Solenoid Spectrometer DAQ Information

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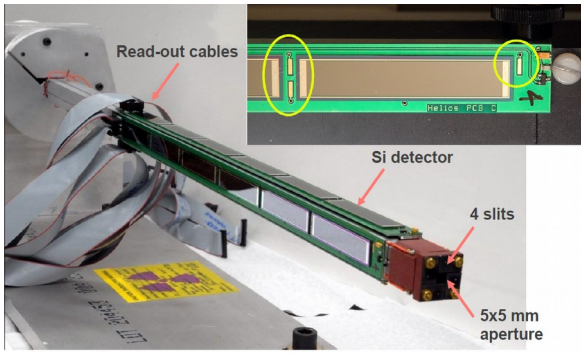
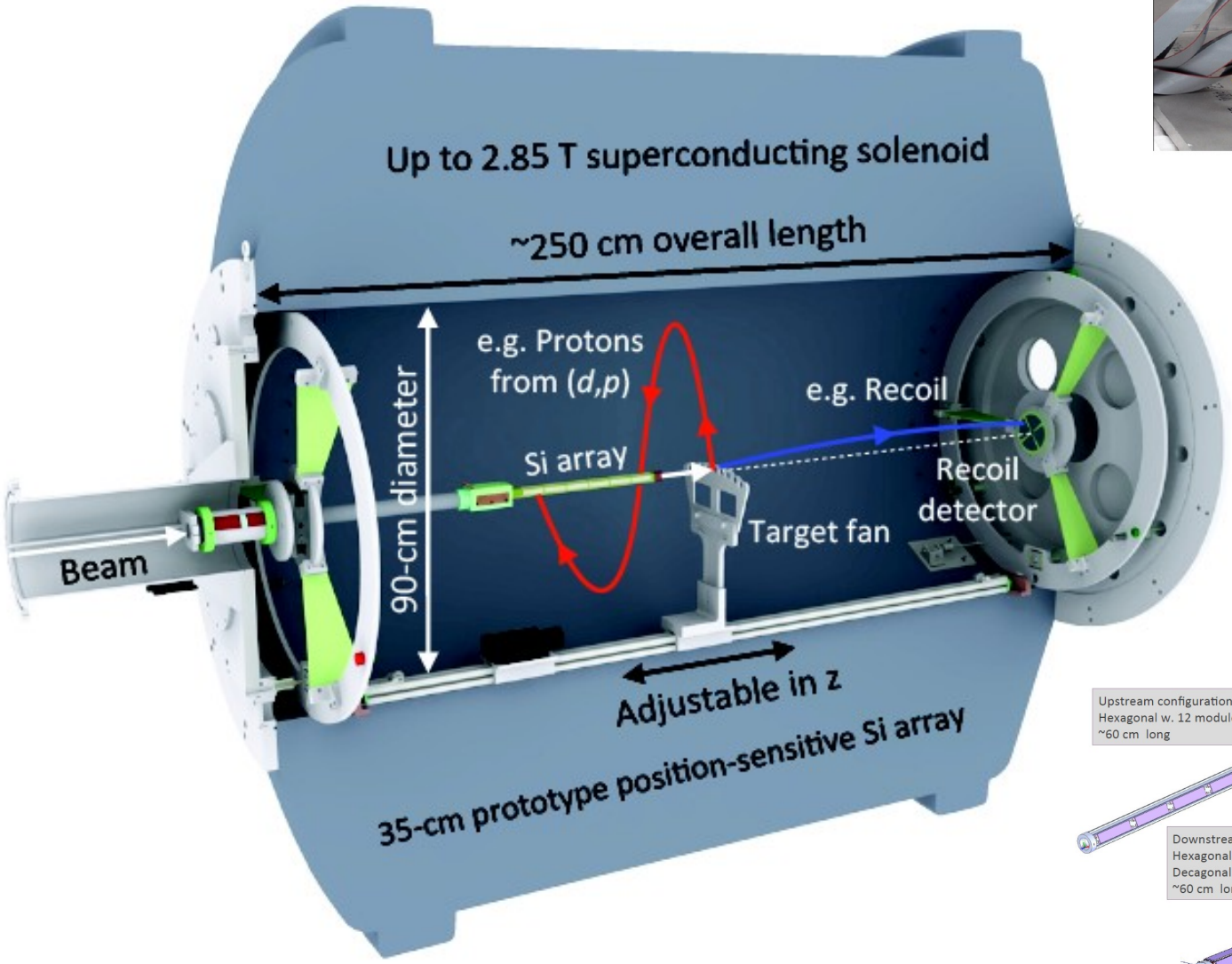
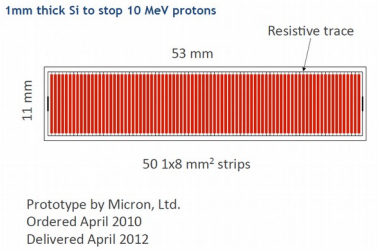
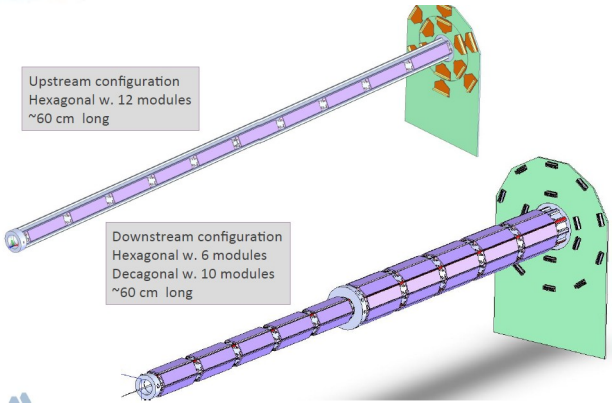
Device Description: HELIOS









Summary of DAQ Requirements

- Position sensitive detector (PSD) Si array
  - Collection of each hit (100Hz – 5k Hz)
  - Energies from each channel (x300)
  - Times relative to common start (e.g., accelerator RF) (~1 ns)
  - Times relative to each other (~100 ns)
  - Trace readout may be beneficial (up to 2 us)
    - < 8 TB per week even with 2 us

- Ancillary detectors (Ionization chamber, MCP, gamma-, etc.)
  - Collect with valid PSD hit
  - Some level of “downscaled” singles collection (raw rates up to 1MHz)
  - Times relative to common start (~1 ns)
  - Times relative to valid PSD hits (~100 ns)
  - Pile-up handling (online or offline)

- Currently set to go into a fully digital system based on Gretina hardware with recent ANL modifications

Triggering and Data

- Two types of detectors:
  - Low-rate PSD Si
  - High-rate ancillary (Recoil or gamma-ray)
- Typically Low-rate PSD Si defines “master” triggering
  - Little need for elaborate triggering due to low counting rates
  - Singles triggering from total energy signal (< x100)
  - Ancillary collected in “slave” mode
- May require “down-scaled” collection of high-rate data

- Storage expectations (Digital System):
  - Without trace data required, storage amounts are small
  - With trace data – 2 us based on event size of Gretina/DGS digitizers
    - 100 Hz per detector (x60 = 6k singles trigger rate)
    - < 3 MB per back plane (x5 digitizers per plane)
    - < 8 TB per week of running

Coupling other Detectors and Acc. Controls

- Plug directly into LBNL digitizers whenever feasible
  - Use of a third party module to assist in gain and offset matching
- Share time-stamp with “independent” system through MyRIAD type board
  - Working model already exists, e.g., Gretina at NSCL/ANL w/ Ancillary devices

- Need a common start/stop to extract cyclotron orbit times from PSD detector times
  - Presently use accelerator RF signal – possible (and planned) with current digital system
    - Extract phase of RF clock – readout through master trigger module

Analysis Needs

- Online:
  - Some level of “event” monitoring needed
  - Events comprised of all four (4) signals from a single PSD Si detector + correlated events (similar to a TAC) between PSD and ancillary recoil detector
  - Constant monitoring of the beam / targets
  - Trace analysis not needed online

- Offline:
  - Global event building from individual data, e.g., combing PSD signals and coincidences with ancillary devices
  - If trace data is deemed advantageous, large processing needed
    - Central computing / analysis center?
  - Otherwise, relatively simple data processing
  - ROOT framework preferred

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