Development of a ^{19}Ne Source: in Search of Chirality Flipping Interactions

presented by
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   Chirality flipping, Fierz interference, and the Neon-19 β decay spectra

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   The target cell and a method for rapid and continuous Neon extraction

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   Current progress towards Neon-19 production

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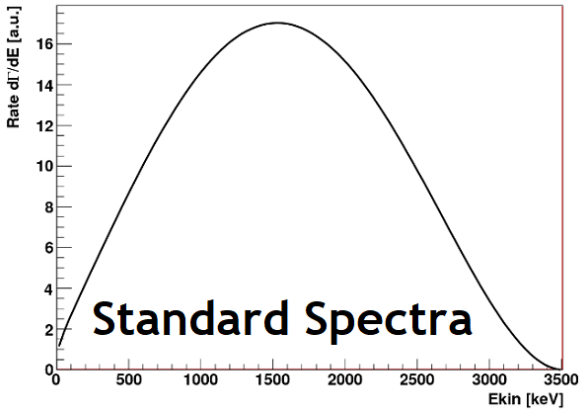
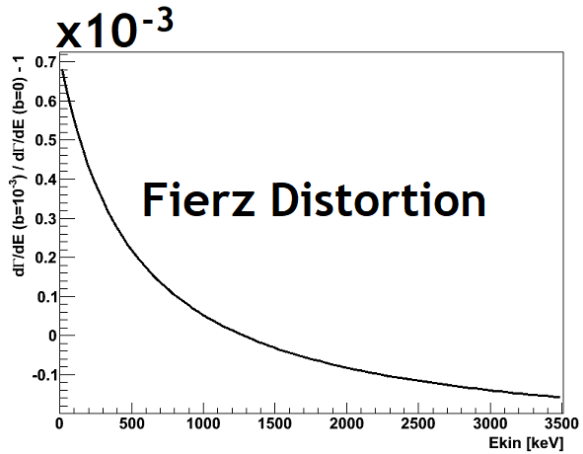
Motivation

Why Produce Neon-19?

Check for chirality flipping!

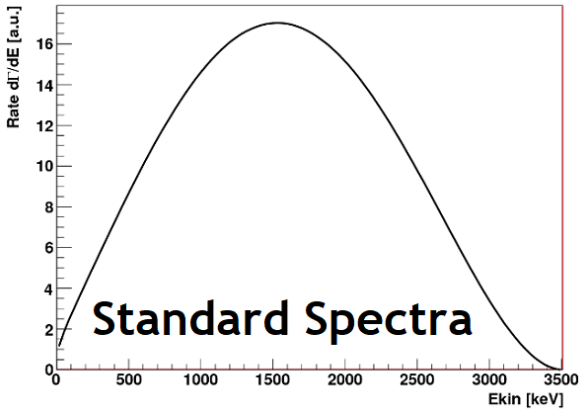


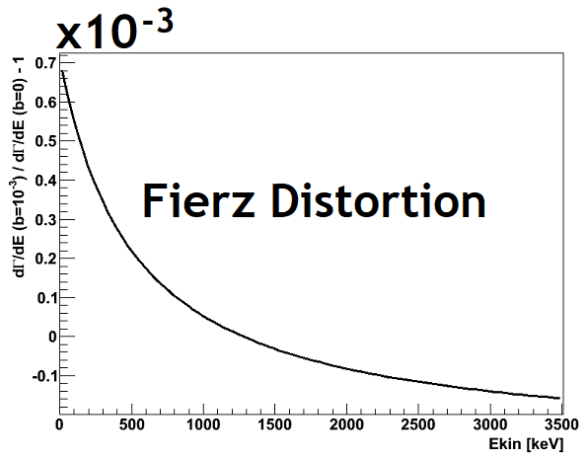


Why Produce Neon-19?

Check for chirality flipping!

- Precision test of the Standard Model





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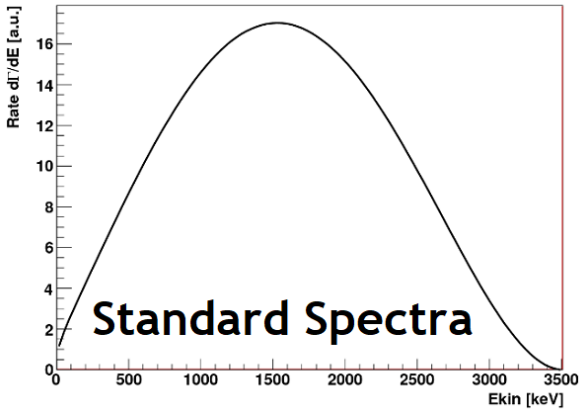
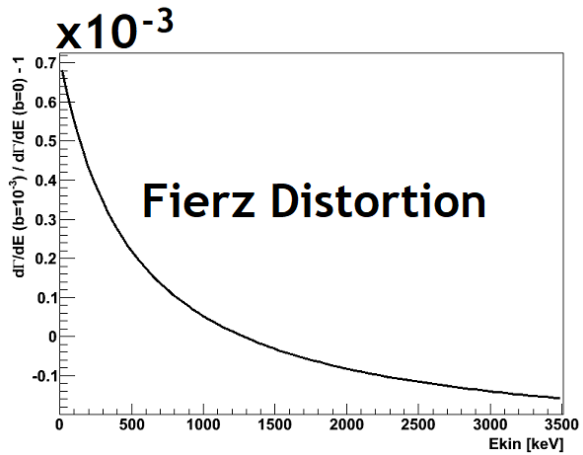
- Chirality flipping interactions appear as Fierz interference in β decay energy spectra





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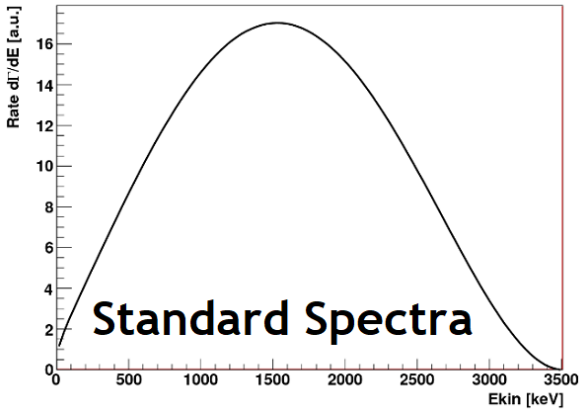
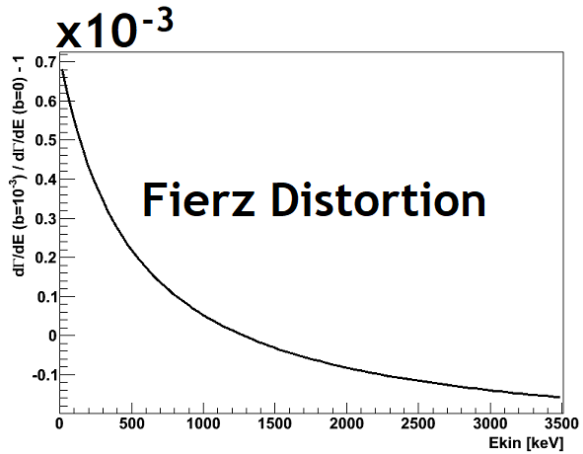
Tricky to measure





Why Produce Neon-19?

Check for chirality flipping!

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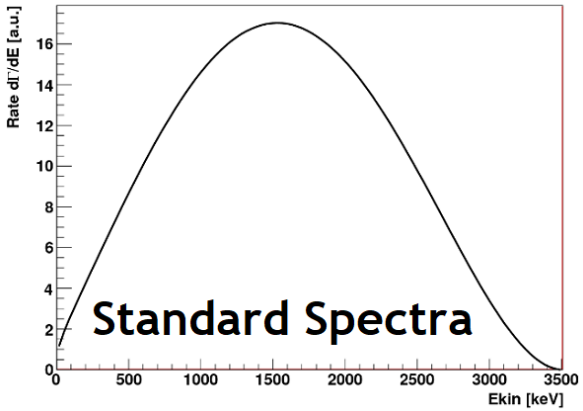
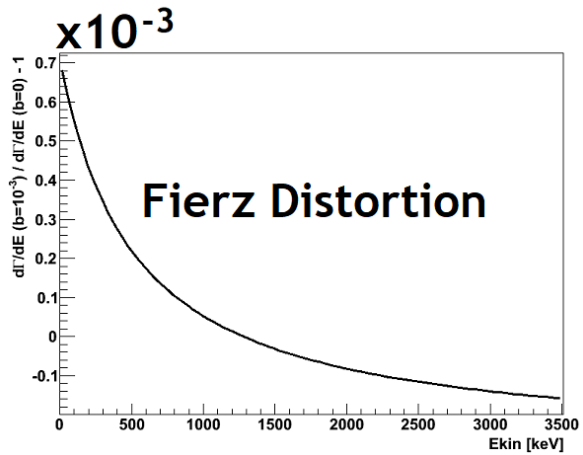
Tricky to measure

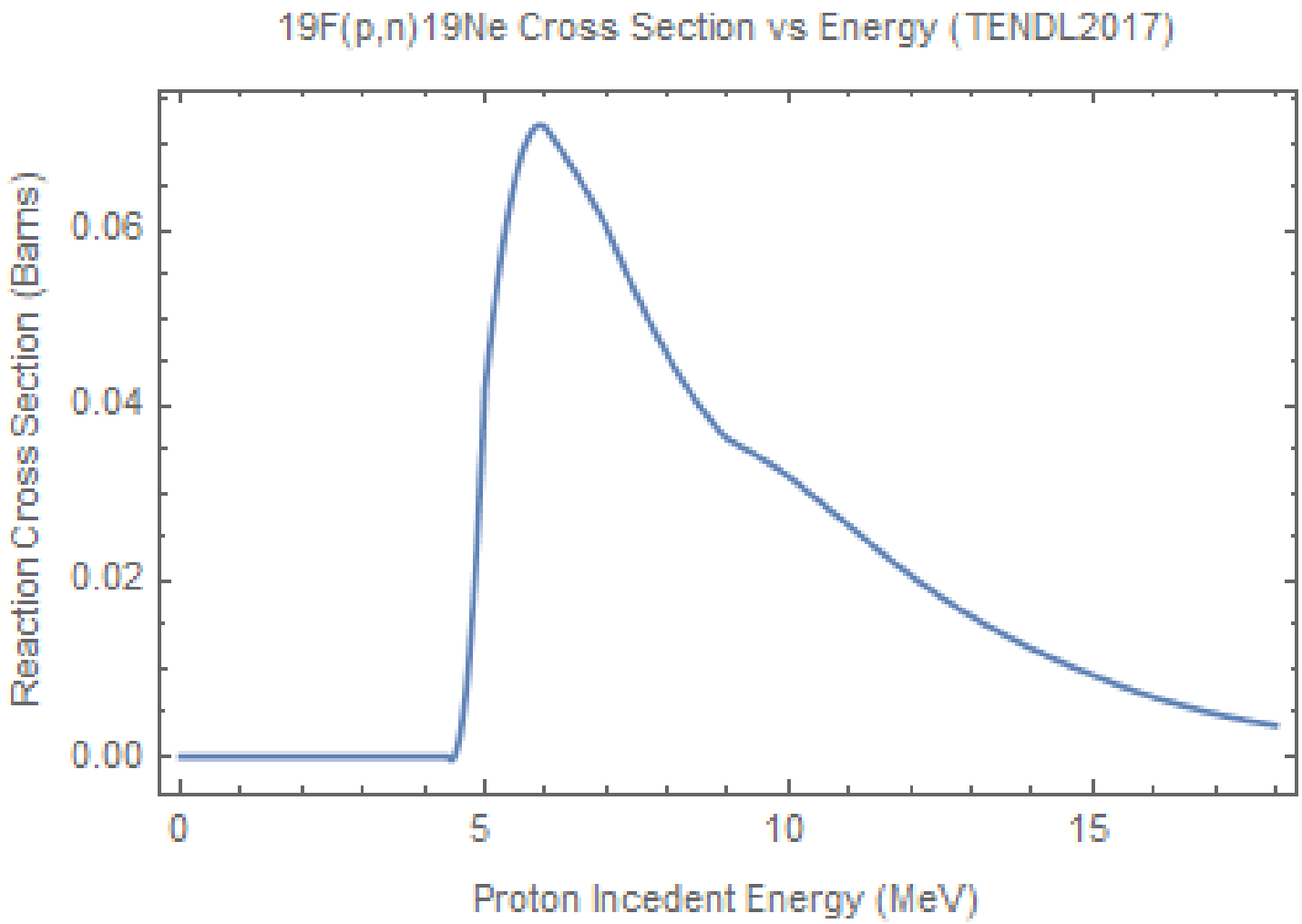
Solution: measure $-\beta$ and $+\beta$ decay



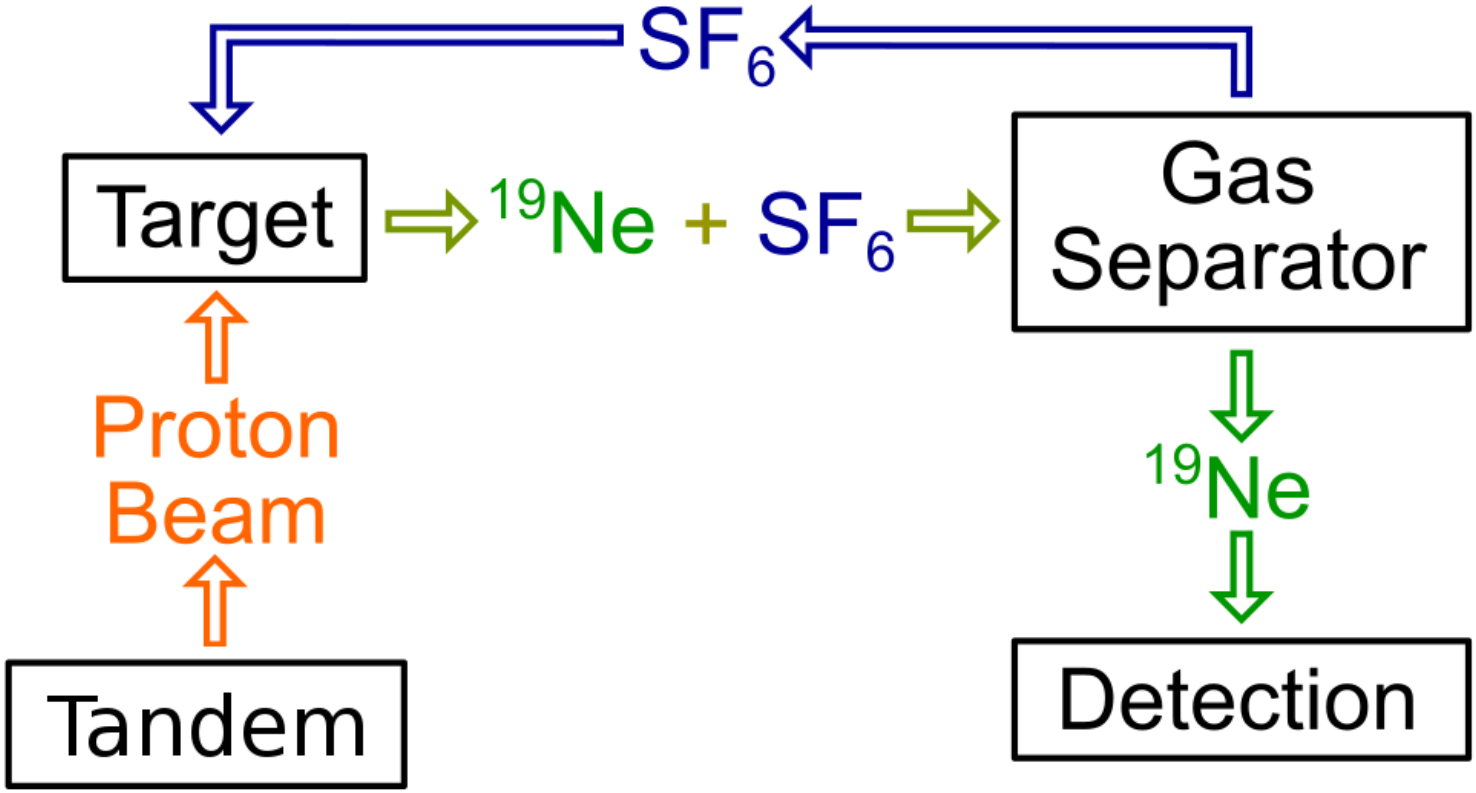


An Overview of the Source

$^{19}F(p,n)^{19}Ne$

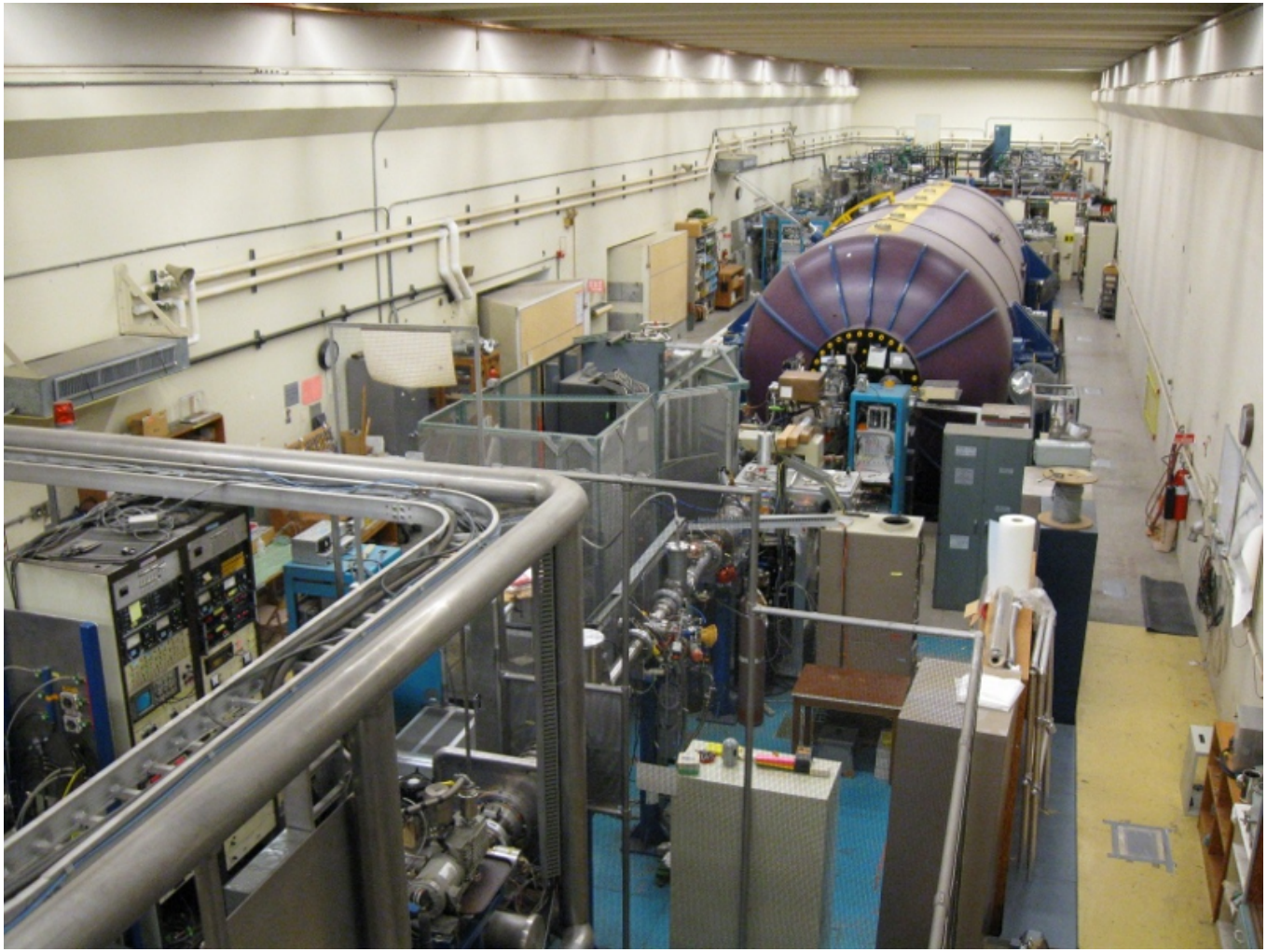

19F(p,n)19Ne Cross Section vs Energy (TENDL2017)
Reaction Cross Section (Barns)
0.06
0.04
0.02
0.00
0
5
10
15
Proton Incedent Energy (MeV)

Source Block Diagram



The Tandem

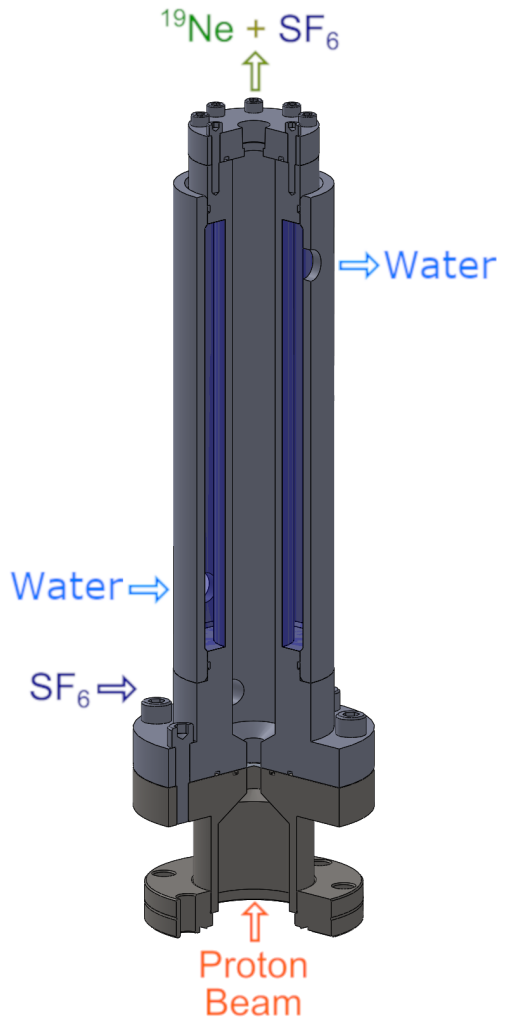
18 MeV proton max.



Model FN tandem VDG, pelletron charging

Target Design

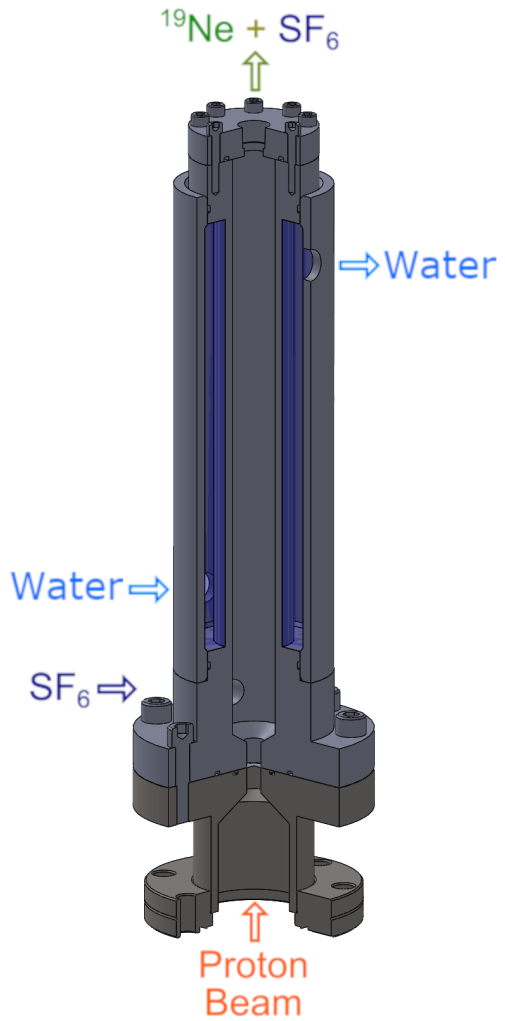
Gas target



Target Design

Gas target

- 3 atm target pressure



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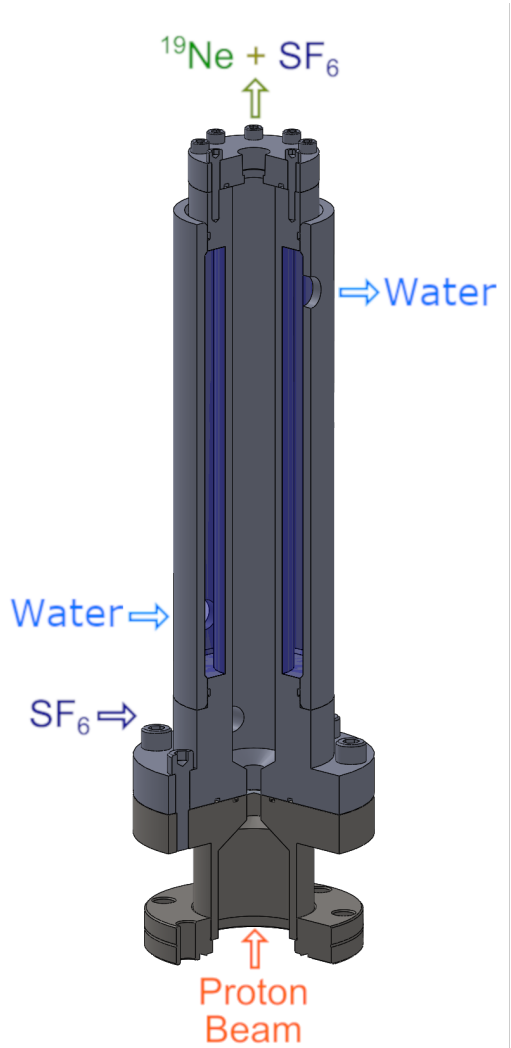
Aluminium construction



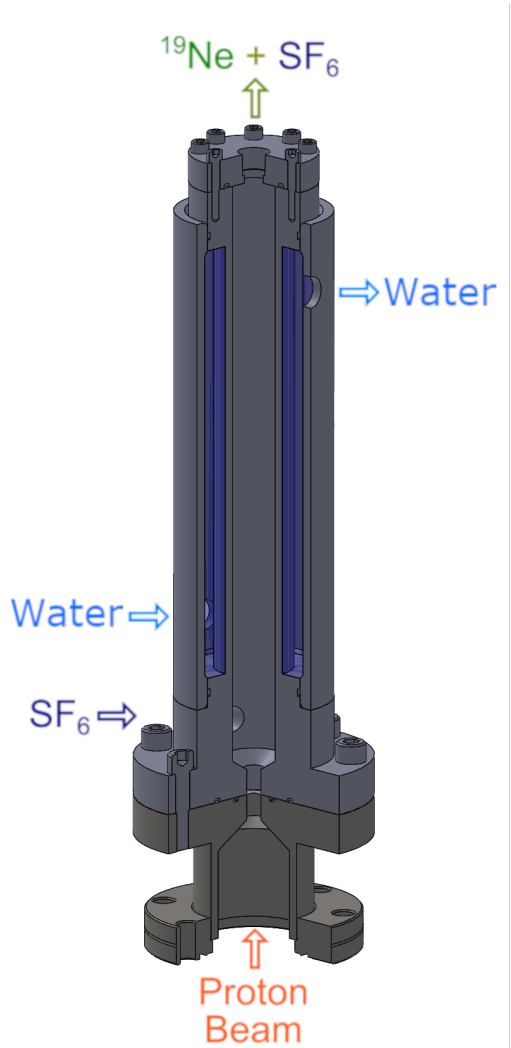
Target Design

Gas target

- 3 atm target pressure

Aluminium construction

- Limited activation



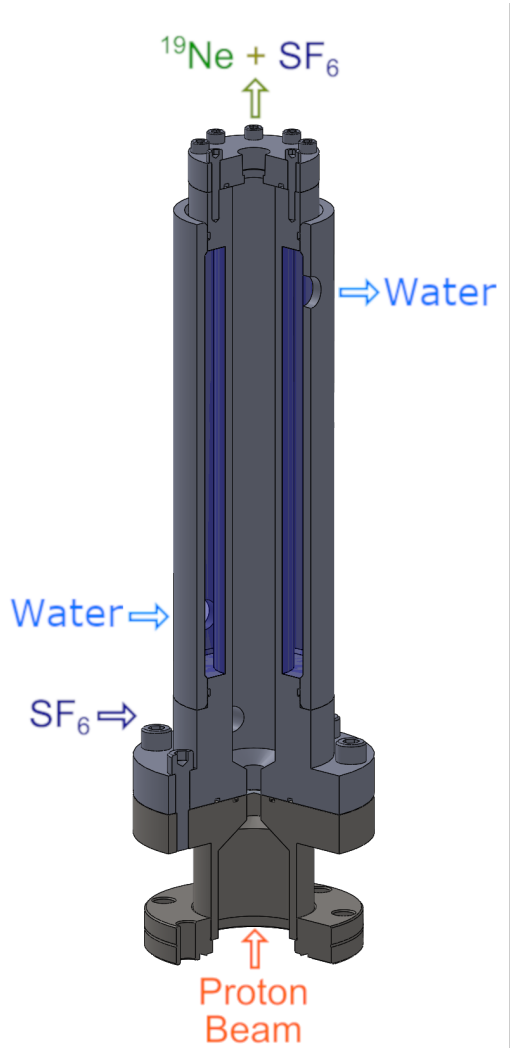
Target Design

Gas target

- 3 atm target pressure

Aluminium construction

- Limited activation
- Fluorine resistant



Target Design

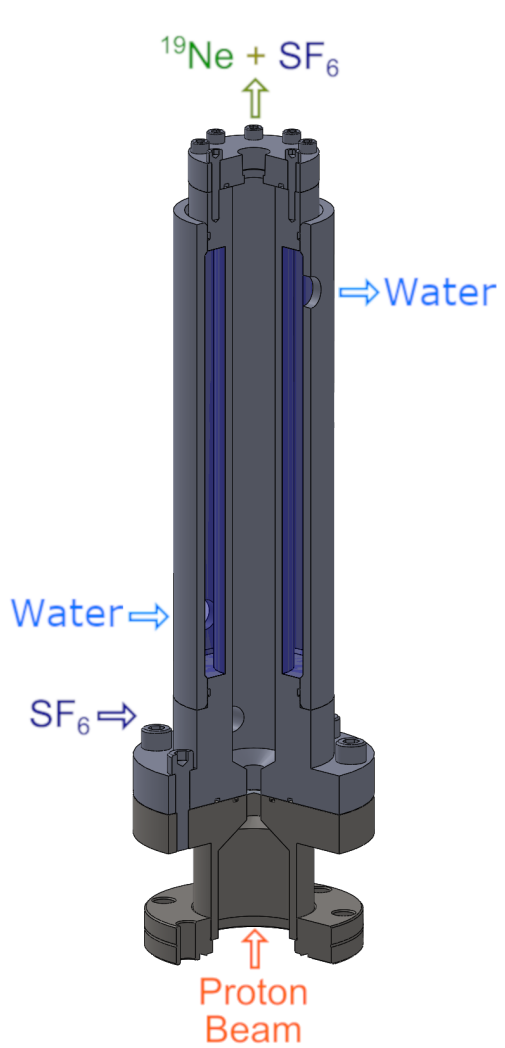
Gas target

- 3 atm target pressure

Aluminium construction

- Limited activation
- Fluorine resistant

6 mm diameter, 50 μm aluminium window



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- 3 atm target pressure

Aluminium construction

- Limited activation
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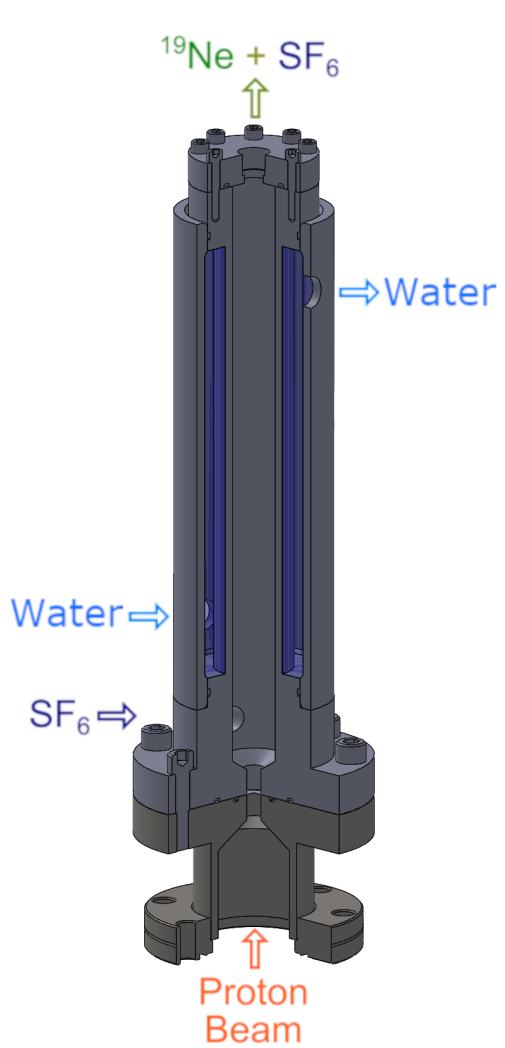
6 mm diameter, 50 μm aluminium window

- 11.6 atm mechanical burst strength



Target Design

Gas target

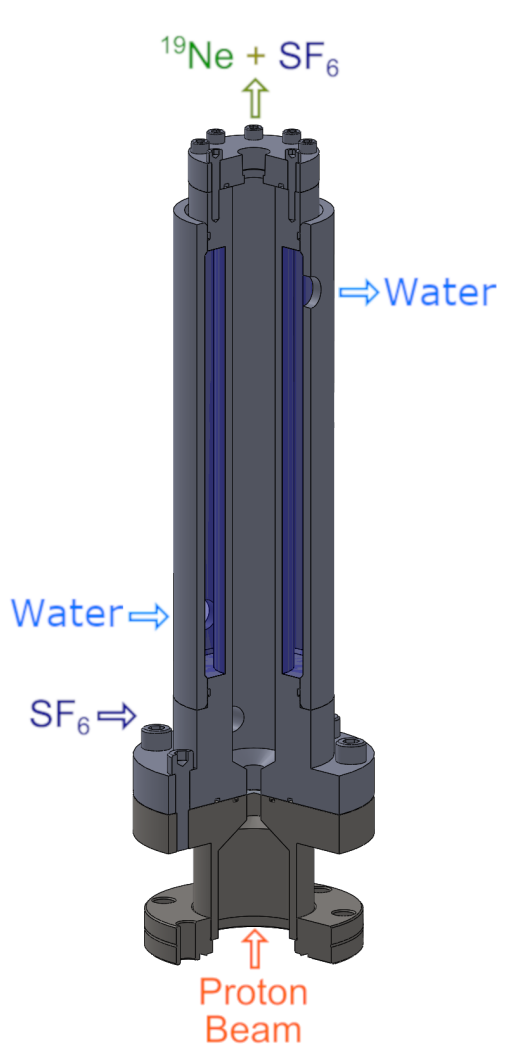
- 3 atm target pressure

Aluminium construction

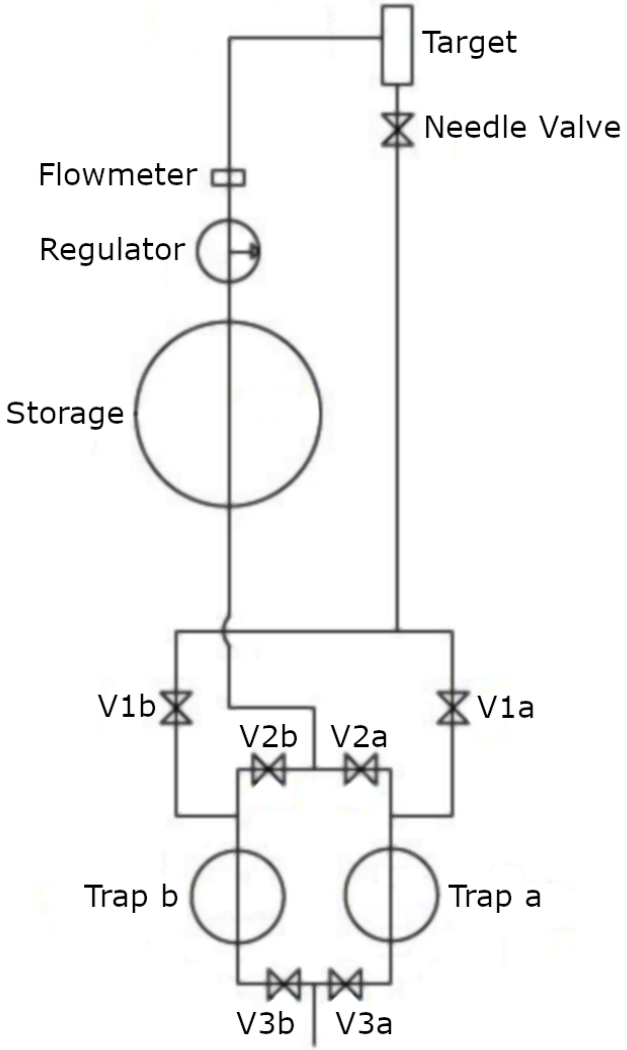
- Limited activation
- Fluorine resistant

6 mm diameter, 50 μm aluminium window

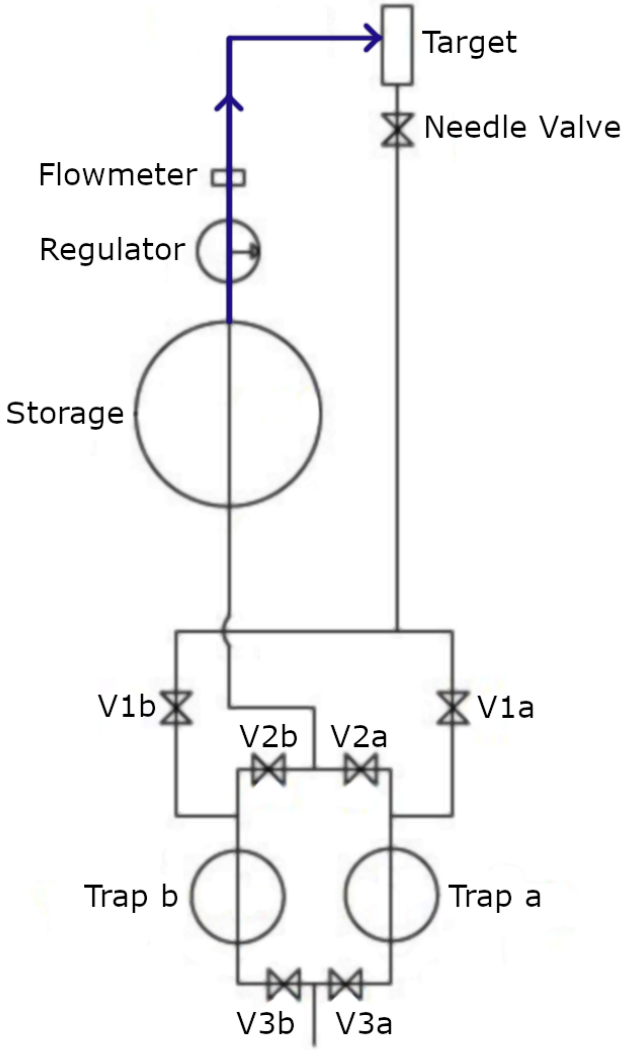
- 11.6 atm mechanical burst strength
- 108 K temp rise for 10 MeV 10 μA 2 mm beam



Gas Cycle


Target
Needle Valve
Flowmeter
Regulator
Storage
V1b
V1a
V2b
V2a
Trap b
Trap a
V3b
V3a

Gas Cycle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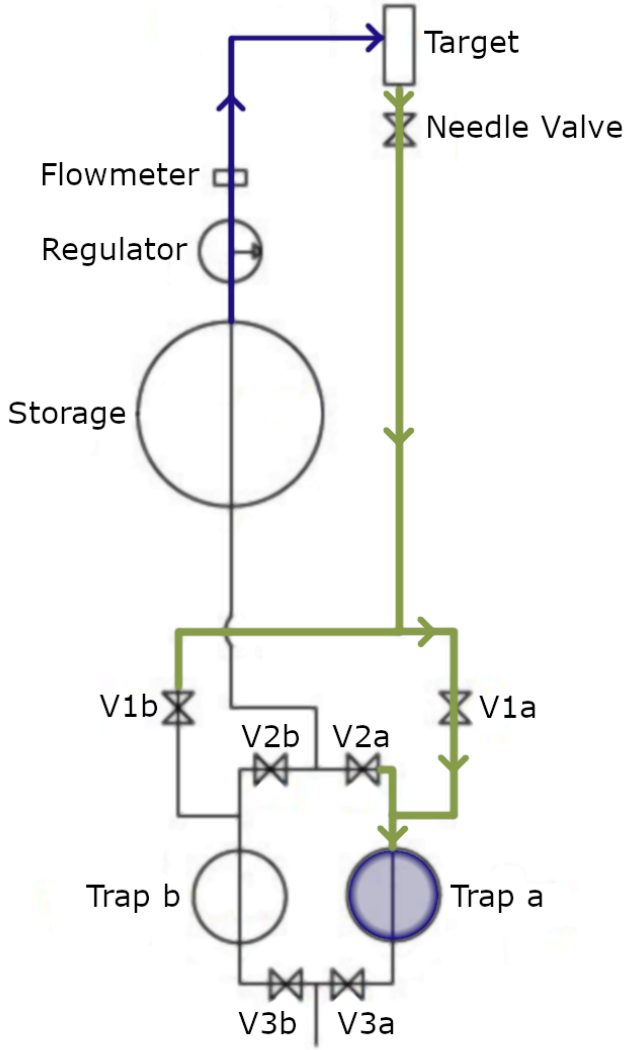
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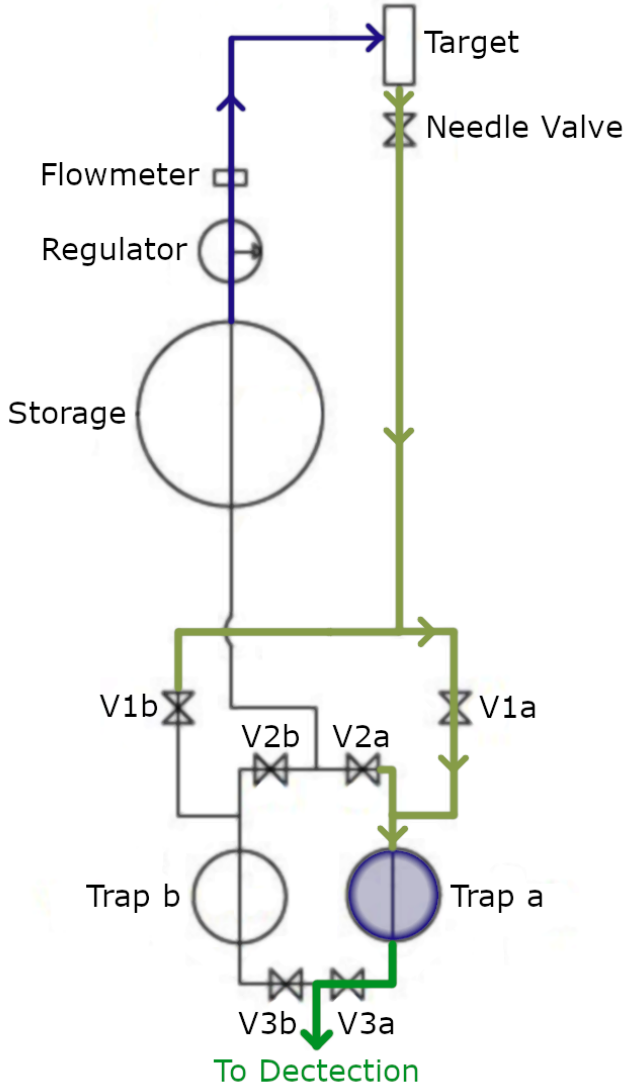
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To Dectection

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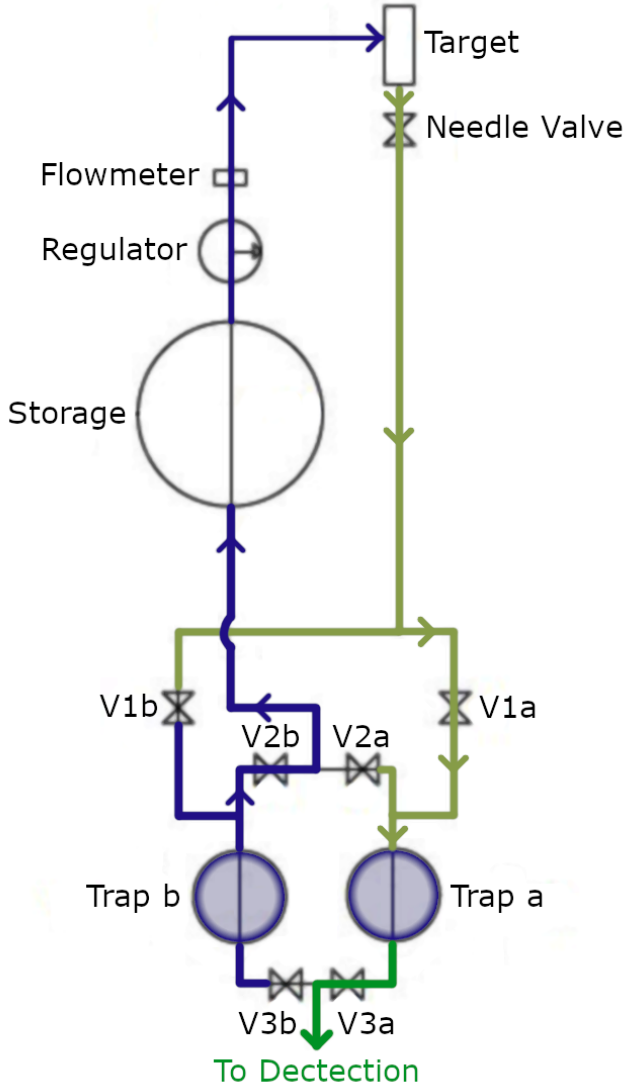
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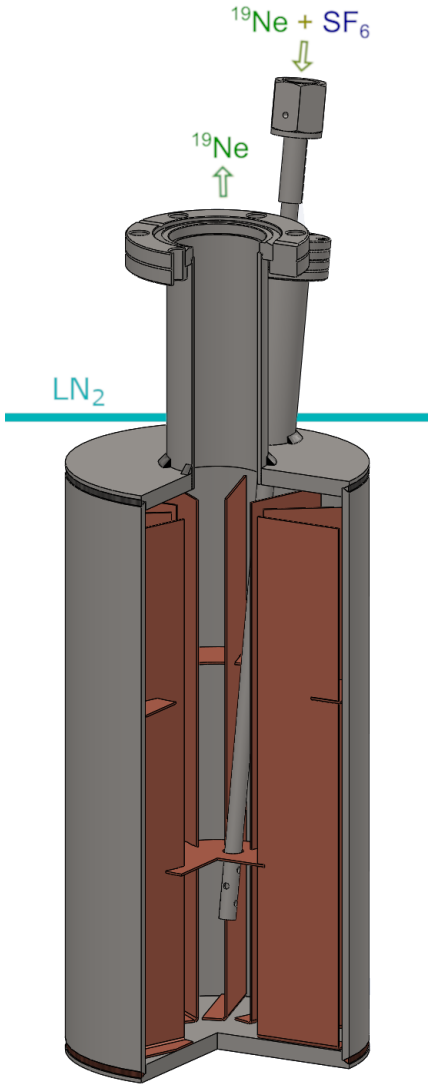
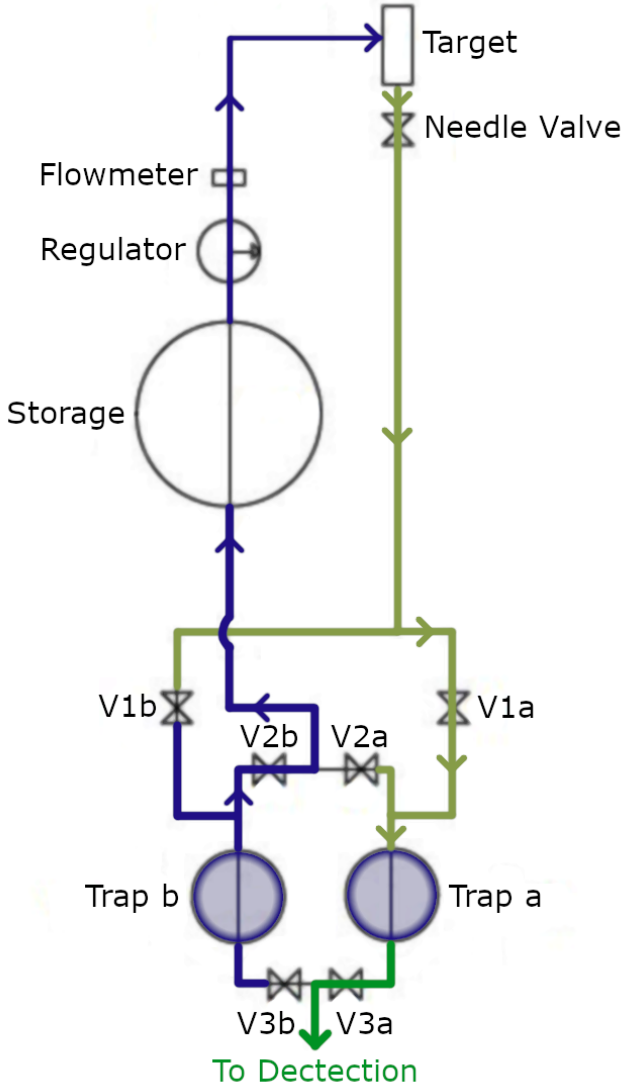
Gas Cycle

LN_2 cooled traps

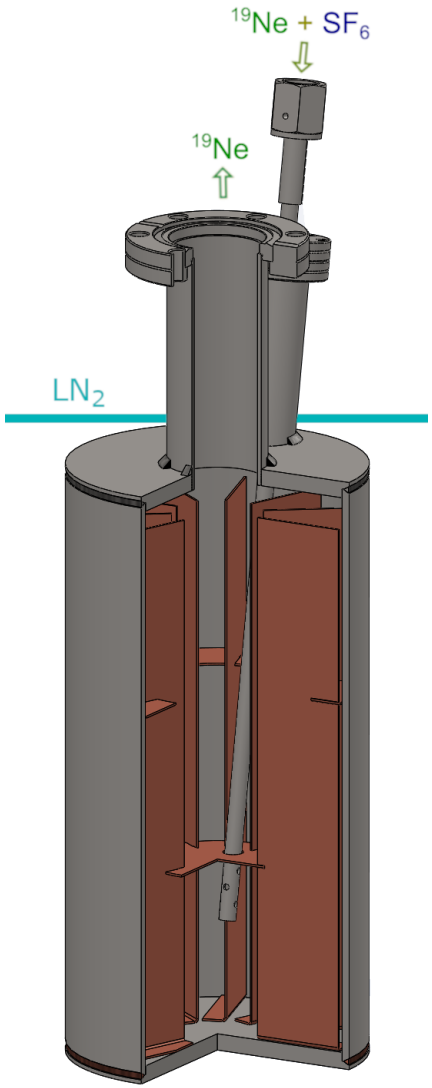


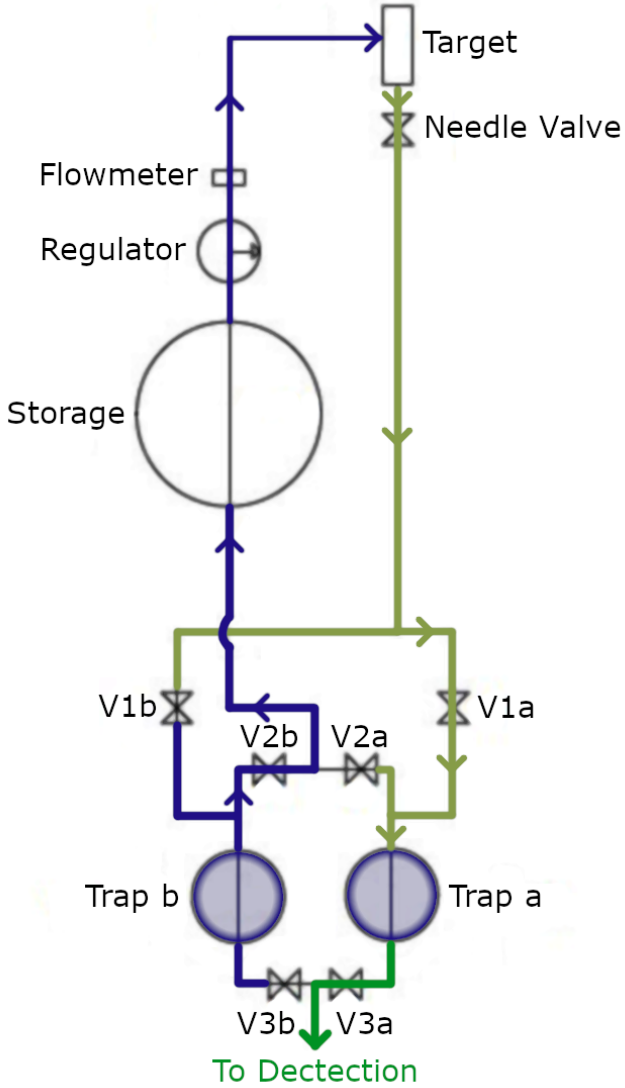


Gas Cycle

LN_2 cooled traps

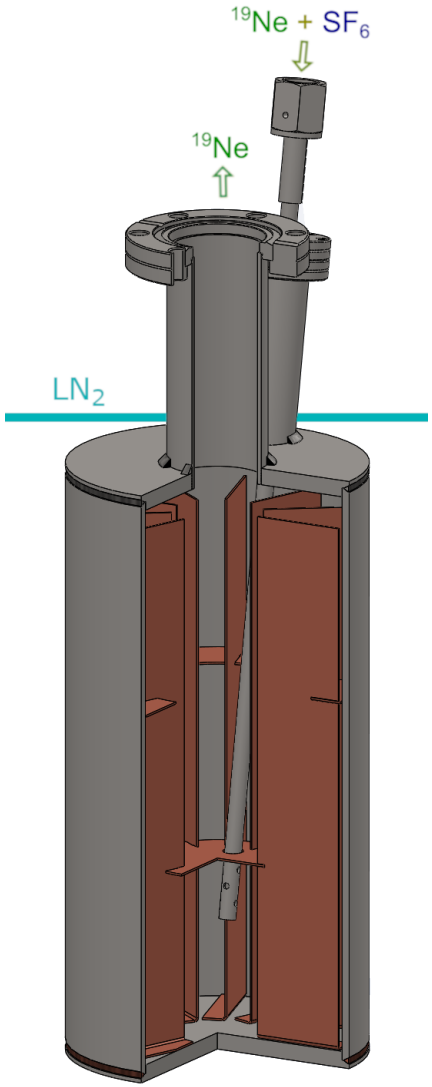
- designed to withstand 33 atm

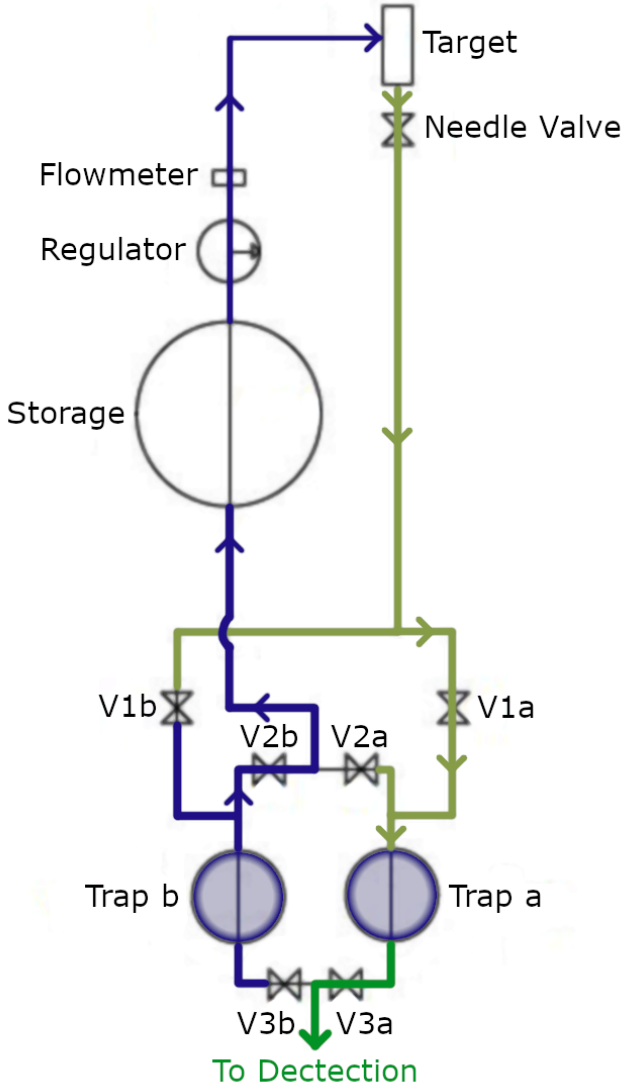




Gas Cycle

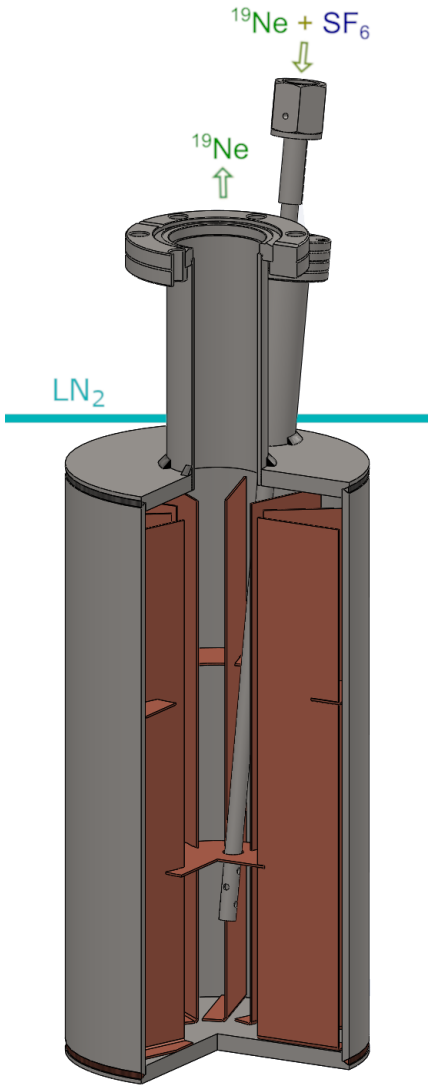
- LN_2 cooled traps
  - designed to withstand 33 atm
  - 2 L volume

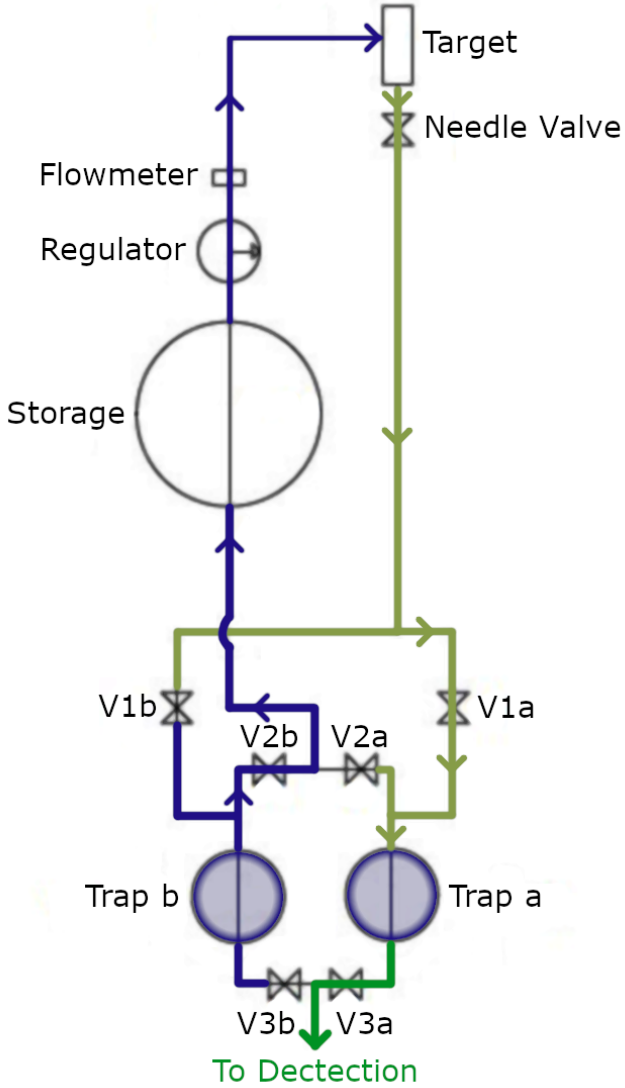




Gas Cycle

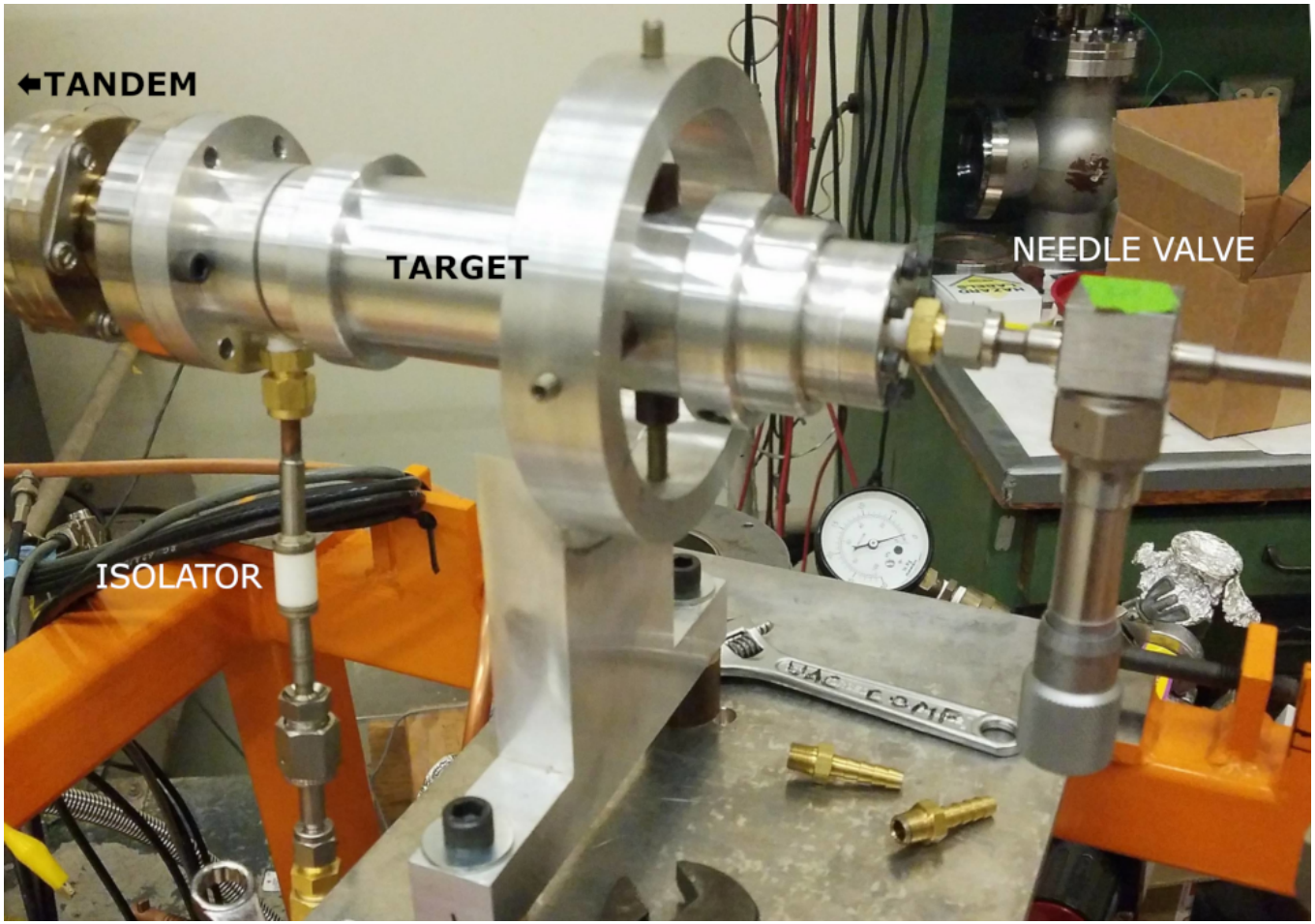
- LN_2 cooled traps
  - designed to withstand 33 atm
  - 2 L volume
- 12 hr cycle time



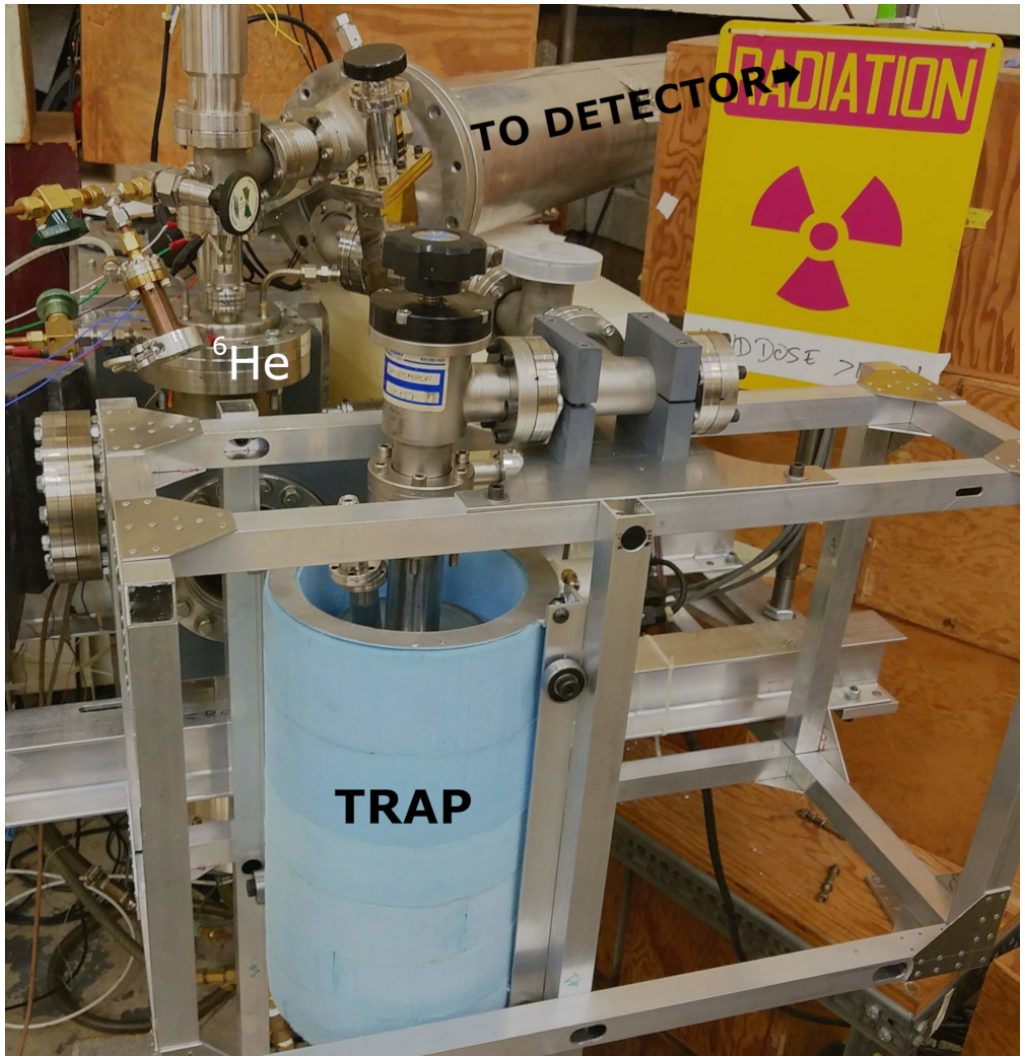


State of the Source

Target



Traps



Cycle Testing

Gas cycle verified for CO_2

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- Traps not overwhelmed by gas flow

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- System leak tight

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No beam yet!

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- Tandem reconfiguration and ion source troubles

Future Work

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1. Finish tandem reconfiguration and ion source rebuild

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2. Measure Neon-19 production rates

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2. Measure Neon-19 production rates
3. Automate system to permit remote operation

Questions?