Basic Science Beamline(TR104) at PEFP

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1. Introduction

PEFP(Proton Engineering Frontier Project) is developing beamlines for various application fields by using the high current 100MeV proton linear accelerator. Beamlines were characterized and categorized by the beam energy, average currents, and irradiation conditions. Among these beamlines the TR104 is designed for the basic science and the research of the aerospace. Before the construction and installation of beamlines, we try to practice and prepare the detail process of installation by the precedent study of TR104 beamline in KAERI site. By this work installation process was checked and confirmed for the same condition of the PEFP site.

2. Specifications of PEFP Beamlies

Table 1 shows brief specifications of PEFP beamlines which were determined on the basis of users' demand[1]. Proton beam will be supplied as 20MeV or 100MeV. And there are four special beamlines for industrial applications such as radio isotope production, semiconductor development, and neutron science. Others are general application beamlines which will be operated with an AC magnet. The irradiation can be done in the vacuum or the air condition. Additionally, the maximum irradiation area is 300mm in diameter by using the thin beam window.

Table 1: Specifications of PEFP Beamline

Target Room	Application Field	Rep. Rate (Hz)	Max. Avg. I(mA)	Irradi. Cond.	Max. Dia. (mm)
TR101	Isotope	60	0.6	Hor. Vac.	100
TR102	Medical(Proton Therapy Research)	7.5	0.01	Hor. Atm.	300
TR103	Materials/Energies and Environment	15	0.3	Hor. Atm.	300
TR104	Basic science (Physics, Chemistry), Aerospace	7.5	0.01	Hor. Atm.+Vac	100
TR105	Neutron Source/Irrdiation Trial	60	1.6	Ver. Atm.+Vac	100
TR21	Semiconductor	60	0.6	Hor. Atm.	300
TR22	Biotech/Medical	15	0.06	Hor. Atm.	300
TR23	Materials/Energies and Environment	30	0.6	Hor. Atm.	300
TR24	Basic science (Physics, Chemistry)	15	0.06	Hor. Atm.+Vac.	100
TR25	Isotope	60	1.2	Hor. Vac.	100

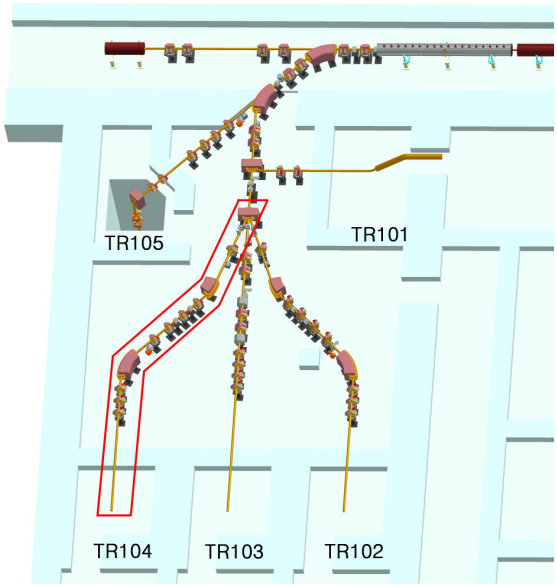

Figure 1: Layout of 100MeV Beamlines at PEFP


Figure 2: TR104 Beamline for the precedent installation practice at KAERI site

3. TR104 Beamline at KAERI site

TR104 beamline, from the AC magnet to beam window, was installed as figure 1 and 2 to practice and setup the install scenario of beamlines. It consists with 8 quadrupole magnets, a 45 degree dipole magnet, a 25 degree dipole magnet, an AC magnet and a beam window. Each quadrupole magnet assembly has two supports for the beam pipe. So, there is no additional support except the fast closing valve, which is adopted to protect the accelerator system from the rupture of the beam window. All magnets were aligned with a laser

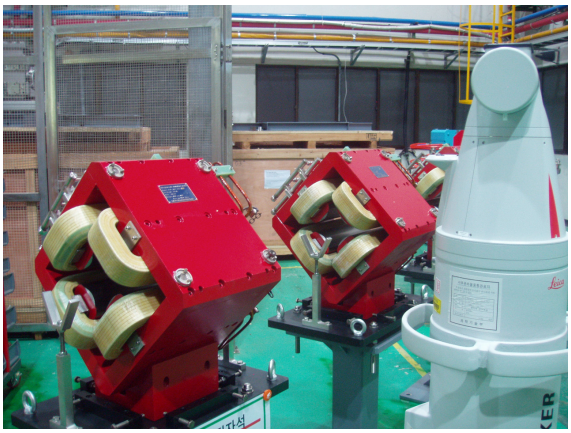

Figure 3: A laser tracker system and four reference points on magnets

tracker system and four reference points on every magnet which was made by the pre-alignment as shown in figure 3.

4. Components R&D

4.1 Vacuum Chamber for AC Magnets

AC magnets were adopted to distribute the proton beam to three beamlines simultaneously. The AC magnet will operate as 7.5Hz for 100MeV beamlines and 15Hz for 20MeV beamlines. The vacuum chamber having Inconel walls will be used in AC magnets. The magnetic field attenuation is negligible for circular shape. But multipole components, eddy current heat generation will be estimated for the elliptical shape[2].

4.2 Beam Window

A beam window, concave type, was already developed with 0.5mm in thickness and 300mm in diameter. It was made with the AlBeMet (38% Al, 62% Be) and vacuum sealed with the O-ring. But there is radiation damage to the rubber seal in real condition. So a beam window which is welded to stainless steel flange was developed to increase the life time.

5. Summary

One beamline, TR104, was installed as precedent test before the real construction of PEFP beamlines. All magnets aligned with laser tracker system and beam pipes were installed by using small supports assembled in quadrupole magnets. The R&D for beam line components, such as an AC magnet power supply and vacuum chamber, is also in progress.

Acknowledgment

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REFERENCES

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