Coupling FAIMS and LESA:
Improvements in protein analysis directly from biological substrates

Andrew Creese

School of Biosciences,
University of Birmingham.

ASMS
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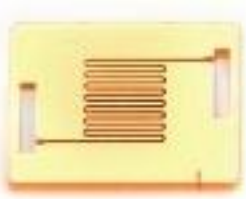
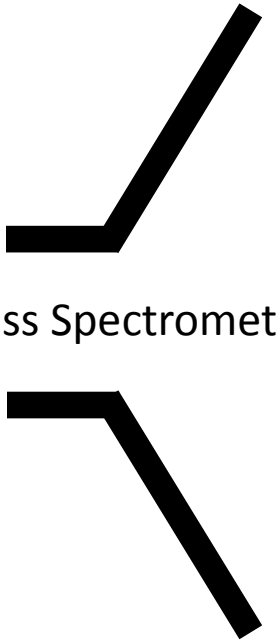
UNIVERSITY OF BIRMINGHAM

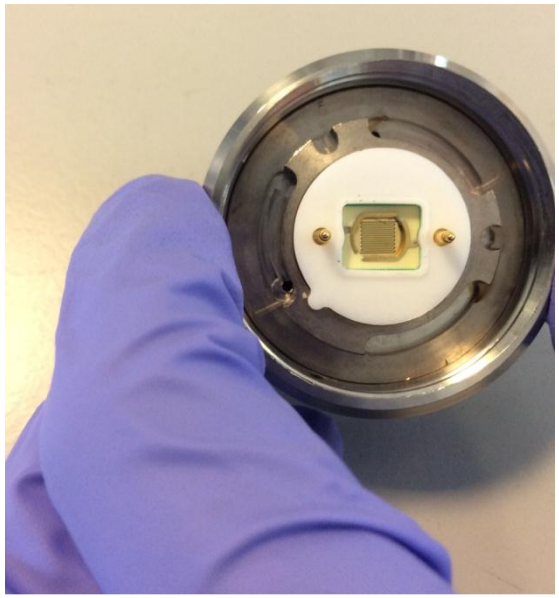
FAIMS: High field asymmetric waveform ion mobility spectrometry

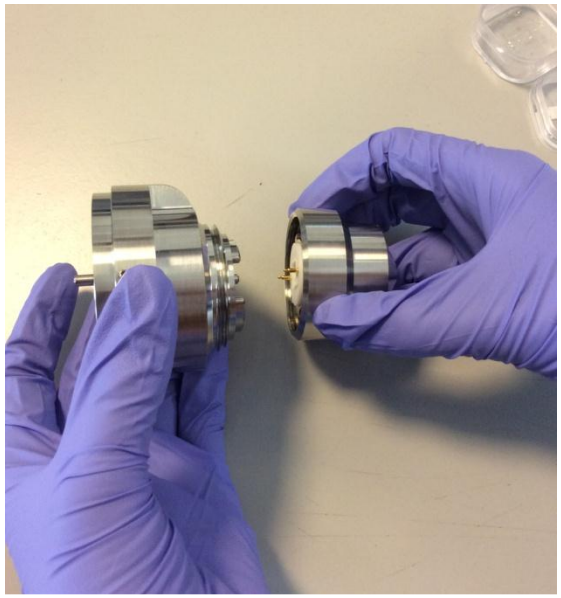
Gap width = 100 µm
Thickness = 700 µm

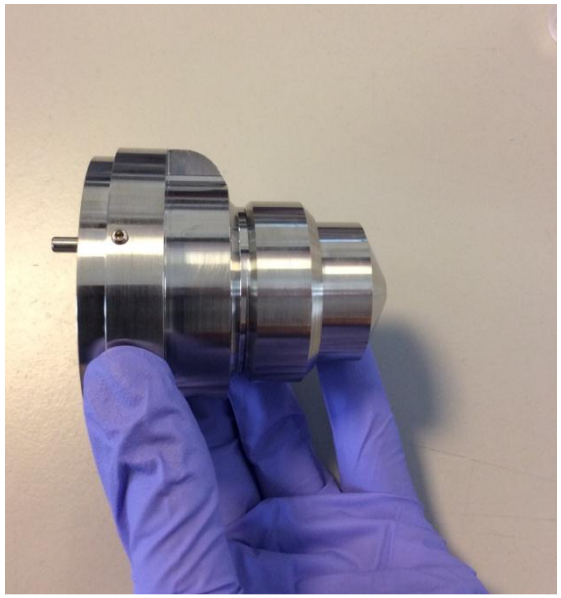


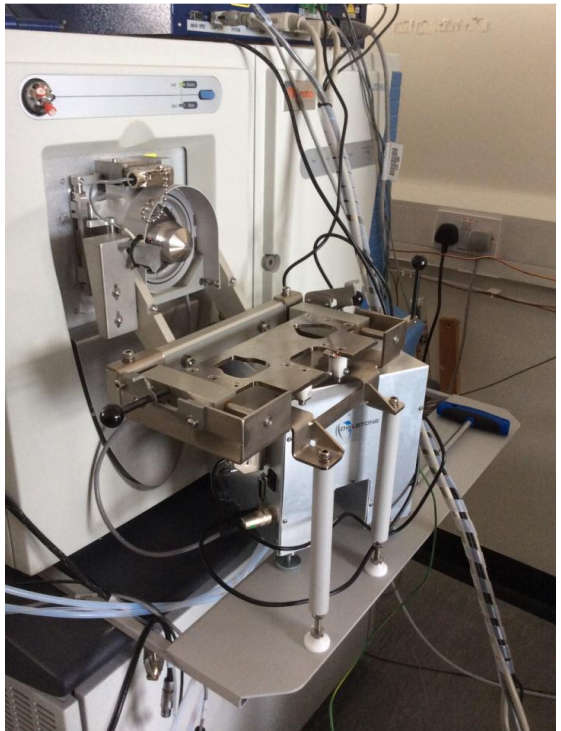


Coupling ultraFAIMS with TriVersa Nanomate







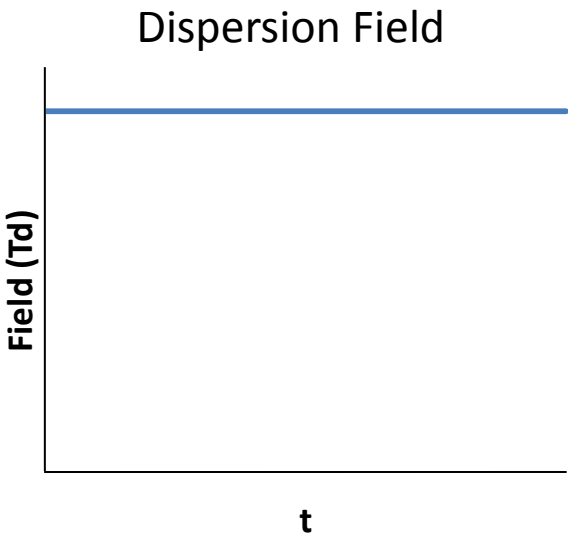


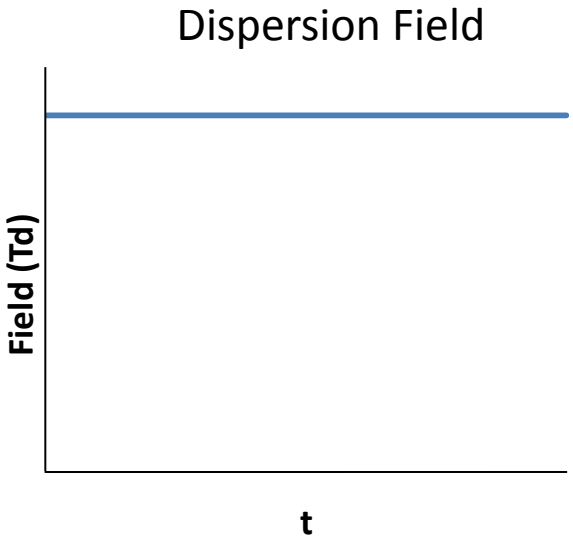
Mode of operation

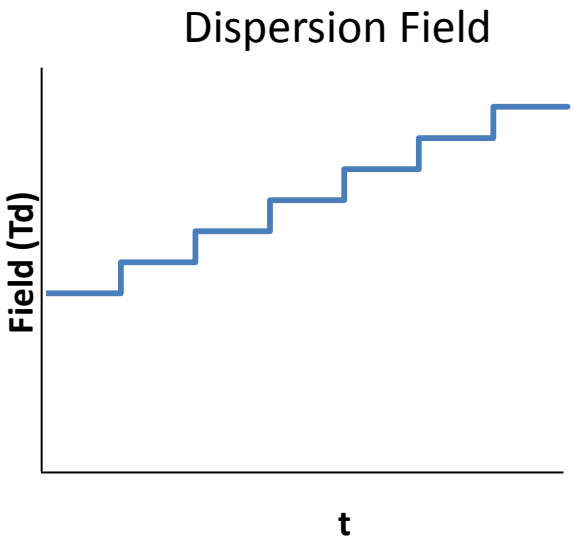
Static

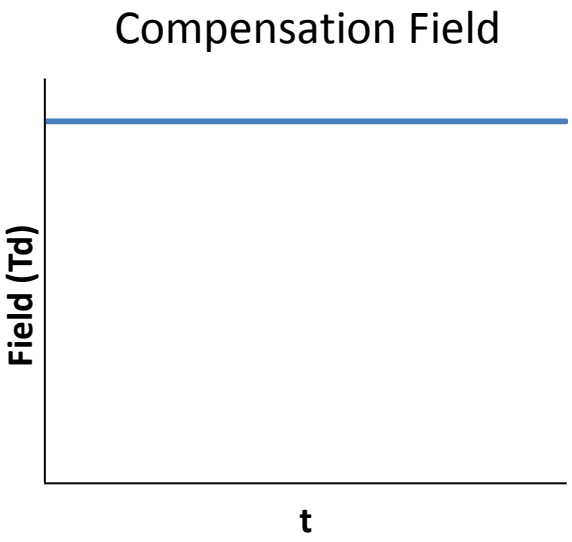
1D

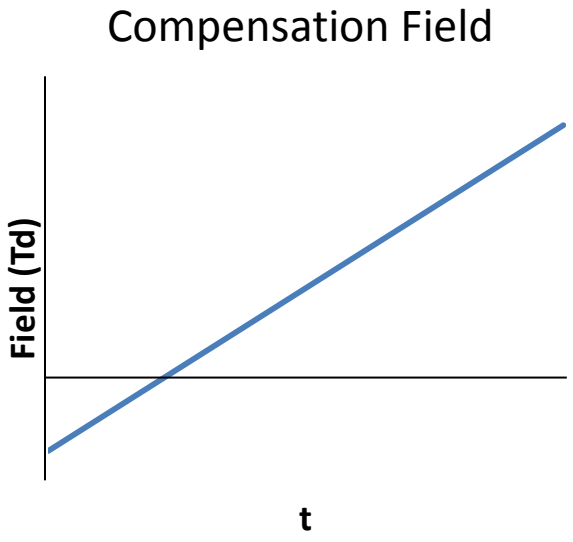
2D

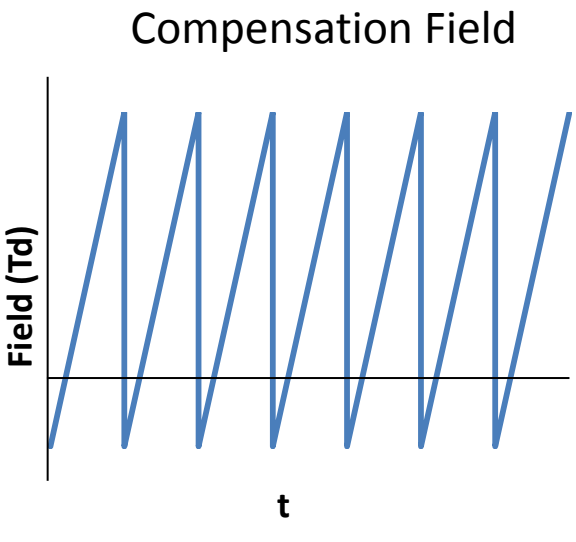


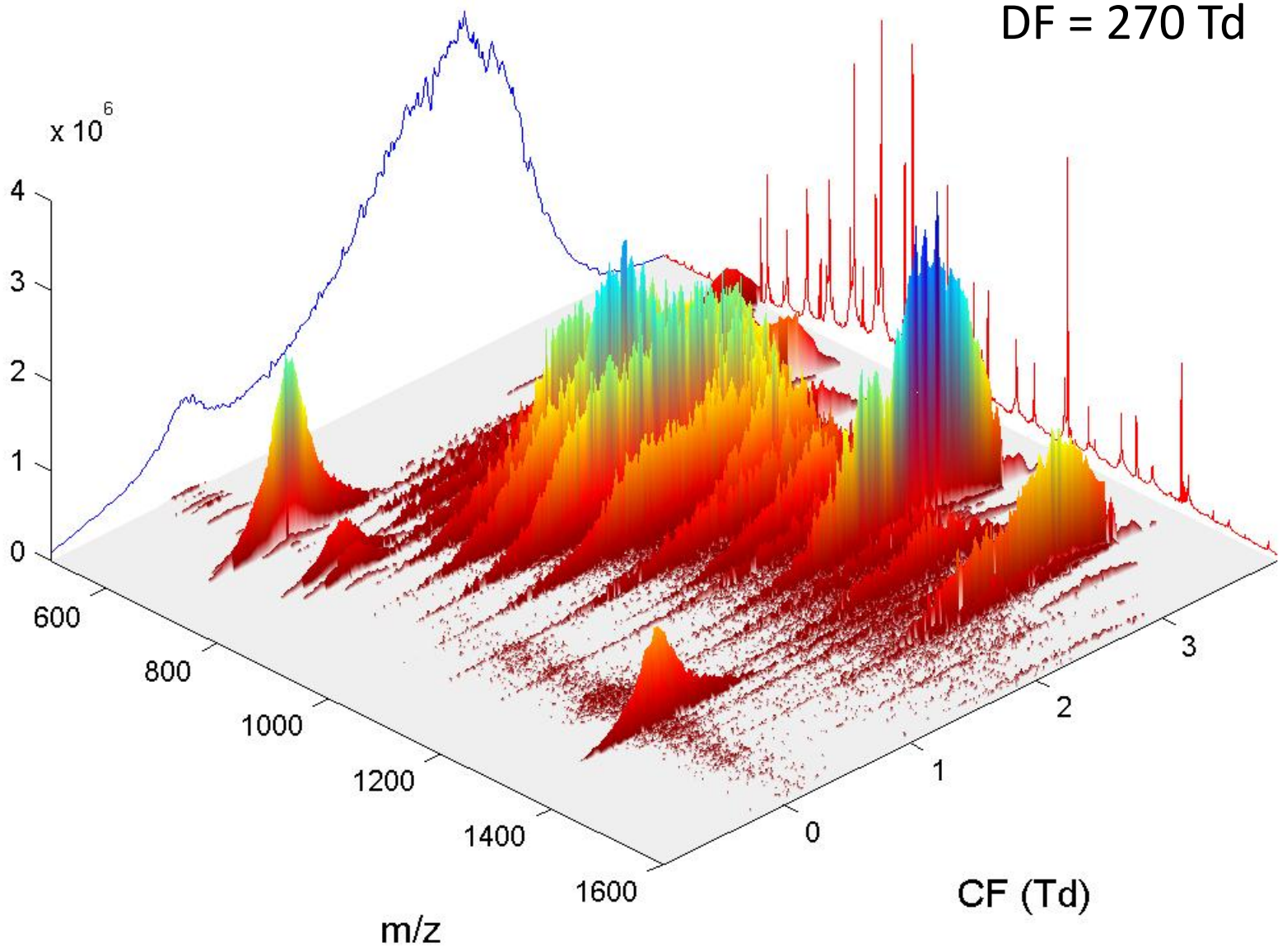






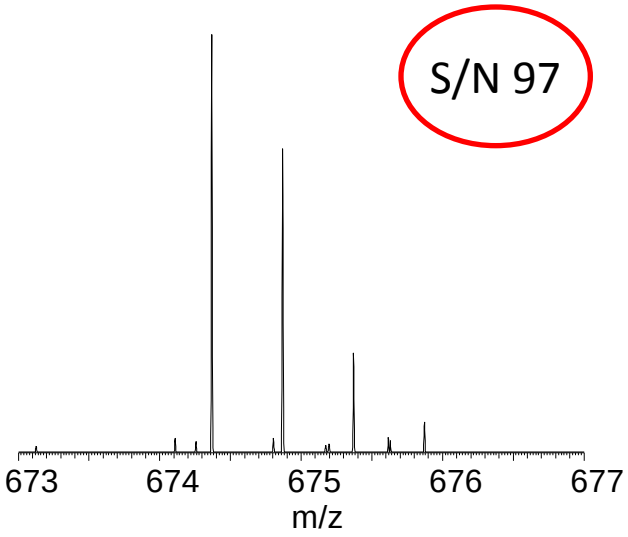




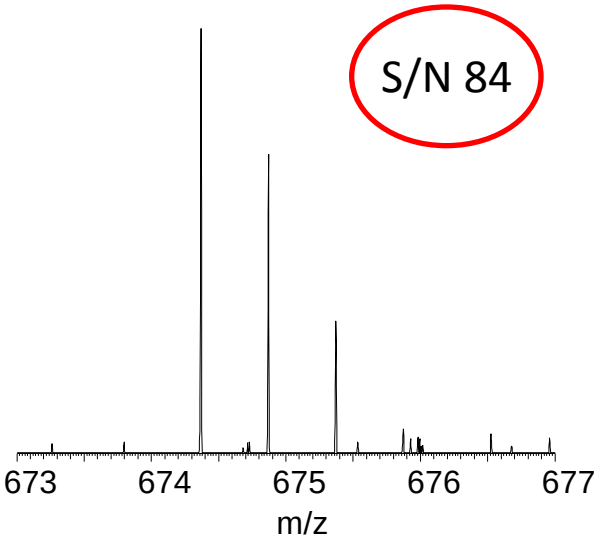

DF = 270 Td
x 10^6
4
3
2
1
0
600
800
1000
1200
1400
1600
m/z
0
1
2
3
CF (Td)

Substance P $[M+2H]^{2+}$

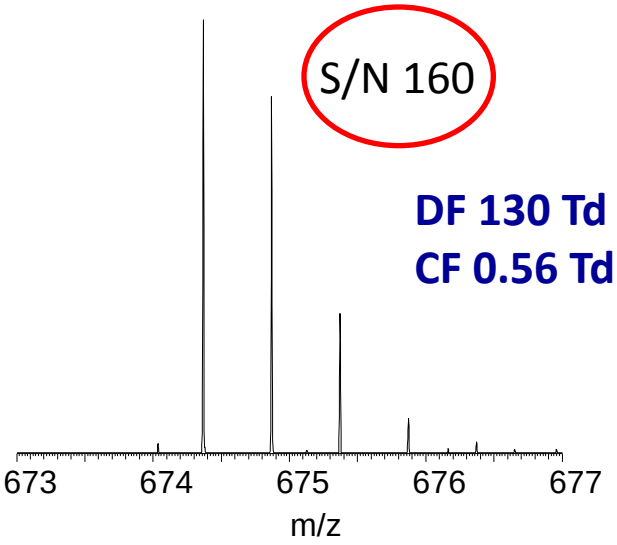
No FAIMS 1.27E7



FAIMS no Field 8.26E5



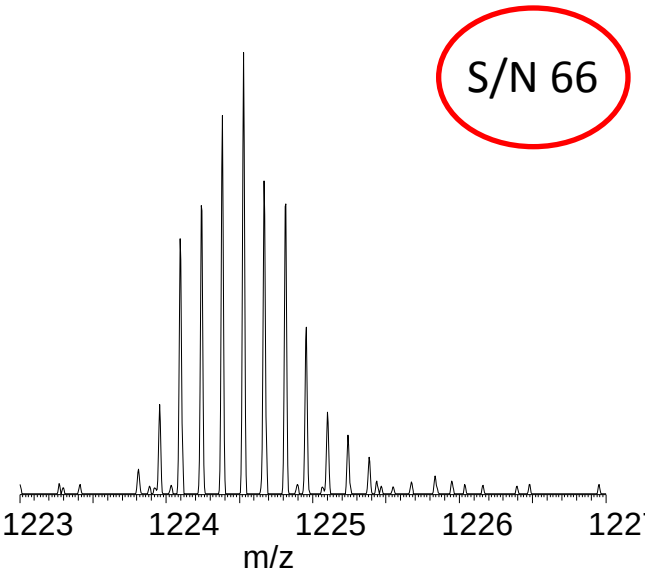
FAIMS 6.74E5



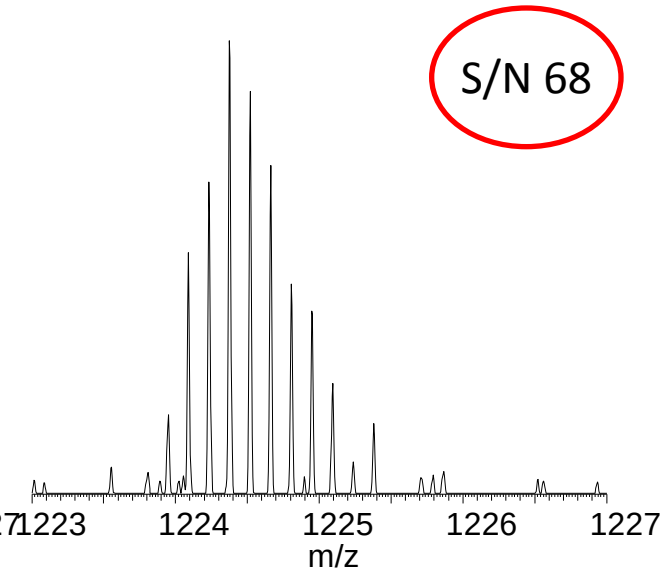
DF 130 Td
CF 0.56 Td

Ubiquitin$[M+7H]^{7+}$

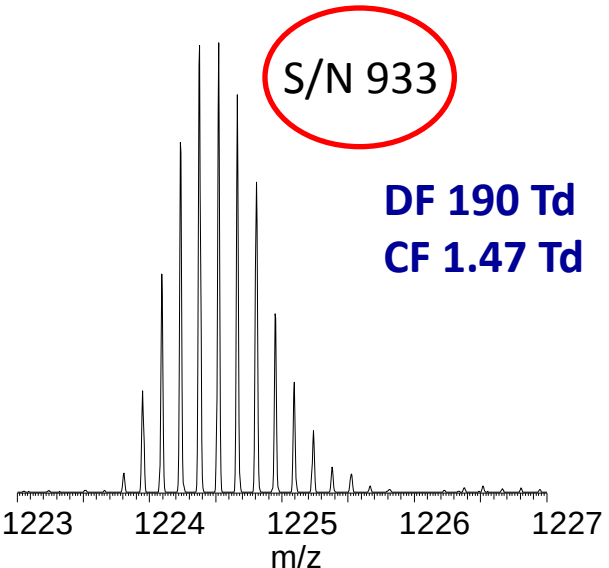
No FAIMS 1.30E7



FAIMS no Field 1.15E6

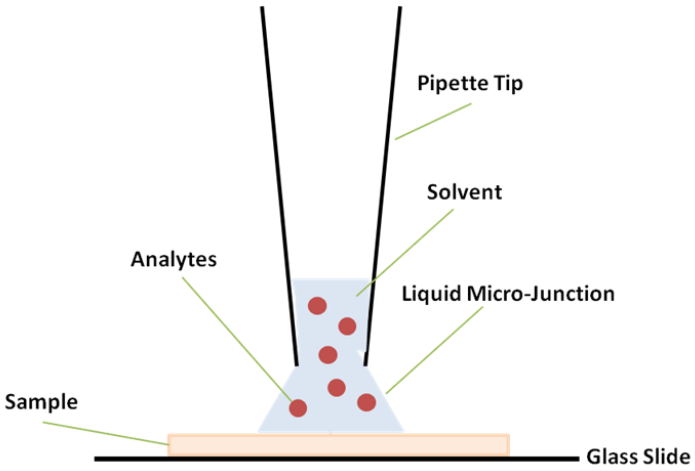


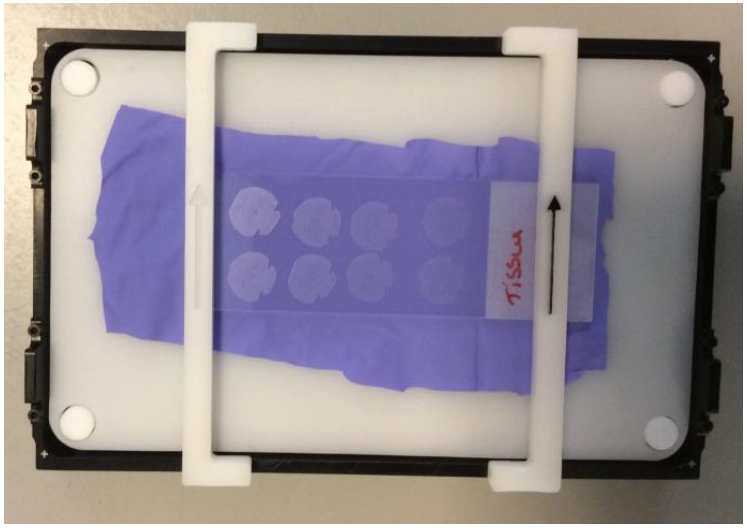
FAIMS 8.88E5

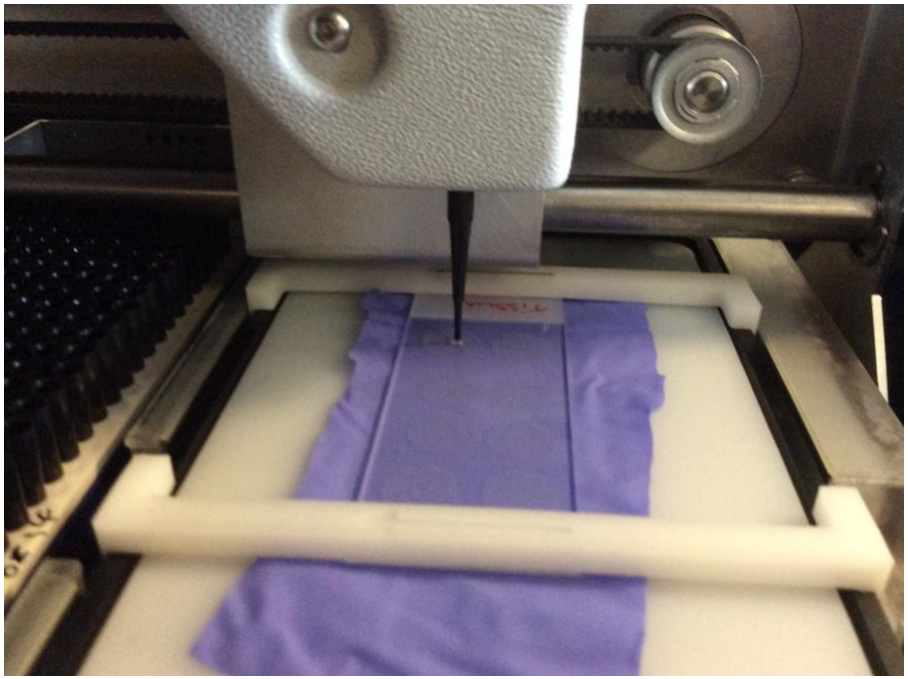


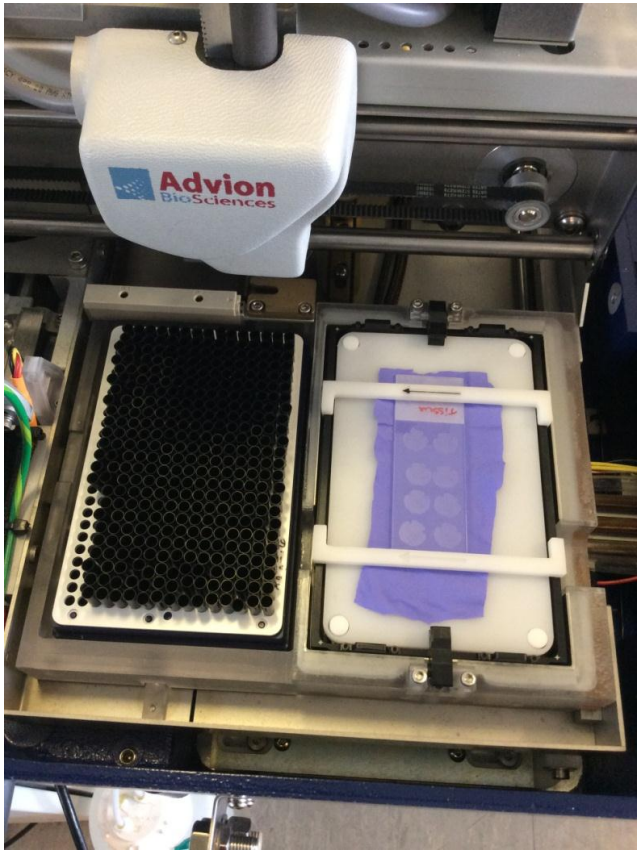
DF 190 Td
CF 1.47 Td

LESA: Liquid extraction surface analysis

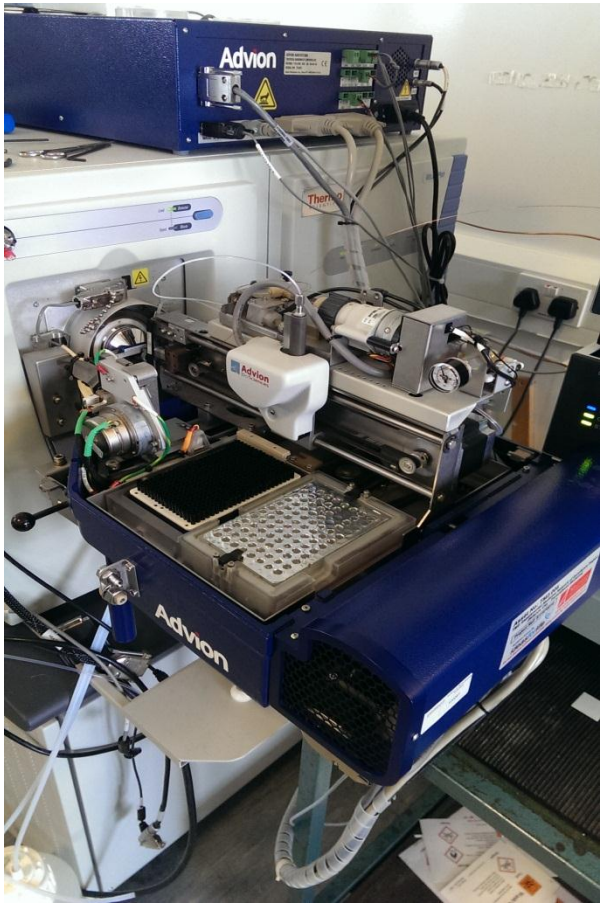




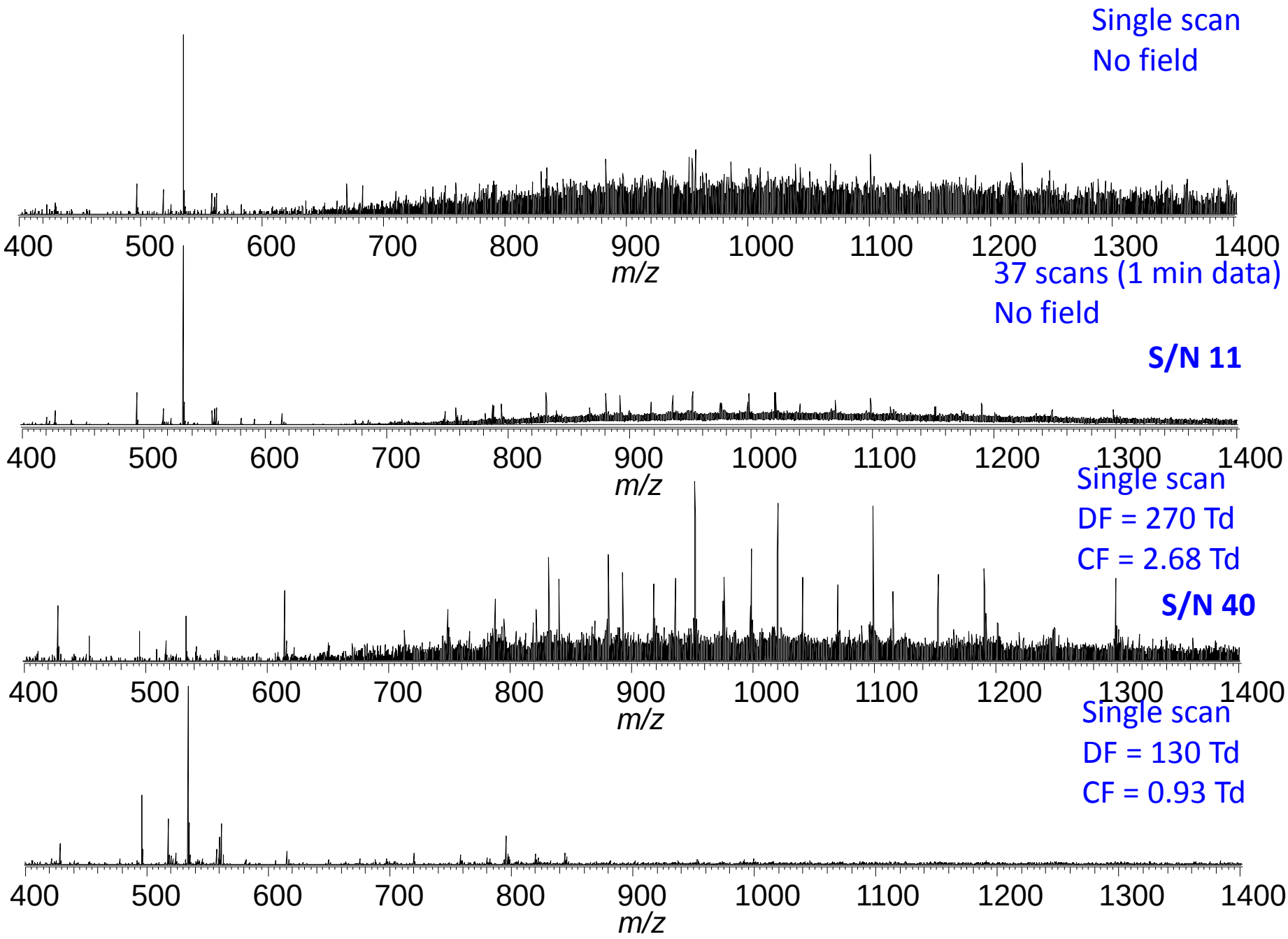




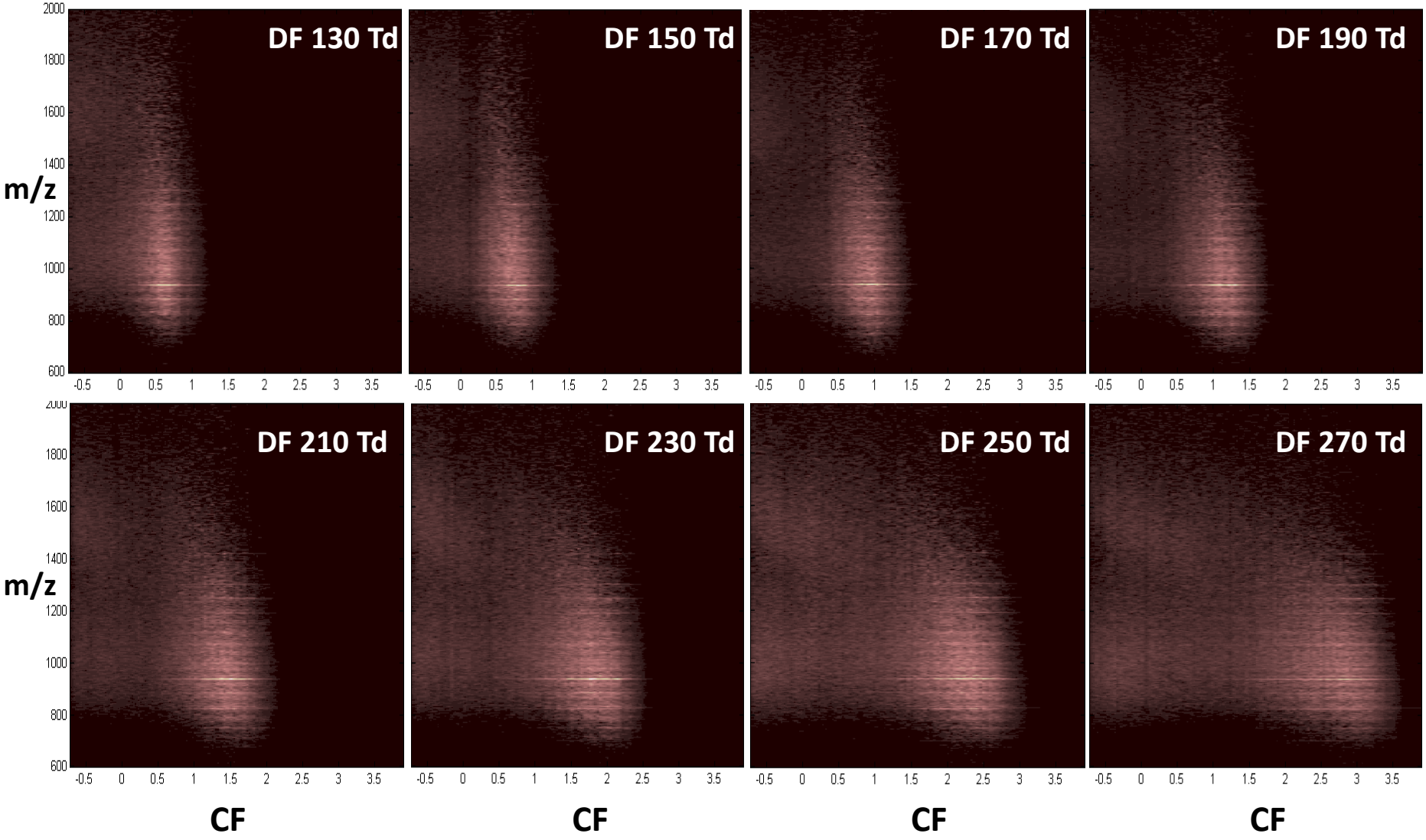
Workflow



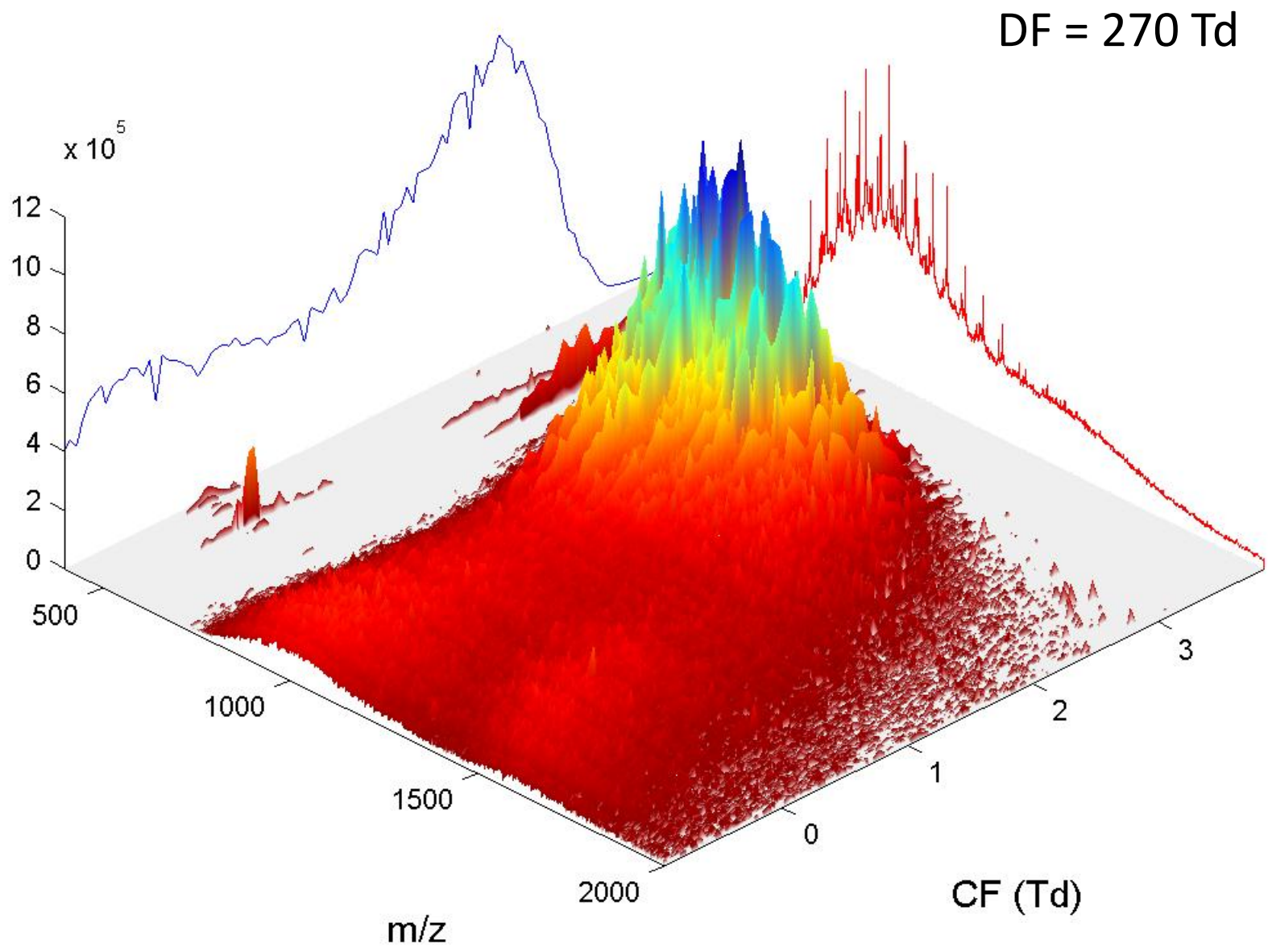
LESA FAIMS MS of mouse liver



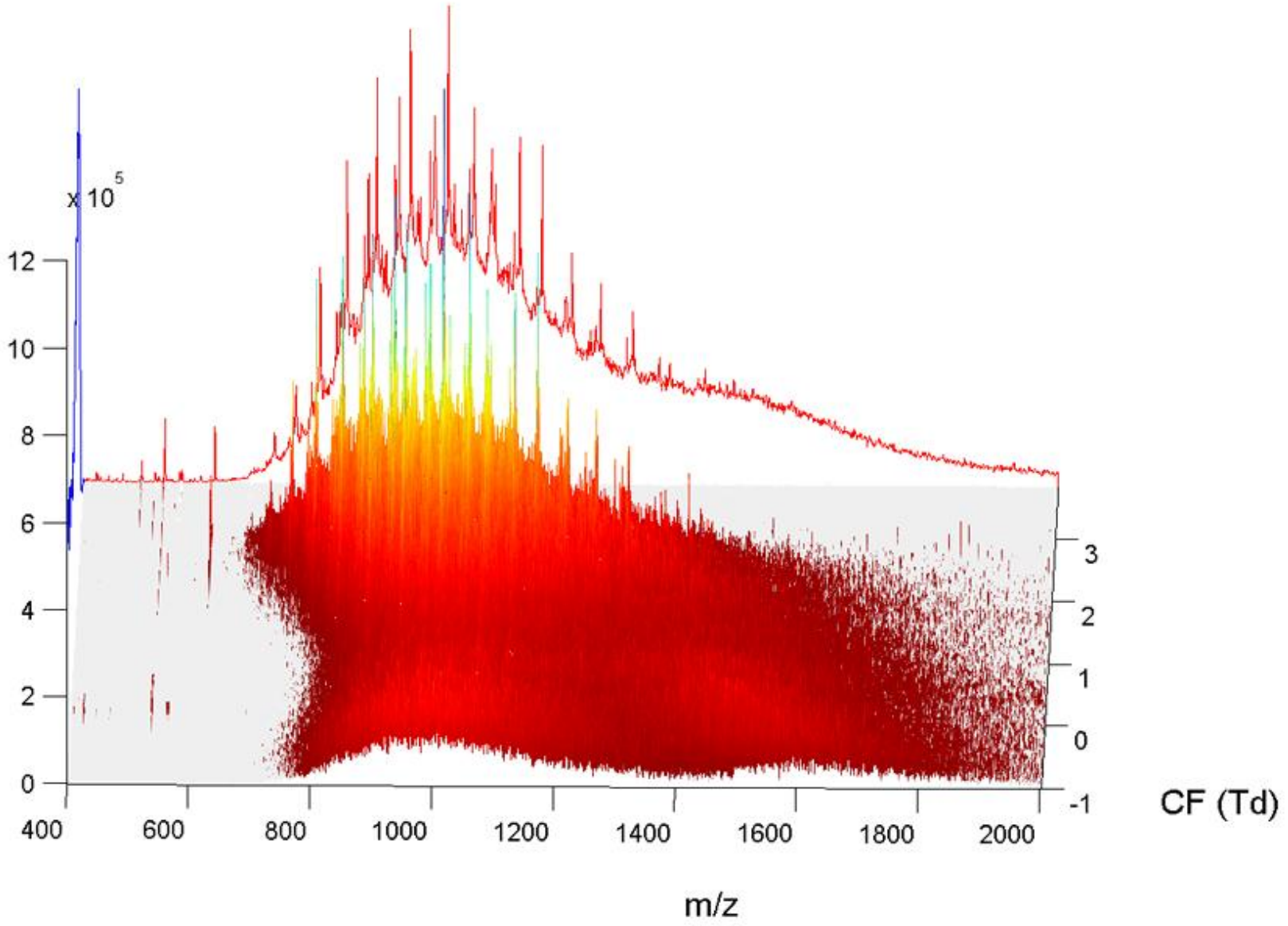
Visualisation: Total ion transmission maps – mouse liver



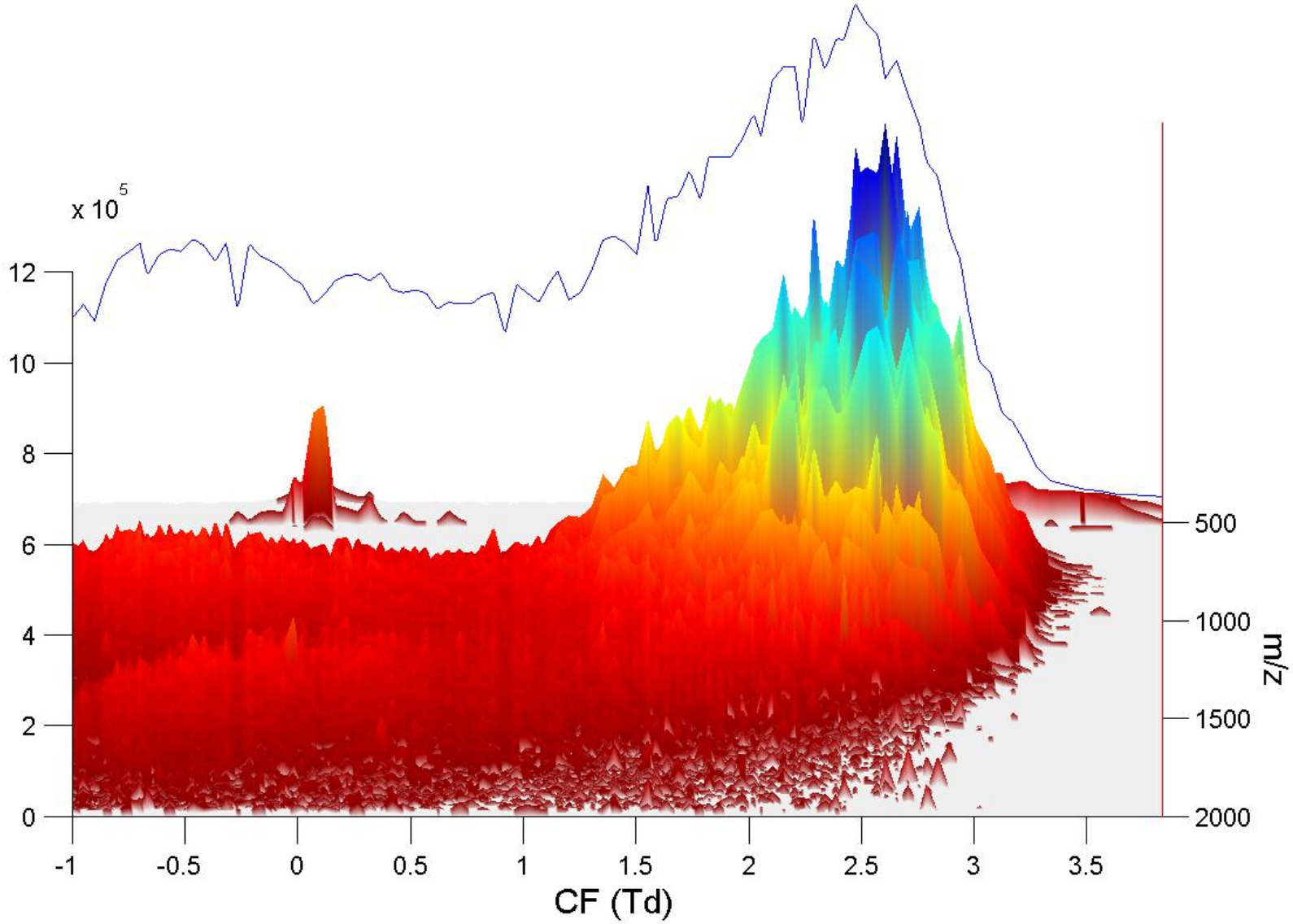
Visualisation: Total ion transmission maps – mouse liver



Visualisation: Total ion transmission maps – mouse liver

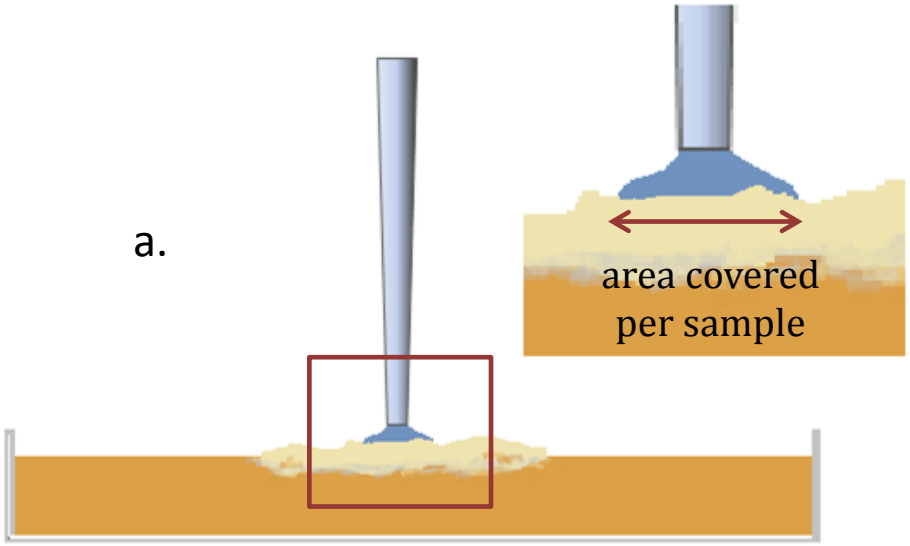


Visualisation: Total ion transmission maps – mouse liver

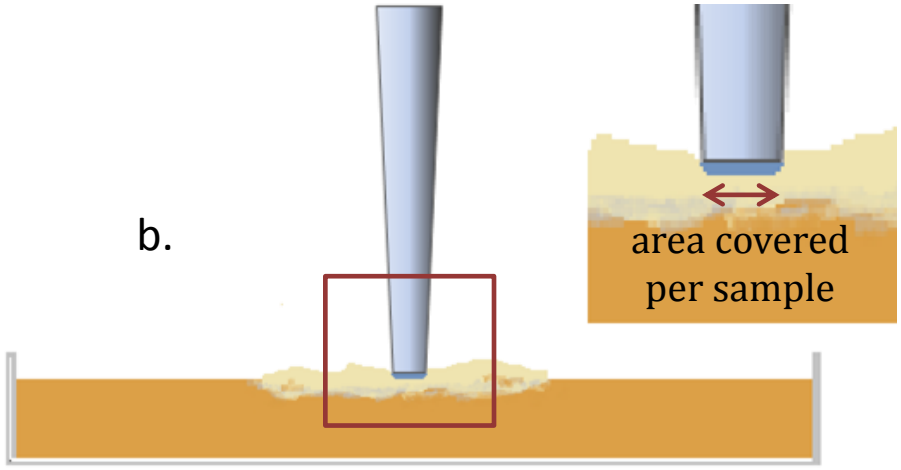


Contact LESA: Liquid extraction surface analysis

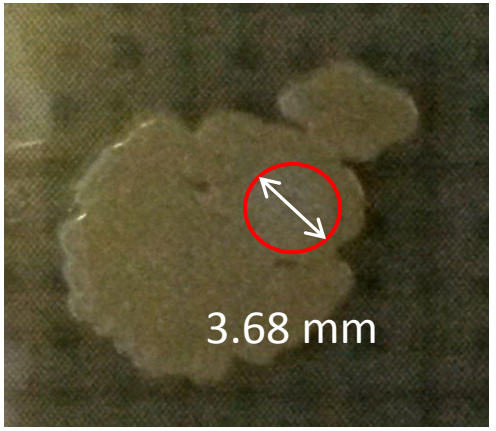
a.



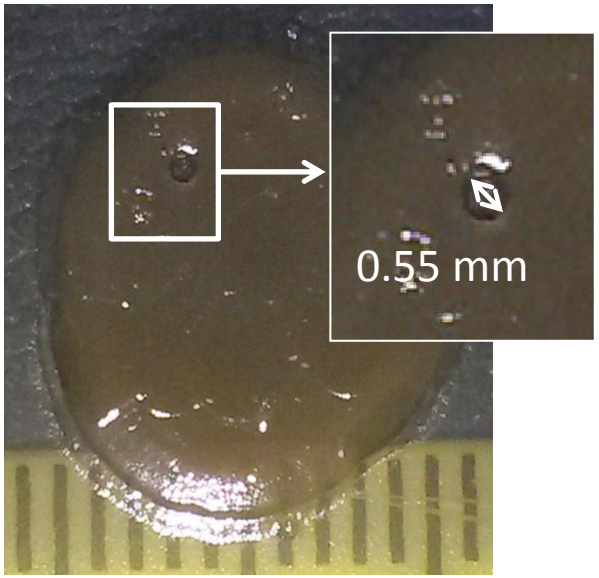
b.



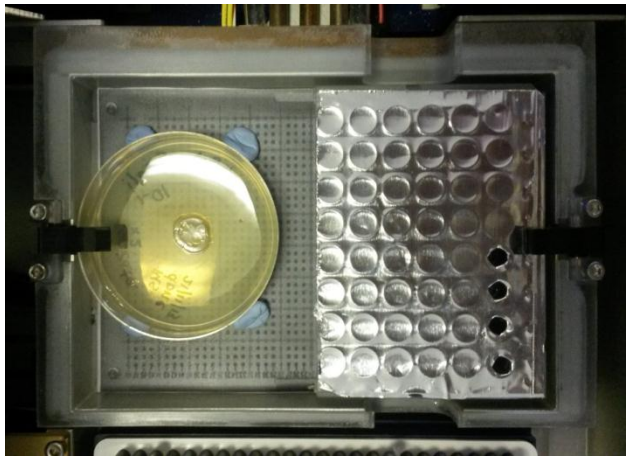
c.

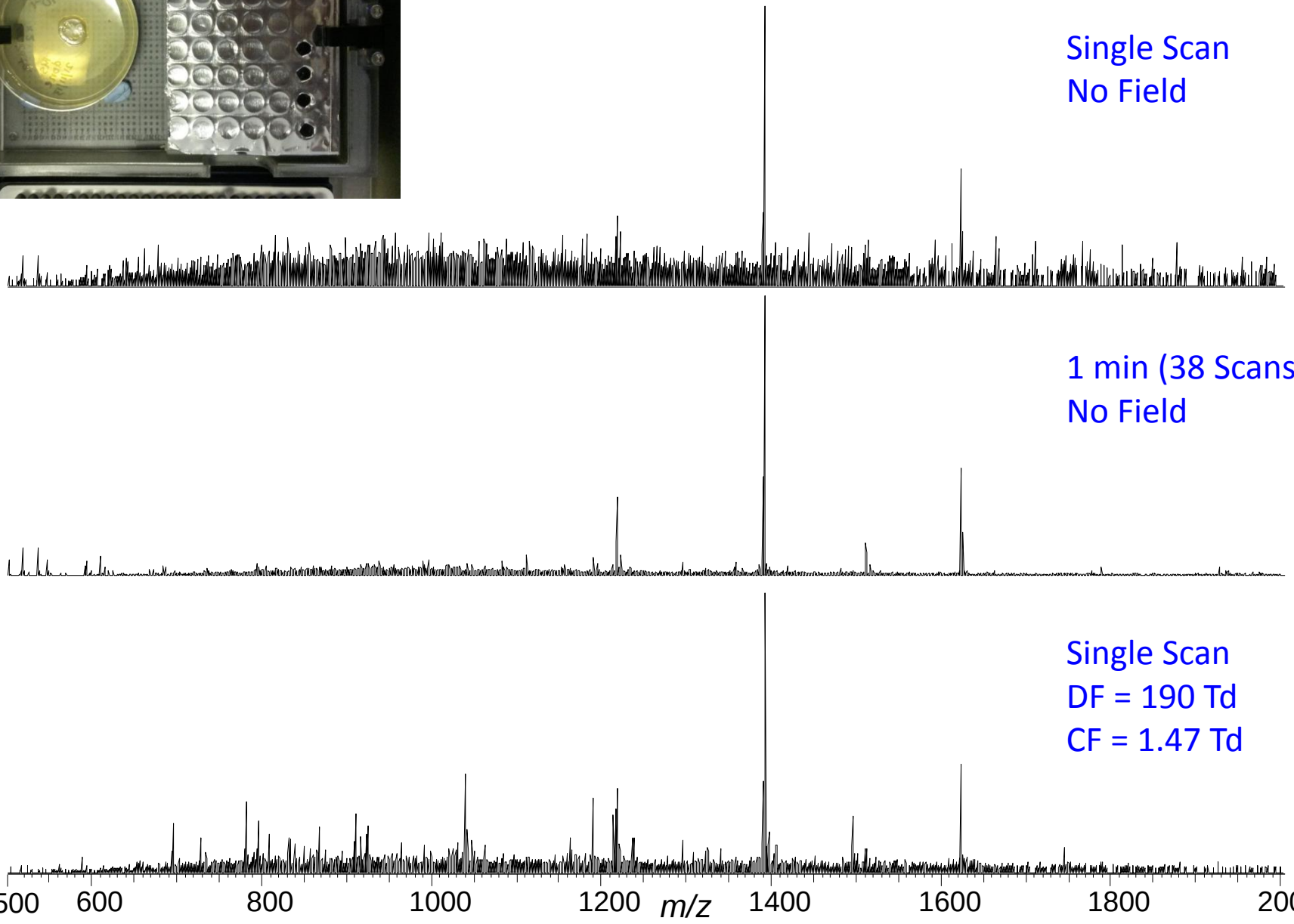


d.

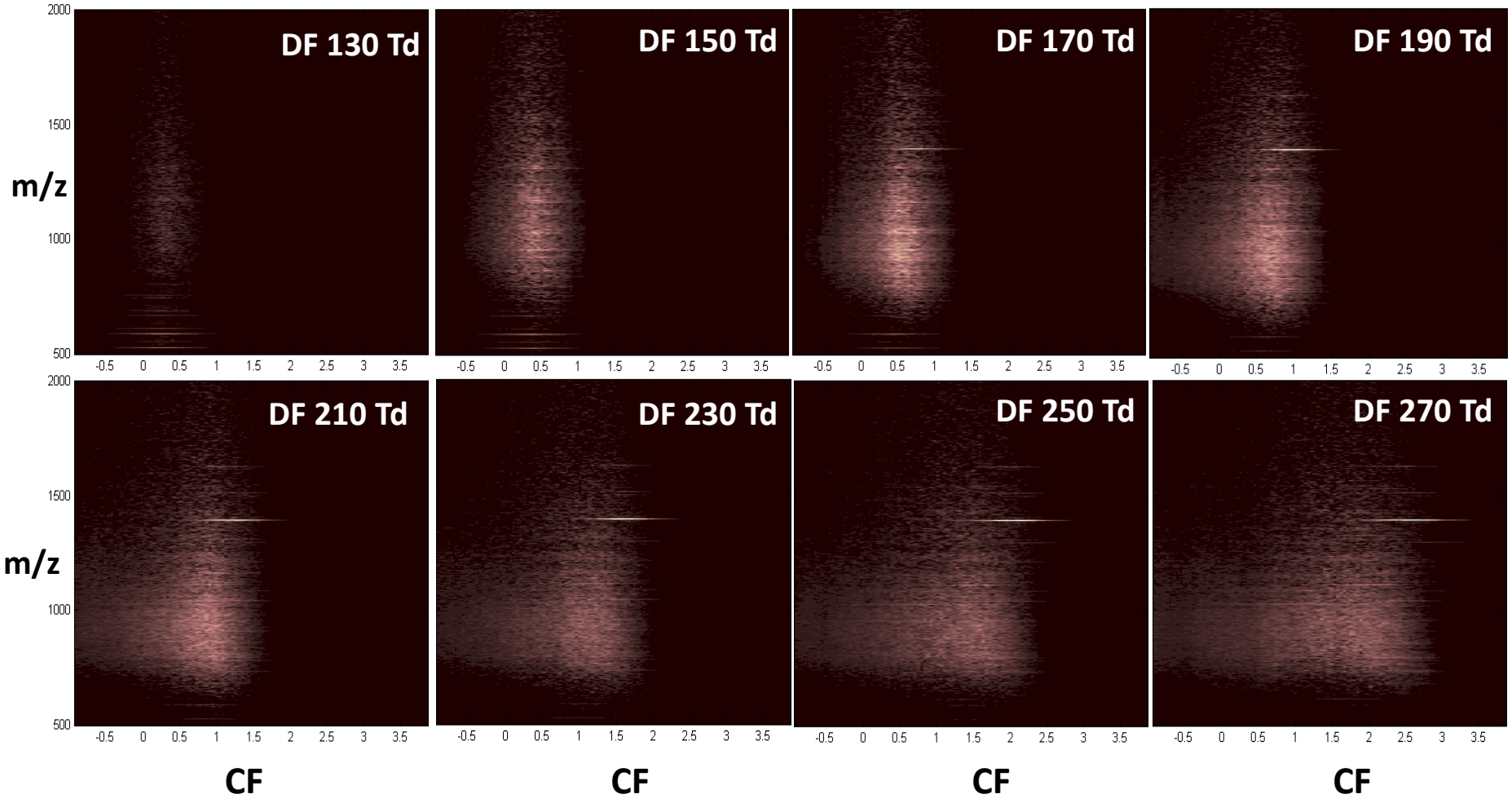


LESA FAIMS MS of *E. coli*

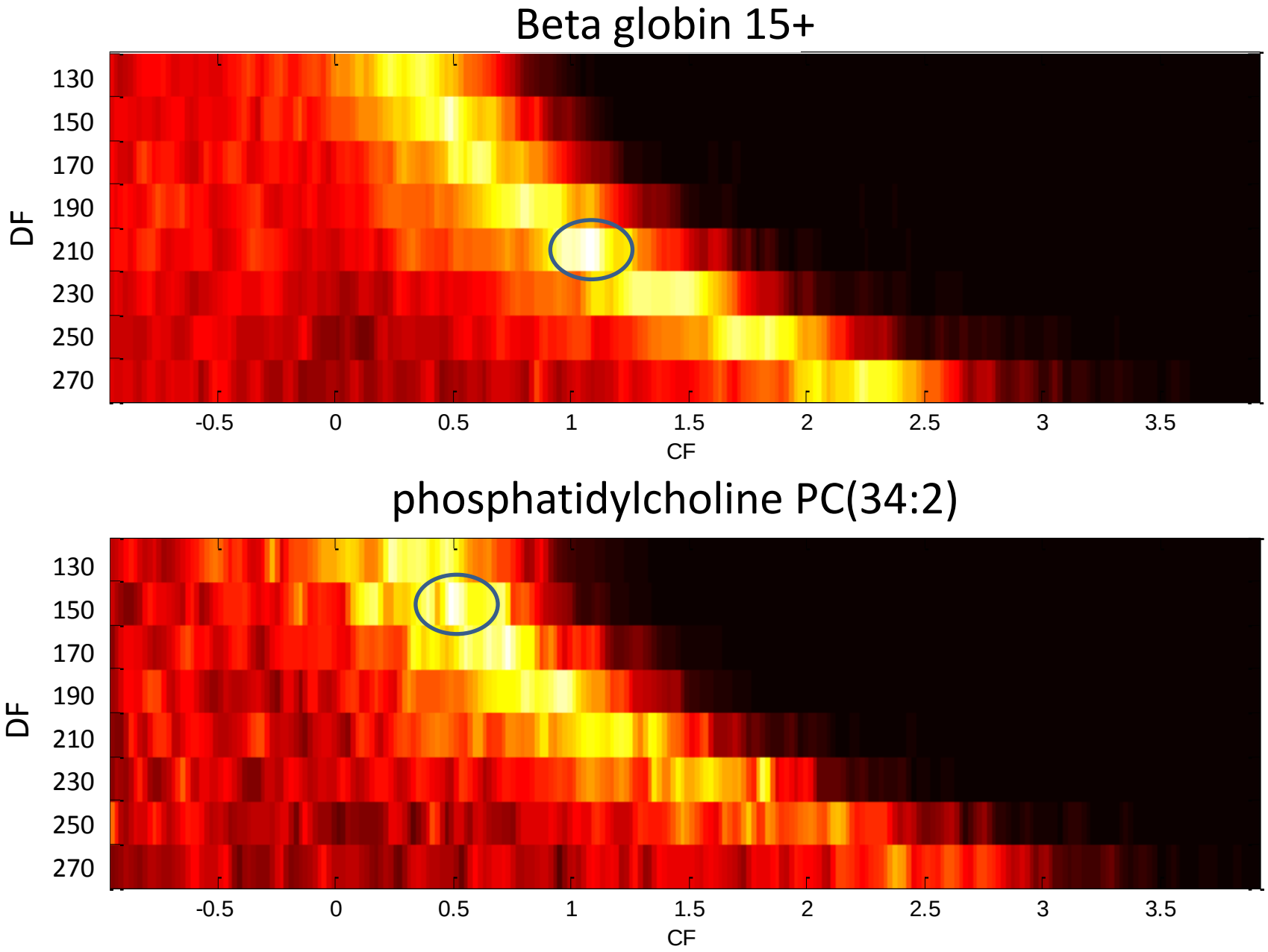




Visualisation: Total ion transmission maps – *E. coli*

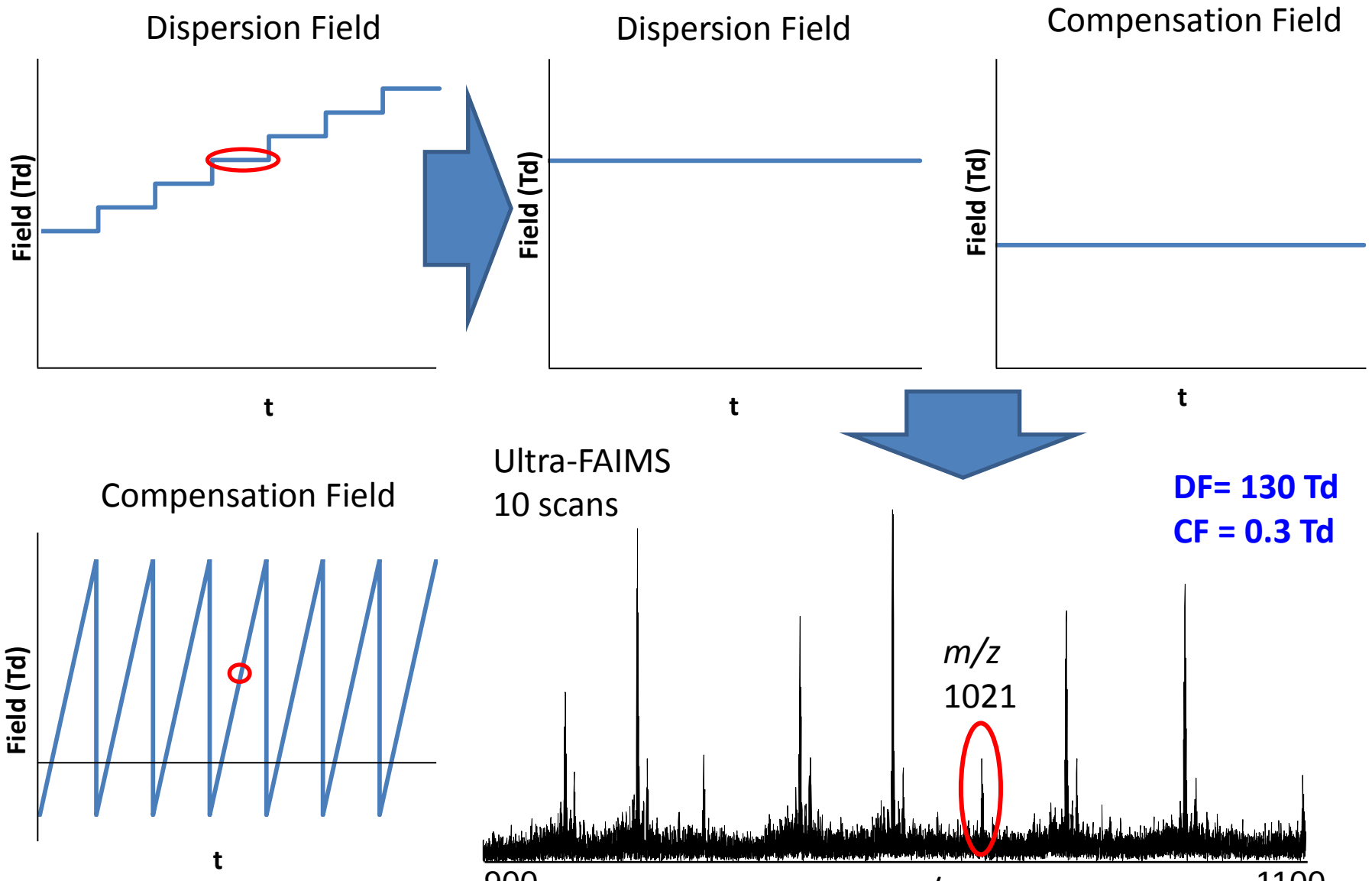


Visualisation: Single ion transmission maps, LESA-FAIMS mouse liver.



Static Analysis

2D



Liver unknown protein ion m/z 1021 (14+)

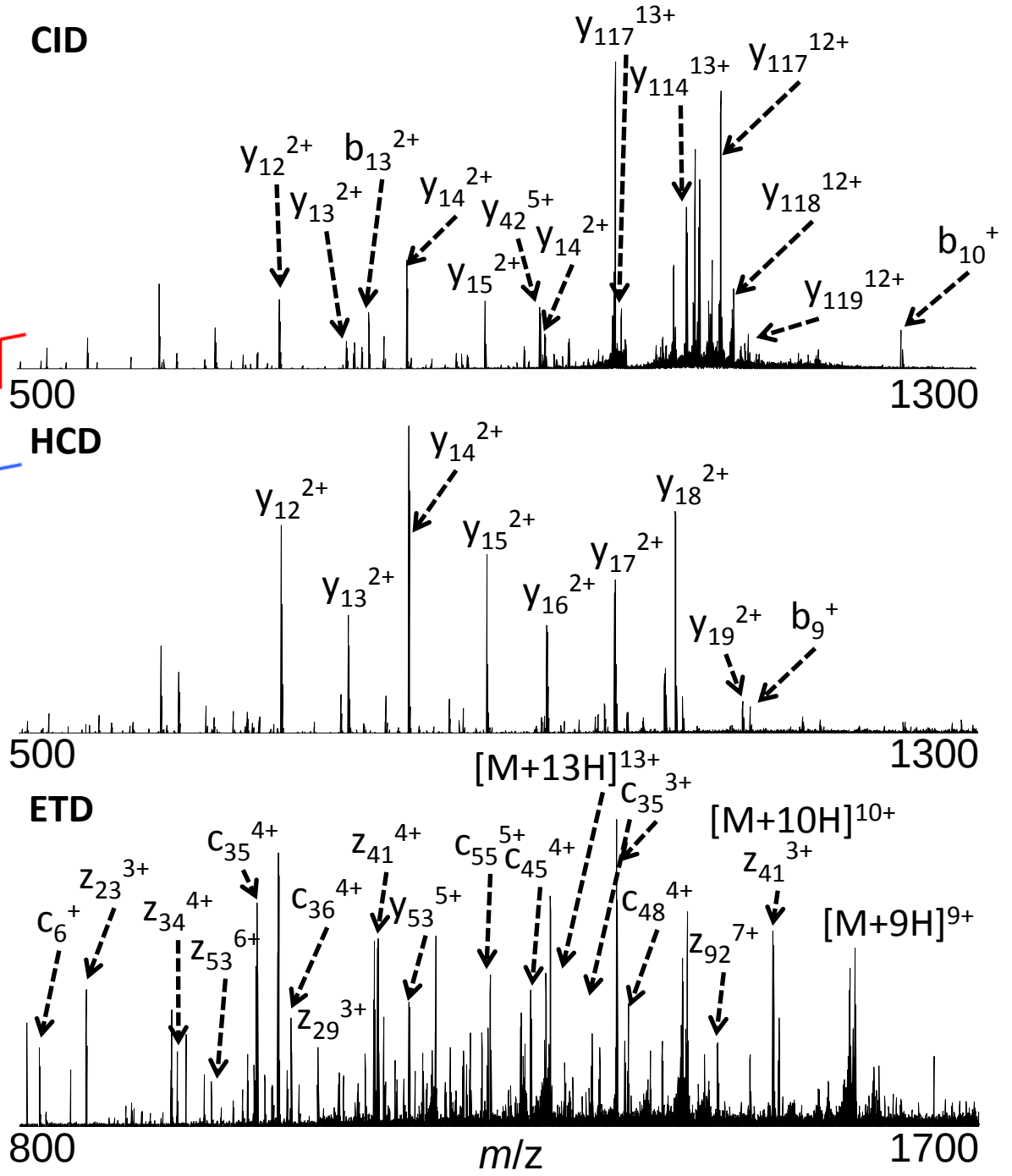
MNFSGKYQLQ SQENFEPFMK
AIGLPEDLIQ KGKDIKGVSE
IVHEGKKIKL TITYGPKVVR
NEFTLGEECE LETMTGEKVK
AVVKLEGDNK MVTTFKGIKS
VTELNGDTIT NTMTILGDIVY
KRVSKRI

Sequence coverage:

- CID 19%
- HCD 15%
- ETD 25%

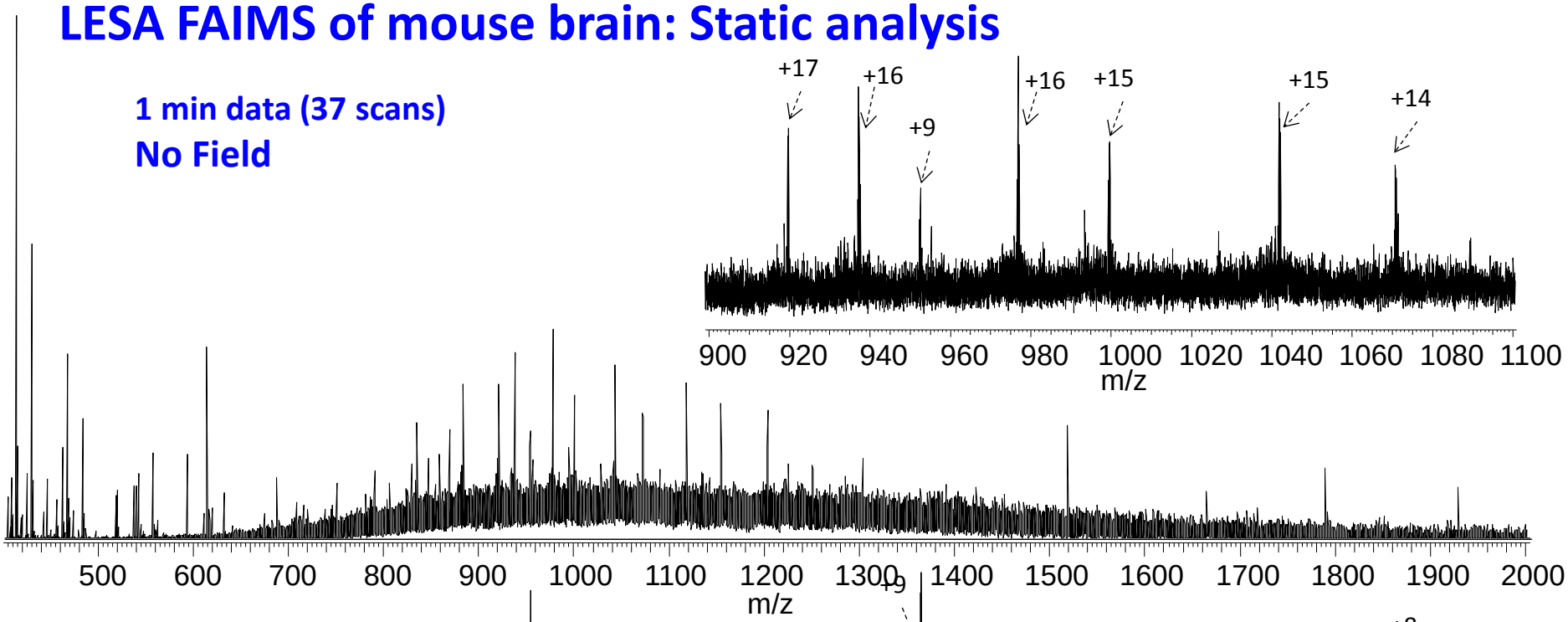
Total: 42%

Liver fatty acid binding protein

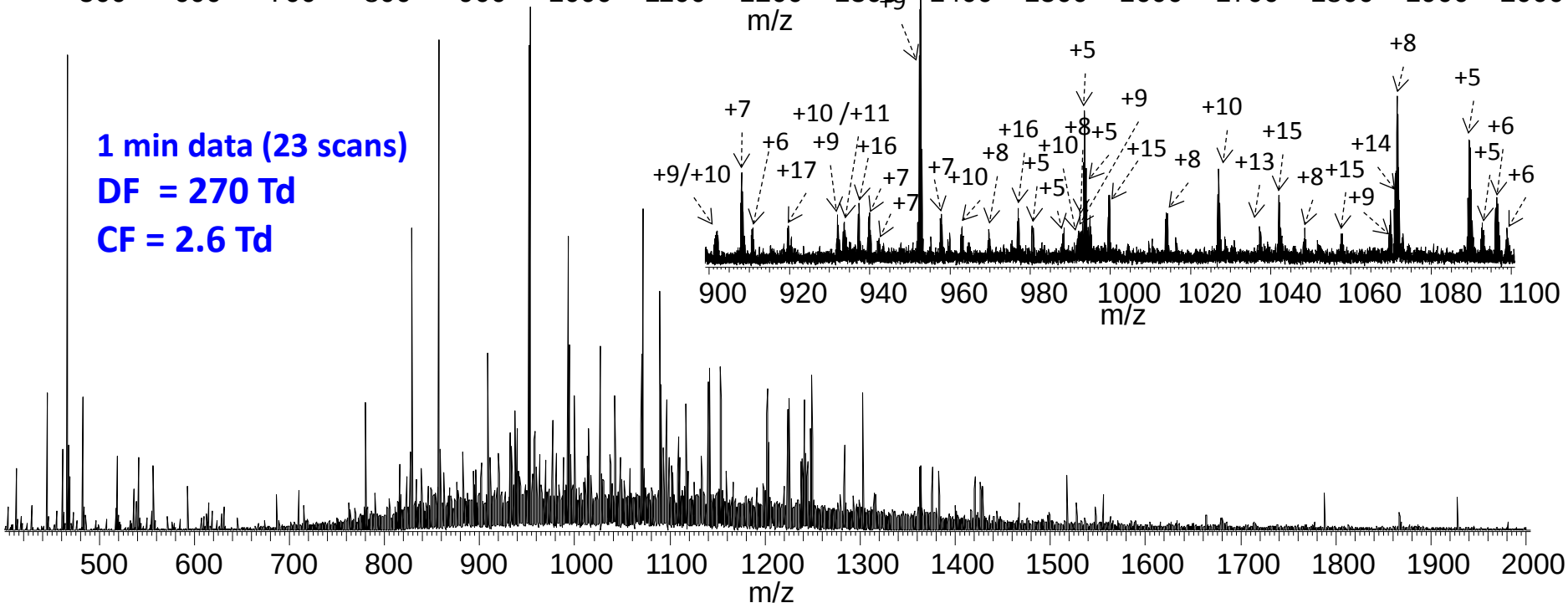


LESA FAIMS of mouse brain: Static analysis

1 min data (37 scans)
No Field



1 min data (23 scans)
DF = 270 Td
CF = 2.6 Td



Conclusions

- Interfaced Advion Triversa Nanomate with Owlstone uFAIMS – LESA-FAIMS-MS
- Separation of different molecular species
- Reduced analysis time
- More information per spectrum
- Greater sequence coverage from MS/MS events

Acknowledgments

UoB

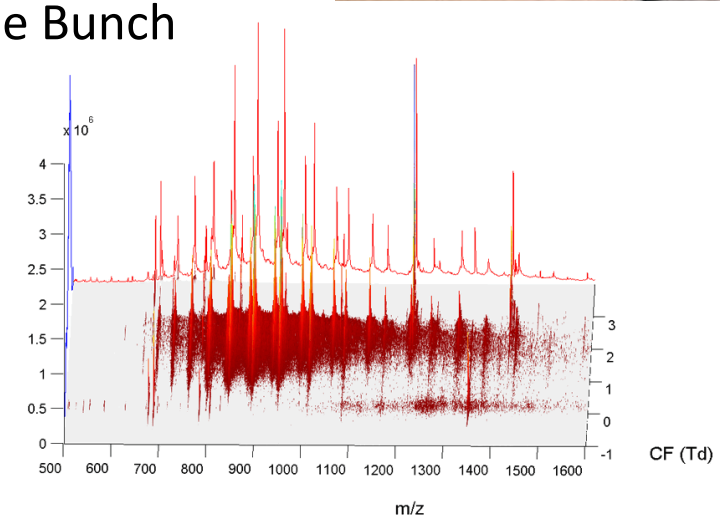
Joscelyn Sarsby
Buffy Randall
Alex Dexter
Dr Rian Griffiths
Dr Andrew Creese
Prof Helen Cooper

Owlstone:

Dr Danielle Toutoungi
Dr Lauren Brown

NPL:

Dr Josephine Bunch
Alan Race



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EPSRC
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