Implementing a new type of boundary condition using the COMSOL Physics Builder

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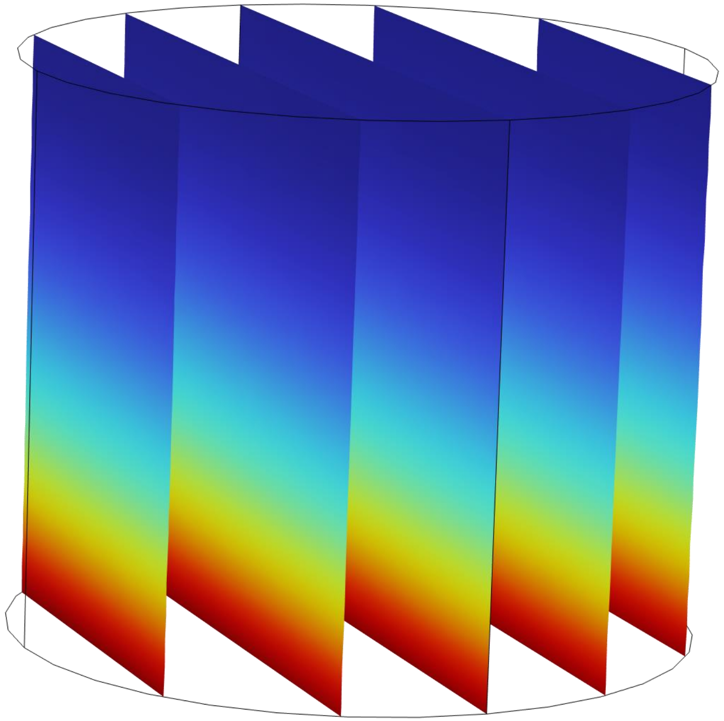


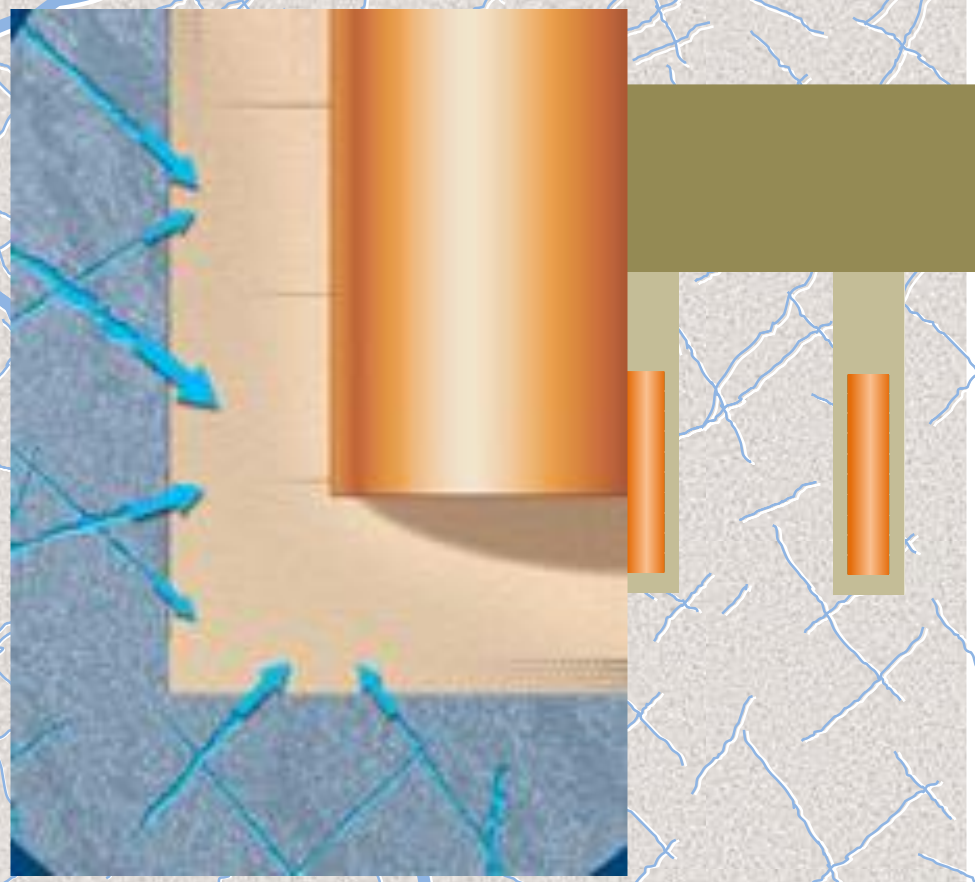
Introduction

Swedish deposition concept: KBS-3

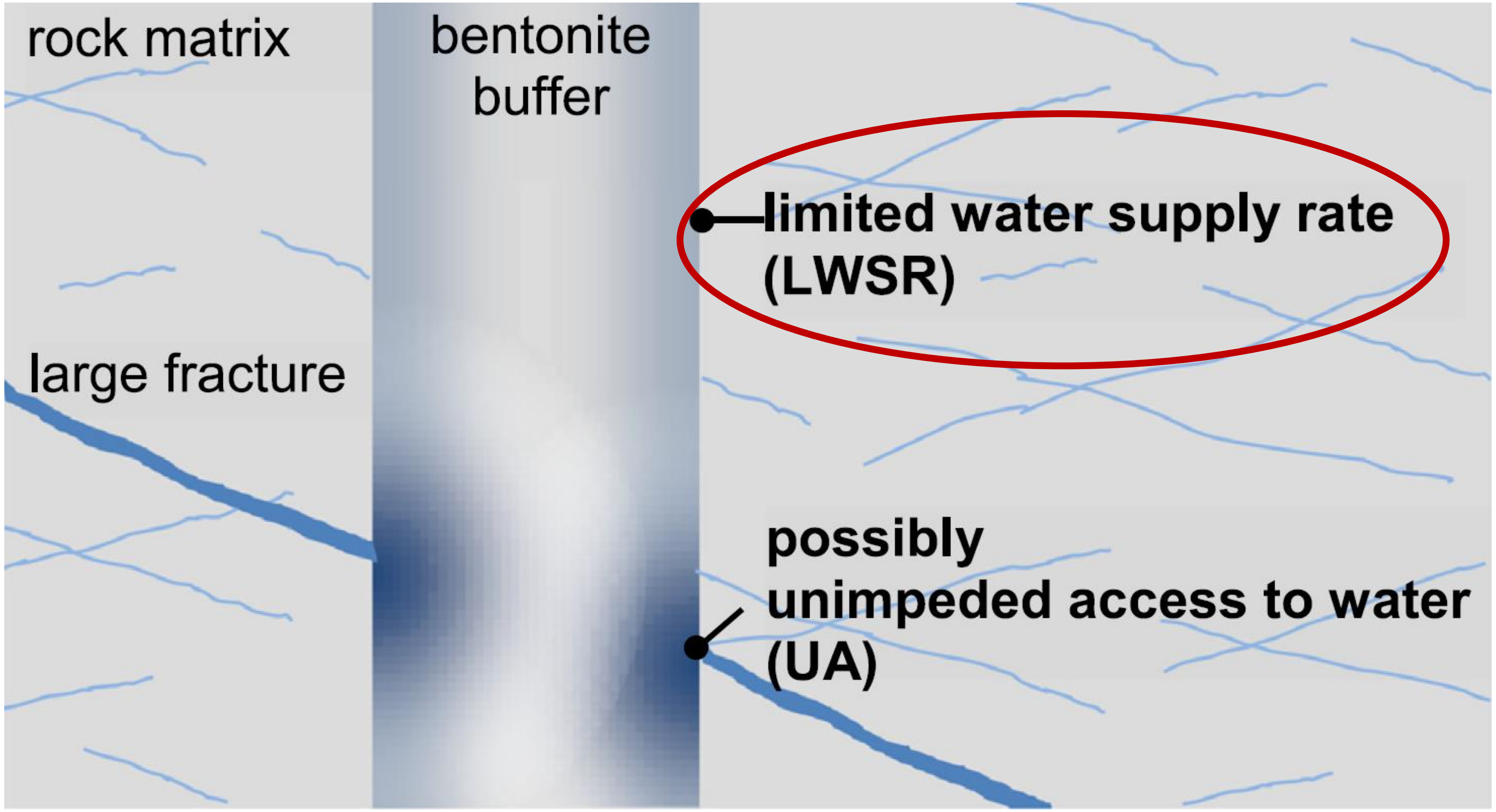
- Excavation of the deposition tunnel
- Drilling of the deposition boreholes
- Installation of bentonite blocks and waste cannisters
- Filling of the deposition tunnel

Planned development:

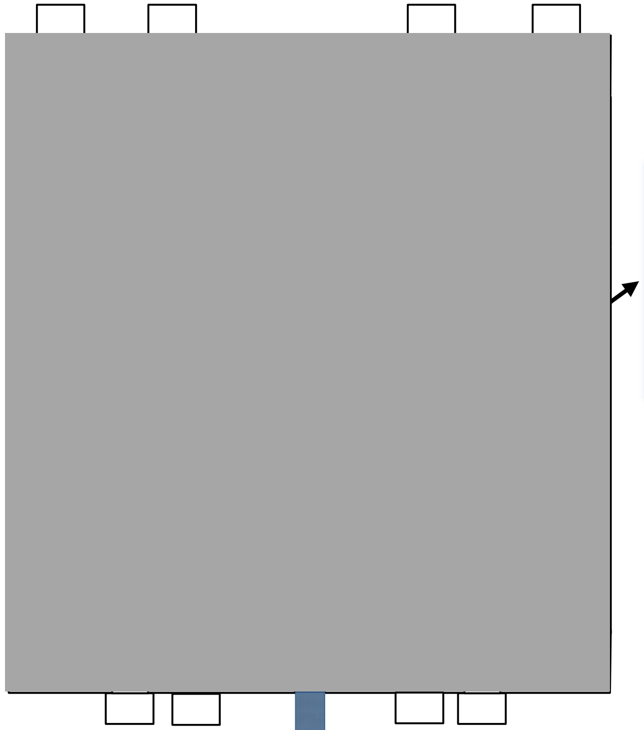
- Waterflow through fractures towards the cannisters



Introduction

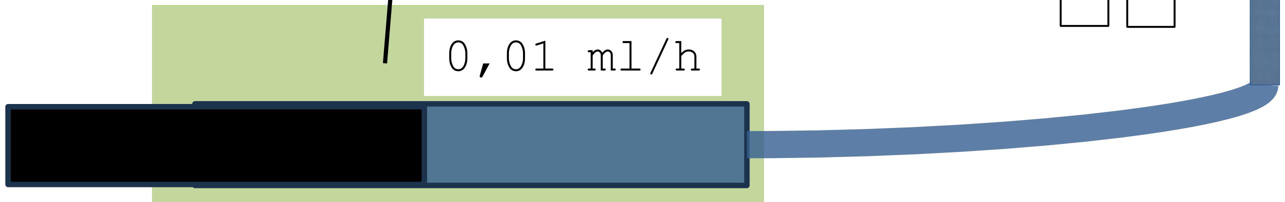


Experimental set-up

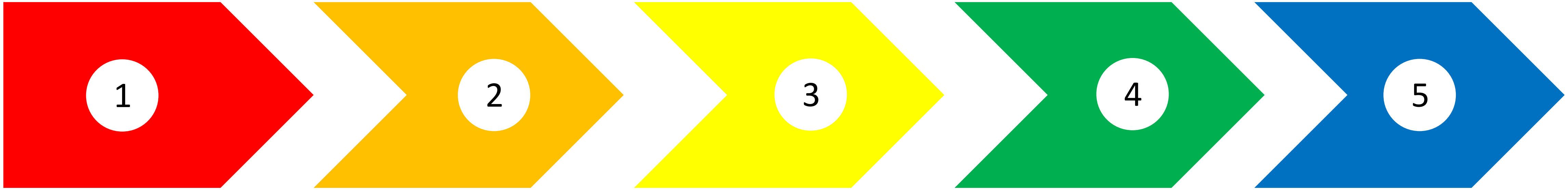


Bentonite sample
- Compacted from granular material
- target density (air dry): 1450kg/m³
- initial water content: ~12.74 %

Syringe pump
- pump rate: 0.01 – 99.99 ml/h
- accuracy: 2.5 % (for intervals > 1 h and pump rates > 2 ml)
- obstruction alarm at 0.3 bar

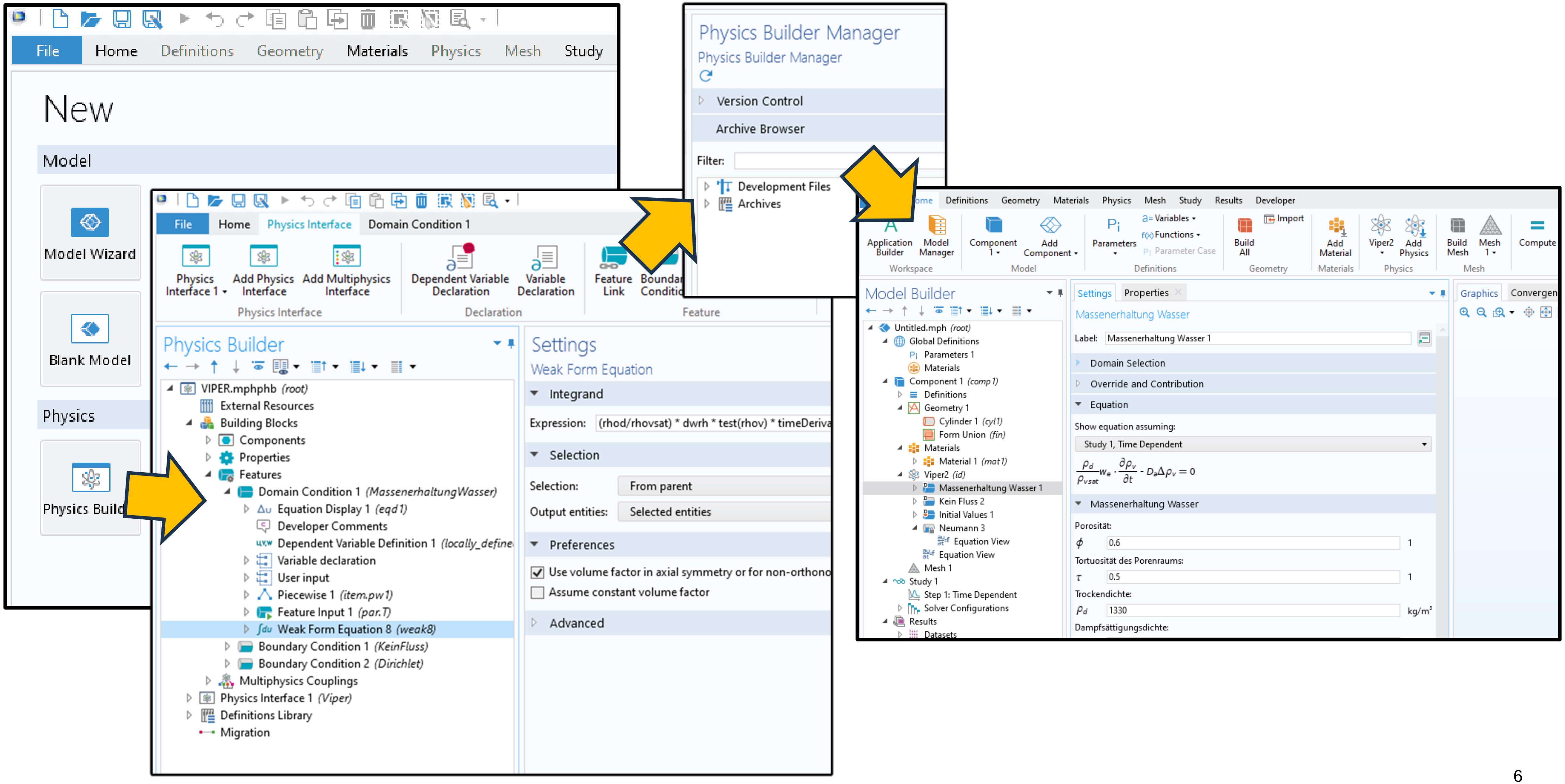


Workflow for creating an own COMSOL Interface



1. Theory
2. Implementation in COMSOL Physics Builder
3. Coupling with Heat Transfer in Porous Media Interface
4. Comparison with non-isothermal experiment data
5. Adding Neumann boundary condition

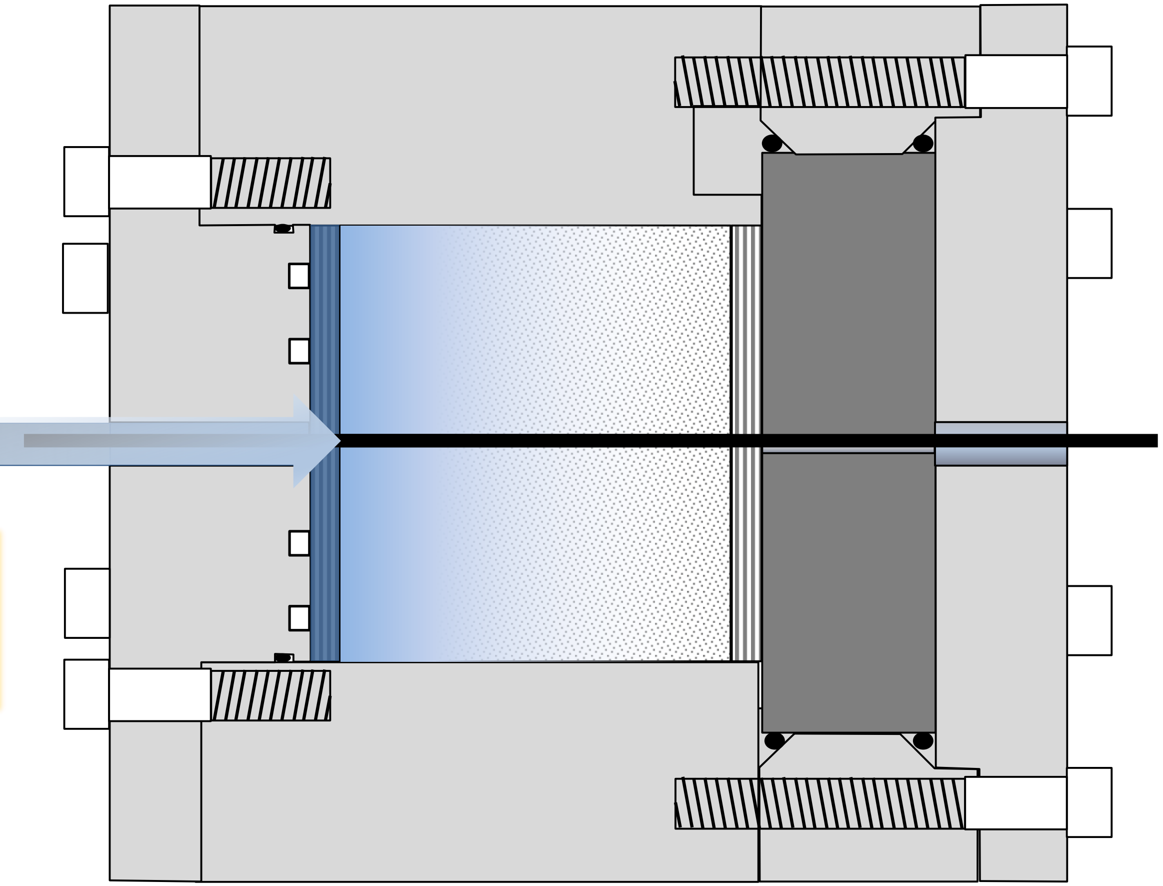
COMSOL Physics Builder



COMSOL model geometry

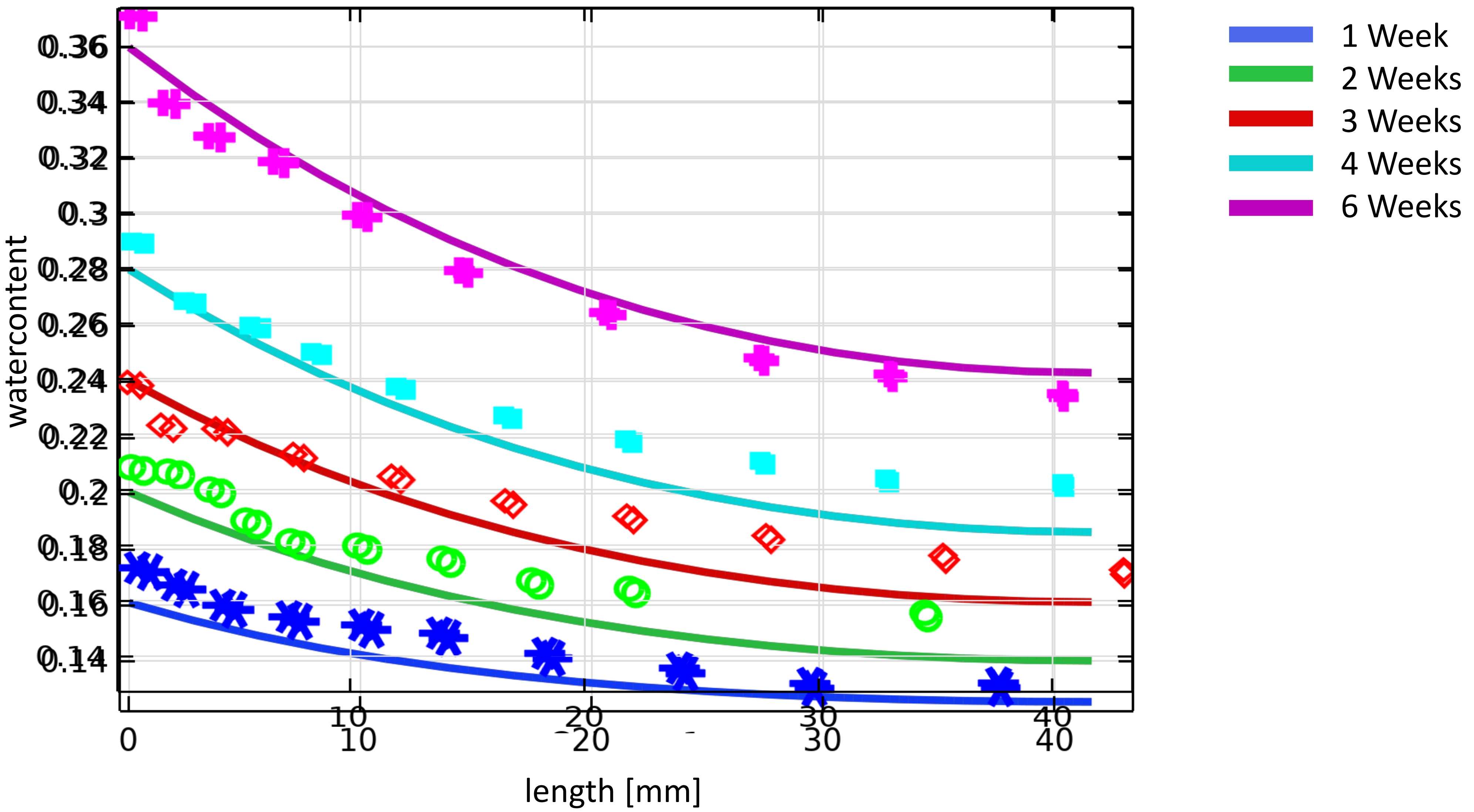
Boundary condition:
Neumann condition

Inflow between
$1{,}41 \cdot 10^{-6}$ and
$7{,}07 \cdot 10^{-6}$ kg/m^2s



Boundary condition:
no flow

Comparison of measurement and simulation results



Conclusions

Results:

- Successful implementation of Neumann boundary condition
- Promising first simulations

Whats next:

- Checking against other test scenarios
- Advancing simulation capabilities
  - Switching from Neumann to Dirichlet condition when full saturation is reached at the boundary
  - Adapt the diffusion coefficient of the interlayer according to the water content

Thanks for your attention

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