CHAPTER - IV

Design Details of One Meter Long PPM Undulator
1. Introduction

The undulator field is a magnetostatic field and a periodic arrangement of several permanent magnets in Hallbach configuration. In our scheme of PPM structure, we use four magnet in one period to fabricate the 20 period and one meter long undulator.

2. Design details

In this chapter we describe the design details of a one meter long PPM undulator using NdFeB magnets of $12.5\text{ mm} \times 12.5\text{ mm} \times 50\text{ mm}$ at DAVV, Indore. There are four magnets in each period of length 5cm. There are twenty periods in the undulator. We use half end magnet i.e. $12.5\text{ mm} \times 6.25\text{ mm} \times 50\text{ mm}$ for end field correction. It is designed with variable uniform gap as well as tapered.

![Magnetic field versus position along the length of the magnet](image)

Fig 1 Magnetic field versus position along the length of the magnet
Fig 2 Magnetic field versus position along the length of the magnet

The NdFeB magnets are procured from Shanghai Strong Magnet Industrial & Commercial Co. Ltd, Shanghai, China. The magnet specifications are Grade- N35, Remanence 1.1-1.28 T. The measured characteristics of the vertical and horizontal magnets are shown in Fig 1 and Fig 2 respectively. The schematic drawing of the undulator jaw is shown in Fig 3a and Fig 3b with the dimensions. All the dimensions are in mm here.

Fig 3a Schematic drawing of undulator jaw with T clamps
The photograph of undulator jaw and T clamps are shown in Fig 4a and Fig 4b. Fig 5 shows the testbed structure for undulator jaws. All the dimensions are shown in figure.
The magnets have to be fixed to the undulator jaws. For this purpose we have developed a special magnet fixture. Fig 6 shows the photograph of magnet fixer. There is a block made of brass with two magnetic points on it. Magnet is attached to
this block with two magnetic points. On both side of brass block there are two slots of aluminium which can be moved back and forth. These slots are set in front first as shown in the Figure. Now the whole assembly of jaw is placed across the fixer which is designed according to the size of the jaw. The first magnet is placed manually. By rotating the handle the magnet is placed in the jaw, now the slots on either side of the magnet are moved at the back and the magnet is fixed by the clamp on either side of the magnet. Similarly other magnets are placed in the whole assembly.

3. Test Results

Undulator magnetic field is measured with the hall probe. Fig 7a and Fig 7b show the photograph of hall probe measurement of one meter PPM undulator. In Fig 8a, magnetic field is plotted for different distance $d = 4\text{mm}$, $d = 6\text{mm}$, $d = 15\text{mm}$ and $d = 20\text{mm}$. $d$ is the distance of hall probe from the top surface of lower undulator jaw. Fig 8b shows the magnetic field profile of lower undulator jaw for $d = 20\text{mm}$. Fig 8c shows the undulator magnetic field at gap i.e. $g = 39\text{mm}$. The magnetic field is get doubled when both the jaws are used for the undulator.

![Hall probe measurement of lower jaw of PPM undulator](image)
Fig 7b Hall probe measurement of PPM undulator

Fig 8a Magnetic field of lower jaw of the undulator at different ‘d’
Fig 8b Magnetic field of a jaw of the undulator at \( d = 20\text{mm} \)

Fig 8c Magnetic field of assembled undulator at gap \( g = 39\text{mm} \)

References