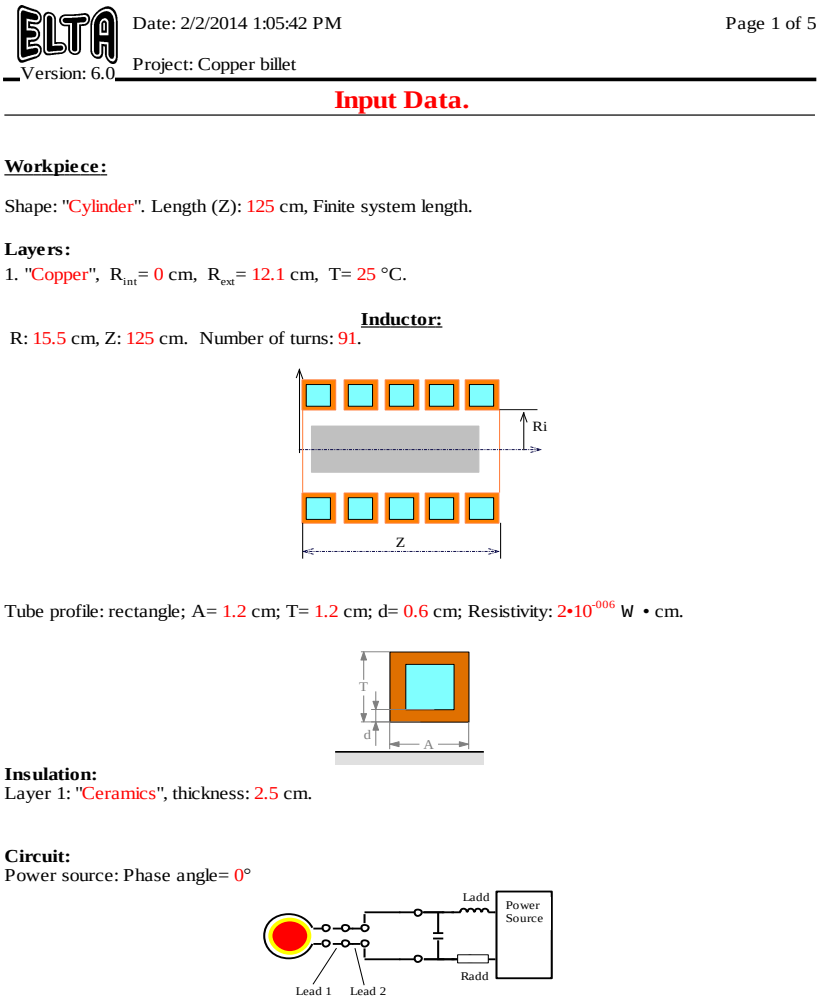
Comparison of simulation and experiment for copper billet heating

Industrial experiment:
Coil: ID = 31 cm, length 125 cm, turn number 91, tube width 1.2 cm, thermal insulation 2 cm, ceramic fiber.
Billet: Dia.= 24.2 cm, material – copper M2, initial temperature 25 °C, final – 850 °C.
Operating conditions: frequency 50 Hz, coil voltage 390 V, heating time 1100 sec.
Simulation: ELTA 6.0
Results:
Experimental and calculated parameters are very close.
Coil current in simulation changed in the process of heating from 4000 A to 3590 A while the experimental values changed from 3750 to 3500 A.
Fig. 1 shows the front page of report with input data.
Fig. 2 shows calculated and experimental data for a mean temperature along the billet as well as the power variation during the heating time.


ELTA Version: 6.0 Date: 2/2/2014 1:05:42 PM Page 1 of 5
Project: Copper billet

Input Data.

Workpiece:

Shape: "Cylinder". Length (Z): 125 cm, Finite system length.

Layers:
1. "Copper", R_{int}= 0 cm, R_{ext}= 12.1 cm, T= 25 °C.

Inductor:
R: 15.5 cm, Z: 125 cm. Number of turns: 91.

Tube profile: rectangle; A= 1.2 cm; T= 1.2 cm; d= 0.6 cm; Resistivity: $2 \cdot 10^{-006}$ W • cm.

Insulation:
Layer 1: "Ceramics", thickness: 2.5 cm.

Circuit:
Power source: Phase angle= 0°

Fig.1 The first page of report with input data

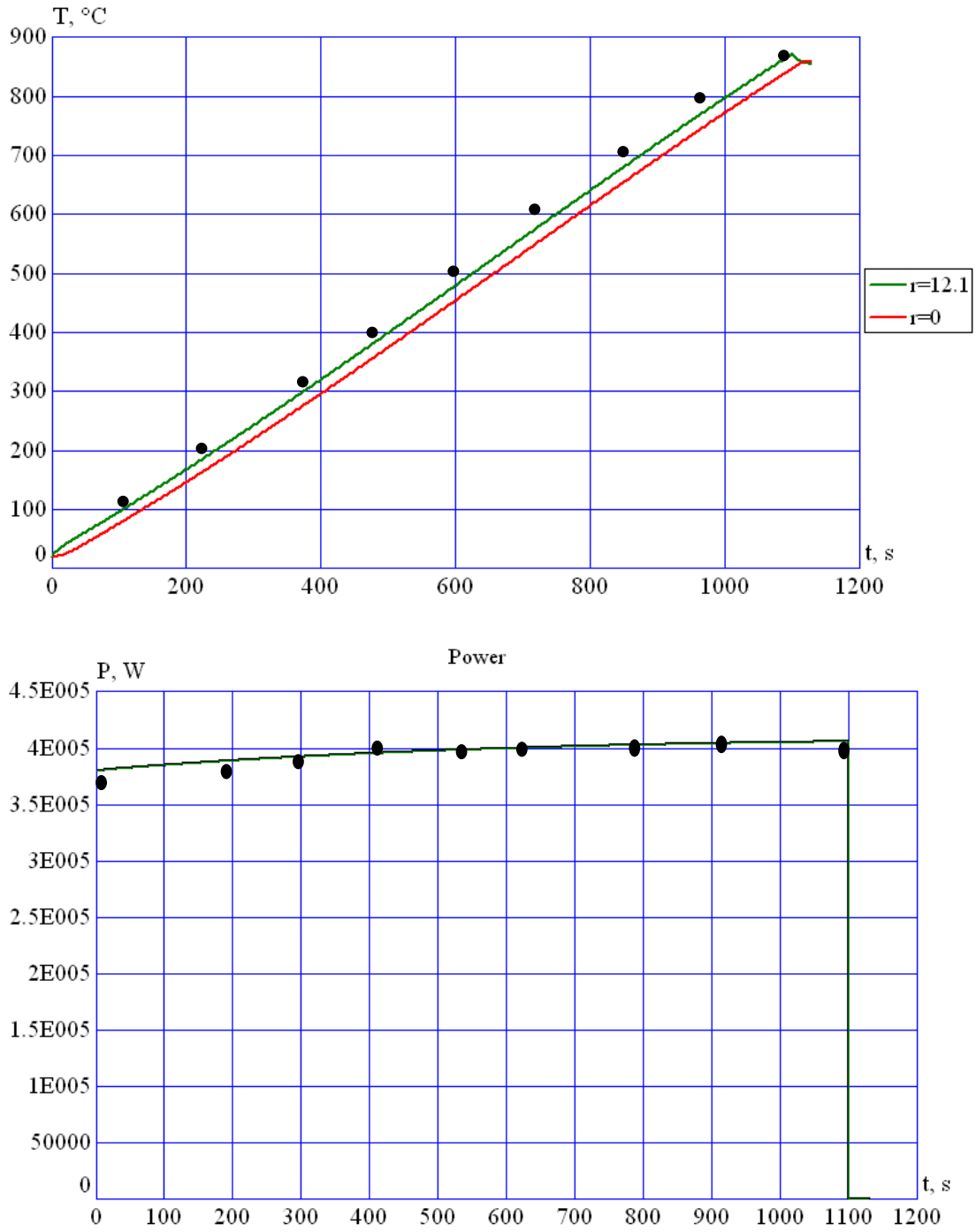


Fig. 2. Variation of billet mean surface temperature and active power of the inductor during the heating cycle (experimental values are presented by dots)