Early Career and Research Associates Retreat

Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

Operation of the OPPIS H^- Ion Source during the RHIC Run-2024

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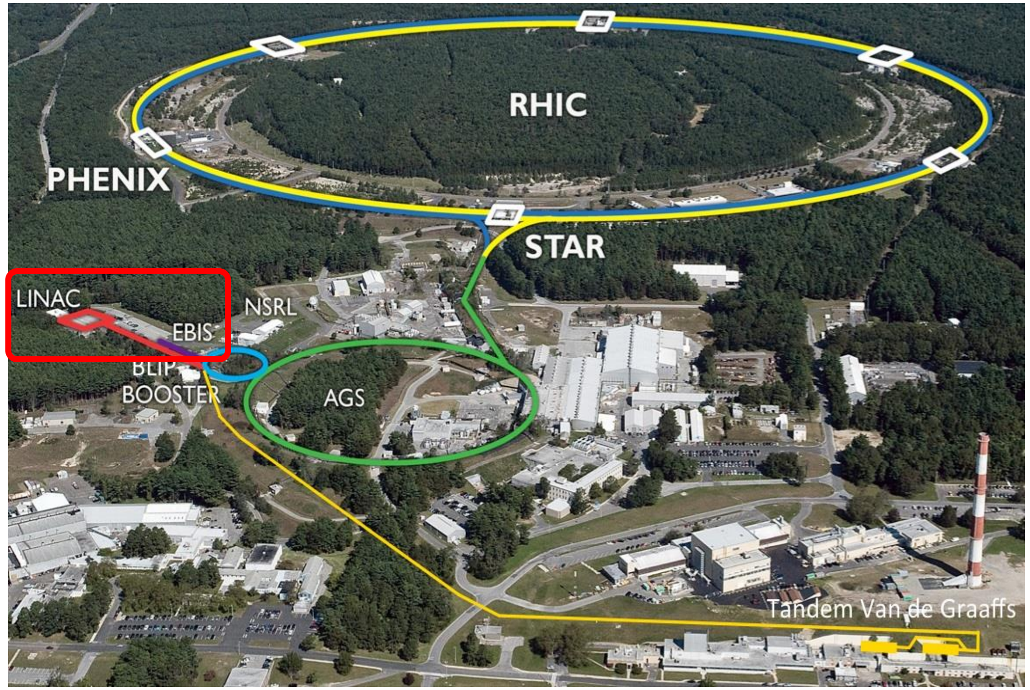
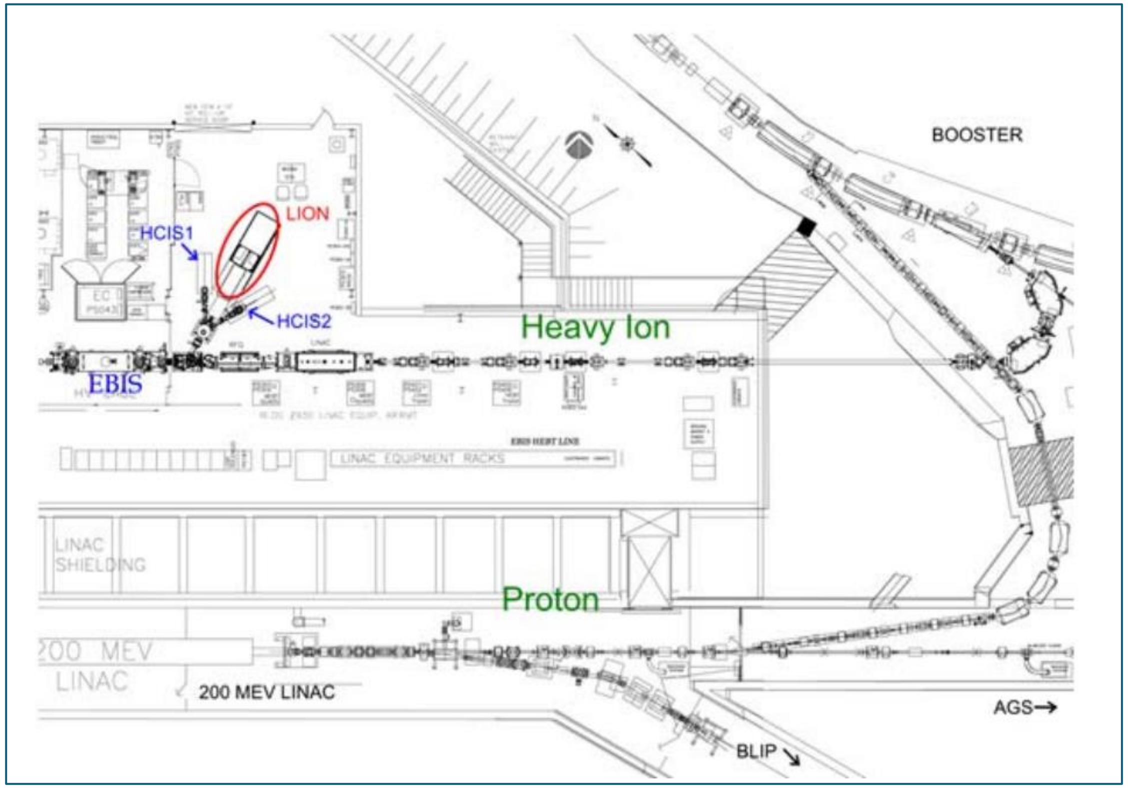
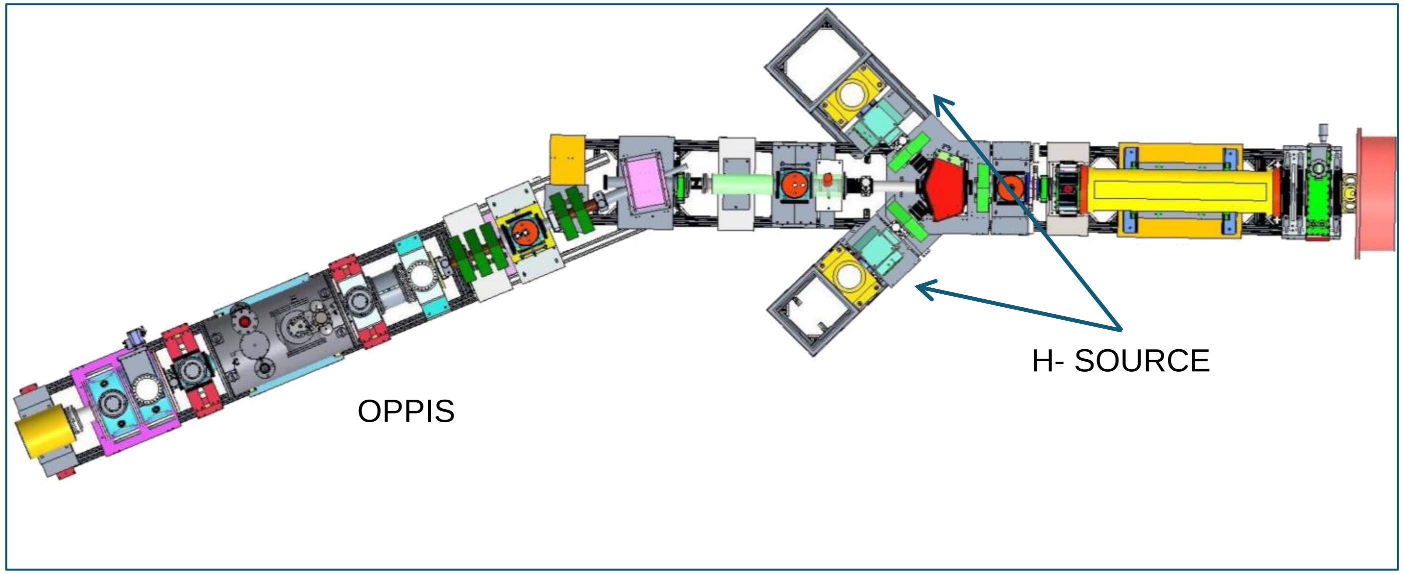




Relativistic Heavy Ion Collider
- Collider physics experiments

NASA Space Radiation Laboratory (NSRL)
- Space radiation research
- Galactic Cosmic Ray (GCR) simulator

Brookhaven Linac Isotope Producer (BLIP)
- Radioisotopes production



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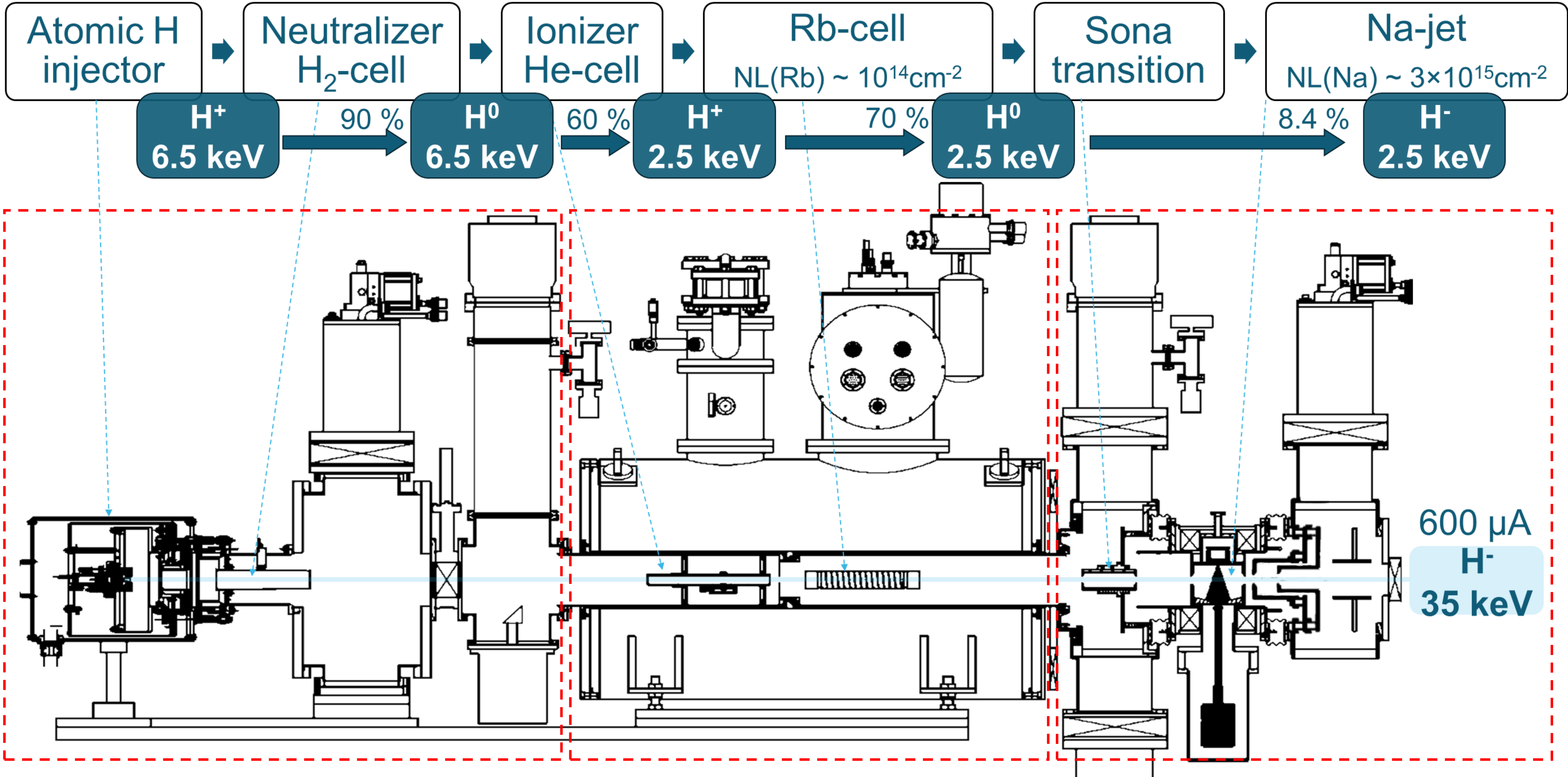
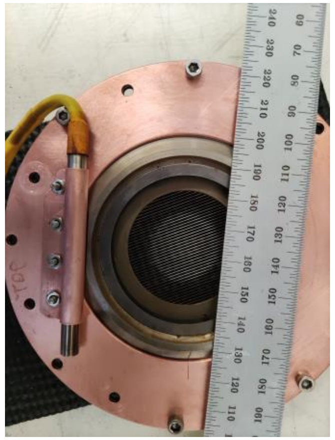
Optically Pumped Polarized Ion Source



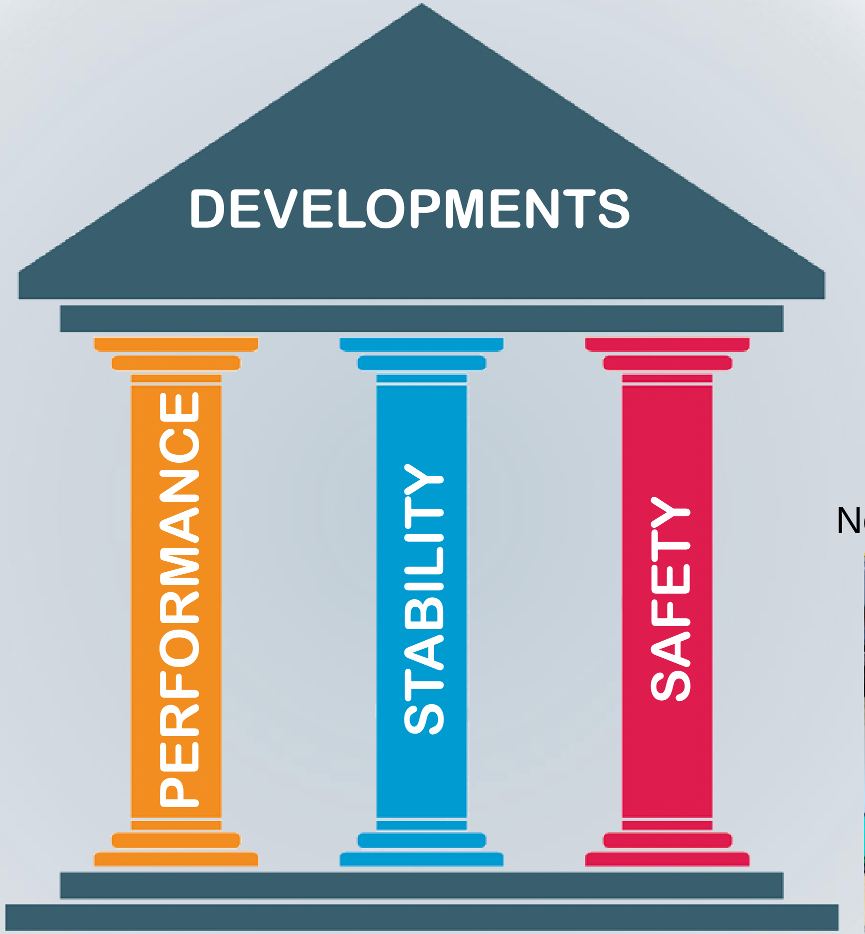
“ReThinking” ion source development

Upgrade in the Na Container shape

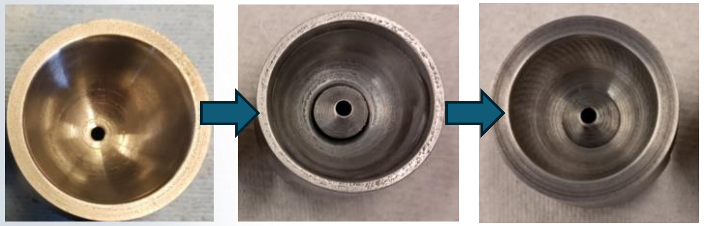
Robust construction of the He grid system



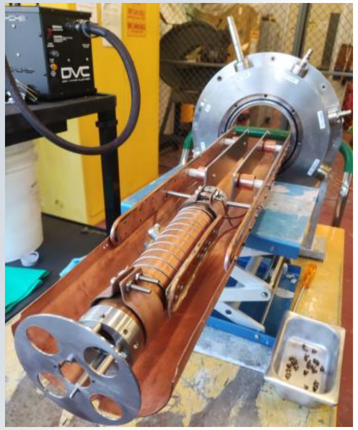
New Na collector water cooling system



Upgrade of the Cathode shape



New design of the Rb Cell

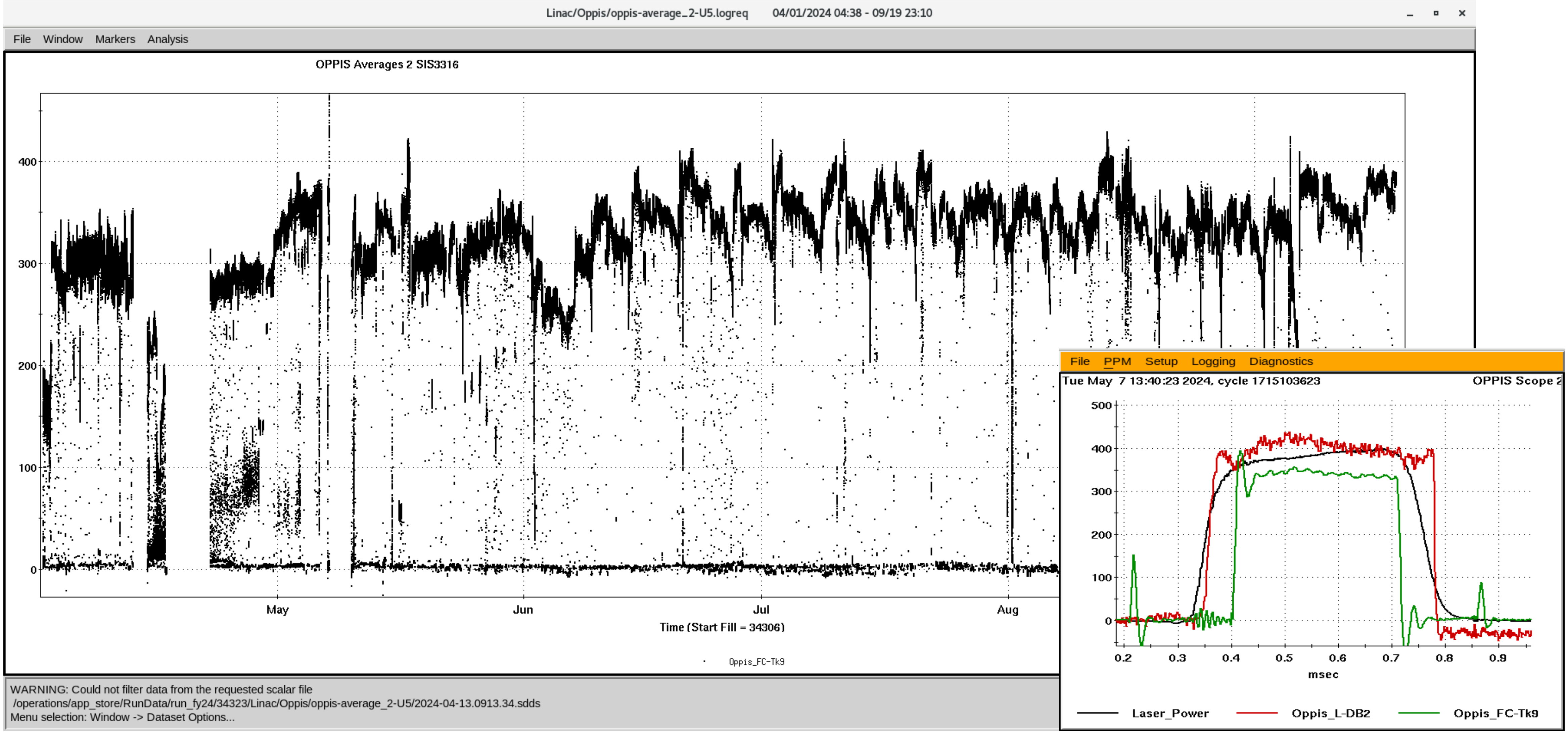


Upgraded glovebox

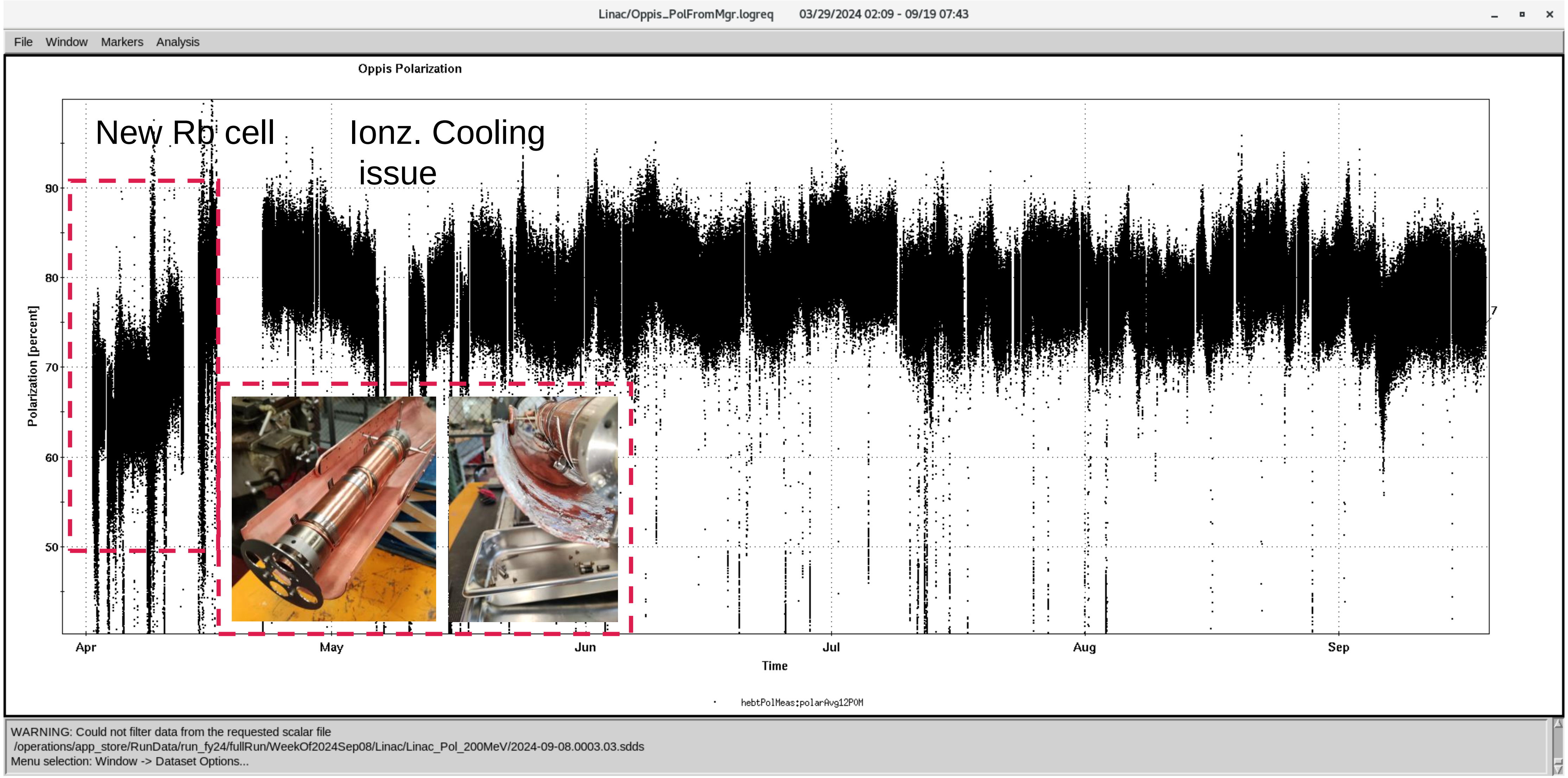
Current @Tk9

T_{source} = 350 μs
I_{Tk9} = 350 μA
Repetition rate 0.5 Hz
Spark Rate < 2%

Bst Input ~ 7×10^{11} protons/bunch



Polarization @200 MeV polarimeter



Development of the Laser Ion Source

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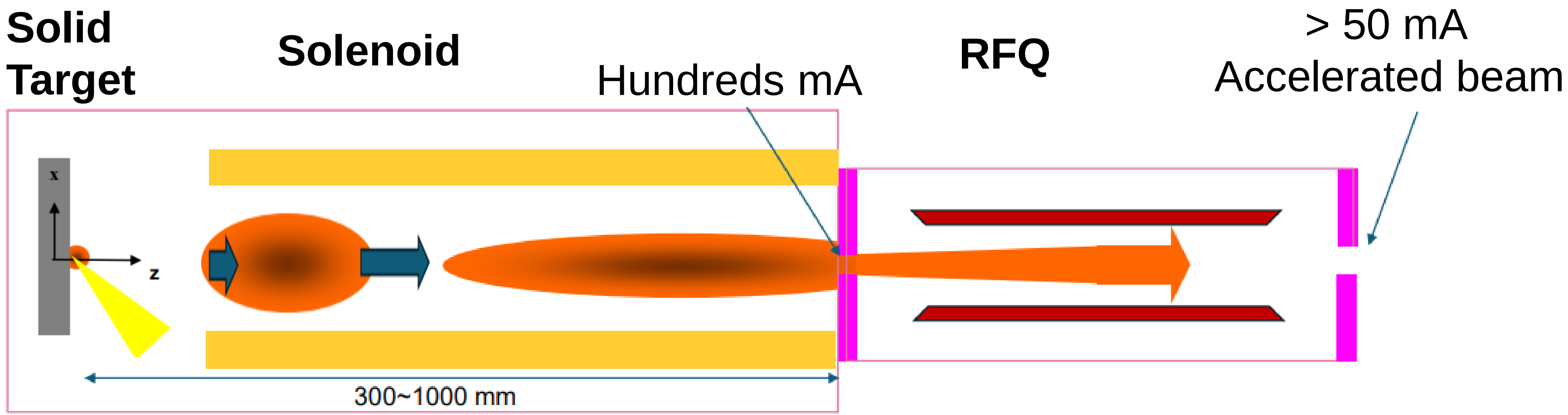
High current heavy ion beam acceleration

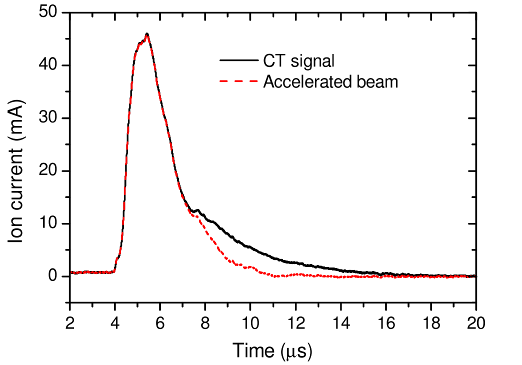


Ultra dense laser ablation plasma → Expanding plasma + Transverse confinement by solenoid field (10-1000 G) →

- **Immediate capture of the extracted ion beam (plasma)**
- **Simultaneous generation of acceleration and electrical focusing field**

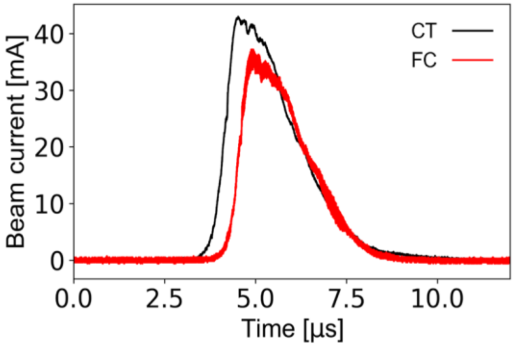
-> suitable for low energy high current beam

35 mA C^{4+}



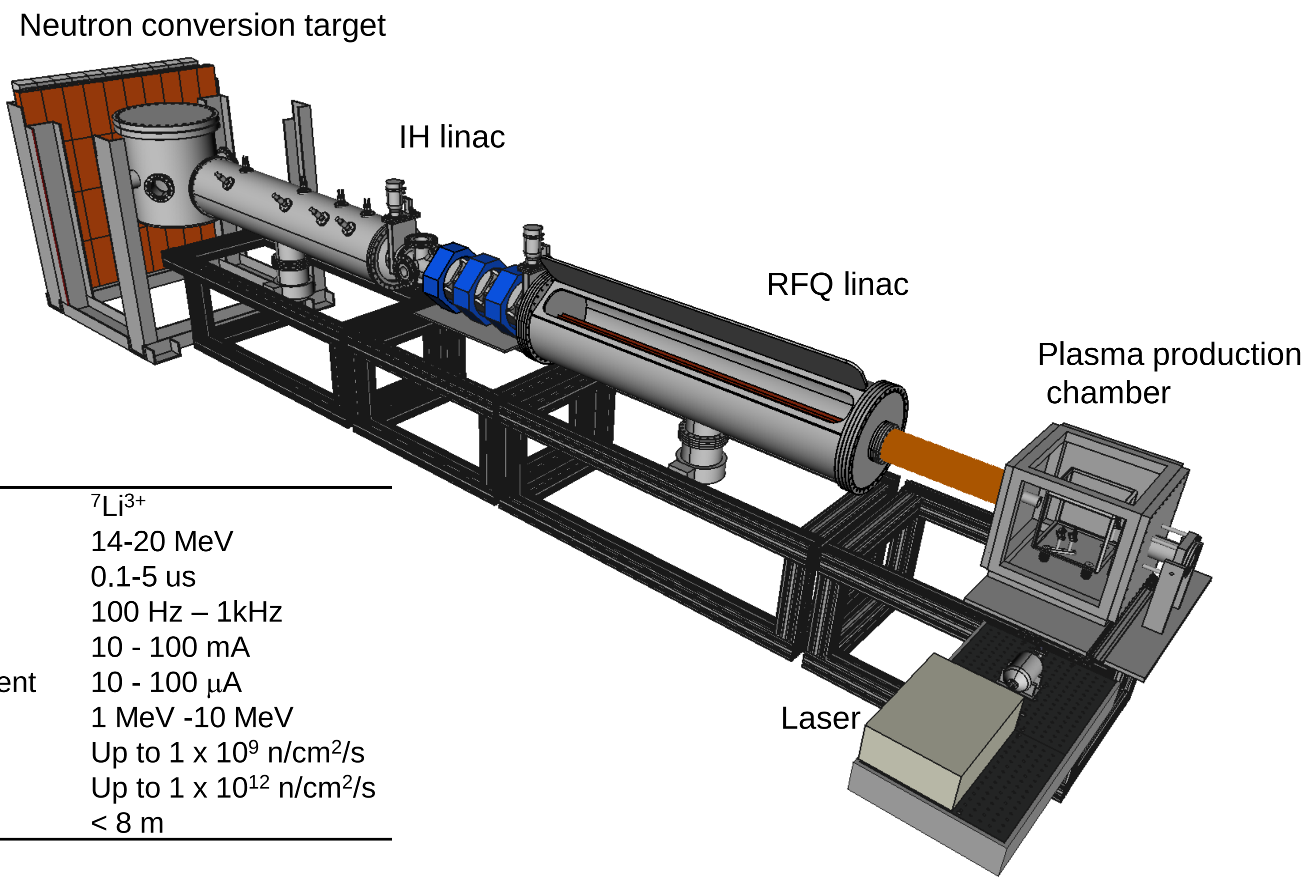
Kanesue et al., *Appl. Phys. Lett.* **105**, 193506 (2014)

35 mA of $^{7}Li^{3+}$



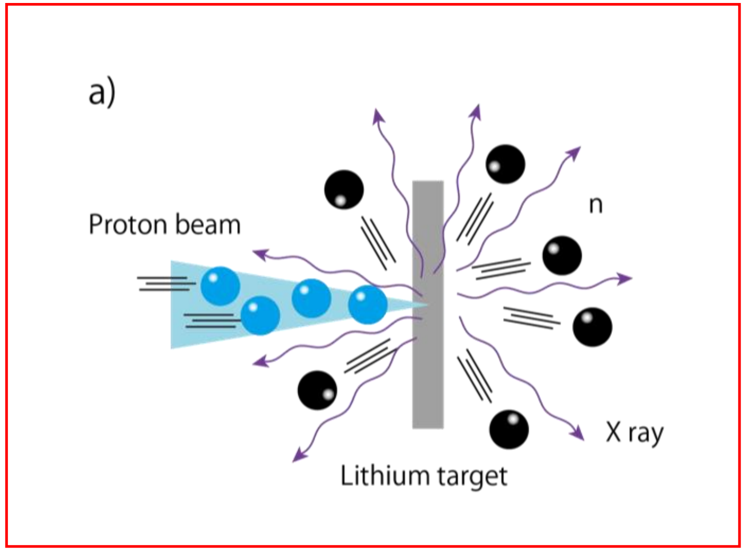
Okamura et al., *Sci Rep* **12**, 14016 (2022).

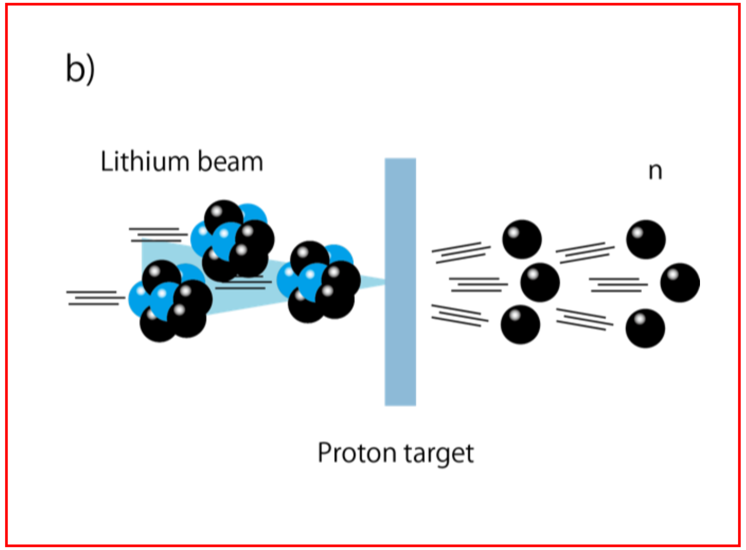
Compact neutron source using intense Li ion beam driver



Ion	$^{7}Li^{3+}$
Ion beam energy	14-20 MeV
Beam pulse width	0.1-5 us
Repetition rate	100 Hz – 1kHz
Peak ion beam current	10 - 100 mA
Average ion beam current	10 - 100 μA
Neutron energy	1 MeV -10 MeV
Average neutron flux	Up to 1 x 10^9 n/cm^2/s
Peak neutron flux	Up to 1 x 10^{12} n/cm^2/s
Length	< 8 m

Advantage1: Forward-directed neutrons = very small number of unwanted neutrons, small shielding
Advantage2: Short beam pulse = Background separation by TOF method





Thanks for your attention