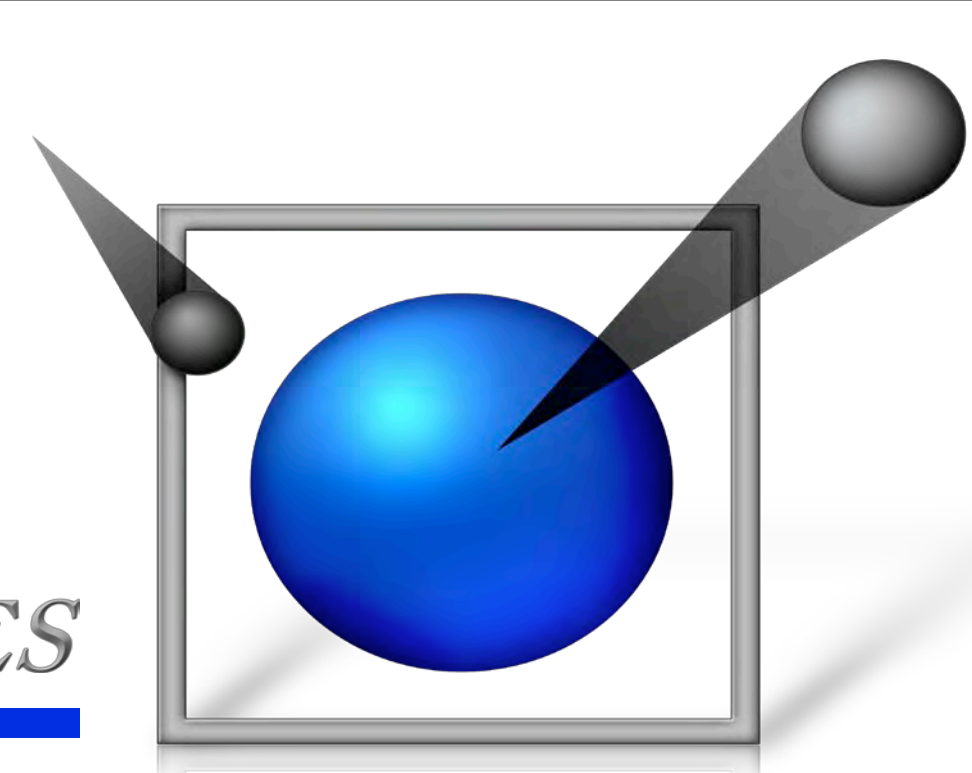


SNS Accelerator Applications for High Power Proton R&D

J. Galambos – on behalf of the SNS team

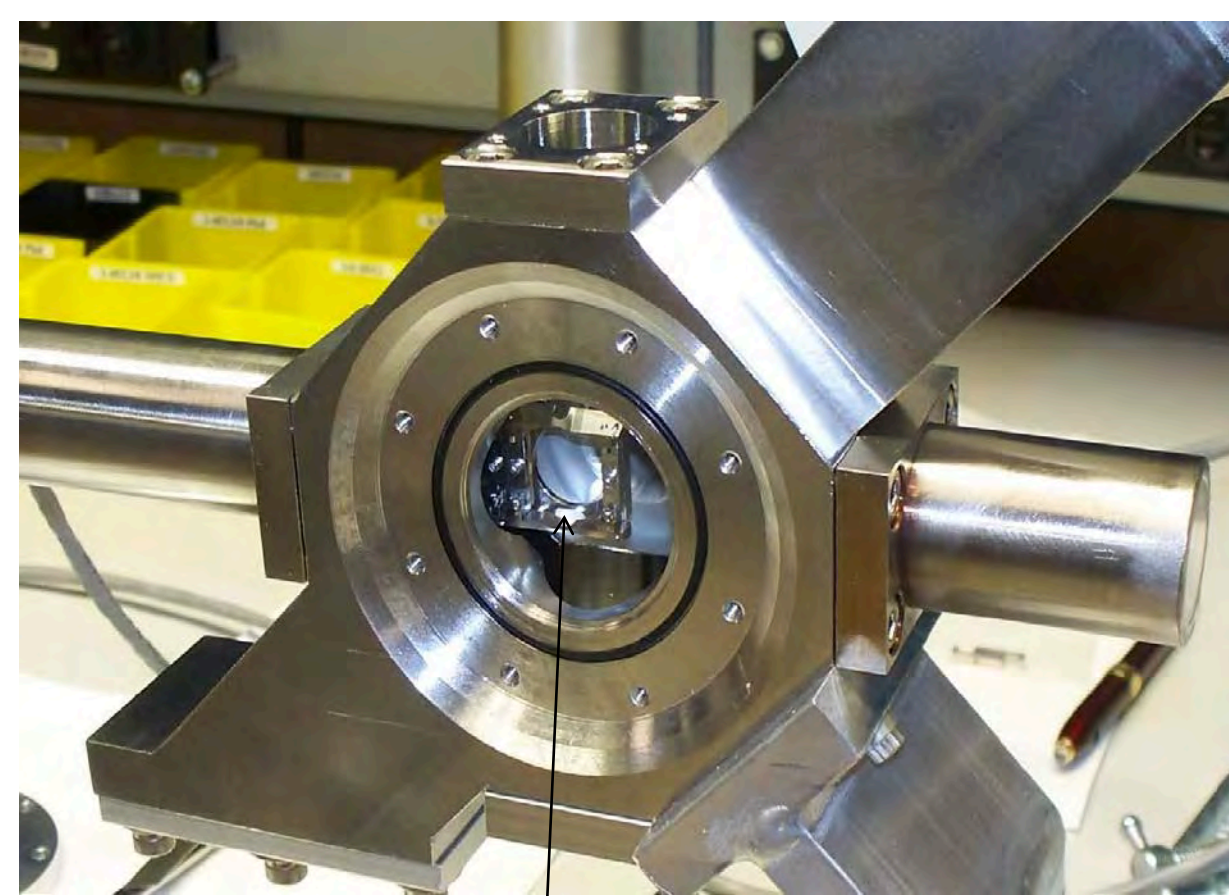
NEUTRON SCIENCES



ABSTRACT

Proposed next generation hadron accelerators for spallation sources, neutrino factory, muon collider, and ADS applications face challenges in a) controlling beam loss and b) ring injection for short pulse applications. SNS is the worlds highest power pulsed proton accelerator, and is an ideal test bed for studying these phenomena. For beam loss studies, large dynamic range profile and emittance measurements are needed to construct initial beam distributions and measure downstream halo development. Simulation tools should be benchmarked with these measurements. In the ring injection area, laser stripping is proposed as an alternative to the usual foil stripping.

Linac Beam Loss



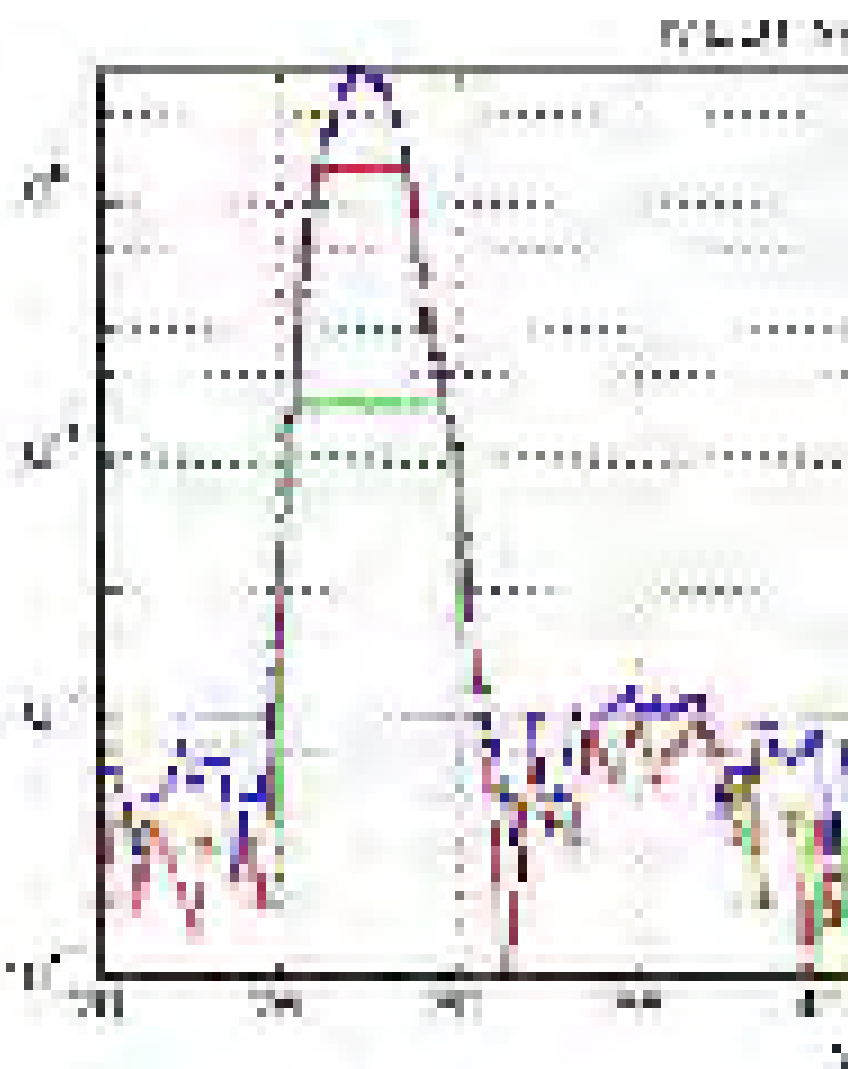
Insertable foil

Linac beam loss: does intra-beam “stripping” cause beam loss particular to H⁻?

- Method: Install an insertable stripper foil at the beginning of the linac, to create a proton beam
- Transport the resulting proton beam through the linac (done)
- Compare the beam loss between the proton and H⁻ cases for various lattices to test the intra beam-stripping hypothesis (ongoing)

Understanding Beam Transport in High Intensity Linacs Path Forward: Careful Benchmark with Measurements

Large dynamic range transverse profiles in the SNS MEBT:

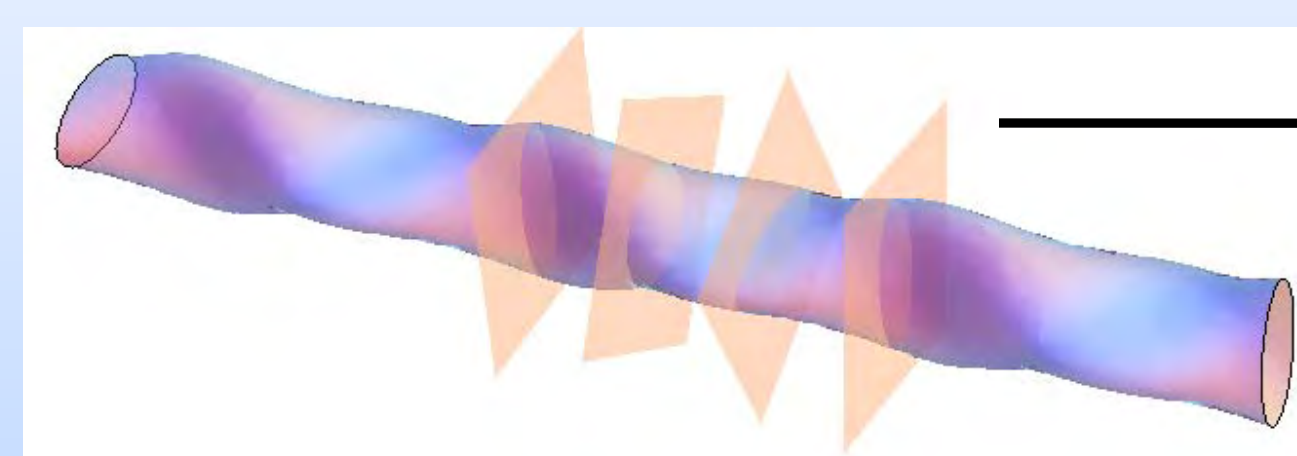


High power beam loss needs to be controlled at the 10⁻⁴ – 10⁻⁶ level to maintain hands on maintenance – a challenge to understand!

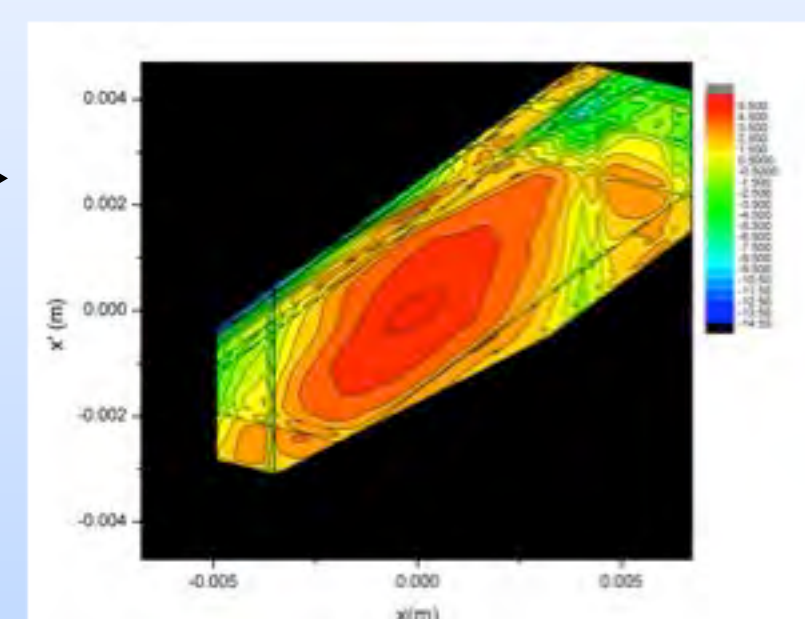
Need large dynamic range profile / distribution measurements.

- Transverse + longitudinal
- Start at the low energy end
 - SNS MEBT has provisions for transverse profile and emittance measurements
 - Can add laser based longitudinal measurements

Reconstruct the initial particle distribution using tomography techniques

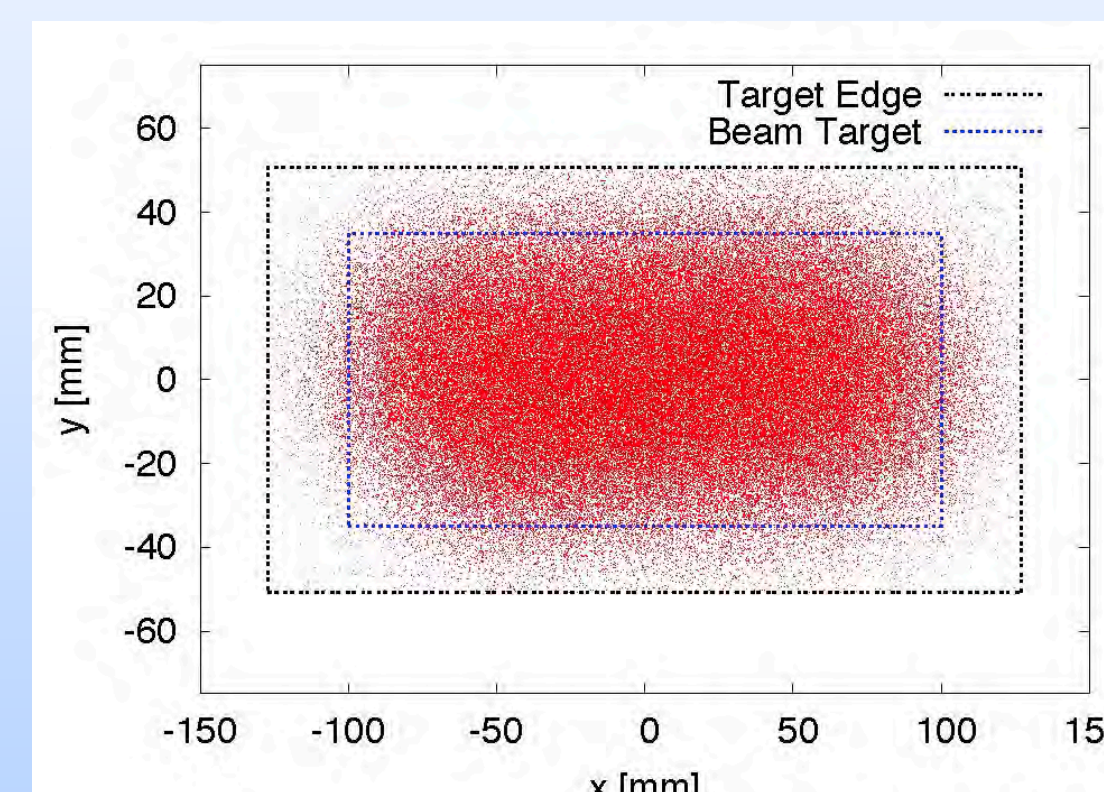


Wire scanner 1-D profiles

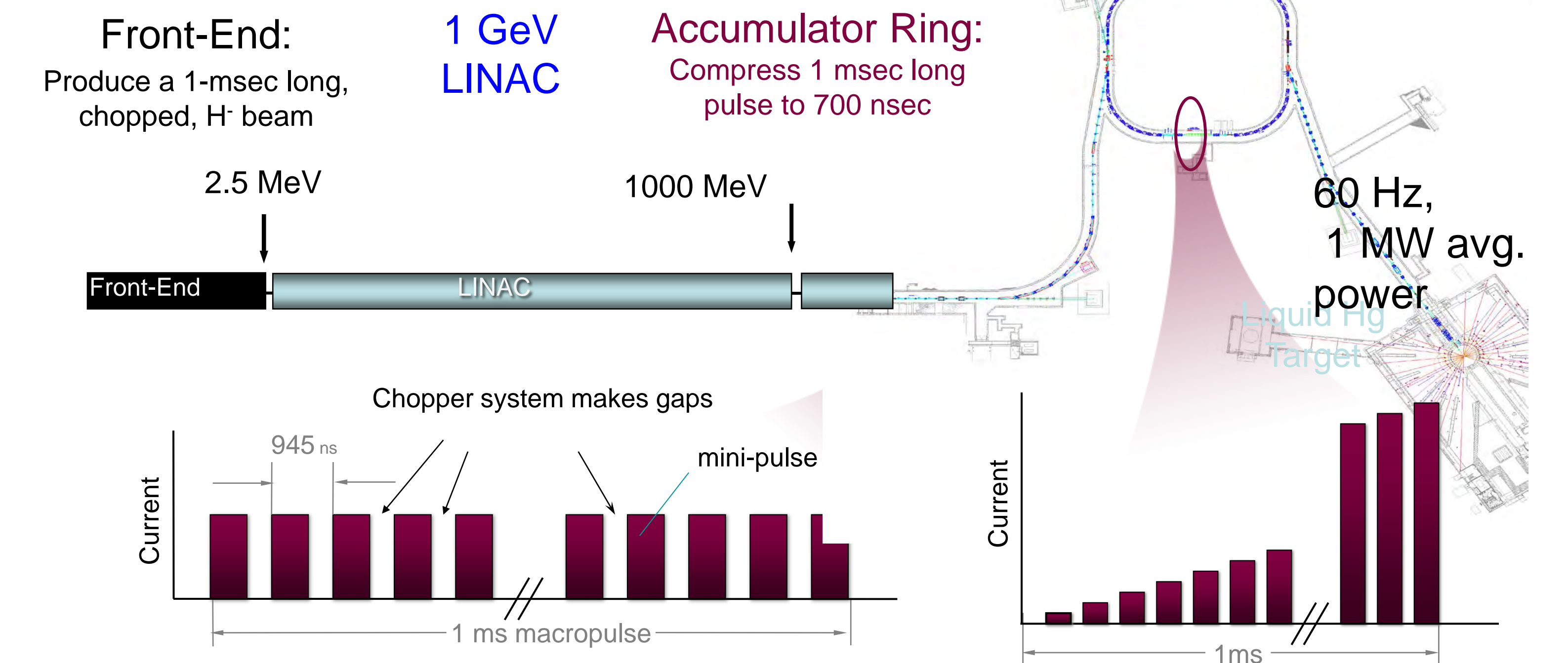


Reconstructed 2-D distribution

Update ORBIT particle tracking code for linacs and benchmark to the measurements



ORBIT tracking for a Ring Application

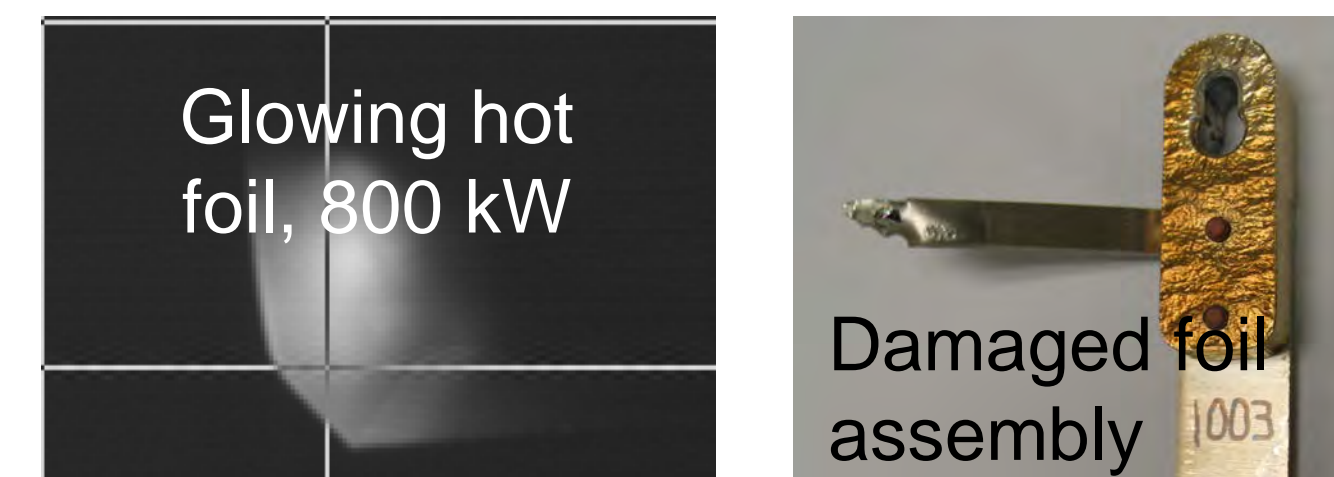


Laser Stripping Ring Injection

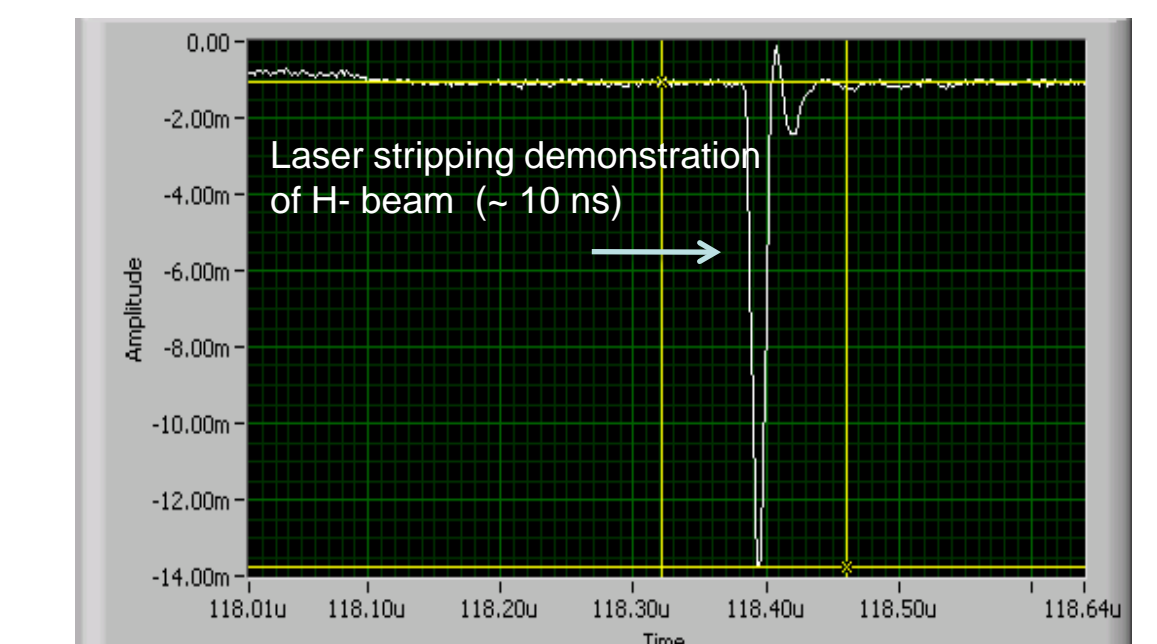
Ring Injection for Short Pulse Applications

H⁻ injection with stripper foils has been used for decades, but:

- Foil lifetime issues at high power
- Scattering induced beam losses are a problem

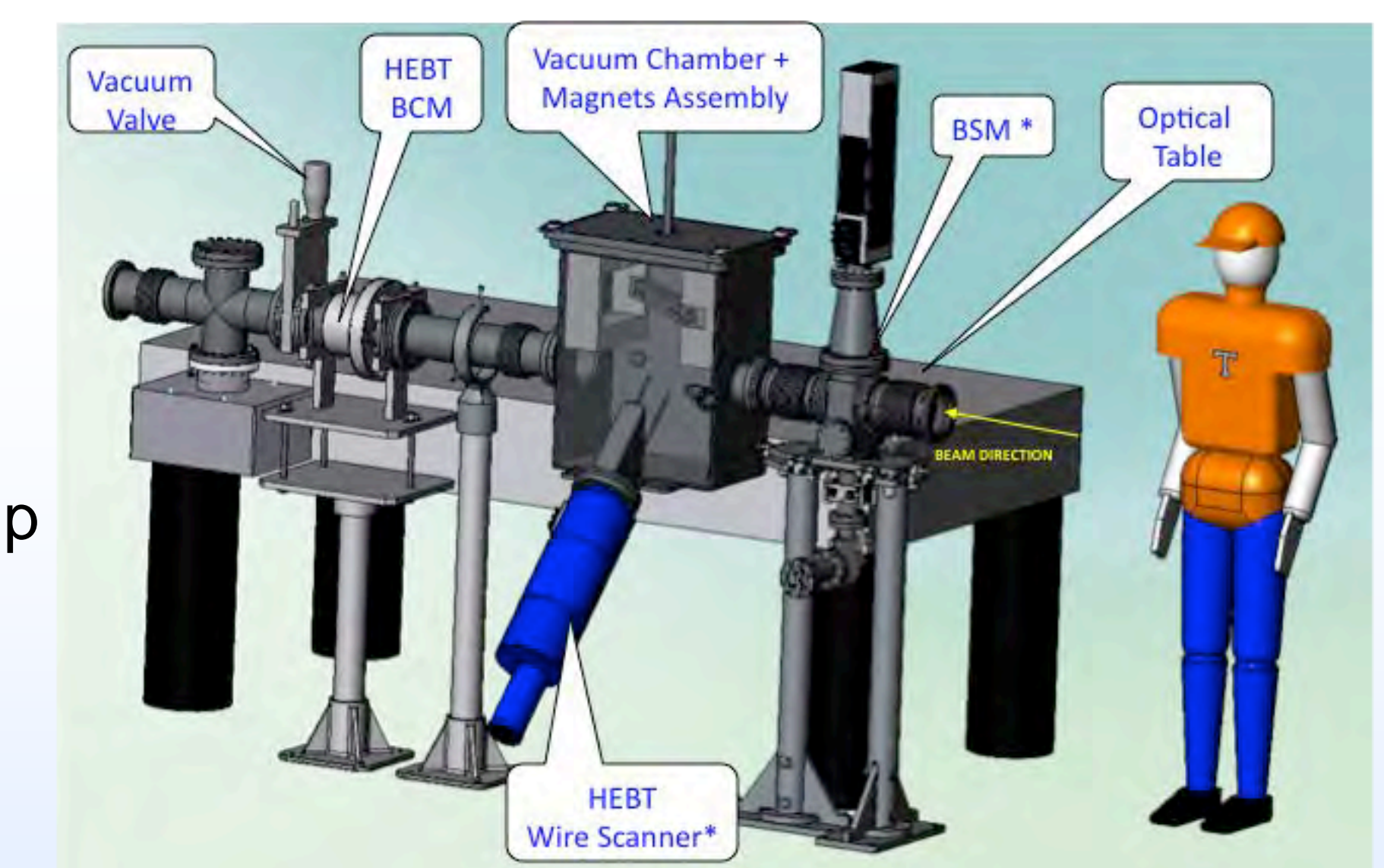


Solution: laser strip injected H⁻, initial 10 ns POP demonstration with the SNS linac is promising



Next proposed step: 1 μs demonstration - relatively simple:

- Uses dispersion control for narrow bandwidth laser to strip H⁻ beam with energy spread



1 μs pulse capable laser exists
5 MW peak power, UV

