

28 December 2013

**Dear Hall B collaborators:**

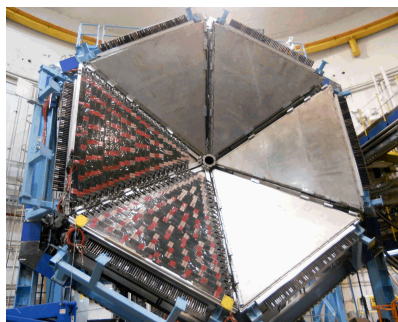
As the year is coming to a close it is fitting to take a look back at some of the highlights of 2013. I like to first welcome new members to the CLAS collaboration as well as to the HPS and PRad collaborations. They are making the Hall B science program stronger and more diverse.

**The 6 GeV science program:**

The CLAS collaboration continued the good harvest of papers published in refereed journals. They included 12 CLAS collaboration papers (with the first paper from the data mining project), 2 papers involving higher-level analysis by individuals or small groups, and one NIM paper. The  $N^*$  group joined by many theorists published a “White Paper” on  $N^*$  excitations at high photon virtuality in support of the 12 GeV program, and a major review article on DVCS and GPDs was published led by members of CLAS DVCS program. Another measure of success are the 155 conference talks of which 75 were invited. Of the 80 contributed talks 40 were given at the DNP meeting in Newport News, mostly by students and postdocs.

A healthy number of publications last year is testimony to the continuing strong effort in the analysis of CLAS 6 GeV data. At the center has been open strangeness production. Over half of all publications focus on hyperon photo- and electroproduction, especially on the investigation of the  $\Lambda(1405)$  whose internal structure is not well understood. The CLAS data brought new insights and prompted new theoretical efforts. A new data mining initiative has been started to study the electromagnetic decays of mesons such as  $\eta$ ,  $\eta'$ , and  $\omega$ . The g11 run has resulted in the worldwide largest data sets for some of these channels, and groups that are currently not members of the CLAS collaboration have been attracted to participate in their scientific exploitation.

**The CLAS12 Upgrade:**

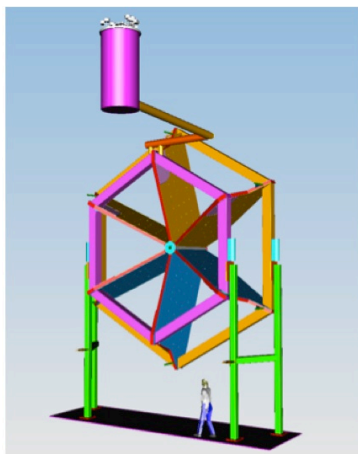


To be ready for detector installation, Hall B had to be first cleared from the huge amount of signal and delay cables. This effort relied heavily on volunteer help from collaborating institutions. Several of the CLAS12 forward detectors have been completed in 2013, especially the pre-shower calorimeter (PCAL) the new forward time-of-flight system (FTOF) and the refurbished TOF panel 1a and panel 2. Their installation in Hall B is in full swing (figure). Major modifications have occurred with the sublevel space frame extension, modifications to the forward carriage motion system and additions to the detector support system. Much of this progress

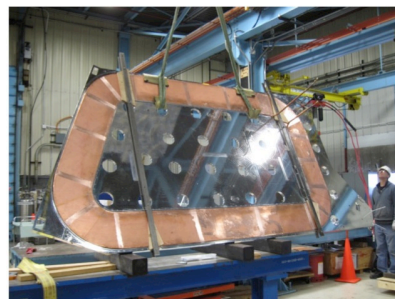
would not have been possible without the dedicated hard work by the Hall B technical team. Much progress, though not visible in the Hall yet, has also been achieved with the other CLAS12 detectors. The last of the 18 drift chambers is currently being completed in the EEL clean room, and following a successful review at Fermilab, production of the SVT modules has started. The first modules have

been tested and showed excellent performance. Assembly of the mirror segment of the HTCC has started and the containment vessel is being assembled. Refurbishment of the low threshold Cherenkov counters (LTCC) has entered a new phase with the mechanical modifications now underway and decisions made about the new mirror coating and to enhance the PMT response at short wavelength by sputtering wave shifter material on the windows. The 48 modules of the central time-of-flight (CTOF) system are now being assembled after some flaws from the light guide bending have been eliminated.

### Superconducting magnets:



The manufacturing plan for the Torus magnet calls for the winding of the coils and the potting into the coil case to be completed at Fermilab, and the design and construction of the other components, i.e. the cryostat, cryogenics, controls, and the final assembly in Hall B will all be done at JLab. A practice coil was wound and fitted into the coil case at Fermilab in November (left figure), and the cryostat factory at JLab is ready to receive the first coils to be assembled with their cryostat. All procedures and plans have been reviewed multiple times and manufacturing of 8 coils (2 for spares) is now proceeding. The solenoid magnet is now on the



critical path, and major efforts are needed to keep it on the DOE approved 12 GeV schedule.

### Software development:

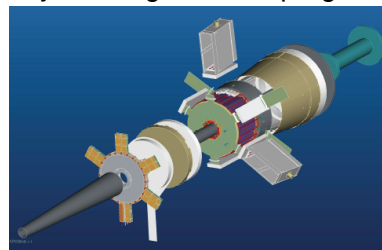
The past year also saw significant progress in the software development for CLAS12. Main focus has been development of the new tracking code as well event reconstruction in several detectors, and the second software review was passed successfully in late November. Increased emphasis is now on calibration procedures for the individual detectors and the CLAS12 system as a whole. This is an area where the collaboration can play an important role in the coming year.

### Extending the CLAS12 science reach:



With 20 approved experiments to which the PAC assigned 1,427 days of beam time, and additional four C1 conditionally approved experiments requesting 510 days of beam time, the Hall B collaborations laid the foundation of a very exciting science program. Several CLAS12 experiments require additions to the base equipment, such as polarized targets, micromesh gas (Micromegas) detectors for improved

charged particle tracking, a central neutron detector (CND) at large scattering angles, and a forward tagging (FT) system. Construction of the CND has started (figure to the left shows several of the 144 scintillator/lightguide elements). Several components of the FT

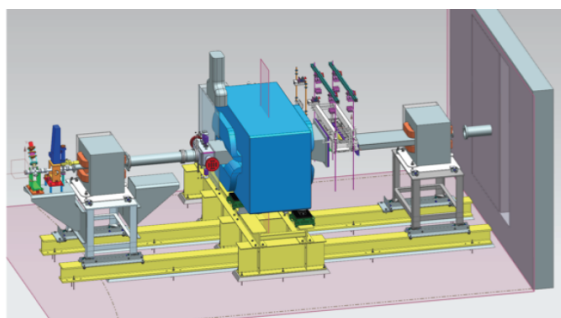


have been procured and testing of the full calorimeter-hodoscope-tracker assembly (right figure) is

planned for the fall of 2014. Detection of high-energy kaons in CLAS12 is insufficient to carry out an essential part of the CLAS12 physics program that requires excellent separation of kaons and pions at high momentum. Several international groups led by INFN institutions in Italy, have proposed to equip one of the CLAS12 detectors with a RICH counter with the possibility of extension to another sector. Extensive test beam studies have been done at CERN showing the feasibility of the proposed system. The project has successfully passed technical and cost-management reviews organized by Hall B and the NP Division, respectively. These initiatives also reflect the strong involvement of international groups into defining the research directions with CLAS12.

The HDIce project team is now planning for beam test in a new injector test facility that is in preparation. This project will allow the group to carry out the detailed electron beam tests needed to characterize the performance of the HDIce target as required for the use of the target in the C1 conditionally approved transverse polarized target program for DVCS and SIDIS at 12 GeV.

### **Preparing for early experiments:**



Although the installation and assembly of 12 GeV equipment will be the priority activity in Hall B, plans have been tentatively approved to make use of time periods when 12 GeV activities in the Hall are at a low level or absent (e.g. during weekends and night times) to execute an engineering run for the heavy photon search (HPS) experiment. The current plan projects completion of the HPS magnet chicane and analysis magnet installation in the downstream alcove for the fall of 2014 (figure), and a possible run

in late 2014/early 2015 when two accelerator periods are scheduled. This run would correspond to the equivalent of 21 PAC days and promises to explore a significant fraction of the parameter space for the A' coupling that would be charted in the full experiment. Also under consideration is the possibility of an early physics run of the PRad experiment that aims at a precision measurement of the proton charge radius.

### **Looking forward to 2014:**

As 2013 has been the year where major components of CLAS12 detectors have been completed and prepared for installation, 2014 is poised to be the year where a large part of the equipment will have been installed in the forward carriage and the Torus magnet assembly will be the main 12 GeV project activity in the Hall. The completion of the Torus magnet assembly and the magnet commissioning is required before the installation of the drift chambers can proceed.

Software development for the detector calibration and commissioning will move to the forefront with a focused effort that needs increased involvement of collaboration institutions to be ready for Day 1 of beam delivery to CLAS12.

Of course, the analysis of CLAS data will continue in full strength, and many new publications and PhD theses in hadron spectroscopy and structure, deeply virtual production, and QCD processes in nuclei can be expected in 2014. Beyond the ongoing analyses, the data accumulated with CLAS are rich in unexplored physics and provide opportunities for new analysis projects for years to come.

So, we are leaving behind the year 2013 that, with the completion of the region 1 and region 2 drift chambers, the pre-shower calorimeters, and the forward time-of-flight system, saw the passing of major milestones towards the completion of CLAS12. For 2014 we are looking forward to the completion of other detector systems, including the central neutron detector (CND) as the first European CLAS12 project, and to the first beam in Hall B since May 2012.

I wish everyone a peaceful and successful year 2014!

*Vala Bueket*