

#### **University of Stuttgart**

Institute for Modelling Hydraulic and Environmental Systems Department of Hydromechanics and Modelling of Hydrosystems DuMu<sup>x</sup>

# RSE in DuMuX

Experiences from 15 years of development

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#### **Exemplary Applications**









Root-soil interaction



Fracture flow

Outline





Overview over the project

Development process

Quality assurance



#### DuMuX as an external Dune module



**Distributed and Unified Numerics Environment** 

#### Status quo



- Main user base at the LH2, but there are considerably many external users
- Almost all of the development is done at the LH2, occasional external contributions
- Almost all developers have an engineering background with little experience in SD
- > 70 contributors so far
- 2961 version-controlled files
- 566 tests, the majority being regression tests by means of small simulations
- Documentation:
  - Website
  - Doxygen
  - Handbook
  - Course material





Overview over the project

Development process



Quality assurance



Development process Git workflow



Rebase required before merging is possible (not depicted in the image above)



# Development process Dumux days



### Development process Releases









Overview over the project

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#### Quality assurance



## Merge requests: guidelines shown in default template

<u>~</u>	Choose a template	
0	Write <b>Preview</b>	
F		
D	What this MR does / why does DuMux need it:	
រេ	TODO: insert text here	
B	Notes for the reviewer	
Φ	TODO: insert text here	
0	Before you request a review from someone, make sure to revise the following points:	
≙	does the new code follow the style guide?	
ଚ	do the test pipelines pass? (see guide on how to run pipelines for a merge request)	
<u></u>	is the code you changed and/or the new code you wrote covered in the test suite? (if not, extend the existing tests or write new ones)	
htt	does your change affect public interfaces or behavior, or, does it introduce a new feature? If so, document the change in CHANGELOG.md.	
+	is the list of the header includes complete? ("include what you use")	
Ę	all files have to end with a \n character. Make sure there is no \ No newline at end of file comment in "Changes" of this MR.	
Ø	(if not applicable remove) are newly introduced or modified physical values/functions backed up with a scientific reference (including doi) in the docs? (if not applicable remove) if the examples are modified, is the documentation regenerated (using generate_example_docs.py)	
»	Closes #1054 (closed)	























git.iws.uni-stuttgart.de/dumux-repositories/dumux/-/pipelines/21181





Quality assurance Test pipelines: saving CPU time

- "Problem": very many tests that take several hours to compile (on a single core)
- Solution strategy:
  - Run only the tests that are affected by changes since the last successful run
  - Only schedules run the entire test suite
  - An example: <u>git.iws.uni-stuttgart.de/dumux-repositories/dumux/-/pipelines/20820</u>



#### Summary

- Development
  - Mainly at our group
  - Standardized Git workflow enforced by GitLab policies where possible and otherwise instructed via merge request template
  - DuMuX days in order to continuously close issues
- Release process is "standardized" via issue template
- Automated test pipelines ensure
  - Support of (at least) current and previous releases of dune dependencies
  - Different compilers and/or versions
  - Different C++ language standard (currently C++17 and C++20)
  - Images used in test pipelines are rebuilt every night





- Large code base, few developers are familiar with all aspects of it
- Currently, only very few developers are familiar with the inner workings of the CI
- Difficult to integrate/motivate new developers, possibly due to
  - the large project size
  - complexity of the code
  - "professional appearance":
    - many things to consider in each merge request
    - merge request "police" commenting on many (sometimes small) things



#### **Thank you!**

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• Let's revisit the dependency structure

