Hall C Status

Hypernuclear Collaboration Meeting

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Jan 2026

Hall C operation in 2025

- Decision to shorten FY25 run period to 22 weeks. Got 2 week extension to Sept 3rd.
- Accelerator was at 87% efficiency for beam to any hall.
- E12-11-107 Spectator tagged DIS d(e,e'p_s) started on April 3rd 2025.
  - On April 21st , Hall C 480-volt switchboard had a short circuit. Also caused fuses in transformer upstream of switchboard to be blown.
  - Hall C had power restored and back to beam on Friday May 9th.
  - Shifted the schedule to complete the LAD experiment by July 14th.
- Second set of experiments was about 3 calendar months (94 calendar days)
  - E12-06-104 $R=\sigma_L/\sigma_T$ in SIDIS $\pi^{+/-}$ on 1H and 2H
  - E12-24-001 Nuclear Dependence (C,Cu) of R in SIDIS
  - Completed half of the calendar days the 2025 run period.
  - Will run the rest of the experiment in the 2026 run period

Hall C Running in 2026

- Preparing for lab furlough with government shutdown in Oct/Nov
  - 3 week delay to beam start
- Machine has completed the 2K cool down in January 2026
- Accelerator on tight schedule to meet Physics beam start date.
- Physics beam with staggered start (beam delayed 2 additional weeks):
  - Fri March 27th Hall B, Mon March 30th Hall D and Wed April 1st Hall C
- Accelerator will start at low pass energy of 345 per linac for compatibility w/PRAD
  - E12-22-001: N-Δ at low Q^2
  - E12-23-001: VCS at low Q^2, 15 of 61 PAC days
- Two weeks for accelerator changeover to standard beam energies
  - Switchover is May 25 to June 8.
  - E12-06-104/E12-24-001: R-SIDIS (Part 2). Run June 8 to July 27th
  - E12-06-107: Color Transparency via exclusive pion electroproduction. Run July 27 to Aug 31st.
- Testing of SoLID detectors will be done parasitically during the run period.

Near future Hall C schedule

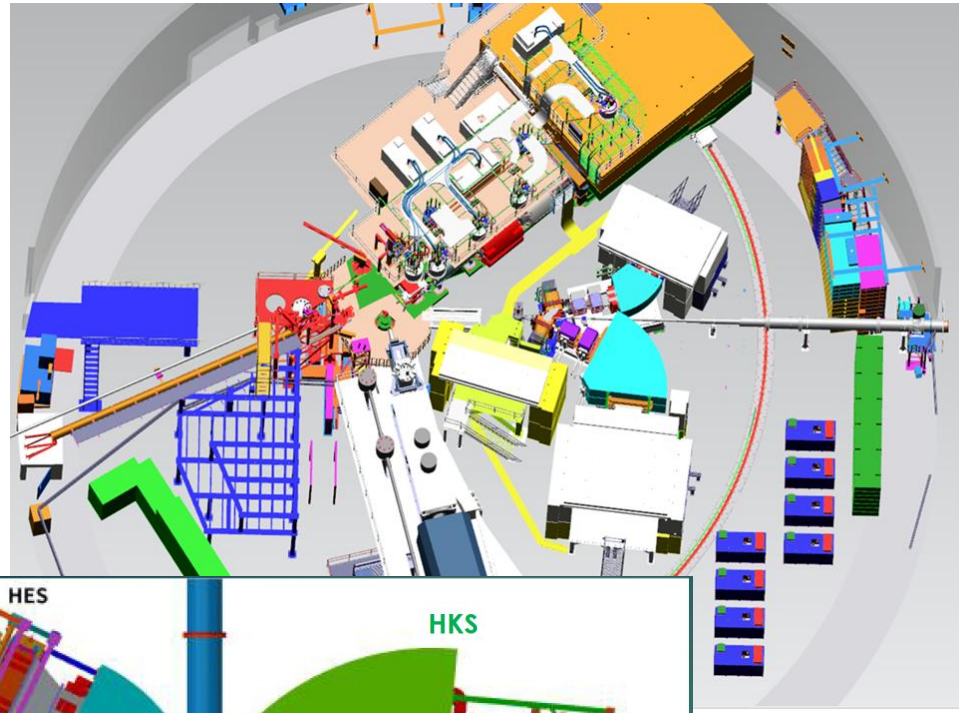
- Still planning for the 2027 run period with MOLLER. **No fixed schedule**
  - Unknown when it would start but guess at Feb 2027.
- Tentative plans for 11 weeks of running for high power cryo targets in Hall C
  - Complete part of the VCS experiment.
  - Run the NucR experiment, E12-14-002: ”Precision Measurements and Studies of a Possible Nuclear Dependence of R”
    - Need to have time at a non-standard linac energy setting
    - Add in completion of KaonLT? (complete the x=0.25 scaling scan)
- Then stop beam to Hall C and start installation of Hypernuclear.
  - Roughly 10 month installation
  - Guesstimate to start hypernuclear in Spring 2028.

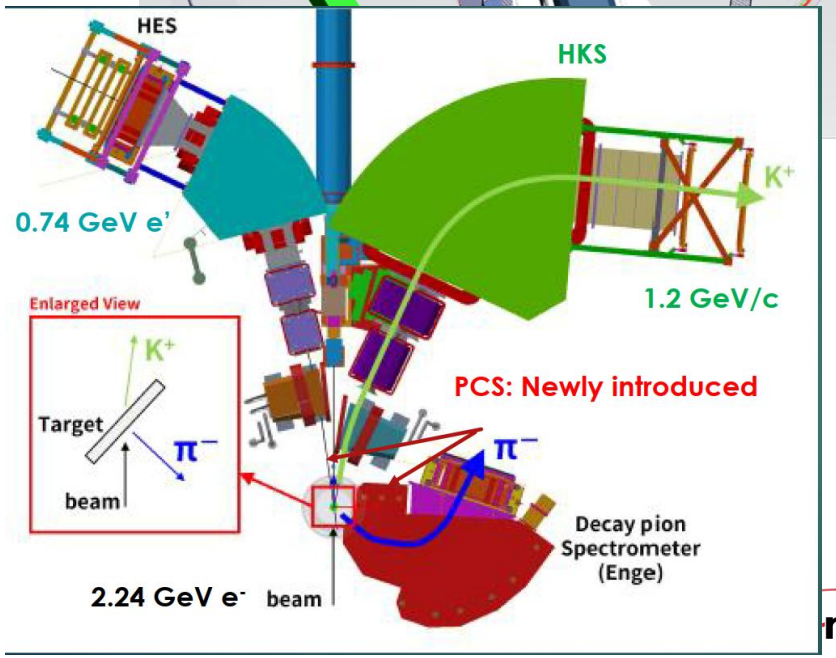
Hypernuclear experiments

- Experiments had ERR in Nov 2024.
- Much work is needed to pass the ERR in May 2026. See report
- Experiment PAC days. Total 149 PAC days. Assuming 50% efficiency that is 42 weeks. Two run periods.

Experiment	Title	PAC Days
E12-23-013	An isospin dependence study of the Lambda-N interaction through the high precision spectroscopy of Lambda hypernuclei	55
E12-24-011	Study of a triaxially deformed nucleus using a Lambda particle as a probe	28
E12-24-003	Studying Lambda interactions in nuclear matter with the ^{208}Pb(e,e' K+)$^{208}{}_{\Lambda}$Tl reaction	42
E12-24-004	Study of charge symmetry breaking in p-shell hypernuclei	24
Run Group	High-resolution spectroscopy of light hypernuclei with the decay-pion spectroscopy (ENGE magnet)	N/A

- MOLLER will be running in Hall A during the time that Hypernuclear experiments would run





Preparations for the May 2026 ERR

- Scheduled for May 20-21. Need to setup up the web page and agenda.
  - Need to coordinate with Patrizia
- Suggest that we should have a run through of the presentations week of May 4th
- For each ERR recommendation and comment need to define the person responsible for documenting the response.

Charge 1

1. What is the status of the equipment required for this set of experiments towards operation? What is the completion/commissioning schedule and tasks? In particular provide detailed information on:
    - The beam line and scattering chamber
    - The target(s) needed
    - The HKS, HES, PCS, ENGE and the effect of the magnetic fields on the beam line. The status of the needed power supplies.
    - The integrated system, including the support structures for the magnets, as expected to be used during the experiment.

Charge 1 recommendations:

a. Beamline magnetic shielding, locations for beamline shield and corrector location needs to be defined and reviewed prior to ERR approval.
    a. Completed. Need to document.

b. PCS magnets have been built. Documentation on testing and specifications needs to be presented and approved. Additional tests at JLAB must be part of acceptance.
    a. Need to supply documentation
    b. Testing at JLab is not possible.
    c. Approved by whom?

c. The HKS collaboration, Hall C management, and Target Group should agree on target configuration(s) and schedule(s) for the entire HKS program
    a. Would like to order the 48Ca this FY. Need to decide on target configuration

d. Given the concerns expressed about acquiring another Ca-48 sample, the collaboration should obtain pricing and delivery estimates for this isotope from DOE.
    a. Need to answer the above recommendation so that we can get the pricing.

Charge 1 recommendations (cont.)

e. All magnet, detector and Target stands need to include and incorporate access and platforms with railings
    a. Done
f. The experiments will use detector packages that were used before, namely the HES and HKS spectrometers. Their components are being tested and presumably they will be operational by the time installation should start. However, no plans to guarantee a minimum number of spares seems to be in place. Considering the duration of the data taking, this is a significant risk that requires a mitigation plan.
    a. Need to write the plan to explain the spares for detectors and how to repair the DC.
g. Clear definition of LCW (cooling power, when Moller is running in parallel) and electrical power requirements needs to be answered and presented with basis of the getting to those, about how they are mitigated.
    a. Had meetings with all Halls and Facilities. Need to document

Charge 1 comments

Charge 1 comments:

a. The basic beamline layout is not finalized, and there are concerns about shared vacuum between so many instruments. While the scattering chamber is still in the conceptual phase, the collaboration should consider a design that will allow the target ladder to be isolated from the rest of the system. Such a design could benefit the insertion, removal, and protection of highly reactive samples such as lithium and calcium and the alpha calibration source.
    a. Decided not to have a mechanism to isolate targets. Need to document why and plan for insertion of highly reactive samples.
b. The beamline vacuum is currently one system. In order to meet the 10e-6 accelerator vacuum requirement, ion pumps may need to be added.
    a. Need plan for the ion pumps and explain how we will met the vacuum requirements
c. Not a lot of detail on the completion/commissioning schedule for the beamline/scattering chamber was given. A detailed resource loaded (cost and manpower) schedule for design/installation and commissioning is required.
    a. Need a documentation
d. The stray fields were estimated via TOSCA simulations. It would be very beneficial to perform a full tracking simulation of the main electron beam through the experimental setup (as well as effect on the detectors) in presence of stray fields in order to assess the adequacy of the setup.
    a. Student has GEANT4 simulation. Need to track through to the beam dump.
e. There is a need for 4 new power supplies for magnets. The PRs (and presumably the SOWs) for 2 power supplies were submitted at one point. None are on order. All the new power supply specifications should be verified to be adequate for the required overhead. The PRs issued soon as there may be a 1-2 year lead time.
    a. Had a PR for 3 supplies in April 2025. Almost into a PO but got help up.
    b. Have plans for PR for the 4th supply

Charge 1 comments (cont.)

f. The HES and HKS support structures are being reused. The PCS magnet support stand is being designed and analyzed currently. It appears to be in a reasonable state but not finalized.
    a. Completed
g. The flux return path (the return yoke) design presented, mentioned that the configuration is old (HKS, HES) and was used earlier but is being revisited. The design document related to the magnet design (yoke), envisaged to be used in the present configuration was not presented.
    a. Jamie is contacting Probir
h. The old Magnet Power Supplies at the lab, need evaluation by re-commissioning. Because of their age (electronics and firmware availability/upgrades), it is a risk moving ahead without being tested upfront and not having a plan how to mitigate if they are not usable.
    a. Is it possible to test the HES PS?

Charge 1 comments (cont.)

i. The magnet-magnet interactions both with mechanical/structural forces, magnet field interferences, fringe field and magnetic field stability and variability studies need to be documented.
    a. Need to document

j. The ENGE calibration procedure needs to be written. The effect of the PCS magnet's stray field on the ENGE optics needs to be investigated. Alpha-source calibration with PCS magnets ON and OFF should be evaluated. Polarity reversal may change calibration, and possible nonlinear effects on calibration from polarity reversal should be evaluated. An NMR probe should be installed to better track the magnetic field.
    a. Need to document

k. The scattering chamber design did not seem to have access for installing or removing "last minute" samples such as Ca-40, Ca-48, Li-6, or the alpha source.
    a. Part of Rec 1c

l. Sharing vacuum among so many different instruments can be problematic. The collaboration should pursue a target design that allows the target ladder to isolated from other elements, such as the Enge and other spectrometers and provide access to target components.
    a. Answer to comment b

m. The collaboration is already developing plans for detector commissioning and calibrations. While HES and HKS detector arms have been used previously, ENGE detectors are new and new calibration procedures need to be developed. Not all the steps of detector calibrations for ENGE detectors were presented in detail.
    a. Collaboration needs to develop plan.

Charge 2

2. Are the requirements for the electron beam fulfilled? **Mostly** What are the beam controls needed for this set of experiments?

Charge 2 Recommendations

a. Requirements on the beam energy stability and energy spread are challenging and subsequent studies are needed. The energy spread of 3e-5 is at the theoretical limit of the accelerator (given by the phase stability in the linacs). Recent upgrades in the SRF systems (C75,C100) may have a significant impact on this and a beam test needs to be scheduled to check whether or not it is feasible.
    a. Have done first study. Need to make clear the needs of energy stability which can have slow drift corrected and the energy spread. Collaboration

b. The collaboration proposal to use 2 additional BPMs to achieve the requirements of beam position and stability at target needs to have a design document supporting the statement.
    a. Collaboration need to write a document.

Charge 2 Comments

Charge 2 comments

a. The stray fields were estimated via TOSCA simulations. It would be very beneficial to perform a full tracking simulation of the main electron beam through the experimental setup in presence of stray fields in order to assess the adequacy of the setup.
    a. Have GEANT4 simulation. Needs to run for tracking.
b. The interaction between the Hall A beam at pass 5 and 40 uamps and the Hall C beam at pass 1 maybe itself need to be checked. For example, if Hall A terminates their beam while Hall C is running, the beam loading effects in the SRF cavities will affect the centroid energy at levels several times beyond 3e-5.
    a. Need to have document with the strategy for dealing with shifts in centroid.
c. Using a NMR probe on the 9th dipole to check and monitor that stability is a good idea. However, there are other effects to consider. When Hall A is running in FFB energy mode, the BSY1C dipole string is what determines it. It is not necessarily balanced with the BSY3C dipole string. So, times during which Hall C run by itself will shift the centroid. Specific procedures will have to be written in collaboration with accelerator to compensate for this. Testing should be performed to verify NMR lock consistency.
    a. Do you still want this NMR? Do we have example from other hypernuclear experiments to show how the drift in the beam energy centroid was compensated?
d. Particular care must be given to aligning the target on the Hall C beamline, and the capability to adjust the target ladder after the scattering chamber is attached to the spectrometers will be important. If the target is off center by more than a few millimeters, it may be difficult to compensate and still ensure an incoming zero angle and position.
    a. What is the adjustment for the target ladder?
e. No failure modes identified at this stage will impose a high risk to the project and run. It will be valuable to identify all failure modes and risks associated, also note how they are mitigated (e.g. design peer reviewed, safety interlocks, etc.), incl design, test and commissioning.
    a. Collaboration needs to take this on.

Charge 3

3. Are the beam commissioning procedures and machine protection systems sufficiently defined for this stage? **No**

Charge 3 recommendations

a. Create a detailed procedure to address machine protection systems as well as beamline commissioning.
    a. Work with Jay, PSS and OPS

Charge 3 comments

a. FSD must be identified and designed with thresholds/locations before start of run. Also, identify the risks with dropping the magnet current to 0A with magnet inductances been dominated by iron.
    a. Do we have someone who can look into the "the risks with dropping the magnet current to 0A with magnet inductances been dominated by iron"?
    b. In GEANT4 , look at beam trajectories in various scenarios of magnets off?
    c. Ion chamber locations?
b. EES and MPS plan not presented
    a. Need to develop the plan.
c. With a configuration change of this size a new ERG and safety walkthrough will be required

Charge 4

4. Are the manpower and other resources necessary to execute the experiments identified? **No** Are the responsibilities for carrying out each job assigned? **No** Please provide a detailed and realistic evaluation of the available FTE with names if possible.

Charge 4 recommendation

a. Provide a realistic estimate of the required FTEs and the identified manpower as well as the corresponding timeline with milestones for preparing, installing and conducting the experiment.
    a. Need to have timelines and personnel from E&D and the collaboration.

Charge 4 comments

a. The Target group does not currently think they can meet the schedule with the existing Engineering/Design staff taking into consideration their current workload.
b. Hall C Engineering is short an Engineer and a Senior Designer leaves next year. They feel that this may jeopardize the schedule.
    a. Getting designer help from Hall A
c. The installation schedule presented did not show much detail. It appears rather optimistic and doesn't have any contingency.
    a. Need installation schedule
d. The collaboration should find sufficient number of members to be able to cover the large number of the shifts.
e. Individuals and institutions should be assigned concrete tasks to evenly distribute the workload .
f. The Hypernuclear Collaboration should consider formalizing by defining the rights and responsibilities of the member of the collaborations through a governance document.

Charge 5

5. What is the simulation and data analysis software status for the experiment? Has readiness for expedient analysis of the data been demonstrated? **No** What is the projected timeline for the first publication? Please provide a documented track record from previous experiments.

Charge 5 recommendations

a. Provide a realistic estimate of the required FTEs and the identified manpower as well as the corresponding timeline with milestones.
    a. Need for software milestones and personel.

Charge 5 comments

a. The reconstruction and analysis software used by the collaboration for the past experiments will have to be ported to the software framework used currently by Hall C. The work has just started. While contributors to this task are listed, it is unclear how much work will be involved in FTEs and whether this would be compatible with the other commitments these contributors may have.
    a. Collaboration needs to answer
b. No estimate of the computing resources (storage and CPU) required for offline simulations, reconstruction and analysis. Traditionally, Hall C experiments are the smallest consumers at JLab but, since the experiment involves new detector packages and requires high precision, it would be advisable to provide an estimate to ensure this is compatible with the available resources.
    a. Alexandre and collaboration

Charge 6

6. Are the radiation levels expected to be generated in the hall acceptable? **Yes** Is any local shielding required to minimize the effects of radiation in the equipment? **Yes**

Charge 6 recommendations

a. Develop a realistic plan for shielding the SiPms from radiation damage.
    a. No longer planning to use the SiPMS
b. Finalize the location and shielding configuration for electronics in the hall.

Charge 6 comments

a. The radiation budget was evaluated without including the full experimental package. The impact of the stray fields on electrons interacted with the target is significant. The field will scatter the electrons along the beamline and increase the radiation level. It is expected that the generated radiation will be acceptable.
    a. GEANT4 simulations have been done

Charge 7

7. What is the status of the specific documentation and procedures (COO, ESAD, RSAD, ERG, OSP's, operation manuals, etc.) to run the

Charge 7 recommendations

a. A draft of each of these documents needs to be developed. COO, ESAD, RSAD, ERG.

Charge 7 comments

a. With a configuration change of this size a new ERG and safety walkthrough will be required. All of the above documents should be developed before the experiment starts. ePAS with accompanying procedures will be required instead of OSPs.