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A generic multi-lidar data batching strategy on the sensor driver level

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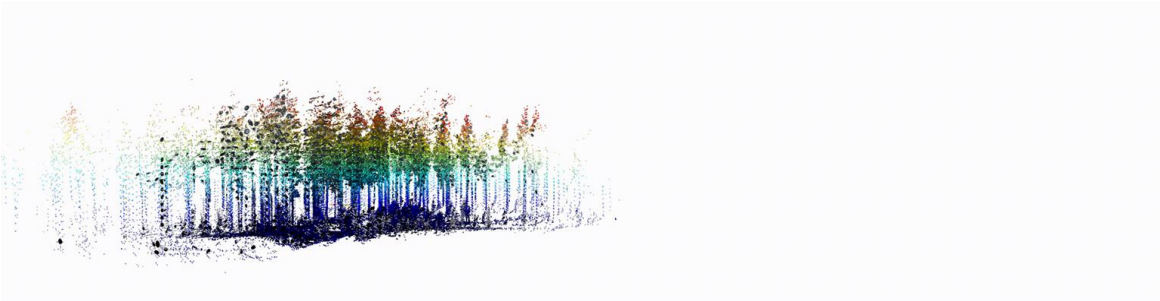
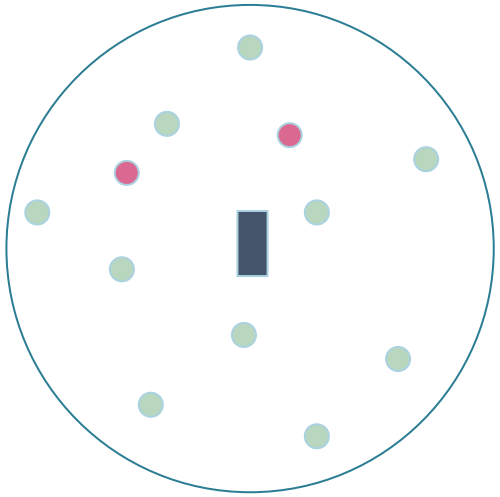
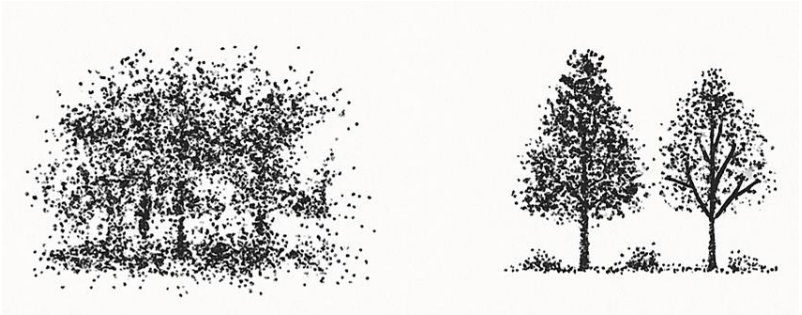
EuroCOW2025 - Warsaw, Poland

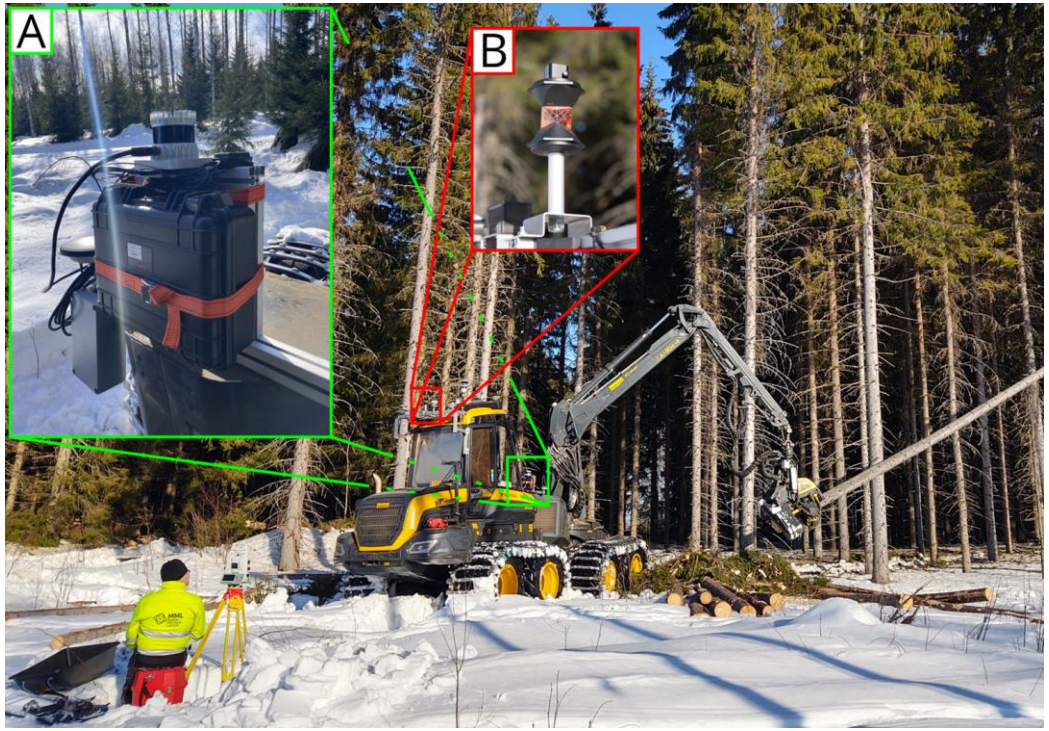
Background



- **Lidar** on **forest harvester**
  - enable **operator support** (in the future..)
  - **requires** good **positioning** inside forest
- **Lidar-inertial** positioning (**SLAM**)
  - **real-time**, not post-processed







Why use multiple lidars?

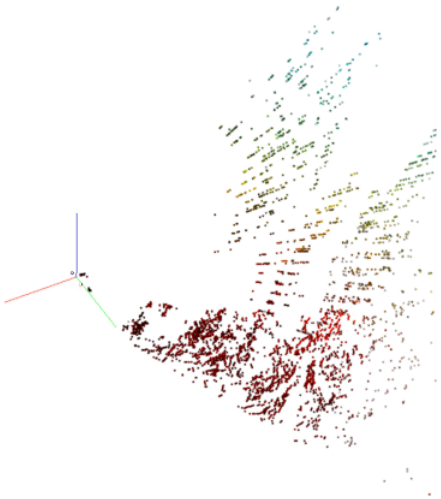
- Larger **field of view** (see tree tops)
- Reduced **occlusion**
- Sensor **redundancy** in case of failure
- (Lidars are becoming more **affordable**)

single lidar scan

Spinning lidars in real-time applications

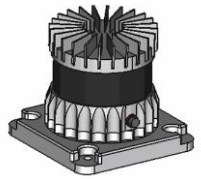
- Sensor sends **data packets** (few columns of points)

- **Batching**, usually, **one spin** provides **one scan**

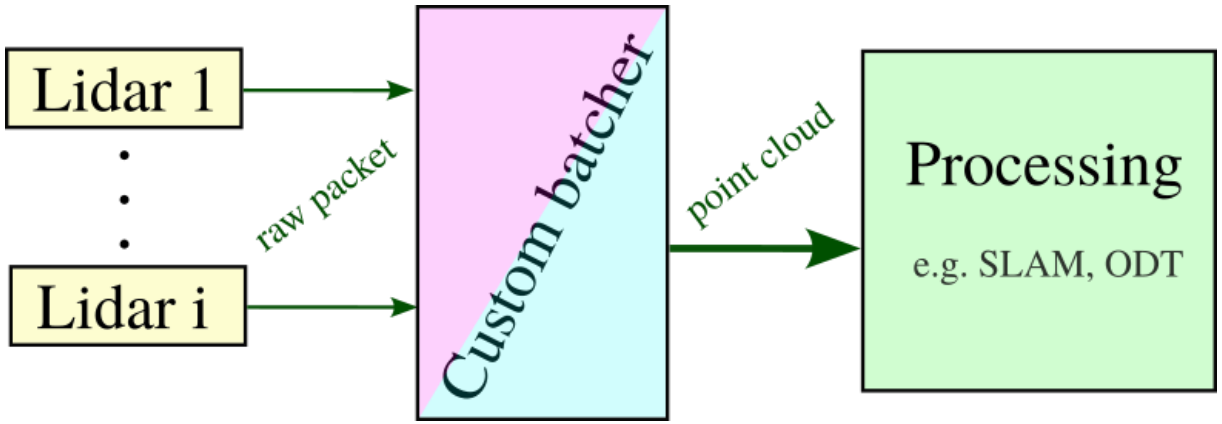


- Perform an **update** on **state** with one scan

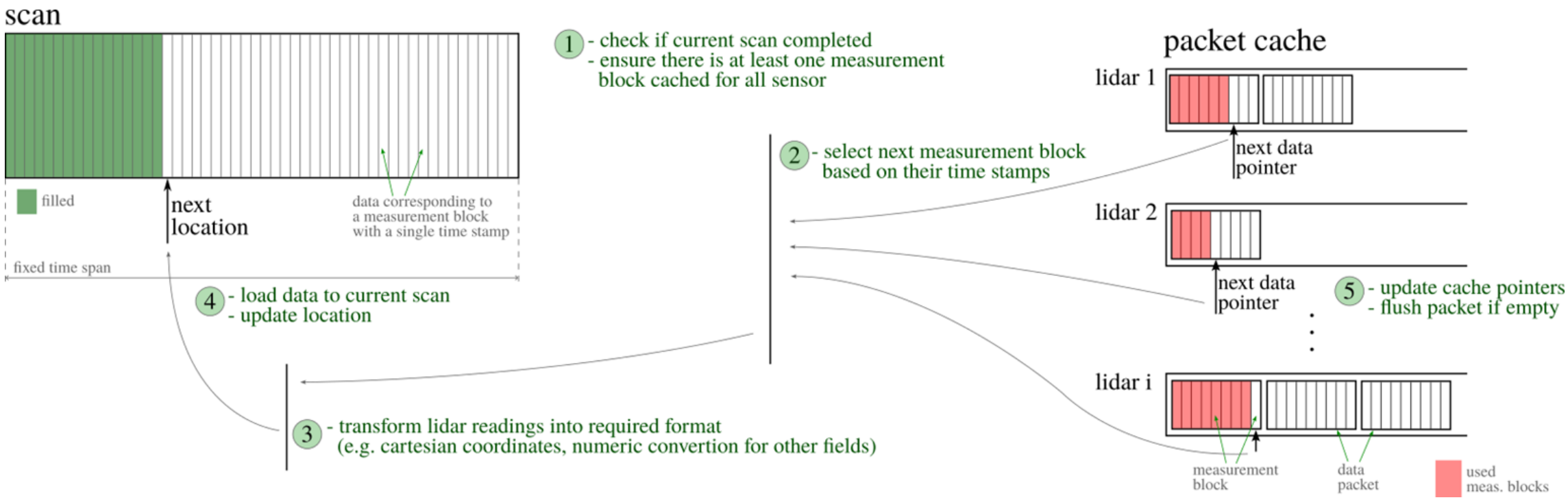
- **What happens when we want to use multiple lidars?**



Common strategies, issues



Custom multi-lidar batching

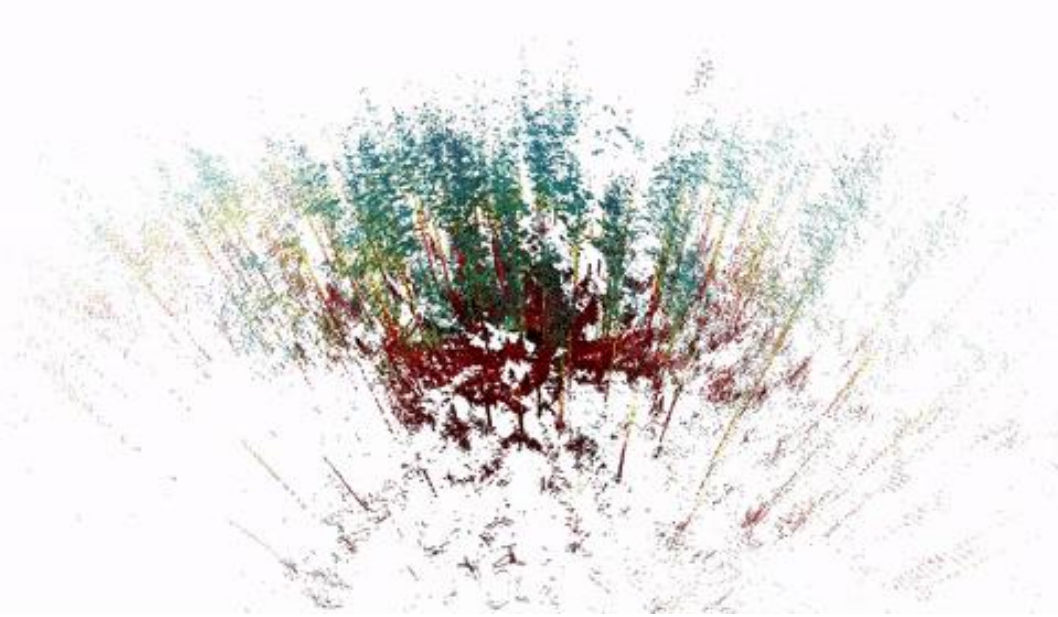


Tests with forest harvester (1/2)

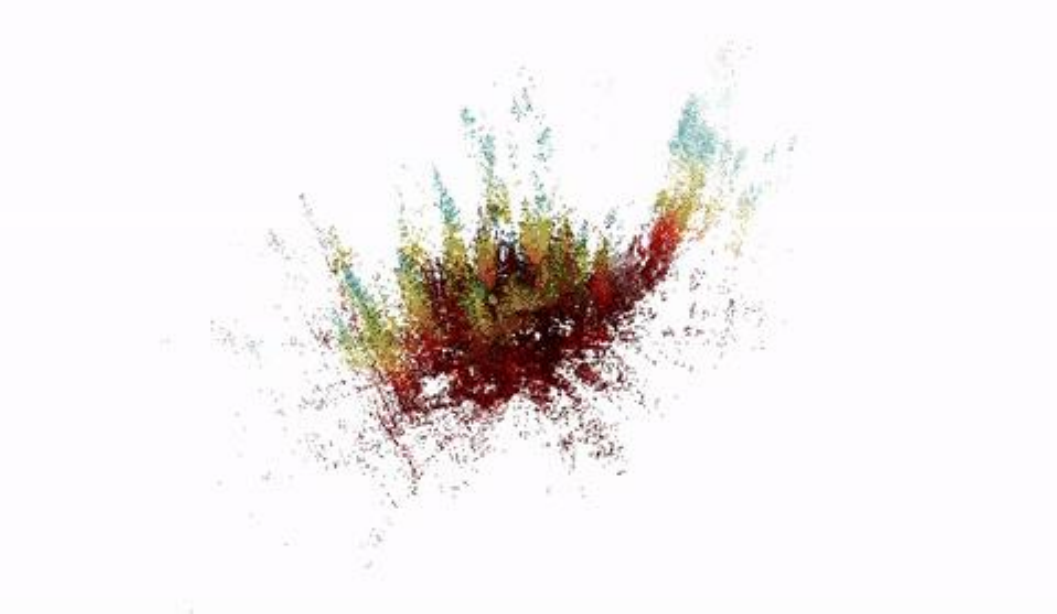
Evo 2023, sparse (pine)

Evo 2024, dense young (mixed)

Tests with forest harvester (2/2)



Evo 2023, sparse (pine)



Evo 2024, dense young (mixed)

Drawbacks, considerations

- **Implementation cost**
- **Image** based representation gets **scrambled**
  - can be solved by projecting from 3D to polar coordinates

Tips:

- use **fixed size** scans (even if not fully filled)
- **parameterize** scan **width** by batching period (to control scan rate)
- precompute **lookup table** with both intrinsic + extrinsic parameters

Conclusions

- **Custom batching** strategy
  - enables the **use** of **existing algorithms** designed for single spinning lidar
  - **solves** potential **time misalignment issues**
  - **controllable** scan **size** (e.g. full revolution, half, quarter etc.)
- **Generic:**
  - supports **any number** of lidars
  - supports **different** lidars

- **Drawbacks**:
  - additional **implementation cost**
  - **issues** with algorithms using **image** and not 3D representation

Advancing together

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