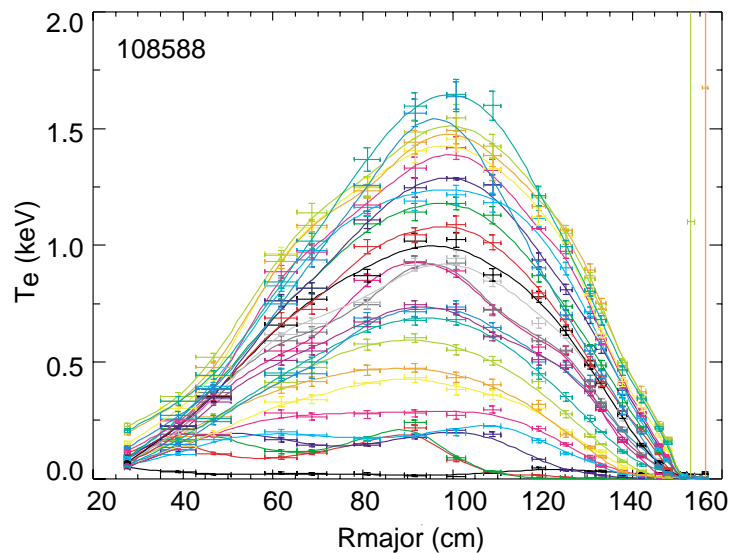# MPTS Data Analysis Update

B.P LeBlanc,

with R.E. Bell, D.W. Johnson,

and D.E. Hoffman

## NSTX Results Review

September 9, 2002

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End-of-run Outstanding Issues
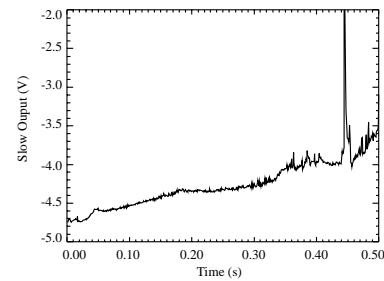
- New spectral calibration gives higher T_e ($\approx 10\%$).

- 20-channel data availability.

- Radial array from in vessel measurements (11/01).

- Rerun analyses with updated software.

  – Improved error calculation.

- Repair data taken with shutter obstruction.

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New *vs.* Old Analysis for 10-channel Case

Fig. 1
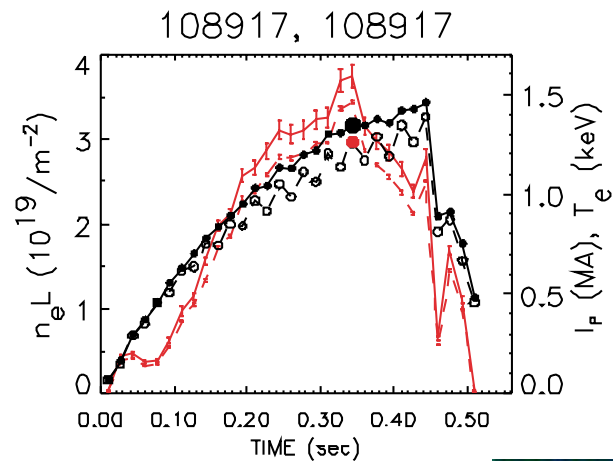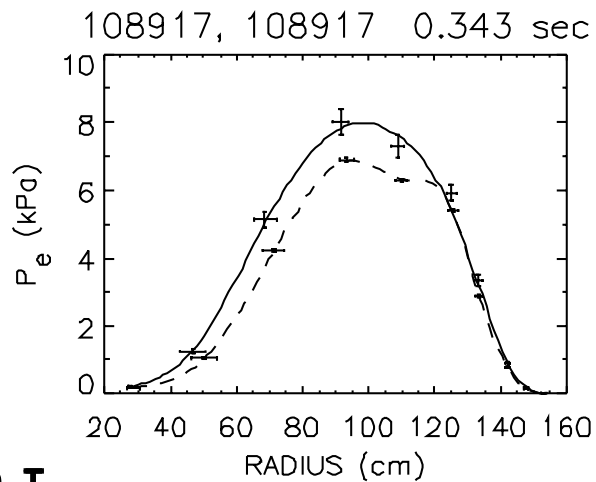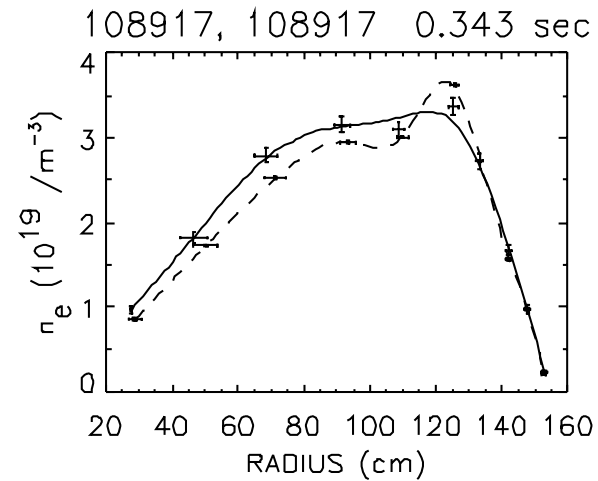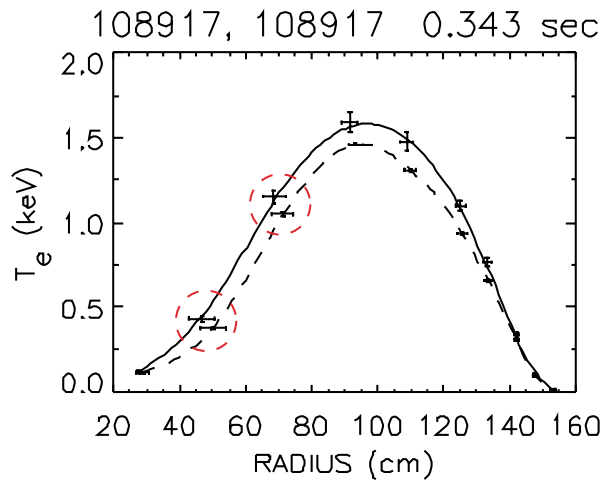
20 Channels: Two 10-Polychromator Stacks
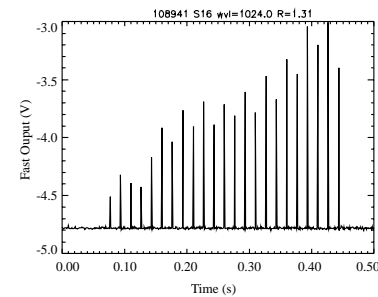
Twenty-channel Implementation

Poly ID

5   15   6   16   7   17

M   Laser 2

Laser 1

Optics

Polychromators 1-10
Trig

Polychromators 11-20
Trig

BS

S

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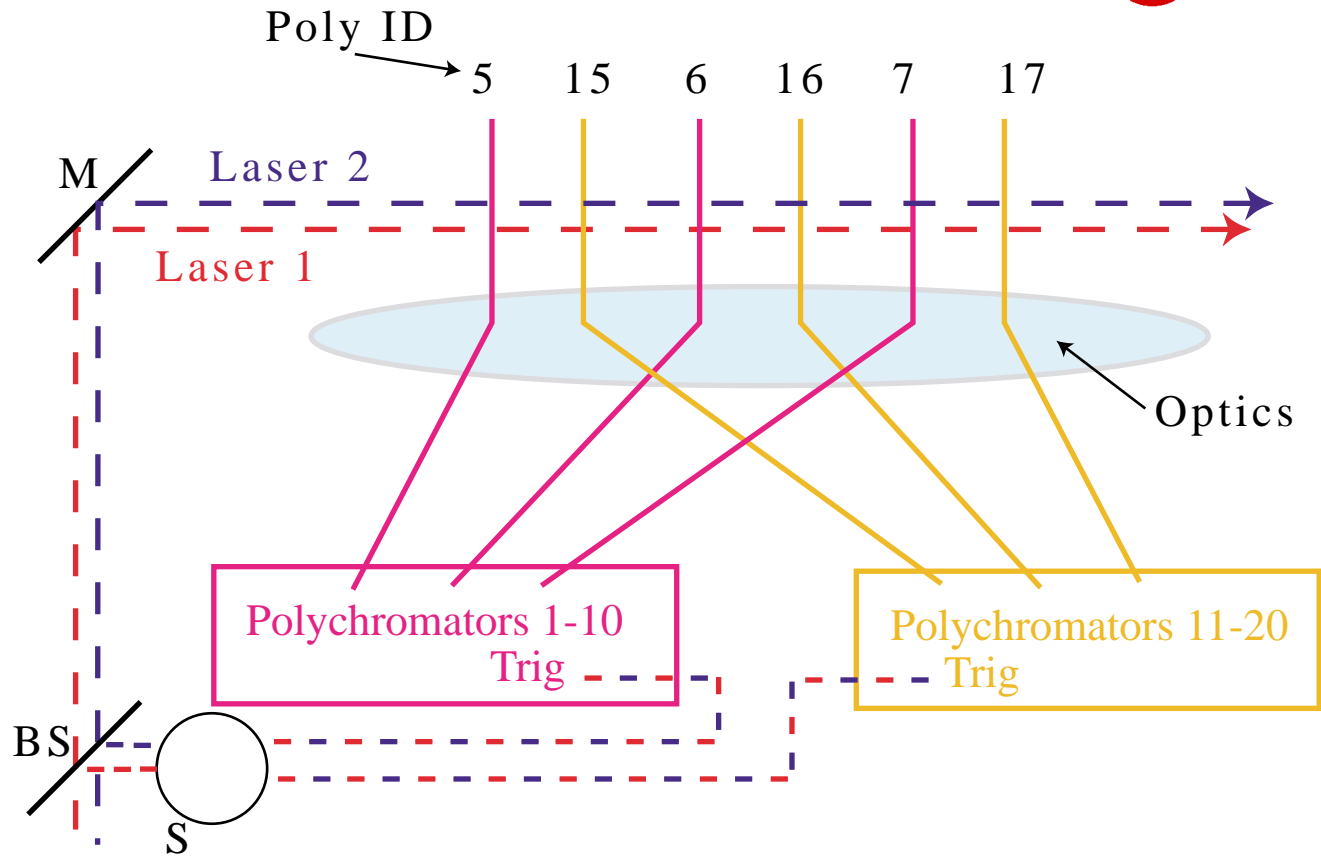
Twenty-channel Analyses on MDS Tree

NSTX

```
: TOP ...
CHERS
CLOCK ...
ICHERS ...
MPTS ...
    # : ENERGY_BYTES
    CONFIG ...
    OUTPUT_DATA ...
        BEST ...
        TS1 ...
        TS2 ...
            : COMMENT
            : DATEANALYZED
            : FIT_NE ...
            : FIT_NE_ERR
            : FIT_PE ...
            : FIT_PE_ERR
            # : FIT_RADII
            # : FIT_R_WIDTH
            : FIT_TE ...
            : FIT_TE_ERR
            # : LASER_ID ...
            : QUALITY ...
            # : RR ...
            : SPLINE_NE ...
            : SPLINE_PE ...
            # : SPLINE_RADII
            : SPLINE_TE ...
            : TS_LD ...
            # : TS_TIMES
```

TS2

- Available 20-channel analyses loaded with same arrangement and variable names as for 10-channel case. MDS branch TS2.

    – Post-bakeout shots: 107280-109079.

- Retrieval from TS2 into IDL structure: s = TS2(123456).

- MPTS 4-panel plotting routine: IDL>plotts,ts2(123456),/nb,/rf,…

    – VMS for the moment...Unix later .

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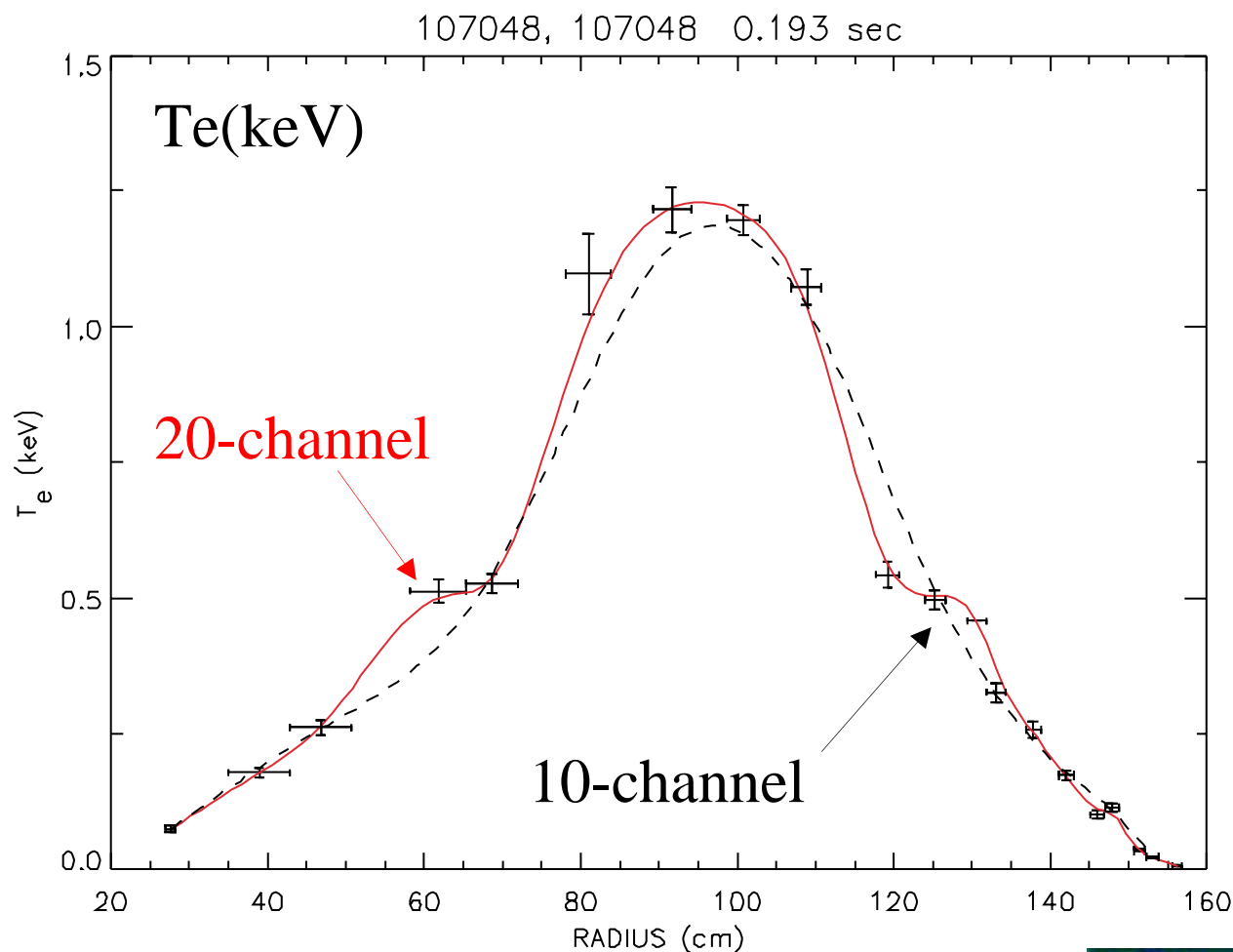PRINCETON PLASMA
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MDS Labels for TS2

treename='\ACTIVESPEC::TOP.MPTS.OUTPUT_DATA.TS2:'

qual = MDSvalue(treename+'QUALITY',/quiet,stat=readstatus)

radius = MDSvalue(treename+'FIT_RADII',/quiet,stat=readstatus)

dr =   MDSvalue(treename+'FIT_R_WIDTH',/quiet)

time =   MDSvalue(treename+'TS_TIMES',/quiet)

Tef =   MDSvalue(treename+'FIT_TE',/quiet)

dTef =   MDSvalue(treename+'FIT_TE_ERR',/quiet)

nef =   MDSvalue(treename+'FIT_NE',/quiet)

dnef =   MDSvalue(treename+'FIT_NE_ERR',/quiet)

Pef =   MDSvalue(treename+'FIT_PE',/quiet)

dPef =   MDSvalue(treename+'FIT_PE_ERR',/quiet)

rs =   MDSvalue(treename+'SPLINE_RADII',/quiet)

nes =   MDSvalue(treename+'SPLINE_NE',/quiet)

Pes =   MDSvalue(treename+'SPLINE_PE',/quiet)

Tes =   MDSvalue(treename+'SPLINE_TE',/quiet)

ld =   MDSvalue(treename+'TS_LD',/quiet)

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20-channel Data Reveal Additional Features
HHFW Heating

107048, 107048 0.193 sec

Te(keV)

20-channel

10-channel

T_e (keV)

RADIUS (cm)

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Nstx-Res-Rev-LeBlanc *et al.-8*

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Some Analyses Show n_e Spatial Modulation
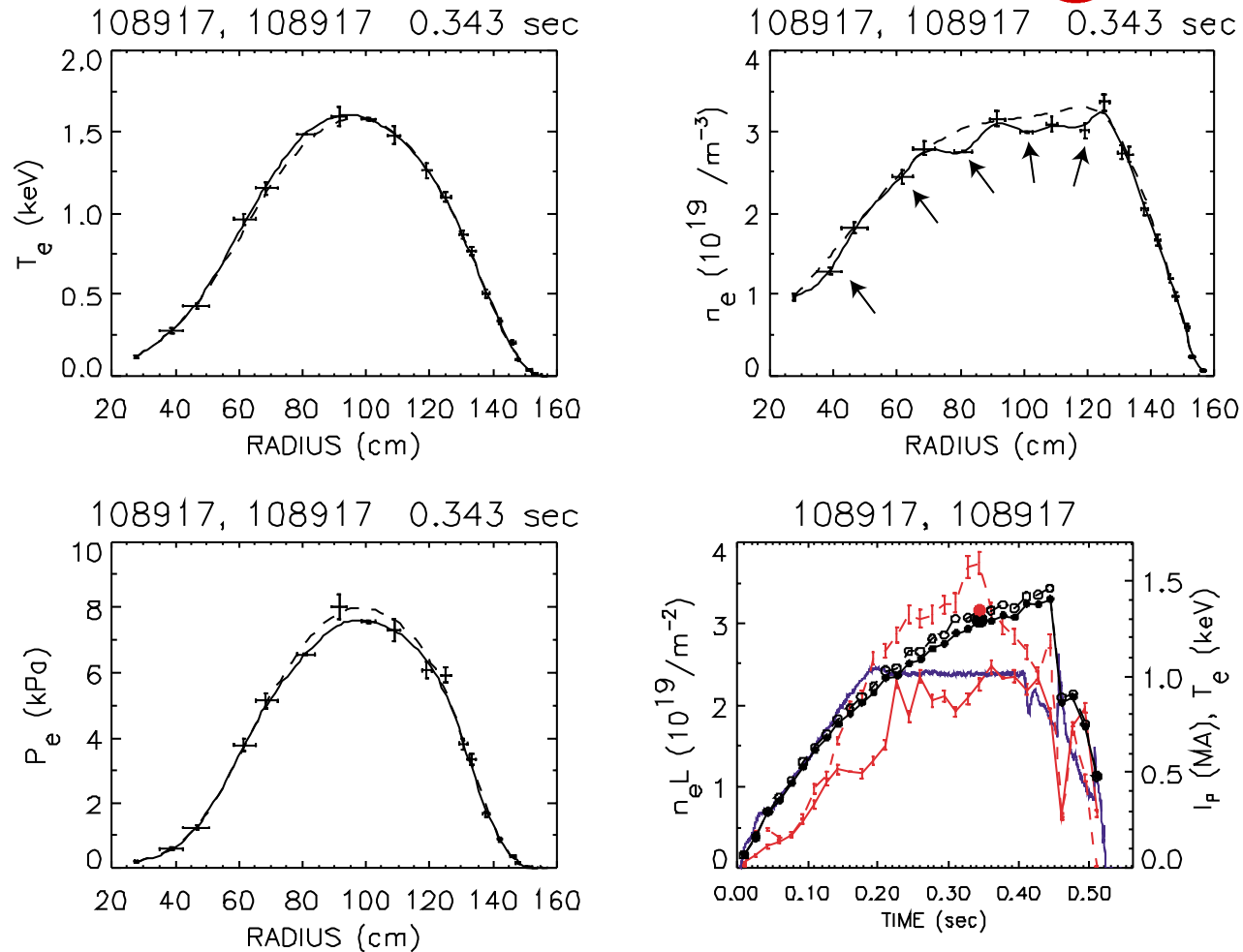
Fig. 2

Spatial Modulation Removed in Final Analysis

108917 @0.39 s

1st cut (dotted)
Final (solid)

$n_e \ (10^{19}/m^3)$

R (m)

Nstx-Res-Rev-LeBlanc *et al.-10*
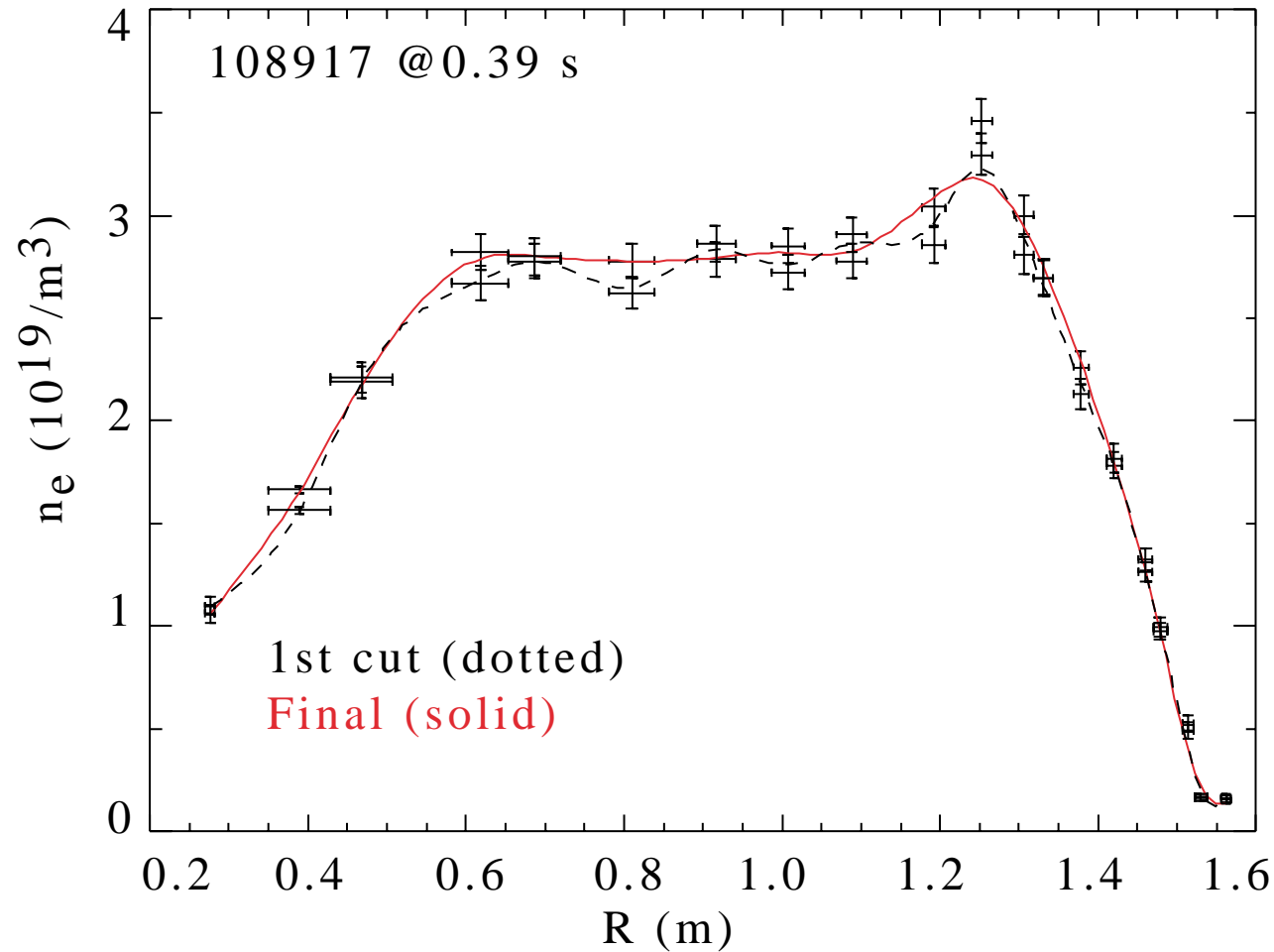
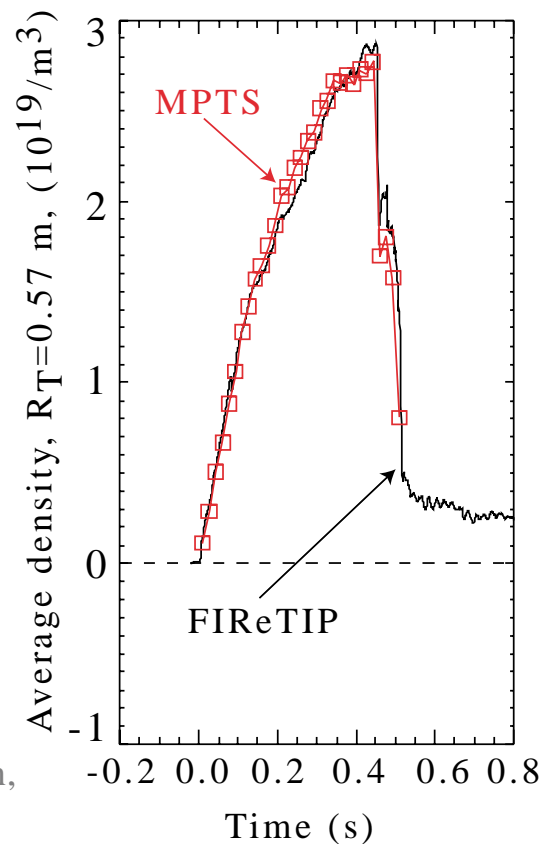# Good Agreement between FIReTIP and MPTS

Comparison between line average density from FIReTIP and MPTS.

R_T=0.57 m and 0.325 m.

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Nstx-Res-Rev-LeBlanc *et al.-11*

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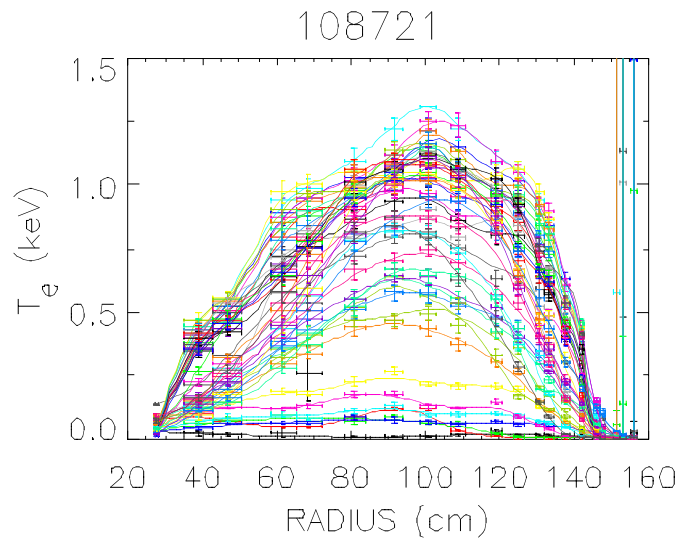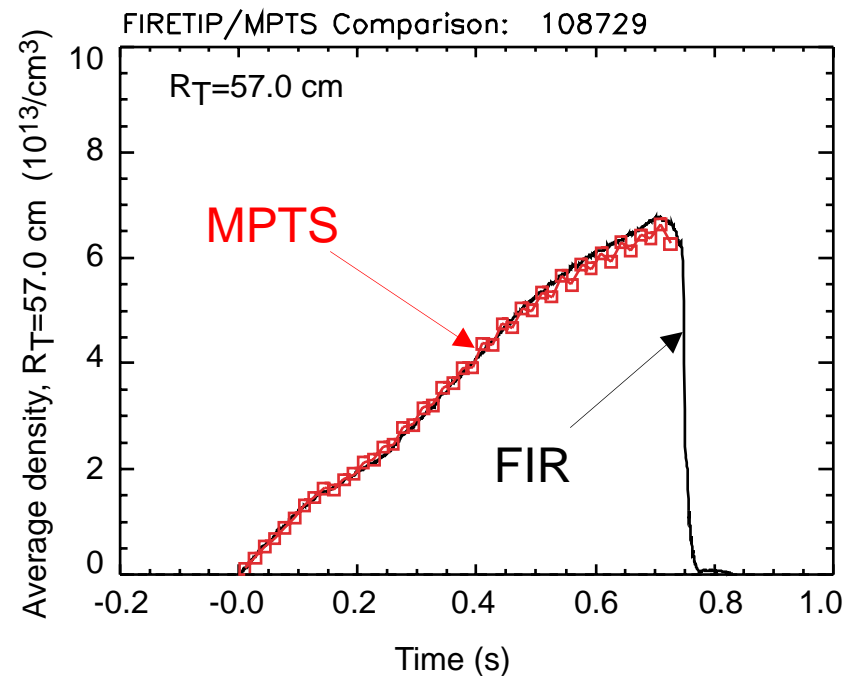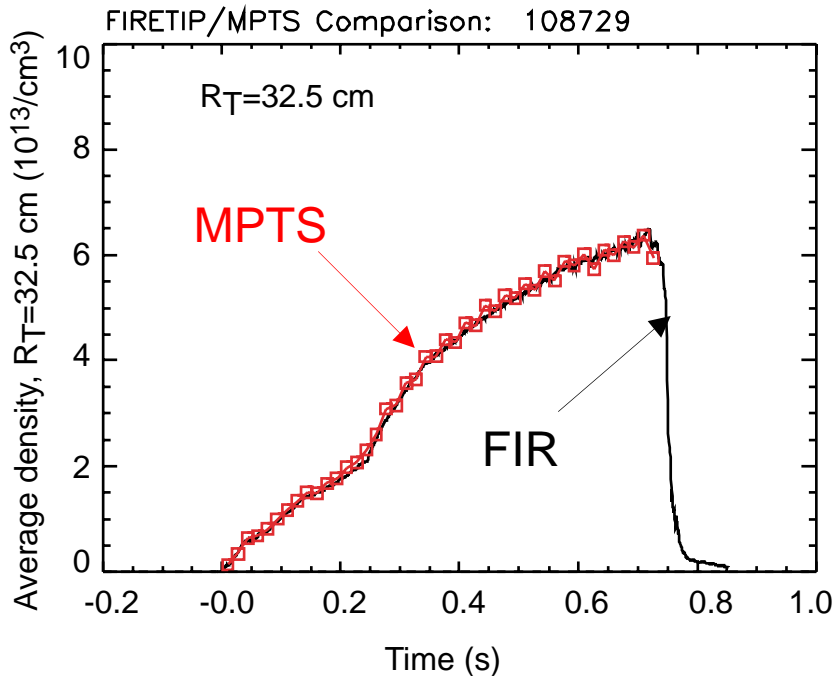
MPTS: 20-channel Output
Shutter Obstruction Repaired
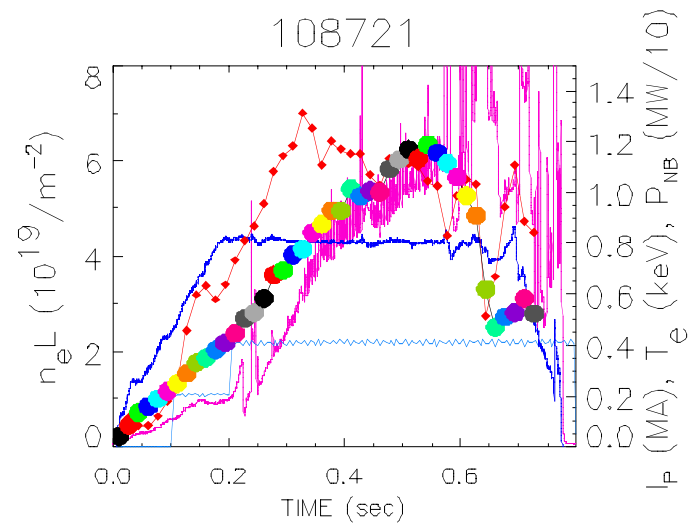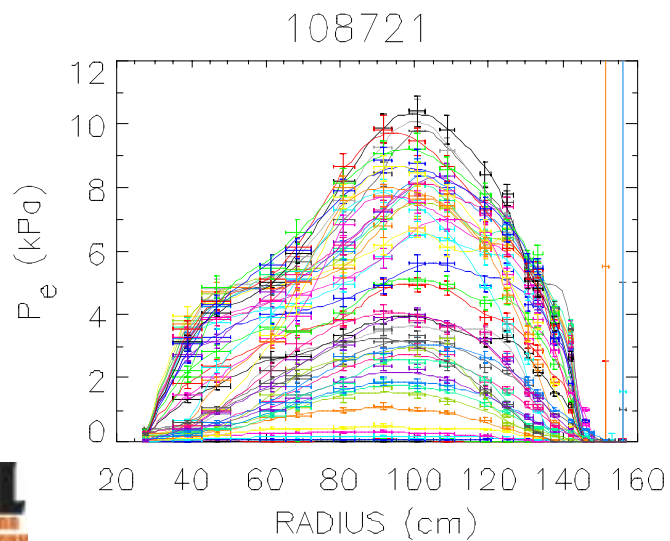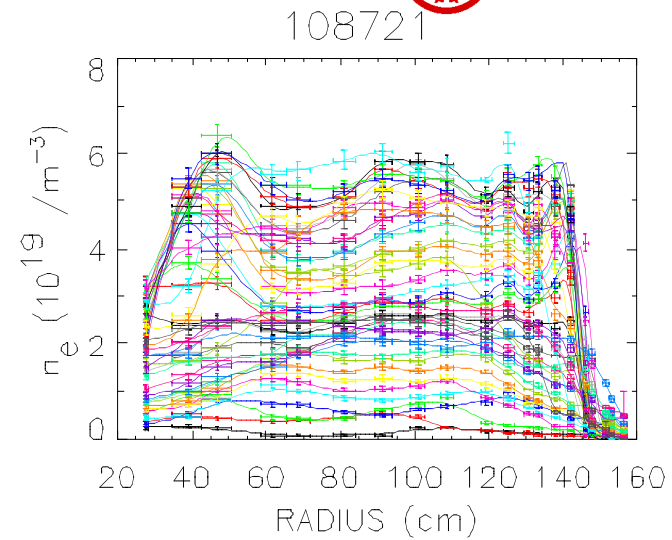
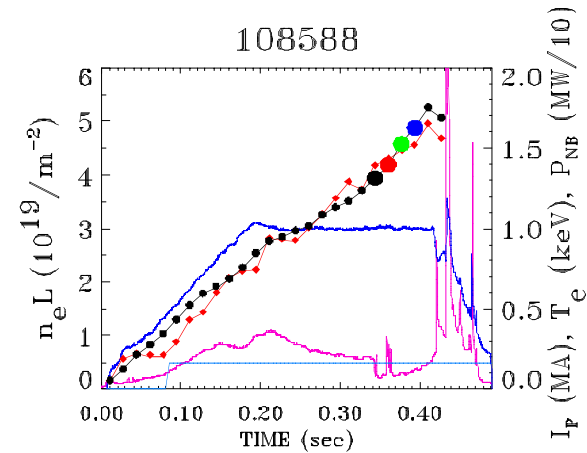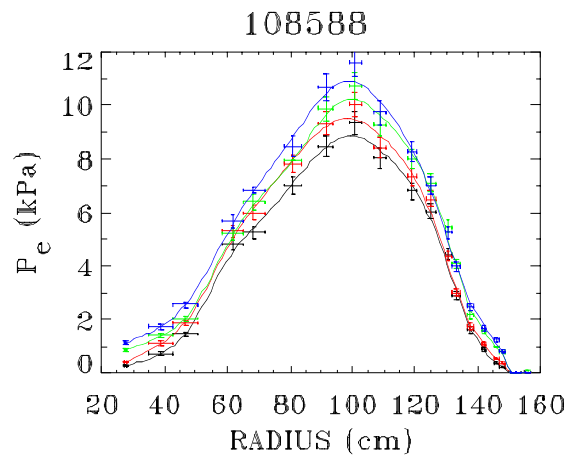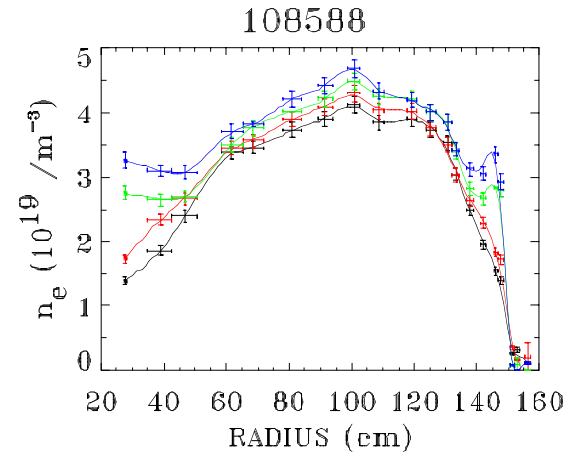# Shutter Obstruction Calibrated out with Rayleigh Scattering

- Good agreement between *nel* from FIR-laser and MPTS.

- MPTS is absolutely calibrated.

FIRETIP/MPTS Comparison: 108729

R_T=32.5 cm

MPTS

FIR

Average density, R_T=32.5 cm $(10^{13}/cm^3)$

Time (s)

FIRETIP/MPTS Comparison: 108729

R_T=57.0 cm

MPTS

FIR

Average density, R_T=57.0 cm $(10^{13}/cm^3)$

Time (s)

FIR Interferometer: K.C. Lee, N.C. Luhmann,

C.W. Domier, *U.C. Davis*, H. Park, *PPPL*

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NBI H-mode: Temporal Zoom Display
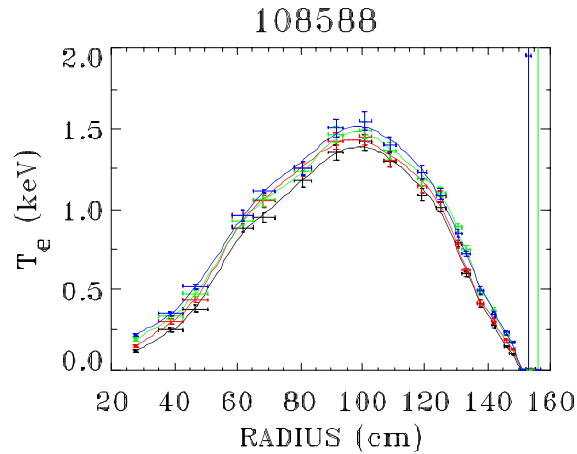
NBI H-mode: Distributed Time Points Display
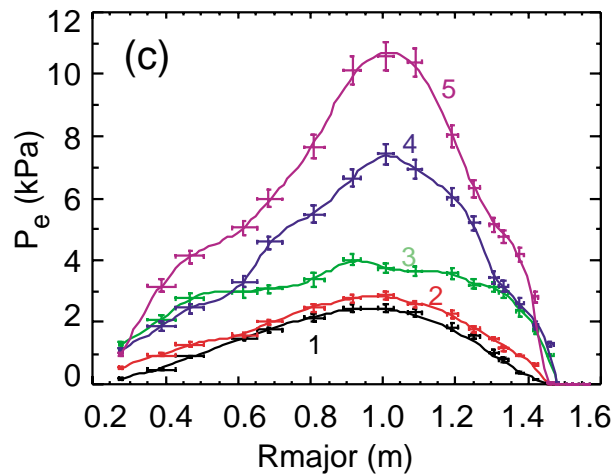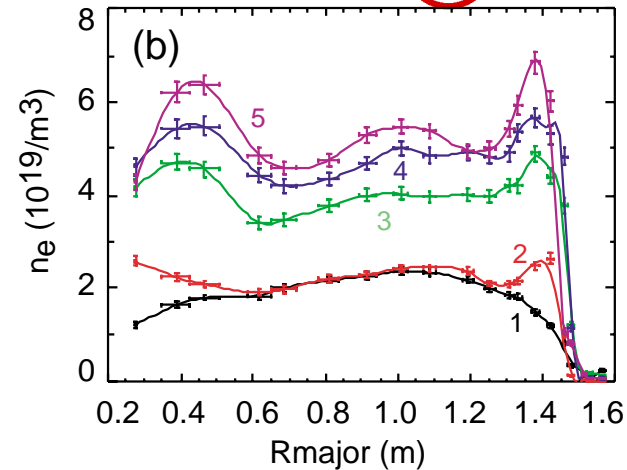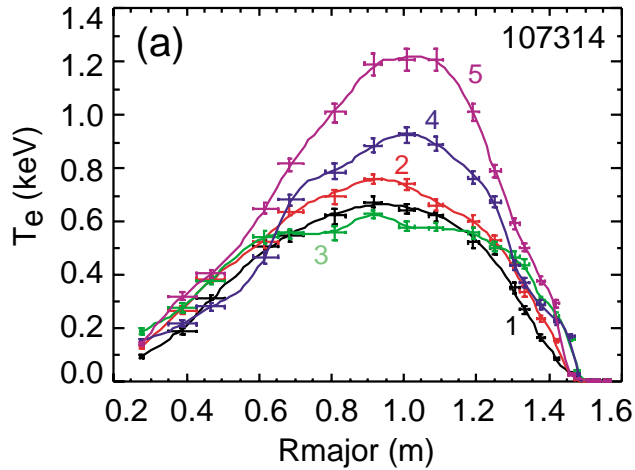
Concluding Remarks

- Re-calibrated 10-channel data in process of being overwritten into MDS: TS1.

- Available 20-channel analyses loaded into MDS: TS2.
  - Post Bake: 107280 -109079.

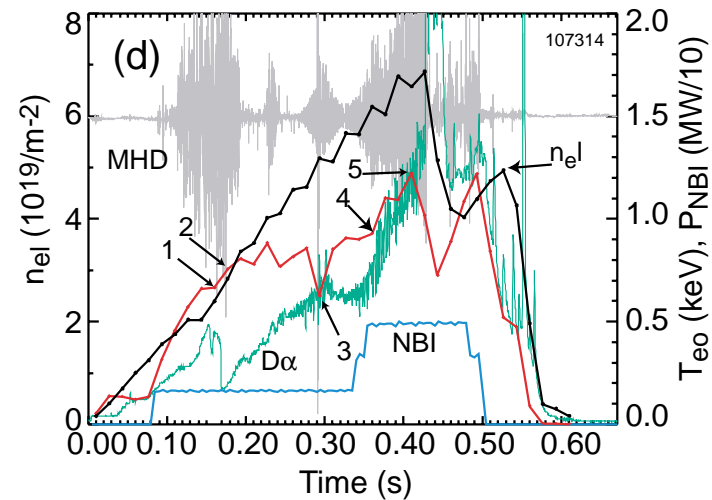- Shutter obstruction issues have been fixed with Rayleigh scattering calibration.

  - Shutter-actuator improvement work in progress.

- Spatial $n_e(R)$ modulation is an instrumental artifact.
  - Can be eliminated with proper calibration in many cases.
  - TS2 will be updated as data become available.
  - T_e is not expected to change.

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Even more Concluding Remarks

- **Hardware maintenance needed before new run.**
    - Lasers need maintenance.
    - Laser delivery optics to be modified.
    - Laser alignment monitoring system to be installed.

- **Important in-vessel work needed before run.**
    - White plate calibration for prospective Z-effective measurement.
    - Verify radial array.
    - Viewing window to be replaced.
    - Etc, etc, etc….

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Multi-point Thomson Scattering: MPTS and Mission and Progress, Long Term Goal

- Main source of kinetic documentation
  - Best technique for measuring $T_e(R,t)$ in low field ST.
  - Measurement of $n_e(R,t)$, $T_e(R,t)$.
- 2000 → 1 laser   (30 Hz), 10 spatial channels
- 2001 → 2 lasers (60 Hz), 10 spatial channels
- 2002 → 2 lasers (60 Hz), 20 spatial channels
- Ultimately:
  - ≥3 lasers (≥90 Hz), 36-45 spatial channels.
  - High edge and scrape-off layer spatial resolution (0.5cm).
  - Z-effective profiles...

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