

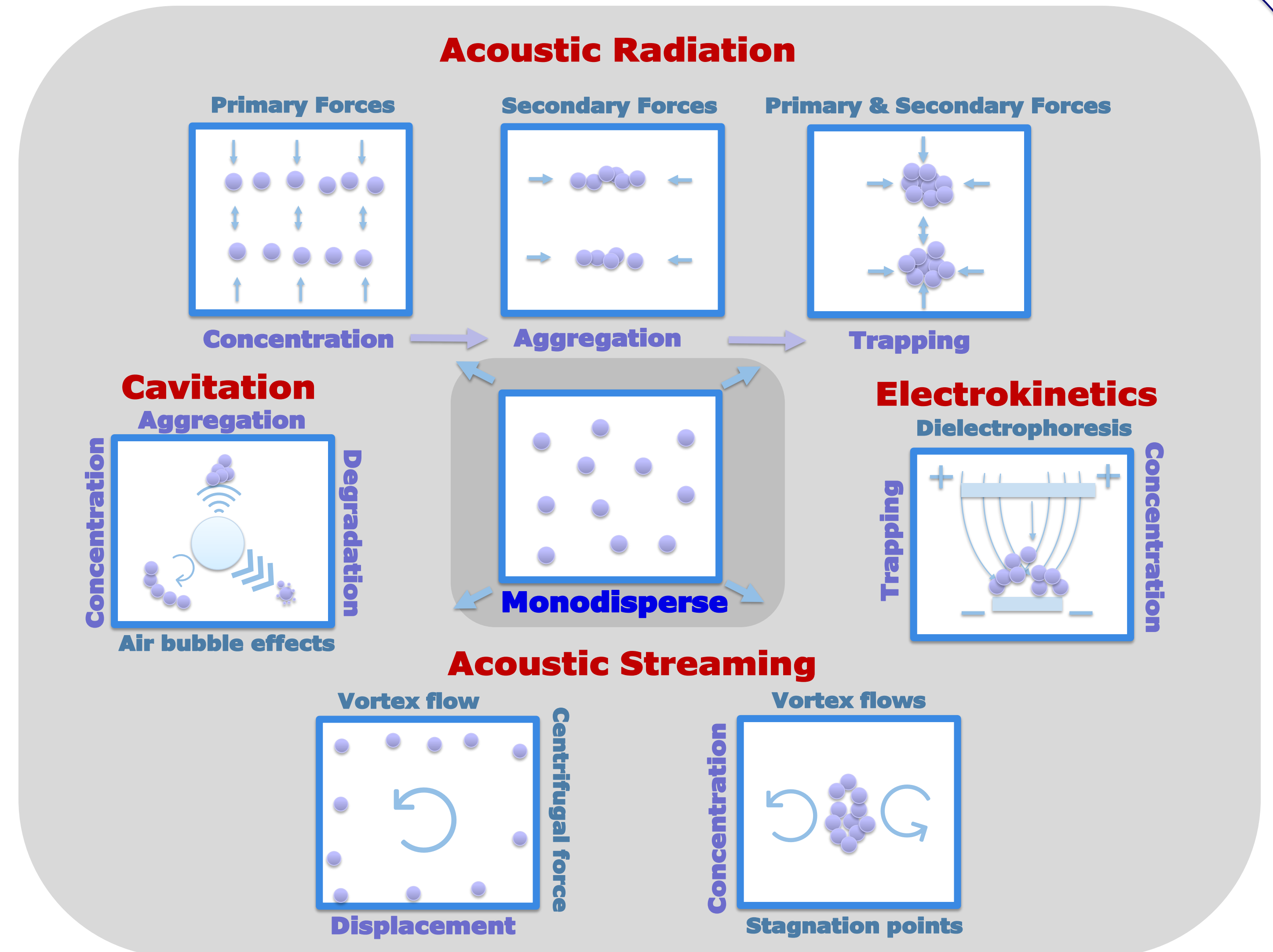
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Why ultrasonic nebulisers cannot aerosolise suspension formulations?

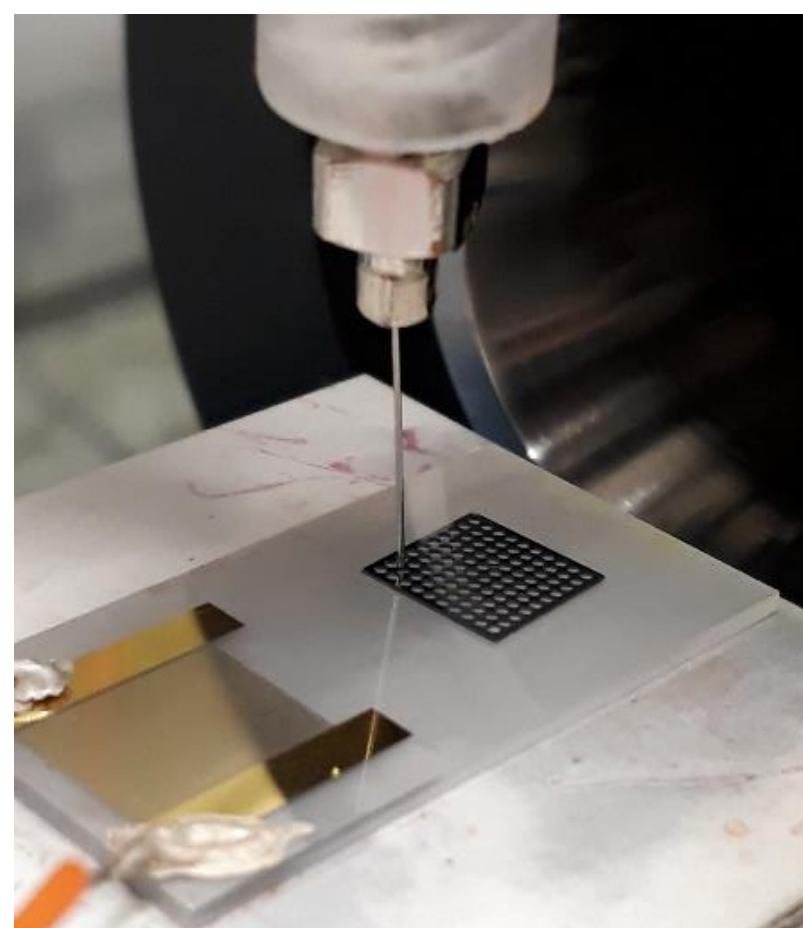
- Suspension formulations contain the drug as undissolved particles dispersed throughout a carrier liquid
- Ideally, drug particles are uniformly sized and dispersed in the liquid, providing enhanced bioavailability with controlled dose release kinetics once administered
- Drug particle sizes are ideally between 2 – 6 μm to enable loading into efficacious aerosols targeting trachea, primary, secondary and terminal bronchi as well as alveoli
- Sedimentation in drug vials prior to loading into device, sedimentation during prolonged nebulisation and stability of suspensions in regards to monodispersity can alter the therapeutic outcome
- Interaction of particles with ultrasound can strongly influence the particle dispersity prior to aerosol generation leading to low drug loading into the aerosol



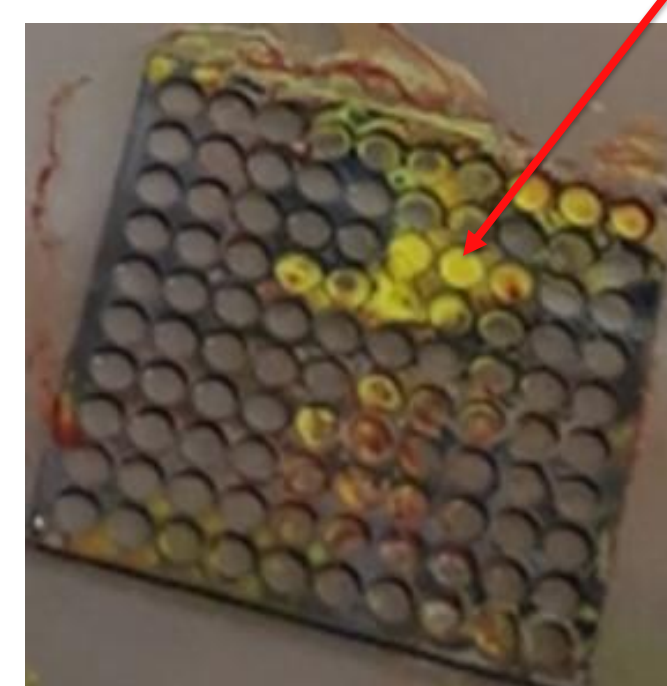
Forces acting on particles in an acoustic field

Suspension particle loading into aerosols

Investigating suspension particle size dependency using monodisperse fluorescent beads



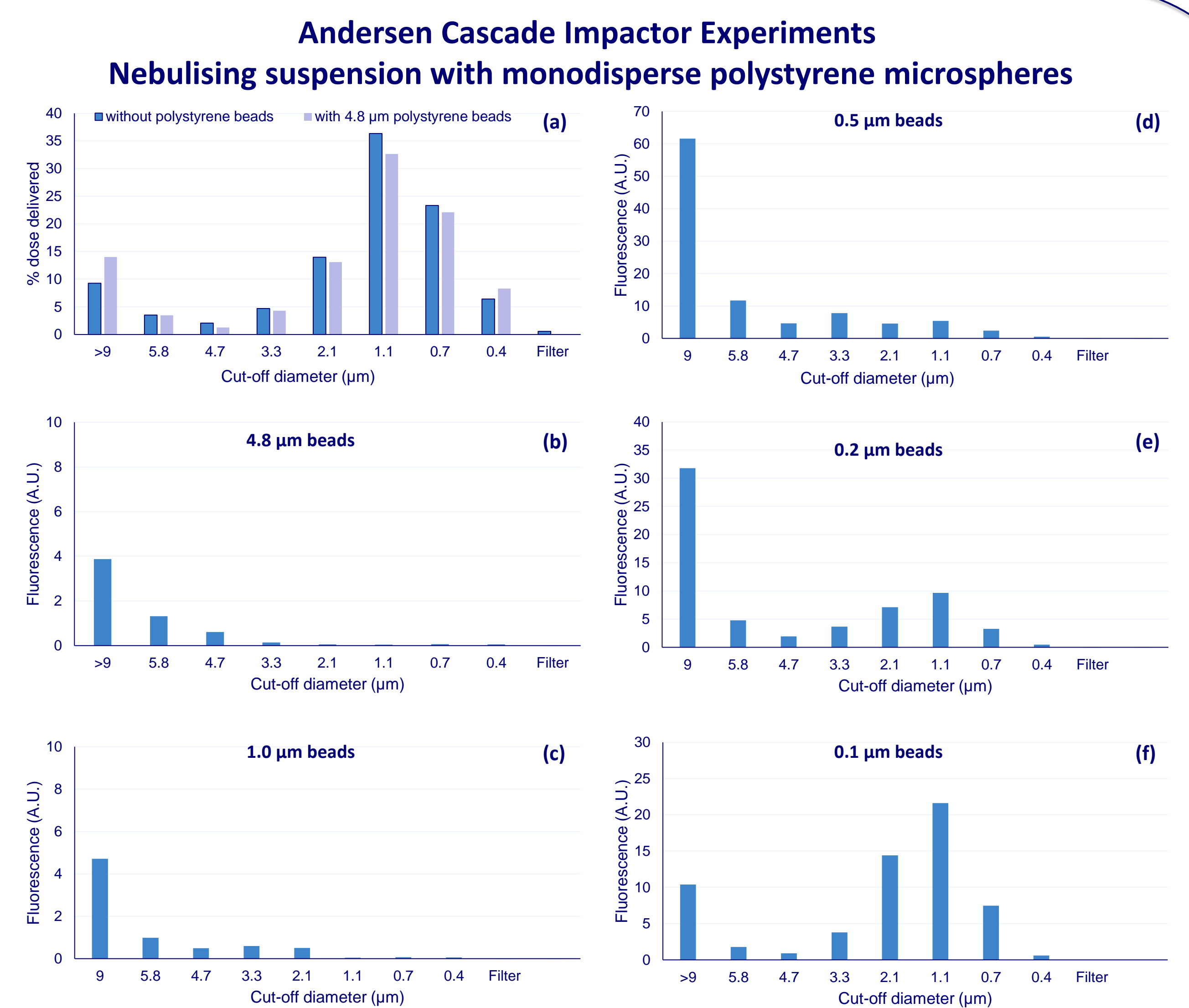
Nebulisation setup consisting of SAW device, microstructure & dispensing needle



Microstructure post nebulisation

- Low aerosol loading caused by acoustic radiation
- Loading improves with reduction in particles size – in line with scaling law for acoustic radiation forces

(a) APSD of carrier liquid with (2mg/ml) and without 4.8 μm polystyrene beads
(b) – (f) Measured fluorescence signal across cascade



Optimising nebulisation of suspension formulations

Optimizing of aerosol loading for large & strongly affected suspension

- Prevents acoustic energy transmission into dispensing system
- Reduction in liquid retention time on platform
- Forcing unstable fluid volumes in microstructure

Dose
250 % increase
Delivery

