

✓ A brief

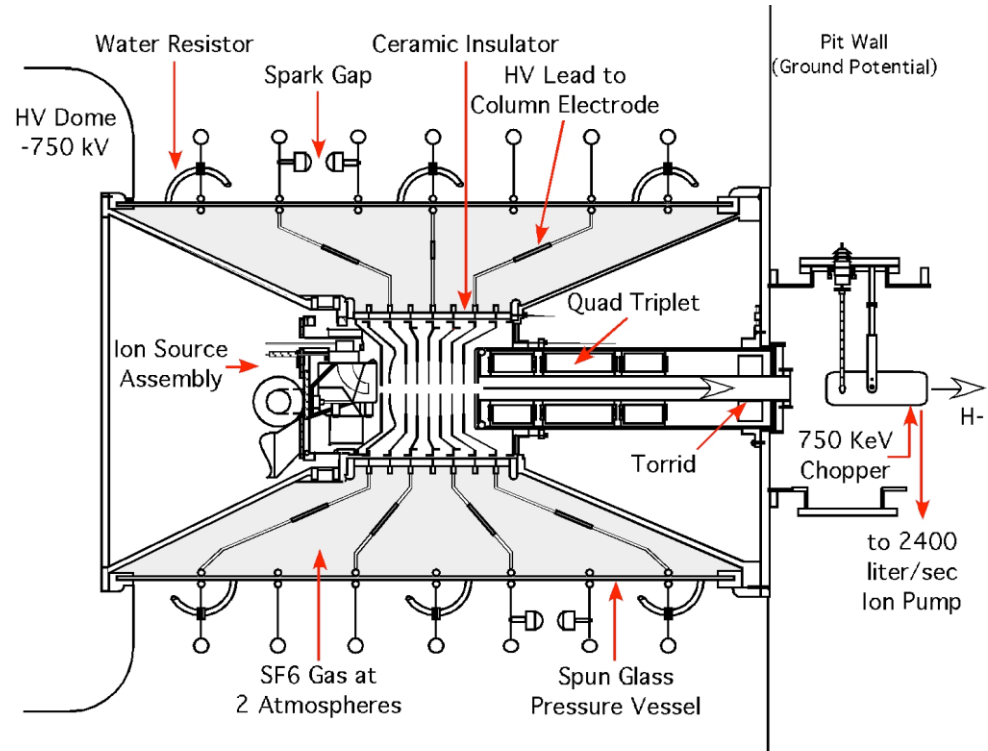
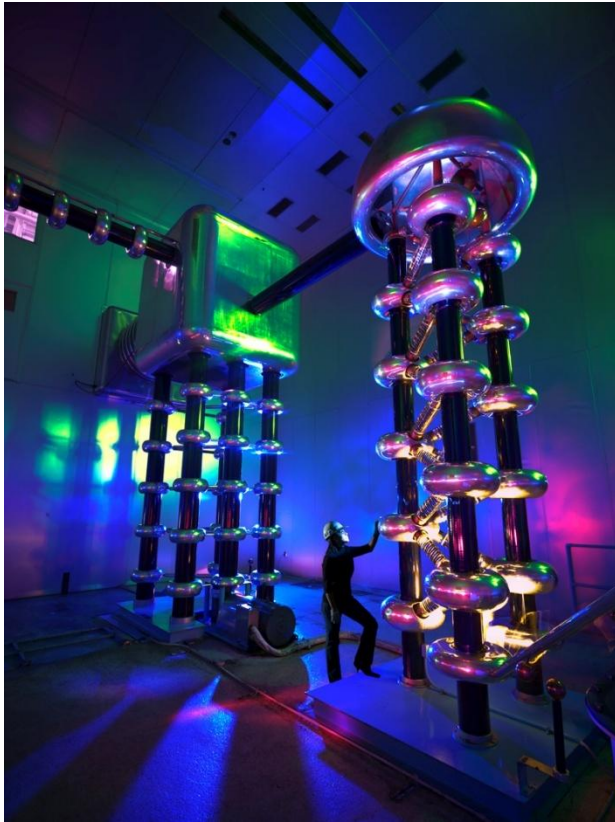
Overview of current and future ion sources at Fermilab

Outline

- Current operational source
- Proposed upgrade to the current source
- High Intensity Neutrino Source (HINS) source development
- Project X requirements ?
- Summary

Current operating source

Two 40yr old Cockcroft-Walton's

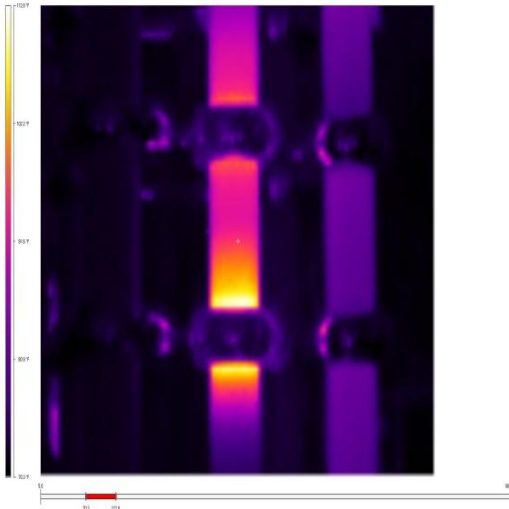


Magnetron source points downward and there is a 90deg bend magnet after the extractor

Operational experience with Cockcroft –Walton accelerators

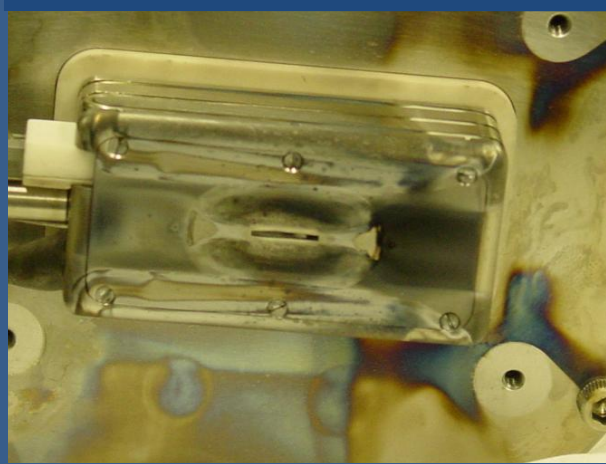
- Lots of mechanical maintenance with the motor generator set
- Accelerating column issues
- Haefely problems
- High Voltage regulation

Fun with Cockcroft and Walton



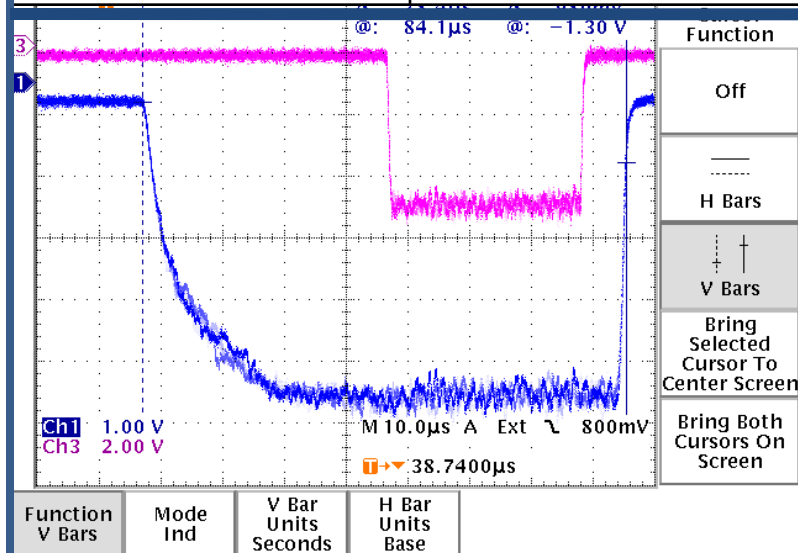
Current H- magnetron design

Current magnetron has a slit aperture

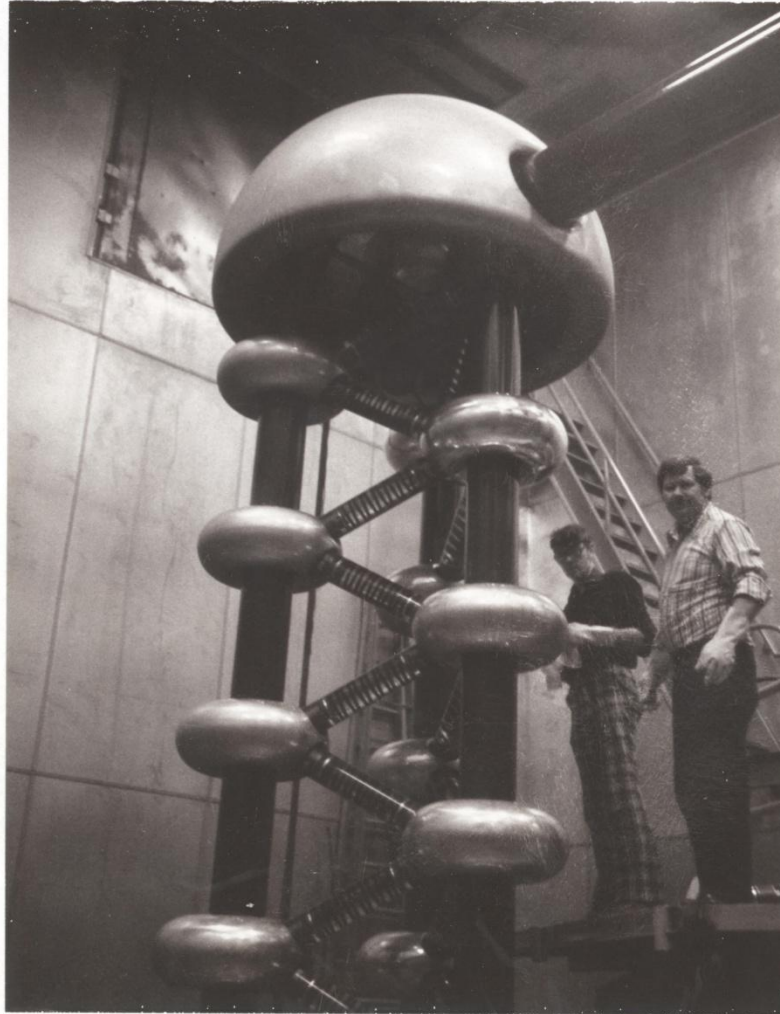


Current operating parameters

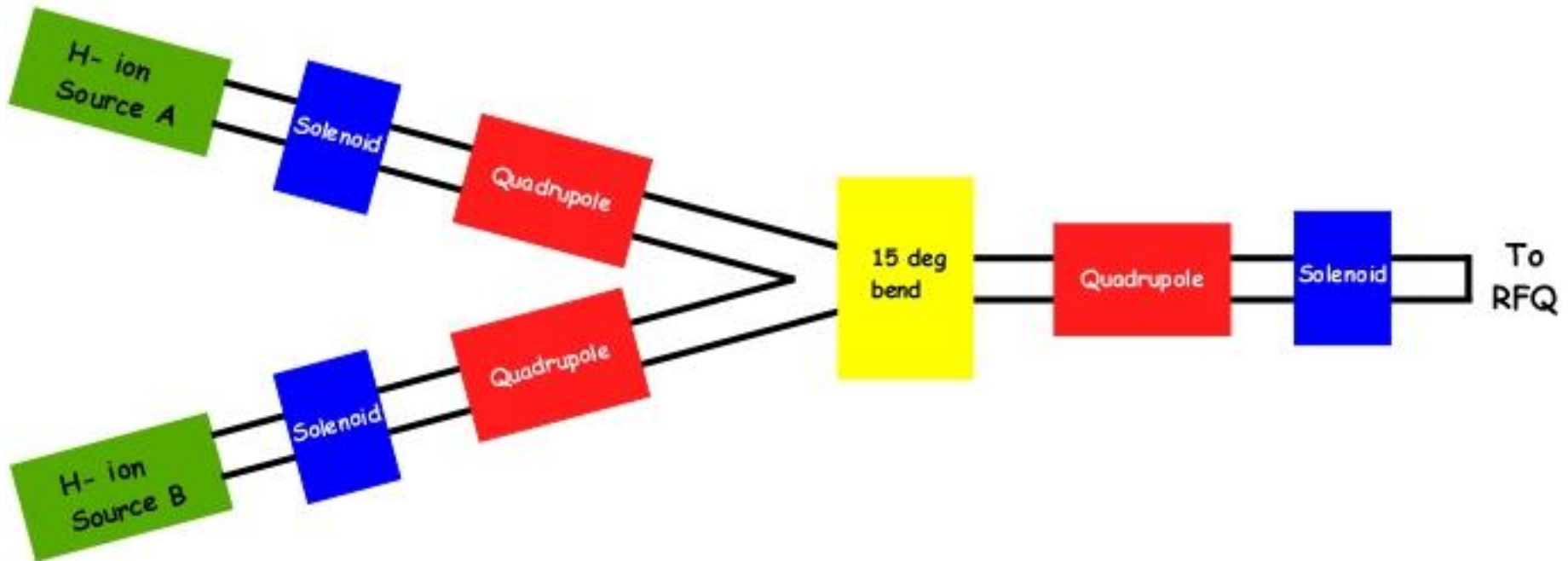
H- current	40-60mA
Extraction Voltage	15-20kV
Arc Voltage	140-160V
Arc Current	45-55A
Rep Rate	15Hz
Pulse width	80 μ s
Duty Factor	0.12%
Cs consumption	0.5mg/hr
Gas Flow	3sccm
Accelerating Voltage	35kV



One of the main reasons for upgrading the Pre-Accelerator



Proposed upgrade of current operating system



Need 2 ion sources:

- 95% + uptime
- Continuous operation for 12+ months
- Current magnetrons only good for 3 months (on average)

H- magnetron for proposed upgrade of current operating system

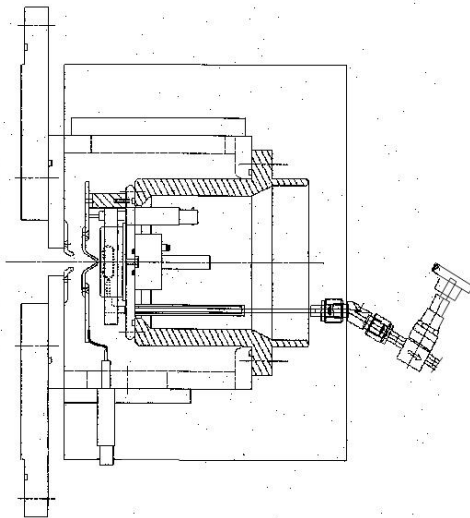


Based on Brookhaven design:

- round aperture
- dimpled cathode
- vacuum chamber: cube with lots of pumping

Operationally:

- lower arc current
- higher extractor voltage
- better vacuum pumping at the source
- longer lifetime (hopefully)



H- current	40-60mA
Extraction Voltage	35kV
Arc Voltage	140-160V
Arc Current	~10A
Rep Rate	15Hz
Pulse width	100ms
Duty Factor	0.12%
Accelerating Voltage	35kV

High Intensity Neutrino Source (HINS)

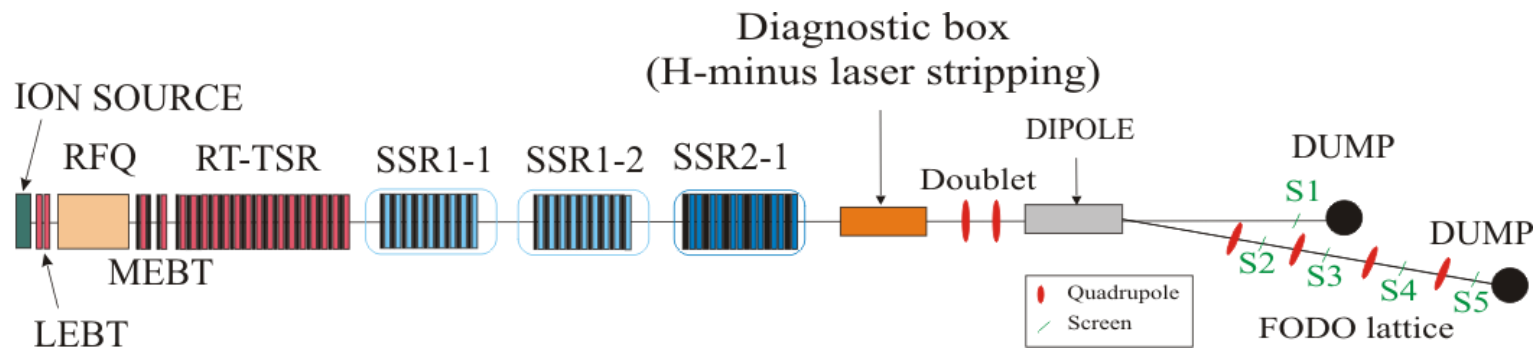
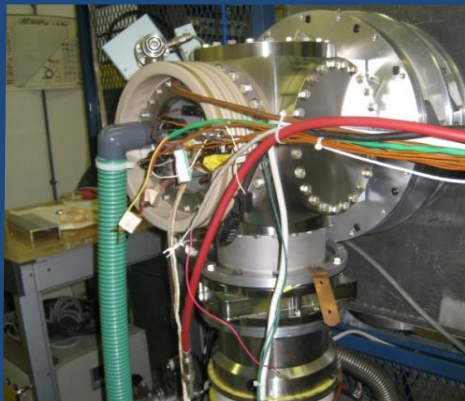
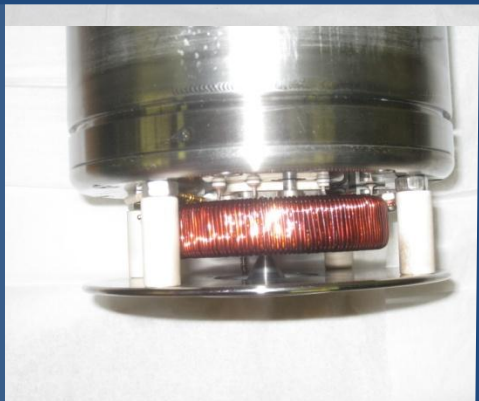
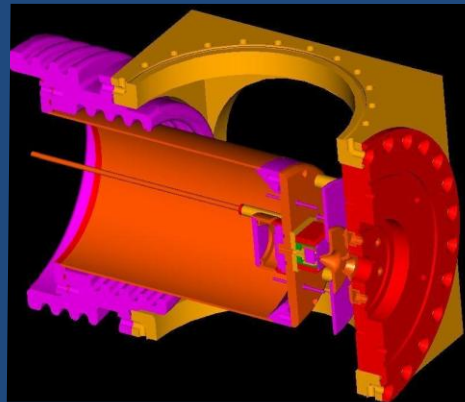


Figure from Jean-Paul Carneiro

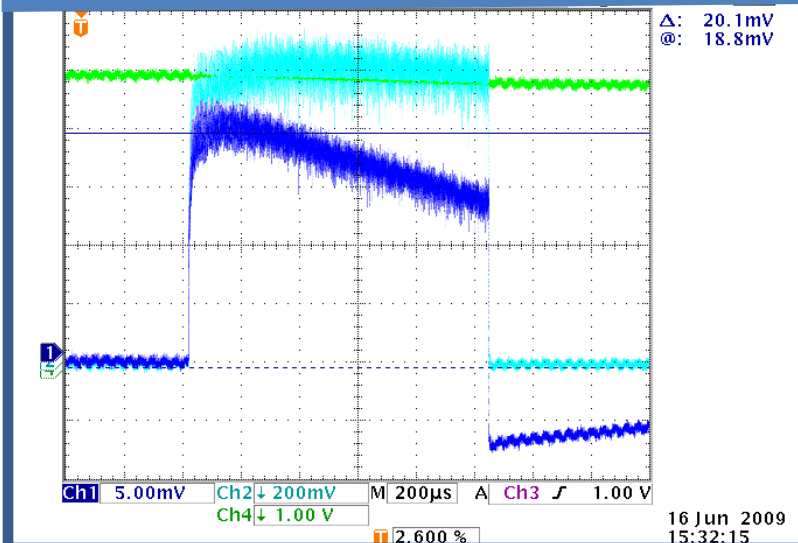
HINS H- direct magnetron

Round aperture direct H- magnetron.
Cube is designed for the possibility of 3 turbo pumps for additional pumping



Design operating parameters

H- current	20mA
Extraction Voltage	15-20kV
Arc Voltage	140-160V
Arc Current	10-15A
Rep Rate	10Hz
Pulse width	1.0ms
Duty Factor	0.12%
Cs consumption	0.5mg/hr
Gas Flow	3sccm
Accelerating Voltage	50kV



HINS source requirements

Options being considered

	Beam current	Pulse width	Rep Rate
Current design	20mA	1ms	2.5Hz
Option 1	35mA	1.25ms	5Hz
Option 2	3mA	5ms	10Hz
Option 3	45mA	1ms	10Hz
Option 4	17mA	3ms	2.5Hz

Project X

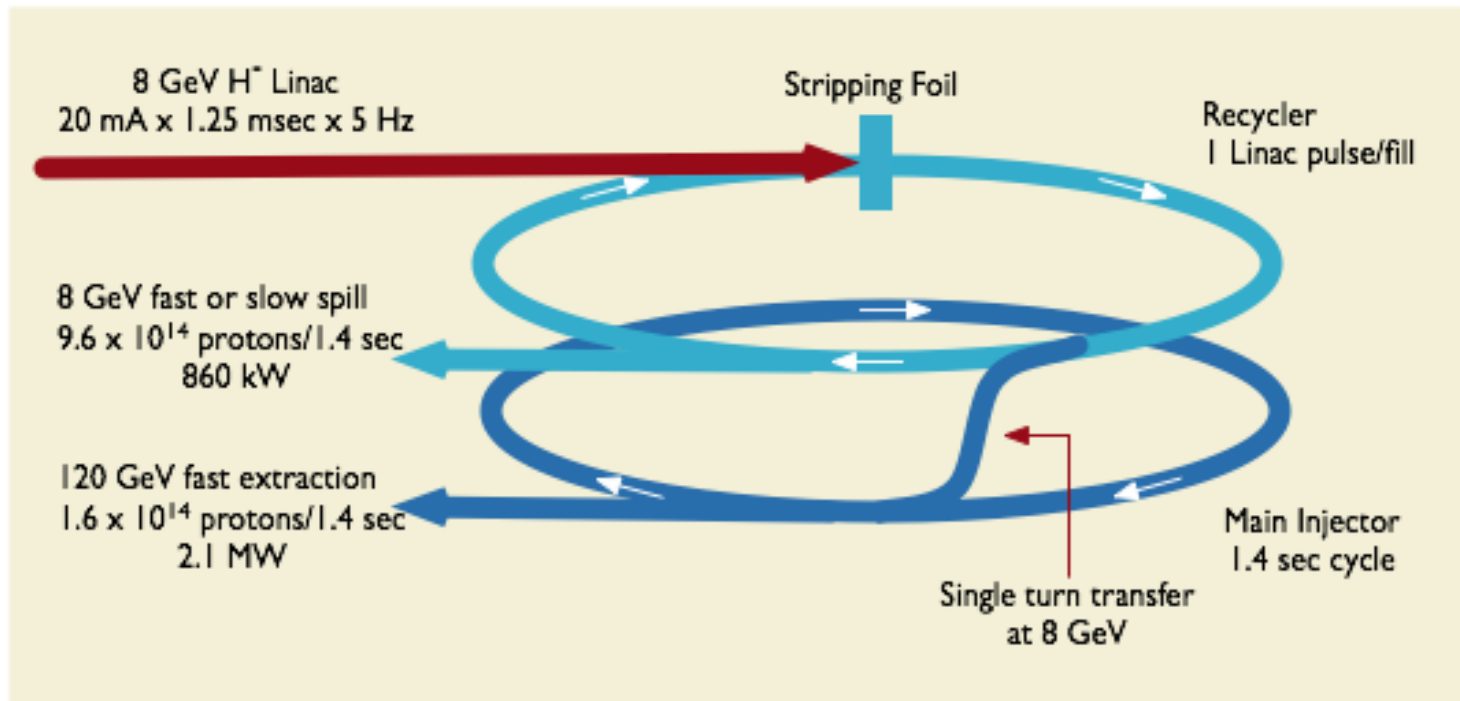


Figure from Project X RD&D Plan v 2.2 9 March 2009

Project X

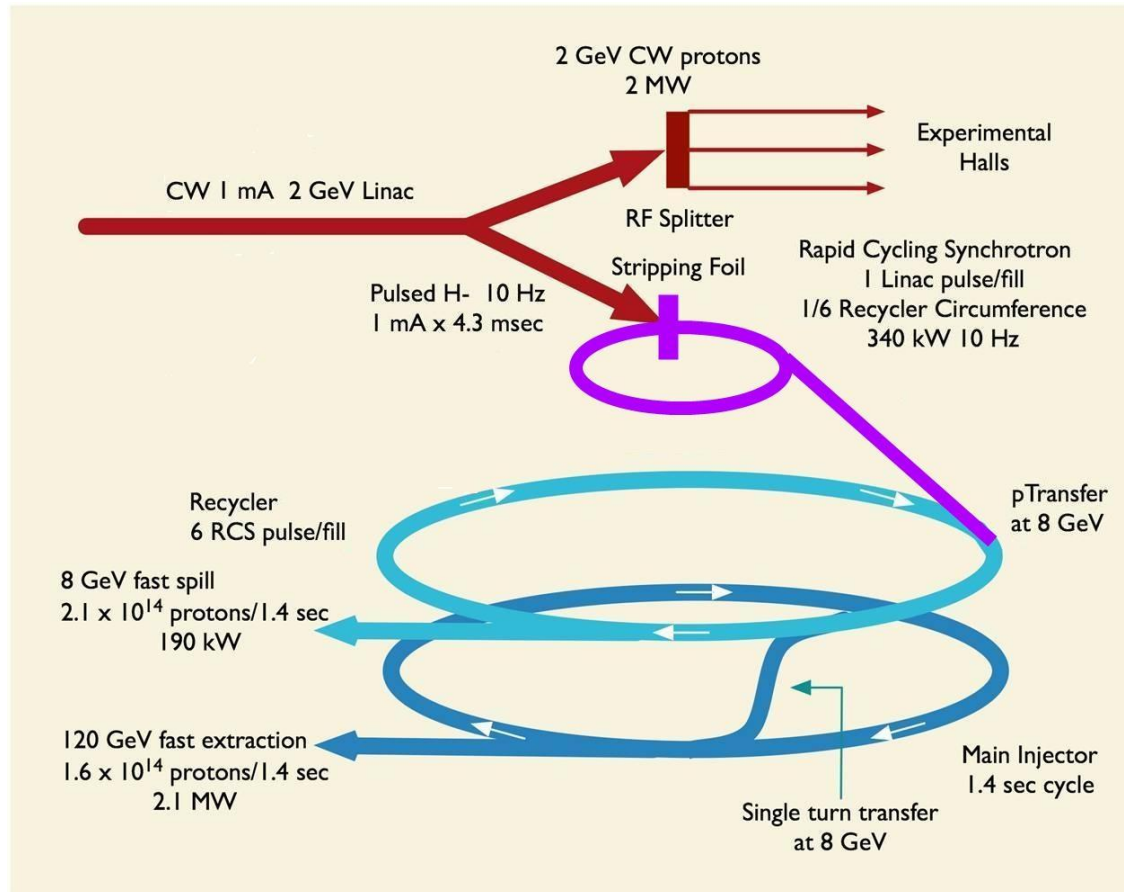


Figure from Sergia Nagaitsev Project X ICD2 Briefing

Project X

Possible DC source

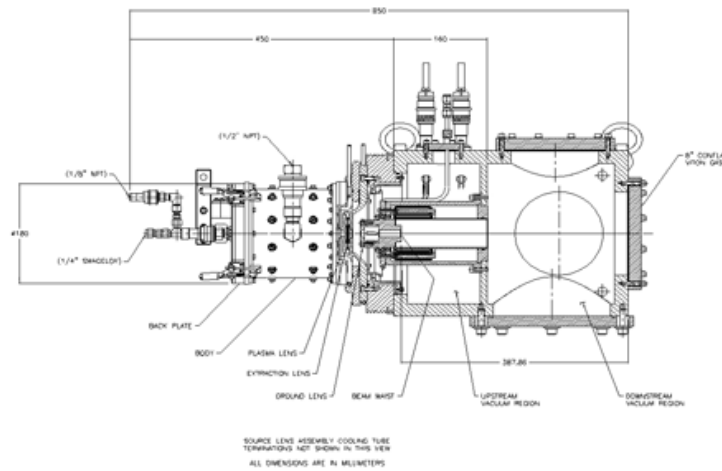
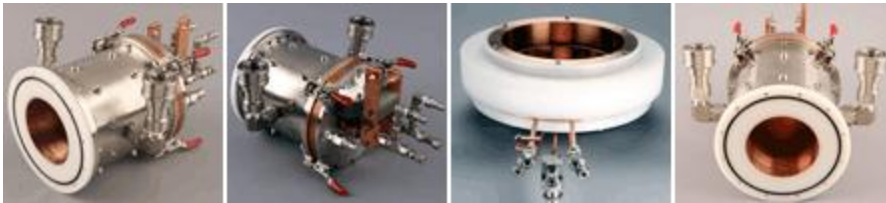


Figure from D-Pace

Parameters	Advertised value
Beam current	10mA
Beam energy	20-30keV
Arc current	22A
Filament lifetime	>350hrs

Summary

Many possible directions that the lab may take in the future:

- Upgrade current operational source from Cockcroft-Walton to ion source & RFQ
- HINS will probably end up being a test bed for H-instrumentation and SRF studies
- Project X continues to be the main focus of the lab and may or may not require a CW ion source
- Too early to tell what type of source will be required for the projects listed above