WOBISTRAX

A vacuum TXRF spectrometer with sample changer
and two exchangeable excitation sources

TU WIEN

ATOMINSTITUT

Design criteria:

- Shortest possible distances between source, sample and detector
- Measurement conditions: air, vacuum
- Compact tabletop design
- Detection limits in the pg range (ng/L)
- Sample changer
- Analysis of low Z elements down to C
- High stability
- Low Power X-ray tubes (air-cooled)
- Silicon drift detector (no LN_2 needed)

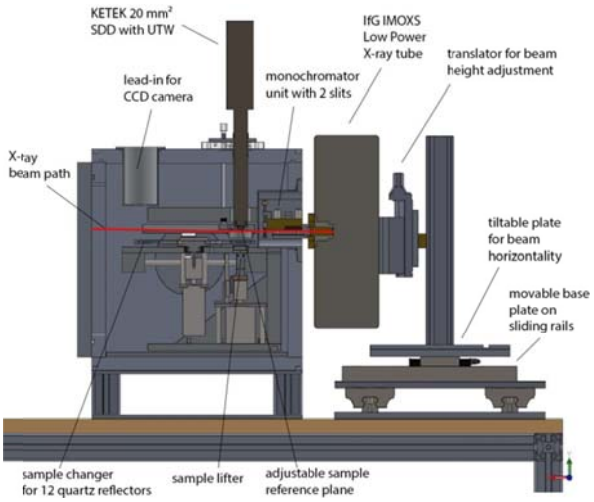
Features:

- Multilayer monochromators: high reflectivity, low background
- Vacuum: no air scatter, no Ar peak, reduced absorption → low Z option
- Two X-ray sources (Cr-Kα, Rh-Kα): ideal excitation conditions for low and high Z elements
- Sample changer tray for 12 samples
- Detection limits: 100 pg for Sr (Rh-Kα), 20 pg for Ti (Cr-Kα)
- Spectra in *.spe format (AXIL)

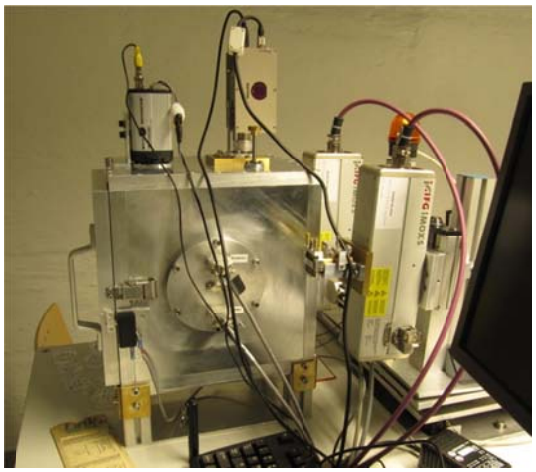
Components:

- Vacuum TXRF chamber (Atominstitut, A)
- 20 mm² Si drift detector with ultrathin polymer window and integrated pulse processor (KETEK, D)
- Two 35 W air-cooled low power X-ray tubes with Cr and Rh anodes (IfG, D)
- Tabletop HV generator (IfG, D)
- Multilayer monochromators: Ni/C (d = 4.03 nm) and Pd/B_4C (d = 3.24 nm) (AXO Dresden, D)
- Sample changer (Atominstitut, A) with vacuum stepper motors (Phytron, D)
- WOBISTRAX operation software (Atominstitut, A)
- AXIL deconvolution software (IAEA, A)

Schematic view:



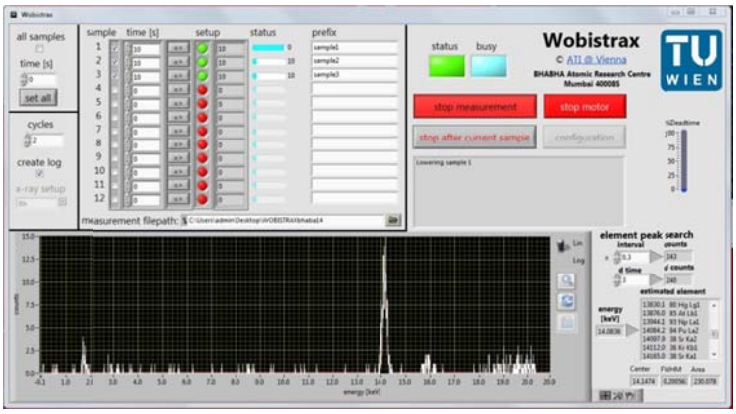
Total view of the spectrometer:



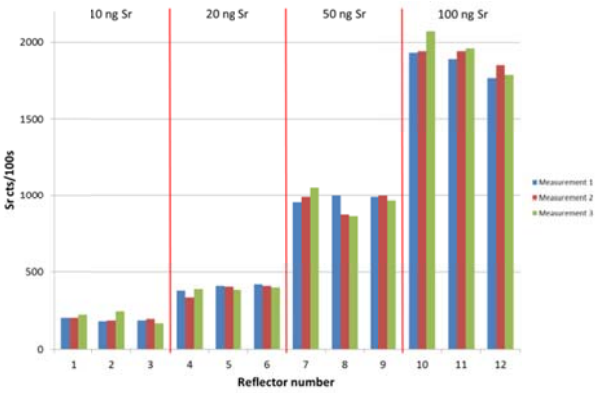
Technical data:

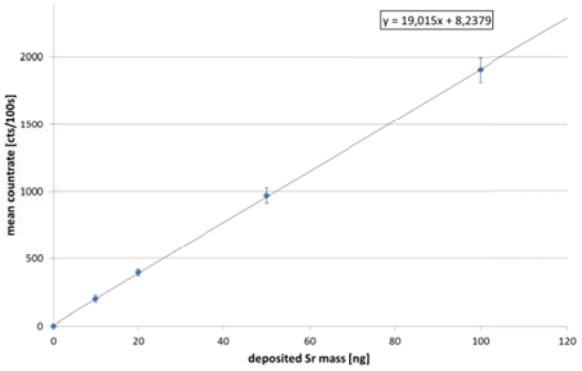
X-ray generator	*IfG Control and Supply Unit (CSU)*
X-ray tubes	*Warrikhoff MCB50-0,7G* 35 W Cr anode, 35 W Rh anode Air cooled, long fine focus *IfG IMOXS* tube housing
Operation conditions	30 kV/1300 µA for Cr excitation 50 kV/700 µA for Rh excitation
Silicon drift detector	*KETEK AXAS-D-H20-136 LE* with *VITUS H20 SDD* 20 mm² x 0.45 mm detector crystal, 300 nm polymer window Magnetic electron trap on external Ag collimator Integrated digital pulse processor (DPP) FWHM @ 100 kcps ≤ 139 eV (Mn-Kα)
Multilayer monochromators	*AXO Dresden* Diameter: 25.4 mm (1 inch) 80 layers Ni/C (d = 4.03 nm) for Cr excitation 100 layers Pd/B_4C (d = 3.24 nm) for Rh excitation Substrate: polished quartz glass
Operation modes	Rough vacuum (3 mbar) membrane pump for Cr excitation Air for Rh excitation
Sample carriers	any substrate with 30 mm diameter (quartz, acrylic glass, silicon)
Sample changer	Tray for up to 12 samples for sequential measurements
Element range	C-K (Z = 6) to Ti-K (Z = 22) and Mo-L (Z = 42) to Ba-L (Z = 56) for Cr K-K (Z = 19) to Mo-K (Z = 42) and Cs-L (Z = 55) to U-L (Z = 92) for Rh
Detection limits	Cr excitation: < 200 ng C, 12 ng F, 3.3 ng Na; 20 pg Ti Rh excitation: < 100 ng Sr (< 10 ppb for a 10 µl droplet)
Operation conditions	10 to 30 °C, 10 to 80 % rel. humidity, non-corrosive environment
Dimensions and weight **Vacuum chamber**	320 x 240 x 320 mm 20 kg
Dimensions and weight **Tube translation unit**	550 x 300 x 400 mm 20 kg

Control software:



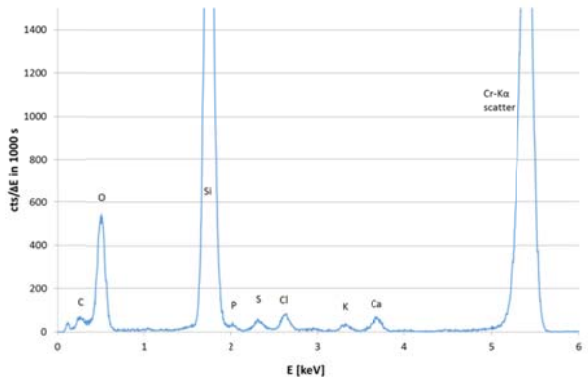
Sr repro test and calibration curve:





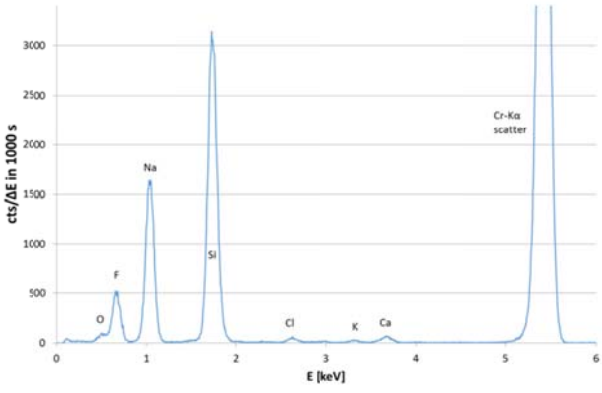
LLD1000(Sr) ≤ 100 pg

Low Z performance:



3000 ng TRIS on quartz reflector

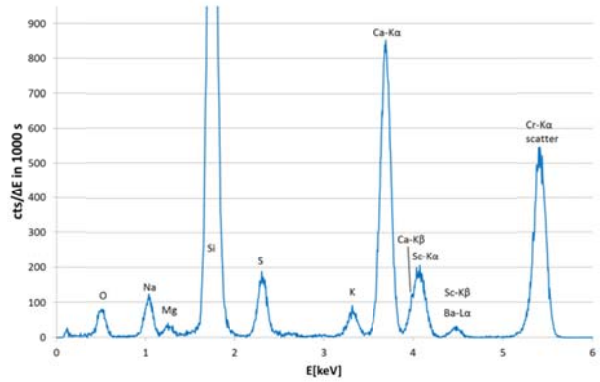
LLD1000(C) ≤ 200 ng

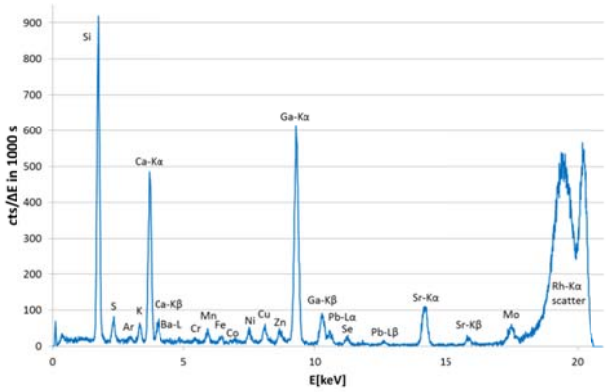


2000 ng NaF on quartz reflector

LLD1000(F) ≤ 12 ng, LLD(Na) ≤ 3.3 ng

NIST 1640:





Cr excitation (vacuum, 30 kV/1300 µA)
Internal standard: 1 ppm Sc

Rh excitation (air, 50 kV/700 µA)
Internal standard: 1 ppm Ga

Future developments:

- Curved multilayer monochromator
  Increase in intensity and reduction of detection limits for all elements

- Large area SDD (100 mm²)
  Reduction of detection limits for all elements

- Double anode X-ray tube
  Rh (or Mo) and Cr excitation possible without tube change

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