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## **Tue-Af-Po2.18-01 [33]: Magnetic field design of a full-scale prototype of the HL-LHC beam separation dipole with a correction of mechanical deformation**

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The beam separation dipole, MBXF, is being prepared by the High Energy Accelerator Research Organization, KEK, for the high luminosity LHC (HL-LHC) upgrade. The new magnet is designed to generate a central field of 5.6 T at the nominal operating conditions of 12.05 kA and 1.9 K. From the past design study, the magnet is designed as a single layer coil wound with a 15 mm wide NbTi/Cu Rutherford cable. According to requirements from CERN, the coil aperture is fixed to 150 mm so that the size matches those of inner triples, and this requires the magnet to withstand a large electromagnetic force.

So far we have tested the two models and a re-assembled magnet. The test of the first model shows the pre-stress of the coil was not at satisfactory level. So, we decided to re-assemble this magnet to increase the pre-stress up to 100 MPa which is 35 MPa higher than the first one. The re-assembled magnet then showed had a good training performance. From the experiences of the first model and its re-assembled magnet, we fabricated the second model where the pre-stress in the straight section was further increased up to 115 MPa. Although it had a good training performance as expected, we observed the measured  $b_3$  is 16-18 units higher than the calculation, the reason of which is presumably due to the coil deformation triggered by the large pre-stress. Therefore, we decided to modify the electromagnetic design of MBXF so that we can cancel out the increase of  $b_3$  even the coil is deformed by the large pre-stress. In this paper, we report results from our design study and a new cross section of MBXF.

**Author:** SUZUKI, Kento (High Energy Accelerator Research Organization )

**Co-authors:** IKEMOTO, Yukiko (KEK); Dr NAKAMOTO, Tatsushi (KEK); OGITSU, Toru; SUGANO, Michinaka; MUSSO, Andrea (CERN); TODESCO, Ezio (CERN)

**Presenter:** SUZUKI, Kento (High Energy Accelerator Research Organization )

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