



Repurposing Existing Accelerator Facilities for Muon Collider R&D

Austin Hoover

APS Global Physics Summit

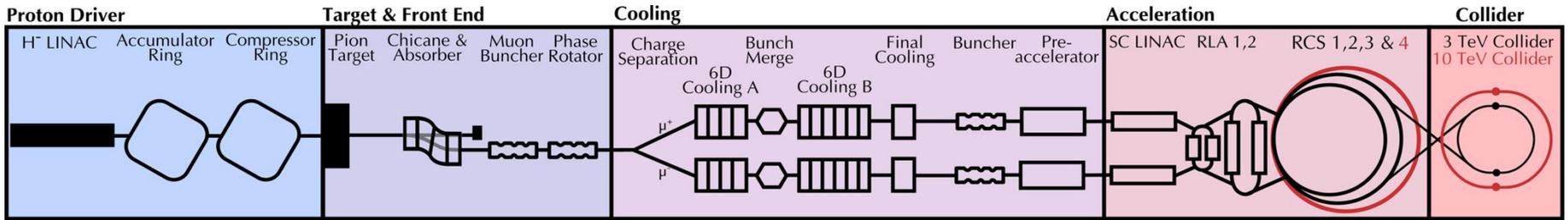
March 17, 2026



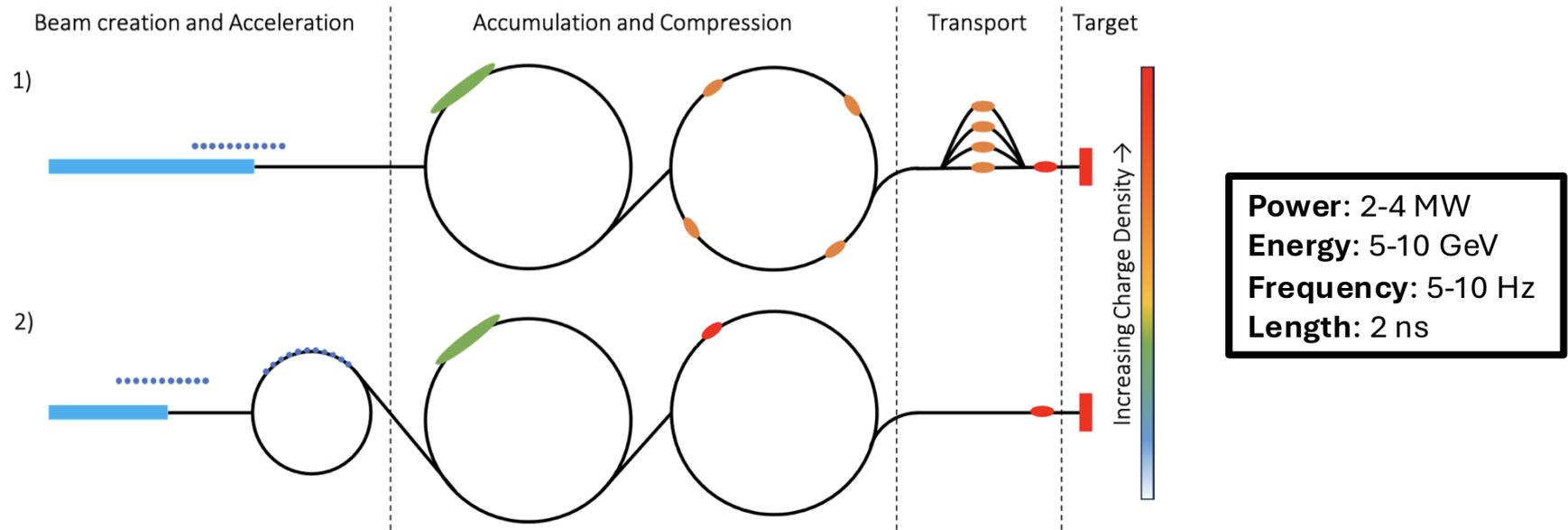
U.S. DEPARTMENT
of **ENERGY**

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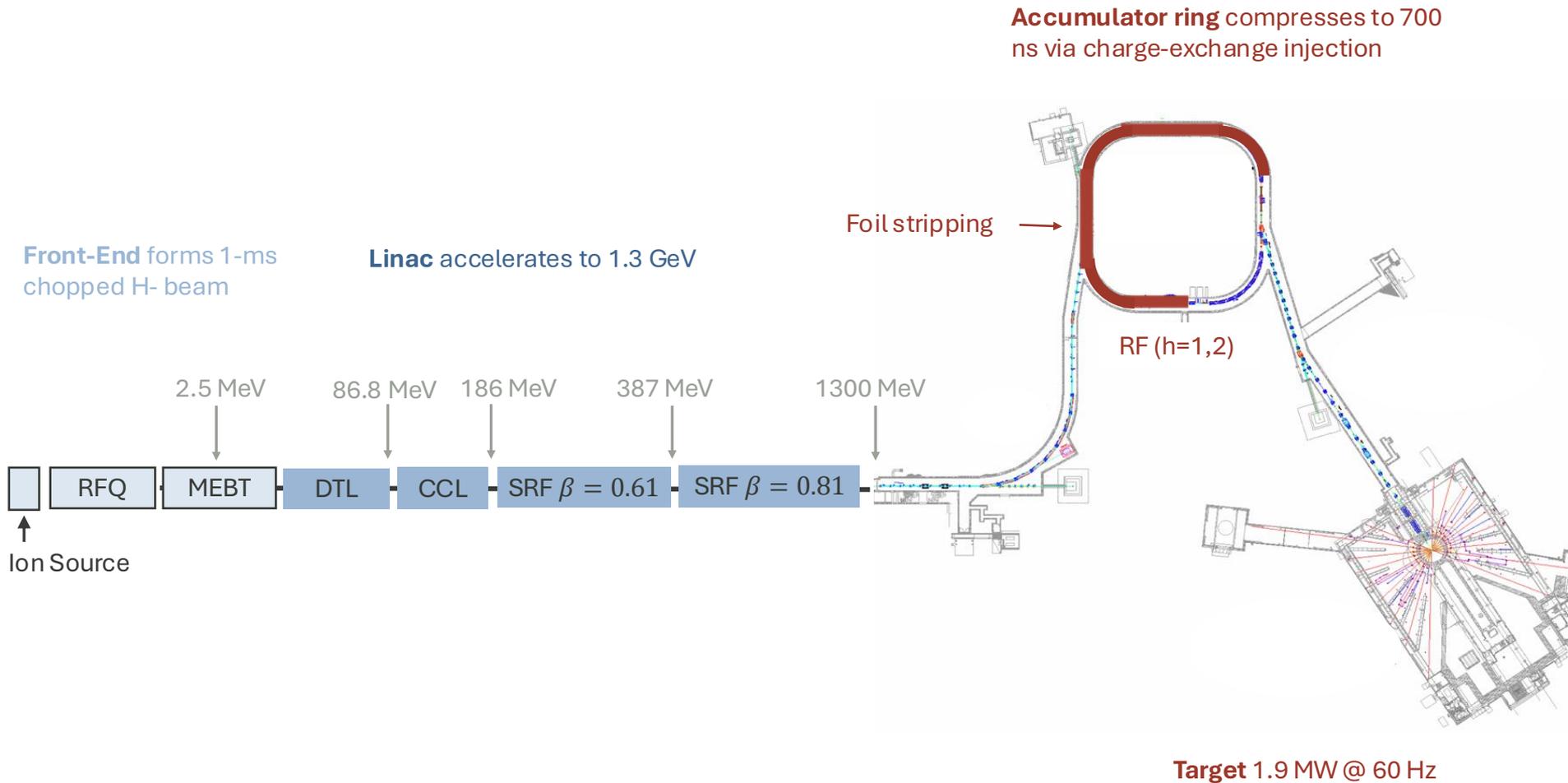




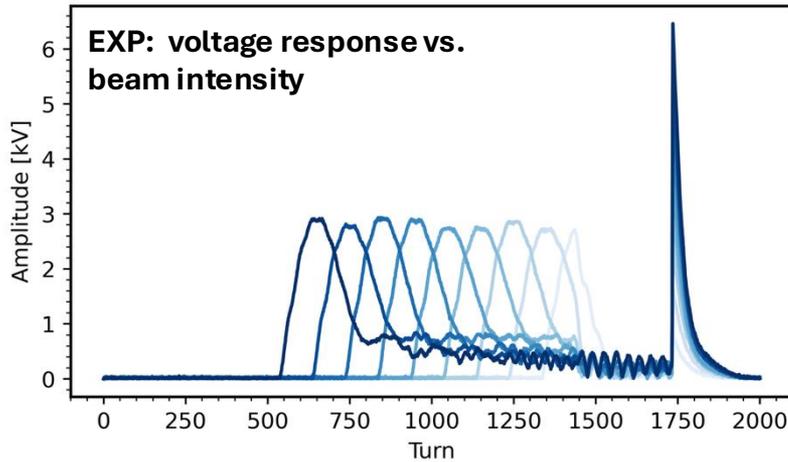
Proton driver needs to accumulate + compress high-power beam



Planned bunch compression experiments at SNS

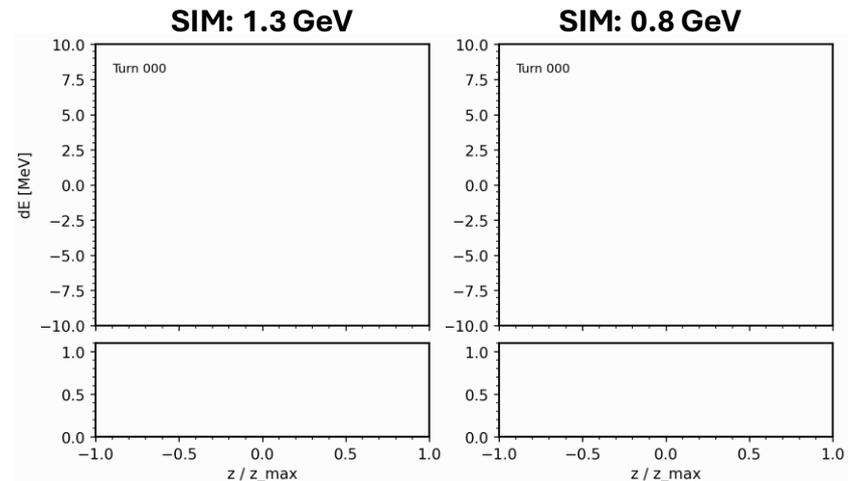


Planned bunch compression experiments at SNS (ORNL)

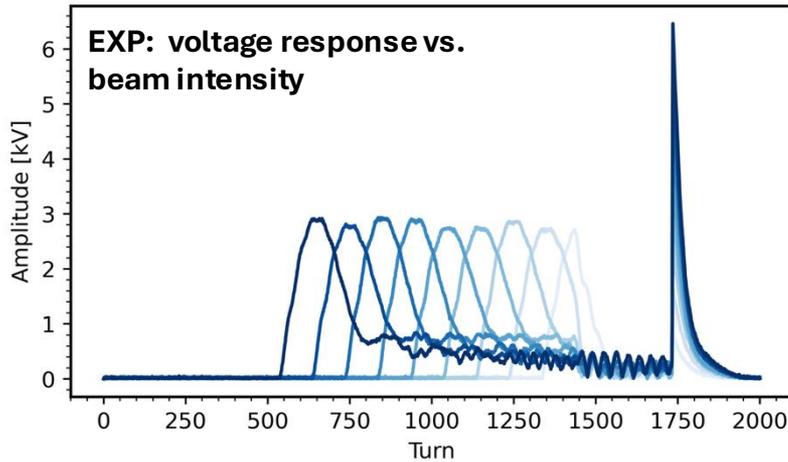


Experiments started to control beam-induced voltage during accumulation.

Potential to amplify space charge forces and compression speed by lowering ring energy.

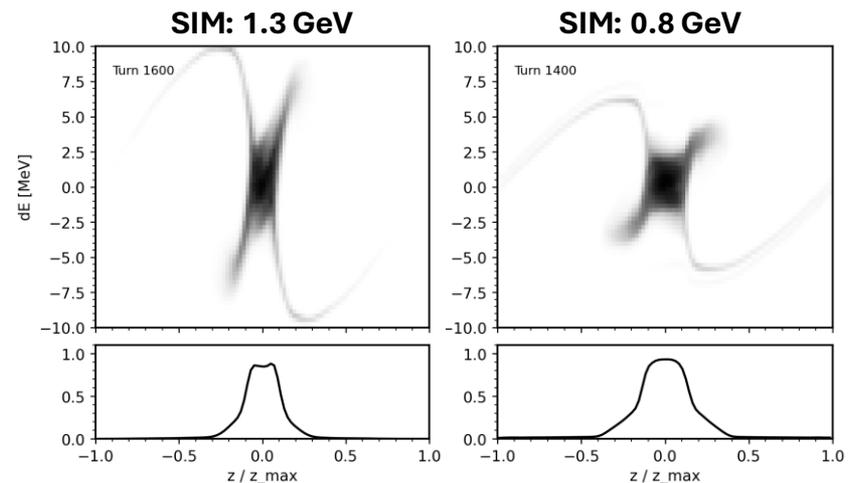


Planned bunch compression experiments at SNS (ORNL)

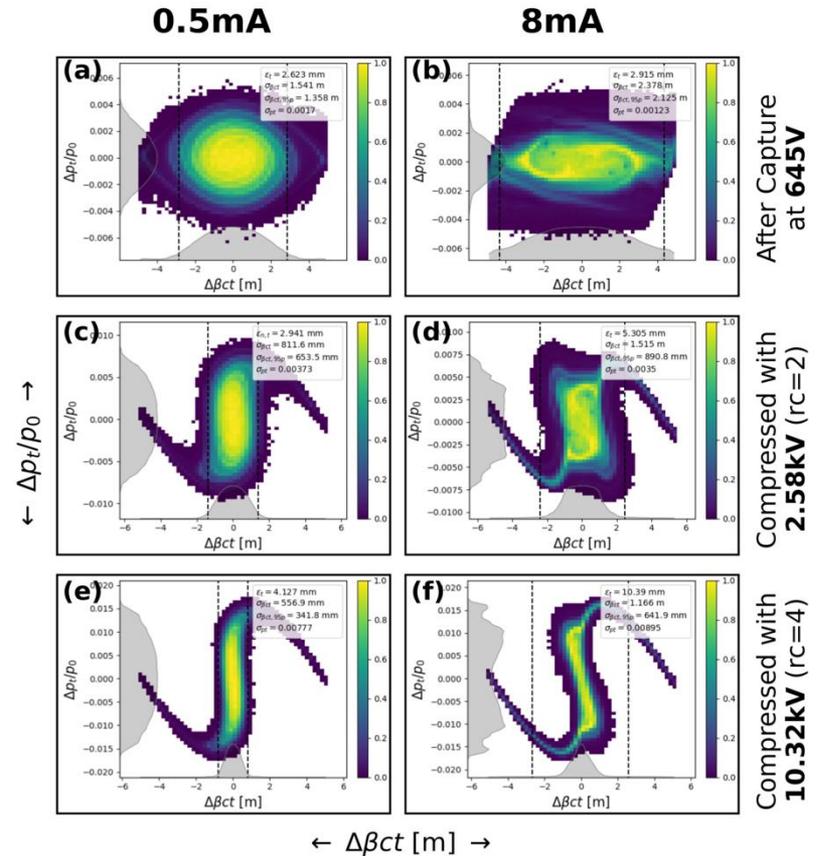
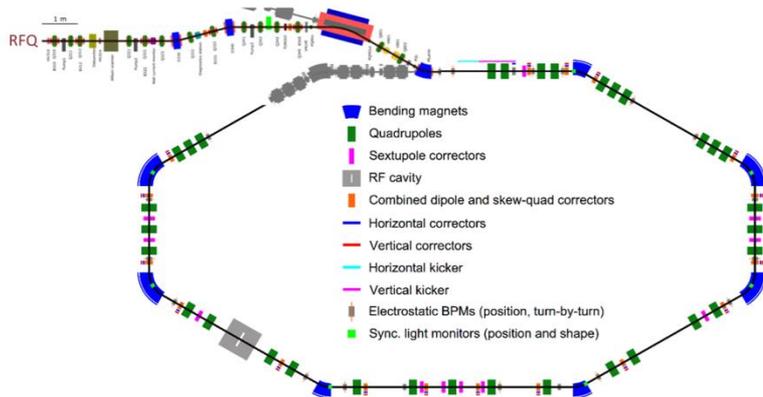


Experiments started to control beam-induced voltage during accumulation.

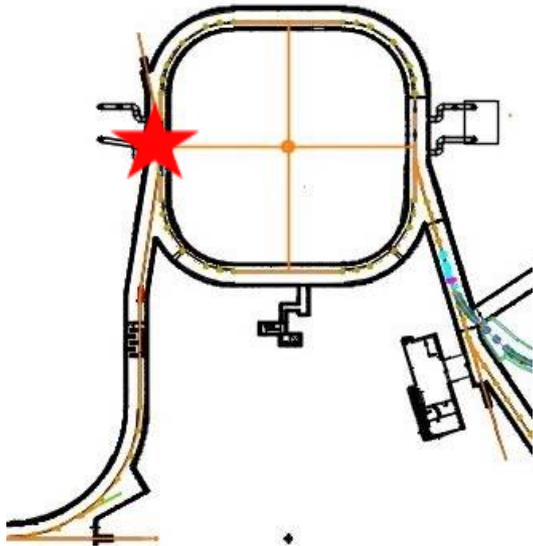
Potential to amplify space charge forces and compression speed by lowering ring energy.



Planned bunch compression experiments at IOTA (FNAL)

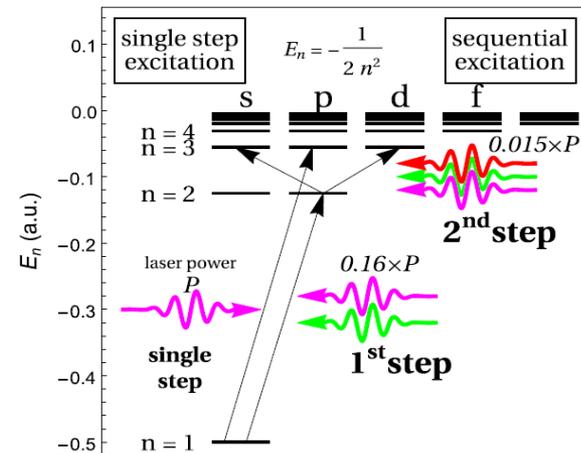
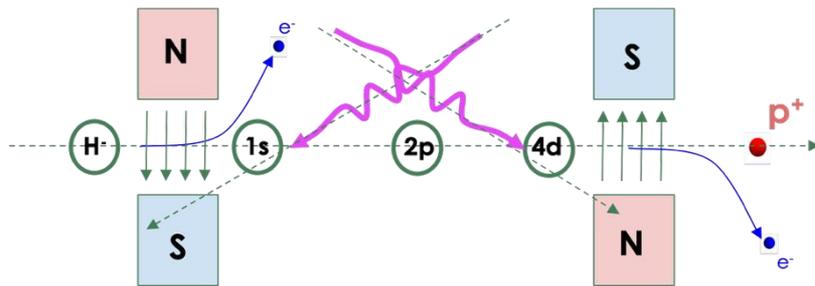
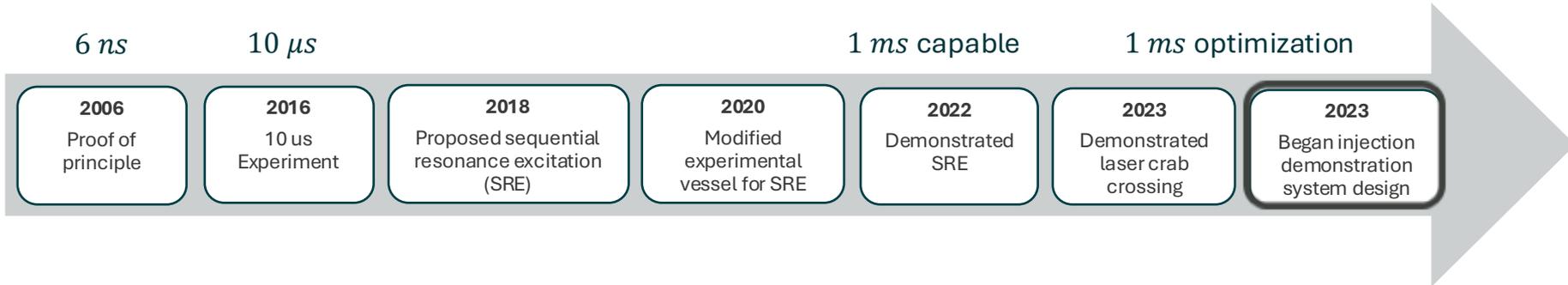


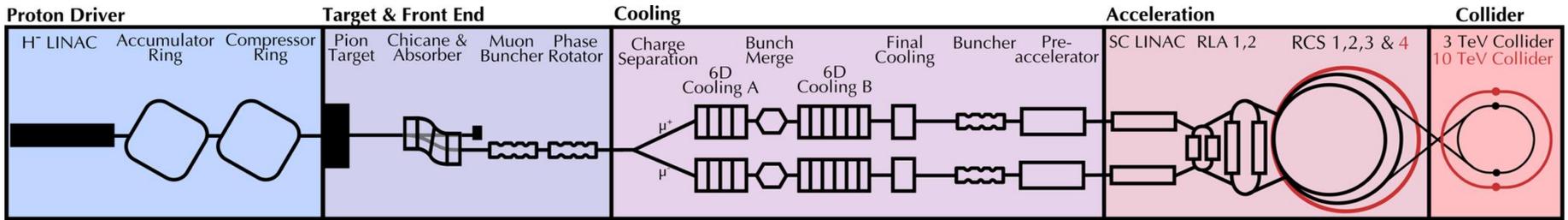
Carbon foils will not work forever...



After 1.2 MW run
(2500 MW·Hr)

Laser-Assisted Charge Exchange (LACE): full injection demo in progress at SNS





Muon target R&D at FNAL

R&D Plan

DESIGN

- FEA simulations



PHYSICS

- Evaluate physics performance



First: feasible study of each concept : pro and con



MATERIAL

- Material Sciences
- Radiation Damage
- Thermal shock

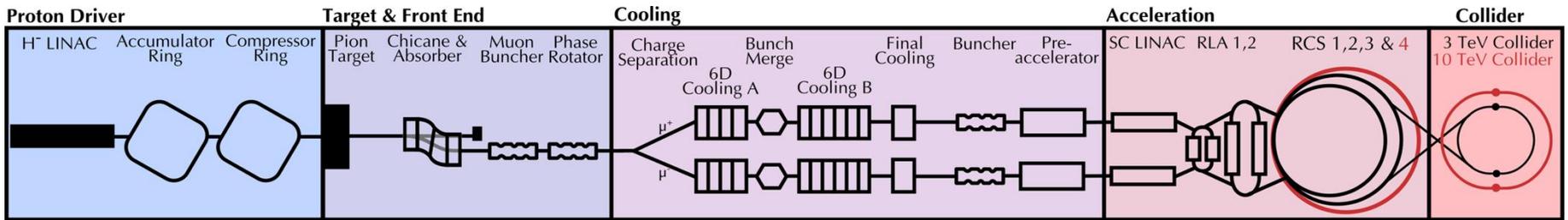


R&D Phase (6-7 years)

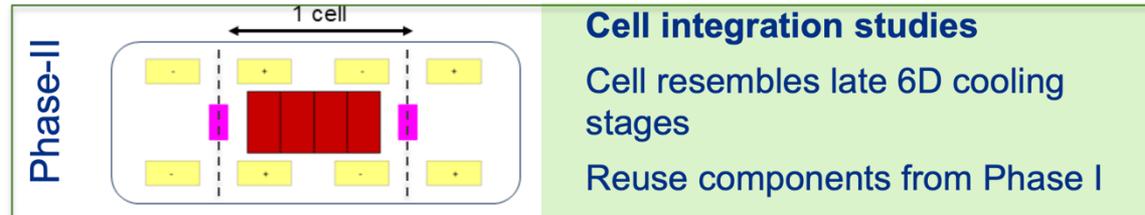
Selected Target Design

Demonstration Phase (~10 years)

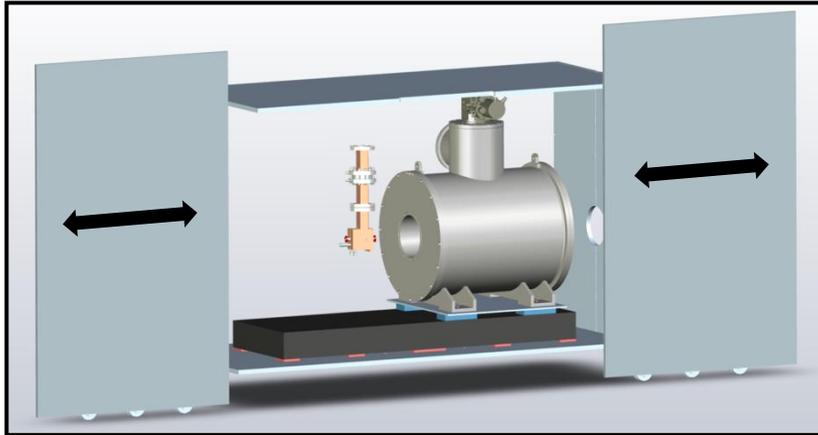
Prototype



Full-scale demonstration of muon cooling will proceed in three phases



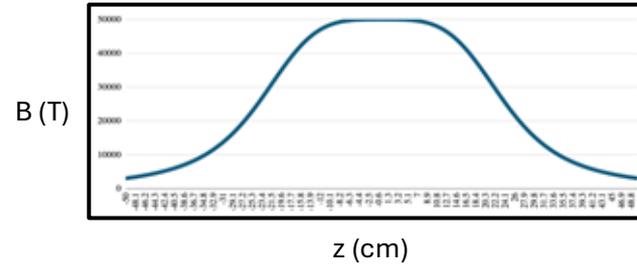
Experiments at SLAC NLCTA will study RF cavities in strong magnetic fields



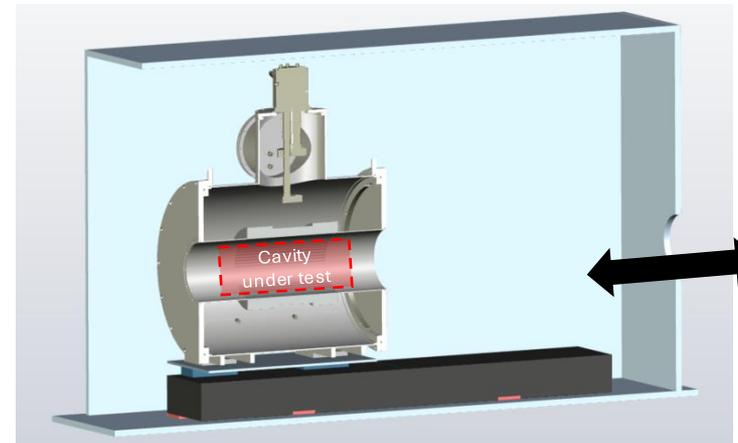
Magnetically shielded enclosure with barn doors.

- Test cavity geometries and materials relevant to muon cooling channel.
- First measurements planned with single-cell S-band cavity in fringe field.
- Benchmark high-gradient results for frequency scaling with measurements at S- and L-band.

Emma Snively (esnively@slac.stanford.edu)



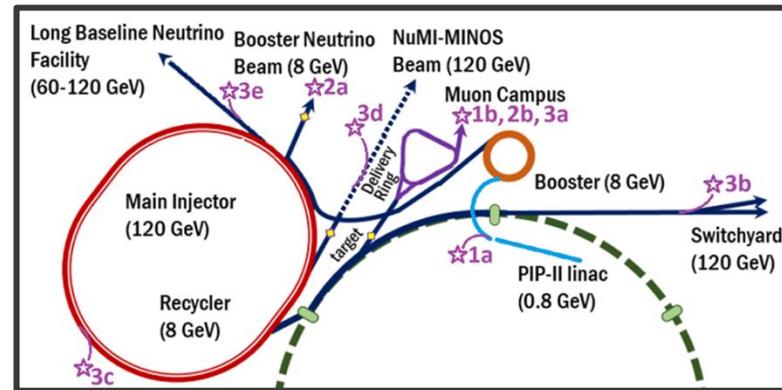
5 T solenoid from Cryomagnetics with $\pm 1\%$ over >10 cm DSV Homogenous Region. 9.5" diameter horizontal bore at room temperature.



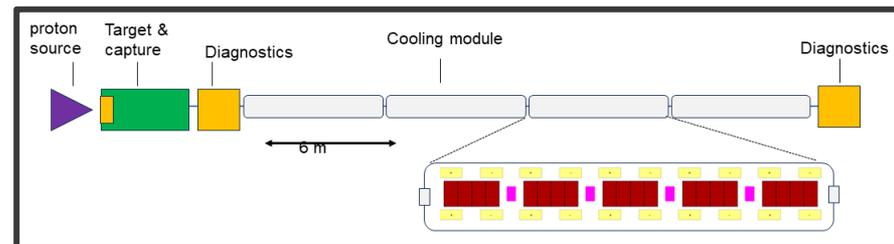
Air casters will allow magnet to move linearly, simplifying cavity installation and variable positioning.

LDRD studying feasibility of muon cooling demonstrator at FNAL (2025-2027)

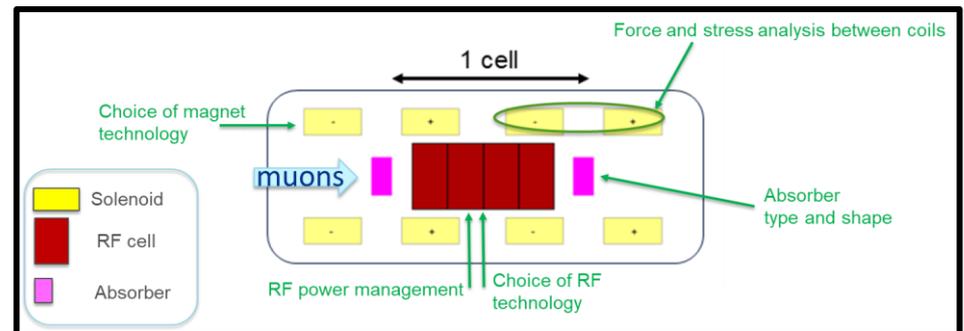
Task 1: FNAL site exploration



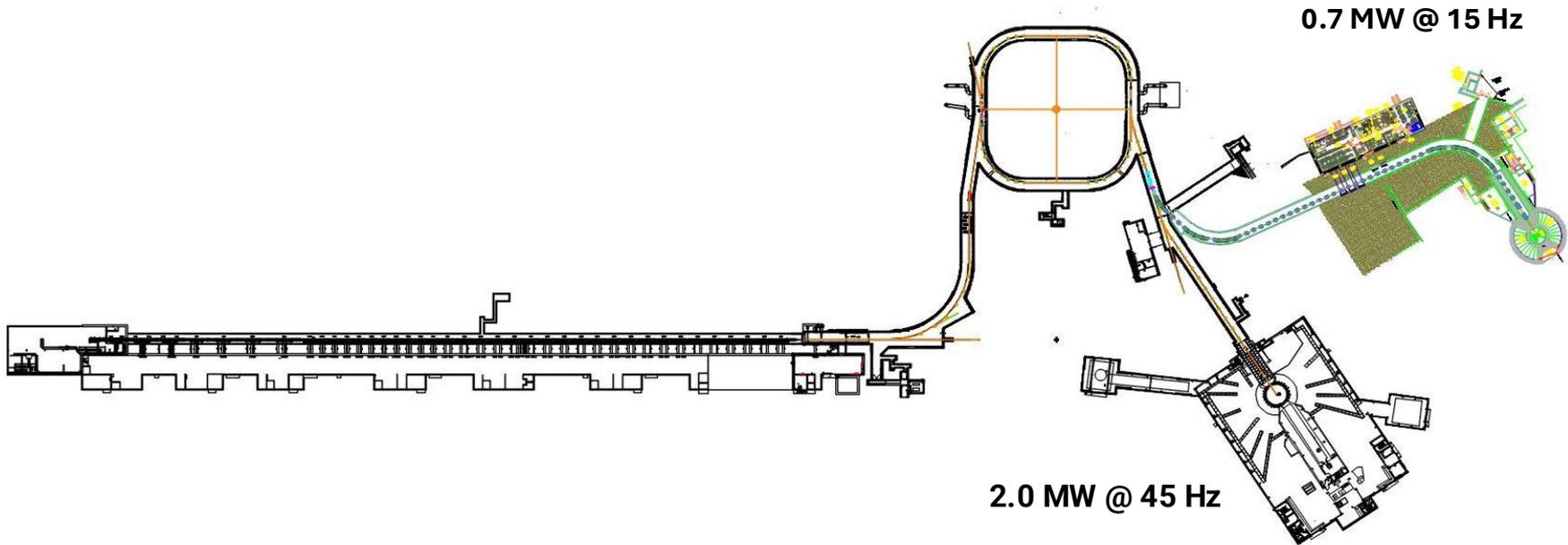
Task 2: Conceptual design



Task 3: Preliminary technical risk evaluation for cooling cells



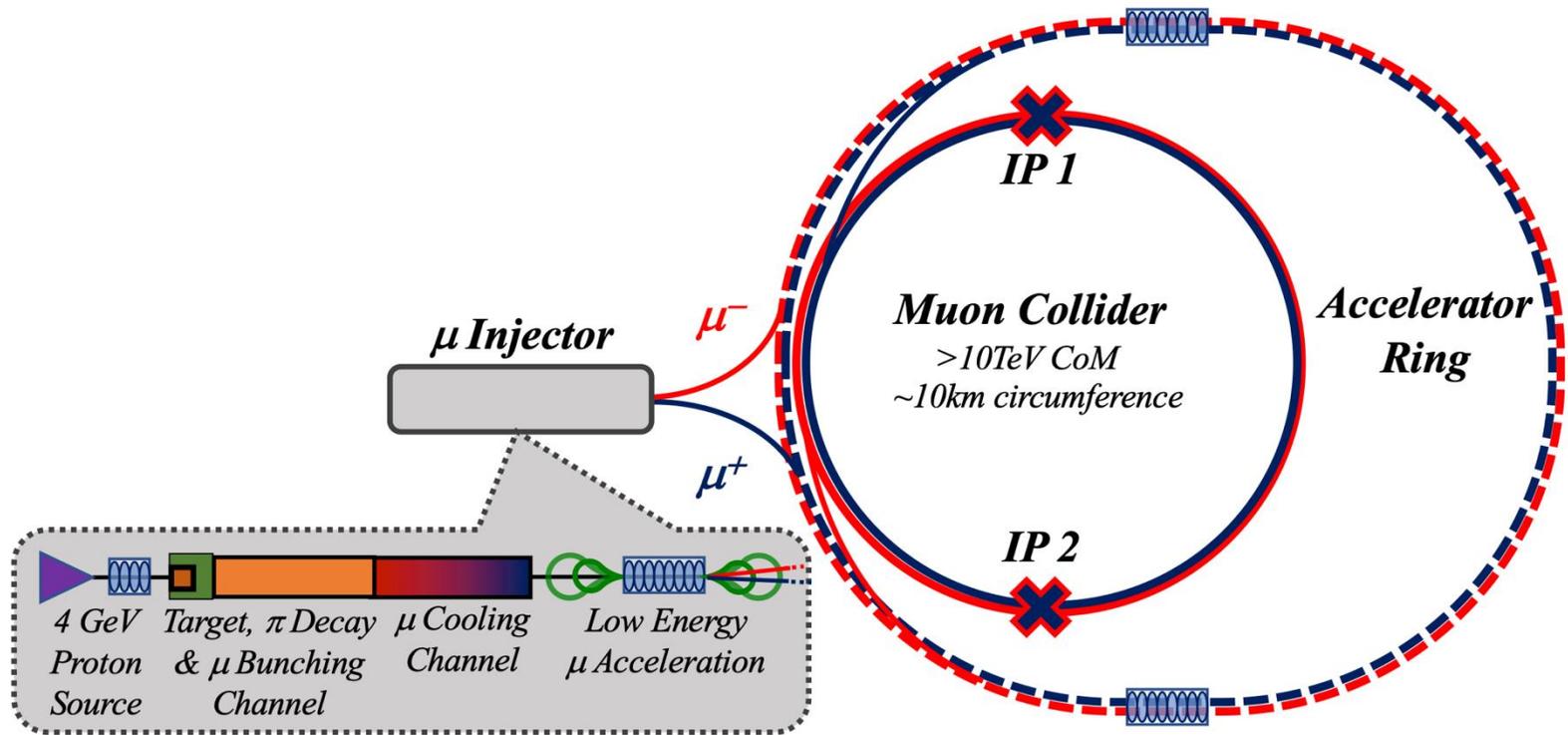
LDRD proposed to explore options for excess beam power at SNS



Era	Beam Power Capability	Beam Power to FTS	Beam Power to STS	Available Beam Power
2026 Capability	2.8 MW	2.0 MW	N/A	800 kW
STS Project Baseline	2.8 MW	2.0 MW	0.7 MW	100 kW
Ultimate Capability	3.0 MW	2.0 MW	0.7 MW	300 kW

Conclusion

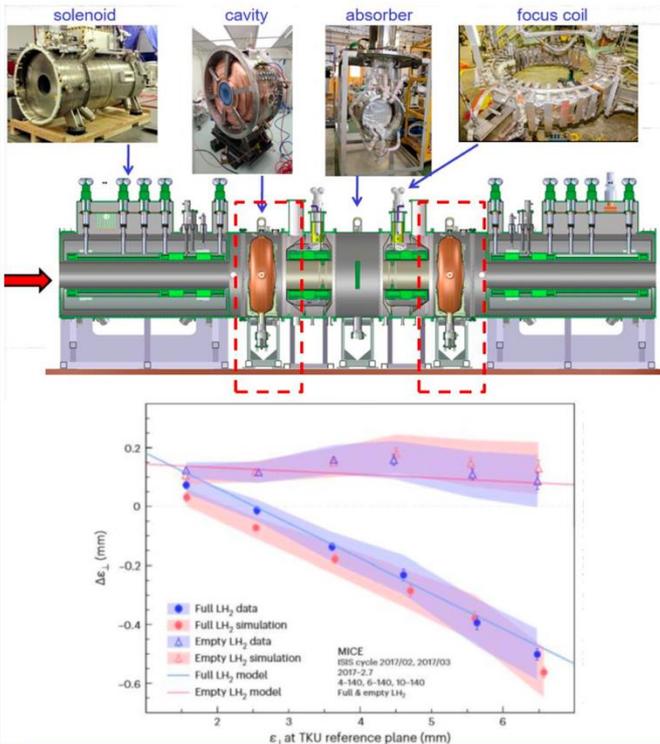
- Several MuC R&D experiments planned in near future in the US.
- Only covered proton driver, target, and muon cooling.
- Thank you:
 - Diktys Stratakis (FNAL) — muon cooling
 - Katsuya Yonehara (FNAL) — target
 - Emma Snively (SLAC) — RF cavities
 - Vasily Morozov (ORNL) — SNS upgrade



Cooling Demonstration – past experience

- Physics of ionization cooling has been demonstrated in two occasions

MICE Experiment



Fermilab Muon g-2 Experiment

