

BTF testbeam simulation

SuperB EMC meeting

**XVII SuperB Workshop and Kick Off Meeting
La Biodola (Isola d'Elba)**

29/05/2011

S. Germani

Outline

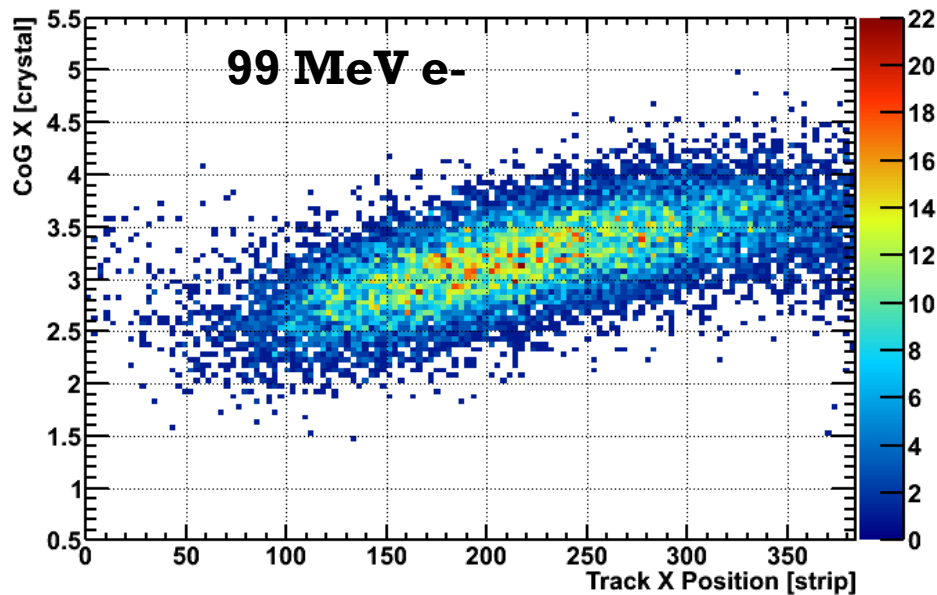
- **Simulation description**
- **Beam position tuning**
- **Not completely known effects study**
- **Conclusions**

Simulation description

- The simulation geometry is as realistic as possible
 - Exact size projective crystals
 - Glass fiber structure
 - Silicon detectors and boxes
 - Plastic scintillators (scintillating fibers counters)
- Simulated effects
 - Shower development from G4
 - Photostatistic smearing with light yield from measurements
 - LY longitudinal non uniformity from measurements
 - Signal cross-talk from measurements
 - Intercalibration error
 - Beam energy spread
 - Electronic signal shape, amplitude and noise
- Signal extraction
 - All DATA and MC results are obtained with signal extracted taking the ADC sample with the maximum value

Data CoG vs Silicon position

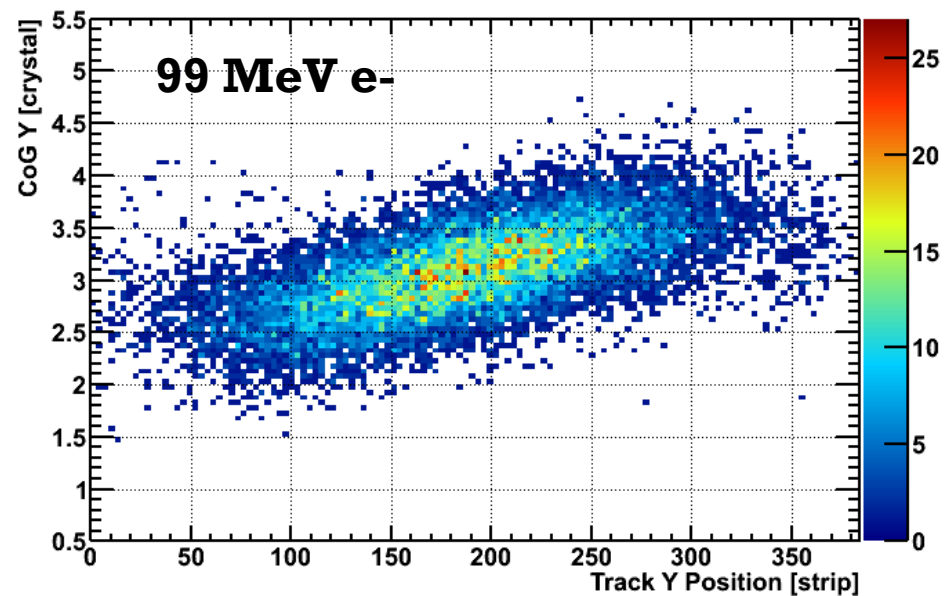
cog vs Si - X



Crystal energy center of gravity shows good correlation with silicon position measurement

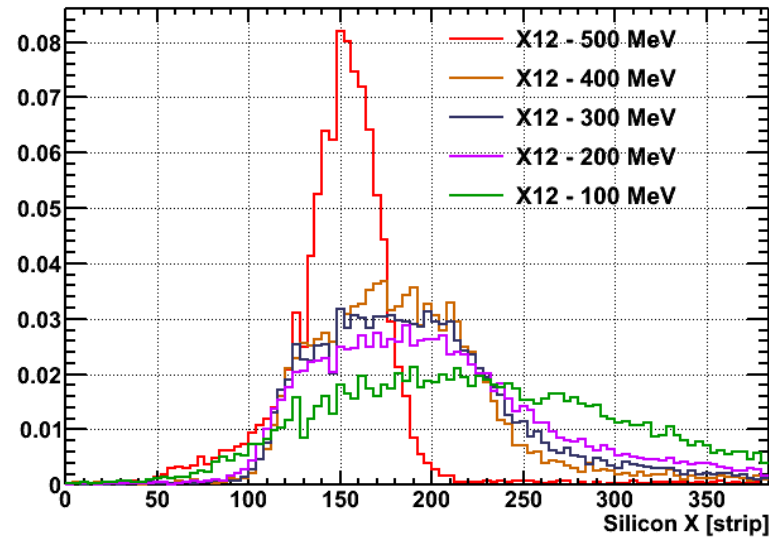
The CoG can be effectively used to find the correct MC beam position

cog vs Si - Y

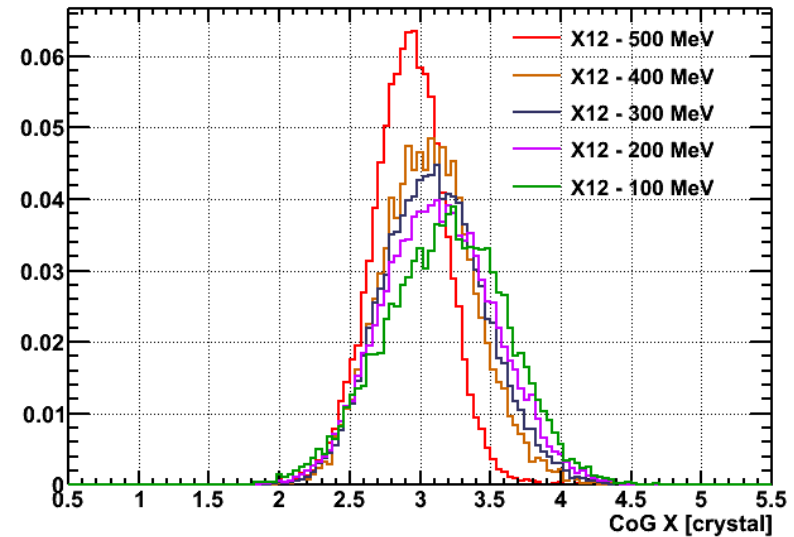


Beam profile – CoG

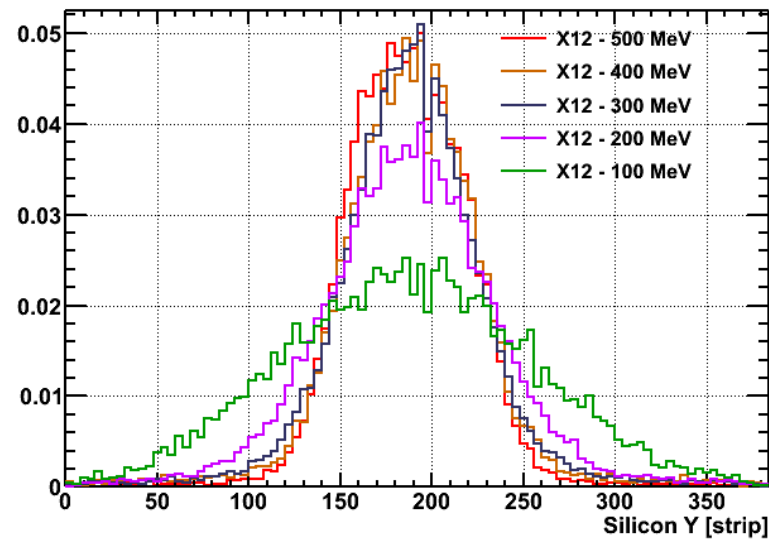
Silicon X



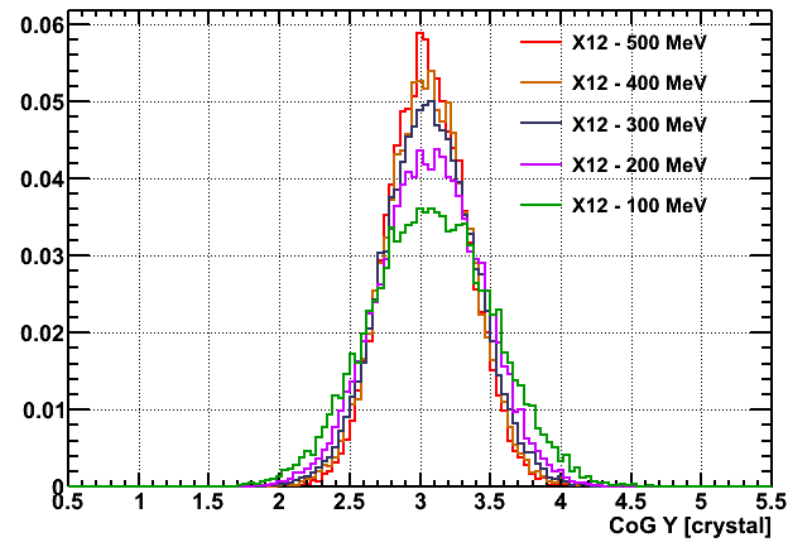
center of gravity, x axis



Silicon Y

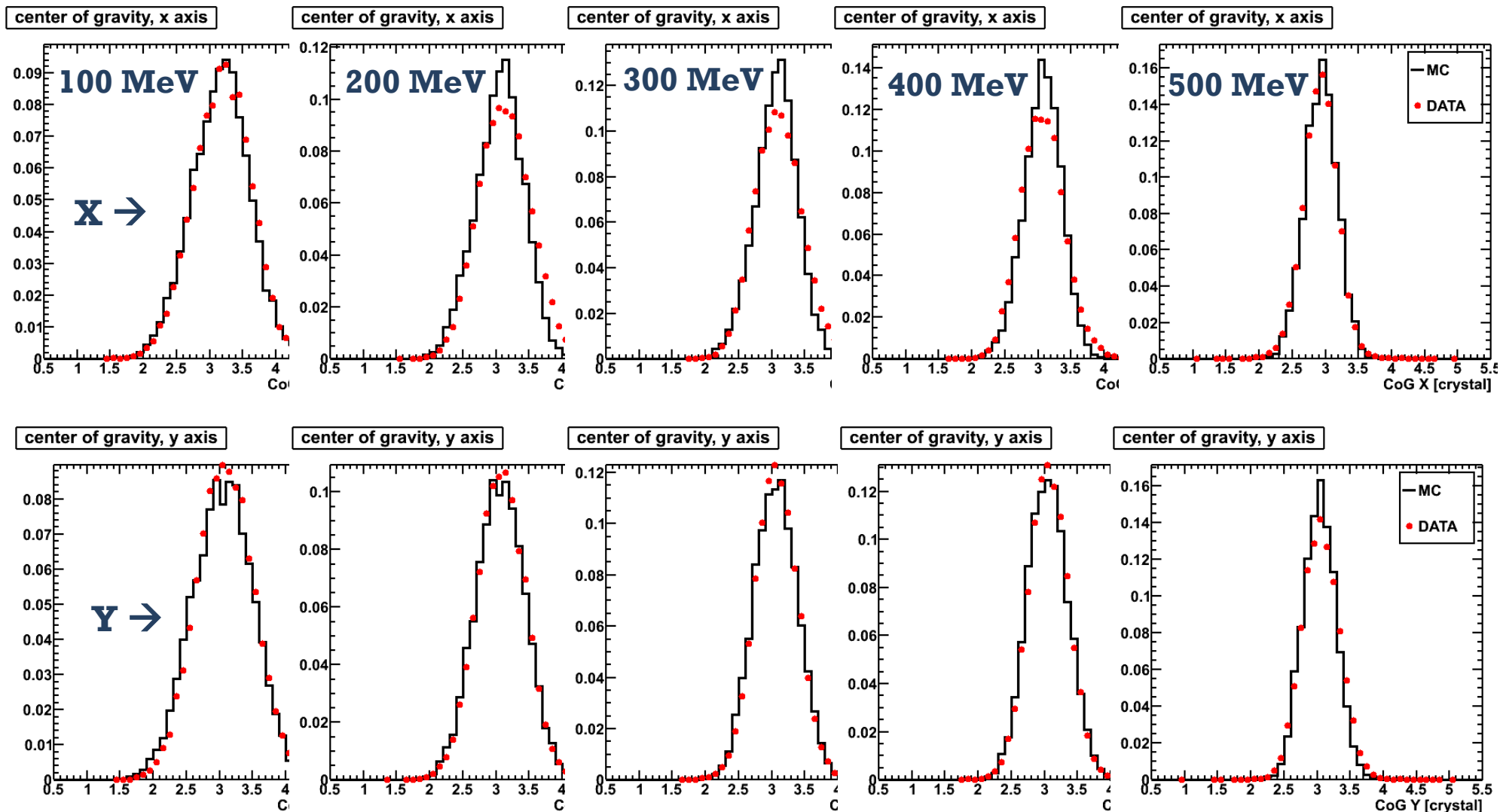


center of gravity, y axis



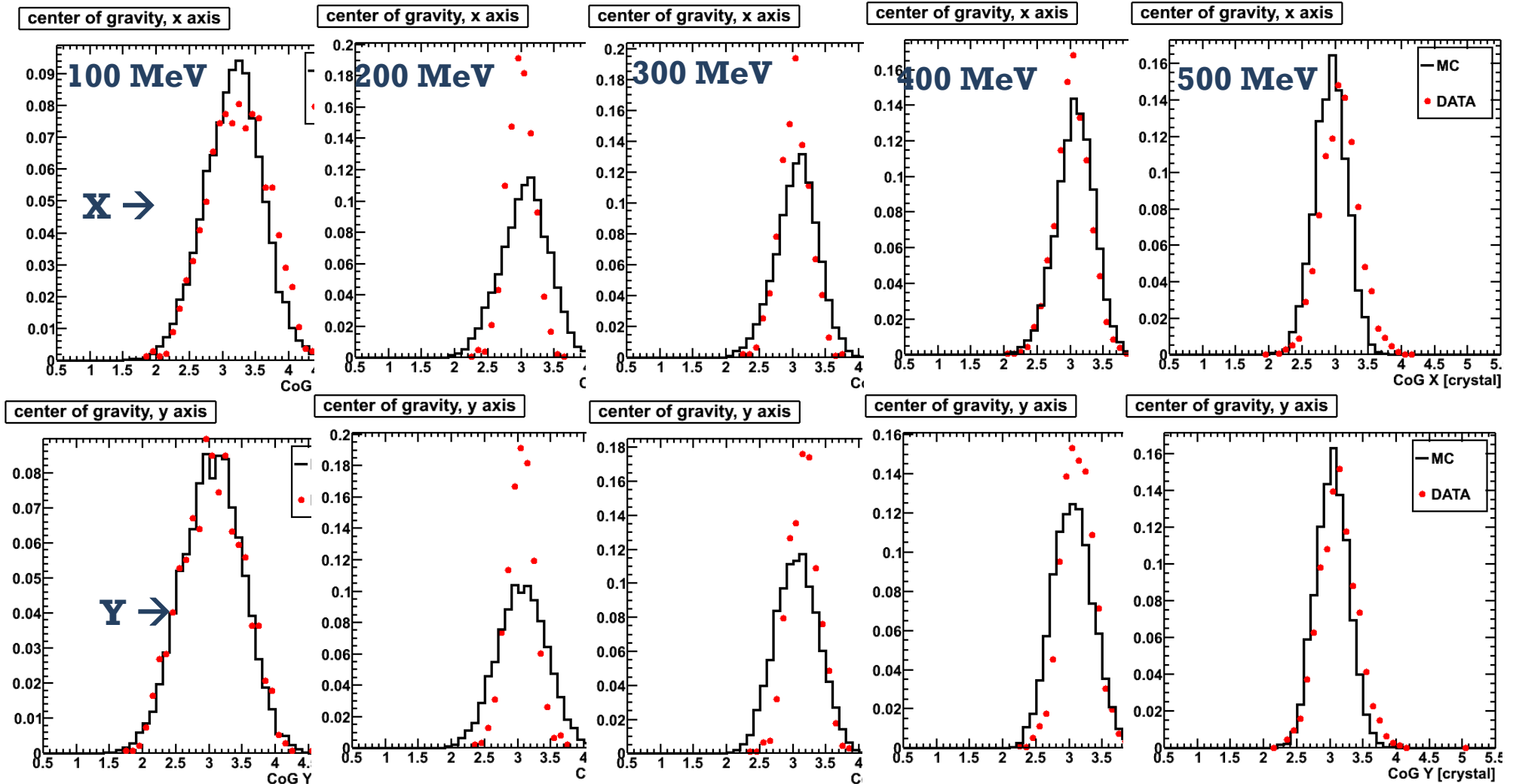
CoG : DATA - MC

Data –MC Energy Center of Gravity (CoG) comparison
No Silicon selction on Data



CoG : DATA Si selected - MC

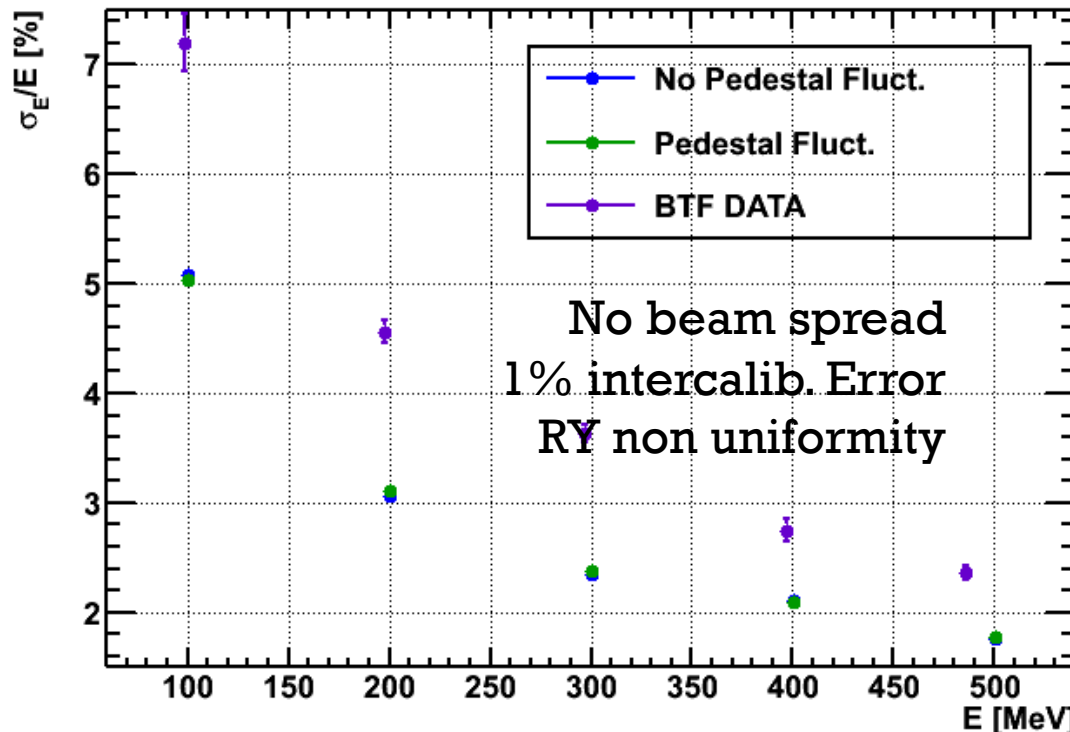
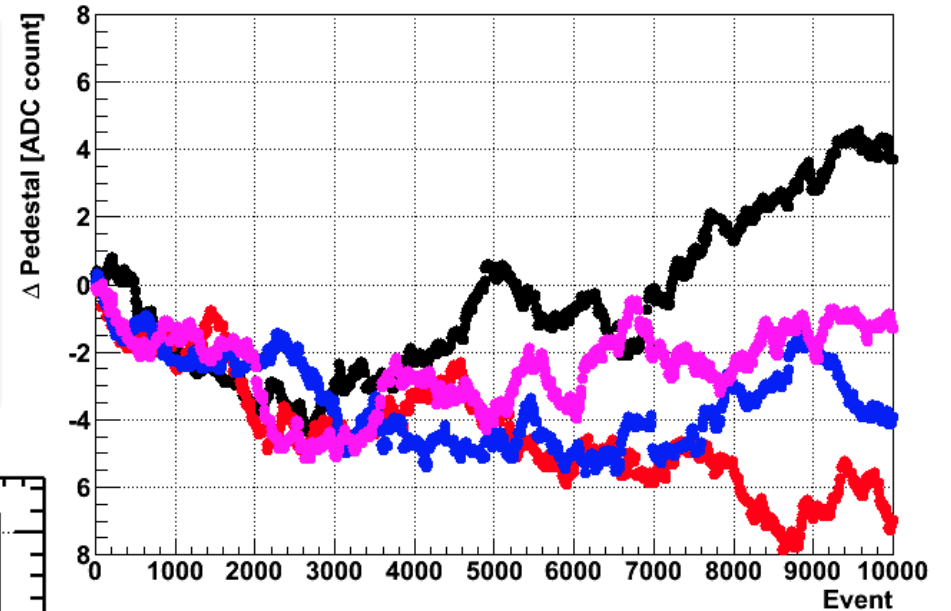
Data -MC Energy Center of Gravity (CoG) comparison
Silicon selected Data → MC spot dimension and position need retuning!



Pedestal oscillations

Try to emulate pedestal
randomoscillations

Simulated pedestal has stronger
variability than data



The simulated pedestal
fluctuations have negligible
effect

Not used for default simulation

Light yield longitudinal non-uniformity

Crystal longitudinal light yield non-uniformity is simulated.

Compare :

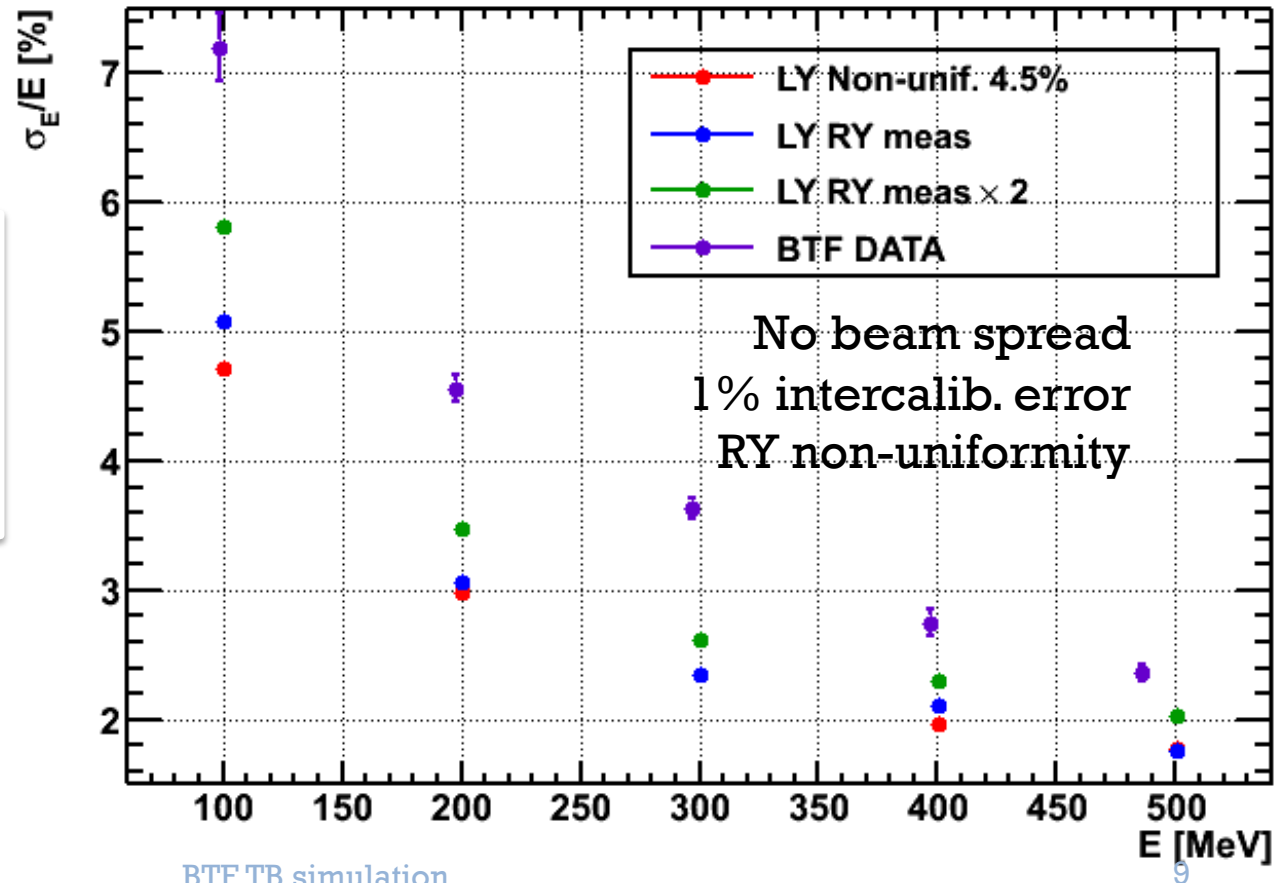
→ All crystals @ 4.5%

→ Ren-yuan measured non-uniformity with 15 mm black paint

→ 2 x Ren-yuan measured values

Non negligible effect

**Not enough to explain
the full DATA-MC
difference**



Crystal intercalibration error

Crystals intercalibration error is simulated.

Compare

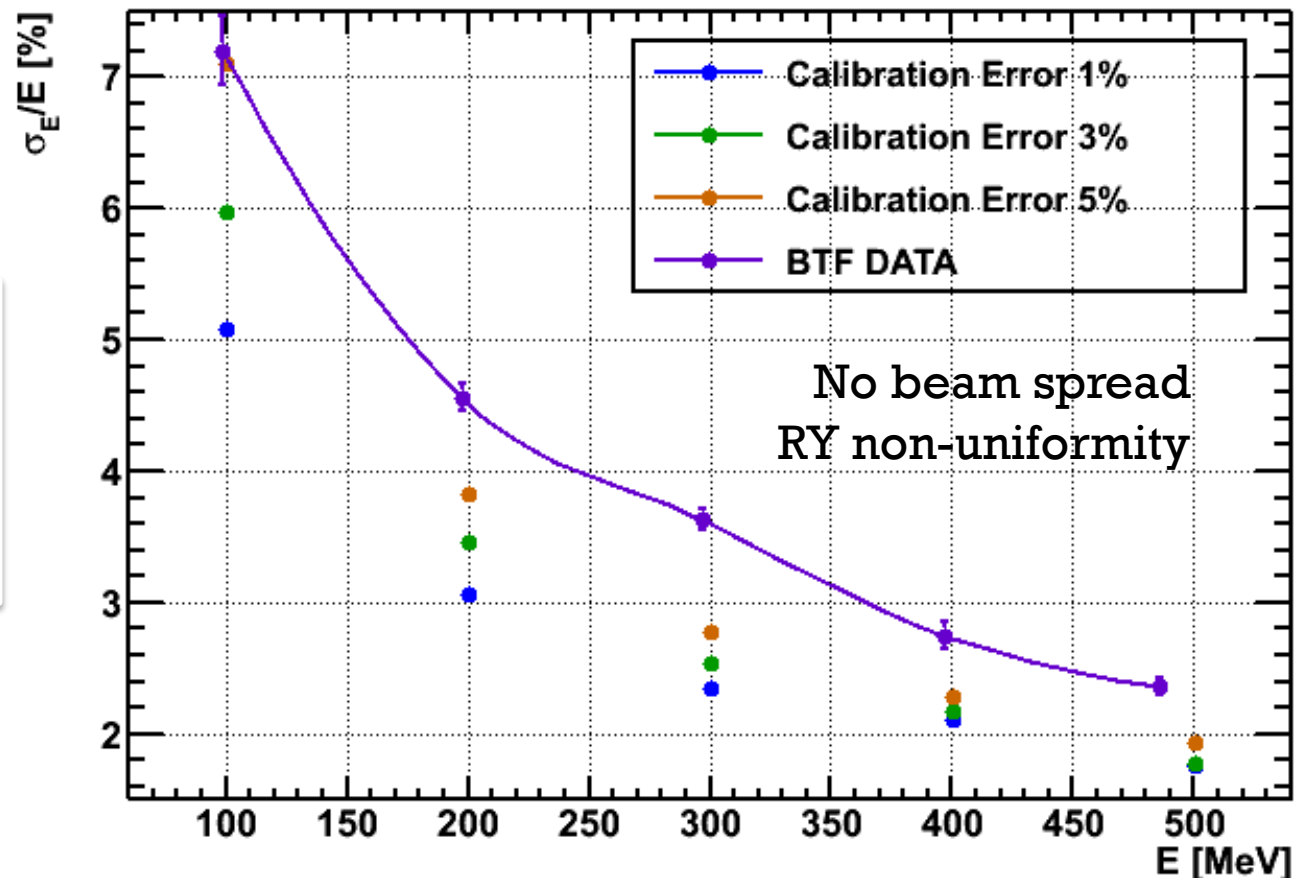
→ 1%

→ 3%

→ 5%

Non negligible effect

**Preliminary
intercalibration error
estimation : ~ 1 %**



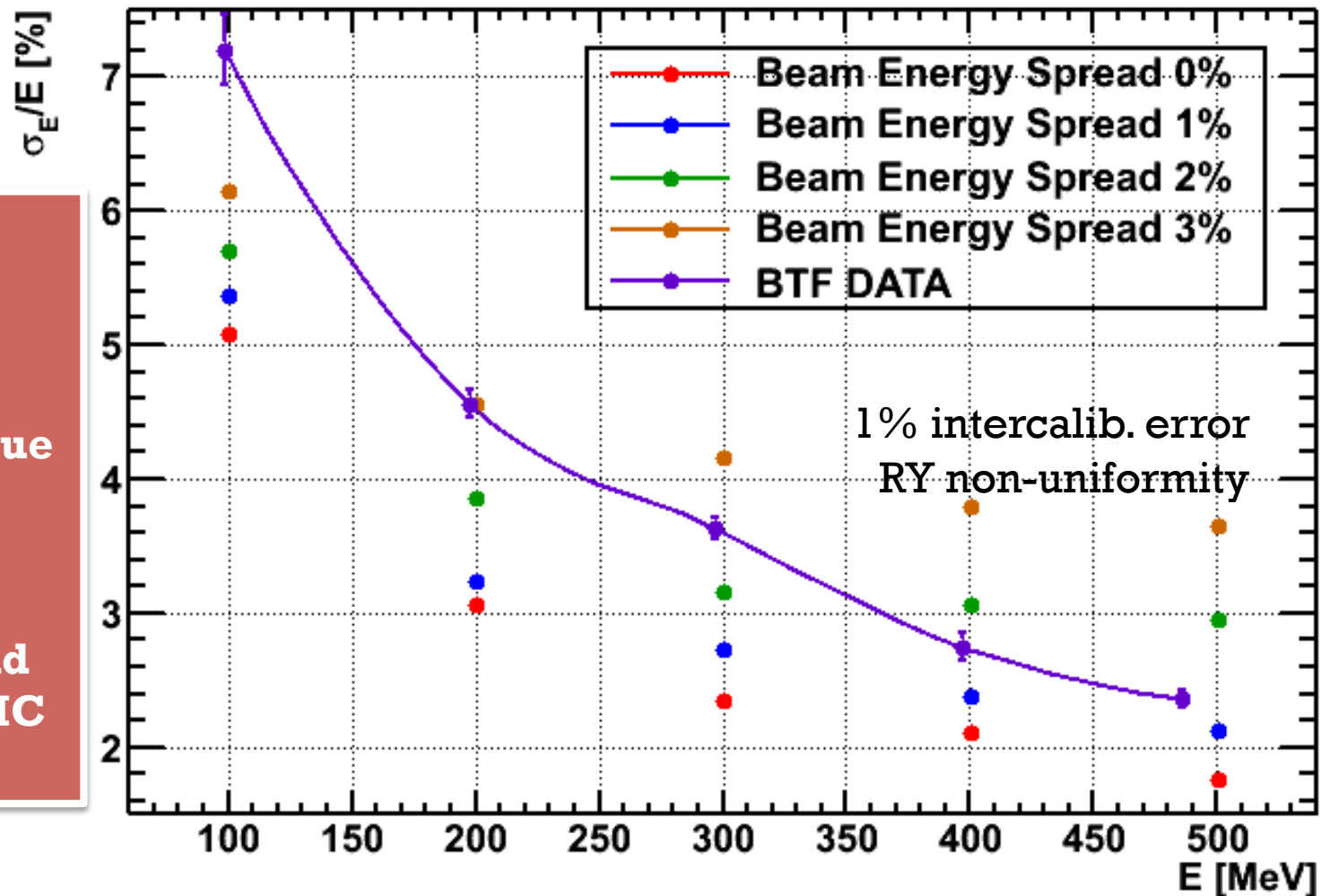
Beam energy spread

Gaussian beam energy spread is simulated
Compare: 0→3% spread

Beam energy spread has large impact

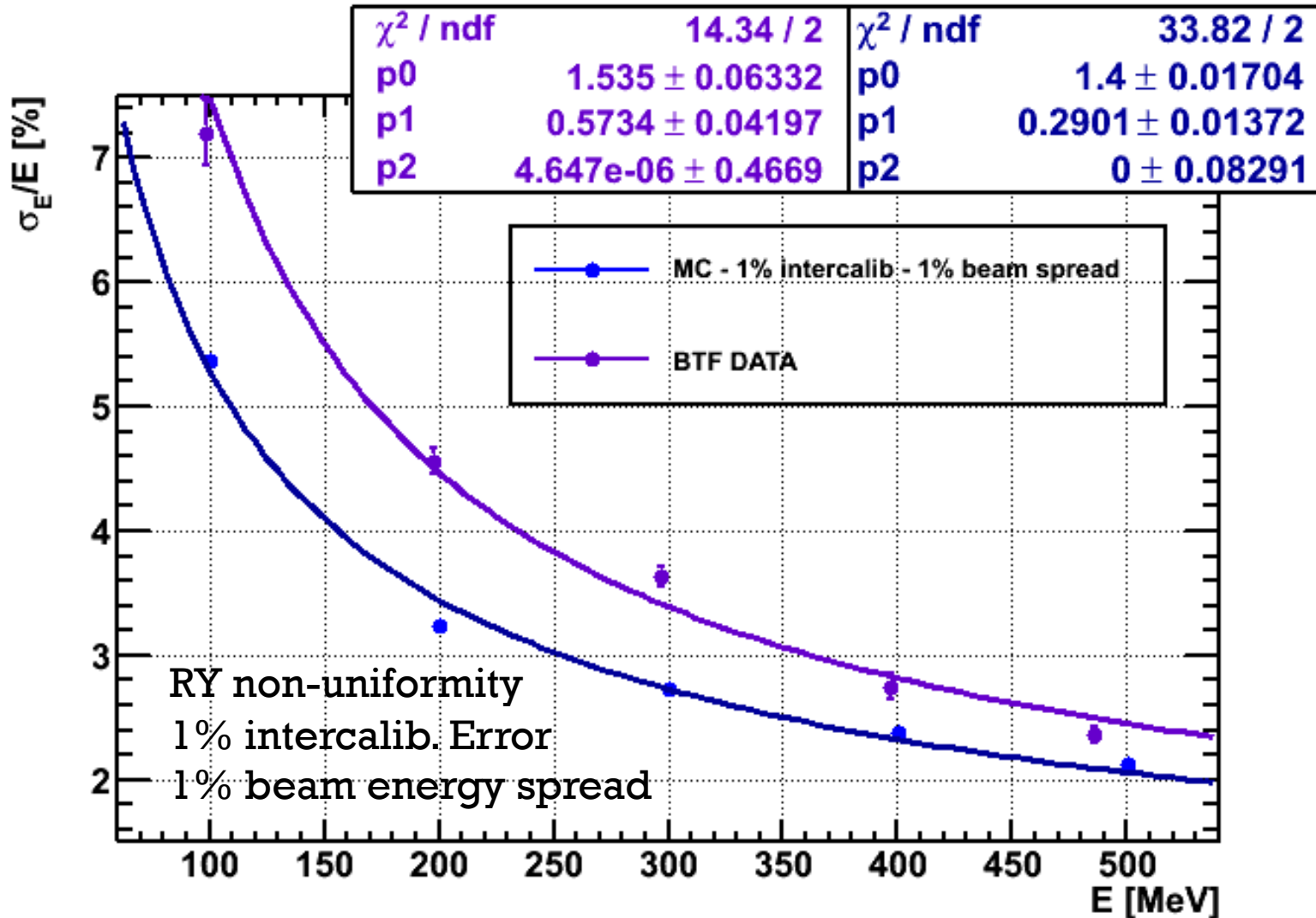
BTF nominal value gives ~1%

Need energy dependent spread to make DATA-MC agree



Energy resolution fit

$$\sigma(E)/E = p0/\sqrt{E(\text{GeV})} (+) p1/E(\text{GeV}) (+) p2$$



Conclusions

- No single realistic effect can account for DATA_MC discrepancy
- Disagreement larger at low energies
- Realistic evaluation of intercalibration error and beam spread vs E is fundamental