Overview of the HVE Singletron accelerators developed for Nuclear Astrophysics

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HVE has designed and built a dedicated 3.5 MV single ended DC accelerator to satisfy the stringent demands of the LUNA-MV project (INFN-LNGS L'Aquila, Italy) for astrophysics research, with high energy stability, low terminal voltage ripple and high beam currents for light ions. The system has incorporated a 10 GHz, all permanent magnet ECR ion source in its high voltage terminal.

Factory test results demonstrated ion beam currents of H^+ ($\sim$1 mA), $^4He^+$ ($\sim$1 mA), $^{12}C^+$ (150 μA) and $^{12}C^{2+}$ (100 μA) at target in the terminal voltage range of 0.5-3.5 MV. Beam energy stability and ripple are in the order of 10^{-5} and energy reproducibility is 10^{-4}. Beam current stability is $\approx$ 5% over 24 hours without feedback, but typically $<$ 1% per hour using a feedback system.

Different specifications are required by another project at TUNL, Duke University, Durham USA, where a replacement for the JN1000 Van de Graaff accelerator system is foreseen. A 2 MV version of the Singletron range providing beam currents in excess of 2 mA for H and He, and featuring 2 ns pulsing capability is being designed for this project. This system is equipped with a new 5.8 GHz, all permanent magnet, ECR source and a chopper-buncher in the high voltage terminal, capable of nanosecond pulsing for H, He and D.

In this contribution, we will discuss the design features of both accelerators, specifically ion optical properties. Results on the performance tests of the LUNA-MV system will be given.