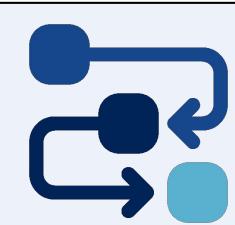


## ACH@BSC-CIEMAT: High-Performance Computing

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### EUROfusion Advanced Computing Hubs

EUROfusion coordinates theory and advanced simulation through two complementary elements:

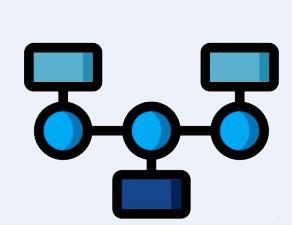
- **Theory, Simulation, Validation and Verification tasks (TSVV)**, which perform fundamental research and channel scientific insight
- **Advanced Computing Hubs (ACHs)** which provide advanced simulation expertise to TSVVs

#### ACH Main Activities

- Performance analysis & optimization of fusion modelling codes
- Refactoring, parallelization & GPU porting for heterogeneous systems
- Software engineering support (Git/GitLab, CI/CD, testing, verification)
- Continuous performance monitoring on reference HPC systems
- User support & technical coordination

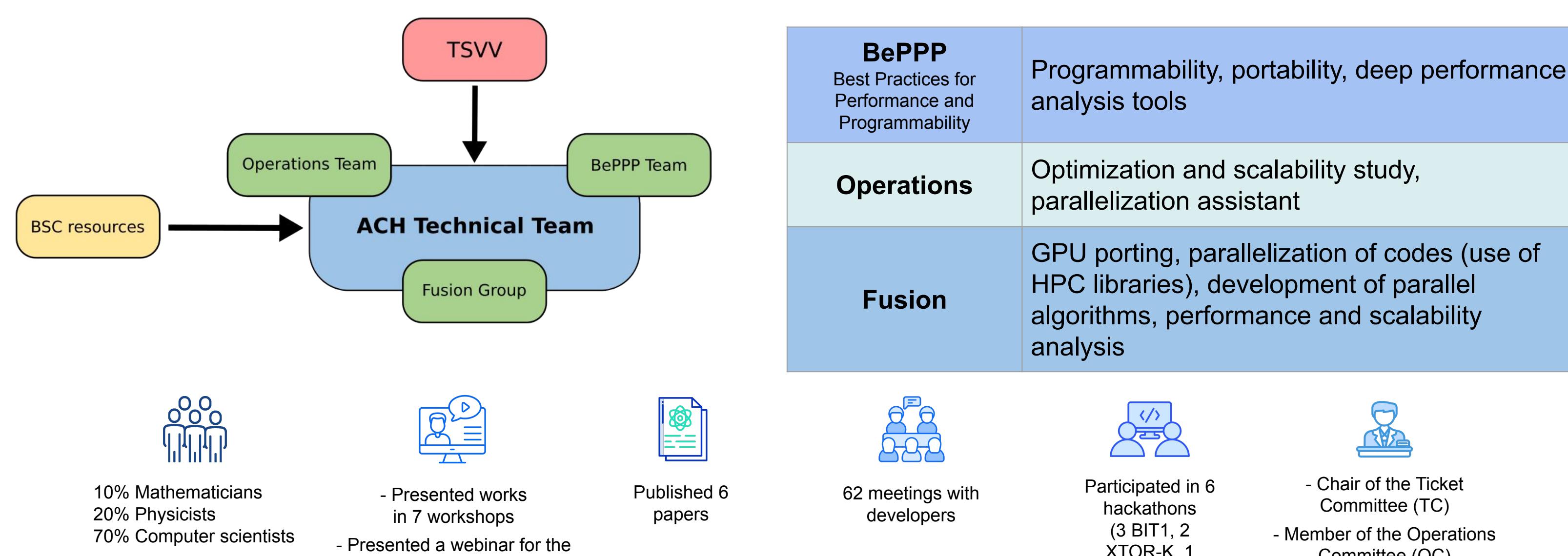


### ACH Network Map

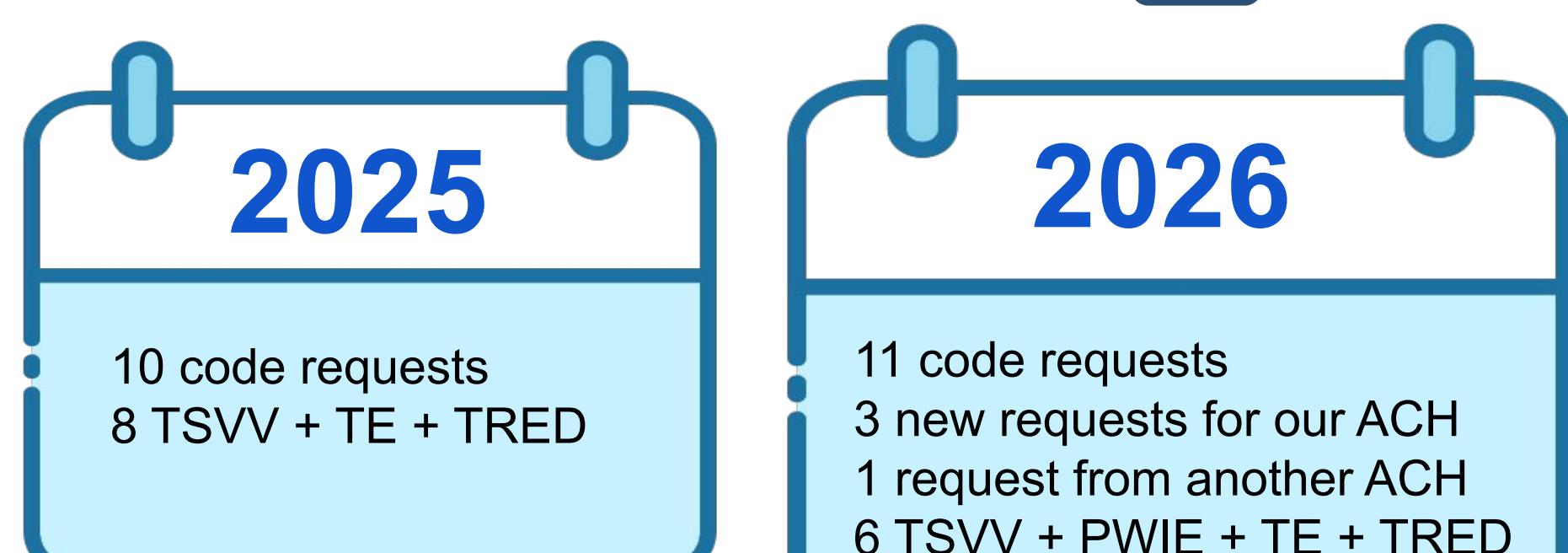


### ACH@BSC-CIEMAT

Provides expert support to users regarding HPC: *scalable algorithms, code parallelization, performance optimization, code refactoring, GPU-enabling, ...*



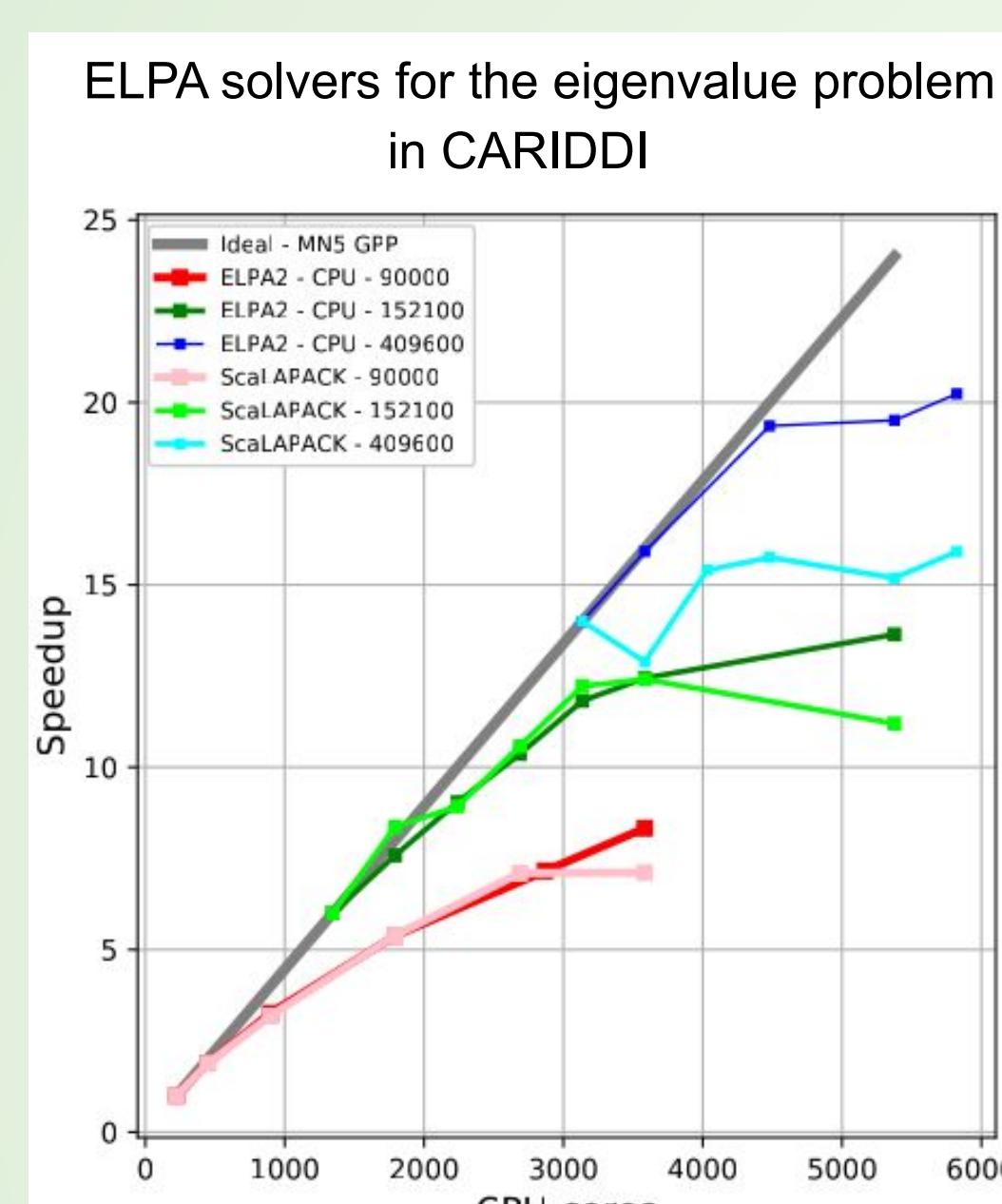
#### Tasks done and on going



| 2025          | TSSV                             | 2026                         | TSSV                     |
|---------------|----------------------------------|------------------------------|--------------------------|
| ERO2.0        | TSVV-2                           | XTAPAS (JOREK)-DREAM CARIDDI | TSVV-F                   |
| BIT1          | TSVV-4                           | TSVV-3                       | TSVV-C                   |
| XTOR-K        | TSVV-7                           | ERO2.0                       | TSVV-B                   |
| JOREK         | TSVV-8                           | BIT1                         | TSVV-D                   |
| SPICE2        | TSVV-10                          | XTOR-K                       | TSVV-G                   |
| SOLPS         | TSVV-12                          | SPICE2                       | TSVV-J                   |
| Stella        | TSVV-13                          | SOLPS                        | WP-PWIE                  |
| Alya          | TE                               | Stella                       | WP TRED                  |
| GENE-x        | WP TRED (Training and Education) | Alya                         | (Training and Education) |
| CINCOMP(2025) | AC-HPC                           | CINCOMP(2025)                | AC-HPC                   |
| TC (2023)     |                                  | TC (2023)                    |                          |

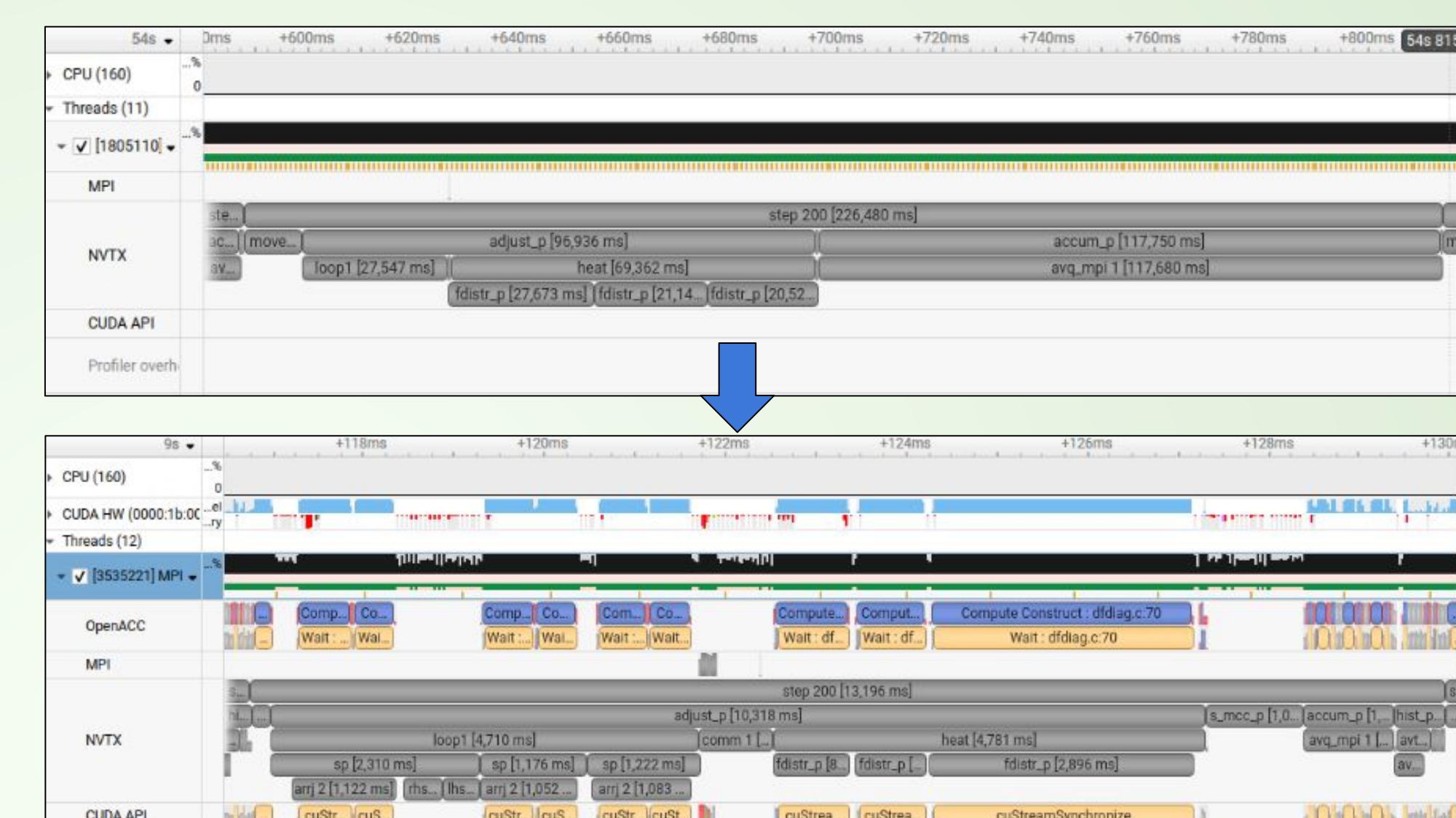
#### JOREK

- Matrix compression in the JOREK-CARIDDI coupling



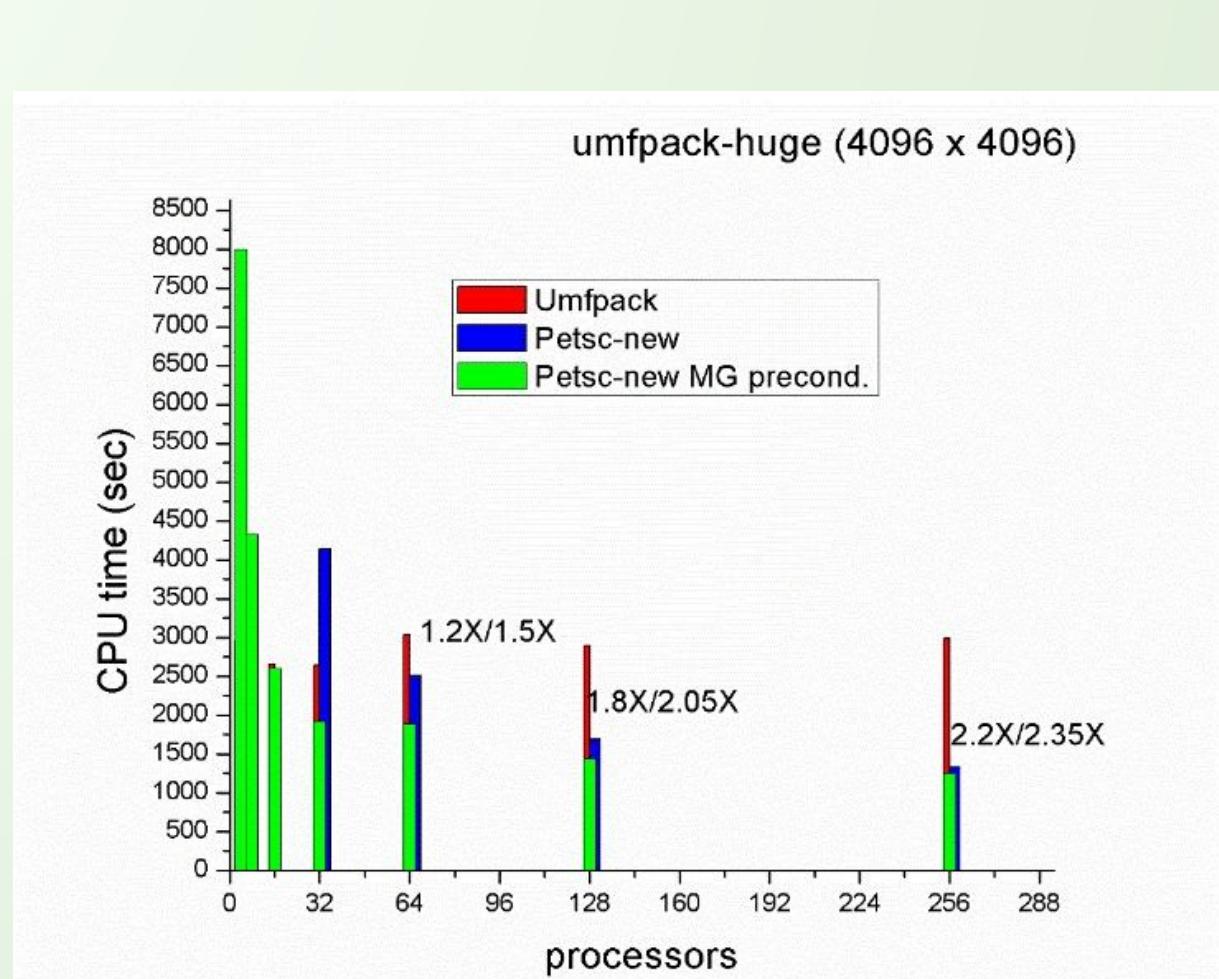
#### BIT1

- Porting to GPU (~7x faster)



#### SPICE2

- Parallel solver based on PETSc to simulate larger domains



#### ACH@BSC - Key Outcomes and Impact

- Key HPC enabler for EUROfusion, providing essential HPC expertise
- Ensures scalable, exascale-ready fusion codes, improving code performance
- Drives innovation through GPUs and AI
- Maximizes performance and efficient use of HPC resources
- Strengthens the EUROfusion ecosystem, through coordinated support, training, and collaboration across European HPC centers