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Simulated Beam Loss Events in the FRIB Linac

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POSTER TUPP04

Why monitor beam loss?

- Assist with beam tuning
- Minimize activation, avoid beam damage, extend machine lifetime

Why simulate faults?

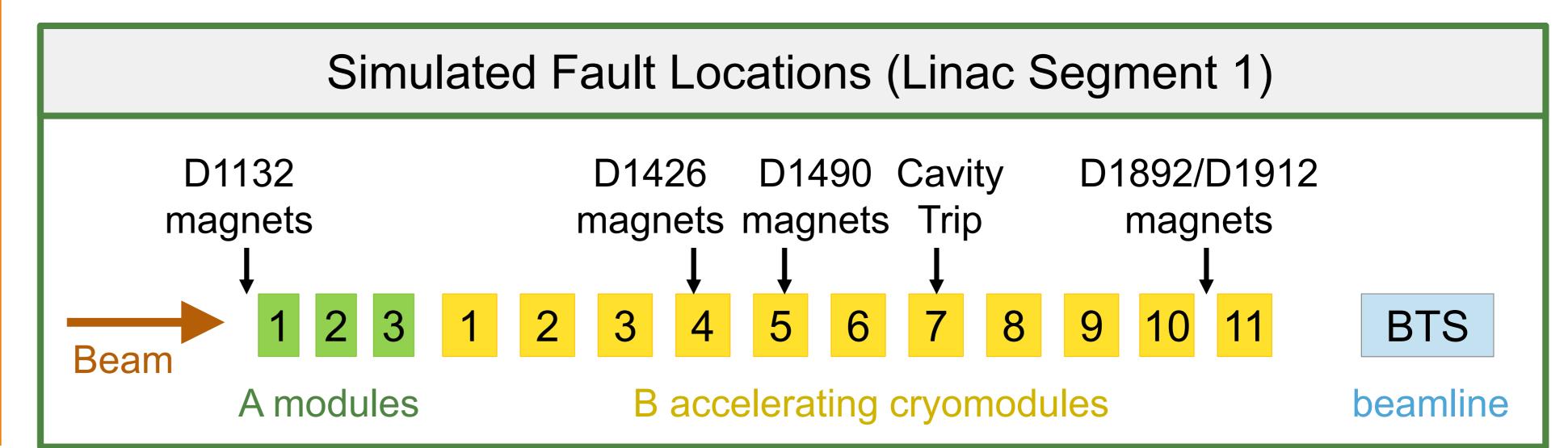
- Loss detection does not necessarily occur at fault location
- Must pinpoint source of beam loss in order to address the cause
- Try to correlate loss detection pattern with fault location

Faults / Mistuning

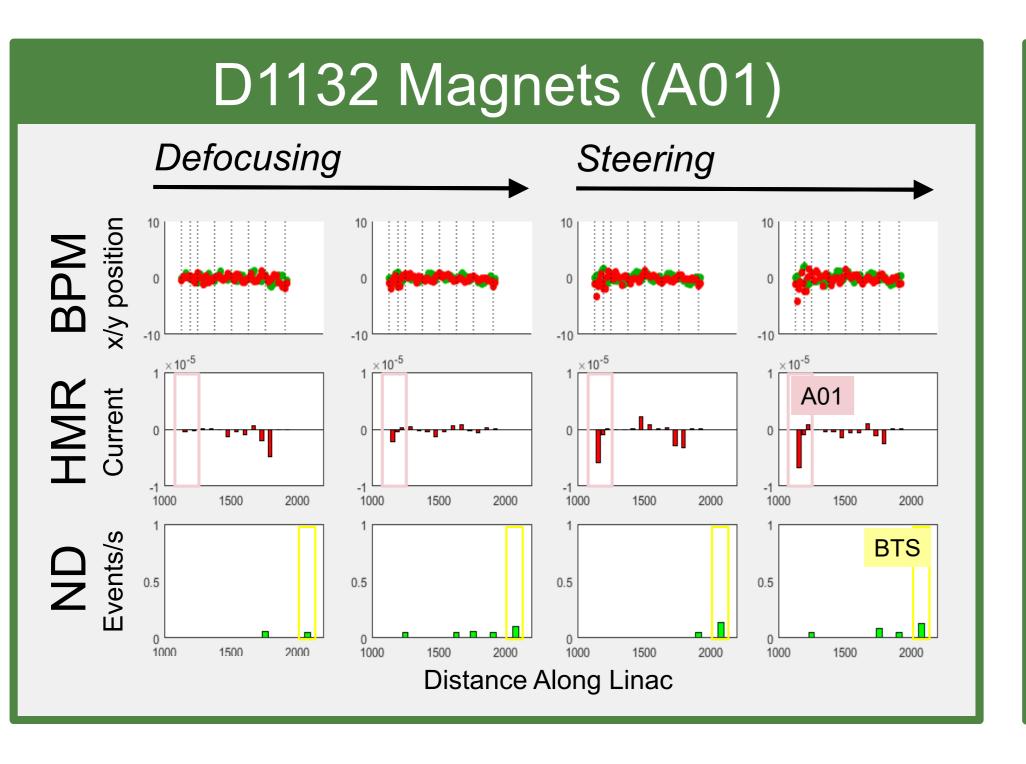
- Steering (corrector magnet current)
- Focusing (solenoid magnet current)
- Energy (accelerating cavity trip)

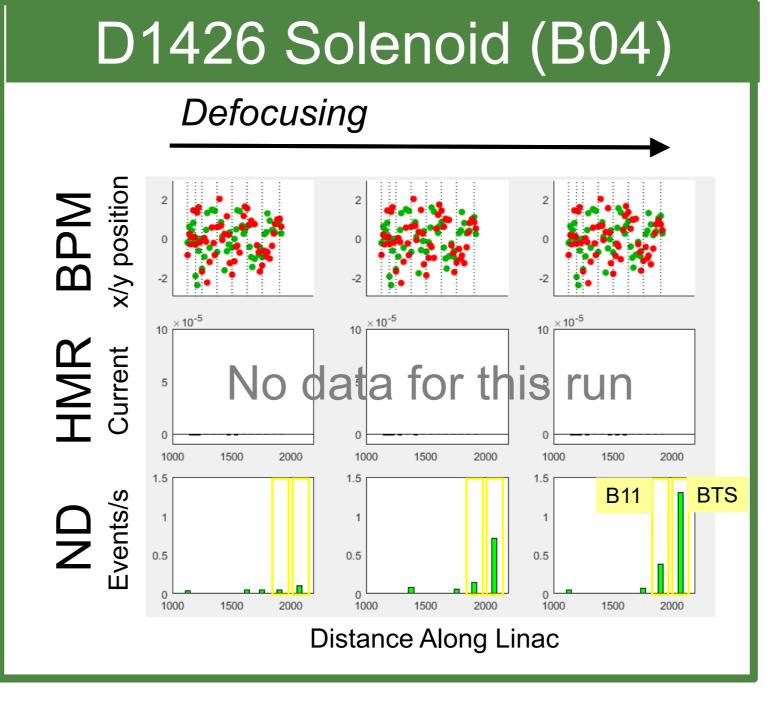
Intentional (not studied)

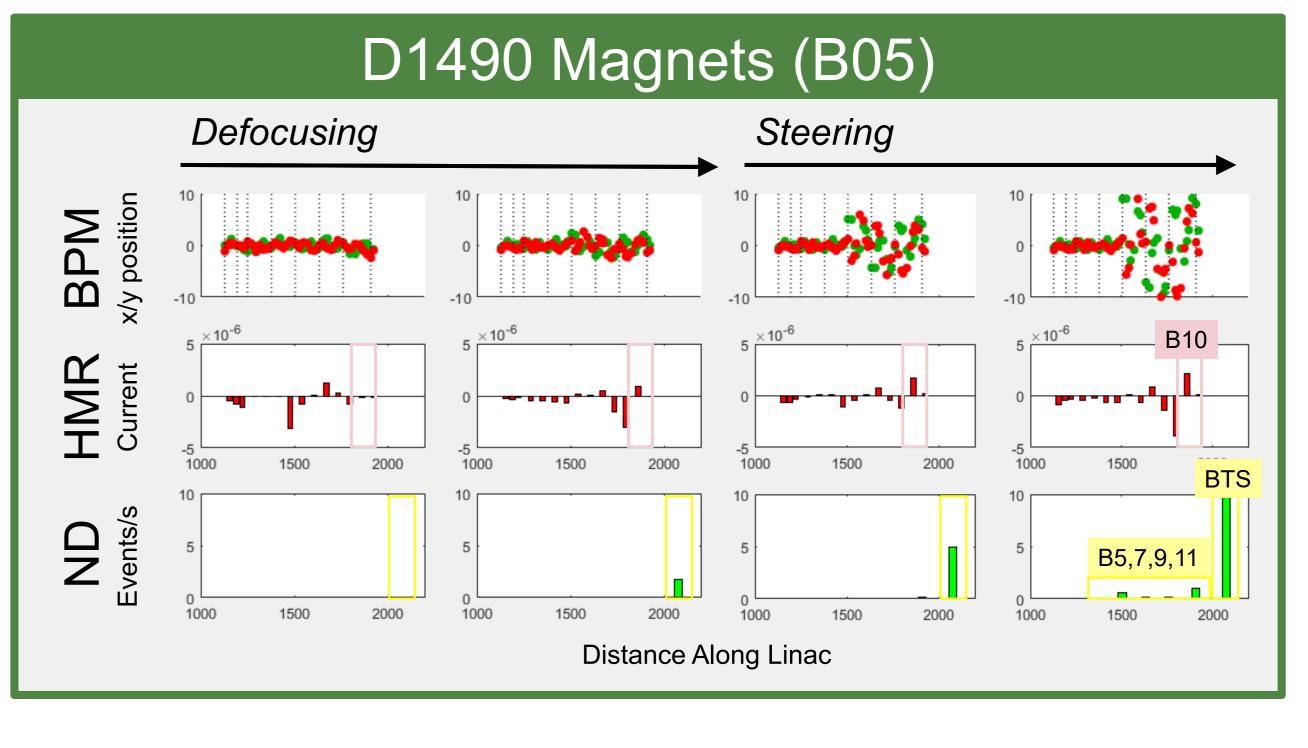
- Beam cleaning / Isotope selection
- Charge-state selection

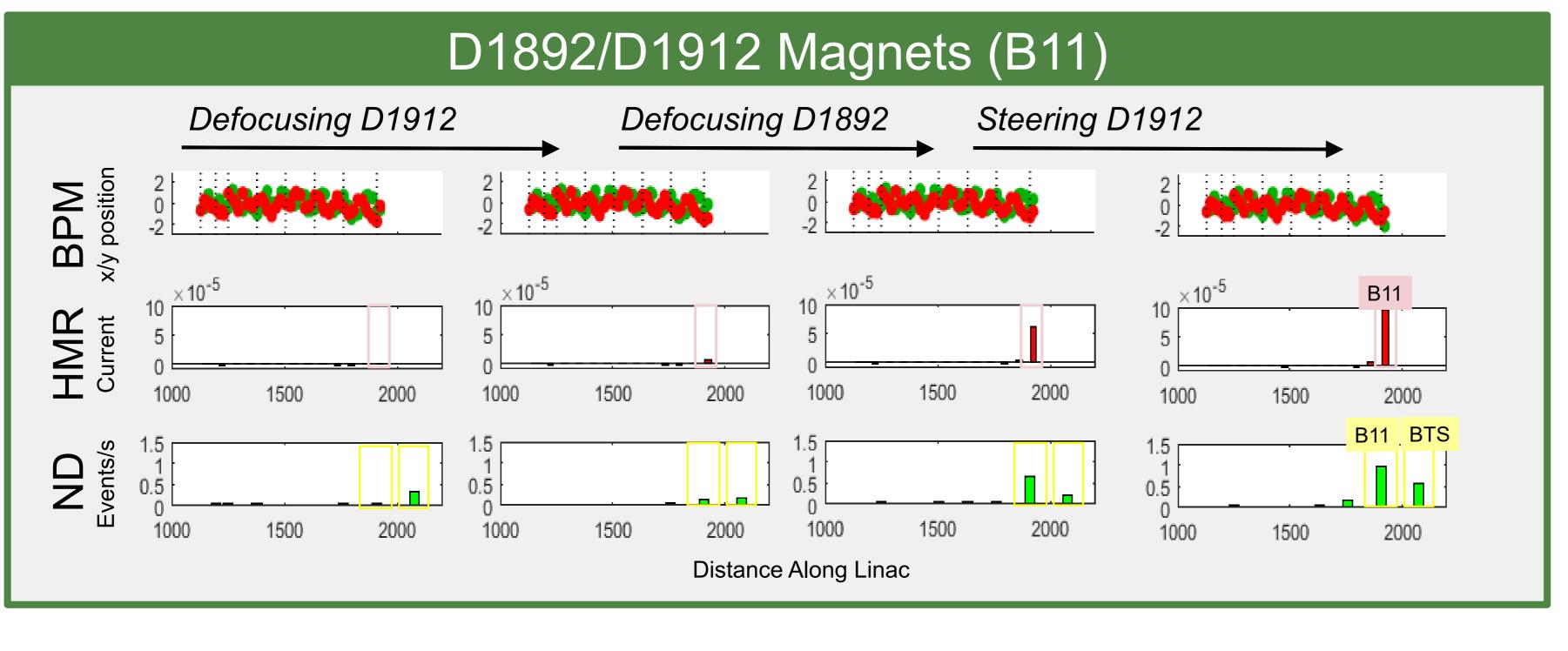


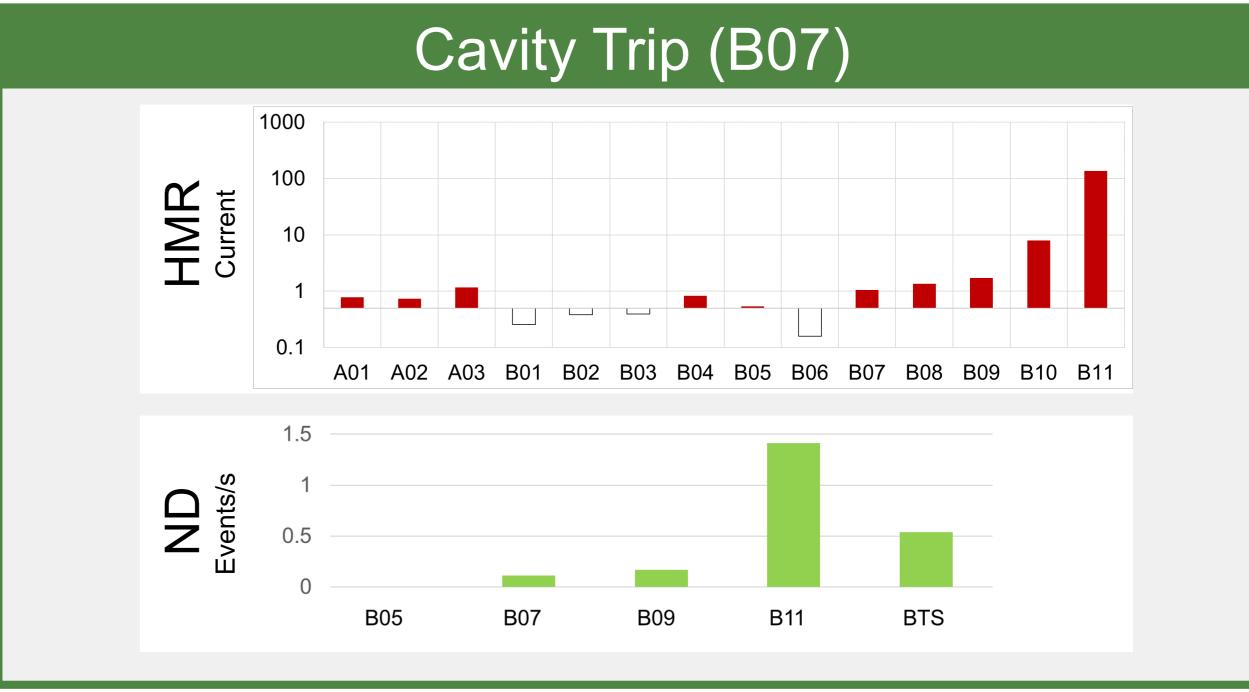
LS1 Detector Locations Halo Monitor Ring (HMR) – in between cryomodules Linac Segment 3 (LS3) Neutron Detector (ND) – beside odd numbered cryomodules Also used Beam Position Monitors (BPM) to plot beam profile **Note: One ND is in the BTS** 200 MeV/u (U238) 150 MeV/u (U238) section, past the cryomodules Beam B accelerating cryomodules BTS beamline A modules 150 MeV/u (U238)/ Folding Segment 1 (FS1) Folding Segment 2 (FS2) Linac Segment 2 (LS2) Linac Segment 1 (LS1)











Neutron Detectors

- Few losses seen in first half of LS1, energy too low?
- Small loss seen for defocusing (solenoid changes)
- Losses typically detected far downstream of fault location, especially for defocusing
- Cavity trip (energy change) loss detected starting with same module, and increasing downstream

Halo Monitor Rings

- Loss signal not much larger than intrinsic variation of readings
- Smaller signals early/mid segment compared to late segment
- Loss seen mostly in nearby HMRs
- Small loss from cavity trip (energy change) detected in nearby modules, but increases exponentially downstream



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