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Physics Program

Original Physics Program

Deuterium and helium targets at 11 GeV

- Tagged DIS / EMC
- ^4He GPDs (DVCS & DVMP)
- Tagged DVCS

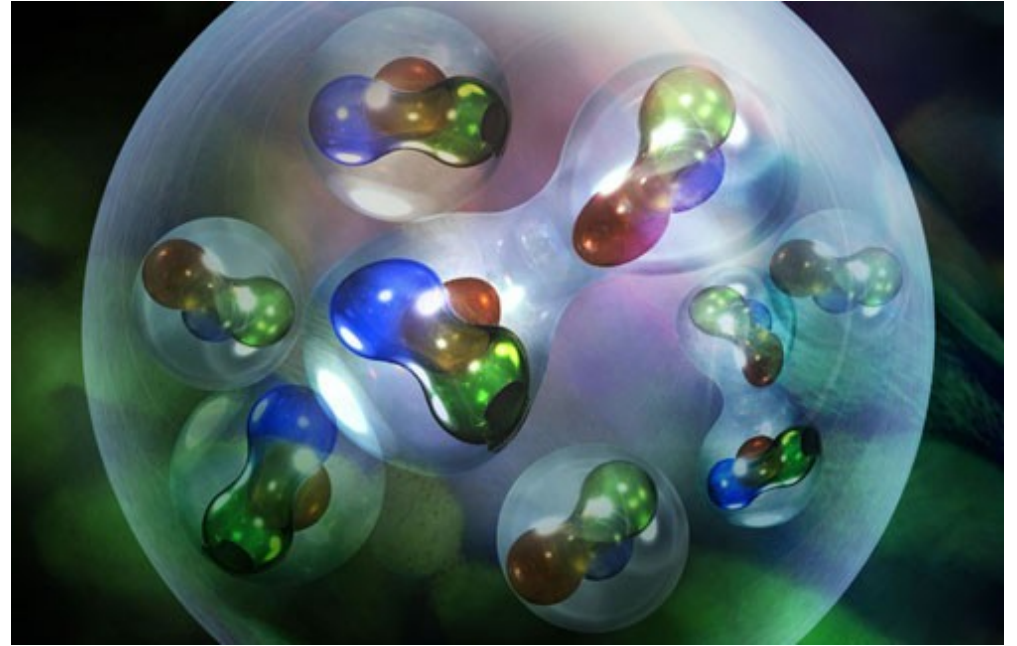
Recent extension

Helium at 6 GeV

- SRC with ALERT

Scheduled for

- 09/19/2024 until spring 25



The Nucleus as quarks and gluons



The ALERT Detector

Hyperbolic Drift Chamber (AHDC)

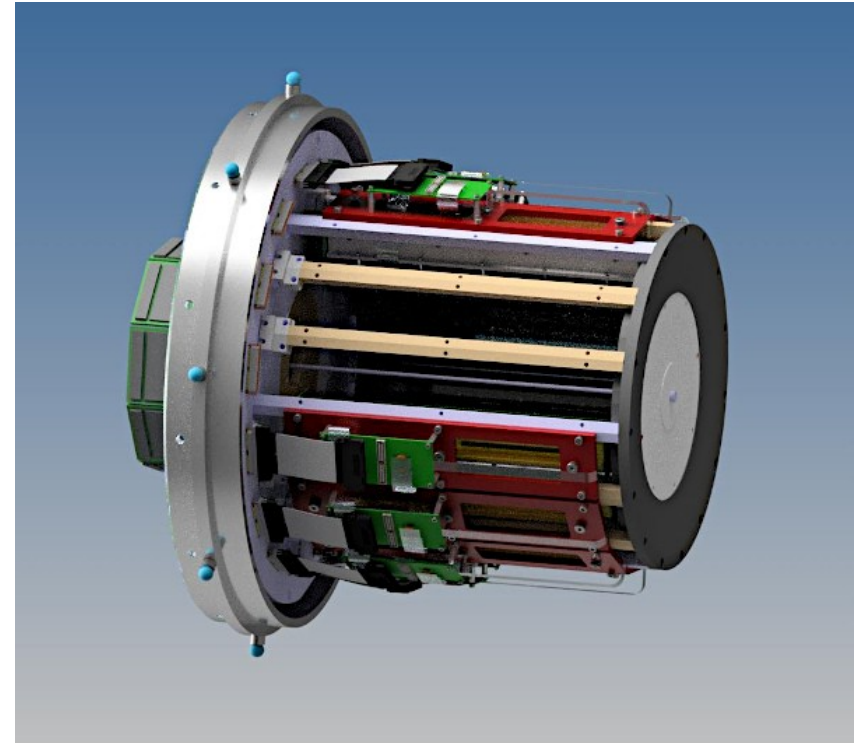
- He CO₂ drift chamber
- Aluminum wires spaced by 2mm
- Stereo-angle for z-resolution

Time-of-Flight (ATOF)

- Two layers for improved PID
 - First 2mm layer, read-out from both sides
 - Thick tiles, read-out from the back
- Using SiPM for read-out

Straw target filled with gas (~5 atm)

- Similar to bonus, eg6, and bonus12



AHDC Assembly

Design has not changed much

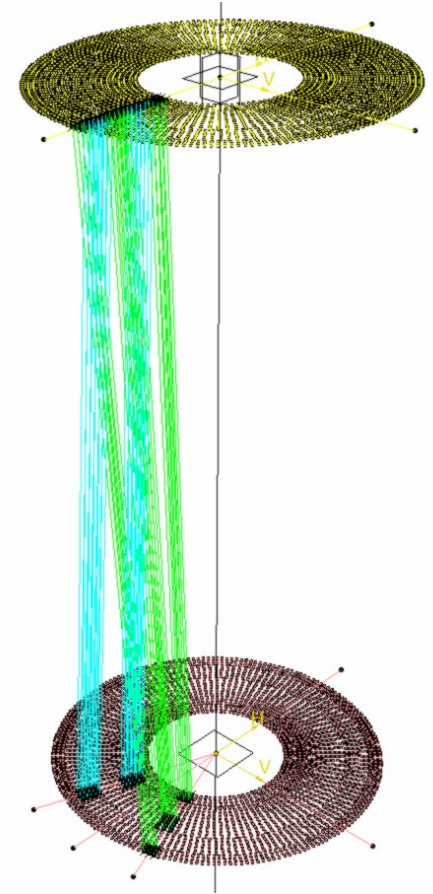
- We adjusted slightly the design of the connection boards for easier connections
- Details in the stringing procedure adapted

Wire procurement was difficult

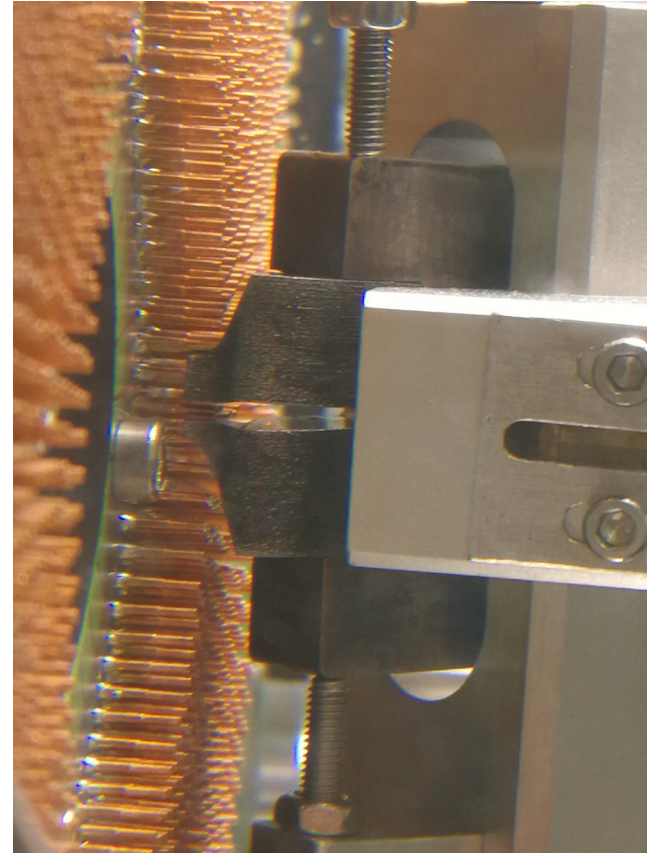
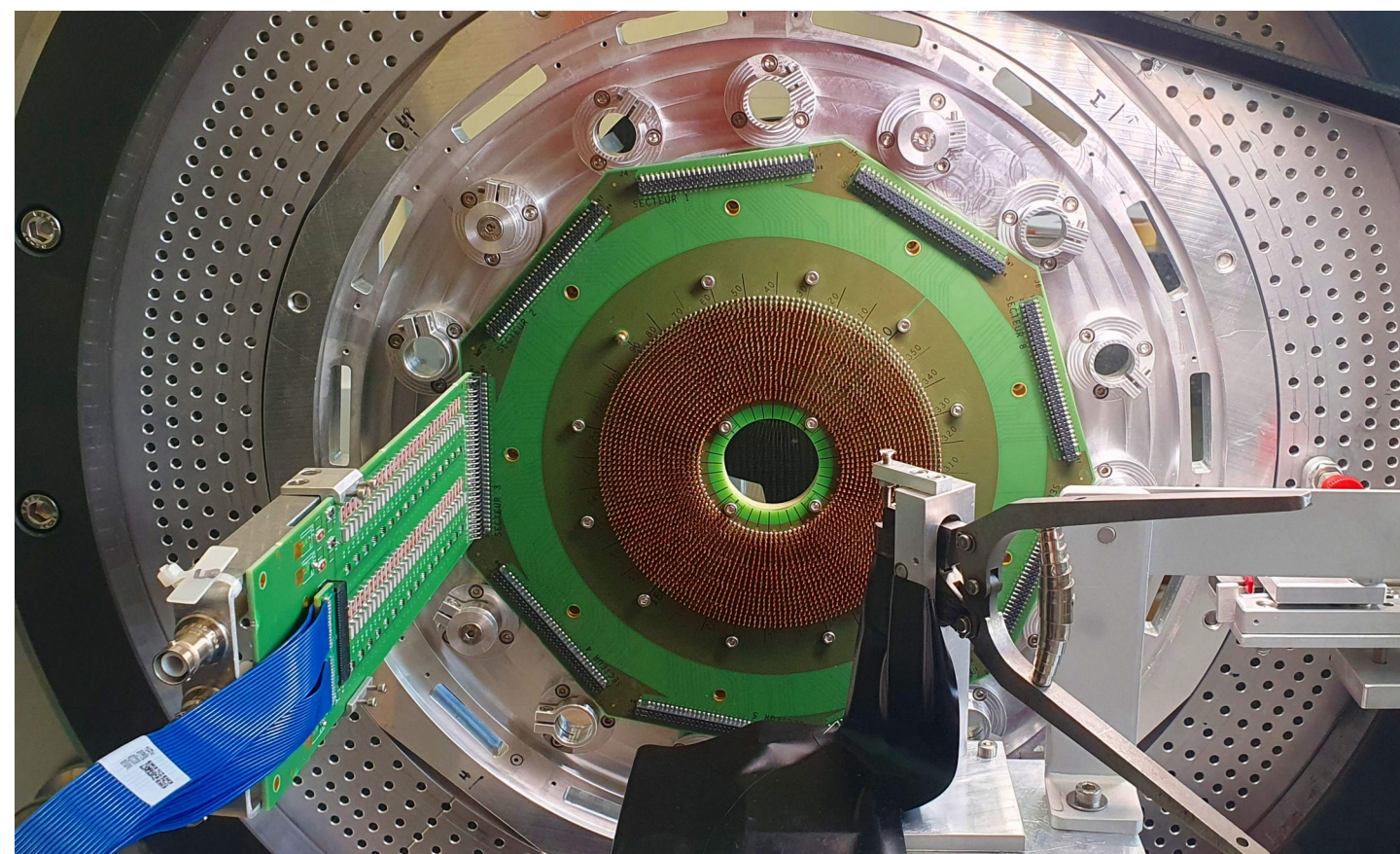
- 30 μ m aluminum wire
- We could not get historical wire properties
- Moreover wire was often curly, making manipulation difficult
- We made compromises

Everything was assembled in the Summer

- Tested in September



AHDC Ready to Start Stringing



November 8, 2023

R. Dupré – ALERT Status

5/14

AHDC Stringing

Started on 10th of October

- 3 full months of work are planned
- We keep track of every problems in the process

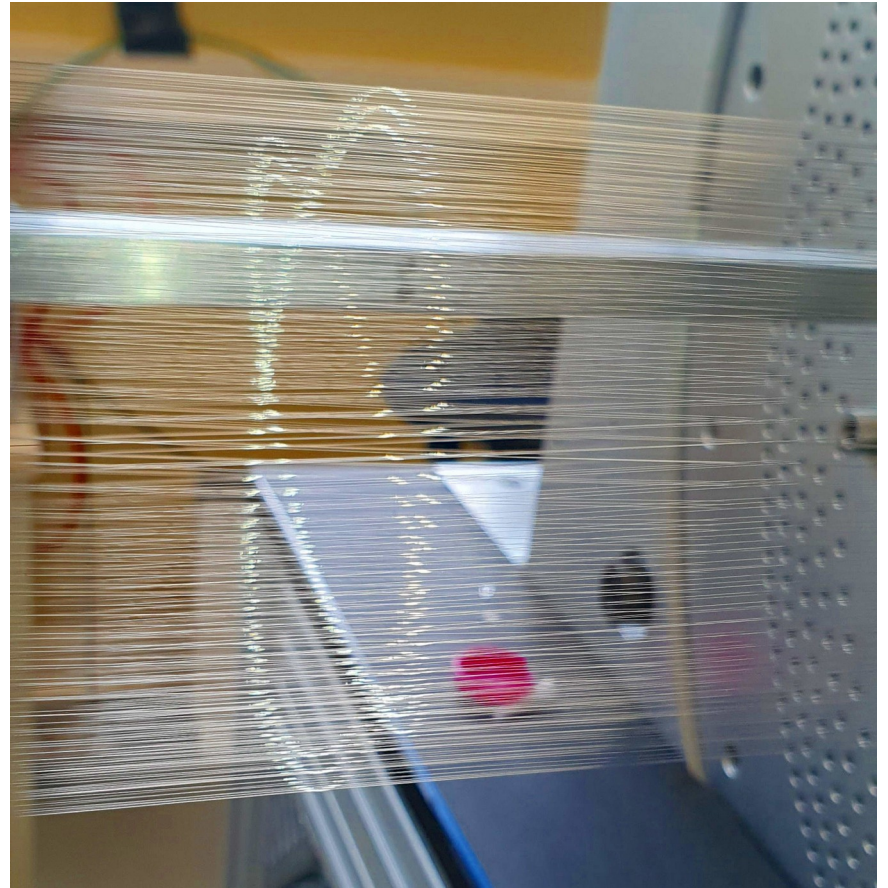
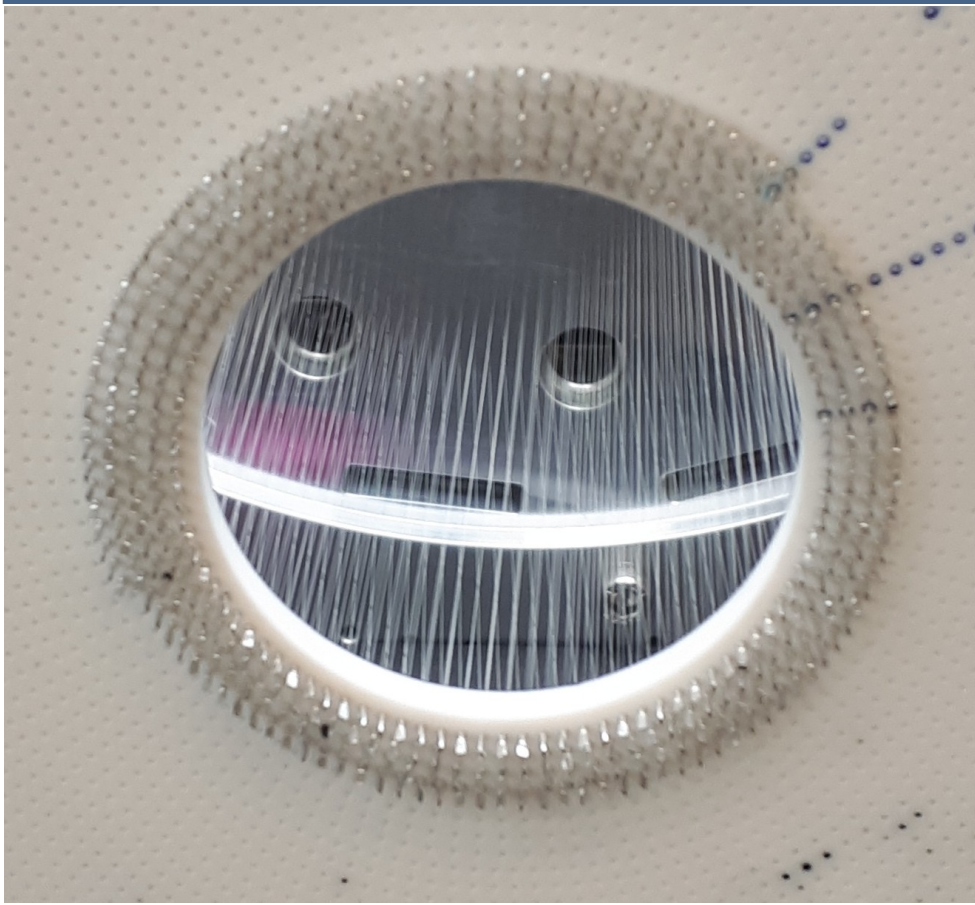
Present status

- 705 wires installed (23%)
- Around 1.5 % of wires caused problems
 - All of which could be repaired

We expect to finish in January



Stringing Pictures



November 8, 2023

R. Dupré – ALERT Status

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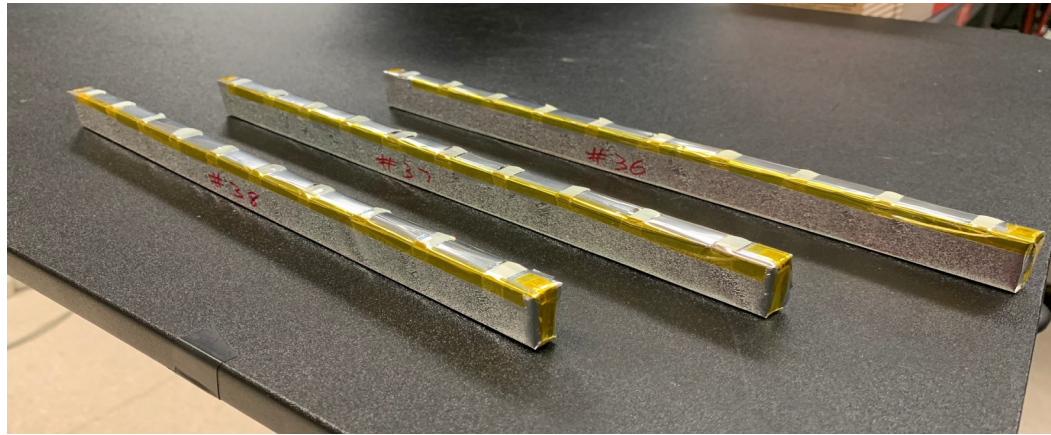
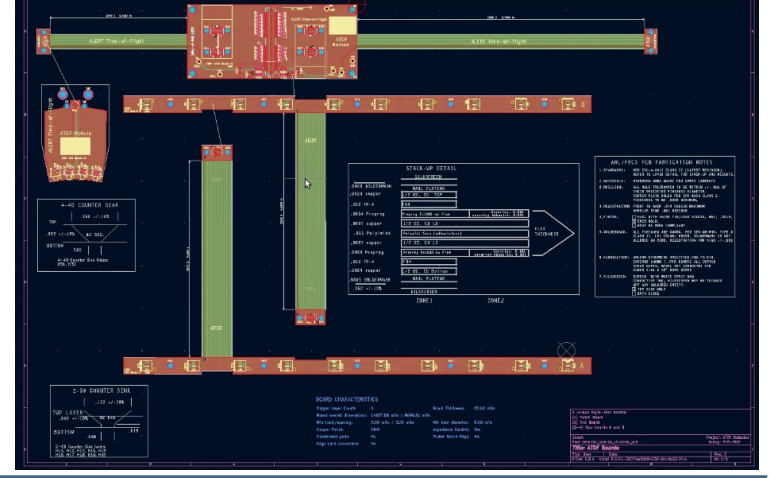
ATOF Assembly

All mechanical parts are in Argonne

- They are all already assembled (15+3 modules)
- Scintillator wrappings are done

Connection boards are in procurement

- Next steps will be to glue SiPMs on scintillators
- Finally test the modules before shipping to JLab



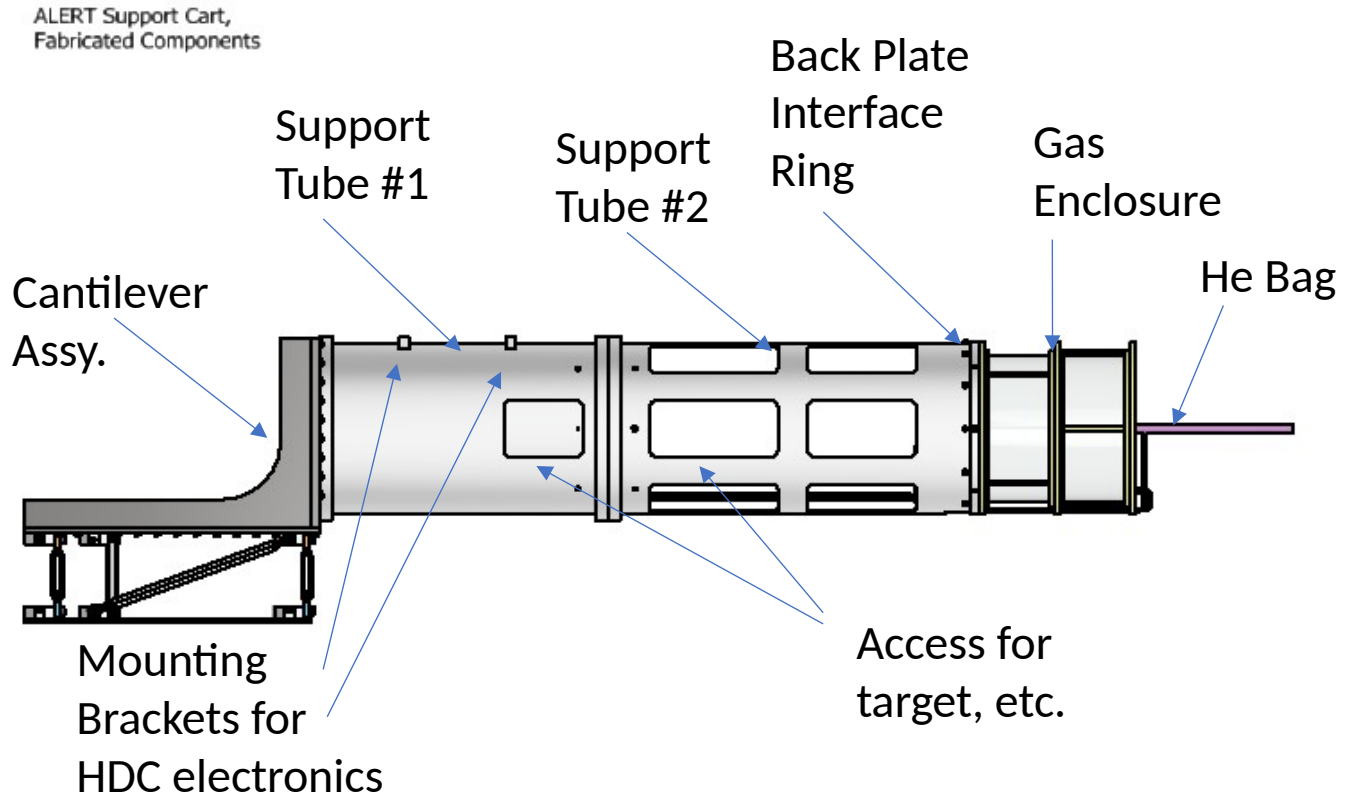
Integration in Hall-B

We are working on the cart design details

- Designer is Argonne engineer Tom O'Connor
 - Works in connection with ALERT group and Bob Miller
- Gas feedthroughs are now included

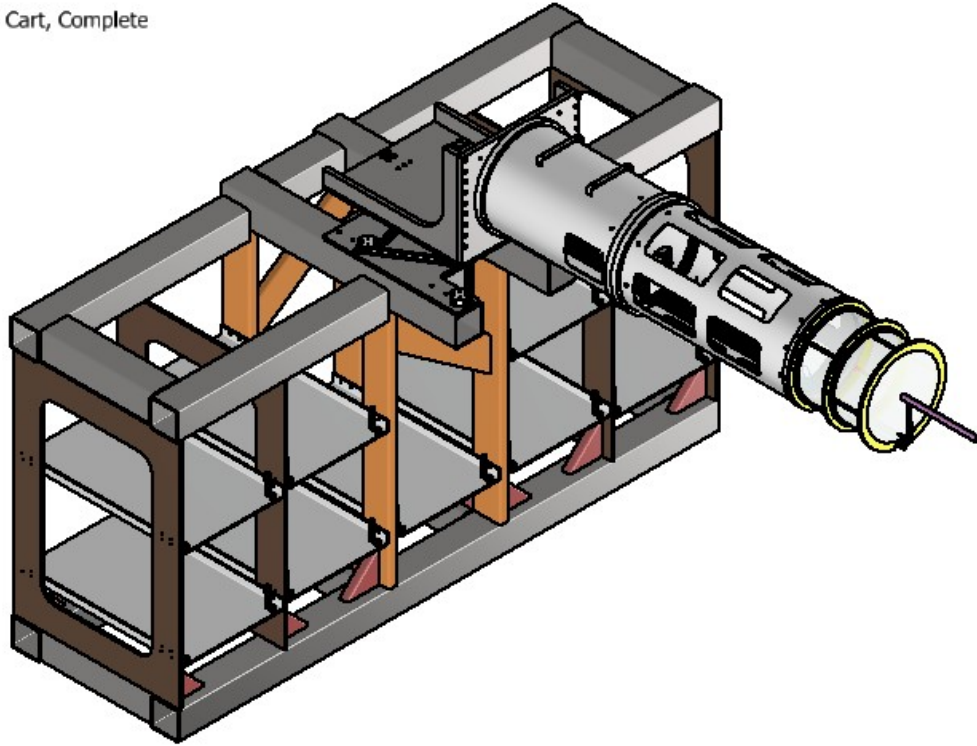
Several other components to finalize

- Gas enclosure, He bag attachment...

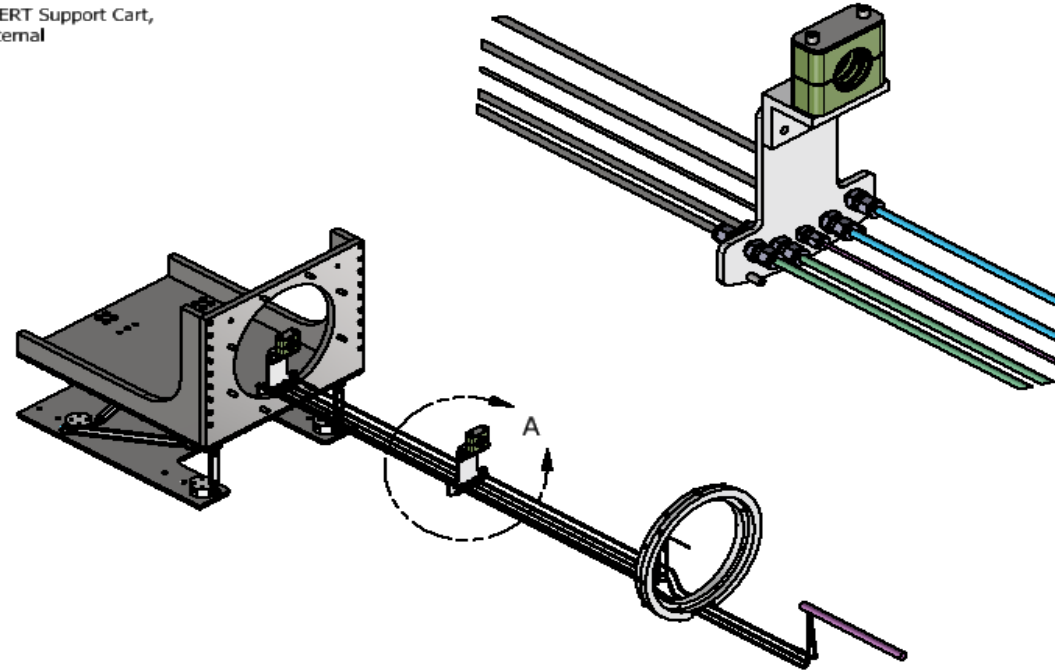


More on the Support Cart

Support Cart, Complete



ALERT Support Cart, Internal



Target and Gas System

We restarted work with Hall engineering

- Discussions started for the gas system
 - **Bob Miller in connection with Gabriel Charles (IJCLab)**
- Well Documented to ease communication

Next will be the target design

- We had meetings on this a couple of years ago
- Now is time for the detailed design and construction

ALERT Gas System Requirements

Author: Gabriel CHARLES

Date: 2023/09/23

Updated: 2023/11/02 (notes of the meeting at the end of the document)

Topic: this note describes the requirements for ALERT Gas System

ALERT detector is composed of a chamber filled with He/CO₂ gas mixture. After a short description of the detector and the gas mixture selected, we show the effect of temperature and pressure change on some of the parameters of the detector. From these results we conclude on the constraints on the gaseous system.

The chamber is filled with gas. The gas is introduced through a small volume before the active area of the detector. The total volume is about 52 L. We probably want to renew the gas volume every five hours. The required flow rate is hence 10L/h or 170 sccm. We probably want to be able to double this value in case of problem, so if the system can reach a flow of **340 sccm**, it would be nice. A high flow also ensures a good homogeneity of the gas in the detector. Studies were carried out to see the effect of pressure and temperature changes on the drift time (fig. 1) and gain (fig. 2) in the gas in presence of a 5T magnetic field in He/CO₂ (80/20), the parameters are important for precise reconstruction. The variations chosen for the pressure and temperature are the one obtained from sensors installed in Hall B.

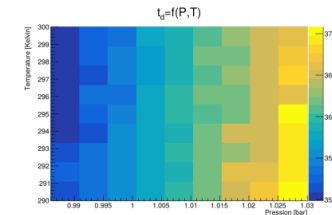


Fig. 1 Drift time in ns as a function of pressure (X) and temperature (Y)

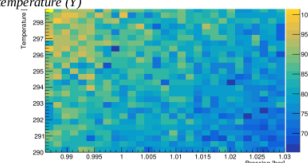


Fig. 2 Gain as a function of pressure (X) and temperature (Y)



Software Overview

Slow progress in the last few months

- We detailed our bank format
 - Matching CLAS12 conventions as much as possible
- Getting ready to test codes with data in the spring

Many projects in Software remain to be completed

- Tracking, calibration, PID, use of AI...
- If you want to get involved with ALERT let us know
 - Or if you just need to do some service work



Planning for the Coming Year

- 09/24 Start of the experiment
- 08/24 ALERT in place in the Hall for commissioning
- 08/24 ALERT installation
- 06/24 Cart assembled in JLab
- 05/24 ALERT fully assembled and tested off beam at JLab
- 04/24 Assembly of AHDC and ATOF
- 03/24 ATOF delivery in JLab
- 02/24 AHDC delivery in JLab followed by tests
- 01/24 End construction of detectors in ANL/Orsay
- 01/24 Bring ATOF module to Orsay to test the assembly procedure



Summary

A Low Energy Recoil Tracker

- Hyperbolic drift chamber
- Time-of-Flight array

It will be used for a large array of experiments

- Nuclear DVCS and DVMP for nuclear GPDs
- Tagged processes and SRC for EMC effect

Collaborative effort within CLAS12

- ANL, IJCLab, JLab, Mississippi SU, NMSU, and Temple
- Construction of the main elements is in progress
- Integration in the Hall is in progress
- Lots of work still on the software side

We are scheduled for September 2024

