

Compton Systematic tests at event generator level

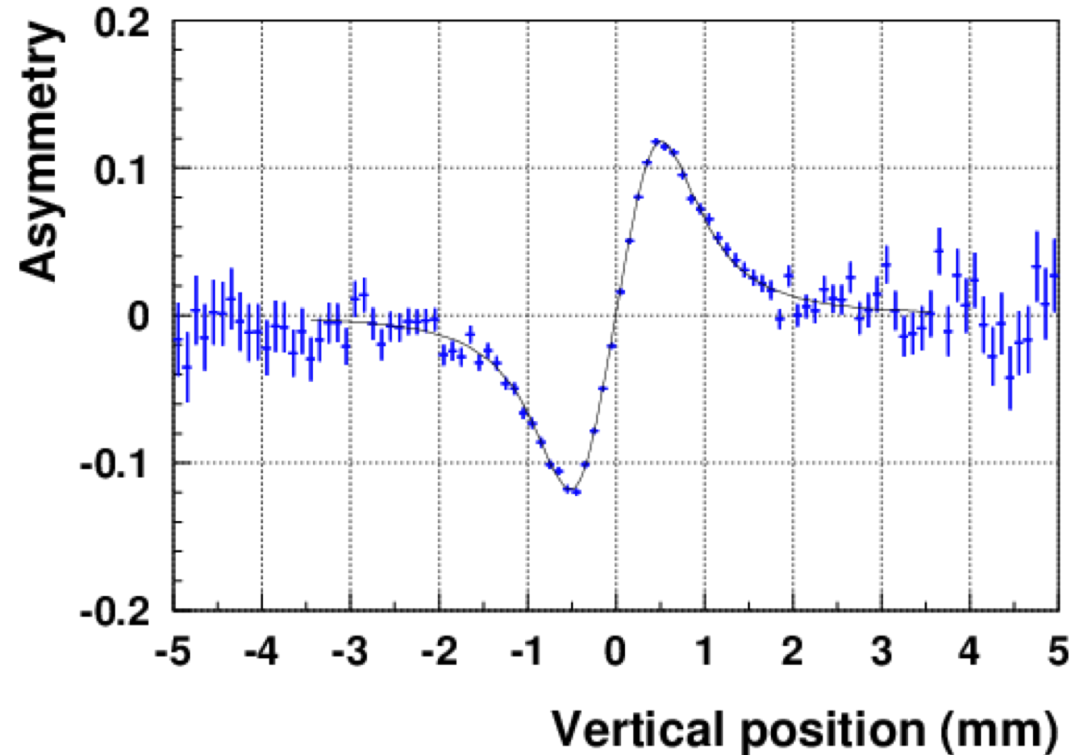
Study sensitivities, detector segmentation just using event generator

- Detector/beam offsets
- Collision location
- Detector segmentation
- Beam size (transverse, longitudinal)

Need pseudo-analysis chain to constrain systematics

Assumptions: 18 GeV electrons, 532 nm laser

- Photon detector 25 m from collision point



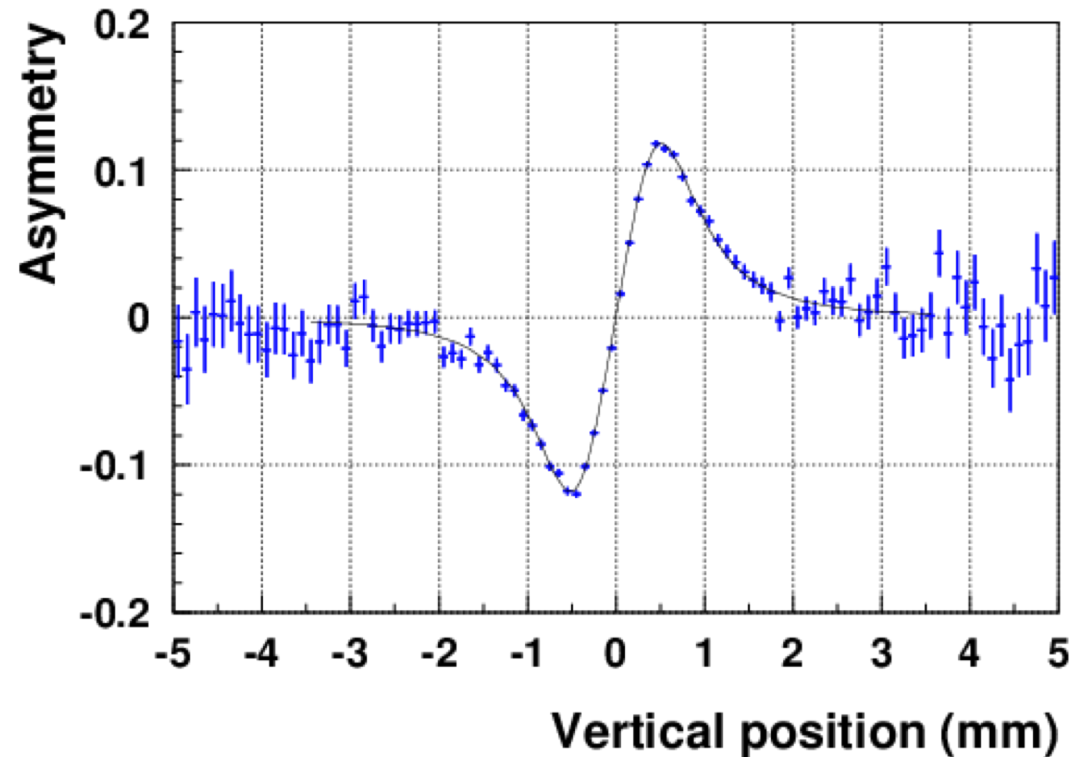
Segmentation

Used MC run to generate “ideal” spectrum (5 μm resolution)

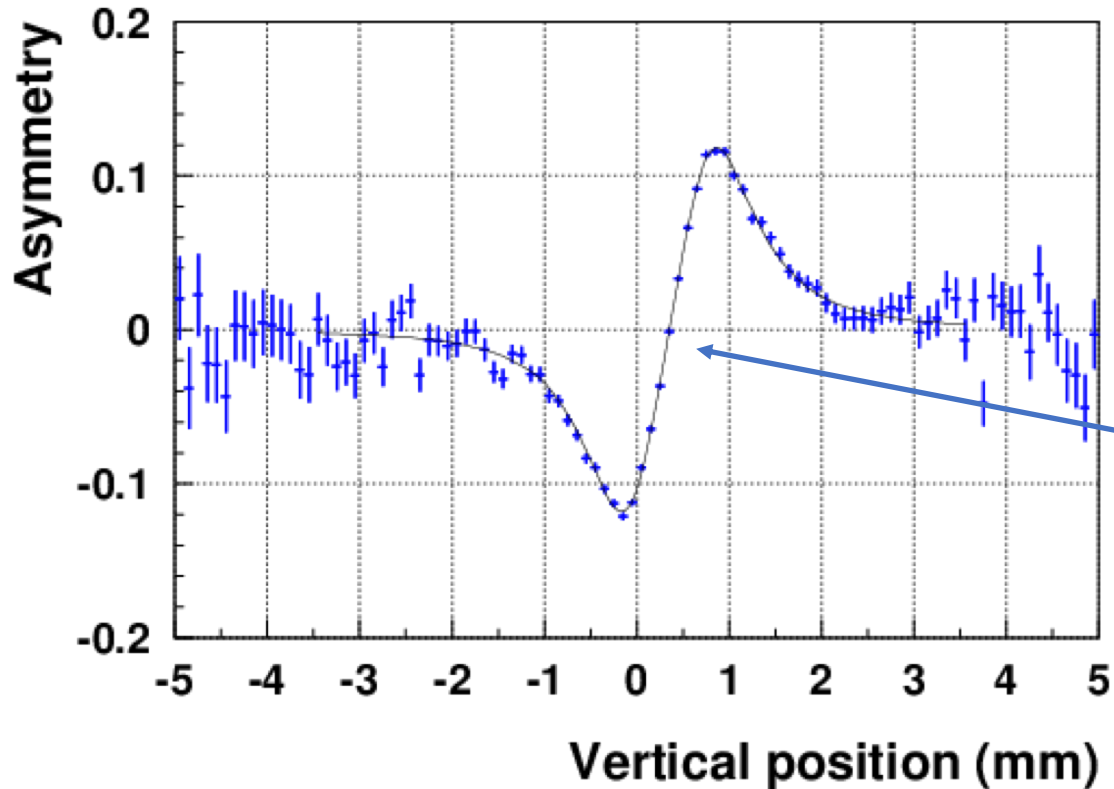
→ Fit that spectrum to another MC trial with different segmentation

Detector pitch (μm)	Extracted polarization
50	85.02 +/- 0.50
100	85.07 +/- 0.50
200	84.38 +/- 0.50
333.33	82.69 +/- 0.50
400	80.44 +/- 0.52
500	77.71 +/- 0.51

At photon detector plane
Nominal P=85%



Vertical offset



0.35 vertical offset applied to MC trial spectrum

→ Let vertical position float – recover nominal polarization to $\sim 0.1\%$

No offset: $P_{\text{fit}} = 85.02 \pm 0.50$

0.35 mm offset: $P_{\text{fit}} = 84.88 \pm 0.51$

Transverse Beam size

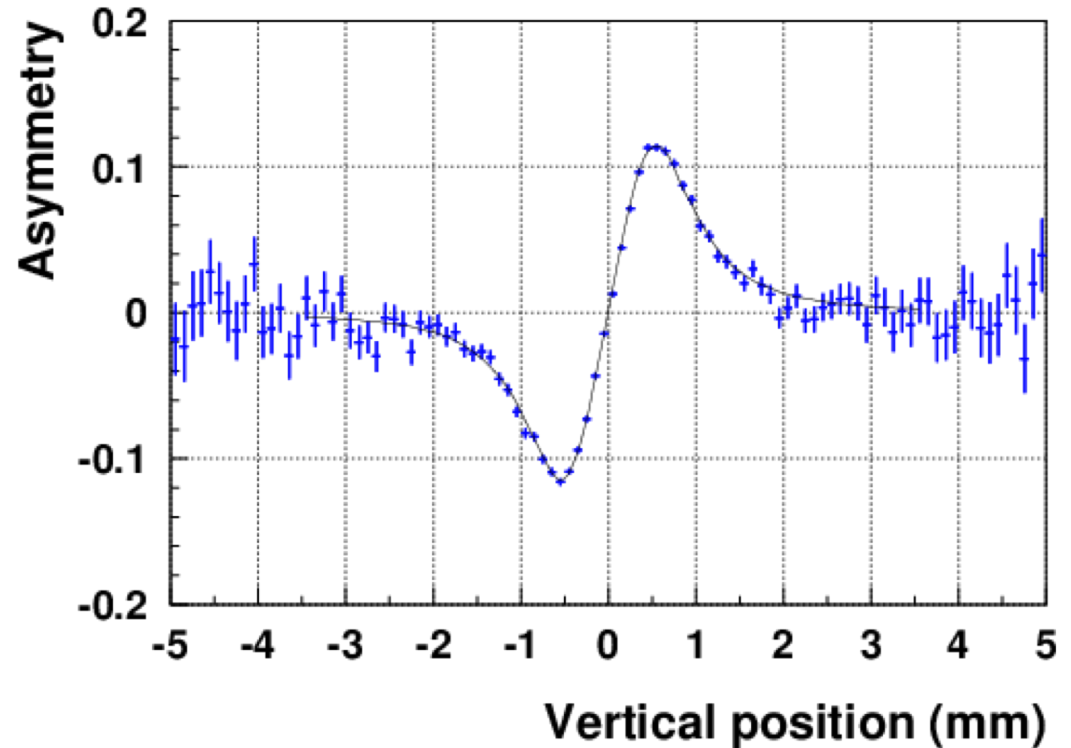
$$\sigma_x^{\text{beam}} = 636 \mu\text{m} \quad \sigma_y^{\text{beam}} = 303 \mu\text{m}$$
$$\sigma_x^{\text{laser}} = \sigma_y^{\text{laser}} = 100 \mu\text{m}$$

Can also explore beam size effects

→ “Ideal” analyzing power must also include beam size effects

Analysis ignoring beam size: $P = 81.23 \pm 0.49\%$

Beam size	Extracted polarization (%)
Nominal	85.32 \pm 0.51
0.5*nominal	85.61 \pm 0.52
0.8*nominal	84.30 \pm 0.51
1.2*nominal	85.83 \pm 0.51
1.5*nominal	84.47 \pm 0.51



No clear systematic trend with beam size over range sampled – likely because laser is significantly smaller