Abstract
Magnetic reconnection in MST generates a non-Maxwellian and anisotropic population of energetic ions. Neutral particle analysis shows a fast deuterium ion tail out to the diagnostic limit of 5 keV, and the measured neutron flux indicates that ions with higher energies must exist.

A recently installed Advanced Neutral Particle Analyzer (ANPA) is capable of simultaneously measuring hydrogen and deuterium ions with energies up to 30 keV. Hydrogen beam ions are observed up to the nominal beam injection energies, and deuterium ion energies up to 25 keV are observed after magnetic reconnection events. ANPA signal levels are dependent on the background neutral density n_0, calculated from D_2 emission and NENE Monte Carlo computations. Neutron flux measurements, which are less sensitive to n_0, are in conjunction with the ANPA signals to constrain the time behavior of the fast ion distribution. The current ANPA viewpoint primarily samples ions with high v_perp; a tangential view will be installed to sample ions with high v_parallel and Fokker-Planck modeling will be used to reconstruct the energetic ion velocity space. Work supported by US DOE.

Motivation: Previous ions studies in MST
- Reconnecting magnetic field energizes ions, but mechanism not well understood
- The heating rate is very large (3-10 MeV/ns) and too quick to be collisionally relaxed (s<100 µs)
- Anisotropy observed in impurity heating; impurities hotter than bulk ions
- Fully-developed magnetic turbulence is required for ion heating (i.e., m<) is a necessary condition
- Bulk heating efficiency scales as m^2
- Previous measurements show a fast ion tail fitting a power law spectrum
- D-D neutron measurements indicate an ion population with even higher energies (>20 keV)

See posters 82-83 and S. Kumar’s talk, Weds. Session A12

Diagnosis of ions in MST
Thermal and impurity ions
- CHERS -> impurity ion temperature, charge state distributions
- Rutherford scattering analyzer -> bulk ion temperature
Energetic ions
- Neutron scintillator -> D-D neutrons indicative of energetic ion population
- Neutral Particle Analyzers -> ion energy spectra
- ANPA measures 0.5-6 keV ions
- ANPA monitors 10-20 keV ions with H/D mass separation

Neutral Beam Injector
- 1 MW source of 25 keV ions (97% H, 3% D), 20 ms pulse length

See posters 79-84 and D. Liu’s talk, Weds. Session P04

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