Collaborations on Codes for Analysis of NPA Measurements on NSTX

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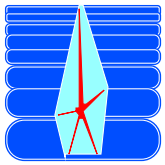
NSTX Research Forum, PPPL, November 2001

Outline

- **DOUBLE analytical code for analysis of NPA thermal spectra and correction of T_i for plasma opacity**



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M. Petrov, E. Suvorkin

- **LOCUST full orbit, Monte Carlo code for analysis of NPA energetic ion spectra**

UKAEA Fusion

R. Akers, MAST

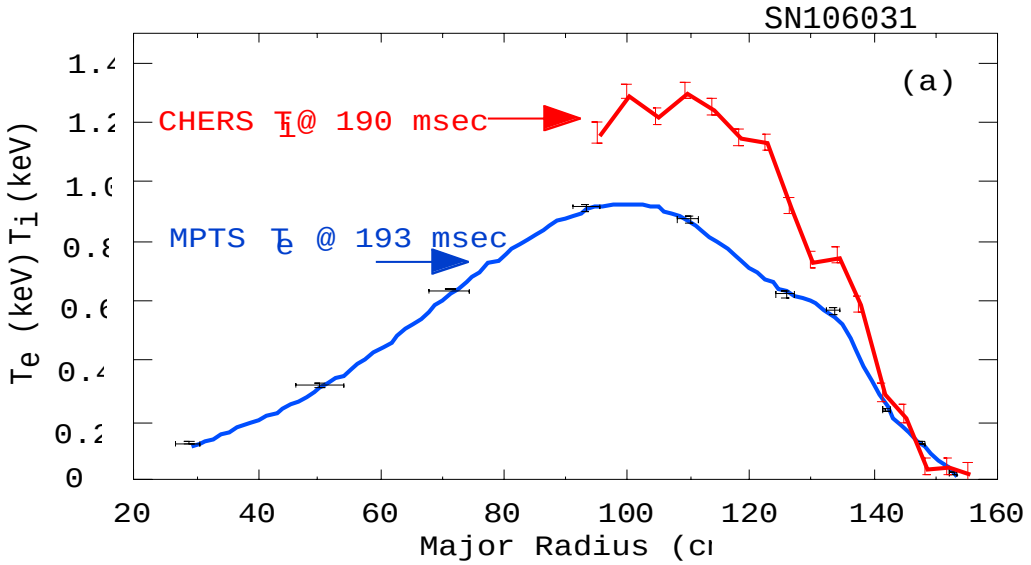
PPPL PRINCETON PLASMA PHYSICS LABORATORY

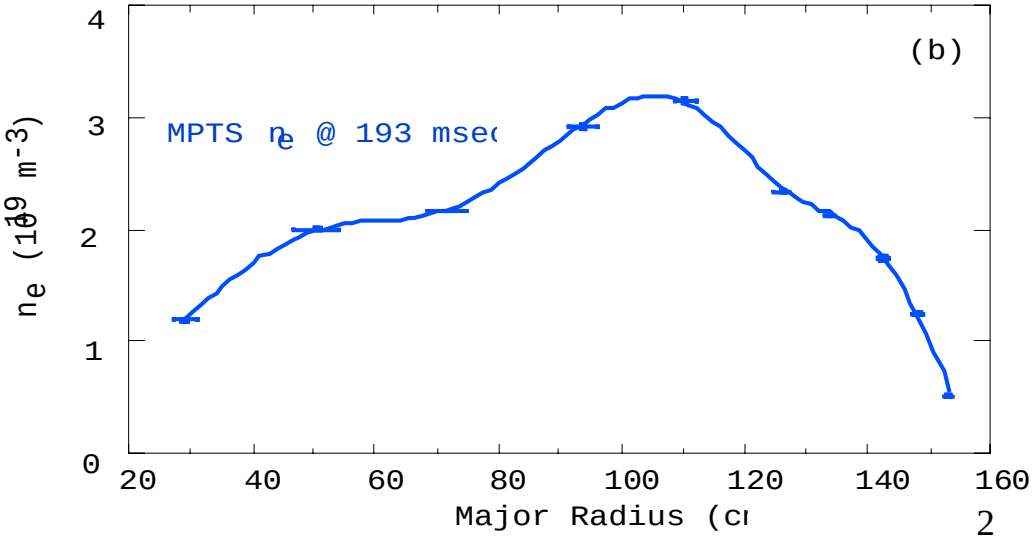
Modeling of NPA Measurements using the DOUBLE Code

- The DOUBLE code developed at IOFFE simulates the measured NPA thermal spectra produced by charge exchange on both passive (background) and active (NBI) neutrals.

- Code inputs are:
  - NSTX and NPA/NBI geometry
  - $T_i(r)$ from CHERS
  - $T_E(r)$ and $n_e(r)$ from MPTS
  - Z_{eff} to derive $n_H(r)$ and $n_D(r)$
  - NBI power and energy

- Code outputs are:
  - neutral density profile
  - CX source profile
  - CX flux spectrum





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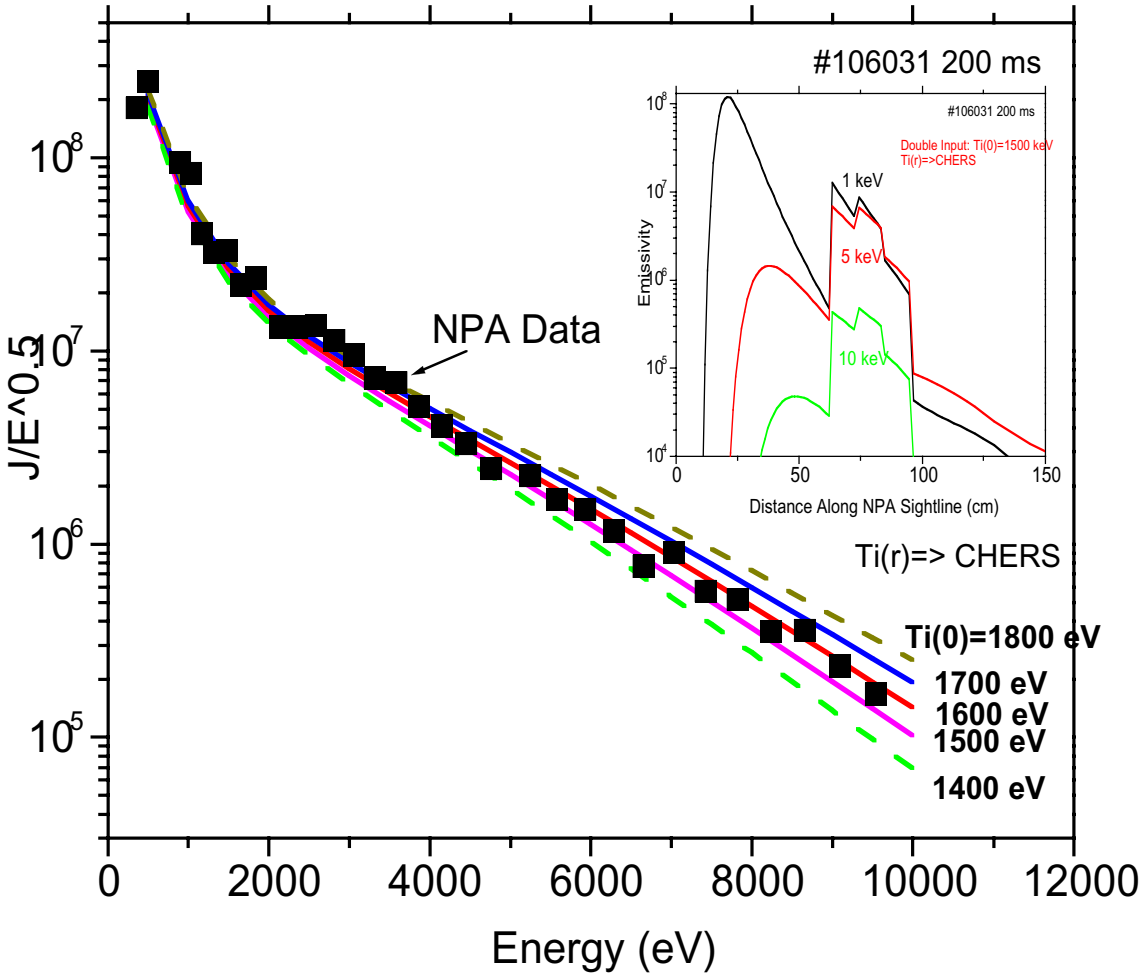
Comparison of NPA Measurements with the DOUBLE Code for t = 200 msec, $n_e(0)$ = 3.2E19 cm^{-3}

- The ion temperature profile, $T_i(r)$, from CHERS corresponding to t = 200 msec is used in the DOUBLE code to simulate the NPA spectrum at that time.

- The core temperature, $T_i(0)$, in the code is then varied to obtain the best fit to the NPA spectra.

- Good agreement is obtained with T_{code} ~ 1500 - 1600 eV compared with $T_{CHERS,NPA}$ ~ 1500 eV .



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Progress

- Install the DOUBLE code at PPPL and test functionality for modeling NPA measurements on NSTX.
- Upgrade the DOUBLE code to include charge exchange on beam primary neutrals.
- Using the DOUBLE code, the difference between NPA and CHERS ion temperature measurements for neL > 3.0×10^{19} m^{-2} was shown to be caused by charge exchange source profile effects. Now, DOUBLE code modeling of NPA data provides an independent estimate of $T_i(0)$ for for neL > 3.0×10^{19} m^{-2}.

Plans: FY02

- Upgrade the DOUBLE code to include beam halo neutrals.
- Upgrade DOUBLE to predict/model NPA measurements with the new horizontal/vertical scanning capability.
- 'Automate' DOUBLE to read profile data from MDS Plus data base and run in 'batch' mode. Return corrected NPA $T_i(0)$ to data base.

Status of LOCUST v3.0 at PPPL

- **Code was installed 11/00 and upgraded to v3.0 11/01. Code runs on PUFFIN and PARED || clusters.**

- **Input interfacing complete. At PPPL, input via EFIT g-file, TRANSP UFILE for TS data. Ambient neutral density currently hard-coded.**

- **Output from the code is currently unavailable at PPPL (all in IDA-3 [Culham version of MDS+]).**

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LOCUST Project Plan @ 11-09-01

- **Get code working on NSTX data at Culham and benchmark code with TRANSP.**
- **UKAEA to package up IDA-3 libraries and deliver to PPPL.**
- **PPPL to install IDA-3 code, which will allow all the LOCUST IDL post-processors to work.**

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- **Add additional interfacing to the code (for TS data, Ti data, neutral density etc.). This could be done either through a) providing wrappers from the IDA-3 read routines to MDS+ or b) through an IDL interface that reads in MDS+ data and writes out IDA-3 data.**

- **Complete coding of 'time dependent simulations'. This is being coordinated to coincide with the arrival of multi-pulse TS on MAST but could be brought forward for use on NSTX.**

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