



Product Support  
Life Science Mass Spectrometry

Revision 00 – June 2019

# Orbitrap Exploris 480 Calibration, Evaluation & Troubleshooting

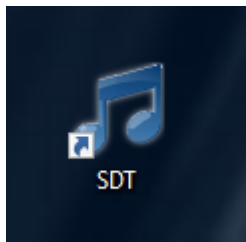
## **SDT**

- Calibrations
- Evaluations/Checks
- Troubleshooting

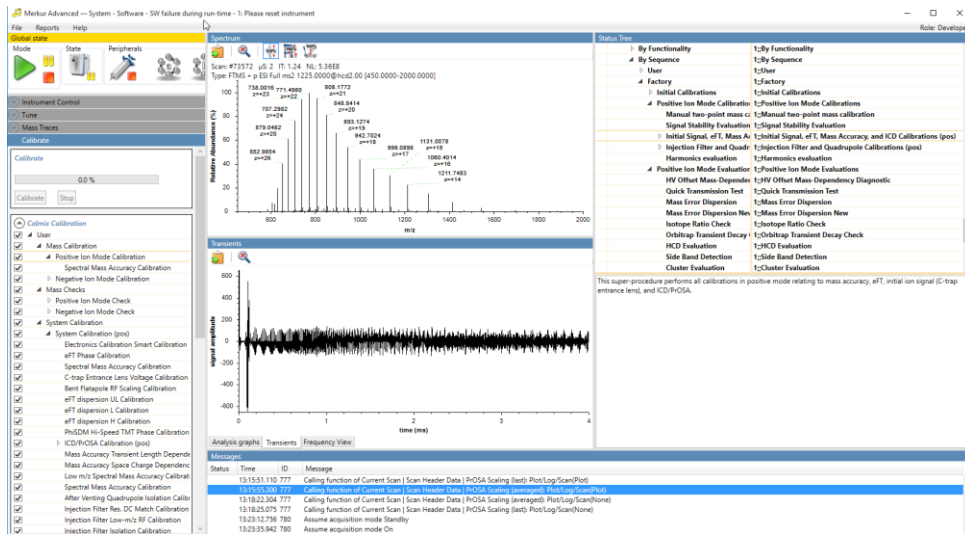
## **Orbitrap Exploris Tune**

- Calibrations/Checks
- Diagnostics

# SDT: Service Diagnostic Tool



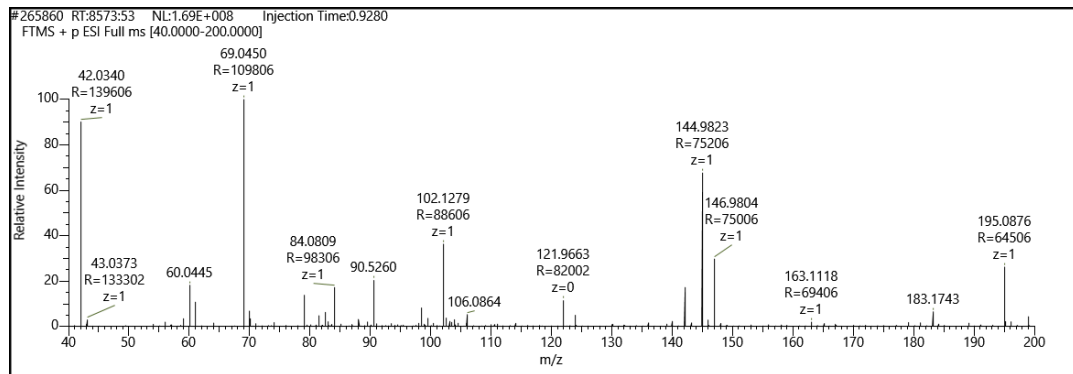
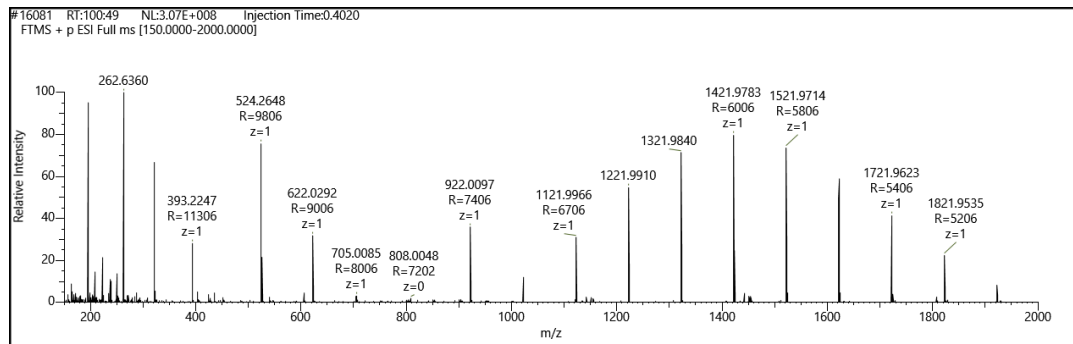
- C:\Thermo\Instruments\Exploris\1.0\System\Programs\ServiceDiagnosticTool.exe
- Not available for customer
- Similar to Tune (Exacte Series)



Location:

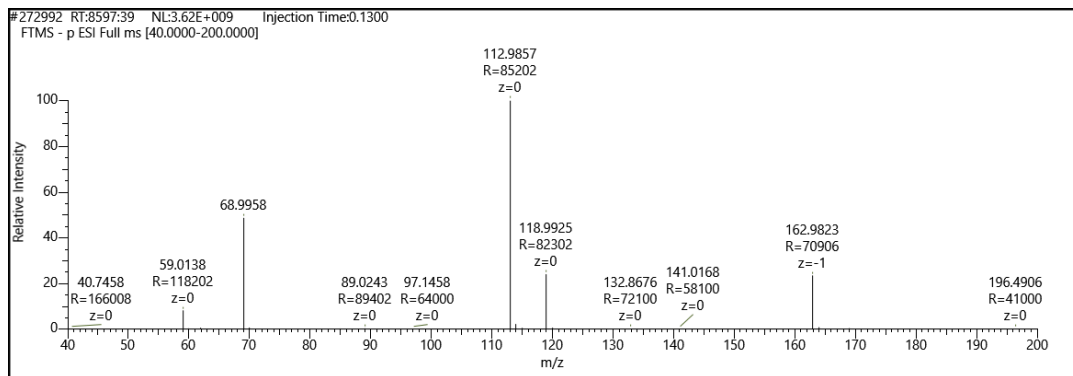
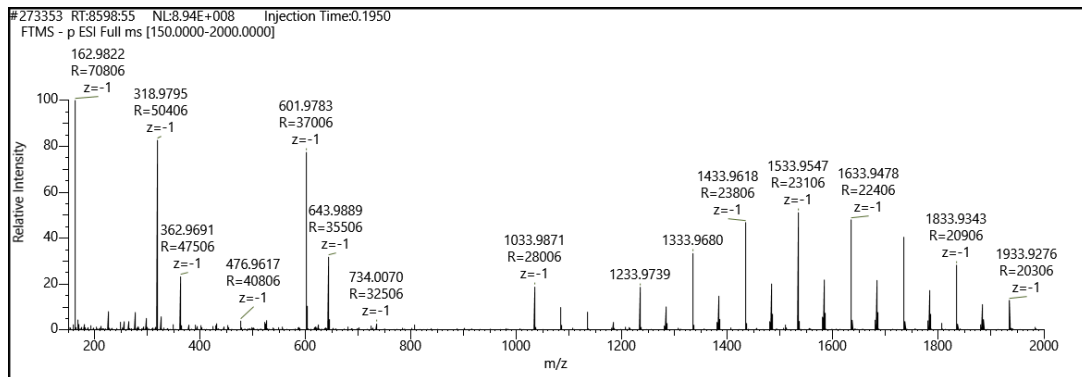
C:/ProgramData/Thermo/Exploris/instruments/msx\_instrument

# FlexMix – Positive Ion mode



| Components:                                    | Accurate Mass (m/z) | Ion Type             |
|------------------------------------------------|---------------------|----------------------|
| Imidazole                                      | 69.04472            | [M+H] <sup>+</sup>   |
| Triethylamine                                  | 102.12772           | [M+H] <sup>+</sup>   |
| Tetramethylpiperidine                          | 142.15902           | [M+H] <sup>+</sup>   |
| Caffeine                                       | 195.08763           | [M+H] <sup>+</sup>   |
| MRFA 2+                                        | 262.63609           | [M+2H] <sup>2+</sup> |
| Hexamethoxyphosphazene                         | 322.04808           | [M+H] <sup>+</sup>   |
| MRFA                                           | 524.26491           | [M+H] <sup>+</sup>   |
| Hexakis(2,2-difluoroethoxy)phosphazene         | 622.02888           | [M+H] <sup>+</sup>   |
| Hexakis(2,2,3,3-tetrafluoropropoxy)phosphazene | 922.00967           | [M+H] <sup>+</sup>   |
| Ultramark 1621                                 | 1022.00327          | [M+H] <sup>+</sup>   |
|                                                | 1121.99687          | [M+H] <sup>+</sup>   |
|                                                | 1221.99047          | [M+H] <sup>+</sup>   |
|                                                | 1321.98407          | [M+H] <sup>+</sup>   |
|                                                | 1421.97767          | [M+H] <sup>+</sup>   |
|                                                | 1521.97127          | [M+H] <sup>+</sup>   |
|                                                | 1621.96487          | [M+H] <sup>+</sup>   |
|                                                | 1721.95846          | [M+H] <sup>+</sup>   |
|                                                | 1821.95206          | [M+H] <sup>+</sup>   |
|                                                | 1921.94566          | [M+H] <sup>+</sup>   |
| Hexakis(1h,1h,7h-perfluoroheptoxy)phosphazene  | 2121.93286          | [M+H] <sup>+</sup>   |
| Hexakis(1h,1h,9h-perfluorononyloxy)phosphazene | 2721.89445          | [M+H] <sup>+</sup>   |

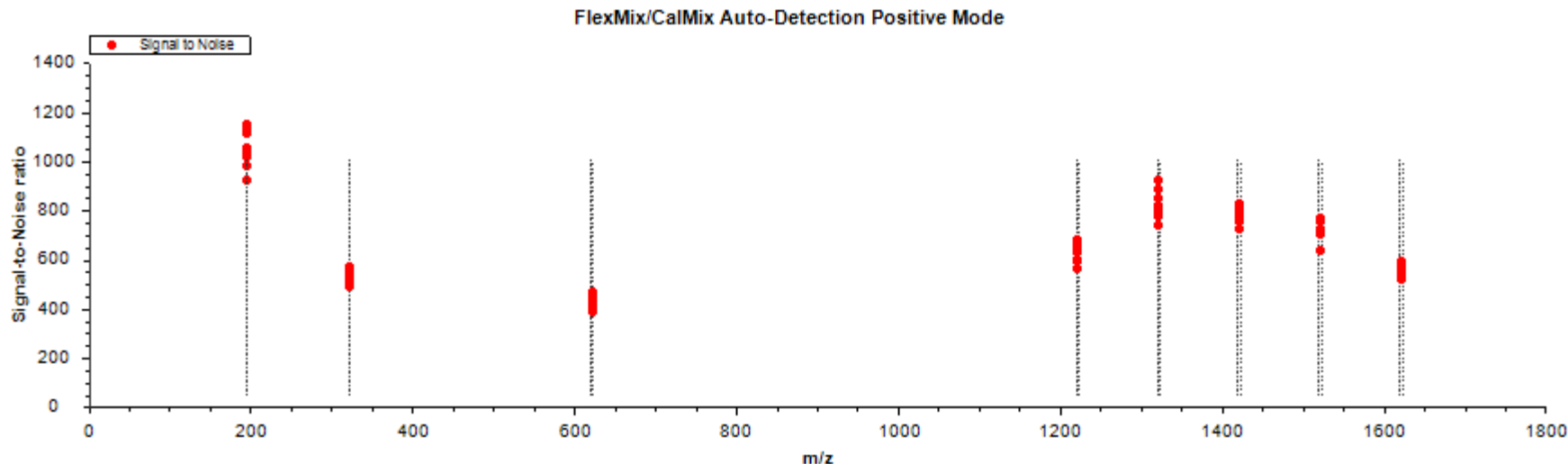
# FlexMix – Negative Ion mode



| Components:                                    | Accurate Mass (m/z) | Ion Type             |
|------------------------------------------------|---------------------|----------------------|
| LC-MS grade acetic acid                        | 59.01384            | [M-H] <sup>-</sup>   |
| Trifluoroacetic acid (TFA)                     | 112.98557           | [M-H] <sup>-</sup>   |
| Pentafluoropropionic acid                      | 162.98237           | [M-H] <sup>-</sup>   |
| Perfluoroheptanoic acid                        | 362.96957           | [M-H] <sup>-</sup>   |
| 2,4,6-Tris(heptafluoropropyl)-1,3,5-triazine   | 601.97889           | [M+OH] <sup>-</sup>  |
| Hexakis(2,2,3,3-tetrafluoropropoxy)phosphazene | 1033.98797          | [M+TFA] <sup>-</sup> |
|                                                | 1133.98156          | [M+TFA] <sup>-</sup> |
|                                                | 1233.97516          | [M+TFA] <sup>-</sup> |
|                                                | 1333.96876          | [M+TFA] <sup>-</sup> |
|                                                | 1433.96236          | [M+TFA] <sup>-</sup> |
|                                                | 1533.95596          | [M+TFA] <sup>-</sup> |
|                                                | 1633.94956          | [M+TFA] <sup>-</sup> |
|                                                | 1733.94316          | [M+TFA] <sup>-</sup> |
|                                                | 1833.93676          | [M+TFA] <sup>-</sup> |
| Ultramark                                      | 1933.93036          | [M+TFA] <sup>-</sup> |
|                                                | 2233.91115          | [M+TFA] <sup>-</sup> |
|                                                | 2833.87275          | [M+TFA] <sup>-</sup> |
| Hexakis(1h,1h,7h-perfluoroheptoxy)phosphazene  | 2233.91115          | [M+TFA] <sup>-</sup> |
| Hexakis(1h,1h,9h-perfluorononyloxy)phosphazene | 2833.87275          | [M+TFA] <sup>-</sup> |

# FlexMix/Calmix Quality Check

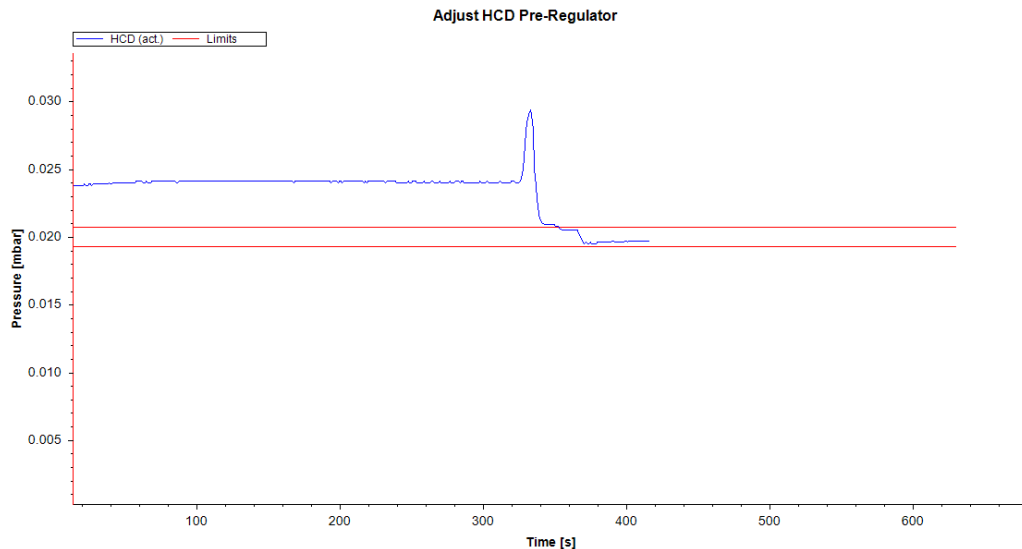
- FlexMix/Calmix quality and spray stability is checked before starting calibrations/evaluations
- Can be disabled under Control>Configuration Settings>Performance & Procedures Settings



- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Positive Ion Mode Calibrations>
  - Calibrate HCD Gas Supply
  - Wait for Spray recovery (necessary if you're starting all procedures together)
  - Spectral Mass Accuracy Calibration (pos)

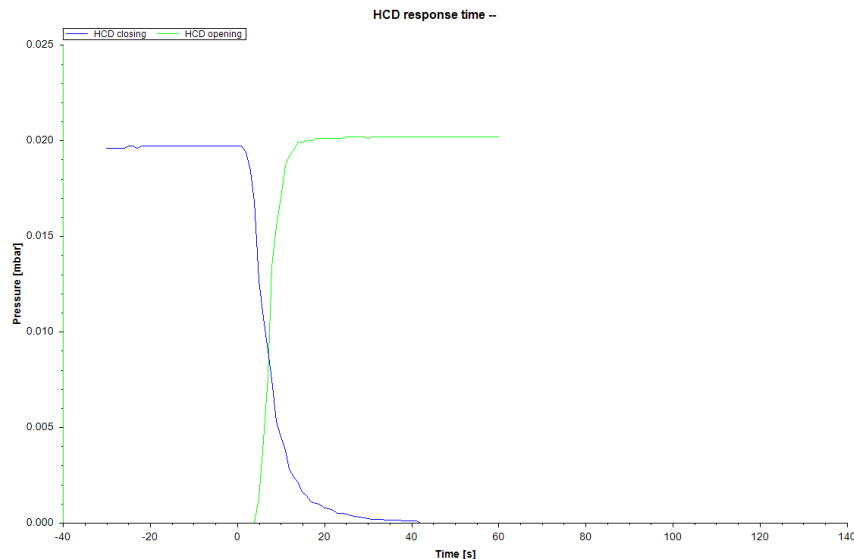
# Installation Acceptance Procedures

- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Positive Ion Mode Calibrations>Calibrate HCD gas supply
- May have to manually adjust gas regulator inside right-hand panel
- Aim between the goal posts (red lines)



# Calibrate HCD Gas Supply

- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Positive Ion Mode Calibrations>Calibrate HCD gas supply
- Evaluates gas ON/OFF rates of change

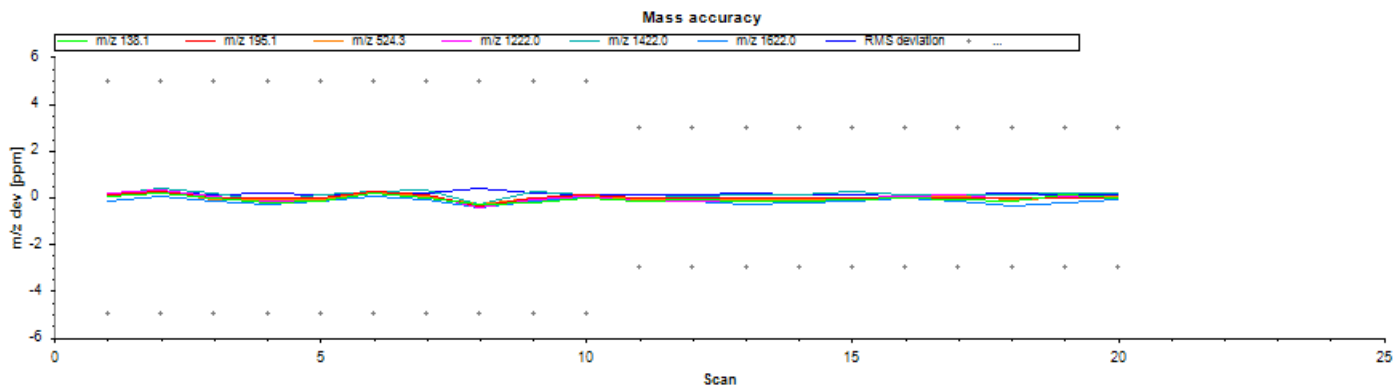


# Spectral mass accuracy calibration

- Checks  $m/z$  136, 195, 524, 1222, 1422, 1522 for mass accuracy

without lock mass

with lock mass 195.08765  $m/z$



Acceptance limit

5 ppm

3 ppm

# Installation Acceptance Procedures: System Calibration

- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Positive Ion Mode Calibrations>System Calibration (pos)

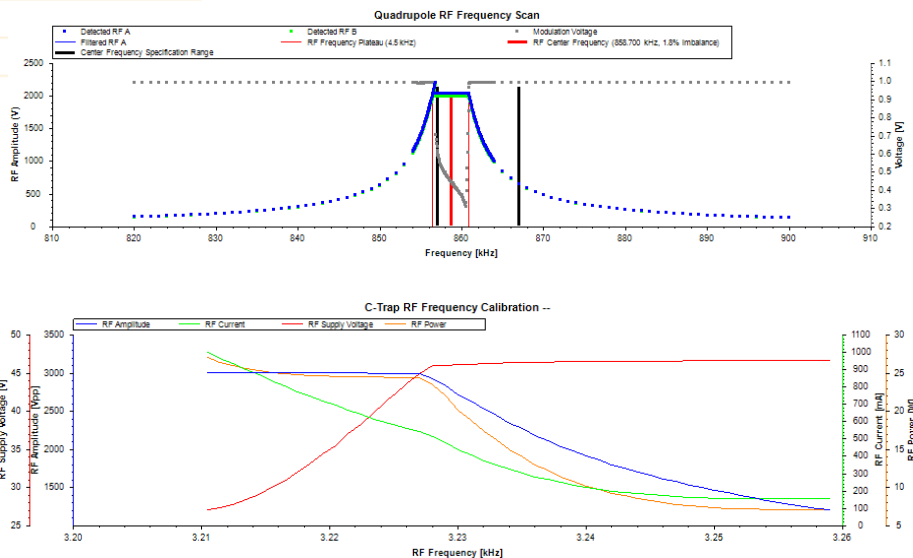
# Electronics Calibration Smart Calibration

This procedure performs all electronics calibrations if the instrument has been vented and baked out.

- ] ▲ System Calibration
- ] ▲ System Calibration (pos)
- ] ▲ Electronics Calibration Smart Calibration
- ] ▲ After Venting and Bake Out
- ] Inject Filter RF Frequency Calibration
- ] Quadrupole RF Frequency Calibration
- ] C-Trap RF Frequency Calibration

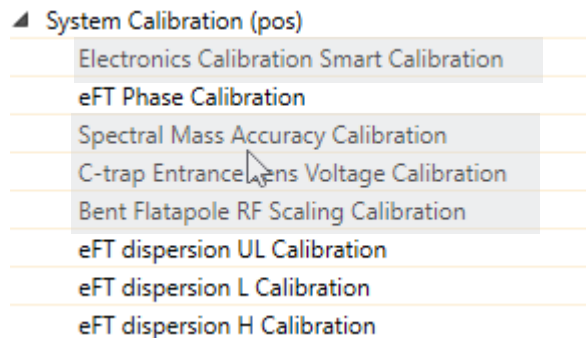
## Specifications

- Inject filter High frequency: 850 kHz-1100 kHz
- Inject filter Low frequency: 467.5 kHz-605.0 kHz
- C-Trap RF Frequency:
  - C Trap Supply voltage deviation: Value should not exceed 1 V
  - C Trap Supply voltage deviation: Value should not exceed 150 Vpp



# eFT Phase Calibration

- eFT Parameter: Determines the initial phase information



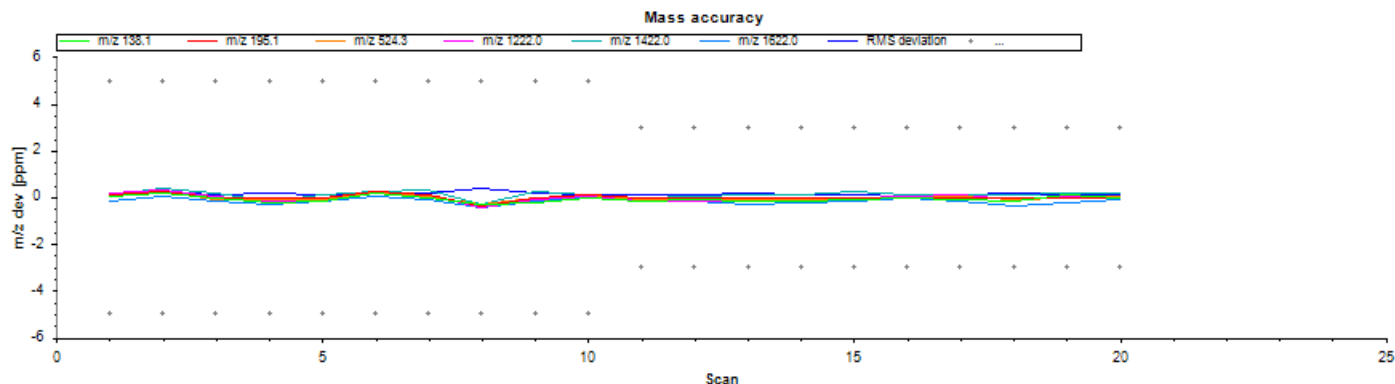
- The eFT calibration determines the theoretical starting time of the signal  $t_0$ , where all ions are in phase.
- After changing analyzer values eFT calibration is required.
- A mass calibration is always required after the eFT was calibrated.

# Spectral mass accuracy calibration

- Checks  $m/z$  136, 195, 524, 1222, 1422, 1522 for mass accuracy

without lock mass

with lock mass 195.08765  $m/z$



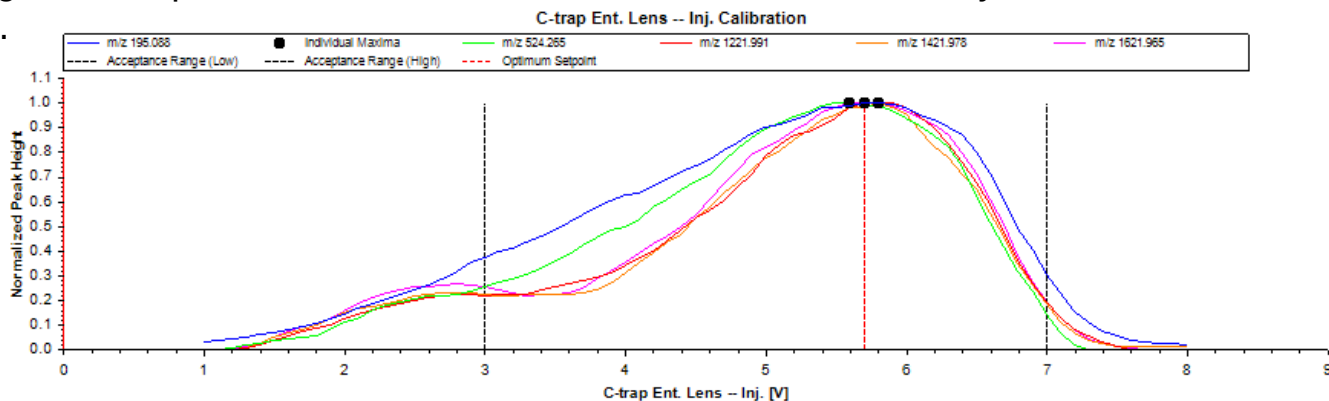
Acceptance limit

5 ppm

3 ppm

# C-Trap Entrance Lens Voltage Calibration

- This procedure calibrates or checks the C-trap Entrance Lens – Inject voltage to ensure optimal ion transmission into the C-trap.
- If Flexmix ions are present and signal is sufficient, this procedure uses Flexmix ions to calibrate or check the C-trap Entrance Lens -- Inject voltage. If Flexmix ions are not present or signal is too low, TIC will be used for the optimization.
- After a calibration using TIC, it is suggested to re-run the calibrations a second time with Flexmix to improve the calibration results.
- Since during normal operation the ions are stored in the IRM, this is only used for some of the calibrations.



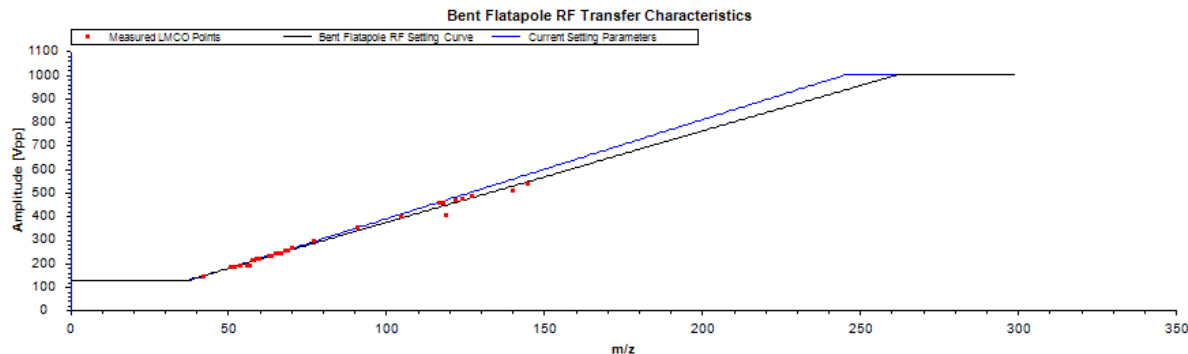
# Bent flatapole RF scaling

## Calibration:

- This procedure ramps the bent flatapole RF amplitude while tracking low  $m/z$  ion intensities.
- It determines the LMCO RF for each ion and builds a calibration curve relating first mass and RF amplitude.
- Specifications: The %RSD of  $m/z$ -normalized LMCO points must be less than 5% to ensure linearity.

## Check:

- The average transmission difference between the current (saved) bent flatapole parameters and the measured parameters cannot exceed 10% for all  $m/z$ . The absolute minimum or maximum transmission difference observed must fall within +/- 30%



## Phased ( $\phi$ ) Spectrum *Deconvolution Method* for Fourier Transform Mass Spectrometry

- Alternative to eFT
- Higher resolution at the same transient length
- Only calibrated and applied for the TMT reporter ion mass range, due to high computational demand.

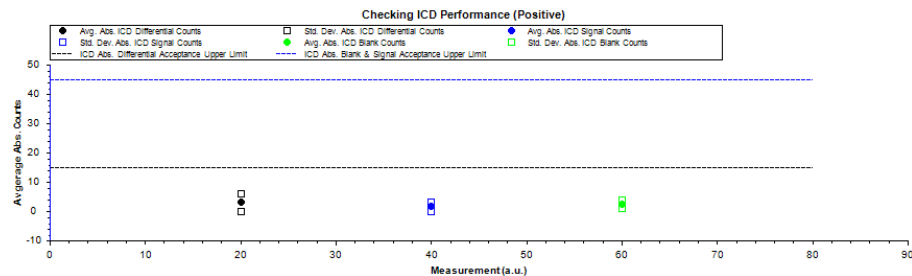
<https://pubs.acs.org/doi/abs/10.1021/acs.analchem.6b03636>

# ICD Calibration (pos)

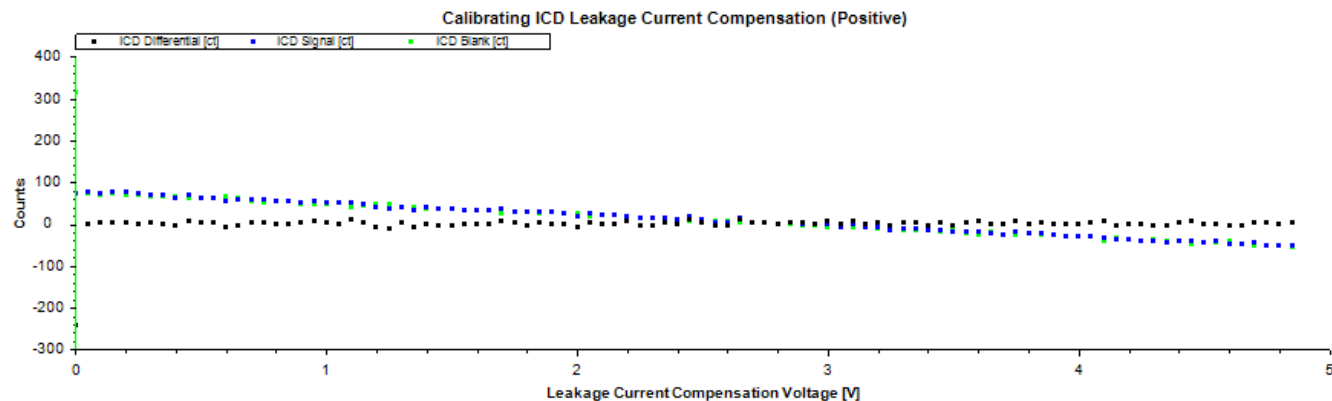
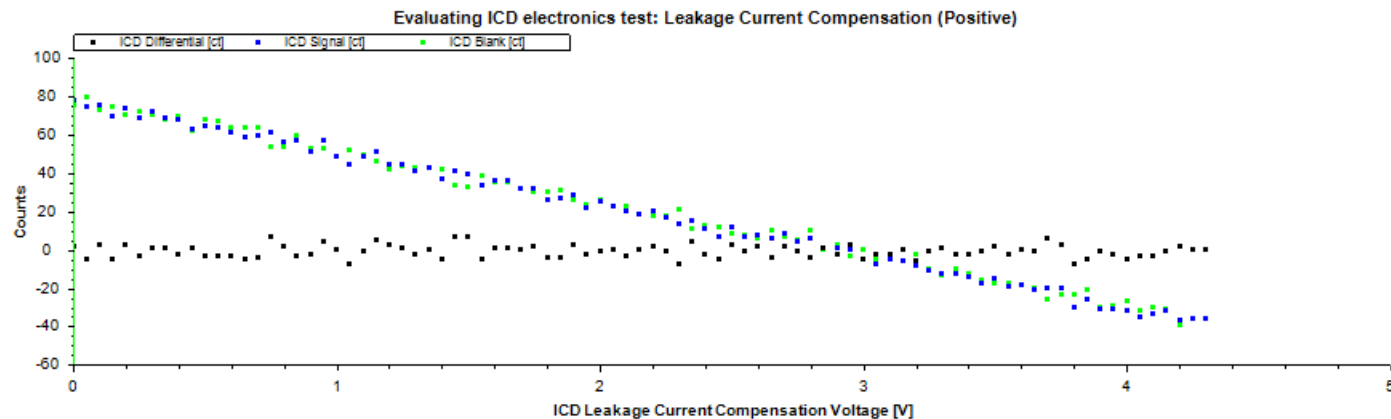
- Performs a full calibration of ICD and PrOSA, including
  - ICD Electronics Tests
  - ICD compensation voltages calibration,
  - ICD deflector voltage calibration,

# ICD/PrOSA: ICD Compensation Voltages

- This procedure calibrates or checks
  - ICD compensation voltages,
  - The cross-talk and
  - leakage current compensation voltages.
- The ICD compensation voltages ensure that other instrument voltages do not affect the ICD measurement results, and that the blank and signal measurements are not offset (i.e. 0 cts are measured for no ion current).
- If this procedure fails (during a calibration or check), PrOSA measurements are disabled. This prevents usage of PrOSA with an un-calibrated ICD. A successful calibration with all ICD-relevant procedures is required to re-enable PrOSA.

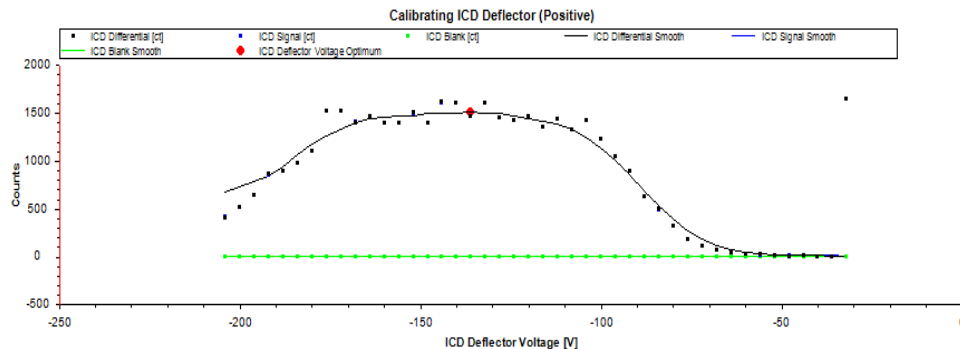


# ICD Calibration: Leakage Current



# ICD Deflector Voltage Check

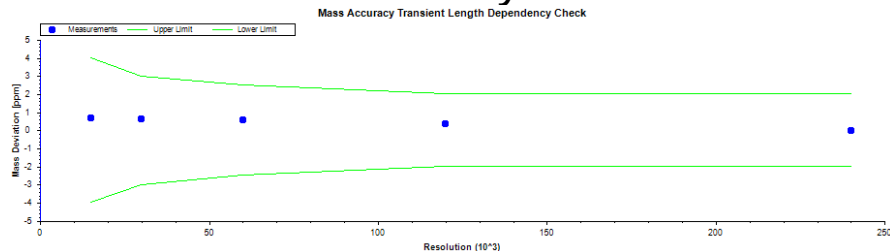
- This procedure calibrates or checks the ICD deflector voltage.
- The ICD deflector voltage is the voltage used to focus ions on the ICD electrodes during the PrOSA measurement.
- This procedure requires that the ICD compensation voltages are calibrated. If this procedure fails (during a calibration or check), PrOSA measurements are disabled.



# Mass Accuracy Transient length Dependency Calibration

- This procedure calibrates the dependency of Orbitrap transient length on mass accuracy (via the resolution setting).
- The procedure acquires mass accuracy data at resolutions spanning from 7.5 - 240k and determines the mass accuracy correction needed as a function of transient length.
- Lastly, the procedure checks if mass accuracy deviations are within specification following the calibration.

Allowable deviations in mass accuracy are resolution-dependent.



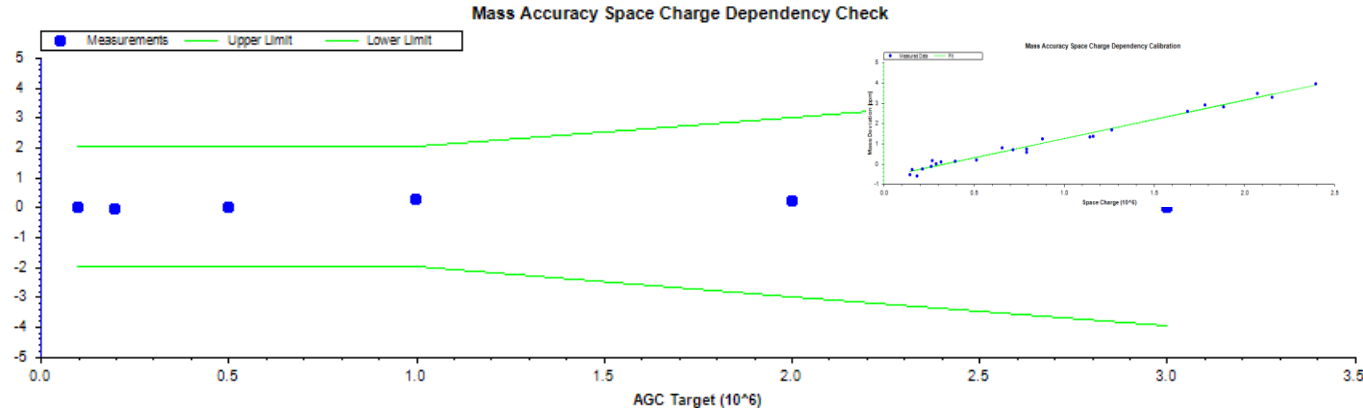
# Mass Accuracy Space charge Dependency

- This procedure calibrates the dependency of space charge in the Orbitrap on mass accuracy (via the AGC target setting).
- The procedure acquires mass accuracy data at AGC targets spanning from  $1e5$  -  $3e6$  and determines the mass accuracy correction needed as a function of AGC target.
- Lastly, the procedure checks if mass accuracy deviations are within specification following the calibration.

Allowable deviations in mass accuracy are AGC target-dependent.

Resolution | Specification [ppm]

|     |         |
|-----|---------|
| 1e5 | +/- 2.0 |
| 2e5 | +/- 2.0 |
| 5e5 | +/- 2.0 |
| 1e6 | +/- 2.0 |
| 2e6 | +/- 3.0 |
| 3e6 | +/- 4.0 |

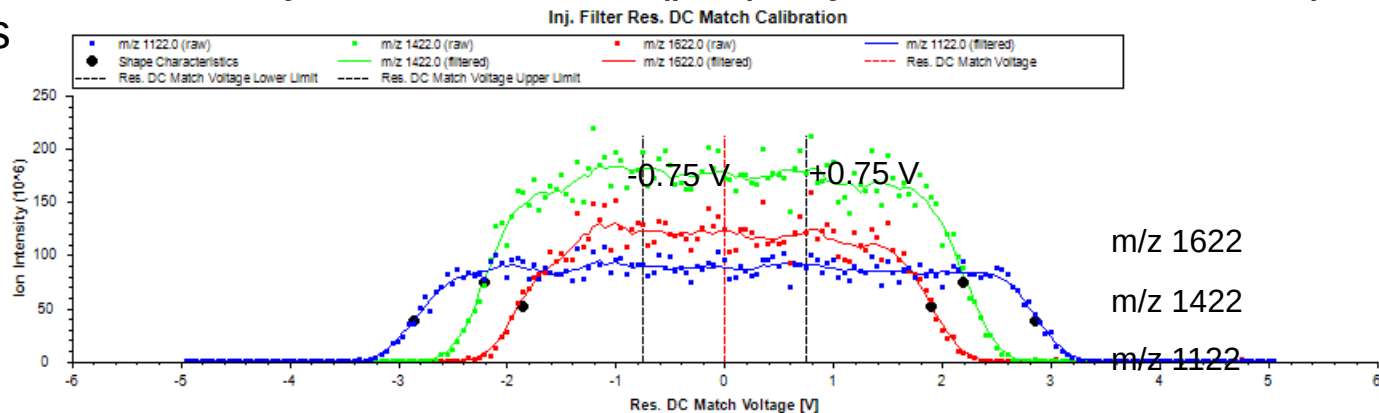


# After Venting Quadrupole Isolation Calibration (rough)

Will perform a rough calibration of the quadrupole if the instrument was vented.

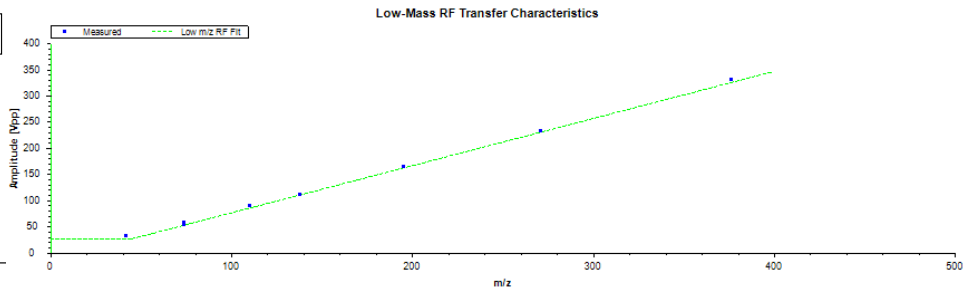
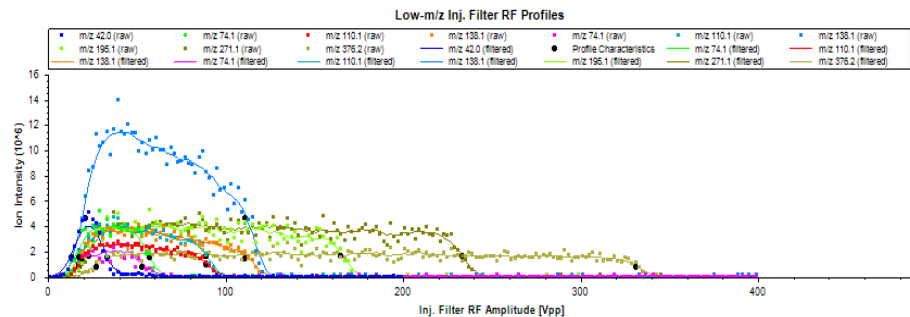
# Inject Filter Res. DC Match

- This procedure calibrates or checks the injection filter resolving DC match (or adjust) voltage.
- The match voltage ensures that the DC applied between rod pairs is matched so that no isolation width discrepancies arise when alternating injection filter rod polarity, as during normal operation.
- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Positive Ion Mode Calibrations>System Calibration(pos)>Injection Filter & Quadrupole Calibrations



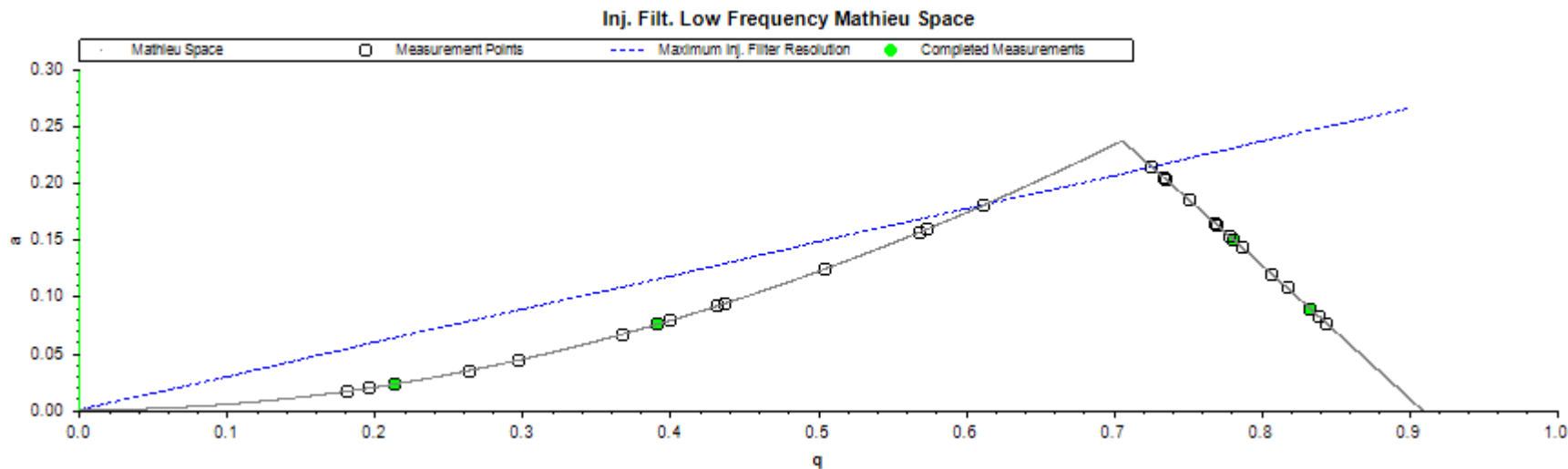
# Inject Filter Low

- This procedure calibrates or checks the injection filter low- $m/z$  RF parameters.
- The procedure measures injection filter RF profiles by scanning the injection filter RF in RF-only mode and measuring the intensity of a variety of FlexMix ions and fragments thereof under  $m/z$  400.
- The LMCO RF amplitudes for each  $m/z$ 's profile are determined.
- A linear fit of  $m/z$  and LMCO RF is executed to find the slope and offset (-5 V for safety). The offset, slope, and minimum RF amplitude are used to set the RF of the injection filter in low- $m/z$  mode (first mass <  $m/z$  149).

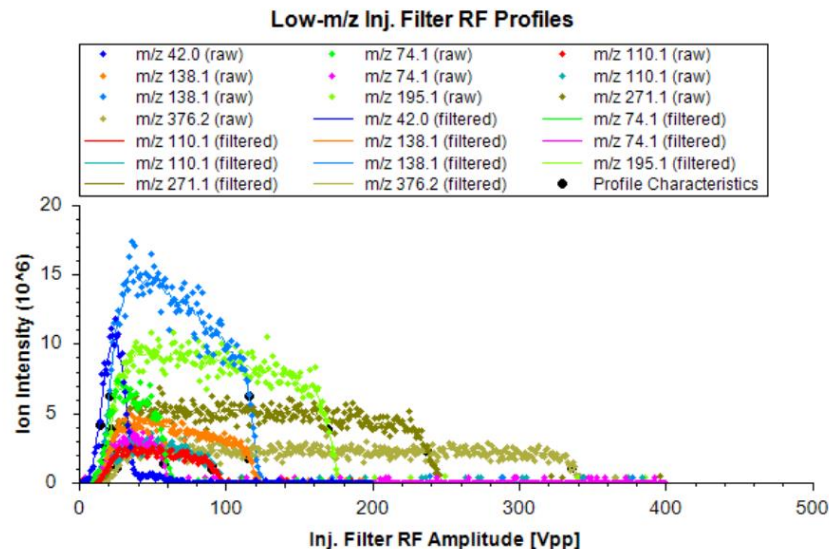


# Injection Filter Isolation Calibration

- Calibrates the inject filter in low and high frequency. This calibration is done only in positive ion mode. The calibration parameters determined are valid for both ion polarities.

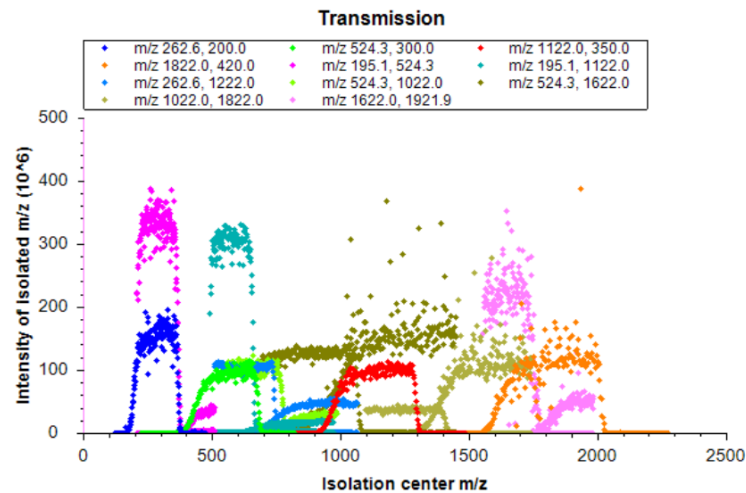
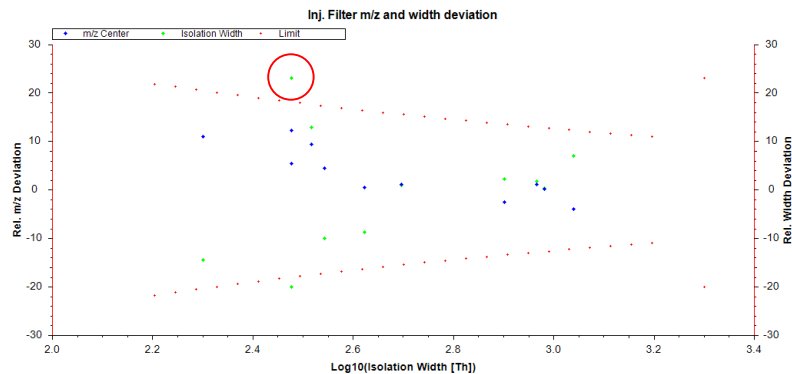


# Injection Filter Isolation Calibration



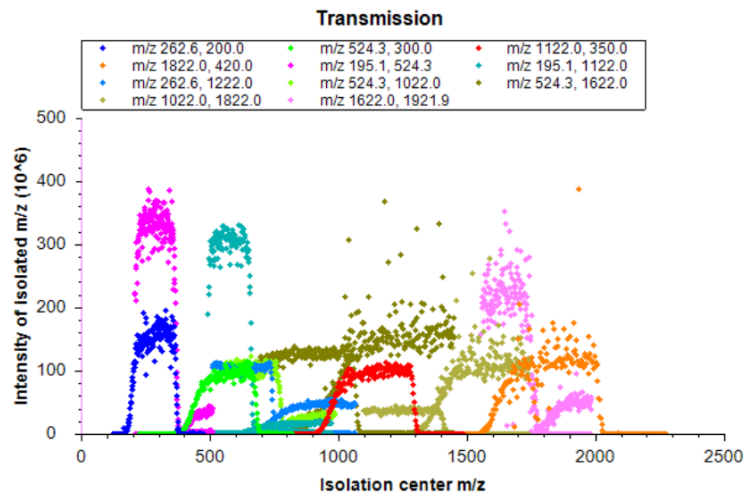
# Injection Filter Isolation Check

- Failing Calibration (below)



# Injection Filter Isolation Check

- The specifications are given by the following function:  
Center m/z and width:  $\pm(200 * \text{width}^{-0.3})$



# Injection Filter Isolation Check

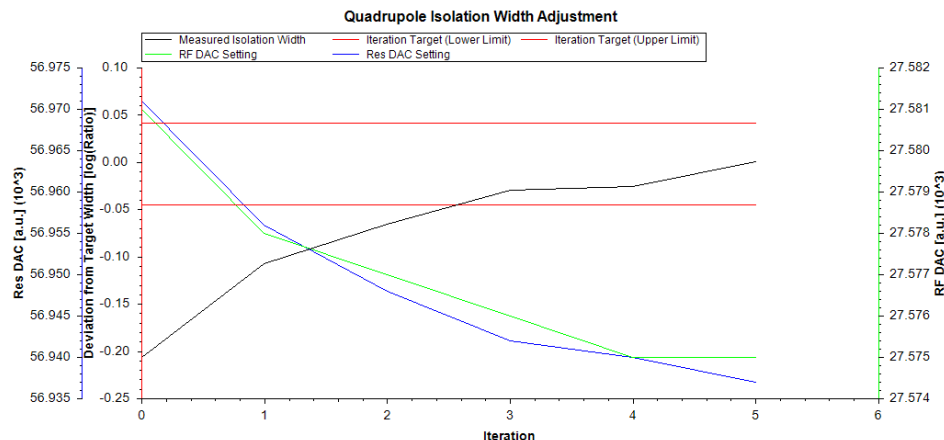
- Checks Ion Signal first
- The Injection Filter Isolation Check evaluates the injection filter isolation calibration in alternating rod polarity (normal operation mode of the injection filter) by scanning isolation profiles for several  $m/z$  and widths spanning the operational range of the instrument. The actual center  $m/z$  and width are measured and checked against specifications.
- All measurements must be within the specifications for the procedure to pass and the injection filter to be considered successfully calibrated.

# Quadrupole Isolation Calibration (wide)

- Performs the wide quadrupole isolation calibration.
- The wide calibration further refines the coarse correction coefficients by iterating to a particular isolation width.
- Together with the rough calibration, this calibration ensures quadrupole performance at isolation widths  $> 1.5$  amu.

# Quadrupole Isolation Calibration (wide)

- Instrument>Procedures>By Sequence>Factory>Initial Calibrations>Positive Ion Mode Calibrations>Injection Filter & Quadrupole Calibrations

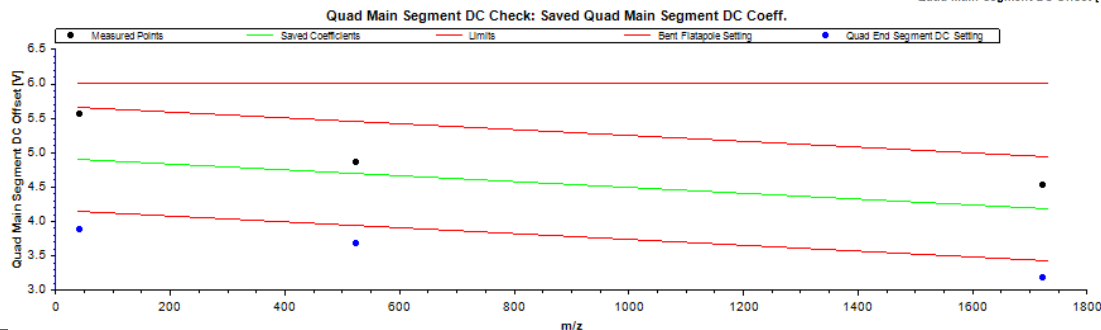
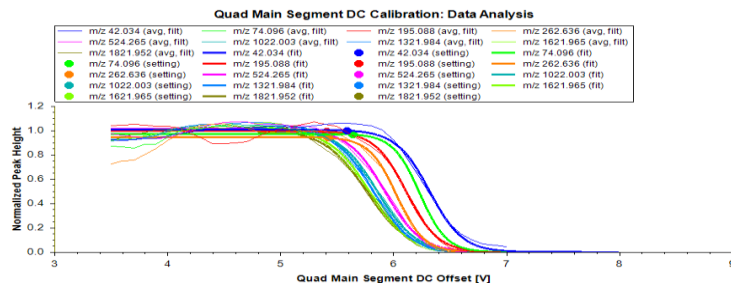
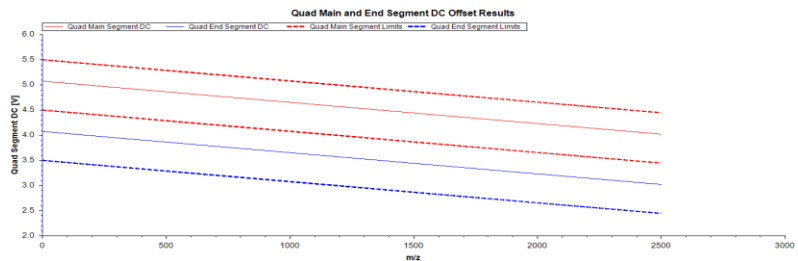


# Quad Main and End Segment DC Calibrations

- This procedure calibrates or checks the mass-dependent DC offsets of the main and end segments of the quadrupole while isolating.
- This calibration ensures that ions pass through the quadrupole with the appropriate ion energy and that no ion storage effects arise.
- A consistency check after determination of the coefficients for the main and end segments ensures that the delta voltage between quadrupole main segment and bent flatapole is smaller than the delta voltage between quadrupole end segments and bent flatapole (to prevent ion storage).
- In the check procedure, quadrupole main segment DC profiles are collected and fit for a selection of the mass list.

# Quad Main and End Segment DC Calibrations

- Instrument>Procedures>By Sequence>Factory>Initial Calibrations>Positive Ion Mode Calibrations>Injection Filter & Quadrupole Calibrations



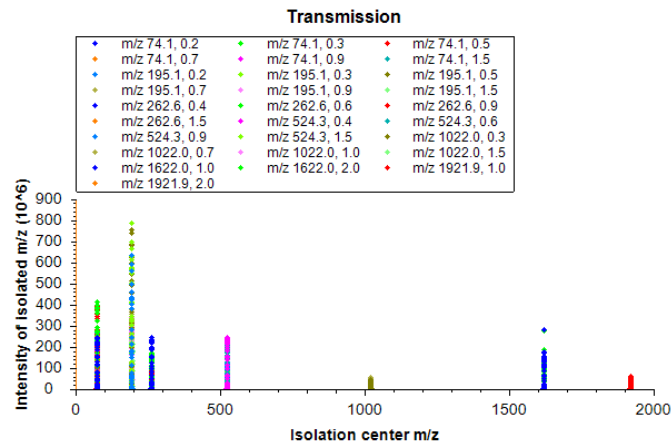
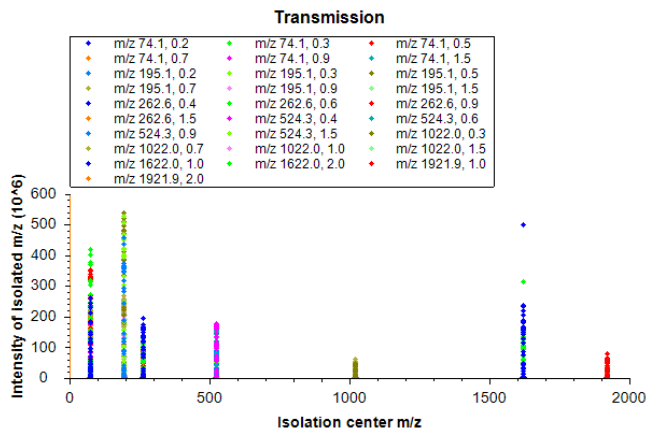
# Quadrupole Isolation Calibration (Narrow)

- Performs the narrow quadrupole isolation calibration. The calibration measures the isolation shapes for  $m/z$  spanning the mass range with widths up to 2.0 amu.
- The measured (actual) isolation center  $m/z$  and width are used to create a look-up table. The look-up table is used when quadrupole isolations from  $m/z$  50-2000, up to width 3 amu, are requested by the system.
- The coarse quadrupole isolation parameters overlap with the calibration parameters determined here between 1.5 and 3 amu.

# Quadrupole Isolation Calibration (Narrow)

- Instrument>Procedures>By Sequence>Factory>Initial Calibrations>Positive Ion Mode Calibrations>Injection Filter & Quadrupole Calibrations
- Checks in both rod polarity orientations

Quadrupole Isolation Calibration (narrow) passed: Narrow quadrupole calibration passed in both rod orientations.

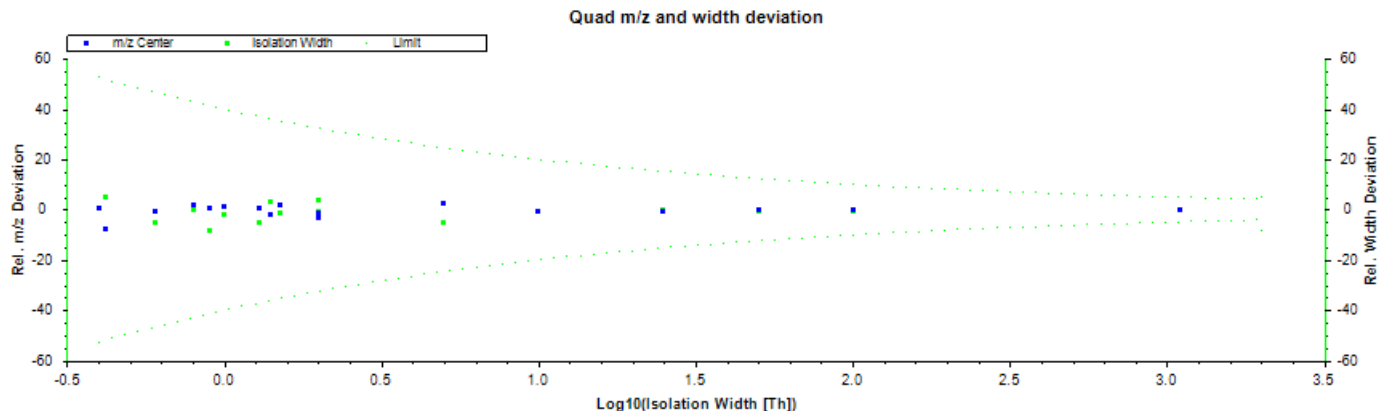


# Quadrupole Isolation Check

- The Quadrupole Isolation Check evaluates the quadrupole isolation calibration by scanning isolation profiles for several  $m/z$  and widths spanning the operational range of the instrument
- for both rod orientations
- The actual center  $m/z$  and width are measured and checked against specifications.
- All measurements, for both rod orientations, must be within the specifications for the procedure to pass and the quadrupole to be considered successfully calibrated.

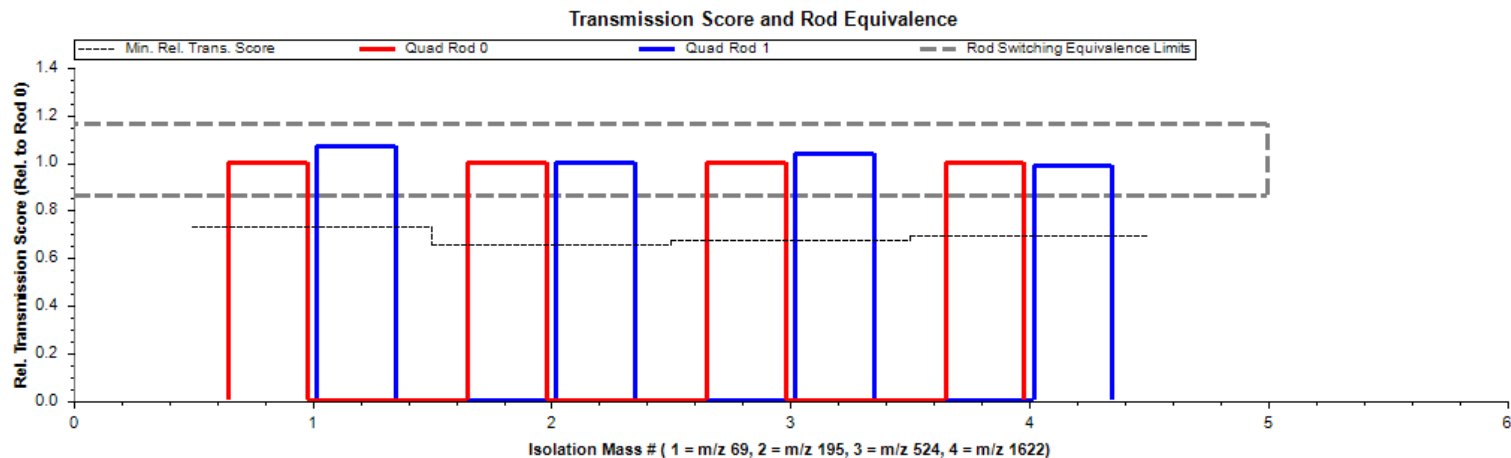
# Quadrupole Isolation Check (Quad Isolation Eval)

- Instrument>Procedures>By Sequence>Factory>Initial Calibrations>Positive Ion Mode Calibrations>Injection Filter & Quadrupole Calibrations
- Checks in both rod polarity orientations



# After Venting Quad Transm./Rod config. Smart Cal.

- This procedure, executed only after the instrument is vented and baked out, calibrates quadrupole transmission and rod polarity, and runs additional quadrupole calibrations if necessary.

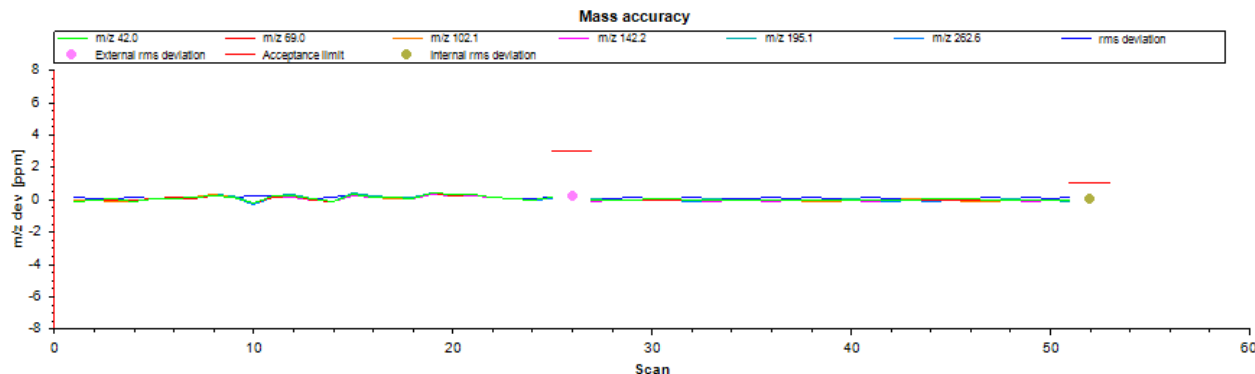


# Low m/z Spectral mass accuracy calibration

- Checks m/z 42, 69, 102, 142, 195, 262 for mass accuracy

without lock mass

with lock mass 69.04472 m/z



Acceptance limit

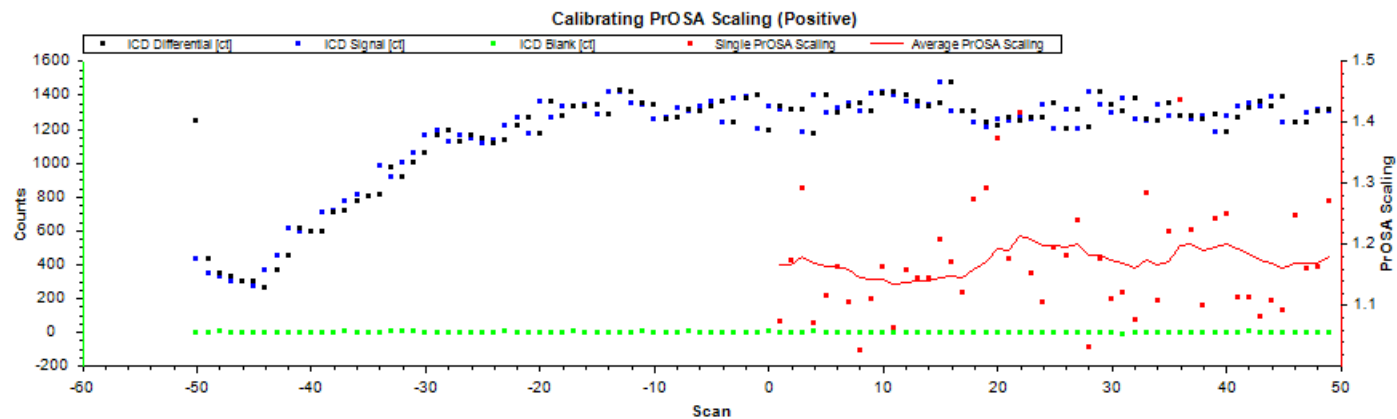
3 ppm

1 ppm

# ICD PrOSA Scaling

- This procedure calibrates or checks the ICD PrOSA Scaling Factor.
- The ICD PrOSA Scaling Factor is the ratio between the signal detected by the ICD and the signal detected by the Orbitrap under "clean" FlexMix conditions.
- This factor is used when PrOSA is enabled to support automatic gain control.
- Every 5 - 10 s, a PrOSA measurement is conducted during an analytical measurement to determine if the detection ratio of ICD to Orbitrap has changed relative to the factor determined here. If so, Orbitrap injection times are adjusted to prevent overfilling or underfilling of the C-trap and Orbitrap.
- This procedure requires that the ICD compensation and deflector voltages are calibrated. If this procedure fails (during a calibration or check), PrOSA measurements are disabled.

# ICD ProSA Scaling Check



# ICD PrOSA Scaling Calibration

- ⌚ Upon success of the calibration, PrOSA will be enabled for all measurements in this polarity. Start with ICD Electronics Tests for statistics, currently does not affect calibration.

# Positive Ion Mode Evaluations

|                                    |                                                    |
|------------------------------------|----------------------------------------------------|
| ▲ Positive Ion Mode evaluations    | 1;;Positive Ion Mode evaluations                   |
| ▶ System Check (pos)               | 1;;System Check (pos)                              |
| Q Transmission Eval                | 1;;Q Transmission Eval                             |
| Quadrupole Isolation Shape Check   | 1;;Quadrupole Isolation Shape Check                |
| HCD Fragmentation and Trapping Eff | 1;;HCD Fragmentation and Trapping Efficiency Check |
| HCD Axial Field Evaluation         | 1;;HCD Axial Field Evaluation                      |
| HCD RF Amplitude Evaluation        | 1;;HCD RF Amplitude Evaluation                     |
| HCD Trapping Gas Evaluation        | 1;;HCD Trapping Gas Evaluation                     |
| Isotope Ratio Check                | 1;;Isotope Ratio Check                             |
| Cluster Evaluation                 | 1;;Cluster Evaluation                              |

# Quadrupole Transmission Evaluation

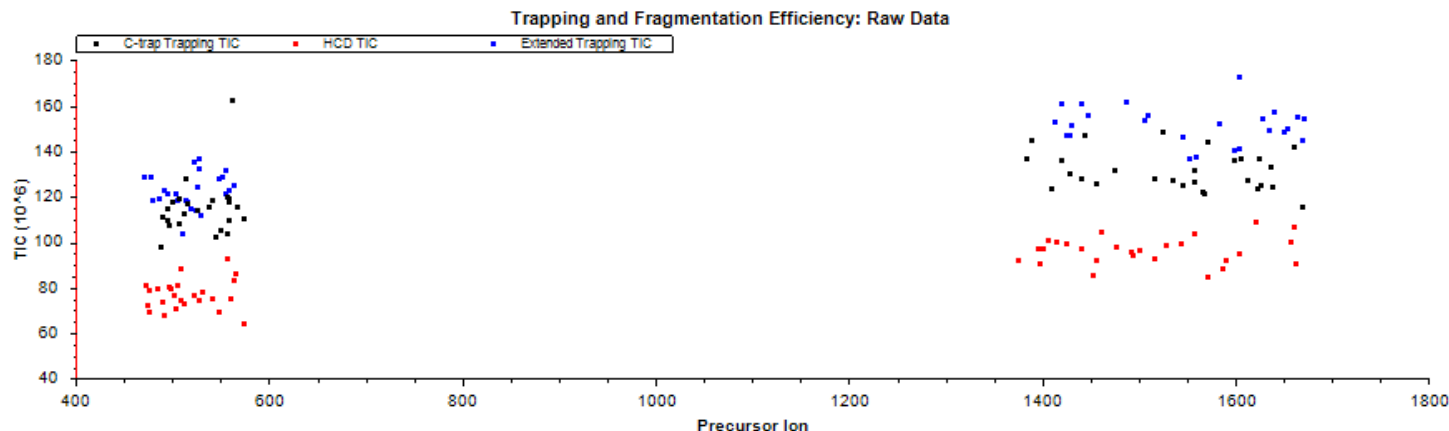
- This procedure evaluates the intensity loss due to quadrupole isolation relative to RF-only mode in both quadrupole rod configurations
- The calibration determines which quadrupole rod configuration results in the least intensity losses and selects this as the primary quadrupole rod configuration.
- The evaluation reports but does not apply the primary quadrupole rod configuration
- If Quad Rod Switching is configured, the cumulative quadrupole transmission score each rod configuration for each isolation center mass are compared. If all scores differ by no more than 15%, the quadrupole is suitable for rod switching applications

# Quadrupole Isolation Shape Check

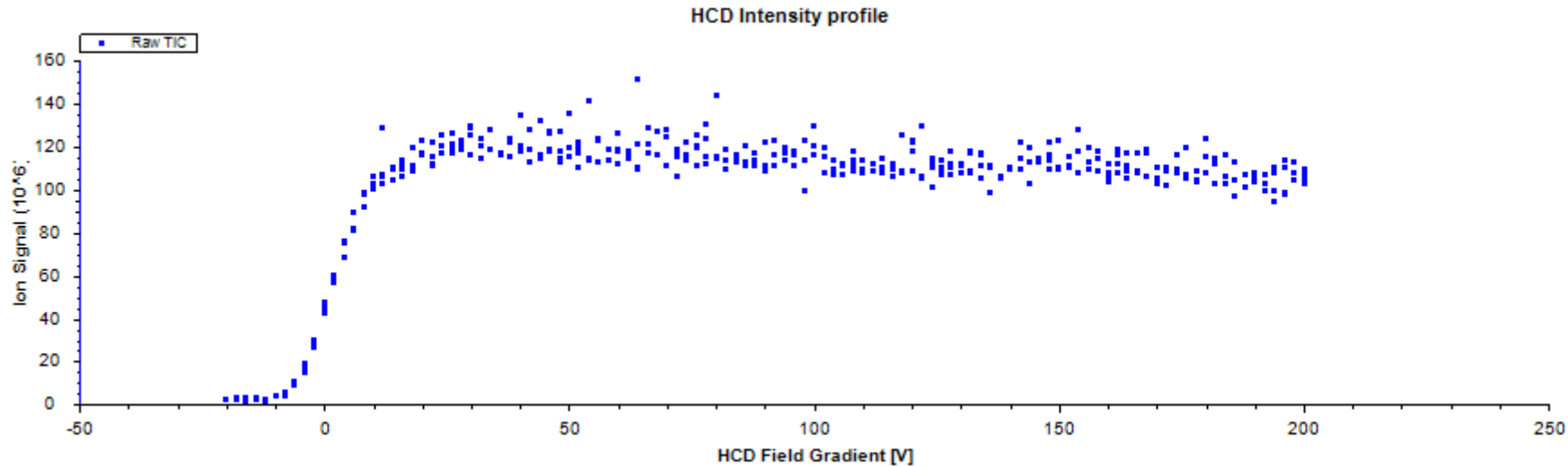
- The Quadrupole Isolation Shape Check is not supported anymore and available in “service” level only in 1.0

# HCD Fragmentation and Trapping Efficiency Check

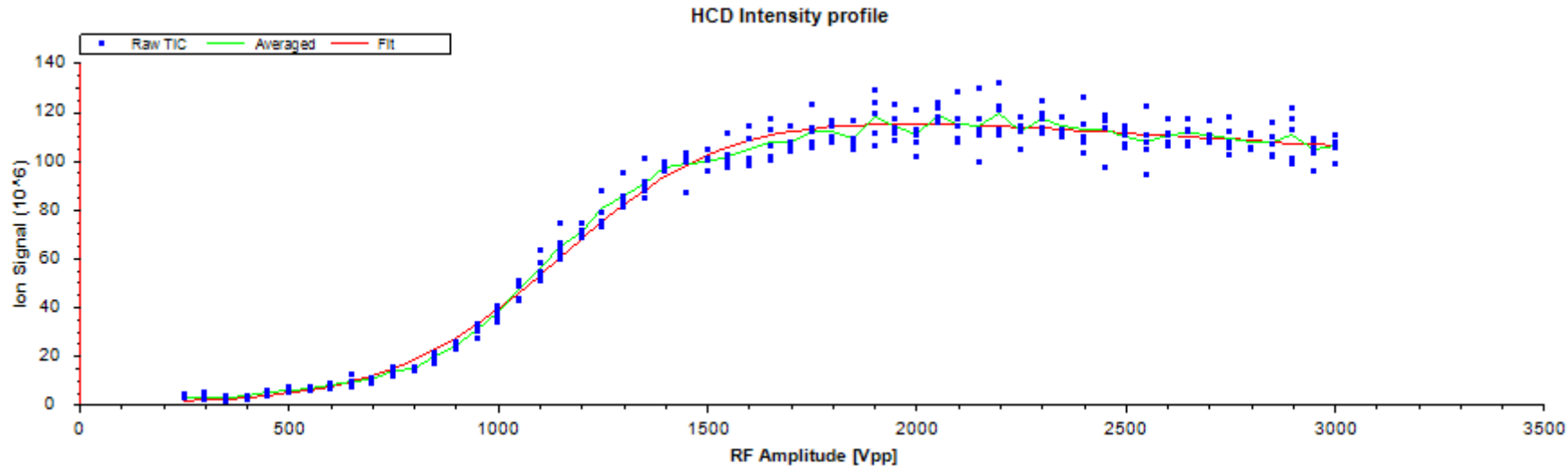
- This procedure checks the trapping and fragmentation efficiency in C-trap trapping, extended trapping (2 eV), and HCD fragmentation modes.
- The HCD fragmentation spectra are compared for similarity against gold standard HCD spectra and spectral distribution rules are checked.



# HCD Axial Field Evaluation



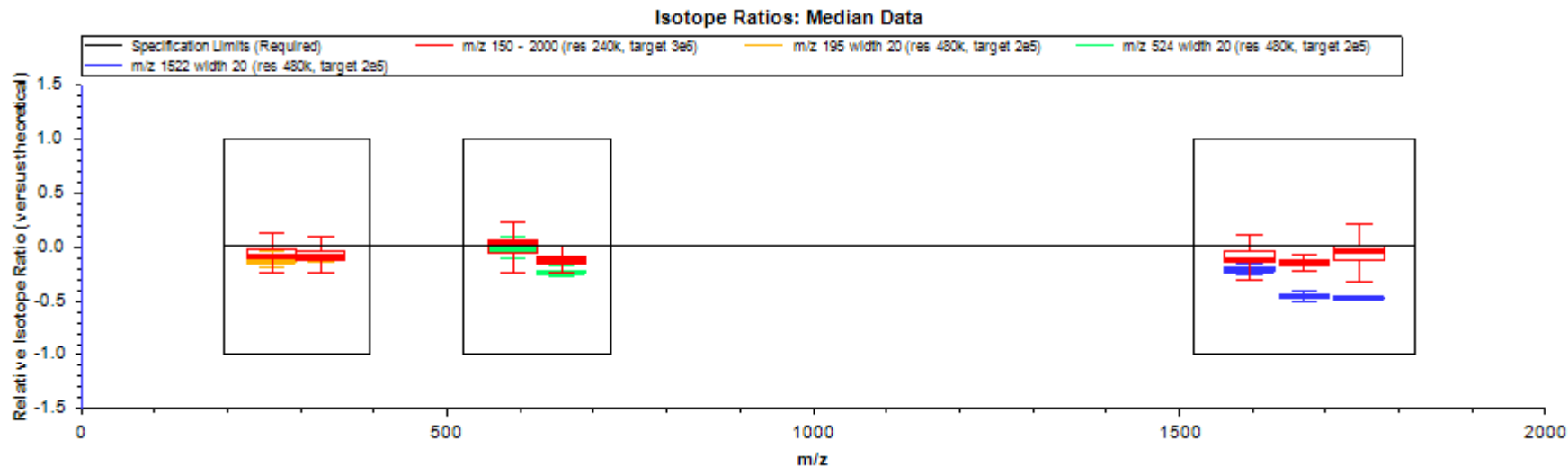
# HCD RF Amplitude Evaluation



- Evaluates the HCD Trapping Gas fragmentation influence

# Isotope Ratio Check

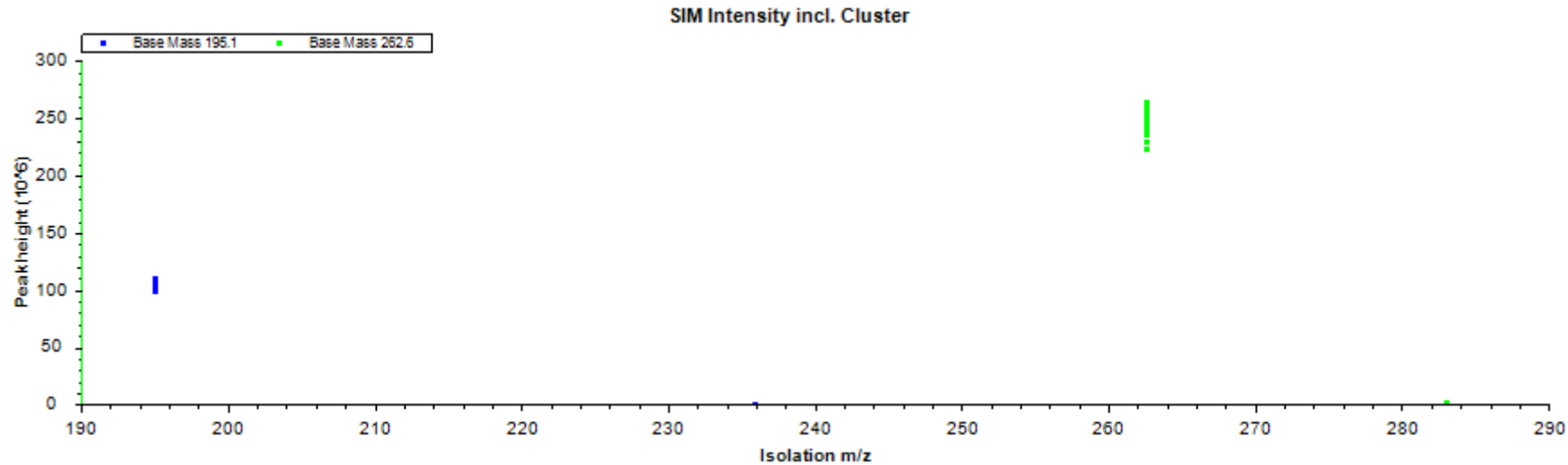
- Checks Isotopic Ratios



# Cluster Evaluation

- Checks for (absence of) acetonitrile clusters of Flexmix peaks:
- 195 (236, <3% of 195)
- and 262 (283, <10% of 262)

# Cluster Evaluation



# Neg. Mode Calibration: Internal Calibrant Calibration

- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Negative Ion Mode Calibrations>System Calibration(neg)>
- ICS Active HV Current Calibration
- ICS Switch-on HV Current Calibration

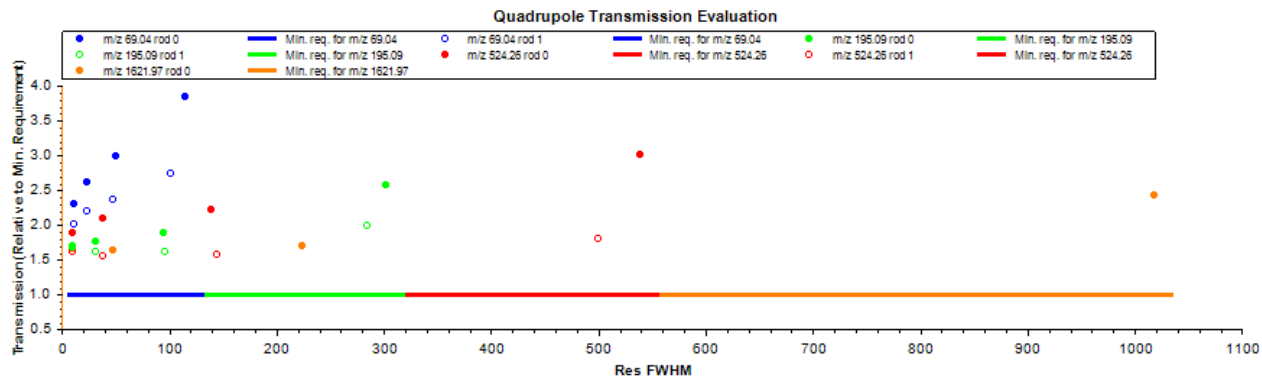
# Neg. Mode Check:

- Instrument>Procedures>By Sequence>Service>Installation Acceptance>Negative Ion Mode Evaluation>System Check(neg)>
- ICS Switch-on HV Time Evaluation (neg)
- ICS Switch-off HV Time Evaluation (neg)

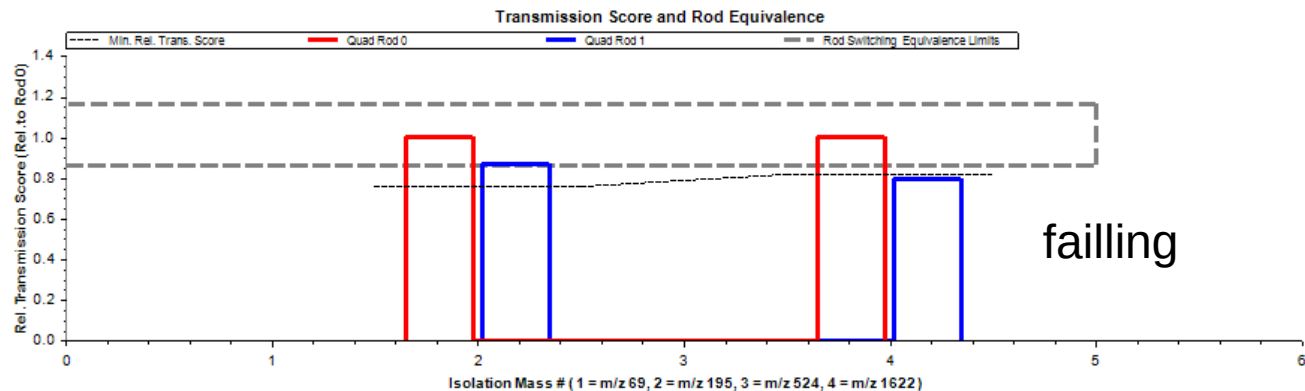
# Troubleshooting

|                                       |                                                    |                                       |                                                    |
|---------------------------------------|----------------------------------------------------|---------------------------------------|----------------------------------------------------|
| ▲ Troubleshooting                     | 1;;Troubleshooting                                 | ▲ By Symptom                          | 1;;By Symptom                                      |
| ▲ By Topic                            | 1;;By Topic                                        | ▲ No Ion Signal                       | 1;;No Ion Signal                                   |
| Readback and voltage check            | 1;;Readback and voltage check                      | Readback and voltage check            | 1;;Readback and voltage check                      |
| Lens and Multipole Connectivity Check | 1;;Lens and Multipole Connectivity Check           | Lens and Multipole Connectivity Check | 1;;Lens and Multipole Connectivity Check           |
| ▲ Ion Detection                       | 1;;Ion Detection                                   | ▲ Low MS1 Intensity                   | 1;;Low MS1 Intensity                               |
| Harmonics evaluation                  | 1;;Harmonics evaluation                            | Readback and voltage check            | 1;;Readback and voltage check                      |
| Long Term Mass Accuracy               | 1;;Long Term Mass Accuracy                         | Lens and Multipole Connectivity Check | 1;;Lens and Multipole Connectivity Check           |
| Signal to Noise Evaluation            | 1;;Signal to Noise Evaluation                      | Discharge Evaluation (Medium)         | 1;;Discharge Evaluation (Medium)                   |
| FT Transmission Evaluation (pos)      | 1;;FT Transmission Evaluation (pos)                | Orbitrap Transient Decay Diagnostic   | 1;;Orbitrap Transient Decay Diagnostic             |
| Orbitrap Transient Decay Diagnostic   | 1;;Orbitrap Transient Decay Diagnostic             | FT Transmission Evaluation (pos)      | 1;;FT Transmission Evaluation (pos)                |
| Side Band Detection                   | 1;;Side Band Detection                             | ▲ Low MS2 Intensity                   | 1;;Low MS2 Intensity                               |
| ▲ Performance Checks                  | 1;;Performance Checks                              | Readback and voltage check            | 1;;Readback and voltage check                      |
| Q Transmission Eval                   | 1;;Q Transmission Eval                             | Lens and Multipole Connectivity Check | 1;;Lens and Multipole Connectivity Check           |
| Q Isolation Eval                      | 1;;Q Isolation Eval                                | Q Isolation Eval                      | 1;;Q Isolation Eval                                |
| HCD Fragmentation and Trapping Eff    | 1;;HCD Fragmentation and Trapping Efficiency Check | Q Transmission Eval                   | 1;;Q Transmission Eval                             |
| ▲ Charging Diagnostics                | 1;;Charging Diagnostics                            | HCD Fragmentation and Trapping Eff    | 1;;HCD Fragmentation and Trapping Efficiency Check |
| Charge-up Evaluation (Mild)           | 1;;Charge-up Evaluation (Mild)                     | Quadrupole Maintenance Check          | 1;;Quadrupole Maintenance Check                    |
| Discharge Evaluation (Medium)         | 1;;Discharge Evaluation (Medium)                   |                                       |                                                    |
| Charging Evaluation (Aggressive)      | 1;;Charging Evaluation (Aggressive)                |                                       |                                                    |
| Quadrupole Maintenance Check          | 1;;Quadrupole Maintenance Check                    |                                       |                                                    |
| ▲ By Symptom                          | 1;;By Symptom                                      |                                       |                                                    |

# Quadrupole Transmission Evaluation



Final picture:



# Quadrupole Maintenance Check

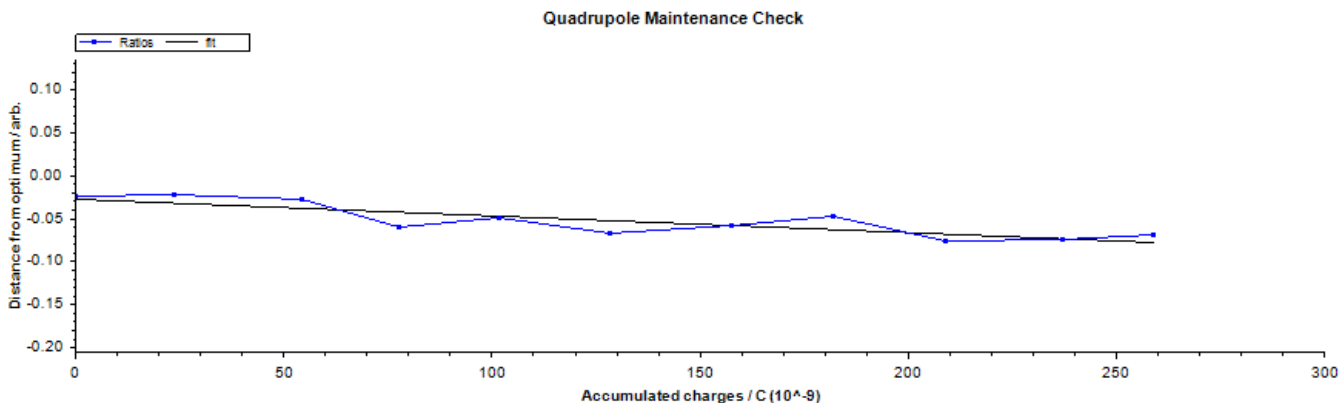
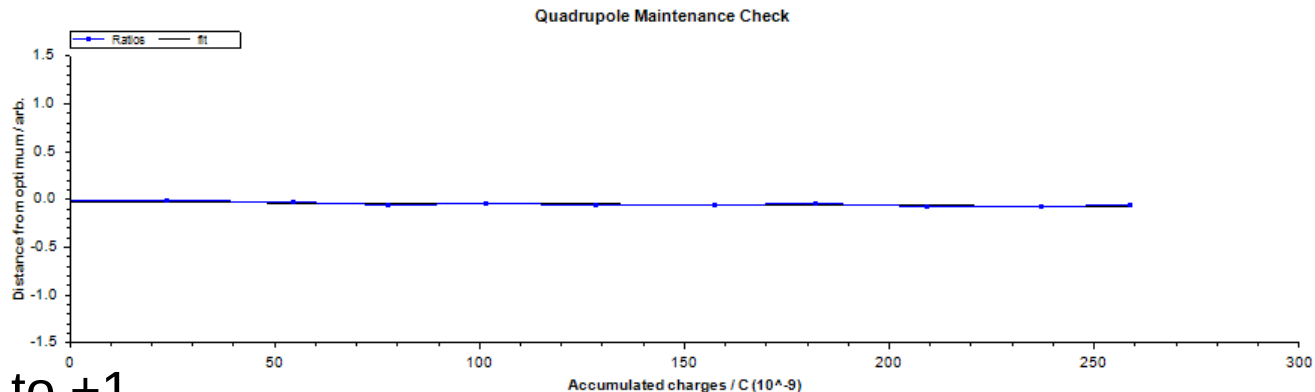
- This check tries to charge up potential contamination inside the quadrupole.
- It uses ions of both polarities, so
  - stable and bright spray is required
  - recommended to set the source gases and temperatures to the same levels in positive and negative ion mode.
- On a clean quadrupole, no charge can be deposited, so the plot will show a straight line. With increasing contamination of the quadrupole, the plot will start showing a slope. This is expected and to a certain level tolerated by the instrument.
- Once the fail threshold is reached the quadrupole should be cleaned. The cycle time between two cleanings depends strongly on the sample type and the sample amount injected.
- procedures takes less than 10 min

# Quadrupole Maintenance Check

Optimal Value: 0

Acceptance Range: -1 to +1

Available for  
customers in Orbitrap  
Exploris Tune

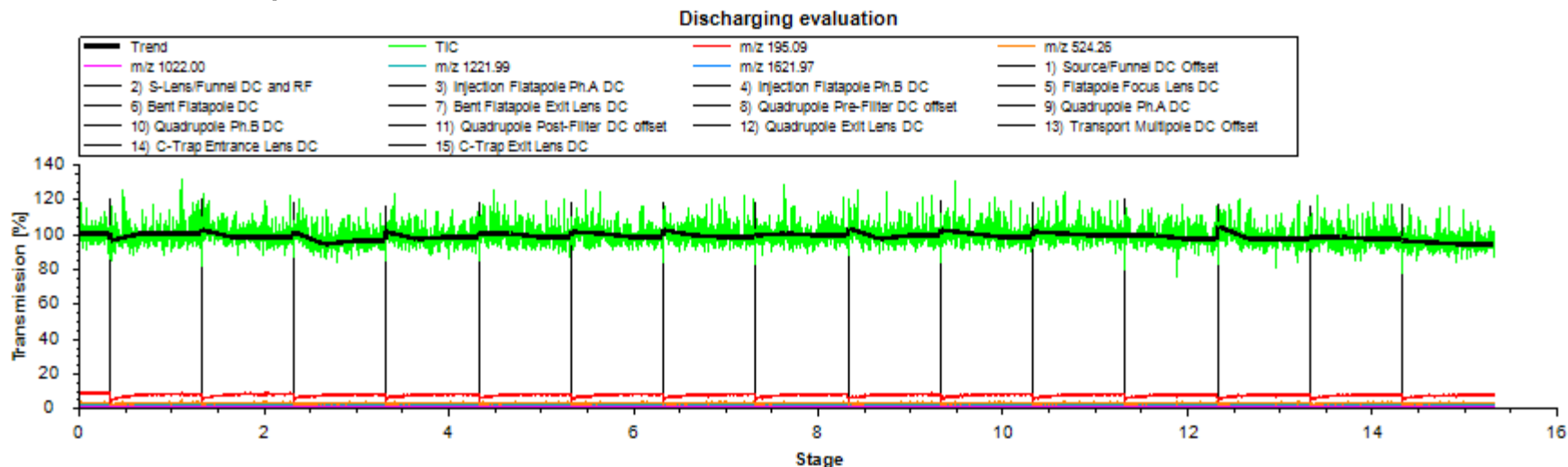


# Charging Evaluation (Mild)

From Source to C-Trap actively charges ion optical elements (pos. Ions) and subsequently evaluates transmission trend.

# Charging Evaluation (Medium)

- From Source to C-Trap actively discharges system (neg. ions) and subsequently evaluates transmission trend
- Ion optics Maintenance Check in Orbitrap Exploris Tune (available for customer)

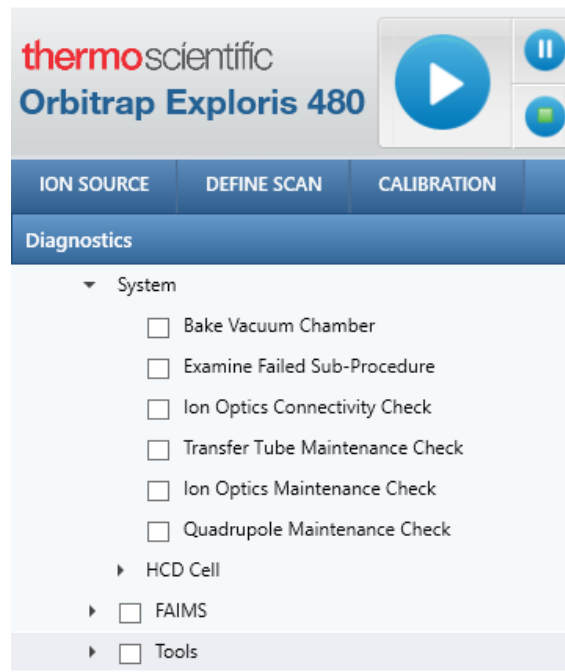


# Charging Evaluation (Aggressive)

From Source to C-Trap, discharges system (neg. Ions), actively charges ion optical elements (pos. Ions) and subsequently evaluates transmission trend

# Orbitrap Exploris Tune Diagnostics

- Available for customer



# Orbitrap Exploris Tune Diagnostics

- Bake Vacuum Chamber
- Examine Failed Sub-Procedure: Restarts procedures which were failing in the System calibration or check only.
- Ion Optics connectivity Check: See Lens connection test
- Transfer Tube Maintenance Check: Checks Fore Vacuum pressure
- Ion optics Maintenance Check: See Discharging Evaluation (Medium) but stops at Bent flatapole exit lens
- Quadrupole Maintenance Check (See Quadrupole Maintenance Check in SDT)