The real time multi point Thomson **NSTX-U** scattering diagnostic at NSTX-U

<u>F. M. Laggner¹, E. Kolemen¹, A. Diallo², B. P. LeBlanc², R. Rozenblat², G. Tchilinguirian², and the NSTX-U Team</u> ¹Princeton University, Princeton, New Jersey 08544, United States, ²Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, United States

1. Motivation

- Thomson scattering (TS) is a key diagnostic at the National Spherical Torus eXperiment Upgrade (NSTX-U):
 - Electron density (n_e) and electron temperature (T_e) profiles measured at 42 spatial positions
 - \rightarrow Access to the electron pressure (p_e) profile
 - Currently available after post discharge analysis
- Real time (rt) availability would be beneficial for:
 - Rt equilibrium reconstruction (rt-Efit) with pressure constraint
 - Rt profile availability for control purposes [1]:
 - \rightarrow ELM control (timescale ~ 10 ms)
 - \rightarrow Transport (timescale > 10ms)
 - \rightarrow Resistive wall mode (timescale ~ 1 ms)
- Rt-upgrade of the existing TS system at NSTX-U requires:
 - Rt capable data acquisition (hardware)
 - Rt TS analysis (software)
 - \rightarrow Similar rt TS system previously implemented on DIII-D [2]

2. Thomson Diagnostic Setup at NSTX-U [3,4,5]

dump

focused rays

Far-edge in MPTS viewing

NSTX-U center stack

Old beam pat

- Currently 2 Nd:YAG lasers
 - Total repetition rate ~60 Hz
 - Horizontal beam path crossing the plasma from / low field to high field side passing the center stack
- 42 fibers collecting the scattered light
 - Spherical mirror focuses on fiber bundles
- Polychromators and avalanche photodiode (APD) detectors [6] for spectral analysis
 - 32 polychromators with 6 filter & APDs
 - 10 polychromators with 4 filter & APDs
- Boundary conditions for rt-upgrade
 - Old system should be unaffected \rightarrow Data access should be unaffected
 - Additional laser with burst capability [7]:
 - \rightarrow 60 Hz repetition rate will increase to 90 Hz
 - \rightarrow Fast burst mode up to 10 kHz

This work was supported by the U.S. Department of Energy under DE-SC0015878 and DE-SC0015480. NSTX-U is sponsored by the U.S. Department of Energy Office of Science Fusion Energy Sciences



<u>corresponding author:</u> flaggner@princeton.edu





59th Annual Meeting of the APS Division of Plasma Physics, Milwaukee, October 25, 2017, PP11.00068

