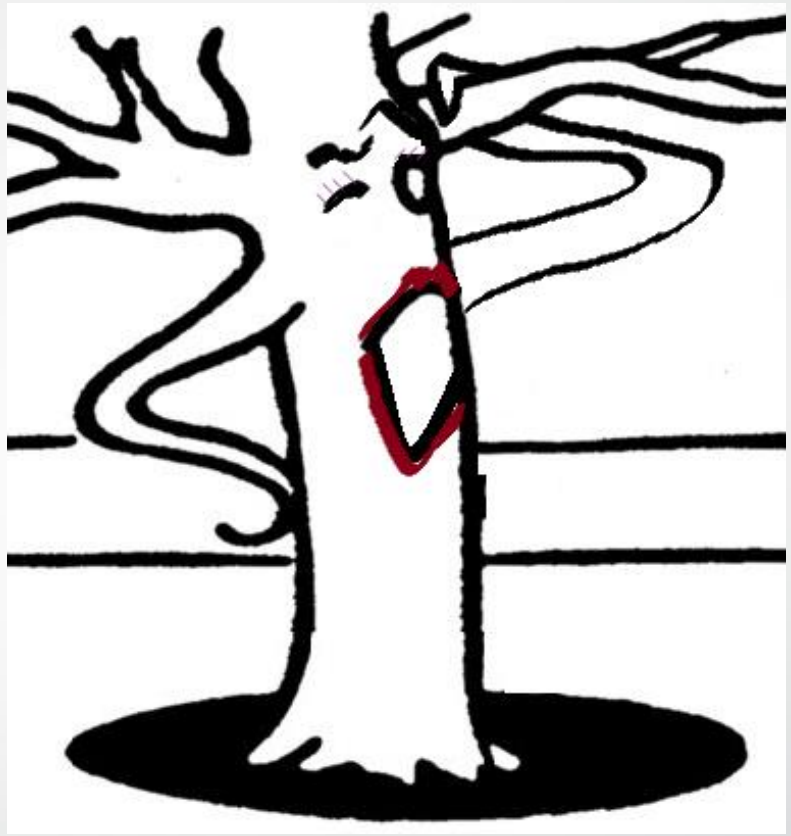
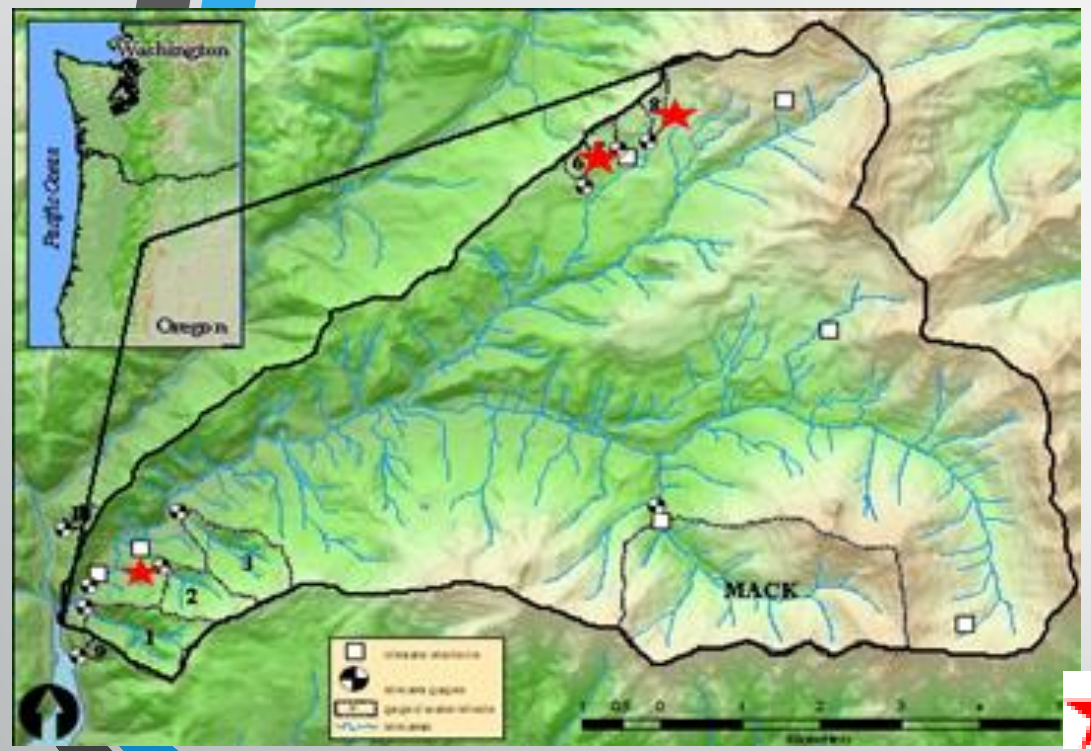
Approaches for Modeling Timber Volume

With TLS



Max Boath

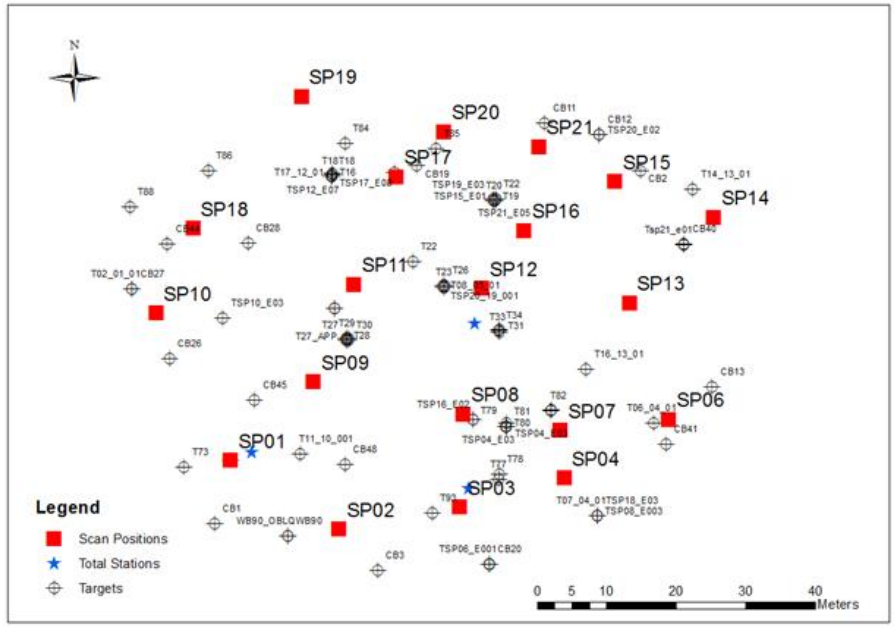
Study Site



http://andrewsforest.oregonstate.edu/lter/about/site/map.cfm?topnav=219

http://andrewsforest.oregonstate.edu/lter/about/media.cfm

Scan sites



Previous Collection

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+

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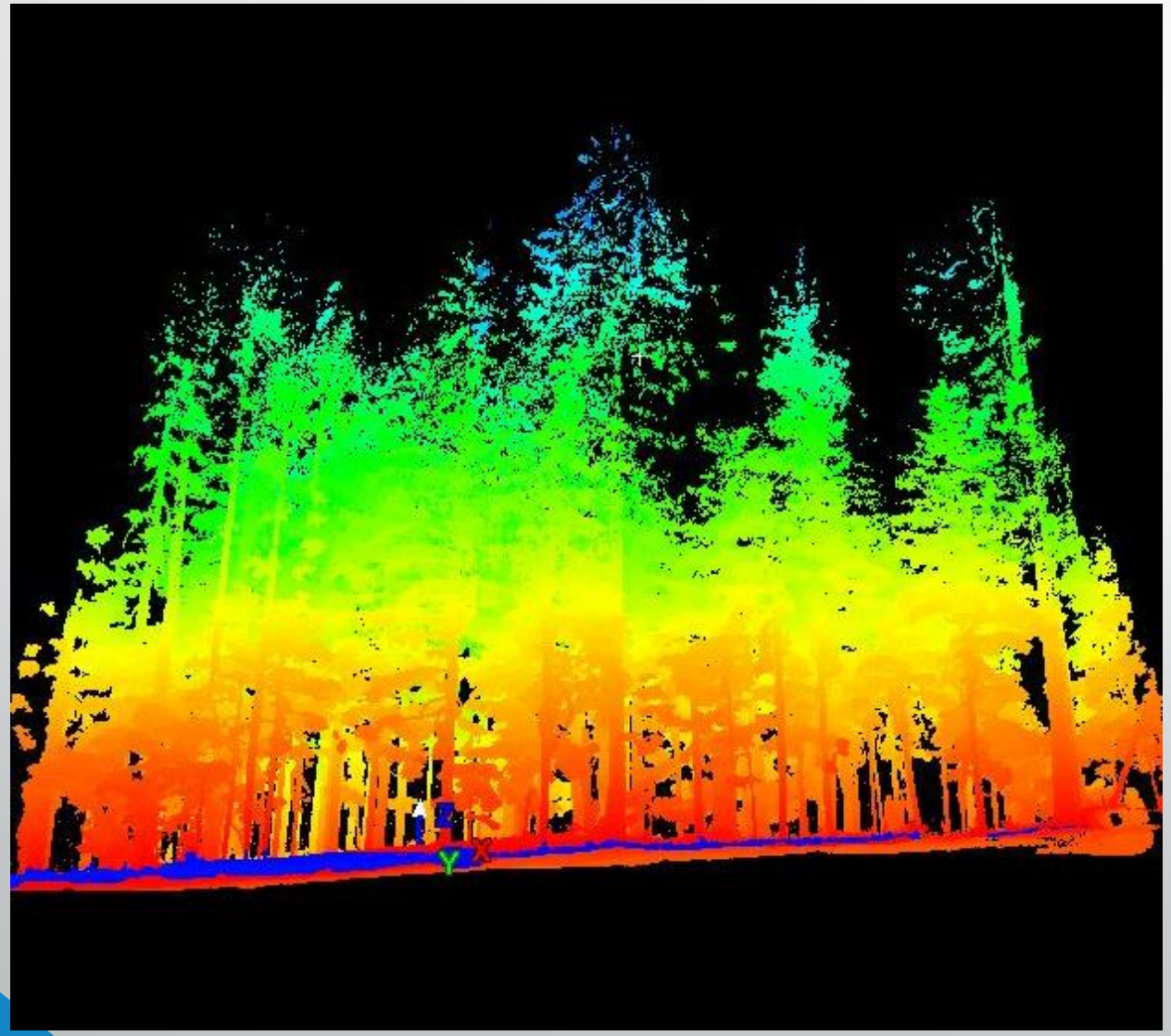
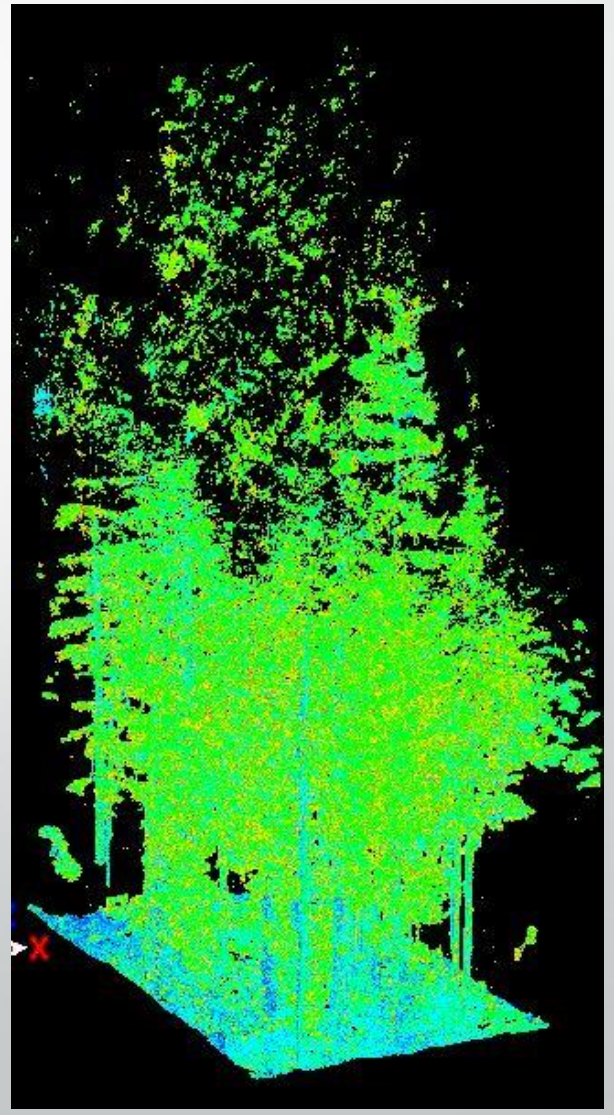
Photographs by Rong Fang

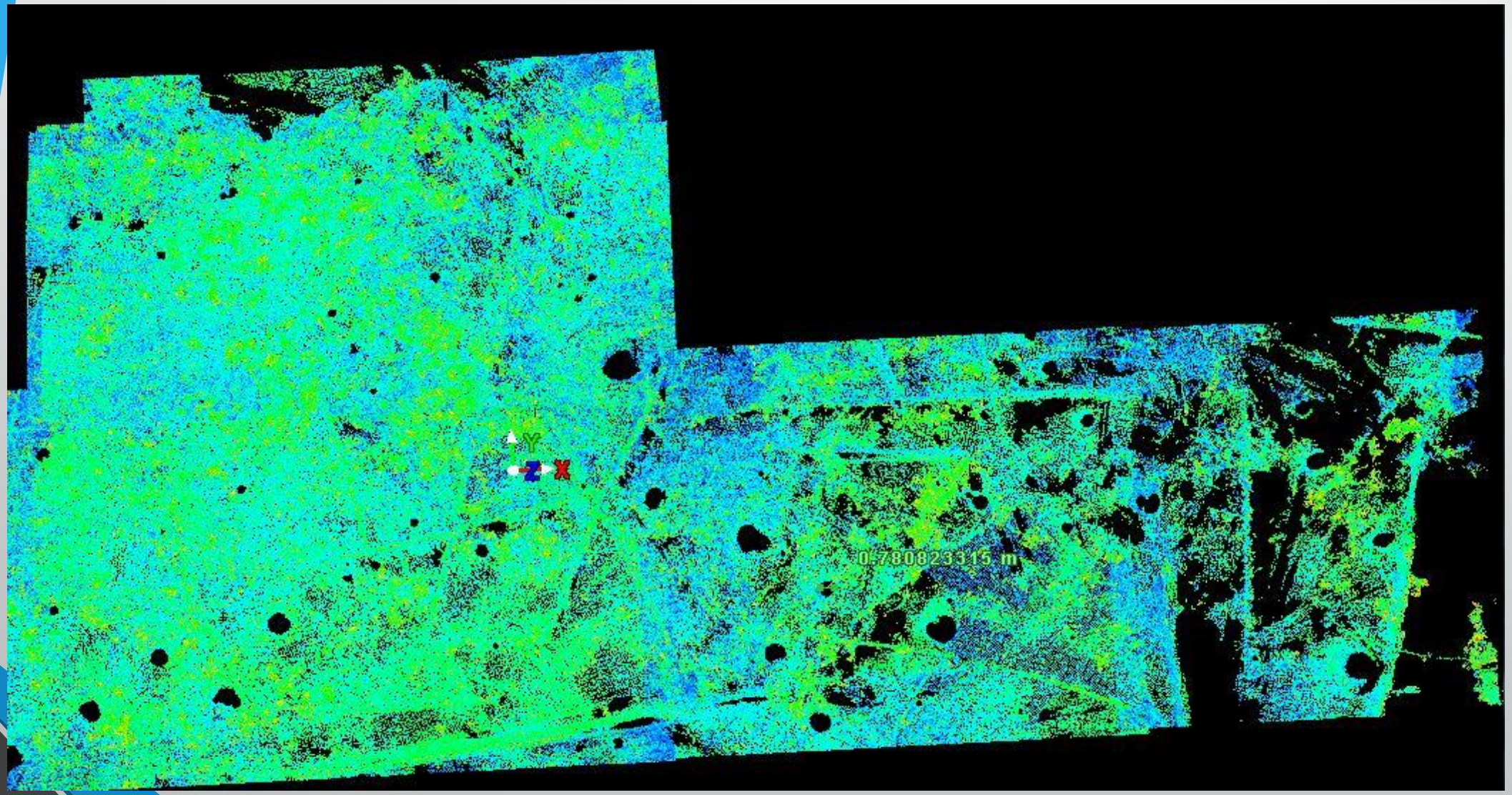
Point Cloud

=

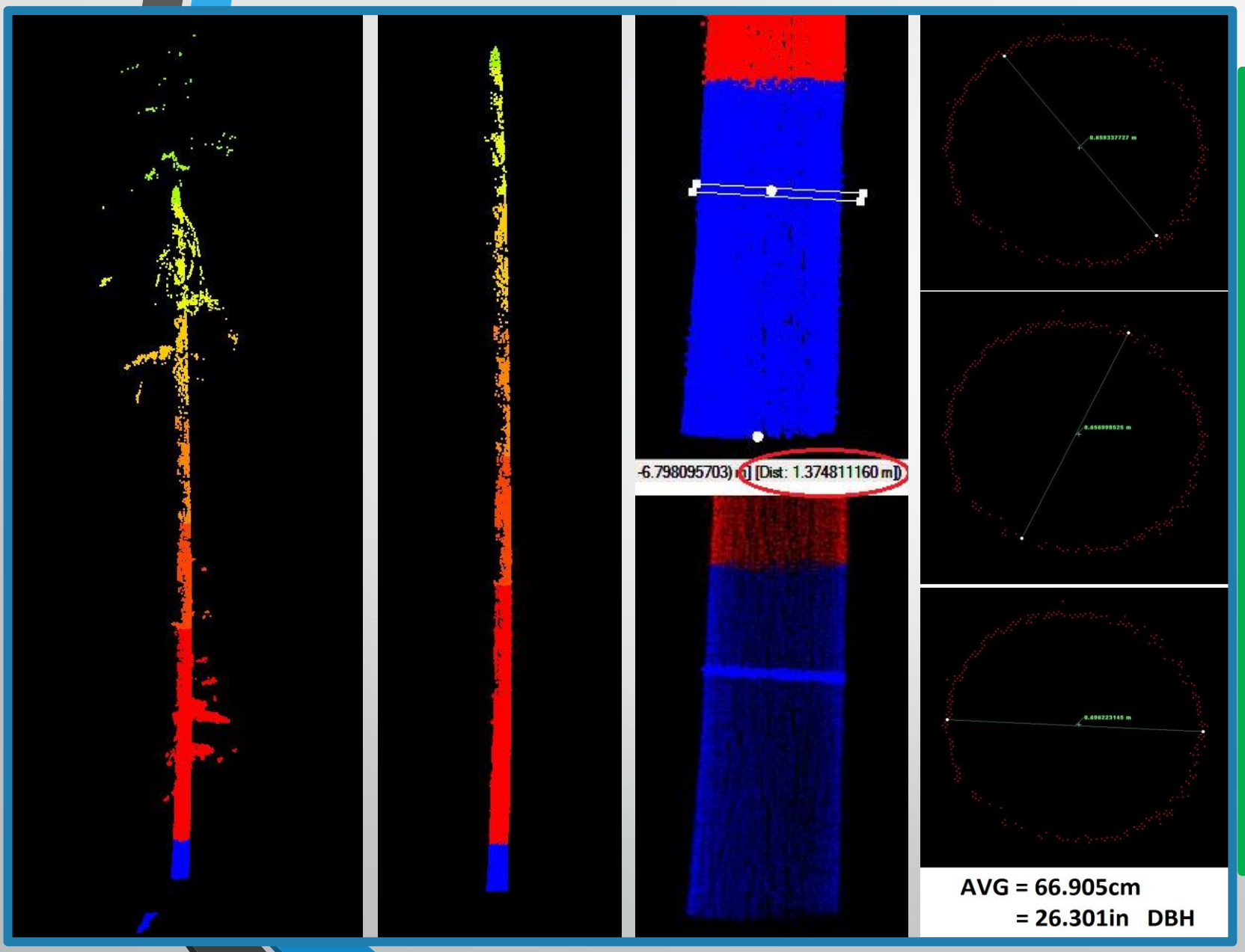


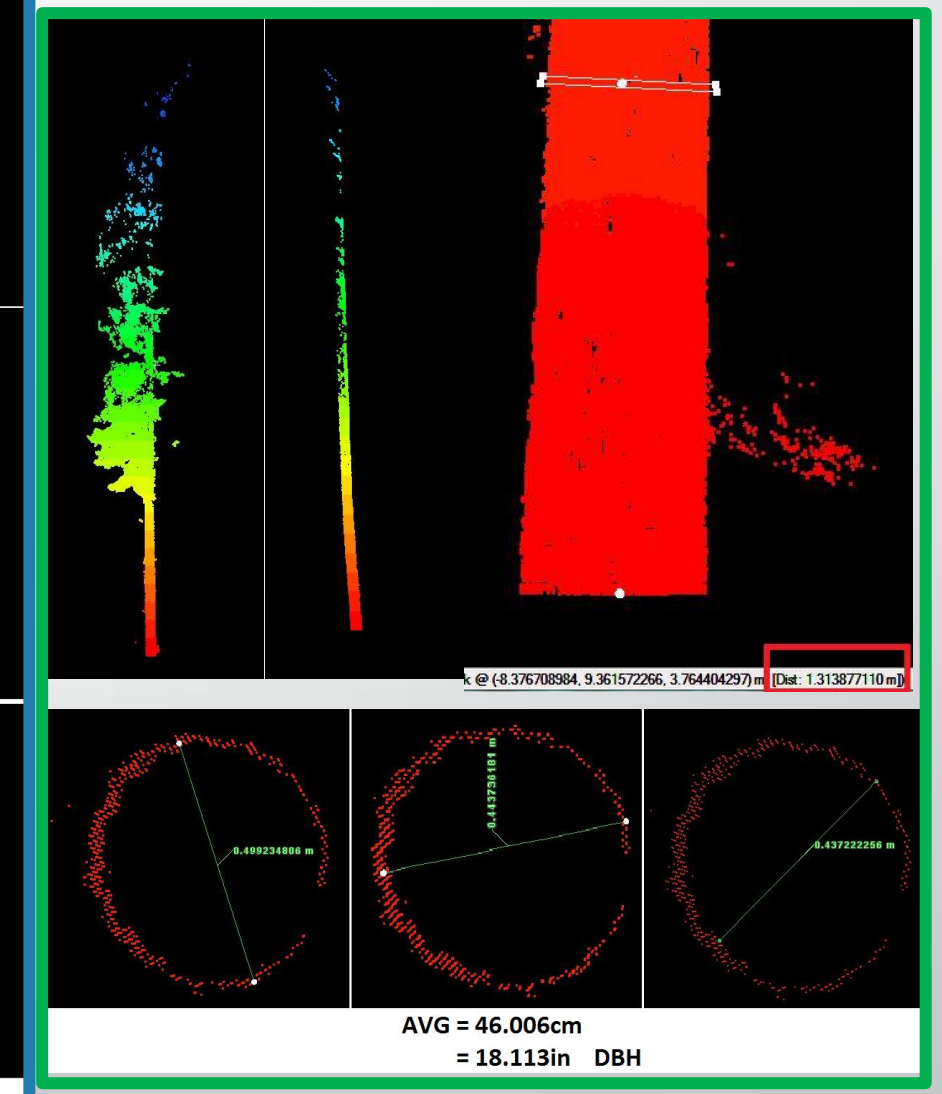


Study Site Point Cloud

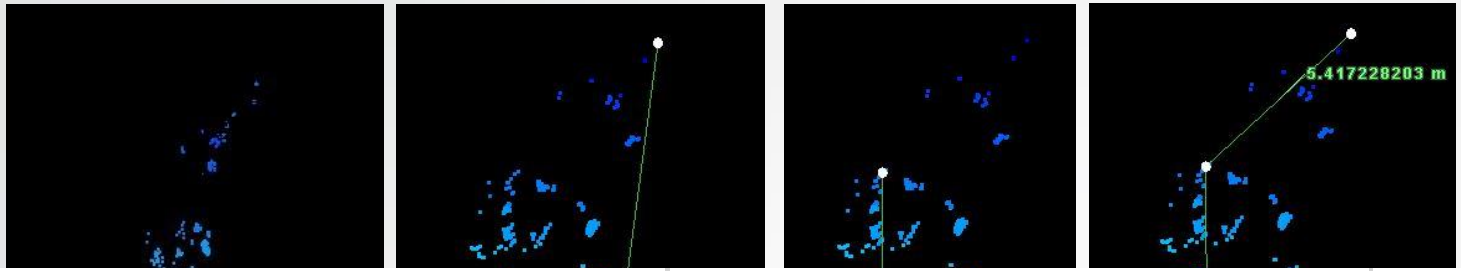


Methods


-6.798095703) m] [Dist: 1.374811160 m])
AVG = 66.905cm
= 26.301in DBH


k @ (-8.376708984, 9.361572266, 3.764404297) m [Dist: 1.313877110 m])
0.499234806 m
0.437222256 m
AVG = 46.006cm
= 18.113in DBH

Methods – Height Estimations



Tree FID	DBH-Derived Height(m)	Measured Height(m)	Difference(m)
T1	32.588	34.359	-1.771
T2	44.796	39.694	5.102
T3	31.840	31.410	0.430
T4	32.539	40.000	-7.461
T5	65.393	55.768	9.625
T6	38.976	36.145	2.831

Methods - Volume

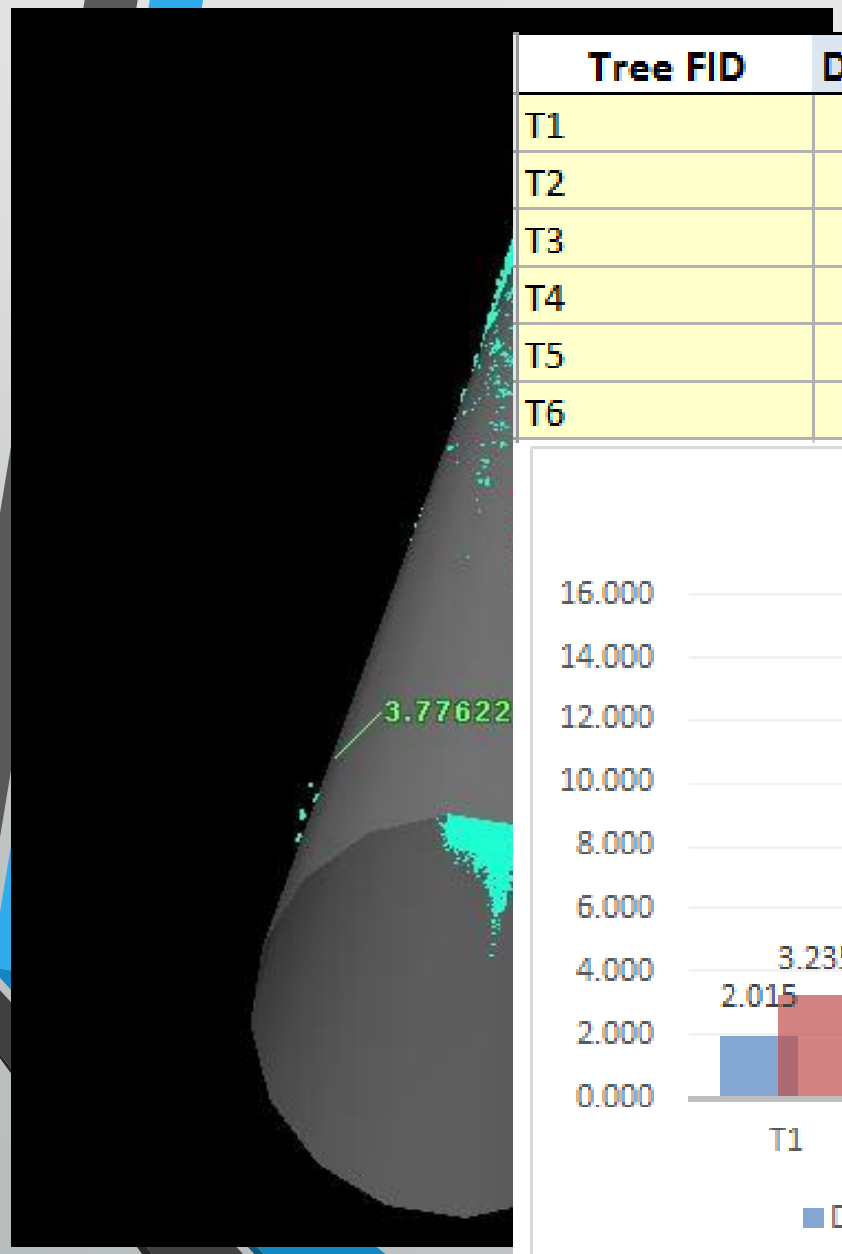
Table 1a—Pacific Northwest volume equations—group 1

Eqn	CVTS: Cubic-foot volume of total stem, ground to tip (DBH ≥ 1 inch or 2.5 cm)	Major species[a]	Reference
1	$CVTS = 10^{-3.21809 + 0.04948 \times \log(HT) \times \log(DBH) - 0.15664 \times (\log(DBH))^2 + 2.02132 \times \log(DBH) + 1.63408 \times \log(HT) - 0.16185 \times (\log(HT))^2}$	Douglas-fir (PNWW)	Brackett 1973

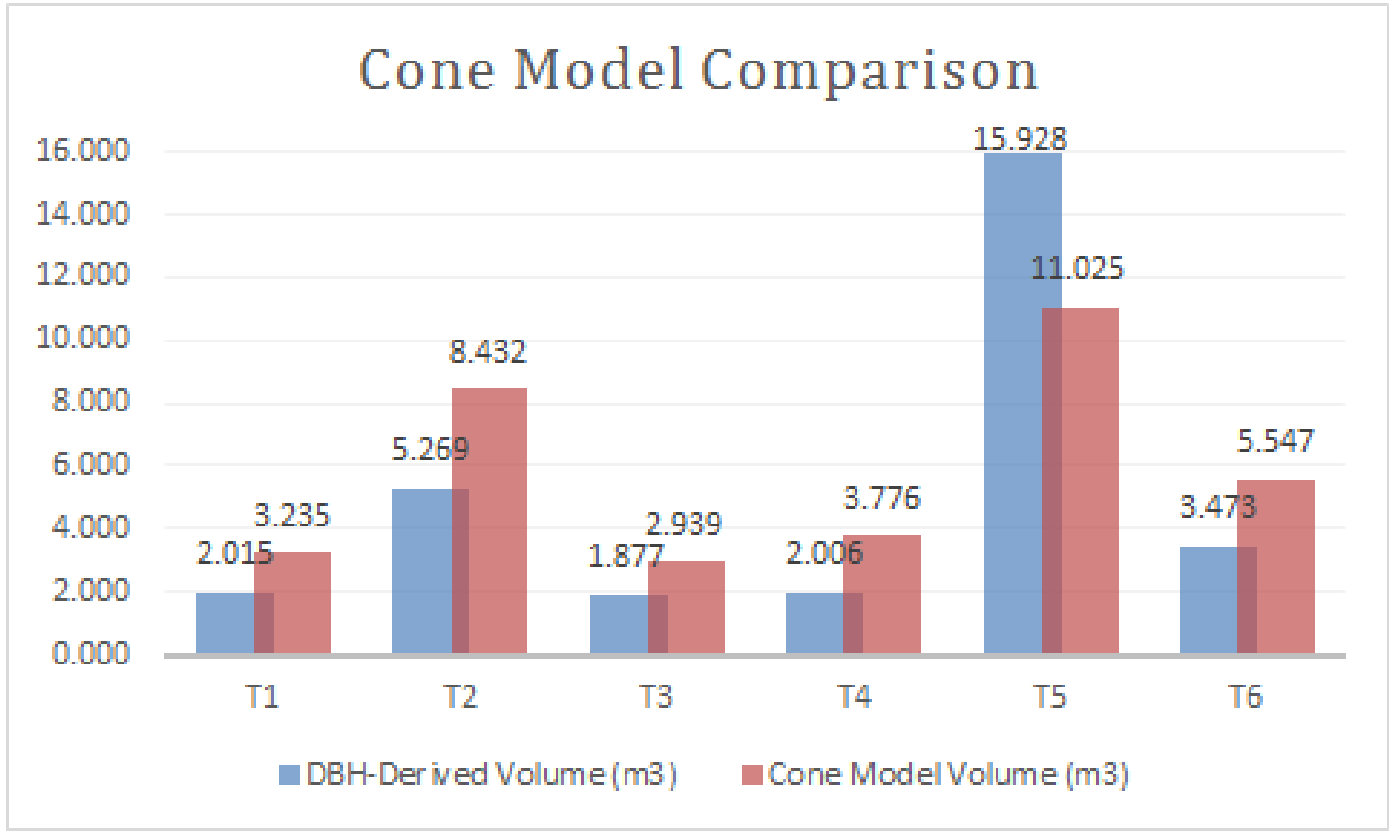
Xiaoping Zhou and Miles A. Hemstrom (2010) *Timber Volume and Aboveground Live Tree Biomass Estimations for Landscape Analyses in the Pacific Northwest*

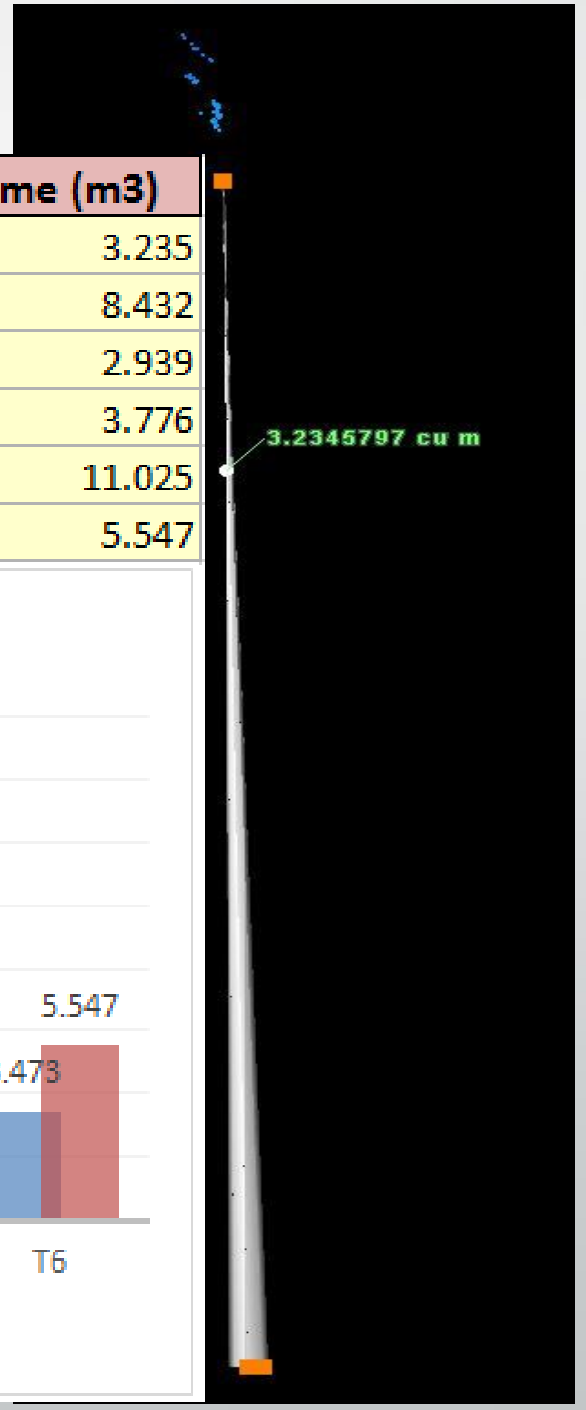
Tree FID	DBH-Derived Volume (m3)	Measured-Height Derived Volume (m3)	Difference(m3)
T1	2.015	2.129	-0.114
T2	5.269	4.664	0.605
T3	1.877	1.851	0.026
T4	2.006	2.479	-0.473
T5	15.928	13.651	2.277
T6	3.473	3.215	0.257

Cone Model



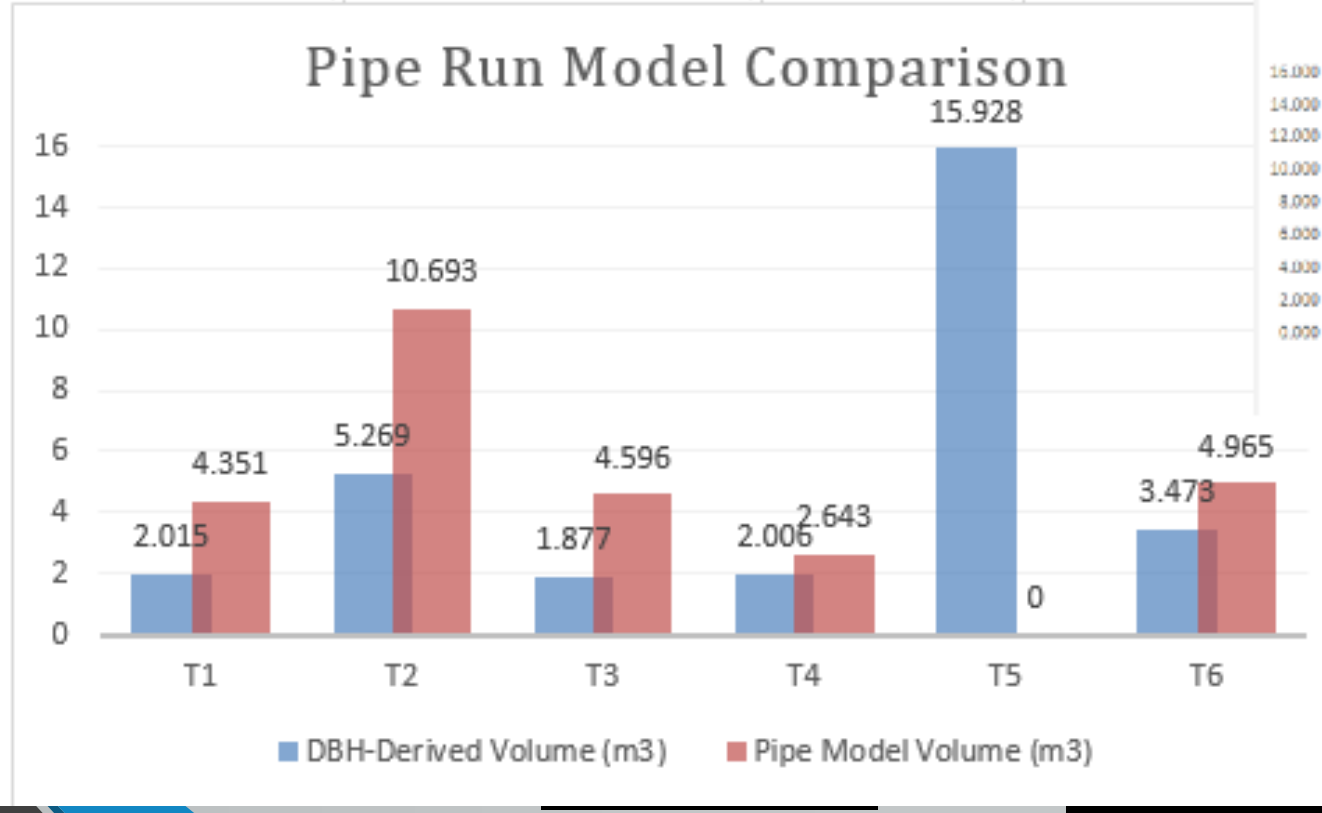
Tree FID	DBH-Derived Volume (m3)	Cone Model Volume (m3)
T1	2.015	3.235
T2	5.269	8.432
T3	1.877	2.939
T4	2.006	3.776
T5	15.928	11.025
T6	3.473	5.547

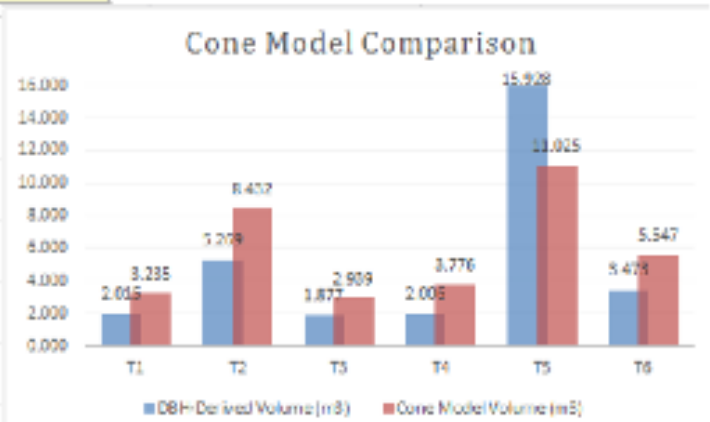




Pipe Run (Region Grow) Model

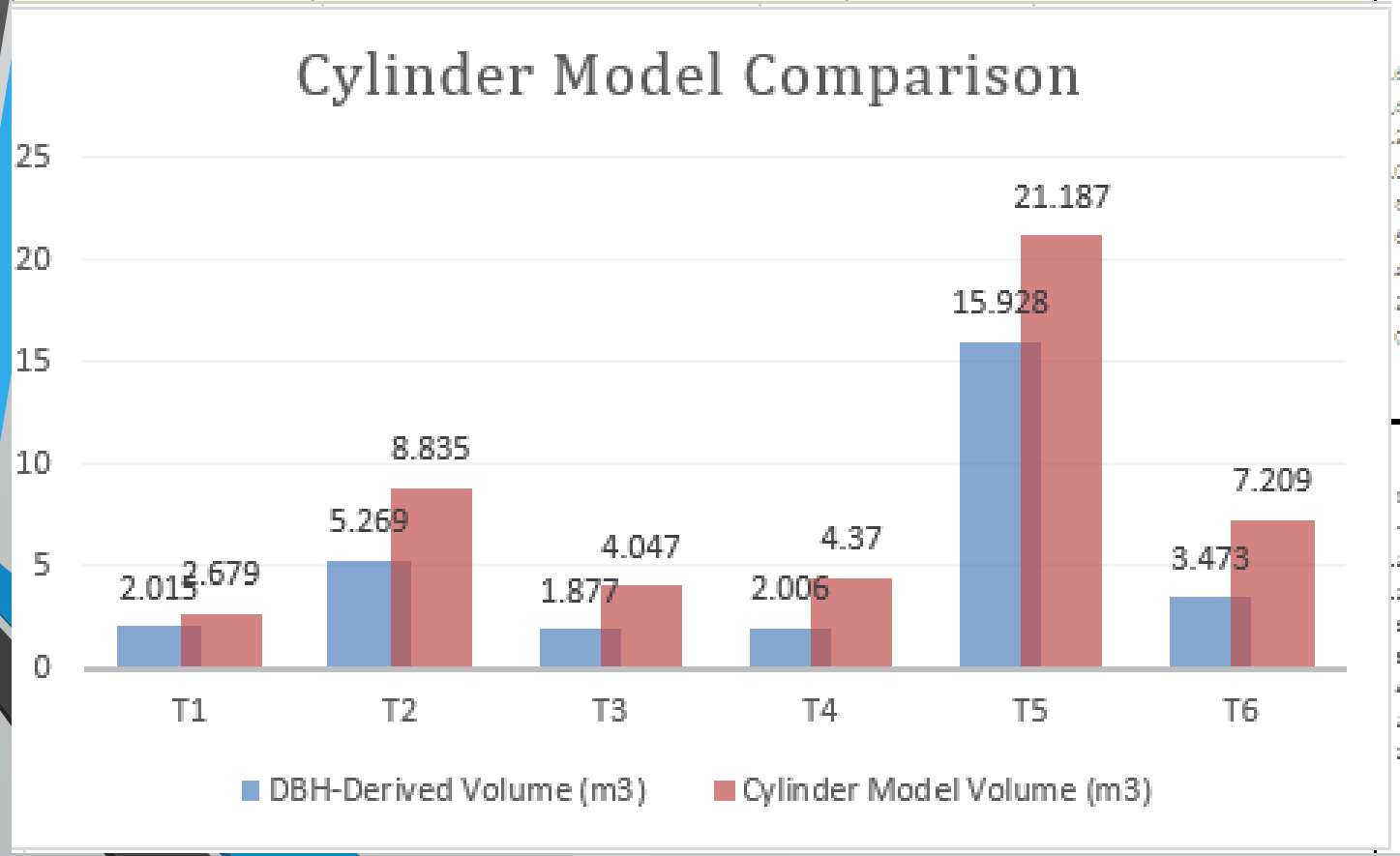
Tree FID	DBH-Derived Volume (m3)	Pipe Model Volume (m3)
T1	2.015	4.351
T2	5.269	10.693
T3	1.877	4.596
T4	2.006	2.643
T5	15.928	*Failed*
T6	3.473	4.965

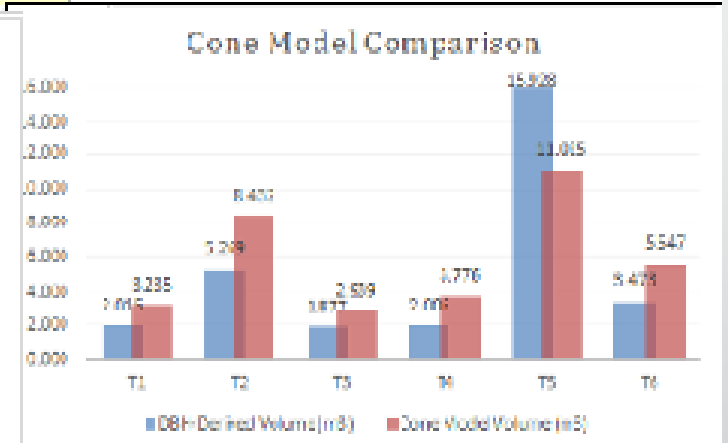


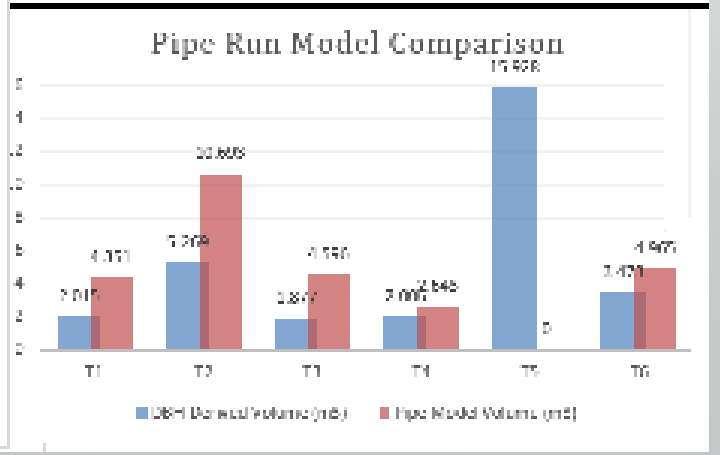


Cylinder Model

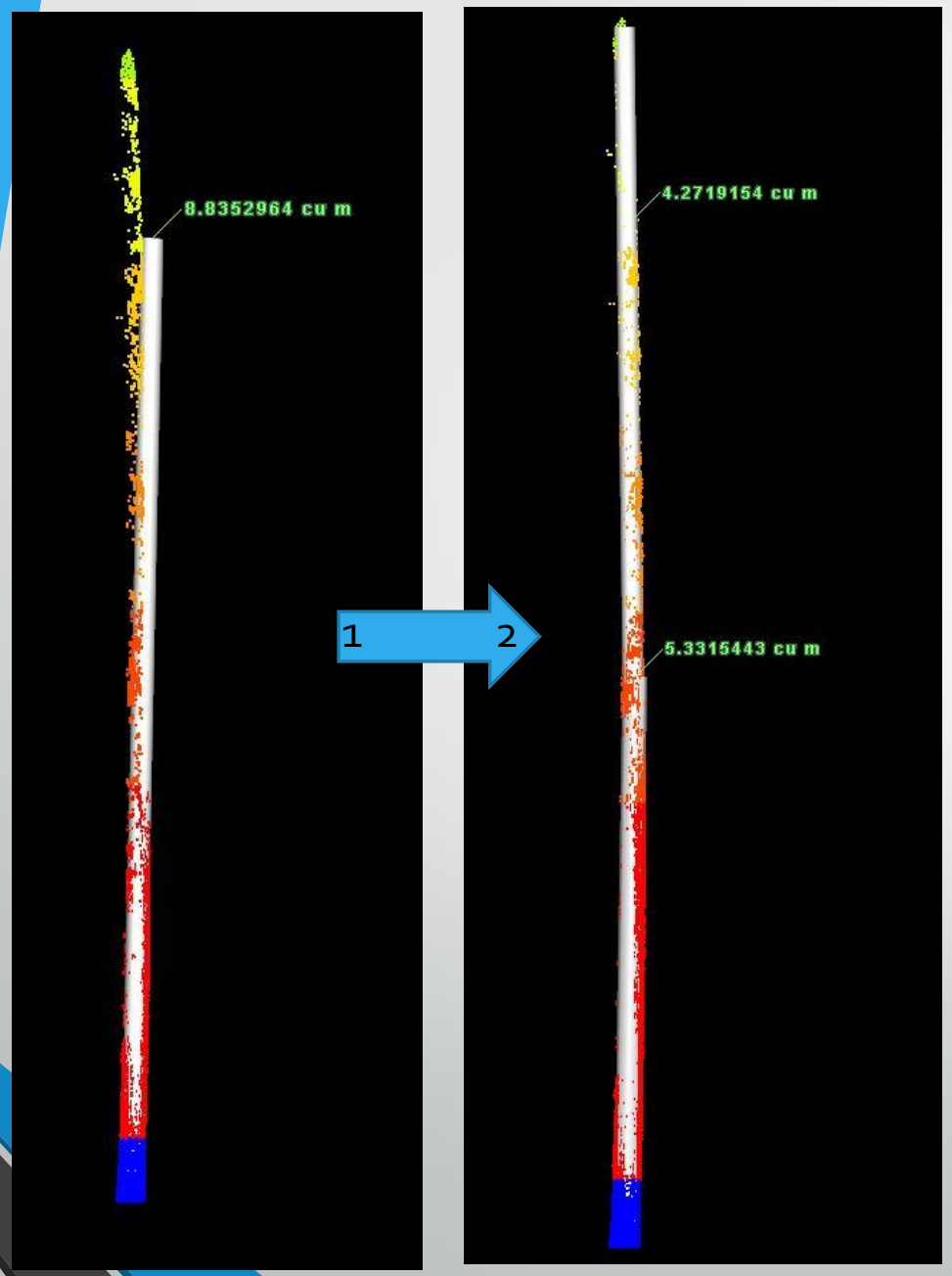
Tree FID	DBH-Derived Volume (m3)	Cylinder Model Volume (m3)
T1	2.015	2.679
T2	5.269	8.835
T3	1.877	4.047
T4	2.006	4.37
T5	15.928	21.187
T6	3.473	7.209

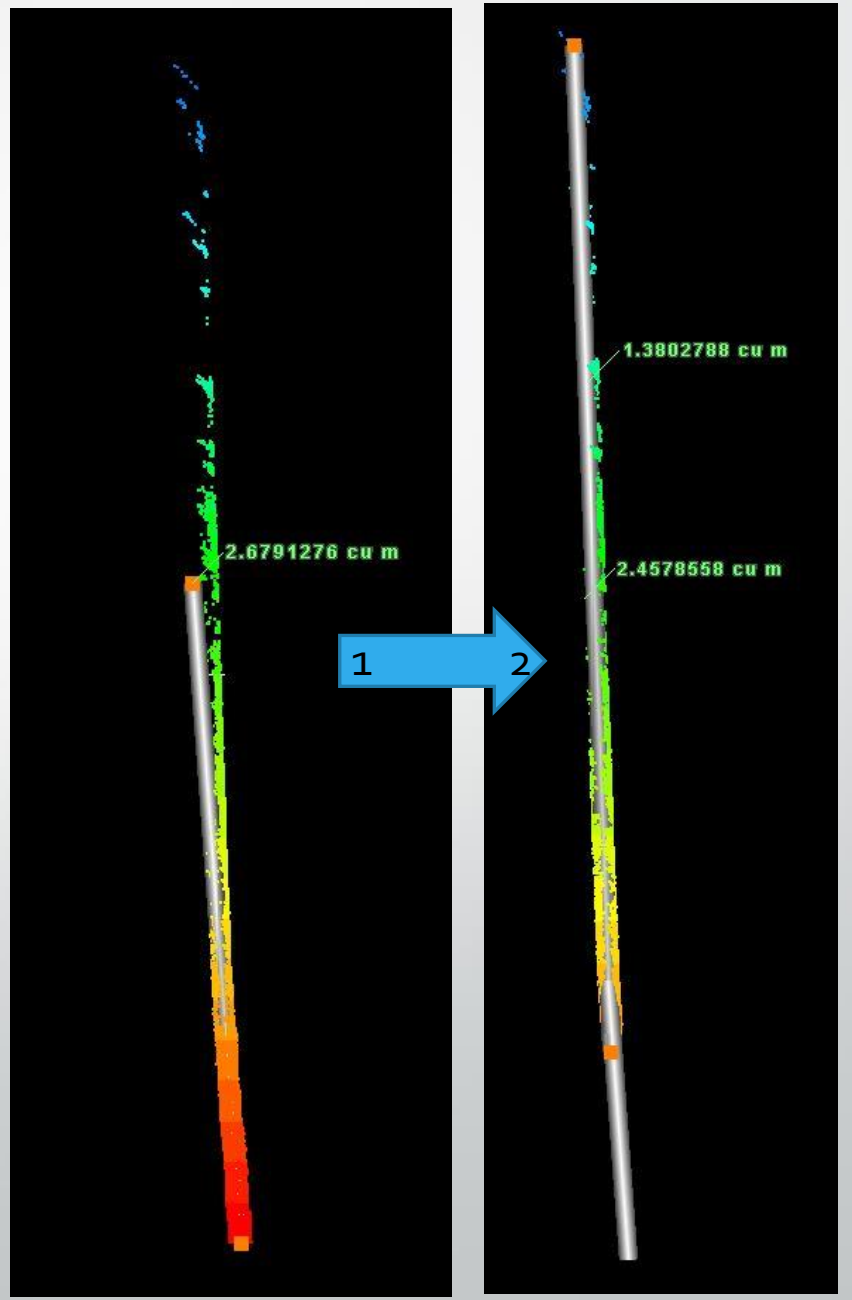




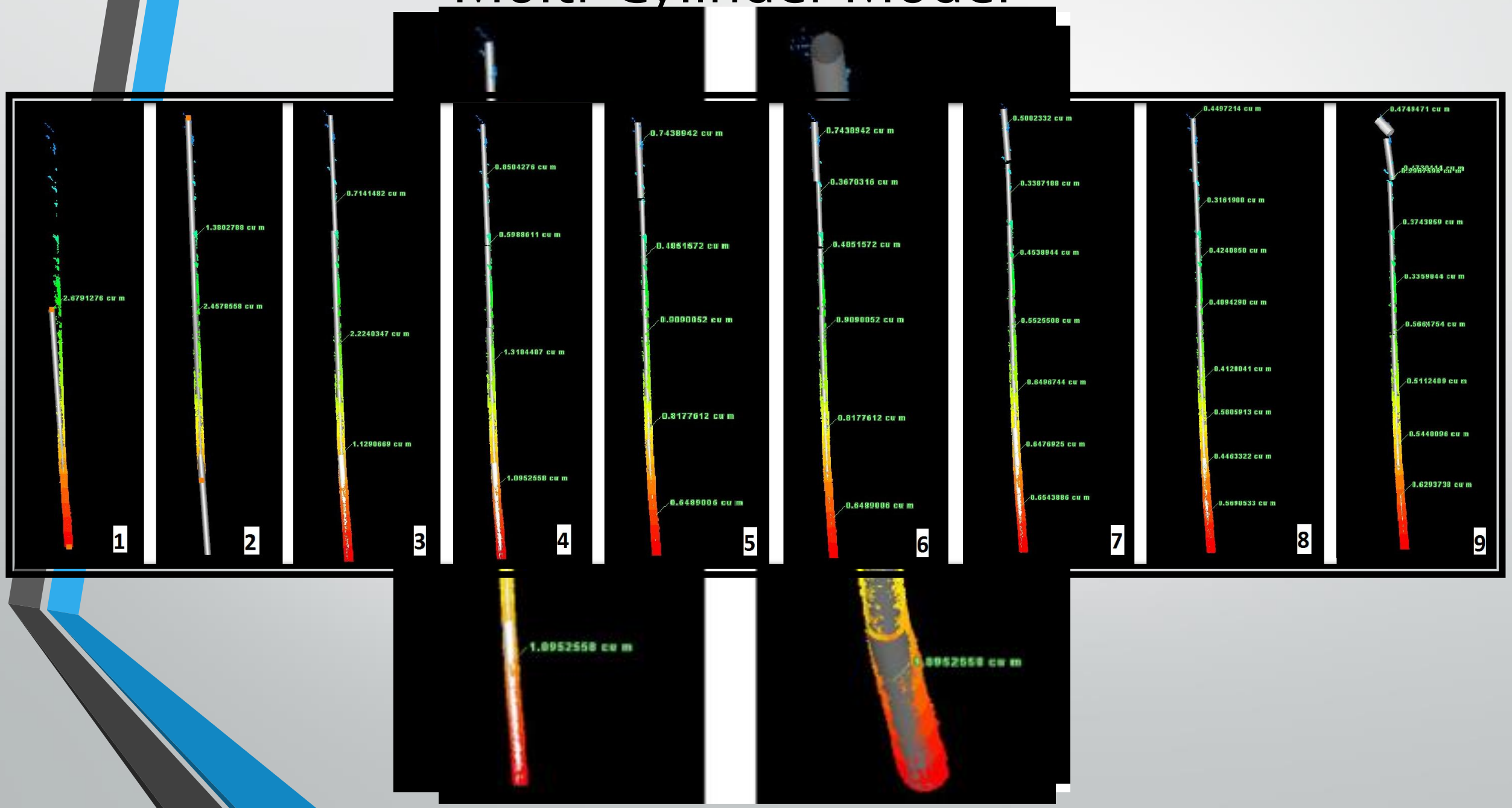


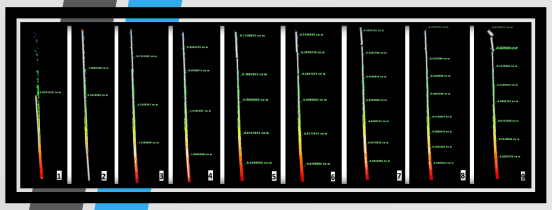
Two Cylinder Model



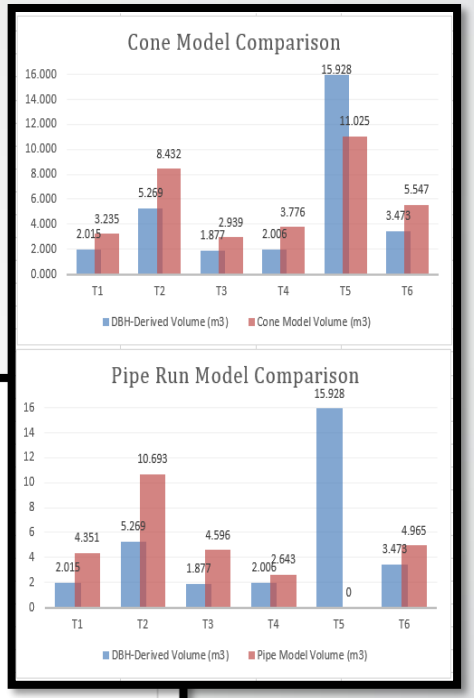


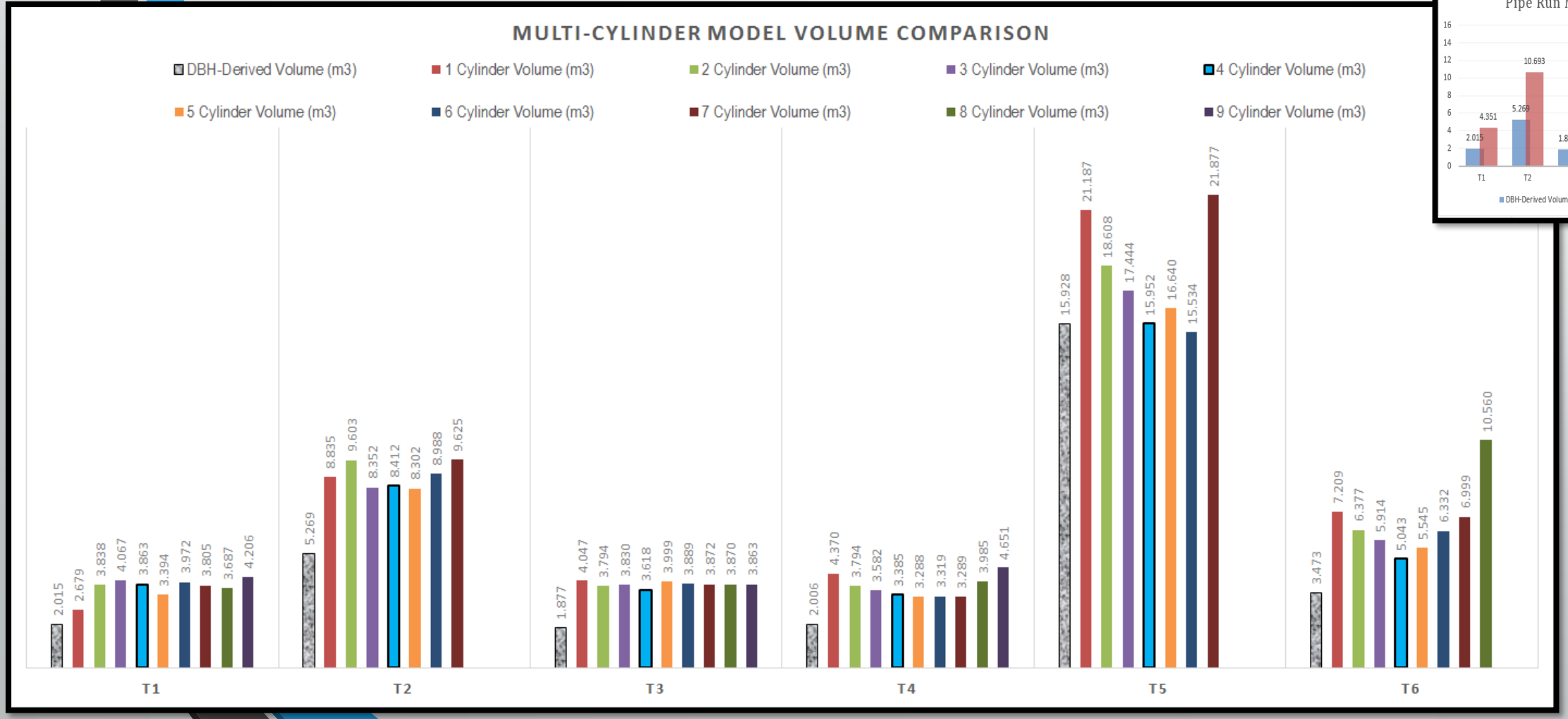
Multi-Cylinder Model



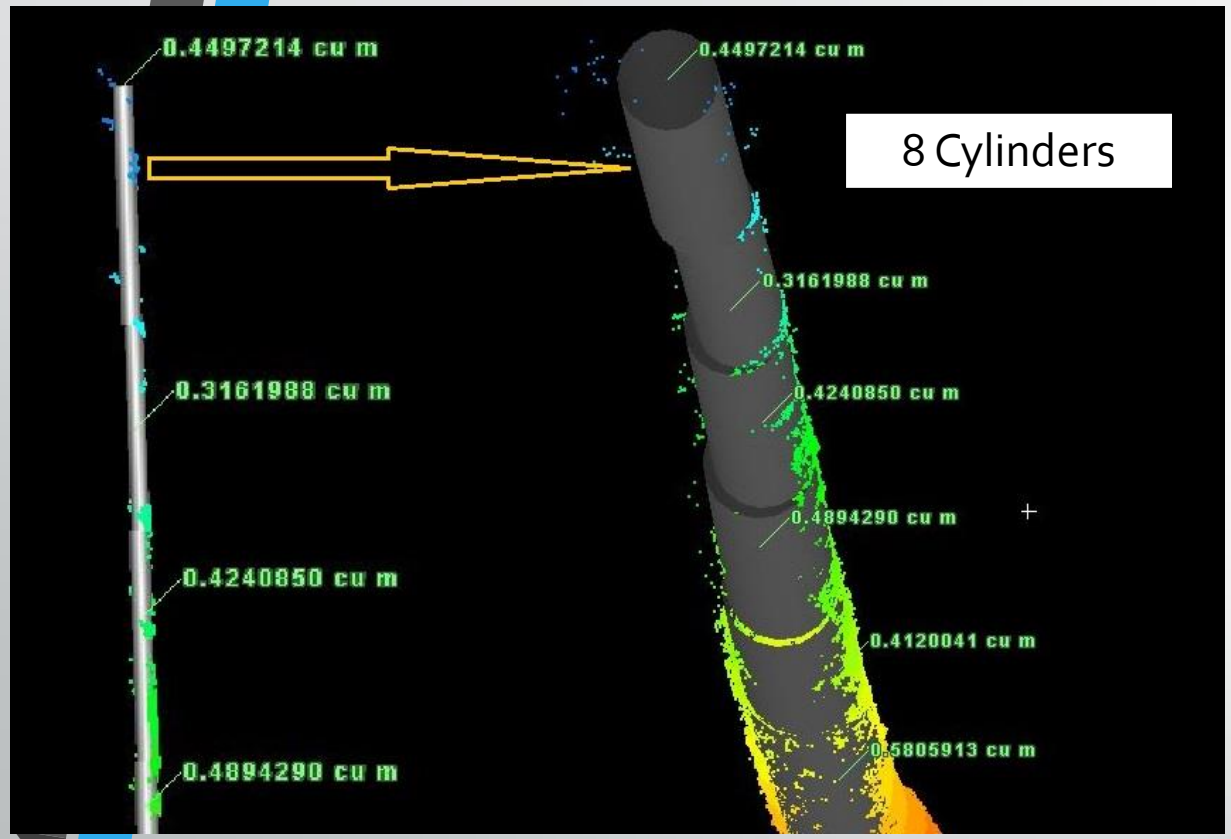


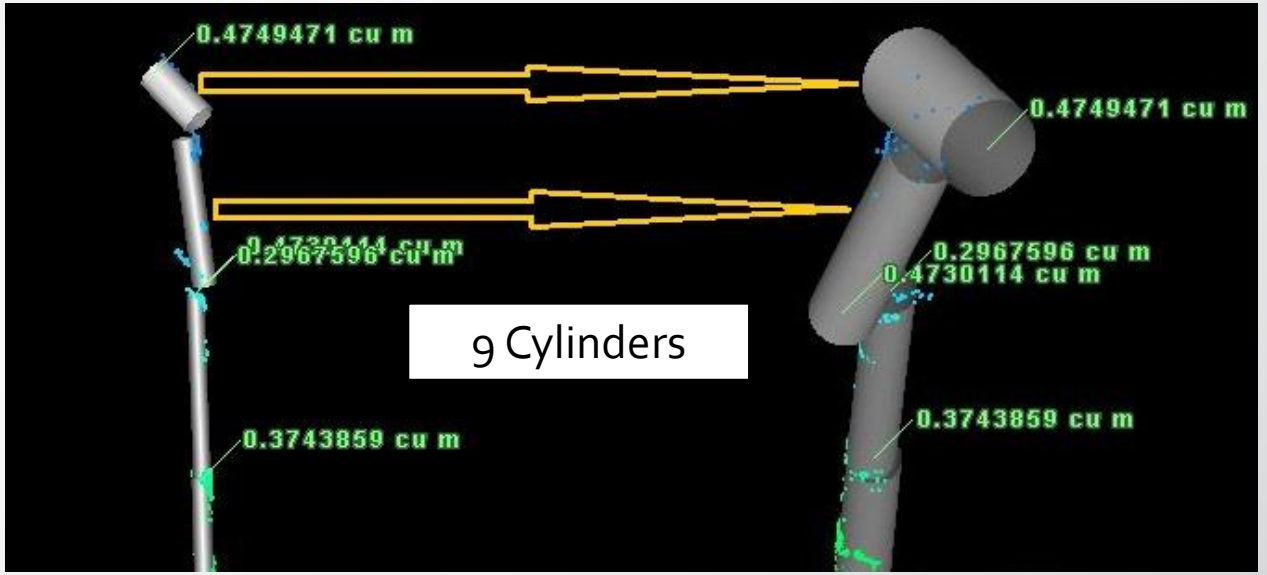
Multi-Cylinder Comparison

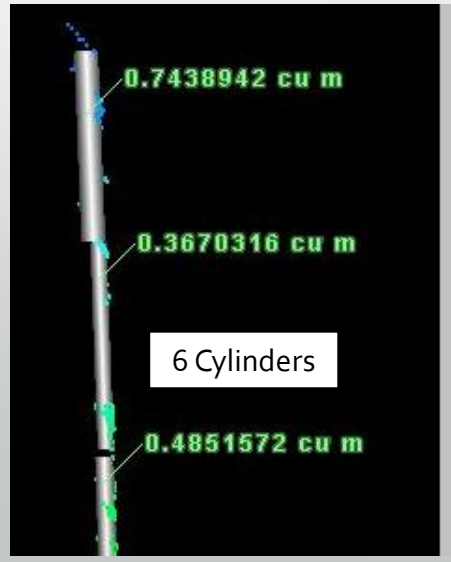


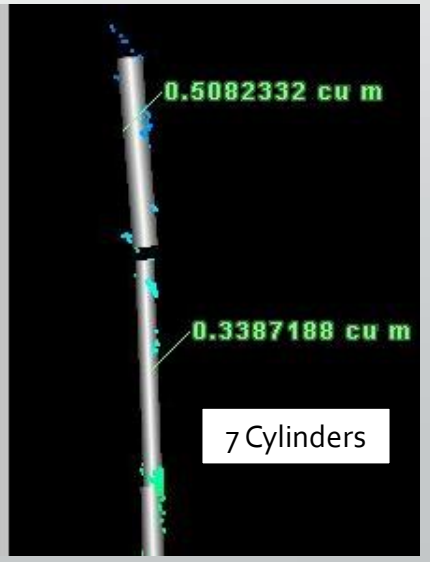


Bad Fit!


0.4497214 cu m
0.4497214 cu m
8 Cylinders
0.3161988 cu m
0.3161988 cu m
0.4240850 cu m
0.4894290 cu m
0.4240850 cu m
0.4120041 cu m
0.4894290 cu m
0.5805913 cu m

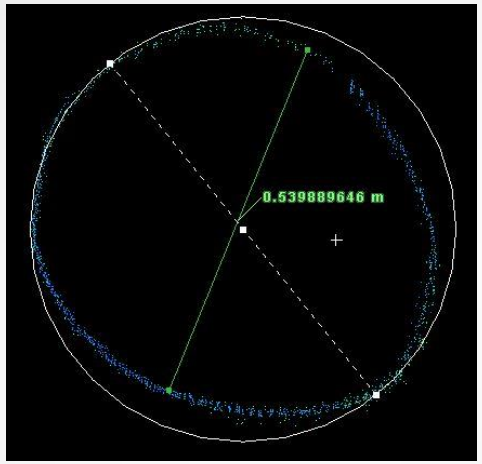

0.4749471 cu m
0.4749471 cu m
0.2967596 cu m
0.2967596 cu m
0.4730114 cu m
9 Cylinders
0.3743859 cu m
0.3743859 cu m

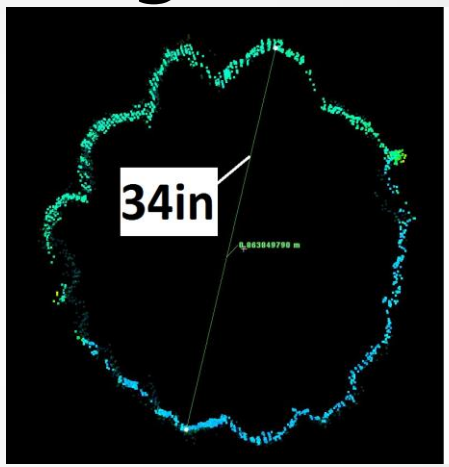

0.7438942 cu m
0.3670316 cu m
6 Cylinders
0.4851572 cu m

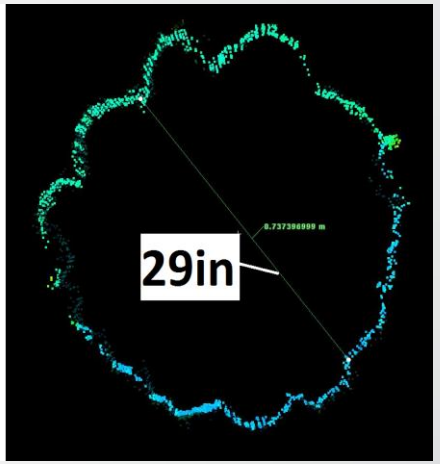

0.5082332 cu m
0.3387188 cu m
7 Cylinders

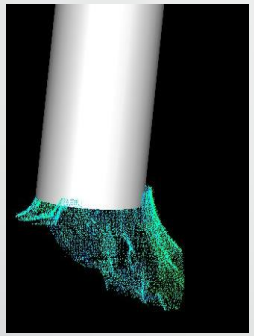
Issues with Modeling

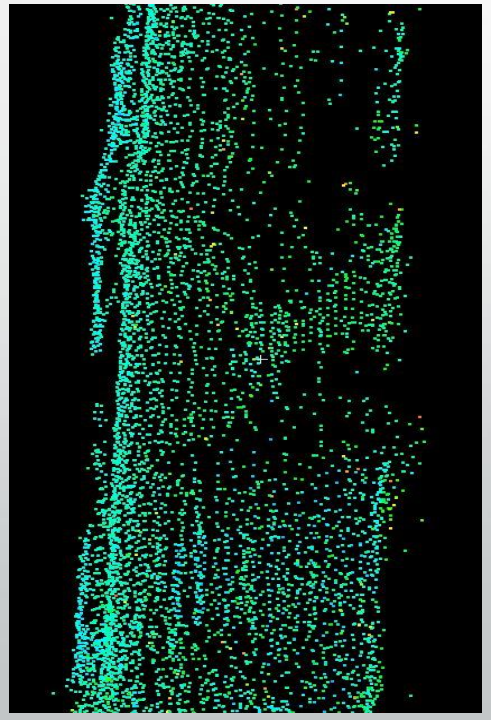
- Accuracy of volume reference?
- Tree Imperfections
  - Circularity
  - Bark
- Hill Slant
- Faster than Fieldwork?
- Loud Bark = Lot of Noise

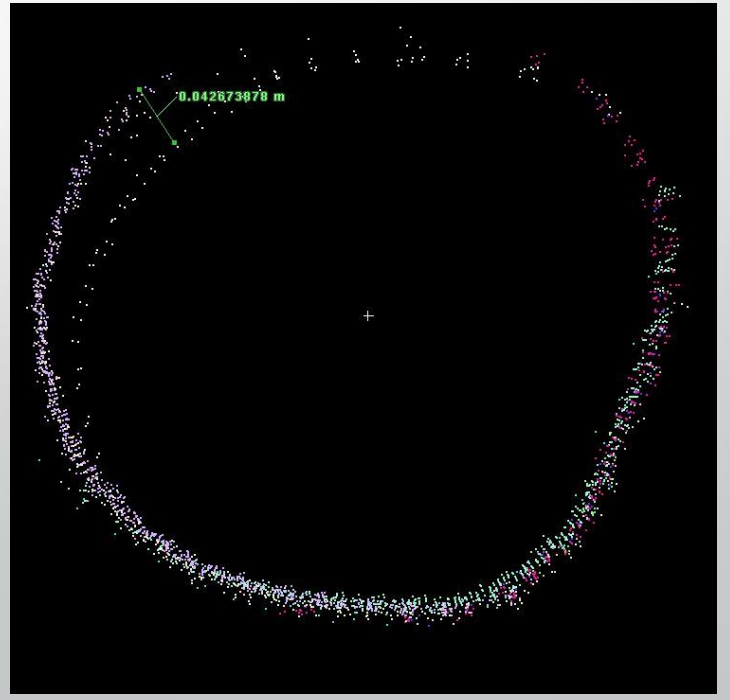




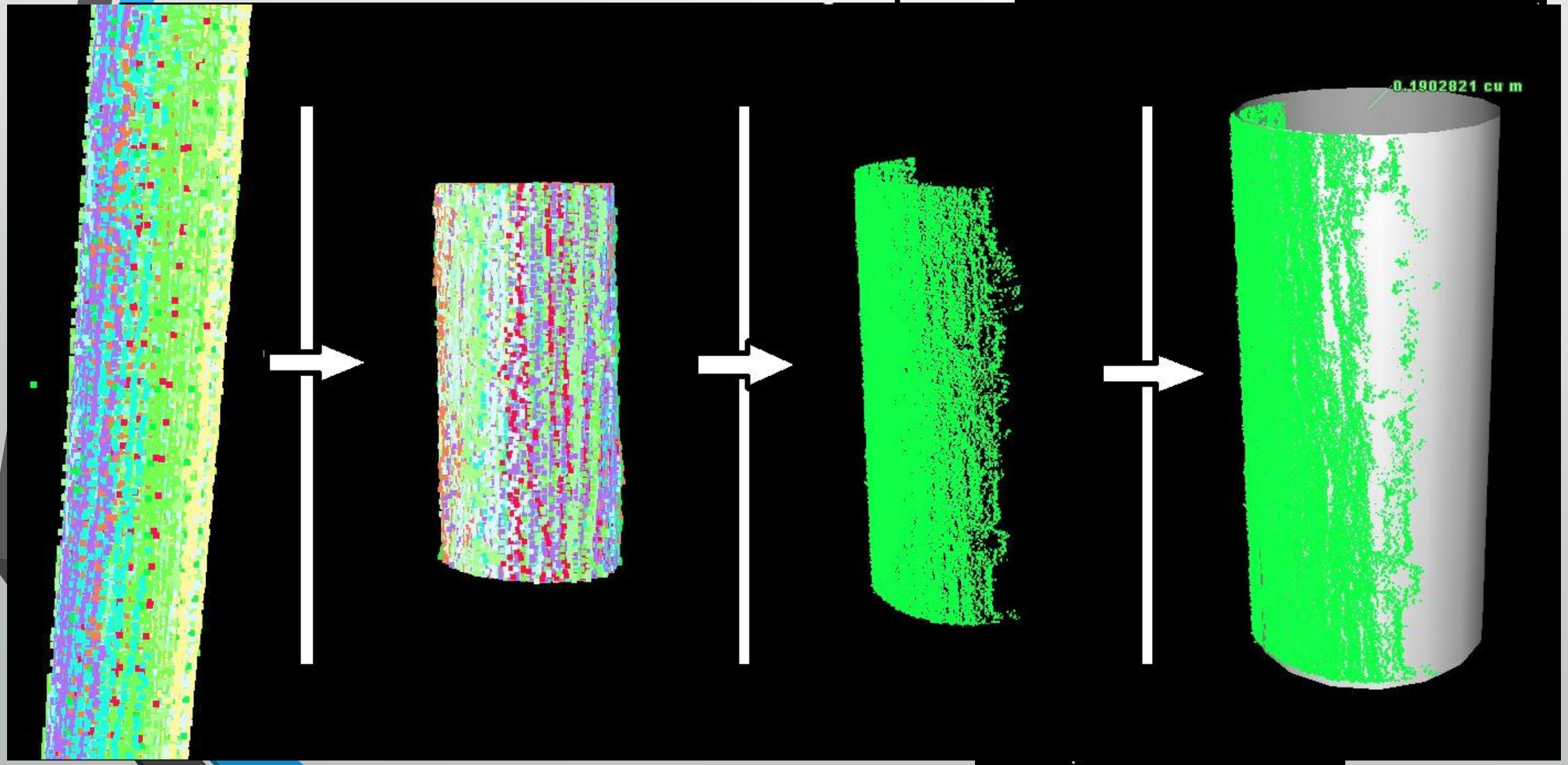




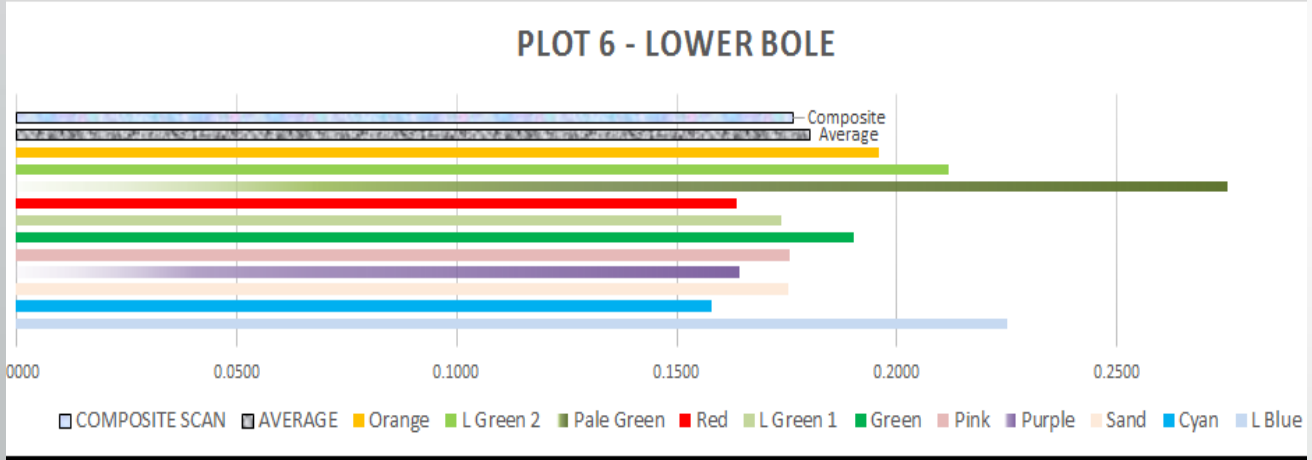


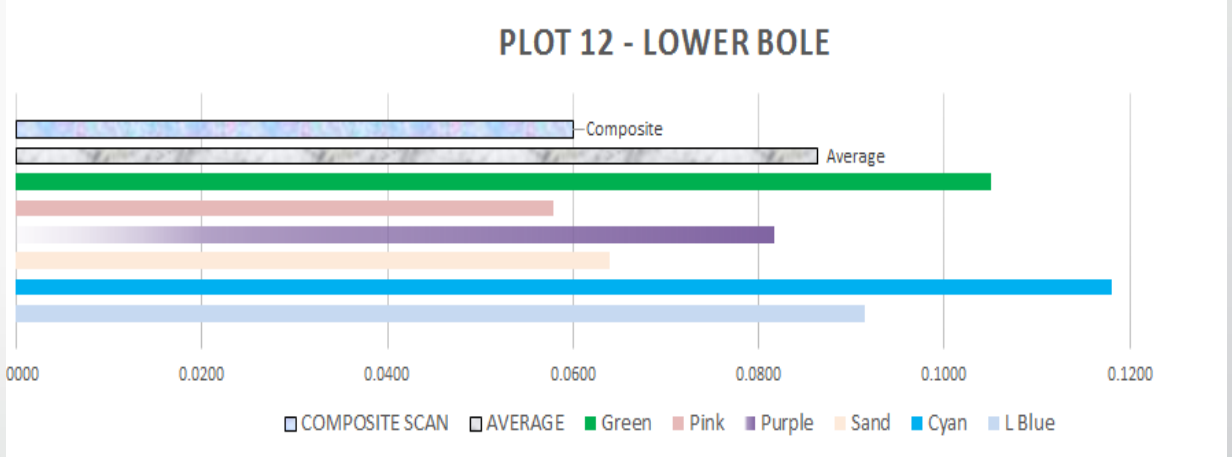


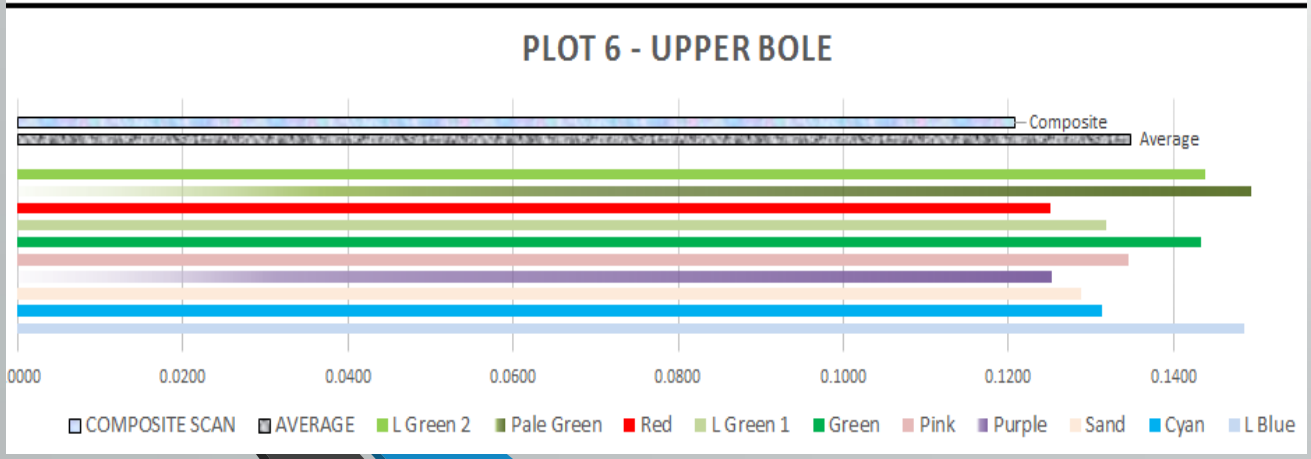
Model Inputs

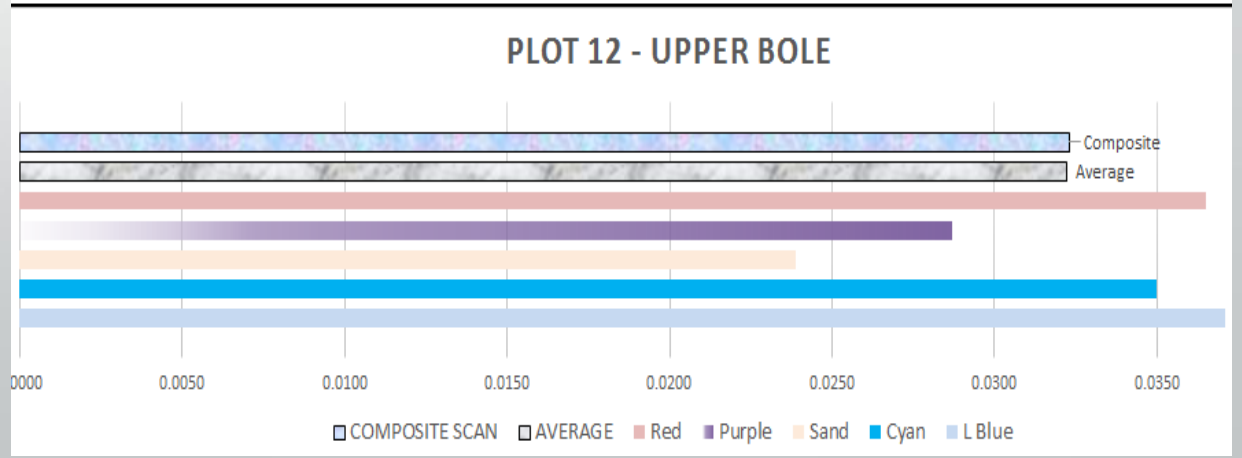


Plot / Portion	Cylindar Model Volume by Scan (cubic meter)													
6 (High Coverage)	L Blue	Cyan	Sand	Purple	Pink	Green	L Green 1	Red	Pale Green	L Green 2	Orange	AVERAGE	ST DEV	COMPOSITE SCAN
Lower Bole	0.2250	0.1578	0.1754	0.1644	0.1756	0.1903	0.1736	0.1635	0.2750	0.2118	0.1960	0.1803	0.0329	0.1766
Upper Bole	0.1486	0.1313	0.1288	0.1253	0.1346	0.1434	0.1318	0.1251	0.1495	0.1439	N/A	0.1348	0.0083	0.1208
12 (Low Coverage)	L Blue	Cyan	Sand	Purple	Pink	Green	L Green 1	Red	Pale Green	L Green 2	Orange	AVERAGE	ST DEV	COMPOSITE SCAN
Lower Bole	0.0915	0.1180	0.0640	0.0817	0.0579	0.1051	N/A	N/A	N/A	N/A	0.0703	0.0864	0.0219	0.0600
Upper Bole	0.0371	0.0350	0.0239	0.0287	N/A	N/A	N/A	0.0365	N/A	N/A	N/A	0.0312	0.0050	0.0323









Thank you