

The logo for CEA (Commissariat à l'énergie atomique et aux énergies alternatives) features the lowercase letters 'cea' in a white, sans-serif font. A horizontal green line is positioned directly beneath the letters. The entire logo is centered within a dark red square background.

cea



DE LA RECHERCHE À L'INDUSTRIE

WPSA Code Management Area Progress Meeting

Q. Le Coz & CEA team

06 June 2024

WPSA meeting

Task Title	TF and EF Thermohydraulic models
Task Coord	Q. Le Coz
Task Description	TF and EF Thermohydraulic models including casing-winding pack exchanges and pulsed PF operation.

Del 01 / PM----->	2
Title	TF coil model with TACTICS for casing-winding pack exchange.
Owner/Beneficiary	Q. Le Coz / CEA IRFM
Description	<p>Implement variable pressure boundary conditions. Implement time dependent thermal contact between the casing and the winding pack.</p> <p>Identify relevant runs to stand for reference cases in the integrated commissioning database.</p> <p>Optimize fittings versus all reference cases and establish winding pack (WP)/casing thermal contact distribution versus Lorentz force. Make predictions for any TF coil current and any current profile of fast safety discharges.</p>

- TACTICS models ready (task 2023) → **done**
- Pressure boundary conditions extracted from the IC database → **done**
- Implementation of the time dependent thermal contact laws ongoing (varying Lorentz forces during the current discharge) → **ongoing**
- Perform the calculations of discharges at different TF coil currents → **not started**

Task Title	TF and EF Thermohydraulic models
Task Coord	Q. Le Coz
Task Description	TF and EF Thermohydraulic models including casing-winding pack exchanges and pulsed PF operation.

Del 02 / PM----->	2
Title	Pulsed coils THEA models of all PFs & apply for predictions
Owner/Beneficiary	Q. Le Coz / CEA IRFM
Description	<p>Integrate new superconducting material in THEA corresponding to the strands used in the EF coils for critical current calculations. Consolidate AC losses THEA calculation script.</p> <p>Implement the magnetic field dependence for each EF coil on the current of all the other EF coils.</p> <p>Extend to all EFs and benchmark with IC database.</p> <p>Initiate CS configurations and benchmark with IC database.</p> <p>Scan several plasma scenarios and assess their risk level (minimum temperature margin) and identify their repetition rate.</p>

- EF coil THEA models ready (task 2023) → **done**
- EF magnetic field coupling with other EF coils → **not started**
- CS THEA models → **started on CS3**, models to be further consolidated →
- Update of AC losses in the models with experimental results on Josefa tests → **test of CS conductor sample performed on the 5th of June, test of EF-L conductor sample to be performed later in June.**

Hotspot temperature for each solid component with THEA.				
Detection	Thermal	T _{max} [K]	Time [s]	S _{curv} [m]
U _t = 1 V τ _p = 4.7 s ; τ _{delay} = 1 s	Sc. strands	189.1	8.1	56.8
	Copper strands	198.1	7.7	56.8
	Jacket	120.2	27.9	56.8
U _t = 2 V τ _p = 6 s ; τ _{delay} = 1 s	Sc. strands	251.9	9.1	56.8
	Copper strands	263.9	8.7	56.8
	Jacket	154.2	30.0	56.8
U _t = 3 V τ _p = 6.9 s ; τ _{delay} = 1 s	Sc. strands	301.5	9.8	56.8
	Copper strands	315.7	9.5	56.8
	Jacket	181.5	30.9	56.8



Thank you for your attention

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