



DriftRadar® concept: Towards the automatic management of spray drift

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Who are we (Who am I) ?



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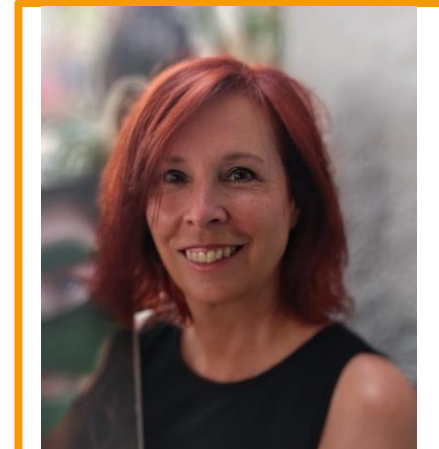
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Summary

1. Concepts of smart sprayers
2. DriftRadar® components
3. DriftRadar® evaluation methods
4. Results
5. Conclusion



01

Concepts of smart sprayers



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1- Different types of smart sprayers

Functionalities

- ▶ Detection : vegetation-crop architecture/width, weeds*, diseases,
 - RGB or multispectral imagery
 - Lidar
- ▶ Variable Rate Application (VRA)
 - Boom section control
 - PWM nozzles : spot spraying, acc/decc phases, spraying while turning,...
 - Canopy adapted sprayers air/spray adjustment
- ▶ Spray drift adjustment
 - Multiple nozzle holders (Amazone, John Deere, ...)

*Liu, B., Bruch, R. Weed Detection for Selective Spraying: a Review. *Curr Robot Rep* 1, 19–26 (2020).



JD See and spray

02

DriftRadar® components

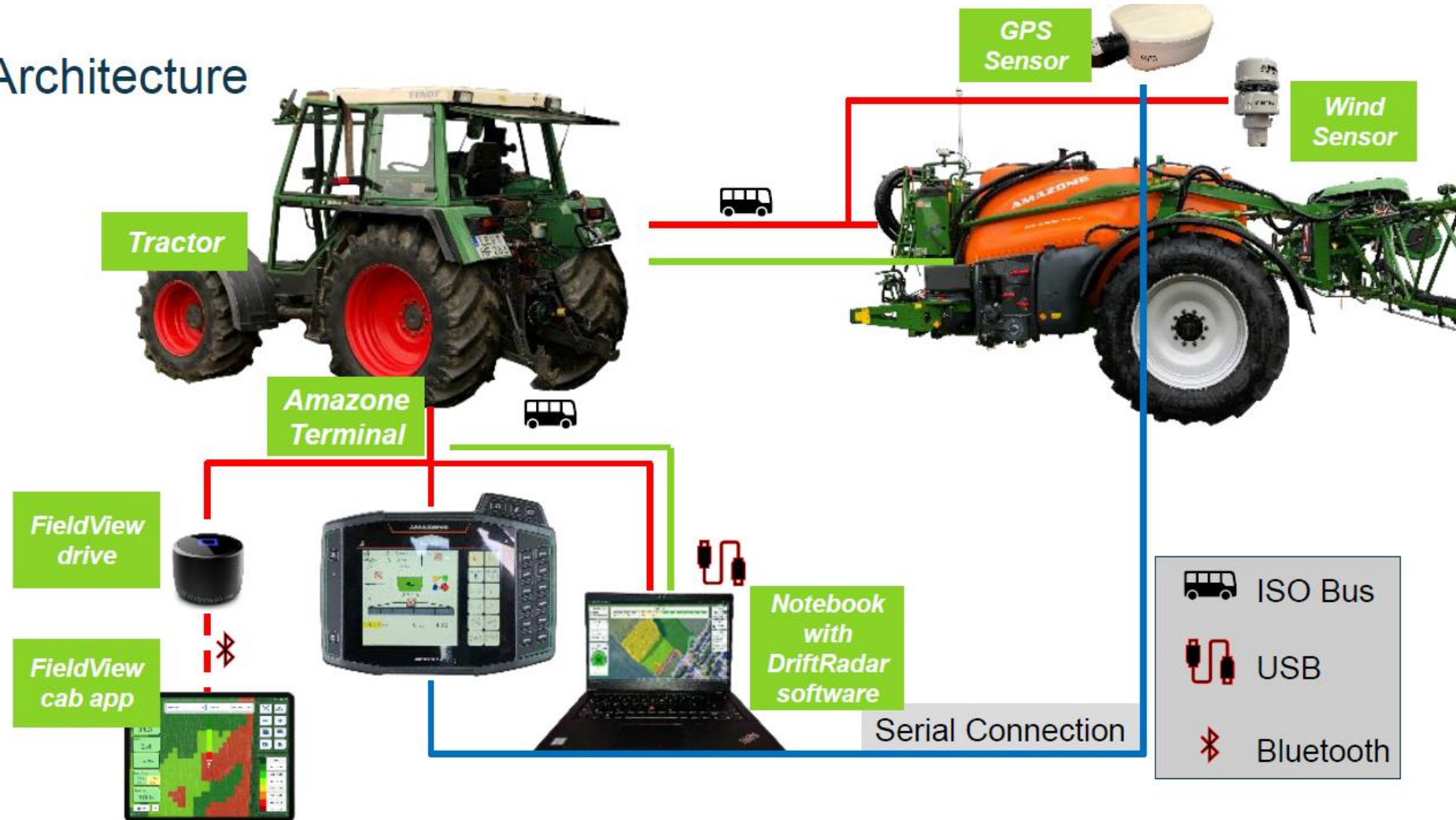


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2- DriftRadar® components





Architecture



2- DriftRadar® settings : digital label interface

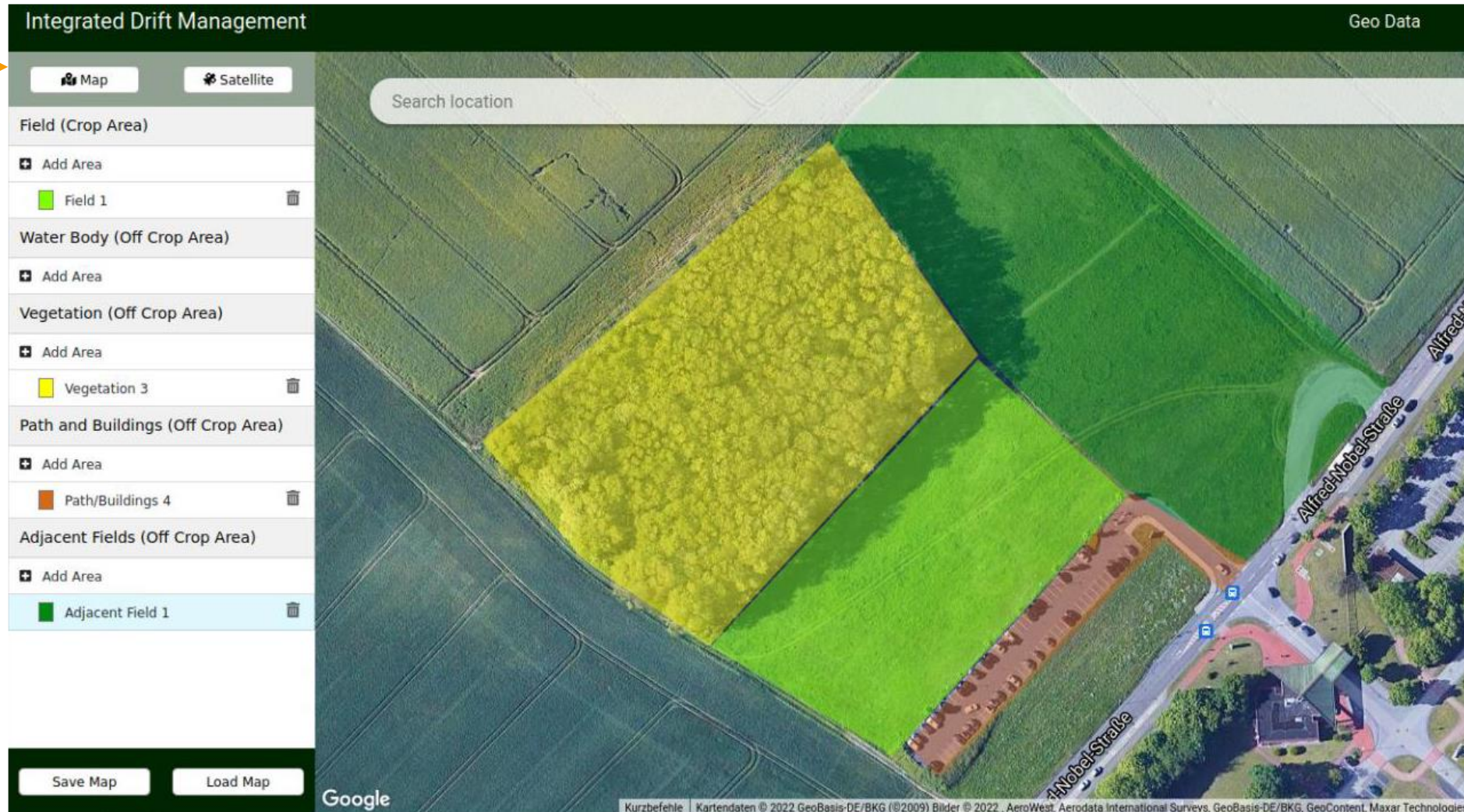
Product Selection

Product Decis Protect ▼	Scan	Crop Wheat ▼	Amount 0.42 - 0.5 l/ha ▼	
Product Input ▼	Scan	Crop Wheat ▼	Amount 1.25 l/ha ▼	

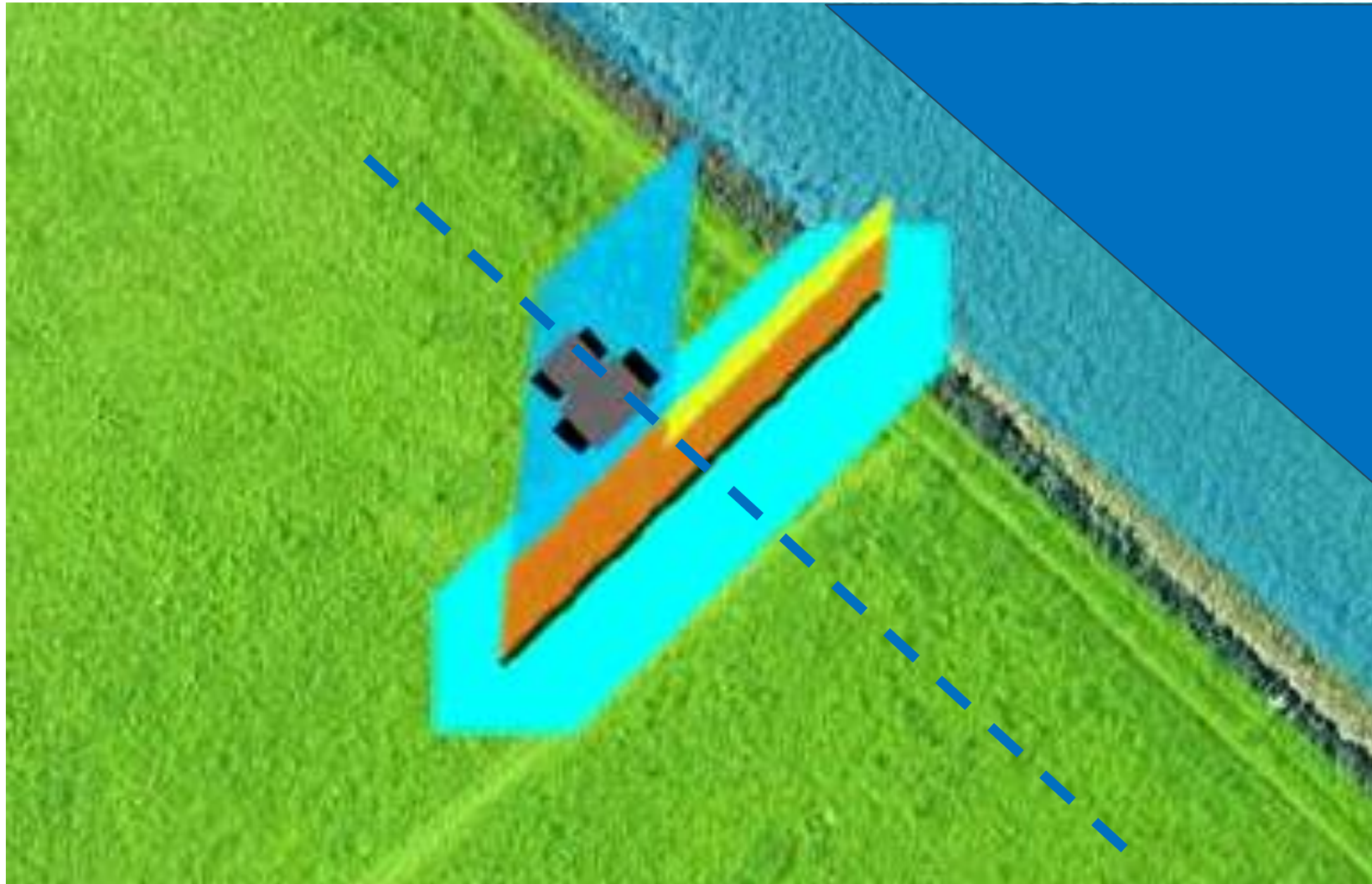
Zone	Standard Nozzle (Meters)		Drift Reducing Nozzle (Meters)		
	Default	Local Requirements	Reduction Level	Default	Local Requirements
Water bodies	20	_____	66%	5	_____
NTTP & NTA	5	_____	66%	5	_____
Bystanders & Residents	5	_____	66%	3	_____
Adjacent Field	0	_____	66%	0	_____

Vegetated Filter Strip (Meters)	
Default	In-Place
5	_____

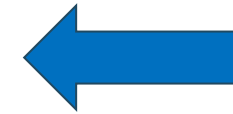
2- DriftRadar® settings : Field/sensitive area mapping



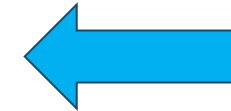
2- DriftRadar® settings : Control system settings



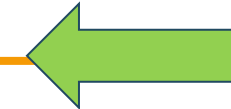
Sensitive area



Buffer distance (CFBZ)



Buffer distance according to the PPP (SFPZ)



03

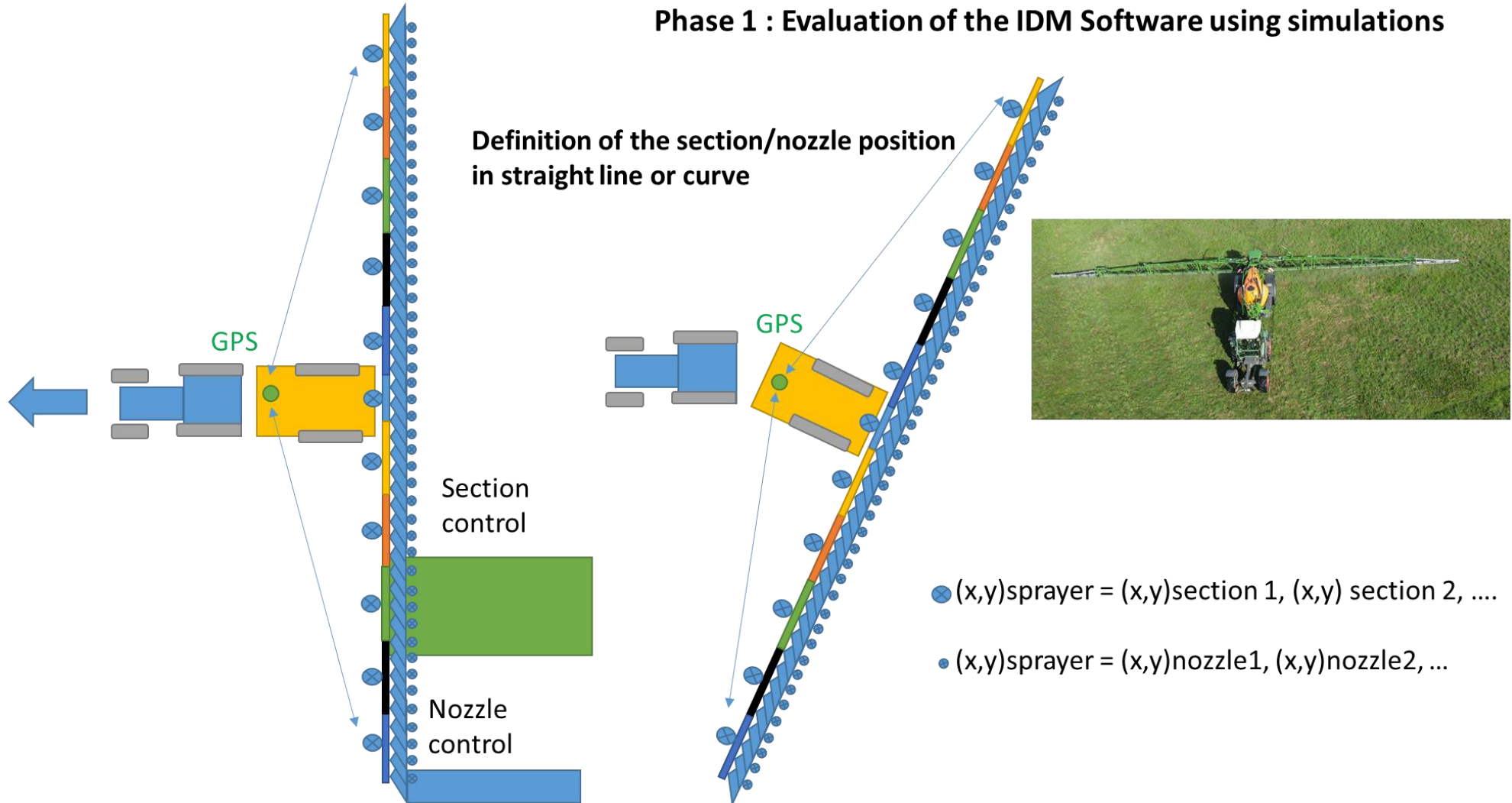
DriftRadar® Evaluation methods



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2- DriftRadar® evaluation: Nozzle/section mapping

Phase 1 : Evaluation of the IDM Software using simulations






2- DriftRadar® evaluation: Nozzle/section monitoring



GPS
RTK



-  FF nozzle
-  DR nozzle
-  no nozzle



2- DriftRadar® evaluation through simulations and field tests

Buffer location	NTTP & NTA (5m)	Water (5m)	Residents (28m)	Nozzle control	Section control	Wind	Total
outside	X	X	X	X	X	X8	16
inside	X	X	X	X	X	X8	48
outside + inside	X	X	X	X	X	X8	48
No inside No outside				X	X	X8	16
inside	X	X	X	X	X	No wind	8
outside	X	X	X	X	X	No wind	8
						Total	144

Modalities	Sensitive Area	Control		Date
Map 1	Outside	Section	3 rep	23/03/2021
Map 1	Outside	Nozzle	3 rep	24/03/2021
Map 2	Outside + inside (multi)	Section	4 rep	23&24/03/2021
Map 2	Outside + inside (multi)	Nozzle	3 rep	24/03/2021
Water	Outside + inside Water	Section	3 reps	30/03/2021
Water	Outside + inside Water	Nozzle	3 reps	30/03/2021
Vegetation	Outside + inside vegetation	Section	3 reps	30/03/2021
Vegetation	Outside + inside Vegetation	Nozzle	3 reps	30/03/2021
Road	Outside + inside Road	Section	3 reps	30/03/2021
Road	Outside + inside Road	Nozzle	3 reps	30/03/2021
		Total	21	

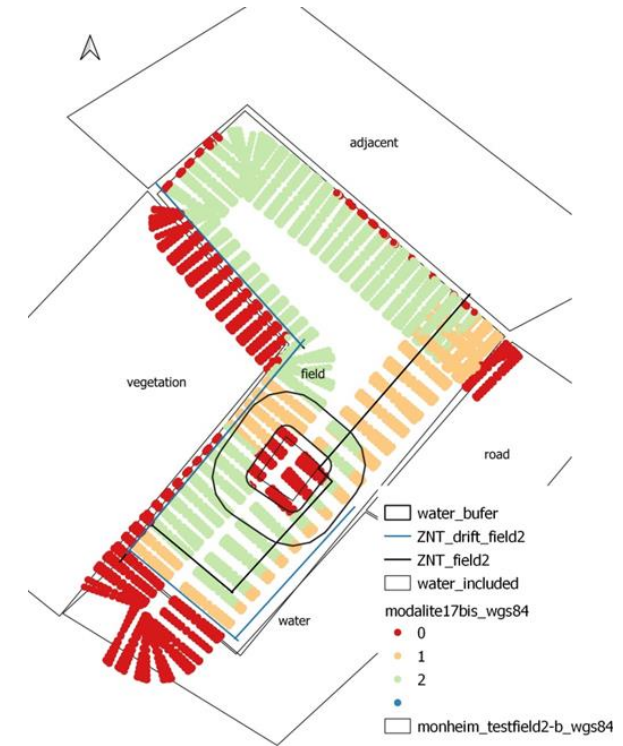
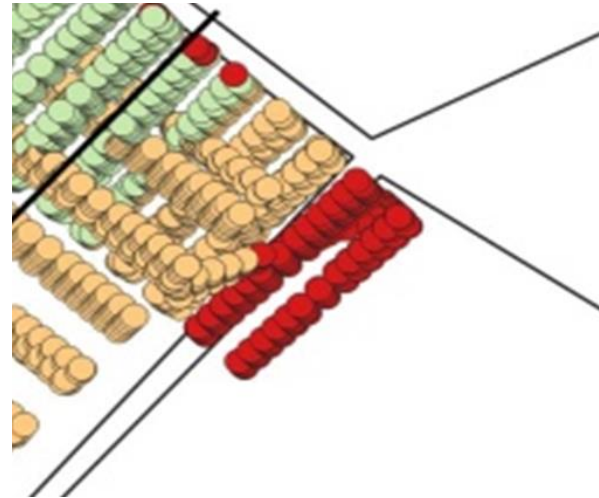
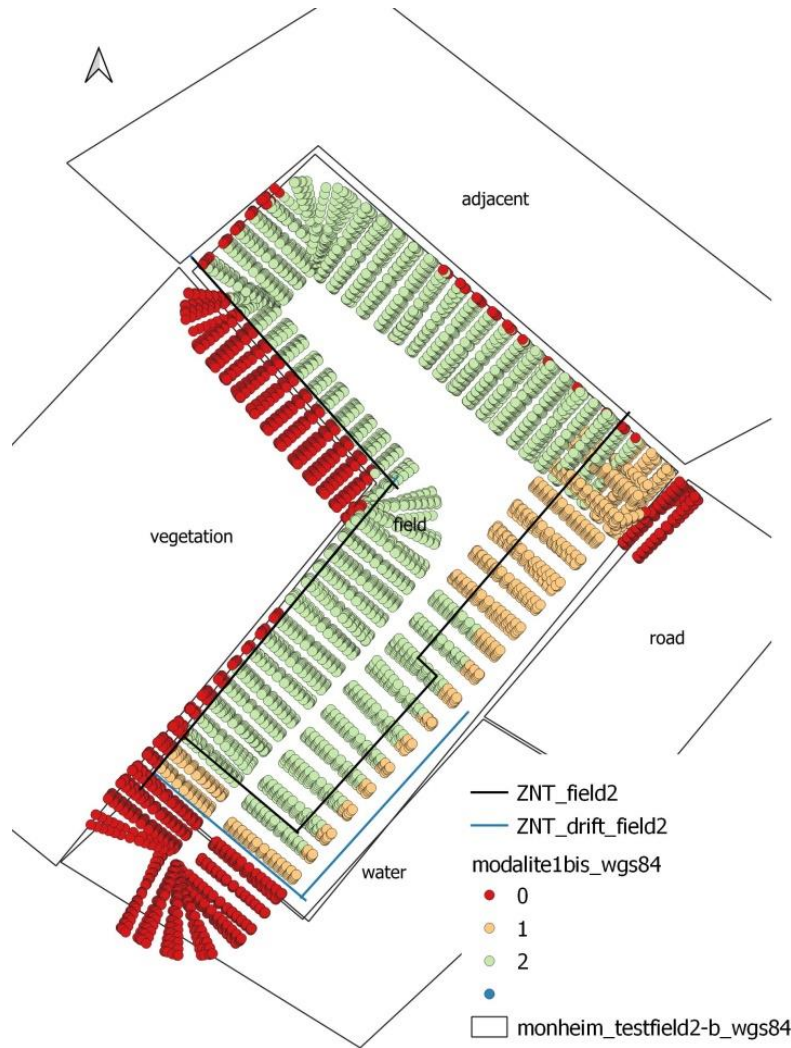
04

Results



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2- DriftRadar® evaluation through simulations



Manual field delineation on spraying map
End nozzle/section inappropriate response

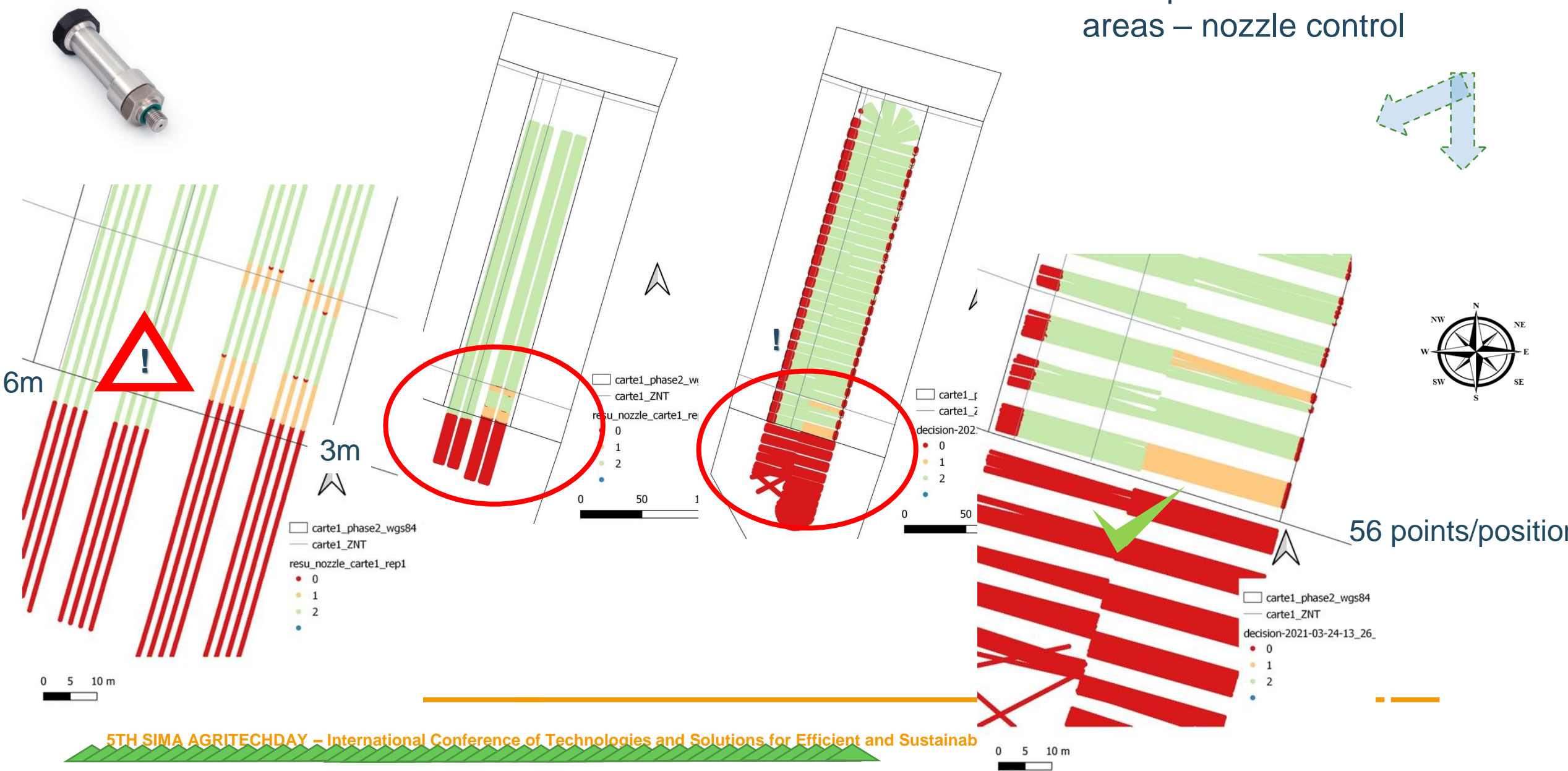
2- DriftRadar® evaluation through Field tests



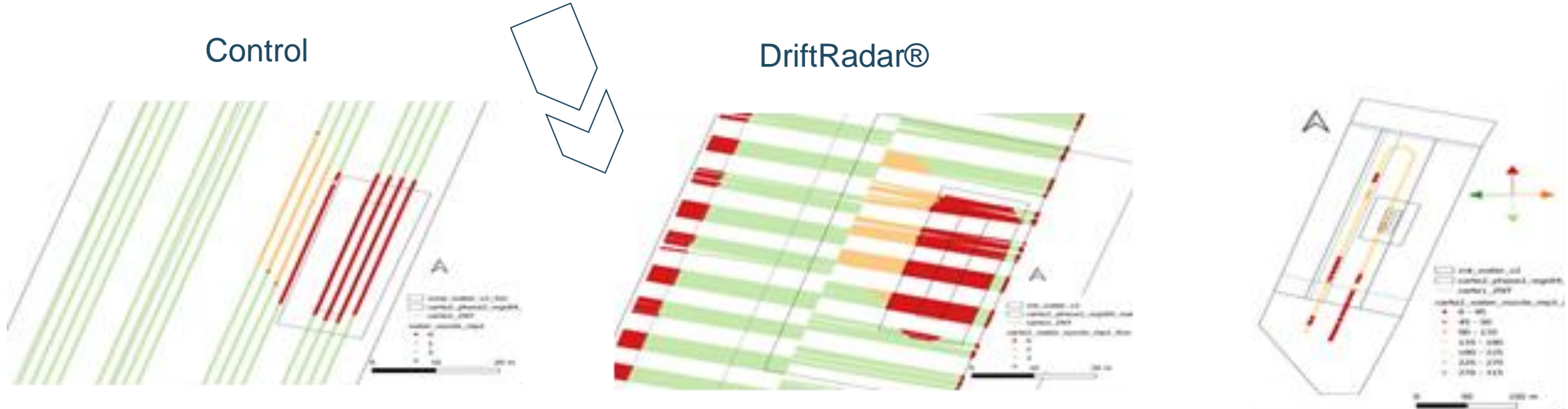
Arvalis experimental site (Boigneville, 91)

2- DriftRadar® evaluation through Field tests

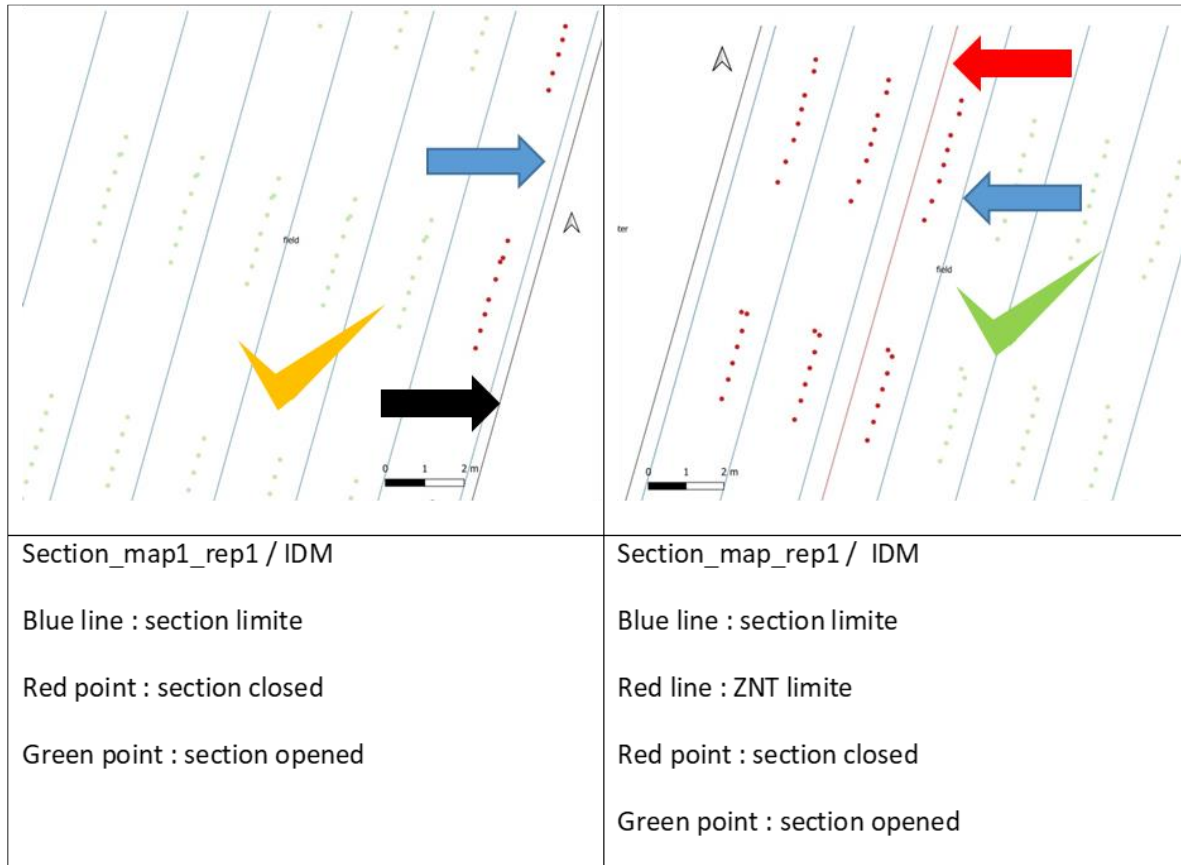
Example 1 : outside sensitive areas – nozzle control



2- DriftRadar® evaluation through Field tests



2- DriftRadar® evaluation through Field tests



Left : GPS EGNOS accuracy: End nozzle/section inappropriate response

Right : appropriate response, the last section passes over the buffer area (no spray required)

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Conclusion



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2- DriftRadar® evaluation through Field tests

The DriftRadar® system aimed at automatically adjust either individual nozzle or boom section settings according to the real-time wind direction.

First the DriftRadar® software was tested using simulations of eight wind directions and a virtual field where inner and/or outer sensitive areas were defined.

Second, the complete system installed on a 28m monitored boom sprayer was tested. Results showed that although the system was able to react correctly according to the situation, different sources of variability were observed.

The GPS using EGNOS correction showed some accuracy limitations compared to a GPS RTK and end of boom nozzles were sometimes improperly set.

The second source of variability was due to the reaction time of control valves leading to a delay in activating or deactivating nozzles close to a buffer area.

These defaults were reworked soon after the evaluation in order to better comply with the requirements of the system. This system was awarded “DLG - Agrifuture Concept Winner” by the DLG (German Agricultural Society) at this 2022 Agritechnica event.



QUESTIONS & ANSWERS

