NSTX

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Simple As Possible Plasmas (SAPP) on NSTX

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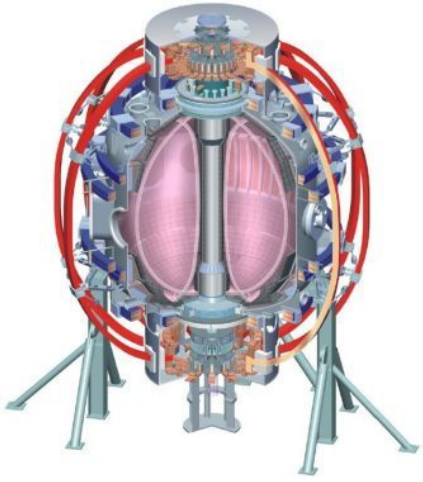
Boundary TSG Session
NSTX Research Forum
Dec. 2, 2009



SAPP studies on DIII-D have proved highly valuable for modelling of L- and H-mode plasmas

- Purpose: Produce a set of Simple-As-Possible Shots with complete edge diagnosis for purposes of testing and validating advanced edge analysis codes
  - Codes which incorporate a broad range of diagnostic inputs, or are capable or reproducing diagnostic results synthetically (e.g., UEDGE, OEDGE, SOLPS (B2-EIRENE), DEGAS, REDEP, etc.)
- Motivation: To identify controlling processes in the tokamak edge, many of which have only begun to be identified.
  - Many boundary phenomena remain poorly understood.
  - 3D features in NSTX, and the advent of the LLD will complicate the situation considerably
- Goal: Produce a set of 'go to' shots for detailed simulation purposes in the modelling community, including all available diagnostic coverage

Ample new capabilities in 2010 pertinent to physics interpretation and modelling

- Triple Langmuir probe array (Kallman)
- New spectroscopic capabilities (Soukhanovskii, Roquomere, McLean)
  - Phantom camera with emission filters
  - Divertor spectrometer
  - Possible new full-time spectroscopic monitors on LLD
- Fast two-color IR viewing the LLD full time (McLean/Ahn)
  - Heat flux changes with LLD operating mode (cold, warm, hot)
  - Emissivity/surface condition variability
- …Many more improvements, enhancements in addition to existing capabilities
- Involve modelers in planning to best utilize diagnostic data

Proposal: 1 day experiment for running SAPP discharges

- Run repeat low triangularity discharges with maximum diagnostic coverage and repeatable characteristics
  - Repeat discharges required to change camera filters and spectrometer settings, multiply datapoints from LPs, MPTS, RCP, etc. for equivalent plasmas
  - Current filter acquisition list includes: Da, Db, Dg (recycling, background parameters), HeI, HeII (recycling), CI, CII, CIII (chemical and physical erosion of C), LiI, LiII (chemical and physical erosion of Li), MoI (physical erosion of moly), FeI (physical erosion of iron), possibly CD (chemical erosion of C)
- Run discharges with swept strike points to further characterize target parameters
- Repeat with LLD cold/warm/hot
- Repeat XP with LLD near-empty and LLD full (1/2 day each?)

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Regular spectroscopic characterization of the LLD

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Adam McLean, ORNL
Rajesh Maingi, Travis Grey,
Vlad Soukhanovskii, LLNL

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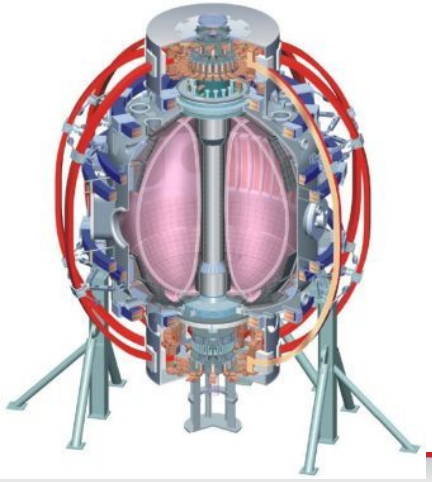

Long-term changes in NSTX with operation of the LLD are almost assured

- 15 weeks are required to completely fill the LLD
- Transient (long-term) LLD influence on plasma performance and parameters largely unknown
  - Recycling, pumping, impurity sources, etc.
- Interpretation of results from other XPs as a consequence of variable LLD impact may depend heavily on modelling
  - Emphasis on large modelling effort post-2010 may ensue
- Regular monitoring of impurity generation and transport will be a key parameter to know
  - Spectroscopic coverage valuable (filtered cameras and spectrometers)
- Additional spectroscopic diagnostics fixed on monitoring key emissions would be highly valuable

Proposal: Piggyback experiment to characterize emissions and track long-term variability in emissions

- Run repeat low triangularity discharges with maximum diagnostic coverage and repeatable characteristics
  - Current filter acquisition list includes: Da, Db, Dg, HeI, HeII, CI, CII, CIII, LiI, LiII, MoI, FeI, CD
- Purchase new spectroscopic system(s) of small, high throughput devices (e.g., from Ocean Optics) for study of key emission region (e.g., near 430 nm):
  - DI, CD, CII, LiI, LiII and MoI simultaneously
  - Number and location of view chords TBD (view on LLD and view of divertor floor highly desirable)
- Diagnostians… Run, run, run your systems!

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Spectroscopic characterization of molecular sources in NSTX

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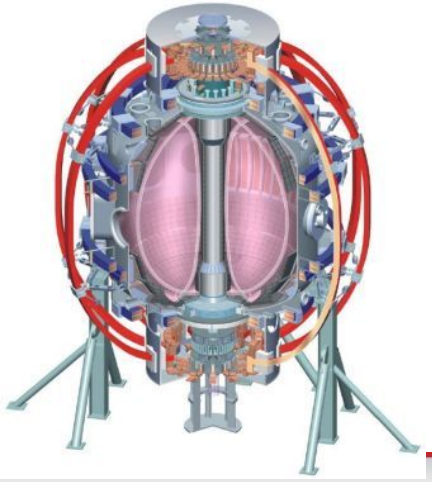

Characterization of Molecular Sources in NSTX

- Molecules will be found in considerable amounts in the NSTX divertor
  - Have seen D_2, CD (chemical sputtering), LiD
  - Will there also be Li_2 (should be visible), LiOD, Li_2O, Li_2O_2, LiC (all possible)
- Existence of molecules in the edge region is an important validation of advanced modelling codes (e.g., REDEP, MD simulations)
- Detailed, careful scan of the observable spectral window for DIVSPEC and VIPS-2 where molecular bands are expected should be carried out
- Proposal: ½ day experiment to scan spectroscopic systems, search for emissions in plasmas with controlled parameters
- Run with OSP off and on LLD, LLD cold/warm/hot