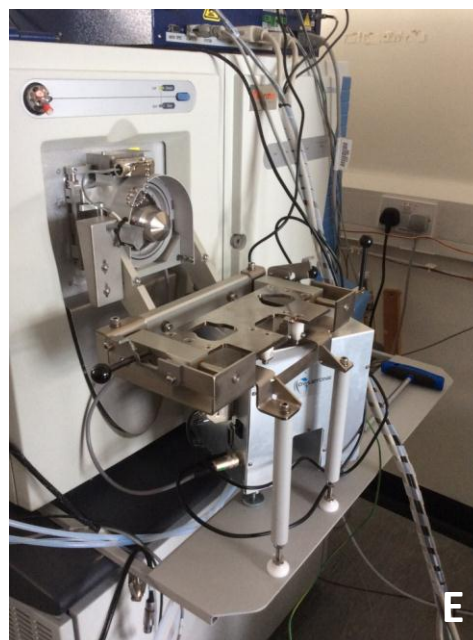
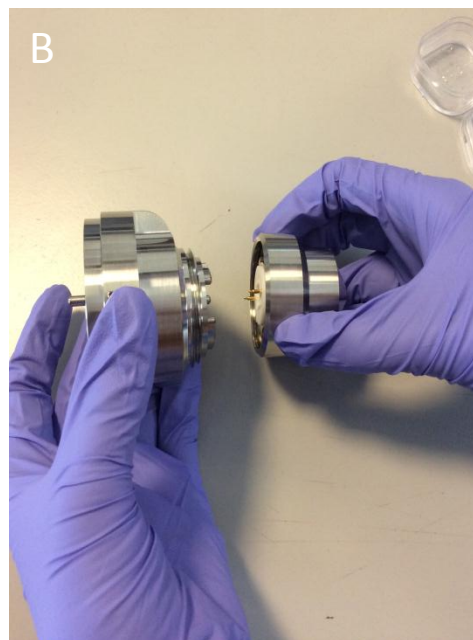
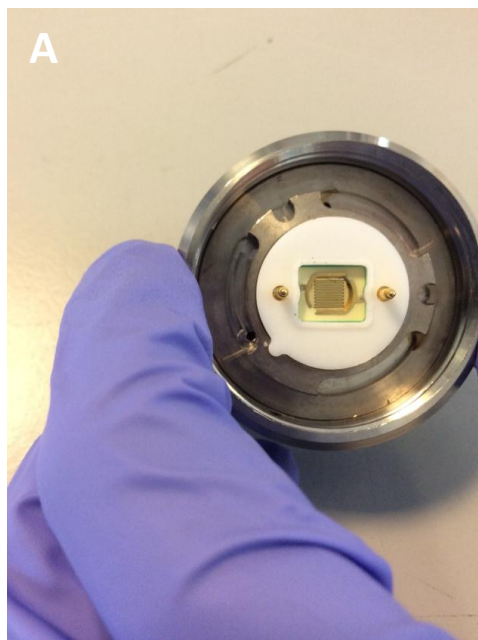
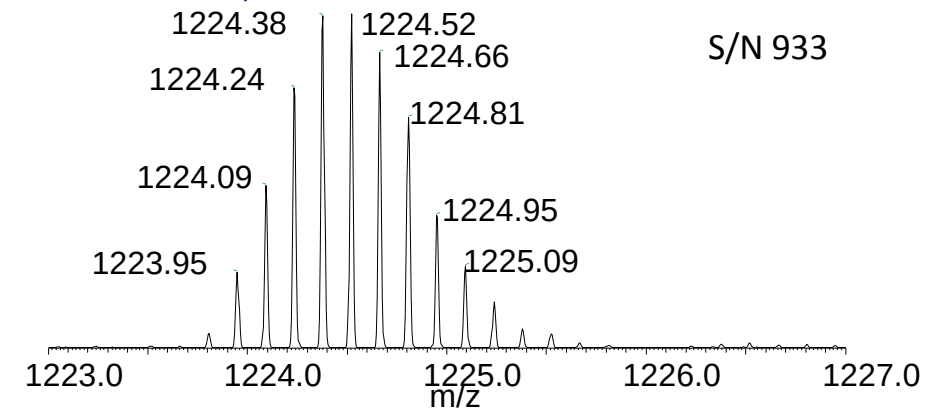
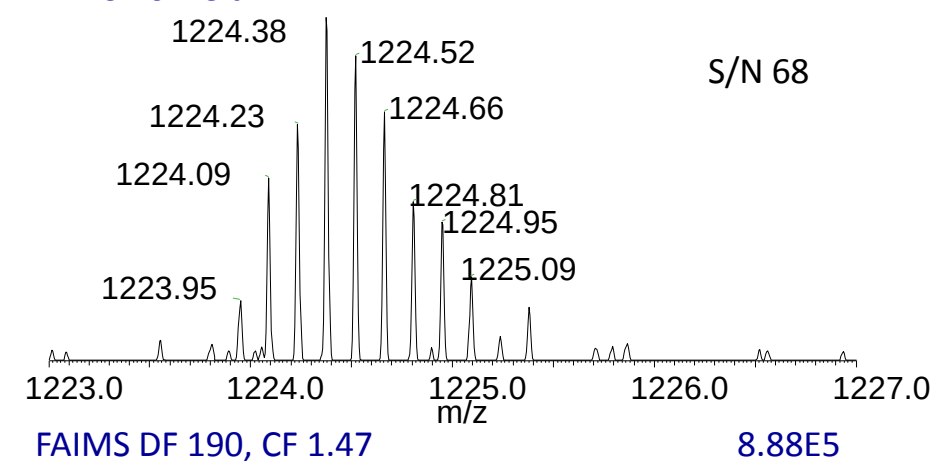
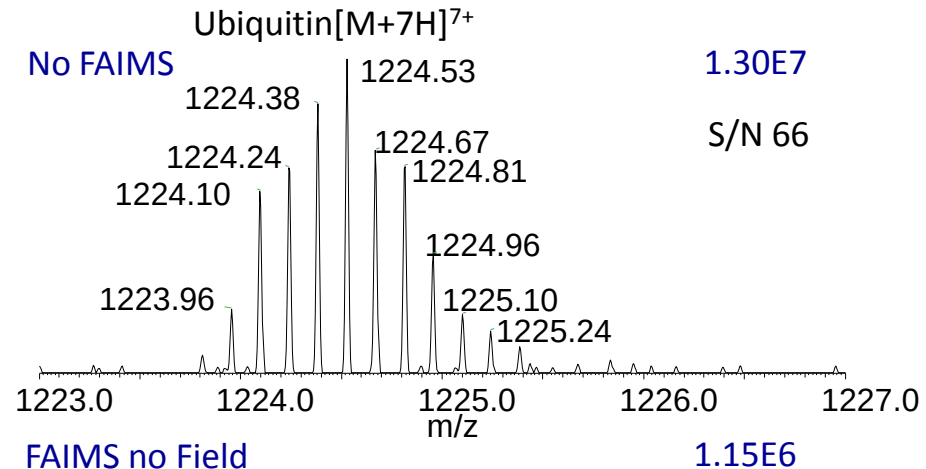
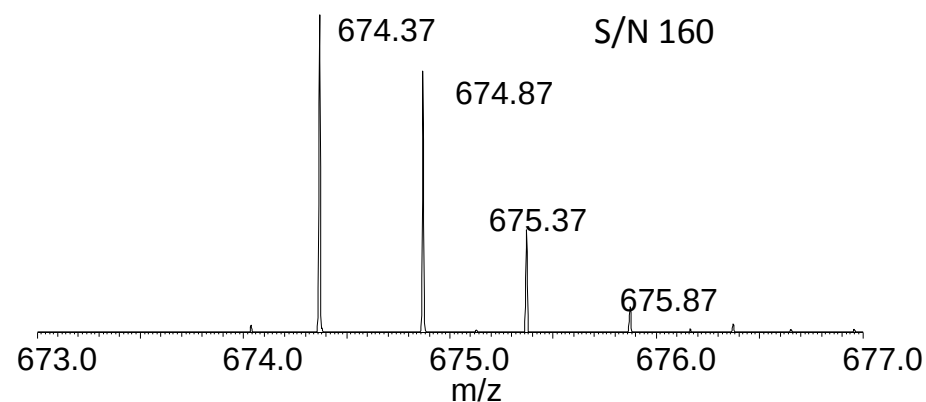
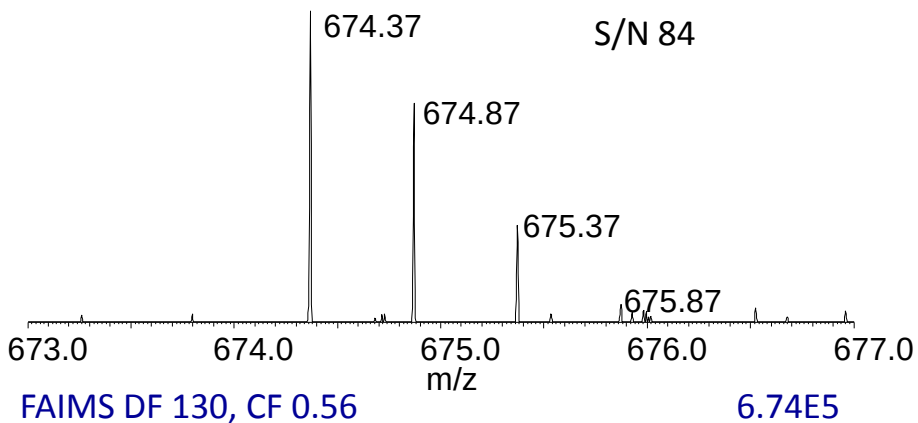
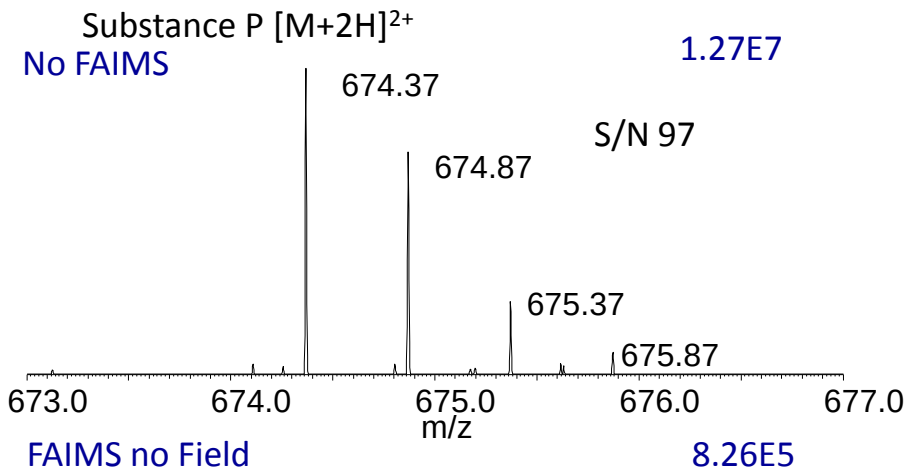
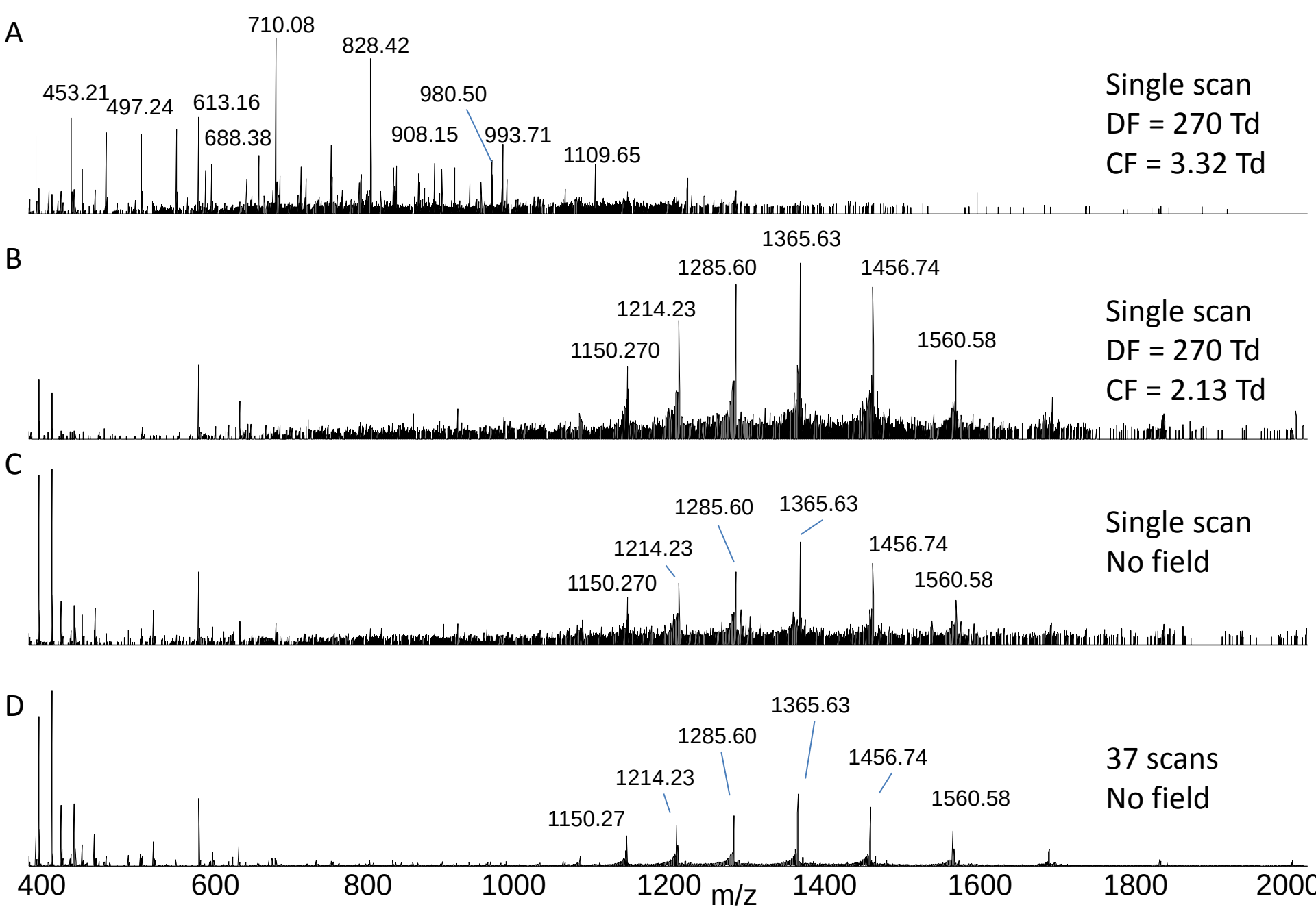




Supplementary figure 1: (A-C) UltraFAIMS chip mounted in sampling cone. (D-F) UltraFAIMS waveform generator and Triversa Nanomate are mounted on front-end of Orbitrap Velos.

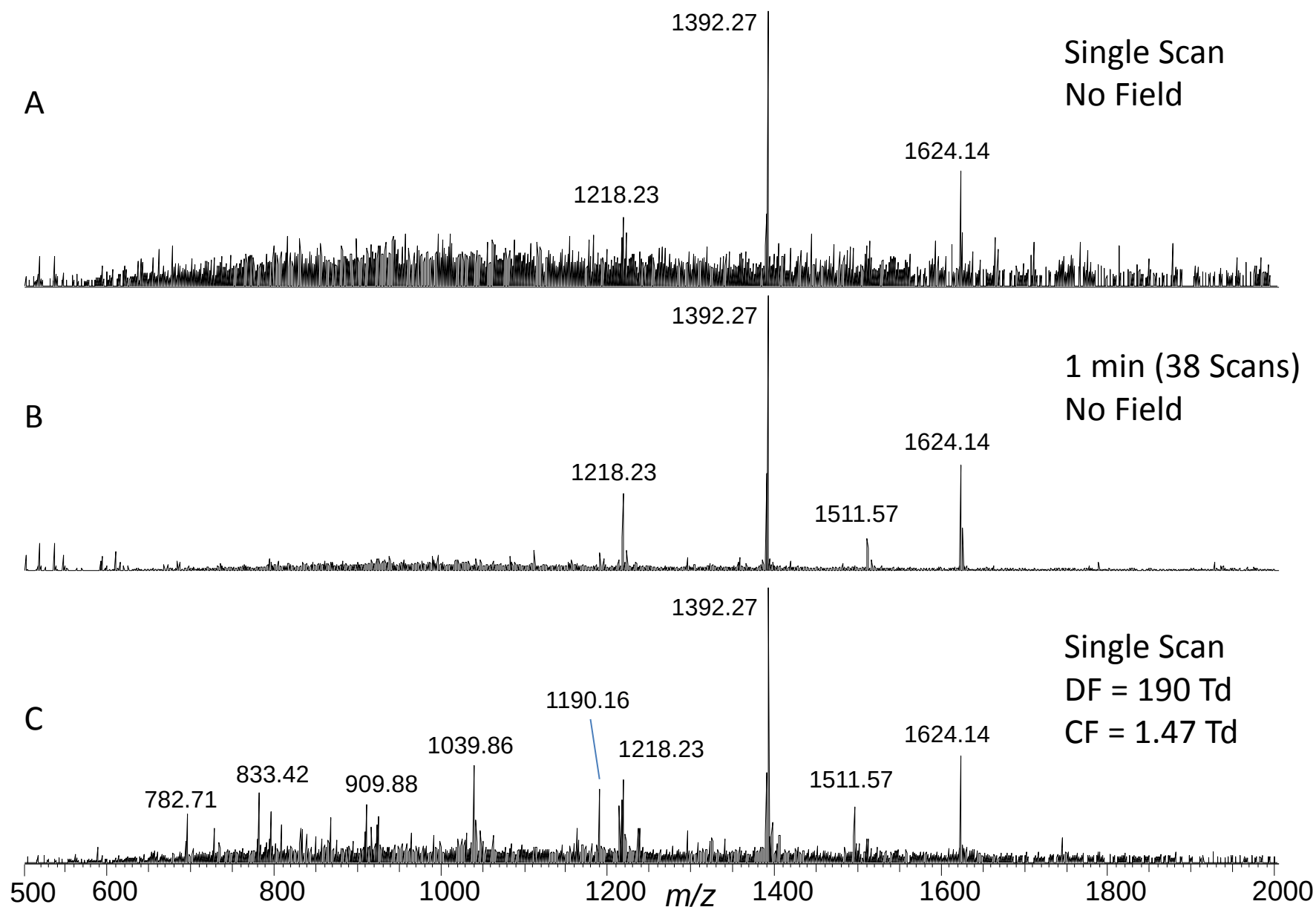


Supplementary Figure 2: Transmission efficiency of ultraFAIMS for $[M+2H]^{2+}$ ions of substance P and $[M+7H]^{7+}$ ions of ubiquitin.

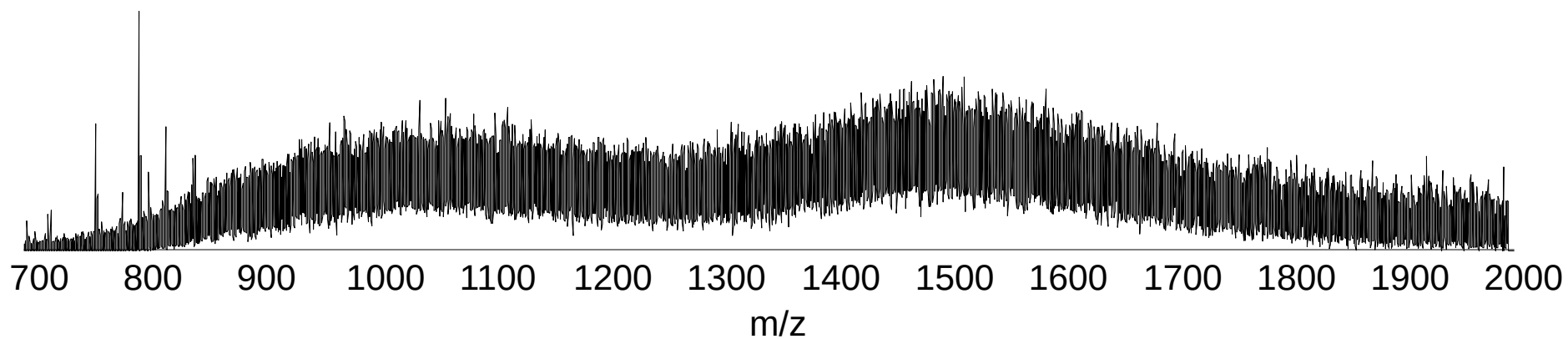


Supplementary Figure 3: LESA 2D FAIMS mass spectrometry of mouse brain. (A) Single scan mass spectrum at DF = 270 Td, CF=3.32 Td; (B) Single scan mass spectrum at DF = 270 Td, CF = 2.13 Td; (C) Single scan mass spectrum recorded in the absence of FAIMS field; (D) Mass spectrum recorded in the absence of FAIMS field comprising 37 co-added scans (~1 min data).

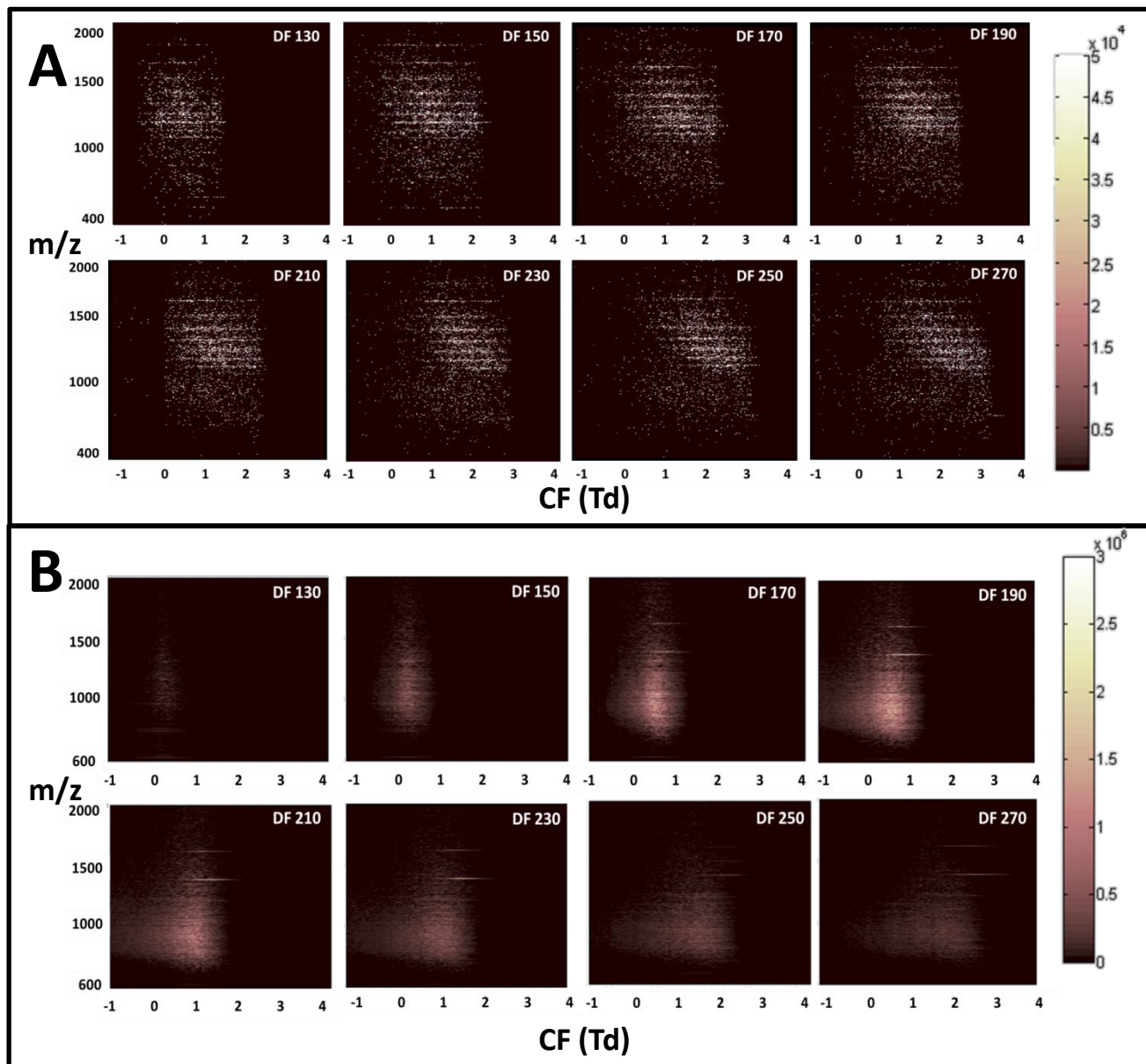
Supplementary Figure 4: LESA 2D FAIMS mass spectrometry of *E. coli*. (A) Single scan mass spectrum recorded in the absence of FAIMS field; (B) Mass spectrum recorded in the absence of FAIMS field comprising 38 co-added scans (~1 min data); (C) Single scan mass spectrum at DF = 190 Td, CF=1.47 Td.

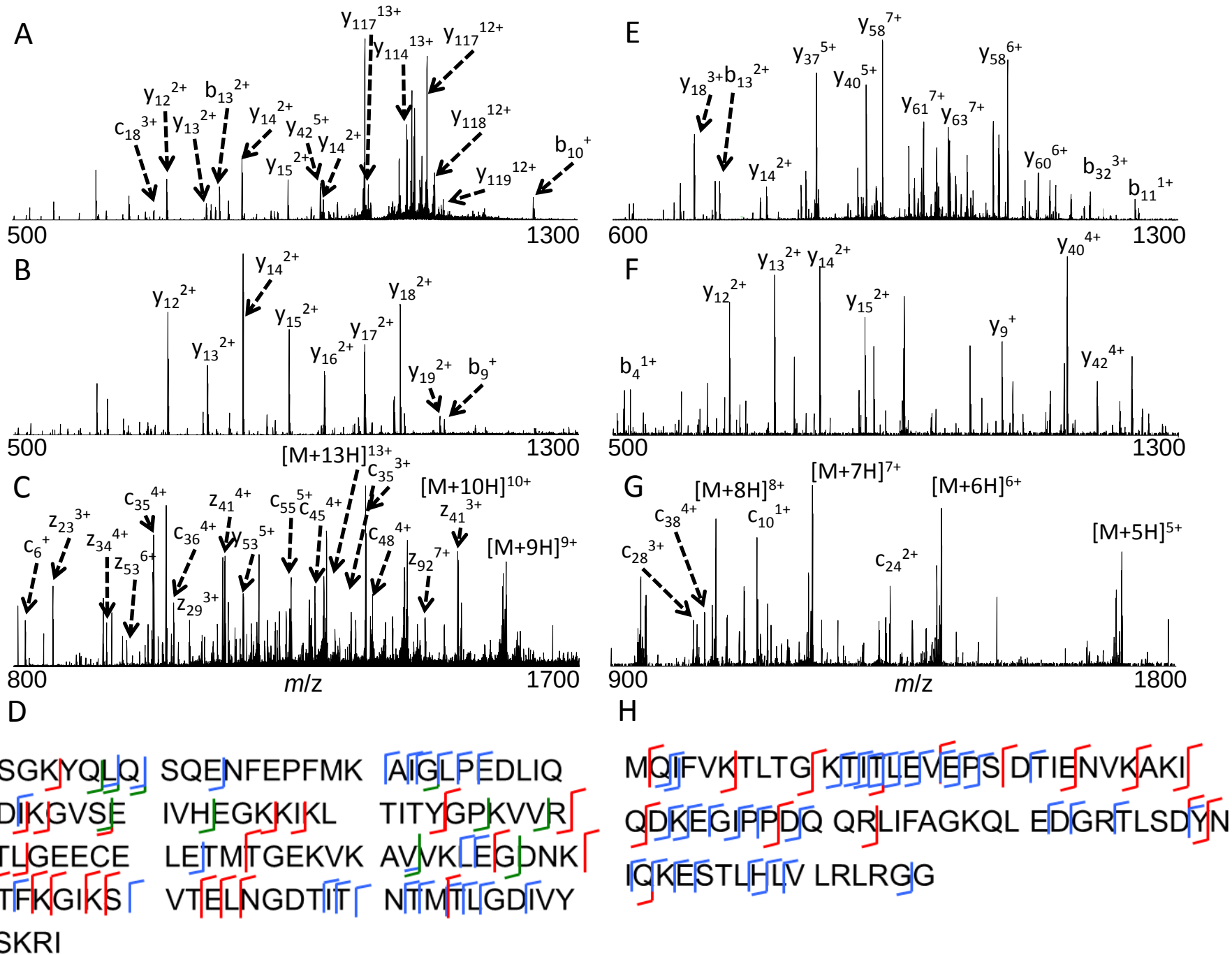


Supplementary Figure 5: LESA 2D FAIMS mass spectrometry: Summed mass spectra from CF range – 0.5 – 1 Td (DF = 270 Td).

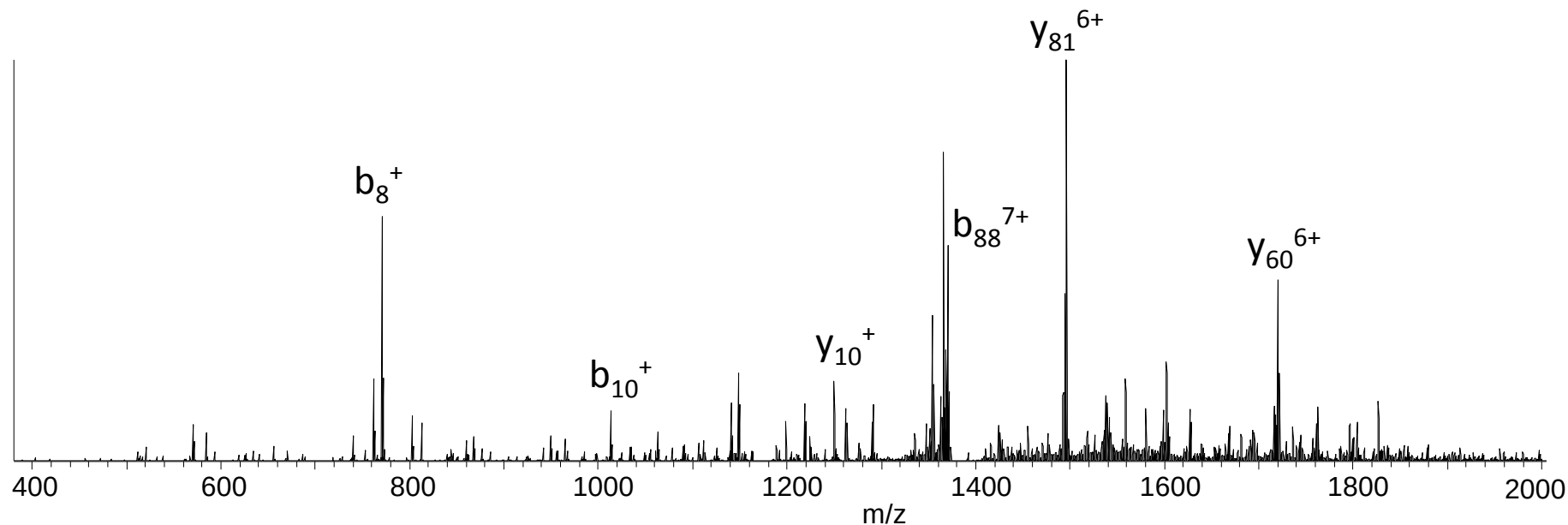


Supplementary Figure 6: Total ion transmission maps of (A) mouse brain and (B) *E. coli* colony





Supplementary Figure 7



ADAQKAADNK	KPVNSWTCED	FLAVDESFQP
TAVGFAEALN	NKDKPEDAVL	DVQGIATVTP
AIVQACTQDK	QANFKDKVKG	EWDKIKKDM

Supplementary Figure 8: LESA FAIMS MS/MS. CID mass spectrum of ions with m/z 1392.27 from *E. coli*, obtained at $DF = 210$ Td, $CF = 1.65$ Td. Protein identified as acid stress chaperone HdeA.