



STEREOSCOPIC VISION FOR PROFILING

DAVID MALMGREN-HANSEN, GREENWOOD ENGINEERING, CTO

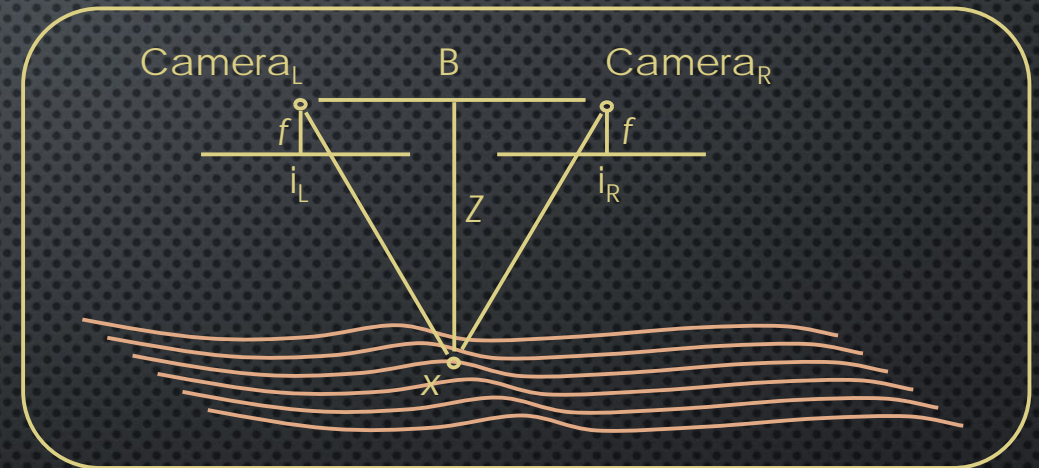
OUTLINE



- STEREOSCOPY – WHAT?
- STEREOCOPY – WHY?
- DESIGN
- EXPERIMENTS
- RESULTS
- CONCLUSION

STEREOSCOPY – WHAT?

- **STEREOSCOPY / STEREO VISION / PHOTOGRAMMETRY**
MEASUREMENTS WITH CAMERAS
- 3D VISION SYSTEM
- CAMERAS MEASURES REFLECTANCE AND GEOMETRY
- DEPTH FROM 2 IMAGES
 - RECTIFICATION
 - MATCHING
 - DISPARITY
 - DEPTH
- 2 LINESCAN (LS) CAMERAS
- LIGHT SYSTEM TO SUPPRESS DAYLIGHT



$$i_L - i_R = \text{disparity} = \frac{Bf}{Z}$$

STEREOCOPY – WHY?

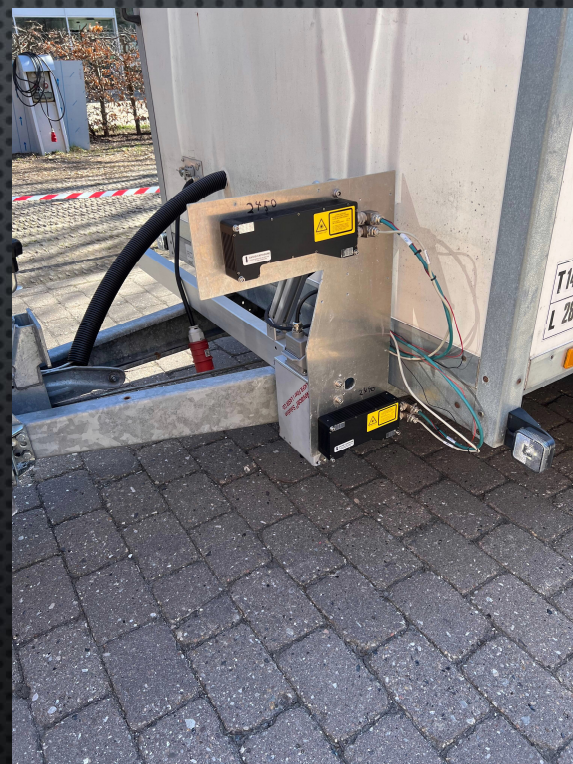
ADVANTAGES

- HIGH LINE RATES FOR LS CAMERAS
- DIFFUSE HOMOGENOUS (LIKE LED) ILLUMINATION PROVIDES HIGH QUALITY IMAGES.
- CAMERAS ARE INEXPENSIVE SENSORS
- LARGE WORKING RANGE (FOCUS)
- A LOT OF RESEARCH IN ALGORITHMS

DISADVANTAGES

- LED - HIGHER POWER CONSUMPTION THAN LASER
- MATCHING IS COMPUTATIONAL COMPLEX
- CALIBRATION IS DIFFICULT

DESIGN



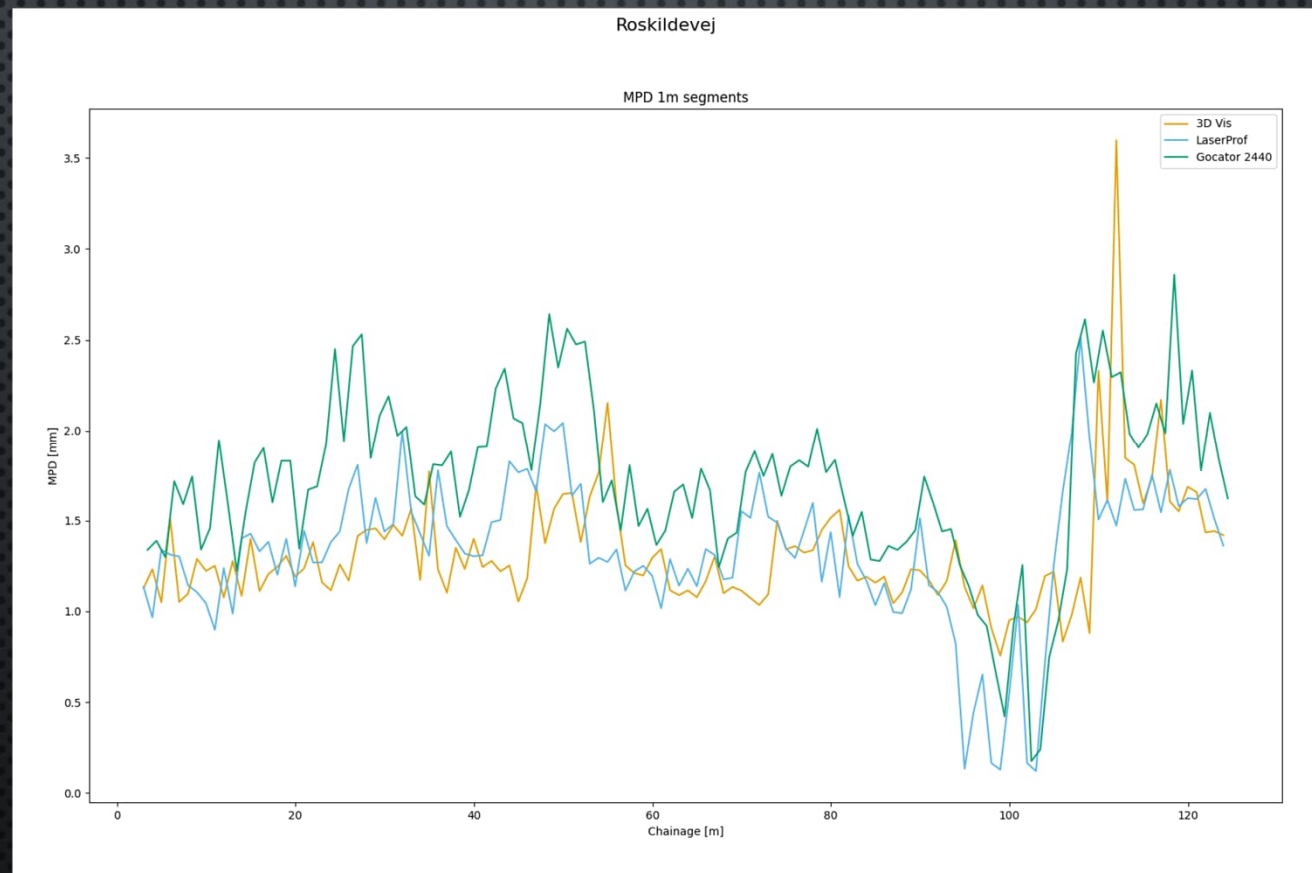
EXPERIMENTS

- DRIVING AROUND THE BLOCK
 - 2 SMALL ROADS (50KMH)
 - 1 MEDIUM ROAD (50KMH)
 - 1 LARGER MUNICIPAL ROAD (60KMH)
- THREE SENSORS MOUNTED
 - LINE LASER (LMI GOCATOR 2450)
 - POINT LASER (LMI GOCATOR 1350)
 - 3D VISION SYSTEM
- NB! IN THIS EXPERIMENTS THE SYSTEM HAD NOT UNDERGONE ALIGNMENT PROCEDURE ON VEHICLE

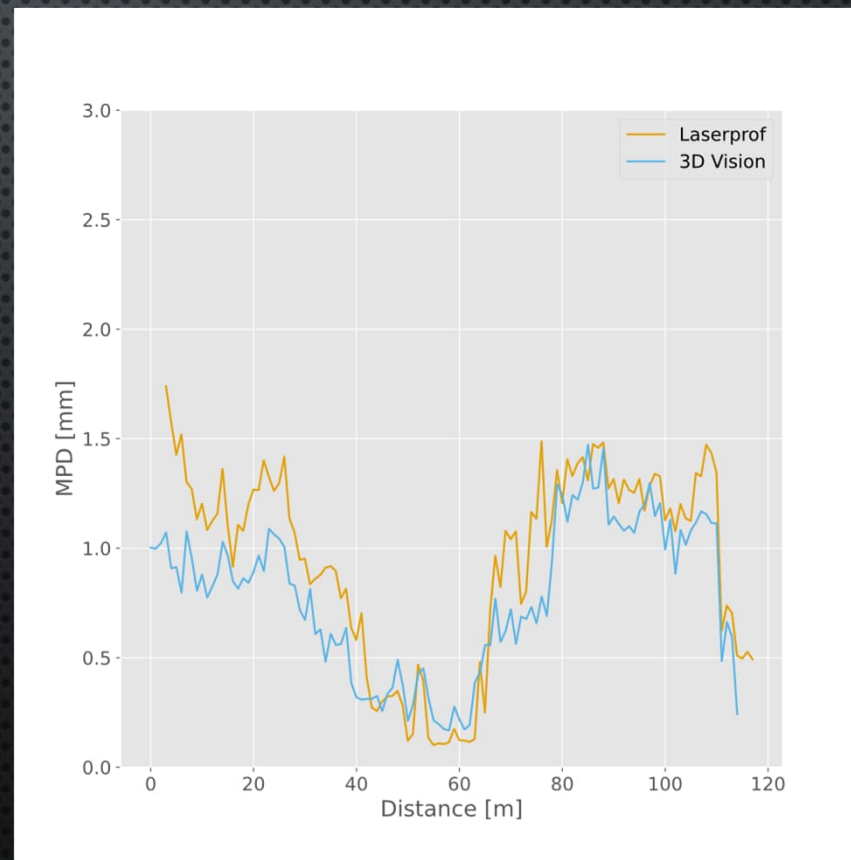
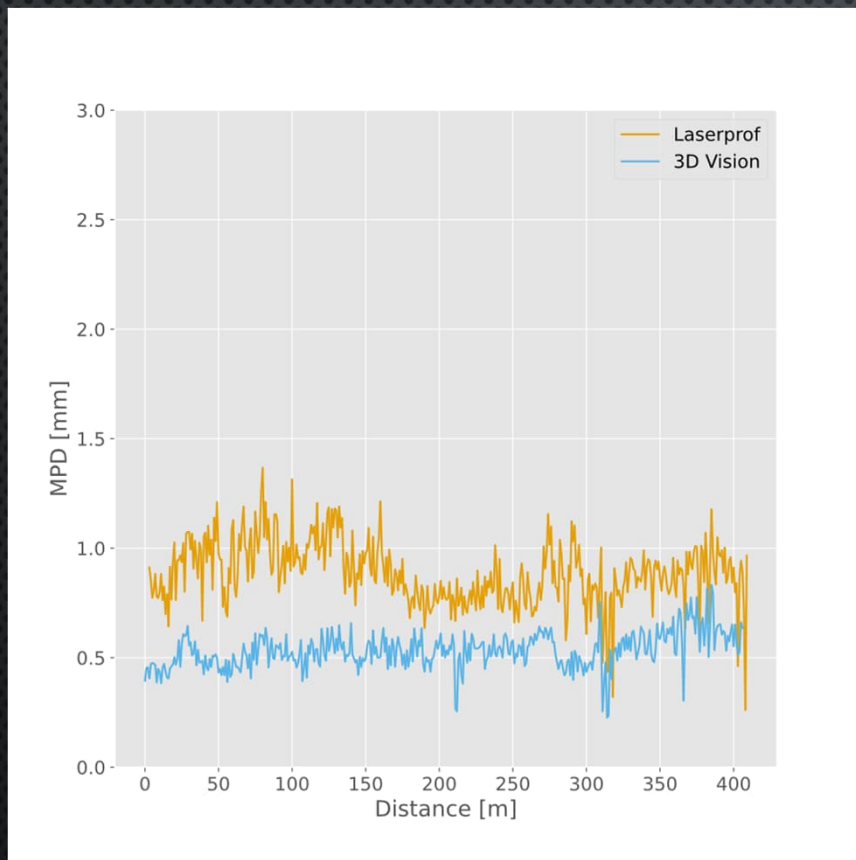
EXPERIMENTS



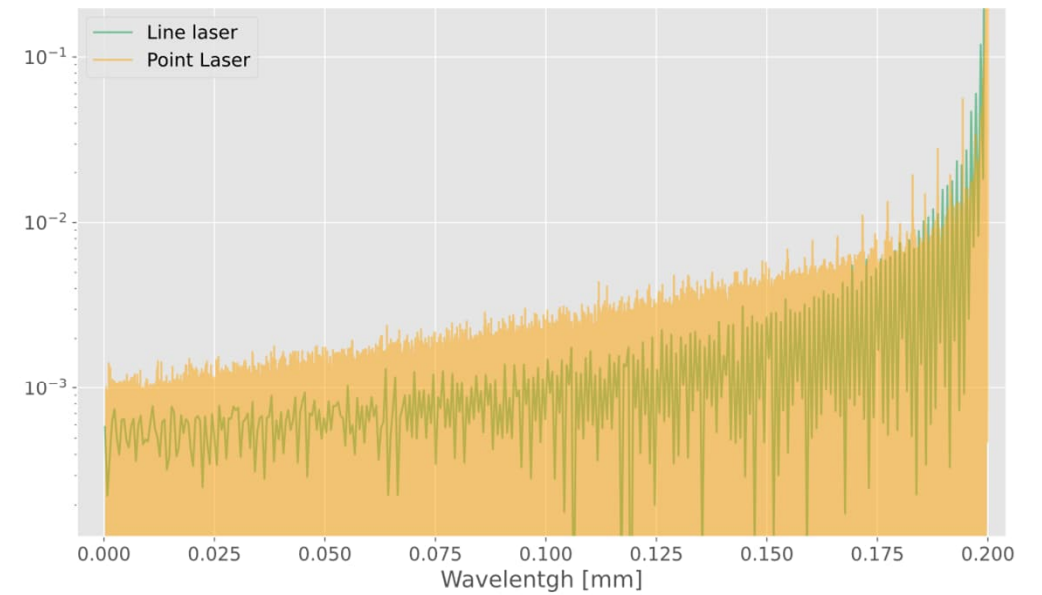
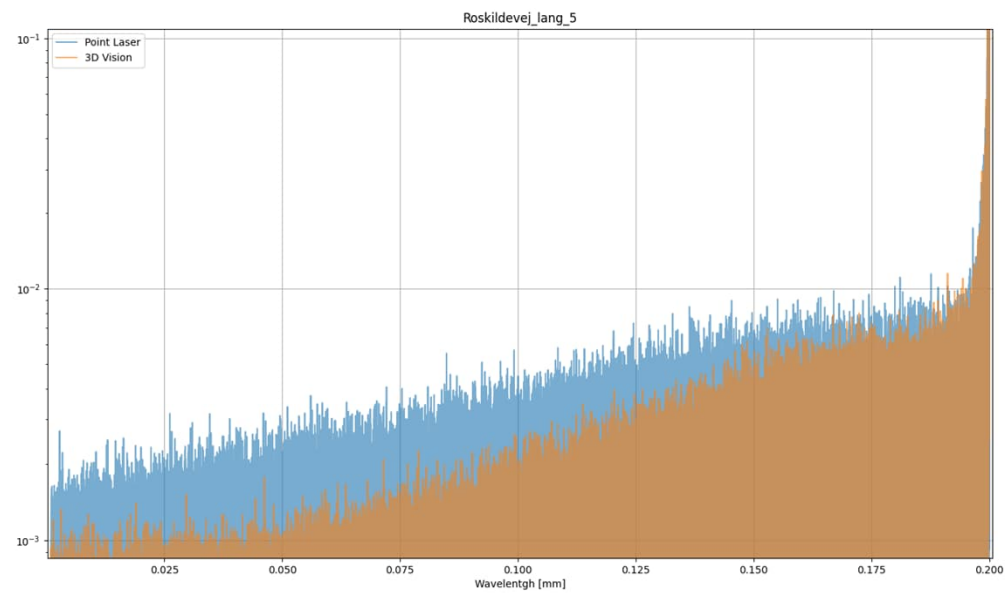
RESULTS – ALL THREE SENSORS



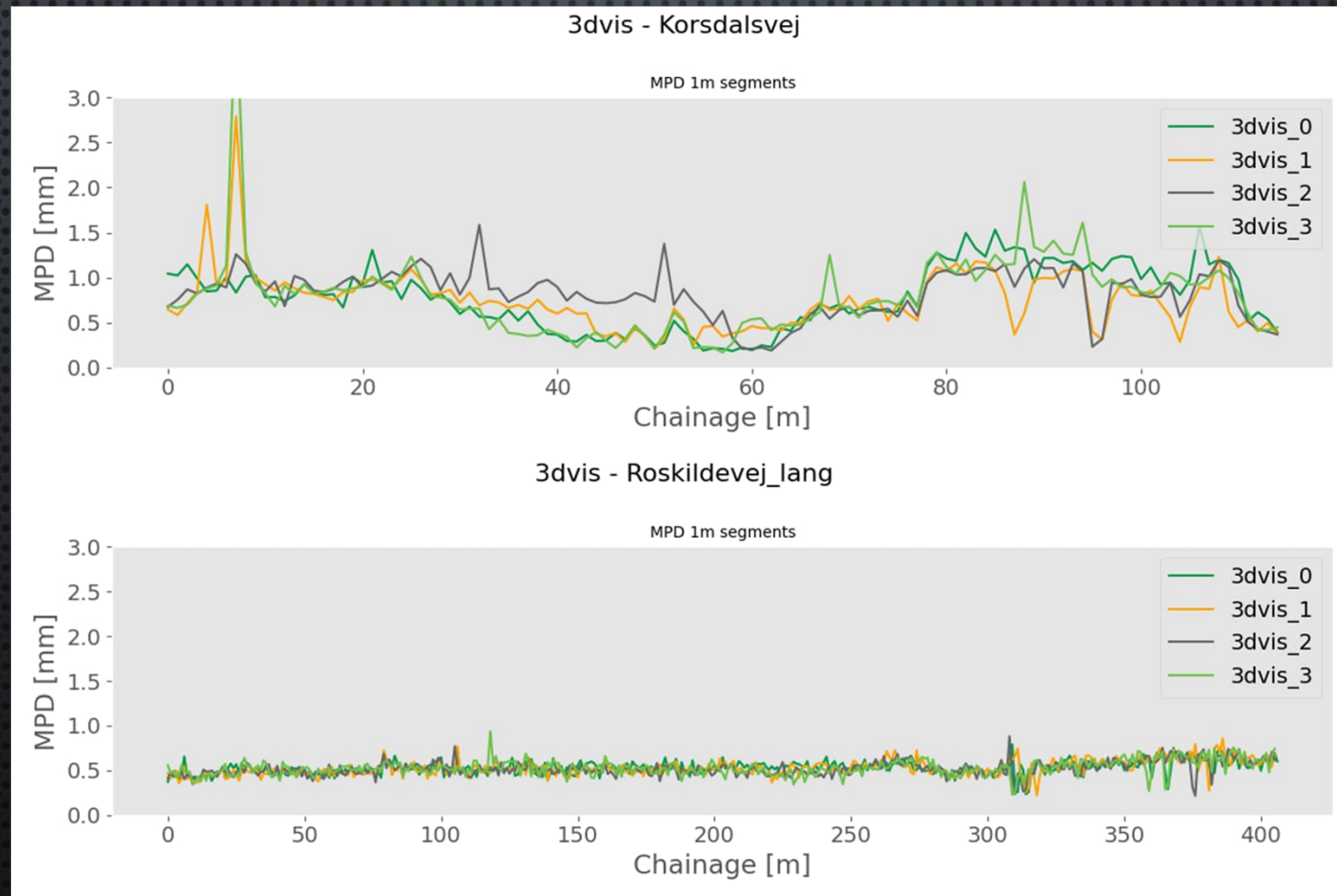
RESULTS – SENSOR COMPARISON



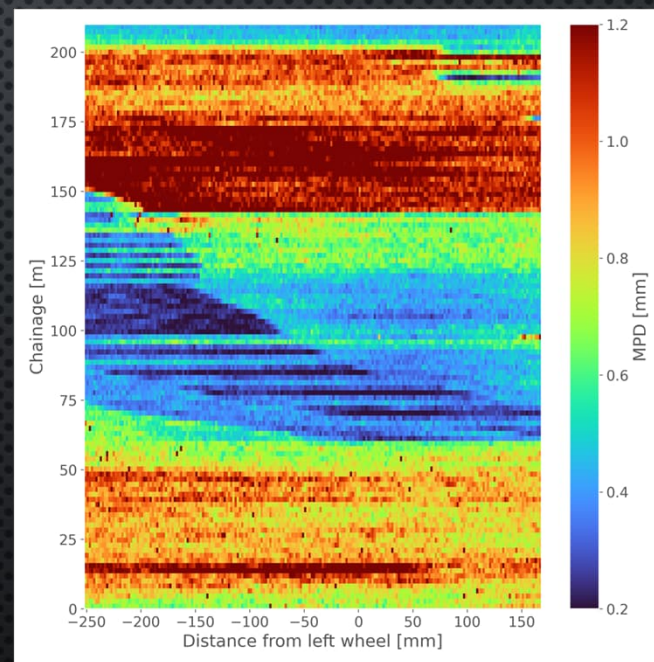
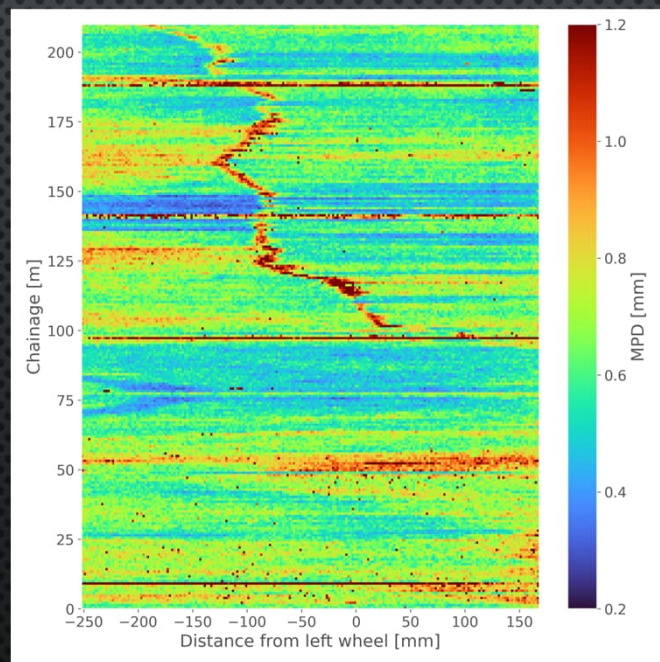
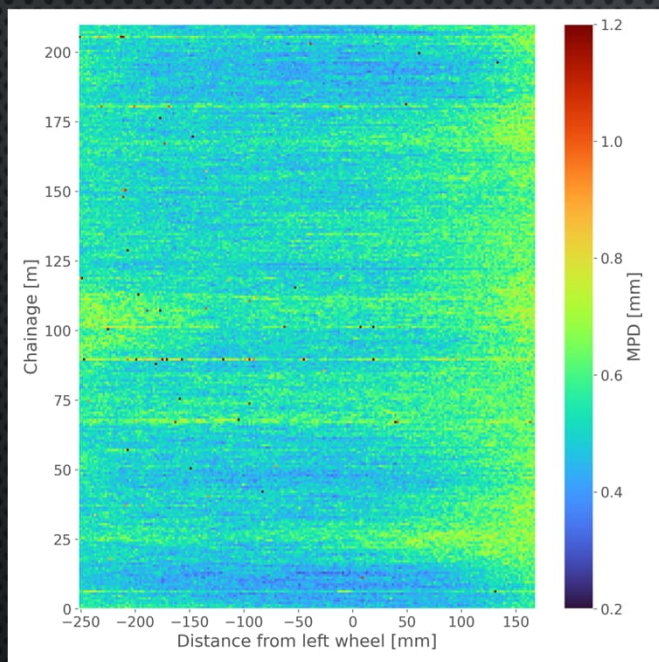
RESULTS - SPECTRUM



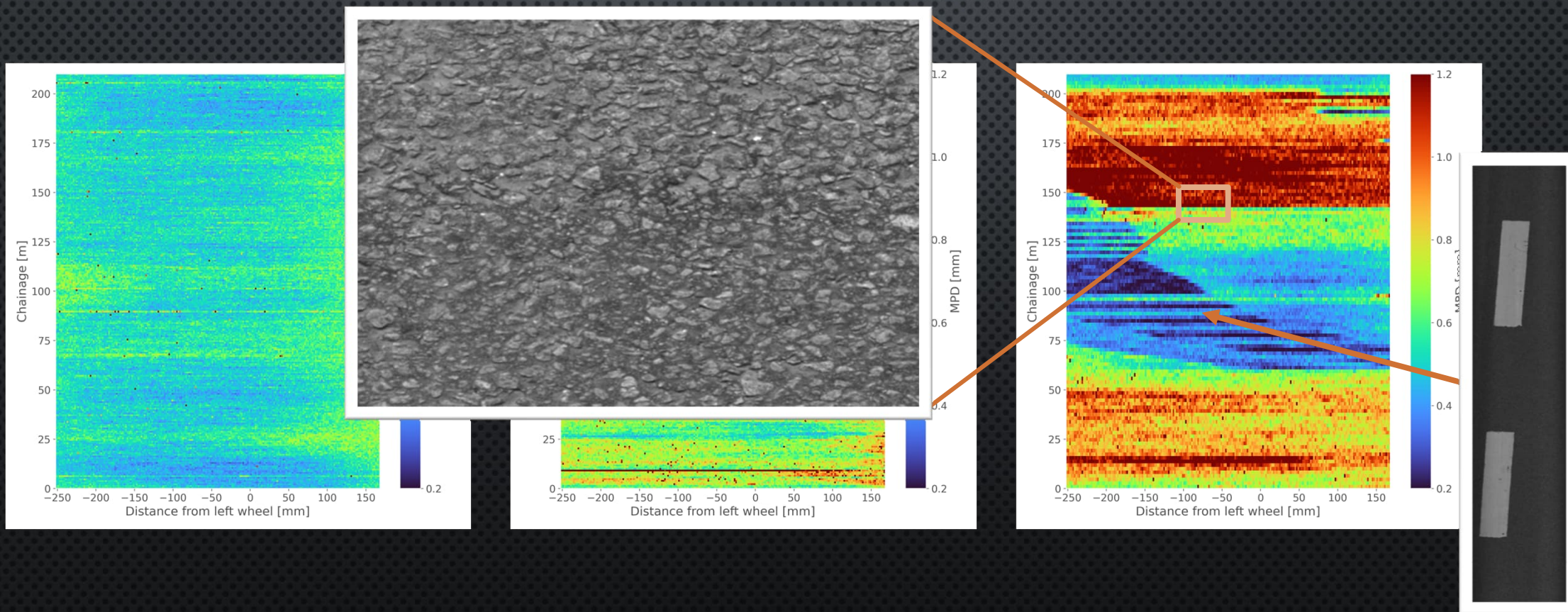
RESULTS - REPEATABILITY



RESULTS – 2D TEXTURE MAPS

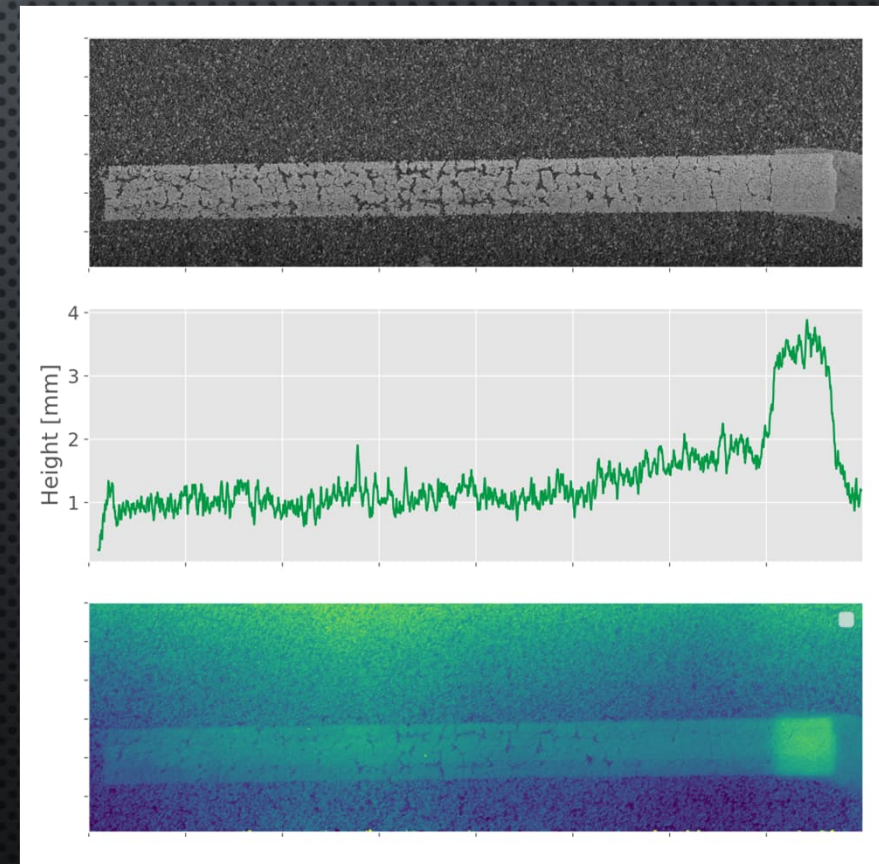


RESULTS – 2D TEXTURE MAPS



RESULTS – OTHER APPLICATIONS

- ROAD MARKING THICKNESS IS ALSO POSSIBLE TO CALCULATE
- VERIFIED ON TEST OBJECTS TO ACCURACY $<0.1\text{mm}$



CONCLUSION

- STEREO VISION FOR PROFILING IS PROMISING
- OFFERS MANY ADVANTAGES... AND FEW DOWNSIDES
- HIGH REPEATABILITY
- COMPARABLE TO EXISTING TECHNOLOGIES
- ACCURACY IS THE MOST IMPORTANT BUT DIFFICULT PARAMETER TO MEASURE
- 2D TEXTURE MAPS
- OPENS FOR OTHER APPLICATIONS



THANKS



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