

Density Limit Mechanisms in NSTX NBI Heated Discharges

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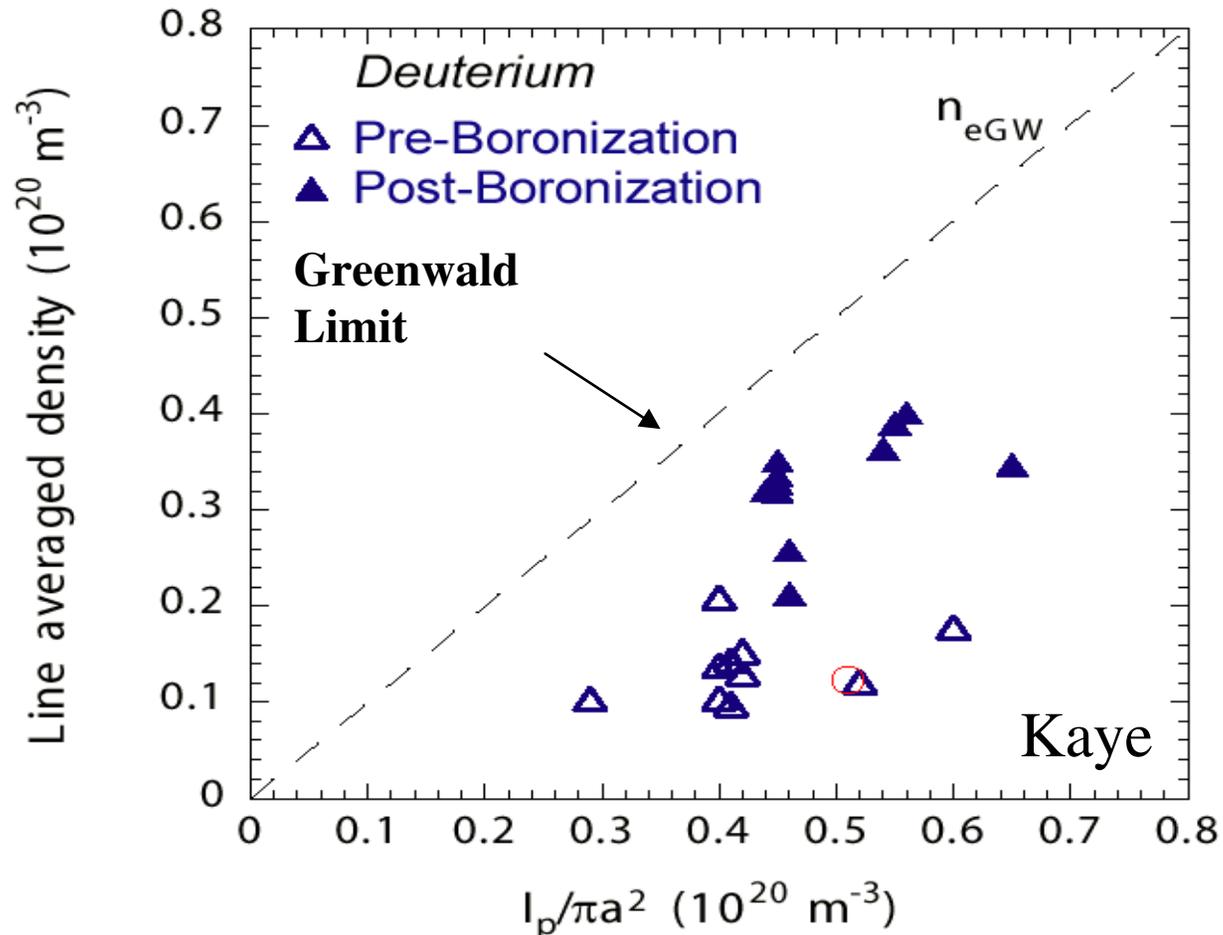
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Many processes can impose limit on plasma density

- Confinement in NSTX tends to increase with density
 - understanding processes can have big payoff
- Hughill/Greenwald empirical scaling is $n_e^{\max} \sim I_p/(\pi a^2)$
- Proposal: identify processes which limit density in good performance NBI heated discharges
 - MARFE limit
 - MHD imposed limit (e.g. tearing modes)
 - Particle confinement limit
 - Fueling limit
 - Radiative collapse limit

NBI density limit should occur after ohmic density limits have been established



- Bake-out and inner wall gas puffing should extend density limit

**DIID-D density limit study resulted in H-mode discharges
~ 50% above Greenwald “limit”**

- **Divertor detachment sequence: caused transition back to L-mode and subsequent disruption (cryopump on)**
- **Pellet particle confinement time: increased non-linearly with I_p (high I_p)**
- **Fueling limit: pellet efficiency increased with decreasing NBI power; near $P_{\text{heat}} \sim P_{\text{LH}}$ pellets caused H-L mode transitions (low P_{NBI} , low B_t for margin over P_{LH})**
- **MARFE: restricts $n_{\text{edge}} * q_{95}$ (pumping, low q)**
- **Tearing modes: observed over wide NBI range and sometimes triggered by pellets (n=1 modes avoided for $P_{\text{heat}} < 3\text{MW}$)**