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High Power Cyclotrons for Accelerator Driven System (ADS)

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We present an accelerator module based on a injector cyclotron and a Superconducting Ring Cyclotron (SRC) able to accelerate H2+ molecules. H2+ molecules are extracted from the SRC stripping the binding electron by a thin carbon foil. The SRC will be able to deliver proton beam with maximum energy of 800 MeV and a maximum power of 8 MW. This module is forecasted for the DAEdALUS (Decay At rest Experiment for δ_{cp} At Laboratory for Underground Science) experiment, which is a neutrino experiment proposed by groups of MIT and Columbia University. Extensive beam dynamics studies have been carrying out in the last two years and proved the feasibility of the design. The use of H2+ molecules beam has three main advantages: 1) it reduces the space charge effects, 2) because of stripping extraction, it simplifies the extraction process w.r.t. single turn extraction and 3) we can extract more than one beam out of one SRC. A suitable upgraded version of the cyclotron module able to deliver up to 10MW beam is proposed to drive ADS. The accelerator system which is presented, consists of having three accelerators modules. Each SRC is equipped with two extraction systems delivering two beams each one with a power up to 5 MW. Each accelerator module, feeds both the two reactors at the same time. The three accelerators modules assure to maintain continuity in functioning of the two reactors. In normal operation, all the three accelerators module will deliver 6.6 MW each one, just in case one of the three accelerator module will be off, due to a fault or maintenance, the other two modules are pushed at maximum power of 10 MW. The superconducting magnetic sector of the SRC, as well as the normal conducting sector of the injector cyclotron, is calculated with the TOSCA module of OPERA3D. Here the main features of the injector cyclotron, of the SRC and the beam dynamic along the cyclotrons are presented.