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high vacuum

NEG Solutions in Large Vacuum Systems from Materials Design to Integrated Engineering Solutions

Enrico Maccallini
Business Manager
Technology and Digital Innovation Manager

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Industry meets Academia

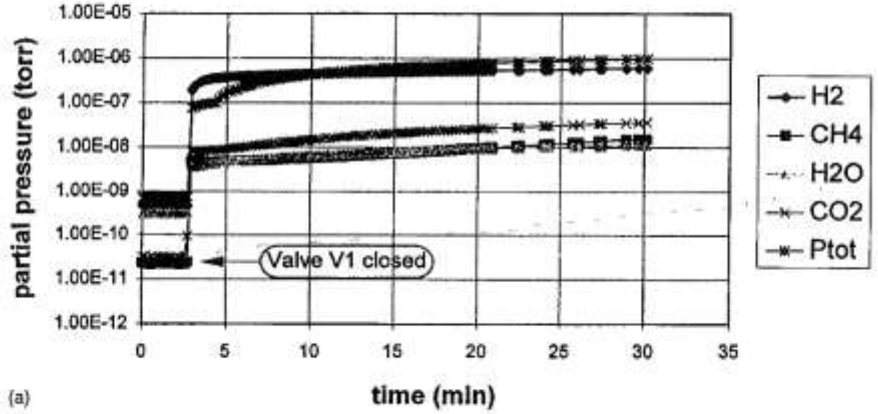
NEGs and cryogenics

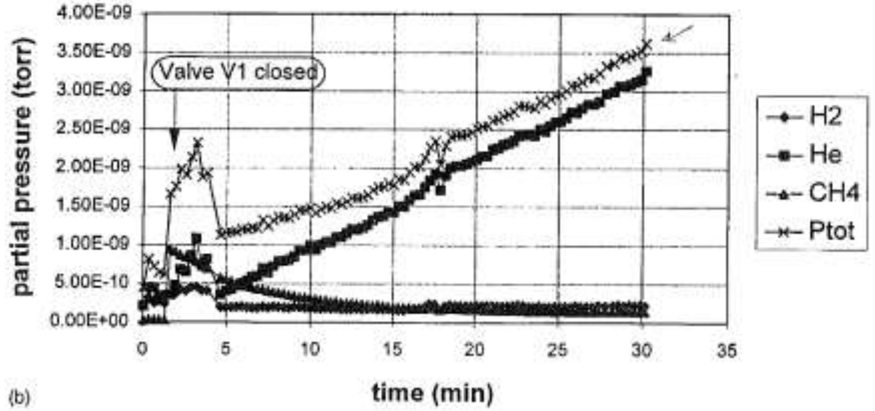
NEG

- Can pump efficiently H2 and active gases
- Can start its operation at 1e-2 Torr

Cryogenics

- Can pump gases depending on its temperature
- The pumping of all gas species requires high energy and infrastructure demand





- All gas species jump when V1 is closed if NEG is not activated
- Probably the two technologies can be used together?
- When NEG is active, only He increase
- H2 and other gases remain in the UHV conditions

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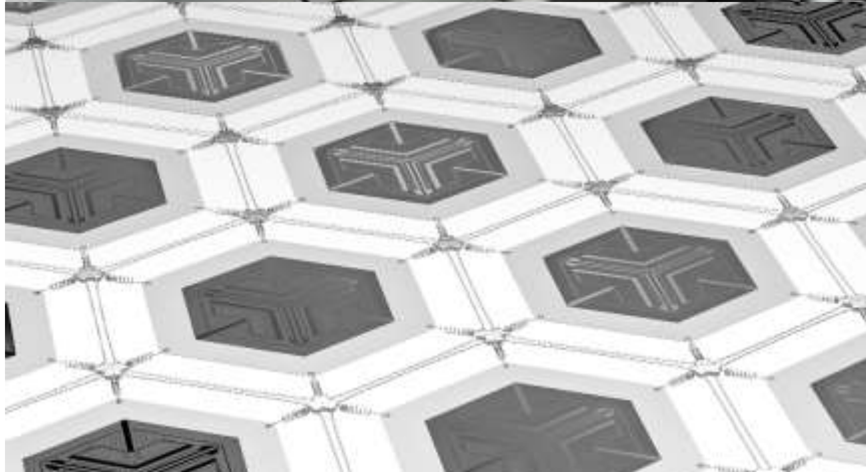
SAES® Core Business

SAES® is an advanced functional materials Group, focusing its business on the development and production of proprietary and specifically engineered solution (components and systems) for many industrial and scientific applications.

- Getters components and pumps to guarantee high and Ultra-High Vacuum conditions in a variety of applications such as :
  >Particle Accelerators and High Energy Labs
  >Analytical Instrumentation
  >Processing Tools for semiconductor
  >Vacuum Systems
  >Consumer electronics

- Shape memory components and systems like SMA wires , springs, actuators and valves for consumer electronics, automotive and white goods industries

- Functional composites and coated films to protect goods for the packaging industry



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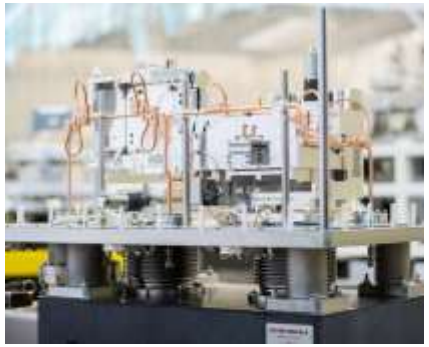
High Vacuum Division: 4 pillars

1: NEG Pumps

1970-2025: Pumps and getter solutions for high and ultra-high vacuum for accelerators, synchrotrons, research and industry

2: SAES Rial Vacuum

2015: Vacuum chambers and components for the synchrotron ring through **SAES RIAL Vacuum** (Parma)



3: CINEL

2021: vacuum chambers, monochromators, mirror systems, front end, beamlines and scientific instrumentations for synchrotrons through **Strumenti Scientifici Cinel** (Vigonza)

4: FMB

2024: Vacuum chambers, soft X-Ray beamlines and NEG coating additional capabilities through FMB acquisition

With 4 manufacturing sites (Parma, Vigonza, Lainate, Berlin) and 100 headcounts, the High Vacuum Division is well positioned to provide integrated solutions to research and industrial applications

The first pillar: NEG Pumps

NEG pumps

St707™ compressed

St172™ sintered

ZAO® sintered alloy

1960 1970 1980 1990 2010 2017

Capacitorr®

NEXTorr®

ZAO® pumps

NEG pumps extended from UHV to HV

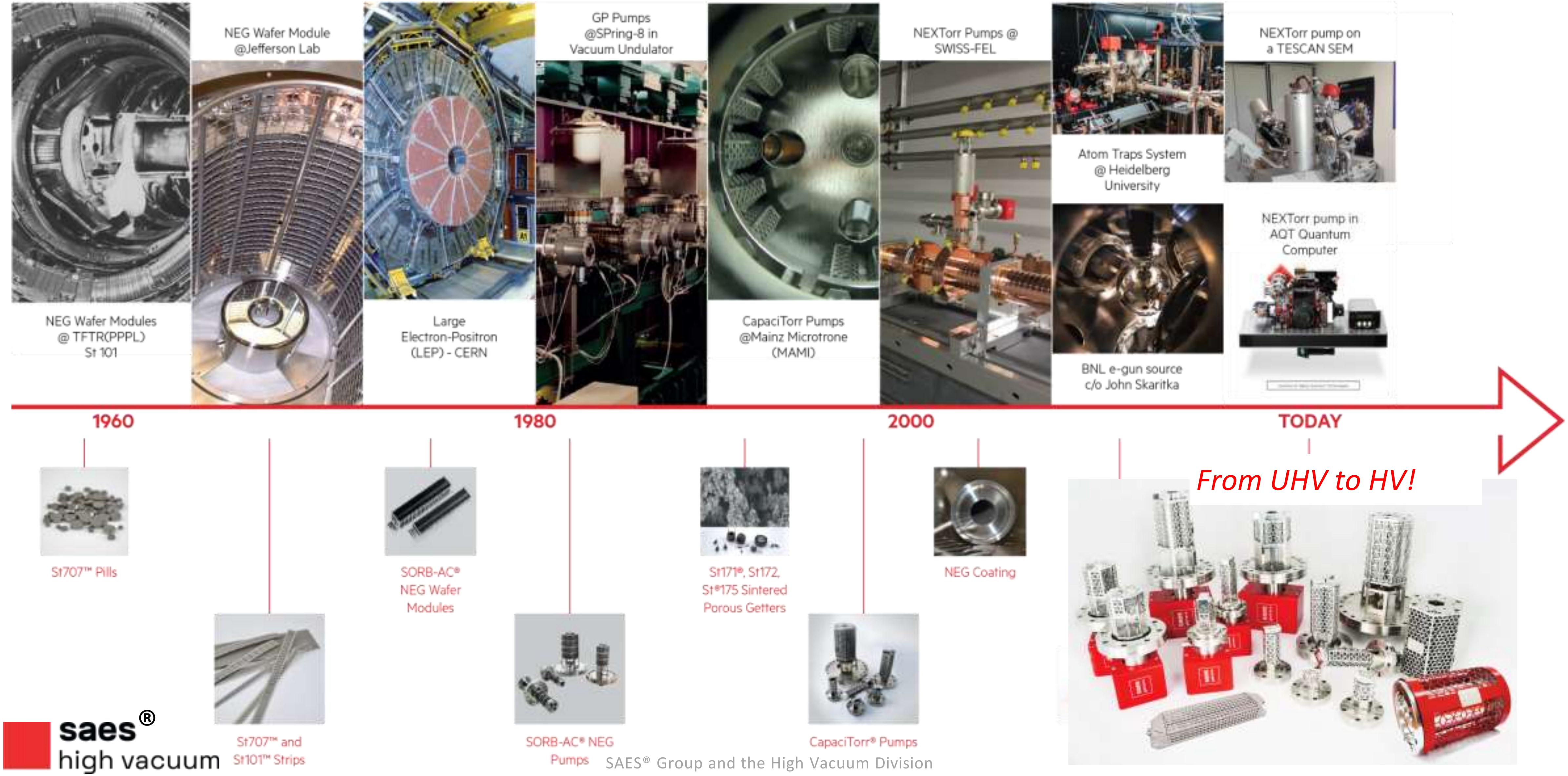
extremely low emissions of particles
Ultra-low degassing

NEG coating* for accelerators

MEGA ZAO® pump for Fusion Energy

*Technology developed at CERN. SAES® industrialized the deposition process

The first pillar: NEG Pumps



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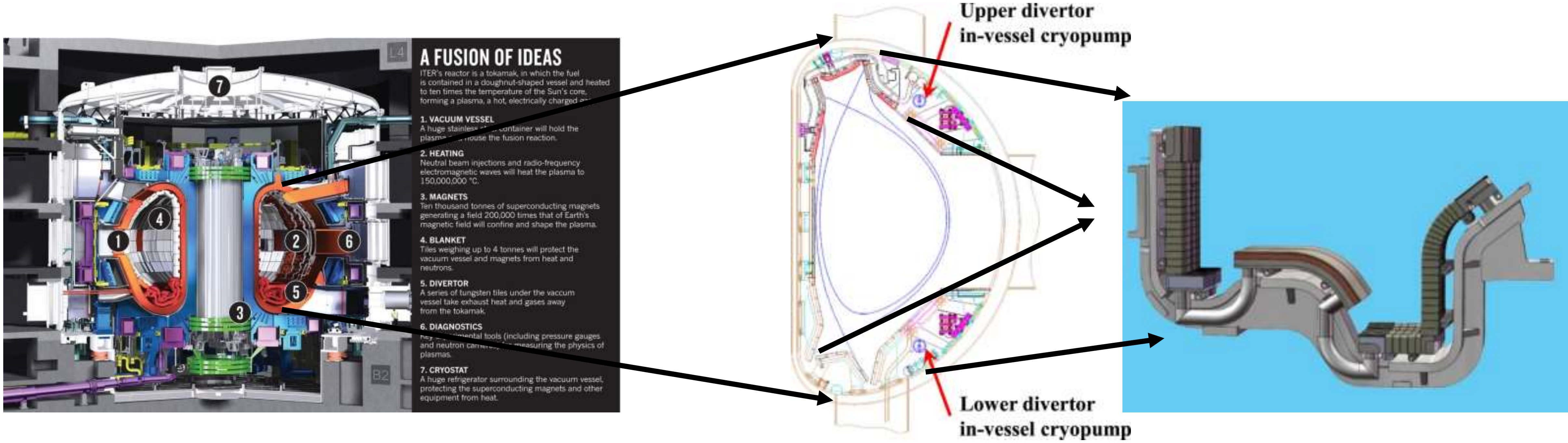
The other pillars: the key value of the Mechanical Engineering

Design & Manufacturing of Research and Industrial Equipment for
- Particle Accelerators
- Quantum computing
- Electron Microscope
- Fusion Devices
- Semiconductor Industry
- …

Complexity of the Fusion Energy Devices



COMPLEXITY **MORE COMPLEXITY**

<u>**Complexities in Divertor and Fusion Energy Subsystems**</u>

- ❑ High load of hydrogenic species → Know-how in material design, development and large-scale production
- ❑ Reduced available space → Engineering of Installation and Integration + modular solution
- ❑ Thermal load → Design based on the thermal exchange with the environment
- ❑ Different working conditions → Control Software to make easier Integration of Components

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Know-how in material design, development and large-scale production

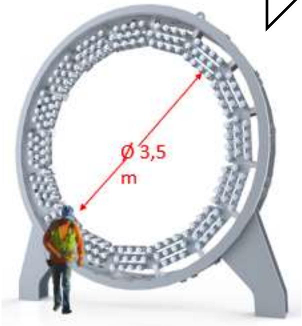
Complexity in NEG pumping devices

Material design

NEG Sintering
(Process knowledge)

Standard and reliable NEG pumping units
(Industrial Capabilities)

More Integrated NEG pumping units
(R&D Know-how)

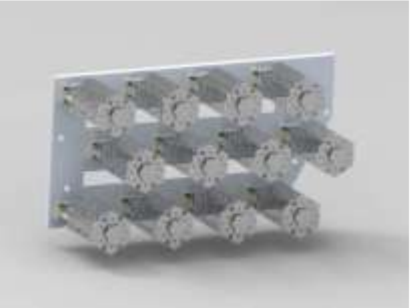


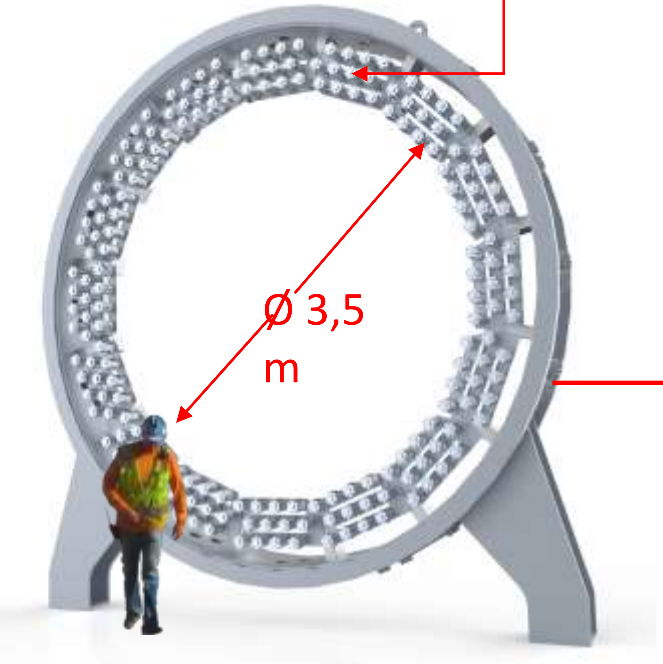
Large NEG pumping device
(Engineering and Project Management)

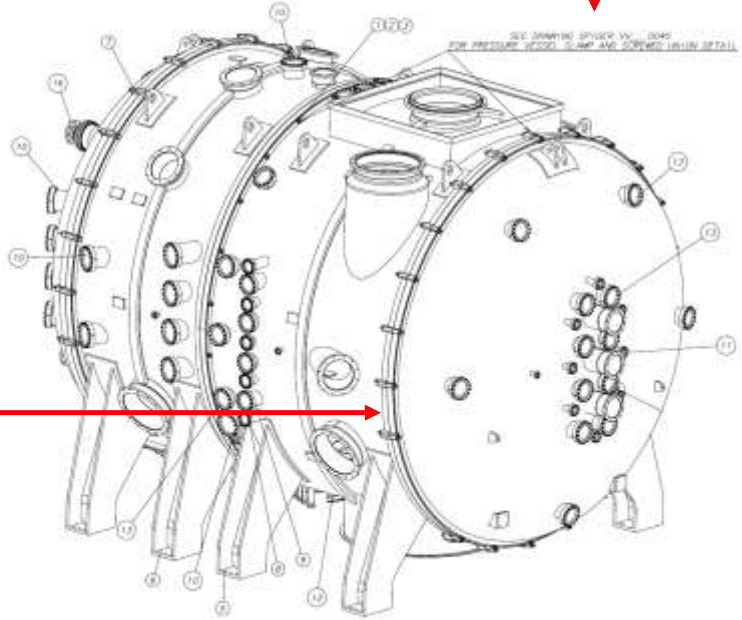
An example of large vacuum system: mega NEG pump for Spider (RFX-ITER)

- **Anular pump (Stargate)** to be installed in a new area of Spider vessel;
- Ø int. 3440 mm with 384 NEG cartridges installed on 32 modular panel

SPIDER is the ion source of the Neutral Beam Injector (NBI) designed and realized by RFX for ITER







SAES Offer in Vacuum Integrated Engineering Solution

- SAES® is installing the largest vacuum pump ever built
- This is possible thanks to the many expertise in
  - Materials
  - Vacuum
  - Mechanical Engineer
  - Thermal load
  - Elctrical system
  - Control Software
- SAES® can be the partner to design, produce and test in situ effective and reliable large NEG pumping system

HOW TO ACHIEVE THIS?

MISSION: leverage on the Division Core Competences in Vacuum, Material Science, Engineering, Vacuum Chambers and Instrumentation Manufacturing to support the Research and Industrial Communities

Technological competences	Design & Engineering	Production capacity, equipment, resources	NEG coating, R&D, physical modeling	Financial Solidity, Entrepreneurial vision

Thank you for your attention

www.saesgroup.com
enrico_maccallini@saes-group.com
www.saeshighvacuum.com