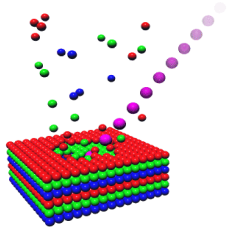
SIMS Workstation & Bolt On Components

- Rugged general purpose SIMS analysis station
- Rapid turnround of all types of samples
- Static and Dynamic SIMS
- Integral front end ionizer for RGA and SNMS
- Integral ion gun raster control with signal gating for depth profiling

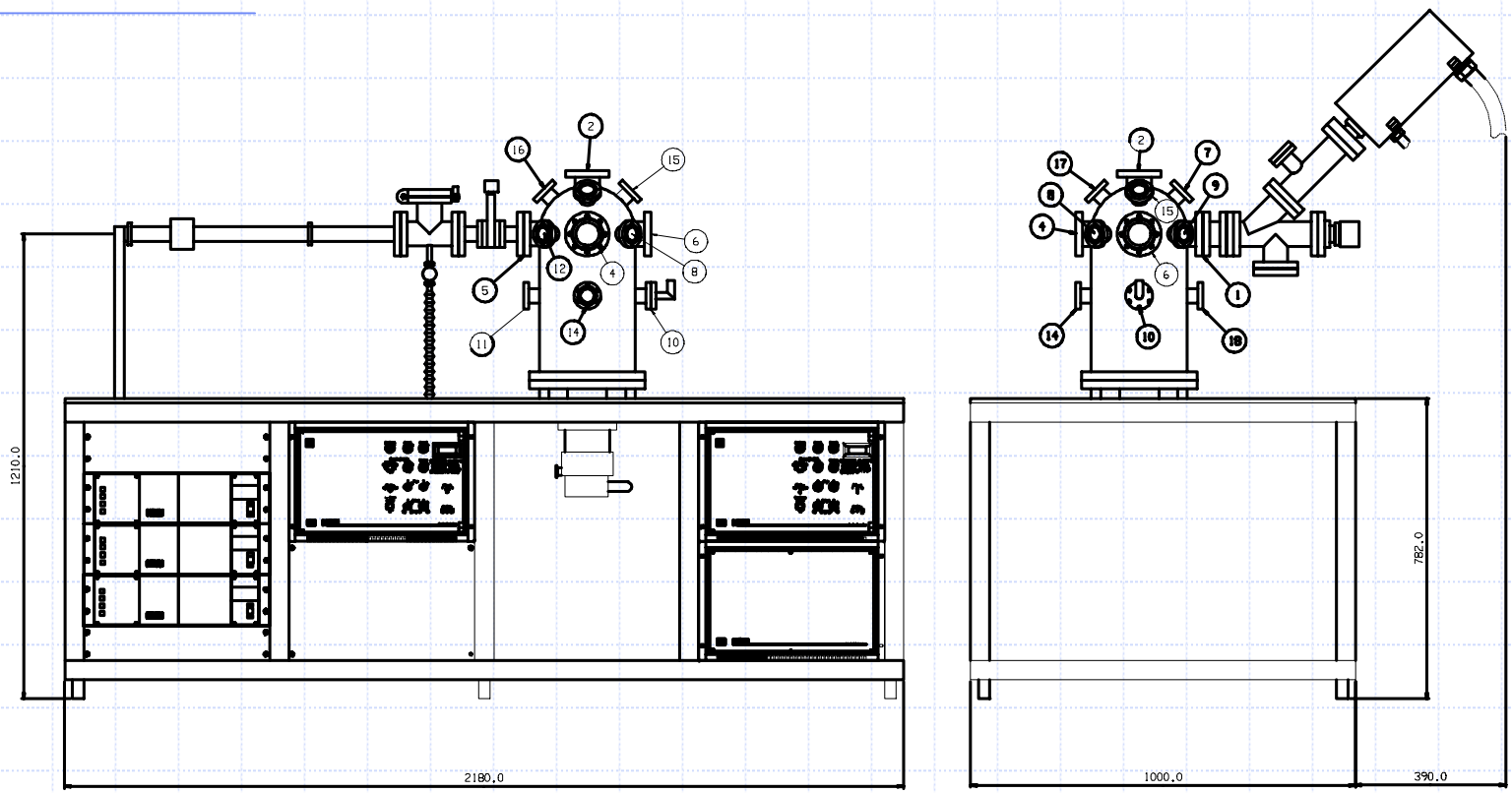




SIMS – The Technique

- Primary excitation
  - A. Oxygen/Noble Gas Ions up to 5keV
  - B. Ga Metal Ions up to 25keV
- Spatial resolution
  - A. 100 to 150 micron
  - B. 50nm
- Sampling depth
  - 2 monolayers (static)
    Almost unlimited (dynamic)
- Information
  - Elemental and chemical. Easy to understand
- Sensitivity
  - ppm levels
    (the most sensitive of all surface techniques)
- Quantification
  - Easy when compared to standard samples
- Specimen preparation
  - Straight forward
- Support data
  - Readily available

Schematic of the SIMS Workstation



Components of the SIMS Workstation

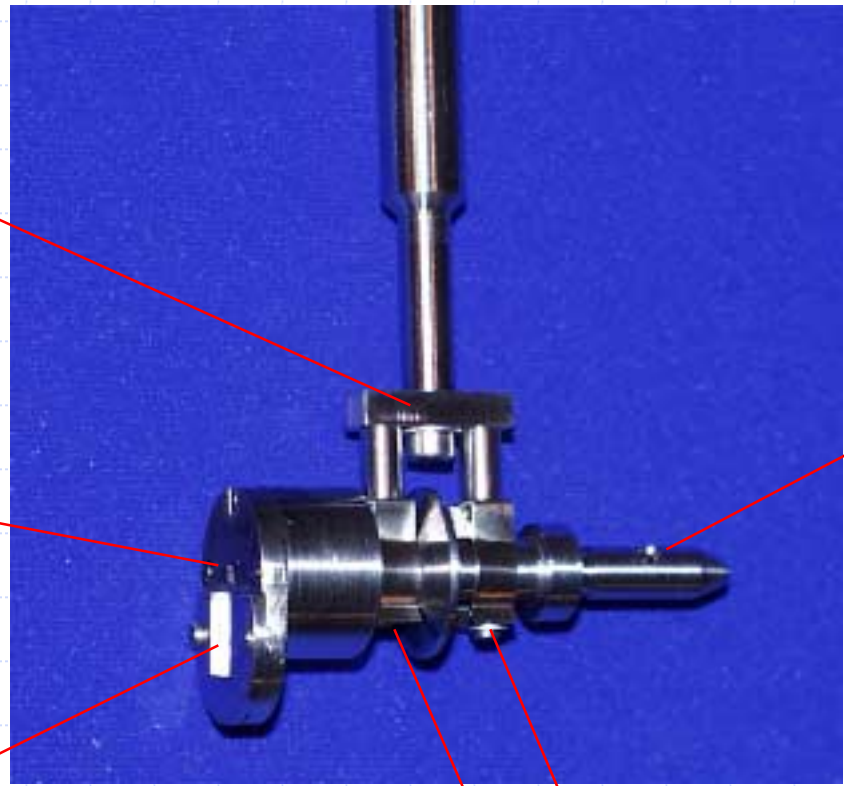
Flange	Purpose	Size
1	EQS 500	DN 63 CF
2	IG20 Ion Gun	DN 63 CF
3	Pumping	DN 100 CF
4	View Port	DN 63 CF
5	Sample Holder/Load Lock	DN 63 CF
6	Energy Analyzer (not fitted)	DN 63 CF
7	Flood Gun	DN 35 CF
8	X-Ray Source (not fitted)	DN 35 CF
9	Electron Gun (not fitted)	DN 35 CF
10	Cryo	DN 35 CF
11	Ion Gauge	DN 35 CF
12	Gas Feed	DN 35 CF
13	Auxillary	DN 35 CF
14	Auxillary	DN 35 CF



Quality Assurance

- ISO 9001 registered (certificate 6738)
- Year 2000 compliance
- Full one year warranty
- Lifetime technical support
- International service support

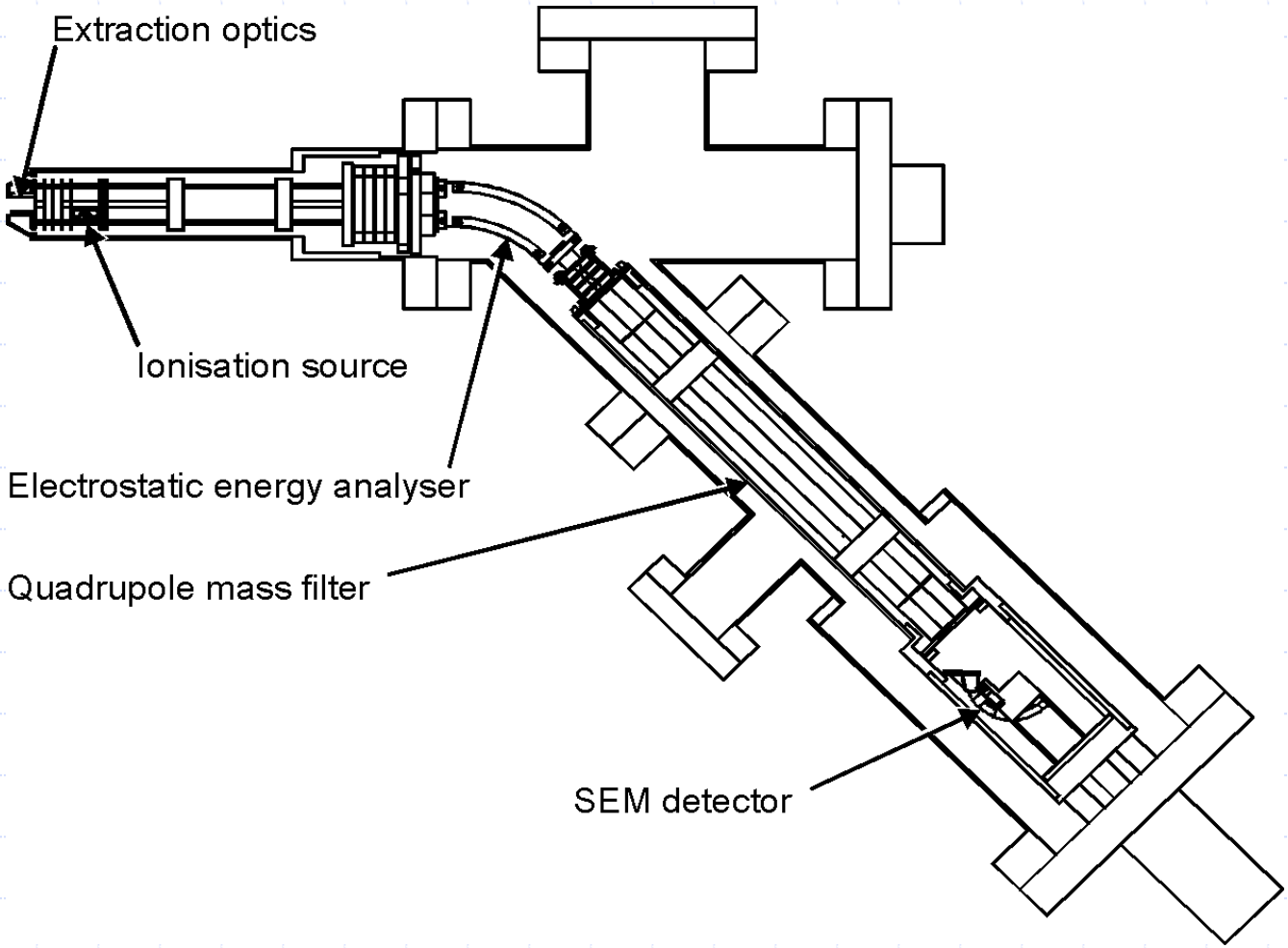
Components of the SIMS Workstation



The Hiden EQS SIMS Analyzer

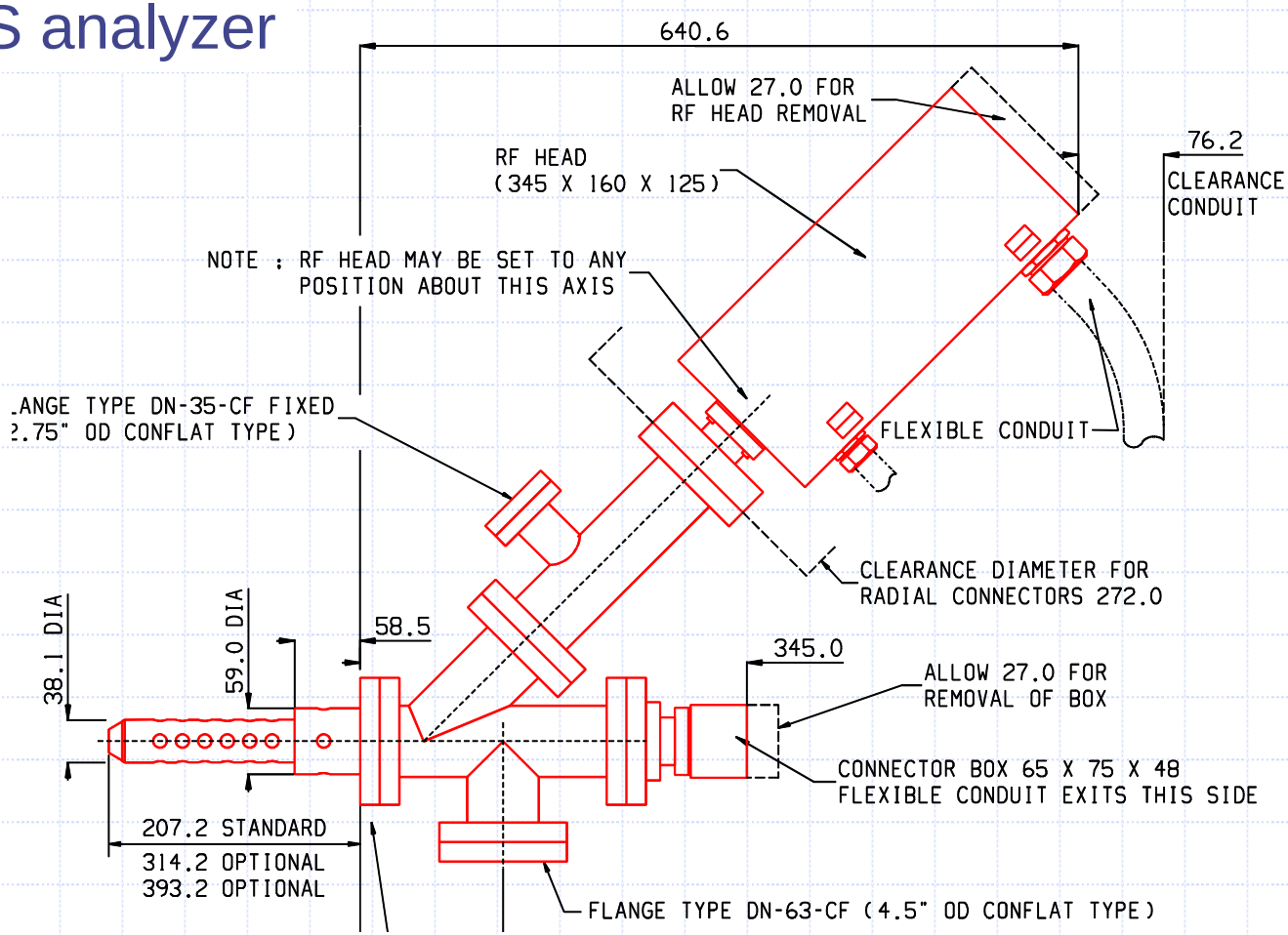


The Hiden EQS SIMS Analyzer

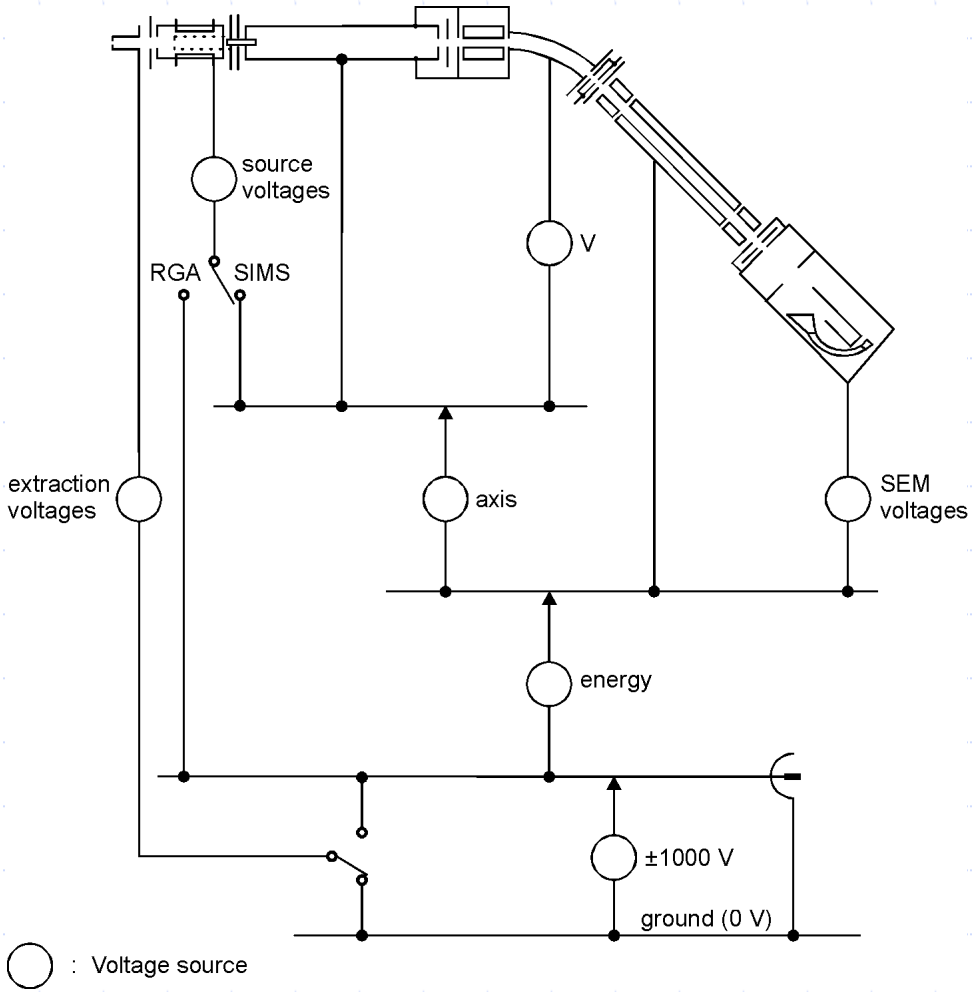


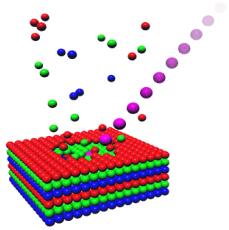
The Hiden EQS SIMS Analyzer

EQS analyzer



The Hiden EQS SIMS Analyzer



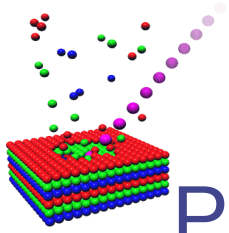


EQS SIMS Analyzer Specifications

Aluminum target
Ar positive ion beam at 5 KeV energy

30,000 cps / nA ---------- Al^+ at 27 amu

7,000 cps / nA ---------- O^- at 16 amu

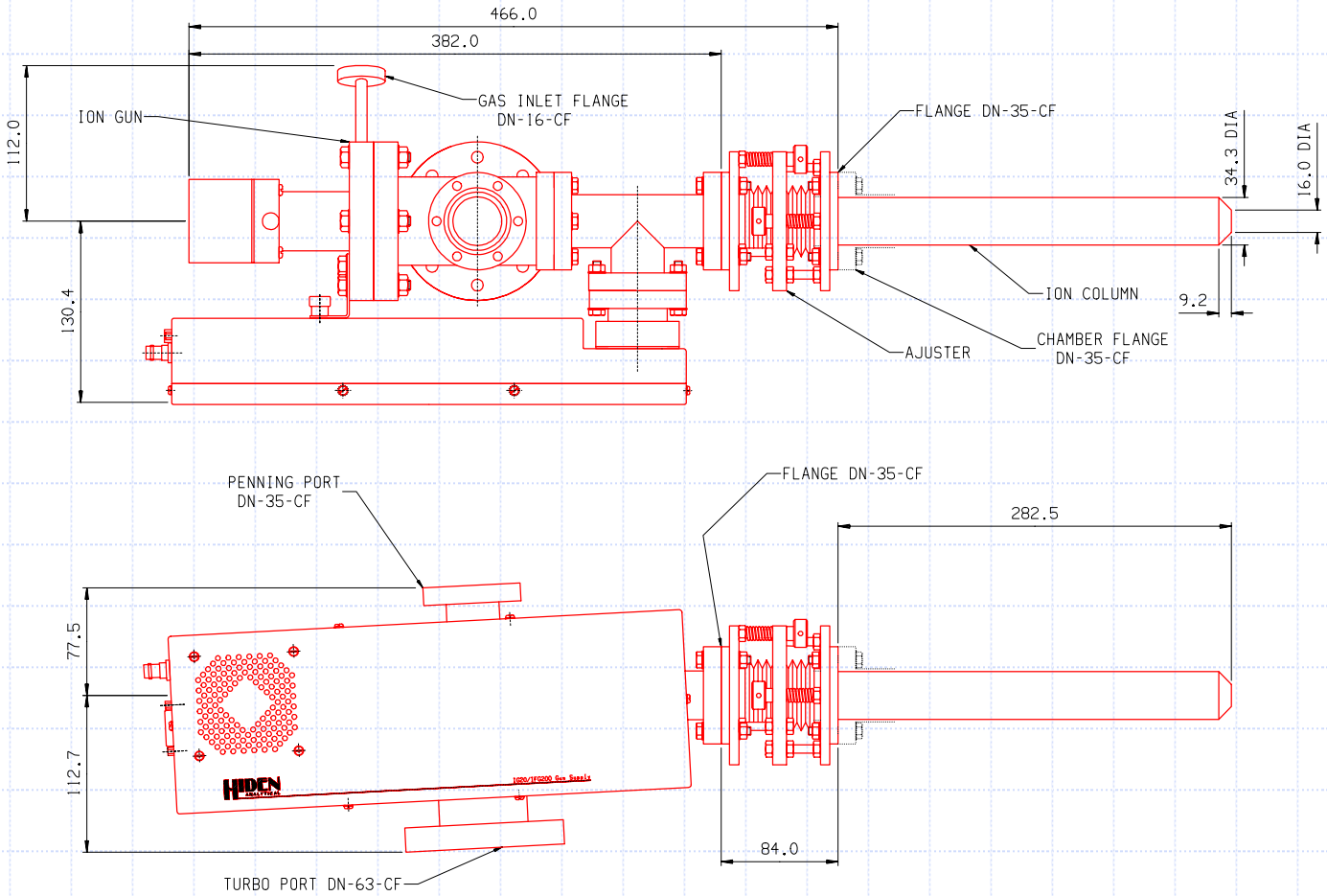


Primary Excitation - Hiden Ion/FAB Guns (Liquid Metal Ion Guns Available)

The HAL IG20 Ion Gun features:

- Intense ion beam - 100 micron spot size, energies from 0.5 to 5keV
- High current density, up to 4.5mA/cm^2 with stable positioning
- Electron impact ion source with argon and oxygen capability
- Steering optics for line scanning and beam rastering in depth profiling
- 3°offset in the ion gun column for optimum rejection of neutrals
- Beam blanking facility for rapid beam switching in rastering applications
- Differential pumping of the source reduces gas load on the chamber
- Easily replaceable twin filaments
- Charge exchange chamber to convert ions into fast atoms for FAB
- Electrostatic deflection lens ensures a clean FAB beam
- Control unit fully compatible with the IG20 high-brightness ion gun

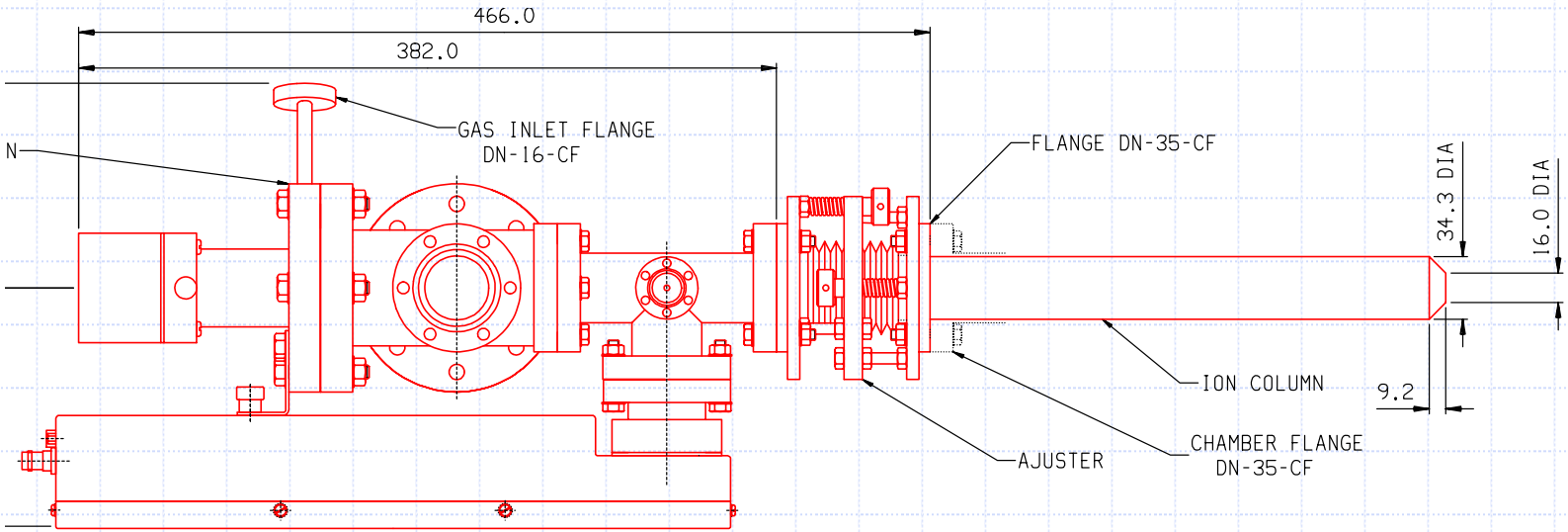
Hiden Analytical IG20 – Ion Gun



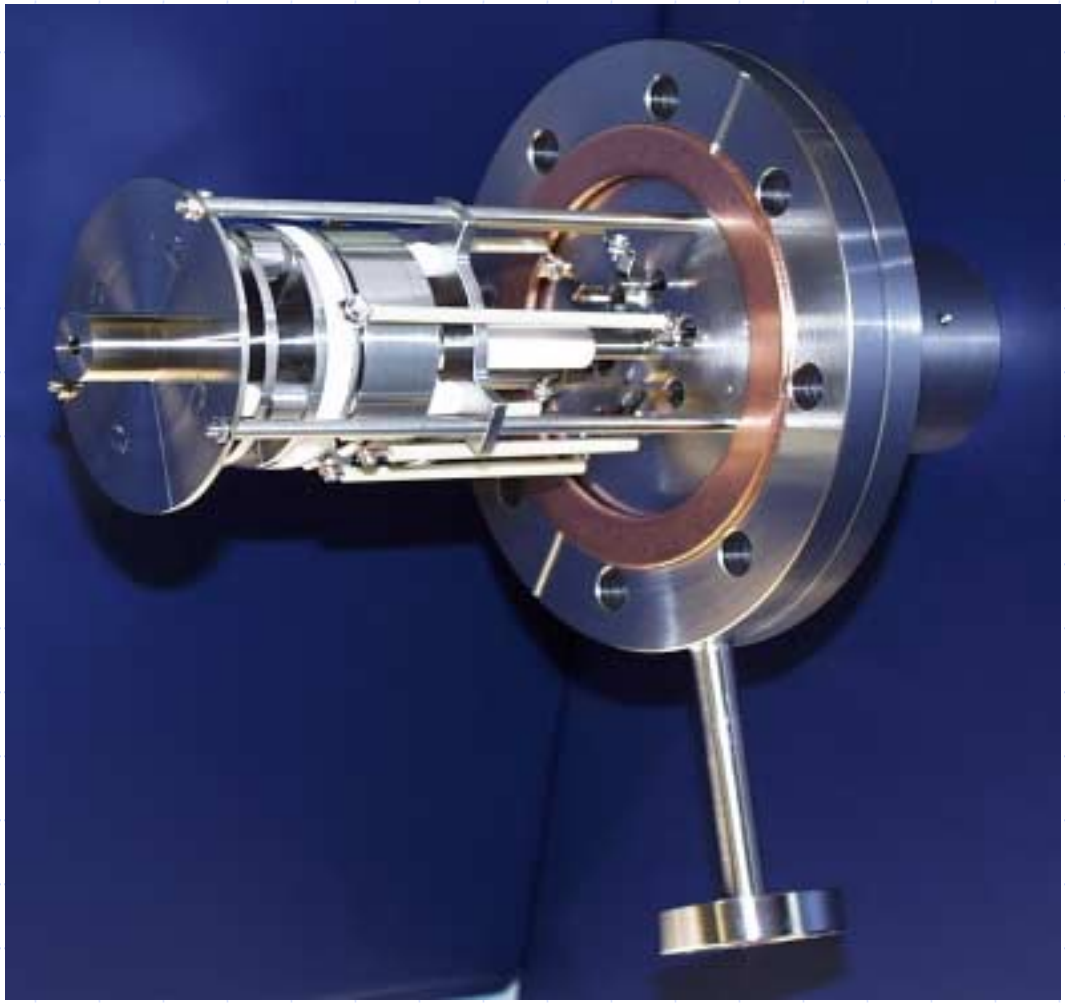
Hiden Analytical IG20 – Ion Gun

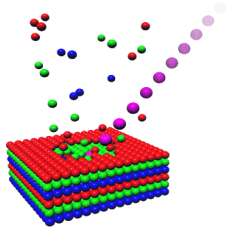


Hiden Analytical IFG200 – Ion/FAB Gun



IG20 and IFG200 Source Assembly



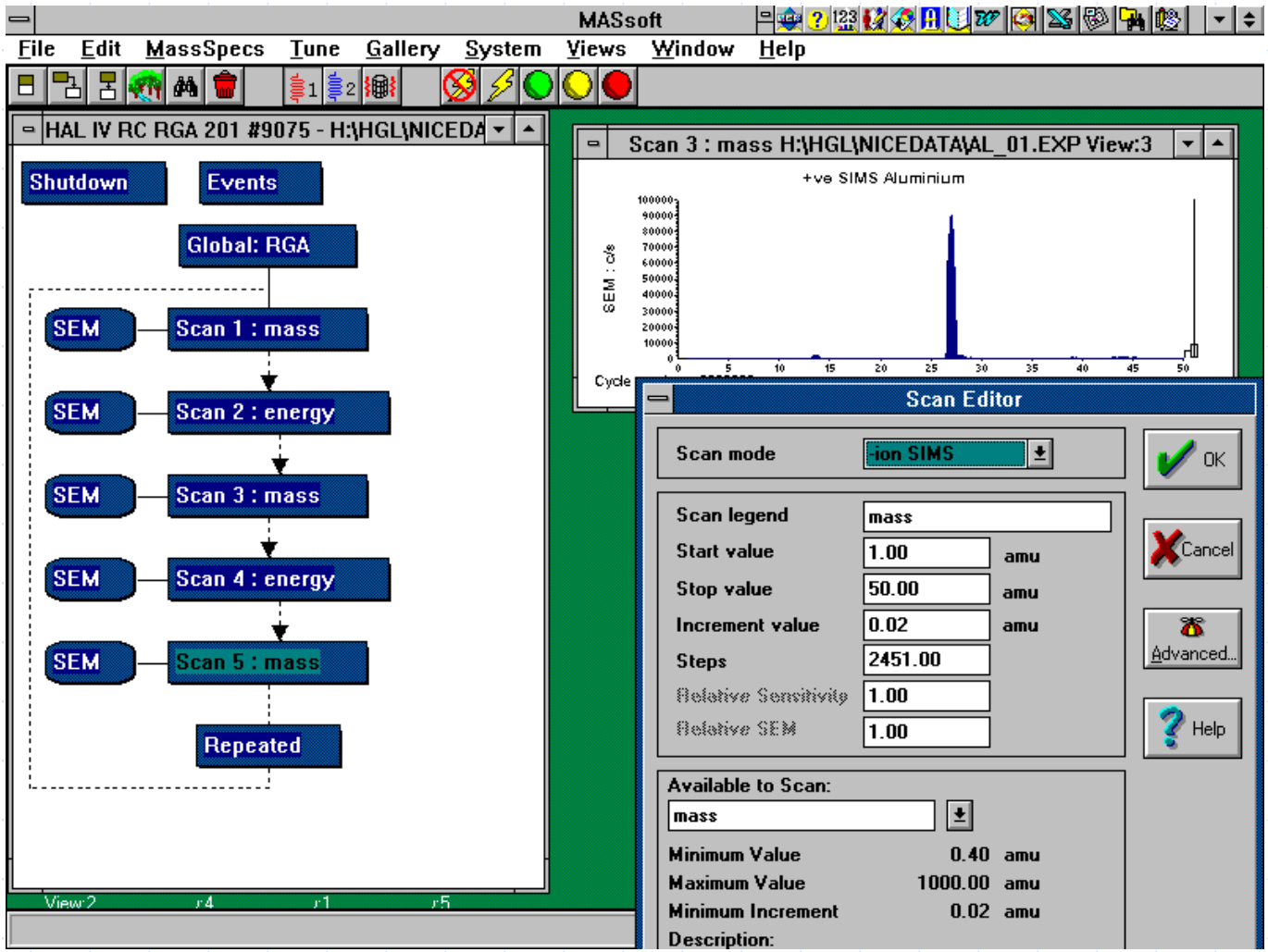


PC Control with Hiden SIMS Software

- Multi windows display
- Icon driven control
- Automatic data storage
- Real time display of mass spectra/depth/elemental map
- Zoom click and drag facility
- Template files / Scan Tree control
- Ethernet LAN / RS232

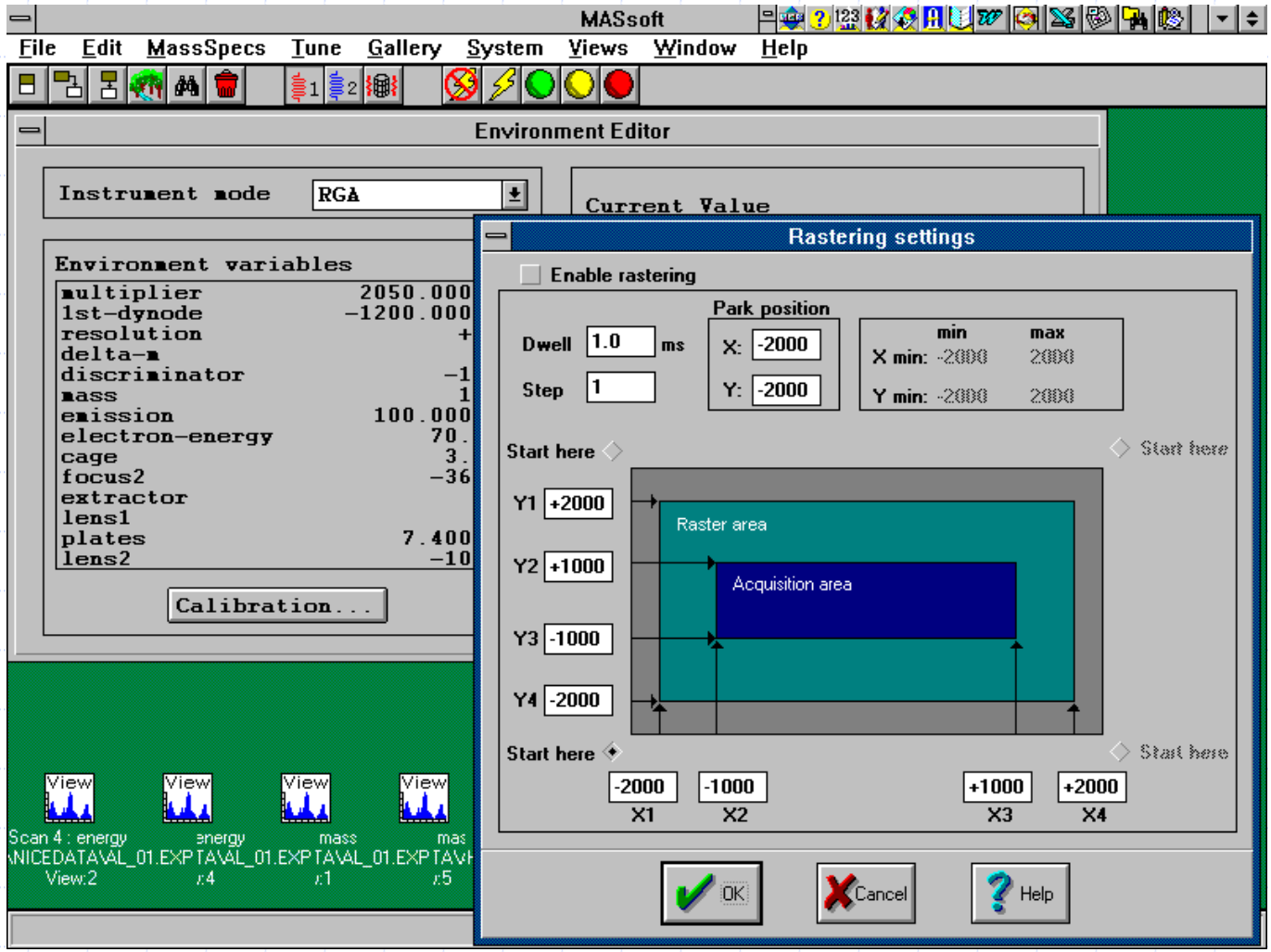
Software

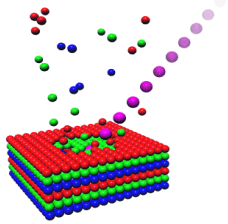
Rapid, simple data acquisition using the MASsoft Scan Tree



Software

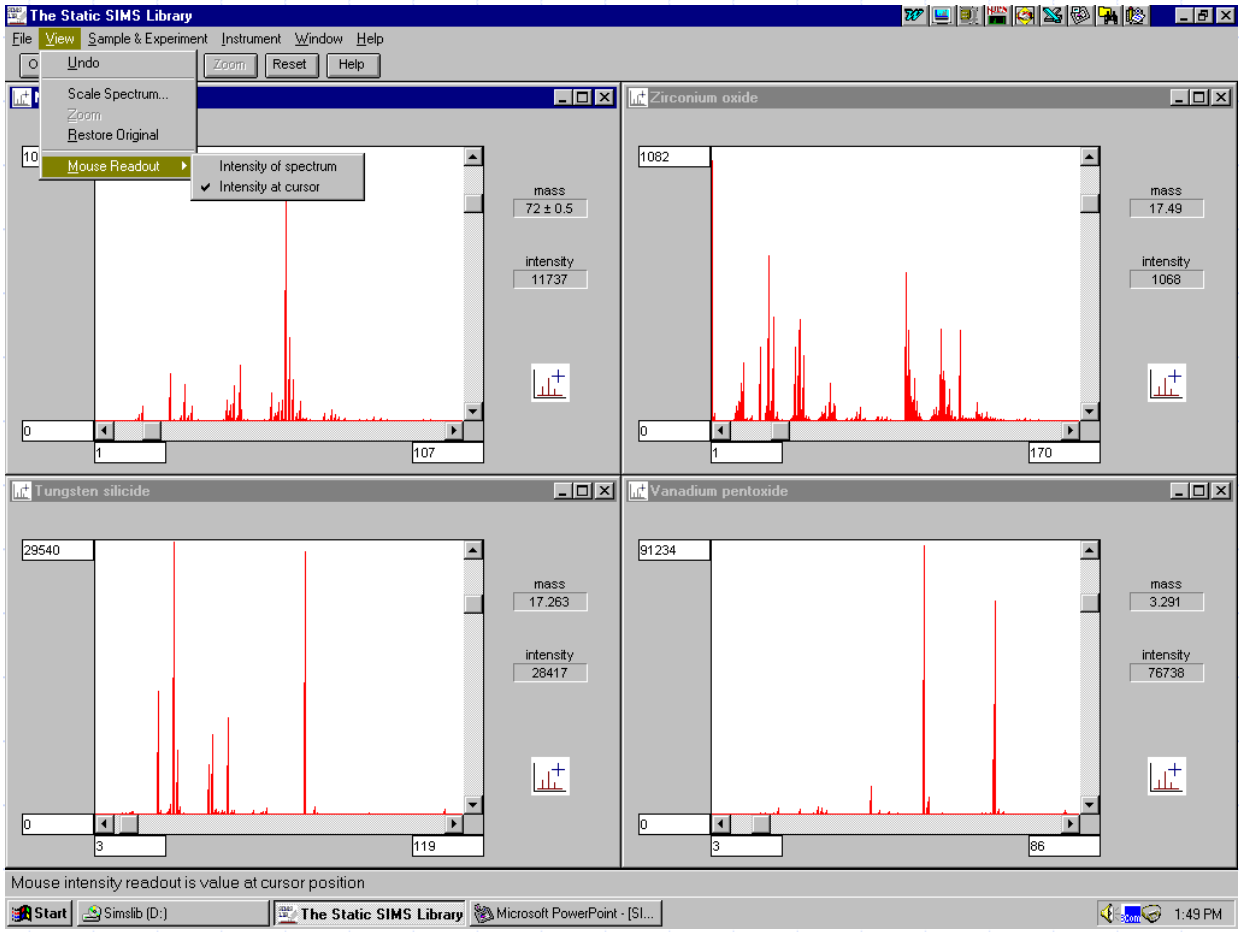
Rastering and depth profiling using MASsoft





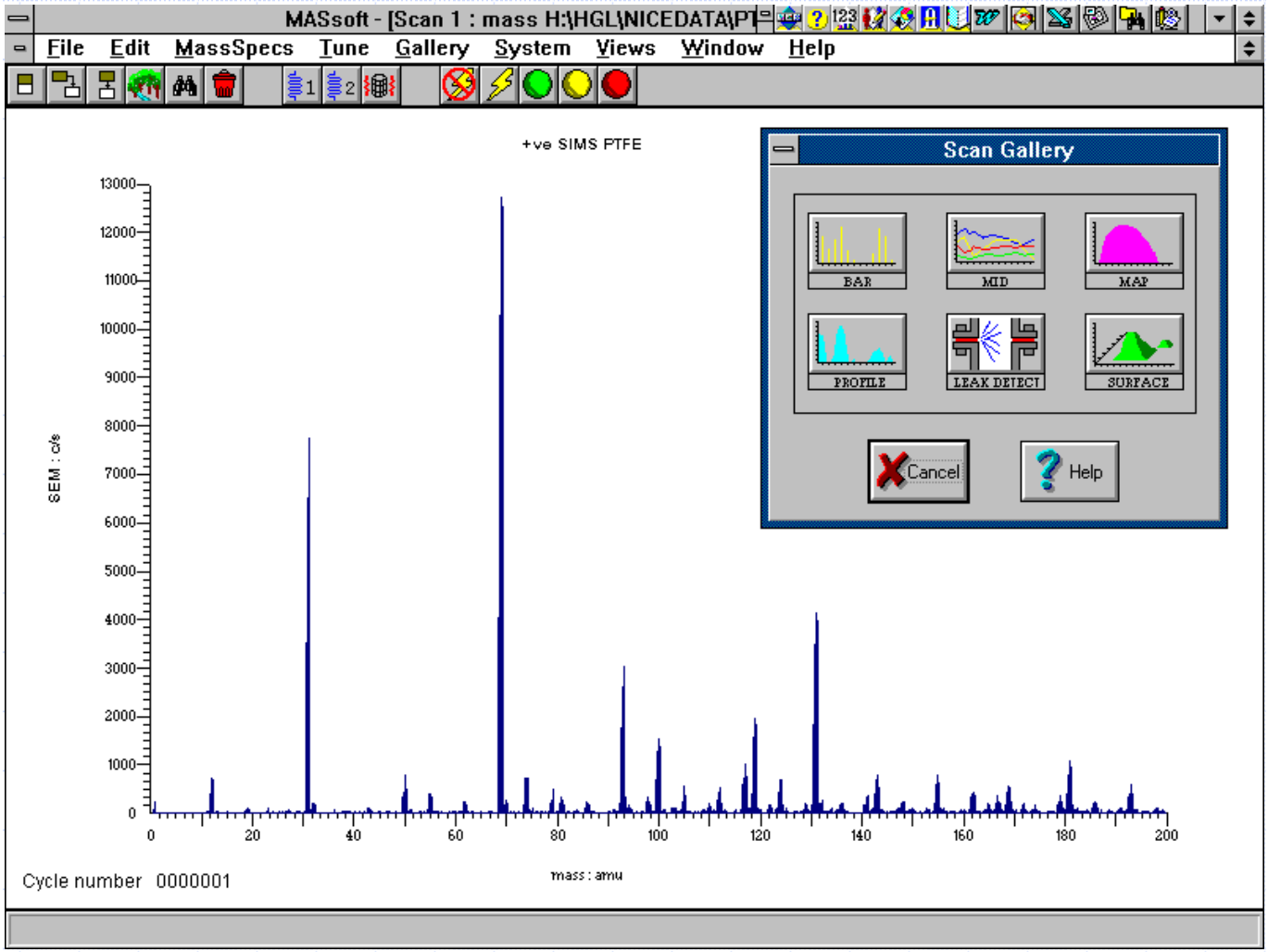
Static SIMS Library

- inorganics
- polymers
- lipids
- natural products
- pharmaceuticals
- surfactants
- alloys

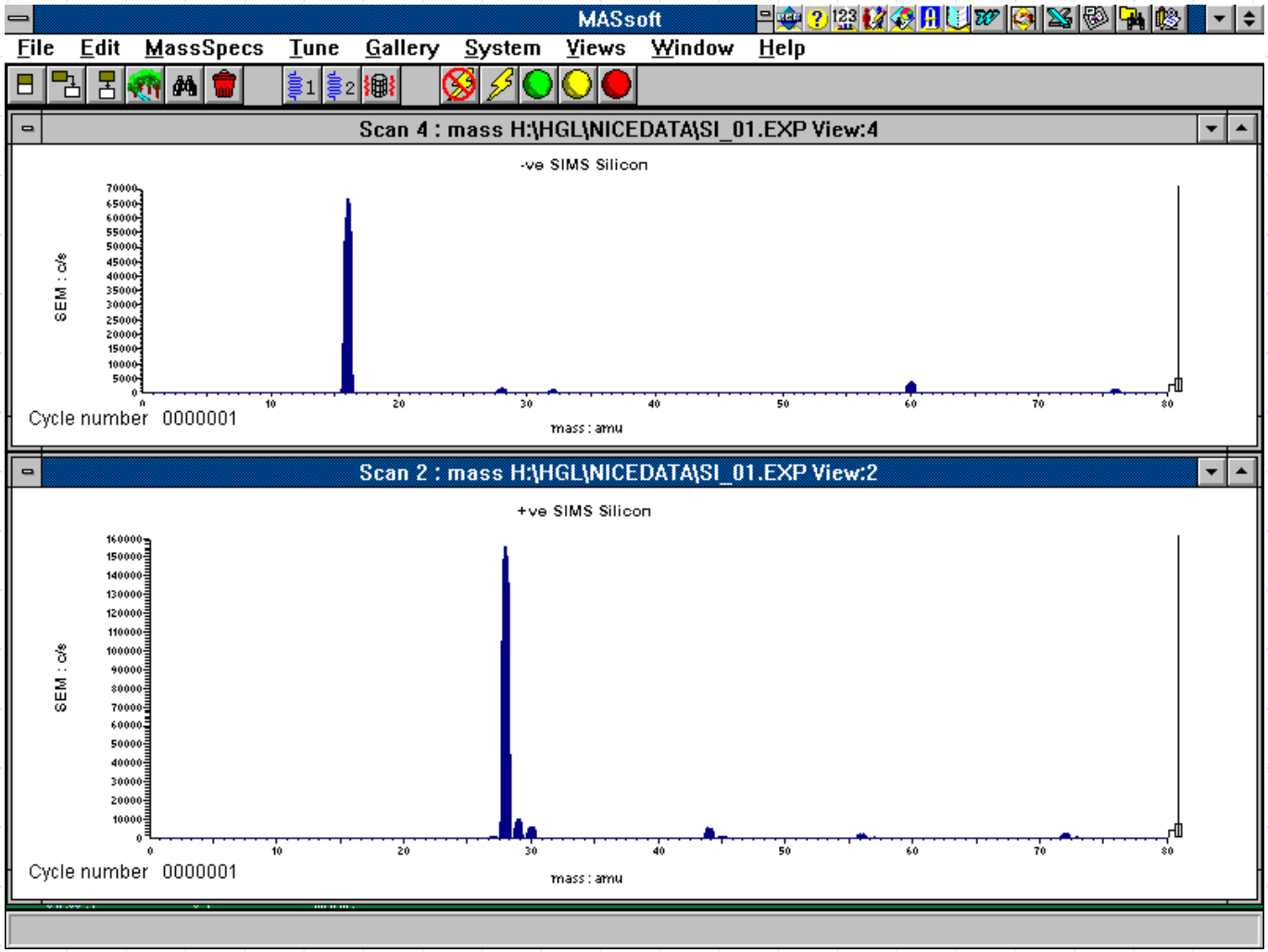


Positive and negative ion spectra with details about sample source, preparation and acquisition parameters

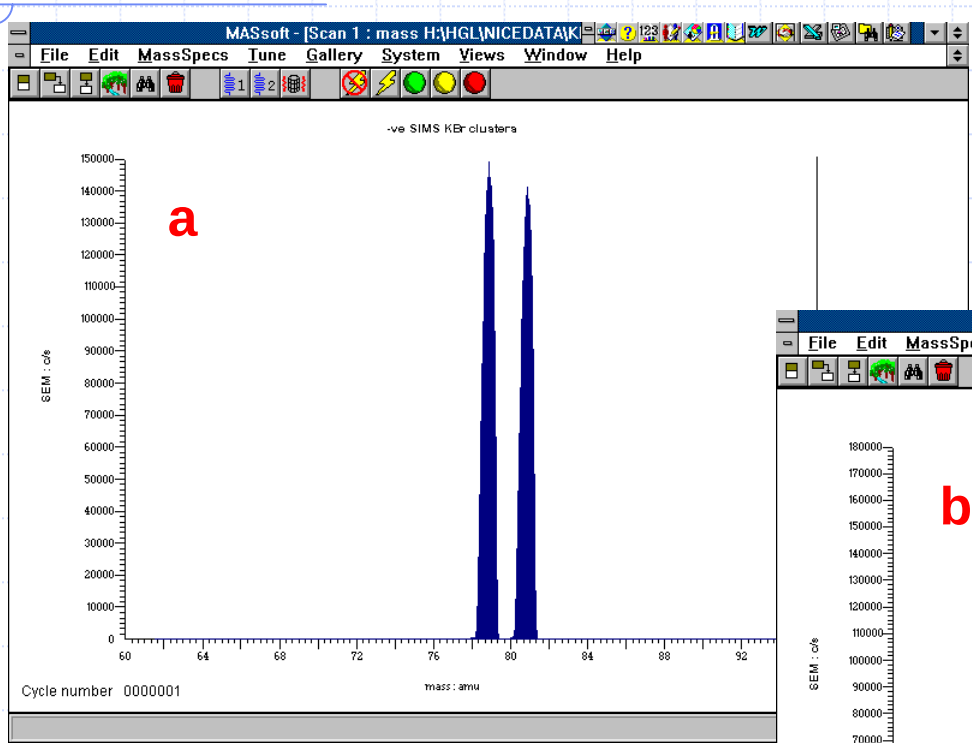
Example Data

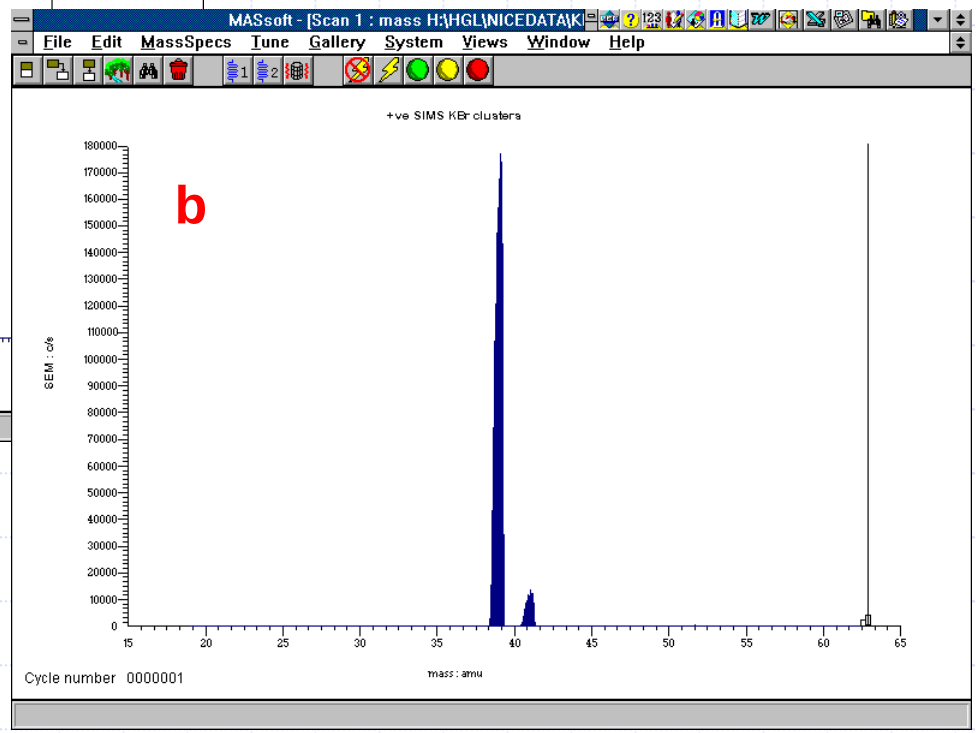


Example Data



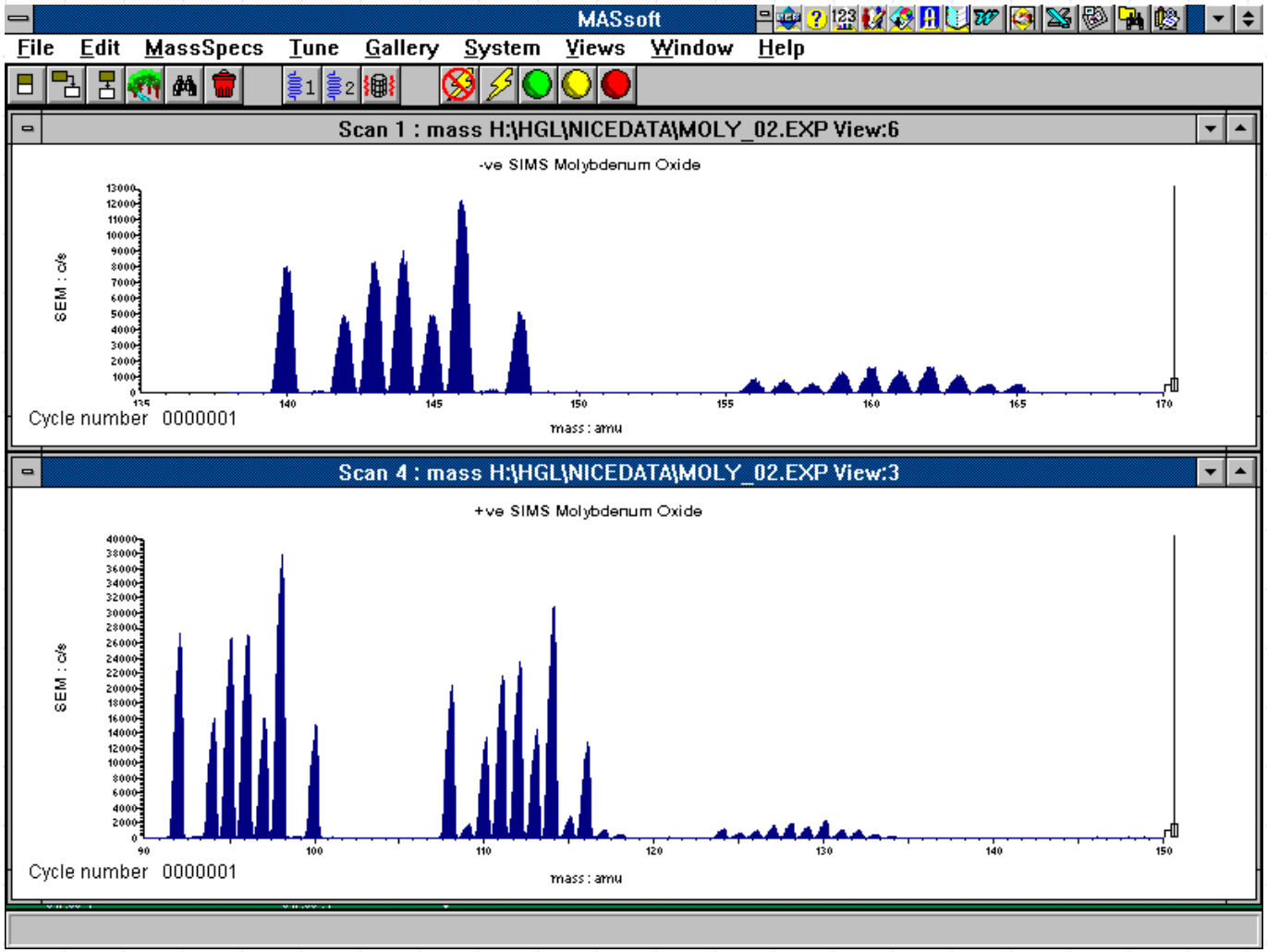
Example Data



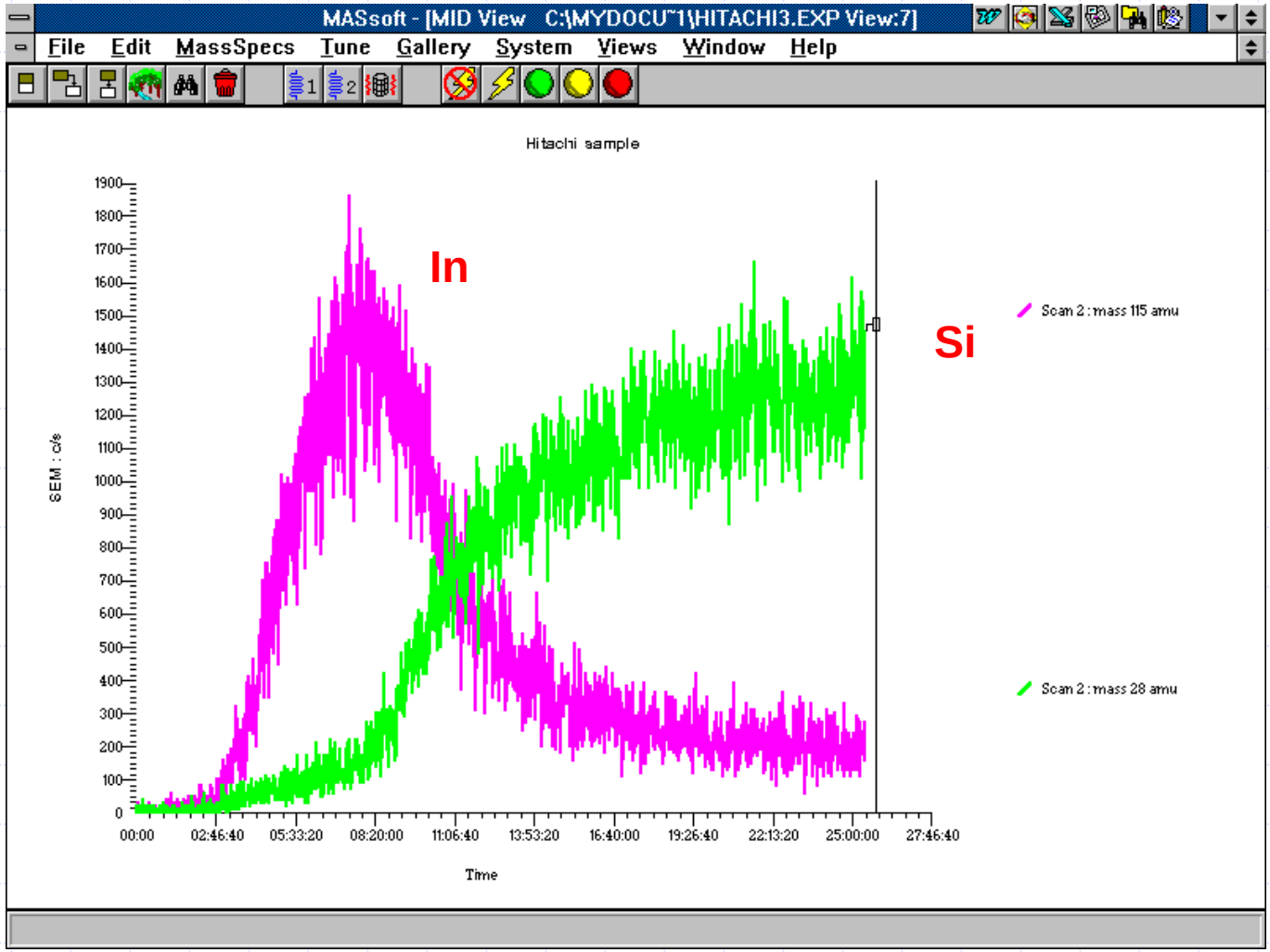


A comparison of (a) –ve / (b) + ve SIMS of KBr

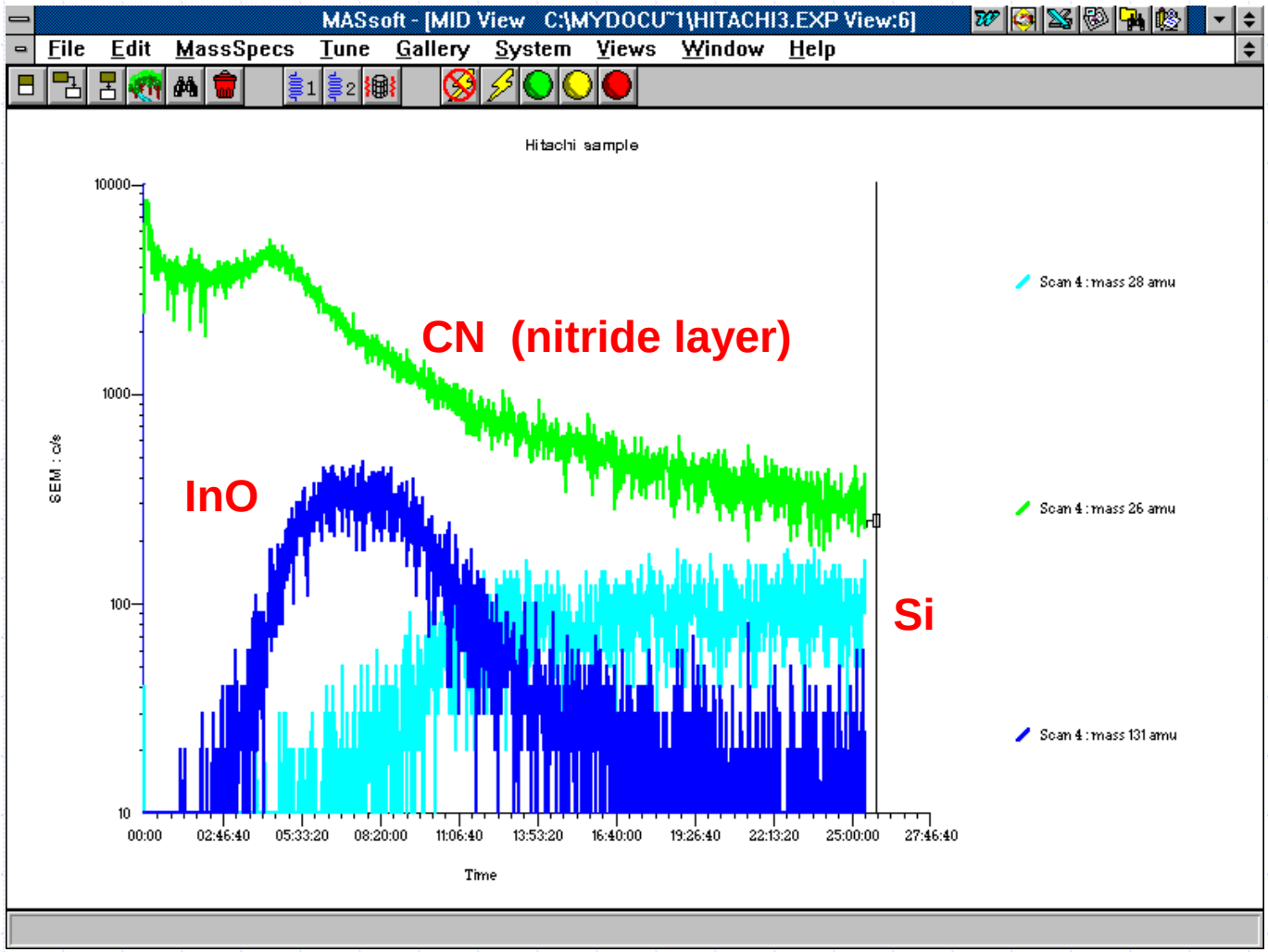
Example Data

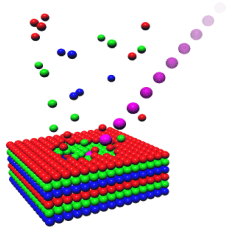


Example Data – Positive Ion SIMS



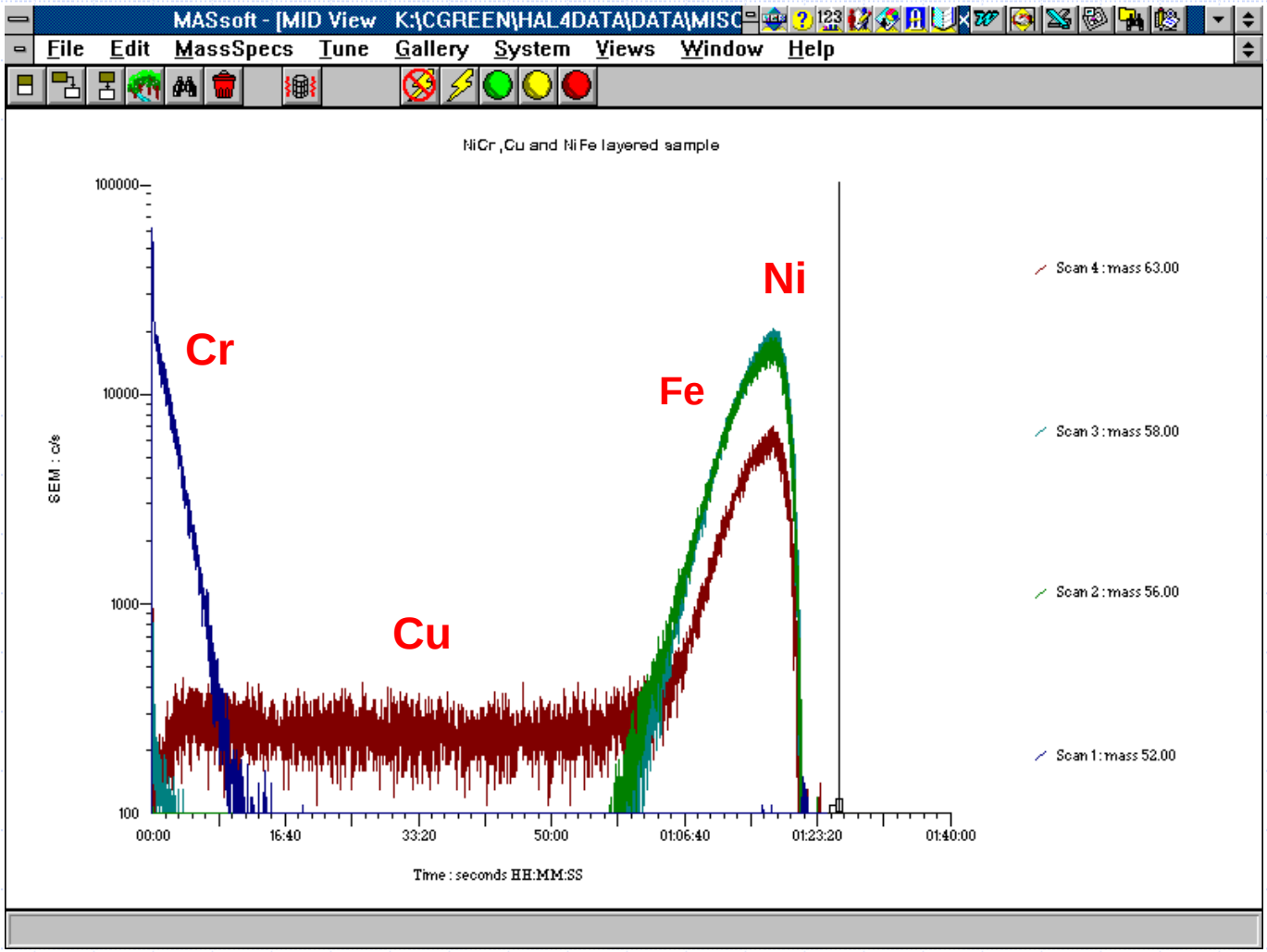
Example Data- Negative Ion SIMS

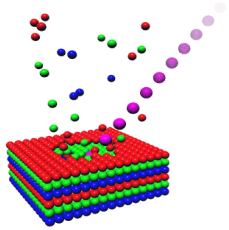




Example Data – Depth Profiling

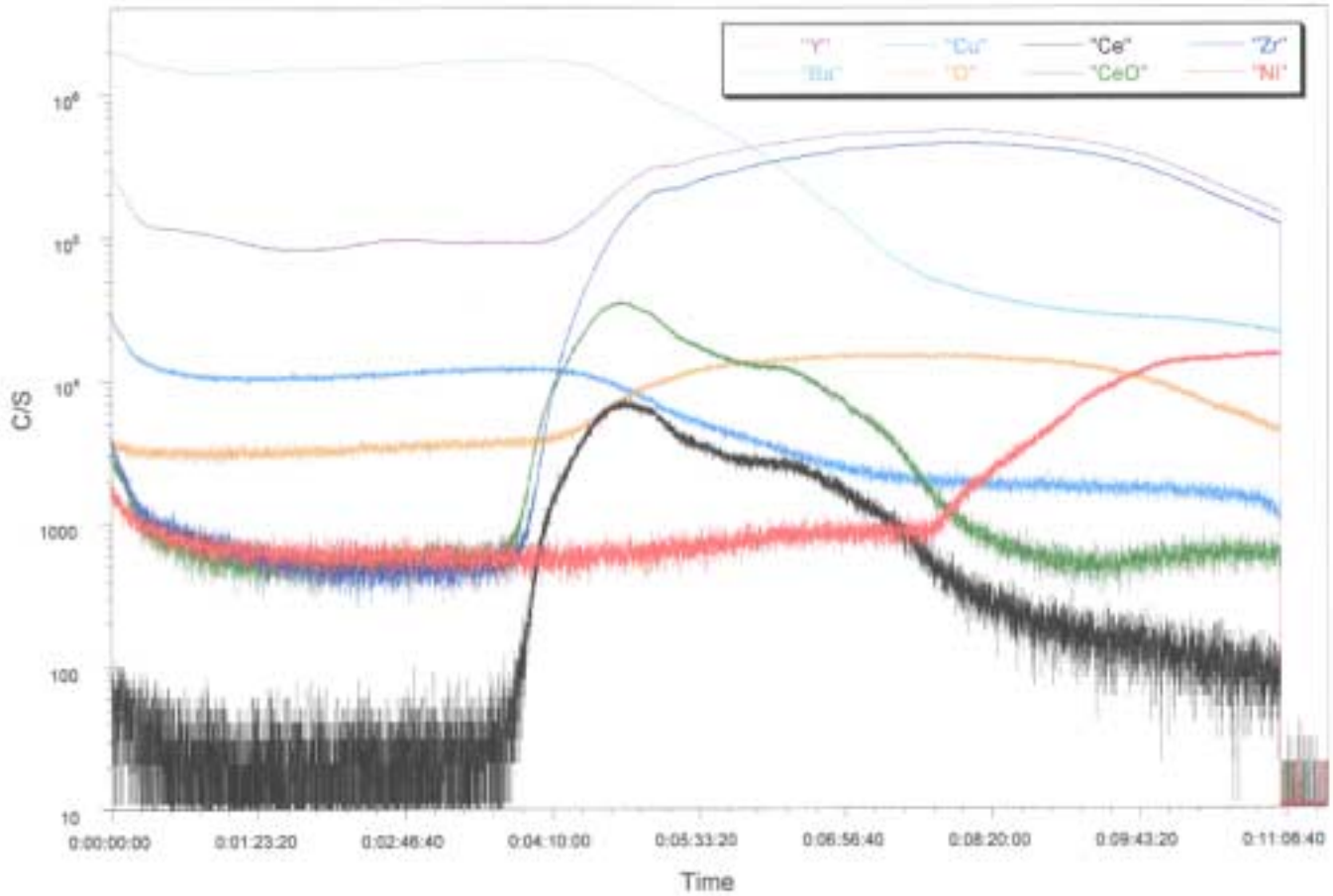
Depth profile of a NiCr, Cu and NiFe Layered material



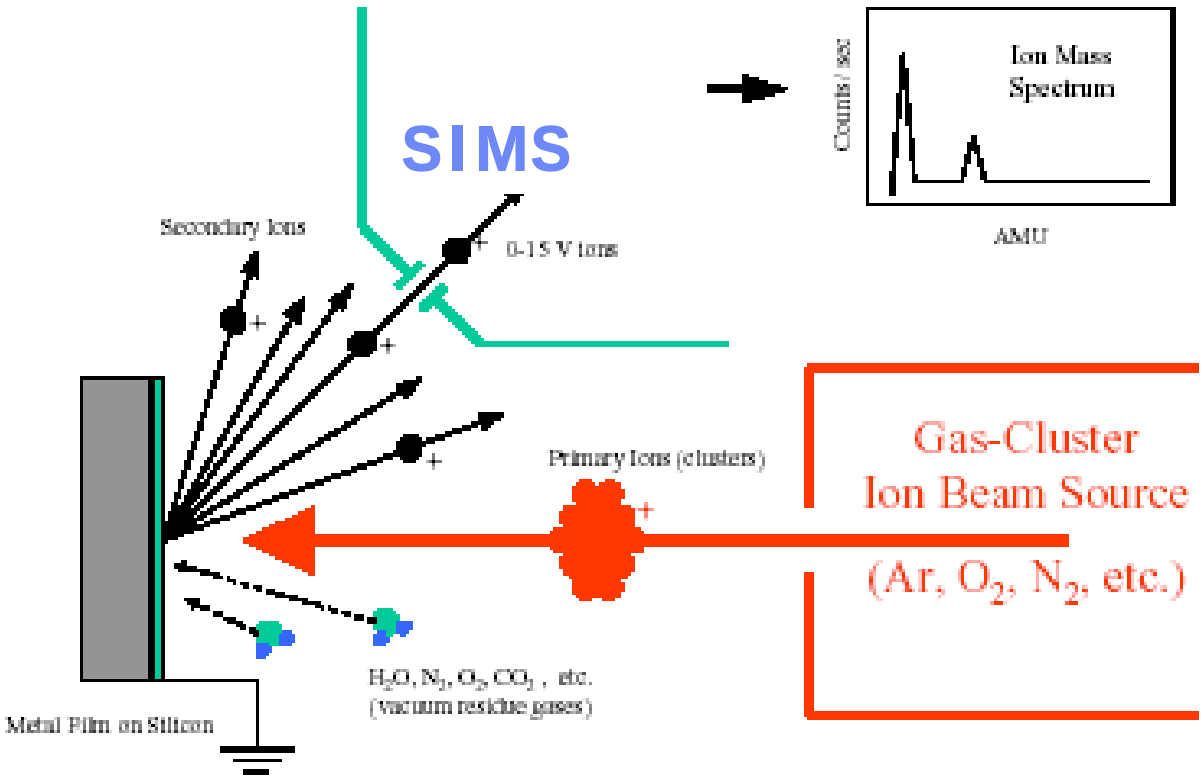


Example Data – Depth Profiling

Depth profile of a YBCO, CeO_2, YSZ and Ni Layered material



Example Data – Cluster Ion Beam SIMS



Surface analysis by secondary-ion mass spectroscopy during etching with gas-cluster ion beam

D B Fenner & Y Shao, *J. Vac. Sci. Technol. A 21(1), Jan/Feb 2003, 47-58*

Example Data – Cluster Ion Beam SIMS

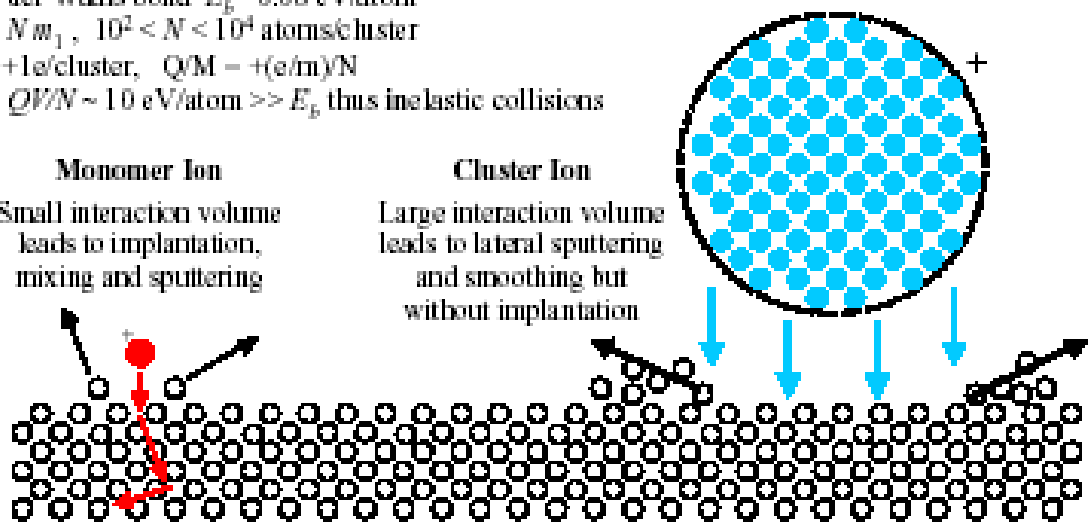
Argon cluster ions: cryogenic solid, $D \sim 5$ nm
Van der Waals bond $E_b \sim 0.08$ eV/atom
$M = N m_1$, $10^2 < N < 10^4$ atoms/cluster
$Q \sim +1e$/cluster, $Q/M = +(e/m)/N$
$E_k = QV/N \sim 10$ eV/atom $>> E_b$ thus inelastic collisions

Monomer Ion

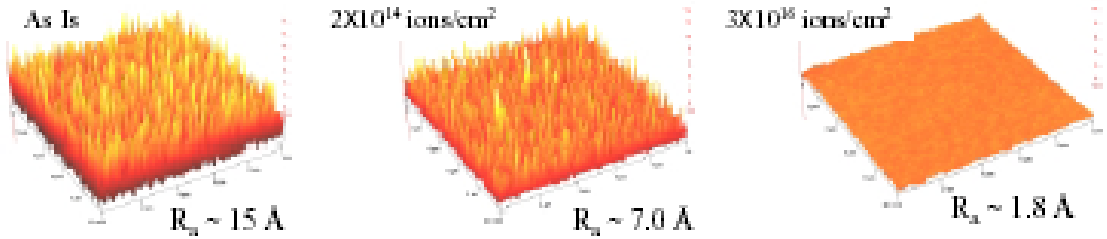
Small interaction volume leads to implantation, mixing and sputtering

Cluster Ion

Large interaction volume leads to lateral sputtering and smoothing but without implantation



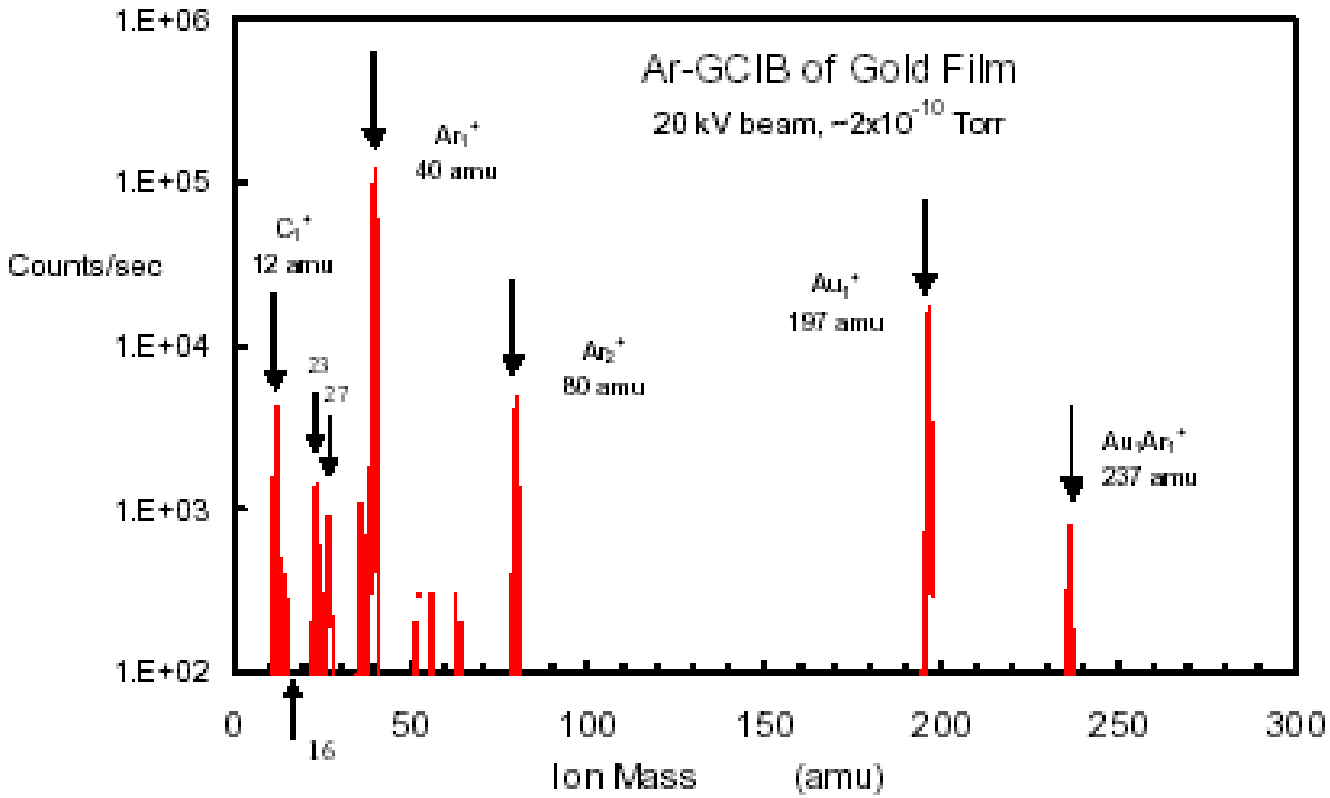
Tantalum Smoothing



Surface analysis by secondary-ion mass spectroscopy during etching with gas-cluster ion beam

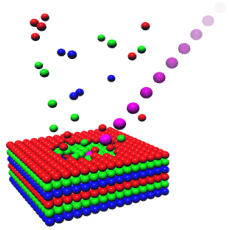
D B Fenner & Y Shao, *J. Vac. Sci. Technol. A 21(1), Jan/Feb 2003, 47-58*

Example Data – Cluster Ion Beam SIMS



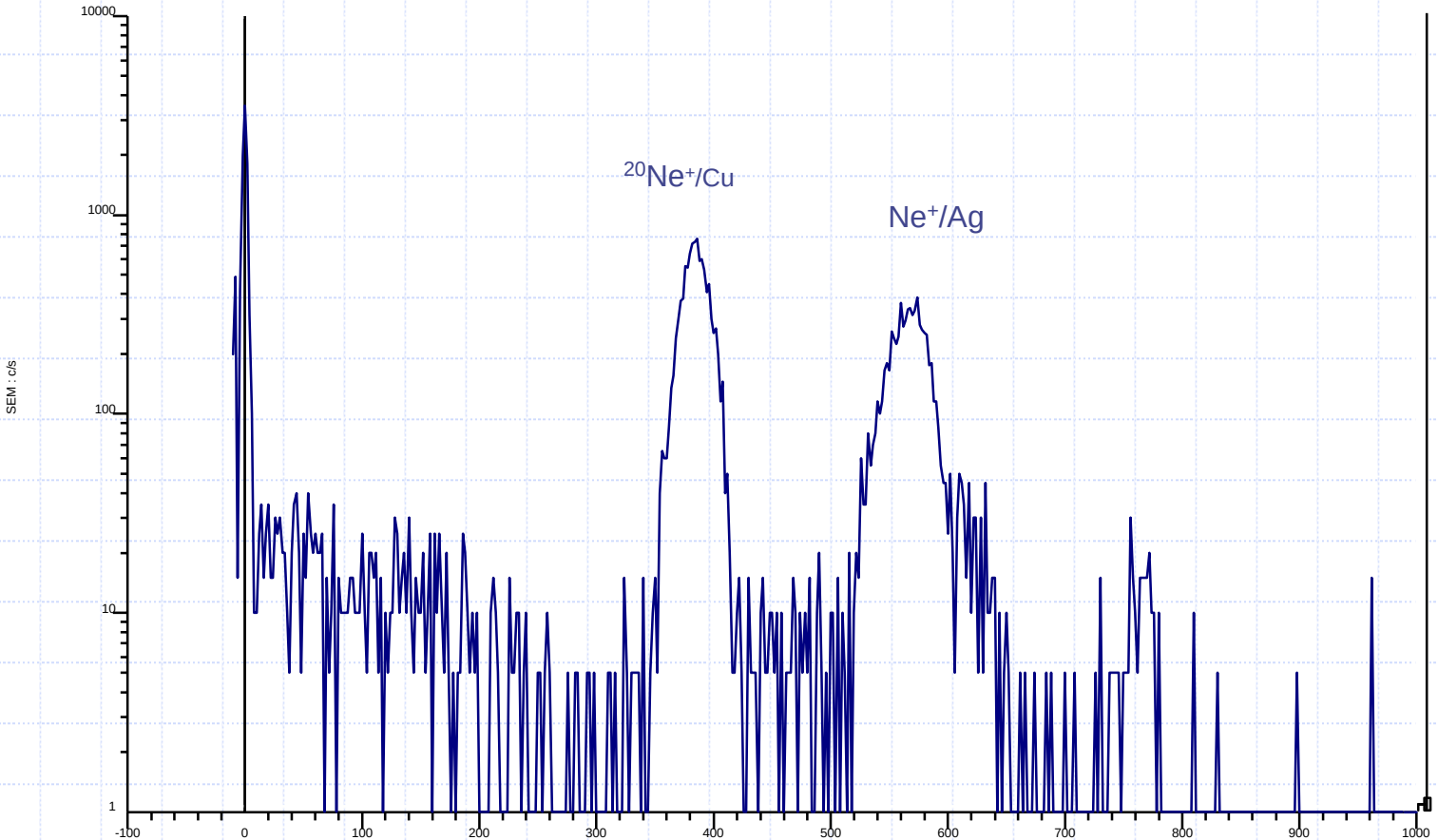
Surface analysis by secondary-ion mass spectroscopy during etching with gas-cluster ion beam

D B Fenner & Y Shao, *J. Vac. Sci. Technol. A 21(1), Jan/Feb 2003, 47-58*

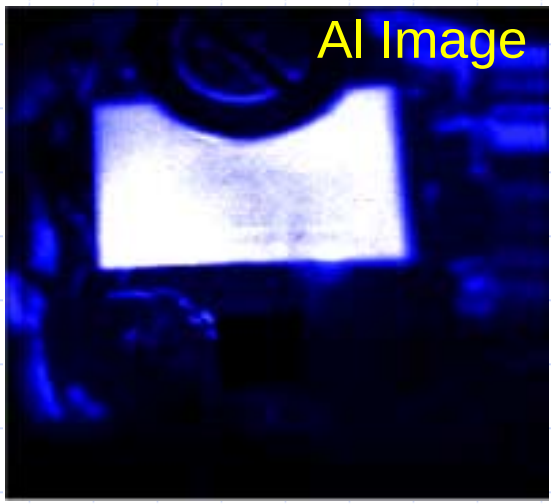


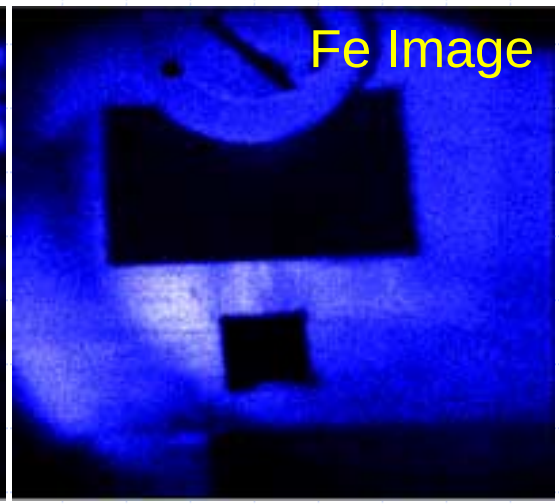
Example Data – MARISS

Energy distribution of $^{20}Ne^{+}$ scattered ions (Ne^{+} and He^{+}, 1 keV, 2x2 mm2, 120° scattering angle, specular reflection geometry).

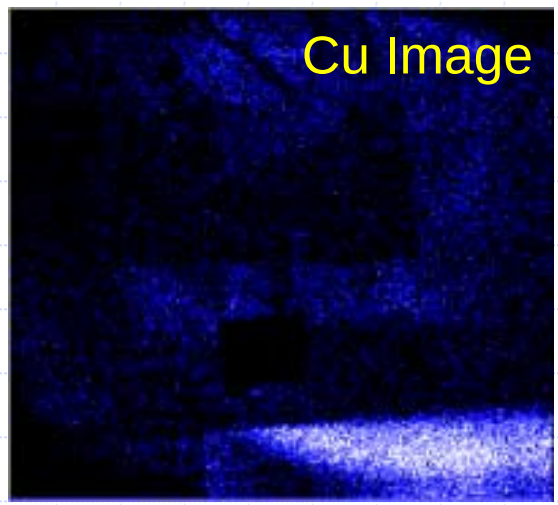


Example Data – Elemental Maps









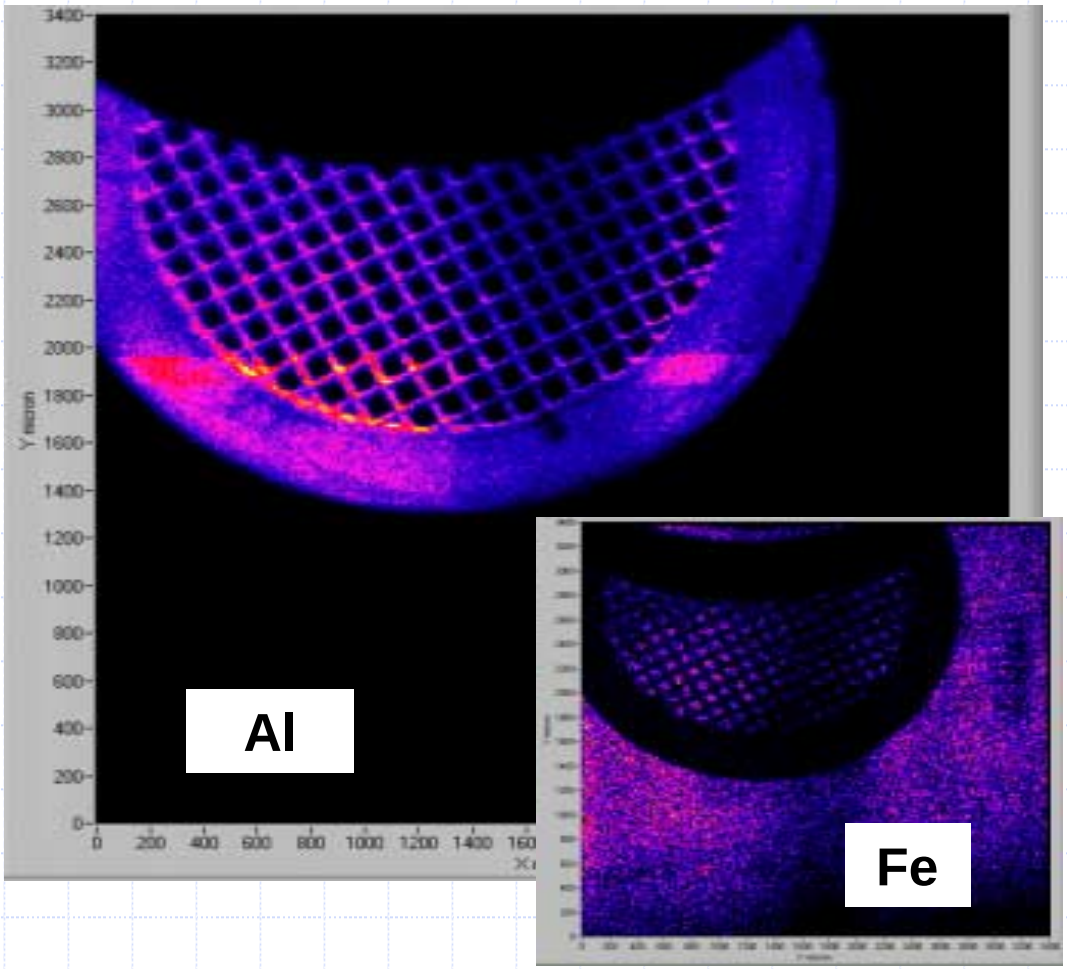
2 uA, 5 keV O_2 primary beam normal to sample from Hiden IG20

12 mm EQS1000, 40mm from sample, -100 V extraction

250 * 250 pixel images, less than 8 minutes to complete all scans

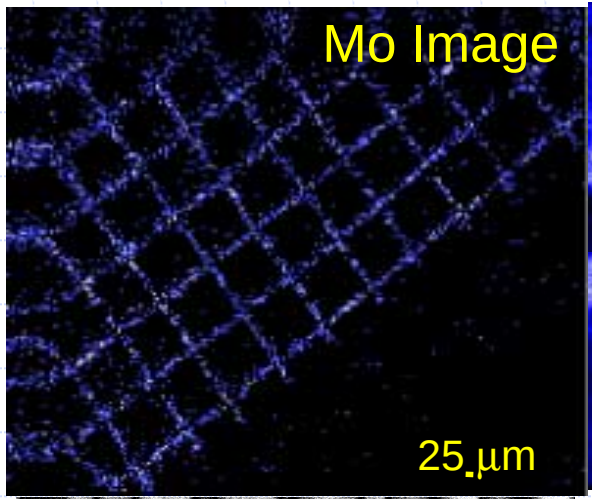
~10^6 cps for ^{27}Al, ~ 2000 cps for ^{63}Cu

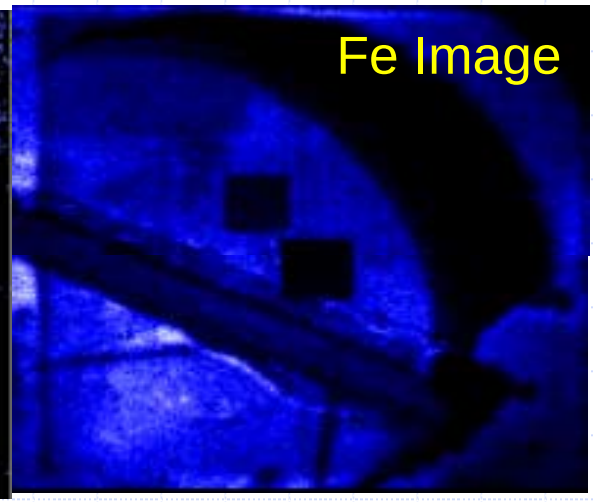
Example Data – Elemental Maps

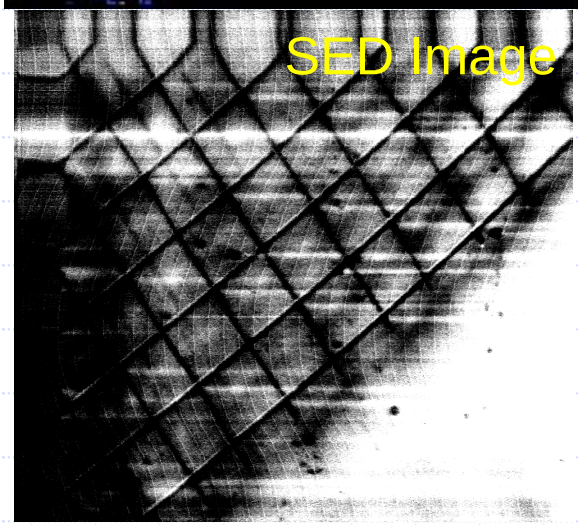


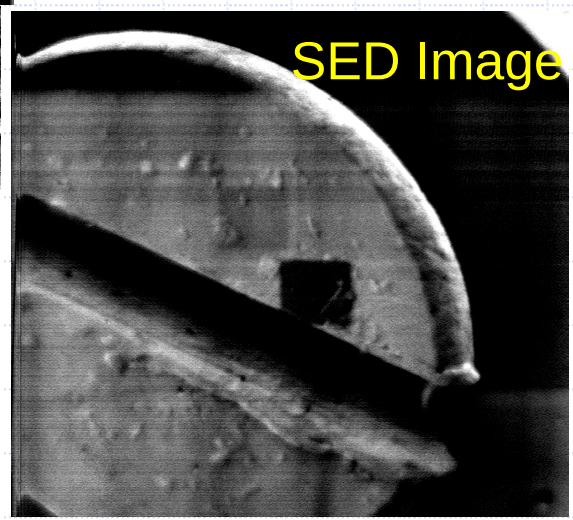
Aluminium mesh (200) on a stainless steel holder.

Example Data – Elemental Maps







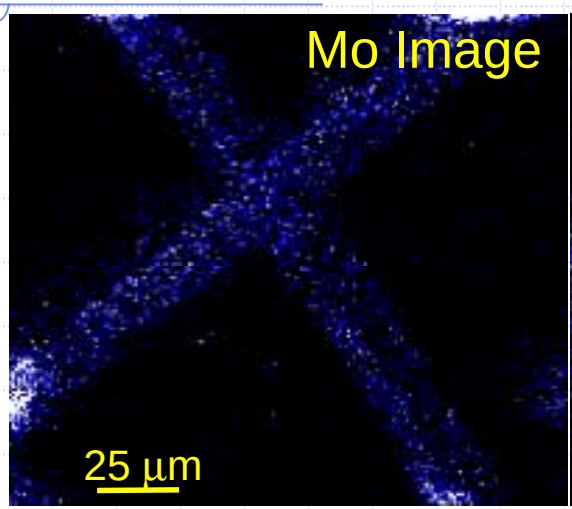


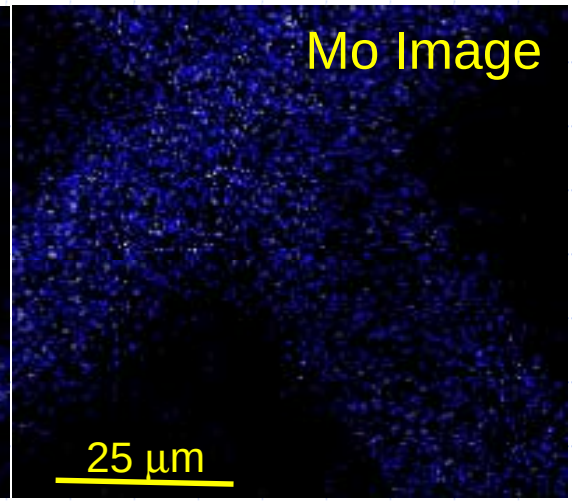
20 keV Ga primary beam normal to sample

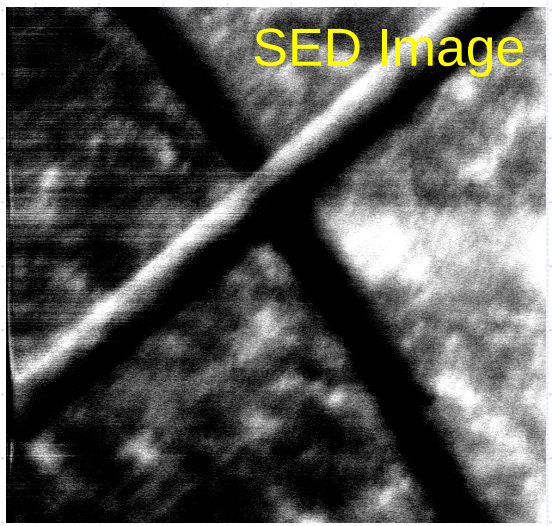
12 mm EQS1000, 40mm from sample, -33 V extraction

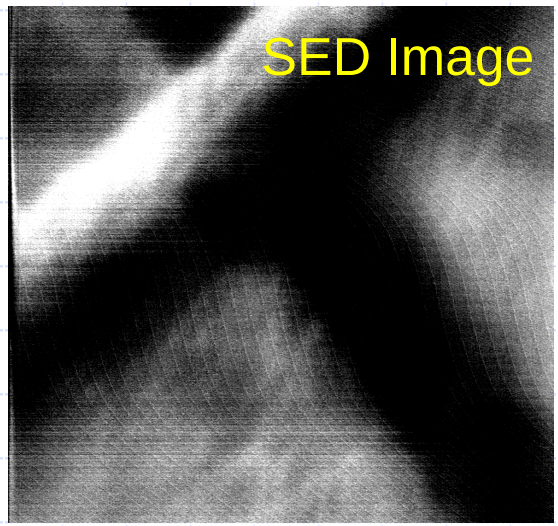
200 * 200 pixel images, ca. 8 minute to complete each scan

Example Data – Elemental Maps







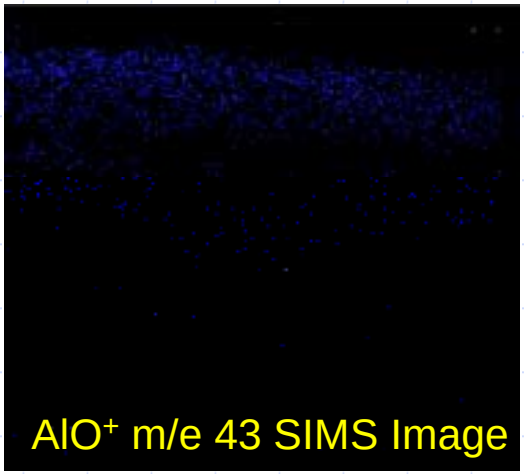


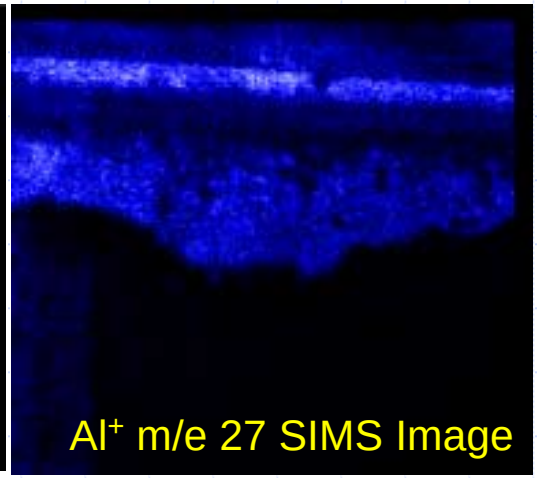
20 keV Ga primary beam normal to sample

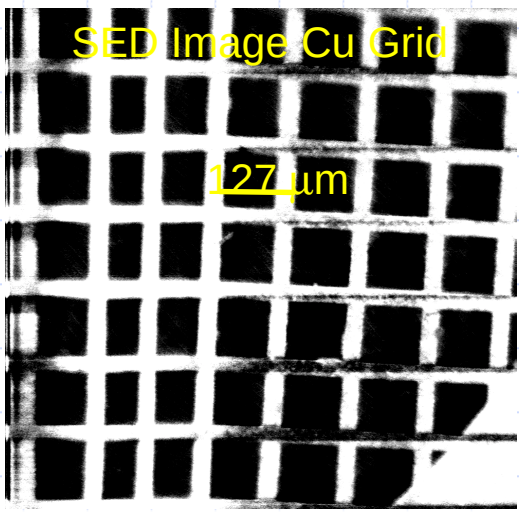
12 mm EQS1000, 40mm from sample, -33 V extraction

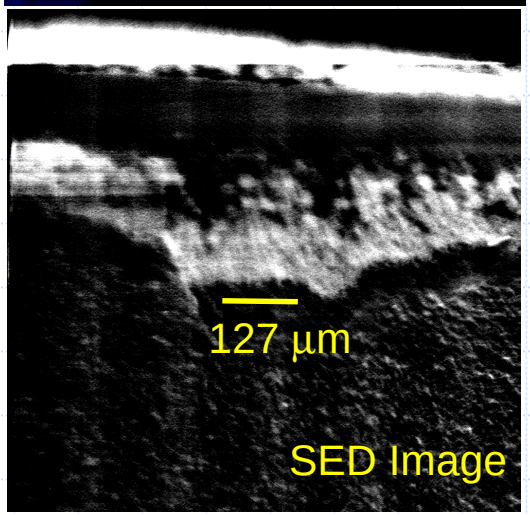
200 * 200 pixel images, ca. 8 minutes to complete each scan

Example Data – Elemental Maps









20 keV Ga primary beam normal to sample

12 mm EQS1000, 40mm from sample, -33 V extraction

200 * 200 pixel images