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Divertor electron temperature and EEDF modification due to connection length modification

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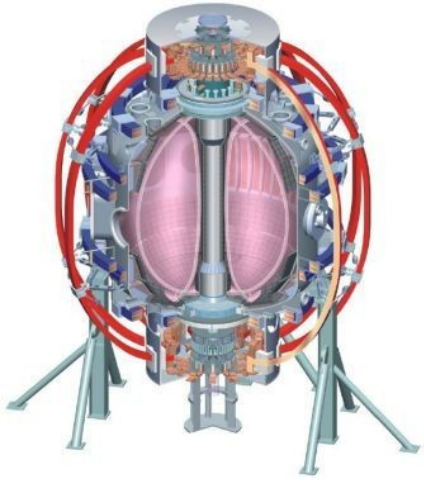
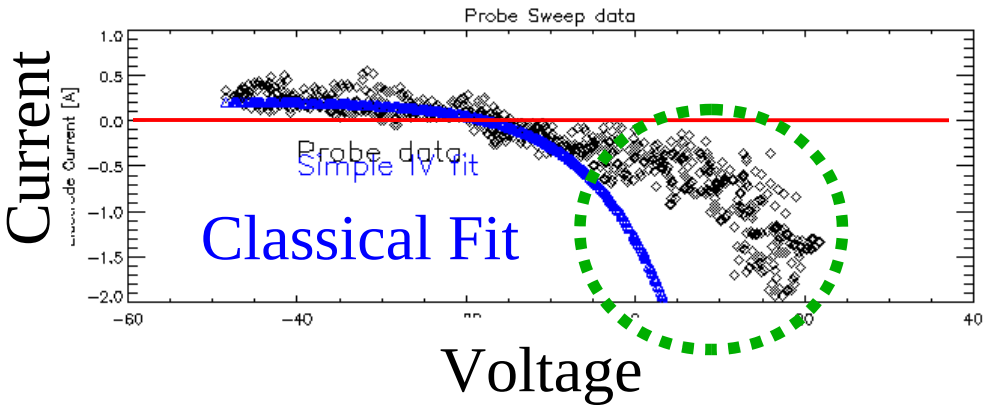
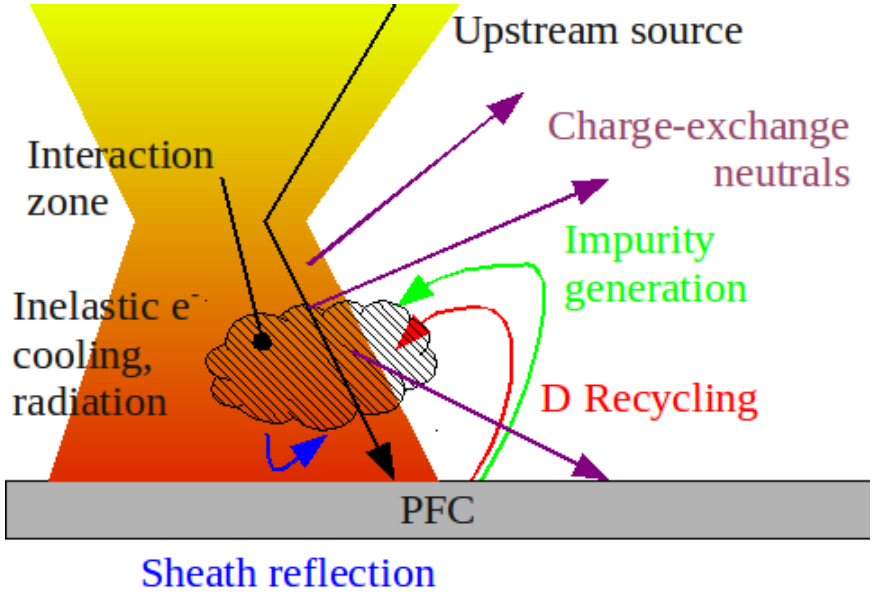
NSTX 2011 Research Forum BPTSG Session
LSB-318 – 1:30-5:30pm, March 16, 2011



Electron energy distribution function (EEDF) provides insight into SOL processes

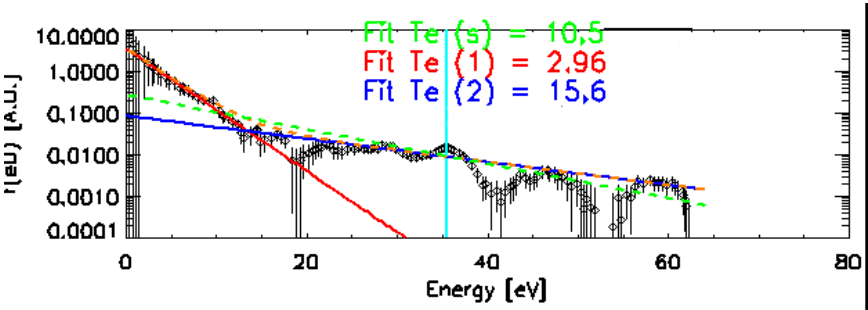
- Classical interpretation “throws away” data above floating potential
- First derivative method (Popov, 2009, PPCF; Arslanbekov, 1995, PoP) provides interpretation of complete characteristic
- In principle, EEDF contains resulting distribution of electrons after numerous interactions in the SOL
  - e.g. inelastic interactions increase low energy population (D or different impurities, diff. energies)
  - Plasma potential can be evaluated for sputter yield estimation

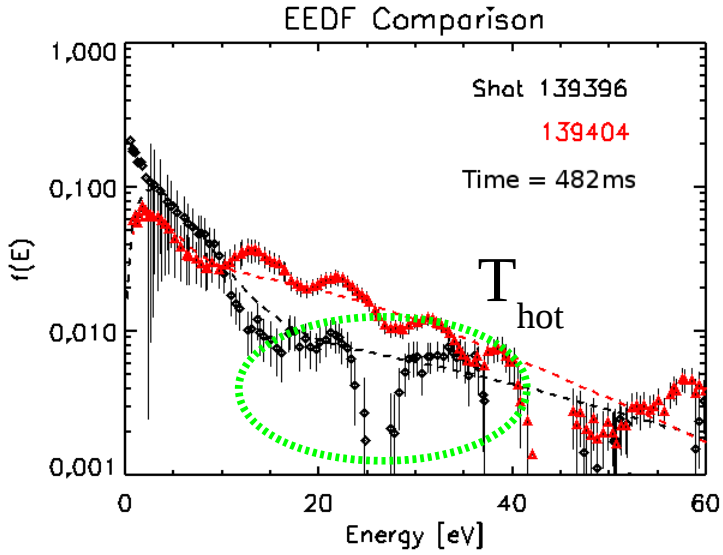




Desirable to understand parallel heat conduction cooling and impact on EEDF at target independent of impurities

- Have indications of EEDF modification during LLD discharges – some exploration occurring in LRTSG
- Simple two-point model indicates that mid-plane temperature and target temperature easily related with collisionality
- If bi-modal temperature arises from inelastic interactions, then collisionality-based cooling should manifest itself in the temperature of the hot population
- XP would perform collisionality scan by varying connection length (Ip and Bt variation) and measure target temperature and EEDF for comparison to upstream (MPTS) and target (HDLP) temperatures
- 1 run day requested, 0.5 minimum useful





$$\frac{T_u}{T_t} = \left(\frac{7\,e\,\gamma}{8\times10^{-16}\,\kappa_0\,(m_i/2\,e)^{1/2}}\right)^2 \left(\frac{\nu_{SOL}}{1-f_{power}}\right)^2$$

$$\nu_{SOL} \approx 10^{-16}\,\frac{n_u\,L}{T_{eu}^2}$$