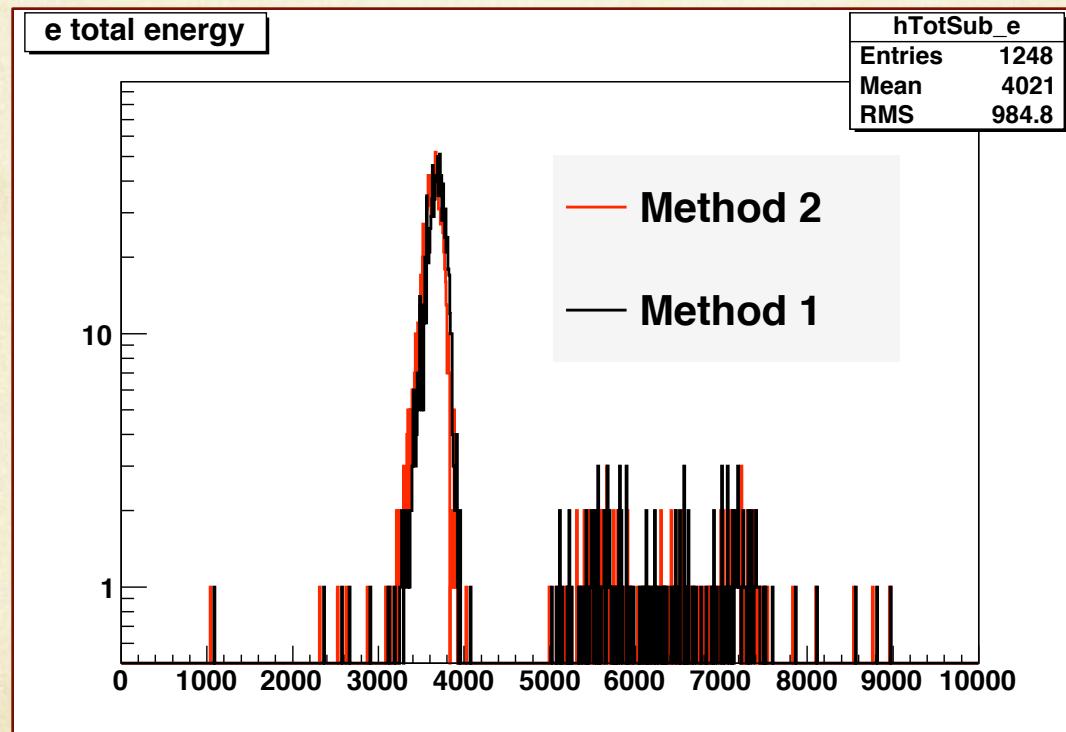


Xtal multiplicity, METHOD 2



Deposited Energy computation

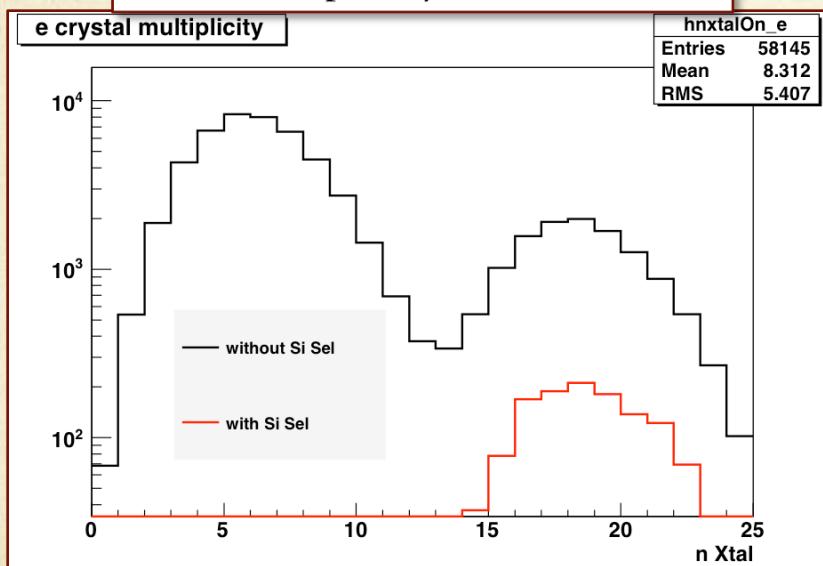
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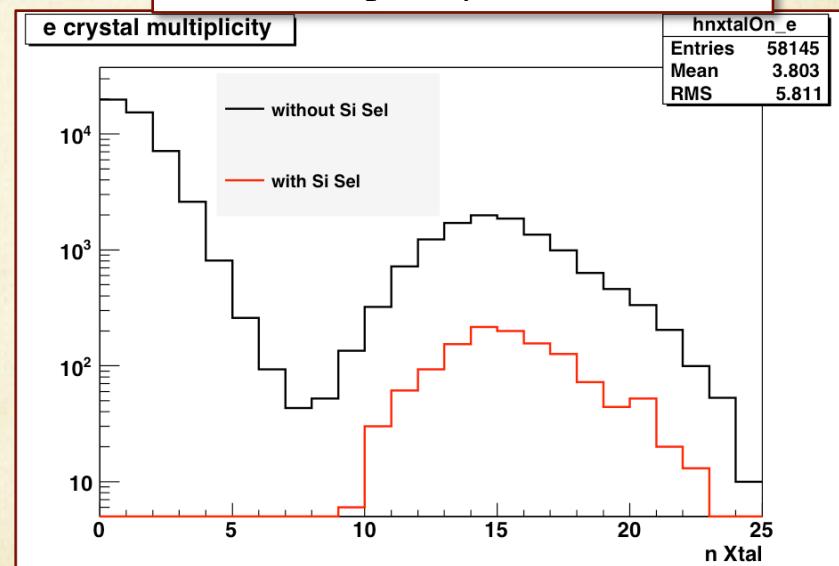
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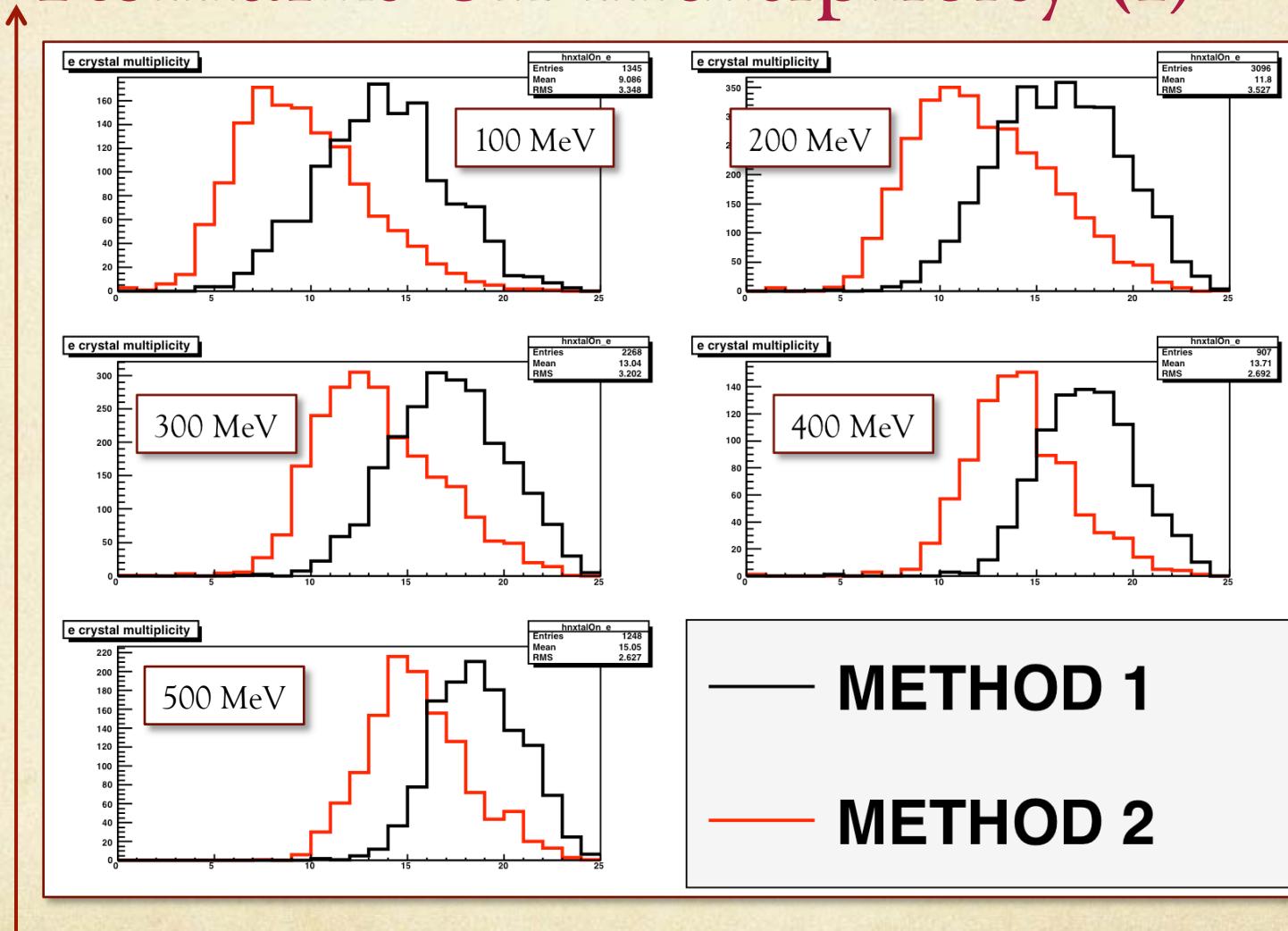
Xtal multiplicity, METHOD 1



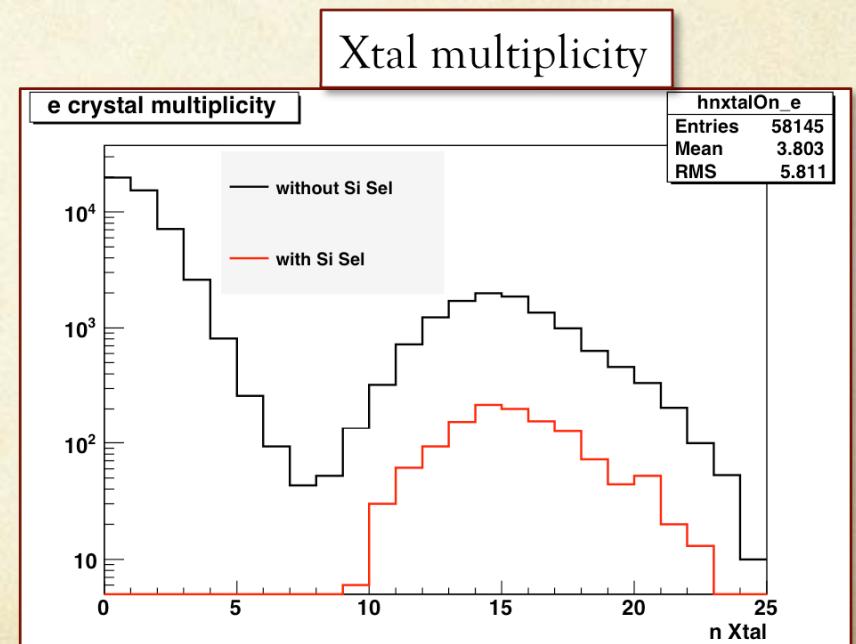
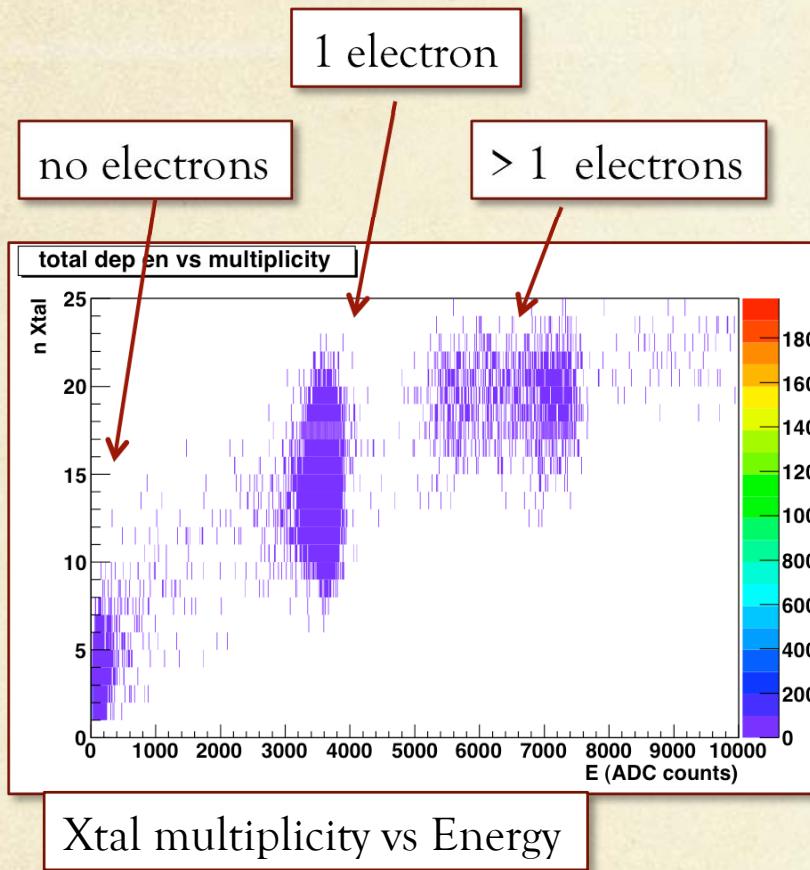
Xtal multiplicity, METHOD 2



Remarks on multiplicity (I)

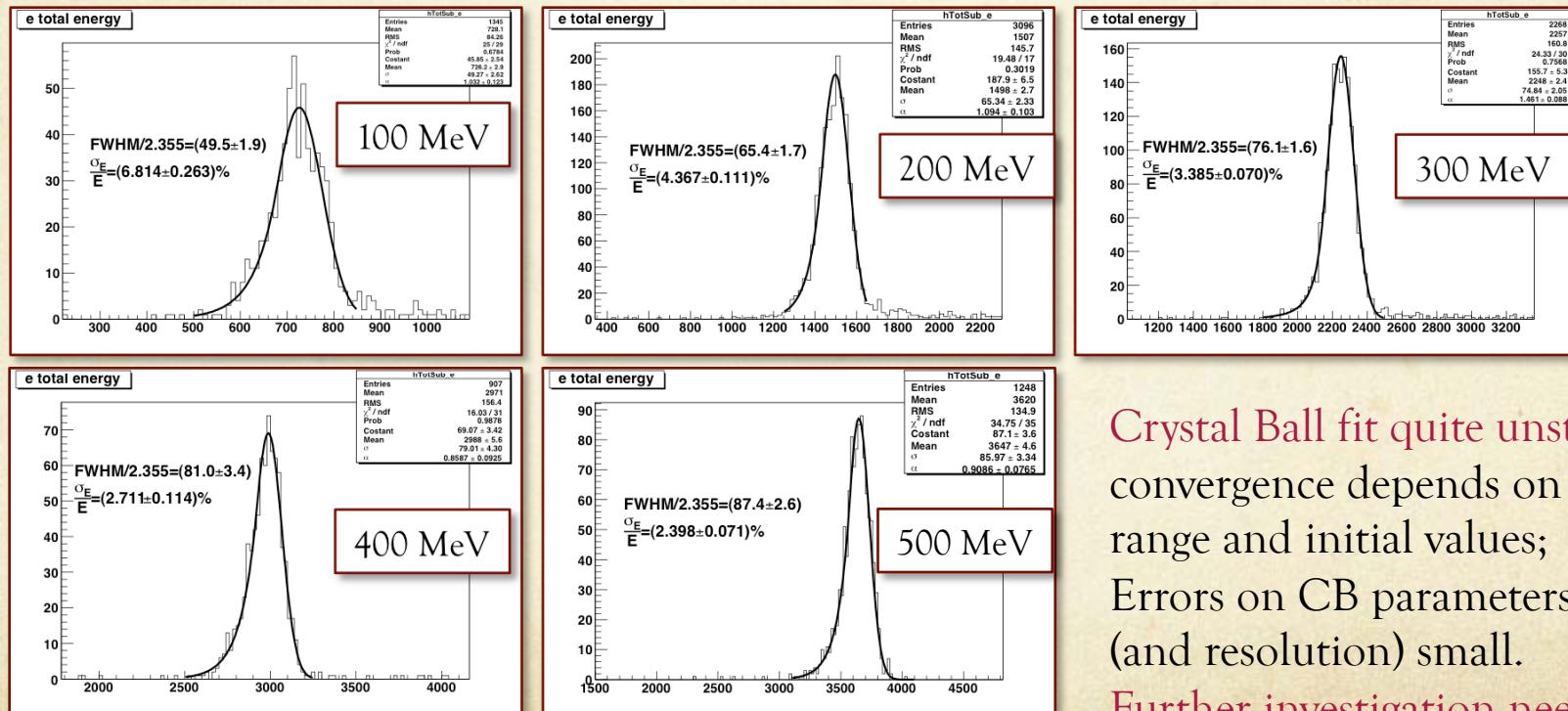


Remarks on multiplicity (II)



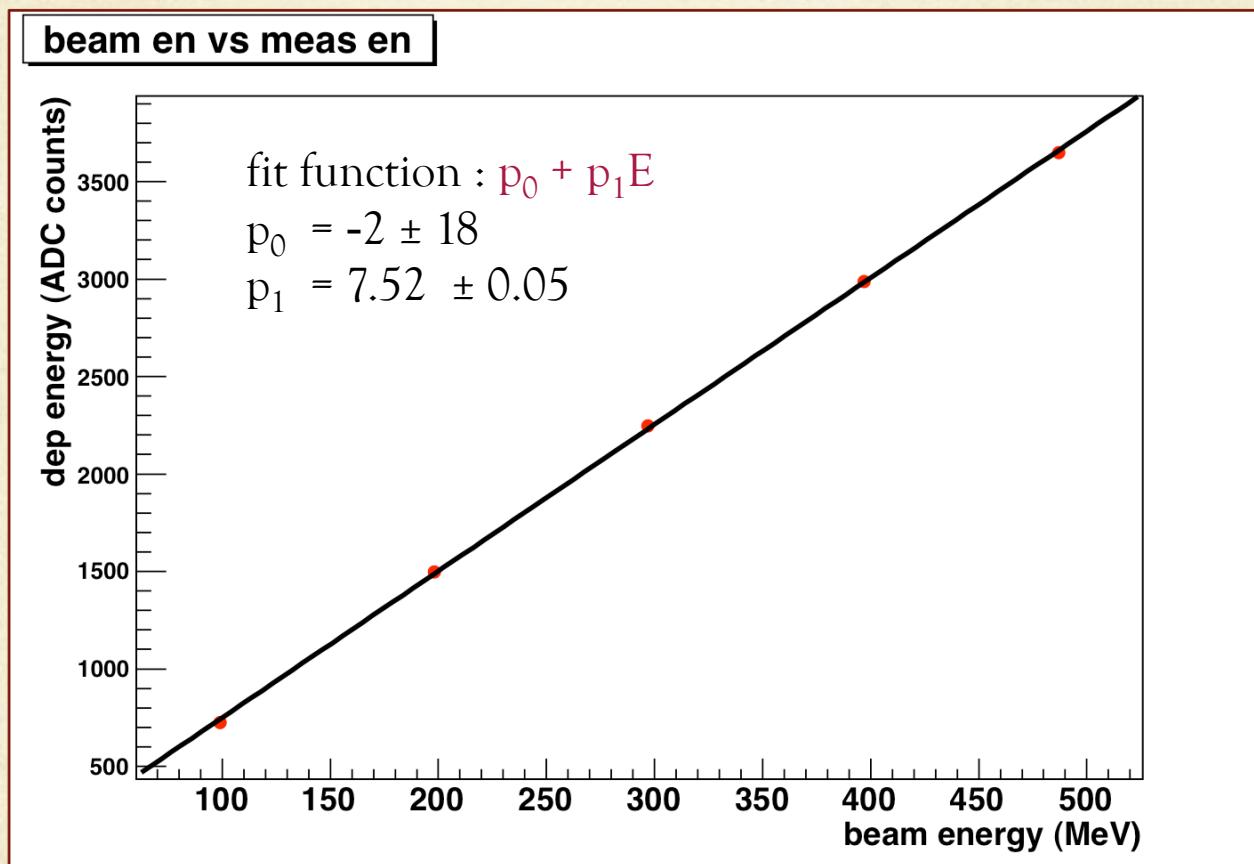
Deposited Energy fits

- Fit with Crystal Ball function
 - run by run pedestal, with xtal deposited energy from gaussian fit (METHOD 2)

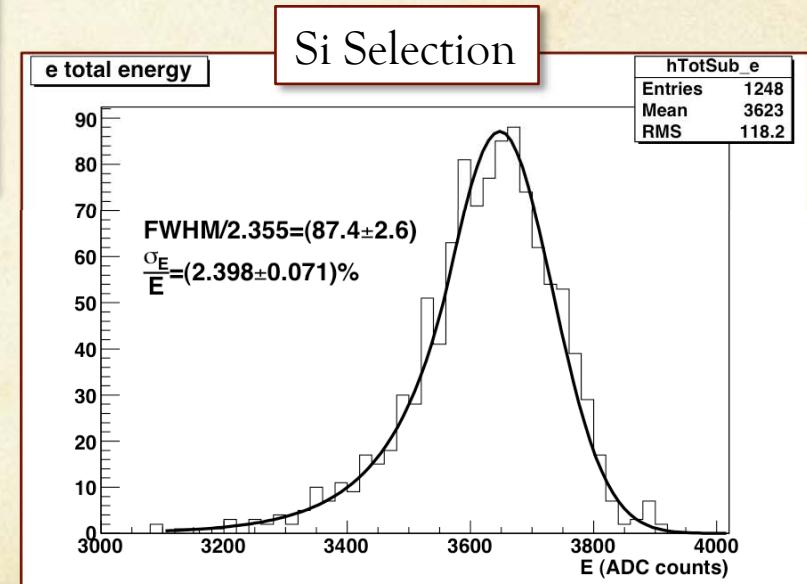
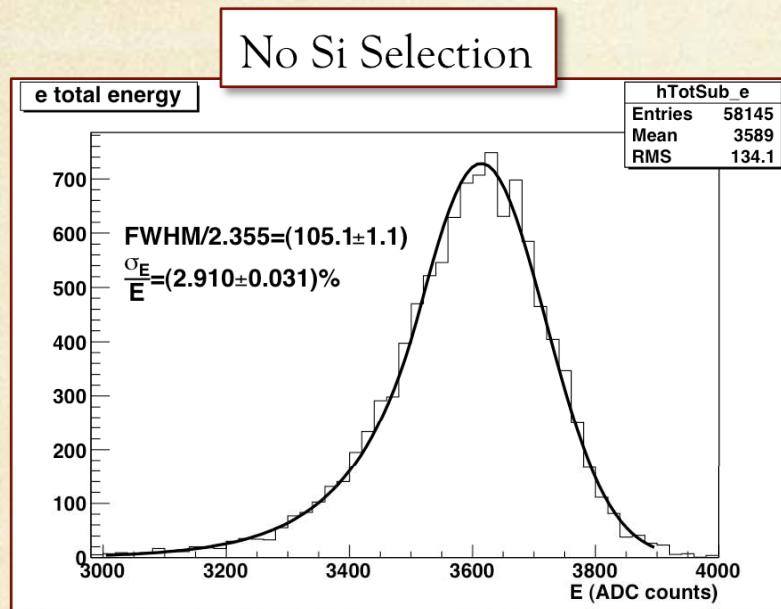


Crystal Ball fit quite unstable,
convergence depends on fit
range and initial values;
Errors on CB parameters
(and resolution) small.
Further investigation needed

Linearity



Resolution & Si cut

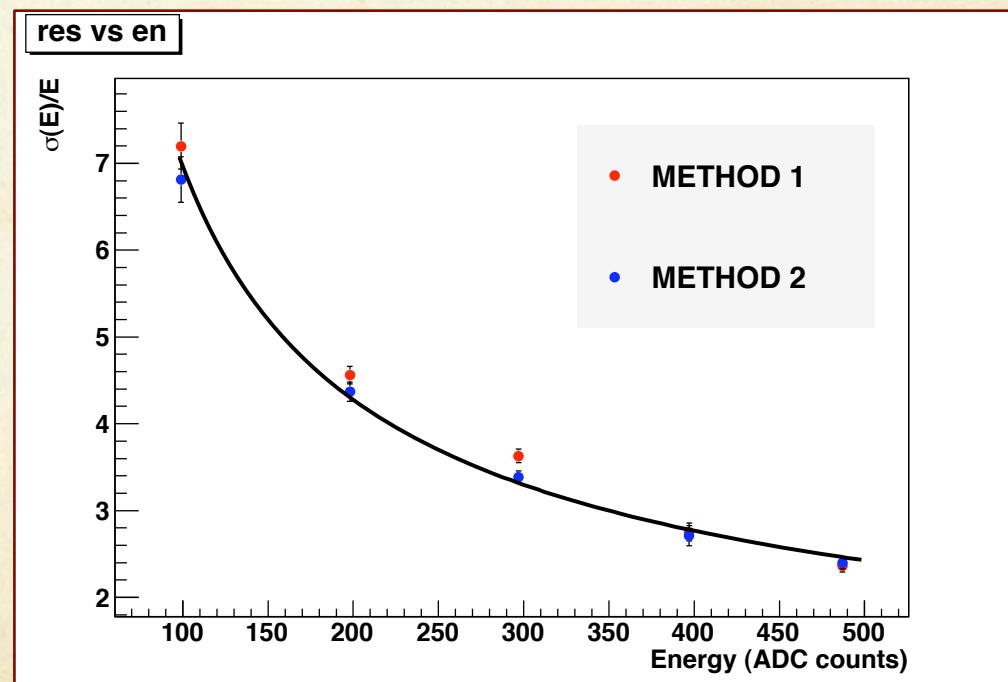


$\sigma(E)/E$ vs E - BTF

- Fit function : $p_0/\sqrt{E(\text{MeV})} + p_1/E(\text{MeV}) + p_2$

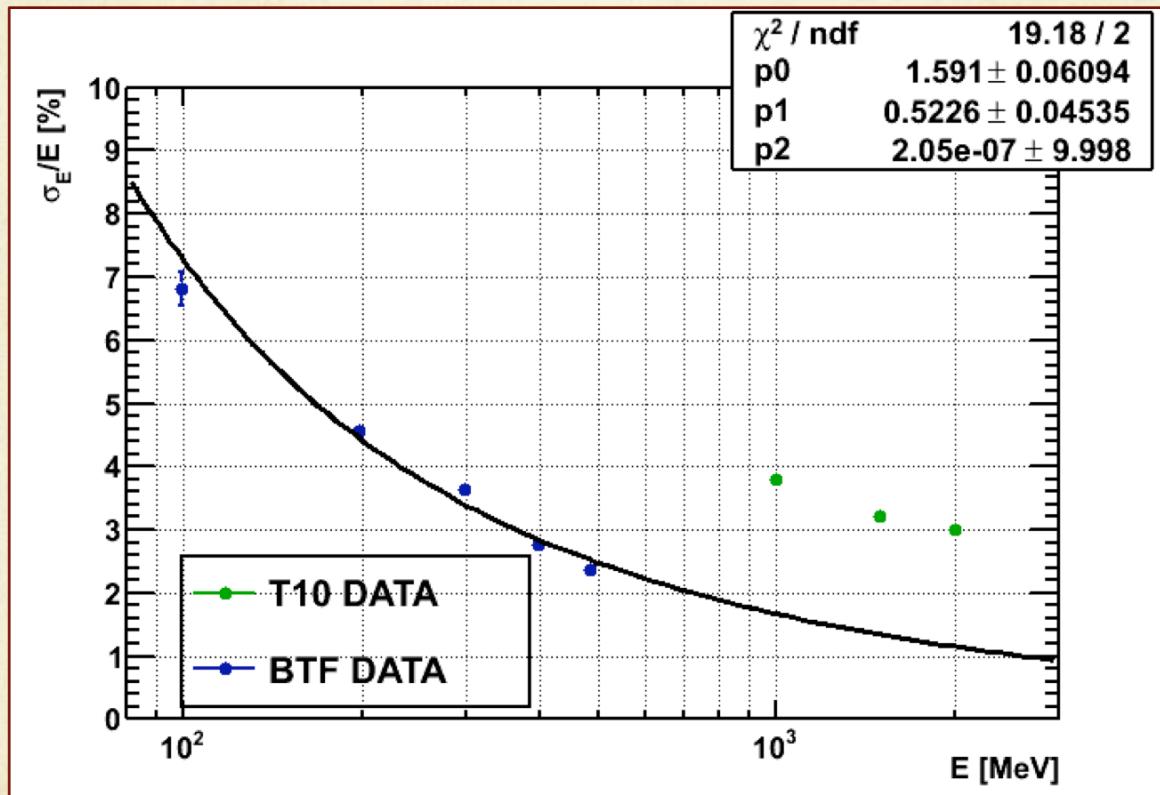
- $p_0 = (50 \pm 2)$
- $p_1 = (488 \pm 47)$
- $p_2 = (0.0 \pm 0.6)$

(METHOD 2 - points)



$\sigma(E)/E$ vs E – CERN + BTF

- Fit function : $p_0/\sqrt{E(\text{GeV})} + p_1/E(\text{GeV}) + p_2$



Conclusions

- BTF Xtal 12 data analyzed
- Energy threshold, silicon selection and pedestal optimized (see Matteo's talk)
- Test performed on algorithm for energy deposit calculation
 - gaussian fits seem to perform better than old method in terms of multiplicity
 - study to improve CB fits stability in our to-do-list
- Check on linearity of detector response in energy gives satisfactory results
- Silicon selection has a big impact on the resolution
 - @ 500 MeV : $\sigma(E)/E$ from 2.9% (w/o sel) to 2.4% (w sel)
- Comparing with Cern results:
 - Cern points higher wrt expected distribution from BTF data due to Si selection and better signal/noise ratio @ BTF

Extra - slides