Department of Physics

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Memo

Date: April 7, 2022

To: Russell Feder

From: Jim Mills (Review Chair)

Subject: sPHENIX beam pipe support and installation FDR

A Final Design Review addressing tools and procedures for installation and support of the sPHENIX aluminum-beryllium beam pipe was held on Wed, March. The INDICO page is:

Beam pipe install and supports FDR (30 March 2022) · Indico (bnl.gov)

Design Review Panel
Russ Feder (Chair) – BNL sPHENIX construction manager
Jim Mills – sPHENIX Project Engineer and mechanical engineering
John Haggerty – sPHENIX physics and integration
Jason Bessuille – MVTX detector, mechanical engineering and integration
Walter Sondheim – MVTX detector, mechanical engineering and integration
Cameron Dean – MVTX detector, physics
Dan Cacace – INTT detector, mechanical engineering and integration
Rich Ruggiero – sPHENIX design and integration
Lori Stiegler – sPHENIX safety

The general questions to be addressed at this review were as follows.

1. Scope and Requirements – Are the requirements for the presented scope appropriate and well understood by the design team? Has all the required scope been addressed?

   Yes, requirements were presented as well understood and complete. All required scope has been addressed.

2. Engineering and Design – Are the mechanical and structural designs appropriate to meet the requirements and are they mature enough to proceed to fabrication and construction? Are there any ongoing design related questions that have yet to be addressed?

   Yes, the mechanical and structural designs as presented are appropriate to meet the requirements for beam pipe installation and support. Design are mature and ready for detailed drawings and fabrication. ***Detailed drawings must be reviewed and checked before starting fabrication and procurement.***

3. Interfaces – Are the main interfaces identified and defined in a released and controlled sPHENIX Interface Control Document?

   Yes, interfaces were thoroughly reviewed and incorporated into the design.

   The ICD defining beam pipe interfaces with the other surrounding sPHENIX structures and detectors does need to be updated and should be completed by April 30, 2022.

4. Quality and Acceptance – Are Q/A requirements for major components of this subsystem documented properly? Are they reasonable? Is testing and acceptance criteria been documented in the specification or statement of work and is it reasonable for the complexity, cost, and schedule impact the subsystem has to the overall sPHENIX project plan?

   All of the parts for beam pipe installation and support are simple and there are no special quality requirements beyond normal shop practices and what is called out in the build-to-print drawing dimensions and notes.

5. Have all recommendations from prior reviews been addressed and acceptably closed out?

   There were no recommendations from the PDR that were compulsory for completion of FDR. PDR comments and suggestions were reviewed at the FDR and it was shown that the design was improved between PDR and FDR based on some of these comments.

6. Are there any open safety related issues that have been generated as part of the design? How will these be mitigated?

   There are no open safety issues. The main safety consideration will be ergonomics and working smartly in the cramped areas at the north and south beam pipe installation locations. Working planning will be performed and the WP package with procedures will be approved before the work starts.

   Beryllium safety is an important consideration and the beam pipe, when received from , should be swiped and checked by ES&H technicians. See note below.

New comments and suggestions from the FDR panel are summarized below grouped by topics. There were no show-stopper recommendations and the panel was generally in agreement that the components should be fabricated. There are some good suggestions and follow up meetings will held to discuss and to take action on some of them.

1. **Safety Note**
   a. Extensive work planning will be needed, including critical lift evaluation and work plan, and considerations for beryllium contamination testing. **The beam pipe should have a wipe sample performed on arrival to confirm there is no surface contamination. The C-AD ESH group needs to be involved early.**

2. **Beam pipe installation and handling**

a. **This should be a critical lift and treated as such in WP and CLEF docs**
b. Given the central beam pipe is unsupported for a long span in the strongback, is vibration a concern, especially during lifting? Consider using blocks or foam between the beam pipe and the strongback.
c. How is the beam pipe handled when moved from one strongback to the other? Can the same strongback be used?
d. Choreopgraph how a person on the north and on the south will hand lift the pipe to remove strong back
e. Add IR crane limit to Brian's IR lift study to make sure we can lift the pipe and strong back in all positions

3. **Beam pipe supports**
   a. Should we prototype Brian's MVTX-interfacing strap one more time...then practice all this when the actual MVTX and installation mock-up is brought to BNL later this summer?
   b. Bellows is extended to minimize buckling risk during bake-out, about .6" from nominal both ends, creates a total 200 lbf tensile force on the beam pipe. is this OK for the Be-Ali section? Should we look at this FEA to check?
   c. Installation of the INTT-install bellows support shell looks tight with the local bellows supports. Can this split shell be installed?
   d. Add images of integration study between INTT installation rig and the bellows support stanchion. Dan says the INTT install tool OD has grown slightly due to manufacturing issues. We should revisit this and adjust bellows stanchion to make sure no interference.
   e. **The INTT grew in diameter slightly due to manufacturing constraints, so the stanchion may need to be lowered slightly.**
   f. **Need to design protective dog-houses around pipe to protect and prevent contact when people are working at north and south ends**

4. **Beam pipe bake**
   a. **The temperature between the beam pipe jacket and the INTT support tube should be monitored and potentially use a blower for forced air convection.**
   b. TPC ID surface temp due to 41 deg C INTT tube radiating onto TPC...can we look at this black body radiation analysis? --> What is the requirement for TPC max allowable temp**? Need to find out from TPC. Can Chris R attend next TPC meeting to present and ask question.**
   c. Dan C --> Provide some temp monitoring inside INTT tube and between INTT and TPC. Dan W --> This is done for STAR plus some forced air cooling during break. sPHENIX could provide some blown air...??
   d. Can we set up a bake controller and a max TPC temp to turn off bake?

5. **Other beam pipe production and prep questions**
   a. **Provide a better view of the actual TPC south end crowding to get a better idea for handling the bake blanket. What does that area really look like during this operation?**
   b. BNL will do a thorough receipt inspection (dimensional and vacuum pump) when received from Materion. We also need to provide as built straightness and other OD dimensional checks for MVTX fit up.
   c. Should we build a dimensional inspection jig?