

Plasma State Update

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Plasma State Specification – Code Generator Input

- <http://w3.pppl.gov/~dmccune/SWIM/>
 - File name: plasma_state_spec.dat
 - Also at www.cswim.org and in SWIM **svn**.
 - Version 2.xxx, “PSv2”, since FY-2008
- Detailed comments on state specification syntax, etc.
- Update log near the top of comments...

Some FY-2009 Highlights

- Plasma State Coupled NUBEAM
 - Single version shared by PTRANSP, SWIM, FACETs, MPI enabled.
 - Minor tweaks to PSv2 were sufficient.
- PTRANSP:
 - “trxpl” extracted time slices input to GYRO in GA / MAST experimental collaboration.
 - Flux profiles added to PSv2 at GA request.
 - “playback mode” – new run reuses source data from existing run.

MCMD and Plasma State

- Plasma state software supports “updates only” NetCDF output file;
- Concurrently running components can each generate their own state updates;
 - Sets of updated elements should be *disjoint*.
- Framework runs “update_state” to serialize merge of updates (new FY-2009 capability).
- Result is single state containing all updates.

In Progress...

- Plasma State based 1d transport equation solver framework
 - Plasma state @t0 contains old profiles;
 - Plasma state @t1 before solve contains input data profiles and boundary conditions;
 - Plasma state @t1 after solve contains new profiles filled in: temperatures, densities, toroidal angular velocity.
- Being developed in PTRANSP (w/FMCFM).
- Will yield shareable, modular 1d solver.

Possible f90 Solver Design

```
use Plasma_State_Mod      ! Plasma State Objects
use Gen_Solver_Mod        ! Define "solve" Controls

type (plasma_state) :: ps_ta, ps_tb

type (Newton_Solver_Control) :: nscon
type (XYZ_Solver_Control) :: xyzcon

[previous time step in ps_ta]
[boundary conditions @new time in ps_tb]

nscon%max_iterations = <desired number>; ... ..

call solve(ps_ta,ps_tb,nscon,ierr)
! Choice of control object selects solver method
```

Odds and Ends

- Heavy PTRANSP use of Plasma States leads to debugging:
 - Use of Sulfur ions as a plasma impurity in a C-Mod TRANSP TORIC simulation reveals an internal table name conflict error (fixed)...
- Trxpl-extracted TRANSP time slice states in ELVis service prototypes:
 - NUBEAM
 - Linear MHD Stability
 - Turbulent transport...

Development Ideas?

- Extension to “cstate” – interactive Plasma State editor?
- 3d Plasma State data elements?
- Further development to machine description, e.g. standardized ICRF antenna?
- Your ideas?