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Radiative divertor with impurity seeding and with LLD

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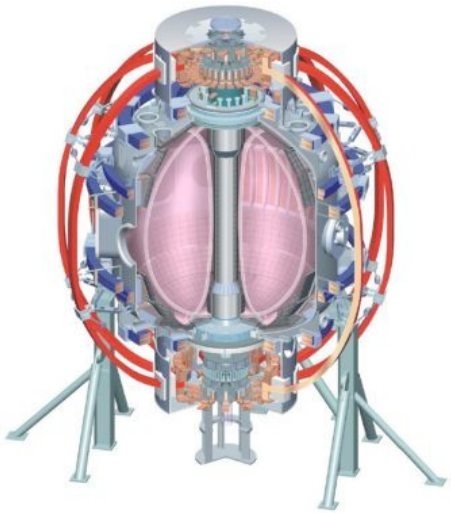
Boundary Physics Break-out Session
NSTX Research Forum
Princeton, NJ
2 December 2009



Use of impurity seeding will yield an opportunity to study reactor-relevant radiative divertor

- Radiative divertor experiments used D_2 injection to demonstrate peak heat flux reduction in NSXT with carbon radiation
- NSTX-U will require a significant divertor peak heat flux reduction probably not possible with low Z impurities
- Reduced density LLD / LITER operation will reduce radiated power due to extrinsic impurity seeding – is radiative divertor possible at all?
- Need to learn control aspects of radiative divertor
  - Identify divertor quantities that can be monitored and used as actuators for feeding into PCS to regulate impurity injection
- Additional emphasis – consider joining ITPA DSOL-20 "Transient divertor re-attachment"
  - ITER will run with partially detached divertor (PDD)
  - Study possible fault conditions – loss of PDD regime
  - Dynamic / transient experiment – how intrinsic carbon can replace extrinsic impurity radiated power due to loss of impurity seeding

Radiative divertor with impurity seeding – complete XP605, XP708, XP814 (1 run day)

- High-performance high κ, δ LSN plasmas with I_p = 0.8 - 1.2 MA, P_{NBI} = 4-6 MW
- Select He, Ne, or CD_4 and use for divertor or midplane injection
  - Need to verify compatibility with LLD due to erosion concerns
  - Neon may be a good candidate in the LLD with higher T_e
- Study divertor conditions as a function of impurity injection rate
- Run plan may include cold and warm LLD to study compatibility of radiative divertor with LLD pumping
- Measurements of pedestal profiles and pedestal stability calculations to understand impact of radiative divertor on core and pedestal plasma

Previous radiative divertor experiments with neon demonstrated that NSTX divertor is too cold for efficient neon radiation