A BEAM CURRENT MONITOR FOR THE VECC ACCELERATOR

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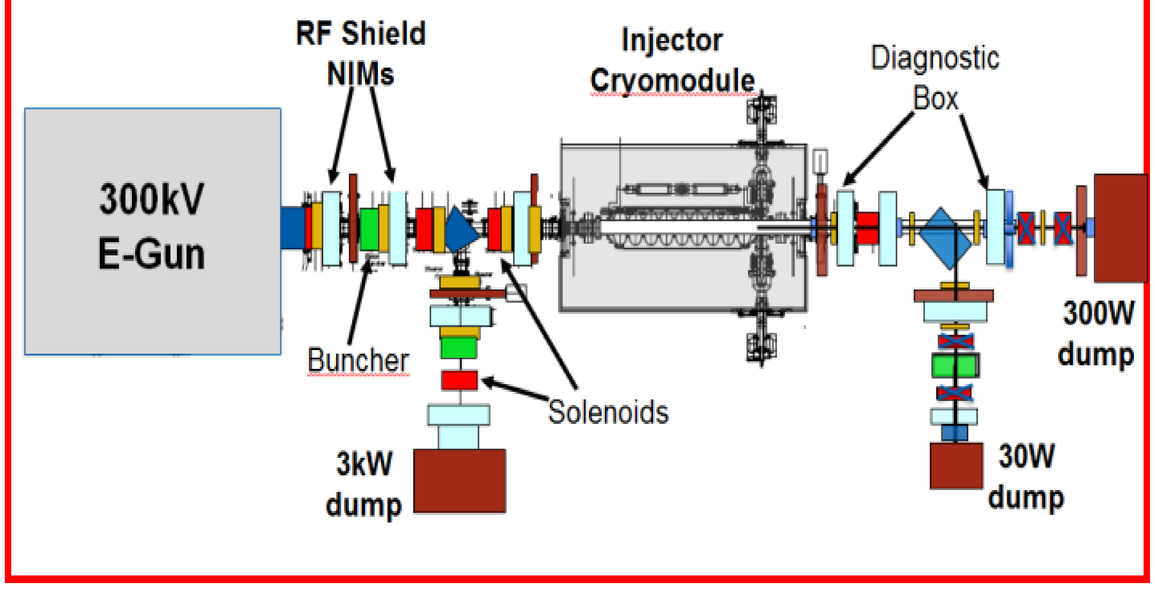
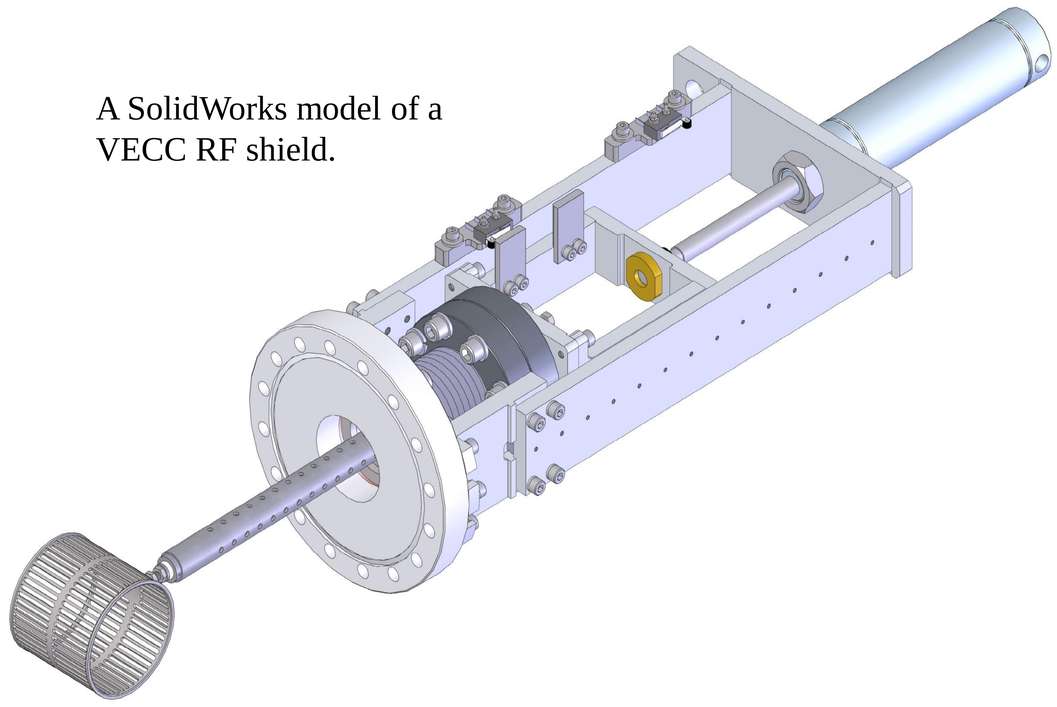
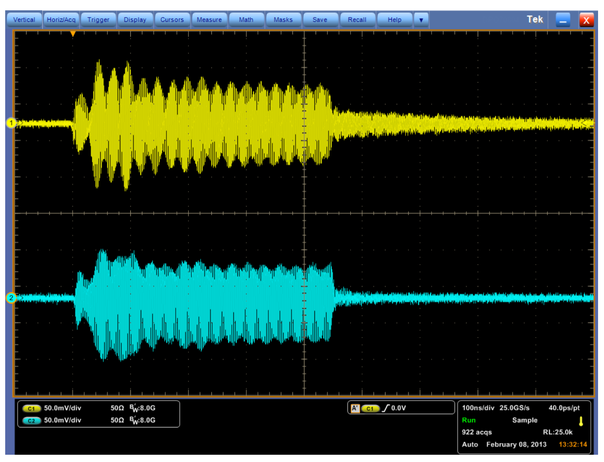
TRIUMF is building VECC, the first stage of a 50 MeV electron linac. Beam diagnostic devices will be inserted radially into 8-port vacuum boxes. RF shields, 6.3 cm diameter tubes perforated by pump out slots, can be inserted to reduce wakefields. They will also serve as capacitive probes picking up harmonics of the 650 MHz bunch rate. 100 mV P/P was measured for 3 mA at 100 keV. A SC cavity will accelerate the beam to 10 MeV. The main dump current is limited by the shielding to 300 W. The e-gun will deliver up to 10 mA with a variable pulse rate and duty cycle. Two RF shields will monitor the current. A circuit will produce dc outputs proportional to the average beam current and either the peak beam current or the duty cycle. It uses a log detector with a range of 70 dB for 1 dB of error and a rise and fall time of ~20 ns. Terasic development boards process the log signals. Each signal is digitized by a 14-bit ADC at a 50 MHz rate and passed to a FPGA programmed in Verilog. Altera Megafunctions offset, scale, convert to floating point, antilog and filter the signal in pipeline architecture. Two 14-bit DACs provide the outputs. Digital processing maintains the wide dynamic range. Beam pulses can be <120 ns and the sample rate insures accuracy at low duty cycle.

The VECC test stand.

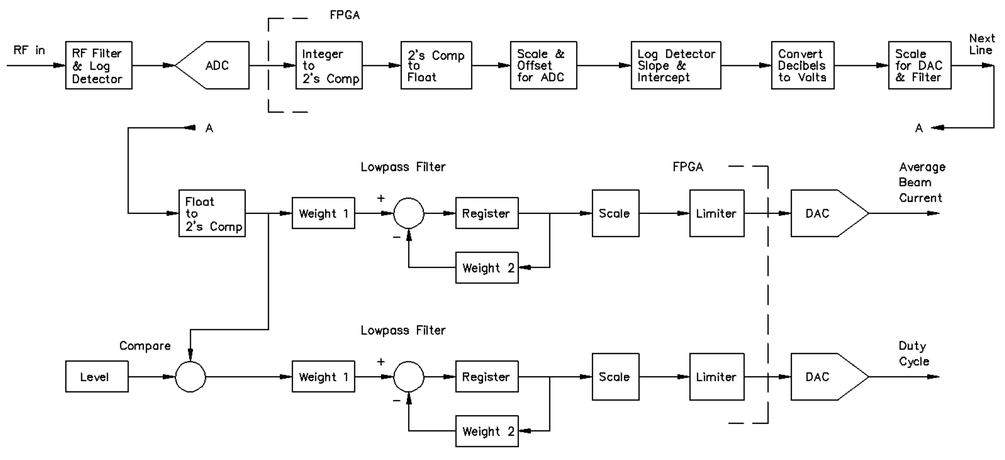


A SolidWorks model of a VECC RF shield.



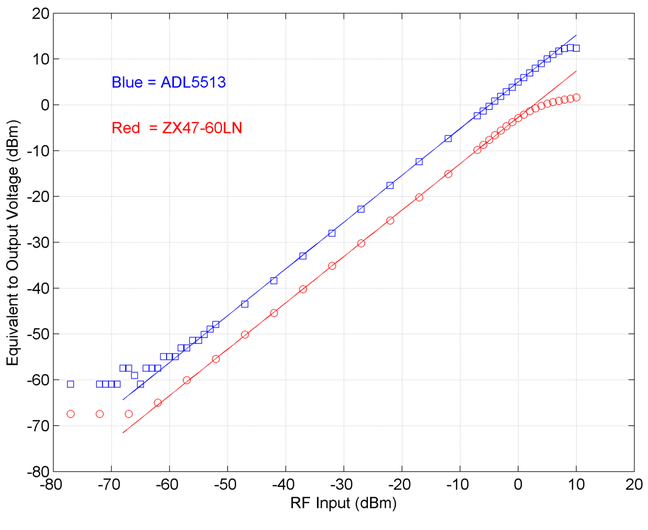


Signals from the two the RF Shields closest to the VECC e-gun. The beam current is 2.8 mA and the pulse width is 520 ns.

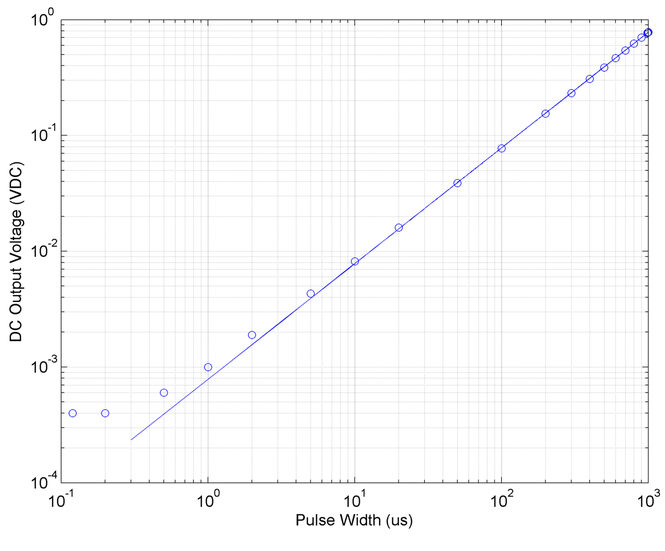


The data flow through the log detector, ADC, DACs and 50 MHz signal processing pipeline.

The prototype module is built into a double width NIM module.



The response of the electronics for two different log detectors. The response of the ZX47-60LN has been decreased by 10 dB for clarity.



The response of the electronics to a pulsed signal.

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