DMP Implementation Status of IPP

2023-06-02

IMAS installation (previously reported)

On the TOK cluster (i.e. linux systems hosted by MPCDF)

- IMAS/3.24.0-4.2.0
- IMAS/3.25.0-4.4.0
- IMAS/3.30.0-4.8.4
- IMAS/3.32.1-4.9.1
- IMAS/3.34.0-4.10.1
- IMAS/3.35.0-4.10.0
- IMAS/3.36.0-4.10.0
- idstools/1.2.3
- idstools/1.5.1
- UDA/2.5.1

Would like to get a recommendation of which version to install, and which tools

IMAS installation (new installation)

On the IPP-IT Citrix nodes (linux system hosted by IPP-IT running "Ubuntu 20.04.6 LTS")

- IMAS/3.38.1-4.11.4
- fundamental-constants/0.1.1
- IDSTOOLS/1.14.0
- AMNS/1.4.0-gfortran

Notes

- This is in my private area – still waiting for the IMAS volume to be made available
- Used **spack** to install the dependencies
- ~~Only gnu compilers available at the moment~~ **Gnu and intel now supported**

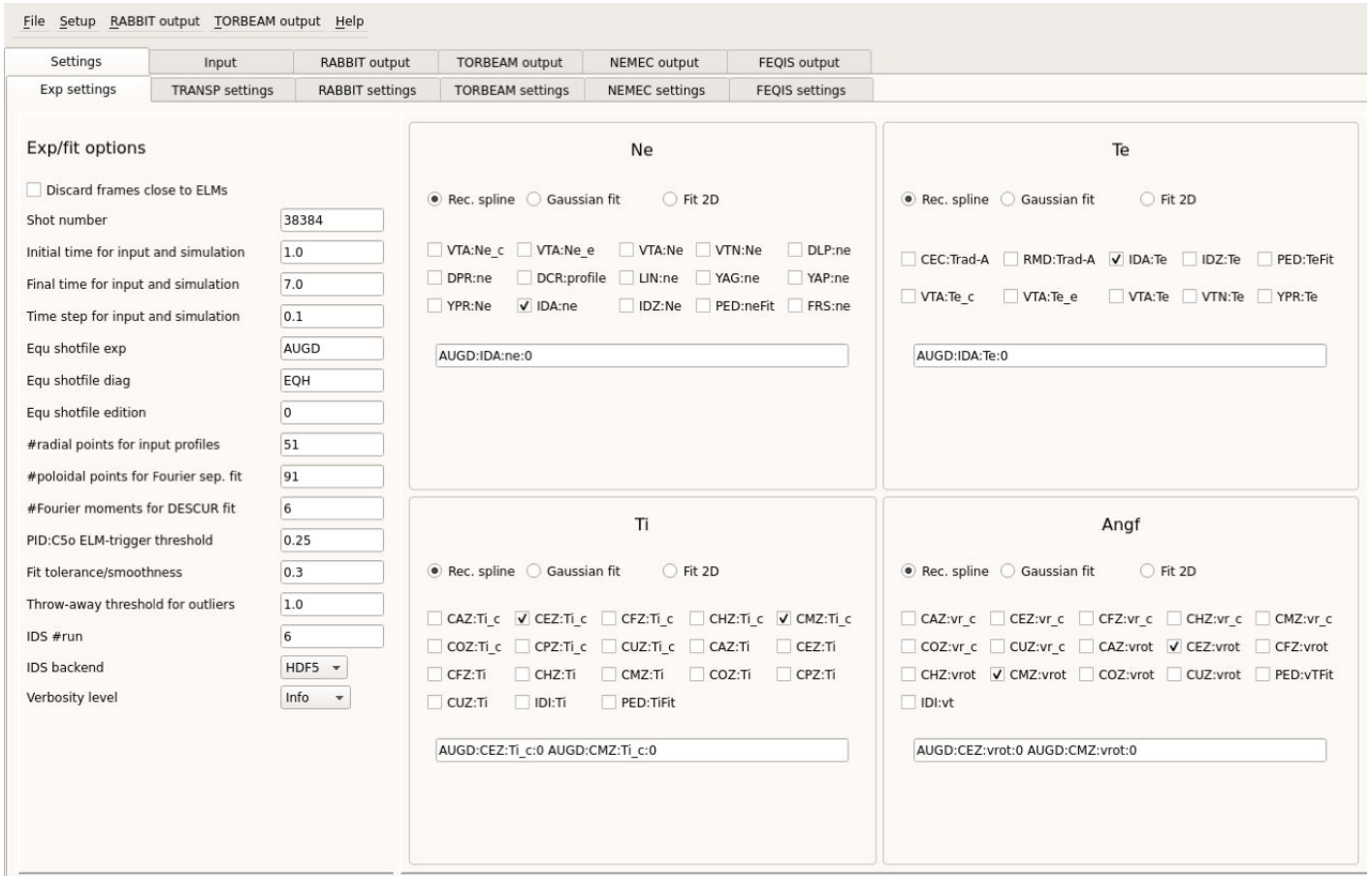
Data mappings

Two distinct branches:

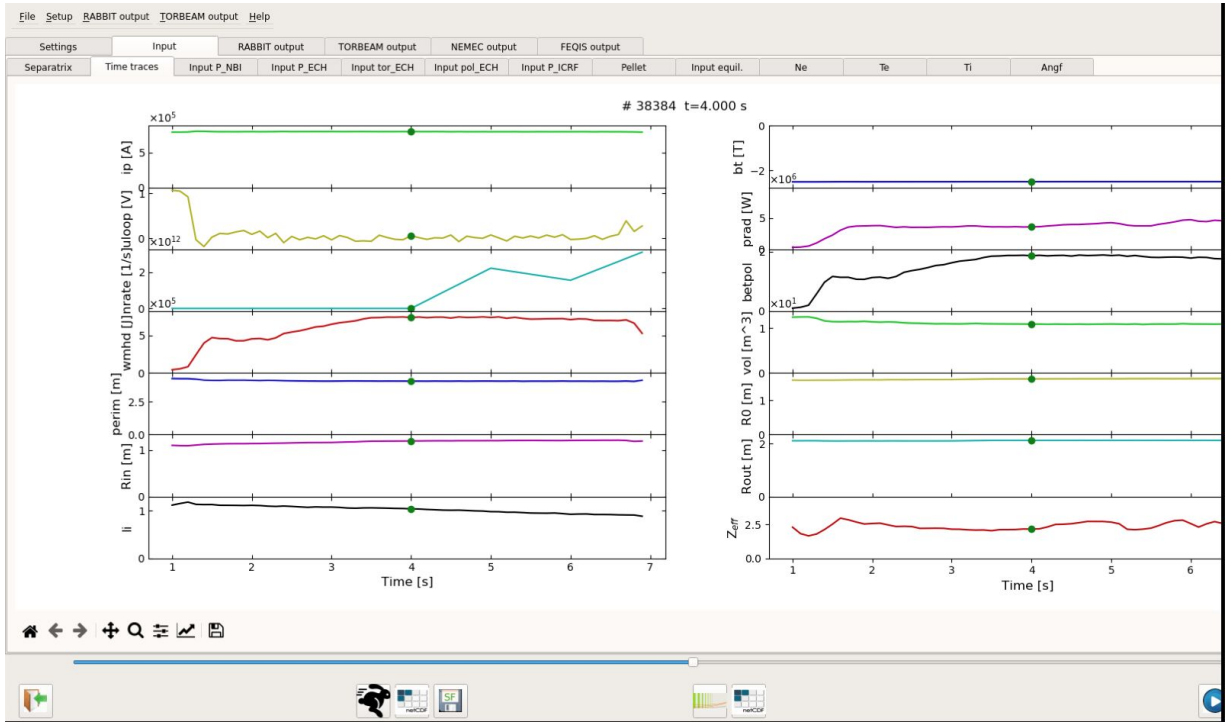
1. Mapping data that already exists (“diagnostics”)
    a. Can build on what has already been done
    b. Perhaps few direct users at the moment
    c. But could be used as new IDS based tools come online (IDA-IMAS)
    d. Needs UDA with plugins
2. Mapping data that doesn’t yet exist (“trview”, augped, IMASgo, or similar)
    a. This is perhaps the data that users need now
        i. But I might be wrong
    b. Currently the tools are based at the experiments
        i. Which is where the expertise is
    c. Future tools might use lower level data – and then back to mapping 1
    d. Good benefit from UDA, but no mappings needed

trview

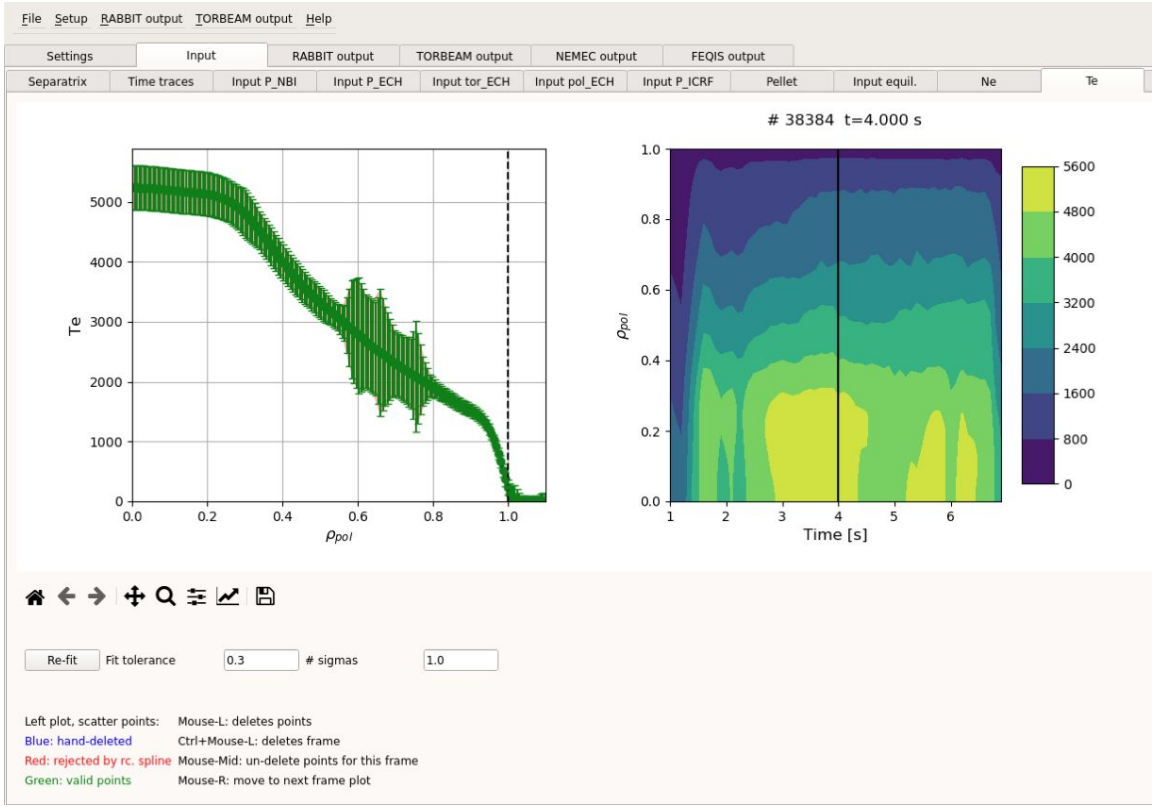
- Reads AUG shotfiles
- Merges data from multiple diagnostics (various options)
- Writes wall, tf, nbi, ic_antennas, ec_launchers, dataset_description, summary, pulse_schedule, master, equilibrium, core_profiles IDS's



Trview: time traces



Trview: profiles (here Te)



IDA

MAX-PLANCK-INSTITUT FÜR PLASMAPHYSIK

SWG Integrated Data Analysis and Validation

ASDEX Upgrade

R. Fischer[1], A. Bock[1], S. Denk[2], A. Medvedeva[3], S. Pinches[4], M. Schneider[4], D. Stieglitz[1]

[1] Max-Planck-Institut für Plasmaphysik, Garching, Germany
[2] General Atomics, San Diego, USA
[3] Aix Marseille University, CNRS, Marseille, France
[4] ITER Organization, St Paul-lez-Durance Cedex, France

EUROfusion

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

IDA

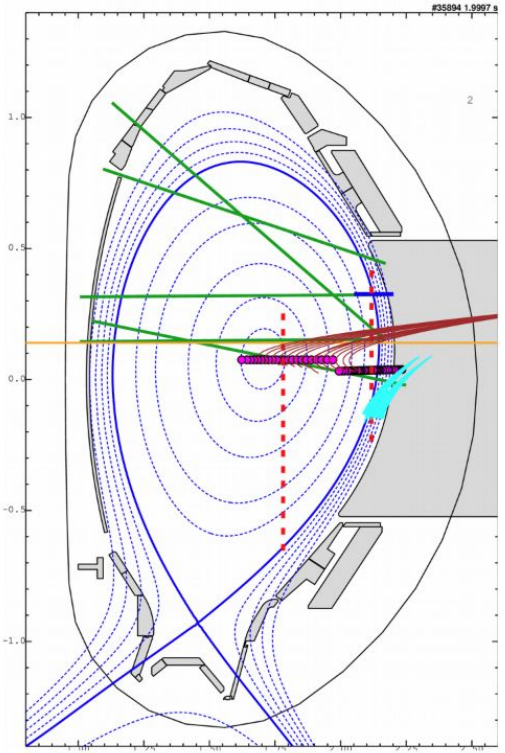
IDA at ASDEX Upgrade

multi-diagnostic profile reconstruction: n_e, T_e

- Lithium beam impact excitation spectroscopy (LIB)
  collisional radiative model → $n_e(T_e)$
- Interferometry measurements (DCN) → n_e
- Electron cyclotron emission (ECE)
  ECRad: Electron cyclotron radiation transport → T_e (n_e)
- Thomson scattering (TS) → n_e, T_e
- Reflectometry → n_e
- Beam emission spectroscopy → n_e (Z_{eff})
- Thermal Helium beam spectroscopy → n_e, T_e

- Equilibrium reconstructions for diagnostics mapping
  (*IDE*: kinetic Grad-Shafranov solution coupled with current diffusion)

A lot of dependencies and uncertainties:
We need a probabilistic approach!

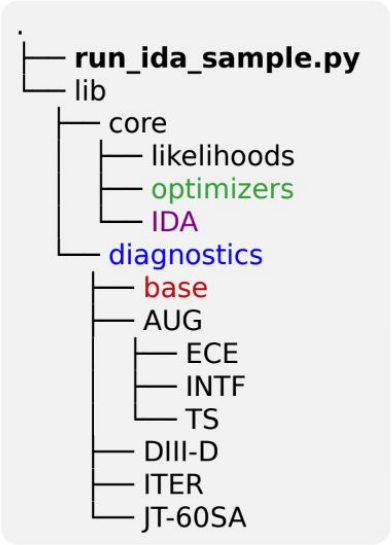


IDA

IDA Basic Implementation for ITER, JT-60SA, ...

Basic implementation in python being completely modular

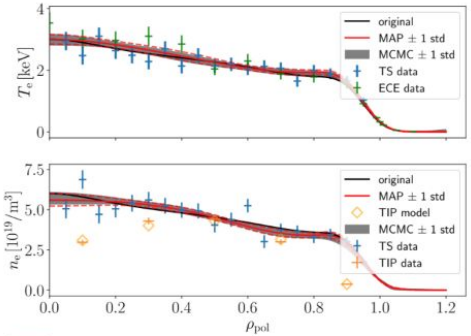
- to be compatible with any fusion device (ITER, DIII-D, JT-60SA, ...)
- diagnostics: Thomson scattering, ECE and interferometry, ...
- likelihoods (data uncertainty): Gaussian, Cauchy (outlier robust), …
- multi-fidelity forward models / synthetic diagnostics
  - ECE: $T_{rad} = T_e$ vs radiation transport modeling $T_{rad}(T_e, n_e)$
  - real-time vs offline analysis
- flexible parameterisation of, e.g., profiles: splines, GPR, ...
- priors: smoothness, positivity, physical modeling, ...
- results and their uncertainties:
  - MAP solution (probability maximum and width)
  - MCMC sampling methods (explore full probability space)



IDA

IDA: ITER workflow

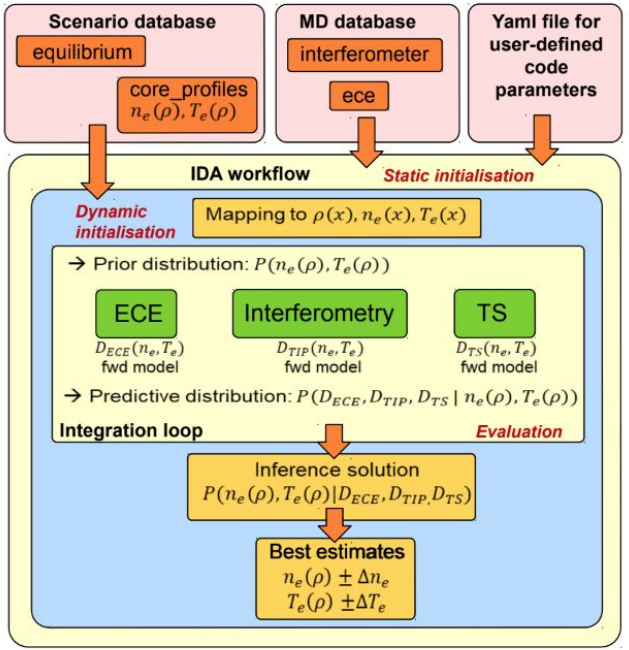
- artificial diagnostics: Thomson scattering, ECE
  → synthetic data set with 10% noise
- 1st ITER diagnostic: Toroidal Interferometer Polarimeter (TIP)
  → synthetic data set with 5% noise
  → IMAS synthetic diag.



- MAP ±1std
- MCMC (50±34)% percentile

IMAS Interface Data Structures (IDS):

- read: TIP geometry (interferometer_md), equilibrium
- write: results ...



M. Schneider

EX2GK from gitlab.com

For first time users, it is STRONGLY RECOMMENDED to use the GUI developed for the corresponding machine to be analyzed. Note that these GUIs are developed to be executed on the local computing clusters of the machine in question.

Machine-specific GUIs are found in EX2GK/guis/<machine>/

Due to implementation of computing clusters and machine-specific options, each machine requires its own unique GUI