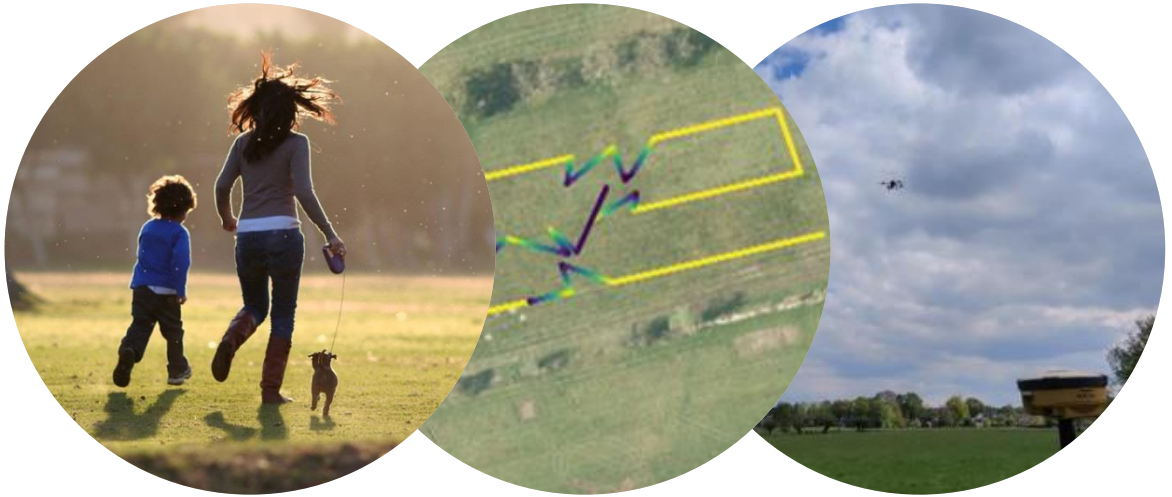
Adaptive path planning for drones

Sub title

3 July 2024, Rick van Essen



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Synergia

Motivation

- Gebruik drones landbouw > ziekte + onkruid
- Waarom sneller? -> efficienter, meer oppervlak per drone etc

Objective

- Niet vaak voorkomend, goed zichtbaar lage hoogte, indicatie vanaf hoger
- Aantonen adaptive path planner is snel
- Beste vlieghoogte
- Effect detetie confidence
- Effect distributie objecten

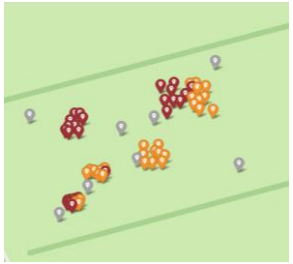
Data collection

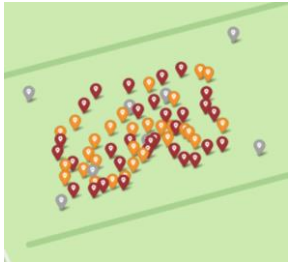
- DJI M300 RTK with DJI Zenmuse P1 camera
- 60 plants distributed in field (30 each):





- RTK-GPS position measured from each plant
- Two distributions:







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Datasets

Date	Distribution	Altitudes
13-02-2024	Uniform	12, 16, 20, 24, 28, 32
13-02-2024	Clustered	12, 20, 24, 28, 32
23-04-2024	Uniform	12, 16, 20, 24, 28, 32, 36, 40
23-04-2024	Clustered	12, 16, 20, 24, 28, 32, 36, 40

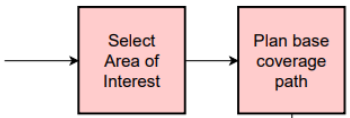
Detection network

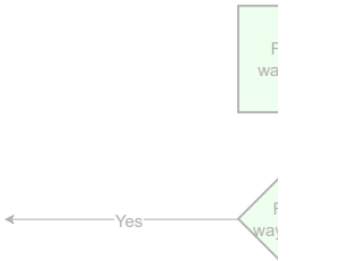
- Standard YOLOv8
- Trained on dataset ‘13-02-2024 – Uniform’
- Automatically annotated using RTK-GPS positions, manually refined

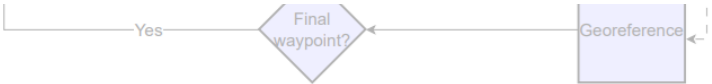
Adaptive planner

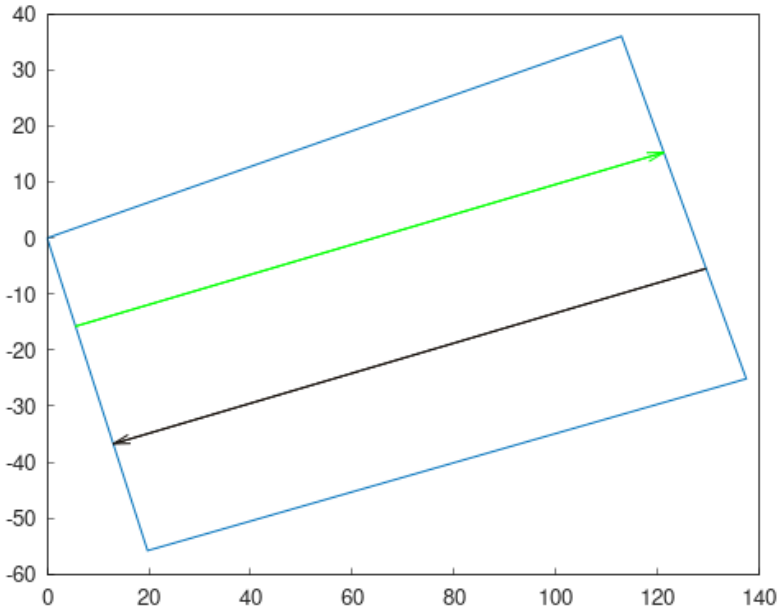


Adaptive planner



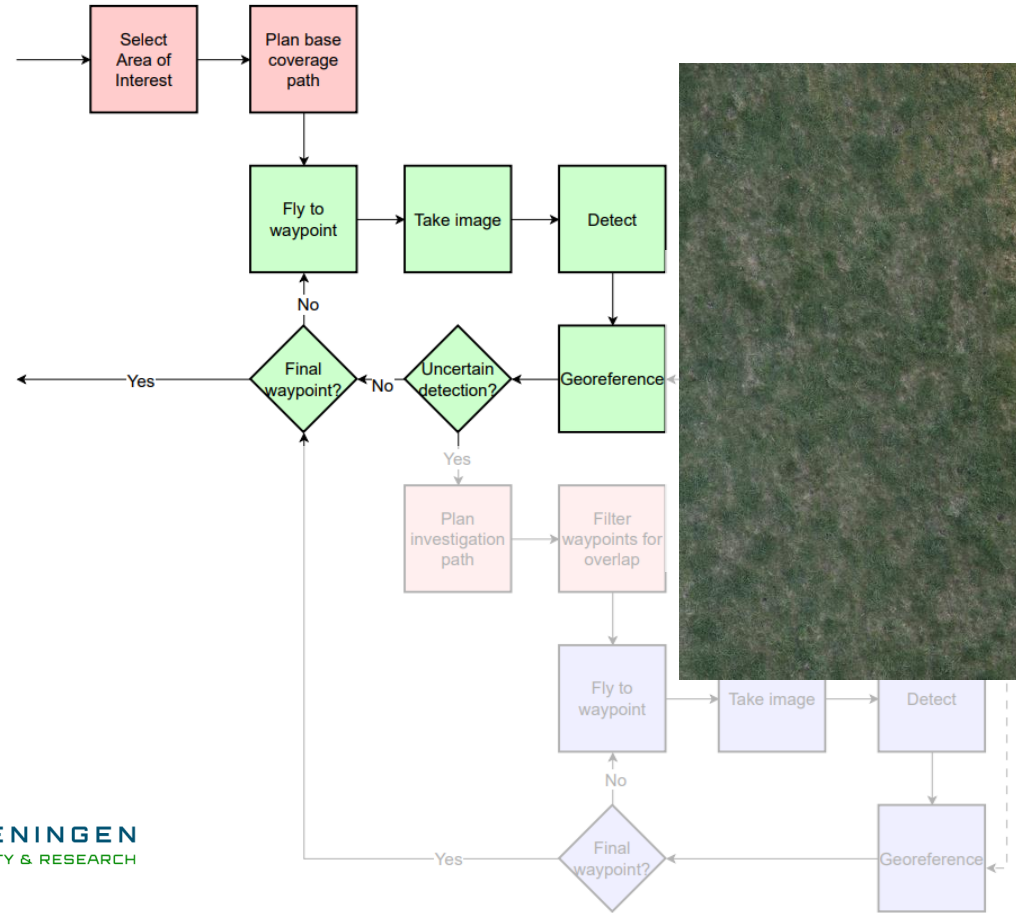






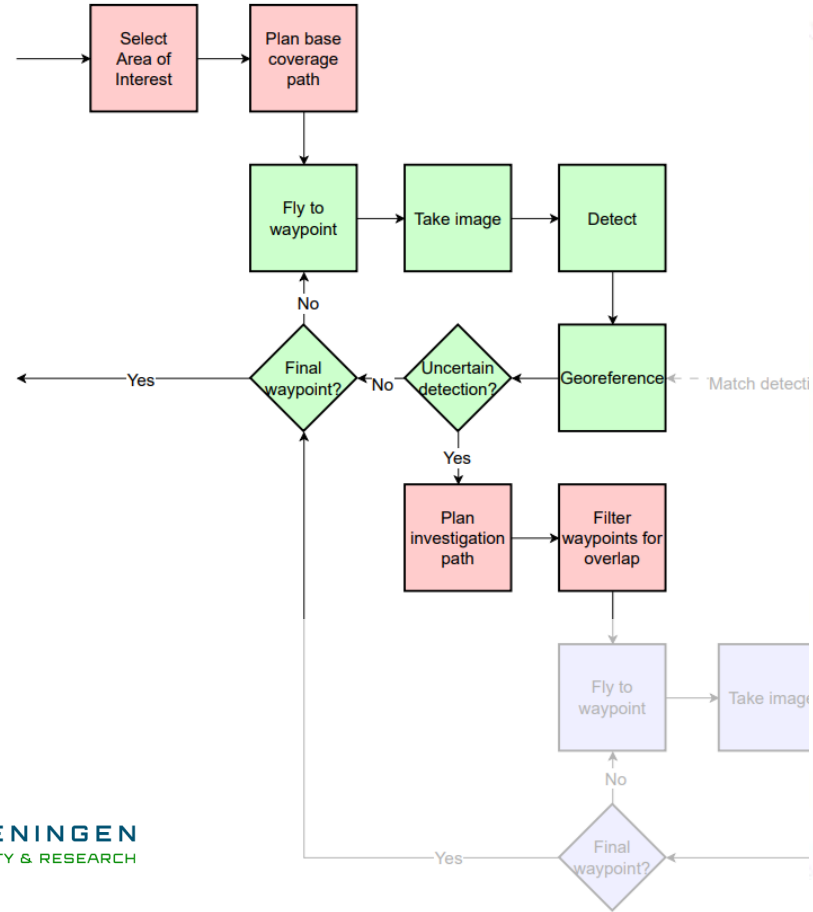
Base altitude

Adaptive planner





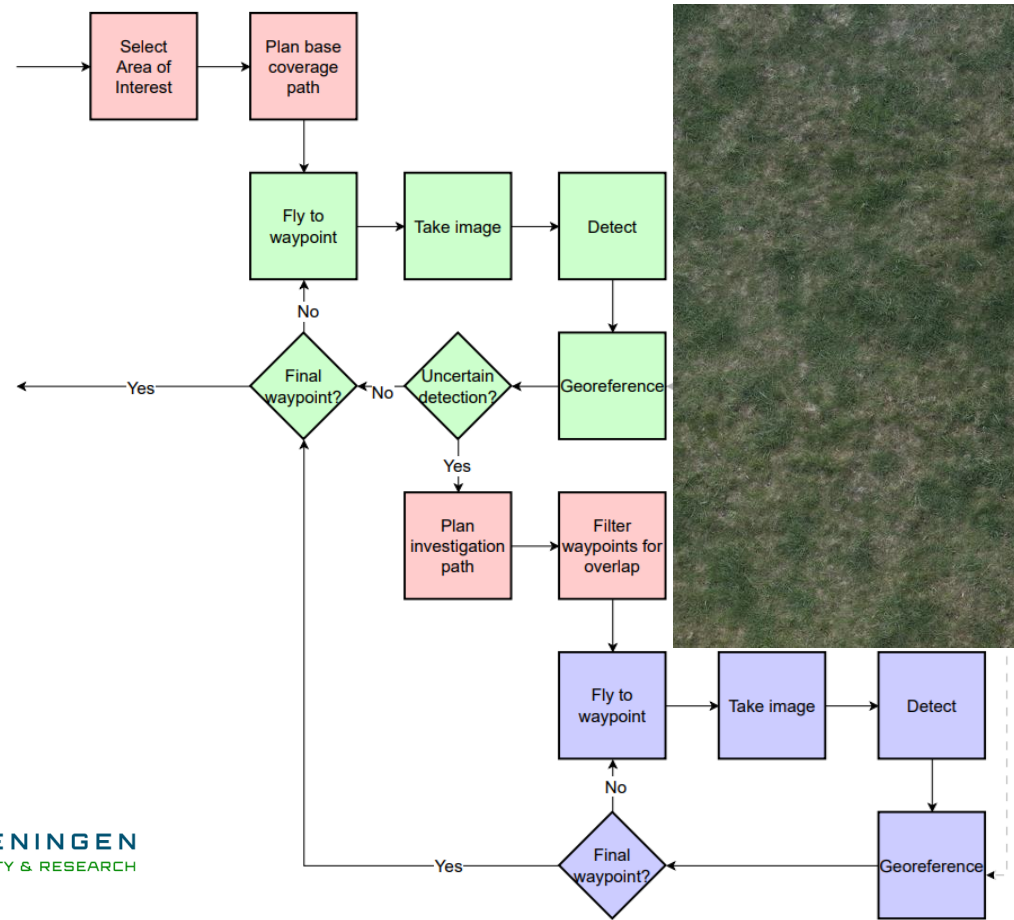
Adaptive planner





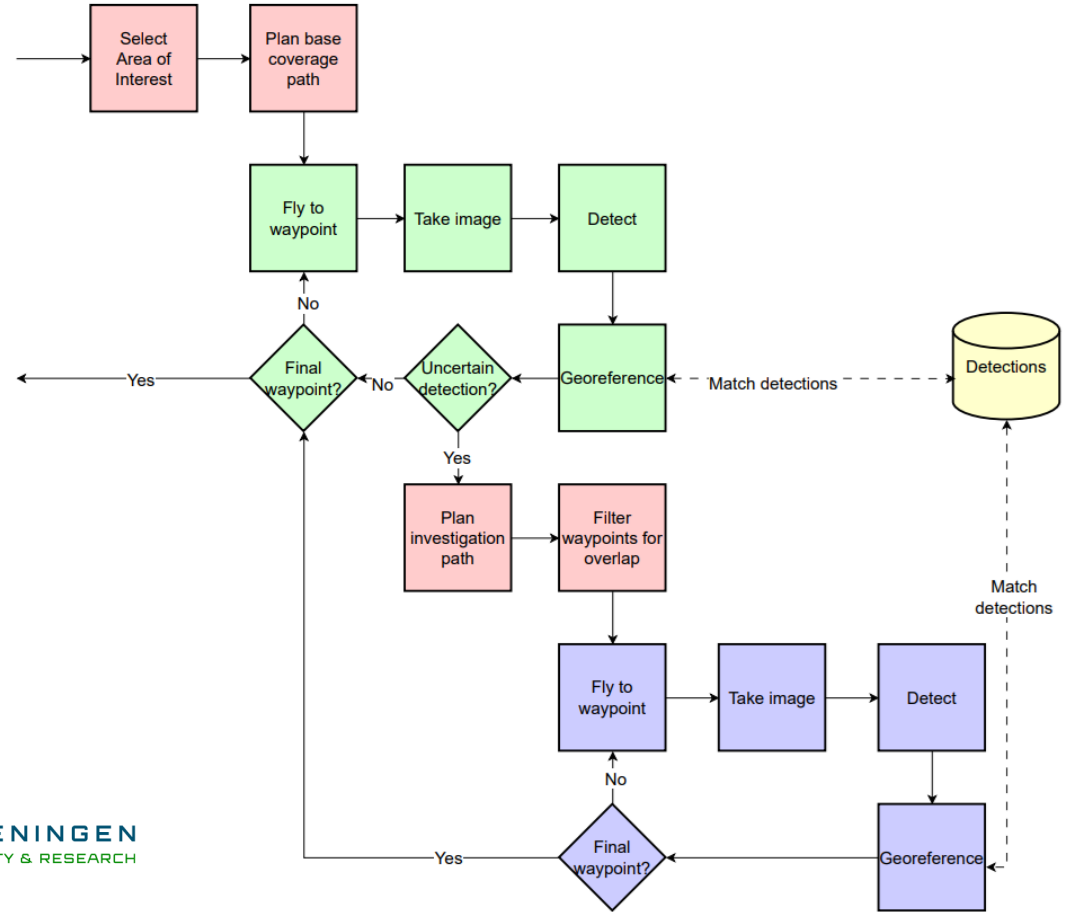
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Adaptive planner



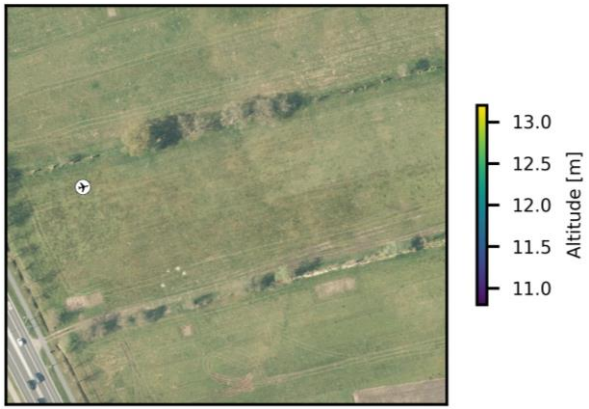


Adaptive planner



Influence base altitude – flight path

12m



726 meter

24m



451 meter

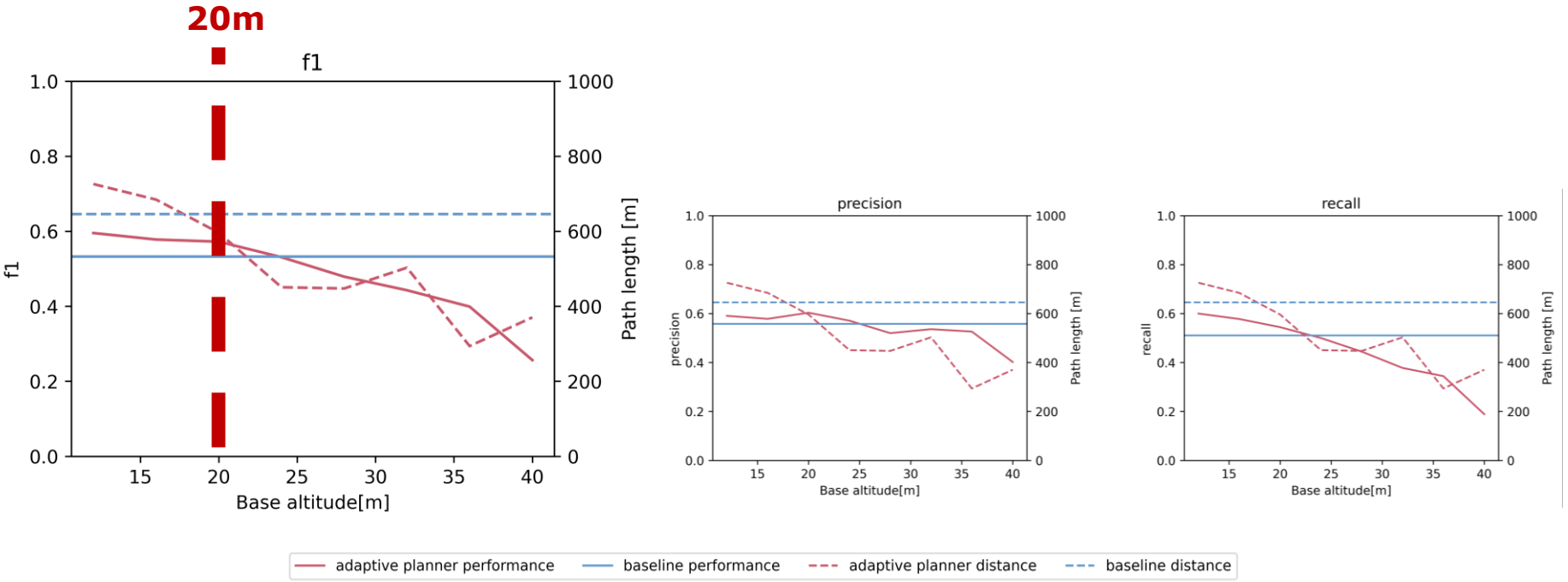
36m

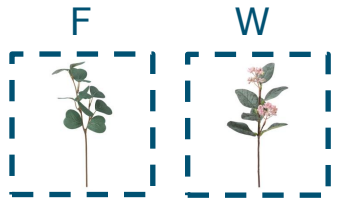


294 meter

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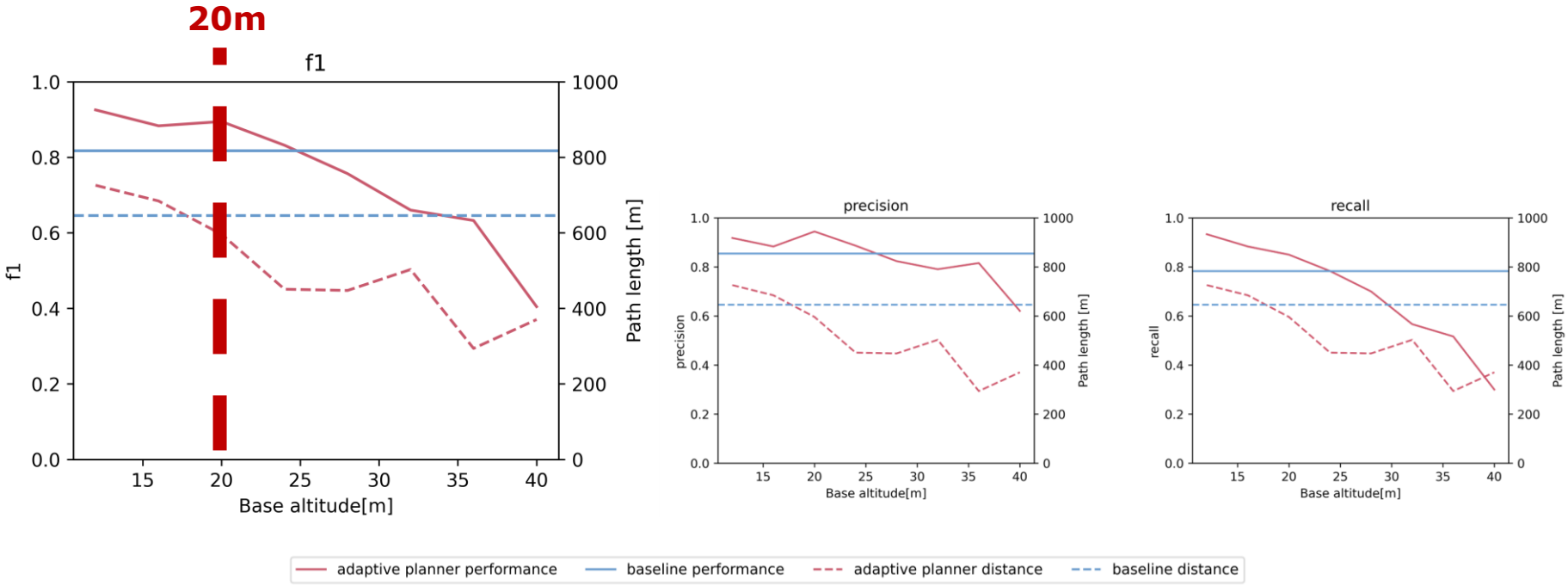
Influence base altitude – performance





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Influence base altitude – performance



Plant



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Influence inspection confidence– flight path

inspection_confidence=0.1



398 meter

inspection_confidence=0.5



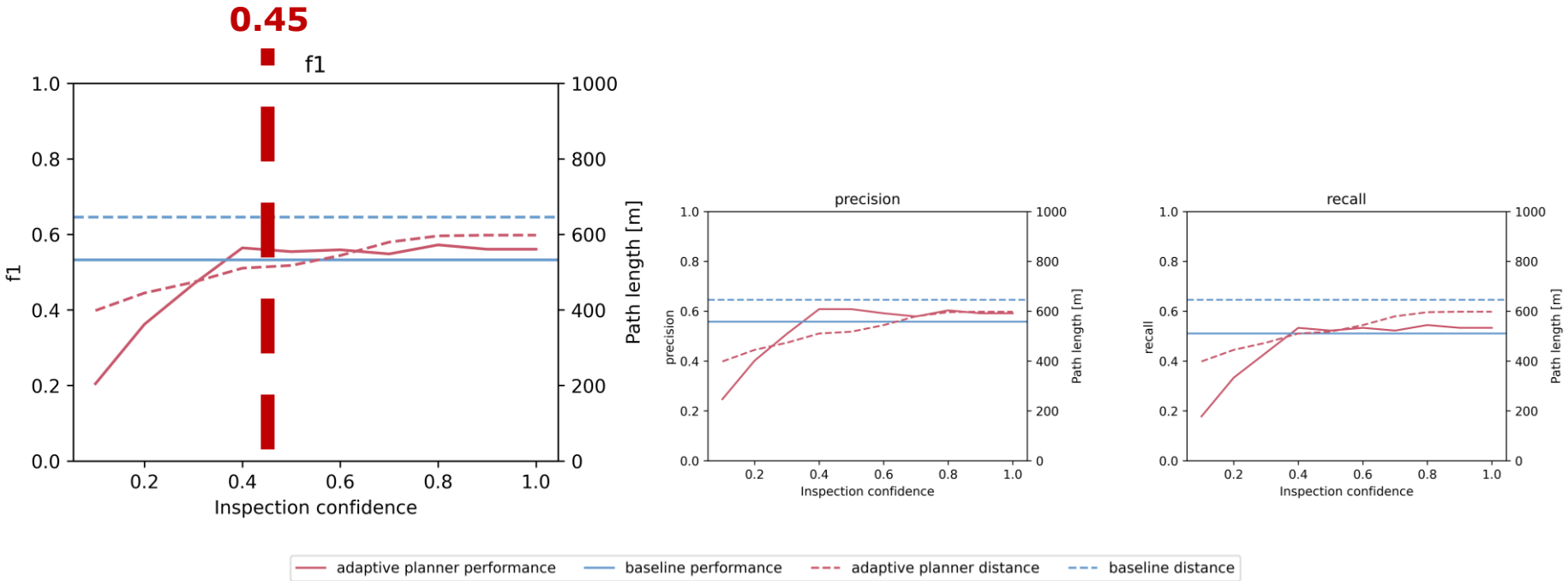
518 meter

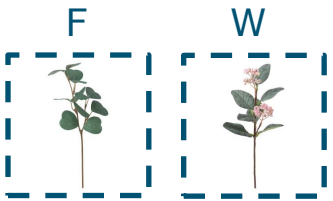
inspection_confidence=1.0



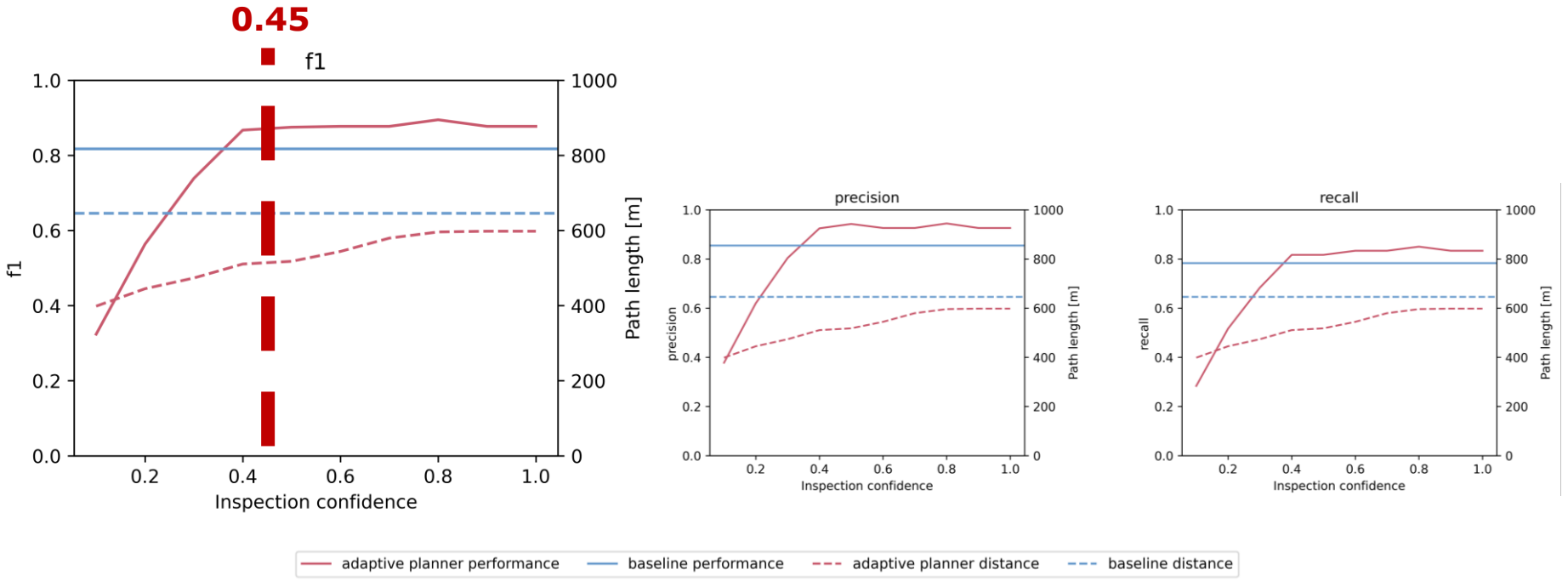
598 meter

Influence inspection confidence – performance





Influence inspection confidence – performance



Plant



Effect object distributions – flight path

- TODO

Effect object distributions – performance

- TODO

Effect object distributions – performance

- TODO

Discussion

- Flight path not optimal yet:



- Flight speed can be increased at higher altitude

- Multi-modal sensing

Take home message

‘When using **adaptive path planning**, you can detect objects **faster** with an **equal or better performance**’

Thanks for your attention!



Rick van Essen

rick.vanessen@wur.nl

Agricultural Biosystems Engineering

Wageningen University and Research

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