# Divertor Options for ARIES-AT: Initial Considerations

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# ARIES-AT Divertor(1)

- Compatibility with Blanket Configuration

- Structural Material
  - SiC/SiC thickness < 1mm ($\sigma th \sim 235$ MPa and $\Delta T_{SiC} = 250°C$ for $q'' = 5$ MW/m$^2$)
  - W with thin SiC insert with or without structural function

- Possible Concepts

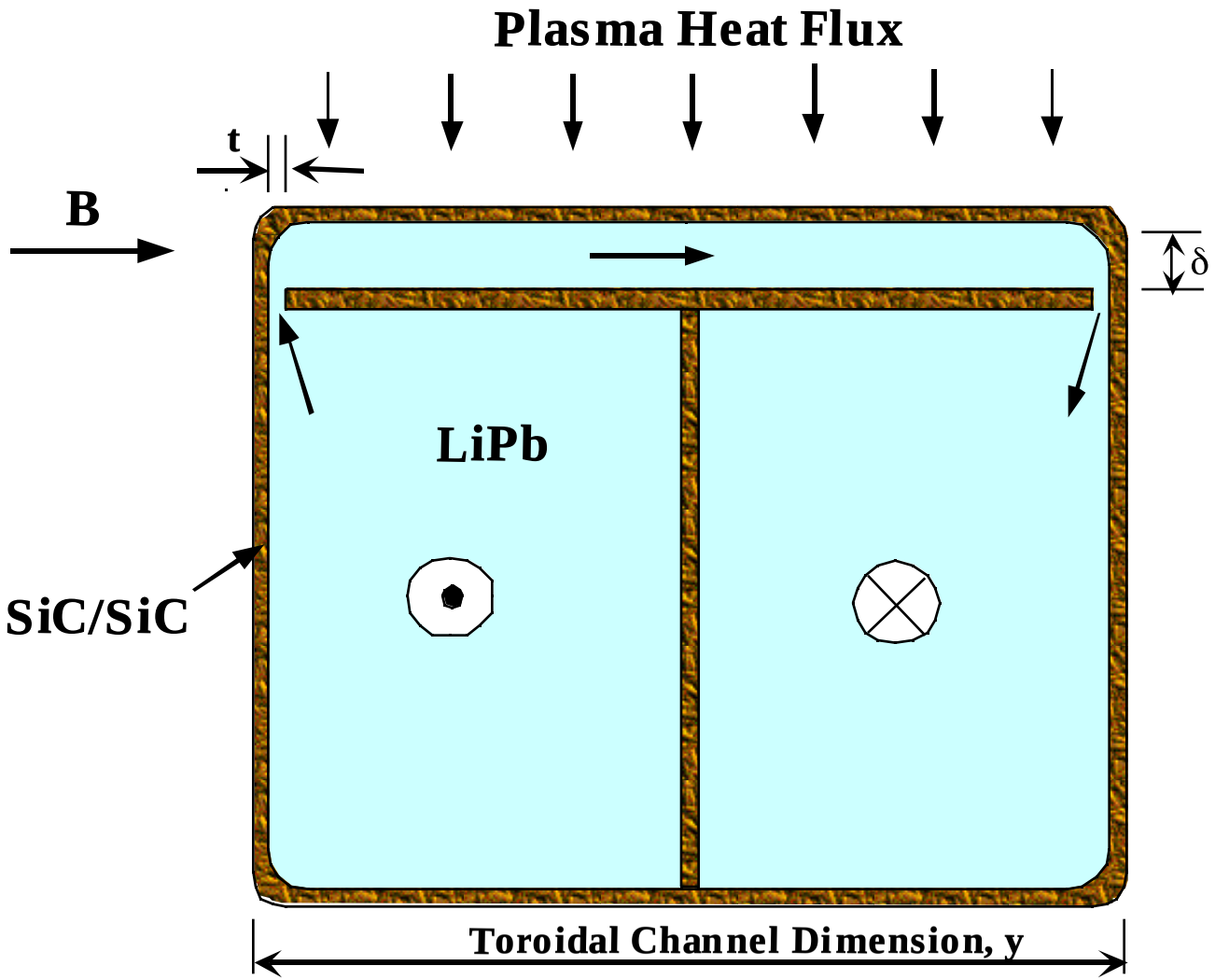
  - Dry Wall
    - Porous W HX concept with He coolant as in ARIES-ST
    - LiPb as coolant (Preferable to avoid in-reactor high pressure He but needs innovative scheme because of poor heat transfer removal capabilities)
    - Phase-change liquid metal (Li)

  - Liquid Wall (Sn-Li)

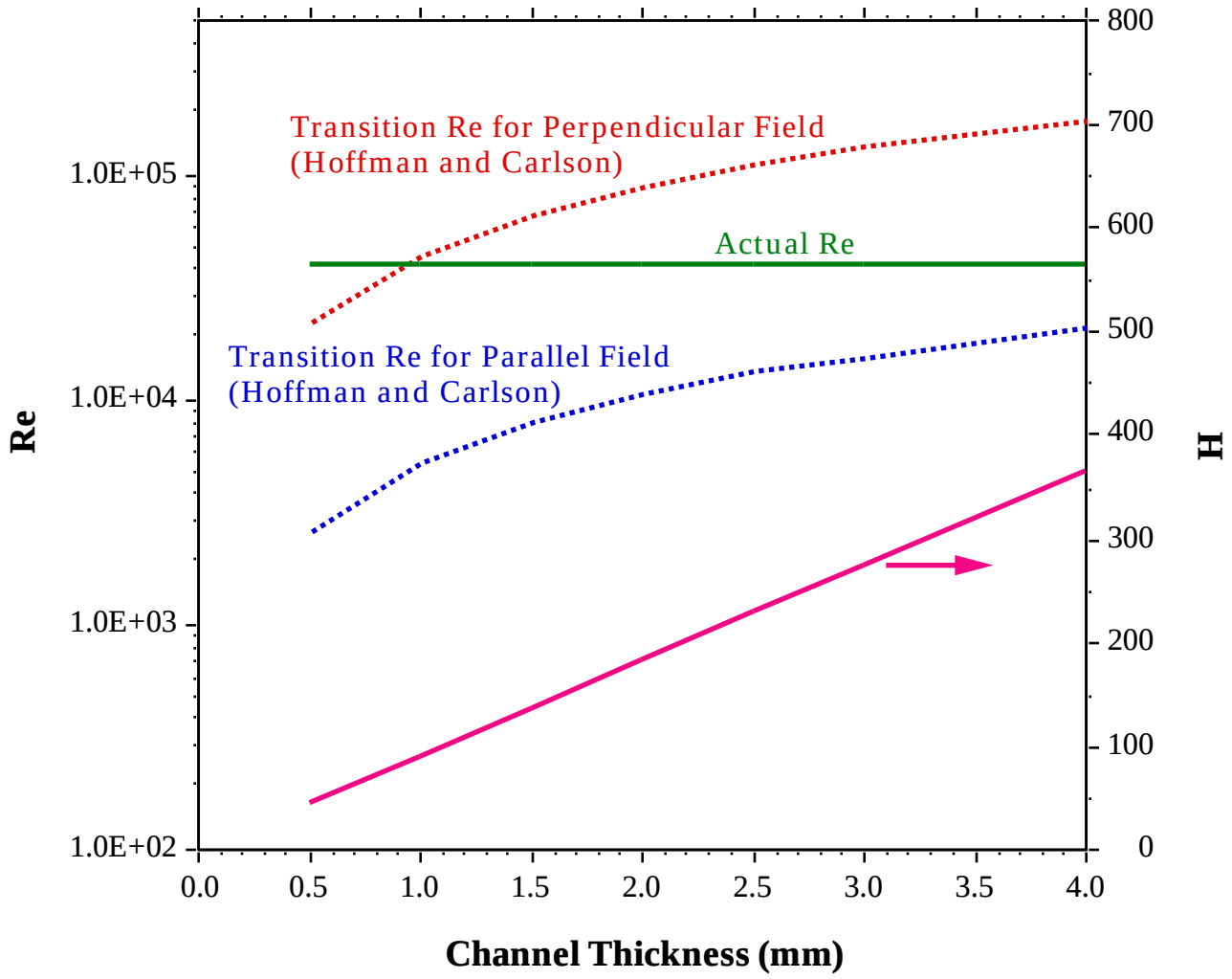
# ARIES-AT Divertor(2)

- Better Definition of Design Requirements
  - Plasma edge modeling
  - Fraction of radiated transport power back to FW
  - Maximum heat flux and footprint
  - If no inboard slot, heat flux to which inboard PFC must be designed locally

# LiPb Poloidal/Toroidal Flow for ARIES-AT Divertor



# Hartmann and Reynolds Numbers as a Function of Divertor Toroidal Channel Thickness



# LiPb Velocity and Effective Heat Transfer Coefficient as a Function of Divertor Toroidal Channel Thickness

**Series Flow through Upper and Lower Divertor**
**Total LiPb Flow Rate = 29,300 kg/s**

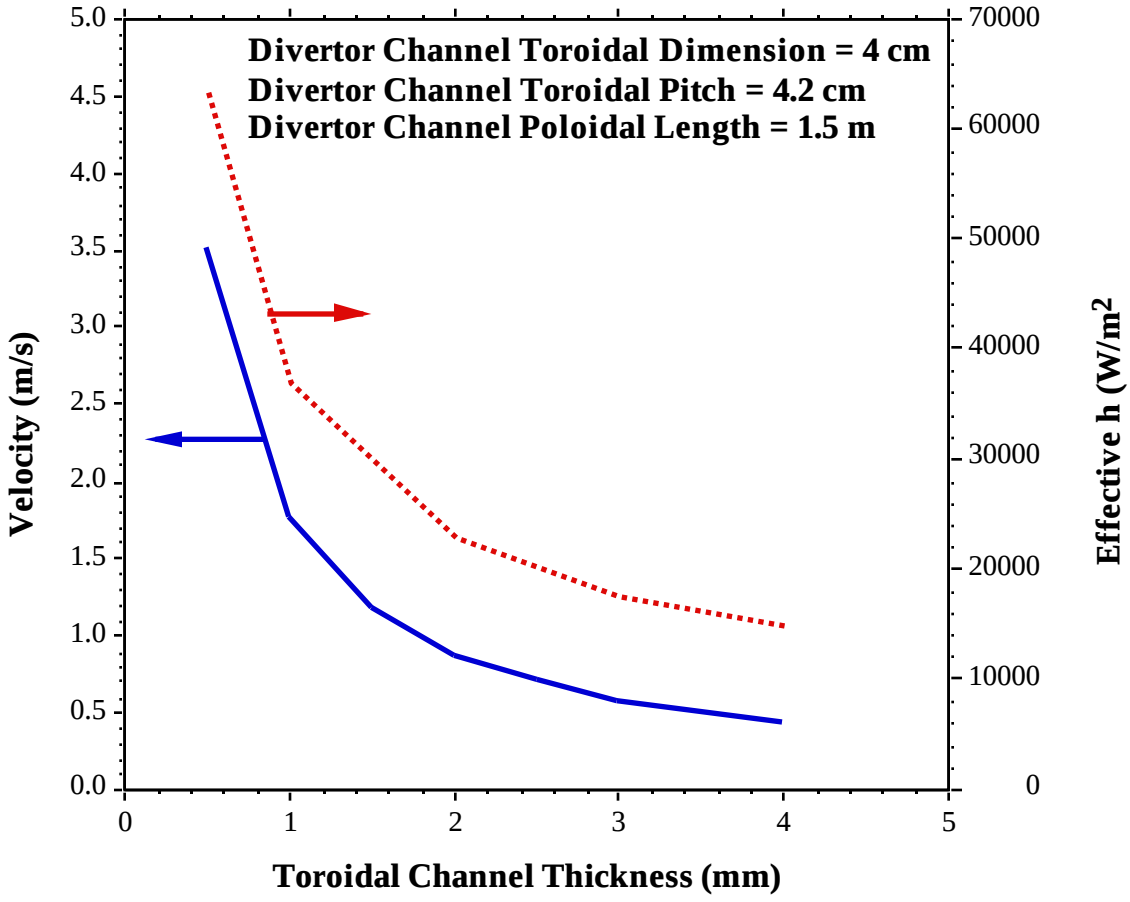
***Example Calculations:***

**$q''_{div}$ = 5 MW/m$^2$**

**$\Delta T_{SiC}$ = 250 °C for 1-mm thickness**

**$\Delta T_{film}$ = 135 °C for h = 37,000 W/m$^2$-K**

**$T_{wall}/T_{max,SiC}$ = 785/1035 °C**



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