EUROPEAN UNION

GOVERNMENT OF ROMANIA

Structural Instruments 2007-2013

Competitiveness Operational Programme

Extreme Light Infrastructure – Nuclear Physics (ELI-NP) – Phase II
Project co-financed by the European Regional Development Fund

Sub-GeV gamma spectrometry

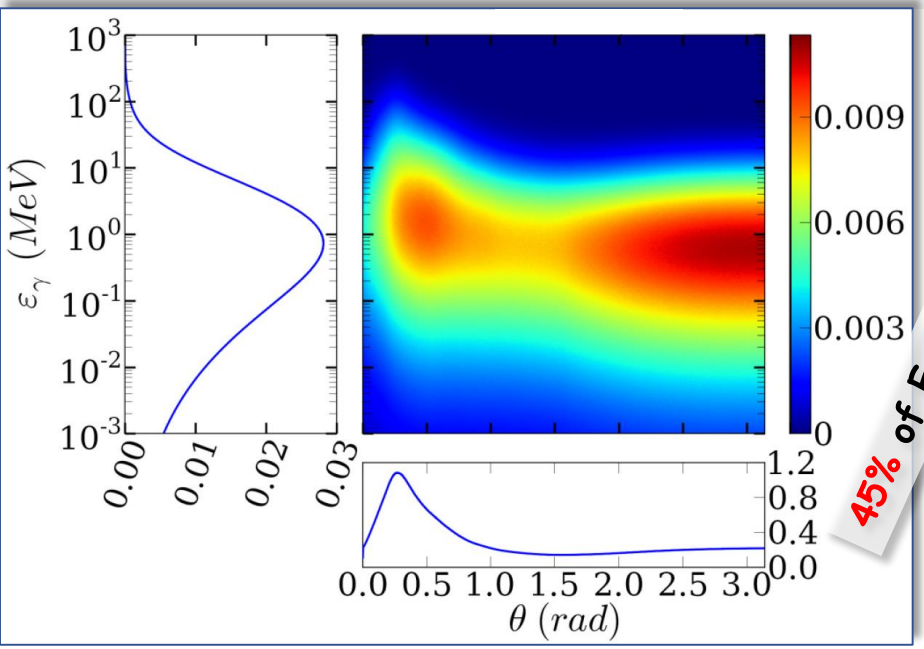
BLIN4: Beam Line and INstrumentation: Fourth Workshop
June 29th 2020 (via ZOOM)

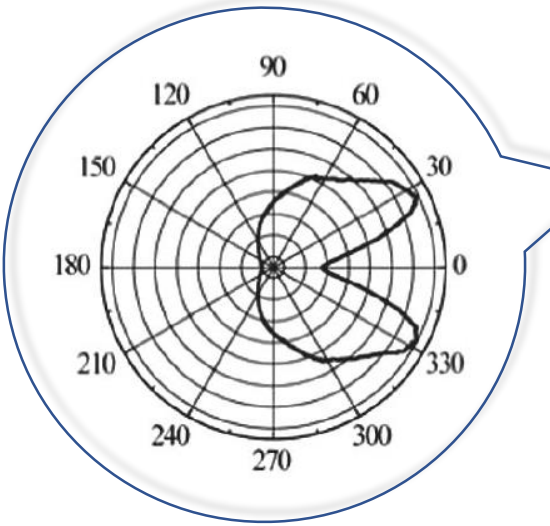
Nuclear Physics

Florin ROTARU
ELI-NP/LDED

Radiation reaction / gamma spectrometry

Ribeyre et al., Phys.Rev.E 93 (2016) 013201 / $I=10^{23}$ W·cm^{-2}

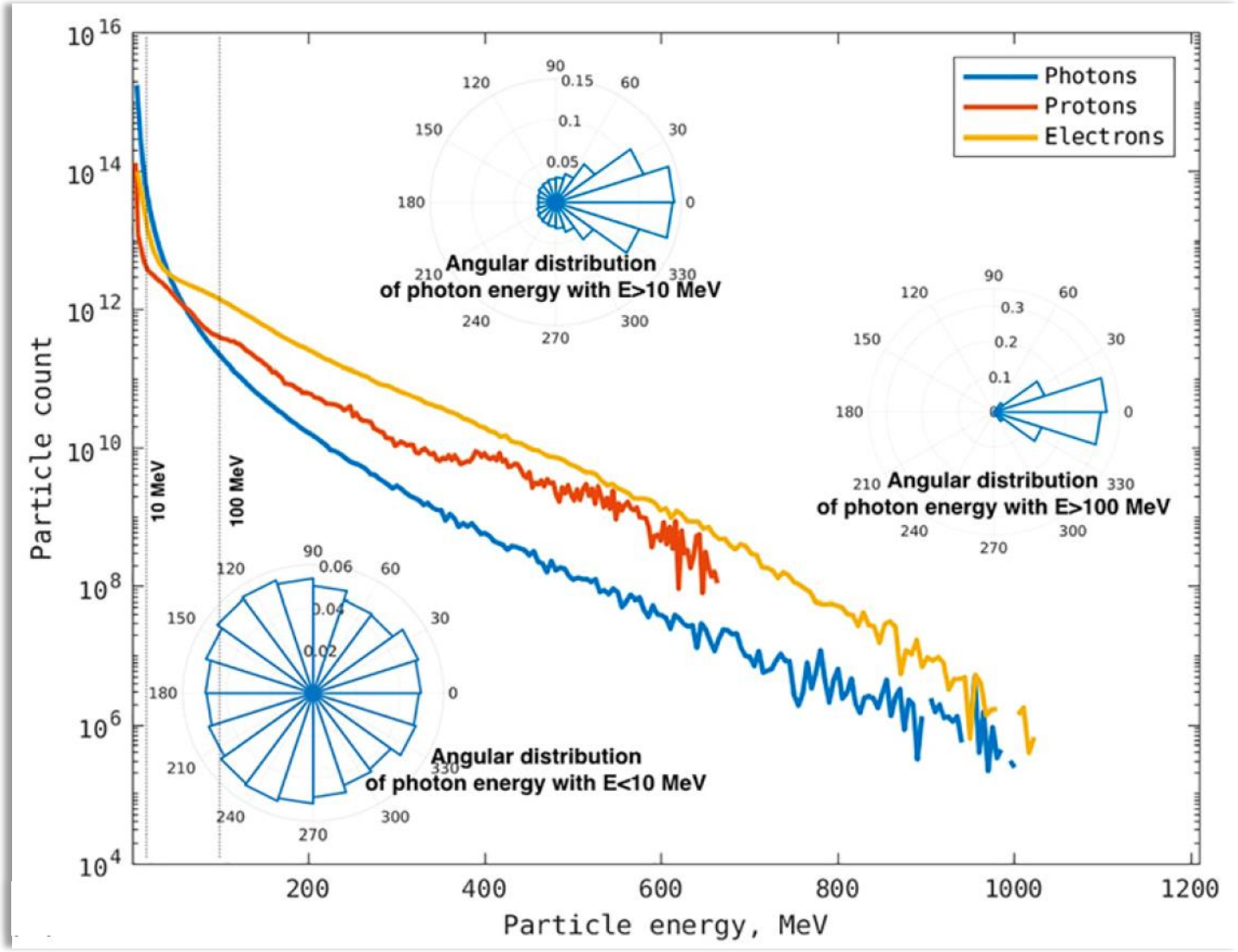




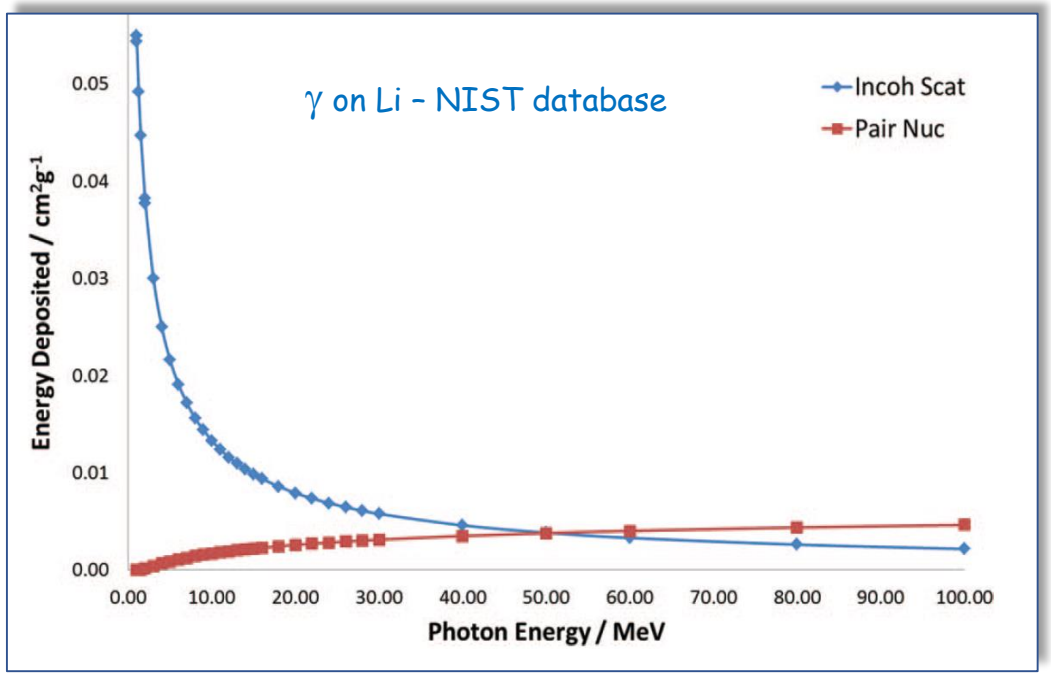
Nakamura et al.,
PRL 108 (2012) 195001

E=300 J, 30 fs, solid tg.
32% conversion to gamma

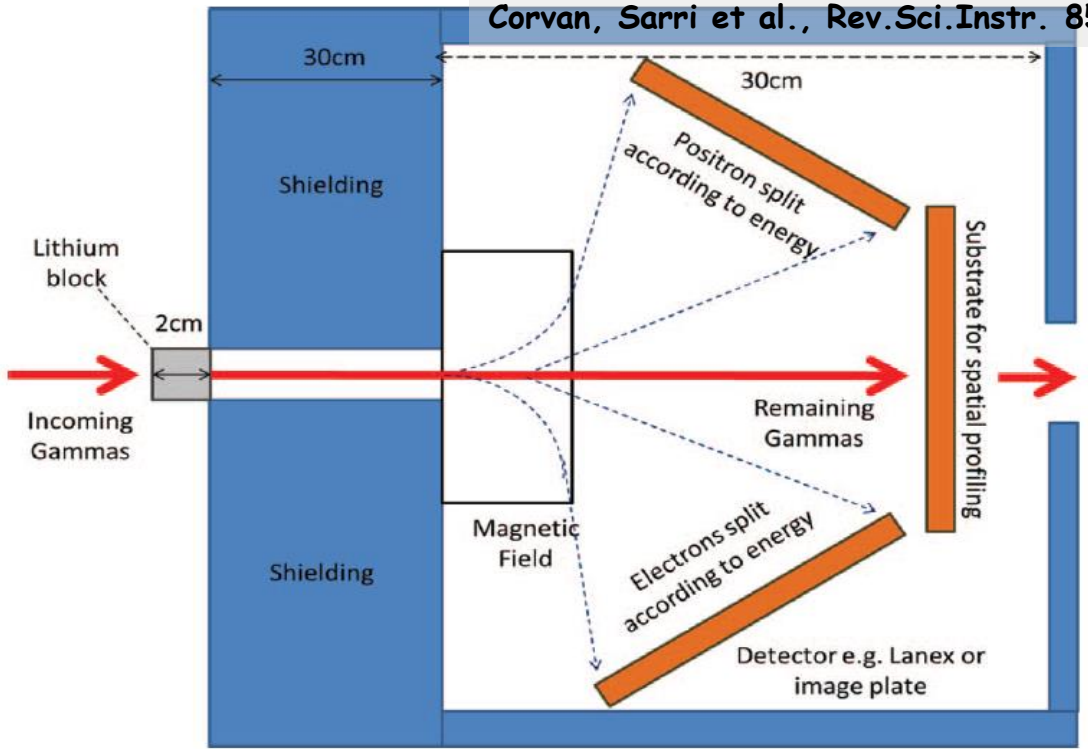
Lezhnin, Bulanov et al., Phys.Plasmas 25 (2018) 123105
37% laser conversion to gamma



0 deg. Compton scattering spectrometry

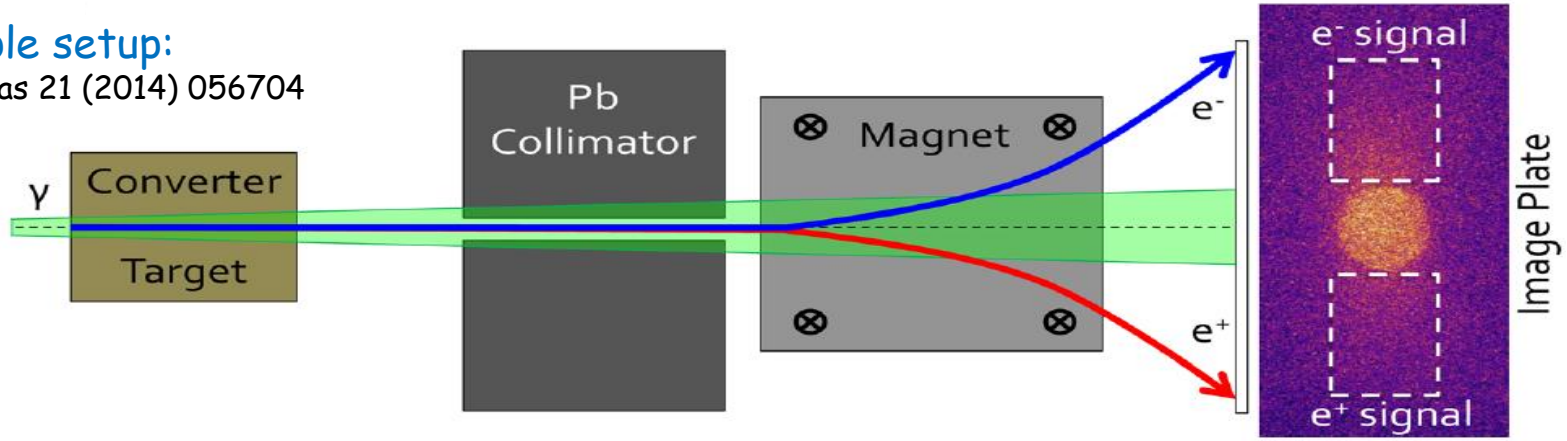


Corvan, Sarri et al., Rev.Sci.Instr. 85 (2014) 065119



proof of principle setup:

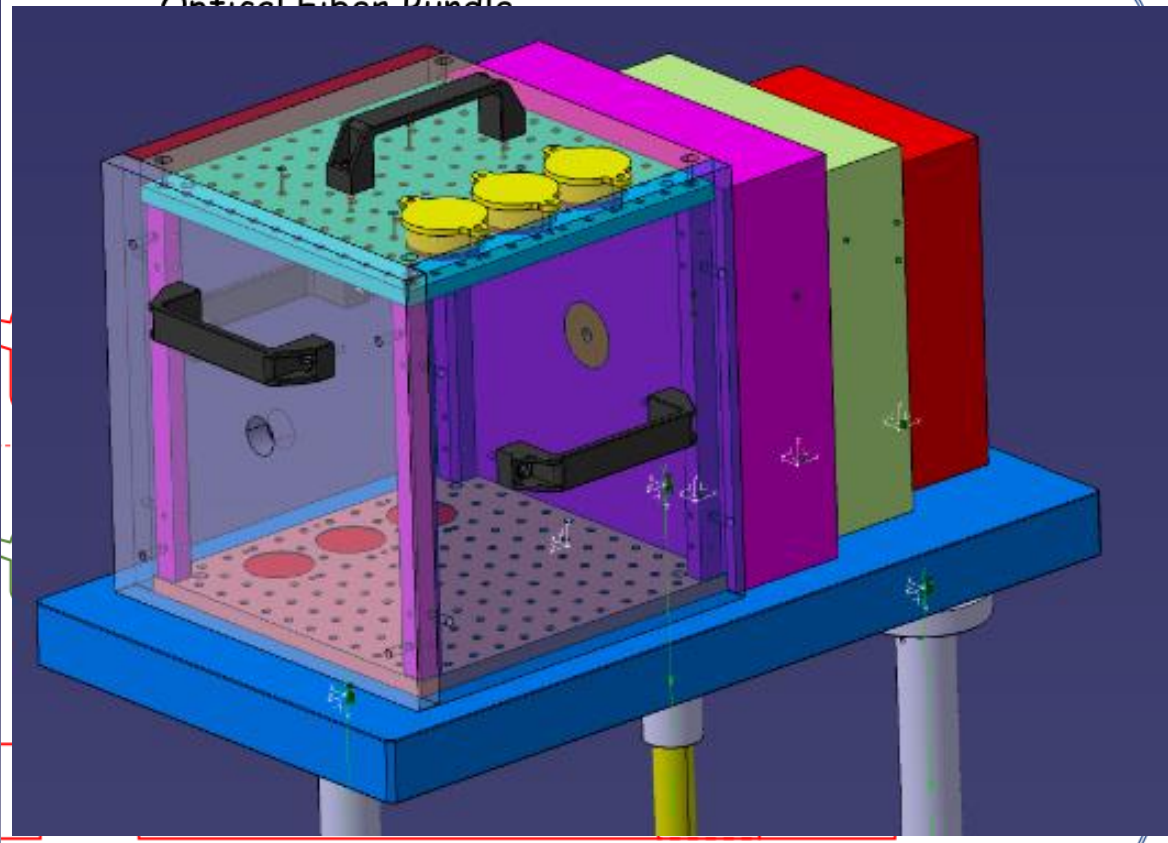
Schumaker et al., Phys. Plasmas 21 (2014) 056704



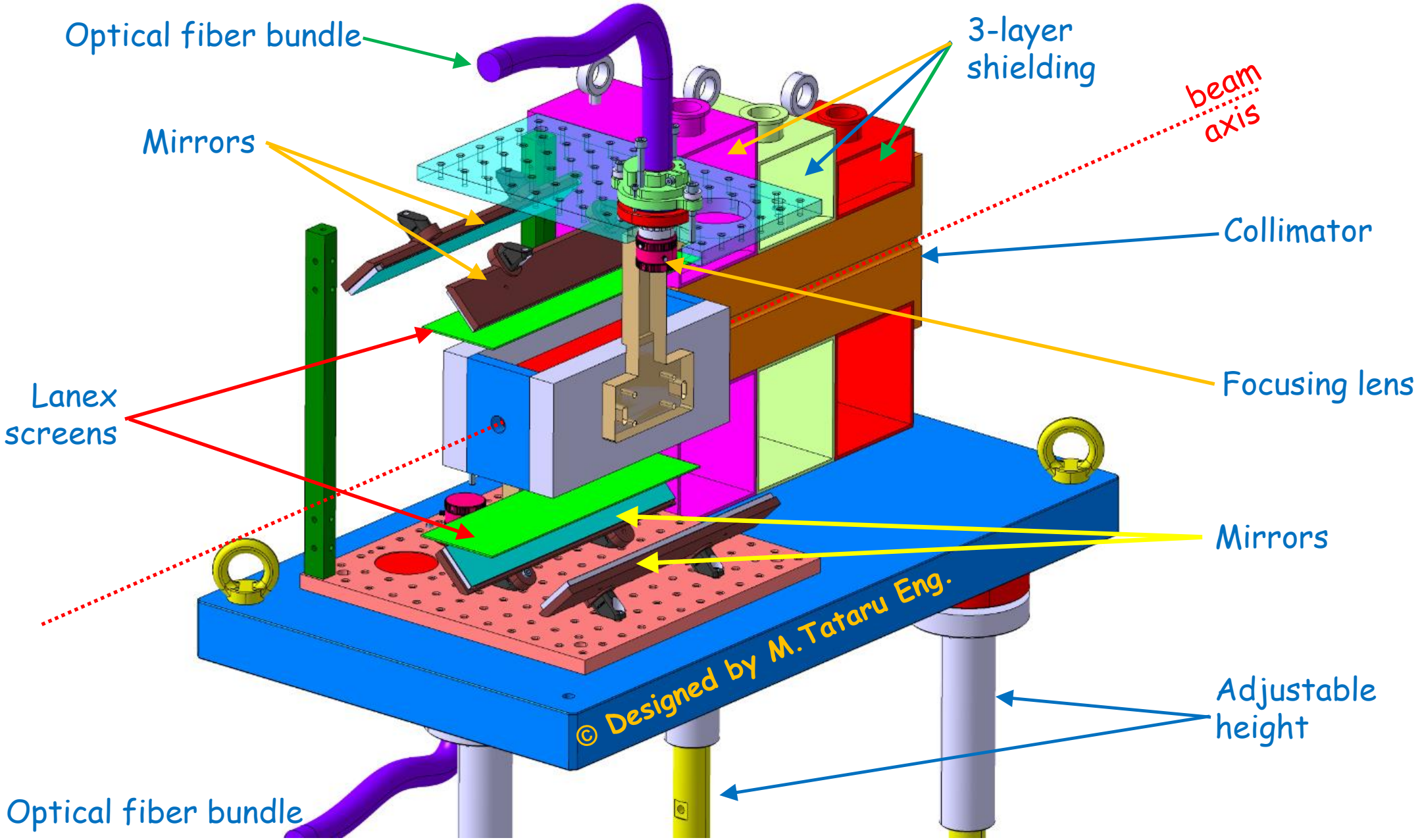
0 degree Compton spectrometer (the design)

The 3D model

the empty volume inside
the shielding box:
300x300x300 mm^3



0 degree Compton spectrometer (detailed CAD)



0 deg. Compton spectrometer (GEANT4)

MAG. FIELD: 0.8 T

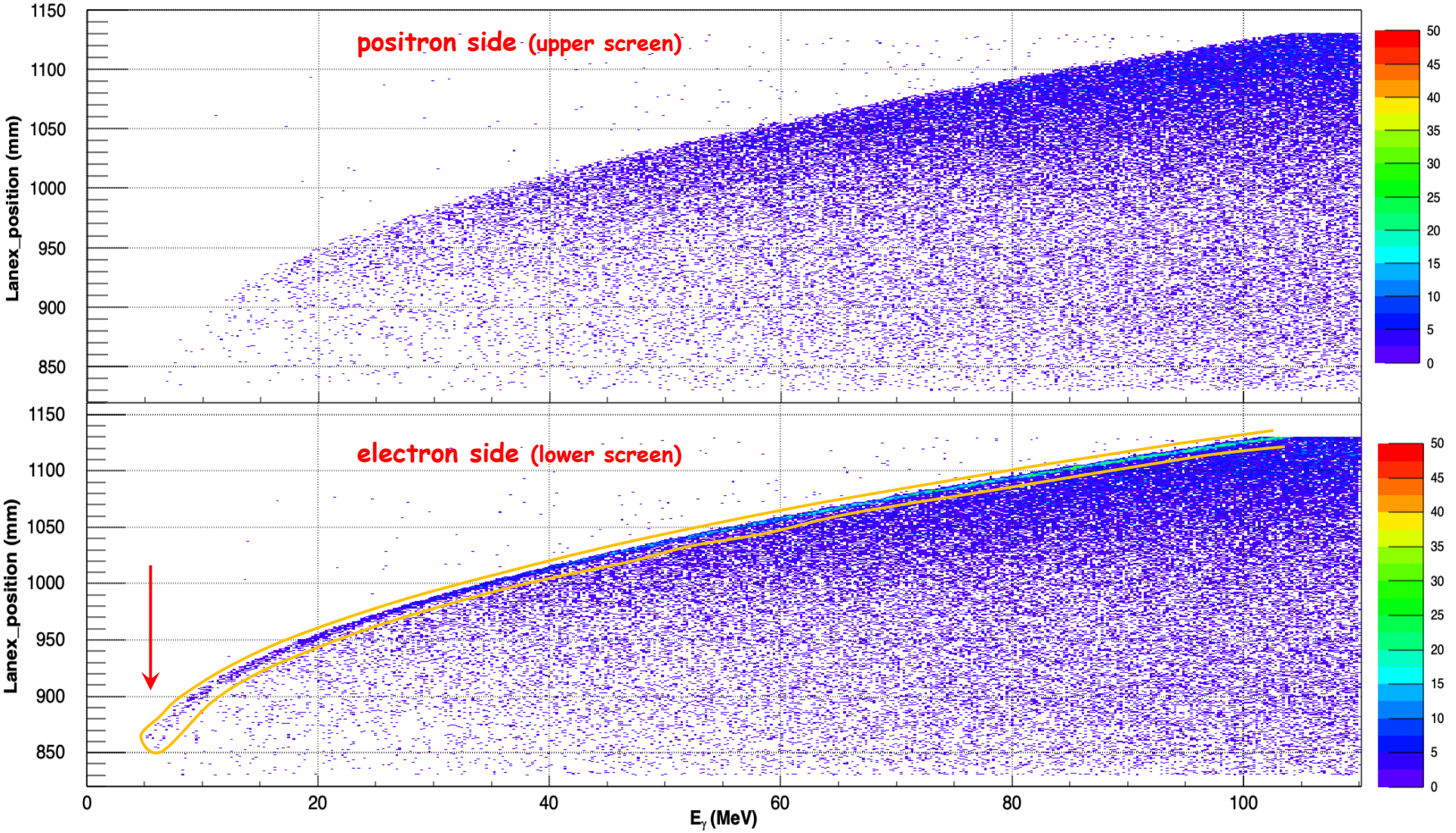
RECTANGULAR MAGNET:
- 50 mm height
- 200 mm length
- 20 mm gap

Incident gamma:
- 5-110 MeV (uniform)
- (axial incidence)

Scattering target:
- 20 mm thick Li

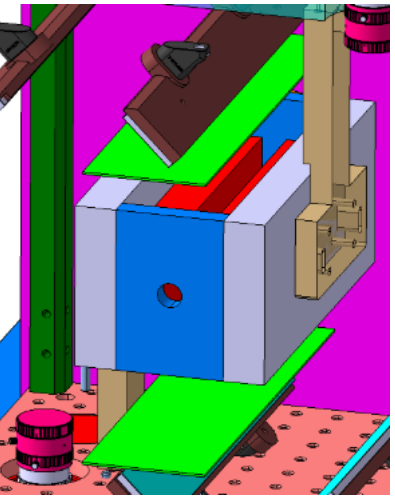
Collimator:
- Φ 5 mm

LANEX screen
- @ 50 mm distance



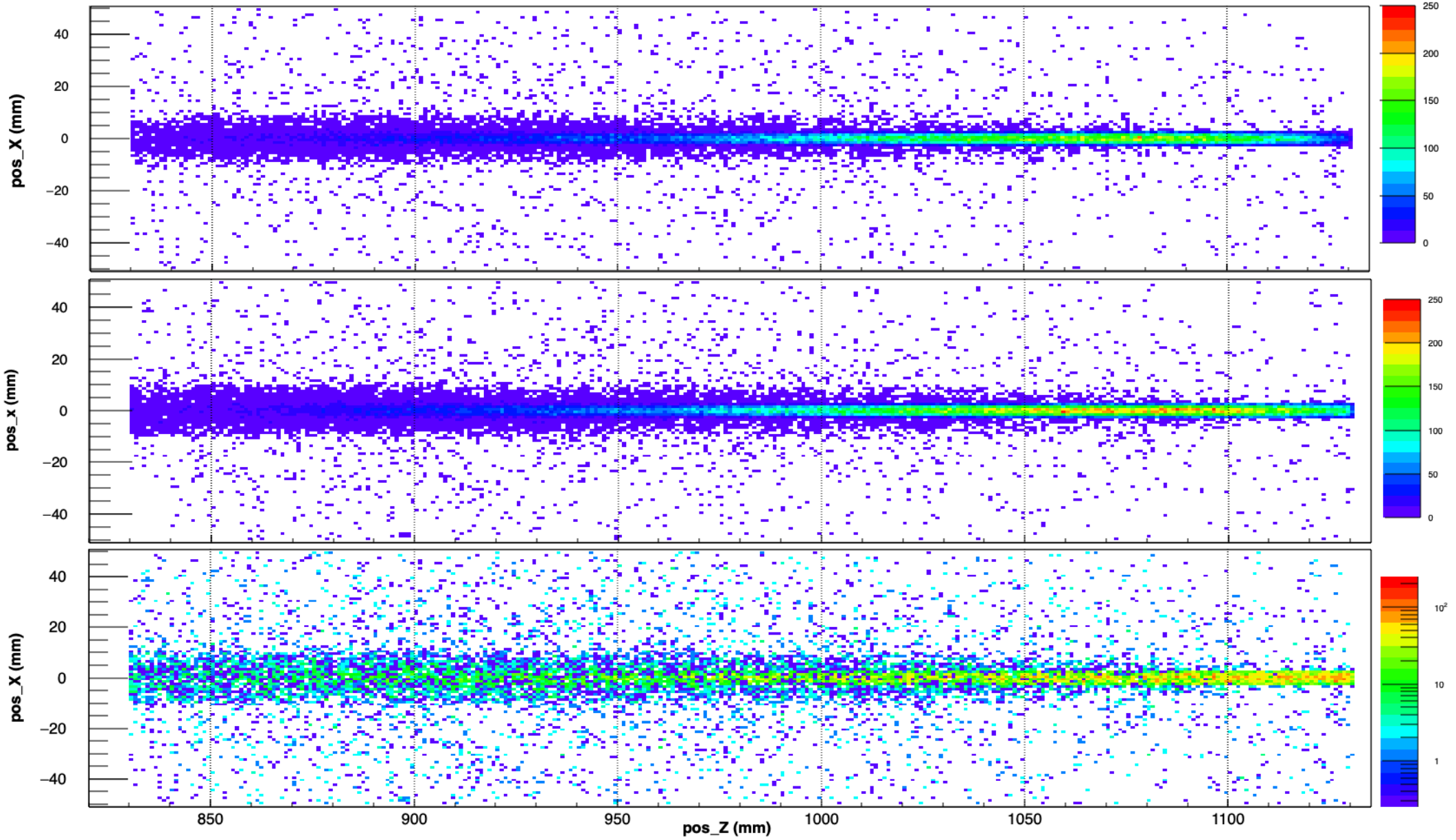
0 deg. Compton spectrometer (GEANT4)

positron side



electron side

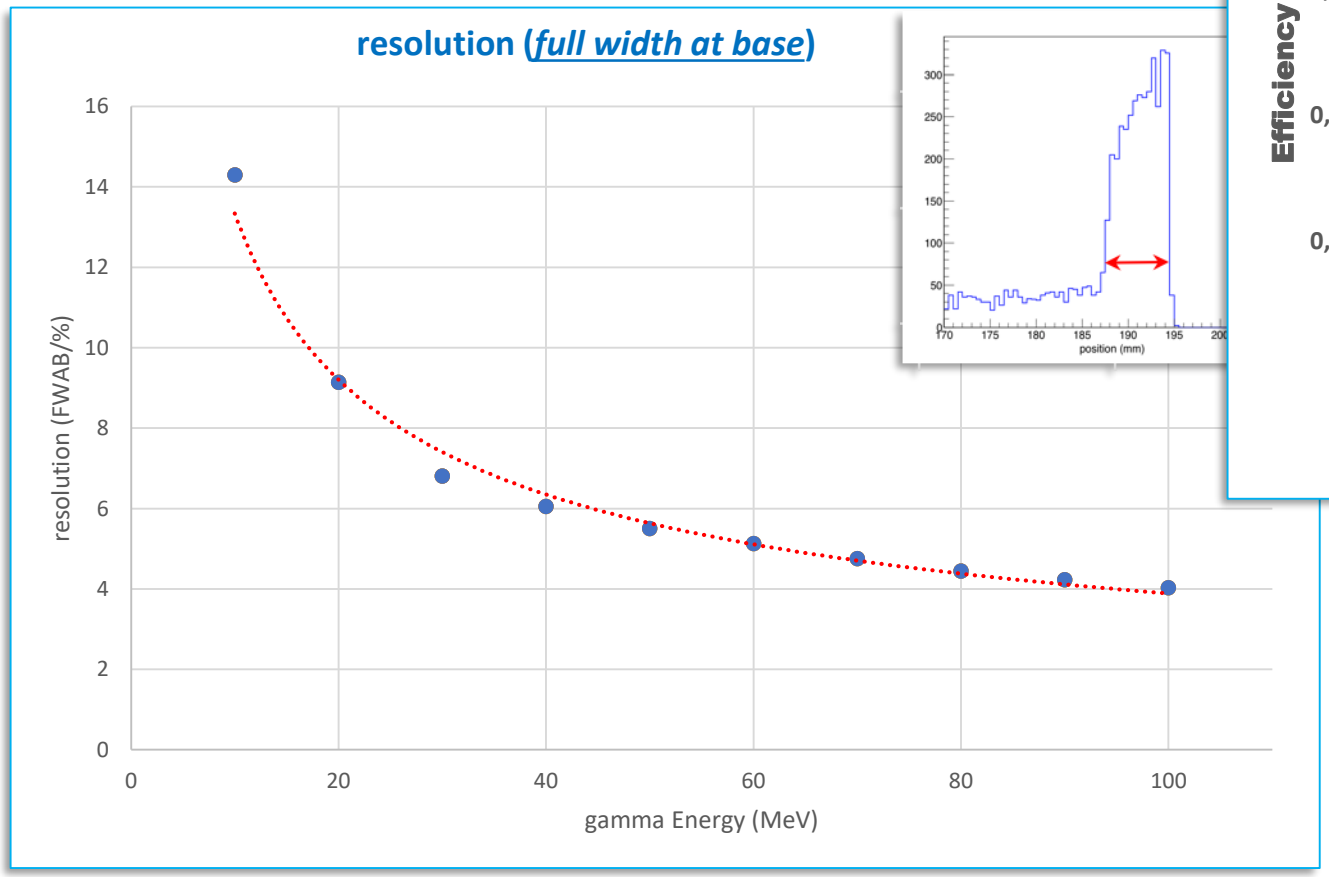
subtraction

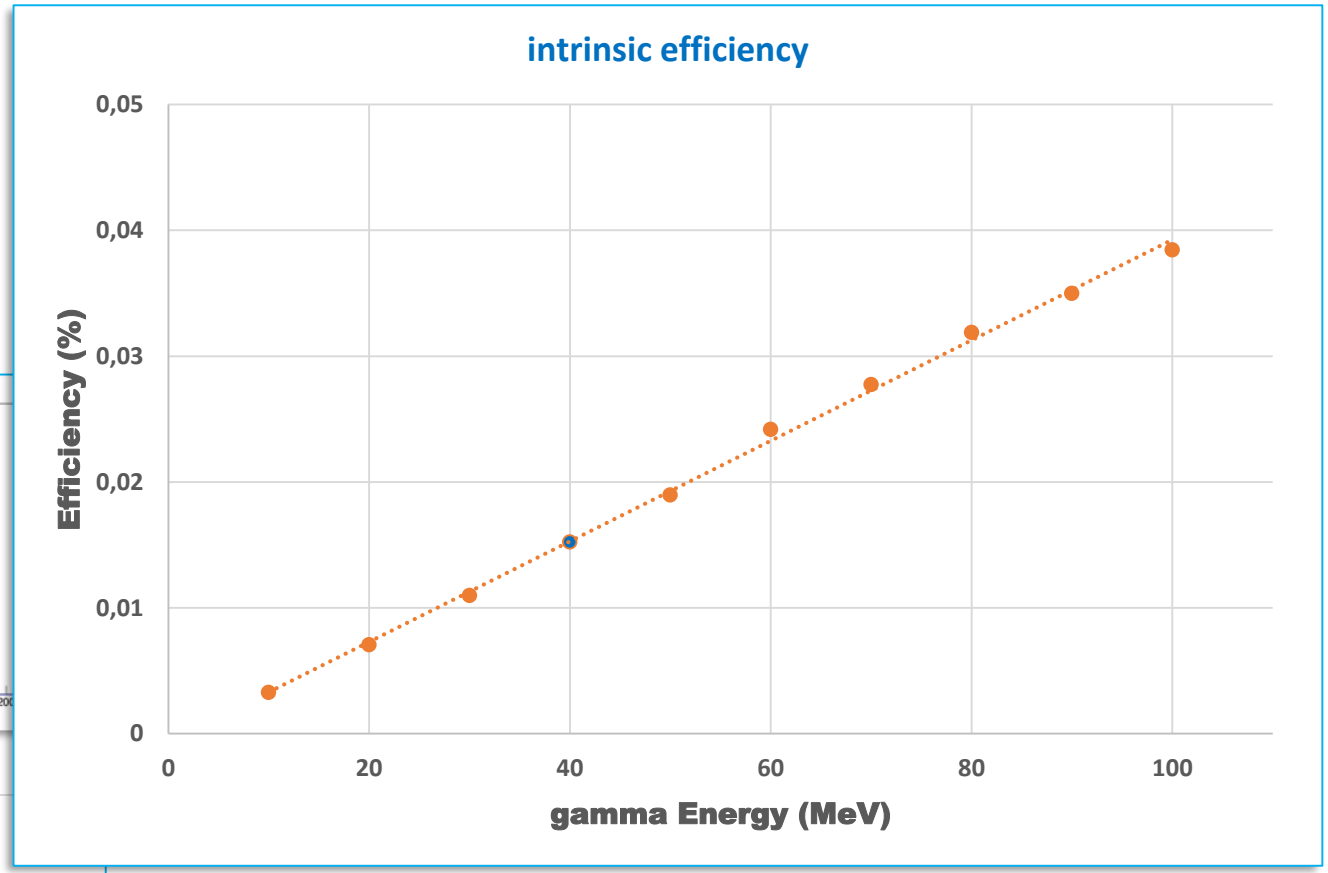


Spectrometer efficiency and resolution (GEANT4)

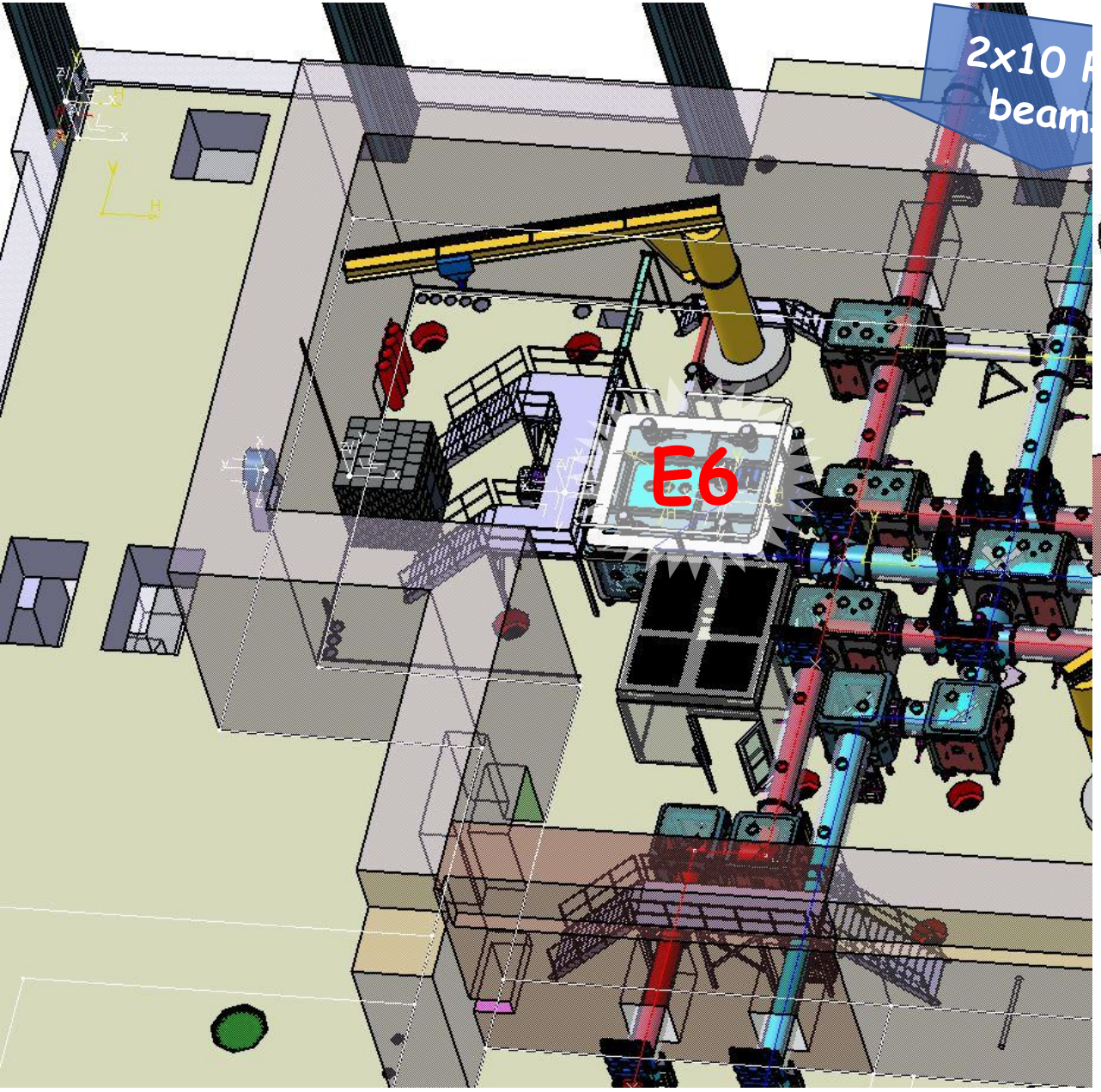
- 10^8 simulated events/energy

Scattering target: Li 20 mm
Collimator: Φ 5 mm

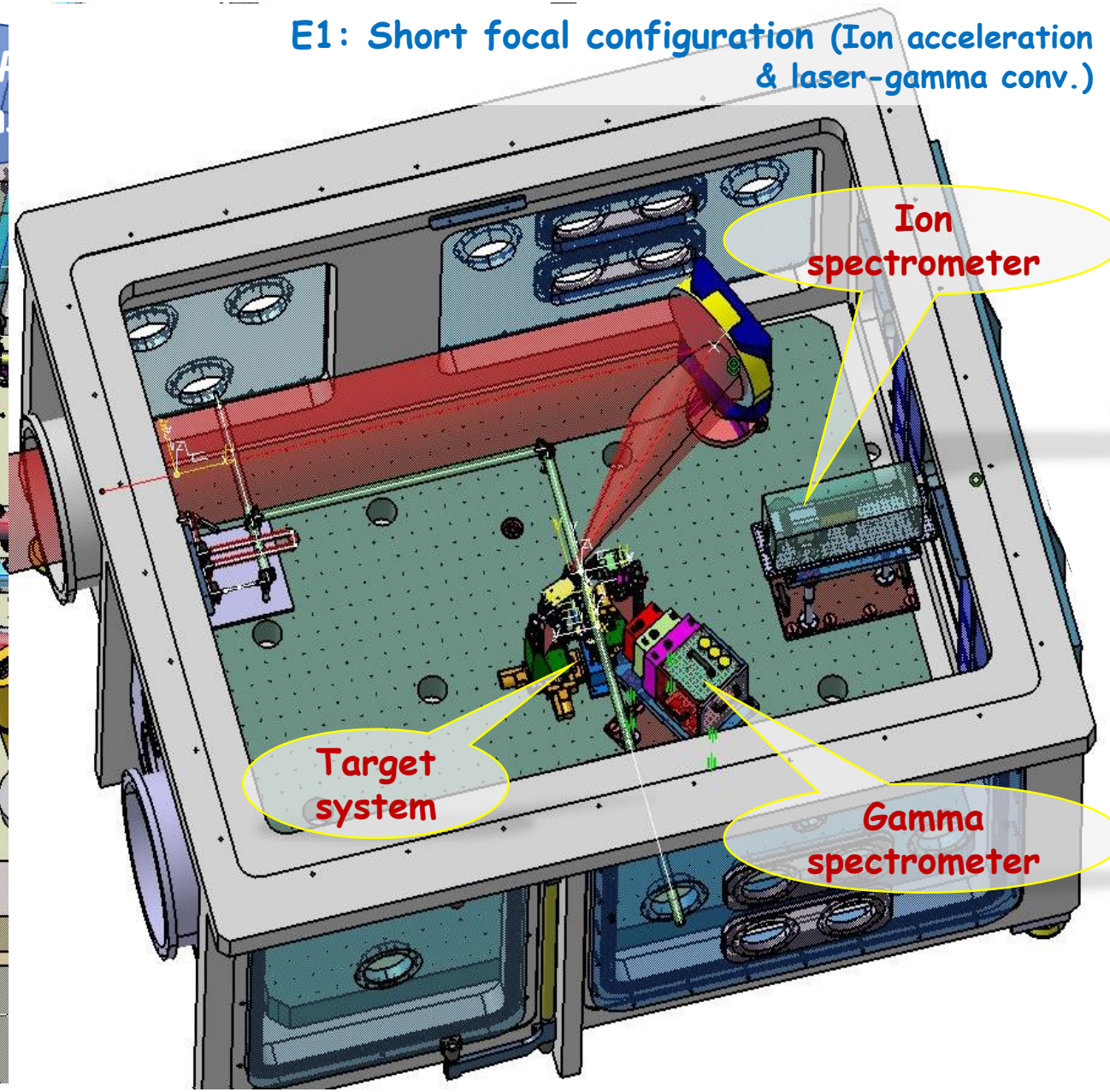




E1-E6: 10 PW experimental area



E1: Short focal configuration (Ion acceleration & laser-gamma conv.)

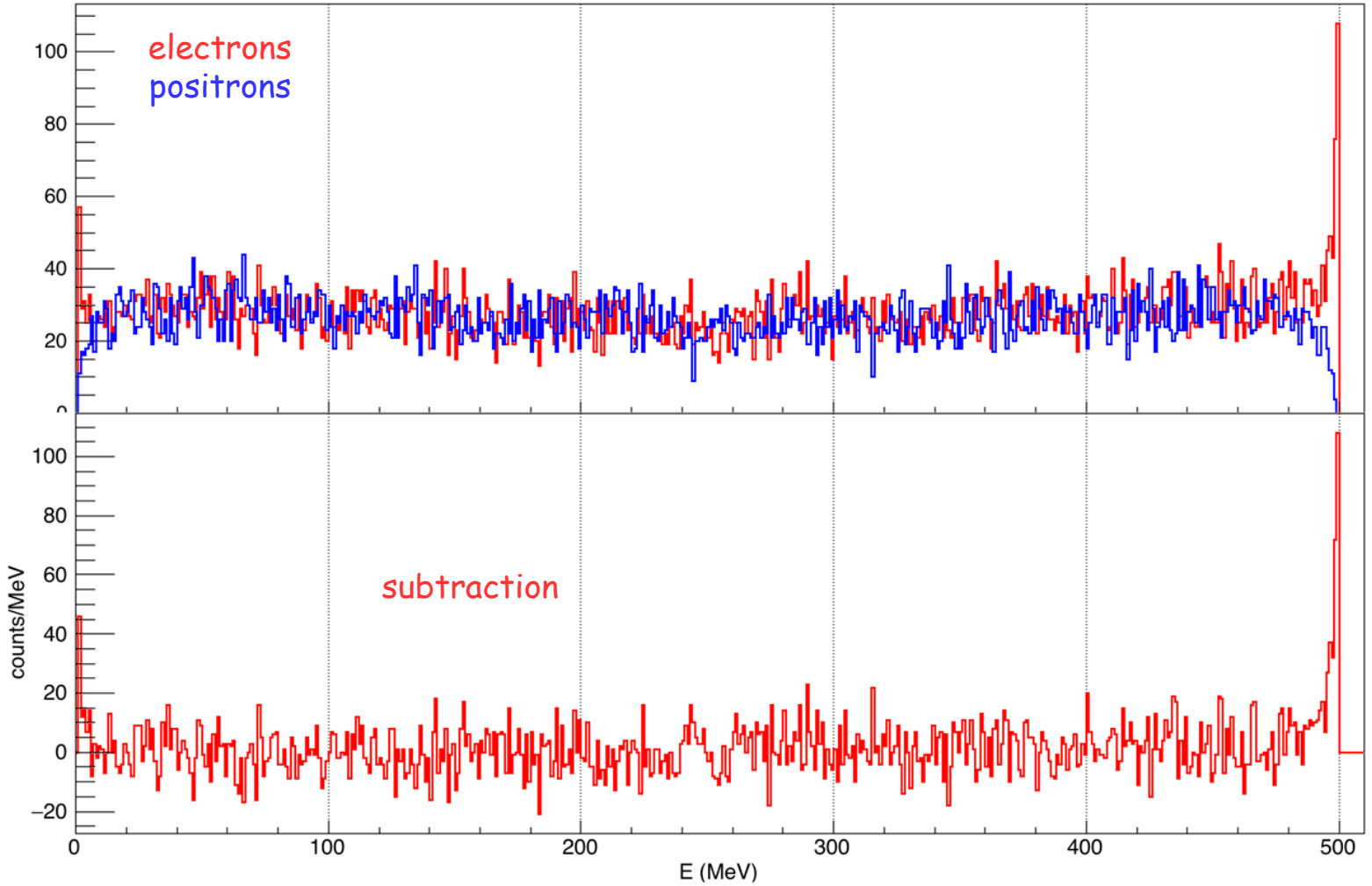


ELI picture...

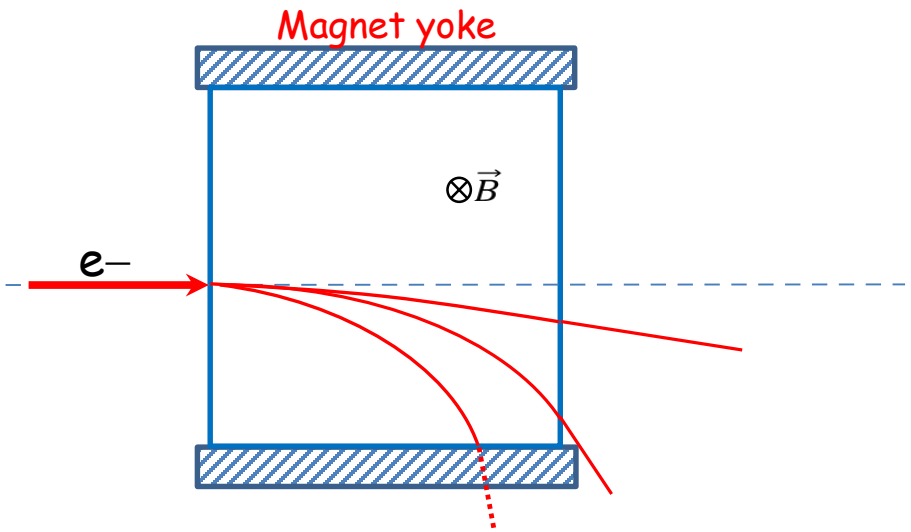
Thank You

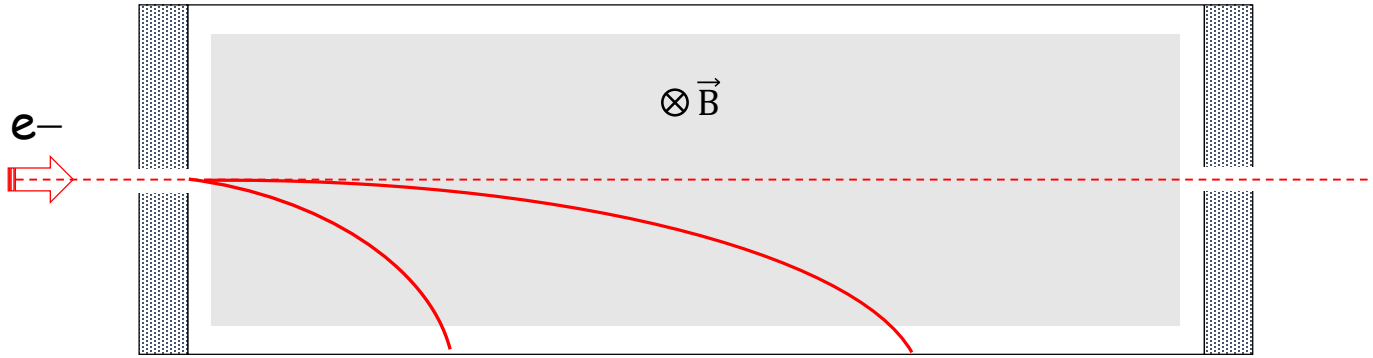
for your attention!

Solid target: polypropylene - $(C_3H_6)_n$ - 1 mm thick
500 MeV photons:



Magnet configurations (backup slide)





Standard magnet configuration:

- low en. (lost e–)
- intermediate en. – longer path through the mag.field
- high en. – short path through the mag.field

NEW proposed magnet configuration:

- shorter path for lower energies
- longer path for higher energies
  - improved resolution @ high energy