High Voltage Pulse Generator for an ExB Chopper System*

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Introduction

High intensity beams which are increasingly needed for a variety of applications pose new challenges for beam chopping. Long drifts must be avoided due to space charge constraints. The duty cycle for electrostatic beam deflection must be minimized in order to reduce the risk of voltage breakdowns. Beam dumping outside the transport line is preferable in order to avoid high power deposition and uncontrolled production of secondary particles at the slit or other vulnerable beamline components.

ExB Chopper System

An ExB chopper system for intense proton beams of up to 200 mA and repetition rates of up to 250 kHz is under development at IAP. It will be tested and installed in the low energy section of the Frankfurt Neutron Source FRANZ [1] with beam energies of 120 keV.

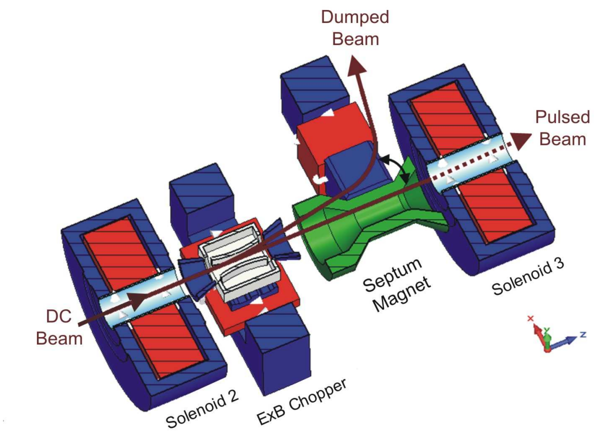

Figure 1: Scheme of the ExB Chopper System.

The chopper consists of a Wien filter-type ExB configuration, where the electric field can be pulsed and is followed by a static septum magnet [2]. As pulsing of the magnetic deflection field is not possible with a repetition rate of 250 kHz due to high power consumption, a pulsed electric field (fig. 3) is generated between two deflector plates located inside the dipole gap. It compensates the magnetic deflection and is thus creating a 100 ns proton pulse in forward direction for injection into the first accelerator structure.

High Voltage Pulse Generator

The electric field will be driven by a High Voltage Pulse Generator shown in fig. 2. It uses fast MOSFET technology in the primary circuit while the high voltage is provided in the secondary circuit around a ferrite transformer core.

Figure 2: High Voltage Pulse Generator.

Two pulses of more than 5 kV of positive and negative voltage, respectively, are required to charge both deflector plates symmetrically. Voltage pulses of ±5.8 kV with a repetition rate of 250 kHz were achieved (fig. 3). In addition post-pulse oscillations were minimized by reducing parasitic capacitances and by installing diodes as well as ohmic resistances.

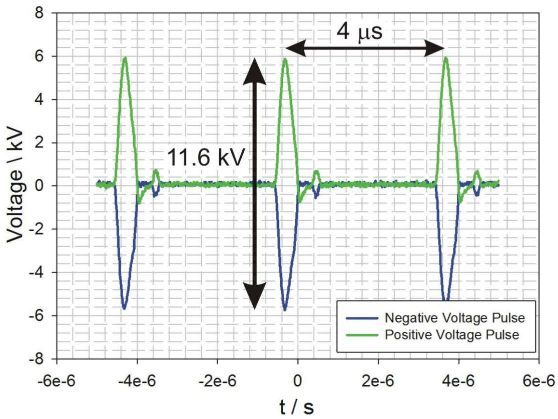

Figure 3: Measured Voltage Pulses.

References

[1] O. Meusel et al., “Injector Development for High Intensity Proton Beams at Stern-Gerlach-Zentrum”, LINAC’08, Victoria, BC, Canada, September 2008, MOP002, p. 49-51.
[2] C. Wiesner et al., “Chopper for Intense Proton Beams at Repetition Rates up to 250 kHz”, PAC’09, Vancouver, BC, Canada, May 2009, TU6PFP088.

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