

# Impurity transport studies in HSX using laser blow-off

Santhosh Kumar

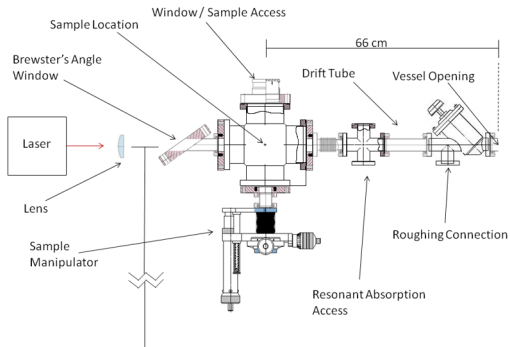
HSX Plasma Laboratory, University of Wisconsin-Madison, USA

CWGM2015, Warsaw



# A laser blow-off system has been built and tested in HSX

( C. Clark *et al.* )



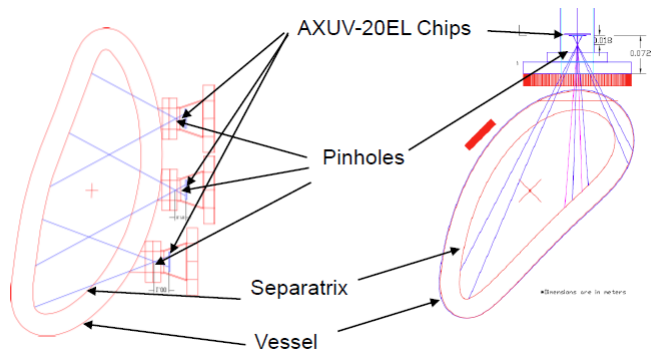
- 850 mJ Nd:YAG laser
- Up to 4 mm spot at  $7 \text{ J/cm}^2$
- Spot size adjustable by movable lens

## Experimental goals

- Inject a non-intrinsic impurity into HSX plasmas.
- Measure the resulting radiation using photodiode arrays.
- Invert the chord measurements into emissivity profile for further modeling and comparison.
- Determine the impurity diffusivity and convective velocity using the STRAHL code.
- Compare these findings with the neoclassical model.

# Photodiode arrays are used to measure total impurity radiation

- Five, 20 channel detectors have been installed on HSX
- Each detector views the plasma through a  $\sim 1$  mm pinhole to achieve spatial resolution

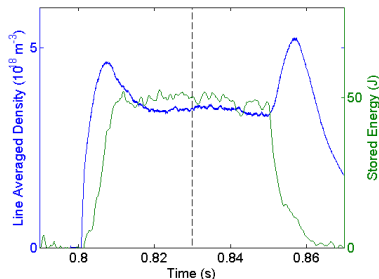
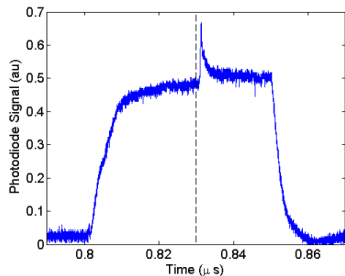


# Aluminum has been successfully injected into HSX discharges, without perturbing the main plasma

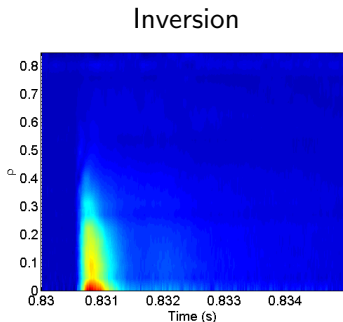
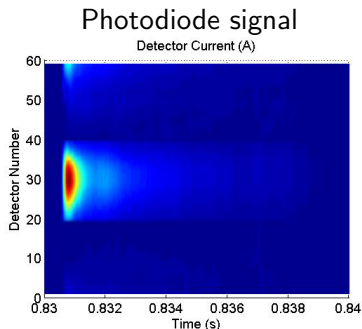
Injections are typically performed with:

- 2  $\mu\text{m}$  aluminum layer over a 10 nm chromium layer
- 2mm diameter laser spot

$\tau_Z \sim 2.3$  ms



A code has been developed to invert the photodiode signals into an emissivity profile



The impurity injection is found to produce a peaked emissivity profile.

## Summary so far

- Aluminum has been injected into HSX discharges
- Five, 20 channel AXUV pinhole cameras have been constructed and installed
- Data from the pinhole cameras has been used to infer an emissivity profile of the AI

# Status and moving forward

- Project has been delayed, but a new student has picked up recently.
- The laser blow-off system is functional, experiments will resume soon.
- Help with STRAHL will be appreciated.
- HSX could provide significant contribution to the Stellarator impurity transport database.
  - Variation of  $\tau_Z$  with ECRH power,  $n_e$ ,  $Z$  etc.
  - Impurity transport in optimized and conventional stellarators.
  - Comparison with various transport codes.

We welcome collaborations.