

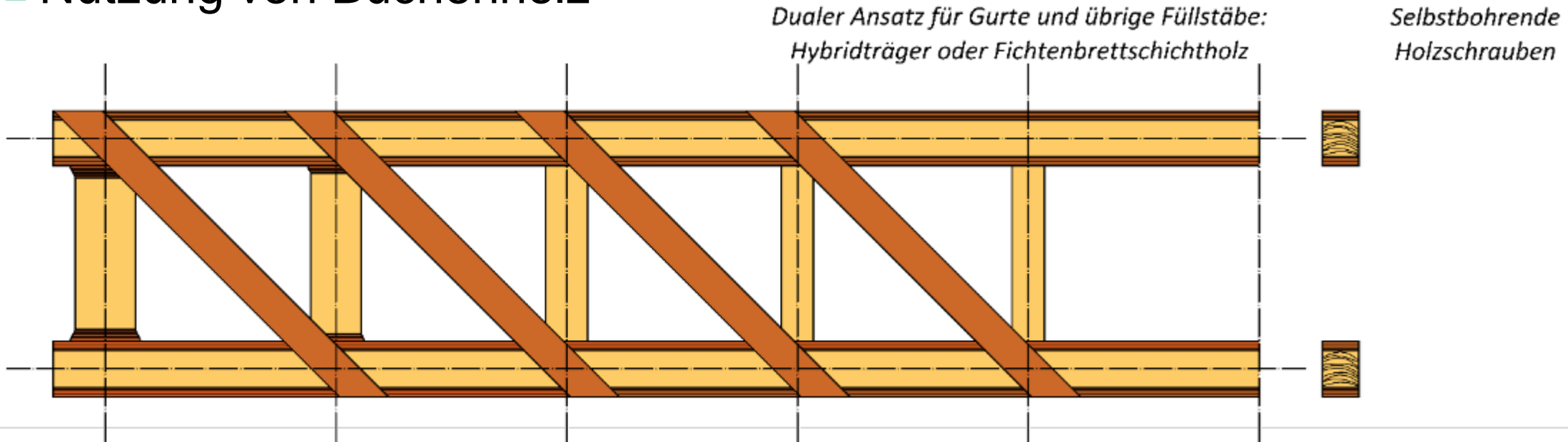
FaNaBu

# Fachwerkträger aus Nadel- und Buchenholz

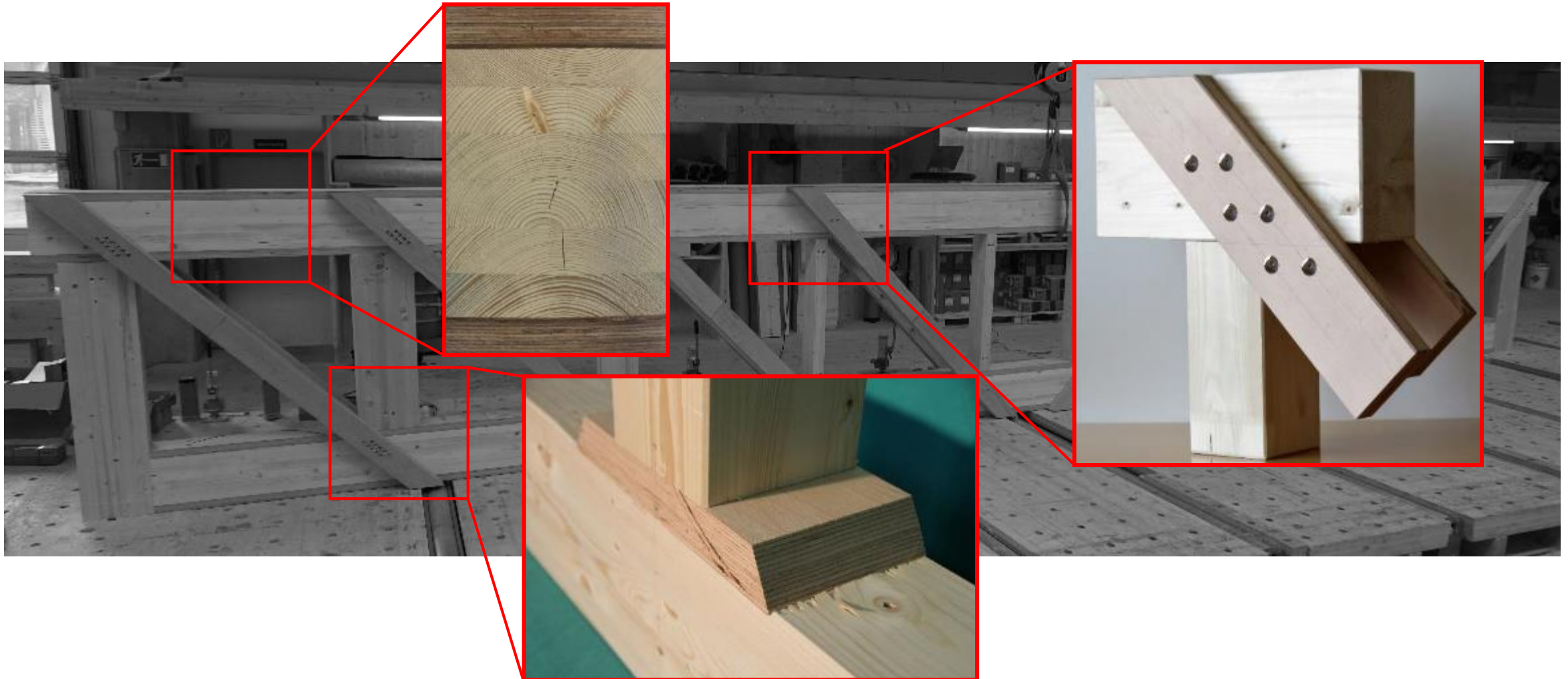


# Entwicklung eines Strukturkonzepts für weitgespannte Fachwerkträger

- Zielgruppe KMU
- Abbund auf CNC Anlagen
- Anschlüsse mit selbstbohrenden Holzschrauben
- Nutzung von Buchenholz



# Untersuchungen



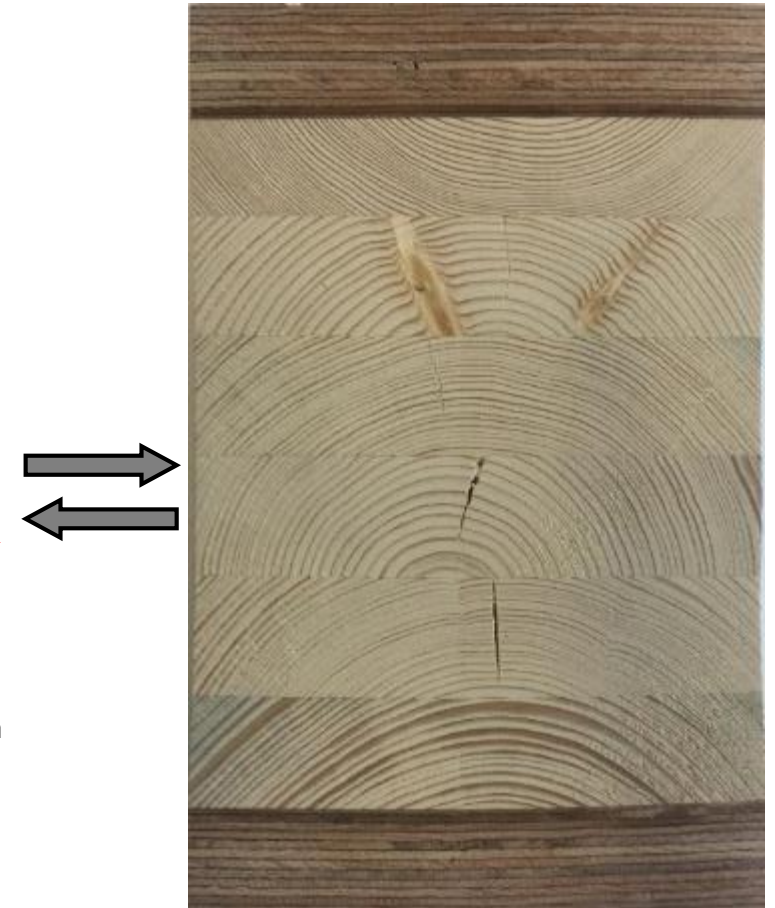
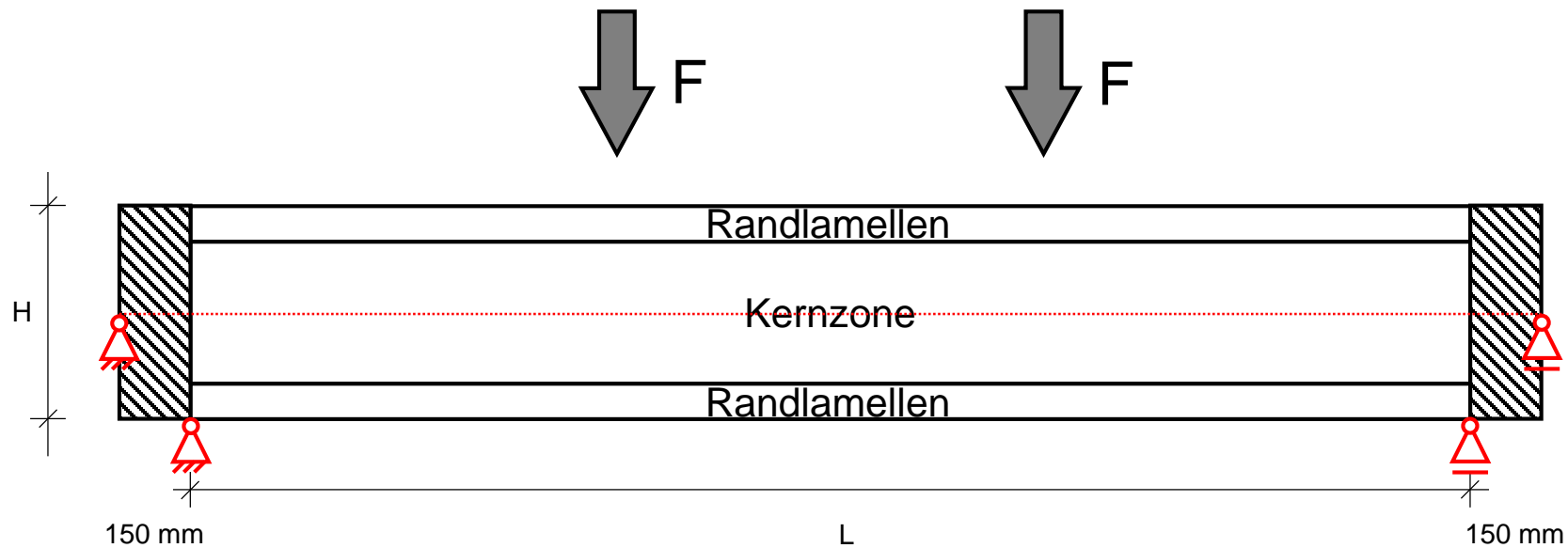
# Hybridquerschnitte

- Optimierung der Materialwahl
- Modellierung von Zug-, Druck- und Biegefestigkeiten
- Experimentelle Validierung der Ergebnisse



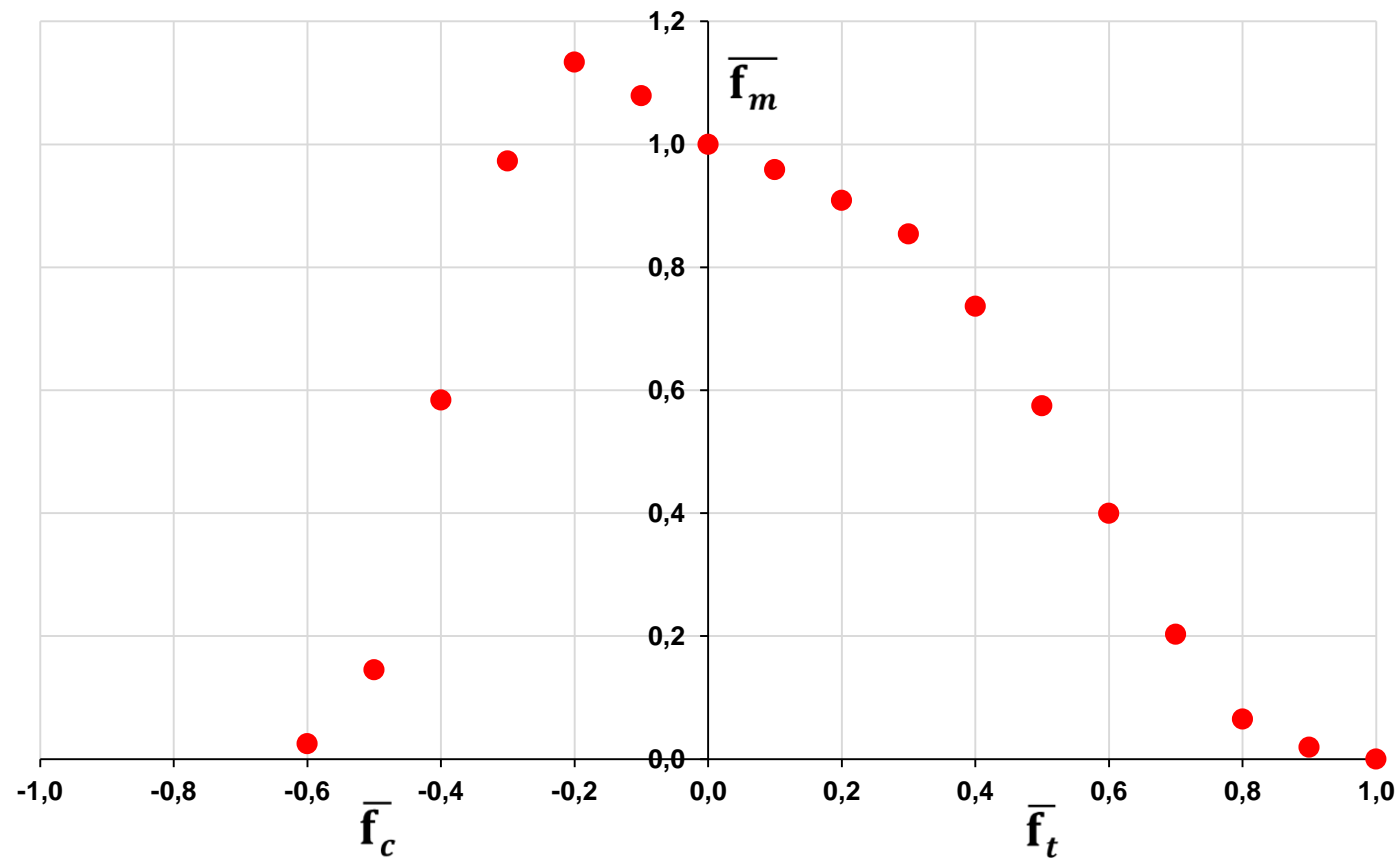
# Hybridquerschnitte

- Interaktion: Biegung + Zug/Druck



# Hybridquerschnitte

## ■ Interaktion: Biegung + Zug/Druck



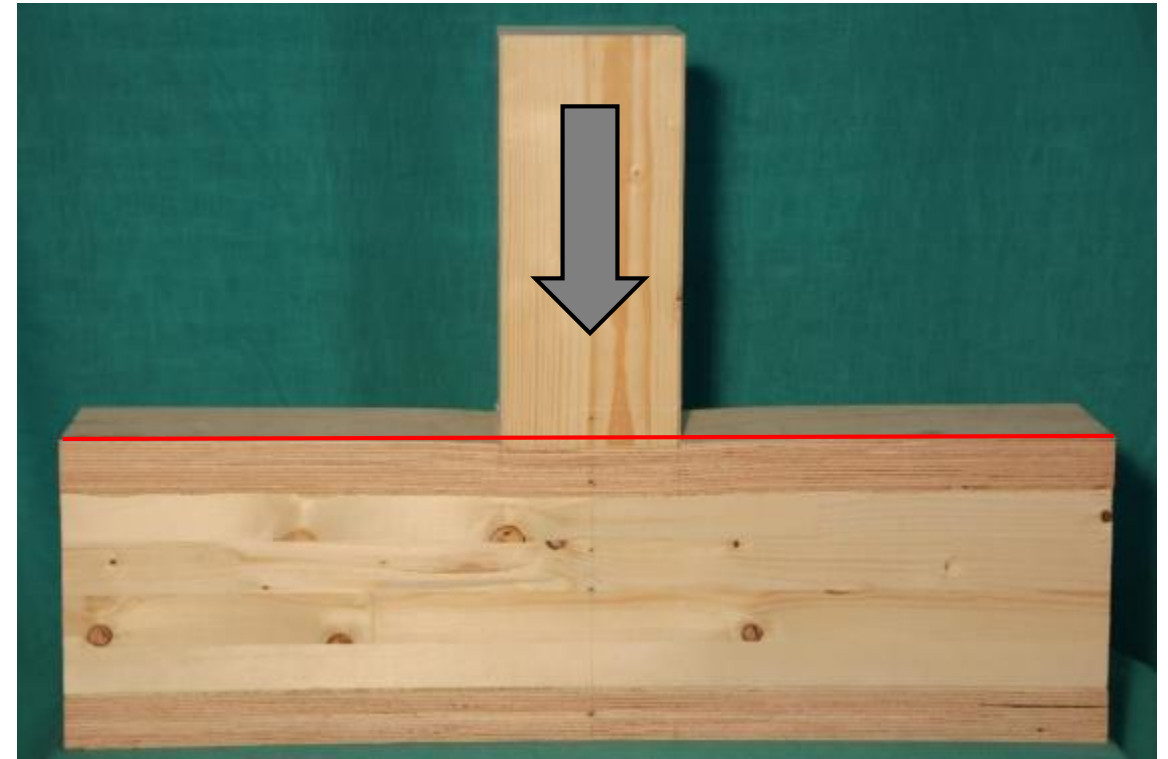
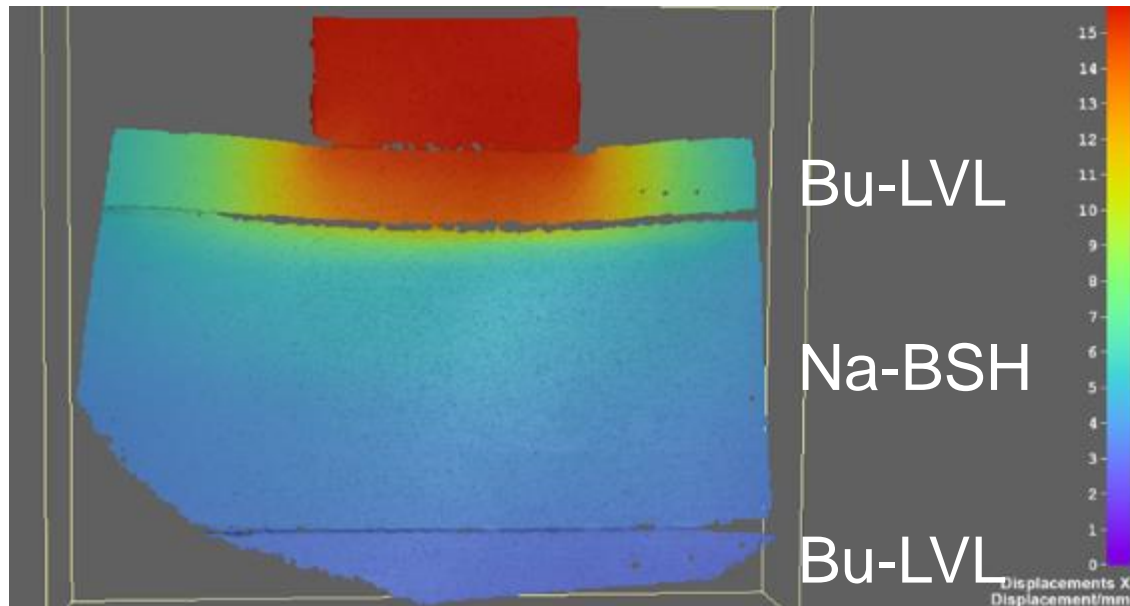
# Druckanschlüsse

- Tragfähigkeitssteigerung durch Verstärkungen
- Querdrucktragfähigkeit von Hybridquerschnitten



# Druckanschlüsse

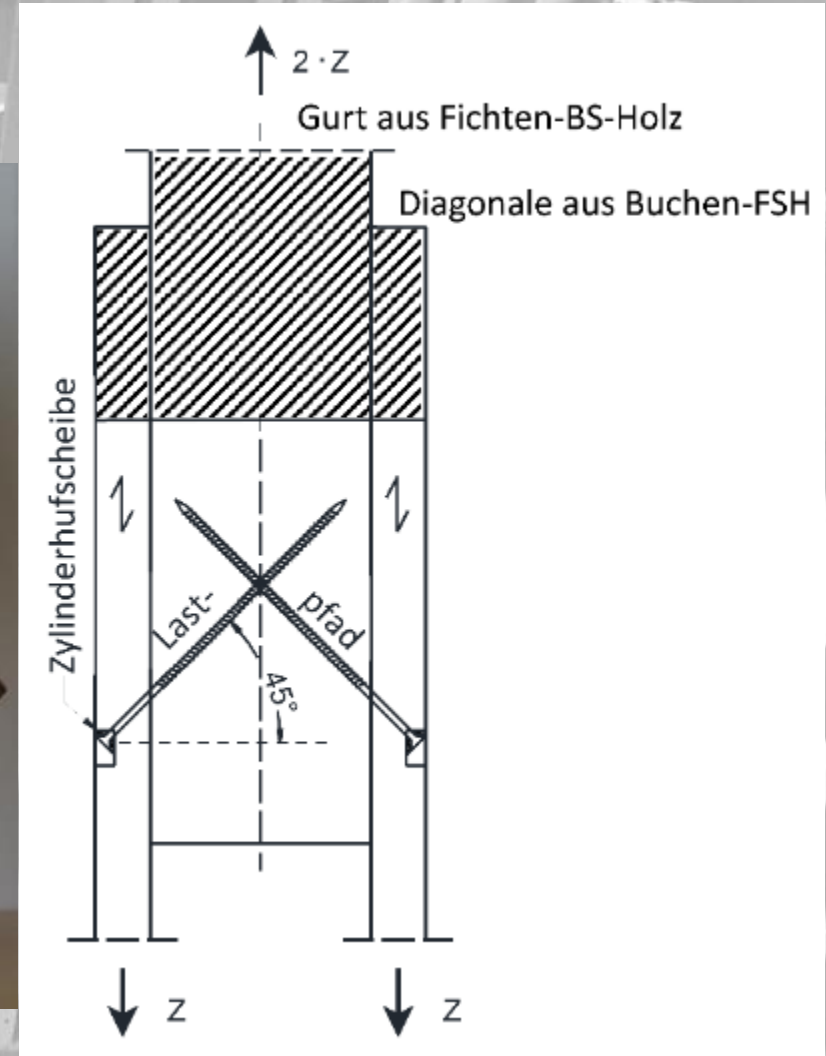
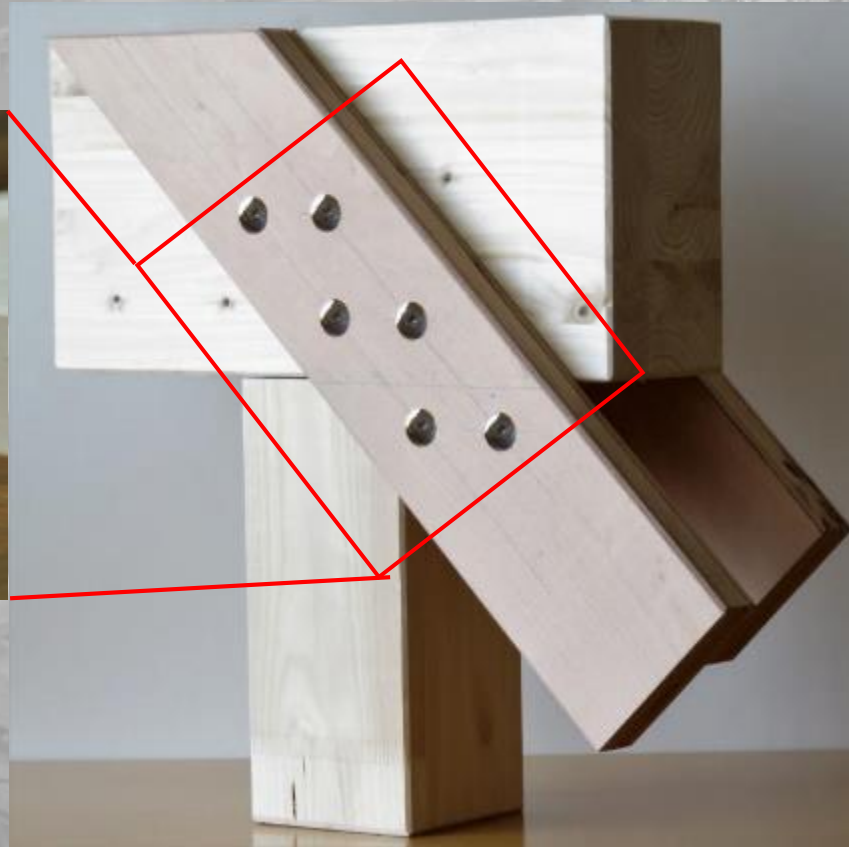
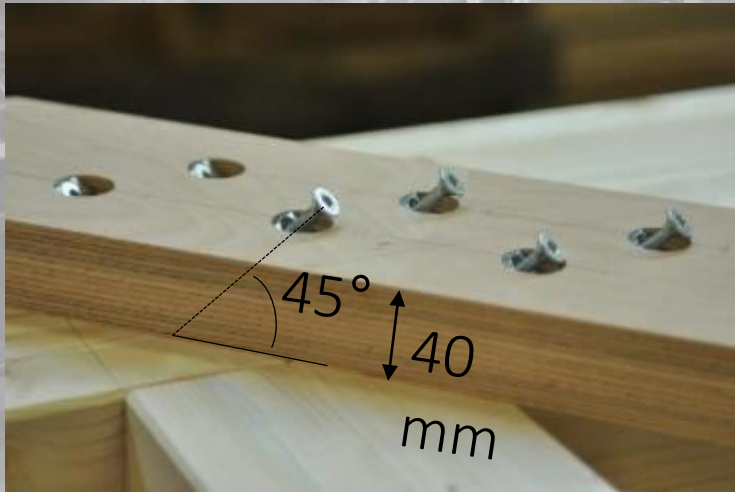
- Verformung in Krafrichtung





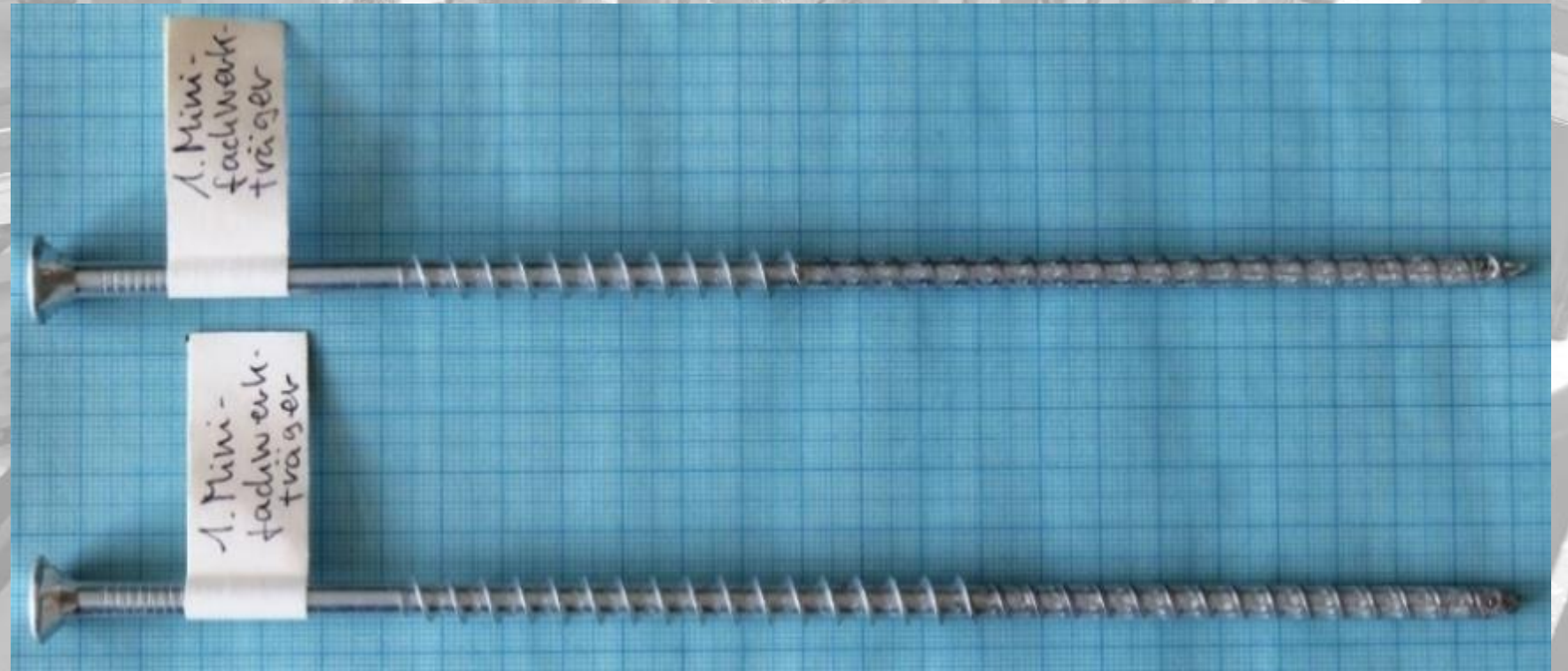
# Zuganschlüsse

- Geneigte Voll- oder Teilgewindeschrauben



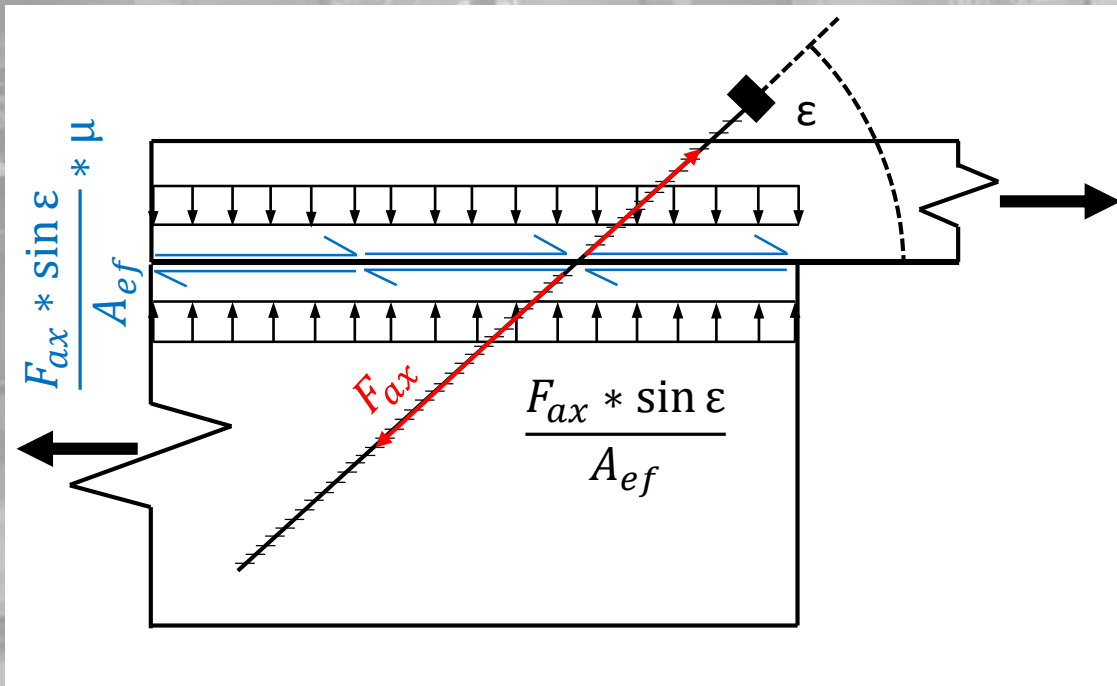
# Zuganschlüsse

- Beschädigung von Schrauben durch enge Verbindungsmittelabstände



# Zuganschlüsse

- Lastübertragung über Kontaktfläche
- Ermittlung des Reibbeiwerts  $\mu$
- Optimierung der Reibbeiwerte



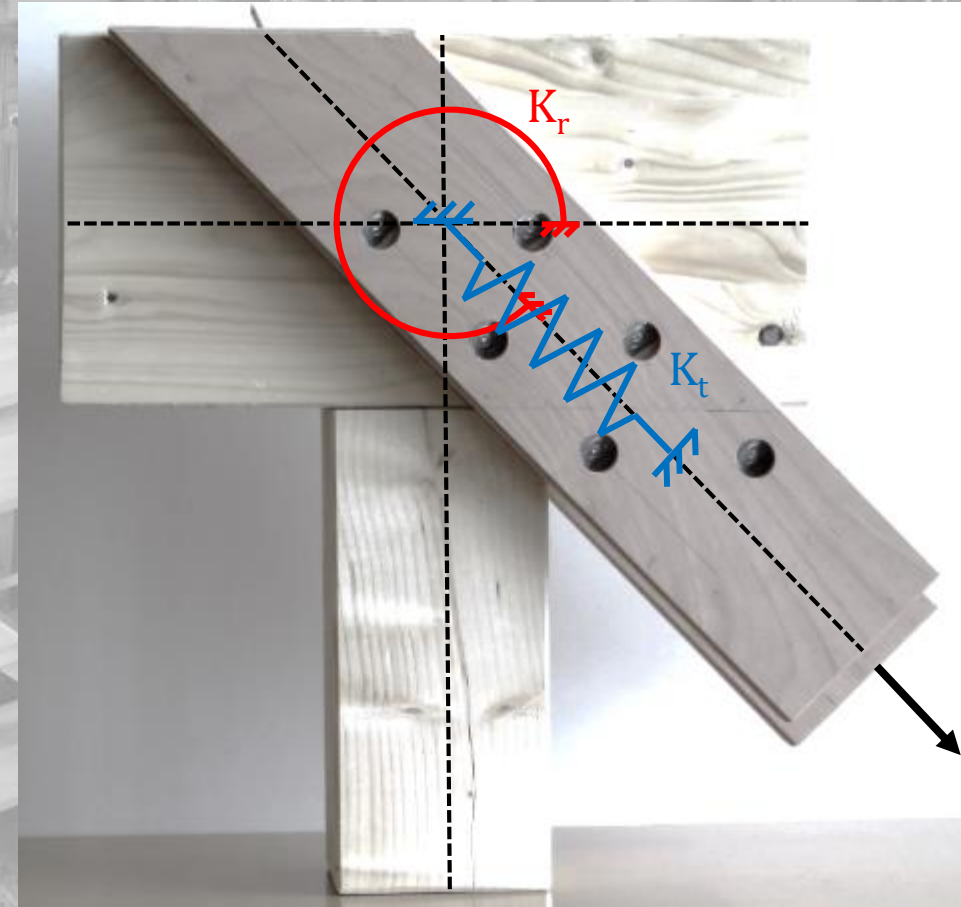
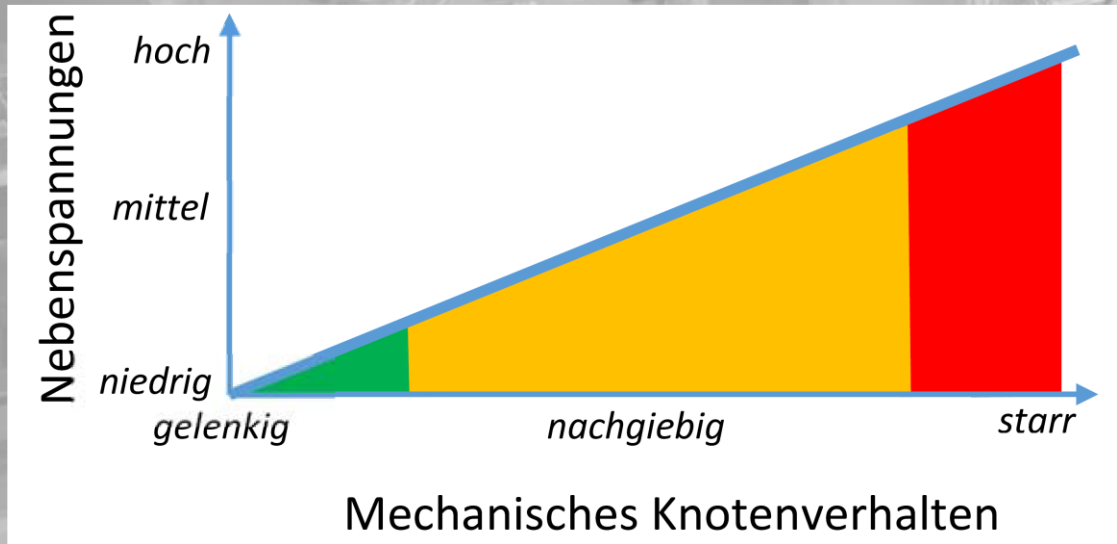
# Bearbeitung der Kontaktflächen



# Zuganschlüsse

■ Steifigkeit der Verbindungsmittel

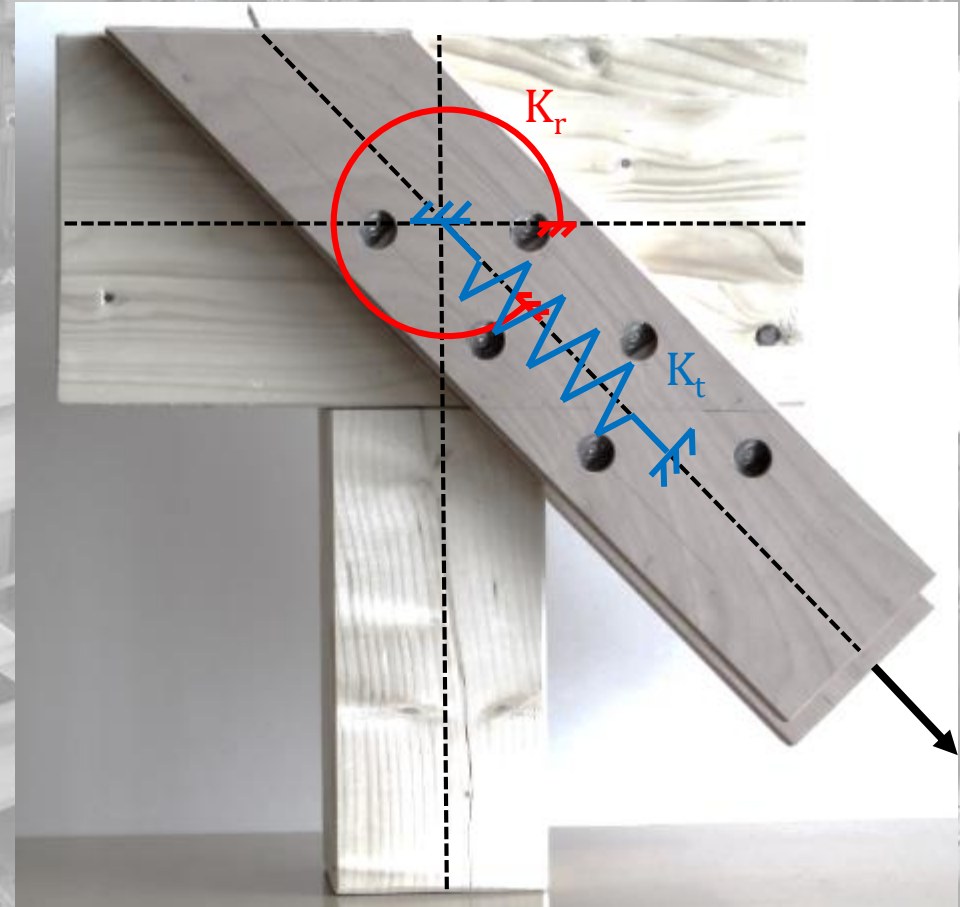
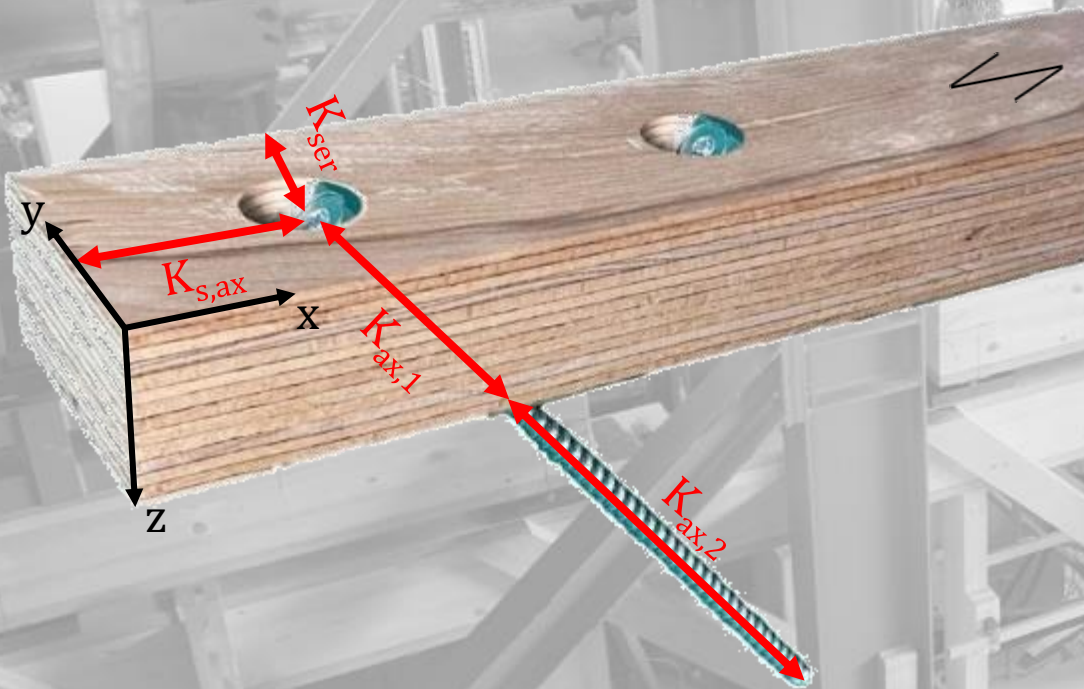
■ Anschlusssteifigkeit



# Zuganschlüsse

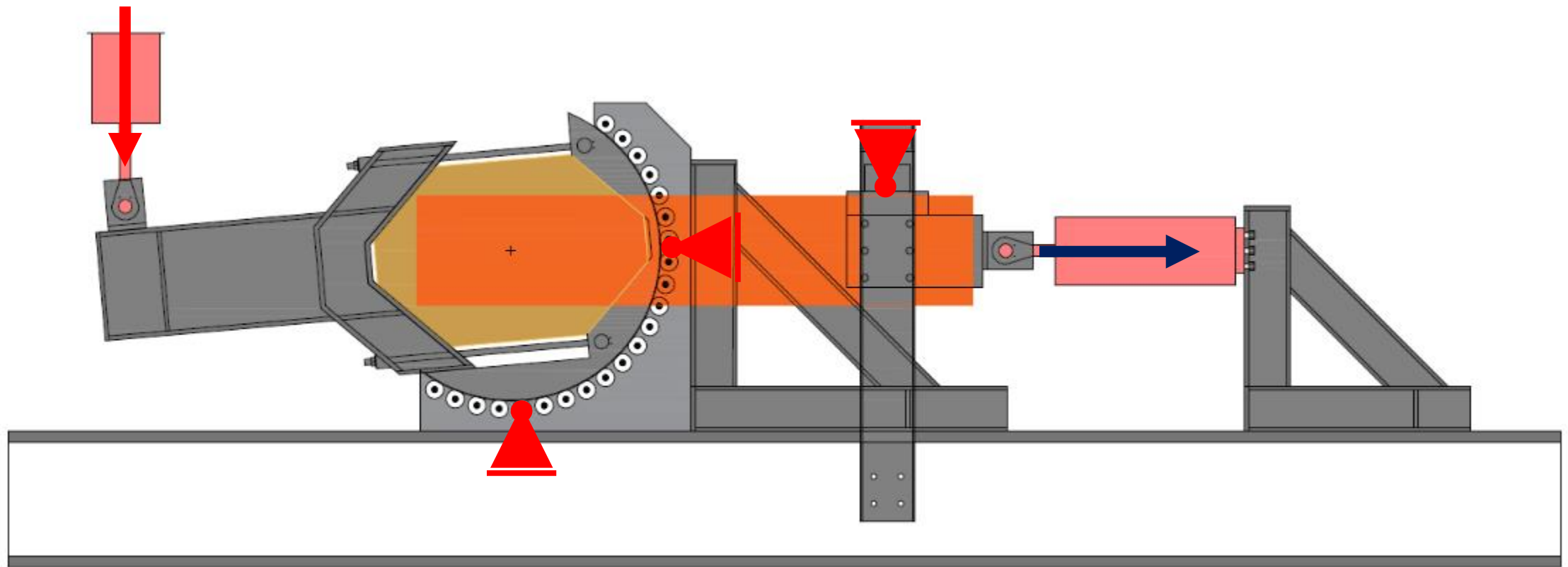
■ Steifigkeit der Verbindungsmittel

■ Anschlusssteifigkeit

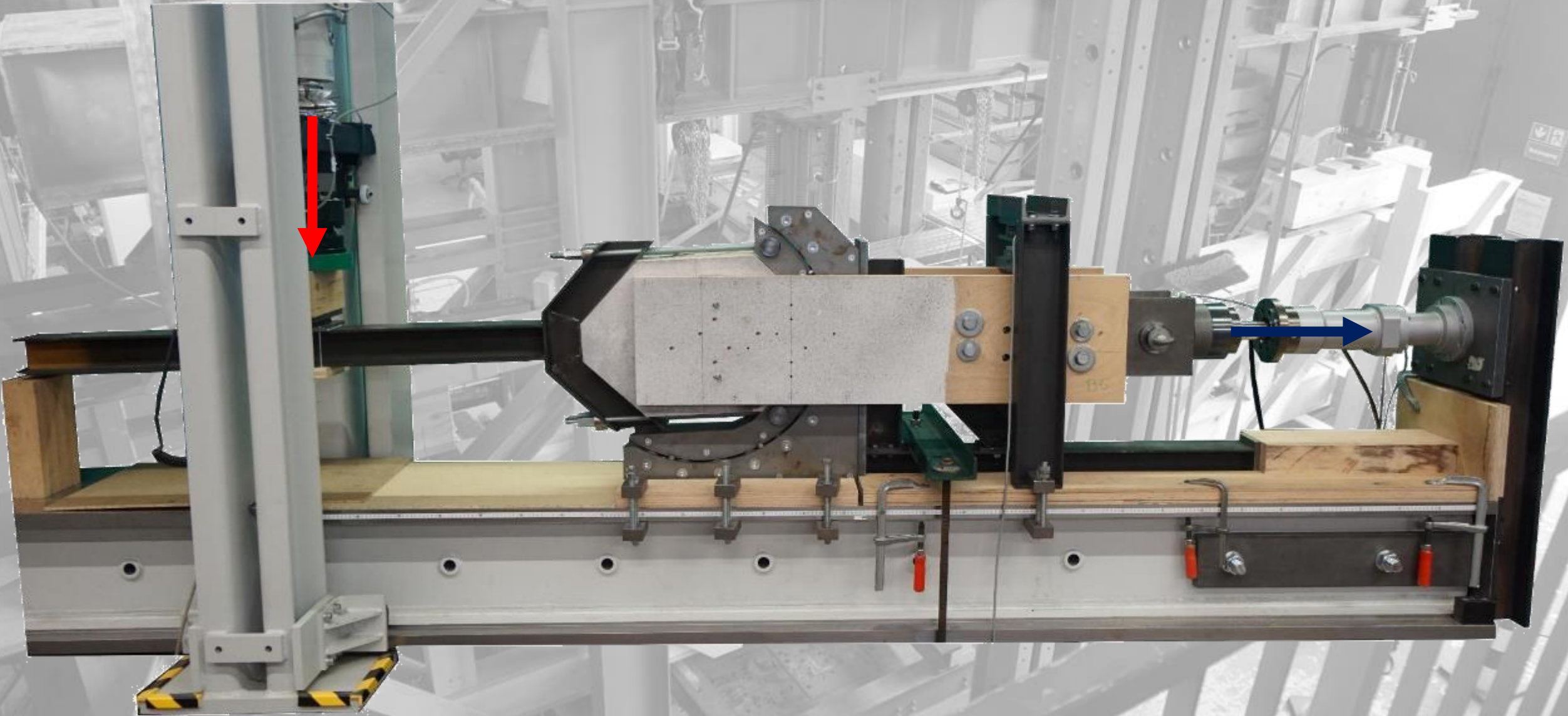


# Anschlusssteifigkeiten

- Aufbringen von Zugkräften und Biegemomenten

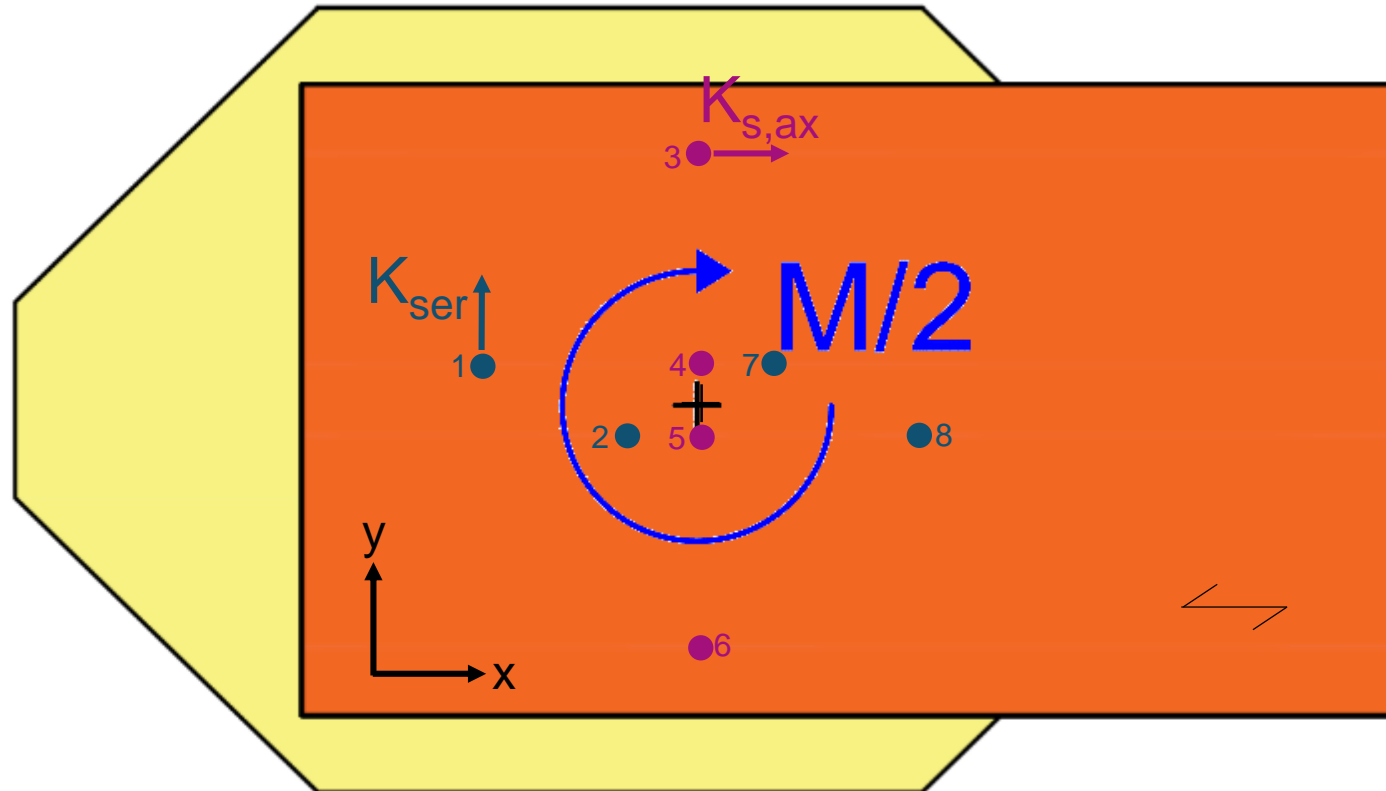


# Versuchsapparatur





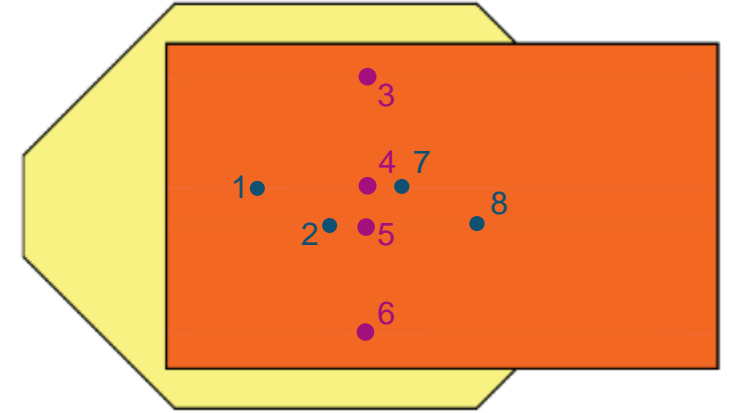
# Schraubengruppe



$$K_r = K_{ser} \cdot \sum_{i=1}^n x_i^2 + K_{s,ax} \cdot \sum_{i=1}^n y_i^2$$

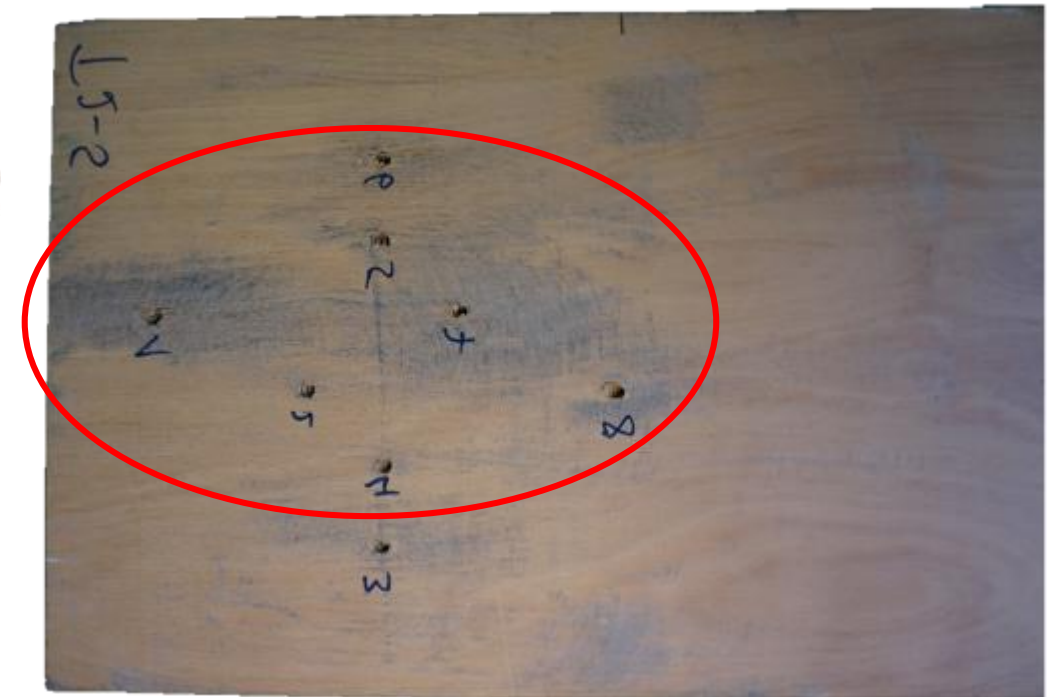
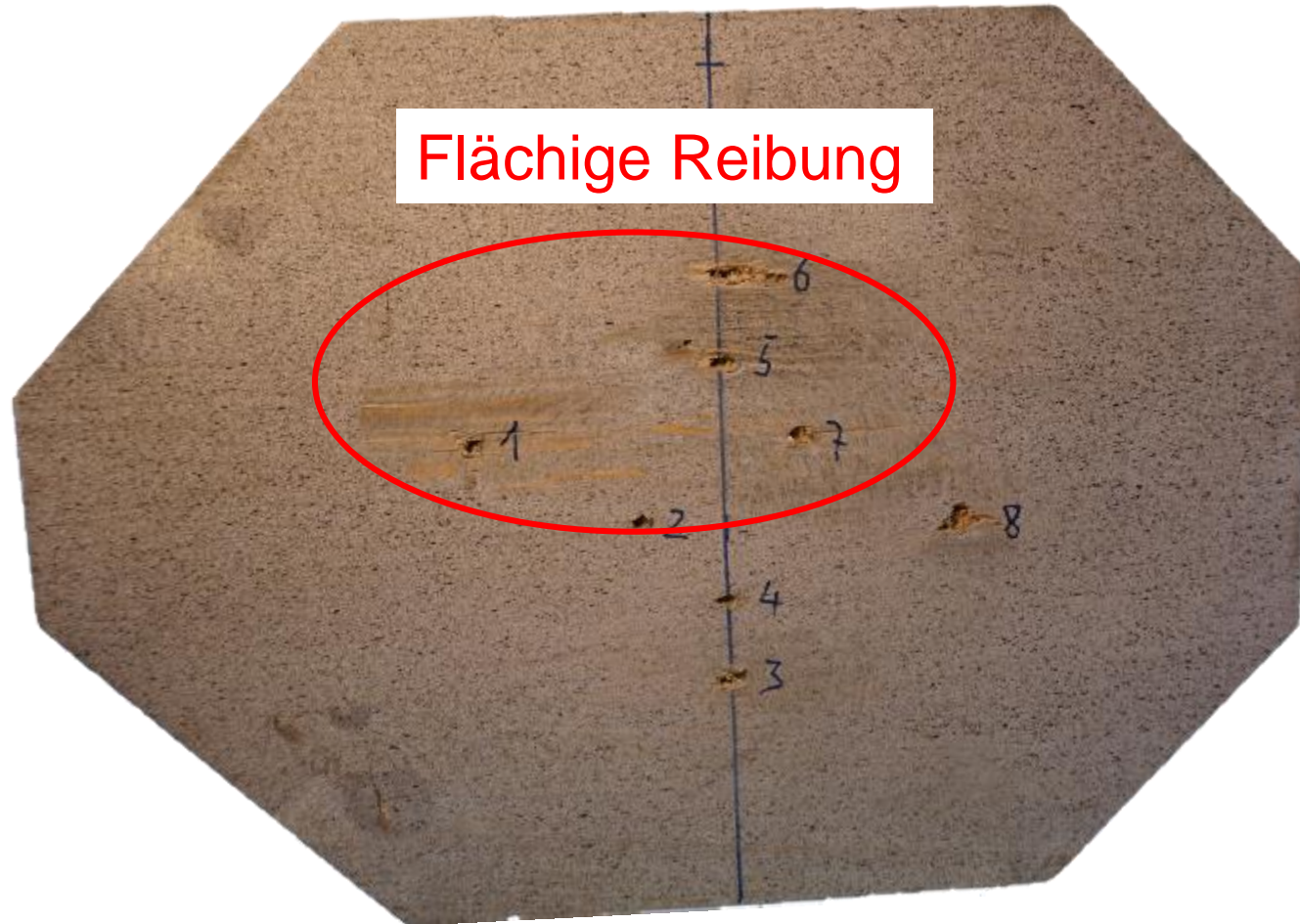
# Versuchsaufbau

- 27 Versuche in 6 Reihen



Schraubenbild	Versuchsanzahl	Schraubenanzahl	Abstandsquadrate [mm <sup>2</sup> ]	Zugkraft [kN]	Beanspruchungsart
1+8	5	4	48000	35	Lateral
2+7	5		6480		
1+2+7+8	4	8	54400	70	
3+6	4	4	48000	35	Axial
4+5	4		6480		
3+4+5+6	5	8	54400	70	

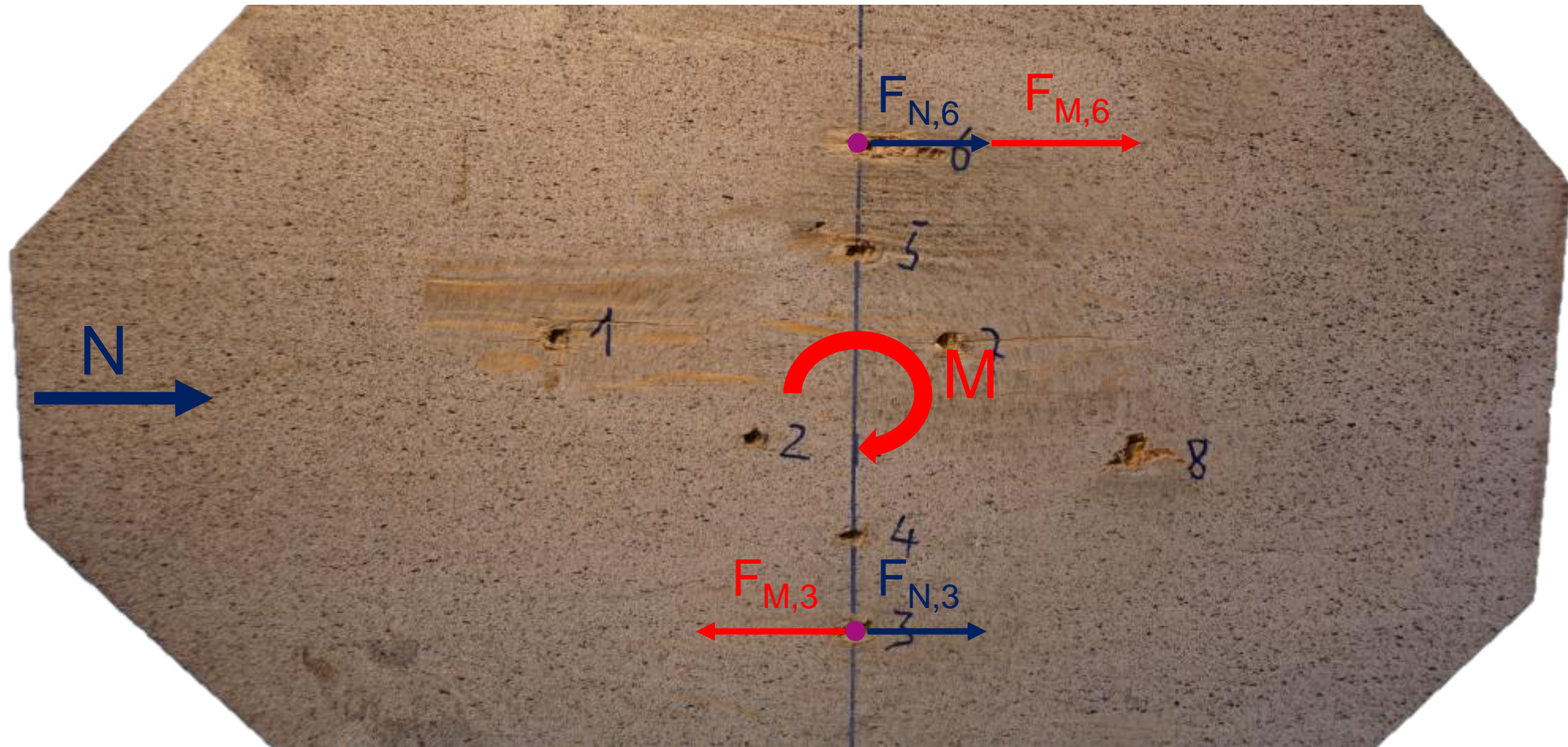
# Beobachtung



# Beobachtung

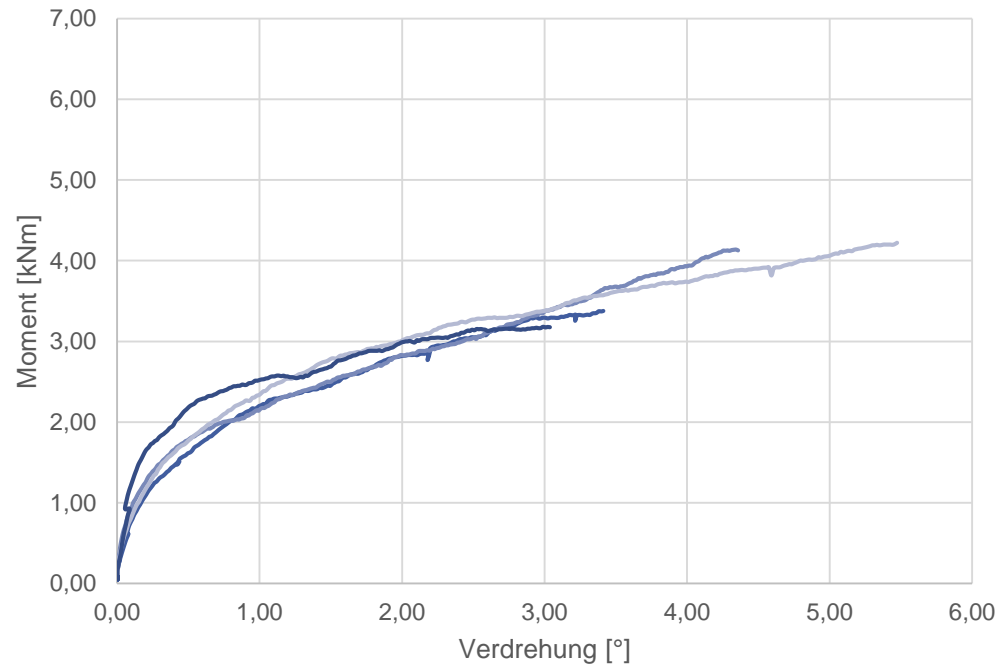


# Beobachtung

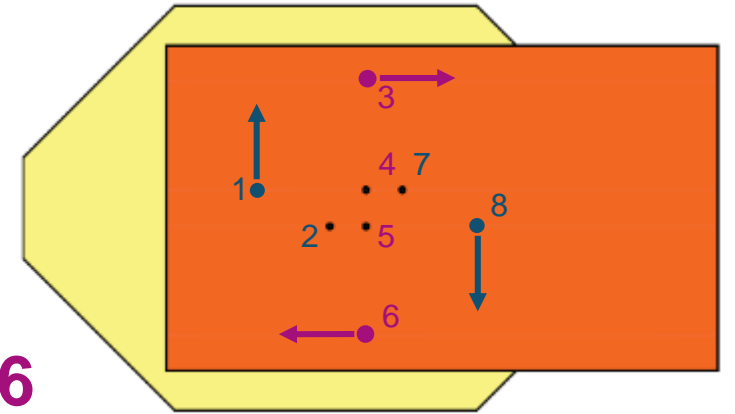
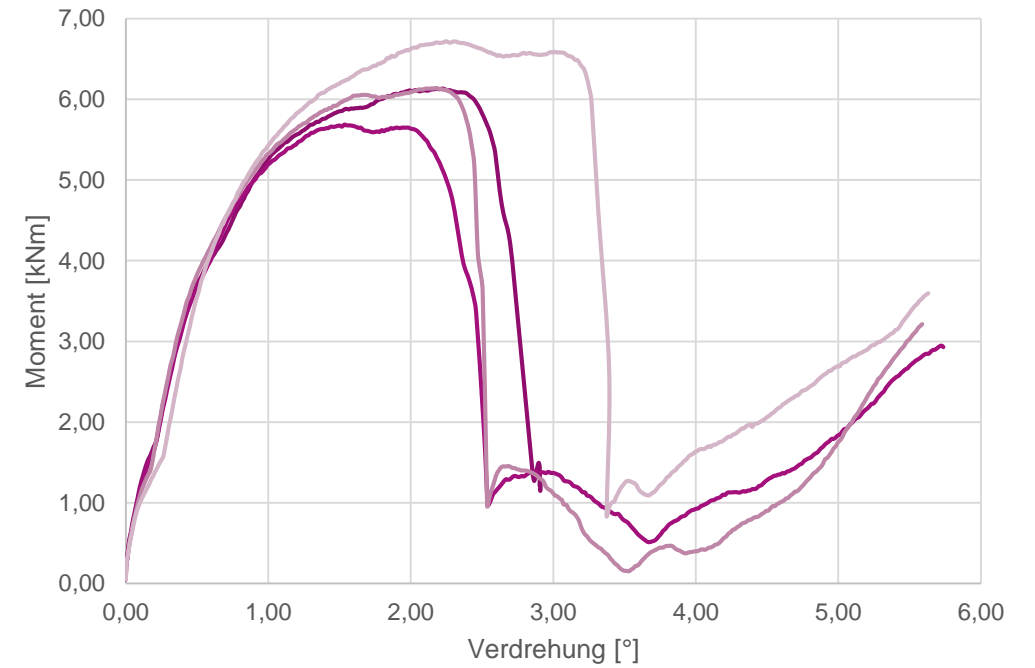


# Auswertung

## Position 1 + 8

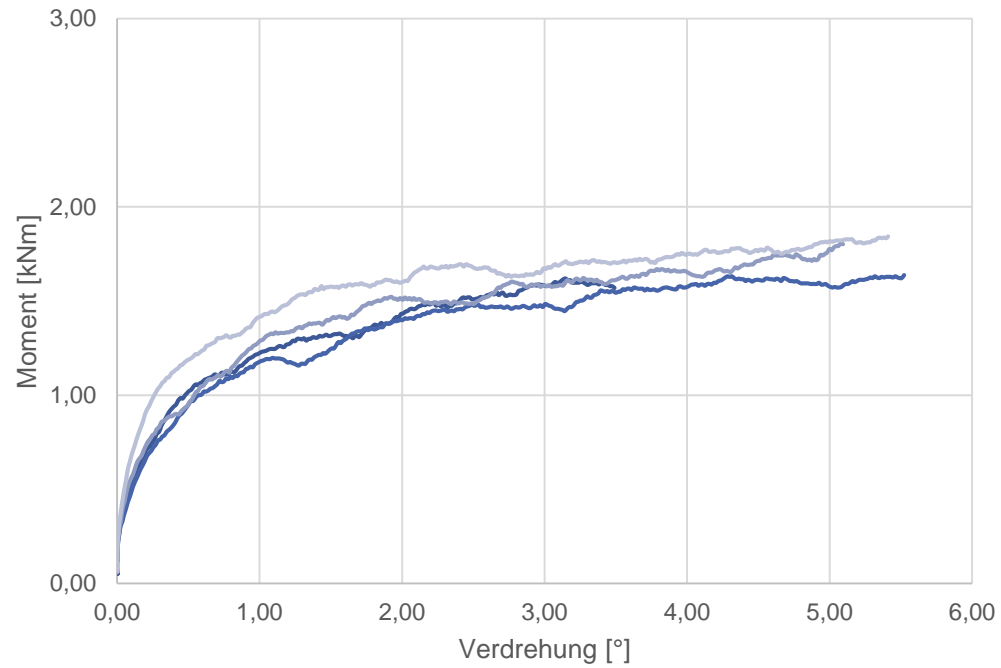


## Position 3 + 6

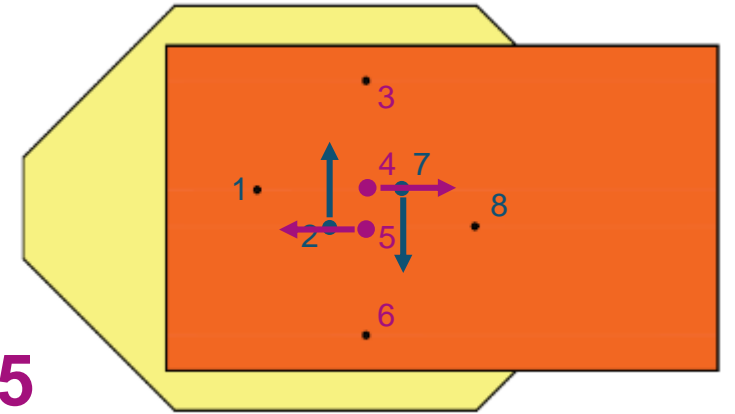
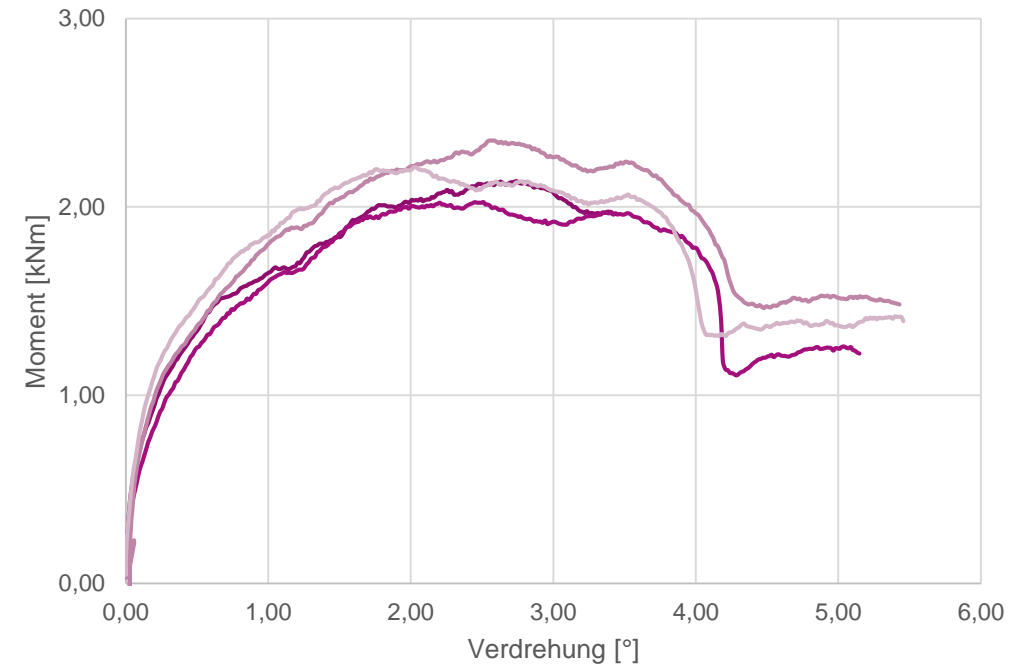


# Auswertung

## Position 2 + 7

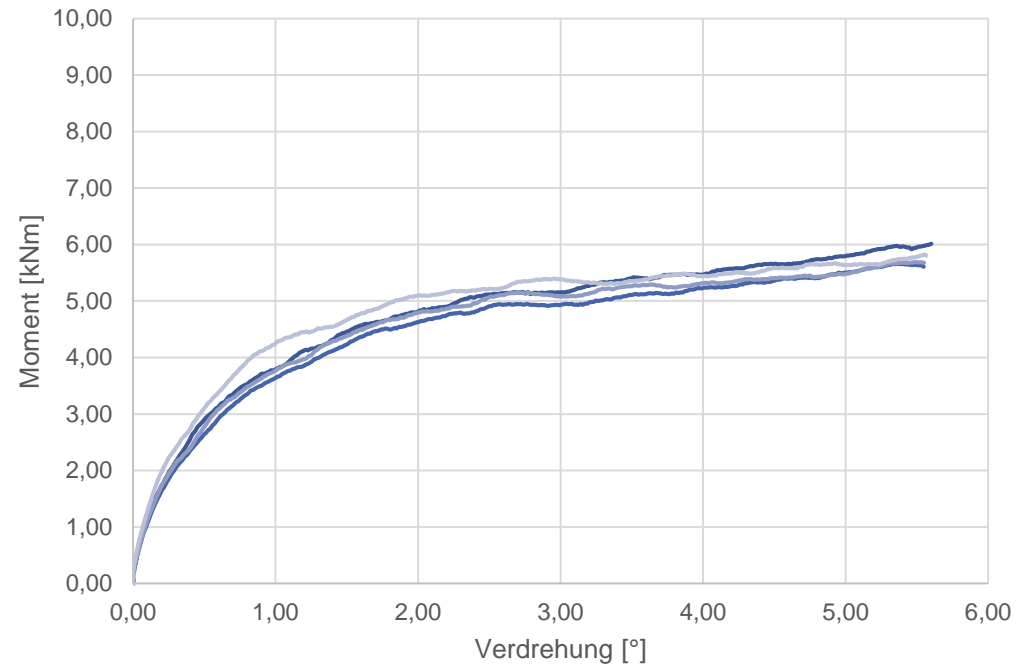


## Position 4 + 5

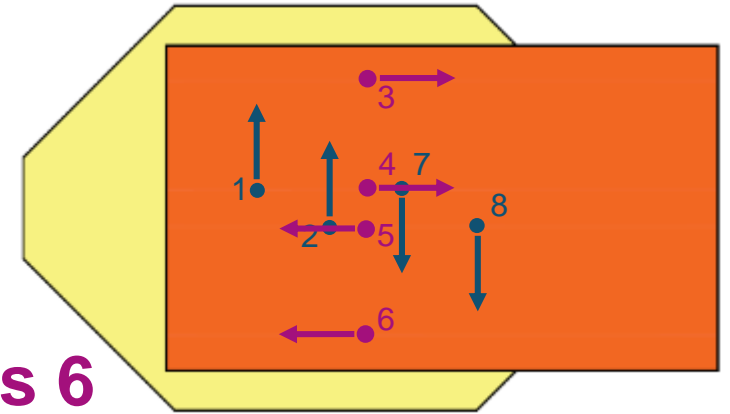
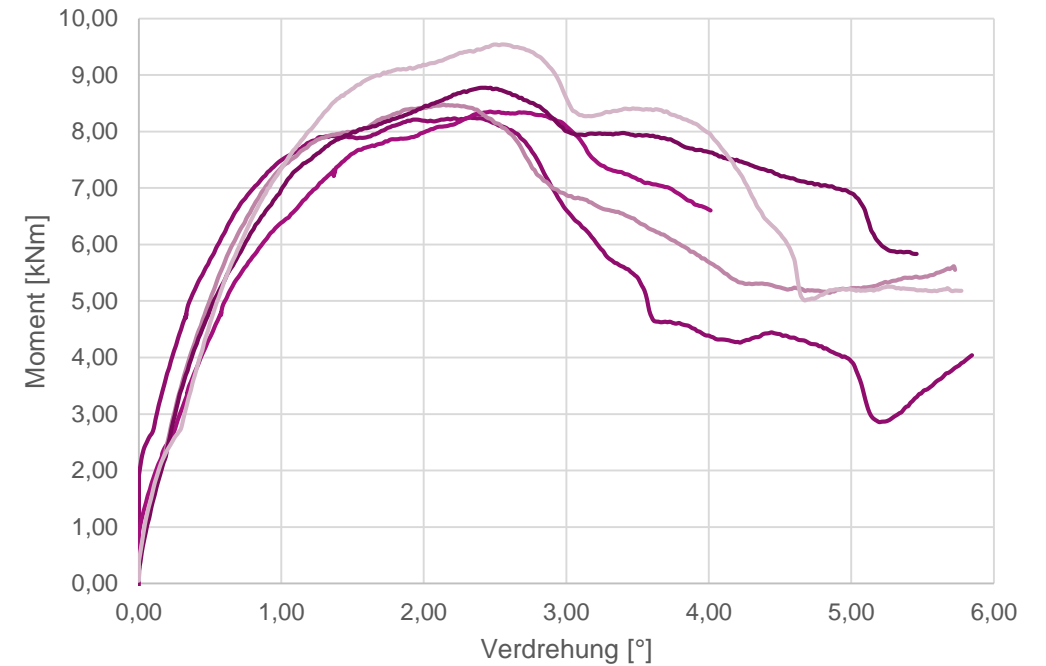


# Auswertung

## Position 1 + 2 + 7 + 8

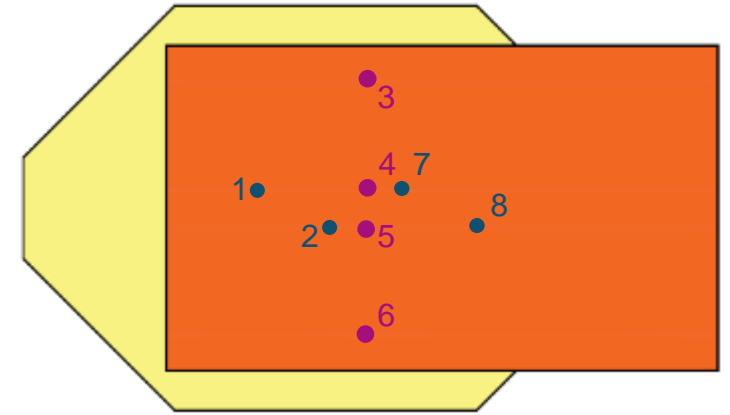
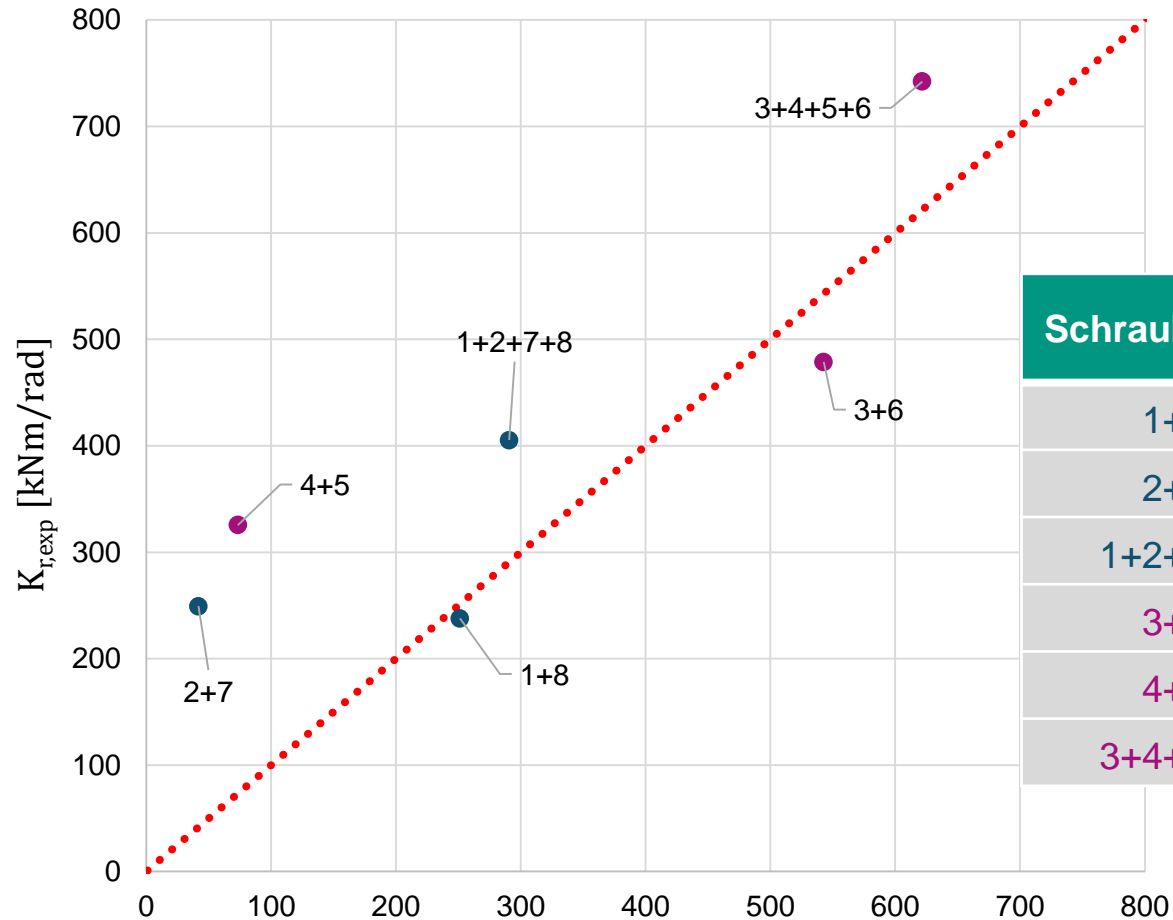


## Position 3 bis 6





# Auswertung



Schraubenbild	$K_{r,l,exp}$ [kNm/rad]	$K_r$ [kNm/rad]	$K_{r,l,exp}/K_r$	Beanspruchungsart
1+8	238	251	0,95	Lateral
2+7	249	41,9	5,96	
1+2+7+8	406	291	1,39	
3+6	479	543	0,88	Axial
4+5	326	73,4	4,43	
3+4+5+6	742	622	1,19	

$$K_r \text{ [kNm/rad]} = K_{ser} \cdot \sum_{i=1}^n x_i^2 + K_{s,ax} \cdot \sum_{i=1}^n y_i^2$$

FaNaBu

# Fachwerkträger aus Nadel- und Buchenholz

