

Comparing two EP analysis codes

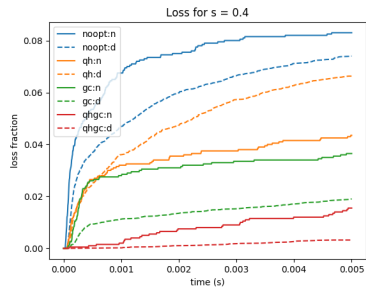
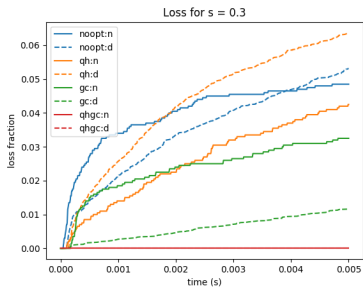
A. Bader

Wistell Meeting, Jan 04, 2019

Outline

- Goal: compare calculations from Michael Drevlak's particle following code with Nemov's drift-orbit code
- Nemov's code, like Drevlak's initializes points at preset locations on a flux surface
- Each particle is given a random velocity
- Particles are followed until they leave the confined region
- Drevlak's code follows passing particle, Nemov's code ignores them (set by user)
- Nemov's code is very slow, my version is also unparallilized - statistics are miserable
- Nemov's code modified by A. Ware to read from a VMEC equilibrium, this is the code that I am using

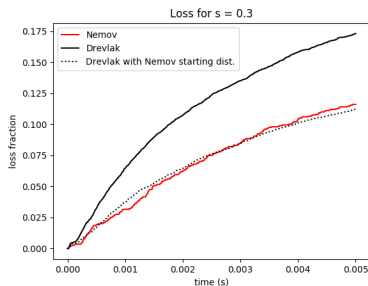
Basic loss comparison



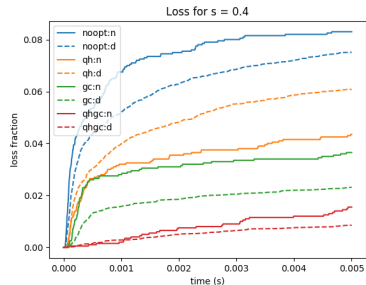
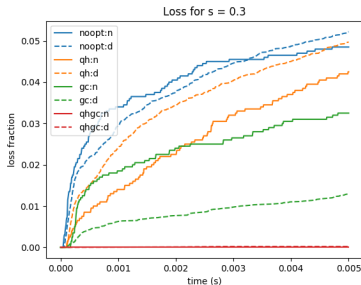
Adjusting starting velocity distribution

- Examining closer discovered that:
 - Trapped fraction differed (5% or so) between Nemov and Drevlak
 - Drevlak had more deeply trapped particles, and fewer passing particles
 - Particle velocity initialization in Drevlak's code was not isotropic
 - Fixing appeared to produce better agreement
 - Trapped fractions now agree

Simulation for ARIES-CS

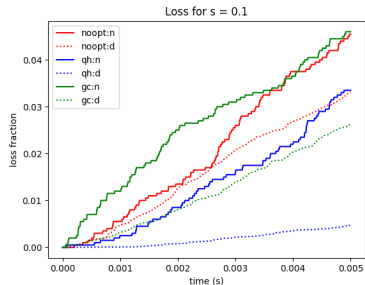
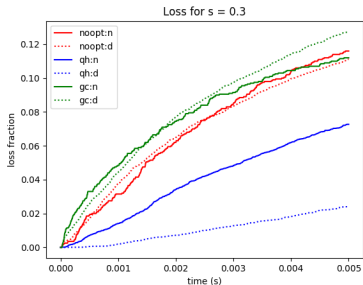


There is still disagreement though



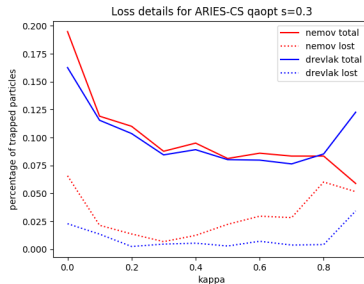
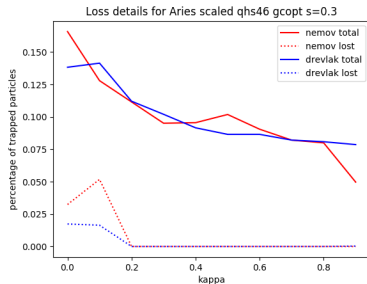
Drevlak's code says that optimizing for γ_c helps a lot, Nemov's code says it only helps a little

Disagreements in ARIES simulations



Drevlak's code says optimizing for QA helps a lot. Nemov's code says it helps only a little.

Velocity distributions look ok-ish now though



Nemov simulations here are claiming more lost particles near trapped passing boundary for QHS, and more deeply trapped losses for QA.

Conclusions - next steps

- Good news: really good configurations (low/zero losses) are good in both codes
- Bad news: There are fairly significant disagreements between the codes
 - This affects the interpretation of the data significantly
- Time behavior looks weird, Nemov uses normalized everything, perhaps I'm missing a normalization
- Possible step - comparison with yet another code
 - OFBZ forces you to input starting velocity distribution rather than producing an isotropic one - results will differ significantly
 - ANTS - I haven't yet used this, but maybe this is necessary
 - Any other options?