



# Open-source Modelica simulation suite.

iPST/PowSyBI day

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# Outline

- **Introduction**
- **iPSL library**
- **Power Systems on Modelica (PSM) tool**
- **Demo**
- **Next steps & challenges**

# Introduction

- RTE-AIA collaboration project on PSM was developed during 2017.
- The project stemmed from the **needs for dynamic power system simulations** towards a single electricity market:
  - Open source and “white-box” tools.
  - Pan-European collaboration.
  - Adaptability to a fast-changing environment.
- **Modelica** seems to be a promising modelling language for PS simulations:
  - Non proprietary. Generic and powerful.
  - Equation based modelling language to conveniently model systems.
- The project **opened a path towards solving these needs** (open source tool, user friendly, easy generation of Modelica systems...)

- **Modelica** is a **open standard generic modelling language**.
  - Normalized by an association.
  - Widely used, mostly in the automotive industry.
  - Allowed in CGMES user-defined models.
- Designed for easy modelling of complex cyber-physical systems:
  - “Textbook” equations, “physical” connections.
  - Easier to write, reuse, maintain.
- But **no Modelica tool** tailored **for power-system studies**:
  - CGMES data compatibility.
  - Load flow.
  - Dynamic data base.
- However, Modelica tools are **not optimized for power system** setups.



# IPSL library

- The **iTesla Power System Library (iPSL)** was developed by different partners during the iTesla project.
- Is a **Modelica library** that contains a set of power system component models for phasor time domain simulations.
- It also includes mathematical models for control systems.
- iPSL is one of the open-source projects on the **GitHub iTesla repository**.
- It was added as a power system Modelica library available in the **OpenModelica** environment in 2017.
- iPSL also uses many models from Modelica standard library.

# PSM Tool

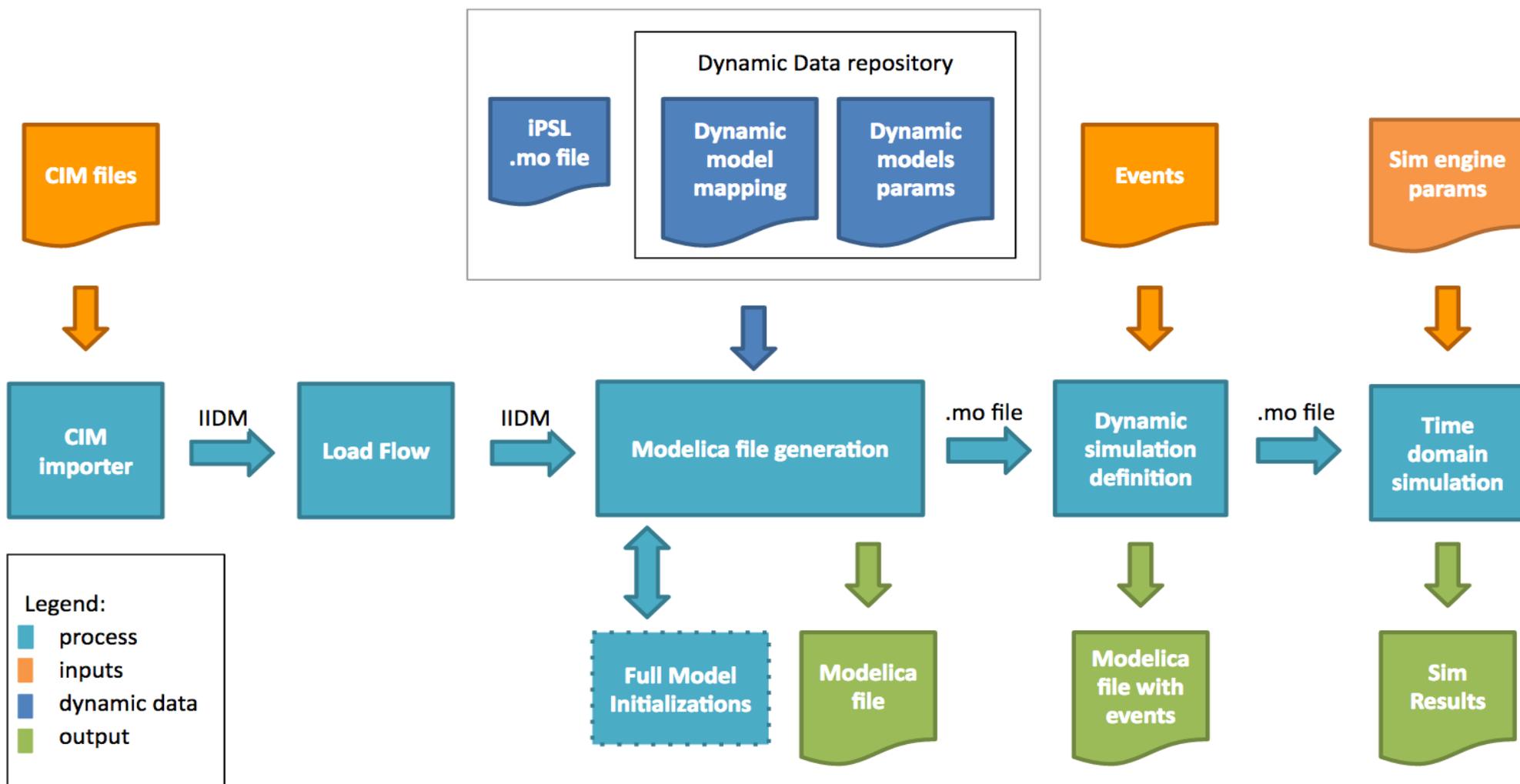
- **PSM** (Power Systems on Modelica)
- **Open source tool** that provides an easy way to prepare and perform dynamic simulations using Modelica.
- Allows **to transform power system** networks from CIM to Modelica.
- Runs a **Load Flow** and uses a Dynamic Data Repository to retrieve dynamic models.
- Two alternatives for LF computation: Hades2 (RTE) and HELM-Flow (AIA) engines.
- Fully compatible with **iPSL** library (but not limited to).
- Dynamic simulations can be run inside PSM using **OpenModelica** or **Dymola** engines.

# PSM Tool

- **Linux** and **Windows OS** versions were made available for internal testing and use at RTE in 2017.
- Distributed with public networks included.
- Designed to ensure **modularity**, allowing to either run processes individually or as a full workflow.
- It includes a **desktop GUI** that allows users to select the processes to run, on which data sets, and display progress and logs.
- **Command line tools** are also available to run the tool.
- **More info** at: Viruez et al., "*A Tool to ease Modelica-based Dynamic Power System Simulations*", Proceedings of the 12th International Modelica Conference 2017.

[Link to publication.](#)

# PSM Tool



Power Systems on Modelica x

## Power Systems on Modelica

Version 1.0.1 build 2017-10-25 11:15:25

Cases
DDRs
Conversion
Simulation
Loadflow
Validation

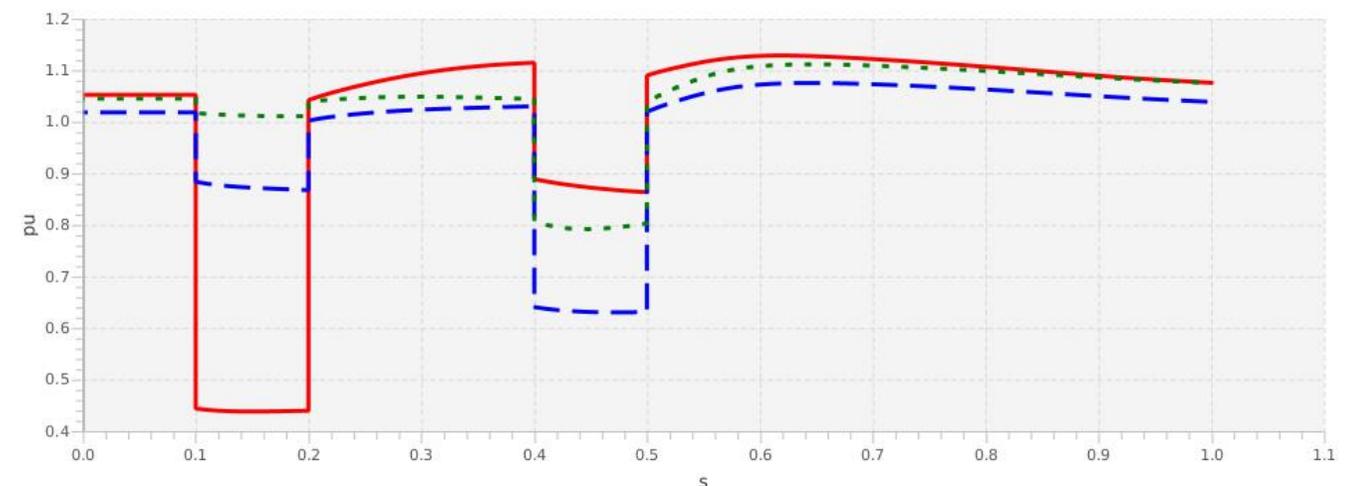
New simulation

**Summary**

Case:	Reference cases - ieee14	Created:	2018/05/22 16:03:59
Dynamic simulator:	Open Modelica		

**Simulation detail**

Results
Modelica file
Modelica file with events
Logs



● bus\_BUS\_\_10\_TN.V
 ● bus\_BUS\_\_4\_TN.V
 ● bus\_BUS\_\_2\_TN.V

Element:  Add

# Next steps & Challenges

- PSM will be open sourced in the very near future.
- iPSL library will suffer large improvements in the near future to improve its clarity, organization and range of models (power flow, transient & EMT).
- PSM will be updated when the new iPSL is ready.
- **Scalability**: PSM allows to convert to Modelica networks of any size but Modelica simulation engines performance **is highly decreased** with networks **above 100 nodes** (very far from realistic models).
- An **hybrid C++ / Modelica simulation tool** is under development in RTE and will be released open source in the next few months.
- This simulation tool enables to overcome the scaling up problems faced by Modelica tools. Its integration in PowSyBI is foreseen for the end of 2018. [rte-des-simulation-dynamique@rte-france.com](mailto:rte-des-simulation-dynamique@rte-france.com)

**THANK YOU!**