PM DM
MinebeaMitsumi Group

# Stellantrieb Ladeklappe AU 516
# 4KE 862 277 A

LDV/lni-File 28.06.2018

MinebeaMitsumi
Passion to Create Value through Difference

# Correlation Analysis of LDV Time Signal (caRMS)

PM DM MinebeaMitsumi Group

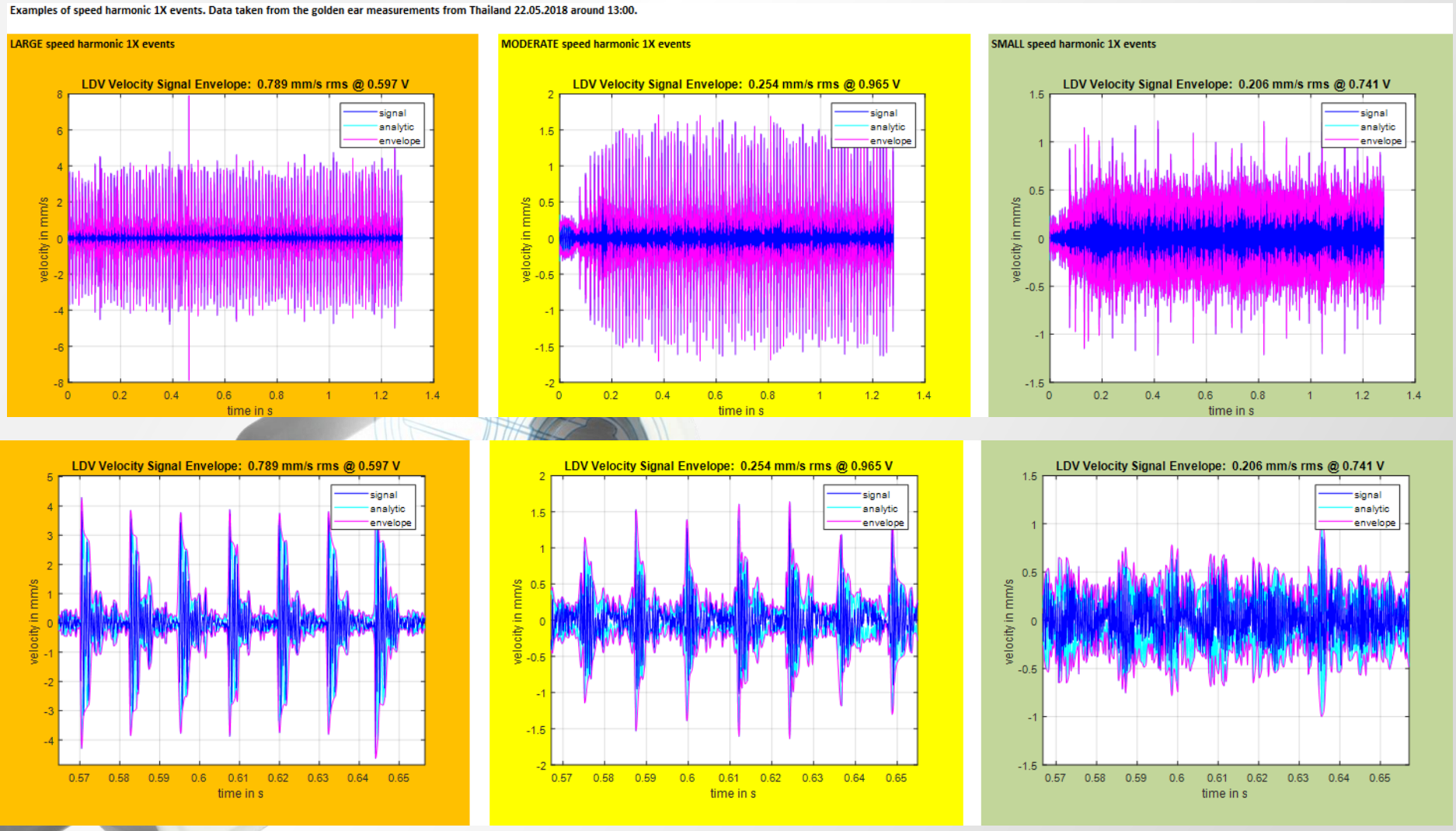
## Algorithm Outline

1. Import data and parameters from LDV tester measurement file
2. Create an envelope of the velocity vs. time signal in order to eliminate high frequency components in the signal
   a) Calculate the discrete-time analytic signal by Hilbert transformation
   b) Connect local peaks by piecewise cubic Hermite interpolating polynoms
3. Determine the rotor speed from the auto-correlation of the envelope signal
   a) Adjust the DC offset of the envelope signal until the minima of the auto-correlation at small time lags become zero
   b) Determine the rotor speed from equidistant peaks in the auto-correlation
   c) In case the rotor speed cannot be determined within tight limits assume nominal speed in further steps
4. Determine the strength of speed harmonic 1X events by cross-correlation between the envelope signal and an artificially created reference signal
   a) Create a bi-gaussian reference signal with a linear speed dependency over time for the speed harmonic 1X
   b) Adjust the DC offset of the envelope signal until the minima of the cross-correlation at small time lags become zero
   c) Adjust the linear speed dependency by maximizing the highest peak in the cross-correlation
   d) Determine the strength of speed harmonic 1X events from the highest peak in the cross-correlation
5. Export results to file and create figures for illustration

The cross-correlation results can be interpreted as the root-mean-square of the velocity signal weighted by a similarity factor to the reference signal.

# Correlation Analysis of LDV Time Signal (caRMS) – Examples

Examples of speed harmonic 1X events. Data taken from the golden ear measurements from Thailand 22.05.2018 around 13:00.



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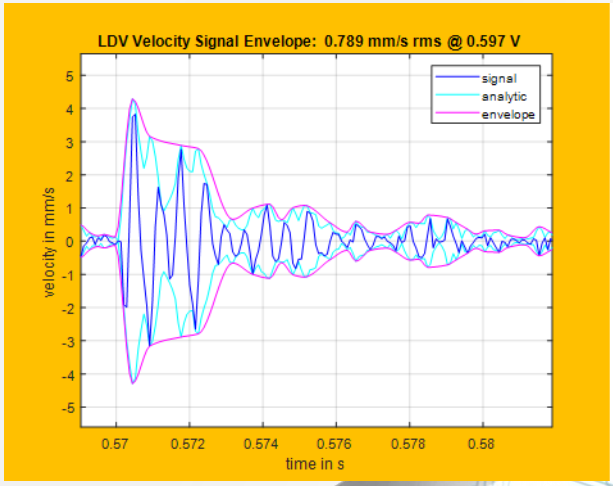


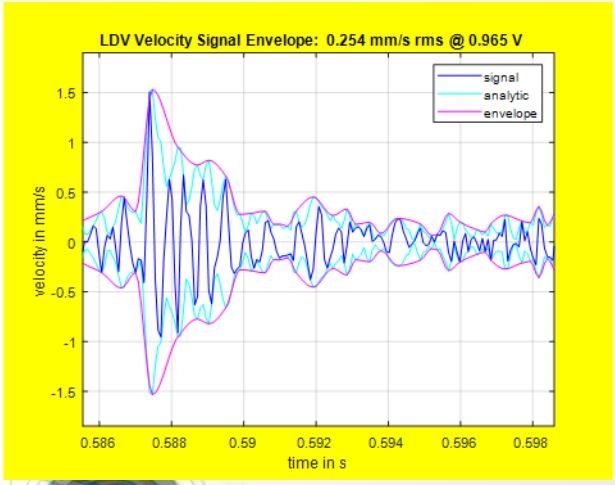


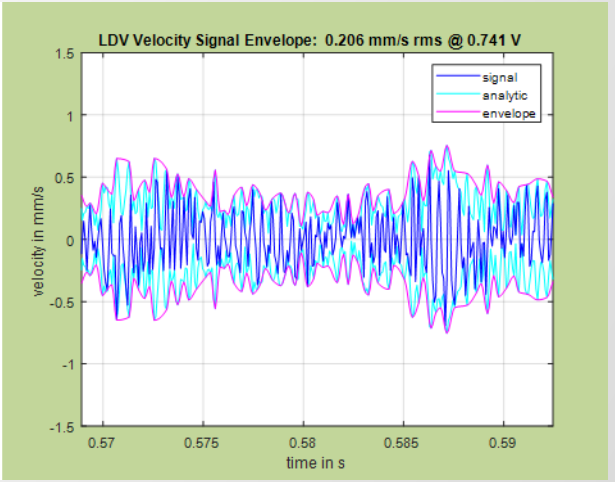


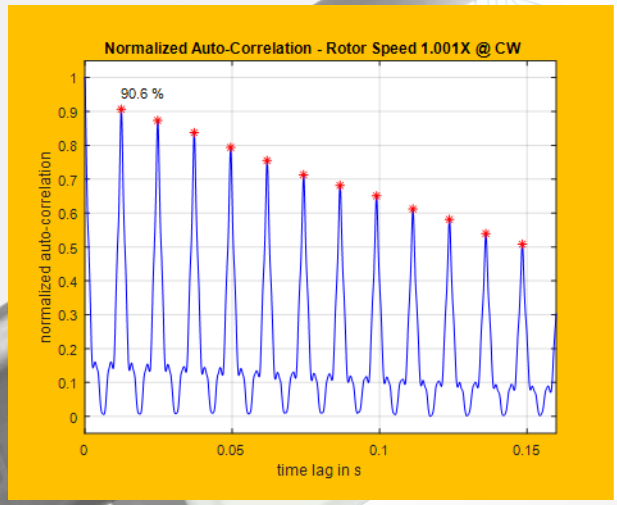


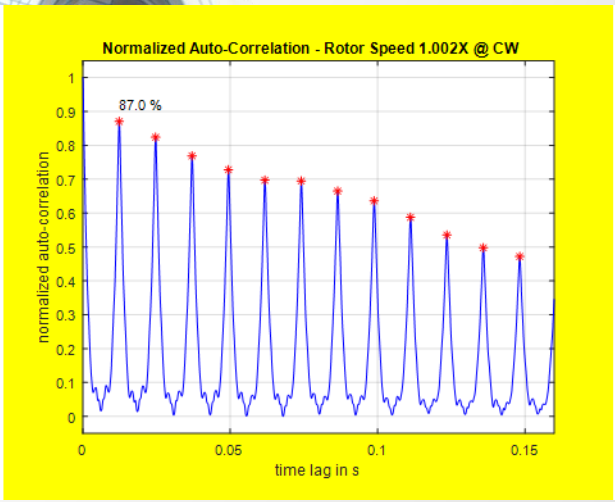


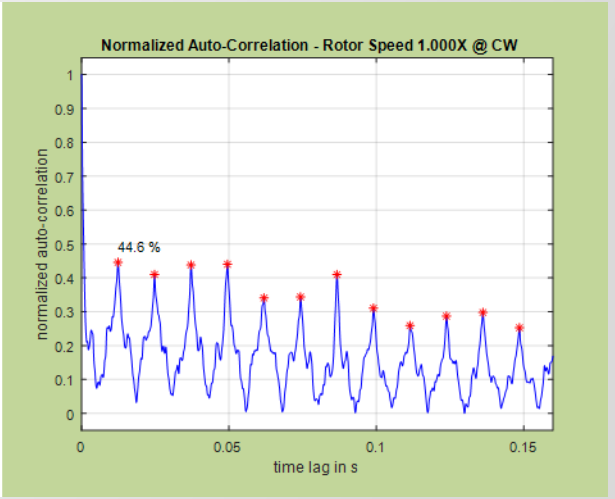

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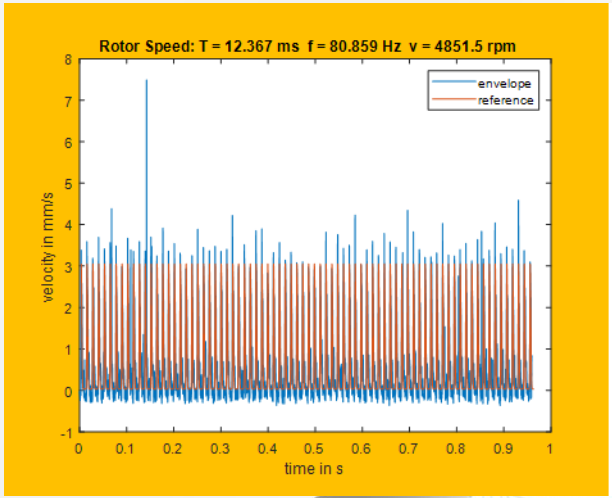


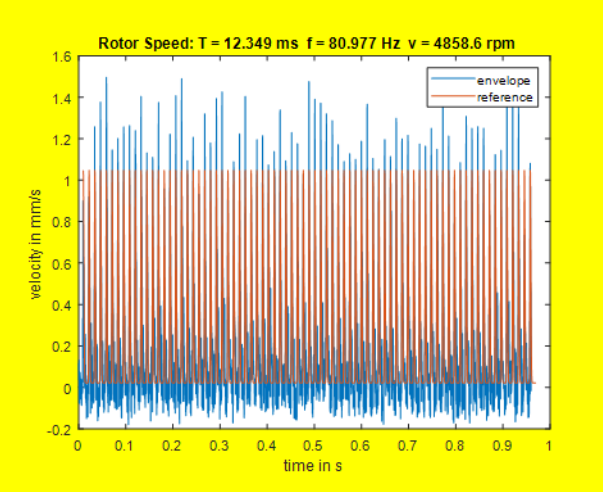


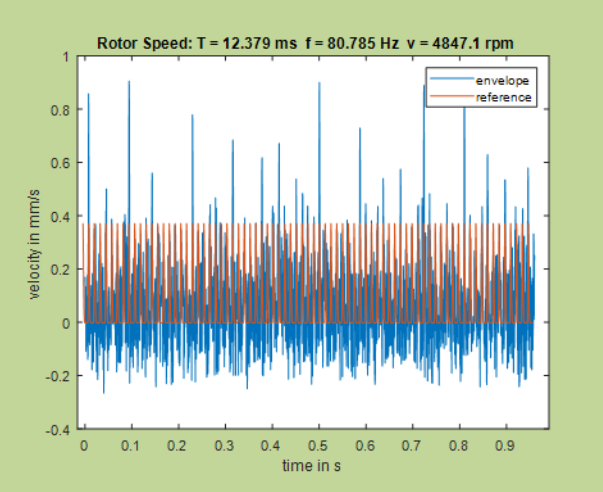


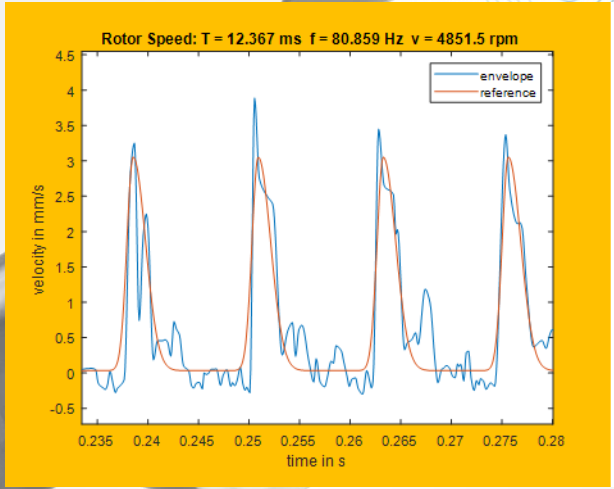


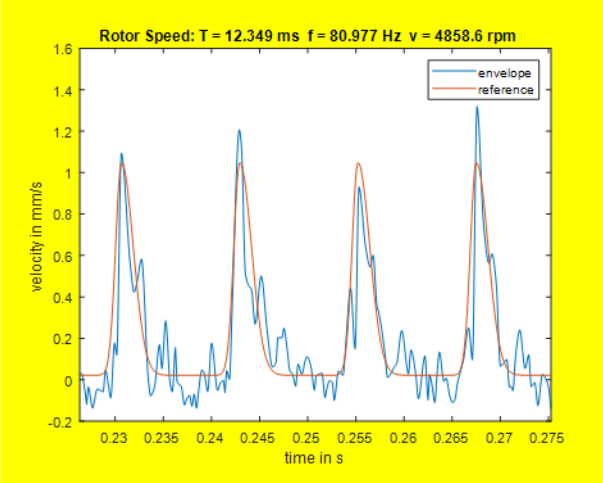


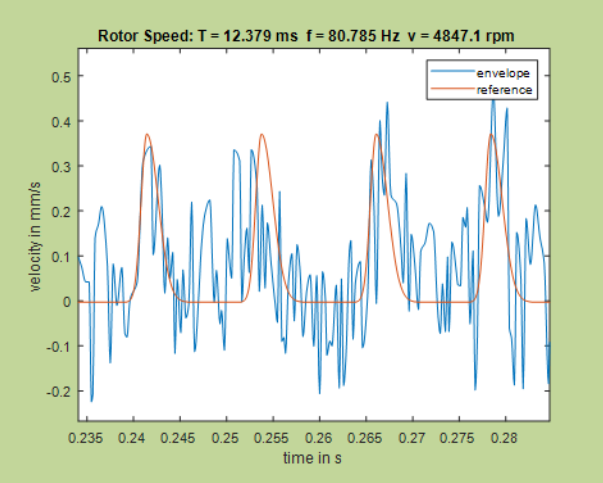

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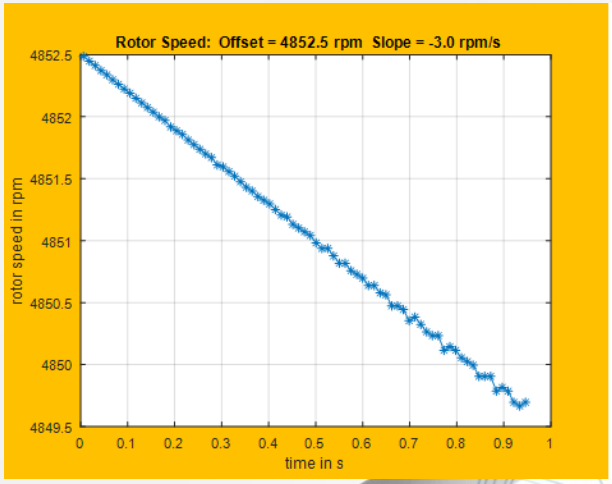
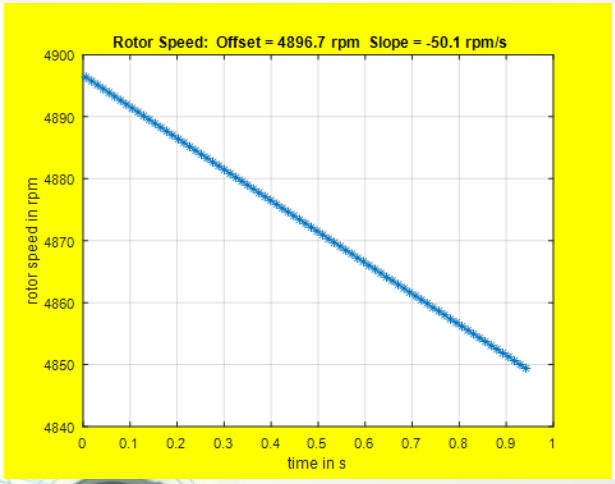
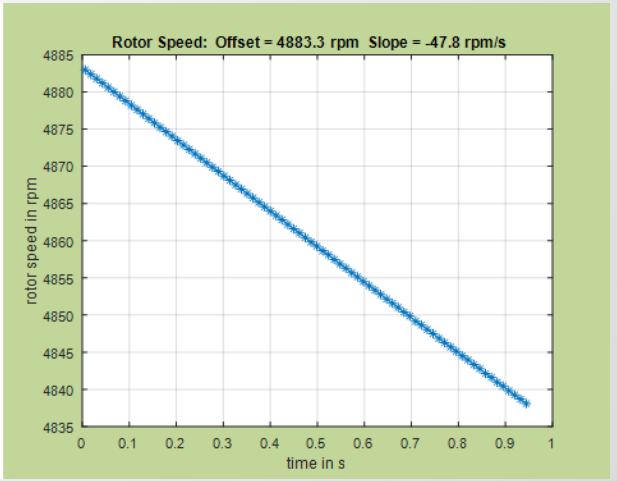
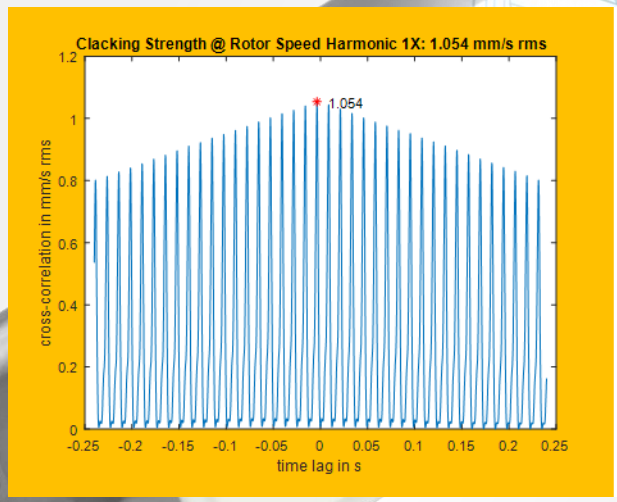
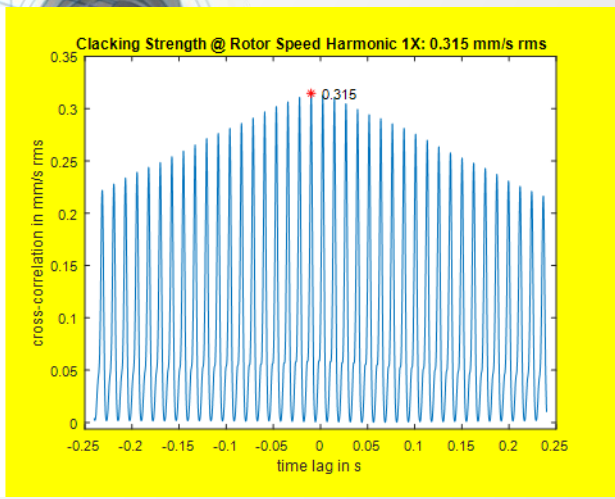
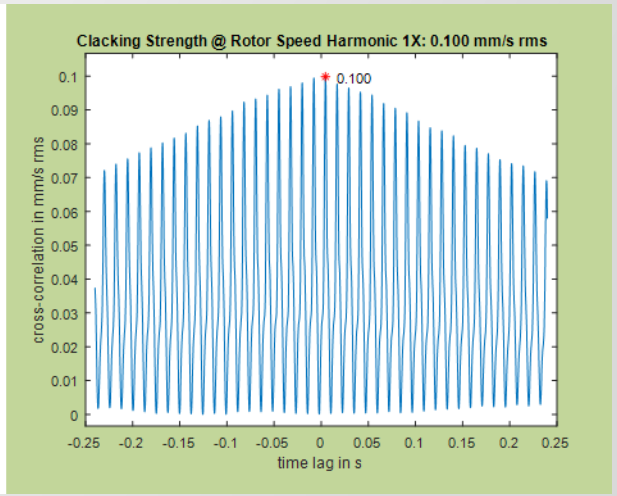


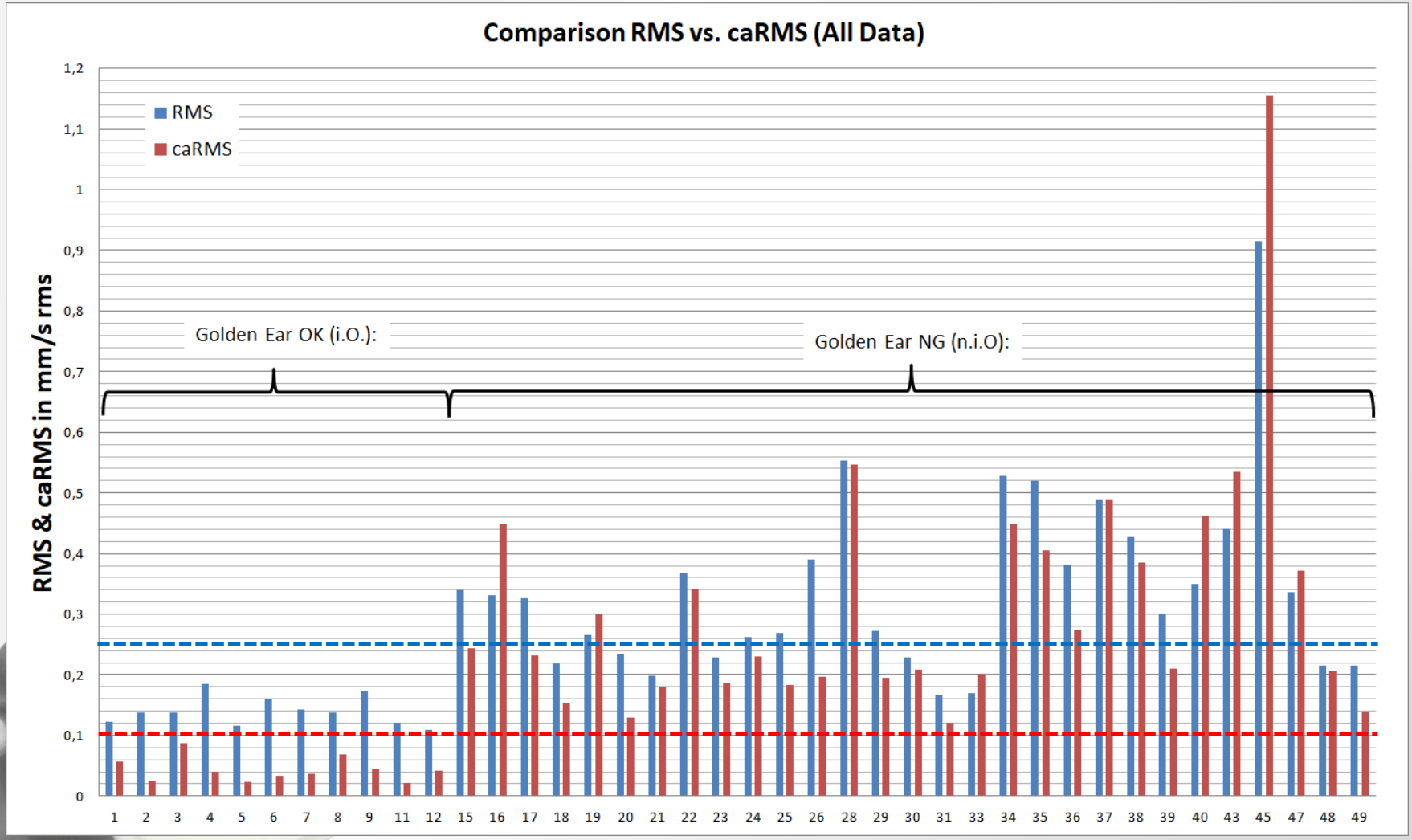



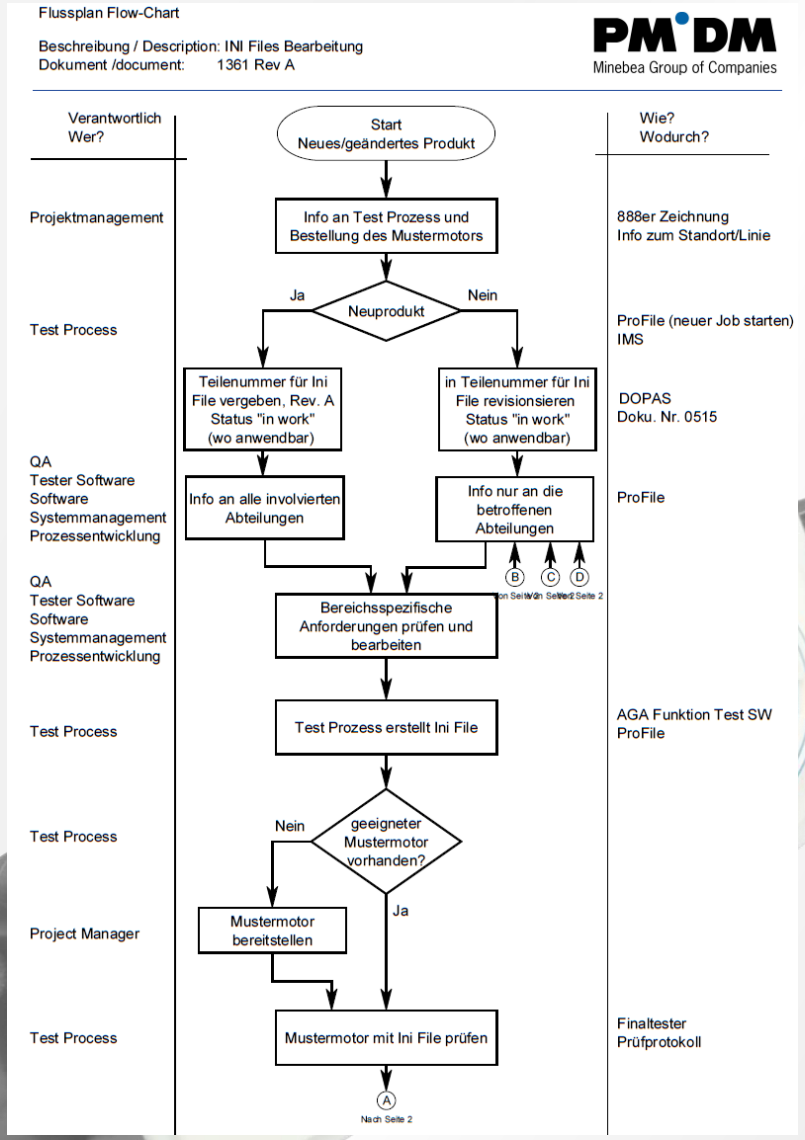



# Correlation Analysis of LDV Time Signal (caRMS) – Golden Ear

Evaluation of the golden ear measurements.



# Aktuelles Ini-File Handling – der Prozess-Flow

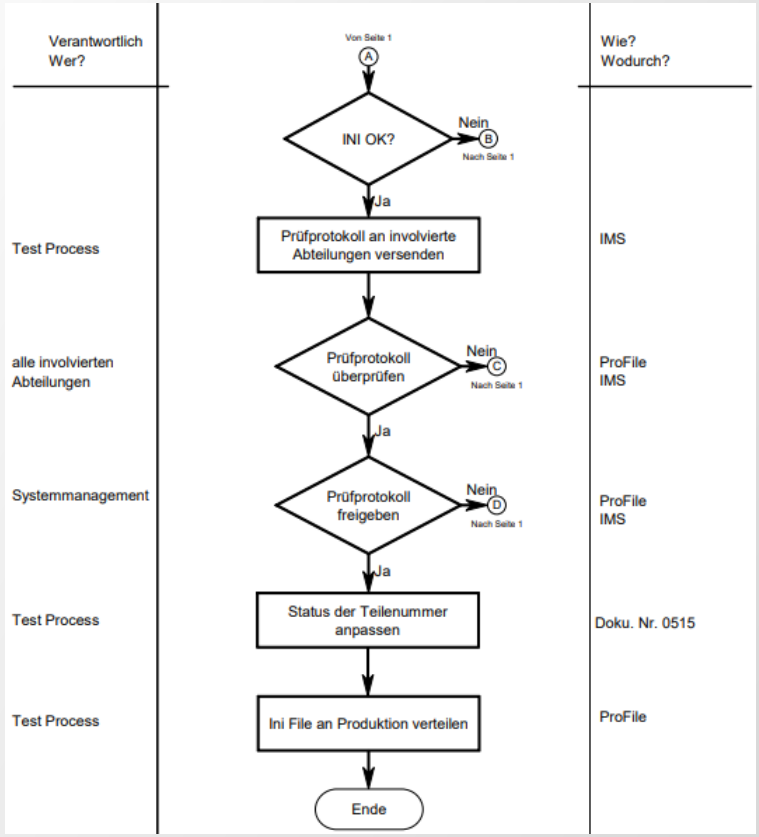



Ini-File wird in ProFile (Datenbank) angefordert

Ini-File wird in Profile abgelegt (Process Test Eng.)

Ini-File wird in Profile freigegeben (System Mg., QS, Test Mg.)

Ini-File wird (an die 888-Zchng. Und Projekt angebunden) in Profile abgelegt und so der Produktion zur Verfügung gestellt.



1. Ini-File muss für erweiterte Akustikanalyse – wie mit Audi abgestimmt – aktualisiert werden
2. Ini-File wird intern freigegeben gemäß PM°DM-Prozess
3. Fähigkeit des LDV mit neuem Ini-File muss in Thailand nachgewiesen werden
4. Upgrade auf Ini-File wird Bestandteil der nächsten Bemusterung (SW 0002) sein und auf das Ini-File (ProFile-ID und Revisionsstand) wird explizit verwiesen
5. Änderungen des Ini-Files werden zukünftig im TGS durch den PM gepflegt und auf Basis des TGS mit Audi und Weber kommuniziert