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NSTX

# MSE Status and Results from XP522

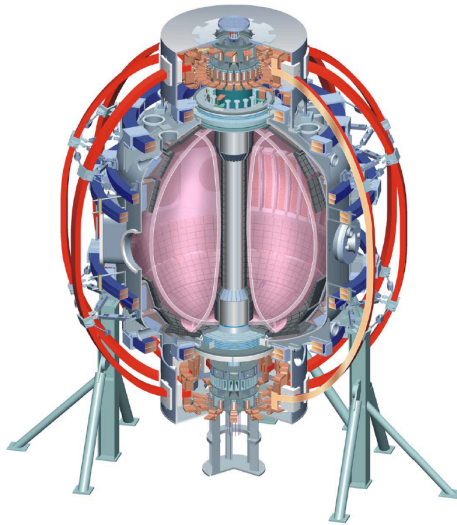
**F. M. Levinton, and H. Yuh**

**NSTX Results Review**

Dec 12-13, 2005

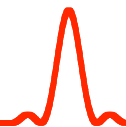
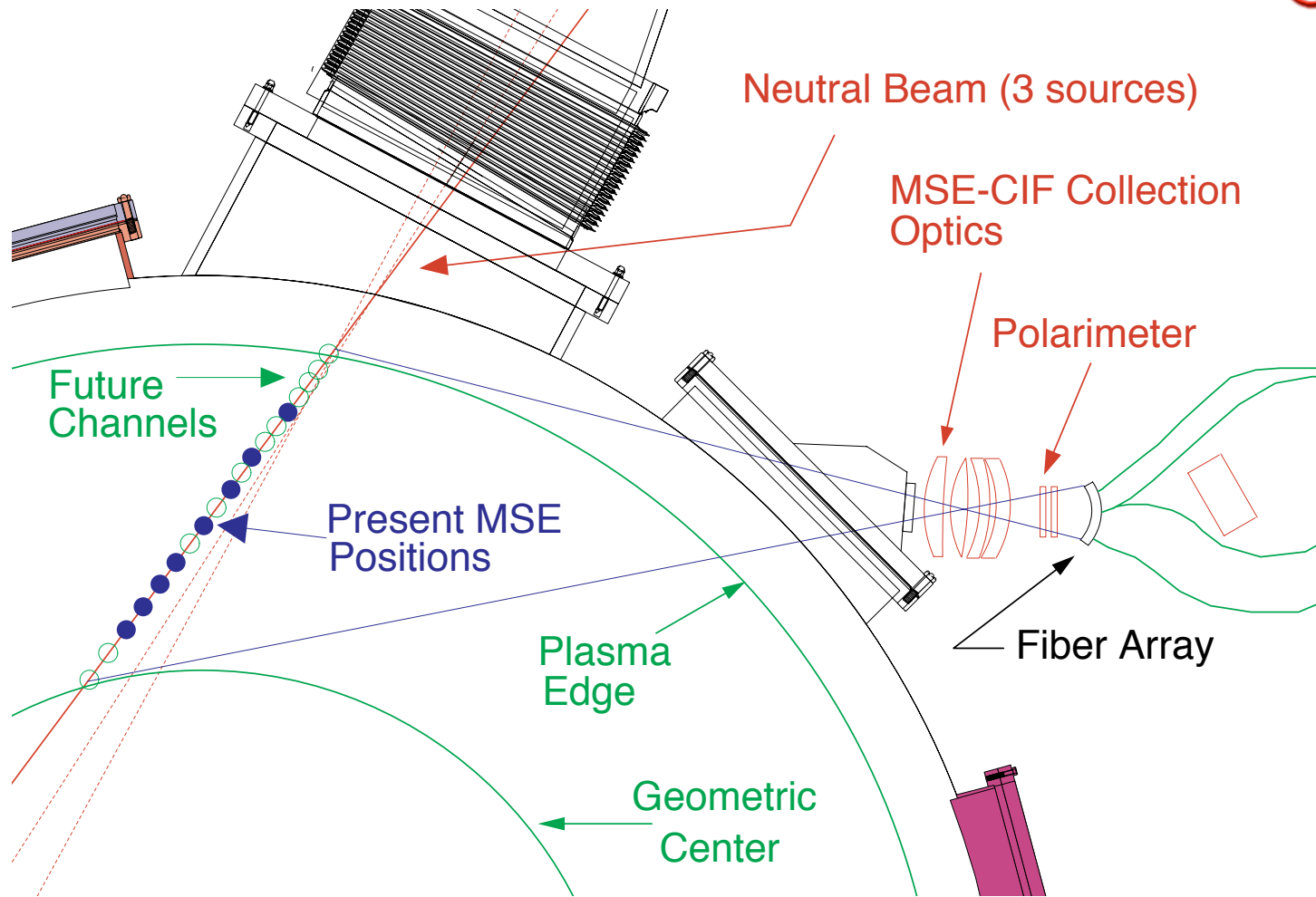
Princeton, NJ

College W&M  
Colorado Sch Mines  
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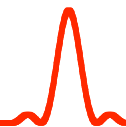
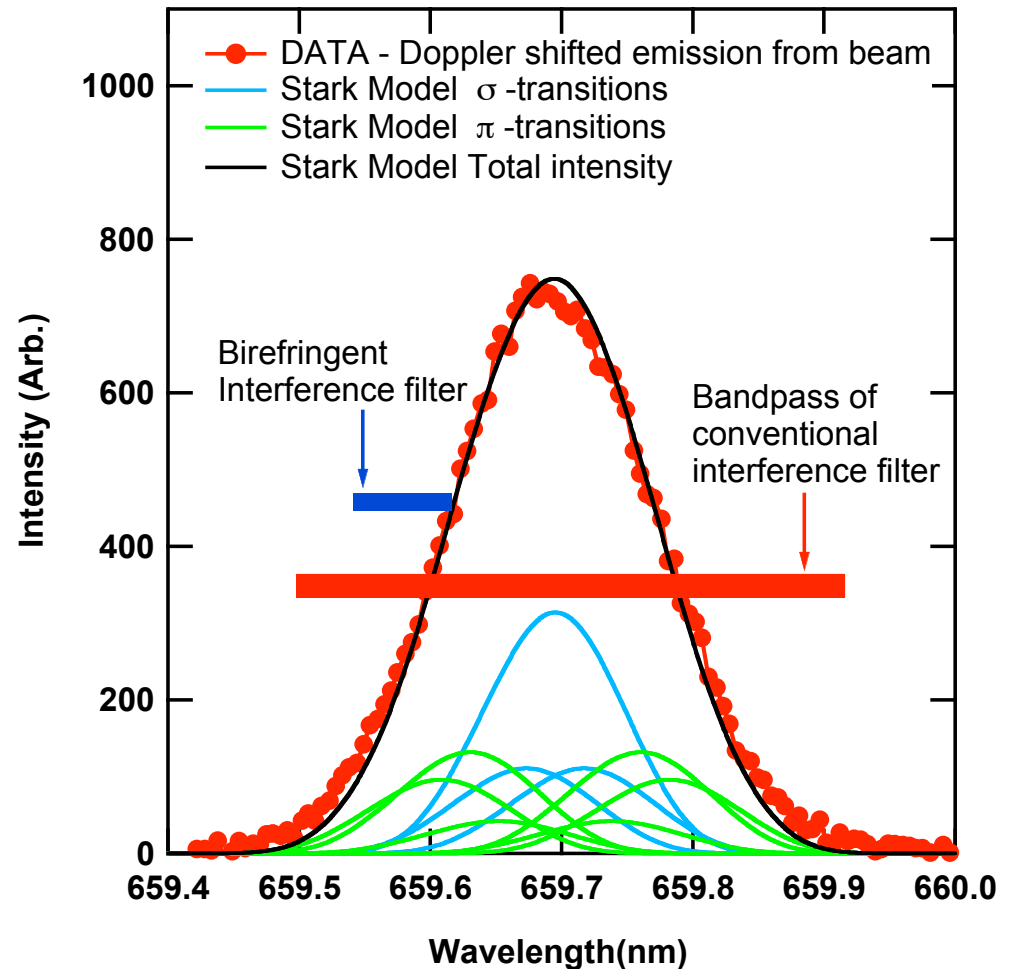
# MSE-CIF Layout on NSTX



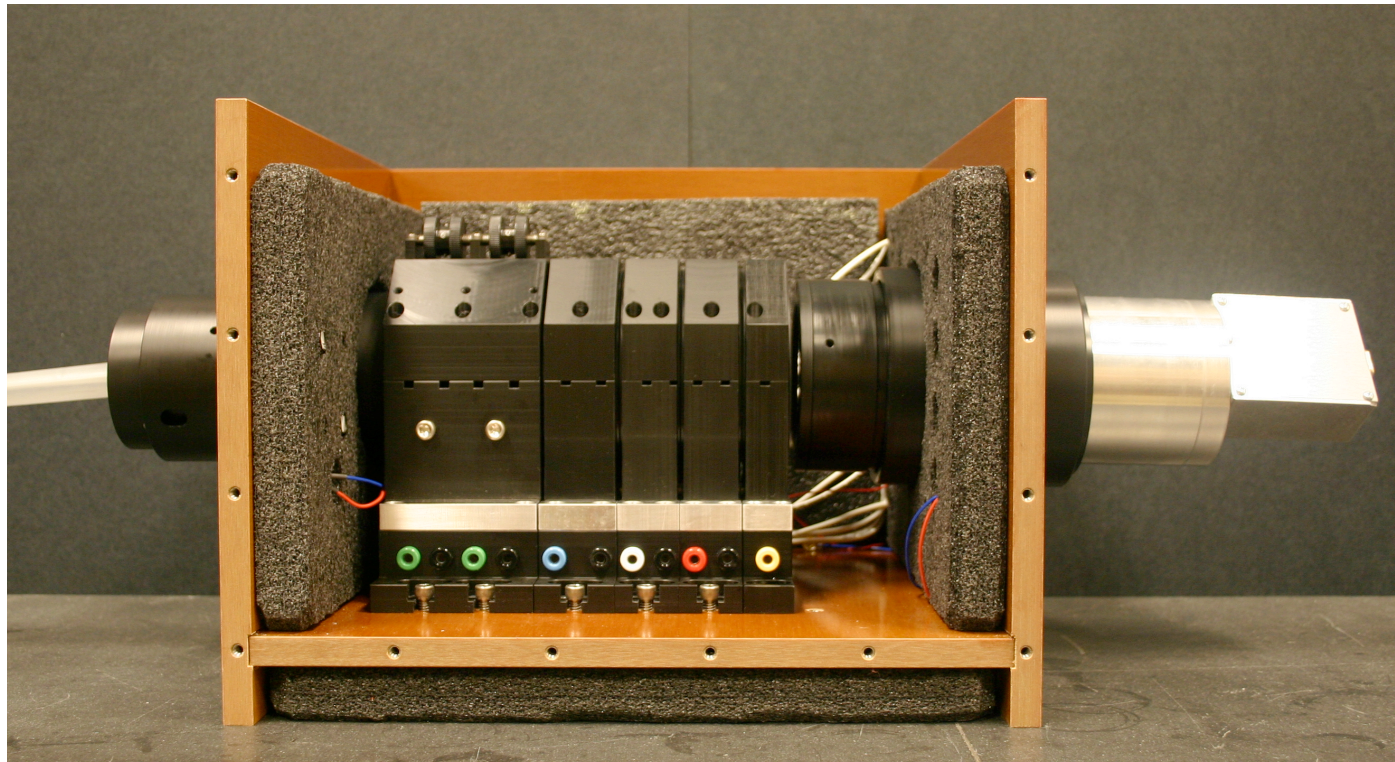
# MSE Issues at Low Magnetic Field



- High resolution spectrum of Doppler shifted beam emission.
- At low magnetic field overlap of Stark multiplet results in low polarization fraction with conventional filter.
- Novel birefringent filter with narrow bandpass can isolate a portion of the spectrum resulting in a much better polarization fraction (~40%).



# Novel Birefringent Interference Filter Developed for NSTX

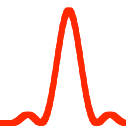
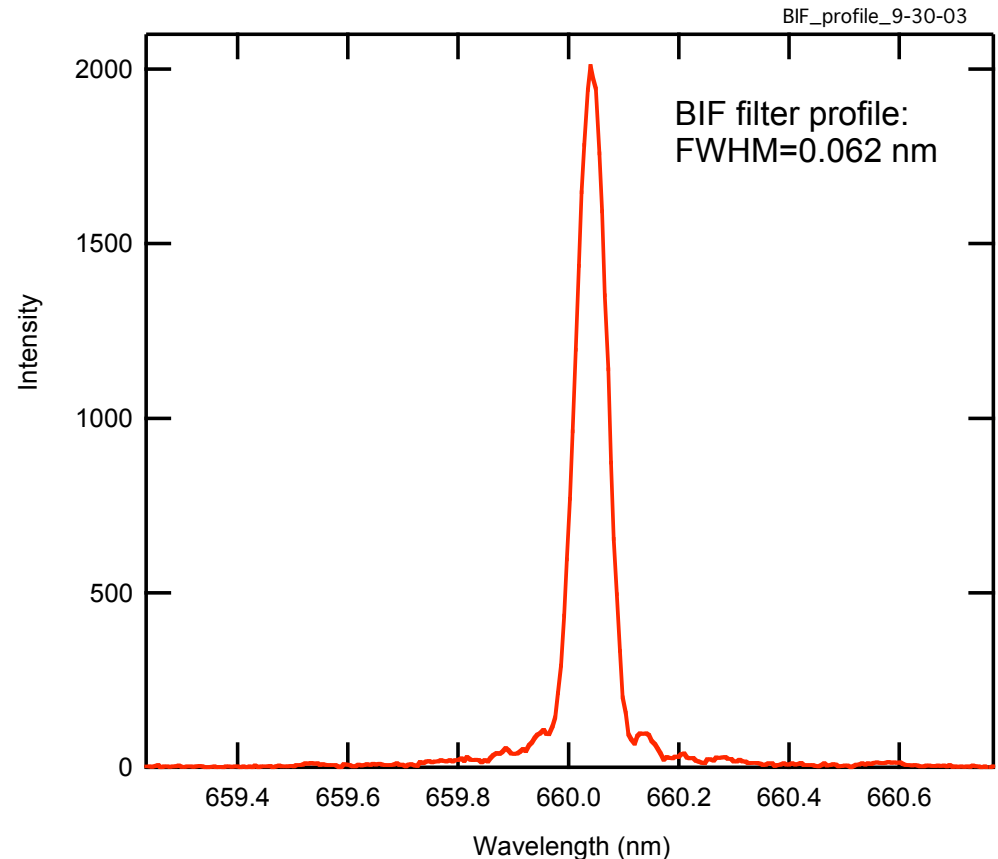


- Modular filter has a 75 mm clear aperture, wide field of view, narrow bandwidth, and is electro-optically tunable.

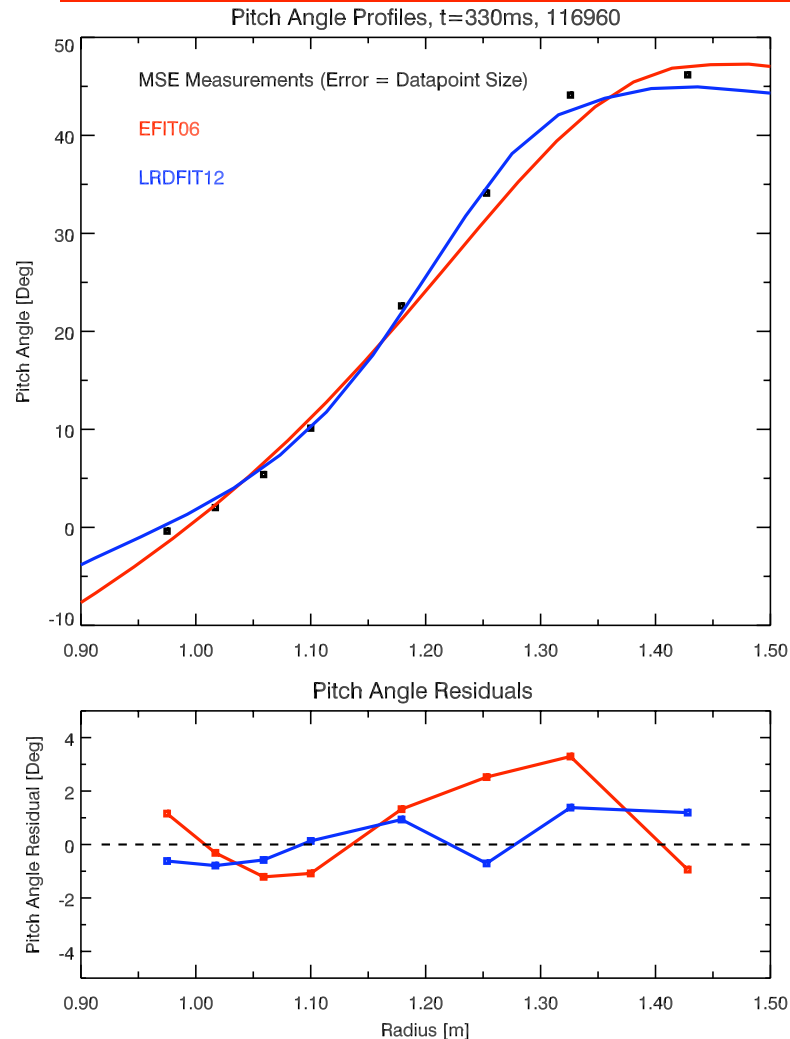
# Birefringent Filter Development for NSTX



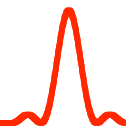
- Novel high throughput, narrow passband filter makes measurements with MSE at low field possible.
- Overall design has resulted in a polarization fraction greater than 40% .
- Achieved good time resolution (~5-10 ms).



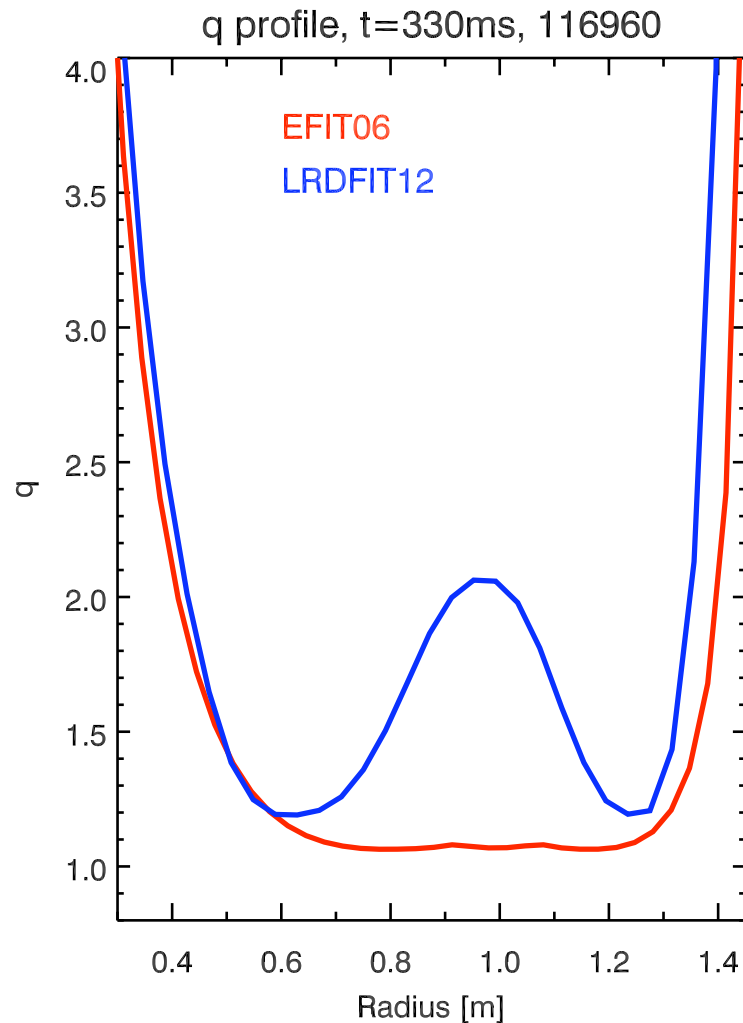
# Equilibrium Reconstruction with MSE



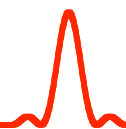
- Equilibrium reconstruction from LRDFIT and EFIT.
- Reconstruction uses  $E_r$  corrected MSE data, but fit residuals are far outside the error bars, especially from EFIT.
- This has a large effect on  $q$ -profiles.



# Equilibrium Reconstruction with MSE



- Poor fit.... Results in a large difference in q-profile.



# MSE Er Correction



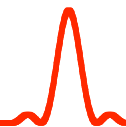
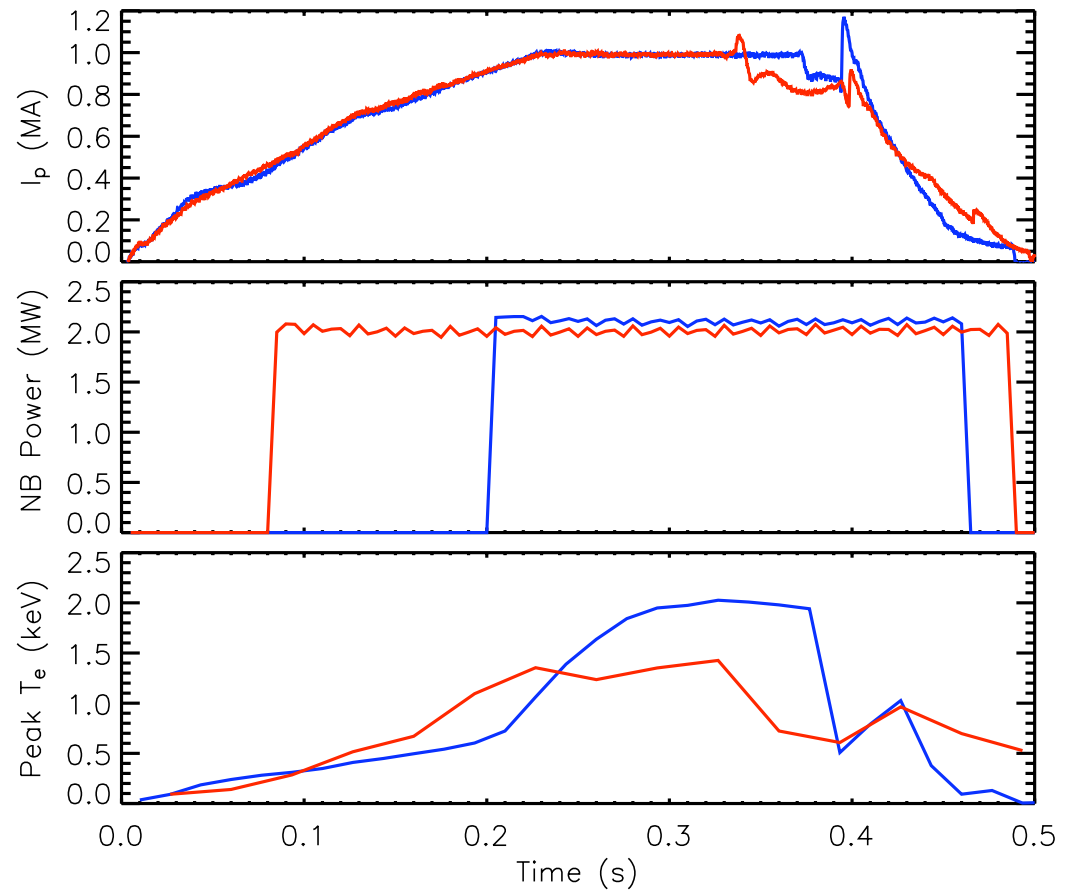
- For the plasma core region the toroidal flow velocity from CHERS is utilized.
- For the edge region we plan to use the MSE-LIF diagnostic, which is presently being developed and the poloidal CHERS, which someday may be installed on NSTX.



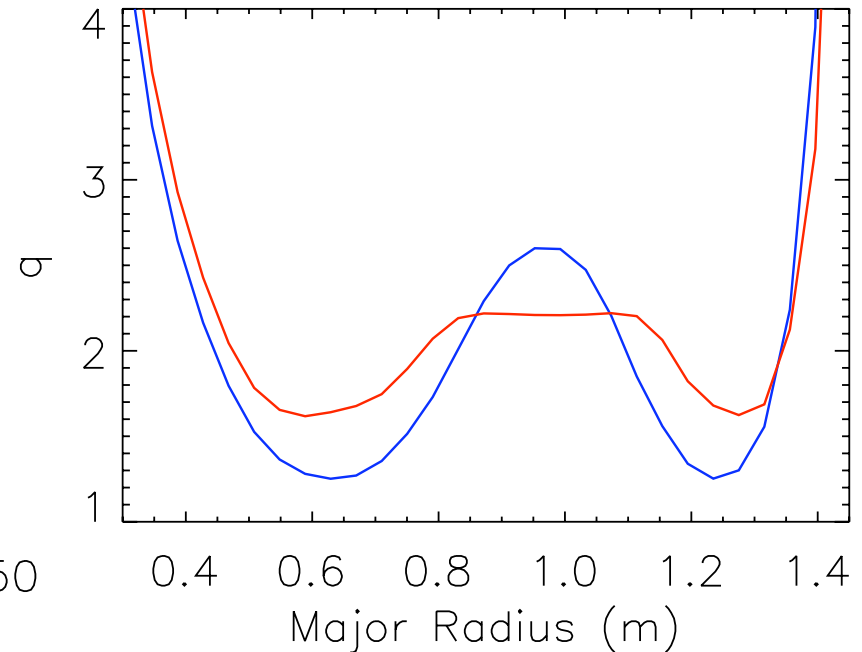
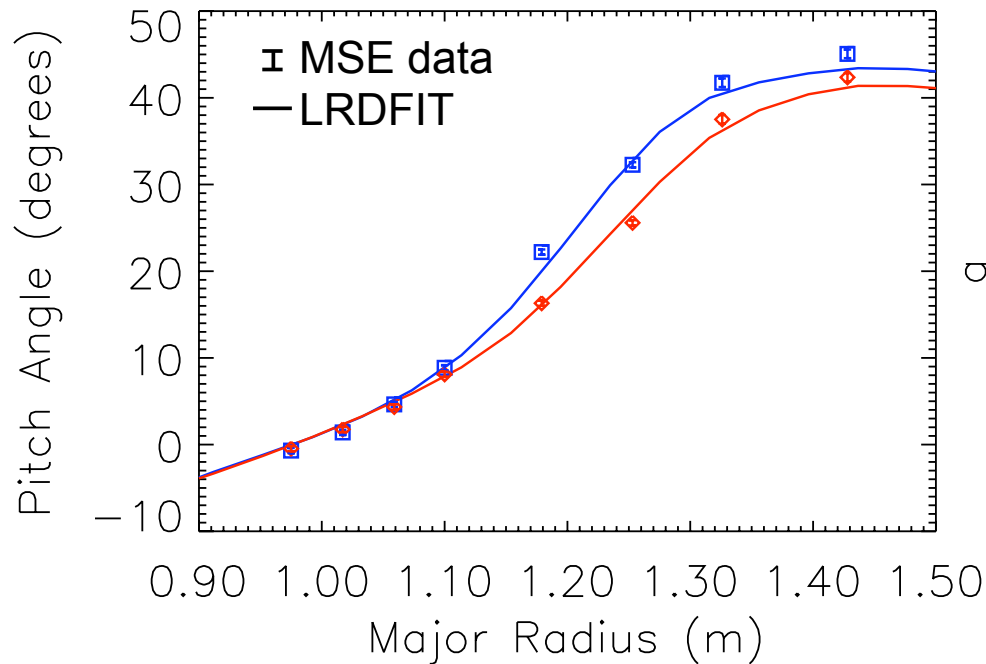
# Transport Dependence on Varying Magnetic Shear



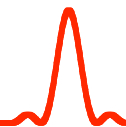
- Development of robust reversed shear startup.
- Varied  $I_p$  ramp rate, NBI timing, plasma shaping, and gas fueling.
- Plasma is L-Mode and MHD quiescent.



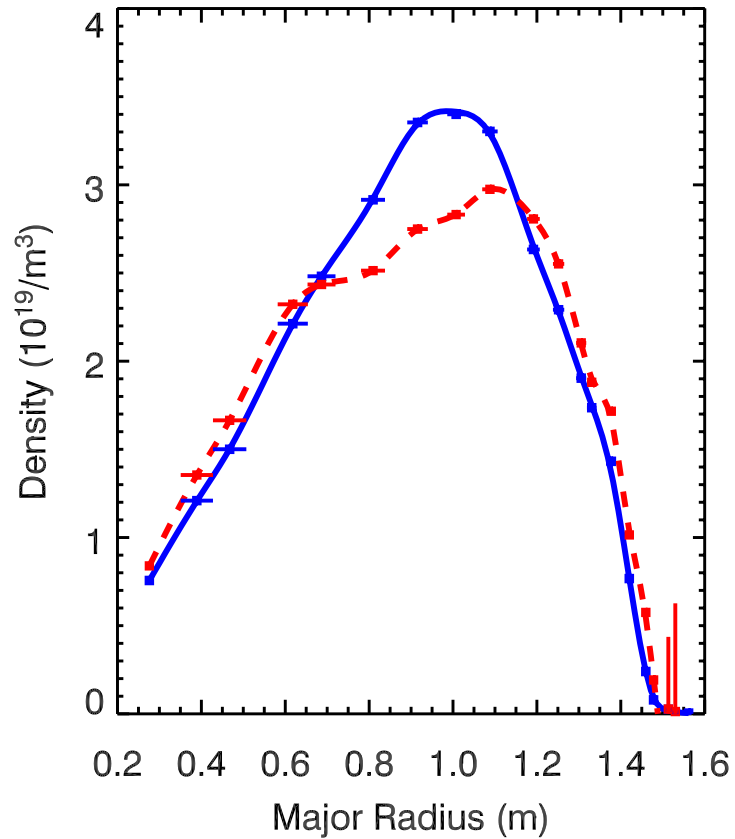
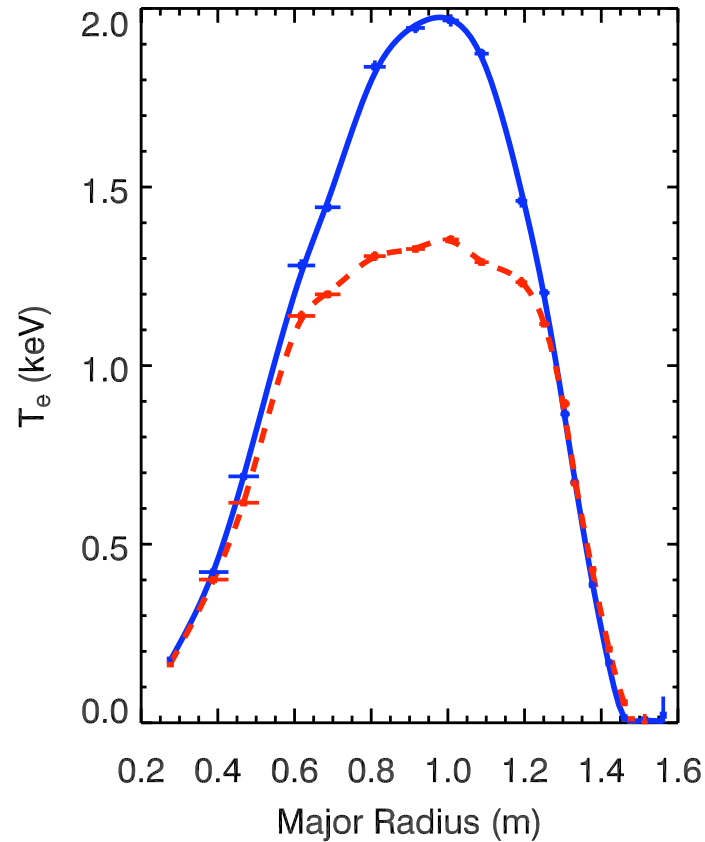
# q-profiles Developed with Varying Magnetic Shear



- Variation of pitch angle and q-profile with NBI timing.
- q-profiles from equilibrium reconstruction with LRDFIT.



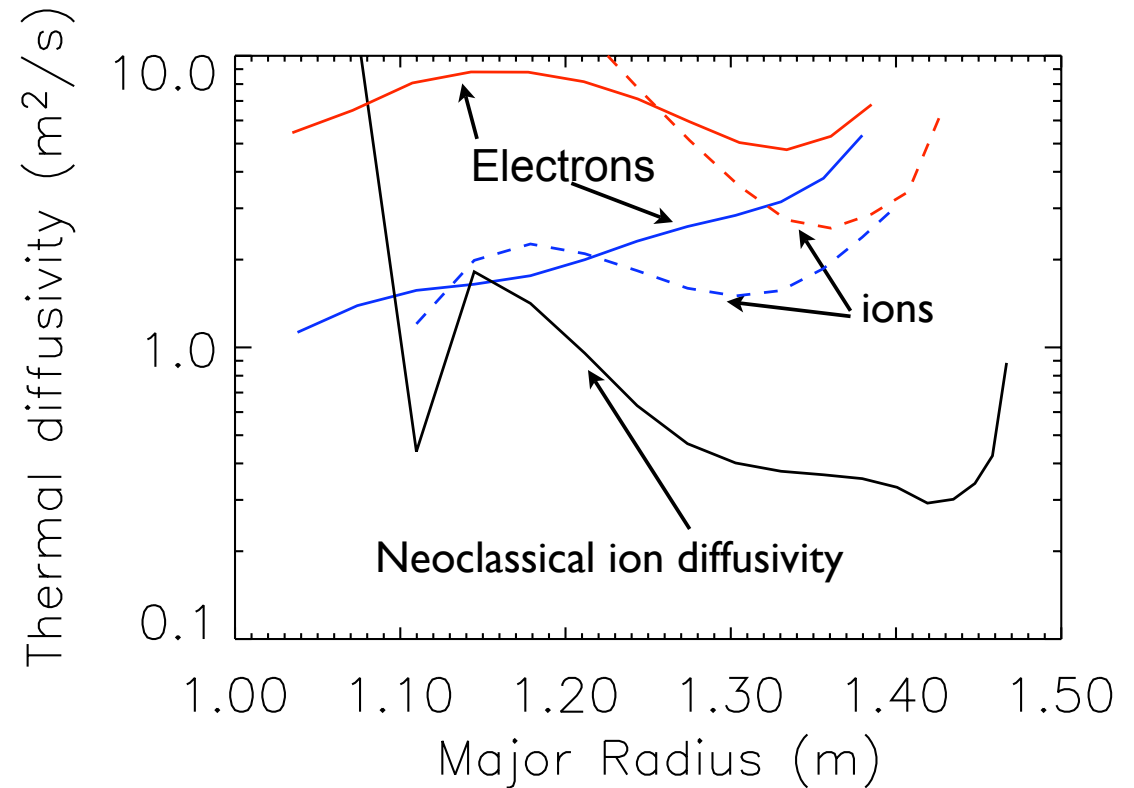
# Discharge with Larger Reversed Shear has Higher Electron Temperature



# Larger Reversed Shear Case has Better Transport



- Blue curves, with larger reversed shear region, have lower electron and ion thermal diffusivities.



# Summary



- The MSE-CIF diagnostic on NSTX presently has 8 channels operational with 19 available for future upgrade. The plan is to add four additional channels for 2006 campaign.
- Novel tunable birefringent interference filter design working well. Makes MSE measurements possible at low magnetic field.
- Good progress made toward development of q-profiles with a wide range of magnetic shear for transport studies.

