Variations of Pair Production

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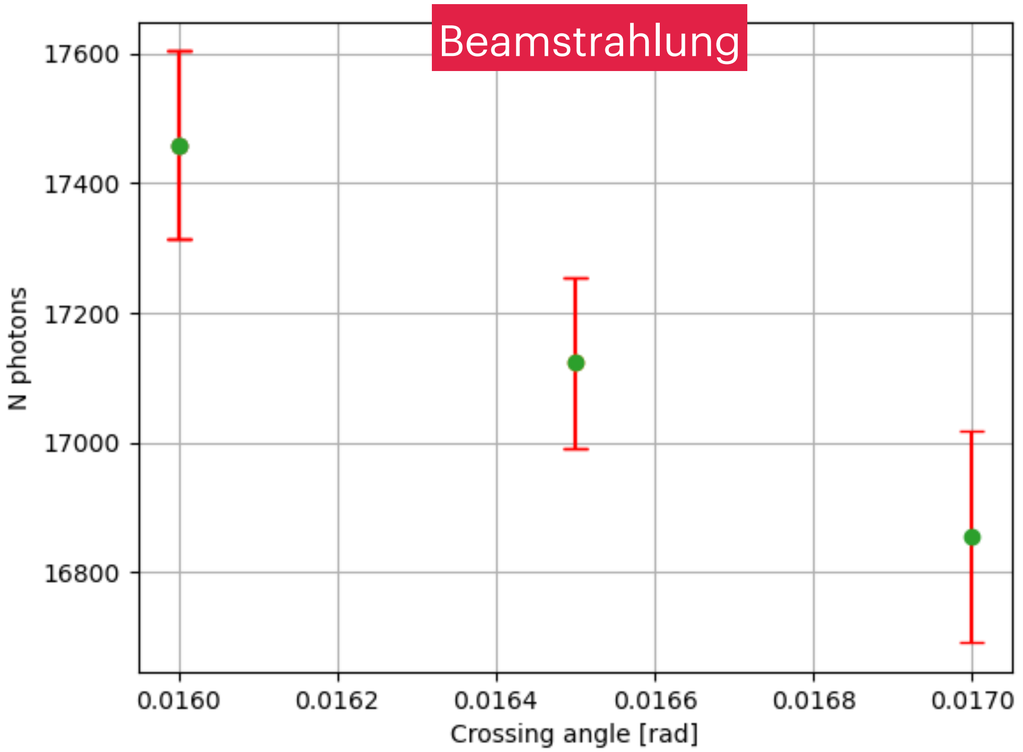
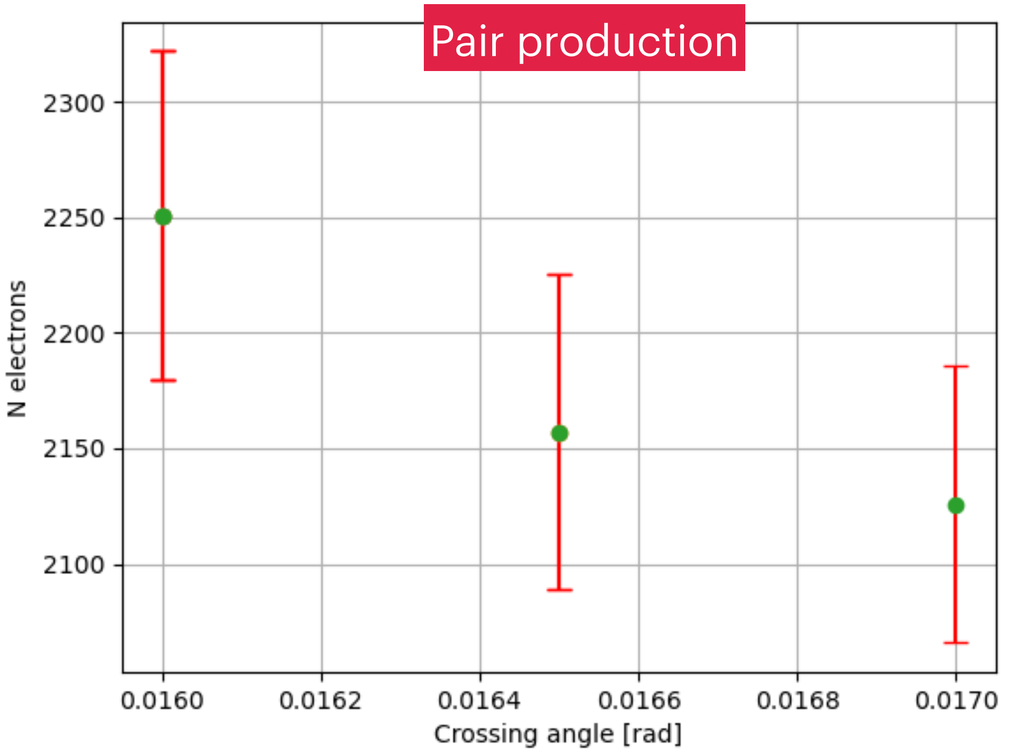
Pair production vs. crossing-angle

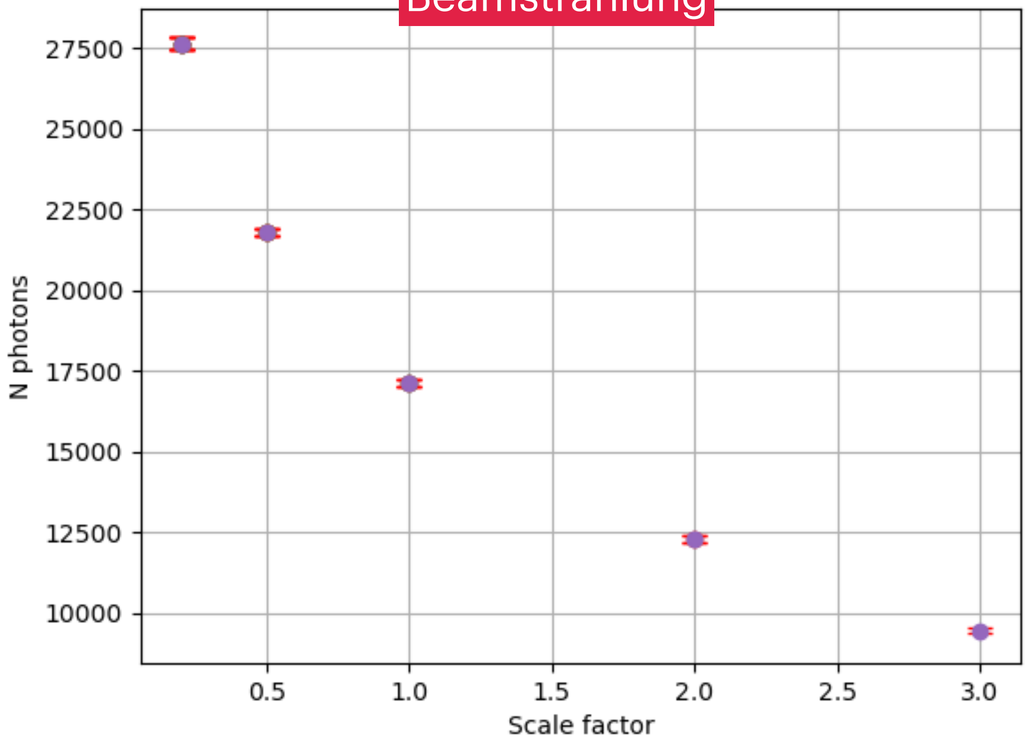




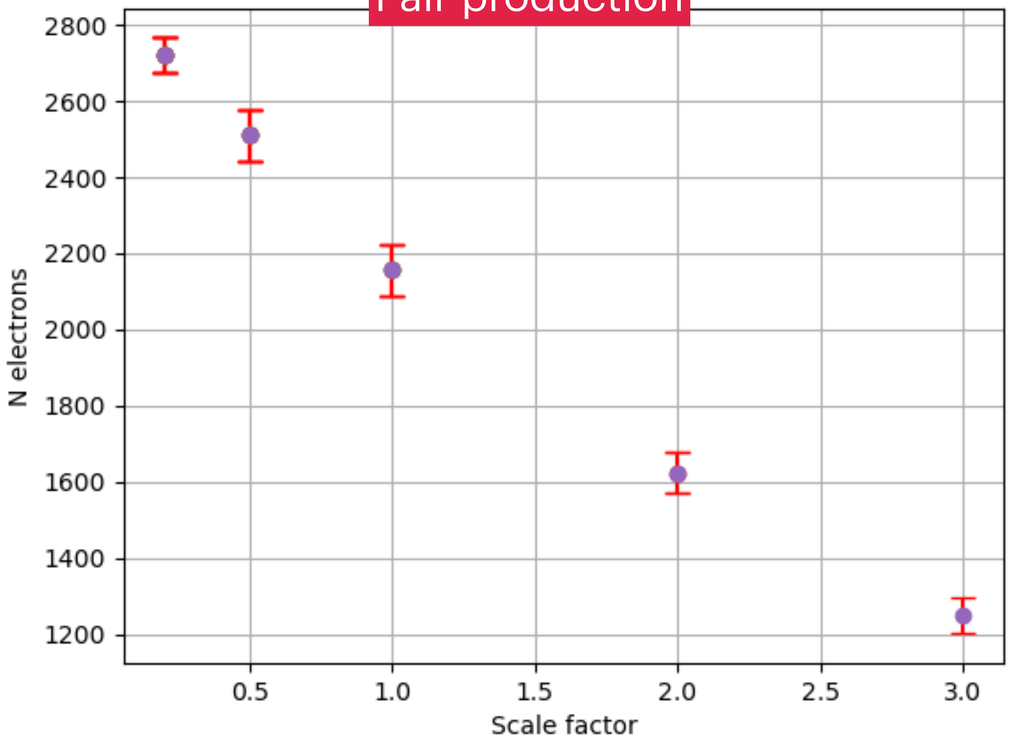
- （2250-2130）/10 mrad —> +/-12/mrad
- Input error, from accelerator group, +/- 1 mrad
- Number of electron ~ +/-0.5%

Pair production vs. beam-size [sigma_x]

Beamstrahlung

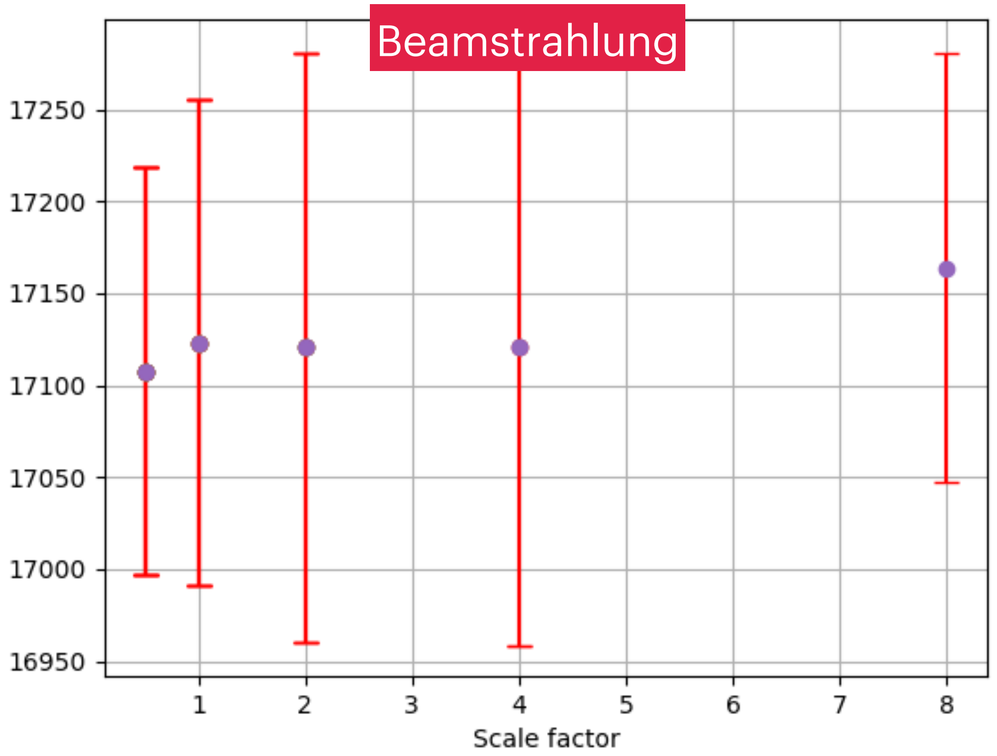


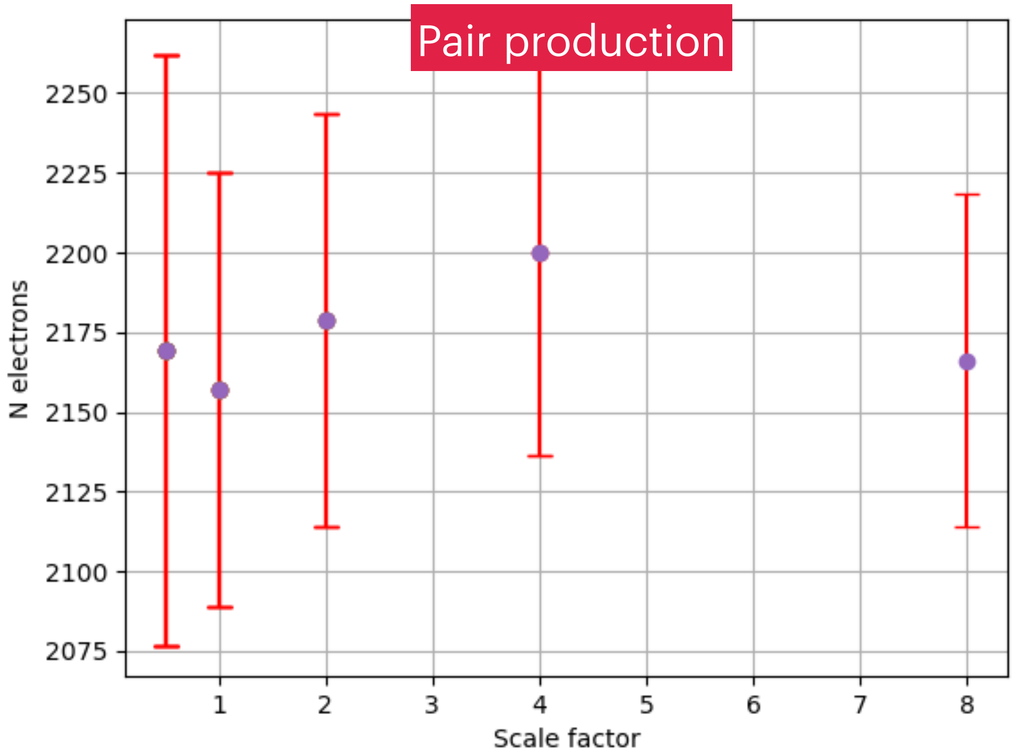
Pair production



- (2500-1600)/(2-0.5)=600
- sigma_x +/- 1% —> N electrons +/- 6 —> 6/2200 < 0.5%

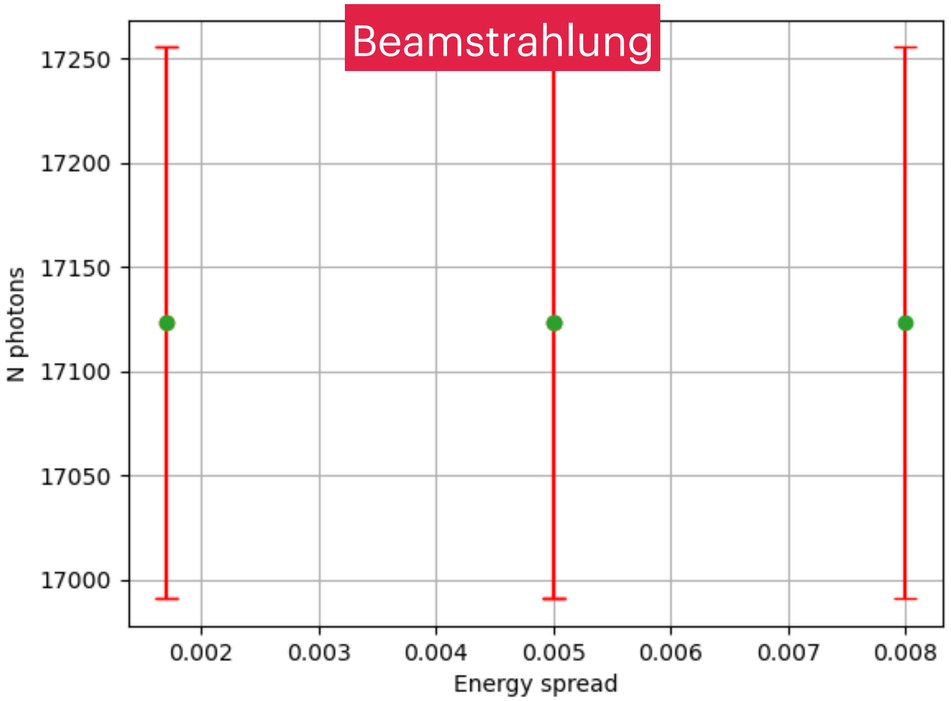
Pair production vs. Beta_x

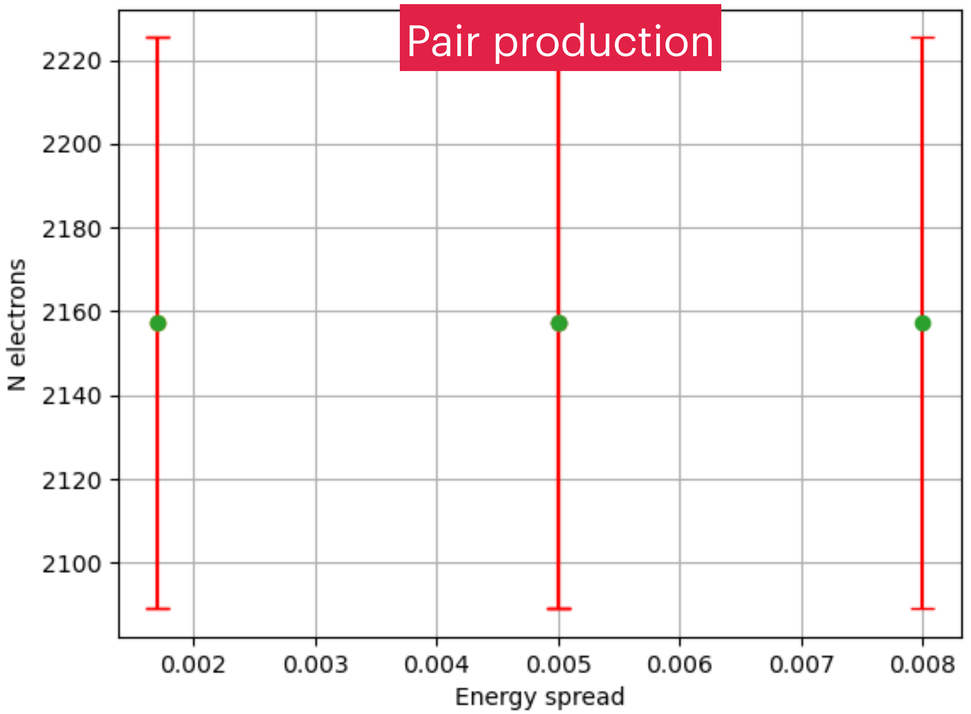




- No Input error
- No clear trend observed

Pair production vs. Energy_spread



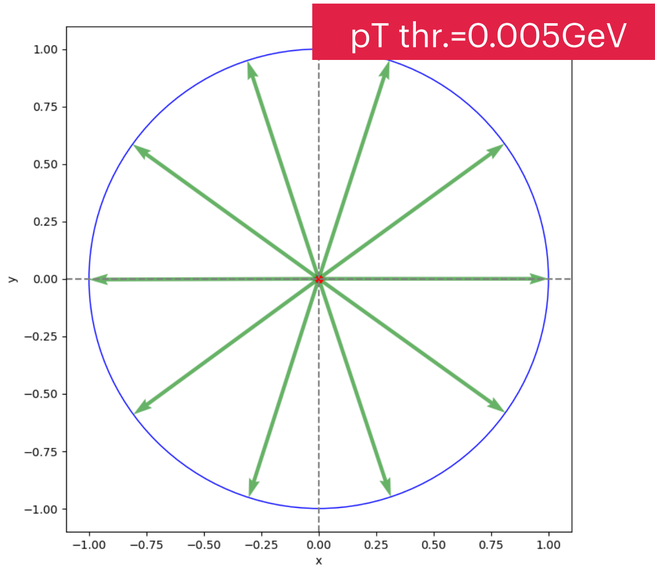


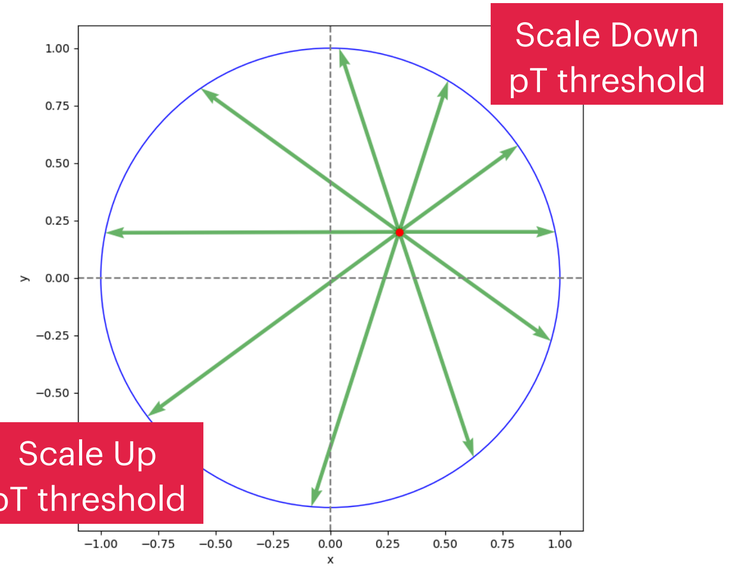
- Not Input error
- No visible variation

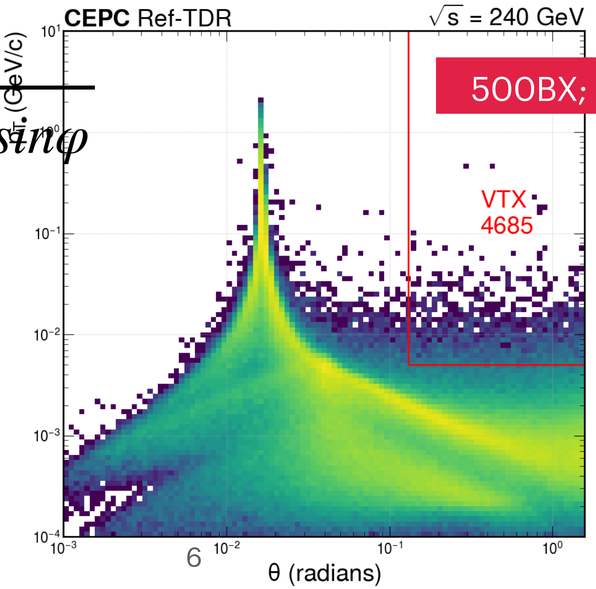
Pair production vs. Beam transverse location

- From accelerator group; the transverse distribution offsets from x:1mm, y:0.5mm
- GUINEA-PIG can not simulate this effect. Just a coarse estimation. FullSim may be needed
  - Adjust the pT acceptance accordingly
  - pT_thr. = $\dfrac{0.005R}{\sqrt{(x\cos\varphi + y\sin\varphi)^2 - x^2 - y^2 + R^2} - x\cos\varphi - y\sin\varphi}$

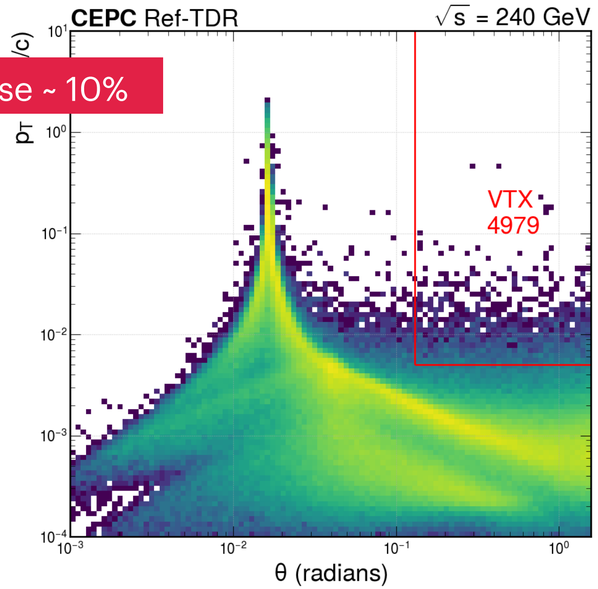
$R = 10\text{mm}, \text{x} = 1\text{mm}, \text{y} = 0.5\text{mm}$







500BX; increase ~ 10%



Summary

- **We trust GUINEA-PIG**
- **The variations have been studied, the impacts are small**
- **A vary conservative estimation from beam offset 1mm —->10%**
  - **New info about the offset is 0.1mm, checking....**

New text in TDR from Haoyu

The tools and models used in simulation (see~\ref{tab:bgtools}) are already widely adopted and their reliability has been thoroughly validated. Possible significant variations in accelerator beam conditions would directly affect the beam-induced background levels. However, once the design luminosity is achieved, the beam quality stabilizes, and **its fluctuations remain relatively minor compared to the nominal values.** For the dominant luminosity-related background, its level is positively correlated with luminosity, and minor variations in beam parameters result in background **fluctuations within 10\%.**