

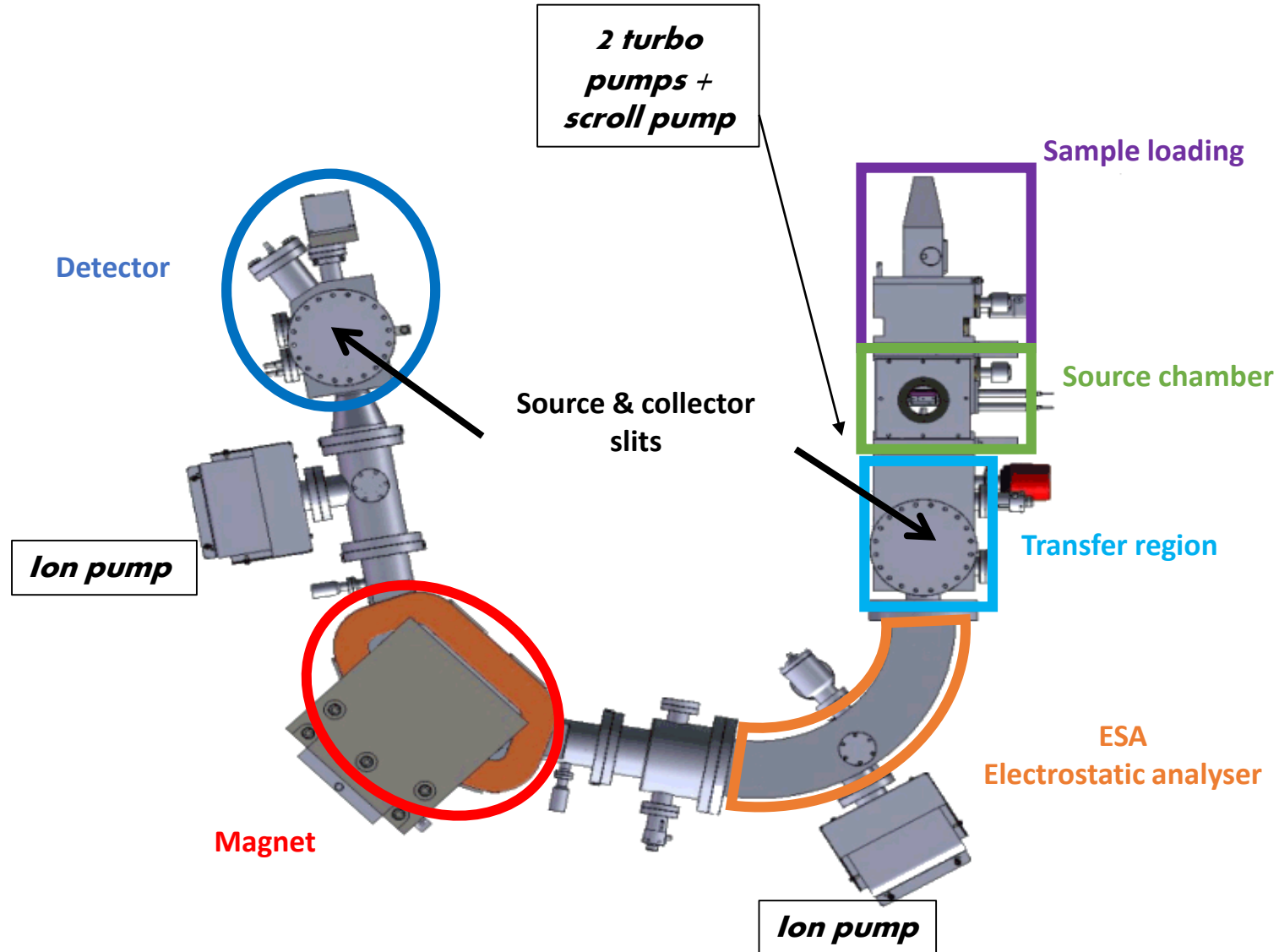


18. GDS-Anwendertreffen, Freiberg
26-27 September 2019

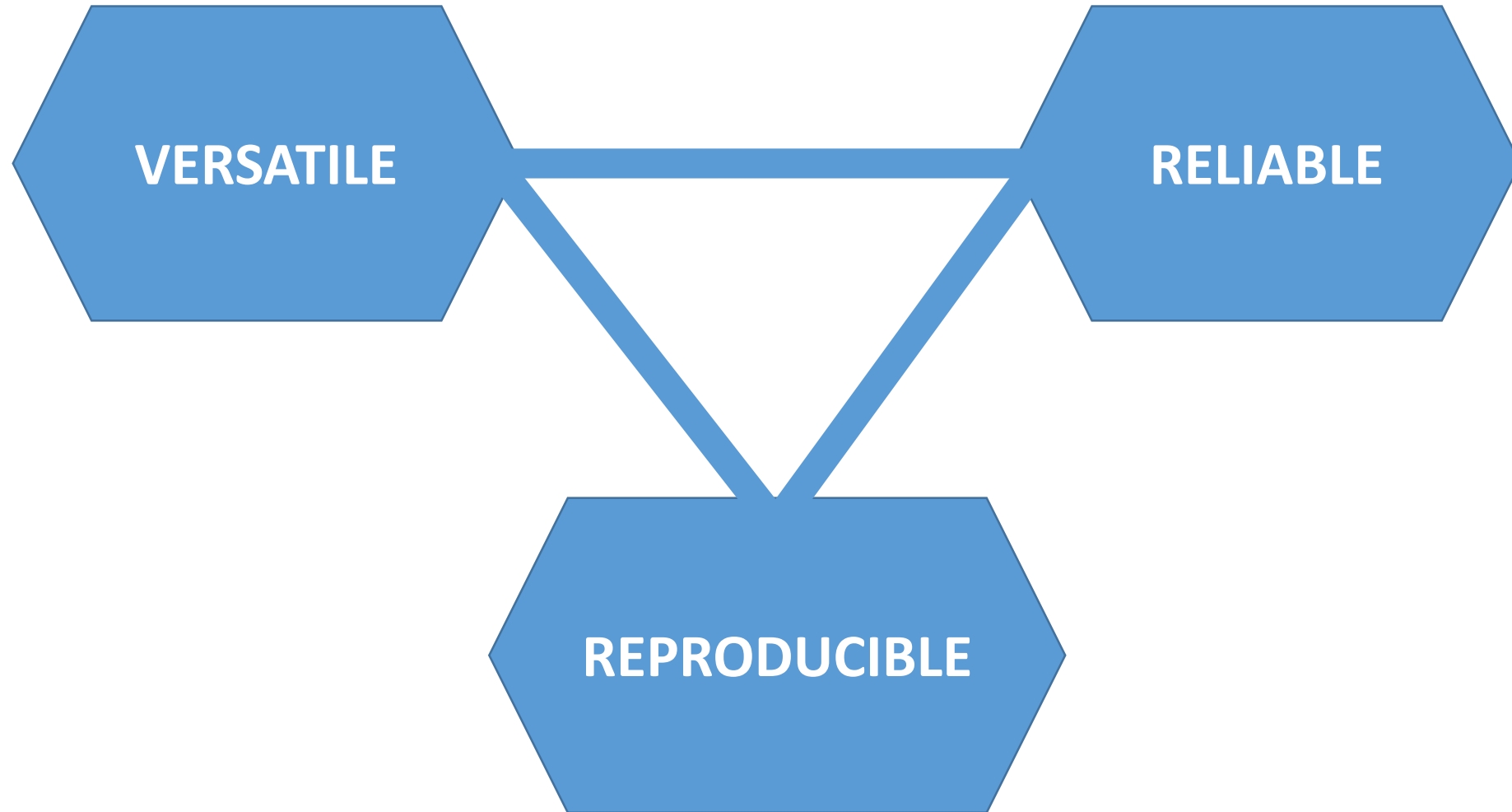
Astrum GD-MS Overview & Applications

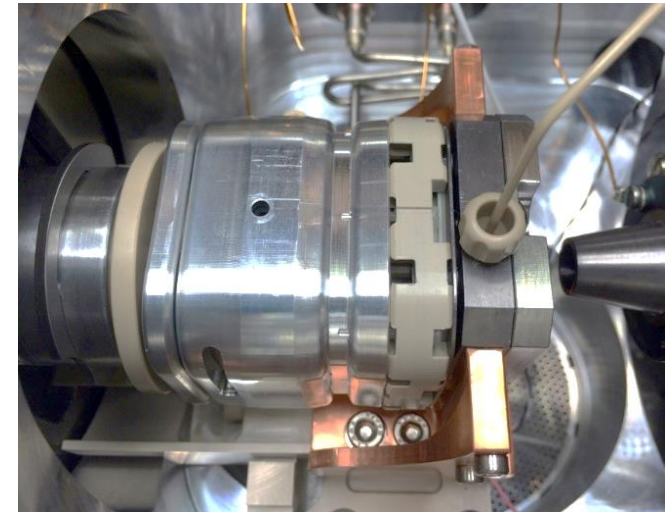
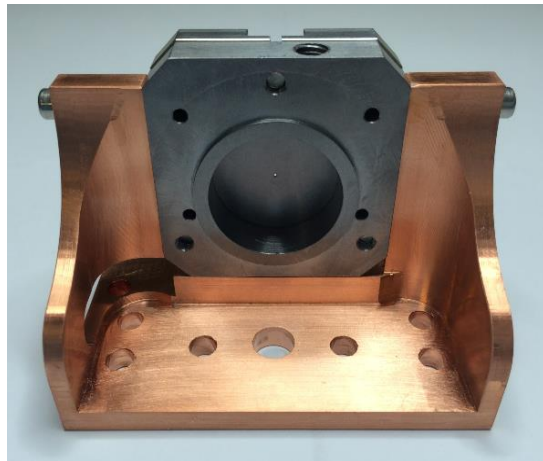
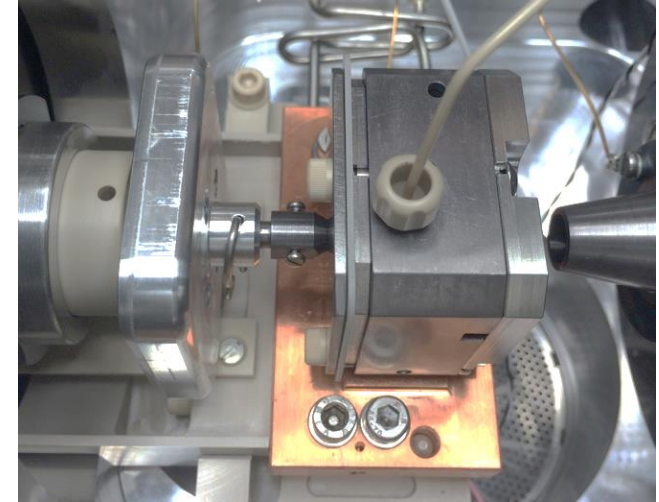
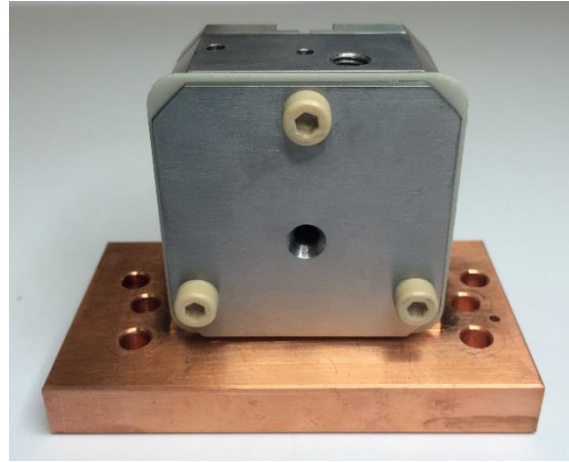
- First instrument commissioned ~10 years ago.
- Request to have a low-flow, low-power source replacement of the discontinued VG9000 “gold standard”.
- Now reaching for 50 working instruments worldwide.
- Used for high purity materials, semi-conductors, non-conductors, powders...



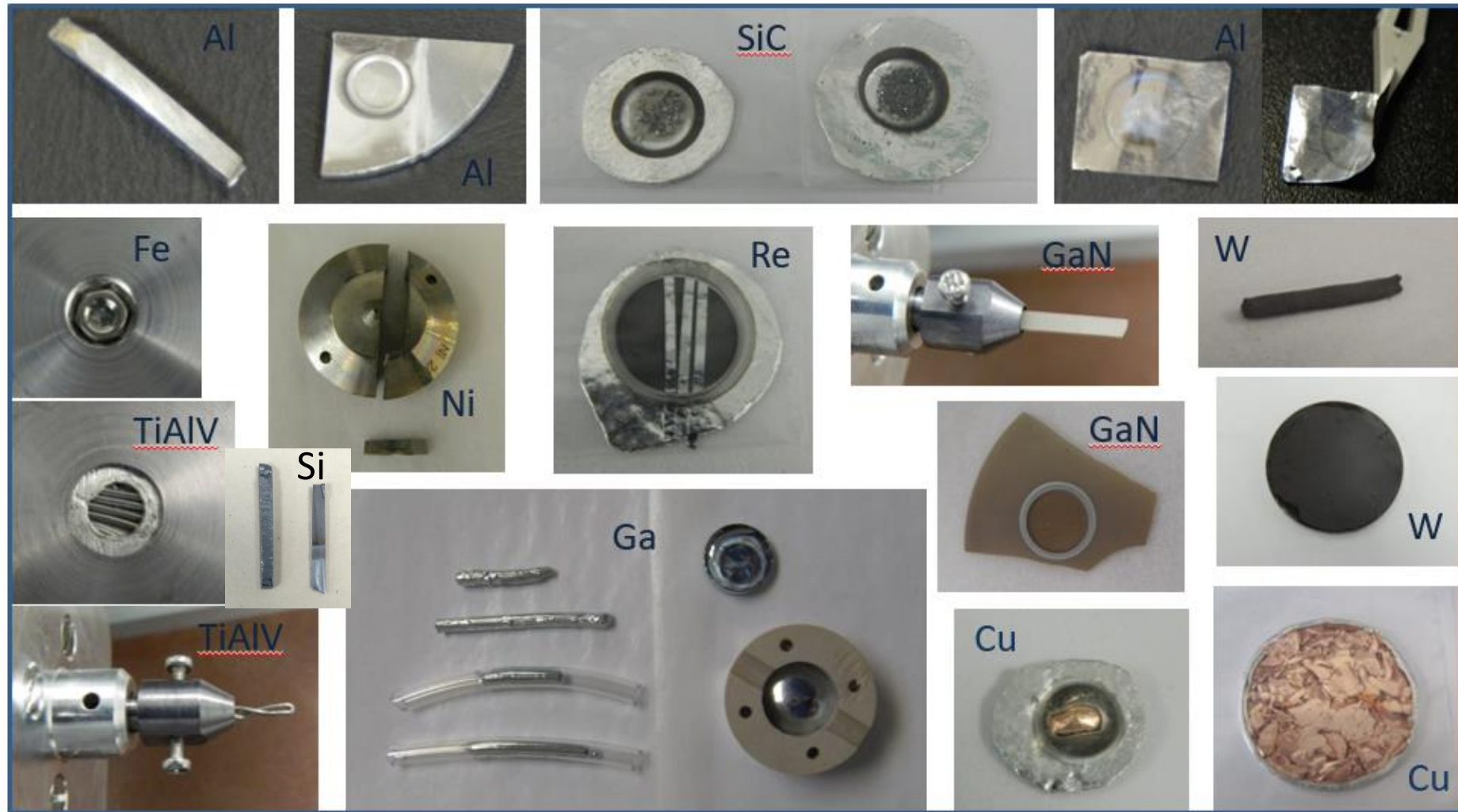


Why Astrum?



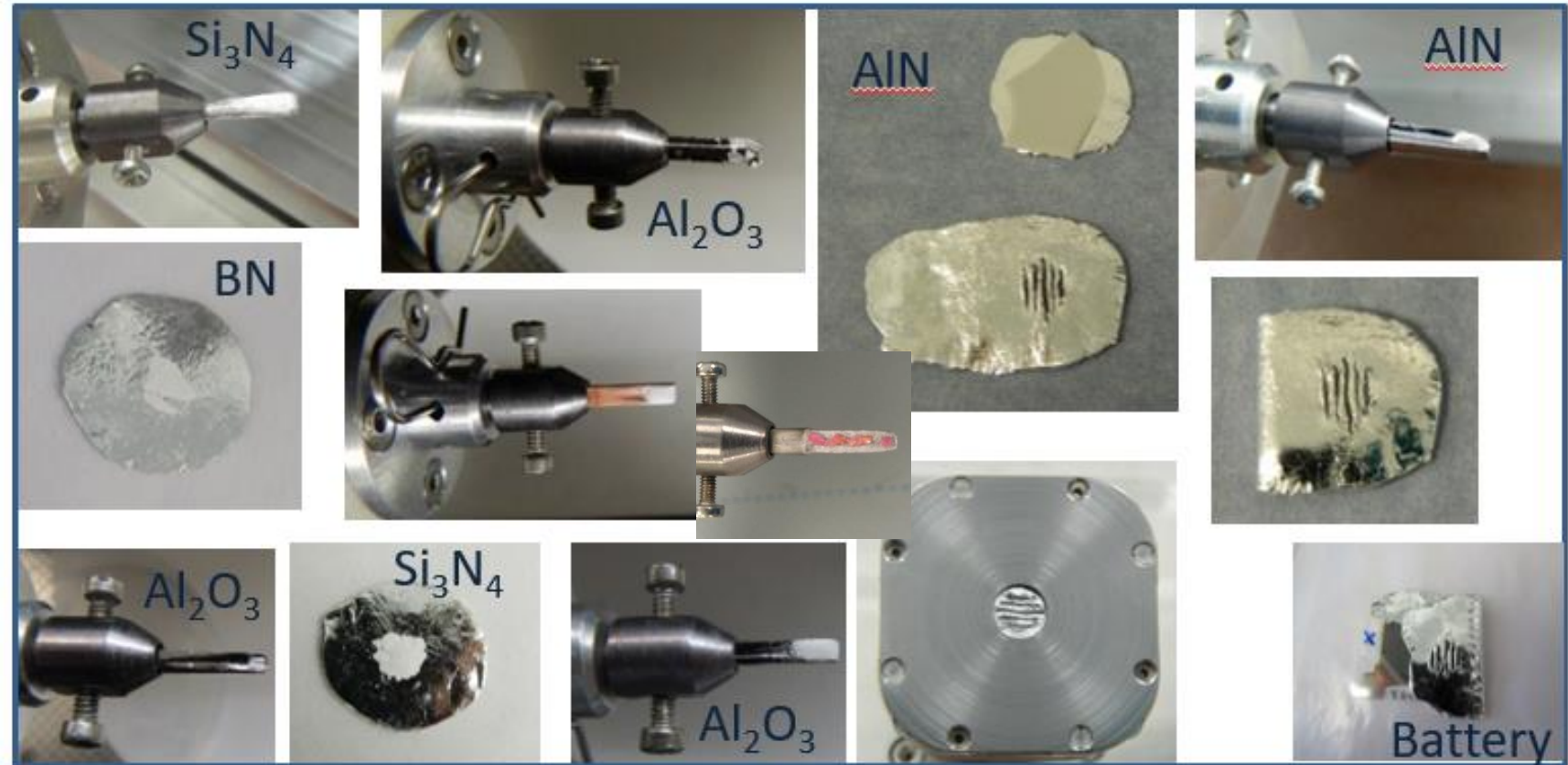


Versatile – Conductive (semi-) samples

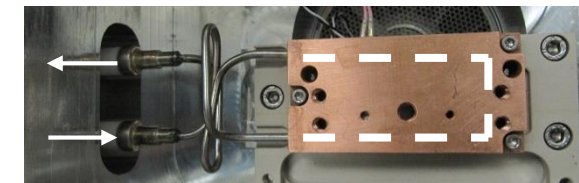
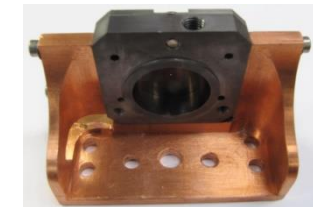
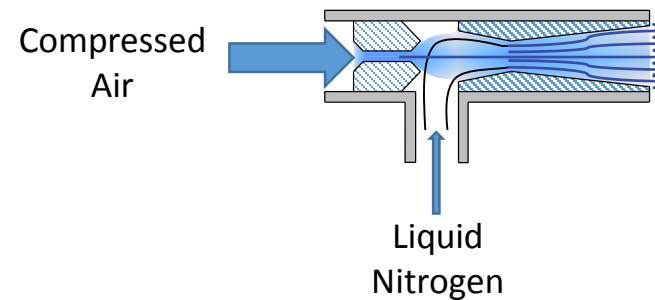


Versatile – Non-conductive samples

Use of **support/sacrificial electrode** such as high purity In disc or Ta/In spoons

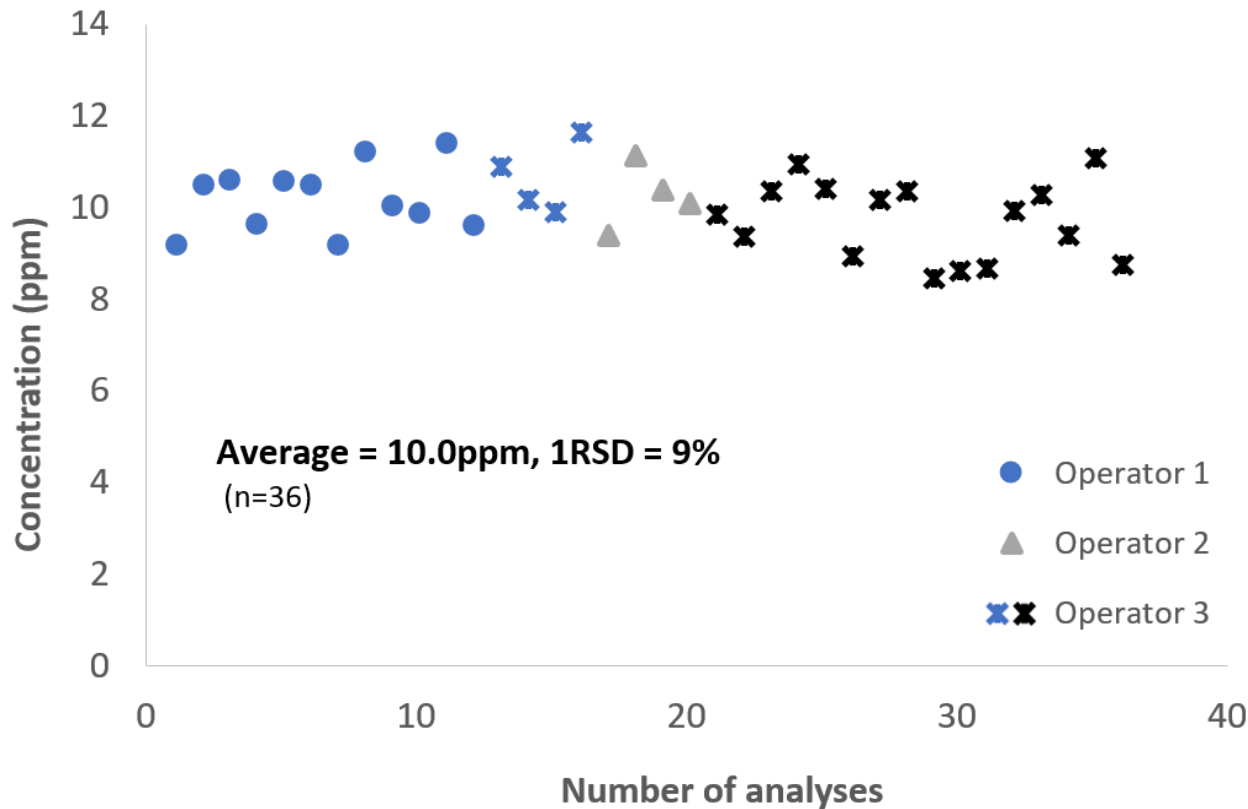


- Use of liquid Nitrogen and venturi system for automatic cell and sample cooling
- Temperature reached below -170°C
- Greatly reduces C, N, O backgrounds and related interferences
- Ideal for low melting point samples (e.g. Ga, In, Pb)
- Software includes auto-start/stop



Block and source (pin and flat)
cryo-cooled

Reproducible – Ni Alloy data with STD RSFs



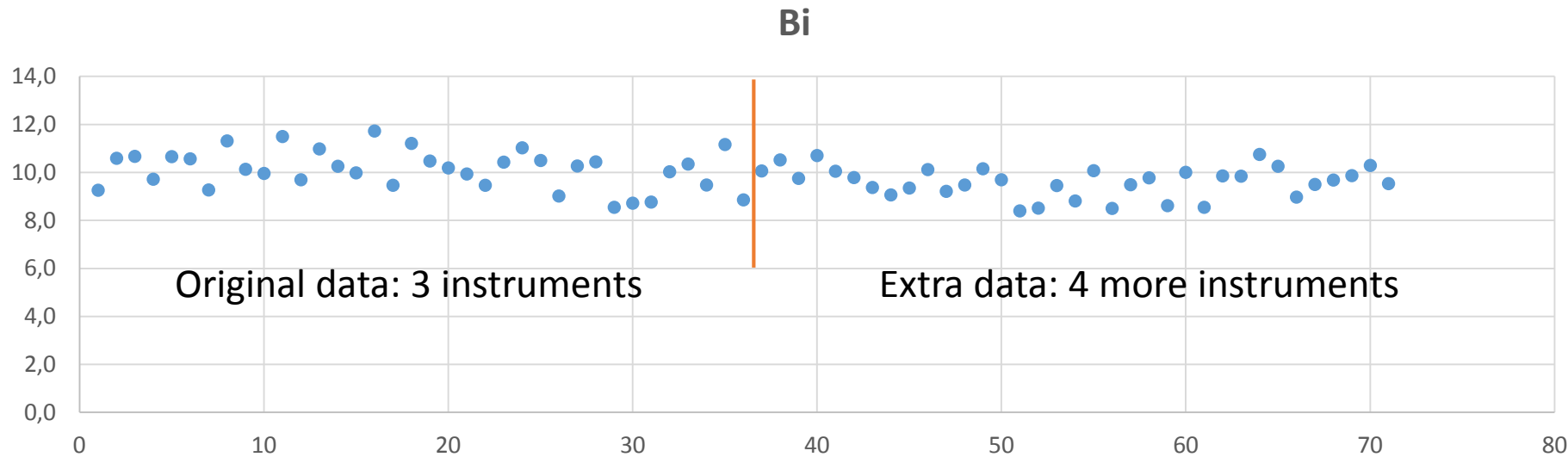
Element	Mean	1SD	RSD%
Mg	119	10	8
Zn	37.1	1.6	4
Ga	66.4	3.4	5
As	31.0	1.2	4
Se	5.2	0.6	12
Ag	30.6	1.4	4
Cd*	0.38	0.13	35

Element	Mean	1SD	RSD%
Sn	77.6	5.0	6
Sb	36.9	2.1	6
Te	6.6	0.6	9
Tl	1.0	0.1	9
Pb	14.3	1.3	9
Bi	10.0	0.9	9

*¹¹¹Cd is used for Cd measurement and has a significant interference close to analyte peak, hindering integration.

- 3 instruments
- 3 operators
- 2014-2018
- 36 analysis of 4-8 reps

Reproducible – Ni Alloy data ++



- 7 instruments
- 5 operators
- 2014-2019
- 71 analysis of 4-8 reps

Element	Mean	1SD	RSD%
Mg	119	10	8
Zn	37.1	1.6	4
Ga	66.4	3.4	5
As	31.0	1.2	4
Se	5.2	0.6	12
Ag	30.6	1.4	4
Cd*	0.38	0.13	35

*¹¹¹Cd is used for Cd measurement and has a significant interference close to analyte peak, hindering integration.

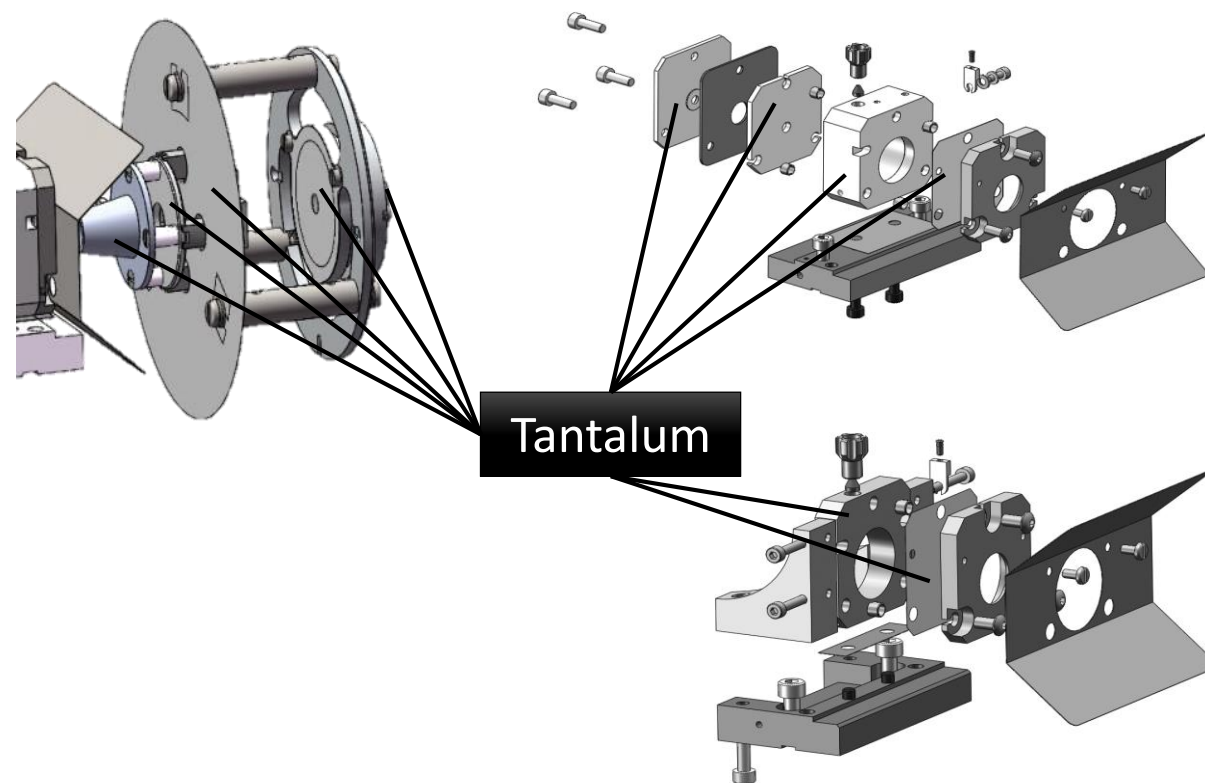
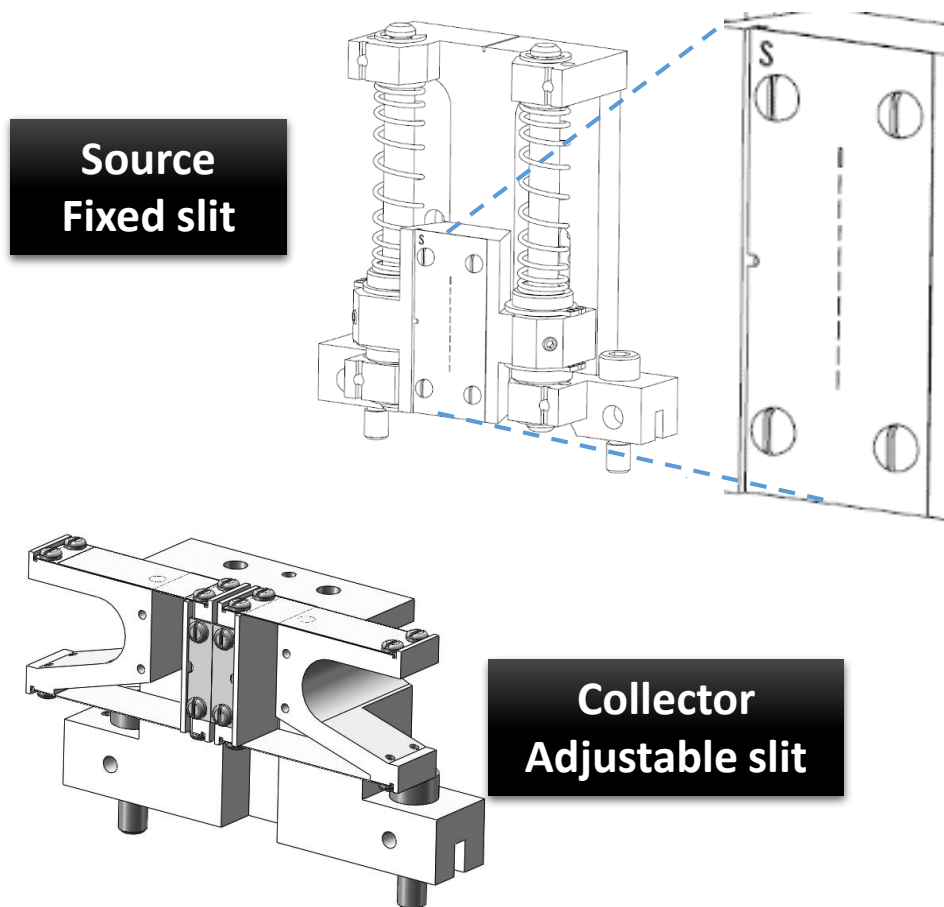
Element	Mean	1SD	RSD%
Sn	77.6	5.0	6
Sb	36.9	2.1	6
Te	6.6	0.6	9
Tl	1.0	0.1	9
Pb	14.3	1.3	9
Bi	10.0	0.9	9

Element	Mean	1SD	RSD%
Mg	119	8.5	7
Zn	37.1	2.2	6
Ga	66.2	3.2	5
As	30.1	1.3	4
Se	5.2	0.6	11
Ag	30.0	1.3	4
Cd*	0.39	0.10	26

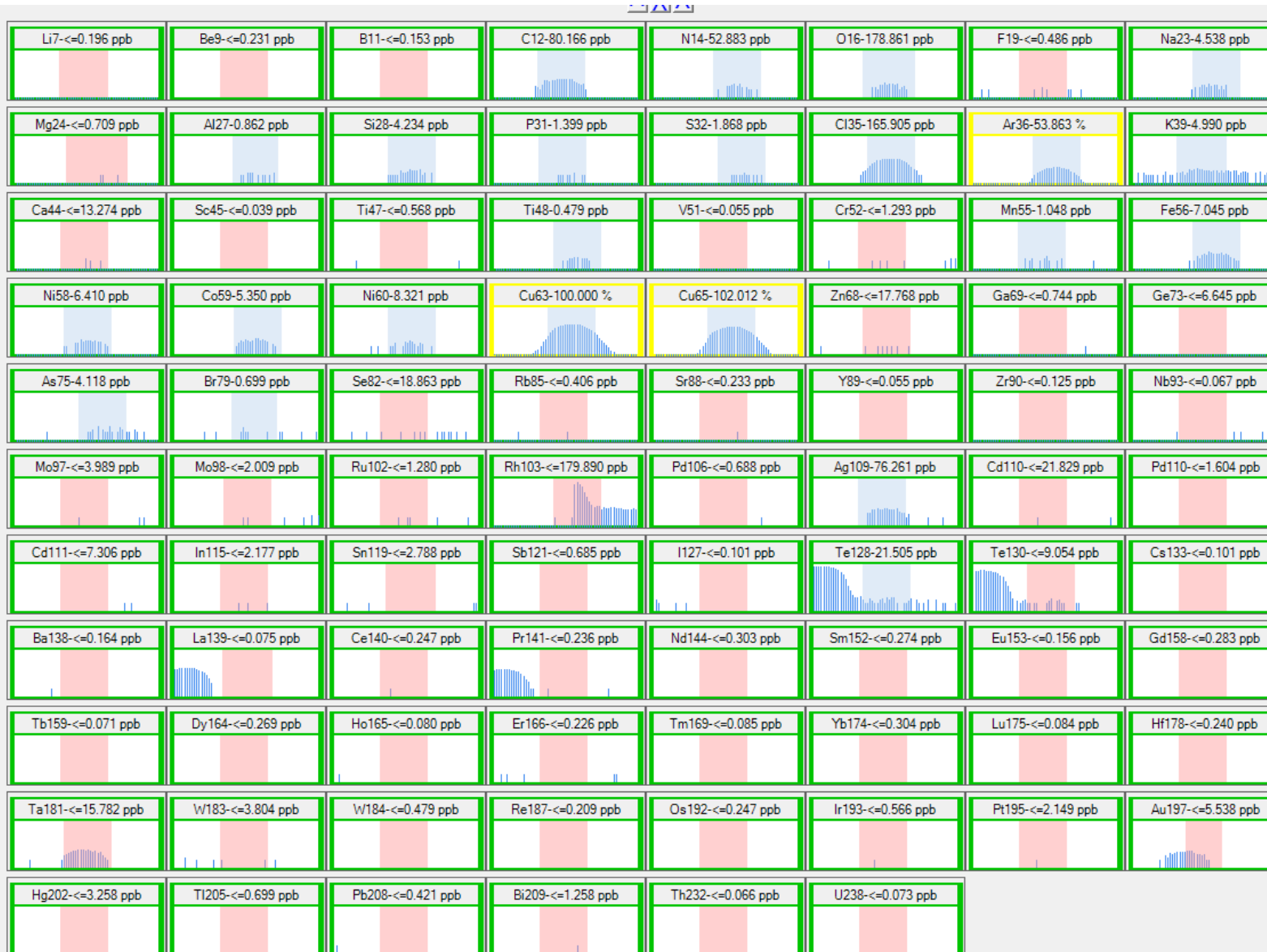
Element	Mean	1SD	RSD%
Sn	76.0	4.2	5
Sb	36.1	2.1	6
Te	6.5	0.6	10
Tl	1.0	0.1	8
Pb	13.9	1.1	8
Bi	9.9	0.8	8

- Two sets of defining slits, **source fixed slit** and **collector adjustable slit**, both software controlled

- Most parts made of Ta and cleanable
=> use of same source/sample holder parts



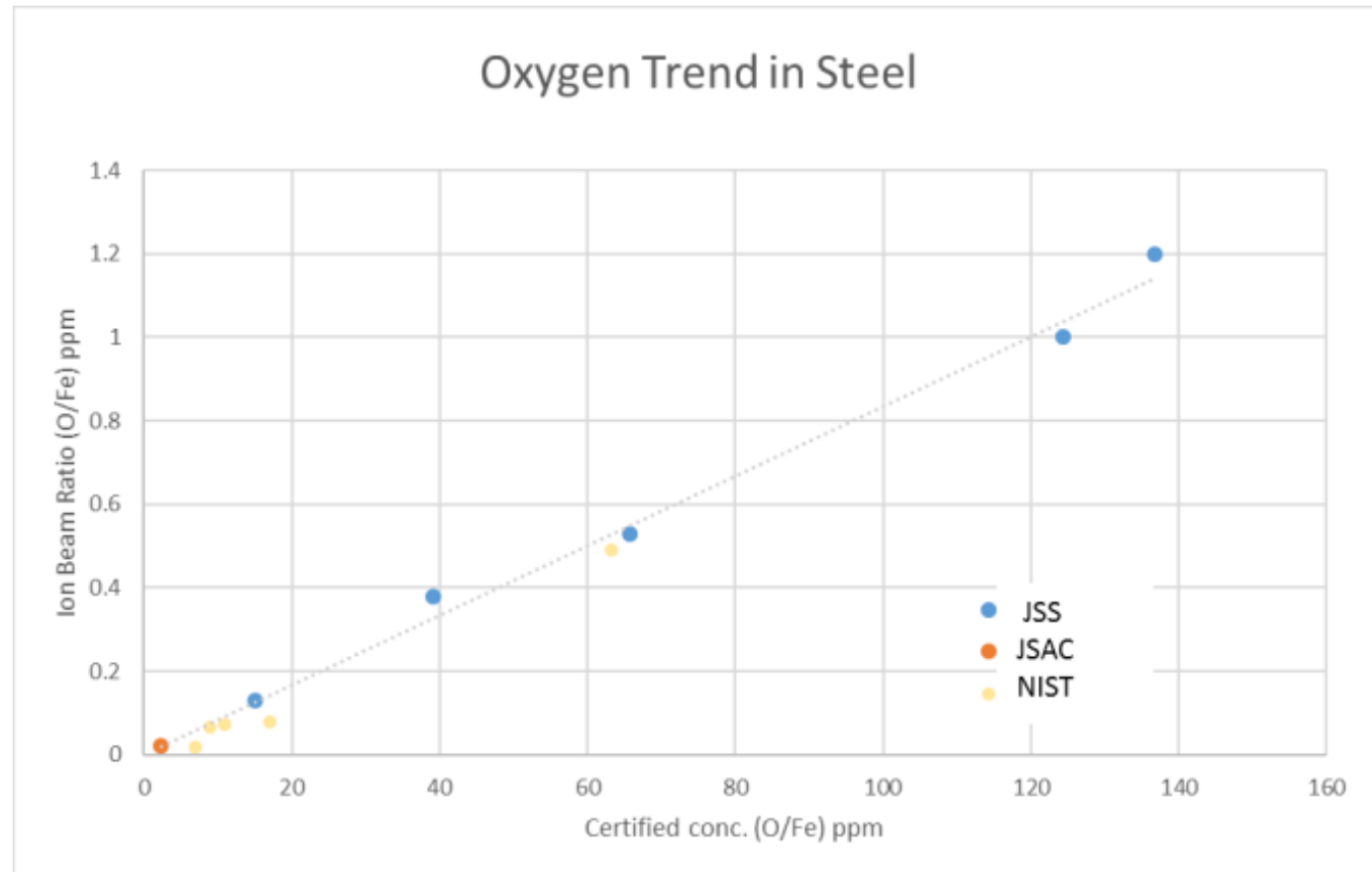
Purity example – 6N Copper



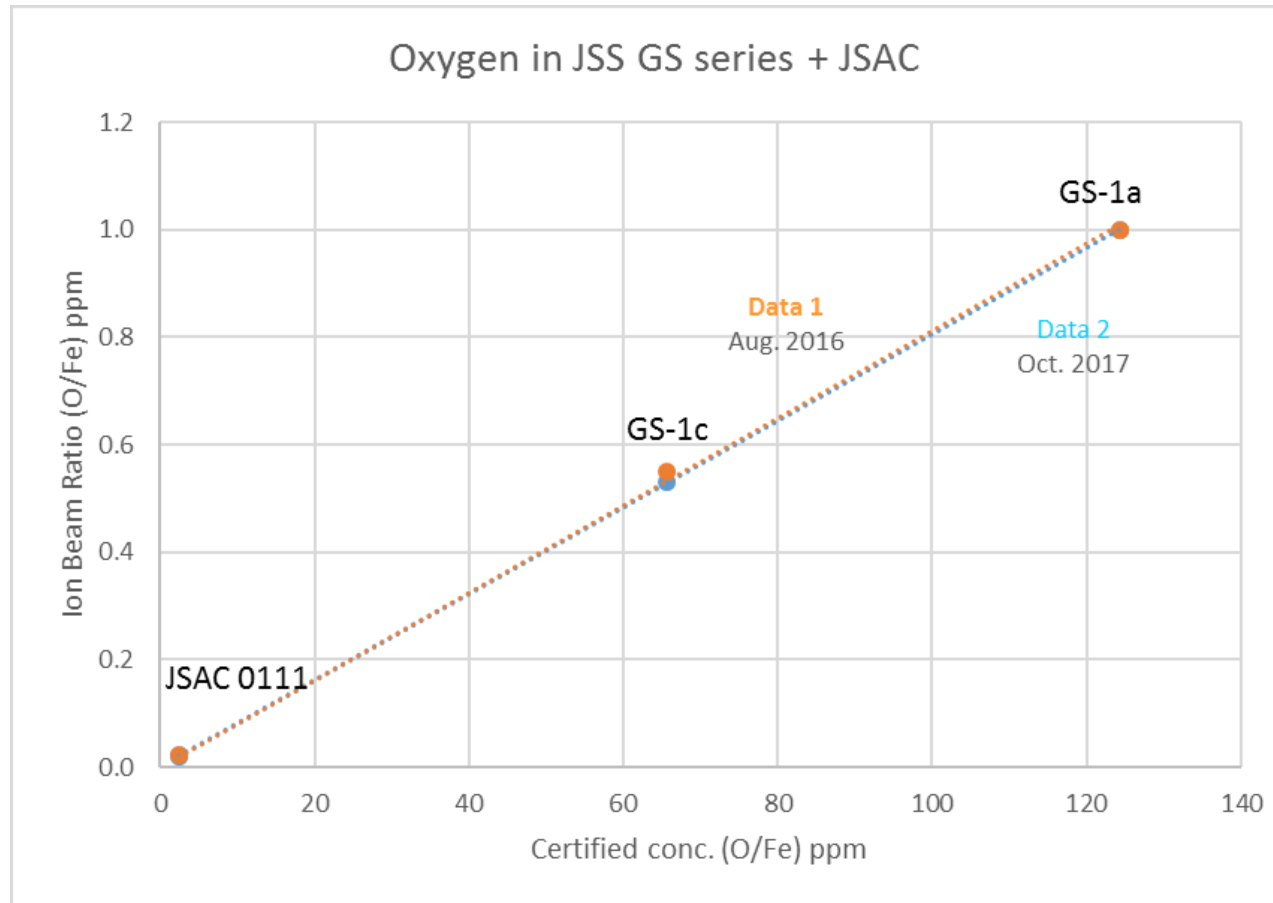
- 1hr including acid etching, tuning, pre-sputtering and analysis
- 1 replicate: ~10min
- >60 elements @ppb or less

- Oxygen in steel

SRM	O (wt ppm)
JSS (The Iron and Steel Institute of Japan)	
GS-1a	87
GS-1c	46.0 ± 3.8
GS-2b	14.6 ± 3.4
GS-3b	38.5 ± 2.4
GS-5a	136 ± 9
JSAC (The Japan Society for Analytical Chemistry)	
JSAC0111	2.3 ± 0.4
NIST (National Institute of Standards and Technology)	
661	(9)
662	(11)
663	(7)
664	(17)
665	(63)

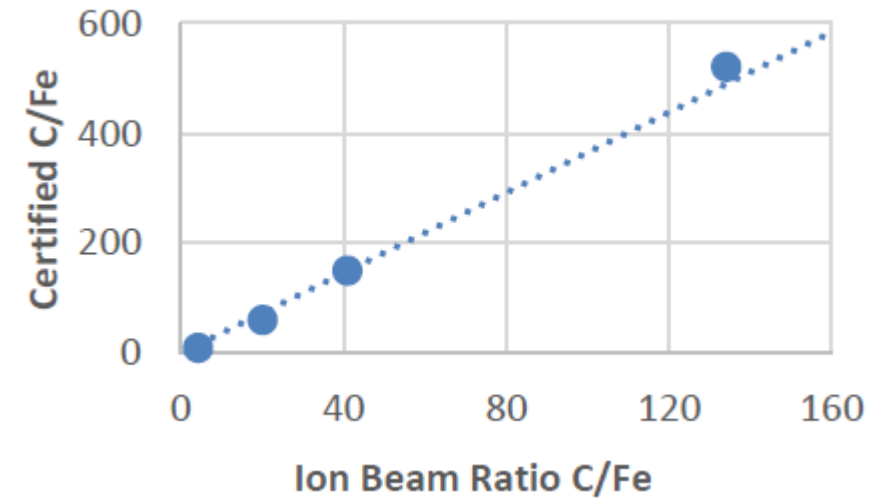
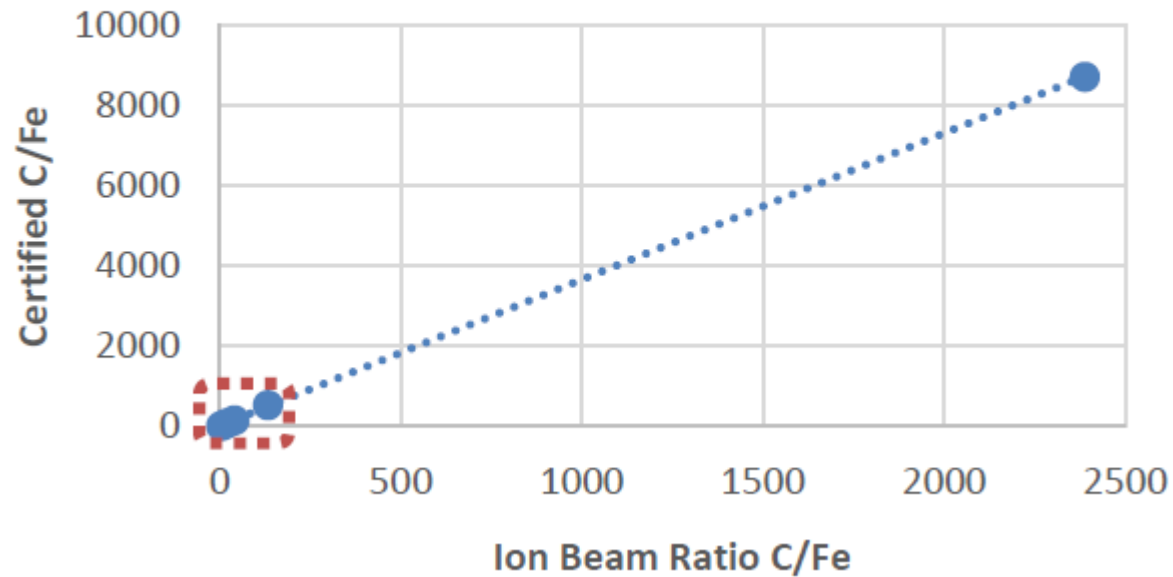


- Oxygen in steel - reproducibility

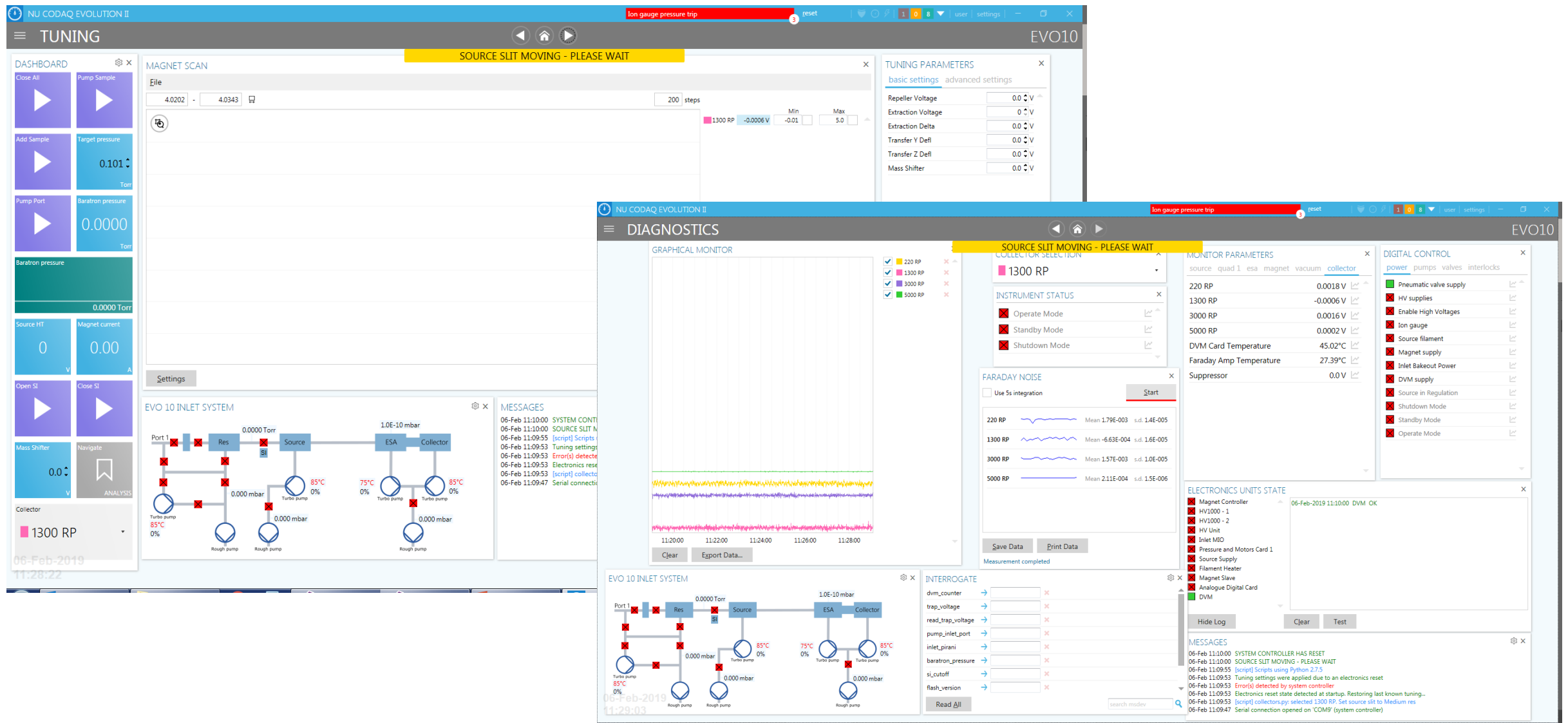


- Carbon in steel

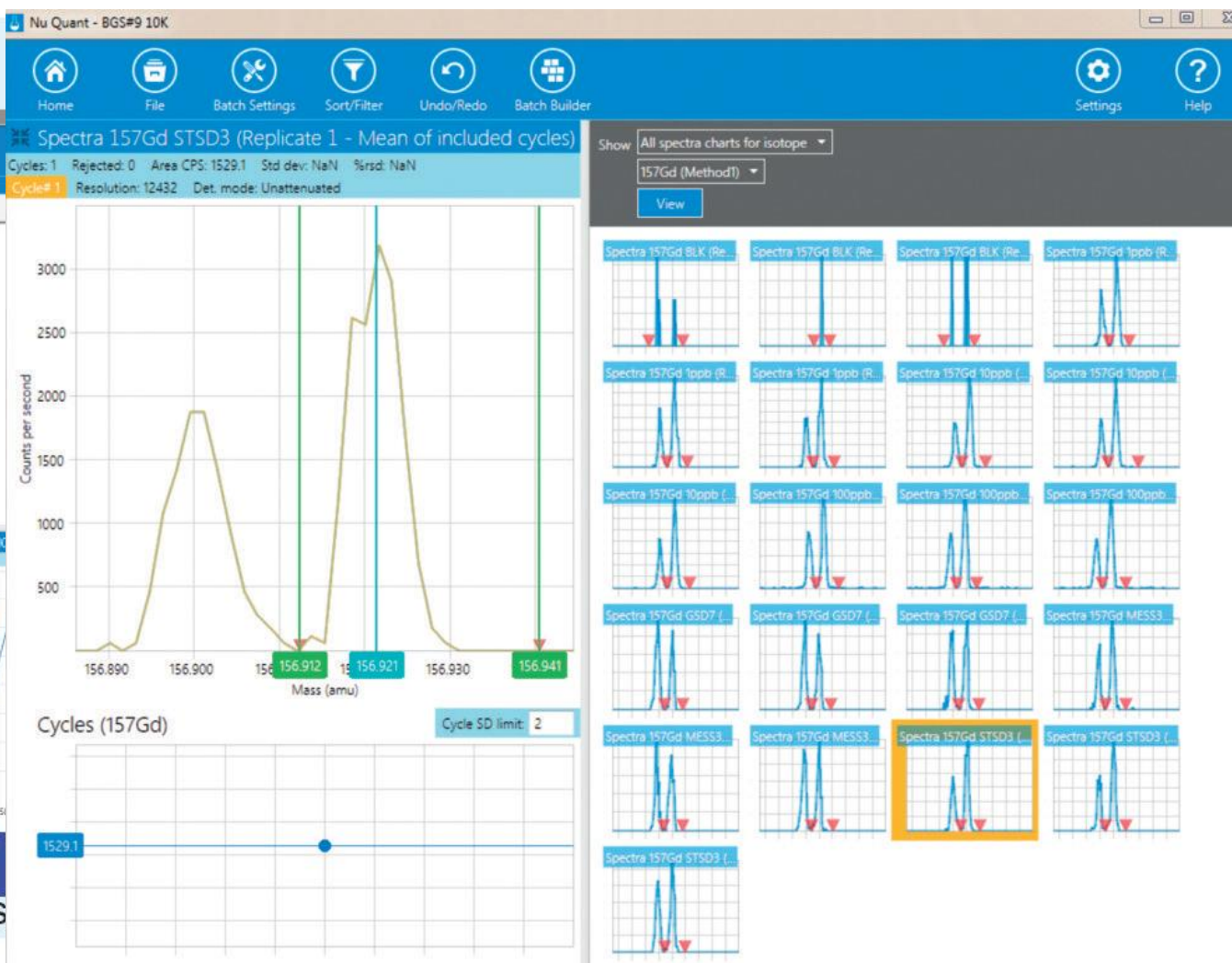
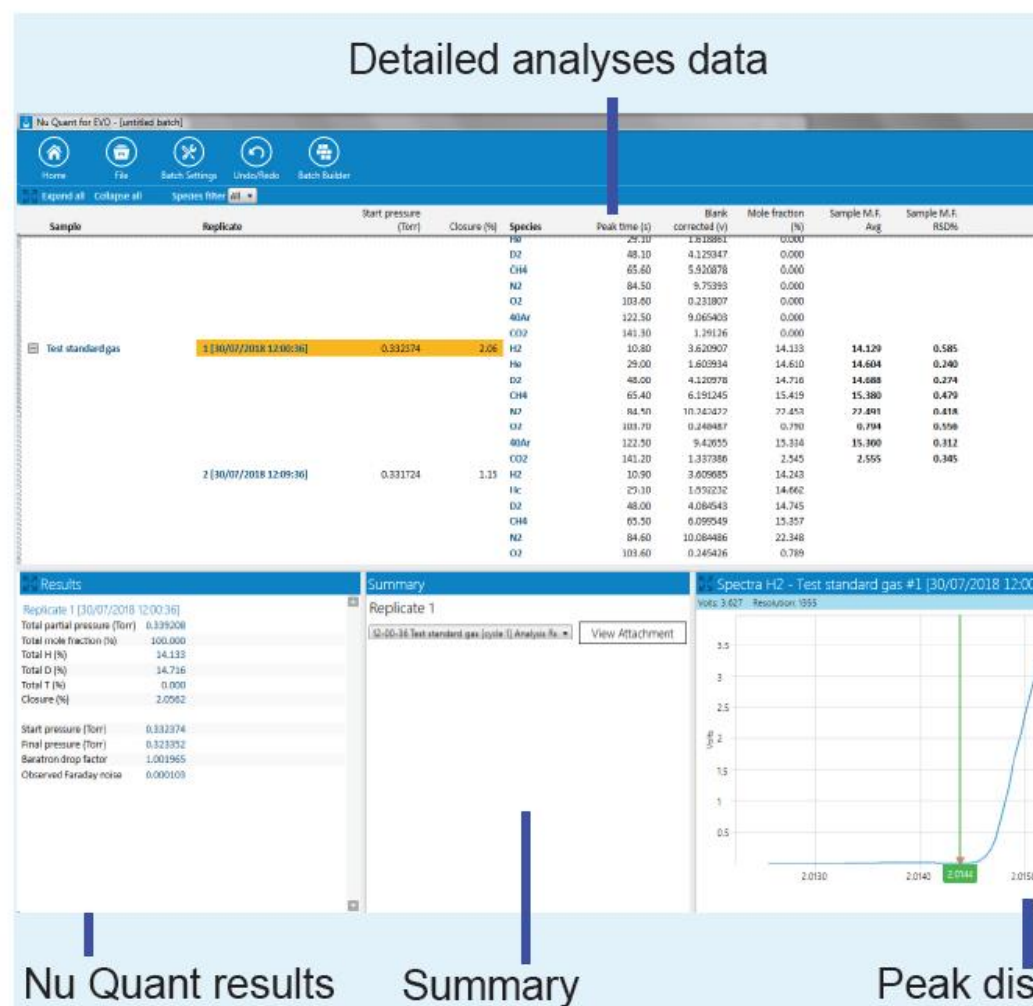
Carbon trend in steel



What next? Software



What next? Software



Vielen Dank für ihre Aufmerksamkeit