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# Conductor procurement and cable development

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## Outline:

Status of the Nb<sub>3</sub>Sn strand procurement

Performances of the 1.0 mm PIT strands

Cable development for the FRESCA2 dipole

## **The procurement is divided in 3 steps:**

- a 1<sup>st</sup> step called “qualification phase”
- a 2<sup>nd</sup> step called “pilot production”
- a 3<sup>rd</sup> step for the full production

## *Qualification phase conducted by CERN*

### **9 km of PIT strand ordered by CERN to Bruker-EAS in March 2010.**

First delivery in July 2010 and last delivery in Feb.2011: 5600 m of strand with hexagonal filaments already used for the cable development work, 1600 m of strand with round filaments available for a FRESCA2 cable or for an SMC cable and 4300 m of strand with hexagonal filaments available for the cable development.

### **10 km of PIT strand ordered by CERN to Bruker-EAS in Aug. 2010.**

Completion of the order in Sept.2011 with the delivery of the last 2 billets, very good piece lengths: 3162 m, 2594 m, 2786 m, 4903 m. Qualification of the strand under way.

### **5 km of PIT strand ordered by CERN to Bruker-EAS in March 2011.**

3400 m already delivered, remaining quantity expected in December 2011.

### **10 km of RRP strand ordered by CERN to OST in Sept. 2010.**

Delivery expected for January 2012 !! Instead of November as foreseen in May 2011.

## *Pilot production conducted by CEA*

**15 km** of PIT strand ordered by CEA to Bruker-EAS in April 2011.

Delivery expected for February 2012

**15 km** of RRP strand with an option for an additional 10 km of strand ordered by CEA to OST in May 2011.

Delivery of the first billet expected in April 2012

## Total quantity of strand available for the fabrication of the first cable unit lengths

30 km of PIT strand available by February 2012

25 km of RRP strand available by May 2012

Minimum quantity of strand needed for a Fresca2 dipole without margin = 42 km

A total quantity of strand equal to 100 km is requested for the fabrication of the two Fresca2 dipoles

## *Production*

**20 km** of strand will be ordered by CEA with an option for 10 km  
**20 km** of strand to be ordered by CERN

# Comparison of the performances of the 1.0 mm PIT strands

- Results given for optimized heat treatments
- Jc values given at 4.2 K

Sample ID	Heat treatment	Jc(12T, 4.2K)	Jc(11T, 4.2K)	Jc(10T,4.2K)	RRR
HE10S0904A24U	120h/620C + 100h/650C	2464	2923	3476	235
HE10S0905A46U	120h/620C + 100h/650C	2451	2937	3459	74/97
HE10S10402A15U	120h/620C + 90h/650C	2477	2946	3481	96/103/105/135
HE10S10503A29U	100h/620C + 120h/640C	2528	2997	3523	153/155
HE10S11201A83U	100h/620C + 120h/640C	2451	2920	3450	160/172
	(Max – Min)/ Average	3 %	2.6 %	1.3 %	

- Very similar results obtained for the 5 billets produced these last 2 years
- Jc(12T) ~ 2470 A/mm<sup>2</sup> and Jc(15T) ~ 1400 A/mm<sup>2</sup> (spec. 1250 A/mm<sup>2</sup>)

# Fresca2 cable development

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- **Work started in February 2010 with hard Cu wires, altogether 22 cabling runs performed to optimize the tooling and the cabling parameters.**
- **4 cabling runs performed with PIT strands to optimize the cable parameters (4200 m of PIT0905 and 1400 m of PIT10402 used for the tests). Different values for the width of the cable and the transposition pitch of the cable were tried to minimize the degradation of the Cable Ic.**
- **Best results obtained with a width of 20.9 mm and a transposition pitch of 120 mm, but still 15 % of Ic degradation.**

# Cable width optimization

Date	Run number	Billet number	Fabricated length	Cable width	Transposition pitch	Ic Degradation
23/11/2010	46	PIT0905	45 m	21.4 mm	120 mm	18.8 %
28/01/2011	50	PIT0905	20 m	22.0 mm	120 mm	25.7 %
1/02/2011	51	PIT0905	10 m	21.4 mm	130 mm	18.3 %
9/08/2011	60	PIT10402	20 m	20.9 mm	120 mm et 140 mm	15 % 18.4 %

**The optimization of the cable parameters will continue with a reduction of the cable width to 20.4 mm and an increase of the cable mid-thickness to 1.86 mm to decrease the cable compaction.**





**Thank you for your attention !**

