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Establish heat transmission pathways in high-Z reference shape

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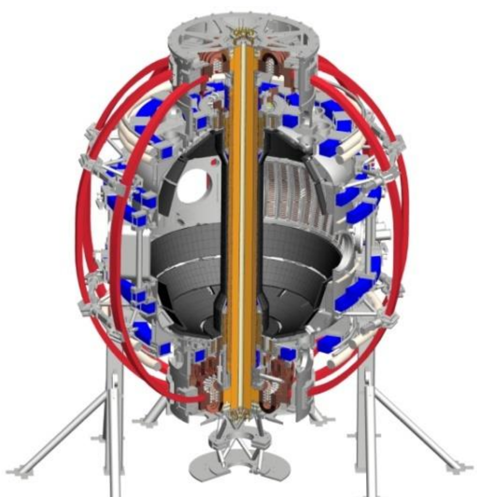

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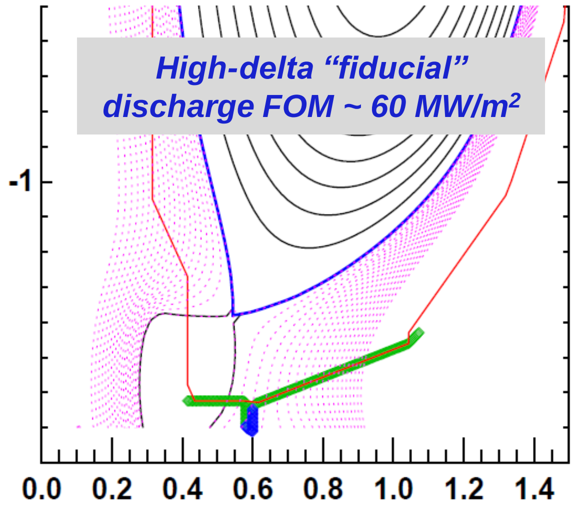
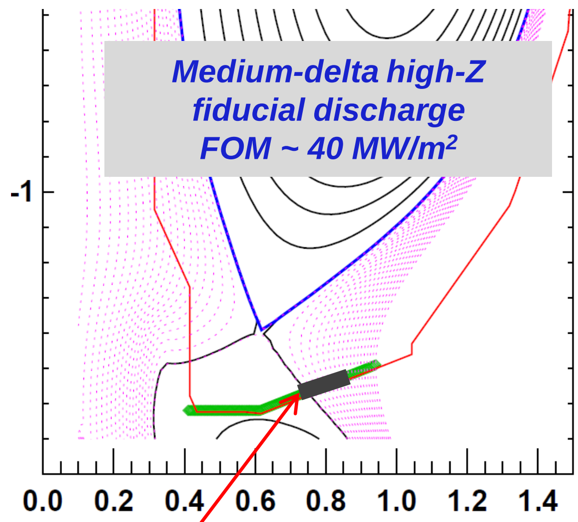
Two-fold purpose: Establish and understand heat flux to PFCs to enable relevant assessment of high-Z design

- R16-2: assessment of high-Z PFCs
  - Eventual upgrade of inboard divertor requires assessment of high-Z design
  - Large operational experience will be created by operation in “standard high-delta shape”
  - Need to create similar heat-fluxes and plasma-conditions to make assessment of future upgrades
- This XP will establish range of heat-fluxes available for FY16 tests
- This XP will also seek to understand transition toward isotropic heat fluxes at high-density



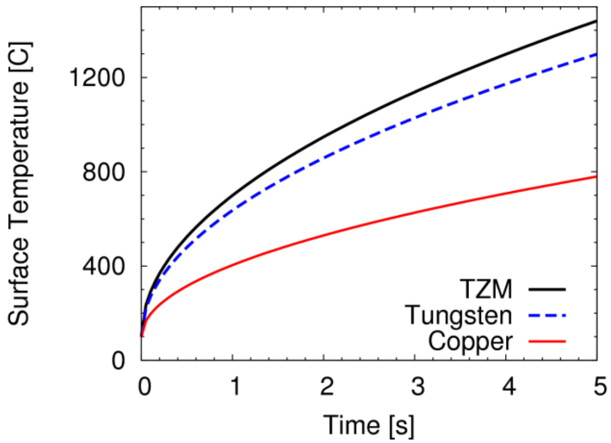


Row 2 Tile location

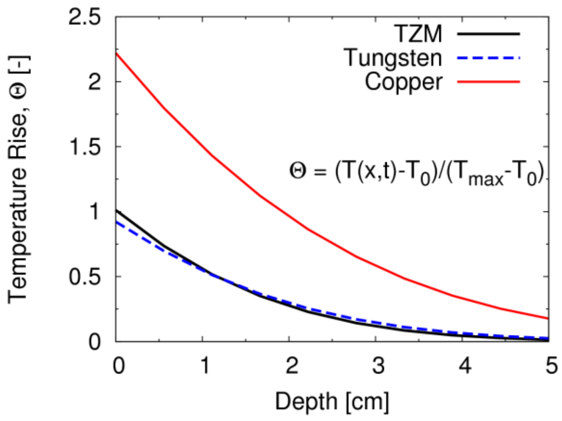
Peak heat flux and time on target will determine range of experimental temperatures available for next year

- Temperature rise roughly proportional to $q^*t^{1/2}$
  - Maximum set by recrystallization temperature
  - Actual temperature will be higher than semi-infinite estimate shown at right
- XP will determine maximum heat flux available
  - Establish high-Z shape
  - Increase power in steps to determine stability limits (ISOLVER + 0D analysis predicts ~9MW for betaN=4.5)
  - Determine peak heat flux over time for discharge
- This portion provides tests of:
  - ISOLVER+0D analysis as "design tool"
  - Usage of unmitigated heat-flux as "figure-of-merit"

Unmitigated temperature rise
$q = 10$ MW/m^2

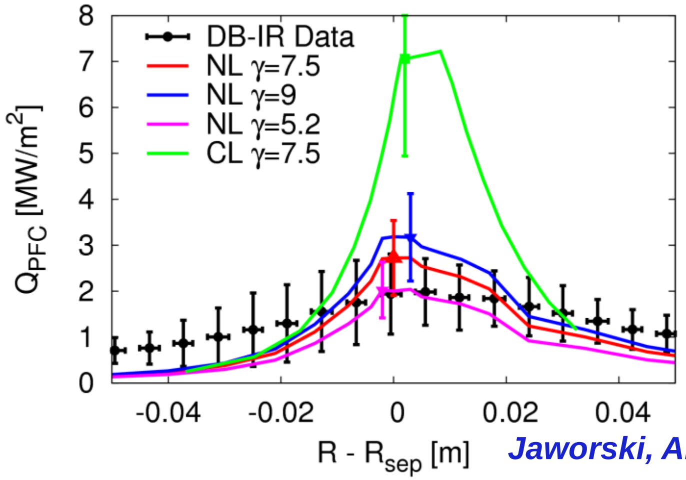


Recrystallization limits



Energy pathways will be analyzed to understand transition to isotropic heat flux

- Heat flux composed of:
  - Charged particle flux (B-aligned)
  - Neutrals (isotropic)
  - Radiation (line of sight)
- Leading edge effects could be mitigated by detachment
  - Leading edges suggest ramped tiles (eliminates reverse Bt)
  - Strong detachment will transition toward isotropic heat flux
  - High-density/detached operation expected for mitigated high-delta
  - Previous work shows breakdown of fluid theory in these cases
- This portion of XP will then:
  - Utilize divertor gas-puff (D2) to raise density at high-power
  - Establish high-recycling/detached conditions and test kinetic target plasma model
  - Provide initial heat-flux mitigation scenario

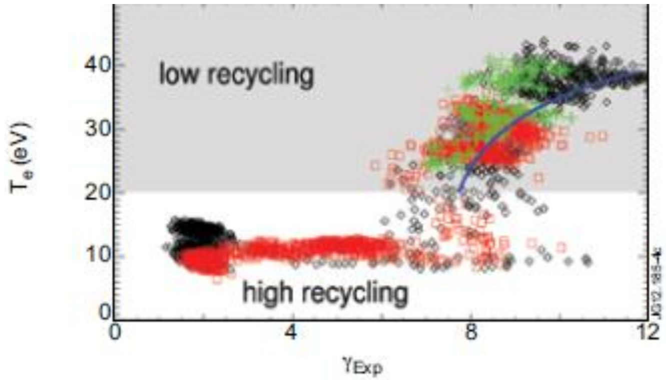


Jaworski, APS2011

Predicted criterion for valid use of fluid-theory

$$T_e^{3/2} \gtrsim \frac{10^{18} q_\parallel}{\kappa_0 n_e}$$

JET Divertor



Marsen, JNM 2013