HRC: (Photon&Electron) High Rate Calorimeters

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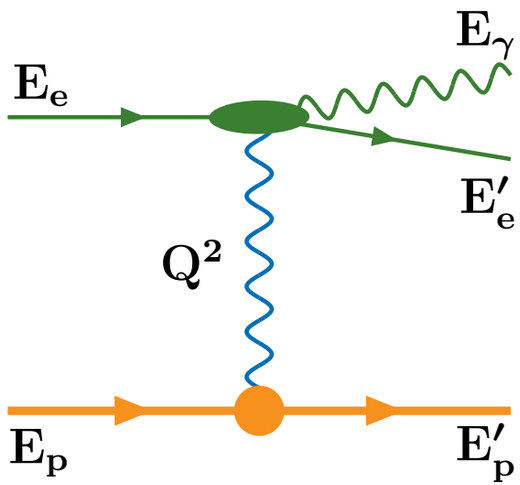
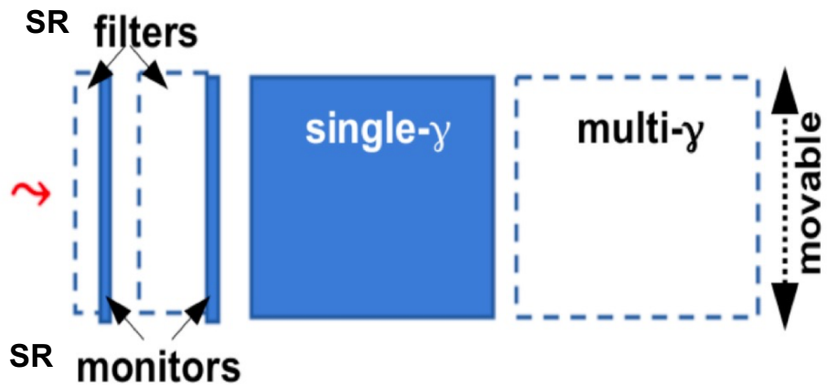


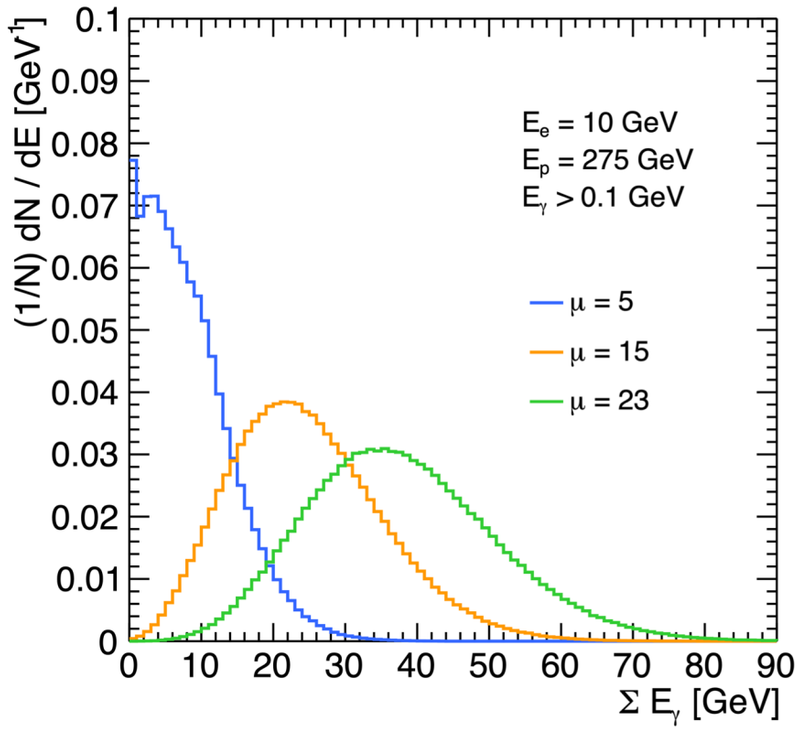


Direct Photon Detection: Introduction

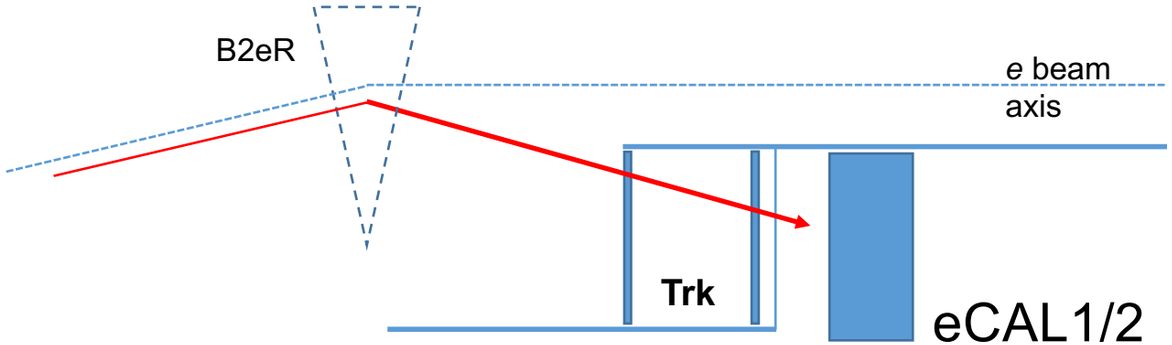
In principle, measurements of direct bremsstrahlung photons should provide very simple and precise luminosity measurements at the EIC, as photon (geometrical) acceptance is almost 100% and one has to simply account for photon energy cutoff, which can be well calibrated.

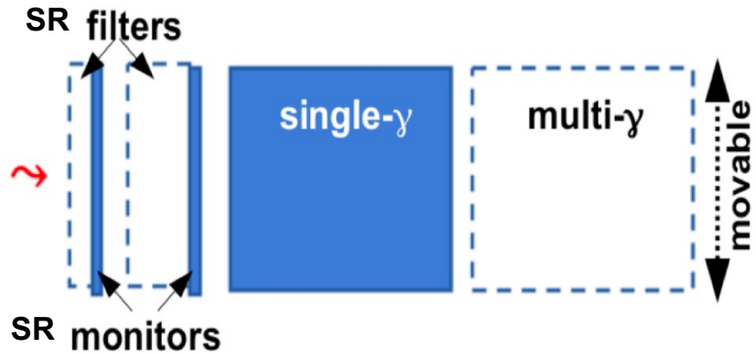
However, using this simple method of photon counting is only possible at low luminosities. For the nominal $L = 10^{34}$ cm^{-2}s^{-1} about 23 hard photons on average will be emitted for each bunch crossing, forcing measurements of energy flow instead, which are more difficult. ⇒

Therefore, **two** separate direct photon calorimeters are proposed: one with an **excellent energy resolution** to be used only for the special luminosity calibration runs at low L, and one which is capable of withstanding > 1 GHz event rates and be used for a robust luminosity monitoring during the nominal ePIC running.



Direct bremsstrahlung photon calorimeters are inevitably exposed to the direct synchrotron radiation, mostly originating in the electron beam ”separating” dipole B2eR. For a 18 GeV electron beam that requires using thick absorbers/filters to attenuate SR, at a cost of deteriorating the energy measurements. We therefore need to carefully study the optimal way of configuring such filters.





HRC *Detector Sub-system Collaboration*:

To develop, design, build & deliver complete systems for direct photon measurements, as well as for low-Q^2 electron energy measurements with calorimeters – great synergies between two parts are due to similar event rate challenges (except for single-γ CAL)

Very fruitful relations with two other DSCs are foreseen:
- single-γ calorimeter developments together with Pair Spectrometer DSC
- simulations of electron trajectories/backgrounds with electron Tracker DSC

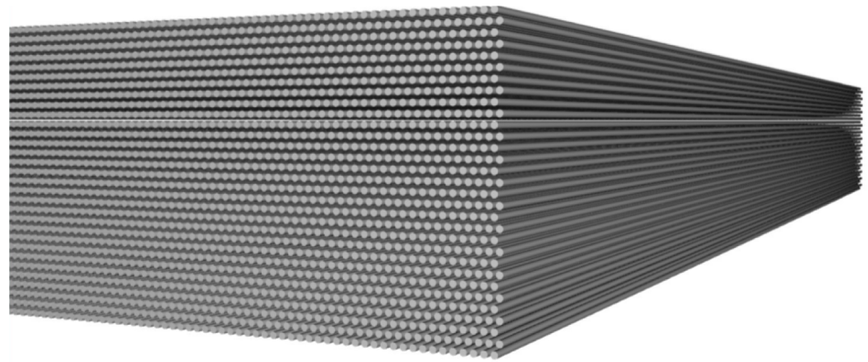
Base-line detector technologies:

1. **Quartz fiber/tungsten spaghetti** calorimeter for energy flow – maximal **radiation hardness**

2. **Sci fiber/tungsten spaghetti** calorimeter for single photon measurements – maximal **energy resolution**

Similar situation for low-Q^2 ECALs

Monte Carlo studies in progress:
Y. Ali + A. Kowalewska



”Direct” FF connection…

Exclusive lepton pair production at the electron–ion collider

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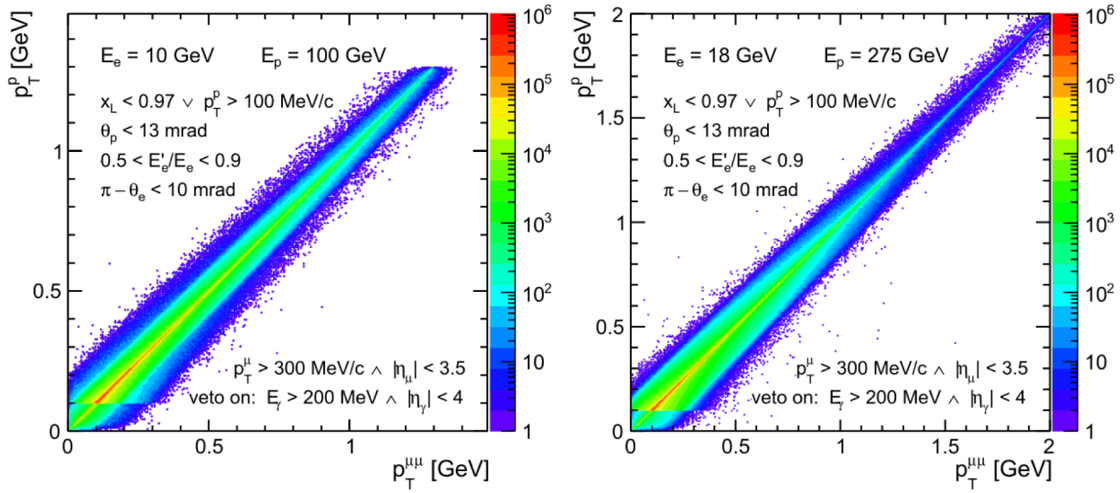

Fig. 2 Correlation of the lepton pair transverse momentum, $p_T^{\mu\mu}$, and the proton transverse momentum, p_T^p for two energy configurations of th EIC. The photon veto (2.4) was applied

…and “triple coincidence” bremsstrahlung?

Organize a meeting on physics FF/FB cross-cut?

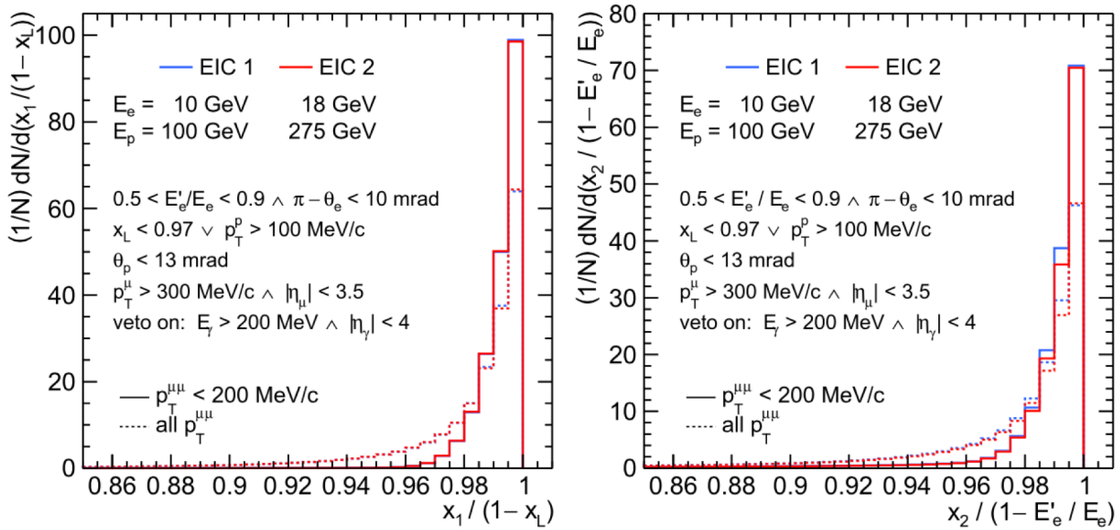

Fig. 3 Distributions of $x_1/(1-x_L)$ and $x_2/(1-E'_e/E_e)$ with (solid line) and without (dotted line) the cut on the transverse momentum of th lepton pair $p_T^{\mu\mu} < 200$ MeV/c