Simulation and Analysis TF

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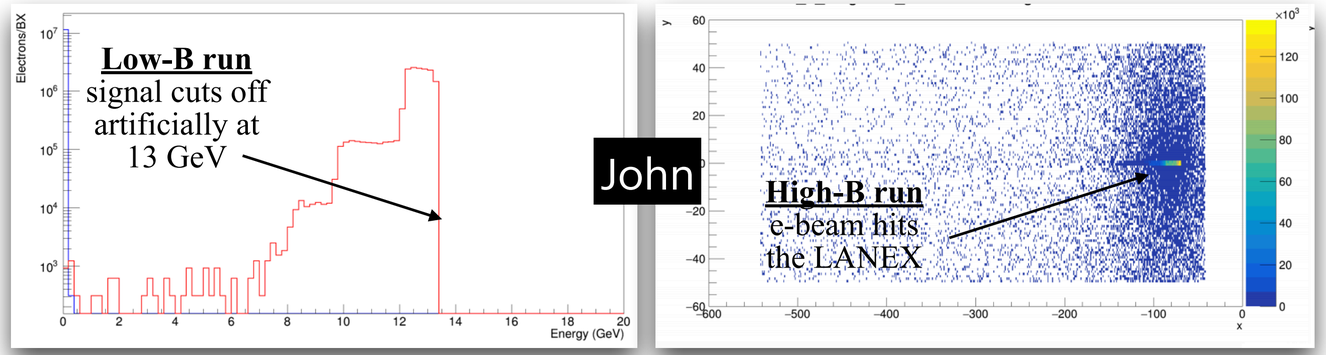
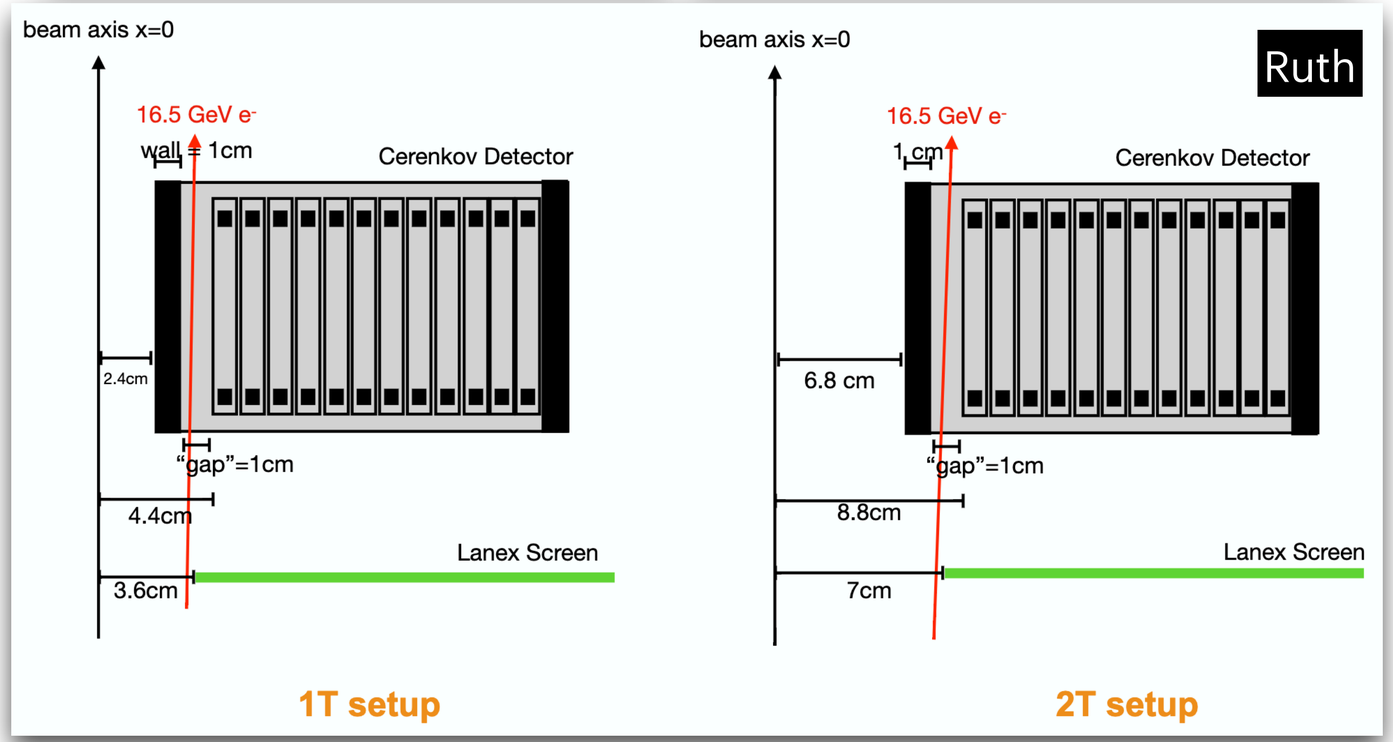
Intro

- IP LANEX+Cherenkov update
- Some background insights
- Tony: signals with new mesh?
- Sasha:
  - electron+laser G4 generation
    - starting from the signal from tony w/o the beam component (status?)
    - starting from beam-only generation (done part of 1 BX, right?)
  - campaign with the beampipe in the FWD part?
- Arka: scrutinised study of the background for the tracker

IP LANEX+Cherenkov

- Saw inconsistencies in the positions of the IP LANEX+Cherenkov for the low/high-ξ runs (using high/low-B)
  - High-B runs (low-ξ)
    - e-beam will destroy the LANEX
    - the bkg is too large for the Cherenkov
  - Low-B runs (high-ξ)
    - the LANEX position was not optimal (lot's of signal lost)
- Ruth and John have introduced a slightly modified geometry
  - will need to be able to move the LANEX+Cherenkov by ±5 cm
  - should put in the model
- We still need to think how to define the dump to suit the two B-field value (and maybe also different beam energies?)

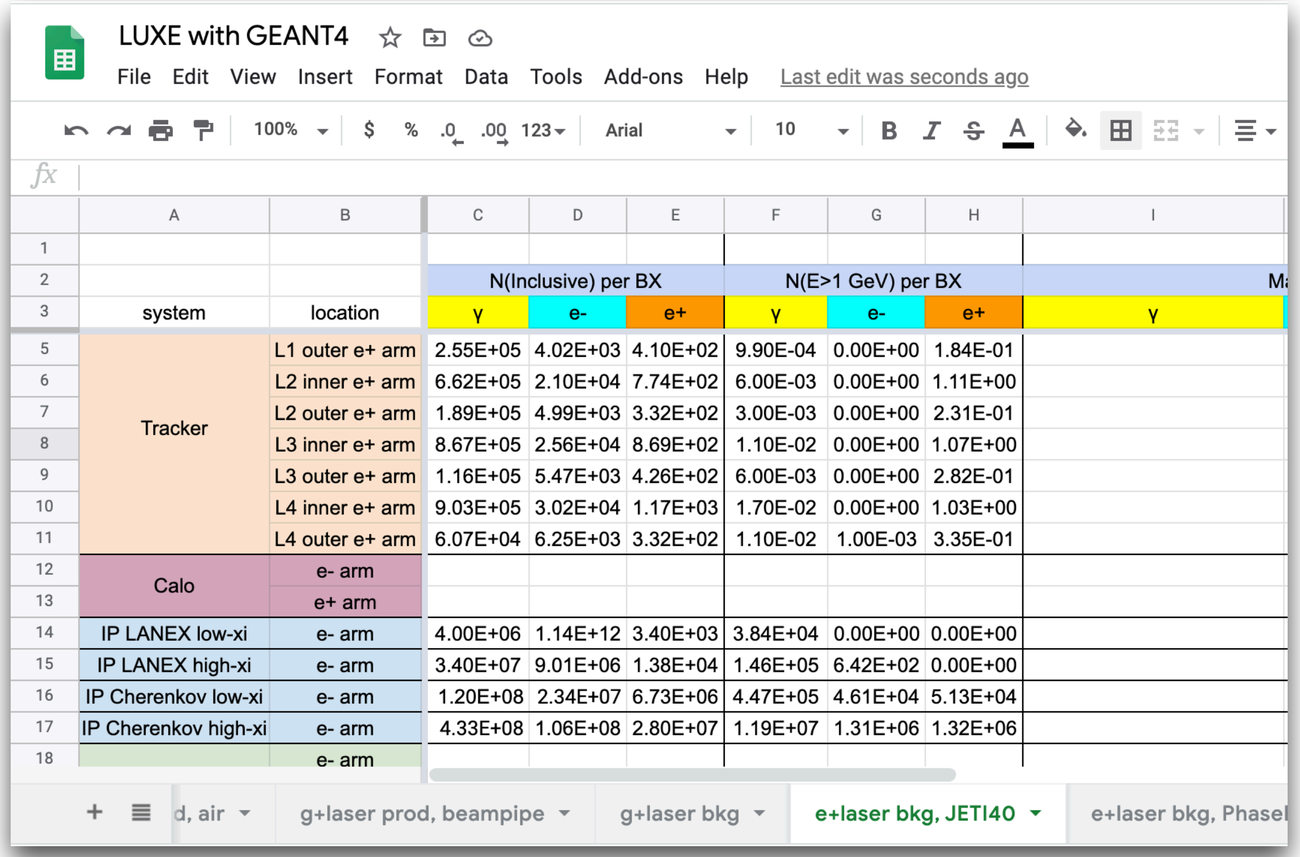




- wall thickness can surely be optimised

Backgrounds table

- Backgrounds are collected in this spreadsheet
  - please update the numbers (thanks John, Ruth, Maryna and Arka who did already)
    - make sure you validate the numbers…
  - please feel free to change the layout of the spreadsheet according to your system's needs



LUXE with GEANT4

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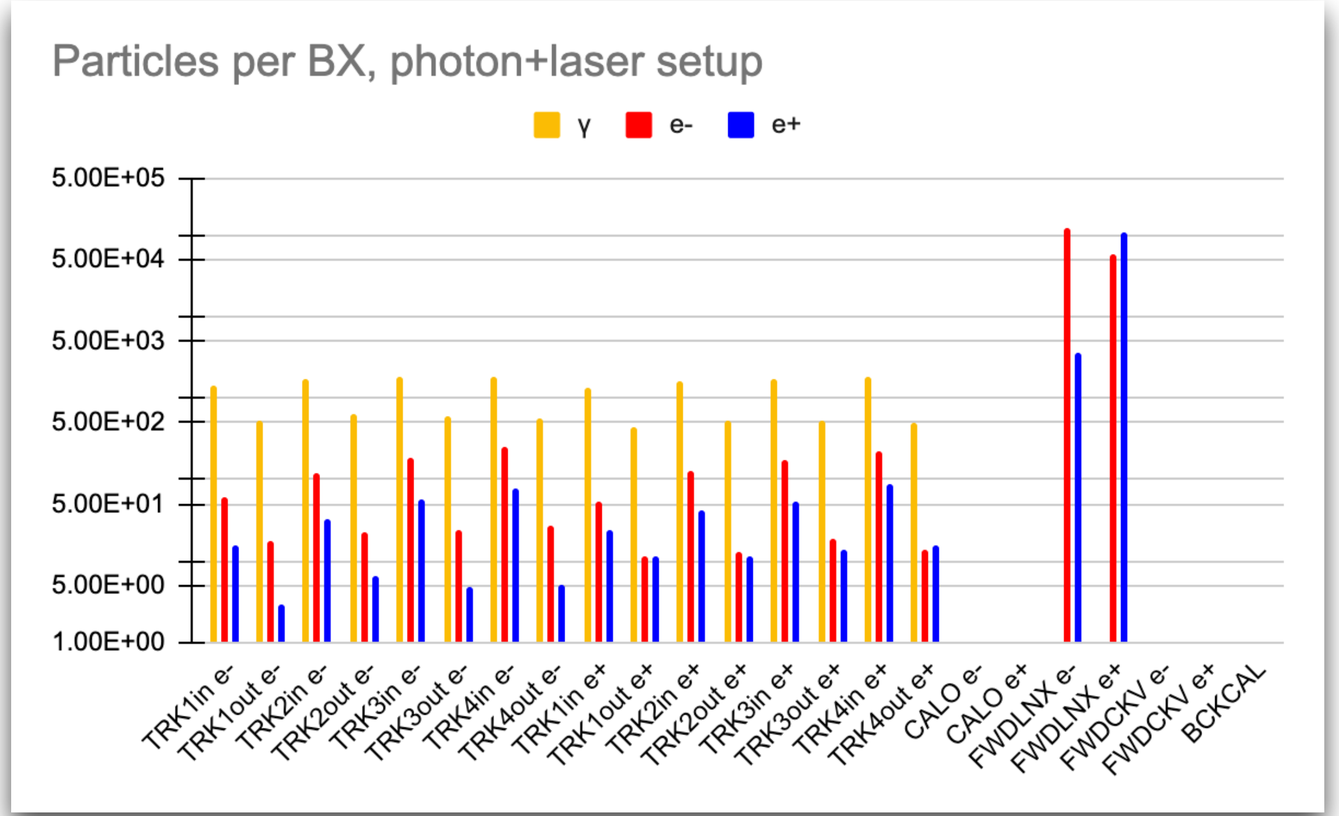
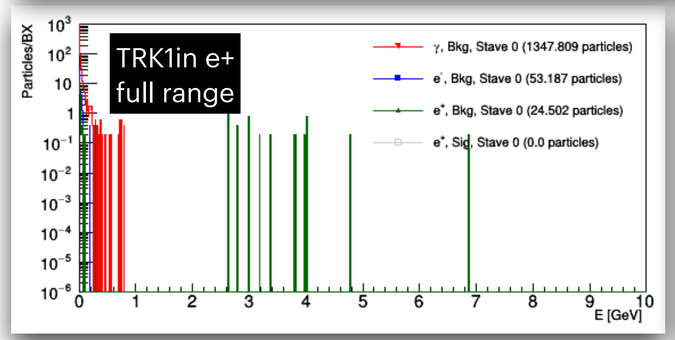
	A	B	C	D	E	F	G	H	I
1									
2			N(Inclusive) per BX			N(E>1 GeV) per BX			M
3	system	location	γ	e-	e+	γ	e-	e+	γ
5	Tracker	L1 outer e+ arm	2.55E+05	4.02E+03	4.10E+02	9.90E-04	0.00E+00	1.84E-01	
6		L2 inner e+ arm	6.62E+05	2.10E+04	7.74E+02	6.00E-03	0.00E+00	1.11E+00	
7		L2 outer e+ arm	1.89E+05	4.99E+03	3.32E+02	3.00E-03	0.00E+00	2.31E-01	
8		L3 inner e+ arm	8.67E+05	2.56E+04	8.69E+02	1.10E-02	0.00E+00	1.07E+00	
9		L3 outer e+ arm	1.16E+05	5.47E+03	4.26E+02	6.00E-03	0.00E+00	2.82E-01	
10		L4 inner e+ arm	9.03E+05	3.02E+04	1.17E+03	1.70E-02	0.00E+00	1.03E+00	
11		L4 outer e+ arm	6.07E+04	6.25E+03	3.32E+02	1.10E-02	1.00E-03	3.35E-01	
12	Calo	e- arm							
13		e+ arm							
14	IP LANEX low-xi	e- arm	4.00E+06	1.14E+12	3.40E+03	3.84E+04	0.00E+00	0.00E+00	
15	IP LANEX high-xi	e- arm	3.40E+07	9.01E+06	1.38E+04	1.46E+05	6.42E+02	0.00E+00	
16	IP Cherenkov low-xi	e- arm	1.20E+08	2.34E+07	6.73E+06	4.47E+05	4.61E+04	5.13E+04	
17	IP Cherenkov high-xi	e- arm	4.33E+08	1.06E+08	2.80E+07	1.19E+07	1.31E+06	1.32E+06	
18		e- arm							

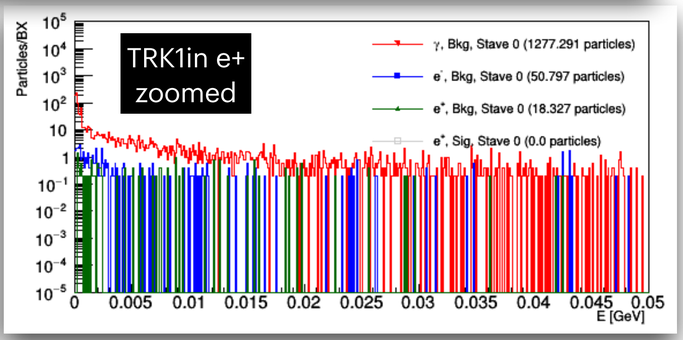
d, air | g+laser prod, beampipe | g+laser bkg | e+laser bkg, JETI40 | e+laser bkg, Phasel

Background for γ+laser

- Reminder: positrons signal in the IP should be at the level of ~5 e^+/BX
- FWD LANEX:
  - why do we have ~10 times more electrons on the e+ side than positrons on the e- side?
  - please add the photons
- Tracker (mostly low-E particles)
  - Positrons: manageable rate at very low energies
  - Electrons: ~manageable rate
  - Photons: peaking below 1 MeV, mostly flat above that
    - for a photon of 1 MeV, practically all absorption in Si is due to Compton scattering with an absorption coefficient $\sigma \sim 10^{-1}$ cm^{-1}. In a 300 μm thick detector, only 0.3% will interact. For 95% absorption, the detector must be 30 mm thick. Even then, the scattered photon may still leave the absorber without further interaction, so only a fraction of the primary photon energy remains in the detector. For full energy absorption with good efficiency the detector would have to be made even larger.
    - the absorption of 10 keV photons in Si is dominated by the photoelectric effect with $\sigma \sim 10^2$ cm^{-1}. If a detector is 300 μm thick, i.e. $\sigma x \sim 3$, then 95% of the photons will interact in the detector. Since the range of the emitted photoelectron is about 1 μm, all of the primary energy is absorbed in the detector volume. The absorption coefficient decreases rapidly with energy.







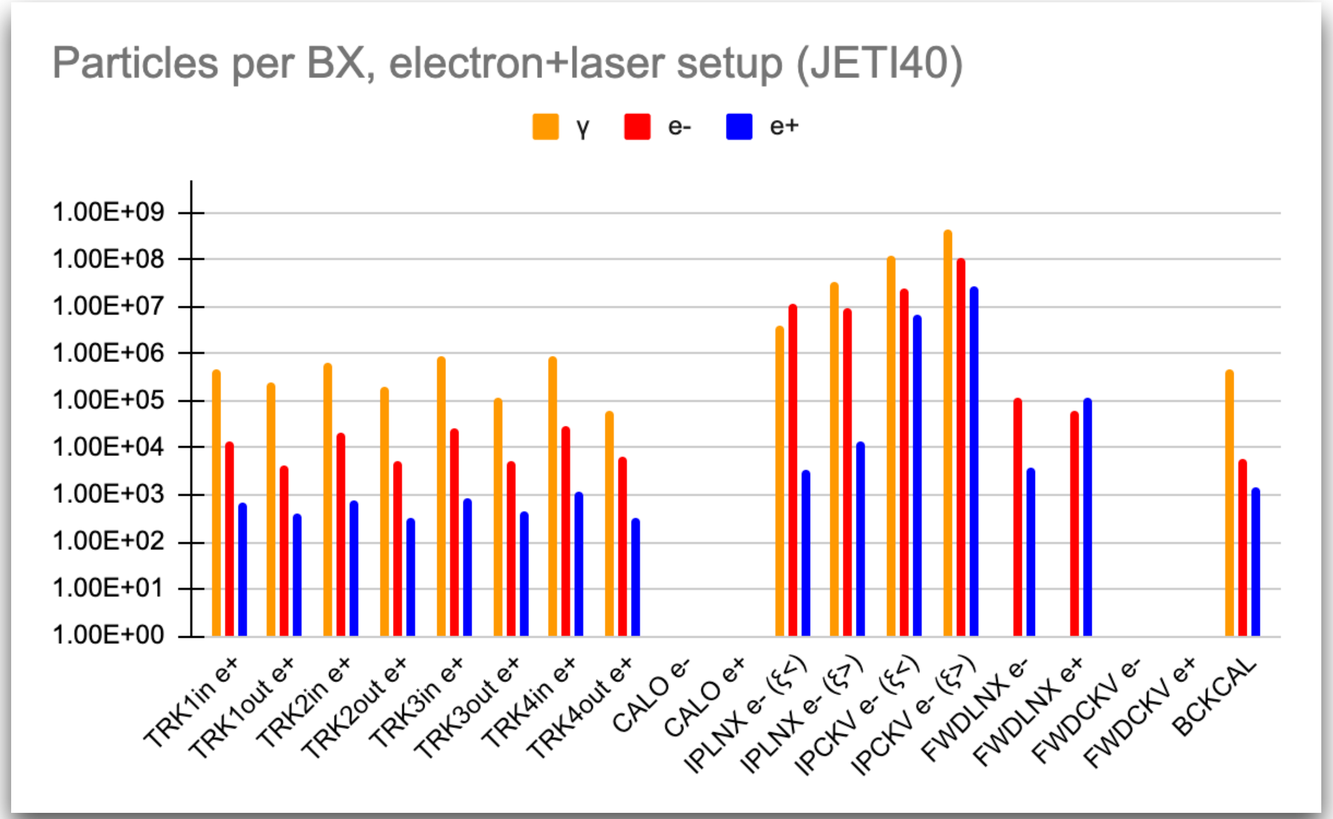
Background for e+laser (JETI40)

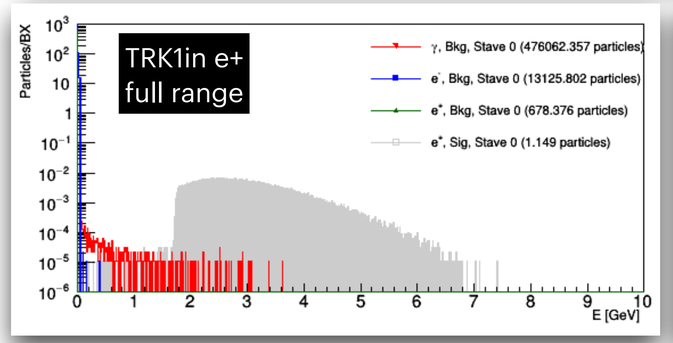
- Reminder:
  - pair production signal for the IP system should be at the level of ~1 e^+/BX
  - Compton rates at the FWD spectrometer are much larger

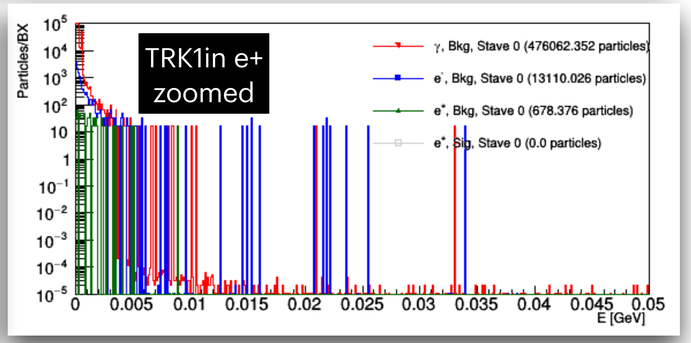
- IP LANEX+Cherenkov:
  - how can it be that you see lower rates for the low-ξ (high-B) runs? (where the beam is crossing the window and the LANEX)
  - we've seen from John that these are very low energy particles

- FWD LANEX+Cherenkov:
  - why do we have ~10 times more electrons on the e+ side than positrons on the e- side?
  - please add the photons for LANEX
  - please add the FWD Cherenkov

- Tracker (mostly low energy particles)
  - Positrons: manageable rate? (~ 2 MeV)
  - Electrons: manageable rate? (~ 2 MeV)
  - Photons: peaking below 1 MeV, mostly flat above that
  - Most of it comes from the beam crossing the LANEX (see later talk by Arka)







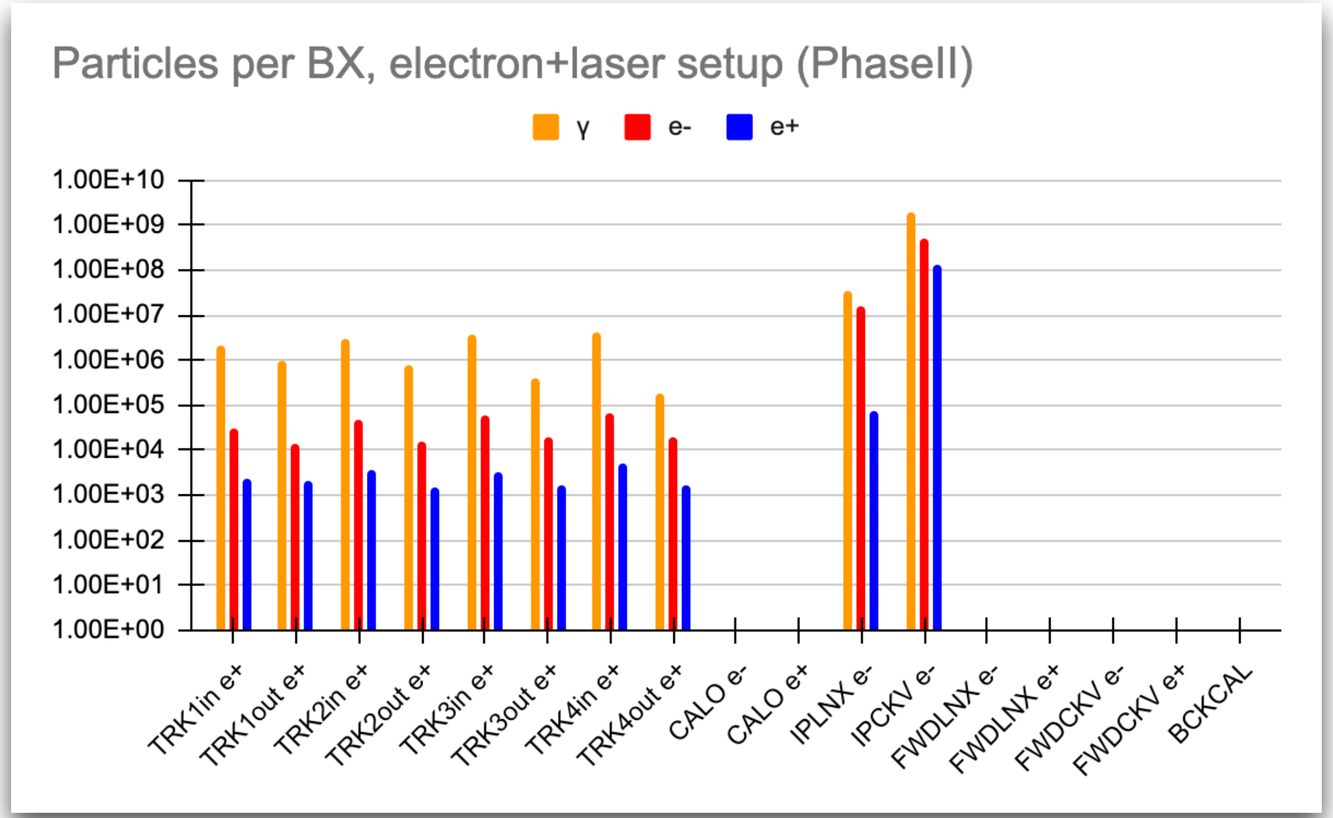
Background for e+laser (PhaseII)

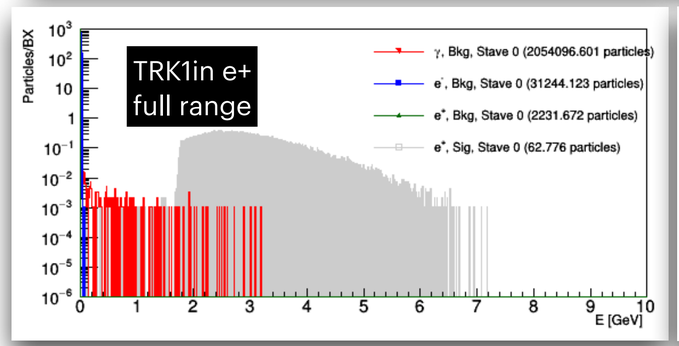
- Reminder:
  - pair production signal for the IP system should be at the level of ~70 e+/BX
  - Compton rates at the FWD spectrometer are much larger

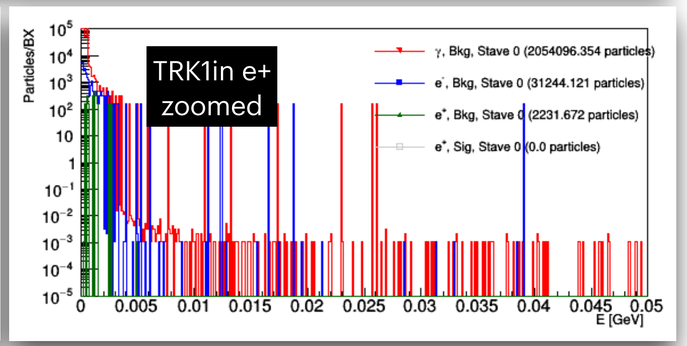
- IP LANEX+Cherenkov: we've seen from John that these are very low energy particles

- FWD LANEX+Cherenkov:
  - please add both

- Tracker (mostly low energy particles)
  - Positrons: manageable rate? (~ 2 MeV)
  - Electrons: manageable rate? (~ 2 MeV)
  - Photons: peaking below 1 MeV, mostly flat above that
  - Most of it comes from the beam crossing the LANEX (see later talk by Arka)







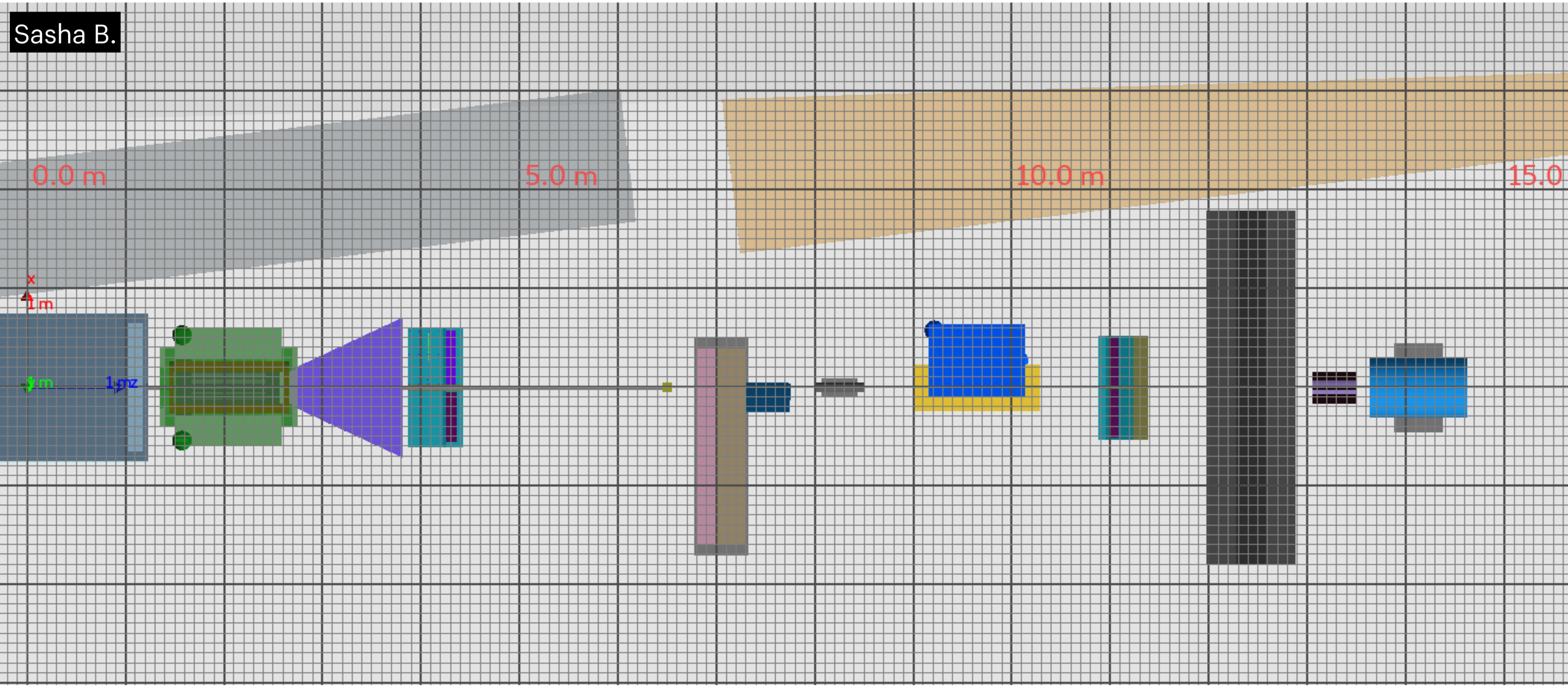
Summary

- New configuration from Ruth and John looks better
  - will need to make sure we can move the setup
  - need to decide about the dump (maybe not urgent for the CDR?)

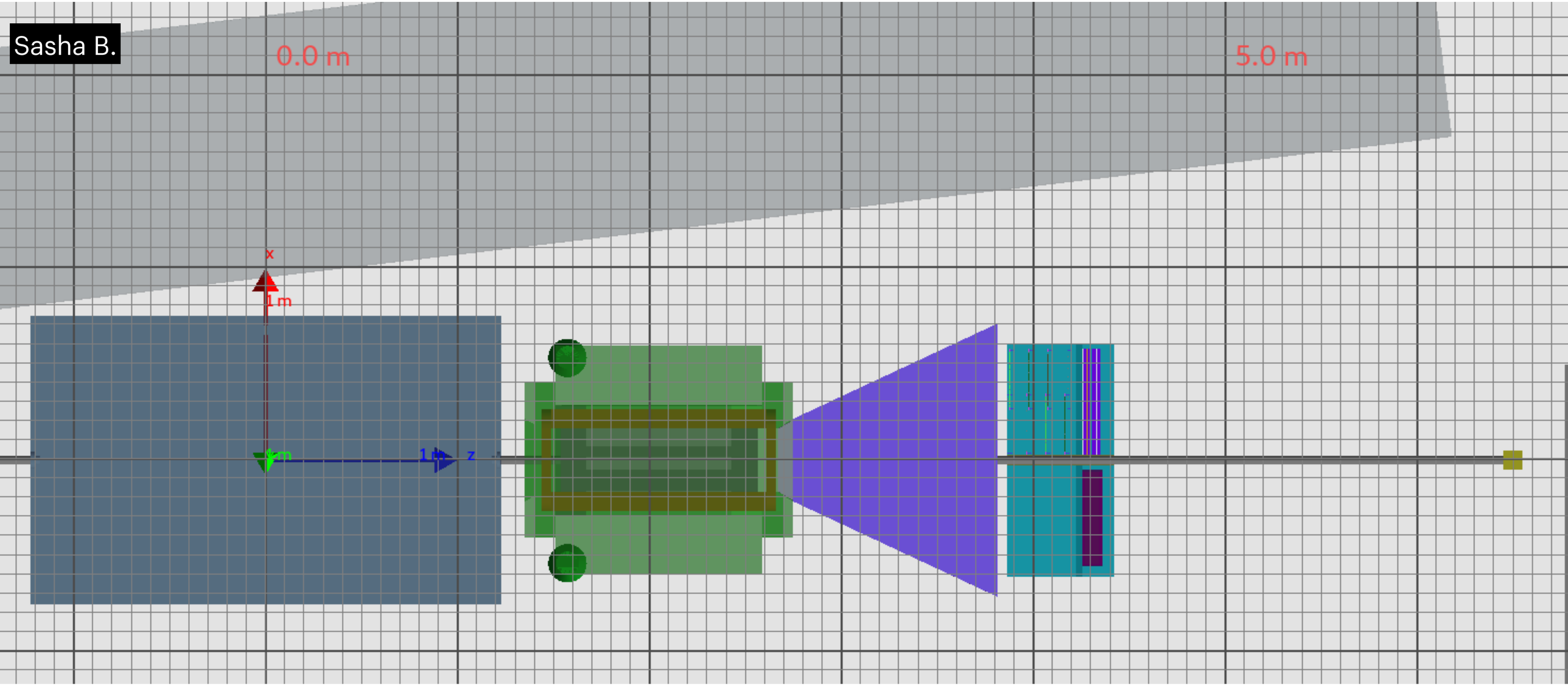
- Bkg in the photon+laser setup
  - looks manageable for the tracker
  - will probably be the same for the calo
  - for the FWD spectrometer it strongly depends on the beampipe (y/n) but the numbers look manageable already

- Bkg in the electron+laser setups
  - looks too high to start with for the tracker (similar for the calo?)
    - can be reduced with minor changes to the setup
  - Not sure if it is also too high for the IP LANEX+Cherenkov
    - but it can be reduced with minor changes to the setup
  - looks manageable for the FWD LANEX

Distances full range



Distances IP area



Distances FWD area