

# TreeConsult Brudi & Partner

court-certified consulting arborists

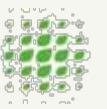
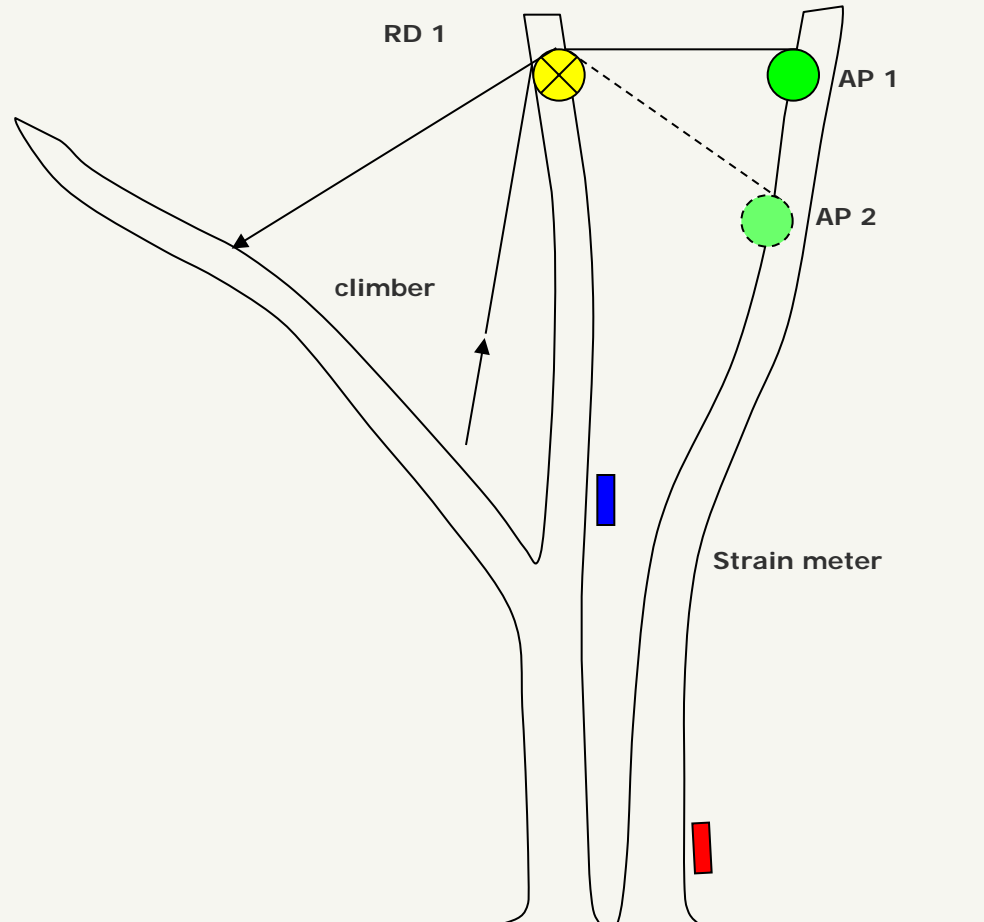
## *Redirects in Rope Systems*

Load Dissipation between Branches

Used as Anchor Points

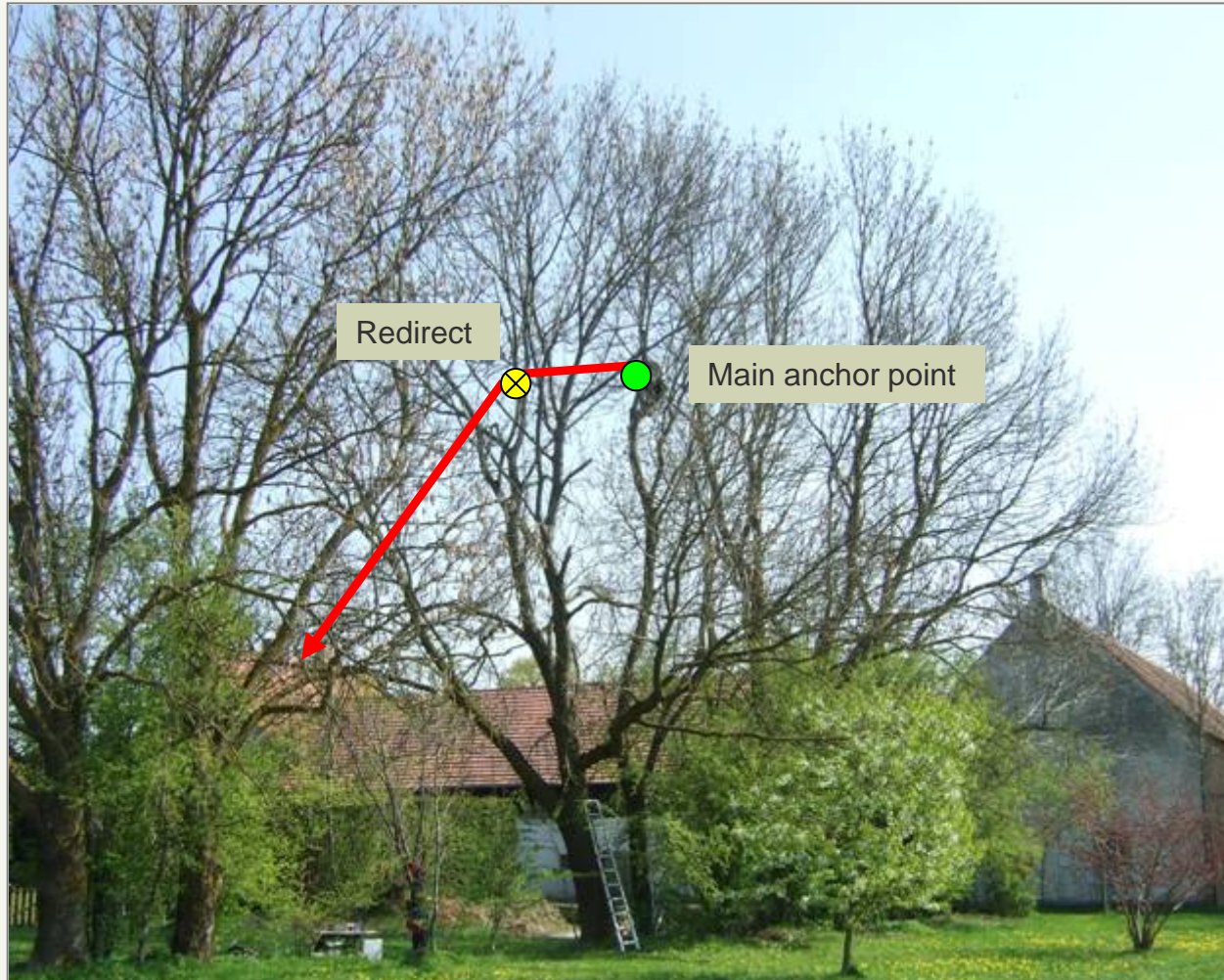
# Loading of anchor points

Test set-up in two Common Ash trees (*F. excelsior*)



# Loading of anchor points

Test set-up in two Common Ash trees (*F. excelsior*)



# Loading of anchor points

Test set-up with two forcemeters



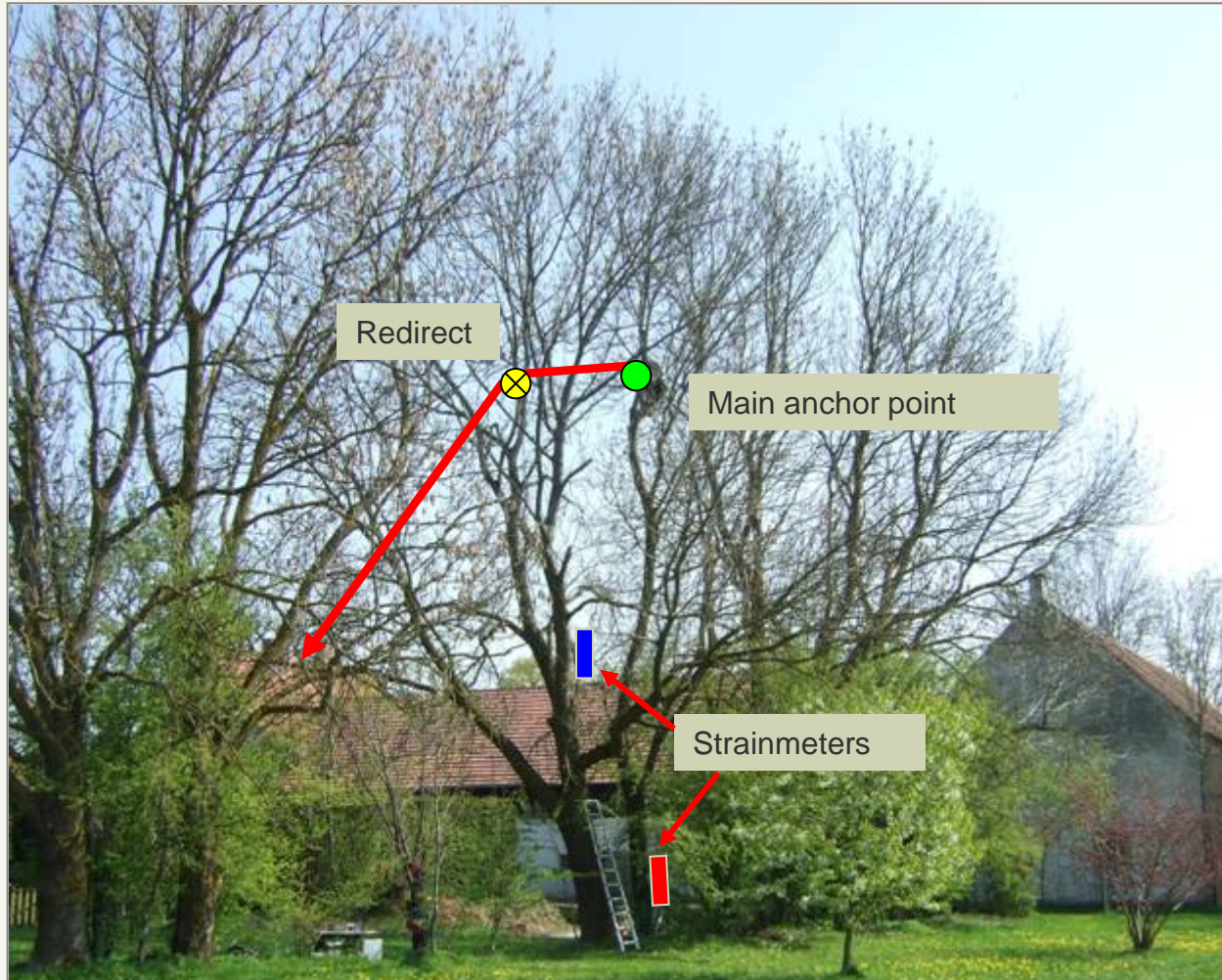
# Loading of anchor points

Test set-up with two forcemeters



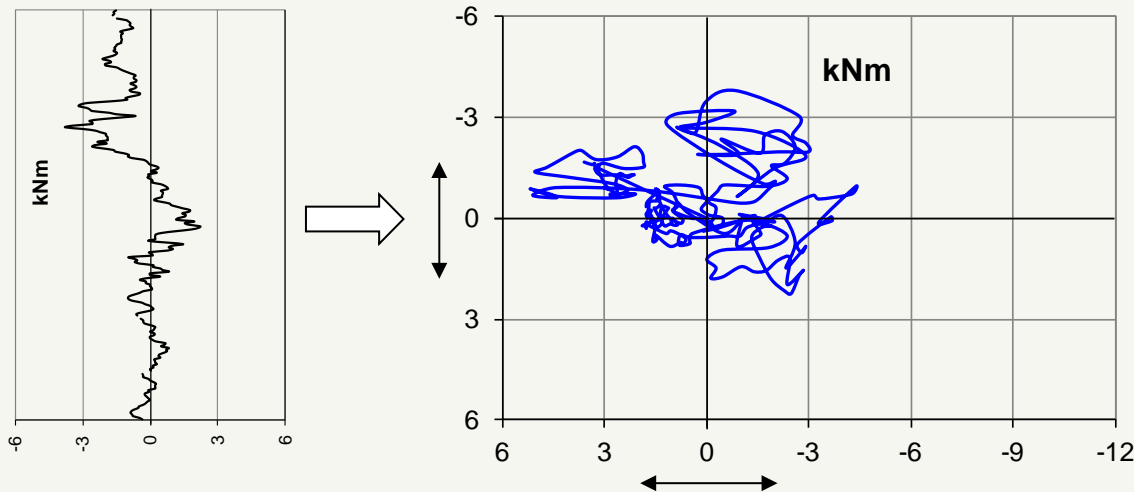
# Loading of anchor points

Test set-up with two strainmeters to monitor stem bending

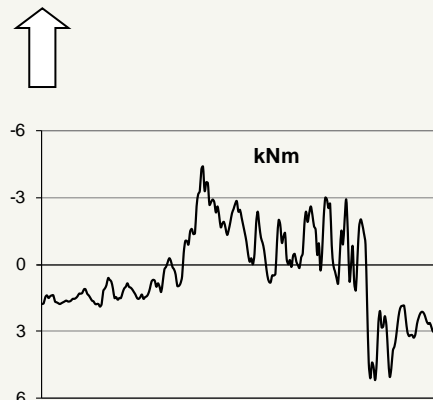
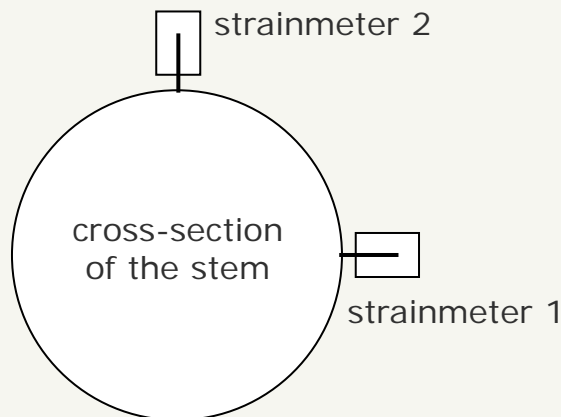


# Loading of anchor points

Measured strains converted to bending moments display stem loading



Strainmeter 1 records loading in one direction (to the right and left in the blue ball of strings diagram), strainmeter 2 monitors loads acting perpendicular to that direction (up and down in the ball of strings).



After correlating fibre strains to bending moments, both the deflection of the anchor points and the loads exerting the deflection can be plotted as a two-dimensional diagram.

cf. JAMES & KANE 2008: Precision digital instruments to measure dynamic wind loads on trees on during storms. *Agricultural and Forest Meteorology* (148): 1055–1061.



# Climbing operation 1

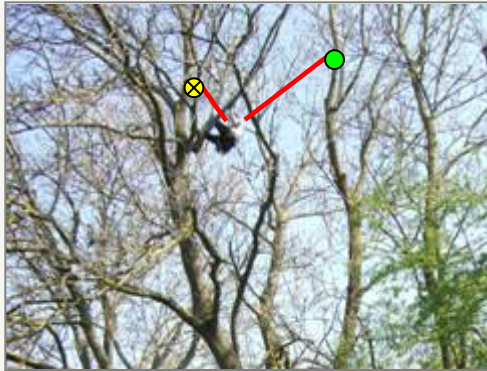
Traverse from Main anchor to Redirect using two climbing systems



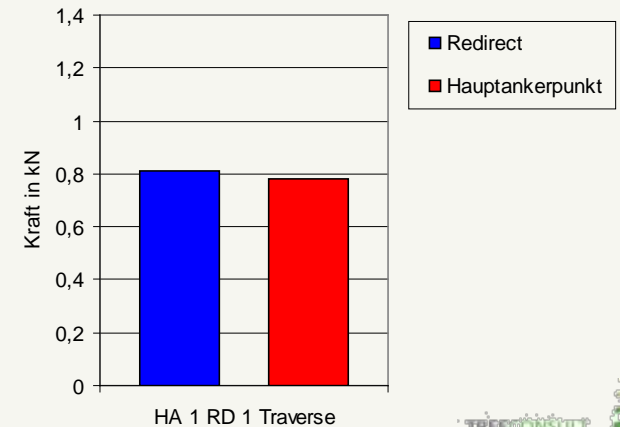
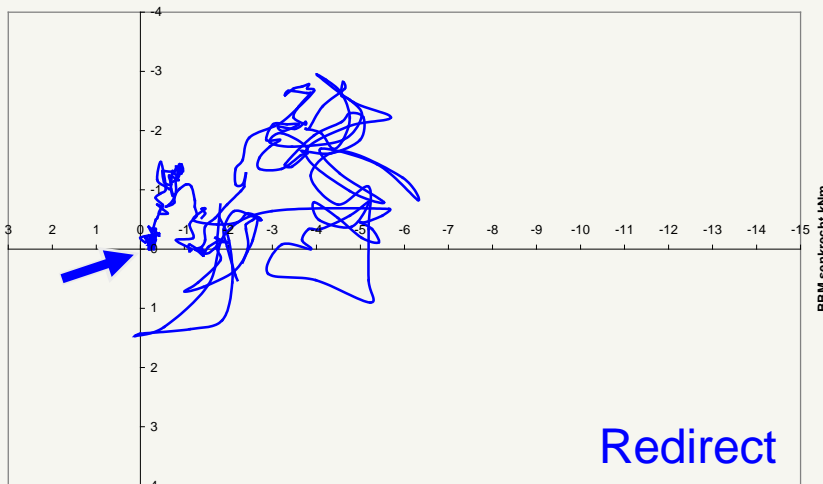
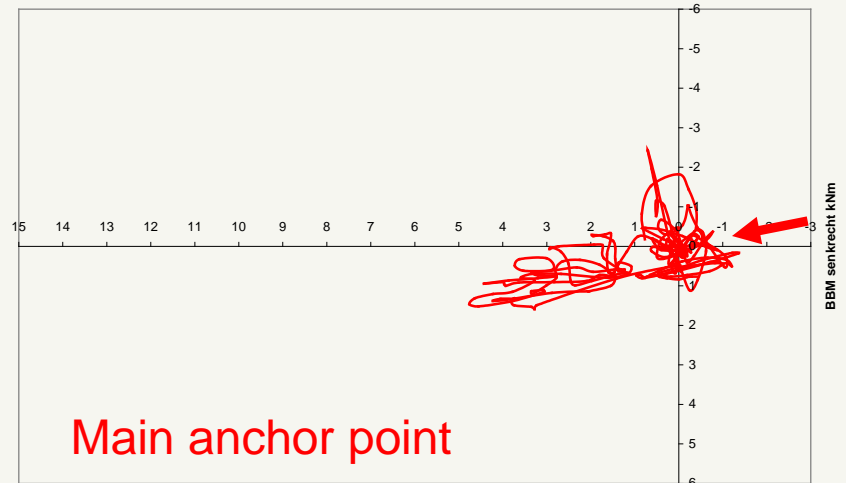


# Analysis: Climbing operation 1

Traverse from Main anchor to Redirect using two climbing systems

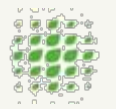
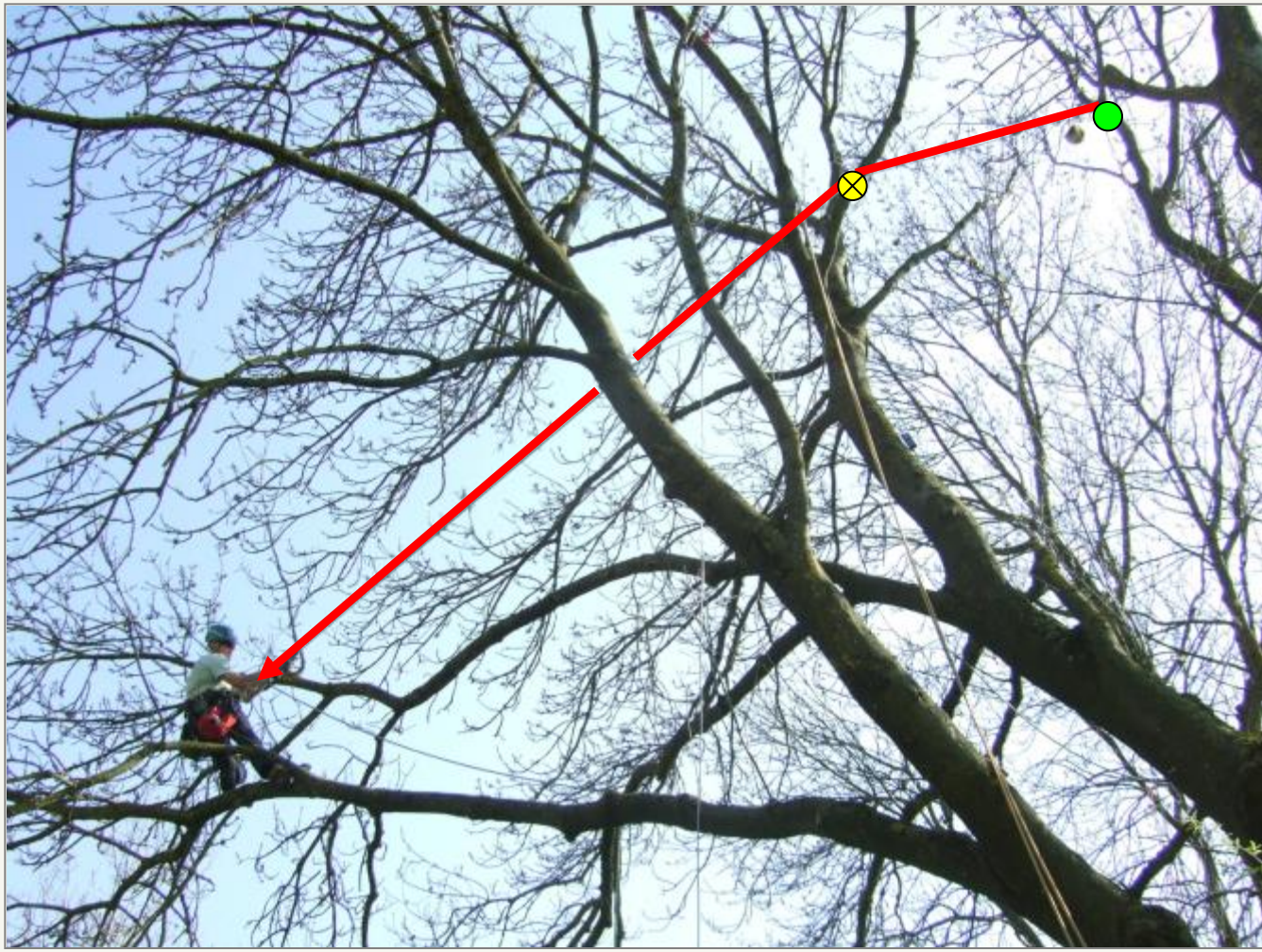


HA 1 RD 1 traverse - Redirect  
BBM parallel kNm



# Climbing operation 2

Descent to working position

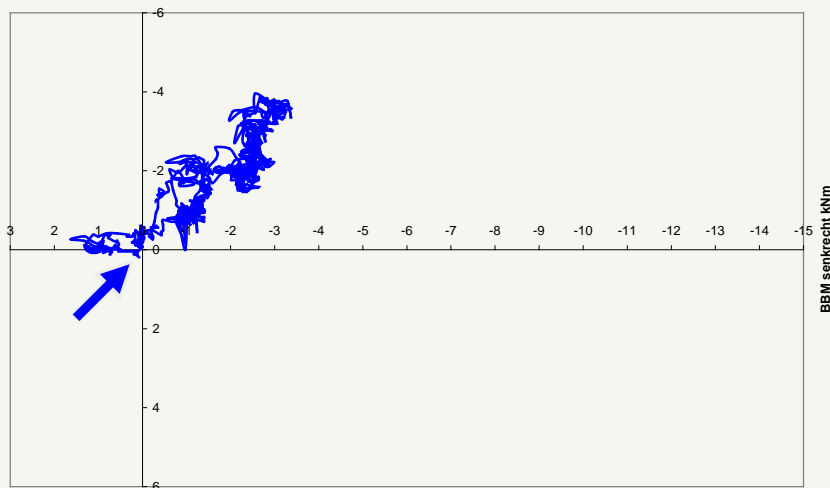


# Analyzing climbing operation 2

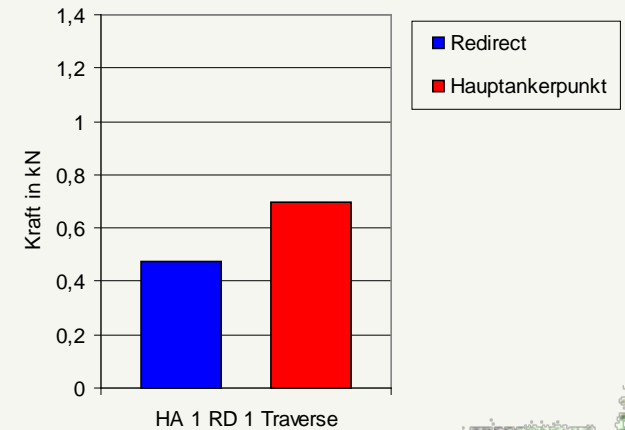
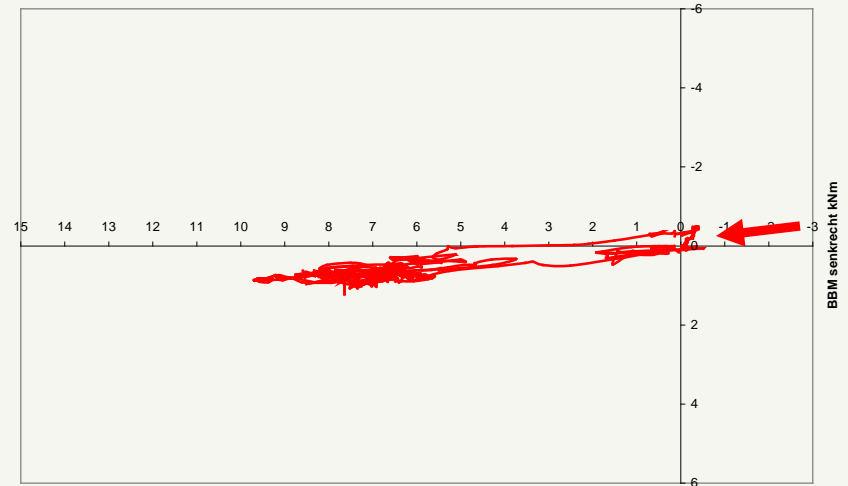
## Descent to working position



RD 1 descent - Redirect  
BBM parallel kNm

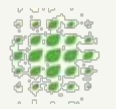
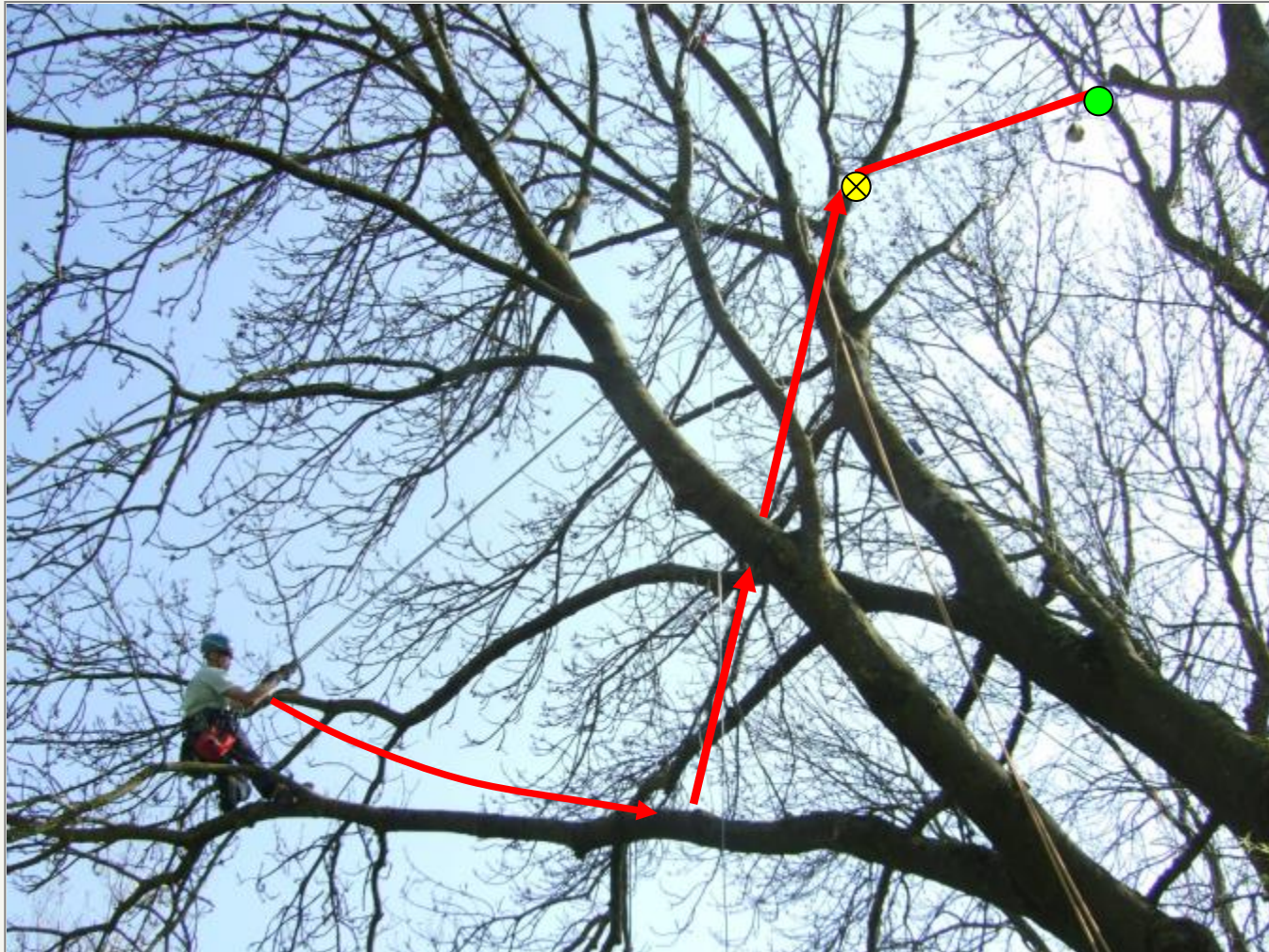


RD 1 descent - Hauptanker  
BBM parallel kNm



# Climbing operation 3

Ascent from working position

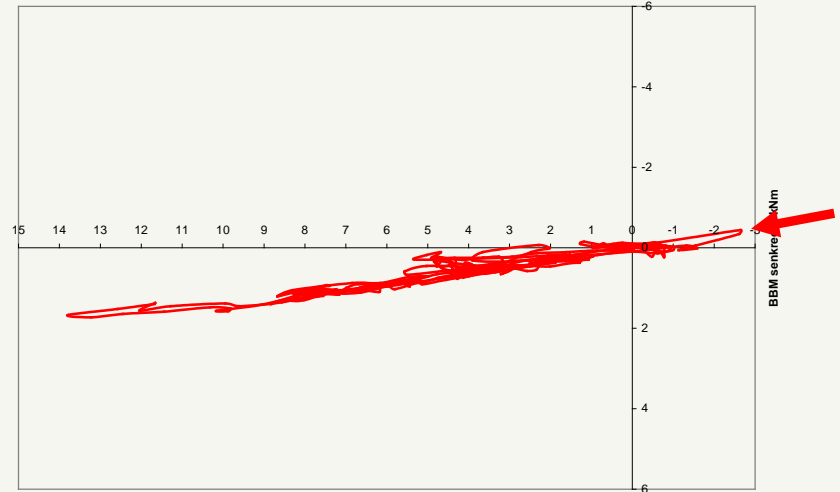


# Analyzing climbing operation 3

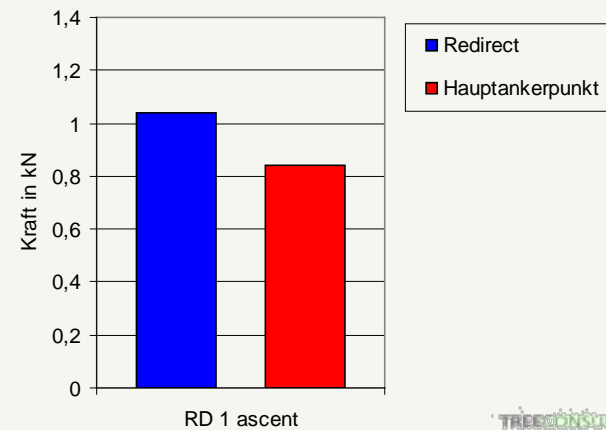
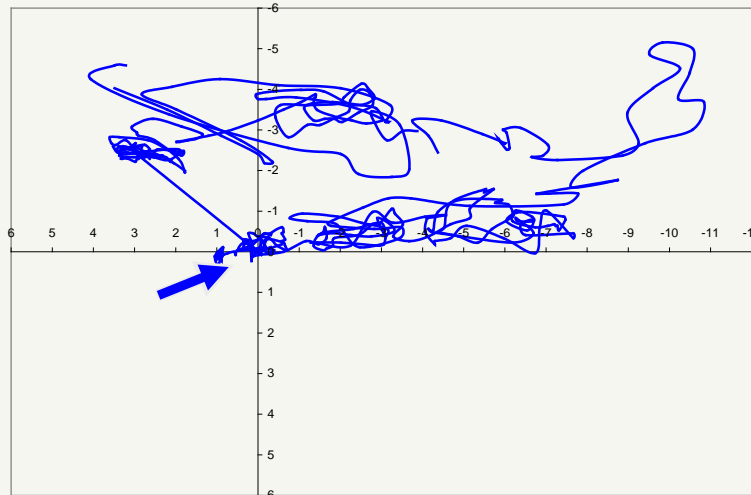
## Ascent from working position



RD 1 ascent - Hauptanker  
BBM parallel kNm



RD 1 ascent - Redirect  
BBM parallel kNm



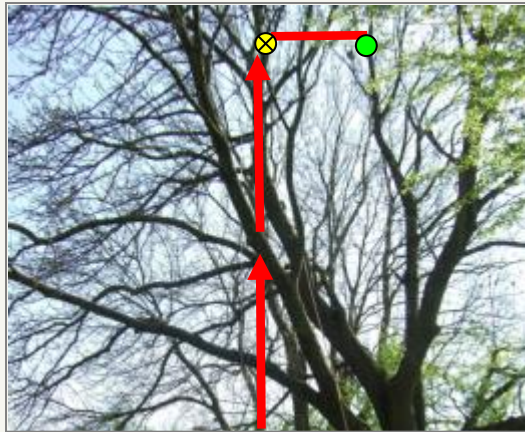
# Climbing operation 4

Ascent from the ground

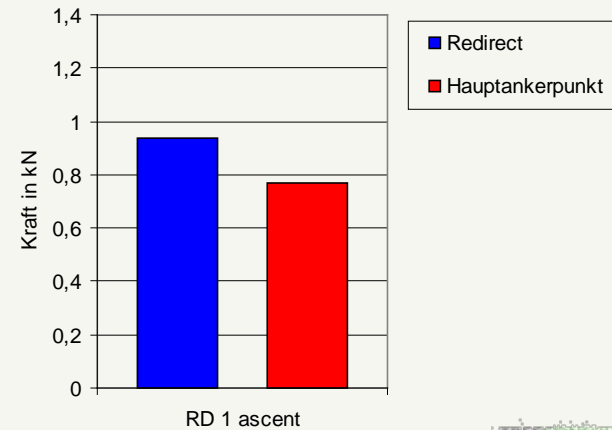
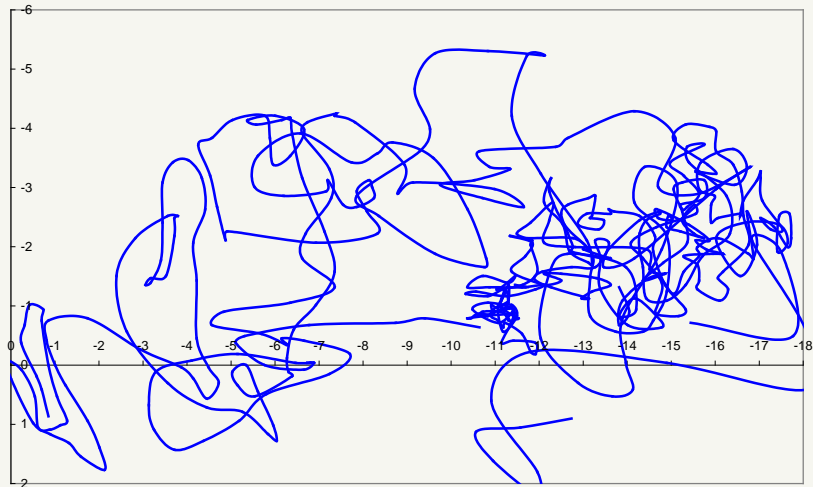
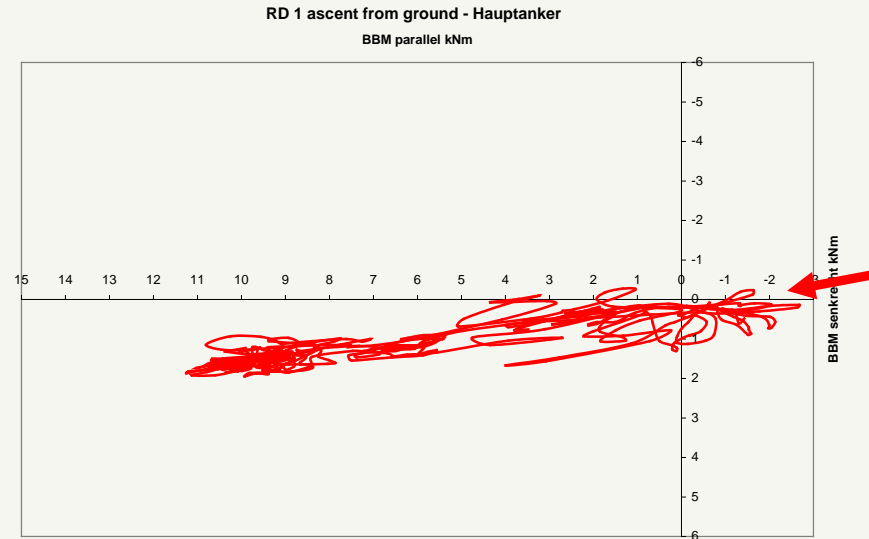


# Analyzing climbing operation 4

## Ascent from the ground



RD 1 ascent from ground - Redirect  
BBM parallel kNm



# Climbing operation 5

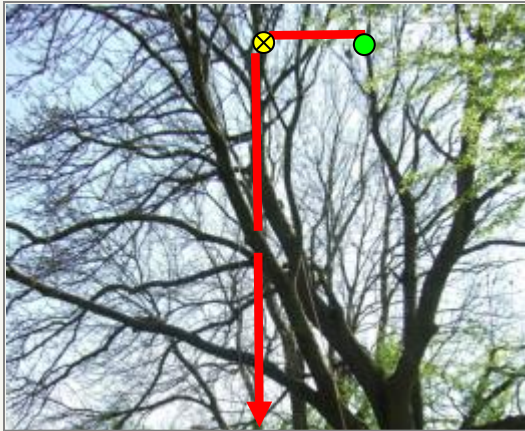
Descent to the ground



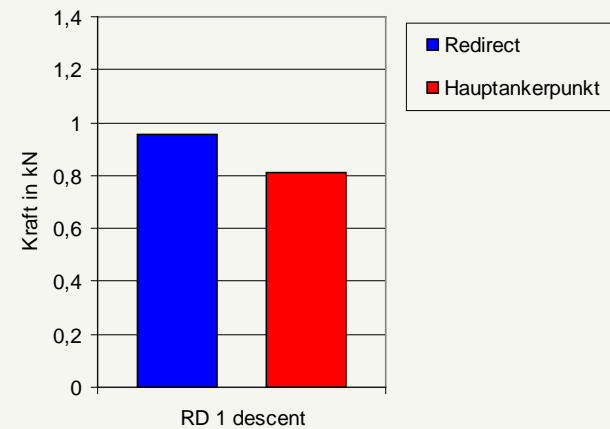
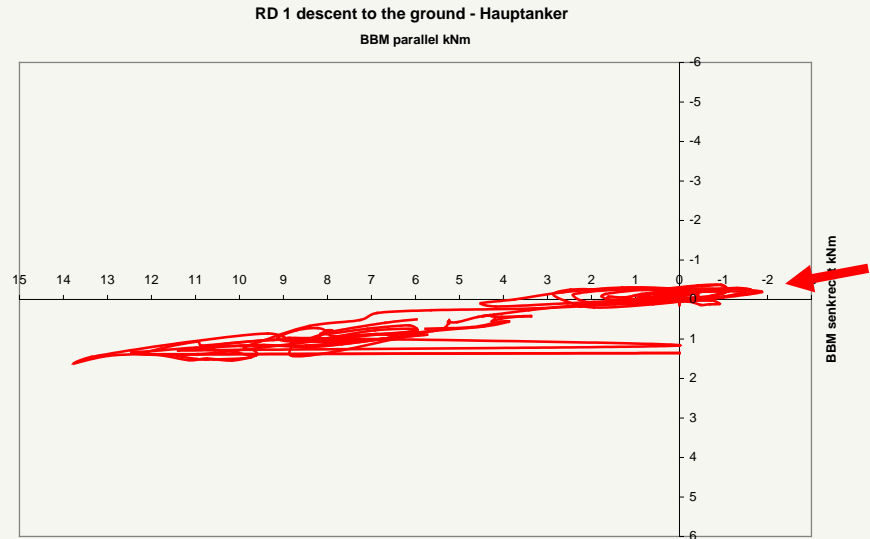


# Analyzing climbing operation 5

## Descent to the ground

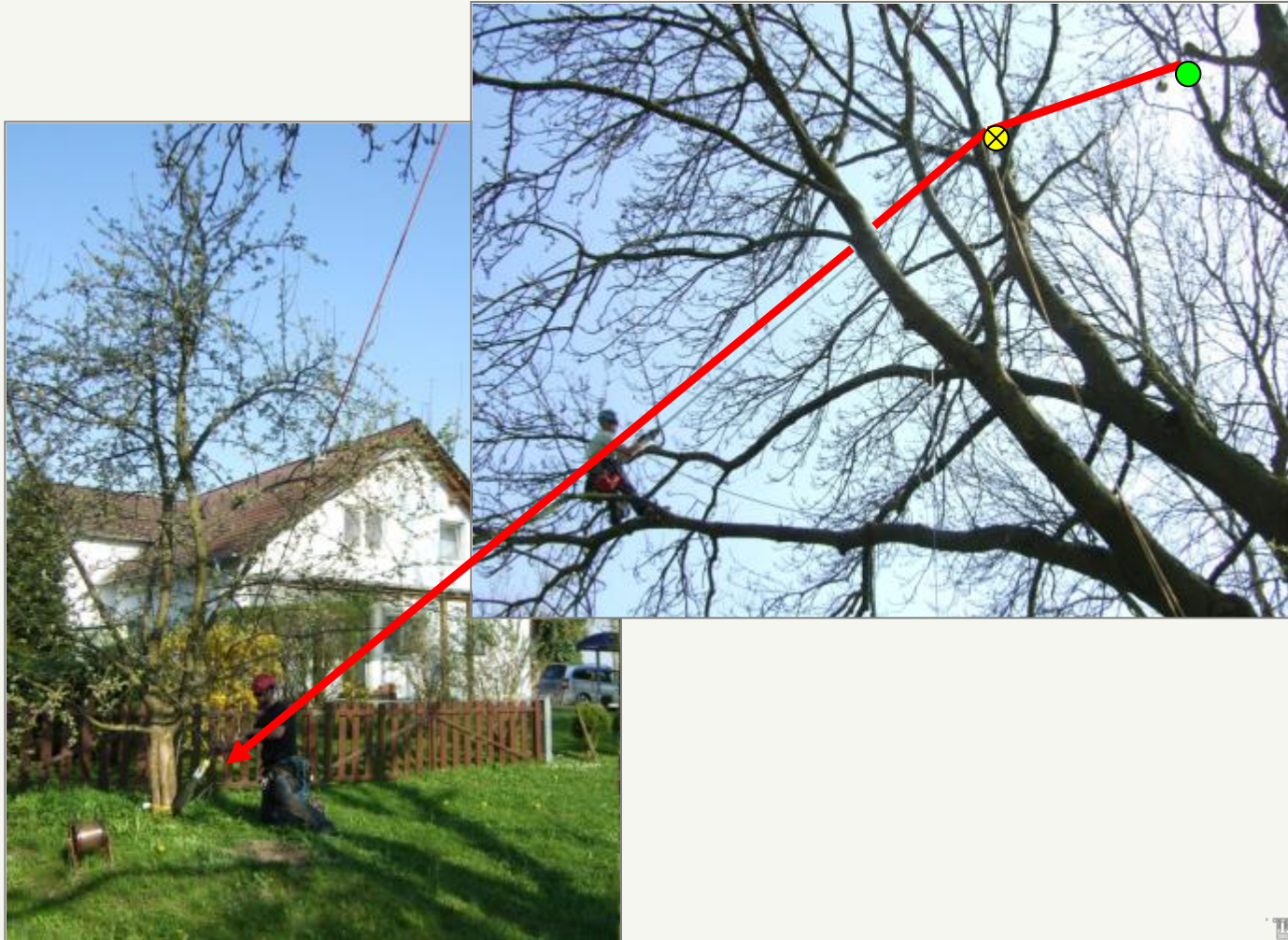


RD 1 descent to the ground - Redirect  
BBM parallel kNm



# Static load test

Static load test with 1.4 kN pulling force ( $\approx 140$  kg mass, 310 lbs)

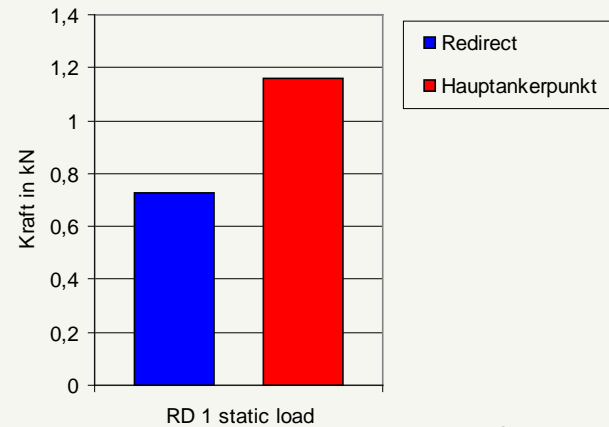
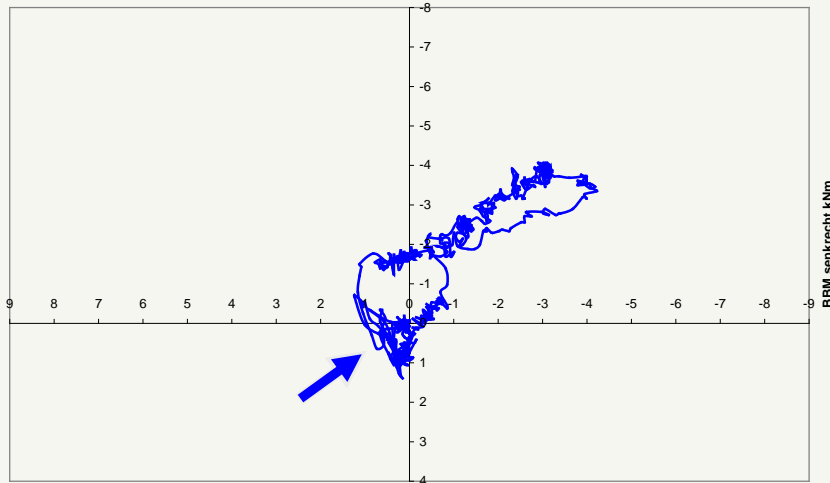
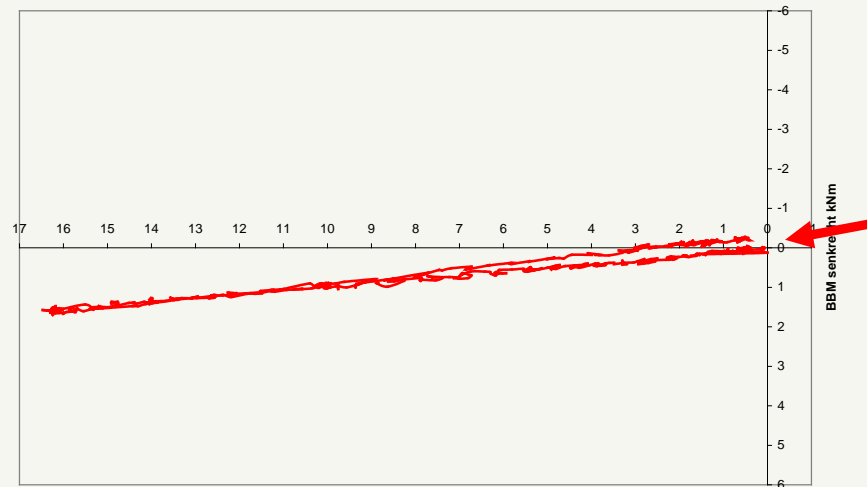


# Analyzing static load test

Static load test with 1.4 kN pulling force ( $\approx 140$  kg mass, 310 lbs)



RD 1 static load test - Redirect  
BBM parallel kNm



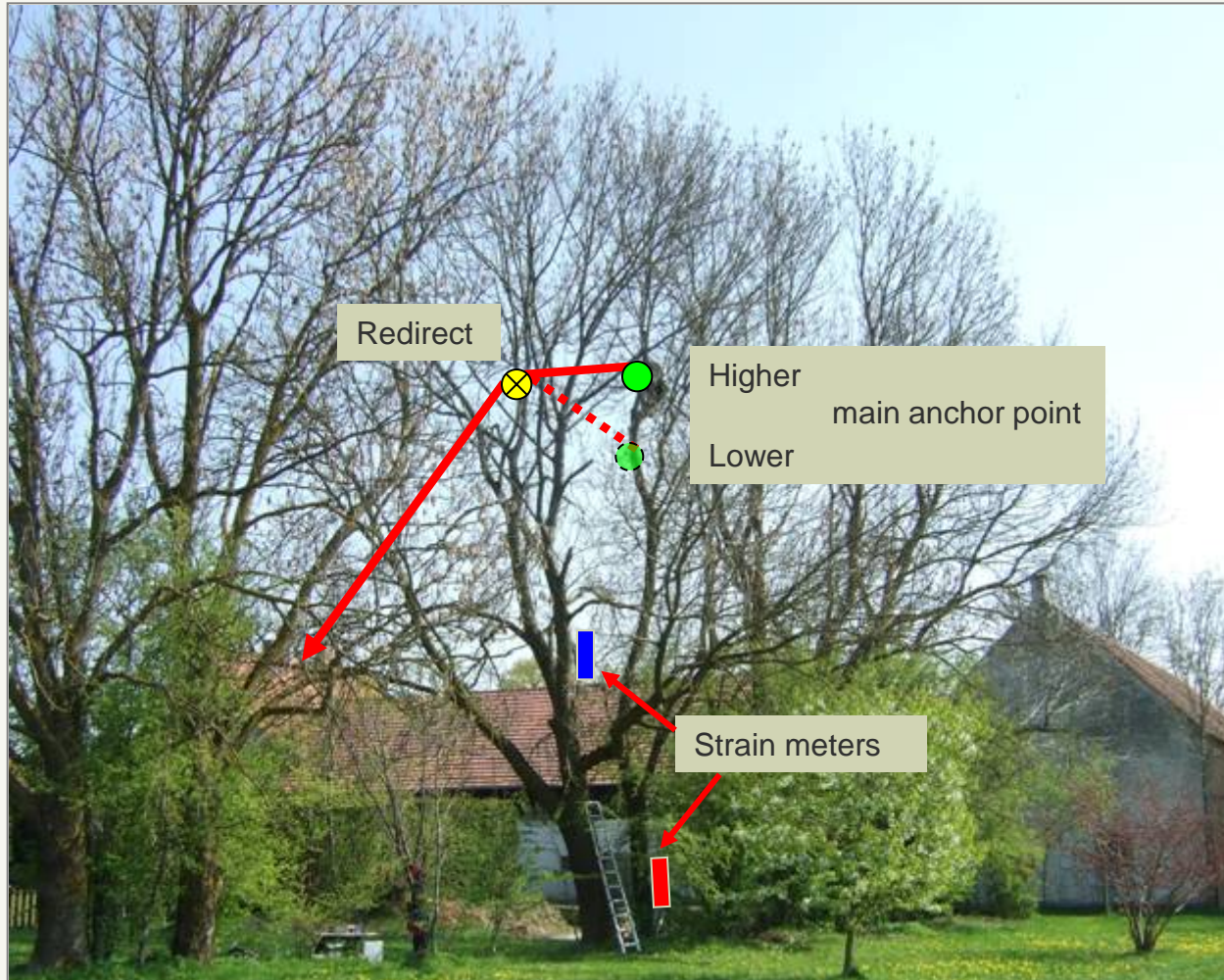
# Changing anchor point configuration

Main anchor point lowered by 2.4 m ( $\approx 8'$ )



# Changing anchor point configuration

Test set-up main anchor point lowered by 2.4 m ( $\approx 8'$ )



# Climbing operation 2

Descent to working position (main anchor point lowered by 2.4 m)

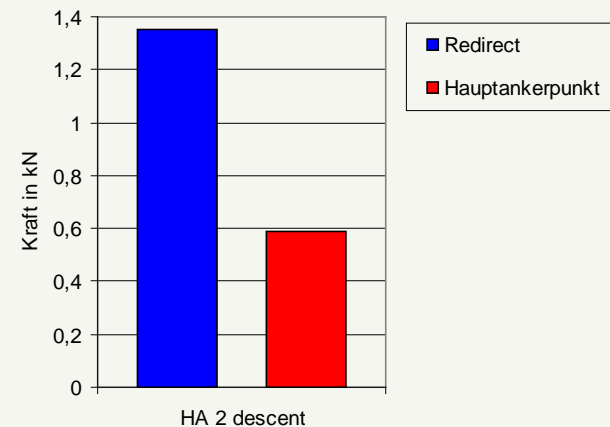
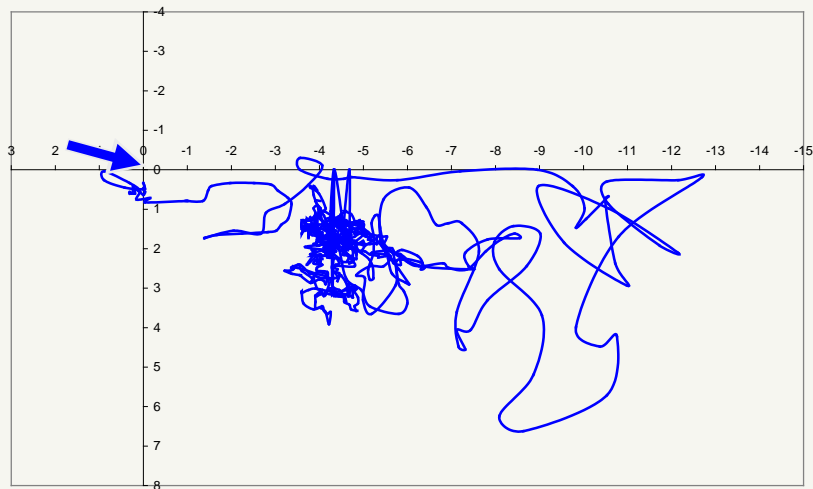
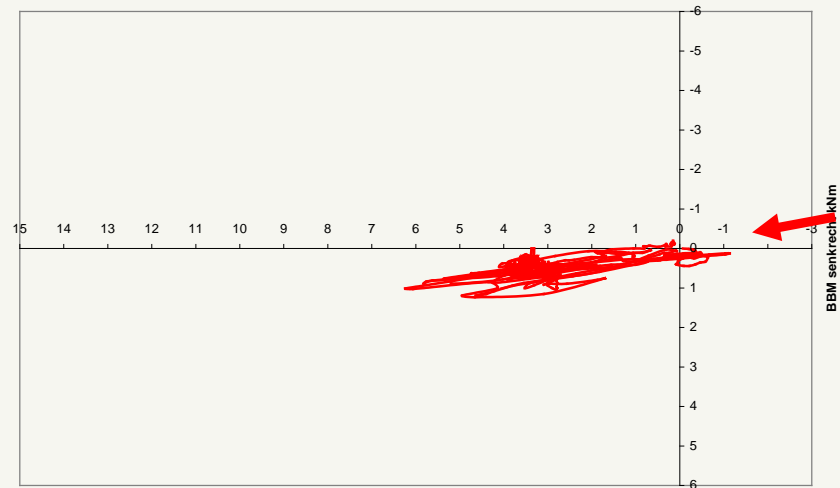


# Analyzing climbing operation 2

Descent to working position (main anchor point lowered by 2.4 m)



HA 2 descent to work position - Redirect  
BBM parallel kNm



# Climbing operation 3

Ascent from working position (main anchor point lowered by 2.4 m)



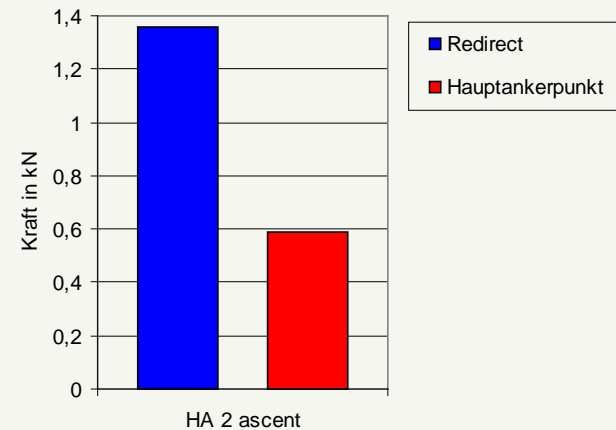
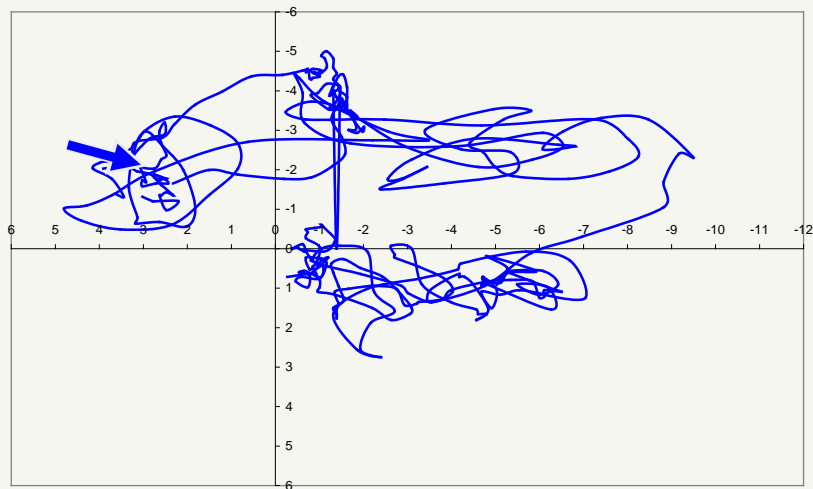
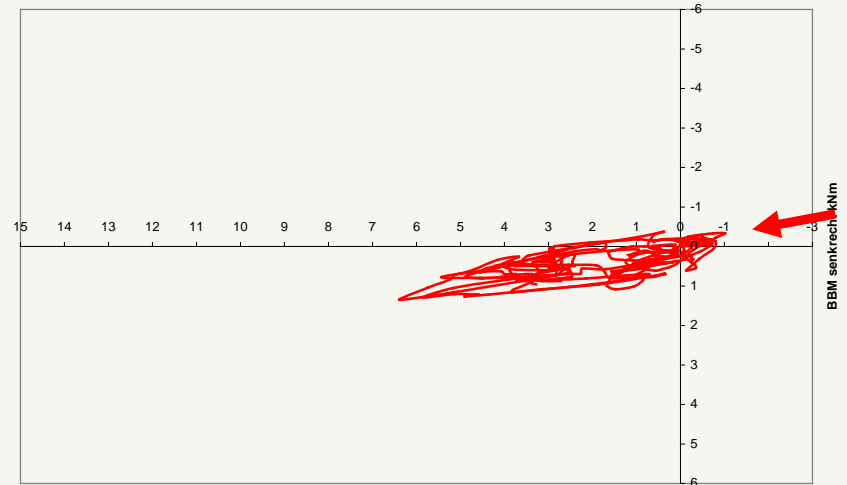


# Analyzing climbing operation 3

Ascent from working position (main anchor point lowered by 2.4 m)

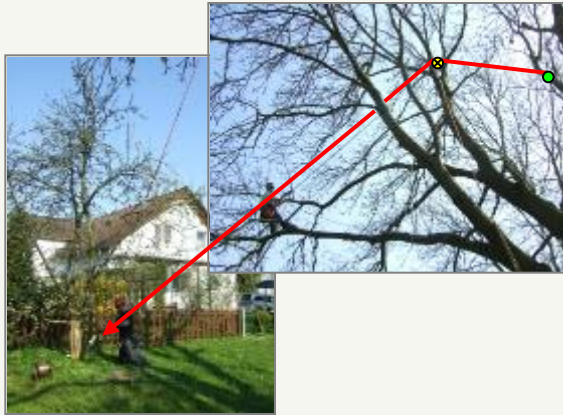


HA 2 ascent from work position - Redirect  
BBM parallel kNm

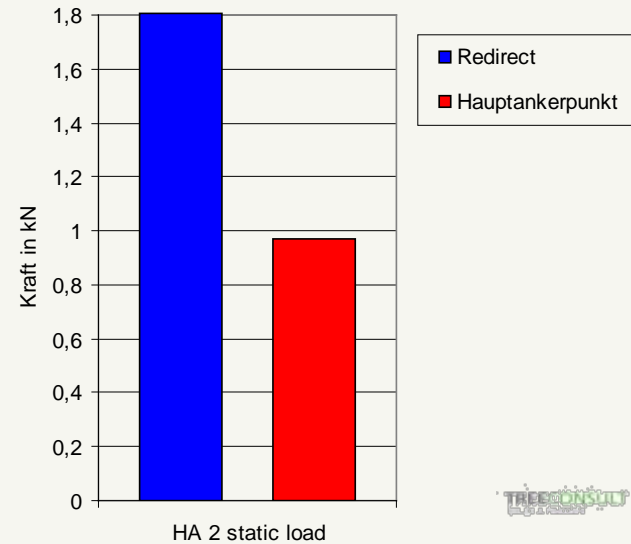
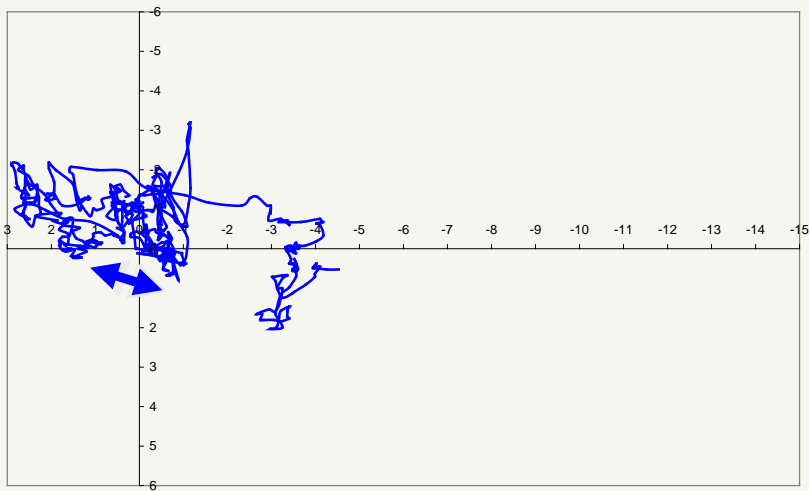


# Loading of anchor points

Static load test with 1.4 kN ( $\approx 140$  kg mass, 310 lbs)



HA 2 static load test - Redirect  
BBM parallel kNm



# TreeConsult Brudi & Partner

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*Thanks for support and sharing ideas to:*

*Chris Cowell, Treepartner, Great Britain*

*Paul Howard, ArBO Baumpflege, Munich*

*Georg-Friedrich Wittmann, Freising*

[www.tree-consult.org](http://www.tree-consult.org)

*Thank you for your attention!*