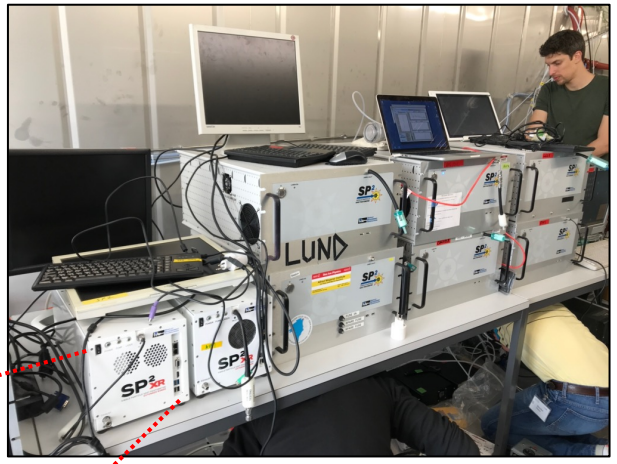
Single Particle Soot Photometer – eXtended Range (SP2-XR)



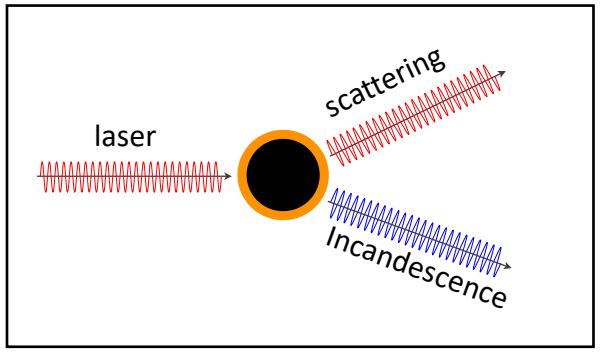
PSI SP2 Intercomparison

Data/Measurements/Retrievals:

- Refractory black carbon (rBC) number/mass loading, size distributions (50 – 800 nm/1.8 g/cc density), and rBC mixing state
- Non-BC size number/mass loading and size distribution (100 – 500 nm) also reported

Principle of Operation:

- Particle-resolved detection of rBC through laser-induced incandescence



Science Drivers:

- Ongoing need to better constrain BC contribution to direct effect for optical closure.
- Vertically-resolved profiles of BC – especially in the cryosphere.
- Understand and quantify altitude-dependent contributions of BC to aerosol radiative forcing (above, in, below cloud).
- Impact of BC mixing state on aerosol optical and hygroscopic properties.

Instrument Specifications:

Weight: 13 kg
Dimensions (LWH): 40.4 cm x 20 cm x 21.5 cm
Power: 25 W
Ground or airborne platform deployment

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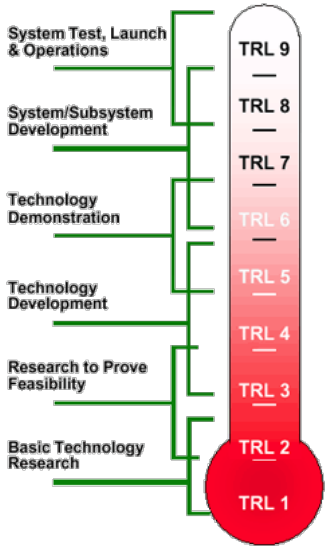
Operational Requirements and Experience:

- King Air 300; 2019 POPSICL campaign.
- Laboratory studies (2019 Paul Scherrer Institute).
- Rack mountable; sample flow is user selectable (0.03 – 0.120 LPM).
- Semi-autonomous operation (auto-start capabilities)
- Cal: fullerene soot for incandescence channel/PSL for the scattering channel (same as SP2).
- Measurement uncertainty similar to the SP2 (25%).

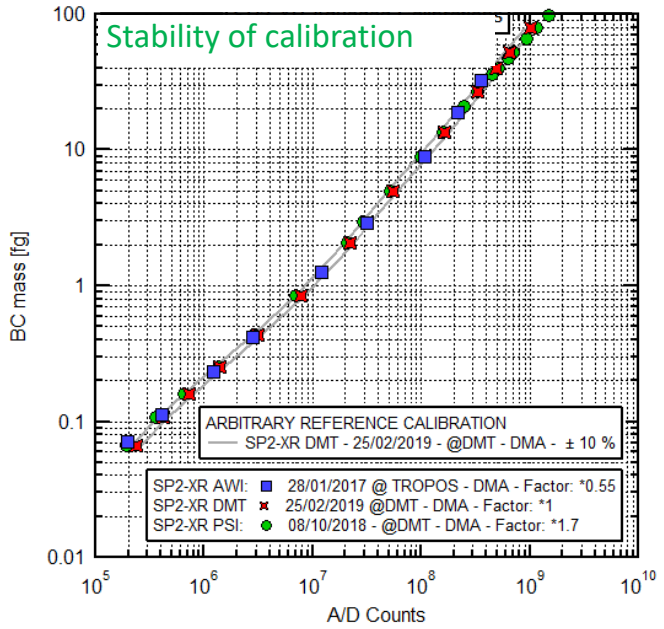
Benefit to ARM

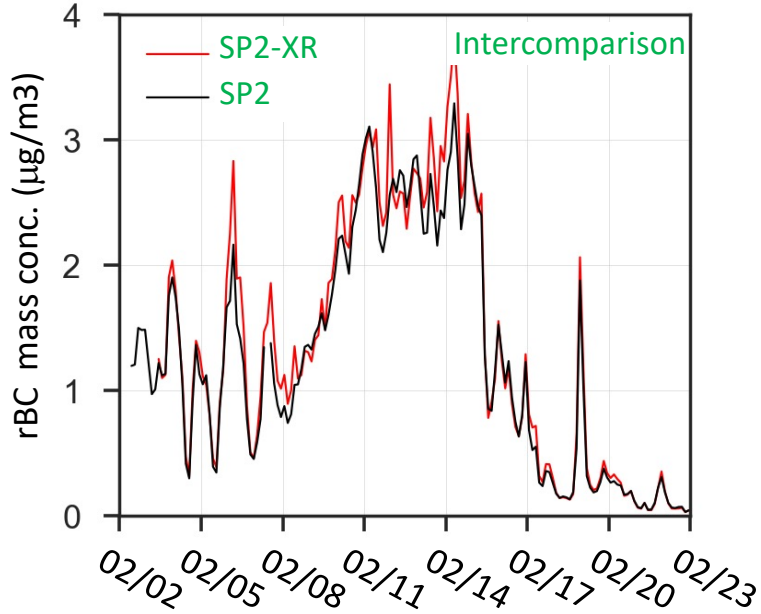
- Real-time processing of raw data by instrument: geophysical unit data is directly outputted
- Designed for 24/7 operation

Technical Readiness Level (TRL)



TRL 9





Plots courtesy of M. Bertó, PSI (manuscript in prep.)