

8-9 et 10 juin 2011
BIARRITZ
Palais des Congrès
1, avenue Edouard VII



ÉTAT DE L'ART EN IMAGERIE CARDIAQUE NON INVASIVE

Echo 3D

Pascal Lim (Pas de conflit d'intérêt)
USIC- CHU Henri-Mondor (Créteil)

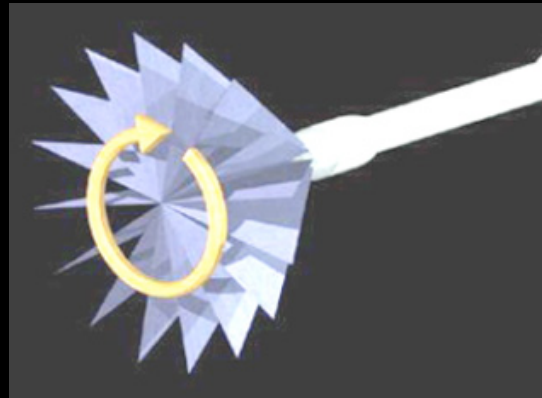
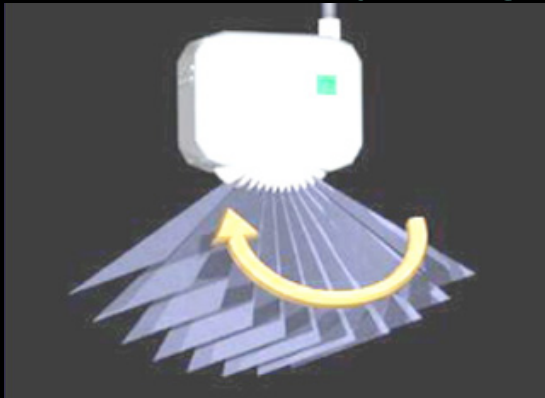
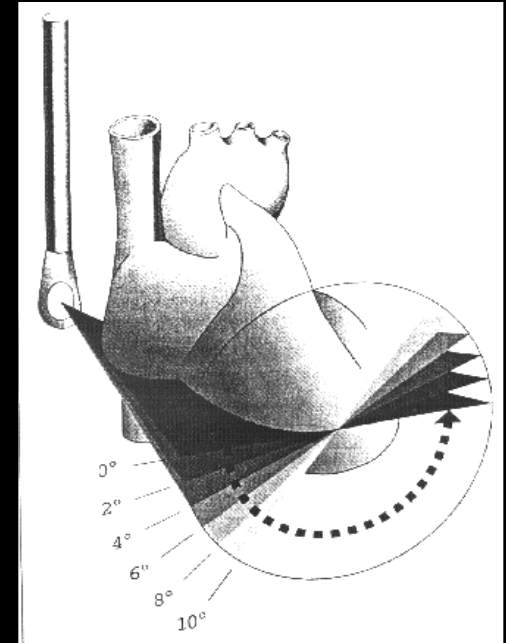
ECHOGRAPHIE 3D : Reconstruction 3D

- PRINCIPE :

- 1) Acquisition

- de coupes successives
- sur des niveaux jointifs
- par translation ou rotation

=> analyse globale du volume



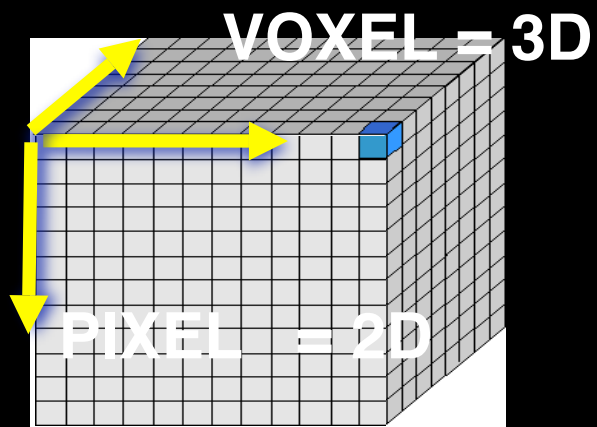
ECHOGRAPHIE 3D : Reconstruction 3D

- LIMITES :
 - Durée d'Acquisition long : 10' minimum
 - Durée de Reconstruction : plusieurs heures
 - Synchronisation parfaite ECG, Resp + + +
 - Matrices 3D à partir 2D

> Acquisition 3D rapide ...
Cadences images

> Sonde matricielle 2D...

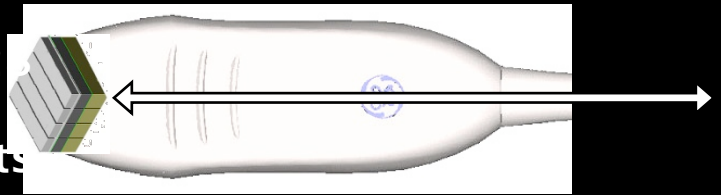
> Sonde volumique 3D...



De la sonde phased array

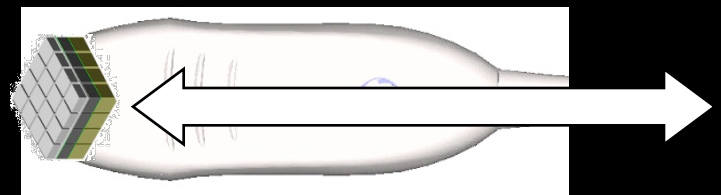
1D...

64 - 128
array
elements

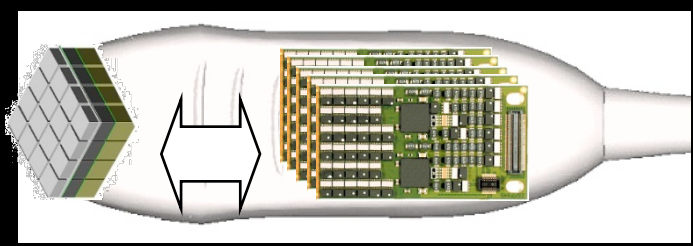


... à la sonde matricielle

Milliers
d'éléments

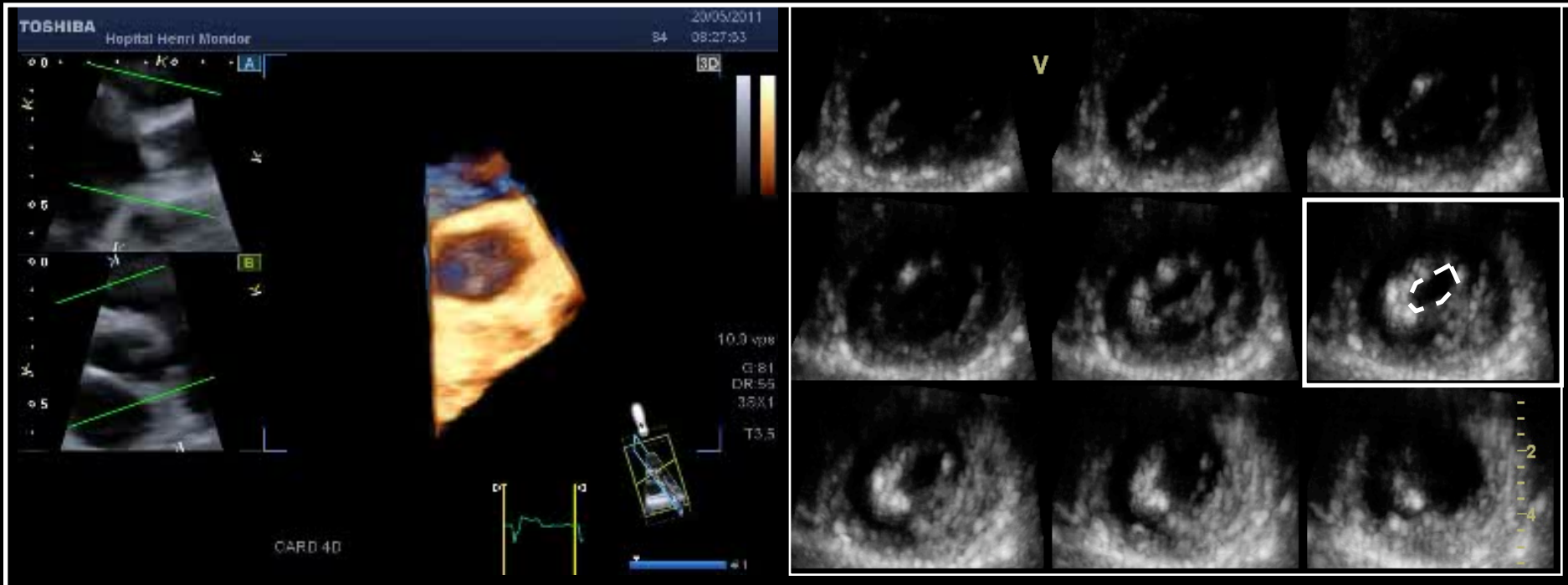


... à la sonde
Volumique



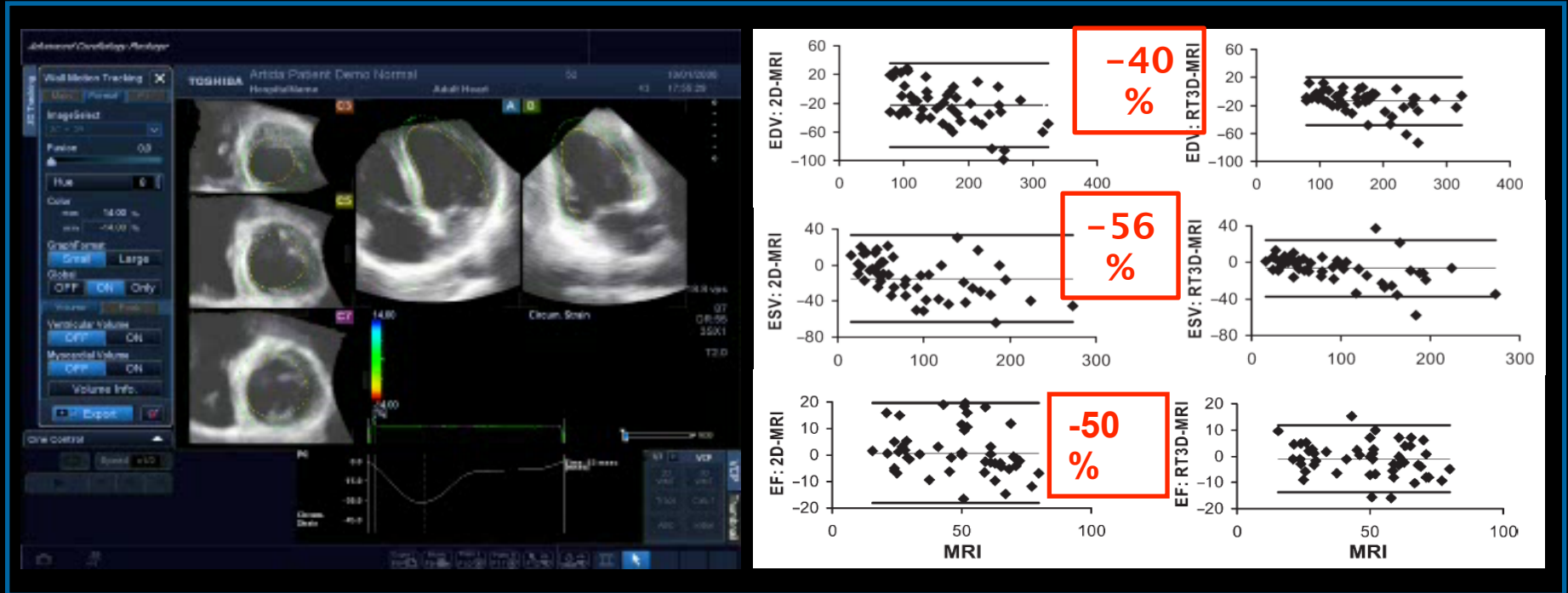
2D Array **Formateur de faisceau
miniaturisé intégré
dans
le corps de la sonde**

Analyse morphologique des valves



intérêt clinique principal : **quantification des RM**

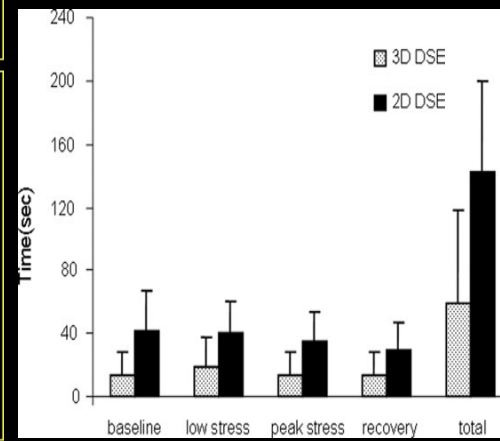
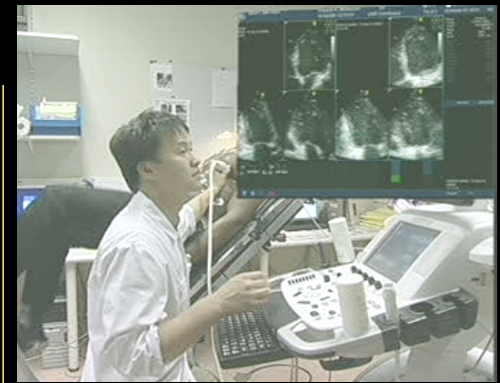
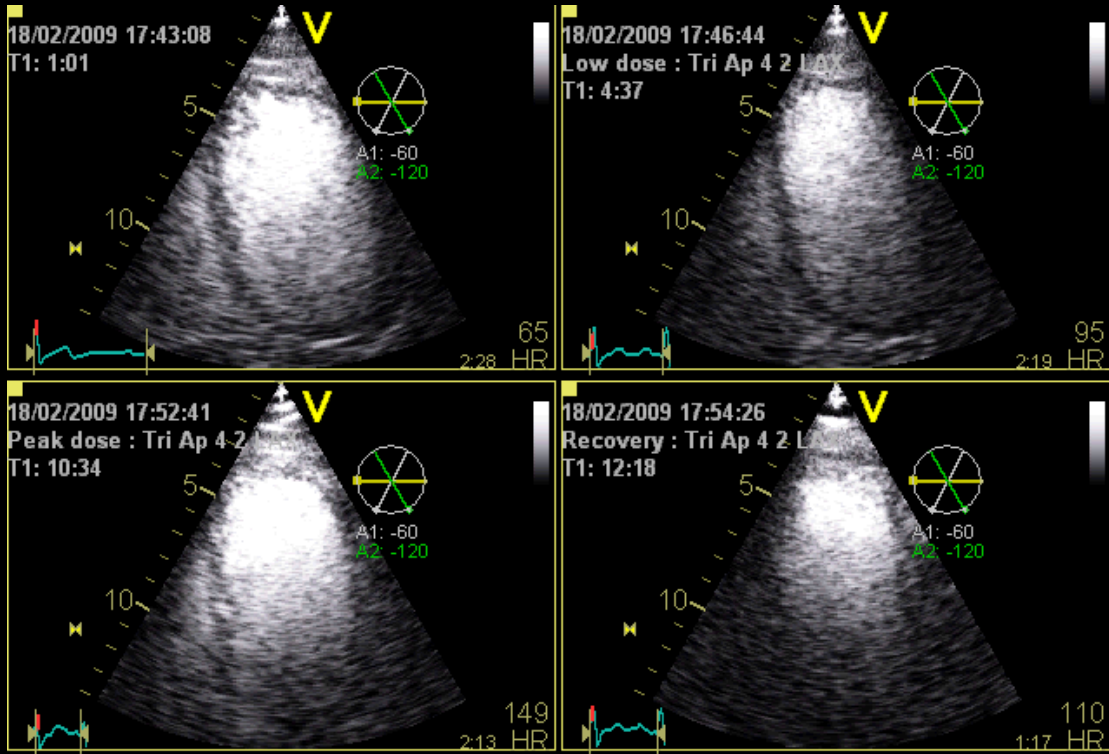
Analyse des volumes et mesure de la FEVG



Réduction de 50% du biais de mesure

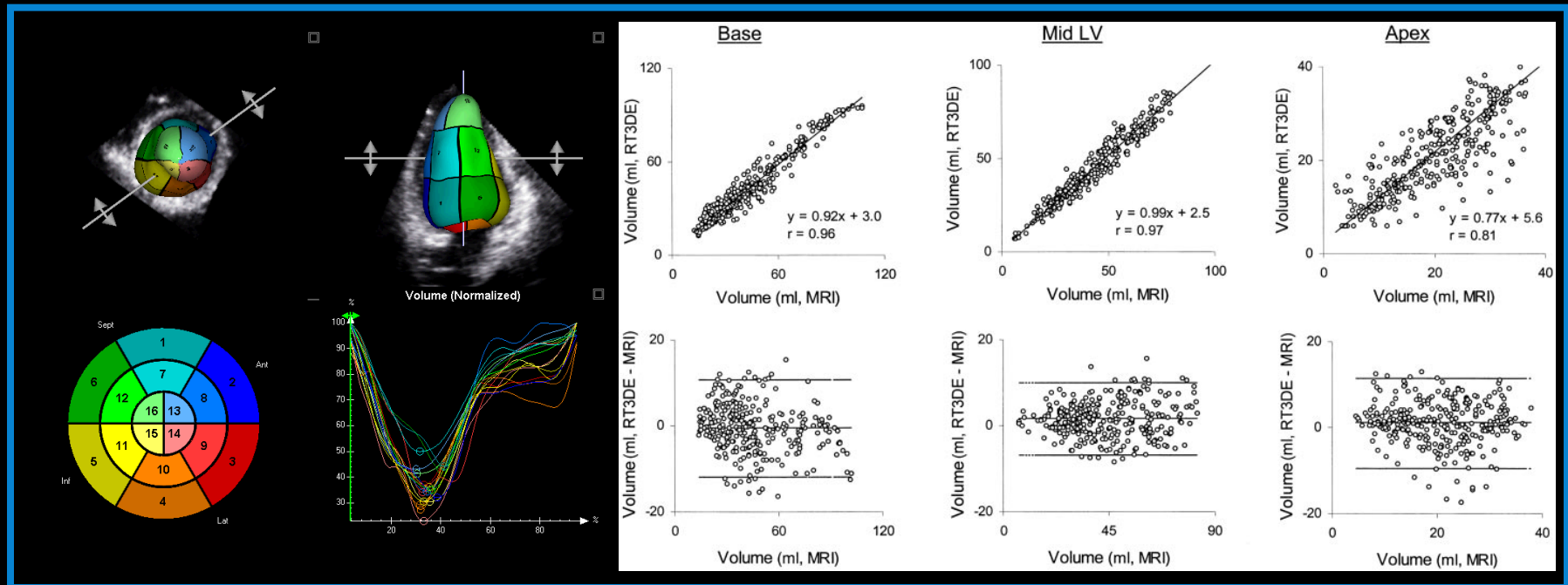
Clinical Application Triplane Stress TTE

● **images acquisition easier and faster**



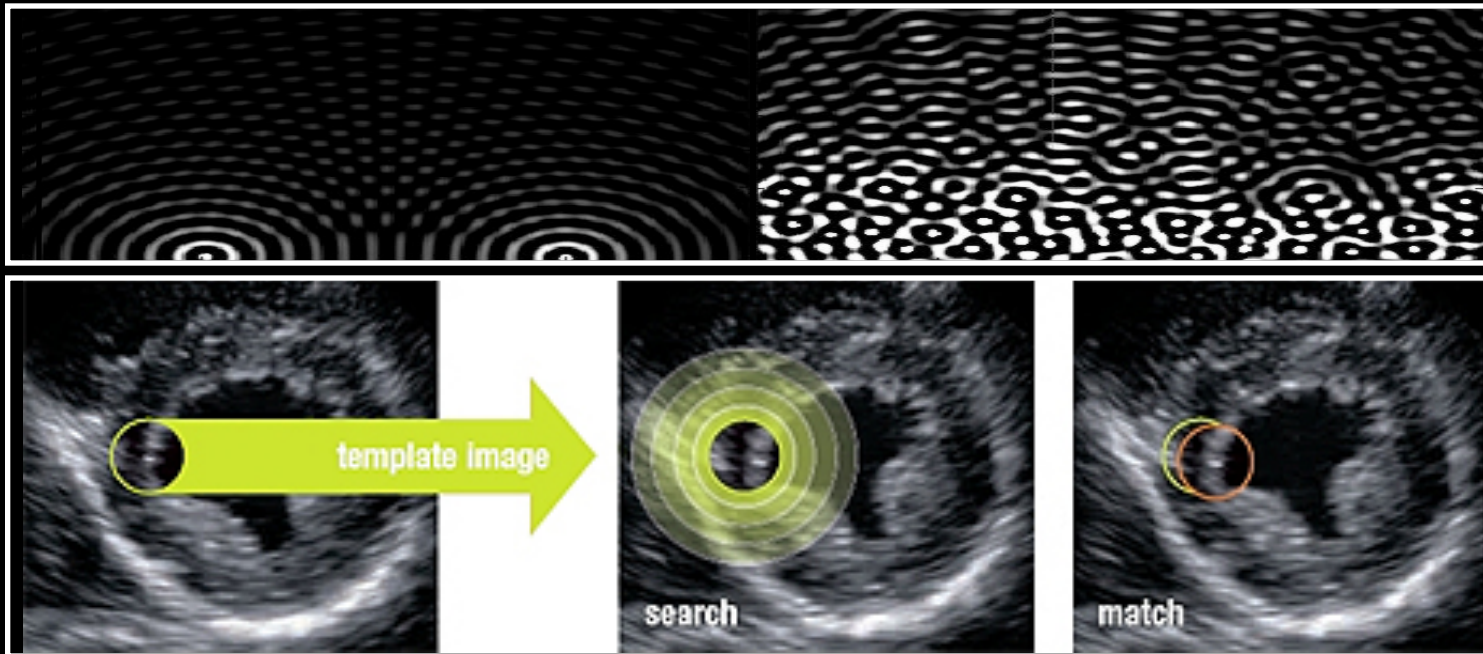
Etude indirect de la

Par l'étude de la variation des volumes régionaux



Speckle Tracking

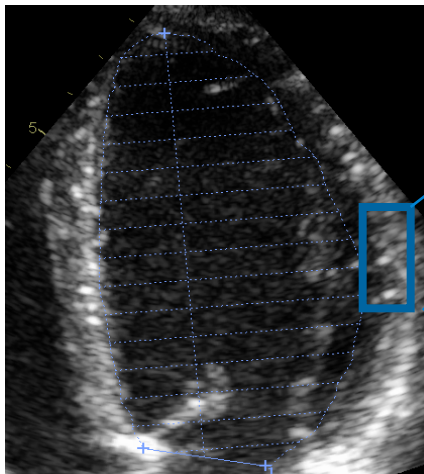
Outil d'étude de la mécanique ventriculaire



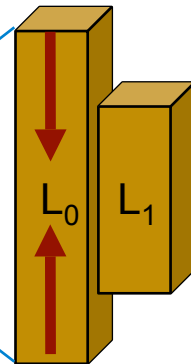
Speckle= Interference pattern by the reflected ultrasound

- Unique speckle pattern for a myocardial segment
- Stable over the time
- No need to detect endocardial borders

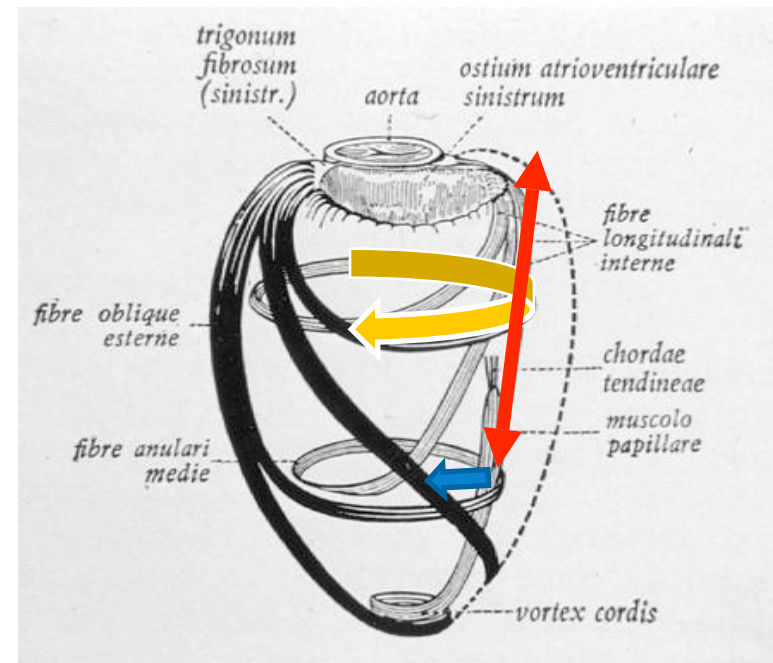
Caractérisation de la fonctionnelle de chaque couche du



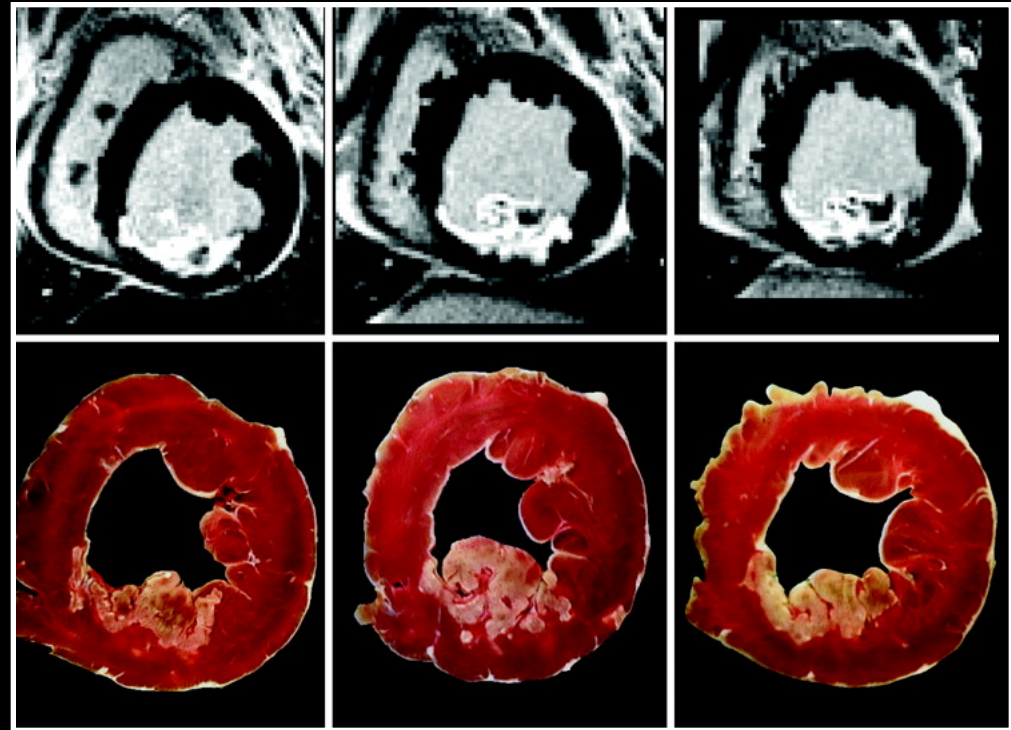
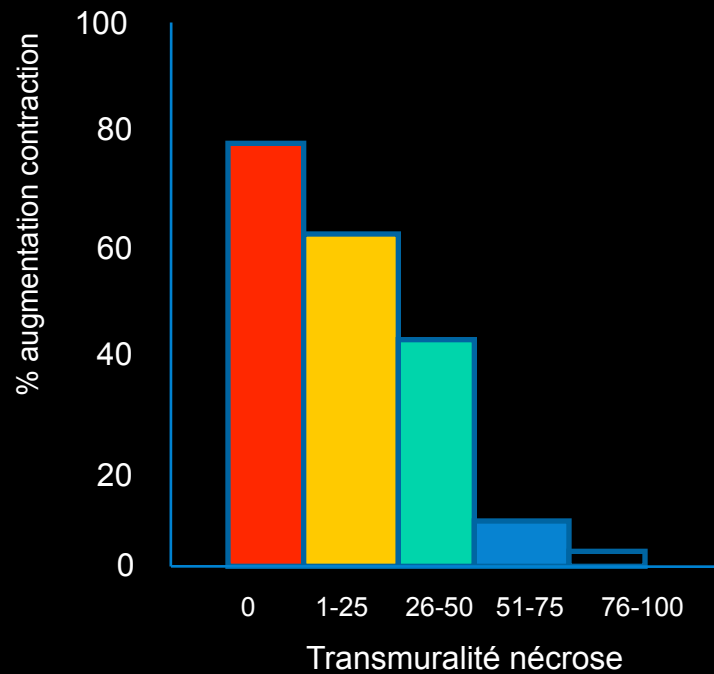
$$EF\% = (ESV-EDV)/EDV$$



$$\text{Strain}\% = (L_1 - L_0) / L_0$$



Transmuralité et Viabilité

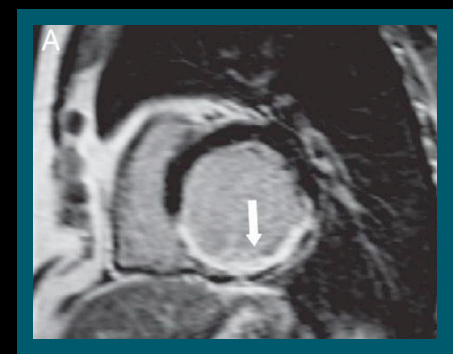
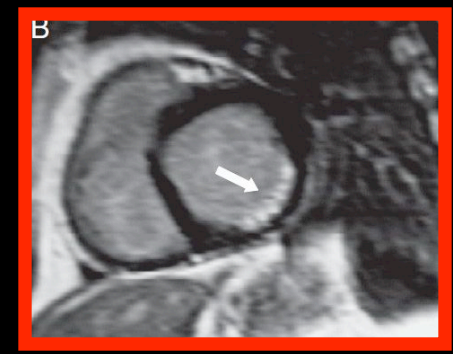
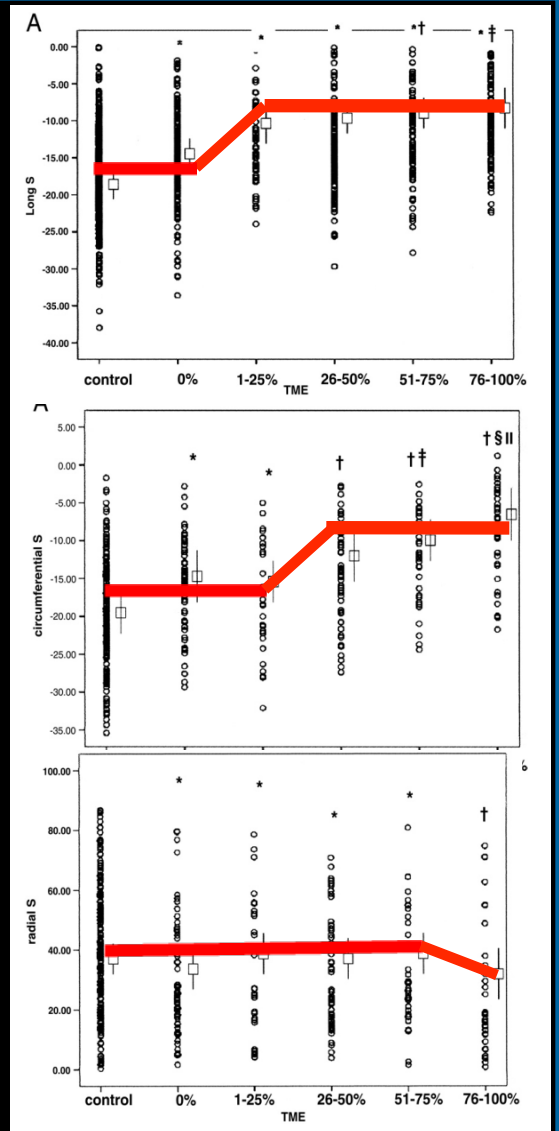


Identification of Scar

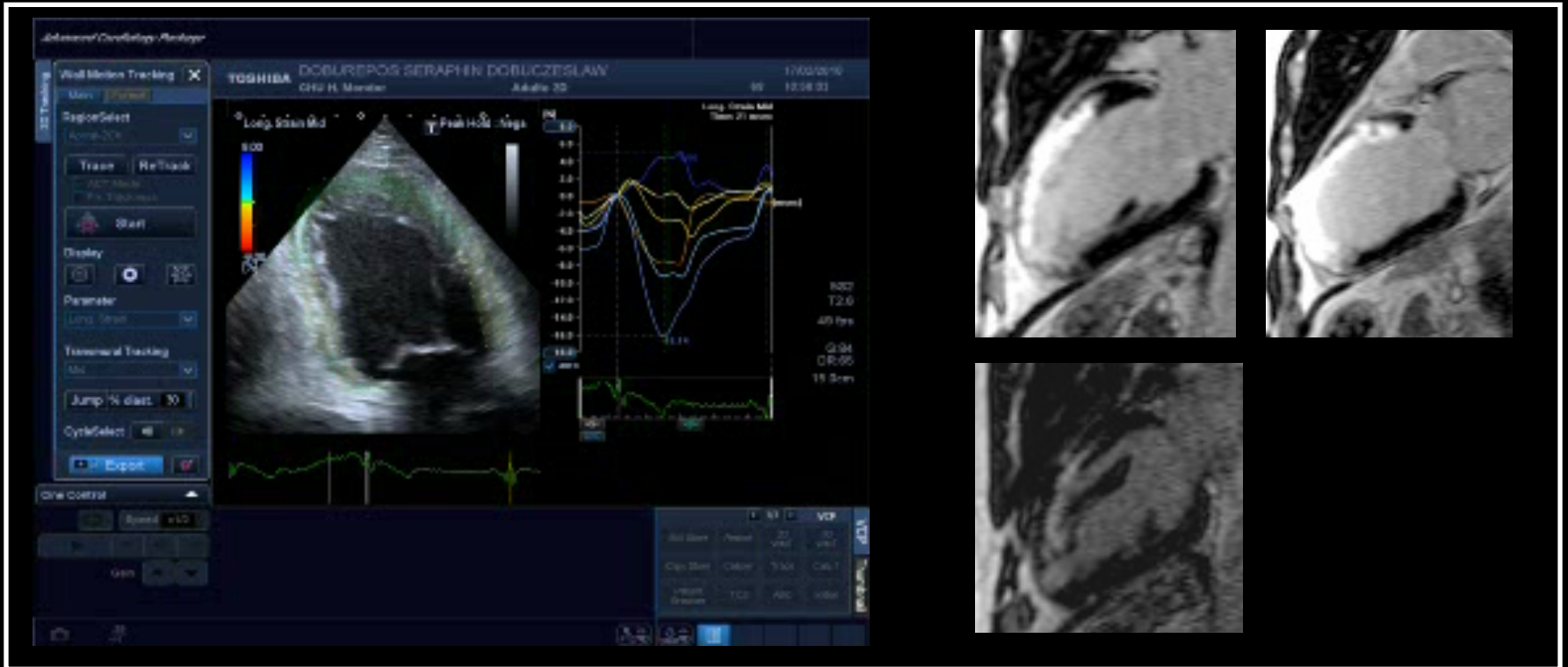
Longitudinal

Circumférential

Radial

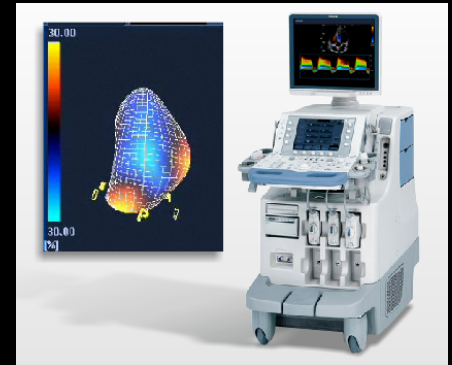


Limites du 2D

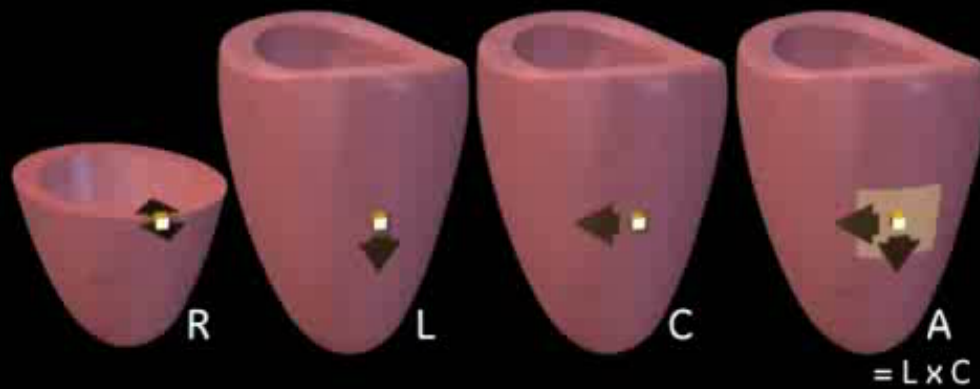


TOSHIBA

1^{er} speckle tracking en 3D

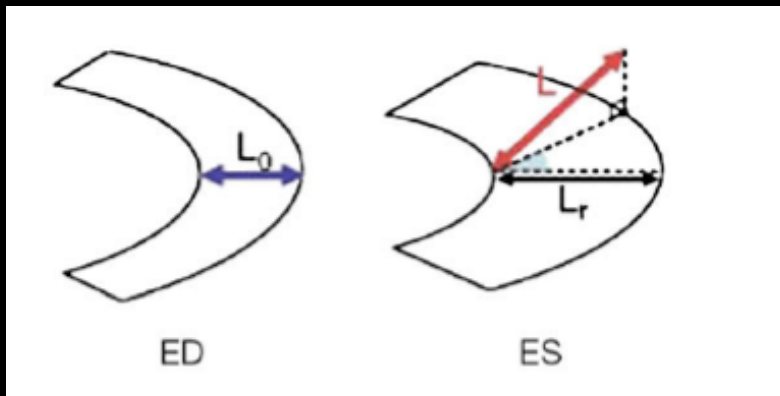


Radial strain, Longitudinal strain,
Circumferential strain and Area strain.



New 3D Markers

3D-strain



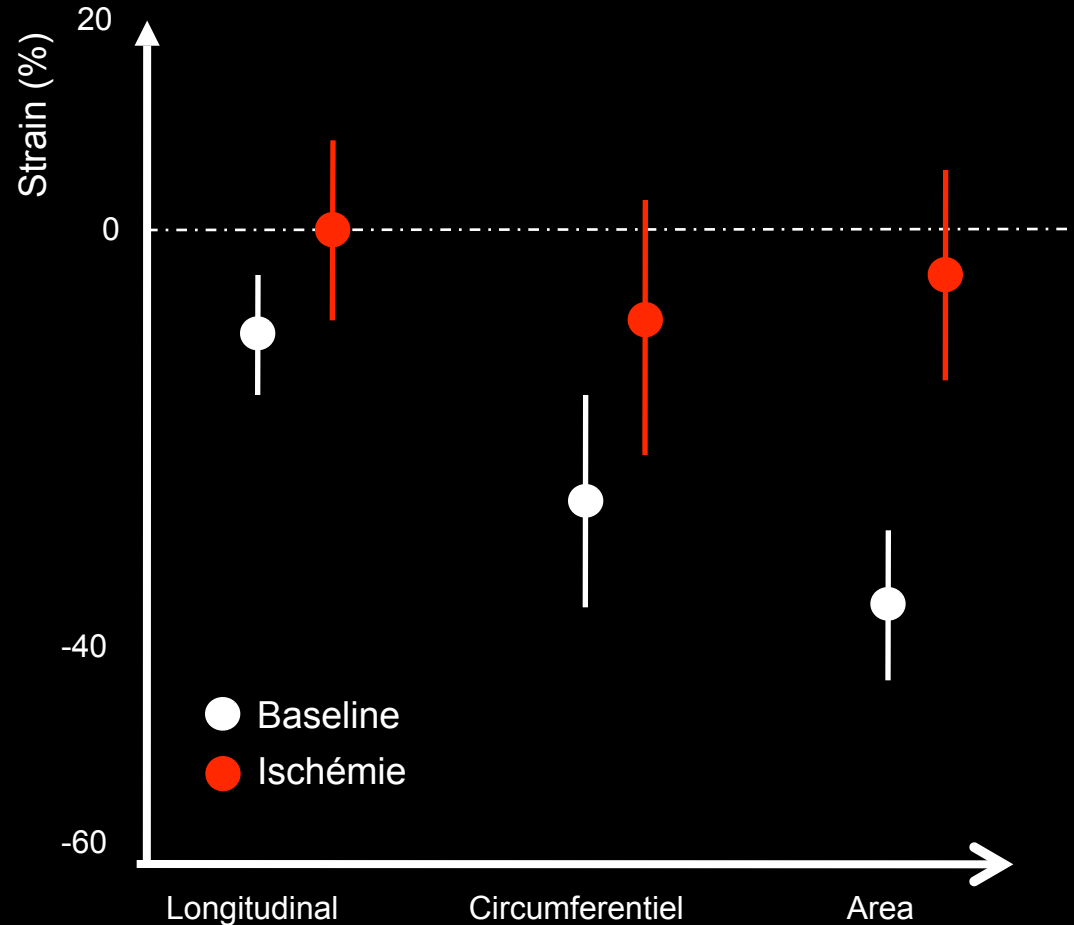
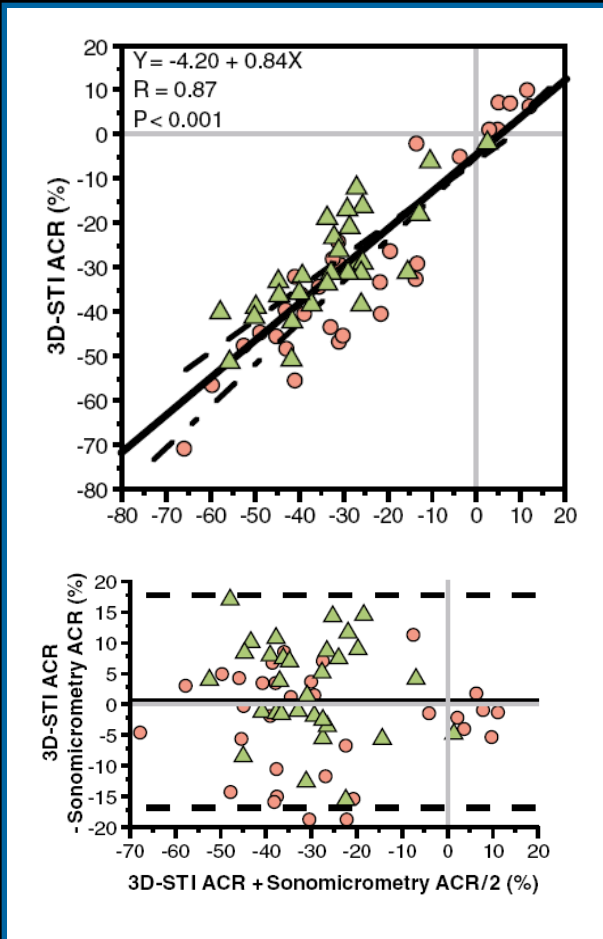
$$\text{Dimensional Strain} = \frac{(L - L_0)}{L_0} \times 100 [\%]$$

Area-strain



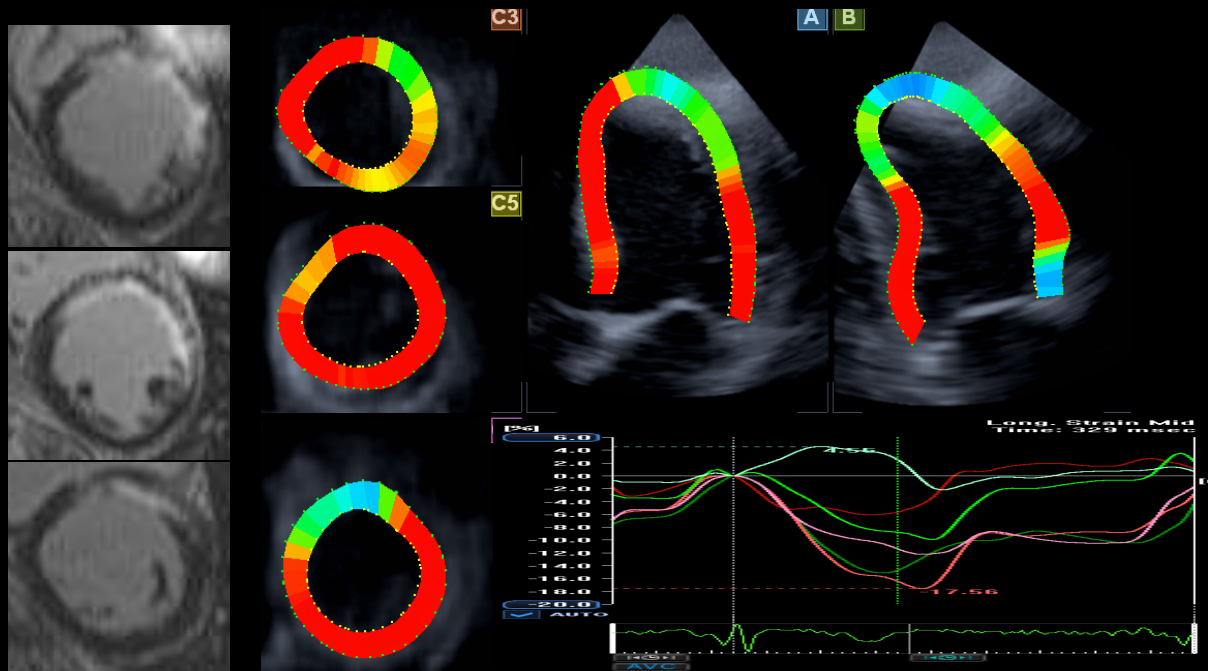
$$\text{Area strain} = \frac{(\text{area-ES} - \text{area-ED})}{\text{area-ED}}$$

VALIDATION EXPERIMENTALE



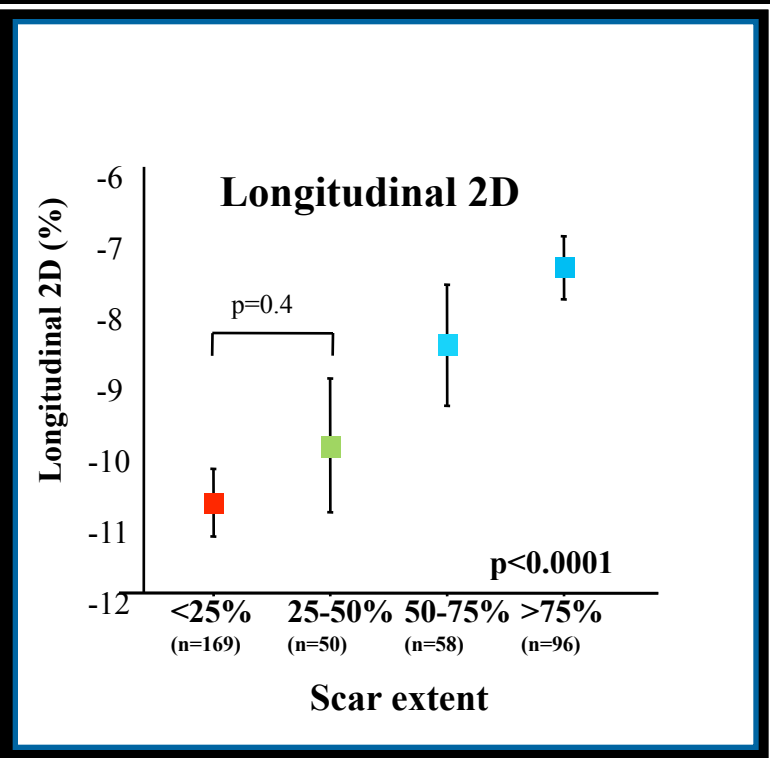
Validation clinique

- Post MI patients (n=25) with LVEF=41±9%
- TTE acquired using Artida 4D (Toshiba) the day of CMR
- Regional peak strain (16 segments) compared to MRI.

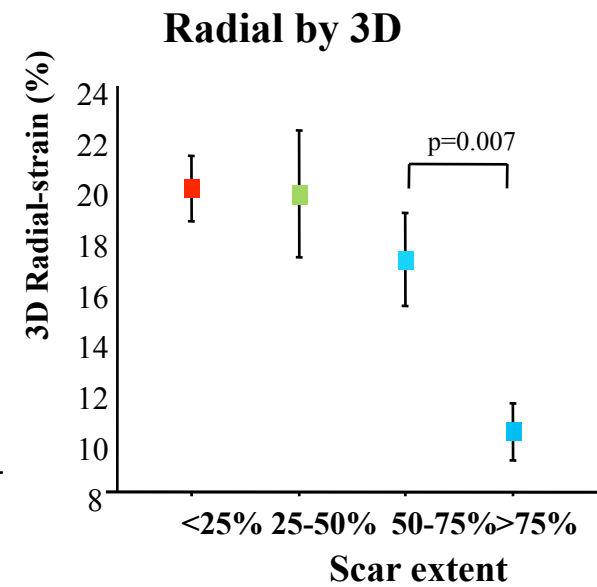
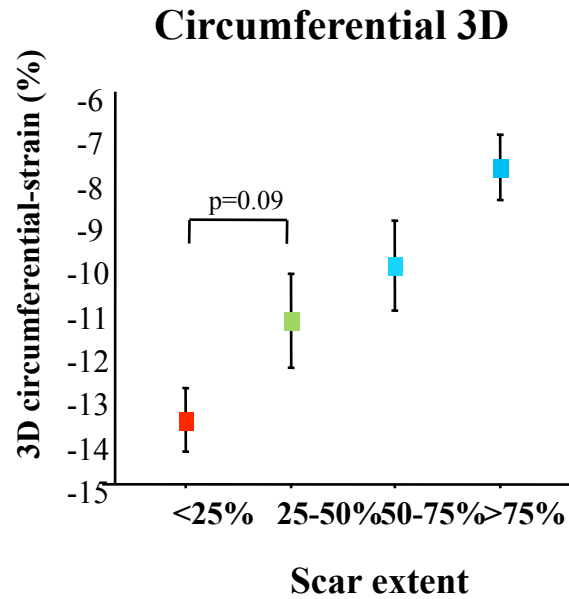
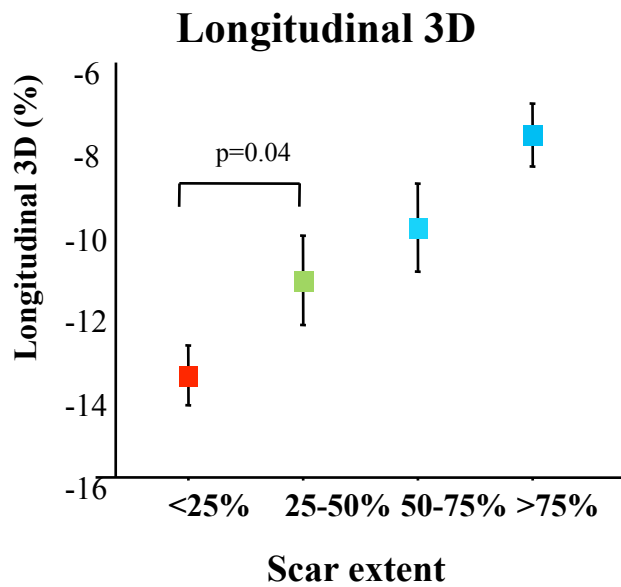


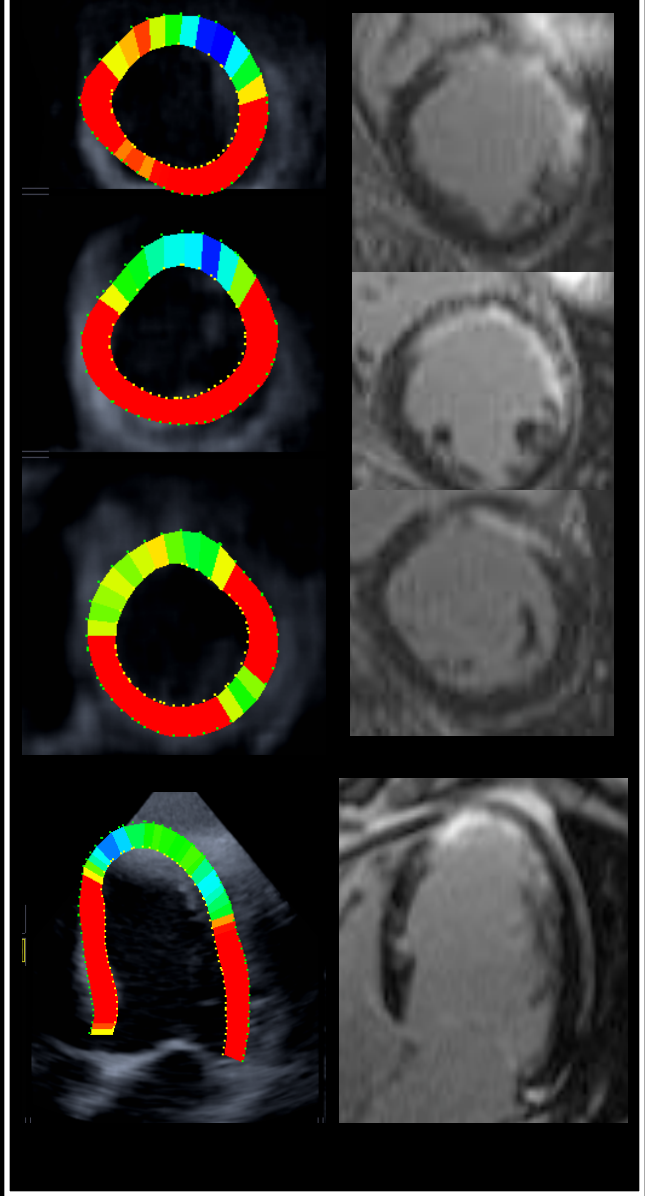
Speckle tracking 2D

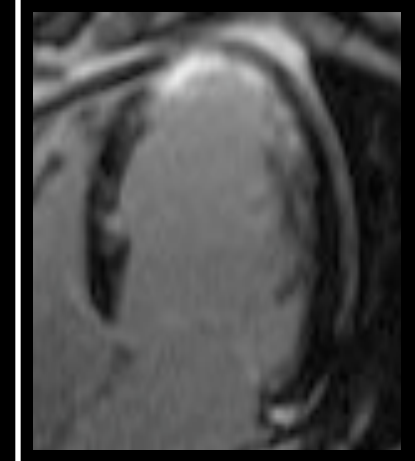
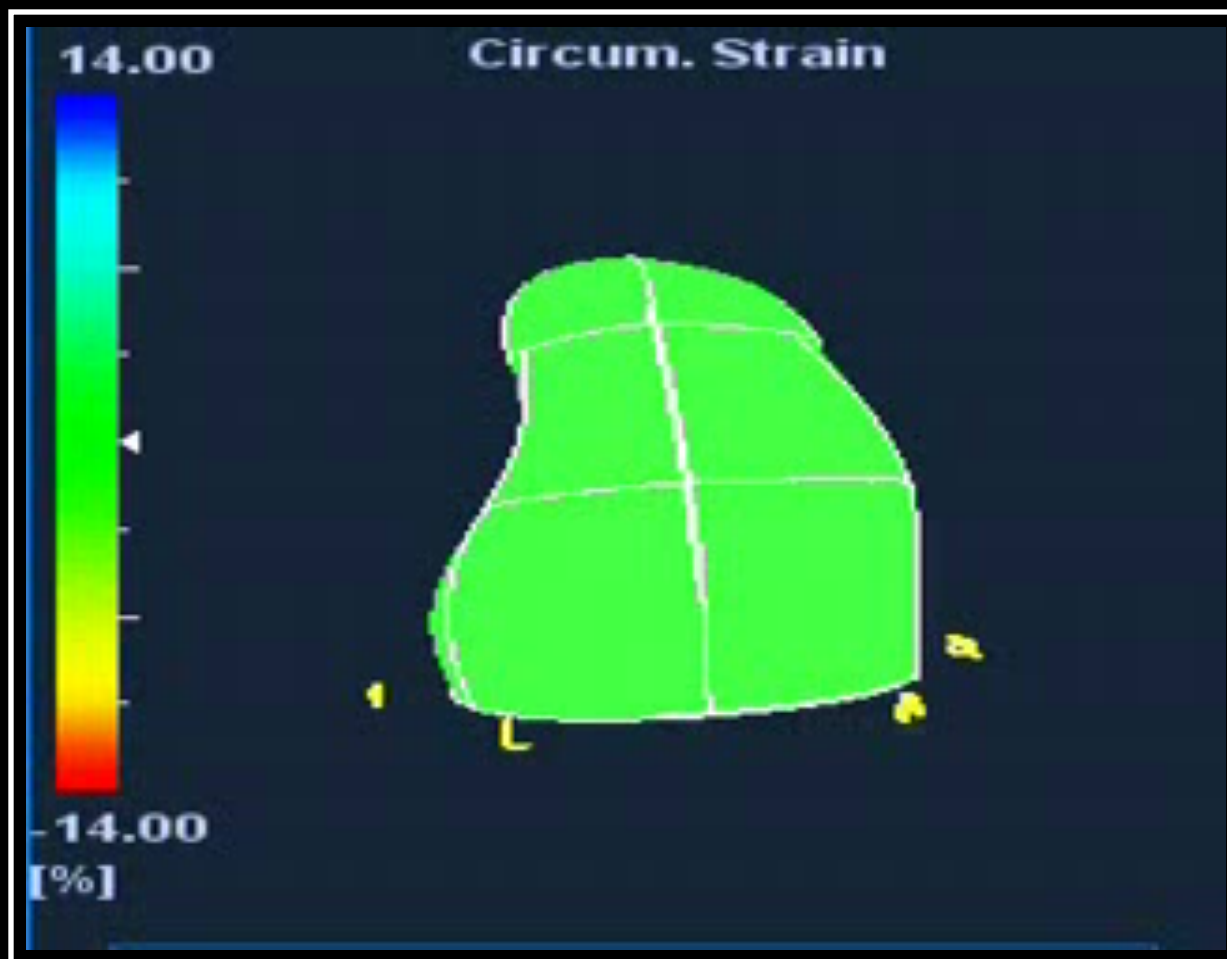
Strain longitudinal



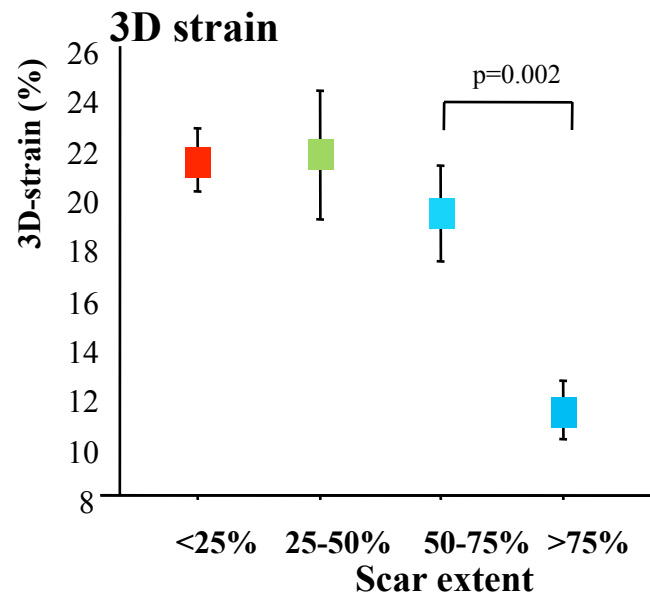
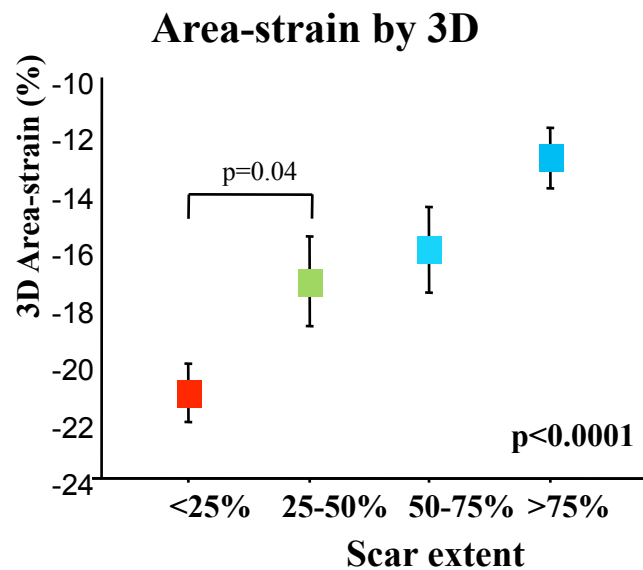
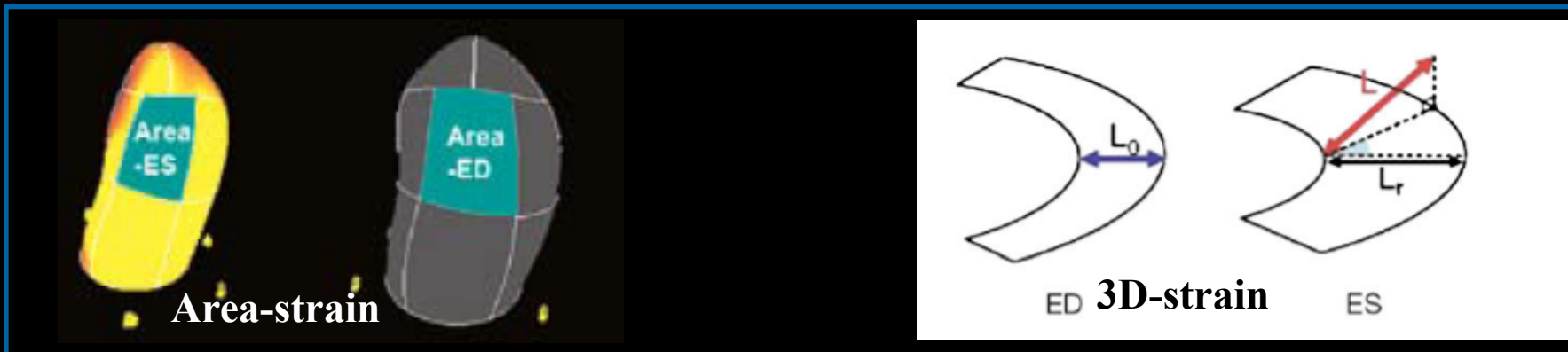
Results



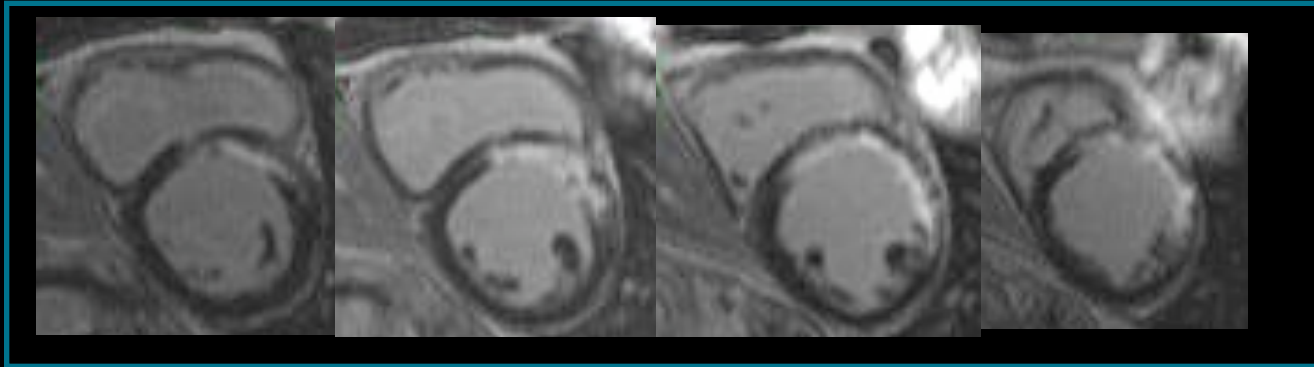




Combined vectors

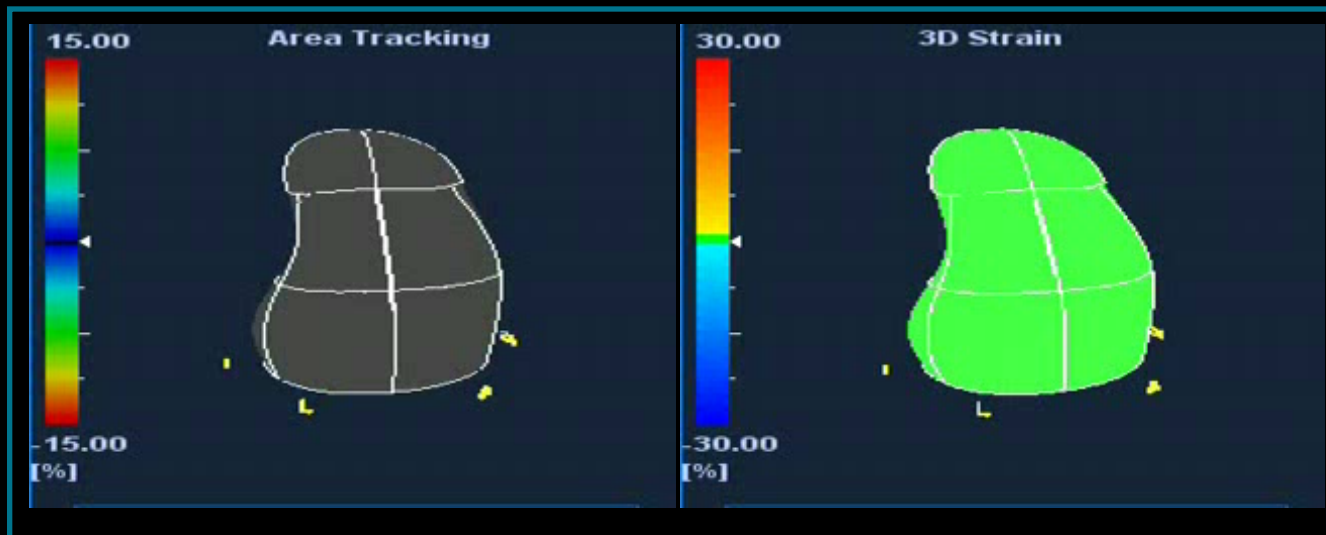


Conclusion



Strain surfacique

3D strain



Sensibilité+++



Spécificité+++

Conclusions

- Le speckle tracking 3D permet de caractériser rapidement et précisément la contraction myocardique couche par couche sur l'ensemble du myocarde
- Cette caractérisation fonctionnelle est corrélée à l'importance de la fibrose myocardique et pourrait guider la décision de revascularisation.
- Effort de **validation rigoureuse** de la part des cliniciens et une optimisation de la qualité et des logiciels de traitement d'image.