Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Ultra Small Angle X-ray Scattering Measurements in Pharmaceutical Aerosols[1] DANIEL DUKE[2], HARRY SCOTT, ANESU KUSANGAYA, Monash University, ALAN KASTENGREN, JAN ILAVSKY, Argonne National Laboratory — Pressurised metered dose medical inhalers (PMDIs) contain a hydrofluorocarbon propellant and an active drug which is dissolved in a cosolvent where solubility in the propellant is poor. As the propellant is more volatile than the cosolvent, the composition of the liquid changes considerably as it flows through the device's nozzle and forms the inhaled aerosol. The initial droplet composition affects precipitation of the inhaled drug particles, but remains elusive. The propellant is too volatile for single-particle optical or acoustic trap measurements, and it is difficult to measure in situ due to multiple scattering and beam steering. We circumvented these problems through a novel application of Ultra-Small Angle X-ray Scattering (USAXS). We considered a PMDI solution of 3.38 μg/μL ipratropium bromide, 85% $^{v}/_{v}$ R-134a propellant and 15% ethanol. The experiments were conducted at the 9-ID & 7-BM beamlines of the Advanced Photon Source at Argonne National Laboratory. USAXS exploits the high electron density of R-134a relative to the cosolvent. Combining USAXS with X-ray radiography and laser diffraction measurements, the ensemble average droplet composition can be determined for the first time.

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Date submitted: 01 Aug 2020 Electronic form version 1.4