Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement des Innern EDI
Bundesamt für Meteorologie und Klimatologie MeteoSchweiz

ICON-C , Status

X. Lapillonne

COSMO-GM 2024

ICON-C, Consolidation Project, Status

- Infrastructure project to make the ICON code more modular, i.e. encapsulate the different components with clear/defined interfaces
- Allow for more scalable development workflow, in particular through an improved testing of individual components
- Step-wise modernization
- The final ICON-C code base should allow for all needed climate and nwp operational applications
- Related project: WarmWorld, EXCLAIM

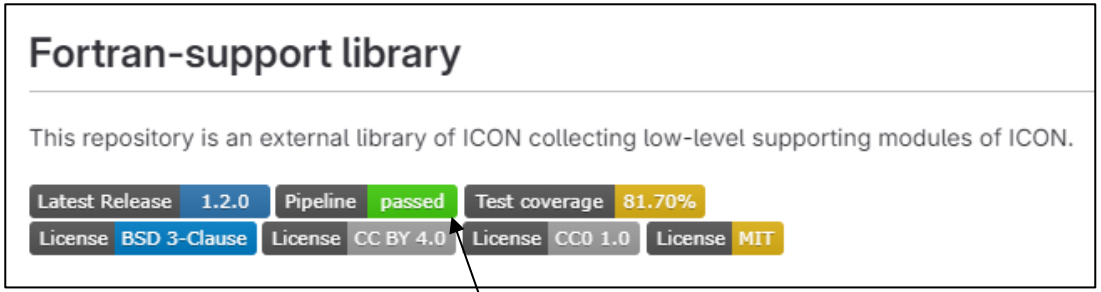
ICON-C Developers: Claudia Frauen; Joerg behrens; Ralf Mueller; P. Samanta; Daniel Reinert; Florian Prill; Roland Wirth; Sergey Kosukhin; Luis Kornblueh; Reiner Schnur; Claudius Holeksa; Yen-Chen Chen ; Terry Cojean; William Sawyer ; Andreas Jocksch; Jonas Jucker

ICON-C development

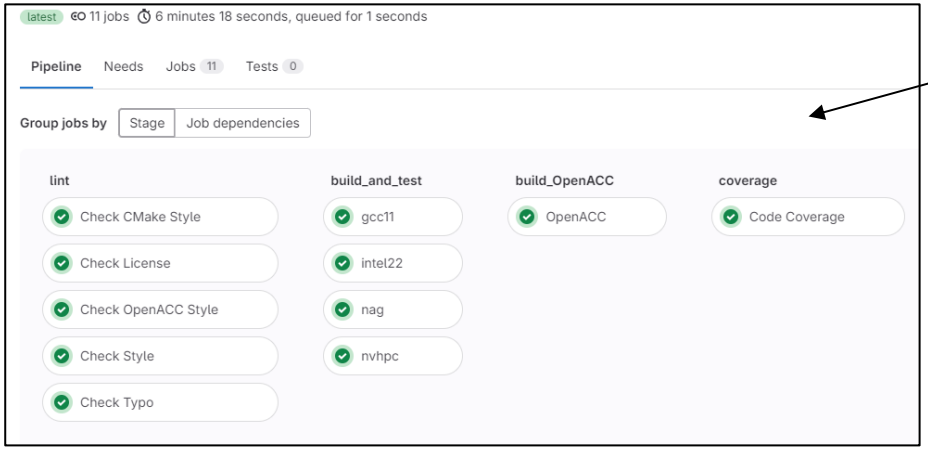
- ICON-C development are being merge one by one to the main repo via the institutional repo, mostly icon-nwp.git and icon-mpi.git
- First features integrated with Open Source Release : code reduction, liberalization of utilities, comin, …
- Planning and coordination every 6 weeks with work package coordinator
- Larger meeting with all developer ca every 6 months.

Fortran support library

Extracted functionalities used in several parts of ICON into an external library



Modern pipeline/CI using gitlab runners, unittesting



Libraries Summary

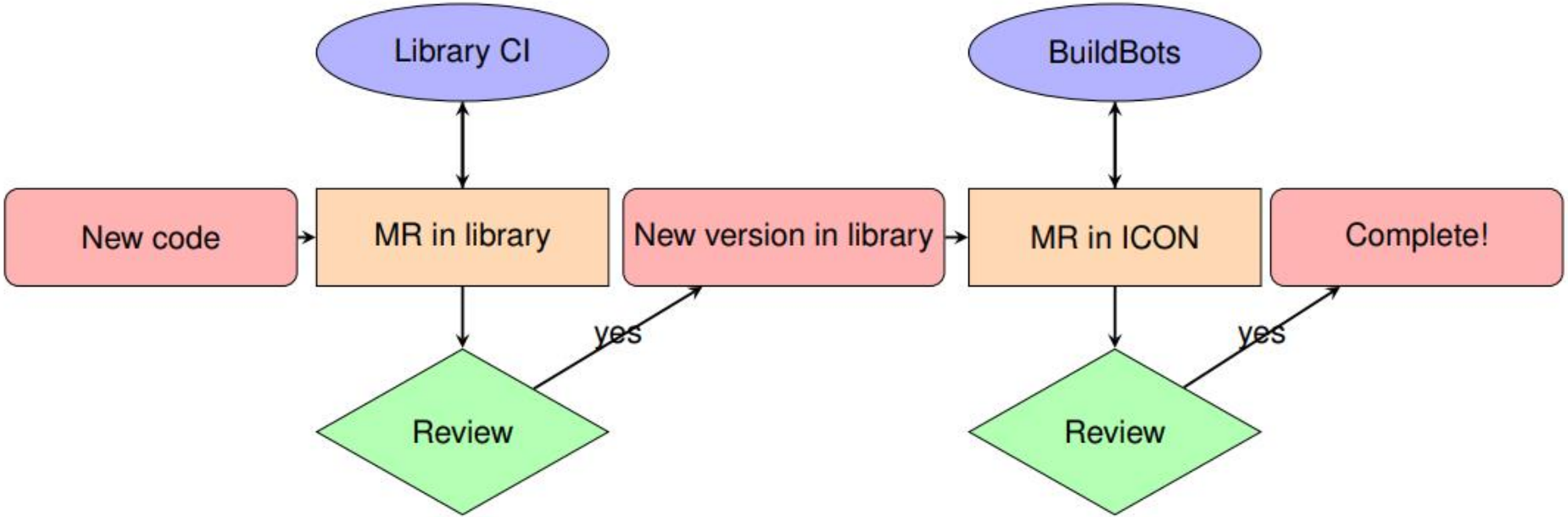
early design | Ongoing | under review | merged / finished

- Basic support, ICON-agnostic (level 1)
  - memory manager — GPU supported
  - libfortran-support — 1.2.0 (2.0.0)
  - libmath-support — 1.0.0 (1.1.0)
  - granule-support
  - mtime — 1.2.0
  - physics
- ICON-aware support, ICON-specific (level 2)
  - libmath-interpolation (libmathintp) — 1.0.0
  - libmath-horizontal (libmathop)
  - grid manager
  - output organization driver layer

level 1
ICON-agnostic
independent libraries

level 2
ICON-specific
depends on level 1

Library Workflow

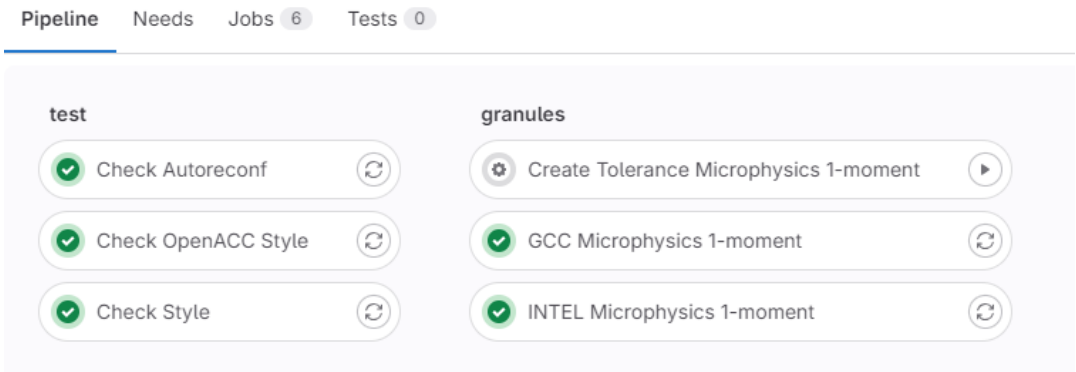


Change in libraries should be done at the icon.git/main level

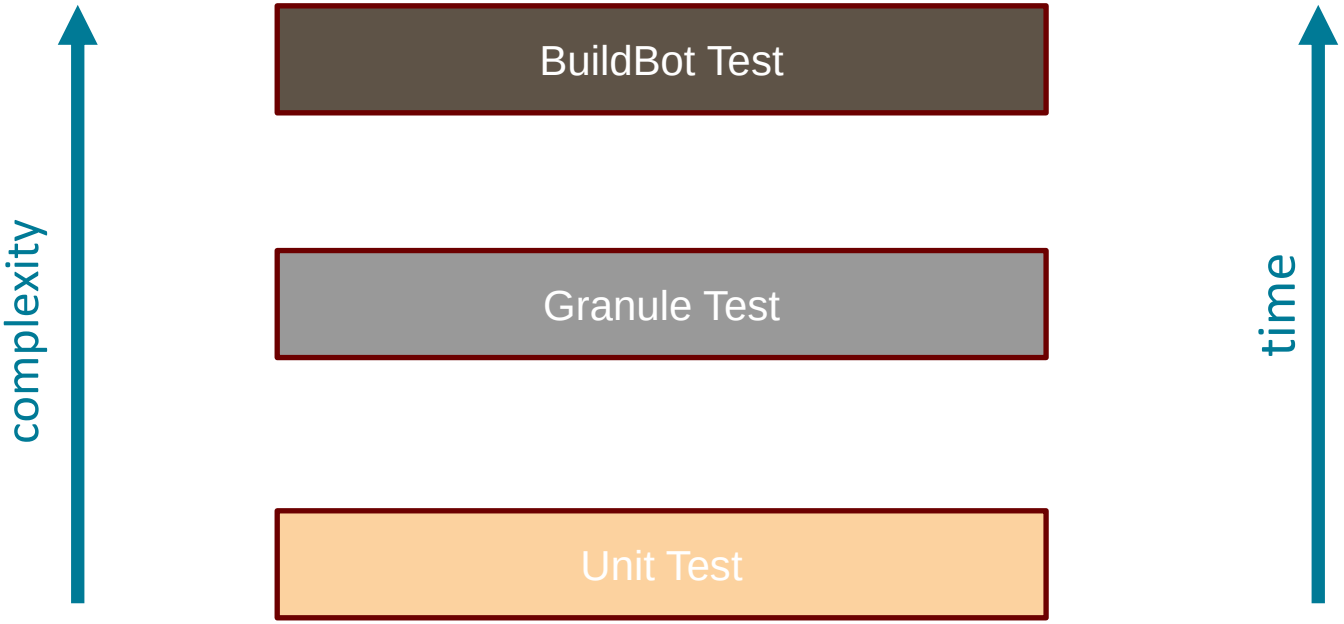
Modularized graupel microphysics

```
SUBROUTINE graupel_init(alv, als , rv, rd, cpv, cvd, cvv, clw, alv, als, tmelt)

SUBROUTINE graupel_run(nvec, ke, ivstart, ivend, kstart,& !! start/end indices
          dt, dz, t, p, rho, qv, qc, qi, qr, qs, qg, qnc,& !! prognostic vars
          prr_gsp, pri_gsp, prs_gsp, prg_gsp, pflx)  !  total precipitation flux

   :
REAL(KIND=wp), DIMENSION(:,:), INTENT(INOUT)    :: & ! dim (ie,ke)
   t             ,& !> temperature (  K  )
   qv            ,& !! specific water vapor content (kg/kg)
   :


SUBROUTINE graupel_finalize()
```

Independent component test / CI



Granule Test



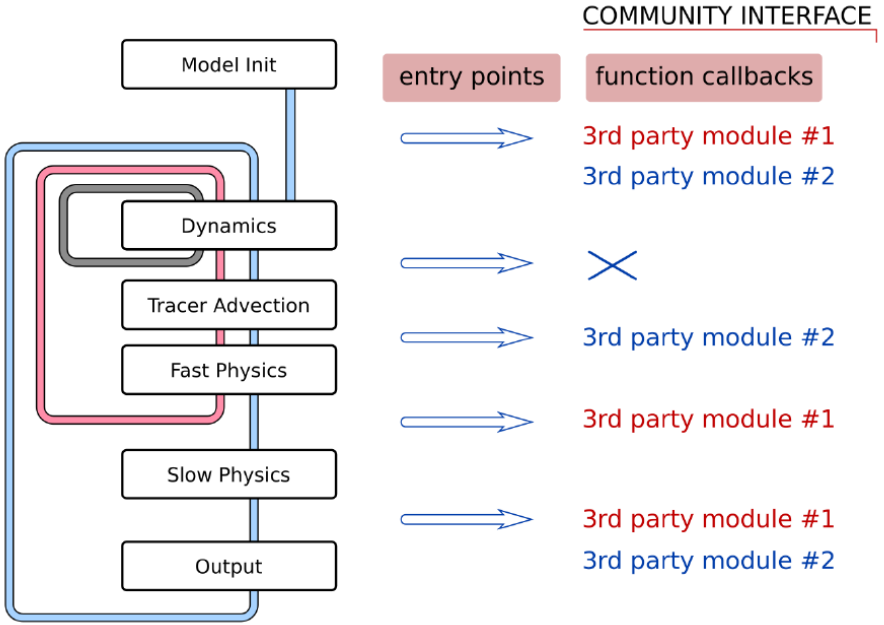
Granule Tests are smart

```
rules:
  - if: $CI_PIPELINE_SOURCE == "merge_request_event"
    changes:
      - .gitlab-ci.yml
      - .gitlab/ci/granules.yml
      - externals/fortran-support
      - externals/probtest
      - src/atm_phy_schemes/mo_lookup_tables_constants.f90
      - src/atm_phy_schemes/mo_satad.f90
      - src/granules/microphysics_1mom_schemes/**/*
      - test/microphysics_1mom_schemes/**/*
```

Run in ca 5 min

Comin: Community interface

- Lead: F. Prill, DWD
- Interface for loosly coupled external/3rd party components , e.g. Messy



Provide access to model state to 3rd party module at selected point in the code

see poster P44 K. Hartung et al.

Source: F. Prill DWD

Release updates

Published release ComIn v0.1.1 ~ June 2024

- small update, mainly bug-fixes for the ICON open source release 2024.07

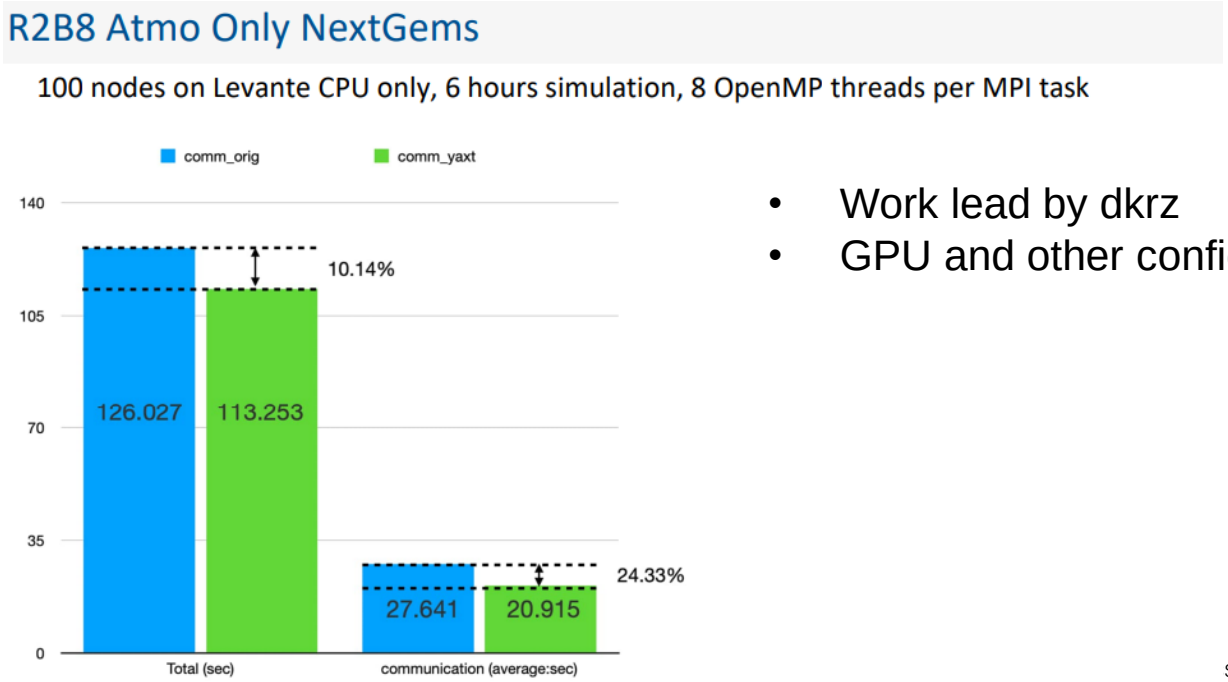
Preparations for ComIn 0.2.0 ~ August 2024

- GPU capability
- consolidation: mainly host model code and Python API
- support for edge-based and vertex based variables
- additional descriptive data
- record and replay functionality
- harmonization with YAC coupler

Should be used by the community !

New communication libryry

- Plan is to replace original com. With Yaxt



- Work lead by dkrz
- GPU and other config will be tested

Conclusions/Next steps

- Several features from ICON-C have been already merged in the main or will be soon
- We need revise soon the road map and decide what is achievable within the project

Next steps

- 28-30.10.2024 ICON all hands meeting – several ICON-C sessions
- Decide which physical parameterization will be modularized next
- Decide which part of the code will go into libraries, besides what is already done
- Decide next step for communication, memory manager and grid manager