

WAMS2004 CARE EU PROGRAM MARCH 04

CABLE DESIGN AND R&D FOR NED

D.LEROY / CERN

➤ **INTRODUCTION**

➤ **MAGNET PRELIMINARY DESIGN**

➤ **STRAND**

➤ **CABLE**

➤ **PROGRAM**

INTRODUCTION

- The Nb₃Sn conductor development is a work package in the NED proposal.
- A preliminary design of a large-aperture (up to 88 mm), high-field (up to 15 T), Nb₃Sn dipole magnet has been made to derive meaningful conductor specifications
- Within the limited funding, it was then decided to concentrate on two routes: (1) Powder In Tube (PIT) and (2) Internal Tin (ITD).
- A technical specification will be written according to CERN procedures.
- The high current densities in the 15-T range represent a new technical challenge for the European superconductor industry,

which will invest in this ambitious program.

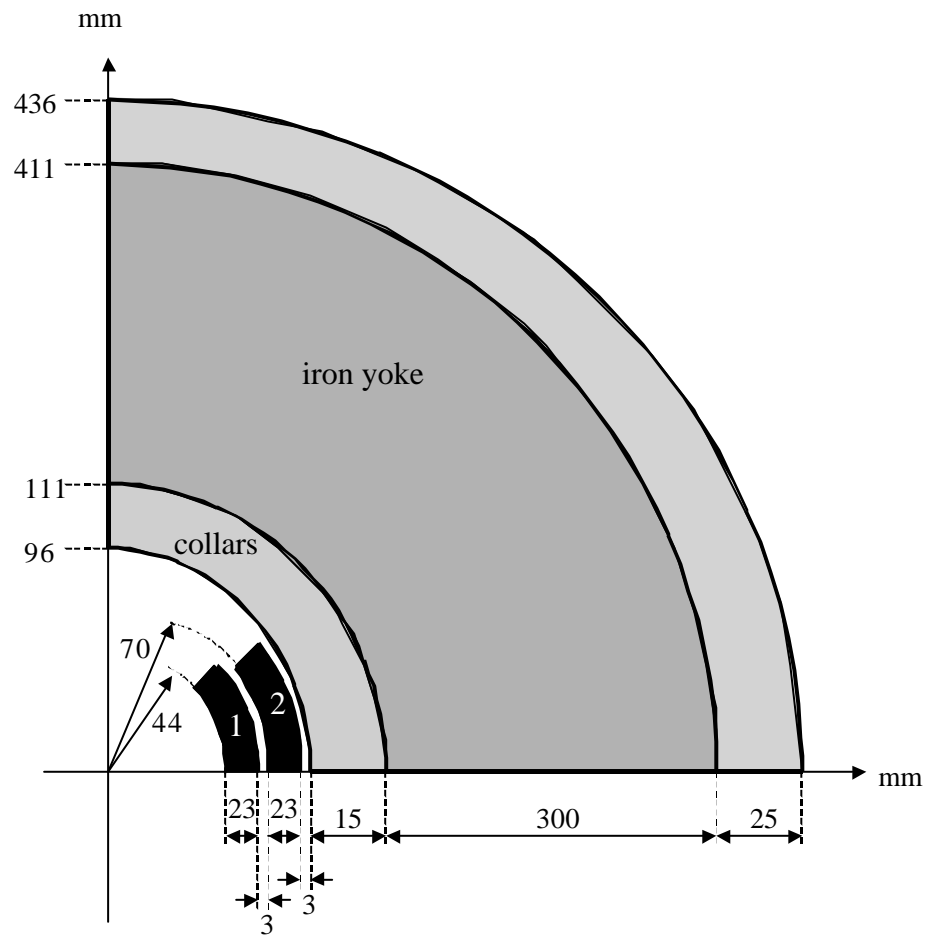
MEASUREMENTS

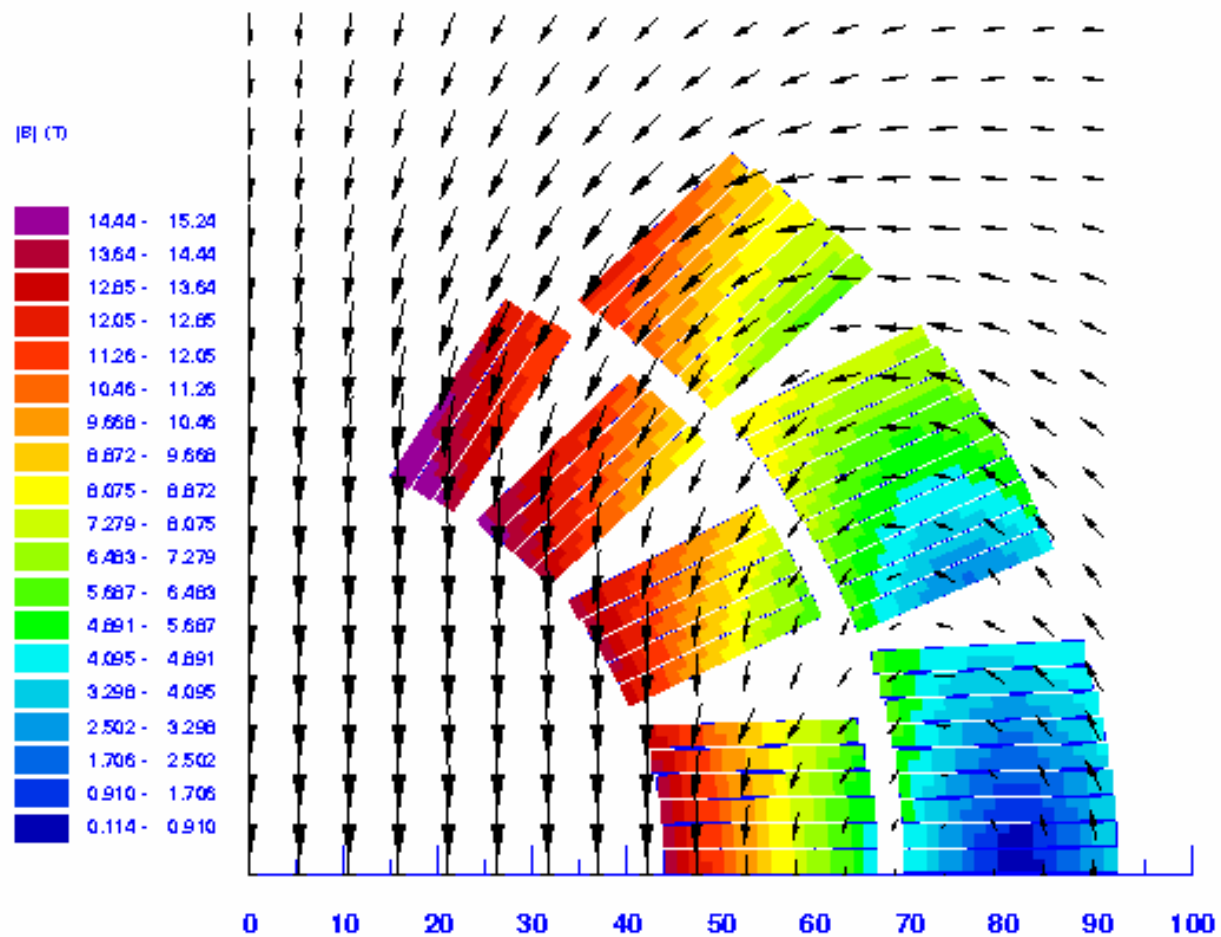
- Wire critical current measurements (following a standardized protocol) will be performed at :
 - **CEA/Saclay,**
 - **INFN-Milano/LASA**
 - **Twente University**

- Wire magnetization measurements at **INFN-Genova.**

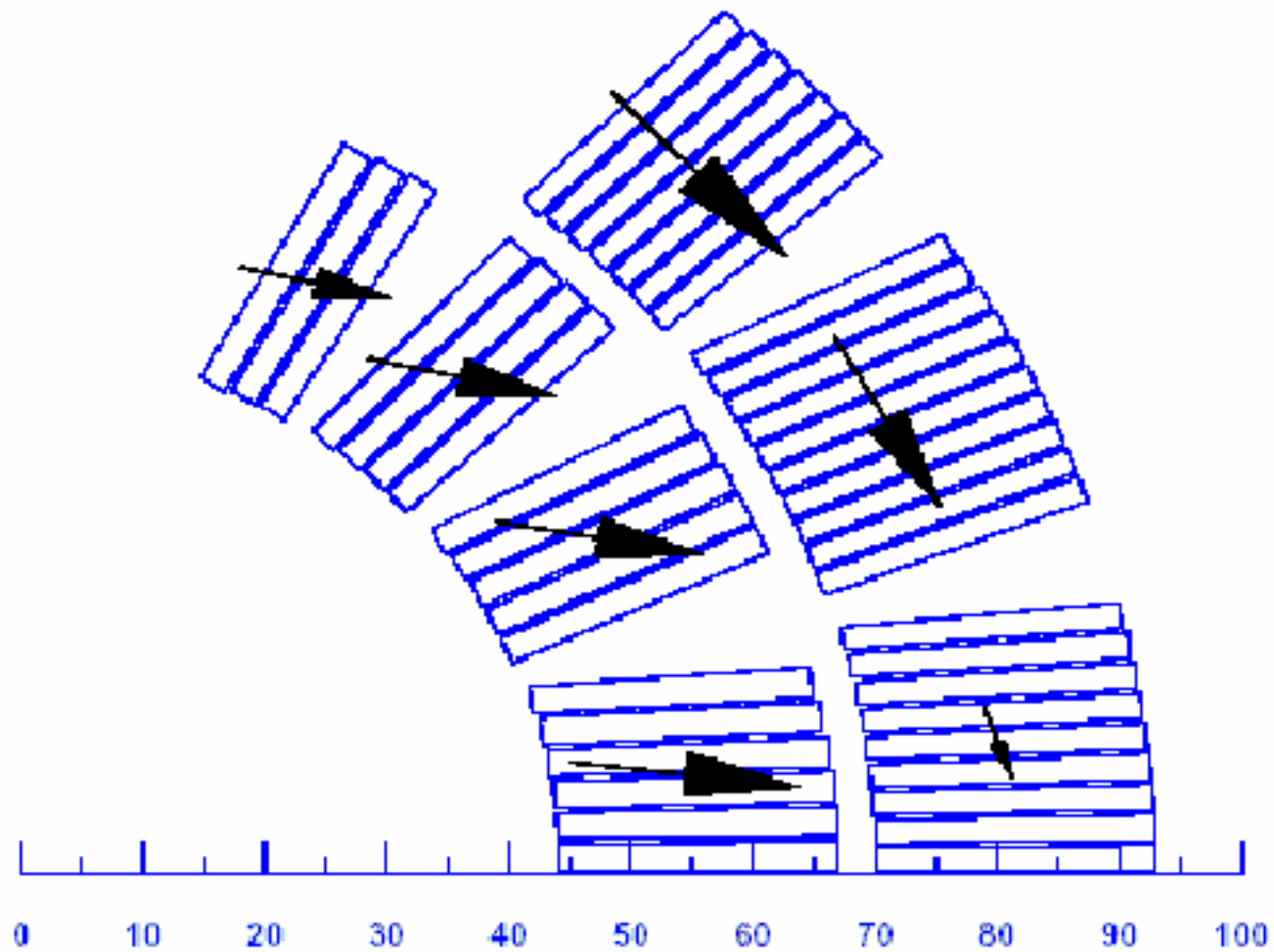
- The cable critical currents will be measured at **Twente University.**

Magnet Overall Structure

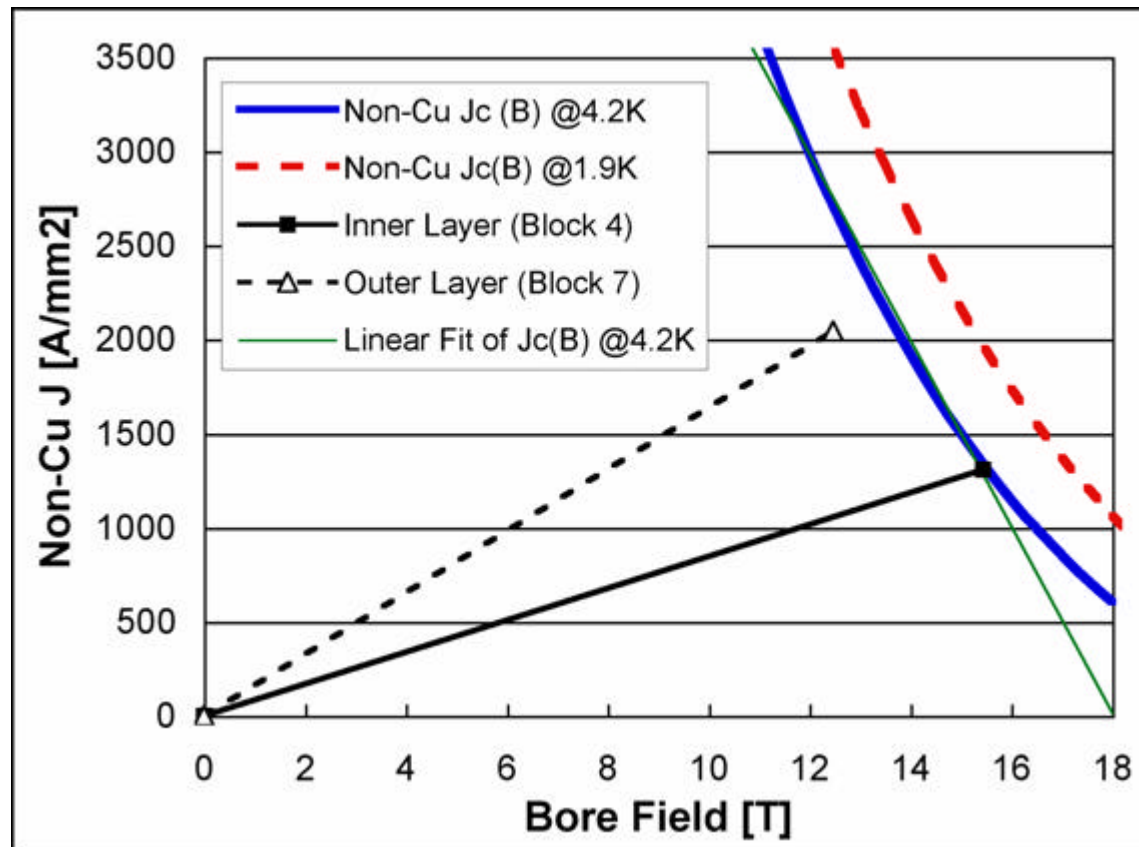




Flux lines



Forces



Load line

Strand Characteristics

Wire diameter **1.25mm**

Cu/nonCu **1.25**

Jc at 15T,4.2K **1500 A/mm²**

Filament size **<50 mm (no flux jump)**
 Collective barrier in ITD not suitable

Coating **NiSn electrolytic (to be tested)**

RRR Cu **>100 after strand annealing for Cu stress relaxation**

Cable Characteristics(Preliminary)

Dimensions preliminary 2.25 X 2.375 X 22.5 mm

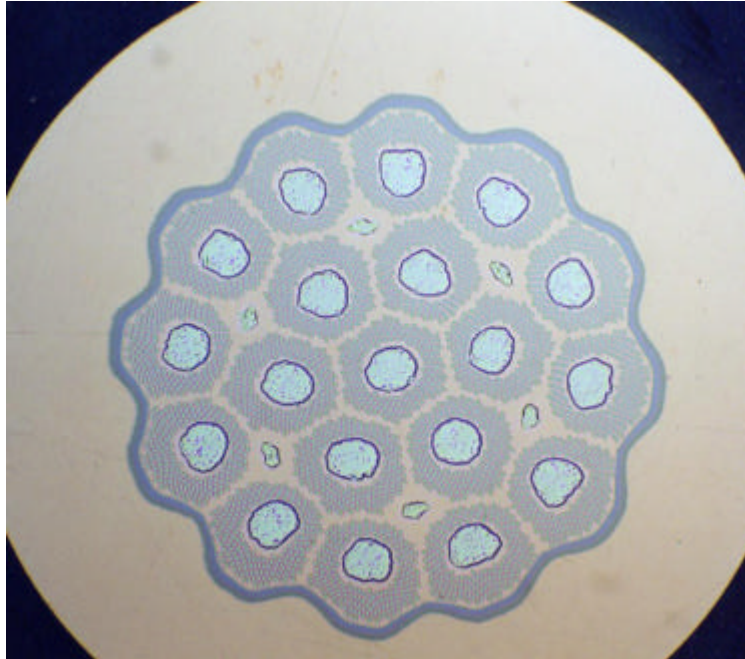
Compaction thin edge 10%

Compaction thick edge 5%

Cabling at 86% filing factor, to have 88% after reaction to limit the effect on cable mid-thickness of the ~ 3% volume expansion

Degradation due to cabling 3 to 6 %

Degradation at 150MPa : 7 to 10%



I T D(Alstom)



PIT(SMI)

PROGRAM FOR NED CONDUCTOR

- **Increase of the Sn content to obtain a large number of small grains and a content > than 24% homogenously distributed**
- **Decrease the filament size to decrease the reaction time and moderates the growing of the grains**
- **Additives in the raw materials**
- **Process suitable for large production. Billets of circa 70kgs**
- **Testing of wires to measure the strain impact**
- **A working group will make the standardization of the electrical characterization(A. den Ouden)**