



US LHC Accelerator Research Program
bnl - fnal - lbnl - slac

Report from the
Round table discussion on Long Nb₃Sn Magnets,
held at CERN on March 24, 2005

LARP Collaboration Meeting 4,
Port Jefferson, 4/7/05
G. Ambrosio



Round table discussion on Long Nb₃Sn Magnets

- **Participants:**

G. Ambrosio (FNAL),

S. Bartlett, S. Gourlay, S. Mattafirri (LBNL),

P. McIntyre (Texas A&M Univ.),

A. Devred (CERN & CEA),

R. Maccaferri, L. Rossi, D. Tommasini (CERN),

A. Den Ouden (Twente Univ.)

- **Talks:**

Long Sub-scale coils (S. Bartlett)

Furnace for Nb₃Sn long coils at Texas A&M U. (P. McIntyre)

Long cos-theta coil (N. Andreev, G. Ambrosio)

Long coil R&D plan (G. Ambrosio)



Upgrade TEXAS A&M Univ. furnace and impregnation fixture

- Vertical Furnace, present characteristics:
 - Max coil length: 54 inch (1.4 m)
 - Temperature uniformity: ~2.5 C (tuning each Kiln with dedicated TC)
- Possible upgrade to 4m:
 - 9 additional kiln units \$20k
 - additional spool \$20k
 - overhead lift lengthening \$40k
 - Technician 0.7 FTE
- Impregnation fixture:
 - Max coil length: 124 inch (3.15 m)
- Possible upgrade to 4m:
 - Total cost: \$30k



Cost of new furnaces

Quotes:

- ~\$100,000 4 m working area, side loading, gas tight,
 - » The Grieve corporation, Round Lake IL (?)
- \$114,000 – 119,000 4 m working area
- \$131,000 – 140,000 6 m working area
 - Side loading – shuttle furnace
 - Working area cross-section: 0.5x0.5 m
 - Load: 500 Kg/m
 - » L&L Special Furnaces Co, Aston PA



Furnace – my conclusions

1. We should buy a new furnace,
2. We should start a Working Group with the goals of:
 - Set specs for the new furnace,
 - Collect and evaluate quotes,So that on **October 1st we are ready to place the order!**

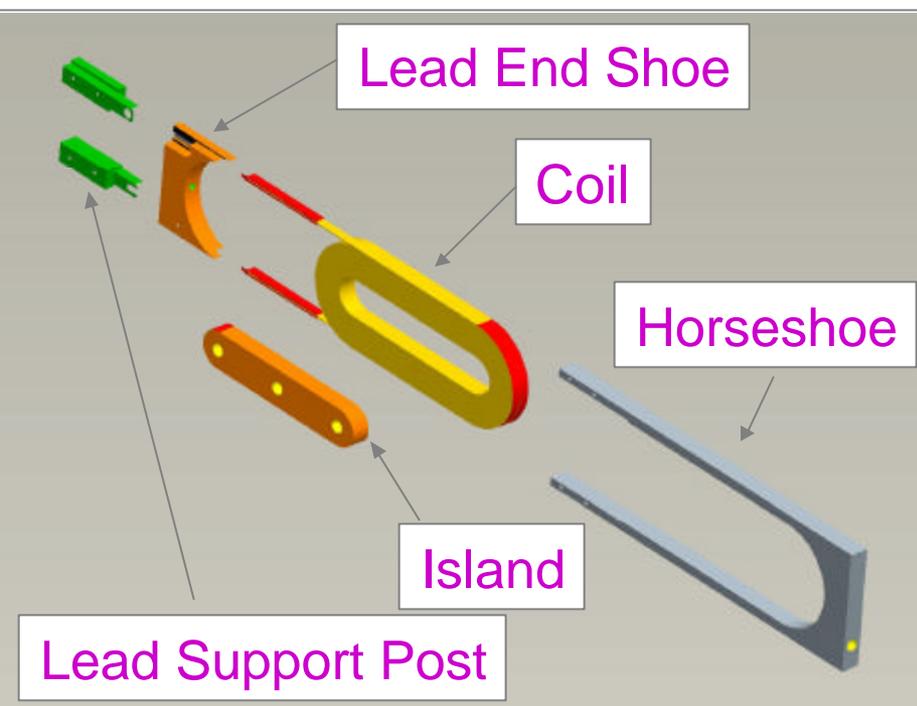
... please let me know if you are interested in participating



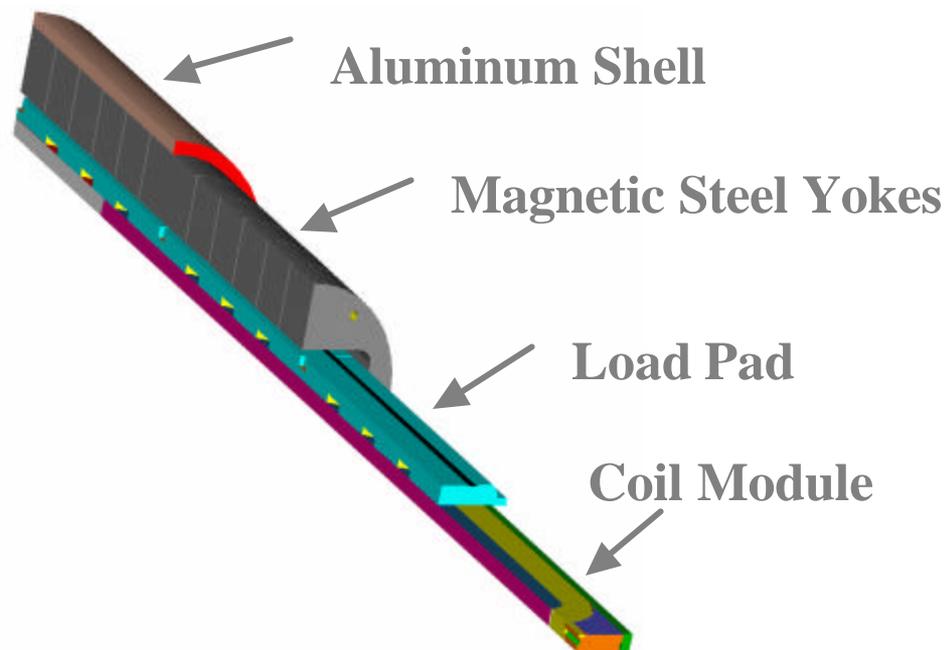
Long Sub-scale Coil

- Concept and plan will be presented by GianLuca Sabbi

Present Sub-scale Coils ~25 cm



Long Sub-scale Coils 4 m





Long Sub-scale Coil - Comments

- **Questions:**

- How do you deal with coil volume increase?
- How do you control coil dimensions?
- How do you get useful information for the successful heat treatment of long shell-type coils (baseline design for LM)?
- Can you reproduce the conditions of long shell-type coils during the heat treatment?

- **Comments:**

- You need to control coil geometry before and after heat treatment (for instance: NO cable width increase and nominal coil thickness increase in order to simulate a shell-type coil with only azimuthal expansion allowed)
- A working magnet is not enough!
- You need to learn → tight parameter control.

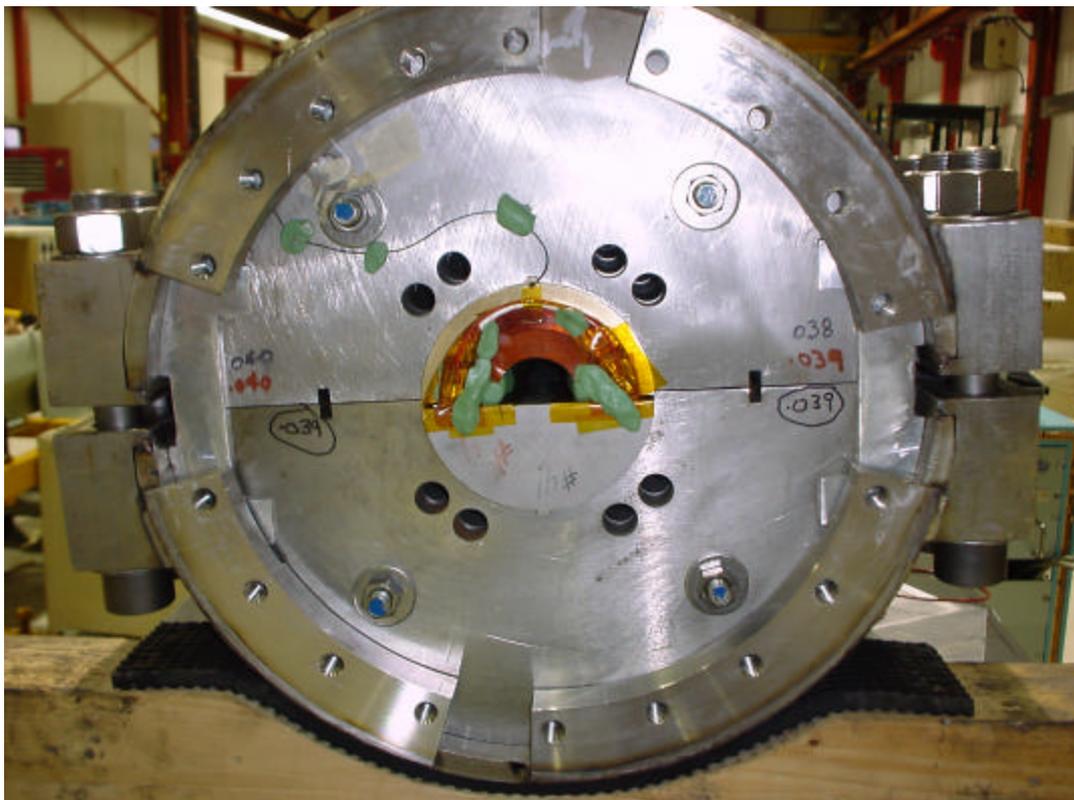


Cos-theta mirror

- Concept will be presented by Nicolai Andreev

Present: 1m mirror magnet,

Proposal: 2m mirror, then 2m dipole, then 4m dipole





Cos-theta mirror - Comments

- **Comments:**

- You need to focus on quadrupole magnets and **have a successful long quadrupole ($\Phi \geq 90$ mm, $G \geq 250$ T/m) by 2009**, because CERN is going to take in 2009 basic decisions about future large projects (including the LHC-upgrade).
- Optimal length is 5.5 m (as the present MQXB quads), 4 m is acceptable

Similar comments may be found in the recent letter by L. Rossi to S. Peggs:

“The manufacturing of a successful prototype for 2009 is real vital to the whole magnet program, on both side of the Atlantic. Year 2009 is crucial since, according to the today plan set by the CERN DG, is when basic decisions on CERN future large projects will be taken”



How much important is this goal?

- Option 1: “It’s a milestone in a larger program”
- Option 2: “It’s **DEATH or LIFE** for all major R&D programs on Nb₃Sn accelerator magnets in the world”

→ The Domino effect...

LHC upgrade, ~~NEL~~, ~~CEA~~ LARP Nb₃Sn, US-Nb₃Sn-base programs **?**

*What do we think about this issue?
The plan depends on this answer.*