TOWARDS AN ITALIAN HIGH-FIELD MAGNET AND SPECIAL TECHNOLOGY PROGRAM FOR FCC

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www.asgsuperconductors.com
• **HIGH-FIELD MAGNETS** enabling technology for **ENERGY FRONTIER HADRON COLLIDER**

**STRONGER MAGNETIC FIELD**

- Bending magnets field of **16 TESLA**

**HIGHER ENERGY OF CIRCULATING PARTICLES**

- **100 TeV (c.o.m.)** on a track of **100 km CIRCUMFERENCE**

- Conceptual and engineering design **16 TESLA ACCELERATOR DIPOLE MAGNET IN LTS**
- Conceptual design and proof-of-principle **20 TESLA ACCELERATOR DIPOLE MAGNET**
- Achieve **ACCELERATOR-GRADE FIELD QUALITY IN 50 mm APERTURE**
- Explore different **COIL GEOMETRIES AND NOVEL MAGNET CONCEPTS**
- **MASTER MANUFACTURING ASPECTS AT LARGE SCALE**
- **OPTIMIZE MANUFACTURING AND OPERATION COSTS**
Superconductors Industry in Europe is **shrinking over the last decade**: root cause is the **discontinuity in R&D projects**.

The only **self sustaining companies** are strongly active in the **healthcare domain** or are a **division of a large corporation**.

**Magnet business is unforgiving and requires continuity and highly specialized personnel.**

**Source:** FuSuMaTech - A. Daël
ITALIAN ENTITIES IN THE FIELD OF SUPERCONDUCTIVITY

SUPERCONDUCTIVITY CLUSTER IN GENOA

14/04/2016
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MRO MgB₂ FCL Proton therapy IMGRT SMES UHF MRI

COMPASS ASDEX FTU JET ITER TFMC JT60-SA ITER PFC W7X ITER TFC

COMPREHENSIVE ROUTE

HERA DAΦNE BABAR LHC CMS

ADONE PS SPS VERTEX

FUSION ROUTE

ASG

SUPERCONDUCTORS

HIGH ENERGY PHYSICS ROUTE

INDUSTRIAL ROUTE

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• In time **Magnets for High Energy Physics** have become **more challenging** in terms of **field intensity and homogeneity**

• With **increasing performance** goes **higher complexity**
ASG is collaborating for the short models of the cold mass, in particular to the MANUFACTURING OF THE 1.5m COILS, in order TO SET UP THE PRODUCTION PROCESS AND TO TEST THESE COILS IN THE FIRST SHORT COLD MASS.

MQXF QUADRUPOLES

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11T DIPOLES

ASG is in charge of the DESIGN AND PROCUREMENT OF THE TOOLS that will be necessary for the COLLARING OF THE 5.5m COILS.

The goal of the activities is to produce, by March 2017:

- ONE TRIAL COLLARED ASSEMBLY WITH TWO Nb3Sn LOW PERFORMANCE COILS
- TWO COLLARED ASSEMBLIES WITH Nb3Sn FULL PERFORMANCE COILS
• In the framework of HiLumi CERN IS DEVELOPING IN CLOSE COOPERATION WITH INDUSTRY SC ELECTRIC LINKS IN ORDER TO POWER LHC ARC DIPOLES moving the power supplies in a radiation free area

• COLUMBUS SUPERCONDUCTORS HAS Manufactured and CERN SUCCESSFULLY TESTED 80 KM OF MgB$_2$ cable proving its fitness to transport 150 kA

• The above results from the OUTSTANDING LEVEL OF COLLABORATION ACHIEVED BETWEEN CERN AND COLUMBUS
Collaboration with the most important Scientific Research Institutes

Merely Supplier → Partner for Development

- ASG Staff Resident @ CERN
- Feasibility Study with INFN

ASG is involved also in the Design Phase
• ASG has contributed **MAGNETS FOR FUSION TO ALL EUROPEAN RESEARCH CENTERS**

• In turn delivering magnet systems for
  • **STELLARATOR**
  • **TOKAMAK**

• And all orders of magnets:
  • **CENTRAL SOLENOID**
  • **TOROIDAL FIELD COILS**
  • **POLOIDAL FIELD COILS**
  • **DIVERTOR COILS**
Continuously facing with unpredictable and cyclical nature of the business:

- Difficulty remaining active on the market
- Lack of attractiveness for qualified personnel
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- **Synergy**
- Transfer of Competencies
• Make a **REAL BUSINESS** of SC magnets

• **OFFSET THE UNPREDICTABLE CYCLICAL NATURE IN RESEARCH MARKET TRENDS**

• Make use of **COMPETENCIES GAINED IN HIGH ENERGY PHYSICS AND FUSION**

• MgB$_2$
ASG ACQUISITIONS

**HEP & Fusion Way**
**Industrial Way**

- Majority of **SC Magnets** designed and manufactured in Genoa benefits of the **VIRTUOUS COLLABORATION BETWEEN INDUSTRY AND PUBLIC RESEARCH**
- We are the **ONLY ITALIAN COMPANY DESIGNING AND MANUFACTURING OF SUPERCONDUCTING SYSTEMS**
- Multi decennial **COLLABORATION WITH INFN**
Towards an Italian High-Field Magnet Technology Program for FCC

- **Synergy**
- Transfer of **Competencies**
The FuSuMaTech initiative is thus a first and remarkable attempt to join the best energy of the research and industrial world in order to obtain a synthesis of those technological improvements that will at once become a technological enabler both in the market of magnets for healthcare and the highest end of physic research.
Thank you for your attention
BACK UP
Conclusion

• The FuSuMaTech working group has visited more than 10 companies in Europe and has been warmly welcomed.

• Companies have a very positive attitude and see the HL-LHC and FCC huge effort as a real opportunity to strongly push the Superconducting Magnet Technology in the next decade.

• European programmes appear as a unique tooling box to drive common work and to prepare efficient actions under the CERN umbrella.

• A promising set of WP and Tasks including generic R&D actions and technology pilots is under discussion between academic partners and high tech companies.

• We are all volunteers for this win-win strategy.

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