Meeting Details

- **Date:** 07/06/2024
- **Time:** 10.00 CEST
- **Location:** Zoom
- Indico page: https://indico.euro-fusion.org/event/3159/

Attendees

- N. Vianello (NV)
- D. Keeling (DK)
- T. Görler (TB)
- P. Tamain (PT)
- D. Told (DT)
- E. Serre (ER)
- C. Roch (CR)
- D. Kalupin (DKa)
- D. Tskhakaya (DTs)

Agenda Items

1. Research Topics and Modelling Needs

- **Presenter:** N. Vianello
- **Duration:** 20 Minutes
- **Objective:** Presentation of recent results from WPTE
- **Comments/Questions**
  - TB: Reporting of activity of RTs in within TSVVs. This is already happening (Italo Predebon, Alberto Mariani, Mattia Dicorato). This was a nice outcome of Thrust meeting #3. These persons are already exchanging on a regular basis. G. Snoep (article on the pinboard mentioned during NV talk) reported under Pedestal task T17-05. Actually looked at T17-05 Pedestal task as well as on the wiki of L-H transition and didn't find the presentation. Maybe other JET tasks/experiments. Status of validation

and request: really difficult to have a small uncertainty of the ion temperature on JET. To be verified if improvements happened in particular for last RT01 experiment. Providing transport coefficient is a challenging. NV to check communication between interpretative modelling and more refined models under RT01 (JINTRAC ⬚ GK).

- PT: Globally agree to put more effort in the validation of WPTE. Thrust meeting is important on this respect. TSVV3 annual meeting held last week but no invitation to TFLs. Maybe presentation in one of the regular upcoming meeting. A lot of activity in particular for S3X also outside of TSVV. Good way forward is increasing the user base. This is happening also outside TSVV. There is the willing to train new persons in within WPTE (S3X is already training even outside EU)

- DT: Edge GK are now at the moment where it could interesting for proper application. Annual meeting in October. Invitation to be sent to TE in order to trigger further interaction.

- DTs: Note that some of the activities are already on-going in within TSVV3/4. Kinetic modelling valid simulation for ELM-mitigation/suppression and ELM buffering. To be reported in within RT05

- CR: Question to TSVV PI. What data you would like to see and which are the codes that are able to handle? Communication and requests should be bi-directional

2. TSVV1 Development and Future Plans

- **Presenter:** T. Görler

- **Duration:** 20 Minutes

- **Objective:** Presentation of recent results from TSVV01

- **Results:**
  - Both AUG and JET pedestal simulations (hybrid) were performed and available on the pinboard.
  - Self-generated current effect on ITBs. Also Global ORB5 studies on reversed shear.
  - Ion orbit losses: model to be extended to GENE-X or GRILLIX (therefore GK and fluid)
  - Further increasing edge physics capabilities: B// fluctuations in global GK. Linear benchmark passed with local GENE. But NL not yet concluded. TSVV1 internal benchmark with ORB5 launched
  - H-mode simulations with self-consistent Er with Grillix with nice match if switching NC ion viscosity. KBMs in the pedestal obtained with GRILLIX but mismatch with GENE in term of frequency. Magnetic flutter in Ohm's law stabilises drift-Alfvén turbulence
  - New quasi-neutral solver fo GYSELA valid for any axisymmetric geometry allowing shaping capabilities
  - GENE-X pre L-H transition studies to AUG.
  - H-L transition studies and scaling law (K. Lim)
  - High dimensional micro-instability characterisation of 7 NBI-heat JET ILW discharges. Qualikiz useful up to $rho\_tor=0.85/0.90$. TGLF-SAT2 matches gene well except at $rho\_tor = 0.95$.
  - Prepare code inputs from core/edge equilibrium IMAS entries from experiment

- Write and read GK IMAS structures (GK IDS)
- **Comments/Questions**
  - CR: Very impressive and lot of work. Little more on the plans for work with TSVV4 code. TB: needs to have flux driven scenario including full SOL therefore treatment of shaping and open field lines in diverted configuration. GENE-X is still in the long-wavelength approximation. CR:
  - NV: actions towards pedestal model since reduced model QLK and TGLs are lacking. IMEP or reduced model for Micro Tearing. Possible use of Neural Networks or AI. Fro mthe ETG levels there are at least 2 reduced models (David Hatck and Gabriele Merlo). To be checked and further explored. At the moment JET is prohibited expensive for GENE-X: about of factor of 6 in computation expense and to ITER is a factor of 20.

3. TSVV3 Development and Future Plans

- **Presenter:** P. Tamain
- **Duration:** 20 Minutes
- **Objective:** Presentation of recent results from TSVV03
- **Results:**
  - Extended workplan for 2024-2025 defined at the end of 2023. All existing tasks renewed + 1 additioanal task on electromagnetic turbulence (high-beta plasmas). TCVX23 as a key-stone + selected applications to other machines. Mutualize selected parts of models/codes starting with kinetic neutrals solvers. Workplan more on validation since maturity is high enough
  - Annual Workshop just handle (29.05-31.05) indico page avaliable (https://indico.euro-fusion.org/event/3165/)
  - Gyrofluid turbulence reached critical milestone: Pros: FLR effects, but as cons no well established model especially for collisions (closure!). FELTOR turbulent simulations can now run routinely and applied to TCVX21. Now contains as much as physics as drift-fluid model. Next steps: implement non-isothermal model with neutrals (TCVX23)
  - TCVX23 validation exercise: validation reference test case for high density regimes. Quality of the data relatively bad and need to re-run with baffle. In the meantime prepare synthetic diagnostics
  - Turbulence in high density regimes both in GBS and S3X: strong turbulence developed at high density (in detached conditions) with significant increase of SOL width heat channel
  - Turbulence in XPR: comparison between GRILLIX (with assumed impurity concentration since can't handle prperly impurities) and SOLPS-ITER
  - Provide reduced model for mean-field community: work in progress and no unique suggestion according to scenario proposed. Very complicated in particular for detached case with complext poloidal structure in the Deff, with even negative values (due e.g. to inverse Temperature gradient)
  - GRILLIX: included electromagnetic fluctuations and landau fluid closure for low nu* plasmas. Electromagnetic turbulence matter dramatically: flutter is important

- Issue of time scales to reach stable solutions: accelerate the codes (GPU porting) and develop accelleration methods
- Neutral solvers modularized in order to exchange among the codes (first within TSVV3)

- **Comments:**
  - DTa:Negative diffusion coefficients in electrostatic may be over-compensated if you keep the electromagnetic as suggested by GRILLIX? take home message depends on the beta (low beta L-mode electrostatic, high beta H-mode electromagnetic)
  - CR: comparison and consistency among the codes in high density have been checked? Not yet and will be addressed although at first sight different outcome (S3X do see temperature shoulder rather than density shoulde)
  - NV: much more visibile the shoulder with the temperature rather than in the density. Baffle configuration for TCV-X23 with limit the capability of the codes since only S3X can handle them properly. The other codes are working on that. For H-mode and electromagnetic effects work in progress. Closure implemented in GRILLIX is not mandatory as far as the same approach already used in 2D codes is used
  - CR: EIRENE. Coupling with EIRENE limited to low resolution and therefore can't be coupled with turbulence case. Major limitation of EIRENE but not officially done in collaboration with TSVV6.
  - DKa: HPC experts issues is presently being addressed with increasing resources (?). HPC are asking as well to have a single contact person on the TSVV side. PT: progress made but still lack of HPC experts.

4. TSVV4 Development and Future Plans

- **Presenter:** D. Told
- **Duration:** 20 Minutes
- **Objective:** Presentation of recent results from TSVV04
- **Results:**
  - Team is fairly constant
  - One of the milestone achieved with the ability to handle arbitrary geometry in Gysela-X. Using primarily now to handle NT
  - Working hard to move Gene-X to 3D and stellarator and verified using MMS
  - Implementation on the neutral gas model for GENE-X. Model (simplified) tested but need to coupling to GK.
  - Moment-based GK approach: the moment based approach is now being included in GENE-X (B. Frei moved from Lausanne to IPP) in order to be able to tackle as well larger tokamaks. In addition GPU porting on the way
  - ACH: up to 2024 TSVV-4 has seen under-allocation of ACH projects. Satisfaction rate high but problem since expertise require/requested didn't match. Some miscommunication reported.

- **Comments**
    - CR: Raised a point of clarification concerning the shown figure on ACH resources. DT clarified that TSVV4 received less than half of the overall requested allocation.
    - CR: Neutral models. Are you sharing knowledge and expertise among the TSVVs? TD: in the annual meeting in 2023 TSVV3 and TSVV4 have exchange on neutral session and sheath session. The neutral model will be the same as implemented in GRILLIX and therefore with natural connections with TSVV3. The same for Gysela-X and SOLEDGE3X/2D
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5. General discussion

- Training:
    - NV: Training should be promoted at E-TASC PB since TE participants are overbooked
    - DKa: Iterative projects. TE informed on the new capabilities available for training. TFLs to collect interest and together with PIs establish case to be used for training.
    - TB: need to find better way to stream the different code requests for ACH. TSVV PI and Thrust facilitator might not be the most suitable people.

Meeting end at 12.30