From labs to world's best commercially available superconducting copper

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LUVATA
Partnerships beyond metals

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Luvata yesterday, today and tomorrow

- Yesterday
  - Outokumpu – Public Listed Company Helsinki
- Today
  - Luvata – Nordic Capital 2005, Private Equity Company
- Tomorrow
  - Luvata Special Products - Mitsubishi Materials Corporation (MMC) – Public Listed Company Tokyo

Luvata Superconductors

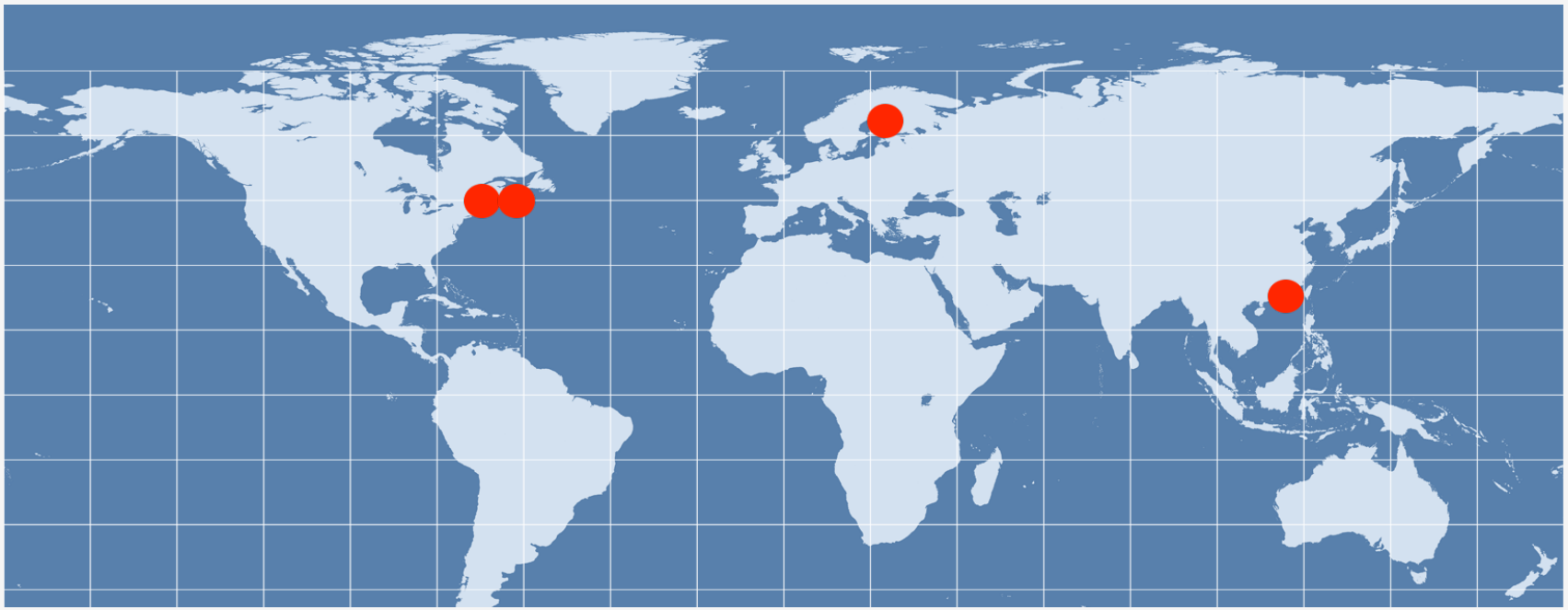
The sun never sets on Luvata Superconductors

Waterbury, USA

Branford, USA

Pori, Finland

Zhongshan, China



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Strengths of Luvata Superconductors

- Over 30 years of experience in LTS superconductors production

- Four production facilities on three continents
  - All mills work in close cooperation; R&D resources, production backup,...

- Three certificates (Quality, Environment, Health and Safety)
- High purity copper in house and other copper alloys
- Own extrusion press

- Experience in a wide range of tailor made wires
  - Standard and Special wires for Special Projects

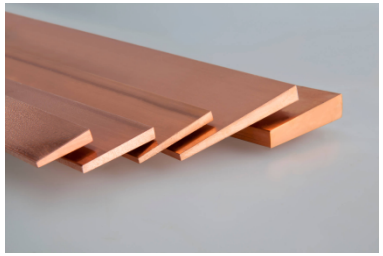
- Customers:
  - All majour MRI and NMR players are our customers
  - Committed project work to CERN, K-Star, KEK, ITER, GSI, ...

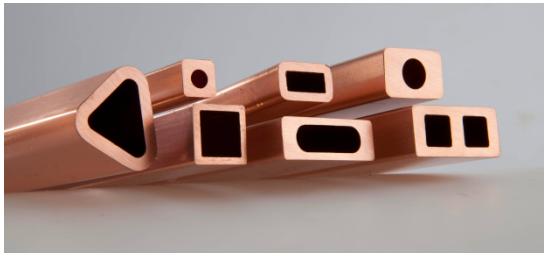
Luvata – Cern

- Deliveries to LHC
  - SC about 400 tons (Fornaci di Barga, Pori and Waterbury)
  - Copper components about 1 000 tons (Pori)

- The Detectors
  - ATLAS / Luvata Fornaci di Barga 50% of SC (main detector)
  - CMS / Luvata Pori 100% of SC (main detector)

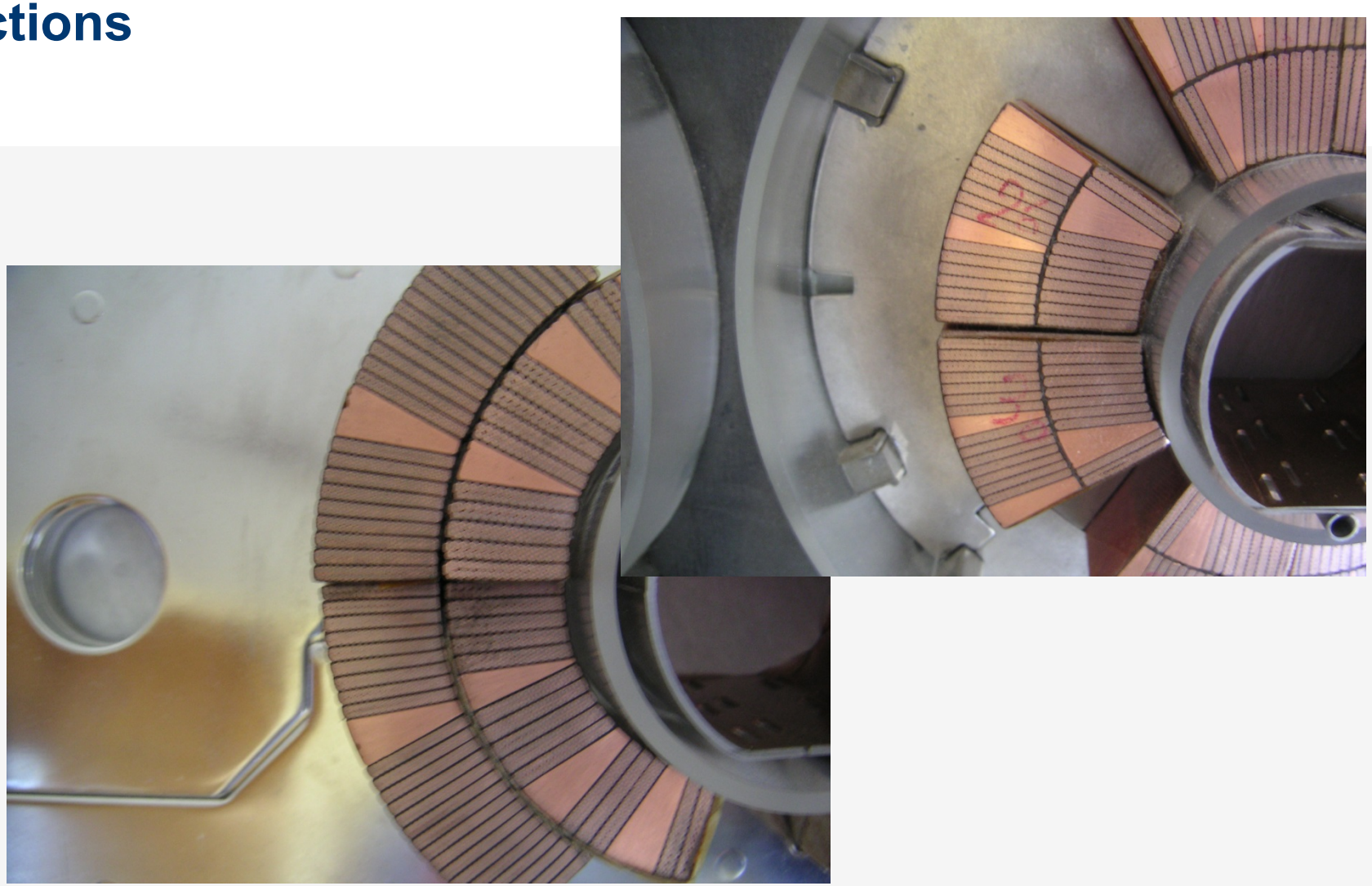
Copper to LHC-Project from Outokumpu / Luvata



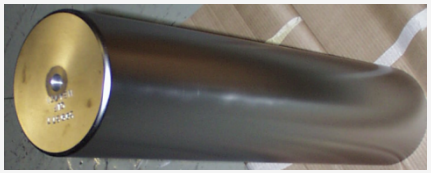


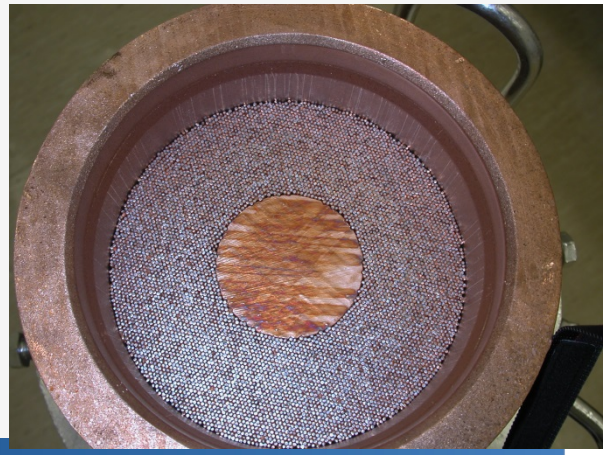
- **256 tons** of OF-OK copper hollow conductors for the high current superconducting bus bars of the LHC magnets
- **105 tons** of OF-OK copper hollow conductos for the coils of the MQW resistive quadropole magnets
- **82 tons** of OF-OK copper hollow conductors for the coils of the MBW resistive dipole magnets
- **342 tons** OF-OK copper wedges for the cold masses of the LHC superconducting dipole magnets
- **66 tons** OF-OK copper for Helium tubes of LHC magnets

Close up of LHC sections



Low Temperature Superconductors





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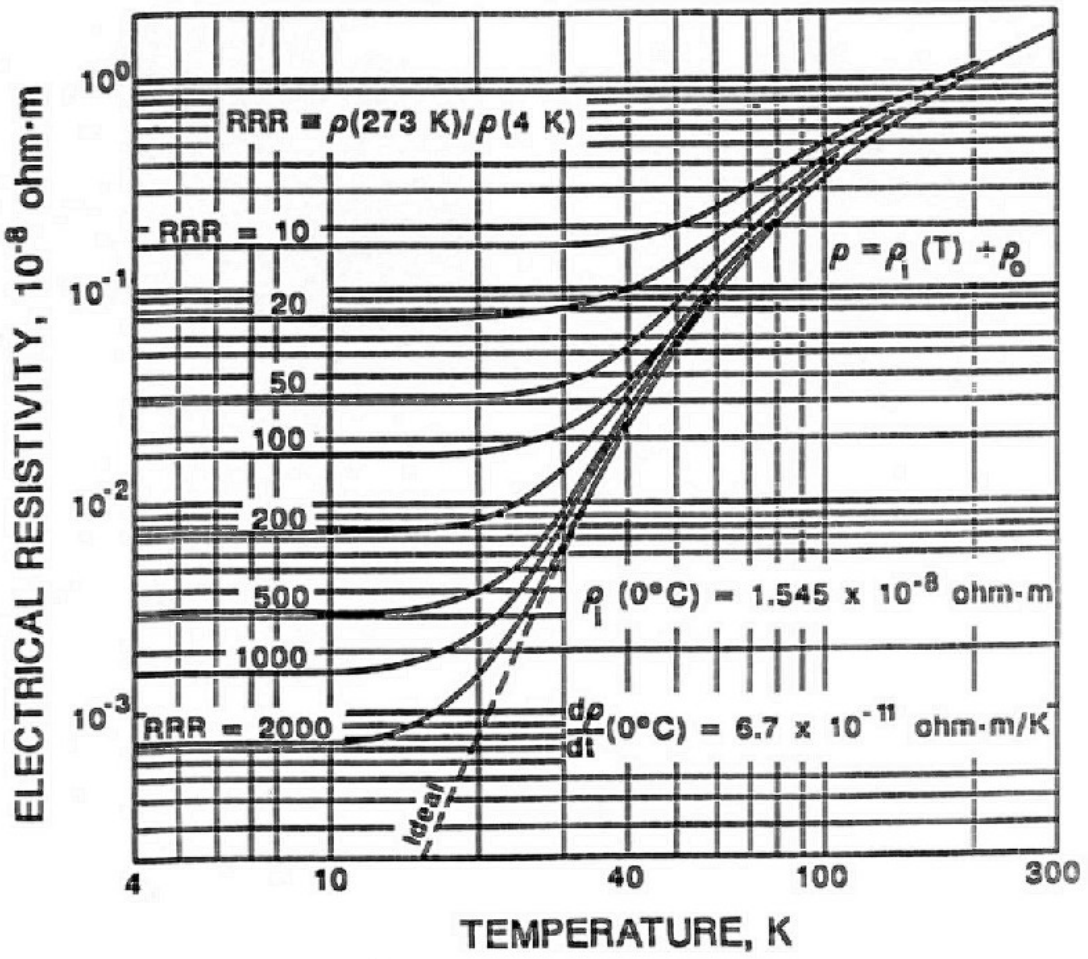
History of OFC copper development

- **OXYGEN-FREE COPPERS:**

	ASTM	EN
OF-OK®	OF, C10200	Cu-OF, CW008A
Solar		
Stamping		
OFE-OK®	OFE, C10100	Cu-OFE, CW009A
OFC-OK™	OFE, C10100	Cu-OFE, CW009A
Cryogenic – RRR>250		
Cryogenic – RRR>300		
Cryogenic – RRR>400		

The RRR as a function of electrical resistance and temperature

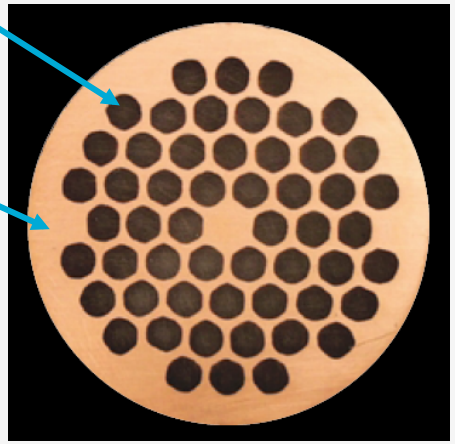


Design of Low Temperature Superconductors (LTS)

- There are two different industrially manufactured LTS superconductors
  - NbTi (workhorse, good mechanical properties, Bc 15T, Tc 10K)
  - Nb3Sn (challenging, brittle after heat treatment, Bc 24,5T, Tc 18K)

- The general design of a LTS wire includes two materials:
  - The superconducting part (non copper part) = NbTi or Nb3Sn
  - The stabilising matrix = copper part
    - Needed to carry current and to dissipate energy when needed.

  - This ratio is typically shown as Cu:nonCu (alpha) range: $0.3 < \alpha < 14$



Summary

- Luvatas future
- Superconductors in Luvata
- Cern / sceintific projects
- OFC development

Thank you.

Questions?

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