

Key deliverables of TSVV#10 (burning plasmas)

1. Gyrokinetic electromagnetic turbulence and fast particles: ORB5/EUTERPE
2. Global AE modes and fast-particle interaction: HMGC, HYMAGYC, ORB5/EUTERPE
3. Coupling of MHD and gyrokinetic codes with a transport code: HYMAGYC
4. MHD stability in presence of a large fusion alpha population: XTOR code family
5. Burn control and energy deposition optimisation strategies: ETS/LIGKA/HAGIS
6. Reduced models for AE/EPM stability and nonlinear dynamics: LIGKA/HAGIS

Organization (complex but conceivable)

- EUROfusion Work Package “Advanced computing” (WPAC)
- Scientific Board (SB) of WPAC (“decision body”)
- Thrusts: communication platform with experiment (WPs)
- Thrust#3: TSVV8(MHD), 9(runaways), 10(burning plasmas)
- Thrust#3: representatives of WPSA, WPTE, WPW7X, WPPWIE, SB
- Advanced Computer Hubs (ACH) of 3 types: HPC, Integrated Modelling, Data Management
- ACH controlled by and report to the Scientific Board

Reporting and Communication

- Yearly brief written reports to SB (due ~Dec)
- Meetings within the Thrust#3 (~2 times per year)
- Meetings of SB with TSVV PI (~2 time per year)
- Middle-term critical report (evaluation) due 2023
- ACH resources distributed by SB based on TSVV needs
- Project Wiki: <https://wiki.euro-fusion.org/wiki/TSVV-10> (IMS password)
- Project Indico: <https://indico.euro-fusion.org/category/283/> (IMS password)
- Project Wiki and Indico can be viewed by WP Pis (“reporting function”)

Resources: Computing time (till March 2022)

- FUAC5_TSVV10 (M100): 736000 core hours=23000 node hours

```
[omishche@login02 ~]$ saldo -b -a FUAC5_TSVV10
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account          start      end      total      localCluster      totConsumed      totConsumed      monthTotal      monthConsumed
                  (local h)  Consumed(local h)  (local h)      %                (local h)        (local h)
-----
FUAC5_TSVV10     20210301   20220228  736000      58203              58203             7.9            60659          1
[omishche@login02 ~]$
```

- FUA35_TSVV10 (Marconi): 72 000 000 core hours

```
(SKL) [omishche@r000u06l01 ~]$ saldo -a FUA35_TSVV10 -b
PI: omishche
COLLABORATORS: epoli001 akoenies thayward cslaby00 lvillard gvlad000 abiancal abottino rkleiber msadr000
-----
account          start      end      total      localCluster      totConsumed      totConsumed      monthTotal      monthConsumed
                  (local h)  Consumed(local h)  (local h)      %                (local h)        (local h)
-----
FUA35_TSVV10     20210301   20220228  72000000    10251              10251             0.0            5934065        0
(SKL) [omishche@r000u06l01 ~]$
```

Resources: ACH support

TSVV	Code name	Task required to ACH	ACH name
Task 10	EUTERPE/ ORB5	Code refactoring: improving the data structures and workflows to facilitate GPU-enabling of EUTERPE and implementation of advanced structure-preserving methods. Targeting unified and inclusive framework with ORB5.	ACH-01 (MPG)
Task 10	ORB5/ EUTERPE	Further development of GPU functionality (OpenACC) for large-scale EM turbulence simulations; extension to other options (such as OpenMP4.5 or Kokkos). Improvement of solver performance and strong scalability on GPUs.	ACH-02 (EPFL)
Task 10	ETS/ LIGKA/HAGIS /HYMAGYC	Up-to-date IMAS support including ITER/WPCD integrated modeling tools, experimental data import/export, visualization on IMAS. Integration of all actors needed for the reduced models and of the reduced models themselves into the ETS. Maintenance of development toolchains (gcc/intel, fortran, c/c++, python3). Speeding up transport models for burning plasmas in presence of Alfvénic waves and energetic particles once these models are established.	ACH-04 (IPPLM)

Resources: EUROfusion Gateway

What roles should the Gateway play?

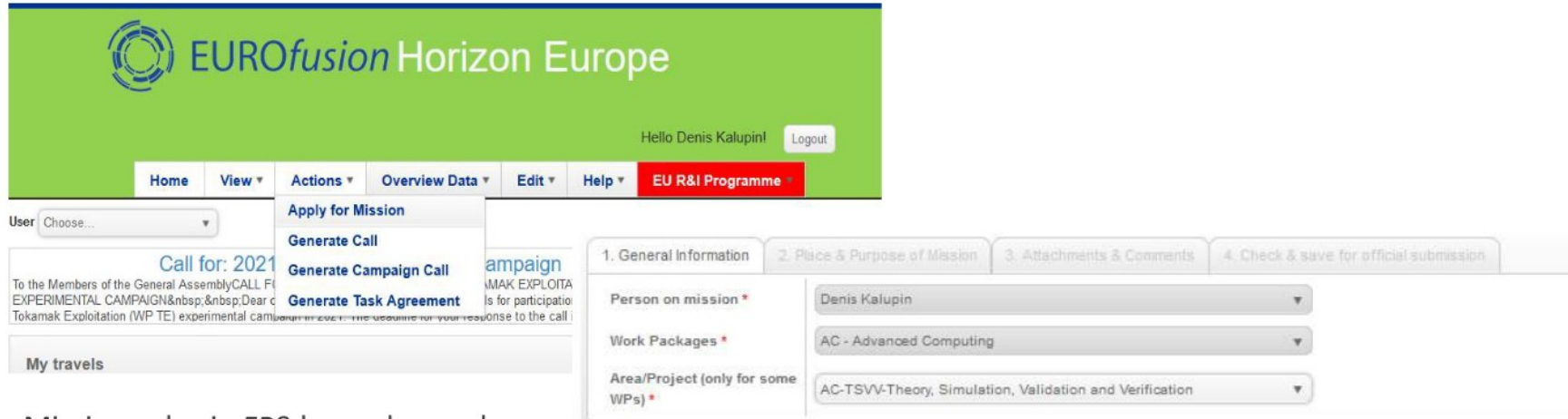
The working group sees the Gateway providing an enhanced role in the EUROfusion ecosystem, providing

1. A home for joint code development including all of the necessary compilers and libraries
2. A host for EUROfusion scientific software development with repository, trouble ticket and CI/CD infrastructure
3. A home where codes that are developed within the TSVVs, ENRs and other parts of EUROfusion are deployed (as part of their deliverables)
4. A home for EUROfusion developed scientific databases
5. A place where medium scale (non-HPC) codes can be run
6. A place where current simulation results can be stored
7. A home for cloud deployable software (that could be run on the Gateway or in the academic or commercial clouds)
8. A place where cloud software could be run

Resources: Mobility

IMS mission application is required – **approval by the PMU**

Limited mission funds are available for TSVV / ACH team members for travelling within their projects or for TSVV staff visiting ACH (Missions of TSVV / ACH team members related to WP activities must be funded through the relevant WP)



The screenshot displays the EUROfusion Horizon Europe web application. The main navigation bar includes 'Home', 'View', 'Actions', 'Overview Data', 'Edit', 'Help', and 'EU R&I Programme'. A user profile for 'Denis Kalupin' is visible. A dropdown menu under 'Actions' is open, showing options: 'Apply for Mission', 'Generate Call', 'Generate Campaign Call', and 'Generate Task Agreement'. Below the menu, there is a 'Call for 2021' announcement and a 'My travels' section. On the right, a form for mission application is shown with steps: '1. General Information', '2. Place & Purpose of Mission', '3. Attachments & Comments', and '4. Check & save for official submission'. The form fields include 'Person on mission' (Denis Kalupin), 'Work Packages' (AC - Advanced Computing), and 'Area/Project' (AC-TSVV-Theory, Simulation, Validation and Verification).

Mission rules in FP9 have changed:

- no unit costs, all missions will be done on **actual costs**
- **tickets are eligible**
- support level: **70%** (indirect costs are eligible)

TSVV#10 topics

- Theory: Dyson GK, phase-space structures (LCS), transport
- Gyrokinetics: ORB5/EUTERPE ; ACH support (HPC)
- Hybrid-gyrokinetic: HMGC/HYMAGYC
- MHD: XTOR + kinetics
- Reduced models: LIGKA/HAGIS
- Integrated modeling: ETS ; ACH support (IM)
- Applied Math: FBL reconstruction
- Validation: input from the Thrust#3 (WPSA, WPTE, WPW7X)

TSVV#10 expertise

- Theory: F. Zonca, A. Koenies, Ph. Lauber, J. Graves, X. Garbet, E. Poli
- Gyrokinetic simulations: A. Bottino, A. Biancalani, T. Hayward-Schneider, R. Kleiber, A. Koenies, E. Poli, M. Sadr, C. Slaby, L. Villard
- Hybrid-gyrokinetic: G. Vlad, S. Briguglio
- MHD: H. Luetjens, J. Graves,
- Reduced models: Ph. Lauber, A. Koenies, J. Graves, R. Dumont, C. Slaby
- Integrated modeling: J. Ferreira, Ph. Lauber
- Applied Math: M. Campos-Pinto, A. Bottino
- Validation: Ph. Lauber, R. Dumont, J. Graves, X. Garbet

TSVV#10 Deliverables for 2023

- EM turbulence saturation with ORB5/EUTERPE: EM-ITG, KBM
- Finish NLED-AUG benchmark and compare to AUG data
- Make gyrokinetic module of HYMAGYC IMAS-compliant
- Linear and nonlinear XTOR simulations of internal kink modes in the range of a single sawtooth period in the presence of AEs and fast particles; linear kink with ORB5/EUTERPE in realistic geometries
- Time-dependent transport simulations with reduced EP transport models to explore the influence of AEs on burn-up physics
- Perform basic ETS studies using CG/QL models included through IMAS
- Validation EP scenarios: AUG, JET, JT-60SA, W7-X; review and extend existing reference cases to ETC modelling; propose ICRH scenarios for W7-X; propose new EP experiments; choose DEMO relevant scenario based on needs of DEMO EF Team