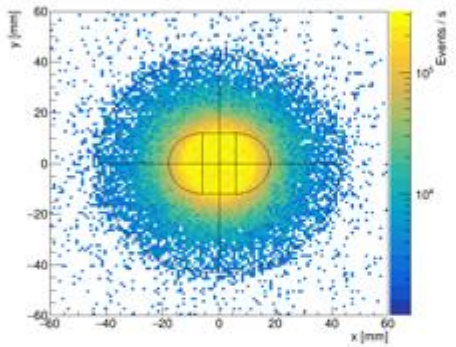
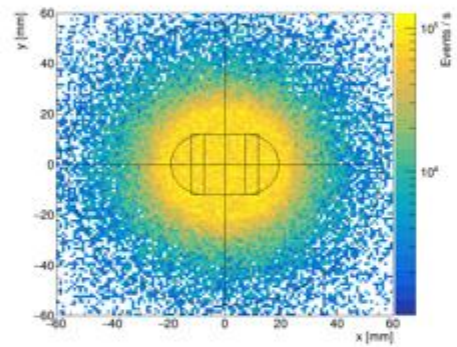
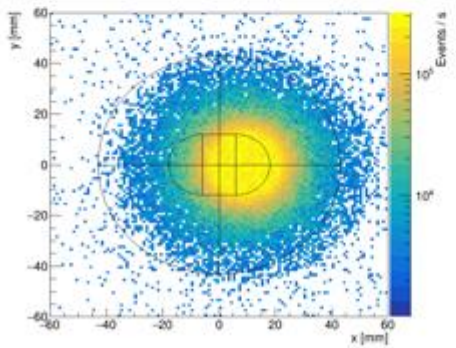
2024.3.19 BHlumi studies of Bhabha processes

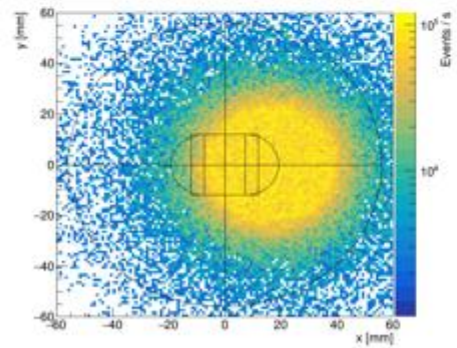
1. Hits on FLM (studied BHlumi from Yilun Wang)

$L = 3 \times 10^{34}\ cm^{-2} \cdot s^{-1}, \sqrt{s} = 240\ \text{GeV}, \theta = [0.022, 0.082]\ \text{rad}$



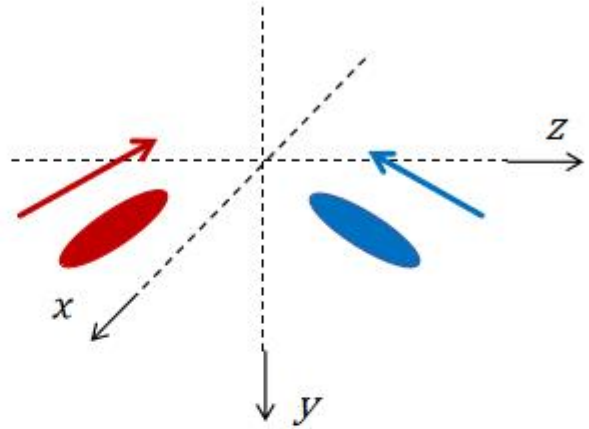


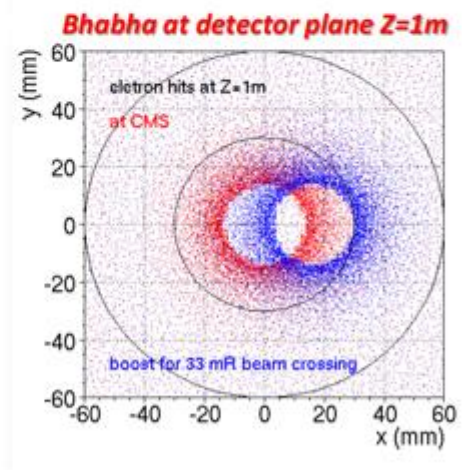




$z = 560$ mm

$z = 1$ m





from Prof. Hou

3. LumiBelle2 studies

Nuclear Inst. and Methods in Physics Research, A 931 (2019) 225–235

A fast luminosity monitor measuring the rate of the radiative Bhabha process at zero degree photon scattering angle based on diamond detectors was developed and successfully operated during the Phase-2 commissioning of SuperKEKB. The main purpose of this system, called LumiBelle2, is to provide: train integrated luminosity signals at 1 kHz with a relative precision better than 1% for luminosities higher than $10^{34}\ cm^{-2}s^{-1}$, input to a dithering feedback system designed to maintain an optimum horizontal overlap between the two colliding beams at the Interaction Point (IP), and bunch integrated luminosity signals at 1 Hz which are useful for machine tuning and beam parameters studies of the successive bunches along the train. In this paper, the design of the LumiBelle2 and Phase-2 results will be reported, including the evaluation of the single beam background, relative luminosity measurements and vertical beam size determinations at the IP using vertical offset scans.

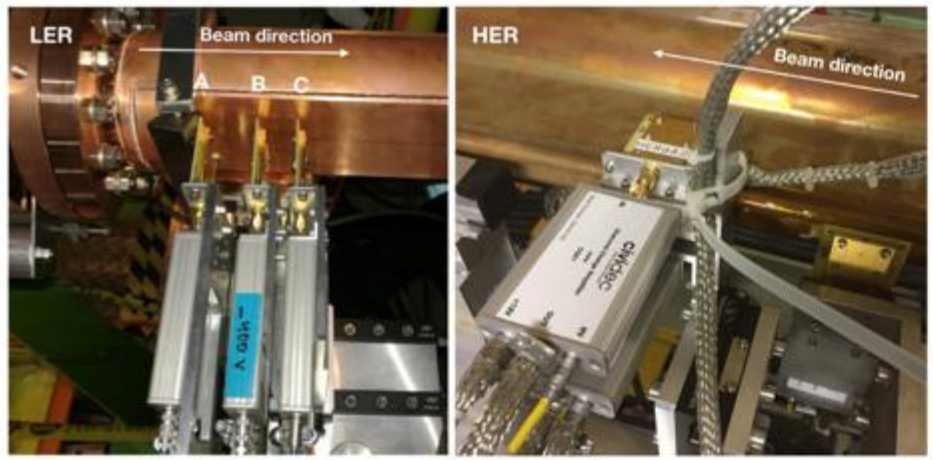


Fig. 1. Experimental layout in both rings (lhs: LER, rhs: HER).

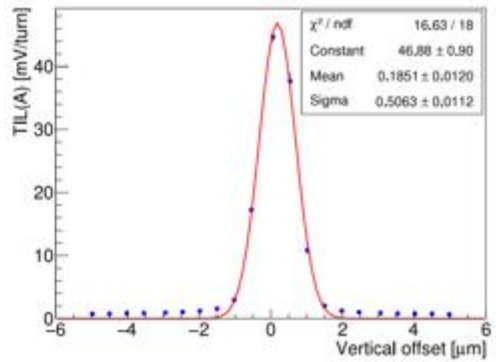


Fig. 19. Relative train integrated luminosity signals with respect to the vertical offset of the electron beam.

$$\sigma_y = \Sigma_y/\sqrt{2} = 0.36 \pm 0.01\ \mu\text{m}$$

4. Next steps: Geant4 studies of multiple scattering and beam pipe $\frac{dE}{dx}$