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Scrape-off layer and divertor transport and turbulence studies with reversed B_t

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Culham Sci Ctr
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NSTX Reversed TF XP discussion

23 July 2009

Princeton, NJ

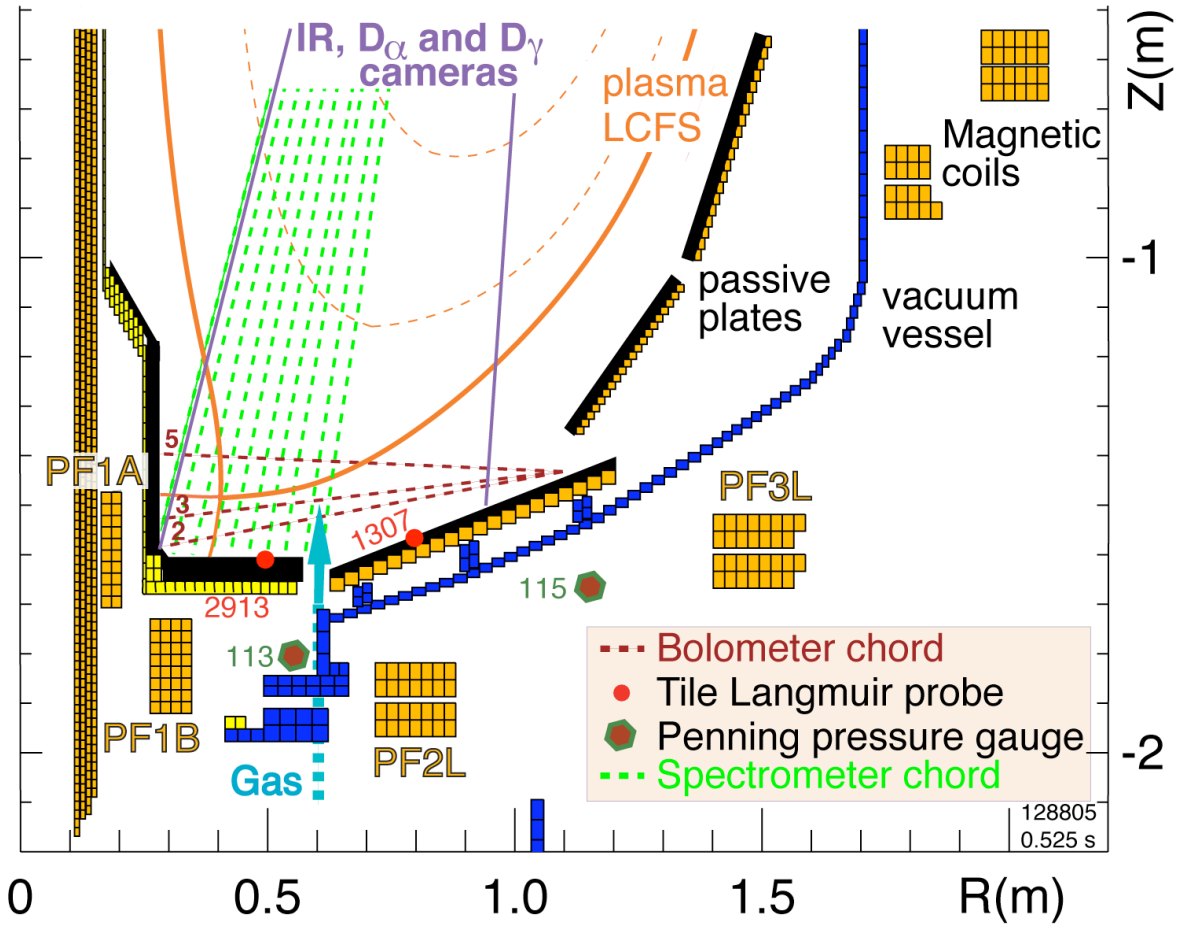
Reversed TF campaign is being planned on NSTX

- Start hardware preparations on 5 August 2009
- Planning to dedicate two days to ISTPs and discharge development (6-7 August 2009)
- TF will be 4.5 kG
- Three T&T and BP TSG experiments have been discussed as leading candidates for the reversed TF campaign
  - L-H threshold studies
  - High-power L-mode studies
  - SOL and divertor characterization
- Proposed XPs will provide initial characterization on
  - NSTX machine performance with reversed TF
  - data to motivate future reversed TF and possibly I_p exp'ts
  - data to compare to large aspect ratio tokamaks (e.g., DIII-D, JET, AUG, JT-60U)

NSTX edge diagnostics set is (well?) suited for the proposed SOL and divertor studies with reversed B_t

- Diagnostic set for divertor studies:
  - IR cameras
  - Bolometers
  - Neutral pressure gauges
  - Tile Langmuir probes
  - Dα, Dγ filtered CCD arrays
  - UV-VIS spectrometer (10 divertor chords) – C II, CIII, Balmer, He profiles
  - Fast cameras
- Midplane Thomson scattering and CHERS systems
- Divertor gas injector

  Γ_{gas} = 20-200 Torr l / s



Expected measurable effects from the experiment

- Present B_t direction: CW from above, B x grad B toward lower X-pt
- Present I_p direction CCW from above (co-dir. w/ NBI)
- Reversed B_t direction: CCW from above, B x grad B away from lower X-pt
  - Classical drifts – ion flows, carbon migration
  - Divertor heat and particle flux asymmetries
  - Divertor regimes – effect on divertor T_e and n_e
  - Detachment
  - Pumping, density limits

Plan for SOL and divertor characterization

- Characterize divertor heat and particle fluxes and asymmetries in low-δ shape
  - Scan P_{NBI} as much as possible in H-mode at 0.8 MA
  - Scan I_p between 0.6 and 1.2 MA
  - Study pumping – scan LITER rate (several data points)

- Characterize outer divertor heat and particle fluxes in high-δ shape
  - Scan P_{NBI} as much as possible in H-mode at 0.8 (1.0) MA
  - Scan I_p between 0.6 and 1.2 MA
  - Study pumping – scan LITER rate (several data points)
  - Study detachment access in 1.0 MA and 1.2 MA discharges – puff D_2 in lower divertor
  - Study fueling w/ SGI

- Obtain “snowflake” divertor (if previously successful)