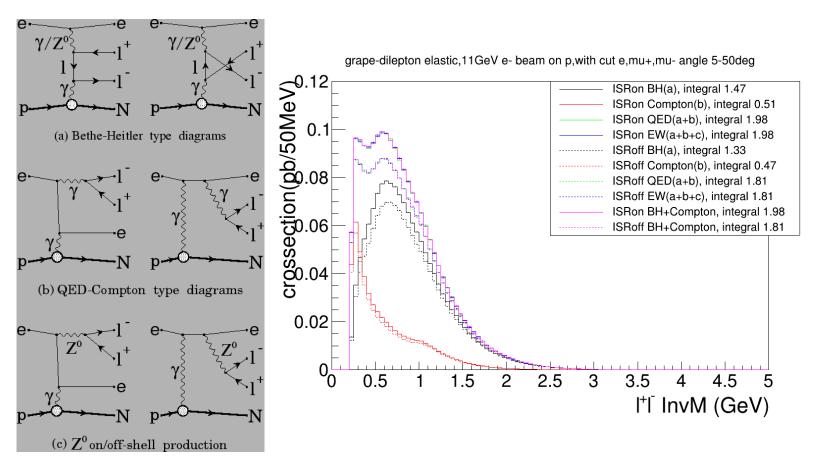
## Grape-dilepton run modes https://research.kek.jp/people/tabe/grape

- Grape-dilepton define 3 types of elastic reaction
  - BH(a),Compton(b),Z0(c)
- Grape-dilepton define 4 run modes
  - BH,Compton,QED=BH+Compton,EW=QED+Z0
- grape BH(a) except Z0 = EpIC BH2
- grape Compton(b) = EpIC BH1
- Grape can turn on and off for ISR (Initial state radiation for the beam lepton)
- The plot shows Z0 contribution can be ignored
- We should use grape mode QED(a+b) to compare with EpIC BH1+BH2 crosssection. Grape should be ISRoff because EpIC has no ISR yet
- We should use grape mode QED(a+b) with ISRon for rate estimation to be more accurate



## Grape-dilepton muon and ele comparison

- Grape "QED ele", "Compton ele" and "BH ele" modes have e-e- interference on, "BHdirect ele" mode has e-e- interference off
- grape doesn't have "QEDdirect ele" or "Comptondirect ele" mode somehow
- Somehow "QED ele" mode produces many events with very small timelike photon mass and they mostly have both e- and e+ along beam axis
- Somehow "QED ele" has much larger crosssection than "BH ele"
- When e-e- interference on, we can select e- with high or low Pt
- If EpIC ele mode have e-e- interference on, we can compare to grape ISRoff QED ele (highPt) or ISRoff QED ele (lowPt). Otherwise, we can't compare directly.
- BHdirect ele could be a direct comparison between grape and EpIC can have BH2 without intereference

0.4 ISRon QED muon, integral 1.98 crossection(pb/50MeV) ISRon BH muon, integral 1.47 ISRon QED ele(highPt), integral 5.47 .35 ISRon QED ele(lowPt), integral 5.45 ISRon BH ele(highPt), integral 2.27 ISRon BH ele(lowPt), integral 2.27 0.3 ISRon BHdirect ele, integral 1.83 ISRoff QED muon, integral 1.81 ISRoff BH muon, integral 1.33 ISRoff QED ele(highPt), integral 5.11 .25 ISRoff QED ele(lowPt), integral 5.11 ISRoff BH ele(highPt), integral 2.07 ISRoff BH ele(lowPt), integral 2.07 0.2 ISRoff BHdirect ele, integral 1.66 15 0 0.05 2.5 1.52 3 3.5 4.5 .5 'n 0 5 I<sup>+</sup>I<sup>-</sup> InvM (GeV)

grape-dilepton elastic,11GeV e- beam on p,with cut e-,mu+,mu- or e-,e+,e- angle 5-50deg

## Compare grape-dilepton to data

- Muon pair production in *ep* collisions at HERA https://doi.org/10.1016/j.physletb.2004.01.003
- HERA H1 data condition
  - e 27.6GeV p 920GeV
  - Two muons at theta 20-160deg
  - mu1 Pt>2GeV, mu2 Pt>1.75GeV
  - Qp > 5GeV
- Grape-dilepton generator condition
  - elastic EW mode with ISRon
  - Same cuts except using mu- Pt>2GeV, mu+ Pt>1.75GeV instead of mu1 mu2
- Comparison show they are in same order, but it's hard to do it more precise without more accurate HERA H1 geometry and momentum cuts?

