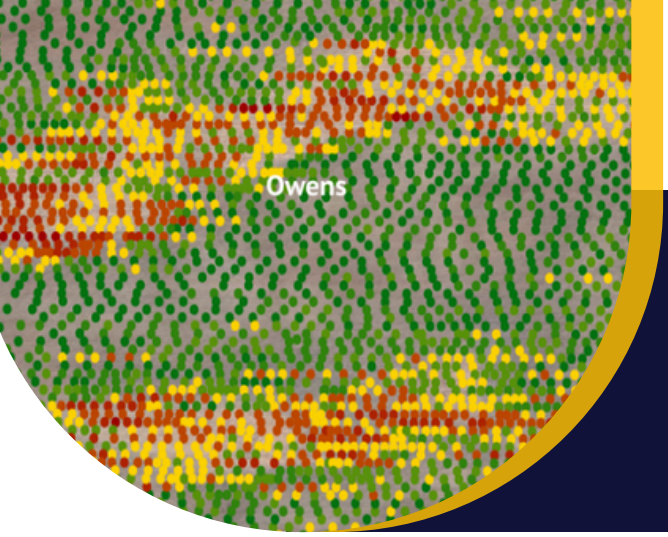

CropScanAg

CASE STUDY - 36

CropScan 4000VT On Combine Grain Analyser

CROPSCAN 4000VT VALIDATION REPORT ON NEXT GEN COMBINES

Date: July 23, 2025

Machine Platform: CNH Next Gen Combines CR 11 / AF 10 / Case IH 8260
Instrument: CropScan 4000VT
Version: Firmware 4.0.1 | VT Software v2.0.1
Purpose: To validate operational performance of the CropScan 4000VT under real-world harvest conditions using the latest Pro 1200 Dual Screen and Next Gen Combine platform.

1. Installation and Hardware Integration

The CropScan 4000VT was successfully installed across six CNH Next Generation Combines, including the CR11, AF10, and 8260 platforms. The installation process was significantly streamlined compared to previous models, with average times of 90 minutes for both the Sample Head and Spectrometer, and 30 minutes for cabling. The introduction of new alloy templates improved hole alignment and installation precision for both sensor components. During the validation phase, minor wiring conflicts were identified—particularly on the early CR11 prototype—which were resolved by reviewing and modifying the wiring pinouts. These findings led to small design adjustments and highlighted the value of testing pre-release machines. Overall, the installation experience was straightforward, repeatable, and represents a notable improvement over legacy systems such as the 8250 series.

Figure 1 Sample Head Installation

Figure 2 NIR Spectrometer Installation

2. Software Compatibility and CANbus Integration

The software stack used for the 4000VT leveraged the existing configuration built for the 8250 series but included critical updates to support the revised CAN message structure used in CNH's Next Gen platforms. During the initial installation by McIntosh & Son, a CAN 1 error code was observed. This was traced to the 500K bitrate used on the CAN 1 network—a variation from previous architectures.
Following collaboration with CNH engineers, message protocols were revised and the 4000VT firmware was updated accordingly. Subsequent testing confirmed stable and error-free communication across all models. The updated CAN message set now enables seamless integration between the CropScan 4000VT and the CNH Pro 1200 Dual Display, ensuring long-term compatibility and robust system stability.

Figure 3 Virtual Terminal

Note: CNH engineering have noted the current version of software for Next Gen Combines does not support CANbus messaging for Grower Farm Field changes within the monitor. CropScan has requested CNH engineering to add the Canbus messaging for Grower Farm Field. CropScan has implemented an Auto Field Select Function within its ECU to scan GPS positioning every 30 seconds and update the Grower Farm Field ID within the CropScan VT.

3. Calibration and Auto-Validation

Calibration accuracy was a key focus of this validation effort. The 4000VT's calibration was benchmarked against Case Study 29 and further validated through internal quality control using wheat, barley, and canola samples cross-verified with FOSS Infratec™ laboratory reference equipment. Each unit underwent a rigorous Auto Calibration Routine post-installation to assess real-time alignment and sensor accuracy. This process ensures that each unit is field-ready and aligned to deliver accurate readings from day one. Results showed the system was able to achieve an average deviation of just ±0.1% for protein and ±0.5% for moisture—well within acceptable tolerances, especially after bias correction was applied to the moisture calibration factor. This level of precision confirms that the 4000VT is suitable for commercial harvest environments and high-resolution field variability mapping.

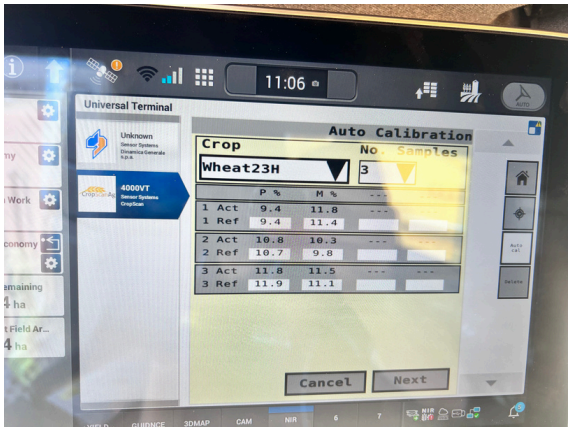

Figure 4 Auto Calibration

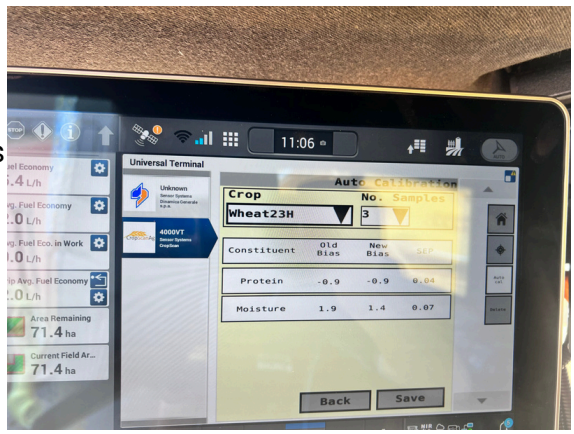

Figure 5 Auto Calibration

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4. Temperature Management and Sensor Stability

Consistent internal temperature is critical for stable spectrometer performance, especially during early morning or cooler harvesting conditions. The CropScan 4000VT is equipped with an internal heater designed to maintain optimal sensor chamber temperature when ambient conditions fall below 30°C.

During field validation, temperature data was logged every three seconds. The heater activated as expected, gradually increasing the chamber temperature at a controlled rate of approximately 2°C per minute. Once the system reached its target range of 35°C, it maintained stability within ±1°C, even as external conditions varied. The peak recorded temperature was 38°C.

These results confirm that the heater system effectively maintains thermal consistency, protecting optical accuracy and ensuring the CropScan 4000VT delivers reliable results across a range of harvest environments.

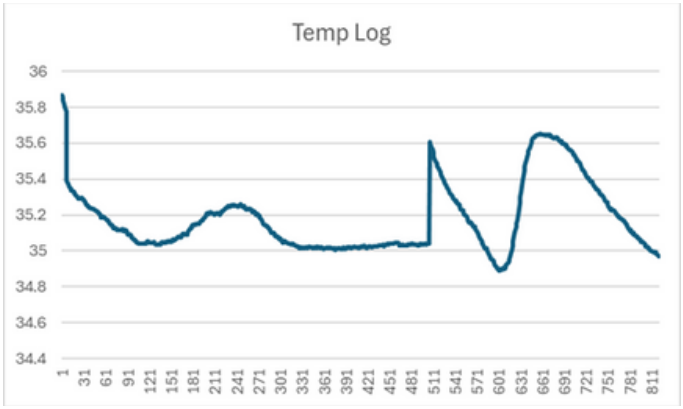

Figure 5 Temperature Plot

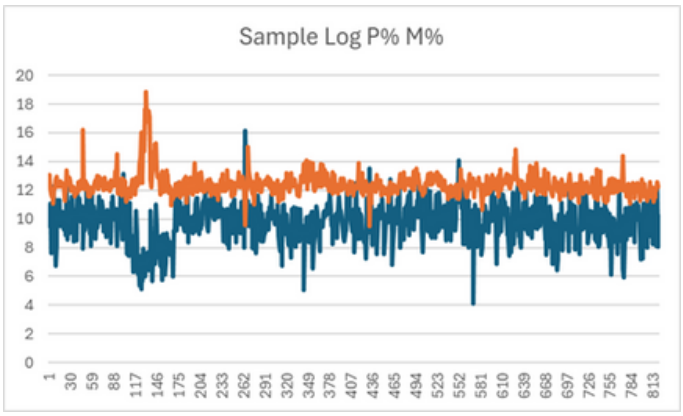

Figure 6 Protein and Moisture Stability

5. In-Field Accuracy and Day-to-Day Stability

While lab-based calibration confirms baseline accuracy, real-world field performance must demonstrate consistent day-to-day reliability. Across four weeks of wheat harvest in Kansas, the 4000VT was tested for in-field repeatability and variability. Protein and moisture readings were averaged across more than 20 fields, representing a broad range of environments and crop conditions. The protein standard deviation (STD) was 0.85%, and moisture STD was 0.97% across the data set—well within expected ranges for a production-grade grain analyser. This consistency over time and geography confirms that the CropScan 4000VT is capable of delivering stable and reliable data, making it a valuable tool for growers looking to optimise nitrogen use, manage crop variability, and improve harvest decisions.

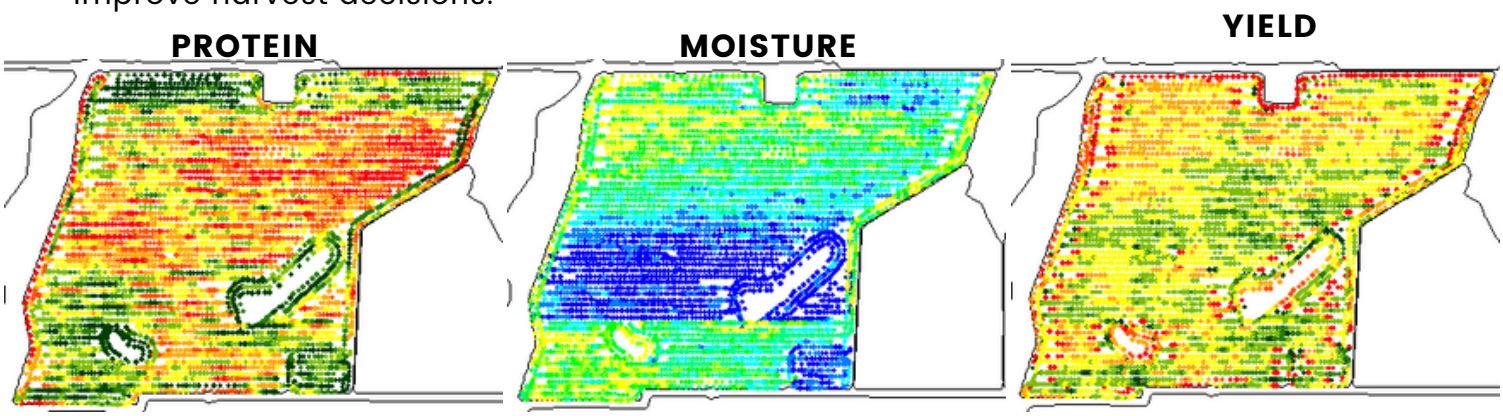

Figure 7

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Field Name	Protein	Moisture
Moreland Farms_Moreland Farms_Art's	11.21	12.55
Moreland Farms_Moreland Farms_Beaver	9.79	12.2
Moreland Farms_Moreland Farms_Cauble Quarter	9.43	12.97
Moreland Farms_Moreland Farms_Cemetery	9.56	12.11
Moreland Farms_Moreland Farms_David Savage Bechtel	9.5	14.08
Moreland Farms_Moreland Farms_E Peterman	9.95	13
Moreland Farms_Moreland Farms_E Werner	9.33	15.17
Moreland Farms_Moreland Farms_Geuda 80	9.42	12.31
Moreland Farms_Moreland Farms_Graces	10.82	11.96
Moreland Farms_Moreland Farms_Hill	10.55	11.34
Moreland Farms_Moreland Farms_Irons Airport	9.59	12.86
Moreland Farms_Moreland Farms_Irons Race Track	9.04	13.33
Moreland Farms_Moreland Farms_Kerry Irons	8.2	11.94
Moreland Farms_Moreland Farms_Knowles	10.13	13.54
Moreland Farms_Moreland Farms_Leon Homeplace	8.86	14.04
Moreland Farms_Moreland Farms_Leon N 80	7.61	14
Moreland Farms_Moreland Farms_Lowe	9.17	13.07
Moreland Farms_Moreland Farms_N Bigler	10.94	13.58
Moreland Farms_Moreland Farms_N Fry Hankey	10.6	10.79
Moreland Farms_Moreland Farms_North Findley	9.9	12.24
Moreland Farms_Moreland Farms_Quarter	10.42	12.27
Moreland Farms_Moreland Farms_Savage Bottom	9.86	12.34
Moreland Farms_Moreland Farms_Savage East Half Section	10.64	13.36
Average	**9.76**	**12.83**

Figure 8

6. Final Conclusions

Parameter	Result
Data Stability	Pass ✅
Temperature Control	Pass ✅
Protein Accuracy	Pass ✅
Moisture Accuracy	Pass ✅

The CropScan 4000VT has met or exceeded all validation benchmarks required for deployment on CNH's latest CR11, AF9/10/11, and 8260 combines. Key achievements included:

- Rapid and repeatable hardware installation
- Seamless CANbus and software integration
- Lab-grade calibration accuracy
- Highly effective internal thermal regulation
- Consistent in-field performance across diverse environments

Issues encountered during testing—such as minor wiring and CANbus protocol mismatches—were promptly resolved, leading to further refinements in hardware and firmware design. These results affirm the 4000VT's readiness for global commercial deployment and reinforce CropScanAg's leadership in precision harvest technology.