Summary of Core Physics Break Out Group Discussions on DIII-D Full Wall Change Out

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Summary (1/2)

- **Closing core physics research gaps is *not* the strongest driver for a wall change out**
  - Gaps for Divertors, PMI, CEI understood to be more of a "customer"
- **Consensus that SiC would be good to try for the Main Chamber**
  - *SiC would be unique contribution, even if result is negative*
  - *Caveat: for optimal core diagnostics, "do nothing" is still easier*
- **No consensus on a divertor material, but agreement that it would be good to test a SiC ring in the divertor before a full wall change out**
- **No consensus that "do nothing" is an OK approach for core physics gaps**

- **With any new wall & divertor materials, the key opportunities for closing core gaps include:**
  - Mapping of core operational space achievable, especially with balanced NBI/low torque and use of 3D/RMP coils not found on other tokamaks
  - Assessment of DIII-D high-performance scenarios, especially steady-state scenarios, with new wall materials: are they resilient?
  - Development of new control techniques to maintain/recover lost performance
  - Demonstrating that DIII-D advanced scenarios long criticized for being done in carbon still work with other wall materials

Summary (2/2)

- **Metal walls (e.g., W) will incur a major cost to core diagnostics**
  - Without low-Z impurity (e.g., C), CER will need a lot of work, and maybe active seeding, all for still poorer data quality
  - Reflections would be a big problem for MSE
- **Metal walls would likely make spin polarized fusion program impossible (funded project)**
  - Need Ti~10 keV to do this physics, concern it's not possible with high-Z impurities
  - Recycling at a W wall would depolarize the nuclei and limit max measurable lifetime
    - *But SiC would be ok, like carbon*
- **Metal walls would increase ability to study fast ion loss sourcing of W, important for ITER, but reduce ability to study EP physics generally with IWL, low-density, high-power**
- **Have clear examples of DIII-D scenario development being hindered by W, & other examples where scenarios look more resilient**
  - Balanced-NBI IBS radiative collapse with C_W the same as predicted in ITER, where ITER would not collapse because of lower radiative loss rate at higher temperature
  - High-beta-poloidal plasmas with betaN~3, H98~1.25, q95~6.5, 2tauR, on W rings, ctr-210.
- **DIII-D scenarios that fail with W may not fail in ITER/FPP**
- **DIII-D scenarios shown to be resilient to W increase confidence they'll work on ITER/FPP**
- **Core high-Z impurity transport model validation is easier to do with controlled injections/LBO in a non-metal wall (metal wall complicates analysis), but –**
- **Impurity puffing/injection probably insufficient for full scenario development because doesn't include all the real interaction physics, and not obvious how to handle the access phase**

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