PIP-II 800 MeV Proton Linac Beam Pattern Generator

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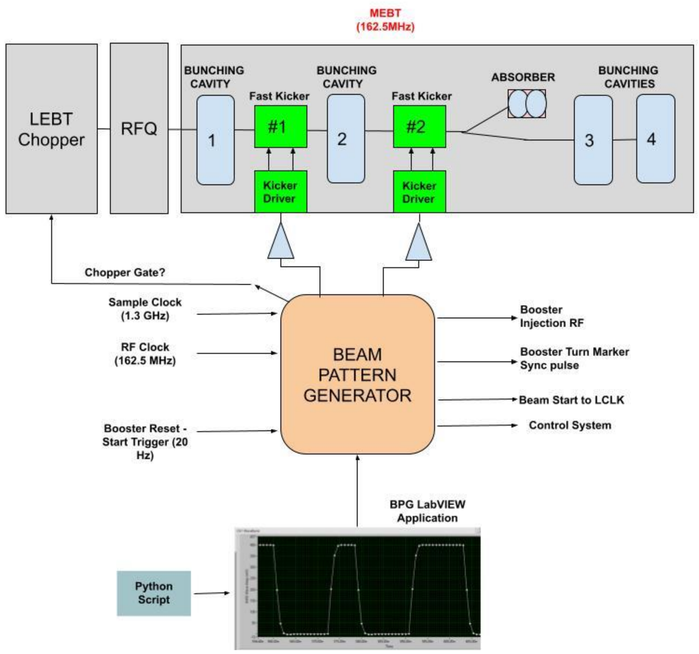
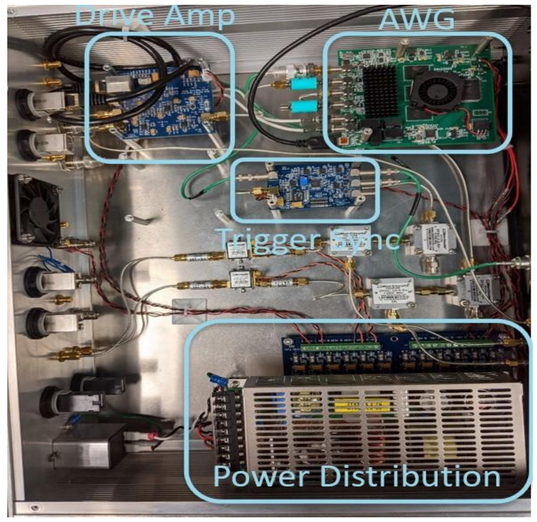
BPG System Description

- Generate the beam pattern as requested by experiment or by Booster injection
- Drive the MEBT Fast Kicker,
  - 162.5 MHz bunches, repeated at 20 Hz machine repetition rate
  - Arbitrary pattern frequency range 20 Hz to 81.25 MHz, must maintain extremely flat amplitude and phase response
- Capable to drive the LEBT chopper
- Provide the injection RF signal for Booster, Sync pulse to generate the Booster revolution marker
- Generate output trigger, precisely aligned with 162.5 MHz RF clock
- System verified and tested at PIP2IT



PIP2IT BPG system diagram



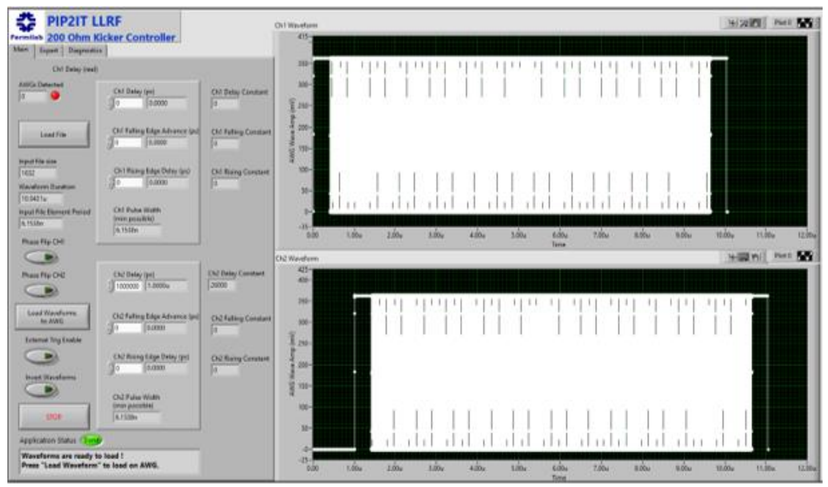
BPG chassis, installed at PIP2IT

AWG: Up to ~4ms of beam chopping waveforms

Drive Amp: 750 mVpp output to 0-1.3V signal

Trigger Sync: Samples timing trigger to 162.5 MHz RF clock

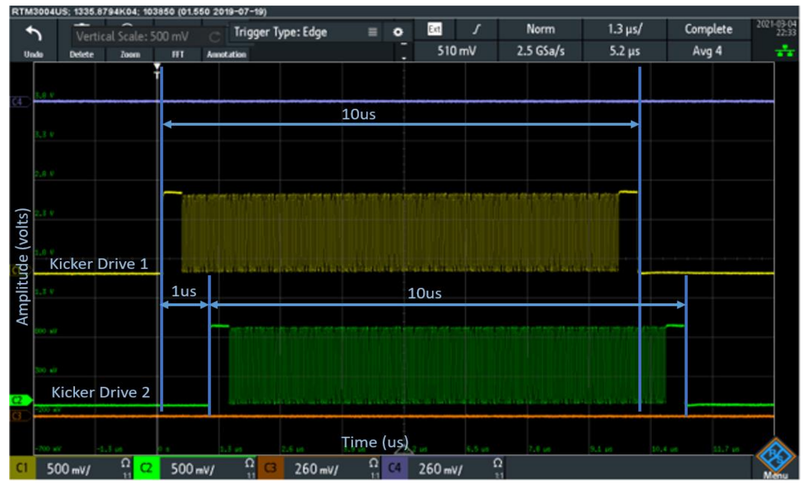
- **Python Script:** Generates .csv file with kick and beam pattern
- **LabVIEW application:** Generates beam pulse patterns for AWG running at 1.3 GHz, adjustable channel delays and rising/ falling edges
- **Signal Processing**: 26 GSPS virtual signal processing rate; ~38ps timing resolution



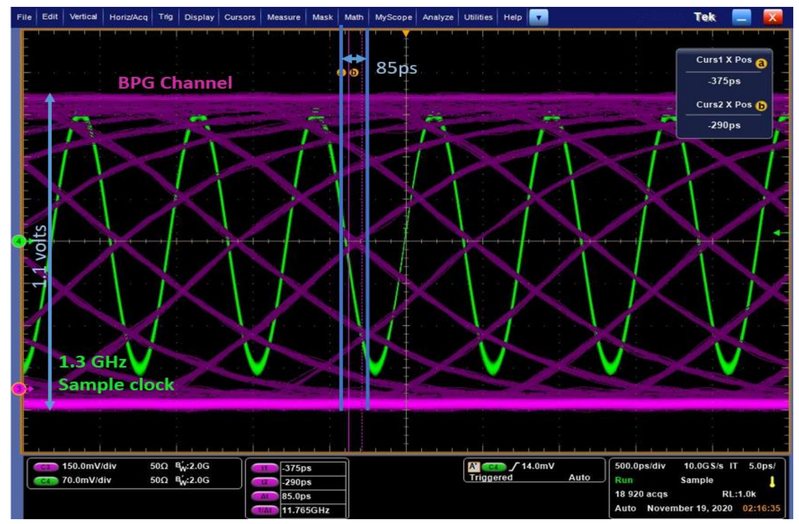
BPG LabVIEW application, Generating 10us pattern

BPG Test Results

- Beam patterns up to 550us has been generated and tested on prototype BPG system
- Sample clock to channel electronic jitter and system dispersion ~85ps for both channels



BPG output channels, CH2 delayed by 1us compared to CH1



BPG Output channel with Infinite persistence