NuMI Target Systems AIP FY19 Q3 Updates

Yun He
Proton PMG Meeting, August 1st, 2019

(New shielding blocks to be installed in August)
Progress Overview - FY19 3rd Quarter vs. 2nd Quarter
from design / procurement to fabrication

Key Activities in FY19 Q3
getting ready for 2019 Summer Shutdown

Project Status for Each Task
12 tasks

June Monthly Project Performance Report
a few tasks have underspent, one VAR

Baseline Change Request
add a few activities, extend a few tasks to FY20

Summary

More details are available at the project SharePoint:
https://web.fnal.gov/project/TargetSystems/NuMI-AIP/
## Progress Overview - FY19 3rd Quarter vs. 2nd Quarter

**Project scope:** 1MW beam power (from 700 kW)
**12 Control Accounts**

### FY19 Q2
- **Scope / plans / design / procurement**
- **Started Jan. 03, 2019**

### FY19 Q3
- **Design review / fabrication**
- **Ready for summer shutdown**

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Activity list</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARS simulations</td>
<td>Re-run for changes in target</td>
<td>50% MARS, done Target DS window</td>
</tr>
<tr>
<td>Pre-target window vac pipe</td>
<td>Procurement, fabrication</td>
<td>70% fabrication =&gt; final welding</td>
</tr>
<tr>
<td>1 MW Target</td>
<td>Design and FEA, fabrication</td>
<td>90% fabrication =&gt; final survey</td>
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<tr>
<td>1 MW Horn 1</td>
<td>Design and FEA, fabrication</td>
<td>70% stripline fabrication =&gt; welding</td>
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<tr>
<td>Stripline air diverter T-block</td>
<td>Design</td>
<td>100% design, PO placed</td>
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<tr>
<td>Target / horn 1 module drives</td>
<td>Design</td>
<td>90% design =&gt; fabrication/procurement</td>
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<tr>
<td>RAW skids</td>
<td>Procurement</td>
<td>100%, installation in process</td>
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<tr>
<td>Target hall chiller/air handling</td>
<td>Specifications, procurement</td>
<td>100%, installation in process</td>
</tr>
<tr>
<td>Target chase shielding</td>
<td>Fabrication</td>
<td>100%, ready for installation</td>
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<tr>
<td>Tritium mitigation</td>
<td>Re-define scope</td>
<td>Activity identified</td>
</tr>
<tr>
<td>Decay pipe window</td>
<td>Design and FEA, test welding</td>
<td>Test done =&gt; drawing and FEA</td>
</tr>
<tr>
<td>Hadron monitor &amp; absorber</td>
<td>Design</td>
<td>SOW settled =&gt; R&amp;D</td>
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</tbody>
</table>
2019 summer shutdown | 2020 summer shutdown | Other tasks
--- | --- | ---
1 MW target installation | 1 MW horn 1 installation | MARS simulations
Target & Horn 1 RAW upgrade | Stripline air diverter T-block | Pre-target window spares
Target chase cooling / air upgrade | Target and horn 1 module drives | Decay pipe window
Target chase supplemental shielding | Hadron beam monitor & absorber | Tritium mitigation

Focus in FY19 Q3, and we reached our goal for getting ready.
1 MW Target MET-05 (A1901.02.02 Kavin Ammigan / Cory Crowley / George Lolov / Kris Anderson / Mike Stiemann)

Leak checking cooling line
- To be completed mid-August
- Installation schedule: week of Sep. 23-27
- Quality control travelers / documentation: SharePoint MET-05

Baffle
- Target fins
- Cooling rail assembly
- 1st Survey
- Cooling rail into canister
- 2nd survey
- US/DS flanges
- Hylen device
- 3rd survey
- Can onto carrier

Carrier
- Cooling lines
- Final survey

Next:
- Install instrumentation wires
- Hanger angle motion control test
- Target helium expansion chamber installation

Additional cooling loop on DS Be window
Target & Horn 1 RAW System

RAW skid job in process

10 HP pumps removed

15 HP pumps installed

Next: Piping modifications in Target Hall

- The 15 HP pumps are ~2 In. longer
- Back wall is moved outwards
- Discharge / suction piping replaced
- Valves / pressure sensors replaced
Pumps replaced and piping run is in place
Next:
- Insulation will be fitted after successful pressure test is complete.
- To have the electrical installed.

New cooling coils installed in heat exchanger bank
- Custom channels were installed
- Field fits are being made for directing air to coils.

Next:
- Routing new manifold run from main branch
A36 steel
Ready to be installed
### 2019 Shutdown NuMI-AIP Job Schedule (Marty Murphy)

**July 8 – Sep. 27, We are slightly ahead of the schedule**

*We are in Week 4*

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<th>Job/Week</th>
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<td>Chase Cooling HVAC/Fitting</td>
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<td>Install MET-05 Crowley &amp; Lolov</td>
<td>MET-03 to Morgue</td>
<td>Install MET-05</td>
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<td>Replace Stipline Hardware</td>
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8/1/2019 Yun He | Proton PMG meeting
Pre-target Beam Window Vacuum Tubes (A1901.02.01 George Lolov)

Fabrication of pre-target vacuum pipe spares (qty. 3)
• 100% parts on hand
• EB-welding of titanium window assembly is in process at Sciaky

Next: Assembly welding

Titanium window assembly

Beryllium window

4” Bellows

Tube transition

Pre-target beam window vacuum tubes

Fermilab
Air diverter is tested with wind tunnel
- Efforts to increase the convection cooling coefficient on the 1MW NuMI / NOvA Horn 1 stripline structure were successful

To be replaced with 1 MW stripline, which is 70% complete
Stripline Air Diverter T-block (A1901.03.02 / Cory Crowley)

Design 100% F10116201, A36 Steel, ~ 9900 lbs
PO (#658192) is placed for fabrication
  (machining, welding, and painting), delivery Dec. 2019, ready to install

Outlet
  Provides additional dedicated air cooling routed through shielding block to Horn 1 stripline

Heating sources:
  1. energy deposition from beam
  2. joule heating from current pulse
Mock-up frame 80%

Design review is done

Next:
- Finish drawing package of the drive mechanism
- Procurement
- Transverse drive pre-assembly
- Lower transverse drive remote handling training
Tritium Mitigation (A1901.04.04 Keith Gollwitzer / Lee Hammond)

- TTF performed several studies and measurements concerning tritium at MI65.
- The relevant tritium measurements (concentration in the sanitary sewer system from the MI-65 Air Handling Units condensate) show that different configurations of systems for the studies do not affect the fact that the Air Handling Units are condensing tritiated water from the air.

Tritium mitigation plan – to separate the MI-65 sanitary plumbing from the AHU drains to isolate the AHU condensate for capture, holding and pumping to the MI65 evaporation system.
Decay Pipe Window (A1901.05.01 Mike Campbell)

- A 3-day weld testing (Robot laser ablation welding) at IPG Photonics
  - Material selection (Al 5083 or 5052 over failed section Al 6061)
  - Samples, welding, testing & characterize properties

Weld head features: “wobble” technology (optics stir the weld pool w/ circular path)
a) Enhanced weld quality & consistency
b) Enhanced ability to fill gaps
c) Minimizes voids/porosity (get filled as you go)
Statement of Work (SOW) with U. of Texas at Austin in process

a service for design modifications, engineering and performance analysis, technical specifications, drawing set, consultation, and one hadron monitor product plus two spares.

On-going activities:

- **Studies for hadron monitor design improvements**
  - Pressure analysis
  - Electrode surface study, collaborate with Material Science Lab (MSL) at Fermilab
  - Study electron-ion dynamics in ion chamber (mitigate recombination process)

- **Upgrade gas handling system**
  Jordan Bohn, Sean Sellberg from PPD
  - Mass flow controlled device, add bubbler
  - Operate through PLC

- **Upgrade High Voltage Power Supply**
  - Apply individual pixel
  - Remote control through ACNET
    - voltage can be changed
    - Leakage current monitoring
MAR re-run completed for target DS window:
- With target 4 winged fins placed upstream
- With cooling loop on the DS Be window

Two scenarios:
- Beam normal operation
- Beam 6mm off-center accident condition

FEA evaluated

Next: MARS re-run for:
- Horn 1 stripline air diverter T-block (environment)
- Decay pipe window (thermal)
- Hadron beam absorber (water)
One VAR on A1901.03.03 “Module drive mechanism modification” for Schedule Variance.

- Explanation: The procurement was delayed due to the time needed for design review. Now the design review is completed, we are in the process of completing the drawings set.
- No impact on the overall project schedule: In the Project Plan, the module installation is to take place in the 2020 summer shutdown.
- Corrective Action: The procurement is expected to start in August 2019.
## Processing a Baseline Change Request

### Due to implementation methods or plans changed

<table>
<thead>
<tr>
<th>Task</th>
<th>Changes</th>
<th>Impact</th>
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<tbody>
<tr>
<td>A1901.06.01</td>
<td>Collaboration with U. of Texas at Austin, SOW is placed (92K)</td>
<td>Schedule</td>
</tr>
<tr>
<td>A1901.03.03</td>
<td>Fabrication at Fermilab PPD MAB (they charge time on task code)</td>
<td>M&amp;S ➔ Labor</td>
</tr>
<tr>
<td></td>
<td><strong>Add installation activity</strong> (with Horn 1 installation in 2020)</td>
<td>Labor ➔</td>
</tr>
<tr>
<td>A1901.04.04</td>
<td>Scope re-defined, due to new findings and on-going investigations that the Tritium Task Force is conducting</td>
<td>Schedule ➔ 2020</td>
</tr>
<tr>
<td>A1901.05.01</td>
<td>Reduce the scope of “fabrication” – just welding test, instead of fabricating the entire weldment,</td>
<td>M&amp;S ➔</td>
</tr>
</tbody>
</table>

### Due to underspent in a few tasks

**Financials as of 06/26/19**

<table>
<thead>
<tr>
<th></th>
<th>Budget</th>
<th>Obligated</th>
<th>Costed</th>
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<tbody>
<tr>
<td><strong>Budget</strong></td>
<td>5,600,000</td>
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<tr>
<td><strong>Obligated</strong></td>
<td>1,118,543.08</td>
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<tr>
<td><strong>Costed</strong></td>
<td>868,416.92</td>
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<thead>
<tr>
<th>Task</th>
<th>Actions</th>
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</table>
| A1901.04.01   | **Add two activities, extend to 2020:**  
1). Absorber RAW Intermediate System Upgrade  
2). D.S. Decay Pipe Chiller Upgrade                                                                                                              |
| A1901.04.02   | **Add one activity, extend to 2020:**  
1). MINOS Surface Chiller System Upgrade                                                                                                         |
| A1901.01      | Transfer labor fund to A1901.03.03                                                                                                           |

A1901.01 (Labor) ➔ A1901.04.04 (Labor) ➔ A1901.03.03 Labor (add module changeout activity, with Horn 1) A1901.05.01 (M&S)
Summary

- Work is on track for 2019 summer shutdown
  - The most challenging task 1 MW target MET-05 fabrication is to be completed a few weeks before the scheduled installation
- Task plan for tritium mitigation (A1901.04.04) is identified
- SOW with U. of Texas in Austin for Hadron monitor is in process
- Beam size / beam lattice study is in progress
- We are adding a few activities with available fund, and processing baseline change request