

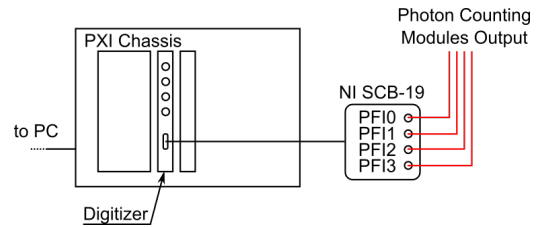
# Configuring Photon Counting Modules

**!** This feature is only available with the [Resonant Scanning](#) imaging system.

## Introduction

ScanImage 2016 can use photon counting modules instead of standard PMTs. A photon counting head / module consists of a PMT and a subsequent photon counting circuit. This circuit generates a TTL pulse of a defined duration when a photon is detected. ScanImage samples this TTL pulse using the auxiliary digital inputs PFI0-3 of the NI 573x digitizer modules.

## Wiring for Photon Counting Modules



Photon Counting Modules that output a TTL pulse for each detected photon are connected to the digital I/O port on the NI573x digitizer module using a NI SCB-19 breakout box.

## Configuration

To configure photon counting for ResScan, add the following entries to the Machine Data File:

```
%% ResScan
% the features 'Aux Triggering'
'I2C' and 'Photon Counting' are
mutually exclusive
I2CEnable = false;
auxTriggersEnable = false;

photonCountingEnable = true; %
enable photon counting feature
photonCountingDisableAveraging =
true; % disable averaging of samples
into pixels; instead accumulate
samples
photonCountingScaleByPowerOfTwo = 0;
% if photonCountingDisableAveraging
== false scale count before
averaging to avoid loss of precision
by integer division
photonCountingDebounce = 0; % [s]
time the TTL input needs to be high
before a pulse is registered
```

The setting `photonCountingDebounce` can be used to clean up a noisy signal. The delay introduced by `photonCountingDebounce` can be eliminated by adjusting the value for the scan phase in [Configuration Controls](#).

## Limitations

**i** To be detected by the digitizer, the duration of the pulse output by the photon counting module needs to be longer than the sample period of the digitizer module. See the list below for the sample duration of digitizers typically used with ScanImage.

Digitizer	Sample Rate	Minimum Pulse Duration
NI 5732	80 MHz	12.5 ns
NI 5733	120 MHz	8.4 ns
NI 5734	120 MHz	8.4 ns

**i** Photon Counting Modules cannot discriminate multiple photons arriving in a small time interval. After a photon arrives, the photon counting circuit outputs a high pulse followed by a low signal of a specified duration. During this output time, the photon counting circuit ignores all photons arriving at the PMT.

This makes photon counting modules only suitable for applications where a low photon rate is expected.

**i** The digital inputs on the SCB-19 are unterminated single ended inputs. To impedance match the 50Ohm BNC cable used for connecting the photon counting module to the SCB-19 breakout, use a 50Ohm resistor between the PFIx and GND rail of the breakout.