DESIGN OF THE SECTOR MAGNET FOR THE IPCR SSC

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The characteristics of the IPCR SSC are presented in this proceedings. In order to realize the sector magnets of this SSC, the measurements and the analysis for the magnetic properties have been carried out using two 1/4 scale model magnets. The geometrical shape, electromotive force and structure of the sector magnet are designed. Table 1 lists the parameters of the sector magnet. The main magnet system of the SSC consisits of four sector magnets with sector angle of 50°, gap distance of 8 cm and maximum magnetic field of 15.5 kG. The maximum magnetic motive force was estimated to be 1.3 x 10^5 ampere turn for the maximum field of 15.5 kG. The maximum power consumption of the main coils was estimated to be 450 kW. The distance between the outer edges of the magnets opposite to each other is 12 m. The total weight of this main magnet system is estimated to be about 2300 tons. The shape of the sector magnet is shown in Fig. 1. The sector magnet is composed of two poles, a side yoke and a pair of upper and lower yoke. The upper and lower yoke will be divided into four or five slabes for the convenience of construction and transportation. The ratio of the cross-sectional area of the pole base to that of the yoke is 1.05. The shape of the pole edge is approximated by the Rogowski profile so that the effective angle of the sector magnet may not change in the range of magnetic field to be used. The effective angle resulting from model measurements agrees with the designed value of 50° within 1.0°.

The field level and configuration of the sector magnet strongly depend on the iron material. The very homogeneously forged steel with a carbon content of 0.02 ± 0.01 % were specified for iron material of the poles and the iron material of yoke is 0.08 % carbon forged steel. The two poles of each sector magnet should be prepared from single ingot. The design of the main coils has been almost completed. They will be formed in size of 6 cm in thickness and 45 cm in hight to insert the RF-cavities in the narrow space between two sector magnets and will be confined in vacuum-tight stainless steel container. The main coils will be connected in series and excited with maximum current of 1100 A. Maximum current density of copper conductor is 4 A/mm^2. The design of the trim coils has been made on the basis of the results of the calculation and the model measurements.

The trim coils of the model magnet consist of 14 pairs of copper plates which have a curved shape of Gordon's trajectory. They have different width and pitch. Fig. 2 shows configuration for the model. The measurement of the radial field distribution was made along the center line of the sector magnet. An example of the measured field distribution in the case of γ = 1.06 and relative deviations are shown in Fig. 3. Relative values were normalized to the magnetic field strength at injection radius. The figure shows comparison of measured field distribution with 14 trim coil pairs and calculated isochronous field.

The detailed design of the trim coil system for the sector magnet is now in progress.

Table 1. Parameters of the sector magnet

Number of sector magnet	4
Sector angle	50°
Gap width	8 cm
Maximum magnetic field	15.5 kG
Maximum ampere turns	1.3×10^5 AT
Power consumption	450 kW
Number of trim coils	30 pairs x 4
Trim coil power	400 kW
Injection mean radius	89.3 cm
Extraction mean radius	373 cm
Total height	5.2 m
Overall diameter	12.8 m
Magnet weight	2300 ton

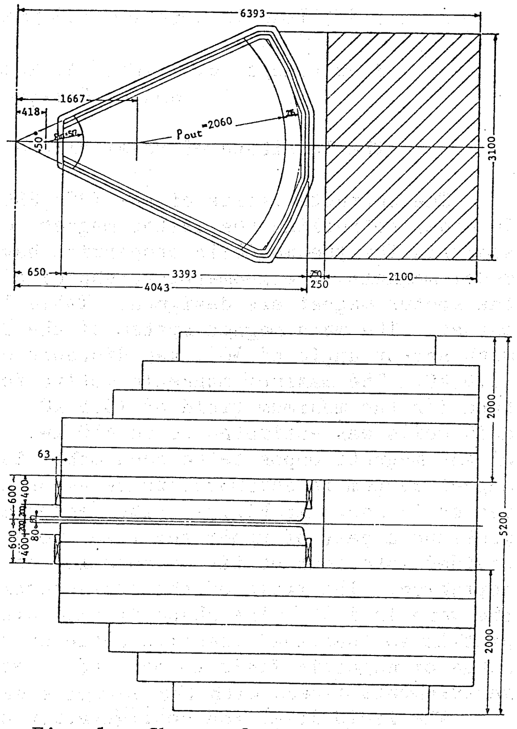

Fig. 1. Shape of the sector magnet

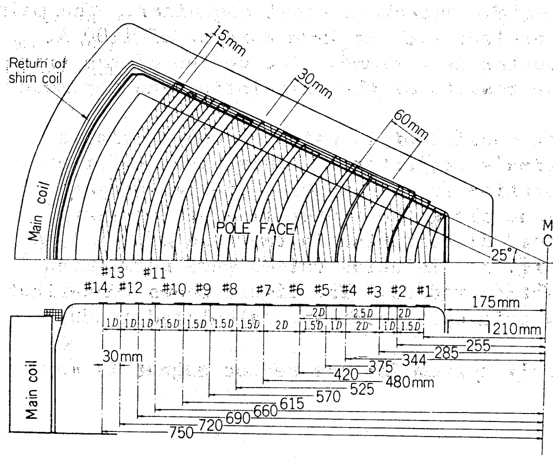

Fig. 2. Configuration of the trim coils for the model magnet

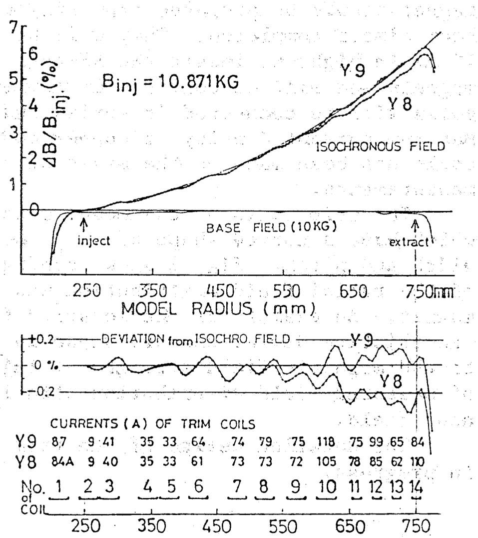

Fig. 3. Comparison of measured field distribution with trim coils excited and isochronous field for γ= 1.06