UT-BATTELLE

nTOF11 Collaboration Meeting

Non-Design Issues for the Mercury Jet Target

P.T. Spampinato

V.B. Graves

T.A. Gabriel

Princeton University
April 29-30, 2005

fact Muon Collaboration

OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

Mercury Fill Procedure

- **Verify total inventory by weight before and after fill**
- **Peristaltic or vacuum pump will be used to transfer Hg from standard flasks**
  - **pump is connected to sump tank fill-port**
- **Up to twelve 2-liter flasks may be shipped to MIT and CERN**
  - **each flask is in an overpack container**
- **Hg fill operation occurs in the TT2A tunnel**
  - **fill directly from a flask using a steel tube insert**
- **Secondary containment is open during fill operation**
  - **local vapor sensing using the portable monitor**
  - **usual drip precautions … plastic liner and gauze**
  - **“spill” clean up kit will be available**

Peristaltic Pump & Standard Flask

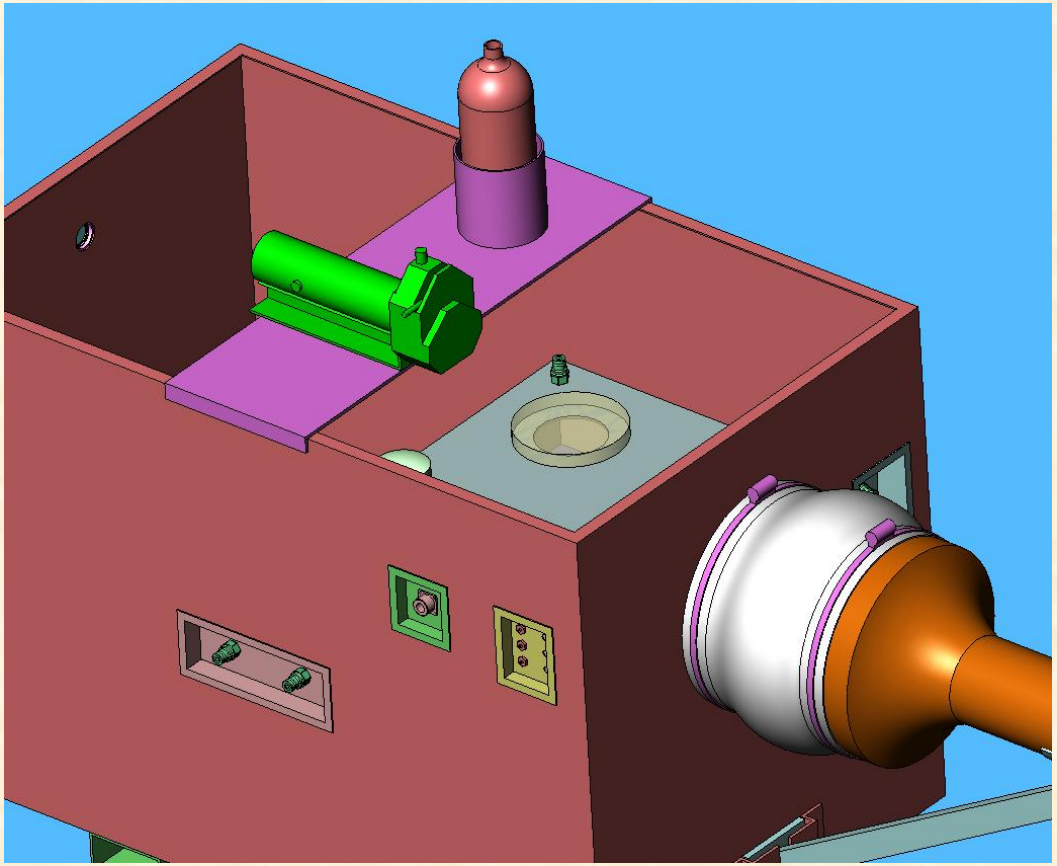
Peristaltic Pump Test

Standard 2 Liter Flasks

Mercury Emptying Procedure

- **Peristaltic or vacuum pump used to transfer Hg from primary containment directly into a standard flask**
  - **accurately monitor amount of Hg transferred into each flask using a scale and visually verify**
- **Some small quantity of Hg inventory will remain in the primary containment … 100s ml ??**
- **Does CERN have the means to dispose of the secondary waste that will be generated**
  - **PPEs, gauze, plastic sheeting, tape, filters, … ?**

Target Cutaway Showing Fill Port

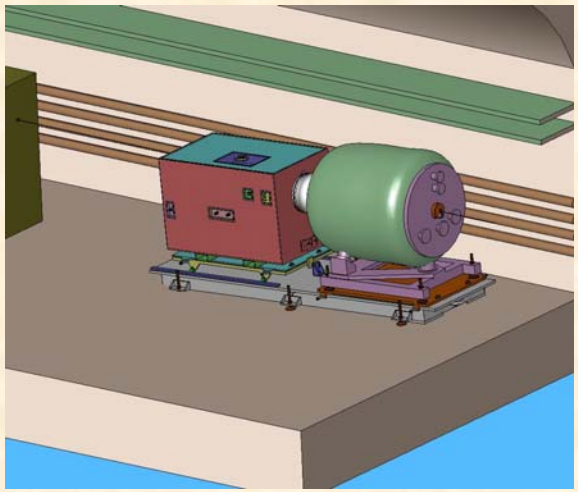


Peristaltic pump and standard flask ready for Hg fill operation

Equipment Installation

- **The integrated systems test at MIT is practice for the activities to be done at CERN**
  - **Unpack target and store crates for reuse**
  - **Move target system, Hg flasks/overpacks, support structure, hydraulic pump and fluid into the lab**
  - **Place the solenoid onto the common support base structure**
  - **Install target into the solenoid bore**
  - **align and elevate the equipment as required**
  - **Connect electrical and hydraulic services to the target system**
  - **Operate solenoid, target, and diagnostic**

- **Practice for CERN experiment operations:**
  - **installation sequence**
  - **alignment sequence**
  - **service connections**
  - **systems controls**
    magnet/target/diagnostic
  - **dismantlement, removal**



CERN Decommissioning

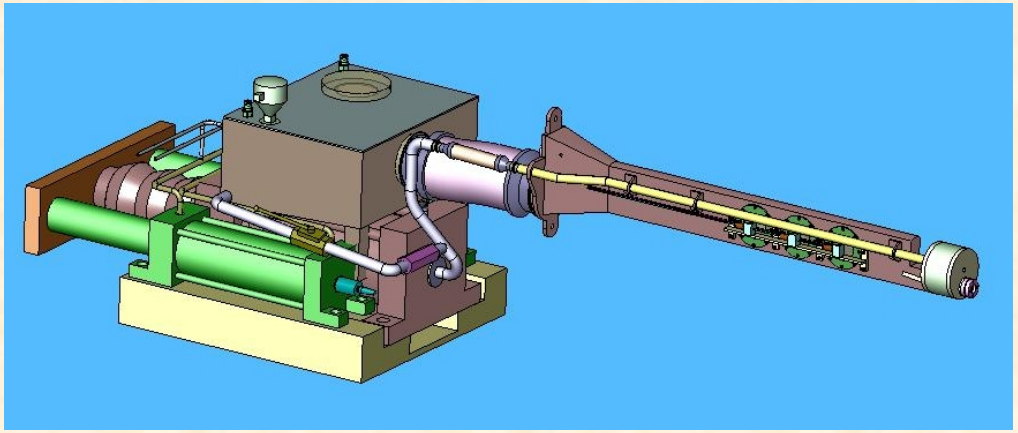
- **1 day minimum cool down for limited hands on access (1 wk. pfd.)**
- **Disconnect services as required**
- **Move equipment out of the beam line**
- **Store in TT2A tunnel for 1 month minimum cool down (1 yr. pfd.)**
  - **drain Hg into flasks in TT2A, and**
  - **drain hydraulic fluid into drums**
  - **move to surface facility**
  - **CERN packs equipment into original crates**
  - **load into sealand container**
  - **CERN ships to ORNL**

Transport Plan

- **Components to be shipped are:**
  - **Target system secondary/primary containment unit mounted on the "rolling cart" base structure**
  - **Common base support structure for the target and solenoid**
  - **Up to 12 overpacks containing Hg flasks**
  - **Hydraulic tank & fluid (~250 liters) and 20-hp motor**
  - **Misc. equipment and tools: vapor monitors, spill kit, PPEs, wrenches etc.**
  - **Satellite accumulation area (55 gal. Drum)**
- **Target system and hydraulic pump packed in wood crates**
  - **All crates are designed for fork lift handling, easy opening, and reuse**
- **Hg flasks shipped in overpack containers (10 gal. drum)**
- **Truck shipment of equipment to MIT for integrated systems testing, then return to ORNL**
- **Surface ship to CERN in a 20-ft sealand container**
- **Return to ORNL for reuse**

Procurement Plan

- **Long lead item – pump equipment**
  - **Write procurement spec for pump cylinders prior to Title II design review**
  - **16 weeks delivery time for cylinders**
  - **start bid & award process in July 2005**
  - **purchase pump cylinders with FY06 $$ after Oct. 1, 2005**
  - **BNL handles $$ and procurement**
  - **$50-60K is estimated**
- **Target loop**
  - **Write procurement spec for target loop prior to Title II design review**
  - **start bid & award process in Oct 2005 using ORNL Procurement Group**
  - **$40-50K needs to be available from Collaboration**
- **Hg**
  - **obtain quantity needed from ORNL**
  - **Current market cost is $850/liter**



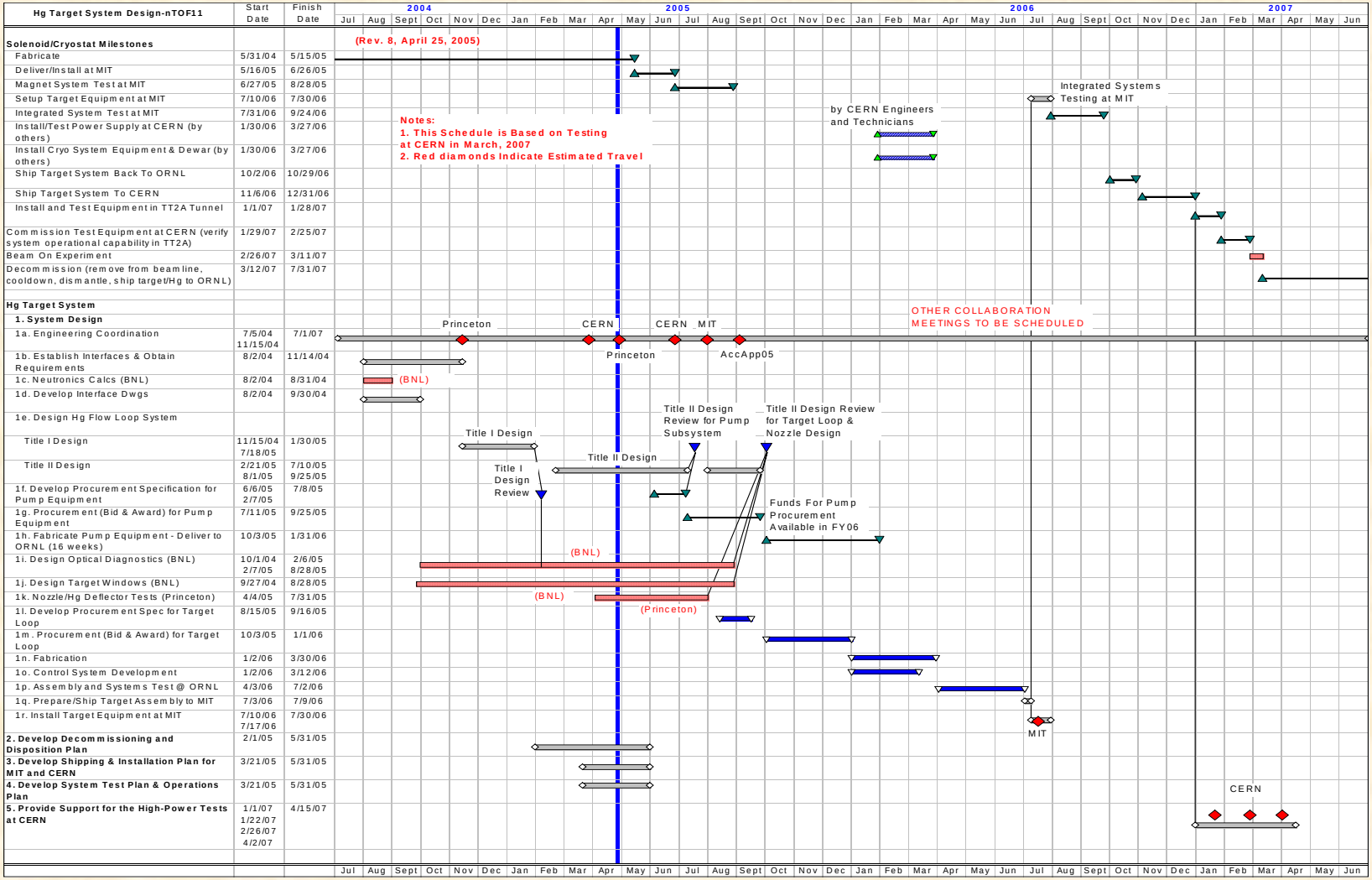
Off Normal Events and Recovery

- **Worst Case: Entire Hg inventory leaks into secondary containment (SC)**
  - **contained in bottom of containment box**
  - **after cool down move equipment out of beam line**
  - **after additional cool down period pump from SC emergency port to refill flasks**
  - **Add "new" SC (plastic bag)**
  - **Return equipment to ORNL**
- **Likely Case: Hg vapors detected in SC**
  - **After 1 day cool down monitor exterior of SC for leakage, visually inspect for leak, connect portable monitor to test port (false + ??)**
  - **If no apparent leak continue with testing**

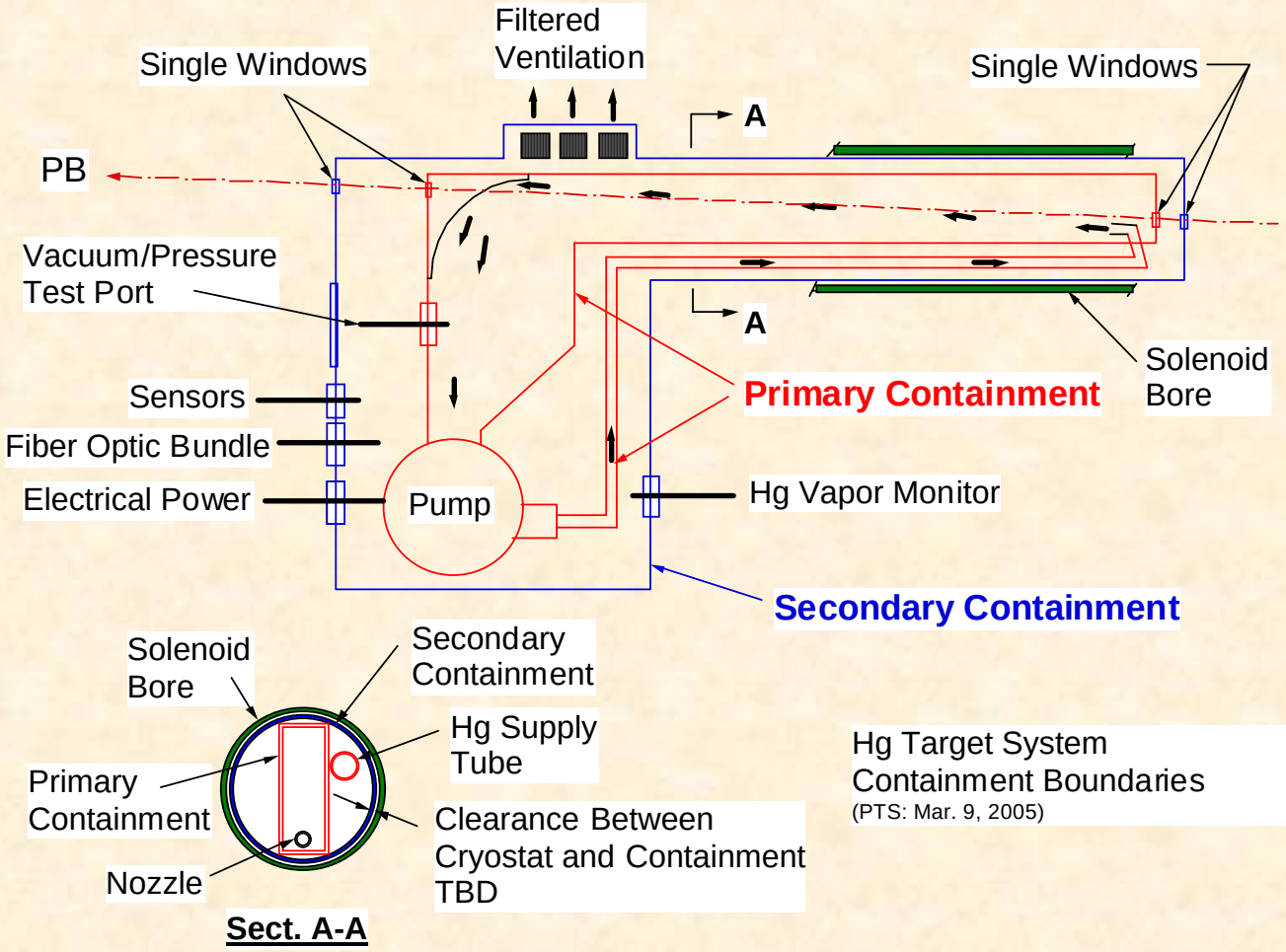
Updated Schedule

Muon Collaboration

CERN experiment shown in March 2007



Schematic Diagram



Operations

(Approx.) Time (sec.)	Solenoid		Target Pump System	Proton Beam	Optical Diagnostic
	Cryogenics	Power Supply			
minus 30	Magnet full of LN_2 @ 80ºK	Standby	Refill syringe pump w/ Hg	Call for beam	Off
minus 10	Purge LN_2 with gaseous He	Standby	Standby	Wait for beam	Standby
0 to 8	Magnet full of He gas	Ramp to full current	Pressurize Hydraul. Cylinder	Wait for beam	Standby
8 to 8.5	Magnet full of He gas	Ramp to full current	Maintain Cylinder Pressure	Wait for beam	Standby
8.5 to 9.5	Magnet full of He gas	At full current	Activate syringe for 20 m/s jet	24 GeV, 1 MW	Operate laser and high speed camera
9.5 to 10.0	Magnet full of He gas	Begin de-energizing	Shut down syringe pump	Standby	Off
10.0 to 13.5	Magnet full of He gas	De-energize to zero	Standby	Standby	Off
13.5 to 1800.0*	Fill magnet with LN_2 @ 80ºK	Cool down to ~80°K	Standby	Standby	Off

* Assumes a 30-minute dwell period.

Operations (cont.)