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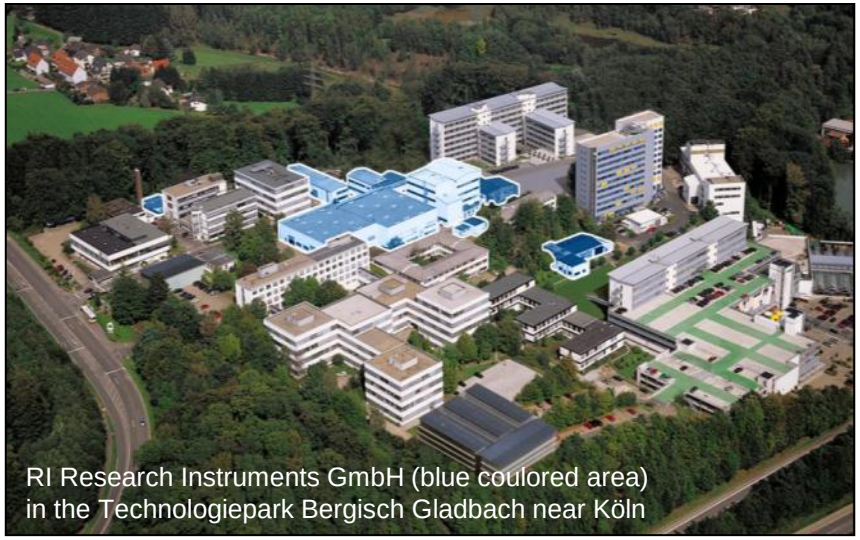
Dr. Michael Peiniger

Superconducting RF activities at RI Research Instruments with a focus on EXFEL cavity production

RI Research Instruments GmbH

Advanced Technology Equipment and Turn-Key System Supplier for Research, Industry and Medical worldwide



RI Research Instruments GmbH (blue coulored area)
in the Technologiepark Bergisch Gladbach near Köln

- Linear Accelerators
- RF Cavities, Coupler, Auxiliaries
- Superconducting Accelerator Modules
- Electron and Ion Sources
- Beam Diagnostic Elements and Particle Beamlines
- Accelerator Equipment for Particle Therapy
- Specialized Manufacturing Projects

RI Research Instruments is continuing the business of the former ACCEL Instruments and former Siemens activities in rf accelerator and specialized manufacturing.

51% of shares by Bruker EST, Inc. and management holding a significant equity stake of the company.

Project management, engineering and manufacturing with a staff of about 150 people

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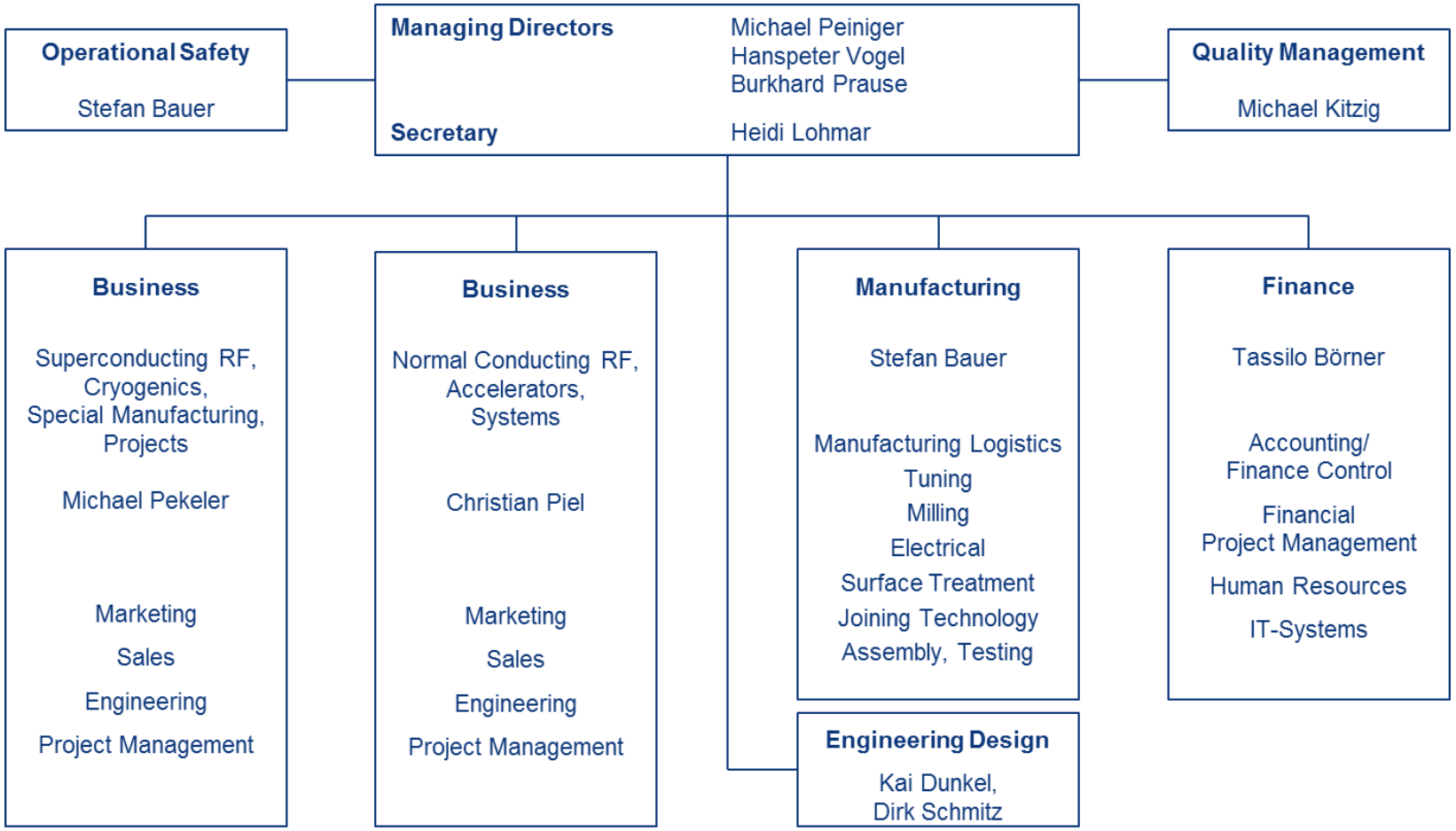
RI Company Organization



Core Competences and Markets

Quality Management certified according to DIN EN ISO 9001:2008, KTA

Technologies

- RF, Accelerator
- Superconductivity
- Cryogenics
- Vacuum
- Specialized Manufacturing
- Surface Treatment
- System Integration
- Integrated System Control

Products / Services

- Linear Accelerators
- RF Cavities, Couplers
- SRF Accelerator Modules
- Electron and Ion Sources
- Beam Diagnostic Elements
- Particle Beamlines
- Precision Manufacturing Equipment

Markets

- Fundamental Physics
- Applied Research
- Medical/ Particle Therapy
- Inspection
- Energy/Nuclear
- Advanced Technology Industry

physics layout – engineering – design – manufacturing – assembly – testing – service

broad technology portfolio - more than 20 years long track record

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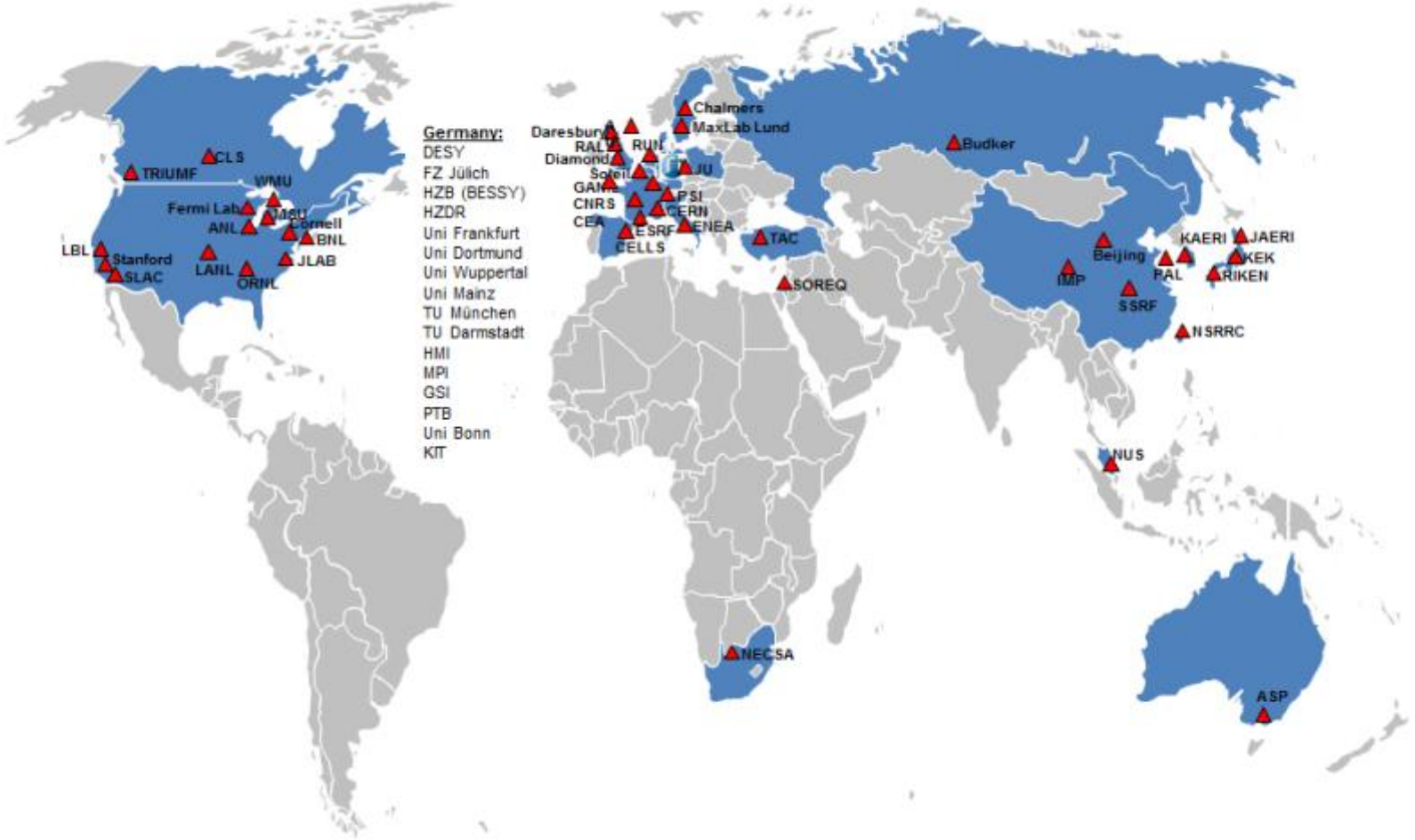
Customers and partners in «Big Science»



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RI's specialized manufacturing technologies (1/2)

Brazing Furnace (1/2)

Electron Beam Welder (1/2)

Manufacturing Premises

Manufacturing technologies:

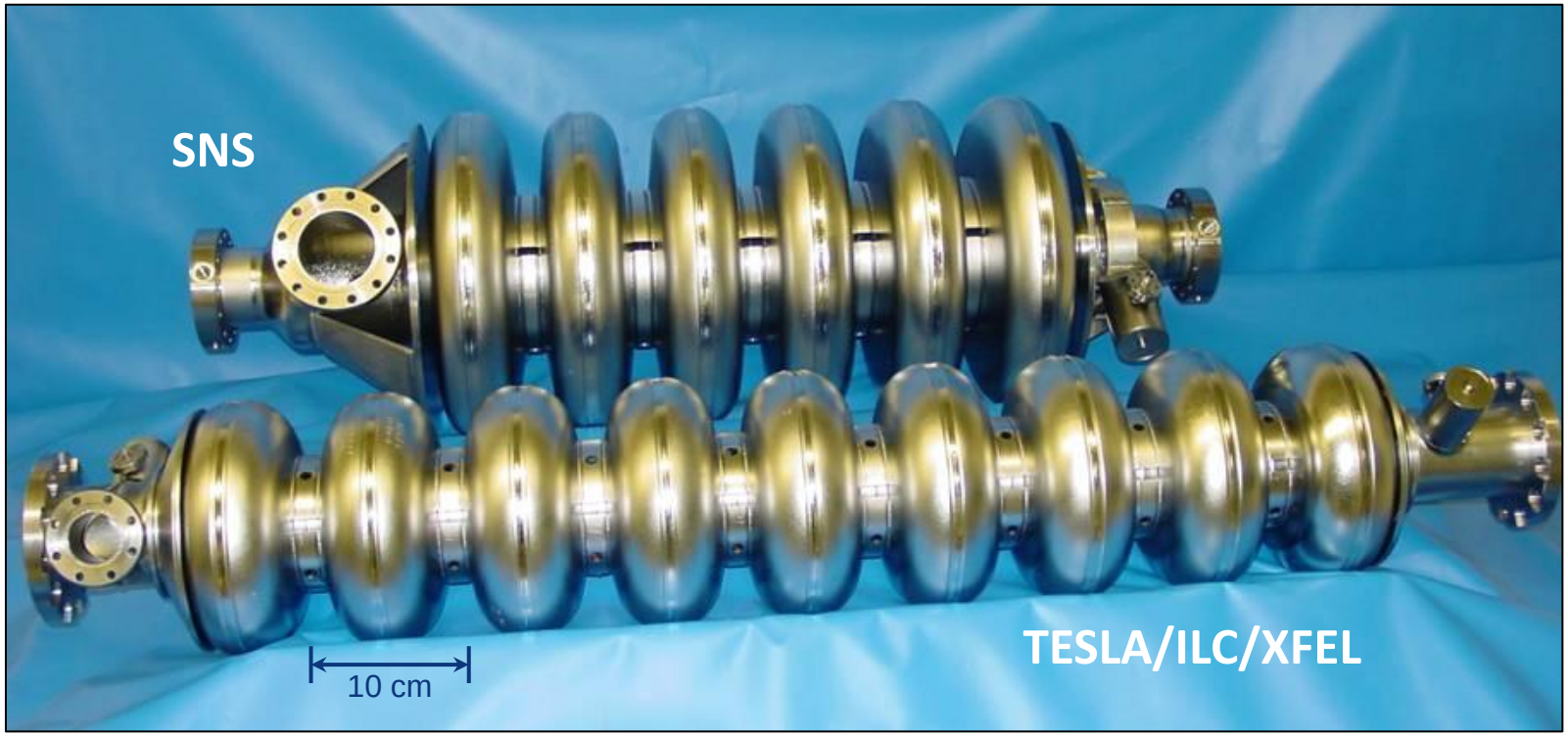
- Turning (CNC)
- 5-axis milling (CNC)
- Metal working
- Surface technology (cleaning, etching, coating)
- Joining technology (EB, TIG, vacuum brazing)
- Heat treatment
- Assembly (partly in cleanroom) and testing
- RF, vacuum cryogenic
- Quality control

RI's specialized manufacturing technologies (2/2)

RF testing and assembly of linear accelerator systems

Assembly of superconducting rf structures in clean room condition (ISO 4)

Overview of RI activities in accelerator technology: Superconducting RF



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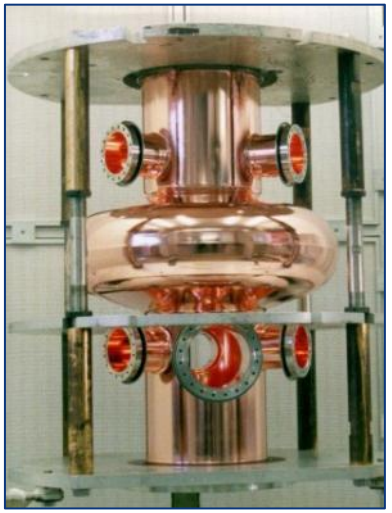
Superconducting cavity production









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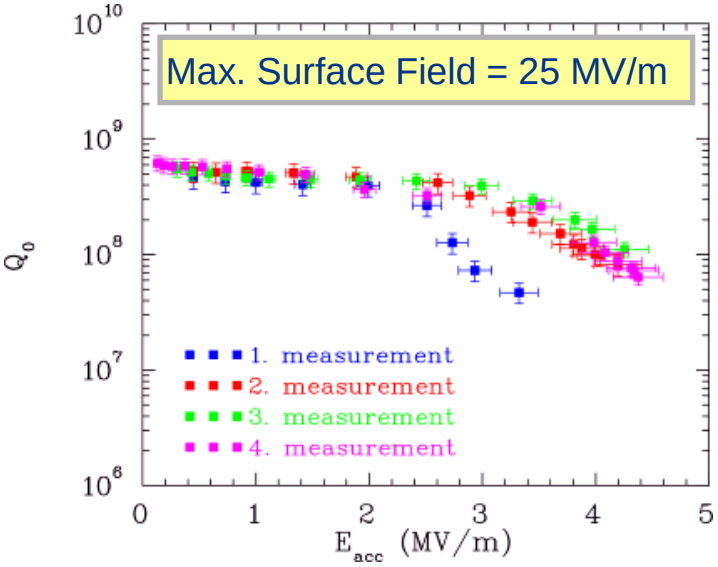
Superconducting cavities - prototypes

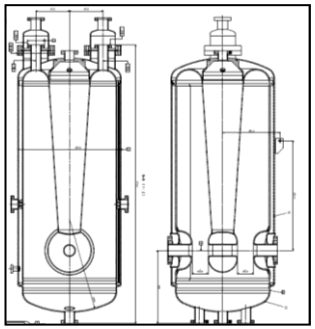
Frankfurt CH mode cavity, 357 MHz
Second CH mode prototype for Frankfurt University contracted end of last year
One more CH mode cavity for Darmstadt University contracted this year

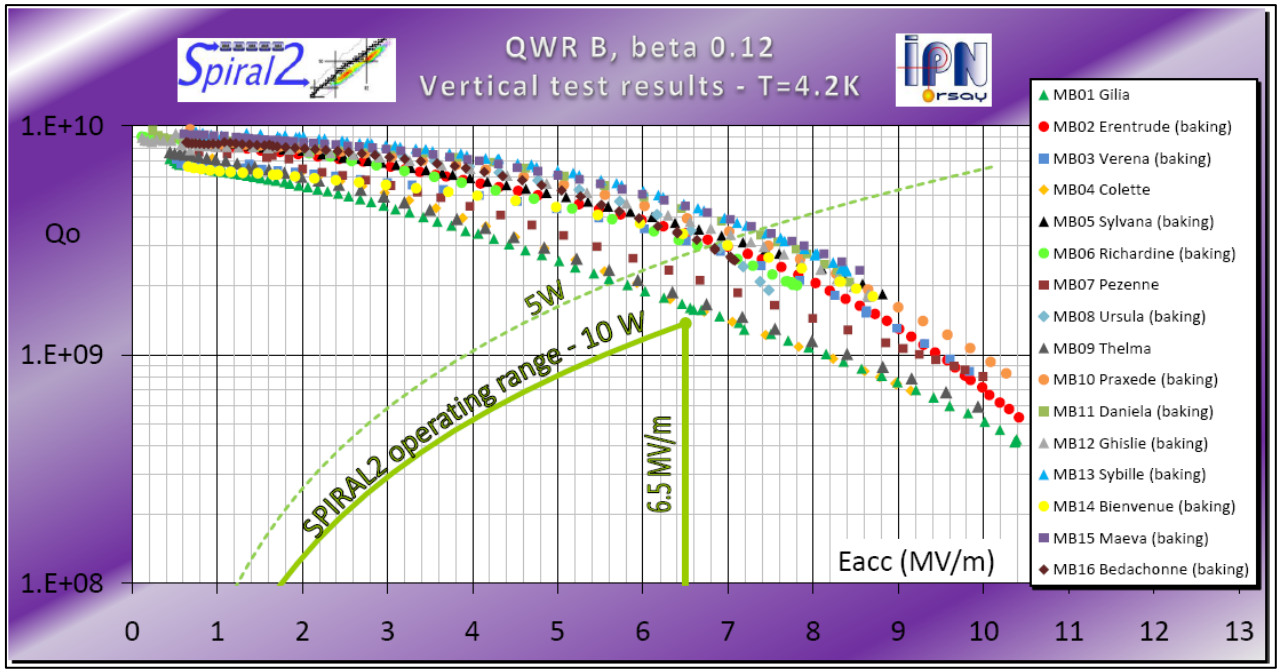


Chemical preparation, High pressure rinsing, assembly in our clean room
Vertical test at University Frankfurt.

16 QWR (88 MHz) cavities for GANIL

Cavities (4 mm thick sheet) and helium vessel
Tight tolerances, especially after helium vessel welding,
no bellows on helium vessel





Production of CEBAF upgrade cavities

Procurement of niobium
cavity manufacturing, bulk chemistry
RF tuning (fundamental mode and HOM couplers).

- Order for 86 pieces 1.5 GHz 7-cell cavities received in July 2009
- Niobium at RI in November 2009.
- Original schedule:
  First article to be delivered in June 2010,
  last cavity to be delivered middle of 2011
- Achieved schedule:
  First article delivered July 2010,
  84 cavities delivered in November 2010, one year after niobium supply,
- 2 last cavities delivered in March 2011 (lack of niobium material, additional material had to be ordered for the last two cavities).

Schedule improved by 2 shift operation on turning, milling and electron beam welding machines.

XFEL cavity production project

Order for 300 cavities received from DESY in September 2010

Niobium and helium vessel supplied by DESY

RI scope:

- Mechanical manufacturing of cavity, respecting the pressure vessel code
- Complete Surface preparation and helium vessel welding
- Shipping to DESY under vacuum and “ready for vertical test”
- Extensive documentation and QA is crucial and will ensure that cavities are manufactured and treated according to detailed DESY specification. No performance guarantee

DESY:

- Cavities will be cold RF tested at DESY (vertical test) with helium vessel already welded
- After successful test, DESY will ship the cavities under vacuum to CEA for module assembly

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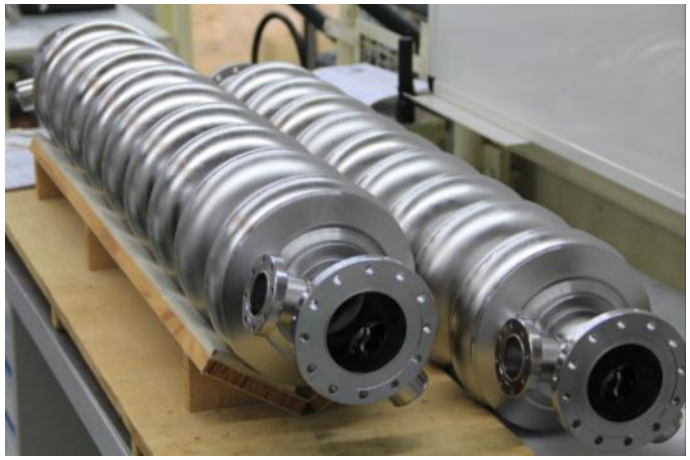
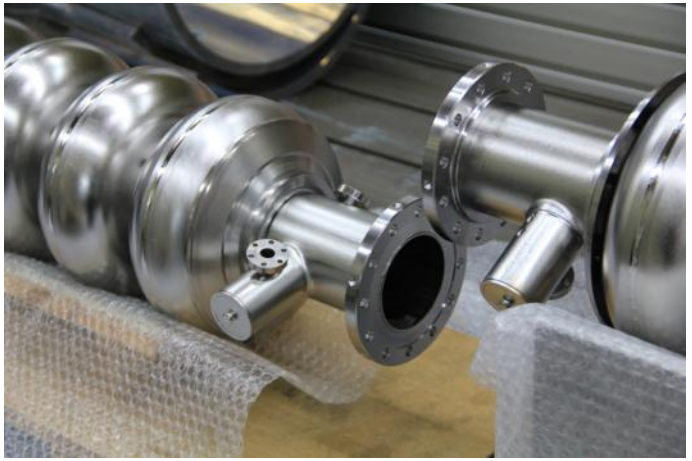
XFEL cavities / subcomponents





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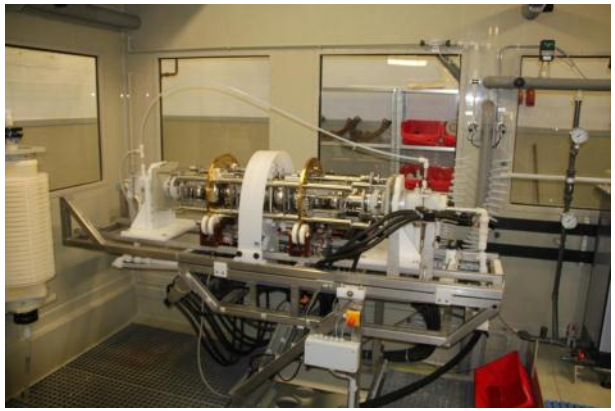
RI infrastructure for XFEL

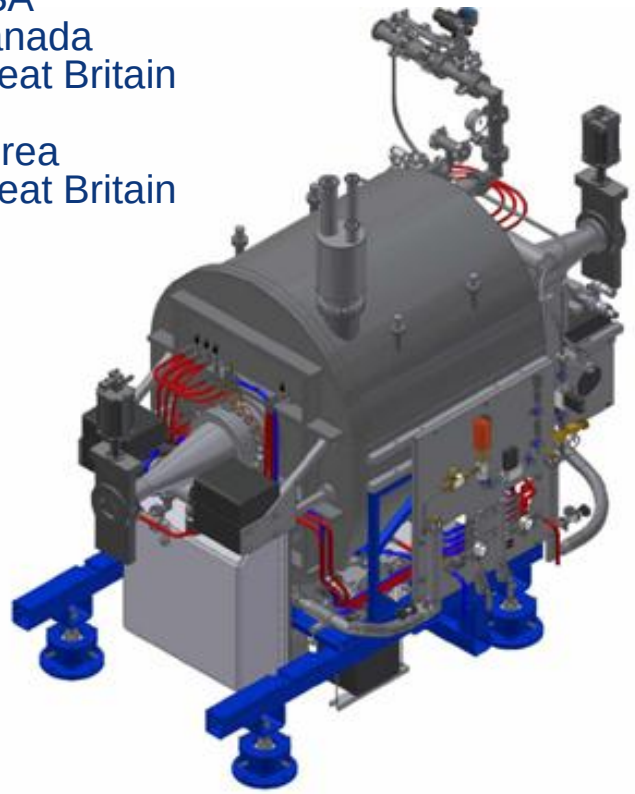


500 MHz accelerator modules

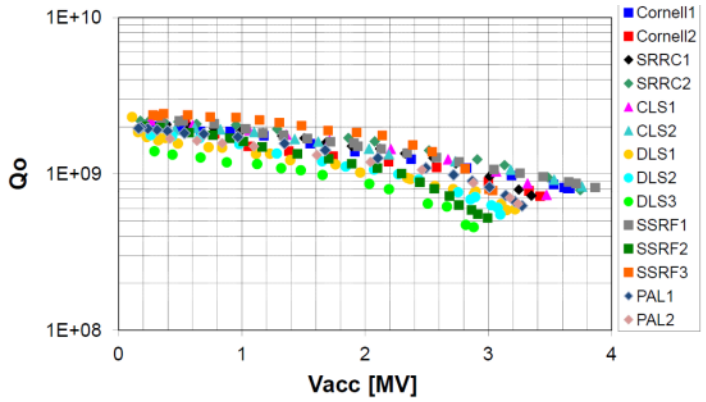
Technology transfer from Cornell University, USA

2000:	2 SRF modules	for NSRRC,	Taiwan
2000:	2 SRF modules	for CORNELL,	USA
2000:	2 SRF modules	for CLS,	Canada
2003:	3 SRF modules	for DLS,	Great Britain
2005:	3 SRF modules	for SSRF, PR China	
2010:	3 SRF modules	for PAL,	Korea
2012:	1 SRF module	for DLS	Great Britain

- Cavity production
- Cavity surface preparation
- Cavity vertical test
- Coupler production
- Coupler conditioning
- Ferrite style HOM loads
- Module assembly
- Installation on customer site
- Commissioning
- Valve boxes and transfer lines
- SRF Electronics
- Interlock and data acquisition system



Cavity preparation and test



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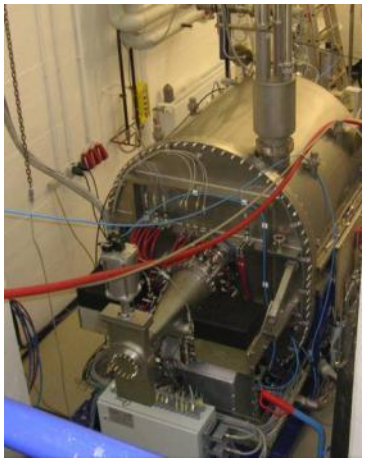
Factory testing, shipping, installation



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RI Research Instruments GmbH

- Advanced technologies, turnkey systems
- Project management, engineering and manufacturing
- Integrated system control, software
- Highly motivated, qualified people
- Project oriented, integrative, flexible
- Intensive, multinational cooperation's
- Global player in an expanding worldwide business