Trapped ion mobility spectrometry (TIMS) enhances sample complexity resolution in LC-MS by introducing an additional gas phase separation dimension. In TIMS, ions of a specific mass-to-charge and mobility are accumulated and concentrated, enabling improved separation of signal from noise and enhancing sensitivity without sacrificing speed. In TIMS, ions can be trapped in TIMS funnel 1, and then released sequentially in TIMS tunnel 2. This parallel accumulation serial fragmentation (PASEF) process enables rapid collisional cross section (CCS) analysis. The timsTOF HT instrument supports all PASEF acquisition modes, including DDA-PASEF, DIA-PASEF, and PRM PASEF.