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Digitally Controlled Four Harmonic Buncher for FSU LINAC

DANIEL S. MOERLAND, INGO WIEDENHOEVER, LAGY T. BABY, DAVID CAUSSYN, DAVID SPINGLER, Physics Department, Florida State University — Florida State University's John D. Fox Superconducting Accelerator Laboratory is operating a Tandem-Linac system for heavy ion beams at energies of 5-10 MeV/u. Recently, the accelerator has been used as the driver for the radioactive beam facility RESOLUT, which poses new demands on its high-intensity performance and time-resolution. These demands motivated us to optimize the RF bunching system and to switch the bunch frequency from 48.5 to 12.125 MHz. We installed a four-harmonic resonant transformer to create 3-4 kV potential oscillations across a pair of wire-mesh grids. This setup is modulating the energy of the beam injected into the tandem accelerator, with the aim to create short bunches of beam particles. Asawtooth-like wave-form is created using the Fourier series method, by combining the basis sinusoidal wave of 12.125MHz and its 3 higher order harmonics, in a manner similar to the systems used at ATLAS [1] and other RF-accelerators. A new aspect of our setup is the use of a digital 1GHz function generator, which allows us to optimize and stabilize the synthesized waveform. The control system was realized using labview and integrated into the recently updated controls of the accelerator. We characterize the bunching quality achieved and discuss the optimization of the bunching wave-form. The bunching system has been successfully used in a number of Linac-experiments performed during 2011.

[1] S. Sharamentov, J. Bogaty, B.E. Clift, R. Pardo, UPGRADE OF THE ATLAS POSITIVE ION INJECTOR BUNCHING SYSTEM, Proceedings of 2005 Particle Accelerator Conference, Knoxville, Tennessee

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