

10.15 - 10.45 WP1. Theory, instrument overview and status
10.45 – 11.15 WP1. IMS Electronics & IMS Mechanical design

11.15 – 11.45 Coffee break

11.45 – 12.15 WP2. Implementation of CAD, ECD, HECD, UV, IR, PD, and EID MS/MS techniques in Omnitrap

12.15-12.45 WP3. Development and application of H-atom bombardment techniques

12.45-13.45 Lunch

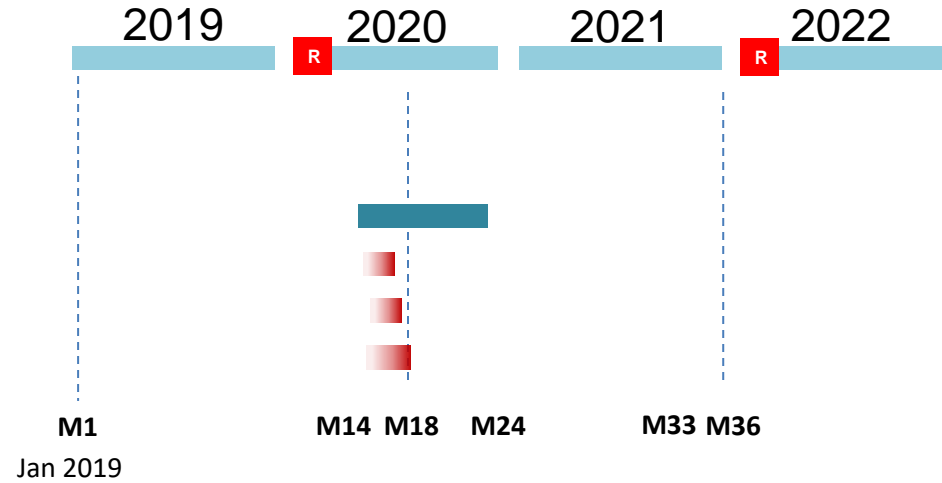
13.45-14.15 WP4. Development and application of Coulomb explosion MS/MS technique

WP2 – Implementation of Activation Techniques

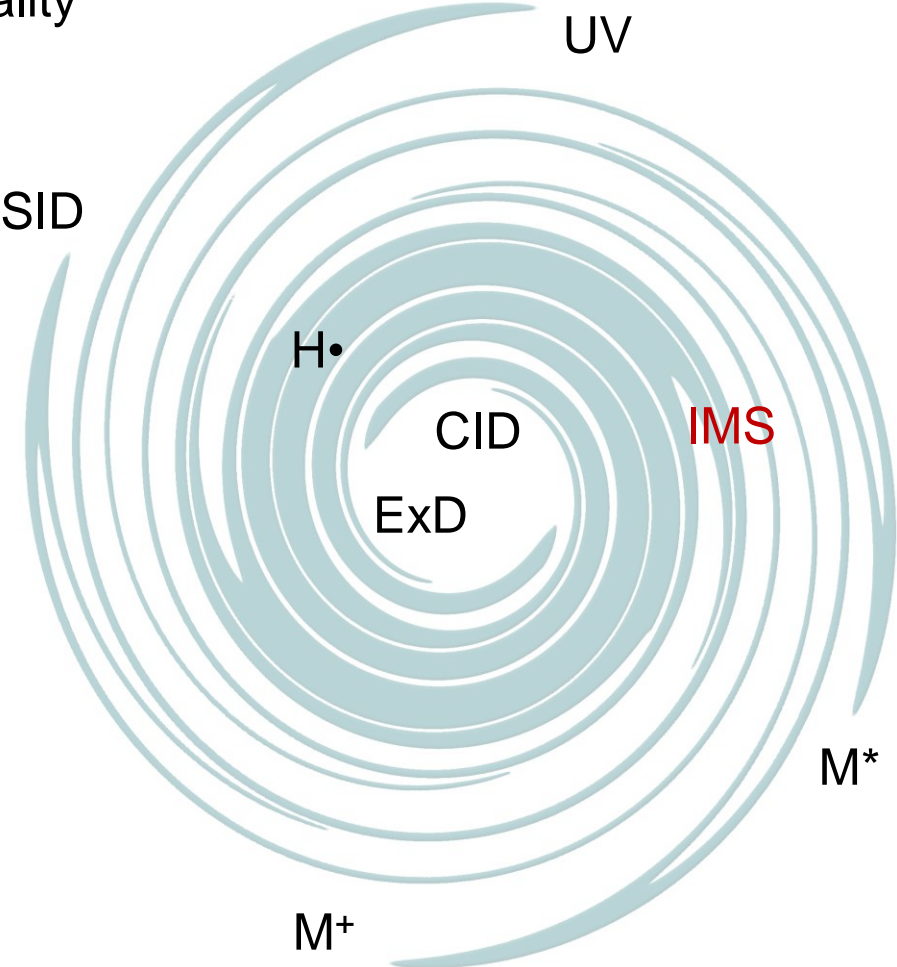
D2.1 – Ion Isolation

D2.2 – CID

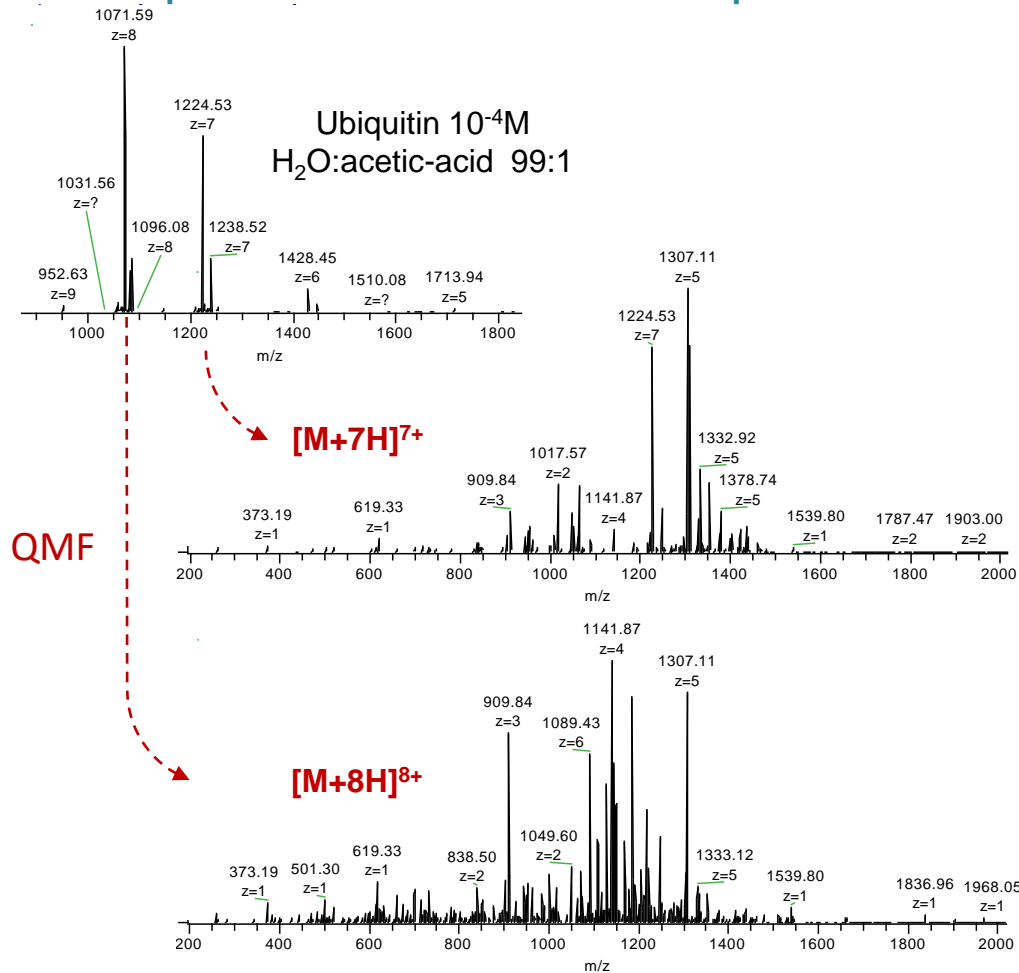
D2.3 – ECD, HAB & CED



Omnitrap Functionality



WP2 – Implementation of Activation Techniques



Collision Induced Dissociation

Slow heating CID parameters:

RF: 100V_{op} - 600KHz

$\omega_{exc} = 39.75\text{KHz} - 125\text{mV}_{op}$ (q~0.15)

20ms excitation in Ar gas pulse

63% residue cleavage

18% fragments explained

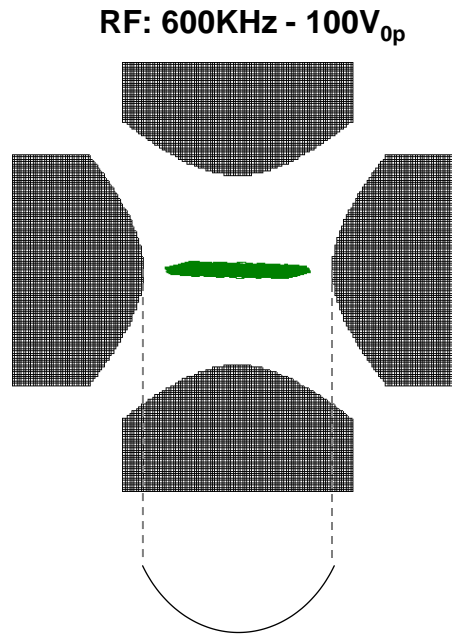
N M|Q|I|F|V|K|T|L|L|T|G|K|T|I|I|T|L|L|E|V|E|P|S|D|T|I|L|E|N 25
 26 V|K|A|K|I|Q|D|K|E|G|I|P|P|D|Q|Q|R|L|I|F|A|G|K|Q|L 50
 51 E|D|G|R|T|L|S|D|Y|N|I|Q|K|E|S|T|L|H|L|V|L|R|L|R|G 75
 76]G C

77% residue cleavage

11% fragments explained

N M|Q|I|F|V|K|T|L|L|T|G|K|T|I|I|T|L|L|E|V|E|P|S|D|T|I|L|E|N 25
 26]V|K|A|K|I|Q|D|K|E|G|I|P|P|D|Q|Q|R|L|I|F|A|G|K|Q|L 50
 51 E|D|G|R|T|L|S|D|Y|N|I|Q|K|E|S|T|L|H|L|V|L|R|L|R|G 75
 76 G C

WP2 – Implementation of Activation Techniques



Ubiquitin
 [M+8H]⁸⁺
 m/z=1071.61

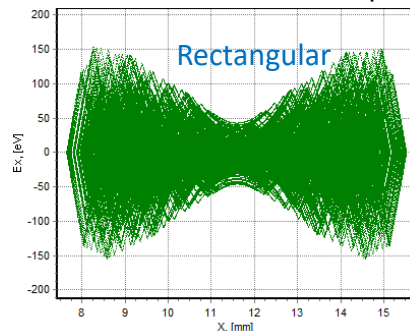
Effective potential

$$D_{\text{rec}} = 0.411 q_z V_{0p}$$

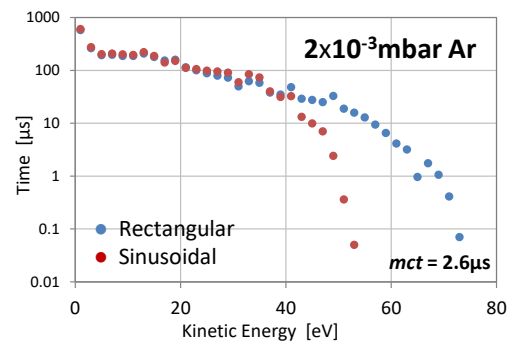
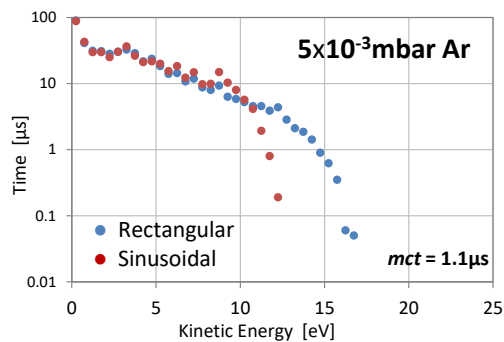
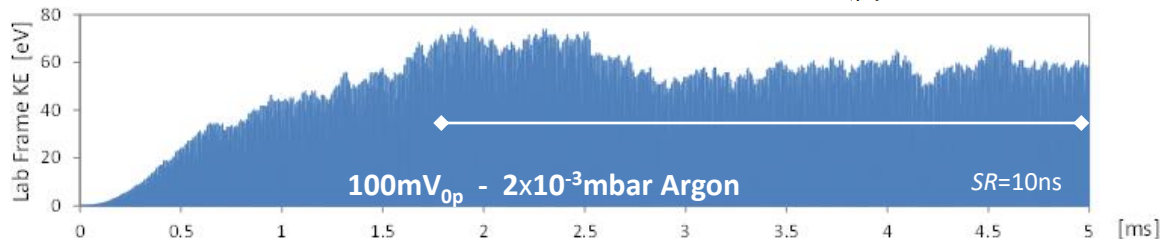
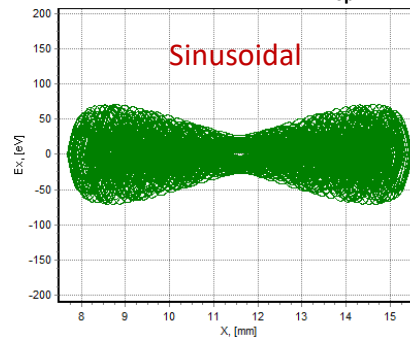
$$D_{\text{sin}} = 0.250 q_z V_{0p}$$

Collision Induced Dissociation

q=0.15: $\omega=41.5\text{KHz} - 50\text{mV}_{0p}$

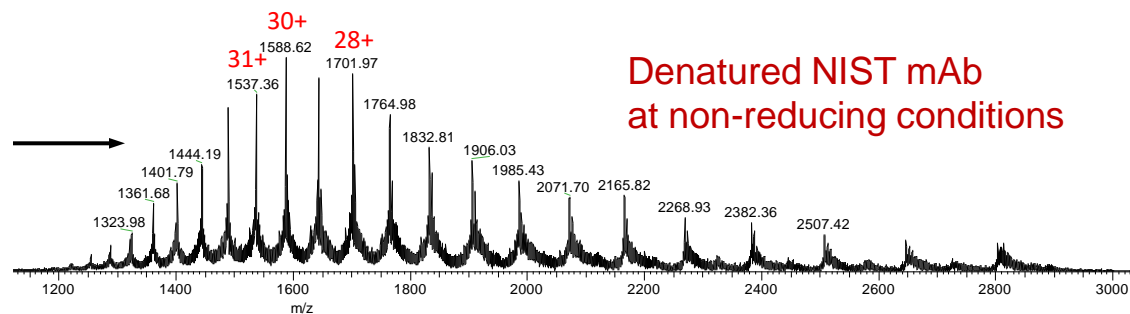
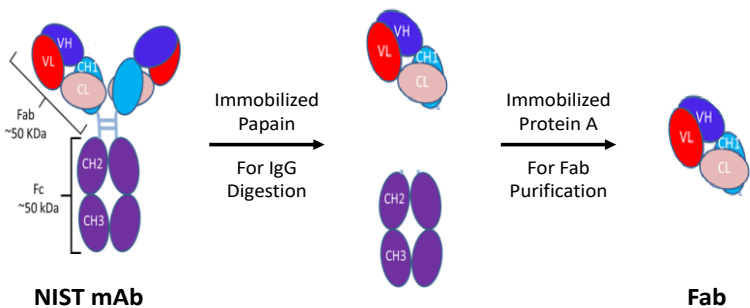


$\omega=32.3\text{KHz} - 50\text{mV}_{0p}$

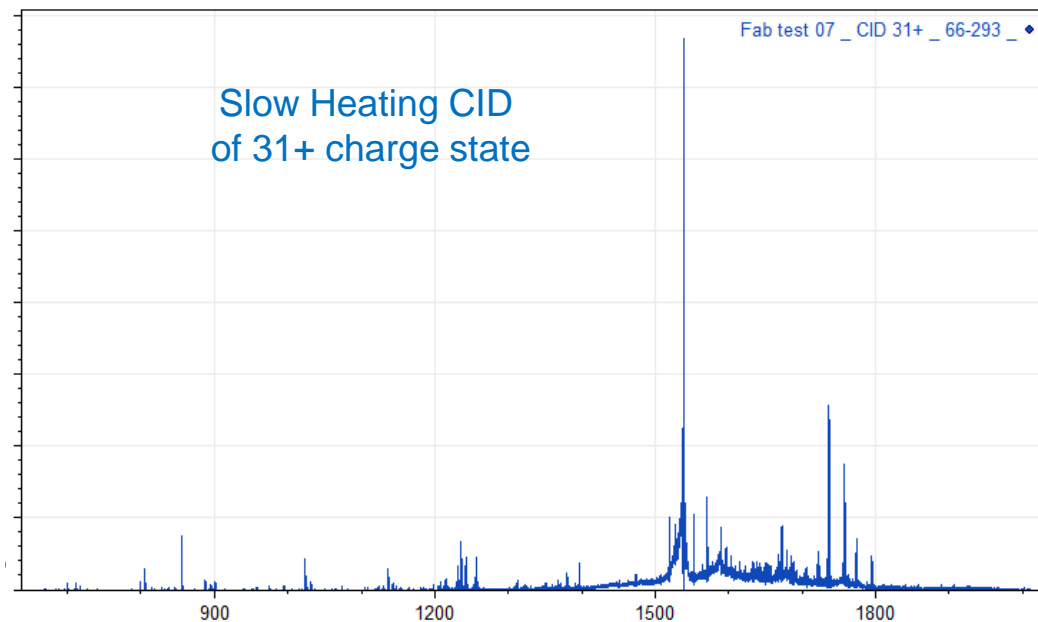
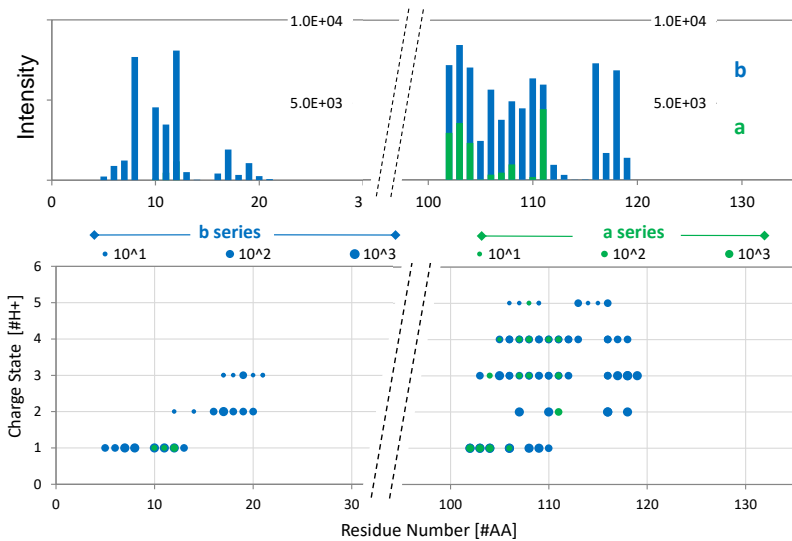


WP2 – Implementation of Activation Techniques

Collision Induced Dissociation

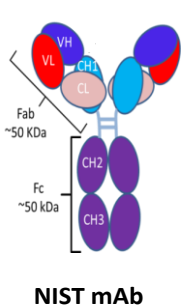


CID (31+) Heavy Chain



WP2 – Implementation of Activation Techniques

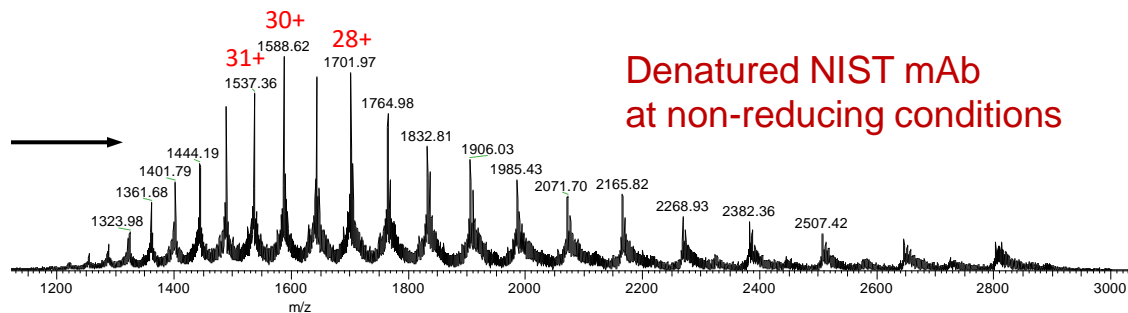
Collision Induced Dissociation



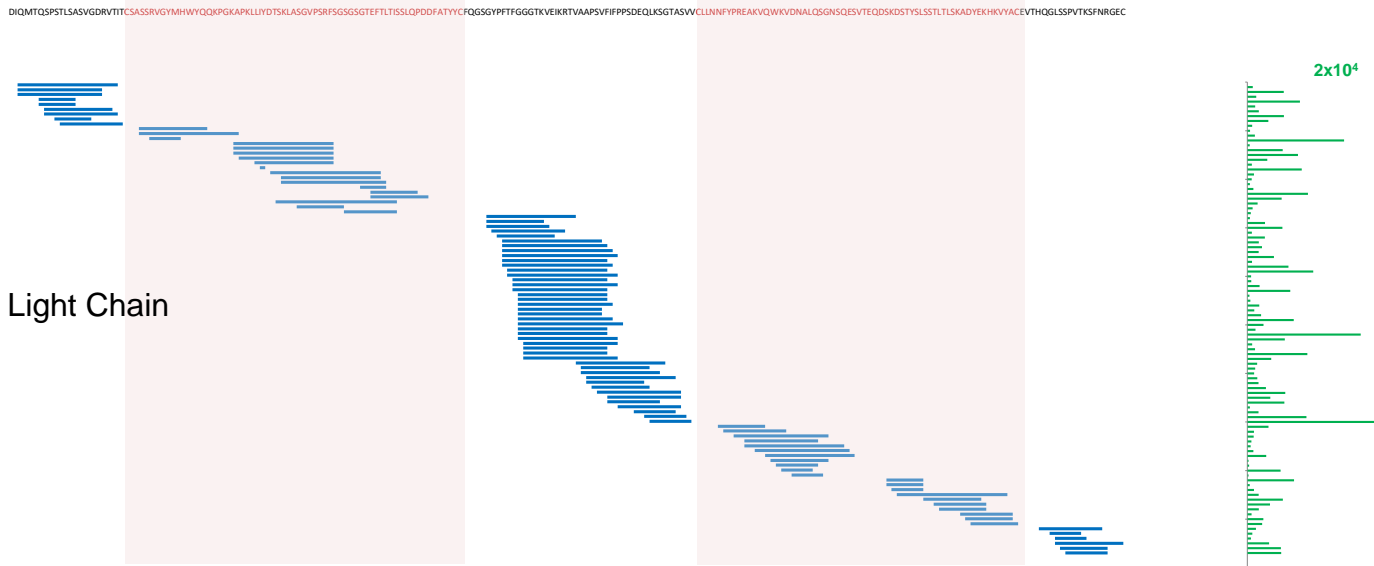
Immobilized
Papain
For IgG
Digestion



Immobilized
Protein A
For Fab
Purification

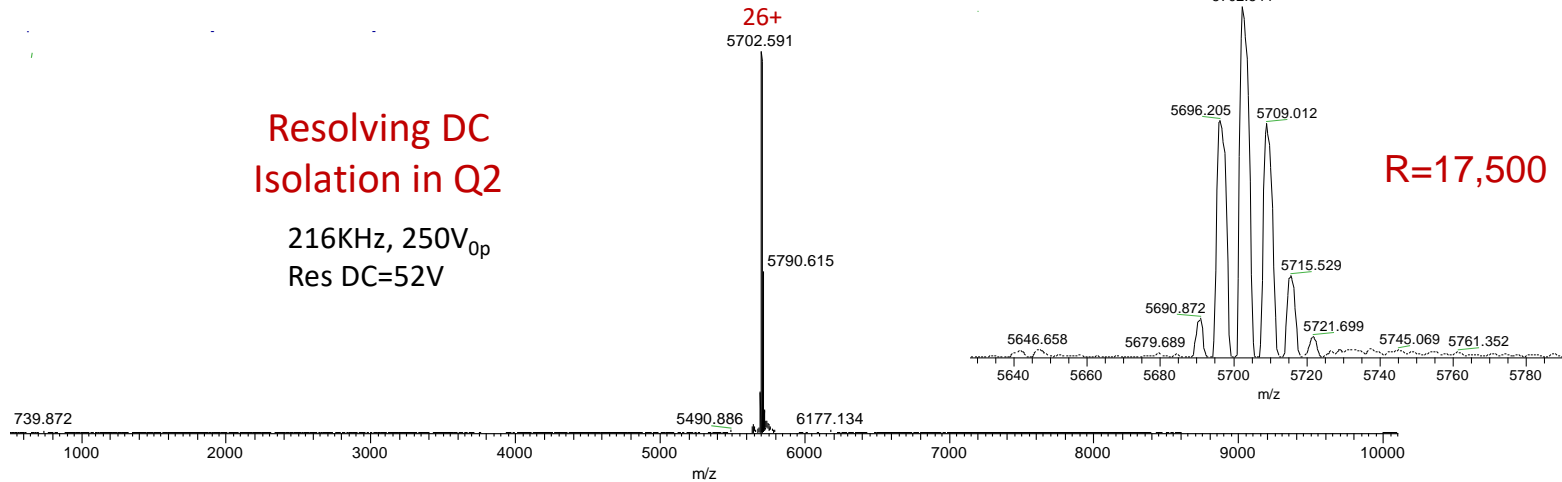
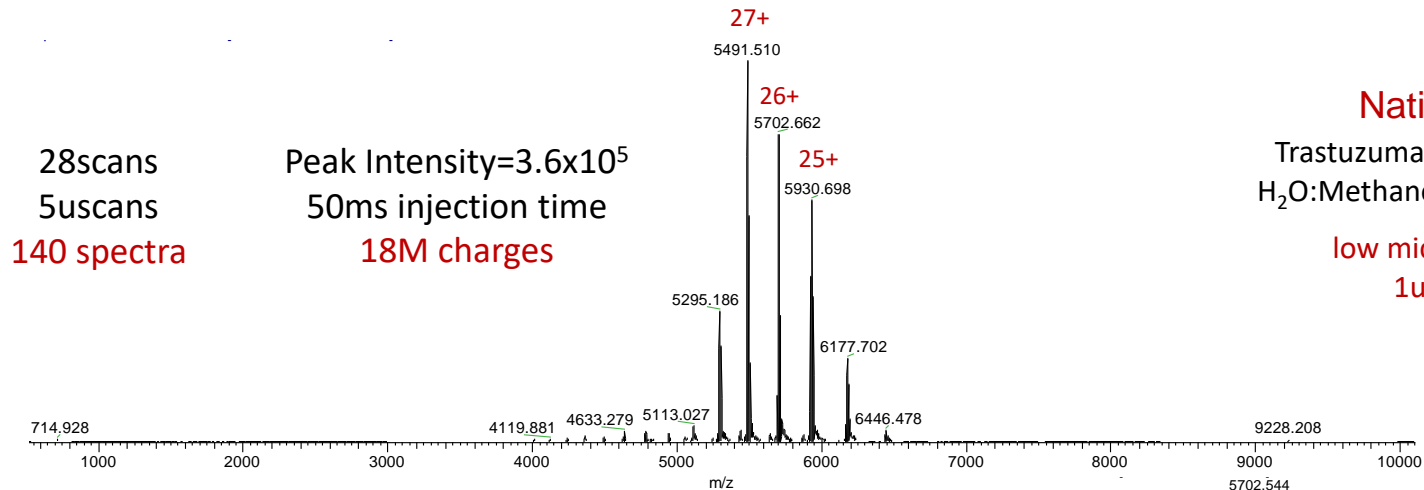


HCD – Light Chain



WP2 – Implementation of Activation Techniques

Collision Induced Dissociation



Native ESI

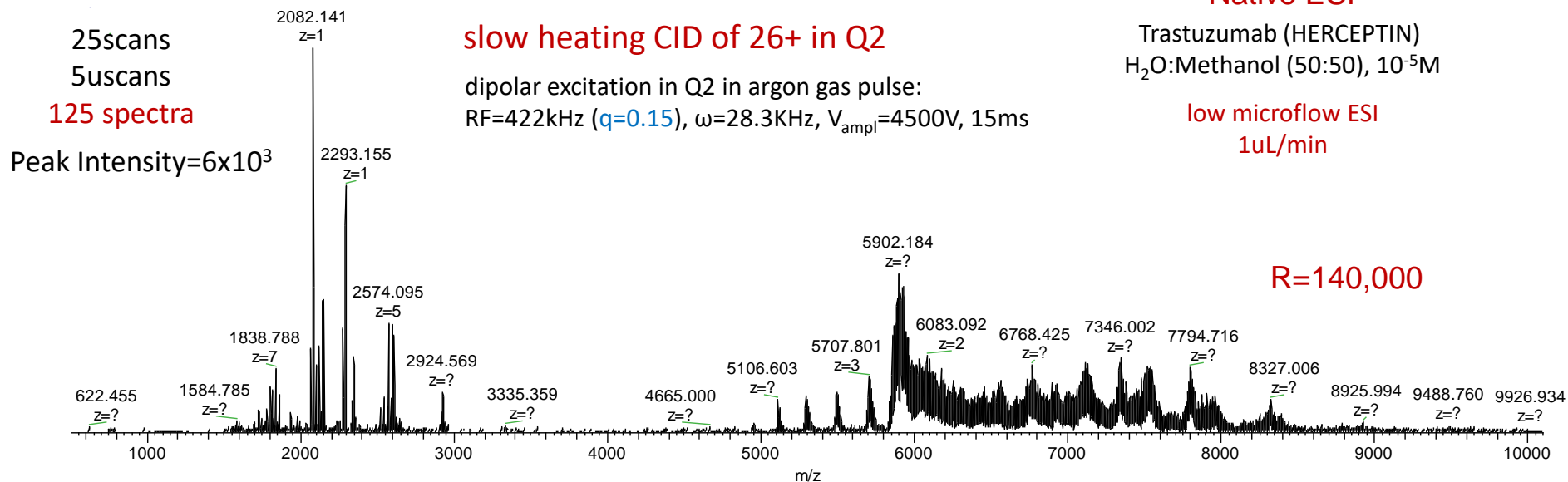
Trastuzumab (HERCEPTIN)
H₂O:Methanol (50:50), 10⁻⁵M

low microflow ESI
1uL/min

R=140,000

slow heating CID of 26+ in Q2

dipolar excitation in Q2 in argon gas pulse:
RF=422kHz ($q=0.15$), $\omega=28.3$ KHz, $V_{\text{ampl}}=4500$ V, 15ms



25scans

5uscans

125 spectra

Peak Intensity=6x10³

slow heating CID fragments

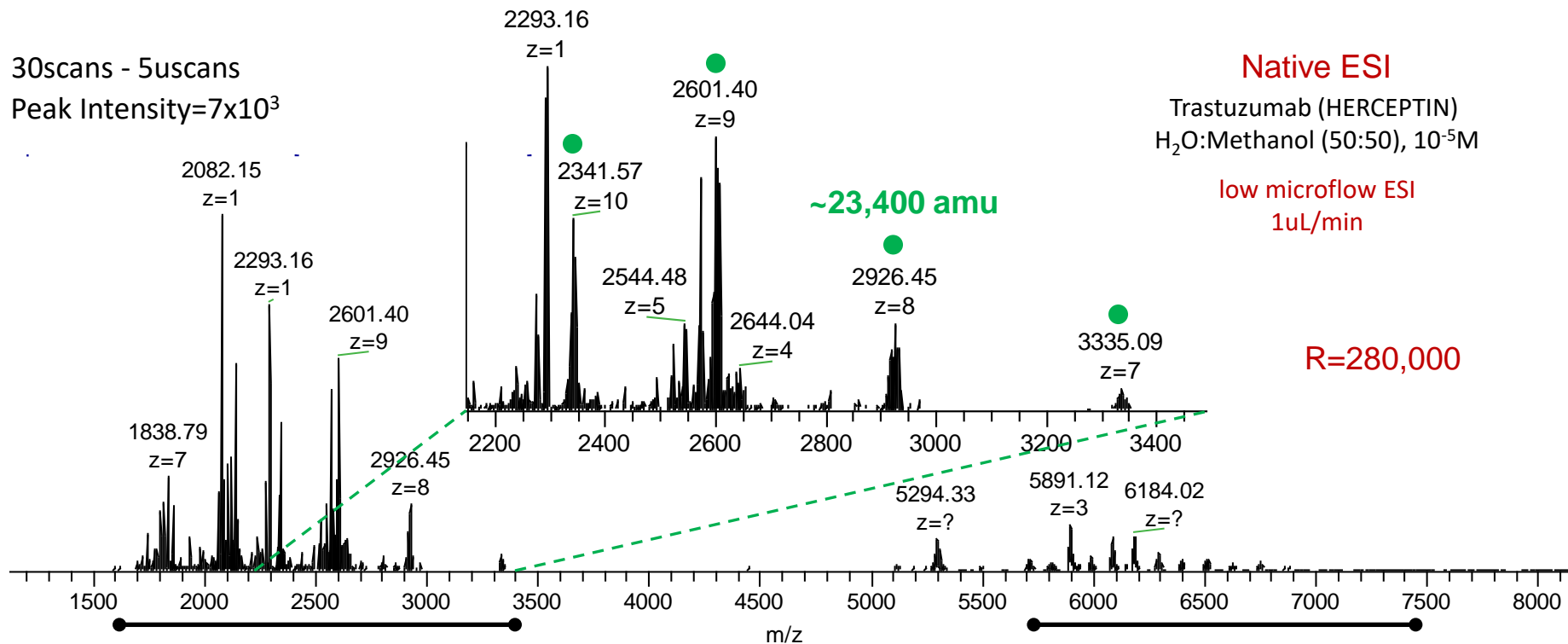
high mass fragment ions &
charged reduced precursor species

WP2 – Implementation of Activation Techniques

Collision Induced Dissociation

30scans - 5scans

Peak Intensity= 7×10^3



Native ESI

Trastuzumab (HERCEPTIN)
H₂O:Methanol (50:50), 10⁻⁵M

low microflow ESI
1 μ L/min

R=280,000

slow heating CID fragments

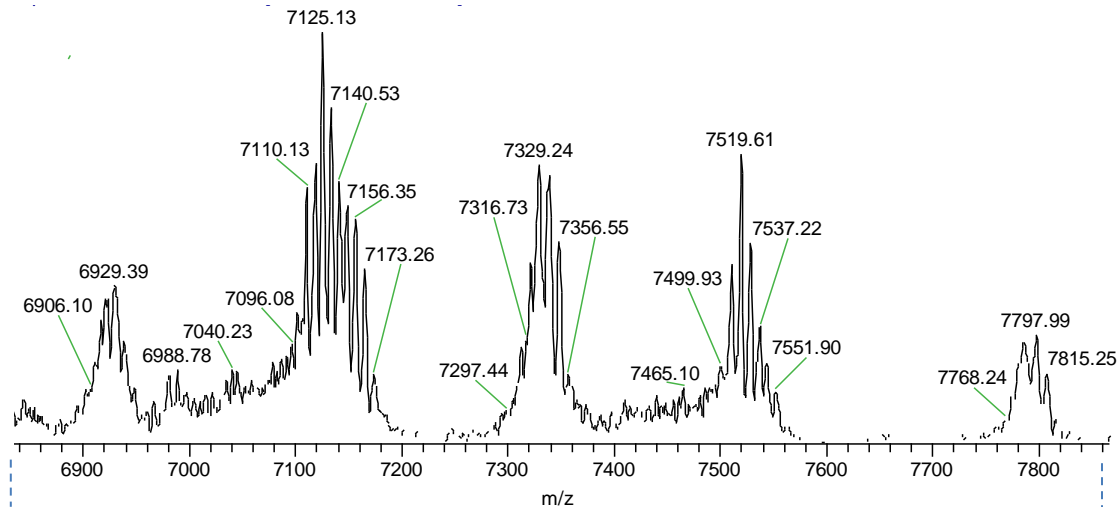
dipolar excitation in Q2 in argon gas pulse:
RF=366kHz ($q=0.2$), $\omega=33.0$ KHz, $V_{\text{ampl}}=4500$ V, 7ms

Broadband Excitation Window

broadband excitation in Q2 in argon gas pulse:
RF=366kHz, $\omega=15-33$ KHz, $\delta\omega=500$ Hz, $V_{\text{ampl}}=1300$ V, 10ms

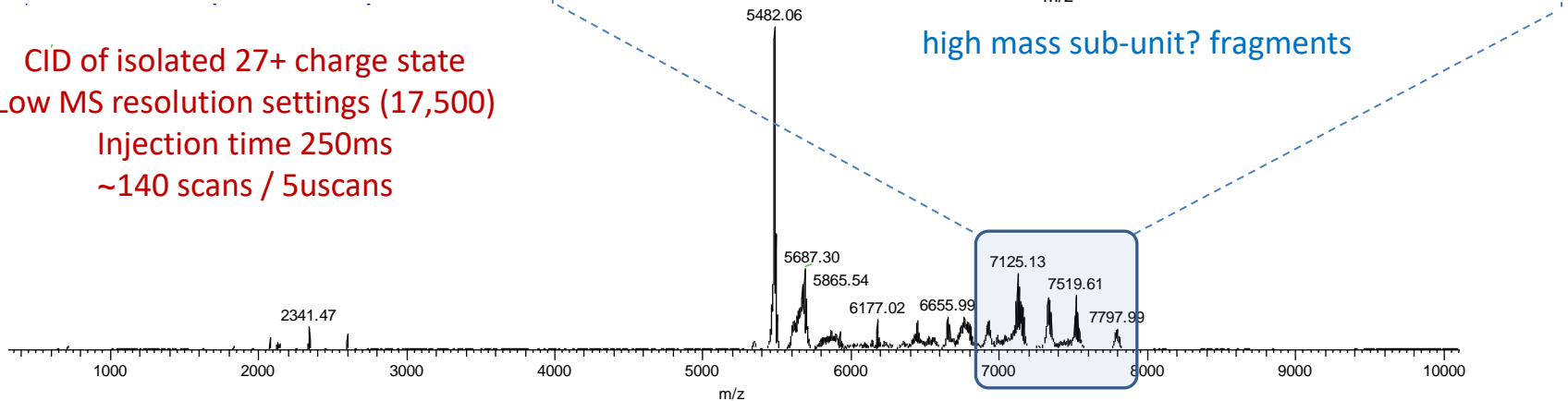
Native ESI

Trastuzumab (HERCEPTIN)
5uM in 100mM Am Ac
Static nESI



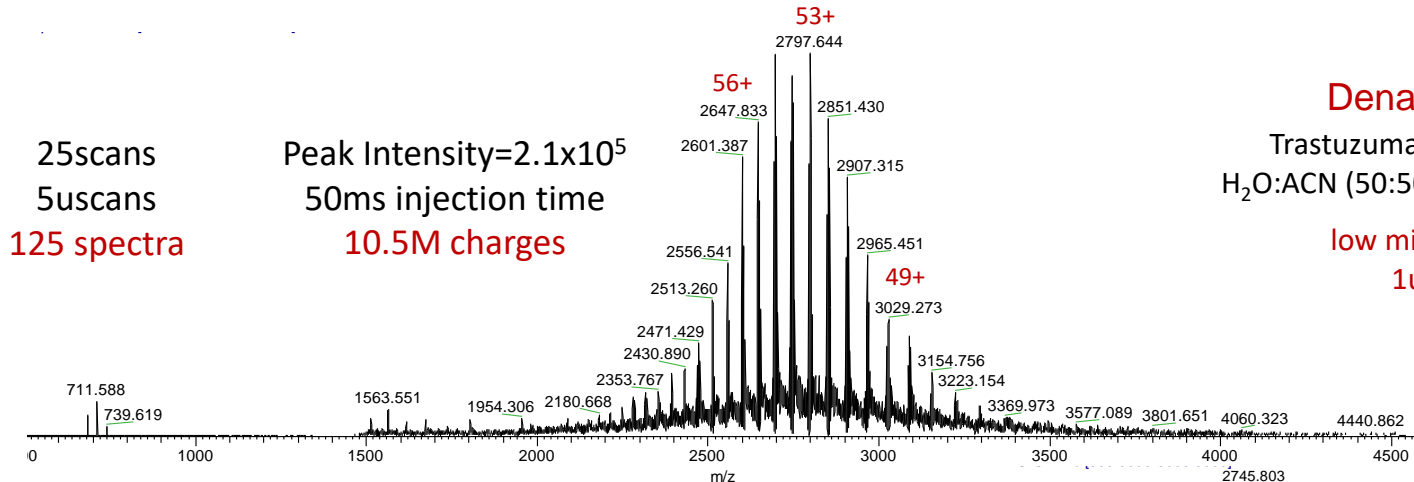
CID of isolated 27+ charge state
Low MS resolution settings (17,500)
Injection time 250ms
~140 scans / 5scans

high mass sub-unit? fragments



WP2 – Implementation of Activation Techniques

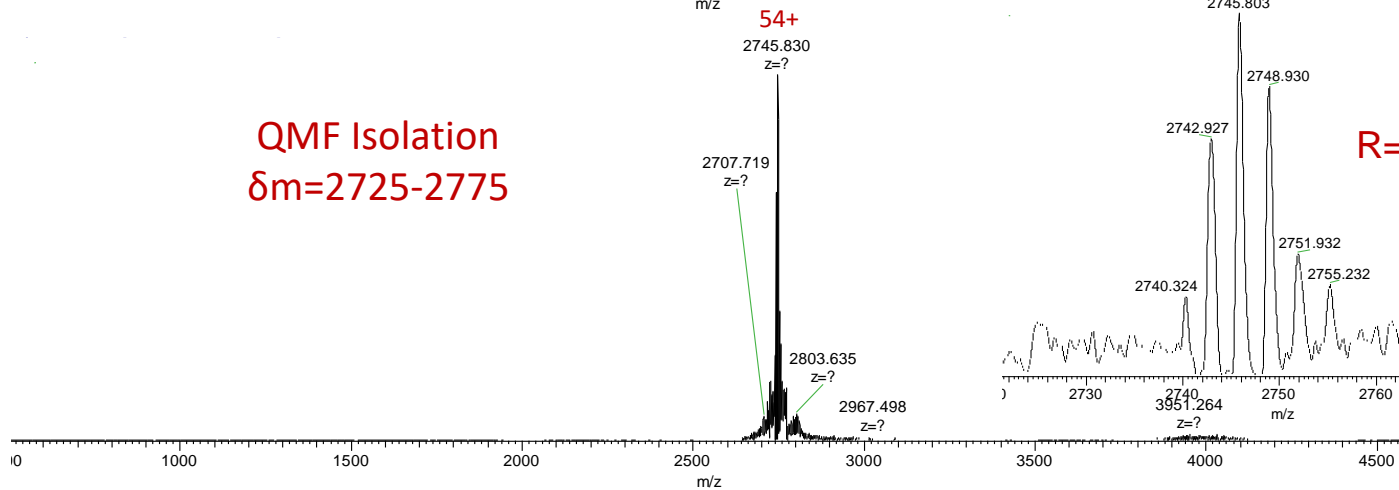
Collision Induced Dissociation



25scans
5scans
125 spectra

Peak Intensity = 2.1×10^5
50ms injection time
10.5M charges

Denatured ESI
Trastuzumab (HERCEPTIN)
H₂O:ACN (50:50) & 0.1% FA, $10^{-5}M$
low microflow ESI
1uL/min

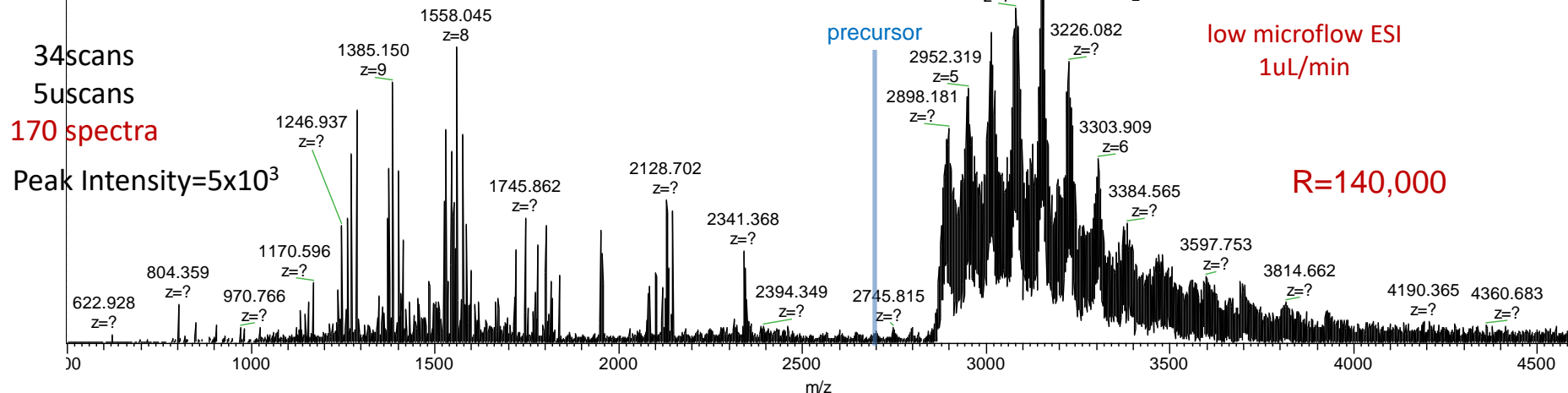


QMF Isolation
 $\delta m = 2725 - 2775$

R=17,500

slow heating CID of 54+ in Q2

dipolar excitation in Q2 in argon gas pulse:
 RF=608.53kHz (q=0.15), $\omega=40\text{kHz}$, $V_{\text{exc}}=4500\text{V}$, 25ms



Denatured ESI

Trastuzumab (HERCEPTIN)
 $\text{H}_2\text{O}:\text{ACN}$ (50:50) & 0.1% FA, 10^{-5}M

low microflow ESI
 1 $\mu\text{L}/\text{min}$

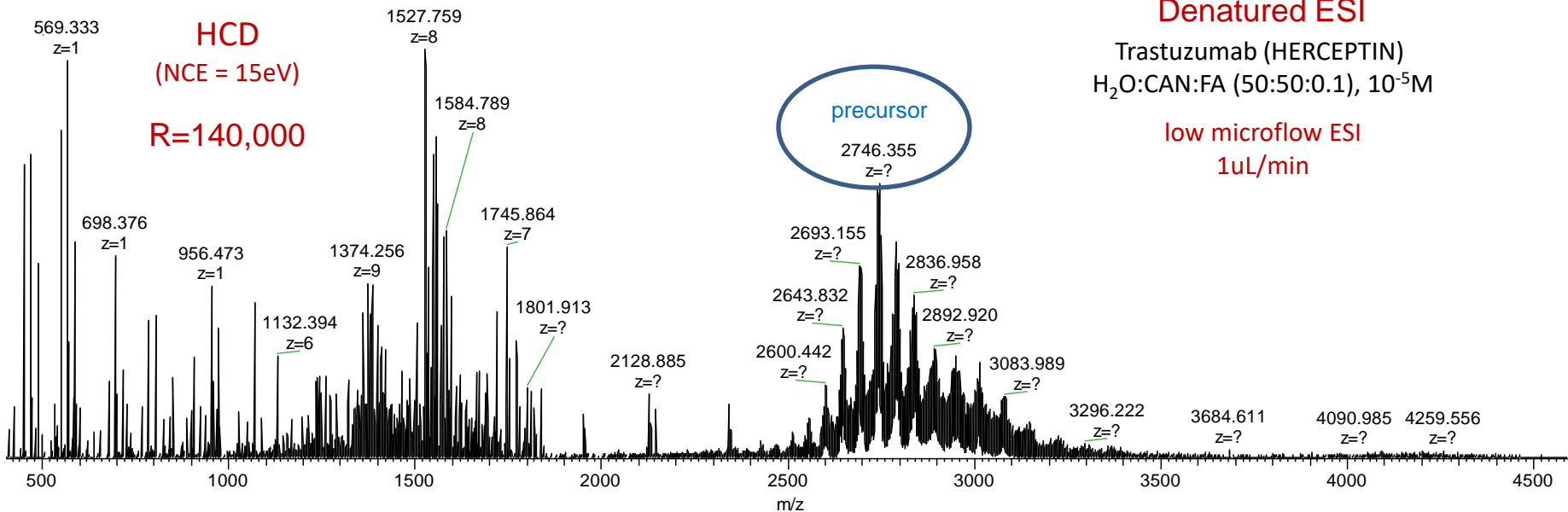
R=140,000

slow heating CID fragments

charged reduced precursor ions (proton loss)
 & high mass fragments

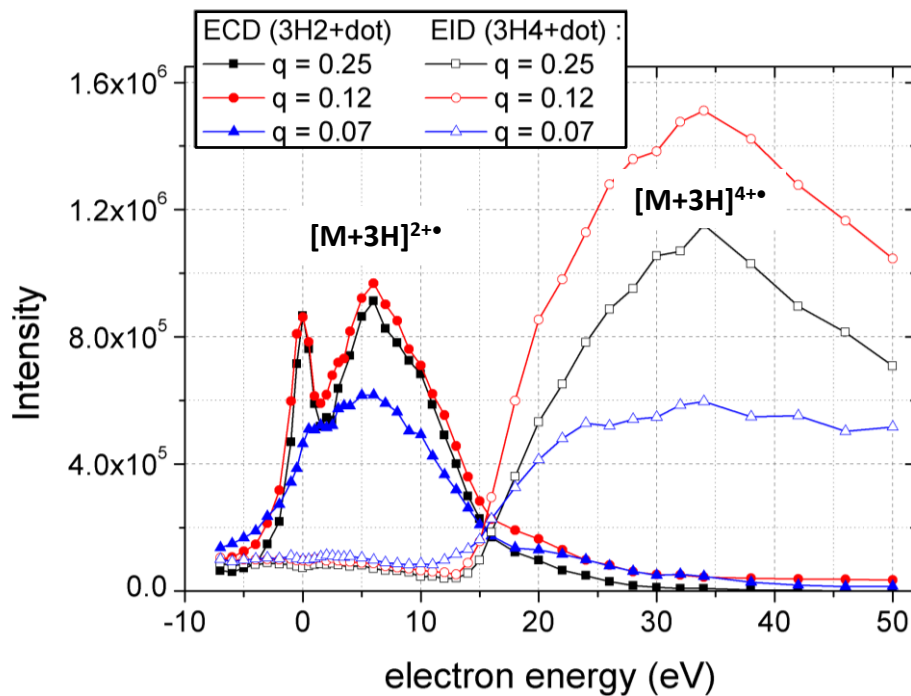
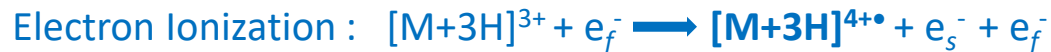
WP2 – Implementation of Activation Techniques

Higher-Energy CID

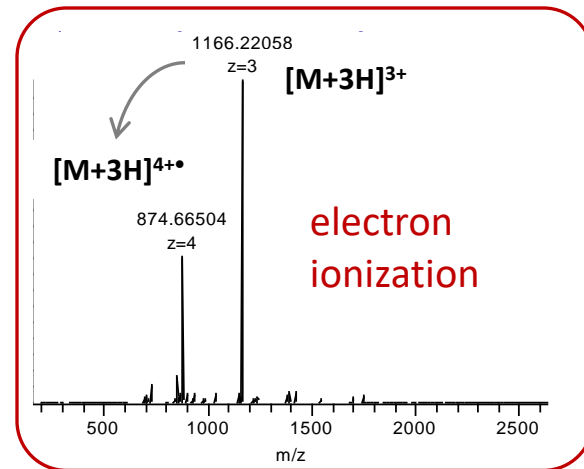
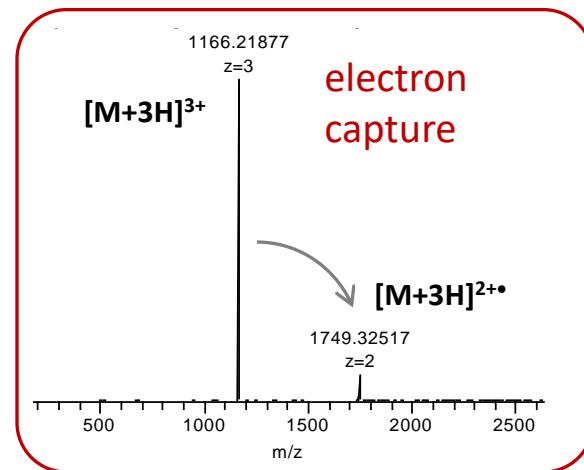


WP2 – Implementation of Activation Techniques

Insulin Chain B



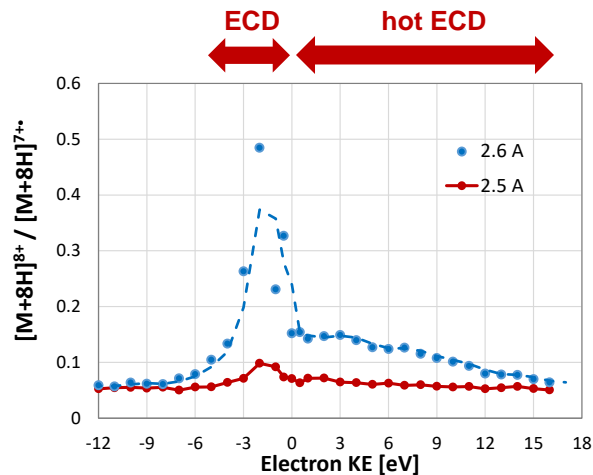
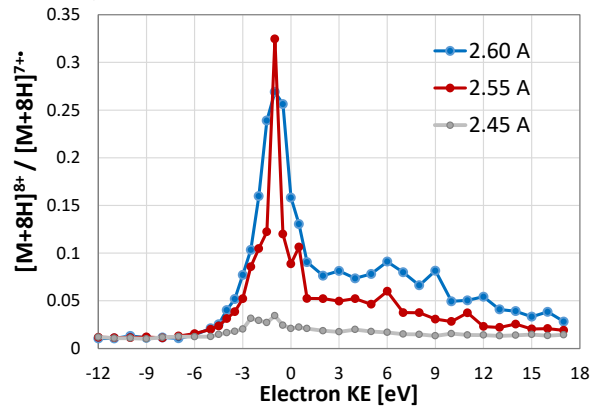
Electron-based Dissociation



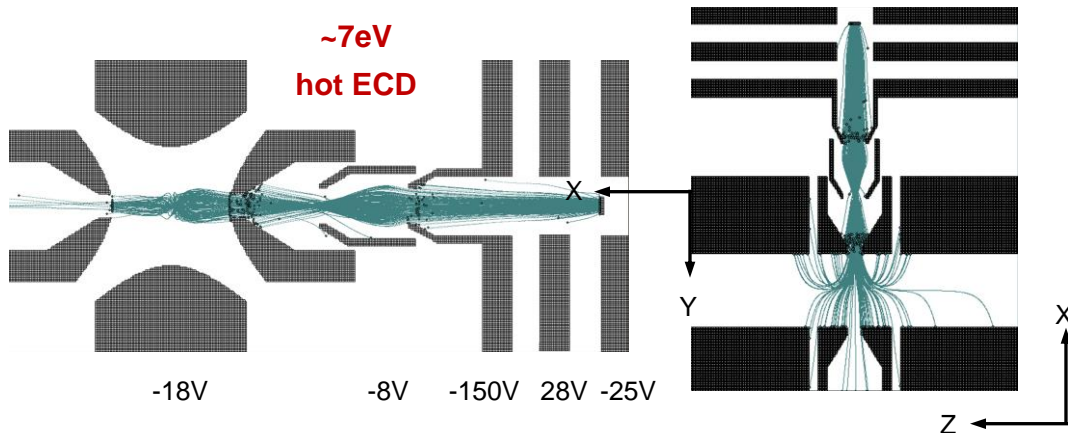
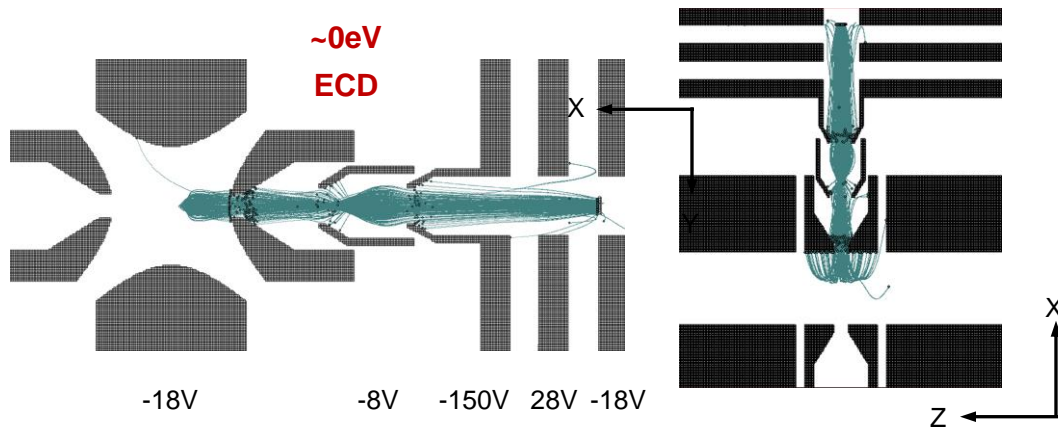
WP2 – Implementation of Activation Techniques

ECD of ubiquitin

charge reduction: $[M+8H]^{8+} + e^- \rightarrow [M+8H]^{7+}$

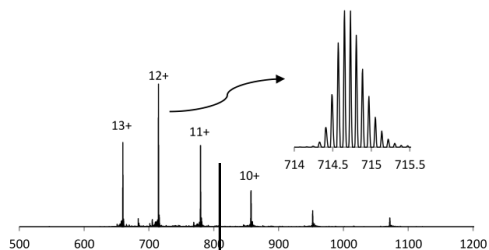


Electron Capture & Hot Electron Capture Dissociation



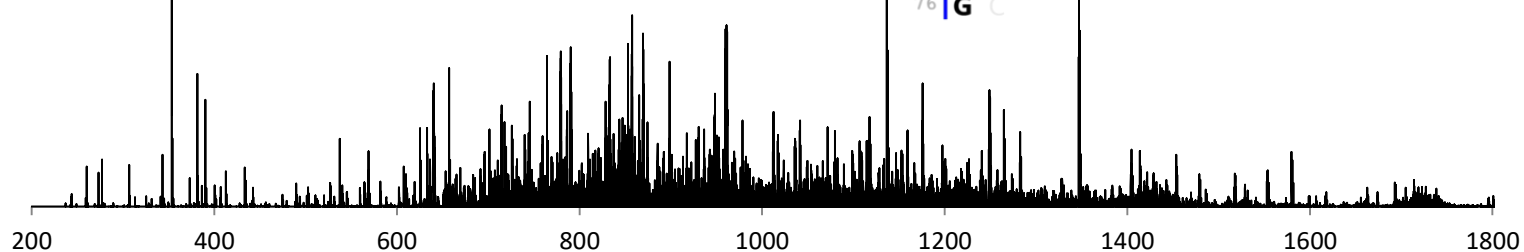
WP2 – Implementation of Activation Techniques

Electron Capture/Induced Dissociation



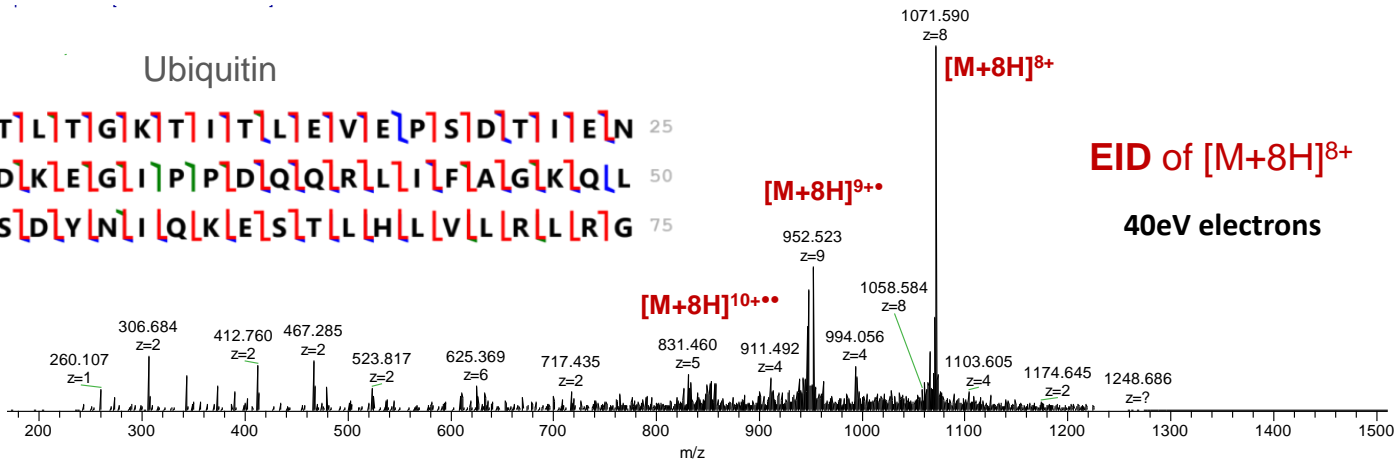
ECD of all charge states

8+ → 13+



Ubiquitin

N M[Q]I[F]V[K]T[L]T[G]K[T]I[T]L[E]V[E]P[S]D[T]I[E]N 25
 26 [V]K[A]K[I]Q[D]K[E]G[I]P[P]D[Q]Q[R]L[L]I[F]A[G]K[Q]L 50
 51 [E]D[G]R[T]L[L]S[D]Y[N]I[Q]K[E]S[T]L[L]H[L]V[L]R[L]R[G] 75
 76]G C



EID of [M+8H]⁸⁺

40eV electrons

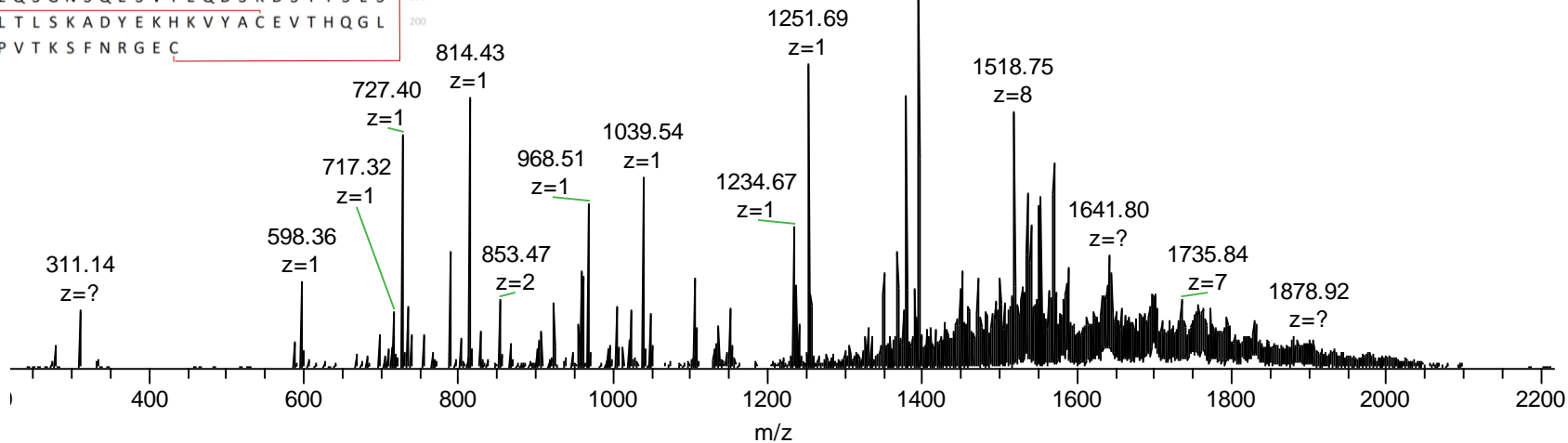
Ubiquitin

N M[Q]I[F]V[K]T[L]T[G]K[T]I[T]L[E]V[E]P[S]D[T]I[E]N 25
 26 [V]K[A]K[I]Q[D]K[E]G[I]P[P]D[Q]Q[R]L[L]I[F]A[G]K[Q]L 50
 51 [E]D[G]R[T]L[L]S[D]Y[N]I[Q]K[E]S[T]L[L]H[L]V[L]R[L]R[G] 75
 76]G C

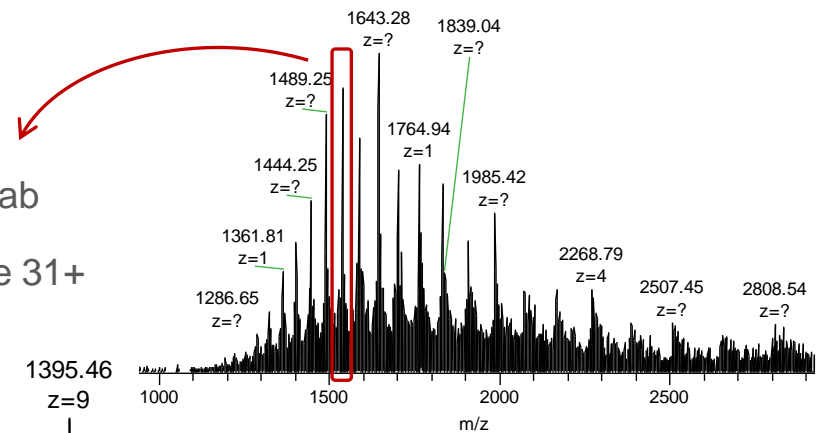
WP2 – Implementation of Activation Techniques

```
Q V T L R E S G P A L V K P T Q T L T L T C T F S 25
G F S L S T A G M S V G W I R Q P P G K A L E W L 50
A D I W W D D K K H Y N P S L K D R L T I S K D T 75
S K N Q V V L K V T N M D P A D T A T Y Y C A R D 100
M I F N F Y F D V W G Q G T T V T V S S A S T K G 125
P S V F P L A P S S K S T S G G T A A L G C L V K 150
D Y F P E P V T V S W N S G A L T S G V H T F P A 175
V L Q S S G L Y S L S S V V T P S S S L G T Q T 200
Y I C N V N H K P S N T K V D K R V E P K S C D K 225
T H
D I Q M T Q S P S T L S A S V G D R V T I T C S A 25
S S R V G Y M H W Y Q Q K P G K A P K L L I Y D T 50
S K L A S G V P S R F S G S G S G T E F T L T I S 75
S L Q P D D F A T Y Y C F Q G S G Y P F T F G G G 100
T K V E I K R T V A A P S V F I F P P S D E Q L K 125
S G T A S V V C L L N N F Y P R E A K V Q W K V D 150
N A L Q S G N S Q E S V T E Q D S K D S T Y S L S 175
S T L T L S K A D Y E K H K V Y A C E V T H Q G L 200
S S P V T K S F N R G E C
```

ECD of NIST mAb Fab
Isolation of charge state 31+



Electron Capture Dissociation

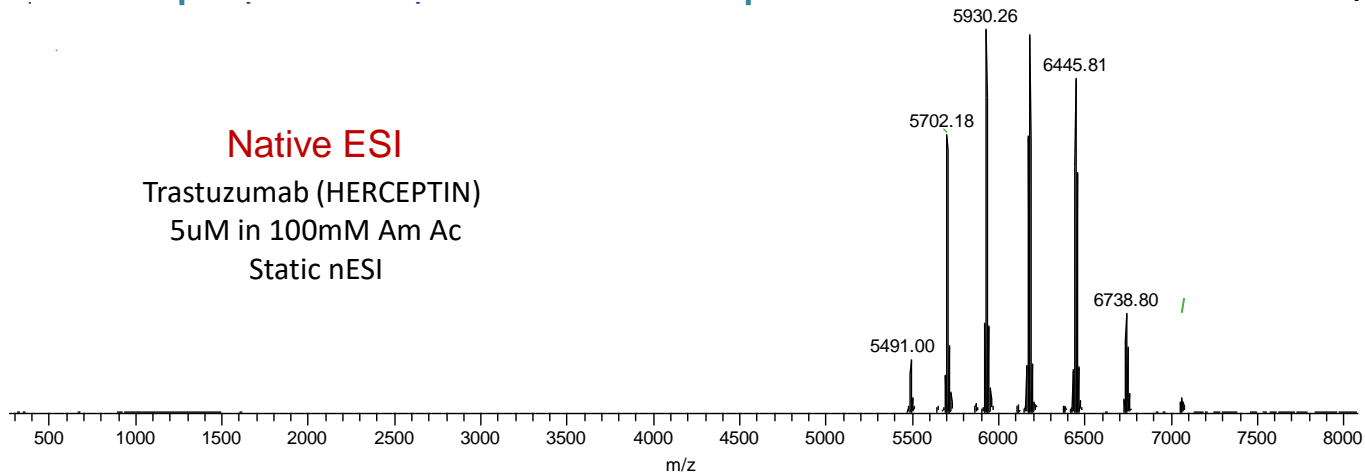


WP2 – Implementation of Activation Techniques

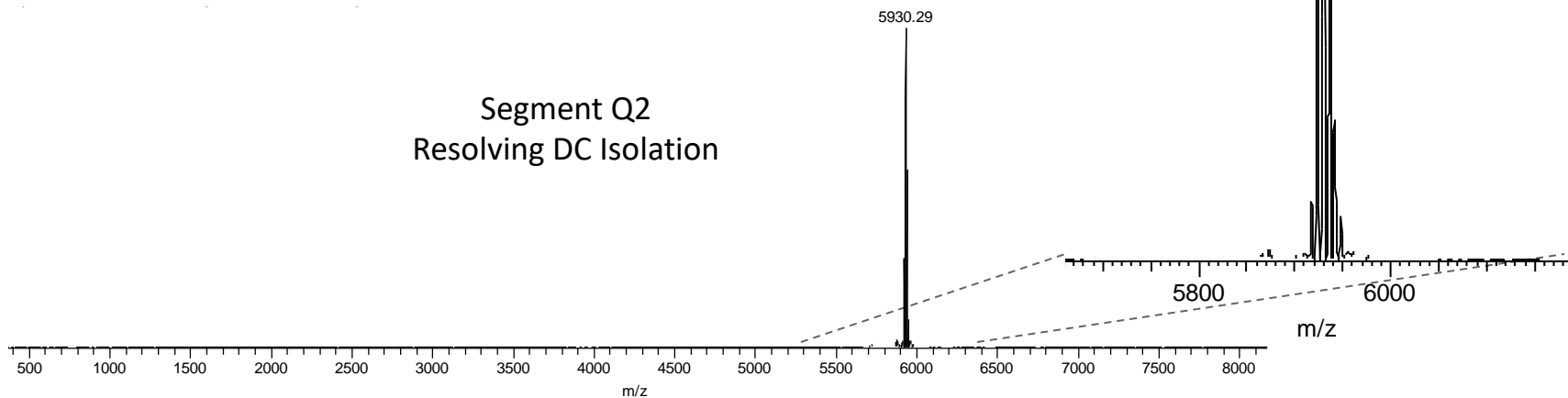
Isolation of Native Species

Native ESI

Trastuzumab (HERCEPTIN)
5uM in 100mM Am Ac
Static nESI



Segment Q2
Resolving DC Isolation



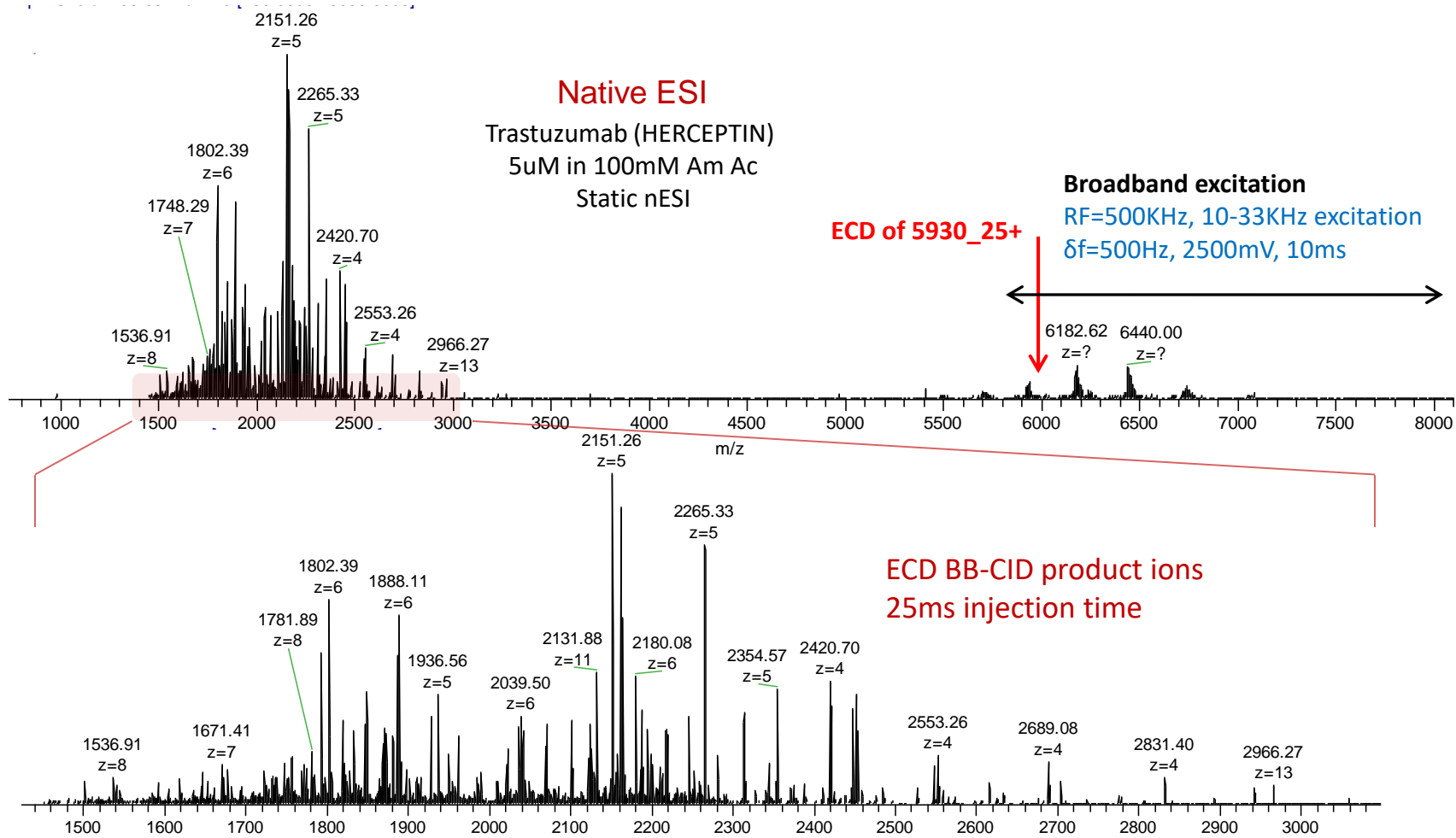
25+

5930.29

5947.94

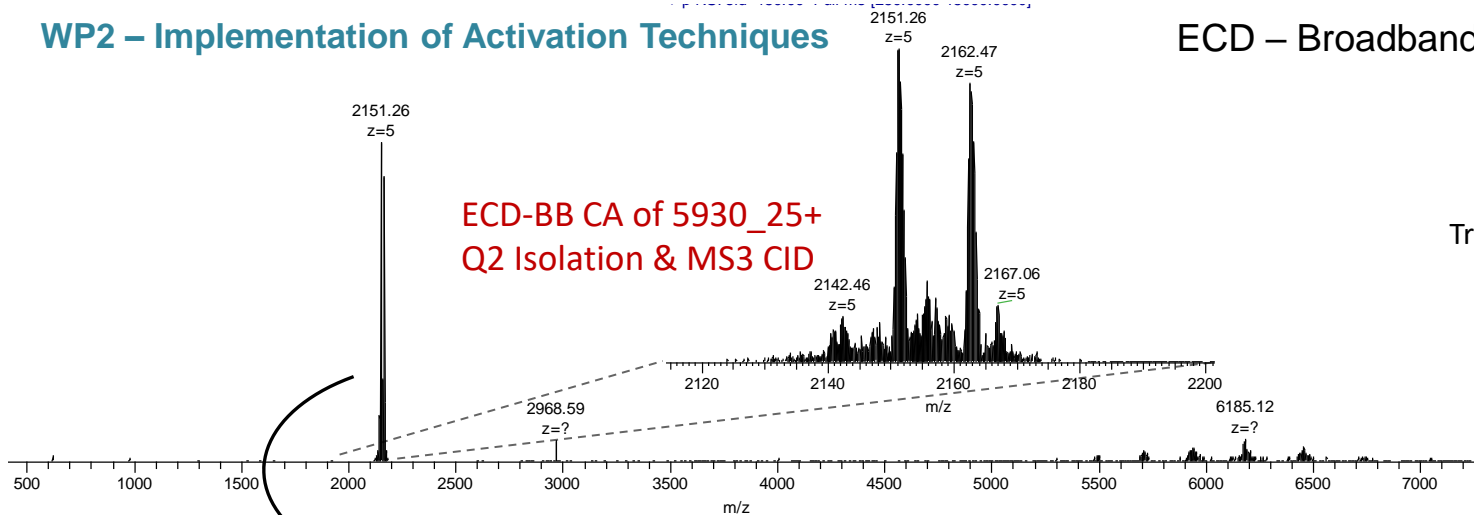
WP2 – Implementation of Activation Techniques

ECD & Broadband CID

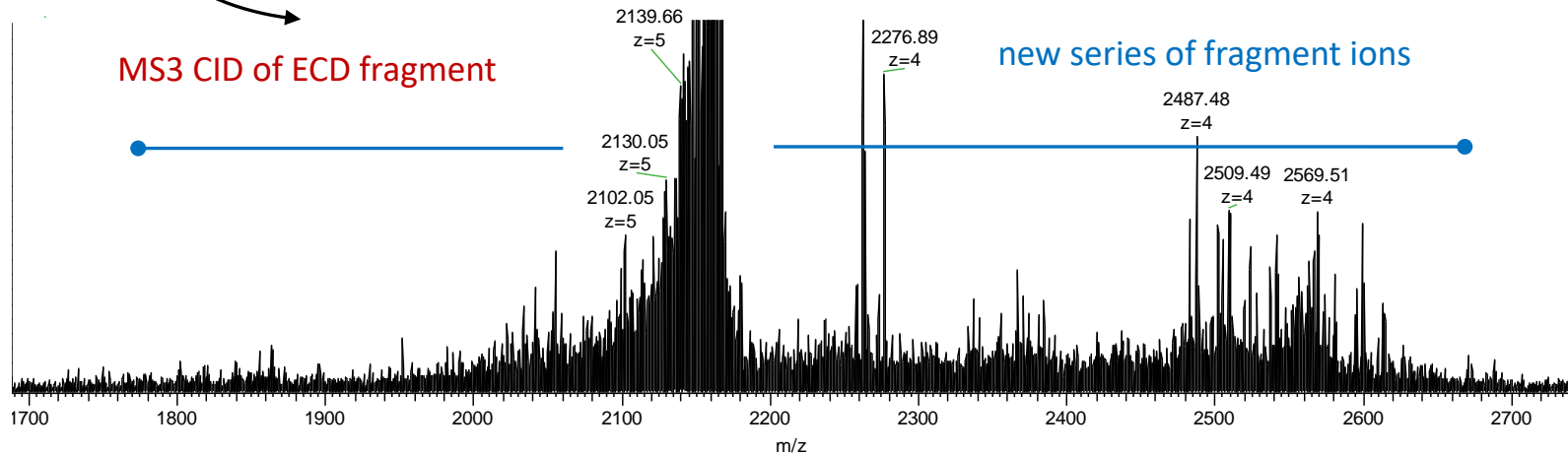


WP2 – Implementation of Activation Techniques

ECD – Broadband CID – MS3 CID



Native ESI
Trastuzumab (HERCEPTIN)
5uM in 100mM Am Ac
Static nESI



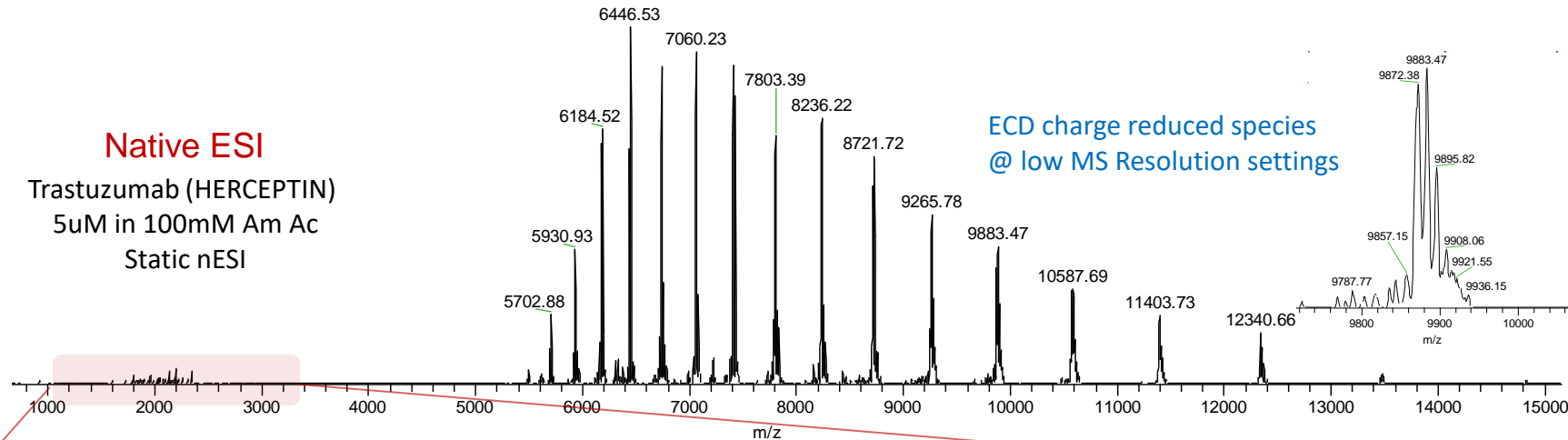
WP2 – Implementation of Activation Techniques

Electron Capture Dissociation

Native ESI

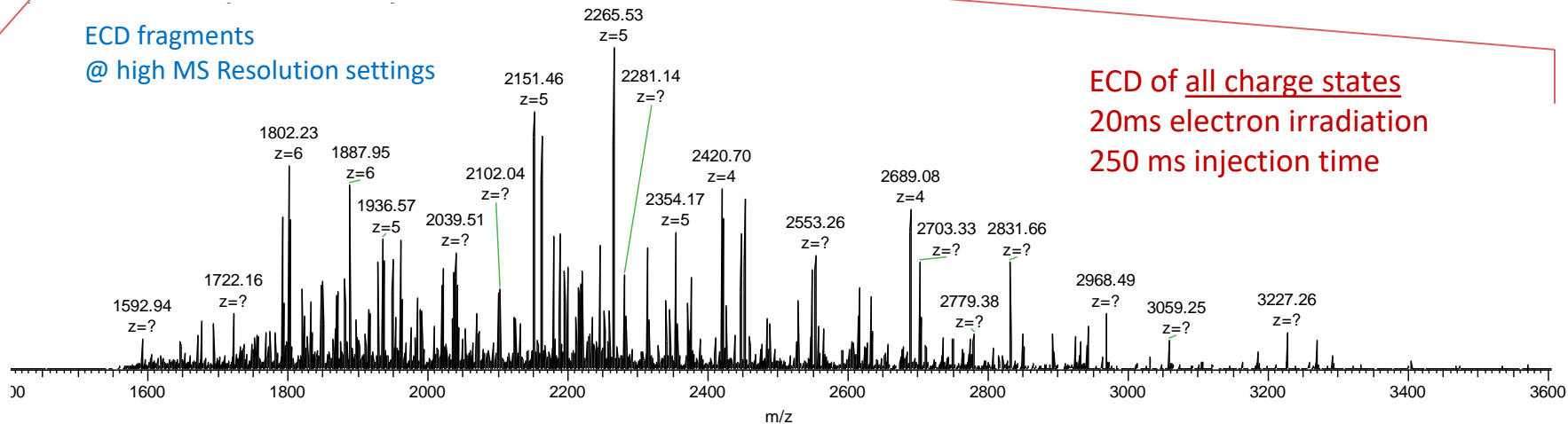
Trastuzumab (HERCEPTIN)
5uM in 100mM Am Ac
Static nESI

ECD charge reduced species
@ low MS Resolution settings



ECD fragments
@ high MS Resolution settings

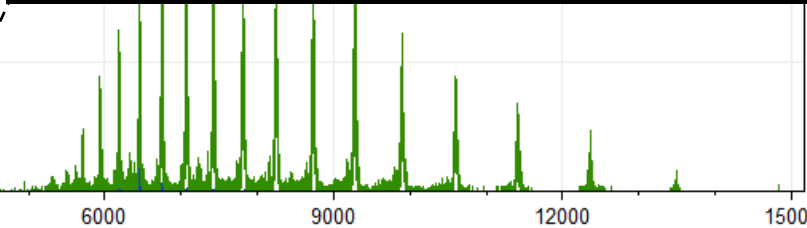
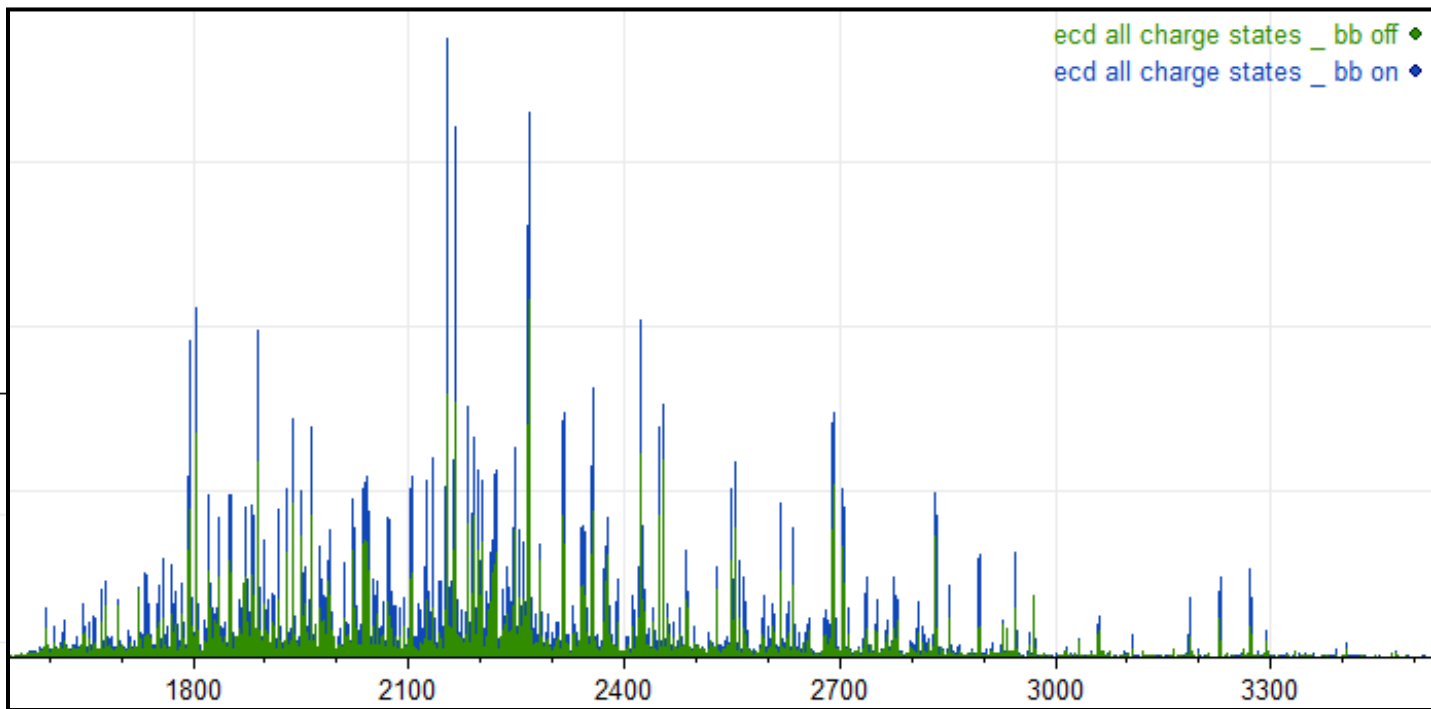
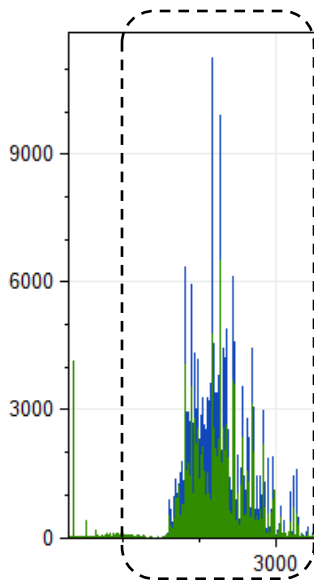
ECD of all charge states
20ms electron irradiation
250 ms injection time



Native ESI

Trastuzumab (HERCEPTIN)
5uM in 100mM Am Ac
Static nESI

a.u.



WP2 – Implementation of Activation Techniques

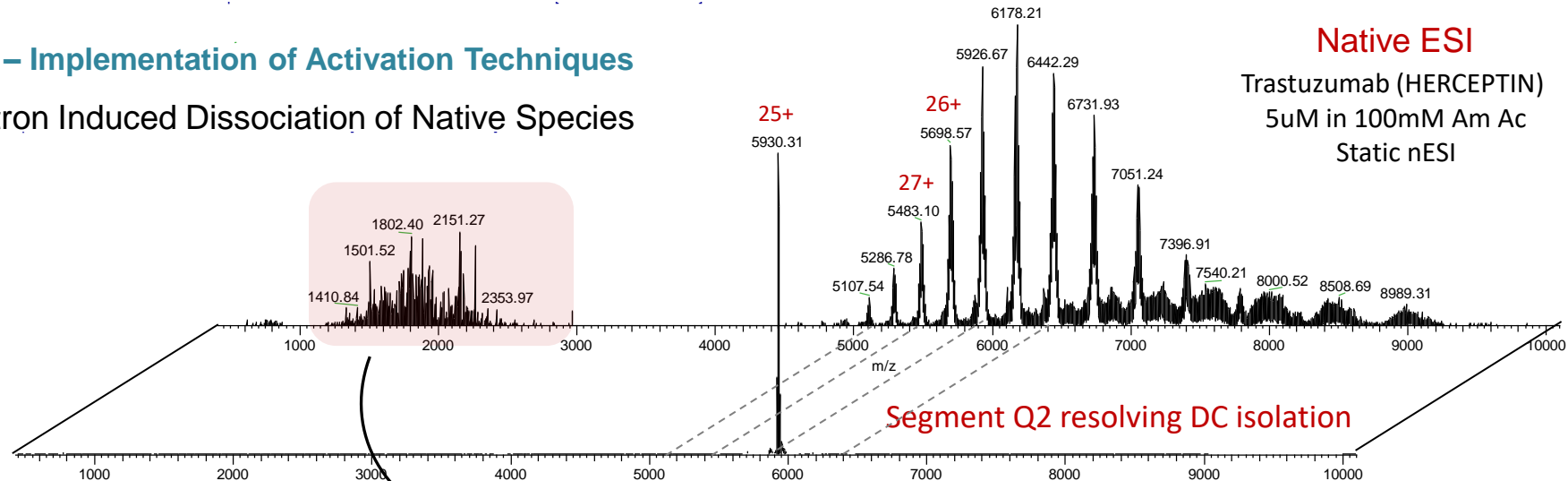
Electron Induced Dissociation of Native Species

Native ESI

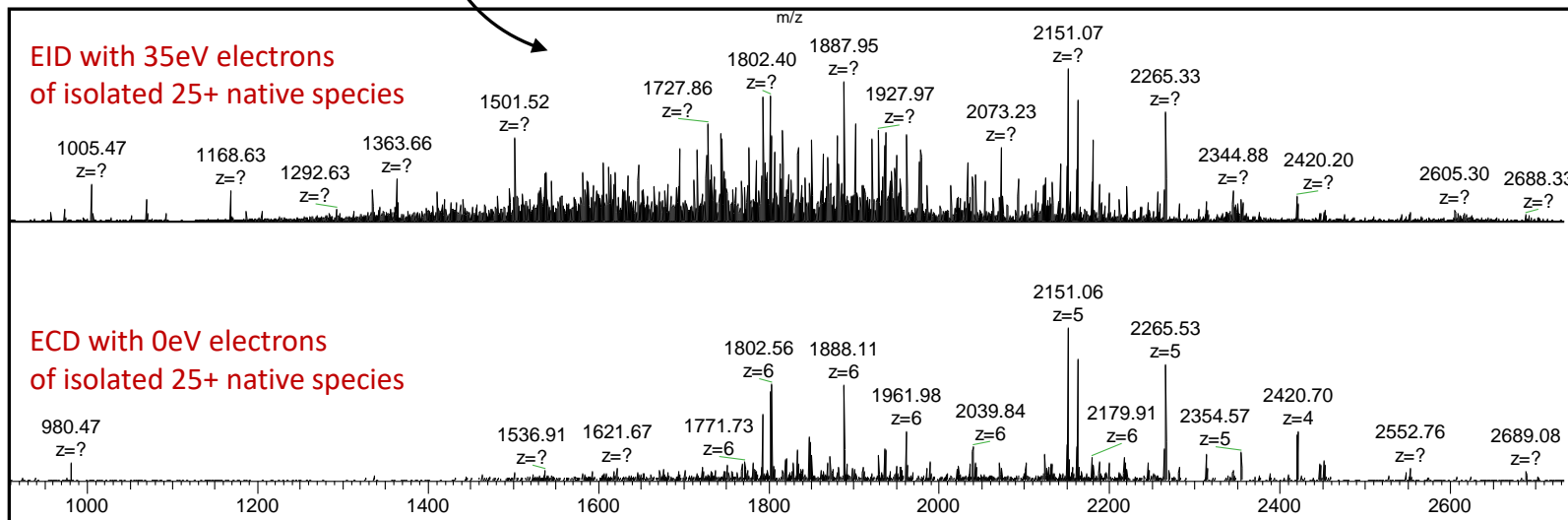
Trastuzumab (HERCEPTIN)

5uM in 100mM Am Ac

Static nESI



Segment Q2 resolving DC isolation

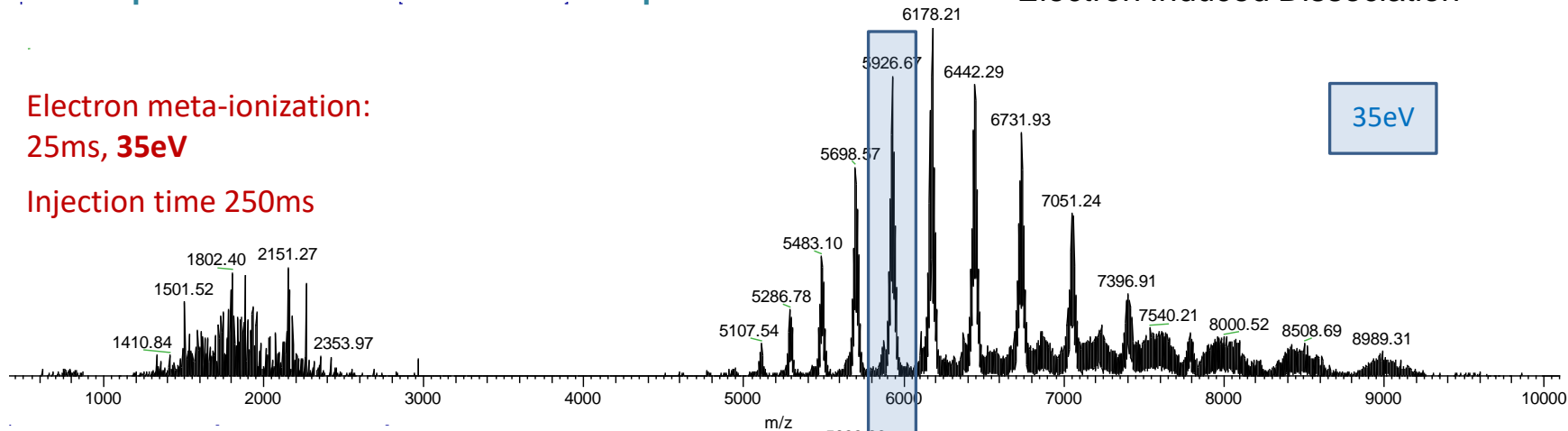


WP2 – Implementation of Activation Techniques

Electron Induced Dissociation

Electron meta-ionization:
25ms, **35eV**

Injection time 250ms

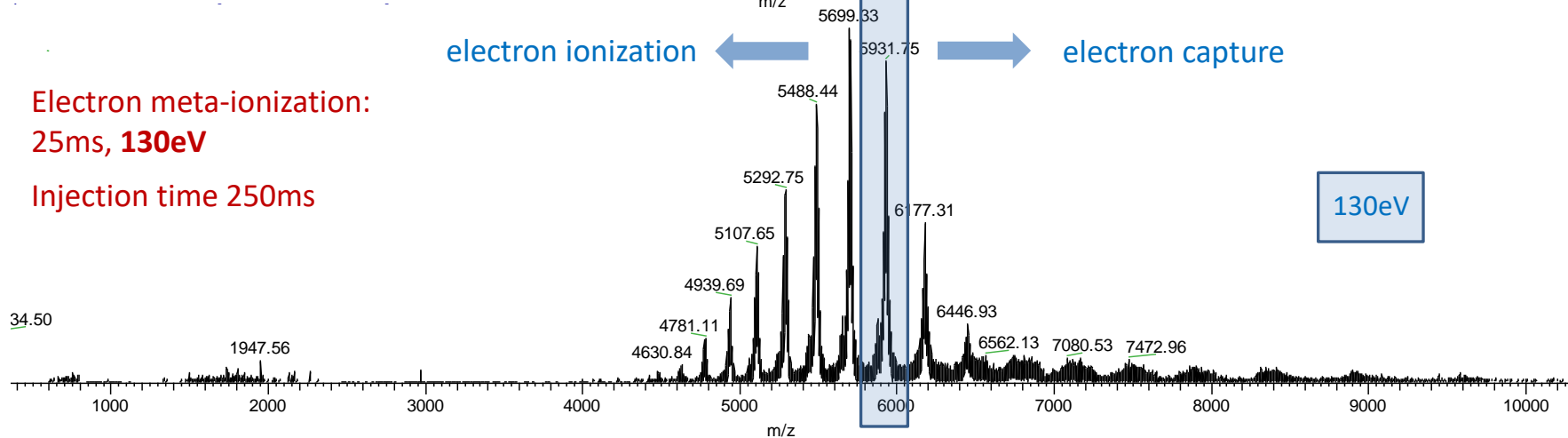


electron ionization ←

→ electron capture

Electron meta-ionization:
25ms, **130eV**

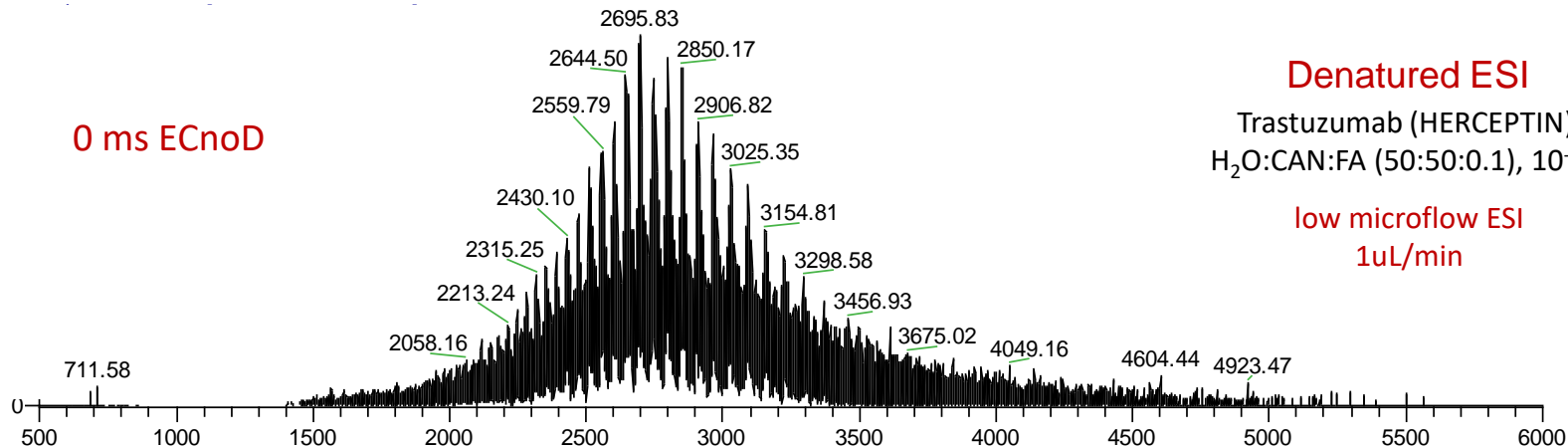
Injection time 250ms



WP2 – Implementation of Activation Techniques

ECnoD

0 ms ECnoD

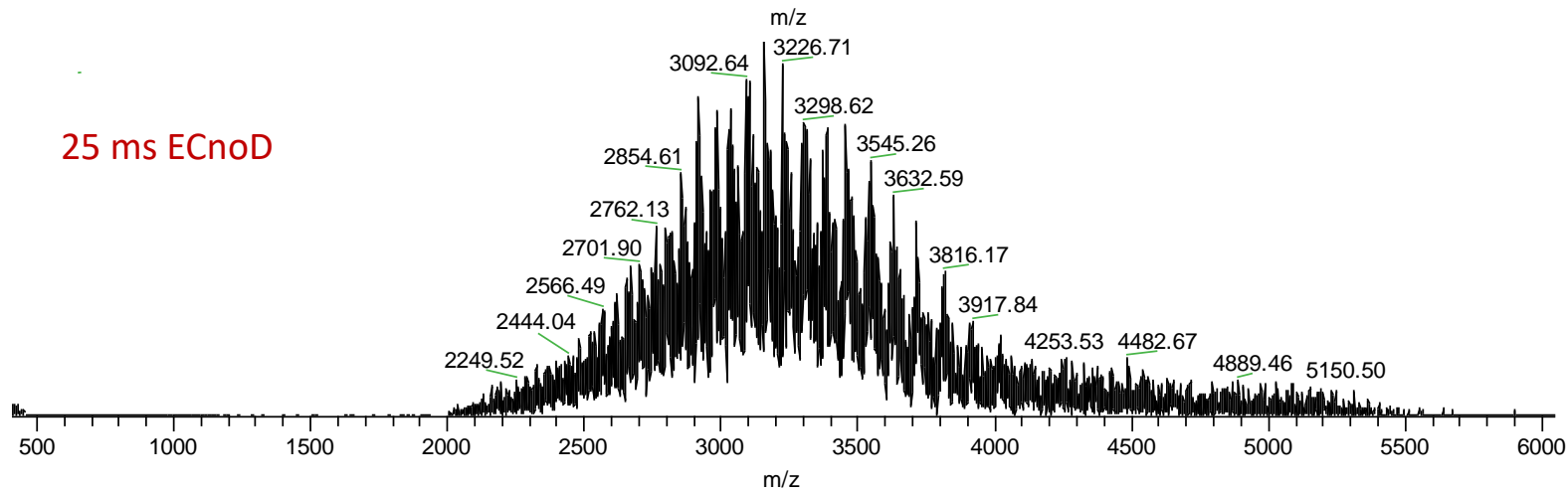


Denatured ESI

Trastuzumab (HERCEPTIN)
H₂O:CAN:FA (50:50:0.1), 10⁻⁵M

low microflow ESI
1uL/min

25 ms ECnoD

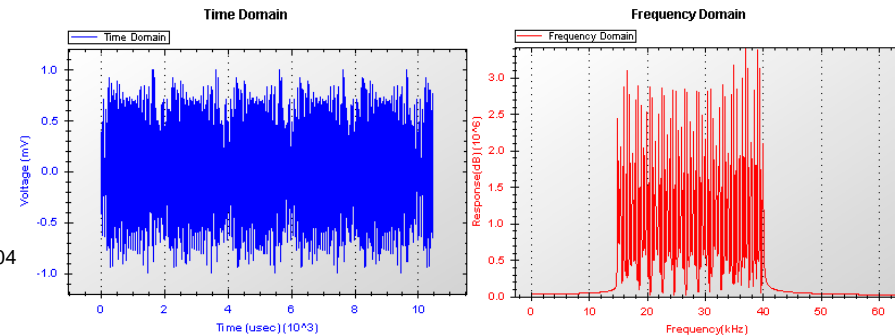
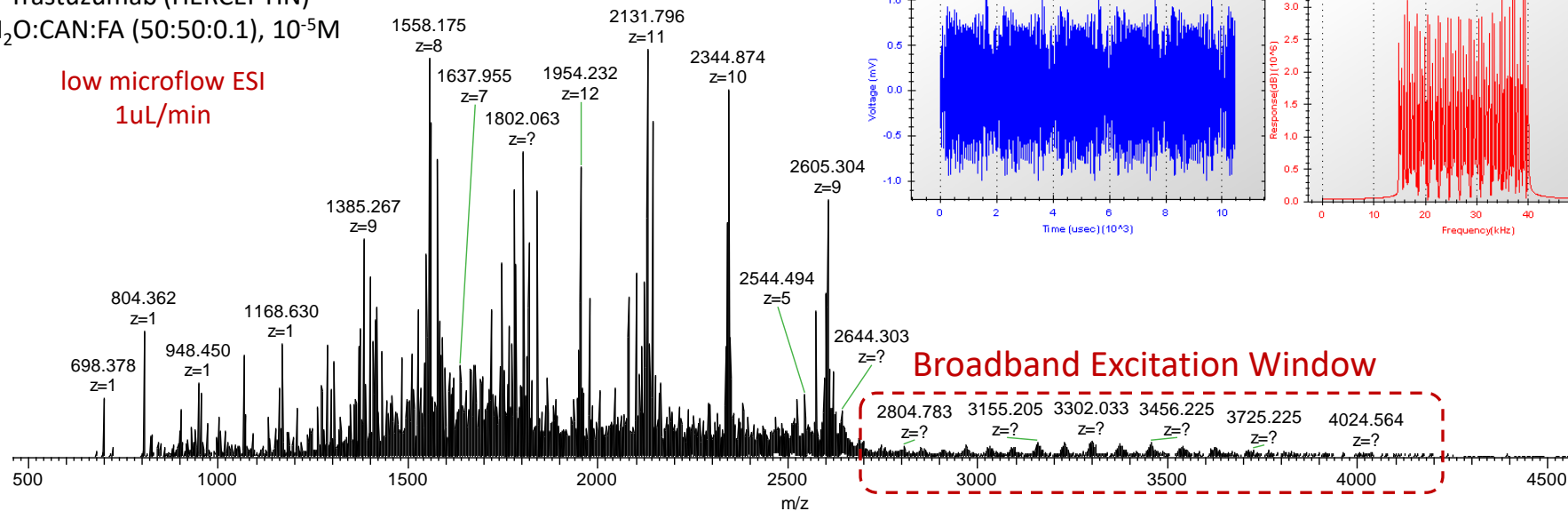


Denatured ESI

Trastuzumab (HERCEPTIN)

H₂O:CAN:FA (50:50:0.1), 10⁻⁵M

low microflow ESI
1uL/min



25ms Electron Capture (1eV electron energy)

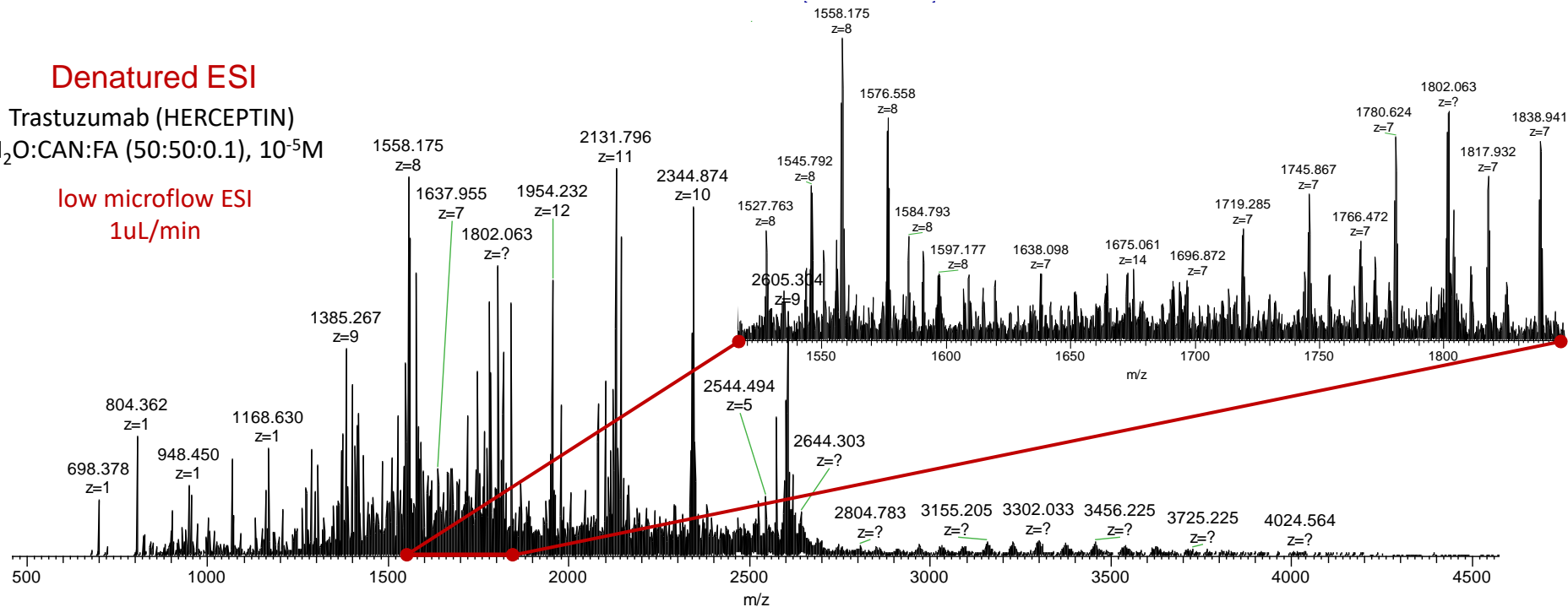
10ms Broadband Excitation CID (RF=600kHz, $\omega = 15-40$ kHz, $\delta\omega=500$ Hz, gain=2500mV)

Denatured ESI

Trastuzumab (HERCEPTIN)

H₂O:CAN:FA (50:50:0.1), 10⁻⁵M

low microflow ESI
1 μ L/min

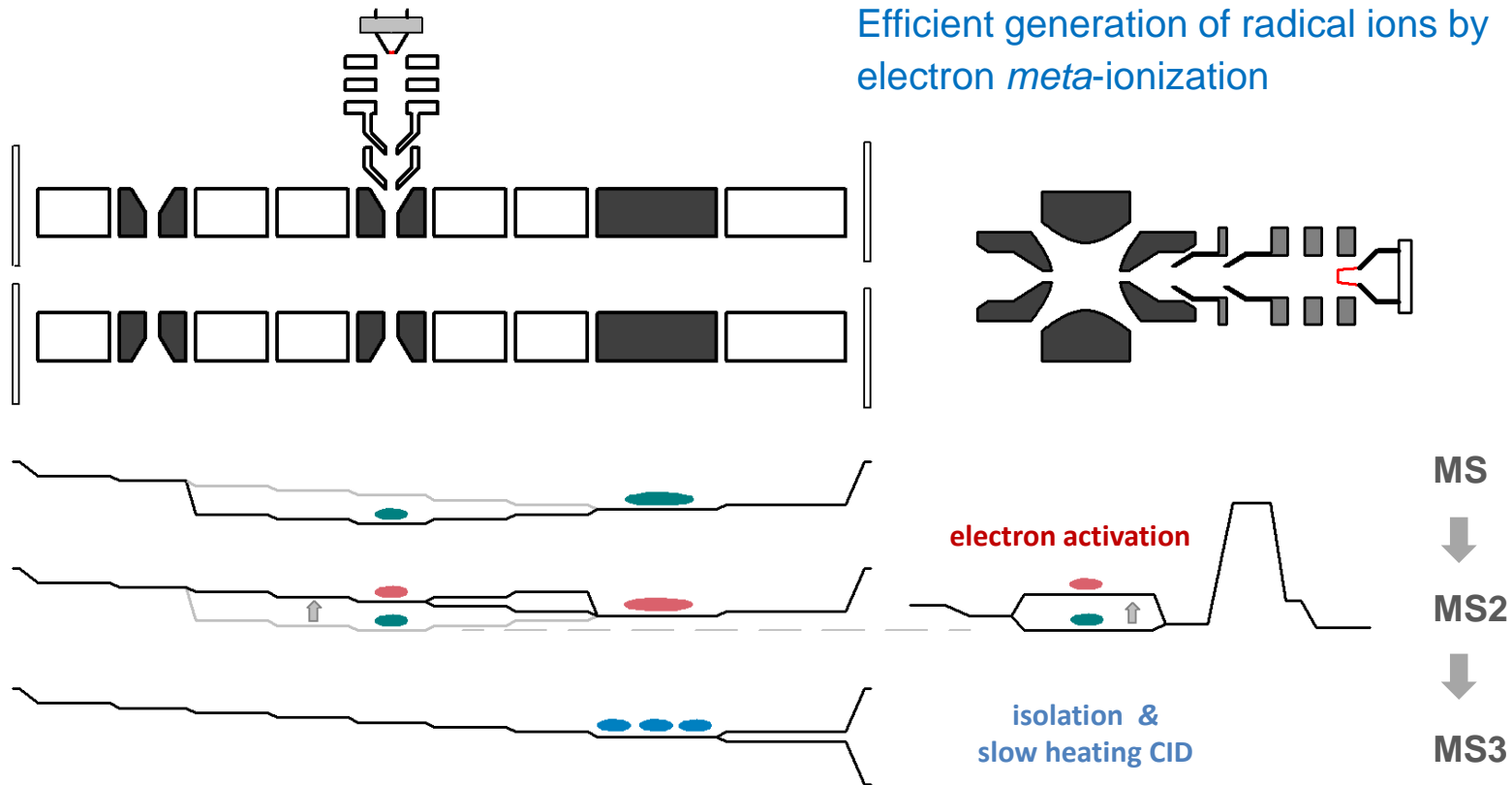


25ms Electron Capture Dissociation (1eV electron energy)

10ms Broadband Excitation (RF=600kHz, ω = 15-40 kHz, $\delta\omega$ =500Hz, gain=2500mV)

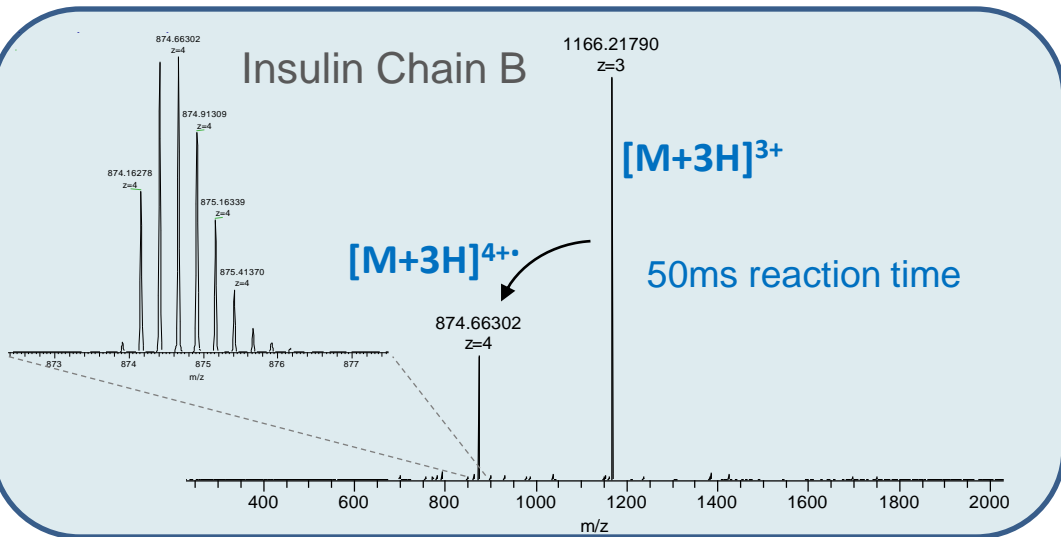
WP2 – Implementation of Activation Techniques

Multiple-Stage Tandem Mass Spectrometry

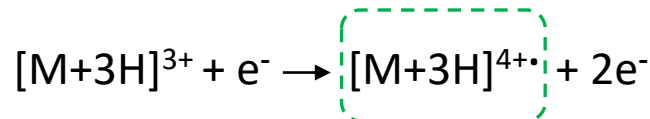


WP2 – Implementation of Activation Techniques

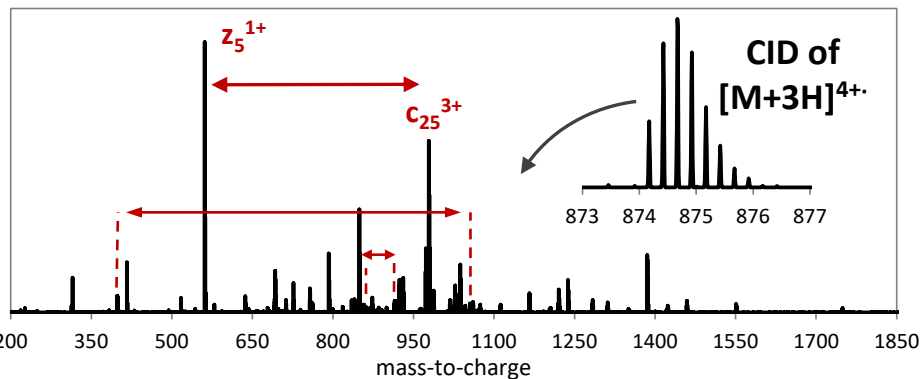
Multiple-Stage Tandem Mass Spectrometry



Electron *meta*-Ionization



Slow heating
CID



b-y & a primary fragment ions identical to CID of $[M+4H]^{4+}$

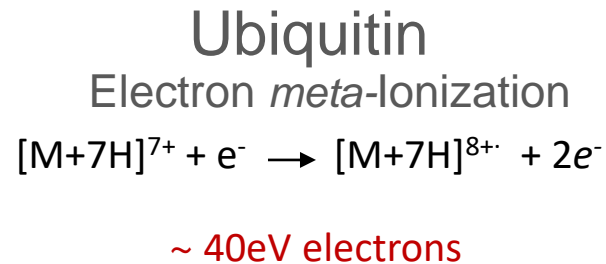
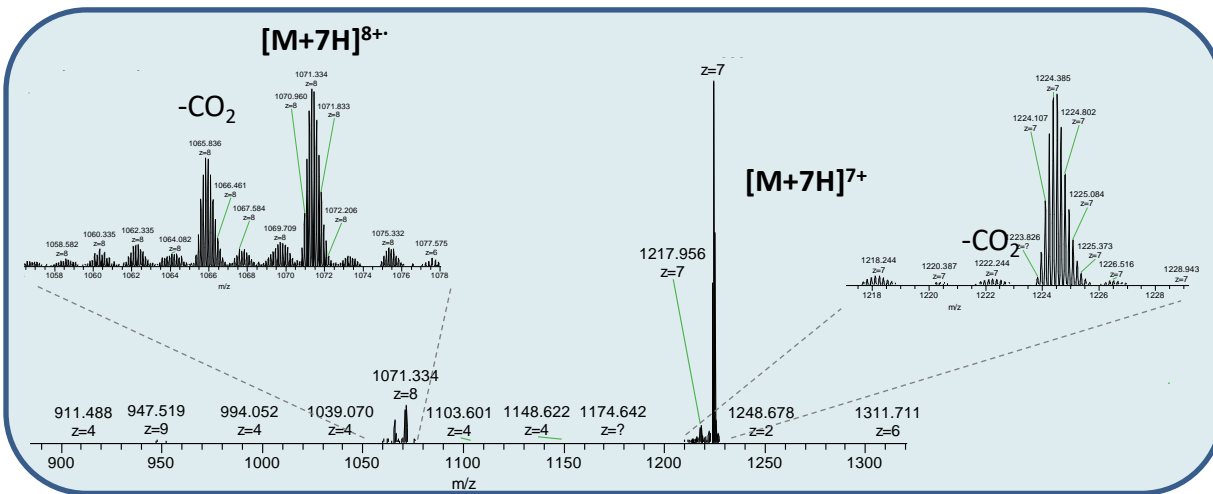
F V N Q H L C G S H L V E A L Y L V C G E R G F F
Y T P K A

preferential c-z* cleavages on aromatic residues for $[M+3H]^{4+}$

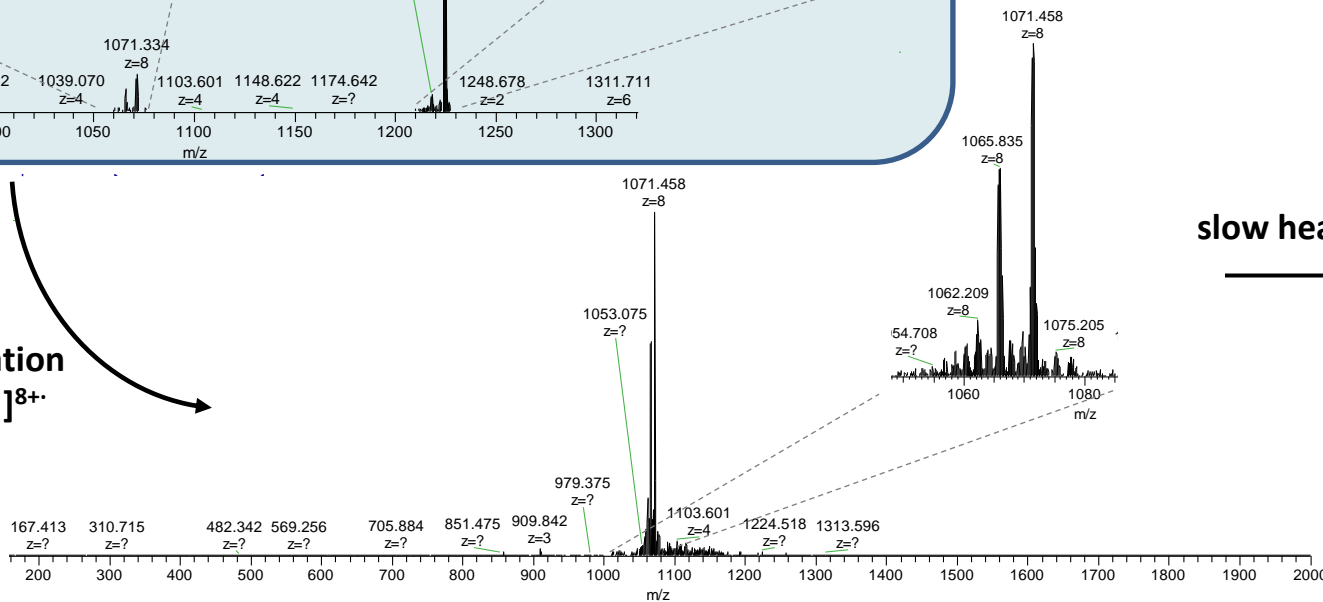
F V N Q H L C G S H L V E A L Y L V C G E R G F F
Y T P K A

WP2 – Implementation of Activation Techniques

Multiple-Stage Tandem Mass Spectrometry



Q2 isolation
 $[M+7H]^{8+}$



slow heating CID

WP2 – Implementation of Activation Techniques

[M+7H]⁸⁺

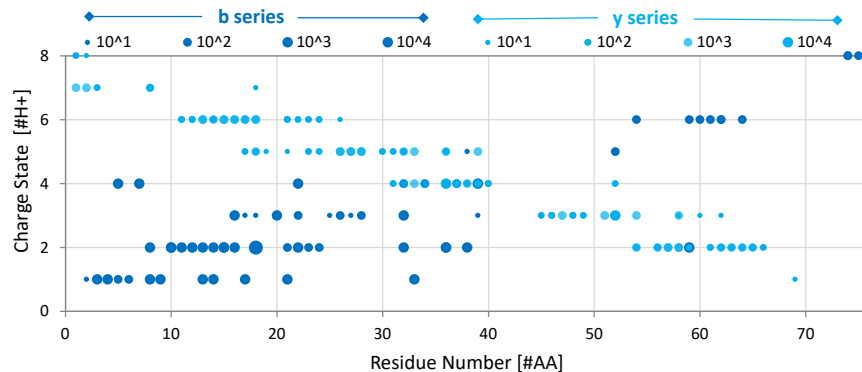
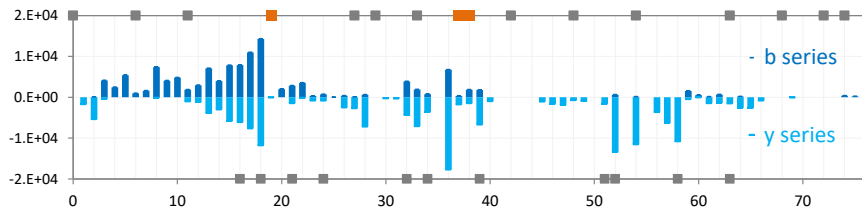
M Q I F V K T L T G K T I T L E V E P S D T I E N
 V K A K I Q D K E G I P P D Q Q R L I F A G K Q L
 E D G R T L S D Y N I Q K E S T L H L V L R L R G

Multiple-Stage Tandem Mass Spectrometry

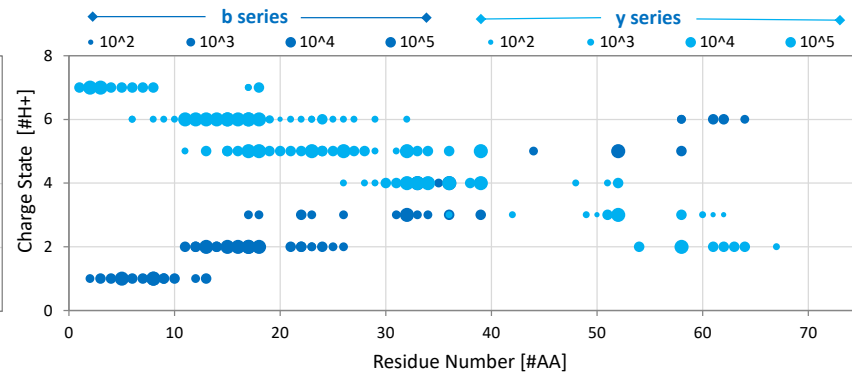
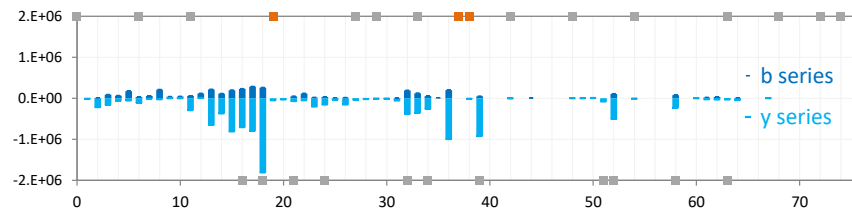
[M+8H]⁸⁺

M Q I F V K T L T G K T I T L E V E P S D T I E N
 V K A K I Q D K E G I P P D Q Q R L I F A G K Q L
 E D G R T L S D Y N I Q K E S T L H L V L R L R G

G



G



WP2 – Implementation of Activation Techniques

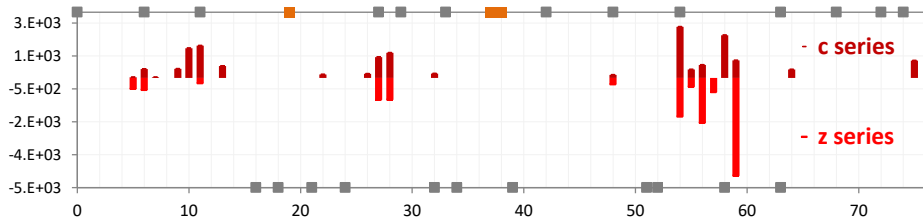
Multiple-Stage Tandem Mass Spectrometry

Hydrogen deficient protein ion : $[M+7H]^{8+}$

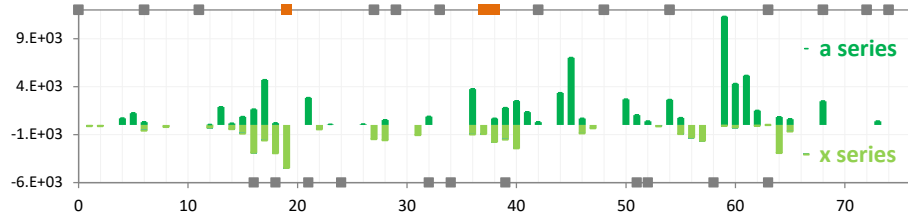
MQ I F V K T L T G K T I T L E V E P S D T I E N
V K A K I Q D K E G I P P D Q Q R L I F A G K Q L
E D G R T L S D Y N I Q K E S T L H L V L R L R G

M Q I F V K T L T G K T I T L E V E P S D T I E N
V K A K I Q D K E G I P P D Q Q R L I F A G K Q L
E D G R T L S D Y N I Q K E S T L H L V L R L R G

G



G



preferential c-z* and a-x cleavages for $[M+7H]^{8+}$

Primary fragment types, complementarity and H atom rearrangements

| -3H• | -2H• | -H• | 0 | +H• |
|------|------|-----------------------|---------|------------|
| | | b (mMass) ← b• | b• | b' |
| | | secondary losses ↓ | y• → y' | y' |
| | | a (mMass) | | |
| | | Z (mMass) | z• | z' |
| | | c | c• | C' (mMass) |
| | | a (mMass) ← a• | a• | a' |
| | | x (mMass) ← x• | x• | |
| | Z• | Z (mMass) | Z• | |
| | | | c• | C' (mMass) |
| b° | b• | b (mMass) | b• | b' |
| | | y | y• | y' |
| | Z• | Z (mMass) | Z• | z' |
| | | c | c• | C' (mMass) |

 complementary fragments observed

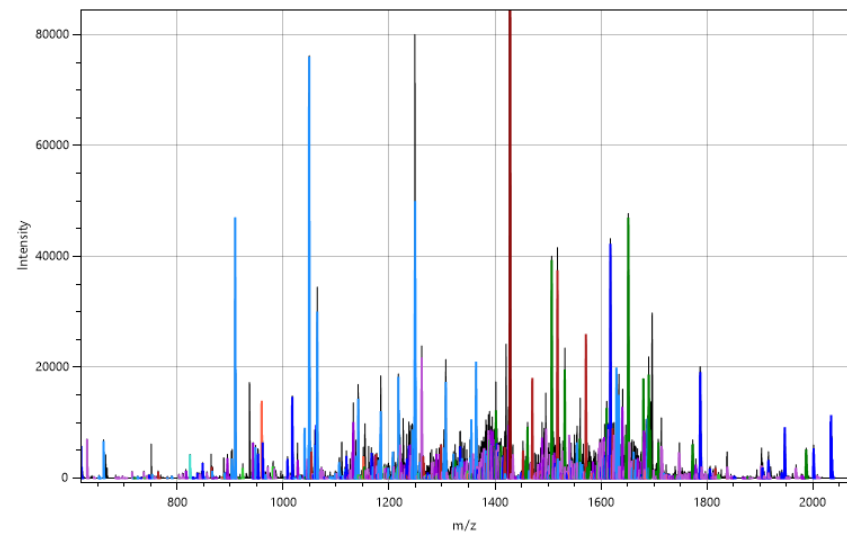
| Experiment type | Precursor mass |
|------------------------------|--|
| | $[M+nH]^{n+}$ |
| CID of $[M+nH]^{n+}$ | $b + y' = b• + y•$ |
| ECD of $[M+nH]^{n+}$ | $[M+(n+1)H]^{n+}$ $c' + z• = c• + z• + H•$ |
| | $[M+(n+1)H]^{n+}$? |
| MS3 CID of $[M+nH]^{(n+x)+}$ | $[M+nH]^{(n+1)+}$ $c' + z• = c• + z• - H•$ $y' + b• = y• + b = y• + b• - H•$ |
| | $[M+nH]^{(n+2)+}$ $y' + b° = y + b = y• + b• - 2H•$ |
| MS3 ECD of $[M+nH]^{(n+1)+}$ | $[M+nH]^{n+}$ or $[M+nH]^{n+•}$ $c' + z = c• + z•$ |

Accelerated Manual Processing Software for Deep Data Analysis

Peak Finder v13.4

Fit Diagrams Primary Fragments Internal Fragments

Primary Internal % a b c x y z inter. Clear all



Intensity

m/z

Experimental Data

Load Experiment

peak list Settings

ubi 6+1 sumto36 spectra

Spectrum Centroids

Theoretical Data

Load PP MS/MS Load MS/MS File

MQIFVKLTGKTTITLEVEPSDTIENVKAKIQDKEGIP

Profiles Centroids

Fitting Options

Auto fit Fit select

Plot fit Settings

Fit results Filter & Sort

Fragments

| | | | |
|--------------------------------|------------------------------|------------------------------|--|
| <input type="checkbox"/> a | <input type="checkbox"/> b | <input type="checkbox"/> c | <input type="checkbox"/> internal a |
| <input type="checkbox"/> a-1 | <input type="checkbox"/> b-1 | <input type="checkbox"/> c-1 | <input type="checkbox"/> internal b |
| <input type="checkbox"/> a-2 | <input type="checkbox"/> b-2 | <input type="checkbox"/> c-2 | <input type="checkbox"/> internal b-H2O |
| <input type="checkbox"/> a+1 | <input type="checkbox"/> b+1 | <input type="checkbox"/> c+1 | <input type="checkbox"/> internal b-NH3 |
| <input type="checkbox"/> a+2 | <input type="checkbox"/> b+2 | <input type="checkbox"/> c+2 | <input type="checkbox"/> internal b-2H2O |
| | | | <input type="checkbox"/> internal b-2NH3 |
| <input type="checkbox"/> x | <input type="checkbox"/> y | <input type="checkbox"/> z | <input type="checkbox"/> a-NH3 |
| <input type="checkbox"/> x-1 | <input type="checkbox"/> y-1 | <input type="checkbox"/> z-1 | <input type="checkbox"/> b-NH3 |
| <input type="checkbox"/> x-2 | <input type="checkbox"/> y-2 | <input type="checkbox"/> z-2 | <input type="checkbox"/> b-H2O |
| <input type="checkbox"/> x+1 | <input type="checkbox"/> y+1 | <input type="checkbox"/> z+1 | <input type="checkbox"/> b+H2O |
| <input type="checkbox"/> x+2 | <input type="checkbox"/> y+2 | <input type="checkbox"/> z+2 | <input type="checkbox"/> y-NH3 |
| <input type="checkbox"/> M | <input type="checkbox"/> da | <input type="checkbox"/> wb | <input type="checkbox"/> y-H2O |
| <input type="checkbox"/> M-H2O | <input type="checkbox"/> wa | <input type="checkbox"/> v | <input type="checkbox"/> b-2NH3 |
| <input type="checkbox"/> M-NH3 | <input type="checkbox"/> db | | <input type="checkbox"/> b-2H2O |
| | | | <input type="checkbox"/> y-2NH3 |
| | | | <input type="checkbox"/> y-2H2O |
| | | | <input type="checkbox"/> b-H2O-NH3 |
| | | | <input type="checkbox"/> y-H2O-NH3 |

M/z boundaries

min max

Charge

min max All

Index

primary internal from to

Resolution Machine Custom Resolution

Elite_R30000@400

OrbitrapXL_Velos_VelosPro_R12000

OrbitrapXL_Velos_VelosPro_R60000

Clear Calculation Settings Calculate

Fragment list

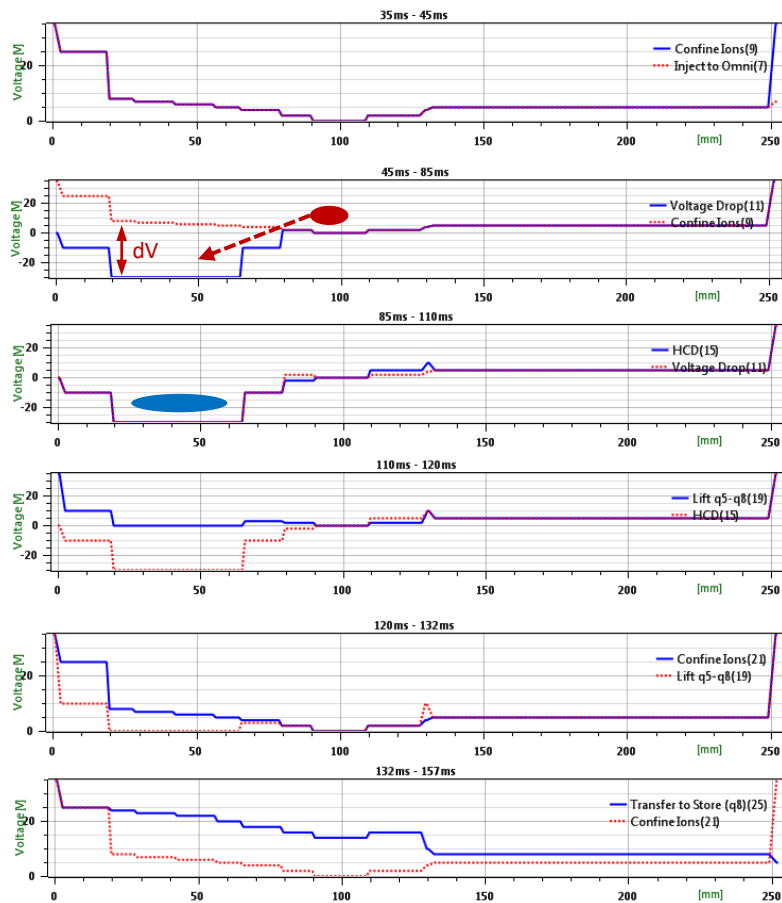
- 471.2602 - 780.9584(40)
- 781.4623 - 941.8457(40)
- 943.5446 - 1049.1000(40)
- 1052.8276 - 1122.1114(40)
- 1122.6024 - 1183.6446(40)
- 1183.8966 - 1239.6753(40)
- 1239.6761 - 1280.0944(40)
- 1282.2062 - 1324.3973(40)
- 1324.7296 - 1368.0725(40)
- 1369.2471 - 1390.5054(40)
- 1391.7637 - 1412.7715(40)
- 1412.7715 - 1477.3082(40)
- 1478.1256 - 1489.3082(40)
- 1489.3089 - 1523.8378(40)
- 1524.1558 - 1554.8486(40)
- 1558.1016 - 1601.8646(40)
- 1604.1137 - 1636.3753(40)
- 1639.3834 - 1685.3987(40)
- 1686.7225 - 1735.6887(40)
- 1736.1779 - 1782.9596(40)
- 1785.4604 - 1875.0123(40)

Fragment Storage

- [z-2]29_3+ - 1107.9311 - C144H242N44O46 - 2.6 - 1.3
- [z-2]31_2+ - 1725.4223 - C149H249N46O48 - 2.12 - 1.3
- [z-2]33_3+ - 1237.3348 - C164H270N48O50 - 0.21 - 1.3
- [z-2]34_3+ - 1275.0295 - C170H281N49O51 - 2.08 - 1.3
- [z-2]36_3+ - 1369.7494 - C181H301N55O54 - 0.36 - 1.3
- [z-2]41_4+ - 1165.1326 - C206H340N61O62 - 3.66 - 1.3
- [z-2]52_5+ - 1174.441 - C258H431N77O79 - 0.28 - 1.3
- [z-2]54_4+ - 1528.3311 - C269H448N79O83 - 0.4 - 1.3
- [z-2]55_5+ - 1243.0759 - C273H456N80O85 - 1.93 - 1.3
- [z-2]56_4+ - 1582.3497 - C277H460N81O88 - 3.11 - 1.3
- [z-2]60_4+ - 1685.3987 - C295H488N85O95 - 3.55 - 1.3
- [z-2]60_5+ - 1348.5204 - C295H489N85O95 - 2.12 - 1.3
- [z-2]66_5+ - 1485.6006 - C326H544N92O105 - 0.62 - 1.3
- [z-2]69_5+ - 1539.8313 - C338H565N95O109 - 2.47 - 1.3
- [z-2]71_5+ - 1585.6598 - C348H584N98O112 - 1.37 - 1.3
- [z-2]75_5+ - 1683.1157 - C373H621N103O117 - 1.3 - 1.3

x internal a lwa

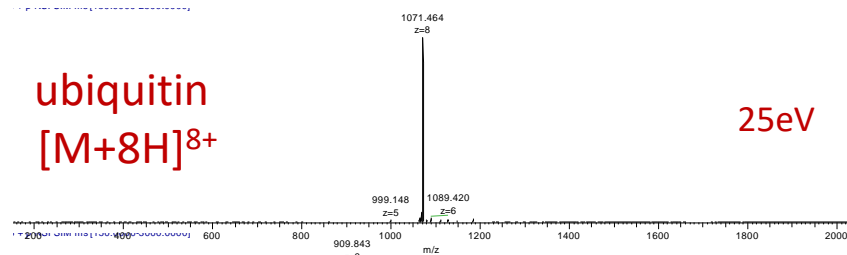
WP2 – Implementation of Activation Techniques



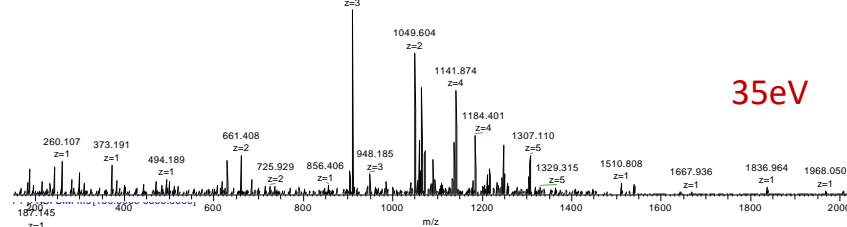
High Energy Collision Induced Dissociation in the Omnitrap

ubiquitin
[M+8H]⁸⁺

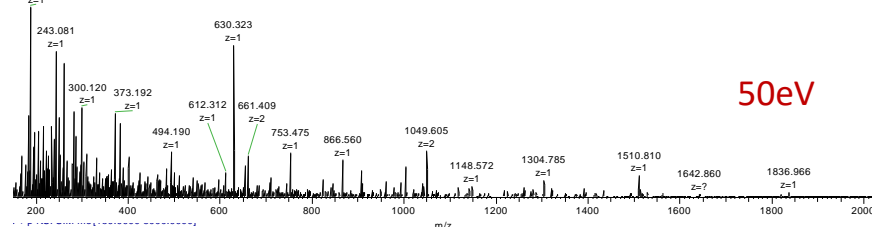
25eV



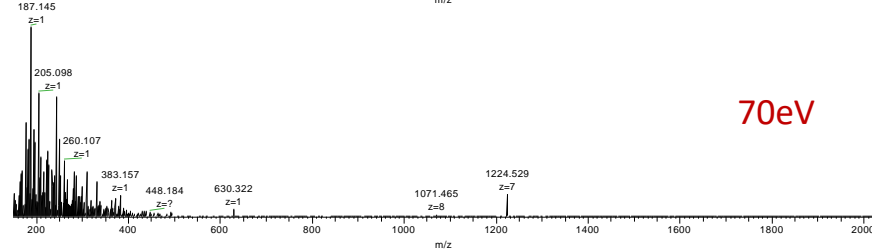
35eV



50eV

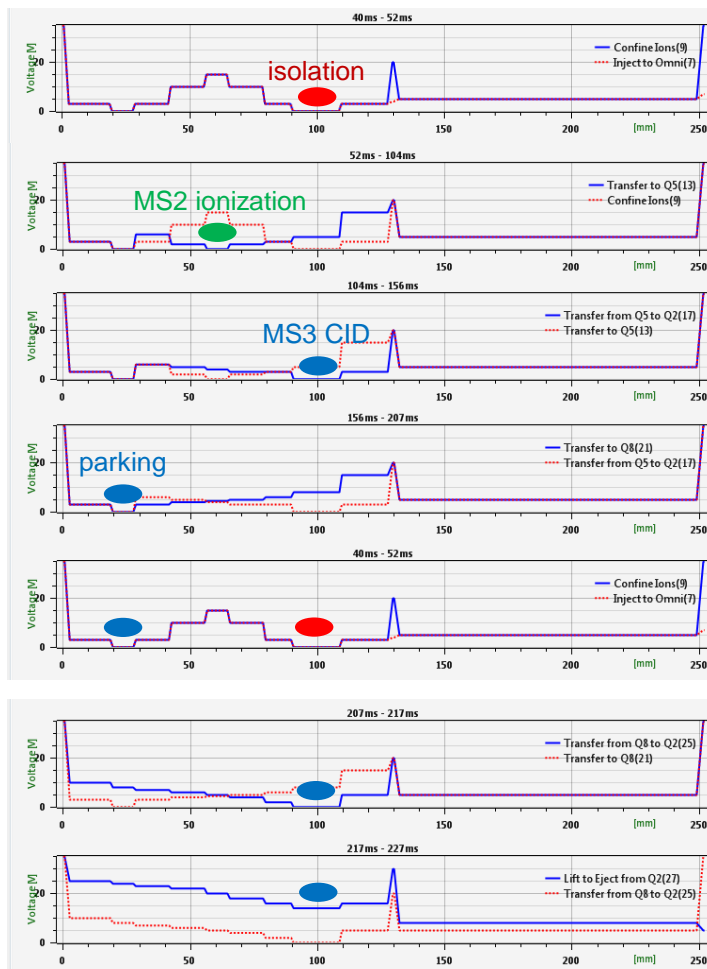


70eV

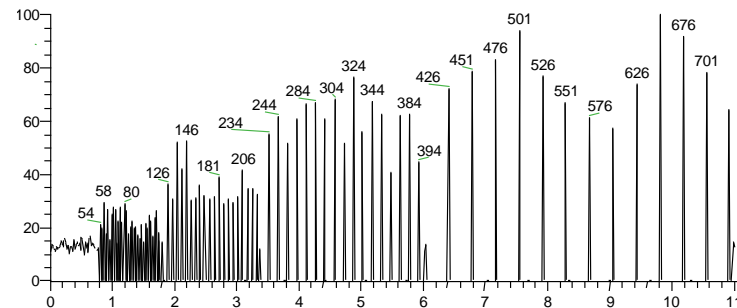
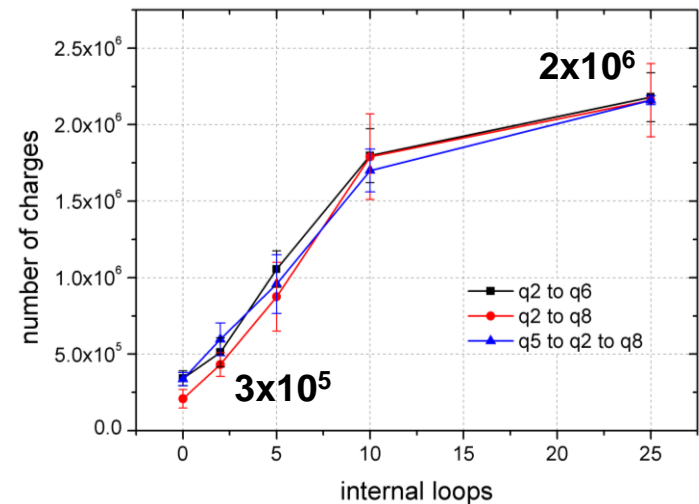


WP2 – Implementation of Activation Techniques

| internal loop | | | |
|---------------|-------------------------|---------------|----------------|
| # | Instruction | Duration [ms] | Exp. Time [ms] |
| 1 | Trigger In | Set | 0 |
| 2 | Digital RF [KHz] | 900 | 0 |
| 3 | Delay | -> | 0 |
| 4 | Normal Q2 | 10 | 10 |
| 5 | Gas Pulse 2 [μs] | 285 | 10 |
| 6 | Delay | 5 | 10 |
| 7 | Inject to Omni | -> | 15 |
| 8 | Delay | 25 | 15 |
| 9 | Confine Ions | -> | 40 |
| 10 | Delay | 10 | 40 |
| 11 | Gas Pulse 1 [μs] | 155 | 50 |
| 12 | Delay | 2 | 50 |
| 13 | Transfer to Q5 | -> | 52 |
| 14 | Delay | 50 | 52 |
| 15 | Gas Pulse 2 [μs] | 285 | 102 |
| 16 | Delay | 2 | 102 |
| 17 | Transfer from Q5 to ... | -> | 104 |
| 18 | Delay | 50 | 104 |
| 19 | Gas Pulse 1 [μs] | 155 | 154 |
| 20 | Delay | 2 | 154 |
| 21 | Transfer to Q8 | -> | 156 |
| 22 | Delay | 50 | 156 |
| 23 | Gas Pulse 2 [μs] | 285 | 206 |
| 24 | Delay | 1 | 206 |
| 25 | Transfer from Q8 to ... | -> | 207 |
| 26 | Delay | 10 | 207 |
| 27 | Lift to Eject from Q2 | -> | 217 |
| 28 | Delay | 10 | 217 |
| 29 | Eject to HCD cell | -> | 227 |
| 30 | Delay | 50 | 227 |
| 31 | Digital RF [KHz] | 0 | 277 |
| 32 | Delay | 15 | 277 |
| 33 | Normal Q2 | -> | 292 |

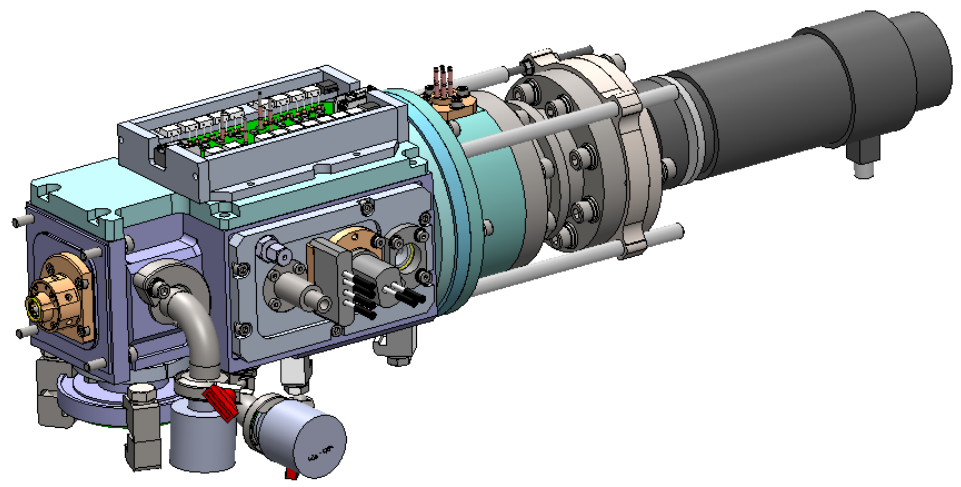
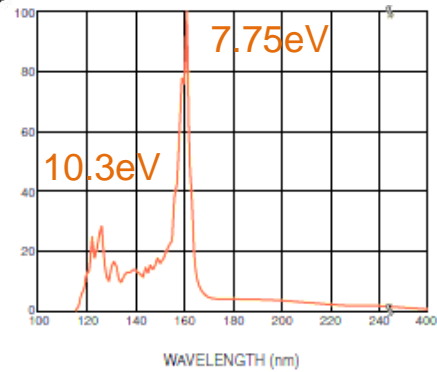
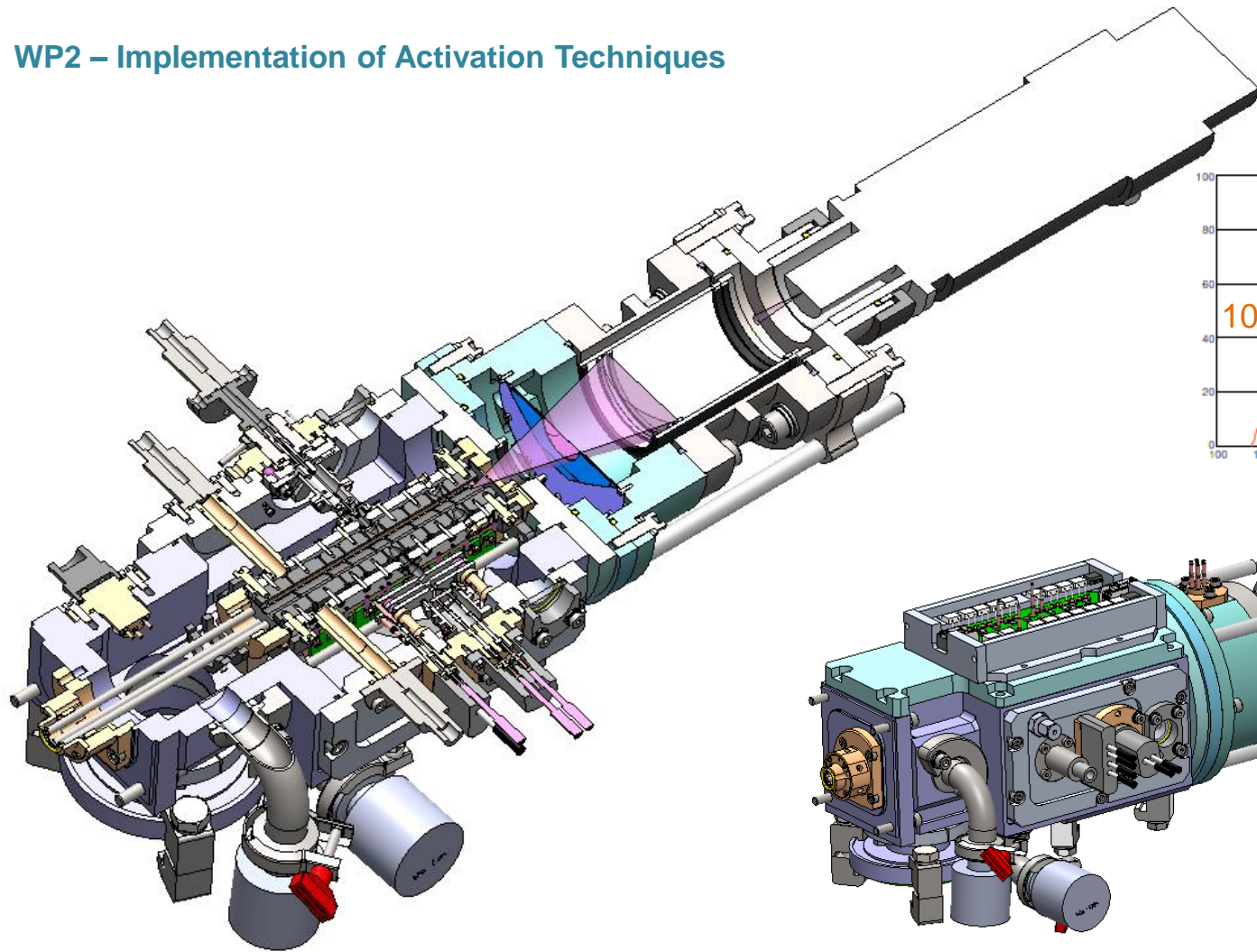


Ion Accumulation in MS3 Mode

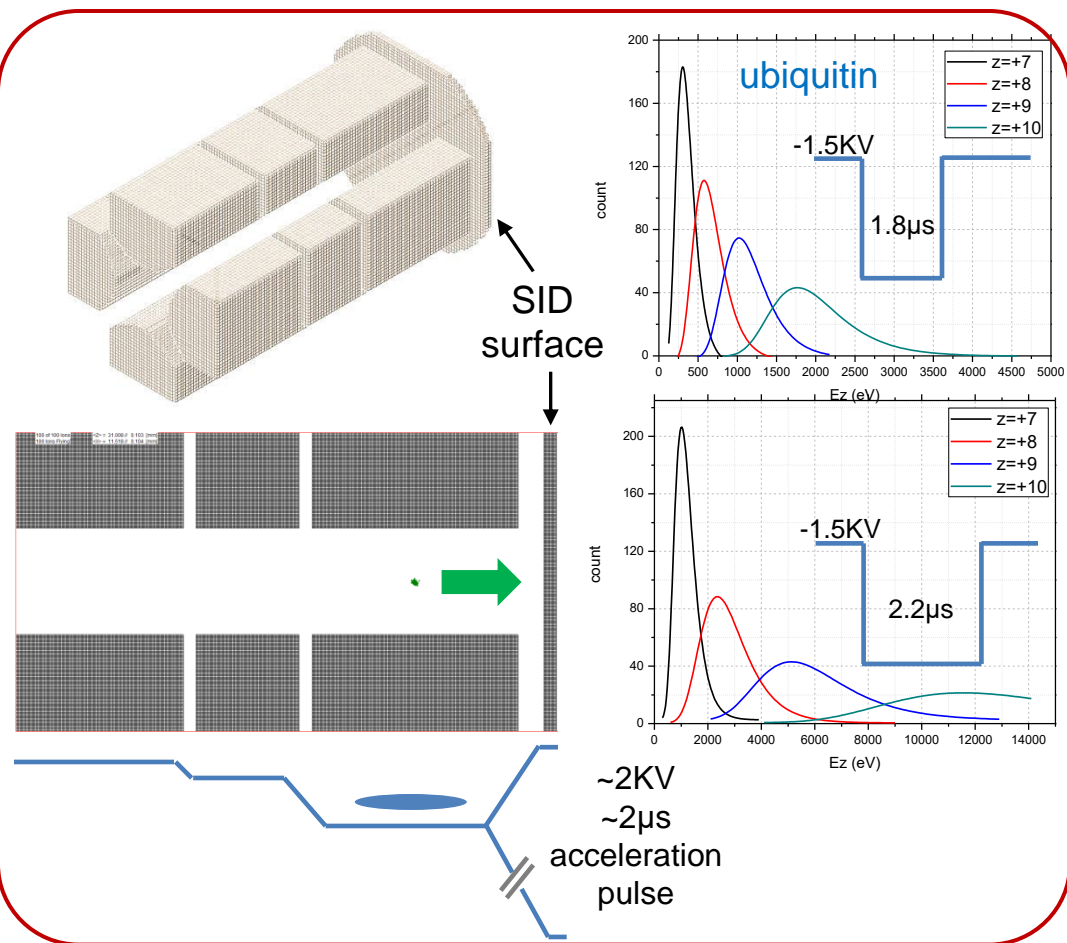


WP2 – Implementation of Activation Techniques

VUV Photo-dissociation



WP2 – Implementation of Activation Techniques



Surface Induced Dissociation

