E-TASC General Meeting: Welcome and Introduction

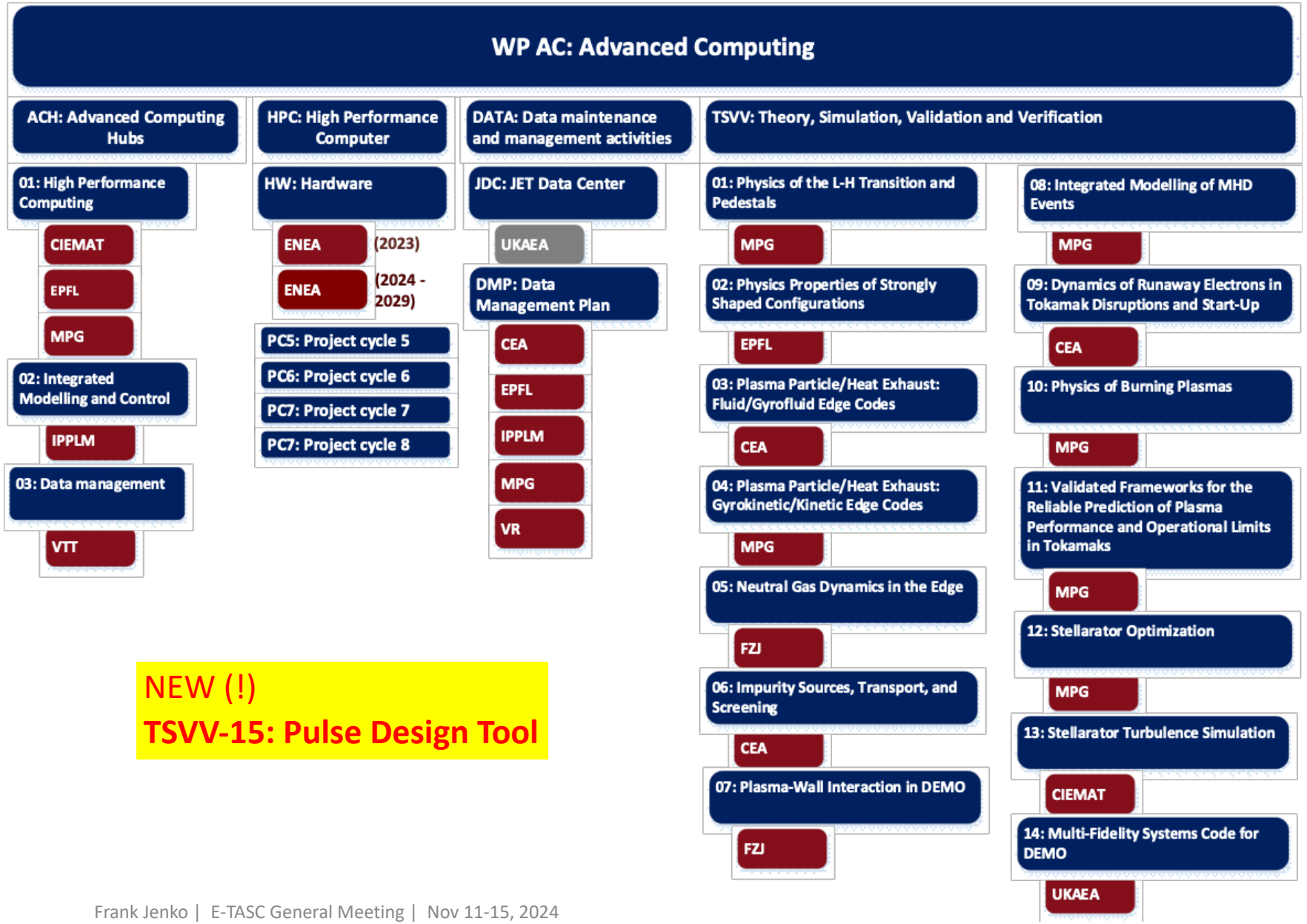
Garching| Nov 11-15, 2024

Frank Jenko

On behalf of the E-TASC SB

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

E-TASC within the WP Advanced Computing



NEW (!)
TSVV-15: Pulse Design Tool

WP AC objectives are to run a coherent program of TSVV projects and to develop a suite of "EUROfusion Standard" software

Scientific objectives TSVVs were pre-defined by the E-TASC SB, prior to the TSVV CfP (2021-2025)

Scientific objectives ACHs are defined following requests by code developers with approval by the E-TASC SB (annually)

Monitoring of activities is by the E-TASC SB and the PMU

TSVV selection & monitoring (by E-TASC SB)

EUROfusion

Call: Spring 2020

TSVV Task 1: Physics of the L-H Transition and Pedestals

Expected resources: Up to about 10 ppy per year (incl. about 30% for ACH personnel)

Background

Regarding the plasma core, present-day gyrokinetic (GK) simulations of turbulent transport may be characterized as relatively mature, allowing for quantitative comparisons with measurements on a regular basis. Meanwhile, an important new frontier of GK is to advance towards a comprehensive, self-consistent description of the pedestal/edge region, including the physics of the L-H transition. The time is ripe to address these outstanding challenges, building on years of preliminary work and exploiting the capabilities of emerging exascale supercomputers.

Initial applications of GK codes to the near-edge region of tokamak plasmas over the last decade or so have highlighted the importance of a range of physical effects, calling for global simulations in realistic magnetic geometries – involving electromagnetic effects, high-quality collision operators, and the ability to retain both sub-ion-scale fluctuations and relevant macroscopic (MHD-like) instabilities. Moreover, GK codes have demonstrated the capability to reproduce experimentally measured fluxes in near-edge L-mode plasmas and have been used to explore to some degree the residual turbulent transport in H-, QH-, and I-mode pedestals. In addition, full-f GK codes applicable to the edge and SOL are being developed (see TSVV Task 4), providing new ways to attack the L-H transition problem. Another key aspect of the present TSVV task is the development of validated and fast reduced transport models – on the basis of the GK simulations – to be used in integrated modelling codes.

Aims of the project

- Capability to carry out self-consistent, robust, and validated GK simulations of L-H transitions and to accurately predict the pedestal profiles; extension to QH-/I-mode discharges.
- Validated and fast reduced transport models which can be used for multi-channel core-edge predictive modelling.
- Applications of GK simulations and reduced models to (natural or controlled) small/no ELM regimes, studying their transferability to ITER and DEMO.

Key deliverables

1. Validated local and global (electromagnetic, collisional) GK simulations of ion-scale, electron-scale, and multi-scale turbulent transport in the H-, QH-, I-, and L-mode edge.
2. Extension of these simulations to self-consistently include relevant macroscopic (MHD-like) instabilities and the development of a radial electric field.
3. Consistent application of at least one edge GK code (developed in TSVV Task 4) – which is able to bridge the core, pedestal, and SOL regions and includes neutral physics – to the L-H transition problem.
4. An interpretative and predictive capability of L-H transitions (based on a sound validation strategy and ideally also including extensions to QH-/I-mode discharges) accurately capturing the observed edge plasma dynamics in various machines.
5. Reduced transport models for the pedestal on the basis of GK simulations, involving electron-scale, ion-scale, and macroscopic (MHD-like) instabilities; these can then be included in MHD and transport studies, exploiting synergies with TSVV Tasks 8 and 11.

Detailed workplan with timeline, milestones, SMART deliverables, and risk assessment (2021-25)

Mid-term review of Theory Simulation Verification & Validation (TSVV) projects 2021-2025 by the E-TASC Scientific Board

Mid-term review: Fall 2023

Purpose of the review

The goal of this review is to assess the TSVV projects' performance, the achievements in computational science and plasma physics, the efficiency of the project management, and the project's broader impacts on the EUROfusion programme and the wider scientific community.

The project achievements are considered, along with possible deviations from the original proposal. Specific challenges and opportunities are identified, and changes to project priorities, activities and objectives are proposed.

Furthermore, on a higher level, additional synergetic interactions between projects in EUROfusion and adjustments to the overall project portfolio are proposed.

Methodology

The review was carried out as a three-step process:

- Presentation of each TSVV project's achievements to date to a broad audience of EUROfusion scientists, focusing on the main scientific and technical highlights, briefly mentioning specific impacts (achieved or anticipated) on the WPs, and plans. All materials are available at https://indico.euro-fusion.org/event/2429/

ACH selection & monitoring (by E-TASC SB)

Call: Spring 2020

EUROfusion

EUROfusion · Boltzmannstr. 2 · 85748 Garching · Germany

PROGRAMME MANAGEMENT UNIT
Tony Donné
Programme Manager

Phone: +49 89 3299-4201
Fax: +49 89 3299-4299
tony.donne@euro-fusion.org

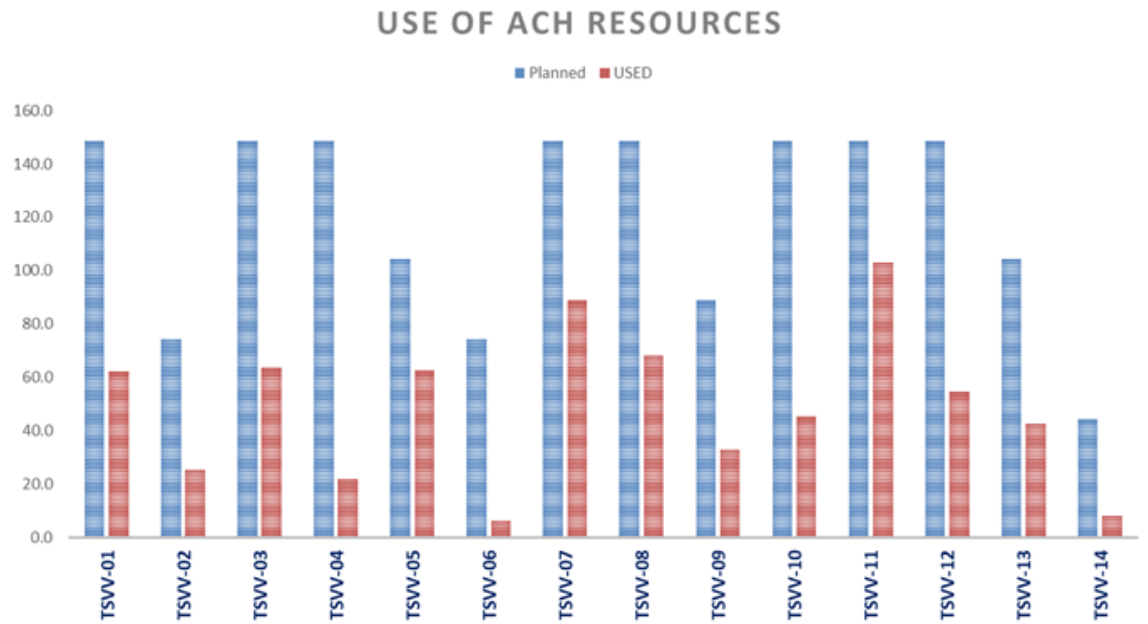
Our ref: PMU/1740

Date: 12th May 2020

To the Members of the General Assembly

Subject: Work Plan for the Implementation of the Fusion Roadmap in 2021 – 2025: Call for proposals for hosting *Advanced Computing Hubs* within the *EUROfusion – Theory and Advanced Simulation Coordination (E-TASC)*

Mid-term review: Spring 2024



	Year	ACH	Customer Project/WP	Code	Project Coordinator	PM's requested	PM's assigned	ACH team members	Tasks description	Comments
11	2021	EPFL	TSVV-10	EUTERPE		2,0	0,5	Lanti	Further development of GPU functionality (OpenACC) for large-scale EM turbulence simulations;	
12	2021	EPFL	TSVV-13	EUTERPE		2,0	0,0	To be hired in eM+	Development and application of tools for advanced visualization of 3D data resulting from global	
13	2021	EPFL	TSVV-03	FELTOR		1,5	0,5			task distributed per code
14	2021	EPFL	TSVV-03	GBS		1,5	0,5			task distributed per code
15	2021	EPFL	TSVV-03	GBS		1,2	1,0	Lanti	Optimization of kinetic neutrals treatment (method of characteristics and coupling to EIRENE)	
16	2021	EPFL	TSVV-03	GBS		6,0	1,0	Peybernes/Varini	Code profiling and optimization	
17	2021	EPFL	TSVV-03	GRILLIX		1,5	0,5			task distributed per code
18	2021	EPFL	TSVV-03	GRILLIX		6,0	1,0	Peybernes/Varini	Code profiling and optimization	
19	2021	EPFL	TSVV-01	GYSELA		1,5	1,0	Peybernes	Support for GPU porting and increased vectorisation for ARM-based architectures	
20	2021	EPFL	TSVV-04	GYSELA		1,5	1,0	Peybernes	Support for GPU porting and increased vectorisation for ARM-based architectures	
21	2021	EPFL	ACH	management	Paolo Ricci	1,5	1,5	Paolo Ricci	management of ACH activities	
22	2021	EPFL	TSVV-01	ORB5		4,0	1,0	Lanti	Improve multi-threading of ORB5 & particularly of its field solver. Adaptations to the M100	
23	2021	EPFL	TSVV-02	ORB5		4,0	1,0	Lanti	Improve multi-threading of ORB5 and particularly of its field solver. Adaptations to the M100	
24	2021	EPFL	TSVV-09	ORB5		4,0	1,0	Lanti	Further development of GPU functionality (OpenACC) for large-scale EM turbulence simulations;	task distributed per code
25	2021	EPFL	TSVV-10	ORB5		2,0	0,5	Lanti	Further development of GPU functionality (OpenACC) for large-scale EM turbulence simulations;	task distributed per code
26	2021	EPFL	TSVV-03	SOLEDGE3X		1,5	0,5	Varini	Poisson solver optimization, including porting to GPU	
27	2021	EPFL	TSVV-06	SOLEDGE3X		3,0	1,0	Peybernes/Varini	Profiling and optimisation of SOLEDGE3X in the case of high number of species	
28	2021	EPFL	TSVV-01	Various codes		2,0	0,0	To be hired in eM+	Development of community visualisation tools that will enable us to easily navigate the huge	
29	2021	IPPLM	ALL	AAI	Liviu Joita	5,0	5,0	Pawel Spychala	AAI Infrastructure Rollout and support	
30	2021	IPPLM	TSVV-12	ASCOT5	Per	0,5	0,2	Michal Poradzinski	ASCOT5. Implementation in IMAS framework	
31	2021	IPPLM	TSVV-12	BEAMS3D	Per	0,5	0,2	Michal Poradzinski	BEAMS3D. Implementation in IMAS framework	
32	2021	IPPLM	TSVV-07	BIT1	Dmitry	2,5	0,2	Dimitriy Yadykin	code adaptation to IMAS, focusing firstly on IMAS compatible outputs.BIT-1D, BIT-3D	
33	2021	IPPLM	TSVV-03	DATABASES	Patrick	6,0	2,5	Daniel Figat	This task is led by VTT ACH. We can help with the Repository and Continuous Integration	
34	2021	IPPLM	TSVV-11	DATABASES	Clarisse	3,0	1,0	Dimitriy Yadykin	Initial implementation of multimachine remote data gathering and (for 1D profiles) fitting using	
35	2021	IPPLM	ALL	DEVOPS	Clarisse	2,4	3,0	Daniel Figat	Aid with setup and maintenance of potential new DevOps platform and documentation. To be	
36	2021	IPPLM	TSVV-09	DREAM	Eric Nardon	6,0	0,5	Dimitriy Yadykin	DREAM.Integration into IMAS	
37	2021	IPPLM	TSVV-11	DYON	Clarisse	1,2	0,0	Michal Owsiak	Adapt DYON to IMAS and containerise (and adapt from matlab to octave or python)	
38	2021	IPPLM	TSVV-05	EIRENE	Dmitriy	0,5	0,2	Dimitriy Yadykin	Integration of code I/O in the IMAS:	
39	2021	IPPLM	TSVV-07	ERO2.0	Dmitry	2,5	0,2	Dimitriy Yadykin	code adaptation to IMAS, focusing firstly on IMAS compatible outputs.ERO2.0	
40	2021	IPPLM	ALL	ETS	Par Strand	3,9	3,9	Par Strand	ACH-workflows/ETS	
41	2021	IPPLM	TSVV-03	FELTOR		1,5	0,1			task distributed per code
42	2021	IPPLM	TSVV-03	GBS		1,5	0,1			task distributed per code
43	2021	IPPLM	TSVV-02	GENE	Justin Ball	0,0	0,2	Michal Poradzinski	Ensure IMAS compatibility of software. All codes (GENE, ORB5, GBS, HYMAGYC, XTOR)	
44	2021	IPPLM	TSVV-03	GRILLIX		1,5	0,1			task distributed per code
45	2021	IPPLM	TSVV-11	HPFS	Clarisse	3,0	3,0	Bartosz Bosak	Containerise HCD workflow (Docker)	
46	2021	IPPLM	TSVV-11	HPFS	Clarisse	1,2	2,0	Piotr Grabowski	Give input into concept design for a generic python GUI - cloud native, web based, data driven	
47	2021	IPPLM	TSVV-11	HPFS	Clarisse	1,8	1,0	Barek Palak	Adapt existing HPFS python components from FC2K to Iwrap	
48	2021	IPPLM	TSVV-11	HPFS	Clarisse	2,4	3,0	Daniel Figat	Setup common IMAS-python workflow testing framework. Add CI build and run tests for HPFS	
49	2021	IPPLM	TSVV-11	HPFS	Clarisse	3,0	2,0	Bartek Palak	Adapt existing Kepler based components to IMAS Python workflows and Iwrap	
50	2021	IPPLM	TSVV-11	HPFS	Clarisse	0,6	0,0	Dimitriy Yadykin	Provide SOL models (as in Luda NF2020 for example) parameterisation as a simple IMAS python	
51	2021	IPPLM	ALL	IMAS	Marcin	8,0	8,0	Marcin Plociennik	IMAS Ecosystem Infrastructure support+maintanance+deployments	
52	2021	IPPLM	TSVV-01	IMAS	Tobias	1,0	0,2	Michal Owsiak	IMAS code output support/training	
53	2021	IPPLM	TSVV-10	IMAS	Oleksiy	2,0	2,0	Par Strand	Up-to-date IMAS support including ITER/WPCD integrated modeling tools, experimental data	
54	2021	IPPLM	TSVV-11	IMAS	Clarisse	1,2	1,0	Tomasz Zok	Design python IMAS workflows for multiple containers, use JINTRAC-HCD as template / proof of	
55	2021	IPPLM	TSVV-11	IMAS	Clarisse	1,2	1,0	Bartosz Bosak	Containerise NICE (Docker)	

E-TASC General Meeting (Nov 11-15, 2024)

About 80 registrations

https://indico.euro-fusion.org/event/3034

Plenary 1: Research gaps and opportunities in simulation / theory
- Perspective of the Plasma Science Department (Marco Wischmeier)
- Perspective of the DEMO Central Team (Hartmut Zohm)
- Simulation and Theory in the USA (Michael Halfmoon)
- Advanced Simulation, Modelling & Digital Twins in the UK (Andy Davis)

Plenary 2: Status and plans of the TSVVs
- Overview talk (Frank Jenko)
- Poster session (TSVV coordinators)

Breakout sessions:
- PSD clarifications
- DEMO clarifications
- UK program clarifications
- DMP clarifications and demo
- Data requirements by TSVVs
- Tools for code development
- Benefits of open science and open source software
- Organization of trainings on codes/capabilities
- Examples of ACH activities
- EUROfusion strategy for integrated modelling tools
- Core transport models for burning plasmas
- Round table discussion for TSVV / ACH PIs

Plenary 3: E-TASC and DSD beyond 2025
- DSD — present and future (Volker Naulin)
- E-TASC — present and future (Frank Jenko)
- Update on the Data Management Plan (Pär Strand)
- Perspectives for utilization of AI/ML (Fredric Granberg)
- Perspectives of HPC (Paolo Ricci)
- Further development of the TSVV-ACH ecosystem (guided discussion)

Plenary 4: Towards EUROfusion Standard Software & Code dissemination
- Motivation, criteria, progress, and challenges (Frank Jenko)
- Steps forward and the role of ACHs (Mervi Mantsinen)
- Existing examples within EUROfusion (various speakers)
- Building user communities (guided discussion)

Plenary 5:
- ITER-related research gaps (Simon Pinches)
- Closing research gaps -- incl. engineering & materials (guided discussion)
- Outcome of the meeting (Frank Jenko)

Some practical aspects of this week‘s meeting

This meeting is designed to be highly interactive, with **plenty of time intentionally reserved for discussions**

Presenters: Please upload your slides before your session and stick to the allocated time 😊

Breakout sessions will also take place in **two additional rooms** (D2 Seminar Room, EUROfusion R3.054)

Some participants will need to join via **Zoom**

A **summary document** will be drafted by Friday

Joint dinner & beer tasting: Wednesday evening

Reminder: No food or drinks inside the lecture hall

Restrooms: Located just around the corner