Design and analysis of the IFMIF-EVEDA Beam Dump cooling system

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The IFMIF-EVEDA Beam dump is designed to cope with a 9 MeV, 125 mA continuous wave deuteron beam that deposits along its surface a total of 1.125 MW. The beam dump consists of two coaxial cones of 2.5 meters length and 30 cm of aperture diameter. The cone is cooled by a high velocity deionized water mass, that flows through the annular space conformed between both cones. The outer one is conformed by four truncated cones of slightly different slopes. The geometry has been chosen in order to obtain the adequate channel width that guarantees the needed heat transfer coefficient values (**figure 1**).

A one dimension simulation code has been developed in order to design the cooling circuit and analyze the velocity, temperature, pressure, vibration and critical heat flux along the beam dump cooling channel.

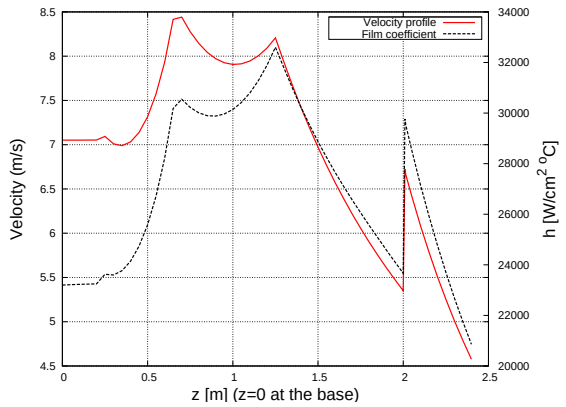

Figure 1: Film coefficient and velocity profile

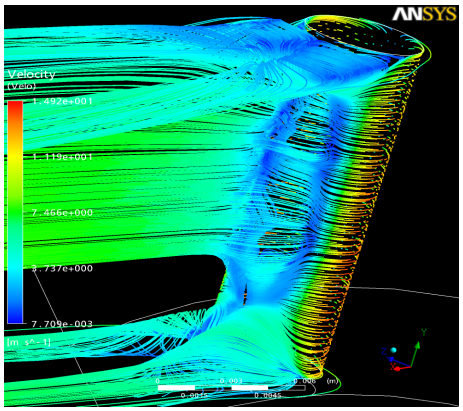

Figure 2: CFX thermocouple analysis

In order to evaluate the behavior of the flow at certain critical points such as the cone tip, the water return at the cone base, or the effect of thermocouples placed perpendicular to the flow, 3D fluid dynamic calculations with CFX codes have been performed (**figure 2**).

In this paper the beam dump cooling system will be briefly described, and the relevant 1D and 3D results will be presented, paying especial attention to the computational fluid dynamics results.