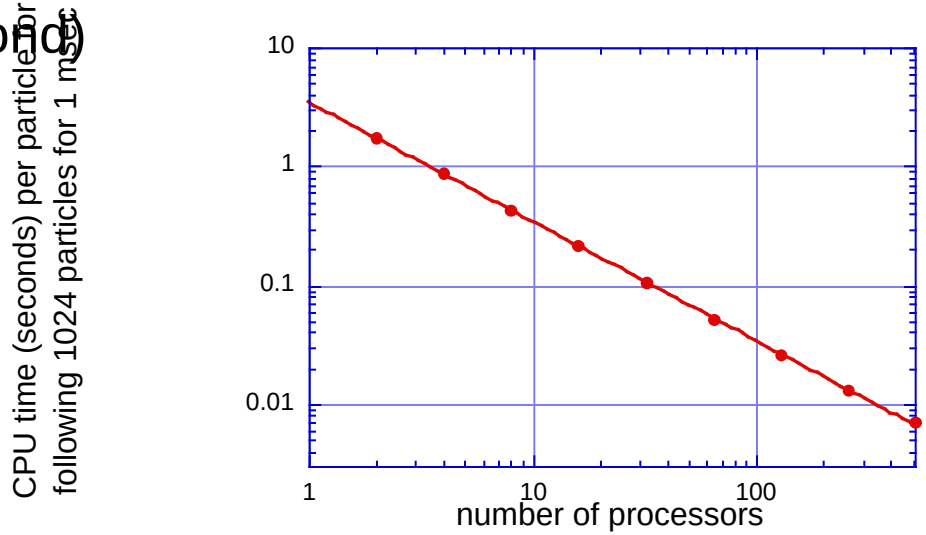
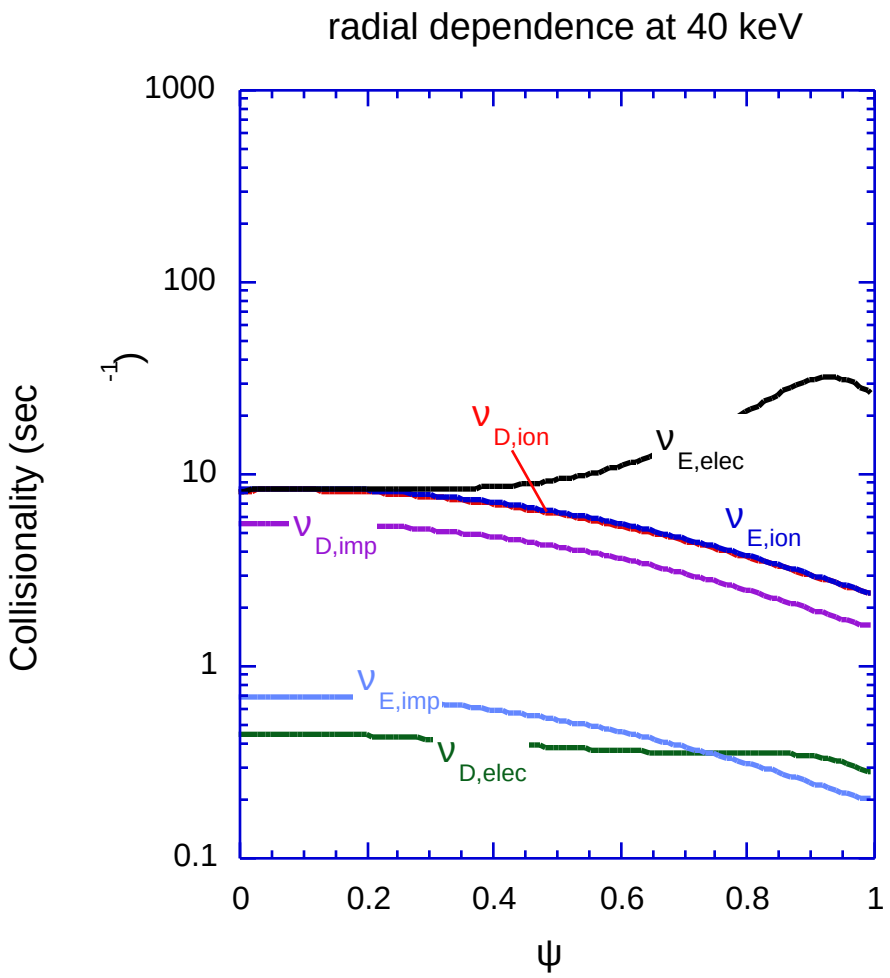
Fast Ion Slowing-Down Calculations for QAS-C10

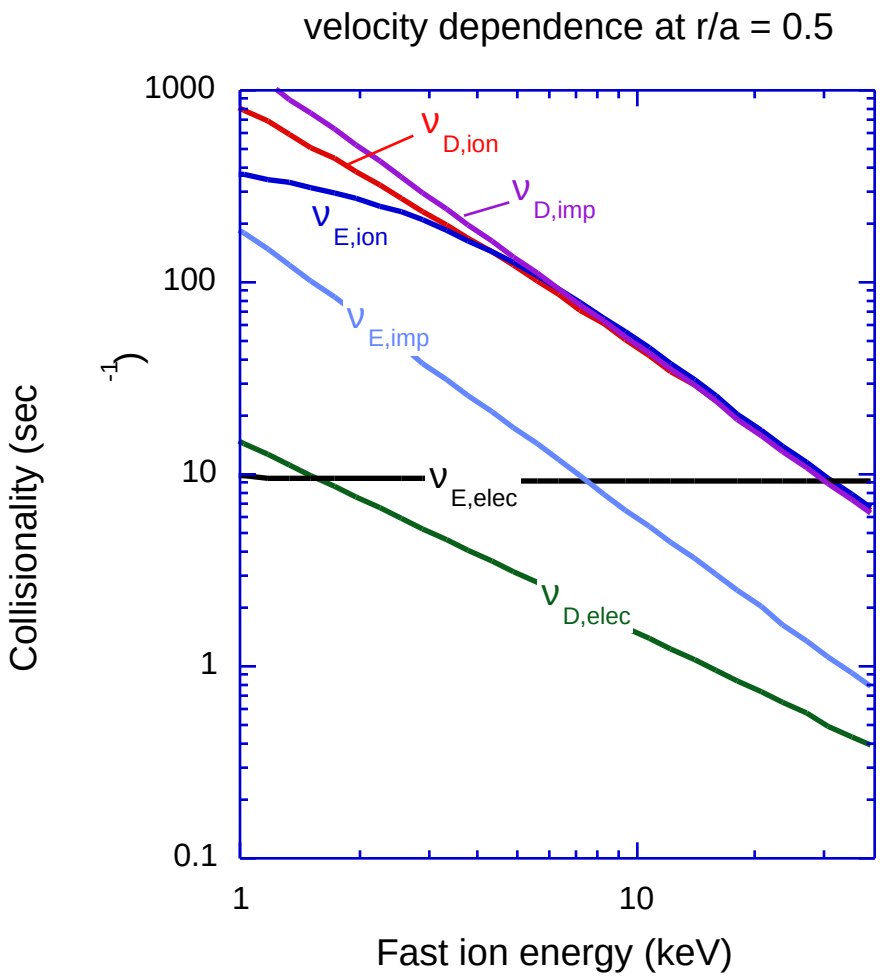
Don Spong
Oak Ridge National Laboratory

- A fast ion Monte Carlo code has been developed which runs in parallel on the T3E
- Includes velocity dependent collision operator
  (ref. Trubnikov, Vol. 1, Reviews of Plasma Physics, S. P. Hirshman, D. J. Sigmar, Phys. of Fluids **19**, 1532 1977)
  - pitch angle scattering, slowing-down, energy diffusion
- Status of benchmarks
- Scalable performance - linear scaling with processors will allow:
  - following a large number of particles (self-consistent core transport)
  - following fewer particles for long times (alpha particle slowing down - τ_{sd} ~ 1 second)

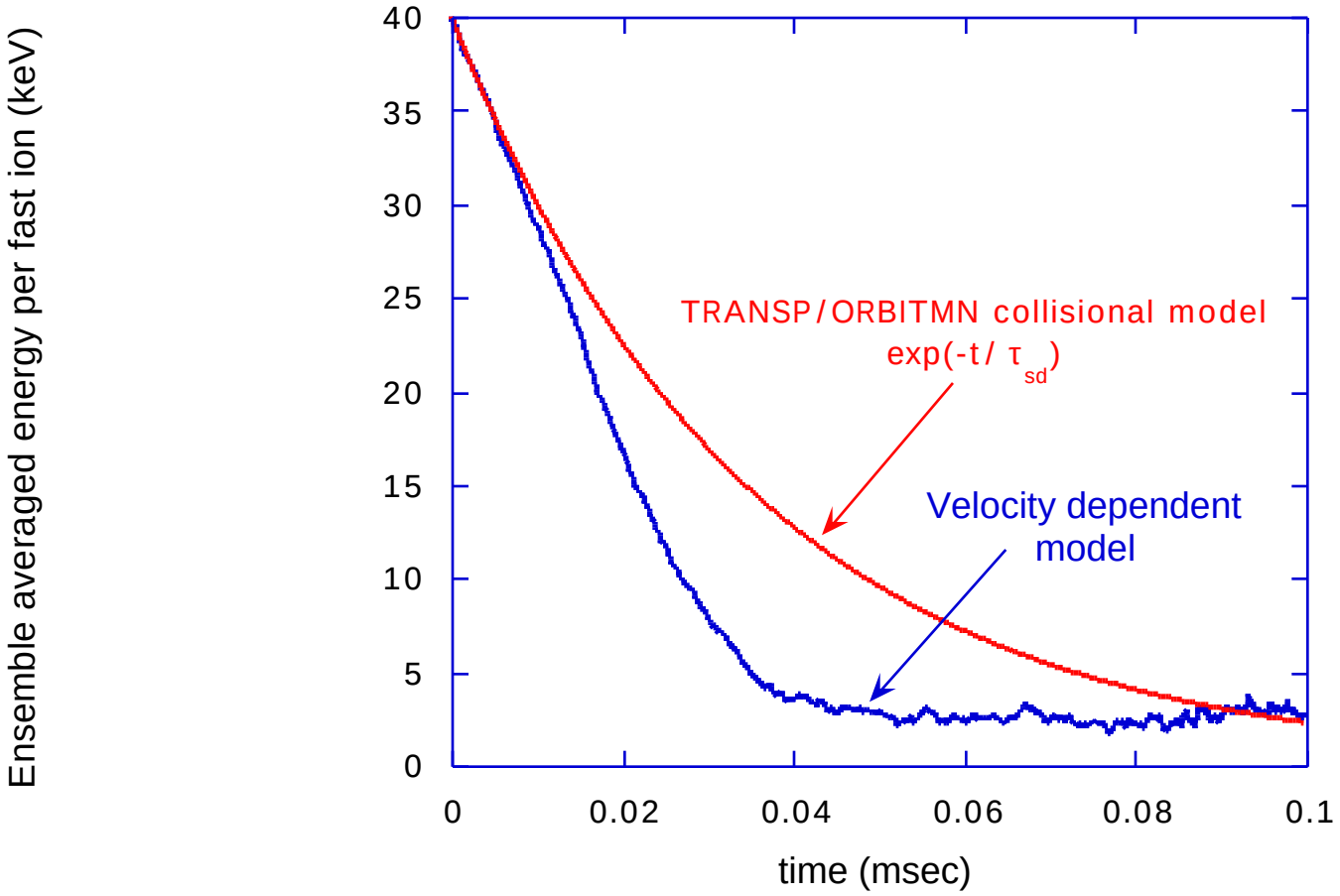


Collision frequencies:

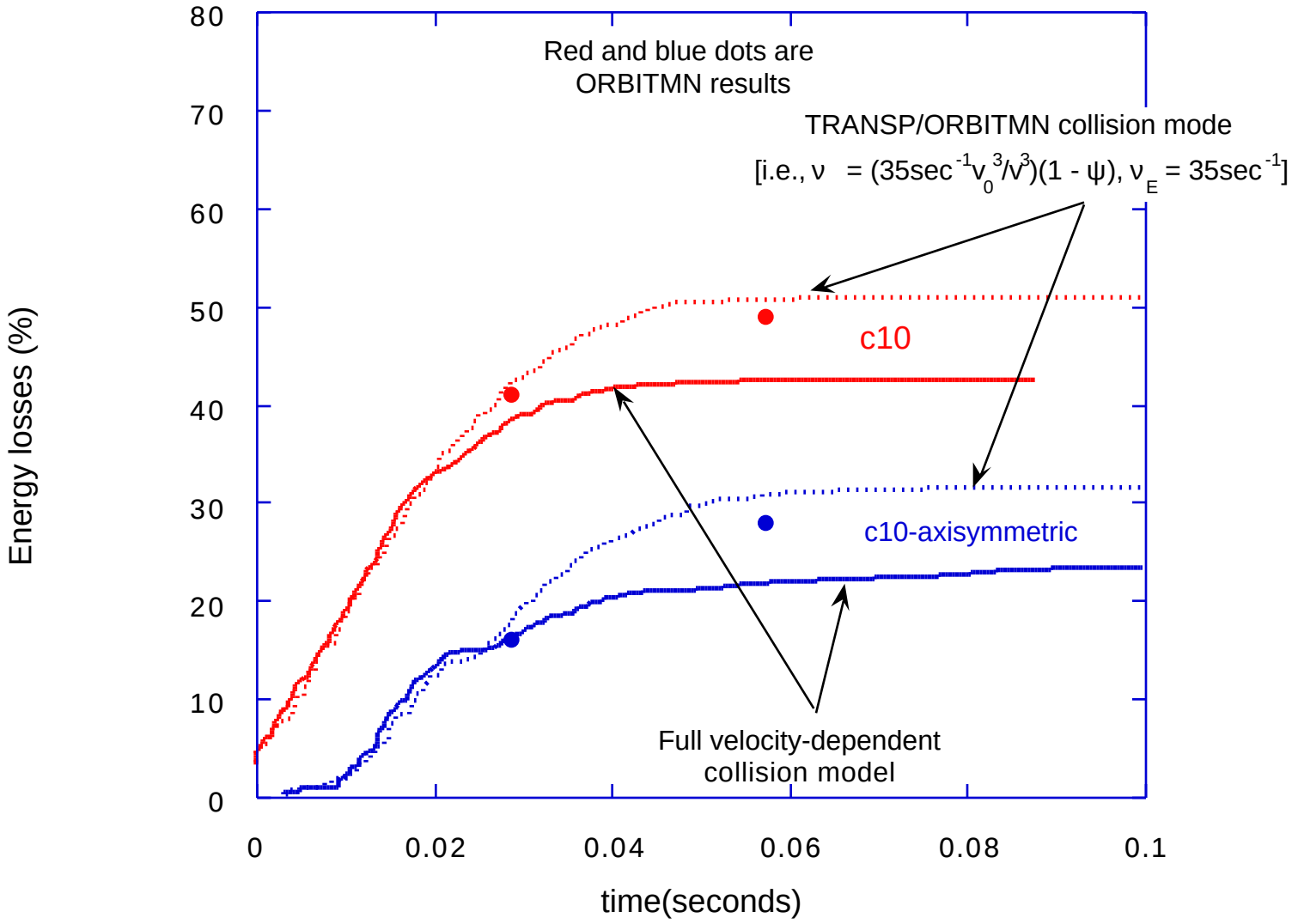




Comparison of slowing-down rates:

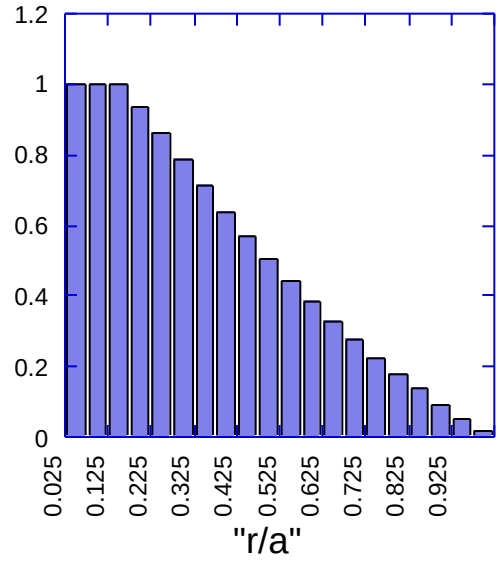


Benchmark comparisons on energy losses vs. time:

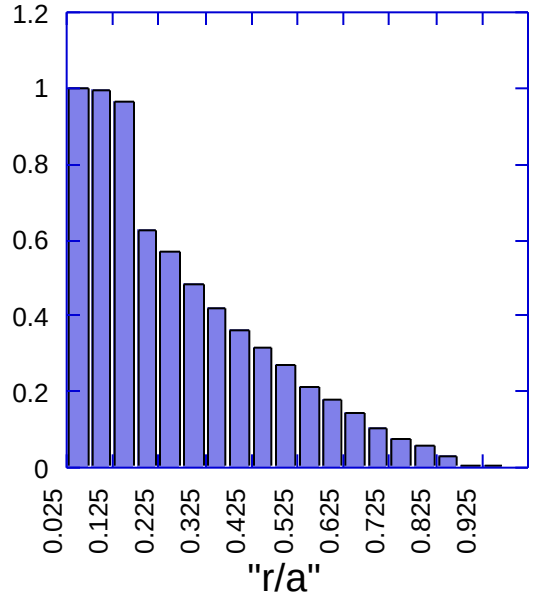


Evolution of fast ion profile:

t = 0



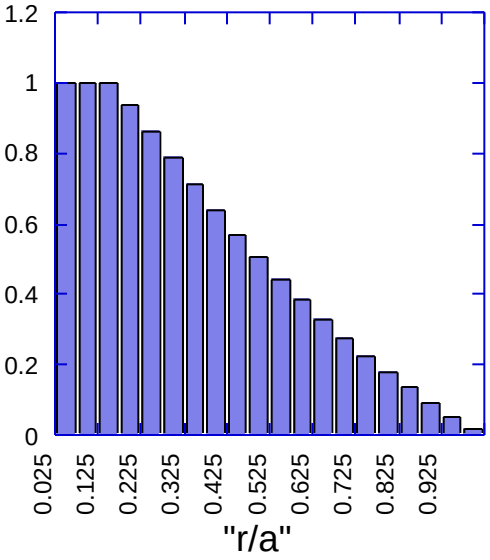
t = 30 msec

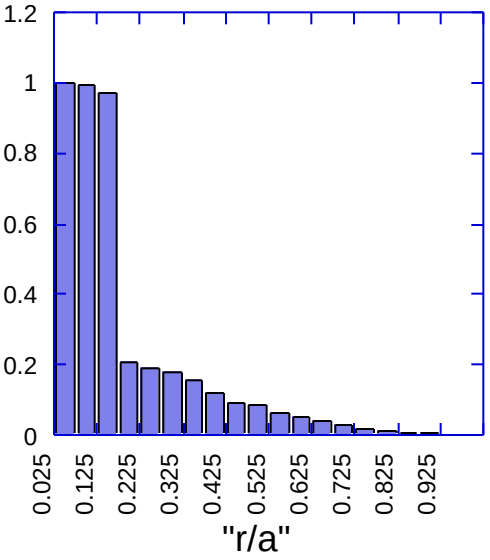


c10 axisymmetric

# of particles

c10 non-axisymmetric



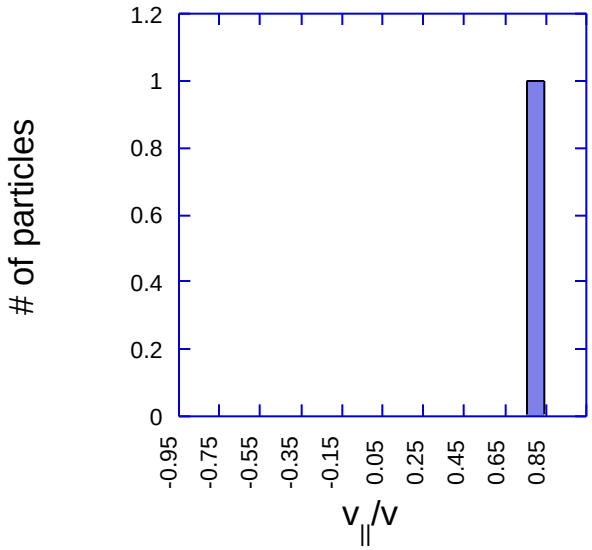


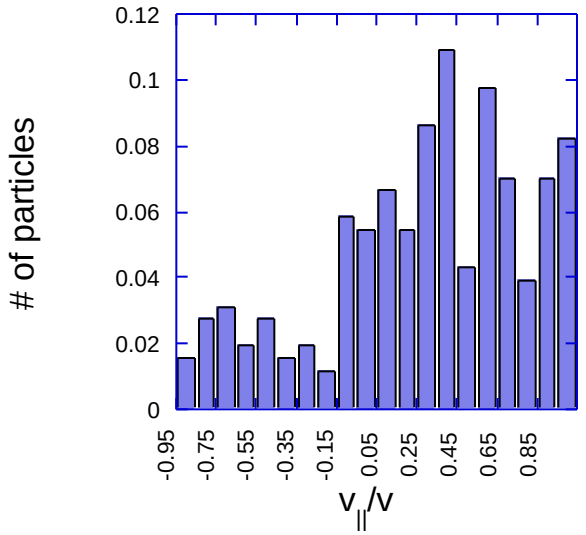
Evolution of fast ion pitch angle distribution:

t = 0

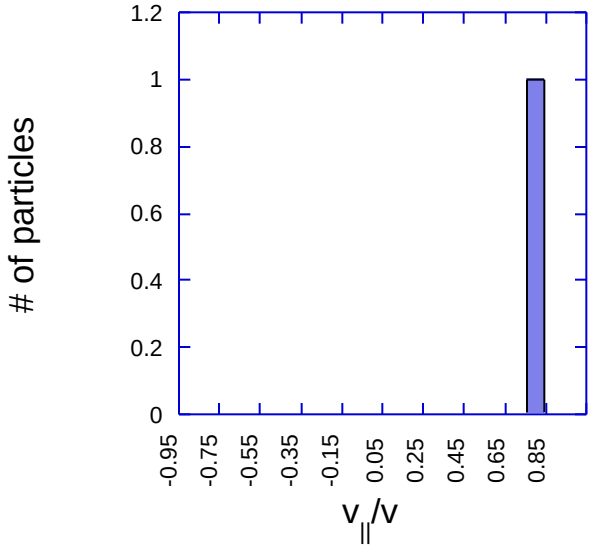
t = 30 msec

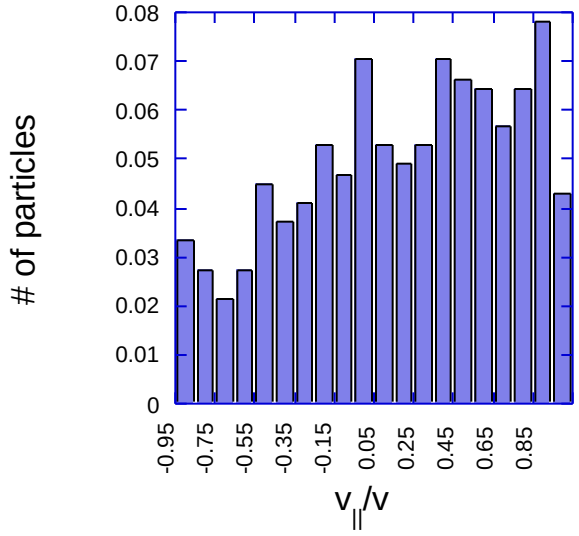
c10 axisymmetric





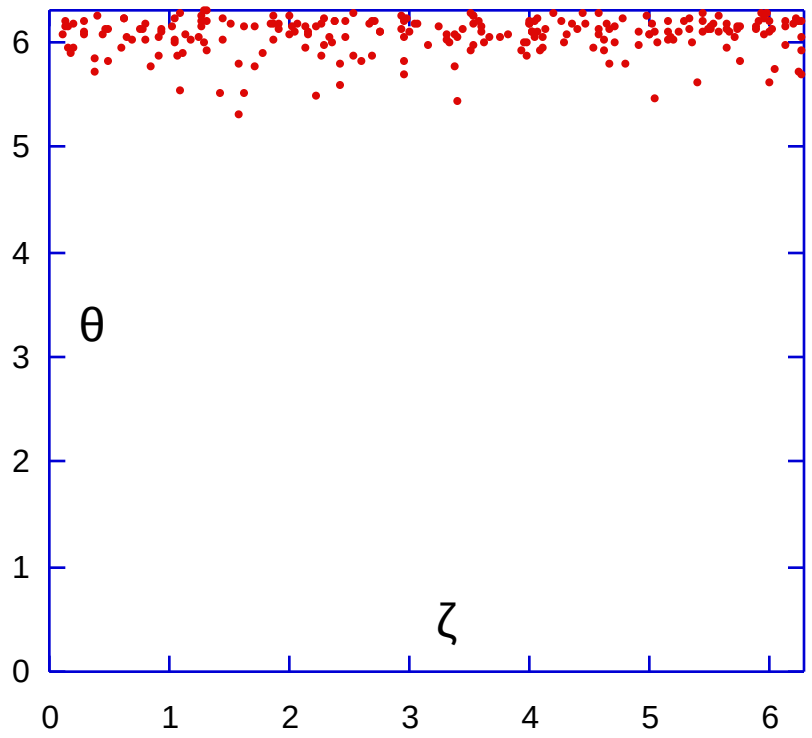
c10 non-axisymmetric





Pattern of locations where fast ion orbits leave the last flux surface:

Axisymmetric C10



Non-axisymmetric C10