EUROfusion
FUSION SCIENCE DEPARTMENT

Project Board Theory Meeting

Oct 21, 2021

Frank Jenko, E-TASC Co-Chair

With Volker Naulin and Denis Kalupin
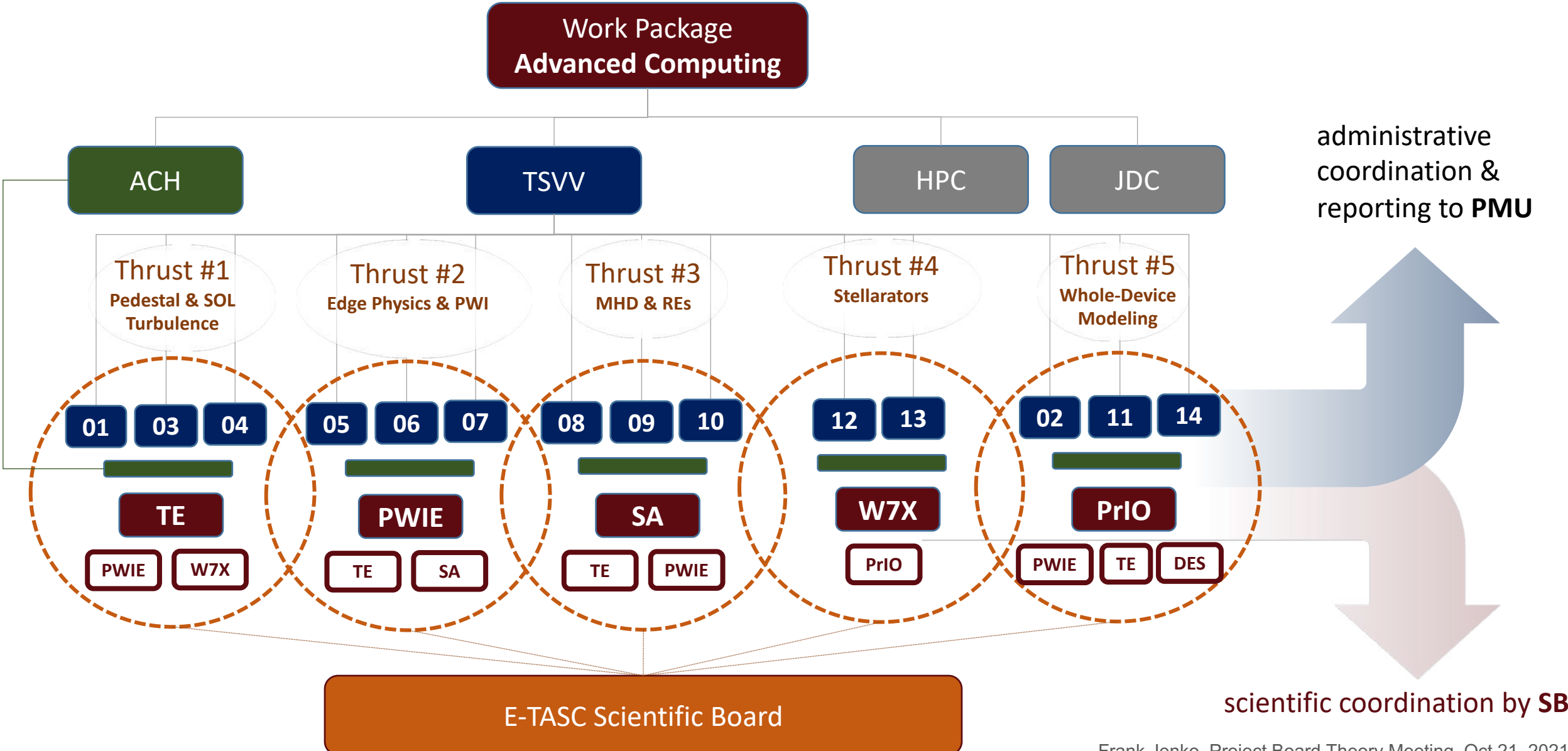
List of TSVV Tasks and ACHs

TSVV

TSVV No	Lead Beneficiary	Principal Investigator	Title
1	MPG	Tobias Görler	Physics of the L-H Transition and Pedestals
2	EPFL	Justin Ball	Physics Properties of Strongly Shaped Configurations
3	CEA	Patrick Tamain	European boundary plasma modelling towards reactor relevant simulations
4	MPG	Daniel Told	Plasma Particle/Heat Exhaust: Gyrokinetic/Kinetic Edge Codes
5	FZJ	Dmitriy Borodin	Neutral Gas Dynamics in the Edge
6	CEA	Guido Ciraolo	Impurity Sources, Transport, and Screening
7	FZJ	Dmitry Matveev	Plasma-Wall Interaction in DEMO
8	MPG	Matthias Hölzl	Integrated Modelling of Transient MHD Events
9	CEA	Eric Nardon	Dynamics of Runaway Electrons in Tokamak Disruptions
10	MPG	Oleksiy Mishchenko	Physics of Burning Plasmas
11	CEA	Clarisse Bourdelle	Validated frameworks for the Reliable Prediction of Plasma Performance and
12	MPG	Per Helander	Stellarator Optimization
13	CIEMAT	Jose Manuel Garcia Regana	Stellarator Turbulence Simulation
14	CCFE	James Morris	Multi-Fidelity Systems Code for DEMO

ACH

ACH Cat.	Lead Beneficiary	Principal Investigator	Category Title
1	MPG	Roman Hatzky	**High Performance Computing** (scalable algorithms, code parallelization & performance optimization, code refactoring, GPU-enabling etc.)
1	EPFL	Paolo Ricci	**High Performance Computing** (scalable algorithms, code parallelization & performance optimization, code refactoring, GPU-enabling etc.)
1	CIEMAT	Mervi Mantsinen	**High Performance Computing** (scalable algorithms, code parallelization & performance optimization, code refactoring, GPU-enabling etc.)
2	IPPLM	Marcin Plociennik	**Integrated Modelling and Control** (code adaptation to IMAS, IMAS framework development, code integration etc.)
3	VTT	Fredric Granberg	**Data management** (open access, data management, data analysis tools, aspects of AI and VVUQ etc.)

Organizational structure within the WP Advanced Computing

Work Package
Advanced Computing

ACH · TSVV · HPC · JDC

administrative coordination & reporting to **PMU**

Thrust #1
Pedestal & SOL Turbulence

Thrust #2
Edge Physics & PWI

Thrust #3
MHD & REs

Thrust #4
Stellarators

Thrust #5
Whole-Device Modeling

01 03 04 — **TE** — PWIE · W7X

05 06 07 — **PWIE** — TE · SA

08 09 10 — **SA** — TE · PWIE

12 13 — **W7X** — PrIO

02 11 14 — **PrIO** — PWIE · TE · DES

E-TASC Scientific Board

scientific coordination by **SB**

Frank Jenko, Project Board Theory Meeting, Oct 21, 2021

https://indico.euro-fusion.org/event/1309

Thrust 1: Pedestal & SOL Turbulence
Specific goals for data interpretation & validation will (have to) be set jointly later this year.
Theory-driven experimental proposals for validation are welcome.

Thrust 2: Edge Physics & PWI
A deliberate effort is to be made to foster the further development of EMC3.

Thrust 3: MHD & REs
The future of ETS and its modules must be clarified by/to the community.

Thrust 4: Stellarators
It is expected to be beneficial to further foster interactions between the tokamak and stellarator communities, both generally and specifically.

Thrust 5: Whole-Device Modeling
Need to spell out and monitor various key aspects of EUROfusion Standard Software (action taken).

https://indico.euro-fusion.org/event/1309

Some general issues

Travel funding sufficient for at least one team meeting per year will be made available to each TSVV; the travel budget for 2021 will stay at its present level, but for 2022, the PMU aims to allocate more money.

It is encouraged to integrate people from the DEMO Central Team into the Thrust activities.

It is very important to develop reduced models, identifying and addressing high-priority issues first.

ITER physics priorities relevant to WPAC (presented by Simon Pinches)

Besides addressing important physics and R&D issues, collaborations on the following topics have high priority:
- IMAS
- High-Fidelity Plasma Simulator (HFPS)
- Pulse Design Simulator (PDS)
- data processing and interpretation (synthetic diagnostics)
- reduced models

Some key points from the last E-TASC SB meeting (Sept 29, 2021)

General comments by the TSVV Task leaders

 All 14 projects have been launched successfully

 Exciting initial results

 Some delays w.r.t. original work plan due to:

  late start of E-TASC (3-month delay)

  slow start of ACHs (6-month delay, plus current resource limitations due to gradual ramp-up)

  unforeseen staff changes

 Collaborations within the TSVVs are currently facilitated via email, Zoom etc.

 Hunger for in-person meetings in 2022; ***travel budget is universally requested***

 Inter-TSVV collaborations (within and across Thrusts) have also been started

 Marconi resources are much appreciated and heavily used

Some open issues

 Going IMAS (training is provided by ACH-IPPLM)

 Dealing with data bases

 Getting adequate ACH support

 Licensing questions will have to be addressed

Some key points from the last E-TASC SB meeting (Sept 29, 2021)

https://indico.euro-fusion.org/event/1208

General comments by the ACH leaders

Overall, the project matching between TSVVs and ACHs has worked quite well
In some cases, discussions are ongoing (due to a lack of available resources and/or expertise)
Projects have been launched successfully
Availability of code coordinators is essential
Slow start will have to be accommodated
Important to achieve a fair resource distribution in the long run

Open issue for today's meeting

Formal approval of ACH-VTT task revision (already endorsed by the E-TASC SB)

Monitoring the progress of TSVV codes towards EF Standard Software

SOFTWARE ENGINEERING

1. Version control implemented
2. Software engineering standards (incl. CI and regression/units tests) established
3. Coding standards (facilitating code maintainability and portability) established; this includes the use of modern programming languages and compilers
4. Performance optimization on HPC systems

CODE INTERFACES

1. User-friendly interface (e.g., GUI) for easy code handling
2. Post-processing and visualisation tools as a part of the code releases
3. Interface to the IMAS Data Dictionary

VVUQ

1. Specific plans for code verification, inter-code benchmarking, and code validation
2. Code verification studies accomplished, reports/papers available for download
3. Inter-code benchmarking accomplished, reports/papers available for download
4. Code validation studies accomplished, reports/papers available for download

Monitoring the progress of TSVV codes towards EF Standard Software

CODE DISSEMINATION

1. Up-to-date release version of the source code available on the Gateway for download
2. Trainings provided to code users within EUROfusion

CODE DOCUMENTATION

1. High-quality technical documentation (including a detailed description of the underlying model) available for download
2. User manual available for download

USER SUPPORT

1. Responsive support team (involving code developers) in place
2. Tools for managing support requests (mailing list, issue tracker etc.)

Current version of the monitoring table (as of Oct 21, 2021)

https://indico.euro-fusion.org/event/1192

CODE	TSVV No	From	Subject	Receive	Size	Categor	ACH support start in 2021/2022	SOFTWARE ENGINEERING				INTERFACES			VVUQ				DISSEMINATION		DOCUMENTATION		USER SUPPORT	
								1. Version control implemented	2. Software engineering standards	3. Coding standards established	4. Performance optimization on HPC systems	1. User-friendly interface	2. Post-processing and visualisation tools	3. Interface to the IMAS Data Dictionary	1. Specific plans for code verification	2. Code verification studies	3. Inter-code benchmarking accomplished	4. Code validation studies accomplished	1. Up-to-date release version on the Gateway	2. Trainings provided to code users	1. High-quality technical documentation	2. User manual available for download	1. Responsive support team	2. Tools for managing support requests
GRILLIX	3	Andreas Stegmeir	Andreas.St	EPFL	Nicola Varini	nicola.vari	In Progress	Completed	In Progress	Completed		Not started	In Progress	Not started	In Progress	Completed		In Progress	Not started	Not started	In Progress	In Progress	Completed	In Progress
HESEL	3	Anders Nielsen	ahnie@fysi				N.A.	Completed	Completed	N.A.		Completed	Completed	Completed	N.A.	N.A.		Completed	Completed	N.A.	Completed	Completed	N.A.	N.A.
GENE-X	4	Dominik Michels	dominik.mi	MPG	Rafael Lago	rafael.lago	In Progress	Completed	Completed	Completed		N.A.	In Progress	Not started	In Progress	In Progress		In Progress	Not started	Not started	Not started	Not started	Not started	Not started
GYSELA	4	Virginie Grandgirard	virginie.gra	EPFL	Mathieu Peybernes	mathieu.p	In Progress	Completed	Completed	In Progress		N.A.	Completed	Not started	In Progress	In Progress		In Progress	Not started	Not started	Completed	In Progress	Completed	Completed
PICLS	4	Alberto Bottino	bottino@ip				Not started	Completed	Completed	In Progress		N.A.	In Progress	Not started	Completed	In Progress		Not started	Not started	Not started	In Progress	Not started	Not started	Not started
EIRENE-NGM	5	Dmitriy Borodin	d.borodin	VTT	Jan Åström	astrom@c	In Progress	In Progress	Completed	In Progress		In Progress	Not started	In Progress	Not started	In Progress		In Progress	In Progress	Not started	Not started	In Progress	Completed	Not started
EMC3	6	Derek Harting	d.harting@				Not started																	
SOLEDGE3X	6	Hugo Bufferand	hugo.buffer	EPFL	Mathieu Peybernes	mathieu.p	In Progress	Completed	In Progress	In Progress		In Progress	In Progress	Not started	In Progress	In Progress		In Progress	Not started	Not started	In Progress	Not started	In Progress	In Progress
ERO2.0	7	Juri Romazanov	j.romazano	CIEMAT	Xavier Saez	xavier.sae	In Progress	Completed	Completed	In Progress		Completed	In Progress	Completed	In Progress	In Progress		In Progress	Completed	Completed	In Progress	In Progress	Completed	Completed
MEMOS-U	7	Svetlana Ratynskaia	svetlana.ra				Not started																	
MIGRAINe	7	Svetlana Ratynskaia	svetlana.ra				Not started																	
RAVETIME	7	Udo von Toussaint	udo.v.tous				Not started																	
SDTrimSP	7	Udo von Toussaint	udo.v.tous				Not started																	
SPICE	7	Michael Komm	komm@ipp	CIEMAT	Irina Gasilova	irina.gasil	In Progress	Completed	Completed	Not started		N.A.	Not started	N.A.	In Progress	In Progress		In Progress	Not started	In Progress	In Progress	Not started	Completed	Not started
JOREK	8	Matthias Hölzl	mhoelzl@i	MPG	Ihor Holod	ihor.holod	In Progress	Completed	In Progress	In Progress		In Progress	In Progress	In Progress	In Progress	In Progress		In Progress	In Progress	In Progress	In Progress	In Progress	Completed	In Progress
DREAM	9	Mathias Hoppe	hoppe@ch	VTT	Jan Åström	astrom@c	In Progress	Completed	Not started	Completed		In Progress	Completed	Not started	In Progress	Completed		In Progress	Not started	Not started	In Progress	In Progress	Completed	Completed
ETS	10	Jorge Ferreira	jferreira@i	IPPLM	Dimitriy Yadykin	dimitriy@c	In Progress	Completed	Completed	In Progress		Completed	In Progress	Completed	In Progress	In Progress		Completed	Not started	Not started	In Progress	Not started	Completed	Completed
EUTERPE	10	Ralf Kleiber	ralf.kleiber	MPG	Nils Moschüring	nilsm@ipp	In Progress	Completed	In Progress	In Progress		In Progress	Completed	N.A.	In Progress	In Progress		Completed	Not started	Not started	In Progress	Completed	In Progress	Completed
HAGIS	10	Philipp Lauber	philipp.lau	IPPLM	Michał Poradziński	michal.por	N.A.	Completed	Completed	In Progress		In Progress	In Progress	Completed	Completed	Completed		Completed	In Progress	Not started	In Progress	Not started	Not started	Not started
HMGC	10	Gregorio Vlad	gregorio.vl	IPPLM	Michał Poradziński	michal.por	N.A.	Completed	In Progress	In Progress		N.A.	Completed	N.A.	Completed	Completed		Completed	N.A.	N.A.	Completed	Completed	N.A.	N.A.
HYMAGYC	10	Gregorio Vlad	gregorio.vl	IPPLM	Michał Poradziński	michal.por	N.A.	Completed	In Progress	In Progress		N.A.	Completed	In Progress	In Progress	Completed		In Progress	In Progress	N.A.	In Progress	Not started	Not started	Not started
LIGKA	10	Philipp Lauber	philipp.lau	IPPLM	Michał Poradziński	michal.por	N.A.	Completed	In Progress	In Progress		Completed	In Progress	Completed	Completed	Completed		In Progress	In Progress	Not started	Completed	In Progress	Not started	Not started
ORB5	10	Thomas Hayward-	thomas.ha	EPFL	Emmanuel Lanti	emmanuel	In Progress	Completed	Completed	Completed		N.A.	Completed	In Progress	Completed	Completed		In Progress	Not started	In Progress	Completed	Completed	Completed	Completed
XTOR	10	Hinrich Lutjens	hinrich.lutj				In Progress	In Progress	In Progress	Not started		Not started	In Progress	Not started	In Progress	In Progress		In Progress	Not started	Not started	In Progress	In Progress	Not started	Not started
HCD-WF	11			IPPLM	Thomas Johnsson	johnso@kt	N.A.																	
HFPS	11	Francis Casson	Francis.Cas	IPPLM	Dimitriy Yadykin	dimitriy@c	Not started	Completed	Completed	Completed		Completed	Completed	Completed	In Progress	In Progress		In Progress	In Progress	Completed	Completed	Completed	Completed	Completed
QLKNN	11	Clarisse Bourdelle	clarisse.bo	VTT	Jukka Nurminen	jukka.k.nur	Not started	Completed	Completed	Completed		N.A.	Completed	In Progress	N.A.	Completed		In Progress	In Progress	N.A.	Completed	In Progress	Completed	Completed
ASCOT5	12	Simppa Äkäslompolo	simppa.ak	EPFL	Gilles Fourestey	gilles.four	In Progress	Completed	Completed	Completed		In Progress	In Progress	Not started	Not started			In Progress	In Progress	In Progress	In Progress	Not started	In Progress	Completed
CAS3D	12	Carolin Nührenberg	Carolin.Nu	EPFL	Gilles Fourestey	gilles.four	In Progress	Completed	Completed	In Progress		N.A.	Completed	N.A.	In Progress			Completed	Not started	Not started	Not started	Not started	In Progress	Not started
GVEC	12	Omar Maj	Omar.Maj	MPG	Tiago Ribeiro	tiago.ribei	In Progress	Completed	Completed	In Progress		N.A.	In Progress	In Progress	In Progress	In Progress		Not started	Not started	Not started	In Progress	In Progress	Not started	Not started
KNOSOS	12	José Luis Velasco	joseluis.vel	CIEMAT	Mervi Mantsinen	mervi.man	In Progress	In Progress	In Progress	Not started		Not started	In Progress	Not started	Completed	In Progress		In Progress	Not started	In Progress	In Progress	Completed	Not started	
VM2MAG	12	Michael Drevlak	michael.dr	MPG	Tiago Ribeiro	tiago.ribei	In Progress																	
GENE-3D	13	Alejandro Bañón-	ABANONNA	MPG	Rafael Lago	rafael.lago	In Progress	Completed	Completed	In Progress		Not started	Completed	Not started	Completed			In Progress	Not started	In Progress	In Progress	Completed	Completed	
STELLA	13	Michael Barnes	michael.ba	CIEMAT	Xavier Saez	xavier.sae	In Progress	Completed	In Progress	In Progress		In Progress	In Progress	Not started	In Progress	Completed		In Progress	Not started	Not started	Completed	In Progress	In Progress	Not started
BLUEMIRA	14	Dan Short	dan.short	CIEMAT	Mervi Mantsinen	mervi.man	In Progress	Completed	Completed	Not started		N.A.	Completed	Not started	In Progress	In Progress		N.A.	Not started	Not started	In Progress	In Progress	In Progress	Completed

Other developments

Goal 1: Strengthen the interactions with the DEMO Central Team

Dedicated discussions planned for the next meeting of Thrust #5
Want to include DCT members into various Thrusts

Goal 2: Organize discussions to define "standards" for reduced models

Two meetings are planned:
1. Discussions within TSVVs to create a catalogue of existing/future models
2. Discussions with ITER and the DCT on identifying potential gaps in this portfolio

Bottom line

After about 6 months, we start to see the first fruits of the E-TASC initiative

Key open issues in fusion research (as identified by the WPs) are addressed in a targeted way

Community is forming a "team of teams" – with a **highly collaborative spirit**

First steps towards a **more professional approach to software development**

Important goal is to **create, disseminate, and apply state-of-the-art tools**

Essential, in particular, for **ITER operation and DEMO design**

One of the most promising opportunities to **accelerate fusion research**