

ePIC far forward electron beam gas simulation

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- **New simulation of electron beam gas conducted**

- ▶ previous .hepmc file did not include y-direction divergence for outgoing electrons (instead, it was performed twice for photons)
 - ★ bug found and fixed by Anna Kowalewska
- ▶ new .hepmc file located at
`/gpfs02/eic/ceska/eic/simulation/beam_gas_ep_10GeV_foam_emin10keV_10Mevt_rotx.hepmc`
- ▶ 23.12.0 ePIC release with epic_brycecanyon geometry used
- ▶ 2M events produced, analysed

Rates

Sub-detector	OLD		NEW		DELTA		RELATIVE CHANGE	
	Hit Rate (raw)	Hit Rate (threshold applied)	Hit Rate (raw)	Hit Rate (threshold applied)	Hit Rate (raw)	Hit Rate (threshold applied)	Hit Rate (raw)	Hit Rate (threshold applied)
VertexBarrel	2.54E+06	2.54E+06	6.14E+06	6.13E+06	3.60E+06	3.59E+06	58,63%	58,56%
SiBarrel	2.40E+05	2.39E+05	6.33E+05	6.31E+05	3.93E+05	3.92E+05	62,09%	62,12%
TrackerEndcapP	3.40E+06	3.40E+06	6.34E+06	6.33E+06	2.94E+06	2.93E+06	46,37%	46,29%
TrackerEndcapN	4.21E+06	4.20E+06	8.31E+06	8.30E+06	4.10E+06	4.10E+06	49,34%	49,40%
TOFBarrel	5.13E+05	5.03E+05	1.32E+06	1.30E+06	8.07E+05	7.97E+05	61,14%	61,31%
TOFEndcap	2.33E+05	2.30E+05	4.80E+05	4.74E+05	2.47E+05	2.44E+05	51,46%	51,48%
EcalEndcapP	1.70E+06	6.71E+03	4.36E+06	7.56E+03	2.66E+06	8.50E+02	61,01%	11,24%
EcalEndcapPInsert	2.04E+05	2.43E+04	5.69E+05	7.14E+04	3.65E+05	4.71E+04	64,15%	65,97%
EcalEndcapN	1.49E+07	3.30E+06	3.98E+07	9.06E+06	2.49E+07	5.76E+06	62,56%	63,58%
EcalBarrelSciFi	6.17E+06	5.56E+02	1.85E+07	1.31E+03	1.23E+07	7.54E+02	66,65%	57,56%
LFHCAL	6.91E+04	1.50E+04	4.79E+04	6.18E+03	-2.12E+04	-8.82E+03	-44,26%	-142,72%
HcalEndcapPInsert	1.11E+05	4.10E+04	1.93E+05	6.89E+04	8.20E+04	2.79E+04	42,49%	40,49%
HcalBarrel	1.81E+05	4.81E+04	3.85E+05	4.84E+04	2.04E+05	3.00E+02	52,99%	0,62%
HcalEndcapN	3.79E+05	1.16E+05	1.23E+06	4.73E+05	8.51E+05	3.57E+05	69,19%	75,48%
PFRICH	6.93E+07	2.31E+07	6.26E+07	2.09E+07	-6.70E+06	-2.20E+06	-10,70%	-10,53%
DRICH	8.49E+05	2.83E+05	2.44E+06	8.15E+05	1.59E+06	5.32E+05	65,20%	65,28%
MPGDBarrel	2.15E+05	1.88E+05	5.40E+05	4.71E+05	3.25E+05	2.83E+05	60,19%	60,08%
DIRCBar	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
B0Ecal	1.47E+04	3.81E+03	1.73E+04	3.49E+03	2.60E+03	-3.20E+02	15,03%	-9,17%
B0Tracker	3.65E+04	3.63E+04	6.83E+03	6.80E+03	-2.97E+04	-2.95E+04	-434,41%	-433,82%
ZDCEcal	5.70E+01	5.70E+01	1.88E+03	1.88E+03	1.82E+03	1.82E+03	96,97%	96,97%
ZDCHcal	2.29E+02	2.29E+02	1.12E+02	1.12E+02	-1.17E+02	-1.17E+02	-104,46%	-104,46%
ForwardRomanPot	3.00E+00	3.00E+00	9.00E+00	9.00E+00	6.00E+00	6.00E+00	66,67%	66,67%
ForwardOffMTracker	2.00E+00	2.00E+00	6.00E+00	6.00E+00	4.00E+00	4.00E+00	66,67%	66,67%
TaggerTracker1	2.70E+07	2.70E+07	1.17E+06	1.17E+06	-2.58E+07	-2.58E+07	-2207,69%	-2207,69%
TaggerTracker2	5.72E+06	5.72E+06	1.54E+06	1.54E+06	-4.18E+06	-4.18E+06	-271,43%	-271,43%

Rates

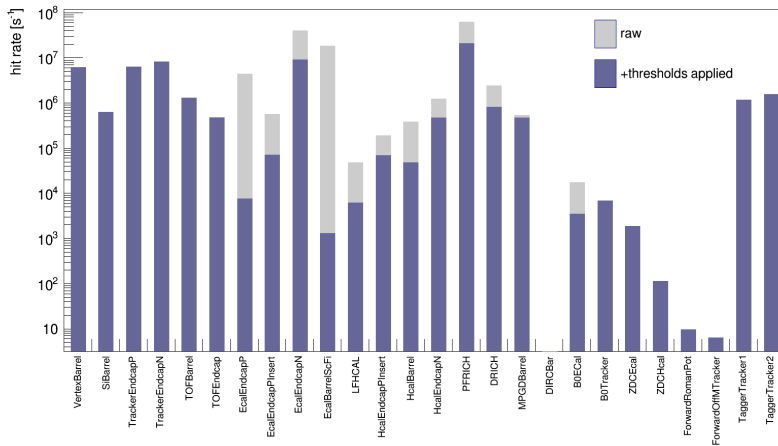


Figure 1: Rates for individual detectors without and with thresholds applied.

xy hit distribution

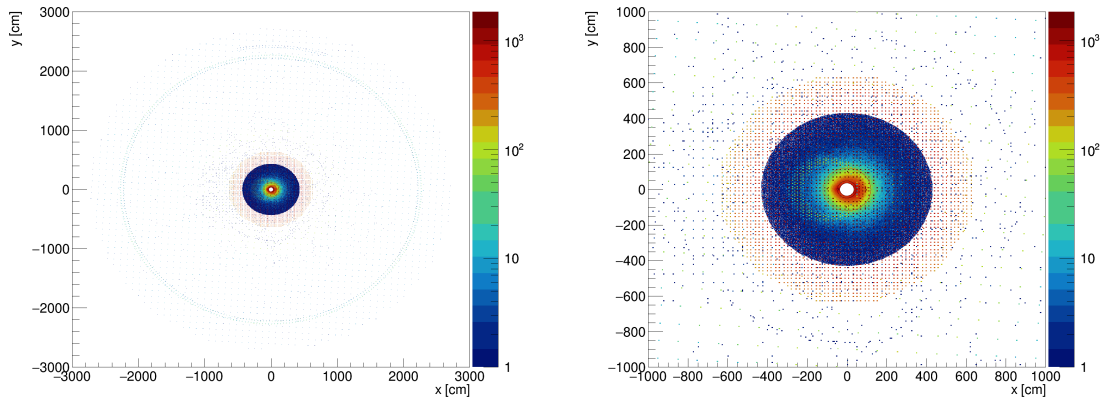


Figure 2: xy distribution of hits in full (left) and close-up (right) view.

zr hit distribution

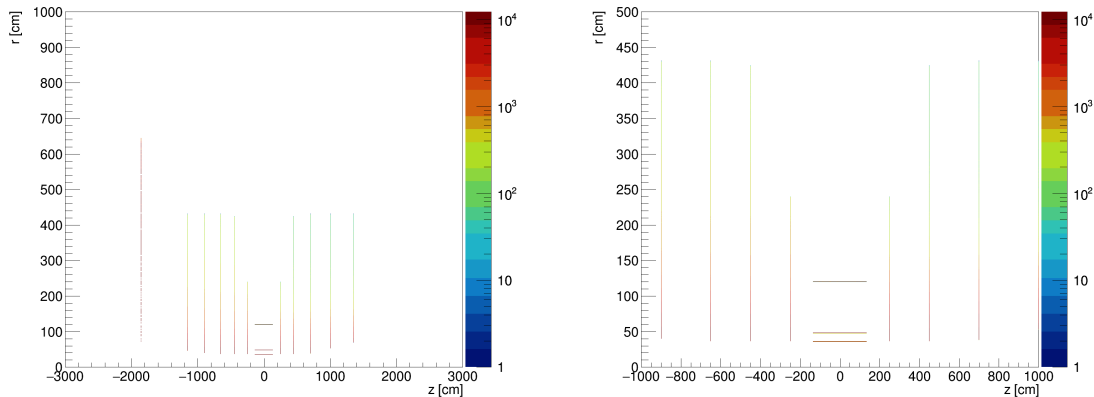


Figure 3: zr distribution of hits in full (left) and close-up (right) view.

Thank you for your attention

Hit rate

Detector and beam parameters

- Total production rate for electron-beam gas due to bremsstrahlung for $E_\gamma > 10$ keV calculated as 3.177 MHz
- Integration time for detector readout (information from Elke) - $2 \mu s$
 - ▶ $3.177 \text{ MHz} * 2 \mu s \doteq 6.35$ bremsstrahlung interactions per integration time

Simulation parameters

- $\sim 2M$ events (bremsstrahlung interactions) simulated
- number of hits in the most populated detector (*Tracker Endcap*) $\sim 15M$
 - ▶ $15 \text{ M hits} / 2M \text{ events} \doteq 7.5$ hits per simulated event/interaction

Conclusion

- $7.5 \text{ (hits/interaction)} * 6.35 \text{ (interactions/integration time)} \doteq 47$ hits in the entire detector per readout time