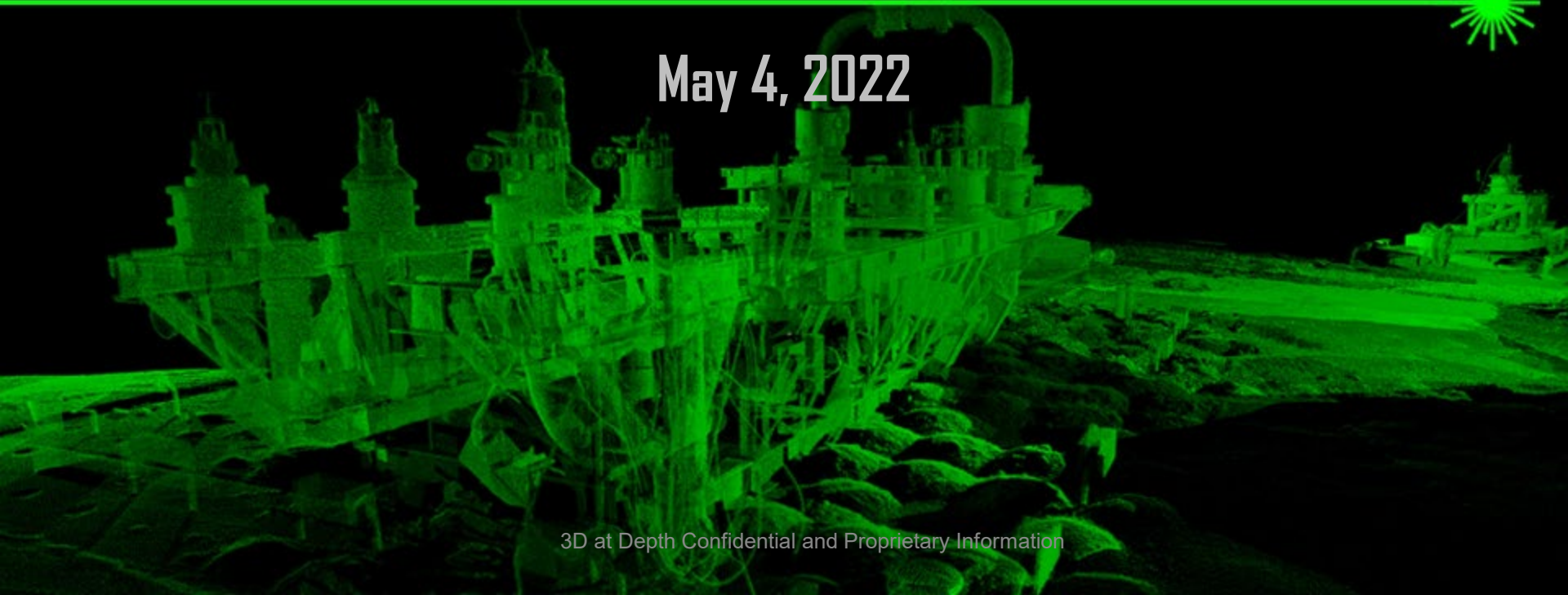
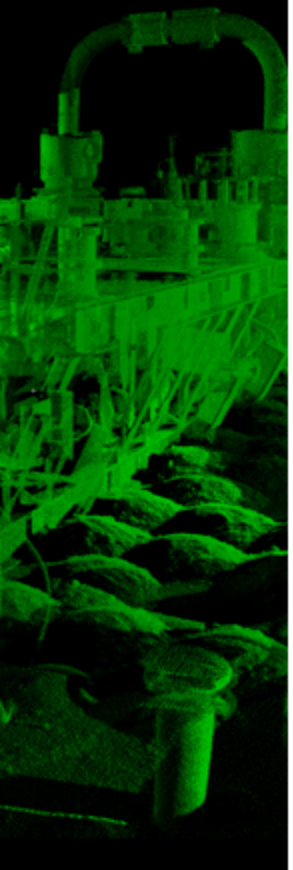
3D at Depth

MBARI WIDE SWATH LIDAR G2 UPDATE

May 4, 2022

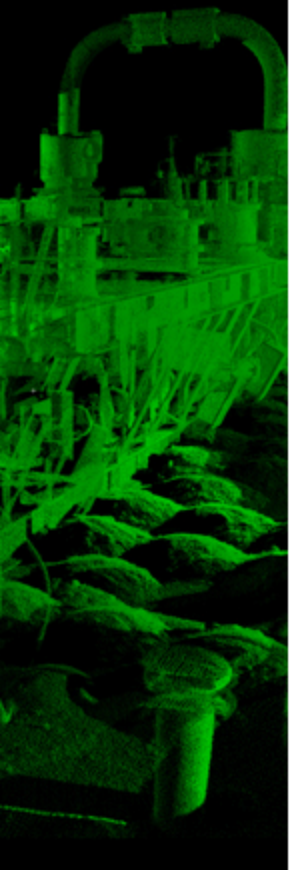


TOPICS



- Proprietary Information
- Flat window design
- LiDAR modeling
  - 3D
  - Temperature
- MBARI input and feedback

PROPRIETARY INFORMATION



NOTICE: This presentation contains 3D at Depth Confidential and Proprietary information.

In order to better describe some of the design decisions and options, this presentation contains details about the internal architecture and design decisions for 3D at Depth's current 3D laser scanning products. Therefore, this information should ONLY be shared with MBARI employees who need to read and evaluate the presentation. 3D at Depth appreciates our customers taking the appropriate safety measures when distributing this information internally.

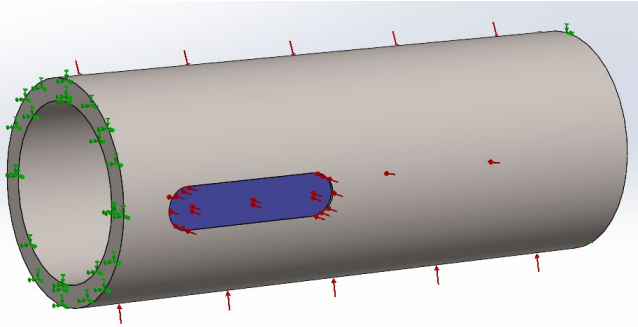
WINDOWS, MOTORS, MIRRORS

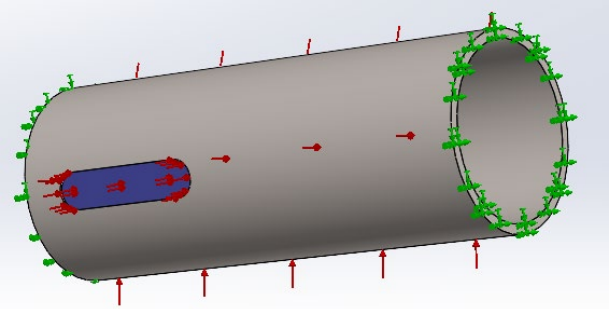
CURVED WINDOW

- Normal flat window vendor unable to provide the curved window
- Normal AR coating vendor unable to AR coat the new window
- Found a new vendor, but some risk
- Found a full mirror plus motor solution integrated solution off-the-shelf
- 95% confidence in fit. Will need to perform detailed opto-mechanical design for 100% certainty – next phase

FLAT WINDOW VERSION ANALYSIS

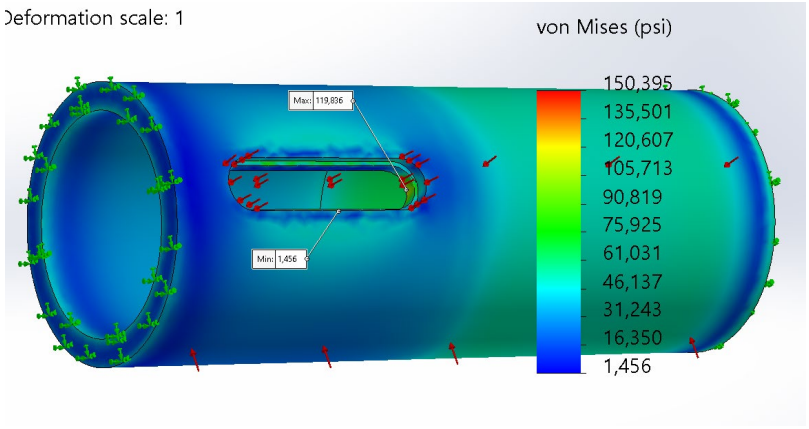
- Window length ~5”
- Window thickness ~6mm

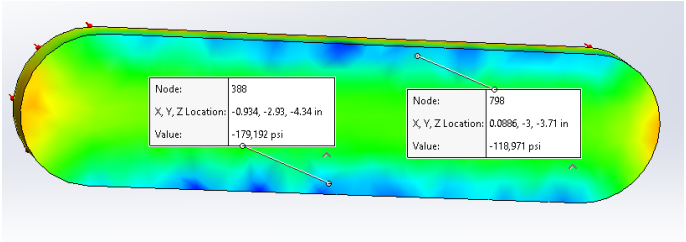




FLAT WINDOW ANALYSIS

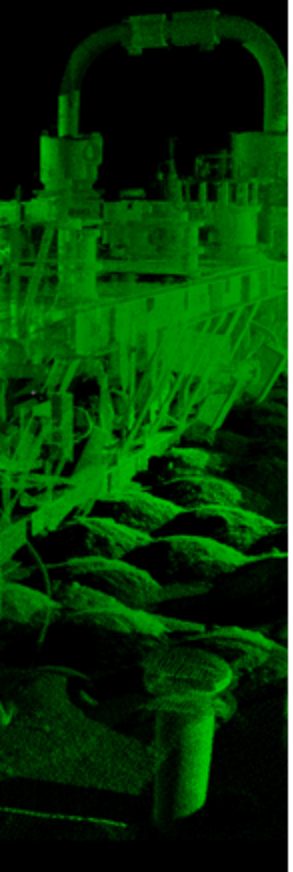
System	Applied Pressure	Window Stress 3rd Principal (Compression)
Flat window	6,723 psi	160 - 180 ksi
Curved window	6,723 psi	80 – 90 ksi





Blue areas indicate higher compression

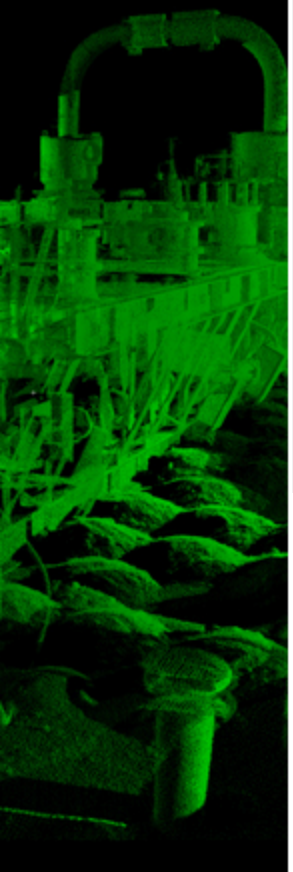
SUMMARY OF FLAT WINDOW

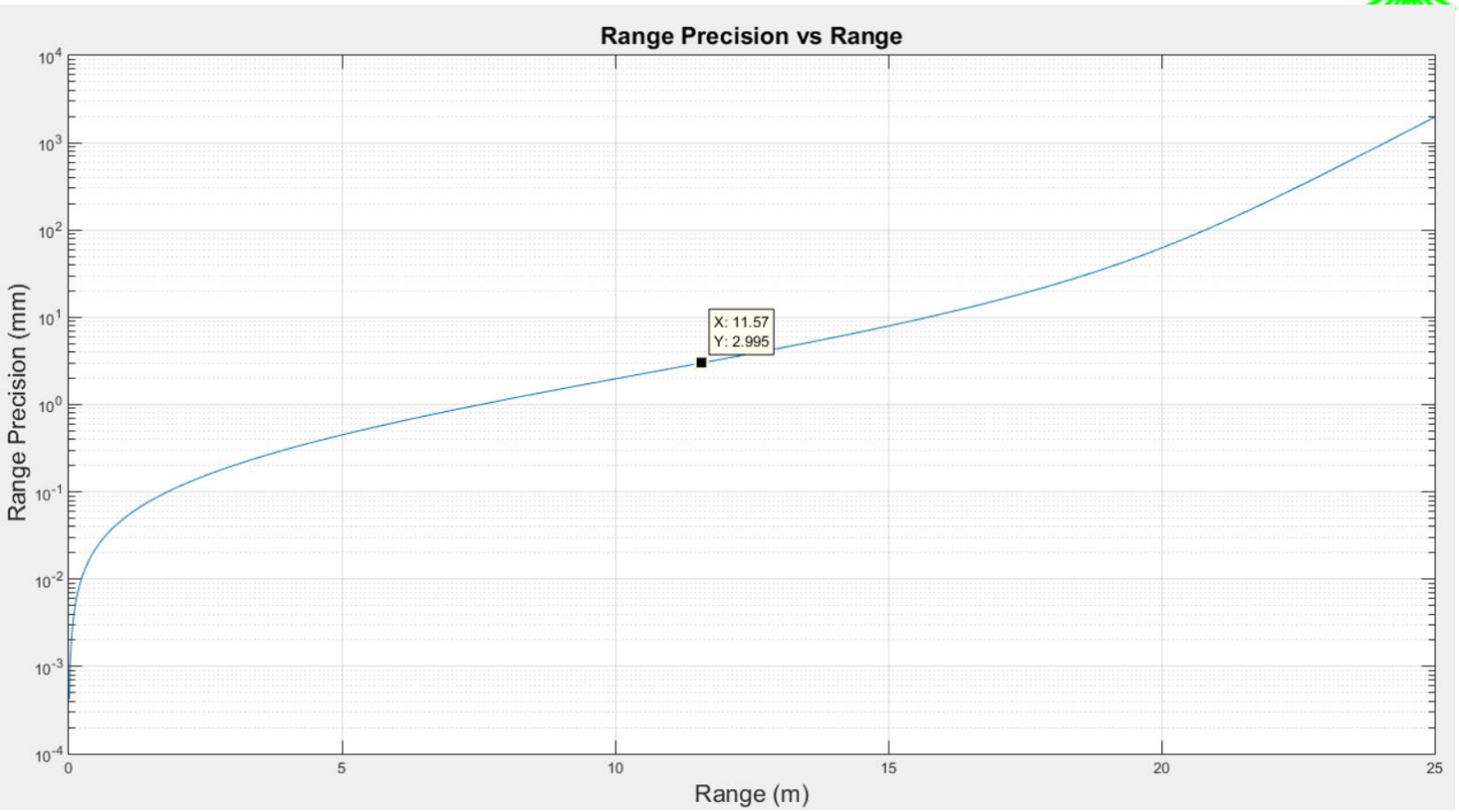


- High compression at end of the curved window shifted to the flat window's edges
- Window deflection was not improved
- Flat window design did not improve mechanical performance

LIDAR MODELING

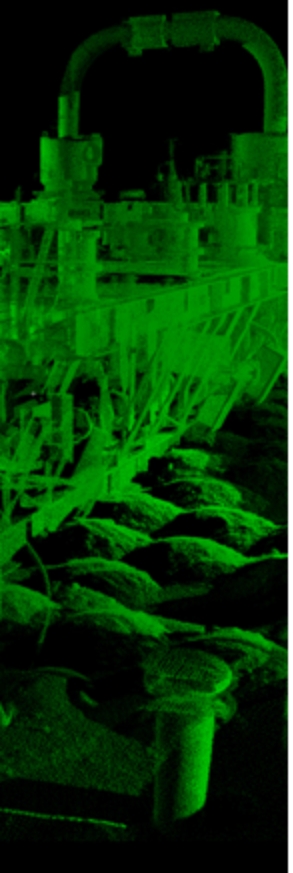
LIDAR MODELING – WISSL GEN 1

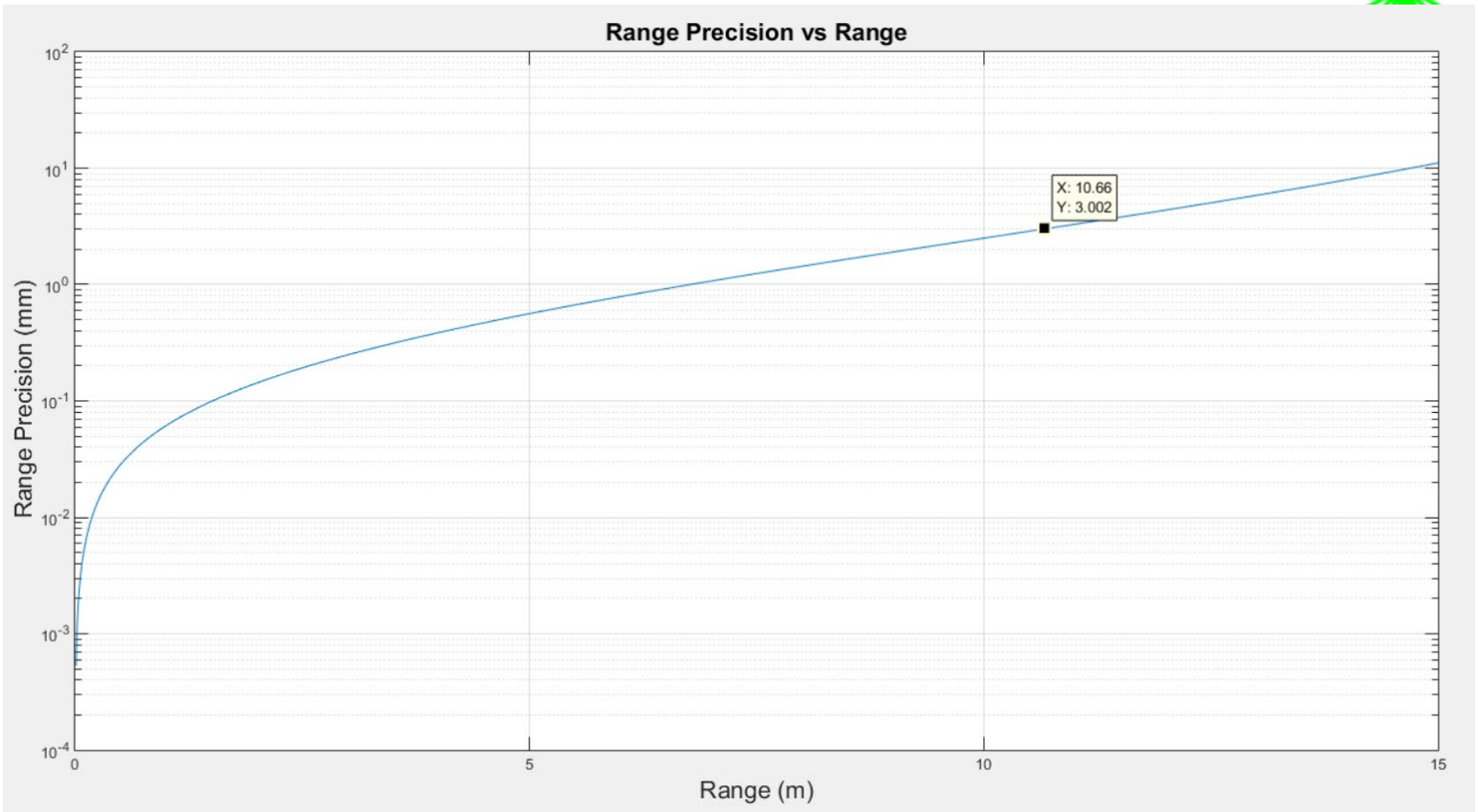




- Goal = 7m NADIR, 11m LOS range
- Water model: Jerlov Type III
- Target model: Lambertian, 10% reflectivity, normal incidence
- Background light: a ‘typical’ Kongsberg ROV light illumination and color temp
- Detector Gain setting: High

LIDAR MODELING – WISSL GEN 1





- 50° incidence angle with Lambertian target decreases range below 11m LOS goal
- Water model: Jerlov Type III
- Target model: Lambertian, 10% reflectivity, 50° incidence – below 11m goal
- Background light: a ‘typical’ Kongsberg ROV light illumination and color temp
- Detector Gain setting: High

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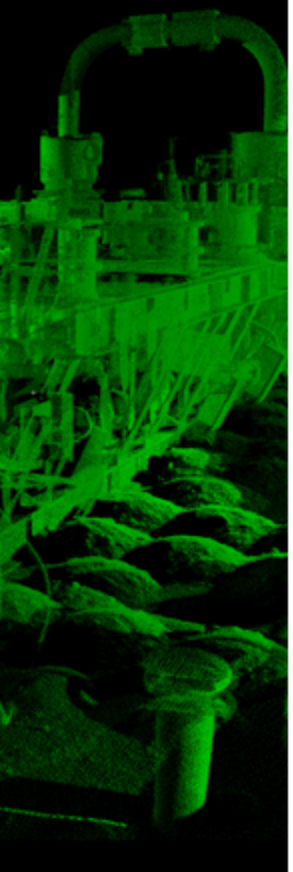
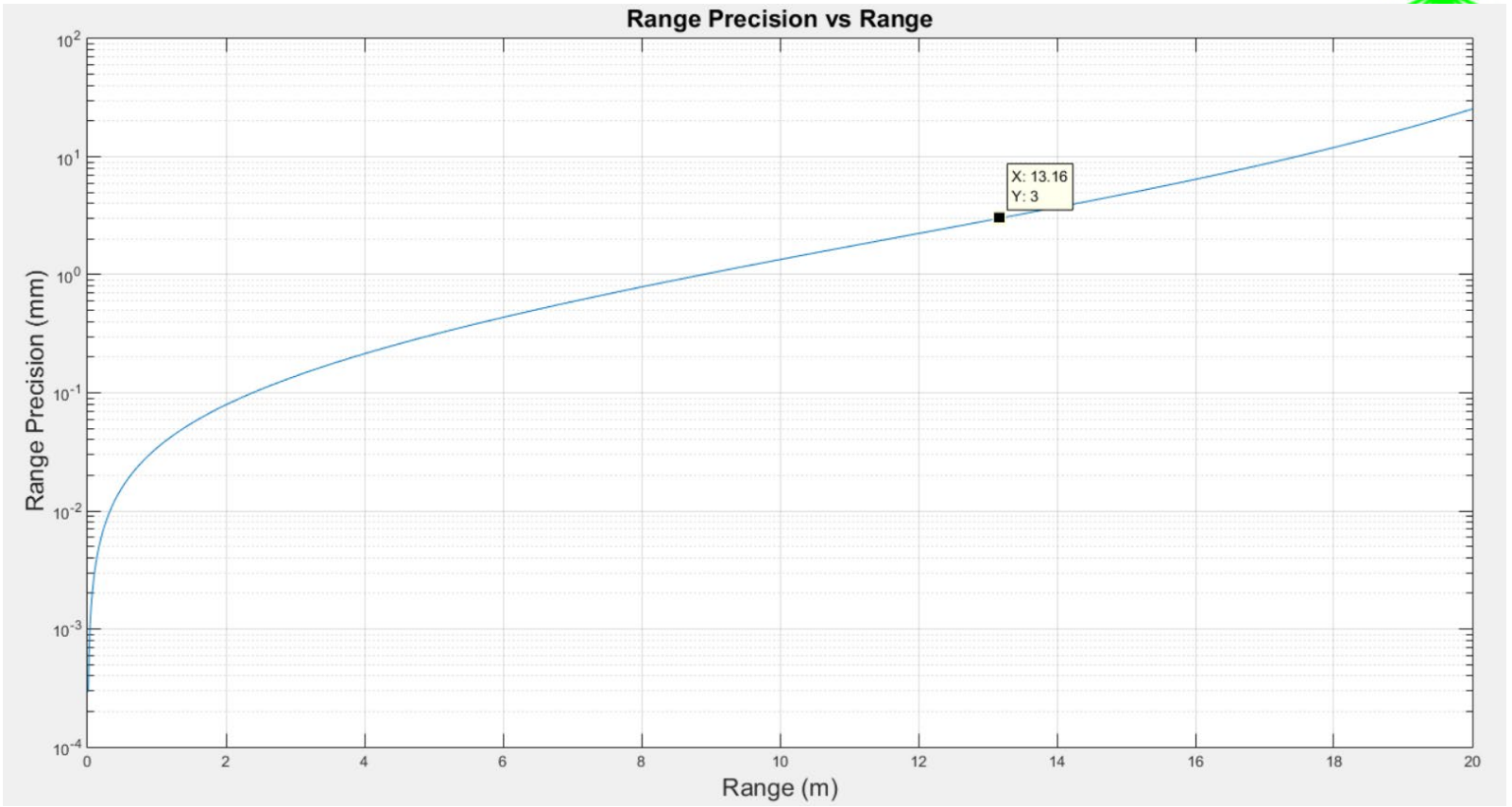
LIDAR MODELING – WISSL GEN 2



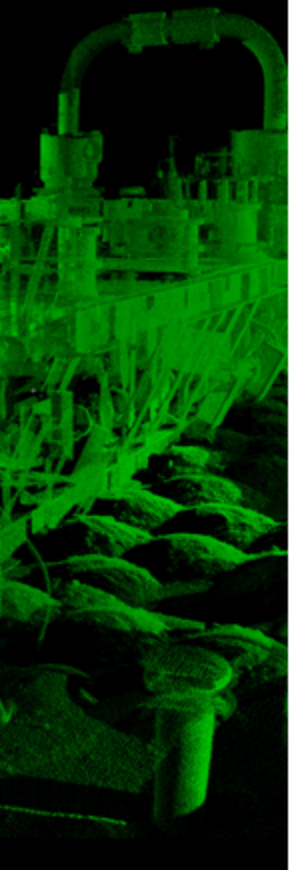


- 13m LOS range. ~ 3x increase in clear aperture area. ~ 30% increase in pulse energy
- Water model: Jerlov Type III
- Target model: Lambertian, 10% reflectivity, 50° incidence
- Background light: a ‘typical’ Kongsberg ROV light illumination and color temp
- Detector Gain setting: High

LIDAR MODELING – TEMPERATURE

Use WiSSL Gen 2 design from above, estimate ~ 3m LOS range (~2m NADIR)

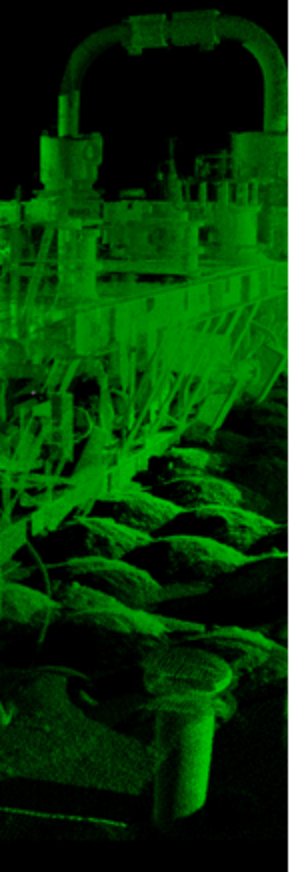
Range NADIR / Max LOS (50°)	Aperture Area	Laser Energy
2m / 3.1m	1	1
5m / 7.8m	~59x	1
7m / 10.9m	~650x	1



Range NADIR / Max LOS (50°)	Aperture Area	Laser Energy
2m / 3.1m	1	1
5m / 7.8m	1	~60x, ~6kHz laser
7m / 10.9m	1	~600x, 583Hz

Range NADIR / Max LOS (50°)	Aperture Area	Laser Energy
2m / 3.1m	1	1
5m / 7.8m	~6.5x	10x, 35kHz

LIDAR MODELING – TEMPERATURE 3M NADIR



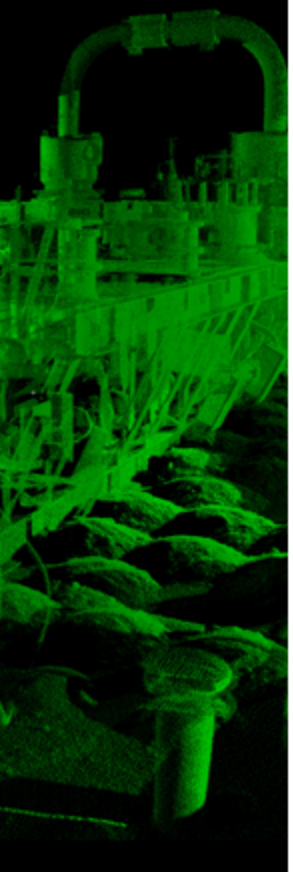
Range NADIR / Max LOS (50°)	Aperture Area	Laser Energy
2m / 3.1m	1	1
3m / 4.67m	~5x	1
3m / 4.67m	1	~5x, 70kHz
3m / 4.67m	~2.25x* back to custom scanner	~2x, 175kHz
3m / 3.5m (30°) = 60° FOV	~1	~1

Other Options

- Spatial averaging

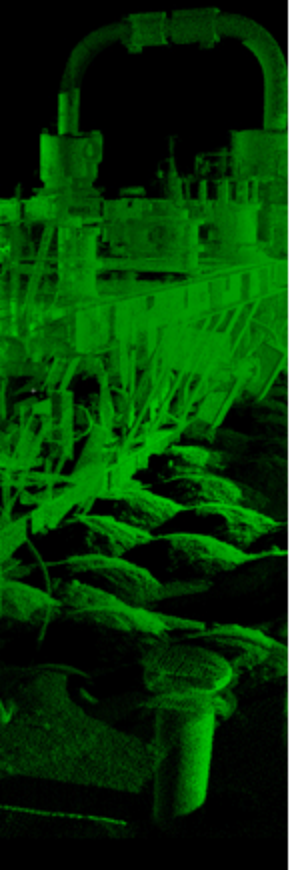
MBARI FEEDBACK

MBARI FEEDBACK FROM APRIL & MAY



- Send all slides to Eric this week.
- Review with Eric (small group) ~ June 13th
- Feasibility study review and concept review morning of June 14th
- 3D at Depth – submit proposal to Dave by July 10th
  - Detailed design – start Jan. 2023
  - Build and FAT at 3D at Depth – estimate
  - Integration / test at MBARI
- Final Phase 1 proposals due July 13th (Dave submits)
- Check Temp capability at NADIR of 3m (4.66m 50deg)
- OK to spatial average. Lateral resolution of 10cm is good.
- Flat window design will not fit as well in tube AUVs

MBARI FEEDBACK FROM MARCH



- Send step file of housing to Eric – Jeremy
- PPS to PTP conversion devices – send to Eric
- Eric send dimensions of MBARI pressure test vessel
- Move ahead with suggest Point Spacing design from slide 5

SW Topics

- Still need to decide 2 or 3 points
- Must be able to run on only 100Mb/s in case of network or vehicle issues
- Like the option to reduce number of returns or range bit resolution to reduce bandwidth requirements.
- Prefer to flag data as opposed to delete data. Can create our own definitions
- Add in the SW document that SL4 is Linux but RTV and 3D Collect are Windows based

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