Initial Campaign

Last week: “Initial Campaign” of the water bag replacement work

- Key things we learned
- Task list
- Items to be moved/disconnected over Bag 28
Key Things We Learned

Recall:

- One of the key problems is how to remove the threaded rods that run across the top of the water target SuperPØDules and through the bag headers
- Rods held on the end by T-nuts (aka “Dave nuts”)
- We’d considered two approaches:
  - Option A: lift the SuperPØDule 10cm to access the T-nuts and remove the threaded rods
  - Option B: cut the threaded rods in place
- Baseline plan:
  - Lift the central water target SuperPØDule (CTARG)
  - Use the existing lift fixture (from original installation)
  - Use 3/8” aircraft cable between the SuperPØDules, as standard lifting straps won’t fit.
Key Things We Learned

Issue #1: There is no space between the two water target SuperPØDules

-> They are mounted flush with each other so that the water layer between them is supported by PØDules on both sides.

-> Impossible to fit aircraft cables between them.

-> Workaround: change the lifting approach to run the cables outside the basket.

-> This approach was discussed with Tsukamoto and the Goto-san (rigger) on July 2.
**Key Things We Learned**

**Issue #2:** The CTARG cannot be lifted straight up without interfering with the USTARG

-> Not only are the two flush, but the CTARG T-nuts actually fit into recesses in the USTARG (upstream target SuperPØDule)
Solutions with lifting:

1. Lift the central ECAL (CECAL) out of the detector entirely.
   - Then CTARG can be shifted ~1cm downstream
   - Clearly possible - reverse of installation.
   - Requires disconnecting everything from the CECAL
   - Likely several weeks of work more than expected
Solutions with lifting:

2. Lift both target SuperPØDules together

• Requires designing and certifying an entirely new lift fixture

• Must consider issues of the relative motion of the two target SuperPØDules during a lift

• Several weeks of engineering design at minimum
Solutions without lifting:

Option B: Cut the threaded rods in place

- Previously disfavored because of concerns about risk
  -> Using a saw near delicate detector components
  -> Fine metal shavings or dust

- After looking in detail at the PØD last week, Dave and I came up with a better cutting approach:

- Precision bolt cutter
  -> Mounts onto the PØD itself for alignment
  -> Hardened blades cut into the threaded rod
  -> Screw-driven (unlike usual bolt cutter, which has long lever handles)

- Cut away HDPE (high density polyurethane) to access bolt (another custom tool)
Solutions without lifting:

Preferred option is now to cut the bolts in place.

- Developing tools now at CSU

- Will test them both at CSU and at Stony Brook next week
Task List

Summary of the work we’d planned for the week
(in the order from the method statement)

1. Remove dry air covers
   -> Done June 28-29 by Water, Alex, Aaron

2. Remove drip pans
   -> Done June 28-29 by Water, Alex, Aaron

3. Install the support rails and movable platform on top of the PØD
   -> Done July 3 by Bruce, Alex, Aaron, Dave
4. Test two custom tools

- Low-profile Allen wrench
  -> Used to unscrew bolts that go up through the bottom of the water bag frame into the bag footer
  -> Has to be low profile to fit above the support I-beam
  -> Wrenches work well

- Special wrenches to turn jack screws in limited space
  -> Needed to lower screws to be able to slide out crossbars
  -> Also needed to potentially jack up SuperPODule a small distance for better bottom access
  -> Further wrench modifications needed (shorter handles, multiple sizes, offset heads)
Task List

5. Detailed inspection of the CTARG mount points to the basket  
   -> Done

6. Assess which PØD utilities would have to be disconnected to  
   raise the CTARG by 10 cm.  
   -> Done

7. Assess which MPPC cables will have to be disconnected to remove  
   water bag 28  
   -> Done (see later slides)

8. Test installation of 3/8" aircraft cable to lift the CTARG.  
   -> Immediately found that it could not fit as planned, see above.
Task List

9. Test the connection of the crane to the existing lift fixture.
   Discuss the lifting plans with Tsukamoto and the rigging company.

-> We discussed the lifting plans extensively with Tsukamoto and Togo-san (from the rigging company) on July 2, based on the approach of lifting just the CTARG with the cables outside the basket.

-> They were happy with this lifting approach.

-> We didn’t physically lift the existing lift fixture, but we did verify that it could be connected to the crane as before.
Task List

10. Make necessary measurements to complete the design of the water bag extraction fixture, and complete the design.

-> Measurements are complete. Design is largely complete.
Above Bag 28

1. Water drain and fill tubes
   (Bags 27 and 28)

   -> Disconnect at the top of the PØD,
      pull out the north side

2. Water sensor connections
   (Bags 27 and 28)

   Bag 27: Pull back out of the way
      (disconnect from the sensor electronics board if necessary)

   Bag 28: Disconnect from the sensor board,
      will be removed completely before water bag removal.
Above Bag 28

3. Electronics support rails

Dismount and move to temporary locations

-> Attachment at SuperPØDule edge easy to disconnect

-> Attachment to the electronics ladders will require temporarily dismounting two TFBs (but no MPPCs)

-> Support rails on blocks at temporary locations during bag replacement
Above Bag 28

4. Water electronics power and ground connections

-> These terminal blocks are right above the boundary between the upstream and central water targets

-> Lying on top of other utilities, not mounted to anything

-> Not enough slack in the wires to move them completely out of the way

-> Plan: disconnect the power/ground connections at the terminal block

-> Should be done by water electronics expert (e.g. Scott Davis)
Above Bag 28

5. MPPC cables

• All the MPPC cables from the MPPCs on the north side of Layer 20 need to be disconnected (the layer just upstream of Bag 28)

• Disconnect at the TFB end, move bundles of MPPC cables over to the upstream side

• All TFB connections are to the upstream edge of the TFBs on the upstream side of the electronics ladder (connections to Layer 21 MPPCs also along this edge)

• Cables to be disconnected are labeled 2-00-0-000 through 2-00-0-0071 (All are also labeled with electronics channel.)
Above Bag 28

6. Water sensor electronics board

This board is mounted above one of the TFB mounting plates (at the north side of the central water target)

-> Need to temporarily unmount it to access the MPPC connections underneath