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Summary of XP 836
Parametric scan of high elongation plasmas

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NSTX 2009 Results Review
Conference Room LSB-B318, PPPL
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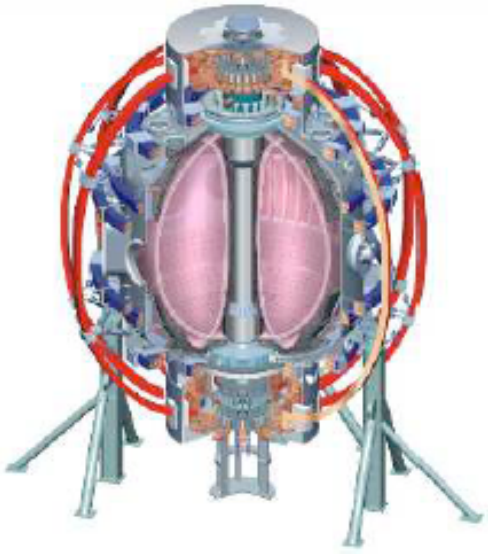

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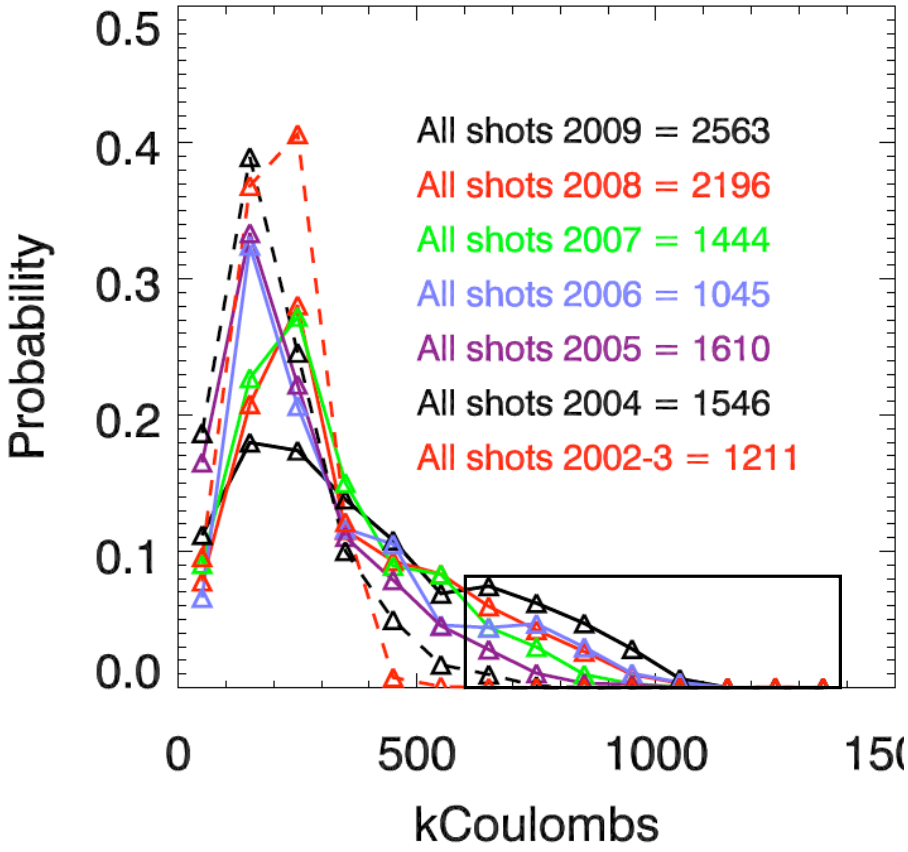
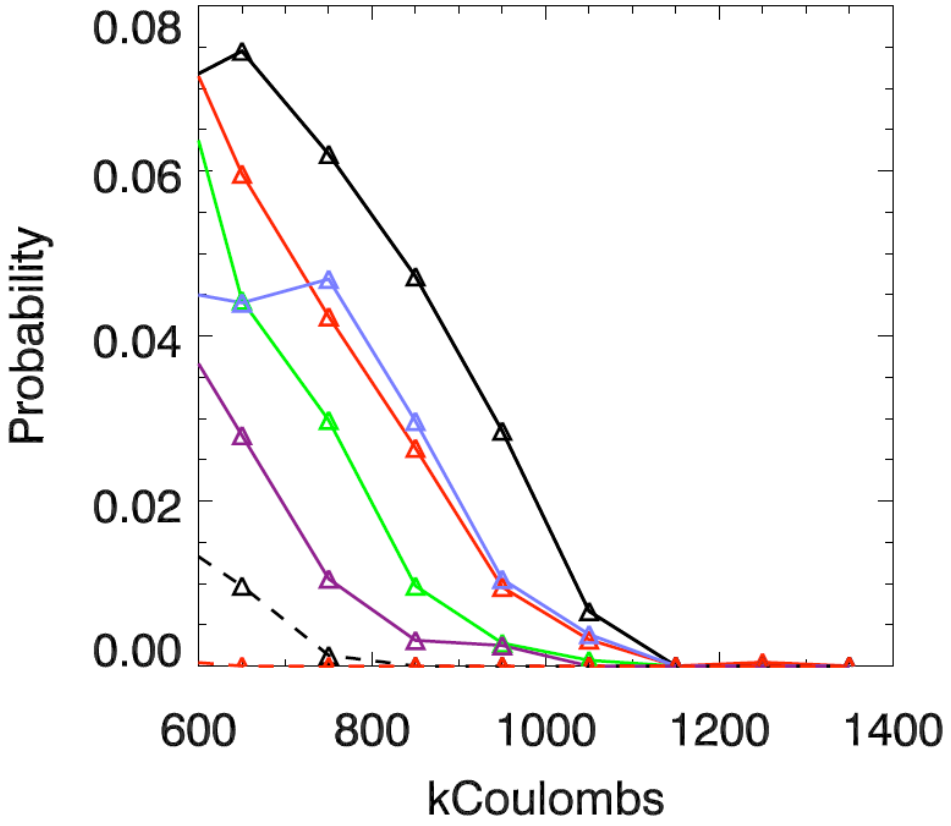
Reproducibility of long pulse discharges improved this year

- Substantial probability of succeeding with long pulse scenarios
- Several technical issues were identified and solved
- Several new control features should improve success further in the near future (strike point control, improved basis functions)





XP 836

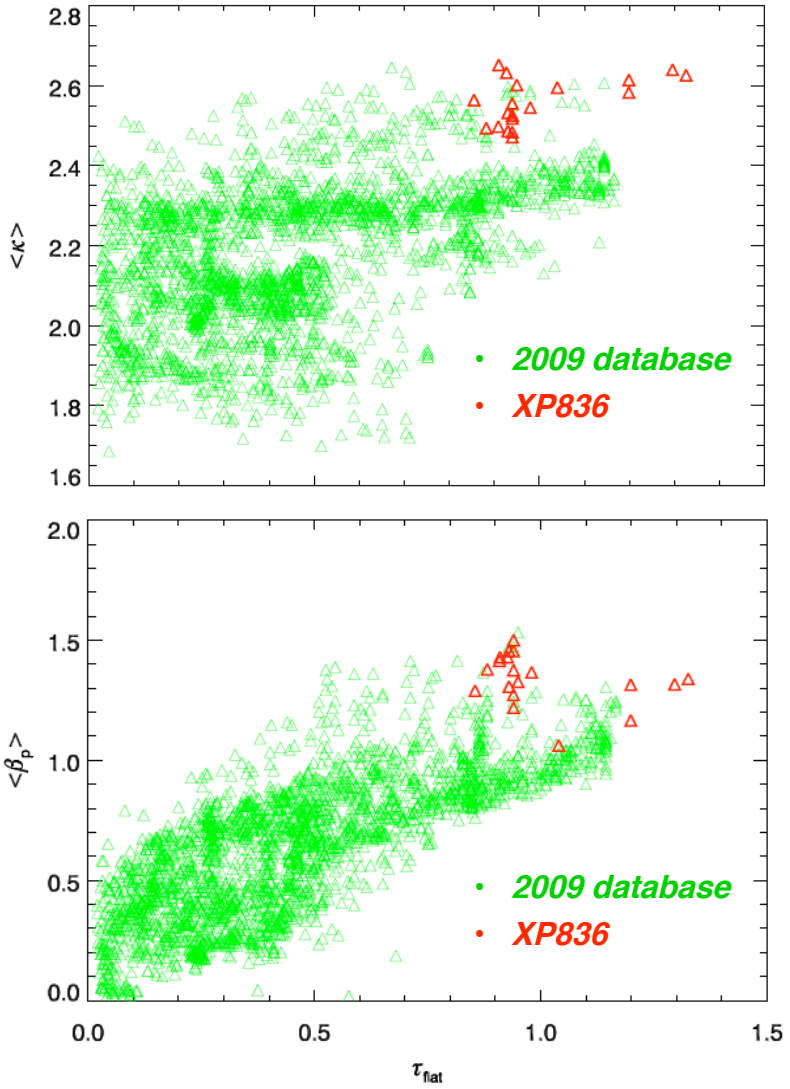
- Goal: Improve reproducibility for last years high beta results at high elongation (129986 - 1 shot)
  - Attempt small perturbations in parameters to identify what is required to achieve reproducibility
- Did scans of the following parameters
  - Bt (0.4 - 0.5T), PNBI (4-6.5MW), Ip (650-750kA), outer gap (13-17cm)

- ~2.5 run days

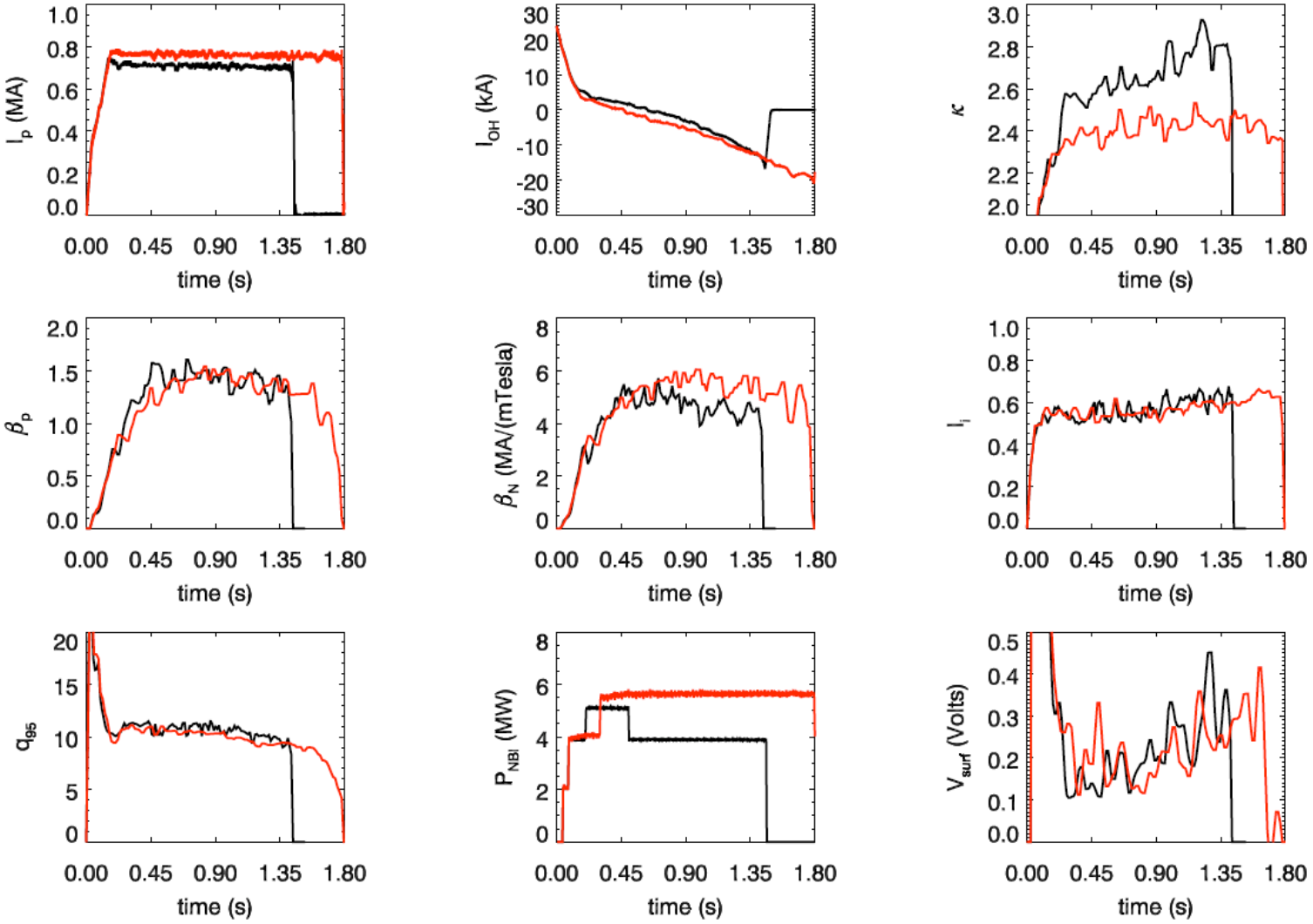
- 1st half day moderate success due to lithium coating and beam issues
  - 2 useful shots
- 2nd day (5kGauss, 6MW) aimed at low loop voltage, high betap
  - 9 shots with tflat > 1s
- 3rd day (4kGauss, 4MW) aimed at longer pulse
  - 8 shots with tflat > 1s 2 with 1.5s (end of TF)

Overview of XP results

- Routinely reproduced high elongation scenarios, with lithiumization, and non-axisymmetric control
- These values were sustained for long pulse ($\tau_{pulse} >> \tau_{CR}$)
- Achieved record $\beta_p \sim 2$ during the I_p flattop
- Longest pulse this year
  - See also XP954 which is based on discharge from this XP



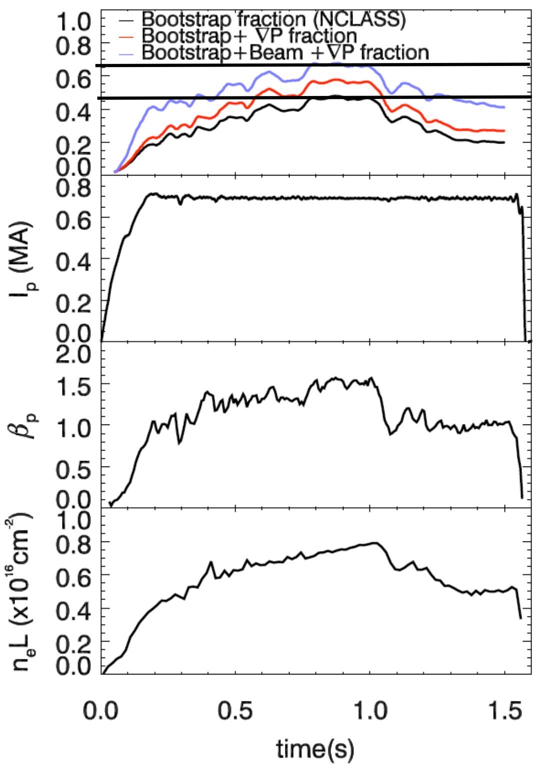
Comparison of 133445 to 129125 (longest pulse)

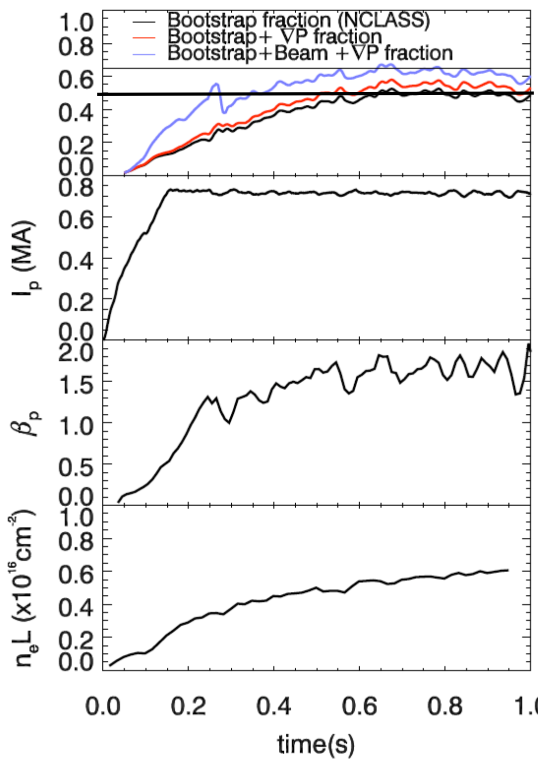


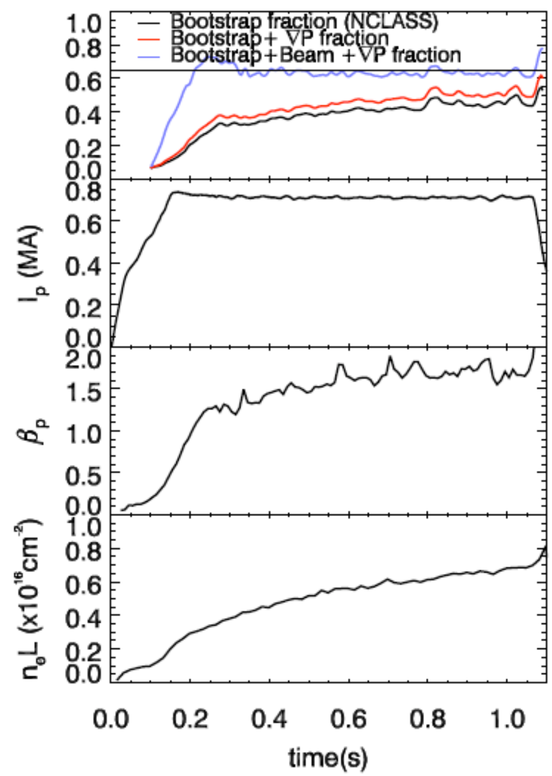
TRANSP indicates 65% non-inductive current fraction

- Same as levels achieved in previous “best discharges”
  - High non-inductive current fraction maintained longer
  - TRANSP always gives 65%!
- Analysis of current profile constituents shows 25% deficit of current relative to total from MSE
  - Issues with Z_{eff}, reconstructions, edge bootstrap resolution?

- ***Results of TRANSP analysis for shot 129986***





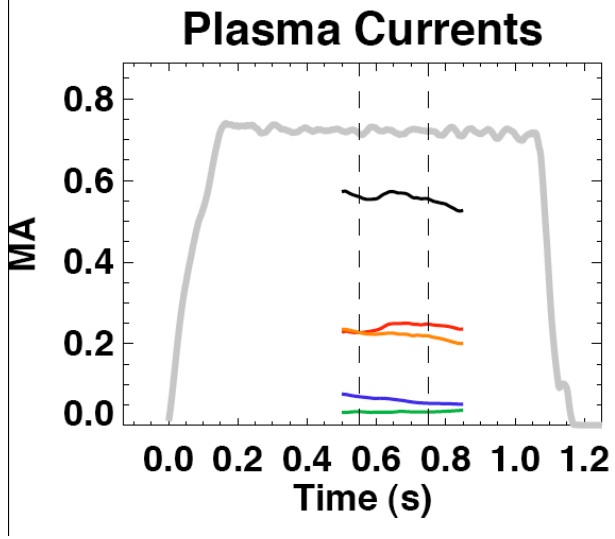


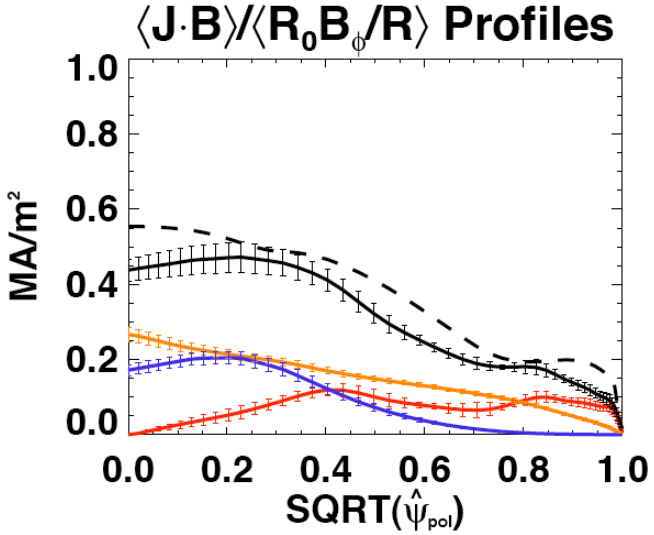
- ***Results of TRANSP analysis for shot 116318***
- ***Results of TRANSP analysis for shot 133964***

Current profile analysis shows ~20% discrepancy

- Historically current profile analysis gives good agreement
- Most easily explained by a problem with the electron density
- Correction of ~20% to n_e would raise non-inductive current fraction to record value and explain total current
- Z_{eff} high and Vloop low, also indicative of a potential data anomaly
- Could also be insufficient edge resolution of bootstrap current

- *Current profile analysis for 129968*

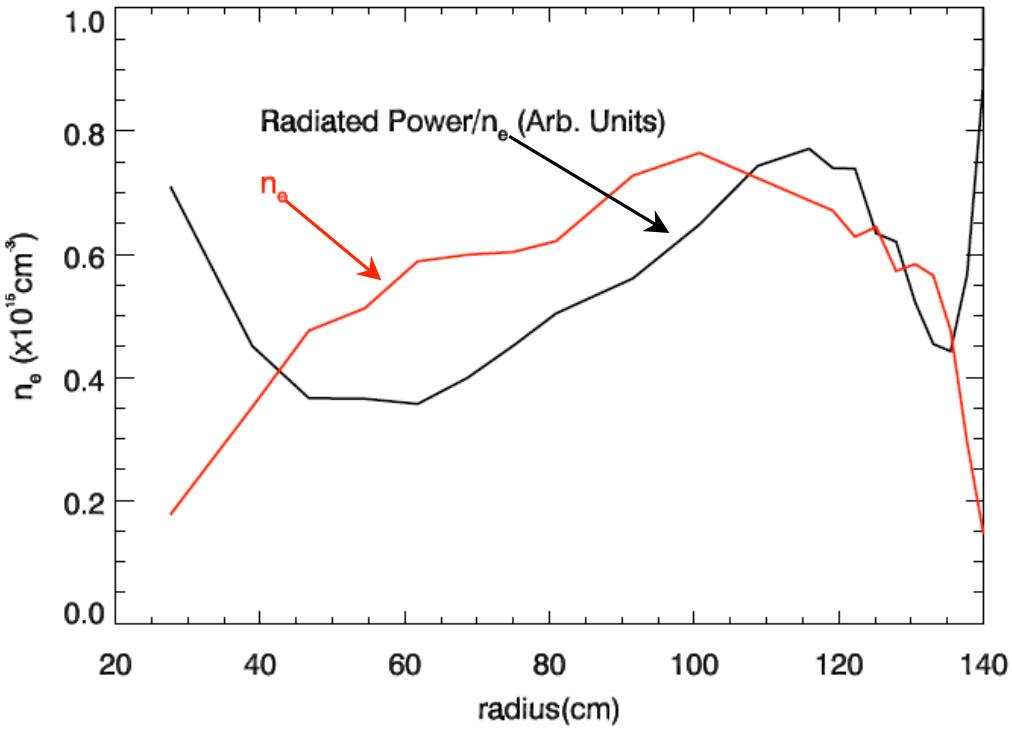




Bolometer array shows significant off-axis peaking

- Possibly due to rotation?
- If Carbon profile is also, this shift would lead to an error in the inferred Z_{eff} from CHERS
- Can we see this with USXR or visible cameras and appropriate filters?

Overlay of the electron density profile (red) with the density normalized radiated power from the bolometer arrays for shot 135445 at t= 0.8s



Observations

- Need to revisit lower I_p now that OH overtime trip is repaired
- Shot will benefit from strike point control to avoid late ramp in elongation
- Should implement rtEFIT new basis functions to see if control is improved
- Real-time β control may allow operation closer to limit
- Need to identify source of discrepancy in the predicted total current
  - Z_{eff}, edge bootstrap, reconstruction fidelity