

W PFC transition in JT-60SA

J. Garcia



Priorities for the exploitation of JT-60SA in EUROfusion



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2. Avoidance and mitigation of disruptions and runaways;
3. Fast-ion physics;
4. Development and validation of high-level real-time control strategies.

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Priorities for the technology side of JT-60SA

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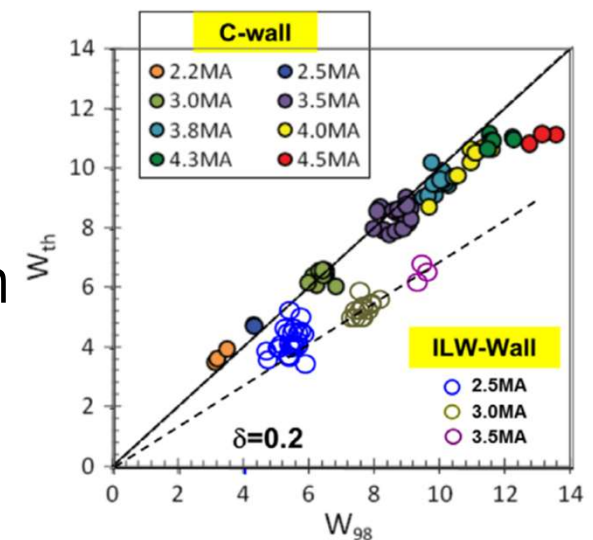


1. Development of cost-effective W-PFC materials;
2. Development of a remote handling system to address specific needs for the device operation phase;
3. An enhancement program for the toroidal field, cryogenics, power supplies and heating systems;
4. Consolidation and verification of the engineering models to expedite the verification against structural integrity during the operation phase.

Considerations from Experiment Leaders



- Impact of W on scenario integration and scenario output is significant
- Scenario integration would benefit from an earlier transition to W-ACD, so skipping the C-ACD
- Otherwise, the transferability of the solutions found in JT-60SA to ITER or DEMO cannot be granted and the scientific impact would be lower
- **We suggest to skip the C-ACD and to proceed straightforward to a W-ACD and wall, but take measures to reduce the risk of failure**



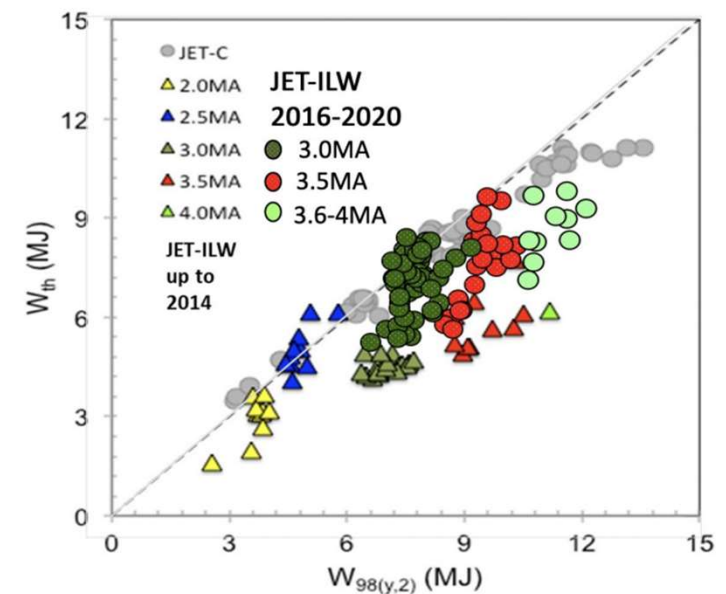
Considerations from Experiment Leaders



- Experiment Leader's view are basically in agreement with EUROfusion' views
- QST views also in agreement
- JA did not fully accept yet to skip C-ACD. Experiment Leaders preparing further reports and explanations for JA MEXT.

EL: W-div&wall Is Key to be fully relevant to ITER and DEMO from Integration Viewpoint

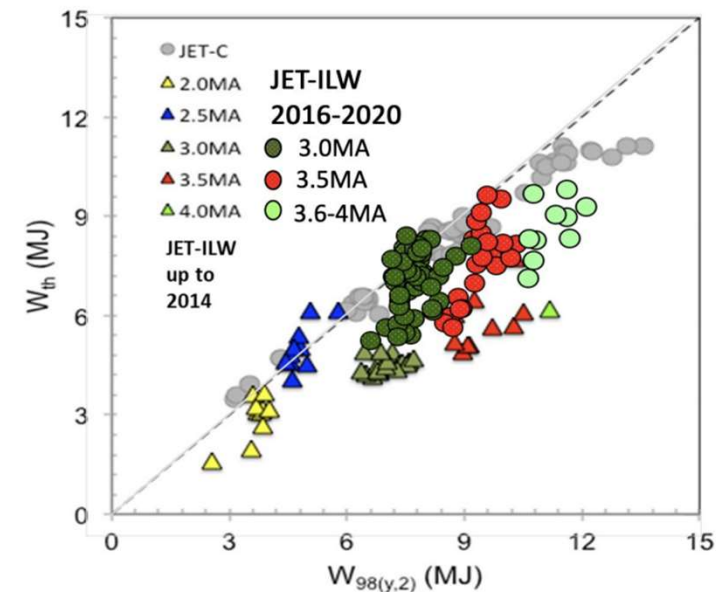
- Wall material changes the plasma performance through W impurity accumulation in the core.
- Control methodologies at ITER/DEMO relevant plasmas can be big contribution.
- **Compatibility between high β and metal wall for long time** will be the role of JT-60SA.
 - Radiative divertor with Ne/Ar in V-shaped W-div
 - Divertor detachment => **Div diagnostics should be stronger**
 - W shielding at large T_{ped}
 - W control in the core => **Higher ECH may be required**
- An early transition to W wall and divertor might be beneficial with satisfying the wall transition logics



EL: JT-60SA risk mitigation for W



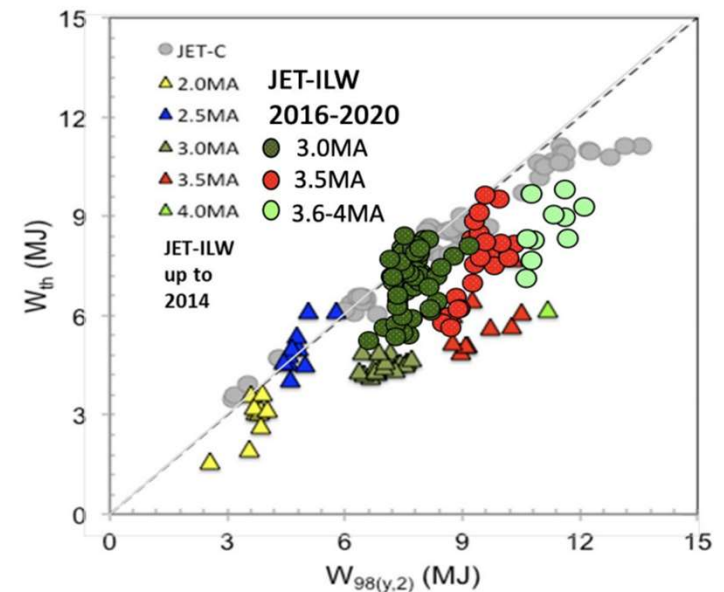
- **Central heating** (deposited entirely very close to axis) is essential to prevent W core accumulation,
 - State of the art modelling is reinforced in the ET can help to calculate the requirements, in terms of ECRH power, to prevent such an accumulation.
 - In JET, 2-4MW of ICRH power on axis is needed to develop scenarios. Considering the larger volume in JT-60SA, ~3-7MW of ECRH might be needed on-axis. Such amount of power would not leave any margin for ECRH power used for NTM control at high beta.
- **Test of W transport by using TESTPEL or installing some W tile** in JT-60SA conditions can be performed during C ICD.



EL: JT-60SA risk mitigation for W



- **Dedicated diagnostics upgrades** (e.g. W flux monitor, W density measurement, Visible camera, etc) should be also considered, the development on new real time control schemes able to actively control the actuators needed to prevent the W accumulation.
- **Self-consistent modelling** exploring the possibility of W screening at the pedestal and amount of ECRH power to avoid accumulation → ET activity
- **Specific experiments**
 - during the C ICD to assess some of the previous points.
 - experiment in other devices with a W-divertor and wall (eg. AUG) could assess some of the specificities of the JT-60SA scientific programme.



Specific modelling group in the ET



- A specific group for W modelling is being organized in the Experiment Team
- Topics to be covered:
 - What level of W expected in the plasma core of typical JT-60SA scenarios
 - W screening in the pedestal
 - W sources expected
 - Level of central heating required to control W penetration in the core
 - Damage in PFC due to plasma disruptions and RE beam
- Members of the Experiment team selected from EUROfusion, F4E, QST-Japan institutions, ITER
- With Background or workplan on W modelling
- Kick-off meeting and specific tasks being discussed in July

EUROfusion members



- Members of Experiment Team from EUROfusion in this group replied to the WPTE call for expression of interest or to A&M call
- Some members already started W modelling within EUROfusion before. This group will provide a platform to share their results with other modelers and check their coherence with the JT-60SA research plan
- This group will be managed by two JT-60SA Topical Groups:
 - T&C: Luca Garzotti
 - DSP: Tomohide Nakano