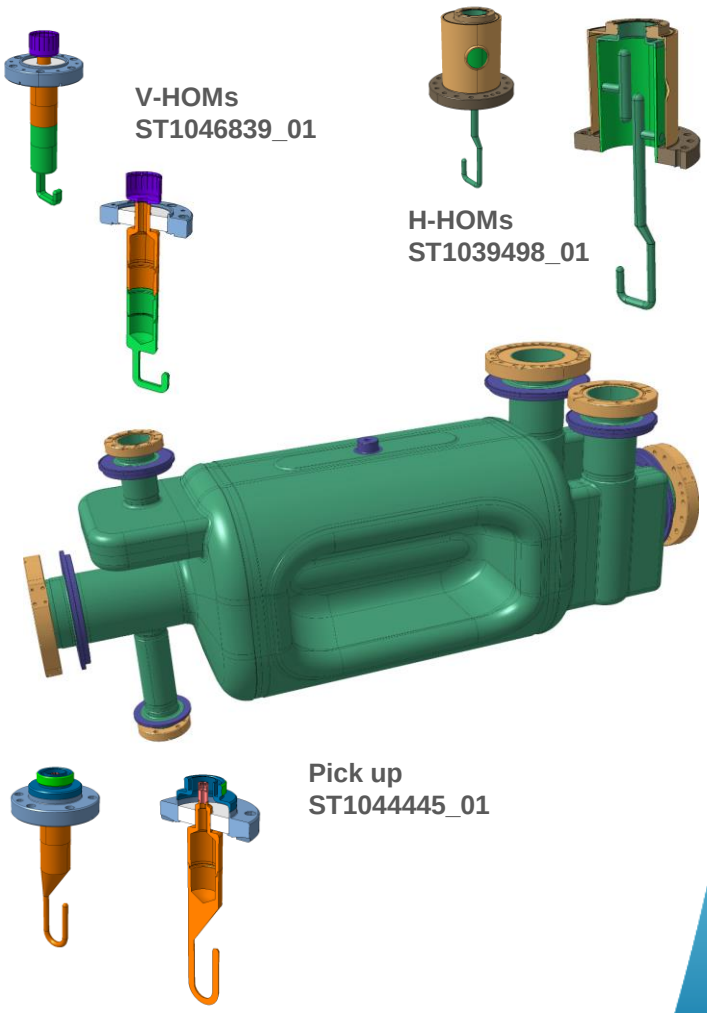
RFD cavity antennae
Thermal evaluation of pickup and HOM antennas

Eduardo Cano
CERN, EN-MME

Introduction

- RFD presents a vertical pickup antenna, VHOM and HHOM.
- Last models provided by Teddy – 25 Ohm
- Thermal evaluation:
  - Pickup in copper
  - VHOM in copper body + Nb hook – Effect of moving the Nb boundary
  - HHOM in Nb
- Thermal evaluation accounting for the temperature-dependency of material properties



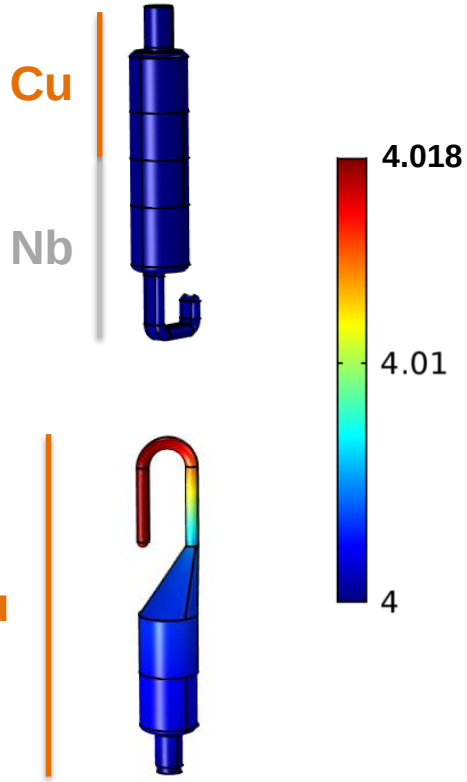
Numerical conditions

- Material properties – Electrical and thermal conductivities **dependent with temperature**
  - Initial temperature of 4 K
  - Energy 18.74 J ~ 4.5 MV
  - Niobium thermal conductivity: Padamsee
  - Niobium electrical conductivity: James Mitchell data – 20 nOhm
  - Copper thermal conductivity: Cryocomp RRR90
  - Copper electrical conductivity: Calculated so that Rs=1 mOhm **(constant** as it is constant in the 2 K – 9 K range)

Thermal analyses – Nominal design

PU & VHOM

Surface temperature [K]



Heat loss PU = 3.2 mW
VHOM = 0.14 mW

HHOM

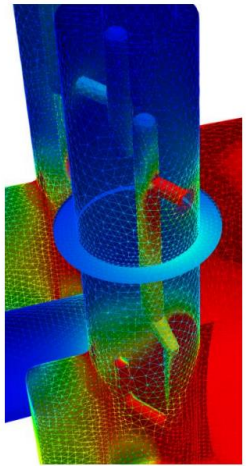
Copper gasket **not included** in the calculation

Comparison with previous results
Further analysis needed

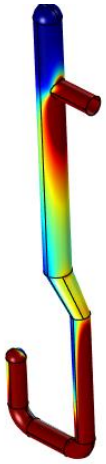
Was this done already by AUP?

RF heating (qualitative)

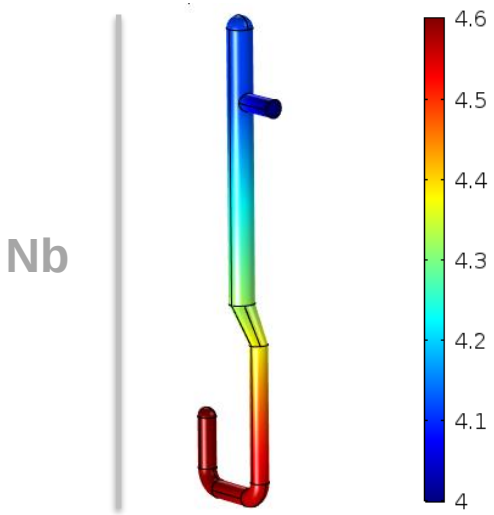
by Zenghai Li



by E. Cano



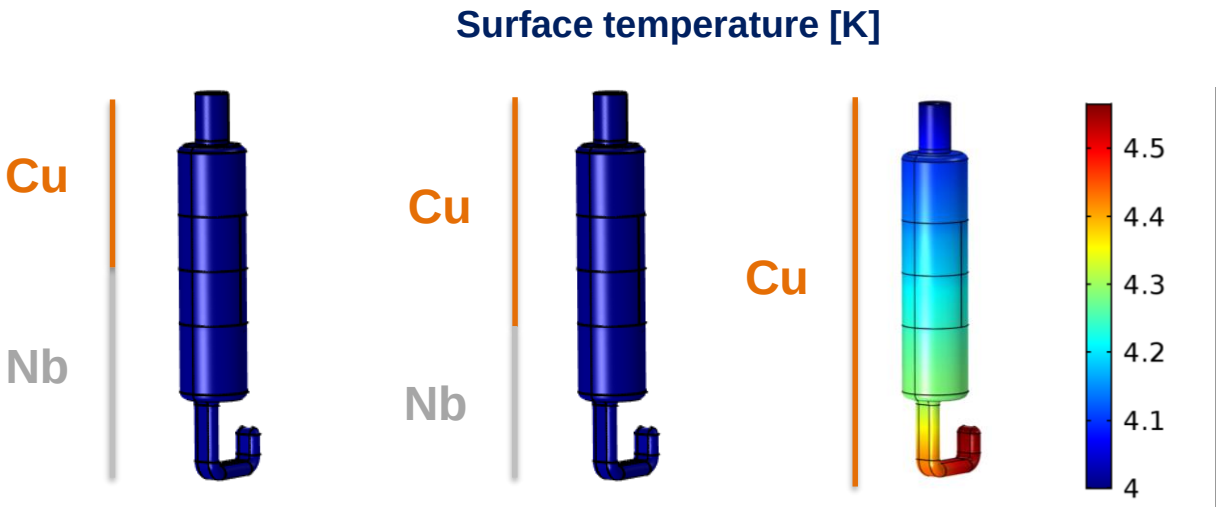
Surface temperature [K]



Heat loss = 19 mW

Thermal analyses – Nominal design

- VHOM sensitivity to Nb-Cu boundary position



Nb = 78 mm
Heat loss = 0.14 mW

Nb = 58 mm
Heat loss = 1.3 mW

Nb = 0 mm
Heat loss = 200 mW

- Reducing the amount of Nb does not significantly affect the maximum temperature and heat loss.
- Nevertheless, a **hook in Nb is necessary**

Thank you for your attention!