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DYNAMIC POSITIONING CONFERENCE
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SENSORS

**Impact of Reduced Visibility Conditions on
Laser-Based DP Sensors**

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Guidance Marine



Impact of reduced visibility conditions on laser-based DP sensors



2014 MTS DP Conference


- An old wives tale

*Laser based sensors do not
work in bad weather.*

- A rule of thumb?

*If you can see it, the laser can
see it ...*

- Old methods using phase modulation
 - Backscatter mixes with the measurement and degrades the signal.
- Pulsed lasers
 - Rejection of backscatter
 - Attenuation is the criteria for signal loss

- Experimental verification – how to measure fog.
 - Meteorological
 - Observable
 - Range
- 
- MOR – via forward scatter measurement

- Experimental validation – Controlled and instrumented area
- Enclosed area
- Laser based DP sensor
- Selection of targets

Target	Range
0.85m Cylinder	57.0m
Prism cluster (8 prisms)	56.7m
0.85m Cylinder	32.8m

- Experimental validation – A source of fog



- Experimental validation – reducing visibility to 40m



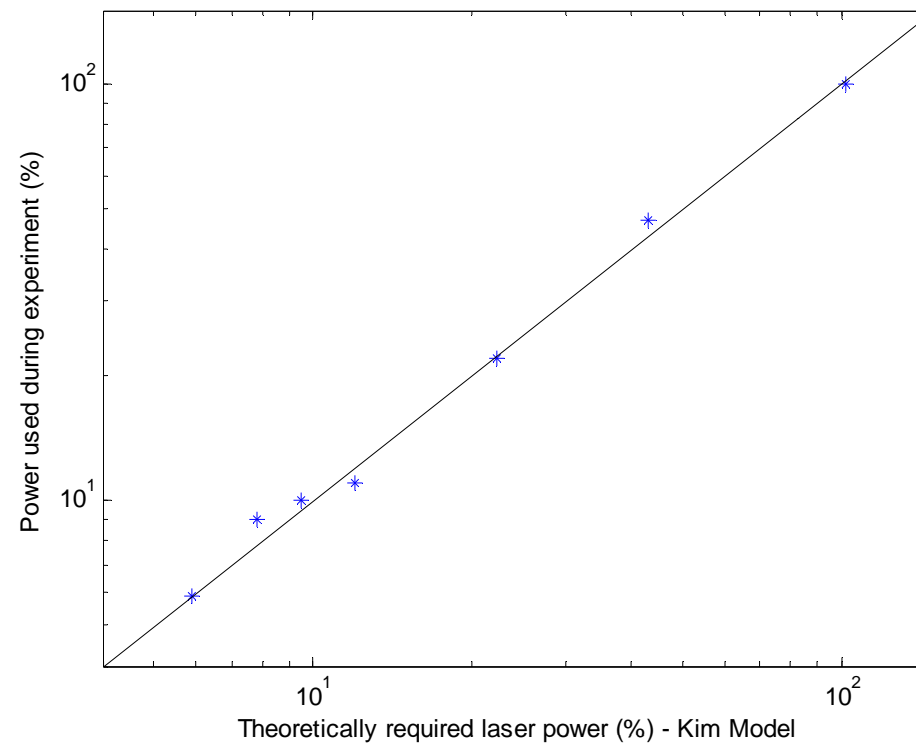
- Experimental validation – Visibility down to 14m



- Experimental validation – results

Visibility	Laser power	Returned signal intensity		
		Near cylinder	Far cylinder	Prism
20m	100%	94%	-	45%
25m	47%	90%	-	41%
31m	22%	92%	6%	72%
40m	11%	92%	7%	80%
45m	10%	90%	7%	85%
50m	9%	90%	8%	90%
60m	5.9%	85%	6%	80%

- Experimental validation – standard models



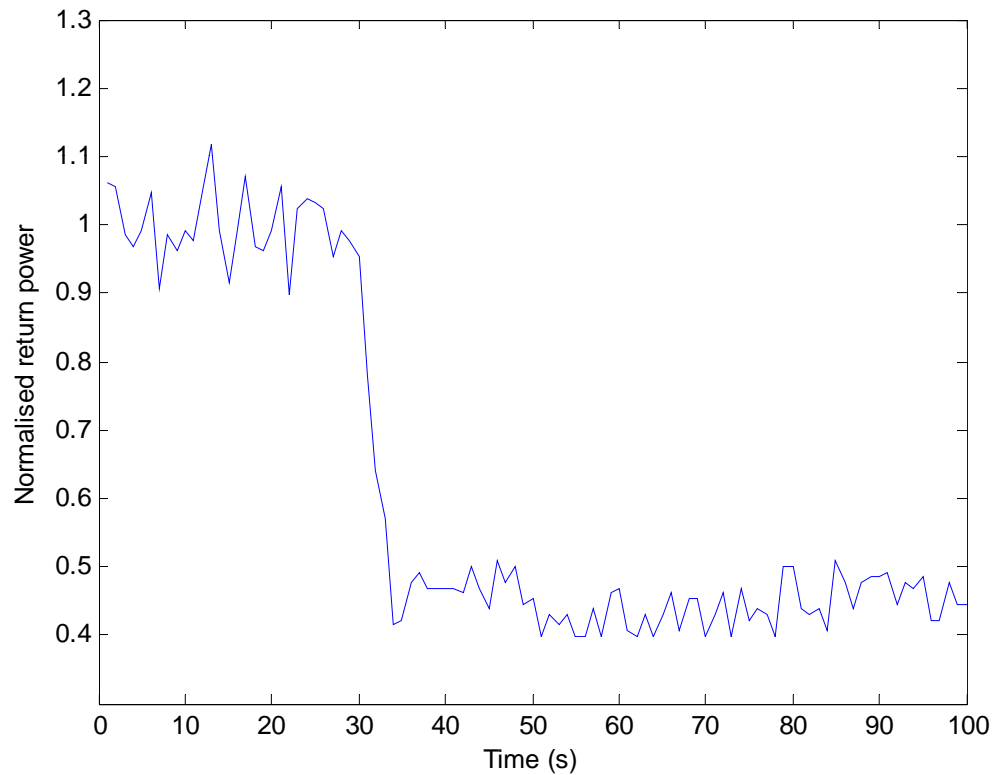
- Performance prediction
- Using the attenuation of the fog models to predict the signal intensities is valid.
- Any other effects of relevance in the real world?



- Theoretical attenuation through rain

Conditions	Rainfall (mm hr-1)	Transmittance of 1.8km path.
Light rain	2.5	0.88
Medium rain	12.5	0.74
Heavy rain	25	0.65
Cloudburst	100	0.38

- Further effects – Wetting optical surfaces



- Combining effects - performance estimation

Environmental conditions	Range to reflector in a sea fog	
	Fully populated (8 prism) cluster	0.85m tape cylinder
Clear, dry	2500m	250m
100m visibility, dry	240m	95m
100m visibility, wet system	133m	54m