



Velodyne Laser Control Window in HYSWEEP® SURVEY

By Joe Burnett

When the driver for the Velodyne lasers was first created, we also created a controller window in HYSWEEP® SURVEY..

However, it was created, so that it could serve as a controller for both the VLP-16 and HDL-32E models.

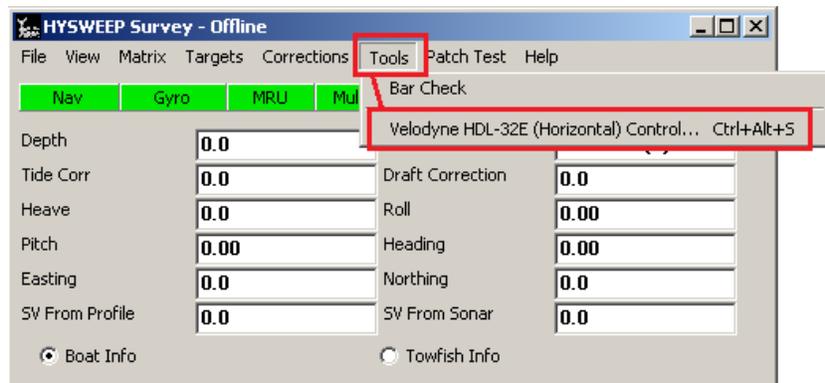
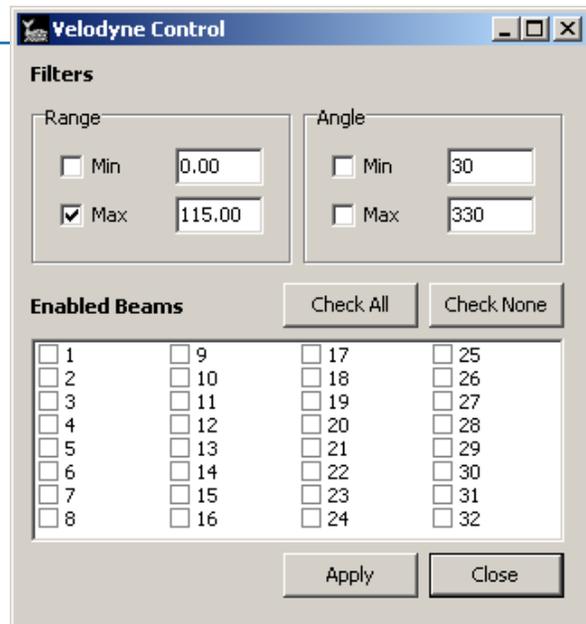


FIGURE 1. Original Velodyne Controller

This caused some confusion, as users wondered if their VLP-16 had 32 beams.

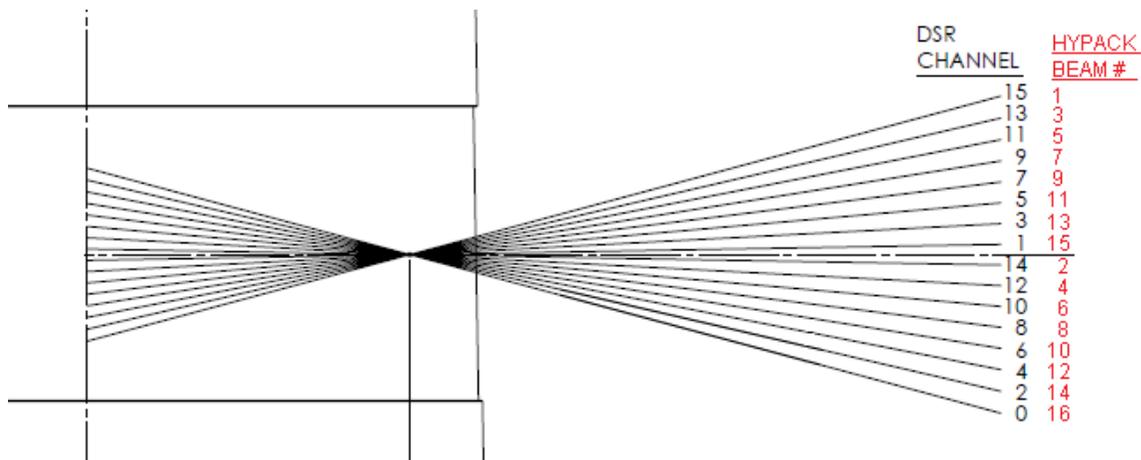
Also, the HYPACK® beam numbers did not correspond with the Velodyne beam numbers, which caused additional confusion as to which beam numbers to turn on and turn off.



BEAM NUMBERS

Here's an example of the mismatch:

FIGURE 2. Velodyne Beam Numbers Didn't Match HYPACK® Beam Numbers in the First Velodyne Driver



The software Development team decided to modify the driver so each model had its own control window and the beam numbers corresponded with those in the Velodyne manual.

FIGURE 3. Velodyne VLP-16 Beam Pattern Diagram

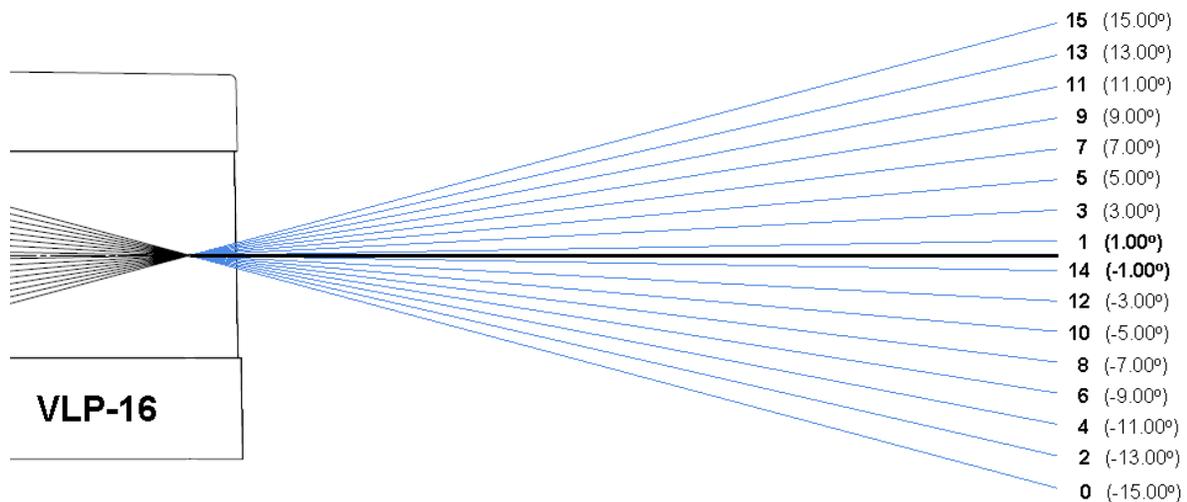


FIGURE 4. *New Velodyne VLP-16 Control Window*

Since the VLP-16 has 16 beams spread across a 30 degree swath (8 beams going 15 degrees above the horizon and 8 beams going 15 degrees below the horizon).

It is important to know the orientation of the beam numbers. We added the beam angle next to the beam number, to make it easier to decide which beam to enable without needing to refer to the Velodyne manual.

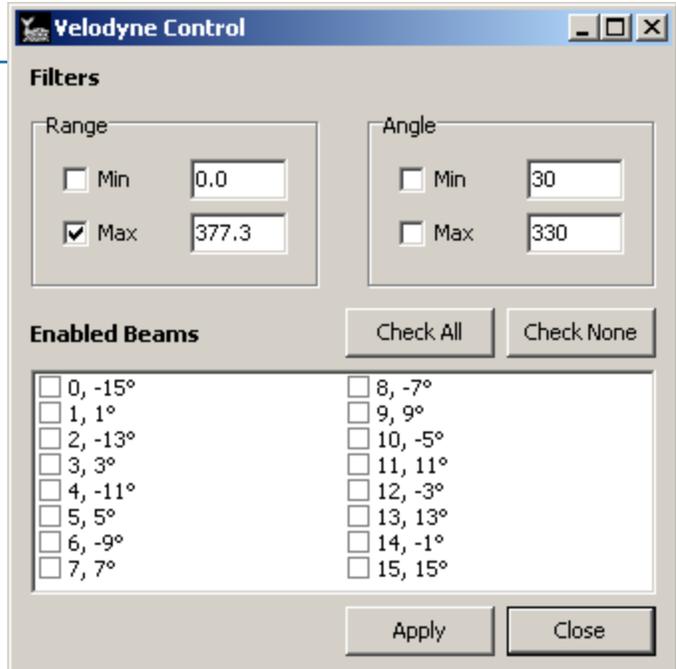


FIGURE 5. *Velodyne HDL-32E Beam Pattern Diagram*

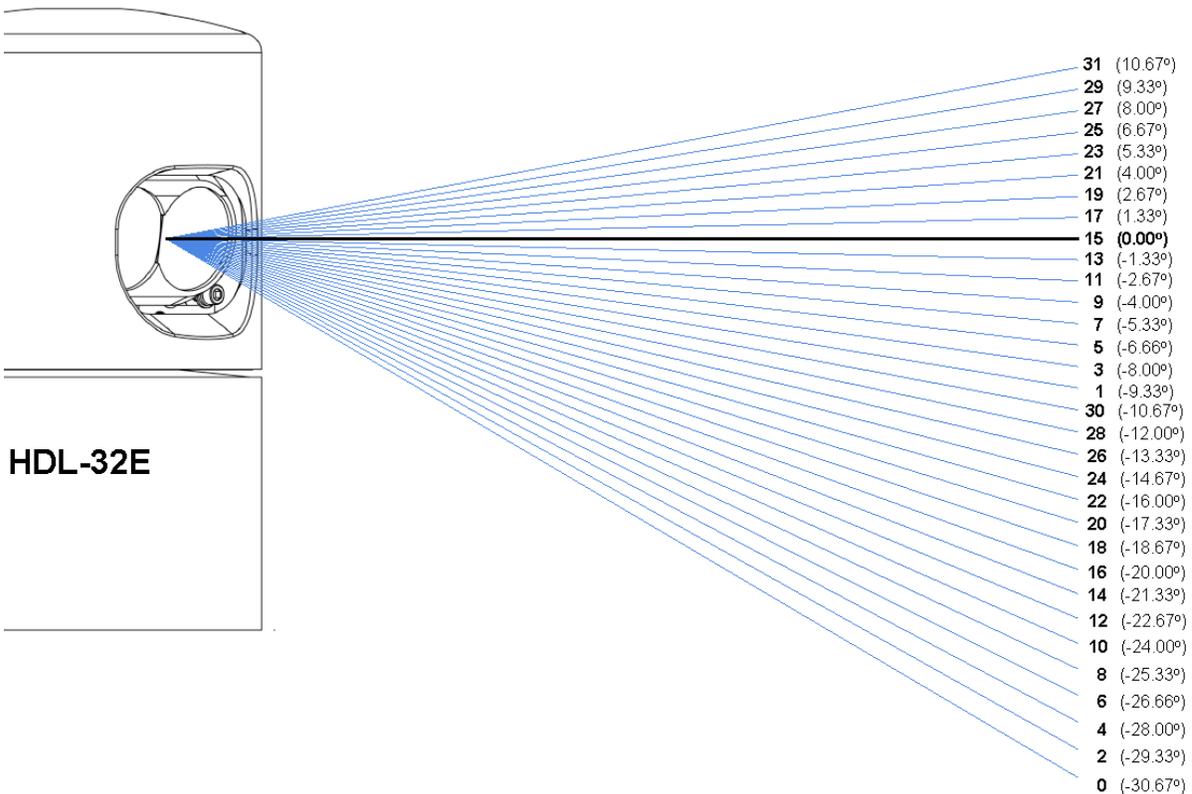
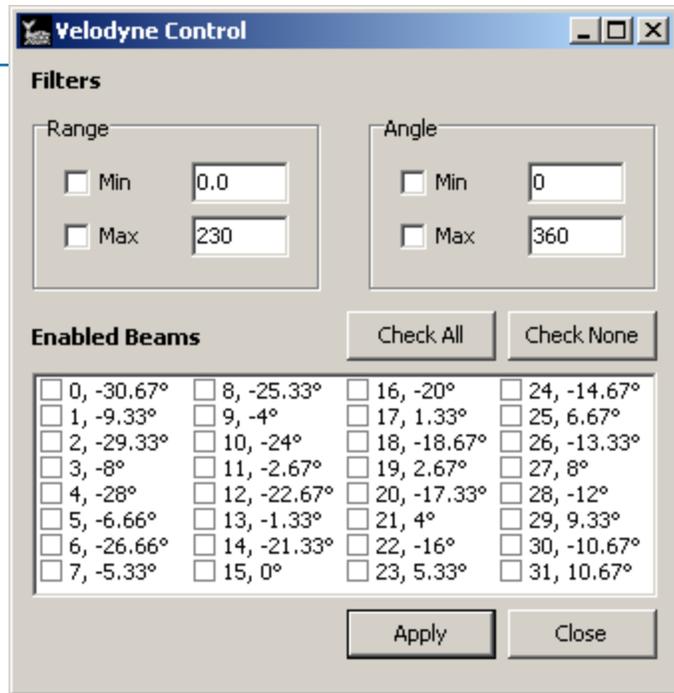


FIGURE 6. *New Velodyne HDL-32E Control Window*

The HDL-32E has 32 beams spread across a 41.3 degree swath (8 beams going 10.67 degrees above the horizon, 1 at 0.00 degrees, and 23 beams going -30.67 degrees below the horizon).

It is important to know the orientation of the beam numbers.

Again, we added the beam angle next to the beam number, to make it easier to decide which beam to enable without needing to refer to the Velodyne manual.



USING THE OPTIONS WITHIN THE VELODYNE CONTROL WINDOWS

RANGE FILTER

Because the Velodyne lasers are 360 degree rotating lasers, the range filter is really performing a radial range application. With this filter, you can apply a Minimum ('Min') and/or a Maximum ('Max') Range Distance.

FIGURE 7. *Defining the Velodyne Range Distance*

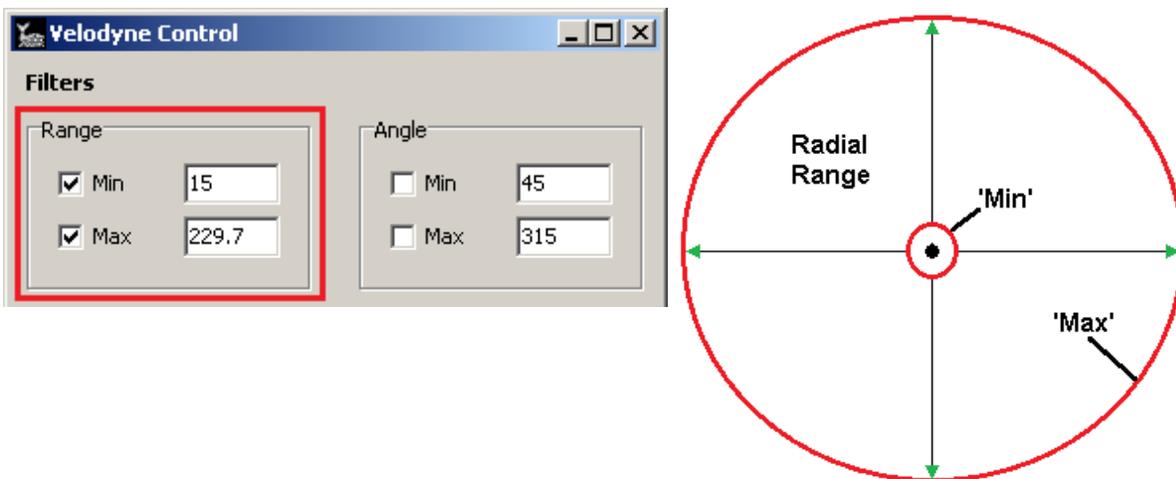
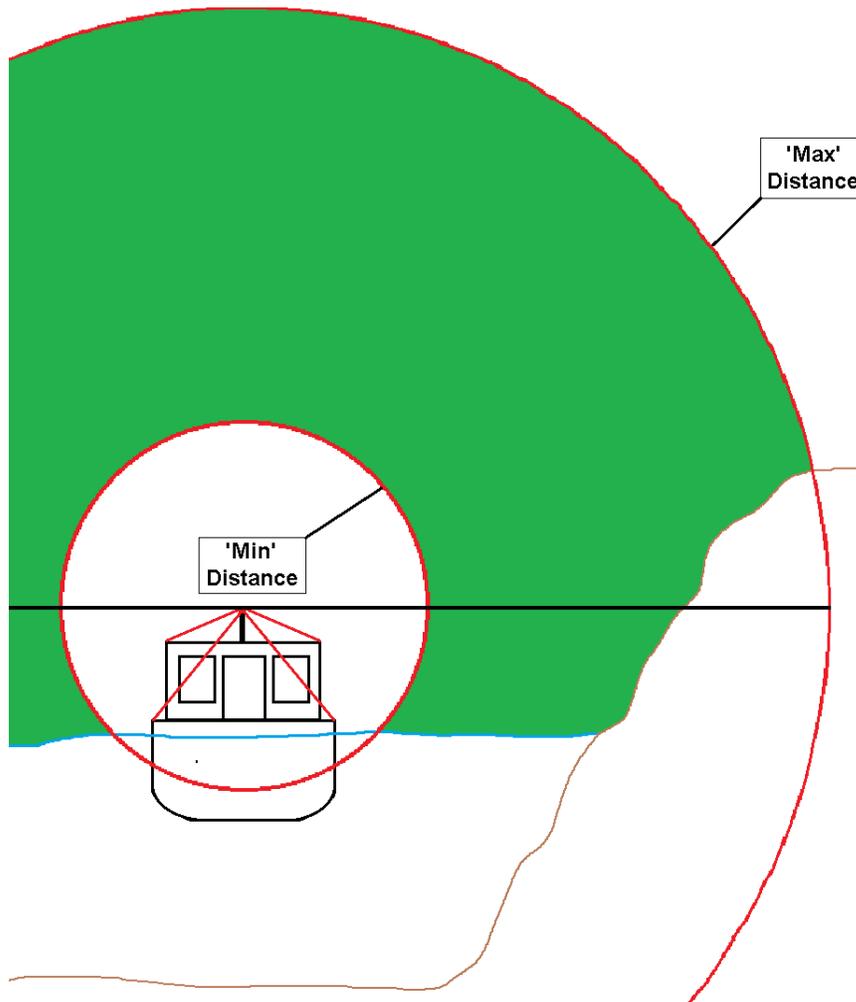


FIGURE 8. HYSWEEP® Logs Only Data from the Green Area



The Min. Range Distance can be very useful when the laser is mounted on the top of the vessel and you want to instantly ignore the beams that are striking the vessel so they are not recorded in the raw data file.

NOTE: Only beams that are returned within the green area are recorded.

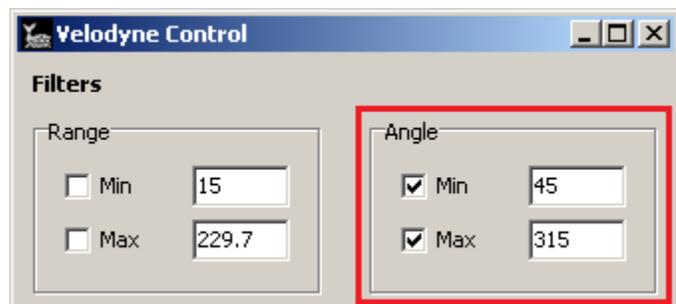
Per Velodyne:

The VLP-16 has returns of up to 100 meters. (The useful range depends on application.)

The HDL-32E has usable returns up to 70 meters.

ANGLE FILTER

The Angle filter sets the field of view for the laser and works in reverse of what you would normally expect a filter to do: *Enter the range in which you want to keep the data, instead of what you want to remove.*



In this example, the Angle filter will 'start' at the Min angle of 45 degrees and continue to the 'end' at the Max angle of 315 degrees, keeping *only* the data that falls within those field of view angles.

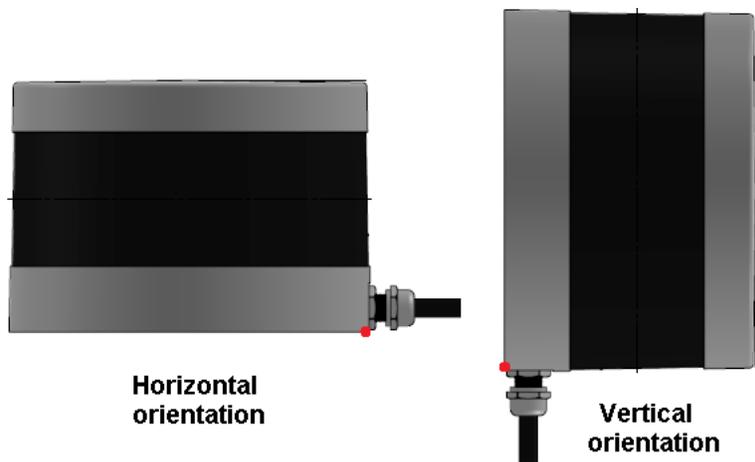
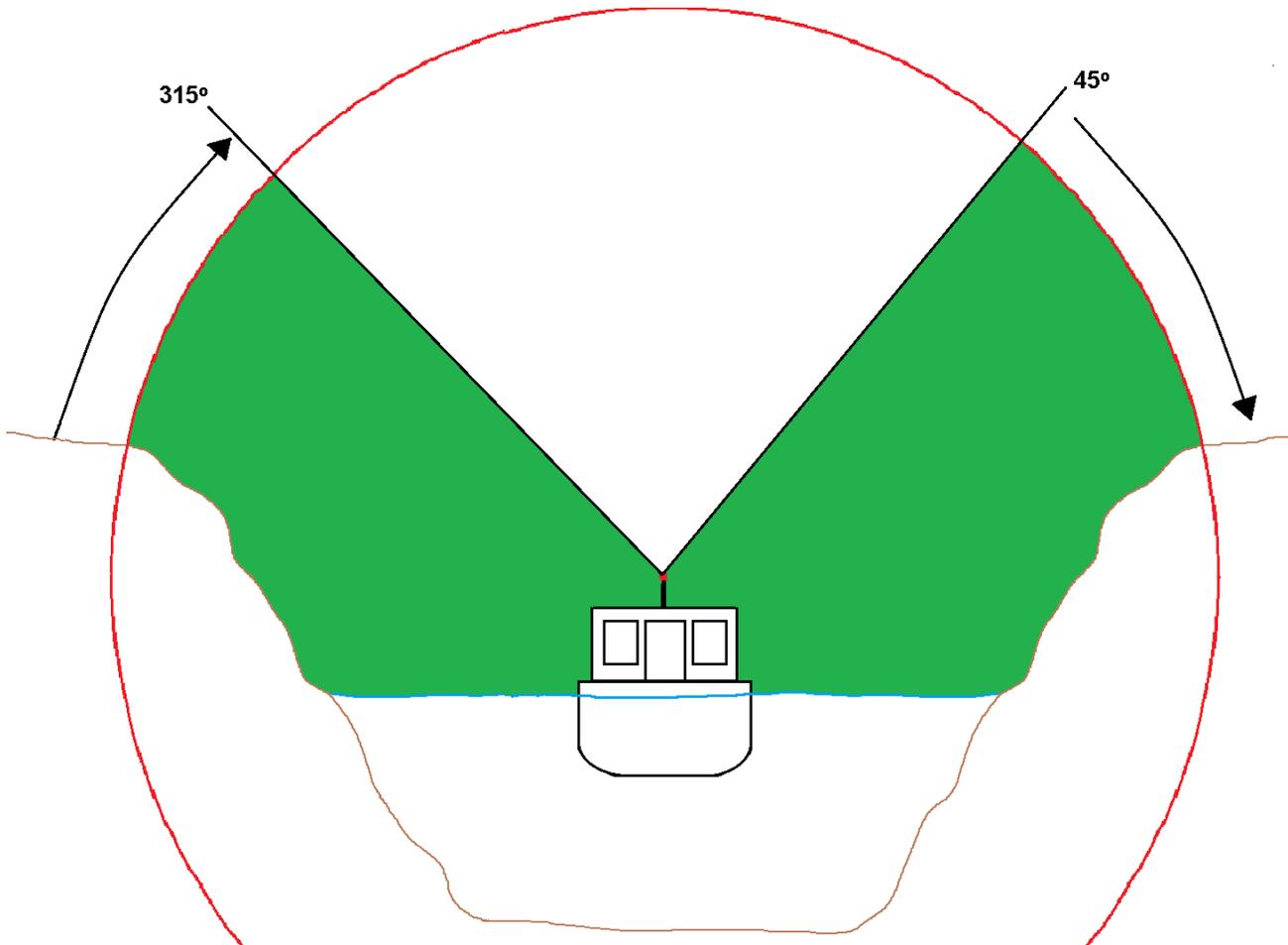


FIGURE 9. This Diagram Assumes the Laser is Mounted Vertically.



Question: Where does 0 degrees begin on the Velodyne lasers?

Answer: According to the Velodyne Manual, 0 degrees is located at the point directly opposite from where the cable comes into the laser.

IMPORTANT: BE AWARE that within the Velodyne Web Interface, you can set the Field of View ('FOV') angles before the data is even transmitted to HYPACK®. If the 'FOV' values are being limited here, they have 'priority', and the HYPACK® Controller cannot override them.

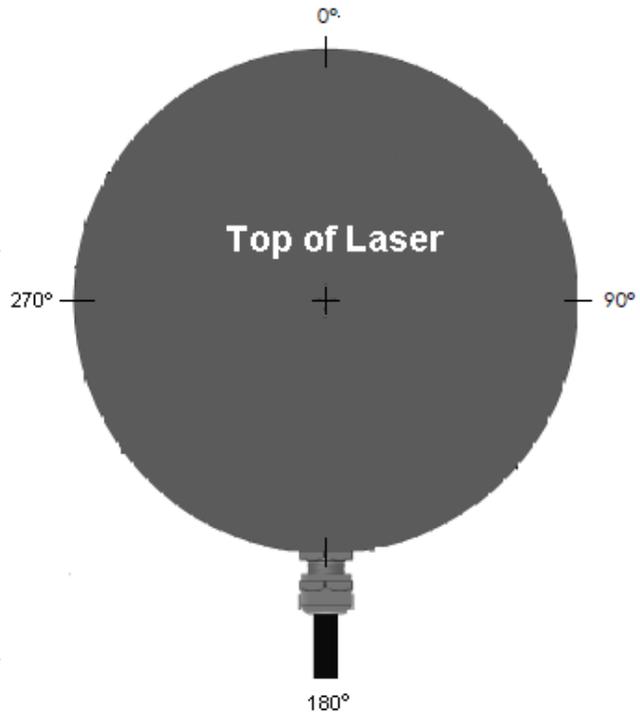
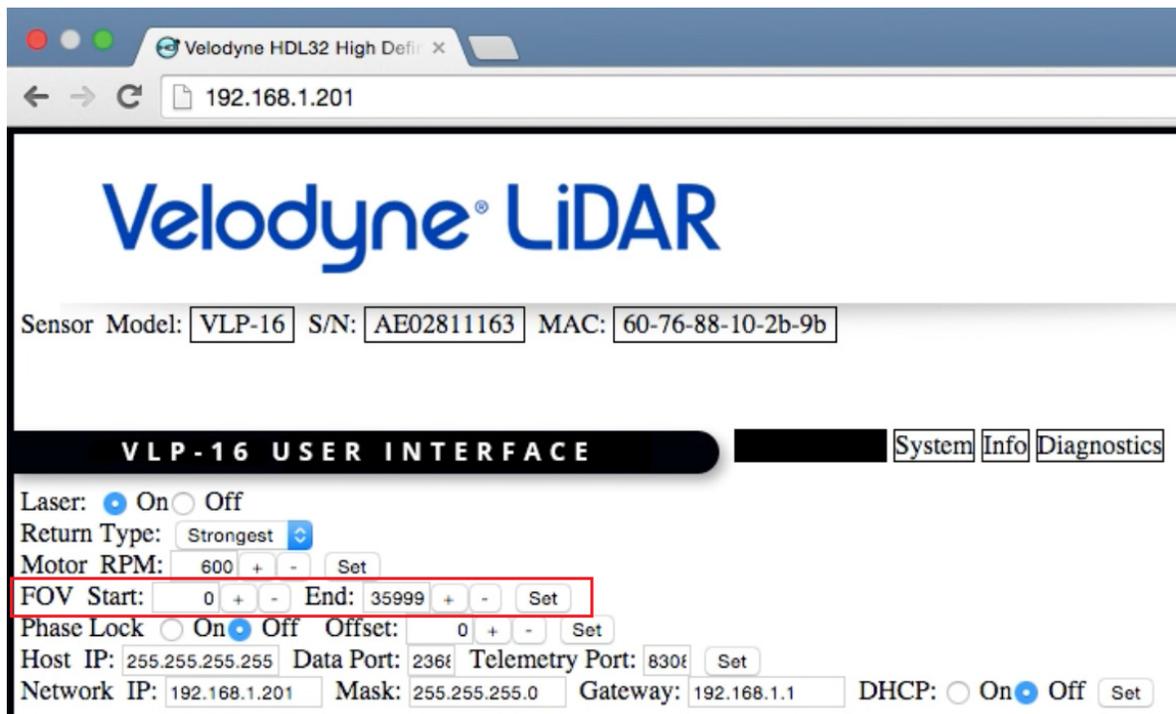


FIGURE 10. Velodyne Web Interface



ENABLED BEAMS

With the capability of collecting 300,000 points per second with a VLP-16 and 700,000 points per second with the HDL-32E, the real question is “How much data is enough ?”

- Do you really need to collect ALL 16 or 32 beams ?
- How fast will the vessel or vessel-of-opportunity be travelling when collecting the data ?
- What density of data is required for this survey ?

The option to enable/disable select beams enables you to turn beams on/off to determine which will be useful for your survey and how many will be needed.

FIGURE 11. *Enabling Select Beams—VLP-16 (left) and HDL-32E (right)*

VLP-16 Enabled Beams	
<input type="checkbox"/> 0, -15°	<input type="checkbox"/> 8, -7°
<input checked="" type="checkbox"/> 1, 1°	<input type="checkbox"/> 9, 9°
<input type="checkbox"/> 2, -13°	<input type="checkbox"/> 10, -5°
<input checked="" type="checkbox"/> 3, 3°	<input type="checkbox"/> 11, 11°
<input type="checkbox"/> 4, -11°	<input checked="" type="checkbox"/> 12, -3°
<input type="checkbox"/> 5, 5°	<input type="checkbox"/> 13, 13°
<input type="checkbox"/> 6, -9°	<input checked="" type="checkbox"/> 14, -1°
<input type="checkbox"/> 7, 7°	<input type="checkbox"/> 15, 15°

HDL-32E Enabled Beams			
<input type="checkbox"/> 0, -30.67°	<input type="checkbox"/> 8, -25.33°	<input type="checkbox"/> 16, -20°	<input type="checkbox"/> 24, -14.67°
<input type="checkbox"/> 1, -9.33°	<input type="checkbox"/> 9, -4°	<input checked="" type="checkbox"/> 17, 1.33°	<input type="checkbox"/> 25, 6.67°
<input type="checkbox"/> 2, -29.33°	<input type="checkbox"/> 10, -24°	<input type="checkbox"/> 18, -18.67°	<input type="checkbox"/> 26, -13.33°
<input type="checkbox"/> 3, -8°	<input checked="" type="checkbox"/> 11, -2.67°	<input checked="" type="checkbox"/> 19, 2.67°	<input type="checkbox"/> 27, 8°
<input type="checkbox"/> 4, -28°	<input type="checkbox"/> 12, -22.67°	<input type="checkbox"/> 20, -17.33°	<input type="checkbox"/> 28, -12°
<input type="checkbox"/> 5, -6.66°	<input checked="" type="checkbox"/> 13, -1.33°	<input type="checkbox"/> 21, 4°	<input type="checkbox"/> 29, 9.33°
<input type="checkbox"/> 6, -26.66°	<input type="checkbox"/> 14, -21.33°	<input type="checkbox"/> 22, -16°	<input type="checkbox"/> 30, -10.67°
<input type="checkbox"/> 7, -5.33°	<input checked="" type="checkbox"/> 15, 0°	<input type="checkbox"/> 23, 5.33°	<input type="checkbox"/> 31, 10.67°

In our testing with the Velodyne VLP-16 laser, we have seen that using just the inner 2 beams (#1 & #14) or the inner 4 beams (#1, #3, #12, & #14) will produce more than enough data for any project.

If you are purchasing the HDL-32E, you already know that you need the higher density of data, or that its larger off-horizon angle of 30.67 degrees, will allow it to locate data points behind objects that might otherwise obstruct the perpendicular beam from the laser.

However, limiting the HDL-32E to just the inner 2, 4, or 5 beams (#11, #13, #15, #17, and #19) may still provide you with more than enough data for your project.