



**PhotonVisionLib**

**LabVIEW**

**Reference**

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## Introduction

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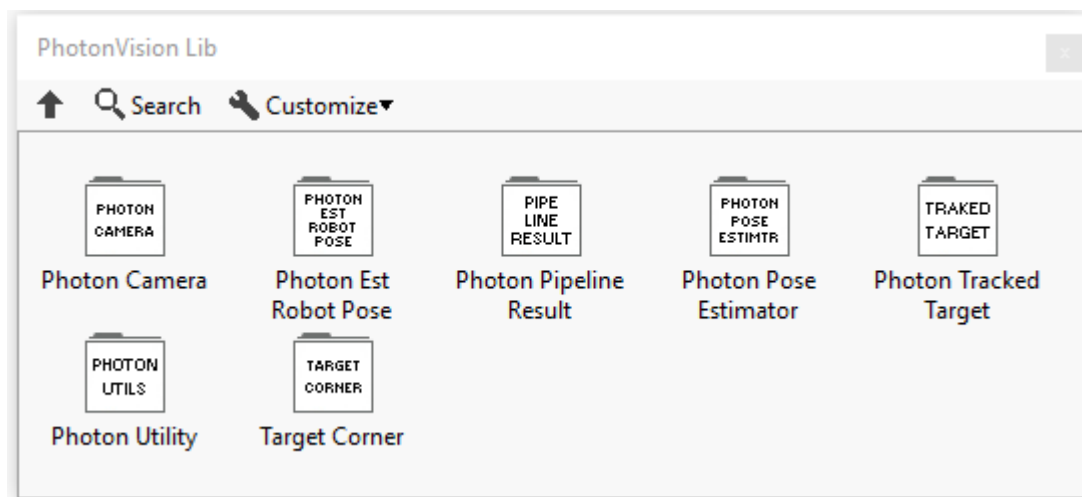
The PhotonVision LabVIEW library provides utility functions to read, decode, and interpret data sent from PhotonVision application.

The library source code, package build specifications, and test package can be found here <https://github.com/jsimpso81/PhotonVisionLabVIEW>

## Function Menus

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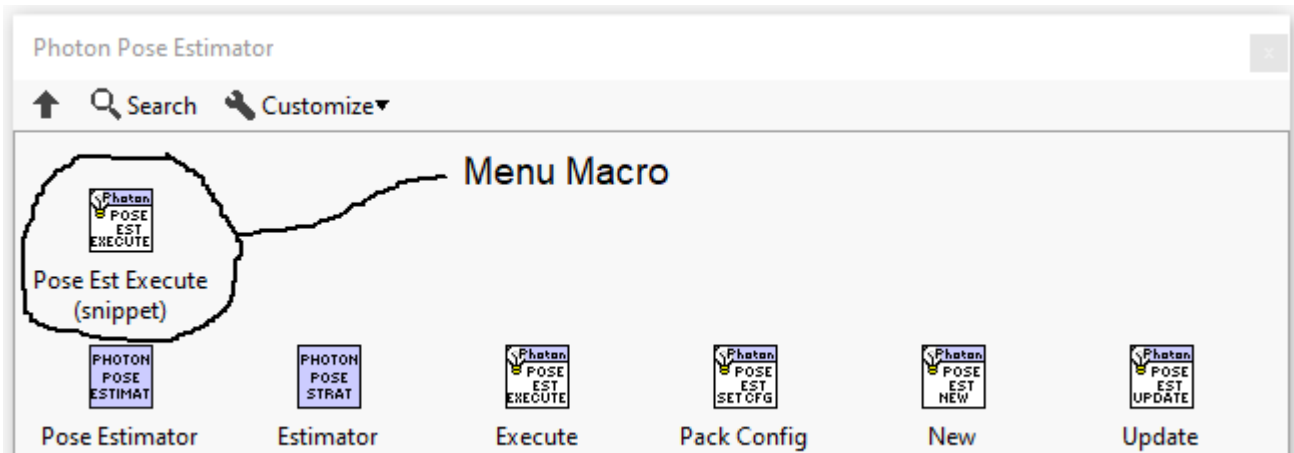
A PhotonVision function palette contains the PhotonVision functions and type definitions. This palette can be accessed from the WPI Robotics Library Third Party palette.



## Menu Macros

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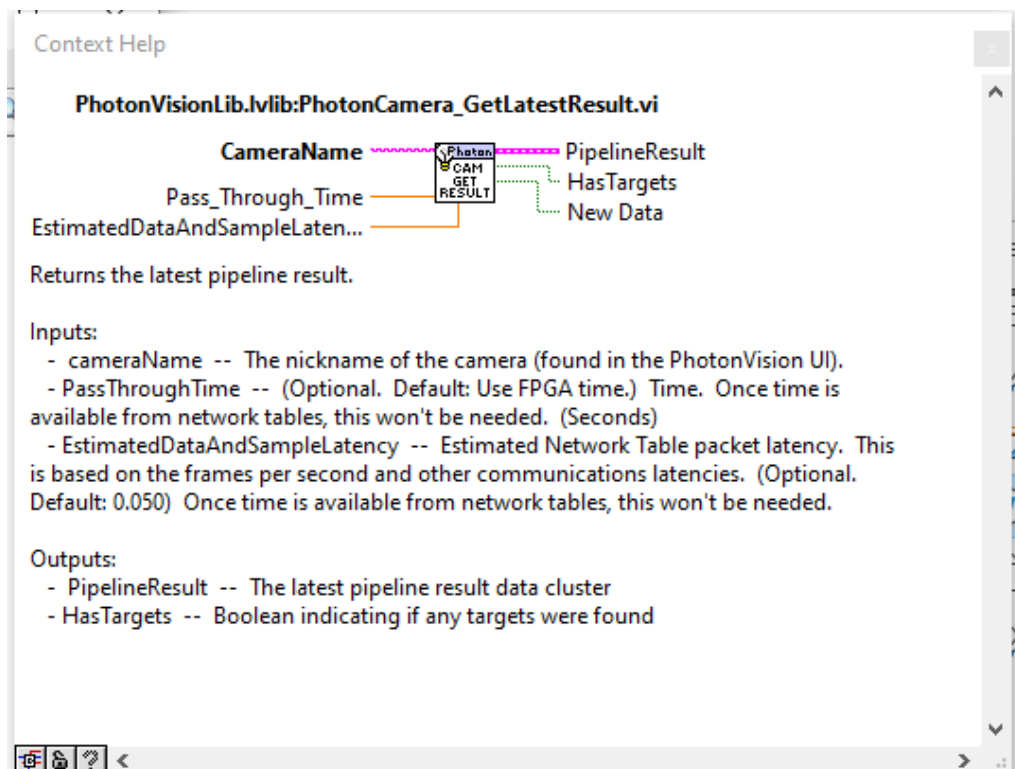
Some of the menu items place “snippets” of code into a VI. These “macros” can greatly speed up development by placing large sections of mostly completed code in a VI. Usually macros have a different color menu palette icon and may contain “(snippet)” in the description.



## Function Help

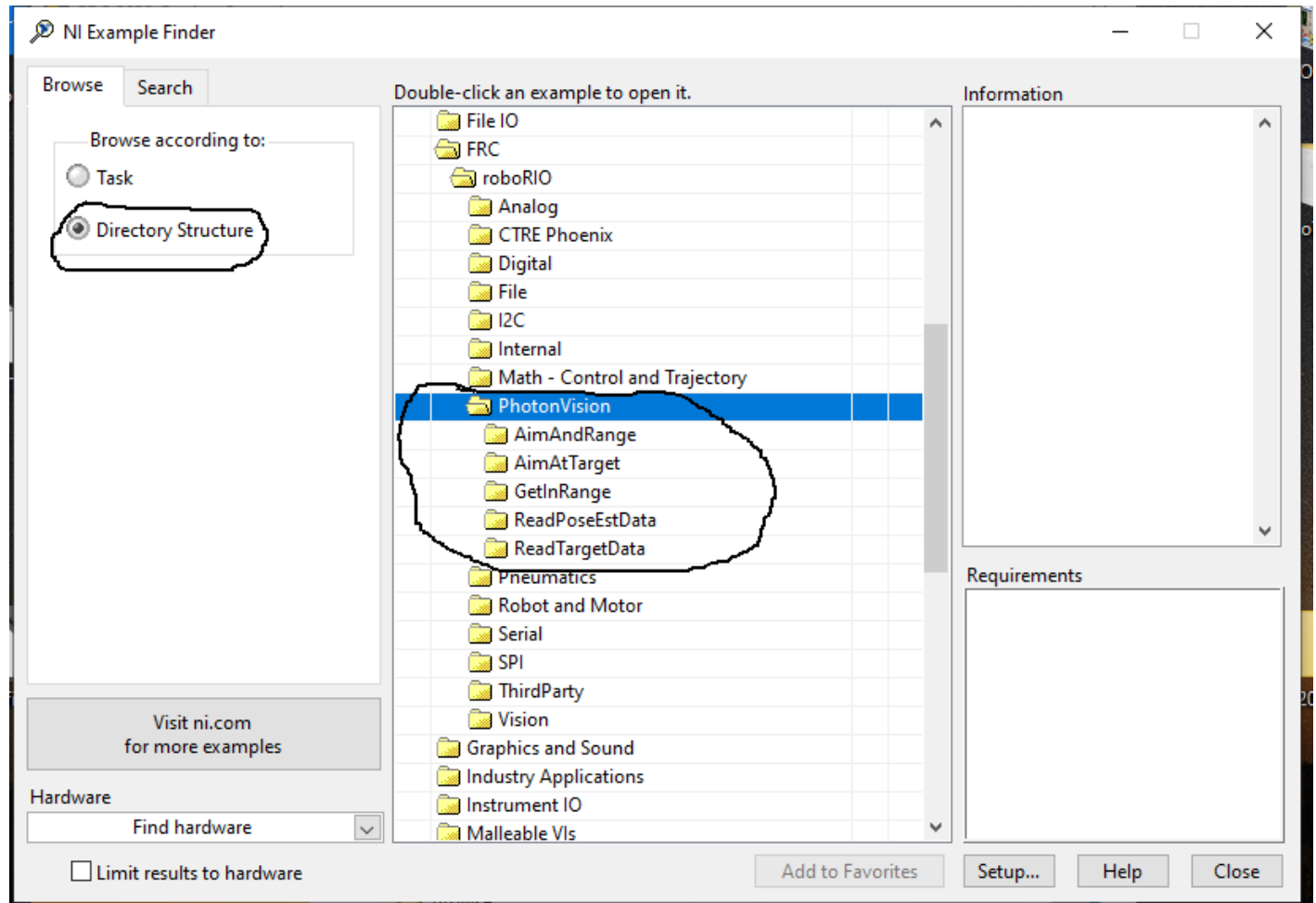
---

Each VI includes help that can be accessed using the standard LabVIEW help toggle (Ctrl H).



## Function Examples

Many of the functions have examples that can be found under the LabVIEW "Find examples..." function. (Help -> Find Examples...). The function examples are easiest to find when "Directory Structure" is selected.



# Function Groups

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## Packet

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### Packet\_decode\_Boolean



Decode (or strip out) a boolean from an array of bytes. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type. A TRUE boolean is stroed as an integer value = 1.

#### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

#### Outputs

- Boolean\_Value -- Boolean value.
- NextByte -- The starting byte index for the next value (regardless of type).

---

### Packet\_decode\_ByteI8



Decode (or strip out) an unsigned byte from an array of bytes. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

#### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

#### Outputs

- Int8\_Value -- Byte in the form of an INT 8 value.

- NextByte -- The starting byte index for the next value (regardless of type).

---

## Packet\_decode\_Flt32



Decode (or strip out) a single precision floating point value FLT 32. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- FLT32\_Value -- Extracted float 32 (single float) value.
- NextByte -- The starting byte index for the next value (regardless of type).

---

## Packet\_decode\_Flt64



Decode (or strip out) a double precision floating point value FLT 64. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- FLT64\_Value -- Extracted float 64 (double) value.



- NextByte -- The starting byte index for the next value (regardless of type).

---

## Packet\_decode\_Int16



Decode (or strip out) a 16 bit integer value from the provided byte array. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- INT16\_Value -- Extracted 16 bit integer value.
- NextByte -- The starting byte index for the next value (regardless of type).

---

## Packet\_decode\_Int32



Decode (or strip out) a 32 bit integer value from the provided byte array. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- INT32\_Value -- Extracted 32 bit integer value.

- NextByte -- The starting byte index for the next value (regardless of type).

## Packet\_decode\_Int64



Decode (or strip out) a 64 bit integer value from the provided byte array. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- INT64\_Value -- Extracted 64 bit integer value.
- NextByte -- The starting byte index for the next value (regardless of type).

## Packet\_decode\_TargetCornerArray



Decode (or strip out) aTarget Corner Array value from the provided byte array. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- Target Corner Array -- Extracted Array of Target Corner cluster.

- NextByte -- The starting byte index for the next value (regardless of type).

## Packet\_decode\_Transform3d



Decode (or strip out) a Transform3d value from the provided byte array. No conversion or decoding is actually done, the memory is just copied, and the value is cast to the correct type.

### Inputs

- RawData -- Array of bytes containing the data to be extracted.
- StartByte -- The starting byte number (the first byte starts at 0)

### Outputs

- Transform3d -- Extracted Transform3d cluster.
- NextByte -- The starting byte index for the next value (regardless of type).

## Packet\_encode\_Boolean



Encode (or append) a boolean to the end of an array of bytes. The boolean is stored as an unsigned integer byte, where TRUE = 1, FALSE = 0.

### Inputs

- RawData In -- Array of bytes to be appended to..
- Boolean\_Value -- Boolean value.

### Outputs

- RawData Out -- Array of bytes containing the appended value.

---

---

## Packet\_encode\_ByteI8



Encode (or append) an unsigned byte at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

### Inputs

- RawData In -- Array of bytes to be appended to..
- Int8\_Value -- Byte in the form of an INT 8 value.

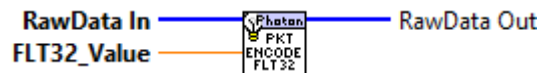
### Outputs

- RawData Out -- Array of bytes containing the appended value.

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## Packet\_encode\_FLT32



Encode (or append) a single floating point value (FLT 32) at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

### Inputs

- RawData In -- Array of bytes to be appended to..
- FLT32\_Value -- Single floating point value.

### Outputs

- RawData Out -- Array of bytes containing the appended value.
- 
-

## Packet\_encode\_FLT64



Encode (or append) a double floating point value (FLT 64) at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

### Inputs

- RawData In -- Array of bytes to be appended to..
- FLT64\_Value -- Double floating point value.

### Outputs

- RawData Out -- Array of bytes containing the appended value.

---

---

## Packet\_encode\_Int16



Encode (or append) a 16 bit integer at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

### Inputs

- RawData In -- Array of bytes to be appended to..
- Int16\_Value -- 16 bit integer the form of an INT 16 value.

### Outputs

- RawData Out -- Array of bytes containing the appended value.

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## Packet\_encode\_Int32



Encode (or append) a 32 bit integer at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

#### Inputs

- RawData In -- Array of bytes to be appended to..
- In32\_Value -- 32 bit integer the form of an INT 32 value.

#### Outputs

- RawData Out -- Array of bytes containing the appended value.

---

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### Packet\_encode\_Int64



Encode (or append) a 64 bit integer at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

#### Inputs

- RawData In -- Array of bytes to be appended to..
- In64\_Value -- 64 bit integer the form of an INT 64 value.

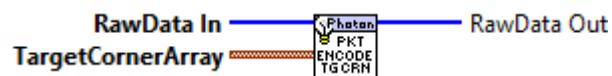
#### Outputs

- RawData Out -- Array of bytes containing the appended value.

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### Packet\_encode\_TargetCornerArray



Encode (or append) a Target Corner Array at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

## Inputs

- RawData In -- Array of bytes to be appended to..
- Target Corner Array -- Array of Target Corner clusters to be encoded.

## Outputs

- RawData Out -- Array of bytes containing the appended value.

---

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## Packet\_encode\_Transform3d



Encode (or append) a double floating point value (FLT 64) at the end of an array of bytes. No conversion is actually done, the memory is just copied to the end of the array.

## Inputs

- RawData In -- Array of bytes to be appended to..
- FLT64\_Value -- Double floating point value.

## Outputs

- RawData Out -- Array of bytes containing the appended value.

## PhotonCamera

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### PhotonCamera\_ChkTimeSync



Check Time Sync. If server has not been running, then signal this to the user. Write a message to the driver station error message.

Inputs:

- PhotonPipelineResult -- Cluster containing photon pipeline result.
- Pass\_Through\_Time -- Optional. Current roboRIO FPGA time. If not provided, this VI will read the time.

Outputs:

- TimeNotSynced -- TRUE if time sync server has NOT been functioning correctly.
- 

### PhotonCamera\_GetCameraMatrix



Returns the camera matrix

Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- CameraMatrix - matrix - 3 x 3 matrix of camera intrinsics. If empty, nothing was returned or nothing exists.



- Error Out -- Contains error information if a Network table ot other error occurred.

## PhotonCamera\_GetDistCoeffs

CameraName ..... Dist Coeffs  
 BaseNTName ..... error out



Returns the distortion coeeficitions

Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- DistCoeffs - matrix - 5 x 1 matrix of distortion coefficients. If empty, nothing was returned or nothing exists.
- Error Out -- Contains error information if a Network table ot other error occurred.

## PhotonCamera\_GetDriverMode

CameraName ..... DriverMode  
 BaseNTName ..... error out



Returns whether the camera is in driver mode.

Inputs:

- CameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- DriverMode -- Boolean indicating whether the camera is in driver mode.
- Error Out -- Contains error information if a Network table ot other error occurred.

### PhotonCamera\_GetLEDMode



Returns the current LED mode.

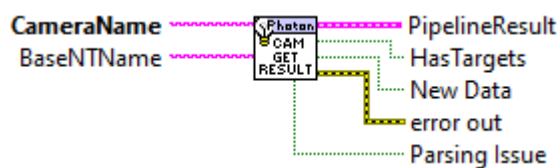
Inputs:

- BaseNTName - string - Base Nework Table name. (Optional. Default: /photonvision )

Outputs:

- LedMode -- The current LED mode.
- Error Out -- Contains error information if a Network table ot other error occurred.

### PhotonCamera\_GetLatestResult



Returns the latest pipeline result.

Inputs:

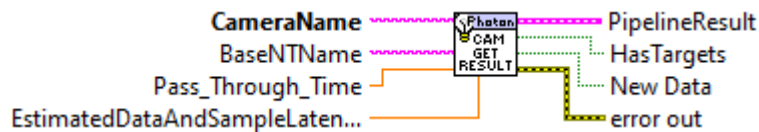
- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Nework Table name. (Optional. Default: /photonvision )
- PassThroughTime -- (Optional. Default: Use FPGA time.) Time. Once time is available from network tables, this won't be needed. (Seconds)

- EstimatedDataAndSampleLatency -- Estimated Network Table packet latency. This is based on the frames per second and other communications latencies. (Optional. Default: 0.050) Once time is available from network tables, this won't be needed.

Outputs:

- PipelineResult -- The latest pipeline result data cluster
- HasTargets -- Boolean indicating if any targets were found
- New Data -- Boolean indicating if response is new.
- Error Out -- Contains error information if a Network table ot other error occurred.
- Parsing Error -- Boolean indicating that number of bytes processes <> number of packet bytes

## PhotonCamera\_GetLatestResult\_OLD



Returns the latest pipeline result.

Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Nework Table name. (Optional. Default: /photonvision )
- PassThroughTime -- (Optional. Default: Use FPGA time.) Time. Once time is available from network tables, this won't be needed. (Seconds)
- EstimatedDataAndSampleLatency -- Estimated Network Table packet latency. This is based on the frames per second and other communications latencies. (Optional. Default: 0.050) Once time is available from network tables, this won't be needed.

Outputs:

- PipelineResult -- The latest pipeline result data cluster
- HasTargets -- Boolean indicating if any targets were found
- Error Out -- Contains error information if a Network table ot other error occurred.

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## PhotonCamera\_GetPipelineIndex



Returns the active pipeline index.

Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- PipelineIndex -- Active Pipeline Index
  - Error Out -- Contains error information if a Network table ot other error occurred.
- 
- 

## PhotonCamera\_GetVersion



Returned photonvision version string

Inputs:

- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- Version - string - Photonvision version string
- Error Out -- Contains error information if a Network table ot other error occurred.

## PhotonCamera\_IsConnected



Determines if communications to camera is valid.

Inputs:

- CameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- IsConnected -- TRUE if communications have been received within the last 0.5 seconds.
- Error Out -- Contains error information if a Network table ot other error occurred.

## PhotonCamera\_SetDriverMode



Toggles driver mode.

Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )
- DriverMode -- Whether to set driver mode.

Outputs:

- Error Out -- Contains error information if a Network table ot other error occurred.

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## PhotonCamera\_SetLEDMode



Sets the LED mode.

Inputs:

- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )
- LedMod -- The mode to set to.

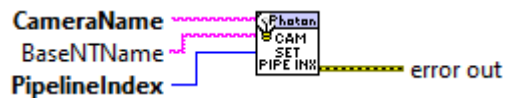
Outputs:

- Error Out -- Contains error information if a Network table ot other error occurred.

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## PhotonCamera\_SetPipelineIndex



Allows the user to select the active pipeline index.


Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )
- index The active pipeline index.

Outputs:

- Error Out -- Contains error information if a Network table ot other error occurred.
- 
-

## PhotonCamera\_TakeInputSnapshot

CameraName .....  
 BaseNTName .....  ..... error out

Request the camera to save a new image file from the input camera stream with overlays. Images take up space in the filesystem of the PhotonCamera. Calling it frequently will fill up disk space and eventually cause the system to stop working. Clear out images in /opt/photonvision/photonvision\_config/imgSaves frequently to prevent issues.


### Inputs:

- cameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

### Outputs:

- Error Out -- Contains error information if a Network table or other error occurred.

## PhotonCamera\_TakeOutputSnapshot

CameraName .....  
 BaseNTName .....  ..... error out

Request the camera to save a new image file from the output stream with overlays. Images take up space in the filesystem of the PhotonCamera. Calling it frequently will fill up disk space and eventually cause the system to stop working. Clear out images in /opt/photonvision/photonvision\_config/imgSaves frequently to prevent issues.

### Inputs:

- CameraName -- The nickname of the camera (found in the PhotonVision UI).
- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

### Outputs:

- Error Out -- Contains error information if a Network table or other error occurred.

## PhotonCamera\_VerifyVersion



Verify photonvision version string

Currently this does not write a driver station message if the version is wrong.

Inputs:

- BaseNTName - string - Base Network Table name. (Optional. Default: /photonvision )

Outputs:

- VersionOk - string - Version matches co-processor.
- Error Out -- Contains error information if a Network table or other error occurred.



## PhotonEstimatedRobotPose

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### PhotonEstimatedRobotPose\_GetAll



Extracts individual data items from a Photon Estimated Robot Pose cluster.

Inputs:

- PhotonEstimatedRobotPose -- PhotonEstimatedRobotPose -- Data cluster..

Outputs:

- EstimatedPose -- Pose3d -- Estimated absolute position of robot on field.
  - TimeStamp -- Double -- Time stamp (seconds) of the packet from photonvision. This uses the FGPA elapsed time.
  - TargetsUsed -- array -- Array of targets used for pose estimation
  - StrategyUsed -- enum -- Strategy used for pose estimation.
- 

### PhotonEstimatedRobotPose\_New



Create a new Photon Estimated Robot Pose cluster.

Inputs:

- EstimatedPose -- Pose3d -- Estimated absolute position of robot on field.
- TimeStamp -- Double -- Time stamp (seconds) of the packet from photonvision. This uses the FGPA elapsed time.
- TargetsUsed -- array -- A list of the targets used to compute this pose

-- Strategy -- enum -- The strategy actually used to produce this pose

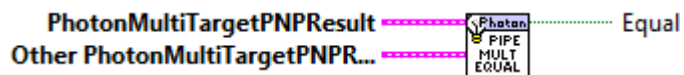
Outputs:

- PhotonEstimatedRobotPose -- Created data cluster..

## PhotonMultiTargetPNPResult

---

### PhotonMultiTargetPNPResult\_Equals



Determines if two PhotonMultiTargetPNPResult clusters are equal.

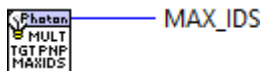
Inputs:

- PhotonMultiTargetPNPResult -- PhotonMultiTargetPNPResult cluster.
- OtherPhotonMultiTargetPNPResult -- OtherPhotonMultiTargetPNPResult cluster.

Outputs:

- Equal -- Returns TRUE, if both PhotonMultiTargetPNPResult clusters are equal..

### PhotonMultiTargetPNPResult\_MAX\_IDS



Seeing 32 april tags at once seems like a sane limit. (Current value is 32.)

### PhotonMultiTargetPNPResult\_New



Creaaate an empty Multi Target PNP result

Inputs:

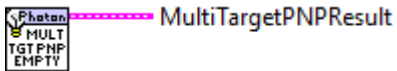
- PhotonPNPResult - cluster - Result to store in this mutilTarget results
- FiducialIDsUsed - Array - List of Fidicual IDS (april tags) used to locate this target.

Outputs:

- MultiTargetPNPResult - cluster - created result cluster.

---

## PhotonMultiTargetPNPResult\_New\_Empty



Create an empty Multi Target PNP result

Inputs:

Outputs:

- MultiTargetPNPResult - cluster - created empty result cluster.

---

## PhotonMultiTargetPNPResult\_pack



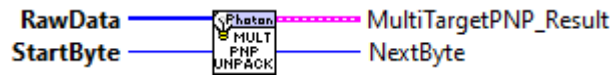
Encode a MultiTargetPNPResult cluster into an array of bytes.

Inputs:

- MultiTagetPNPResult -- cluster containing the data to pack.

Outputs:

- RawDataOut -- Byte array containing the encoded data.

**PhotonMultiTargetPNPResult\_unpack**

Internal function to parse the data for MultiTargetPNPResult

Inputs:

- RawData -- Byte array containing the data to parse.
- StartingByte - Index into RawData to start parsing. Beginning of data is index 0.

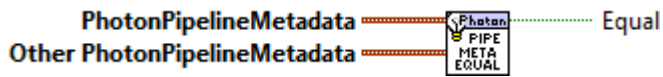
Outputs:

- MultiTargetPNPResult -- Parsed result cluster.
- NextByte -- Index to byte following this data in RawData.

## PhotonPipelineMetadata

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### PhotonPipelineMetadata\_Equals



Determines if two PipelineMetadata clusters are equal.

Inputs:

- PipelineMetadata -- PipelineMetadata cluster.
- Other PipelineMetadata -- Other Pipelinemetadata cluster.

Outputs:

- Equal -- Returns TRUE, if both pipeline metadata clusters are equal..

### PhotonPipelineMetadata\_GetAll



Returns individual elements of PipelineMetadata cluster

Inputs:

- PipelineMetadata -- Parsed PipelineMetadata cluster.

Outputs:

- CaptureTimestampMicros -- Image capture timestamp, in microseconds
- PublishTimestampMicros -- NT publish timestamp, in microseconds
- SequenceID -- Mirror of the heartbeat entry -- monotonically increasing
- TimeSinceLastPong -- Time from last Time Sync Pong received and the construction of this metadata, in uS

---

## PhotonPipelineMetadata\_GetLatency



Returns the time between image capture and publish to NT

Inputs:

- PipelineMetadata -- Parsed PipelineMetadata cluster.

Outputs:

- Latency\_ms -- Latency between capture and publish (milliseconds)
- 

## PhotonPipelineMetadata\_New



Create new Pipeline MetaData cluster

Inputs:

- CaptureTimestampMicros -- Image capture timestamp, in microseconds
- PublishTimestampMicros -- NT publish timestamp, in microseconds
- SequenceID -- Mirror of the heartbeat entry -- monotonically increasing
- TimeSinceLastPong -- Time from last Time Sync Pong received and the construction of this metadata, in uS

Outputs:

- PipelineMetaData -- Parsed PipelineMetadata cluster.

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## PhotonPipelineMetadata\_Pack



Convert a PipelineMetadat cluster to a Packet array of bytes ready for writing to a Network Table variable.

Inputs:

- PipelineMetadata -- PipelineMetadata cluster.

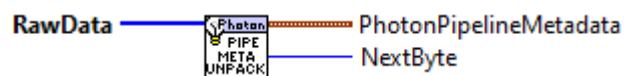
Outputs:

- Pacet\_RawData -- Byte array containing the encoded PipelineResult.

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## PhotonPipelineMetadata\_Unpack



Internal function to parse the data returned by PhotonCamera\_GetLatestResult.

Inputs:

- RawData -- Byte array containing the data to parse.

Outputs:

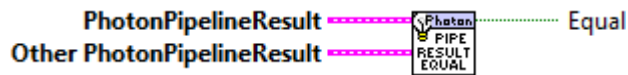
- PipelineMetadata -- Parsed PipelineMetadata cluster.



## PhotonPipelineResult

---

### PhotonPipelineResult\_Equals



Determines if two PipelineResults are equal.

Inputs:

- PipelineResult -- PipelineResult cluster.
- Other PipelineResult -- Other PipelineResult cluster.

Outputs:

- Equal -- Returns TRUE, if both pipeline results are equal..

---

### PhotonPipelineResult\_GetBestTarget



Returns the best target in this pipeline result. If there are no targets, this method will return an empty target. The best target is determined by the target sort mode in the PhotonVision UI.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- TrackedTarget -- Cluster containing the best target
-

## PhotonPipelineResult\_GetBestTargetById



Returns the best target in this pipeline result filtered by fiducial ID (April tag number). If there are no targets, or no targets with this fiducial ID, this method will return an empty target. IF more than 1 targets have the same fiducial ID, the best target is determined by the sort mode in the PhotonVision UI.

### Inputs:

- PipelineResult -- Parsed PipelineResult cluster.
- Fiducial ID -- The April tag number being searched for.

### Outputs:

- TrackedTarget -- Cluster containing the best target
- TargetFound -- TRUE if a target matching the search criteria exists.
- TargetIndex -- Index into the targets array of the best target matching the search criteria.

## PhotonPipelineResult\_GetLatency\_Millis



Returns the latency in the pipeline.

### Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

### Outputs:

- Latency\_Millis -- The latency in the pipeline.
- TimeStampSec -- Time stamp of packet (FPGA elapsed time) seconds

## PhotonPipelineResult\_GetMetadata



Returns the metadata in this pipeline result.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- Metadata -- Metadata cluster.

## PhotonPipelineResult\_GetMultiTagResult



Returns the MultiTargetPNPResult in this pipeline result. Be sure to check IsPresent before using the pose estimate!

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- MultiTargetPNPResult-- Cluster containing the multitarget PNP result
- IsPresent - boolean - TRUE if a MultiTarget PNP result contains a pose.

## PhotonPipelineResult\_GetTargetCount



Returns the targets in this pipeline result. If there are no targets, this method will return an empty target array.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

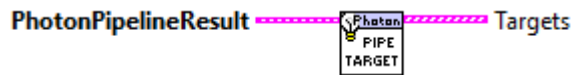
Outputs:

- Targets -- Array of Target clusters.

---

---

## PhotonPipelineResult\_GetTargets



Returns the targets in this pipeline result. If there are no targets, this method will return an empty target array.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- Targets -- Array of Target clusters.

---

---

## PhotonPipelineResult\_GetTimeStampSecs



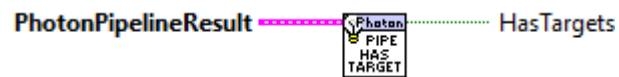
Returns the estimated time the frame was taken, in the Time Sync Server's time base (nt::Now). This is calculated using the estimated offset between Time Sync Server time and local time. The robot shall run a server, so the offset shall be 0.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- TimeStampSec -- The timestamp in seconds

**PhotonPipelineResult\_HasTargets**

Returns whether the pipeline has targets.

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.

Outputs:

- HasTargets -- Whether the pipeline has targets.

**PhotonPipelineResult\_New**

Create a new PhotonPipelineResult cluster.

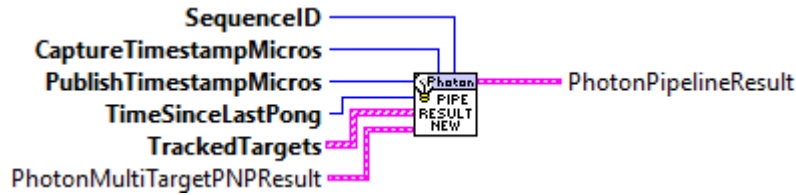
Inputs:

- Metadata -- Cluster containing pipeline meta-data
- PhotonTrackedTargets -- Array of tracked targets. (could be empty)
- PhotonMultiTargetPNPResult - Multi Target Result.

Outputs:

- PipelineResult -- Parsed PipelineResult cluster.

## PhotonPipelineResult\_NewIndividual



Create a new PhotonPipelineResult cluster.

Inputs:

- CaptureTimestampMicros -- Image capture timestamp, in microseconds
- PublishTimestampMicros -- NT publish timestamp, in microseconds
- SequenceID -- Mirror of the heartbeat entry -- monotonically increasing
- TimeSinceLastPong -- Time from last Time Sync Pong received and the construction of this metadata, in uS
- PhotonTrackedTargets -- Array of tracked targets. (could be empty)
- PhotonMultiTargetPNPResult - Multi Target Result.

Outputs:

- PipelineResult -- Parsed PipelineResult cluster.

## PhotonPipelineResult\_Pack



Convert a PipelineResult to a Packet array of bytes ready for writing to a Network Table variable.

Inputs:

- PipelineResult -- PipelineResult cluster.

Outputs:

- Pacet\_RawData -- Byte array containing the encoded PipelineResult.

---

---

## PhotonPipelineResult\_SetTimeStampSecs



Returns pipeline packet time stamp

Inputs:

- PipelineResult -- Parsed PipelineResult cluster.
- TimeStampSec -- Time stamp of packet (FPGA elapsed time) seconds

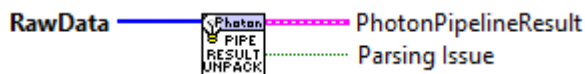
Outputs:

- Out PipelineResult -- Updated PipelineResult cluster.

---

---

## PhotonPipelineResult\_Unpack



Internal function to parse the data returned by `PhotonCamera_GetLatestResult`.

Inputs:

- RawData -- Byte array containing the data to parse.

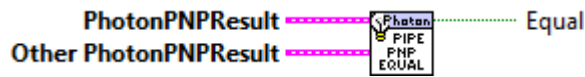
Outputs:

- PipelineResult -- Parsed PipelineResult cluster.
- Parsing Error -- Boolean indicating that number of bytes processes  $\neq$  number of packet bytes

## PhotonPNPResult

---

### PhotonPNPResult\_Equals



Determines if two PhotonPNPResult clusters are equal.

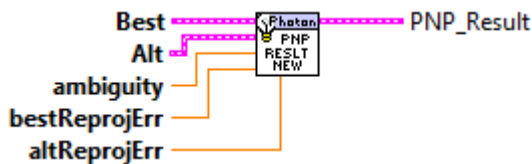
Inputs:

- PhotonPNPResult -- PhotonPNPResult cluster.
- OtherPhotonPNPResult -- OtherPhotonPNPResult cluster.

Outputs:

- Equal -- Returns TRUE, if both PhotonMultiTargetPNPResult clusters are equal..
- 

### PhotonPNPResult\_New



Creates a PNP result with both "best" and "alt" result.

Inputs:

- best - transform3d - Best result
- alt - transform3d - Alternate result
- ambiguity - double - result ambiguity
- bestReprojErr - double - best error (pixels)
- AltReprojErr - double - alt error (pixels)

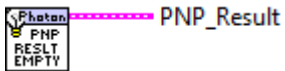


Outputs:

- PNP\_Result - cluster - created cluster.

---

## PhotonPNPResult\_New\_Empty



Returns an empty (invalid) result.

Inputs:

Outputs:

- PNP\_Result - cluster - created cluster.

---

## PhotonPNPResult\_New\_OnlyBest



Returns only the BEST result.

Inputs:

- best - transform3d - Best result
- bestReprojErr - double - best error (pixels)

Outputs:

- PNP\_Result - cluster - created cluster.

**PhotonPNPResult\_pack**

Encode a PNP Result cluster into an array of bytes.

Inputs:

- PNP\_Result -- PNP\_Result cluster.

Outputs:

- RawDataOut -- Byte array containing the encoded data.

**PhotonPNPResult\_pack\_OLD**

Encode a PNP Result cluster into an array of bytes.

Inputs:

- PNP\_Result -- PNP\_Result cluster.

Outputs:

- RawDataOut -- Byte array containing the encoded data.

**PhotonPNPResult\_unpack**

Internal function to parse the data for each PNP\_Result returned by PhotonCamera\_GetLatestResult.

Inputs:

- RawData -- Byte array containing the data to parse.

- StartingByte -- Index into raw data to start parsing. First byte is index 0.

Outputs:

- PNP\_Result -- Parsed PNP\_Result cluster.

---

## PhotonPNPResult\_unpack\_OLD



Internal function to parse the data for each PNP\_Result returned by PhotonCamera\_GetLatestResult.

Inputs:

- RawData -- Byte array containing the data to parse.
- StartingByte -- Index into raw data to start parsing. First byte is index 0.

Outputs:

- PNP\_Result -- Parsed PNP\_Result cluster.

## PhotonPoseEstimator

---

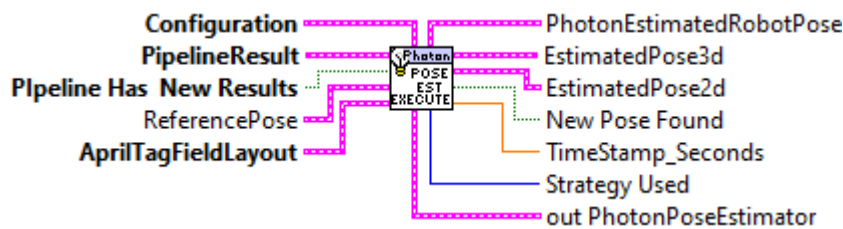
### PhotonPoseEstimator\_CalcDifference



This is an internal function. Use Update or Update\_Pipeline instead of this function.

It calculates an overall difference between two poses. Difference is defined as the vector magnitude between the two poses

### PhotonPoseEstimator\_Execute



Provided data from polling a camera, update the estimated position of the robot. Returns empty if there are no cameras set or no targets were found from the cameras.

Inputs:

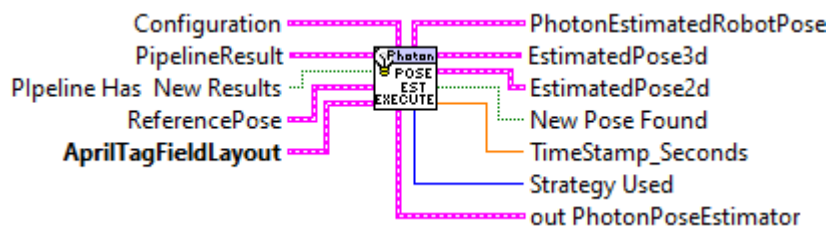
- PhotonPoseEstimator -- data cluster -- Data guiding how the position determination is done.
- PipelineResults -- data cluster -- Data provided from PhotonCamera\_GetLatestResults.
- HasResults -- boolean - TRUE if targets have been identified in the Pipeline results. This can be provided by PhotonCamera\_GetLatestResults.
- AprilTagFieldLayout -- data cluster -- Field layout defining the location of April Tags

Outputs:

- EstimatedPose3d - Pose3d - Estimated 3d position. Only value if NewPoseFound = TRUE
- EstimatedPose2d - Pose2d - Estimated 2d position. Only value if NewPoseFound = TRUE

- NewPoseFound -- boolean -- A new position has been determined.
- TimeStampe - double - Target timestamp (seconds)
- StrategyUsed -- enum -- The strategy used to determine the pose.
- PhotonEstimatedRobotPose -- data cluster -- Complete estimated robot position and timestamp data cluster
- PhotonPoseEstimator -- data cluster -- Updated data cluster.

### PhotonPoseEstimator\_Execute\_OLD



Provided data from polling a camera, update the estimated position of the robot. Returns empty if there are no cameras set or no targets were found from the cameras.

#### Inputs:

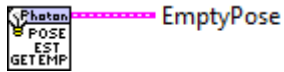
- PhotonPoseEstimator -- data cluster -- Data guiding how the position determination is done.
- PipelineResults -- data cluster -- Data provided from PhotonCamera\_GetLatestResults.
- HasResults -- boolean - TRUE if targets have been identified in the Pipeline results. This can be provided by PhotonCamera\_GetLatestResults.

#### Outputs:

- EstimatedPose3d - Pose3d - Estimated 3d position. Only value if NewPoseFound = TRUE
- EstimatedPose2d - Pose2d - Estimated 2d position. Only value if NewPoseFound = TRUE
- NewPoseFound -- boolean -- A new position has been determined.
- TimeStampe - double - Target timestamp (seconds)
- StrategyUsed -- enum -- The strategy used to determine the pose.
- PhotonEstimatedRobotPose -- data cluster -- Complete estimated robot position and timestamp data cluster

-- PhotonPoseEstimator -- data cluster -- Updated data cluster.

## PhotonPoseEstimator\_GetEmptyPose



This is an internal function.

This returns an empty pose3d.

Inputs:

--

Outputs:

-- EmptyPose -- Pose3d -- Empty Pose

## PhotonPoseEstimator\_GetFieldTags



Get the AprilTagFieldLayout cluster from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- AprilTagFieldLayout -- cluster -- Contains the absolute definitions of the April tags on a field.

## PhotonPoseEstimator\_GetHighestAmbiguity



Get the highest allowed ambiguity from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- HighestAmbiguity -- double -- This is the highest allowed ambiguity for targets to be considered valid. Ambiguity describes the difference between the "best" and "alternate" targets. Lower numbers are better.

## PhotonPoseEstimator\_GetLastPose



Get the last pose3d calculated by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- LastPose -- Pose3d -- Last robot pose calculated by the PhotonPoseEstimator

## PhotonPoseEstimator\_GetReferencePose



Get the reference pose from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- referencePose -- Pose3d -- This is the reference pose being used by the Photon Pose Estimator. Often this would be set the the current Pose calculated by the robot's odometry.

## PhotonPoseEstimator\_GetRobotToCameraTransform



Get the robot to camera transform from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- RobotToCamera -- Transform3d -- This describes the location of the camera relative to the robot.

## PhotonPoseEstimator\_GetStrategy



Get the current strategy being used by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- PhotonPoseStrategy -- enum -- Current strategy being used by the Photon Pose Estimator



## PhotonPoseEstimator\_GetTagModel



Get the current tag model used by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- TagModel -- cluster -- Current tag model.

## PhotonPoseEstimator\_InvalidatePoseCache



Invalidate Pose Cache.

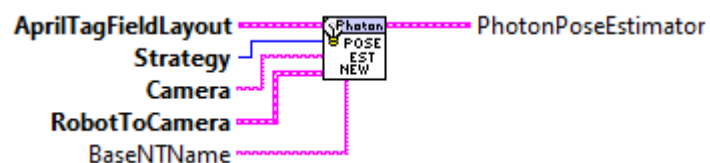
Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_New



Create a new Photon Pose Estimator data cluster.

The PhotonPoseEstimator functions filters or combines readings from all the AprilTags visible at a given timestamp on the field to produce a single robot in field pose, using the strategy set below. Example usage can be found under the LabVIEW Find Examples..

Inputs:

-- AprilTagFieldLayout -- cluster -- A WPILib LabVIEW Math cluster defining the absolute positions of April Tags on a FIRST field. with respect to the FIRST field

-- Strategy -- Enum -- The strategy it should use to determine the best pose. Current strategies include:

LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity

CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height.

CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position.

CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated

AVERAGE\_BEST\_TARGETS -- Weight average of acceptable targets based on ambiguity..

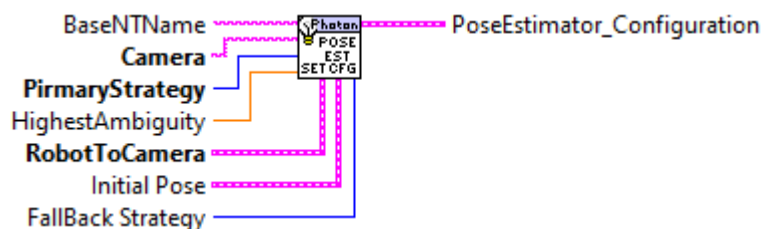
-- CameraName -- String -- Name of the photon camera.

-- RobotToCamera -- Transform3d -- Transform from the center of the robot to the camera mount positions

Outputs:

-- PhotonPoseEstimator -- cluster -- created data cluster.

## PhotonPoseEstimator\_PackConfig



Provided data from polling a camera, update the estimated position of the robot. Returns empty if there are no cameras set or no targets were found from the cameras.

Inputs:

- BaseTNName -- string - Base network tables name. Default: /photonvision
- Camera -- string - Camera name
- Primary Strategy -- enum - Primary estimation strategy
- HighestAmbiguity -- double -- Highest permitted ambiguity value
- RobotToCamera -- Transform3d -- Position of camera on robot
- InitialPose -- Pose3d - Initial location of robot on the field.
- Fallback Strategy -- enum - Strategy to use when primary strategy fails.

Outputs:

- PhotonPoseEstimator\_Configuration -- data cluster -- Pose Estimator Configuration data

## PhotonPoseEstimator\_SetCamera



Set the current strategy being used by the PhotonPoseEstimator.

Inputs:

- PhotonVisionPoseEstimator -- cluster -- The estimator.
- PhotonPoseStrategy -- enum -- Current strategy being used by the Photon Pose Estimator. Current strategies include:

LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity

CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height.

CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position.

CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated

AVERAGE\_BEST\_TARGETS -- Weight average of acceptable targets based on ambiguity..

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetFieldTags



Set the AprilTagFieldLayout cluster into the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

-- AprilTagFieldLayout -- cluster -- Contains the absolute location definitions of the April tags on a field.

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetHighestAmbiguity



Set the highest allowed ambiguity from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

-- HighestAmbiguity -- double -- This is the highest allowed ambiguity for targets to be considered valid. Ambiguity describes the difference between the "best" and "alternate" targets. Lower numbers are better.

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetLastPose



Set the last pose3d calculated by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.  
 -- LastPose -- Pose3d -- Last robot pose calculated by the PhotonPoseEstimator

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetLastPose\_Pose2d



Set the last pose3d calculated by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.  
 -- LastPose -- Pose2d -- Last robot pose calculated by the PhotonPoseEstimator

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetMultiTagFallbackStrategy



Set the current fallback strategy being used by the PhotonPoseEstimator.

Inputs:

- PhotonVisionPoseEstimator -- cluster -- The estimator.
- Fallback Strategy -- enum -- Current strategy being used by the Photon Pose Estimator. Current strategies include:
  - LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity
  - CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height.
  - CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position.
  - CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated
  - AVERAGE\_BEST\_TARGETS -- Weight average of acceptable targets based on ambiguity..

Outputs:

- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetPrimaryStrategy



Set the current strategy being used by the PhotonPoseEstimator.

Inputs:

- PhotonVisionPoseEstimator -- cluster -- The estimator.

-- PhotonPoseStrategy -- enum -- Current strategy being used by the Photon Pose Estimator. Current strategies include:

LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity

CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height.

CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position.

CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated

AVERAGE\_BEST\_TARGETS -- Weight average of acceptable targets based on ambiguity..

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetReferencePose



Set the reference pose from the PhotonPoseEstimator cluster.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.

-- referencePose -- Pose3d -- This is the reference pose being used by the Photon Pose Estimator. Often this would be set the the current Pose calculated by the robot's odometry.

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetReferencePose\_Pose2d



Set the reference pose from the PhotonPoseEstimator cluster.

Inputs:

- PhotonVisionPoseEstimator -- cluster -- The estimator.
- referencePose -- Pose2d -- This is the reference pose being used by the Photon Pose Estimator. Often this would be set the the current Pose calculated by the robot's odometry.

Outputs:

- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetRobotToCameraTransform



Set the current strategy being used by the PhotonPoseEstimator.

Inputs:

- PhotonVisionPoseEstimator -- cluster -- The estimator.
- PhotonPoseStrategy -- enum -- Current strategy being used by the Photon Pose Estimator. Current strategies include:

LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity

CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height.

CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position.

CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated

AVERAGE\_BEST\_TARGETS -- Weight average of acceptable targets based on ambiguity..



Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_SetTagModel



Set the current tag model used by the PhotonPoseEstimator.

Inputs:

-- PhotonVisionPoseEstimator -- cluster -- The estimator.  
 -- TagModel -- cluster -- Current April Tag model used by the Photon Pose Estimator.

Outputs:

-- PhotonVisionPoseEstimator -- cluster -- The updated estimator.

## PhotonPoseEstimator\_Update



Poll data from the configured cameras and update the estimated position of the robot. Returns empty if:

- New data has not been received since the last call to {@code update()}.
- No targets were found from the camera
- There is no camera set

Inputs:

-- PhotonPoseEstimator -- data cluster -- Data guiding how the position determination is done.  
 -- PassThroughTime -- double -- FPGA time stamp in seconds. (Optional. Default: Read FPGA time.)

Outputs:

- PhotonPoseEstimator -- data cluster -- Updated data cluster
- PhotonEstimatedRobotPose -- data cluster -- Estimated robot with an estimated pose, timestamp, and targets used to create the estimate.
- PosFound -- boolean -- A position has been determined.
- NewData -- boolean -- The data from photonvision is newer than the last time this routine was called.

## PhotonPoseEstimator\_Update\_All



Provided data from polling a camera, updates the estimated position of the robot. Returns empty if:

- New data has not been received since the last call to update.
- No targets were found from the camera
- There is no camera set

Inputs:

- PhotonPoseEstimator -- data cluster -- Data guiding how the position determination is done.
- PipelineResults -- data cluster -- Data provided from PhotonCamera\_GetLatestResults.
- HasResults -- boolean - TRUE if targets have been identified in the Pipeline results. This can be provided by PhotonCamera\_GetLatestResults.
- cameraMatrix -- matrix -- Camera calibration data that can be used in the case of no assigned PhotonCamera.
- distCoeffs -- matrix -- Camera calibration data that can be used in the case of no assigned PhotonCamera

Outputs:

- PhotonPoseEstimator -- data cluster -- Updated data cluster.

-- PhotonEstimatedRobotPose -- data cluster -- Estimated robot position, timestamp, and targets used to create the estimate.

-- PosFound -- boolean -- A position has been determined.

## PhotonPoseEstimator\_Update\_PipeResult



Provided data from polling a camera, updates the estimated position of the robot. Returns empty if:

- The timestamp of the provided pipeline result is the same as in the previous call to update
- No targets were found in the pipeline results.
- No camera is set.

Inputs:

-- PhotonPoseEstimator -- data cluster -- Data guiding how the position determination is done.

-- PipelineResults -- data cluster -- Data provided from PhotonCamera\_GetLatestResults.

-- HasResults -- boolean - TRUE if targets have been identified in the Pipeline results. This can be provided by PhotonCamera\_GetLatestResults.

Outputs:

-- PhotonPoseEstimator -- data cluster -- Updated data cluster.

-- PhotonEstimatedRobotPose -- data cluster -- Estimated robot position, timestamp, , and targets used to create the estimate.

-- PosFound -- boolean -- A position has been determined.

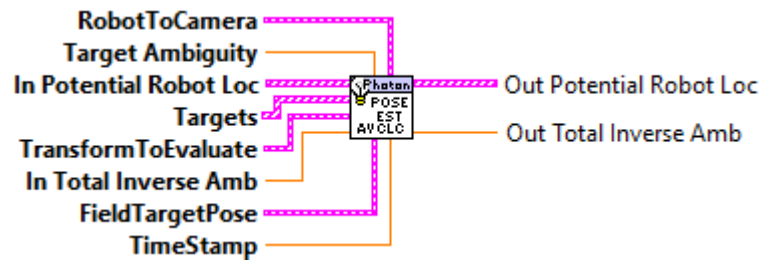
## PhotonPoseEstimator\_averageBestTargetsStrategy



This is an internal function. Use Update or Update\_Pipeline instead of this function.

Determine the best target based the weighted average position of valid potential positions.

## PhotonPoseEstimator\_averageBestTargetsStrategy\_calc



This is an internal function. Use Update or Update\_Pipeline instead of this function.

Determine the best target based the weighted average position of valid potential positions.

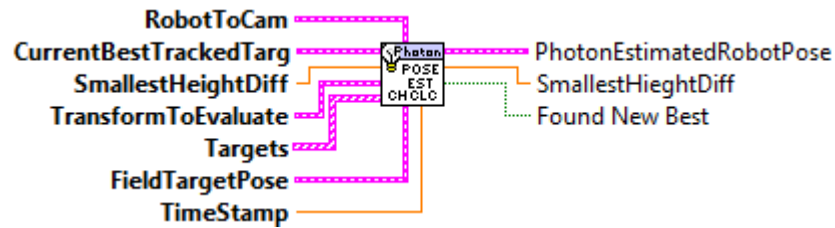
## PhotonPoseEstimator\_closestToCameraHeightStrategy



This is an internal function. Use Update or Update\_Pipeline instead of this function.

Determine the best target based on the target height closed to the camera height.

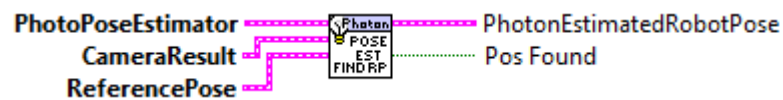
## PhotonPoseEstimator\_closestToCameraHeightStrategy\_calc



This is an internal function. Use `Update` or `Update_Pipeline` instead of this function.

Determine the best target based on the target height closed to the camera height.

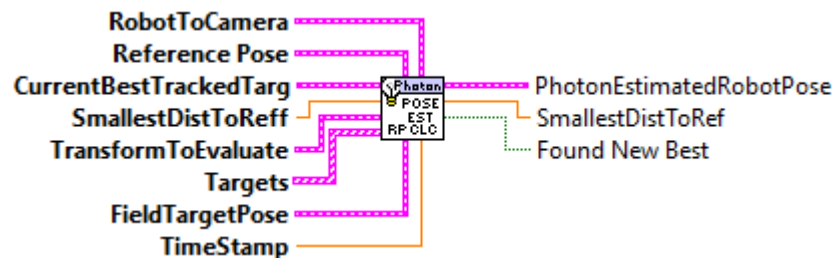
## PhotonPoseEstimator\_closestToReferencePoseStrategy



This is an internal function. Use `Update` or `Update_Pipeline` instead of this function.

Determine the best target based on the closest to a set Reference position

## PhotonPoseEstimator\_closestToReferencePoseStrategy\_calc



This is an internal function. Use `Update` or `Update_Pipeline` instead of this function.

Determine the best target based on the closest to a set Reference position

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**PhotonPoseEstimator\_lowestAmbiguityStrategy**



This is an internal function. Use Update or Update\_Pipeline instead of this function.

Determine the best target based the lowest ambiguity.

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**PhotonPoseEstimator\_multiTagOnCoprocStrategy**



This is an internal function. Use Update or Update\_Pipeline instead of this function.

Determine the best target based the multi-target routine on the coprocessor

## PhotonTargetModel

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### PhotonTargetModel\_New



Creates a rectangular, planar target model given the verticies and type information..

Inputs:

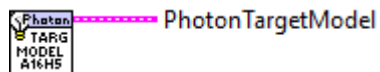
- veerticies -- Translation3d array -
- IsPlanar - boolean
- IsSpherical - boolean

Outputs:

- TargetModel - cluster - created target model

---

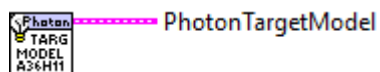
### PhotonTargetModel\_New\_AprilTag16h5



Create target model for 16h5 April Tag

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### PhotonTargetModel\_New\_AprilTag36H11



Create target model for 36h11 April Tag

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**PhotonTargetModel\_New\_RectPlanar**

Creates a rectangular, planar target model given the width and height. The model has four vertices:

- Point 0: [0, -width/2, -height/2]
- Point 1: [0, width/2, -height/2]
- Point 2: [0, width/2, height/2]
- Point 3: [0, -width/2, height/2]

Inputs:

- widthMeters - double - Width (meters)
- HeightMeters - double - Height (meters)

Outputs:

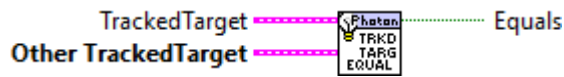
- TargetModel - cluster - created target model



## PhotonTrackedTarget

---

### PhotonTrackedTarget\_Equals



Determines if two tracked targets are equal

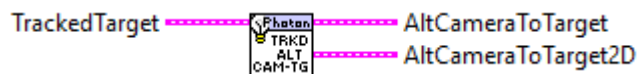
Inputs:

- TrackedTarget -- TrackedTarget cluster.
- OtherTrackedTarget -- Second TrackedTarget cluster.

Outputs:

- Area -- Boolean, equals TRUE if both TrackedTargets are the same.
- 

### PhotonTrackedTarget\_GetAltCameraToTarget



Get CameraToTarget Transform2d from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- CameraToTarget -- Camera to Target Transform2d
- 

### PhotonTrackedTarget\_GetArea



Get Area from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Area -- Area value

---

---

PhotonTrackedTarget\_GetBestCameraToTarget



Get CameraToTarget Transform2d from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- CameraToTarget -- Camera to Target Transform2d

---

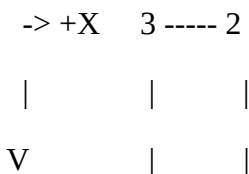
---

PhotonTrackedTarget\_GetDetectedCorners



Get Detected Corners from Tracked Target

For fiducials, the order is known and is always counter-clock wise around the tag, like so:



+Y      0 ----- 1

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Detected Corners -- Array of TargetCorner cluster containing detected corners

## PhotonTrackedTarget\_GetDetectedObjectClassID



Get the object detection class ID number, or -1 if not set.

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- DetectedObjectClassID

## PhotonTrackedTarget\_GetDetectedObjectConfidence



Get the object detection confidence, or -1 if not set. This will be between 0 and 1, with 1 indicating most confidence, and 0 least.

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- DetectedObjectConfidence

---

---

## PhotonTrackedTarget\_GetFiducialId

TrackedTarget  Fiducial Id

Get Fiducial ID (April Tag value) from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Fiducial ID

---

---

## PhotonTrackedTarget\_GetMinAreaRectCorners

TrackedTarget  MinAreaRectCorners

Get Minimum Area Rectangle Corners from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- MinAreaRectCorners -- Corners array of TargetCorner cluster

---

---

## PhotonTrackedTarget\_GetPitch

TrackedTarget  Pitch

Get Pitch from Tracked Target

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Pitch -- Pitch value

---

## PhotonTrackedTarget\_GetPoseAmbiguity



Get the ratio of best:alternate pose reprojection errors, called ambiguity. This is between 0 and 1 (0 being no ambiguity, and 1 meaning both have the same reprojection error). Numbers above 0.2 are likely to be ambiguous. -1 if invalid.

Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- PoseAmbiguity - double - Get the ratio of pose reprojection errors, called ambiguity. Numbers above 0.2 are likely to be ambiguous. -1 if invalid.

---

## PhotonTrackedTarget\_GetSkew



Get Skew from Tracked Target

Inputs:

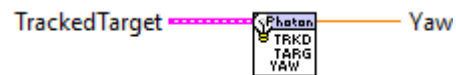
- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Skew -- Skew value

---

## PhotonTrackedTarget\_GetYaw



Get Yaw from Tracked Target

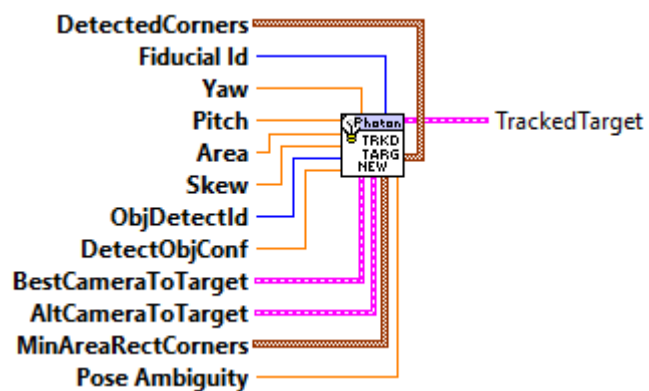
Inputs:

- TrackedTarget -- Parsed TrackedTarget cluster.

Outputs:

- Yaw -- Yaw value
- 

## PhotonTrackedTarget\_New



Create a new TracedTarget data cluster

Inputs:

- Yaw --
- Pitch --
- Area --
- Skew --

- CameraToTarget -- Transform2d
- MinAreaRectCorners -- Array of 4 corners.
- Pose Ambiguity
- Fiducial ID
- Detected Corners

Outputs:

- TrackedTarget -- Created TrackedTarget cluster.

---

## PhotonTrackedTarget\_Pack



Encode a TrackedTarget cluster into an array of bytes.

Inputs:

- TrackedTarget -- TrackedTarget cluster.

Outputs:

- RawDataOut -- Byte array containing the encoded data.

---

## PhotonTrackedTarget\_Unpack



Internal function to parse the data for each target returned by PhotonCamera\_GetLatestResult.

Inputs:

- RawData -- Byte array containing the data to parse.

Outputs:

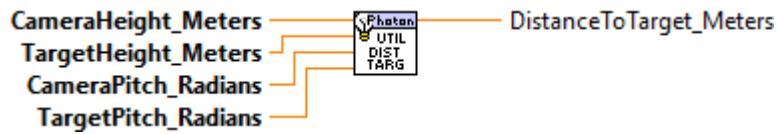
- TrackedTarget -- Parsed TrackedTarget cluster.



## PhotonUtils

---

### PhotonUtils\_CalculateDistanceToTarget



Algorithm from [https://docs.limelightvision.io/en/latest/cs\\_estimating\\_distance.html](https://docs.limelightvision.io/en/latest/cs_estimating_distance.html) Estimates range to a target using the target's elevation. This method can produce more stable results than SolvePNP when well tuned, if the full 6d robot pose is not required. Note that this method requires the camera to have 0 roll (not be skewed clockwise or CCW relative to the floor), and for there to exist a height differential between goal and camera. The larger this differential, the more accurate the distance estimate will be.

Units can be converted using the {@link edu.wpi.first.math.util.Units} class.

#### Inputs:

- CameraHeight\_Meters -- The physical height of the camera off the floor  
in meters.
- TargetHeightMeters -- The physical height of the target off the floor in meters.

This should be the height of whatever is being targeted (i.e. if the targeting region is set to top, this should be the height of the top of the target).

- CameraPitch\_Radians -- The pitch of the camera from the horizontal plane  
in radians.  
Positive values up.

- TargetPitchRadian -- The pitch of the target in the camera's lens in radians.  
Positive values up.

#### Outputs

- DistanceToTarget\_Meters -- The estimated distance to the target in meters.

## PhotonUtils\_EstimateCameraToTarget



Estimates a Transform2d that maps the camera position to the target position, using the robot's gyro. Note that the gyro angle provided *must* line up with the field coordinate system -- that is, it should read zero degrees when pointed towards the opposing alliance station, and increase as the robot rotates CCW.

Inputs:

- CameraToTargetTranslation -- A Translation2d that encodes the x/y position of the target relative to the camera.
- FieldToTarget -- A Pose2d representing the target position in the field coordinate system.
- GyroAngle -- The current robot gyro angle, likely from odometry.

Outputs:

- EstimateCameraToTarget -- A Transform2d that takes us from the camera to the target.

## PhotonUtils\_EstimateCameraToTargetTrans



Estimate the Translation2d of the target relative to the camera.

Inputs:

- TargetDistance\_Meters -- The distance to the target in meters.
- Yaw -- The observed yaw of the target.

Outputs:

- CameraToTarget -- The target's camera-relative translation.

## PhotonUtils\_EstimateFieldToCamera



Estimates the pose of the camera in the field coordinate system, given the position of the target relative to the camera, and the target relative to the field. This *only* tracks the position of the camera, not the position of the robot itself.

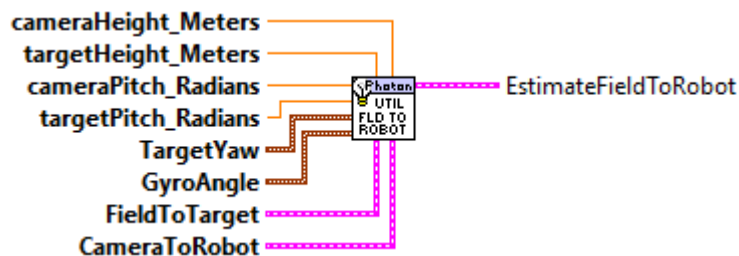
Inputs:

- CameraToTarget -- The position of the target relative to the camera.
- FieldToTarget -- The position of the target in the field.

Outputs:

- EstimateFieldToCamera -- The position of the camera in the field.

## PhotonUtils\_EstimateFieldToRobot



Estimate the position of the robot in the field.

Inputs:

- CameraHeightMeters The physical height of the camera off the floor in meters.

- TargetHeightMeters The physical height of the target off the floor in meters.

This should be the height of whatever is being targeted (i.e. if the targeting region is set to top, this should be the height of the top of the target).

- CameraPitchRadians The pitch of the camera from the horizontal plane in radians. Positive values up.
- TargetPitchRadians The pitch of the target in the camera's lens in radians. Positive values up.
- TargetYaw The observed yaw of the target. Note that this *must* be CCW-positive, and Photon returns CW-positive.
- GyroAngle The current robot gyro angle, likely from odometry.
- FieldToTarget A Pose2d representing the target position in the field coordinate system.
- CameraToRobot The position of the robot relative to the camera. If the camera was mounted 3 inches behind the "origin" (usually physical center) of the robot, this would be Transform2d (3 inches, 0 inches, 0 degrees).

## Outputs

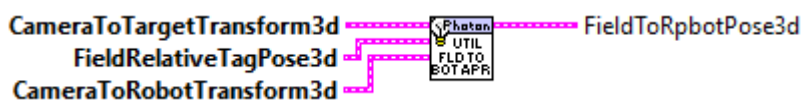
- EstimateFieldToRobot -- The position of the robot in the field.

---



---

## PhotonUtils\_EstimateFieldToRobotAprilTag



Estimates the pose3d of the robot in the field coordinate system, given the pose3d of the fiducial tag, the robot relative to the camera, and the target relative to the camera.

## Inputs:

- CameraToTarget -- Transform3D of the target relative to the camera, returned by PhotonVision

- FieldRelativeTagPose3d -- The field relative pose3d of the target
- CameraToRobot -- Transform3D of the robot relative to the camera. Origin of the robot is defined as the center.

#### Outputs

- FieldToRobot -- Transform3d Robot position relative to the field

### PhotonUtils\_EstimateFieldToRobot\_Alt



Estimates the pose of the robot in the field coordinate system, given the position of the target relative to the camera, the target relative to the field, and the robot relative to the camera.

#### Inputs:

- CameraToTarget -- The position of the target relative to the camera.
- FieldToTarget -- The position of the target in the field.
- CameraToRobot -- The position of the robot relative to the camera. If the camera was mounted 3 inches behind the "origin" (usually physical center) of the robot, this would be Transform2d(3 inches, 0 inches, 0 degrees).

#### Outputs:

- EstimateFieldToRobot -- The position of the robot in the field.

## PhotonUtils\_GetDistanceToPose



Returns the distance between two poses

Inputs:

- RobotPose -- Pose2d of the robot.
- TargetPose -- Pose2d of the target

Outputs

- DistanceToPose -- The calculated distance to the pose.

---

## PhotonUtils\_GetYawToPose



Returns the yaw between your robot and a target.

Inputs:

- RobotPose -- Pose2d of the robot.
- TargetPose -- Pose2d of the target

Outputs

- YawToPose -- Yaw to the target

## TargetCorner

---

### TargetCorner\_Equals



Determines if two target corners are equal

Inputs:

- TargetCorner -- TargetCorner cluster
- OtherTargetCorner -- TargetConrer cluster to compare

Outputs:

- Equals -- TRUE if both TargetCorners are equal

---

### TargetCorner\_GetAll



Get the individual components of a TargetCorner

Inputs:

- TargetCorner -- TargetCorner cluster

Outputs:

- X --
- Y --

**TargetCorner\_New**

Create a new TargetCorner data cluster

Inputs:

- X --
- Y --

Outputs:

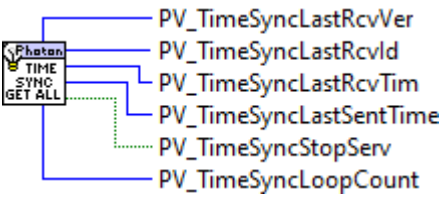
- TargetCorner -- Created TargetCorner cluster.



# TimeSyncServ

---

## TimeSyncServ\_GetAll



Get information on photonvision time sync server.

Inputs:

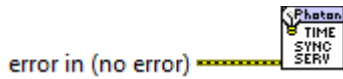
-

Outputs:

## TimeSyncSrv

---

### TimeSyncSrv\_Exec



error in (no error)

Execute a PhotonVision Time Sync Server. It listens for UDP requests from PhotonVision devices and responds with the current FPGA time.

This VI contains a loop. Do not place this in another loop.

Place this all by itself in Periodic Tasks.

Inputs:

-- Error In -- Optional error input cluster.

Outputs:

--

## Type Definitions

---

## TypeDef

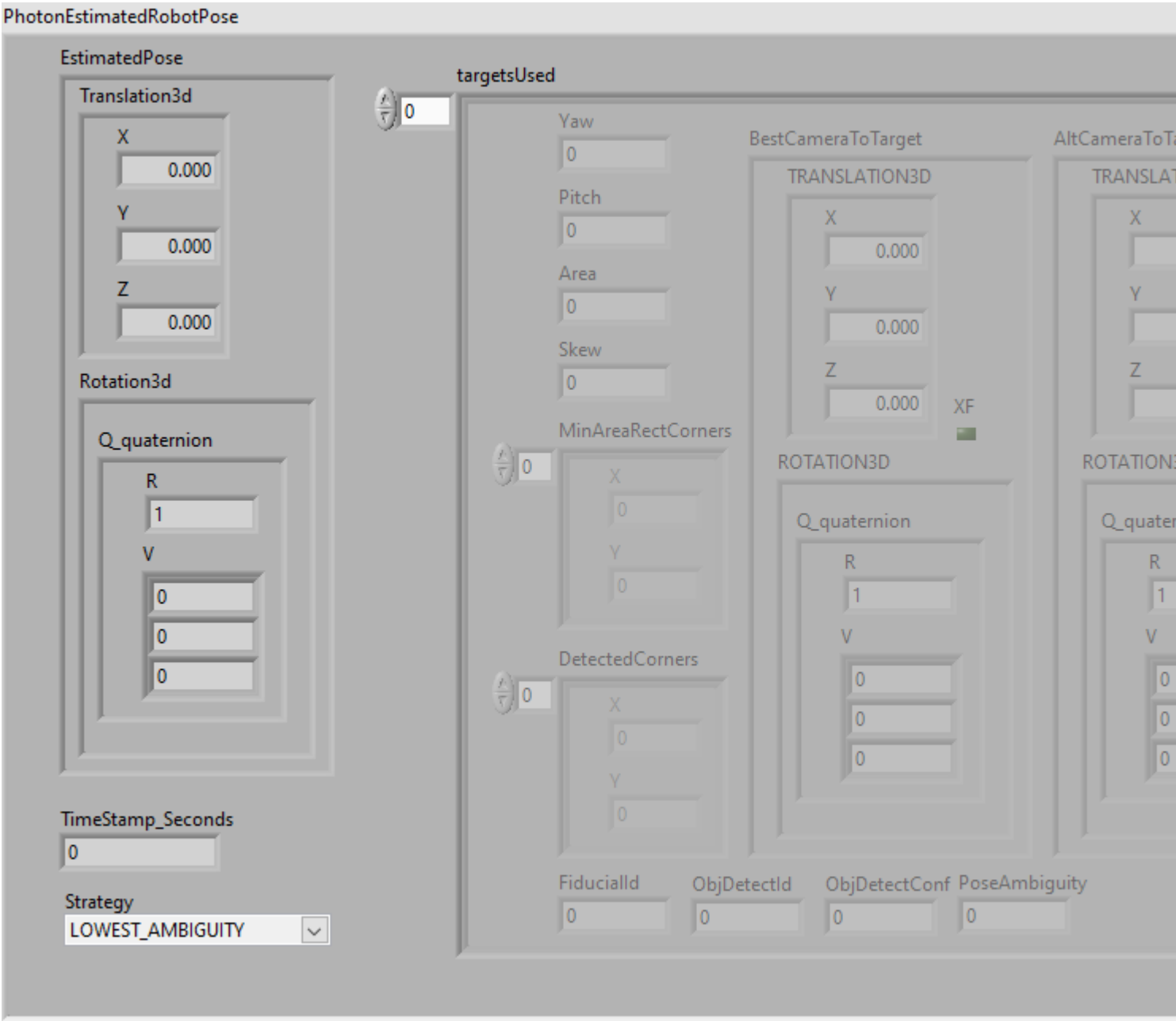
---

### TypeDef-PhotonEstimatedRobotPoseType



An estimated pose based on pipeline result. This cluster contains:

- EstimatedPose -- Pose3d -- Estimated absolute robot position based on vision location of April Tags
- TimeStamp\_Seconds -- Double -- Timestamp of data from photonvision. This can be set by the user to add latency or other time offsets.



TypeDef-PhotonMultiTargetPNPResultType



The best estimated transformation from solvePnP, and possibly an alternate transformation depending on the solvePNP method. If an alternate solution is present, the ambiguity value represents the ratio of reprojection error in the best solution to the alternate (best / alternate).

Note that the coordinate frame of these transforms depends on the implementing solvePnP method.

Contains:

- isPresent - boolean - If this result is valid. A false value indicates there was an error in estimation, and this result should not be used.
- best - Transform3d - The best-fit transform. The coordinate frame of this transform depends on the method which gave this result.
- bestReprojErr - double - Reprojection error of the best solution, in pixels
- alt - Transform3d - Alternate, ambiguous solution from solvepnp. If no alternate solution is found, this is equal to the best solution.
- altReprojErr - double - If no alternate solution is found, this is bestReprojErr
- ambiguity - double - If no alternate solution is found, this is 0
- FidudicalIDsUsed - array - List of fiducial IDs used to determine multi target result.

PhotonMultiTargetPNPResult

PhotonPNPResult

IsPresent

bestReprojErr

0

altReprojErr

0

ambiguity

0

Best

TRANSLATION3D

X

0.000

Y

0.000

Z

0.000

XF

ROTATION3D

Q\_quaternion

R

1

V

0

0

0

Alt

TRANSLATION3D

X

0.000

Y

0.000

Z

0.000

XF

ROTATION3D

Q\_quaternion

R

1

V

0

0

0

FiducialIDsUsed

0

0

TypeDef-PhotonPNPResultType



The best estimated transformation from solvePnP, and possibly an alternate transformation depending on the solvePNP method. If an alternate solution is present, the ambiguity value represents the ratio of reprojection error in the best solution to the alternate (best / alternate).

Note that the coordinate frame of these transforms depends on the implementing solvePnP method.

Contains:

- `isPresent` - boolean - If this result is valid. A false value indicates there was an error in estimation, and this result should not be used.
- `best` - `Transform3d` - The best-fit transform. The coordinate frame of this transform depends on the method which gave this result.
- `bestReprojErr` - double - Reprojection error of the best solution, in pixels
- `alt` - `Transform3d` - Alternate, ambiguous solution from solvepnp. If no alternate solution is found, this is equal to the best solution.
- `altReprojErr` - double - If no alternate solution is found, this is `bestReprojErr`
- `ambiguity` - double - If no alternate solution is found, this is 0

PhotonPNPResult

	Best	Alt
<b>IsPresent</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>bestReprojErr</b>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>altReprojErr</b>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>ambiguity</b>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>TRANSLATION3D</b>	X <input type="text" value="0.000"/> Y <input type="text" value="0.000"/> Z <input type="text" value="0.000"/>	X <input type="text" value="0.000"/> Y <input type="text" value="0.000"/> Z <input type="text" value="0.000"/>
<b>ROTATION3D</b>	<b>Q_quaternion</b> R <input type="text" value="1"/> V <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>	<b>Q_quaternion</b> R <input type="text" value="1"/> V <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="0"/>



---

## TypeDef-PhotonPipelineMetadataType



Represents a pipeline metadata

Contains:

- CaptureTimestampMicros -- Image capture timestamp, in microseconds
- PublishTimestampMicros -- NT publish timestamp, in microseconds
- SequenceID -- Mirror of the heartbeat entry -- monotonically increasing
- TimeSinceLastPong -- Time from last Time Sync Pong received and the construction of this metadata, in uS

PhotonPipelineMetadata

CaptureTimestampMicros

-1

PublishTimestampMicros

-1

SequenceID

-1

TimeSinceLastPong

9999999999

---

## TypeDef-PhotonPipelineResultType



Represents a pipeline result from a PhotonCamera.

Contains:

- targets - array - Targets to store.
- latencyMillis - double - Latency in milliseconds.
- timestampSeconds - double - Timestamp in milliseconds.
- MultiTargetPNPResult - cluster - Multi-tag result

PhotonPipelineResult

PhotonPipelineMetadata

CaptureTimestampMicros

PublishTimestampMicros

SequenceID

TimeSinceLastPong

Targets

0

Yaw

Pitch

Area

Skew

MinAreaRectCorners

DetectedCorners

BestCameraToTarget

TRANSLATION3D

X

Y

Z

ROTATION3D

Q\_quaternion

R

V

AltCameraToTarget

TRANSLATION3D

X

Y

Z

ROTATION3D

Q\_quaternion

R

V

FiducialId

ObjDetectId

ObjDetectConf

PoseAmbiguity

PhotonMultiTargetPNPResult

PhotonPNPResult

IsPresent

bestReprojErr

altReprojErr

ambiguity

Best

TRANSLATION3D

X

Y

Z

ROTATION3D

Alt

TRANSLATION3D

X

Y

Z

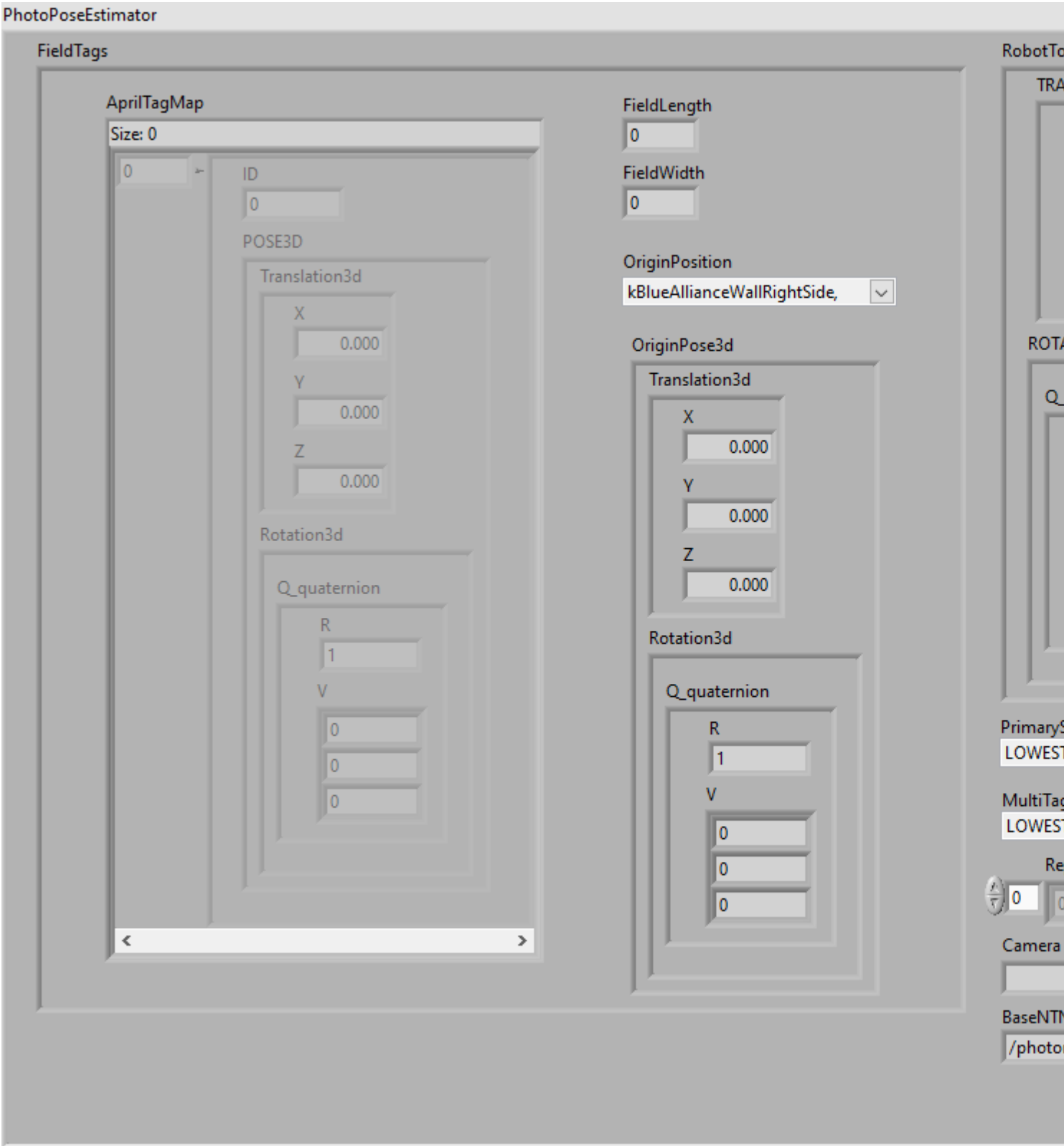
ROTATION3D

---

## TypeDef-PhotonPoseEstimatorType



The PhotonPoseEstimator cluster contains data that filters or combines readings from all the fiducials visible at a given timestamp on the field to produce a single robot in field pose, using the strategy set below. Example usage can be found under LabVIEW Find Examples..



## TypeDef-PhotonPoseEstimator\_Configuration



Stores the configuration information for PhotonPoseEstimator\_Execute.

Contains:

- AprilTagField -- enum - Field selector
- UseCustomField -- boolean -- use a custom apriltag field instead of one of the predefined ones.
- Primary Strategy -- enum - Primary estimation strategy
- Fallback Strategy -- enum - Strategy to use when primary strategy fails.
- Highest Ambiguity -- double -- Highest allowed ambiguity.
- Camera -- string - Camera name
- BaseTNName -- string - Base network tables name. Default: /photonvision
- RobotToCamera -- Transform3d -- Position of camera on robot
- InitialPose -- Pose3d - Initial location of robot on the field.
- CustomAprilTagField -- cluster -- If a custom field is used, this defines the field.

PhotonPoseEstimator\_Configuration

Primary Strategy  
LOWEST\_AMBIGUITY

HighestAmbiguity  
0

FallBack Strategy  
LOWEST\_AMBIGUITY

Camera

BaseNTName  
/photonvision

RobotToCamera

Initial Pose

TRANSLATION3D

Translation3d

X  
0.000

Y  
0.000

Z  
0.000

XF

X  
0.000

Y  
0.000

Z  
0.000

ROTATION3D

Rotation3d

Q\_quaternion

Q\_quaternion

R  
1

V  
0  
0  
0

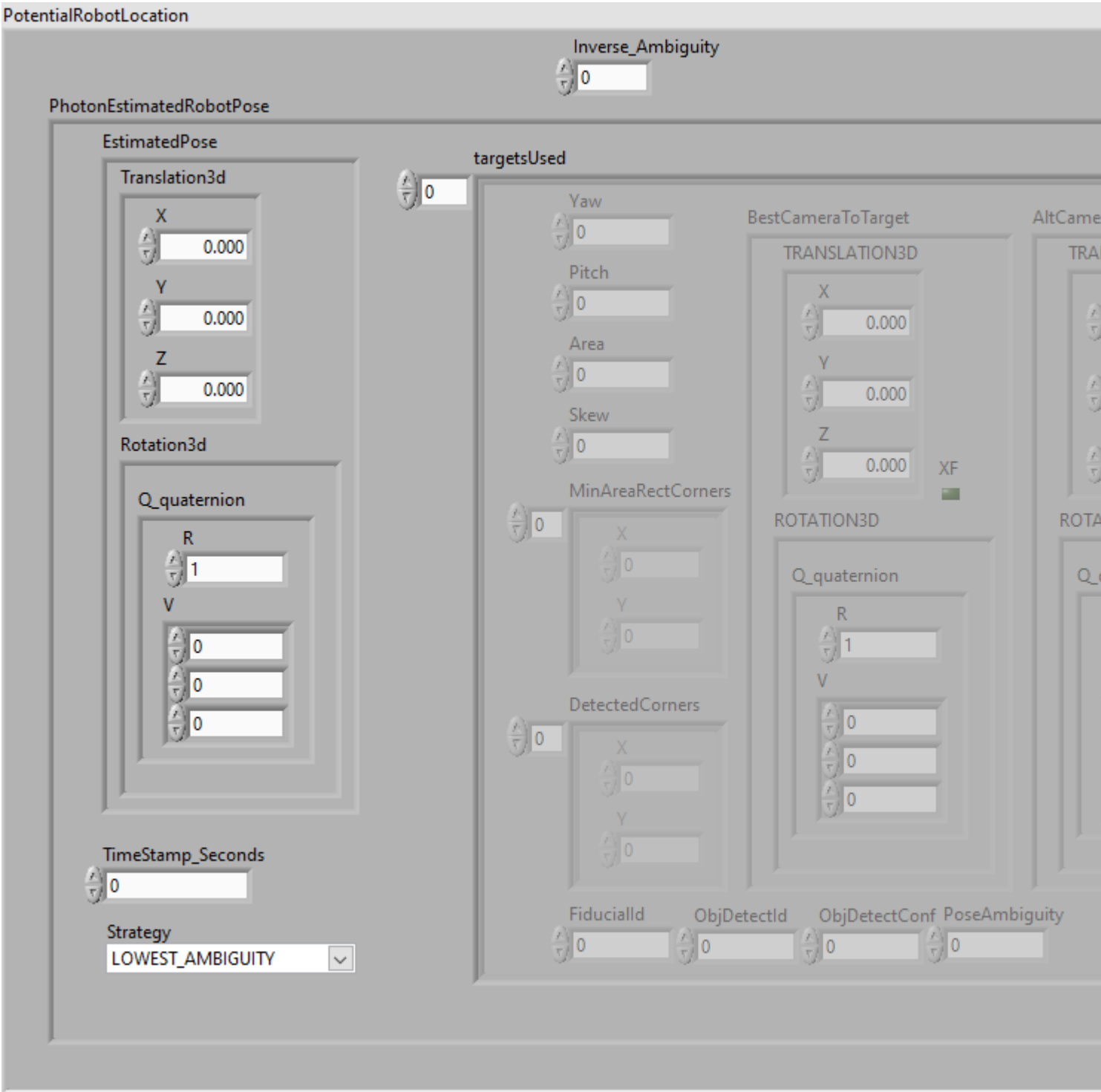
R  
1

V  
0  
0  
0

TypeDef-PhotonPoseEstimator\_PotentialRobotLocation



This data cluster is used internally by the PhotonPoseEstimator routines to compare individual potential positions.



TypeDef-PhotonTargetModel

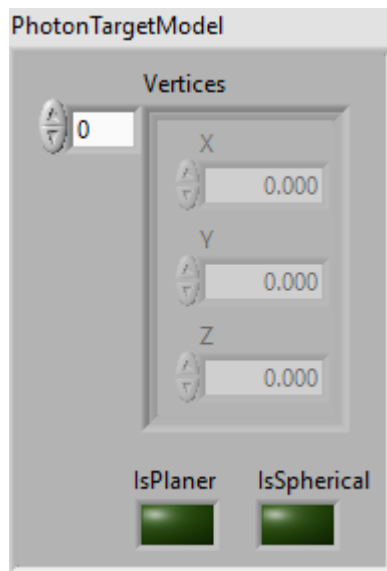




Describes the 3d model of a target.

Contains:

- vertices - Translation3d array - Translations of this target's vertices relative to its pose. Rectangular and spherical targets will have four vertices. See their respective constructors for more info.
- isPlanar - boolean
- isSpherical - boolean



---

## TypeDef-PhotonTrackedTargetType



Stores information about identified tracked targets.

PhotonTrackedTarget

Yaw

0

Pitch

0

Area

0

Skew

0

MinAreaRectCorners

0

X

0

Y

0

DetectedCorners

0

X

0

Y

0

FiducialId

0

ObjDetectId

0

ObjDetectConf

0

PoseAmbiguity

0

BestCameraToTarget

TRANSLATION3D

X

0.000

Y

0.000

Z

0.000

XF

ROTATION3D

Q\_quaternion

R

1

V

0

0

0

AltCameraToTarget

TRANSLATION3D

X

0.000

Y

0.000

Z

0.000

XF

ROTATION3D

Q\_quaternion

R

1

V

0

0

0

TypeDef-TargetCornerType



Represents a point in an image at the corner of the minimum-area bounding rectangle, in pixels. Origin at the top left, plus-x to the right, plus-y down.

TargetCorner

X

0

Y

0



## Enumerated Type Definitions

---

## Enum

---

### Enum-PhotonPoseStrategy\_ENUM



Position estimation strategies that can be used by the PhotonPoseEstimator VIs.

Values are:

LOWEST\_AMBIGUITY -- Choose the Pose with the lowest ambiguity

CLOSEST\_TO\_CAMERA\_HEIGHT -- Choose the Pose which is closest to the camera height

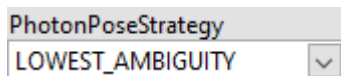
CLOSEST\_TO\_REFERENCE\_POSE -- Choose the Pose which is closest to a set Reference position

CLOSEST\_TO\_LAST\_POSE -- Choose the Pose which is closest to the last pose calculated

AVERAGE\_BEST\_TARGETS -- Choose the Pose with the lowest ambiguity

MULTI\_TAG\_PNP\_ON\_COPROCESSOR -- Use all visible tags to compute a single pose estimate on coprocessor. This option needs to be enabled on the PhotonVision web UI as well.

MULTI\_TAG\_PNP\_ON\_RIO -- Use all visible tags to compute a single pose estimate. This runs on the RoboRIO, and can take a lot of time.



---

### Enum-VisionLEDModeType



Enumerated variable type for LED mode

Selections are:

- Default
- Off
- On
- Blink

