Design of Vacuum Chamber at Variably Polarizing Undulator Section

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1. Introduction

The vacuum chamber for the section of a variably polarizing undulator for a soft X-ray beamline is under construction. This chamber is divided into three chambers. The long chamber with a length of 4595mm is inserted in the gap of the undulator, and two short chambers equipped with bellows are located both ends of the long chamber. The useful space for the vacuum chamber is narrow and complicated as the beamline from the upstream is close to the undulator. The layout of this undulator section is shown in Fig.1. A local bump orbit feedback system to correct beam position distortion caused by the undulator is adopted in this section. Four sets of beam position monitors (BPMs) are mounted on the vacuum chamber, and steering magnet (STM) is located next to the BPM to correct the beam distortion.

2. Design of vacuum chamber

The long chamber is an antechamber which consists of an 26.2 × 70mm elliptic shaped electron beam chamber and an antechamber for pumping slot. The photon beam from the bending magnet is passed through this antechamber. The chamber height is 30.2mm so that the undulator gap is capable of closing to 36mm. Upper and lower side of the chamber is machined independently from the non-magnetic stainless steel block and welded by laser beam for the benefit of its little heat deformation of the chamber. The cross section

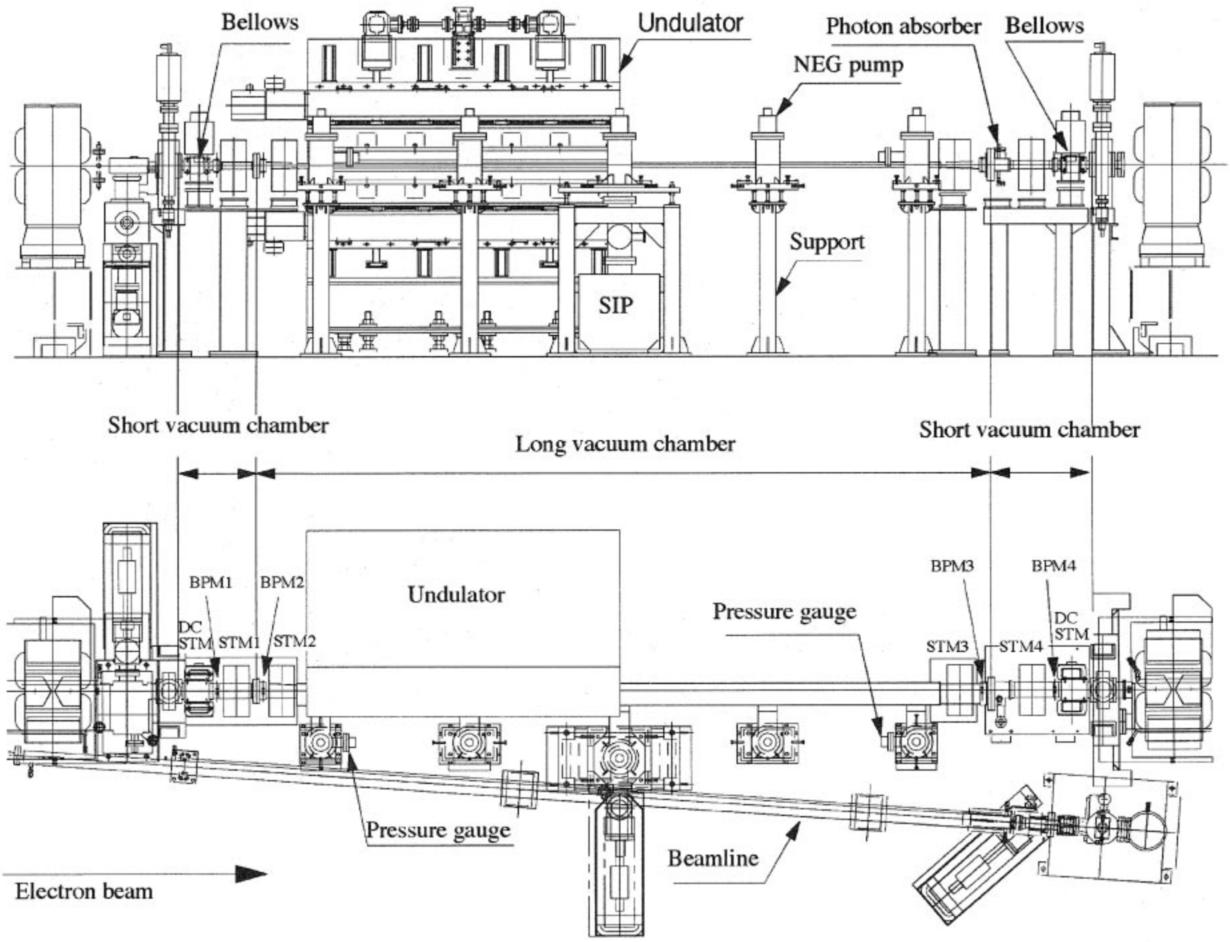

Fig.1 Layout of the undulator section

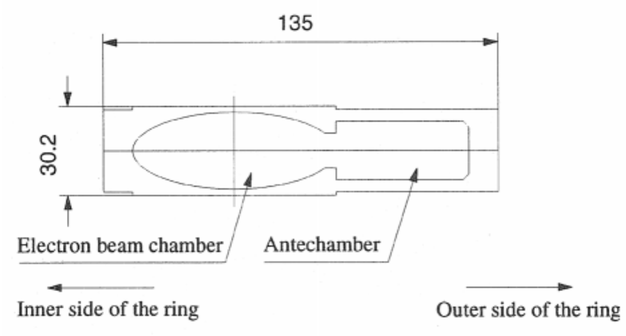

Fig.2 Cross-sectional view of the long vacuum chamber

of the chamber is shown in Fig.2. The elliptic beam chamber size of the short chamber is 40 × 90mm, so the transition chamber is welded both ends of the long chamber to connect the inner wall continuously. The transition chamber is inserted in the fast excited steering magnet. The thickness of the chamber wall is 2~3mm to decrease the influence of eddy current. Four electrodes of the BPM are mounted on the BPM block which is

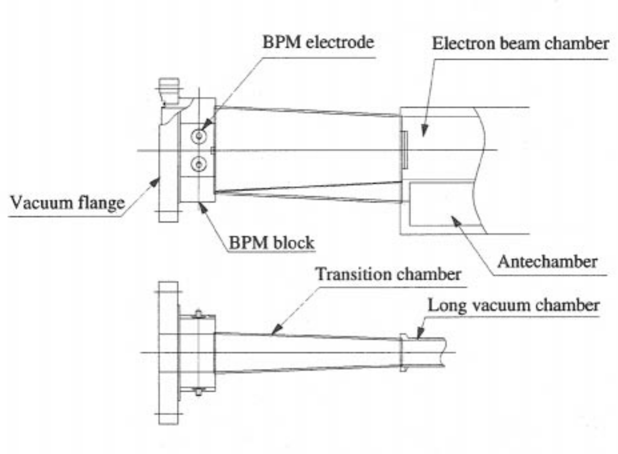

Fig.3 Transition chamber

located next to the vacuum flange. The transition chamber is shown in Fig.3. The main vacuum pump is non-evaporable getter (NEG) vacuum pump. We adopted the cartridge type of NEG for its easiness of the maintenance. Five NEG pumps and a sputter ion pump is attached to the chamber to reduce the pressure to less than 1.3×10^{-8} Pa. The pressure is measured by two Bayard-Alpert gauges which locate at both ends of the long chamber. The chamber is supported only from the outer side of the ring through the gap of the undulator. The chamber is held by five vacuum ports as a cantilever support which is attached to the chamber. The long coils for correcting the orbit distortion of the undulator are also attached to the chamber in the undulator gap.

The short chamber is consisted of thin wall chamber, bellows with RF slide fingers, vacuum flange

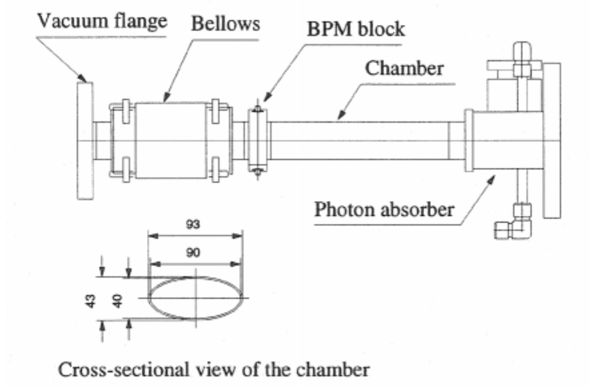

Fig.4 Short chamber of the downstream

with RF contact and BPM block as shown in Fig.4. The downstream short chamber has an photon absorber to cut the SR from the electron orbit in the upper stream bending magnet. The thin wall chamber is inserted in the fast excited steering magnet to decrease the eddy current. The bellows is inserted in the DC steering magnet to make longitudinal space for BPM block.

Four electrodes of the BPM are mounted on the BPM block to avoid the deformation caused by outer force and pressure. Four electrodes is arranged to get same sensitivity for both horizontal and vertical position. The BPM is made of non-magnetic materials to decrease disturbance to the magnetic fields of the near magnet. The cross sectional view of the BPM is shown in Fig.5.

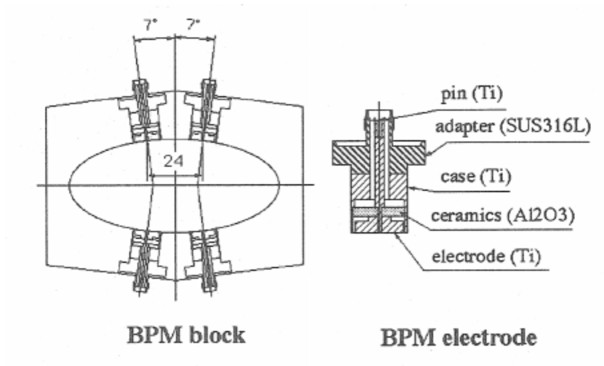

Fig. 5 Cross-sectional view of the BPM