

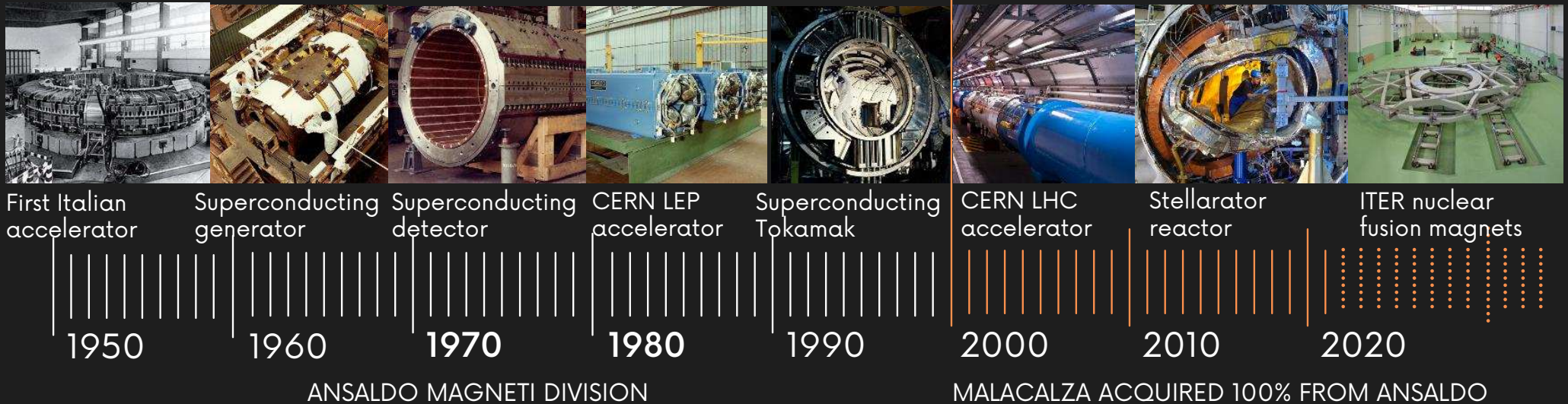


Superconducting detector magnets at ASG Superconductors



ASG until today

A RECOGNIZED LEADER OF AN ELITE TECHNOLOGY EVOLVING TO THE DESIGN AND PRODUCTION OF **SUPERCONDUCTING SYSTEMS** FOR A GLOBAL MARKET



ASG Superconductors

Cables



POWER DEVICES



MgB₂ wires



Open MRI



Fault Current Limiter



ASG Superconductors

THREE FACTORIES IN ITALY
dedicated to:

- Superconducting wires
- Medical and research magnets & systems
- Large scale magnets & systems

FIELD offices in France,
USA & UK



a quick look at

200+ DEDICATED PEOPLE:

- Around 80 skilled workers
- More than 100 engineers, Physicists, material scientists, many holding a PhD
- Sales and Service teams present in various countries

Our Factories



TECHNOLOGIES



MATERIALS



COMPONENTS



SYSTEMS

CONVENTIONAL



INNOVATIVE



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Our Business Strategy

FROM CERN ACCELERATOR TO INDUSTRY & GRID APPLICATIONS

FROM CERN ACCELERATOR TO INDUSTRY & REFRIGERATION-COOLED POWER DEVICES FOR THE ELECTRICITY GRID

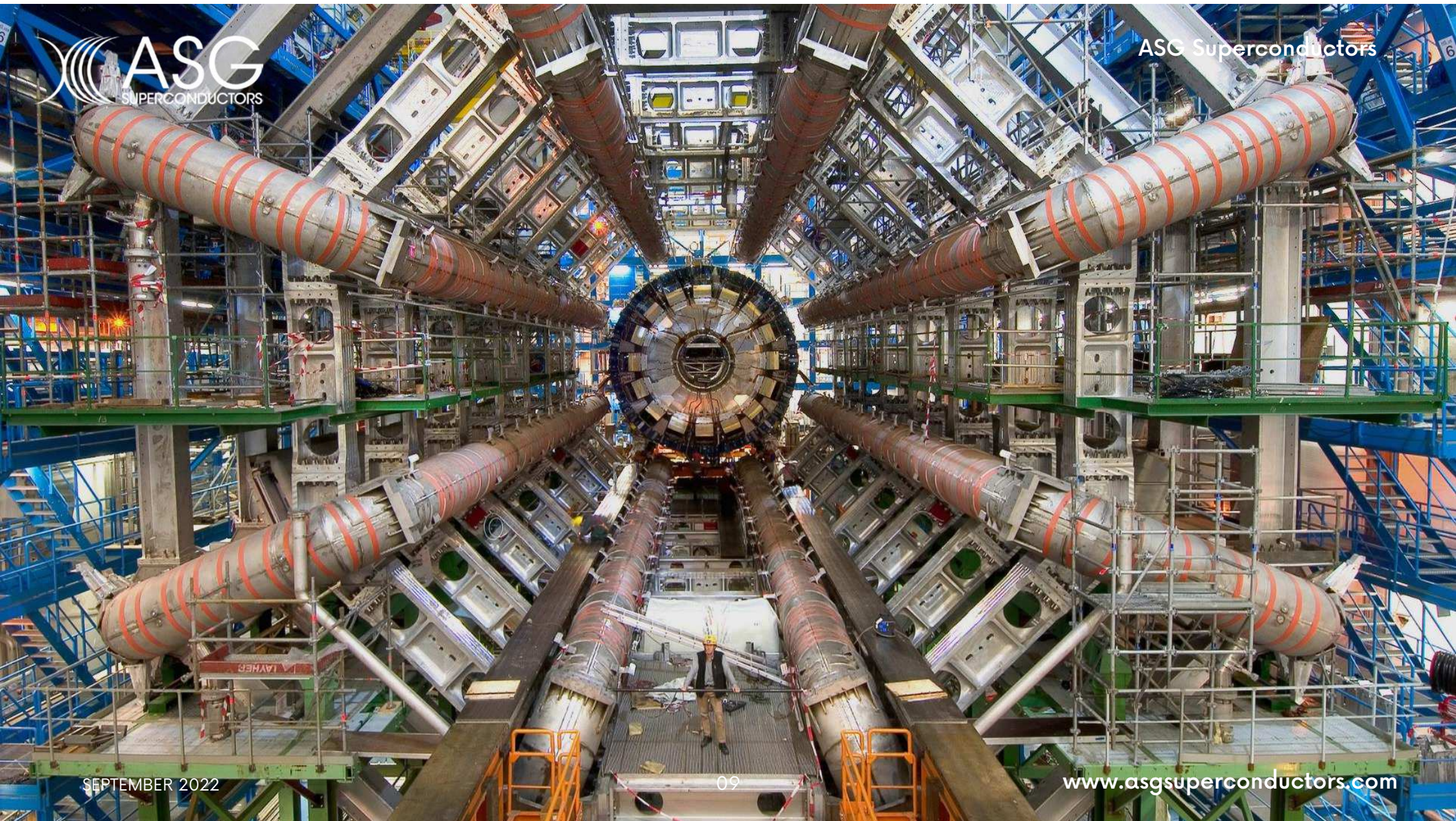
ROTATING MRI APPLIED TO CANCER THERAPY

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A selection of our CUSTOMERS



Manufacturing of the ATLAS Barrel Toroid Double Pancakes



BT ATLAS conductor preparation line

The unit lengths allow the winding of one single layer of each Double Pancake.

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TWO UNIT LENGTHS ARE WELDED TOGETHER TO OBTAIN THE OVERALL LENGTH OF A DP.

UNWINDING SPOOL

STRAIGHTENING UNIT

ULTRASONIC Cleaner

SANDBLASTING UNIT

TAPING MACHINE

WINDING MACHINE

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SC RUTHERFORD:
38-40 NbTi strands – 22x2.3 mm²
Aluminum matrix – 57x12 mm²



DOUBLE PANCAKE WINDING:

- Applied winding tension regulated at the requested value of 3000 N.
- The forms are made in iron subdivided into modules of about 2 m length, joined by aluminum bars to compensate the expansion of the conductor.

The inter-layer insulation (2 x 0.25 mm thick).

Layer dimensional and electrical checks.



THE DOUBLE PANCAKE GROUND INSULATION AREA

The handling tool is designed avoid a coil deformation $> 0.6 \text{ mm/m}$.

Ground insulation is applied manually (2x0.25 mm thickness)

Main dimensional and electrical tests are repeated



DP CUSTOM FITTED IMPREGNATION CHAMBER:

- thermal behavior coherent with that of the coil
- seal for vacuum tightness by TIG welding (~ 120 m).

IMPREGNATION CYCLE:

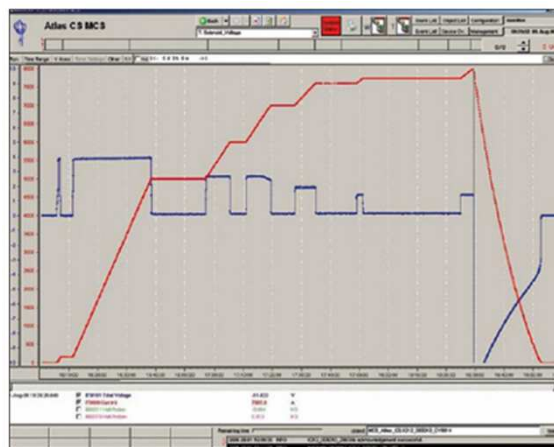
- OUT GASSING,
- IMPREGNATION WITH EPOXY RESIN,
- DP COMPRESSION (112 HYDR. JACKS, $1 \div 2.5$ MPA),
- GELIFICATION & CURING (JOULE EFFECT).

DIMENSIONAL AND FLATNESS CHECK,
ELECTRICAL AND
GROUND INSULATION TEST (~ 2 KV).



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	Nominal [mm]	Measure d [mm]	Sprea d
Inner Length	24149 +0/-14	24141	0.5 ‰
Inner Width	4170 +2/-10	4162	2 ‰
Thickness	384.5 +/-4.5	382.2	5 ‰
Height	118.1 +/-0.6	117.8	3 ‰

Manufacturing of the CMS solenoid

Pellecchia - Superconducting Magnet
Magnets Workshop

SEPTEMBER 2022

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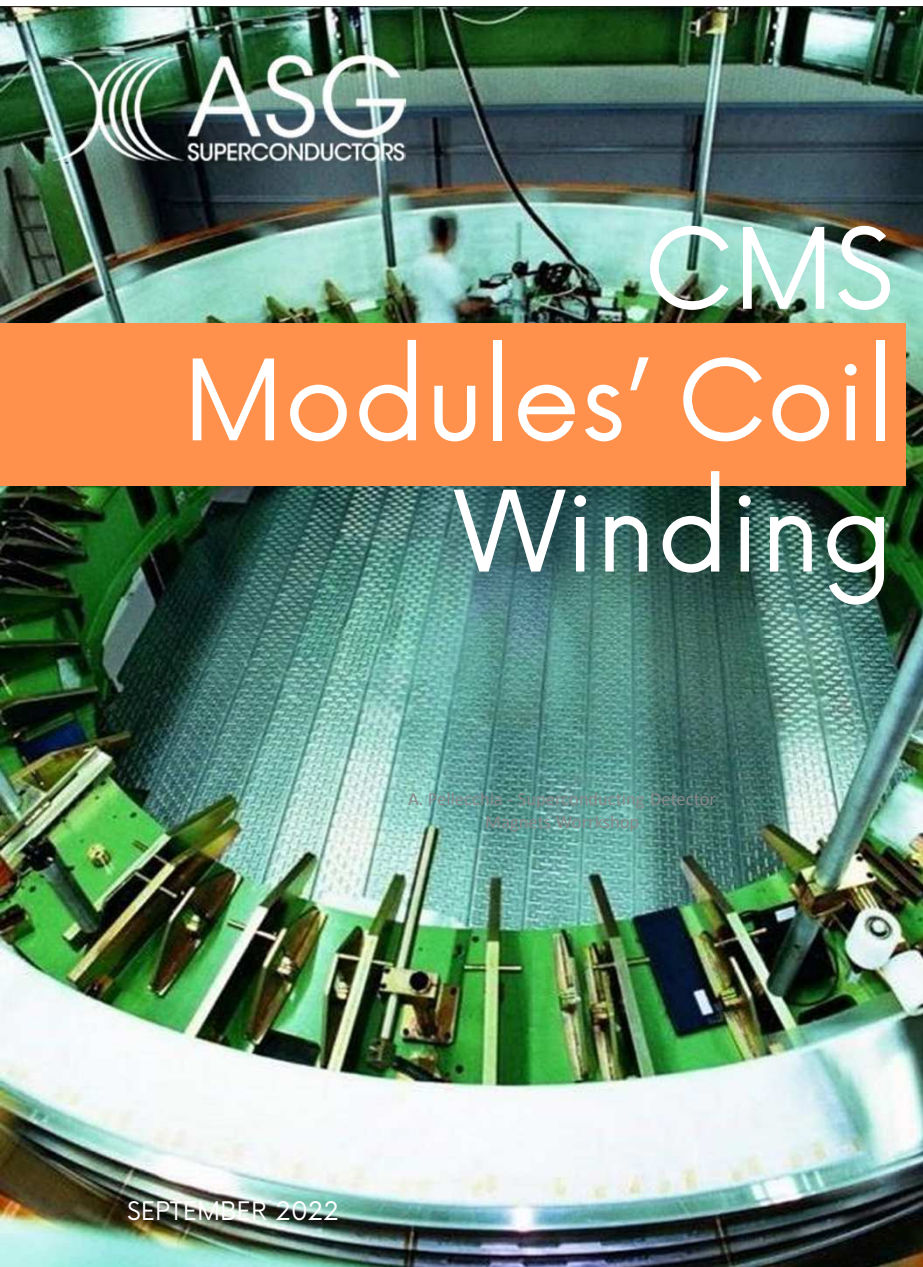
CALENDERING, WELDING AND MACHINING THE COIL MANDREL

Welding of cooling circuit

Coil Winding on the inner side of the mandrel

Construction of the resin vessel

Vacuum impregnation



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DOWNSPOILING

Straightening unit

Two step bending unit

Sandblasting unit

Taping unit

Winding table

Conductor positioning sys.

Axial pressing system



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SUPERCONDUCTORS

CMS Modules' Coil Impregnation

A. Pellicchia - Superconducting Detector
Magnets Workshop

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IMPREGNATION CYCLE:

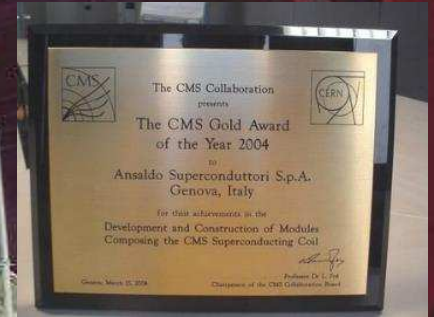
out gassing,

impregnation with epoxy resin,

Coil compression,

gelification & curing (Joule effect).

CMS Gold and Crystal Awards



Manufacturing of the Multi Purpose Detector for JINR

A. Pellegrini - Superconducting Magnet
Magnets Workshop

Modules' Coil Winding



MODULE WINDING was derived by the CMS winding technique with the complication implied by the softness of the Al stabilizer that made the conductor very malleable

Magnet was wound in three modules, to be assembled together at a later stage

MPD Modules Assembly

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3RD MODULE ASSEMBLY



MODULES ASSEMBLED

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MPD coils Insertion into Vacuum vessel

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SUPERINSULATION

A special jig was developed in order to insert the cold mass into the vacuum vessel, that had to allow for safe operation of a number of workers in and around the cold mass

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MPD Shipment

A. Pellecchia - Superconducting Detector Magnets Workshop

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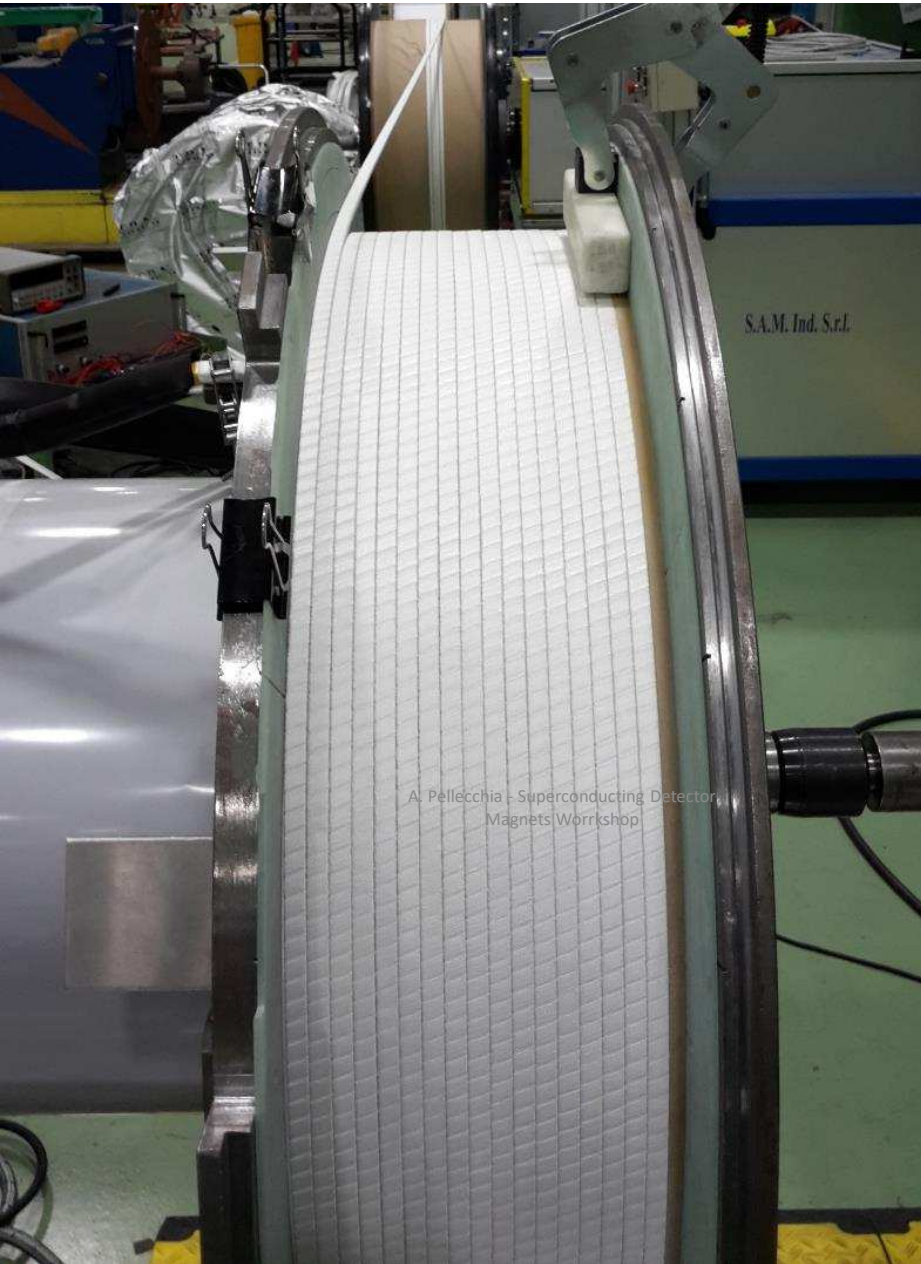


UNLOADING @ ST. PETERSBURG

AV Pelliccia - Superconducting Detector
Magnets Workshop

Manufacturing of the Mu2e Transport Solenoid Detector

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TS detector is composed of 56 , very similar, coils made of NbTi Rutherford conductor.

The coils are assembled in couples into an Al mandrel to form 23 modules, that assembled together do compose the Transport Solenoid

A. Pellegrini - Superconducting Detector
Magnets Workshop

Mu2e

Coil

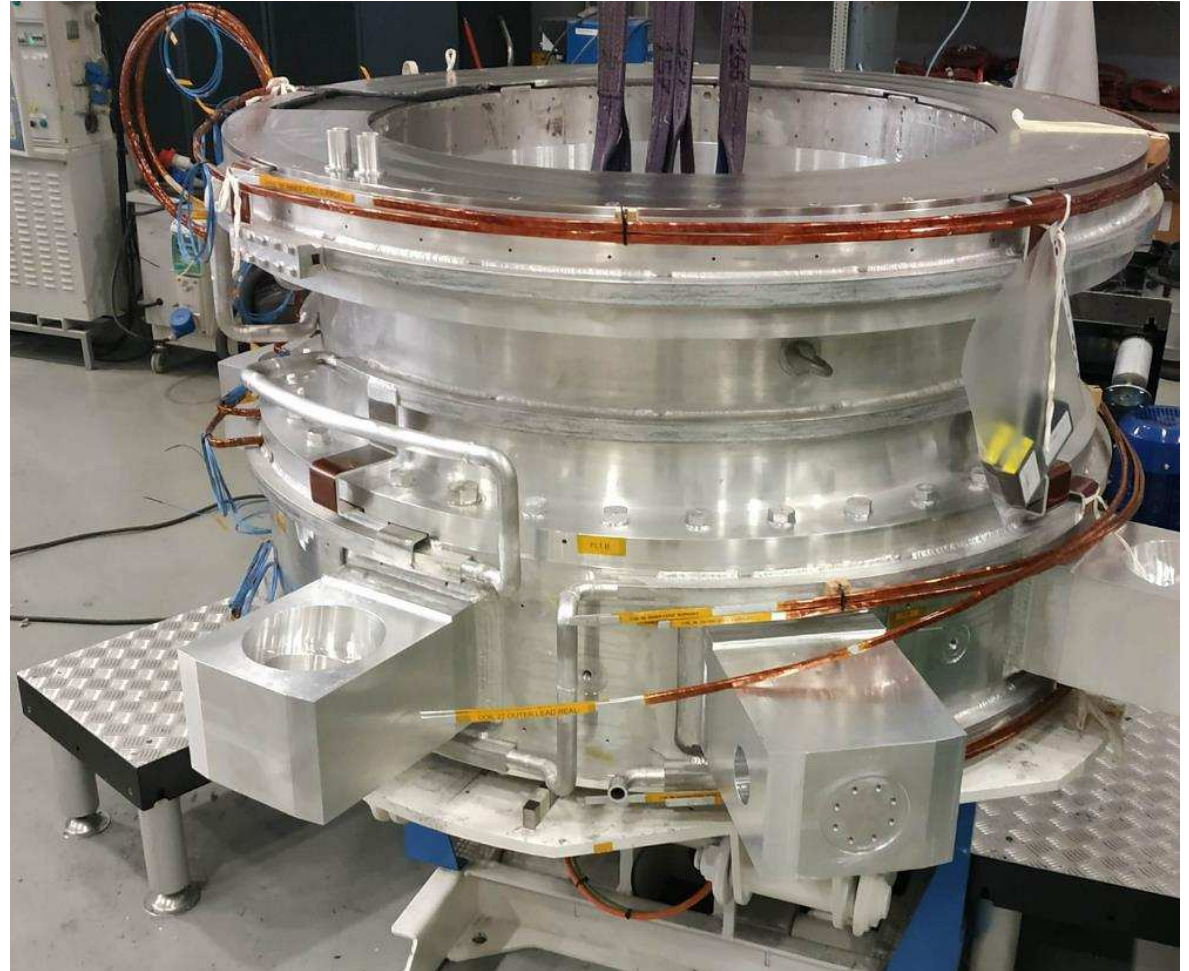
Manufacturing

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Conclusions

Detector magnet manufacturing is an unforgiving segment of the market:

- At ASG we would like to concentrate on the magnet while YOU concentrate on the Physics
- Budgets do play a role: complex equipment in a evermore complex world

New physics will probably determine the use of HTS conductor technology, in our opinion MgB₂ is currently the most viable solution for a number of reasons (capex, opex, rad. resistance, ease of use, splice length)

Please do involve us (the industry folks) from day 1

Thank you to all of you at CERN, INFN, FNAL, JINR for making this great journey possible.