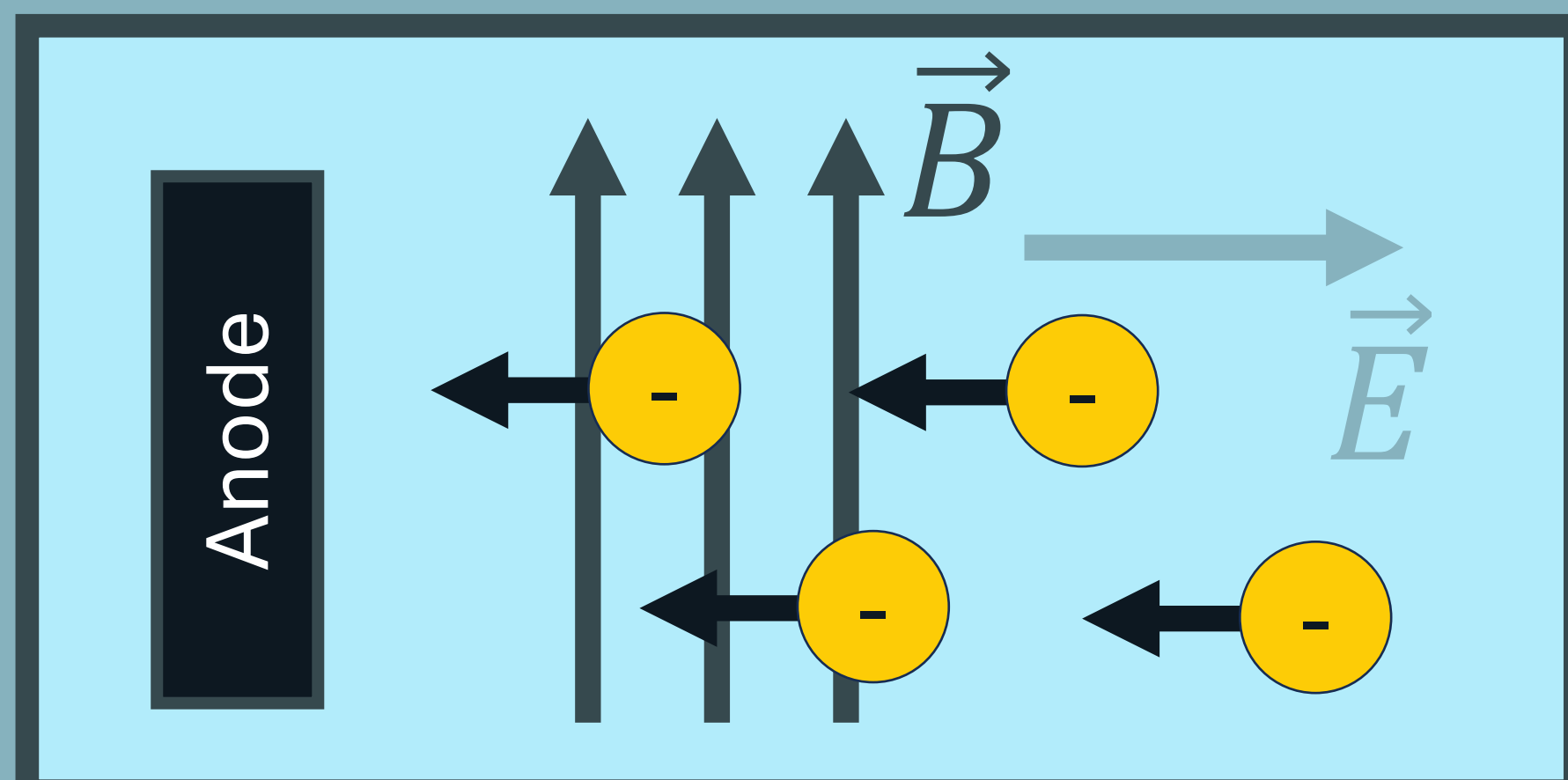
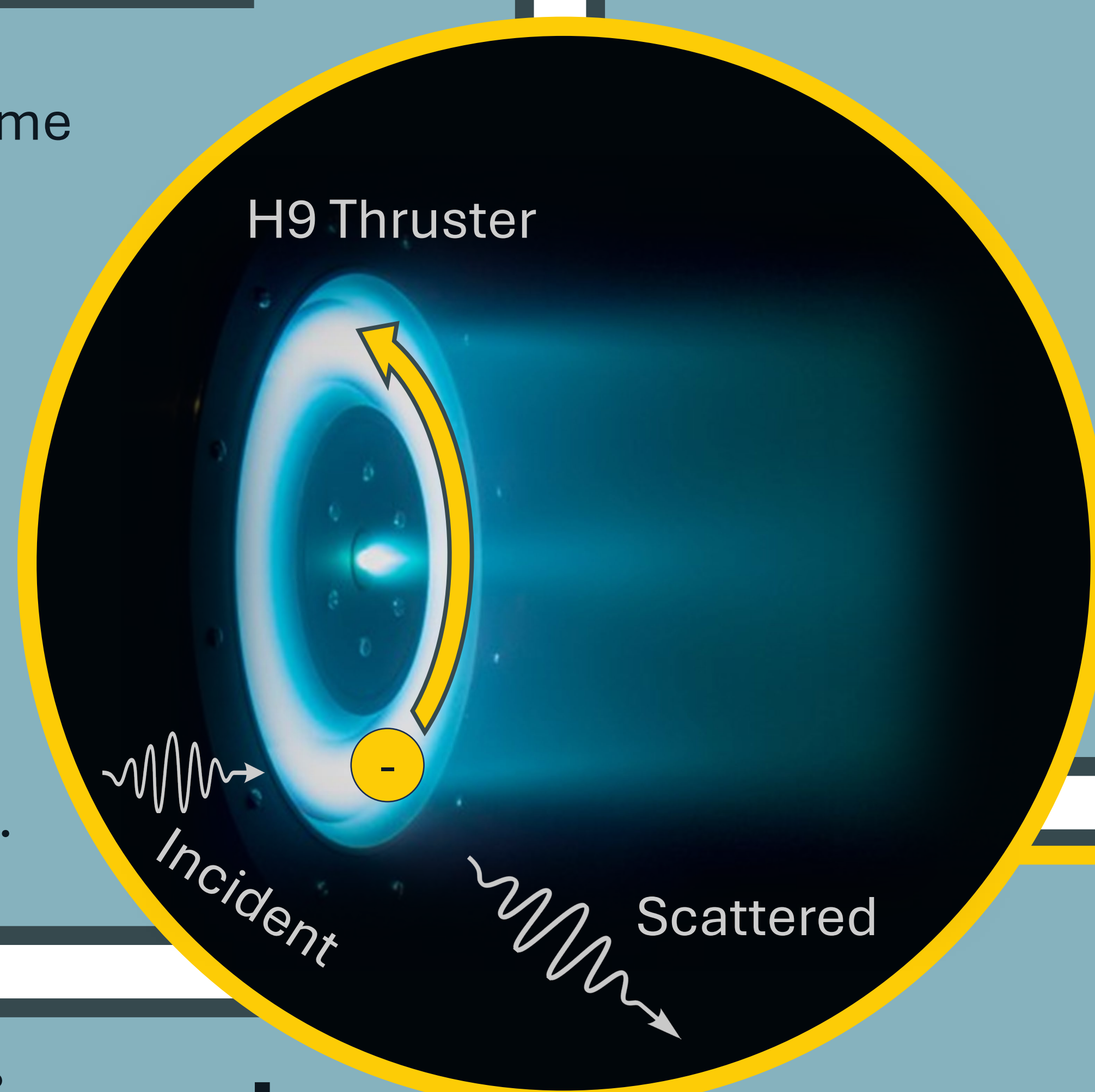


## Motivation

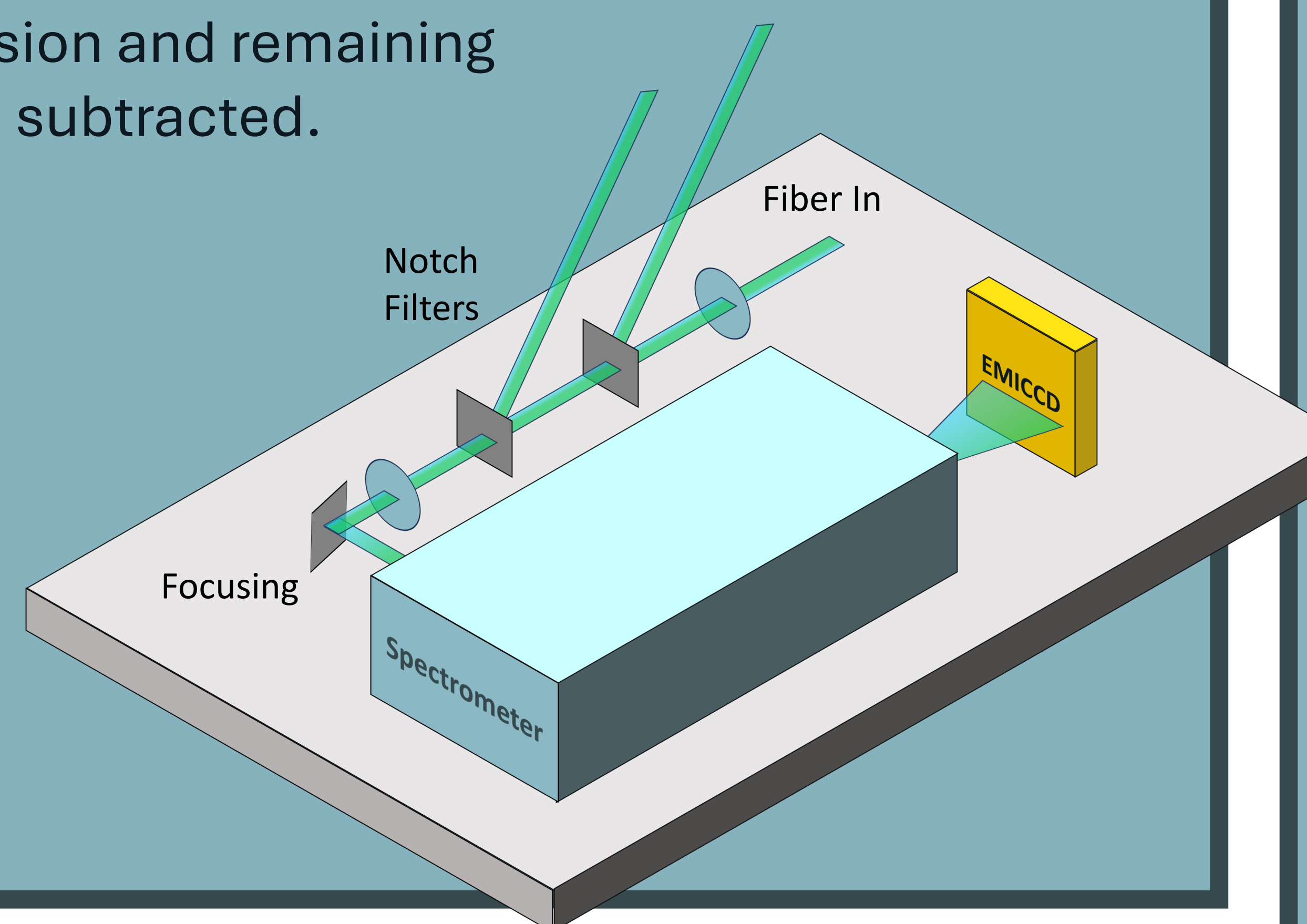


- Accurate performance and lifetime models are necessary for Hall thruster design.
- Cross-field electron transport in Hall thrusters is non-classical, preventing predictive models [1].
- Directly measuring the electron swirl (Hall drift) provides a way to infer collision properties that govern transport.

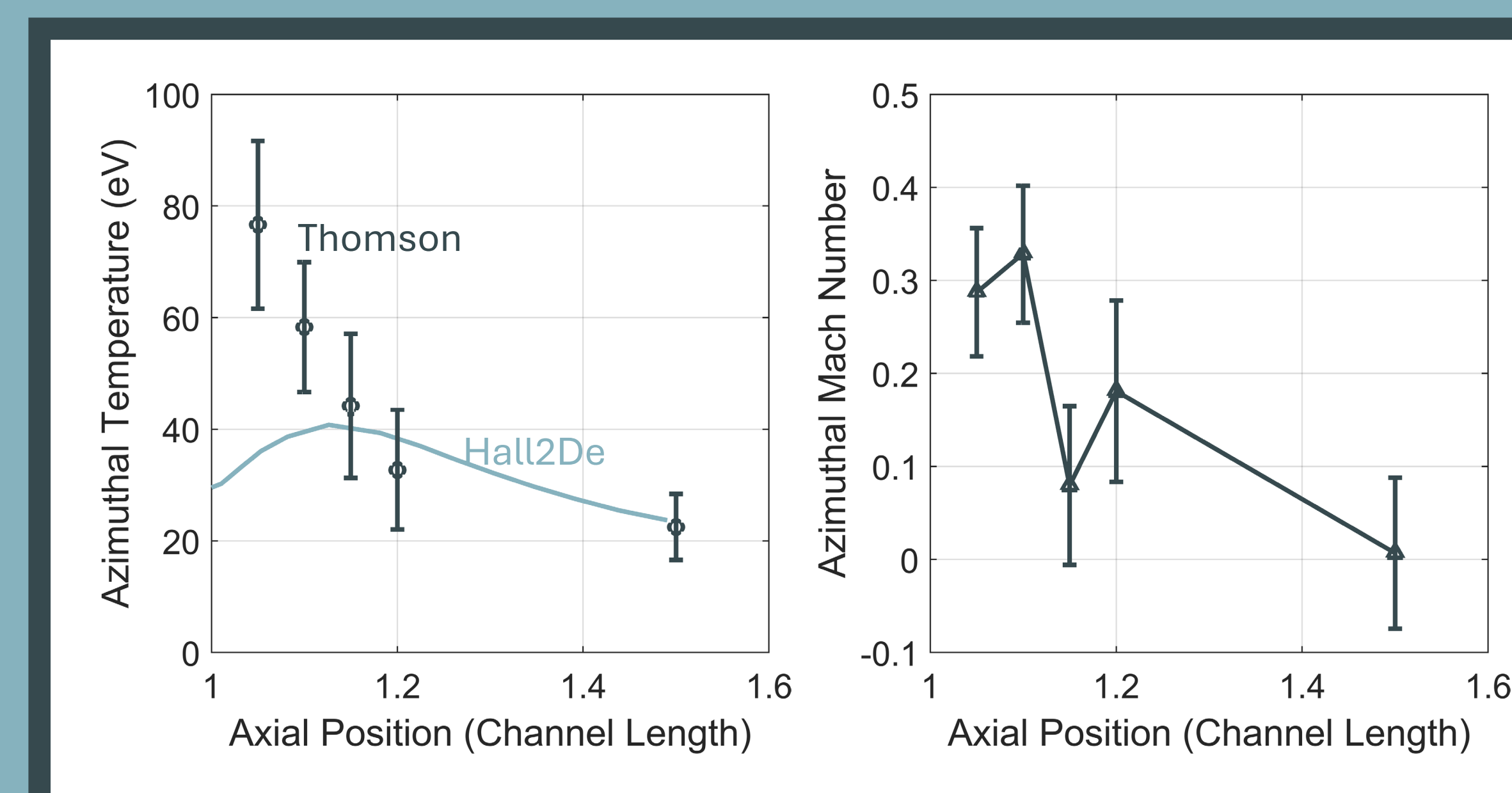


## Light Collection & Analysis

- An optical fiber routes scattered light to the detection apparatus.
- Bragg-grating notch filters reduce stray light [2].
- Photon-counting is applied over 6000 laser shots.
- Plasma emission and remaining stray light are subtracted.



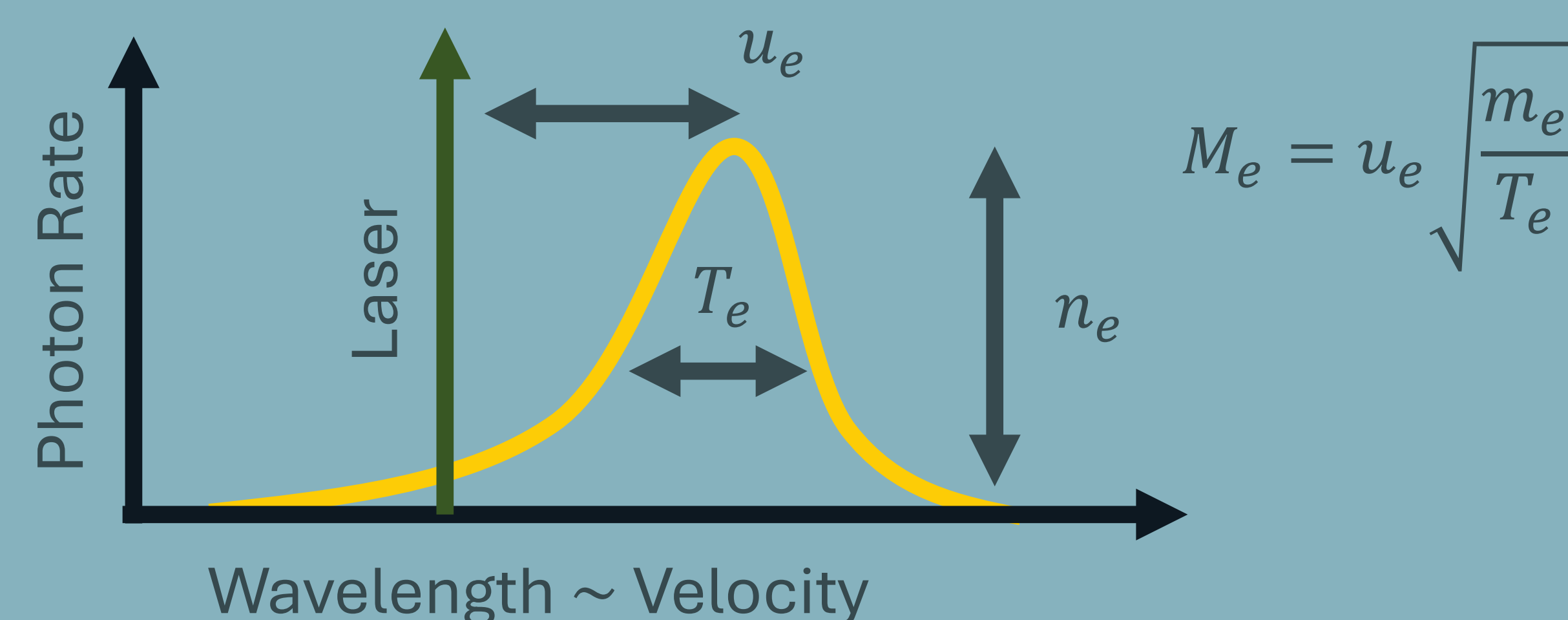
## Conclusions



- Temperatures agree downstream [3], but are high in acceleration region.
- Mach number projection approaches significant fraction in acceleration region.
- Future work:
  - Improve SNR and measure full azimuthal component of velocity.
  - Investigate oscillatory mode vs. large temperature values and assess isotropy.
  - Relate  $M_e$  to collision frequency to directly calibrate simulations.

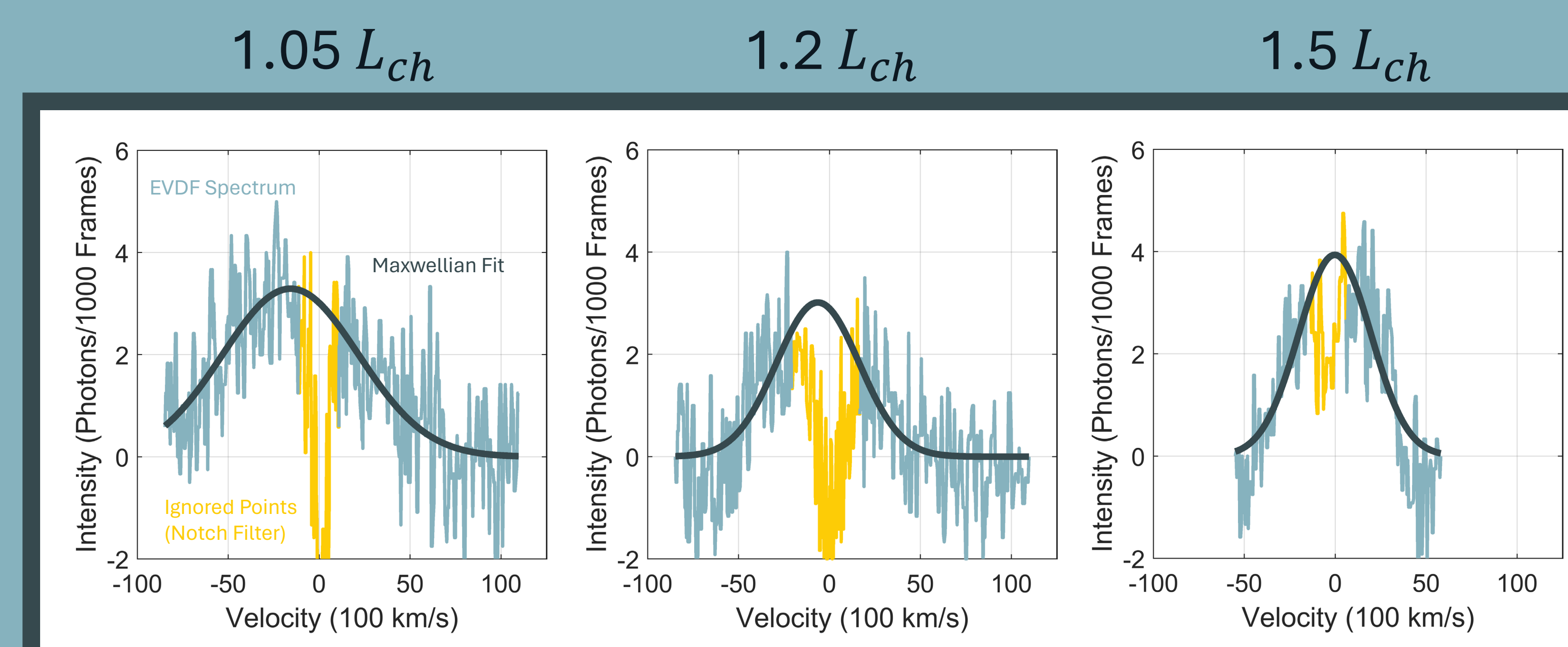
## Scattering Experiment

- We tested the H9 thruster on Kr at 300 V, 15 A in the Alec D. Gallimore Large Vacuum Test Facility.
- A 700-mJ Nd:YAG laser is focused to a 1-mm<sup>3</sup> spot on channel centerline.
- The spectrum of scattered light is representative of the electron velocity distribution, projected along a vector 45° between azimuthal/radial.



## Results

- Electron spectra reveal trends in heating and acceleration.
- Data agrees well with fits to Maxwellian distributions
- Electron drift and high temperatures in the acceleration region are observable.
- We take 1D moments to obtain fluid properties.



## Acknowledgements

- This work was supported by a NASA Space Technology Graduate Research Opportunity (Grant 80NSSC20K1229).
- We thank William Hurley for experimental assistance and Leanne Su for her work calibrating simulations.

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2. Vincent, B., Tsikata, S., Mazouffre, S., Minea, T., & Fils, J. (2018). *Plasma Sources Science and Technology*, 27(5), 055002.
3. Su, L. (2023). Ph.D. Dissertation, University of Michigan.