

Influence of Rain and Fog on the Received signals of LiDAR and RADAR sensor



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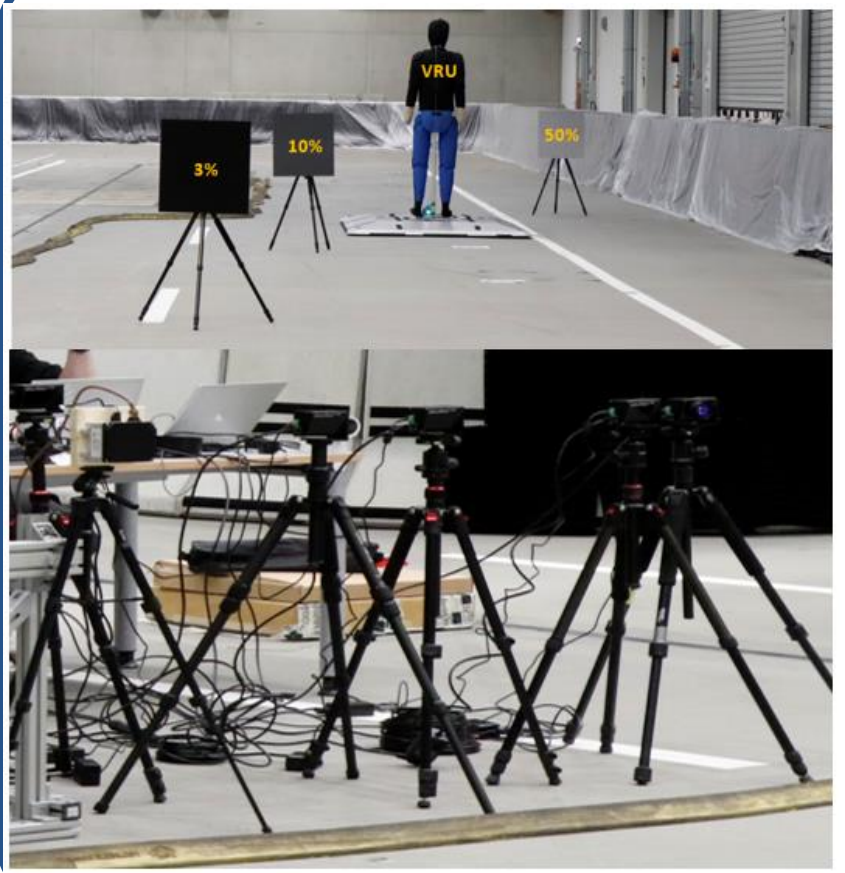


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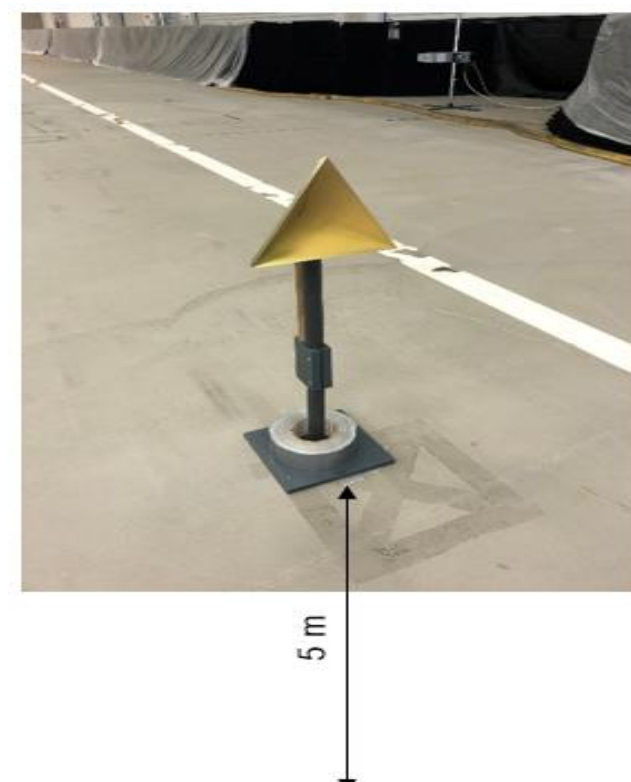
Goal

- Investigation of the LiDAR and RADAR sensors received signals attenuation due to the rain and fog particles
- Clutter detection by the RADAR/LiDAR sensor (false alarm due to backscattering from the rain/fog drops)
- Increase in the noise floor due to the backscattering from the rain/fog drops

Test Setup

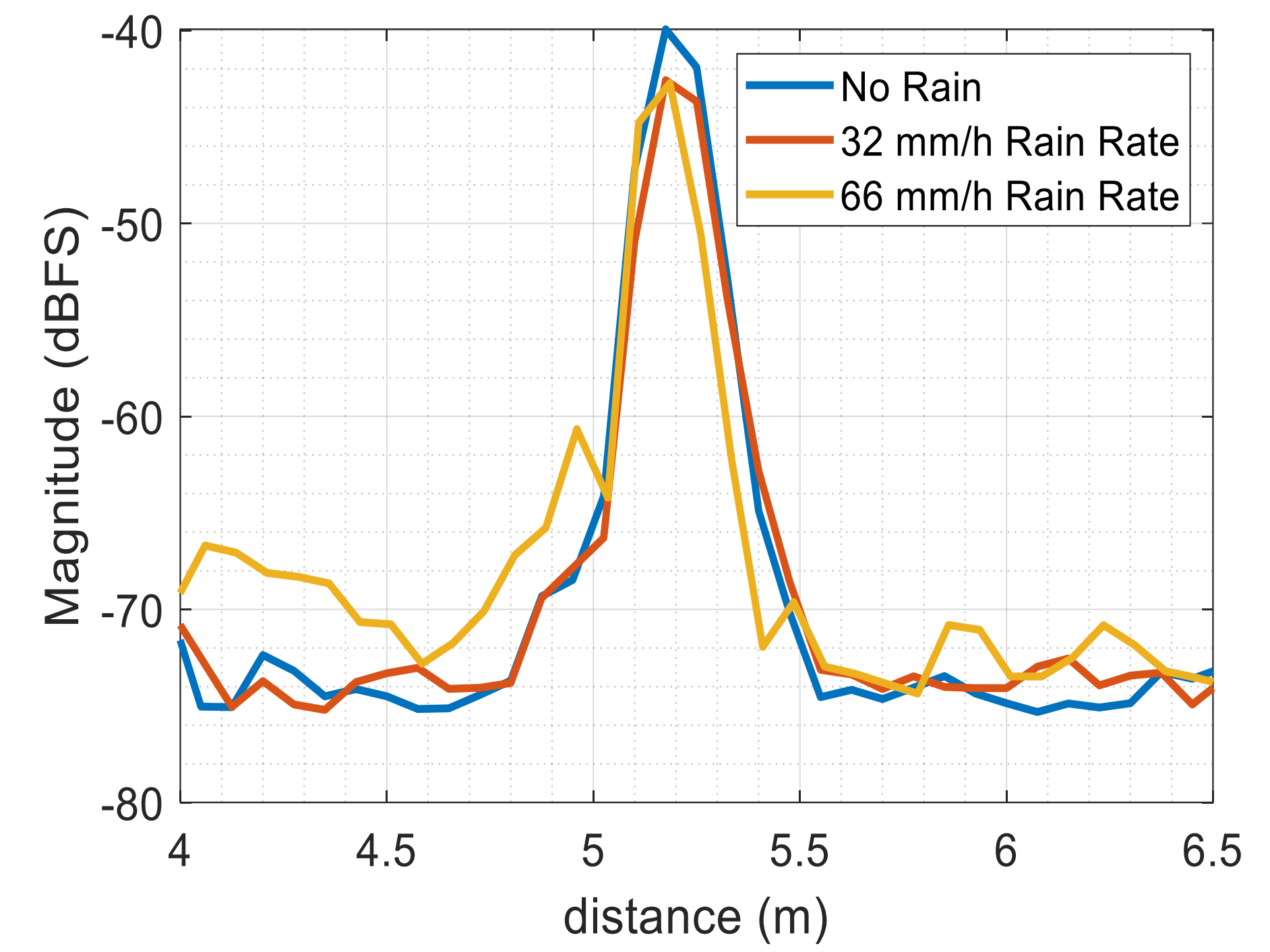


Rain Facility: CARISSMA
Corner reflector: 14dBm²
Lambert Plates: 1m x 1m



Source: Blickfeld, TUIL

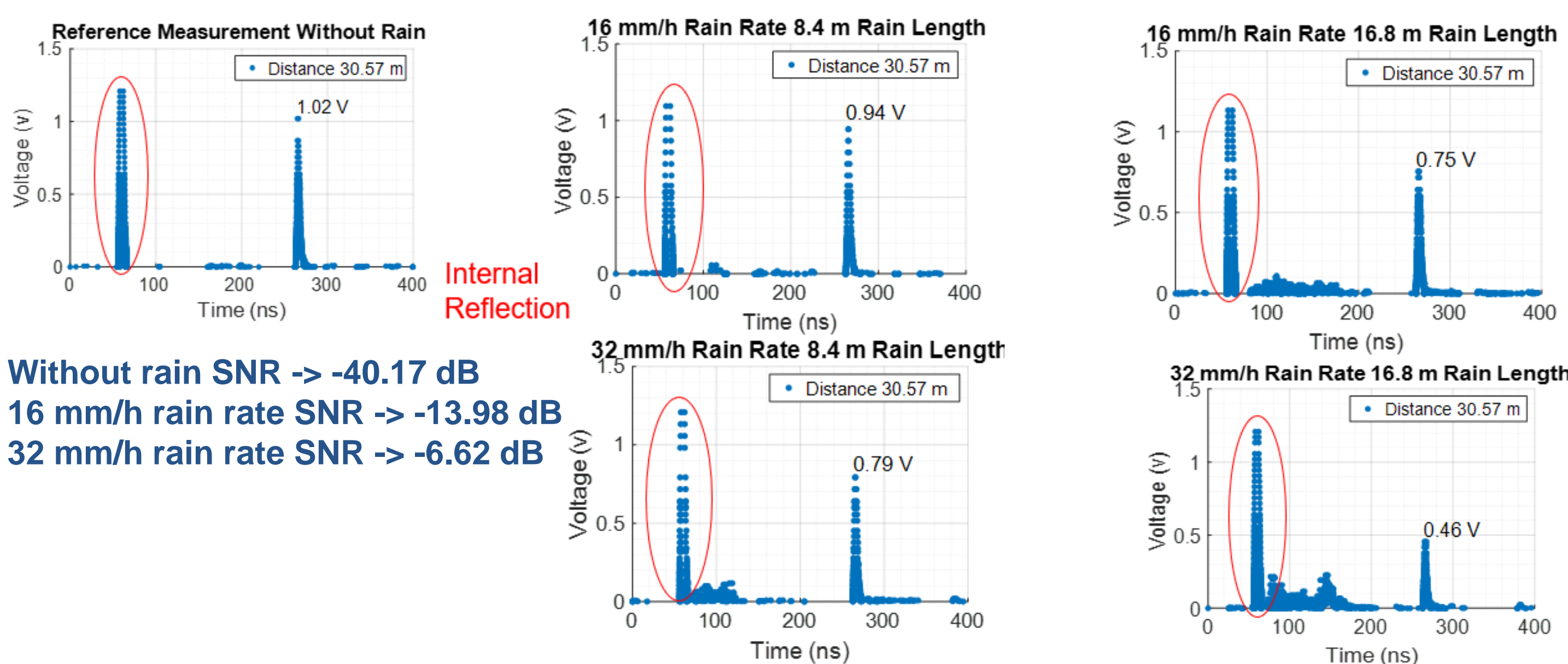
Results for RADAR Sensor



- The corner reflector is placed at 5.15 m
- 32 mm/h attenuation 0.49 dBFS/m
- 66 mm/h attenuation 0.55 dBFS/m
- Without rain SNR -> 33.93 dB
- 16 mm/h rain rate SNR -> 30.97 dB
- 32 mm/h rain rate SNR -> 28.03 dB

Results for LiDAR Sensor

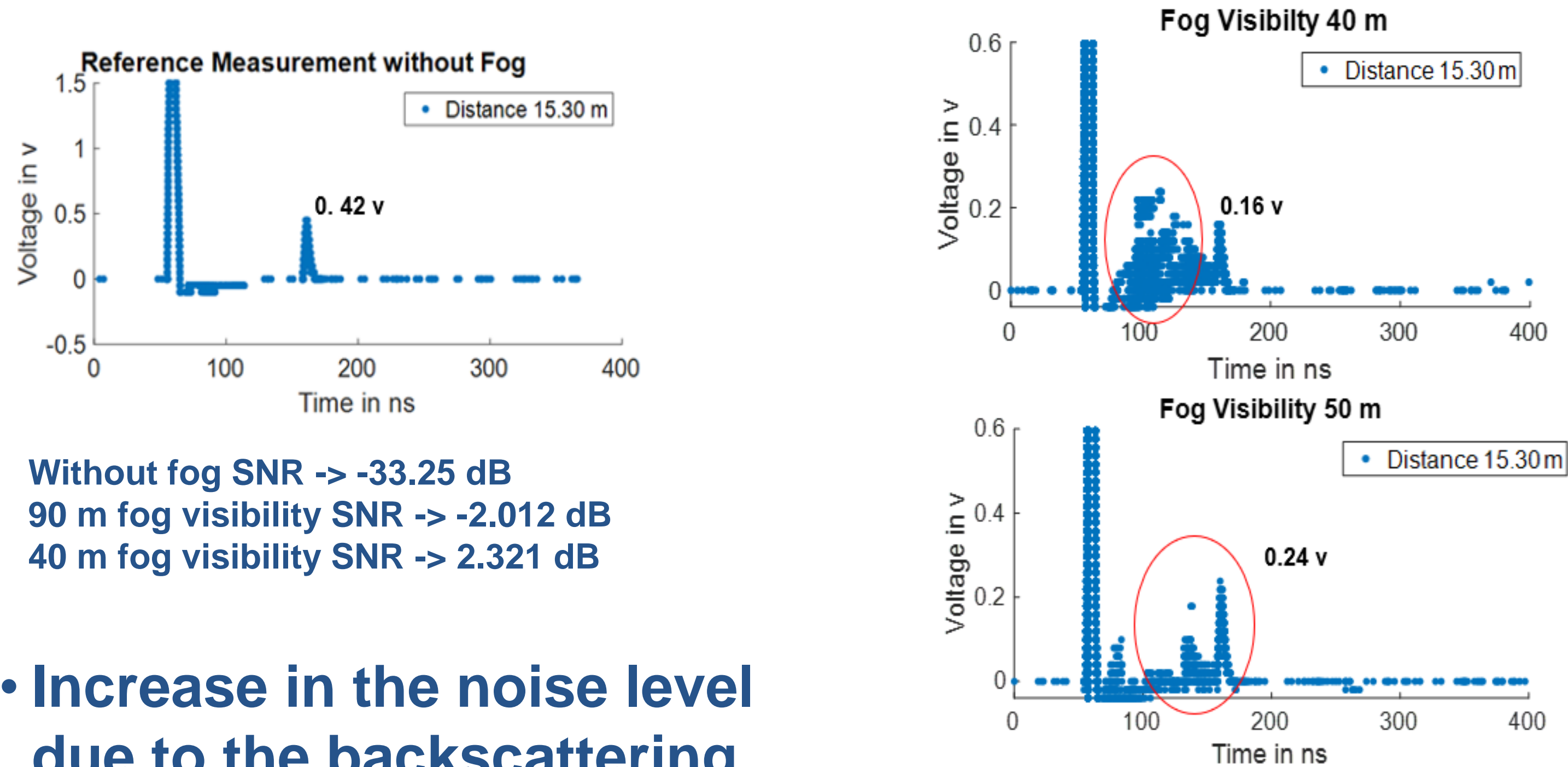
LiDAR Sensor Results for Rain:



- Without rain SNR -> -40.17 dB
- 16 mm/h rain rate SNR -> -13.98 dB
- 32 mm/h rain rate SNR -> -6.62 dB

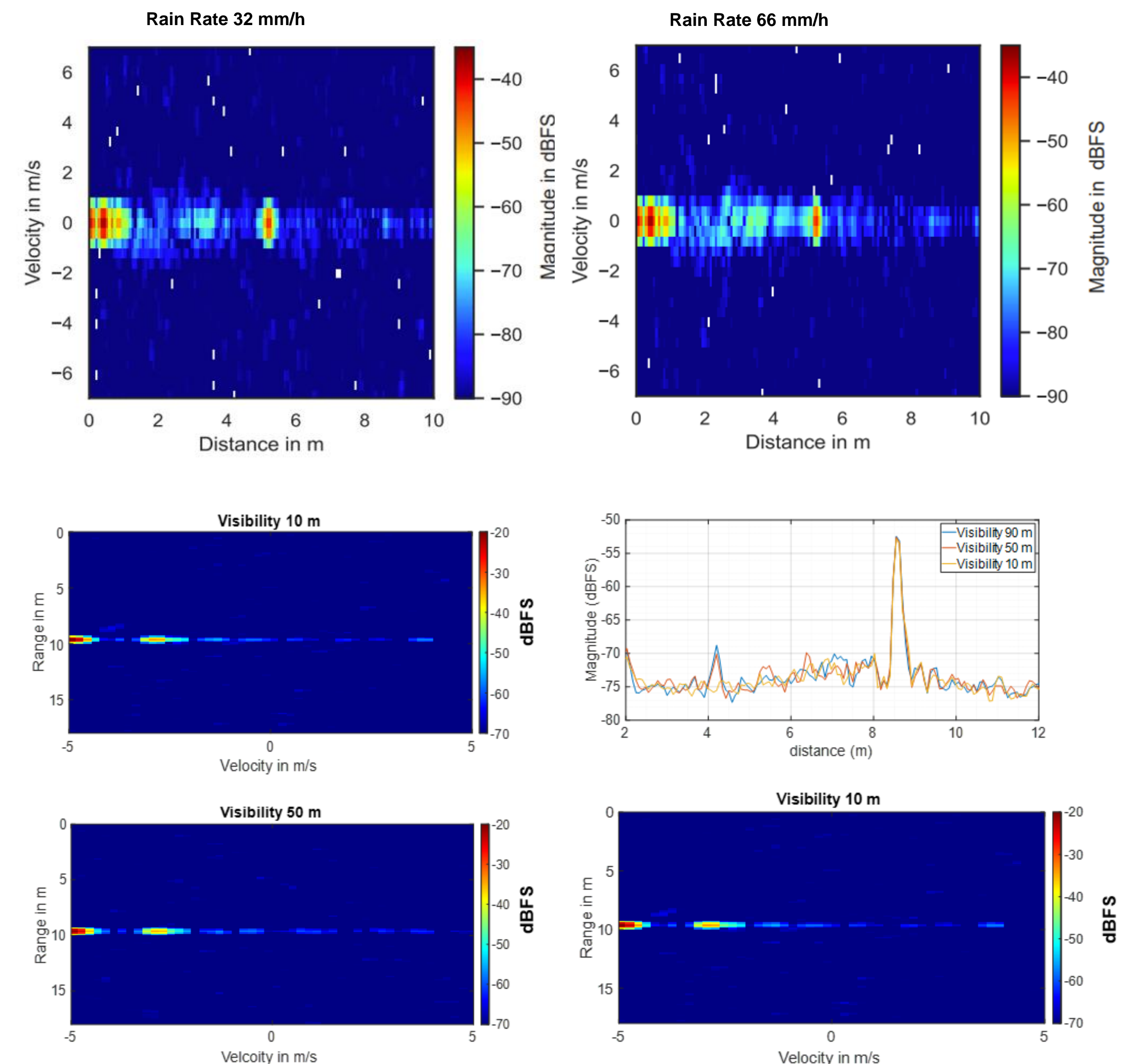
- Increase in the noise level due to the backscattering from the raindrops
- Specific attenuation is approximately 0.0417 dB/m at 16 mm/h rain rate
- Specific attenuation is about 0.1131 dB/m at 32 mm/h rain rate

LiDAR Sensor Results for Fog:



- Without fog SNR -> -33.25 dB
- 90 m fog visibility SNR -> -2.012 dB
- 40 m fog visibility SNR -> 2.321 dB

- Increase in the noise level due to the backscattering from the fog drops



- The corner reflector is placed at 8.55 m
- 50 m visibility attenuation 0.0312 dBFS/m
- 10 m visibility attenuation 0.0409 dBFS/m

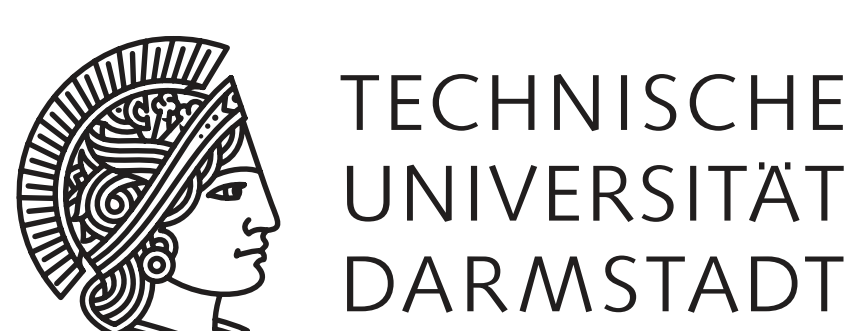
Next Steps

- The rain and fog effects will be modeled in LiDAR and RADAR FMU models, such as
 - Specific attenuation of the received signals
 - Backscattering from the rain drops

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