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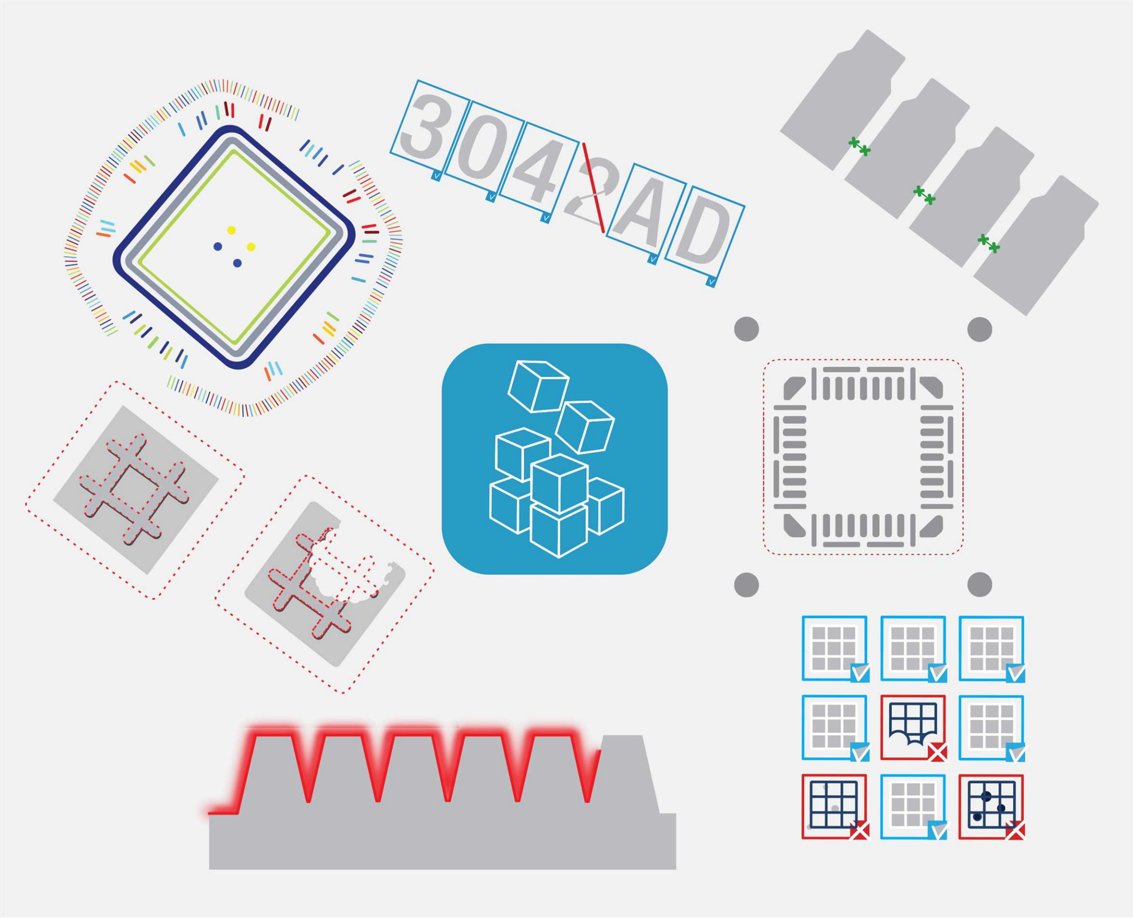
USER GUIDE

# Open eVision

## Easy3D Compatibility with Lucid Helios 3D Sensors



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This documentation is provided with Open eVision 2.12.0 (doc build 1129).

# Easy3D Compatibility with LUCID Helios 3D Sensors

## Introduction

Helios is a 3D time of flight camera based on the **Sony DepthSense** sensor.

The specifications are available on the manufacturer website:
`https://thinklucid.com/helios-time-of-flight-tof-camera/`

- This document explains how to use the 3D data coming from these sensors with **Open eVision** 3D libraries and tools.
- A sample application distributed with source code demonstrates that integration.

### *Resources*

This document and the sample applications are based on the following resources:

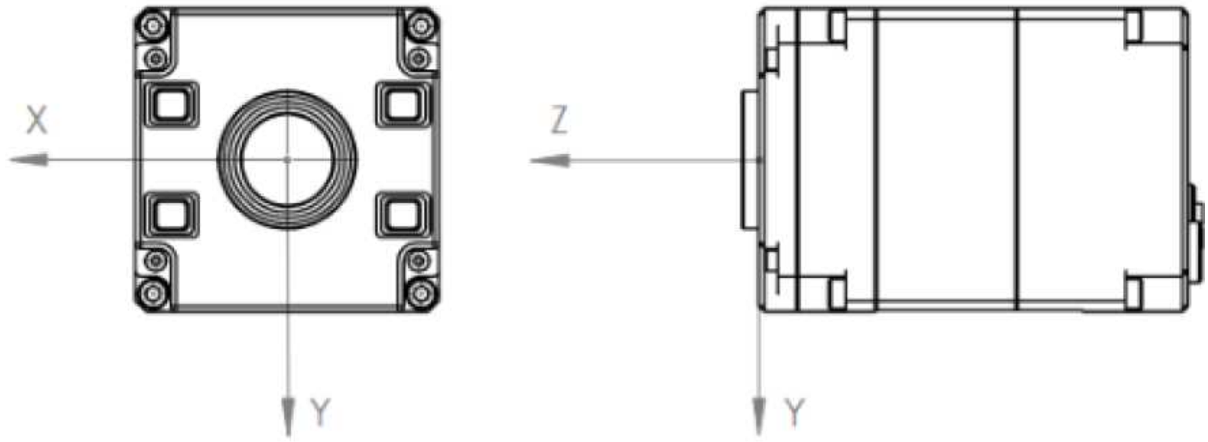
- □ **Helios** camera HLS003S-001, firmware version 1.13.0.0
- □ **Lucid Arena** SDK v1.0.20.4
- □ **Open eVision** 2.12
- □ Microsoft Visual Studio 2017

## Features

- The **Helios** camera is **Genicam** compliant and produces the range data in the following formats:

| Range data format | Description | Bits per pixel |
|---|---|---|
| `Coord3D_ABCY16` | 4-channel point cloud XYZ + intensity, 16-bits per channel | 64 |
| `Coord3D_ABC16` | 3-channel point cloud XYZ, 16-bits per channel | 48 |
| `Coord3D_C16` | Depth map Z plane | 16 |

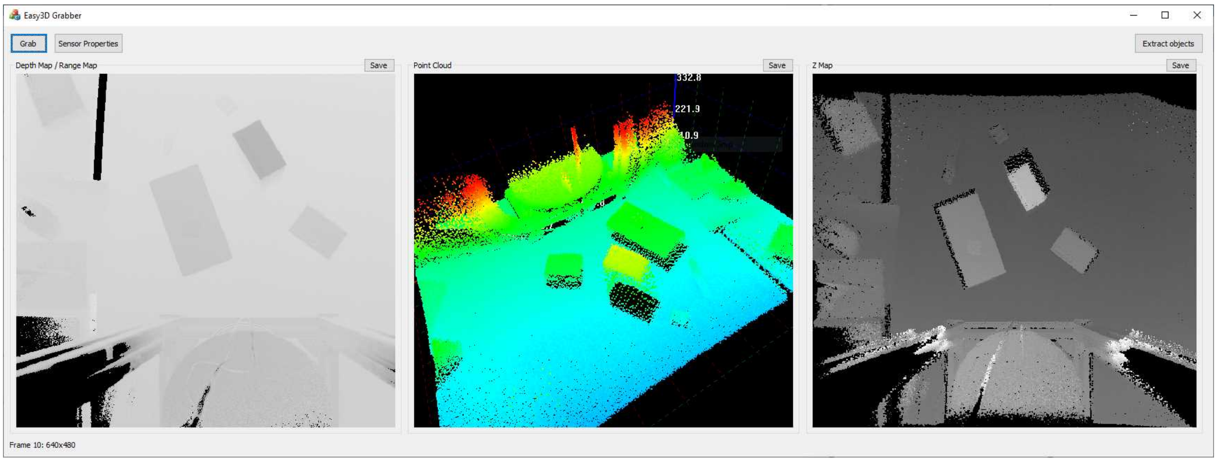
- The XYZ positions are expressed in a coordinate system centered on the camera:
  - □ To convert the 16 bits X, Y and Z values to millimeters, apply a scale factor (`Scan3dCoordinateScale` parameter).
  - □ The position is invalid if the value of one of the coordinates is 0x8000.



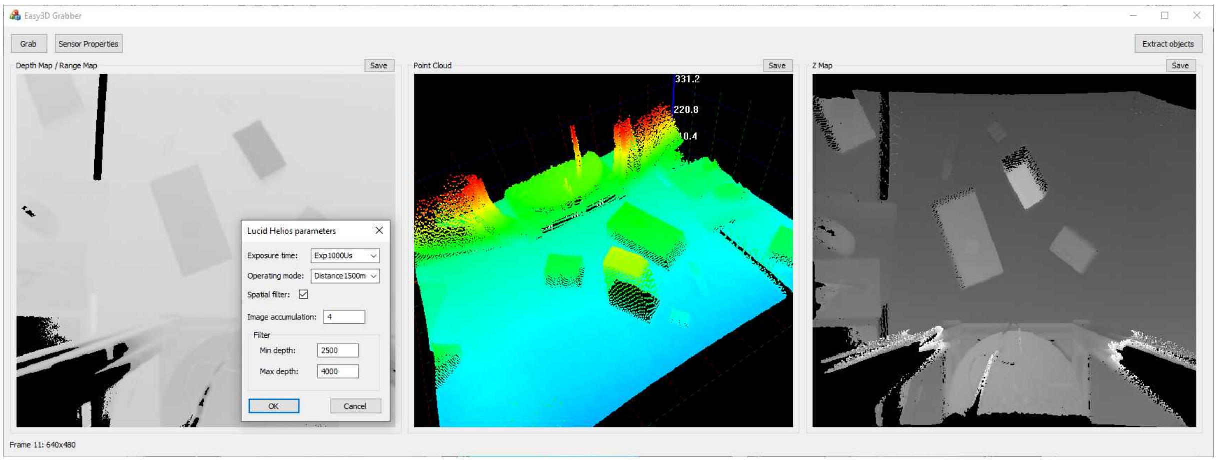
## Easy3DGrab sample application

**Easy3DGrab** is distributed with C++ source code as an **Open eVision** additional resource.

- □ It features the acquisition of **Helios** range data, the conversion to depth maps, point clouds and ZMaps.
- □ You can save these representations.
- □ Each time you click on the Grab button, a new image is captured.
- □ Some camera parameters are exposed in the Sensor Properties dialog.
- □ An optional object extraction function is exposed but only available if the **Easy3DObject** license is installed.



The Easy3DGrab application: EDepthMap (left), EPointCloud (center), EZMap (right)



Lucid Helios parameters

Exposure time: Exp1000Us

Operating mode: Distance1500m

Spatial filter: ☑

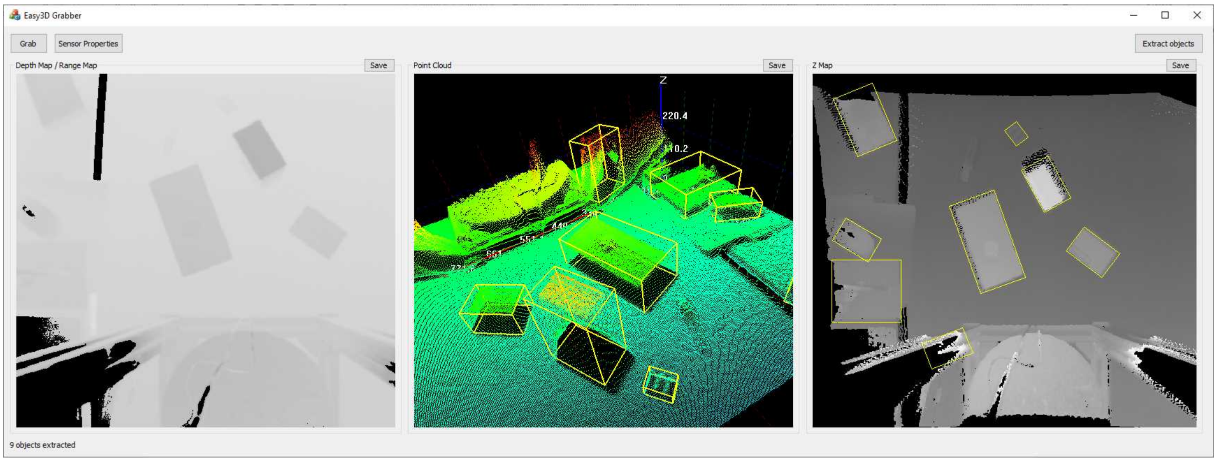
Image accumulation: 4

Filter

Min depth: 2500

Max depth: 4000

Tuning the Helios camera parameters to filter the range data



Automatic extraction of 3D objects with Easy3DObject library

# C++ code sample to convert Helios range data to Easy3D objects

## *Converting an Helios range map to a depth map*

Here is the code snippet to fill an `Easy3D::EDepthMap16(map16)` object from an `Arena::IImage(image)`:

```
int w = (int)image->GetWidth();
int h = (int)image->GetHeight();
uint64_t pf = image->GetPixelFormat();
int pix_size = (int)image->GetBitsPerPixel() / 16;

const uint16_t* data = (const uint16_t*)image->GetData();
if (pf == Coord3D_ABC16 || pf == Coord3D_ABCY16)
  data += 2;    // move data origin to the Coordinate_C start offset

// Initialize EDepthMap16
map16.SetSize(w, h);
uint16_t undef = map16.GetUndefinedValue().Value;

// Loop on lines and columns and copy valid Z positions to the depth map
for (int y = 0; y < h; ++y)
{
  const uint16_t* src = data + y * w * pix_size;
  uint16_t* dst = (uint16_t*)map16.GetBufferPtr(0, y);
  for (int x = 0; x < w; ++x)
  {
    if (*src != 0x8000)
      *dst = *src;
    else
      *dst = undef;

    src += pix_size;
    dst++;
  }
}
```

### Converting an Helios range map to a point cloud

Here is a code snippet to fill an `Easy3D::EPointCloud(pc)` from an `Arena::IImage(image)`.

**NOTE**

Only `Coord3D_ABC16` and `Coord3D_ABCY16` image formats are supported.

```
int w = (int)image->GetWidth();
int h = (int)image->GetHeight();
uint64_t pf = image->GetPixelFormat();
const int16_t* data = (const int16_t*)image->GetData();
int pix_size = (int)image->GetBitsPerPixel() / 16;
int npix = w * h;
// Initialize array for converted 3D points
std::vector<Easy3D::E3DPoint> pts;
pts.reserve(npix);
Easy3D::E3DPoint p;

for (int i = 0; i < npix; ++i, data += pix_size)
{
  if (src[0] != -32768)        // Test invalid position
  {
    p.X = coordA_scale * data[0];       // Coordinate_A
    p.Y = coordB_scale * data[1];       // Coordinate_B
    p.Z = coordC_scale * data[2];       // Coordinate_C
    pts.push_back(p);
  }
}
// Fill point cloud
pc.AddPoints(pts);
```

### ZMap

- You cannot generate a ZMap (a gray scale image encoding distance from a reference plane) directly from **Helios** camera data.
- Generate a ZMap from the point cloud with the `Easy3D::EPointCloudToZMapConverter` class.

**TIP**

The sample application **Easy3DGrab** implement the `EDepthMap16`, `EPointCloud` and `EZMap` conversions.