Plans for TRANSP-IMAS (TRANSPi), including testing on experimental facilities

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Why this seminar?

- To share our plans for making TRANSP IMAS-compatible and tell you what opportunities the new TRANSPi code opens
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There are two levels of IMAS-ification for TRANSP

- Lowest level: translators around a black box (started in 2016)
  - imas2transp => reads IMAS database and writes UFILEs
    - helpful to mimic what is needed to interpret an ITER experiments
    - insufficient for most applications that need exchange of modules

    => Will be deprecated once the transition to IMAS is completed
  - transp2imas => can store any TRANSP simulation in IDS
    - for database analysis (summary_ids search, simDB)

    => Will be maintained until no longer needed (for conversion of old databases)
- Deeper level: full IMAS-ification (started in 2022, after ~4yr of preparation)
  - Aggressive plan to deliver in 15 months a *fully* IMAS-compatible code (05/24).

Status and plans for the transition to IMAS

- Working with ITER Organization to implement TRANSP in IMAS at the IO
  - Taken initial steps towards using IDS input/outputs
- Working with the community of users for buy-in
  - meetings with TRANSP ROs to discuss transition plan
- Spring 2023
  - dual way of running TRANSP: inputs from UFILEs OR from IDS
  - outputs for physics both in the standard CDF file and in IDS
- By the end of summer 2023
  - all 0D inputs ONLY from IDS (device and systems, diagnostics geometry etc)
  - input/output for diagnostics ONLY in IDS (not used, low disruptivity for users)
  - all H&CD modules exchanged via IMAS/IDS (keep some internal models)
- Winter 2023-2024
  - expand IMAS to core-edge and MHD (and schemes for self-consistency)
  - path forward for self-consistent coupling with IMAS compatible with dynamics

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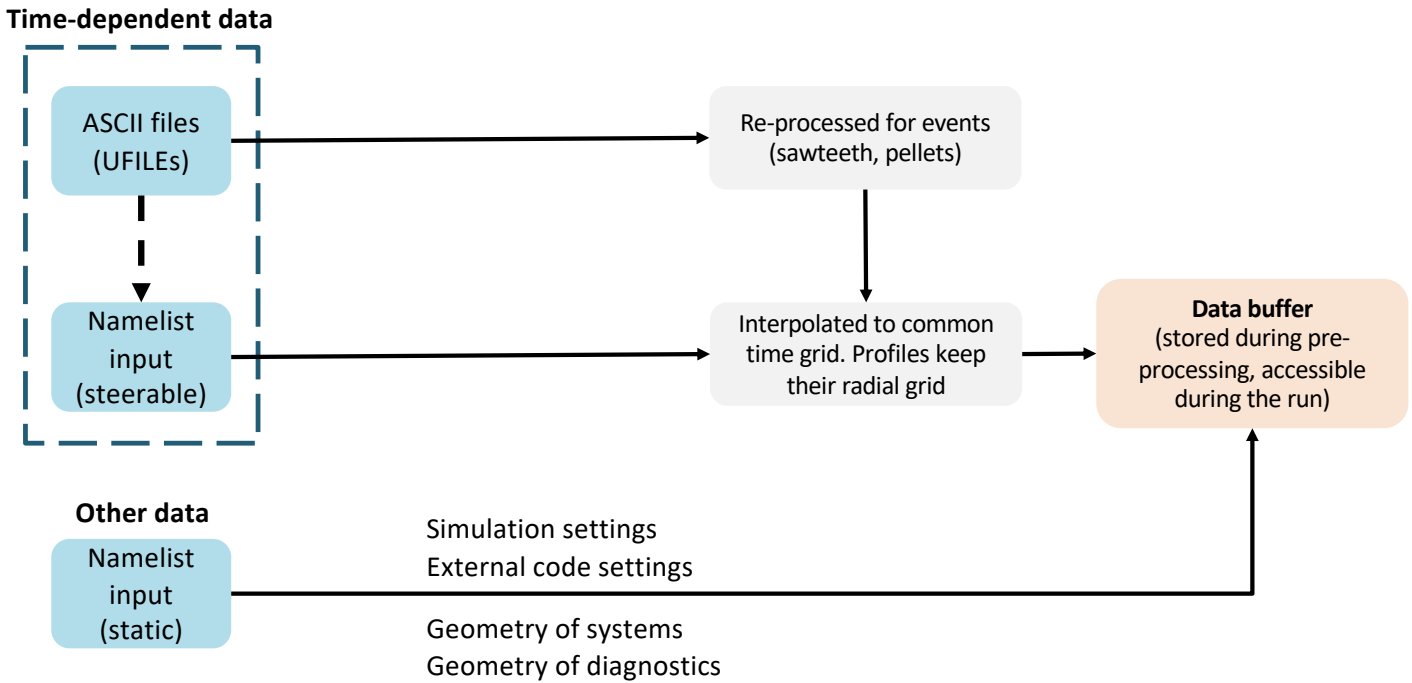

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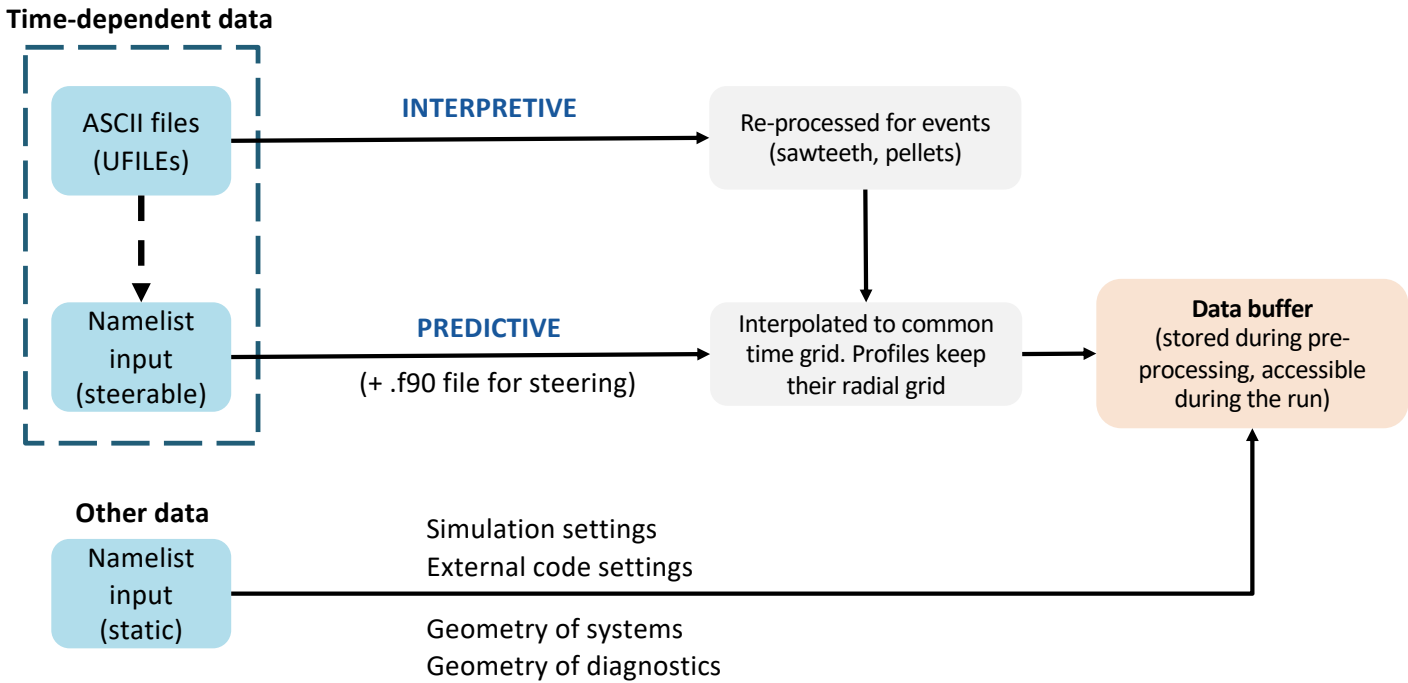
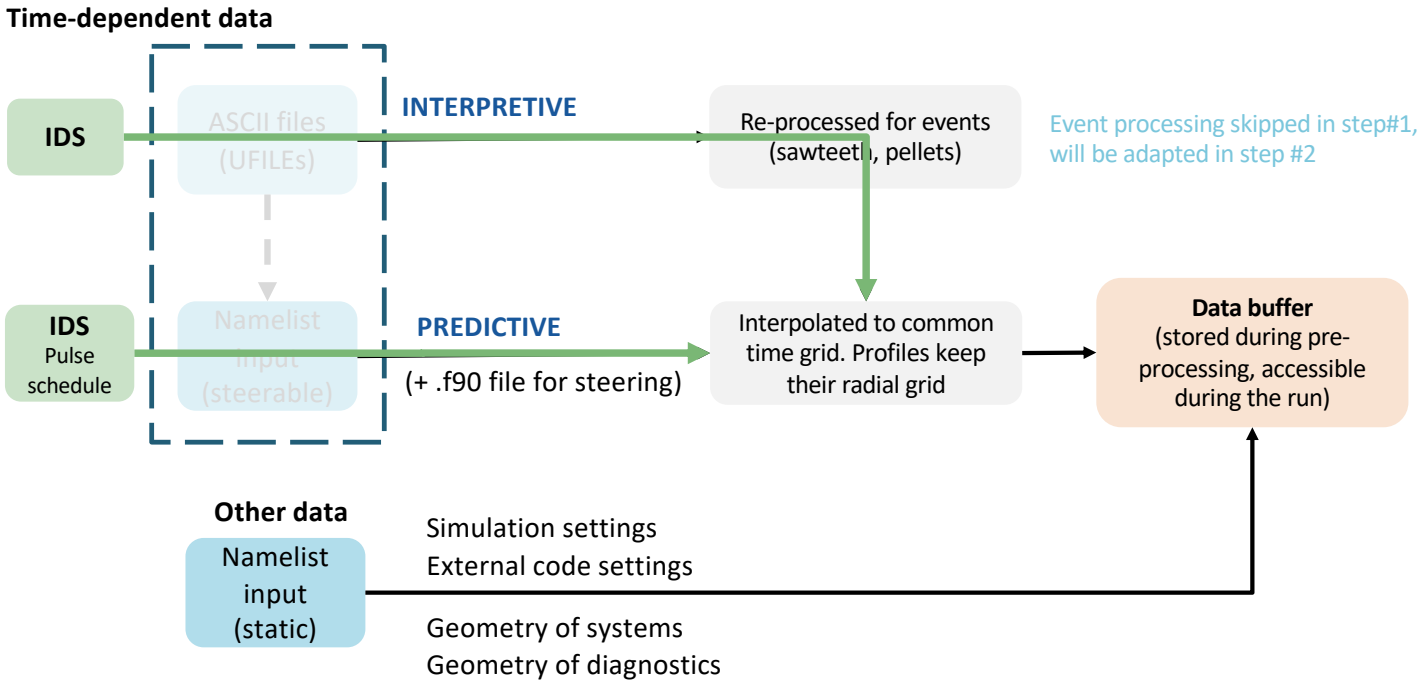
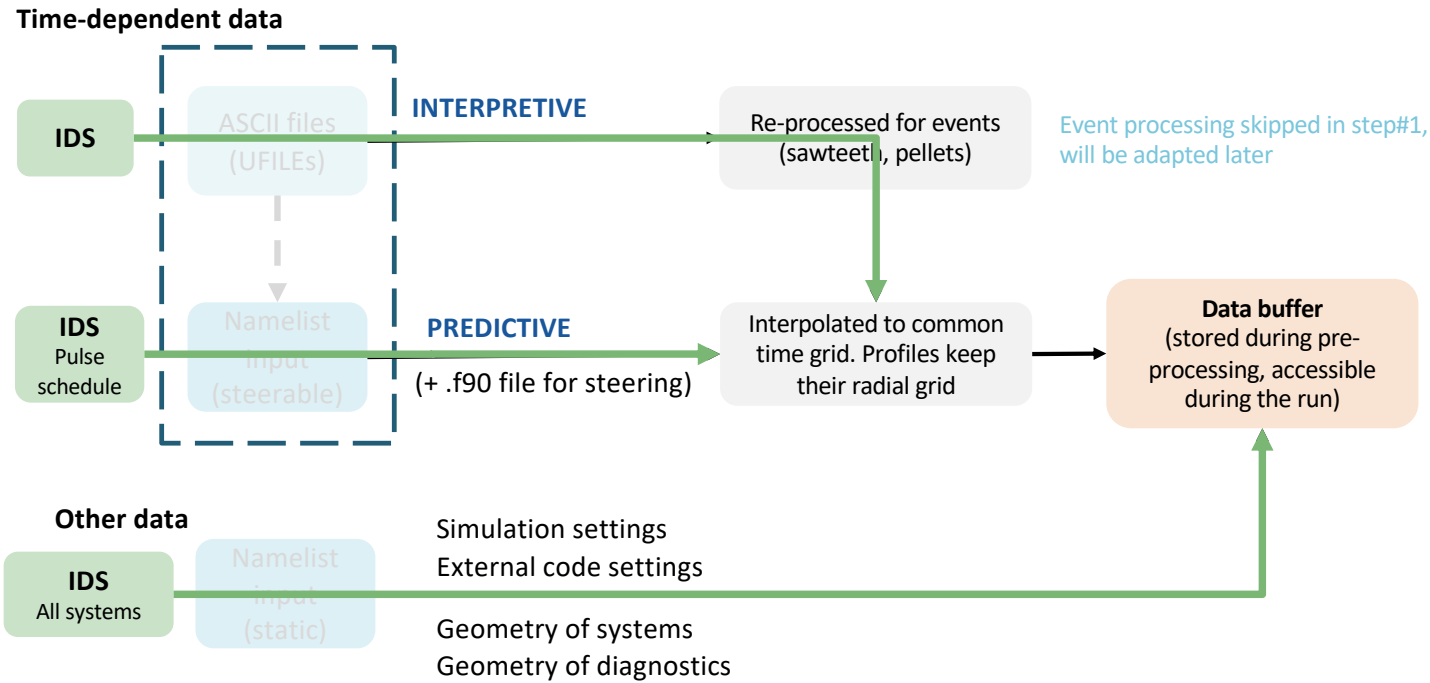


What is going to change for users with IMAS, step #1



What is going to change for users with IMAS, step #2



What you will be able to test in the first TRANPi release

- Interpretive simulations
  - Run a ‘standard’ TRANSP interpretive simulation with inputs from IDS
    - Wall, I_P, RB, V_{loop}, ne, T_e, Ti, n_Z, Z_{eff}, full equilibrium, EC power and steering
- Predictive simulations
  - Any predictions you were doing before, with the above inputs

Important: you will be able to use UFILEs until the transition to IMAS is complete, but support to UFILEs will be suspended

Will adopt a 3 months testing/release cycle, to accelerate development/adoption

Important differences in the equilibrium analysis/predictions

- NOW: EFIT equilibrium (or geqdsk files) pre-processed via scrunch2
- With TRANSPi: the magnetic equilibrium is stored in the equilibrium IDS
  - No need to run scrunch2
  - No need to write geqdsk files
- IMPORTANT: TRANSPi will analyze the full equilibrium, will read boundary, separatrix and gaps => no longer an analysis based on moments
  - ⇒ you will see differences when using LEVGEO=8
  - ⇒ You will see differences when running fixed-boundary and free-boundary

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TRANSPi will directly interface with the synthetic diagnostics under development at ITER

- NOW: diagnostics inputs/outputs via namelist and CDF file
  - inputs for diagnostics via namelist
  - outputs processed through internal integration functions
- With IMAS: everything goes via IMAS
  - Geometry of diagnostics input via IDS
  - Outputs from TRANSP analyzed through the synthetic diagnostics interface (more accurate for general geometry and shaped plasmas)

No longer need to define diagnostics and hardware geometry in the namelist

Plans for the implementation of the H&CD module

- Step 1: all power waveforms and dynamic inputs available from IDS
- Step 2: EC interface (available to users in the Spring 2023)
  - Test with TORBEAM, generalize to any IMAS-compatible EC code
- Step 3: NB interface (to users in the fall of 2023)
  - Test with NEMO, make NUBEAM IMAS-compatible, generalize
- Step 4: IC interface (to users in the winter of 2023)
  - Test with PION and TORIC6, make it general
- Step 5: full H&CD package (to users in the spring of 2024, pending tests)
  - IC-NBI synergy and full package of codes, inter-operability

No longer need to define H&CD geometry in the namelist

You get a code that can use ANY H&CD module that is IMAS compatible

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