SLC AND NLC POSITRON TARGET DESIGN

ISG5 MEETING, SLAC

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SCHEMATIC OF TARGET

Cooling Tubes (5/16" or 3/8" O.D.).
Water Flow Rate = X to Y GPM.
Supply Water at 200 PSIG, 100 Deg. F.
Return Water at 75 PSIG.

Silver (Ag) or Copper (Cu) encapsulation of cooling tubes for high conductivity heat conduction path from Tungsten/Rhenium Target.

Target Drive Shaft: Stainless Steel with water passages for supply and return cooling water to the target cooling loop.
* Assuming infinite speed rotation and circular coolant channels, an estimate of coolant channel wall temperature was made.

* Beam power of 23 KW assumed.

* Wall temperatures of 290 F are estimated.

* Subcooled boiling is predicted

* Two-phase flow instabilities not likely

* DNBR not very large.
NLC TARGET COOLANT CHANNELS MAY BE RECTANGULAR SHAPED

* The sketch shows a possible arrangement of coolant channels. Instead of two round channels, numerous rectangular channels spaced closer and more evenly around the heat source are being considered.
The target will be cooled by conduction heat transfer to water cooling channels.

- Hand calculations will be made to estimate temperatures in the target.

- Three-dimensional finite element computational models will be made to more accurately determine expected temperatures in the target.
The thermal stresses expected in the part will be modeled using a coupled conduction heat transfer and structural analysis code.

- The time dependent and spatially dependent aspects of the beam energy deposition in the target will be modeled.

- A three dimensional simulation will be attempted

- Heat transfer to the coolant channels will be modeled using Nusselt number correlations for convective heat transfer in rectangular channels
The rapid deposition of heat in the target will result in pressure waves in the target material.

A hydro-code (LS-DYNA) will be used to model the rapid heat deposition from the beam and the resultant pressure waves and material stress.