Preparation for HL-LHC BPM Final Design Review

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Overview

- Last Review May 2018
- Scope
- Agenda
- Reviewers and Dates
Last Review May 2018

- HL-LHC Conceptual Design Review
  - Foreseen half-day 17 May 2018, [https://indico.cern.ch/event/725045/](https://indico.cern.ch/event/725045/)
  - Summary in EDMS 2021763
  - Many recommendations and actions
Since Last review

- No String Test

- Memorandum for Responsibility share between BE-BI, EN-SMM, TE-VSC and TE-MSC [https://indico.cern.ch/event/725045/](https://indico.cern.ch/event/725045/)

- Addendum P110/A17 for BPM manufacture with BINP

- Many technical up-dates, examples
  - Cooling
  - Feedthroughs including M6 screws
  - D2 cold BPM
Scope for Final Design Review

Are all technical questions answered in order to prepare for a production at BINP of prototypes and series BPMs for the HL-LHC Interaction Regions including procurement of the raw material and cryogenic cables?

- **Does each BPM design meet the functional requirements?**
  The characteristics to be assessed in particular are: beam position measurement capability, beam coupling impedance, electron cloud mitigation, cooling and heat-load management, vacuum integrity, collision debris absorption (where applicable).

- **Is each BPM design sound and optimised?**
  Design aspects to be assessed in particular are: selected raw materials, machined conflat flanges, synergies with TE/VSC designs (thermal links, RF fingers), coating materials, tooling for BPM alignment, copper inserts, welding lips, cooling tubes.

- **Is the BPM integration within a cryo-assembly well defined?**
  The integration issues to be assessed in particular are: definition of interfaces to the downstream and upstream components, BPM installation procedure including use of the necessary tooling, routing of the cryogenic cables installed within the cryo-assembly, location of cryostat flanges, mock-up plans.

- **Does the procurement and mechanics production plan promise a successful delivery?**
  Production aspects to be assessed in particular are: selected machining methods, division of responsibilities between CERN and BINP, production capabilities at BINP, prototyping plan, quality assurance plan, documentation, coating and assembly procedures, non-conformity treatment.

- **Are the project budget and schedule clear and in line with the HL-LHC project?**
  Parts of the project to be assessed in particular are: alignment with the global HL-LHC schedule, missing expenses, overlooked tasks.
Proposed Agenda (topics)

Session 1: BPM design 9:00 – 10:30
- Introduction and summary of the 2018 review (Gerhard Schneider) – 10 min + 5 min
- Overview of the HL-LHC BPMs (Michal Krupa) – 20 + 10 min
- Mechanical design, integration and tooling (Gerhard Schneider) – 20 + 10 min

Session 2: Integration and vacuum aspects 11:00 – 12:15 AM
- BPM integration in the Inner Triplet (Delio Duarte) – 15 + 5 min
- BPM integration in D2 (Arnaud Vande Craen?) – 10 + 5 min
- Vacuum connections, interfaces and technologies (Cedric Garion) 20 + 10 min
Lunch break: 12:15 – 13:30

Session 3: BPM manufacturing, assembly and quality checks: 13:30 - 15:00
- Manufacturing and assembly procedures (Dmitry Gudkov) – 20 + 10 min
- Manufacturing capabilities and production plans at BINP (BINP staff) – 20 + 10 min
- Budget and schedule (Michal/Gerhard/Ray/Manfred) – 10 + 10 min

Session 4: Closed session and close-out – 15:00 – 17:30
- Closed sessions for the reviewers – 2 h
- Close-out: Presentation of conclusions and recommendations by panel members – 30 min
Proposed Agenda detailed (1)

Session 1: BPM design 9:00 – 10:30
- Introduction and summary of the 2018 review (Gerhard Schneider) – 10 min + 5 min
- Overview of the HL-LHC BPMs (Michal Krupa) – 20 + 10 min
  - The three types of BPMs: Q1, Q2a-D1, D2
  - Electrode, feedthrough, button design
  - Summary of beam coupling impedance simulations
  - Summary of thermomechanical simulations
  - Amorphous carbon coating for electron cloud mitigation
  - Tungsten shielding for collision debris absorption
  - Cabling routing overview
- Mechanical design, integration and tooling (Gerhard Schneider) – 20 + 10 min
  - Mechanical differences between the three types of BPMS: Q1, Q2a-D1, D2
  - Machined conflat flanges: tests done at CERN, M6 screws
  - Design of copper inserts
  - Quasi-symmetric D2 button BPM design
  - Synergies with TE/VSC: tungsten blocks, thermal links
  - Alignment procedure and tooling
  - Status of manufacturing drawings
- Coffee break: 10:30 – 11:00

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Proposed Agenda detailed (2)

Session 2: Integration and vacuum aspects 11:00 – 12:15 AM

- **BPM integration in the Inner Triplet** (Delio Duarte) – 15 + 5 min
  - BPM relevant differences between the Inner Triplet innerconnections
  - Any open points regarding BPM integration in the Inner Triplet interconnections
  - Interconnection assembly sequence
  - Plans for mock-ups

- **BPM integration in D2 (Arnaud Vande Craen?)** – 10 + 5 min
  - Move of the BPMs from the warm IP-side to within the D2 cryostat on the arc side
  - Any open points regarding BPM integration in the D2 QQS
  - QSS assembly sequence
  - Plans for mock-ups

- **Vacuum connections, interfaces and technologies** (Cedric Garion) 20 + 10 min
  - Formal distribution of responsibilities between WP12 and WP13
  - Solutions for cooling of the vacuum components
  - Tolerances of the BPM-relevant vacuum components in the Inner Triplet and D2
  - Assembly sequence of the BPM and vacuum components in the Inner Triplet and D2
  - Overview of the design of welding / cutting machines

- Lunch break: 12:15 – 13:30
Proposed Agenda detailed (3)

Session 3: BPM manufacturing, assembly and quality checks: 13:30 - 15:00
- Manufacturing and assembly procedures (Dmitry Gudkov) – 20 + 10 min
  - Raw materials: 3D forged 316LN, OFE copper + procurement plan
  - Coatings and relevant tooling (gold + copper, amorphous carbon)
  - Manufacturing technologies and sequences: Wire EDM, knife-edge machining + ...?
  - Quality assurance: documentation, metrology + ...?
  - Prototypes + tests already done at CERN
  - Final checks to be performed at CERN on series BPMs
- Manufacturing capabilities and production plans at BINP (BINP staff) – 20 + 10 min
  - Details of the talk to be agreed with BINP
- Budget and schedule (Michal/Gerhard/Ray/Manfred) – 10 + 10 min
  - Prototype and production planning
  - Delivery plans – needed by date
  - Alignment with the global HL-LHC schedule
  - Budget overview

Session 4: Closed session and close-out – 15:00 – 17:30
- Closed sessions for the reviewers – 2 h
- Close-out: Presentation of conclusions and recommendations by panel members – 30 min
Possible composition of the Review Panel and dates

Proposed dates: 25\textsuperscript{th} or 26\textsuperscript{th} June 2020

- HL-LHC management: O. Brunning, P. Fessia
- EN/MME: D. Perini
- WP13: R. Jones or delegate
- BINP management: A. Krasnov or delegate
Others invited - suggestions

- WP2: G. Arduini, B. Salvant (impedance), G. Iadarola (electron cloud)
- WP12: V. Baglin, G. Riddone, J. Hansen, P. Chiggato, P. Cruikshank
- WP13: all
- WP15: H. J.-F. Fuchs, M. Mainaud Durand,
- EN/MME: N. Chritin (design), M. Garlasche, K. Scibor, E. Rigutto (workshop), F. Carra (thermomechanical simulations)
Steps after the review

Assume a successful design review in view that all technical problems are solved and interfaces agreed:

Prepare for Manufacturing Readiness Review, could be in September 2020, duration half day or less. This is verification check the HL-LHC procedures are respected.
Comments and Suggestions?