Will, Tim, and Andrew,

Per our conversation, this short note describes the scope of UITF work for each Engineering group, and it lists under/over estimates relative to my May 2015 cost estimate, which was created using specific input from each group leader. I don’t think there’s any point to making a comparison to Hari’s 2014 estimate.

Spreadsheets can be found at this address: <https://wiki.jlab.org/ciswiki/index.php/UITC_meeting_minutes>

**Cryo Group:**

Connect the ¼ CM to the CTF, and provide cryo controls. We must build a cryo system compatible with the old spare ¼ CM and the new ¼ CM. Also consider that there are other LHe users at building 58 and that CTF has limited capacity. We expect to operate the ¼ CM cold and with high power RF approximately 18 weeks per year (three 6-week intervals). When not being used, we need a reasonable means to “park” the ¼ CM to avoid opening leaks and Q desease.

Devise and implement a means to fill the HDIce helium buffer dewar (e.g., purchase LHe dewars from vendor or connect to CTF). It makes sense to capture the helium boiloff from HDIce.

Timeline: ¼ CM plumbing and controls complete by April 2016. Connections to HDIce later. Note, Facilities won’t be done installing utilities inside Cave2 until August. And CTF cold box work starts October and ends (?). So we have to discuss sensible start and completion dates for HDIce specific work.

**Original budget estimate was low by $55k and 127 PW labor.**

Possible explanations: Controls electronics were not part of Dixon/Creel estimate. Inexperienced engineer was only person available to begin the design. Rao Ganni reminded everyone that we needed to add a heat exhcnager inside the Cave, to provide more reliable ¼ CM operation, an added expense. I note there was some transfer line available on-site, so maybe we won’t need to buy as much pipe as originally anticipated?

**Installation Group:**

Provide installation support for UITF, including: racks above the cave, cable trays, radiation shielding below the penetrations, PSS box conduit, compressed air lines, nitrogen lines and LCW lines. And for all of the “oh shit, we forgot....” moments.

Timeline: I imagined 3 PW of labor each month from now through May. Known tasks that remain include finishing the cable tray installation, stacking lead block on the iron plates below the penetrations, and completing the installation of PSS box conduit, LCW, GN2 and compressed air lines around the perimeter of Cave2. Renzo thinks this could happen May 2016, when the Cave2 construction starts to wrap up. (I also volunteered Neil’s group to help install seismic bracing on the yellow blocks that form Cave2, because they might be radworker2 trained, but don’t know if Renzo thinks this is a good idea. This work, if it happens, is not part of any estimate, old or new)

**Original budget estimate was low by $47.2k and 35.5 PW** because I did not include any of this work from Installation Group in my estimate. An oversight

**High Power and Low Level RF:**

Deliver high power RF to the two cavities inside a ¼ CM. Install klystrons, the high voltage power supply and klystron control chassis. This includes waveguides.

Low level rf: build 6 LLRF control chasses (750 MHz for laser and the FEL buncher, 1497 MHz for two chopper cavities, 1497 MHz for two cavities inside the ¼ CM. OK to build a spare chassis, too). Water skid for the buncher, water skid for the chopper cavities (one skid, chopper cavities plumbed in series). Provide a master oscillator (borrow one initially?). Provide amplifiers for the chopping cavities (note, we have 350kV beam, so the chopper amps must be powerful). We can defer this, because money is tight. Cable things up.

Cable up and commission the FEL buncher from “VA beamline”, which was part of the envisioned FEL injector upgrade (we figured Tom Powers would do this for us, since he bought the buncher and SSA, and he is interested in knowing that it works – it will one day go to the FEL and we will acquire the buncher that gets pulled out)

Timeline: focus on building LLRF boards first (I think there are almost done). Then focus on “RF to a cold ¼ CM” which means we have a master oscillator, two 1497 MHz LLRF boards, two fully functional klystyrons attached via waveguides to the cold ¼ CM in April, 2016. Next, focus on RF to the laser. After this, focus on turning ON the FEL buncher and SSA. Finally, we can think about the choppers. With the exception of the choppers, I hope ALL rf to be complete by August 2016.

I list in my spread sheet that the **estimate for high power + low level rf was high by $78.5k and 107 PW**, but actually I think it was pretty accurate. The original estimate reflected what I asked for. Together with Rick and Curt, we have made changes to save money. These include having Kevin Jordan work on some of the klystron stuff “for free”, borrowing a master oscillator to get started, using the FEL’s VA beamline buncher and SSA, and foregoing the installation of chopper amplifiers until a later date. So I hope Rick and Curt agree with my “cuts” to their original estimate.

Other relevant comments. Andrew Hutton likes to say “we don’t need new rf control chasses” but this is not true per Dave Seidman. Old rf control modules are needed to maintain the old stuff at CEBAF. They use CAMAC which is obsolete, and we won’t have CAMAC at UITF.

One water skid was paid for by the 750 MHz commissioning work, I think. So some savings there.

**SSG:**

Provide an ODH monitoring system inside UITF.

Provide a PSS that interfaces to entry/exit doors, the klystron racks, the gun HV power supply and the drive laser. We are presently discussing with Bob May and indirectly with SCMB the correct means by which we limit beam current at MeV energy (there’s not enough passive shielding to limit radiation exposure).

Timeline: ODH system complete by April 2016. PSS system done by August 2016.

In my spreadsheet I indicate that **my original estimate was low by $3k and 7.7 PW (combined ODH and PSS tally)**. It’s possible Henry made more progress in FY15 than I am aware.

Of note: The big “red flag” is 63 PW for the PSS system. Not a red flag because I object to the hours, but I wonder if Henry has enough staff available to get the work done in a relatively short amouint of time. I note that Neil and Installation Group are installing the PSS box conduit, maybe this reduces the 63 PW labor estimate for SSG?

We are using an older ODH system from the FEL storage container, to save money.

Bob May and Vashek recently informed us that we might need PSS BCM cavities, to limit possible radiation exposure....this could add scope.

**Mechanical Design:**

With input from CIS, provide a beamline layout for UITF, from the gun to a faraday cup upstream of HDIce. This includes drawings for components unique to UITF. We have come to appreciate that this job also includes some non-trivial responsibility for being aware of the Cave structure, interfacing with Team HDIce, and helping Vashek appreciate where radiation sources are at. We hope we have passed responisbility for HDIce-specific stuff to Mike Zarecky, but so far, he has not attended a meeting. And we have since come to appreciate that someone has to design the waveguide layout, from klystrons to ¼ CM.

Timeline: keV portion and ¼ CM layout, with waveguide layout complete by April 2016. MeV portion of UITF complete by August 2016.

I indicate **my budget estimate was low by $15.9k and 7.5 PW**. The procurement overage stems from hiring Forrest Ellingsworth via a headhunter, and we underestimated the size of the design job. But I am very happy with the service I am getting. I speculate sometimes “3D” actually adds work, and without necessarily added benefit.?

**Magnet Measurement**

Map a fairly large subset of UITF magnets. My guys tell me now is the time to do this. If we don’t map all or some of the magnets, will will regret it later.

Timeline: map the keV magnets by March 2016, then map the MeV magnets (or a subset of them) by August 2016.

**I underestimated this effort by 22 PW**, because I did not include this work in the original scope of project.

**Instrament and Controls (I&C):**

Provide epics controll and monitoring of valves, stripline BPMs, viewers, current monitoring at cups, dumps and apertures, harps. We want to use Hansknecht’s ion pump power supplies, but we would appreciate Engineering support stuffing the boards, and talking to these supplies via epics. We need an SCAM to make different beam modes. The SCMB might insist we install a PSS BCM (maybe two).

It has been a bit fuzzy estimating the costs for some hardware, because CIS owns many viewers and cups, valves, etc., And we own some old controls equipment from the old test stand. We also hope Omar has squirreled away lots of stuff he can let us use as CEBAF hot spares. Not trying to be stingy, but indeed money is tight, particularly procurement money.

Timeline: once the electricity is available in the racks above Cave1, I hope I&C can start hitting this work hard, or when opportunities arise. We want to make keV beam by summer 2016, and MeV beam winter 2016.

I humbly allocated $160k in procurements for I&C and ~ 50 PW of labor for FY16. This new allocation means that **my original estimates were high by $44k and 46 PW**. I hope Omar can live with these new, lower numbers. We will learn soon enough as Phil wraps up his inventory of CIS shelves. I have the impression that we made some progress on the stripline BPM electronics in FY15 (hope this is true, since this is the biggest procurement cost for UITF I&C, 17 sets of stripline BPM electronics). I owe Omar a songsheet that lists all devices, and a tally of devices we have on hand.

**DC Power:**

Provide trim cards for solenoids, steering magents, quads and dipoles at UITF. Use the old injector test cave bulk power supplies and racks. Use the old trim cards (30 of them). We originally imagined making 30 new cards. Pull cables for all magnets, connect them, provide current limiting resistors if necessary.

Timeline: Have 30 functional trim cards ready by April 2016. Have another 30 cards available by August 2016.

I claim **my original estimate was high by $64.5k**. This is because, to save money, we thought we could put new cards together using parts from the FEL storage transportainer. Eventually, we would need to resupply the FEL. **I estimated it would take 22 PW to get all this work done, which means the orginal labor estimate was low by 12.5 PW.**

**Survey and Alignment:**

Assist with the beamline alignnent, as we put the beamline together. We imagined three or four alignment campaigns, e.g., first locate the gun, then align the components of the keV section, then the ¼ CM, then the MeV section.

Timeline: the alignment campaigns would be staged, from now through winter 2016, as sections of UITF get built. We imagined we could interleave other JLab survey work with UITF, these guys are pretty good at scheduling work and pleasing multiple masters.

My spreadsheet indicates **my original estimate was low by $2K and 1.8 PW**, so basically in the noise. Here, I simply defered to Chris Curtis, and basically used the estimate he provided me. We didn’t budget for survey monuments in the original estimate.