Megawatt Recirculating Superconducting Proton Linac for Neutrinos

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Snowmass AF2 workshop, Dec. 10, 2020

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ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION ATAP

High Power GeV Superconducting Proton Linac: An Important Tool for Science and Society

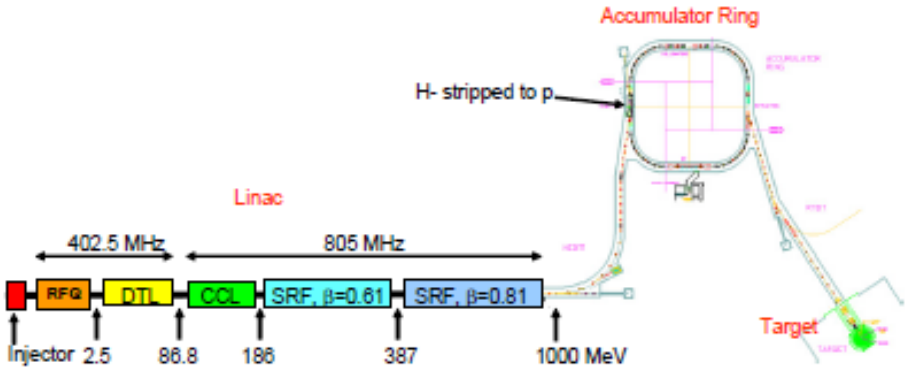


Figure 1: Layout of the SNS accelerator system.

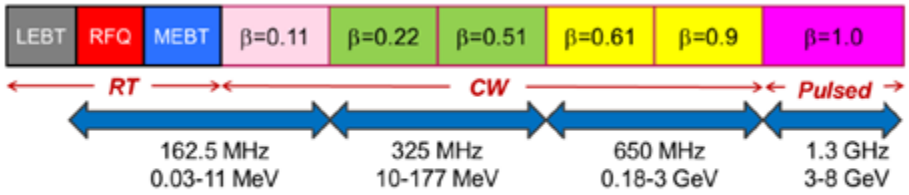
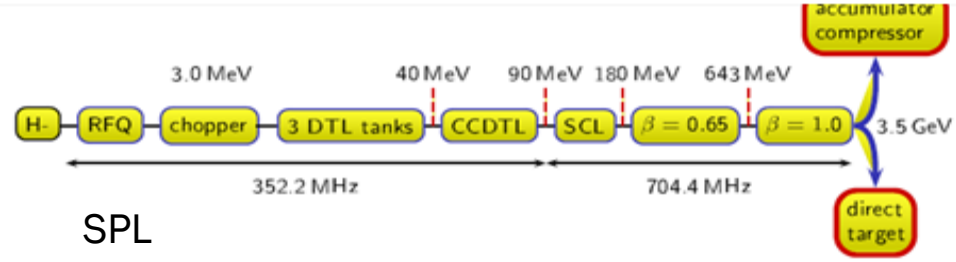


Figure III-1: The Project X Linacs



SPL

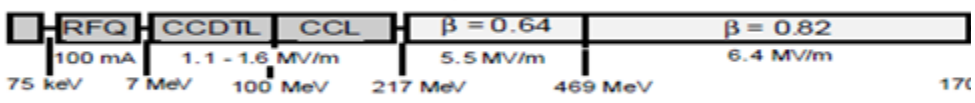


Fig. 2.3: Schematic layout of the linac

Fig. 1. Architecture of APT integrated NC/SC linac.

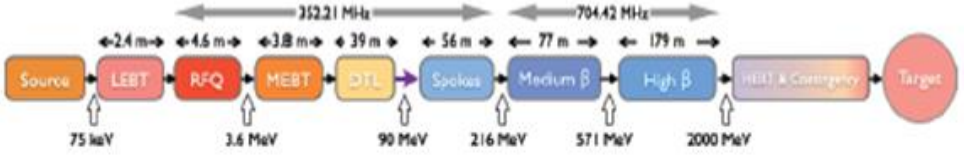


Figure 1: Block layout of the ESS baseline linac 2013, OptimusPlus (not to scale). Warm colored boxes represent the normal conducting components and cold color boxes the superconducting sections.

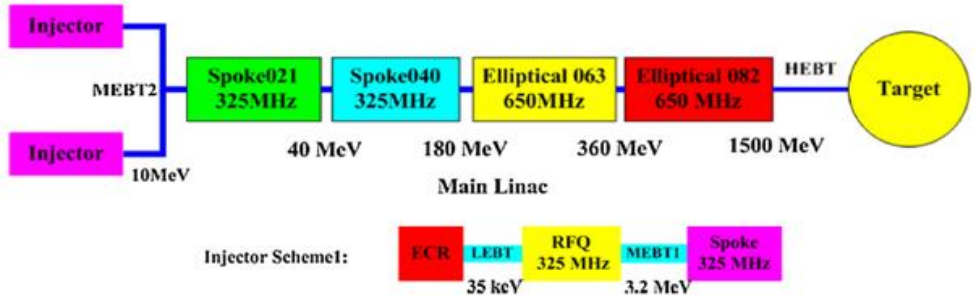


FIG. 3. Layout of the C-ADS driver accelerators.

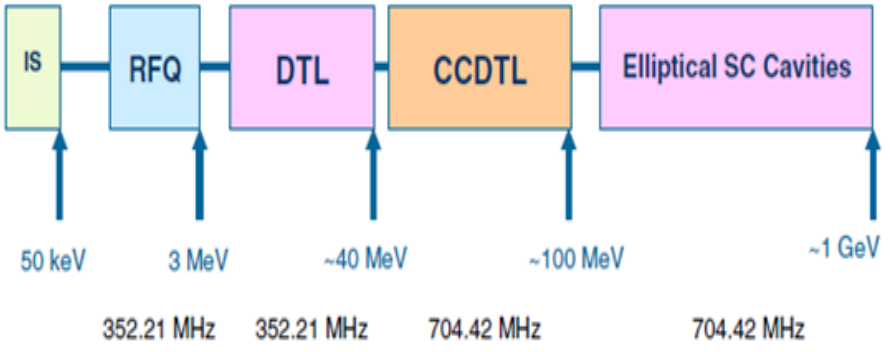
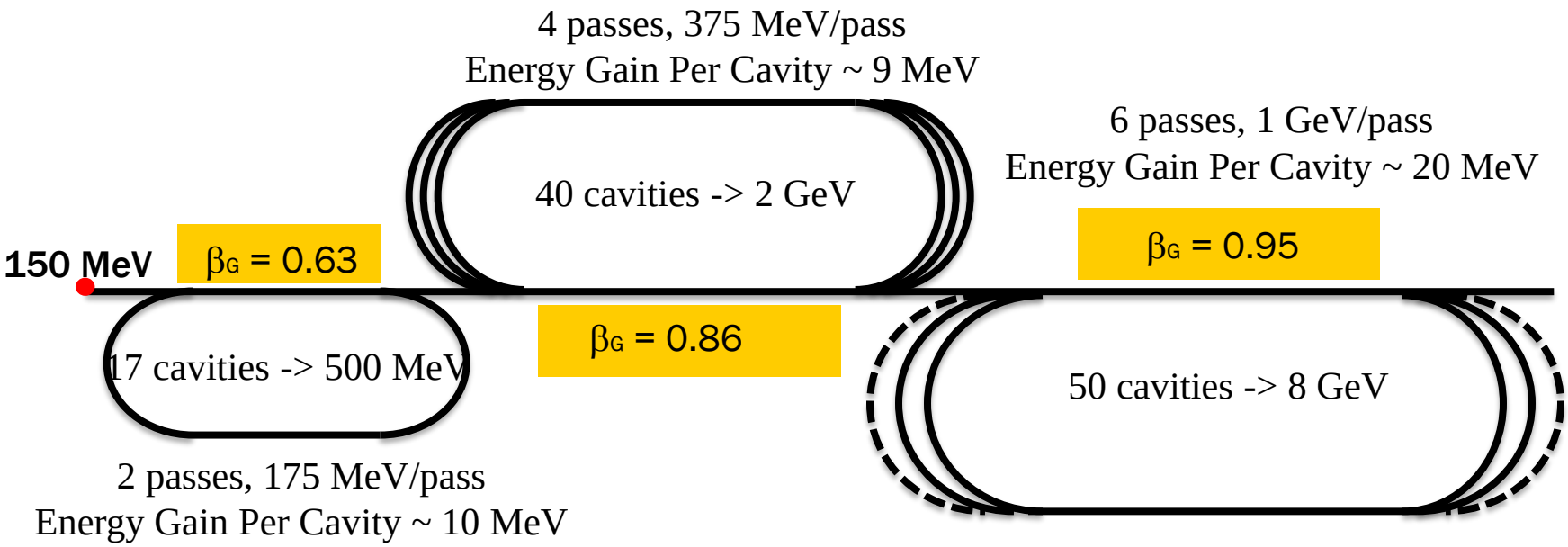


Figure 1. Lay-out of the 1 GeV Linac.

I-ADS

A Multi-Section Multi-GeV Recirculating Proton Linac (~a factor of 5 reduction of superconducting cavities)



- Total number of superconducting cavities: 494 -> 107
- Shorten the distance of straight accelerating section

Fermilab 650 MHz 5 cell superconducting cavity (CW): $E_{acc} \geq 15 MV/m$

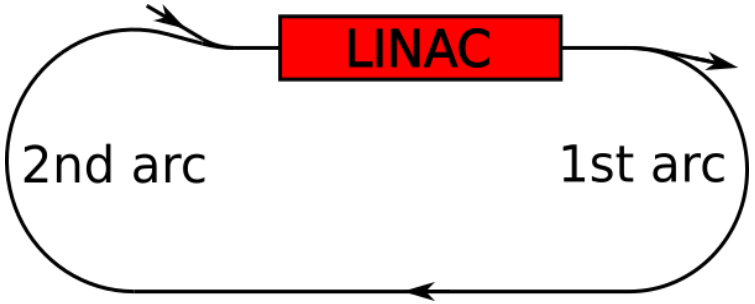
J. Qiang, Nuclear Instruments & Methods in Physics Research A 795, p. 77 (2015).

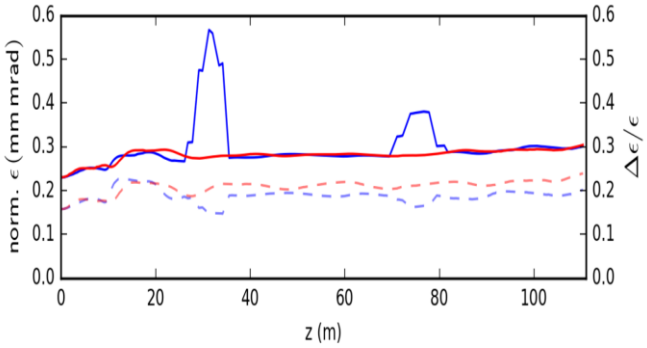
What has been done related to this concept?

- **Proposed the concept:**

J. Qiang, Nuclear Instruments & Methods in Physics Research A 795, p. 77 (2015).

- **Beam dynamics study of a two-pass recirculating proton linac:**

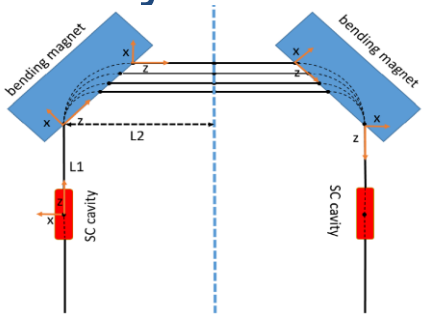


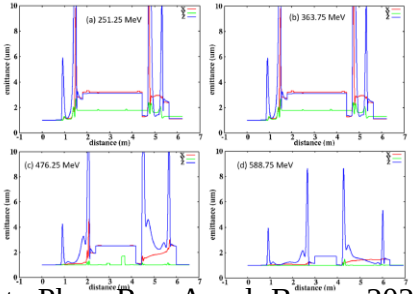


K. Hwang and J. Qiang, Phys. Rev. Accel. Beams 20, 040401 (2017).

Y. Tao, J. Qiang, K. Hwang, linac, Phys. Rev. Accel. Beams 20, 124202 (2017).

- **Beam dynamics study of a multi-pass phase shifter**





J. Qiang, L. Brouwer, R. Teyber, submitted to Phys. Rev. Accel. Beams 2020.

What needs to be done related to this concept?

- Carry out detailed design and optimization of a multi-pass recirculating proton linac including machine nonlinearity, imperfections and space-charge effects

- Develop prototype of the phase shifter superconducting magnets needs to be built to test the achievement of desired magnetic field strength and profile distribution

- Design the proton beam injection and extraction systems

- Build an experimental multi-pass recirculating proton linac to demonstrate the multiple acceleration of proton beam using the same RF cavity while still maintaining good beam quality