Initial proposal of additional instrumentation in the forward region of the electron hemisphere

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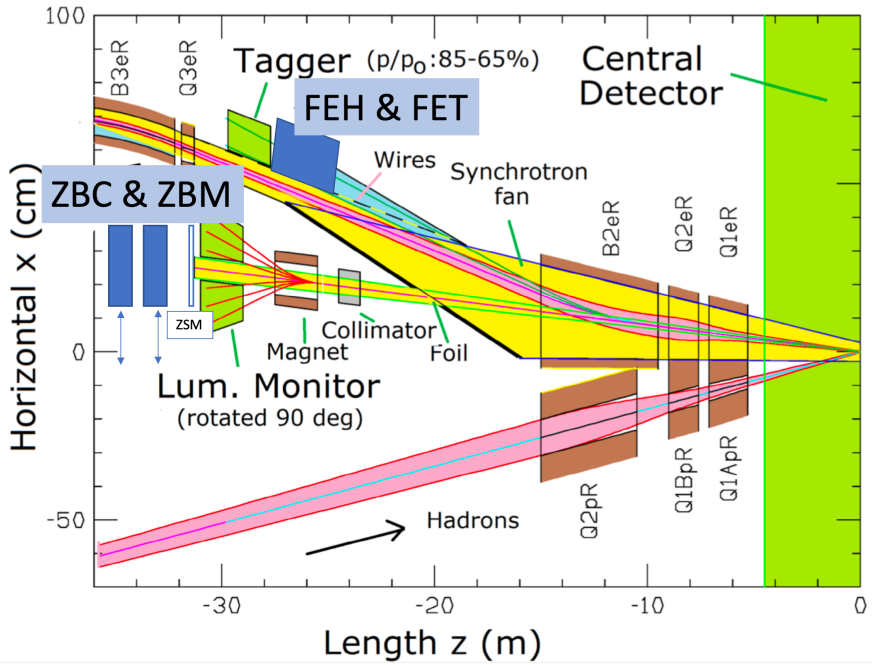
Need to improve detection abilities in e-beam going direction

- Our groups have large experience and diverse competences in physics with forward detectors at colliders, covering all aspects: from physics simulation and detector conceptual studies, through the detector design and development, including the associated electronics and data-acquisition software, and up to the detector construction and installation as well as its deep data analyses.
- IFJ PAN and AGH UST groups were responsible for building the luminosity detectors for the ZEUS experiment at HERA, and providing luminosity measurements during the whole period of data taking.
- As at HERA, also at the EIC it is proposed that not only very forward photons are detected but also very forward electrons. Such a forward electron detector can serve **not only** as a photoproduction tagger but **also** as a detector of the bremsstrahlung electrons, allowing to use it for important luminosity measurement cross-checks (remember: $E_{e'} + E_\gamma = E_e$).
- Precise luminosity measurement at the EIC, with $\delta L/L < 1\%$, and of 10^{-4} for relative measurements, is both crucial to achieve its main physics goals and very challenging (ep: ≈ 10 hard bremsstrahlung photons every 10 ns; e+Au: more than hundred of such photons, for nominal luminosity).
- Forward electron detectors will also suffer from event pileup (ep: ≈ 3 bremsstrahlung electrons every 10 ns, assuming its acceptance range $0.65 < E'/E < 0.85$. For the e+A collisions the event pileup will scale approximately with Z^2/A).

Proposal to install additional detectors in electron hemisphere

Seven components of the proposed detector system for the forward photons and electrons:

1. (ZCB) Zero-degree converted bremsstrahlung photons' detector (Lum. Monitor),
2. (ZSM) Zero-degree synchrotron radiation online monitor,
3. (ZBM) Zero-degree, movable, photon bremsstrahlung monitor,
4. (ZBC) Zero-degree, movable, photon bremsstrahlung calorimeter,
5. (FEH) Forward electron hodoscope (mini-tracker, ~ 5000 channels),
6. (FET) Forward electron timing detector (picosecond resolution using MCP-PMTs),
7. (FEC) Forward electron calorimeter (Tagger).



- We are interested in building detectors $3-6$, and possibly also 2 and 7, including their full front-end electronics with signal pre-processing and to provide the readout chips for the other components, if not extra design is necessary.
- We plan to apply for funding to the Polish Ministry of Science and Higher Education and technical staff support at Temple University.
- We plan to submit an EoI to build these detectors jointly by AGH UST, IFJ PAN, TU.