

# HOW IT WORKS

Shadow images of particles passing through a collimated laser beam are projected onto a linear array of 64 photodetectors. The presence of a particle is registered by a change in the light level on each diode. The registered changes in the photodetectors are stored at a rate consistent with probe velocity and the instrument's size resolution. Particle images are reconstructed from individual "slices,"

where a slice is the state of the 64-element linear array at a given moment in time. A slice must be stored at each time interval that the particle advances through the beam a distance equal to the resolution of the probe. Optional grayscale imaging gives three levels of shadow recording on each photodetector, allowing more detailed information on the particles.

# PIP PRECIPITATION IMAGING PROBE

## INCLUDED ITEMS

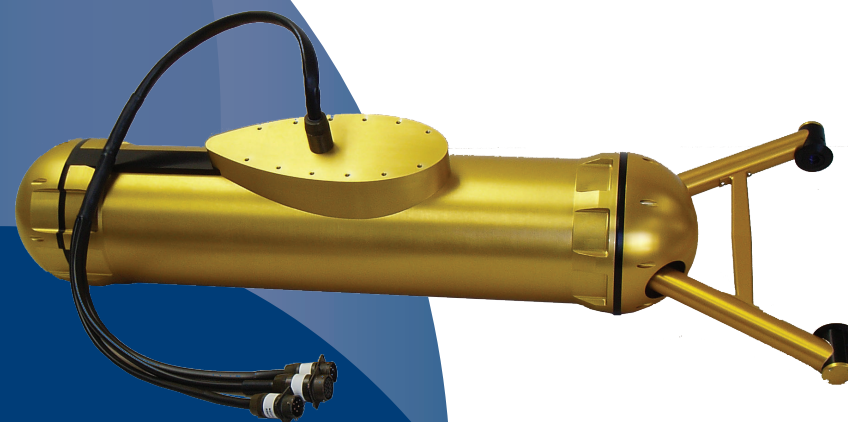
- » Instrument
- » Shipping case
- » Operator manual
- » One-year warranty
- » Spinning disk for calibration check
- » One day of training at DMT's facility
- » Email and telephone technical support

## ACCESSORIES

- » Particle Analysis and Display System (PADS) software
- » OASIS Software
- » Data Acquisition System

## HOW TO ORDER

Contact DMT for pricing or more information: +1.303.440.5576,  
[customer-contact@dropletmeasurement.com](mailto:customer-contact@dropletmeasurement.com).



# OVERVIEW

The Precipitation Imaging Probe (PIP) is a state-of-the-art probe that measures particles in the 100 to 6200  $\mu\text{m}$  range. It is an ideal choice for measuring rain, snow, graupel, and hail. The PIP provides precipitation size distributions and particle images.

The PIP is suitable for fixed site, mobile or airborne sampling.

# SOFTWARE

Two optional software packages are available for PIP users. The first is the Particle Analysis and Display System (PADS), which allows for instrument control and real-time data display. PADS is shown at right. The program displays a user-friendly virtual instrument panel and enables the user to do the following tasks:

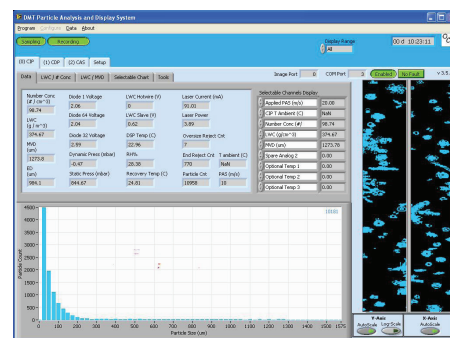
- » Start data recording and sampling
- » View real-time particle image data
- » View particle volume and number concentrations, as well as Median Volume Diameter (MVD) and Effective Diameter (ED)
- » View LWC as calculated by the PIP
- » Monitor instrument parameters like PIP laser



# APPLICATIONS

- » Cloud particle research
- » Climate studies
- » Storm and hurricane research
- » Weather modification
- » Contrails and contrail-induced cirrus
- » Cloud chambers
- » Agricultural and industrial spray characterization

- current and various electronics voltages
- » Play back data for post-flight viewing



The Optical Array Shadow Imaging Software (OASIS, left) is designed for rigorous post-processing analysis. It provides additional particle statistics beyond those generated by PADS. In addition, OASIS allows users to filter particles by various criteria, including particle area, particle shape, area fraction, and inter-arrival time. Written in IGOR Pro, OASIS leverages IGOR's robust statistical analysis features for enhanced data analysis and graphing capability.

# OPTIONAL FEATURES

## ANTI-SHATTER TIPS



The PIP can be purchased with special Korolev anti-shatter tips (left). Korolev tips significantly reduce the incidence of particle artifacts in the sample area.

## GRAYSCALE IMAGING

Grayscale imaging provides detail about particle composition that is missed with monoscale imaging. In particular, grayscale imaging gives three levels of shadow recording on each photodetector as opposed to one. The pictures at left show the same particles recorded with grayscale imaging (near right) and monoscale imaging (far right).



The PIP (behind the FSSP) mounted on a AC690 research aircraft flying over India. Photo by Duncan Axisa.

# PIP SPECIFICATIONS

Technique:	Optical Array Probe with 64 elements: 62 sizing elements, end diode rejection
Measured Particle Size Range:	100 $\mu\text{m}$ – 6.2 mm
Sample Area:	260 mm x 6.2 mm for standard configuration (no Korolev tips)
Upper Concentration Range:	100 particles/ $\text{cm}^3$
Air Speed Range:	10 – 200 m/sec
Number of Size Bins:	62
Sampling Frequency:	Asynchronous, 0.1 - 10 Hz. 1-second sampling is typical
Laser:	660 nm
Calibration Verification:	Spinning glass disk with opaque dots of known size
Data System Interface:	Two channels: RS-422: 56,000 Baud Rate; High-Speed Serial: 4 x 10 <sup>6</sup> Baud Rate (RS-422 only)
Software (Optional):	Particle Analysis and Display System (PADS) Optical Array Shadow Imaging Software (OASIS)
Weight:	21 lbs./9.5 kg in DMT canister 10.5 lbs./4.8 kg outside of canister 25 lbs/11.4 kg with generic canister
Power Requirements:	» 28VDC 3A for System Power » 28VDC and 9A for Anti-ice Power » Optional AC voltages for system power and anti-ice heaters
Environmental Operating Conditions:	Temperature: -40 °C to +40°C RH: 0 – 100%, non-condensing Altitude: 0 - 50,000 ft / 0 - 15 km
Routine Maintenance:	DMT recommends conducting basic instrument performance checks and inspecting the PIP optical windows before a flight. A weekly calibration check is also recommended.

*Specifications are subject to change without notice.*

Rev A

August 8, 2013



2545 Central Avenue  
Boulder, Colorado, USA 80301  
[www.dropletmeasurement.com](http://www.dropletmeasurement.com)  
ph: 303-440-5576, fax: 303-440-1965