EUROfusion

WPSA Code Management Area:
modelling, synthetic diagnostics, operation related tools

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My Background

❑ Physics background : theory, modelling, turbulence, numerical simulation (gyrokinetic and fluid models)

2002 PhD from EPFL, Swiss Plasma Center

2010 – 2013 ITM-TF Task Force Leader - EFDA Integrated Tokamak Modelling Task Force
(200 persons, 20 RU, 40ppy)

2014 – 2018 EUROfusion WPCD Project Leader - Code Development for Integrated Modelling Work Package (100 persons, 21 RU, 20ppy)

2019-2020

❑ Scientific Co-Coordinator for EUROfusion MST1 Topic 16: Effect of filamentary transport on heat and particle loads

❑ Modeler within Theory, Simulation, Verification, and Validation Task1 (TSVV1):   L-H transition and pedestal physics.

❑ Modeler within WPSA A02 : Scenario and plasma edge modelling. Edge and divertor modelling of JT-60SA scenarios with C wall (SOLEDGE).

WPSA Code Management and modelling

Role Title	Required Competencies

Suite of codes manager	• Knowledge of numerical simulation tools in tokamaks
	• Knowledge of the simulation infrastructure and platforms
	• coordination skills
	• Activity goals will include:
	  • to coordinate selection, validation, adaptation and benchmark of simulation tools for application to JT-60SA in order to prepare, perform and analyze the future experimental campaigns
	  • Prepare and coordinate training activities for the application of the simulation tools

Simulation expert, data analysis tools developer	• Scenario development and analysis • Disruption and runaway, physics, consequences and mitigation • Synthetic diagnostics development, including image processing for scientific cameras, particularly but not exclusively for EU-led diagnostics EDICAM, Edge TS, Divertor VUV, FILD • Fast particles • MHD and Control • Edge and divertor modeling • Operation-oriented tools : (equilibrium, control, discharge fast simulator etc.) • Energy, Matter and Impurity Transport

- Adaptation/preparation of analysis tools (predictive, interpretative) to support
  - Experiment preparation
  - Experiment analysis
  - Interpretation of diagnostics data
  - New enhancements
- Strict relation with the Experiment Team before and during the campaigns

C.Sozzi | 8th WPSA PPM | 15 March 2021 |

FP9 : WPSA Code Management strategy

➢ Establish reliable modelling codes, workflows and <u>operation related tools</u> for routine use in the scientific exploitation starting in 2023

➢ Modelling support to the enhancements and diagnostics procured by EU, including control actuators

➢ Specific focus on modelling the first operation phase scenarios: Initial research phase I and II, in H and D, with reduced power and C-PFC (!Divertor not actively cooled)

	Phase	Expected operation schedule		Annual Neutron Limit	Remote Handling	Divertor	P-NB Perp.	P-NB Tang.	N-NB	NB Energy Limit	ECRF 110 GHz & 138 GHz	Max Power
Initial Research Phase	phase I	2021 (5M)	H	-	R&D	USN Carbon	0	0	0	0	1.5MWx5s	1.5MW
		2023 (2M)				LSN Carbon Div. Pumping	3MW	3MW	10MW	23MW x 14s duty = 1/30	1.5MWx100s + 1.5MWx5s	19MW
	phase II	2023-2024 (6M)	D	3.2E19			6.5MW					26.5MW
		2024-2025										
	phase III	2025-2027						7MW		Real Injection : ~ 26MW x 2-3 sec limited by divertor cooling		
Integrated Research Phase	phase I	2029 - 2031	D	4E20		LSN Actively cooled Carbon Div.Pumping	13MW			20MW x 100s 30MW x 60s duty = 1/30	7MW x 100s	37MW
	phase II	2033 -	D	1E21		LSN Actively cooled Tungsten-coated Carbon Div.Pumping						

Plasma operation oriented tools and synthetic diagnostics development

SA.CM TOPICS	2021 PROPOSED TASK - to be discussed
Discharge simulator	D1. Simulate JT-60SA discharge with the plasma discharge simulator coupling METIS-CREATE codes with controllers.
Breakdown simulators	Breakdown simulators, combining free-boundary equilibrium, evolution equations for energy, particles and current and EC beam tracing: application to the optimisation of breakdown with ECRH.
Integrated Data Analysis	Integrated Data Analysis and Validation (IDAV) : requirement capture and specifications
ECWC	Validate ECWC simulation tools on the first data from commissioning
Disruption prediction	Disruption prediction tools. Disruption database provision and verification.
Synthetic diagnostics development	Synthetic diagnostics development for EDICAM, Edge TS, Divertor VUV, bolometry.
Synthetic diagnostics development	D2. Visible imaging analysis tool implemented on JT-60SA and tested (camera tomography)

JT-60SA Modelling

SA.CM Topics	2021 PROPOSED TASKS - to be discussed
Scenario development and analysis	Validation of IM simulators on the nominal scenarios and identification of viable high-radiation long discharge scenarios for the initial phase
Scenario development and analysis : turbulence	E.M. gyrokinetic study of anomalous transport in a JT-60SA high-beta representative plasma discharge
Edge and divertor modeling	Investigate conditions for divertor detachment for the initial phase scenarios, including impurity seeding impact
Fast Particles modelling	Investigate the stability of high-energy ions for the initial phase scenarios
MHD and control	MHD stability workflow: demonstrate routine application on nominal and reduced power scenarios
Disruption and runaway physics, consequences and mitigation	Disruption mitigation and RE current studies on the initial phase scenarios with DMV
Non-linear MHD modelling	Non–linear ELM + pellets modelling with JOREK