Summary of the meeting “Uses of UITF” (M. Poelker)

F113, 9:00 – 12:00, Wednesday, December 12, 2018

On Wednesday, December 12, there was a meeting to discuss possible uses of the Upgrade Injector Test Facility (UITF) which is nearing completion, with expected “first MeV beam” during 2019. The meeting was held in room F113 at CEBAF Center with approximately 25 attendees.

There were 12 “beam request” presentations and one presentation describing the CTF refrigerator. These presentations can be found at:

<https://wiki.jlab.org/ciswiki/index.php/UITF_Meeting_-_December_12,_2018>

The beam request presentations can be grouped into four categories: 1) applications that support CEBAF operations, 2) applications that augment CEBAF physics, 3) applications that advance accelerator technology and push the state of the art, and 4) applications that support the EIC. These applications are discussed briefly below, and summarized in a table. Please visit the website above to see more details.

1. Applications that support CEBAF operations

Testing the Quarter Cryomodule (QCM) and the HDIce target are pressing tasks that helped to justify the creation of UITF. The QCM addresses “flaws” of the present CEBAF ¼ cryomodule, namely the beam trajectory kick and x/y coupling that makes it difficult to properly envelop-match to obtain maximum adiabatic damping required by the Moller experiment. There is a 6-month shutdown scheduled for 2020, to rebuild one of the CHLs, and this would be a perfect opportunity to install the QCM, assuming it has been adequately tested at the UITF. (R. Kazimi)

The HDIce target has been modified to improve past performance, and can provide transverse target polarization required by at least three A-rated but conditionally-approved experiments at Hall B. Successful tests at HDIce are required to obtain full approval for installation at Hall B. (A. Sandorfi)

Solid ammonia (NH3 and ND3) is the most frequently utilized polarized target material at JLab. In the past these targets were provided by Prof. Don Crabb of UVa, who has officially retired. The target group at JLab looks forward to continuing the work of Prof. Crabb. The Target Group could use UITF to manufacture polarized solid targets to support the CEBAF physics program, and to conduct R&D to evaluate other materials leading to innovations that benefit nuclear physics. For example, different materials may benefit from different irradiation temperatures, thereby achieving higher polarization, longer polarization lifetime, and using simplified cryostats, etc., (C. Keith)

1. Applications that augment the CEBAF nuclear physics program

A group from Argonne and the University of Illinois-Chicago has been conducting astrophysics experiments at the CEBAF injector using ~ 10 MeV electron beam, bremsstrahlung radiation and a pressurized bubble chamber. Engineering runs conducted to-date are very promising, but are now harder to schedule because CEBAF shutdowns are relatively short. Although the experiment happens at the injector, the entire North LINAC is off limits during the experiment, which complicates scheduling of necessary shutdown work. The UITF is a perfect location to perform these experiments. (R. Suleiman)

Roger Carlini described the possibility of performing low energy parity violation (PV) experiments at the UITF. He believes there are compelling PV measurements that could be made using just 10 MeV beam, although very high currents would likely be required in order to conduct the experiment in a reasonable duration, and even with milliampere beams, many months would be required. He commented that even short test periods would provide an excellent test bed for new PV experimenters, to “cut their teeth”: creating parity quality beam, learning to manage systematic errors, etc., (R. Carlini)

1. Innovative Accelerator Applications

Although the Vertical Test Area (VTA) and the Cryomodule Test Facility (CMTF) represent excellent resources, the UITF is the place where beam can be accelerated through SRF cavities, including cavities coated with Nb3Sn at 4 K. (G. Eremeev)

Wastewater treatment with electron beams is an exciting new development that could be tested at UITF. Already, there is a nice collaboration formed with professors from ODU with connections to NASA and the Hampton Roads Sanitation Department. Funding for tests is actively being pursued. (G. Ciovati)

The UITF also represents a useful test bed for the development of a polarized positron source, based on the PEPPo technique. Having proven that significant polarization can be transferred to positrons within a conversion target using only MeV beam, the next step is to design a capture section needed to build a viable “source” of polarized positrons. Although listed here as an accelerator innovation, polarized positrons are of course relevant for CEBAF and could have been listed under heading #1 “Applications that CEBAF operations”. And JLEIC would benefit from this work, as well as other accelerator complexes worldwide, including SuperKEKB and the proposed ILC. (J. Grames)

1. Applications that support the EIC

The UITF could be used to validate important JLEIC design assumptions and to address missing technology. Two examples were discussed: it would be good to demonstrate the required bunch charge for beam delivered to the JLEIC complex – which exceeds the bunch charge of typical CEBAF beam. Such a demonstration would identify required modifications to the CEBAF injector, e.g., gun voltage and bunching. This demonstration might inform discussions related to simultaneous beam delivery to JLEIC and fixed target experiments at the end stations. The fast kicker tests could also be performed at UITF, in support of our cooler/recirculator design. (J. Grames, J. Guo, H. Wang)

CTF LHe refrigerator

Ed Daly, Kirk Davis and Jonathan Creel led a discussion related to the CTF refrigerator which is currently oversubscribed and unable to provide sufficient cooling to the three main Users at building 58: VTA, CMTF and now also UITF. That said, the Cryo Group and Facilities have made key improvements to CTF that have significantly improved capacity (e.g., new cold box 3, recovery, purification). In addition to these recent improvements, they have identified other ways to boost CTF capacity and they work with SRF to prioritize these improvements. Some complications are hard to solve, namely there are two modes of operation which seem to me to be incompatible in some respects: “liquefaction” for the VTA and “refrigeration” for CMTF and UITF. And it’s hard to schedule CTF downtimes needed to implement improvements, because there are a number of urgent projects that must be finished, like LCLS2 and C100 rebuilds.

Some Outcomes of the meeting:

1. Arne wonders if we need a spare QCM? We have a spare ¼ crymodule, although we have never needed to use it.
2. Cryo requests specifications of existing and expected CTF cryo loads, to identify requirements for new and improved CTF. Evelyn Akers agreed to schedule a meeting between SRF, Cryo and Facilities to discuss improvements, and to help Rusty include these improvements in the 10 Year Site Plan Document.
3. Related to #2, the UITF cryo load was estimated but has not yet been measured, this can happen in the very near future when we cool down the QCm and test with high power RF. With known cryo loads at VTA, CMTF and UITF, it will then be possible to imagine future CTF upgrades that will support three simultaneous CTF Users. Will there ever be a fourth CTF cryo User? SOLID target?
4. Other possible uses came up in discussion, e.g., SRF photoguns, magnetized beam. Schedule a follow up meeting.
5. Now that we are close to having a functional UITF, approved for operation, Poelker invites more involvement from the Accelerator Division to operate it

