

Meeting Minutes – Cavity BPM and Cryomodule Assemblies with Quadrupole Magnet

Date: [20th May 2025]

Participants:

- Akira Yamamoto (AY)
- Hiroshi R Sakai (HS)
- Yasushi Arimoto (YA)
- Tomohiro Yamada (TY)
- Juan Fuster (JF)
- Nuria Fuster (NF)
- Laura Pedraza (LP)
- Javier Olivares (JO)
- Juan Carlos Fernández (JCF)

1. Opening Remarks

- **Akira-san** opened the meeting and participants introduced themselves.
- Akira-san introduced the goal of the meeting being the discussion of the possibility of performing an assembly test or developing a **dummy model** for a cavity BPM prototype to be integrated in the developed by KEK cryomodule assembly with the splittable quadrupole magnet in order to demonstrate that the alignment of the system can be in the order of 10 μm (ILC requirements).
- Juan Fuster introduced the IFIC team members and the motivation and goals of the project.

2. Progress in BPM development and test at ATF– Laura Pedraza

- Laura presented the status of the **Cavity BPM and quadrupole integration project**, including a review of the IFIC project objectives and report on the BPM installation and first test at ATF. In addition, she presented an updated timeline of the project

Discussion Points:

- **Akira-san** inquired about the **signal reconstruction method** used for beam position determination. To be explained in more detail in another meeting next week.
- Tomohiro-san asked about the material considered on the cavity BPM to verify that cryogenic conditions have been considered, IFIC team replied that this has been taken into account.
- Akira-san also asked if the IFIC team has or plan to set-up a test bench to measure the electric center of the next cavity BPM prototype as well as if the antenna connectivity has been tested. NF replied that both things are in progress. In on hand the equipment to set-up the test bench is being purchased and on the other hand a simplified box resonant cavity have been designed to test the antennas connection to the cavity BPM and the EM model simulations.

3. Progress in SCQ, Test Cryostat with BPM interface (Yasushi Arimoto)

- The progress on the **splitable quadrupole magnet design and fabrication was presented by YA, prototype fabrication and first tests** planned in **2025**. Integration into the cryomodule in 2027.
- Quadrupole magnets simulations and characteristics were presented.
- Structural interface feature presented:
 - Mechanical interface accuracy to BPM: **$\pm 10 \mu\text{m}$**
- The **BPM unit** must be composed by ~ 1 m long beam pipe and the BPM plus the interface including the **alignment pins** for mechanical attachment to the quadrupole.
- The assembly of BPM + beam pipe + flange will take place in a **clean room** and then inserted into the cryomodule.
- **Laser target alignment** will be used for magnet positioning with an expected precision of **$5 \mu\text{m}$** (maximum **$10 \mu\text{m}$**).
- The **BPM alignment accuracy** is defined by the precision of the mechanical pin interface.

4. Cryomodule status – Tomohiro

- Tomohiro presented the status of the designed and built **cryomodule unit** for testing purposes. This can be used to test the quadrupole and BPM or only one of them.
- Key parameters:
 - Internal **diameter of ~ 1 meter**
 - Materials: **aluminum and carbon steel**
 - **Side ports** included for magnetic field measurements
 - An **open beam pipe can also be considered for the BPM assembly**
- The **first cryomodule test** will aim to validate:
 - Mechanical integration
 - Stability and alignment precision

5. Discussion (All)

Participants agreed on the importance of:

- Understanding how both efforts can be aligned in terms of design and schedule for continuing collaboration in the next years to be discussed internally by the different parts.
- A meeting was scheduled for Thursday 29th at KEK to give an update on the IFIC test at ATF as well as more details on the signal processing analysis.

