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Fast ramped dipole and DC quadrupoles design for the Beam Test Facility upgrade

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The Beam Test Facility (BTF) is part of the DAΦNE accelerators system of INFN Frascati National Laboratory (LNF). It is a transfer-line optimized for selection, attenuation and manipulation of electrons and positrons extracted from the DAΦNE LINAC. An upgrade of the line is scheduled by the end of 2018 in order to reach a beam energy of 920 MeV (with respect to the actual 750 MeV) and a new branch of the actual transfer line, in order to have two different beam lines. The layout of the new transfer line foresees seven new quadrupoles and a beam deflection of 135 degrees achieved through a 15 degrees fast ramped dipole, two 45 degrees H-shape sector dipoles and finally a 35 degrees C-shape sector dipole.

The design of the magnets has been completely performed at INFN, including electromagnetic, mechanical, thermal and hydraulic aspects. This effort leads to a complete set of detailed CAD drawings that can be directly used from Industrial partners to build the magnets. The manufacturing processes have been studied in detail in order to reduce the fabrication cost. The goal is to boost the manufacturing of prototypes and small series from Small and Medium Enterprises. Magnetic measurements will be later performed at our Institute.

In this paper we report on two types of magnets for this new line. The first magnet is designed to switch the beam alternatively in the two lines. It will be operated in a fast ramped mode, with a rise time of 100 ms. For that reason, a laminated yoke is necessary: the lamination thickness has been analysed in detail. The gap of the magnet is 25 mm with a magnetic field of 1.11 T. The second is a family of seven quadrupoles with a gradient of 20 T/m and a bore of 46 mm.

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