# Experimental study of the strong interaction with the spectrometer CLAS and ALERT at JLab

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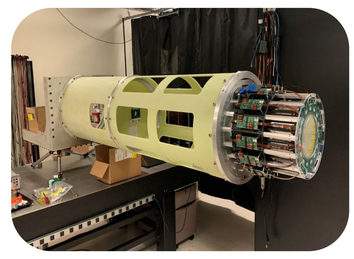
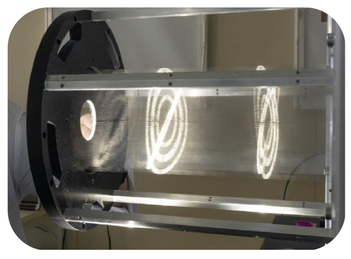


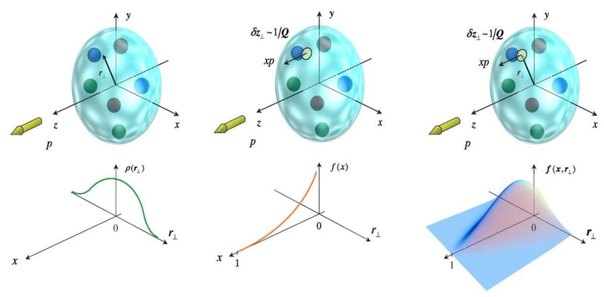


## 1 Overview

- ALERT is an *ongoing* experiment at Jefferson Lab, in *hall B*. It aims to enhance our understanding of the nuclear structure by achieving very sophisticated measurements on the **$^4$He** nucleus.
- At the heart of the experiment is the new detector of the same name, ALERT, which stands for **A L**ow **E**nergy **R**ecoil **T**agger.
- The data taking of the experiment started in *April 2025* and is scheduled for completion in *September 2025*.

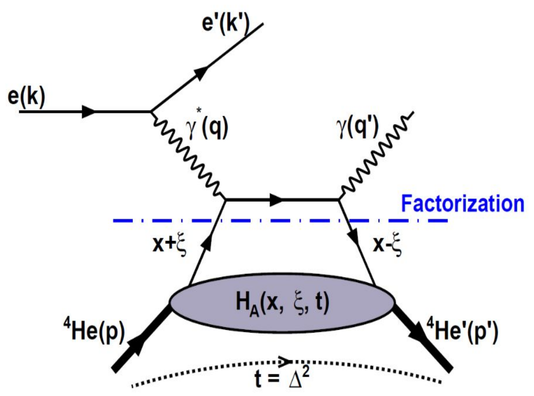
## 2 Physics motivation

- Extract nuclear **Generalized Parton Distributions** (GPDs)
- Measurement on $^4$He, because :
  - spin 0 nuclear target → only 1 chiral-even GPD, $H_A$
  - strong binding energy and high nuclear density
- Study of the **EMC effect**



## 3 A proposed measurement

- **Deeply Virtual Compton Scattering** (DVCS) on $^4$He



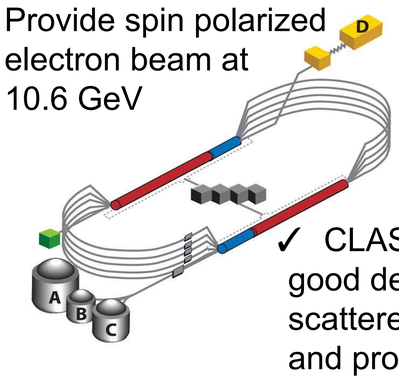

✓ **GPD $H_A$** ← *Compton Form Factor* $\mathcal{H}_A$ ← **Beam-spin asymmetry $A_{LU}$**

$$A_{LU}(\phi) = \frac{d^5\sigma^+ - d^5\sigma^-}{d^5\sigma^+ + d^5\sigma^-}$$

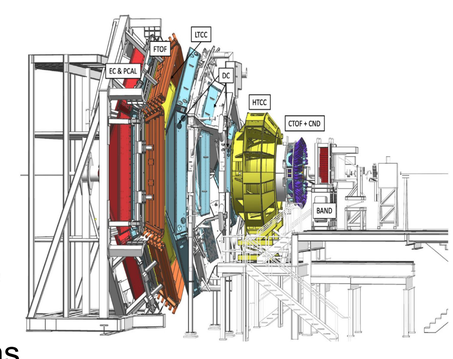
## 4 Experimental setup

- ***Continuous Electron Beam Accelerator Facilities (CEBAF)***
- ***CEBAF Large Acceptance Spectrometer (CLAS)***

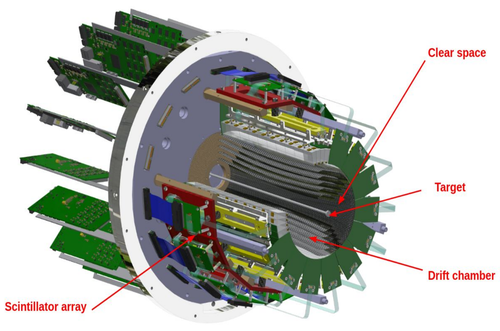
✓ Provide spin polarized electron beam at 10.6 GeV




✓ CLAS provides a good detection of the scattered electrons and produced photons




★ **ALERT**




- Hyperbolic drift chamber (AHDC) + time-of-flight system (ATOF)
- Track reconstruction + particle identification : p, d, $^3$H, $^3$He, $^4$He

✓ **AHDC**

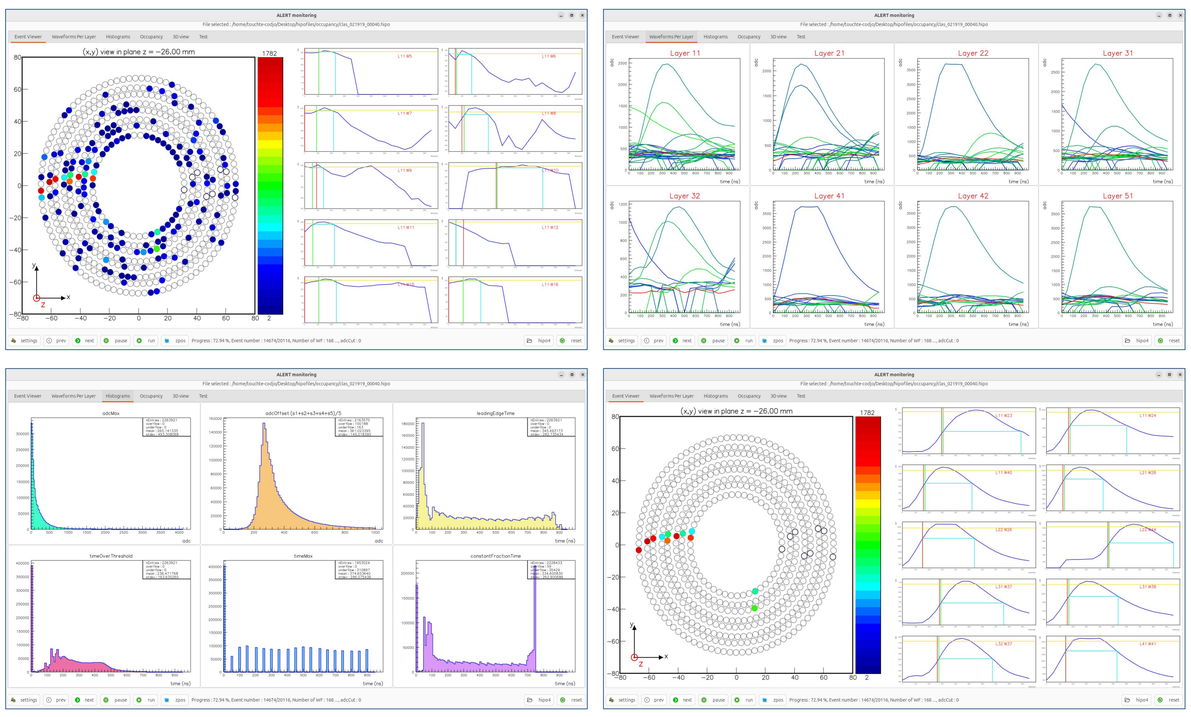
- gaseous detector, mixture of He (80%) + $CO_2$ (20%)
- 3026 aluminium wires, organized in 21 concentric layers around the beam axis, 2 mm apart, 512 sense wires distributed over 8 layers
- +10° or -10° stereo angle, 40 mm between the inner and the outer layers

✓ **ATOF**

- cylindrical plastic scintillator array that is readout by SiPMs
- 15 identical modules, each module consists of 4 scintillator “bars” and “wedges”
- thickness bars (3 mm), wedges (2 cm)

## 5 Ongoing work

- **Data taking,** monitoring, software development, analysis




✓ Decoding, hit rejection, track reconstruction, calibration

## 6 References and links

[1] Partonic Structure of Light Nuclei, arXiv:1708.00888v2
[2] ALERT manual, hall B Run Group L wiki
[3] **amon**, https://github.com/ftouchte/amon

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