

Speckle tracking ny og bedre vevsdopplermeteode?

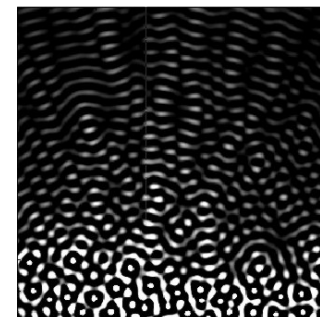
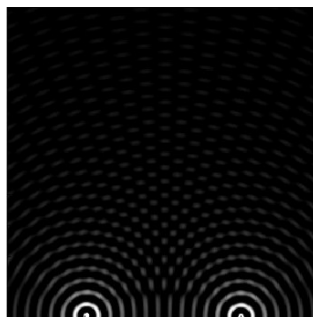
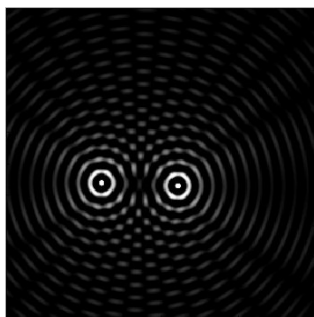
Asbjørn Støylen, dr. Med.
ISB,
DMF,
NTNU

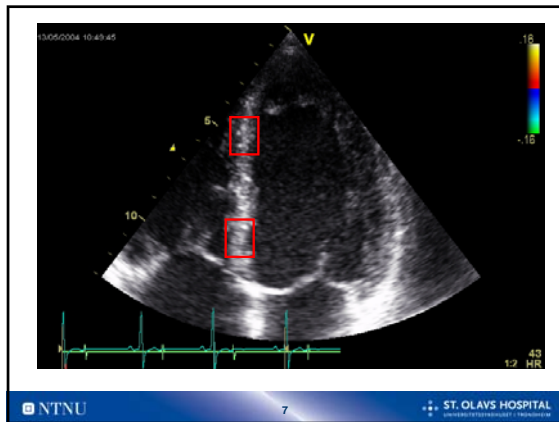
www.ntnu.no/~stoylen/lectures
www.ntnu.no/~stoylen/strainrate

Dopplereffekten: $f_D \approx 2 f_0 (v/c) \cos(\alpha)$

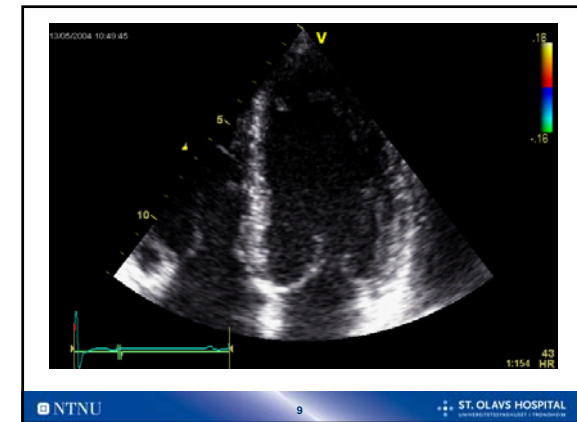
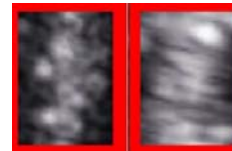


Hva er speckle tracking?

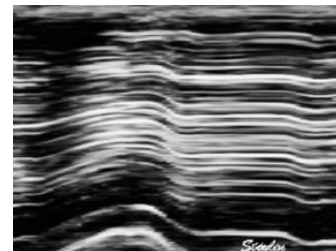




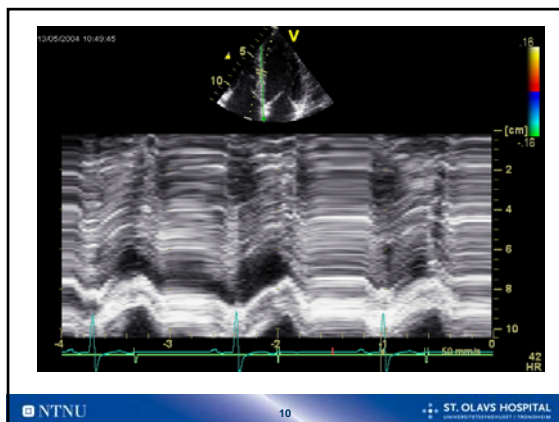
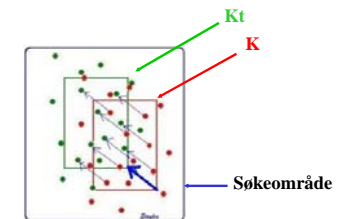
1: Irregulariteten gir hvert område et unikt specklemøster

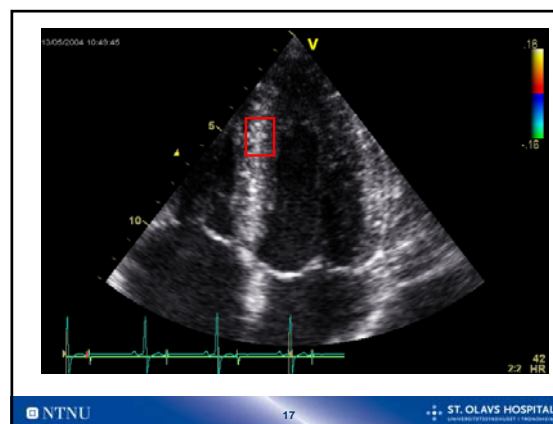
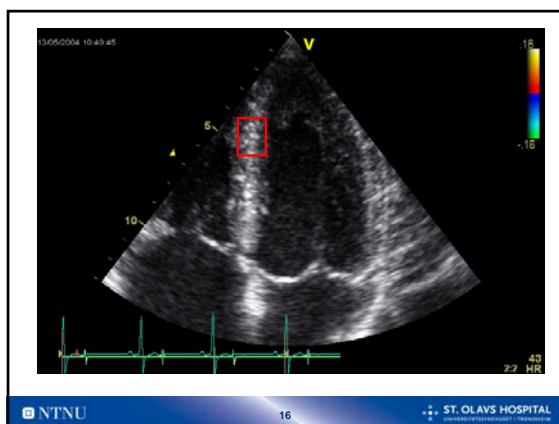
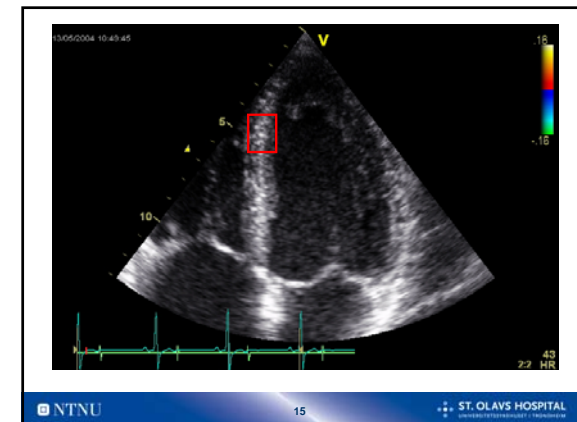
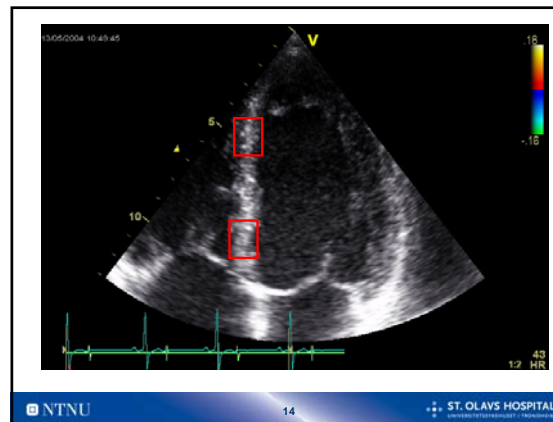
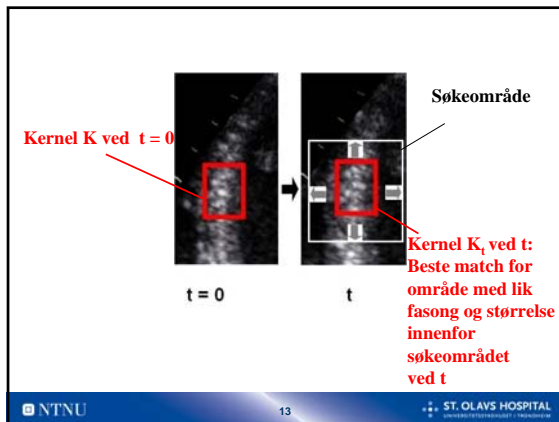


2: Speckle mønsteret er rimelig konstant og følger myokards bevegelse.



Speckle tracking:





Sum of absolute differences

$$SAD = \sum (K - K_t)$$

$$SAD = \sum (|K(x,y) - K_t(x-t,y-u)|)$$

$$R = \sum (|K(x,y) \times K_t(x-t,y-u)|)$$

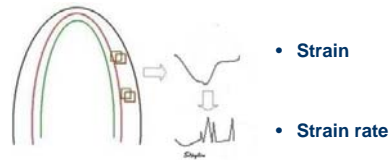
Bohs & Trahey 1991

NTNU 18 ST. OLAVS HOSPITAL

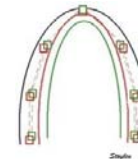
Kan brukes til å beregne bevegelse



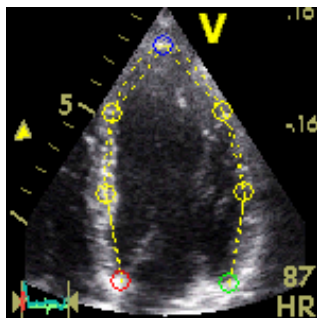
Og med flere områder:



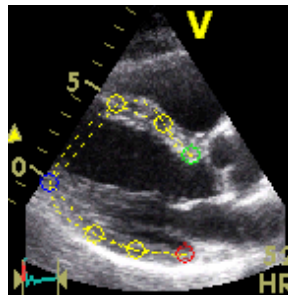
F. eks i alle segmenter:



Resultat:

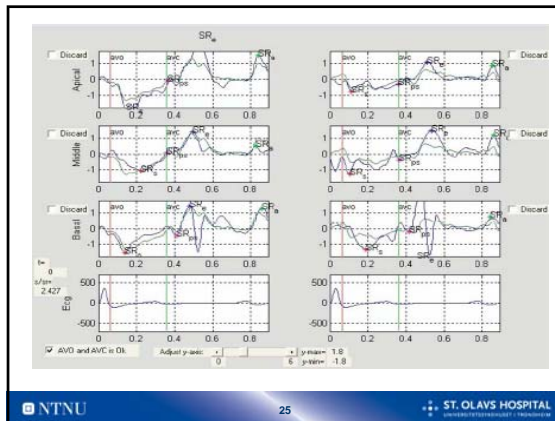


Tracker i alle retninger:



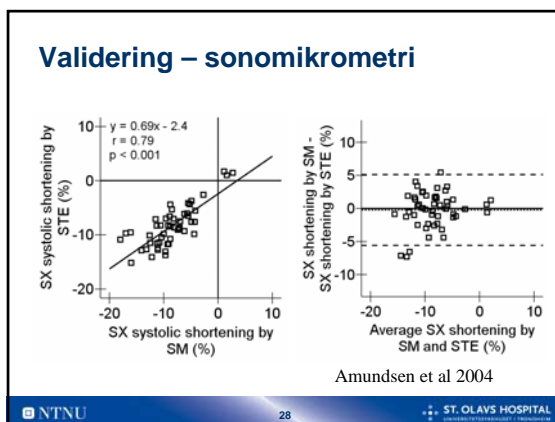
Speckle tracking er ikke en vevsdoppler metode, men kan brukes til å måle hastighet, displacement, strain rate og strain

Hvor god er metoden?

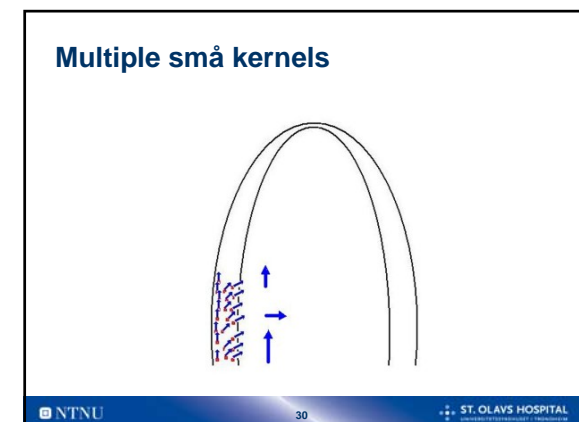


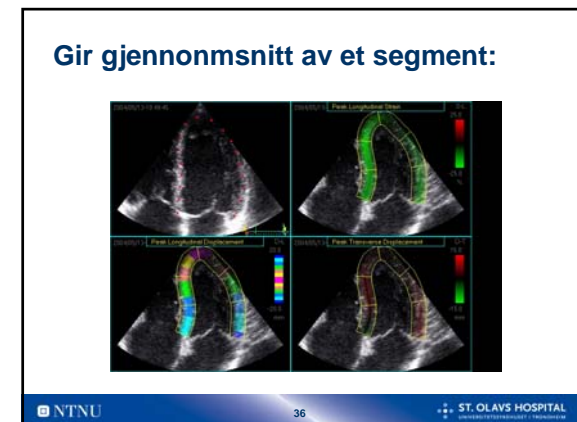
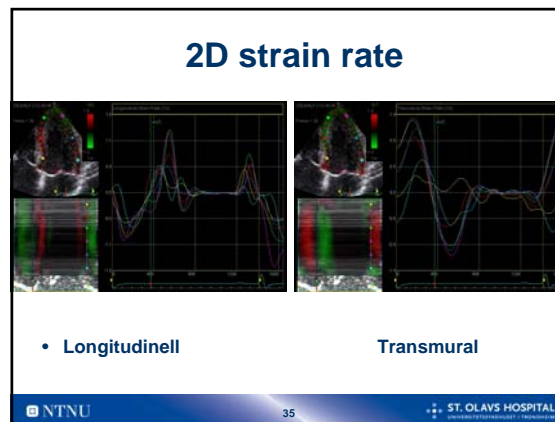
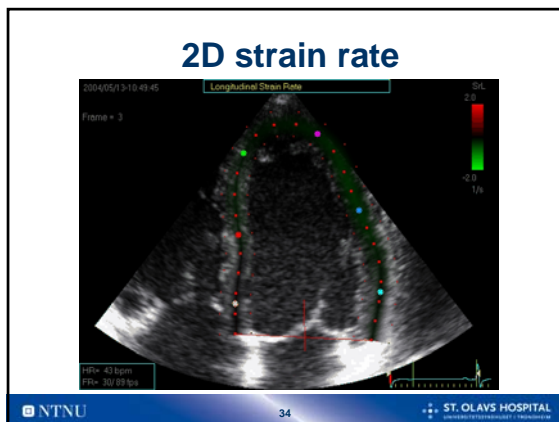
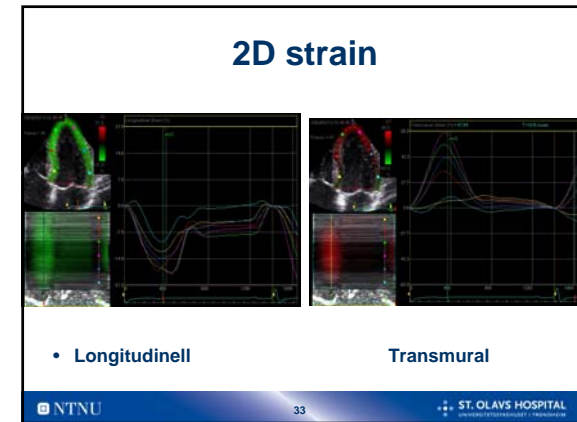
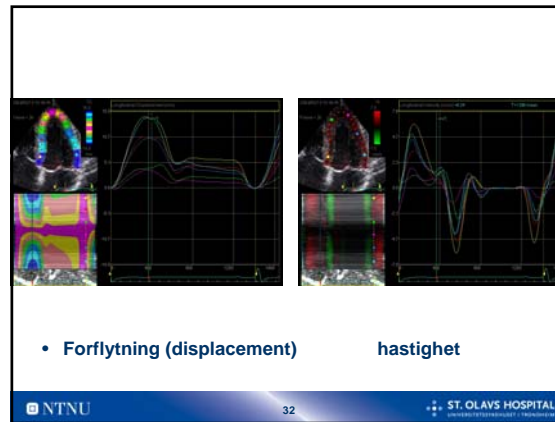
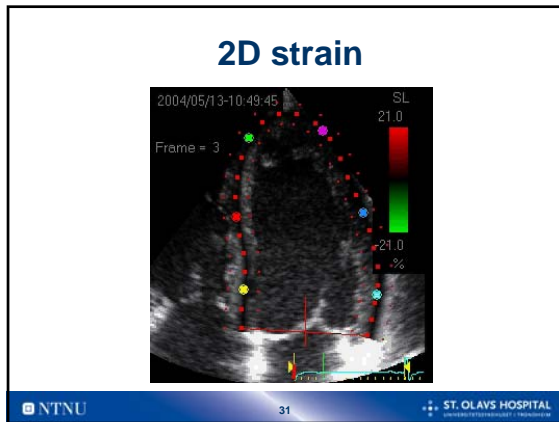
- Validering:
 - Ultrasonomikrometri:
 - Amundsen et al, 2004, 2005 longitudinal funksjon
 - Helle Valle et al, 2004, 2005 Rotasjon
 - MR
- Reproduerbarhet bedre enn vevsdoppler
- Sensitivitet og spesifisitet?

Speckle tracking vs. vevsdoppler: Forskjellige måter å analysere på.

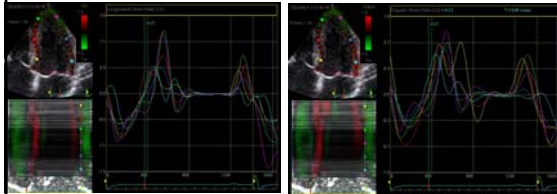


- ### Speckle tracking:
- Fordeler:
 - Vinkeluavhengig
 - Bedre lateral oppløsning
 - Data i to dimensjoner (?)
 - Validering
 - Klinisk nytte?
 - Ulemper
 - Frame rate sensitiv:
 - Lav frame rate – dårlig tracking (stor variasjon frame-to-frame)
 - Høy frame rate: Dårlig lateral oppløsning
 - Begrenset frame rate
 - Undersampling
 - Tracking ved høy HR et problem





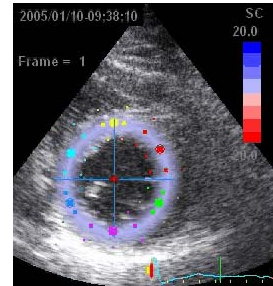
Speckle vs. TVI



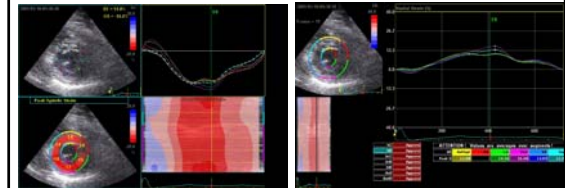
Viser betydelig glatting

- Speckle
- TVI

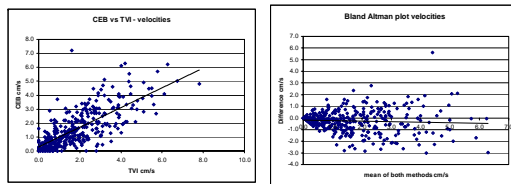
Tracking i kortakse



Circumferentiell og radiell strain

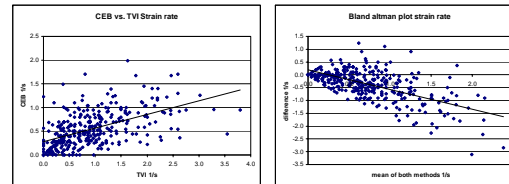


2Ds vs. TVI, 20 pas:



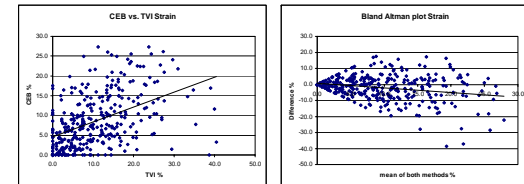
Støylen 04 - unpublished

2Ds vs. TVI, 20 pas:



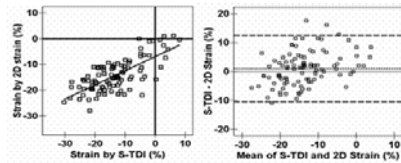
Støylen 04 - unpublished

2Ds vs. TVI, 20 pas:



Støylen 04 - unpublished

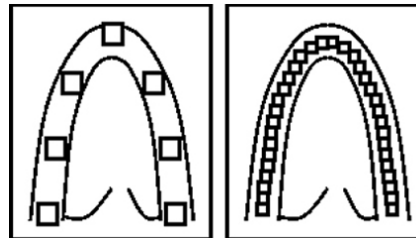
Reproduserbarhet:



- COR TDI: 7,9%, 2Ds 5%

Amundsen 05

Speckle tracking vs. 2Ds

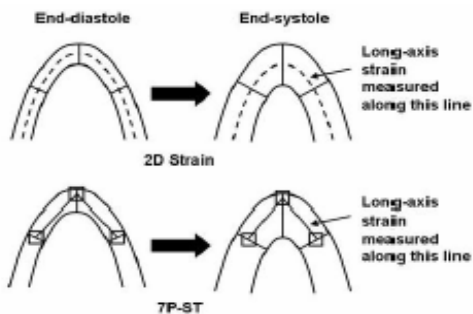


Amundsen 05

Strain ved ST vs. 2Ds

- 5 pas. m/AMI og 5 normale
- Feasibility 180 segmenter:
 - ST 135, 2DS 138, ST best i apex, 2Ds best i midwall
- Rimelig godt samsvar:
 - ($r=0.80$, $p<0.001$, 95% limits of agreement: $(-9.9 - 6.5\%)$)
- 2Ds ga litt høyere strainverdier
 - 14,6 vs. 12,6%, mest uttalt i apex.

Amundsen 05



2D strain er ikke en metode, men en applikasjon

- Speckle tracking
- Spline tilpasning
- Glatting
- Validering?
 - Høy HR
 - Transversell strain.
 - Circumferentiell strain?????
- Klinisk accuracy? Glattingen kan redusere sensitiviteten for hypokinesi
- Begrenset frame rate.
 - HR dependency
 - Undersampling

Speckle tracking:

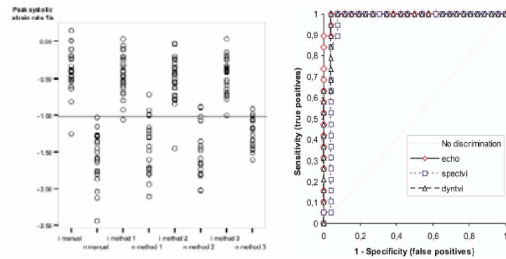
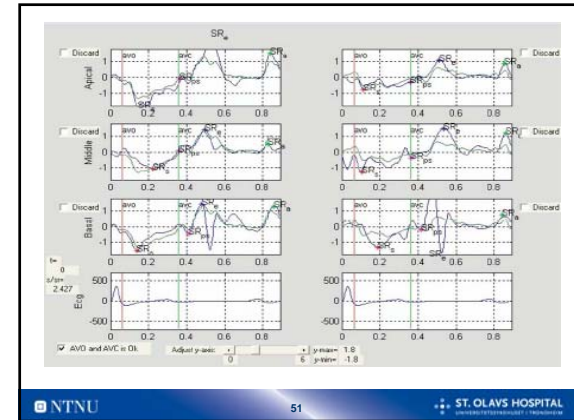
- Ny? Ja.
- Bedre? Tja!



Kombinert bruk av speckle tracking og TVI

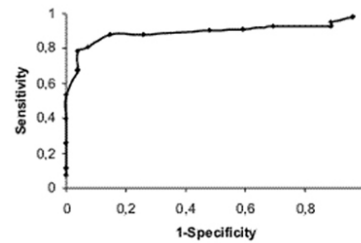
- Automatisk segmentering
- Longitudinell tracking med TVI
- Transversell tracking med ST
 - Måling av hastigheter og displacement av kernel region, kalkulering av strain og strain rate fra
 - segment lengde eller:
 - Plassering av ROI i midten av segmentet som tracker og måler Velocity/SR/ ϵ med TVI eller
 - Stasjonær ROI i midtsegmentet

Søkeområder



Ingul 2004/2005, Amundsen 2004

Stressekko



Ingul 2005

Speckle tracking eller vevsdoppler?



Ja, takk, begge deler.

