Fokker-Planck Modeling of HHFW

R.W. Harvey,[1] *A. Smirnov*[2] *, N. Ershov*[2]

NSTX 5 Year Plan Ideas Forum, June 24-26, 2002

[1] CompX, Del Mar, California
[2] Moscow State University, Moscow.

- CQL3D/GENRAY Fokker-Planck code

- Illustrative Results

- Proposed plans

CQL3D/GENRAY Modeling of NSTX FW with/without NBI

(105830_0193 test case)

Features:
 *GENRAY rays are cold (or optionally hot).
 *CQL3D uses ray data to calculate 2−velocity/1−radius collisional/quasilinear
   electron and ion distributions.
 *Ray absorption is iterated to be self−consistent with the ql distortion
   of the distributions.
 *RF interaction with NB injected fast ions included.

*Primary limitation of model: −CQL3D is zero−banana width model,
                                     but fast ion loss regions included.

   −Full−wave effects to be included within next year.

Rays

NBI

CompX
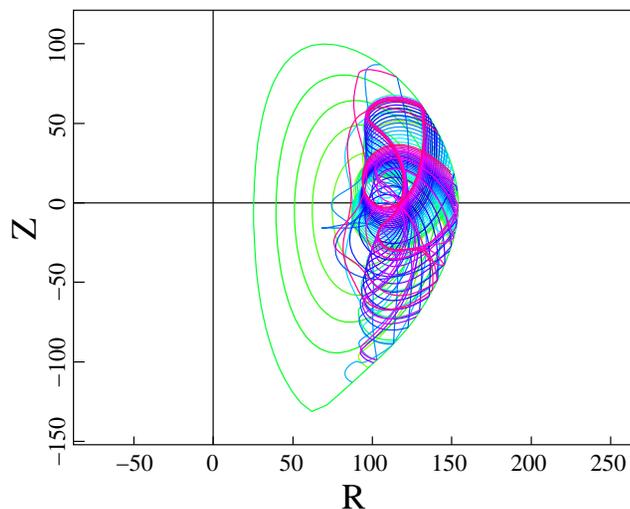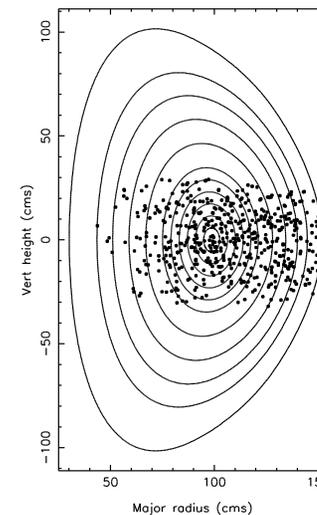
Ion Distribution Functions with: RF, NBI, RF+NBI,. no−banana losses

(Cuts through f(v,theta) at cnst theta, and 2D distn, at rho =0.25a)
(unorm corresponds to 500 keV.)

CompX
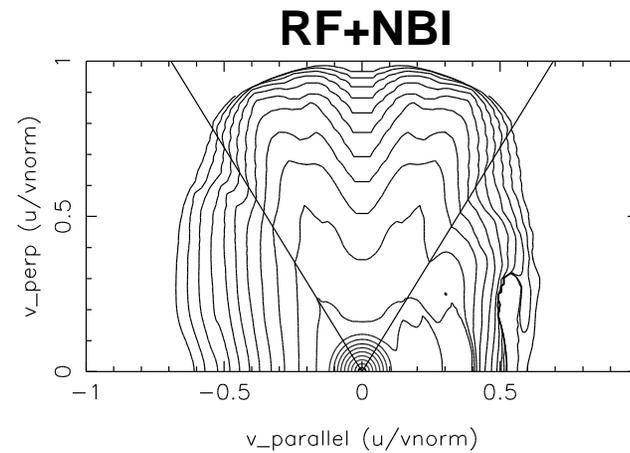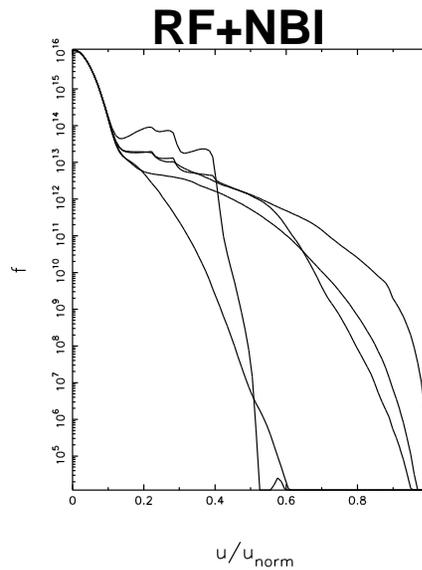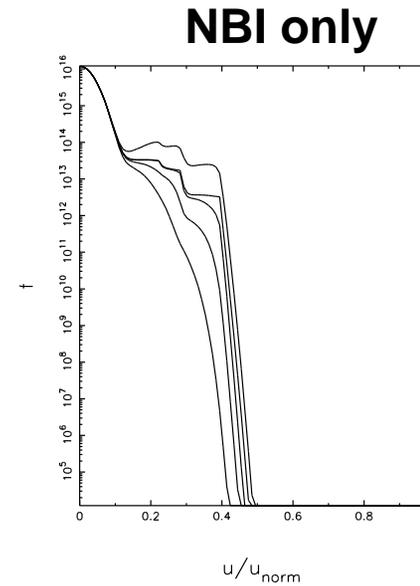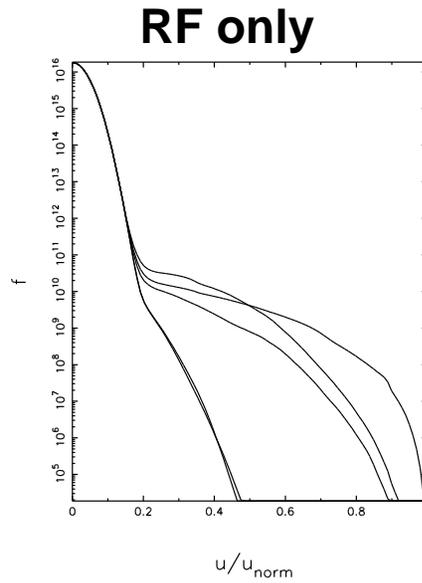
Results:

- Electron damping from the Fokker-Planck code agrees with CURRAY and GENRAY for a NSTX test case.

- Ion damping seems to be high by a factor ≥ 3 near the cyclotron harmonics.

- There is an RF induced ion runaway, which needs further validation.

- Electron transport has proven to be a key to understanding ECCD in small, highly driven tokamaks. Both ion and electron transport may give important nonthermal features in NSTX.

Plans:

- Benchmark GENRAY/CQL3D against CURRAY, HPRT, and full wave codes.

- Improvements for multi-species QL and increased harmonics> 3.

- Improvements of fast ion loss models.

- Neutral Particle + other FI diagnostics.

- HHFW CD and Radial transport studies of electrons/ions.

- Direct experimentalist use of the code suite.