

# **Express Setup Guide: the Precipitation Imaging Package (PIP)**

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## The Task: an Operational PIP

Herein are basic instructions to do that.

If possible, learn to setup & to operate a PIP in a handy location.  
Then move the camera and lamp outside for weather monitoring.

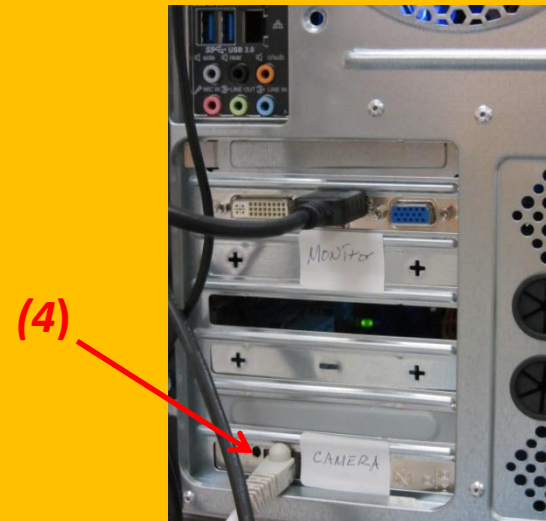
The [PIP User Manual](#) provides additional information.

C:\PIP\Software\User\_Guide\PIP\_User\_Manual.pdf

# Hardware Components

This PIP is located at the GPM field site at NASA Wallops Flight Facility. Outside are (1) the high speed video-camera and (2) the halogen lamp.

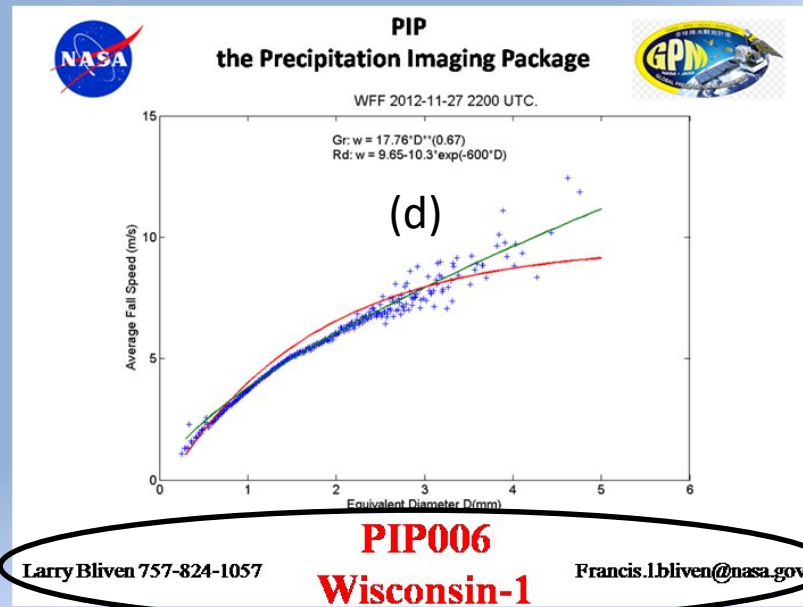
Inside there is (3) the PIP workstation, which is connected via (4) Ethernet cable to the camera.



# PIP-PC Desktop



(a)



(b)

(c)



5:09 PM  
7/20/2016

When a PIP-PC boots, the desktop should look like this one.

- (a) the PIP Tool Box connects to routine processes.
- (b) Handy reference stuff.
- (c) Icons of running PIP apps (video recording\processing).
- (d) The first rain event monitored by a PIP shows excellent agreement between measured fall speeds and models.

# PIP Tool Box Primer

You select commonly used processes and products.

Note that by default, Button #20 displays this quick guide, which is also in the User Manual (#1).

PIP Tool Box

Button	Tip	Description
1. User Manual	How operate a PIP	1. Quick setup guide. 2. Operations Details 3. Example Data Products
2. Hardware	Lamp & Camera Details	Run National Instruments NI IMAQ app, which (a) enables physical alignment of camera to lamp, (b) adjustment of light intensity gain, and (c) setting of other camera options. Useful for PIP installation and then for periodically checking light bulb.
3. Setup File	Software Control File for all PIP Apps	Control all PIP Apps from a single setup file. ASCII text file. Descriptor, tab, the instruction. *Must* have tab!
4. Log File	Listing of PIP_3 operations.	Daily file shows PIP_3 progress by records containing time stamps and processing instructions. Useful for documentation and assessing system performance. Daily files are zipped to the Zip directory.
5. Dir	Directory of PIP Products	Windows Explorer to the root for data products from PIP-1, PIP-2 and PIP3.
6. Movie Now	Recent Precipitation AVI	(1) To see what recent precipitation looks like, goto the most recent precipitation AVI , which is C:\PIP\Current_Weather\Recent_Lar.avi.zip. (2) Note that largest AVI for each 10 minute interval is located in root_1\PIP_3\10_Summary\Movies, where Analysis Root Directory_1 is defined in the Setup File. (3) AVIs for each minute of precipitation are in root2\PIP_2\q_Viewer, where Analysis Root Directory_2 is defined in the Setup File.
7. Figures All	Daily Summary Figures	DSD, Vel, eDen, P Summary Plot for each days. This 4-Figure presentation displays the basic input and output, i.e. DSD & Vel distributions, as well as the volume average density by minute and the rain & not-rain precipitation rates by minute. Additionally, Rain and not-Rain accumulations are presented.
8. Figures Now	Today's Summary Plot	Current Conditions: DSD, Vel, eDen, P Summary Plot. This 4-Figure presentation displays the basic input and output, i.e. DSD & Vel distributions, as well as the volume average density by minute and the rain & not-rain precipitation rates by minute.. Additionally, Rain and not-Rain accumulations are presented.
9. PSD Vel	Daily PSD & Velocity Summary	Time history of PSD, Fall Velocity, Relative Fall Velocity and Fall Speed Variability. Visual display of storm characteristics. Fall Speed by Size for each 10 minute increment.
10. Vel	Today's 10 Minute Fall Velocity Plots	Visualization of storm evolution by particle size. Rain and not-rain fall speed changes are useful for seeing frontal passage and other features. See (a) root_1\PIP_3\2_3_1_Velocity_Ebar and (b) root_1\PIP_3\2_3_0_Velocity_Plots_seg for mean & error bar, as well as individual particle fall speeds. For daily archiving, these are zipped to the Zip Directory.

PIP Tool Box

Button	Tip	Description
11. Task Mngr	What's running?	Windows TaskManger shows which Apps are running.
12. Scheduler	Schedule Startup Apps	Run Windows Scheduler and Goto PIP subdirectory. Turn on PIP startup apps (Tool_Bar and PIP_123). Note that Tool_Bar is always useful, however for setup, PIP_123 should not be running. Use button 14. Kill PIP as necessary.
13. Run PIP	*Run* PIP App	Run PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
14. Kill PIP	*Kill* PIP Apps	Kill PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
15. Re-Start PIP	*Re-Start* PIP Apps	Re-Start PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
16. PC Health	Monitor PC Temperature	Check Temps to ensure cool operations, i.e. don't want to see temperatures in the 60's degree C.
17. Fig\Tables Web	Figures and Tables for Web	Daily tables and figures in one place enables backup and web distribution.
18. Movie Web	Movies for Web	Daily AVI's enables backup and web distribution.
Button_19.bat	Link to an app of your choice	This button links to: C:\PIP\Software\Setup\Tools_16\button_19.bat At NWS-MQT, links to URL for MRR-PIP daily figures.
Button_20.bat	Link to an app of your choice	This button links to: C:\PIP\Software\Setup\Tools_16\button_20.bat At NWS-MQT, links to this file.

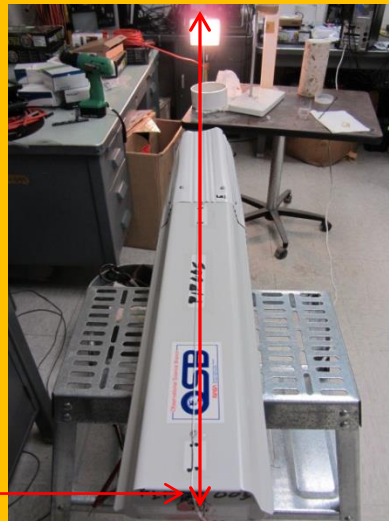


Mouse Roll Over = Tip  
Right Click = Description



# Initial Alignment

A string provides rough alignment between the camera housing and the lamp.  
Then go to Fine Alignment (next page).



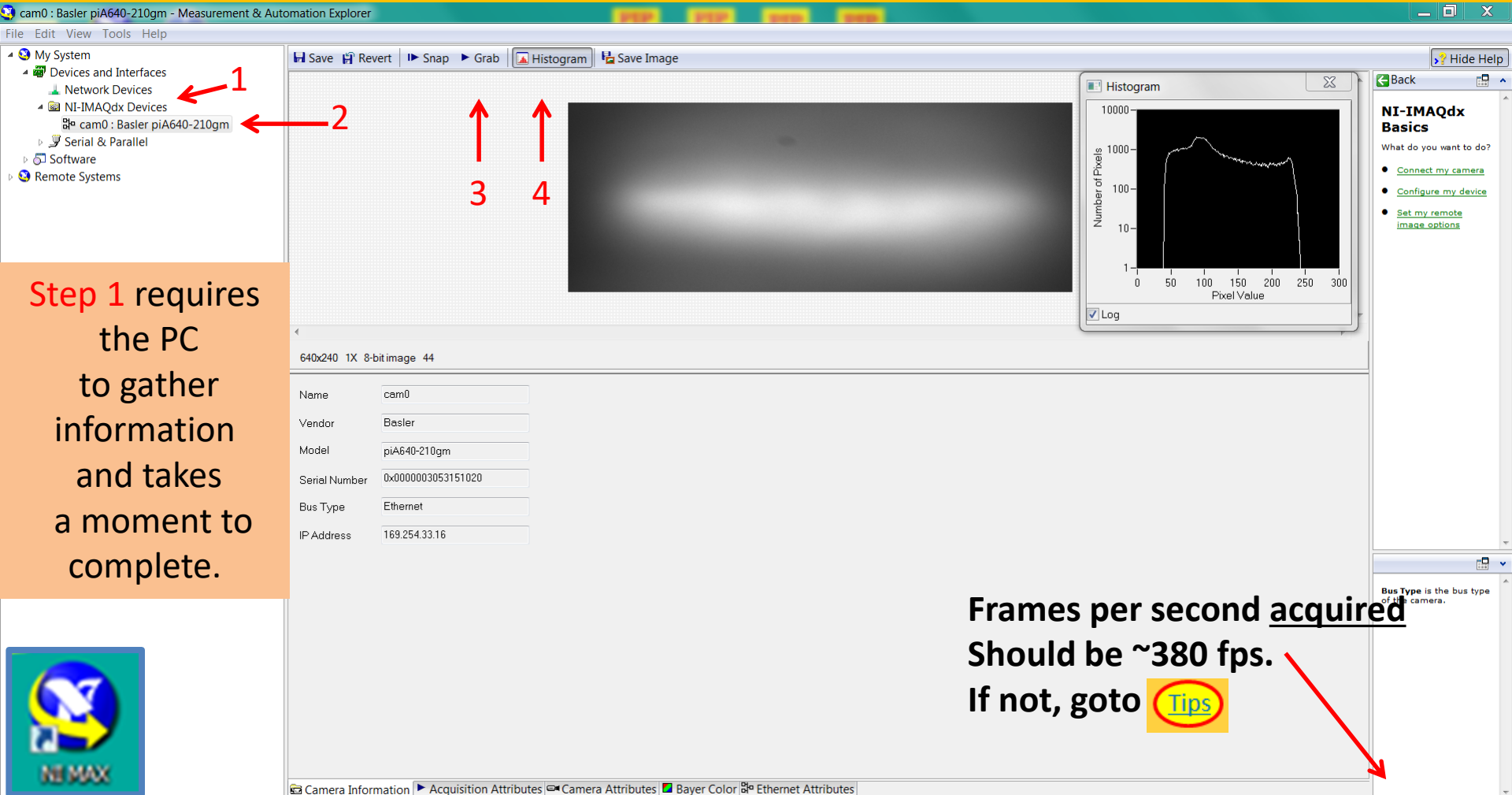
String




String

# Fine Alignment

Adjust things so that light from the halogen lamp is centered.  
Move the camera and/or lamp to get the NI-MAX image to look like this one,  
Then adjust the Gain (next page).



Step 1 requires the PC to gather information and takes a moment to complete.

Frames per second acquired  
Should be ~380 fps.  
If not, goto 



Frames per second: 178, 379 (displayed, acq

# Gain

Adjust the Gain so the histogram looks like this one, i.e. Max ~220 & min ~50. Want >200 but never saturate (>255).

5. Save

Be sure to \*Save\*.

6. Exit

The screenshot shows the NI-IMAQdx Basics software interface. At the top, there are buttons for Save, Revert, Snap, Grab, Histogram, and Save Image. A red arrow points to the Histogram button, labeled '2. Histogram'. Below the main image area, there is a 'Camera Attributes' panel with sections for Analog Controls, Image Format Controls, AOI Controls, and Acquisition Controls. A red arrow points to the 'Gain (Raw)' setting in the Analog Controls section, labeled '4. Adjust Raw Gain to get histogram like above.'. A red box highlights the 'Gain (Raw)' dropdown menu, which is set to 'All'. A red arrow points to the 'Gain (Raw)' dropdown menu, labeled '3. Attributes'. To the right of the 'Gain (Raw)' dropdown, there is a blue slider bar. A red arrow points to the slider bar, labeled '3.1 Confirm and reset if needed. It is unusual for these to change.'. Below the slider bar, there is a text box that says 'Frames per second acquired Should be ~380 fps. If not, goto **Tips**'. At the bottom of the interface, there is a status bar that says 'Frames per second: 236, 379 (displayed, acquired)'. On the left side of the interface, there is a logo for NI MAX. On the right side, there is a sidebar with a 'Back' button and a 'Hide Help' button. The sidebar also contains a 'NI-IMAQdx Basics' section with a 'What do you want to do?' question and several links: 'Connect my camera', 'Configure my device', and 'Set my remote image options'. There is also an 'Expand All/collaps All' button and a 'Refresh' button in the sidebar.

1. Grab  
2. Histogram

4. Adjust Raw Gain to get histogram like above.

3. Attributes

3.1 Confirm and reset if needed. It is unusual for these to change.

Frames per second acquired Should be ~380 fps. If not, goto **Tips**

When you are sure that settings are saved, you are ready to run PIP Apps.

If you \*can not\* set them as needed, goto **Tips**. (Other settings sometimes change during shipment.)





# Falling Drops

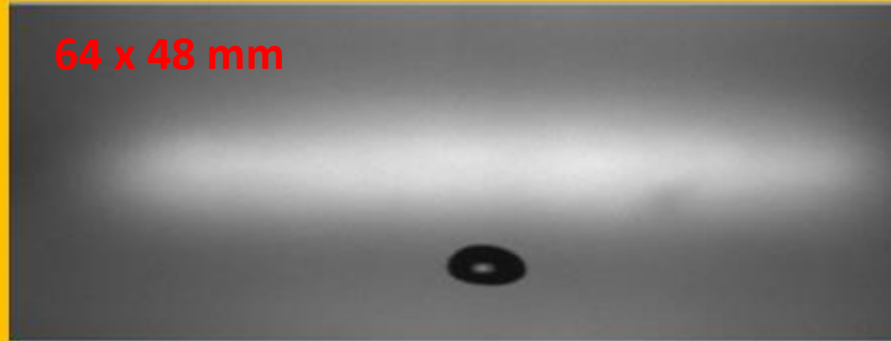
This step is optional. It is useful to demonstrate video operation.  
Setup a dripper so that water drops fall in the focal plane,  
Which can be located by a knot along the string.



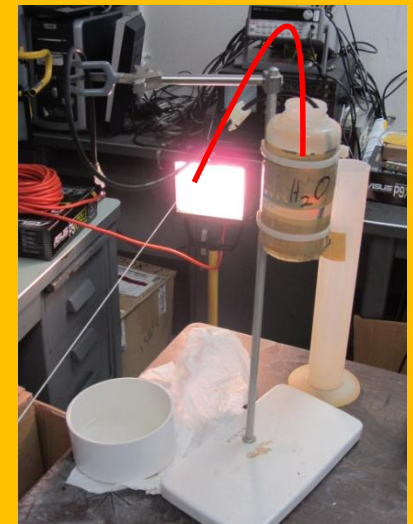
## Water Drop

Looks Distorted due to 2 to 1 resolution.  
PIP Apps account for this.

64 x 48 mm



## Tube Siphons Water for Dripper



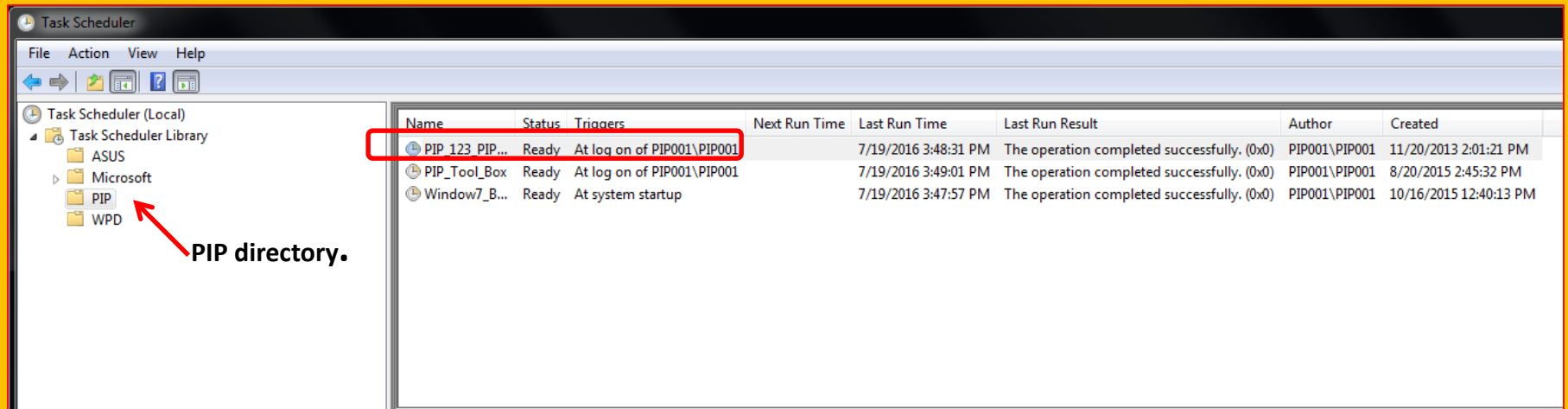
PIP\_1 App has pixel by pixel Automatic Gain Control (AGC)  
That adjusts for non-uniform brightness,  
So that grayscale thresholding is effective for image compression.

**Schedule PIP to run at boot,  
Which is useful after power failures because PIP apps will run whenever power is restored.**

**Run the Windows Task Scheduler program.**

**Change Status of PIP\_123 to Enabled (right click).**

**>> exit program. Re-boot. PIP should come up running the PIP Apps.**



# Checked Flag

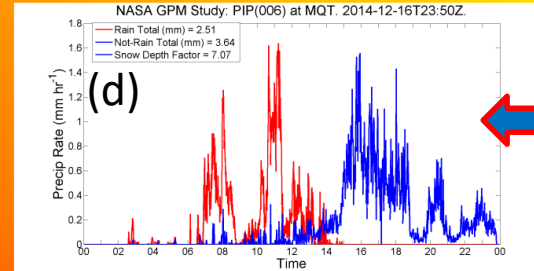
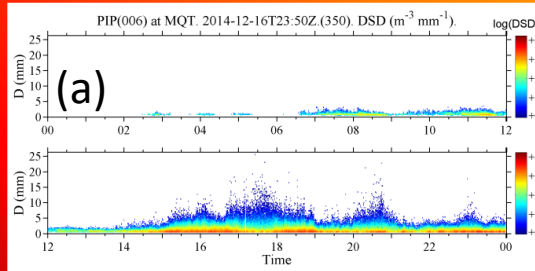
i.e. recording video input and producing products.

At ~10 minute points (maybe delayed during precip), graphs popup on screen.

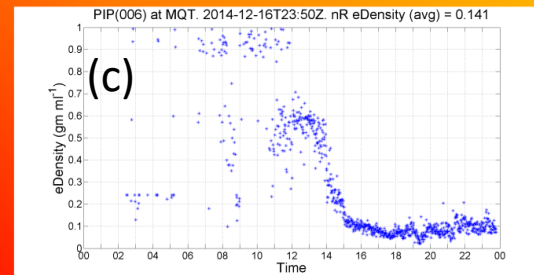
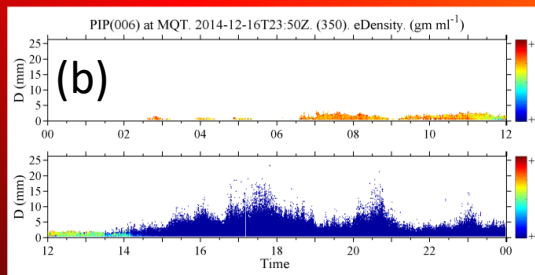
Tool Box Buttons 4-10 provide access to lots of stuff.



## PIP at MQT. 2014/12/16.



**Rain and not-Rain**  
Measured  
Independently and  
Simultaneously!



Time Series  
Of not-Rain  
Density  
( Cold Front )

High Speed Video Images Yield  
(a) Particle Size Distributions  
(b) Fall Velocity Distributions

Models Produce  
(d) Rain & not-Rain Water Flux  
(c) Density Estimates

**Tip: Camera exposure settings (advanced).**  
**Confirm that your settings are as shown.**  
**These are needed for exposure time and frame rate!**  
**After adjustments, [GoTo.](#)**

The screenshot displays the NI-IMAQdx Basics software interface. The main window shows a camera view with a histogram overlay. The histogram plots 'Number of Pixels' (log scale, 1 to 10000) against 'Pixel Value' (0 to 300). The histogram shows a peak around 150 pixels. Below the camera view, the 'Acquisition Controls' section is expanded, showing various settings. A red box highlights the 'Acquisition Mode' section, which is set to 'Continuous'. Other settings in this section include 'Legacy' (Off), 'Acquisition Start' (Off), 'Line 1' (Line 1), 'Rising Edge' (0.00000000), 'Timed' (Off), 'Exposure Time (Abs)' (28.00000000), 'Exposure Time (Raw)' (14.00000000), 'Readout Time (Abs)' (2.00000000), 'Acquisition Frame Rate (Abs)' (379.939210), and 'Resulting Frame Rate (Abs)' (381.097561). The 'Frame Trigger Wait' is set to 1. The 'Averaging' section shows 'Number of frames' set to 2. The 'Digital I/O Controls' section shows 'Line Selector' set to 'Output Line 1', 'Line Mode' set to 'Output', 'Line Logic' set to 'Positive', and 'Line Format' set to 'On-to-counted'. The 'Gain (Raw)' section is also visible, with a minimum value of 0. The bottom status bar shows 'Frames per second: 236, 379 (displayed)'. A 'NE MAX' logo is visible in the bottom left corner.

Setting	Value
Acquisition Mode	Continuous
Legacy	Off
Acquisition Start	Off
Line 1	Line 1
Rising Edge	0.00000000
Timed	Off
Exposure Time (Abs)	28.00000000
Exposure Time (Raw)	14.00000000
Readout Time (Abs)	2.00000000
Acquisition Frame Rate (Abs)	379.939210
Resulting Frame Rate (Abs)	381.097561
Frame Trigger Wait	1
Number of frames (Averaging)	2

# End of PIP Express Setup Guide