**Introduction:** This poster presents the optimized design and simulation of a waveguide applicator has been presented for superficial microwave hyperthermia. The 3D modeling of the waveguide applicator is performed and the performance is verified by analyzing the resistive heating and temperature distributions in muscle like phantom.

**Computational Methods:**
Waveguide design equations:
\[ a = \frac{1}{2f_c \sqrt{\mu_0 \mu_r \varepsilon_0 \varepsilon_r}}; \quad b = \frac{a}{2}; \quad \lambda = z = \frac{1}{f_c \sqrt{\mu_0 \mu_r \varepsilon_0 \varepsilon_r}} \]

SAR(Specific Absorption Rate):
\[ \text{SAR} = \frac{\sigma E^2}{\rho} \quad \text{(W/kg)} \]

Bio-heat equation:
\[ \delta s \rho c \frac{\partial T}{\partial t} + \nabla \cdot (-k \nabla T) = \rho_b c_b \omega_b (T_b - T) + Q_{\text{met}} + Q_{\text{ext}} \]

**Modeling in COMSOL Multiphysics:**
The dimensions of the waveguide are 60 x 30 x 58 mm. A water bolus which is 20 mm thick is placed between the waveguide and the surface of agar jelly muscle phantom.

**Results:**

At operating frequency of 404 MHz S11 reaches a minimum of -26.7 dB indicating good impedance matching. The applicator frequency bandwidth (S11 < -10 dB) is 57 MHz (from 371 MHz to 428 MHz)

**Conclusions:** A 3D model of waveguide applicator presented here for hyperthermia treatment also performs the analysis of the distribution of electric field along with the resistive heating distribution. Finite element full-wave modeling has been performed to predict to a high degree of accuracy the performance of 3D model of the applicator. In the next step of research the formulation of 3D model will be done for several tissue types.

**References:**