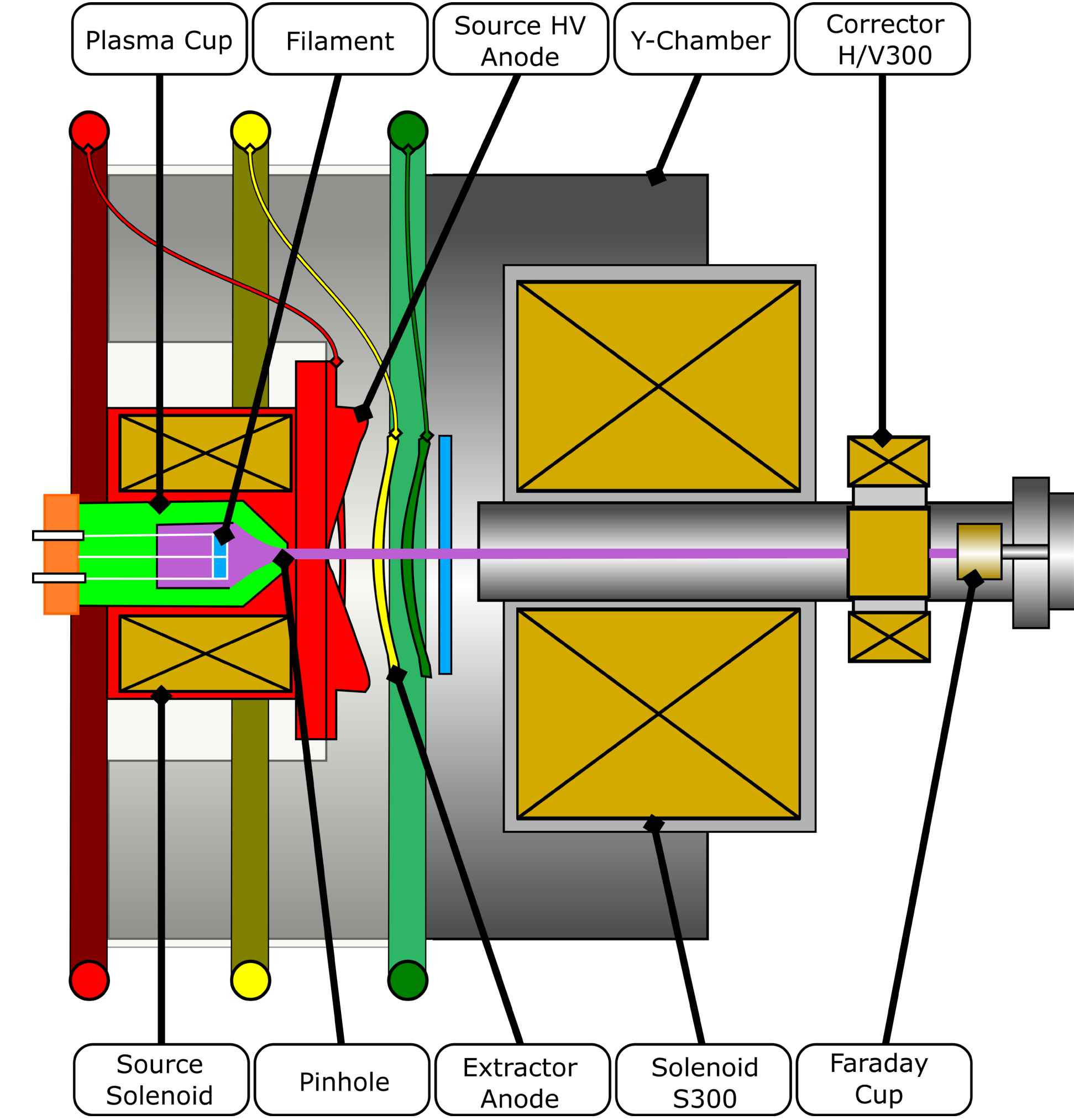
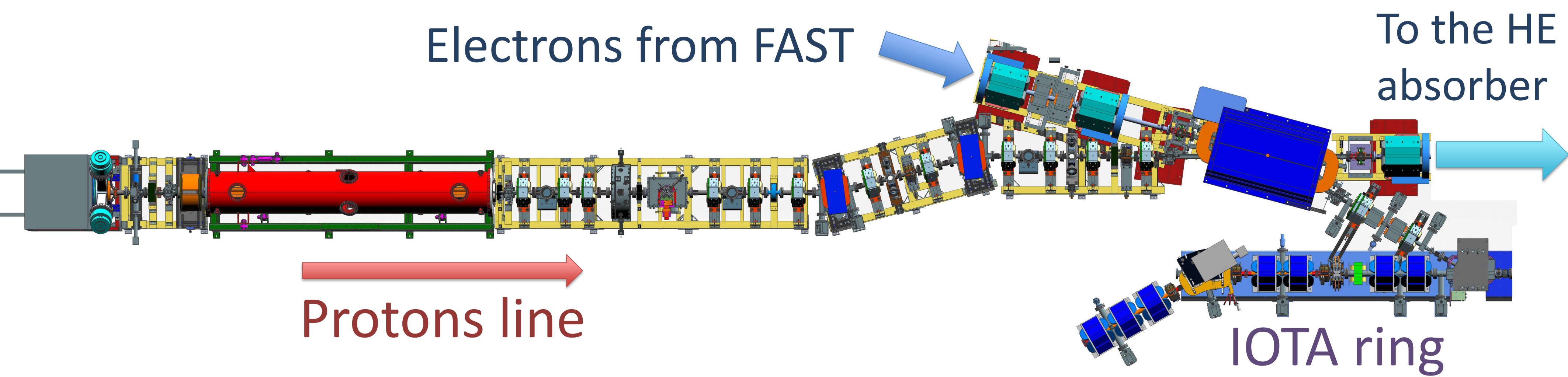
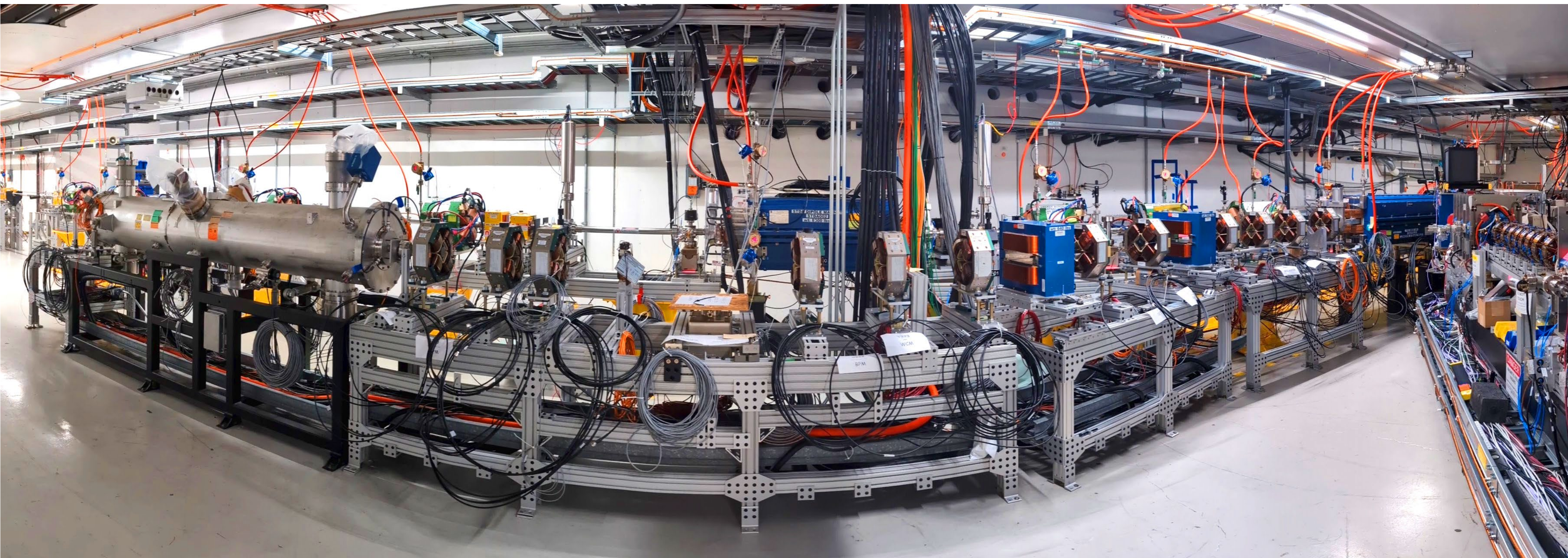


Abstract

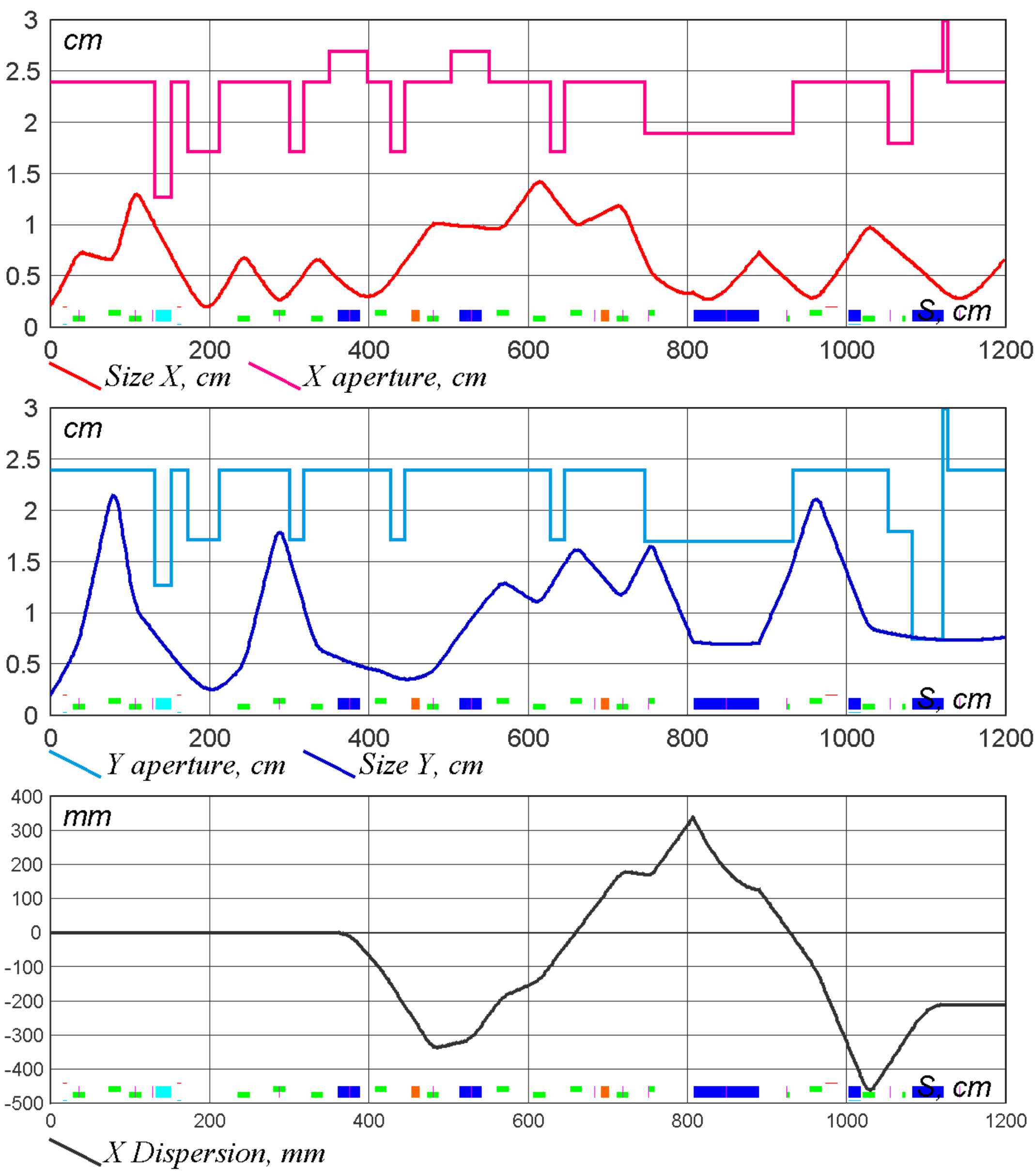
The Proton Injector for the IOTA storage ring (IPI) is being constructed at the Fermilab Accelerator Science and Technology facility (FAST). It will be a machine capable of delivering 20 mA pulses of protons at 2.5 MeV. IPI will operate alongside the existing electron injector beamline to facilitate further beam physics research and the continued development of novel accelerator technologies at the IOTA ring. This report details the results of the initial commissioning of IPI and an overview of the upcoming experiments with intense proton beams at IOTA.

Duoplasmatron ion source

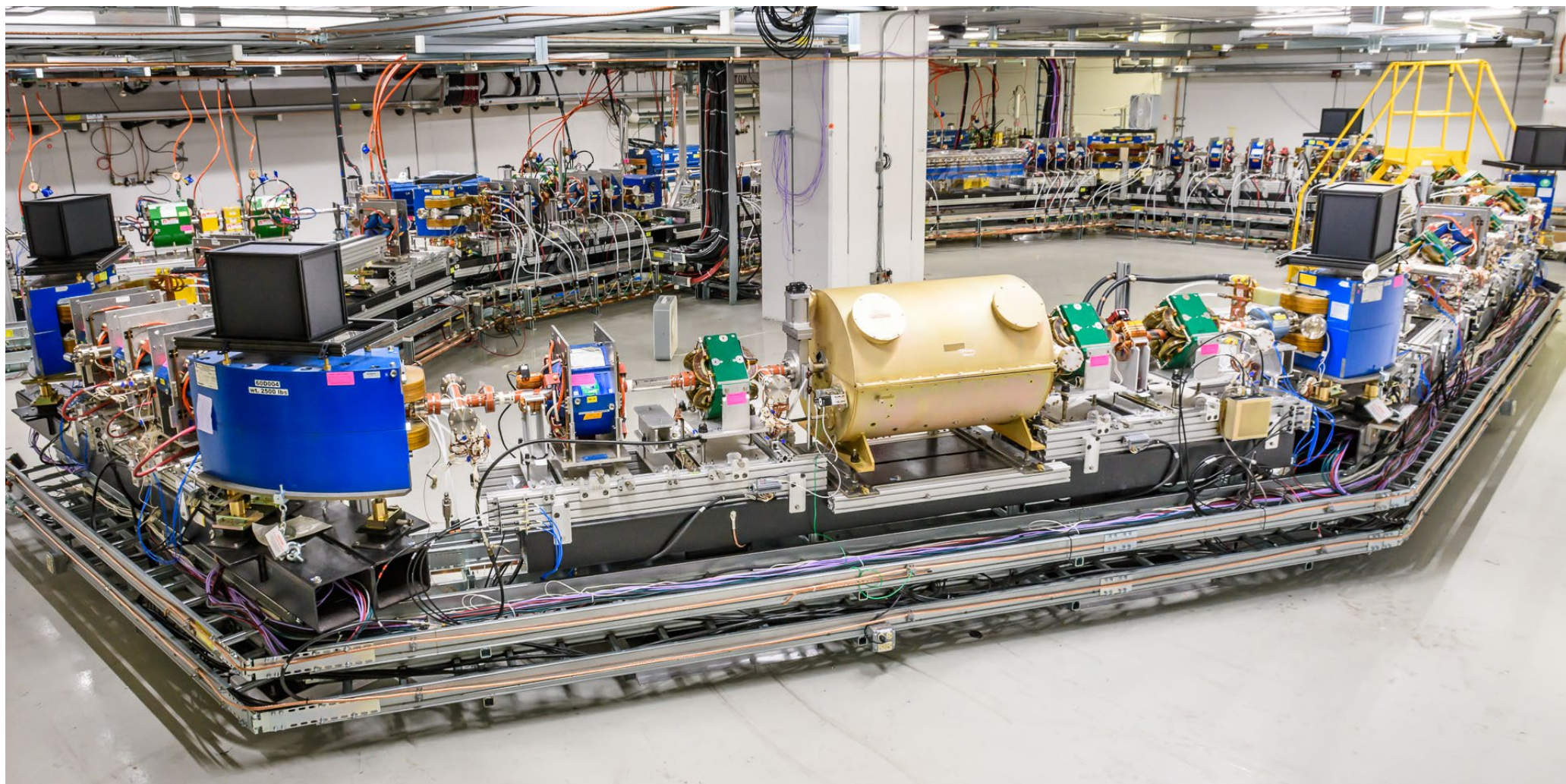


	Parameter	Nom.	Unit
LEBT	Energy	50	keV
	Proton beam current	20	mA
	Pulse length (99 %)	350	μs
	Source pulse rate	1	Hz
	Transverse beam size	0.7	mm
MEBT	Energy	2.5	MeV
	RF pulse rate	1	Hz
	RFQ frequency	325.0±0.5	MHz
	RFQ duty factor	< 0.002	%
	Phase/Amp. stability	1°/1 %	
	Beam pulse length	2	μs
	Bunch length (1σ)	0.3	ns

MEBT 3 sigma envelopes



IOTA parameters

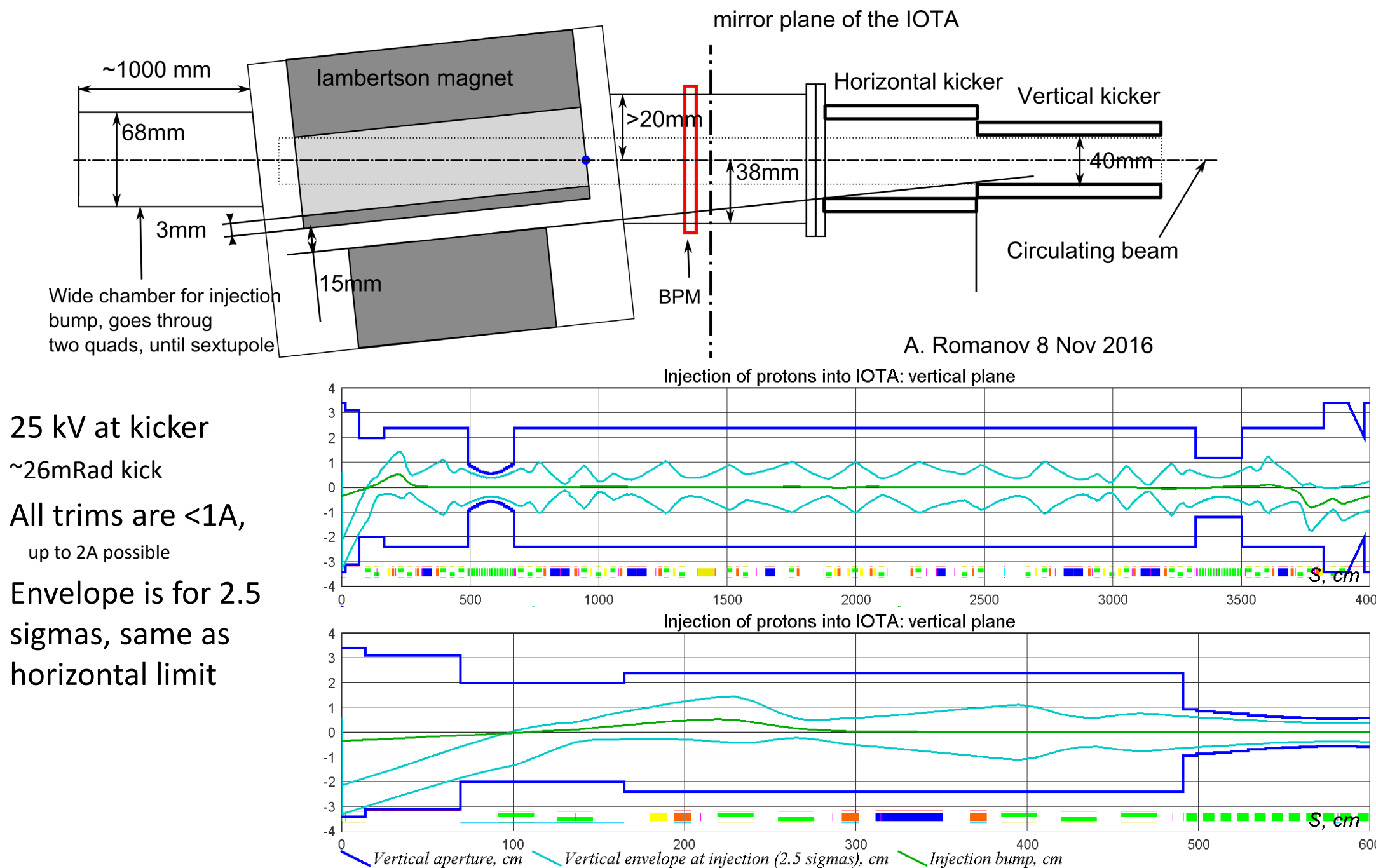


	Parameter	Nom.	Unit
IOTA with protons	Proton beam energy	2.5	MeV
	Relativistic β	2.66 · 10 ⁻³	keV
	Circumference	40	m
	Proton RF frequency	2.19	MHz
	Revolution period	1.83	μs
	RF voltage	1	kV
	Geometric emittance	3.5	μm
	Δp/p (RMS)	0.07	%
	Beam current	8	mA
	Momentum compaction	0.07	
	Betatron tunes (Q _x , Q _y)	5.3, 5.3	

Experiments at IOTA

- Demonstration of integrable optics with Danilov-Nagaitsev nonlinear magnets (e, p)
- Demonstration of integrable optics with octupoles (e, p)
- Demonstration of integrable optics with non-linear electron lenses (e, p)
 - Thin radial kick of McMillan type
 - Axially symmetric kick in constant beta function
- Space-charge compensation with electron lenses (p)
- Space-charge compensation with electron columns (p)
- Optical stochastic cooling (e)
- Electron cooling (p)
 - Electron cooling of protons
 - Diagnostics through recombination
 - Electron cooling and nonlinear integrable optics

Injection configuration



Status

- IOTA proton injector is mandatory for the success of the proposed IOTA research program
- The IPI design is finalized and well thought through
- All necessary components are either on hands or purchased with delivery times within next few months
- Proton source tests are going on
- Active phase of construction will begin in a few weeks, right after conclusion of the current experimental run with electrons