SoLID SIDIS-NH_3 Experiment Studies

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The purpose of the studies

- The NH_3 target polarization is required to be higher than 70% in SoLID
- Due to the large magnetic field in the transverse direction, there will be a different sort of background compared to that of the low field He^3 experiment
- As a result, a very high rate of charged particles will be localized in a very narrow region of the acceptance
- We refer to this strong background as sheet-of-flame
- To handle it and to avoid any damage to the apparatus, detector/sub-detector sectors in the direct line-of sight of any sheet-of-flame should be shielded and/or turned off during the proton experiment

The purpose of the studies

- We need to look at all the sheets-of flame very carefully, in order to figure out the best way for shielding and/or turning off those detector sectors

- We use the eDIS generator and full Geant4 simulations for acceptance studies. Afterwards, we will also look at the trigger and more on the background.

- We also use built-in flux hit processing for the sheets-of-flame near the real detectors, in order to record charged particles, which enter or leave these real detectors

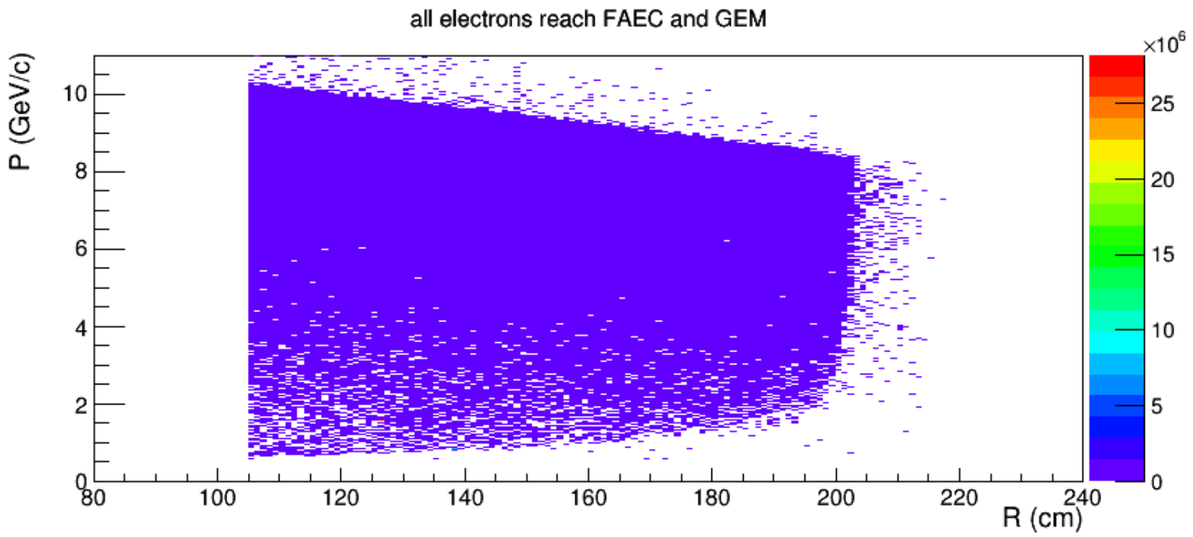
- Each sheet-of-flame has a unique ID for its identification

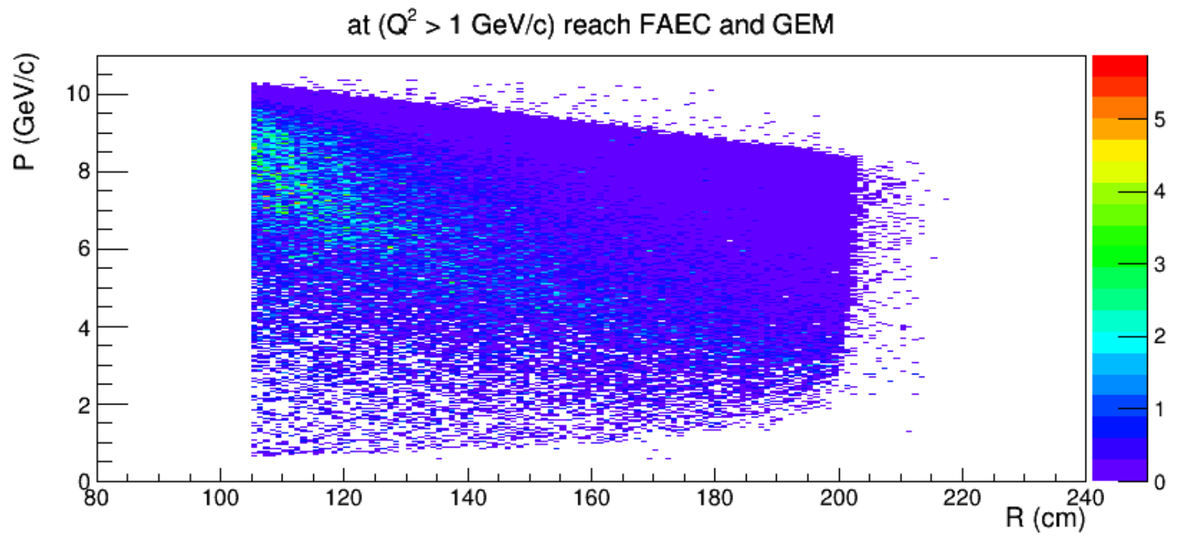
- But first, we look at the electrons (rate) which reach the FAEC and LAEC as well as the GEM (in the SoLID-SIDIS setup)

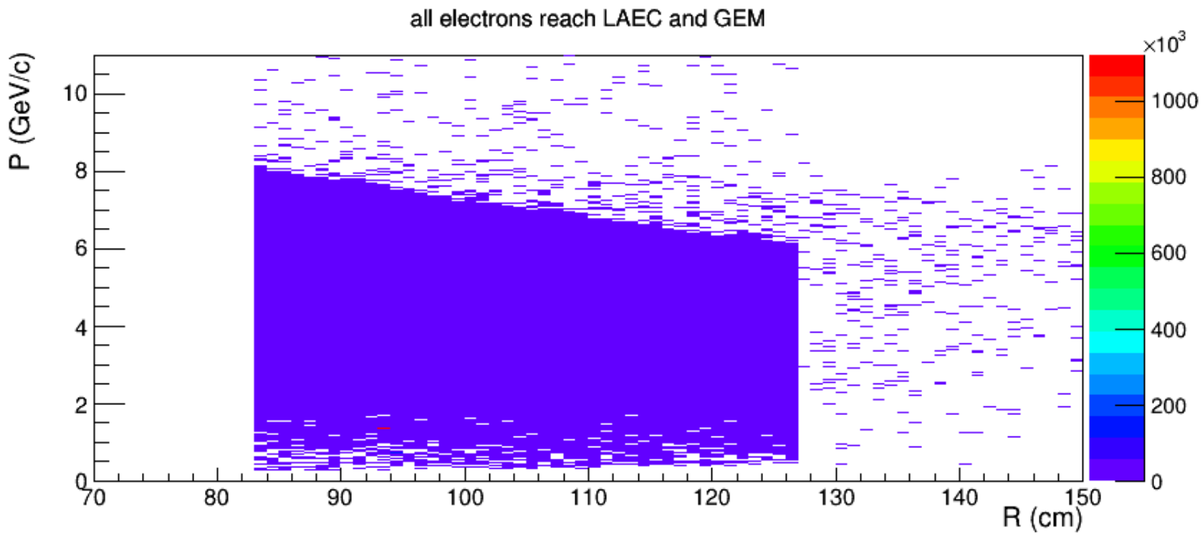
- As in the case of the proton target, the geometry is more complicated, we need to look at plots, which include the X and Y coordinates as well

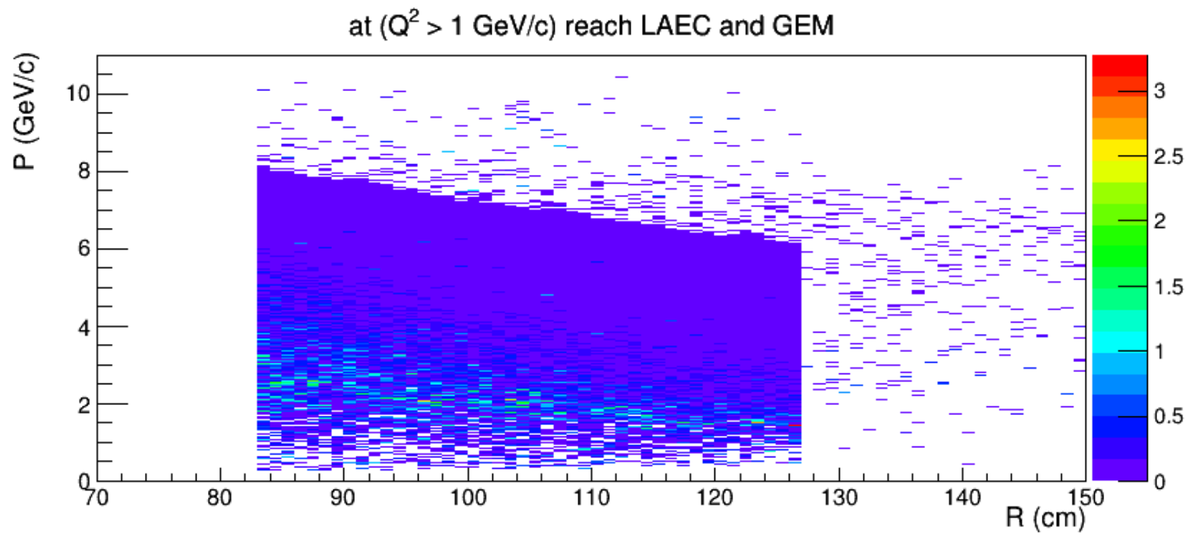
No sheet-of-flame cuts implemented

- Let's now look at the Momentum P (in GeV/c) of electrons vs. the radius R (in cm)



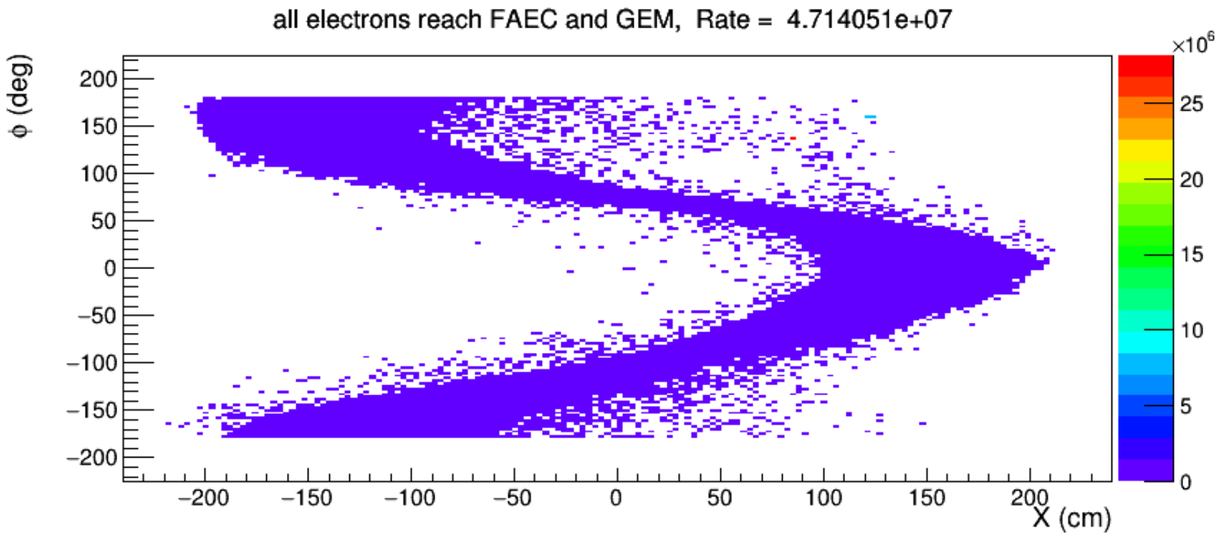


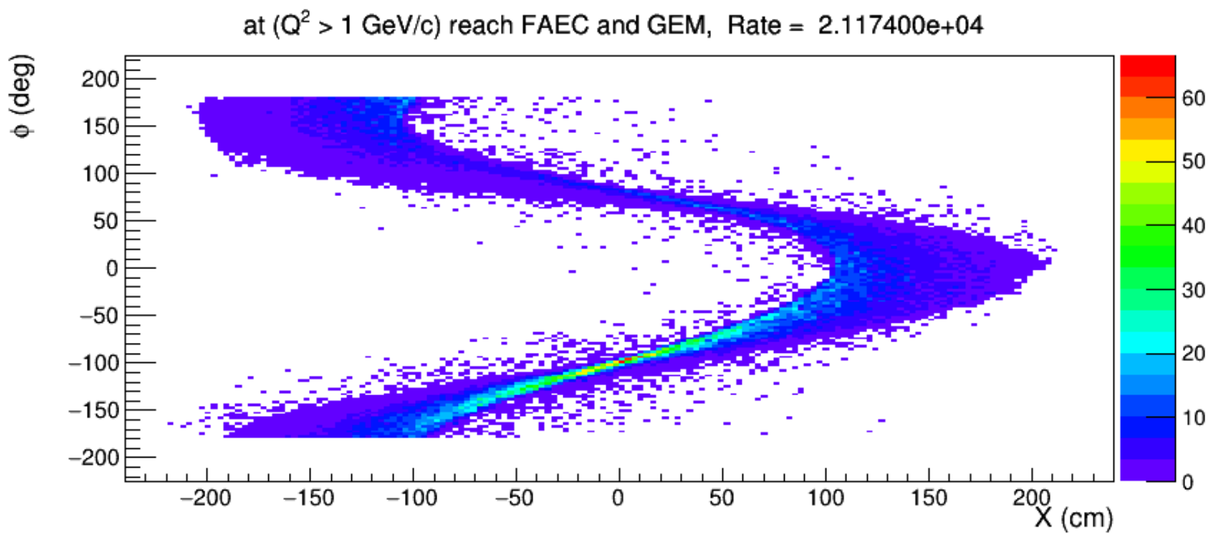


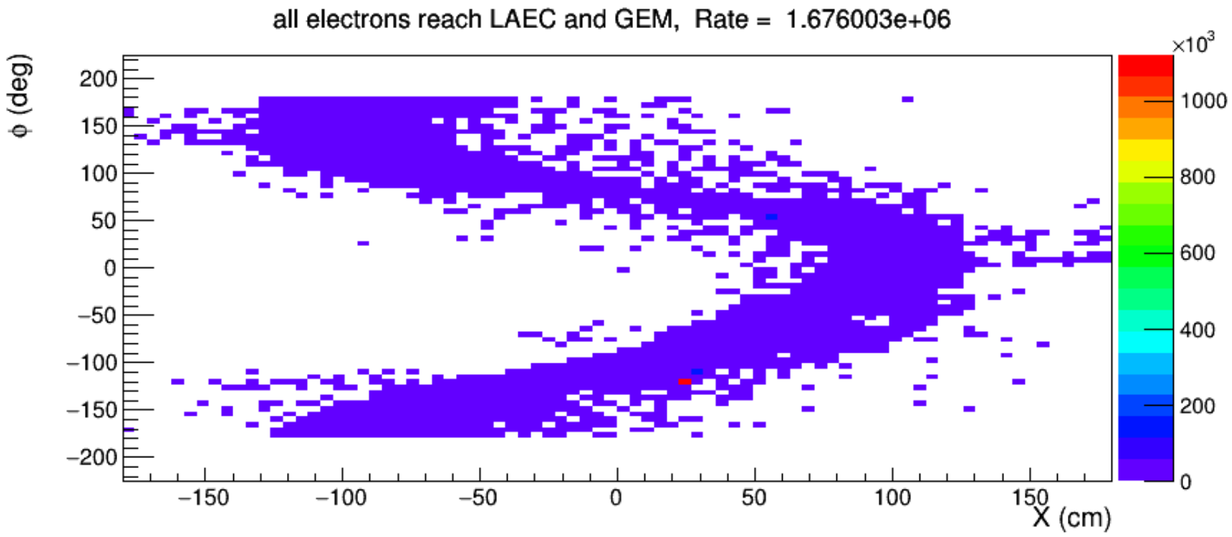


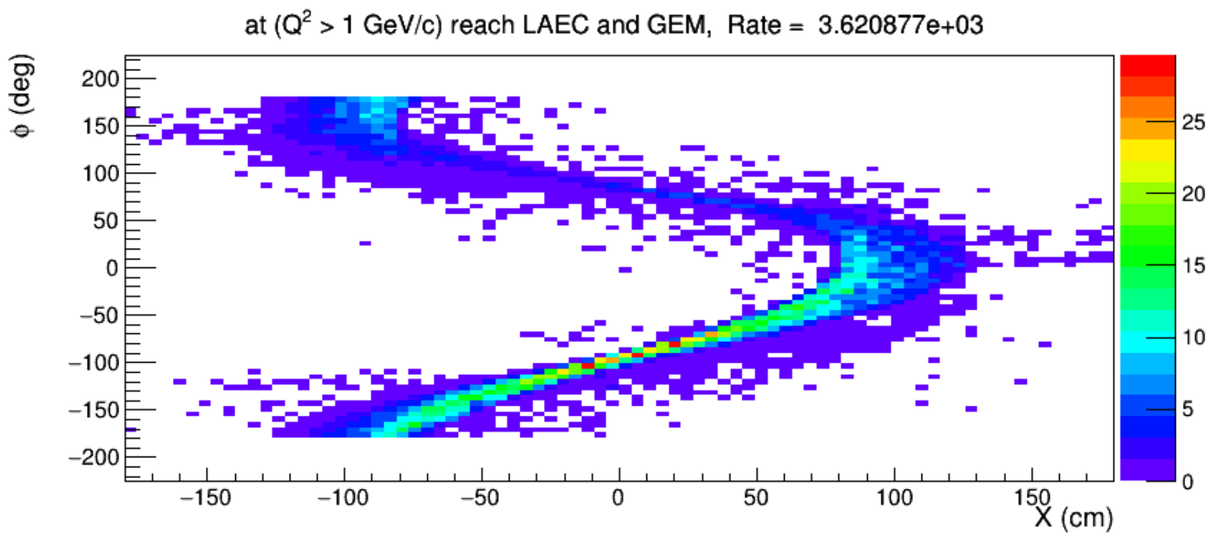
No sheet-of-flame cuts implemented

- We are looking at the azimuthal angle phi (in deg) vs. X (in cm)





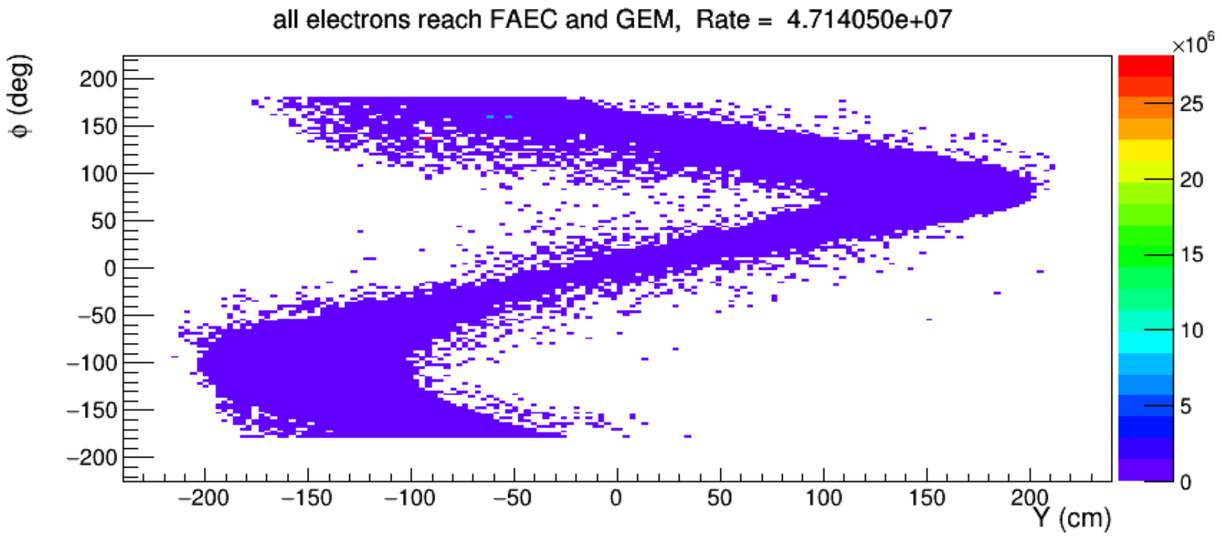


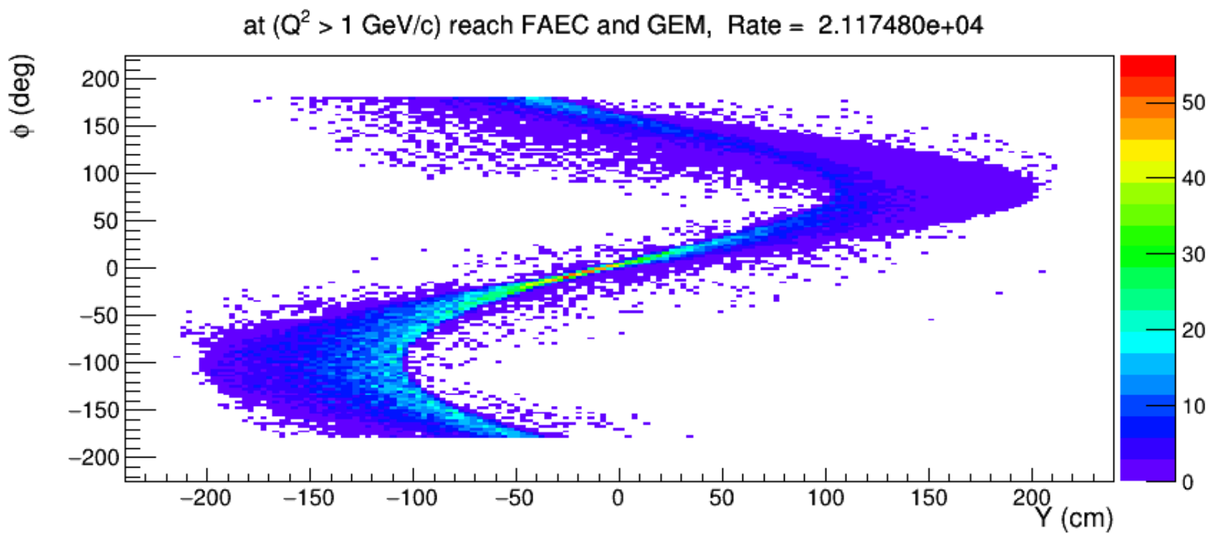


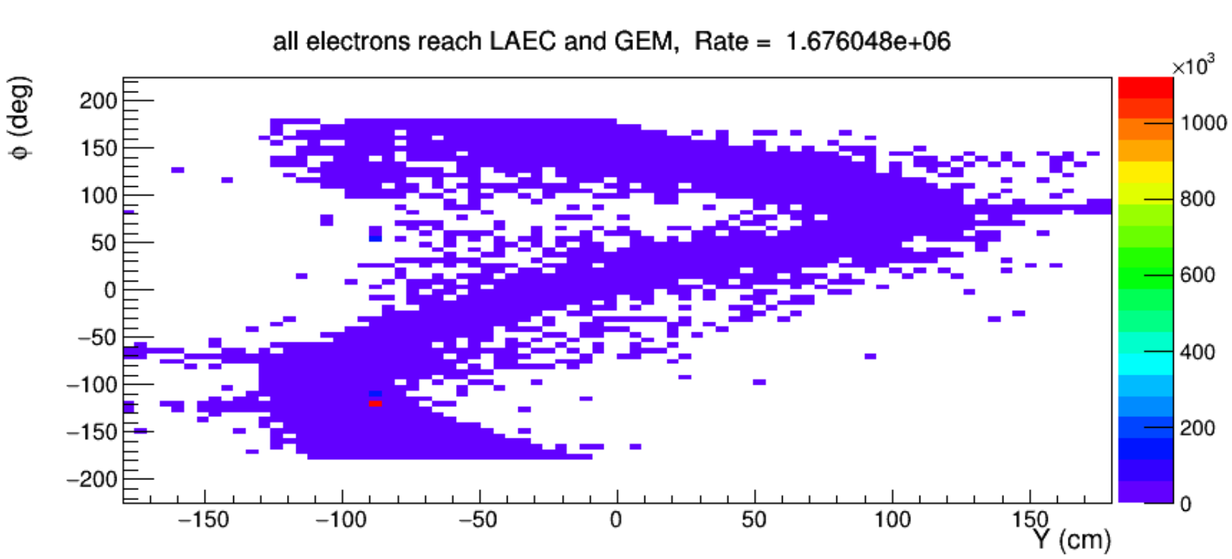
- The electron Rates in the plots are given in Hz

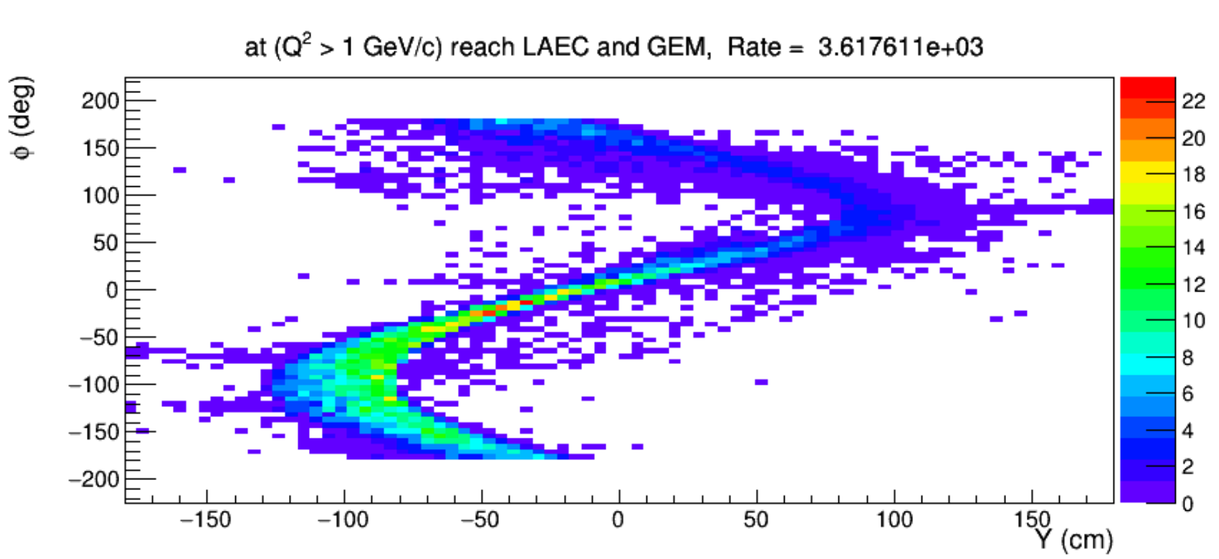
No sheet-of-flame cuts implemented

- We are looking at the azimuthal angle phi (in deg) vs. Y (in cm)





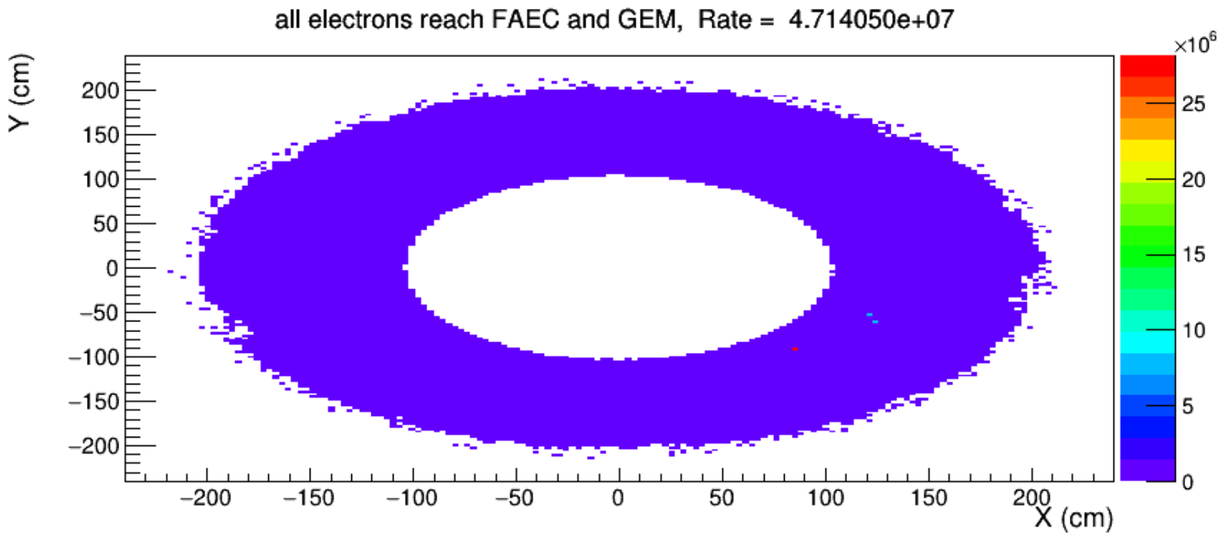


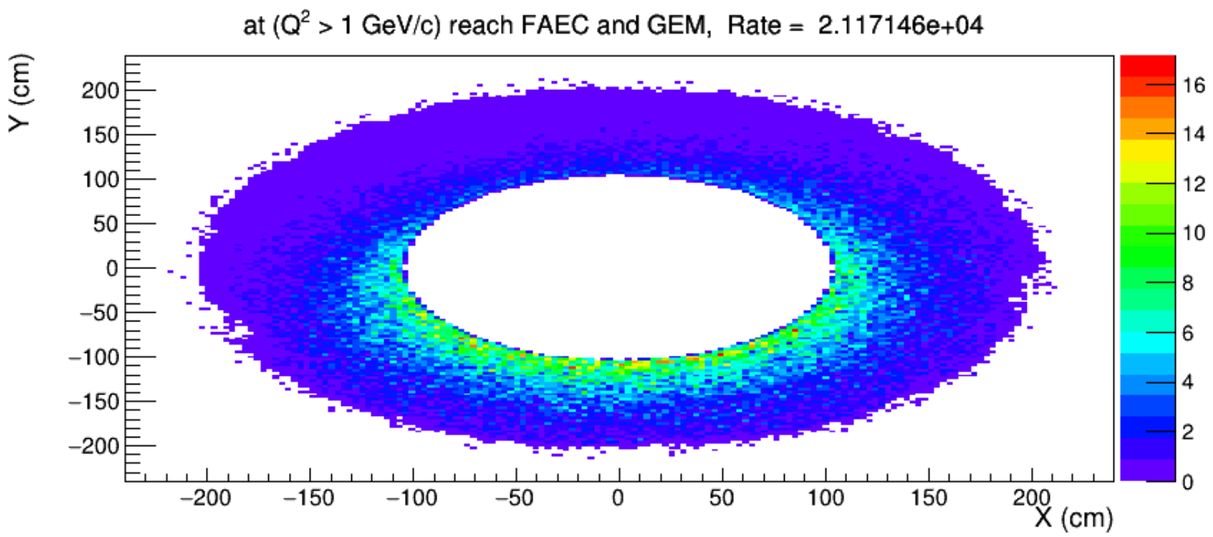


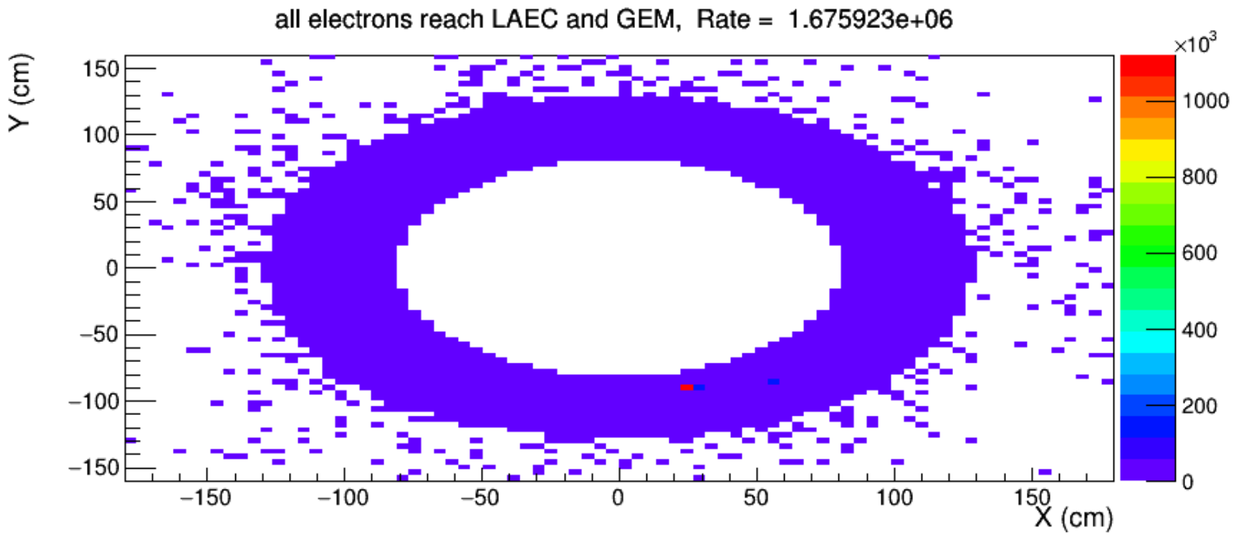
- The electron Rates in the plots are given in Hz

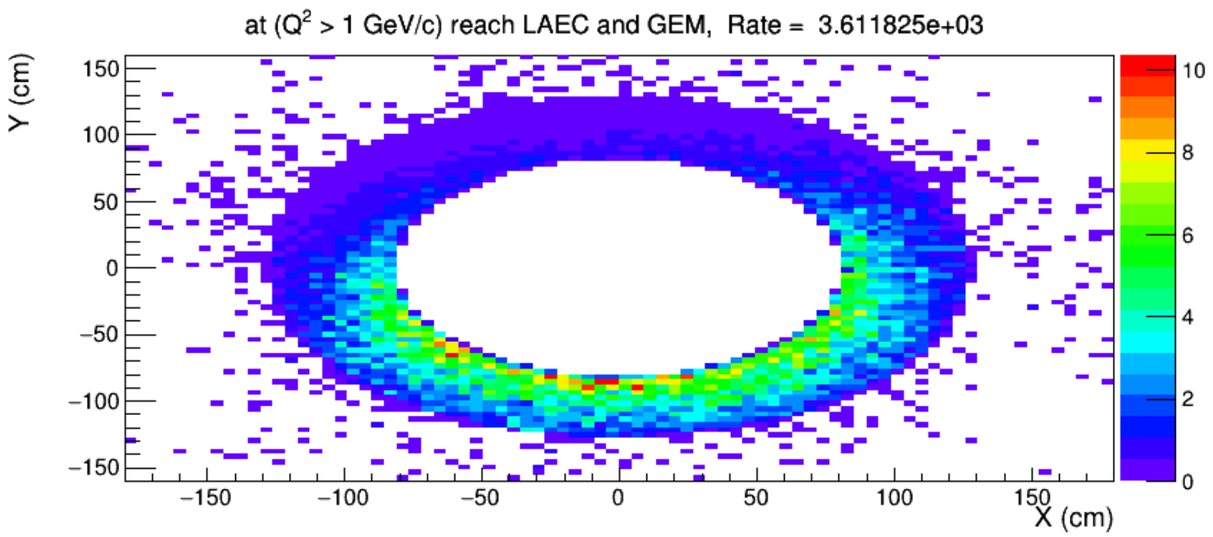
Sheet-of-flame cuts implemented

- We are looking at Y (in cm) vs. X (in cm)









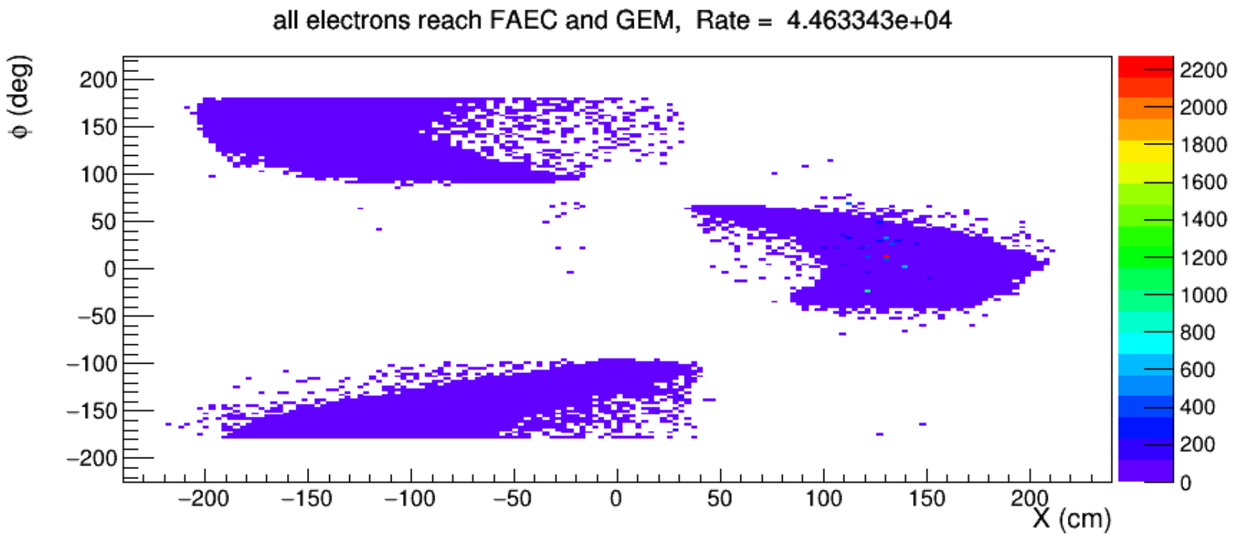
- The electron Rates in the plots are given in Hz

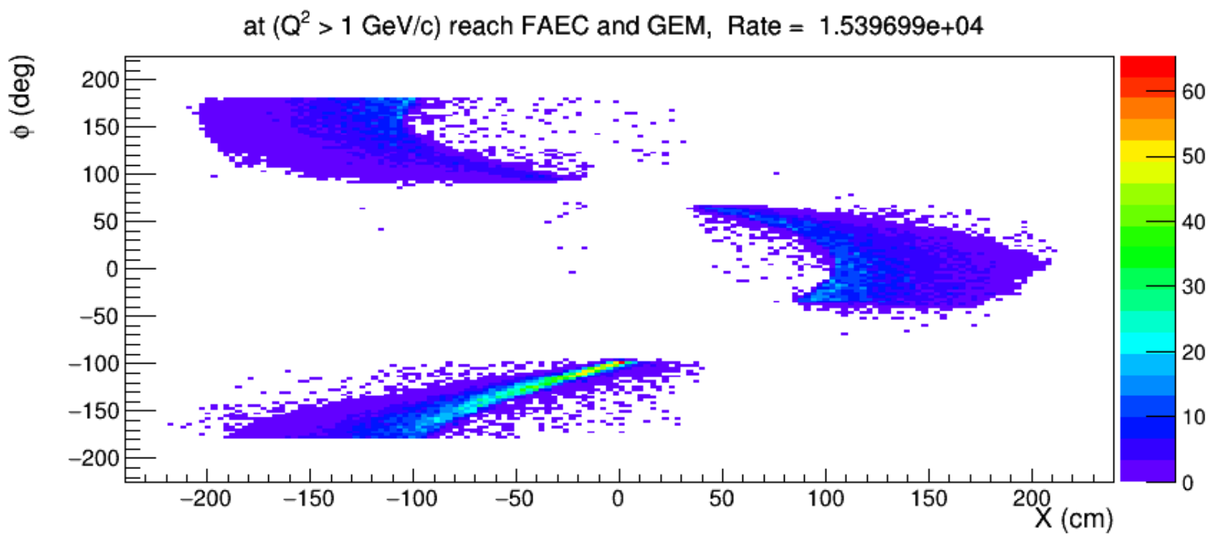
Now let's look at plots, which have the sheet-of-flame cuts implemented

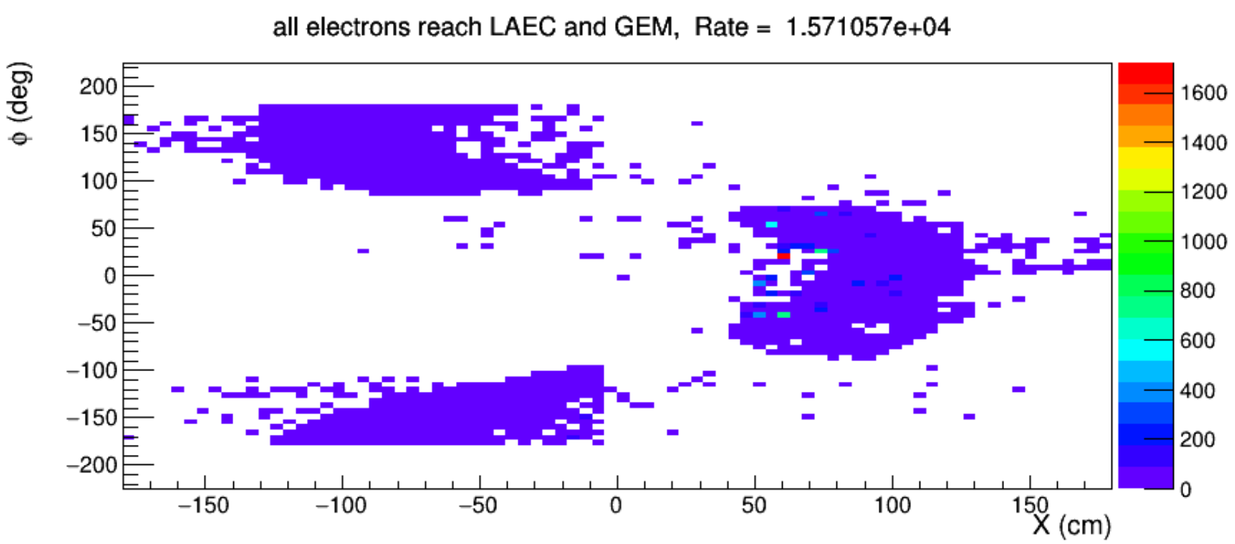
Totally there are thirteen cuts for the following subsystems:

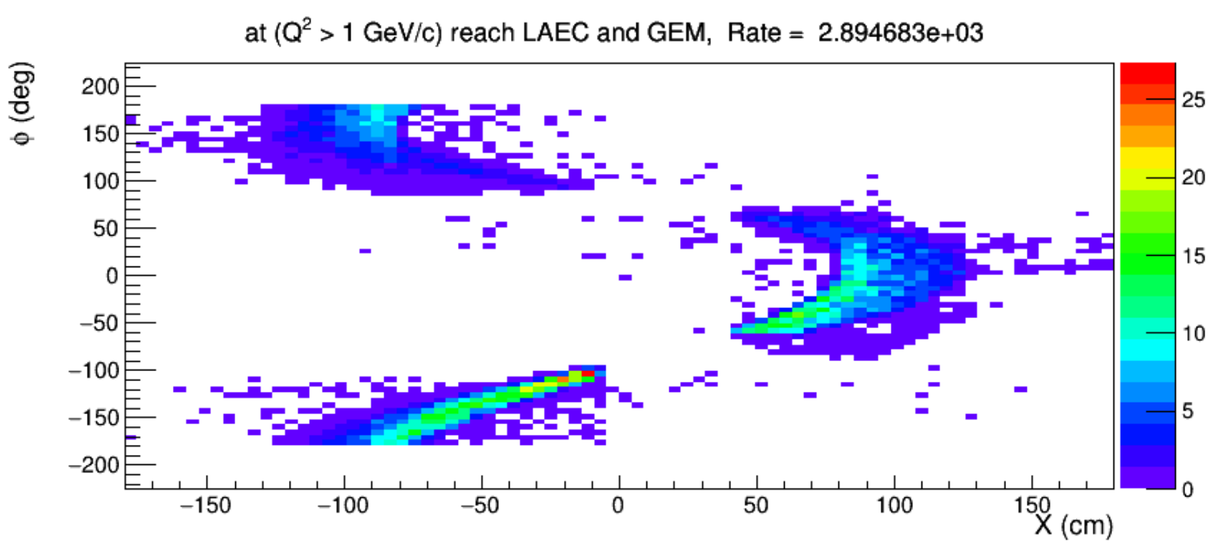
Six layers of GEM, LGC, HGC, FASPD, LASPD, MRPC, FAEC, LAEC

Sheet-of-flame cuts implemented



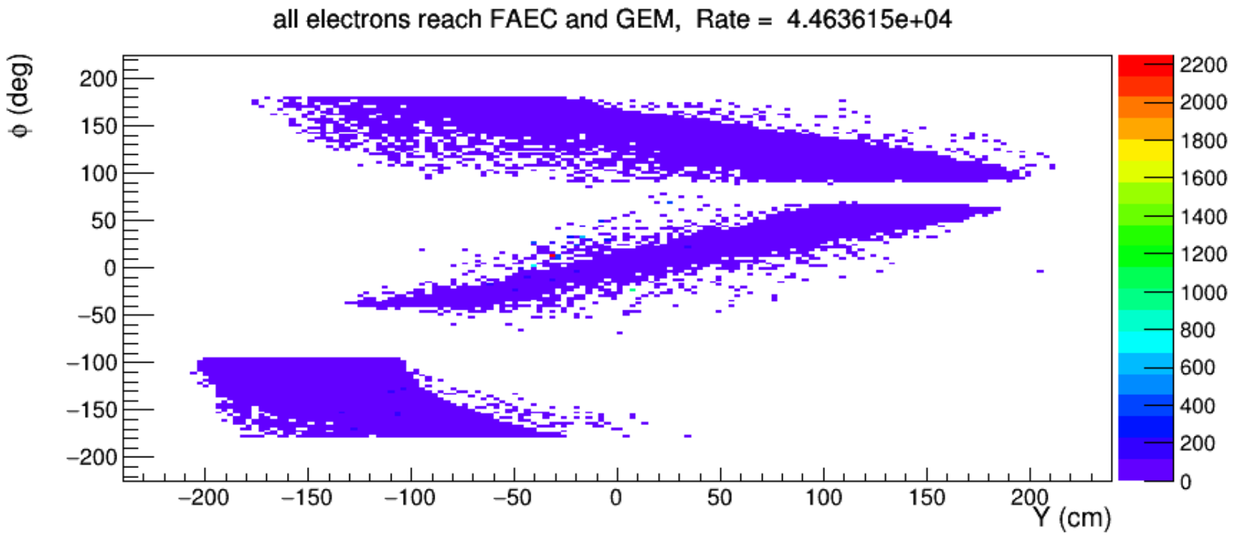


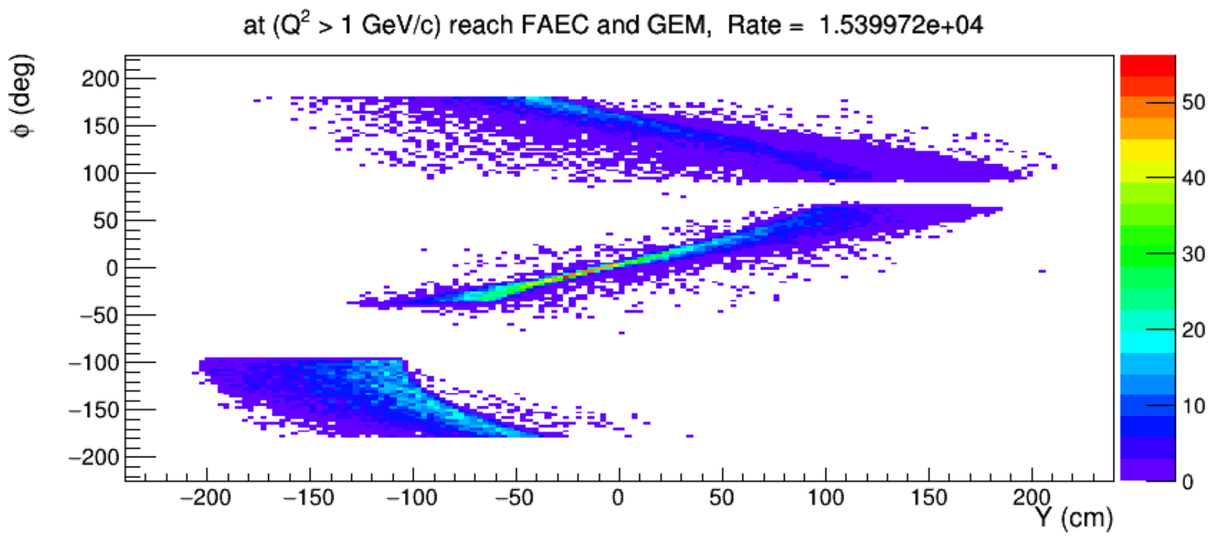


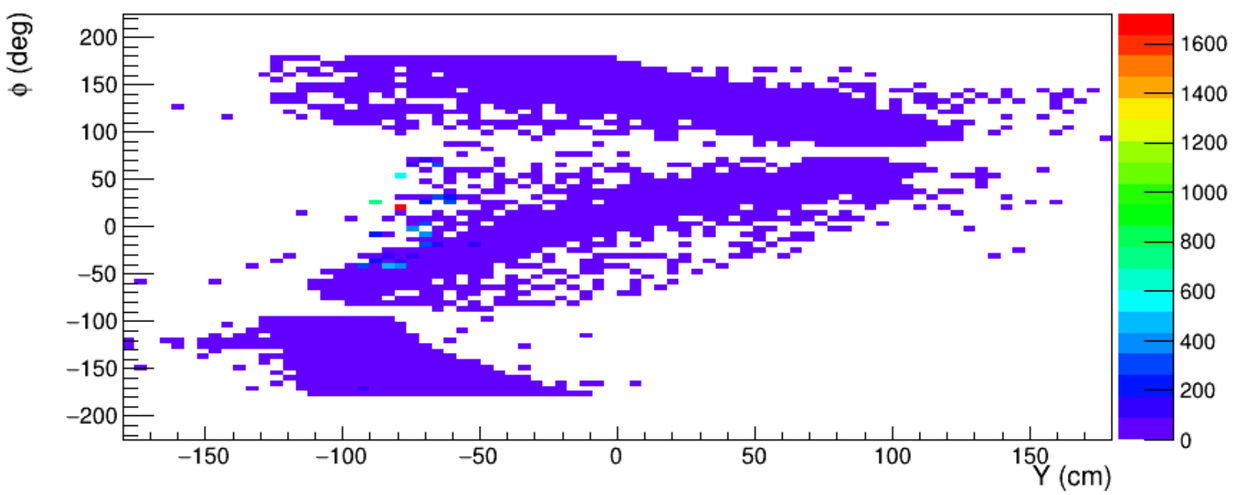


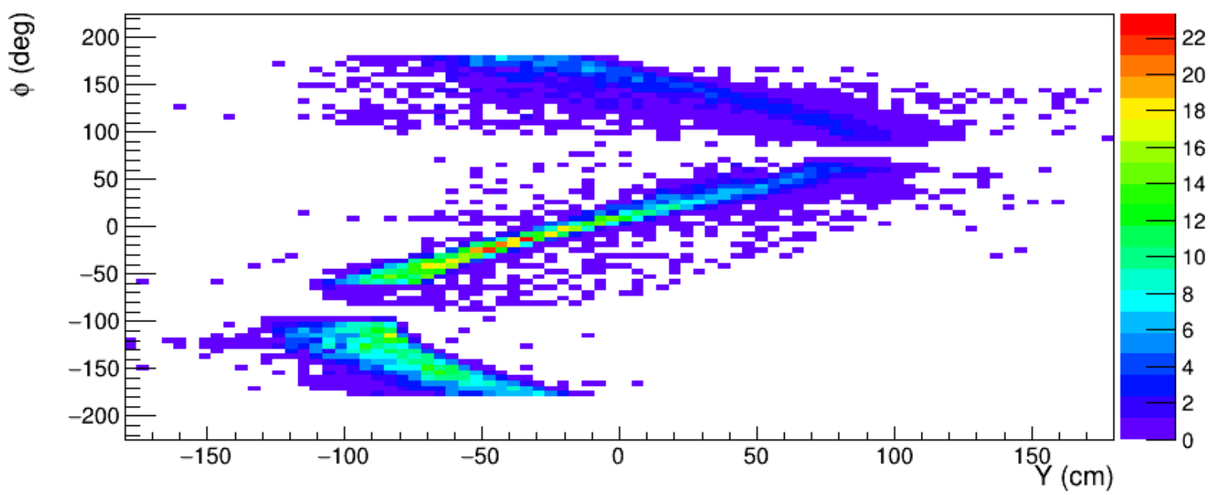
- The electron Rates in the plots are given in Hz

Sheet-of-flame cuts implemented



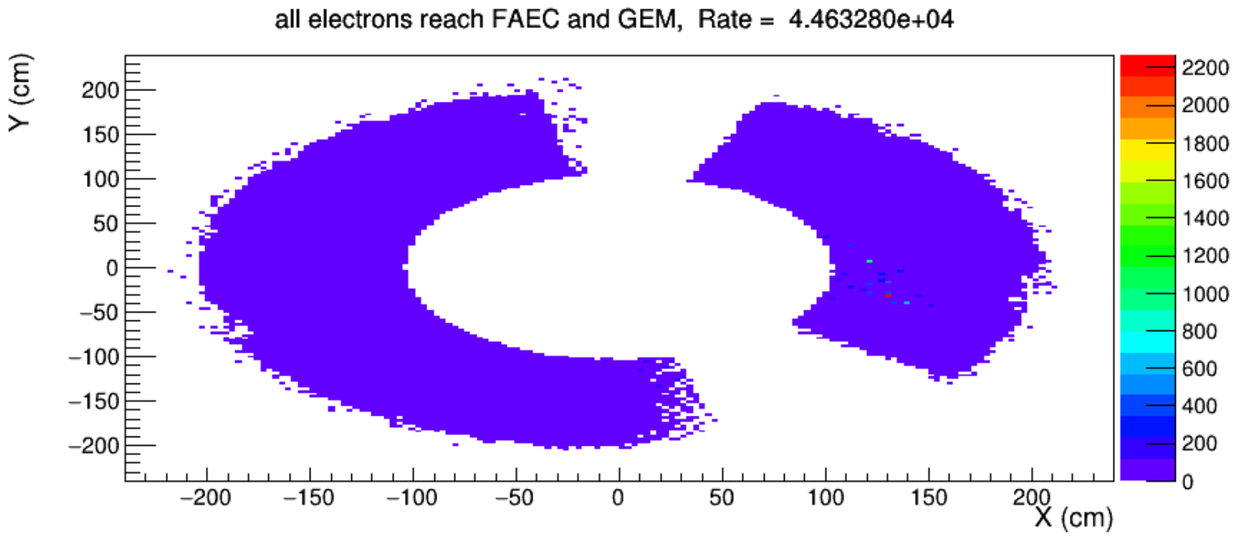


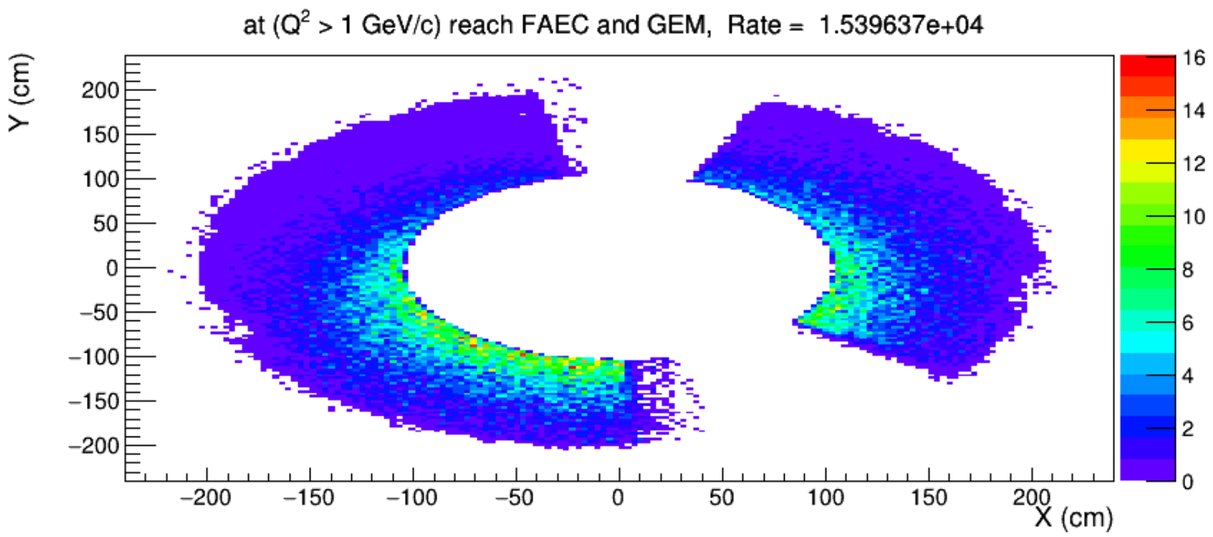


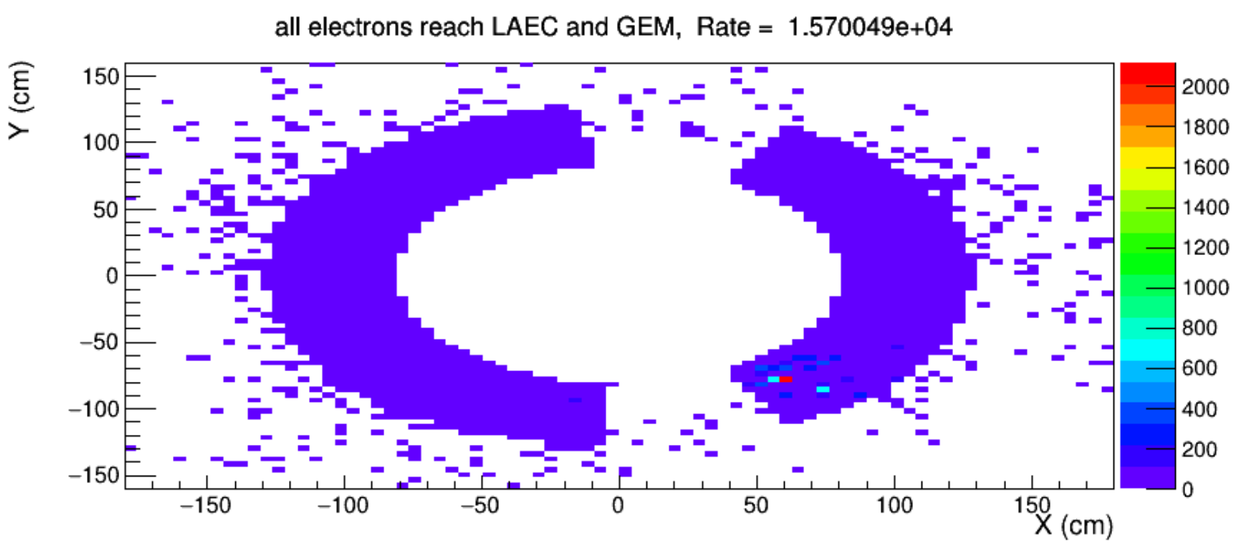


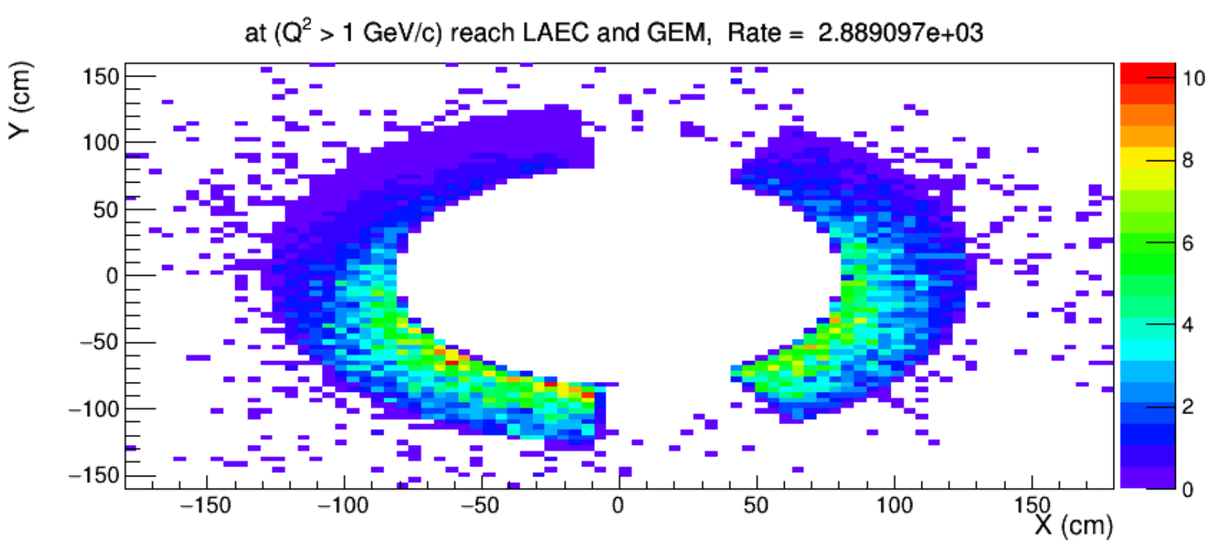
- The electron Rates in the plots are given in Hz

Sheet-of-flame cuts implemented









- The electron Rates in the plots are given in Hz

- Now let's take the ratio between the Rate from a case when only one cut is implemented and the Rate from the case when no cut is implemented (shown in the third row of the first table below)
- These ratios are shown in the next two slides, but here we also show some Rate numbers

for NH_3 Rates in kHz	All electrons reach FAEC and GEM	All electrons reach LAEC and GEM	Q^2 >1 GeV/c electrons reach FAEC and GEM	Q^2 >1 GeV/c electrons reach LAEC and GEM
All sheet-of-flame cuts for all subsystems	44.6	15.7	15.4	2.9
No sheet-of-flame cuts implemented	47140.5	1676	21.2	3.6

for He^3 Rates in kHz	All electrons reach FAEC and GEM	All electrons reach LAEC and GEM	Q^2 >1 GeV/c electrons reach FAEC and GEM	Q^2 >1 GeV/c electrons reach LAEC and GEM
	96	15.9	65.7	12.4

- And here we have each a cut ID corresponding to each subdetector shown below.
- The ratio of the Rates are shown in the second table

Case 21	**detector_ID=2 (C)**	**subdetector_ID=1 (LGC)**
Case 22	**detector_ID=2 (C)**	**subdetector_ID=2 (HGC)**
Case 51	**detector_ID=5 (SPD)**	**subdetector_ID=1 (FASPD)**
Case 52	**detector_ID=5 (SPD)**	**subdetector_ID=2 (LASPD)**
Case 31	**detector_ID=3 (EC)**	**subdetector_ID=1 (FAEC)**
Case 32	**detector_ID=3 (EC)**	**subdetector_ID=2 (LAEC)**

Ratio of the Rates	All electrons reach FAEC and GEM	All electrons reach LAEC and GEM	Q^2 >1 GeV/c electrons reach FAEC and GEM	Q^2 >1 GeV/c electrons reach LAEC and GEM
Case 21	**0.325**	**1.000**	**0.844**	**1.000**
Case 22	**0.00116**	**1.000**	**0.774**	**1.000**
Case 51	**0.326**	**1.000**	**0.817**	**1.000**
Case 52	**1.000**	**0.113**	**1.000**	**0.831**
Case 31	**0.326**	**1.000**	**0.826**	**1.000**
Case 32	**1.000**	**0.113**	**1.000**	**0.829**

Case 11	detector_ID=1 (GEM)	subdetector_ID=1 (GEM, layers)
Case 12	detector_ID=1	subdetector_ID=2
Case 13	detector_ID=1	subdetector_ID=3
Case 14	detector_ID=1	subdetector_ID=4
Case 15	detector_ID=1	subdetector_ID=5
Case 16	detector_ID=1	subdetector_ID=6

Ratio of the Rates	All electrons reach FAEC and GEM	All electrons reach LAEC and GEM	Q^2 >1 GeV/c electrons reach FAEC and GEM	Q^2 >1 GeV/c electrons reach LAEC and GEM
Case 11	1.000	0.0208	1.000	0.889
Case 12	0.00328	0.0462	0.890	0.890
Case 13	0.00446	0.148	0.890	0.891
Case 14	0.00712	0.942	0.890	0.891
Case 15	0.00246	1.000	0.843	1.000
Case 16	0.325	1.000	0.844	1.000
All sheets of flames cuts for GEM	0.00154	0.010	0.792	0.863

Next steps

- We will make other plots, which will include the X and Y dependence, to uncover more information on the configuration geometry

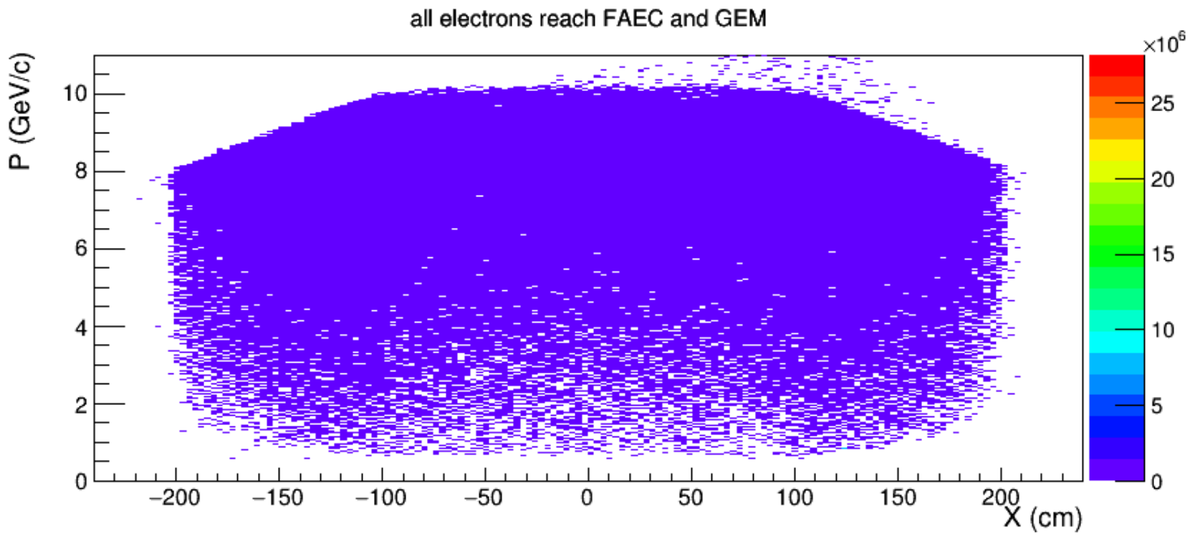
- We should also do some fine-tuning for the Rate numbers after we have new full GEANT4 simulation results, plus also the results from upcoming trigger and background studies

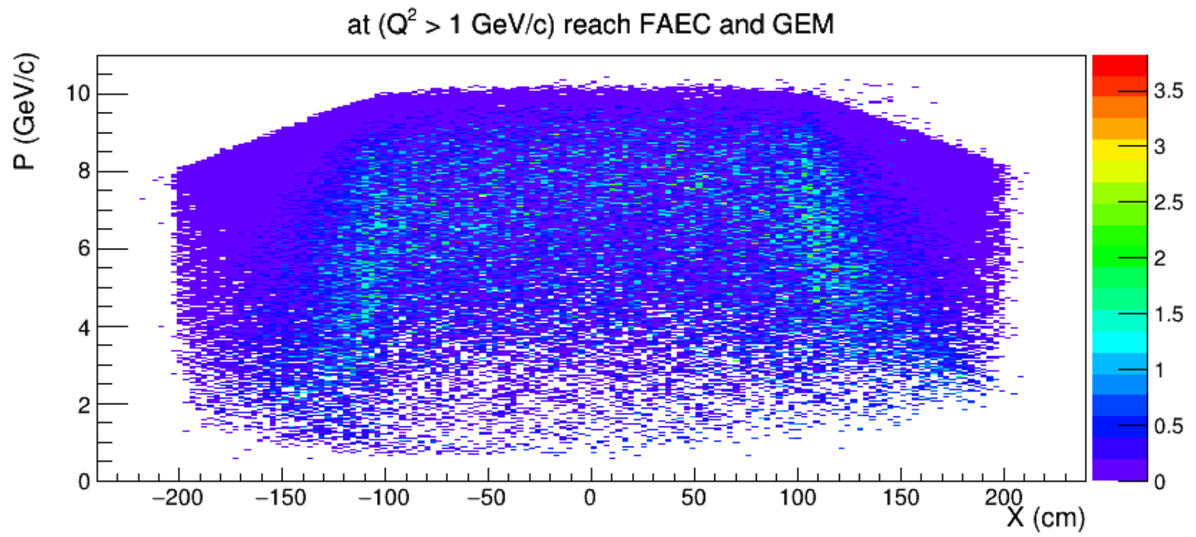
- In addition, we will make similar plots for LGC and HGC as well as for FASPD and LASPD

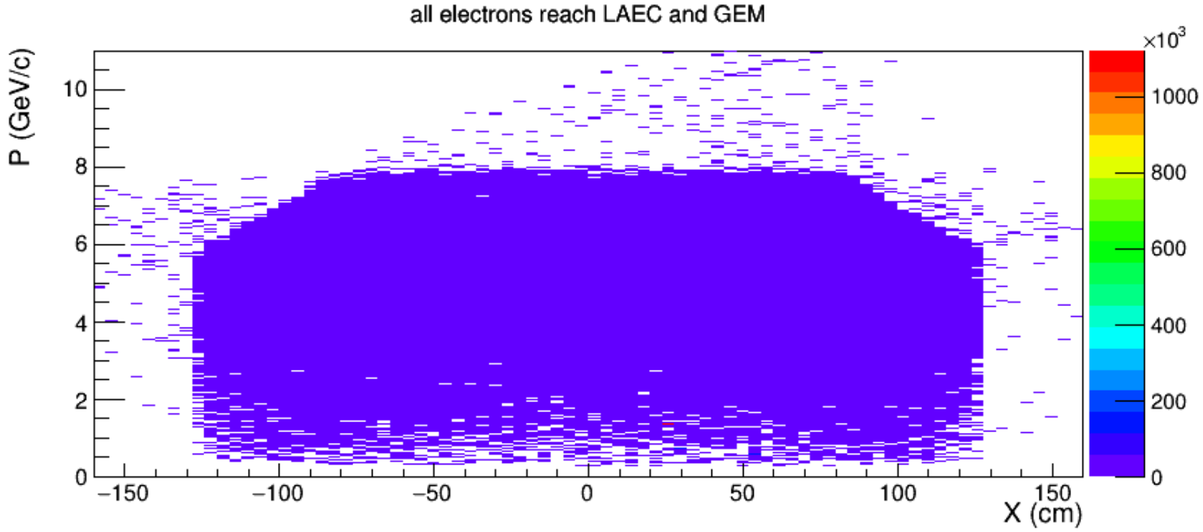
- All such (acceptance) and additional (trigger, background) studies will give us a good sense of a sheets-of-flame behavior and their effects, and how to shield and turn off the detector sections during the SIDIS-proton experiment

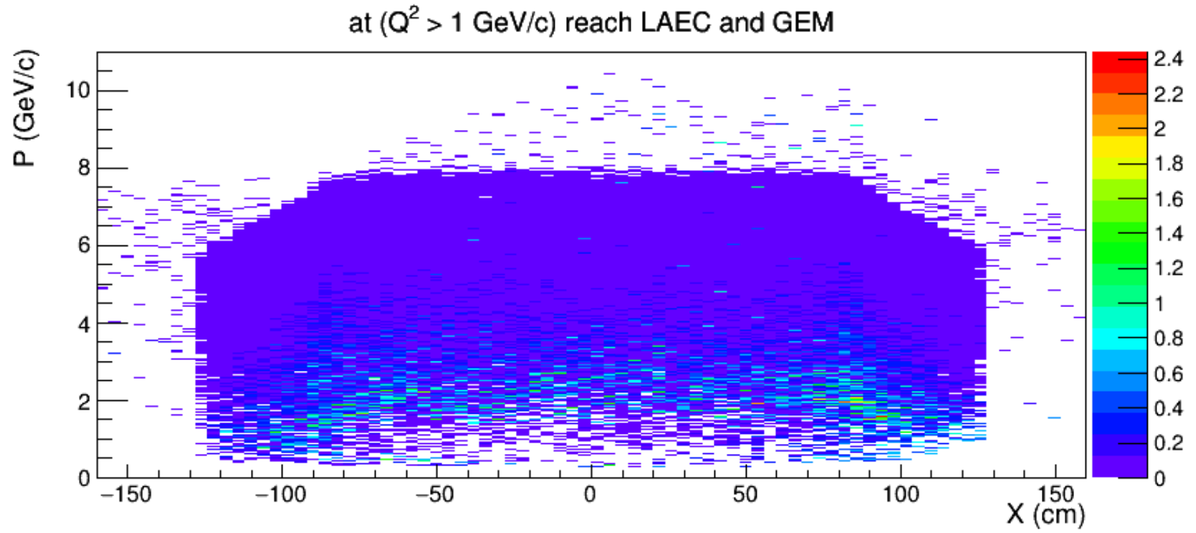
Backups

No sheet-of-flame cuts implemented

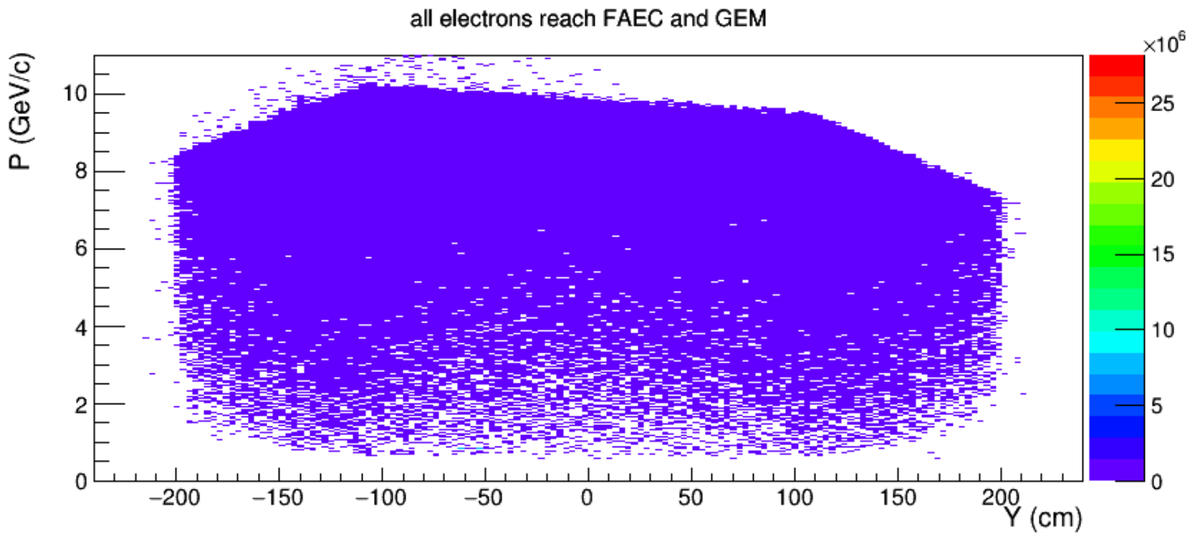


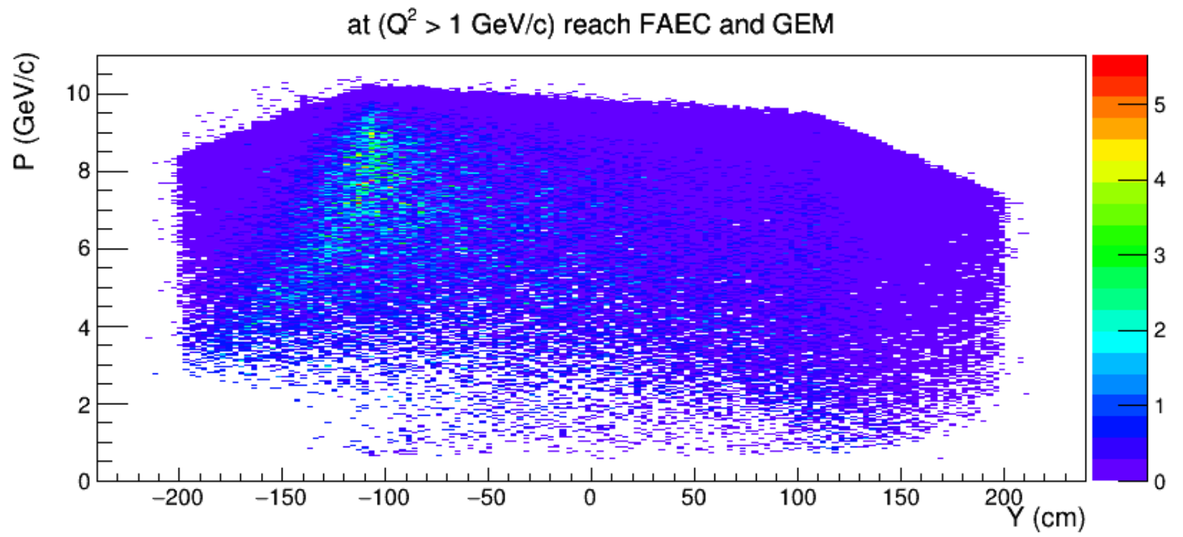


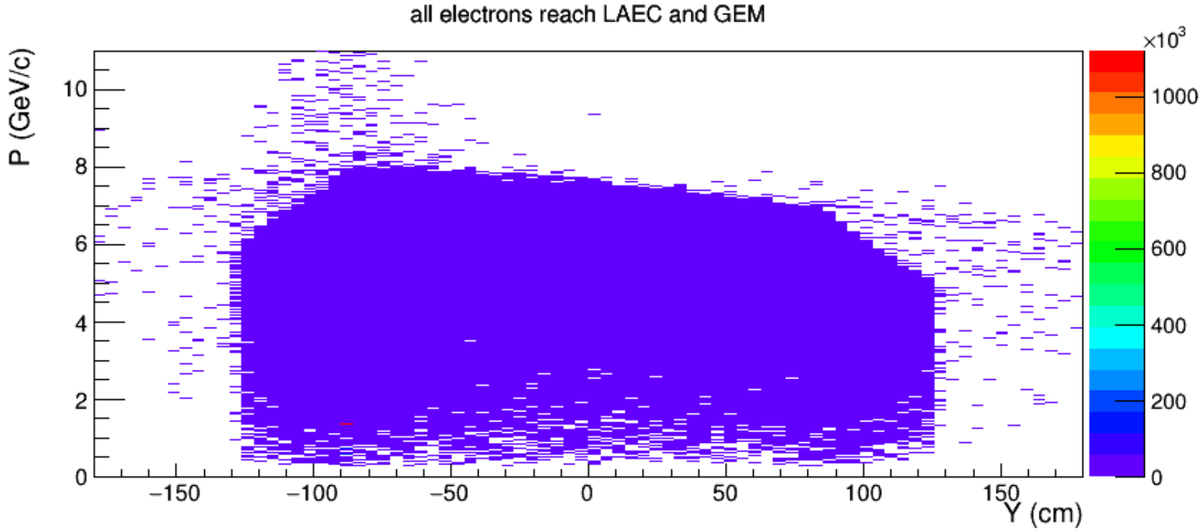


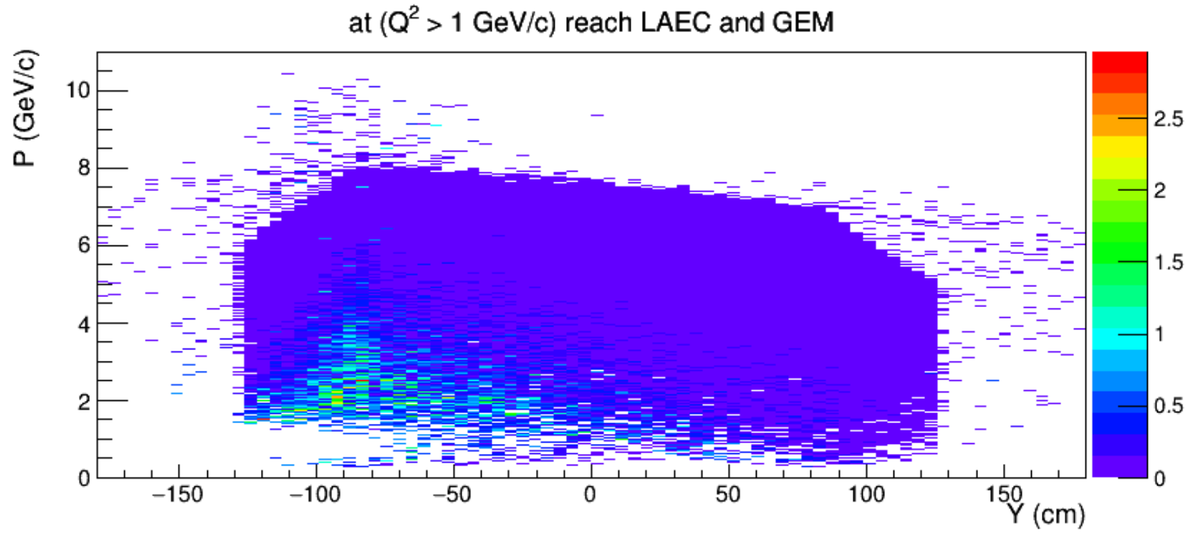


No sheet-of-flame cuts implemented

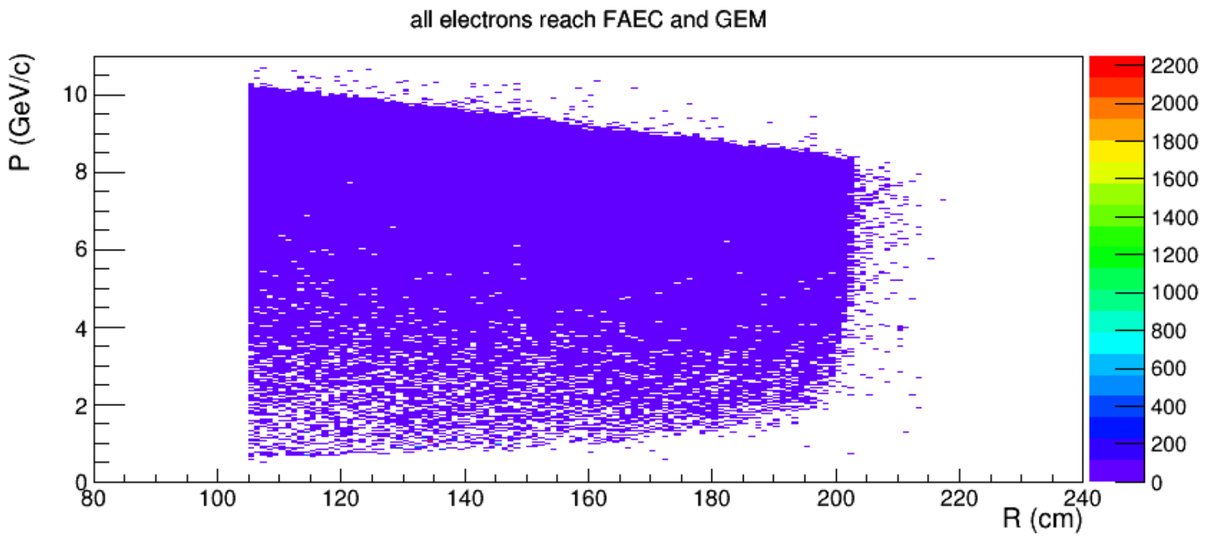


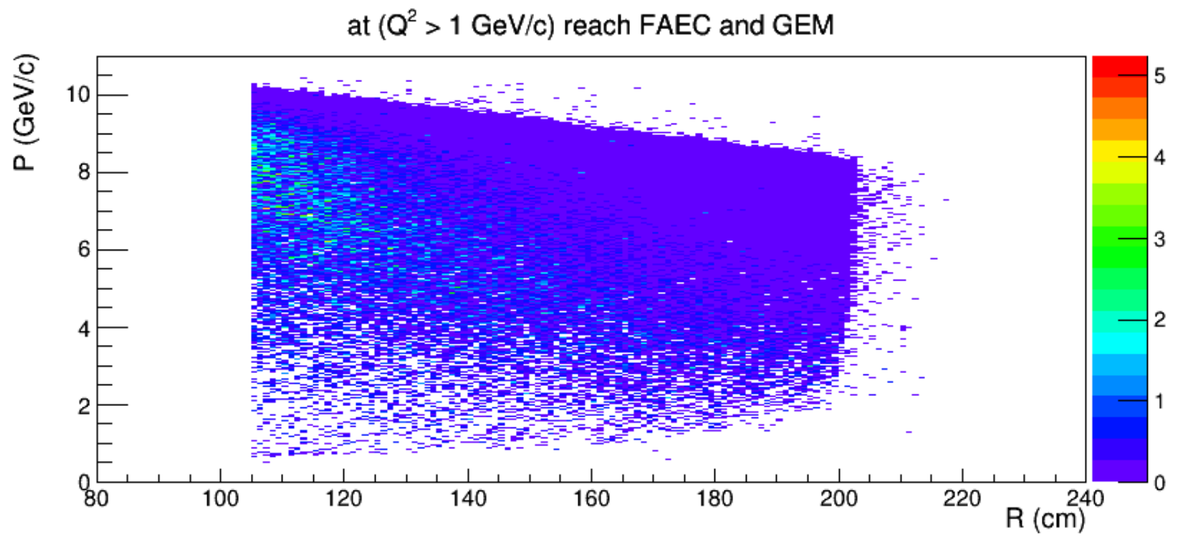


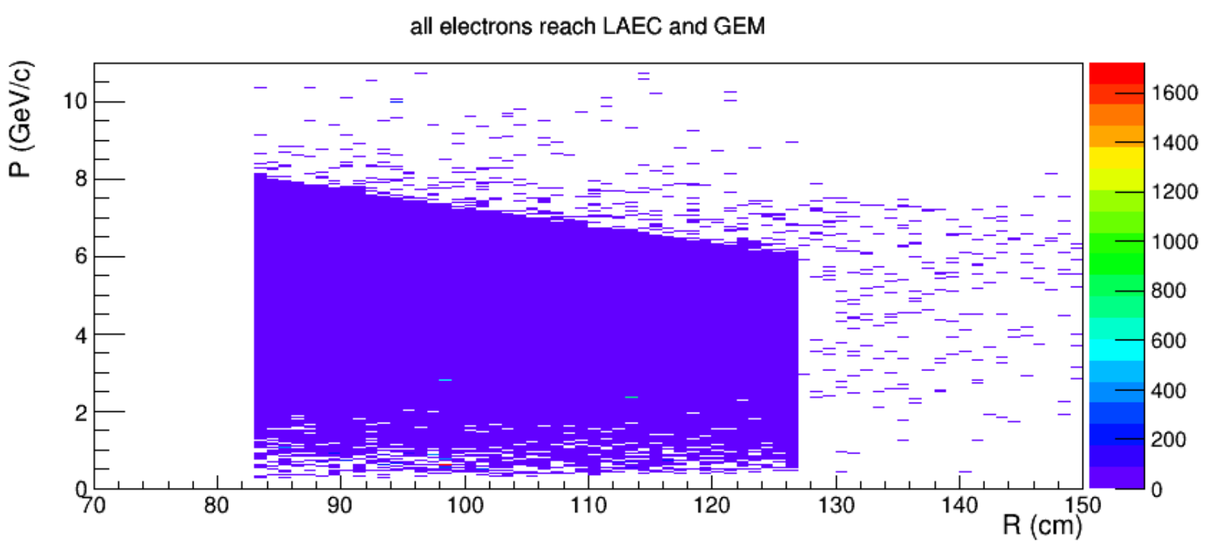


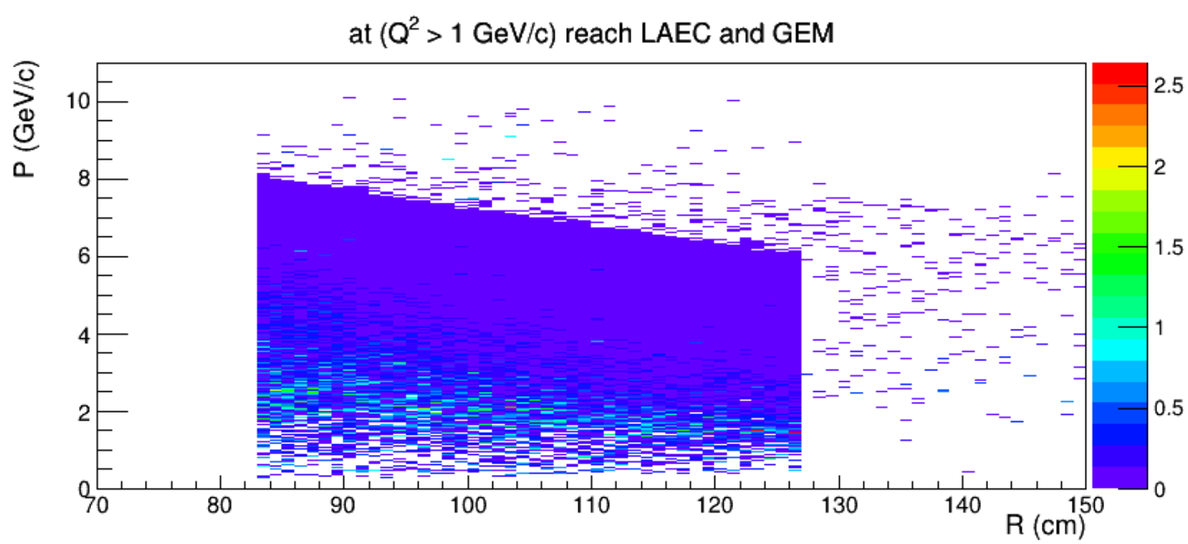


Sheet-of-flame cuts implemented

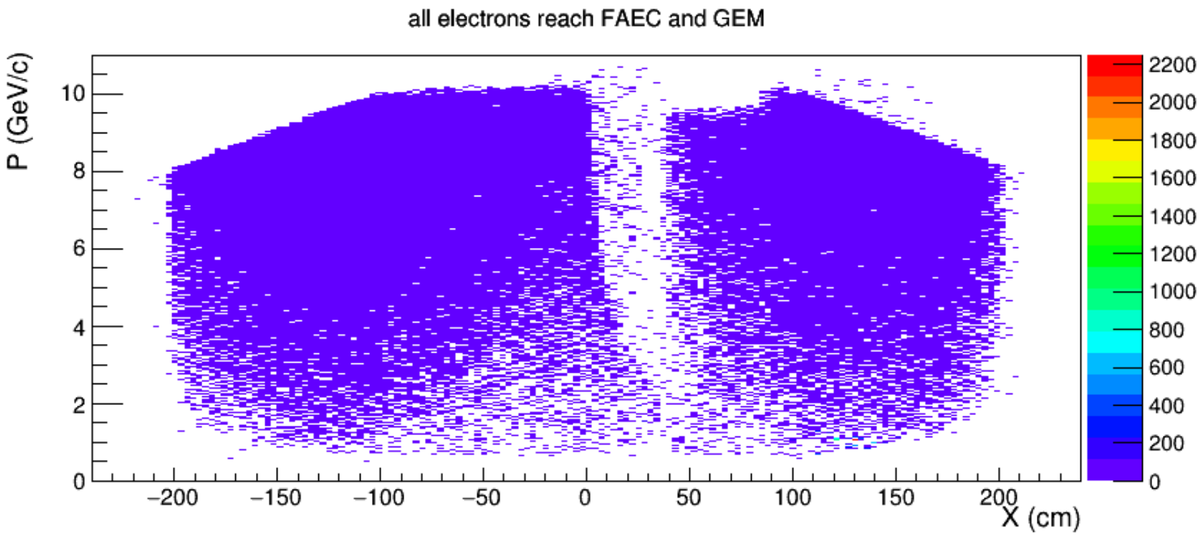


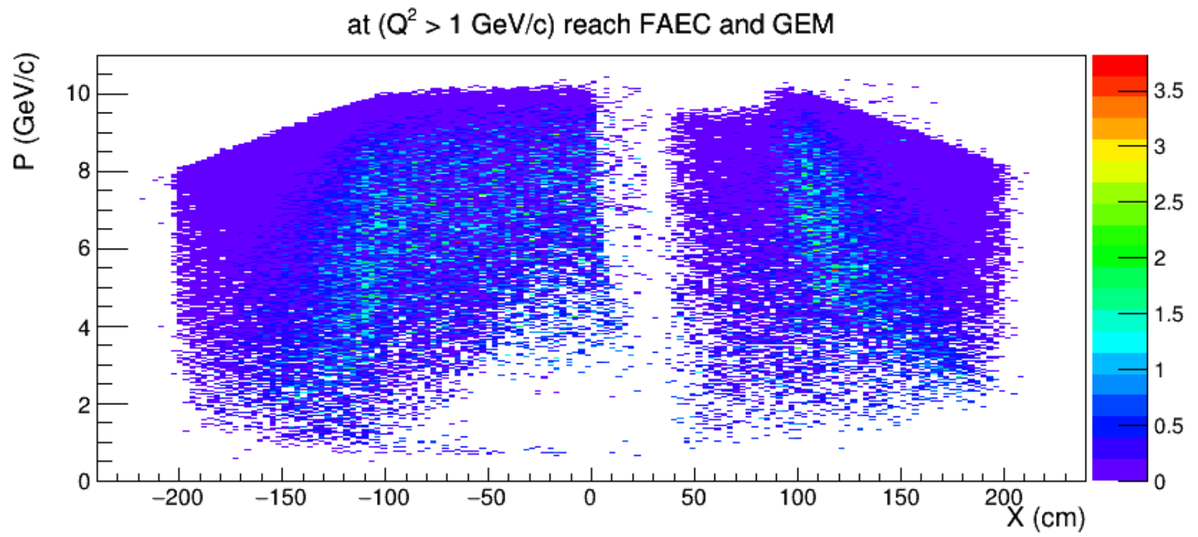


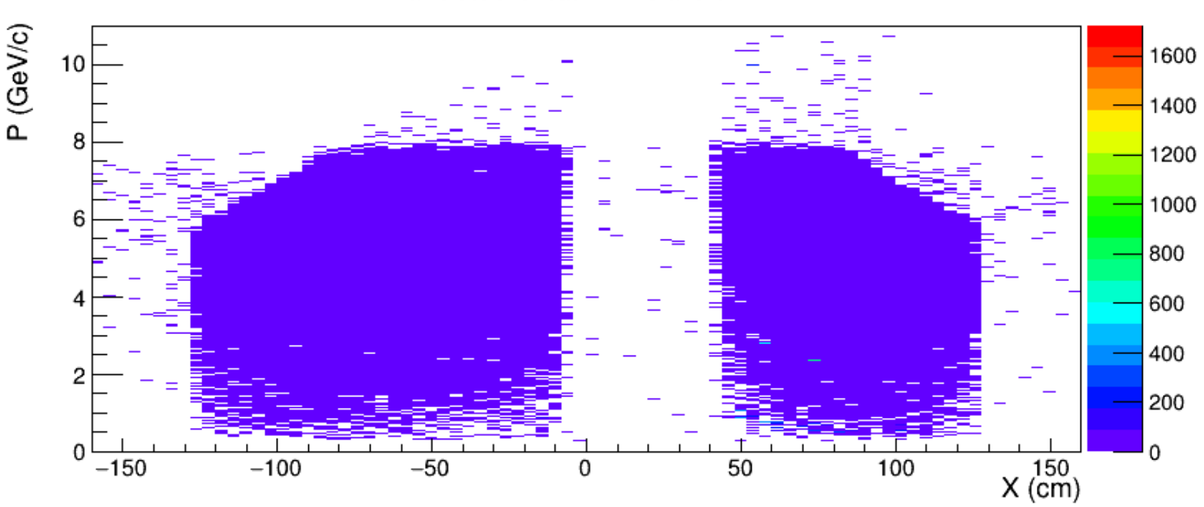


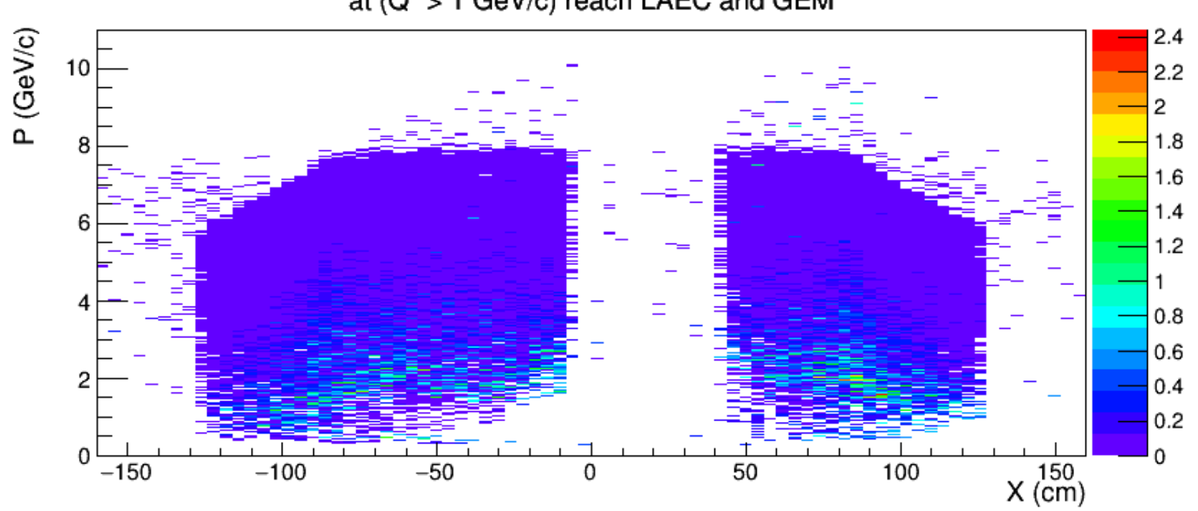


Sheet-of-flame cuts implemented

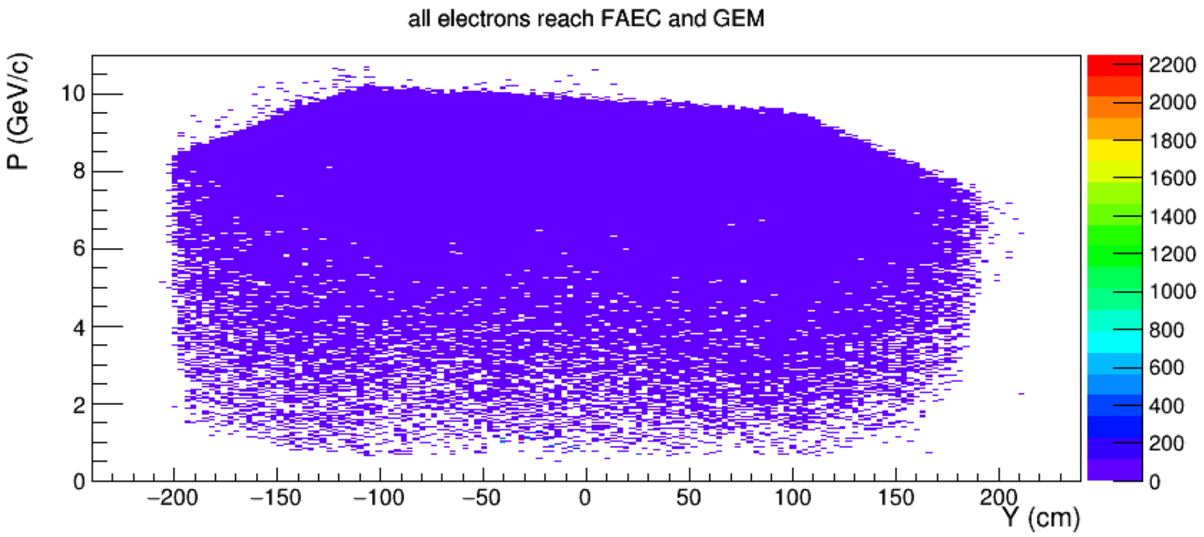


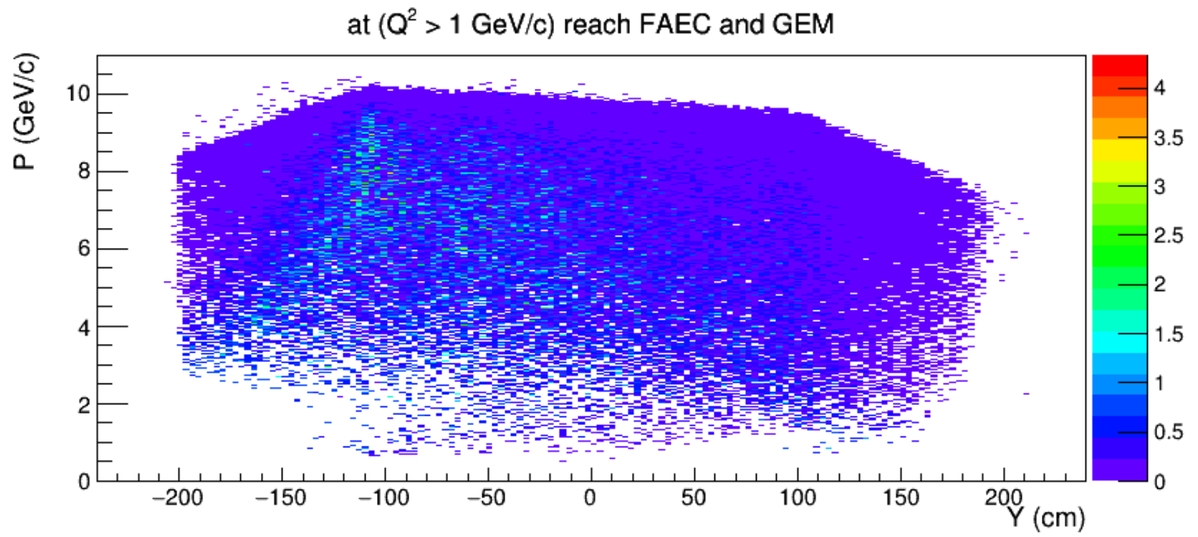


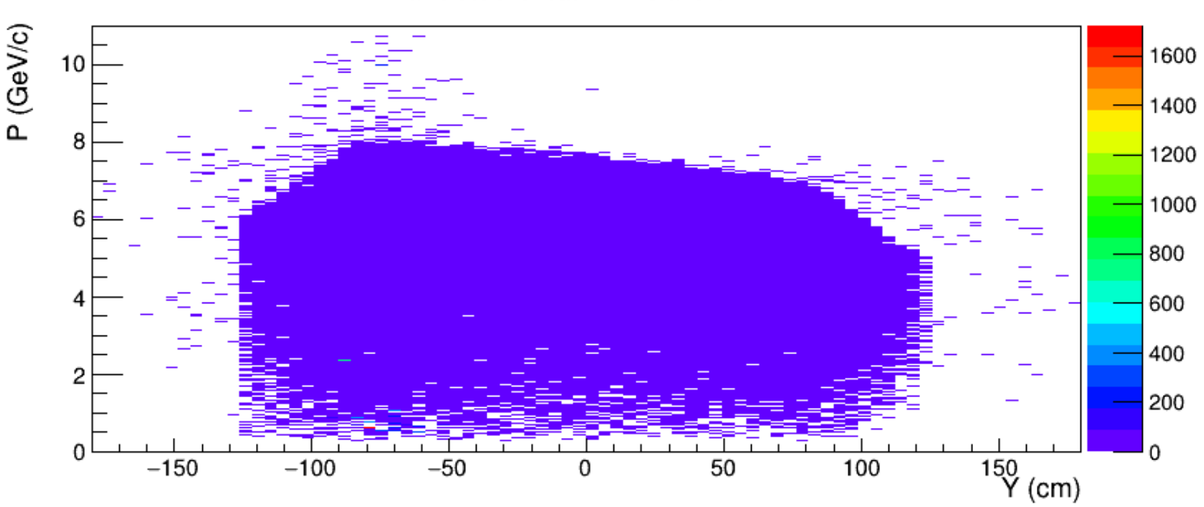


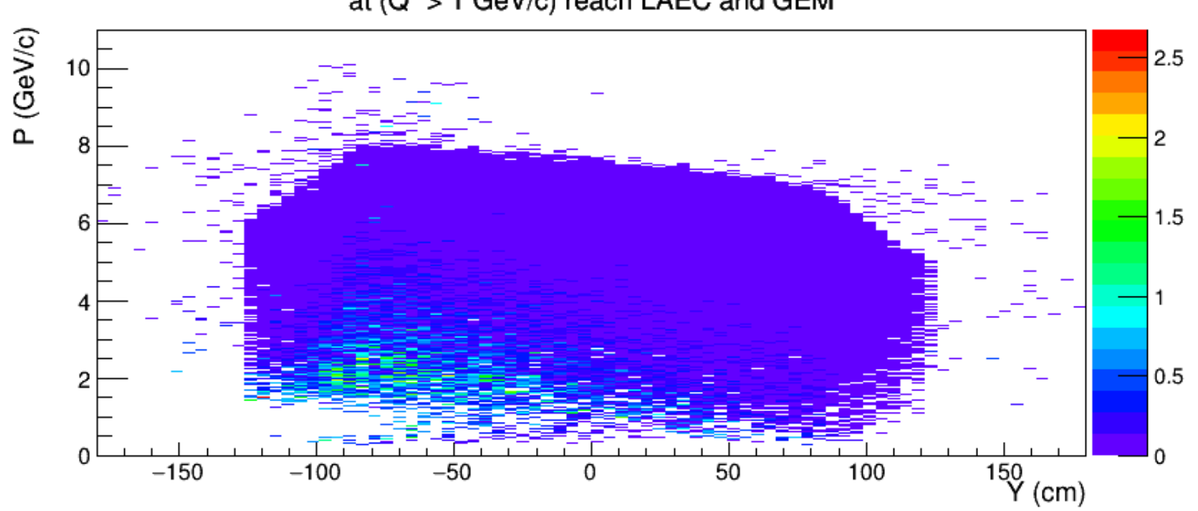


Sheet-of-flame cuts implemented

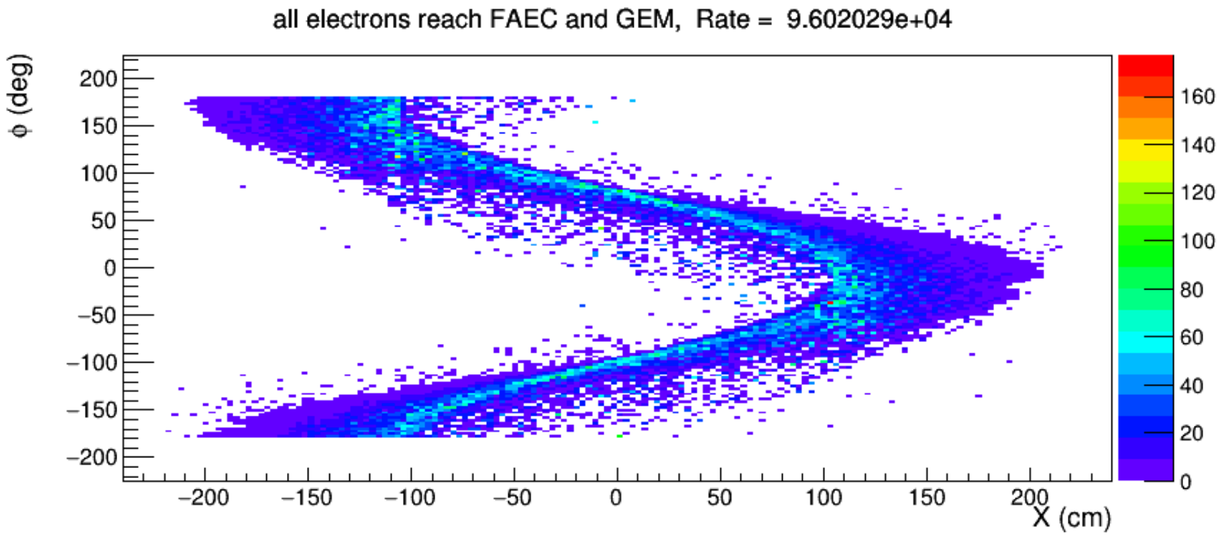


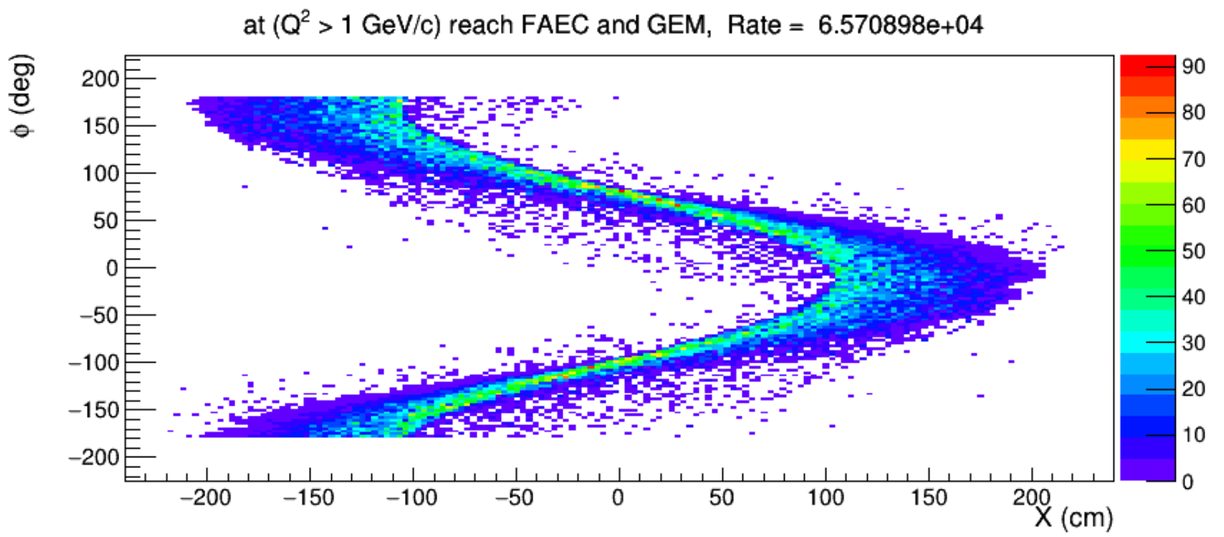


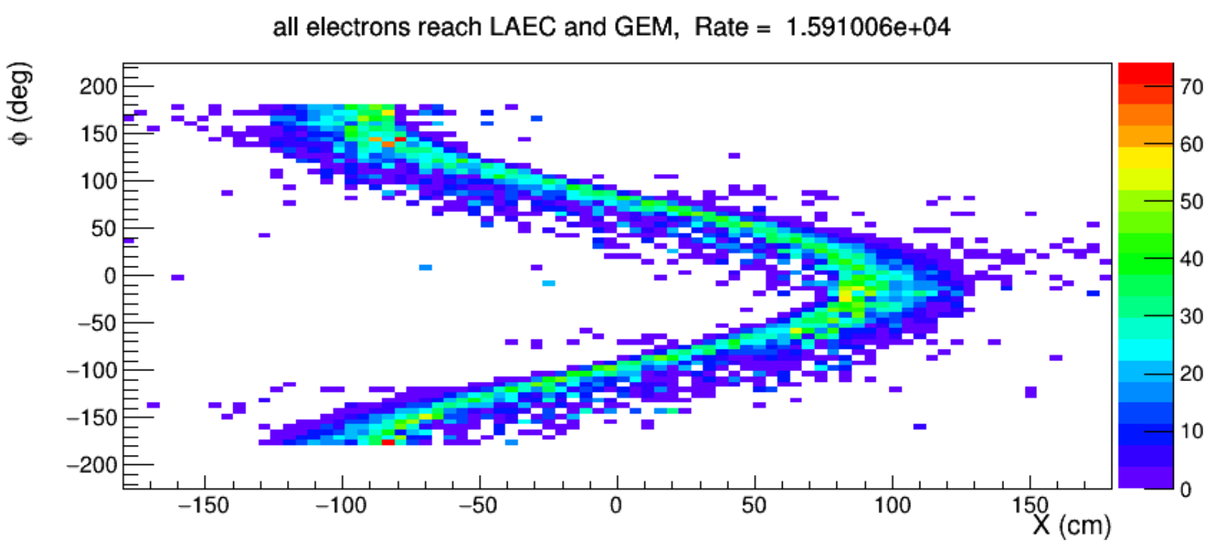


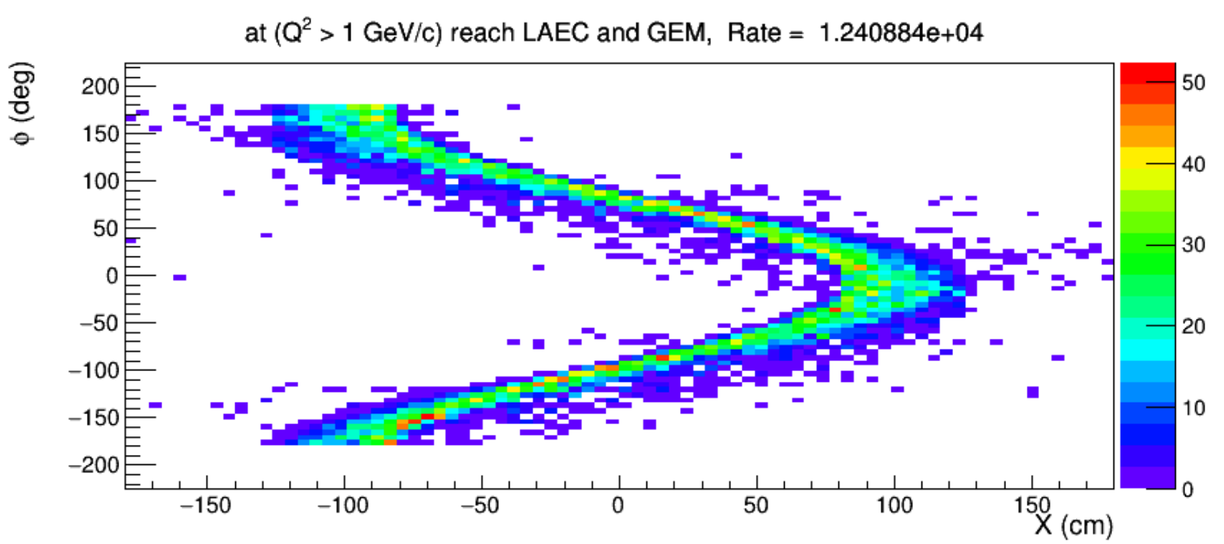


The plots are from the He^3 target configuration simulations



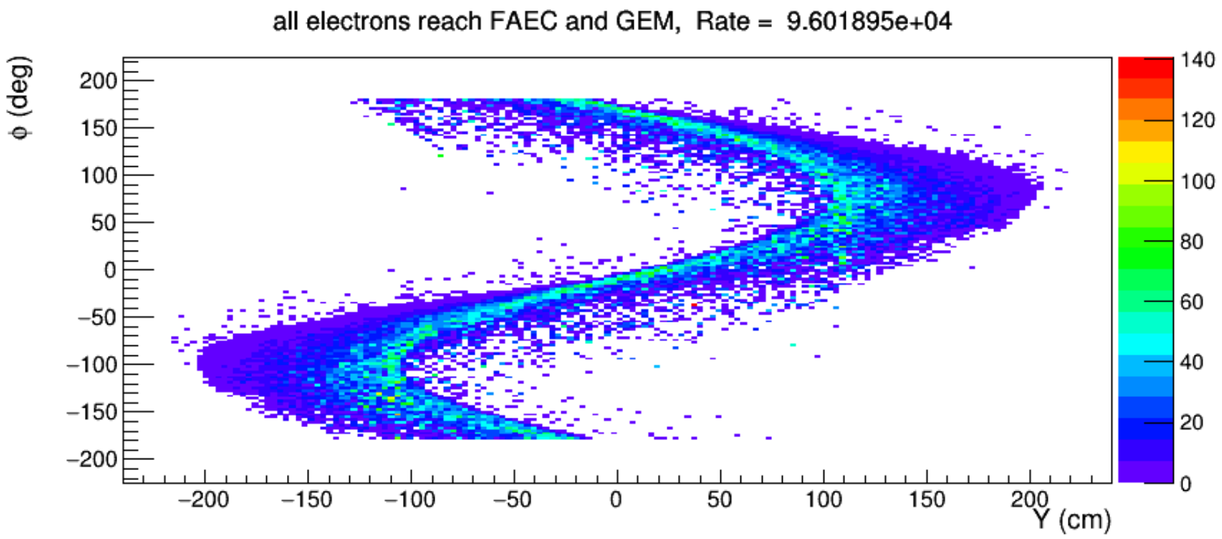


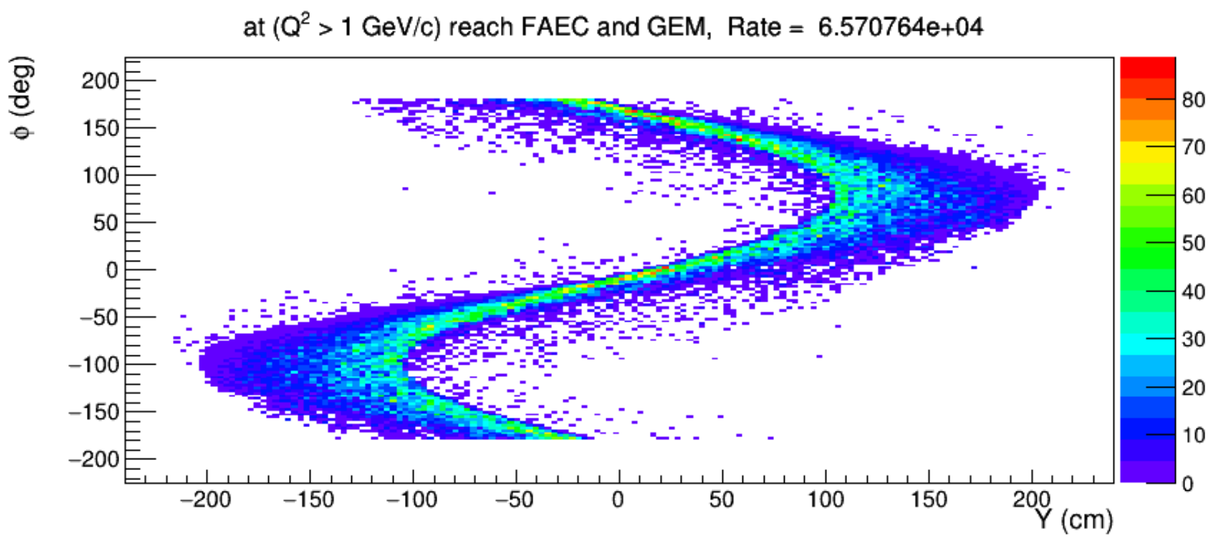


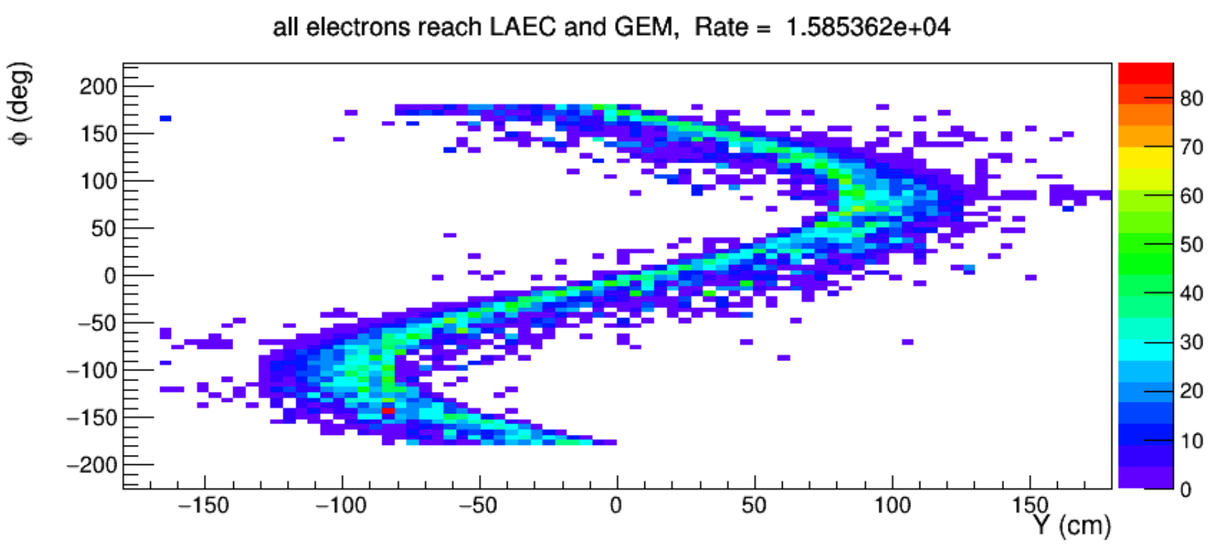


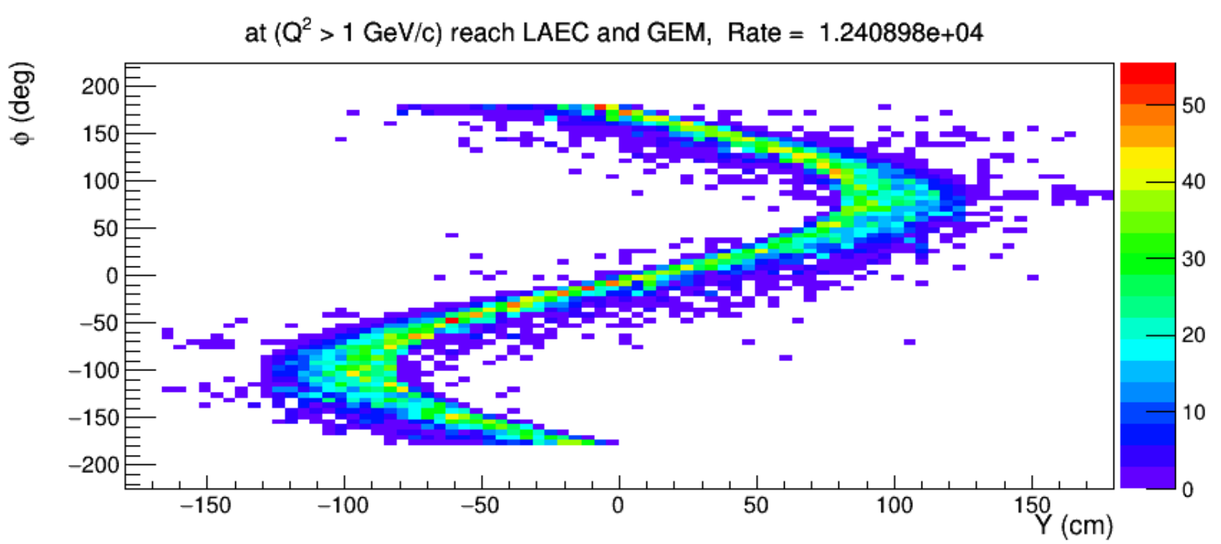
- The electron Rates in the plots are given in Hz

The plots are from the He^3 target configuration simulations









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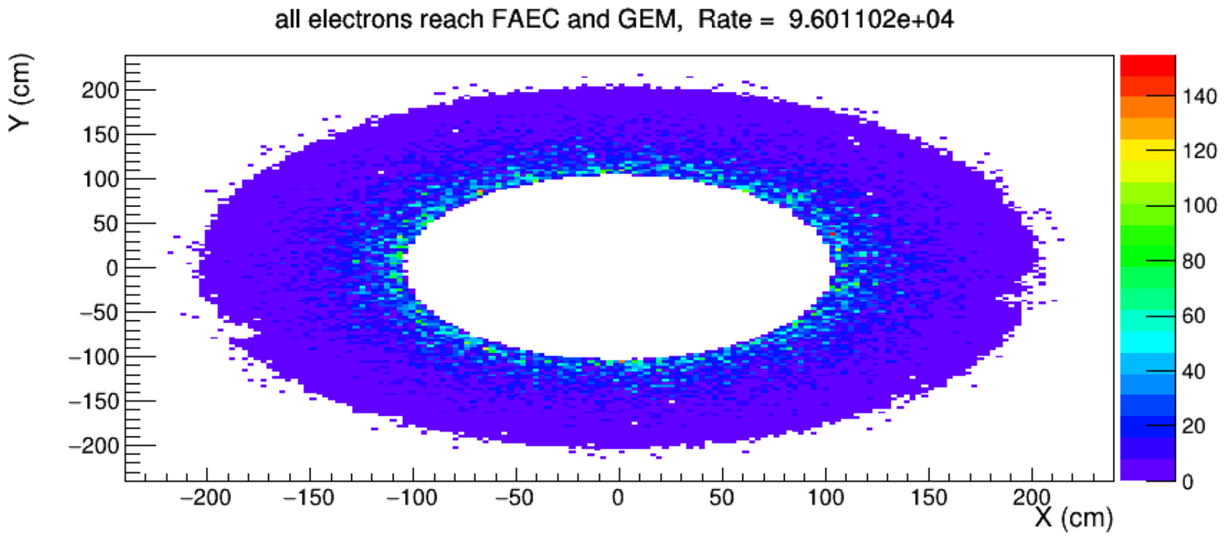
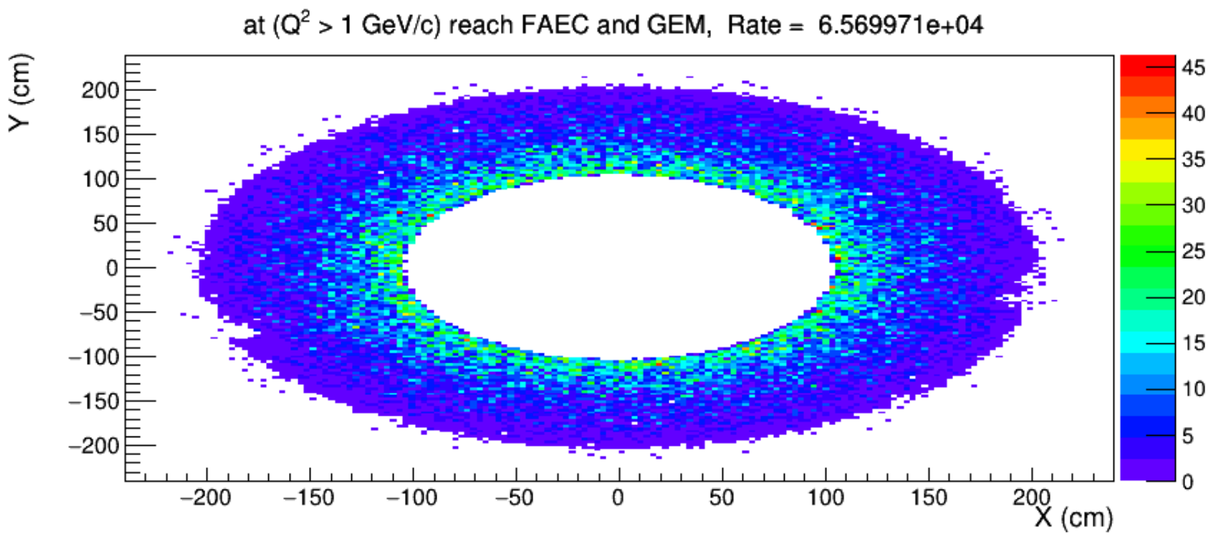
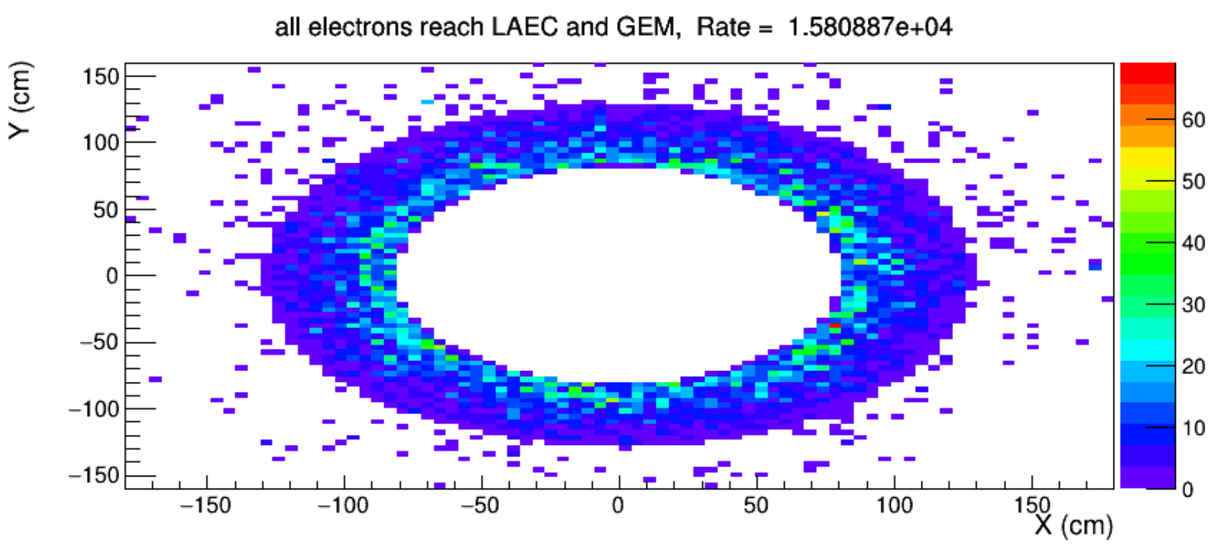
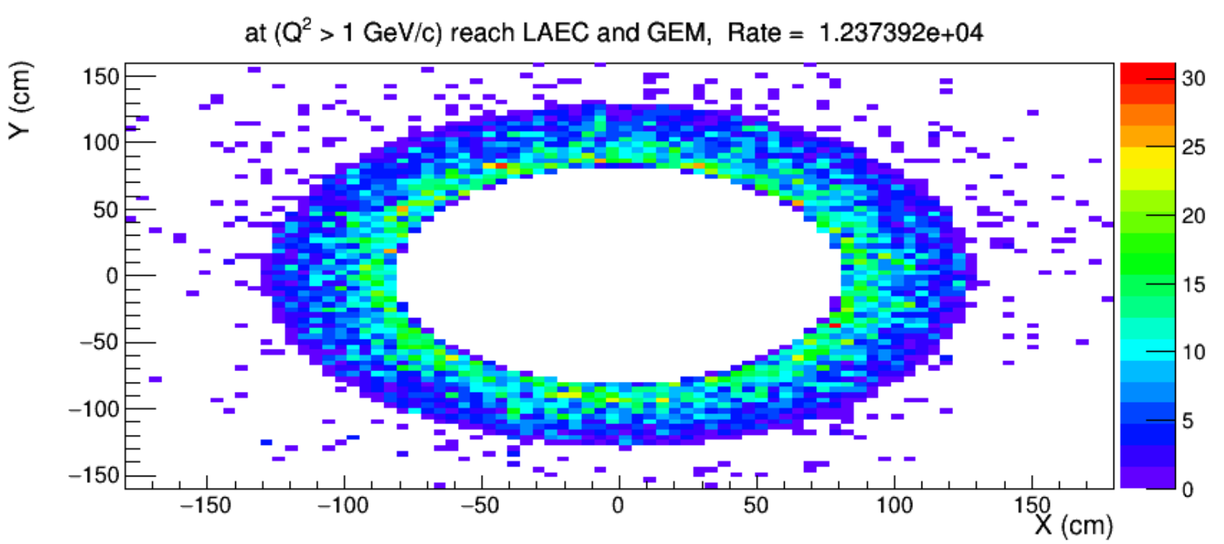
The plots are from the He^3 target configuration simulations









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