



Sprint 1

Challenges and results experienced during the ICON-ART sprint

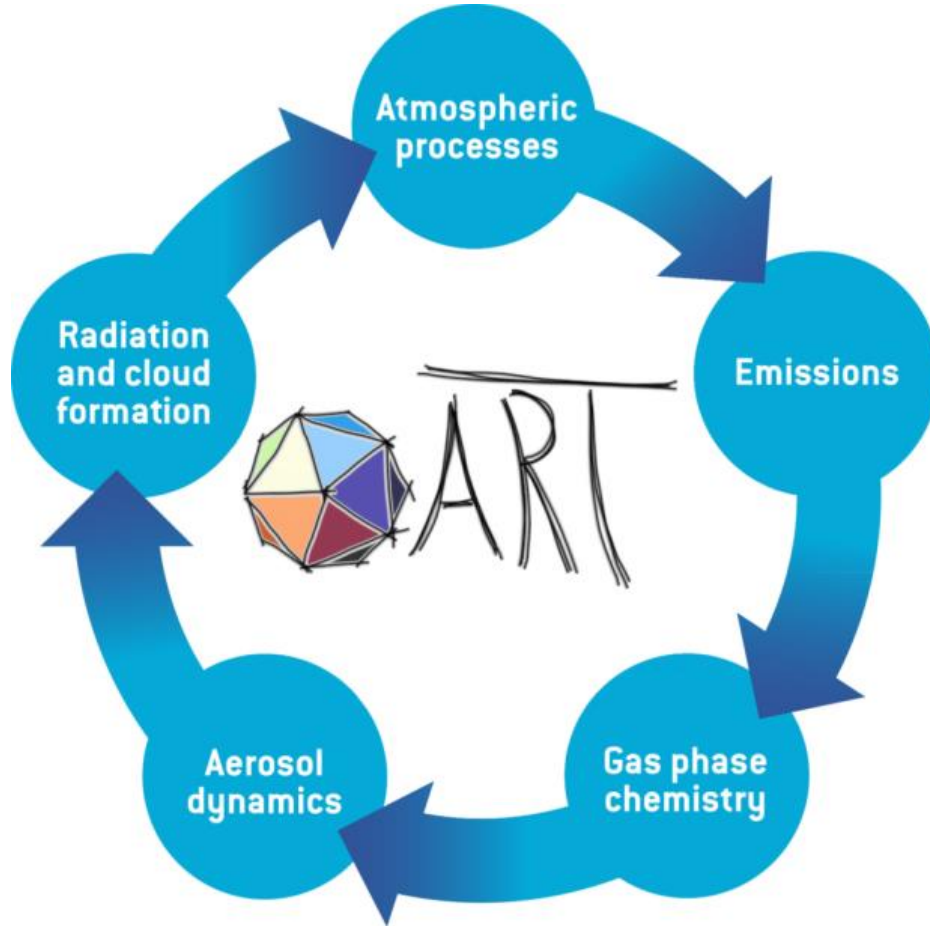
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General information

Objective of Pre-ARTEX sprint

Developing a GPU porting strategy for ICON-ART

- Analysis of ART interfaces and their modularity
- Definition of data to be moved on GPU for each interface (based on a specific experiment)
- Algorithm analysis for GPU porting
- Definition of a roadmap for each experiment



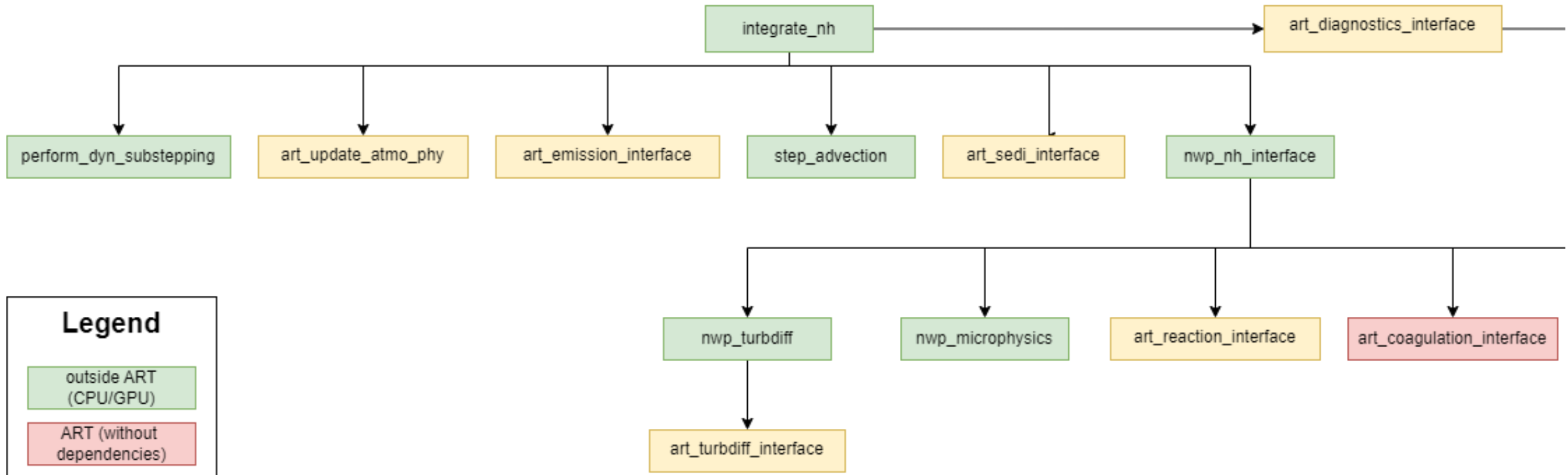
Challenges

Designing appropriate tests that cover

- Operational applications
- Various complexities
- Maximum parts of the code

	Pollen	Dust	Chemistry	Volcano
Tracer #	4	4	50	52
Operational	+	+		
Gas chemistry			+	+
Aerosol microphysics				+
Aerosol-radiation interaction		+		+

Results: Analysis – function call stack



Legend

- outside ART (CPU/GPU)
- ART (without dependencies)
- outside ART (CPU)
- ART (with dependencies)

Potential to:

- simplify the porting of each interface
- allow selective deep copies, thus avoiding full deep copies

Results: Roadmap for GPU porting

Port ART interfaces step-by-step starting from the most expensive interface

Implementing the
(selective) deep copies
necessary to port ART

Using PGI compiler
function inlining where
beneficial.

Further optimization
with respect to
algorithms and data

Results: A problem called ISORROPIA

- External component calculating gas-aerosol partitioning
- One of the most used/verified modules for gas-aerosol partitioning.

- Function inlining not useful
 - Code design
 - Reliance several **FORTRAN77** statements
- Limited vector length beneficial
 - High number of IF statements

- Standalone GPU-version of ISORROPIA provided
 - Adapt the driver to mirror code behavior in ICON-ART.

Outlook & open questions

- Pre-ARTEX serves as the basis for
 - HAMAM (led by EMPA/KIT) with focus on porting chemistry
 - GLORI DT (led by DWD/KIT) with focus on porting aerosol processes
 - Pollen porting (led by MeteoSwiss)
 - Encapsulation and modularization of ART code (ongoing at CSCS)
- Ongoing discussions with the developers of ISORROPIA
 - possible follow-up sprint