



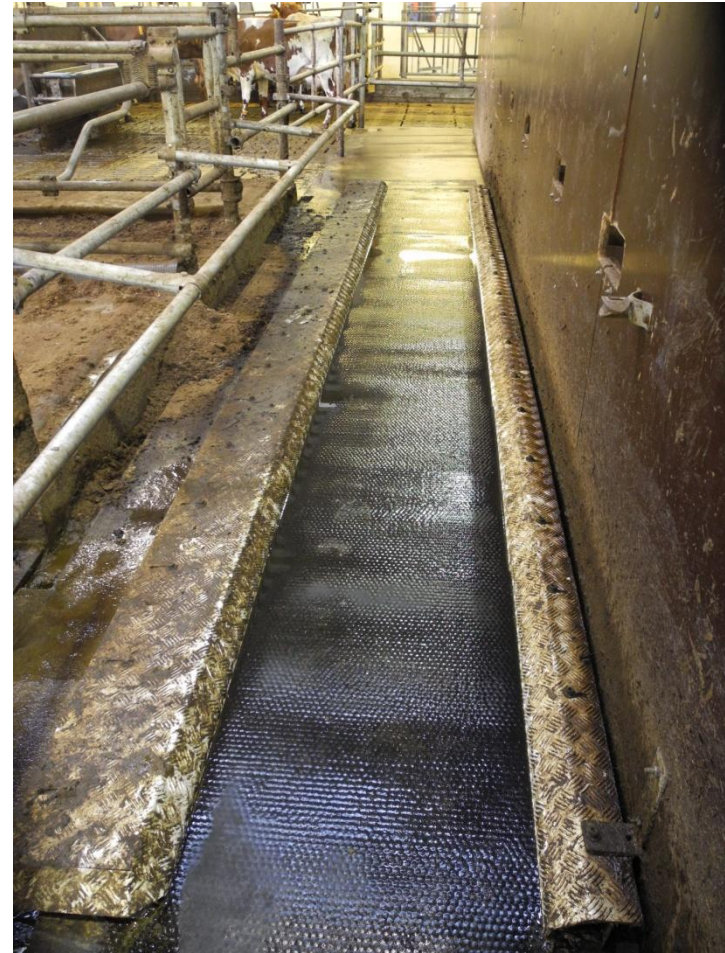
GAITWISE -system

Lilli Frondelius



Mikä ihmeen GAITWISE?

- Kehitysvaiheessa oleva menetelmä
 - ILVO (Belgia) kehittäjänä
 - MTT Maaninka kerää aineistoa
 - Lehmä kävelee maton yli
 - Matto mittaa sorkan paikan ja mattoon kohdistuvan voiman suhteessa aikaan
 - Maton keräämä data syötetään keinotekoiseen neuroverkkoon (Artificial neural network)
- Automaattinen ontumisen tunnistaminen



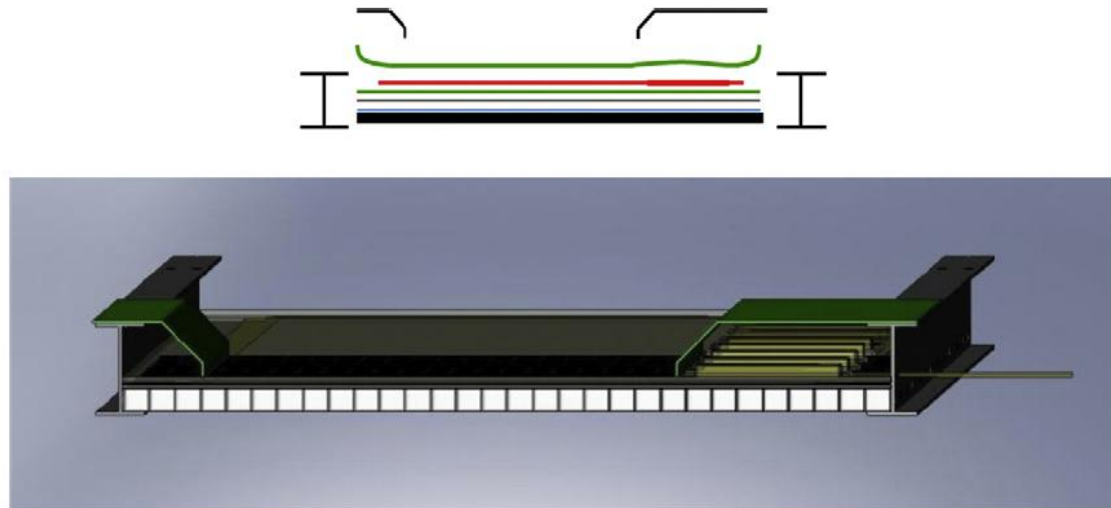


Fig. 1 – Detailed setup of the measurement zone of Gaitwise from bottom to top. Galvanised steel profiles ($2 \times$ IPE 120, 6 m, grey in top figure) and gratings ($6 \times 1 \text{ m}^2$), Quickstep unisound (2 mm, blue in top figure), Stainless steel sheets ($3 \times 2 \text{ m}^2 \times 1 \text{ mm}$, black in top figure), smooth rubber (4 mm, green in top figure), Gaitrite sensor (CIR Systems, Inc) with sealing (EPDM) (red in top figure), rubber (10 mm, green in top figure) with hammered top surface for skid resistance, Aluminium diamond plate (5 mm, black in top figure) folded as clamps to secure the rubber cover and protect the electronics.

Maertens ym. 2011

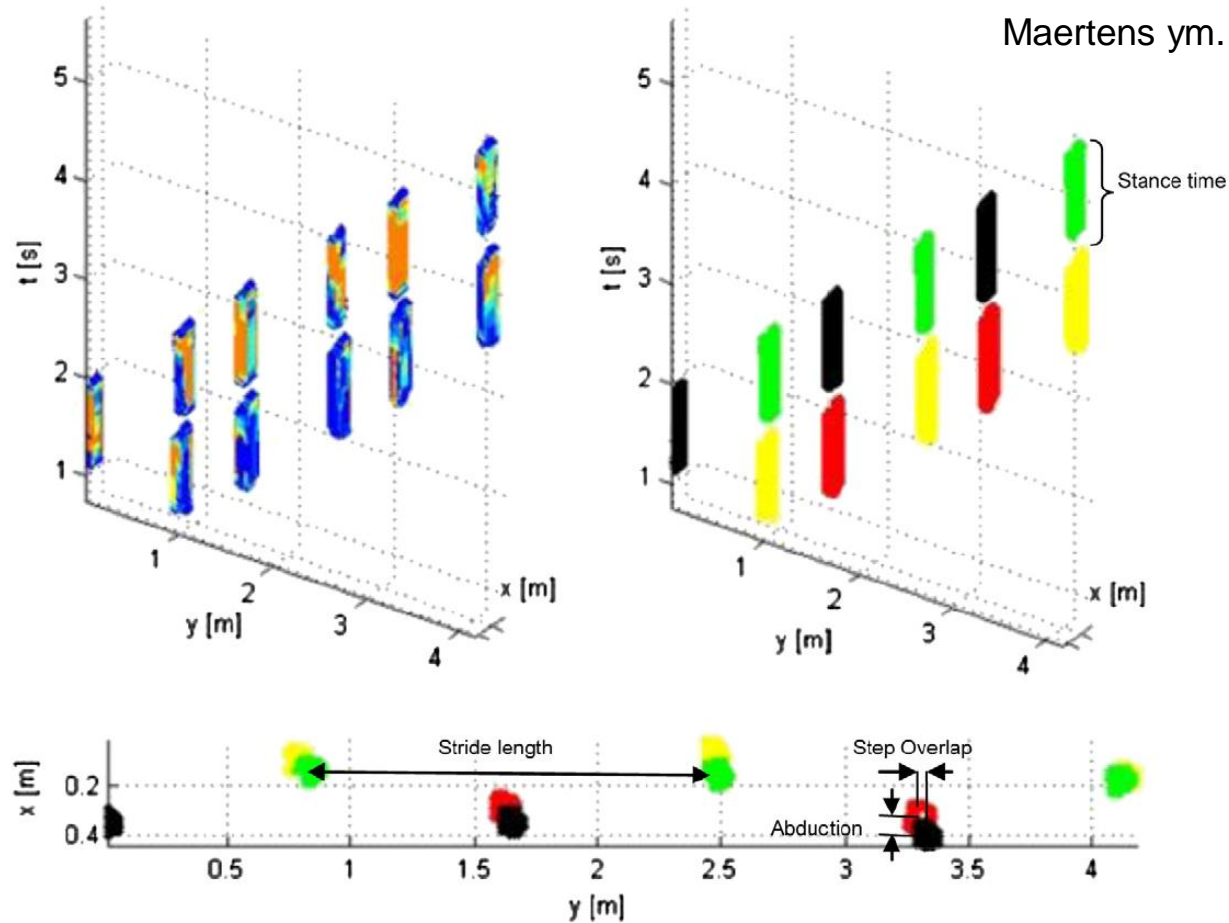


Fig. 4 – Data from an individual measurement after data conditioning (dimensioning and application of 3D binary operations) and identification of each detected imprint. (Lower panel) Locations of each hoof imprint on the measurement zone in x (transverse) and y (longitudinal) coordinates. Each hoof imprint was measured about three times (Red = right front; black = right hind; yellow = left front; green = left hind). (Upper right panel) The same data are represented with a time axis to show the duration of each footfall. (Upper left panel) Colours on the footfall bars represent mean pressure from each sensor during each footfall; the relative scale is from grey (lowest relative pressure) through cyan, yellow, magenta and red to blue (highest relative pressure). Some specific kinematic variables are visualised (stride length, step overlap, abduction and stance time).

Table 2 – General definition, the significance for lameness detection and the calculations based on the vectors illustrated in Fig. 5 and Table 1 of the specific gait variables.

Name (unit)	General definition ^a	Significance for lameness detection ^b	Calculations ^c
Asymmetry in step width (m)	Mean difference in step width between left and right hoof imprints	Asymmetrical gait	$(a_x - k_x + b_x - l_x + c_x - i_x + d_x - j_x) * 0.25$
Asymmetry in step length (m)	Mean difference in step length between left and right hoof imprints	Asymmetrical gait, arched back	$(a_y - k_y + b_y - l_y + c_y - i_y + d_y - j_y) * 0.25$
Asymmetry in step time (s)	Mean difference in step time between left and right hoof imprints	Asymmetrical gait, tenderness, reluctance to bear weight	$(a_t - k_t + b_t - l_t + c_t - i_t + d_t - j_t) * 0.25$
Asymmetry in stance time (s)	Mean difference in time that a hoof is on the ground between left and right hoof imprints	Asymmetrical gait, tenderness, reluctance to bear weight	$(s_t - q_t + t_t - r_t) * 0.5$
Asymmetry in relative pressure (l)	Mean difference in relative force exerted by the legs between left and right hoof imprints	Asymmetrical gait, tenderness, reluctance to bear weight	$(s_f - q_f + t_f - r_f) * 0.5$
Stride length (m)	Distance between two consecutive imprints of the same hoof	Speed, arched back	$(a_y + f_y + k_y + p_y) * 0.25$
Stride time (s)	Time between two consecutive imprints of the same hoof	Speed	$(a_t + f_t + k_t + p_t) * 0.25$
Stance time (s)	Time during one stride that the hoof is on the floor	Speed	$(s_t + t_t + q_t + r_t) * 0.25$
Step overlap (m)	The lengthwise distance between the front hoof imprint and a subsequent imprint of the hind hoof on the same side	Speed, arched back	$(e_y + o_y) * 0.5$
Abduction (m)	The sideways distance between the front hoof imprint and a subsequent imprint of the hind hoof on the same side	Tenderness, reluctance to bear weight	$(e_x + o_x) * 0.5$

a Some definitions are based on spatial gait parameters from Telezhenko (2009).

b Significance of the used specific parameter for general lameness indicators used in literature for lameness detection.

c Specific definitions of the variables based on vectors as illustrated in Fig. 5 and Table 1. X, Y or T projection of these vectors show the spatial and temporal aspect of the hoof placements (i_x relates to the distance between-imprints along the X dimension, i_y relates to the distance between-imprints along the Y dimension and i_t relates to the distance between-imprints along the T dimension). Vectors s, t, q and r point to within-hoof measures.