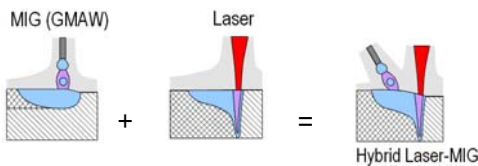


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Hybright




- Introduktion
- Aktivitet partner
- Fallstudier
- Fördjupad genomgång - forskningsspår
- Utbildningsmaterial - seminarium



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Industri partner




BoRö Pannan	Behållare för solarenergi
ESAB	Hybridsvetsutrustning, tråd
GESTAMP	Fordonskomponenter säkerhet
LaserCentrum i Gnosjö:	Lego lasersvetsning
Lasergruppen	Svensk nätverk laserbearbetning
Lasertech LSH	Lego lasersvetsning
Nordic Laser	Lego lasersvetsning
Permanova	Laser(svets)utrustning, - anläggning
Permascand	Elektroder, membranceller, Ti
Volvo CE	Tjocka fordonskonstruktioner

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Luleå tekniska universitet, avd. produktionsutv.

- laserbearbetning, bl.a. hybridsvetsning

Luleå tekniska universitet, avd. hållfasthetslära

- mekanisk och metallurgisk brottbeteende (FEM)

KTH, avd. lättkonstruktioner

- konstruktion, mekaniska egenskaper (FEM)

KIMAB, korrosions- och metallforskningsinstitut

- fogning (bl.a. hybridsvetsning), mekanisk provning

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Bättre förståelse av brottmekanik



Bättre identifikation av huvudorsaken/svetsfel



Katalog med undersökta cases



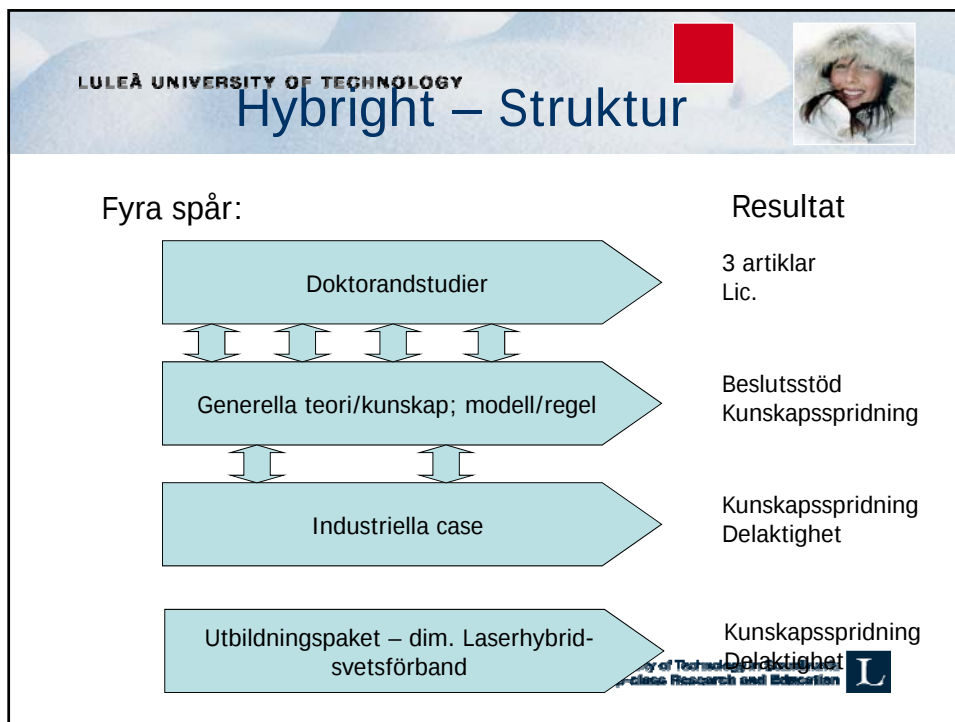
Generella teori/kunskap; modell/regel



Trygghet liknande standard (på sikt)

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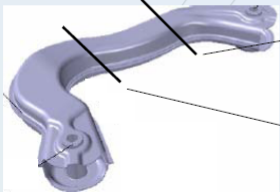
Företag	Fogtyp	Material	Intresse	Status	Resultat
PermaNova	Kälfog (5 mm)	Rostfritt	Process / Statisk last	Provserie+FE genomförd och utvärderad	2 vetenskapliga artiklar?
Gestamp I	Kälfog! (1.5 mm)	Borstål (bel/obel)	Process / Statisk last	Provserie+FE genomförd och utvärderad	Brott i grundmaterial - modellförståelse
Gestamp II	Kälfog! (2 mm)	Borstål (bel/obel)	Process / Utmattnings torsion	Utmattningsprov på gång + FE på gång	
LaserTech	T-fog / överlapp	Aluminium	Process / skjuvning	Provserie svetsad – utvärdering vad gäller geometri	
LaserCentrum	Kälfog /	Stål	Process / Statisk	Provserie svetsad – utvärdering vad gäller geometri och FE	
PermaScand	Stumfog / 5 mm	Titan	Process / Statisk	Provserie svetsad – utvärdering vad gäller geometri	
Volvo CE	Kälfog / 6-8 mm	HSS	Utmattnings	Första struktur provad – avbröts efter ?? cykler	Utbildningsmaterial mm
ESAB					Processstöd
Nordic Laser					Processstöd
Lasergruppen					Stöd utbildningsmaterial mm

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Introduction

Beam member exposed to torsional loading



Part of a side arm to be analysed regarding torsional fatigue and static stiffness

Simplified beam section

Welding along the flanges

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LaserTech



EN/AW 6196
5mm

2.5 mm Plåt
5754

Lasersvets

100 mm

100 mm

10 mm

100 mm

190 mm

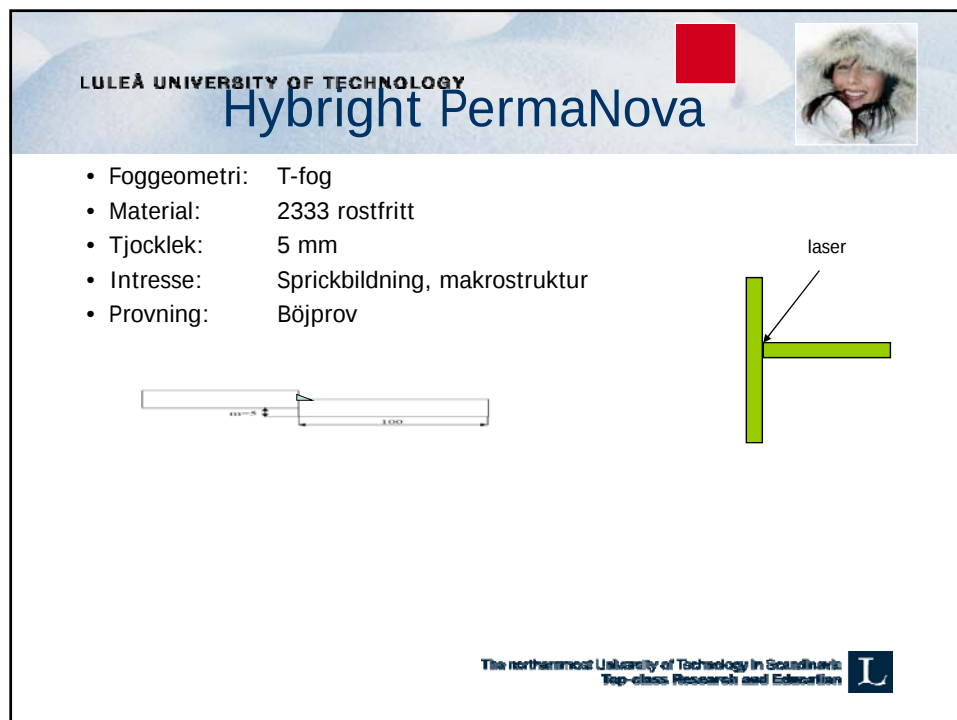
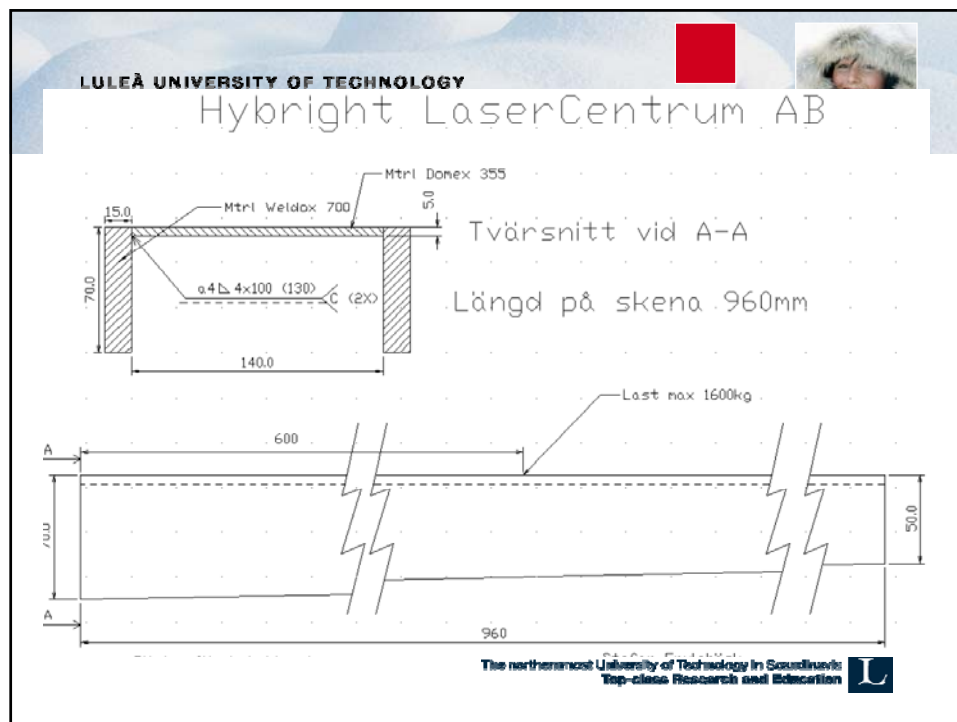
200 mm

Porositet, Medskruv svets, Sprickor.

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Hybrid welding: experimental setup

Eccentric fillet joint

Hybrid welding

4-point bending load

Complex geometrical conditions

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Resulting weld

Ripples

Toes

Lack of fusion

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Research Goal

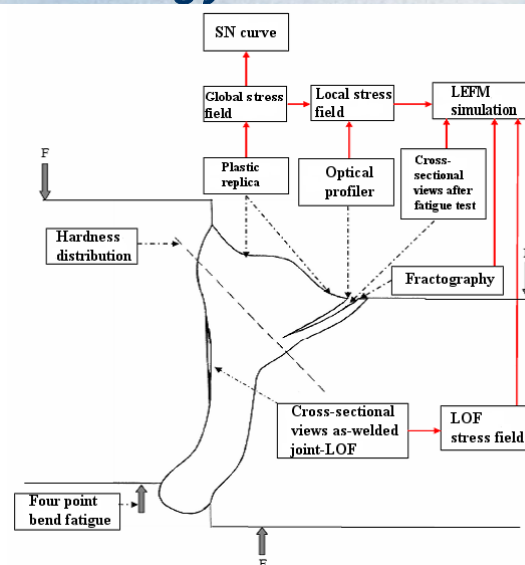
Impact on fatigue by :

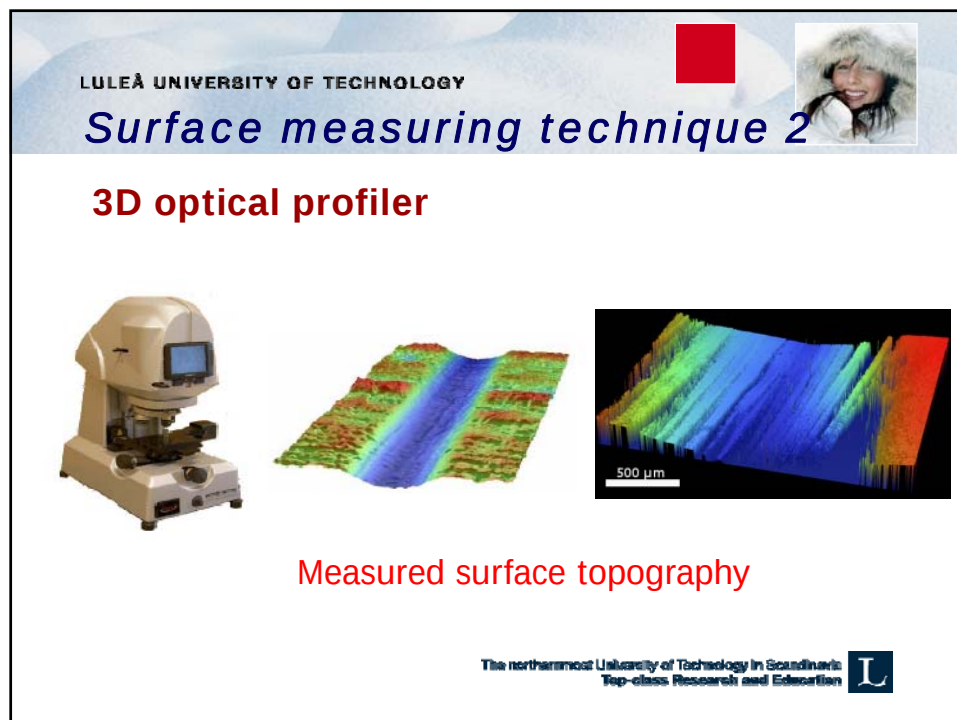
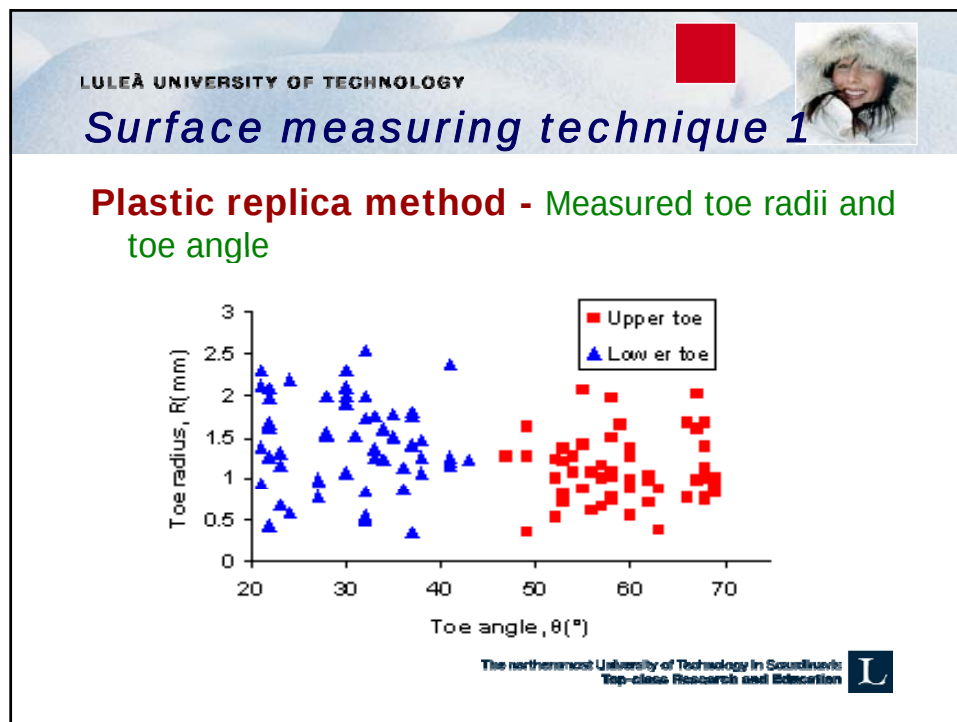
- ❑ Weld surface macro-geometry.
- ❑ Weld surface topography.
- ❑ Lack of fusion.

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Methodology



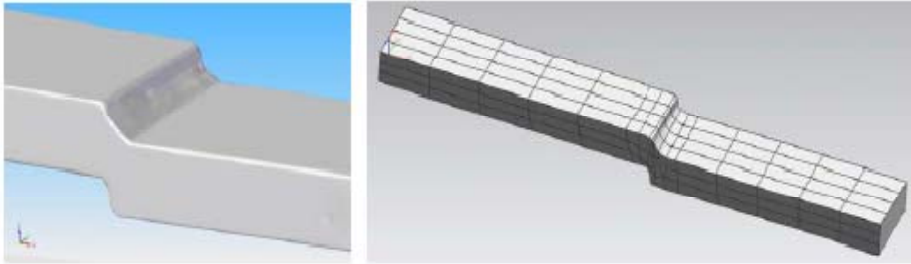


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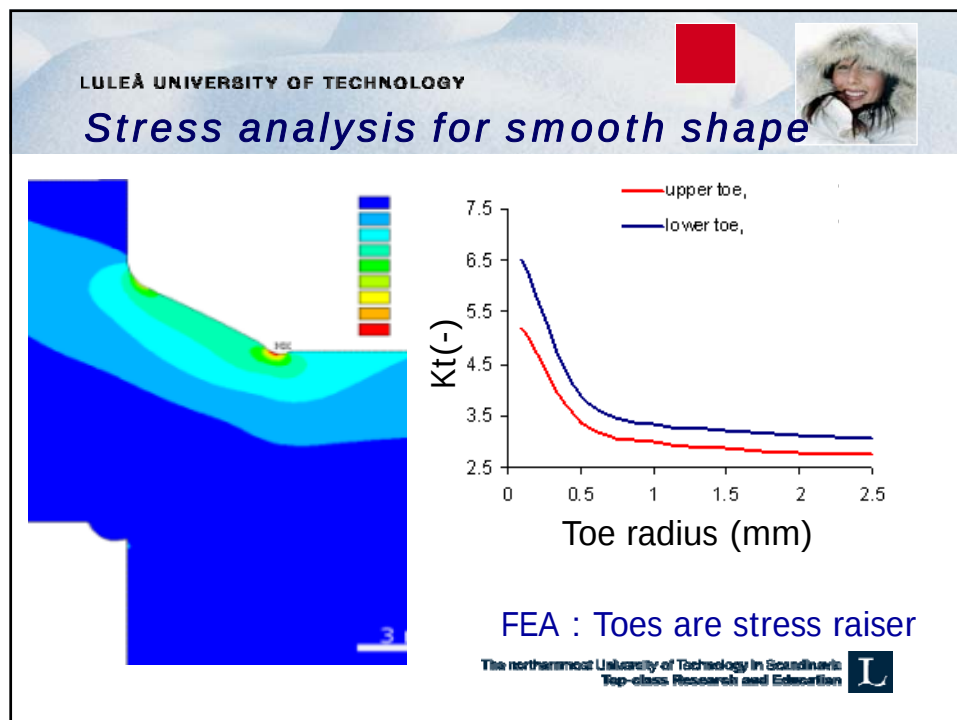
Surface measuring technique 3

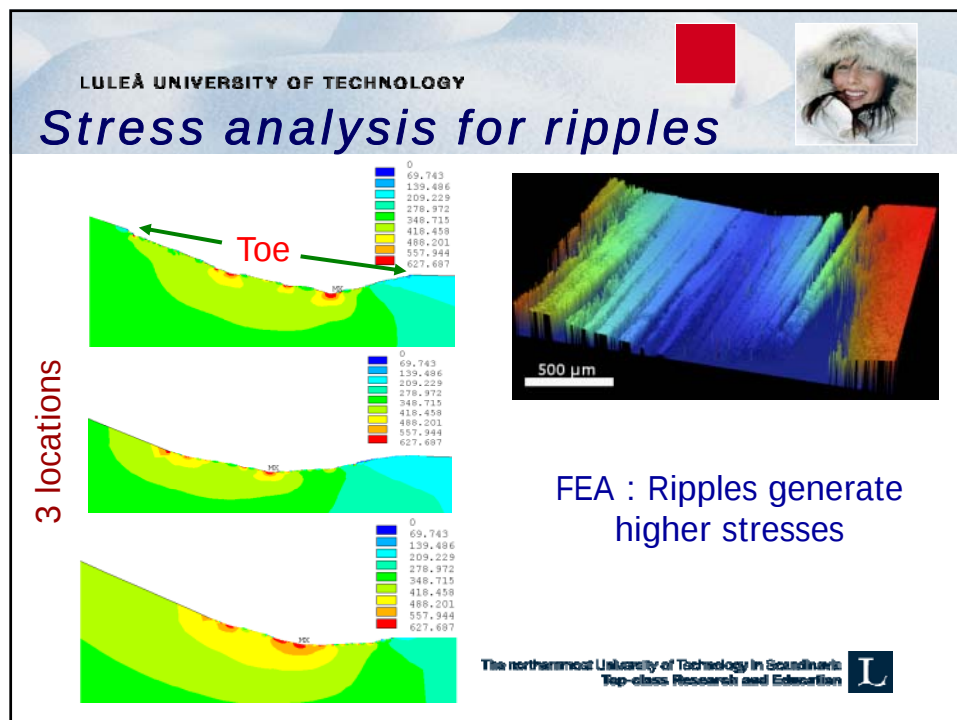
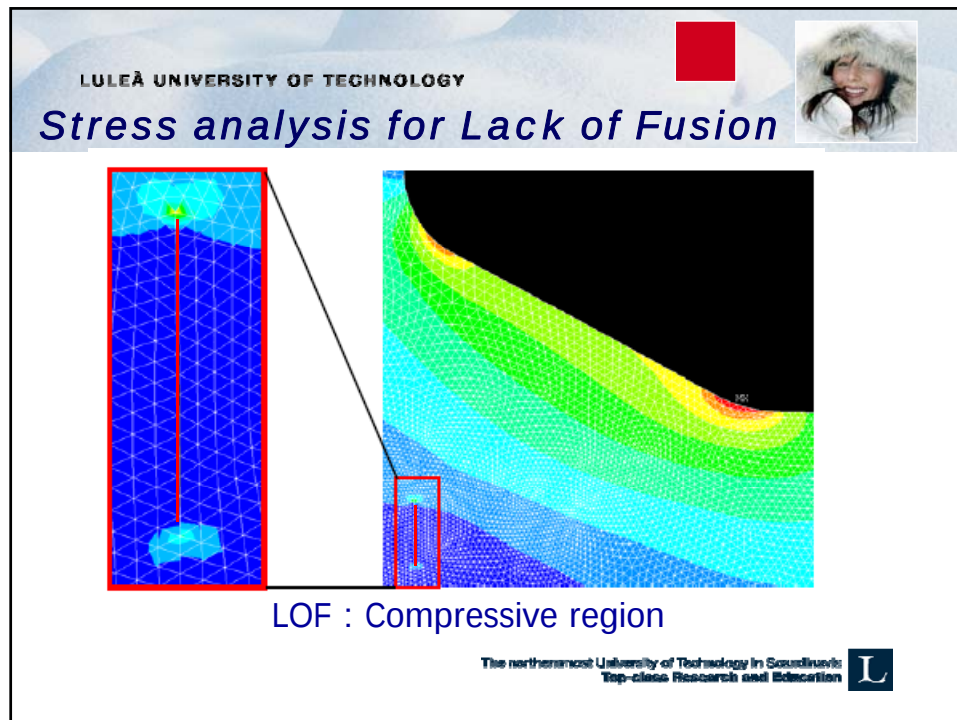
3D digitizer

- ❑ Scanned with two cameras.
- ❑ Polygon mesh of the object's surface.



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Fatigue testing

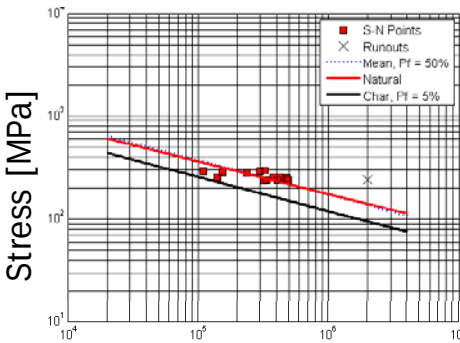


Four-point bending

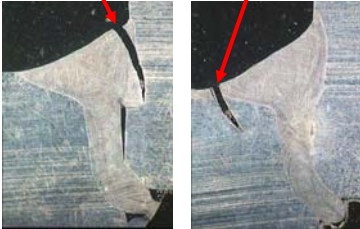
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SN-Fatigue curve, cracks

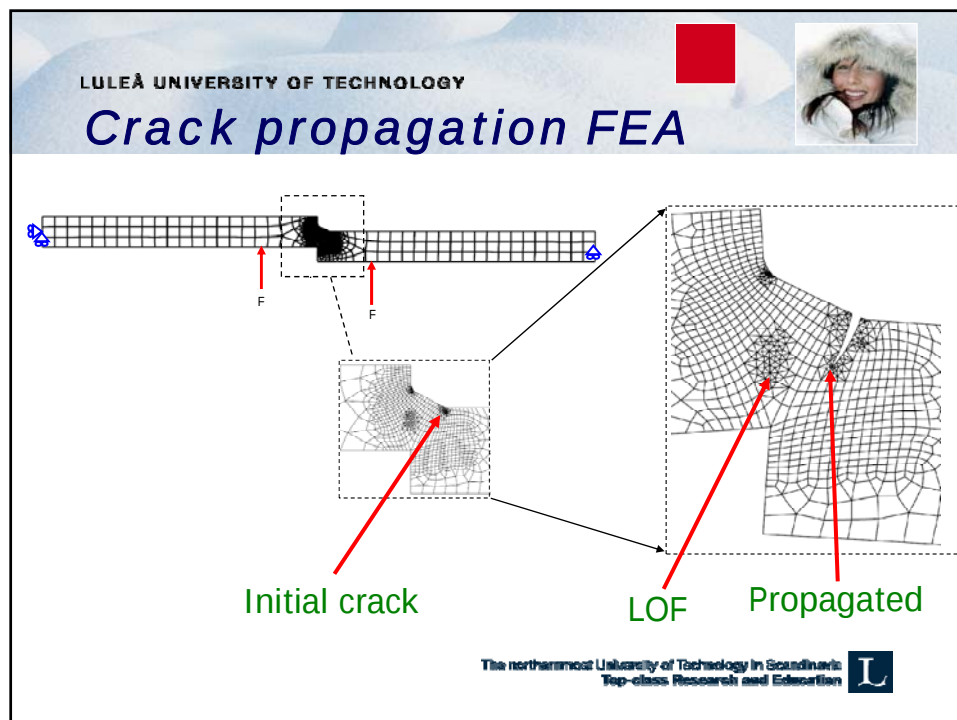
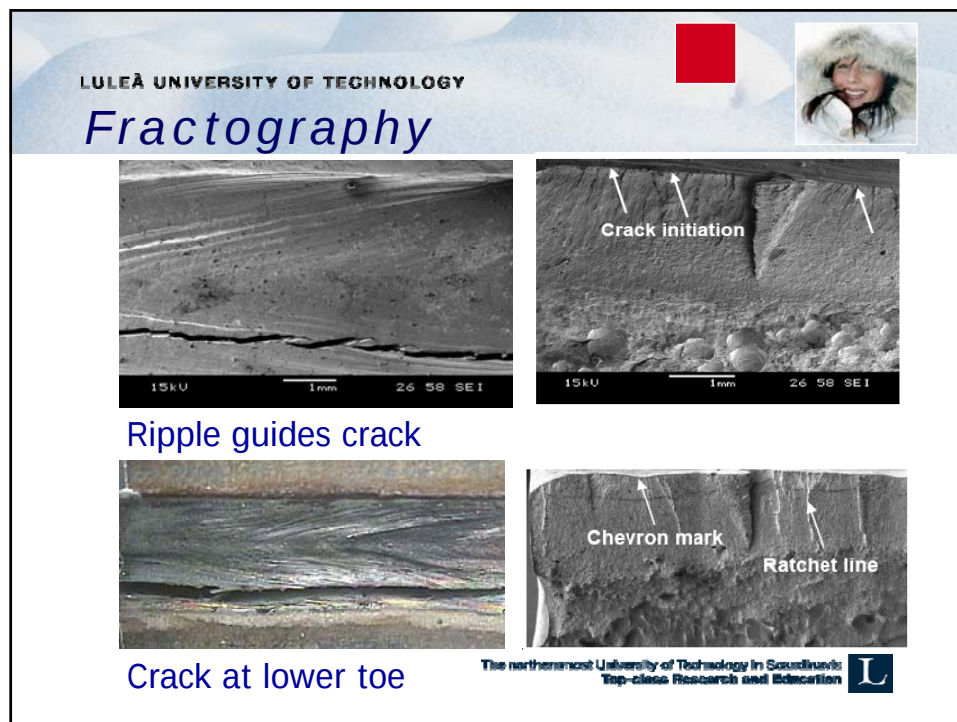


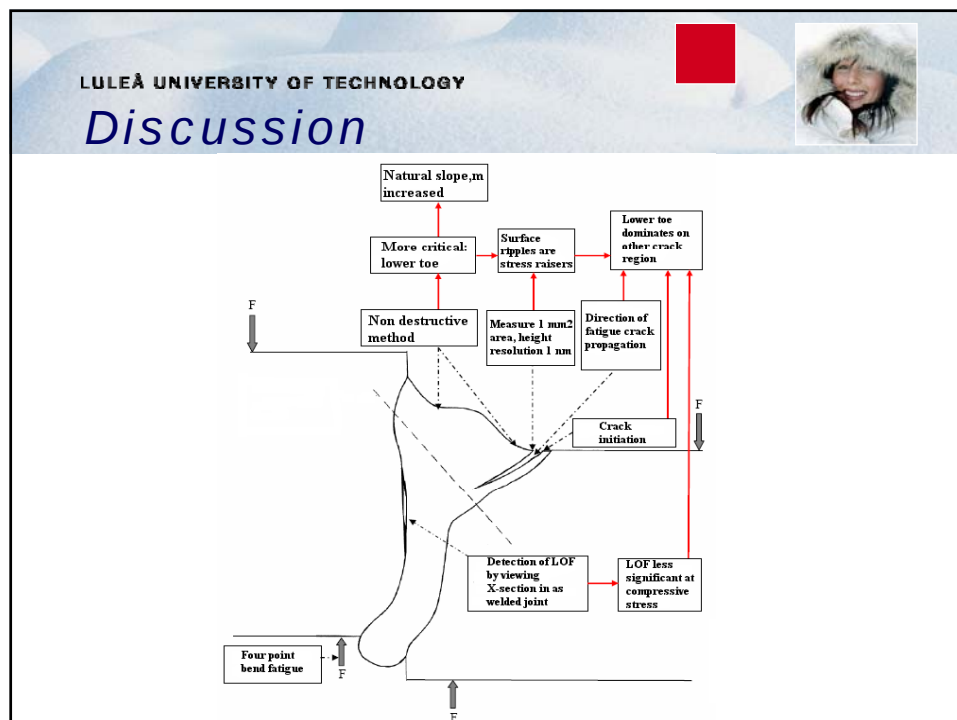
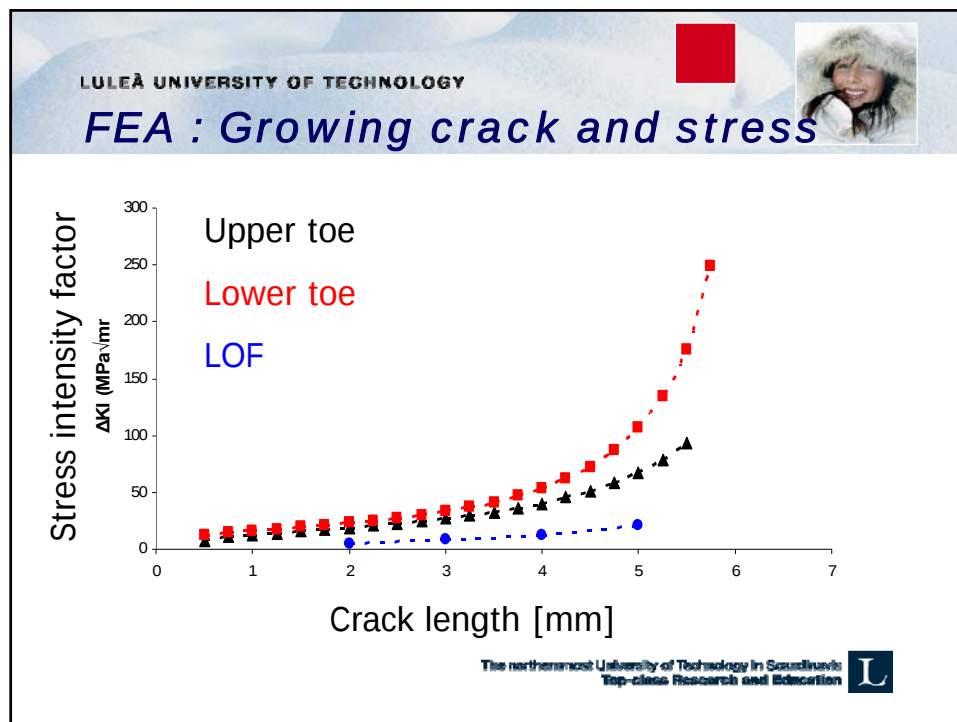
Cracks inside welded area at toes



IIW standard slope: $m=3.0$
Here: $m=3.16$

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Conclusion

- ❑ Weld ripples dominate over toe radius on fatigue performance.
- ❑ Toe radius and topography vary along the weld.
- ❑ Lower toe radii more critical than upper toe.
- ❑ Cracking follows the weld surface ripples.
- ❑ LOF is less significant at compressive stress situation.
- ❑ Cracks started in the weld, not in the HAZ, nor at the fusion interface.

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Utbildningsmaterial (web-baserat)

- Projekt Hybright Inledning, Bakgrund, Mål
- Dimensionering av svetsade konstruktioner
- Volvo standard
- Forskningsresultat
- Fallstudier inom projektet Hybright
- Generella lärdomar
 - Koppling av resultat från fallstudier, forskning, standard och annan erfarenhet

Kostnadsfritt seminarie baserat på ovanstående den 30/10 kl 10 -15 , Esab Göteborg

Anmälan till Torbjörn Ilar, ilar@ltu.se, 070-3268444

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