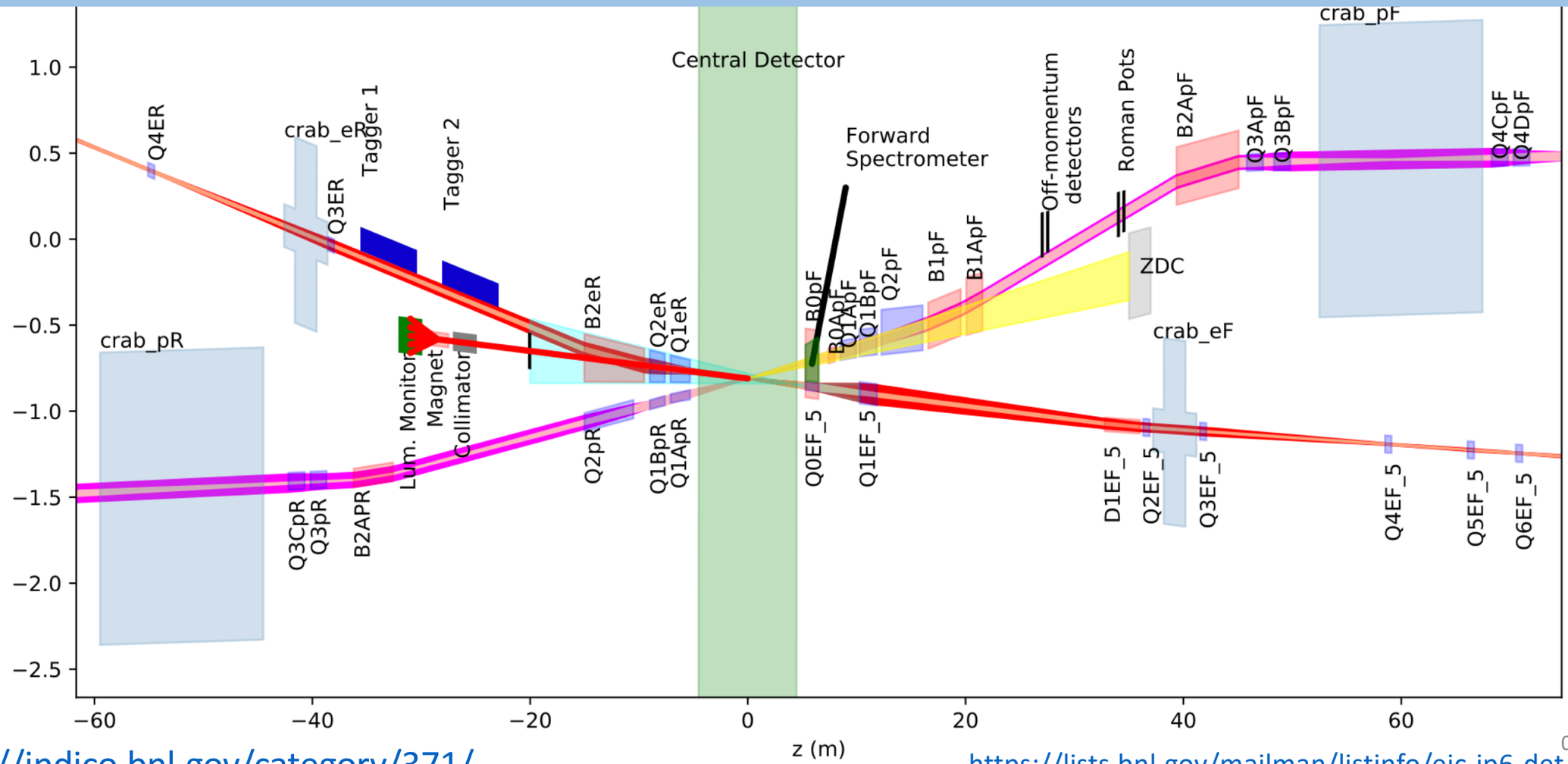
Athena FarBackward Working Group:

Luminosity measurements and low-Q^2 tagging



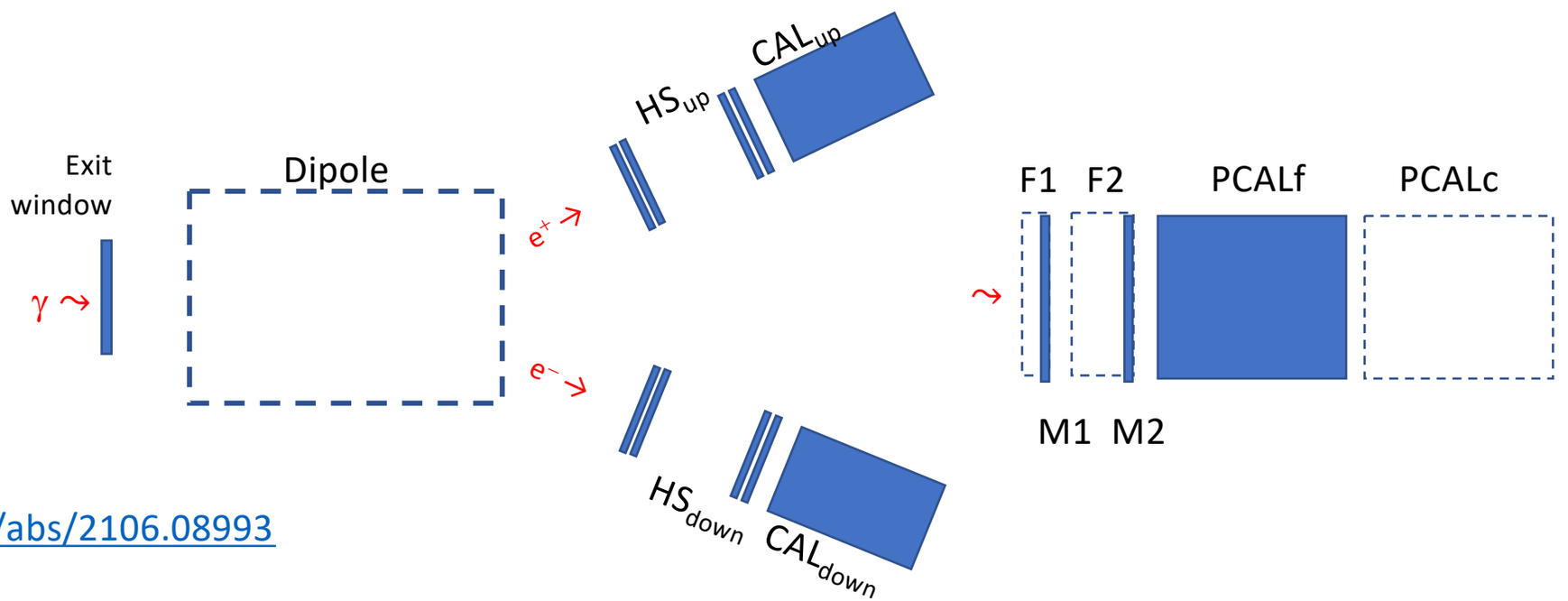
https://indico.bnl.gov/category/371/

https://lists.bnl.gov/mailman/listinfo/eic-ip6-det-back-l (21)

FarBackward WG: need for three luminosity methods

Luminosity measurements at the EIC are very challenging: huge event rates + wide electron beam energy range (5… 10… 18 GeV) + wide spectrum of nuclei species (from *p* to *Au*) ⇒ need to go beyond ZEUS/HERA approach, and use three largely complementary bremsstrahlung measurements

1. Reference measurement – photon **counting** with a movable calorimeter PCALc (at very low *L*)
2. Photon conversion **counting** using $CAL_{up/down}$ + $HS_{up/down}$ (outside SR plane)
3. Photon energy flow, or $\langle E_{PCALf} \rangle$, using a movable calorimeter PCALf, with SR filters/monitors in front



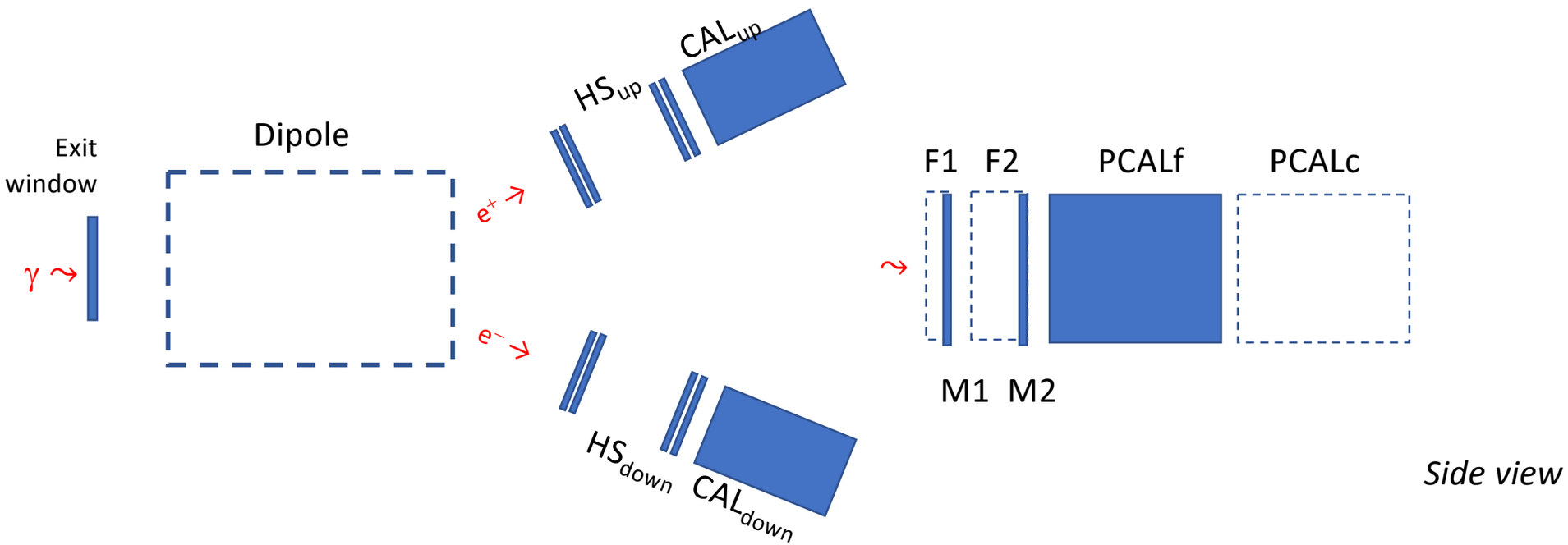
Side view

https://arxiv.org/abs/2106.08993

FarBackward WG: Hodoscopes & PCALf

PCALf: for 10 × 275 GeV *ep* $\langle E_{PCALf} \rangle \approx 50$ GeV ⇒ huge irradiations ≈ 100 Mrad/100 fb^{-1} ⇒ tentative solution – a tungsten spaghetti calorimeter with fused silica + SiPMTs (AGH UST)

HS_{up} + HS_{down}: have to deal with a significant *event pileup*, ≈ 0.1 for *ep* and about 2 for *eAu* ⇒ tentative solution – 2 × up to 10 planes of 1 mm square, straight scintillating fibers read out by SiPMTs (INP Krakow)

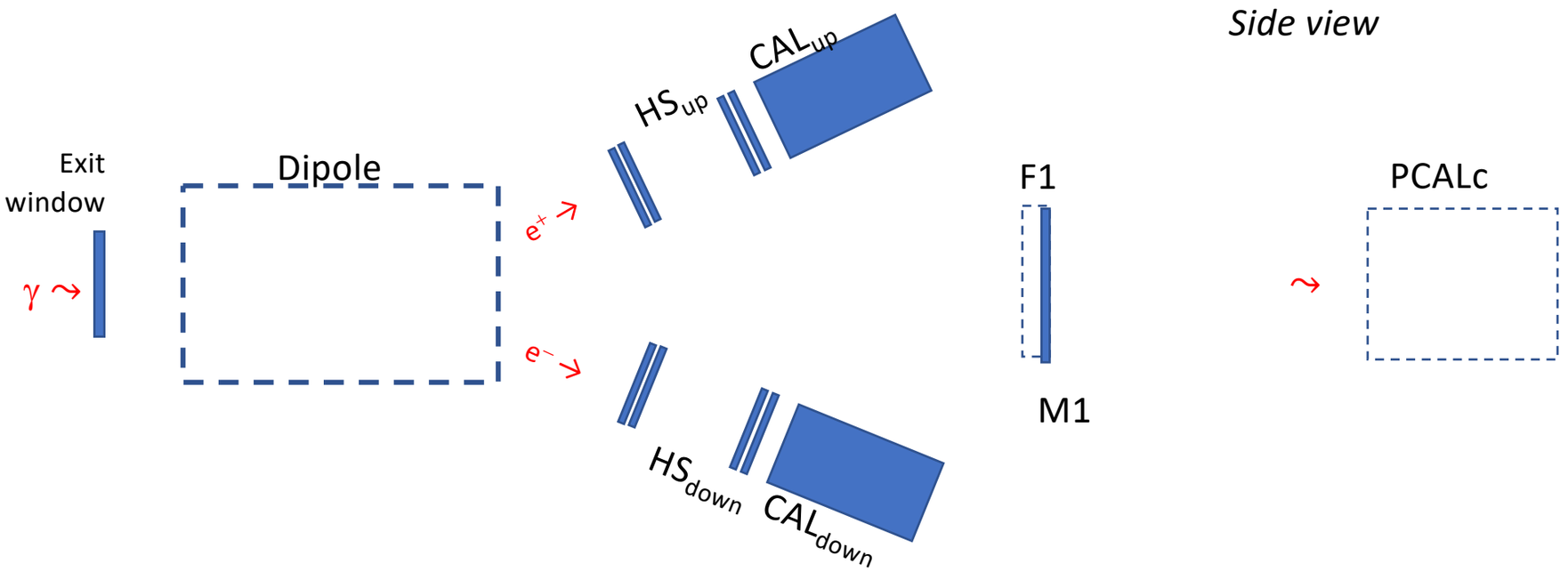


Side view

FarBackward WG: $CAL_{up/down}$ + PCALc

A similar energy resolution of about 10%/√E should be required for the three calorimeters PCALc + $CAL_{up/down}$ + a very good linearity well below 0.1 GeV for PCALc, and rather high segmentation for $CAL_{up/down}$

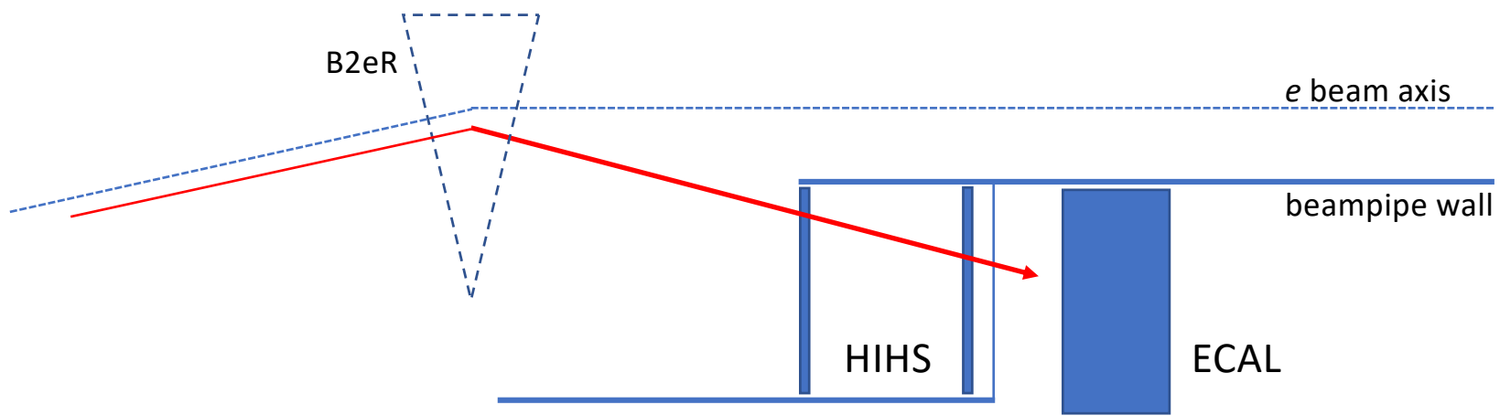
Event rates for $CAL_{up/down}$ are around 100 MHz, and the expected maximal irradiation is less than 1 Mrad per 100 fb^{-1} for *ep* collisions



FarBackward WG: Bremsstrahlung electrons & photoproduction tagging

HIHS – a very high resolution hodoscope ⇒ a (horizontal) vertex detector – essential for an efficient photoproduction tagging at the EIC, in particular for *eAu* collisions

ECAL (one or two?) – have different geometries than from PCALc or $CAL_{up/down}$ but similar energy resolution is expected, however the event pileup in ECAL is **large**, especially for *eAu* collisions, and in addition events are strongly "collimated" in the EIC plane ⇒ higher radiation resistance is required (scintillators excluded?) as well as highly segmented detectors



Top view