
Centrum
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# ClaRa library at CVR

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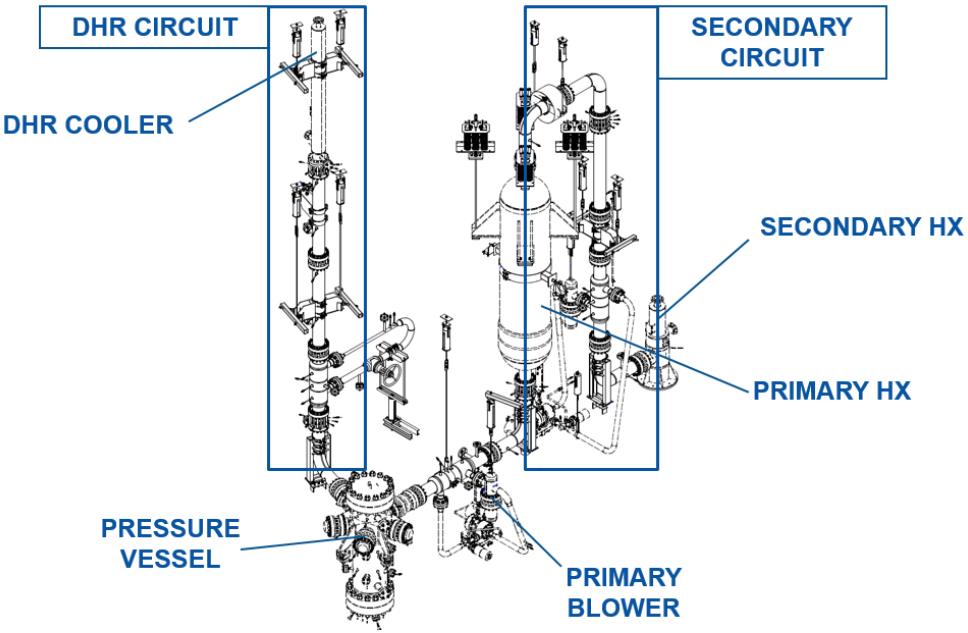
# Modelling of S-Allegro loop

- Experimental loop intended for development of the GFR concept ALLEGRO
- Purpose: Experimental verification of safety systems for residual heat removal, computational codes validation, testing of components in the high temperature helium environment
- Composed of the primary and secondary helium circuits, tertiary water cooling circuit and DHR circuit with natural or mixed convection of helium




# Modelling of S-Allegro loop

**Goals of the modelling activity using ClaRa library:**

- Support of the experimental campaign (setting of proper operational parameters, estimate of transient behavior)
- Validation of the model on the experimental data
- Utilization of validated model to support design of the GFR demonstrator

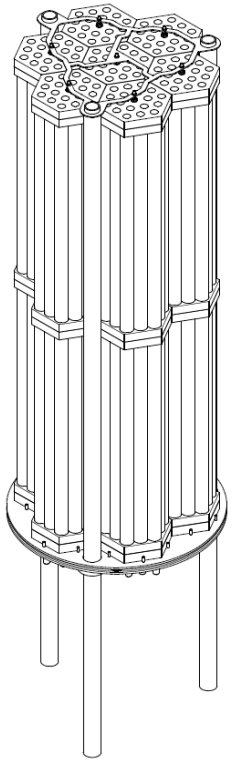
**Main challenges**

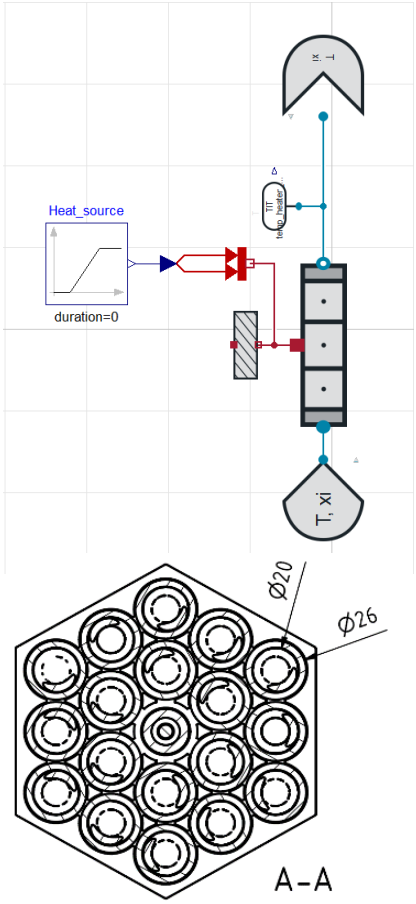
- Unconventional fluids (high temperature helium)
- Natural and mixed convection
- Unavailability of correlations for heat transfer and pressure drop
- Initialization of simulation

# Modelling of S-Allegro loop – main components

## Reactor vessel

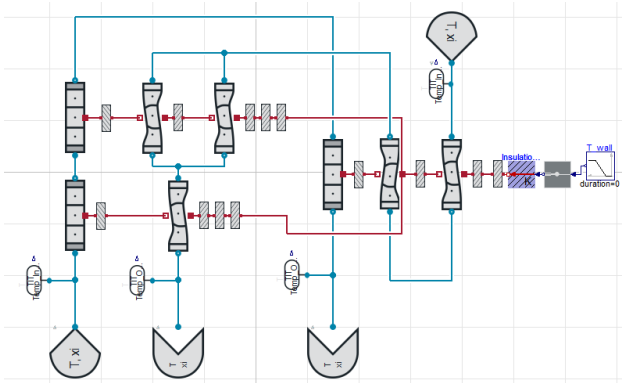
- Composed of 126 ceramic tubes equipped with heating helical elements
- Heating power 1 MW

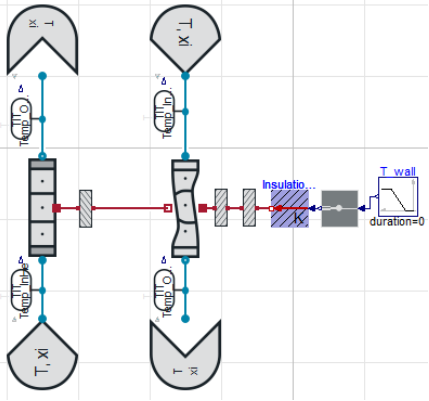


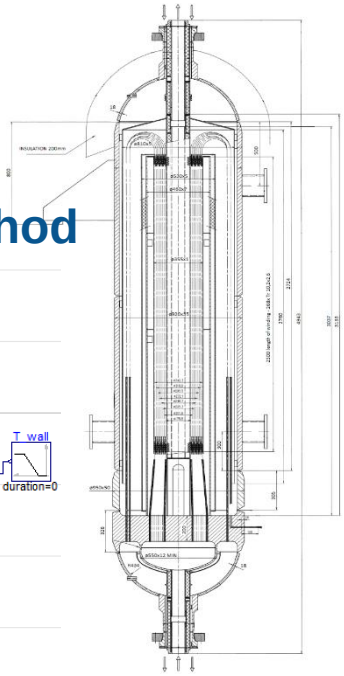



## Heat exchangers

- Helium/helium primary HX
- Helium/water secondary HX
- Gnielinski correlation, Bell-Delaware method

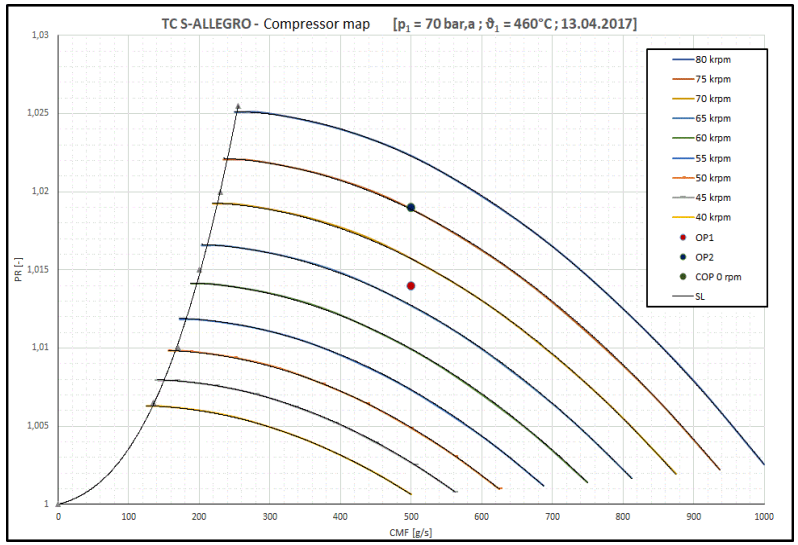


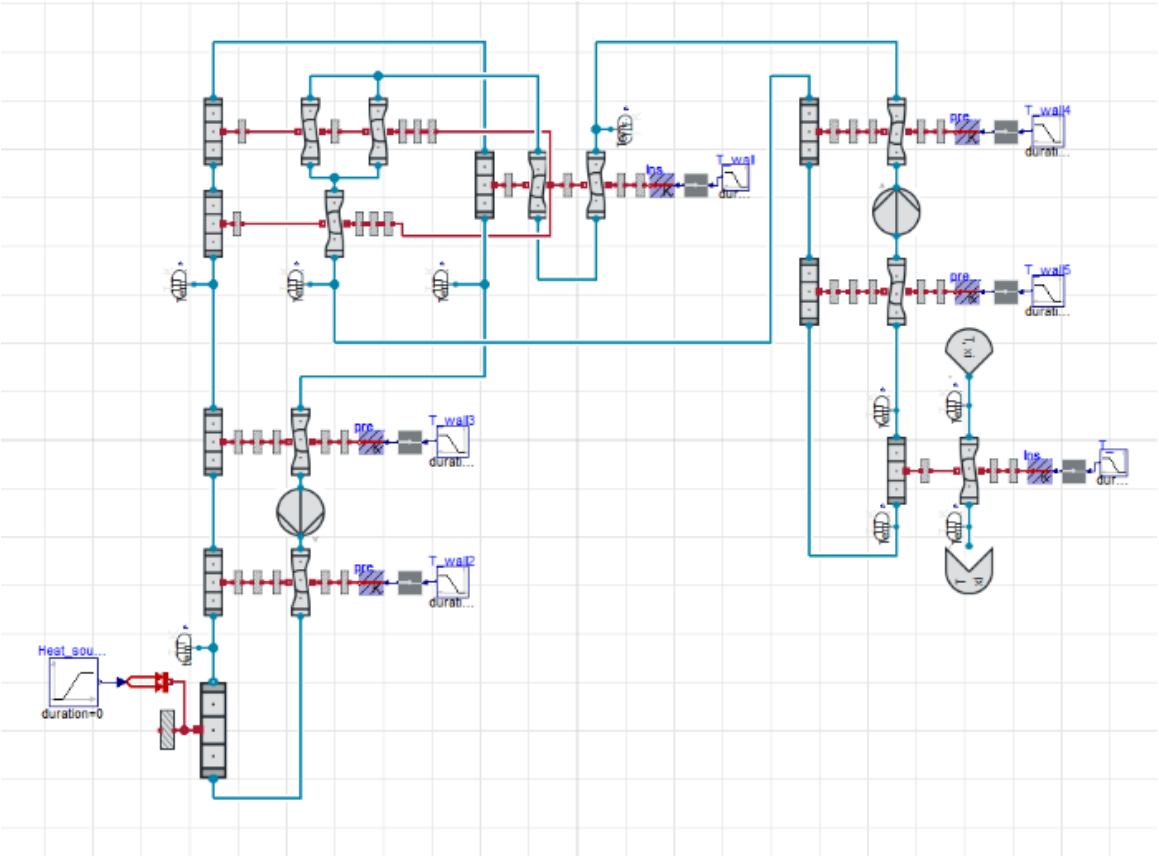
## Compressors

- Used for forced circulation of helium in the primary and secondary circuits
- Implementation of characteristics provided by manufacturer



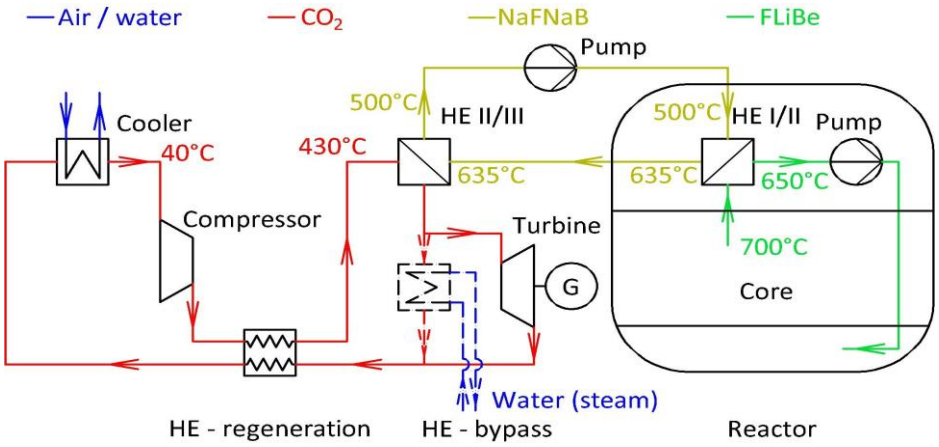
# Modelling of S-Allegro loop – current status

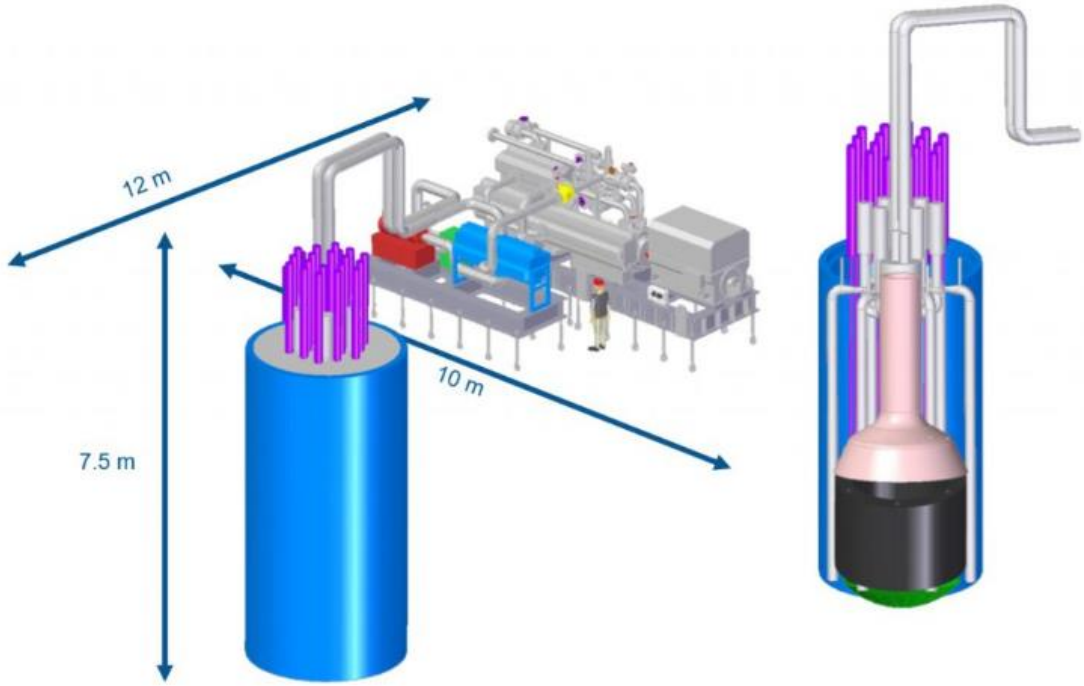
- DHR circuit with natural/mixed convection will be completed
- Available correlations might not be fully applicable – new correlations will be derived from experiments or CFD simulations
- Ability of the model to predict systemic behavior of the loop will be evaluated once the experimental data are achieved
- Model will be then used to support complex experimental campaigns



# Modelling of Energy Well facility

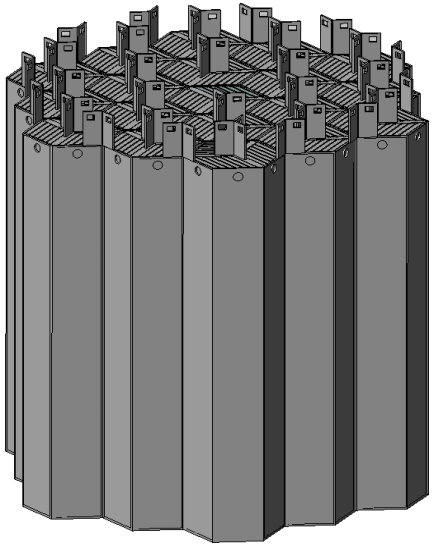
- Small modular reactor cooled with molten salt with solid fuel in the form of TRISO particles
- Composed of molten salt primary and secondary circuit with operational temperature up to 700°C and energy conversion sCO2-based tertiary circuit
- Is being developed at CVR within national projects, currently it the phase of pre-conceptual study
- Ongoing research is focused on optimization of the core layout, material research, development of thermal-hydraulic models and experimental assessment of the basic heat transfer phenomena



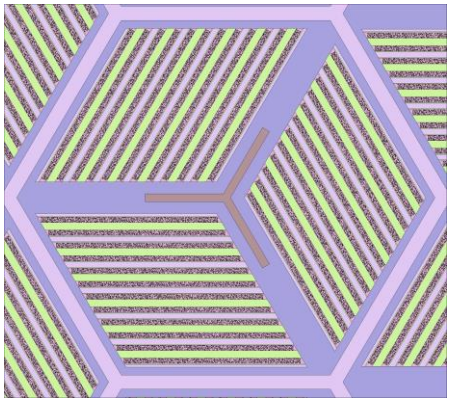



# Modelling of Energy Well facility

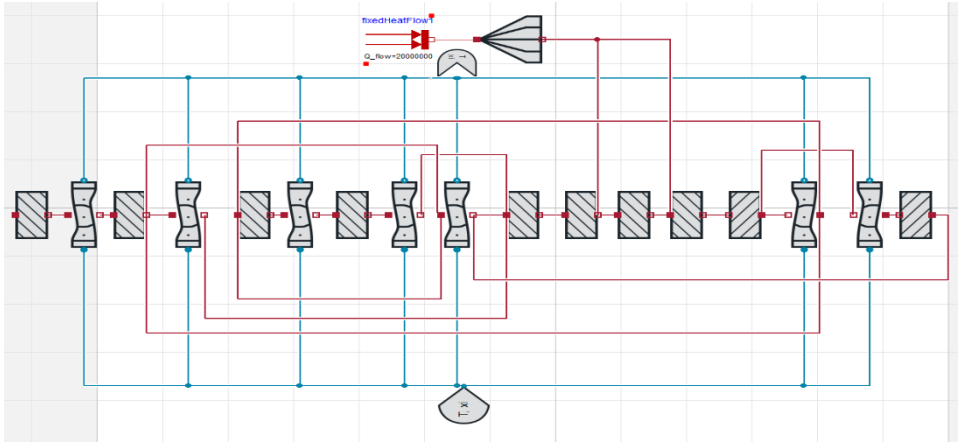
- ClaRa library will be used for design studies and for thermal cycles optimization
- Both molten salt and sCO2 fluids will be included to allow prediction of systemic behavior of the complex system
- Experimental activities will be carried out at CVR to qualify heat transfer in the core  and heat exchangers
- Computational model will be validated or improved based on the experiments
- Simplified component representing the reactor core in terms of neutronic behavior will be developed to allow simulation of the heat generation in the core



REACTOR CORE



FUEL ASSEMBLY




COMPUTATIONAL MODEL OF THE CORE