SBN – Far Detector

Overview & Installation Plans for Warm Vessel

Fernanda G. Garcia

January 17, 2017

FNAL
The SBN Program at Fermilab

- A program with multiple LAr-TPCs exposed to FNAL Booster $\nu$ beam ($<E_\nu> \sim 0.8$ GeV)
- SBND detector (82 t) @ 110m from target;
- Microboone detector (89 t) @ 470m from target
- ICARUS T600 (476 t) @ 600m from target
**ICARUS-T600**

- 476 t LAr active mass
- 2 independent and identical T300 modules, $3.6 \times 3.9 \times 19.6 = 275 \text{ m}^3$ each
- 4 TPC chambers, 2 per T300
- Very elaborate cryogenic and purification systems

- T300 moved to CERN in 2014 for upgrades
  - new warm vessel steel structure
  - new cold vessel and passive insulation
  - refurbishing of the cryogenic and purification equip.
  - fattening of the existing cathode panels;
  - upgrade of the light collection system;
  - new faster read-out electronics

- Cosmic Ray Tagger (CRT) is common to the whole SBN program – jointly developed.
Cold Vessels and Insulation

- **Cold Vessels and Insulation**
  - Parallelepiped shape with internal dimensions of
    - 3.6(w) x 3.9(h) x 19.6(l)
  - Extruded aluminum profiles welded together ~30t each
  - Passive insulation to be installed coupled with a two-phase N2 cooling shield

- **Status**
  - 1\(^{st}\) cryostat complete in Oct’16
  - 2\(^{nd}\) current under construction
Warm Vessel

- **Warm Vessel** will
  - host two T300, thermal insulation, cold shield
  - support on its roof all electronics racks, some cryo vessels and piping.
  - allow personal standing and working on top of the vessel and has to be gas tight
  - operate at slightly overpressure (20-30mbar)

- **Designed as a modular approach**
  - different type modules will be pre-assembled at FNAL
  - Installation consists basically of bolting/welding/survey
  - Three main components:
    - Floor: 28 modules
    - Wall: 26+12+6 modules
    - Roof: 12 modules
  - ETA: January 17\textsuperscript{th}, 2017!
Warm Vessel Pictures at the Factory
SBN Program Organization

Program Coordinator: Peter Wilson
Deputy: Cat James

MicroBooNE Phase 2
Management
Integration in SBN Program

Technical Coordinator: Ting Miao

Prelim Design
Light Detection
TPC
Calib. Laser
Cosmic Ray Tagger
TPC Electronics
Local DAQ
Installation
ND Cryostat

Technical Coordinator: Claudio Montanari
Deputy: Andrea Zani
Both INFN at CERN

Local DAQ
FD Cryostat

Technical Coordinator: Cat James

Conventional Facilities
Cryogenics
Far Detector Installation
Online Systems
ICARUS Cosmic Ray Tagger

BNB Improvement
Proposed AIP

SBN-FD I&I (WBS 4.4)
SBN-FD I&I Current Organization

1. Management
   - 1.1 Management, F.G. Garcia, AD/PS, deputy A. Stefanik, ND/TSD-EG
   - 1.2 Transportation Affairs, M. Dinnon, ND/TSD-EG
   - 1.3 Safety Oversight, A. Aparicio, ES&H
   - 1.4 Reviews, webmaster, F.G. Garcia, AD/PS
   - 1.5 Layout, J. Tilmann, ND/TSD-EG

2. Warm Vessel
   - 2.1 Mechanical Assembly, A. Stefanik, ND/TSD-EG
   - 2.2 Survey, O'Sheg Oshinowo, PPD/Metrology
   - 2.3 Detector Grounding L. Bagby, ND/TSD-OSG

3. Cold Vessel
   - 3.1 Mechanical Assembly, A. Stefanik, ND/TSD-EG
   - 3.2 Survey, O'Sheg Oshinowo, PPD/Metrology

4. Electronics, DAQ
   - 4.1 Detector System Interlocks, TBD
   - 4.2 DAQ installation, A. Fava, ND/NPD-SBN
   - 4.3 TPC Electronics Installation, A. Fava, ND/NPD-SBN
   - 4.4 Detector Grounding L. Bagby, ND/TSD-OSG

5. Commiss.
   - 5.1 Warm Commissioning, CERN/INFN/FNAL
   - 5.2 Cold Commissioning, CERN/INFN/FNAL
   - 5.3 Beam Commissioning, CERN/INFN/FNAL

6. Cosmic Ray Tagger
   - 6.1 Mounting, TBD
   - 6.2 Bottom modules, A. Schukraft, ND/NPD-SBN
   - 6.3 Lateral modules, A. Schukraft, ND/NPD-SBN

7. Building, Infrastructure
   - 7.1 Building Design, Construction, S. Dixon, AD/PIP-II
   - 7.2 Electrical Systems, S. Dixon, AD/PIP-II
   - 7.3 Networking TBD

SBN FD WBS
Nov/2016
This Review

• Agenda and Talks are available on sbn-docdb on the following url: https://sbn-docdb.fnal.gov:440/cgi-bin/DisplayMeeting?sessionid=1221

• Committee to address the following questions:
  1. Is the current plan for the floor flatness likely to meet the experiment requirement?
  2. Are our plans for floor stack conception, alignment plans likely to succeed?
  3. Does any part of the plan raise stability concerns?
  4. Does the committee recommend the SBN PO to proceed with allocation of funding to support the necessary work needed to prepare the detector pit hall prior the installation of the warm vessel?

• Final report is expected to be submitted to the chair 1 week after the completion of the review.
Part II – Organization and Schedule
SBN-FD I&I Current Organization

1. Management
   1.1 Management, F.G. Garcia, AD/PS, deputy A. Stefanik, ND/TSD-EG
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   1.3 Safety Oversight, A. Aparicio, ES&H
   1.4 Reviews, webmaster, F.G. Garcia, AD/PS
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SBN FD WBS Nov/2016

Jan 17, 2017
Fernanda G. Garcia
SBN-FD Overview
SBN-FD Installation and Integration web site

One stop shop for all information pertinent to SBN-FD I&I activities

Current Status
- Pre-launch phase
  - Checking compatibility with different browsers
  - Finalizing some functionality – built-in database capability for easy search

http://sbn.fnal.gov/fd-installation/
SBN-FD I&I (WBS 4.4) Brief Status

- **Apply corrections on the SBN-FD I&I Org. (Jan’17)**
  - A. Stefanik soon to be replaced by a new hire (start date already delayed by 2 weeks)
  - Networking POC identified: D. Torretta
  - Assistance with carrying out the request submitted in Sept’16 for technical expertise recruiting across lab D/S/C: A. Soha

- **The joint Work Package Agreement (WPA) is drafted but not signed-off yet**
  - Defines the responsibilities for each partner institution on the installation of the ICARUS T600 detector at FNAL

- **Upper management** decide to and agree on the itemized list and high level schedule and deliverables from institutions

- **Technical Coordinators** jointly plan the technical approach and are responsible for the collaborative program, schedule and coordination
  - A working schedule exists based on information received in Feb’16, Jun’16, Nov’16, Dec’16 and TC’s meetings carried out weekly
Floor flatness preparation: ~15 days, Cost: TBD

Resources - Labor:
- Fermilab technical labor ~ 180 man-hours
- T&M ~ 18 man-hours
- Fermilab surveyors ~ 72 man-hours
- Fermilab supervision ~ 30 man-hours

Resources - M&S:
- Catalog fasteners, lumber ~ $0.5k
- Steel plates ~ $1k
- RFQ elastometer – TBD
# SBN-FD WV – Working Schedule - PRELIMINARY

## PHASE 2: Warm Vessel Installation

<table>
<thead>
<tr>
<th>MILESTONE: Warm vessel delivery to FNAL</th>
<th>218 days</th>
<th>8/10/16</th>
<th>6/9/17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools transport to FNAL site</td>
<td>1 day</td>
<td>2/9/17</td>
<td>2/9/17</td>
</tr>
<tr>
<td>Stake survey the location of the warm vessel feet</td>
<td>2 days</td>
<td>12/27/16</td>
<td>12/29/16</td>
</tr>
<tr>
<td>REVIEW: Warm Vessel floor stack and heater run</td>
<td>0.5 days</td>
<td>1/17/17</td>
<td>1/17/17</td>
</tr>
<tr>
<td>Cementation grout to level the pads, elastomers, metal shimming to achieve required levelness (max. deviation of any one foot is +/-2 mm)</td>
<td>15 days</td>
<td>1/17/17</td>
<td>2/7/17</td>
</tr>
<tr>
<td><strong>Mechanical assembly of warm vessel</strong></td>
<td>99 days</td>
<td>1/24/17</td>
<td>6/9/17</td>
</tr>
<tr>
<td>Move container to stage area - inventory parts, organization of hardware</td>
<td>10 days</td>
<td>1/24/17</td>
<td>2/6/17</td>
</tr>
<tr>
<td>CRT – 4 modules to from UC – cover the center of the detector – yet to be tested</td>
<td>1 day</td>
<td>2/13/17</td>
<td>2/13/17</td>
</tr>
<tr>
<td>Assembly floor element inside the building (1st half - 7 modules just bolting) – detector hall pit - install g10 at the bottom of the foot for electrical isolation</td>
<td>5 days</td>
<td>2/7/17</td>
<td>2/14/17</td>
</tr>
<tr>
<td>Move 1st half floor over</td>
<td>1 day</td>
<td>2/14/17</td>
<td>2/15/17</td>
</tr>
<tr>
<td>Assembly floor element inside the building (2nd half - 6 modules just bolting) – detector hall pit - install g10 at the bottom of the foot for electrical isolation</td>
<td>5 days</td>
<td>2/15/17</td>
<td>2/22/17</td>
</tr>
<tr>
<td>Move 2nd half floor over</td>
<td>1 day</td>
<td>2/22/17</td>
<td>2/23/17</td>
</tr>
<tr>
<td>Leak tests material arrived from CERN - mass spectrometer (FNAL)</td>
<td>6 days</td>
<td>2/9/17</td>
<td>2/15/17</td>
</tr>
<tr>
<td>Warm vessel grounding (temporary)</td>
<td>1 day</td>
<td>2/23/17</td>
<td>2/24/17</td>
</tr>
<tr>
<td>Assemble the walls on the MSB and lower to the detector hall pit - install by just bolting (15x)</td>
<td>26 days</td>
<td>2/16/17</td>
<td>3/23/17</td>
</tr>
<tr>
<td>MIG weld all stainless steel plates and leak checks</td>
<td>7 days</td>
<td>3/23/17</td>
<td>4/3/17</td>
</tr>
<tr>
<td>Survey stainless steel plates volume</td>
<td>2 days</td>
<td>4/3/17</td>
<td>4/5/17</td>
</tr>
<tr>
<td>Rods installation lower part</td>
<td>5 days</td>
<td>4/5/17</td>
<td>4/12/17</td>
</tr>
<tr>
<td>Leak test on lower warm structure</td>
<td>5 days</td>
<td>4/12/17</td>
<td>4/19/17</td>
</tr>
<tr>
<td>Insulation installation lower part</td>
<td>15 days</td>
<td>4/19/17</td>
<td>5/10/17</td>
</tr>
<tr>
<td>Insulation instrumentation lower part</td>
<td>2 days</td>
<td>5/10/17</td>
<td>5/12/17</td>
</tr>
<tr>
<td>Cold feet delivery to FNAL</td>
<td>1 day</td>
<td>4/7/17</td>
<td>4/7/17</td>
</tr>
<tr>
<td>Cold feet support installation, survey and adjustment</td>
<td>5 days</td>
<td>5/12/17</td>
<td>5/19/17</td>
</tr>
<tr>
<td>Cooling loops transport to FNAL site</td>
<td>1 day</td>
<td>5/20/17</td>
<td>5/30/17</td>
</tr>
<tr>
<td>Cooling loops installation (not top)</td>
<td>5 days</td>
<td>5/31/17</td>
<td>6/6/17</td>
</tr>
<tr>
<td>Cooling loops tests after installation</td>
<td>3 days</td>
<td>6/7/17</td>
<td>6/9/17</td>
</tr>
<tr>
<td>MILESTONE: Warm Vessel ready to receive T600</td>
<td>0 days</td>
<td>6/9/17</td>
<td>6/9/17</td>
</tr>
</tbody>
</table>
Current Documentation Status

• DRAFT JHA
url: https://www-bd.fnal.gov/cgi-msd/admin/haList.pl?deptID=59
  – Need to release to experts for comments and suggestions
  – Submit to work-flow for sign-offs
• First thoughts on TSW*
  – Decision is to develop a generic TSW for ICARUS T600 installation
    and NOT individual TSW’s for each particular task
  – ETC: Jan 20th EBD

* Working on the online form – not sure what happened to the draft version…