CEI/Pedestal Breakout Session

Presented by

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DIII-D Wall Change Community Forum

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Talk summary

- **~30-35 participants, in and out due to SVR experiment**
- **Maybe half the participants spoke at least once**
  - Cannot say any real majority consensus reached, but can describe discussion points
- **Two talks cautioning against W, pro-Li and pro-SiC talk**
  - Tungsten PFC's could reduce DIII-D's relevance and uniqueness (Ernst)
  - On the irrelevance of W and other metals in the physics and operation of present tokamaks (Turco)
  - Lithium in Tokamaks (Zakharov)
  - SiC walls from a core-edge integration perspective in DIII-D (Zamperini)

Capability Gaps

- **How is C preventing us from closing FPP knowledge gaps?**
  - Intrinsic radiator, self-sput, low energy neutral profile, electron source in ped
  - If these properties are hindering for closing FPP gaps, should be explicit
- **DIII-D is not a good device to answer knowledge gap involving W core radiation**
  - At DIII-D temperatures, Kr and Xe are better proxies (already part of research program)
- **New material should create more opaque (to neutrals) SOL**
  - W does opposite, would degrade pedestal/core in DIII-D, risk to scenarios
- **What is DIII-D's priority?**
  - Prioritizing a certain research area (e.g., W walls + detachment) in material choice will likely come at cost to another area (excessive core W rad.)
  - Does changing wall carve out a unique space in this area? Open new possibilities or limit us in scope?

Alignment

- **Interest in chromium**
- **Should test neutron-resistant materials, eye towards reactors**
- **Use materials that are proxies for future reactors**
  - Even if W not solution, it may be good proxy for future materials
- **DIII-D strength is coupling simulation with extensive diagnostics – could make a significant contribution to FPP W-wall designs**
- **Emphasis on simulating impact of different materials on different FPP designs**
- **W would restrict DIII-D same parameter space as ASDEX-U, same problems**
  - Impact to key DIII-D strength (flexibility), make it less unique/relevant
  - DIII-D can do more with shape capability and scenario flexibility
- **DIII-D divertor gets the heat flux expected by an FPP wall**
- **FPP-relevant does not mean high-Z, FPP wall not decided yet**
- **Core W peaking like in DIII-D not anticipated in reactors**
  - Forces us to overcome problems that naturally will go away in ITER

Approaches and Resources

- **Could increase time for new shapes, decrease flexibility**
  - May have to send tiles to be coated
  - More time spent aligning tiles
  - Detriment to one of DIII-D's strengths

Difficulty	Material type
Easiest	Coatings
Harder	Bulk material
Hardest	Liquid metals

But thin coating of lithium would not be hard to do

- **Should not rule out low TRL materials**
- **Consider combining multiple options**
  - Some materials narrow research scope more than others
- **Discussion did not favor W as a main wall material**
  - Would make DIII-D too similar to ASDEX-U, impact to diagnostics
  - DIII-D scenarios already very sensitive to small amounts of W, may hinder multiple scenarios
  - W wall requires more reactor-relevant conditions including high T & T screening, high opaque boundary
- **Some see SiC walls as more innovative, with less impact to DIII-D core program, less hydrocarbon formation than graphite, T retention mitigation with heated tiles**

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