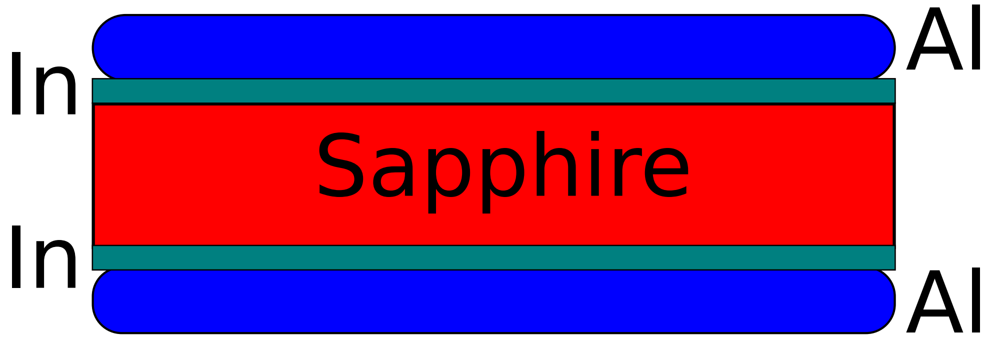
Assume a cold head diameter 7 cm at roughly 2 K. This cold head sees directly room temperature through a 7 cm diameter hole.
Assuming an emissivity of $\epsilon = 0.5$ we get with

$$\dot{Q} = \frac{\epsilon_1 \epsilon_2}{\epsilon_1 + \epsilon_2 - \epsilon_! \epsilon_2} 5.7 \times 10^{-12} A[cm^2](T_{amb}^4 - T_{cold}^4) = 0.177\,\mathrm{W}.$$



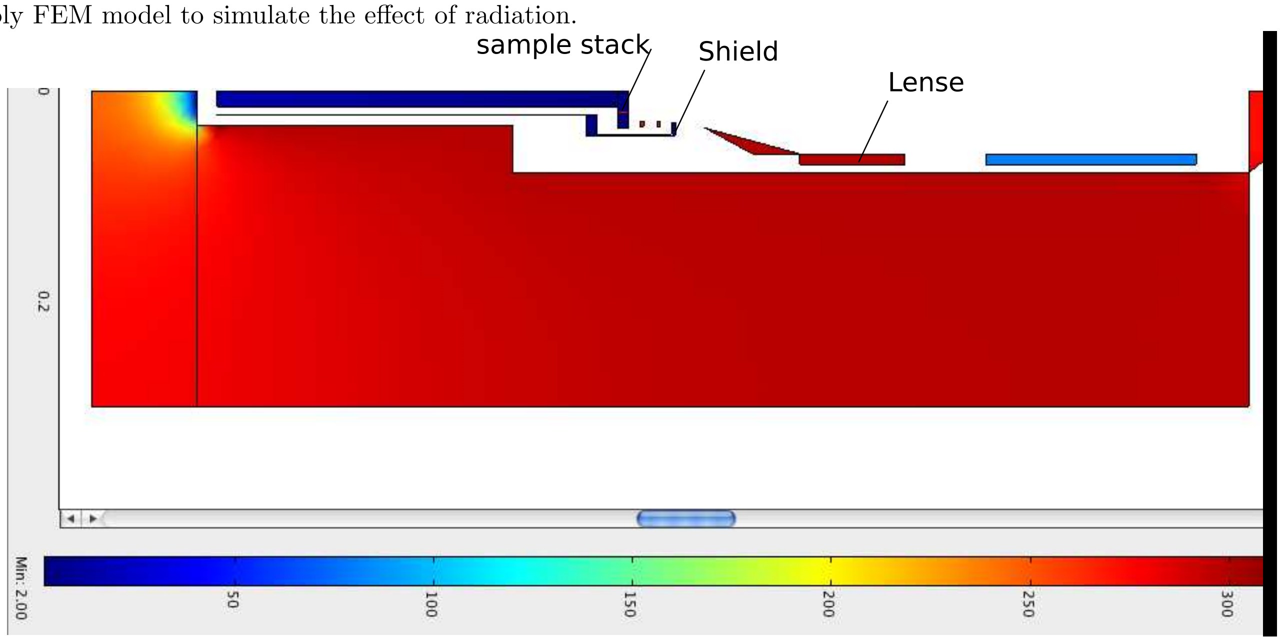
Check the temperature gradient in the sample plate. This plate is a sandwich of Aluminum - Sapphire - Aluminum with a thin layer of Indium in between each interface. The Alumium plates are about 3 mm thick and the Sapphire 5 mm. Thermal conductivity of the Materials:

Material	κ [$\mathrm{Wcm^{-1}K^{-1}}$]	$\kappa * d$ [$\mathrm{Wcm^{-2}K^{-1}}$]
Al	2.0	6.6
AlO_2	0.36	0.72
SiO_2	0.6	1.2

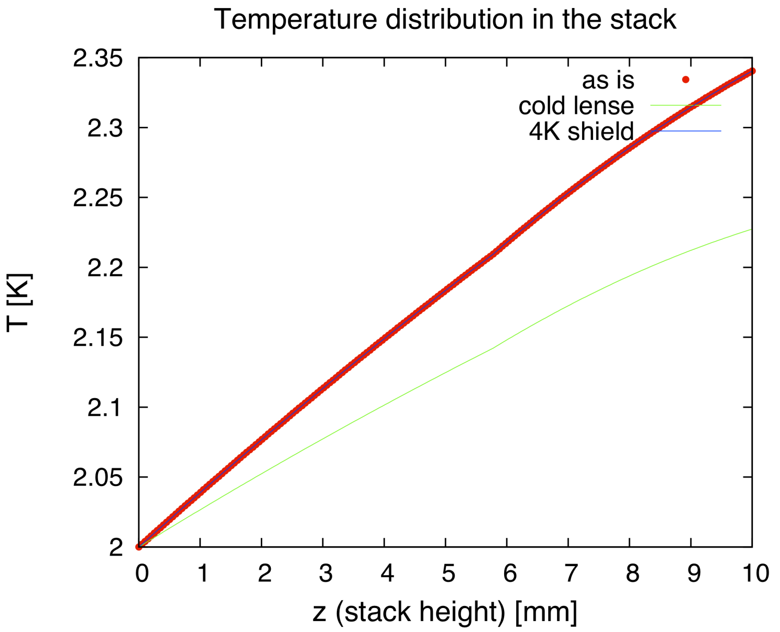
When comparing with the Kapitza resistance of an Indium-Sapphire interface $R_K = 28\,\mathrm{Kcm^2W^{-1}}$ one realises that this is the dominating restriction of the heat flow.
With the given radiation heat the temperature gradient accross the sandwich can be estimated to

$$\Delta T = \dot{Q} 2 R_K A^{-1} = 0.36\,\mathrm{K},$$

where A is the cross section of the sandwich.
To cool the radiation power away the cooling power of the cooler has to match $\dot{Q} = L\dot{n}$, where $L = 90\,\mathrm{J/mol}$ is the latent heat of evaporation and $\dot{n}$ is the flow. We find $\dot{n} = 2^{-3}$ mol/sec that is 0.21 l/h of liquid Helium.
Apply FEM model to simulate the effect of radiation.



The Temperature gradient can be reduced by ca. 25% if the lense is cooled to 80K.



Question:

1 . What is the temperature difference between Al at top and bottom when top sees RT?

2 . What heating power is needed to establish that gradient?

3 . What's the temperature of the radiation shield?

A 3. The radiation shield cools to about 20K. That's in line with the estimates.