P0D Water Target system

J. Wilkes, H. Berns
U. Washington
US T2K Collaboration meeting
April 18, 2008
UW mechanical tasks status

- **P0Dule frames:**
  - UW shop has PVC material on hand, cut and planed. Ready for production of 40 + 4 frame sets
    - Ready to produce about 3 frames/week, 3 weeks out of 4 (remaining week on big mill is promised to Sloane Digital Sky Survey)
      - Will start real production as soon as current SDSS plates are finished
  - Will start real production as soon as current SDSS plates are finished
- **Target frames:**
  - Proto target frame is ready for insertion of bags and long-term testing
  - Gasket material has been identified and proto samples ordered
    - Will test with HDPE bag, proto-2 clamps and proto-1 frame
  - Hi-density polyethylene stock for full set of clamps and frames ready @ UW
  - Ready to produce 25 + 2 HDPE frames for water bladders, and 50+5 pairs of bladder clamps
- **Target modules (bladder, clamps, sensors, frame, strut, gasket):**
  - Bladder material + custom HDPE-welder rings ready @ CSU
  - HDPE material was tested @ UW in February (with proto-1 clamps)
    - no leaks, water loss rate too small to measure
    - Redesigned tubing and ports in clamps for proto-2
  - Proto-2 (final design?) bag clamp bars and sensor strings constructed @ UW
  - UW sent clamps + sensor strings to CSU
    - CSU will weld bladder to clamps, return to UW for long-term testing
Monitor/pump control system status

- Bladder water sensors ready for finalization
  - Proto 2 version of I2C data handling board ready
    - Will use for tests of full tgt module (bag, frame, sensors)
- Monitor/control software
  - Straightforward task when ready - other priorities higher for now
- Buffer tank prototype ordered for next tests
  - Will purchase equivalent in Japan to save shipping (low cost)
- Test plan (late April):
  - Set up test stand with proto 1 HDPE frame (simple design, likely final),
    proto 2 HDPE bag/clamps, sensor strings, gasket
  - Connect pumps with tank/tubing layout equivalent to ND280 hall
  - Check fill/drain rates
  - Fill with water and monitor sensors for >1 month
Timeline

- Send clamps, tubes, sensors to CSU for welding now
- Test I2C interface (proto-2) for sensors now
- Test integrated bladder system @ UW (welded bladders with tubes and sensors; frame with gasket) April
- Finalize control/daq system: May
- Develop water monitor/control software May
- Build necessary custom electronics: Summer
- Produce full set of equipment and integrate with PODules at Stony Brook Autumn
- Deploy, commission and test system when POD is installed
For the record...

- Following are slides shown previously, here in case needed to clarify layout, etc
Water Targets

**Goal:** minimize container mass relative to water
Polyethylene bladder inside frame contains water
No penetrations on bottom: no leaks!

Water Target Support Frame surrounds bladder.
Made with two PØDules, gaskets and a frame.
The frame is also watertight.

On-going prototype tests @ UW
Water monitor sensor scheme

- inside each bag: 6 temperature, 2 pressure, 8 depth sensors

Temperature sensors will be ganged on one I²C bus.

Depth (submersion) sensors require $N+2$ conductors each (so 4 sensors = 6 cond.) up to interface card, then go onto same I²C bus.

Pressure sensors require 3 conductors each.

Depth (immersion) 4 per tube
Bladder layer frames

- HDPE target frame
- Gasket
- Monitor sensor
- \textsuperscript{1}C interface board (handles 2 bags)
- HDPE center strut
Monitor/Control system parts

- I2C data + DC supply cable to/from TFB or PC (RS232-to-I2C adapter)
- Reference pressure sensor (barometer)
- Reference (air) temperature sensor
- I2C sensor interface module (board-side: 1.0" x 5.0")
- UART (RS232) to I2C interface
- I2C + 3.3V power to sensor interface module
- 5V supply from USB port

Slides from earlier reports: for reference
P0D water tank

- Tank location

- Example: US-made tank
  - will buy one in Japan
  - Capacity 2700 liters (700 US gal)

2800 LITERS – 1.2m D x 2.6m H
COST: $600? (BUY IT IN JAPAN)

Grooves for Hold-down Straps

2600 mm

1220 mm

General view of ND280 pit with magnet restraint brackets on the B1 floor

Langstaff, 11/07
POD water target: pump and monitor system

Cole-Parmer 0719210
20 pumps
(each handles 2 layers)
P0D water target bladder testing

- Test stand @ UW
  - Prototype 1 = rubberized cloth
    - Tested for months - no leaks
    - Too expensive!
  - Prototype 2 = Tyvek material
    - Tested for months - no leaks
    - Cheaper, good backup choice
  - Prototype 3 = high density polyethylene
    - Cylindrical stock, sealed by HDPE clamps top and bottom
    - Easier to make than proto 2
    - Now testing
Photos of test setup for bladder III

- No duct tape in final versions!
Also: P0Dule external temperature sensors

- UW will provide temperature sensors for photosensor environmental monitoring
- Use same sensors as inside bags
  - plug into $I^2C$ ports on TFBs, DAQ via Canadian system
- Nominal plan:
  - About 50 sensors, distributed
  - Use to calibrate temperature at a sample of photosensor locations
    - Photosensor dark rates = most sensitive temperature monitor!