IP6 Compton simulation update

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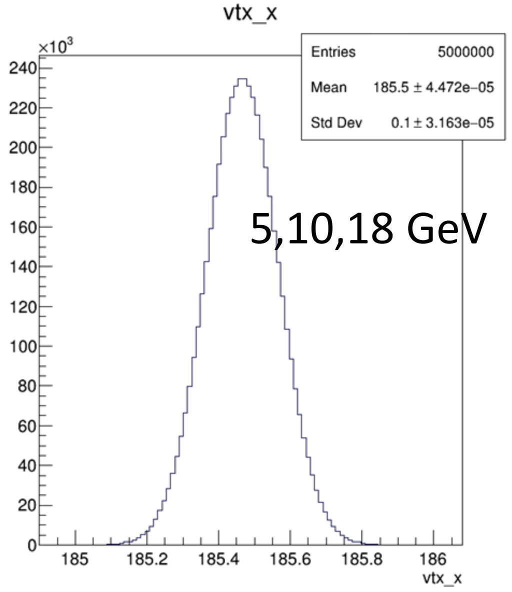
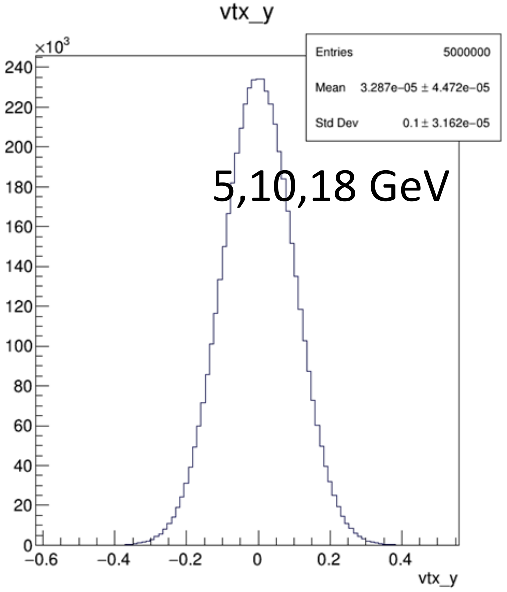
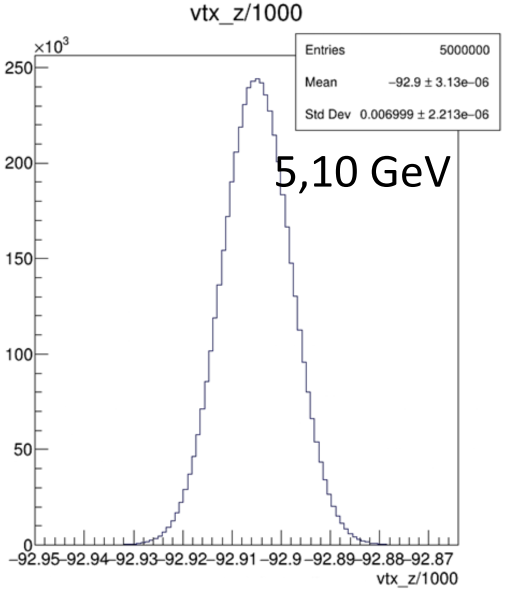
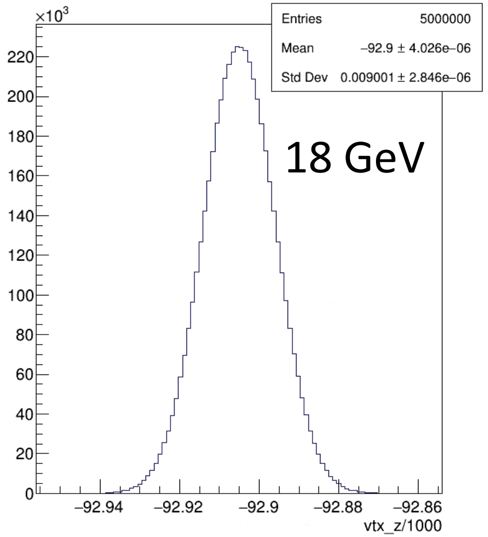
Vertex smearing



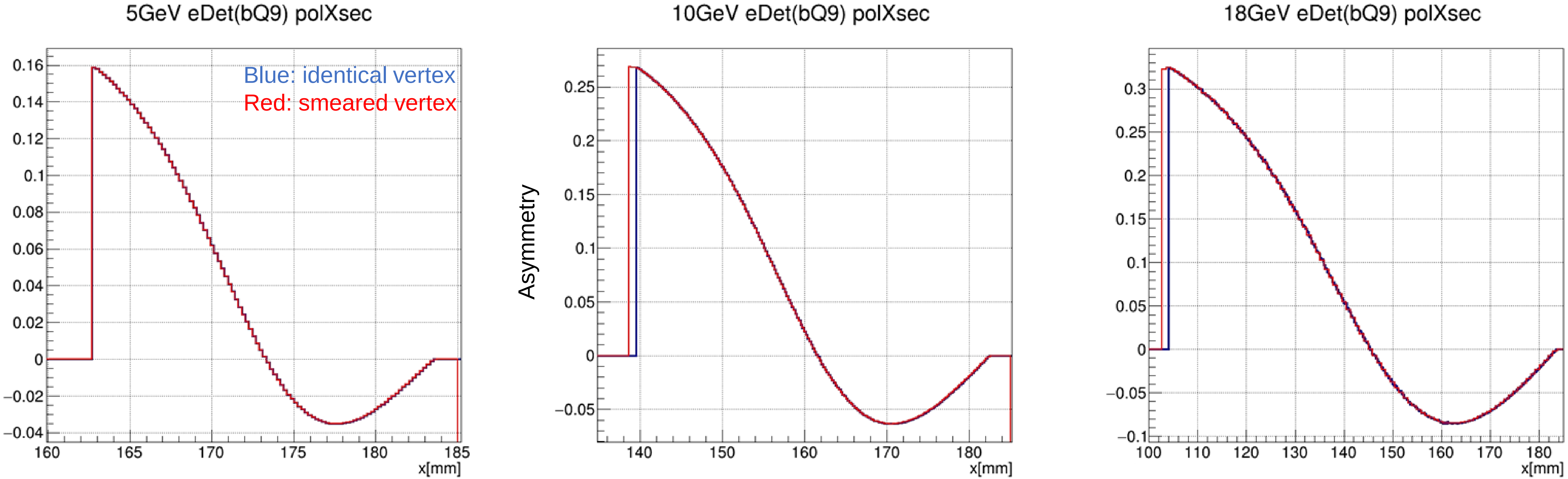






- The transverse smearing was taken as the width of the proposed laser beam (100um) and the longitudinal smearing was taken as the length of the electron bunch
- Assume 1mrad x-ing angle: at 4.5mm (3.5mm) this would be approximately 4.5um (3.5um) off the center which is much smaller than the 100um we assumed for the width of the laser

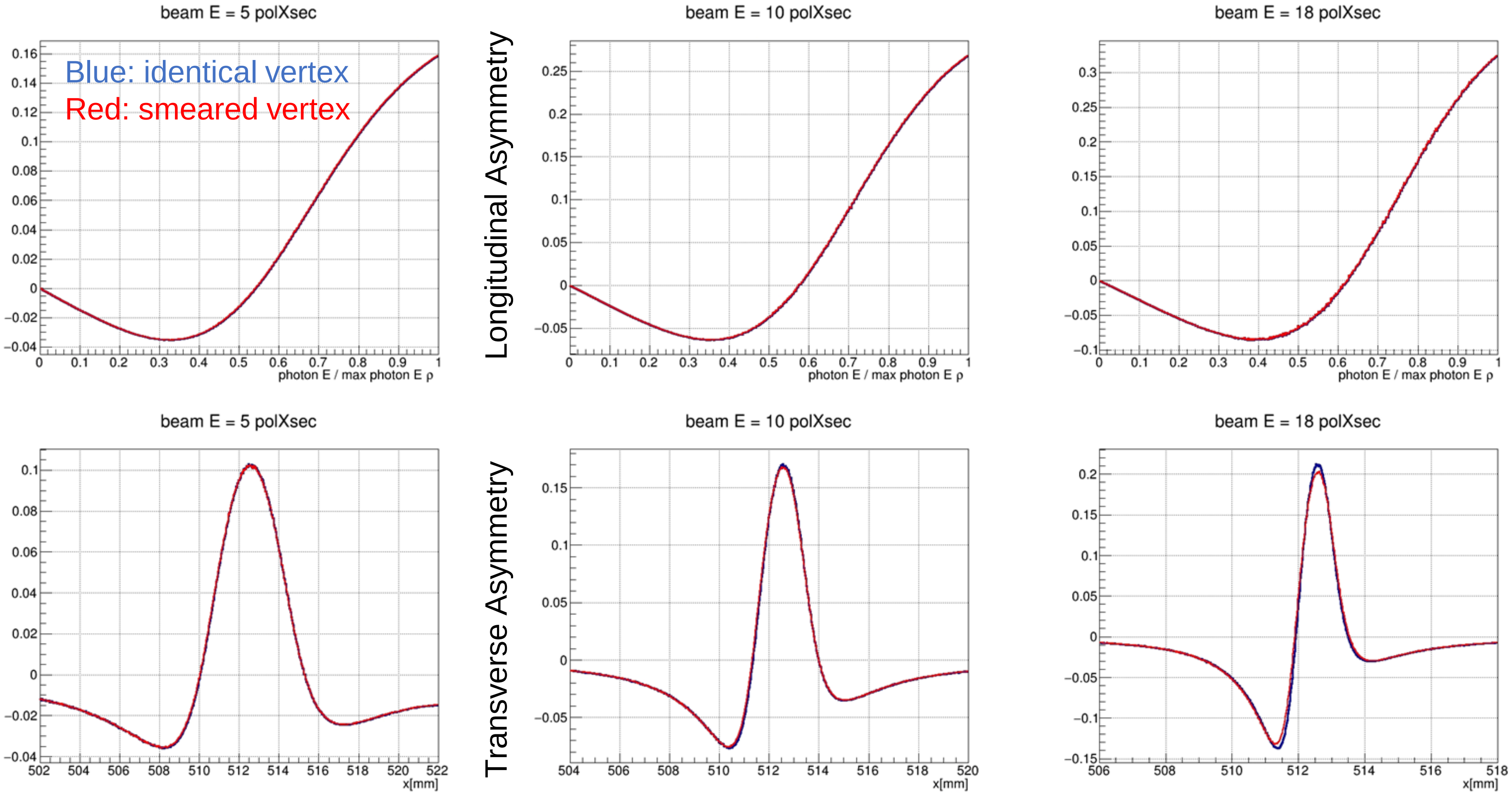
Electron detector



- The segmentation of the electron detector would be given by the “narrow” distribution (5 GeV) and requires about 30 points between Compton edge and a bit over the 0-crossing
  - This means that we are looking at approximately (175-163)/30 = 0.4mm
- The total size of the detector would be given by the widest distributions (18 GeV): approximately 60mm (~150 strips@400 um pitch)
- Additionally the detector would need to come in close to the beamline for us to be able to “see” the 0-crossing
  - Again the 5GeV configuration gives us the tightest constraints: 8-10mm from the beam

Backscattered photon impact

- Minimal impact for both longitudinal (rho) and transverse determinations



Luminosity calculations

$$< A_l^2 > \; = \; \frac{\int_{\rho_{min}}^1 d\rho \;\; \epsilon(\rho) \;\; \frac{d\sigma}{d\rho}(\rho) \;\; A_l(\rho)^2}{\int_{\rho_{min}}^1 d\rho \;\; \epsilon(\rho) \;\; \frac{d\sigma}{d\rho}(\rho)}.$$

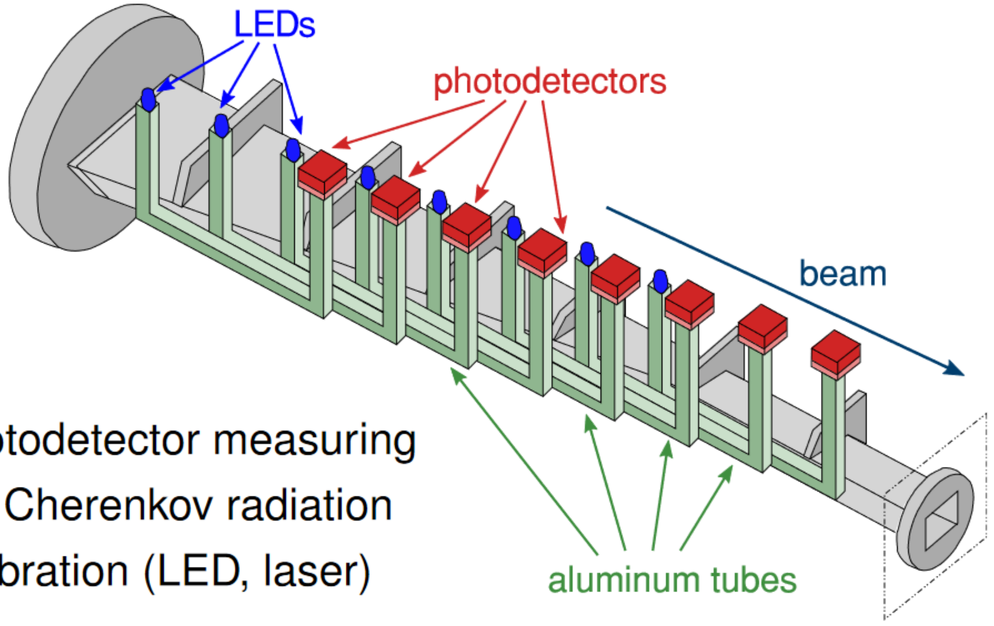
The needed time t_D to achieve an accuracy $\Delta P_e / P_e$ is then

$$t_D^{-1} \; = \; \mathcal{L} \; \left(\frac{\Delta P_e}{P_e} \right)^2 \;\; P_e^2 P_\gamma^2 \;\; \sigma_t \; < \frac{A_l^2}{1 - P_e^2 P_\gamma^2 A_l^2} > \simeq \mathcal{L} \; \left(\frac{\Delta P_e}{P_e} \right)^2 \;\; P_e^2 P_\gamma^2 \;\; \sigma_t \; < A_l^2 >$$

8	Configuration	Beam energy [GeV]	Unpol Xsec[barn]	Tot Unpol Xsec[barn]	Apeak [not used]	<A^2>	L	1/t(1%)	t[s]	t[min]
9	laser:532nm, photon long	18	0.432	0.432	0.310	2.07E-02	1.81E+05	1.17E-01	9	0.14
10	laser:532nm, photon trans	18	0.432	0.432	0.210	3.62E-03	1.81E+05	2.05E-02	49	0.81
11	laser:532nm, electron	18	0.301	0.432	0.320	4.57E-02	1.81E+05	1.80E-01	6	0.09
12										
13	laser:532nm, photon long	10	0.503	0.503	0.270	1.54E-02	1.55E+05	8.69E-02	12	0.19
14	laser:532nm, photon trans	10	0.503	0.503	0.170	2.15E-03	1.55E+05	1.21E-02	83	1.38
15	laser:532nm, electron	10	0.340	0.503	0.270	3.05E-02	1.55E+05	1.17E-01	9	0.14
16										
17	laser:532nm, photon long	5	0.569	0.569	0.160	5.82E-03	1.37E+05	3.29E-02	30	0.51
18	laser:532nm, photon trans	5	0.569	0.569	0.110	1.63E-03	1.37E+05	9.19E-03	109	1.81
19	laser:532nm, electron	5	0.323	0.569	0.160	1.14E-02	1.37E+05	3.65E-02	27	0.46

- Using the average A^2 to determine the time for a 1% statistical measurement (for one bunch) confirms the previous calculations we did at IP12
- The transverse component will be the most time consuming measurement

ILC electron detector



➤ **hind U-leg:** photodetector measuring the Cherenkov radiation

➤ **front U-leg:** calibration (LED, laser)

J. List:
https://indico.bnl.gov/event/7583/contributions/38666/attachments/29034/44954/JList_ILCPol_EICWS.pdf
https://arxiv.org/pdf/1011.6314.pdf

- Would a system as is proposed at the ILC be worth considering for the electron detector?

To-dos

- Smear photon energy (2-20% and analyze effect of longitudinal component extraction)
- Investigate the impact of backgrounds from scattering of beampipe and downstream quads
- Synchrotron light background for both electron and photon detectors