Chapter 10:
Theoretical models and simulation codes

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- Collection of comments and suggestions

- List of EU codes

- Proposed plan of Chap. 10

- Procedure for Chapter revision

- Meeting at Naka (Oct. 24-27)

Collection of comments and suggestions /1

General comments on Sec. 2.6 of SARP v2.1 :

- Section well written, but should be expanded into a full Chapter.

- Its structure should also be modified (subsections etc.).

Clarification questions on Sec. 2.6 of SARP v2.1 :

- Clarify the role of the Broader Approach – **Computer Simulation Center**, its availability to integrated modelling simulations, mention its characteristics. Will it be used essentially for first-principle codes ?

- Clarify the differences (if any) between tokamak **simulator for control** systems development and **integrated modelling** codes for scenario prediction.

Possible modelling results to be included in Chap. 10 (existing or planned) :

- time-dependent 0.5D modelling of main JT-60SA scenario with the **METIS** code

- comparison of **NBI power deposition** profiles obtained with JA and EU codes

General ideas on additional research items to be included in Chapter 10 :

- **Fast particle** physics (development and validation of kinetic code for ions)

- Validation of **gyrokinetic codes** with advanced **turbulence diagnostics**

- **Integrated model validation** for discharges longer than resistive time :

  - q-profile evolution for Hybrid & SS regimes, including role of MHD

  - validate neo-classical current diffusion at different collisionality levels

- Development of **model based control** for real time applications

- Preparation of **burn control experiments** by simulating self-alpha heating effect

- **Physics of ITB** sustainement in different conditions of dimensionless parameters:

  - Mimimum level of injected torque for ITB sustainment for different q-profiles and different dimensionless parameters

  - Validation of models for density and temperature ITBs

- Transport model validation at **low injected torque, ratio Ti/Te and collisionality**

- Validation of **models for Hybrid** regimes :

  - Role of MHD

  - Role of injected torque, various dimensionless parameters

  - Interplay with pedestal and density peaking

- Particle fuelling & sustainment/control of **density profile on long duration**

  - Neutral penetration in SOL

  - Validate continuous pellet fuelling models

  - Transport with low core fuelling and collisionality

  - Role of plasma shape

- Validation of **bootstrap models** in dominant bootstrap regime

  - Role of collisionality

  - Importance of fast-particle vs thermal plasma gradients

- Validation of **pedestal models** (EPED, …)

Specific modifications proposed for Chapter 10 :

- Discuss **specificity** of JT-60SA, with respect to other tokamaks and to ITER, for model validation (in general and in the prospect of DEMO)

- Discuss **coherence** between use of JT-60SA for model **validation** vs **diagnostics**

- Discuss possible **synergies** between JA and EU **development of tokamak simulator**. Give some details on the state of advancement of JA and EU programmes in this area.

- The EU **ITM** Task Force should play a role in this area, and this can be discussed in the Chapter.

- Discuss with some additional detail the plans for the development of a common **framework for data exchange**.

- Add **code catalogue** and short description

- Add **simulation results and/or plans** for coordinated simulation activity

- Add description of validation programme using **JT-60U and JET** discharges

- Improve the structure (more lists of points, issues etc.)

EU codes and models (tentative list)

Transport and turbulence
- KINEZERO
- GYSELA

MHD and Equilibrium
- HELENA
- MISHKA
- CASTOR
- JOREK
- XTOR
- CARMA
- MARS-K
- STARWALL

Divertor, SOL and PMI
- EDGE2D/EIRENE
- SOLPS

High-energy particles
- HAGIS
- XHMGC
- LIGKA
- ASCOT
- SPOT

Integrated operation scenarios
- ASTRA
- JETTO
- CRONOS
- METIS

Heating and CD
- NEMO
- REMA
- GRAY
- FRTC/ASTRA

10.1   Introduction

As in the introductory part of SARPv2.1 - Sec. 2.6

10.2   Research issues in theoretical models and simulation codes

As in SARPv2.1 - Sec. 2.6, 1)

10.3   Research activity before the start of JT-60SA experiment

As in SARPv2.1 - Sec. 2.6, 2)

10.4   Research activity during the JT-60SA experiment

As in SARPv2.1 - Sec. 2.6, 3)

10.5   Codes and models

catalogue, with very short description and main reference.

10.6   Simulation results

The main highlights of the simulations are presented in the various chapters. Here there are details and additional material that cannot be shown in the chapters (discussion and validation of the models used, sensitivity studies etc.).

10.7   Summary

Proposal for Chapter revision

- The final version of the **revision form** is sent to N. Hayashi and A. Fukuyama (this week)

- **Discussion** with them on the proposed modifications, by a remote meeting and/or in written form

- On this basis we should decide **who re-writes the Chapter**: either they do on the basis of our proposal, or we try to do the first draft.

- In parallel, we could try to **produce some results** to be included in Sec. 10.6

- The bulk of the modelling work (e.g., **comparison JT-60U / JET**) is not likely to be ready for SARP v3.0, but some work should be started

Part II: Collaborations between EU and JAEA

Oct.26th				
13:30	15:30	EU/JA Collaborative Studies: Modeling prediction of JT-60SA Plasmas	EU: JA: T. Fujita	
15:30	15:50	COFFEE		
15:30	17:30	EU/JA Collaborative Studies: Experiments and data analyses for JT-60SA	EU: JA: S. Ide	
Oct.27th				
09:20	10:50	EU/JA Collaborative Studies: Diagnostics for JT-60SA	EU: JA: K. Itami	
10:50	11:00	COFFEE		
11:00	12:00	Summary	Chair: T. Fujita	