Process Control in Metal Production: S8 DRAGON – Max out Detection

The best decisions rely on information that is well-founded, confirmed, accurate and precise. Usually the evaluation of such information requires a lot of work, time, and competence – resources that cost money.

The production of high quality alloys constantly calls for exact information: It is essential for defining the composition of raw materials, the quality of metals, and the steps to manufacture a competitive product. Moreover the results of the analytical process have to be evaluated in a precise, fast and easy way. Criteria such as these are critical when choosing an analytical system used for production control.

High expectations to be fulfilled

The choice is not difficult once you consider the following facts. X-ray fluorescence (XRF) spectrometry is the most precise analytical method. Simultaneous XRF is the fastest and most efficient analysis mode. Lastly the S8 DRAGON system is the only XRF instrument to tap these potentials.
The S8 DRAGON, an XRF system for simultaneous elemental analysis, is designed to meet the high demands set by the metallurgist. This powerful, truly simultaneous, Bruker instrument stands alone due to:

- Ultimate analytical precision,
- Analytical flexibility to measure all elements from carbon upwards simultaneously
- Simplicity of its handling.

The S8 DRAGON delivers top results at the highest state of the art – in the most economical way.

Solution for

- Iron
- Steel
- Nickel base
- Cobalt base
- Copper base
- Aluminum

S8 DRAGON

- Truly Simultaneous XRF Analyzer for Metals

Accuracy to the Max

The Metallurgist:
"I require analytical accuracy to quantify the composition of produced metals."

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Focusing crystals


S8 DRAGON

Precision on top.

The Process Engineer:
"I expect analytical precision so I can exactly match the melt composition and meet cost targets."

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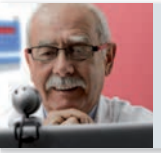
Process samples

S8 DRAGON status



Detection at its best.

The Lab Manager:
"I want analytical flexibility and shortest time-to-result because my colleagues need immediate feedback on the process."

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Multielement Channel™


Non-Routine samples

Ease of use.

The Operator:
"I expect simple operation because I have no time for additional training."

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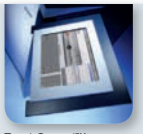
TouchControl™


EasyLoad™

Uptime guaranteed.

The Lab Technician:
"I need 24/7 availability because a failure would cause production delay."

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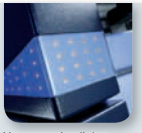
SampleCare™ – Tube above


X-ray warning lights

Teamwork to perfection.

The Plant Manager:
"I want to integrate the analytical system with automation to ensure continuous operation."

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Automation interface

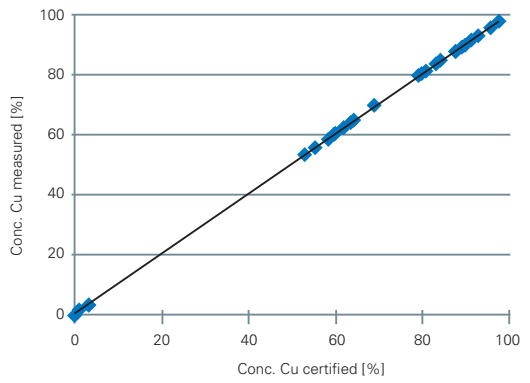

USB – Ethernet Connection

The Metallurgist:
"I require analytical accuracy to quantify the composition of produced metals."

Comparison of measured concentrations versus certified concentrations

Element	Certified Concentration (%)	S8 DRAGON Concentration (%)	Abs. Dev. (%)
Pb	0,010	0,009	0,001
Sn	0,019	0,02	-0,001
Fe	0,008	0,007	0,001
Ni	0,19	0,194	-0,004
Si	0,14	0,14	0,000
Mn	0,02	0,021	-0,001
As	0,011	0,0111	0,000
Al	0,120	0,115	0,005

Calibration Curve for Copper covering a wide concentration range



Accuracy to the Max

The elemental composition of raw materials varies. To meet the standards and the customer's needs, the uniformity of the produced metal alloys has to be ensured. Here the S8 DRAGON proves to be the best choice in terms of accurate results from the very beginning.

The S8 DRAGON covers a broad range of alloy compositions and delivers accurate results no matter what the concentration. Its highly sensitive element channels cope with a dynamic range from very low traces to elements with high concentrations up to 100%.

With METAL-QUANT, the S8 DRAGON comes ready to analyze and is optimized for the analysis of ferrous or non-ferrous materials. Individual calibrations, based on ones own factory samples, are accomplished easily. Even faced with varying conditions the instrument assures best results – simply and straight forward. In both ways, starting in a daily routine, it works quickly, easily, and smoothly.

Maximum speed

Time always matters. Most especially, the production process of metal is time and energy consuming. Therefore, measurement speed is a crucial issue. With the S8 DRAGON, time delay is minimized: It offers a fast approval of the cast sample or immediate results to calculate the exact tonnage to be added. Its intuitive handling, and the simultaneous analysis of the elements assure the most effective process.

Dual Mode: Unrivalled Data Safety

The S8 DRAGON offers best data safety: The most important elements, analyzed with single element channels are controlled permanently with a second simultaneous measurement using the spectrum from the Multielement Channel™ - the unique dual mode.

- Dedicated analyzer for process control in metals
- Ready to analyse solution for ferrous and non-ferrous metals
- Direct, non-destructive analysis of solid and pressed samples

Precision on Top

Precision is not only a matter of quality. It is also a matter of price. By maxing out the potential of the S8 DRAGON, we guarantee the highest sensitivity for each element, but also cost benefits through exact measurements and adhering to strict heavy element limitations.

For example nickel, a basic but expensive component of stainless steel, is used to control the steel's strength and corrosion resistance: The goal is to exactly match the standardized dosage of the element to stay within the limits and keep the costs of the steel low. Furthermore, the analysis of hazardous elements, such as lead or cadmium, also calls for precise trace analysis, ensuring the compliance of the alloy to regulations such as RoHS/WEEE.

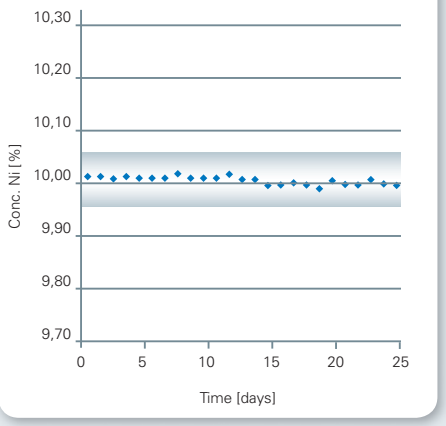
Excellent measurement results

The S8 DRAGON is designed to excite samples with up to 4 kW power, ensuring to achieve the maximum intensity for each element. Due to the compact coupling between X-ray tube anode, sample surface and the X-ray detector, the distances are minimized and the highest possible count rate is attained. Moreover, each important element is measured by a separate channel. These advanced features lead to the best counting statistics and excellent results.

- High intensity X-ray tube for optimal excitation
- Precise sample positioning for ground breaking analytical stability
- Best light element performance due to 170 mA and most compact beam path
- Element specific focusing analyzer crystals

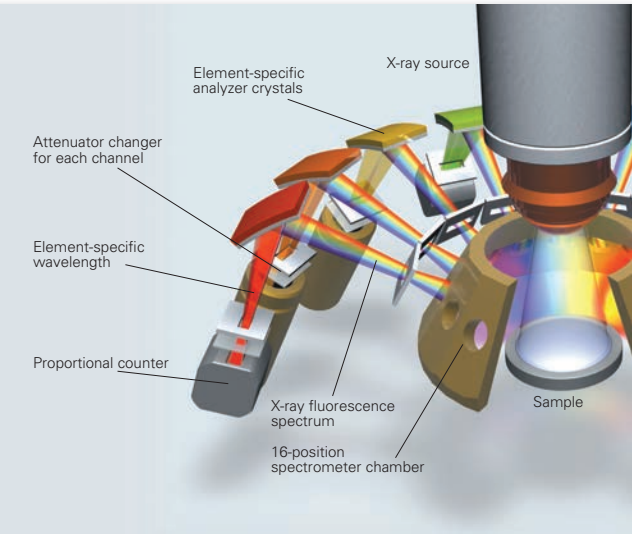
The S8 DRAGON analyzes each element with high precision. The unique design of the spectrometer delivers maximum intensity which finally results in optimal counting statistics.
The outcome is a very narrow 3σ interval with smallest variation of the reported concentrations. Finally this allows optimizing the production close to the specified composition.

Long Term Stability for Nickel in Steel



Competitiveness in a flexible and globalized metal market is a question of the ability to meet three conditions of production: First, a proper work flow and a minimum of complexity. Second, an efficient use of materials. And third, a high quality of fabricated goods.

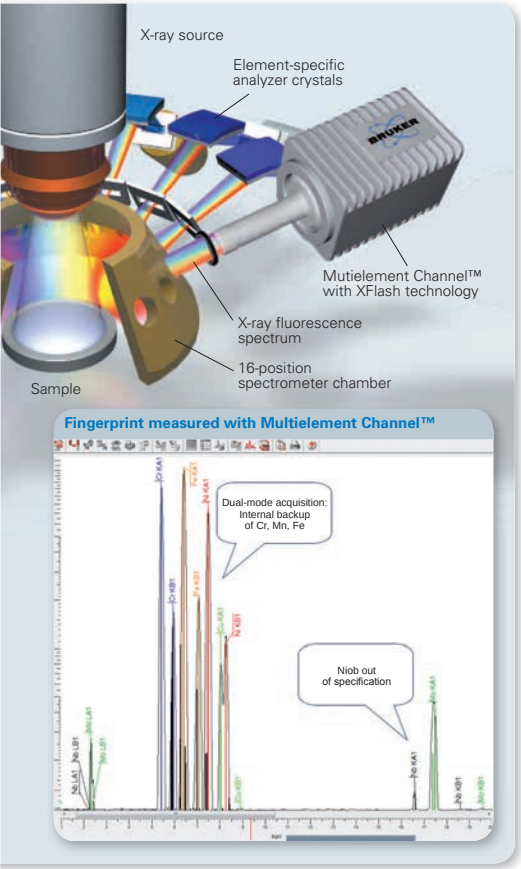
The Process Engineer:
"I expect analytical precision so I can exactly match the melt composition and meet cost targets."



In simultaneous wavelength dispersive X-ray fluorescence (WDXRF) each element is analyzed by recording the signal with an individual channel. Depending on the application, every channel is optimized for the concentration range of the element.

- The X-ray source is located above the sample and directly excites the elements. A very close coupling between tube anode and sample surface guarantees the highest primary intensity for excitation.
- The spectrometer chamber remains always under vacuum to ensure the best sensitivities for all elements. In addition the chamber is very compact and a stable vacuum is maintained by sealing the chamber with a shutter during sample change. The strategic placement of up to 15 element channels around the chamber optimizes the intensities due to shortest sample-to-detector coupling.
- Each element channel owns an analyzer crystal. They select from the multiple wavelength fluorescence spectrum the characteristic wavelengths for the elements.
- And finally the detectors: For the detection of lighter elements, a proportional counter is used. For heavier elements, a scintillation counter is applied. Both types of detectors are perfectly suited to their respective energy ranges. Automated attenuators allow the analysis of wide concentration ranges. The attenuator is moved into the beam automatically. The signal is thereby kept in the linear operating range of the detector.

Detection at its Best



The Lab Manager:
"I want analytical flexibility and shortest time-to-result because my colleagues need immediate feedback on the process."

Imagine that a contamination occurs due to processing scrap metals, or a new element is specified and has to be analyzed in a daily routine.

Traditionally, a conventional spectrometer analyzes an element by using a single preset channel. This implies that the device is preconfigured and has to be extended with additional sources, such as a goniometer or scanner, if further elements need to be measured. But these technologies are costly in terms of time and money and typically delays the feedback to production – it is no longer considered simultaneous.

This is where the S8 DRAGON shines. Next to the fixed channels, the Multielement Channel™ collects the entire spectrum based on Bruker's patented XFlash™ technology called dual-mode acquisition. Thanks to the industry grade superfast detector electronics this channel records the entire spectrum with best resolution and high countrates.
Thus, the S8 DRAGON becomes a truly simultaneous XRF instrument, detecting all elements in a single shot and also providing the fastest and most flexible analysis available.
The integrated Multielement Channel provides accurate and precise results for the complete element range from sodium upwards. In addition it offers unrivaled analytical flexibility:

Elemental fingerprinting of each sample
- All elements contained in a sample are identified and can be analyzed.
- The subsequent evaluation of additional elements is done easily.

Analytical Flexibility
- Contaminations can be traced back regarding their occurrence
- Non-routine samples are quickly analyzed

Upgrading analytical methods
- The analysis of new additional elements is done within minutes by upgrading the calibration - no further installation of new hardware is necessary

Internal Backup
- With the innovative XFlash detector, the S8 DRAGON offers maximum analytical flexibility along with the utmost security of information providing a second internal evaluation source due to dual-mode data acquisition. In case of a channel malfunction, information is still available through an internal backup.

- Simultaneous analysis of the entire periodic table
- Unique analytical flexibility for metals, slags, ores, limestone
- Unrivalled XFlash detector resolution of 129 eV with 100.000 cps at Mn K_α
- Maintenance free operation Peltier cooled SDD technology
- Complete easy-to-use analytical software package for calibration, evaluation and reporting

Variety of metal samples

Glass beads of raw materials, e.g. ferro alloys, ores, slags

Powdered samples, e.g. slags, limestone, ores

The Operator
"I expect simple operation because I have no time for additional training."

Ease of Use

Complexity delays the process and requires expertise in order to run the instrument. Simplicity is always preferred. With TouchControl™, operation becomes incredibly easy:

The sample is placed in the magazine and the touchscreen is tapped only once. The results are displayed immediately. Thanks to the integrated network connection, the data are transmitted to the control center or LIMS system automatically.

This operating mode creates an easily manageable routine for the operator and at the same time assures the flexibility of application. Calibrations, definition of priority samples or other individual adjustments are possible at any time.

The S8 DRAGON runs in the self-sufficient island mode providing access to the system and to all data via the integrated network connection. With equal ease, measuring jobs for reference and calibration samples are automatically started. For this purpose, the S8 DRAGON fetches the drift correction and quality samples out of the automatic EasyLoad™ and puts them back there again.

Easiest operation with TouchControl™

1
Measuring a sample couldn't be easier: Just place the sample into the magazine and select the application. Perfect for industrial use: All routine applications are quick start buttons!

2
Quick: Just type the sample ID directly onto the touchscreen! No hassle with a PC, mouse or keyboard! Simply press "MEASURE" to analyze! There is nothing to remember! It is simply step-by-step.

3
Instant results: Each result is displayed on the touchscreen, sent to the printer and stored in the database. Given customer specific limit values are checked automatically and the values are displayed color coded: Green PASS, Red FAIL. Several user access levels protect relevant data!

Easiest operation with TouchControl™: Intuitive touchscreen interface: Three steps to accurate results!

- No operator training required
- Standalone operation in tough environments (no PC, mouse or keyboard)
- Unmatched data integrity: Routine analysis is separated from advanced tasks like calibration, evaluation, and extended reporting
- Online language switch with free selection: Chinese, English, French,...
- Tailored for industrial environments, "round-the-clock" operation

- Ergonomic and quick sample loading
- Free language selection – Chinese, English, French, German, Portuguese, Russian, Spanish, …
- Reliable and fail-safe analysis
- GLP-compliant data protection
- Island operation with TouchControl™ and integrated PC

Uptime Guaranteed

The Lab Technician: "I need 24/7 availability because a failure would cause production delay."

Flexible sample handling for metals, slags, raw materials

Robust versus dust and particles from slags

The S8 DRAGON is built to maintain its solid performance in the long run: All important parts, like generators, analyzer crystals or high precision mechanical parts, are developed, manufactured and tested at Bruker in Germany. The production is based on high-grade engineering, assuring durability and flawless operation.

The detection channels are mounted outside the spectrometer chamber. Therefore, all components are easily accessible for a quick adjustment or repair. By arranging the X-ray tube and the element channels above the sample, the danger of contamination is eliminated – even damage by dust or broken pieces of the sample material. This guarantees flawless operation, without any elaborate or expensive maintenance and service. Maximum uptime is ensured by this design principle and by reducing movable components to the bare minimum.

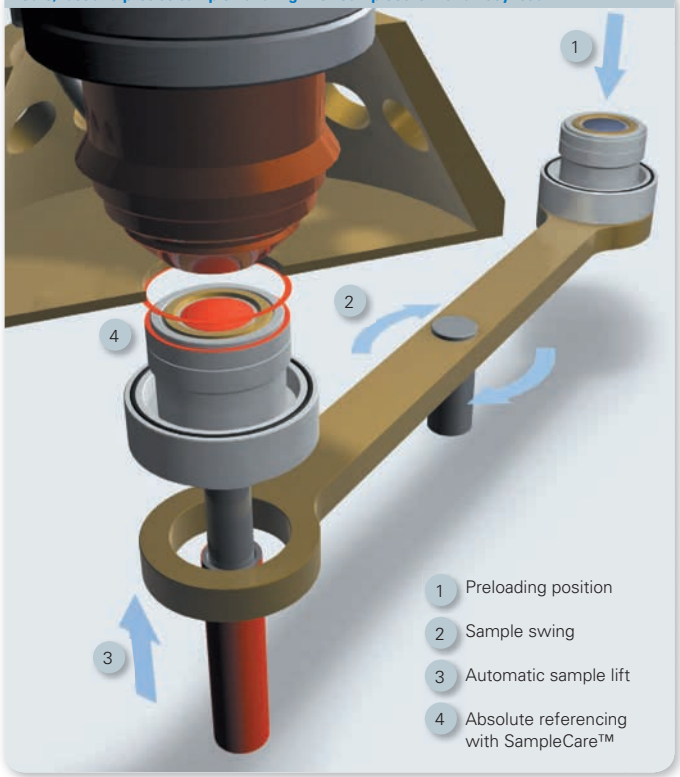
The S8 DRAGON is also environmentally safe. The temperature control of the spectrometer chamber and the detector crystals makes the element channels entirely independent of each other, preventing unstable results. The small sample chamber reduces time wasted while it is evacuated for sample change. To provide an accurate system and prevent malfunctions, more than 240 system parameters are controlled permanently. The unique S8 TOOLS software allows quick and simple trouble shooting providing a fast restart of the routine. Moreover, the TCP/IP connection of the S8 DRAGON permits instant support by Bruker experts – at any time, worldwide.

- Lowest maintenance and best system uptime with tube-above geometry
- Shortest time-to-result using preloading position
- Unique S8 TOOLS software with first aid functionality and remote service access
- System design for quick onsite maintenance and adjustments
- Unrivalled precision due to temperature stabilized X-ray optics

SampleCare™:

- Tube-above geometry keeps instrument uptime high and maintenance low
- Safe sample handling for dusty samples
- Precise and accurate positioning of the sample surface with automatic sample lift
- Pre-evacuation step with separation of sample and spectrometer chamber for highest vacuum stability

Safe, fast and precise sample handling with SampleCare™ and EasyLoad™



The Plant Manager:
"I want to integrate the analytical system with automation to ensure continuous operation."

- Dedicated sample handling for all kind of process samples
- Integration path for seamless connection in automated laboratories
- Automated and manual sample loading with priority levels
- Combined process control with optical emission spectrometry
- Safe storage of valuable reference, drift correction and QC samples in automatic drawer

Automation Interface

USB Port

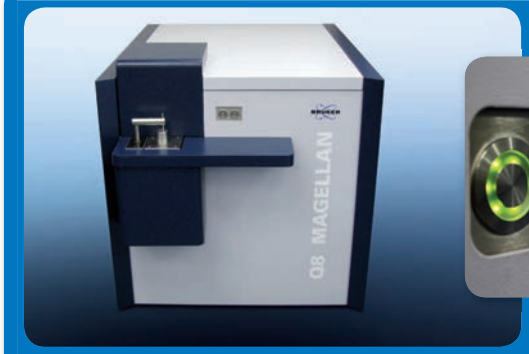
- Flexible sample handling for cups and process samples
- Direct handling of metal samples through automation
- Fastest time-to-result due to preloading and sample swing

EasyLoad™:
- Automatic drawer for reference samples
- Safe storage of samples
- Samples always available for measurement
- 14 positions for 40-mm metal or steel ring sample holders
- 12 positions for 51.5-mm metal or steel ring sample holders
- ONLINE version for automation

Teamwork to Perfection

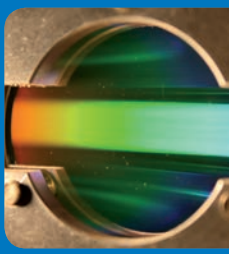
Streamlining the workflow is an essential issue in the metal industry today. To stay competitive, production costs must be decreased without compromise to analytical quality. Often, the combination of complementary analytical technologies and automated, unattended operation is required.

The S8 DRAGON is designed for quick and seamless integration into the plant automation, providing best connectivity.
The sample magazine of the S8 DRAGON can be fed by robot or belt from the back of the instrument. The ability to analyze non-routine samples with lower priority than automation, or start the manual operation if the automation is out for maintenance is possible at any time.
The combination between optical emission spectrometry (OES) and XRF brings process control in metal production to perfection. While XRF provides the best precision and accuracy for high concentration ranges, some elements are contributed by OES measurements. Through the integrated Ethernet connection, the results can be directly sent to the LIMS or to the plant control software, in combination with the OES results.
With the S8 DRAGON, analysis is easily arranged in line.



OES Spectrometer Q8 MAGELLAN

Start the Analysis



Holographic Diffraction Grating

Perfect teamwork

The Q8 MAGELLAN OES spectrometer offers innovative solutions that enable a wide range of customers in all metal producing and metal processing industries to elevate their business into a new level of quality and process control.
Spark optical emission spectrometers (S-OES) are the ideal instruments for metal analysis in combination with XRF. From pure metal trace analysis to high alloyed grades, this combination covers the almost complete range from sub-ppm to 100 % for the entire periodic table. All relevant elements can be directly analyzed in one single run.

Technical Data

Systems	S8 DRAGON 3K	S8 DRAGON 4K
X-ray power	3 kW Rh, 60 kV max. / 150 mA max.	4 kW 60 kV max. / 170 mA max.
Multielement Channel™	XFlash™ technology with dual-mode data acquisition for all elements from Na to U Energy resolution of 129 eV @ 100.000 cps for Mn K_α	
Single element channel	Up to 15 additional element channels	
Attenuators	Up to 6 attenuators (50 %, 80 %, 95 % - silver or stainless steel)	
Detectors	Proportional flow counters with windows: 0.6 µm, 1.5 µm, Sealed proportional counter: 25 µm Be; Scintillation counter	
Sample dimensions	Bare samples with Ø 33 - 51,5 mm Thickness: max. 30 mm Weight max 500g	
Sample handling	8 position cups for maximum diameter of 69 mm 10 position 51.5 mm sample rings or 12 positions 40 mm sample rings ONLINE-Version: 8 positions 51.5 mm sample rings or 9 positions 40 mm sample rings with conveyor belt	
Vacuum system	Vacuum pump integrated	
EasyLoad™ 1)	Automated sample drawer with 12 positions for 51.5 mm steel rings or 14 positions for 40 mm steel rings	
TouchControl™ 1)	Integrated touchscreen for easy and intuitive operation	
Solution packages 1)	METAL-QUANT™; Fe for steel and iron; Cu for copper based alloys	
Power consumption	7 kVA	
Connection	208 – 230 V (50/60 Hz) 40 A single phase or 32 A three phases	
Dimensions	193 cm x 84 cm x 118 cm (height x width x depth); 76'' x 33.1'' x 46.4'' Touchscreen: allow additional 49 cm (19.3'') 560 kg / 1235 lbs	
Cooling water	Automatically regulated, pressure 4 to 6 bar with no back pressure Temperature: 10 to 20 °C	
Compressed air	6 – 8 bar, oil free, 7 L/min Compressor, oil-free, silent, 50 Hz (K130C57), 60 Hz (K130C58)	
Detector gas	P 10 gas (10% methane, 90% argon) required for proportional flow counters	
Quality & safety	DIN EN ISO 9001:2008; CE-certified Machinery directive 2006/42/EC Electrical equipment 2006/95/EC; Electromagnetic Compatibility 2004/108/EC Fully radiation-protected system; radiation < 1 µSv/h (H*) German type approval (PTB) for X-ray safety; Conform to ICRP, IAEA, EURATOM	

1) optional packages

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