European Transport Solver
IMP3

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ETS Workflow

Fortran workflows

- Testing the solver against analytic results using the method of manufactured solutions
- ETS coupled with
  - Equilibrium codes
    - BDSEQ
    - EMEQ
    - HELENA
  - Neutrals
  - Impurities
  - Transport models
    - ETAIGB
    - NEOWES
  - Source modules
    - Generic ECRH
    - Generic ICRH
    - Generic NBI
- Framework for comparing equilibrium codes
- Framework for comparing neoclassical codes
- Programs
  - Printing CPOs
  - Printing the sizes of CPOs
  - Printing the times of CPOs
  -

Kepler workflows

- Separate poster

ETS Equations

$$\sigma_{\parallel}\left(\frac{\partial}{\partial t} - \frac{\rho\dot{B}_0}{2B_0}\cdot\frac{\partial}{\partial\rho}\right)\Psi = \frac{F^2}{\mu_0 B_0\rho}\frac{\partial}{\partial\rho}\left[\frac{V'}{4\pi^2}\left\langle\left|\frac{\nabla\rho}{R}\right|^2\right\rangle\frac{1}{F}\frac{\partial\Psi}{\partial\rho}\right] - \frac{V'}{2\pi\rho}\left(j_{\text{ni,exp}} + j_{\text{ni,imp}}\cdot\Psi\right)$$
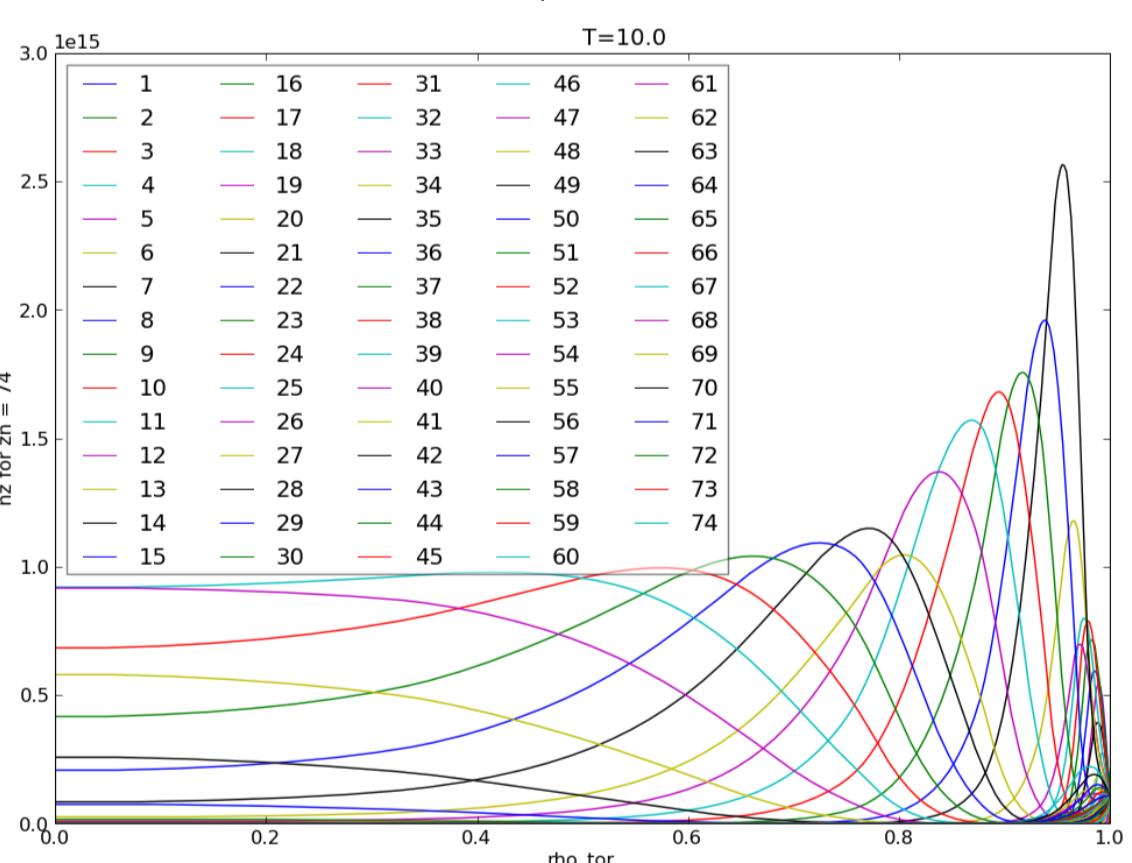
$$\left(\frac{\partial}{\partial t} - \frac{\dot{B}_0}{2B_0}\cdot\frac{\partial}{\partial\rho}\rho\right)(V'n_i) + \frac{\partial}{\partial\rho}\Gamma_i = V'\left(S_{i,\text{exp}} - S_{i,\text{imp}}\cdot n_i\right)$$

$$\frac{3}{2}\left(\frac{\partial}{\partial t} - \frac{\dot{B}_0}{2B_0}\cdot\frac{\partial}{\partial\rho}\rho\right)\left(n_i T_i V'^{\frac{5}{3}}\right) + V'^{\frac{2}{3}}\frac{\partial}{\partial\rho}(q_i + T_i\,\gamma_i) = V'^{\frac{5}{3}}\left[Q_{i,\text{exp}} - Q_{i,\text{imp}}\cdot T_i + Q_{\text{ei}} + Q_{\text{zi}} + Q_{\gamma i}\right]$$
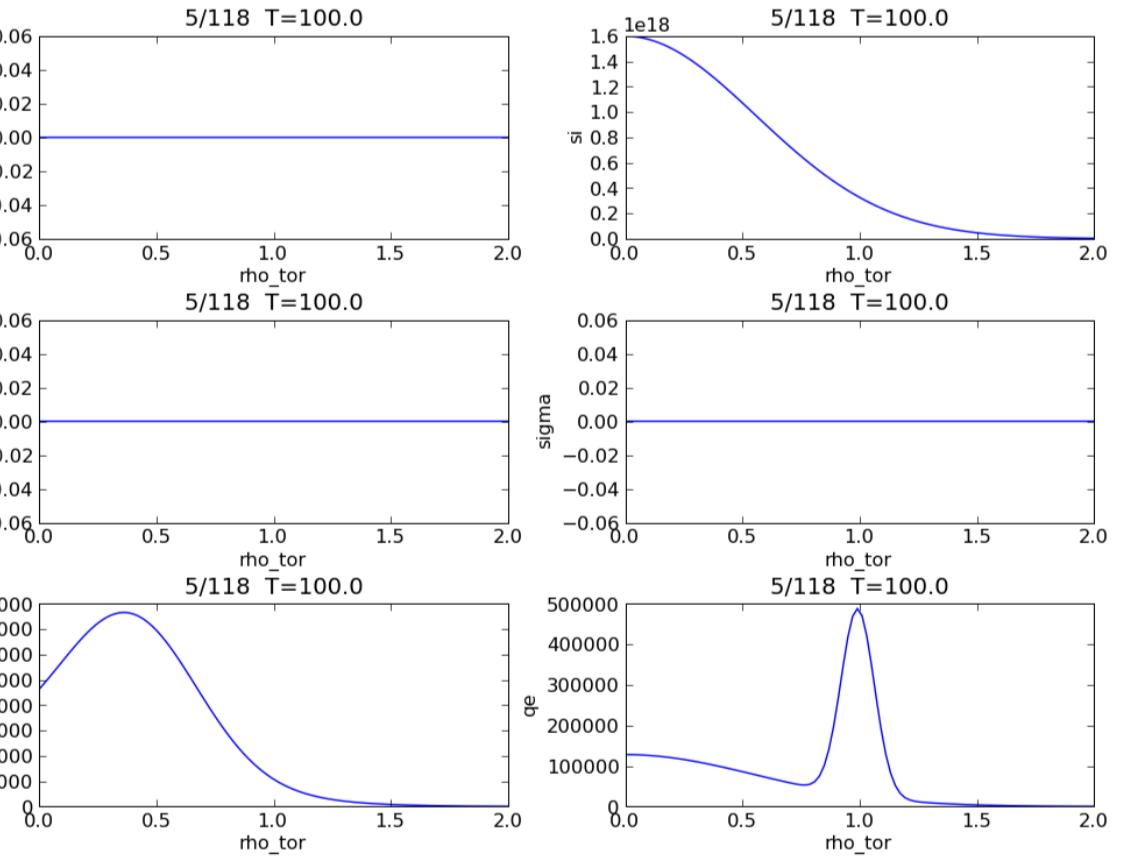
$$\frac{3}{2}\left(\frac{\partial}{\partial t} - \frac{\dot{B}_0}{2B_0}\cdot\frac{\partial}{\partial\rho}\rho\right)\left(n_e T_e V'^{\frac{5}{3}}\right) + V'^{\frac{2}{3}}\frac{\partial}{\partial\rho}(q_e + T_e\gamma_e) = V'^{\frac{5}{3}}\left[Q_{e,\text{exp}} - Q_{e,\text{imp}}\cdot T_e + Q_{\text{ie}} - Q_{\gamma i}\right]$$

$$\left(\frac{\partial}{\partial t} - \frac{\dot{B}_0}{2B_0}\cdot\frac{\partial}{\partial\rho}\rho\right)(V'\,\langle R\rangle\,m_i n_i u_{i,\varphi}) + \frac{\partial}{\partial\rho}\Phi_i = V'\left(U_{i,\varphi,\text{exp}} - U_{i,\varphi,\text{imp}}\cdot u_{i,\varphi} + U_{\text{zi},\varphi}\right)$$

ETS Gantt Chart
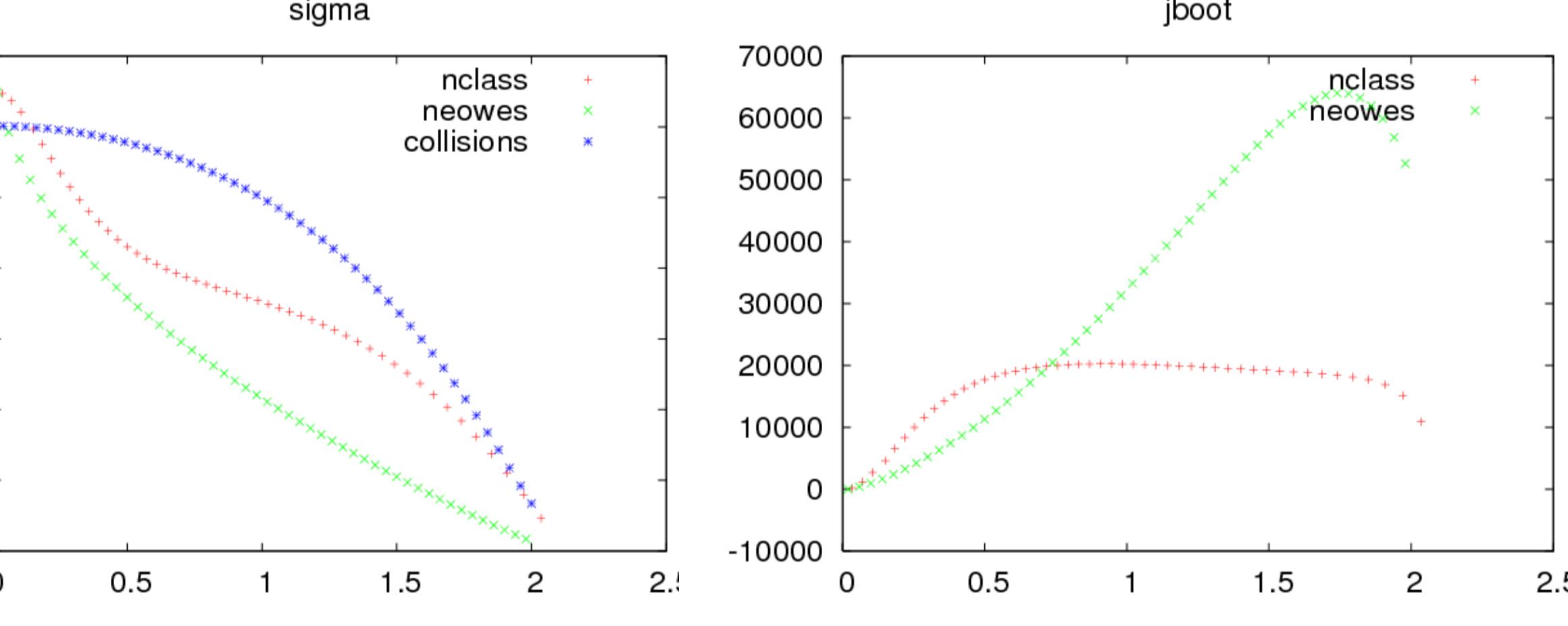
Impurity simulation with W
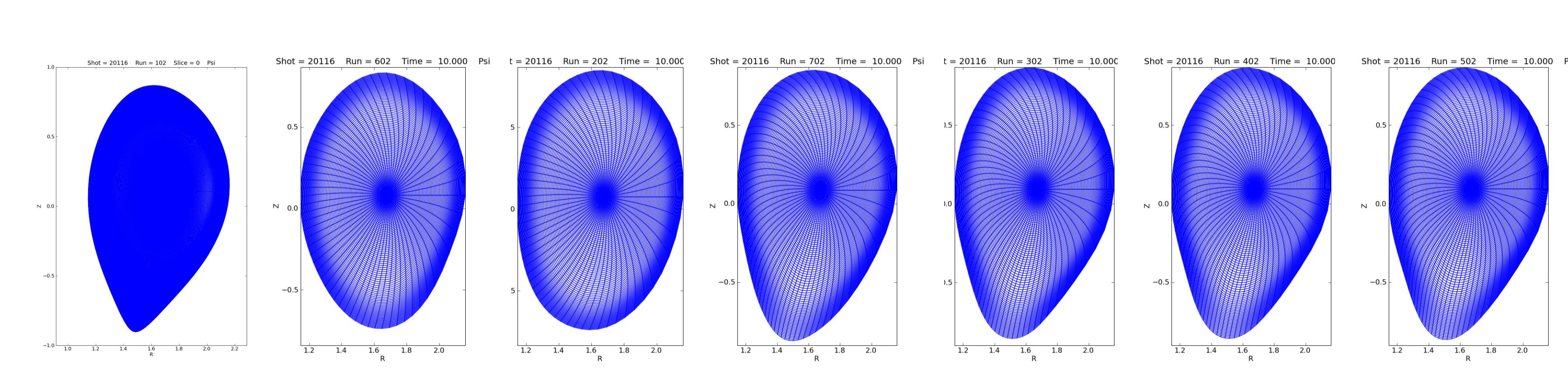
Simulation performed with dummy ECRH, ICRH and NBI
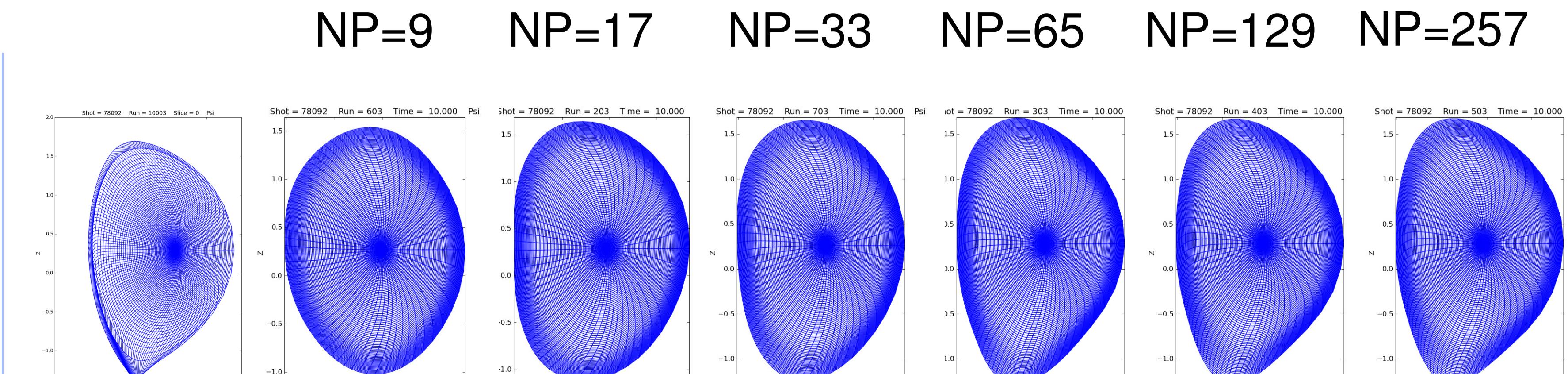
Comparison between nclass (an "unofficial" version), neowes and the built-in "collisions" module

Convergence study (in NP) for AUG and JET runs with HELENA

AUG

NP=9 NP=17 NP=33 NP=65 NP=129 NP=257

JET