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Specifications and Design of the Electric Dipole for the SPIRAL2 Super Separator Spectrometer

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The Super Separator Spectrometer (S3) is a large acceptance mass separator which is under construction for use with intense heavy ion beams at the SPIRAL2 facility at GANIL. It is a two-stage separator comprising a momentum achromat followed by a mass separator. The mass separation stage uses a combination of one electric dipole for energy dispersion and one magnetic dipole for momentum dispersion to create m/q dispersion at the final focal plane. The specifications required to achieve the desired separator resolution, acceptance, and rigidity are: dipole horizontal gap=20 cm, radius of curvature $\rho=4$ m, bend angle $\theta=22$ degree, electric field $E=3$ MV/m (± 300 kV), vertical acceptance 25 cm. Extensive electrostatic simulations have been done to support a mechanical design with peak surface fields limited to 8 MV/m on the electrodes and much smaller surface fields along the support insulators. The anode has a gap and an external Faraday cup to collect beam transmitted by the 1st stage. The electrodes are profiled to achieve the required vertical extent of the good field region with minimum height of the electrodes. The positive and negative high voltage power supplies are being designed starting from the concept high voltage multipliers integrated with the electric dipole's vacuum chamber as currently being used at the ATLAS FMA separator and the ISAC2 EMMA separator. These supplies are being designed for peak voltages of ± 480 kV to a) make sure they operate reliably at required voltages by conditioning to at least 20% higher, and b) to possibly operate at higher than the base-line requirement of ± 300 kV if the design peak fields can be exceeded in practice.

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