Mechanical Design for the p-LINAC BPMs Inter-tank Section

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Introduction

Four-fold button Beam Position Monitors (BPM) will be installed at 14 positions along the 30 m long FAIR p-LINAC [1,2,3]. At four locations, the BPM has to be integrated in the inter-tank section between the CCH and CH cavities within an evacuated housing. The mechanical design of these BPM-locations is most critical. The tight space allows 58 mm insertion length only between CH cavity and quadropole magnet walls. The mechanical design was adapted based on previous numerical simulations as well as the given inter-tank dimensions [4,5]. The device performance was optimized by simulations. Special attention is payed on reduction of the rf-noise at the BPM location as generated by cavity excitation.

BPM Mechanical Design

The BPM system has to cover a beam energy range from 3 MeV to 70 MeV. Moreover, different beam pipe apertures have to be considered (30 mm to 50 mm). A commercial 14 mm button pick-up produced by Kyocera [6] was chosen for this purpose. However, it has to be tested for a 50 Ω impedance matching, which can be influenced by the inner ceramics. The button sub-assembly unit composite a titanium electrode of 2 mm thickness connected to a SMA co-axial cable as shown in Fig. 1.

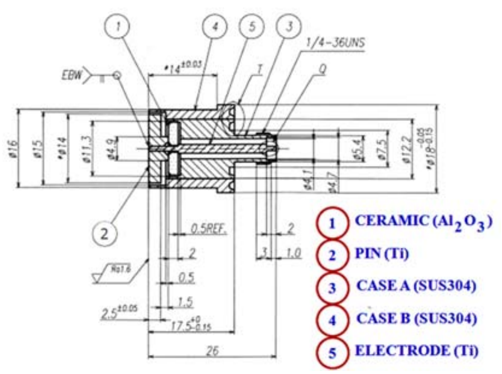

Figure 1: Scheme of commercial button from Kyocera.

The centre of the BPM inter-tank section is only 48 mm apart from the upstream drift tube boundary. The BPM mechanical design was optimized to control the rf field propagation into the tube reaching to the BPM's co-axial signal path [3,5]. The BPM (tube diameter of 30 mm) is connected to the CH entrance flange (20 mm) by a conical section with a length of 20 mm to reduce an rf pick-up signal to max. 5 mV [3]. This value is satisfactory compared to the signal voltage of $\sim$ 1V for nominal beam current of 35 mA. The assembly of the BPM consists of four buttons, a housing and a flange as shown in Figures 1 and 2, respectively. The buttons are recessed 0.5 mm from the inner radius of the tube to protect the electrode from stray beam impingement. Since the BPM is located near quadrupole magnet, a non-magnetic design is mandatory. Therefore, the housing and the flange will be fabricated from 316LN stainless steel. The buttons will be welded inside housing and both will be joined with the flange at the final assembly.

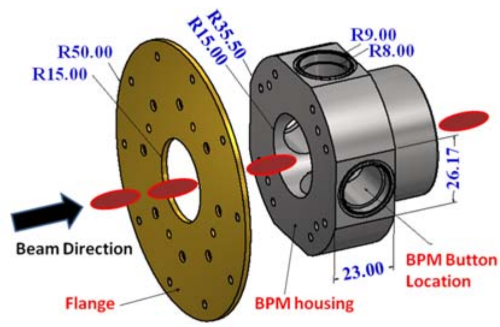

Figure 2: View of the BPM prototype parts.

Summary and Outlook

The first phase of CEA-GSI collaboration for the BPM system includes the design and fabrication of the first BPM prototype. Currently, a button-type BPM has been designed and is being fabricated. It will be used as a test device for the rf field propagation from the cavity to the BPM at GSI and for a dedicated test bench at CEA. The related results will be considered for the final design.

References

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doi:10.15120/GR-2014-1-FG-P-LINAC-02