MAX-PLANCK-INSTITUT
FÜR PLASMAPHYSIK

Overview of the ATEP workflow integration - TSVV-H

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EUROfusion

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Objectives

- Implement a MUSCLE3 compliant workflow that encapsulates the ATEP physics
- Workflow needs to run standalone and inside a larger transport code
- Incorporate various physics to be investigated after each step of the workflow
- Validate ATEP on several scenarios

Overview

- **What is done:**
  - General layout/implementation for the ATEP workflow
  - Moved all the actors (HELENA, LIGKA, HAGIS, Orbit FInder and ATEP) to MUSCLE3
  - Saved results after each actor/time-step
  - Take decisions on what parts of the workflow to run in real time

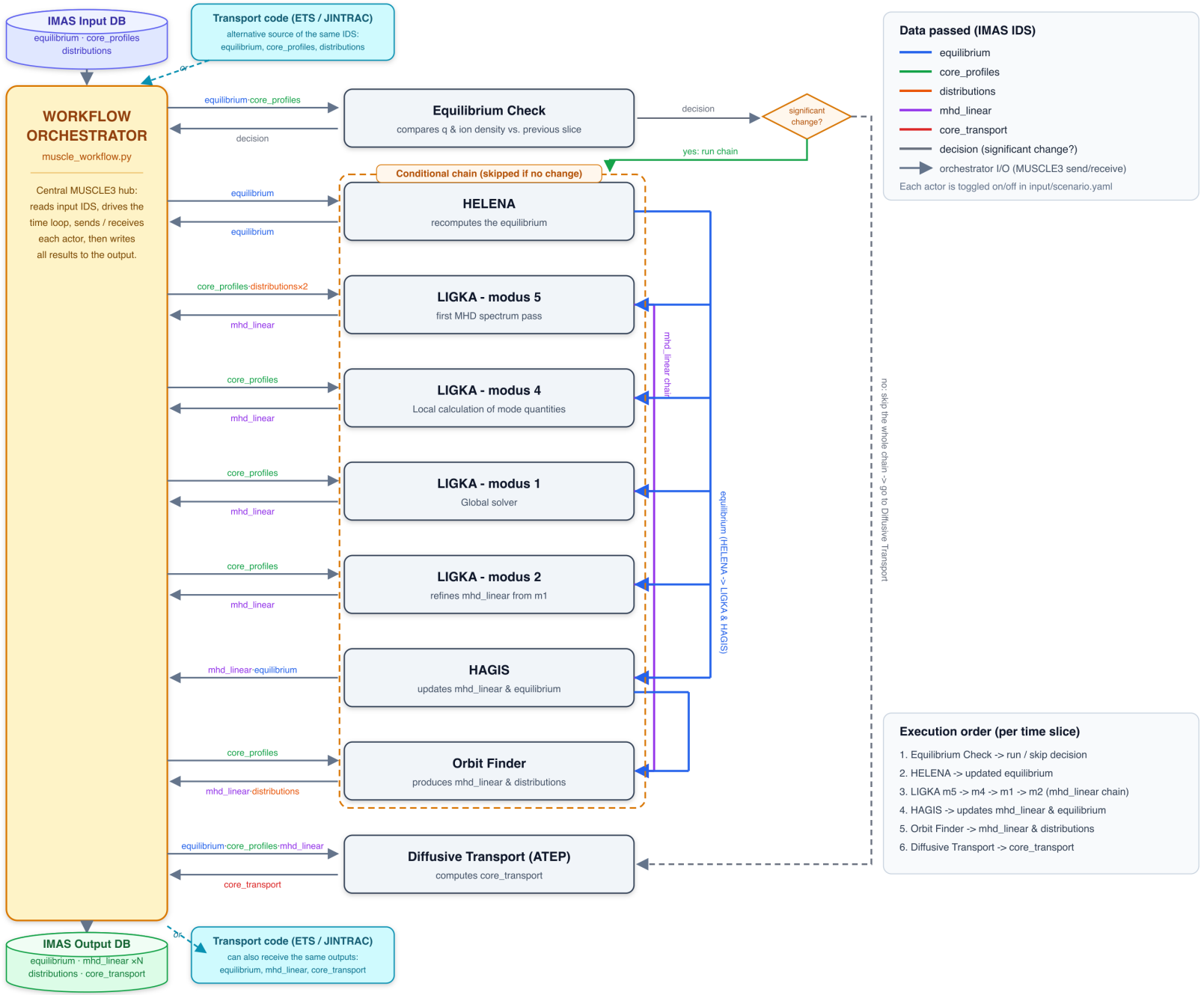
- **What is ongoing:**
  - Porting of ATEP-3D code to Python (fine-tuning ongoing)
  - Integrate ATEP in ETS/HFPS
  - Validation of the ATEP code

Hierarcy of models

- Models depend on eachother, as each one improves/adds on the results given by the previous one.
- From the analytical solver in Ligka_M5 to the refined global solver Ligka_M2
- Hagis_1 convers HELENA equilibrium and mhd_linear given by LIGKA to boozer coordinate system
- Orbit finder is used to calculate neoclassical and diffusion coefficients.
- This allows for easier debugging and saving of the results at each actor/time-step for validation.

ATEP Workflow - MUSCLE3 Data Flow

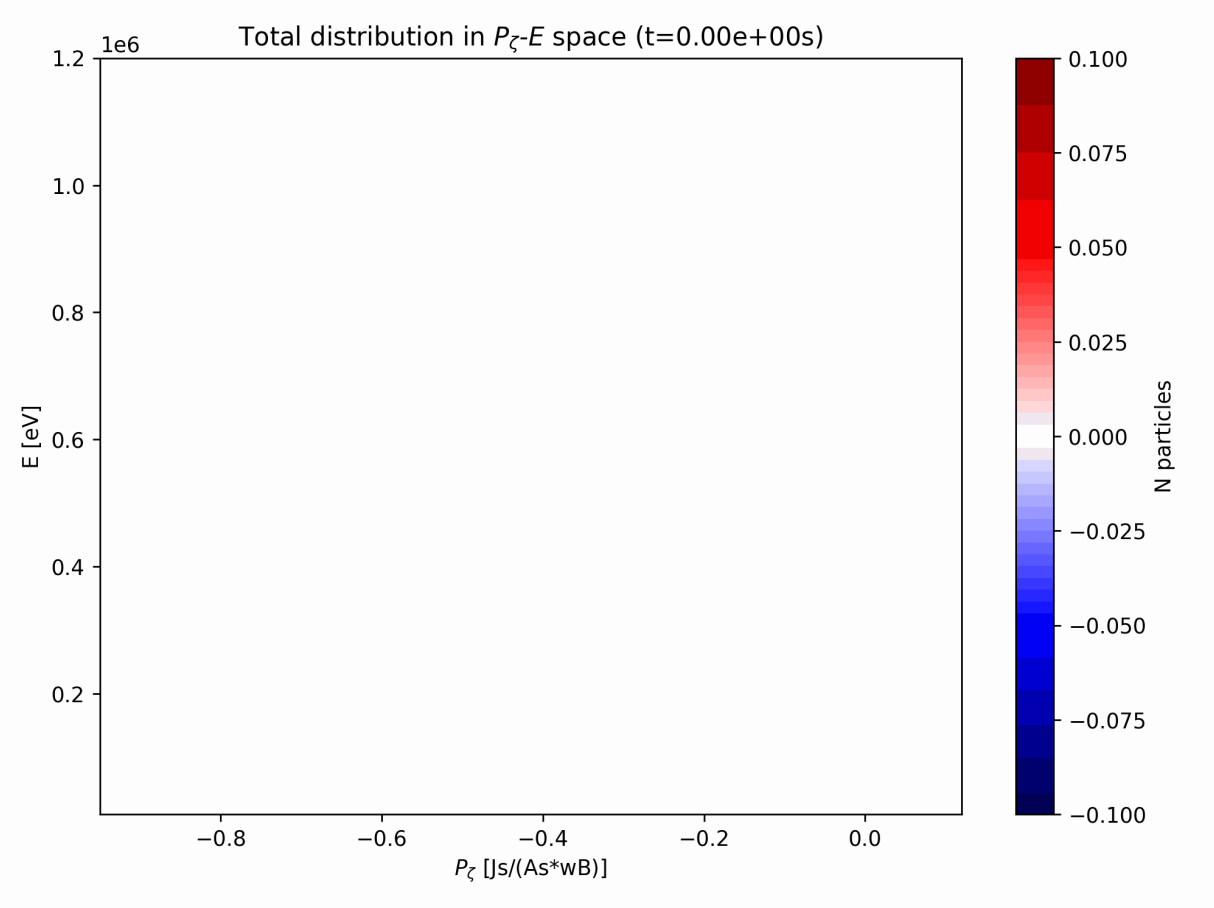
How IMAS IDS data is passed between the orchestrator and the physics actors (defined in coupling.ymmsl)

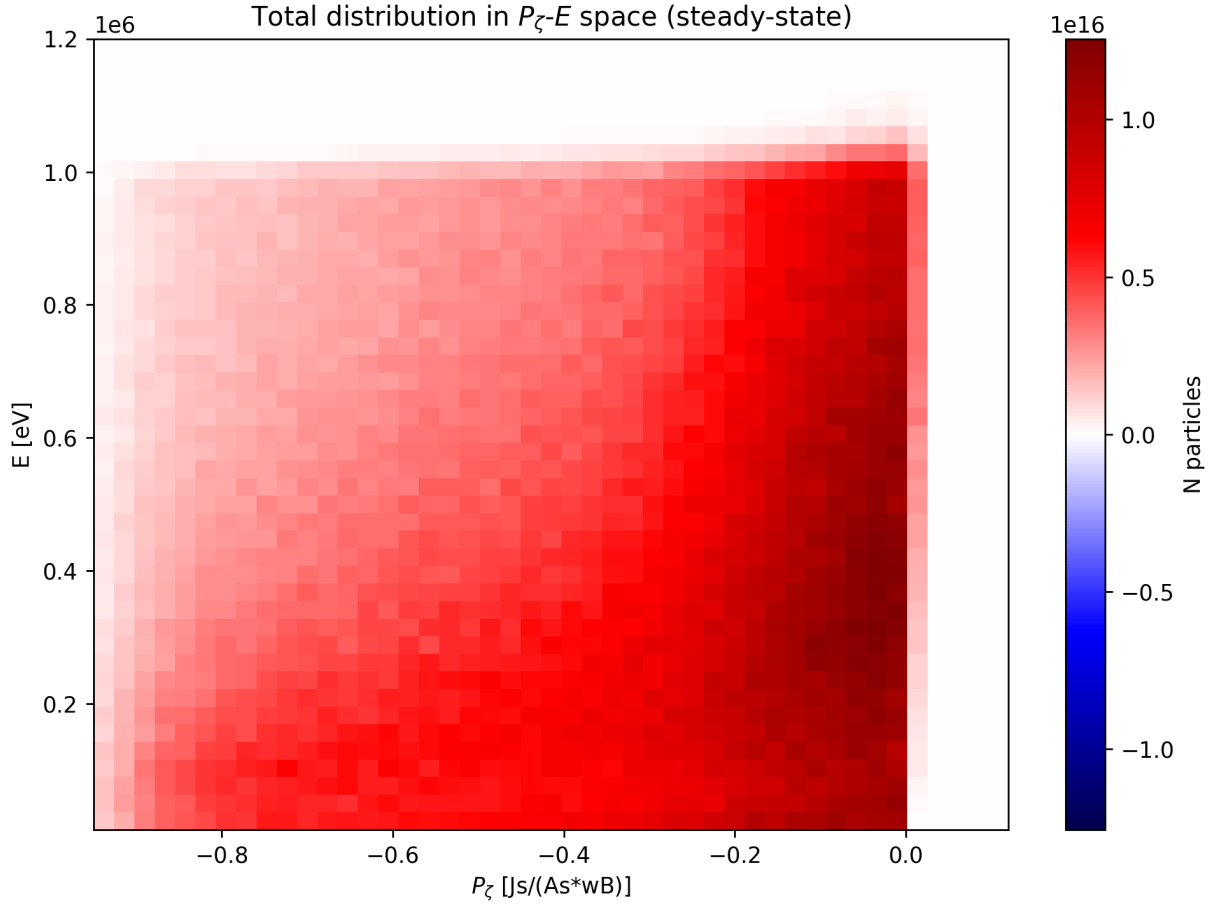


- Starting with all the parts of the workflow enabled, one by one these can be removed and the coupling.ymmsl file will be adjusted automatically.

ATEP - Python implementation - ongoing

Tristan Sterkl - IPP





- Off by a factor of 3, investigation ongoing.
- Checking: input files, normalizations, mapping of IDS data (markers) to solver
- ASCOT/BBNBI IDSs sources given by Chiara De Piccoli

Connecting to the transport code (inputs set, outputs…)

- **Various ways to tackle:**
  - Via core_sources IDS: — give source term for ion density equation and source term for the ion energy transport equation. (source(i1)/profiles_1d(itime)/ion(i2)/energy(:), source(i1)/profiles_1d(itime)/ion(i2)/particles(:))
  - via core_transport IDS: — effective diffusivity (ion density eq) — model(i1)/profiles_1d(itime)/ion(i2)/particles/d(:)) or effective diffusivity (ion energy equation) — model(i1)/profiles_1d(itime)/ion(i2)/energy/d(:)
  - Anything else? Providing the F_EP directly? Are tools available for projection to 1D space?

Discussion

- Integration assistance in ETS/HFPS - need of a simple test case so the ATEP implementation can be tested inside a minimal transport run (preferable ITPA ITER shot 53299)?

- What does a transport code need from us? To be confirmed: heat deposition profile or particle/heat diffusion coefficient?