



research
instruments

RI contribution to fusion

Erfahrungen aus abgeschlossenen aktuellen und in der Angebotsphase befindlichen Projekten

Karlsruhe, 17.05.2022

Mission

- We provide our customers in science and industry with individually tailored key components, systems, solutions and services, based on our special engineering & manufacturing knowhow & capabilities
- We are strongly customer and project driven and enjoy extensive cooperation with the world's leading research labs and specialists for accomplishing best solutions to our customers
- We are worldwide renowned as an **advanced technology engineering and manufacturing specialist**

Facts & Figures

- Founded in 2009
- Employees ca. 320
 - physicists/engineers ca. 130
 - manufacturing specialists ca. 160
- Annual revenue: ca. 50 Mio EUR
- Established with the core team of ACCEL Instruments GmbH (1994-2009) and of INTERATOM/Siemens
- Management holds significant equity stake in the company which is majority owned by Bruker EST, Inc.



Projects & Products

- ✓ Particle accelerators, cavities & modules
- ✓ Energy and fusion components & systems
- ✓ Photon instrumentation
- ✓ Stand-alone XUV and EUV solutions and systems
- ✓ Special manufacturing projects
- ✓ Cryogenic equipment
- ✓ Engineering, design, manufacture, installation and commissioning

Markets

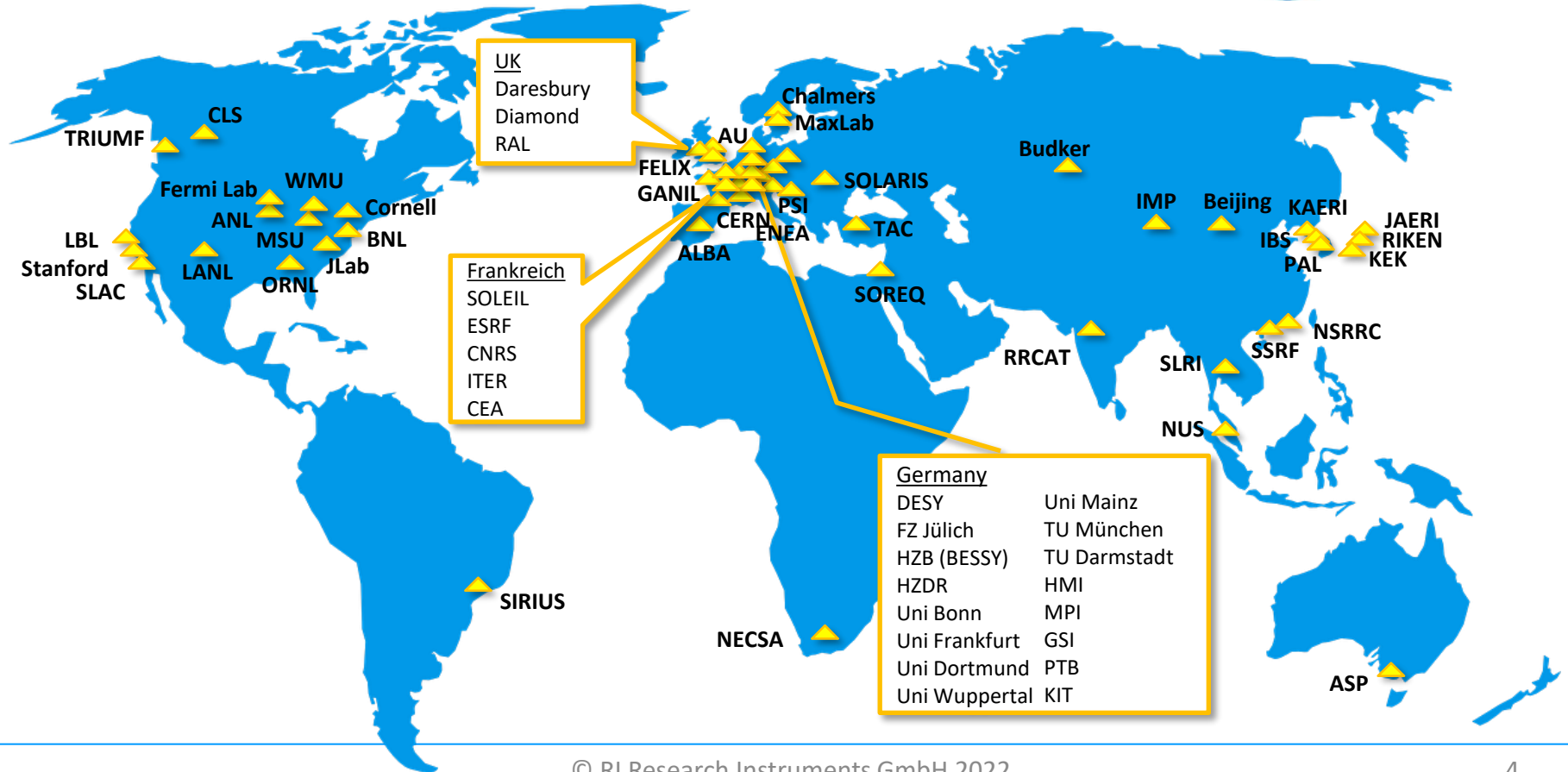
- ✓ Worldwide big science research labs
- ✓ Semicon, Medical, Energy and other advanced technology industry

Technologies

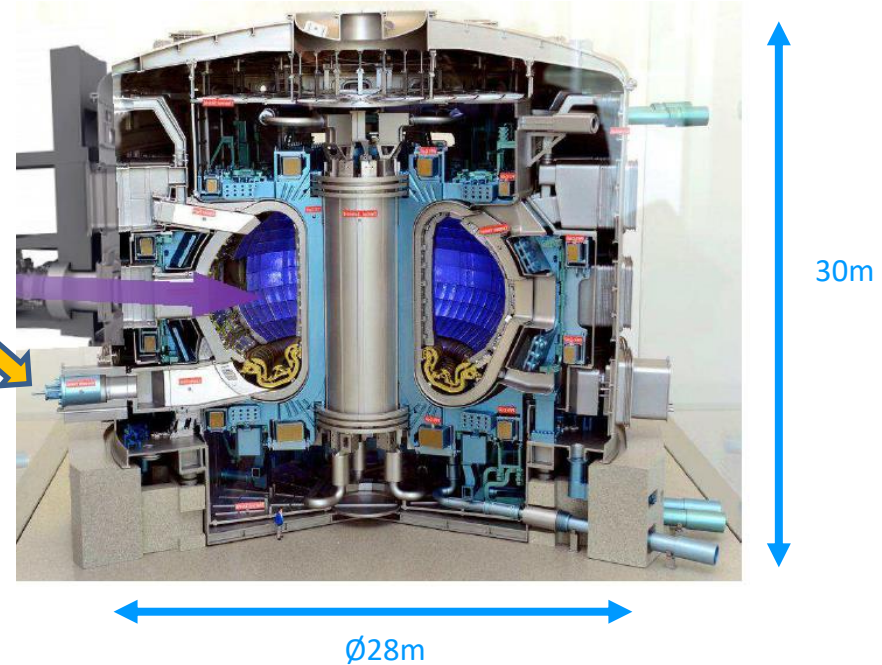
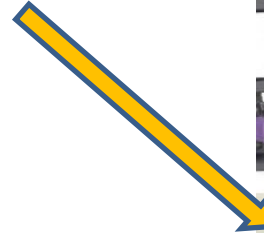
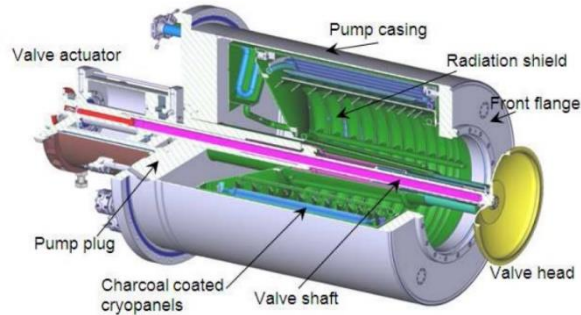
- ✓ Superconducting technology
- ✓ (UHV-) vacuum, cryogenics and pressure vessels
- ✓ RF technology
- ✓ XUV/EUV technology
- ✓ Magnetic field simulations and measurements
- ✓ Metrology
- ✓ High precision machining
- ✓ eb welding, high temp. vacuum brazing
- ✓ Chemical surface preparation
- ✓ Clean room assembly



Our map of the world



Fusion: Cryopumps (in consortium with Alsymex)



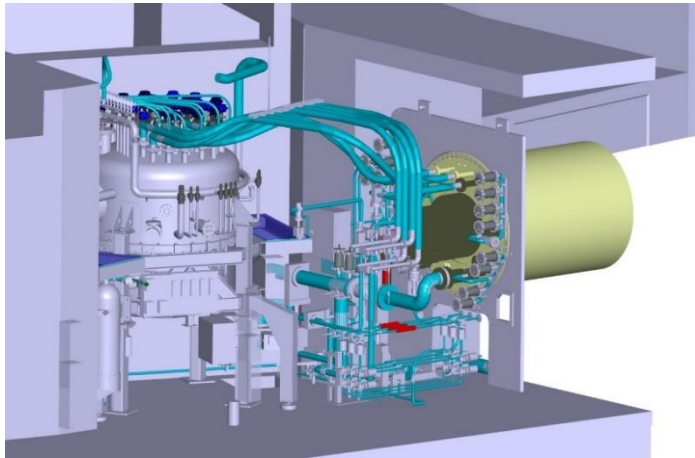
- Cryopumps (3 m length, 1,5 m diameter) contains a big all metal valve designed for 30 000 open/close cycles

Fusion: Valve boxes and WRB

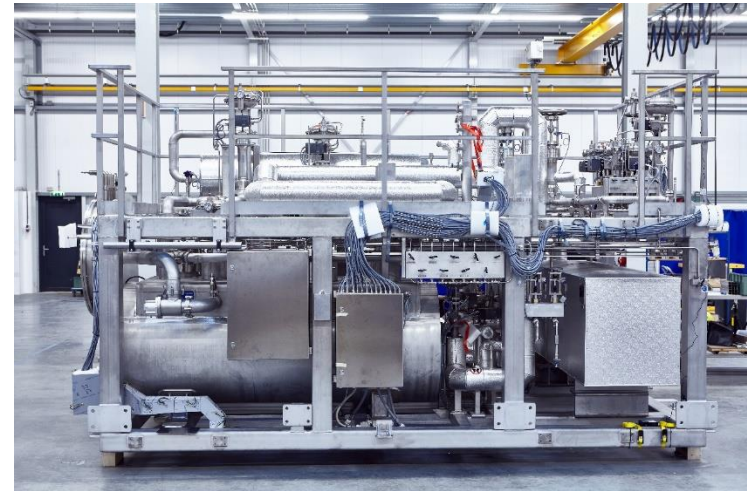
Design of valve boxes for ITER (pressure drop, thermal losses, 1 MGy radiation, earth quake, halogen free) finished

- 8 valve boxes for ITER under production, delivery in 2022/23

WRB (warm regeneration box) designed, produced and successfully delivered



Valve box contains 23 cryogenic valves, operated between 4 K and 500 K

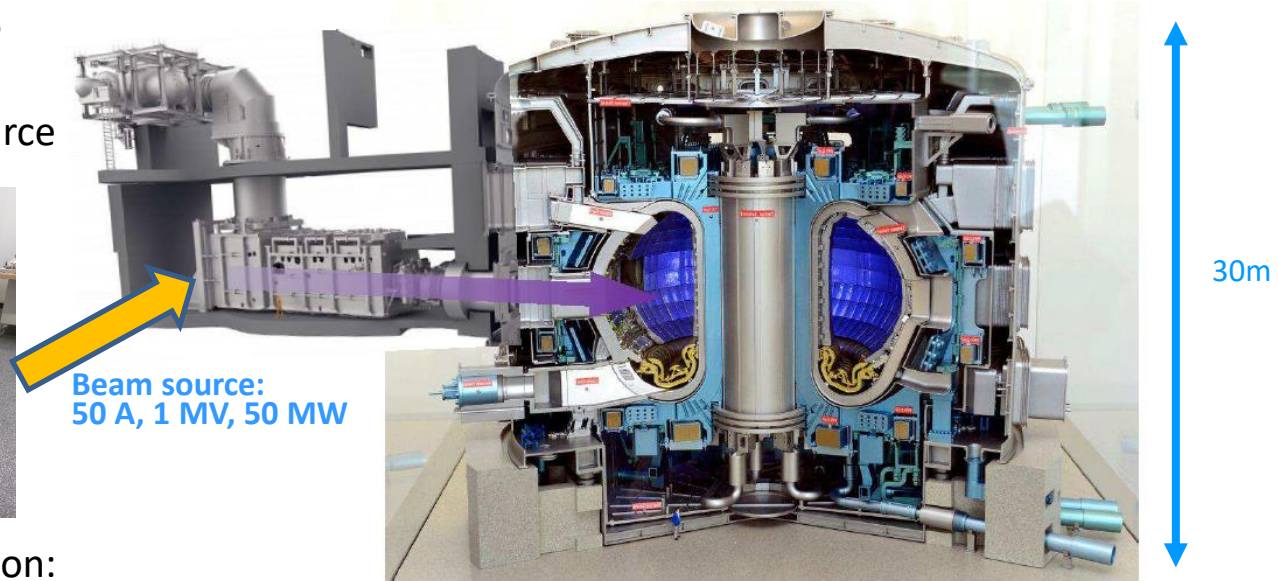
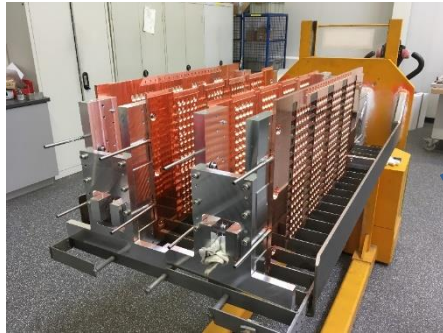


WRB Supplies 500 K helium gas to valve boxes for heat treatment of valve boxes and cryopumps

Fusion: Grids for beam sources

RI produced the grids for H⁻ particle acceleration

- For MITICA beam source
- For SPIDER beam source
- For Diagnostic beam source



Challenges during production:

- Special copper material with high yield strength
- Milling of cooling channels and closing of channels by means of galvanic electroplating of copper
- Tolerances in μm range over a length of 1 m.

Inner vertical target (IVT) for ITER

The divertor is a heavily heat loaded water cooled component (10-20 MW/m² peak) with surface temperature of about 2000 C

- Tungsten monoblocks brazed to CuCrZr-pipe
- Stainless steel cassette for support and water distribution
- IVT prototype production at RI finished and accepted, series production expected to start End of 2022



**RI prototype
IVT at final
acceptance
testing**

Inner vertical target (IVT) production for ITER

2016 - 2017: Mock-up production (1 MEUR)

2018 - 2021: IVT Prototype (4 MEUR)

2021 - 2022: tender phase for series production (54 IVT)

2022 - 2026: contracts to two companies, each:

- built up series production facility
- production of 3 pre-series IVT
- production of 10 series IVT
- estimated volume: 30-35 MEUR for RI

2026: re-opening competition between the two companies for remaining 28 IVT (total 60 MEUR)
- share between the two companies open

2027 - 2029: production of remaining IVT

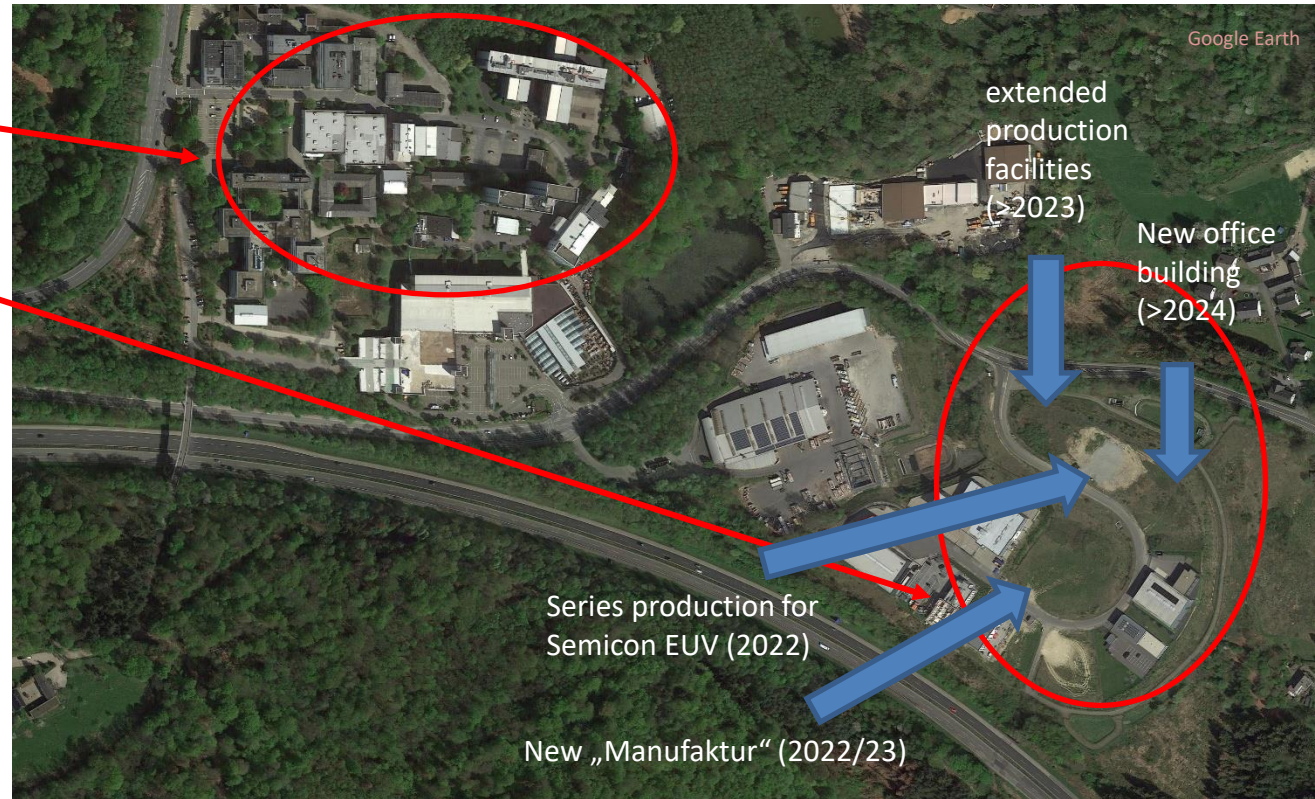


IVT prototype produced at RI
Accepted from F4E/ITER in Dec 2021

Our new additional site

RI site at Technology Park

New additional RI site in
Obereschbach



The long and successful story of Fusion business

- < 1994: Mockup development on high heat loaded components for JET (Siemens/Interatom)
- 1995 - 2000: Series production of Be components for JET (ACCEL Instruments)
- 2007: Founding member of DIIF
- 2012: F4E contract on preproduction cryopump
(learning and negotiating on F4E terms & conditions)
- 2017: F4E contract on IVT prototype
(learning and adopting ITER/F4E management & quality culture)
- 2017 - 2022: many new order bookings from F4E for ITER &
- 2023 - 2035: expectation on more fusion business for worldwide projects

Within the last decade we saw ITER, F4E ...and us substantially growing in volume and staff, with all it's chances and challenges.

Through all this time we worked together the hard, but always the cooperative and fruitful way for finding best technical solutions under acceptable business conditions.

Very special thanks go to Kurt Ebbinghaus as earlier business partner and long term ITER industry liason officer for Germany for his talent and endurance in listening, understanding and solution finding for the good of ITER/F4E and industry.