

Giovanni Volpini

scientific career - an overview

Lucio Rossi

Volpini Memorial Day

LASA, Milano, 19 Maggio 2017

Giovanni Volpini short C.V.

- 1982 Maturità classica: 60/60esimi
- 1989 Laurea in Fisica-UNIMI: 110/110 lode
- 1990-92: Fellow presso CERN/AT-MA
- 1993 Dottore di Ricerca in Fisica UNIMI
- 1994 Ricercatore ex-art 36 INFN-Milano
- 1995 Ricercatore di ruolo a INFN-Milano
- 2006 Primo Ricercatore a INFN-Milano
- 2013-16 PJAS al CERN/TE-MS-C-MDT



Main steps

- From Particles to Quasi-Particle: Superconductors:
 - The doctorate thesis (1990-1993)
 - The period of CERN fellowship (1990-1992)
- LHC Superconducting cables
 - I_c measurements
 - 30 kA facility
 - HTS
- ATLAS Barrel Toroid
 - Il programma 5%, le coestrusioni a Neuchatel
 - Le giunzioni interne delle bobine
 - Il criostato e Protezione Magnete
- After ATLAS: Discorap & other
- Thw retour toward high field: EuCARD – HiLumi – EuCARD2

How Giovanni entered in LASA: 1989-90

- Programma Speciale SC
 - 10 unit lengths LHC SC cable (first)
 - 2 LHC main dipoles (first)
 - Investment about 5 MCHF of '90.
- We had two students:
 - Barrilà & Varieschi;
 - 1 CERN fellowship “tagged” LASA
 - Varieschi left: frantic look for somebody GOOD also out of LASA
 - Personal knowledge ... very good reference. Different personality...
 - Giovanni took up the challenge...
 - But he wanted to make the doctorate...



CERN Fellowship and Doctorate: time sharing

- 1990-92 CERN Fellowship
 - Daniel Leroy & Luc Oberli
 - LHC was not approved yet but R&D was taking off. CERN had no facility yet...
- His studies
 - Current Leads computation
 - Ic measurements
 - Measurements of Rutherford cable size with a continuous machine...
- It was the period of learning SC
(I had to make a PhD school course on applied SC for him and “Cecco”.)
- And of designing the thesis experiment
- In perspective sharing a student was not a great idea but... we gained Giovanni and helped to LASA definitively on that route...

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

CERN - AT DIVISION

CERN LIBRARIES, GENEVA



CM-P00062272

CERN AT/93-04 (MA)
LHC Note 215

Time-dependent Current Lead Simulation

G. Volpini* and L. Oberli

The doctorate research thesis - 1993

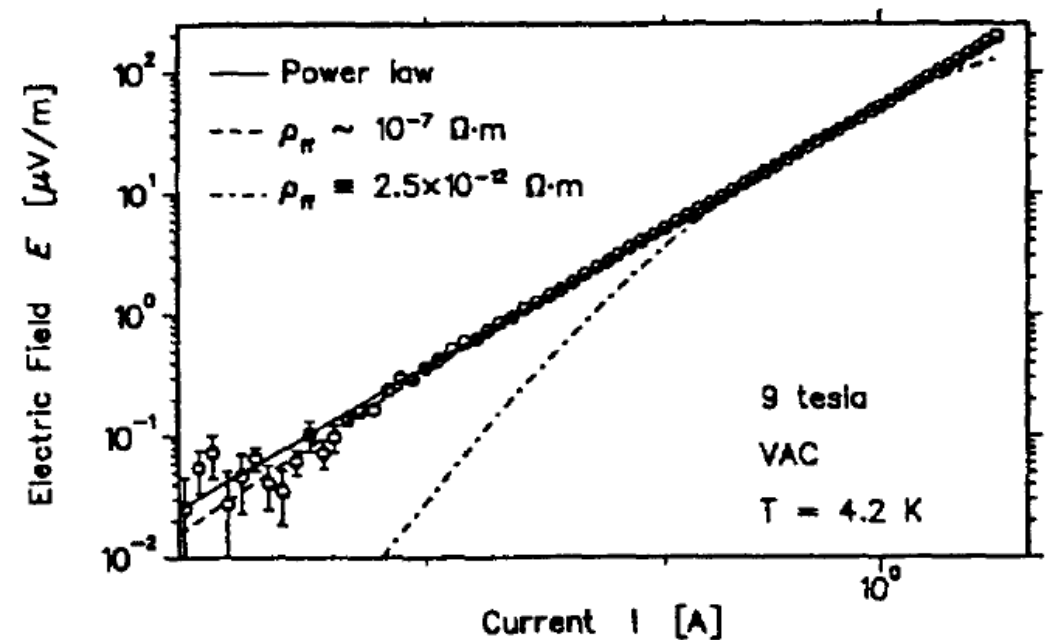
- ***Studio Fenomenologico della Transizione da fase Superconduttiva a fase Resistiva di fili composti multifilamentari in Cu/NbTi***
- LHC was very demanding in quality and the study aimed at the n-value significance by study single filament transition... Was n-value important?
- The study was hard, once he was tempted to dismiss, but was the first basic study we did in LASA on SC material.
- Discussion committee with S. Ceresara, R. Parodi, ... Very well received

2296

IEEE TRANSACTIONS ON MAGNETICS, VOL. 30, NO. 4, JULY 1994

A Detailed Experimental Investigation on the E-J Characteristics of NbTi Filaments and Comparison with Theoretical Models.

E. Acerbi, G. Ambrosio, L. Rossi and G. Volpini,
INFN and University of Milan, LASA via Fratelli Cervi 201



LHC SC works @ LASA

1991-98: Supercompatto apparato da 30 kA

IEEE TRANSACTIONS ON MAGNETICS, VOL. 30, NO. 4, JULY 1994

Critical Current Measurements of the Cable for the Superconducting Dipole Prototypes for the Large Hadron Collider

G. Baccaglioni[†], P. Fabbri^{*}, R. Garrè[‡], R. Musenich^{*},
R. Parodi^{*}, L. Rossi[†], G. Volpini[†]

[†]INFN and University of Milan, LASA via Fratelli 201, 20090 Segrate (I)

^{*} INFN of Genoa, via Dodecaneso 33, 16100 Genova (I)

[‡]Europa Metalli-LMI, BorgoPinti 99, 50121 Firenze (I)

The effect of a cross-over of an outer cable (with 40 strands) was measured and found to be less than 3%. It behaves like a cable with one strand less, but without real damage to the other strands. This figure suggests that a long length with a cross over in the middle could be used if enough I_c margin is left.

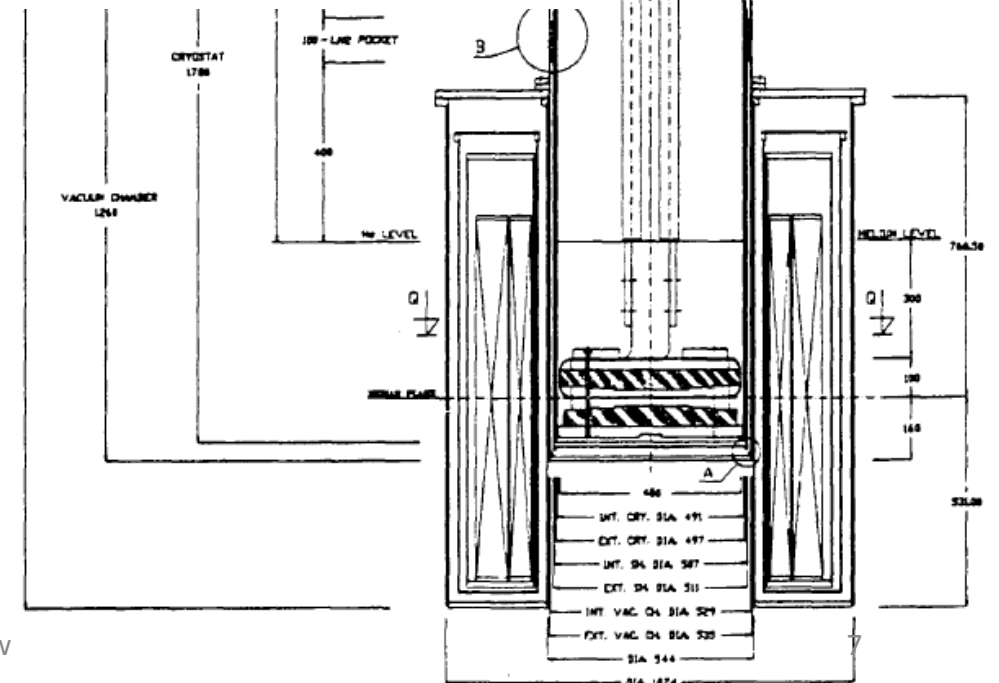
L. Rossi - G. Volpini career overview

A new scheme for critical current
measurements on straight superconducting
cables in a large solenoid

L. Rossi and G. Volpini

Dipartimento di Fisica dell' Università di Milano
and
Istituto Nazionale di Fisica Nucleare sezione di Milano
LASA Laboratory
via F.lli Cervi, 201 20090 SEGRATE (MI) I

October 24, 1991



1827

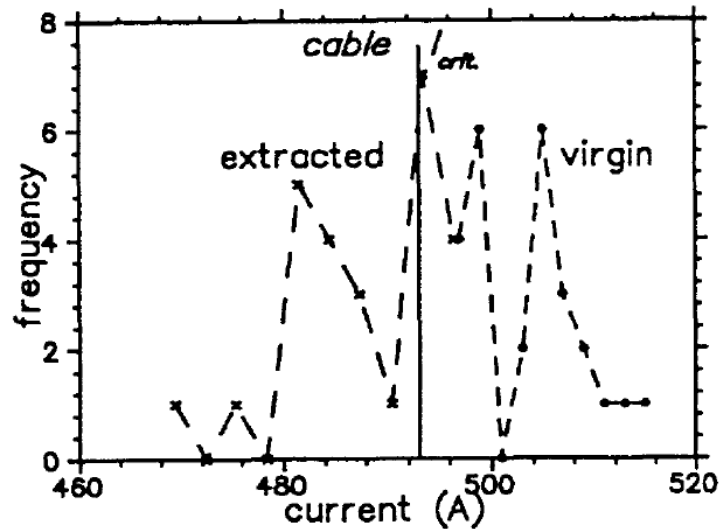
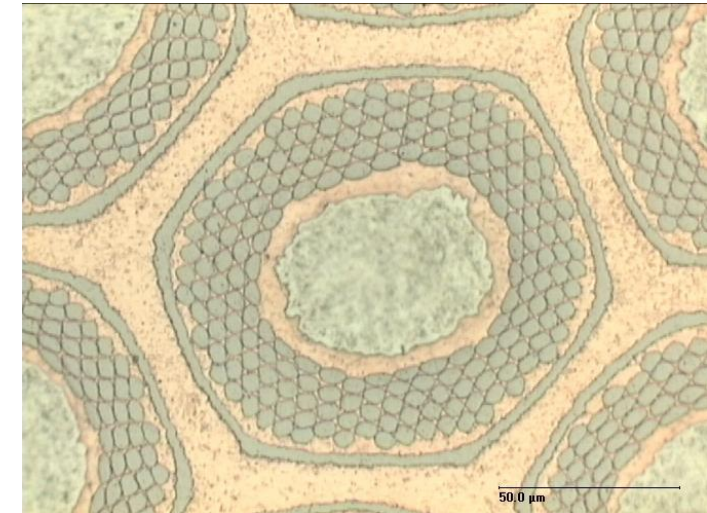
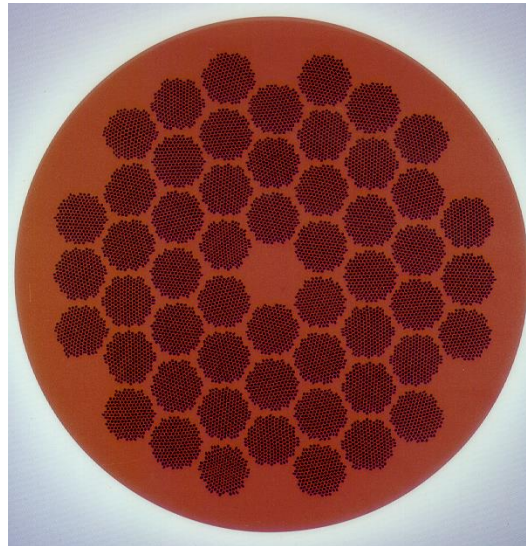


Figure 3: Histogram of I_c of individual strands. The vertical line represents average strand I_c deduced by cable measurements.



IT970024

ISTITUTO NAZIONALE DI FISICA NUCLEARE

Sezione di Milano

118/100

IT9700240

INFN/TC-95/25
13 Settembre 1995

IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 9, NO. 2, JUNE 19

Multilayered Bi-2223 Conductors for Current-Lead Applications

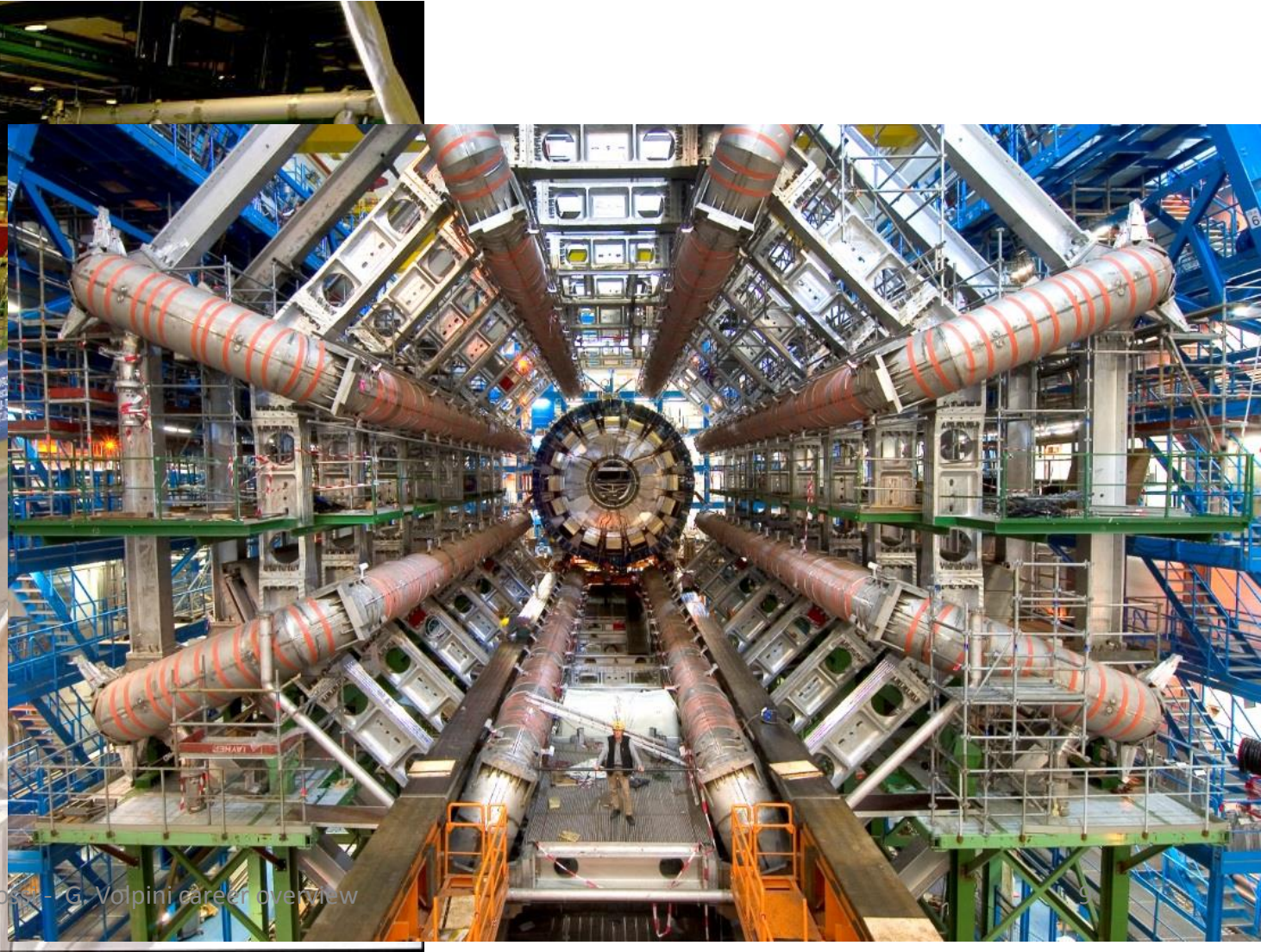
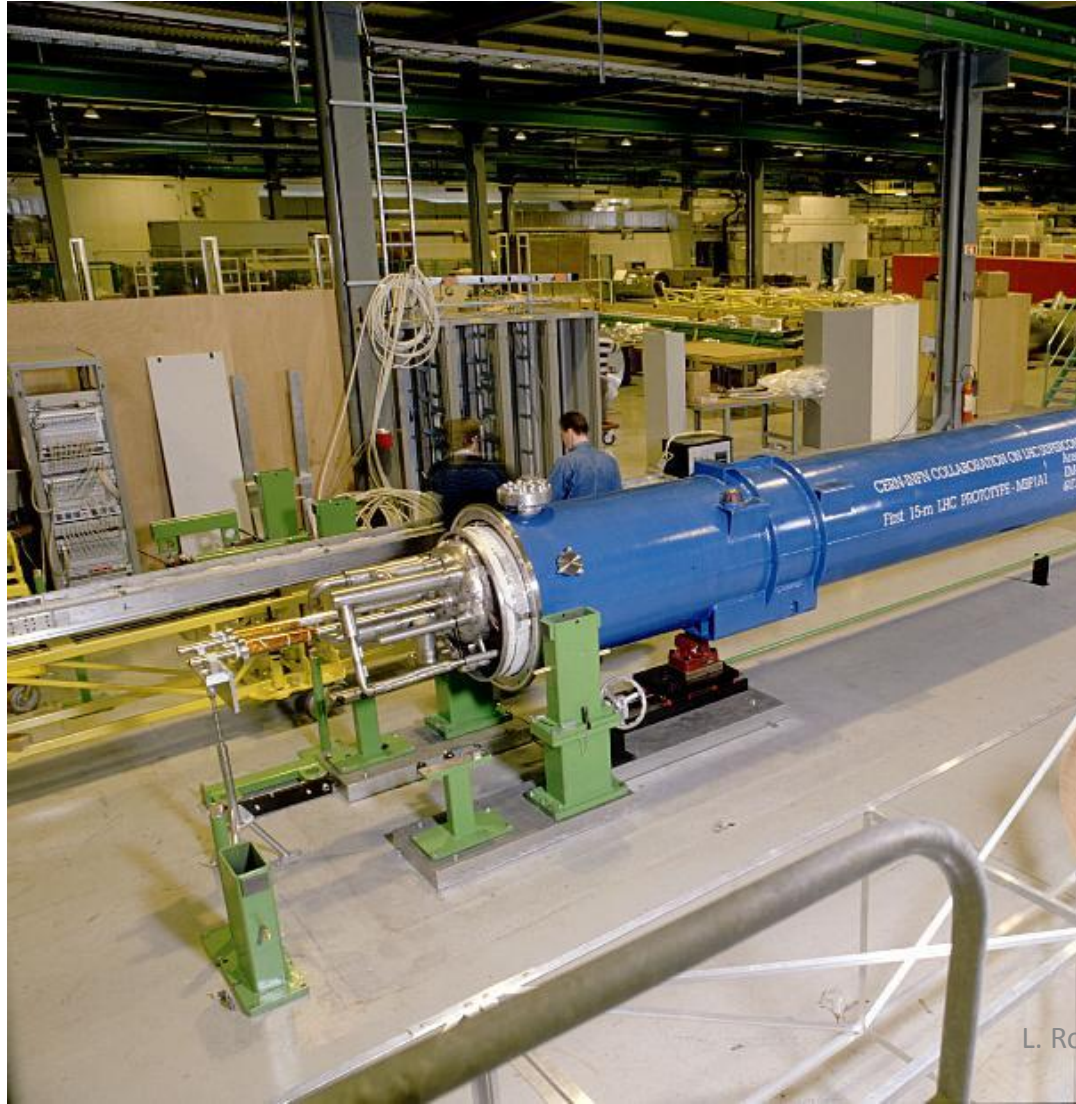
L. Martini, F. Barberis, R. Berti, L. Bigoni, F. Curcio
ENEL-SRI, Segrate (MI), Italy

G. Volpini
INFN-LASA, Segrate (MI), Italy

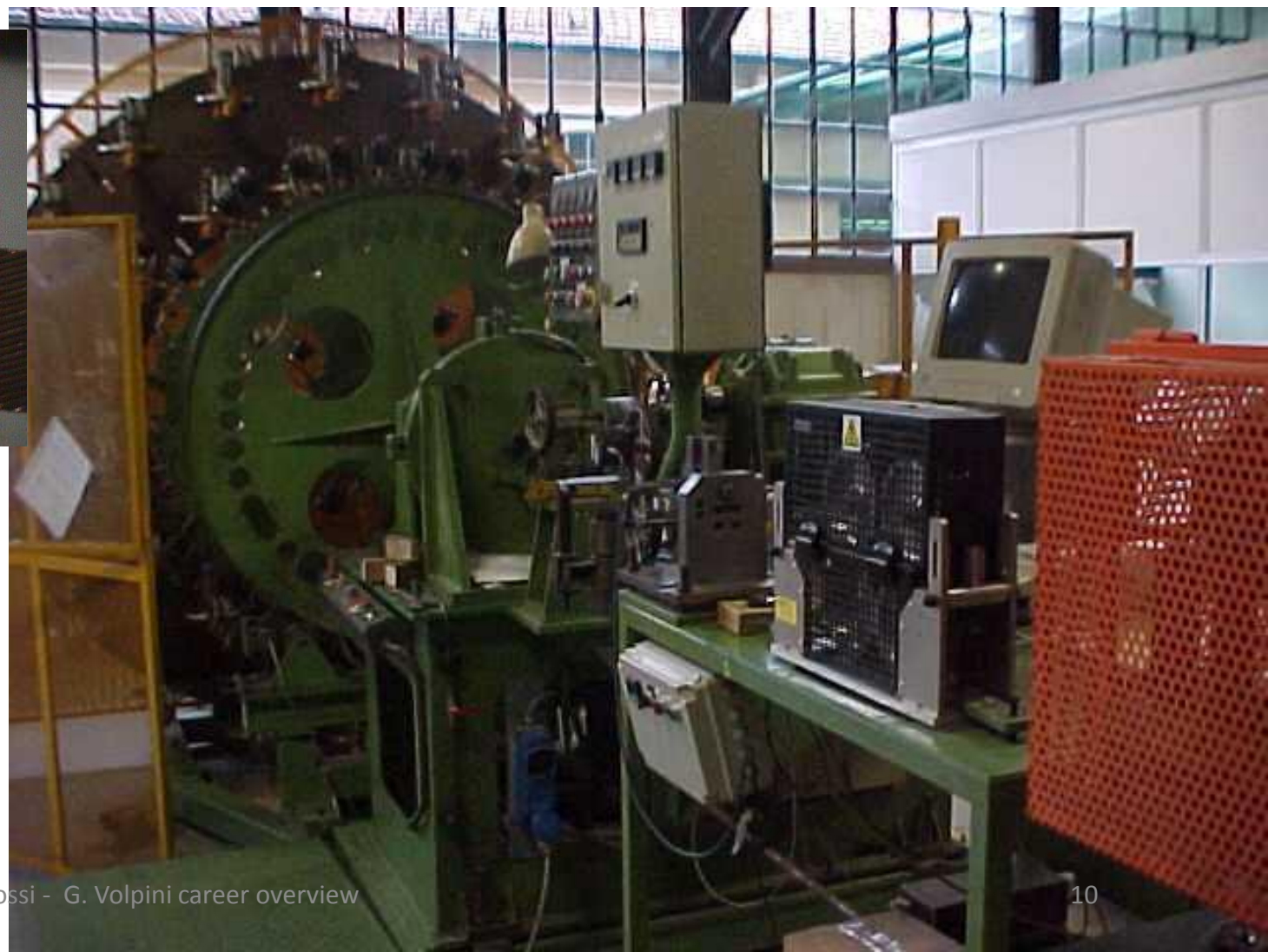
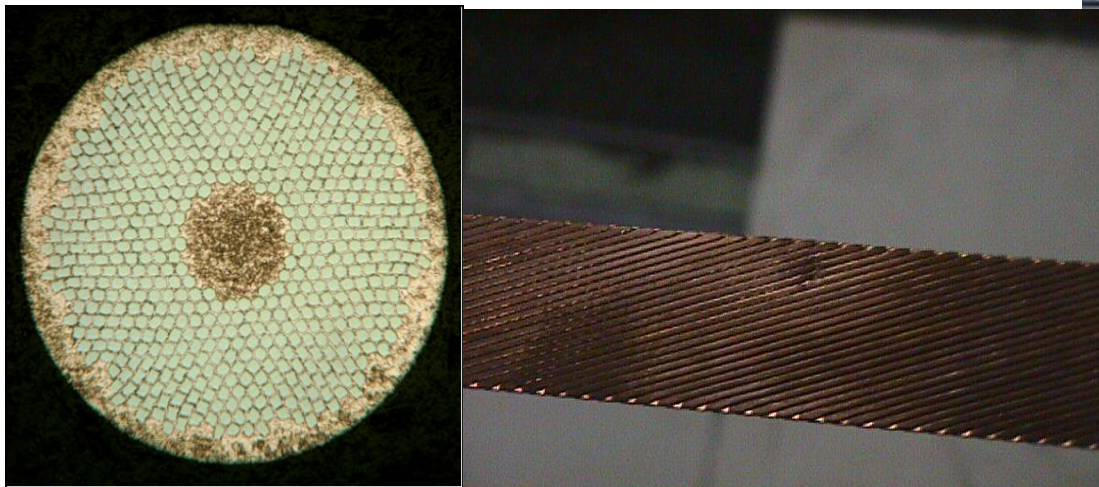
G. Ambrosio, F. Ametrano, G. Bellomo, F. Broggi, L. Rossi, G. Volpini:

PRELIMINARY PROPOSAL OF A Nb_3Sn QUADRUPOLE MODEL FOR
THE low β INSERTIONS OF THE LHC

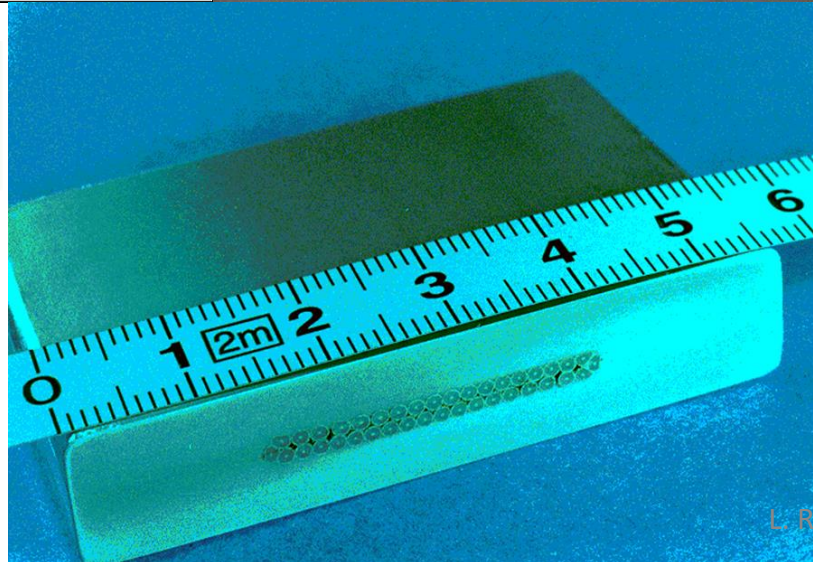
1998 –turning point: first 15 m long dipole tested. Prof. Mandelli urged us toward ATLAS



ATLAS: Conductor 1999-2003 (5% program, CEA, EM)



Europa
Metalli s.p.a.
Superconduc
tors Division



ATLAS: Conductor 1999-2003 (5% program, CEA, ETH)





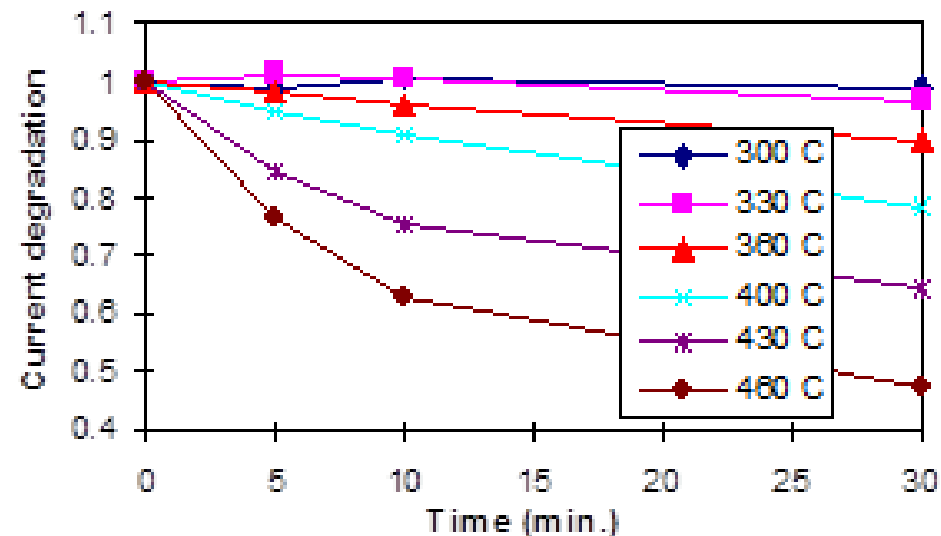
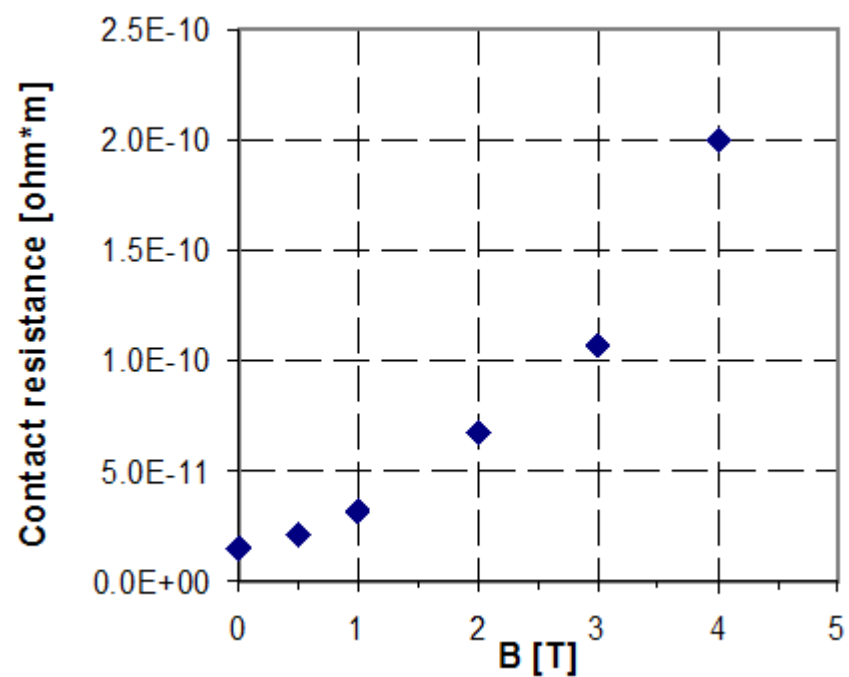
L. Rossi - G. Volpini career overview

Production and Qualification of the 60-kA, Aluminum-Stabilized Conductor for the ATLAS B0 Coil

L. Rossi, M. Sorbi, G. Volpini, D. Pedrini,
INFN and University of Milan, LASA Laboratory, via Fratelli Cervi 201, 20090 Segrate (Milano), Italy

C. Berriaud
DAPNIA/STCM, CEA Saclay, 91191 Gif-sur-Yvette Cedex, France

I.L. Horvath
Laboratory for High Energy Physics, ETH Honggerberg, CH-8093 Zurich



His own work: The ATLAS JOINTS 1999-2002

IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 9, NO. 2, JUNE 1999

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Thermal and Electrical Behavior of a Resistive Joint in the ATLAS Toroids

G. Volpini, E. Acerbi, G. Ambrosio and M. Sorbi

INFN, sez. di Milano, Laboratorio Acceleratori e Superconduttività Applicata, and Università degli Studi di Milano, Dipartimento di Fisica, Via f.lli Cervi 201, Segrate (MI) 20090-Italy



ISTITUTO NAZIONALE DI FISICA NUCLEARE

Sezione di Milano

INFN/IC-00/07
17 Maggio 2000

A MODEL OF THE CURRENT DISTRIBUTION INSIDE THE RESISTIVE JOINTS OF THE ATLAS TOROIDS

Giovanni Volpini



ISTITUTO NAZIONALE DI FISICA NUCI

Sezione di Milano

INFN/IC-00/12
10 Luglio 2000

MEASUREMENT OF AN INTERNAL JOINT AND A LAYER-TO-LAYER JOINT AS A FUNCTION OF THE MAGNETIC FIELD

L. Rossi - G. Volpini¹ - Mirko Pojer^{1,2}

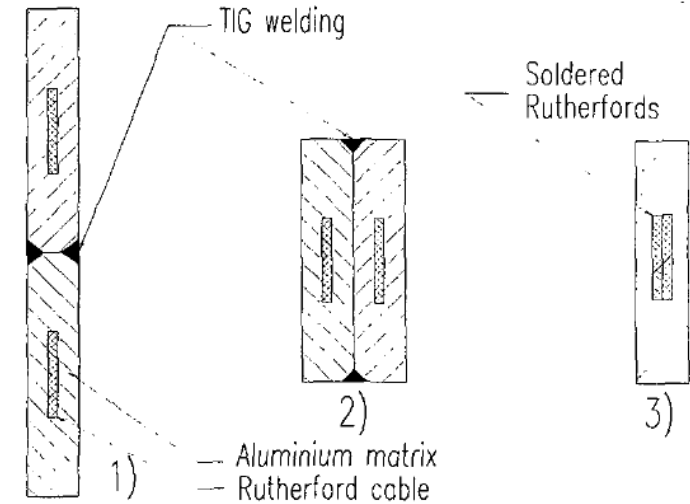


Fig. 2. Schemes of joint. The aluminum matrices are directly TIG-welded in cases 1) and 2), while in 3) first the aluminum has been removed, later the Rutherford cables have been soft-soldered, and then the aluminum matrix has been reconstructed.

The joint saga... with practical consequence

We have exploited our SOLEMI facility for the measurements. This apparatus, described elsewhere [4],

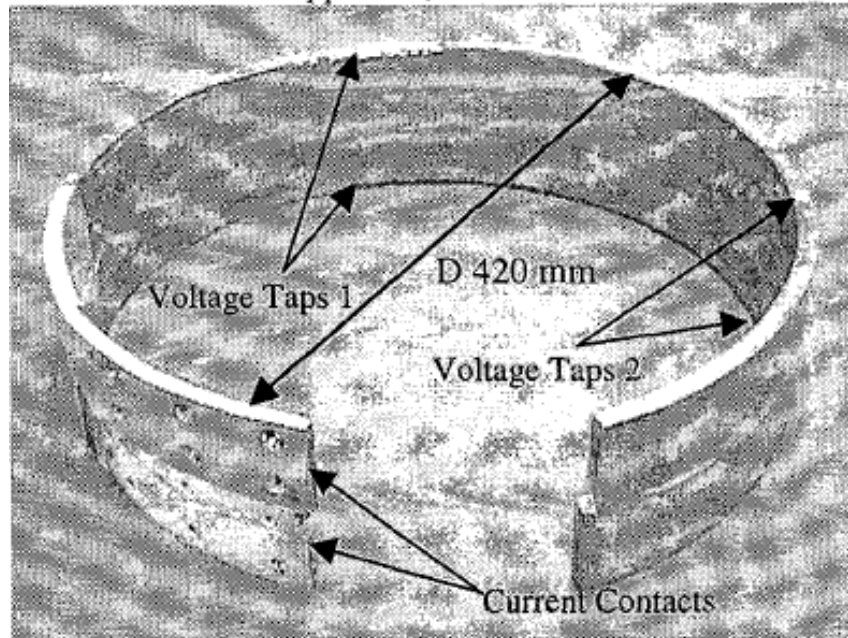
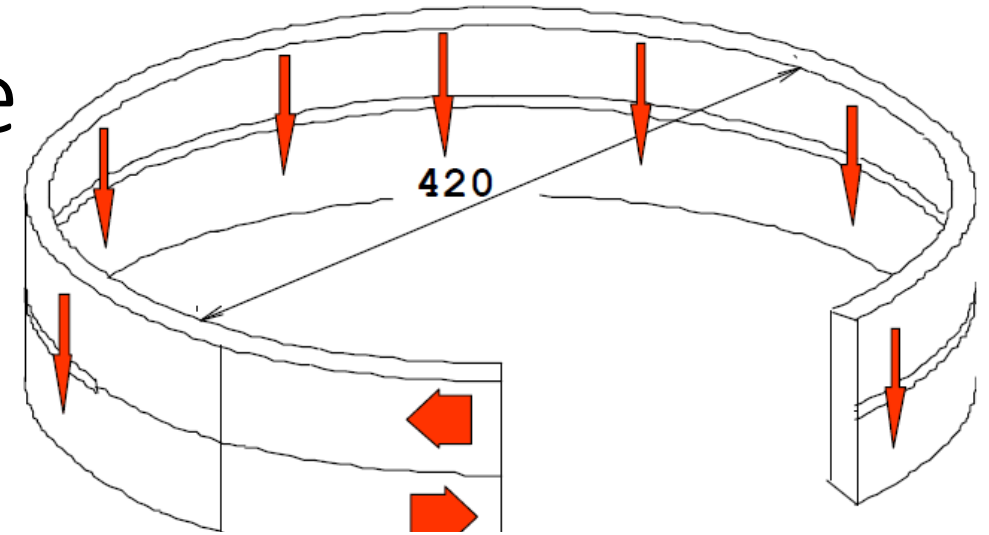


Fig.3. Sample joint with conductors welded along their narrow face. The position of voltage taps and current contacts is shown.

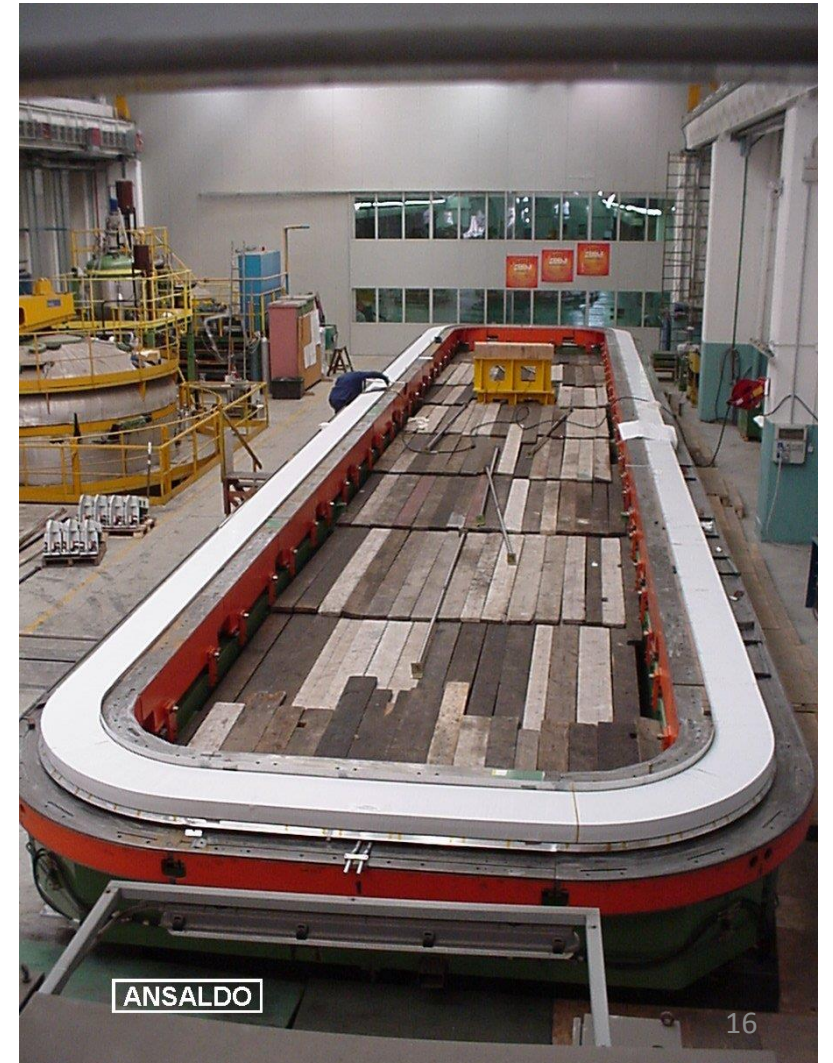


TAB. 2: Peak current, Peak, Steady and Foucault power dissipation during the magnet ramp-up at $dI/dt = 2.85 \text{ A/s}$, along with the induced temperature rise under different hypotheses. †) cooling in the joint zone: Y = yes; N = no; n/a = not applicable. ‡) heat release: P = point-like; D = distributed.

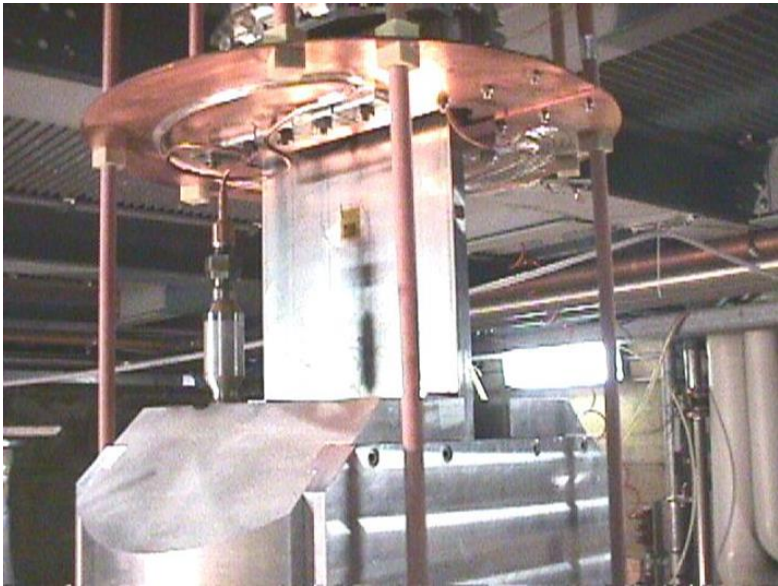
Length [m]	Peak Current [A]	Peak Power [W]	Steady Power [W]	Foucault Power [W]	ΔT Peak [K]	ΔT Steady [K]	ΔT Peak [K]	ΔT Steady [K]
					n/a †)	Y †)	N †)	N †)
					P ‡)	D ‡)	D ‡)	D ‡)
1.0	20,500	0.173	0.165	0.008	0.027	0.015	0.044	0.042
2.0	21,409	0.150	0.083	0.067	0.024	0.005	0.053	0.029
2.5	25,019	0.205	0.066	0.139	0.032	0.003	0.082	0.027
3.0	30,402	0.304	0.055	0.249	0.048	0.002	0.137	0.025
4.0	43,389	0.591	0.041	0.550	0.093	0.001	0.325	0.023
5.0	55,298	0.872	0.033	0.839	0.137	0.001	0.565	0.021

ATLAS and the succession: 2001-2005

The Big Coils! In April 2001 DP#4 was just impregnated



ATLAS - The big trouble: cryostat



The protection and Dump unit of ATLAS

IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 9, NO. 2, JUNE 1999

1101

The Protection System of the Superconducting Coils in the Barrel Toroid of ATLAS

E. Acerbi, M. Sorbi, G. Volpini.

INFN-University of Milan, LASA, via Fratelli Cervi 201, I-20090 Segrate (Milano), Italy

A. Daël, C. Lesmond

DAPNIA/STCM, CEA Saclay, F-91191 Gif-Sur-Yvette Cedex, France

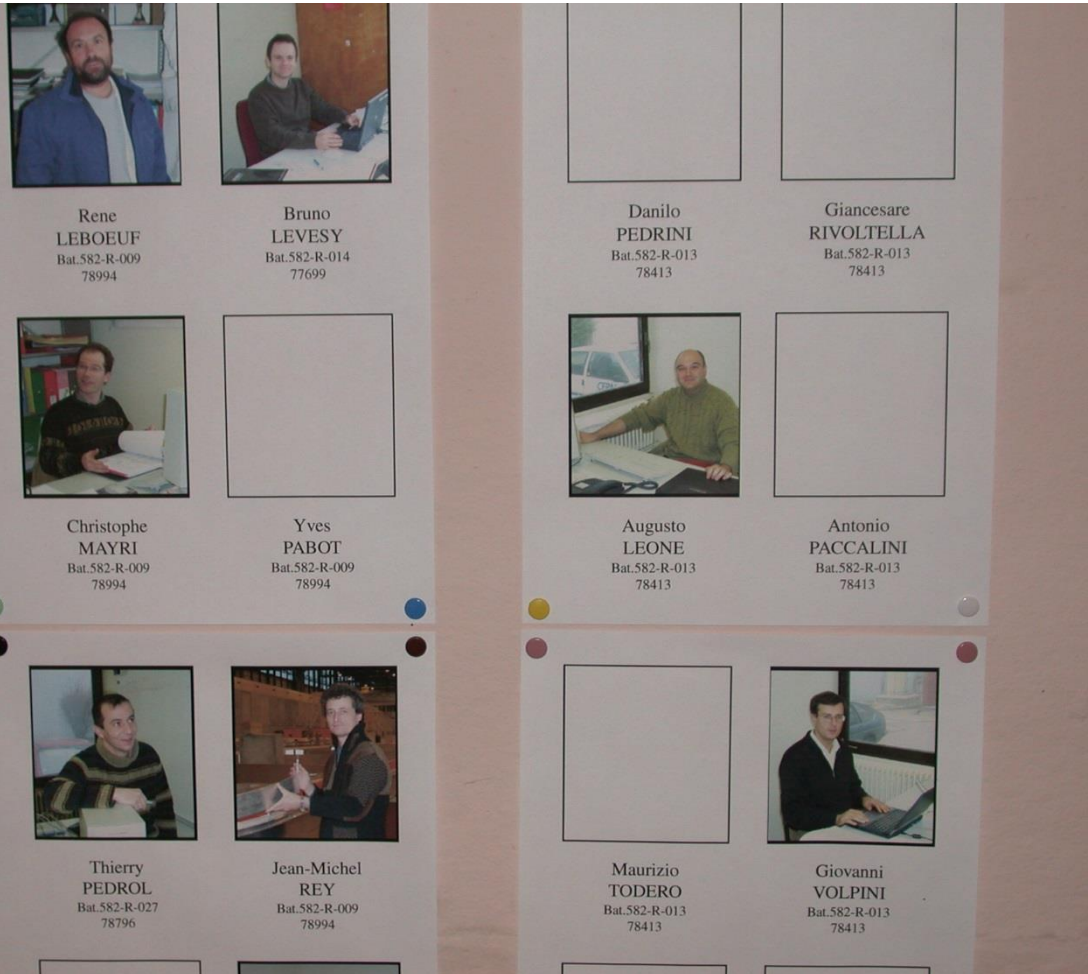
IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 11, NO. 1, MARCH 2001

2587

Analysis of the Discharge of the ATLAS Barrel Toroid and End Cap Toroids with Different Configurations of the Protection Circuit

Emilio Acerbi, Giuseppe Baccaglioni, Francesco Broggi, Massimo Sorbi and Giovanni Volpini

ATLAS the end...



IEEE TRANSACTIONS ON APPLIED SUPERCONDUCTIVITY, VOL. 15, NO. 2, JUNE 2005

1271

First Full-Size ATLAS Barrel Toroid Coil Successfully Tested up to 22 kA at 4 T

A. Dudarev, J. J. Rabbers, C. P. Berriaud, S. Junker, R. Pengo, S. Ravat, L. Deront, E. Sbrissa, G. Olesen, M. Arnaud, J.-M. Rey, P. Veldrine, F. Broggi, G. Volpini, A. Foussat, Ph. Benoit, V. Stepanov, A. Olyunin, I. Shugaev, N. Kopeykin, and H. H. J. ten Kate

Abstract—The Superconducting Barrel Toroid is providing (together with the two End-Cap Toroids not presented here) the magnetic field for the muon detectors in the ATLAS Experiment at the LHC at CERN. The toroid with outer dimensions of 25 m length and 20 m diameter, is built up from 8 identical racetrack coils. The coils with 120 turns each are wound with an aluminum stabilized NbTi conductor and operate at 20.5 kA at 3.9 T local field in the windings and is conduction cooled at 4.8 K by circulating forced flow helium in cooling tubes attached to the cold mass. The 8 coils of 25 m × 5 m are presently under construction and the first coils have already been fully integrated and tested. Meanwhile the assembly of the toroid 100 m underground in the ATLAS cavern at CERN has started. In this paper the test of the first coil, unique in size and manufacturing technology, is described in detail and the results are compared to the previous experience with the 9 m long B0 model coil.

Index Terms—Detector magnets, superconductors, toroid.

I. INTRODUCTION

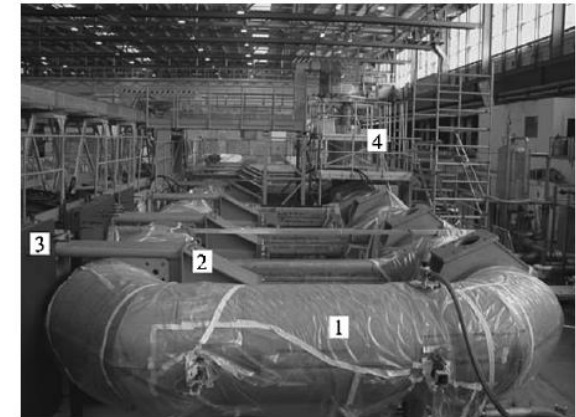


Fig. 1. The coil in the test station in its vacuum vessel (1), support unit (2), magnetic mirror (3) and current lead turret (4).

After 2005... The turning toward Pulsed Magnets

- MARIMBO MgB2 with INFN-GE - 2005
- Skipping CARE-NED (to busy with ATLAS – 2003-2008)
- Skipping SLHC-PP (proposal of corrector magnets)- 2006-2010
- INFN around 2006 engages in pulsed magnets...
 - FAIR SIS300 and DISCORAP and FP7-OCRISP...
- Finally in 2008 (when SIS300 was pushed far in future) I suggested Gijs de Rijk to embark LASA in EuCARD (FRESCA2). Took a while to convince Giovanni... But was the right thing also to put in value QLASA
- And then EuCARD2, more convinced: occasion to continue testing...

Giovanni at Mirko's Wedding: 28 feb 2008



A system similar to the POTAIM cards.

Engineered and built at LASA, it has successfully tested in field conditions during the MAGIX single coil tests from April until November 2015.

It includes:

16 channels (may be expanded), each:
 optoinsulated input,
 bridge/single end
 independently configurable

Voltage thresholds:

$\pm 4V$, $\pm 1.25V$, $\pm 500mV$, $\pm 100mV$

Time validation ranges:

0-10 ms, 0-100 ms, 0-1 s

Input signal made available in copy

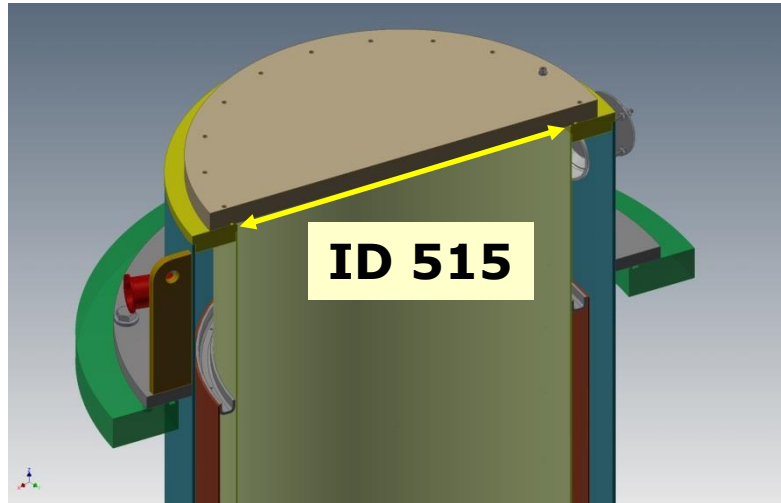
Memory of channels fired



This old-fashioned, voltage-based, Quench Detection System to be integrated by other system(s) to be provided by the collaboration.

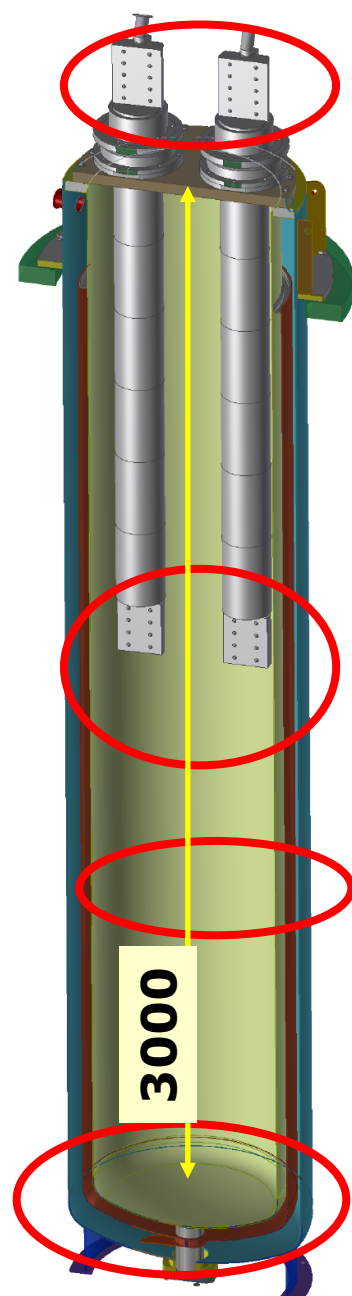
Cryostat

No of sensor, and wiring to be clarified



2.5 ton design load
Conduction cooled thermal shield

Contract awarded
Delivery June 2016



Electrical connections magnet to CLs
Must operate in gas flow up to maximum test temperature

Mechanical connections
Magnet will suspended to three tie rods.

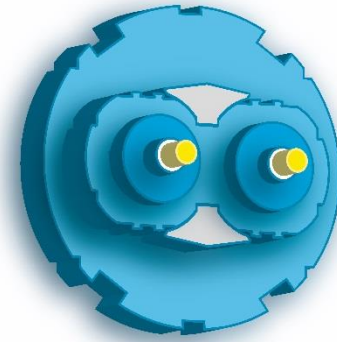
Gas-flow temperature control
A flow of ~ 1 g/s (30 LHe/h) will be vaporized by heaters to a controlled temperature and then the gas will be fed to the vessel containing the magnet. The exit flow should be enough to keep the CL's cold.
Temperature stability and gradient to be assessed.



Hamburg , 22 May
2014 – Dinner of
the 1st Workshop
on Accelerator
Magnets in HTS

The coming to CERN

- 2010 : The HiLumi Project starts
- I asked Giovanni to participate in FP-HiLumi



High
Luminosity
LHC

- Tired of INFN and in general of the slow decay of LASA
- 2012 : discussion about his future and LASA
- 2013: Agreement CERN-INFN for SuperFerric Corrector Magnets (MAGIX)
- As part of the agreement was the proposal for a 3-y PJAS at CERN
- It was the necessary change that Giovanni needed, and the long term perspective for him and LASA (in view of High Field for FCC...)
- **The SF sextupole has been the first prototype built for High Luminosity LHC!**



L. Rossi - G. Volpini career overview

In Milano with
Shlomo Caspi
April 2016

