03P44

準軸対称ステラレータCFQSにおけるコイル配置誤差の磁気面形状への影響
The influence of coil misalignment on magnetic surface for quasi-axisymmetric stellarator CFQS

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CFQS, the world first quasi-axisymmetric stellarator is now under construction. This device will be sited in China as a part of joint project between National Institute for Fusion Science (NIFS) in Japan and South West Jiaotong University (SWJTU) in China.

CFQS has 16 modular coils (MCs), which consist of 4 independent shape (MC1-MC4). We have already finished the production of mock-up model of one type of MCs and conducted several tests such as insulation test and heat-run test. After numerous tests, we have started the production of actual coils.

Coil misalignment will affect magnetic field configuration. Estimating these effects are important for determining the acceptable tolerance error in constructing and assembling the modular coils. We have performed magnetic field calculations with some displacement of the coils. In this report, we consider three types of displacement in direction as shown Fig. 1 and two types of combination of displacement (Case A and Case B) as shown Fig. 2.

According to this calculation, we found that a change of rotational transform, i.e. iota with displacement in Z direction tends to be larger than the other directions. Fig. 3 shows the iota dependence on displacement in Z direction, and these are values on a magnetic surface where its average minor radius is 0.05 m. A displacement of MC2 causes larger change of iota. Therefore, we should give a priority to an accuracy of MC2 during coil assembling process. In addition, Case B also causes a larger change of iota, and a magnetic islands appears with 20 mm displacement as shown in Fig.4. we think more than 20 mm misalignment is supposed to have significant effect from this result. Thus, we will set an acceptable displacement to be 5 mm for potential error of coil location, because coils will be adjusted by spacer with thickness of 5 mm. For assembling accuracy of positioning, we will set it to be 5 mm, therefore the final acceptable value of total misalignment to be 10 mm.

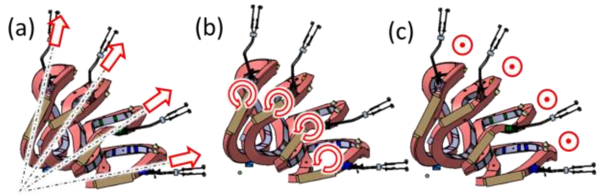

Fig. 1 Direction of MC displacement (a)major radius direction R (b)rotational direction around vertical axis of each coil α (c)vertical direction Z.

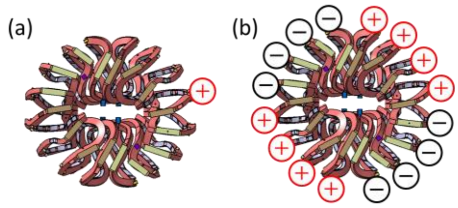

Fig. 2 Combination of MC displacements (a)Case A; One MC is moved (b)Case B; MCs in 90 deg. section are moved together and alternately in toroidal direction.

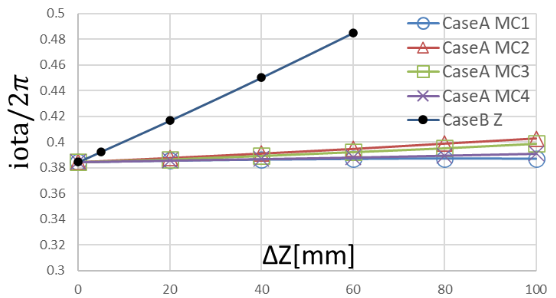

Fig. 4 A change of rotational transform, i.e. iota with displacement in Z direction.

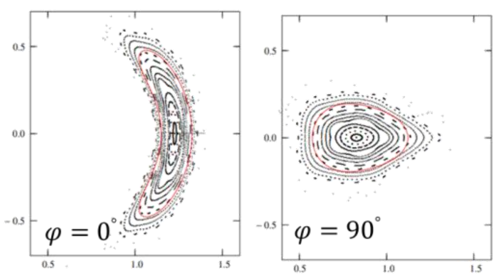

Fig. 3 A plot of magnetic surface in vacuum field with 20 mm displacement in Z direction in case B.