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A CLIC Post-Collision Extraction Line Photon Background Study

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Collaboration



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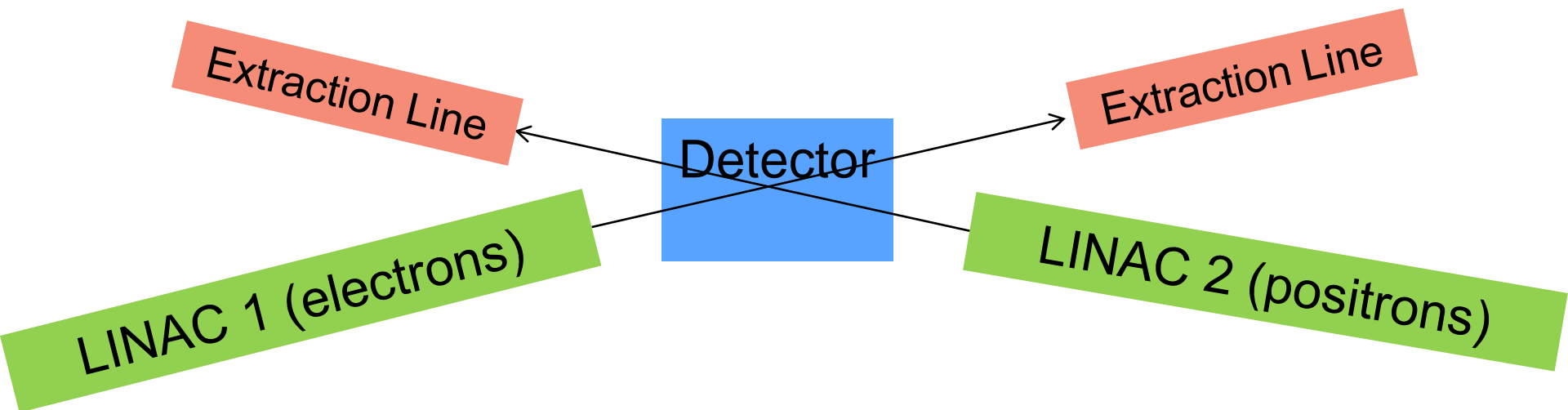
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Compact Linear Collider

- 3 TeV Centre of Mass Energy
- Strong beam–beam interactions
- High coherent pair production

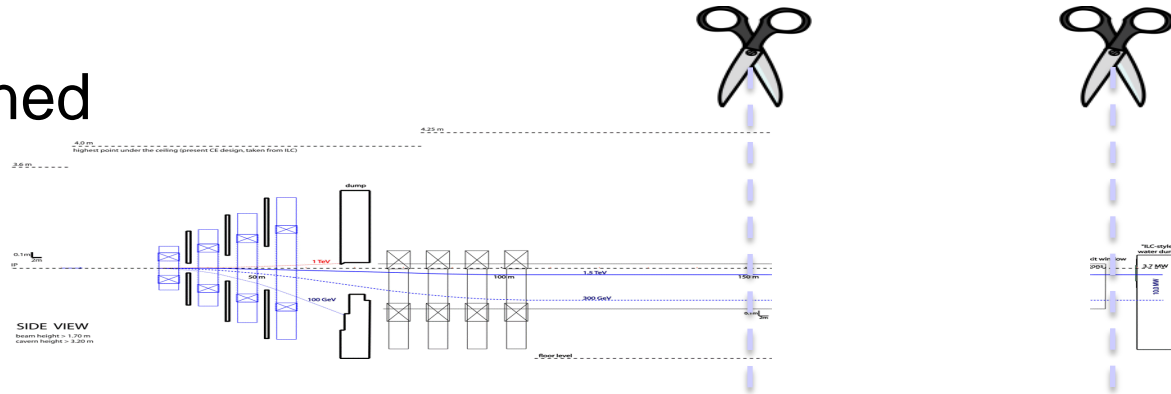




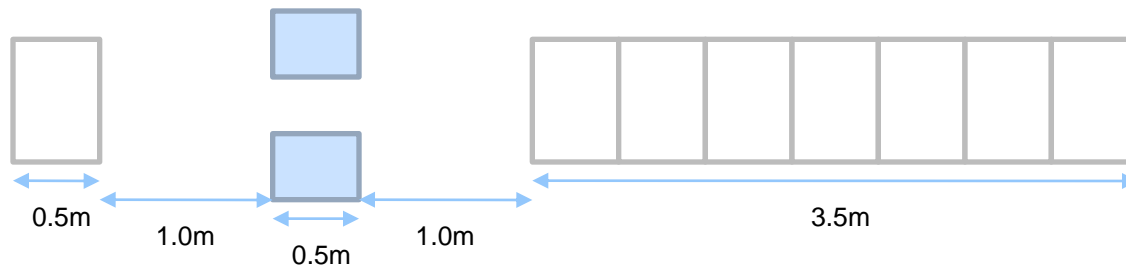
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Latest Design

- Shortened



- Split Magnet 1



- Magnet and mask apertures fine-tuned



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Studied so far...

- Covered in PRST-AB paper 12,021001 (2009)

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS 12, 021001 (2009)

Conceptual design of a beam line for post-collision extraction and diagnostics at the multi-TeV Compact Linear Collider

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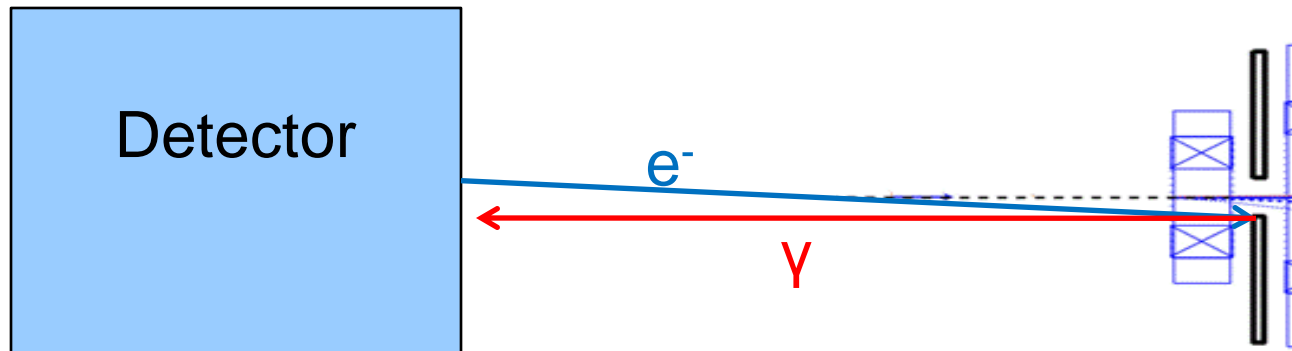
Strong beam-beam effects at the interaction point of a high-energy e^+e^- linear collider such as the Compact Linear Collider (CLIC) lead to an emittance growth for the outgoing beams, as well as to the



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Photon Background

- Particles lost in magnets, dumps and masks produce secondary particles
- Backscattered photons produced in the extraction line may be incident on the IP
- Background contribution due to these particles interacting with silicon detectors at $R < 1.38\text{m}$





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Simulation Method

- Required physics-in-matter simulation tool to generate backscattered photons for tracking – GEANT4
- Required accelerator based interface to GEANT4 – BDSIM (John Adams Institute, Royal Holloway)
- Post-Collision data obtained using GUINEA-PIG simulation (20,000,000 particles)



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BDSIM v0.5

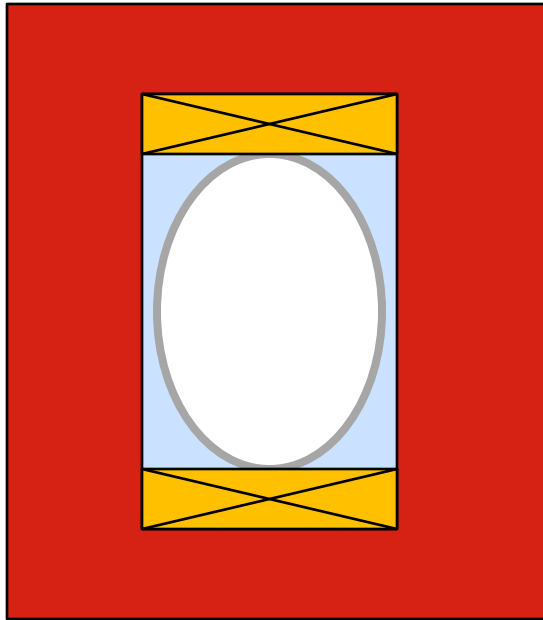
- Able to define XSIF objects in GEANT4
- Able to define more complex geometries using Mokka interface
- Sampler ntuple output option for analysis using ROOT



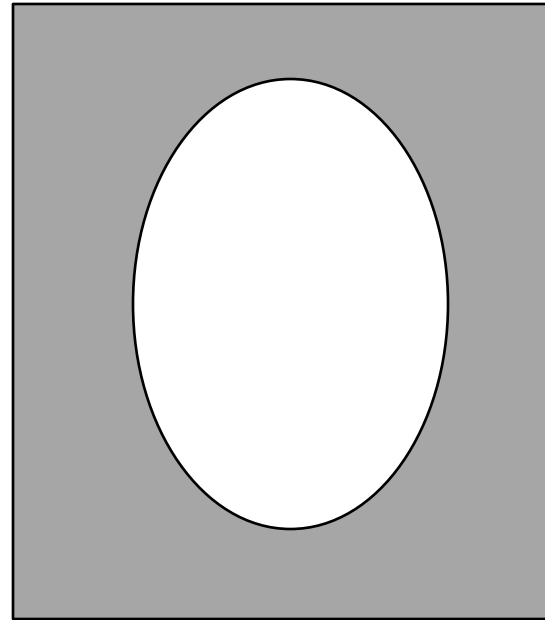
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Mokka Geometries

- Window-Frame Magnet



- Elliptical Aperture Masks





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First Mask Results

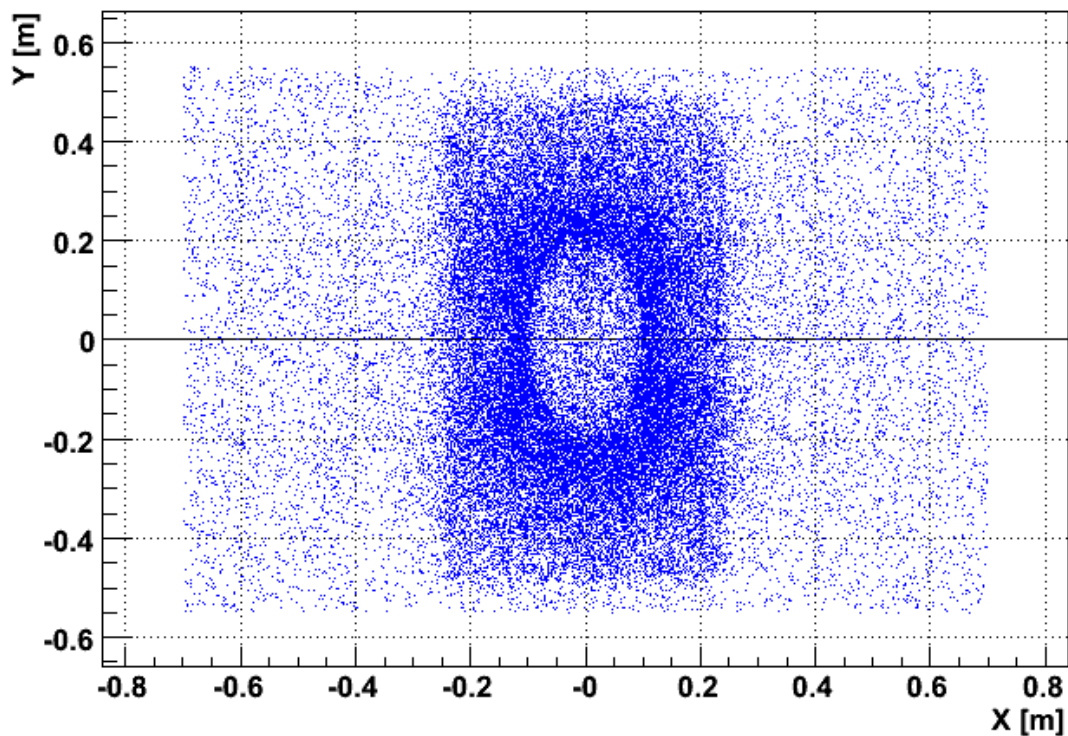
- Due to closeness to IP and lack of masking – first mask identified as likely photon source
- Results obtained from sampler at $s=27.5\text{m}$ (entrance face of first magnet) and mapped onto BeamCal face at $s=3.5\text{m}$



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Photons at $s=27.5\text{m}$

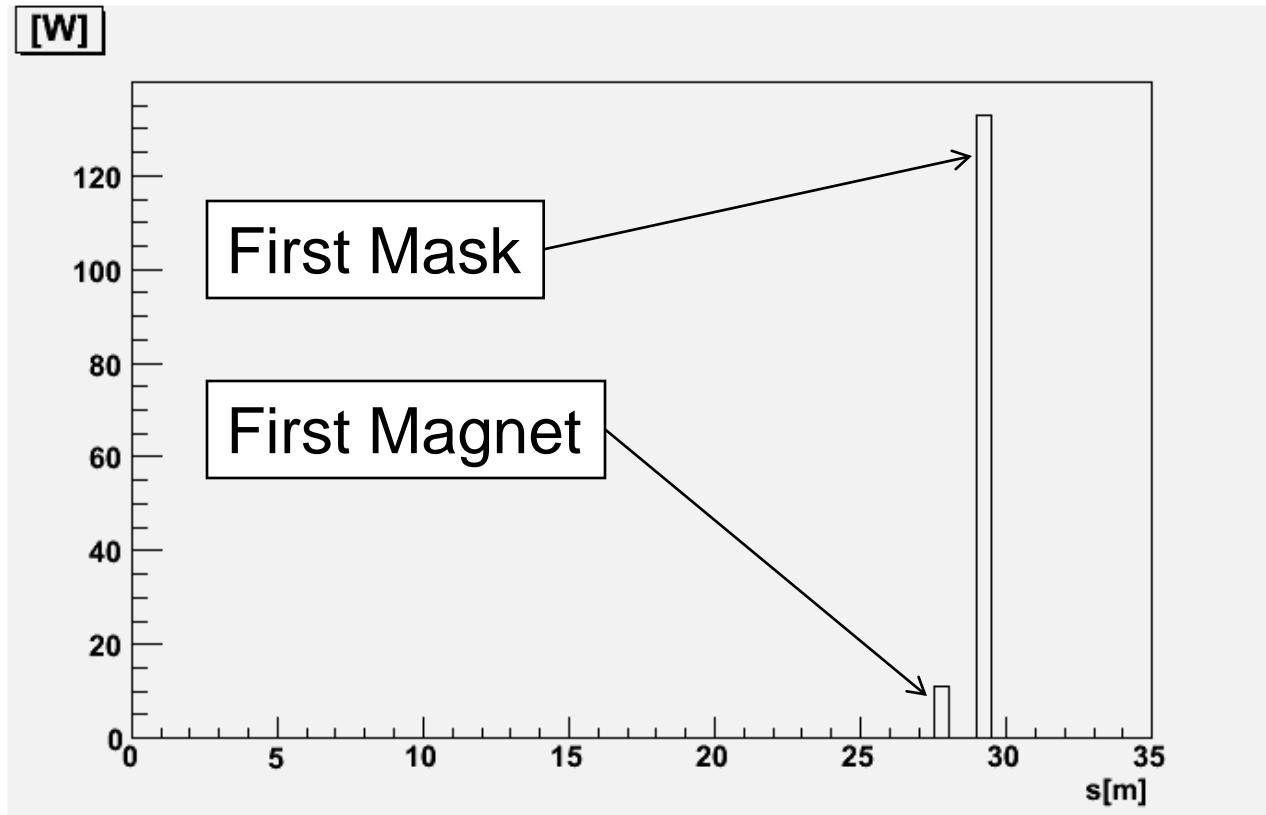
XY Distribution of Backscattered Photons at $S=27.5\text{m}$





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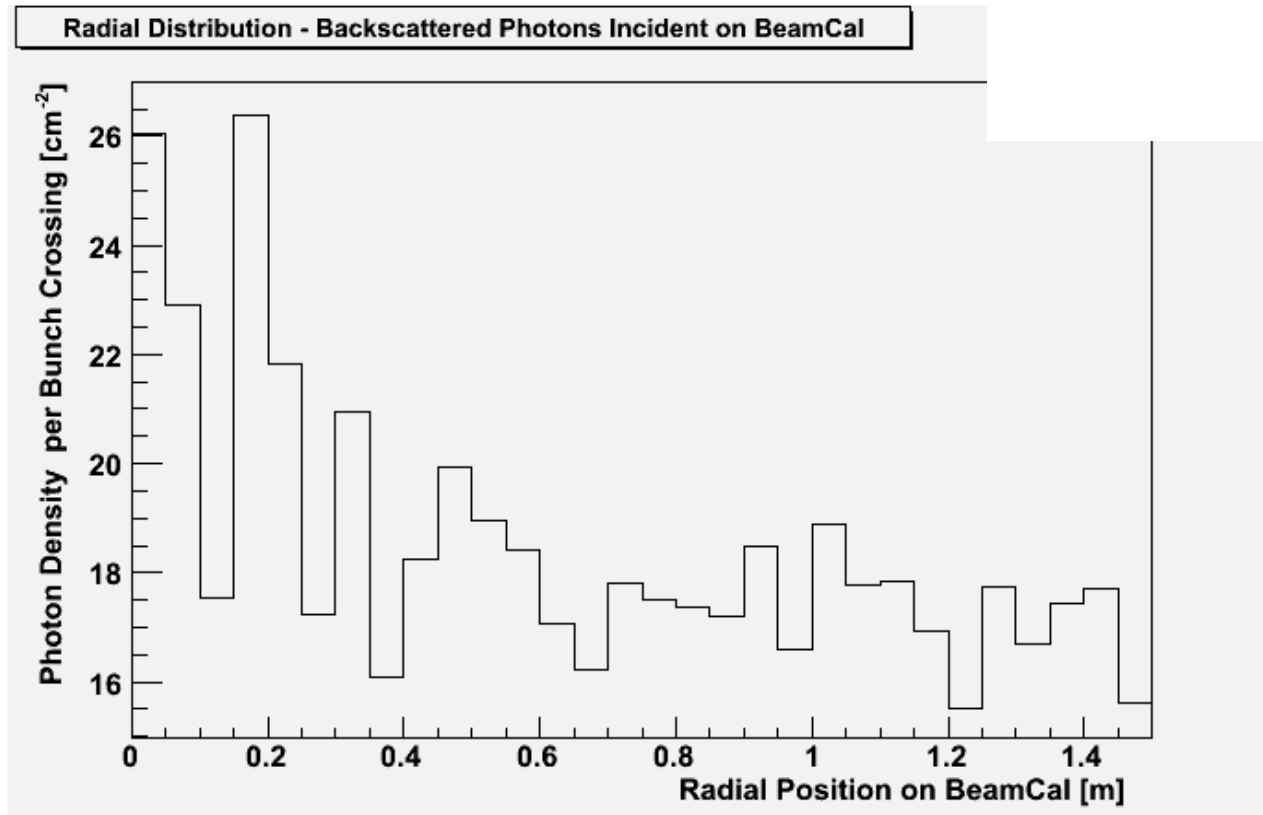
Energy Loss





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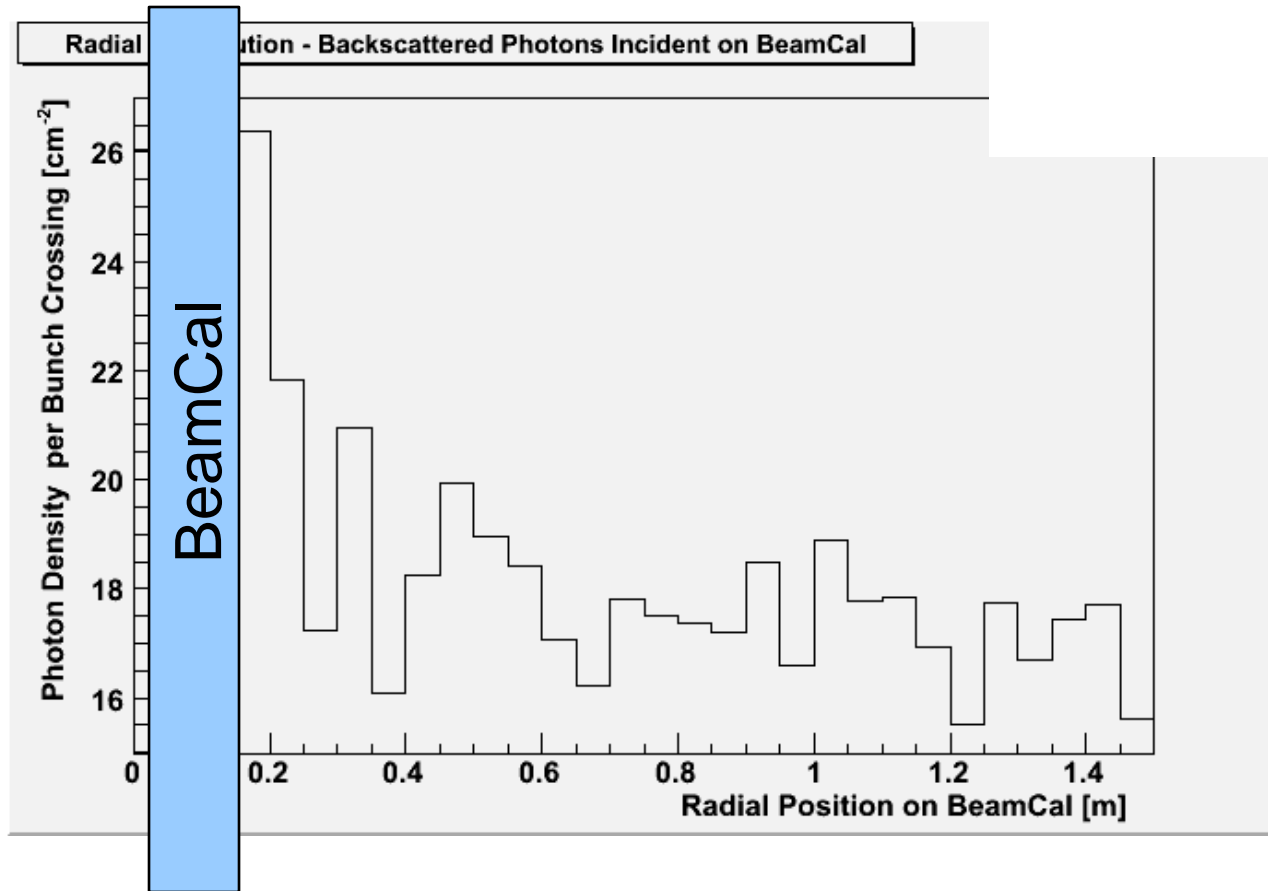
Photons at $s=3.5\text{m}$





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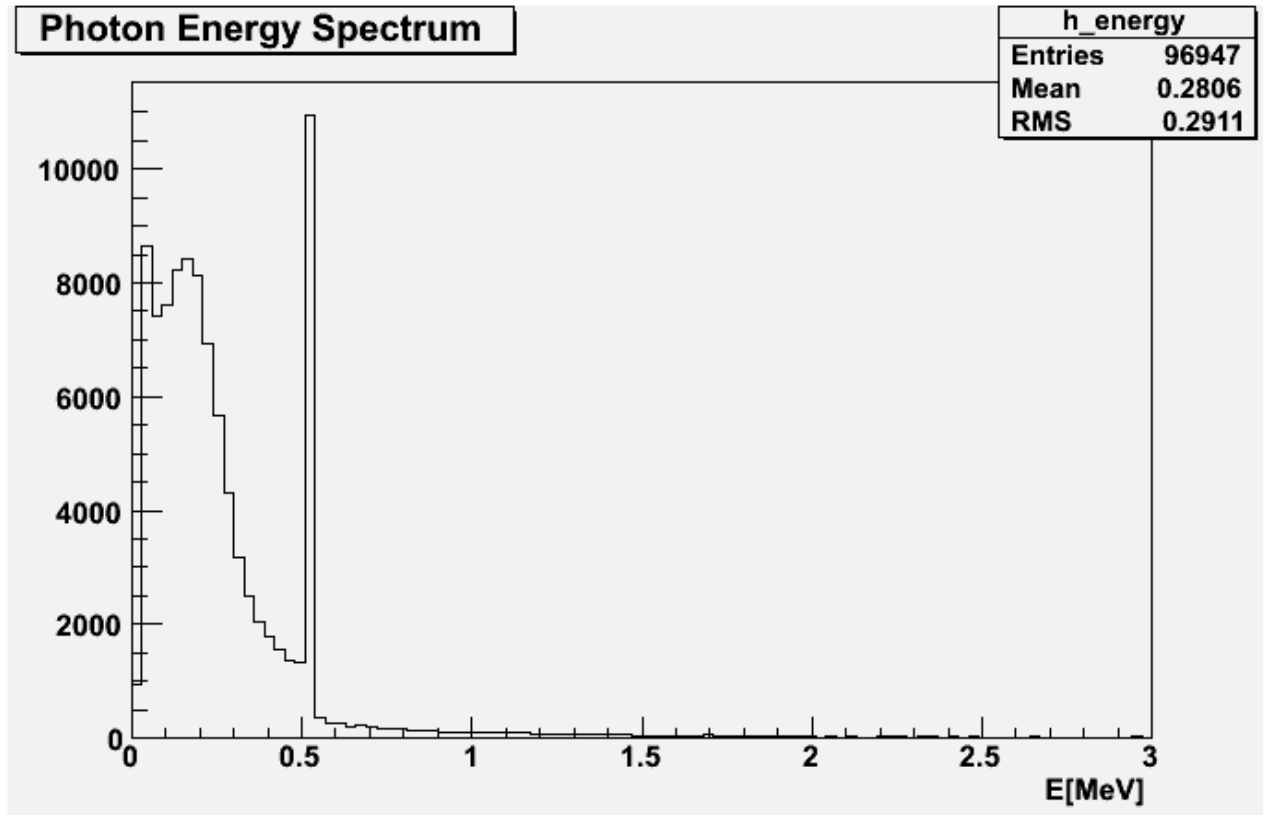
Photons at $s=3.5\text{m}$





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Photon Energy





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Conversion Factor

- What is the likelihood of a photon incident on the IP leading to a fake hit?
- In the ILC, 3% is expected (EUROTeV-Report – 2007-047, Dadoun, Bambade)
- Is this value relevant to the CLIC detector?



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Future Studies

- Simulation of the entire extraction line as far as the main dump
- Higher statistics to improve photon flux resolution in SVD region
- Neutron study to estimate detector damage



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Thank You

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