RPUG
Road Profile Users' Group

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HONORING THE PAST. PAVING THE FUTURE.

2026 RPUG CONFERENCE ★ PITTSBURGH, PA ★ APRIL 28 - MAY 1

STEREOSCOPIC VISION FOR PROFILING

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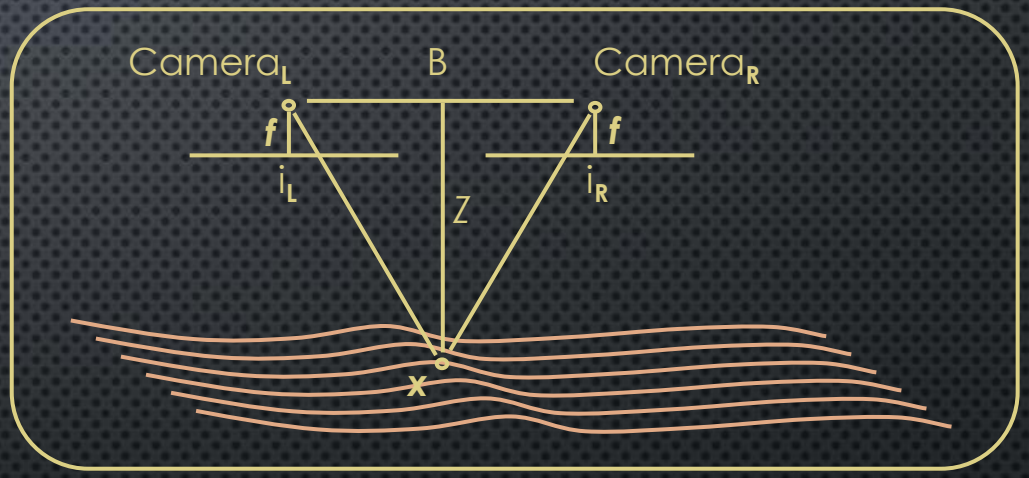
OUTLINE

- 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



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

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

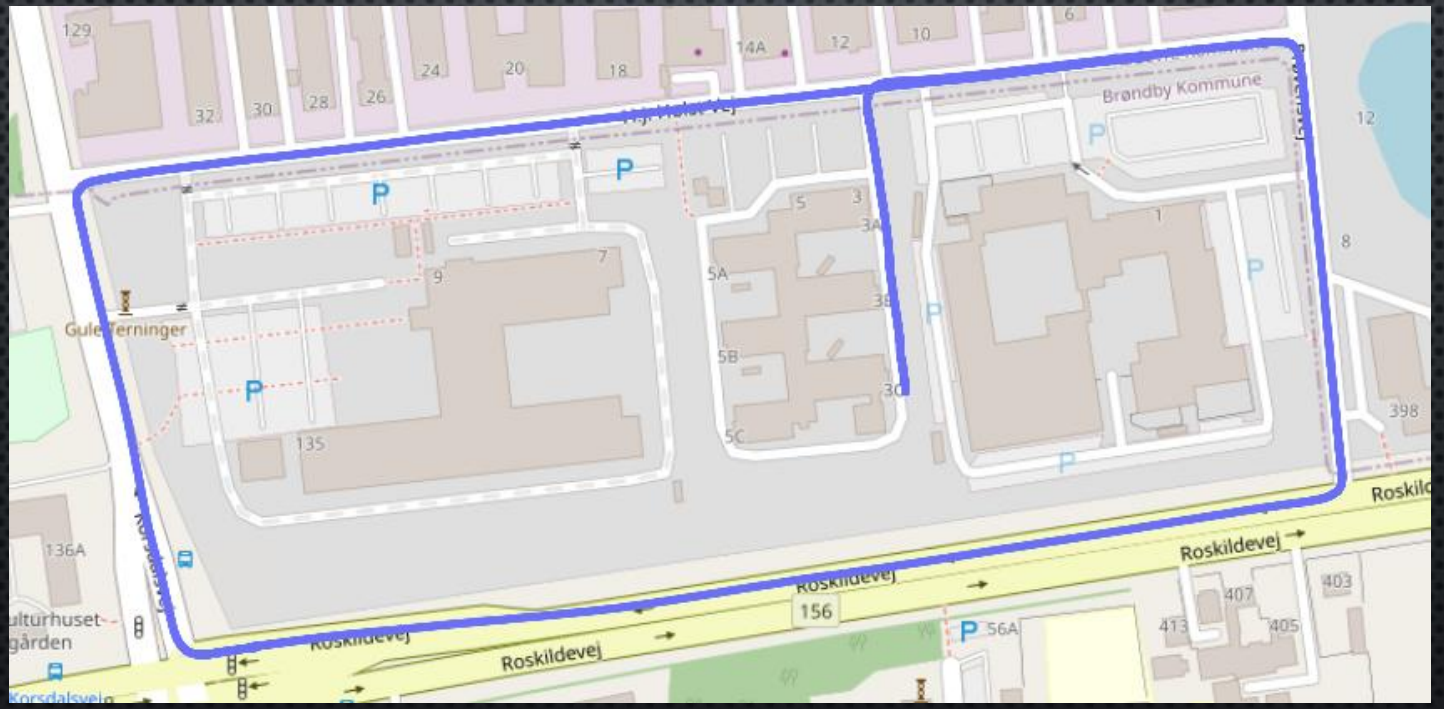
- LED - higher power consumption than laser
- Matching is computational complex
- Calibration is difficult

DESIGN

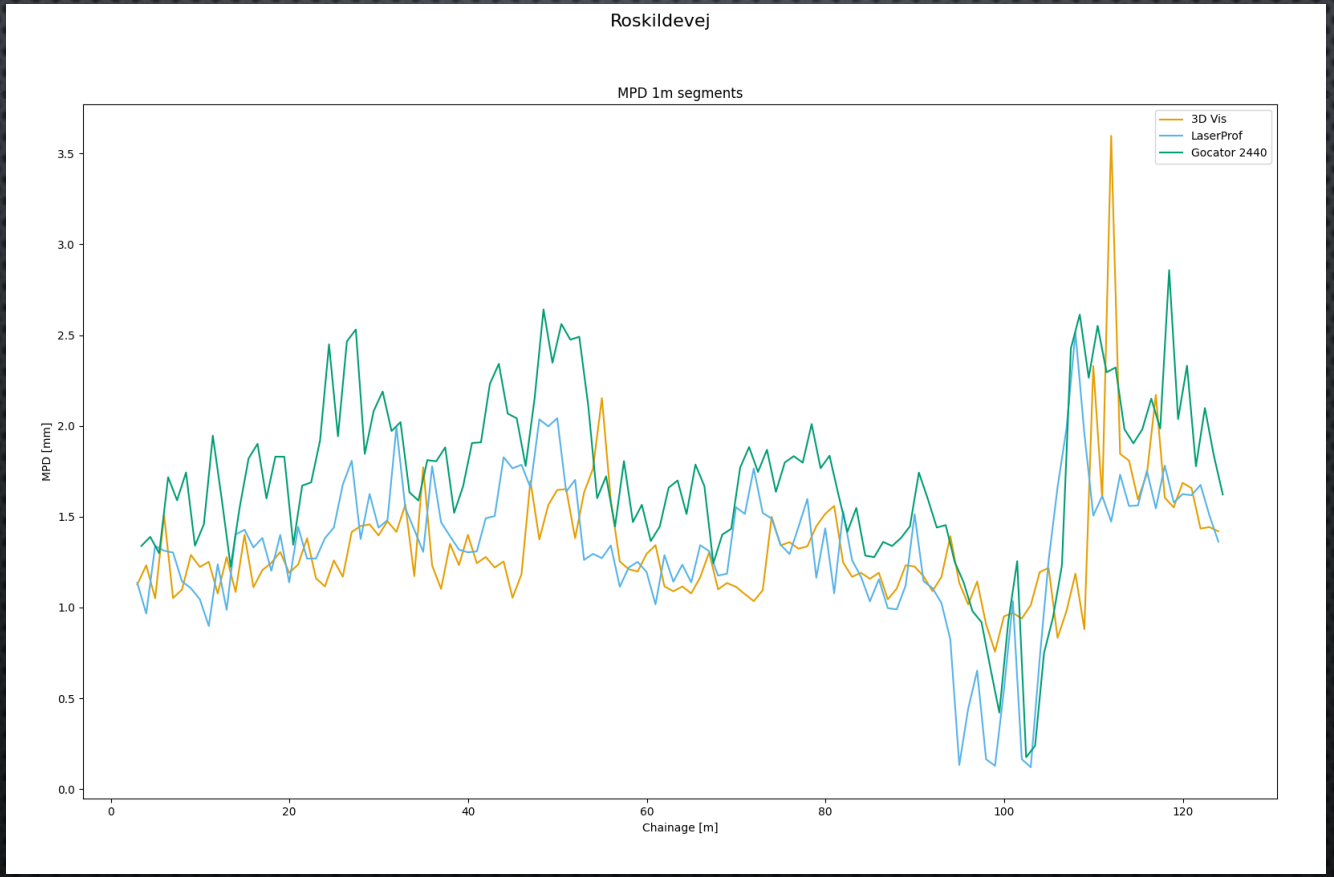
Experiments

- 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

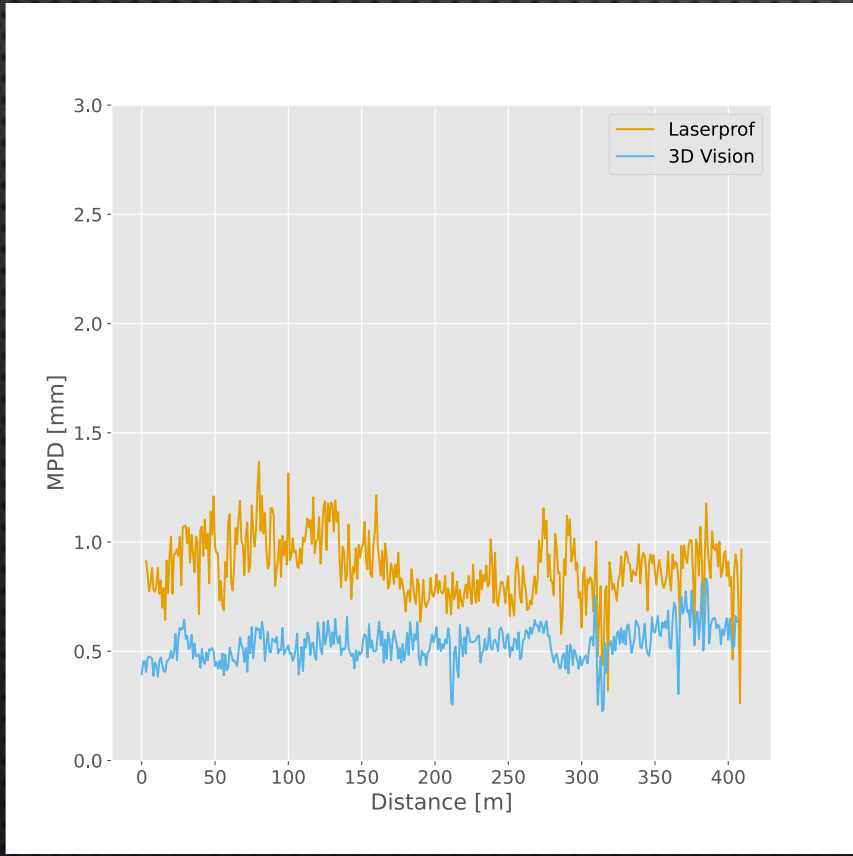
EXPERIMENTS

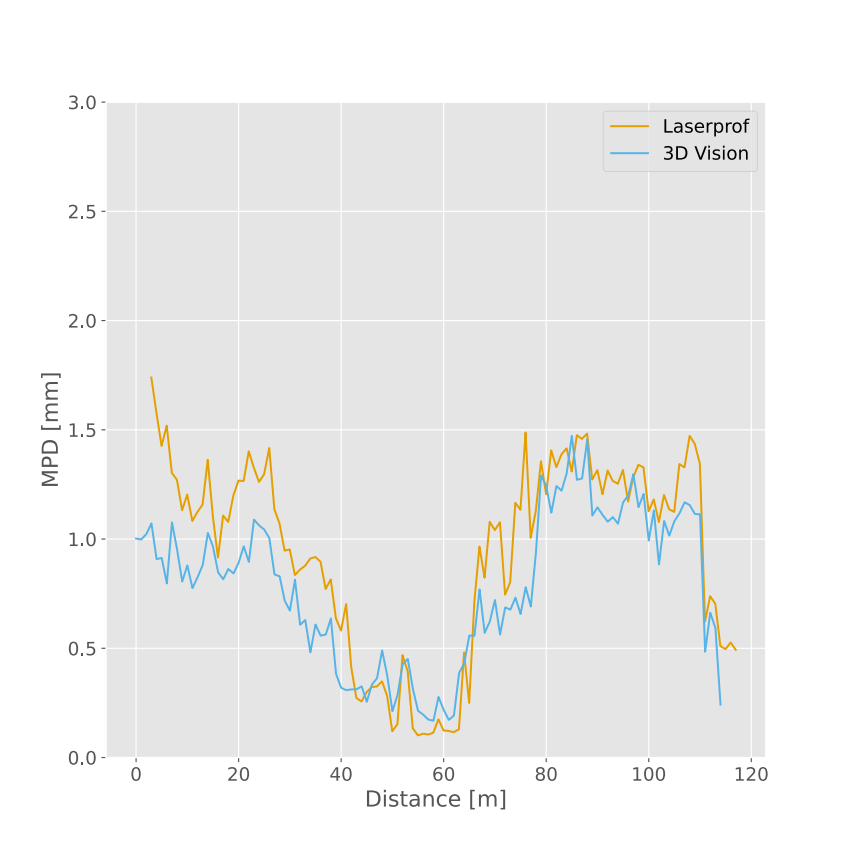


RESULTS – ALL THREE SENSORS

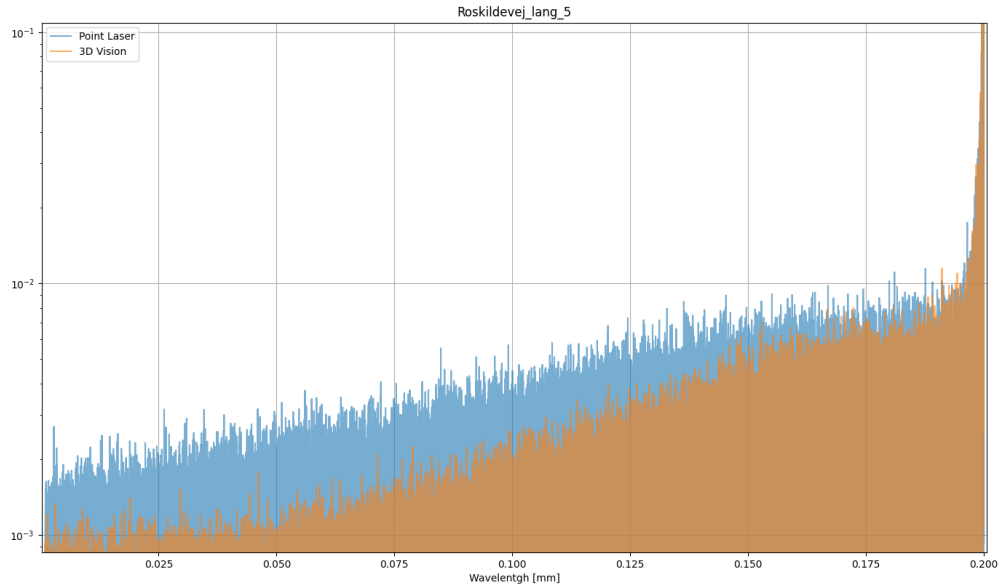


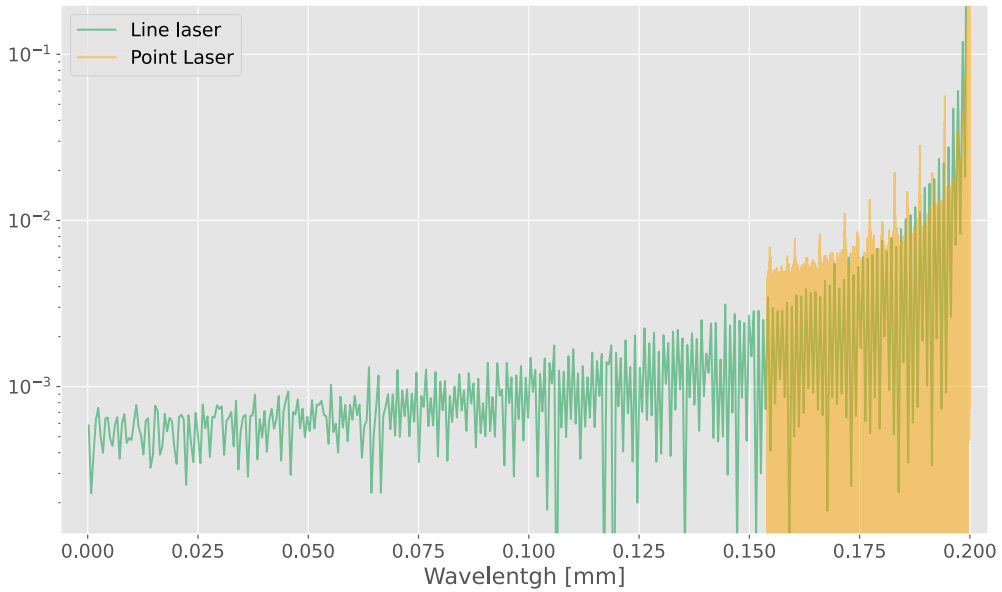
RESULTS – SENSOR COMPARISON





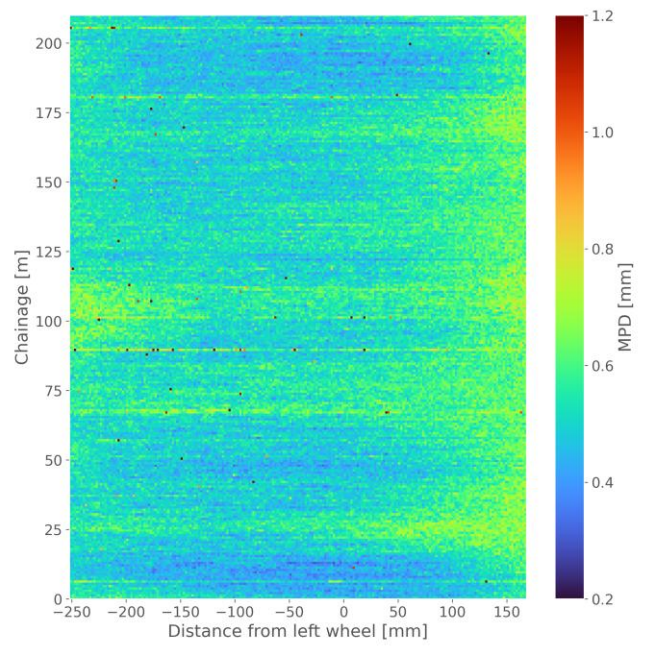
RESULTS - SPECTRUM

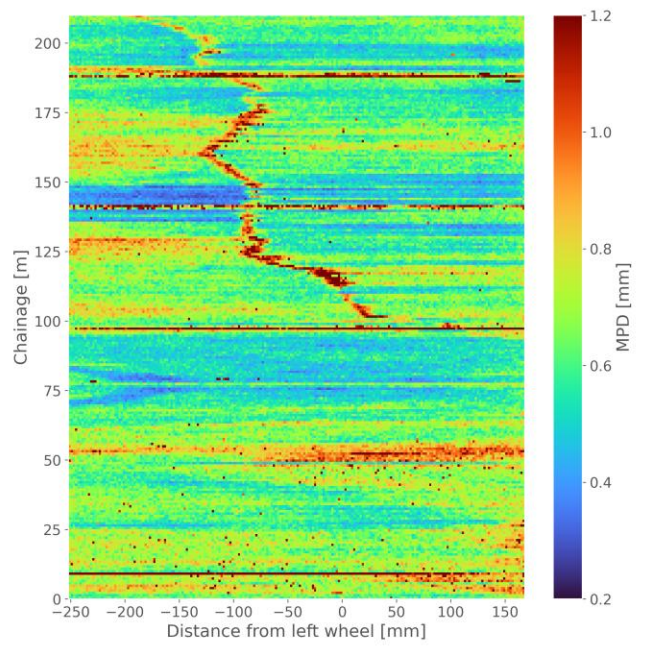


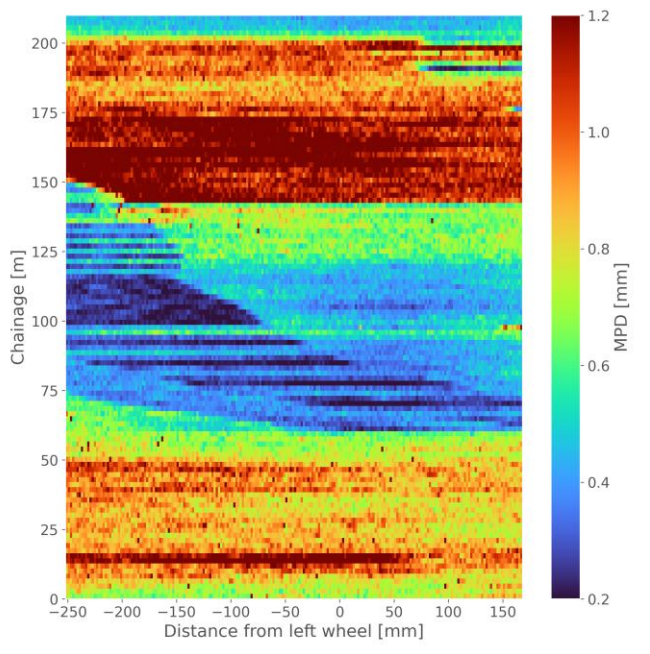


RESULTS - REPEATABILITY

RESULTS – 2D TEXTURE MAPS







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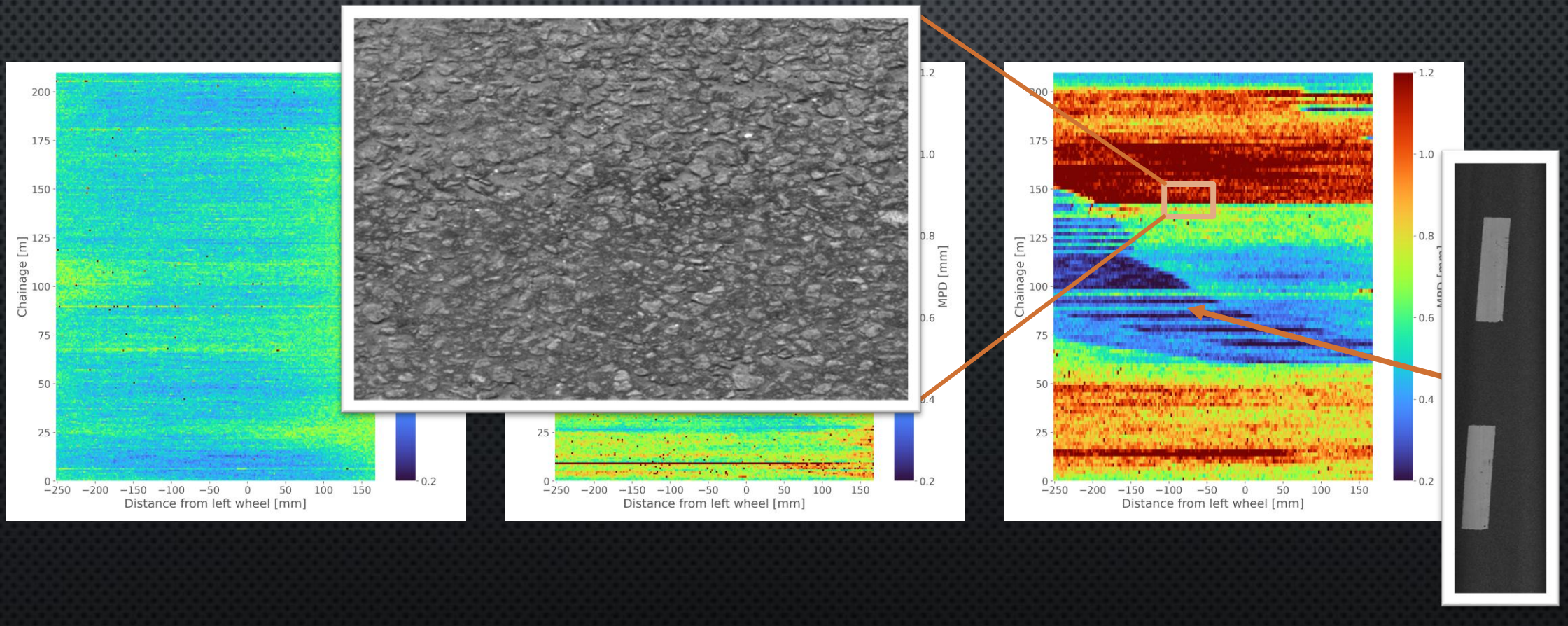
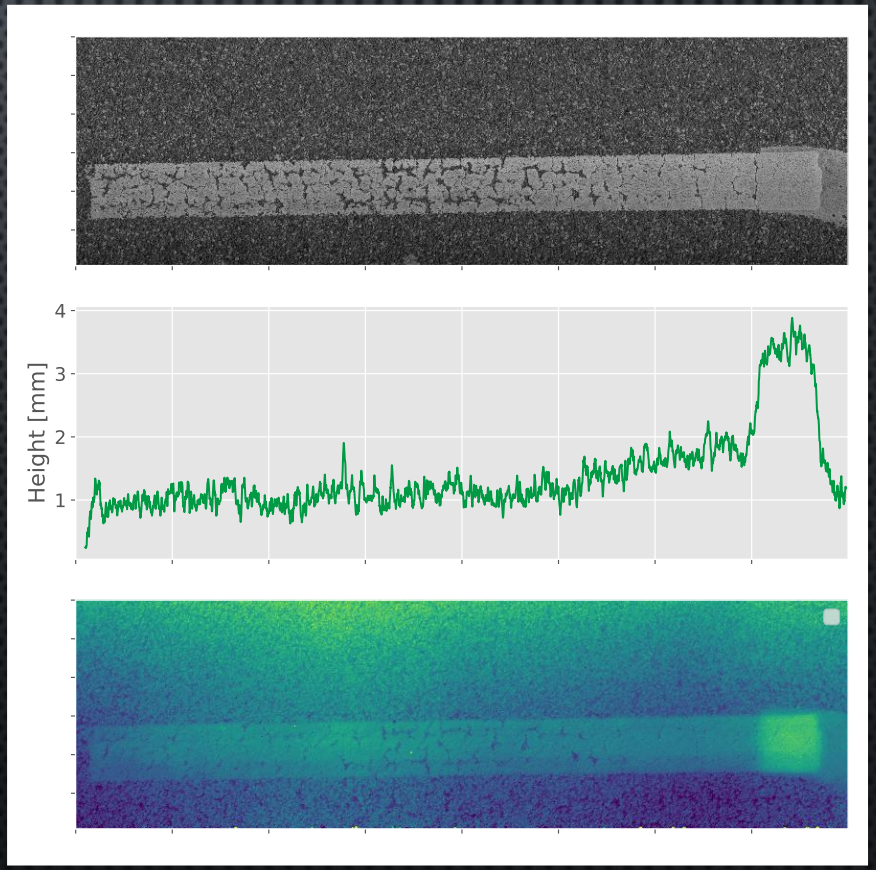
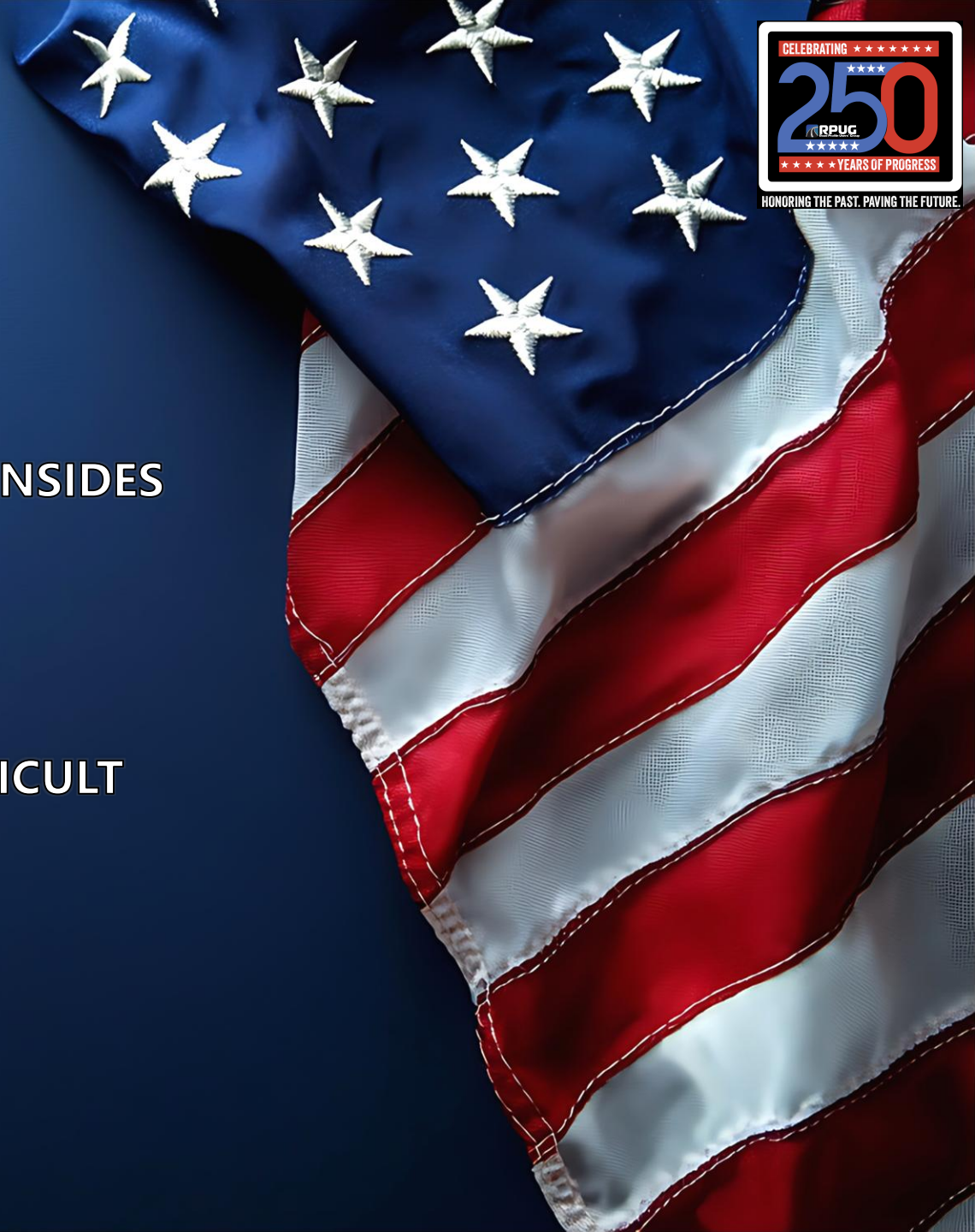


RESULTS – OTHER APPLICATIONS

- ROAD MARKING THICKNESS IS ALSO POSSIBLE TO CALCULATE
- VERIFIED ON TEST OBJECTS TO ACCURACY <0.1MM



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

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THANKS

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