



EFDA

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EUROPEAN FUSION DEVELOPMENT AGREEMENT

Task Force
INTEGRATED TOKAMAK MODELLING

Brief overview of experimental data in the ITM framework

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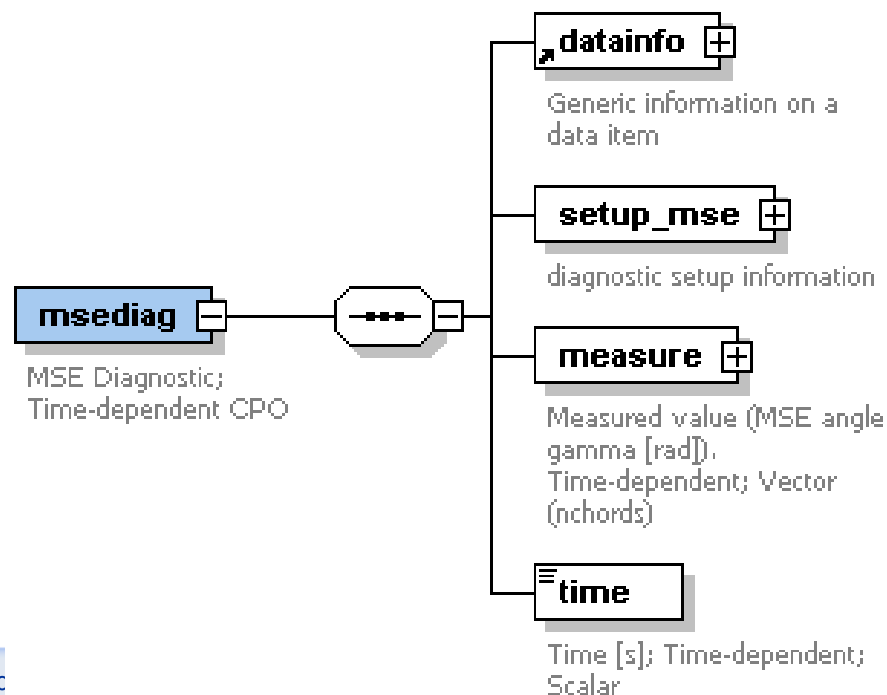
ITM framework : reminder

- Definition of standards of exchange between physics modules : Consistent Physical Objects (CPOs) representing physical quantities (e.g. plasma equilibrium) or experimental objects (RF antennas, diagnostics) → ITM data structure
- Standards must be relevant for any tokamak and any physics code
- Physics modules, adapted to use the CPO standards for input/output
- KEPLER : an environment for creating workflows of physics modules
- Universal Access Layer : a multi-language library that allows codes exchanging physical information via CPOs

- All this to provide a versatile and flexible simulation platform, but needs experimental data at some point to test and validate physics models

Experimental Data in the ITM data structure

- Experimental data is part of the ITM data structure and consists in :
 - Machine description (time independent data, valid for several shot numbers)
 - Time-dependent shot-based data
 - Consistent Physical Objects (CPOs) often gather the machine description and the time-dependent data
- consistency guaranteed between a system description and its related time-dependent signals during GET / PUT operations



Bookkeeping

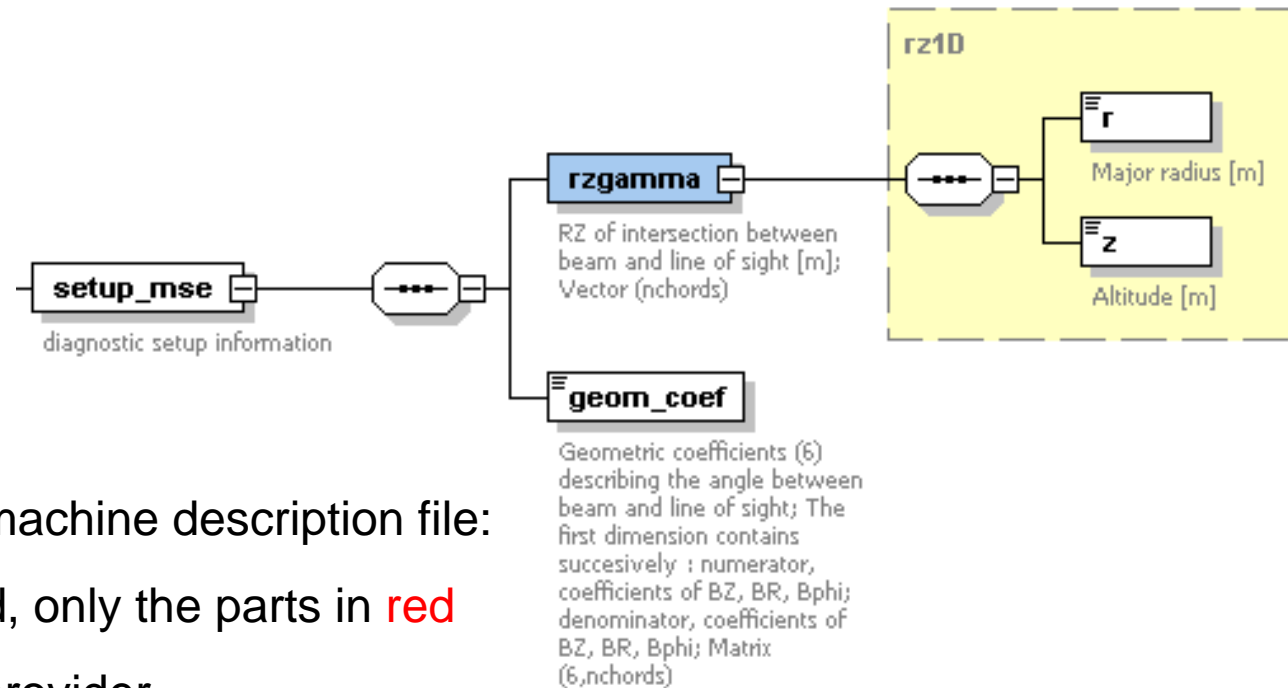
Diagnostic Description

Time-dependent measurements (MSE angles γ)

Time array

Machine description

- Example : diagnostic geometry (MSE)



- Highlight of the XML machine description file:
- A template is provided, only the parts in red are filled by the data provider

```

<msediag type="CPO" documentation="MSE Diagnostic; Time-dependent CPO">
<setup_mse type="structure" documentation="diagnostic setup information">
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Time-dependent data

- The exp2ITM tool has been developed to import time-dependent data into ITM format
 - the exp2ITM main code is generic, machine-independent
 - CPO-dependent parts of exp2ITM are dynamically generated from an XML description of the mapping of local data to the ITM format. This XML file is machine-dependent

- Mapping example (a template is provided, only the parts in red are filled by the data provider)

```

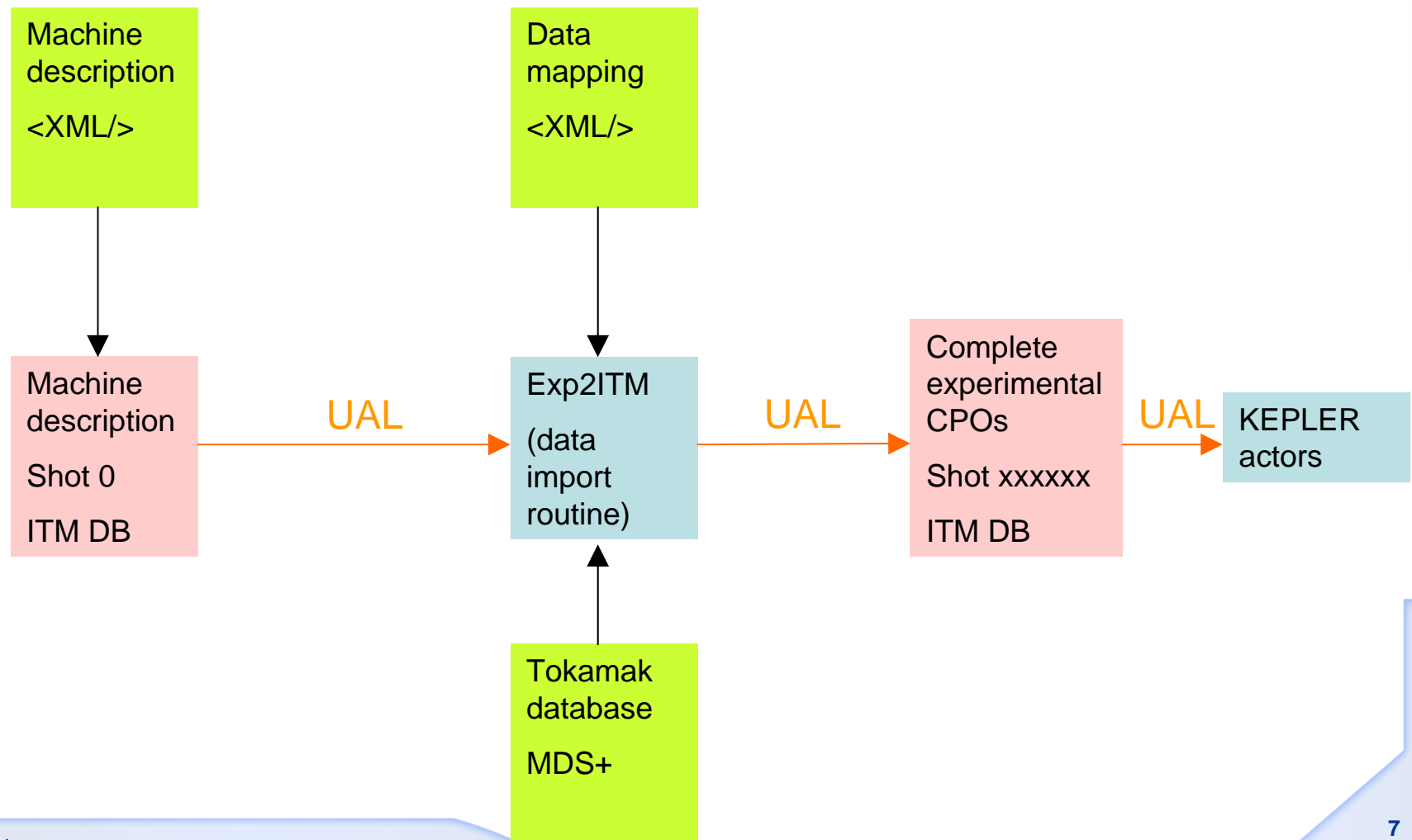
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•       </value>
•   </ip>
• </magdiag>
  
```

Time-dependent data

- The exp2ITM tool deals with
 - Fixed values (e.g. relative errorbars)
 - Simple operations on local signals : $a*X+b$ (unit conversion, ...)
 - Multiple local signals going into one ITM signal : concatenation
 - Multiple local time bases going into one CPO : time interpolation
- All this is parameterised in the XML mapping file

User's view of experimental data

- Machine description and data mapping are originally provided as XML files
- Machine data and time-dependent data are made available to users as Entries of the ITM database, i.e. CPOs that can be GET using the UAL.



Conclusions

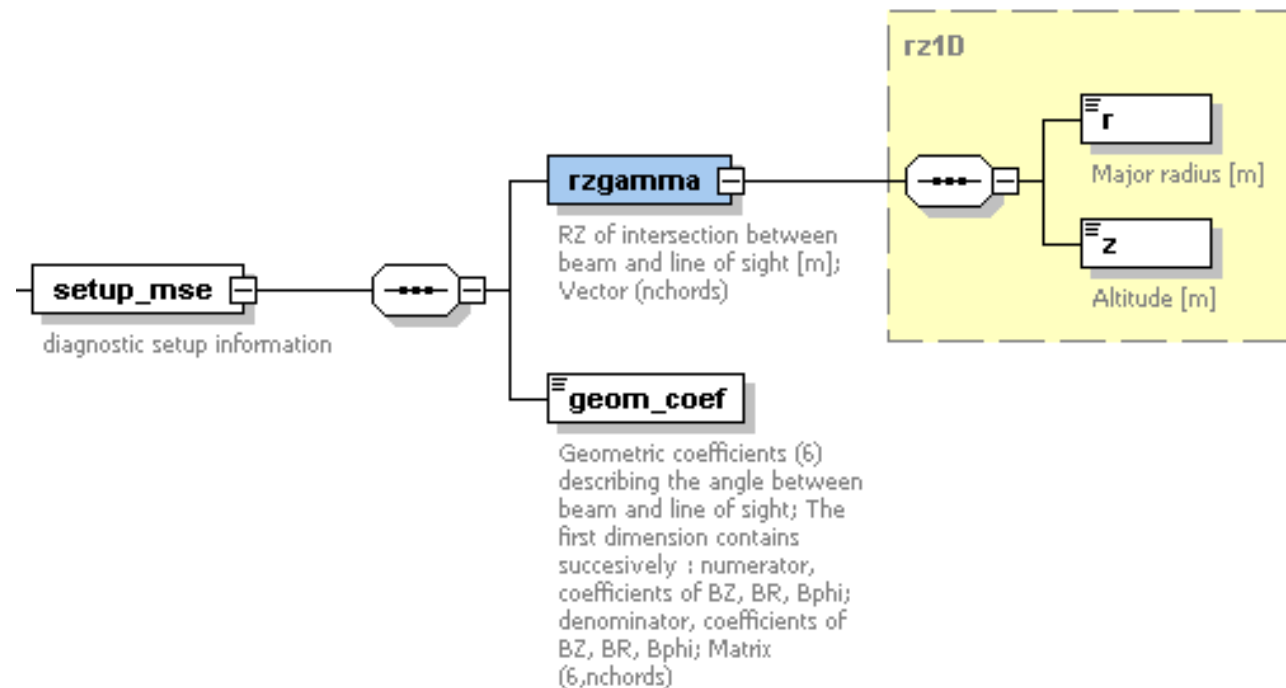
- A suite of tools have been developed to make experimental data of any tokamak device available to modellers in a standard format
- Data providers are only required to provide Machine Description and Data Mapping → copy/paste data in ASCII files.
- Only a few diagnostics in the ITM data structure for the moment, needs to be extended → participate in the definition of the diagnostic standards

More technical details to follow ...

- You do not need to read this now ...

Machine description

- Example : diagnostic geometry (MSE)



- Machine descriptions are provided to the ITM by local contact persons, in the form of an XML file (consistent with the ITM data structure)
- They are then compiled by ISIP tools and PUT in the ITM database under the MDS+ tree of the corresponding tokamak, shot 0.
- Different versions can coexist in the ITM database (e.g. valid for different shot ranges), all stored under shot 0 with different run numbers.
- A machine description can be loaded with the UAL by opening shot 0, the proper run number, and GETting the CPOs. They will be of size 1 if time-dependent and contain only the machine description part of the data structure.

Time-dependent data

- The exp2ITM tool has been developed to import time-dependent data into ITM format
 - the exp2ITM main code is generic, machine-independent
 - CPO-dependent parts of exp2ITM are dynamically generated from an XML description of the mapping of local data to the ITM format. This XML file is machine-dependent
- Three steps :
 - access the data in the local database (mostly MDS+ based) and map it to the ITM format, following the rules described in the machine mapping file
 - initialises the ITM CPOs with
 - the relevant machine description from the ITM DB
 - the calculated common time base
 - puts back the complete CPO (machine description + time-dependent data) in the ITM database.
- Presently, exp2ITM is a Java tool that must be run stand-alone. In the future, it can be used as an actor in the Kepler workflows.

Time-dependent data : example

- Write machine, shot number and run number in exp2itmArgFile.txt
- (set environment variables for MDS+ tree and UAL properly, caution, the Java UAL path is set in exp2ITM.sh)
- Execute exp2ITM.sh
 - it creates a new entry
- Execute plot_expdata.f90 to check what happened
 - Calls to ppplib to create images of the data