

**Tipo di tesi:** Laurea magistrale

**Corso di Laurea:** Ingegneria

**Tipologia:** modellistica

**Titolo della tesi:** Studies on the application of MMC technology to the Acceleration Grid Power Supply of the Neutral Beam Injector of DTT

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**Relatore accademico:** P. Bettini

**Capogruppo:** E. Gaio

**Argomento della tesi:**

The neutral beam injector (NBI) of DTT, the experimental fusion reactor under construction in Frascati (Italy), will accelerate Hydrogen isotopes up to 500 keV. The corresponding power supply for the acceleration grids will provide 500 kV, divided in 3 stages, with a maximum current of about 60 A. One of the main requirements is the capability to limit the energy transferred during the frequent arc breakdowns occurring among the grids, and to restart in few ms once the dielectric insulation is restored. Prosecuting a previous research activity, it is proposed a thesis aiming at evaluating the feasibility of adopting the Modular Multilevel Converter (MMC) technology for this specific application. Widely used in industrial HVDC systems, MMCs has never been applied to HV PS for NBIs, but in principle it could guarantee high efficiency, accurate control of the voltage, and the reduction of the energy transferred to the arcs. In addition, being the MMCs typically insulated in air, the only gas-insulated components would remain the Transmission Line which connect the power supply to the load, simplifying the management of the plant. Unfortunately, the space available for the MMC installation in the DTT site is quite limited, thus the feasibility study shall include the optimization of the submodule topology to reduce the number of components and overall size, and the study of a suitable layout of the conversion towers, taking into consideration also the interface with the transformers and the required clearances for insulation. Starting from the previous work, the study of suitable feedback controls shall be deepened, taking into consideration the requirements in normal and anomalous conditions; this, in combination with the selected topologies, has a direct impact on the peak voltages on the conversion towers, thus on the clearances to be kept and the overall dimensions of the plant. A preliminary fault analysis should be pursued too, to design suitable protections and highlight possible major issues with this technology.

**Competenze richieste (se necessarie):**

**Data della proposta:** ottobre 2020

**Stato:** non assegnata

**Laureando/a:**