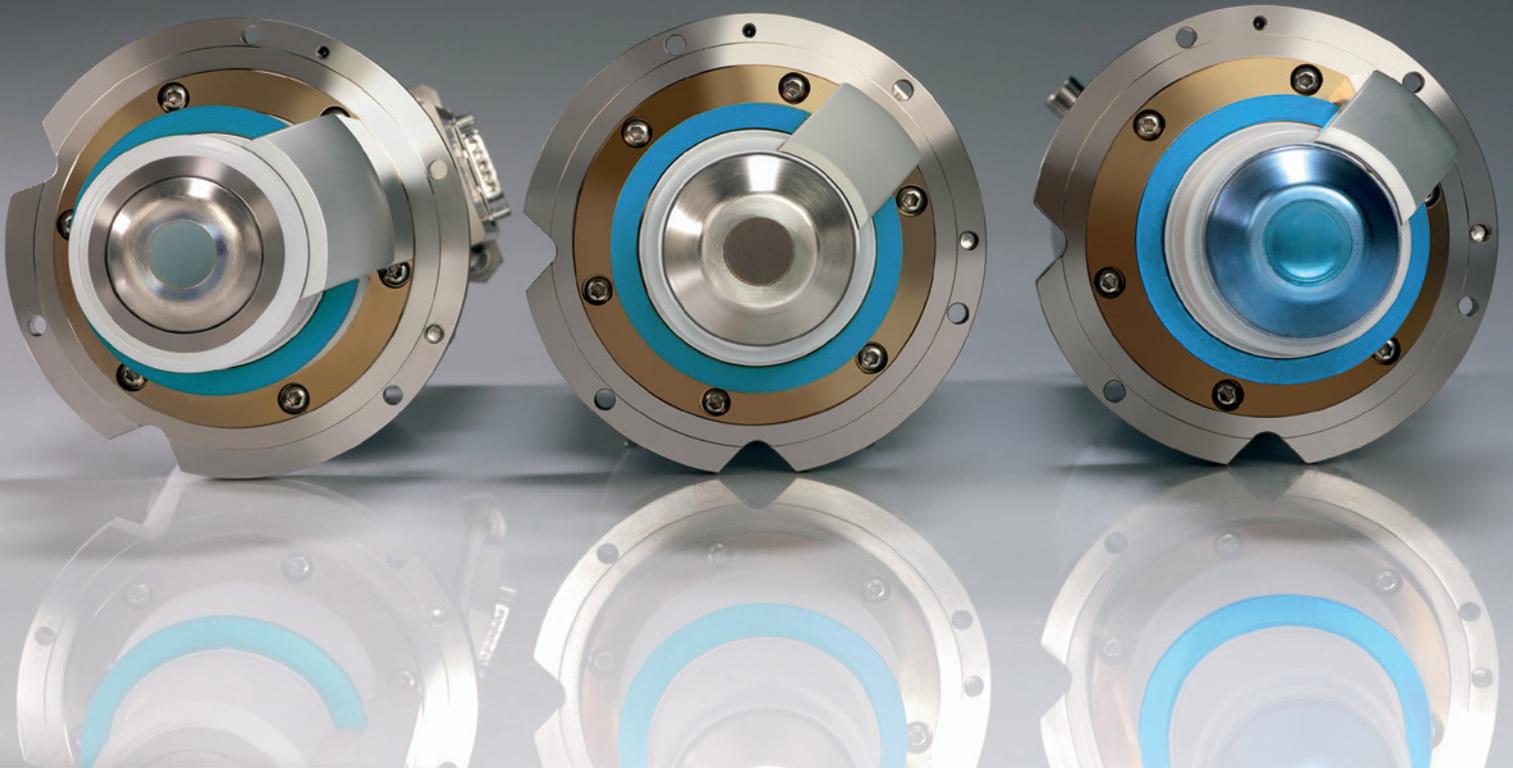




PANalytical
get insight



Super Sharp Tube

The most advanced
analytical X-ray tube
in the world

SST R

SST R-mAX

SST R-mAX⁵⁰



PANalytical



Powerful benefits through

PANalytical's Super Sharp Tube redefines the standards for analytical X-ray tube performance by providing unparalleled benefits.

Unsurpassed tube lifetime

- 2 to 4 times longer lifetime than other high-power end-window tubes
- Unique cathode design, completely eliminating filament burnout

Superior sensitivity

- Tube design allowing close optical coupling for highest spectrometer sensitivity

Maximized uptime

- Eliminating tube drift through ZETA technology
- Minimizing spectrometer calibration maintenance

Durability

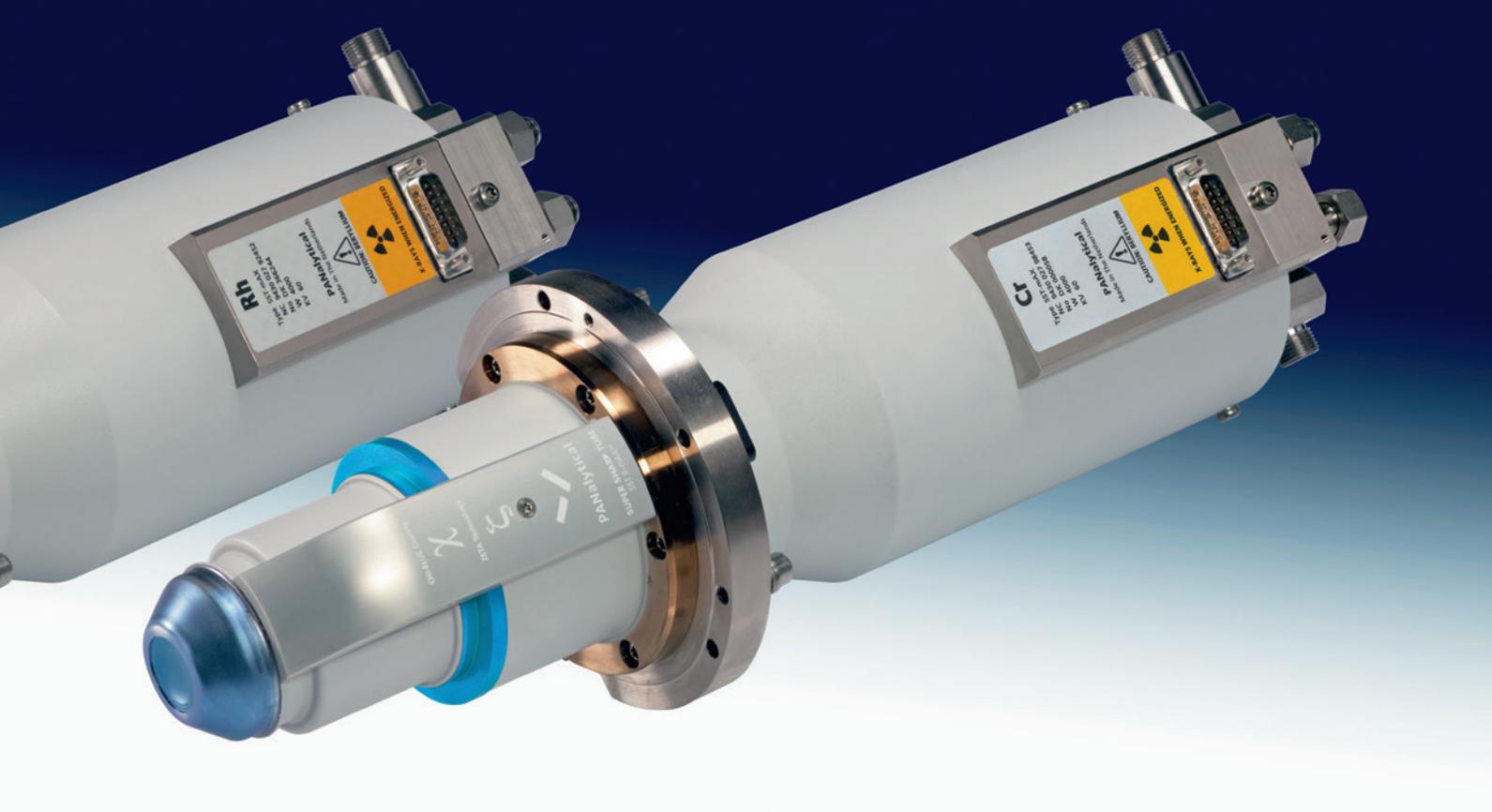
- Corrosion resistance through CHI-BLUE coating
- Enhanced robustness through patent-pending anode design in SST-R tubes

Superior and sustained light-element performance

- Thin window technology
- High emission current



Schematic illustration of the interior design of a PANalytical SST/SST R-MAX X-ray tube



cutting-edge technology

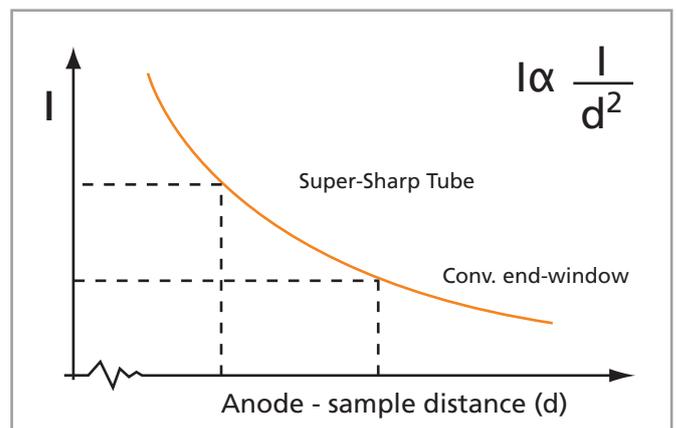
The Super Sharp Tube design

In the early 1990s, PANalytical introduced the groundbreaking 3 kW metal-ceramic end-window SST (Super Sharp Tube) for high-end XRF spectrometry. Building on the success of the first SST, PANalytical introduced the 4 kW SST in 1997.

The SST R tubes range from an efficient 1 kW SST R to the most advanced revolutionary 4 kW SST R-mAX⁵⁰.

The SST R-type advantage

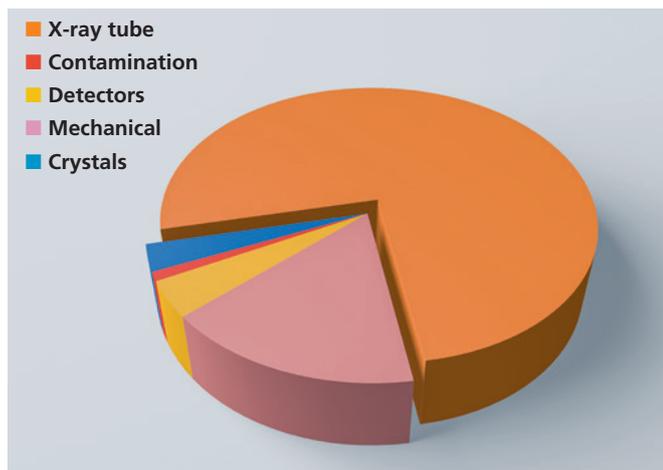
In our restless pursuit of benefit-driven innovation, the latest SST R-type X-ray tubes include yet another step to improve performance durability. Under high power loads an X-ray tube anode is performing close to its melting point. The construction of the anode is critical to effectively dissipate heat. The SST R-type X-ray tubes incorporate a new patent-pending design that improves the durability of the anode under highest possible thermal loads, thereby leading to higher overall robustness compared to the SST tube.



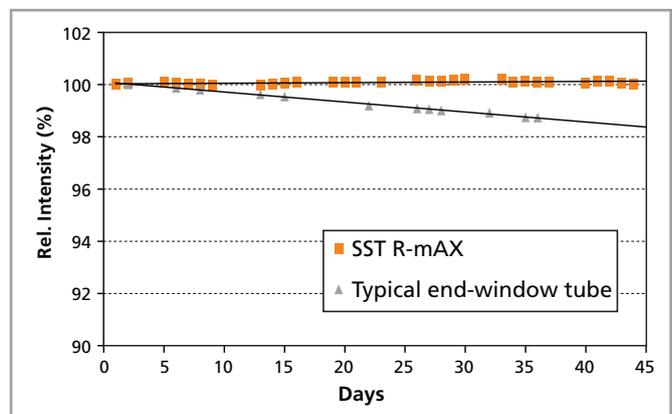
ZETA technology

In conventional high-power XRF spectrometers, X-ray tube aging is a major contributor to instrument drift. SST R-mAX features ZETA technology which eliminates the greatest source of spectrometer drift.

The SST R-mAX incorporates the unique Zero Evaporation Technology Advantage (ZETA). This revolutionary cathode design eliminates the adverse effects of filament evaporation, ensuring new tube performance during the entire lifetime of the tube. Compared to conventional X-ray tubes, SST R-mAX radically reduces the need for calibration maintenance, thereby boosting instrument uptime. A further advantage of the SST R-mAX is that it can be operated at high-power (high-mA settings). Such usage conditions would accelerate aging in conventional tubes, but have no negative effects on the SST R-mAX.



Relative contribution to instrumental drift



SST R-mAX stability in measuring boron. Data collected on a PANalytical 2830 ZT Wafer Analyzer

CHI-BLUE coating

Conventional beryllium tube windows are vulnerable to chemical attack by spilled sample material. PANalytical's revolutionary CHI-BLUE coating greatly reduces these drawbacks, and renders the delicate tube window very reliable and robust.

Beryllium sheet metal contains surface imperfections and crystal irregularities. These imperfections and irregularities can in time develop into vacuum leaks, and are susceptible to chemical attack, e.g. from spilled sample. Protection against these risks by coating the beryllium surface is not trivial, as most coatings miss one or more essential properties:

- Long-term X-ray stability
- Long-term thermal stability
- Perfect adhesion to beryllium
- Perfect coverage of all surface imperfections
- High X-ray transmittance
- No spectral impurity
- High corrosion resistance



The unique CHI-BLUE coating has all these properties. The special coating technology and the coating composition have been carefully developed and optimized by a dedicated team of specialists within PANalytical.

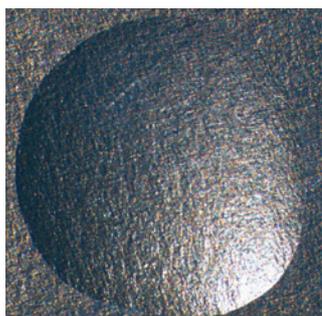
CHI-BLUE offers up to 50x higher resistance to corrosion by protecting the beryllium window against aggressive chemicals such as NaCl, NaOH, HCl and H₂SO₄.

CHI-BLUE coating is available as option on all SST models, and is delivered standard on the SST R-mAX⁵⁰.

Resistance to chemical attack



Uncoated Be exposed to a 1 M HCl solution shows many corrosion holes (orange dots) within 30 minutes.



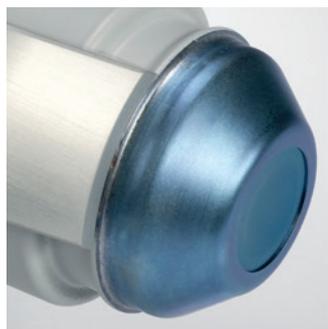
CHI-BLUE coated Be exposed to a 1 M HCl solution shows no corrosion holes after several hours.





Thin window technology

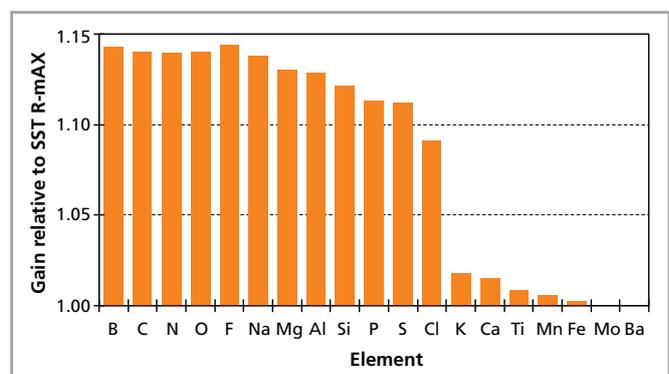
PANalytical's revolutionary SST R-mAX⁵⁰, the world's most advanced analytical X-ray tube, is the latest innovation from the company's specialist team.



The SST R-mAX⁵⁰ provides a synergistic combination of cutting-edge X-ray tube technologies, making it a truly unique product.

The 50 μm thin window delivers ultimate light-element sensitivity. Through the combination with ZETA technology,

the tube, in contrast to other conventional thin window tubes, delivers a sustainable benefit for light-element analysis. The implementation of the thin window technology is therefore the next logical innovation step after ZETA technology.



Intensity gain of SST R-mAX⁵⁰ versus SST R-mAX

The use of CHI-BLUE coating not only provides corrosion resistance to the X-ray tube window, it also enhances its durability by ensuring vacuum tightness. Conventional beryllium windows as thin as 50 μm have a notoriously unreliable vacuum tightness, which compromises the lifetime of the tube. The SST R-mAX⁵⁰ comes standard with CHI-BLUE coating, which guarantees vacuum tightness of the window.

Unlike other X-ray tube coatings, the CHI-BLUE coating does not deteriorate or evaporate under the influence of X-rays, ensuring life-long protection and reliability of the beryllium window.

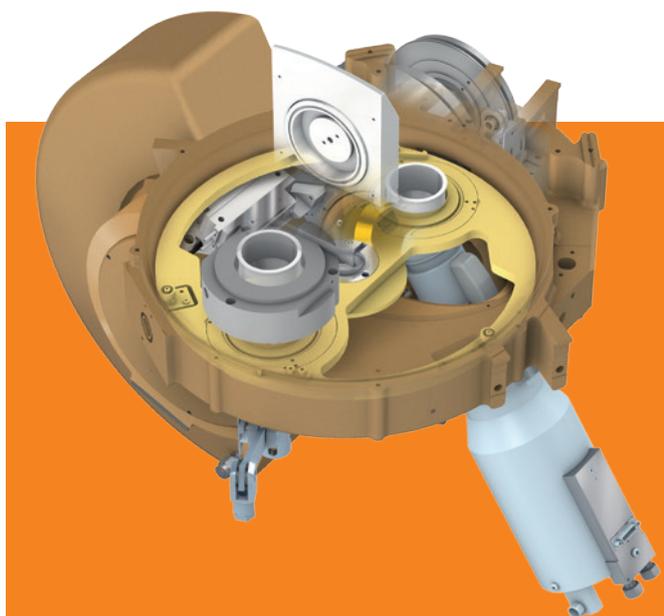


The PANalytical advantage

With more than half a century of experience, PANalytical is the world's leading supplier of analytical instrumentation and software for X-ray diffraction(XRD) and X-ray fluorescence (XRF) spectrometry.

PANalytical is the only manufacturer of analytical X-ray systems that also develops and manufactures high-power X-ray tubes, allowing us to truly optimize the performance of systems we develop. For example, performance for specific applications can be enhanced through a range of different anode materials, with selective excitation characteristics for elements of interest.

All PANalytical X-ray tubes reflect our dedication to innovation and quality. Moreover, they allow for efficient disassembly and recycling for better environmental care at the end of the product life cycle.



About PANalytical

PANalytical's mission is to enable people to get valuable insight into their materials and processes. Our customers can be found in virtually every industry segment, from building materials to pharmaceuticals and from metals and mining to nanomaterials. The combination of our software and instrumentation, based on X-ray diffraction (XRD), X-ray fluorescence (XRF) and near-infrared (NIR) spectroscopy as well as pulsed fast thermal neutron activation (PFTNA), provides our customers with highly reliable and robust elemental and structural information on their materials and is applied in scientific research and industrial process and quality control.

PANalytical employs over 1,000 people worldwide. The company's headquarters are in Almelo, the Netherlands. Fully equipped application laboratories are established in Japan, China, the US, Brazil, and the Netherlands. PANalytical's research activities are based in Almelo (NL) and on the campus of the University of Sussex in Brighton (UK). Supply and competence centers are located on two sites in the Netherlands: Almelo (X-ray instruments) and Eindhoven (X-ray tubes), in Nottingham, UK (XRF applications and standards), in Quebec, Canada (fusion sample preparation) and in Boulder CO, US (near-infrared instruments).

PANalytical is active in all but a few countries of the world. This worldwide sales and service network ensures unrivalled levels of customer support.

The company is certified in accordance with ISO 9001 and ISO 14001.

Visit www.panalytical.com for more information about our activities.

PANalytical is part of Spectris plc, the productivity-enhancing instrumentation and controls company.

Access to expertise

With the largest global network we offer Expertise, the most comprehensive support possible, including:

- On-site training
- Training courses at regional competence centers
- Optimization of analytical methodology
- Consultation on sample preparation
- Push-button solutions
- Customized reference samples
- Analytical services
- Assistance with multi-laboratory standardization

Care Agreements

Our customer support solutions have been developed with your business in mind. They are formulated as a family of four Care Agreements which can be tailored to your specific needs and provide fast, secure and reliable support.

- **ECONOMY:** indispensable coverage for self-sufficient operations
- **ADVANCED:** cost-effective support for routine usage
- **PREMIUM:** flexible package for high equipment usage
- **ELITE:** most comprehensive package for demanding environments

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