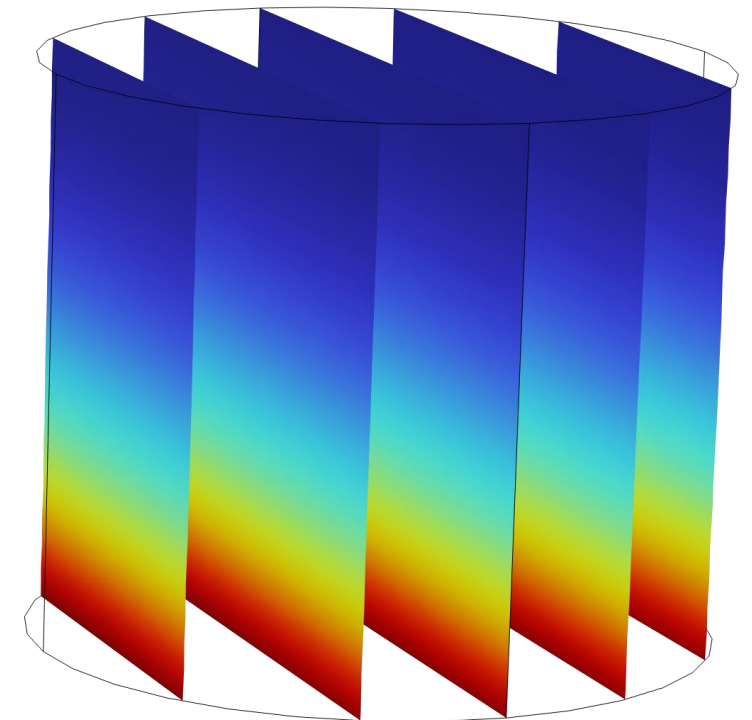


Implementing a new type of boundary condition using the COMSOL Physics Builder

**COMSOL
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Michael Kröhn, GRS
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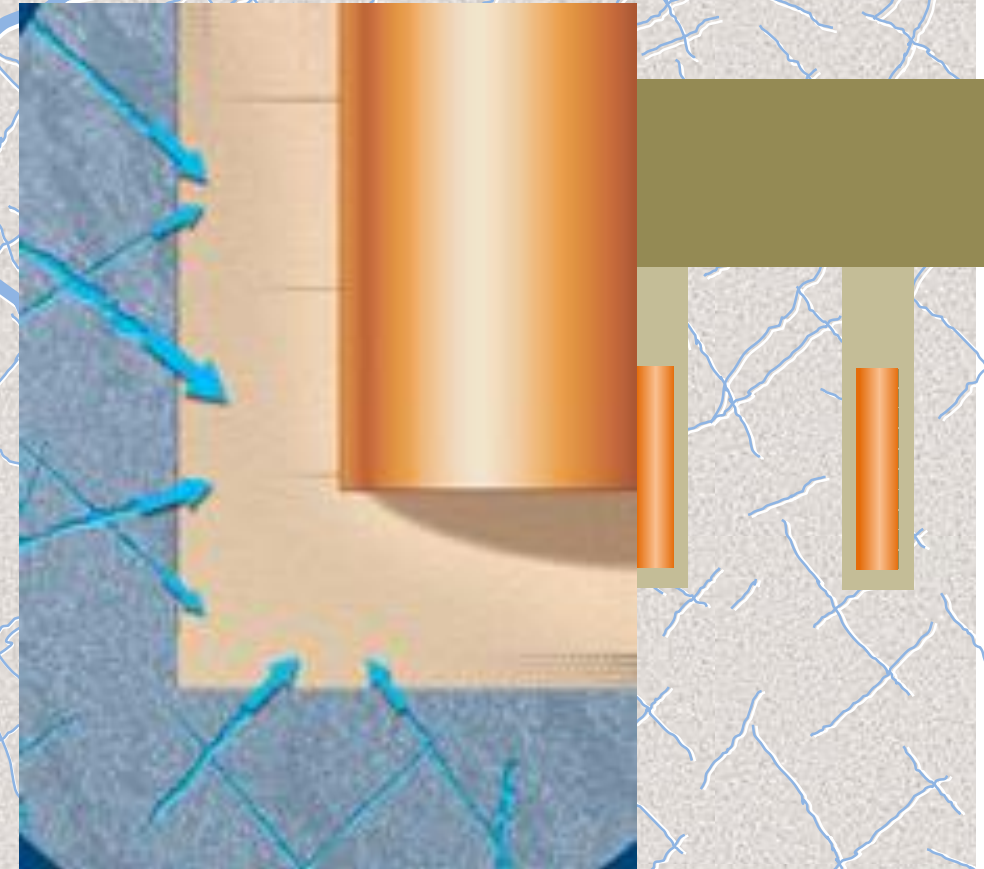
Introduction

Swedish deposition concept: KBS-3

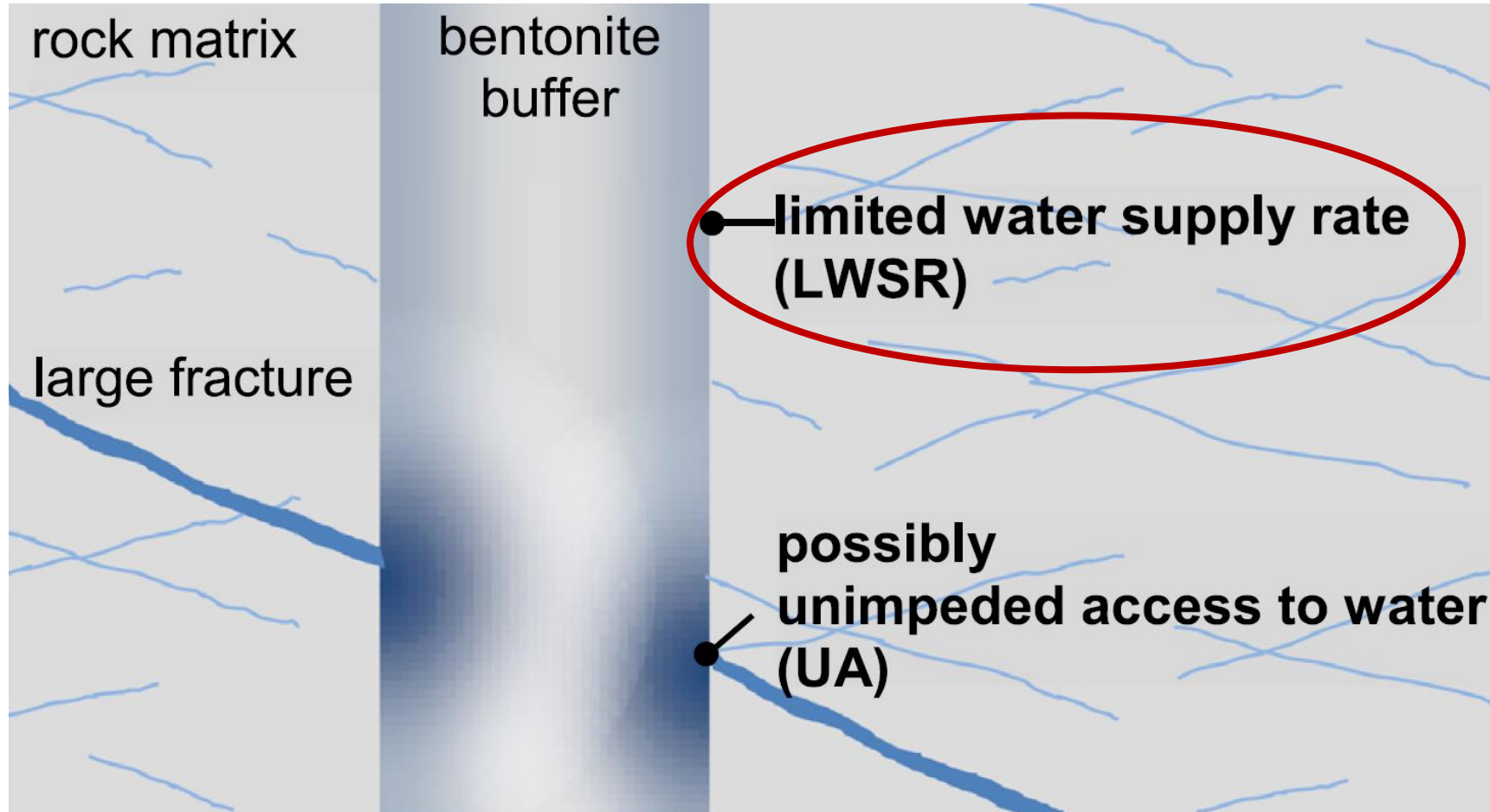
- Excavation of the deposition tunnel
- Drilling of the deposition boreholes
- Installation of bentonite blocks and waste canisters
- Filling of the deposition tunnel

Planned development:

- Waterflow through fractures towards the canisters



Introduction



Experimental set-up

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

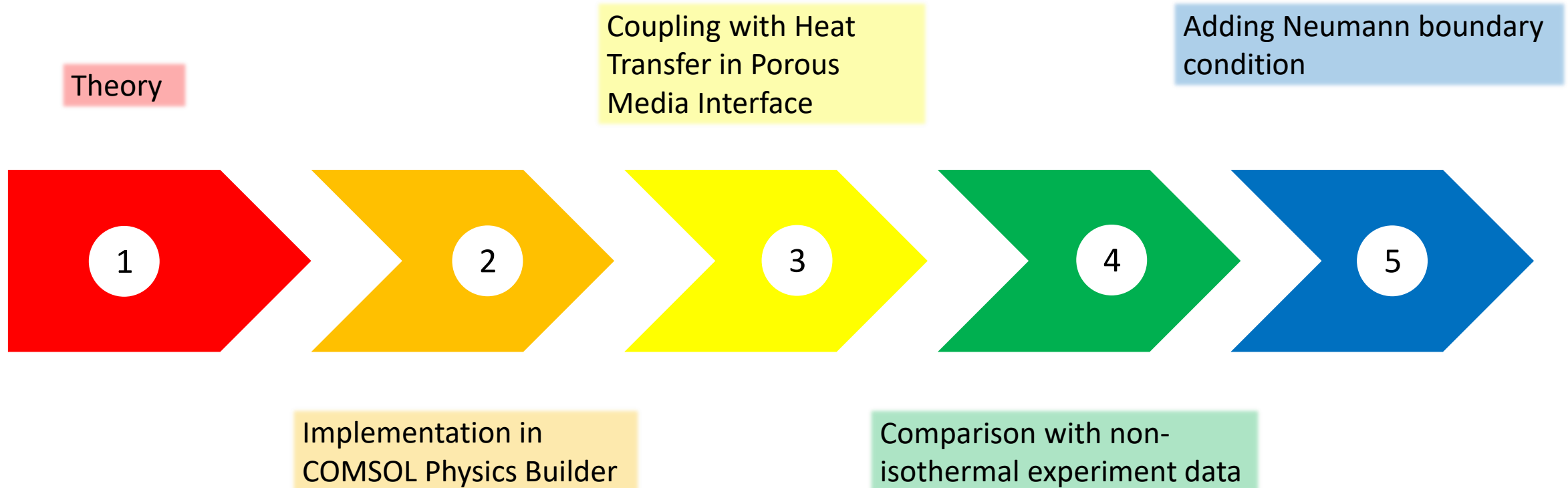
0,01 ml/h



Bentonite sample

- Compacted from granular material
- target density (air dry): 1450 kg/m^3
- initial water content: $\sim 12.74 \%$

Workflow for creating an own COMSOL Interface



COMSOL Physics Builder

The image displays the COMSOL Physics Builder interface, illustrating the workflow for creating a new model and configuring physics features.

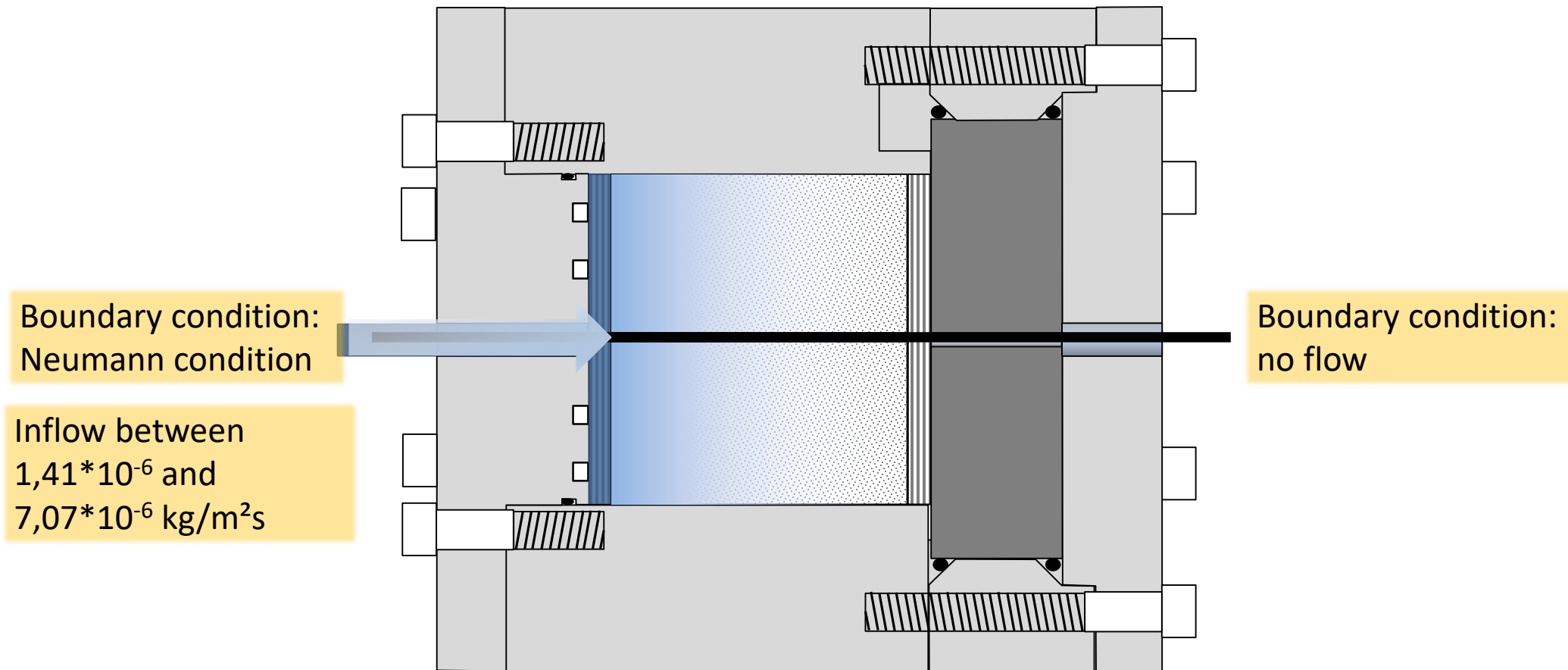
Physics Builder Manager: This window shows the management of development files and archives. It includes a filter and a list of folders: Development Files and Archives.

Physics Builder: This window shows the configuration for a Weak Form Equation. The expression is: $(\rho_{\text{hod}}/\rho_{\text{hovsat}}) * \text{dwr} * \text{test}(\rho_{\text{hov}}) * \text{timeDerive}$. The selection is set to "From parent" and the output entities are "Selected entities". The preferences include "Use volume factor in axial symmetry or for non-orthonormal coordinates" (checked) and "Assume constant volume factor" (unchecked).

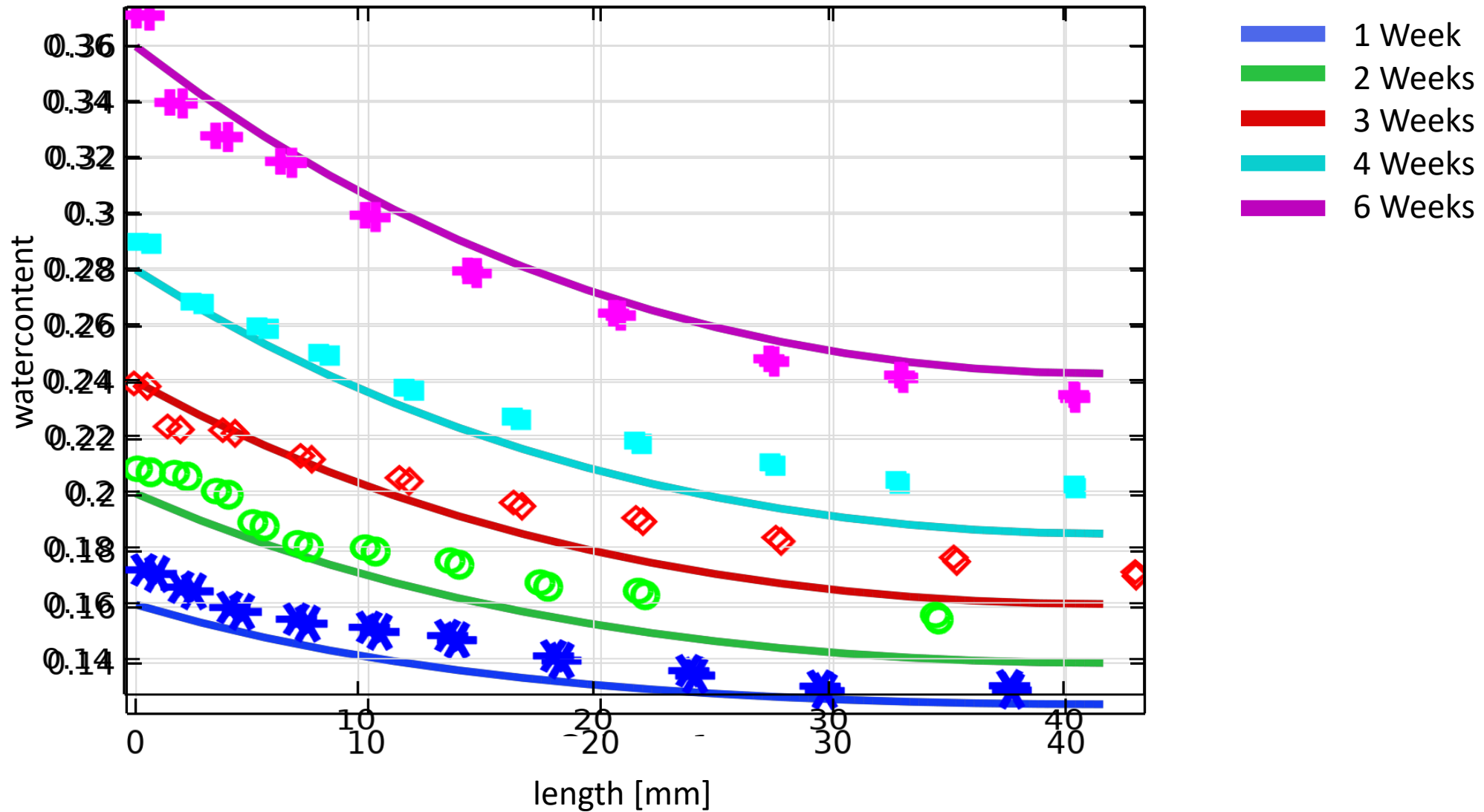
Model Builder: This window shows the tree view of the model. The root is "Untitled.mph (root)". The tree structure includes: Global Definitions, Parameters 1, Materials, Component 1 (comp1), Definitions, Geometry 1, Materials, Material 1 (mat1), Viper2 (id), Massenerhaltung Wasser 1, Kein Fluss 2, Initial Values 1, Neumann 3, Equation View, Mesh 1, Study 1, Step 1: Time Dependent, Solver Configurations, Results, and Datasets.

Massenerhaltung Wasser Settings: This window shows the settings for the "Massenerhaltung Wasser" feature. The label is "Massenerhaltung Wasser 1". The domain selection is "Study 1, Time Dependent". The equation is: $\frac{\rho_d}{\rho_{\text{vsat}}} w_e \cdot \frac{\partial \rho_v}{\partial t} - D_a \Delta \rho_v = 0$. The parameters are: Porosität: $\phi = 0.6$, Tortuosität des Porenraums: $\tau = 0.5$, and Trockendichte: $\rho_d = 1330 \text{ kg/m}^3$.

COMSOL model geometry



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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