

Projektgruppe FastSense

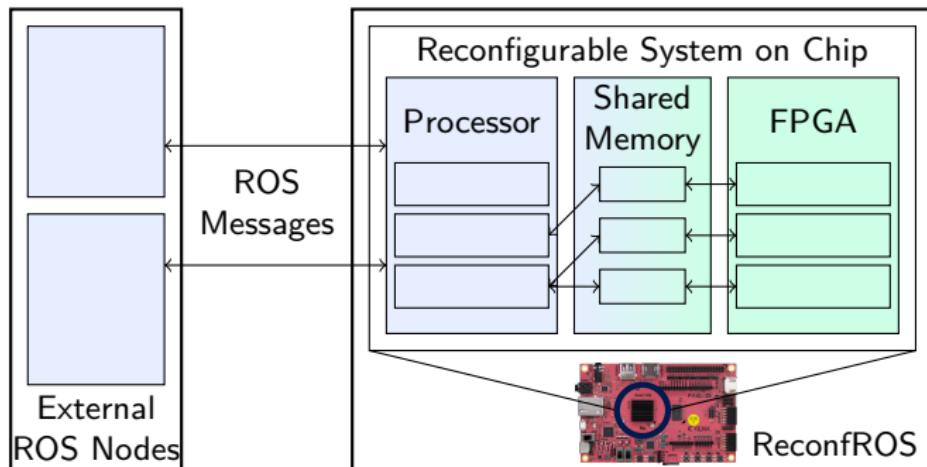
# **Abschlusspräsentation**

11. März 2021

# Zielsetzung

- Autonome echtzeitfähige Kartierung
- FPGA-basierte Hardwarebeschleunigung
- Einfaches, handliches System
- Anbindung an bestehende Systeme (LVR2)

# MS1: Trail Detection



Camera image



Removing noise



Trail pixel extraction



Thresholding

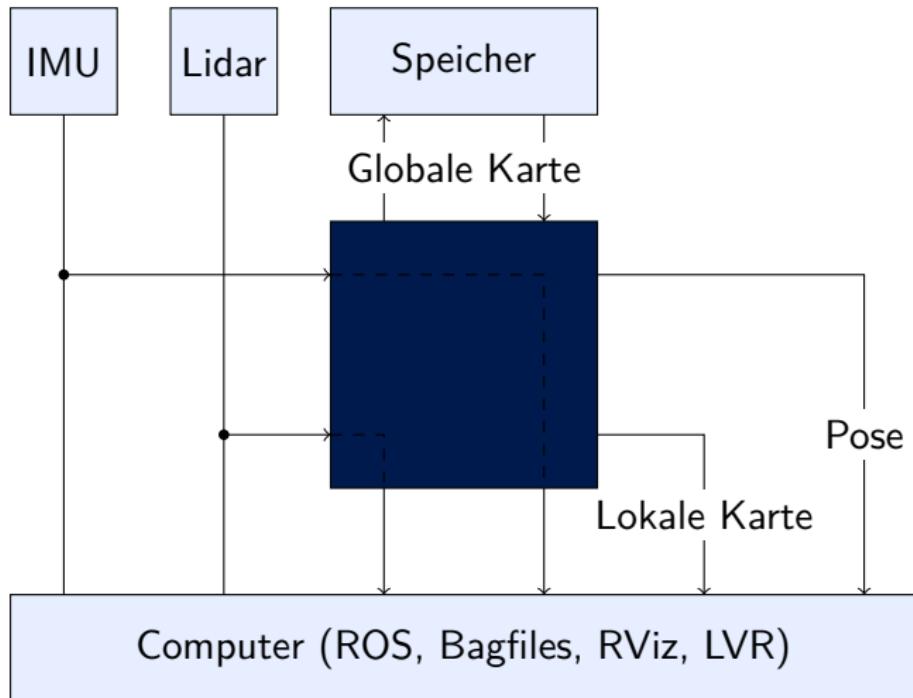


Remove fragments

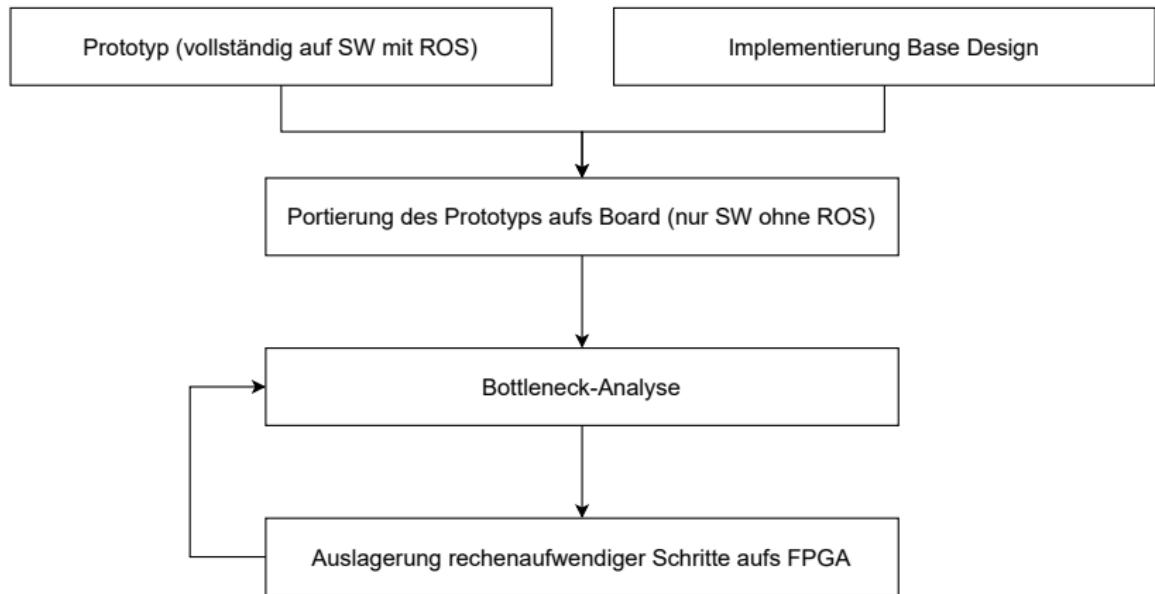


Trail direction

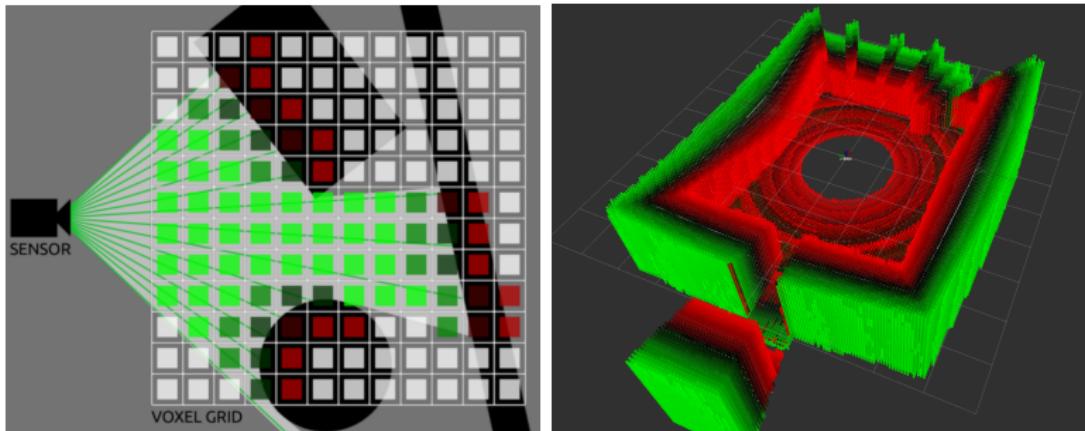
# SLAM-Box



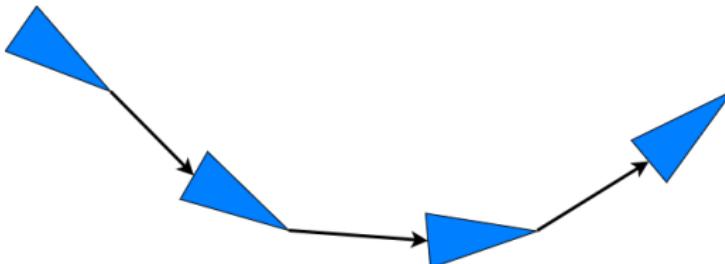
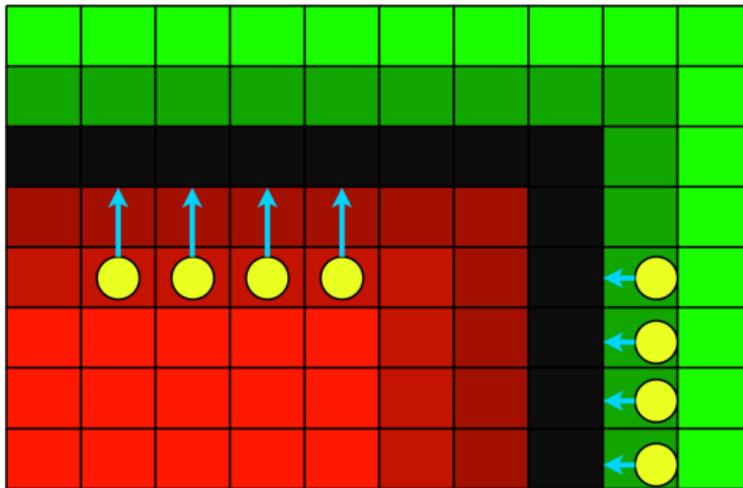
# Vorgehen



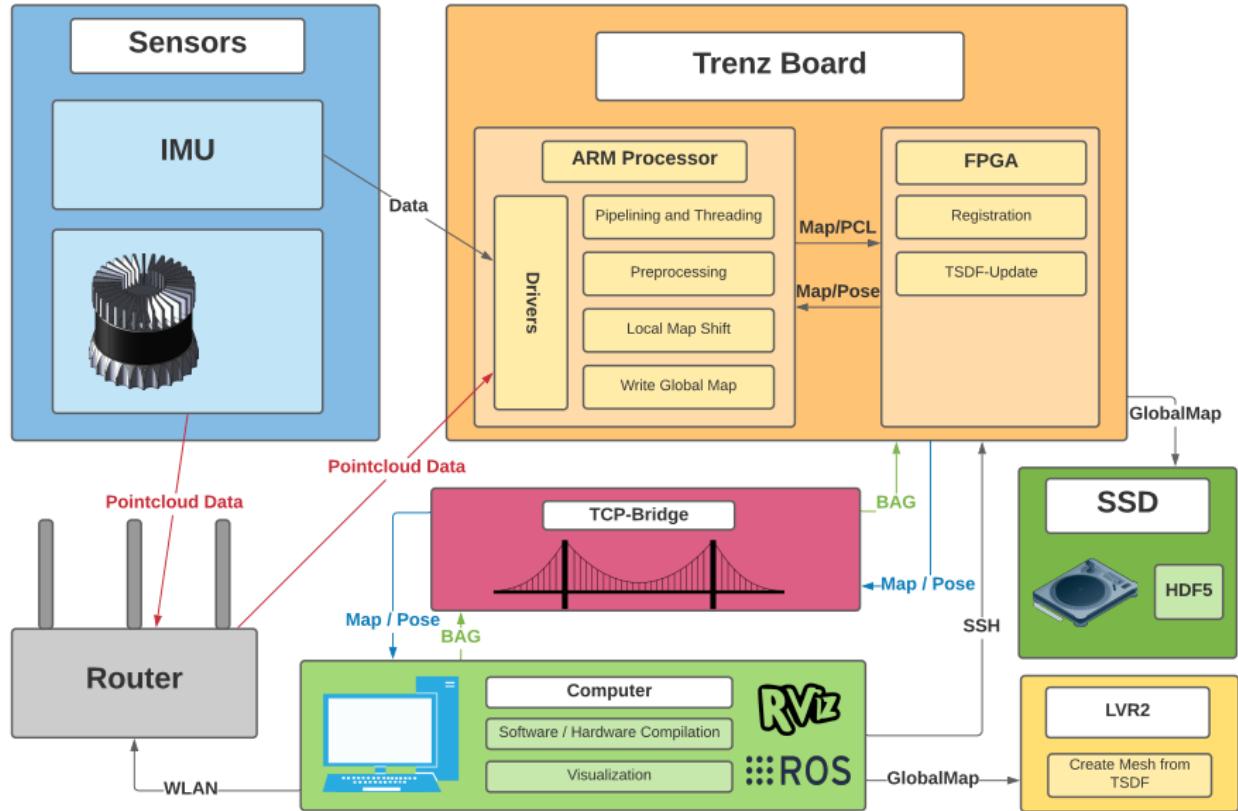
# TSDF



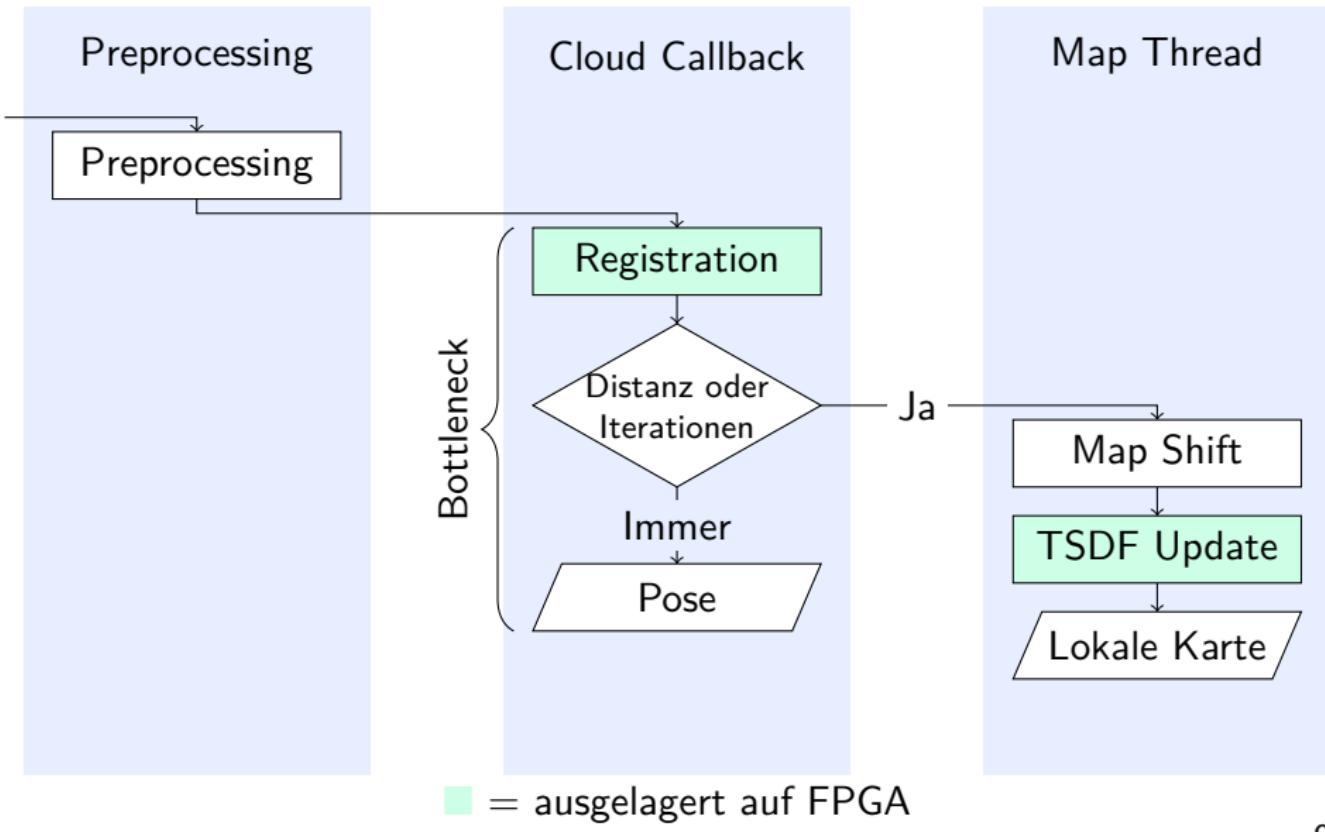
# Point-to-TSDF Registrierung



# Komponenten

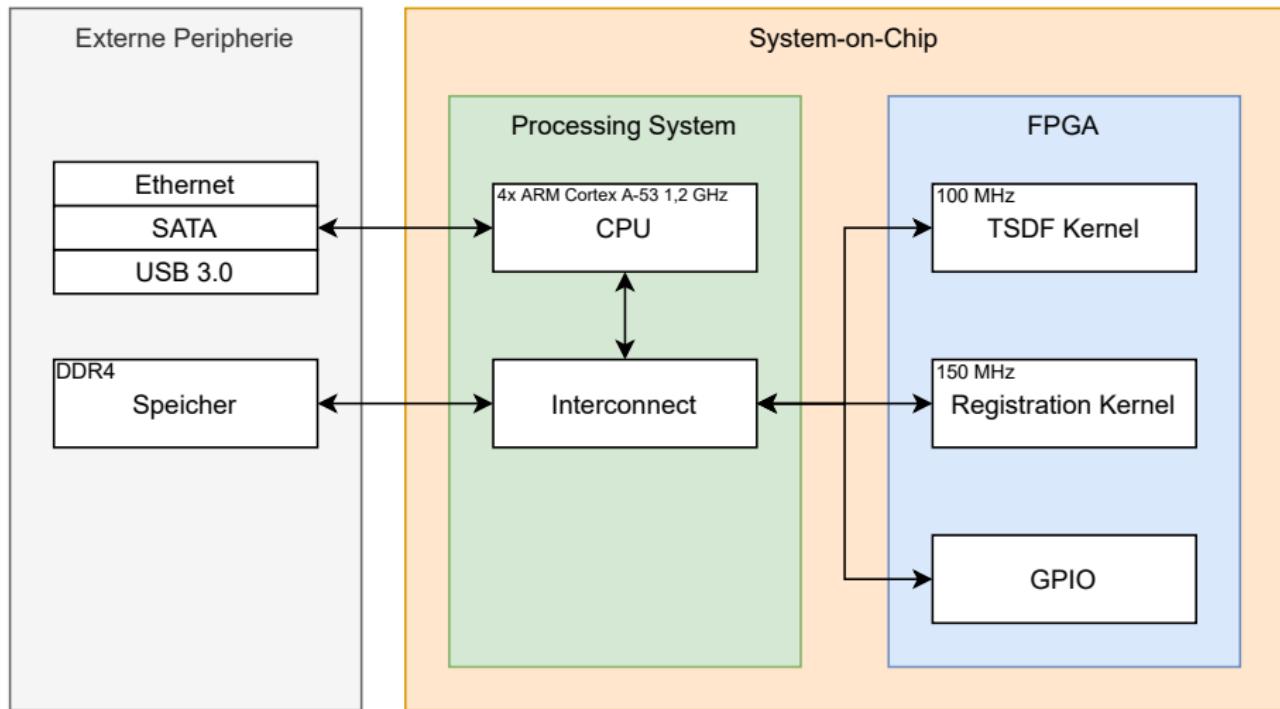


# Algorithmus

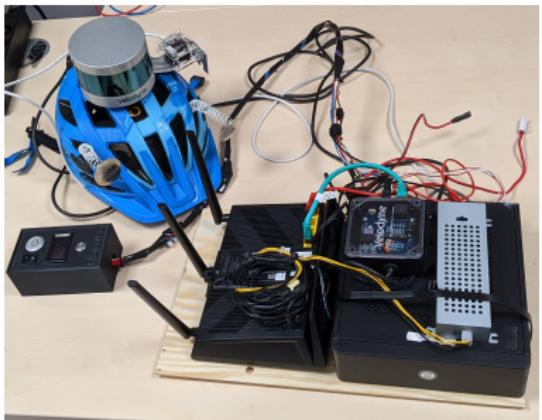
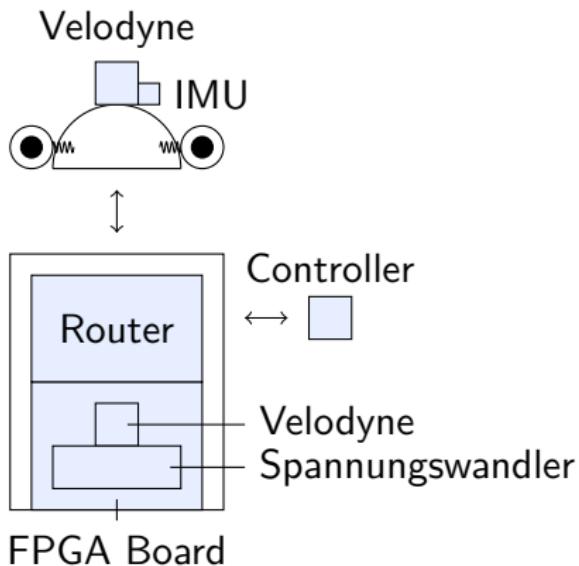


= ausgelagert auf FPGA

# Hardware Architektur

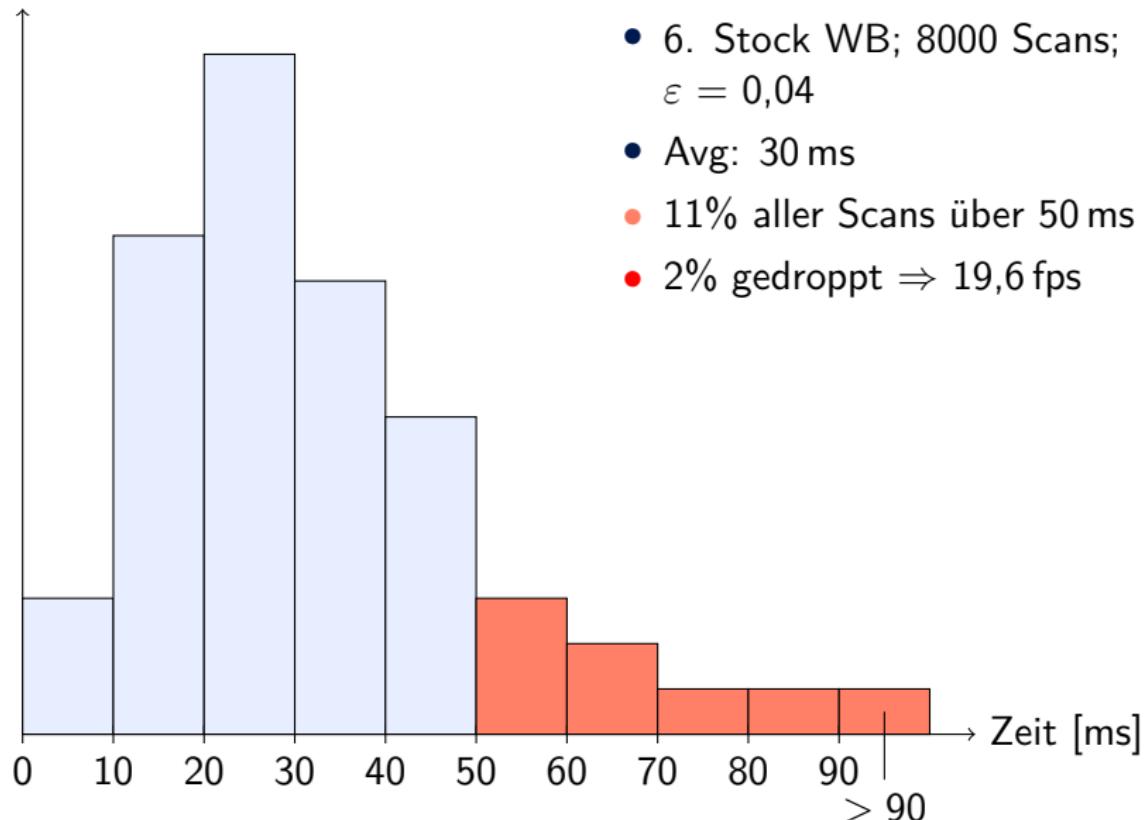


# Aufbau



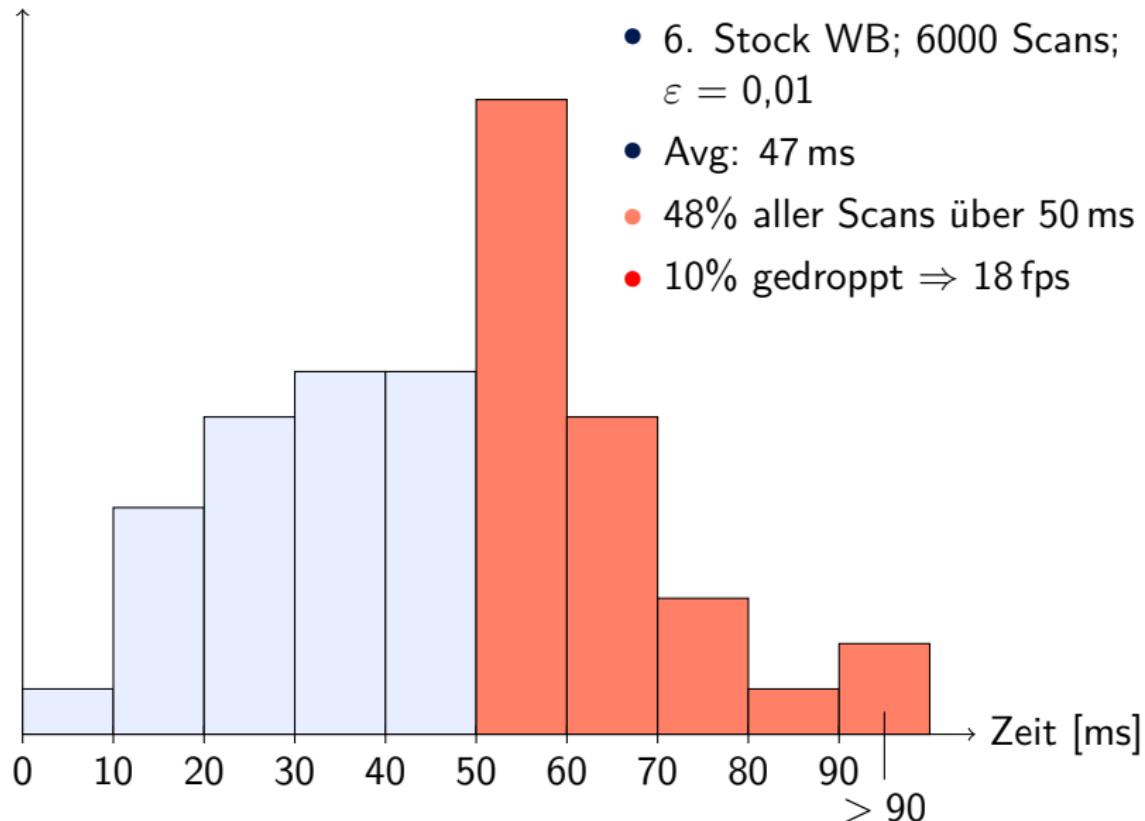
## Evaluation: Zeit

Anzahl Scans

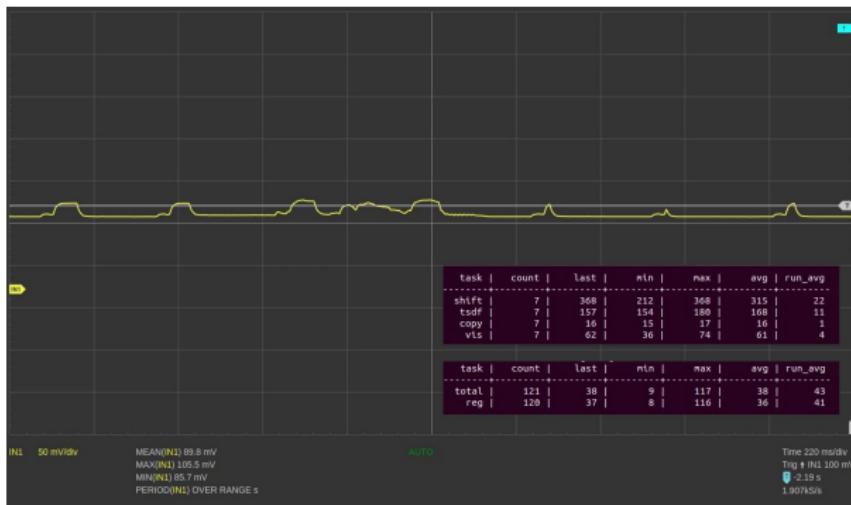


# Evaluation: Zeit

Anzahl Scans



# Evaluation: Power Consumption



|        | Idle   |        |        | Running       |        |        |
|--------|--------|--------|--------|---------------|--------|--------|
|        | Mean   | Min    | Max    | Mean          | Min    | Max    |
| U [mV] | 78,7   | 76     | 88     | 89,8          | 85,7   | 105,5  |
| I [A]  | 1,124  | 1,086  | 1,257  | 1,283         | 1,224  | 1,507  |
| P [W]  | 13,488 | 13,032 | 15,084 | <b>15,396</b> | 14,688 | 18,084 |

# Evaluation: Genauigkeit

- 6. Stockwerk (Distanz in Meter, Auflösung: 6,4cm)

|               |         |         |
|---------------|---------|---------|
| $\varepsilon$ | 0,01    | 0,04    |
|               |         |         |
|               | 0,0615  | 0,0505  |
|               |         |         |
| Geschw.       | langsam | schnell |
|               |         |         |
|               | 0,0505  | 0,0437  |
|               |         |         |

- gesamt (langsam,  $\varepsilon = 0,04$ , Strecke  $\approx 270\text{m}$ ): 0,075349
- 8 Meter Labortest (Distanz in Meter, Auflösung: 6,4cm)

|         | hin    | zurück | gesamt |
|---------|--------|--------|--------|
| langsam | 0,0548 | 0,0650 | 0,0861 |
| schnell | 0,1676 | 0,0459 | 0,1320 |

# Fazit

- Portables System
- Weiche Echtzeitfähigkeit
- Geringer Stromverbrauch
- Einfache Handhabung
- Einfache Analyse

# Ausblick

- Evaluierung mit anderer Sensorik
- Portierung auf Drohne
- Optimierung des Posegraphen (Loop Closing)
- Paper