

Plasma source for Run2

LWFA4AWAKE

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- Present plasma source (Run 2a)
- Plasma source for Run 2b
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Present Plasma source

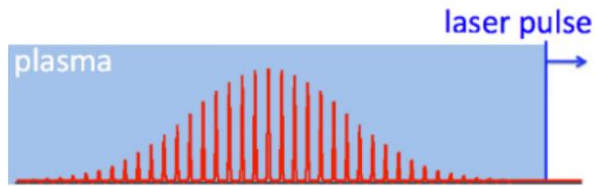
Rubidium vapor source

- $10^{14} \leq n_e \leq 10^{15} \text{ cm}^{-3}$
- $\Delta n_e / n_e \leq 0.2\%$
- Few cm n_e ramp

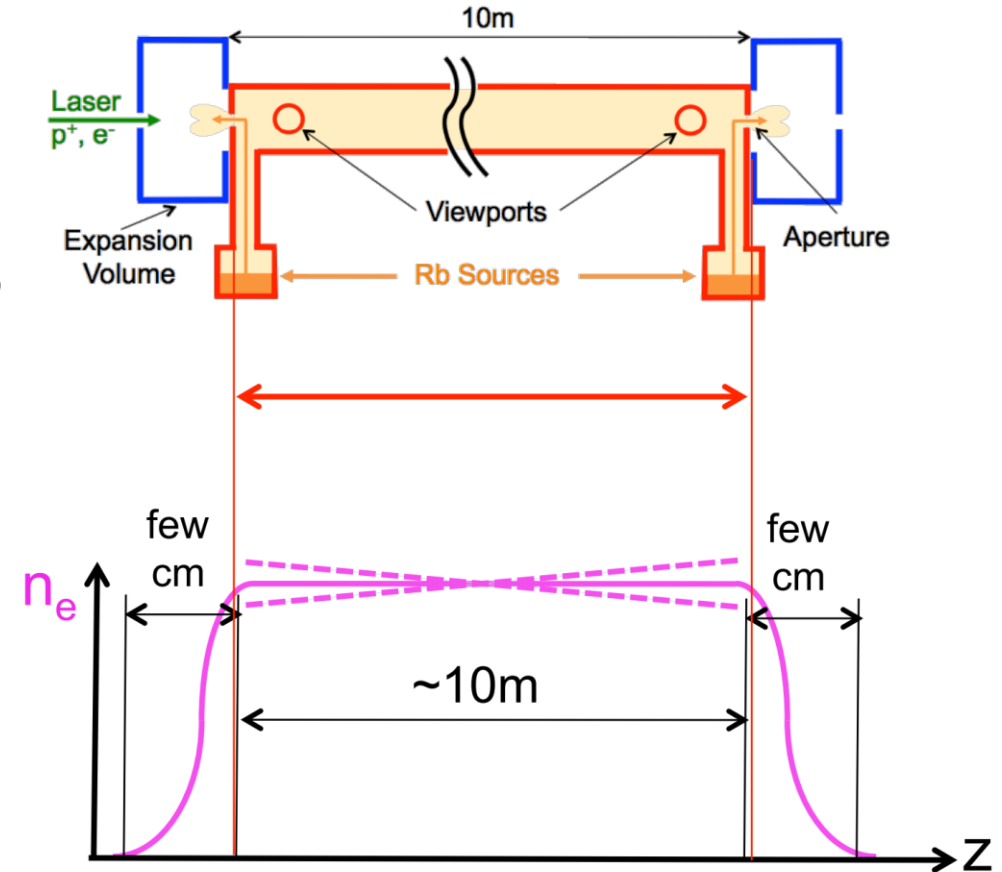
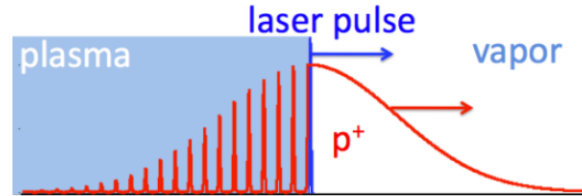
Laser
Field Ionization

- $n_e = n_{Rb}$
- Same for n_{Rb}
- $r_p > 1 \text{ mm}$

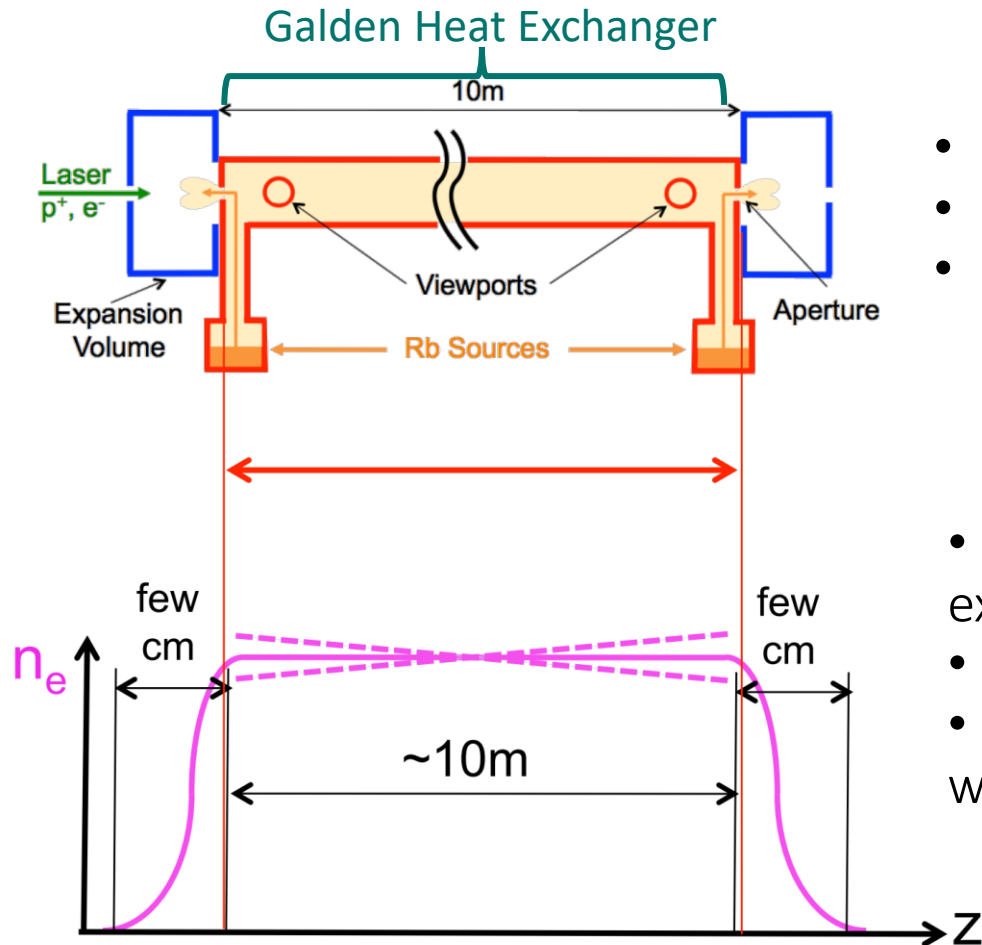
Pre-formed plasma



Partial Plasma



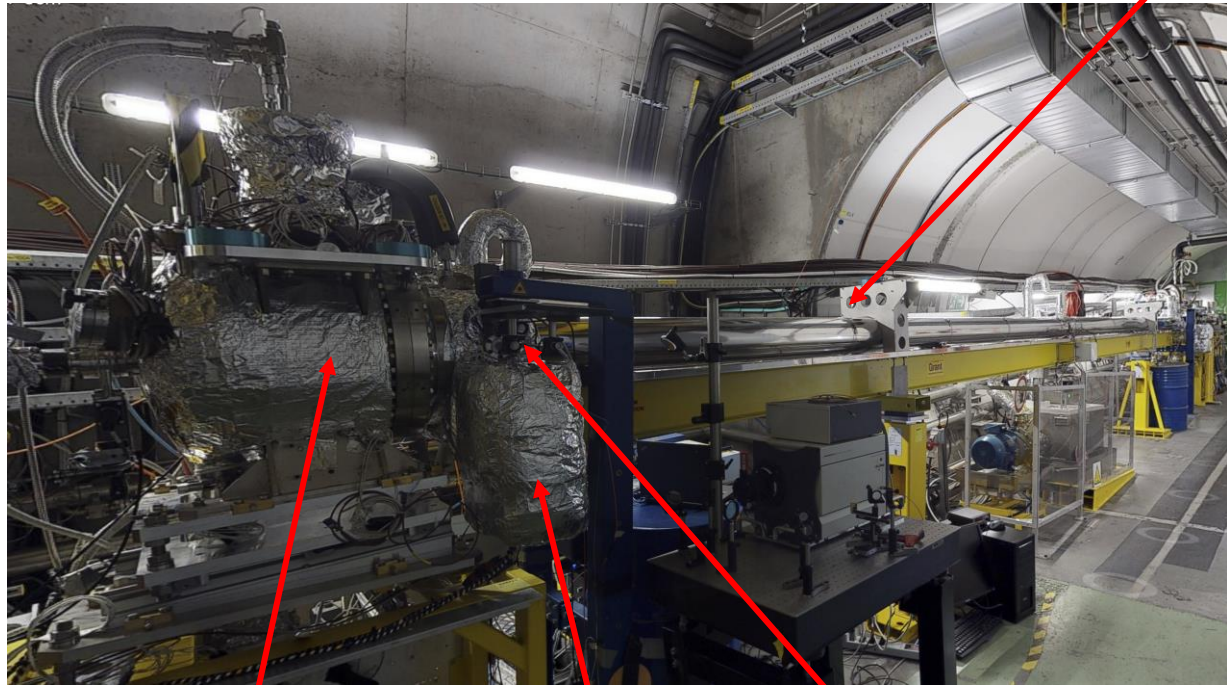
Present Plasma source



- Impose very uniform T : $\delta n_{Rb}/n_{Rb} = \delta T/T \leq 0.2\%$
 - $\Delta n_e/n_e$ $160 \leq T \leq 220^\circ C$ for $10^{14} \leq n_e \leq 10^{15} cm^{-3}$
 - Control n_{Rb} gradient with Rb source T
-
- Rb vapor expands into vacuum and sticks to cold walls of expansion volumes: short ramp
 - Scale lengths \sim diameter aperture: 1cm
 - n_{Rb} Rb measured at both end with $< 0.2\%$ accuracy using white light interferometry

Present Plasma source

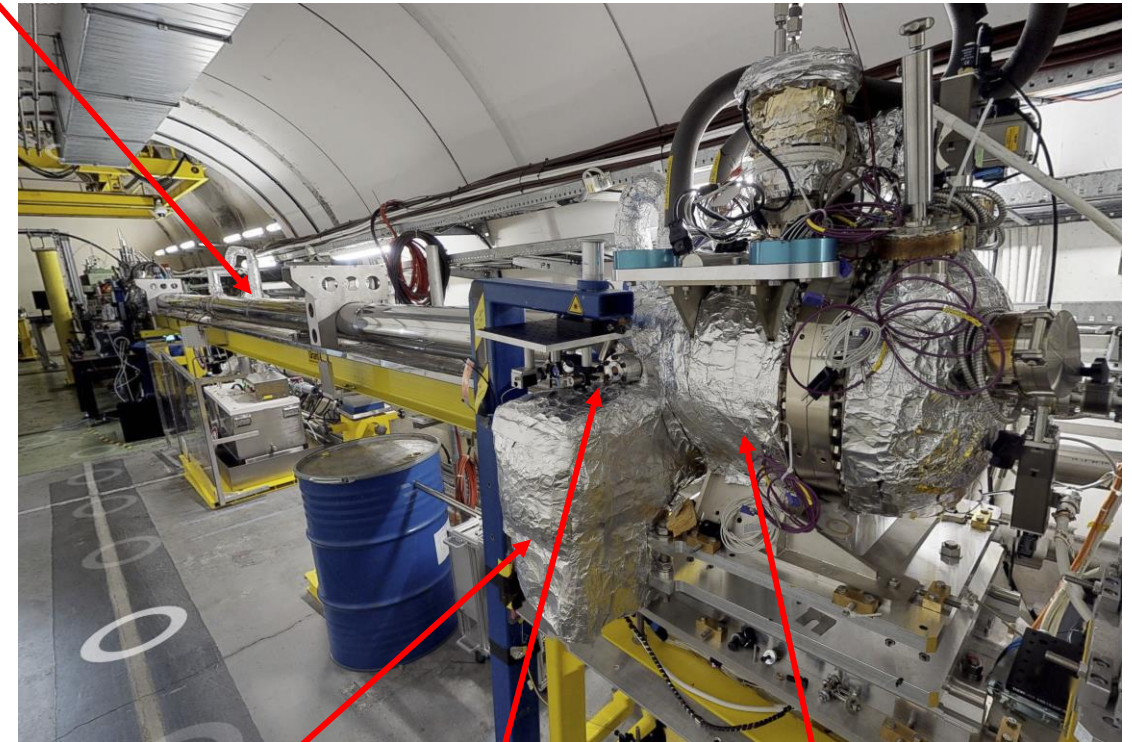
10 m Golden Heat Exchanger



DS Expansion Volume

DS Rb Reservoir

Density Diagnostic



US Rb Reservoir

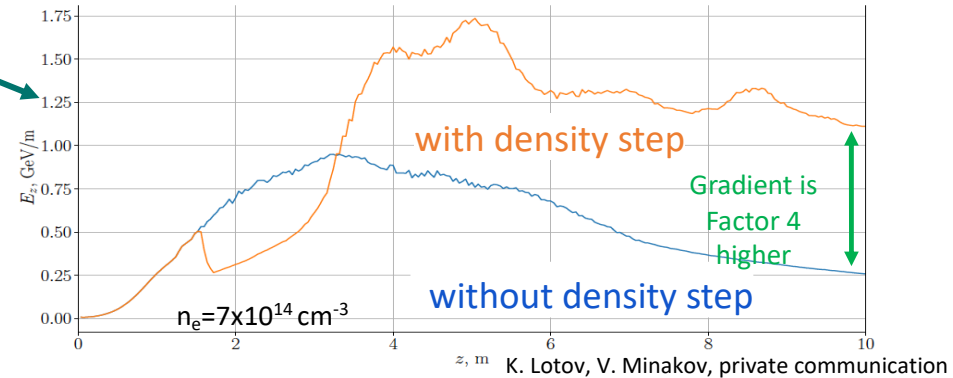
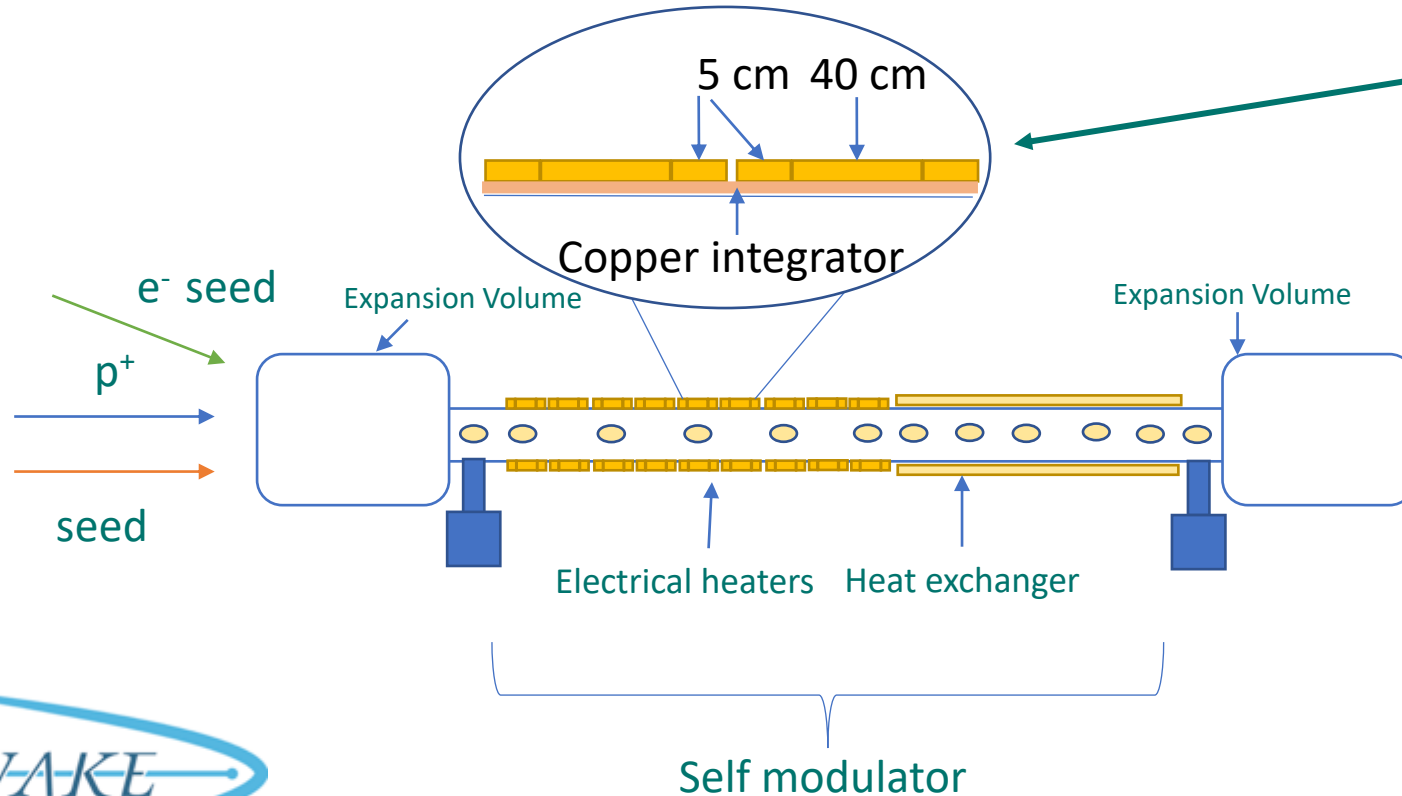
Density Diagnostic

US Expansion Volume

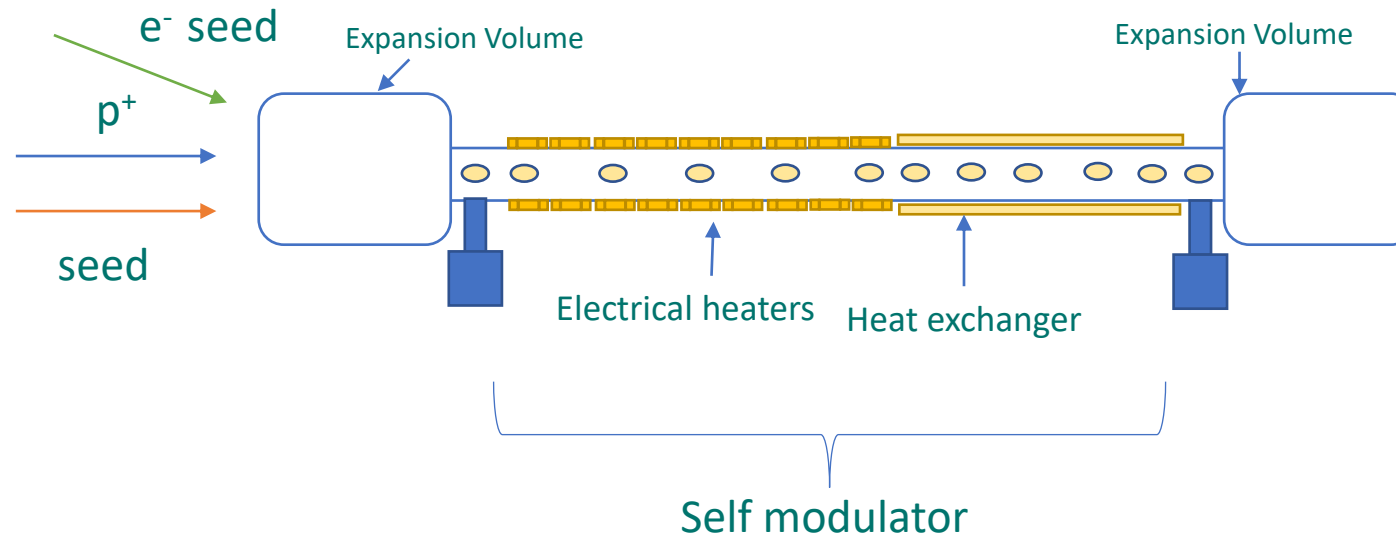


Run 2b Plasma Source

- Same requirements for Rb density uniformity and max value as for Run1 and Run 2a $\delta T (^{\circ}K)/T(^{\circ}K) \approx 0.2\%$
- Additionally have to implement a “sharp” (tens of cm) step from 1% to 10% $\delta T (^{\circ}K)/T(^{\circ}K)$ from 5 to 50°C



Run 2b Plasma Source



- Length: ~ 10 m
- Independent electrical heater of 50 cm from 0.25 to 4.75 meters
- 5.3m of golden heated section
- Step height up to $\pm 10\%$
- 10 diagnostic viewport, for plasma light + 3 for density diagnostic



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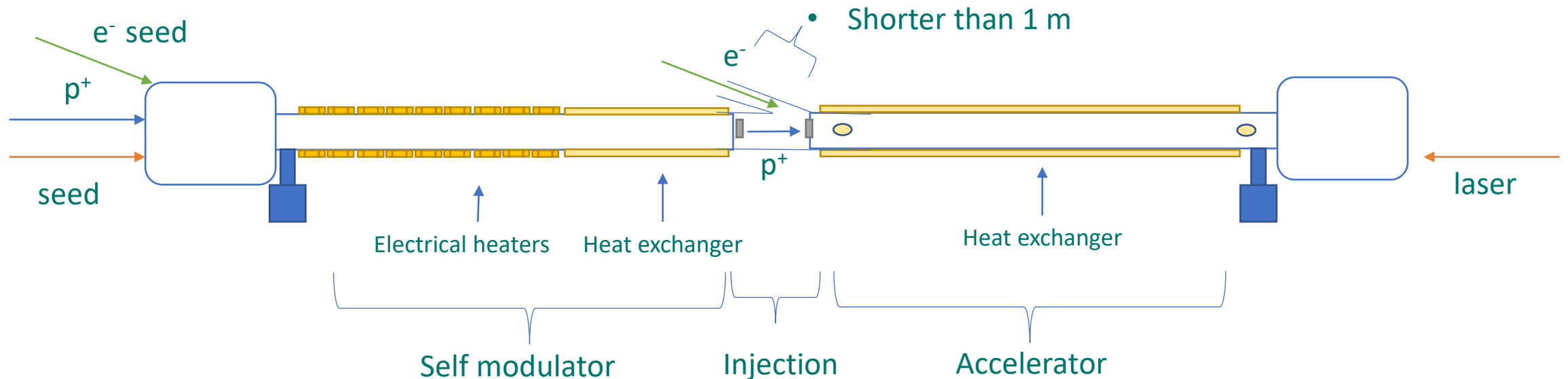
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*not to scale

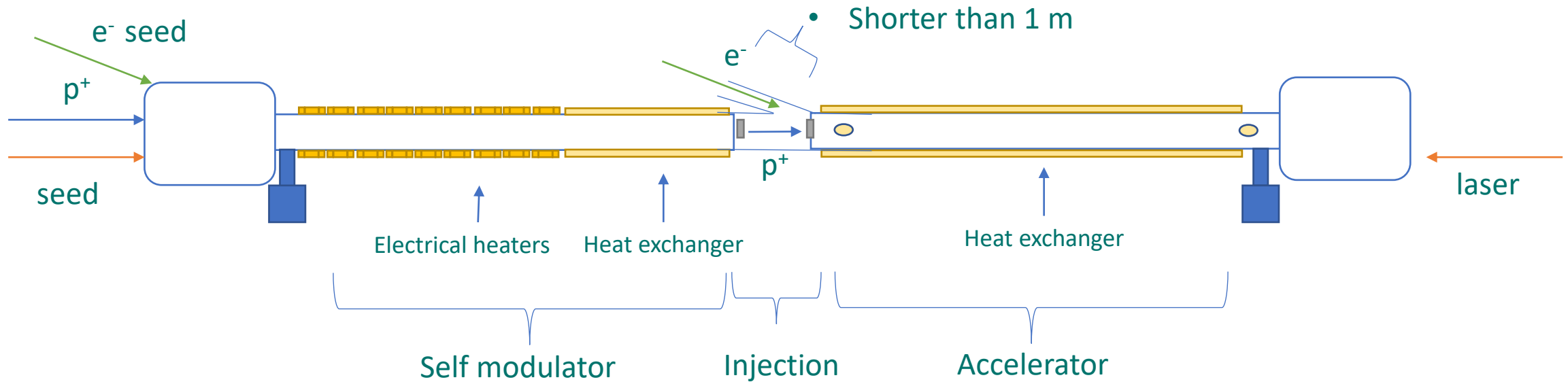


New plasma source Run 2c

- Addition of an accelerator module to the self-modulator from Run 2b
- Modular design to integrate to Run2b pre-existing Plasma source
- Run2c baseline accelerator module is Rb based plasma source
- Discharge source could be considered for the accelerator module



New plasma source Run 2c



- Length: ~ 10 m
- Independent electrical heater of 50 cm from 0.25 to 4.75 meters
- 5.3 m of galden heated section
- Step height up to $\pm 10\%$

- Length: 10 m
- Galden heating only
- Density measurement at two positions



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*not to scale



Thank you for your attention

