CLAS Collaboration Meeting

ALERT reconstruction and first results

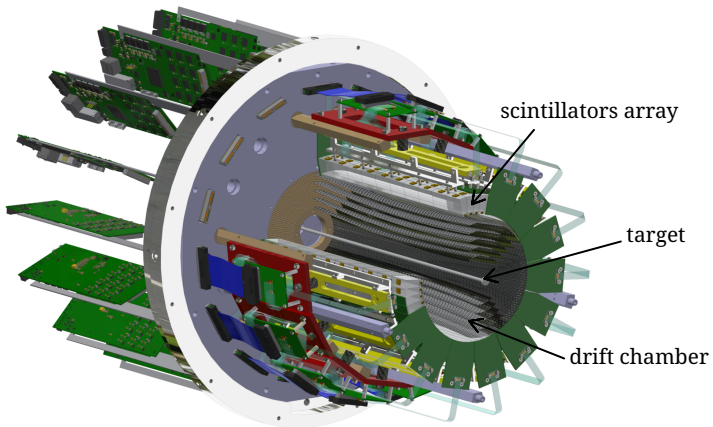
Felix Touchte Codjo

Supervisor : Raphaël Dupré

November 18, 2026

ALERT experiment

- ALERT is an extension of CLAS eg6 at higher luminosity, 12 GeV era
- It based on a new detector, A Low Energy Recoil Tracker
  - Along with the ^{4}He, identify the two isobars ^{3}He et ^{3}H
  - With kinematics: $70 < p < 400$ MeV/c, $\theta > 45°$
  - To be placed inside a 5T solenoid magnet
  - To be transparent to the particles detected by CLAS
- ALERT is a combination of a drift chamber (AHDC) and an array of scintillators (ATOF)
- The run period was from April 2025 to early September 2025

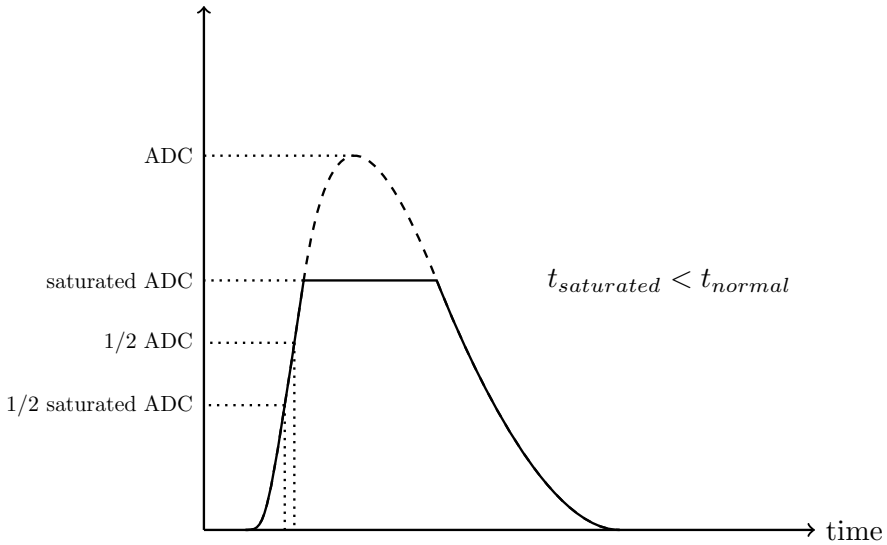


- Statistics in percentage for 6.54×10^{10} trigger events collected.

Target \ Beam	10.68 GeV	6.47 GeV	2.24 GeV	**Total**
^{4}He	58.06	7.32	2.11	67.49
^{2}D	27.13	0.07	2.06	29.26
p	0.21	0.62	1.93	2.76
empty	0.28	0.21	0	0.49
Total	85.68	8.22	6.1	**100 %**

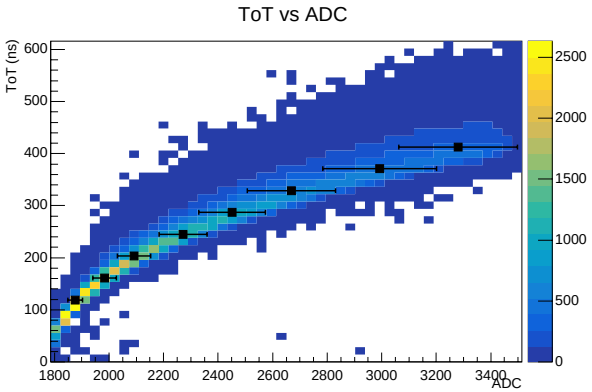
Issue with the time of saturated signals

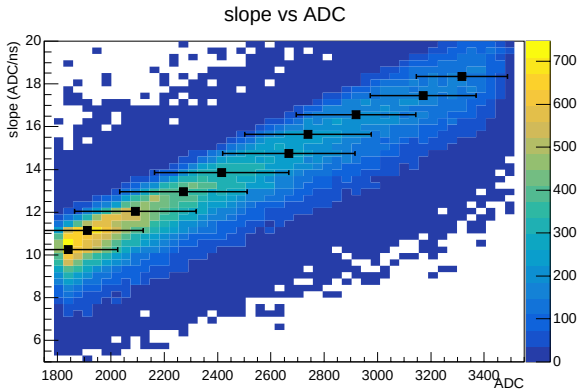
- The AHDC reconstruction starts with the processing of the signals recorded by the sense wires
- The time of arrival of the signals is extracted at half the amplitude
- For saturated signals, this creates a bias
  - The reconstructed time is under-estimated
  - This impacts the track reconstruction of α particles
  - Some hits may not even pass selection cuts and tracks can be lost
- Our approach to fix this issue is to reconstruct the ADC of the saturated signals

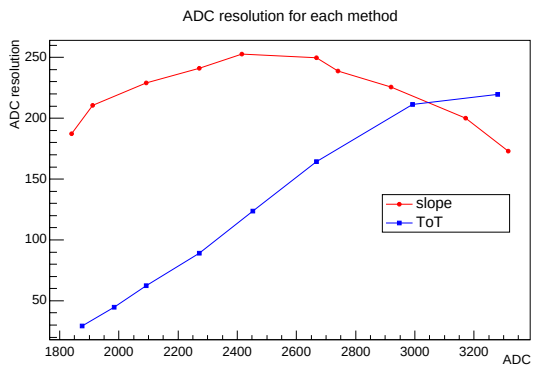


Finding the good method

- We look at two options
  - Using the time over threshold or the maximum of the leading edge slope
  - We compare the two methods using non-saturated signals
  - We look at how correlated these variables are to the ADC
- We decide to use the maximum slope method
  - Its linear behavior will be much easier to extrapolate
  - At larger ADC, the precision will likely be better
  - Large signals are often missing their trailing edge

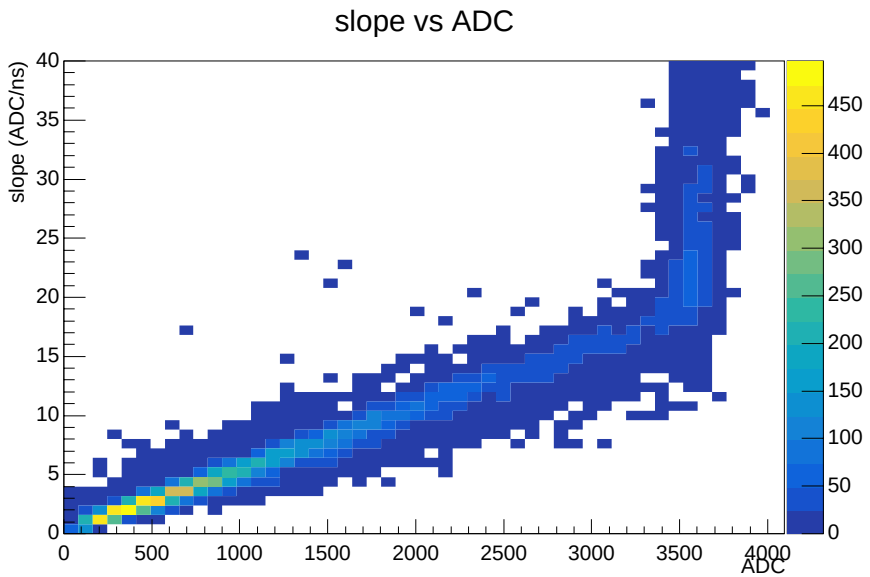


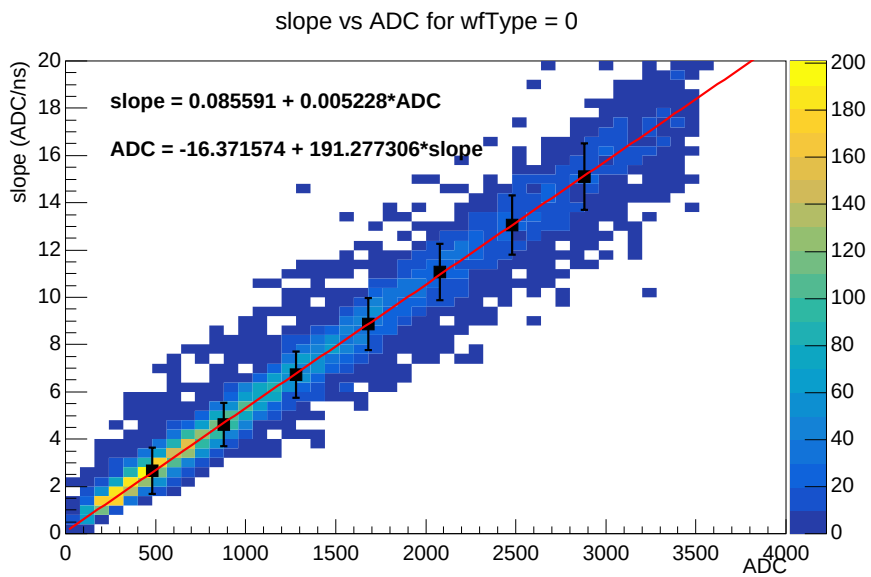




Reconstructing the ADC

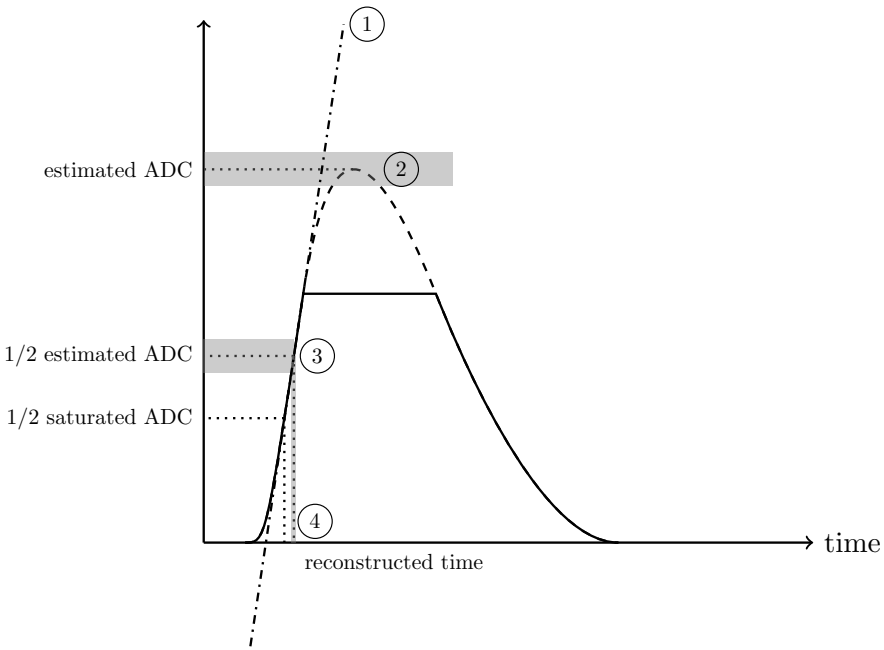
- The maximum of the slope of the signal is linearly correlated to the amplitude of the signal
  - Saturated hits seem to follow the trend
- We can use the slope to estimate the amplitude of the signal
  - We extract the ADC as a function of the slope from non-saturated signals and apply it to the saturated ones



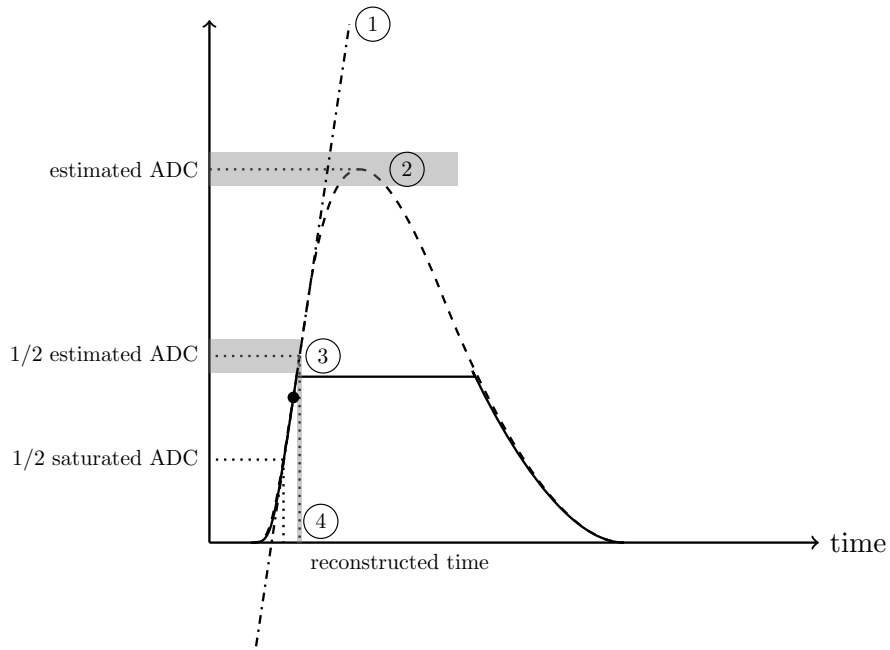


New time reconstruction

- With the corrected amplitude, we can recompute the time
  - We use the time at half the corrected ADC
  - However, sometimes even half ADC is above the saturation threshold
  - In this case, we extrapolate the signal based on the maximum slope to determine the time at half ADC



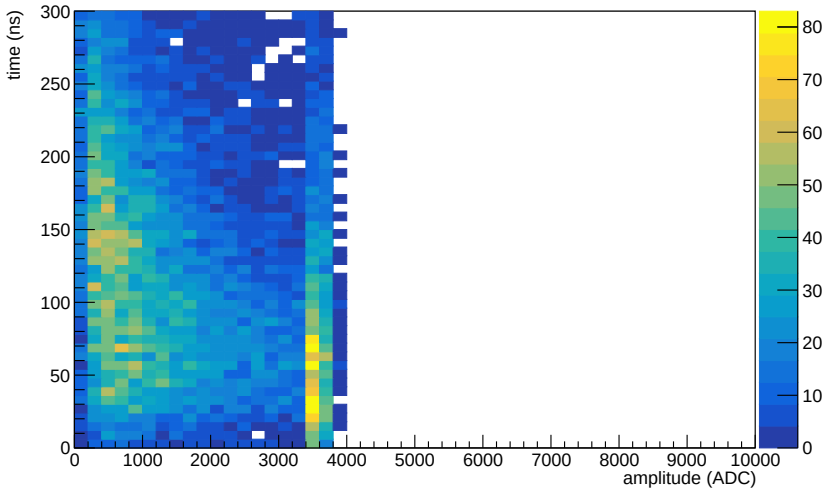
1/2 ADC below saturation
(direct interpolation)



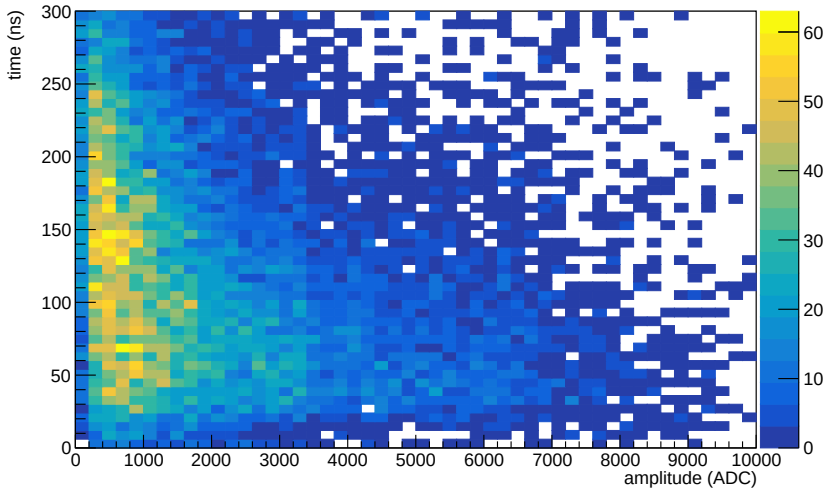
1/2 ADC below saturation
(use the maximum slope to extrapolate)

Results - Effect of the correction

- Before correction
  - We had an accumulation of hits around 3600 ADC
  - Saturated hits had abnormal tail in the low time direction
- After correction
  - We reconstruct ADCs above saturation
  - There are no more hit accumulation at low time and large amplitude
  - We move from 2244 reconstructed tracks to 2478
    - → Using 10 files of run 21476, ^{4}He, 10.6 GeV
    - → Most of the gained tracks have very high energy deposit



before

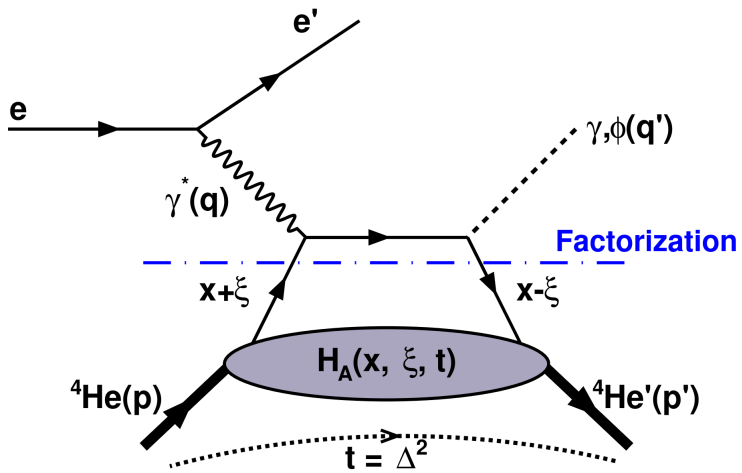


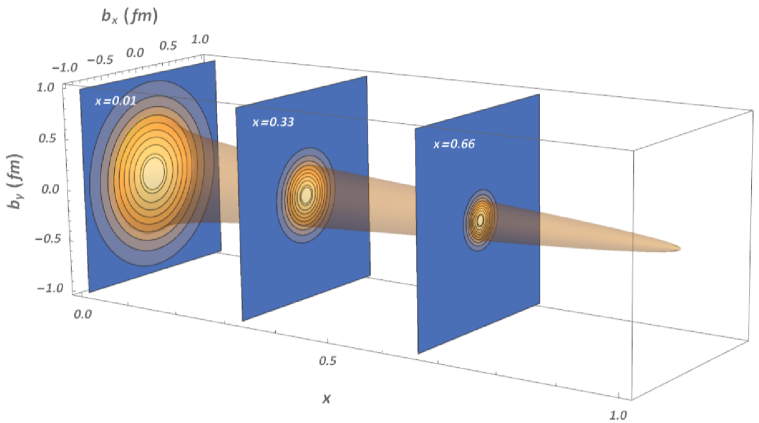
after

Preliminary DVCS analysis

- The calibration of the data is not completed, but we can already observe some processes within the ALERT data
- I look at the coherent Deeply Virtual Compton Scattering (DVCS) off ^{4}He to access the quark GPDs
- In the following slides, I describe the procedure to select DVCS events and I present a preliminary extraction of the Beam Spin Asymmetry (BSA)

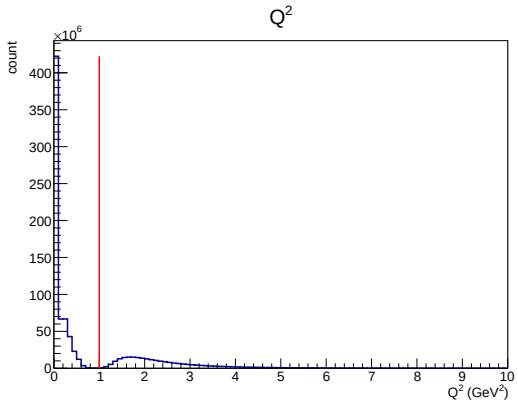
$$A_{LU} = \frac{1}{P_B} \cdot \frac{N^+ - N^-}{N^+ + N^-}$$

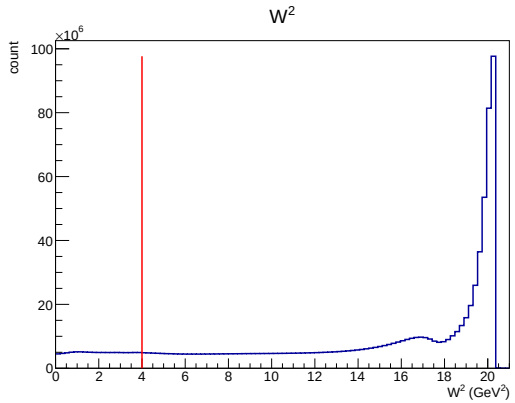


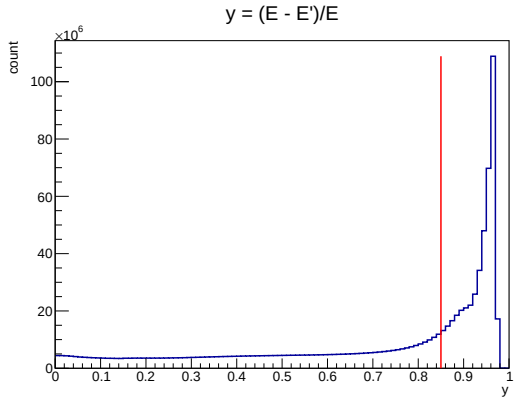


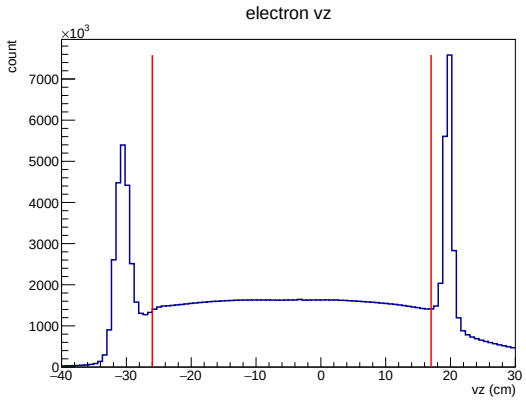
Electron selection cuts

- We select particles with pid $= 11$ in REC::Particle
- $Q^2 > 1$ GeV^2
- $W^2 > 4$ GeV^2
- $y < 0.85$
- -26 cm $<$ vz < 17 cm

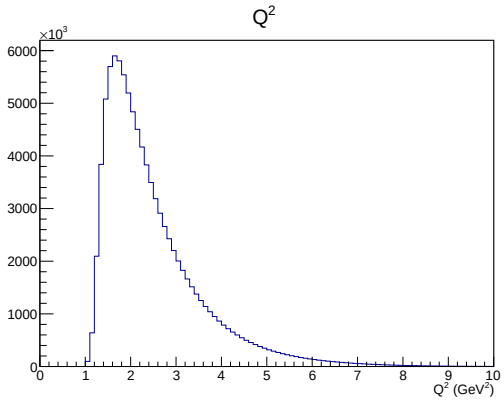


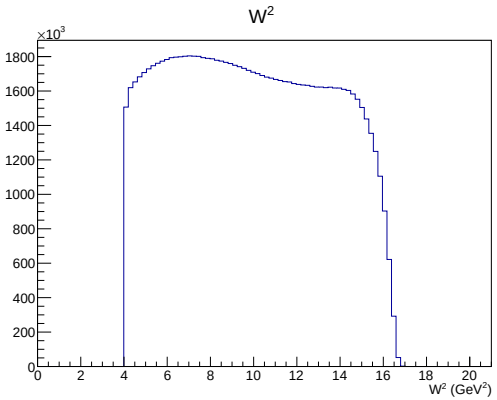


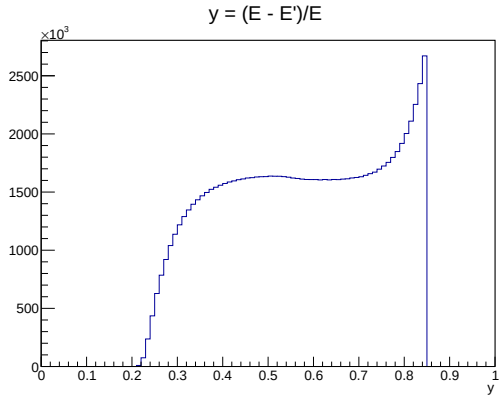


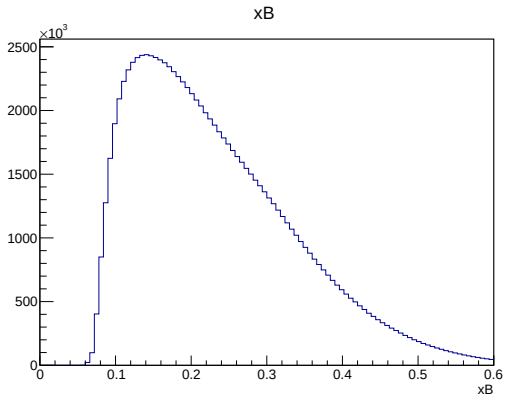


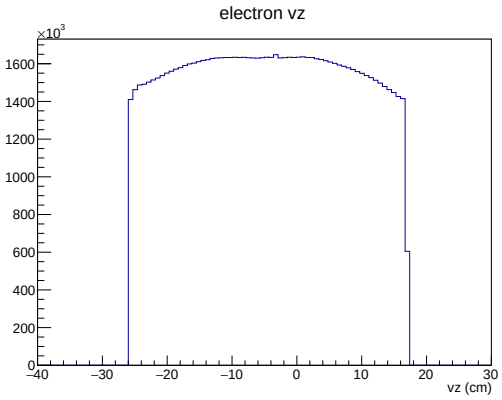
Electron distributions after cuts

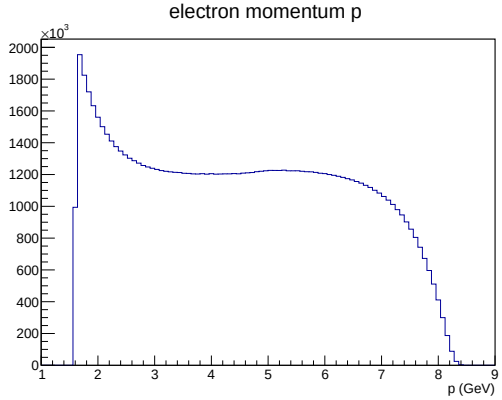


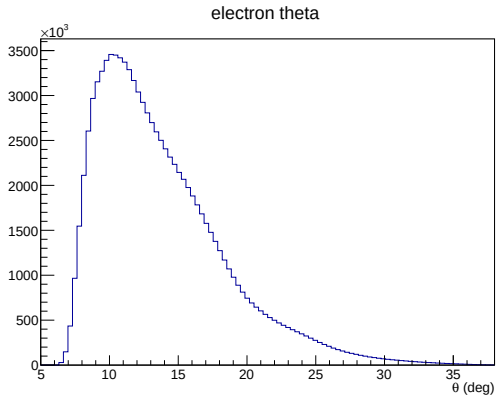


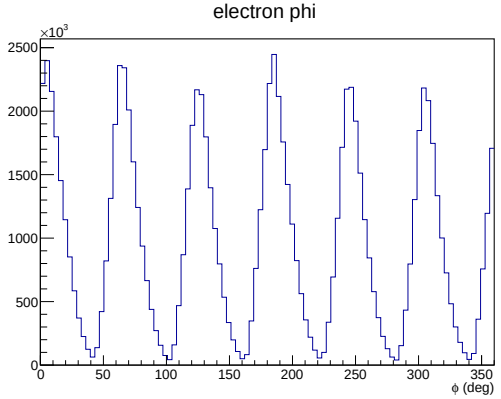






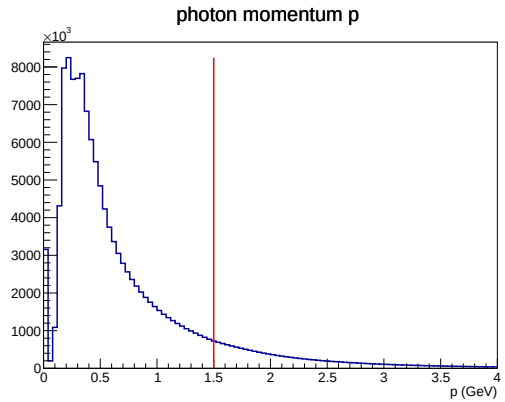


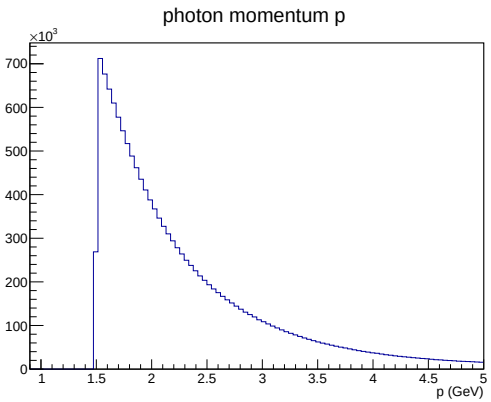


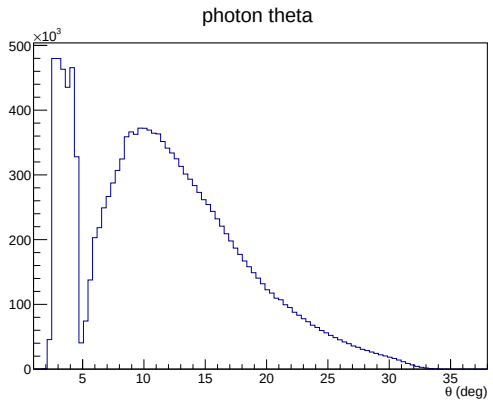


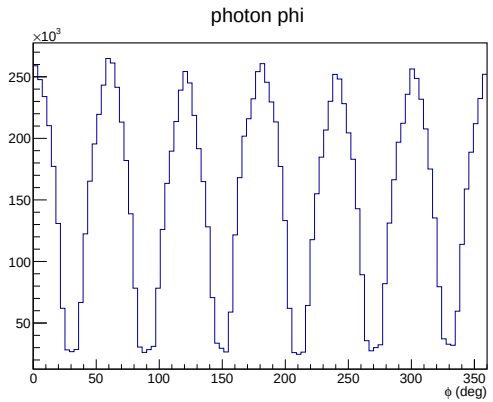
Photon selection cuts and distributions

- We require the detection of 1 electron
- We select particles with pid $= 22$ in REC::Particle
- We select high energy photons : $p_\gamma > 1.5$ GeV



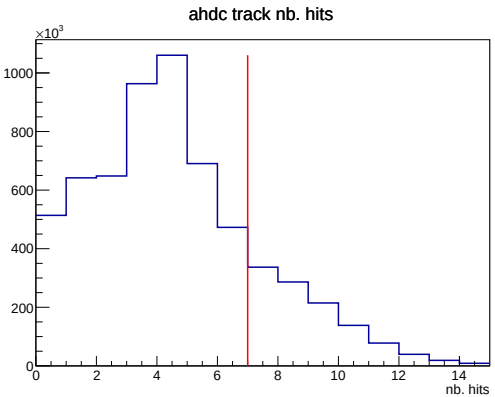


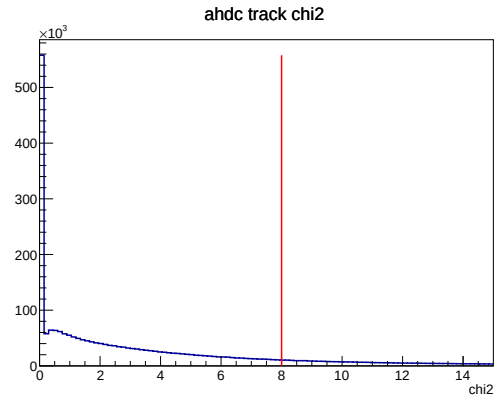


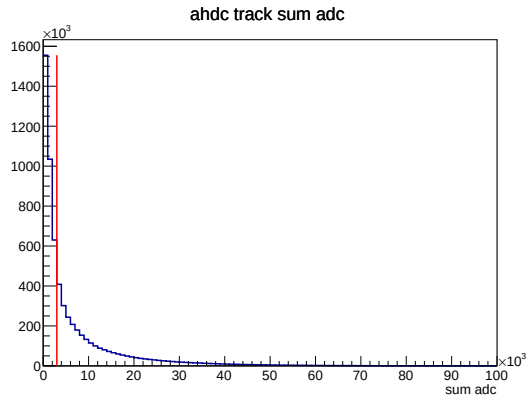


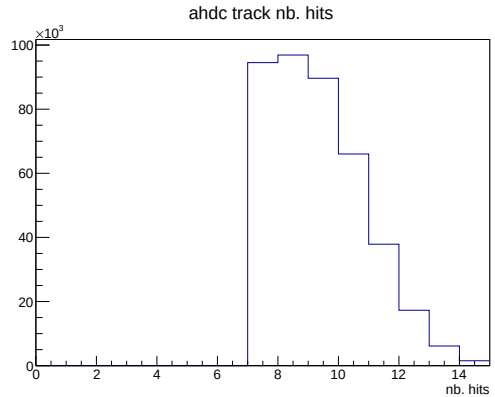
AHDC track selection

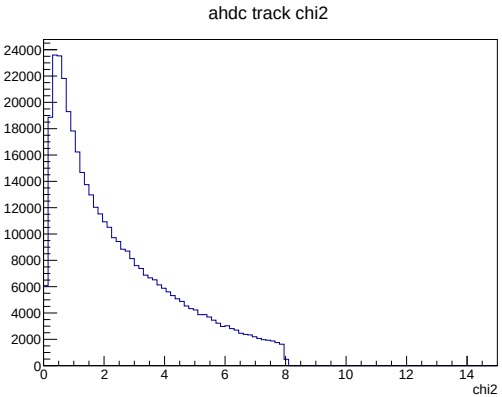
- We require the detection of 1 electron and 1 photon
- The track quality should be good : nb. hits ≥ 7, $\chi^2 < 8$
- The AHDC is not in the Event Builder yet, so we select ^{4}He based on their big deposited energy : $\Sigma \text{ADC} > 10000$

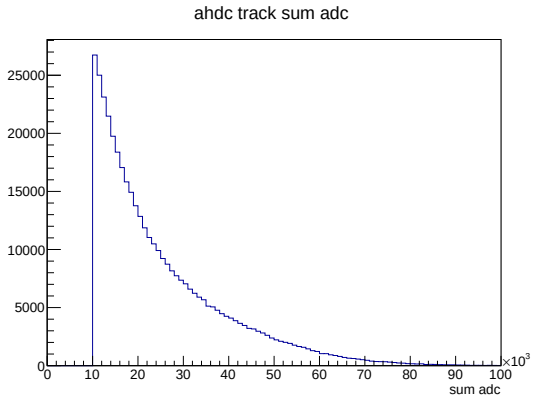






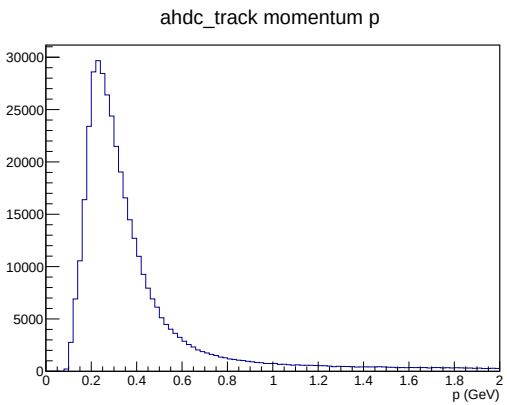


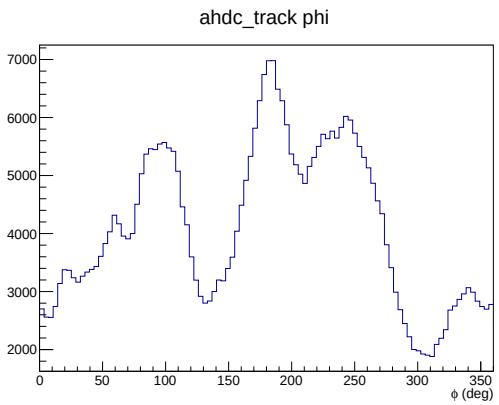


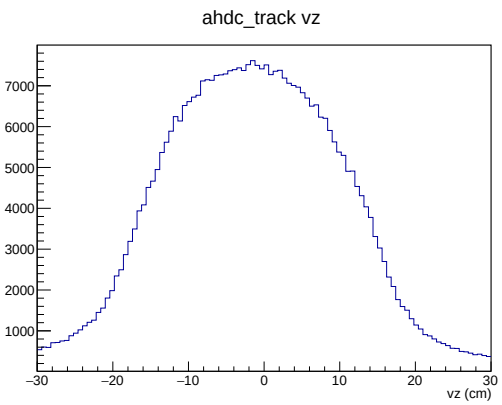


AHDC track kinematics

- The AHDC currently reconstructs p/q, so we correct the momentum by multiplying it by 2 (the charge of ^{4}He)
- The theta reconstruction is not very precise, so we don't use it here

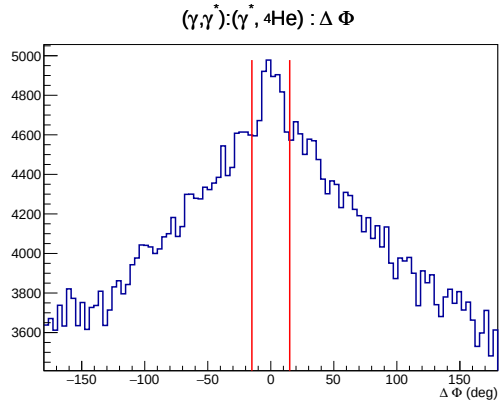


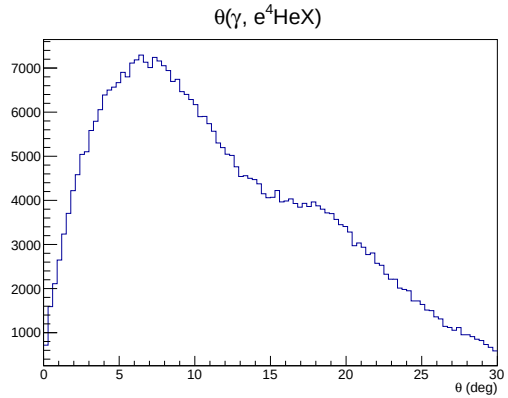


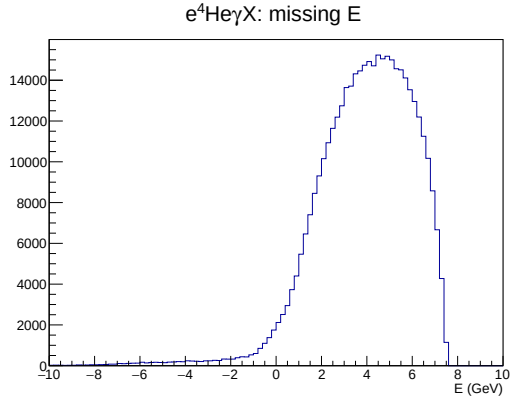


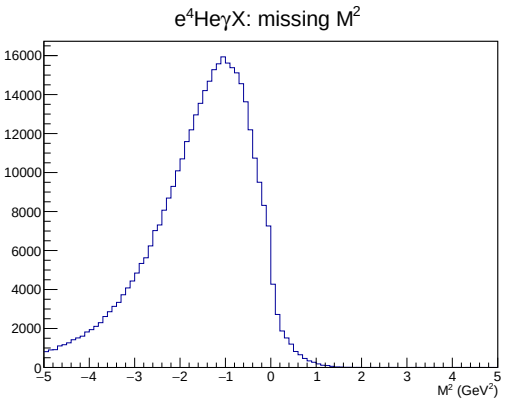
DVCS candidates

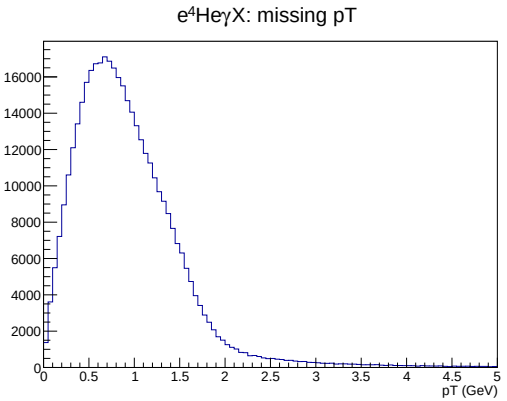
- After selecting 1 electron, 1 photon and 1 AHDC track, we still need to apply the DVCS exclusivity cuts
- At this stage, only $\Delta\Phi$ has a clear peak
- I choose : $|\Delta\Phi| < 15°$

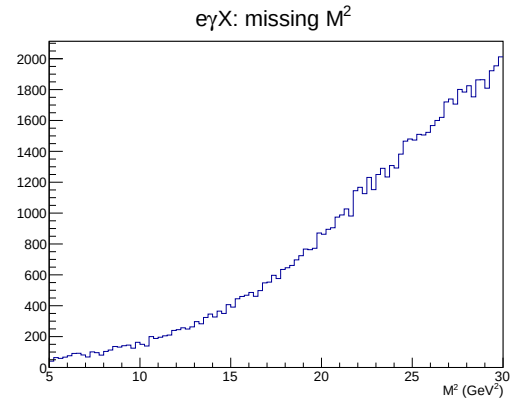






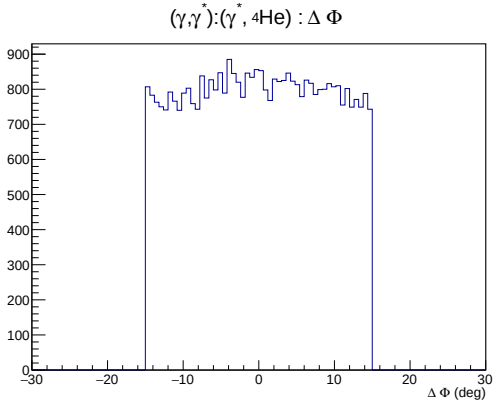


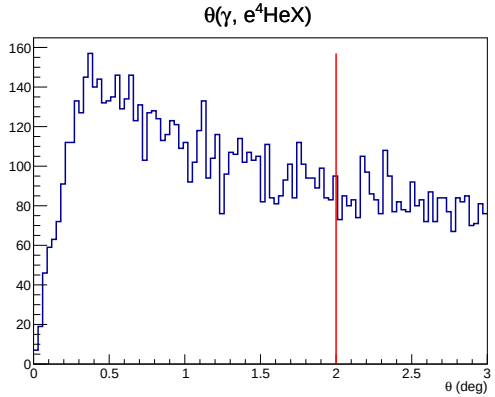


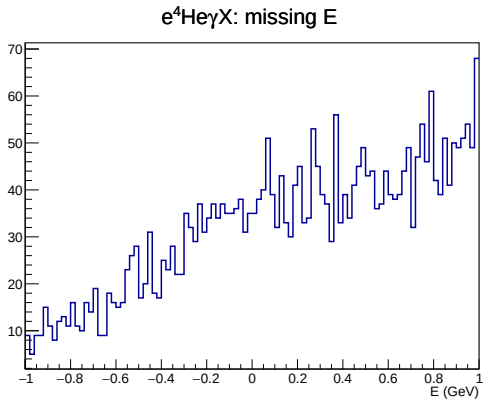


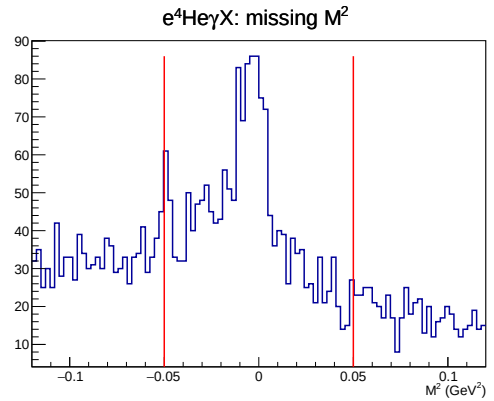
DVCS candidates after the $\Delta\Phi$ cut

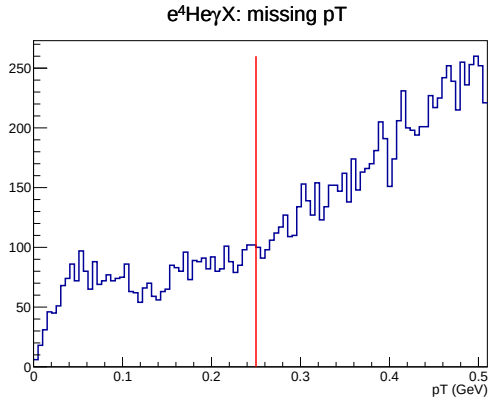
- After the cut on $\Delta\Phi$, others peaks appear
- The others cuts are :
  - cone angle $\theta < 2°$
  - pT < 0.25 GeV
  - $e^4\text{He}gX.\text{M2} < 0.05$ GeV^2
  - $egX.\text{M2} < 20$ GeV^2

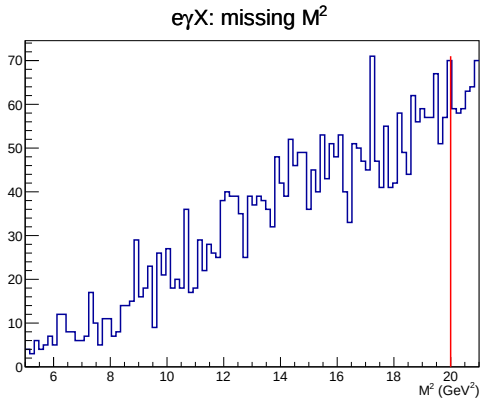






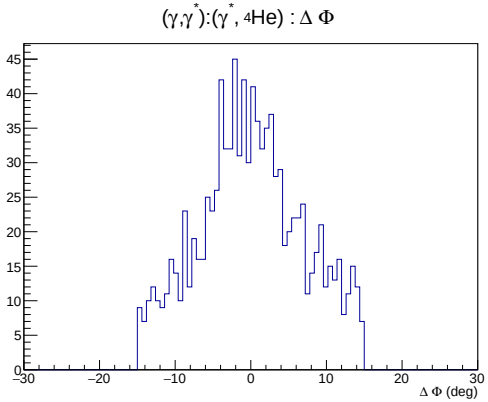


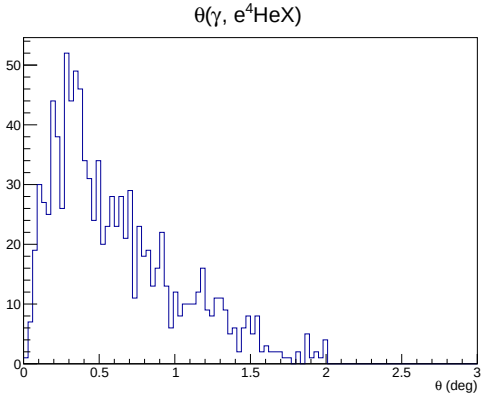


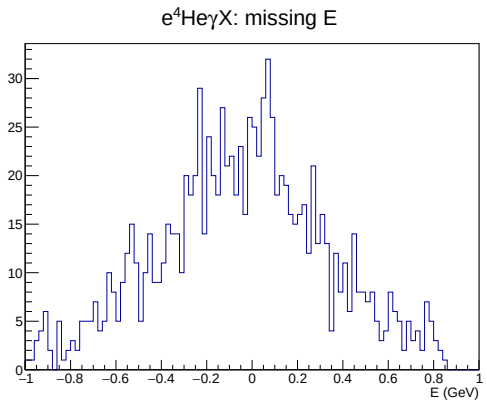


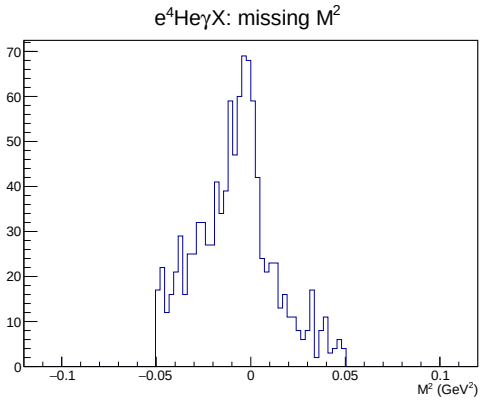
DVCS exclusivity distributions

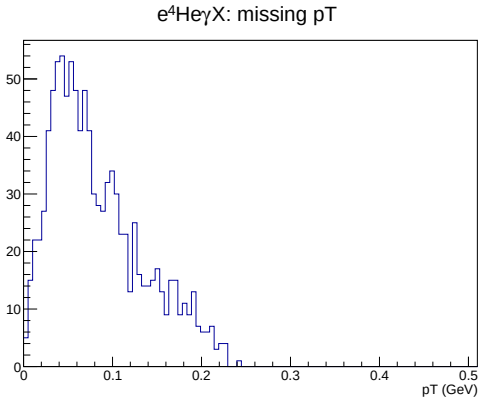
- Here are the distributions after all exclusivity cuts

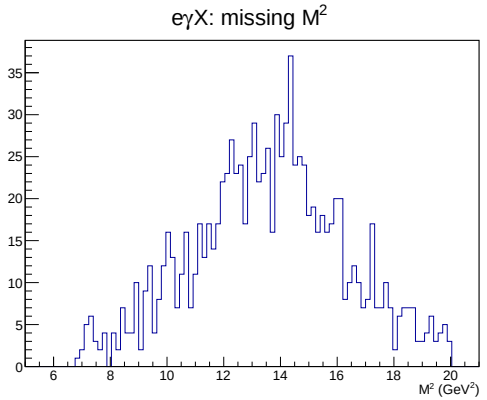






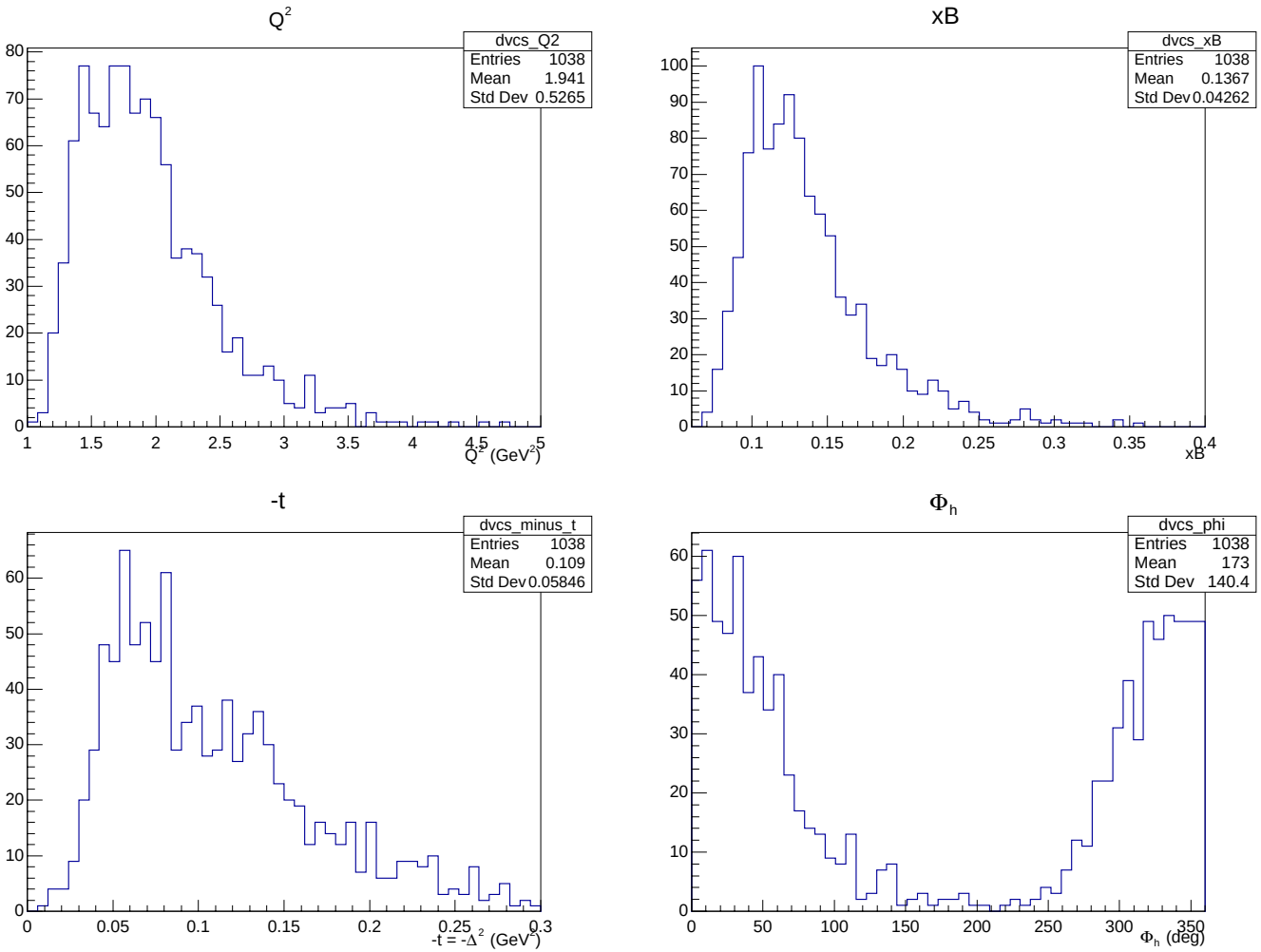






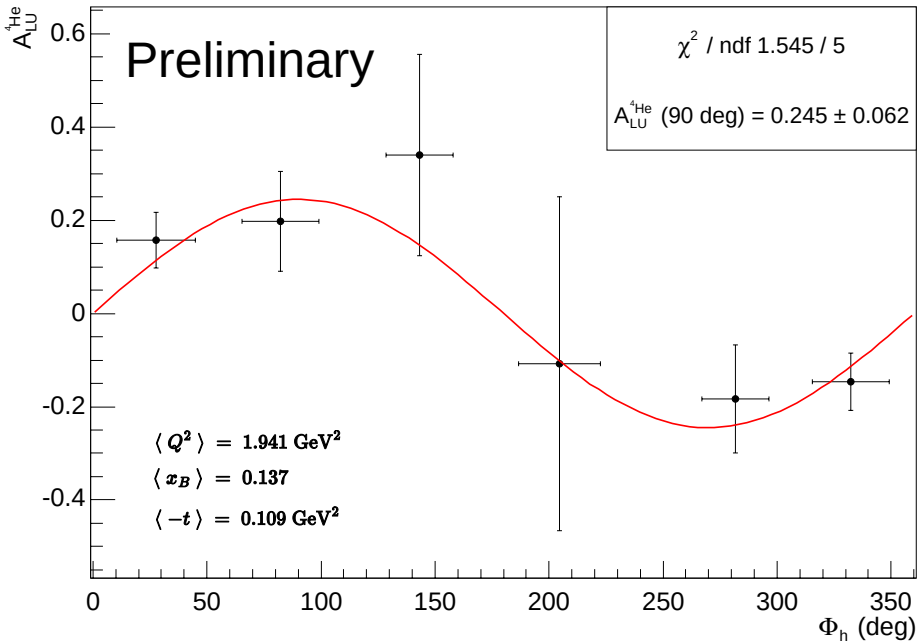
Phase space

- $\langle Q^2 \rangle = 1.941$ GeV^2, $\langle x_B \rangle = 0.137$, $\langle -t \rangle = 0.109$ GeV^2



Preliminary BSA extraction

- Warnings
  - The AHDC reconstruction is not completed (bugs, fine-tuning)
  - The calibration is still ongoing (ALERT ~~and CLAS~~)
  - We made basic selection cuts
  - The BSA has been integrated over Q^2, x_B and $-t$
  - The errors are only statistical (no π^0 background subtraction)
- The study has been done on 7.53 % of the data
- However, we can already see an asymmetry



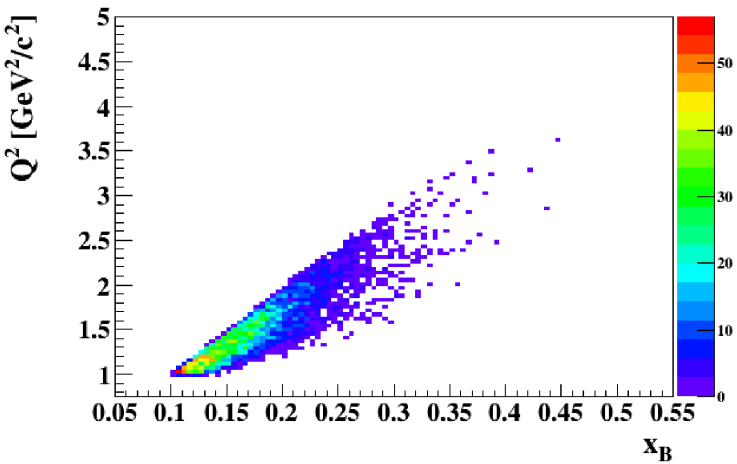
Backup slides

Technical details on the dataset

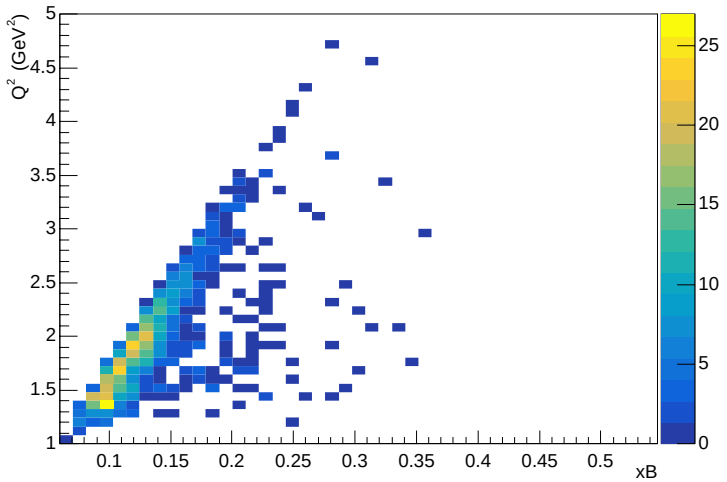
- I used p0v12 data from various cooking
  - /volatile/clas12/rg-l/production/p0v12/CalibTrain/calib/recon/
  - /volatile/clas12/rg-l/production/p0v12/FullRuns/calib/recon/
  - /volatile/clas12/rg-l/production/p0v12/FullNew/calib/recon/
  - /volatile/clas12/rg-l/production/p0v12/NewRunsforKlest/mon/recon/
- List of all runs used : ^{4}He target, 10.6 GeV
  21567, 21460, 21638, 21497, 21536, 21517, 21552, 21626, 21610, 21781, 21559, 21627, 21606, 21575, 21472, 21459, 21782, 21481, 21568, 21534, 21533, 21471, 21576, 21520, 21518, 21793, 21794, 21806, 21807, 21855, 21858, 21915, 21919, 21973, 21976, 22522, 22523, 22524, 22526
- Corresponding nb evio files : 47995
- Total RG-L evio files for ^{4}He target at 10.6 GeV: 637732
- Fraction of data used : 7.53 %

Phase space comparison

- ALERT covers lower x_B and higher Q^2 values



CLAS eg6



ALERT