Projektgruppe FastSense

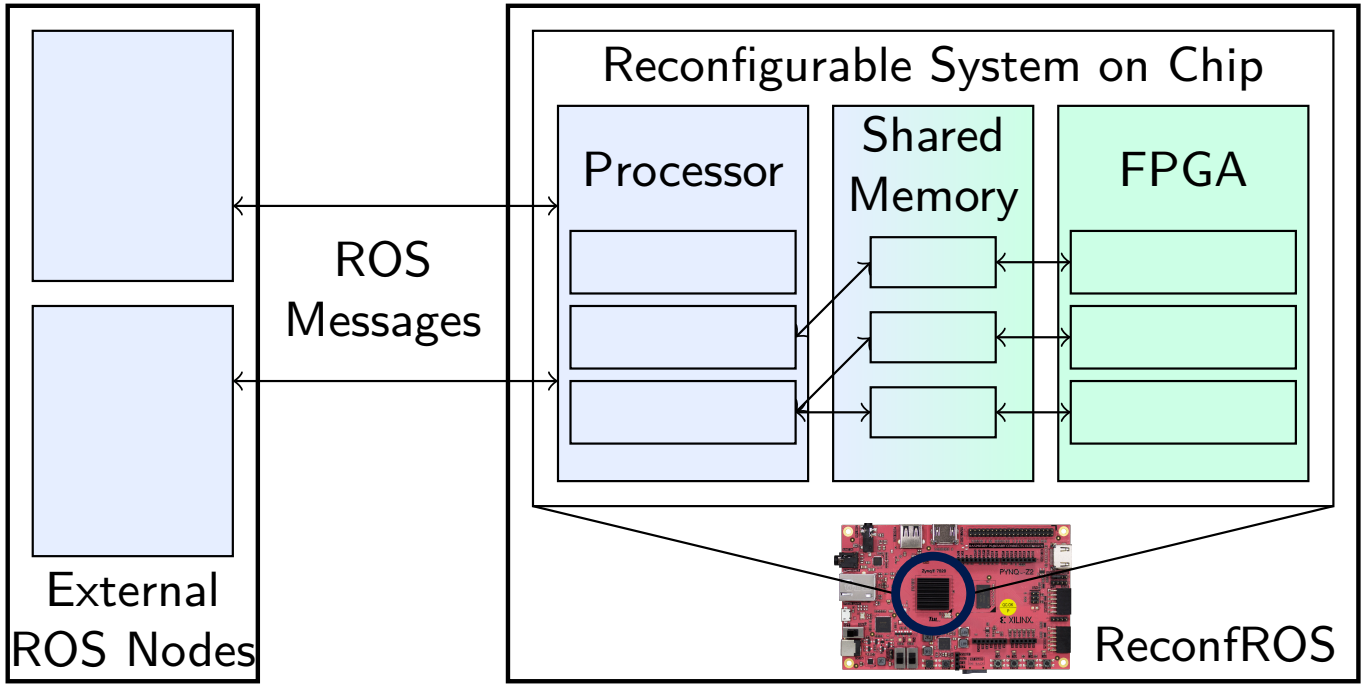
Abschlusspräsentation

11. März 2021

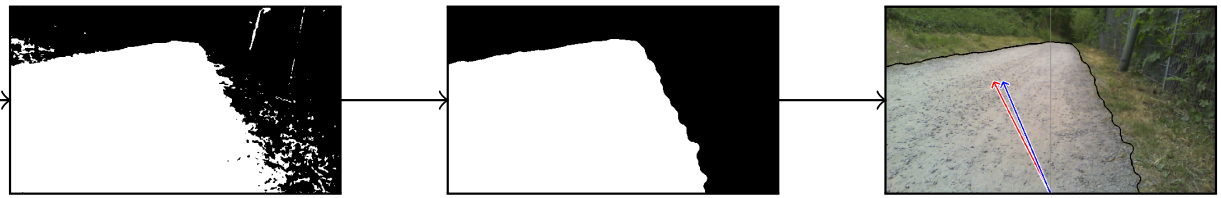
Zielsetzung

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

MS1: Trail Detection

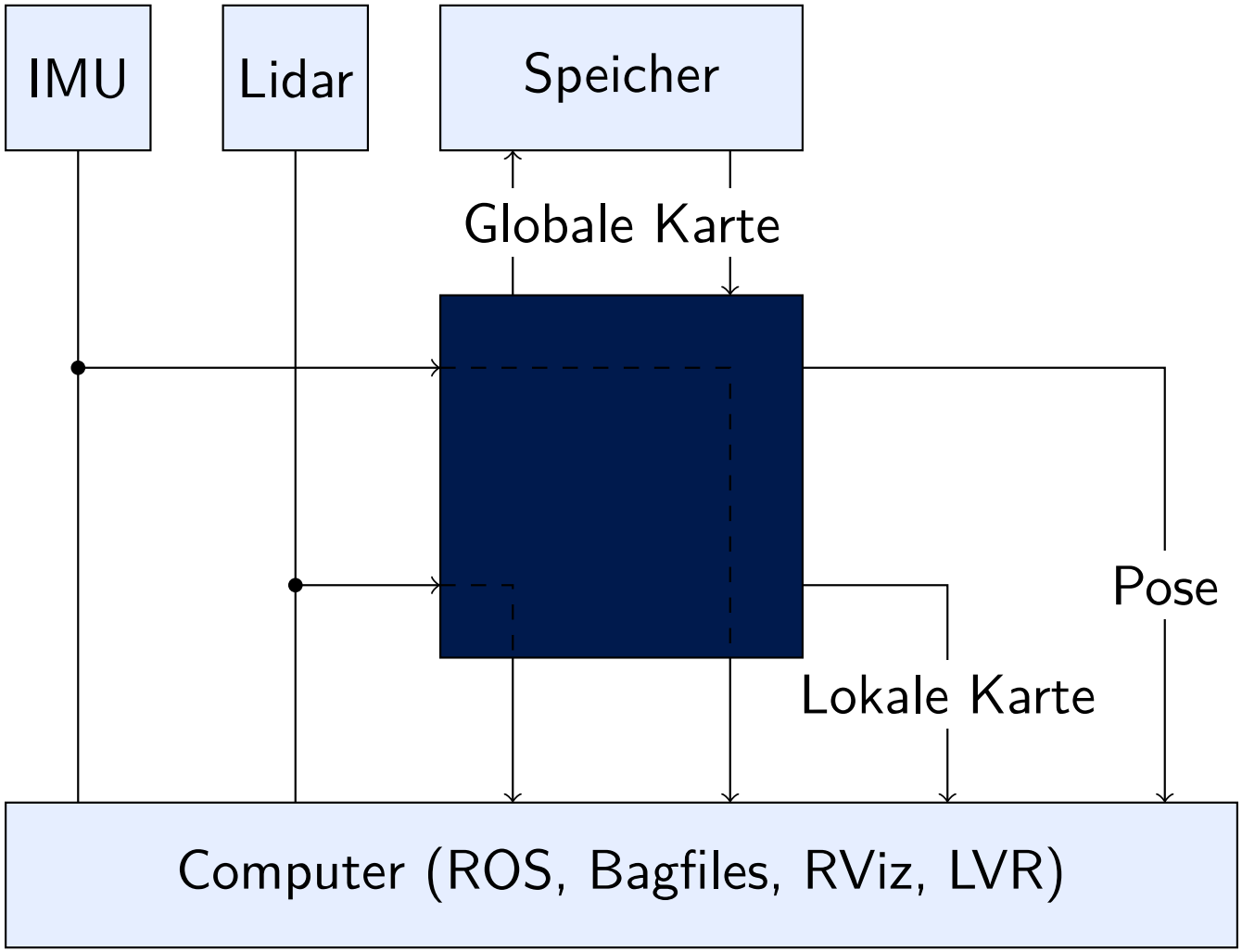


Camera image | Removing noise | Trail pixel extraction



Thresholding | Remove fragments | Trail direction

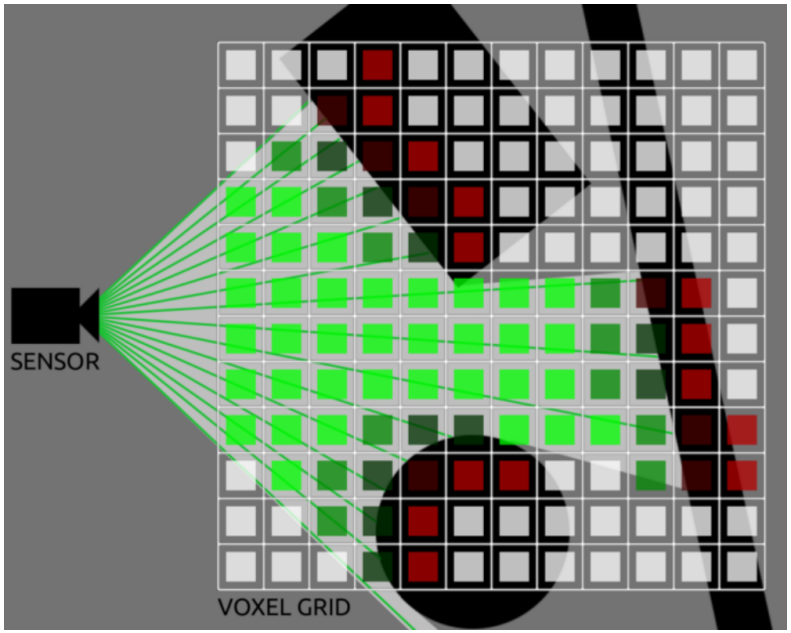
SLAM-Box

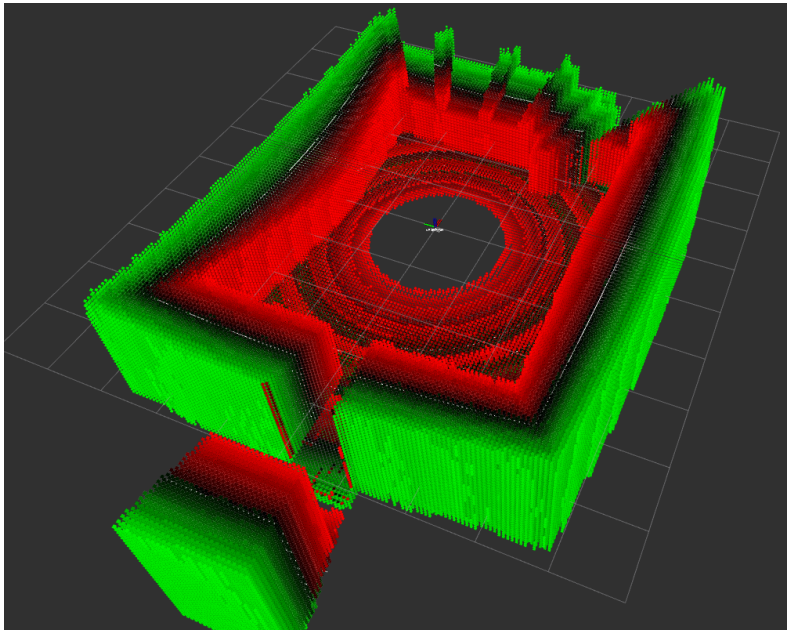

IMU
Lidar
Speicher
Globale Karte
Pose
Lokale Karte
Computer (ROS, Bagfiles, RViz, LVR)

Vorgehen

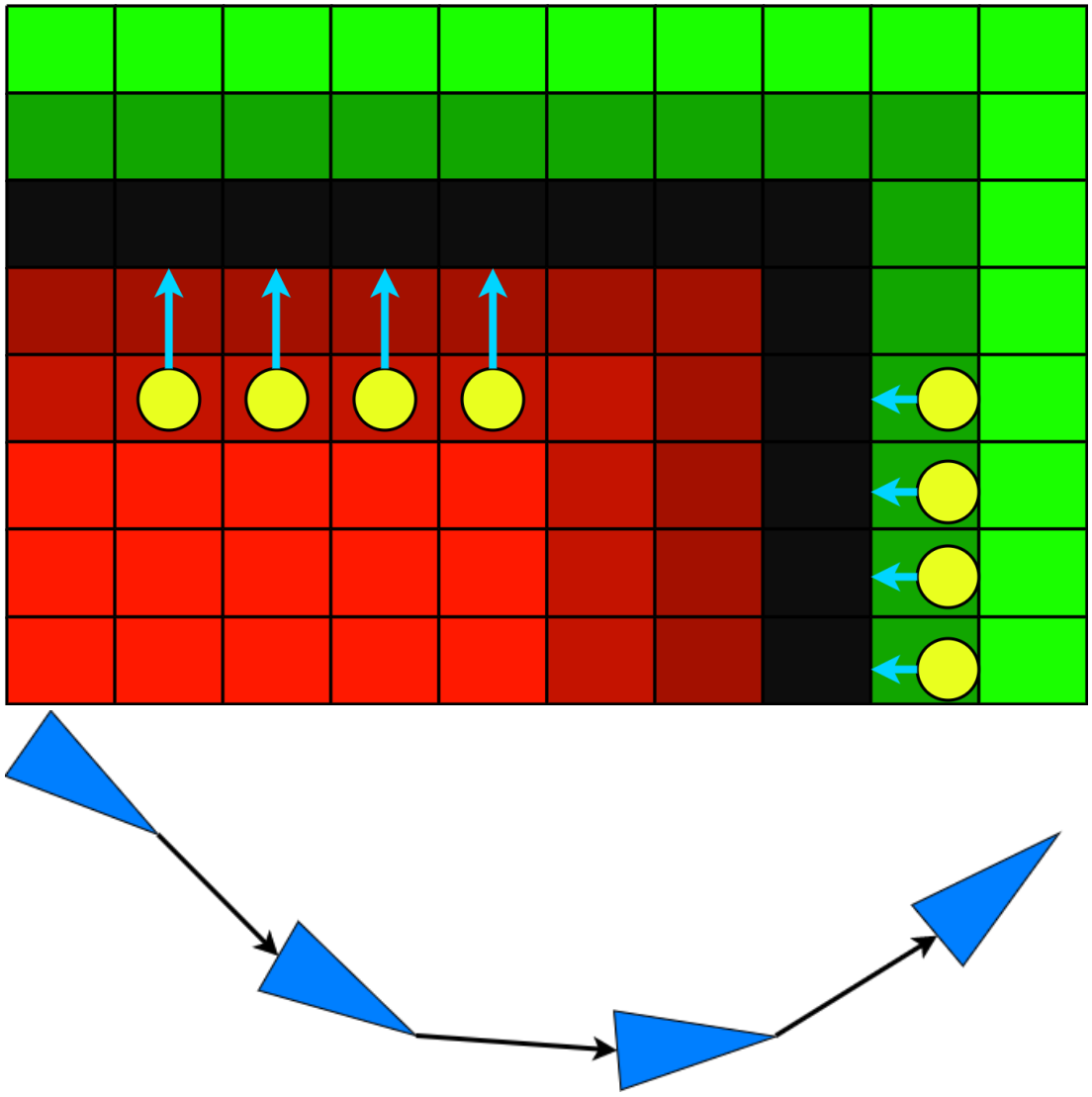
TODO

TSDF

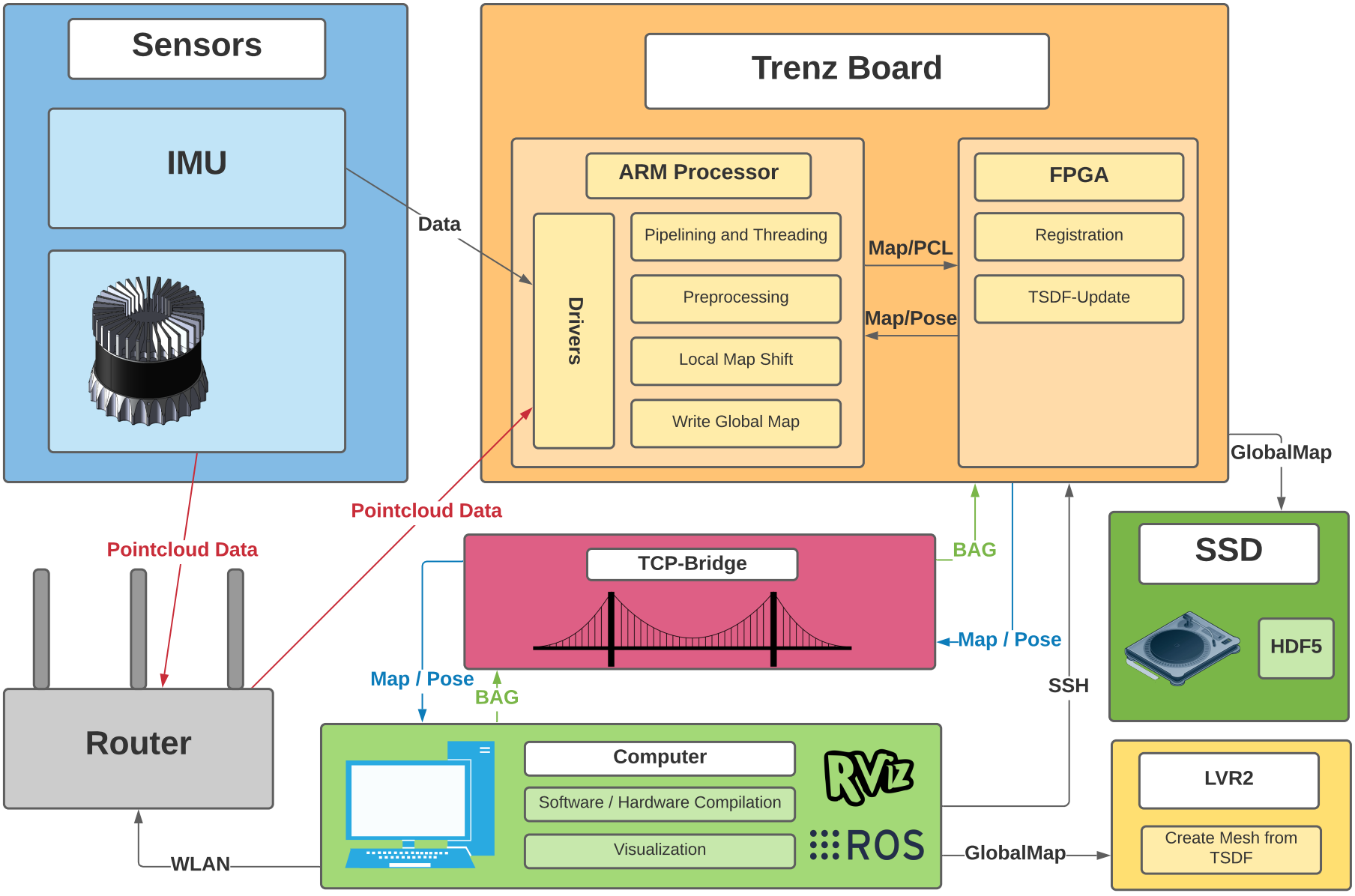




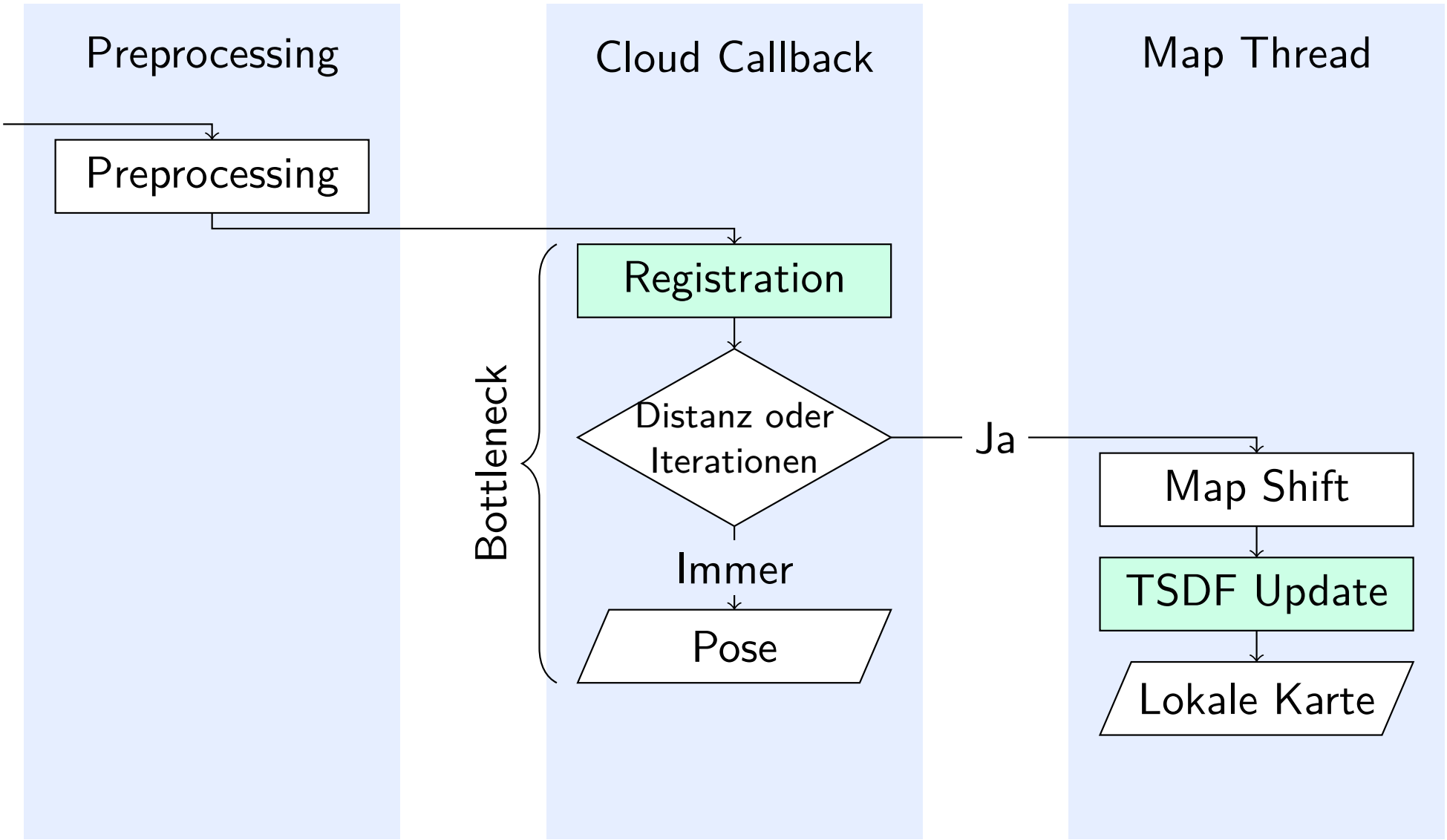
Point-to-TSDF Registrierung



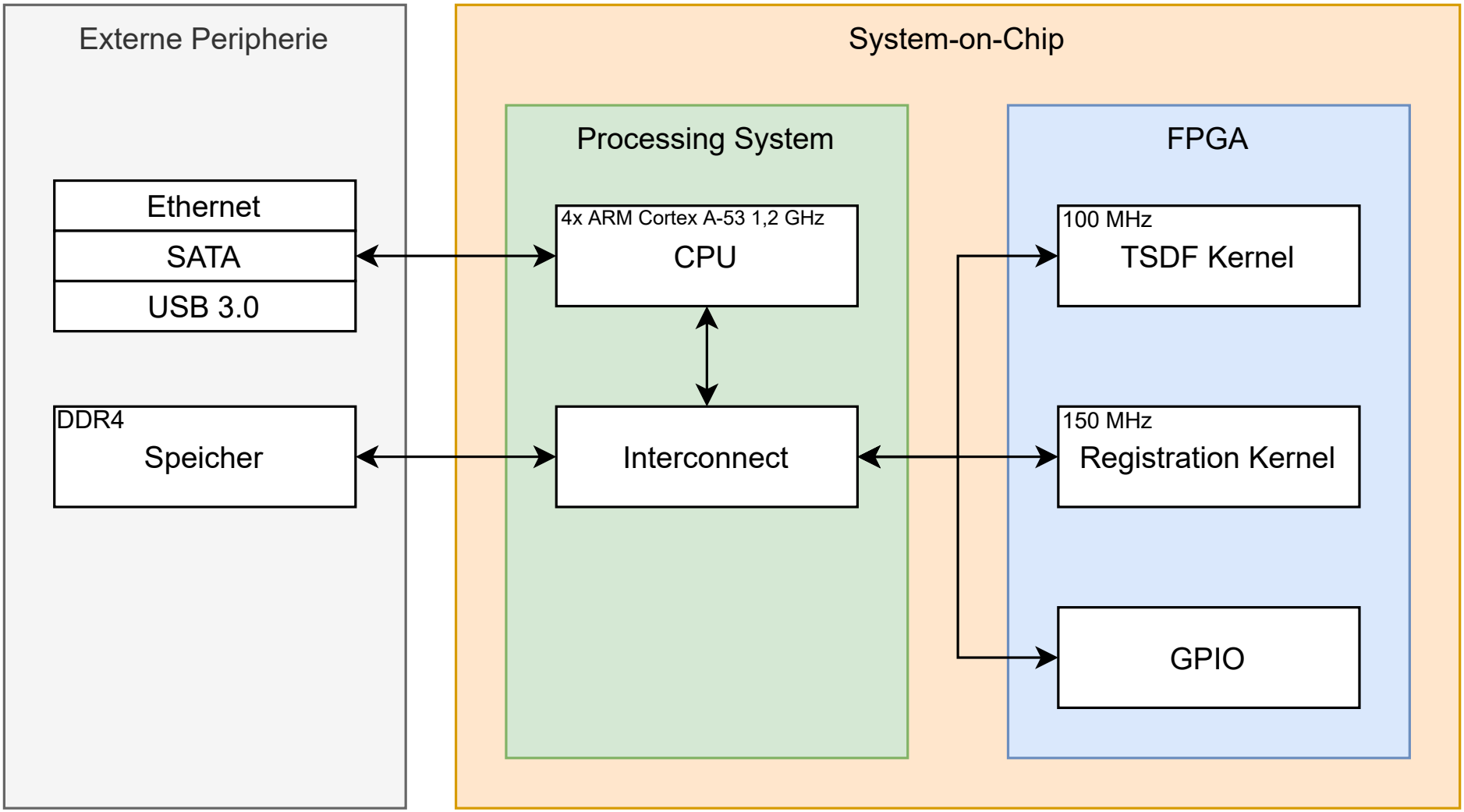
Komponenten



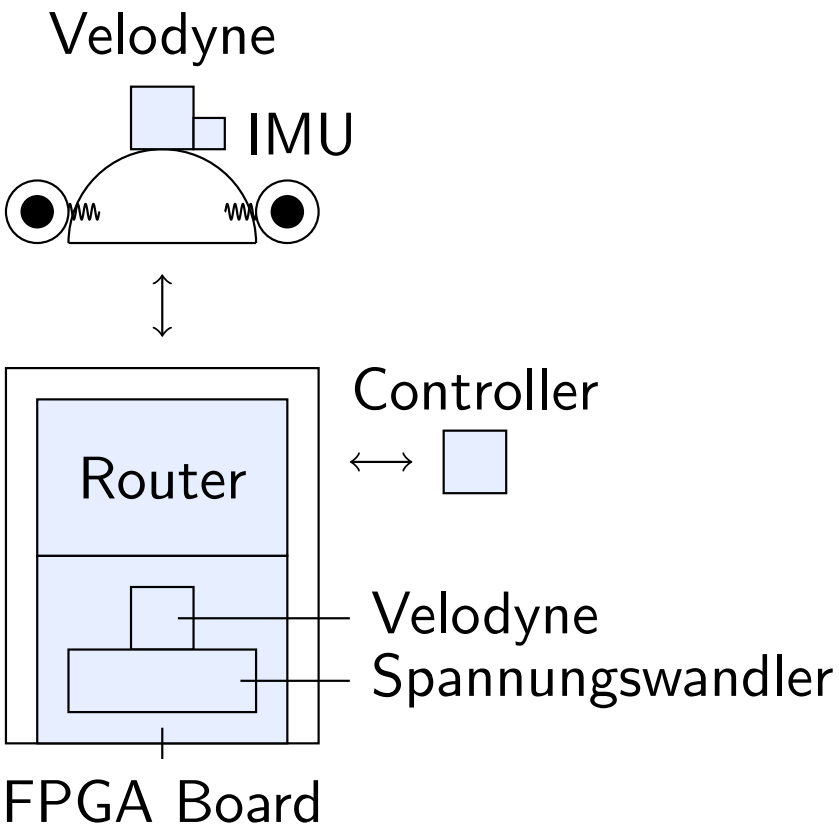
Algorithmus



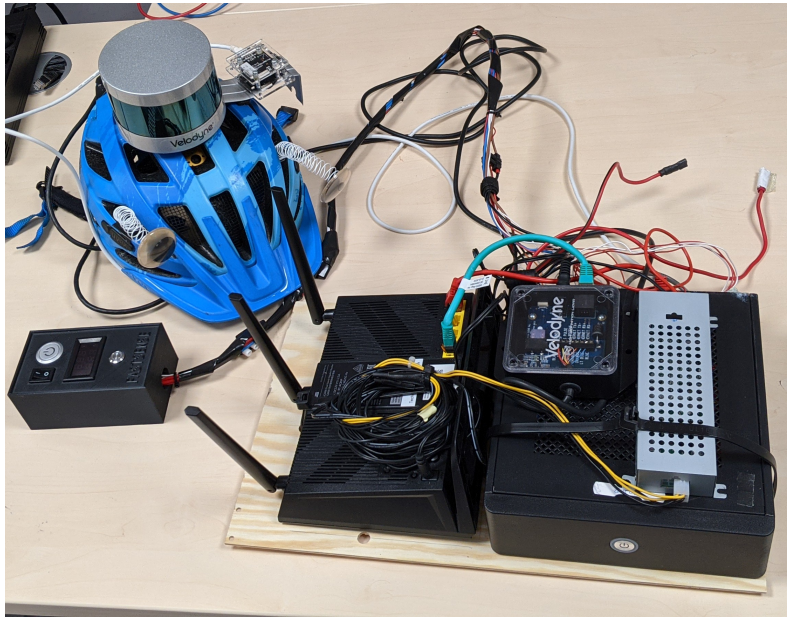
Hardware Architektur



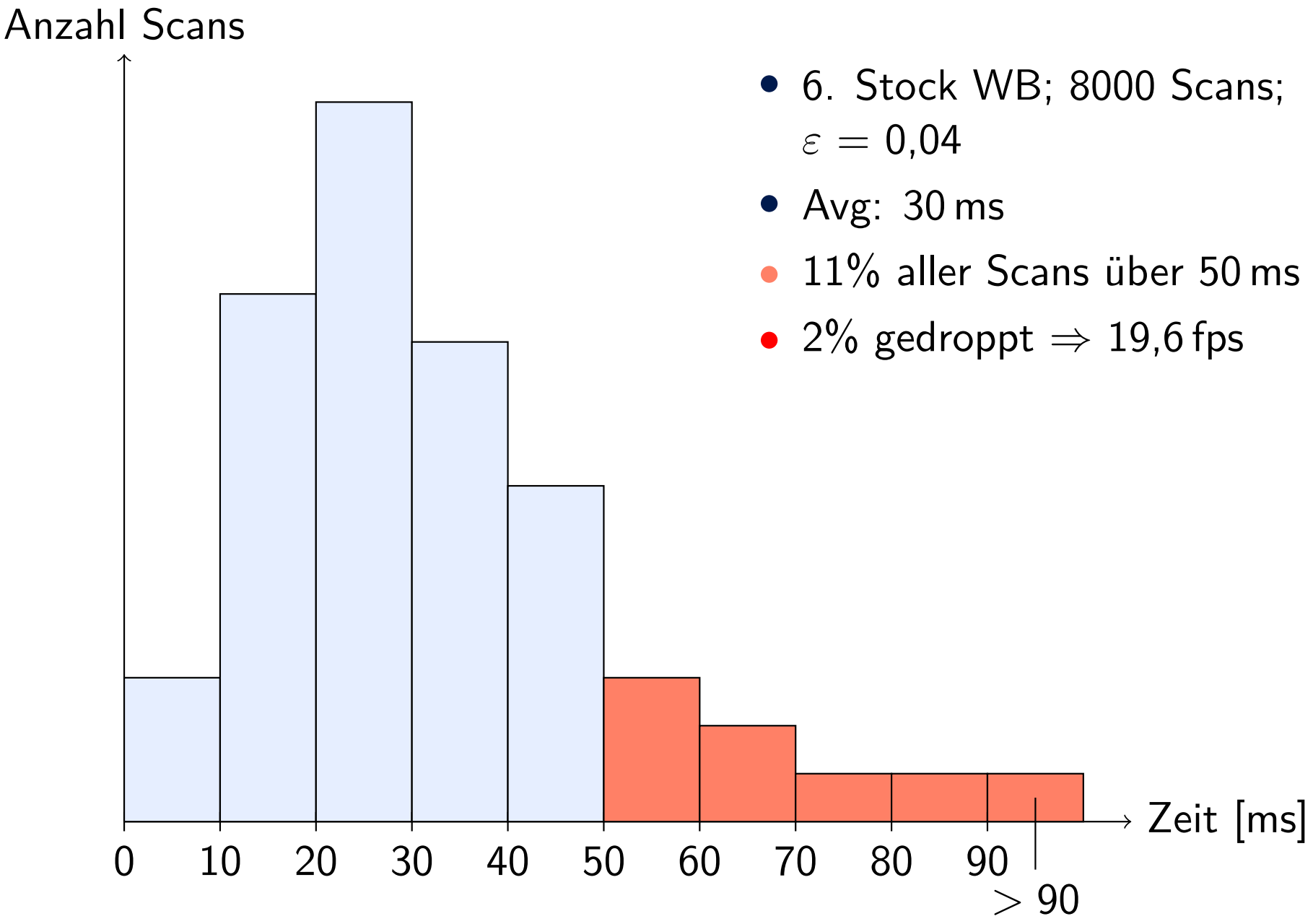
Aufbau


Velodyne
IMU
Controller
Router
Velodyne
Spannungswandler
FPGA Board


Battery On/Off
Board Power Button
Battery Meter (Volt/Ampere)
Start/Stop Button
FASTSENSE

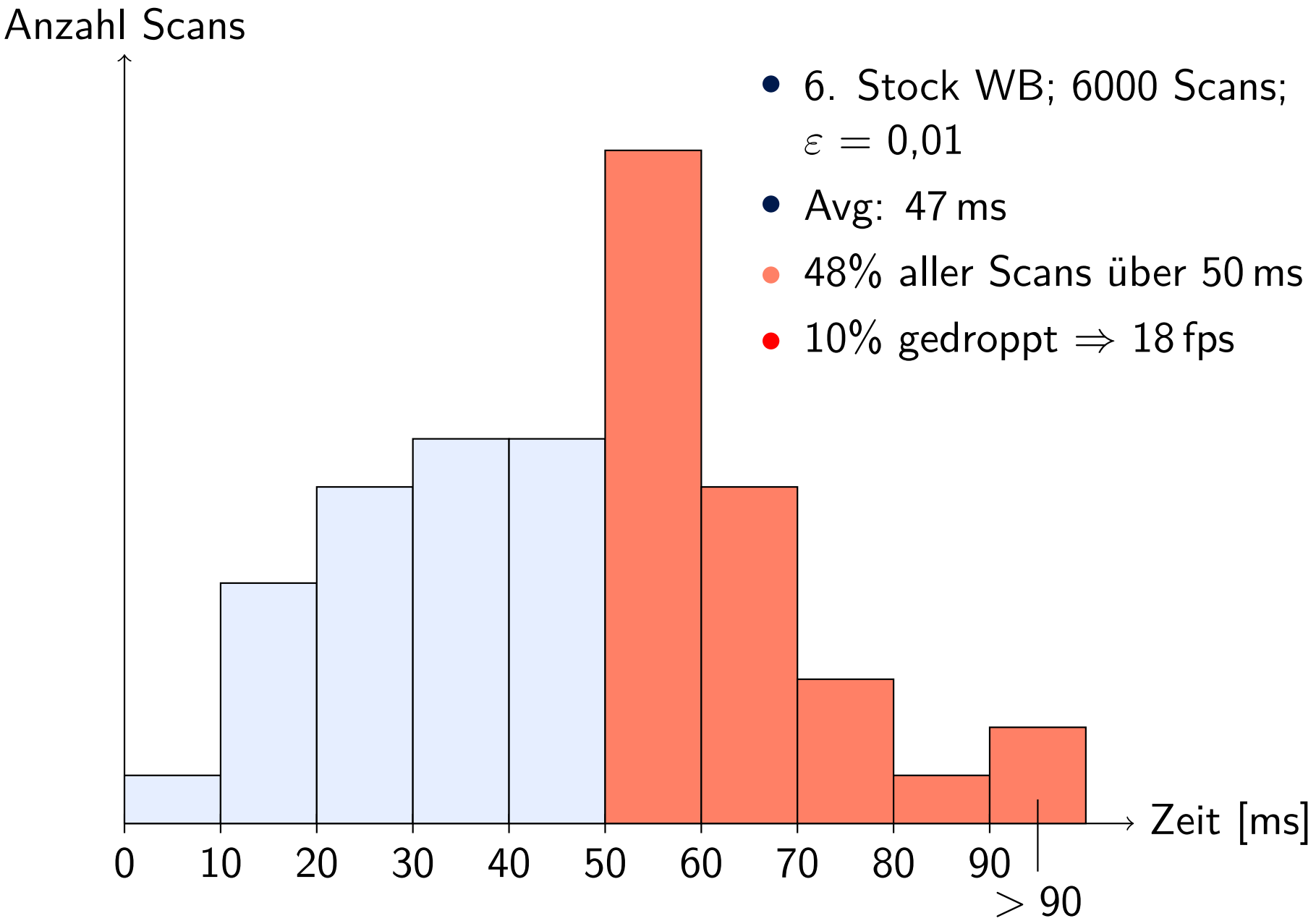


Evaluation: Zeit



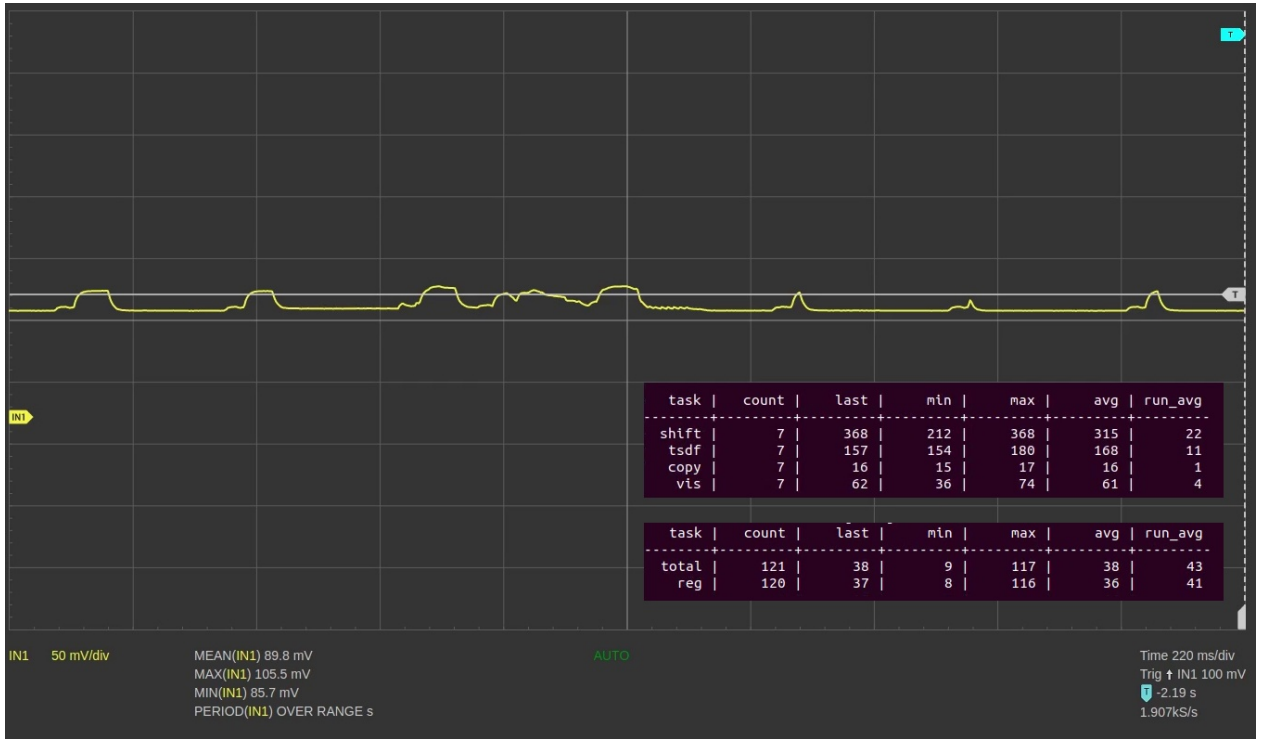
- 6. Stock WB; 8000 Scans; $\varepsilon = 0{,}04$
- Avg: 30 ms
- 11% aller Scans über 50 ms
- 2% gedroppt $\Rightarrow$ 19,6 fps

Evaluation: Zeit



- 6. Stock WB; 6000 Scans; $\varepsilon = 0{,}01$
- Avg: 47 ms
- 48% aller Scans über 50 ms
- 10% gedroppt $\Rightarrow$ 18 fps

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	**15,396**	14,688	18,084

Evaluation: Genauigkeit

- 6. Stockwerk (Distanzabweichung in Meter)

ε	0,01	0,04
	0,0615	0,0505

Geschw.	langsam	schnell
	0,0505	0,0437

  - gesamt (langsam, $\varepsilon = 0{,}04$): 0,075349
- 8 Meter Labortest (Distanzabweichung in Meter)

	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