

The Agile Advantage for the SPUMA code

Reshaping Human Interaction Workflows for Faster and High-Quality CFD Software Development

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INTRO

CINECA’s CFD team developed **SPUMA**, an advanced GPU-enabled computational fluid dynamics (CFD) software based on **OpenFOAM®** [1], to accelerate large-scale simulations for both research and industrial applications [2, 3]. During its development, the organizational framework was changed to adhere to **Agile principles** [4], providing the team with a more structured approach to managing their activities. In Agile **SCRUM**, an iterative workflow designed to deliver incremental improvements while maintaining high adaptability, work is organized into short, time-boxed **sprints** that enable teams to continuously refine **priorities** in line with evolving technological and stakeholder needs, integrate **feedback**, and reassess objectives as the project evolves. This framework enhances transparency, supports **informed decision-making**, and cultivates **regular communication**. After 14 sprints, this approach has clearly proven that redefining human interaction workflows is a key driver in enhancing development processes, ultimately making them faster and more efficient.

METHODOLOGY

The sprint starts with a **sprint meeting** in which the team defines the sprint goals and organizes tasks, while also updating the **product backlog**, a prioritized list of all work items and features planned for the project. To sustain alignment and knowledge sharing, a **30-minute daily meeting** is attended by the **Scrum Master (SM)** and the CFD developers. The SM, a non-technical figure, ensures that discussions remain concise, goal-oriented, and within the allotted time.

Each sprint typically lasts one week and concludes with a **1-hour meeting** during which the team presents completed tasks, discusses encountered issues, and shares the solutions adopted. This meeting serves both as a **sprint review** and as a **retrospective**, providing a clear overview of progress while helping identify improvements for the next development cycle. The process ends with a return to the backlog, where new tasks are selected and ranked, ensuring a continuous and structured advancement of the software.

In our case, given the internal nature of the project, the responsibilities of the **Product Owner (PO)** are held by the Development Team Coordinator, the one who had the intuition of porting OpenFOAM® to GPUs. The PO oversees priorities and ensures coherence between development progress and the broader project objectives. A senior Project Manager, backed by a robust prior expertise in HPC, acts as **Reviewer**, integrating insights from the **European projects** where SPUMA is used and aligning them with stakeholder needs.

A NON-CONVENTIONAL, INNOVATIVE APPROACH

The adoption of Agile was motivated by the need to **enhance efficiency** and support a **more structured and transparent development process**. Beyond its iterative nature, Agile was introduced to provide clearer organizational structure, increase **individual accountability**, and encourage a participatory attitude while preserving strong teamwork dynamics. These practices also supports **conflict management** by fostering **open communication** and offering regular opportunities for external, non-exclusively-technical, **review**.

In our context, adopting an Agile approach represents a **non-conventional** choice. The SPUMA team is primarily composed of scientific professionals rather than full-time software developers: besides contributing to the development of the code, team members support several European research projects, deliver training courses, and apply SPUMA to scientific and innovation-driven activities. Introducing Agile into such an environment marks a significant shift toward a **more adaptive, collaborative**, and **iterative** way of working, enabling the team to balance software development with scientific duties while maintaining **alignment** across diverse activities.

An important element of **innovation** in this workflow is the extension of the Agile approach beyond the internal development of SPUMA to the **European research projects** in which the software is employed. These projects have traditionally relied on a waterfall-based structure, characterized by linear phases and limited flexibility. Introducing Agile in this context represents a **significant shift** toward a more adaptive and collaborative model. In particular, adopting the SCRUM framework allows to:

- 1

minimize risks associated with late discovery of issues and misalignment with objectives.
- 2

remain flexible in a rapidly changing tech market
- 3

adjust to evolving industrial and research priorities
- 4

deliver solutions that meet project goals and stakeholder needs

Before AGILE

- TEAM ORGANIZATION

- **Quasi-pyramidal** structure.
 - Mainly **seniority-based**, with tasks driven by one key person rather than through a structure that clearly prioritised stakeholder needs.
- TEAM INTERACTION

- Monthly “all-hands” meetings.
 - Predominantly **research-driven**, individual work, largely performed by senior team members with relatively little joint development.
- TOOLS

GitLab’s “issue” tracker: tool intended for reporting and resolving bugs in a code.

 - Inappropriately used to keep track of development tasks, assign them to team members, evaluate priority.

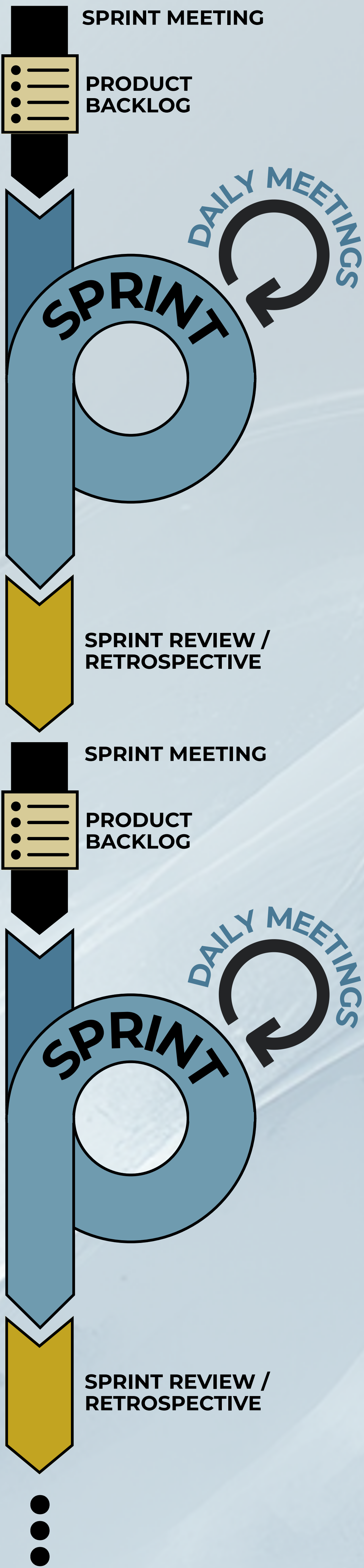
With AGILE

- TEAM ORGANIZATION

- **Fully horizontal**, all members of the development team participate in the process of proposing items.
 - More **shared responsibility** for contacts with stakeholders: team members working on collaborative external projects communicate directly with project partners.
 - New external figures: **Scrum Master** and **Reviewer**, providing oversight and grounding.
- TEAM INTERACTION

- Sprint meetings, daily meetings and sprint reviews provide an avenue for continuous, structured communication within the team, giving **rhythm** and **organisational structure** to the workflow and creating regular opportunities for **feedback** and **mutual aid** and faster convergence on solutions.
 - All team members are aware of each other’s activities and have a better understanding of the **team’s aims**.
- TOOLS

Planner: non-strictly-technical tool that monitors team interactions. It enables precise planning of all activities: defining individual tasks, moving them between backlog and current sprint, assigning them to team members, applying tags to track their relevance.



[1] OPENFOAM® is a registered trade mark of OpenCFD Limited, producer and distributor of the OpenFOAM software via <https://www.openfoam.com/>
[2] S. Bnà, G. Giaquinto, E. Fadiga, T. Zanelli, F. Bottau (2026), “SPUMA: A minimally invasive approach to the GPU porting of OPENFOAM™”, *Computer Physics Communications*, Vol. 321
[3] S. Bnà, et al. (2026), *SPUMA: the power of open-source CFD running on GPUs* [EuroCC Italy White Paper], HPC in Europe Portal
[4] *The Agile Manifesto*, <https://agilemanifesto.org/>