DIII-D Operation for NSTX-U Joint Campaign Brainstorming : Integrated Scenarios

by

B.A. Grierson et. al.

PPPL

Presented at the NSTX-U Integrated Scenarios Meeting

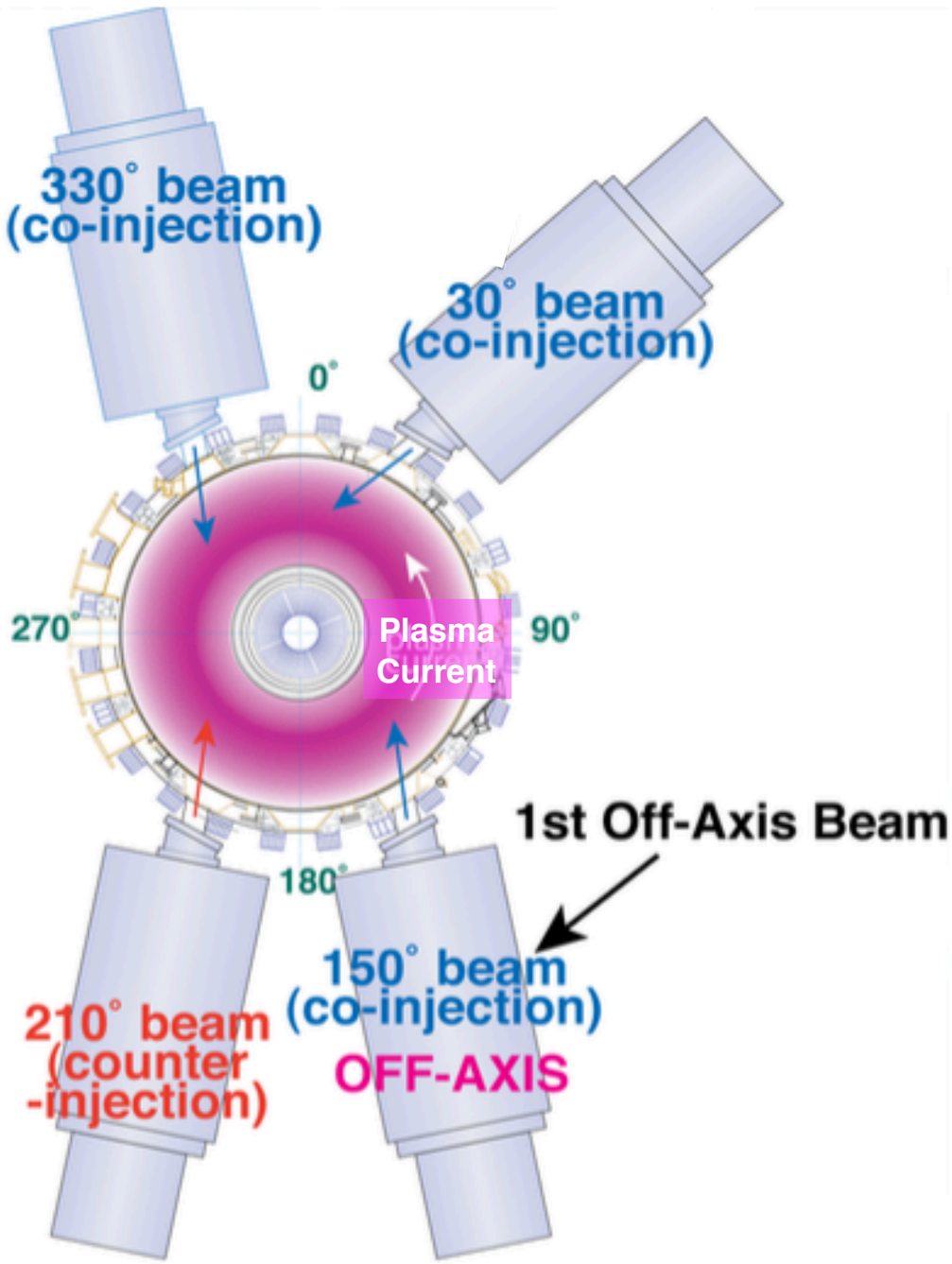
Remote: B252

Oct 13 2016

DIII-D Strengths are Flexible Shaping, Heating, Pumping and 3D Fields

- Maximum Bt ~ 2.15 T
- Maximum Ip ~ 2.0 MA
- Total Neutral Beam Heating Power ~ 16 MW
- Total Electron Cyclotron Heating Power ~ 7 MW
- LSN/USN/DND
- Upper and lower cryo pumping
- Two rows of 6 internal coils (I-coils)
- One row of 6 external coils (C-coils)

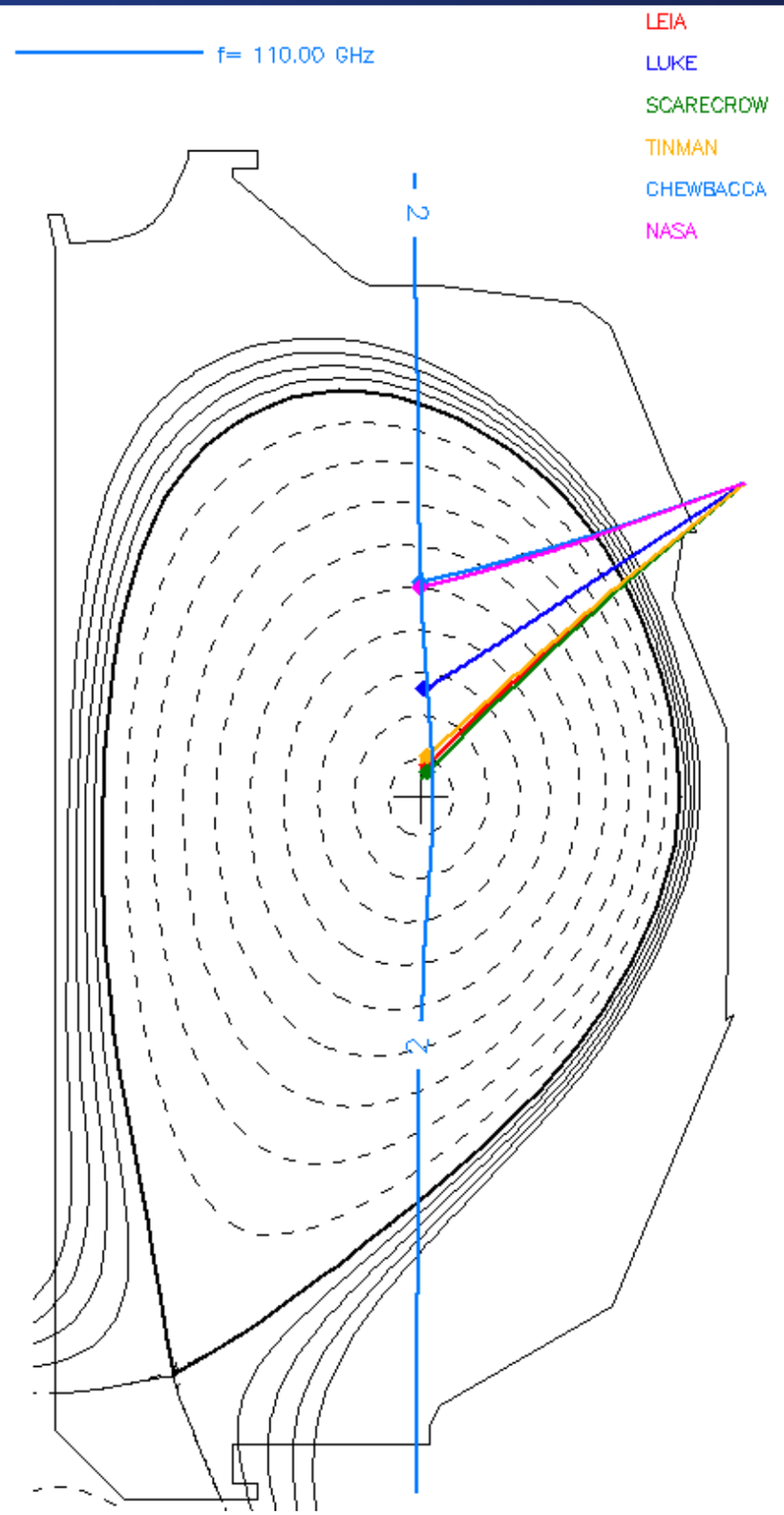
Directed Neutral Beams are the Dominant Heating Systems on DIII-D



- Each beamline has two sources (tang/perp)
- 11.7 MW co with 3.5 MW available to go off-axis
- 4.0 MW ctr for lower torque
- Modulation as fast as 10/10 ms on/off
- Total ontime limits apply

Electron Cyclotron Heating and Current Drive Available for Static, Dynamic and Feedback Controlled Aiming

- **Up to ~ 7 MW of 110 GHz 2nd harmonic (typ.) routinely available**
- **Shot-to-shot aiming routine and feedback for NTM control on request**
- **Modulation available with shot-duration pulse lengths**
- **Typical density limits imposed**

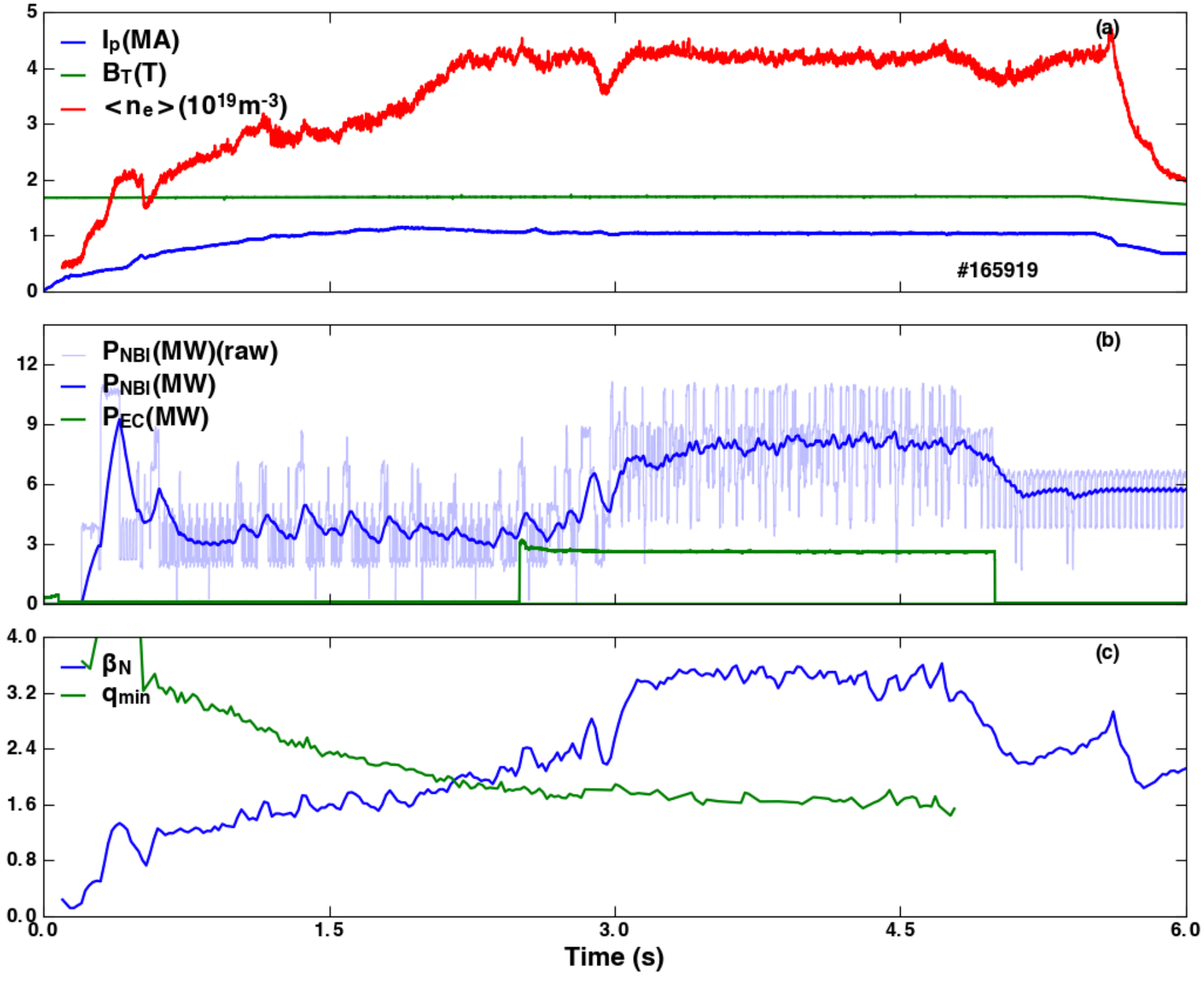


Workhorse Diagnostics and Real-time Measurement Capability

- **Density control through CO2 interferometer and gas puffing**
  - Impurity puffing and radiation feedback possible
- **β_N feedback through NBI**
- **Realtime MSE**
- **Thomson scattering for n_e^{ped} and real-time TORBEAM for EC**
- **Charge-exchange spectroscopy for real-time rotation**
- **Active MHD spectroscopy for MHD stability, optimum error field correction**

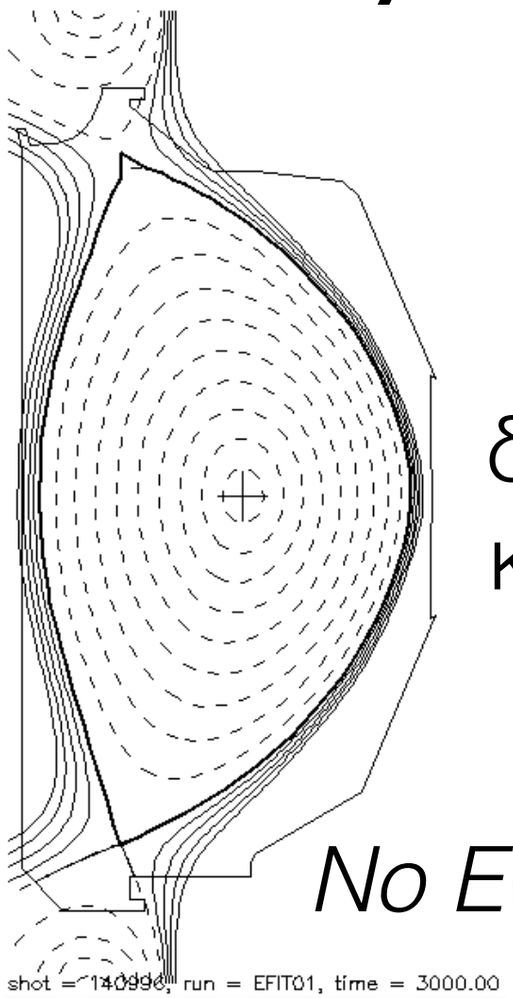
A Representative High β Discharge Used by DIII-D Scenarios Topical Group (courtesy C. Holcomb)

- Early L-H
- q_{min}~1.5
  q_{95} ~ 5
- β_N ~ 3.5



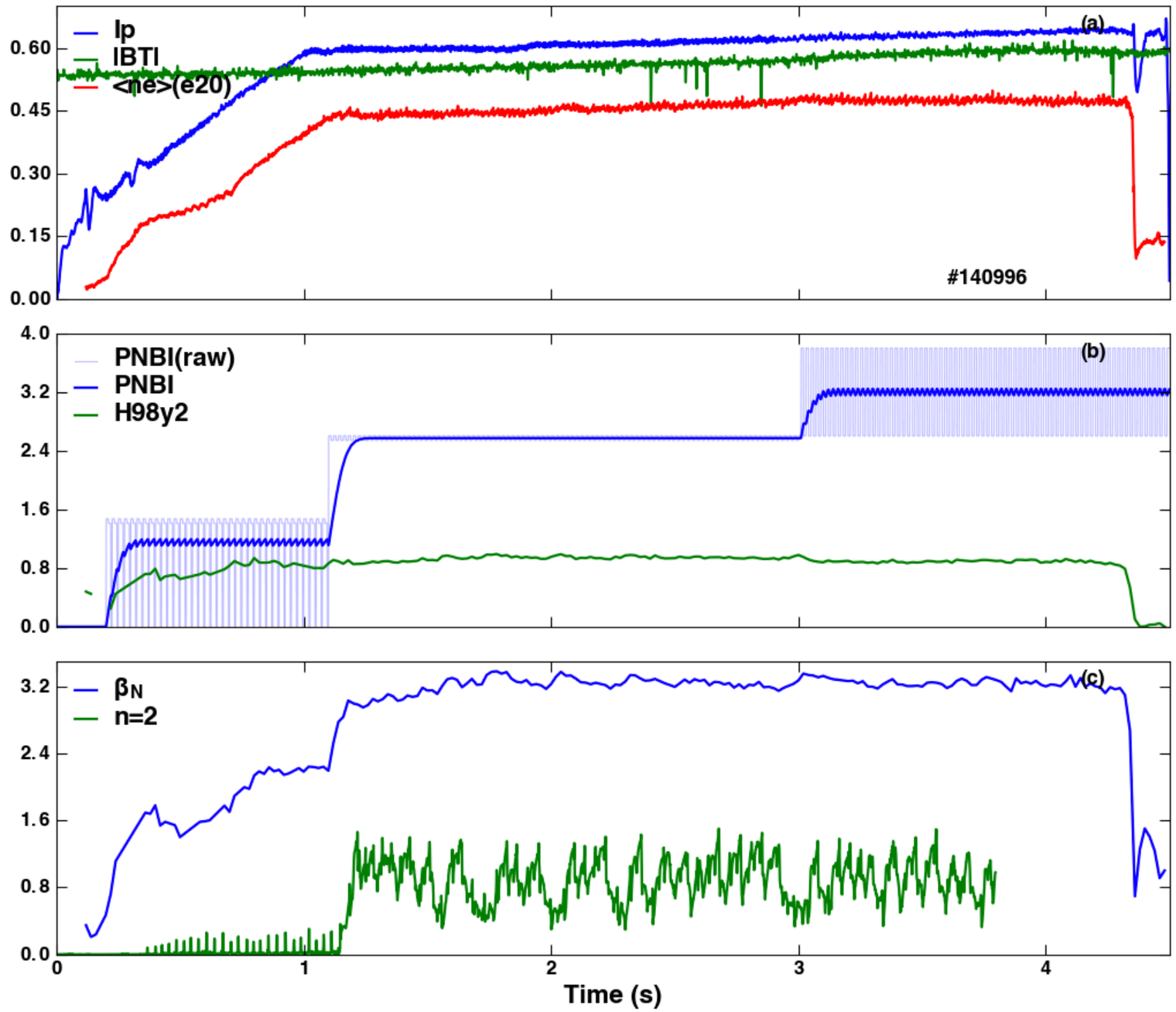
A Previous "NSTX-Like" Discharge on DIII-D

- **BT~0.55 T, Ip~0.62 MA, βN~3.3, H98y,2 ~ 1.0**



δ~0.55
κ~1.86

No EC access



*K.H Burrell, et. al. NF **54** 083424 (2014)*

Anything Else Specifically?

- **Fluctuations?**
- **3D fields, wiring, power supplies, …?**
- **Low field considerations?**
- **Pellets?**