

Multimodality Imaging using Fluoroscopy and FullVolume 3D TEE in Advanced Valve Therapy

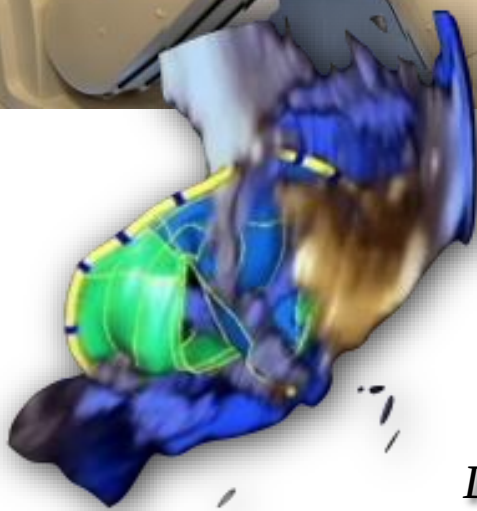


A surgical point of view

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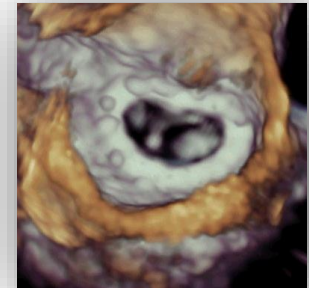
University Hospital Charles Nicolle
Rouen - France



A New Era for Advanced Valve Therapy

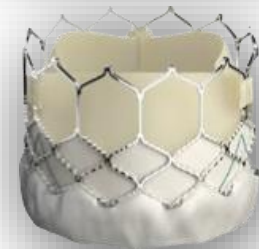
Development of Aortic & Mitral Valve repair

- Standardization of the technique
- Minimally invasive / Robotic surgery
- Use of multiple PTFE neo chordae
- older patients (>80 years old)



TAVI / TMVI

- In 2002: TAVI First in man
- Today: more than 150 000 patients !
- Mitral implantation under development



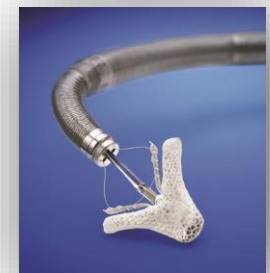
Treatment of Para-Valvular leak

- Percutaneous
- Transapical



New Tools are available

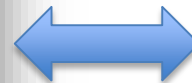
- Mitraclip®
- NeoChord® (Transapical Mitral Valve Repair)



... Needs new imaging tools

The requirements:

- 1 - Real Time imaging and analysis (not post exam !)
- 2 - Without delay : High Volume Rate (Images per second)
- 3 - Precise : Large volume with good spatial resolution
- 4 - For a long duration (Probe temperature)
- 5 - Multimodality imaging (Fusion TEE & Fluoroscopy)



Through the ages... Images have evolved



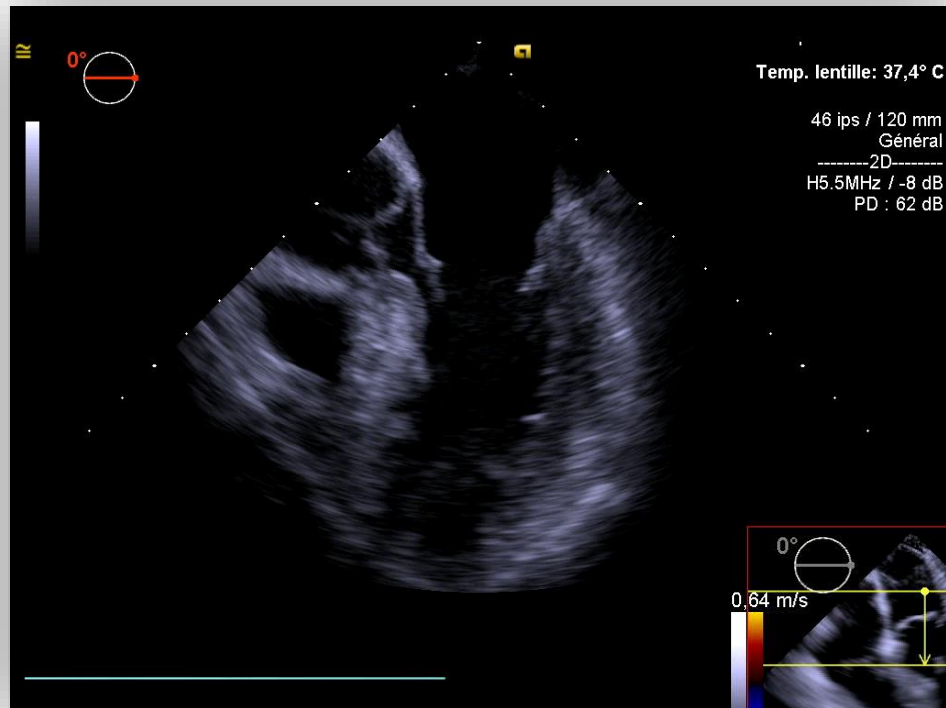
From 2D



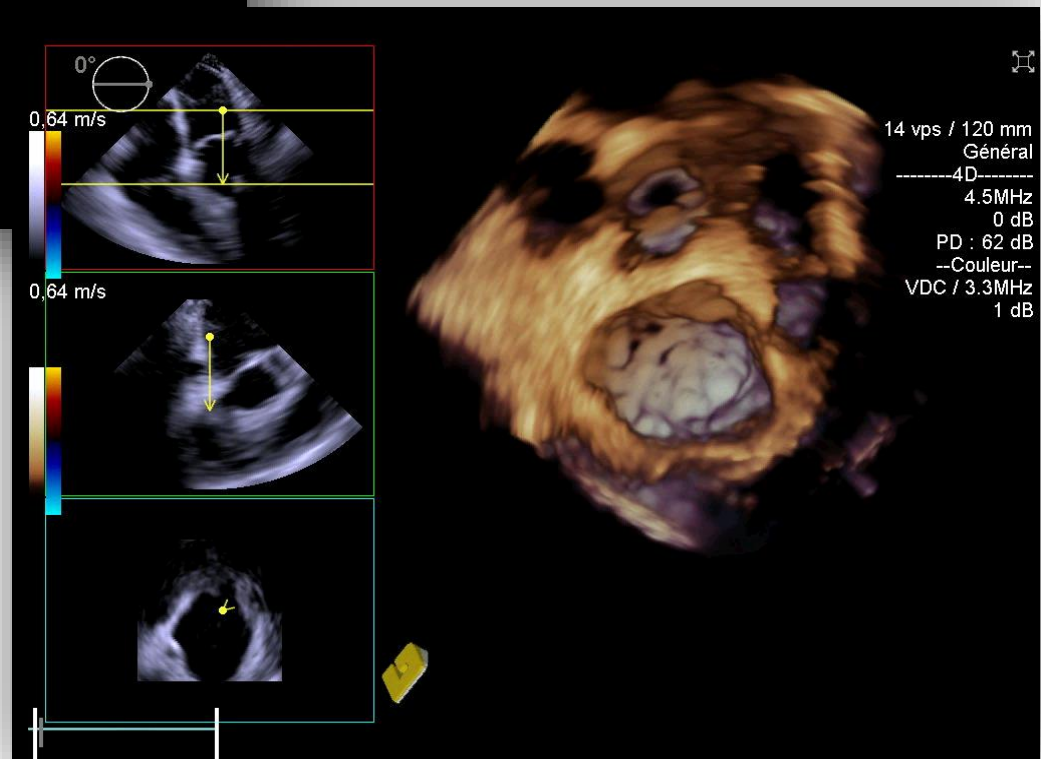
To 3D

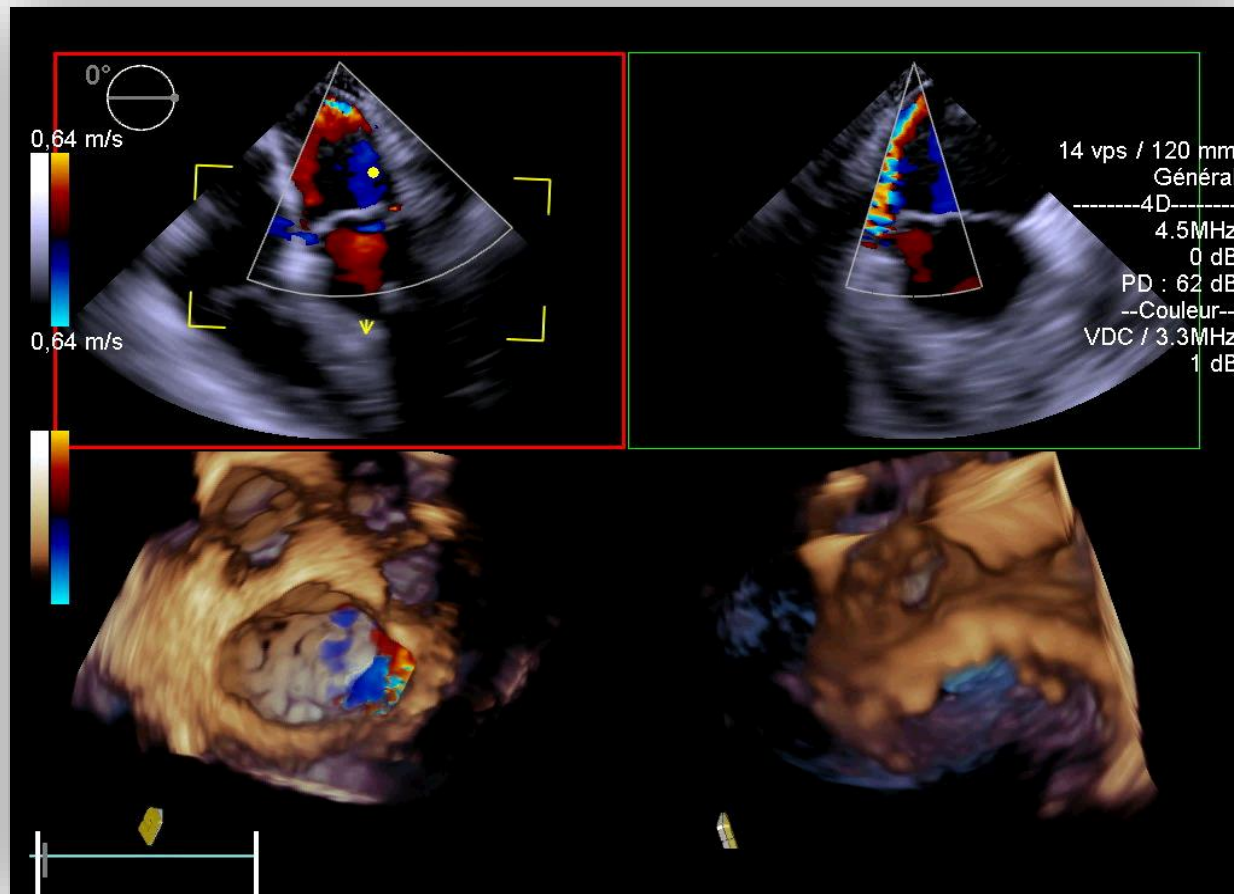
... For a more realistic view

From 2D TEE



To 3D TEE
Full volume view





90° x 90° Full volume view

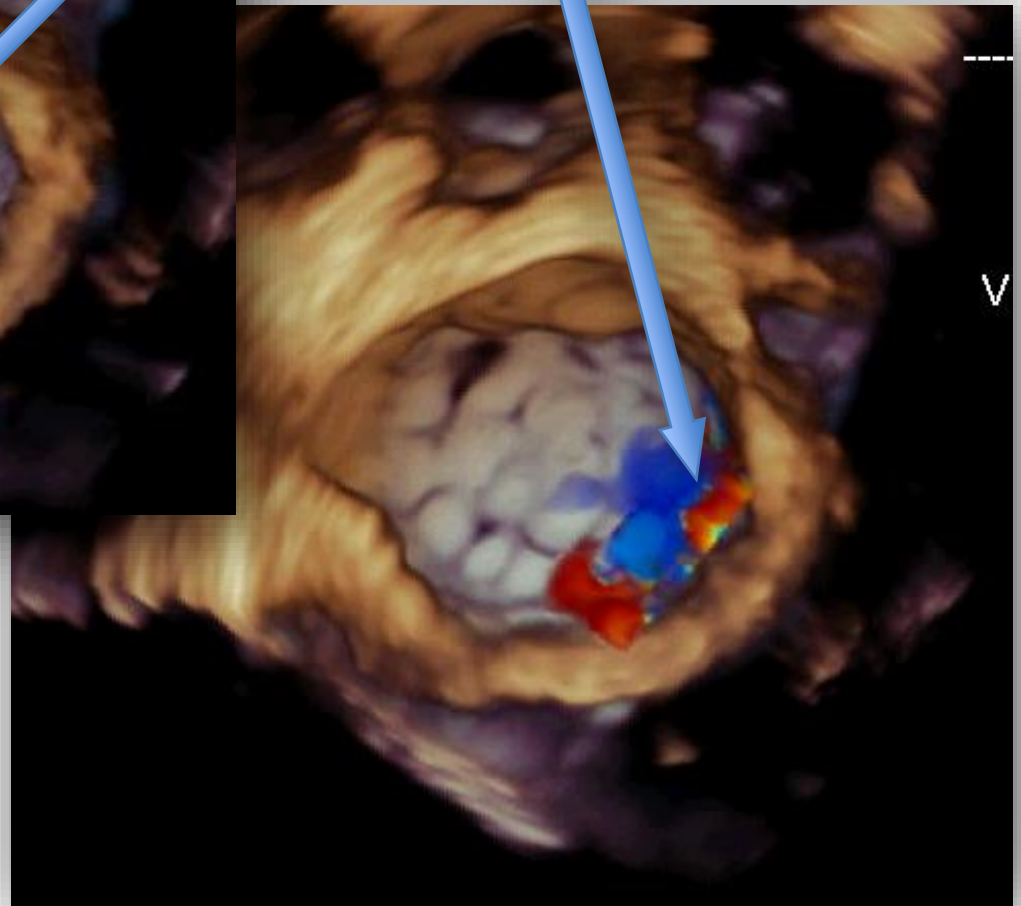
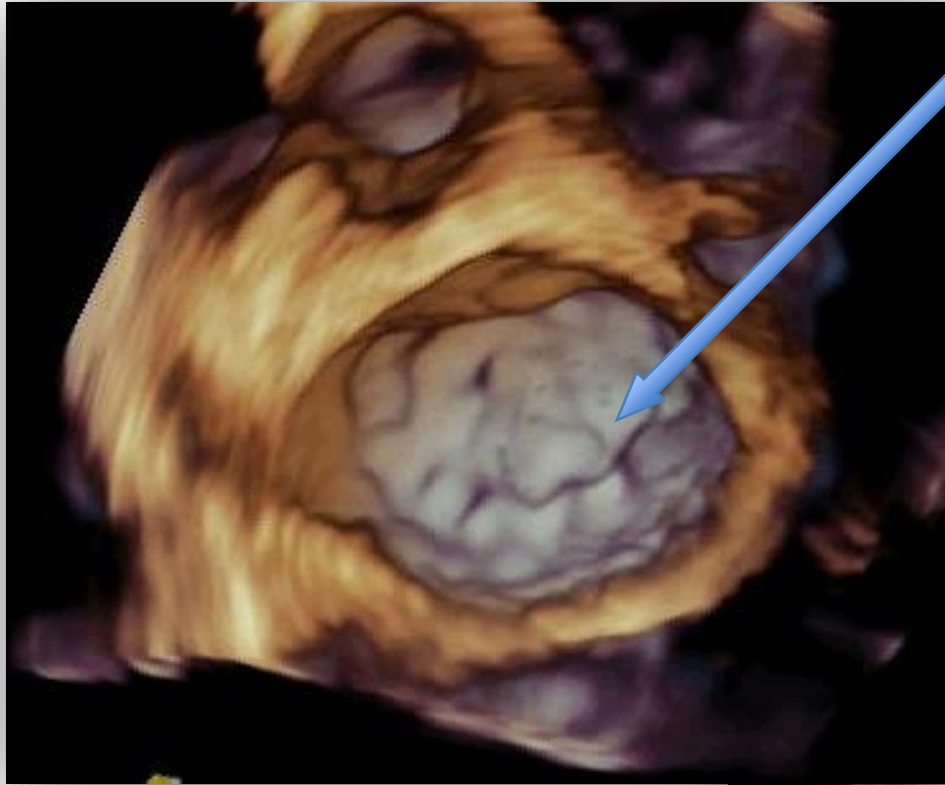
3D with color doppler

Surgical and ventricular view at the same time

High Volume Rate : up to 25 vps

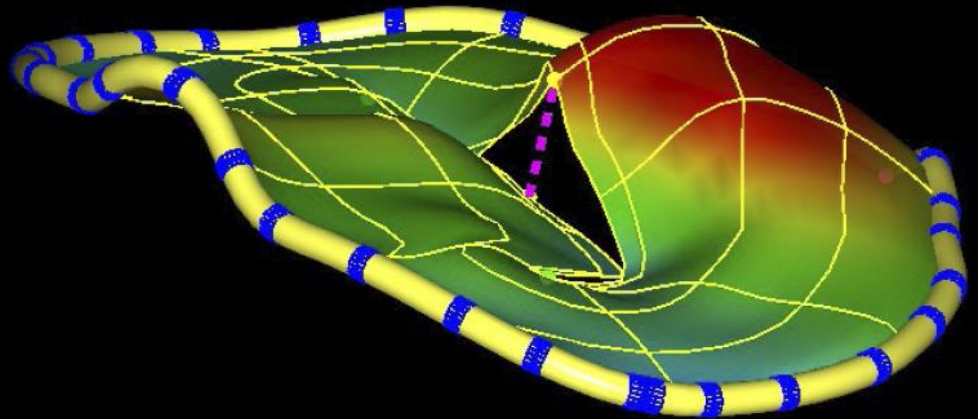
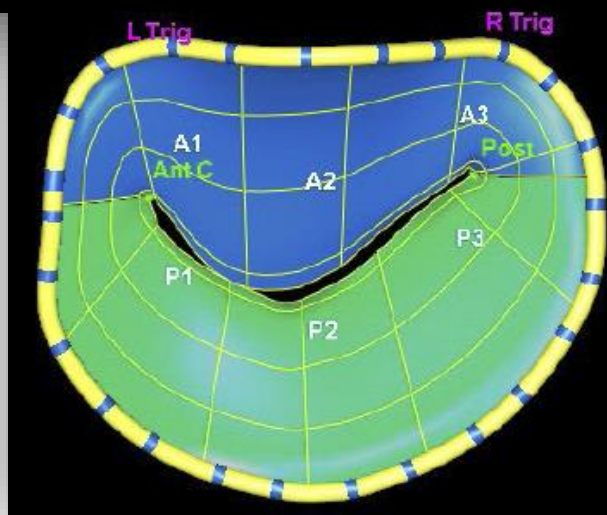
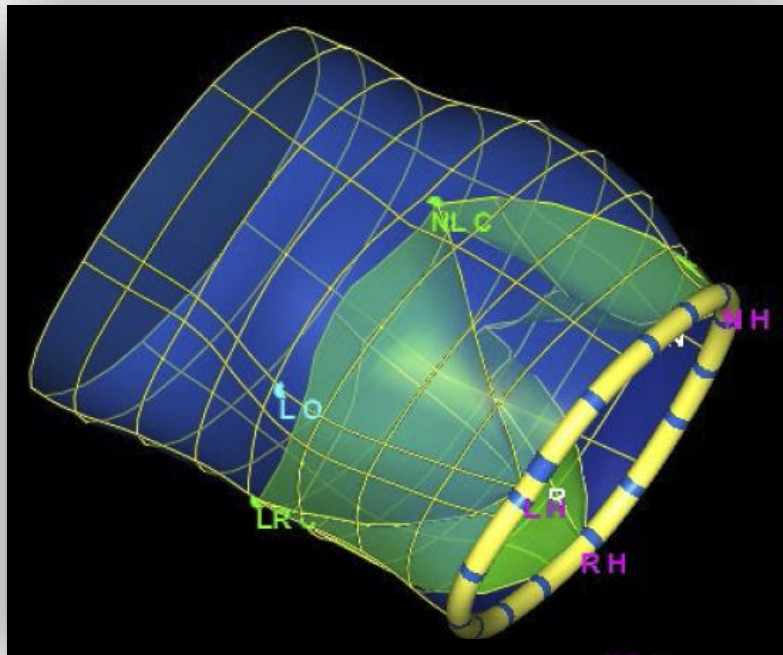
Without ECG: no problem with arrhythmia

Perfect analysis: A2-A3 prolapse



A step further ...

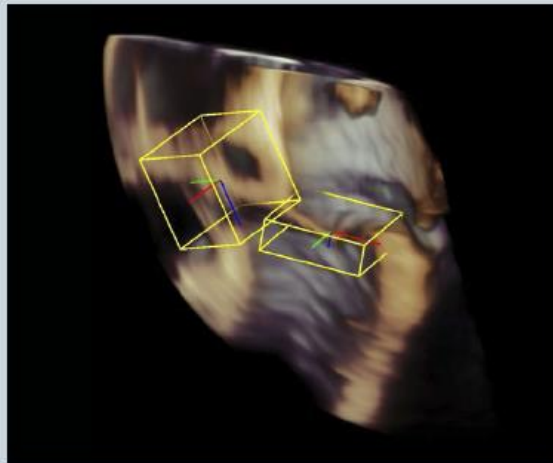
Modeling left heart valves



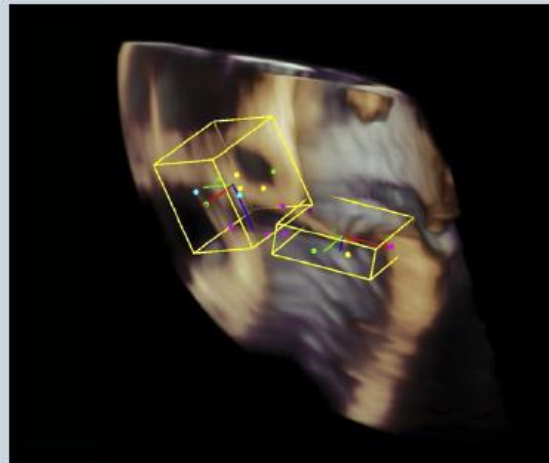
eSie Valves package

How it works ?

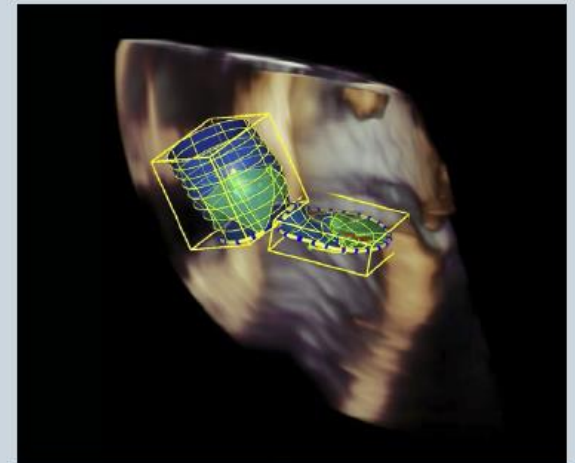
Define details in Region Of Interest (ROI)



a. Valve Location



a. Valve Landmarks



a. Valve Surfaces

Valve position
Size
Orientation

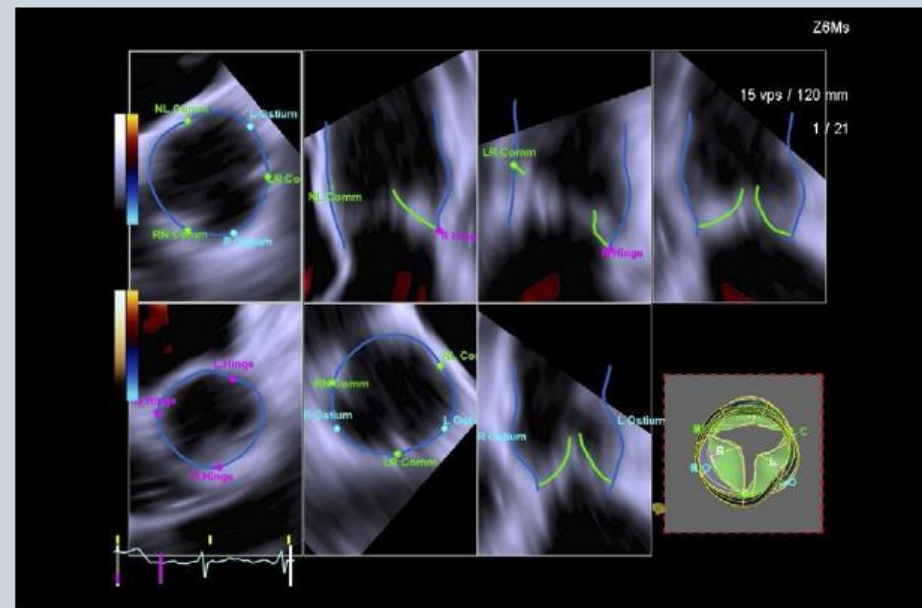
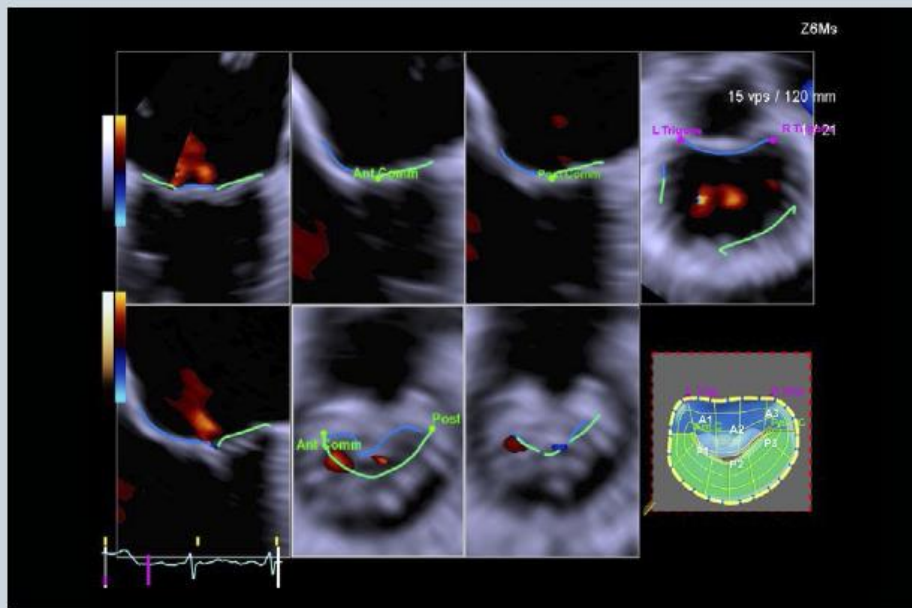
Trigones
Commissures
Leaflet hinges
Ostia

Automated
Mitral leaflets
Aortic leaflets
Aortic roots

eSie Valves package

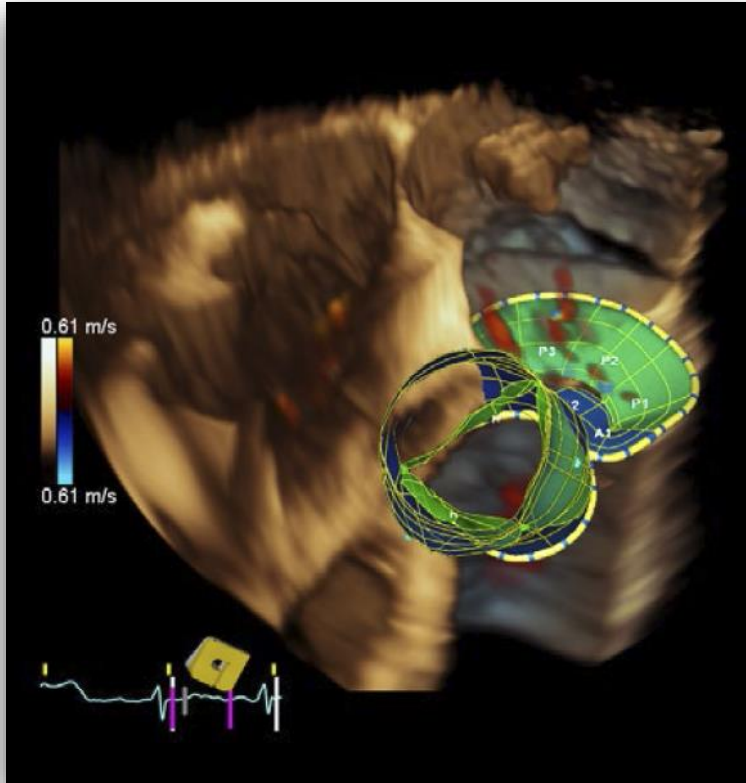
How it works ?

Detection and Tracking of Valves

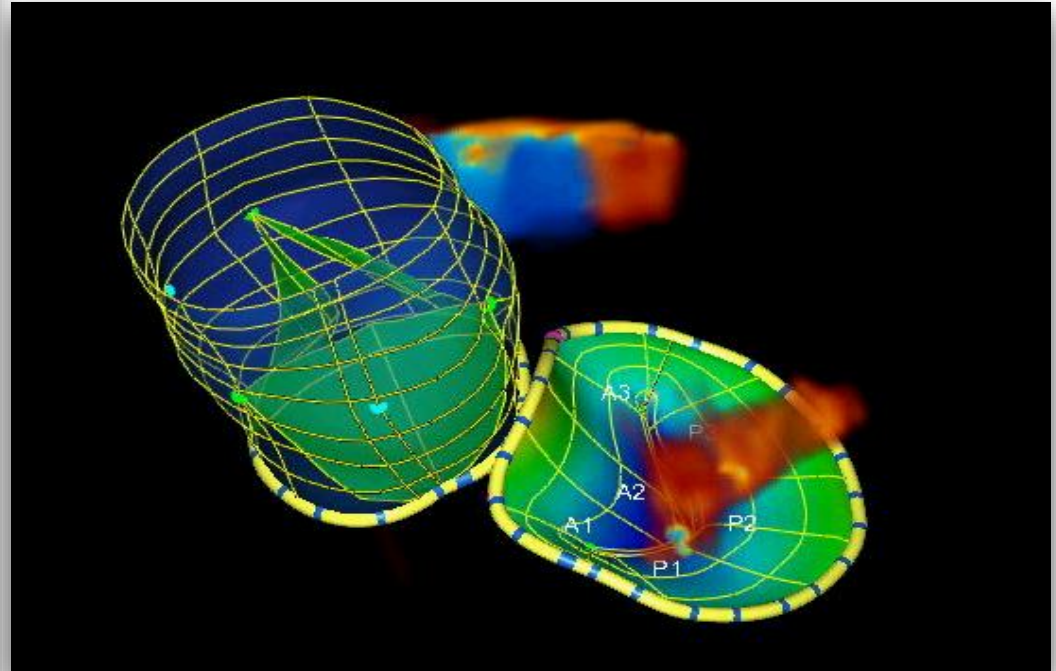


**Reviews the Valve Model
With few clicks ... In few seconds**

eSie Valves package



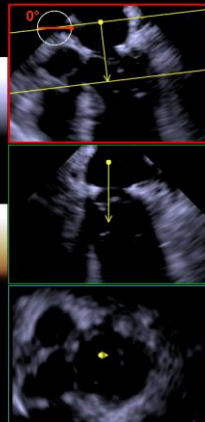
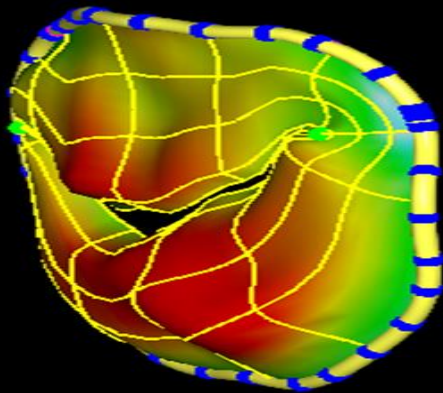
Static Modeling



**Dynamic Modeling
With ECG**

eSie Valves package

Automated Quantitative Valve Assessment Surgery Planification



Diagnosis

Mitral Valve

Ann AP Diam	30.4 mm
Ann AL-PM Diam	38.4 mm
Ant Ann Perimeter	48.6 mm
Post Ann Perimeter	67.4 mm
Total Ann Perimeter	116.0 mm
Ann Area	1008.8 mm2
Intertrigonal Dist	26.5 mm
Valve Orifice Area	112.8 mm2
Intercomm Dist	29.7 mm

13 vps
9 / 39

Intervention

Mitral Valve

Ann AP Diam	44.5 mm
Ann AL-PM Diam	46.7 mm
Ann AP Diam/AL-PM ...	1.0
Ann Area	1771.2 mm2
Intertrigonal Dist	33.2 mm
Intercomm Dist	31.6 mm
A1 Leaf Length	15.7 mm
A2 Leaf Length	23.1 mm
A3 Leaf Length	14.8 mm
P1 Leaf Length	16.5 mm
P2 Leaf Length	22.8 mm
P3 Leaf Length	18.2 mm
A1-P1 Coapt Height	0.0 mm
A2-P2 Coapt Height	0.0 mm
A3-P3 Coapt Height	0.0 mm
Avg Flail Gap	3.7 mm

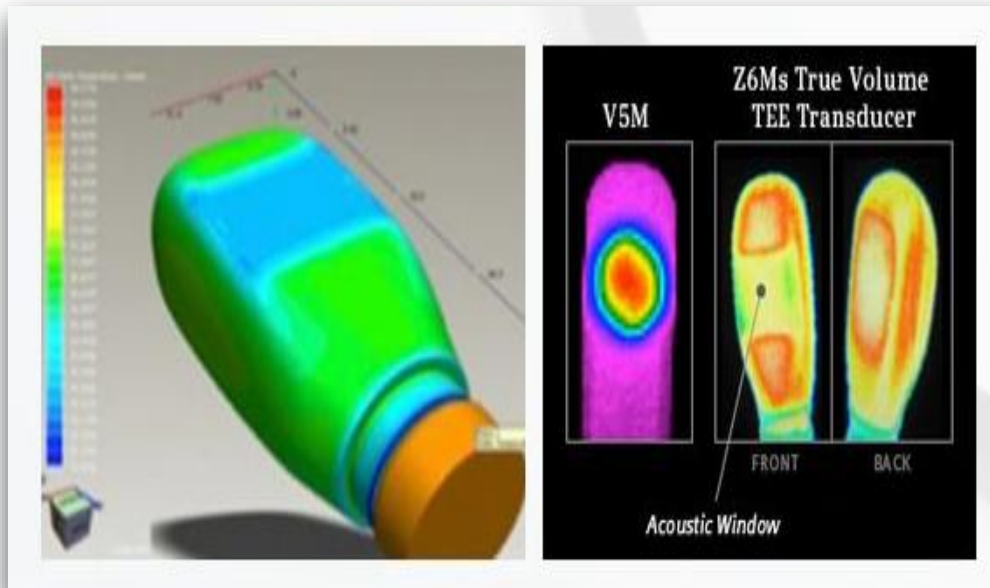
12 vps / 100
Frame# 6 6

The Thermal Management

High temperature of the probe is frequently a problem with 3D TEE probe

- > Risk of esophageal lesion
- > Necessity to interrupt the exam

To obtain uninterrupted imaging and diminished the risk of lesion: Special Thermal insulation and Thermal management

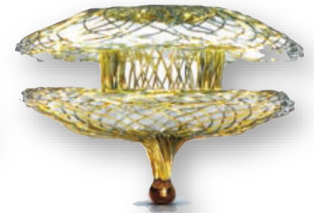


Z6M transducer

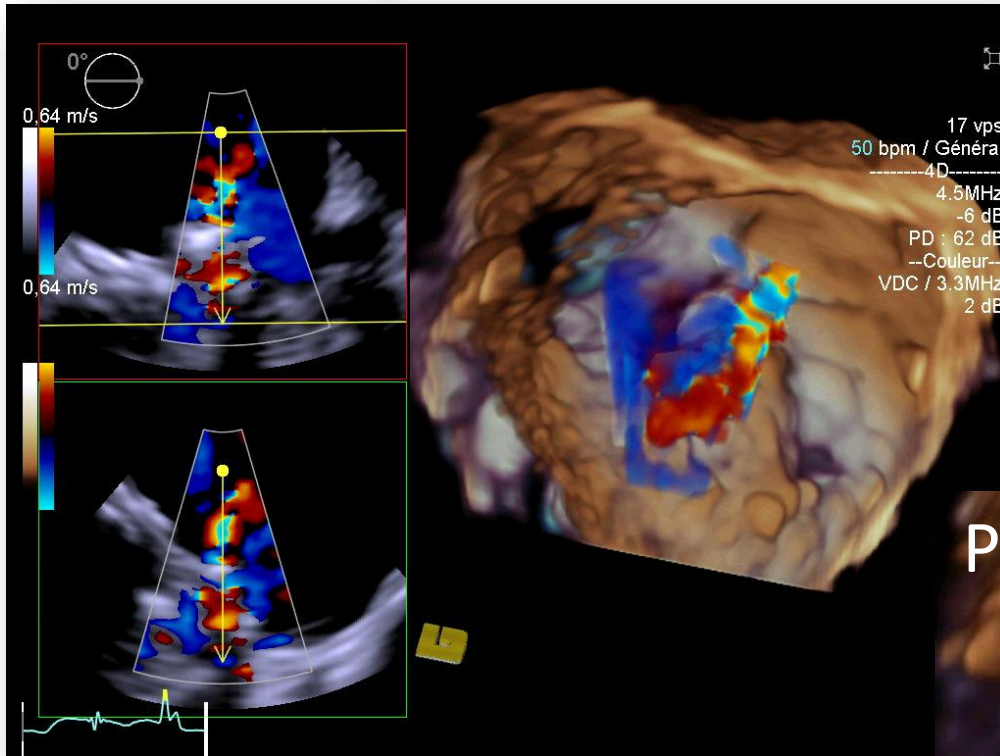
Multimodality imaging

Clinical Case : Treatment of Para-Valvular leak

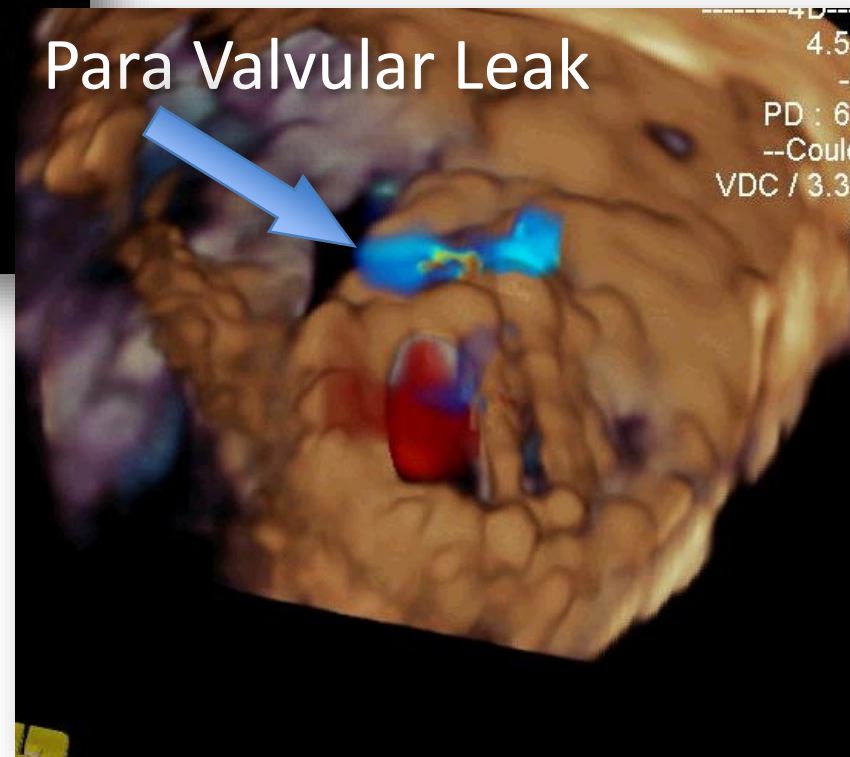
- Female, 76 years old
- Mitral Mechanical (St Jude) valve since 2002
- Para-Valvular leak with severe hemolysis
- Closure with Paravalvular leak Device (Occlutech)
- Transapical access
- Hybrid room
- Multimodality imaging combining
 - Full volume 3D TEE
 - Artis Zeego fluoroscopy



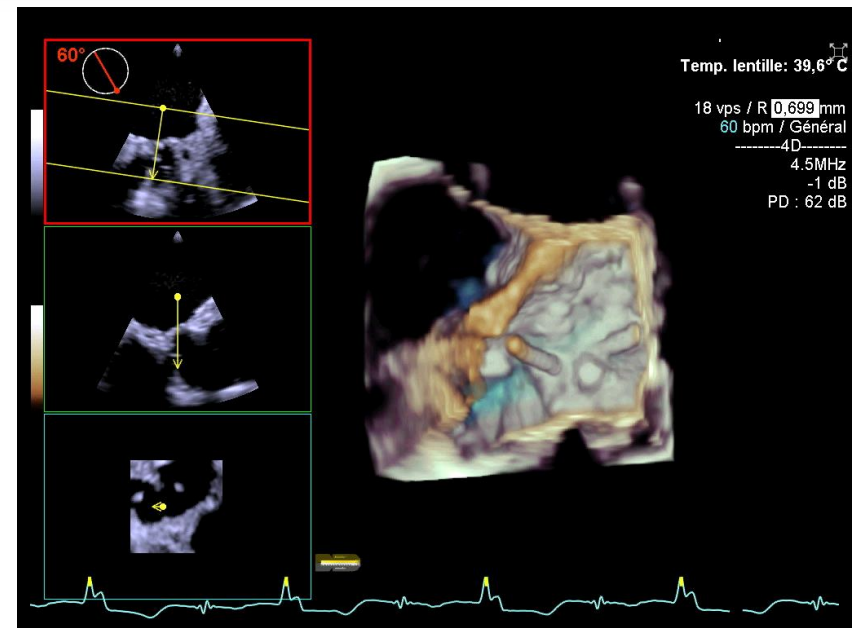
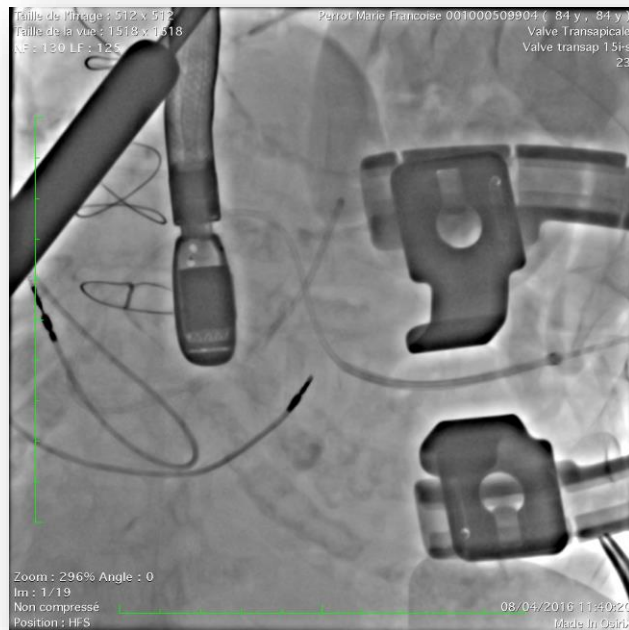
Analysis of the Paravalvular Leak



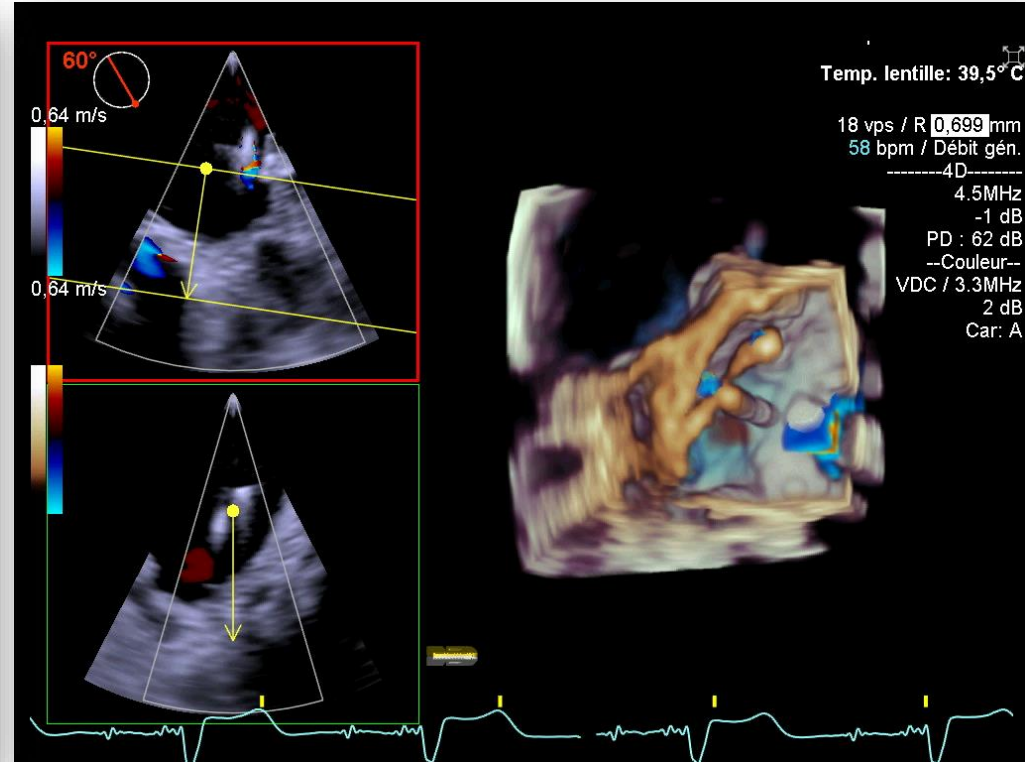
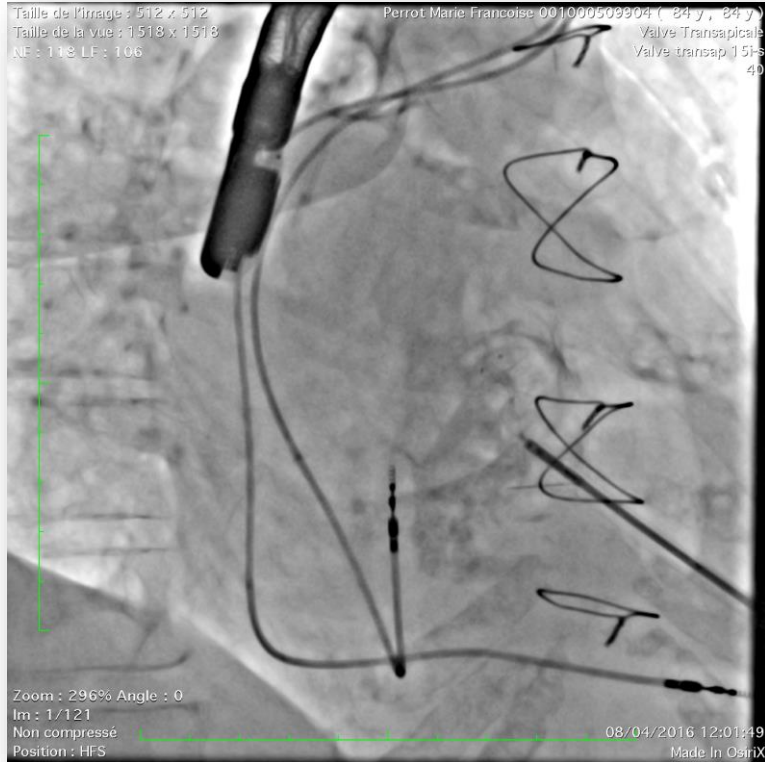
**Full volume 3D TEE
with color doppler
(17 vps)**



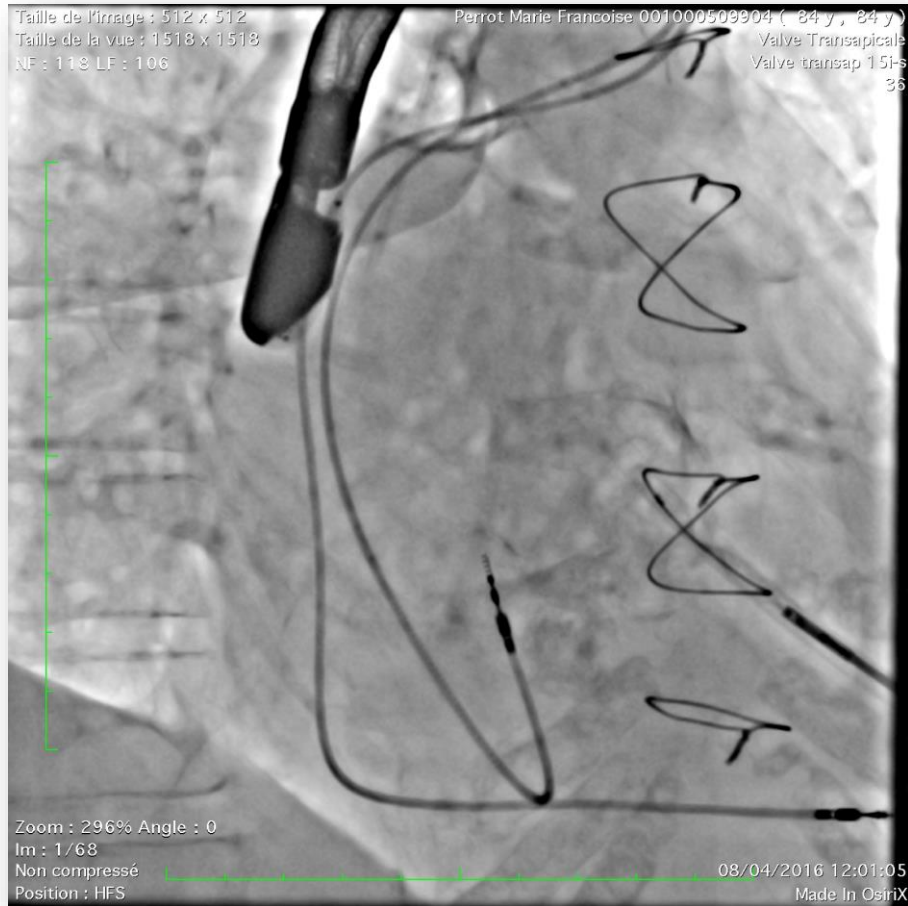
Crossing the dehiscence



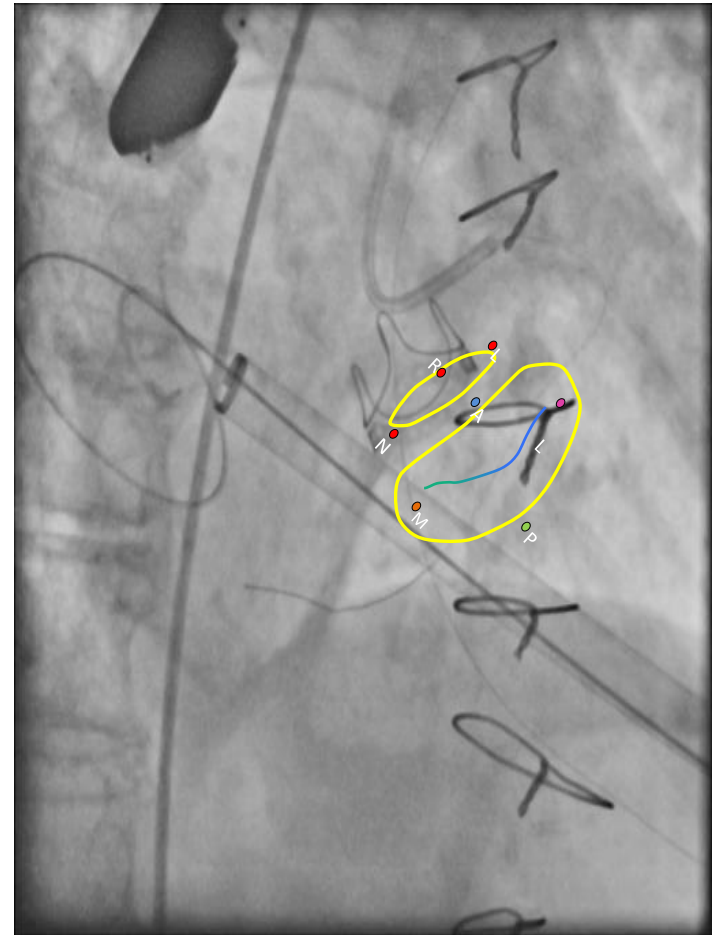
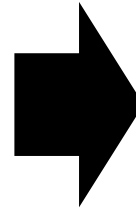
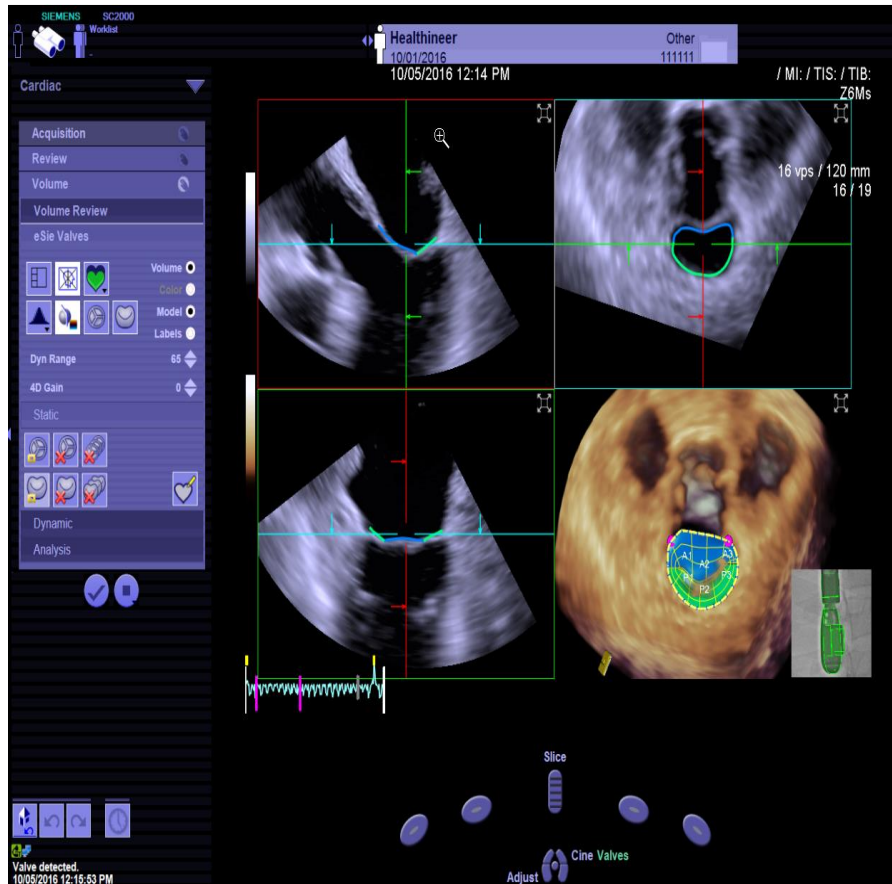
Sheath in place



Paravalvular leak Device in place



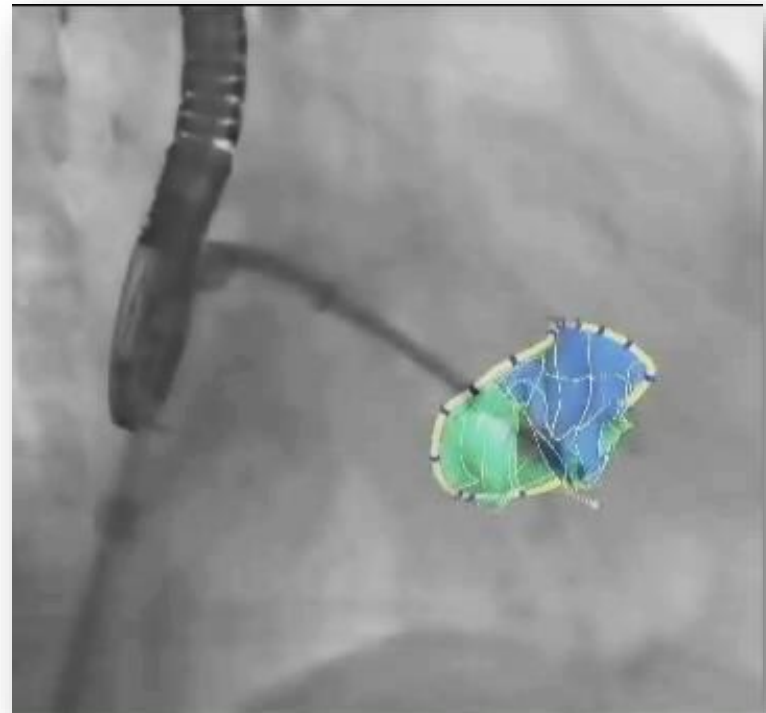
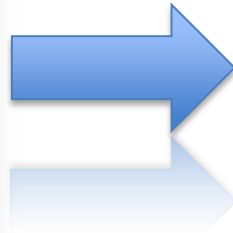
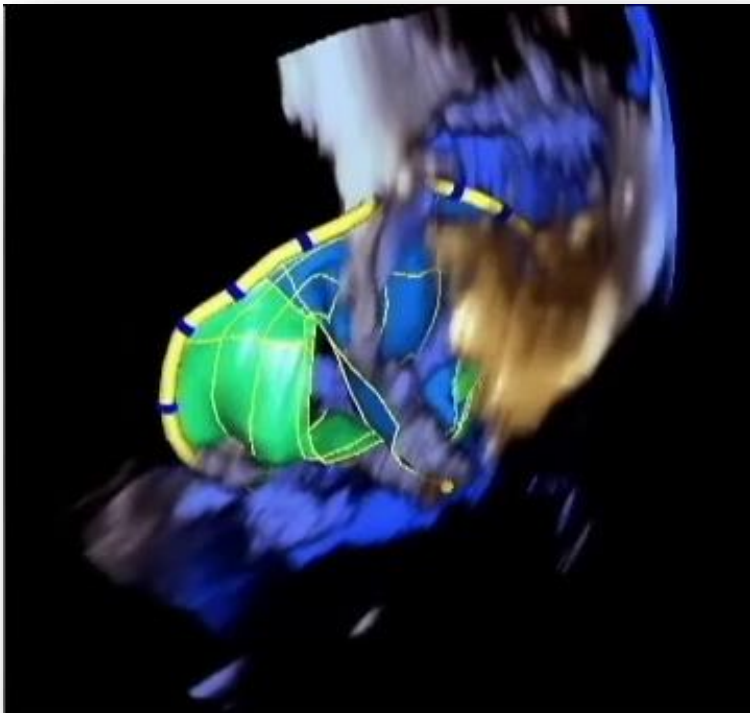
Siemens TrueFusion with eSie Valves



Not commercially available

What we need for the future ?

Dynamic Fusion of Valve modeling with fluoroscopy



CONCLUSION

- Advanced Valve Therapy needs new imaging tools !
- Multimodality imaging is of major interest
- Combining Full Volume 3D TEE and Fluoroscopy
- Images with High Volume Rate is mandatory to obtain
-a precise and “real time” view of the procedure
- Dynamic Fusion will be the further step in a near future

