

# Needed Info for Neutronics and Shielding Analyses

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Fusion power, R, and a (from Strawman)  
(to determine n wall loading distribution  
and heat load to in-vessel components)

R. Miller

SiC burnup limit (is it 3% or more?)  
(to determine thickness of inner blanket  
and FW lifetime)

M. Billone

Comparison between fabrication costs of  
“FS shield with WC filler” and “FS shield”  
(to determine IB shield thickness)

L. Waganer

Composition and dimension of  
HT magnet and cryostat  
(to finalize shield design)

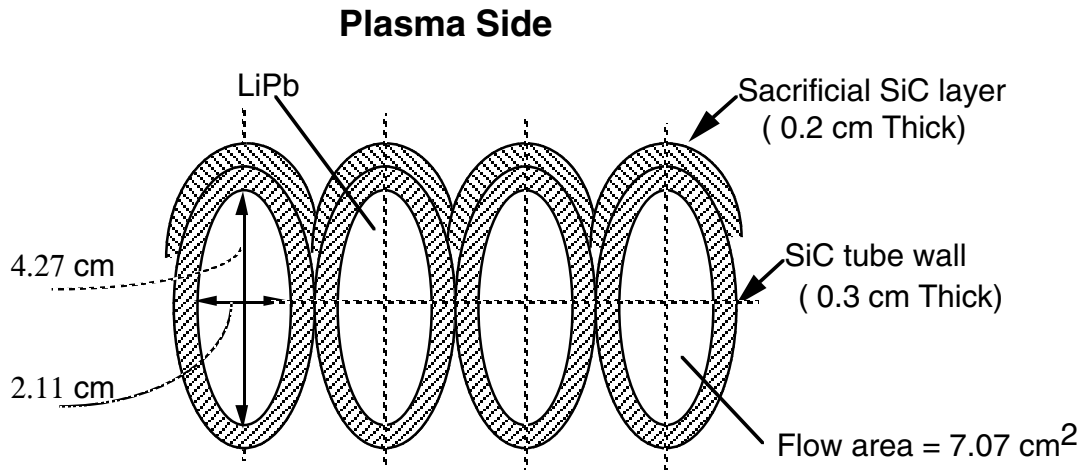
L. Bromberg

Preliminary divertor design  
(to determine vertical build)

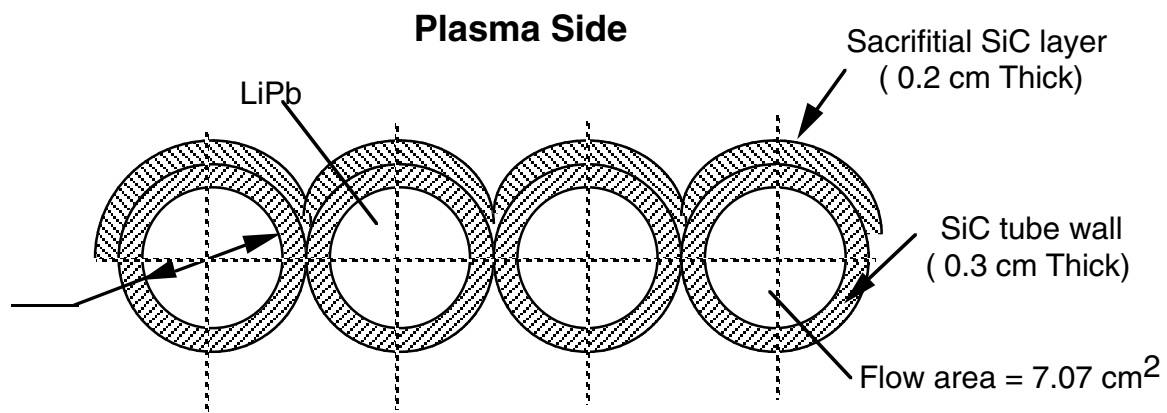
M. Tillack/  
R. Raffray

Info needed to update neutronics/shielding analysis and provide to engineering group the blanket and shield dimensions/compositions, nuclear heat load for thermal hydraulic analysis, input for activation and safety analysis, and radial builds for strawman and CAD drawings.

# LiPb-Cooled First Wall Design for ARIES-AT



## Elliptical Tubes at ends



## Circular Tubes at midplane

**Figure 1. Horizontal cross section through FW at midplane and at top/bottom**

# LiPb-Cooled First Wall Design for ARIES-AT (cont.)



It has been agreed with R. Raffray's concurrence that the **first wall in ARIES-AT would be LiPb cooled**. The original first wall design as presented by UW would not stand up to a seismic event. A new design consists of a connected wall of tubes running poloidally with **coolant flowing upwards**. To accommodate the OB blanket, the tubes are circular at the midplane and elliptical at the upper and lower ends with the narrow end facing the plasma, as shown in [Figure 1](#). **The flow area along the whole length is maintained constant, to keep the velocity uniform**. The dimensions of the ellipses have been determined with that consideration. The [table](#) below gives some parameters of the tubes.

|                                               | Midplane | Ends        |
|-----------------------------------------------|----------|-------------|
| Inner dimension of tubes (cm)                 | 3.0      | 2.11 x 4.27 |
| Thickness of tube walls (cm)                  | 0.3      | 0.3         |
| Flow area/tube (cm <sup>2</sup> )             | 7.07     | 7.07        |
| Thickness of sacrificial layer (cm)           | 0.2      | 0.2         |
| Overall thickness (cm)                        | 3.8      | 5.07        |
| Gap between FW and blanket (cm)               | 0.3      | 0.3         |
| Thickness of FW + gap (cm)                    | 4.1      | 5.37        |
| SiC fraction in FW (excl.gap) (%)             | 28.55    | 28.29       |
| LiPb fraction in FW ( “ ) (%)                 | 51.67    | 51.49       |
| Void fraction in FW ( “ ) (%)                 | 19.77    | 20.23       |
| LiPb velocity in OB FW (m/s)                  | 2.73     | 2.73        |
| Equivalent diameter (cm)                      | 3.0      | 2.46        |
| Re                                            | 8.97e5   | 7.33e5      |
| Nu                                            | 35.08    | 30.91       |
| Heat trans. Coefficient (W/cm <sup>2</sup> K) | 2.4      | 2.1         |