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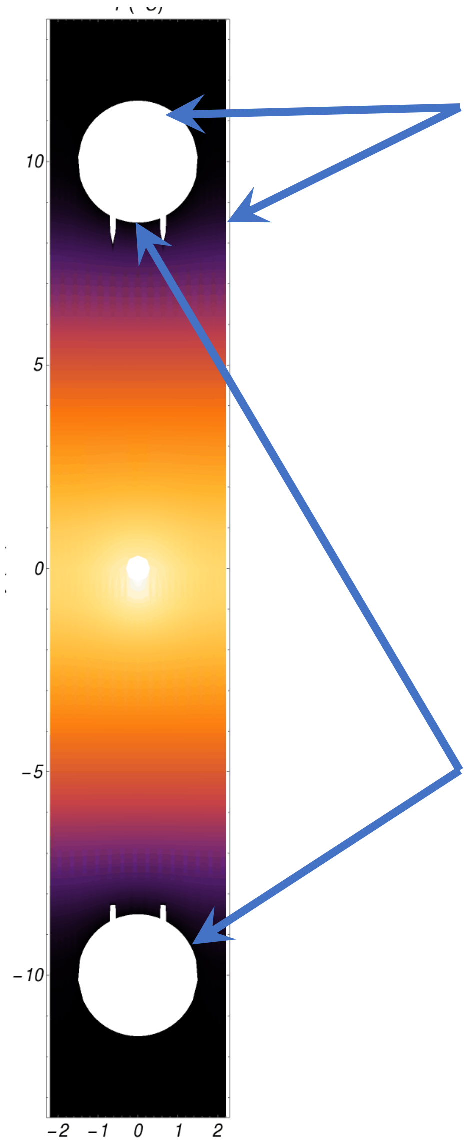
TEMPERATURE EVALUATION FOR KLCPS61 MODEL

Presented method

- The goal of this method is to obtain temperature distribution estimates for the CPS core using a quicker method than full ***ANSYS***
  - Only concentrate on the copper core area to get 3D solutions for the equations in a uniform medium.
- Use Poisson's equation with boundary condition to determine the T-distribution.
  - Use finely binned data from FLUKA simulations by Pavel.
  - The solutions for the equations are assumed to be time-independent.
- Solve the equations using ***Mathematica*** software.
  - JLAB owns license for CUE Linux machines.
  - Can solve Poisson's equation in both Cartesian, Spherical and Cylindrical coordinates.
  - Small details like small 2mm cuts e.t.c. are ignored in geometry.
  - Assumes heat exchange at the boundary with the cooling water which is at some average temperature.
  - Water flow is assumed to be sufficient.
- At this point the warming of the water in the pipes is not taken into account
  - Use effective temperature.
- Already checked against Tim's ***ANSYS*** calculations for many KLF heated items.



$\nabla T \cdot \mathbf{n} = 0$
Neumann boundary conditions

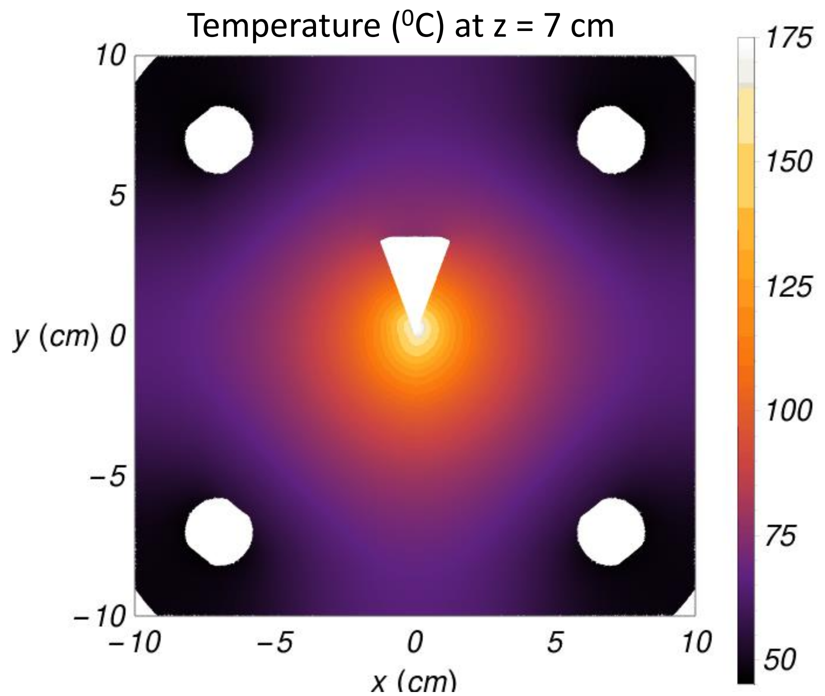
$T = T_0$ Dirichlet boundary conditions
or
$\nabla T \cdot \mathbf{n} = \frac{\alpha}{\kappa}(T_w - T_c)$
Robin boundary condition

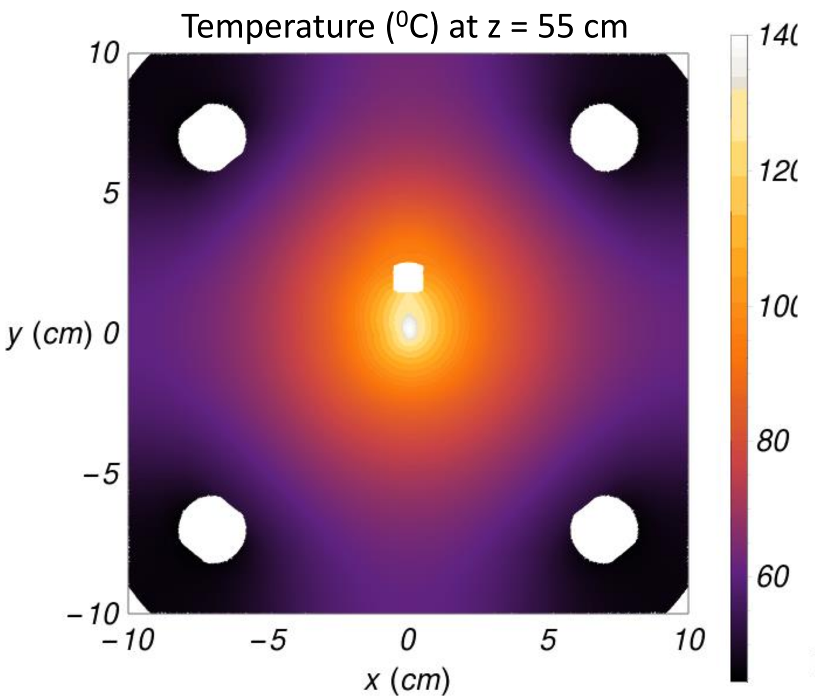
used $k = 385 \ \frac{\text{W}}{\text{K m}}$

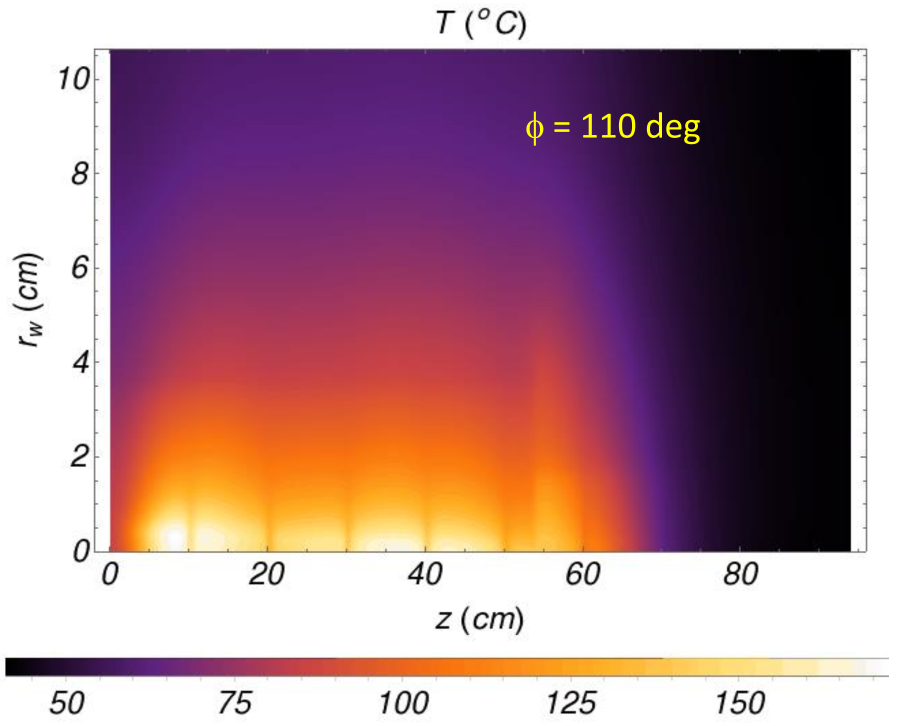
used $\alpha = 5000 \ \frac{\text{W}}{\text{K m}^2}$

$$-\nabla^2 T(x,y,z) = \frac{1}{k}\, q\,(x,y,z)$$

$$-\nabla^2 T(r,\phi,z) = \frac{1}{k}\, q\,(r,\phi,z)$$

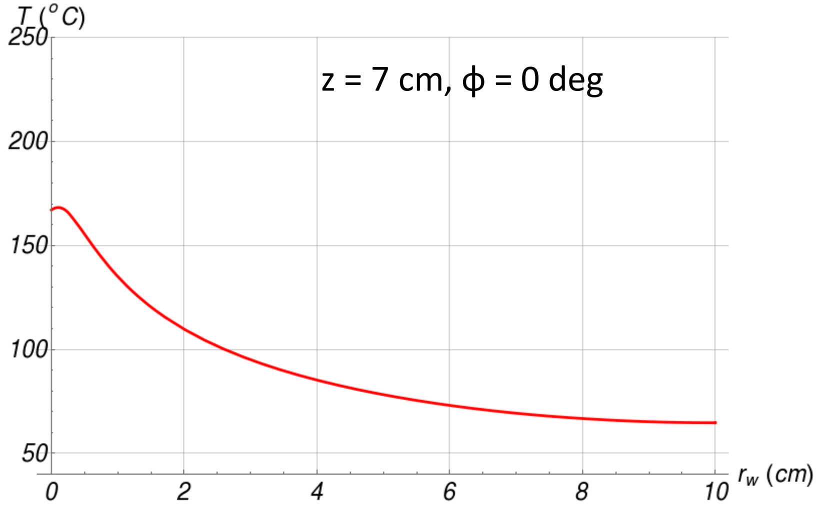


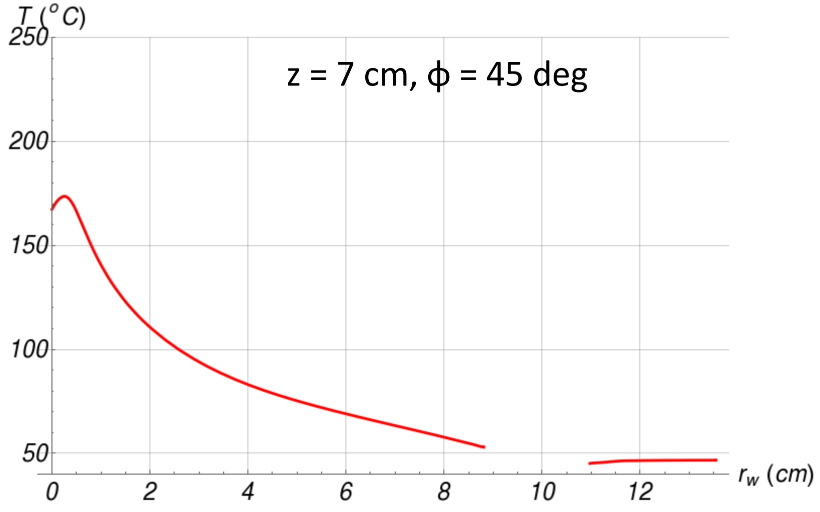


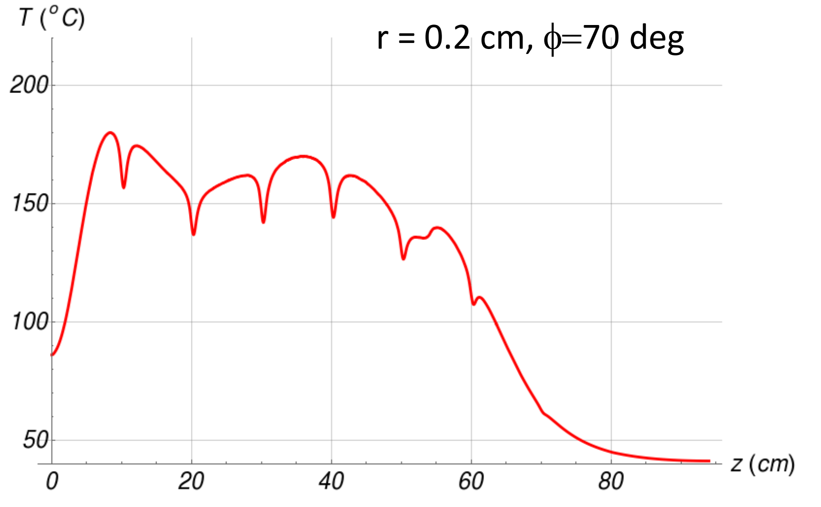


- More even heat deposition and temperature distribution in Z than in KLCPS59.
- Maximum temperature is about $T_{max} \approx 175\ ^0C$.
- Temperature at the water-to copper interface is about 50 ^0C.

- Temperature at the surface of the sides of the absorber is about 65 ^0C.
- The temperatures are lower than those for KLCPS59 model.

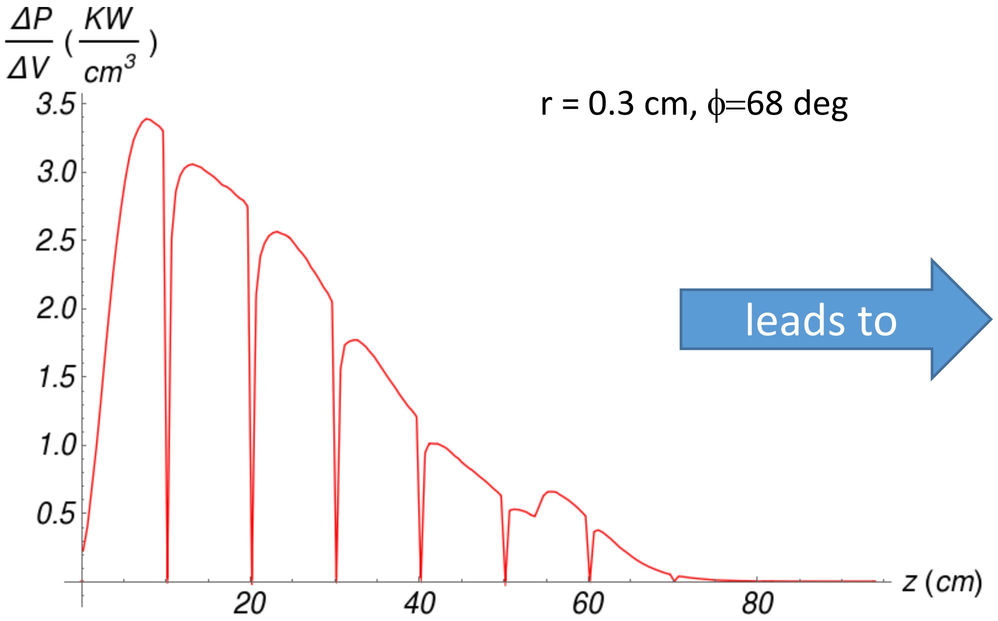






Comparison with KLCPS59

KLCPS59



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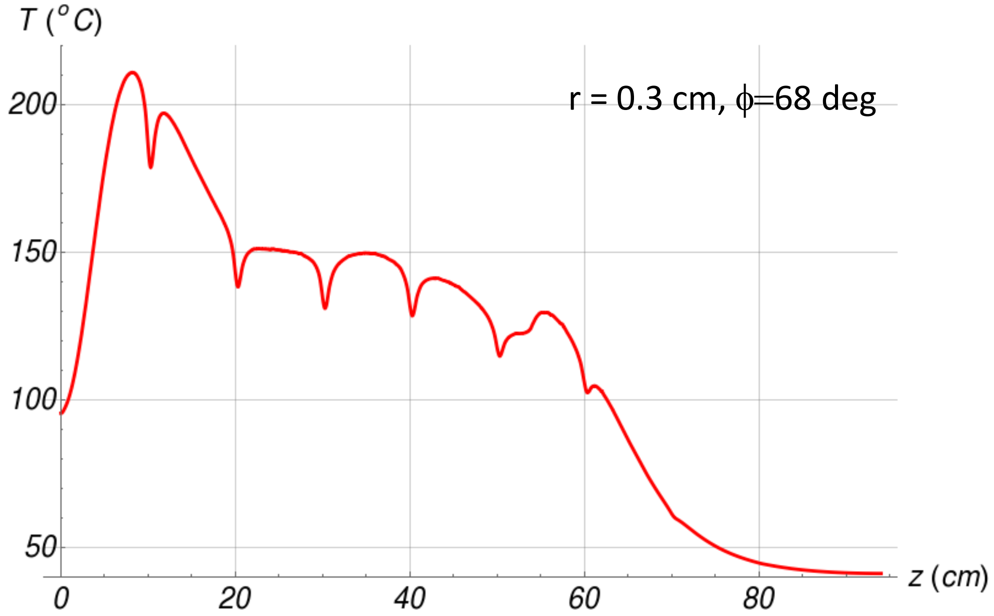
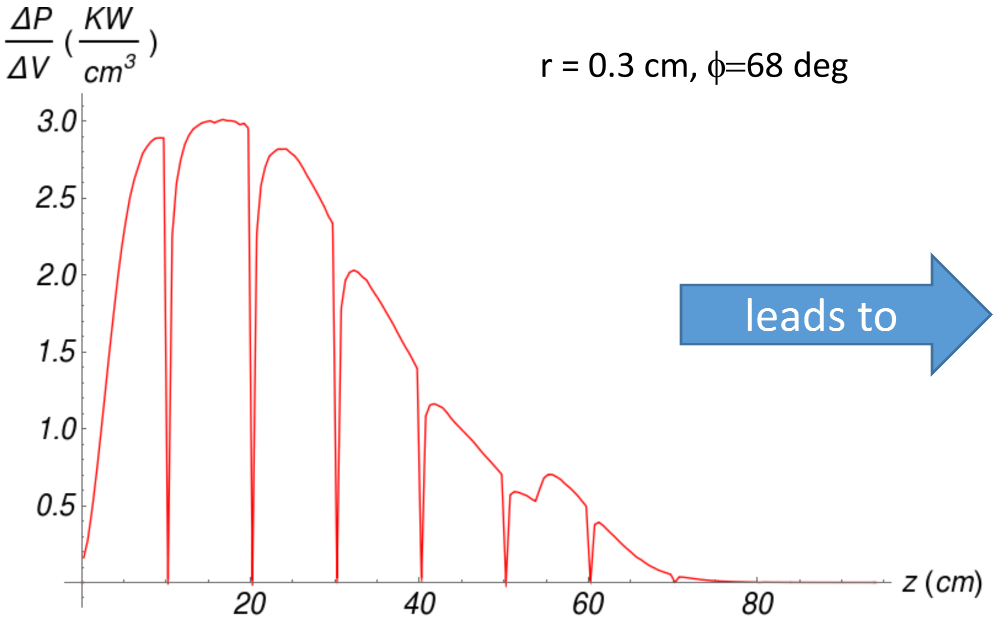


KLCPS61



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