



Electronic controls and assistance systems – challenges for sprayer inspection

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Introduction



- Application of plant protection products shall provide sufficient efficacy, high productivity as well as low environmental impact
- Performance of application techniques can improved by spray computers and electronic assistance systems
- Potential benefits:
 - uniform application parameters (spray pressure, application rate, boom height ...)
 - adapted application parameters (target spraying, curve control ...)
 - increase of productivity
 - relief of operators
 - reduction of PPP amount and mitigation of environmental impact

Electronic assistance – boom sprayers

- Application rate control
- Boom section control
- Boom height control
- Direct injection systems
- Pulse Width Modulation (PWM)
- Target spray systems
- Automatic sprayer cleaning



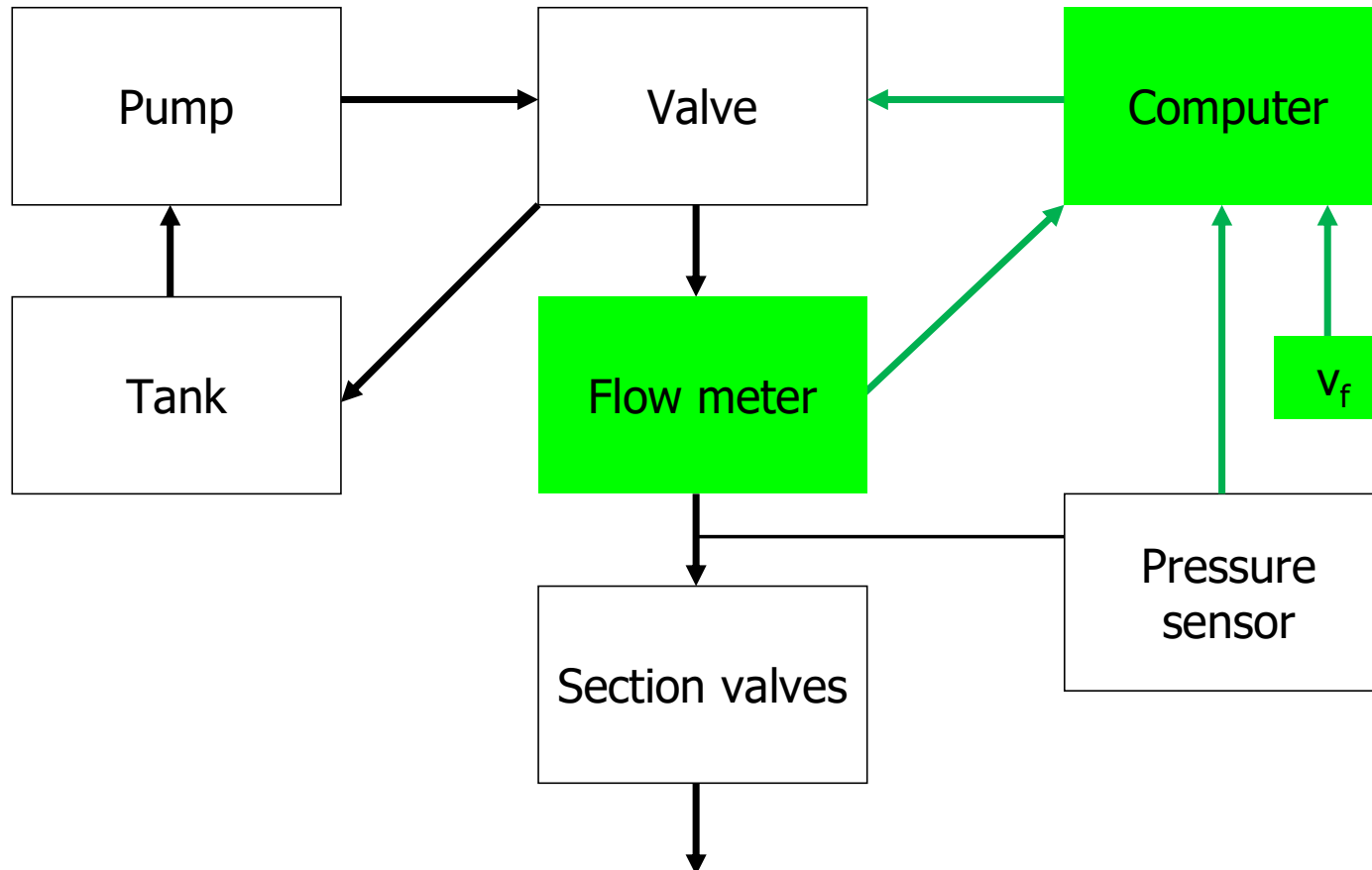
Application rate control



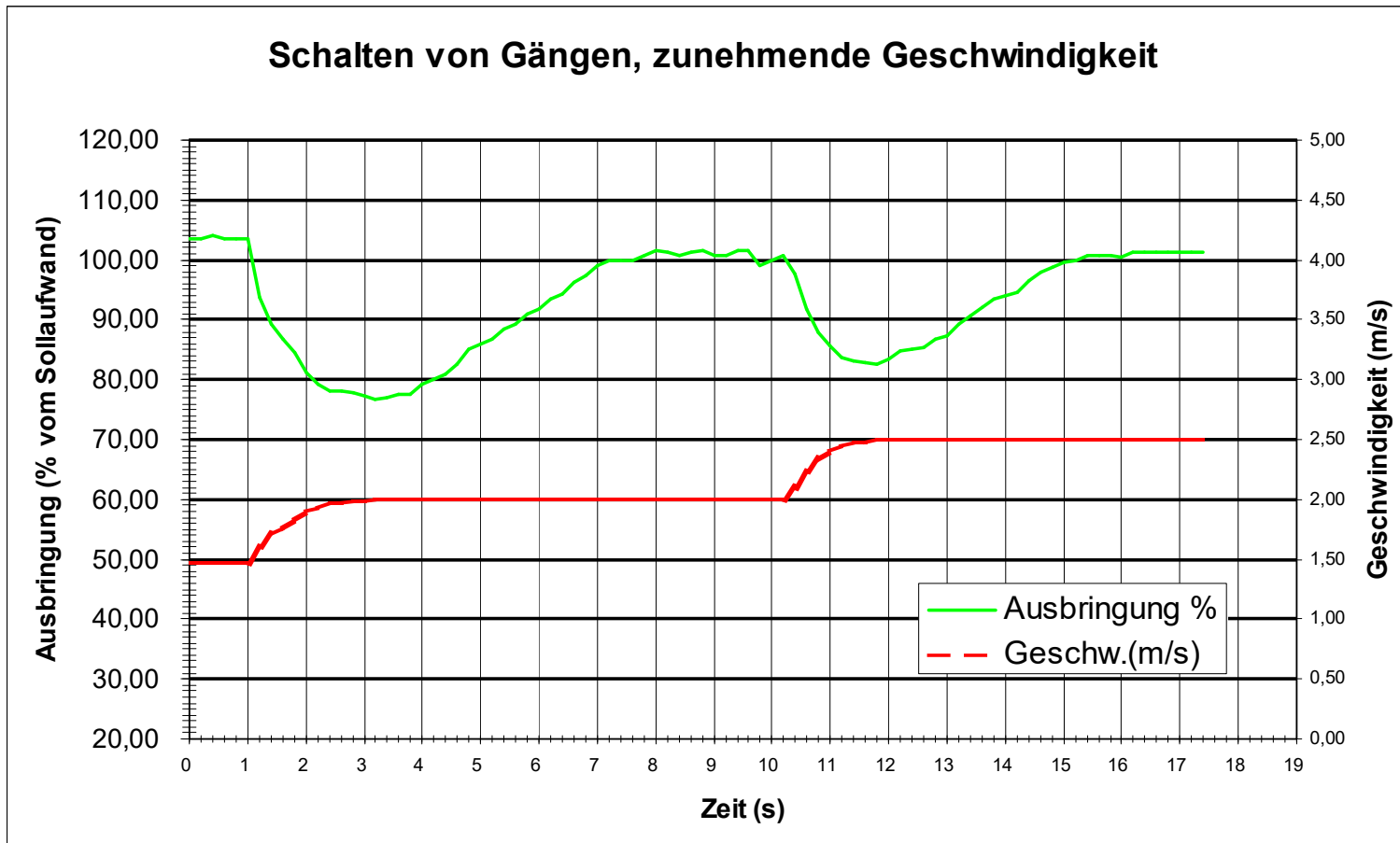
To keep the application rate (l/ha) constant, independent from:

- travel speed
- PTO rotational frequency
- number of sections engaged

Application rate control



Application rate control

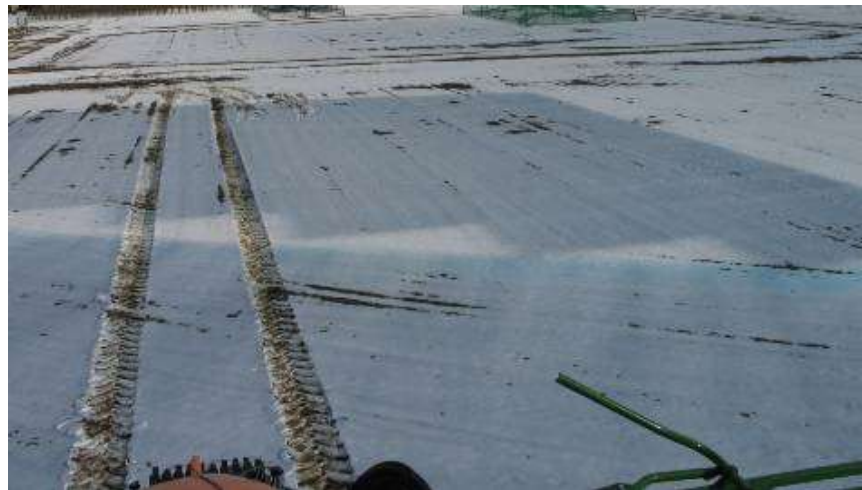


Boom section control



GPS controlled systems for automatic switching of boom sections

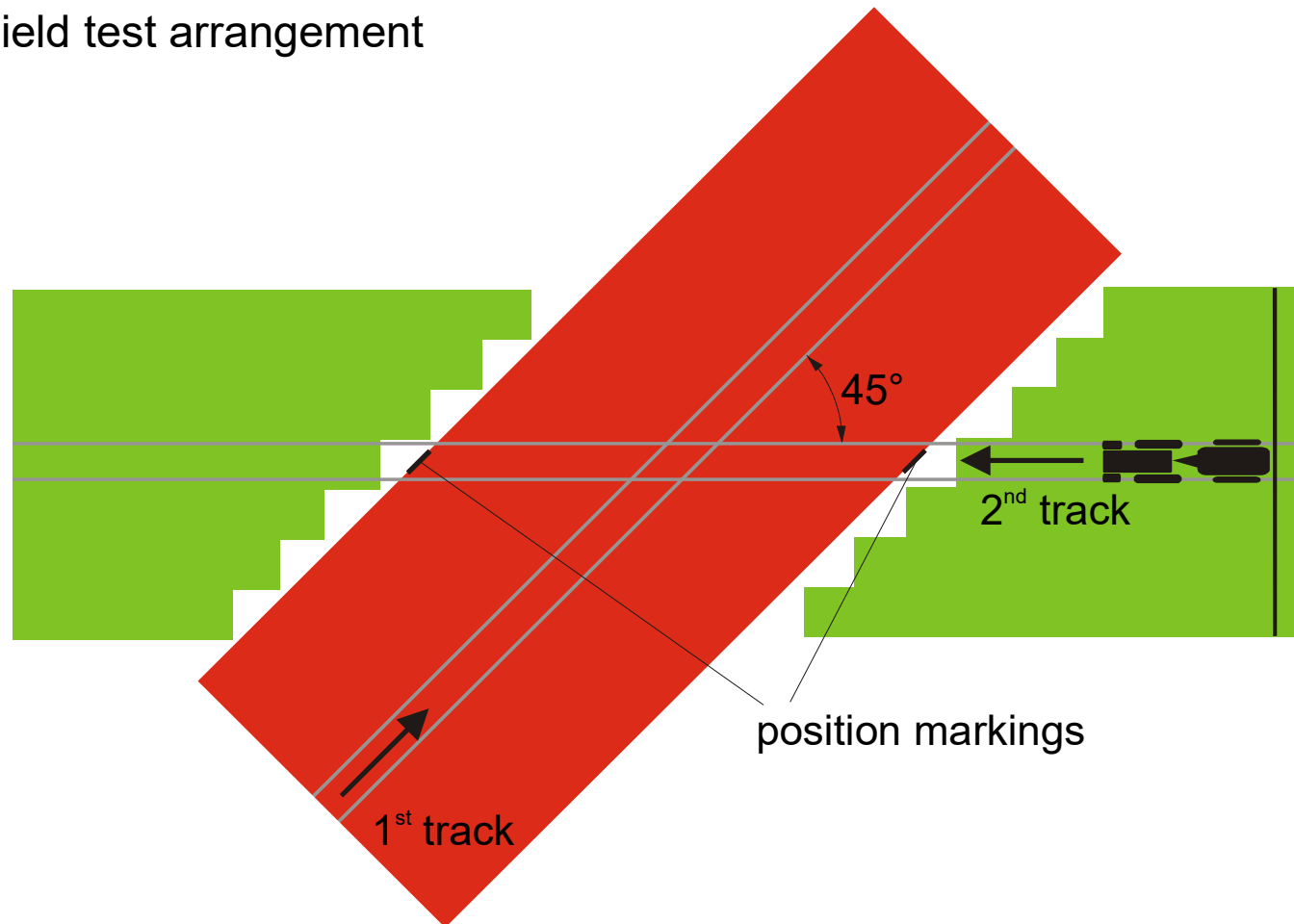
- prevent excessive overlap or unsprayed areas esp. at headlands
- unburden the operator from switching boom sections



Boom section control



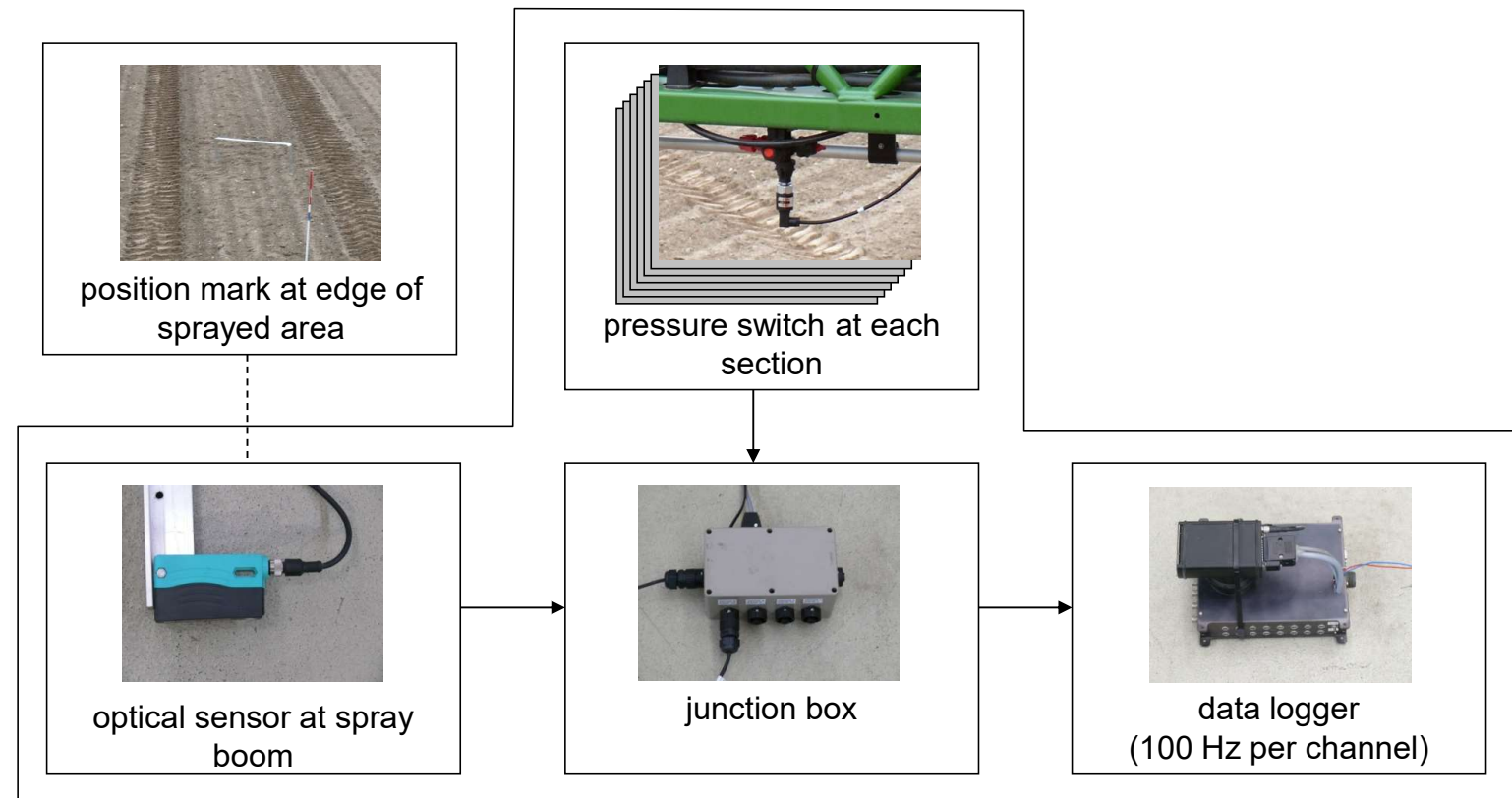
Field test arrangement



Boom section control



Test equipment



Boom section control



Field test

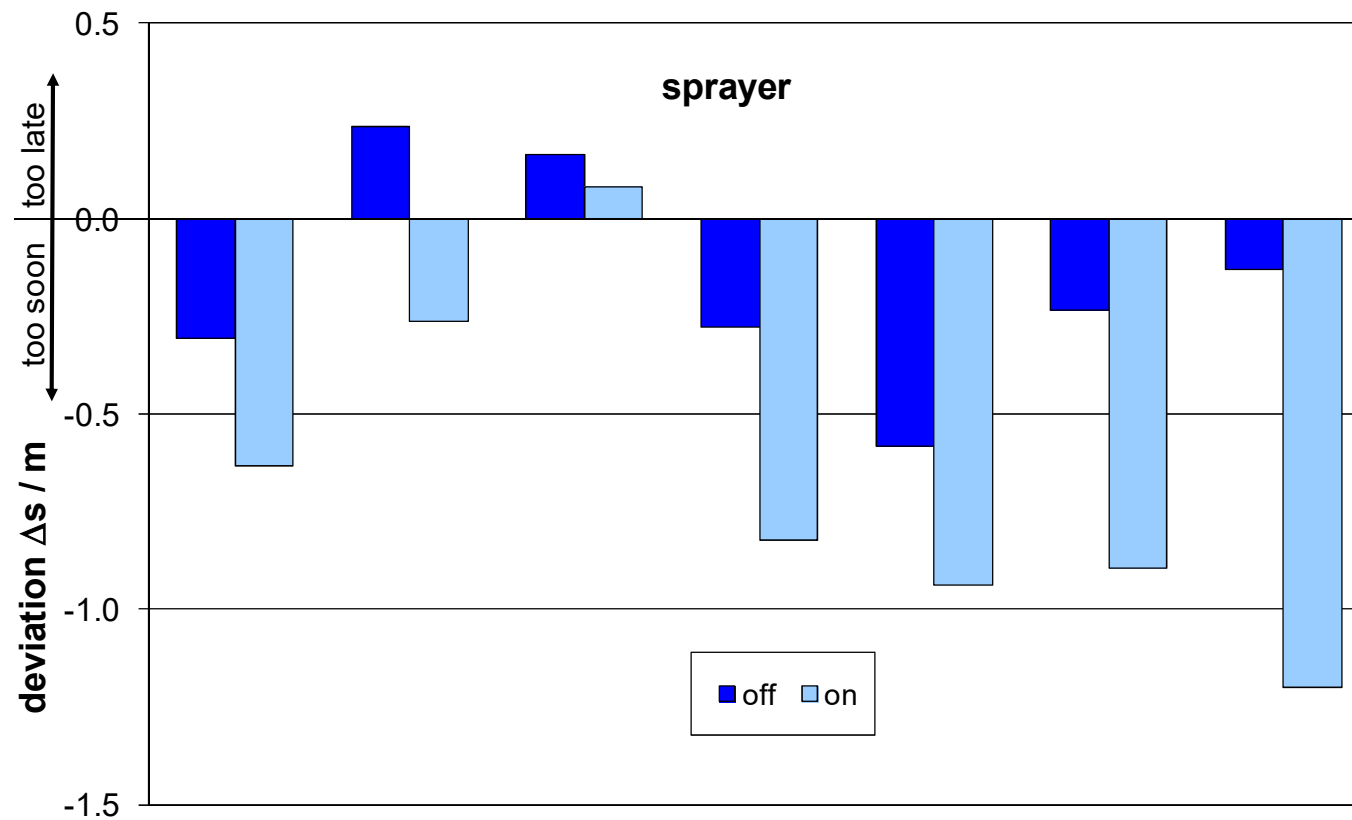


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Boom section control



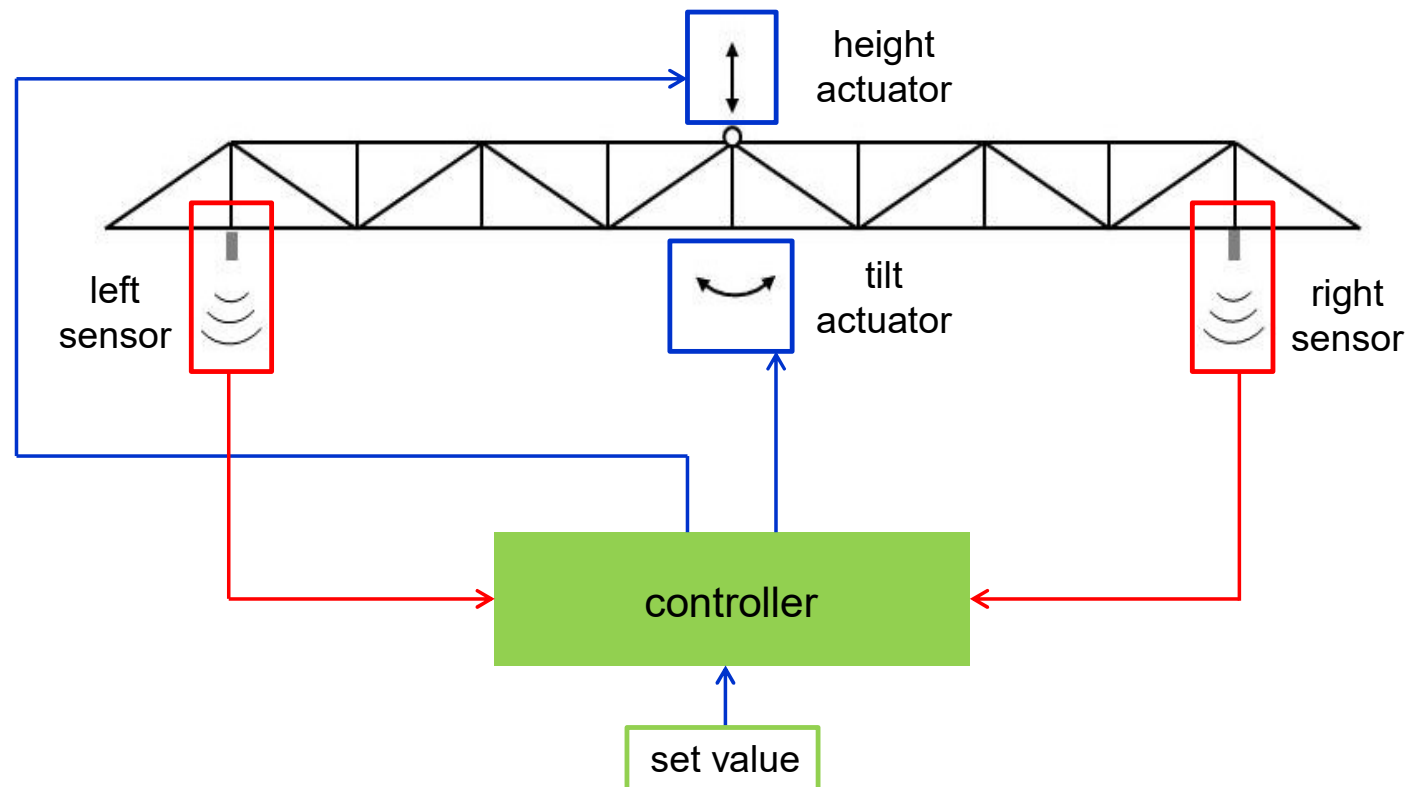
Switching position deviation



Boom height control



Boom height control system



Boom height control



Test bench

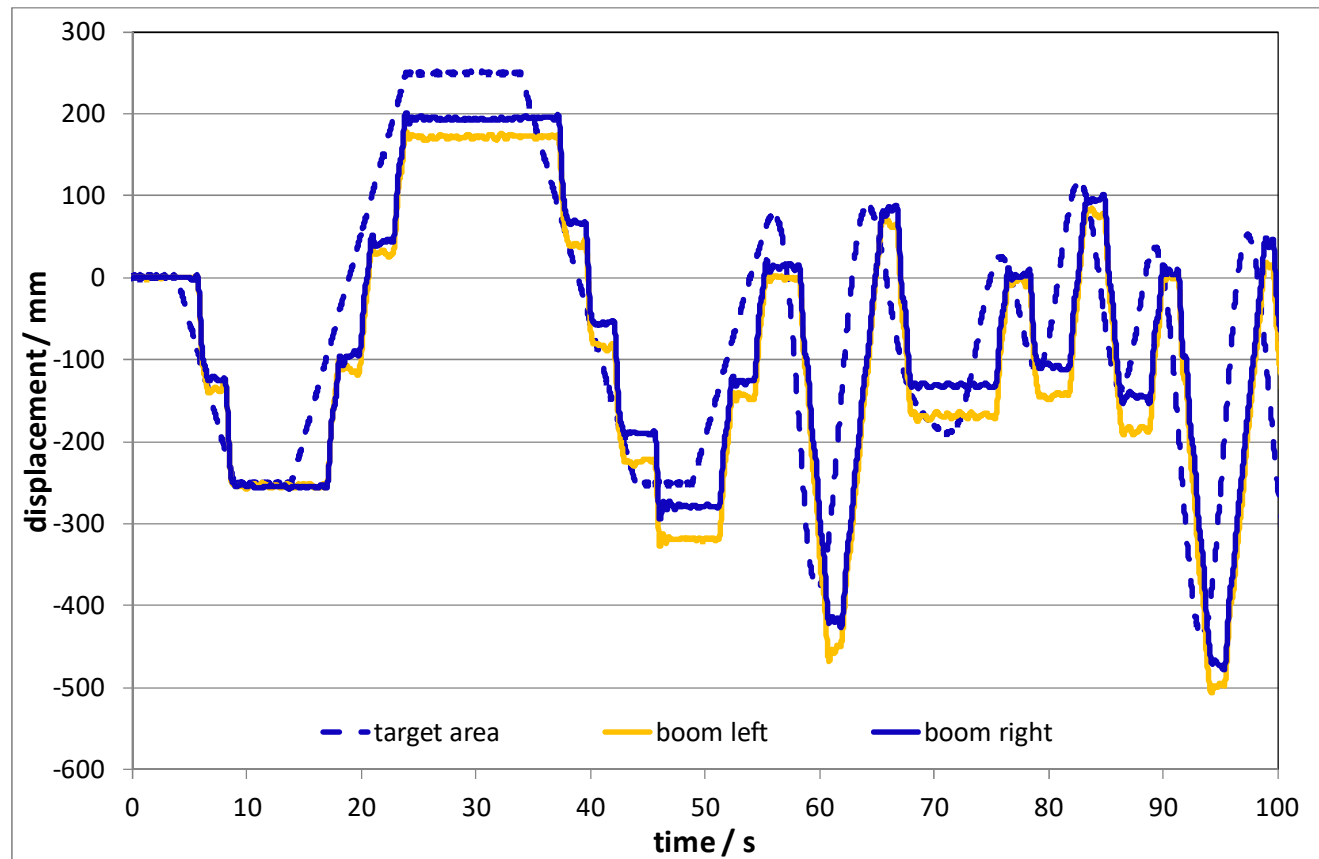


- two target area units
- target area: 1.5 m x 1 m
mesh 10 mm x 10 mm x 0.5 mm
- internal sine wave generator
- any movement possible to be defined by text file
- separate distance sensor

Boom height control



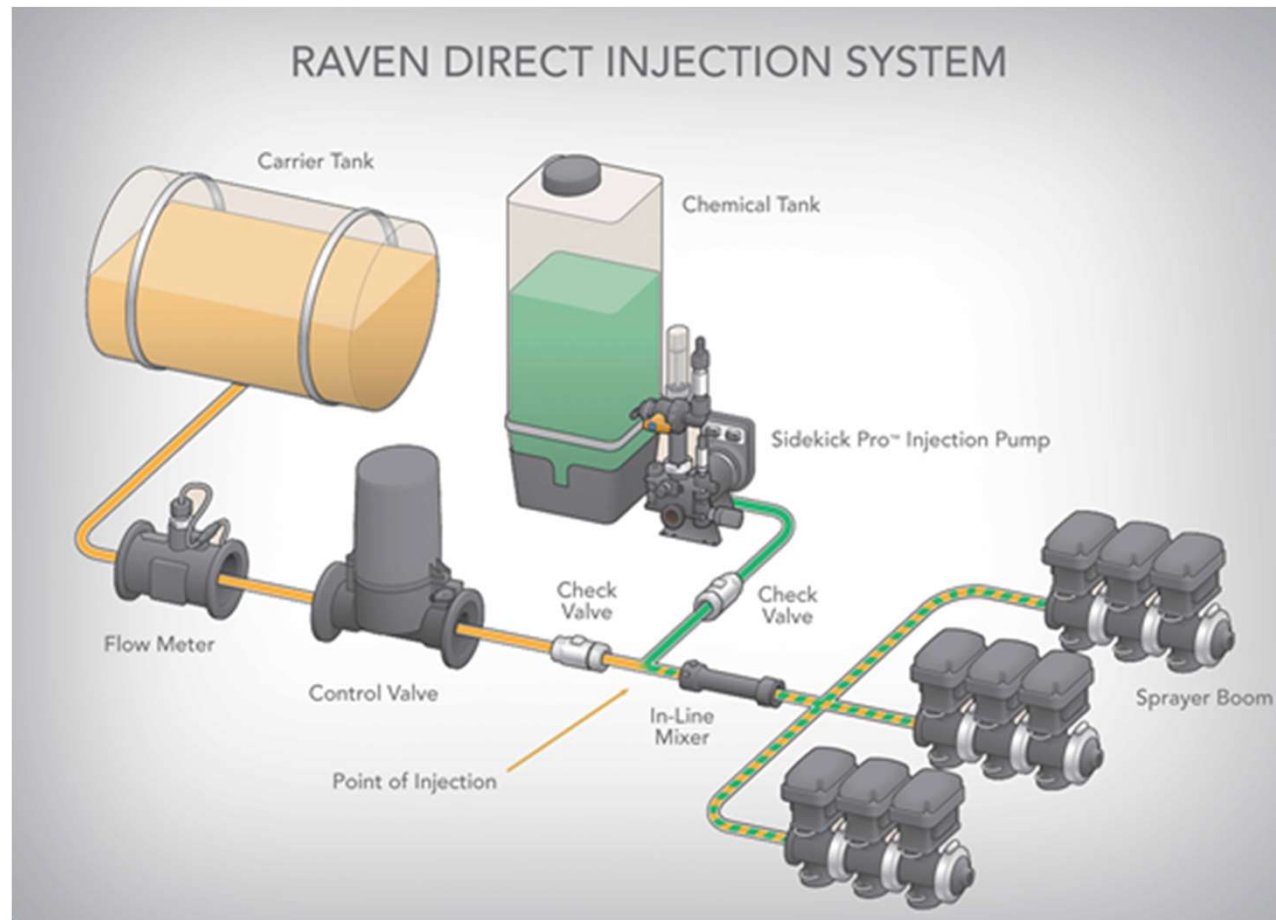
Test results



Direct injection system

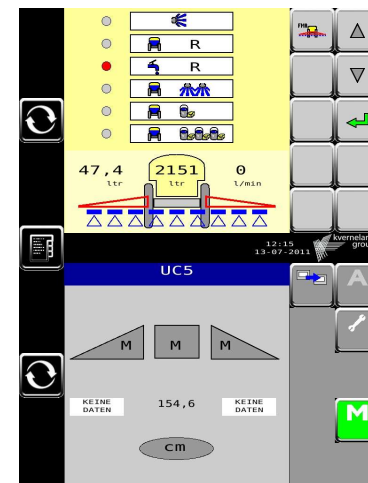


Direct injection system

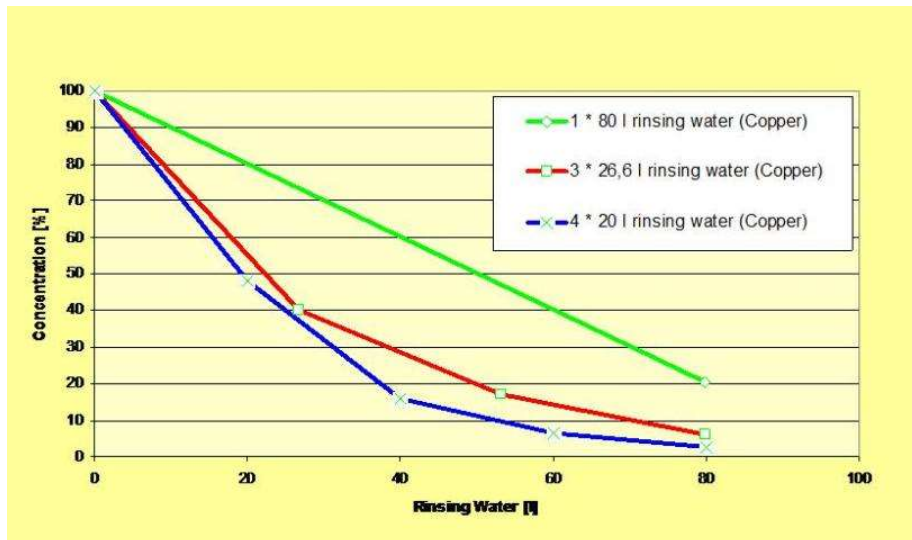


<http://ravenprecision.com/products/application-controls/sidekick-sidekick-pro/>

Automatic sprayer cleaning



Automatic sprayer cleaning



Target spraying



Photo: Amazone

Next presentation!

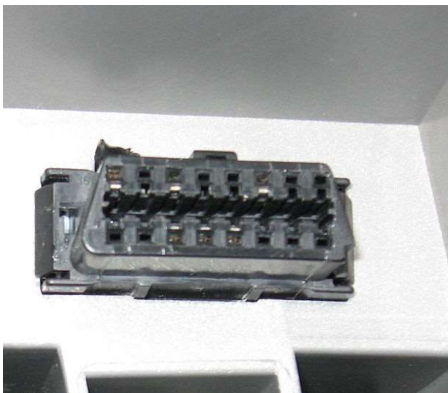
Inspection of electronic systems



- technical measurements for several systems available but can require expensive test rigs and/or field tests
- tests for several systems still under development
- most of these tests are too time consuming and expensive for sprayer inspection
- **simple inspection methods necessary – on-board diagnostics (OBD)?**

Example: On-board diagnostics for cars

- engine and many assistance systems controlled by sensors and electronic control units communicating via CAN bus
- detection of problems – generation and storage of Diagnostic Trouble Codes (DTC)
- DTC codes collected can be accessed via the Diagnostic Link Connector (DLC)
- vehicle data can also be logged during normal operation

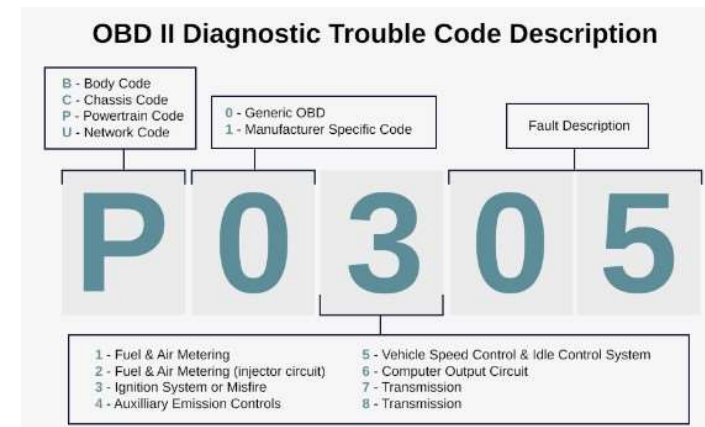
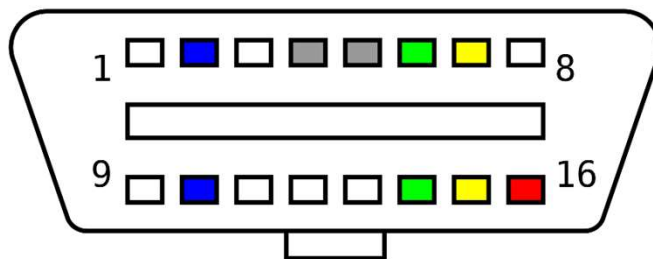


Example: On-board diagnostics for cars



ISO standards available, such as:

- ISO 9141: Road vehicles – Diagnostic systems
- ISO 14230: Road vehicles – Diagnostic systems – Keyword protocol
- ISO 15765: Road vehicles – Diagnostics on Controller Area Networks (CAN)



Discussion and prospects



- a system similar to OBD for cars would facilitate the inspection of electronic assistance systems
- useful for sprayer testing (ENTAM, JKI approval ...)
- future developments of sprayers will include more complex solutions – involving the whole application process, considering chemicals used, sites and restrictions
- these systems include recording of application parameters – first step ISO ISO 4444 Agricultural sprayers - Recording of spray drift parameters
- recent revisions (short, medium and **long** term) of ISO 16119 should define performance limits for electronic aids but could also define a system for OBDlight

Many thanks for your attention!



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