Run Summary of the FIReTIP on NSTX

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NSTX Results & Theory Review

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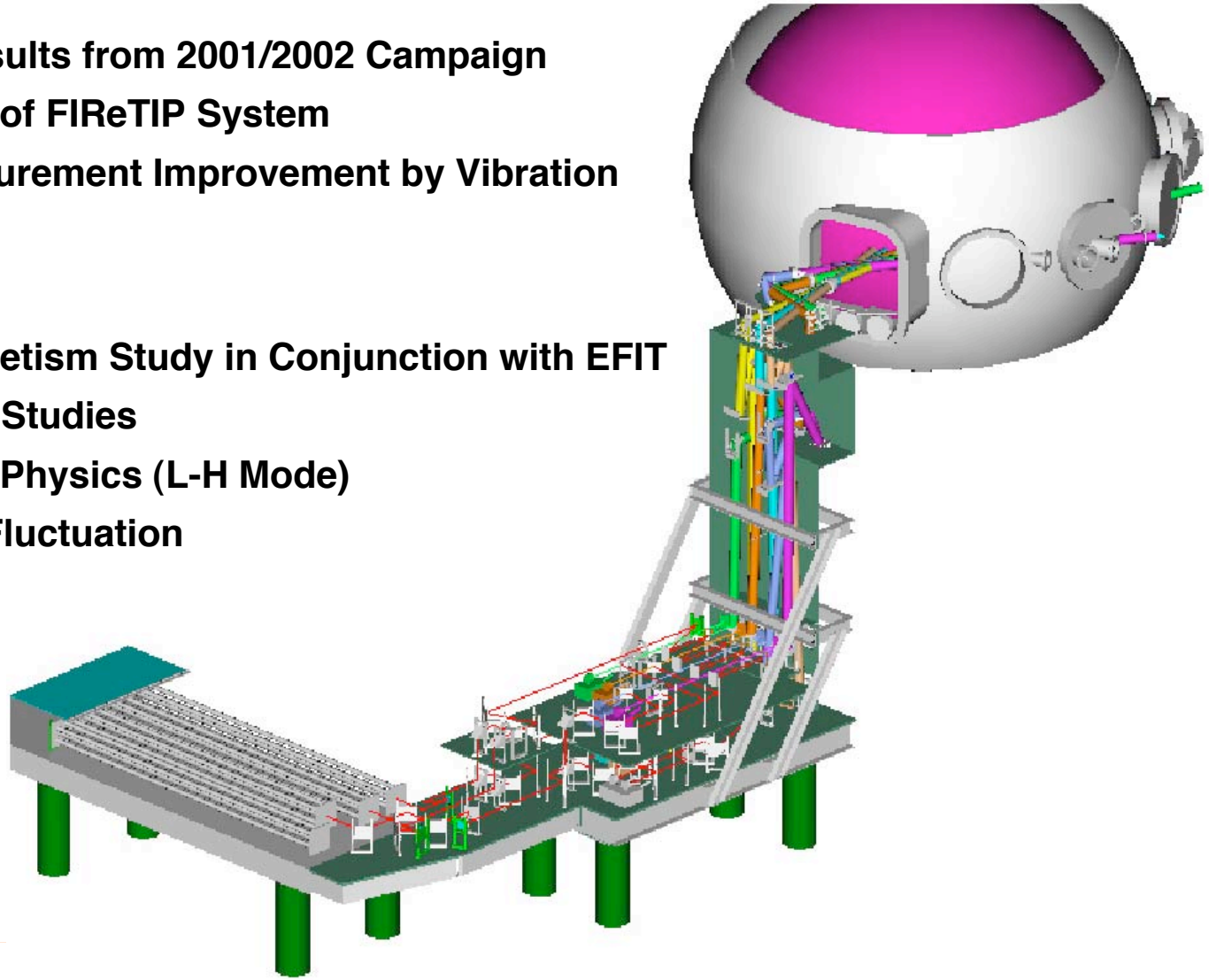
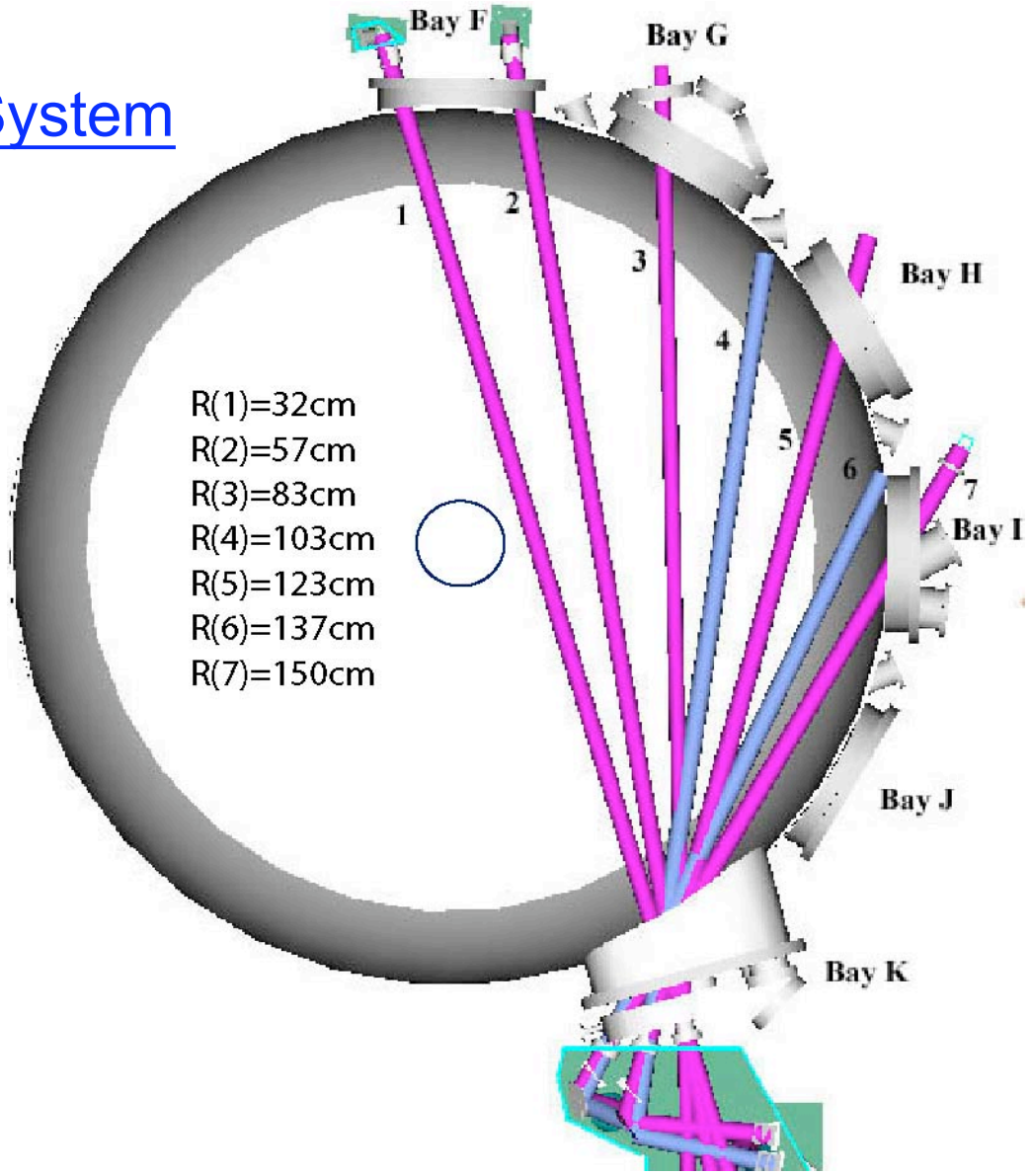
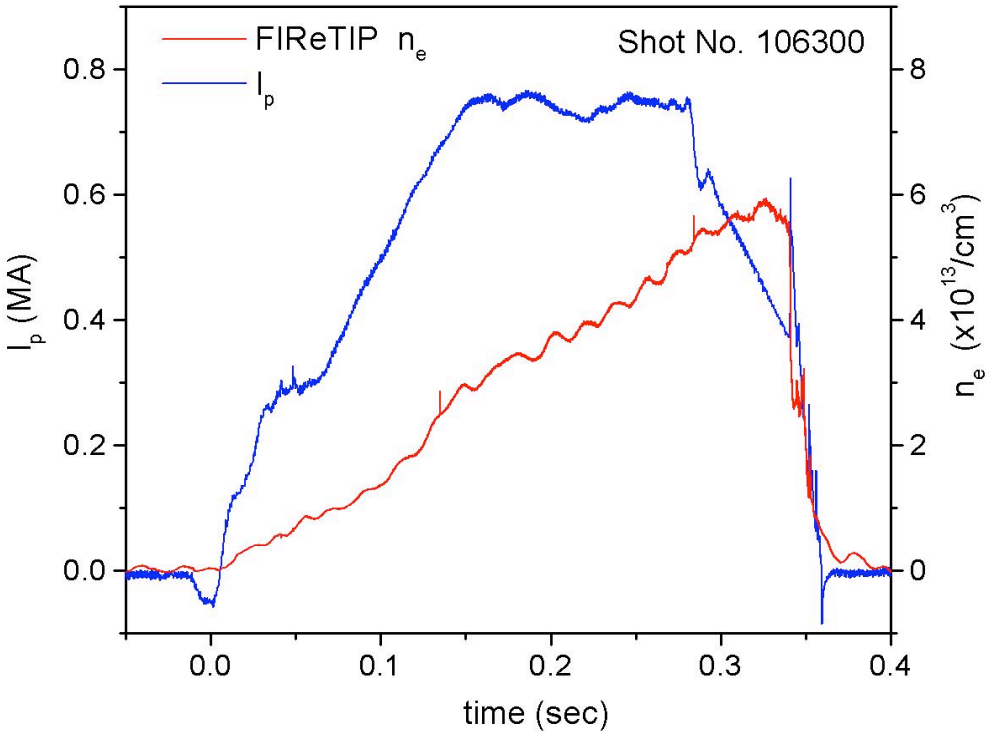


Development of FIReTIP System

- 2001 : one channel at tangency of 66cm
- 2002 : two channels at Ch1, Ch2
- 2003 : four channels at Ch1, Ch2, Ch3, Ch7



Density Measurement Improvement by Vibration Free Stand



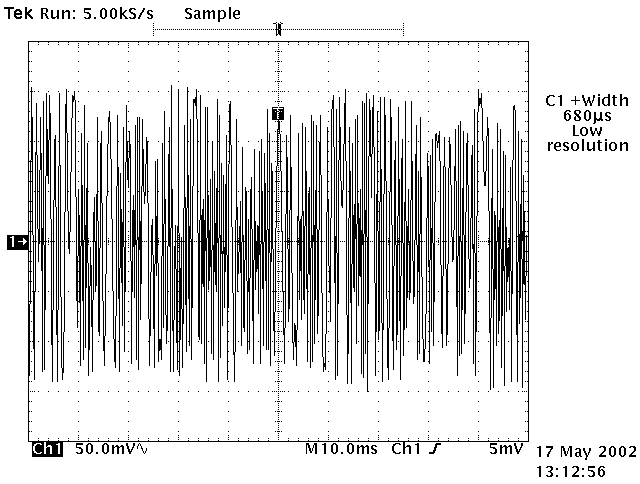
Typical FIReTIP density time traces before the installation of a vibration free stand (2001)

- **Sources of vibrations**
  - **Stray magnetic field**
    *** Magnetic shielding for laser cavity parts**
  - **Vibrations induced by**
    OH force
    *** through floor : optical table is isolated by air cushion**
    *** retro-reflector : installed**
    vibration free stands
- **Characteristics of vibrations**
  - **~ 50 microns at ~ 30 Hz**

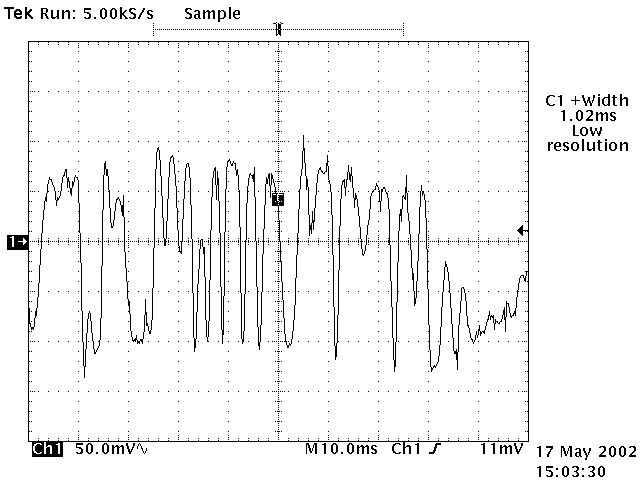
Vibration Free Stand Test

- Vibration free stand

- Vibration reduced to factor of 10 at 30 Hz



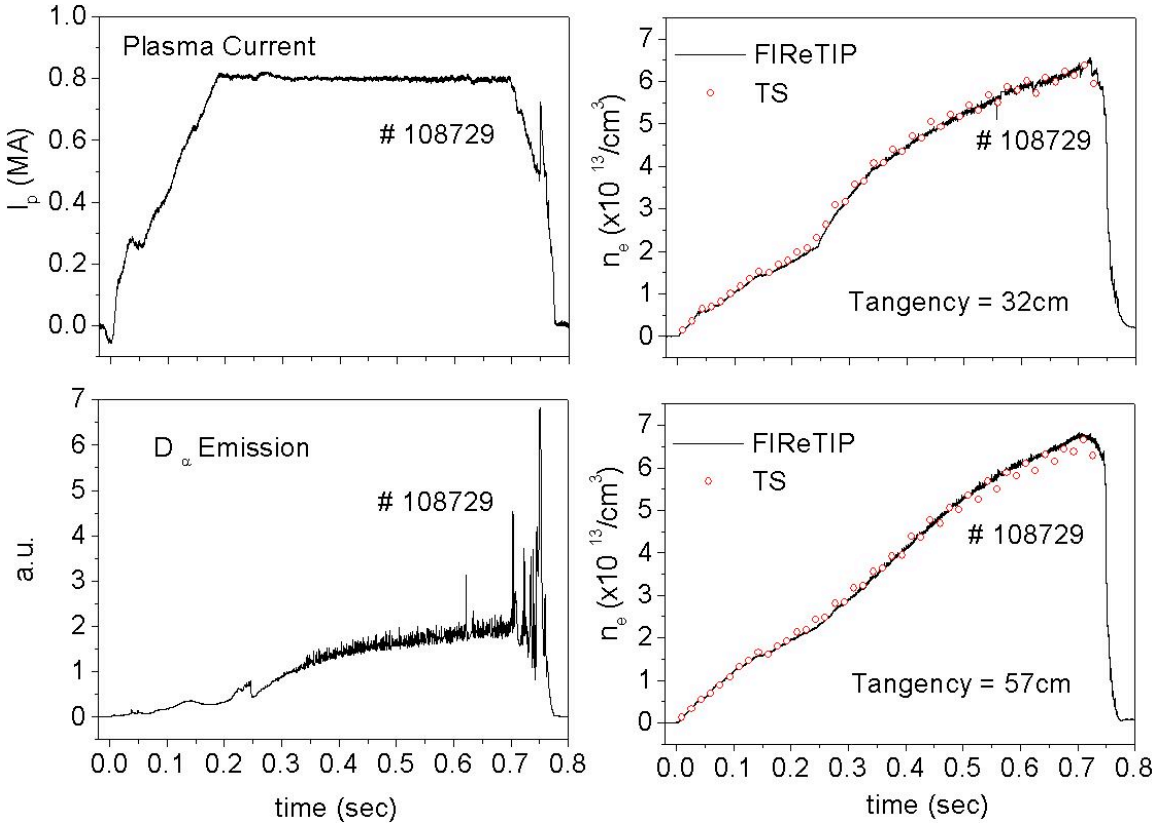
- Without Vibration free stand



- With Vibration free stand

- One full cycle of sine wave corresponds to 0.6micron, number of cycles in a wave packet is proportional to the amplitude of the vibration

Density Measurement with Vibration Free Stands

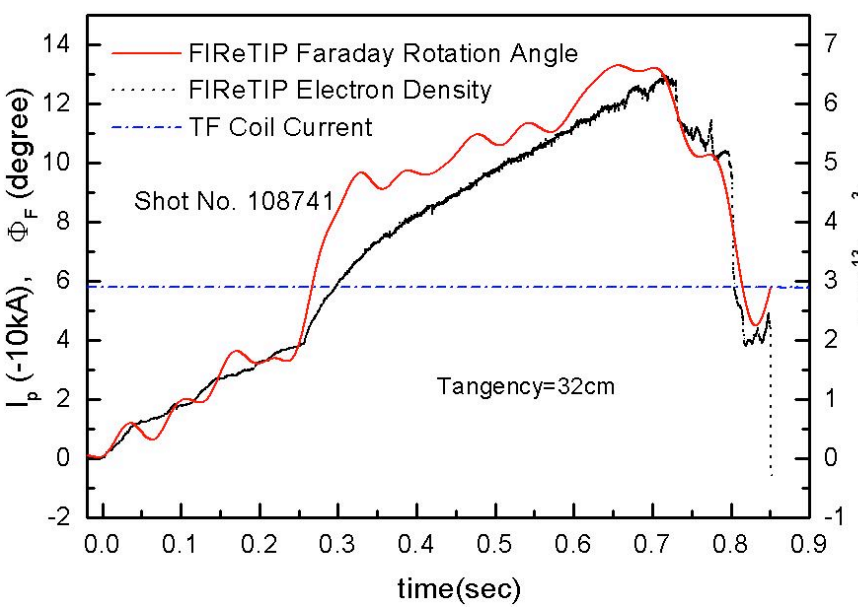


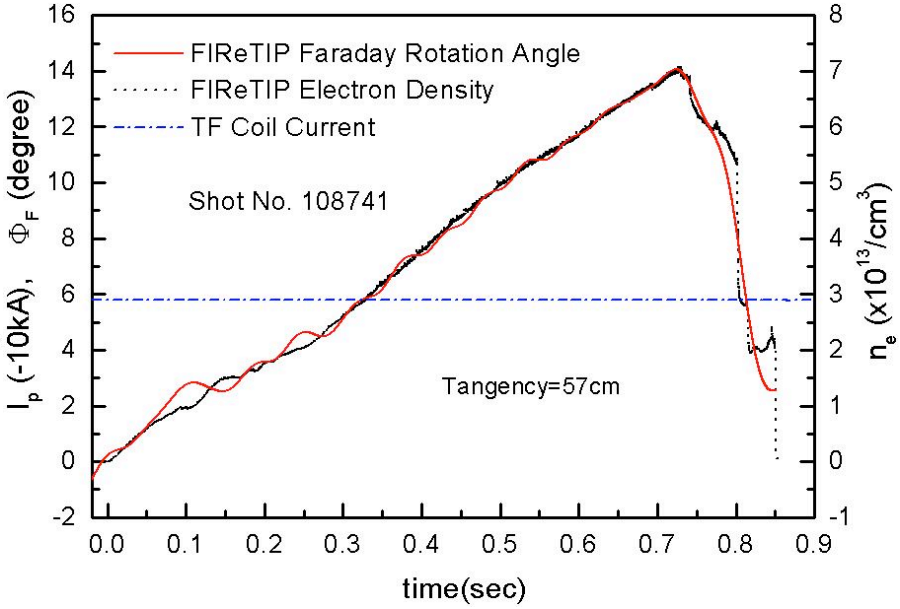
Density traces (channel #1 and #2), free of mechanical vibration, is demonstrated with the line-integrated Thomson scattering data along the same beam paths (2002)

Para/diamagnetism Study in Conjunction with EFIT

Interferometry : $\Delta\phi(x) = 2.8 \times 10^{-15} \lambda \int_0^x n(x)\,dx$

Polarimetry : $\theta(x) = 2.6 \times 10^{-13} \lambda^2 \int_0^x n(x) B_T(x)\,dx$

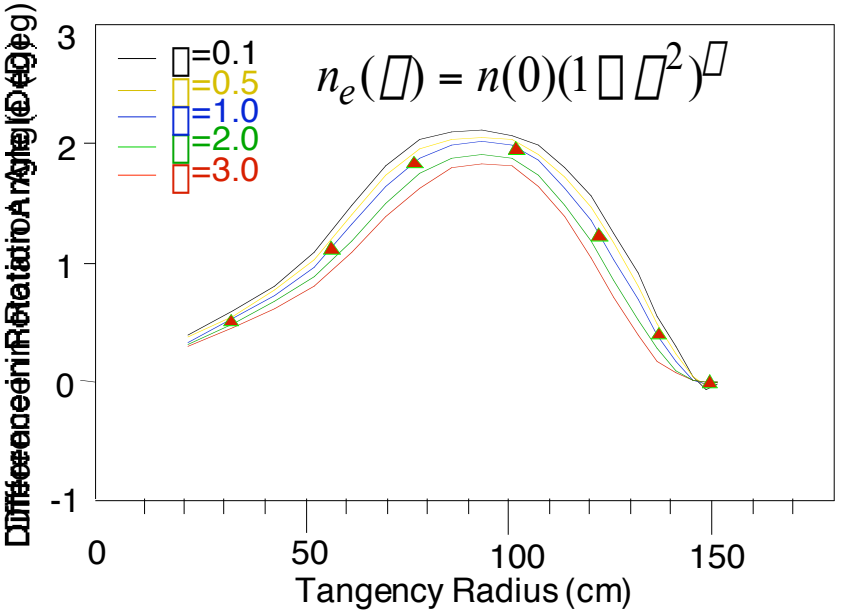




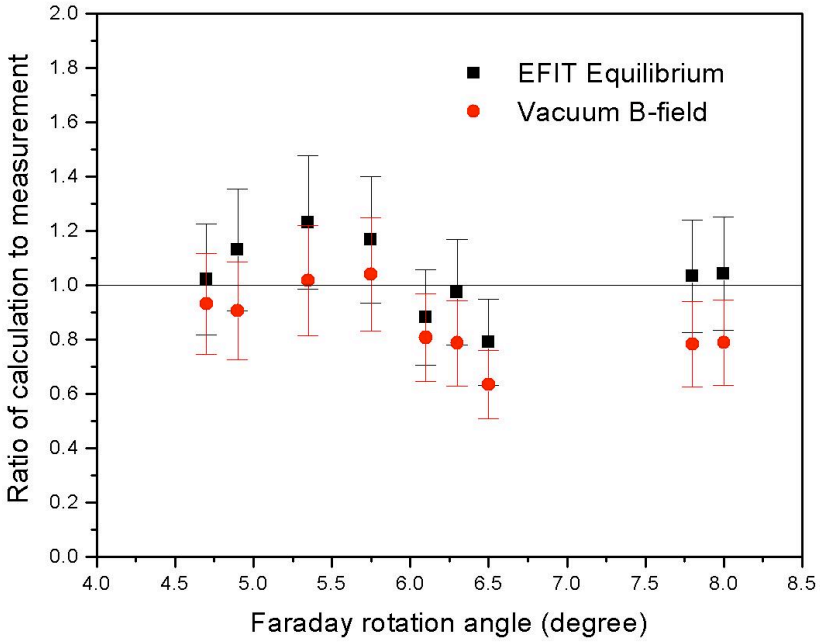
Faraday rotation data were smoothed by filtering out high frequency components above 33Hz

Para/diamagnetism Study in Conjunction with EFIT

Continue

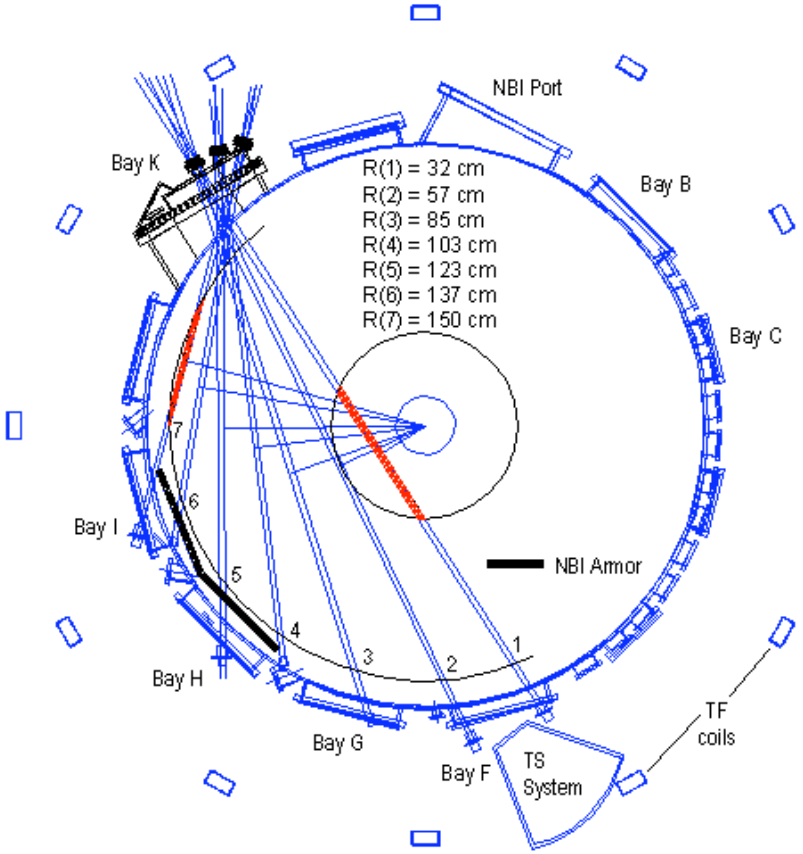


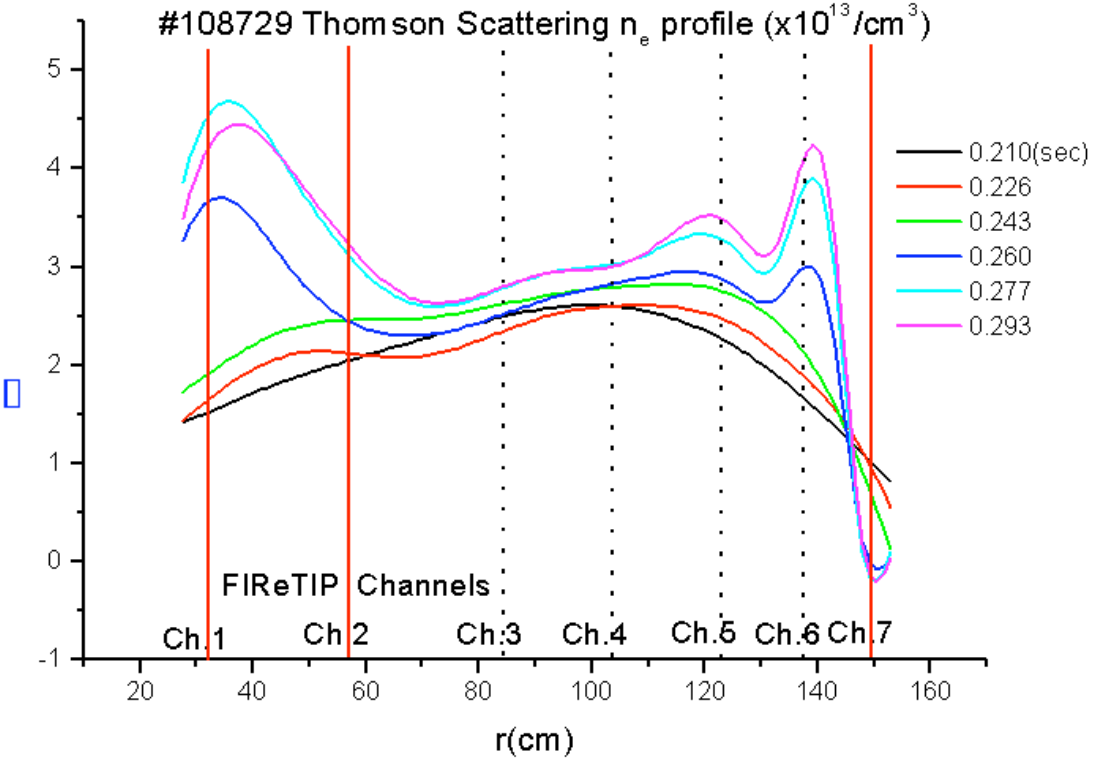
Difference in Faraday rotation angle between vacuum field and presence of diamagnetic effects (~0.5 kG)



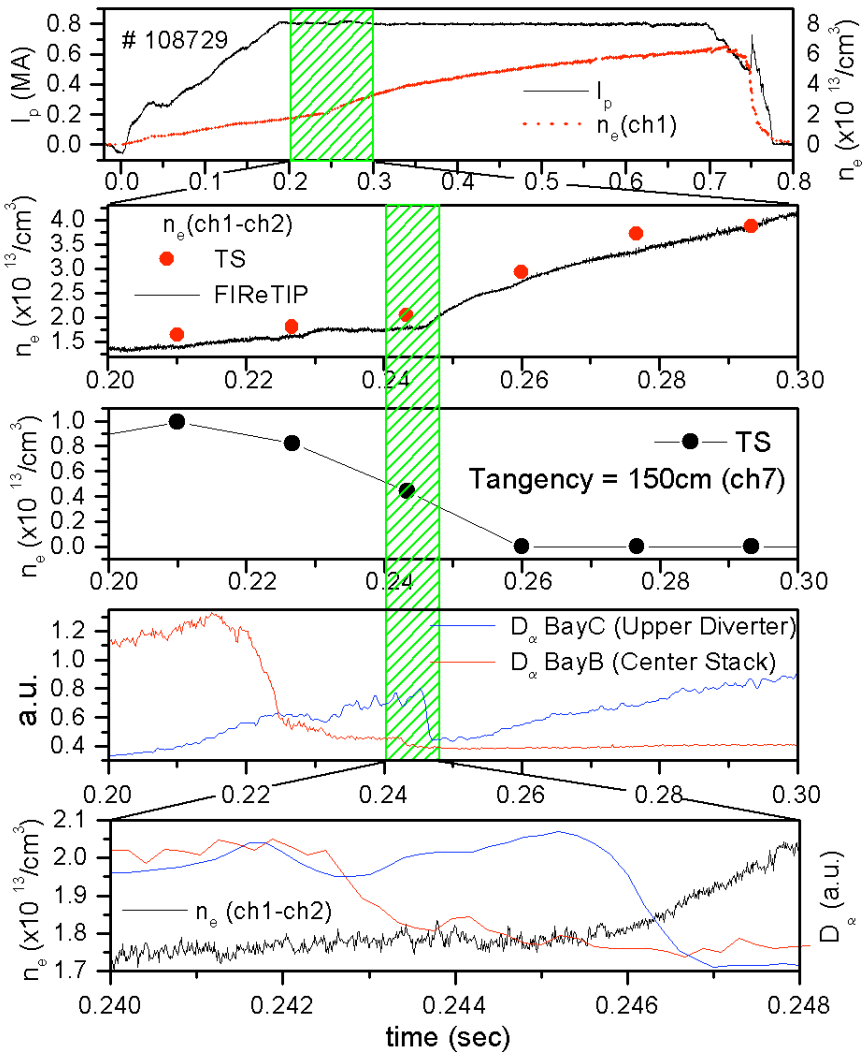
Comparison between Faraday rotation data and calculated rotation angles using both vacuum magnetic field and magnetic field calculated by EFIT equilibrium code (2001)

Edge Density Transition (L-H Mode)





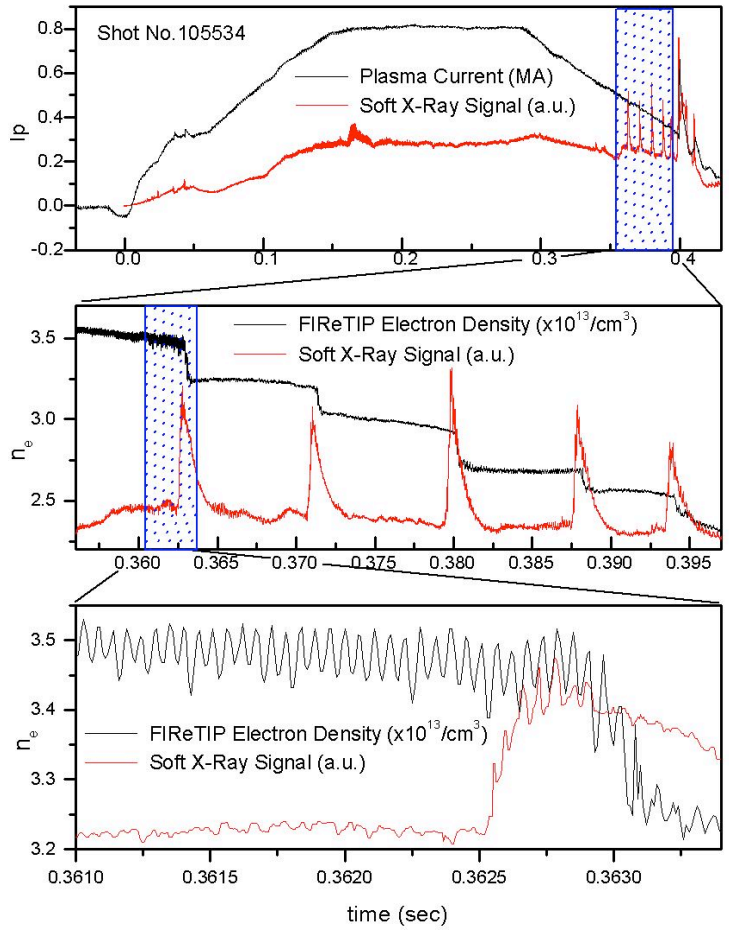
Time evolution of density shows the "ear structure" of the spherical torus



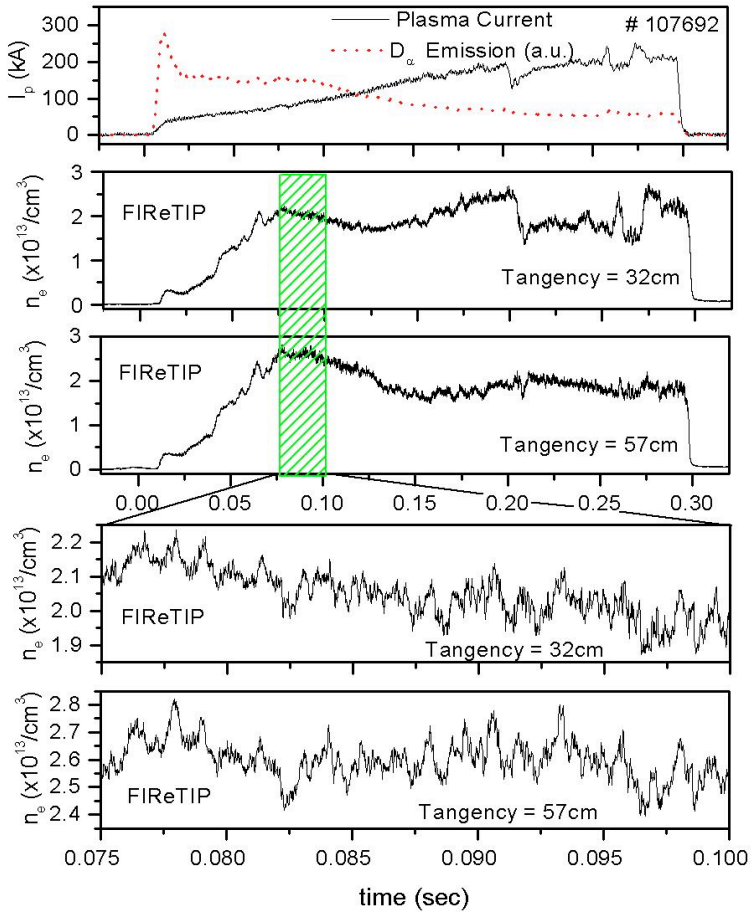
Correlation of Density Rise with Da Emission

- Subtraction ch2 from ch1 indicated sudden rise of L-H mode transition
- FIReTIP edge channels(ch6,ch7) will provide high time resolution data at the edge
- FIReTIP (ch1-ch2) density rise is more close to Da/diverter than Da/center stack
- Near future we will install IF system dedicated for the low frequency fluctuation measurements

Examples of MHD and CHI plasma measurements



Measurement of sawteeth and Mirnov oscillations by FIReTIP



Density evolution during the Coaxial Helicity Injection (CHI)

Conclusion

- Stark-tuned laser provided a potential for the high time resolution (up to ~MHz) and convenient control of the beat waves.
- Density measurement was improved by vibration free stand
- System upgrade including channel expansion is in progress
- Para/diamagnetism (EFIT) and edge density (L-H transition) will be the focus
- Future physics studies : edge turbulence, real time density control and full profile study