

Detector studies for LUXE

Marius Hoffmann

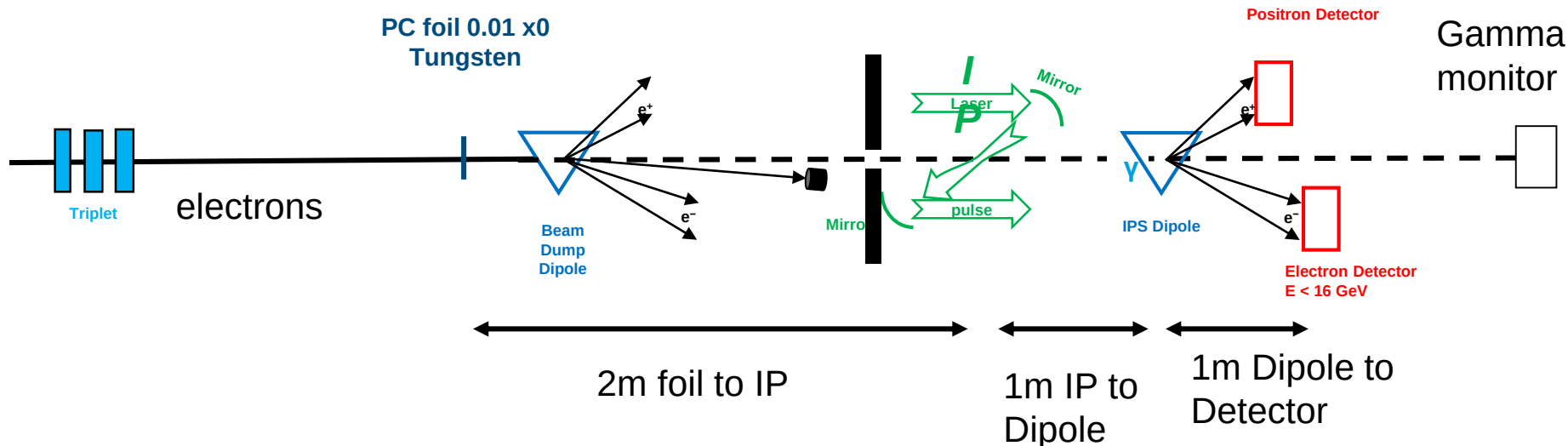
LUXE Meeting

13.12.2018

LUXE

Determination of total positron number

Simulated Setup



Magnet specs

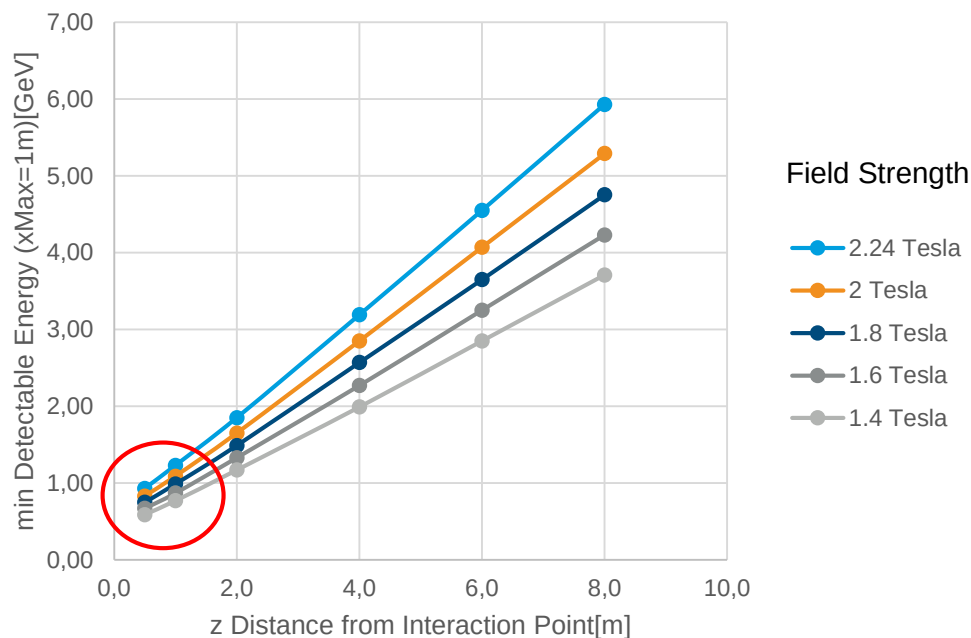
- 1.4 Tesla
- 1.029m length
- Aperture: 0,6m horizontal, 0.108m vertically

Toy Detector Specs

- 2m in horizontal x 10 mm in vertical (half for positrons/electrons)
- 50 μm x 50 μm pixels
- Number of

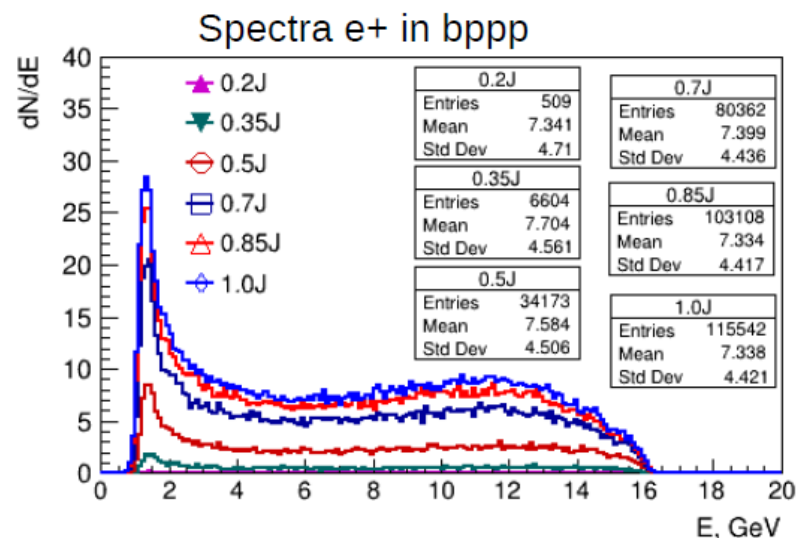
Magnet setup

Magnetic field determination for 2m diameter detector



Min. detectable energy ~1 GeV at 1m Distance

Min. magnetic field 1.4 T due to Beam Dump considerations for electron/laser interaction in principle lower fields are possible

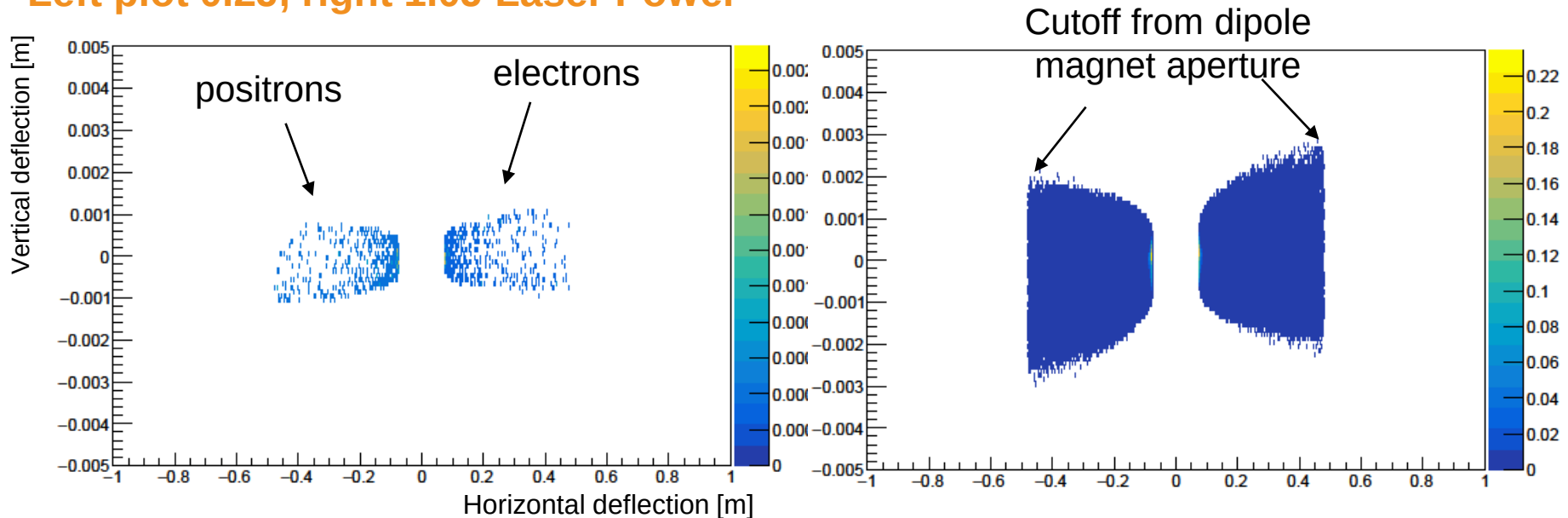


cutoff in positron-spectrum from MC also around 1 GeV. Not yet understood.

Scatter distribution of particles in the detector

1m behind the magnet, 50 μm x 50 μm pixels

Left plot 0.2J, right 1.0J Laser Power

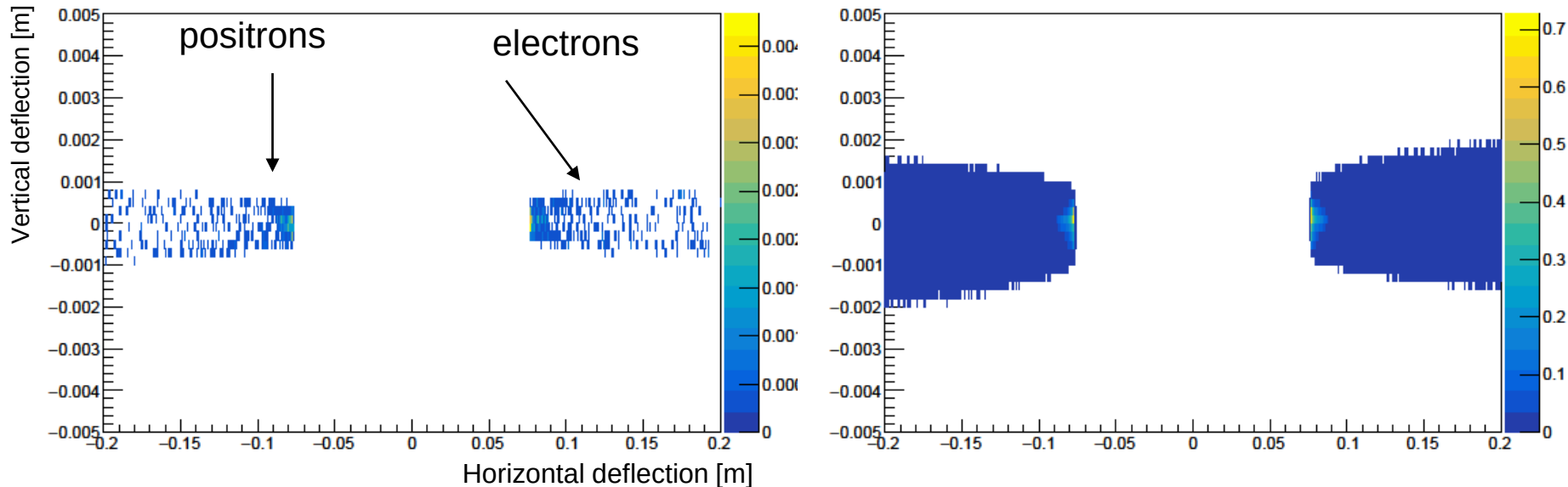


- The average electron/positron number per bin is way below 1
- Cutoff due to the magnet aperture of 0.6m(0.3m in each direction)
- Small angle in y-plane, not yet understood, coming from the interaction

->Even for small beam dump area: detector size is not the limiting factor

Scatter plots of particles (zoomed)

1m behind the magnet, left 0.2J, right 1.0J Laser Power

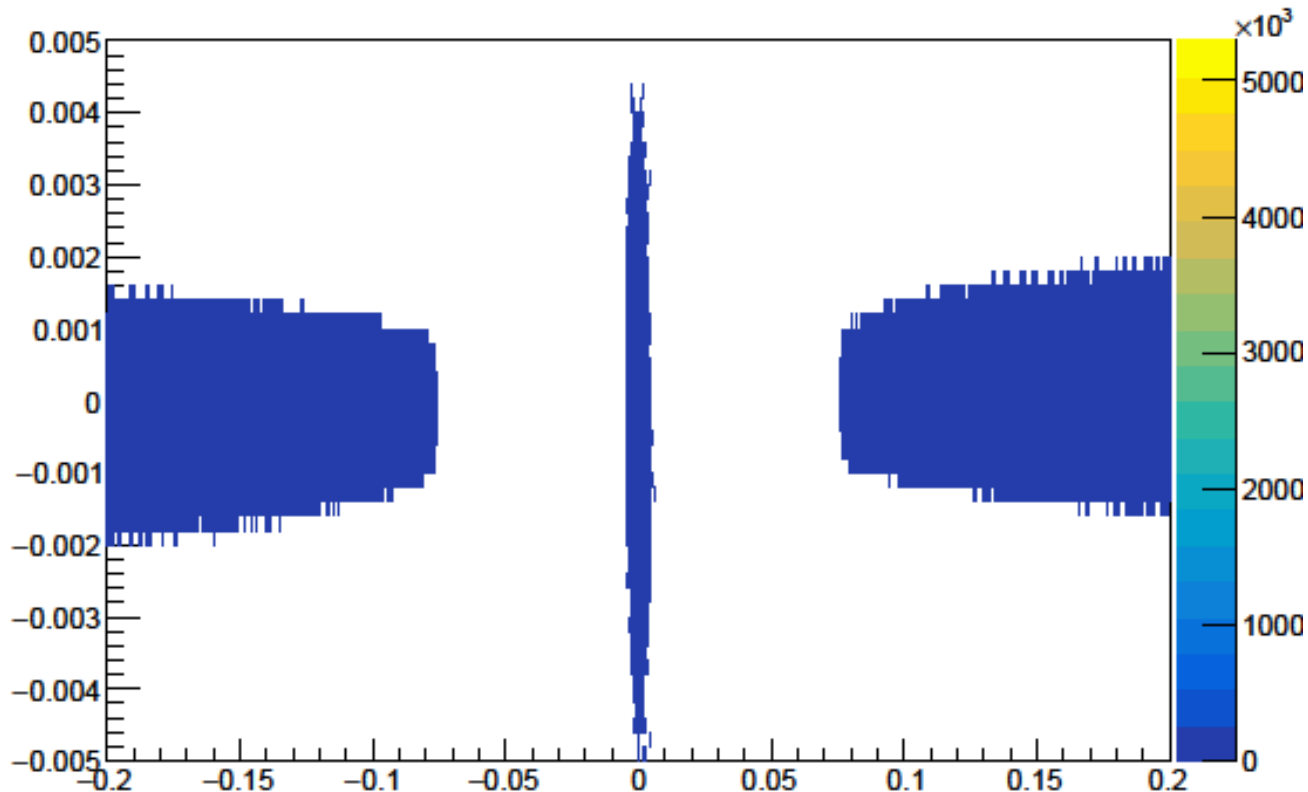


- The average electron/positron number per bin is way below 1
- Cutoff due to the magnet aperture of 0.6m(0.3m in each direction)
- Small angle in y-plane, not yet understood, coming from the interaction

->Even for small beam dump area: detector size is not the limiting factor

Gamma Beam in the Detector

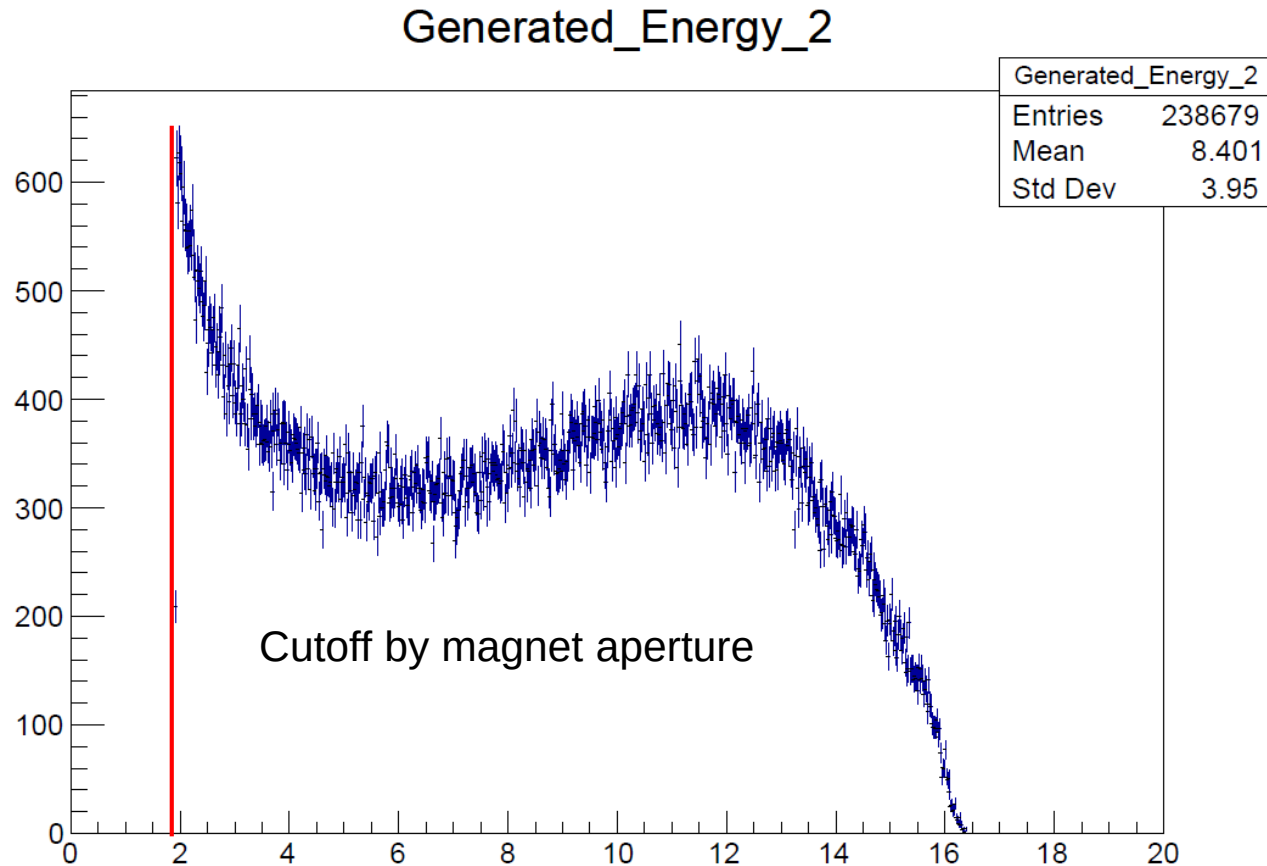
1m behind IP, 1J



- ~ 0.1 m separation between gamma beam and electrons/positron in a detector at 1m distance
- Very high gamma rates in comparison

Detectable Positron Energy

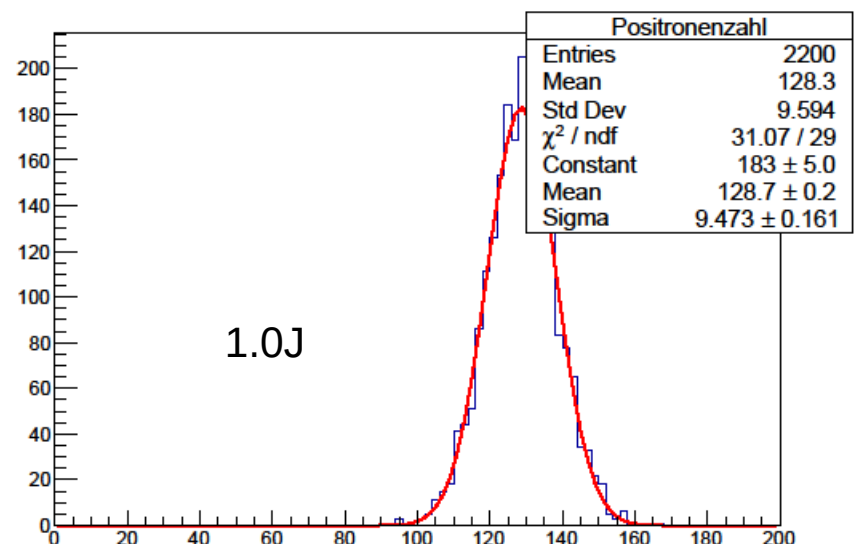
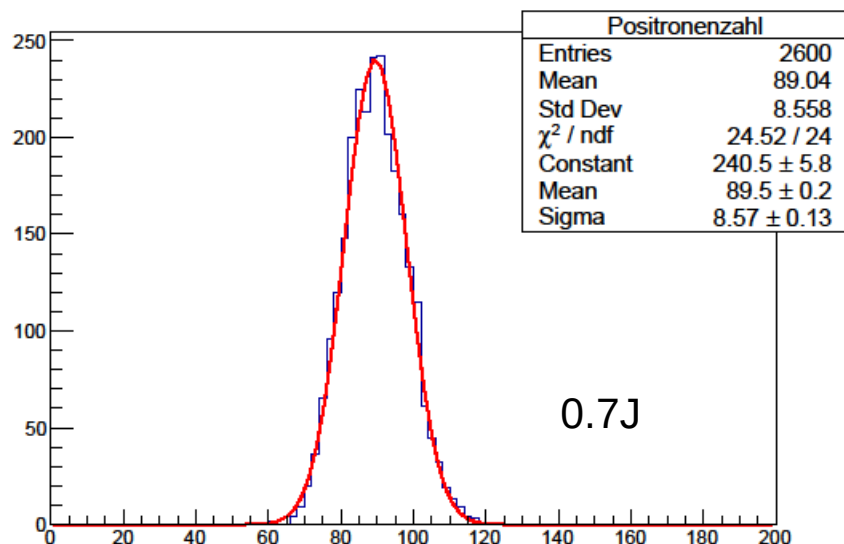
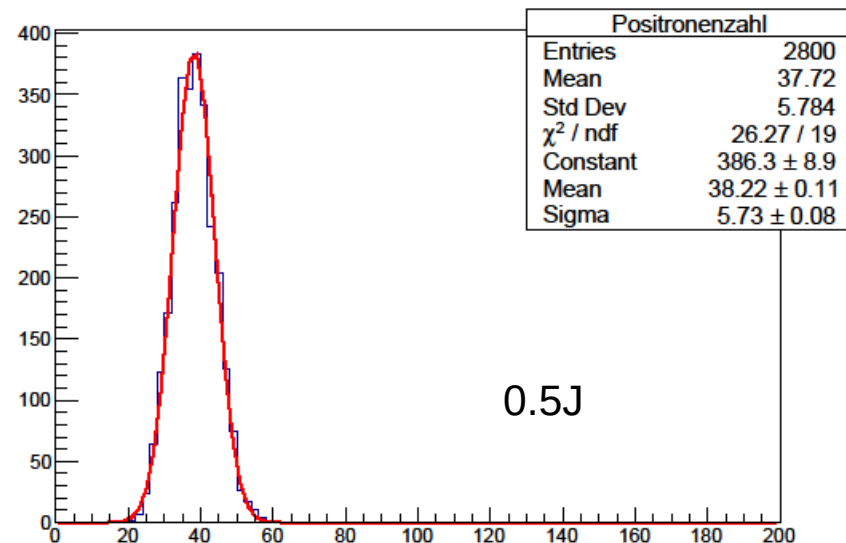
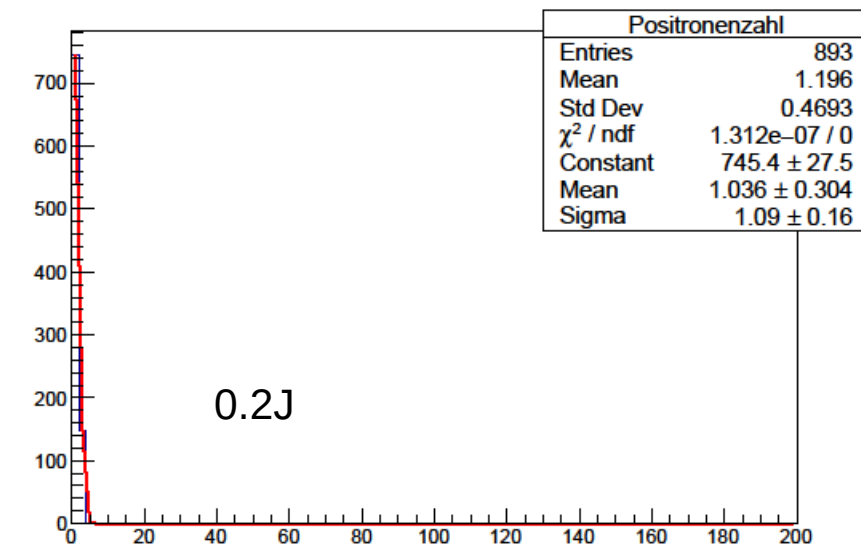
1J



With a 0.6m aperture dipole, $E_{\min} = 2$
GeV positrons can be detected

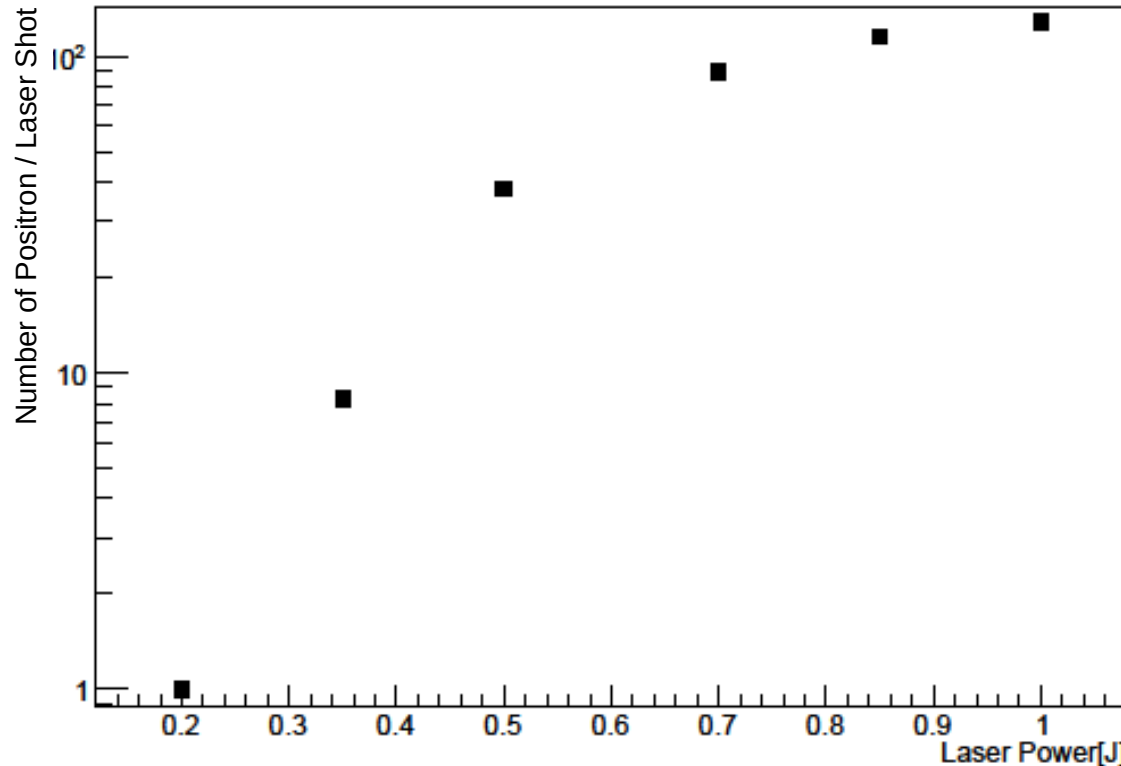
Statistics

Number of positrons per Interaction



Number of Positrons / Laser power plots

Assuming 100% efficiency



This plot includes statistical uncertainties for 3000 events...(5 min worth of Data)

-> statistics should be fine.

intensity[J]	mean	sigma	u_5min	u_2weeks
0.2	1	1	0,02	0,0005
0.35	8,3	2,7	0,05	0,0014
0.5	38,2	5,7	0,10	0,0030
0.7	89,5	8,57	0,16	0,0045
0.85	114,7	9,3	0,17	0,0049
1.0	128,6	9,4	0,17	0,0049

Thank you for your Attention

The logo for LUXE, featuring the word "LUXE" in a bold, blue, sans-serif font. The letter "X" is stylized with a white starburst or spark effect at its center.

Theory plot

