



DYNAMIC SIMULATIONS OF PARABOLIC TROUGH SOLAR FIELDS USING DIRECT STEAM GENERATION: CROSS VALIDATION AND COUPLED APPROACH

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Context

- Need of a robust and validated tool for DSG plant and control design:
- ✓ Able to perform dynamic simulations for non-ideal DNI (cloud passages)
- ✓ Ready to simulate complexes thermo-hydraulic phenomenon (two-fluid model)

Objectives

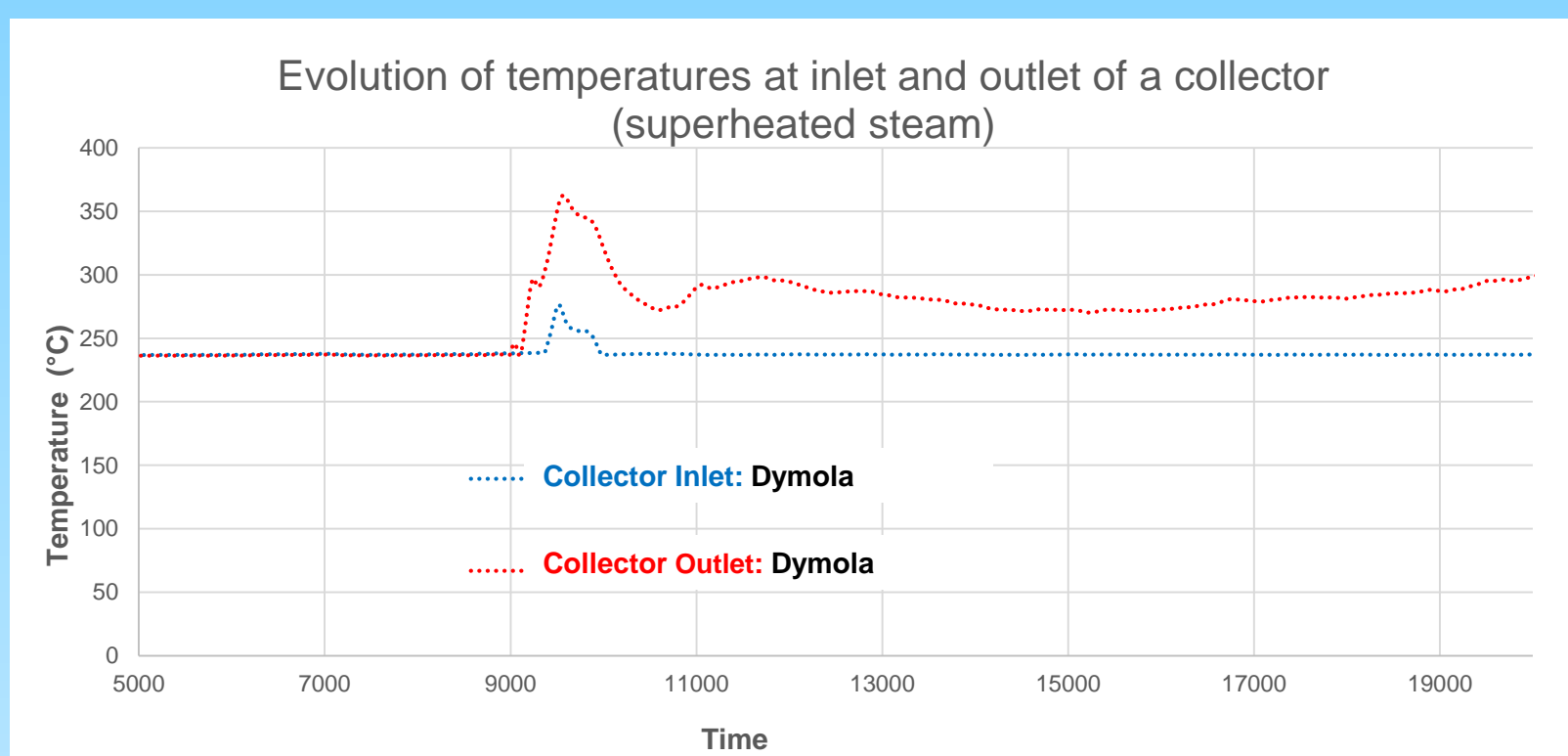
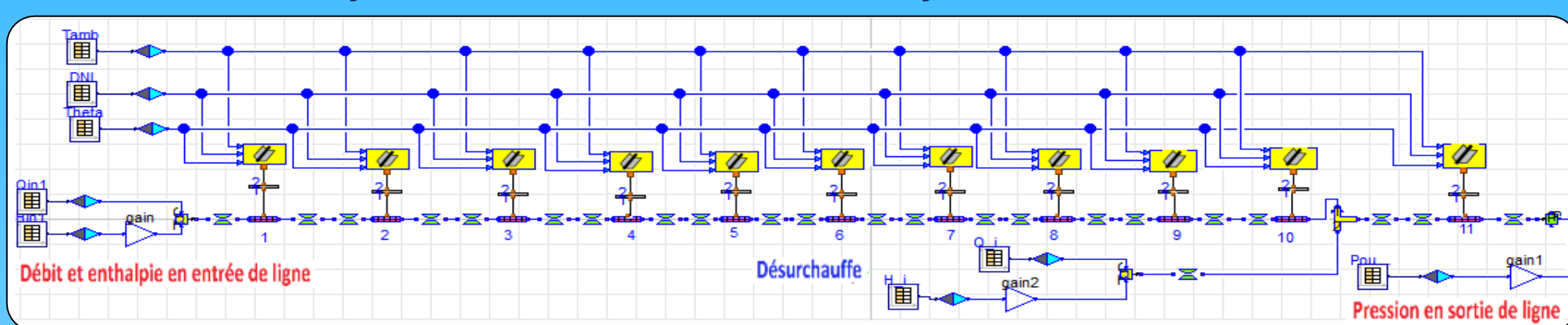
- Use of an advanced reference code for thermo-hydraulic part of the model
- Use of Dymola for optical and control model
- Coupling of both models on PEGASE co-simulation platform

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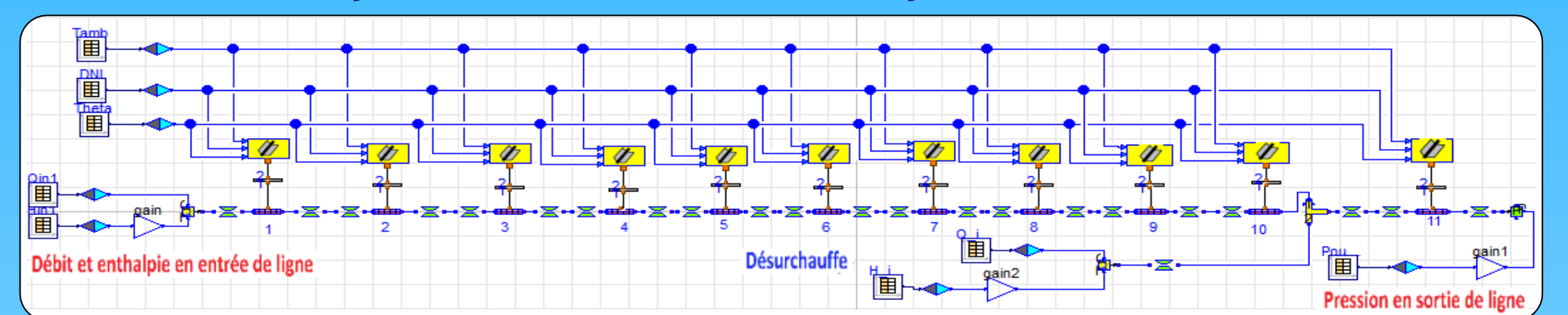
Dynamic simulation with Dymola

Dymola
Optical model + Thermo-hydraulic Model + All Boundary Conditions



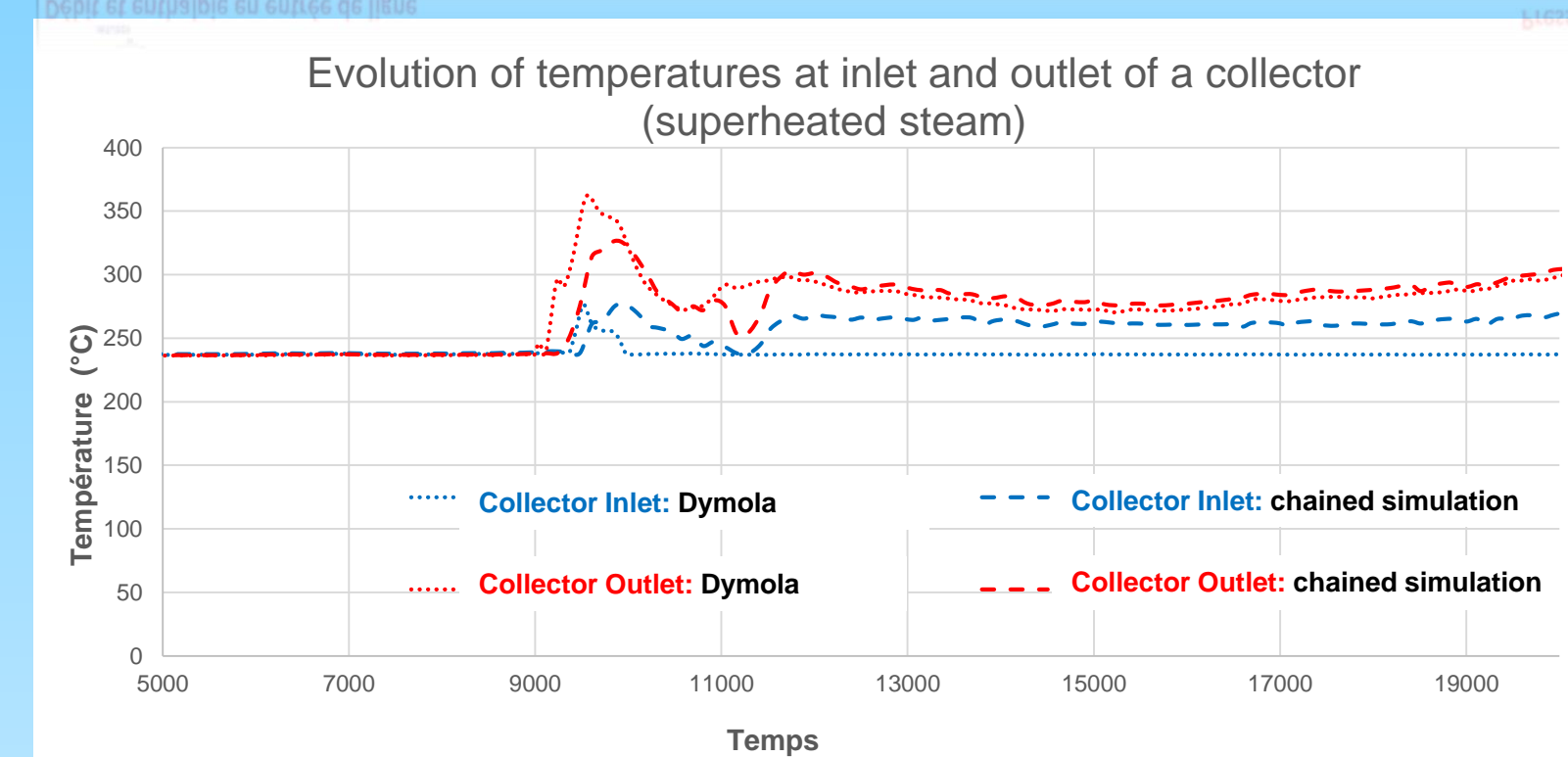
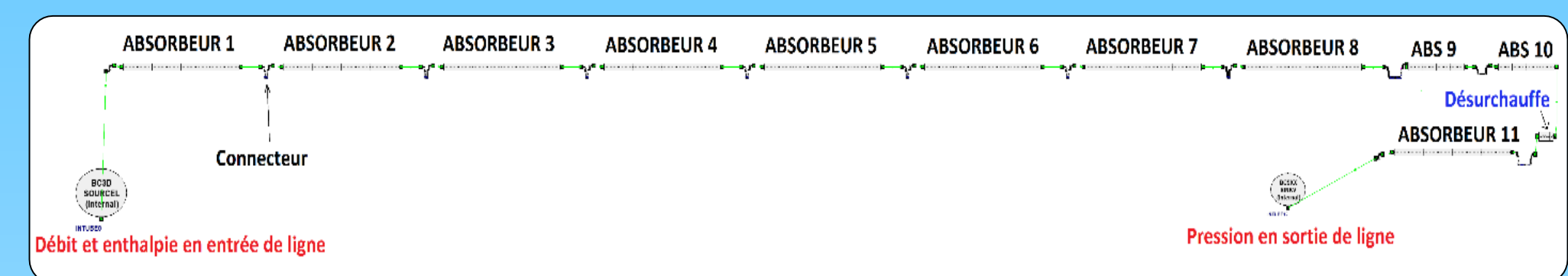
Chained simulation: Dymola ⇒ Cathare

Dymola
Optical model + Thermo-hydraulic Model + All Boundary Conditions



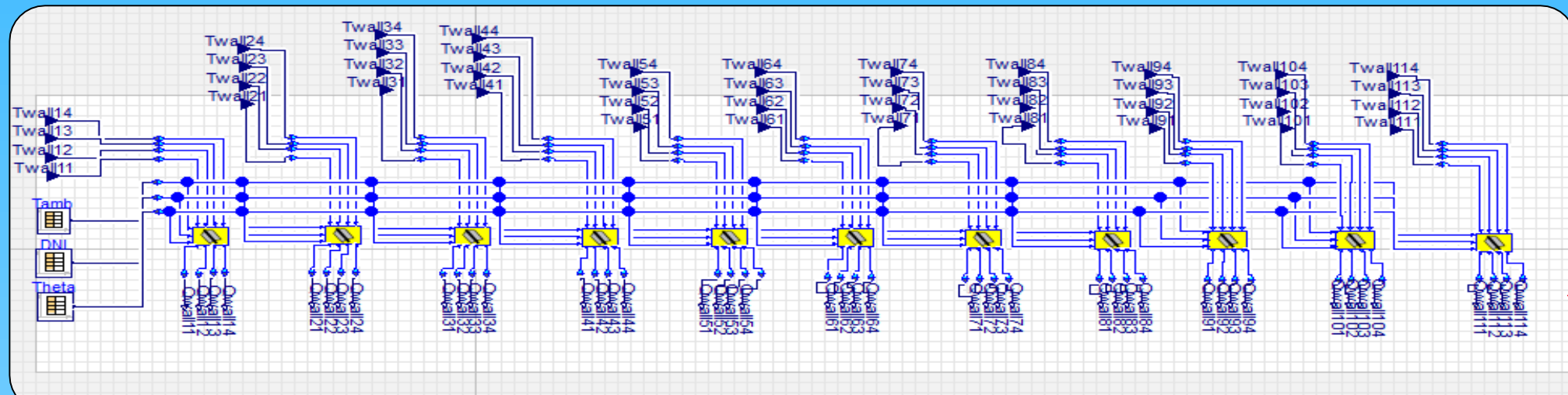
Input of heat flux through a .csv file

Thermo-hydraulic Model + Thermo-hydraulic Boundary Conditions

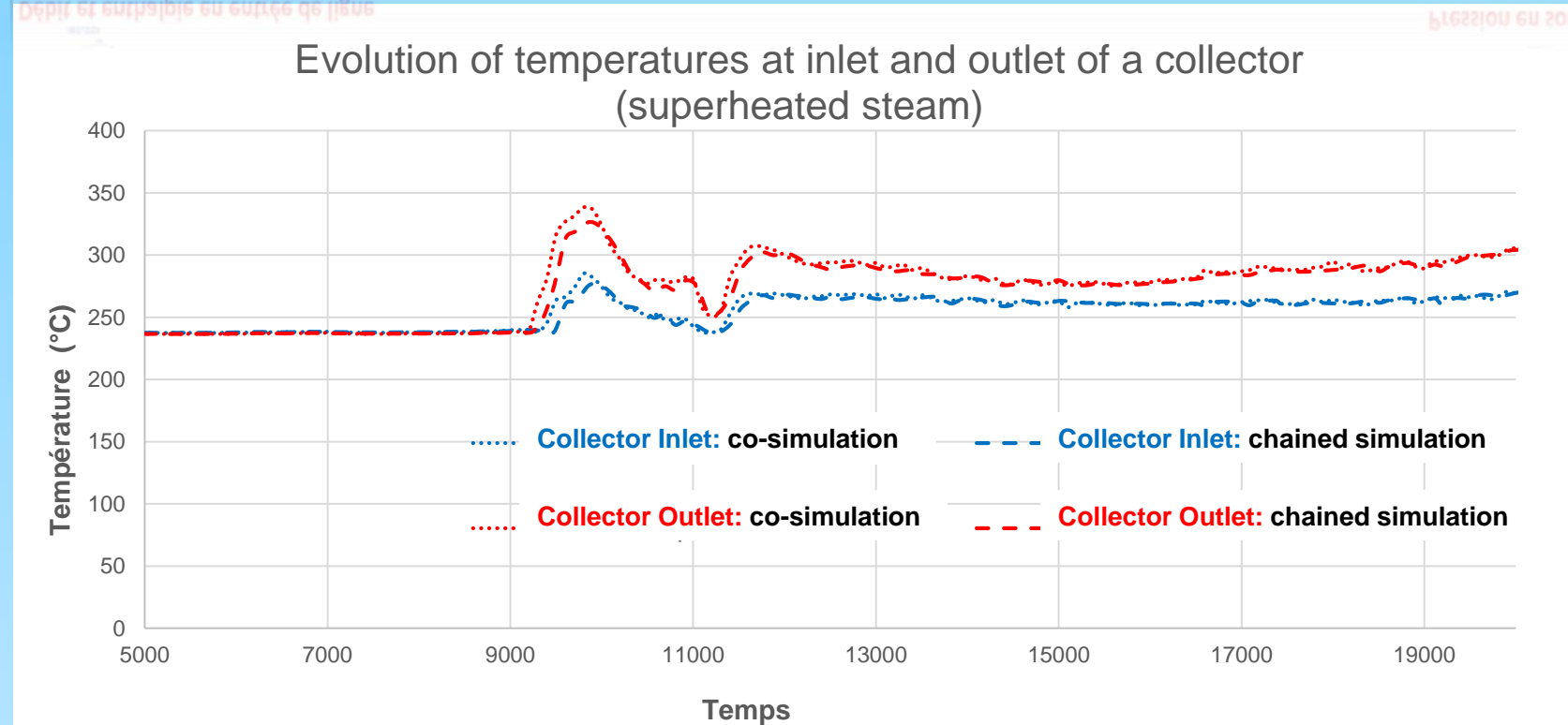
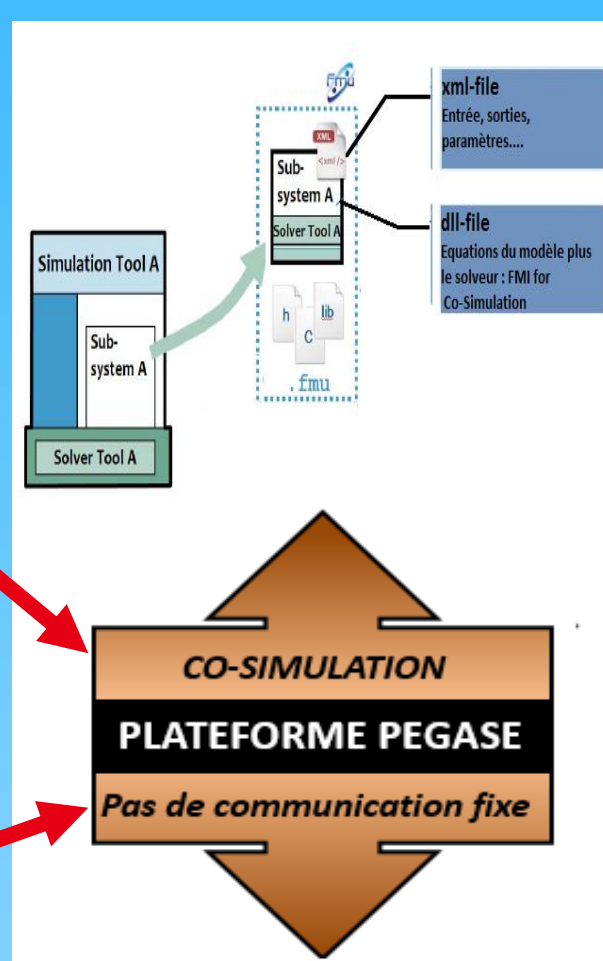
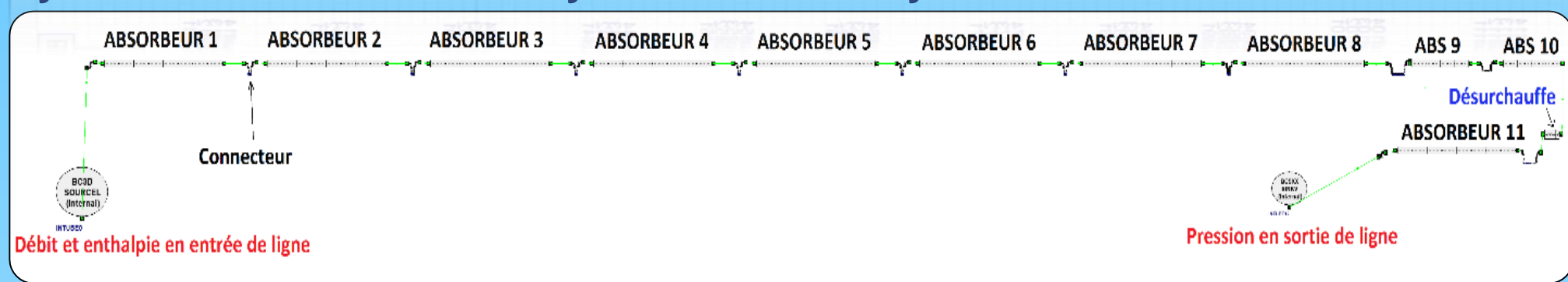


Coupled approach: Dymola with Cathare

Dymola
Optical model + Optical Boundary Conditions



Thermo-hydraulic Model + Thermo-hydraulic Boundary Conditions



Conclusions

- A proof of concept was performed on PEGASE co-simulation platform for one case of simulation (without control models)
- For this particular case (i.e. considering a gentle slope of DNI) there is a very good agreement between results obtain with Dymola, chained simulation and coupled approach → cross validation
- For the communication time, a compromise must be found between calculation time and required accuracy

Perspectives

- Conduct benchmark cases with a very disturbed DNI to show the real contribution of the combined approach
- Integrate the control system in the Dymola FMI or in another FMI model (e.g. from Simulink)