The Compton polarimeter in IR6

——new electron forward layout

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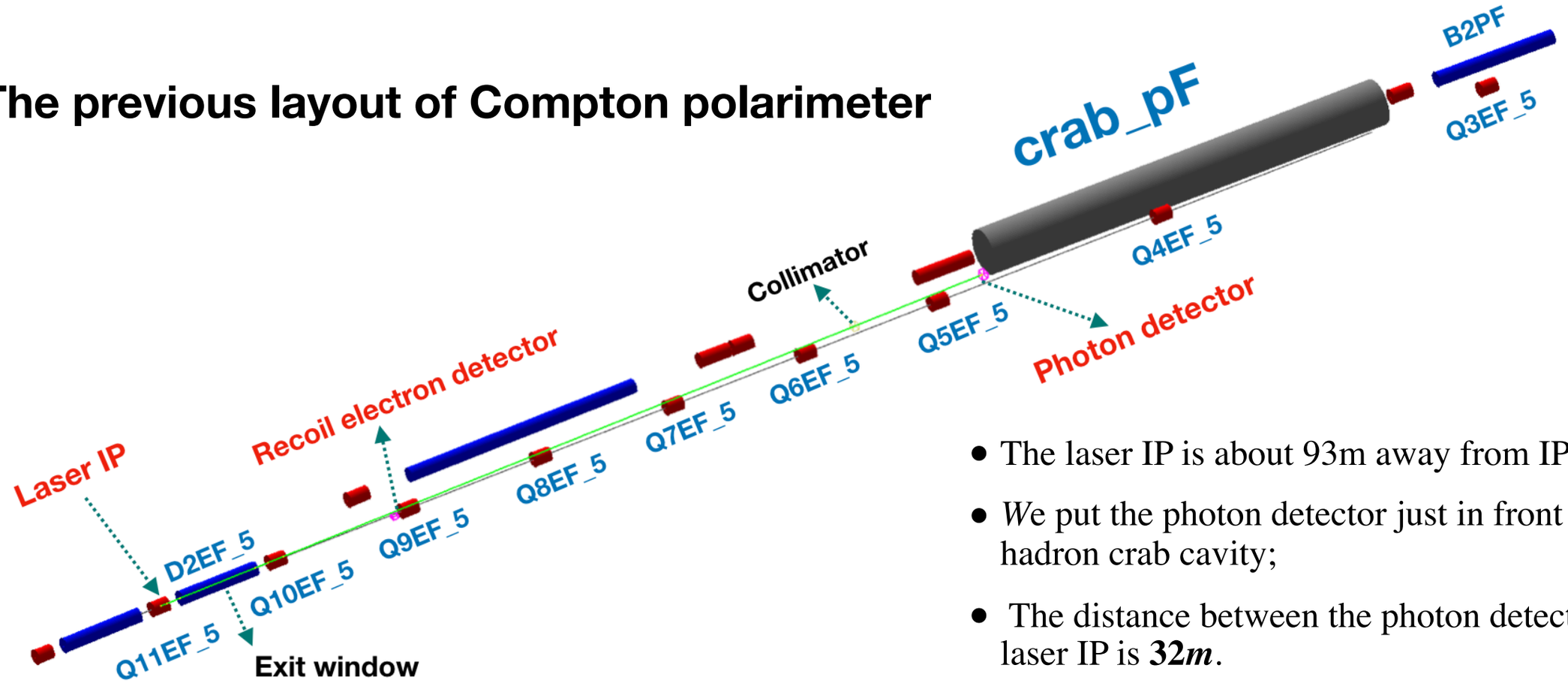
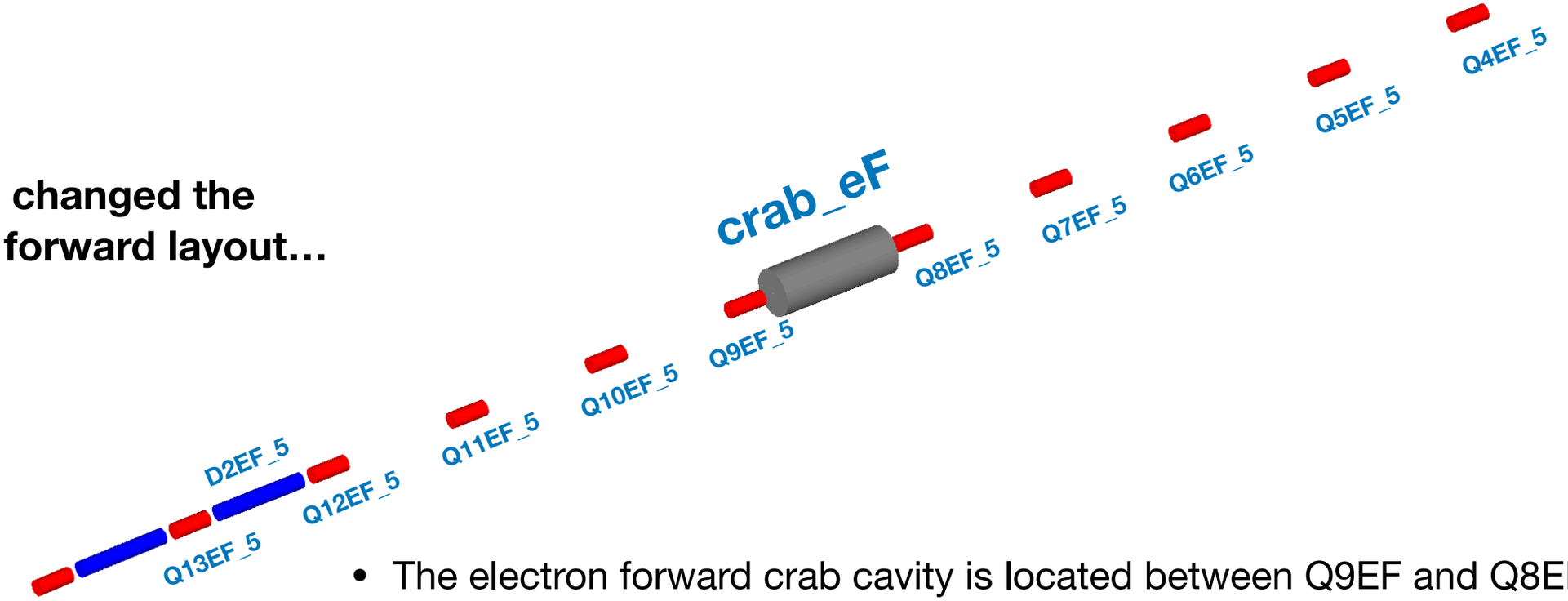
The previous layout of Compton polarimeter



- The laser IP is about 93m away from IP6;
- *We* put the photon detector just in front of the hadron crab cavity;
- The distance between the photon detector and the laser IP is ***32m***.

If we changed the electron forward layout…



- The electron forward crab cavity is located between Q9EF and Q8EF;
- We have shorter dipoles and longer quadrupoles;

Luminosity and X smearing

$$L = f_b N_e N_\gamma G$$

Geometric factor:

$$G = \frac{1 + \beta cos\theta}{2\pi\sqrt{\sigma_y^2 + \sigma_{\gamma y}^2}\sqrt{\sigma_x^2(\beta + cos\theta)^2 + \sigma_{\gamma x}^2(1 + \beta cos\theta)^2 + (\sigma_z^2 + \sigma_{\gamma z}^2)sin^2\theta}}$$

$f_b = 2.2852 \times 10^7; Ne = 6.2 \times 10^{10}; N_\gamma = 2.84974 \times 10^{12};$

$\sigma_{\gamma x} = 0.1mm; \sigma_{\gamma y} = 0.1mm; \sigma_{\gamma z} = 1.3mm;$

$\sigma_z = 10mm; \sigma_x = \sqrt{\epsilon_x \beta_x}, \beta_x = 13.4m; \beta_y = 19m;$

$\delta P_e \approx \frac{1}{A\sqrt{N}}; N = time * L * \sigma_{Compton} * 0.8 * f_b/290;$

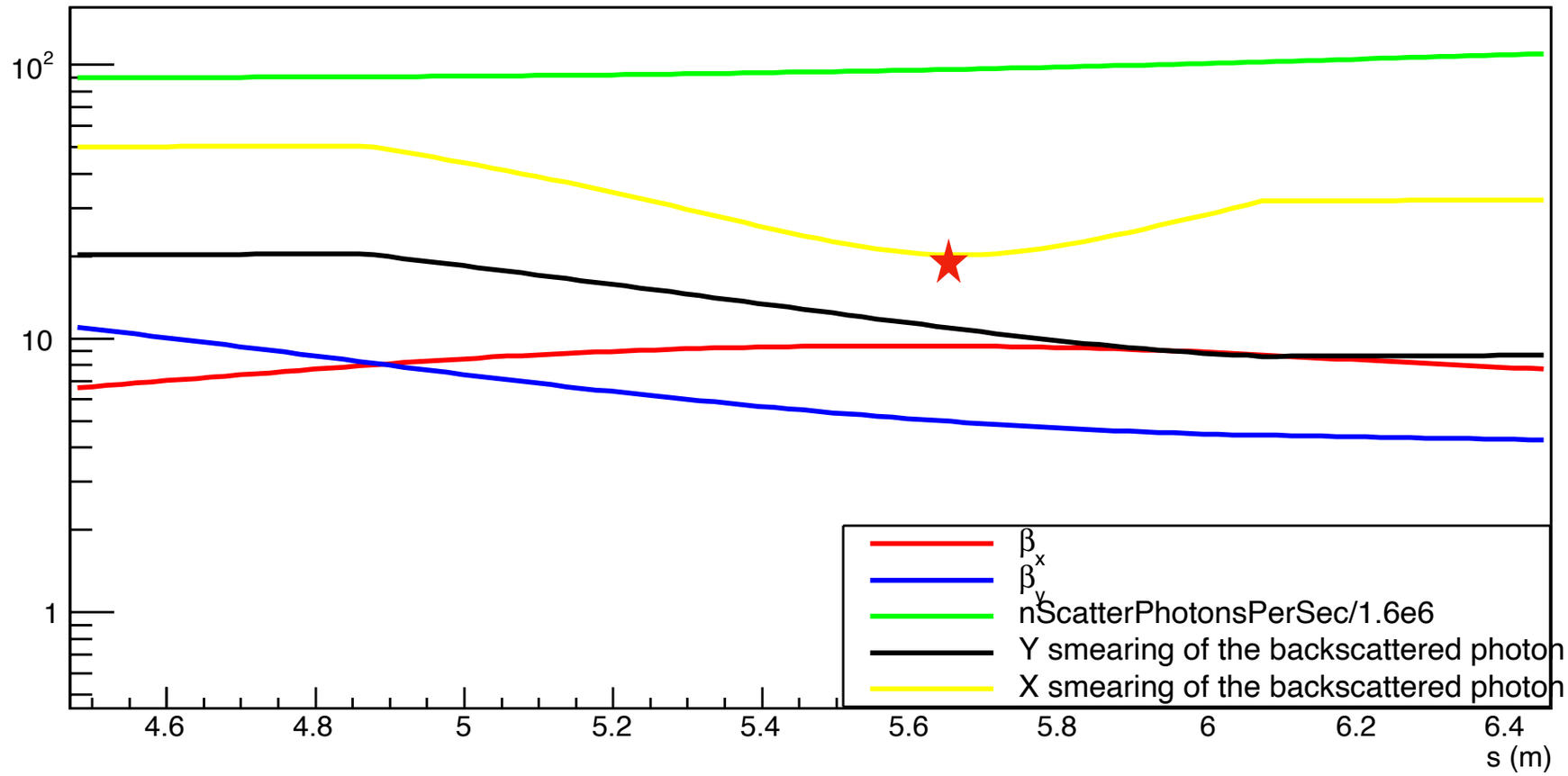
$\theta = 3mrad; \sigma_{Compton} = 400mb;$

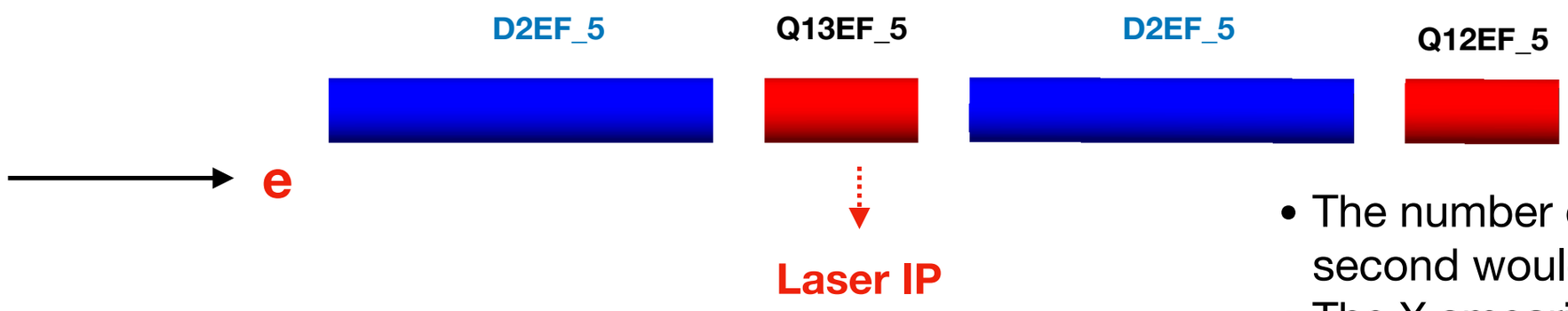
The distribution of the initial electrons would also produce a smearing of the X distribution of the scattered photon; The height of the electron beam at a distance D from the IP is calculated in the following way:

$$\sigma_{e,x}(D) = \sqrt{\epsilon_x \beta_x(D)} = \sqrt{\epsilon_x}\sqrt{\beta_x(0) - 2\alpha_x(0)D + \gamma_x(0)D^2}$$

$$\gamma_x(0) = \frac{1 + \alpha_x^2(0)}{\beta_x(0)}$$

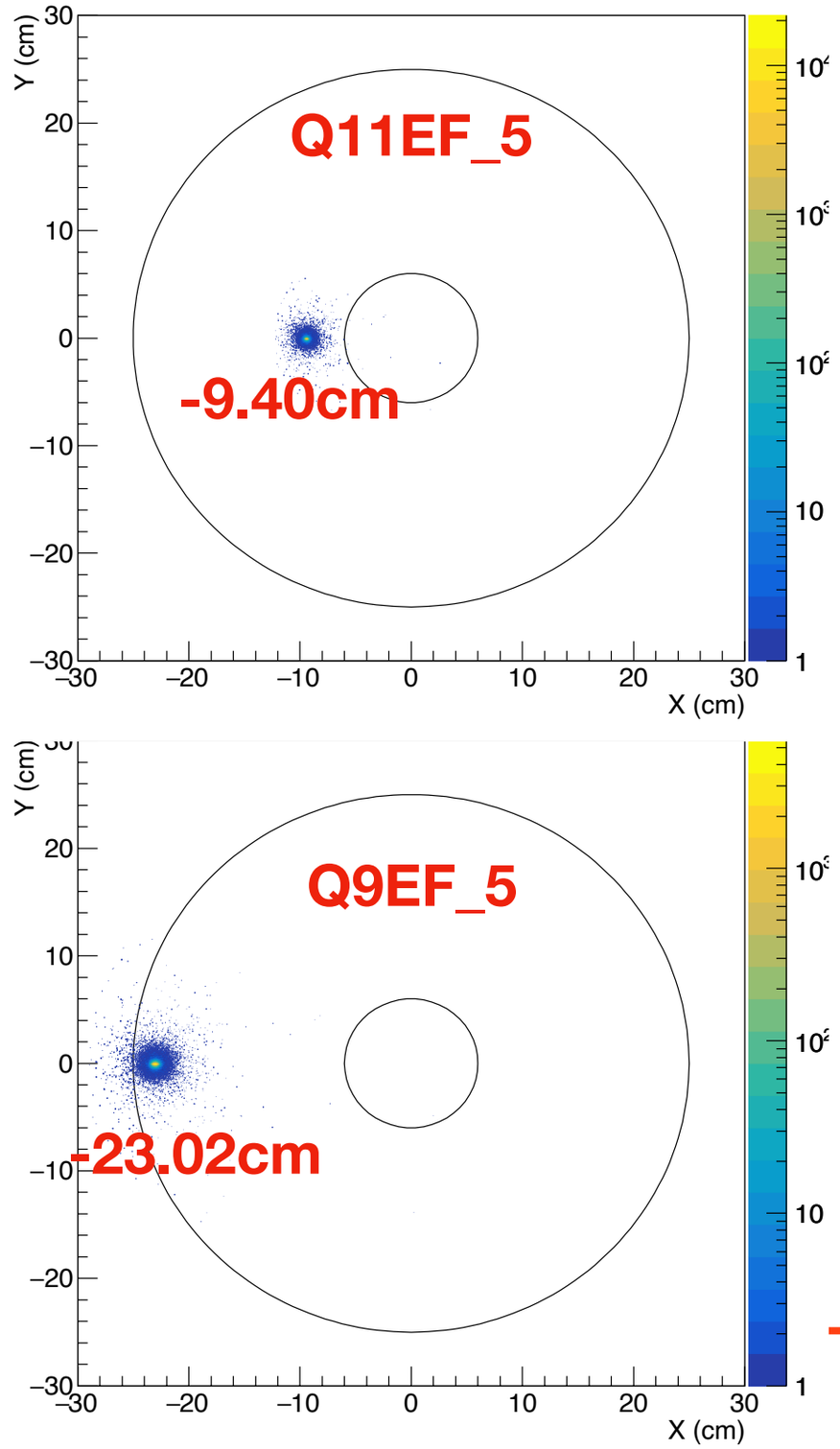
The laser interaction point



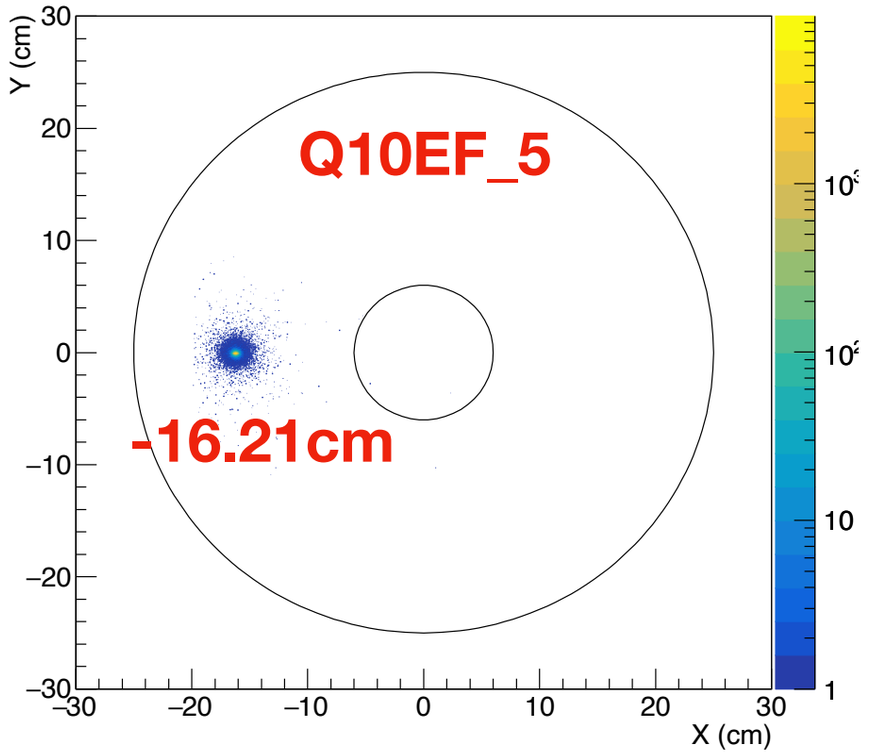


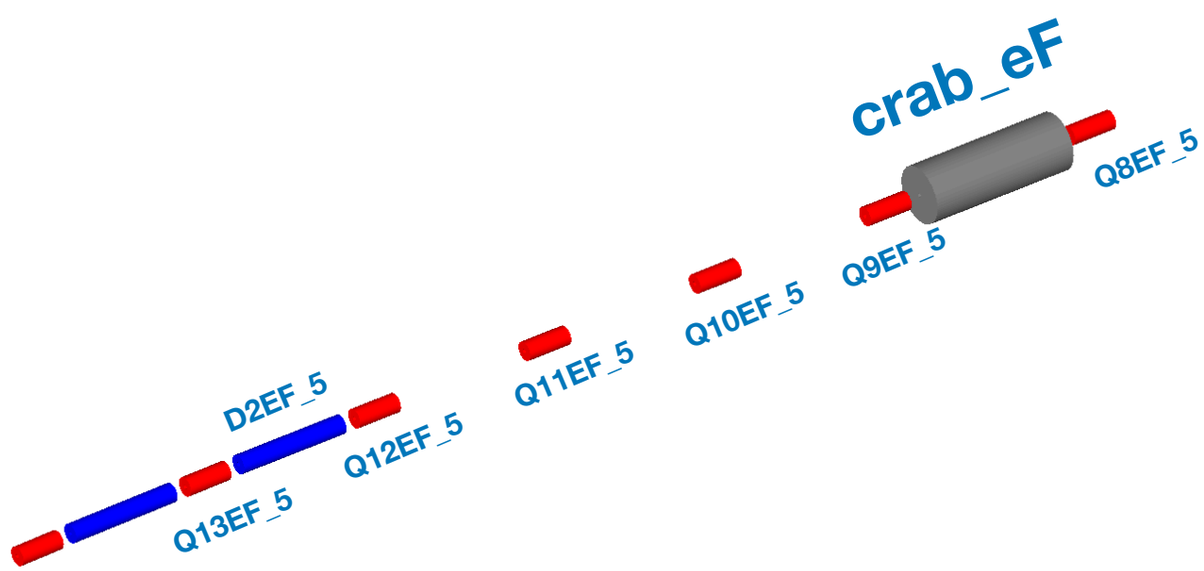
- The number of scattered photons per second would be increased by 70%;
- The X smearing would be 30% smaller;

Front view the magnets



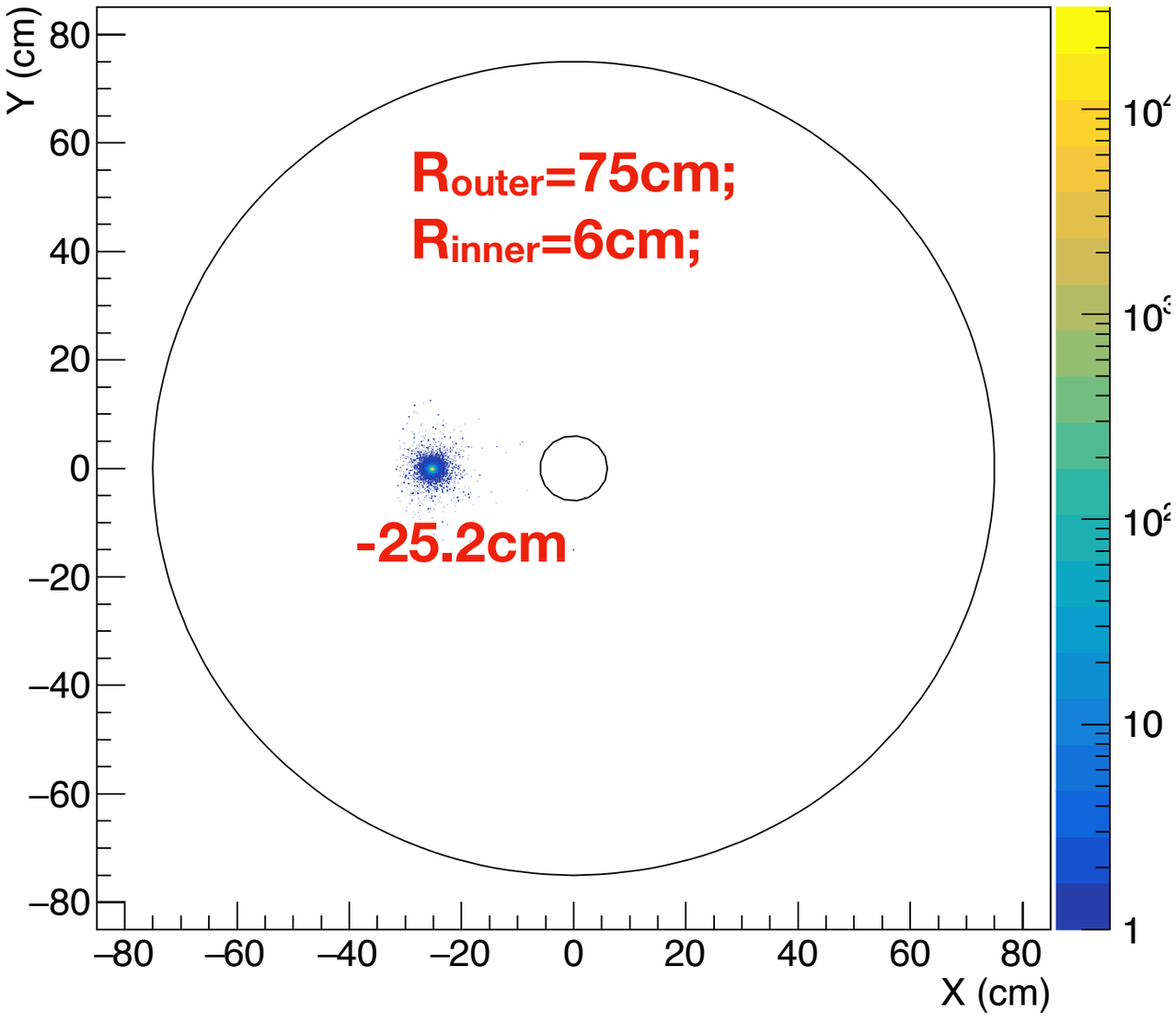
R_{outer}=25cm;
R_{inner}=6cm;



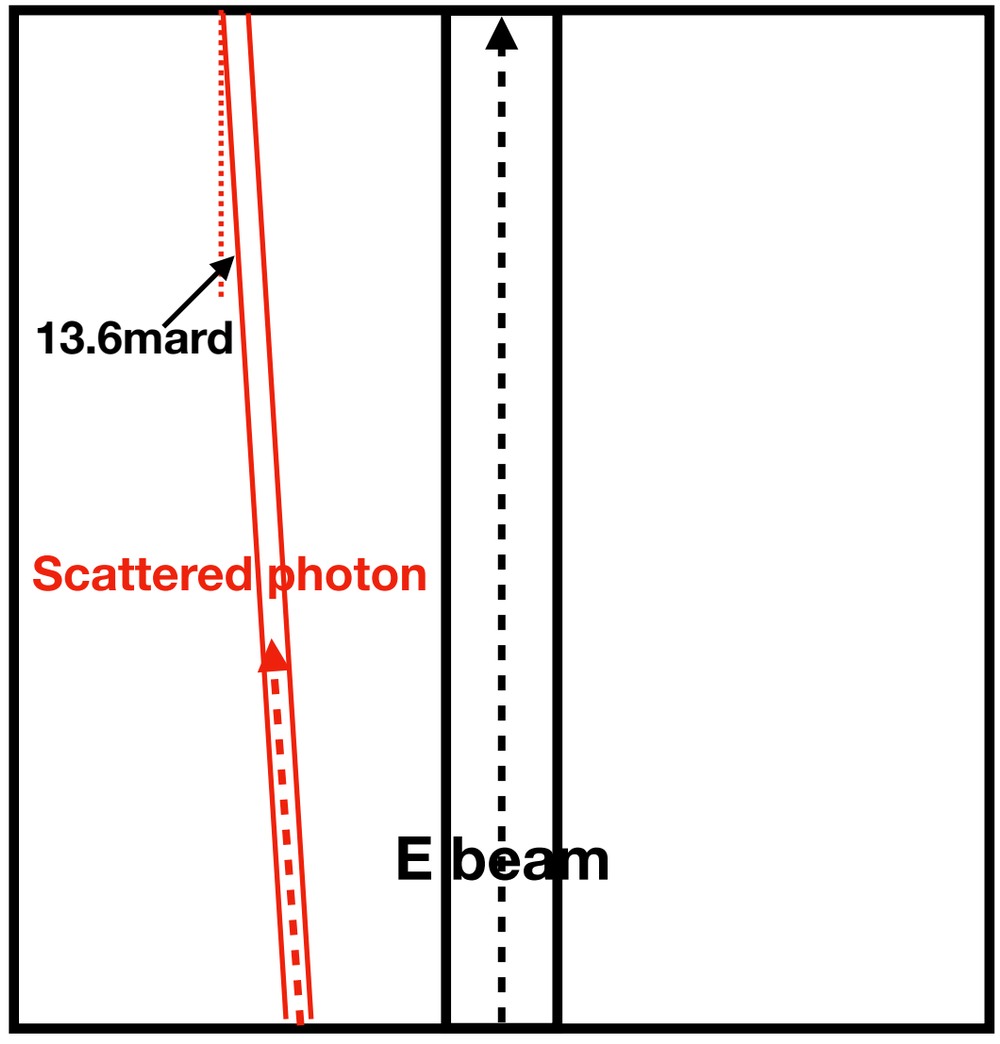


Front view and top view of the electron crab cavity

Front view



Top view (Y=0)



25.2cm, R_{hole}=3.0cm

Summary

- With the new layout, we would have better scattered photon rate and better smearing in X;
- Similar requirements for quadrupoles;
- New requirement for electron crab cavity;