

## *1.6.1 Report on Spatial Distribution Verification*

The USGS LiDAR Base Specification Version 1.0 states that: "The spatial distribution of geometrically usable points is expected to be uniform. Although it is understood that lidar instruments do not produce regularly gridded points, collections should be planned and executed to produce a first-return point cloud that approaches a regular lattice of points, rather than a collection of widely spaced high density profiles of the terrain. The uniformity of the point density throughout the dataset is important and will be assessed using the following steps:

- (1) Generating a density grid from the data with cell sizes equal to the design NPS times 2, using a radius equal to the design NPS
- (2) Ensuring at least 90 percent of the cells in the grid contain at least one lidar point.
- (3) The assessment is to be made against individual (single) swaths, using only the first-return points located within the geometrically usable center portion (typically 90 percent) of each swath.

Excluding acceptable data voids previously identified in this specification.

Note: This requirement may be relaxed in areas of substantial relief where it is impractical to maintain a consistent and uniform distribution.

Note: The process described in this section relates only to the uniformity of the point distribution. It in no way relates to, nor can it be used for the assessment of point density or NPS."

The purpose of this section is to show graphically where unacceptable LiDAR spatial distributions are located. LiDAR spatial distribution can be affected by problems in flight planning (e.g., incorrect scan frequency / pulse rate pairing) or flight execution (e.g., strong headwinds or tailwinds), a lack of coverage at the time of collection, water bodies not reflecting the laser beam back to the receiver, LiDAR occlusions caused by objects above ground like tall buildings, etc. Not all LiDAR spatial distribution violations are truly problematic. The intention of this test is to isolate the first example of LiDAR spatial distribution violations - problems in flight planning or flight execution. A close inspection must be done on the results to determine if the LiDAR spatial distribution was collected and processed to meet the intended specifications.

[Data Source - E:\Pope\\_Hardin\Swath\\_LAS](#)

[E:\Pope\\_Hardin\QAQC2\1\\_6\Boresighted\\_SpatialDistribution\\_SingleFile.jp2](#)

## 1.6.1 Report on Spatial Distribution Verification - Continued



Cell size: 5 US Survey Feet

Green: Cells containing at least 1 first return LiDAR point(s) (number of cells = 793,398,907)

Red: Cells not containing at least 1 first return LiDAR point(s) (number of cells = 10,441,853)

Background Color: Null data

Percentage of cells in the grid that contain at least 1 first return LiDAR point(s) = 98.70% (Requirement is typically 90%)

See JPG2000 file for full resolution results

## 1.6.2 Report on Spatial Distribution Verification of Individual Swath

Swath	Percentage of Cells that Contain $\geq 1$
00001	95.58%
00002	95.23%
00003	97.04%
00004	95.88%
00005	93.22%
00006	82.85%
00007	84.14%
00008	81.14%
00009	83.43%
00010	85.25%
00011_Split1	89.23%
00011_Split2	90.14%
00012_Split1	87.28%
00012_Split2	89.81%
00013_Split1	87.41%
00013_Split2	85.32%
00014_Split1	89.76%
00014_Split2	81.36%
00015_Split1	90.05%
00015_Split2	90.58%
00016_Split1	88.85%
00016_Split2	83.57%
00017_Split1	88.56%
00017_Split2	87.77%
00018_Split1	89.71%
00018_Split2	84.53%
00019_Split1	95.71%
00019_Split2	86.05%
00020_Split1	95.98%
00020_Split2	91.22%
00021_Split1	97.12%
00021_Split2	91.81%
00022_Split1	96.49%
00022_Split2	89.44%
00023_Split1	95.70%
00023_Split2	82.65%
00024_Split1	96.25%
00024_Split2	91.22%
00025_Split1	96.05%
00025_Split2	86.71%
00026	96.41%
00027_Split1	96.92%
00027_Split2	79.64%
00028	96.22%
00029	97.28%
00030	96.24%

## 1.6.1 Report on Spatial Distribution Verification of Individual Swath

Swath	Percentage of Cells that Contain $\geq 1$
00031	97.50%
00032	96.33%
00033	97.43%
00034	96.73%
00035	97.98%
00036	96.80%
00037	97.02%
00038	95.67%
00039	94.98%
00040	93.97%
00041	96.58%
00042	94.99%
00043	96.88%
00044_Split1	93.83%
00044_Split2	97.54%
00045	91.72%
00066	89.75%
00067_Split1	92.47%
00067_Split2	85.34%
00068_Split1	96.01%
00068_Split2	86.99%
00069_Split1	95.94%
00069_Split2	86.02%
00070_Split1	96.06%
00070_Split2	87.44%
00071_Split1	96.98%
00071_Split2	91.22%
00072_Split1	95.78%
00072_Split2	91.65%
00073_Split1	94.64%
00073_Split2	95.45%
00073_Split3	83.16%
00074_Split1	94.09%
00074_Split2	95.08%
00074_Split3	75.81%
00075_Split1	90.08%
00075_Split2	96.93%
00075_Split3	95.04%
00076_Split1	90.50%
00076_Split2	95.97%
00076_Split3	91.14%
00077_Split1	88.52%
00077_Split2	96.49%
00077_Split3	96.02%
00078_Split1	91.15%
00078_Split2	96.44%

## 1.6.1 Report on Spatial Distribution Verification of Individual Swath

Swath	Percentage of Cells that Contain $\geq 1$
00078_Split3	96.27%
00079_Split1	91.43%
00079_Split2	96.93%
00079_Split3	96.55%
00080_Split1	94.60%
00080_Split2	95.26%
00080_Split3	95.42%
00081_Split1	94.58%
00081_Split2	94.89%
00081_Split3	95.25%
00081_Split4	97.91%
00082_Split1	95.43%
00082_Split2	96.32%
00082_Split3	96.34%
00083_Split1	95.10%
00083_Split2	96.24%
00083_Split3	96.99%
00084_Split1	94.02%
00084_Split2	95.73%
00084_Split3	96.20%
00085_Split1	94.59%
00085_Split2	95.93%
00085_Split3	96.14%
00085_Split4	84.13%
00086_Split1	94.56%
00086_Split2	95.05%
00086_Split3	96.45%
00087_Split1	95.75%
00087_Split2	96.47%
00087_Split3	96.40%
00087_Split4	96.18%
00088	96.58%
00129_Split1	95.08%
00129_Split2	96.92%
00129_Split3	96.93%
00130_Split1	96.51%
00130_Split2	97.62%
00130_Split3	96.88%
00130_Split4	95.04%
00131_Split1	94.46%
00131_Split2	95.23%
00131_Split3	97.02%
00132_Split1	94.41%
00132_Split2	97.68%
00132_Split3	97.12%
00132_Split4	97.66%

## 1.6.1 Report on Spatial Distribution Verification of Individual Swath

Swath	Percentage of Cells that Contain $\geq 1$
00133_Split1	94.62%
00133_Split2	95.53%
00133_Split3	96.38%
00134_Split1	94.41%
00134_Split2	96.91%
00134_Split3	97.80%
00134_Split4	97.17%
00135_Split1	94.73%
00135_Split2	96.19%
00135_Split3	96.68%
00136_Split1	94.83%
00136_Split2	97.42%
00136_Split3	97.05%
00136_Split4	98.13%
00137_Split1	94.42%
00137_Split2	94.97%
00137_Split3	95.78%
00138_Split1	94.67%
00138_Split2	95.86%
00138_Split3	97.24%
00138_Split4	87.99%
00139_Split1	94.14%
00139_Split2	95.71%
00139_Split3	95.47%
00140_Split1	94.95%
00140_Split2	96.95%
00140_Split3	97.44%
00140_Split4	96.20%
00141_Split1	95.25%
00141_Split2	96.24%
00141_Split3	96.75%
00142_Split1	96.65%
00142_Split2	97.13%
00143	95.90%