

ITER ICRH Grounding Mechanical Design Status

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Outline of presentation

- **Design Sequence**
 - A generalised list of the questions which need to be answered.
 - Clarification of specification by ITER and Physics modelling is followed by design decisions.
- **Mechanical Challenges**
 - Summary of some of the major considerations at the design stage
- **Previous work**
 - Summary of work done to date, including ongoing tasks.

Design sequence (1)

- **Location**
 - Front or 1m recessed?
- **Type**
 - Capacitive or resistive?
 - *Feasibility of manufacture vs. disruption issues*
- **Interface**
 - Unaltered flat surface or port modification?
- **Shape**
 - Cylindrical contacts or fingers/bands?

Design sequence (2)

- **Current carrying surface**
 - Solid or flexible?
- **Actuation technology**
 - Mechanical, pneumatic, hydraulic, thermal shape change, or something else?

Mechanical Challenges (1)

- **Movement in vacuum**
 - Either sliding electrical contact or flexible conductor
- **Material compatibility**
 - All but mechanical solutions have risks of leaks or possible radiation / electromagnetic incompatibility
- **Cooling**
 - Moving components
 - High currents/temperatures
 - Complex interfaces if contacts are to be replaceable

Mechanical Challenges (2)

- **Precise, reliable electrical contact**
 - Arcing
 - Self-welding
 - Electrical unpredictability if interfaces poorly defined
 - Additional conduction pathways if resistive contacts are used will cause currents and forces in surrounding components that must be considered

Previous work (1)

- **Estimation of Capacitance needed**
 - Based on previous modelling, but value of impedance will need to be $\sim 1\Omega$
- **Bellows assessment**
 - Impossible to cool with previous currents
 - Still likely to prove difficult with new results
- **Bimetallic materials assessment**
 - Part of bellows concept
 - Not suitable for that application
 - Possible uses if concept changed

Previous work (2)

- **Shape memory alloy research**
 - Ongoing work is supervised from ERM
 - Initial studies on Nitinol appear promising.
- **Concept brainstorm**
 - A long list of possible solutions, from the simple to the exotic, with strengths and weaknesses was assembled earlier in the year.
 - Recent contributions from Karl Vulliez gratefully received and added to the list, to be assessed once specifications are defined.

Conclusion

- **Once the specification, including interfaces and physics has been defined, design work can resume.**
- **Until then, concepts can be added to the list, and technologies can be assessed generally, but not specifically.**