Summary of Friday May 21 COUPP-2L logistics discussions

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One idea new to our thinking is to decouple the pressure vessel from the hydraulic cart and DAQ for the Fermilab integration tests. The idea is to perform DAQ system integration tests in Lab 3 with DAQ, hydraulic cart, and NESLAB. We may add a small dummy load with some instrumentation to the hydraulic cart. This gives us all the pieces we need for a complete software evaluation, and it frees up the pressure vessel to ship to SNOLAB whenever we have complete additional sensor installations and performed a dry fit of the hydraulic plumbing.

In this picture we have three distinct timelines for the pieces coming from Fermilab. The first is the pressure vessel timeline including the pressure vessel, its base plate, its hydraulic piping, and the base slabs and pedestal base of the polyethylene shielding[1]. The second is the DAQ/controls timeline including the LINUX computers, the National Instruments PXI chassis and processor, other DAQ components, the hydraulic cart, and the NESLAB unit. The third is the inner vessel assembly timeline, including the cleaning, assembly, and testing of the inner vessel, the attachment of acoustic transducers and other instrumentation and wiring, and the water distillation process.

One virtue of the new model is that we can ship the pressure vessel earlier, and the pressure vessel handling and installation are decoupled from the DAQ until they converge underground at SNOLAB. The pressure vessel can be shipped to SNOLAB as soon as we have prepped it for shipping. The prep work will include removal of camera mounts and the instrumentation breakout box BB-2. The pressure vessel will then be palletized and shipped. The pressure vessel can be received at SNOLAB, cleaned, transported underground. The pressure vessel can be installed onto the shielding base as soon as the base has been installed at the SNOLAB underground site. At that point we would be free to install the hydraulic plumbing from the pressure vessel out through the shielding. We could also install the source tube.

Following the DAQ and controls path, we would receive all new DAQ equipment and transport it to the LAB 3 North clean room for initial acceptance testing, software installation, and system integration tests. This is where we will complete and test any revisions to the data acquisition software or hardware. Once we're happy with the software performance, then these components can be repackaged for shipment to SNOLAB. There they will be received, cleaned, and staged in an above ground clean room area. In the above ground tests, we will populate the relay racks, setting

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[1] Obviously, this intersects with the SNOLAB timelines for the preparation for the shielding base and the site. The water tanks are the last thing to be installed. We really need a chart to make all this clear…

the system up in its final configuration. A complete system integration test will be performed from the DAQ out through the dummy instrumentation, the real hydraulic cart with a dummy load, and the NESLAB unit. The integration test will extend through the LINUX data management and communications computers through the network to Fermilab and all the way through the data storage, analysis, and archiving processes. Once we declare success in the above ground integration tests, then the DAQ/controls equipment can be transported underground. For transport, the LINUX computers are rail mounted in the racks and can be removed. The NI-PXI chassis can also be removed. Other elements can likely ship with the racks, although we should be flexible here as we learn more about the transport process underground. The key element here is that the DAQ meets the relay racks in the SNOLAB above ground facility. We do an above ground integration process and then ship underground.

The next integration step is the installation of the DAQ/controls equipment in the SNOLAB underground site. Here the starting point is a prepared site with electricity, compressed air, and lights. At this point the base of the shielding will be in place and the bubble chamber pressure vessel in place on the shielding base with piping out to the location of the hydraulic cart. Installation steps include placement of the hydraulic cart, the NESLAB unit, and the relay racks. We would connect the hydraulic cart to the pressure vessel hydraulic lines, the NESLAB to the heater/chiller lines, and instrumentation to the DAQ. We would reconnect all the DAQ and computing elements, and establish the network connections. The pressure vessel and the hydraulic lines would be filled with glycol at this point and we could then perform a full system integration test. This would involve pressure cycling the empty pressure vessel and running the full data acquisition chain all the way through to analysis and data archiving at Fermilab. When we declare success in this integration test, we would be ready to install the inner vessel assembly.

Meanwhile, the inner vessel processing would be proceeding at Fermilab. This includes the cleaning of all inner vessel system components at the A0 facility in the Accelerator Division. Components will be bagged and transported to the Lab 3 clean rooms for assembly, final rinsing, and vacuum leak-check. Once the leak check has been completed, the water distillation inner vessel fill will be performed, also in the Lab 3 clean rooms. We have an existing inventory of old SNOLAB water, but there is some uncertainty as to how much we have. Our procedure will be to set up the still and to transfer the balance of the water from the transfer container to the still. If we do not have sufficient SNO water, then we will refill the transfer container using the new high-purity water source from the 60-kg chamber. That will then be used to top off the water supply in the still. We will distill the water into the inner vessel assembly under vacuum. At that point we will complete the instrumentation installation and wiring of the inner vessel assembly. This includes the four new acoustic transducers, plus one additional temperature sensor. Once the sensors are installed and tested, the inner vessel assembly will be secured in its shipping frame and packaging and then it will be back-filled with argon at 1-atm to release the

bellows tension and allow the bellows to function as a vibration isolating spring between the inner vessel and its support structures.

The final step is the installation of the inner vessel assembly. The assembly would be received at SNOLAB and put through the appropriate cleaning and transport steps to get it into the underground site. At this point we would open up the pressure vessel and install the inner vessel assembly. The steps that follow include glycol backfill and de-gassing, the CF_3I fill, completing the insulation, and the warm-up to operating temperature. At this point we are up and running, and we would move on to the full detector commissioning. Once we've determined that the chamber is running well, we would install the outer water shielding.

Some Notes and Details on the specific timelines:

The Pressure Vessel Timeline:

1) In Lab F, remove the cameras and camera mount hardware.
2) In Lab F, remove the instrumentation breakout box BB-2.
3) In Lab F, perform dry run tests of top flange seal procedure.
4) In Lab F, dry fit preliminary SNOLAB hydraulic plumbing.
5) In Lab F, prepare shipping pallet and prep the vessel for shipment to SNOLAB.
6) At SNOLAB, receive and process the vessel.
    a. What cleaning is required? Is external cleaning sufficient or, for example, do the sight-glass windows need to be removed?
7) Transport the vessel to the underground site where it can wait, or be installed on the shielding base, depending on which gets there first.
8) Items (1) through (5) can likely be completed in the next two weeks. We can certainly ship the pressure vessel by mid June.
9) *Are there special considerations with respect to the pallet? How do we manage the transition from shipping (horizontal on a wooden pallet?) to a clean device in a clean room environment? Is it cleaned underground or above ground? Is there anything we can do at the Fermilab that will make the process easier and/or faster at the SNOLAB end?*
10) At SNOLAB, the first site preparation step is the installation of the bottom plates of the shielding. These need to be appropriately leveled. I don't know if grouting is necessary or not.
11) At SNOLAB, once we have the installed base plates and the raised shielding pedestal, then the pressure vessel can be placed.
12) Final Installation Steps at this stage:
    a. Install the hydraulic piping from the pressure vessel out to the cart location.
    b. Install insulated heater/chiller lines.
    c. Install source tube.
    d. Install additional shielding around the chamber legs.

13) It looks like there is some schedule flexibility in the SNOLAB site prep, and shielding installation. The pressure vessel will arrive sometime in June. The earliest point at which the DAQ components could head underground would be the first or second week of July. That is when we would need the pressure vessel in place on the shielding base, along with electricity and compressed air.

The DAQ and Controls Timeline:

1) FNAL Lab 3 Clean Room DAQ Commissioning Test:
    a. The purpose of this activity includes:
        i. Acceptance testing
        ii. Software installation
        iii. System configuration
        iv. System integration
        v. Modifications upgrades to DAQ software and hardware.
    b. Receive the DAQ equipment into the Lab 3 north clean rooms.
        i. We need to develop a procedure for making the transition from computers and equipment in shipping packaging to clean equipment in the clean room.
        ii. Are there special considerations here with respect to bring this equipment into the SNOLAB clean rooms at a later date?
        iii. Are the FNAL clean rooms clean enough?
    c. Set up the Hydraulic Cart with a dummy load outside the clean room
        i. It will have a local network connection to the DAQ inside the clean room.
    d. Setup the NESLAB with a dummy load inside the clean room
    e. Evaluate (2) new linux machines
        i. Fermilab software installations & configuration
        ii. Security et al.
    f. Evaluate new NI PXI machine
        i. Install Cart Communications software
        ii. Install LabVIEW Vision
        iii. Install COUPP DAQ software
    g. System integration test
    h. Software evaluations and checkouts
    i. We see this effort as happening in Lab 3 between May 24 and June 11.
2) Re-Package the equipment for shipment to SNOLAB.
3) It would seem that all the equipment could be at SNOLAB in storage or perhaps already cleaned by the end of June.
4) At this point the first crew of Fermilab people will arrive at SNOLAB for training, and presumably for initial work in the above ground labs at SNOLAB. The target date for first COUPP folks at SNOLAB could be July 5.
5) The goal would be to set up all of the equipment used in the Lab 3 integration test in an above ground laboratory at SNOLAB.
6) Populate the relay racks with the various elements of mounting hardware.

7) Set up the DAQ components and cable things together.
8) Establish operations and communications back to Fermilab.
9) We could accomplish the technical goals of an above ground integration test in the first week (or out into the second week) of July.
10) Now prep the equipment for transport underground.
11) One could imagine that the equipment could be installed underground in the second (or out into the third week) of July. A full system integration test could be concluded around the end of July.

The Inner Vessel Assembly Timeline:

1) This is our most uncertain time line (at east for the moment) but…
2) It looks like we have a pretty generous schedule, driven by site preparation and infrastructure (DAQ, controls) installation at the SNOLAB underground site.
3) We will likely get the inner vessel components cleaned in the last week of May or the first week of June.
4) We will need to have the vessel ready for shipping by the second or third week of July.
5) The actual work of assembly, vacuum leak checking, and water distillation takes only a few days to a week.
6) We will need one week to do the instrumentation installation (acoustic transducers, temperature sensors, wiring.)
7) The question is whether we can schedule the necessary technician time through that 4-5 week period. Right now it looks pretty good, and I think we have some schedule flexibility on the inner vessel assembly.
8) A nominal schedule might show the inner vessel components clean and assembled after the first week in June.
9) The next step would be the setup for the water distillation, and that could happen in Lab 3 in the third week of June.
10) The fourth week of June would then be the time for sensor installation and wiring.
11) This would nominally get us a finished inner vessel assembly at the end of June.
12) We should allow two weeks for the transport process to SNOLAB, including packaging and un-packaging, cleaning at the SNOLAB end, and transport underground. Even there we have around two weeks of schedule slack for a goal of getting the inner vessel ready for installation by the end of July.