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Magnetic Designs of New First Target Beamline Magnets for the ORNL SNS Upgrade

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The Neutron Spallation Source (SNS) at ORNL upgrade from 1.0 GeV to 1.3 GeV is in progress now. There are number of water-cooled magnets which should be upgraded to transport 30% of higher beam energy. There were designed new Chicane Magnets, Injection/Extraction Septum Magnets, and Lambertson Magnet. The magnetic designs were a challenging task because new magnets must have a good combined integrated field quality and should occupy the old magnets space but with an integrated magnetic field increase of about 20 %. Additional strong requirements applied to the magnets fringe field do not disturb the circulating beam. The special field profiles should be provided in foil areas between magnets. The analysis was based on the OPERA3D simulations. The special technique was used for the integrated field harmonics analysis. Initially was simulated the particle track and along this track calculated for the reference radius integrated field components which were used for the harmonic analysis. 3D field maps were provided for the beam optics simulations. The final beamline analysis confirmed the good beam transmission and low losses.

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