

Improving RGA durability and endurance.

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RGA10
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Abstract

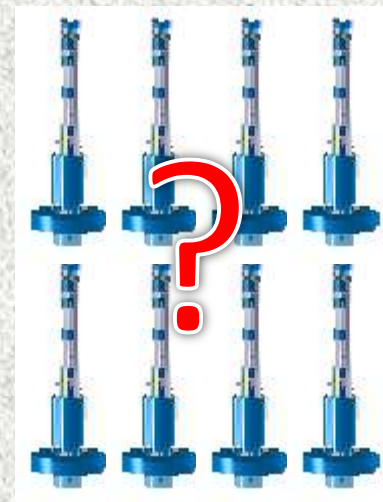
Hidden Analytical has manufactured Quadrupole Mass Spectrometers since 1982. Thousands of RGA's have been supplied to customers worldwide.

After a period of use a proportion of these instruments return to be serviced or repaired.

The detailed records of these units have been studied. The challenges to improve longevity and reliability are discussed.



Manufacturing



Customer sites



Service





Analysis of RGA service records

Broadly categorised as follows;

Contamination

Interface/RF/Cable electrical or electronic failure

Physical damage (excludes feedthru)

Detector end of life* or failure

Broken feedthru/vacuum failure

Wiring disconnect (gauge)

Other

No fault



Broken feedthru



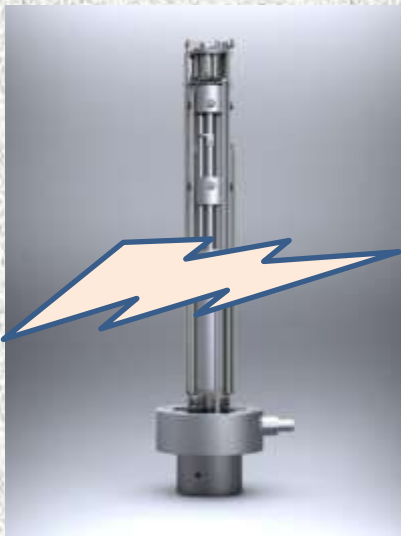
Wiring disconnect



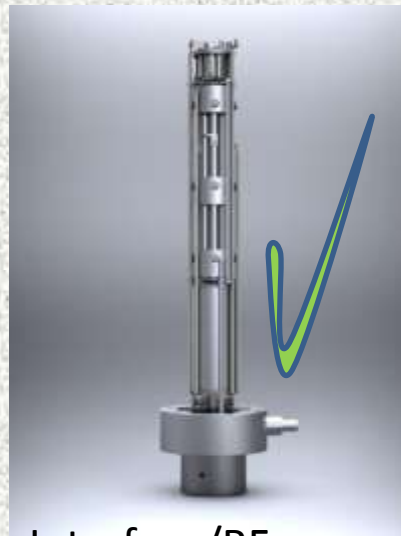
Detector end of life



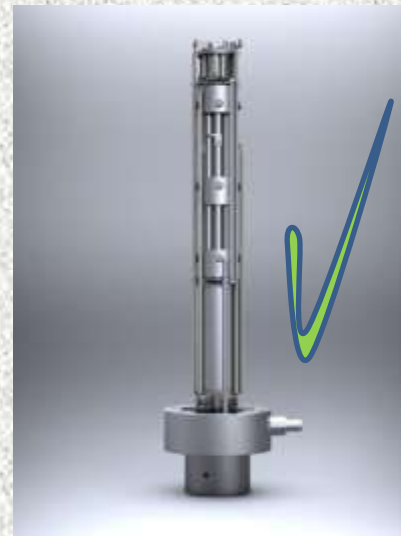
Contamination



Physical damage



Interface/RF
electronic failure



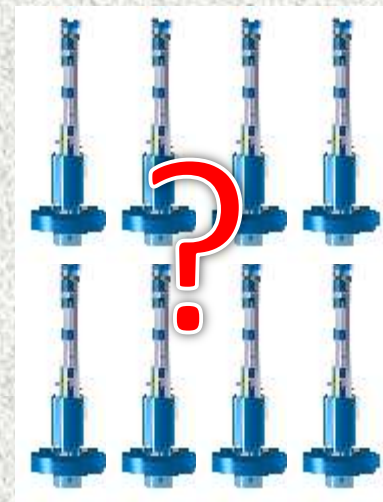
No fault



Other



Manufacturing

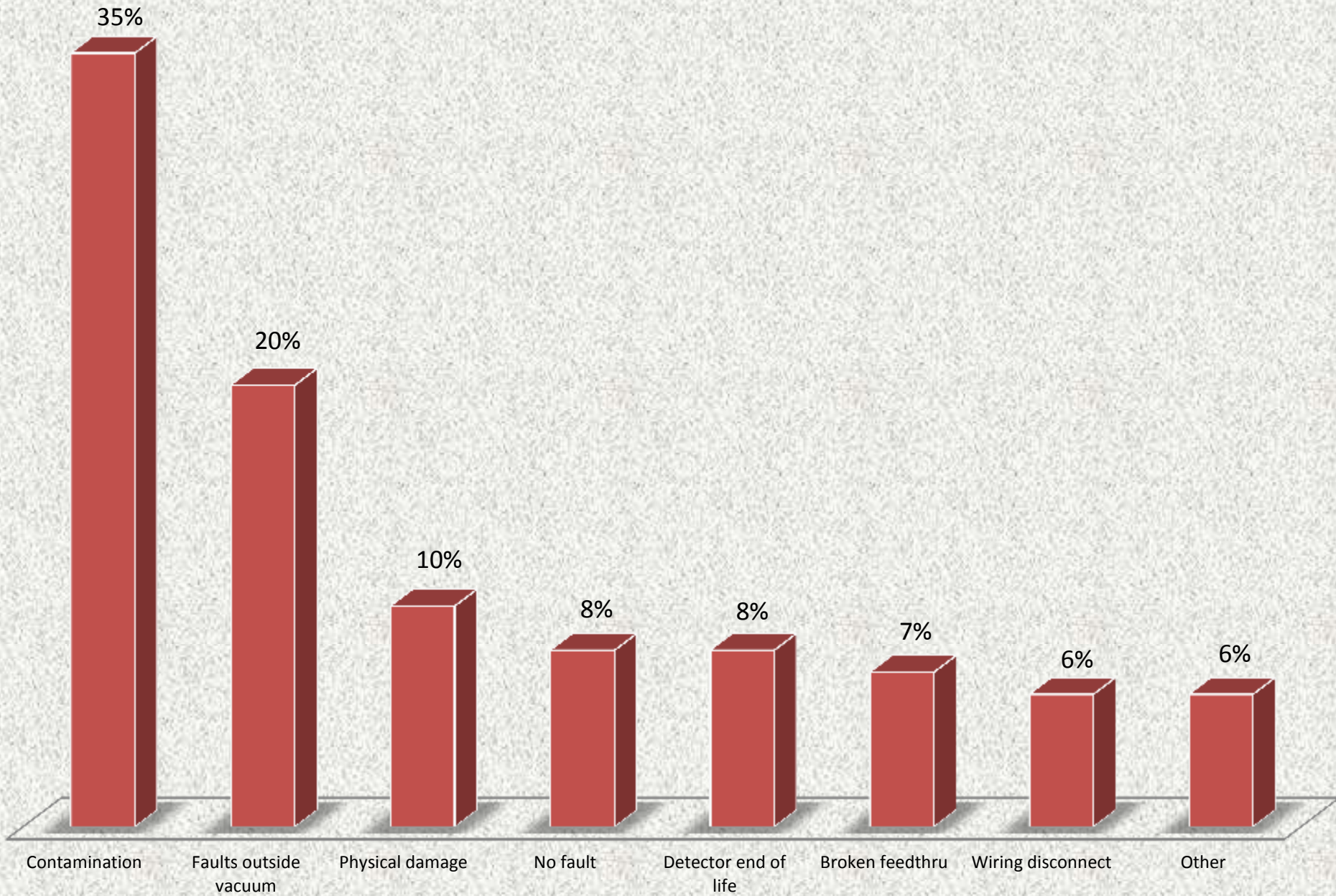


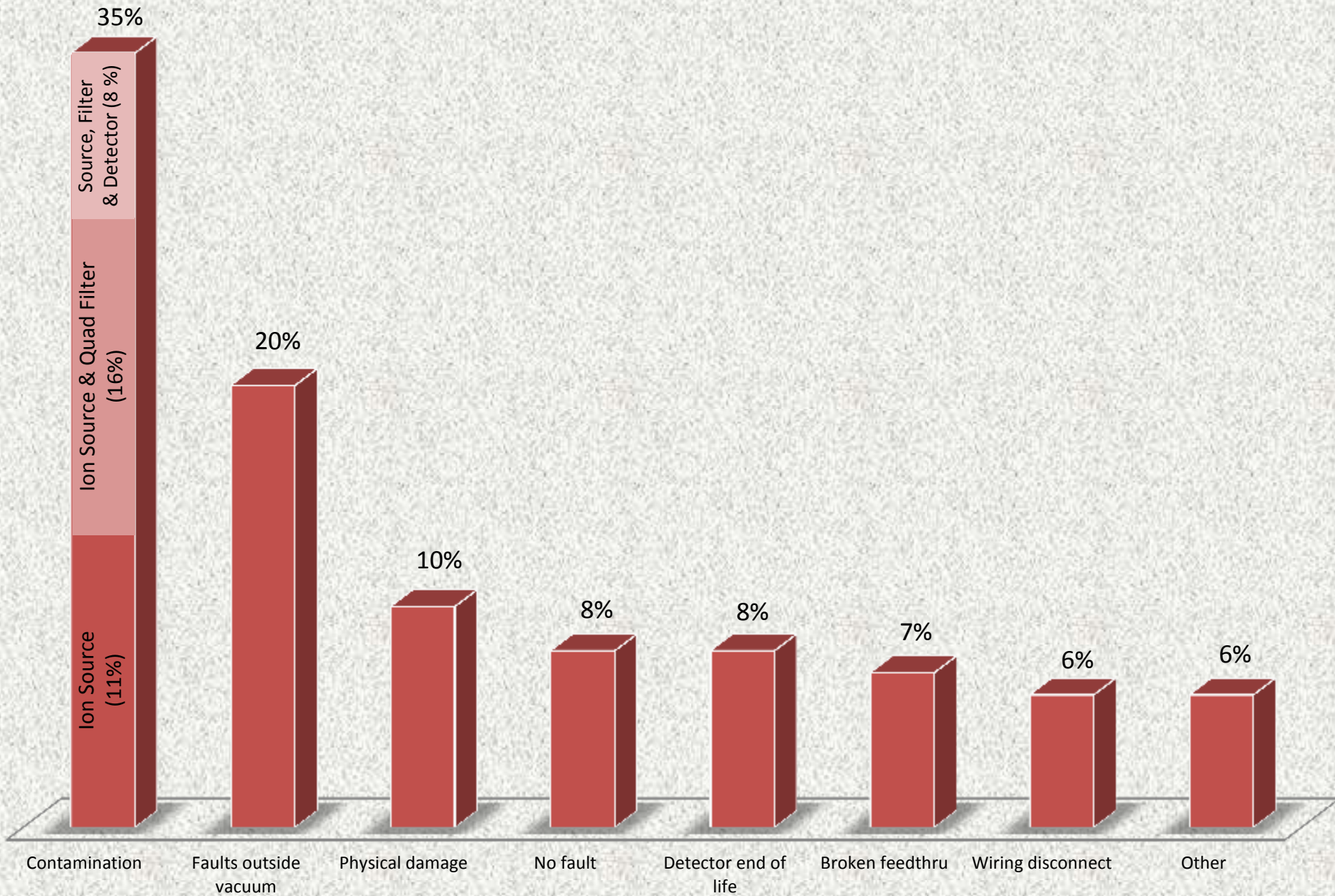
Customer sites

Service



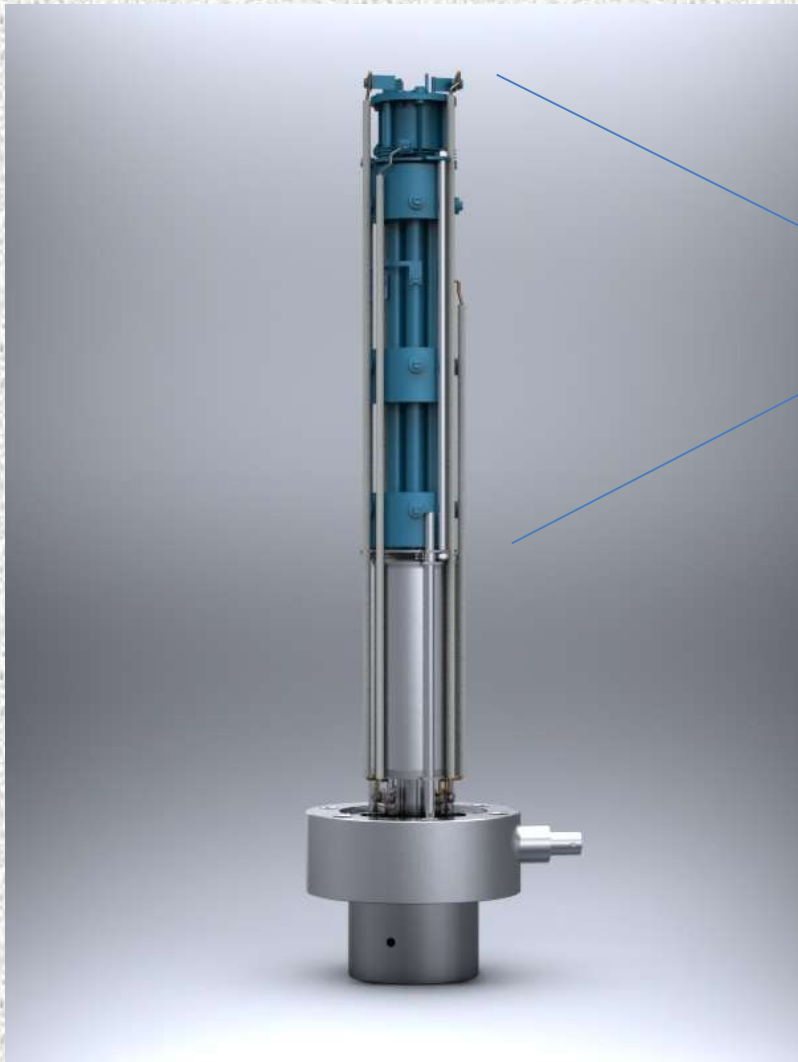
Average age of returning instruments is 6 years 7 months.





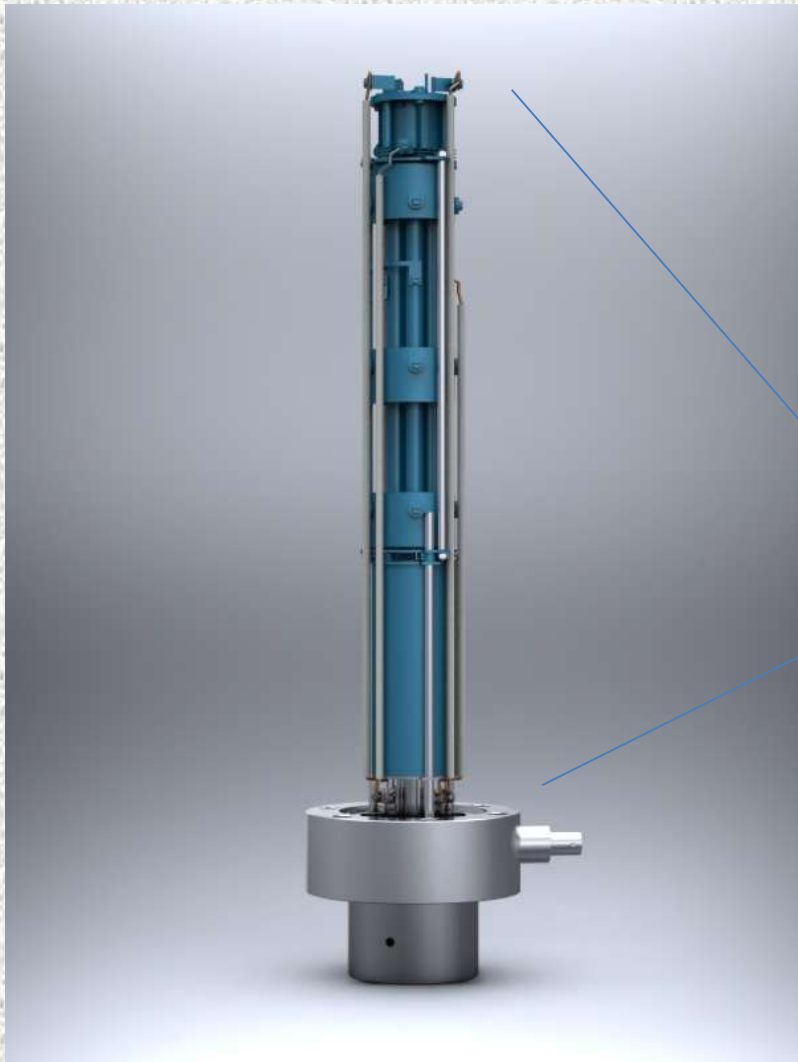


11%



11%

16%



11%

16%

8%

Total 35%

Detector lifetime ;

Detector contamination $\approx 8\%$

Detector life issues $\approx 8\%$

16% multiplier replacements.

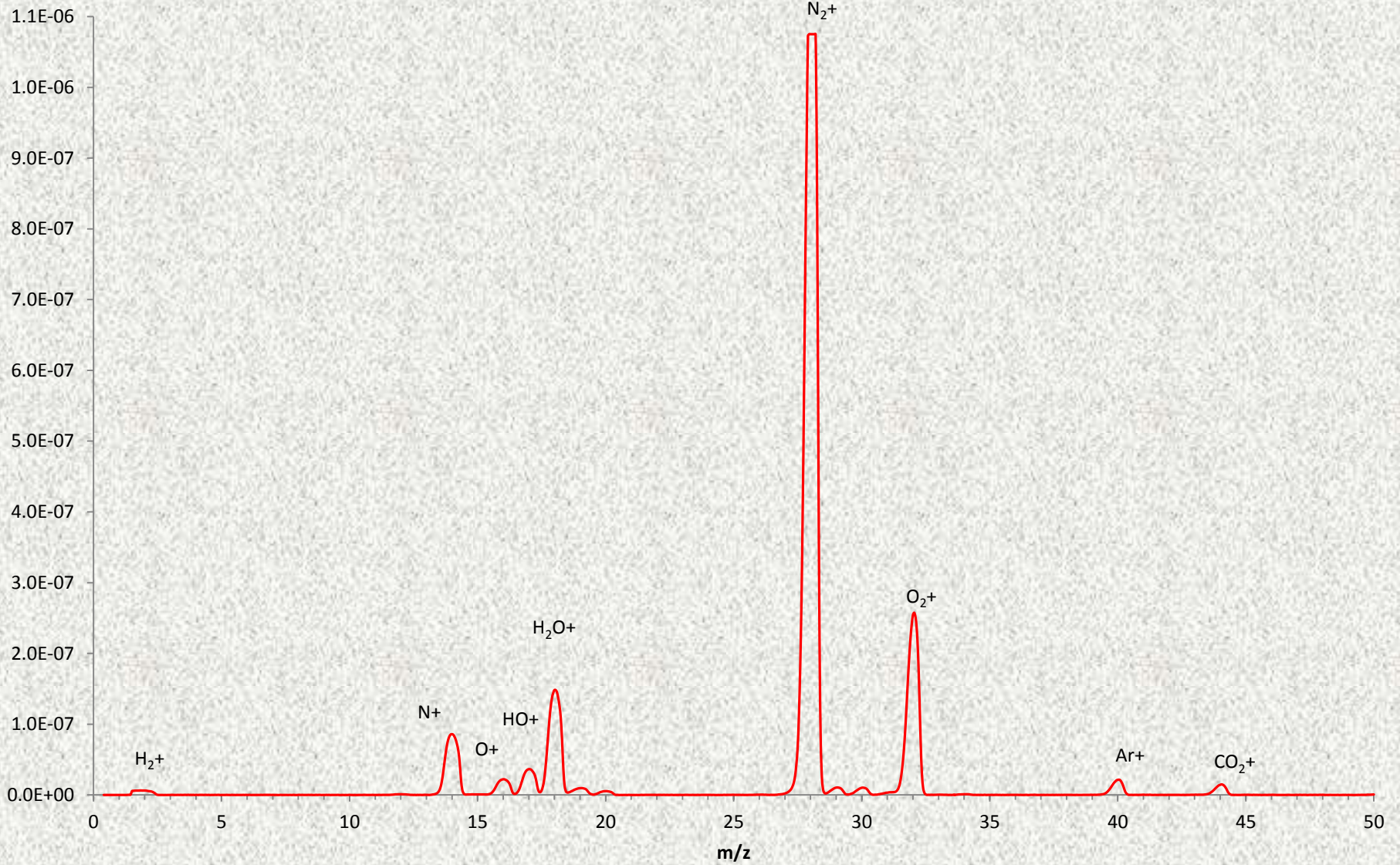
Average age of units having this work is;

6 years 6 months



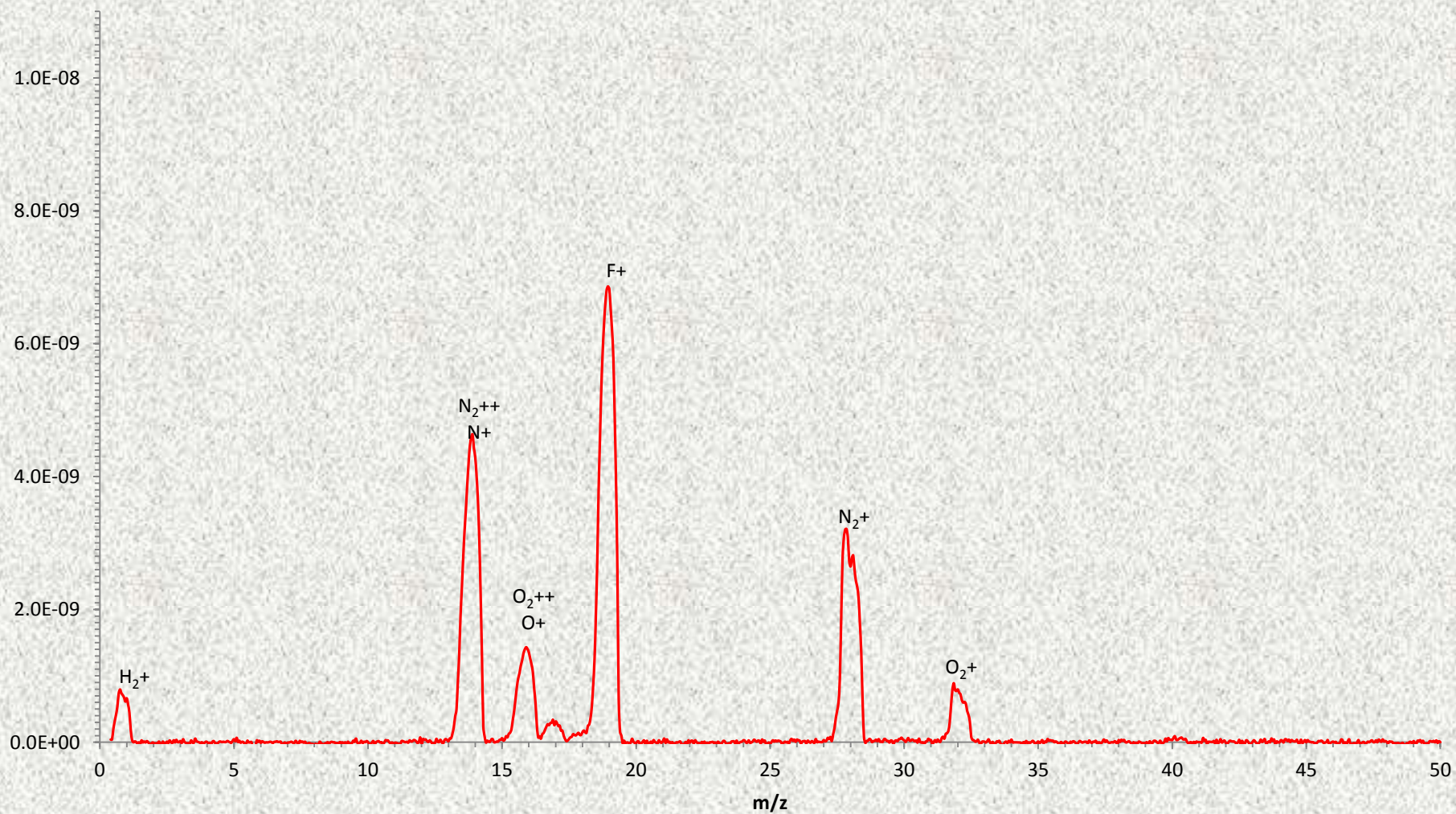


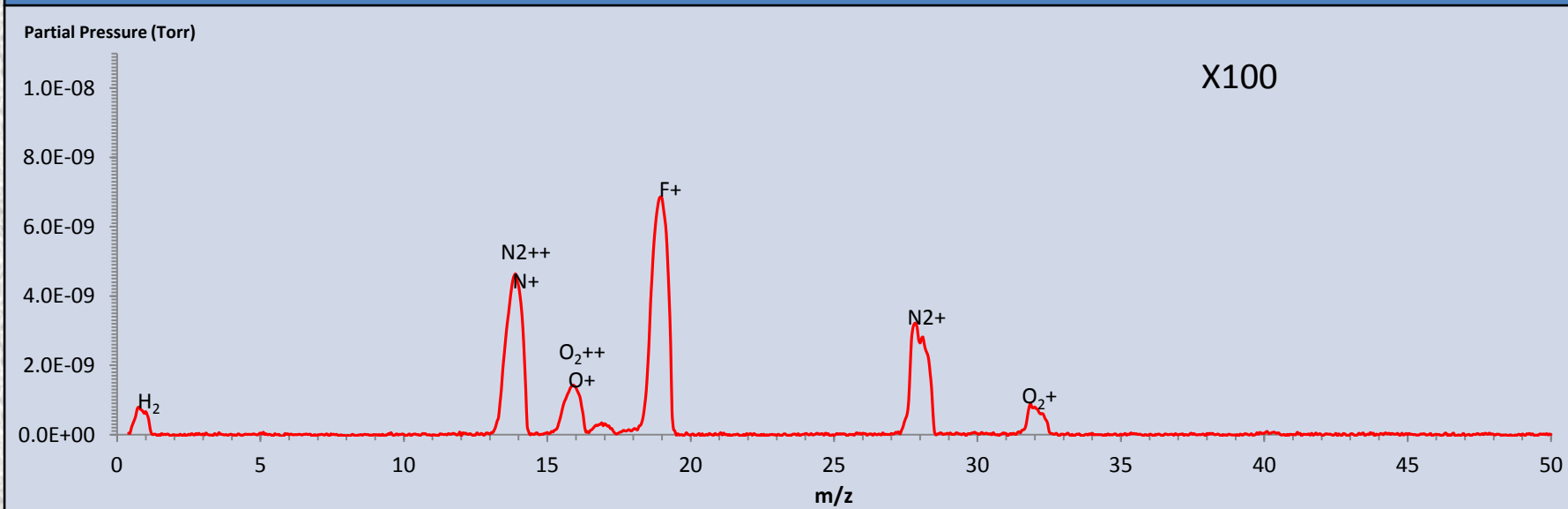
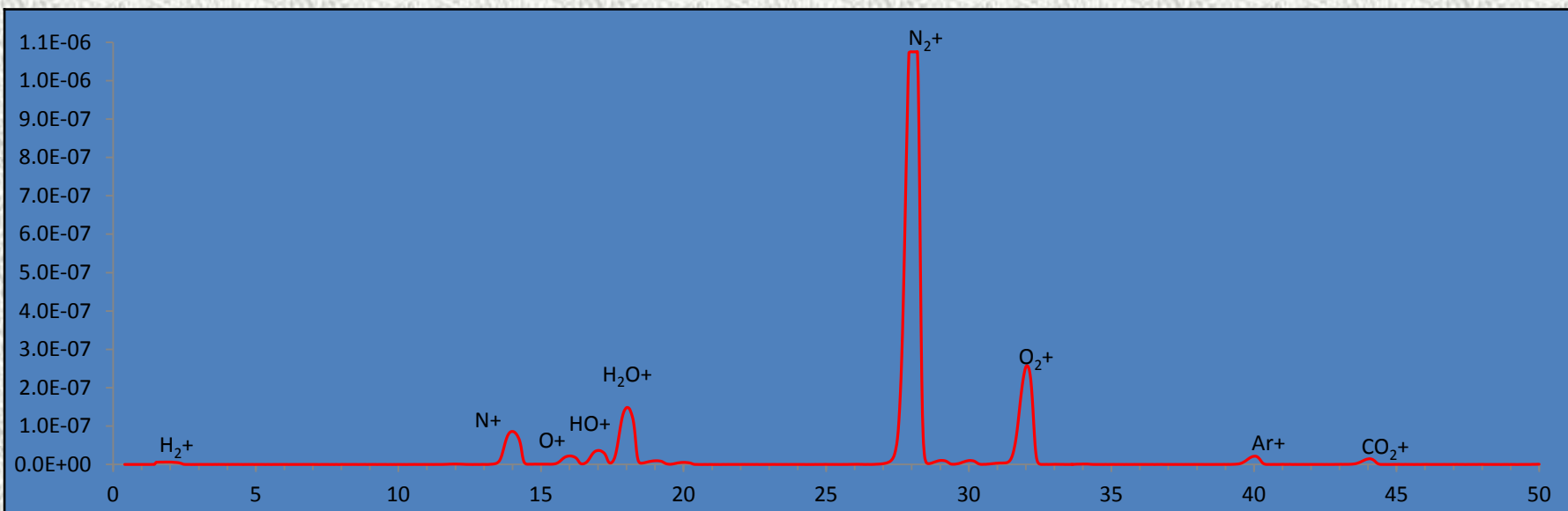
Partial Pressure (Torr)



Partial Pressure (Torr)

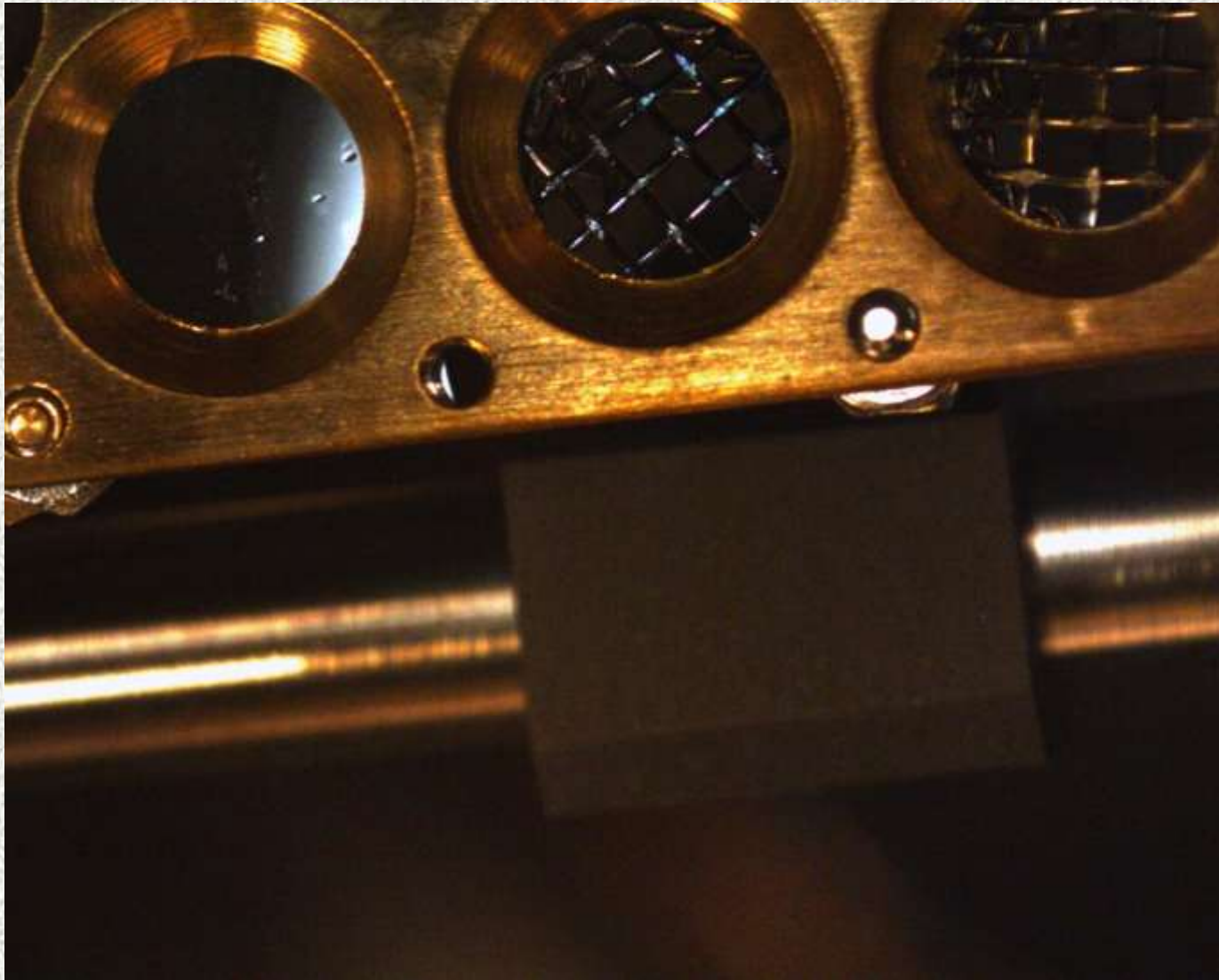
X100





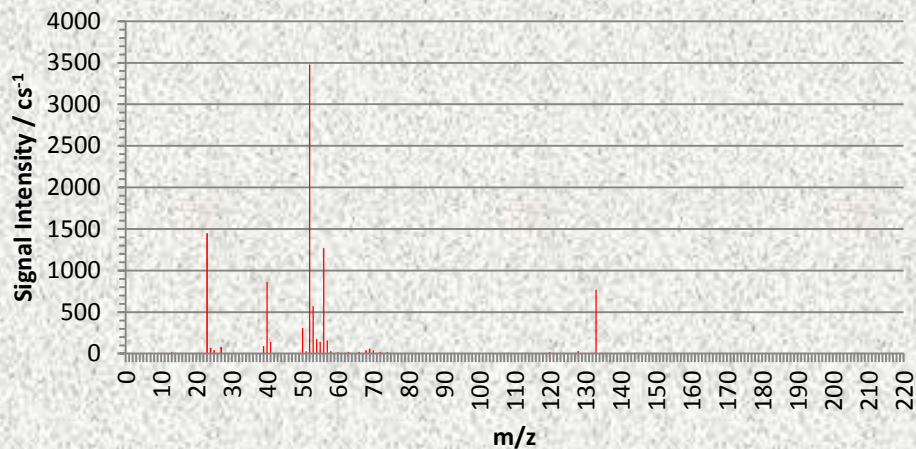
Secondary Ion Mass Spectrometry



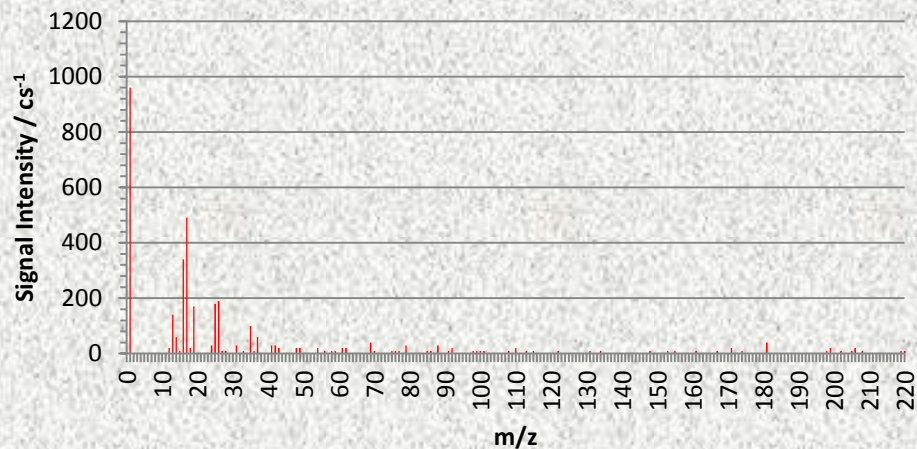


SIMS with 5Kv Cs primary ions

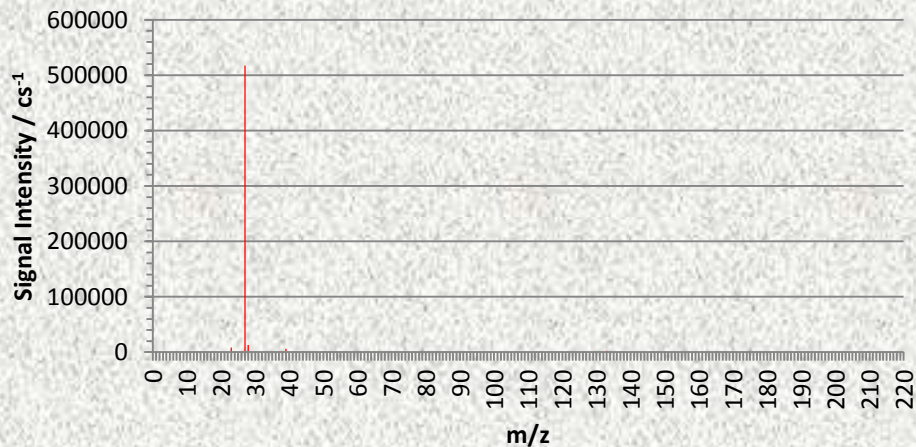
Clean Cage Positive Ion SIMS



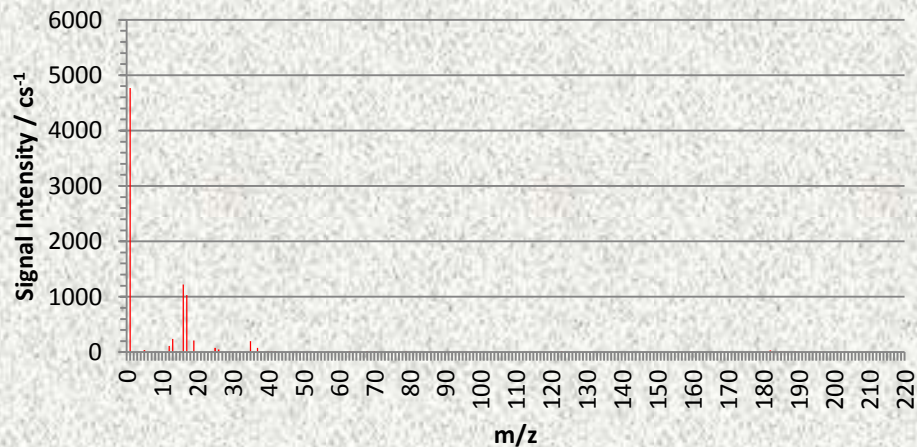
Clean Cage Negative Ion SIMS



Contaminated cage Positive Ion SIMS

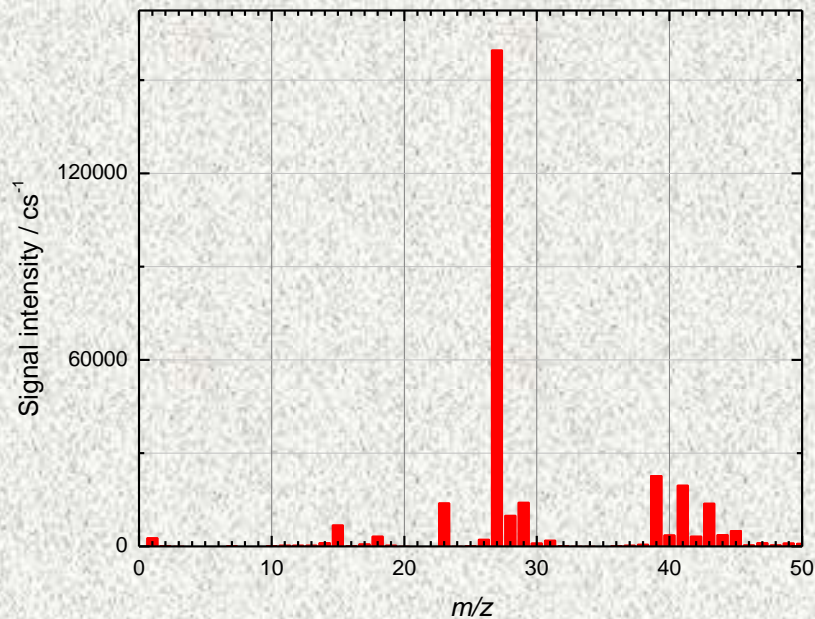


Contaminated cage Negative Ion SIMS



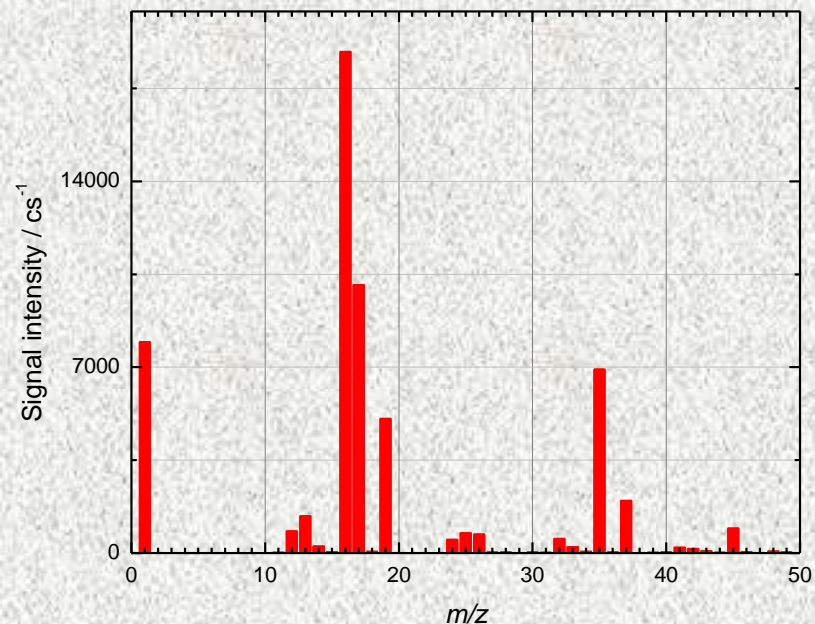
Secondary ion mass spectrum

Positive



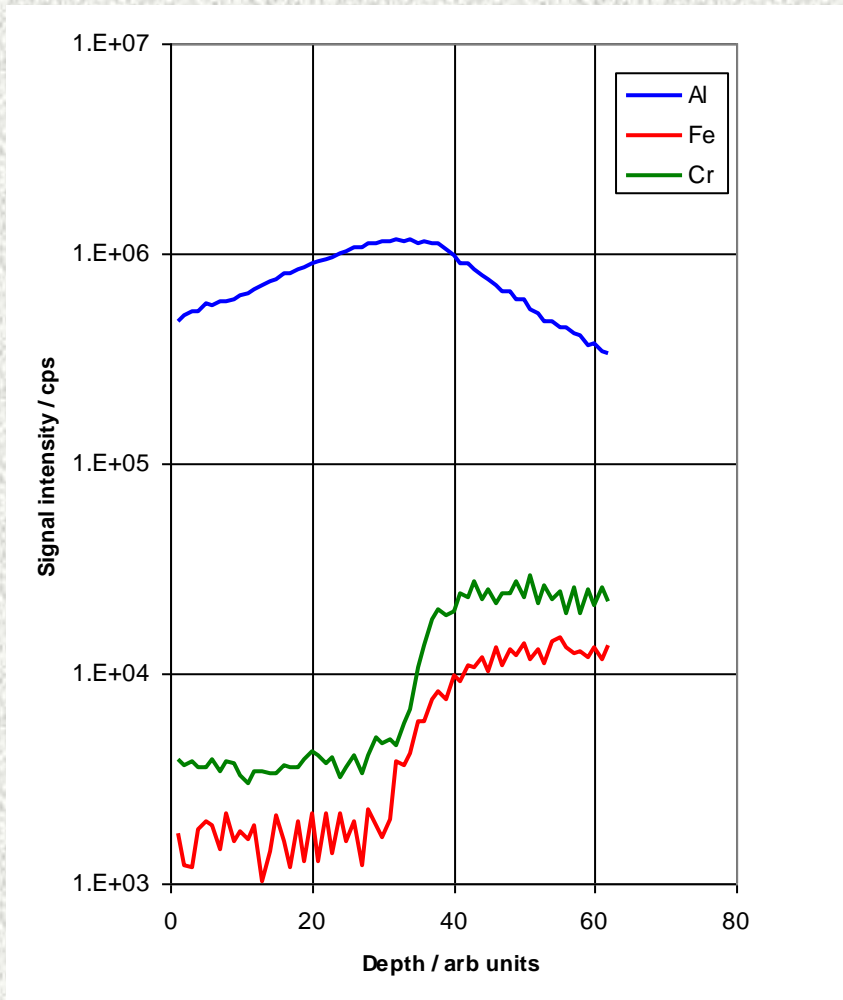
Very clean Aluminium signal
 $m/z=27$

Negative



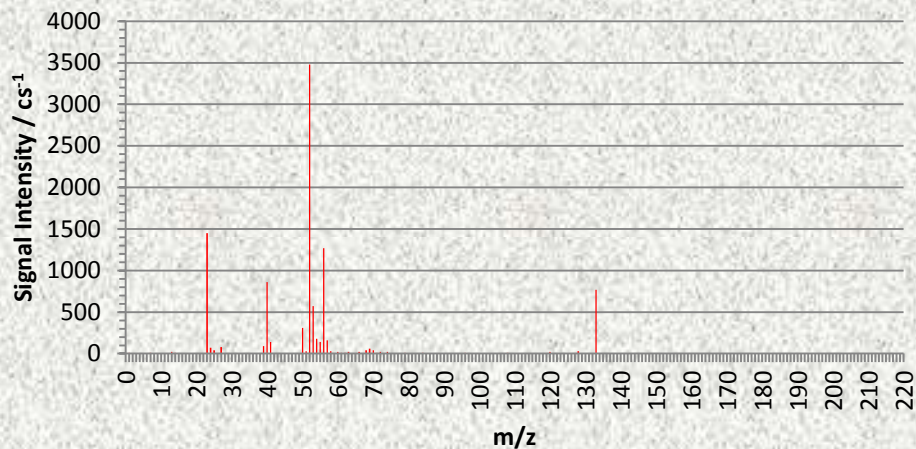
Oxygen peak at $m/z = 16$ and
OH at $m/z = 17$. There is also
evidence of F at $m/z=19$ and Cl
at $m/z 35$ and 37

SIMS depth profile

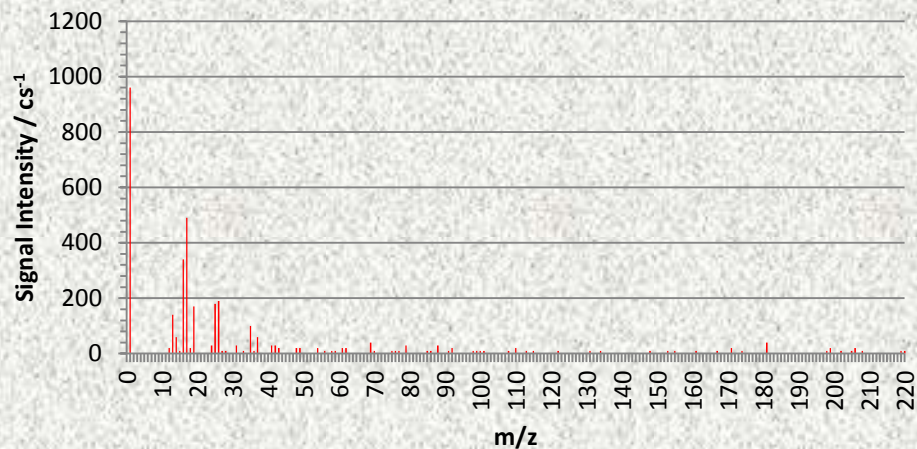


From a system using TMA (Trimethylaluminum) and O₃ for the ALD of alumina

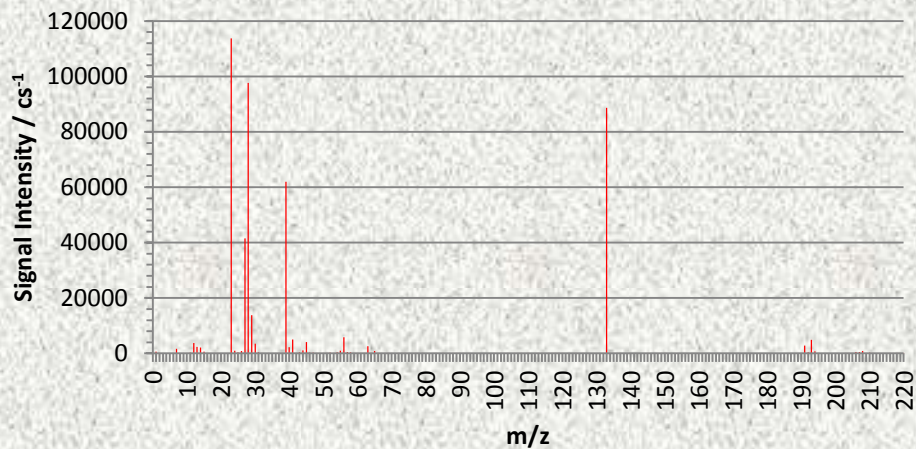
Clean Cage Positive Ion SIMS



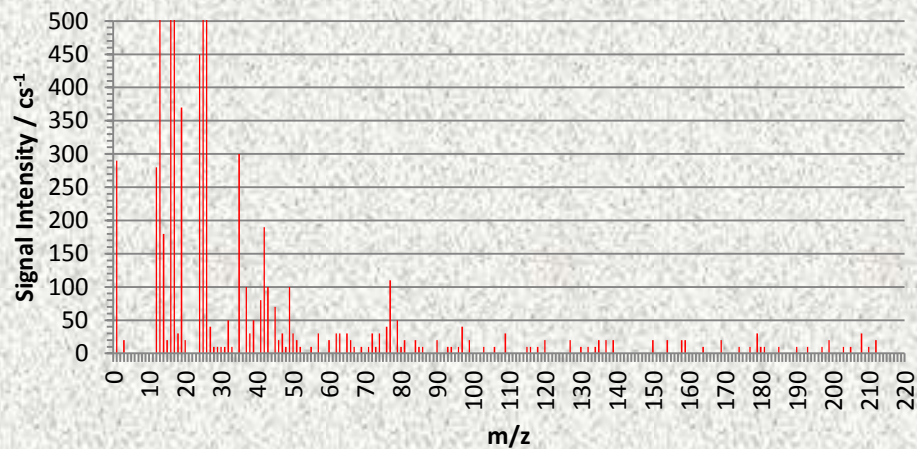
Clean Cage Negative Ion SIMS



Positive Ion SIMS

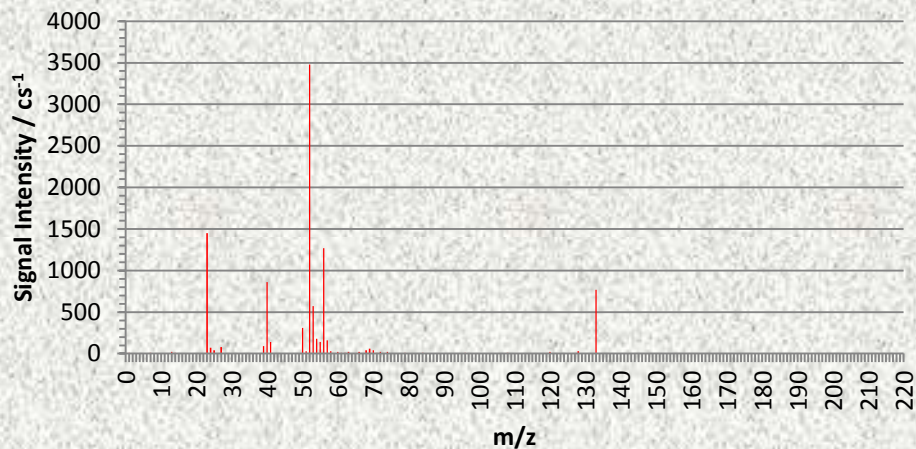


Negative Ion SIMS

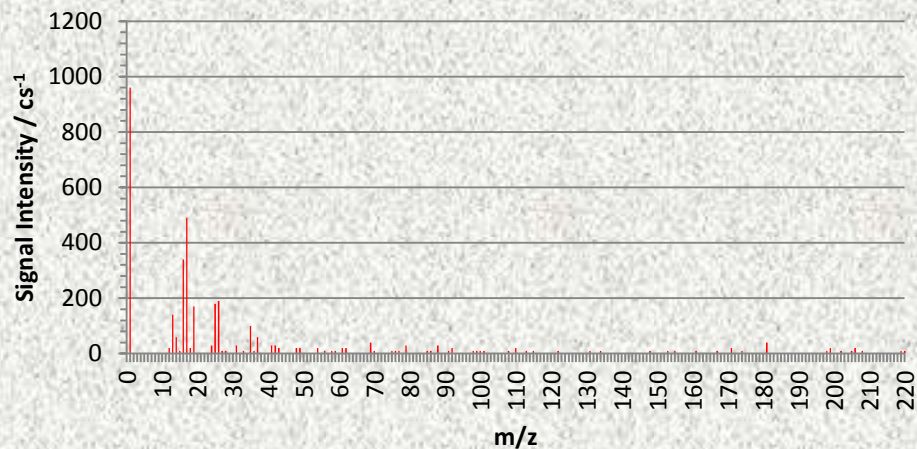


Contaminated with silicon/silica

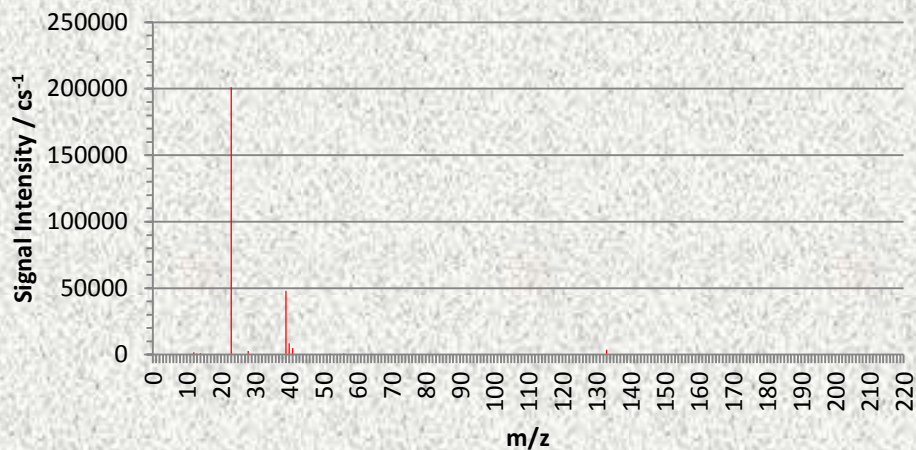
Clean Cage Positive Ion SIMS



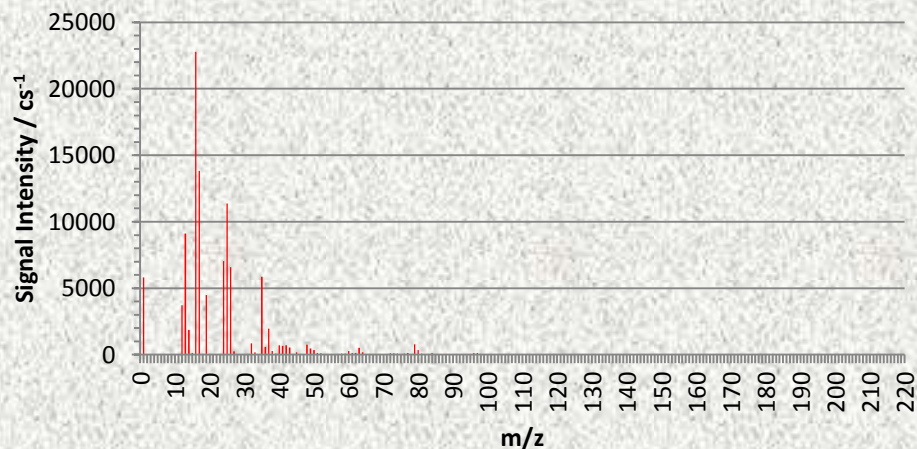
Clean Cage Negative Ion SIMS



Positive Ion SIMS

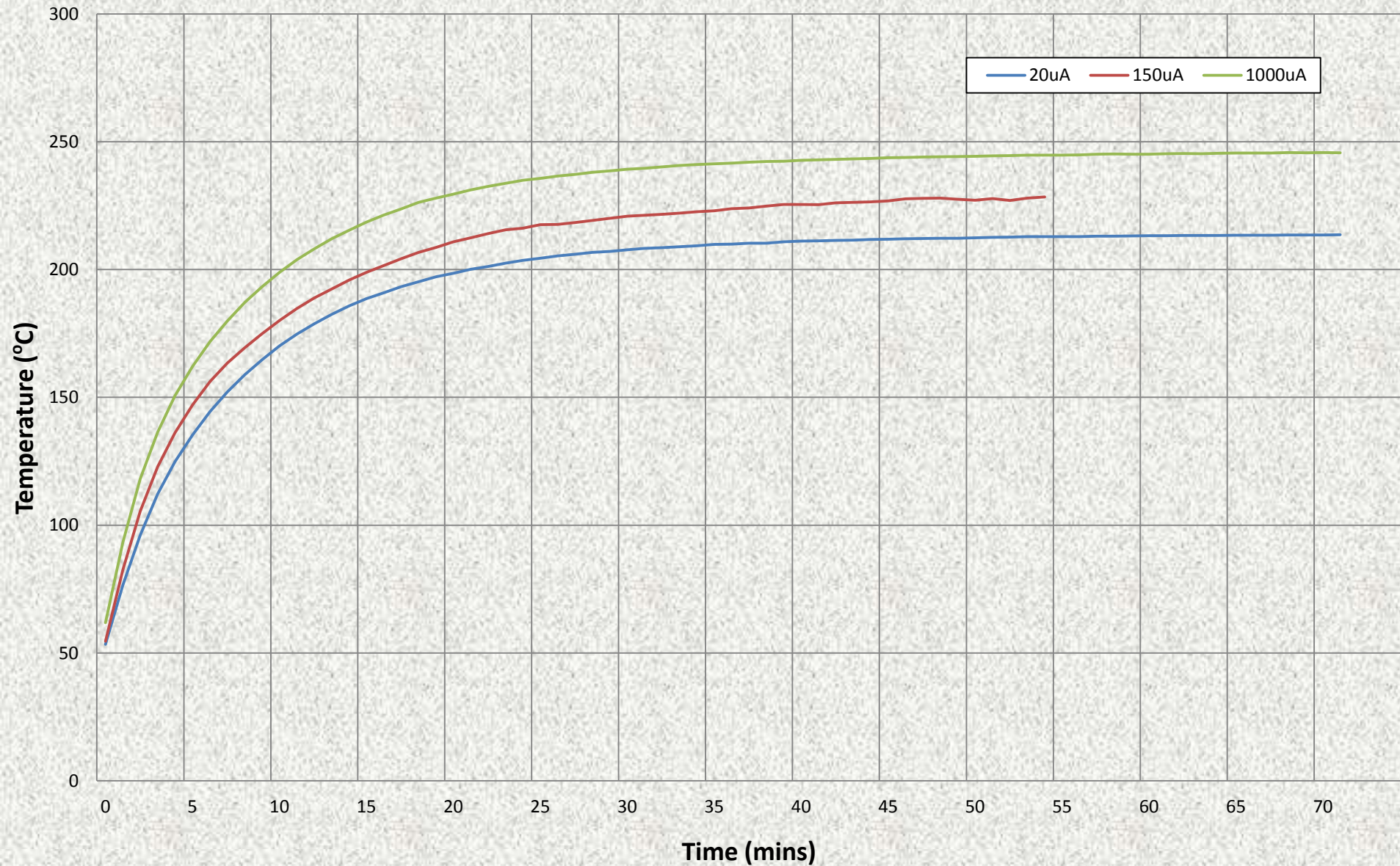


Negative Ion SIMS

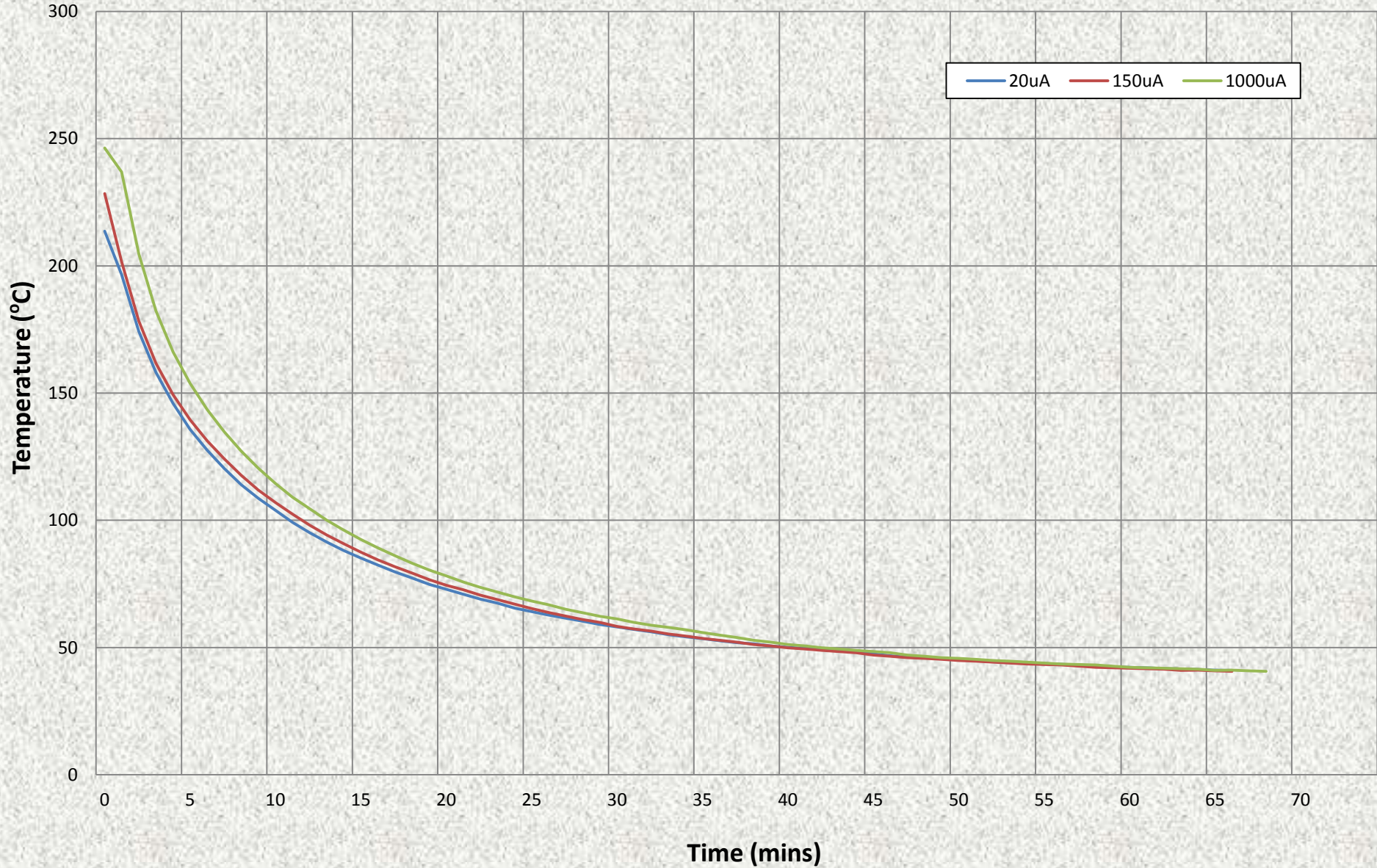


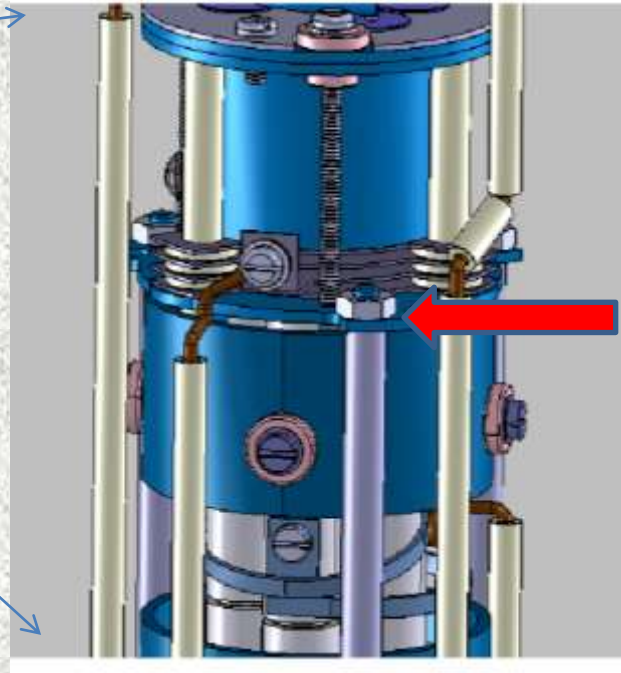
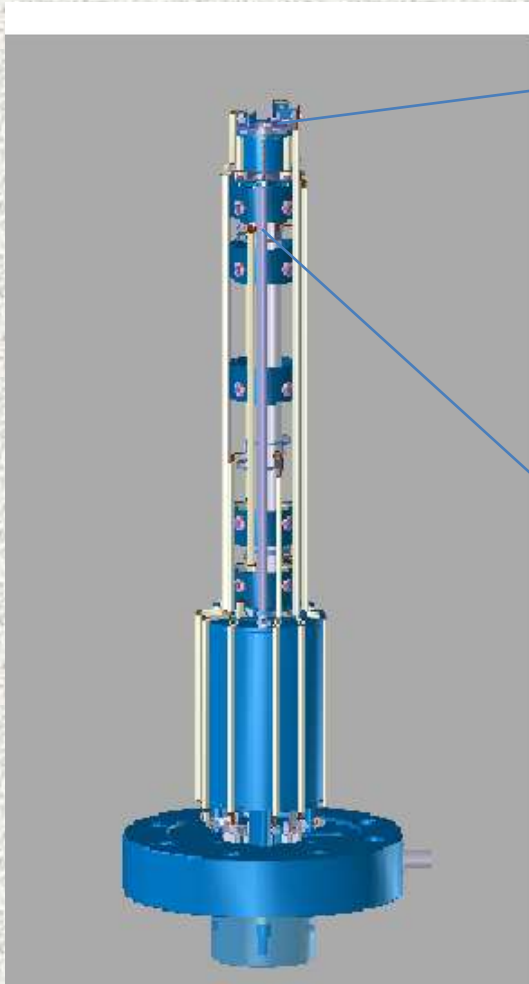
Hydrocarbon contamination

Warm Up



Cool Down





$\leq 32 \text{ degC}$

Conclusions;

Reduce the operating pressure /partial pressure

Clean/dry/inert vent -- and/or a 40 min cool down

Run regular PM template files

Advanced coatings ----- anyone interested let me know

Thank you.

