ETO normale

7 décembre 2009

ML Felten
Service d'Anesthésie du Pr.Fischler
Hôpital Foch, Suresnes

1. Notions générales

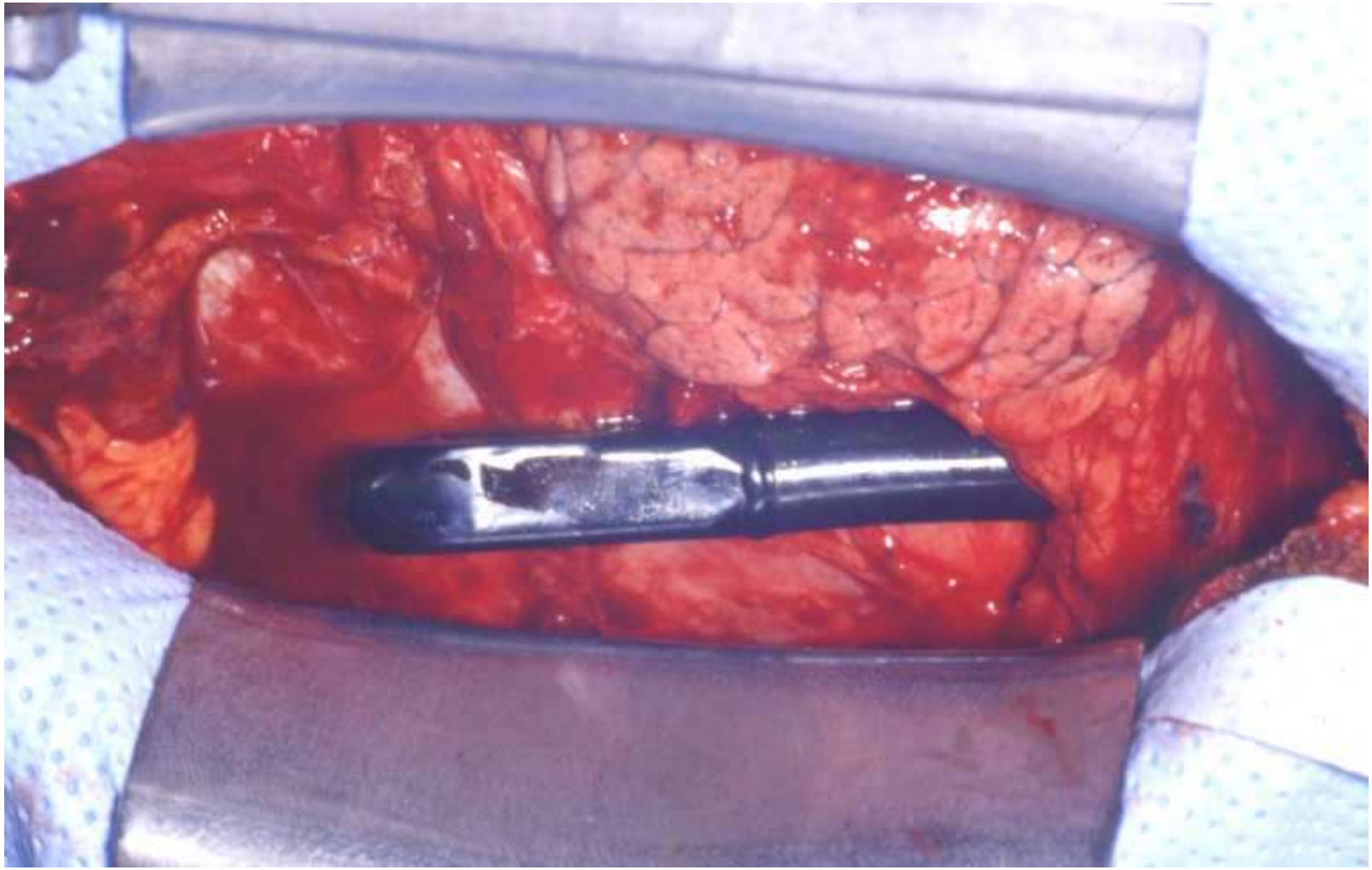
Eliminer une contre-indication à l'ETO :

- lésions rachidiennes cervicales du polytraumatisé
- pathologies oesophagiennes :
  varices, diverticules, tumeurs
- radiothérapie thoracique

Installation de l'ECG

ML Felten
DIU 2009

Introduire la sonde avec le laryngoscope et en douceur !!



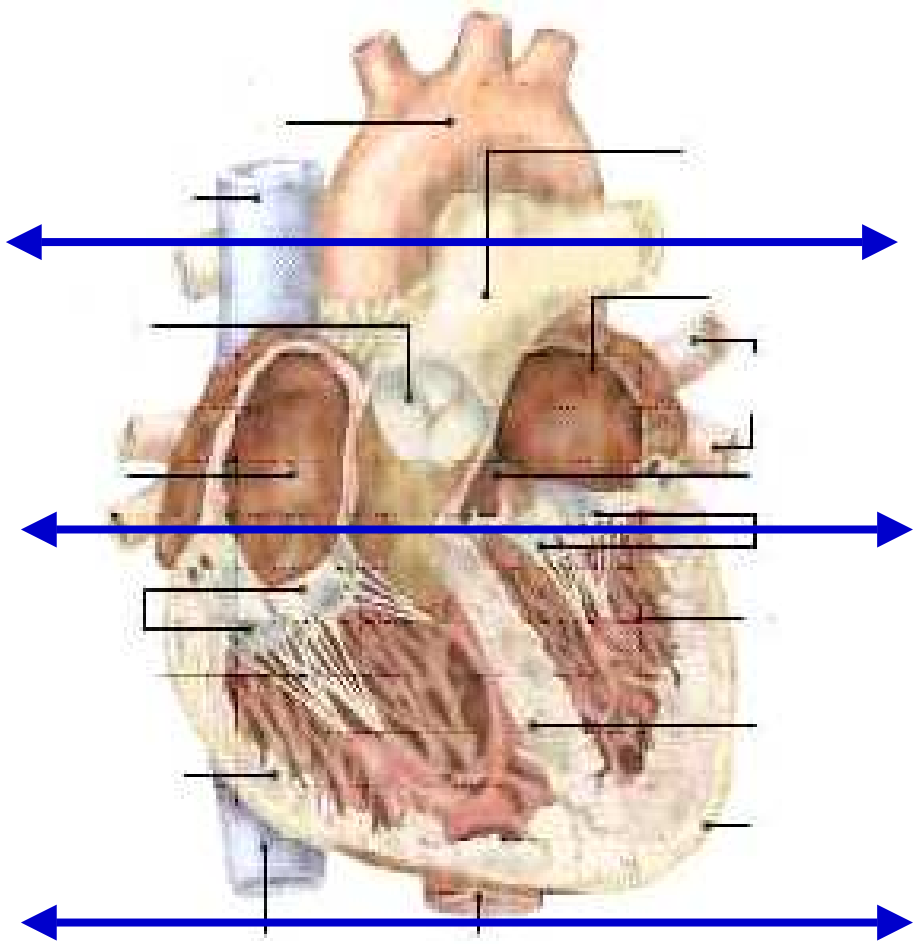
ML Felten
DIU 2009

Niveaux des coupes

Coupes oesophagiennes hautes

Coupes oesophagiennes moyennes
(30 à 40 cm des arcades dentaires)

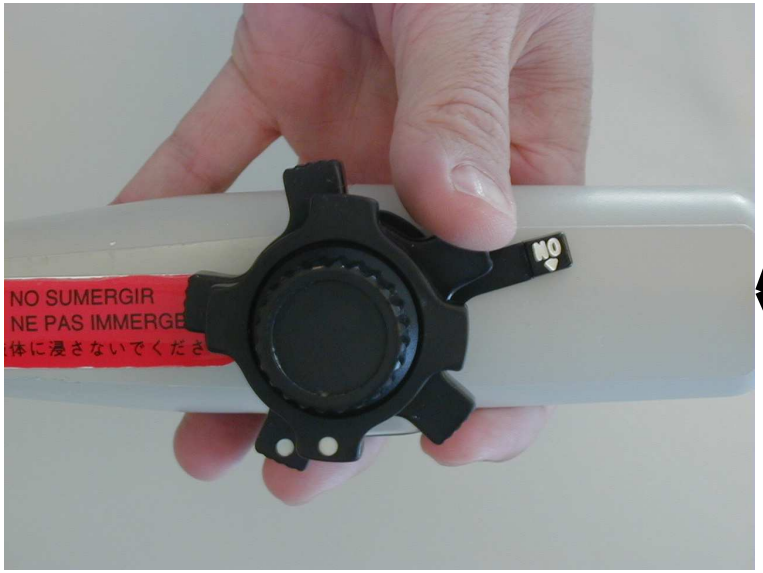
Coupes transgastriques

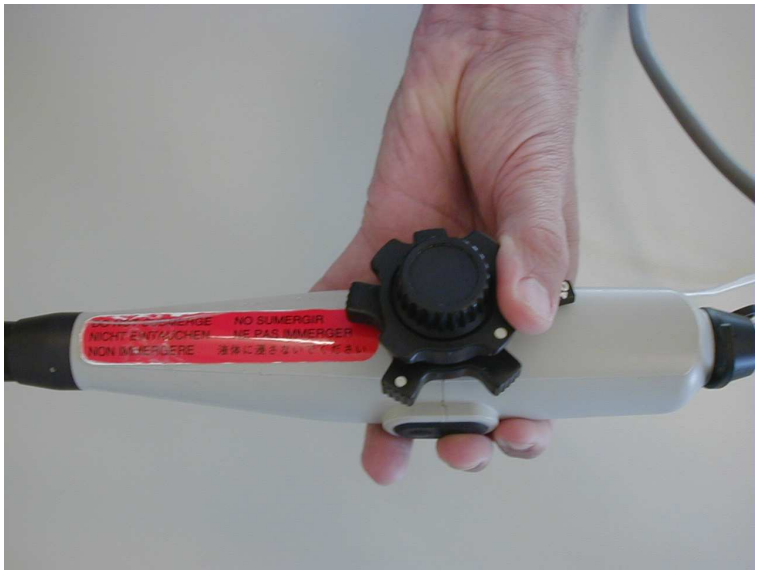


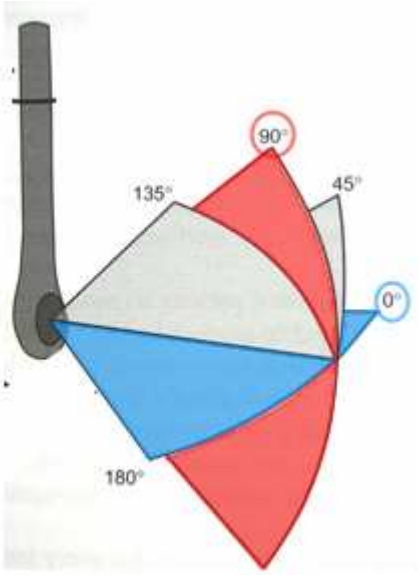
ML Felten
DIU 2009

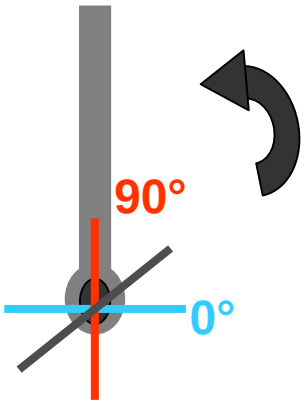
Mouvements de sonde

béquer ou
modifier
l'angle



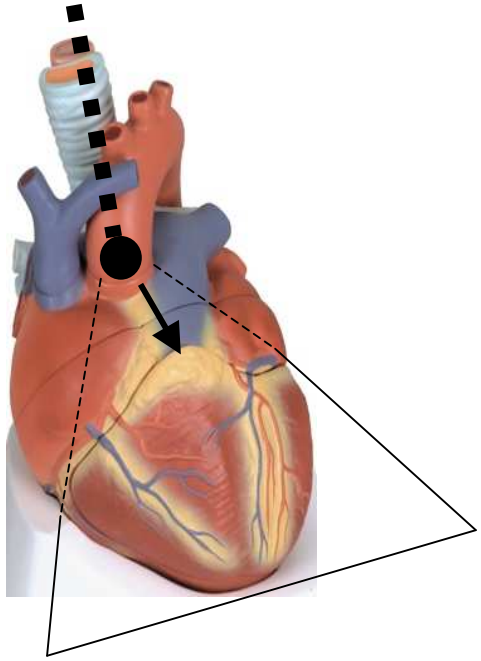


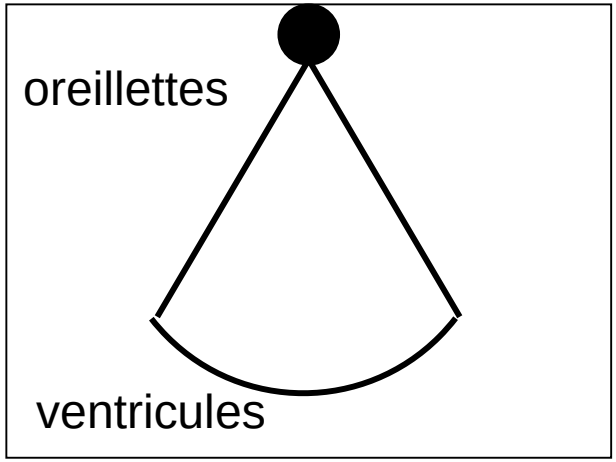


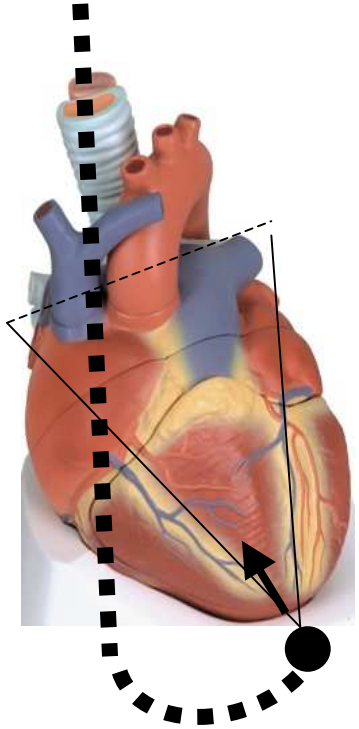


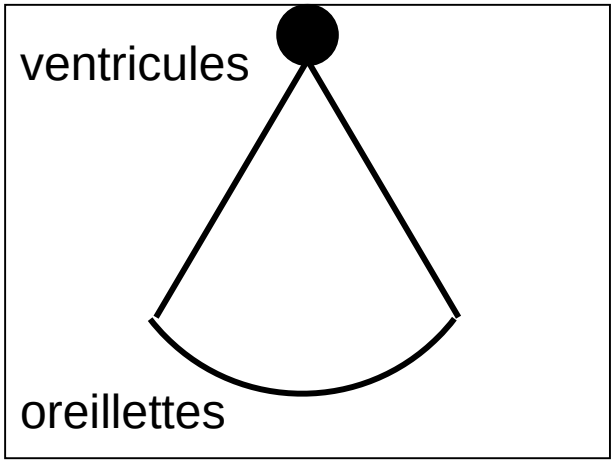
ML Felten
DIU 2009

Convention d'images









ML Felten
DIU 2009

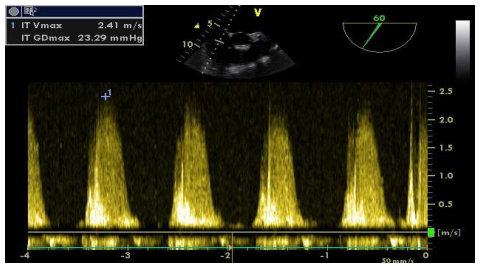
Conventions et modes échographiques

couleur : flux, venant vers la sonde, en rouge

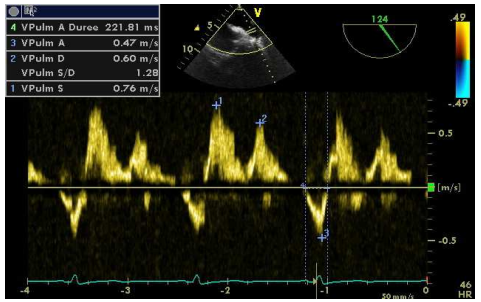
doppler : flux, venant vers la sonde, au-dessus de la ligne de base;

s'aligner sur le flux

continu (CW) : vitesses élevées
enveloppes « pleines »



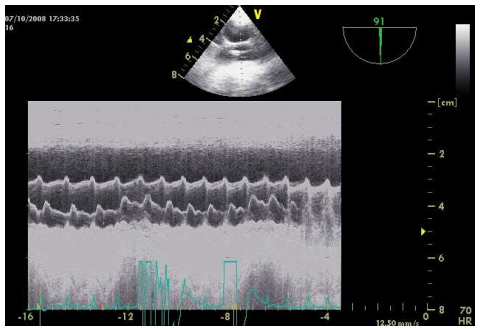
pulsé (PW) : vitesses faibles (< 1,5 m/s)
enveloppes « vides »



$4\ v^2 = \Delta\ P$

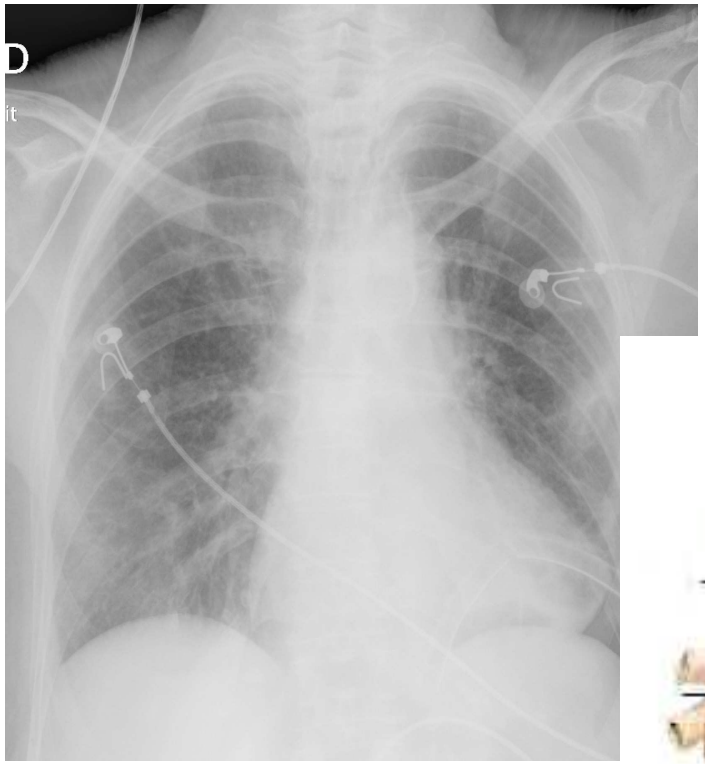
ITV : calcul des débits

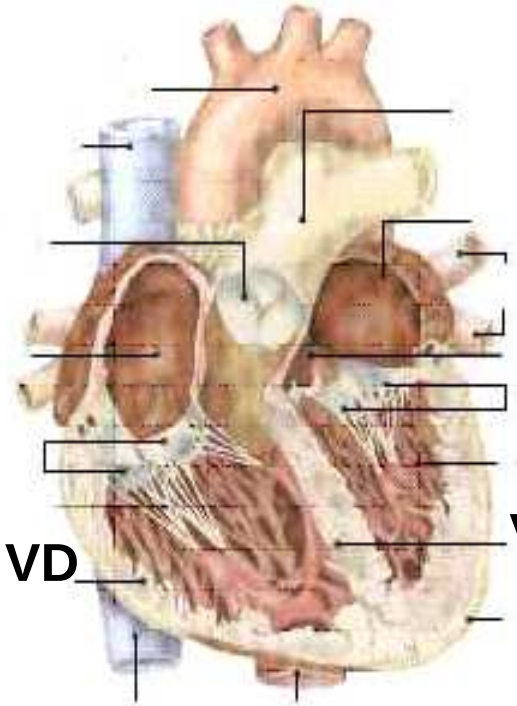
TM : mode temps-mouvements

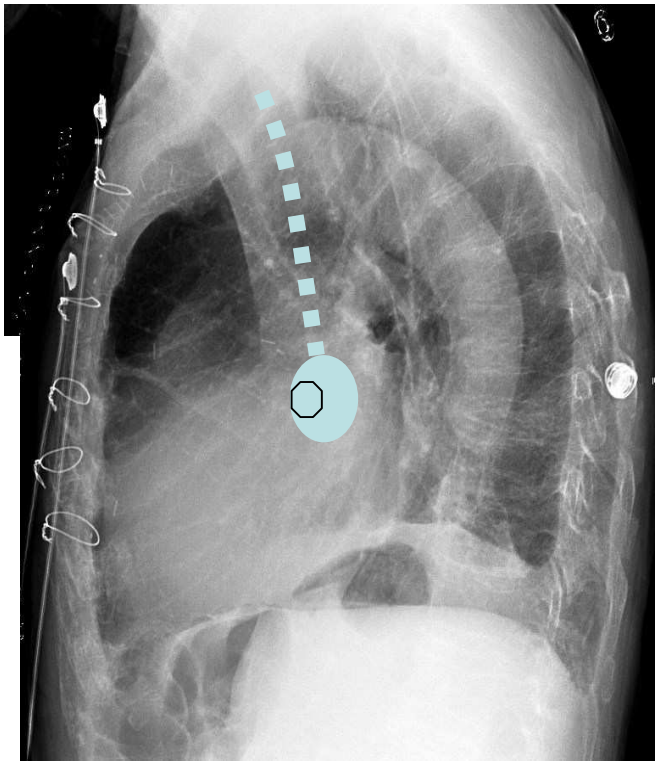


ML Felten
DIU 2009

La position du cœur et les plans de coupe de l'ETO





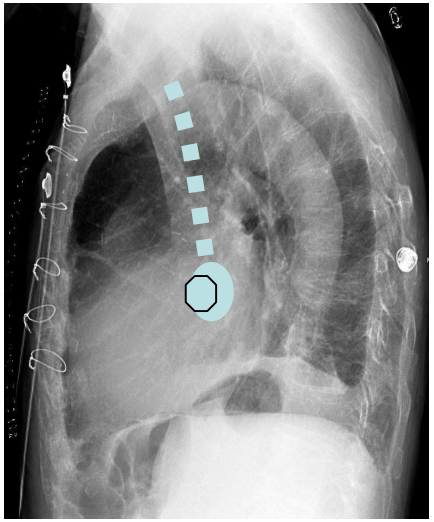


Rx thorax : profil

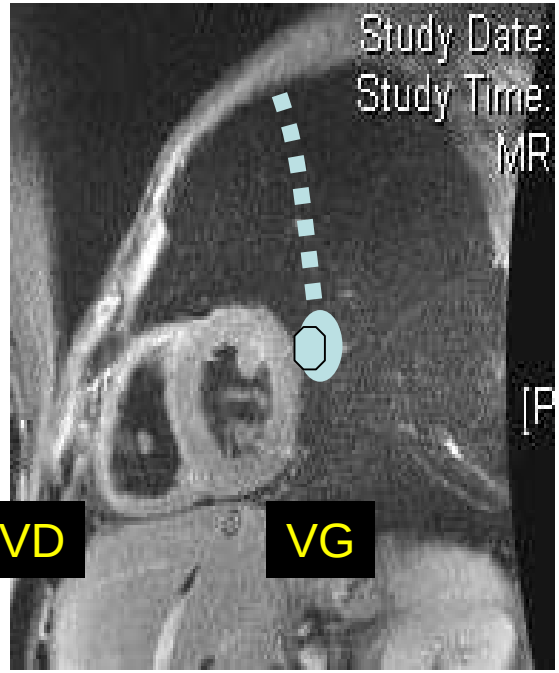
Les cavités droites sont en avant et les cavités gauches en arrière.

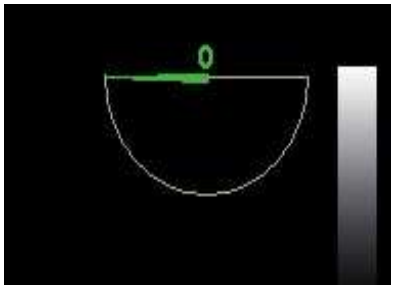
L'aorte thoracique descendante est en arrière.

ML Felten
DIU 2009

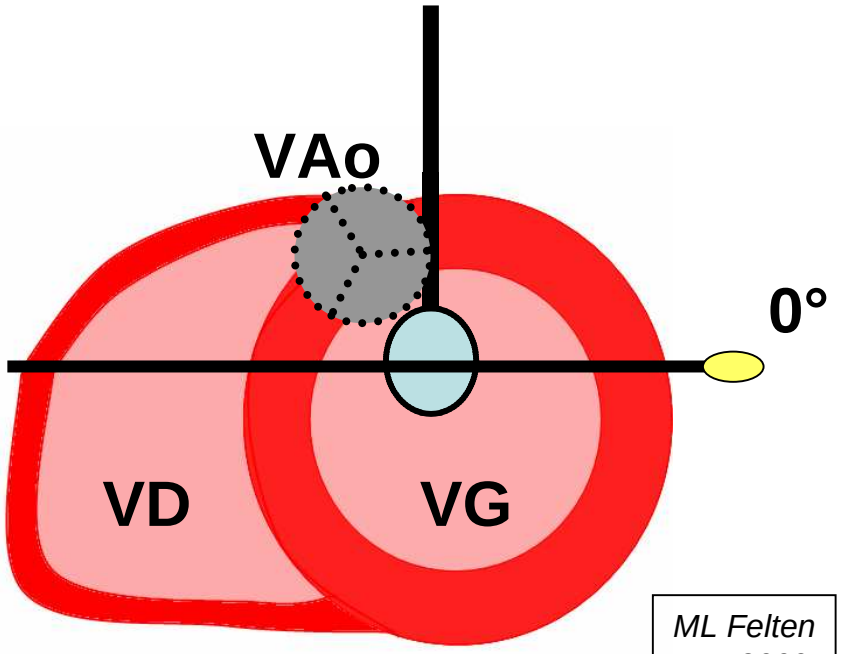


IRM cardiaque (profil)

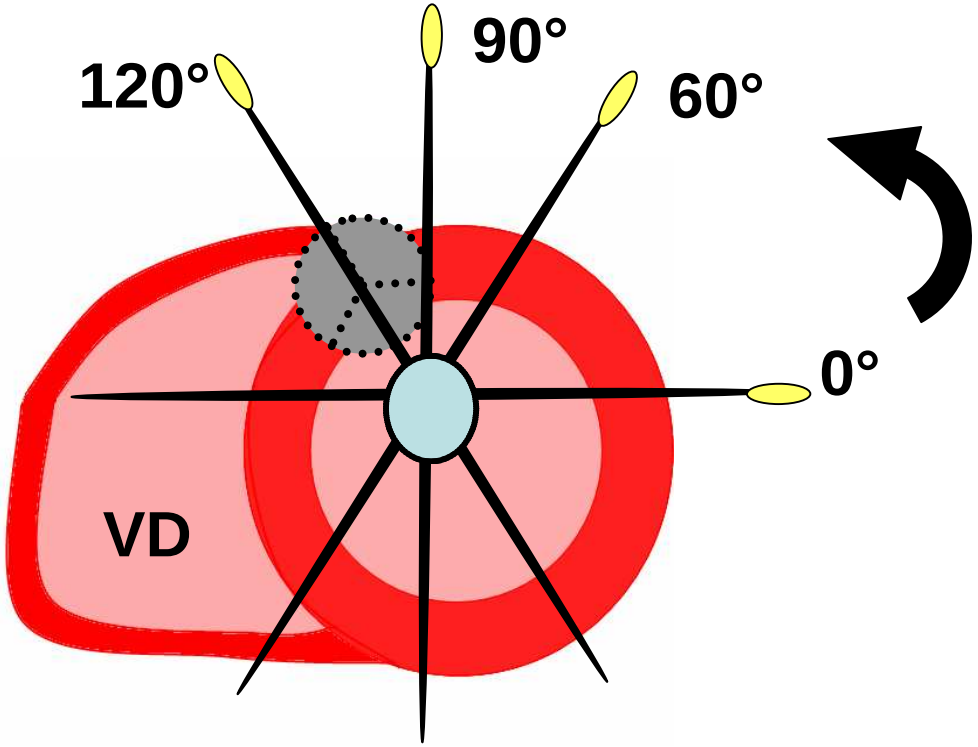




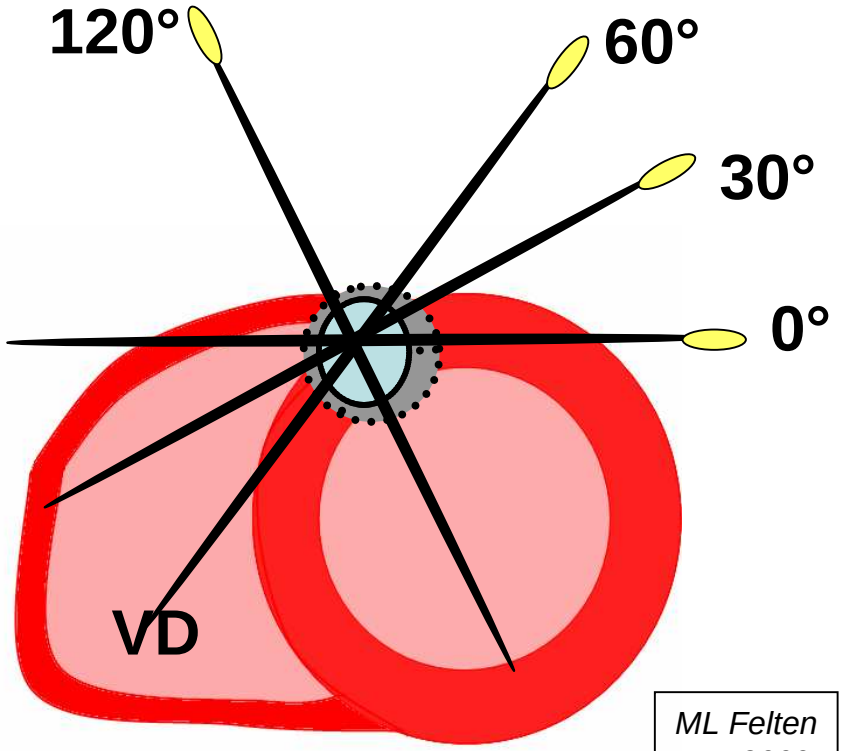
0° est perpendiculaire
à la tête de la sonde



ML Felten
DIU 2009



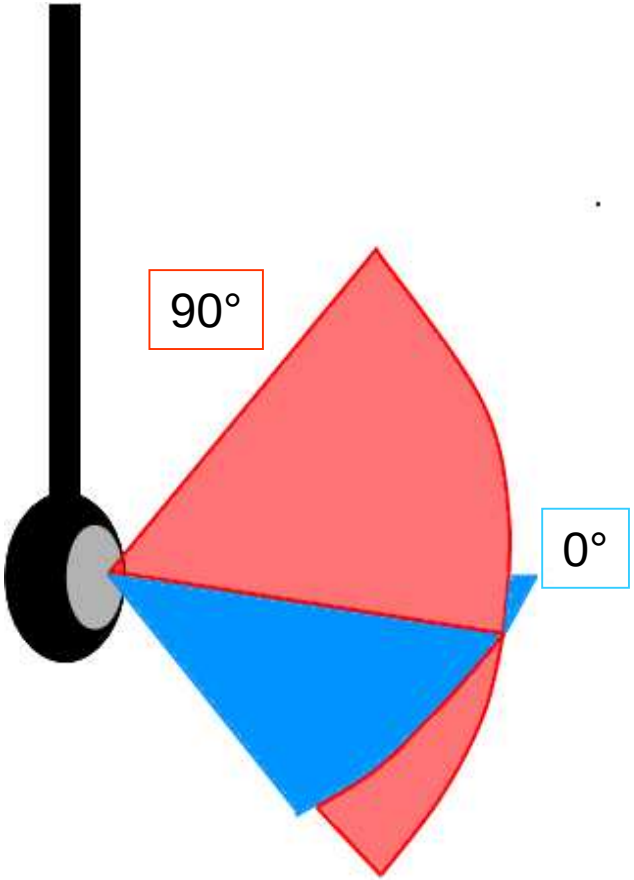
De face, le plan d'ultrasons tourne dans le sens contraire des aiguilles d'une montre.

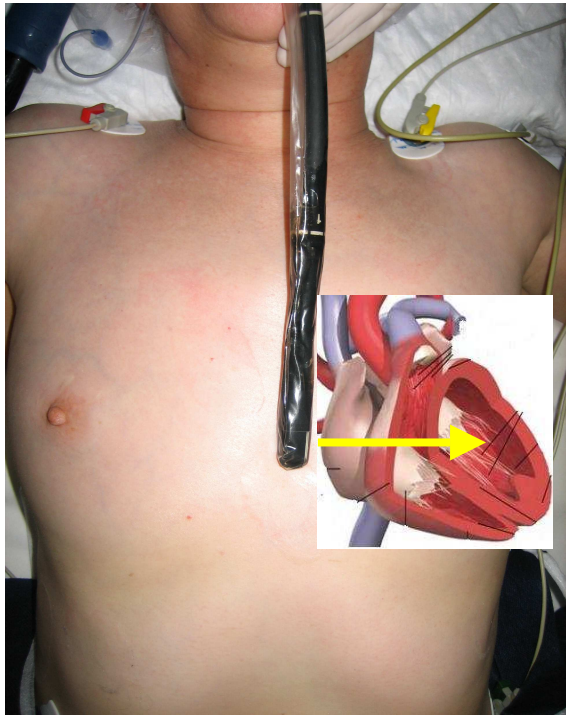


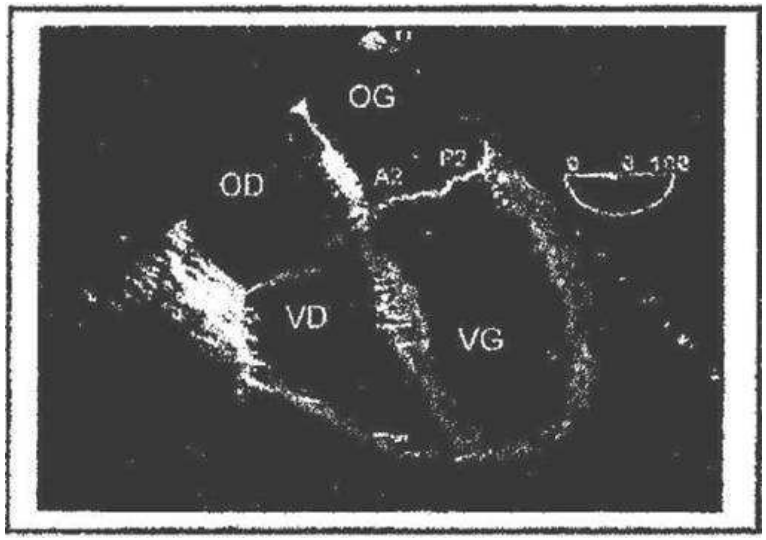
Retrait de la sonde de qqs cm : Pour un même angle de plan d'ultrasons, on visualise des structures différentes.

ML Felten
DIU 2009

0° est perpendiculaire à la tête de la sonde







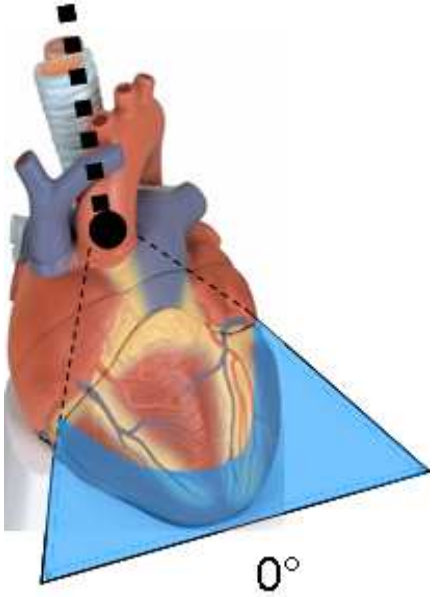
ML Felten
DIU 2009

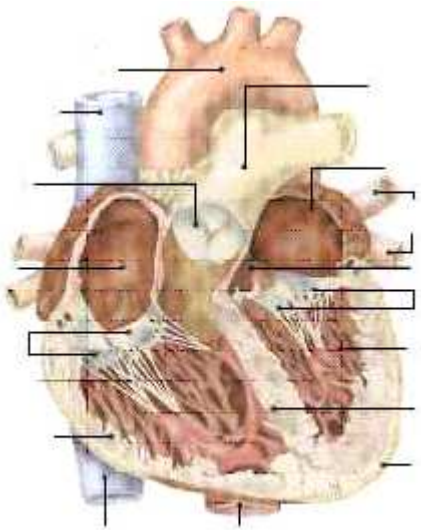
1. Notions générales

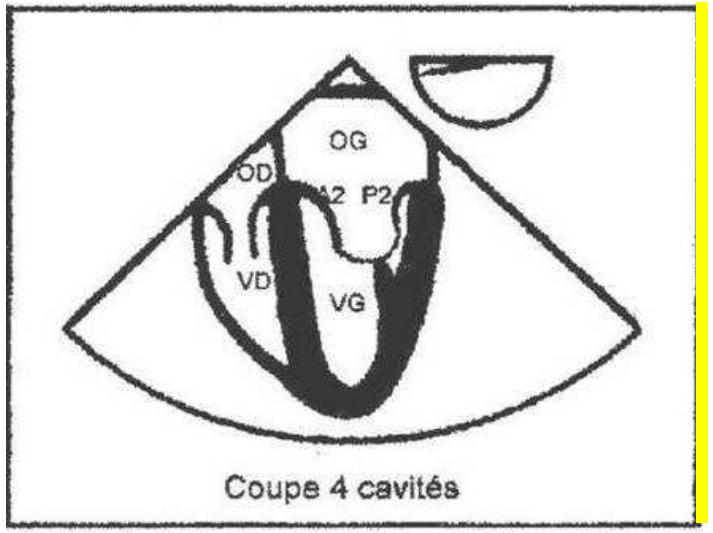
2. Coupes oesophagiennes : 4 cavités / Mercedes et les autres

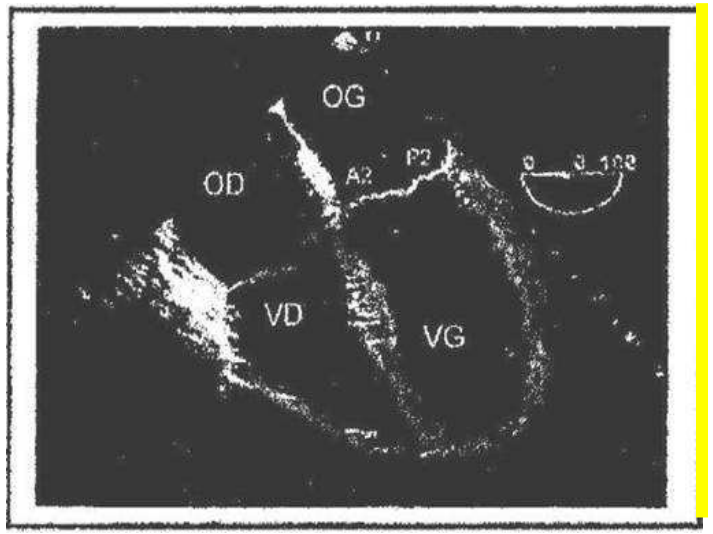
ML Felten
DIU 2009

Coupe oesophagienne moyenne 4 cavités : 0°

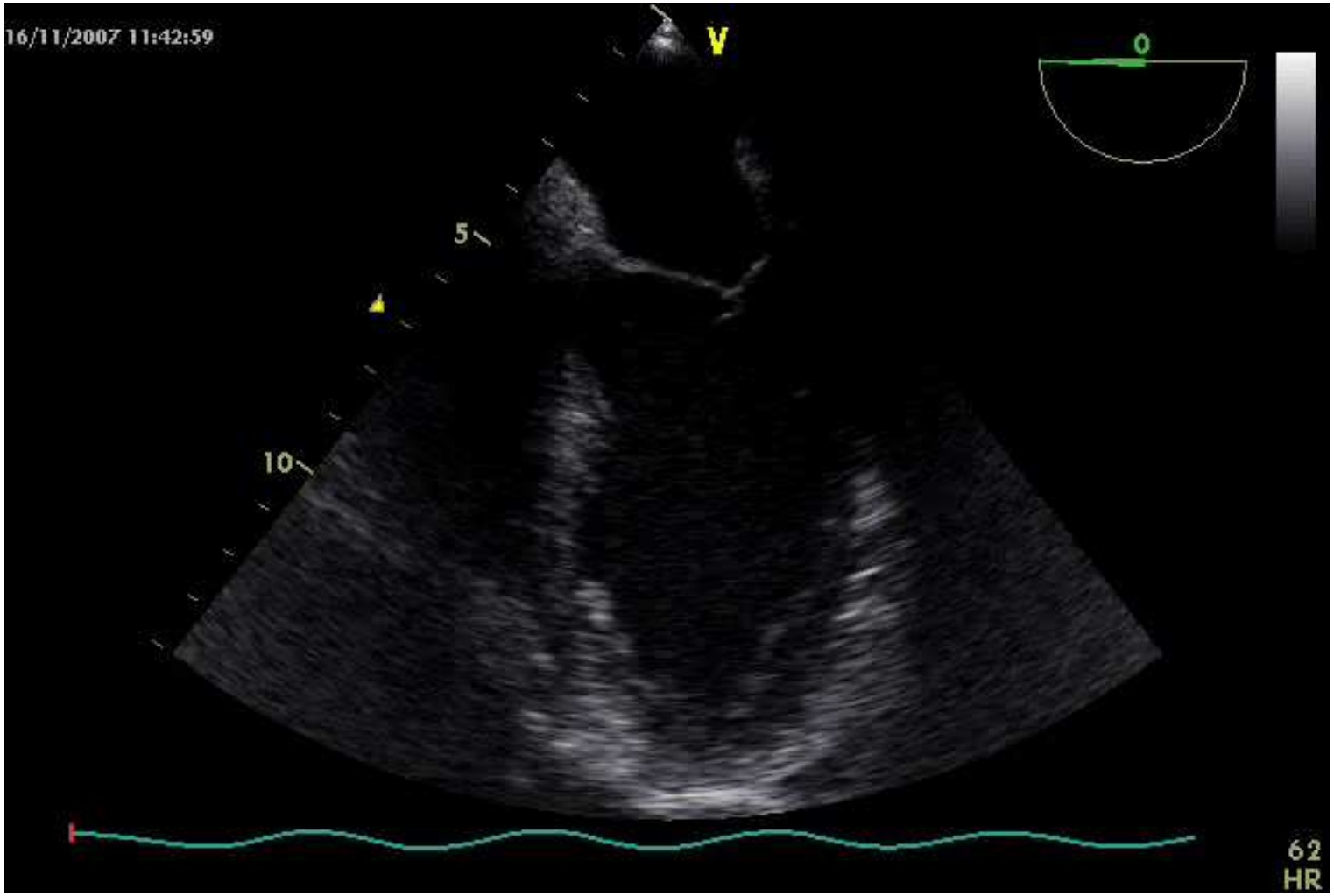








ML Felten
DIU 2009

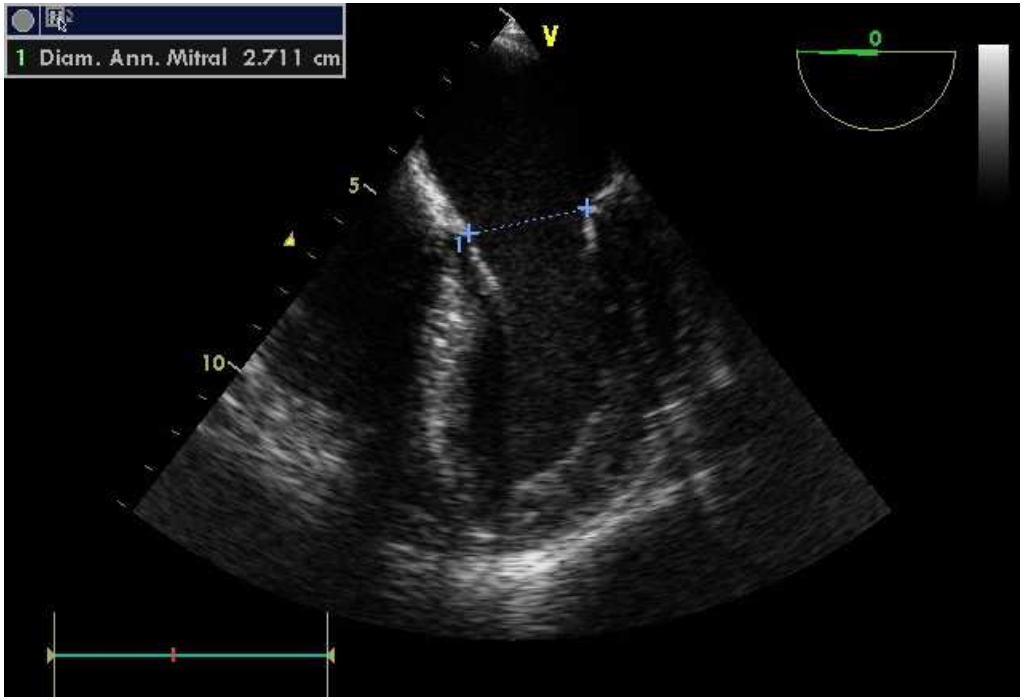


- Evaluations visuelles VG et VD
- Rapport VG/VD : ⅔ - ⅓ et pointe = VG
- Dimensions OG/VG et VG/VD

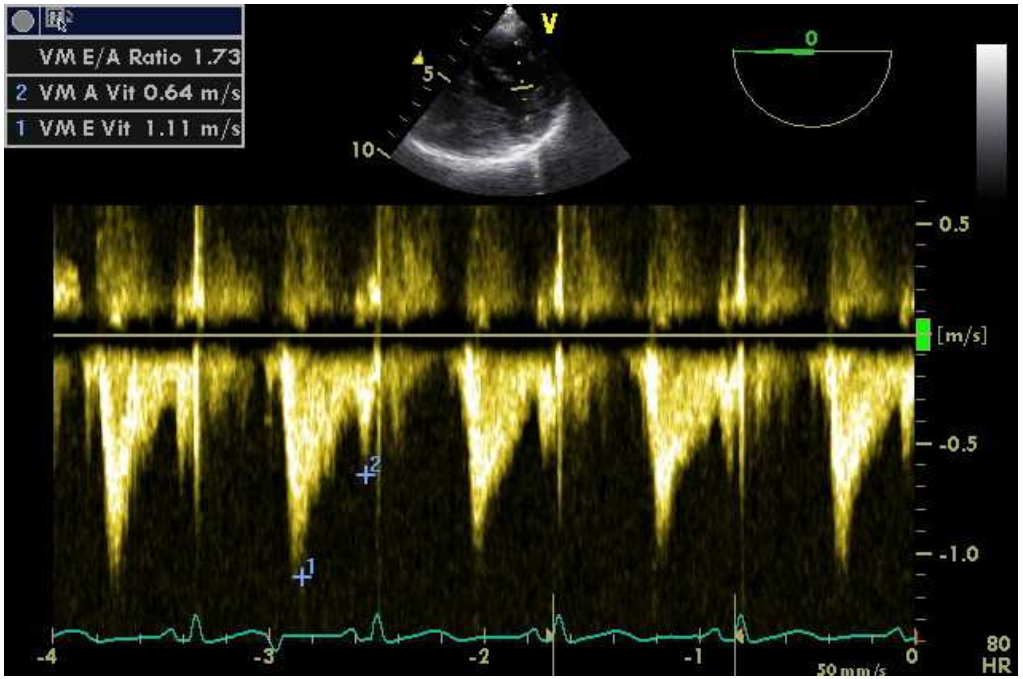
ML Felten
DIU 2009

Valve mitrale : couleur : ? fuite mitrale

ML Felten
DIU 2009



- diamètre de l'anneau mitral (valve ouverte) = 2,9 ± 0,3 cm
- surface 4 – 6 cm^2



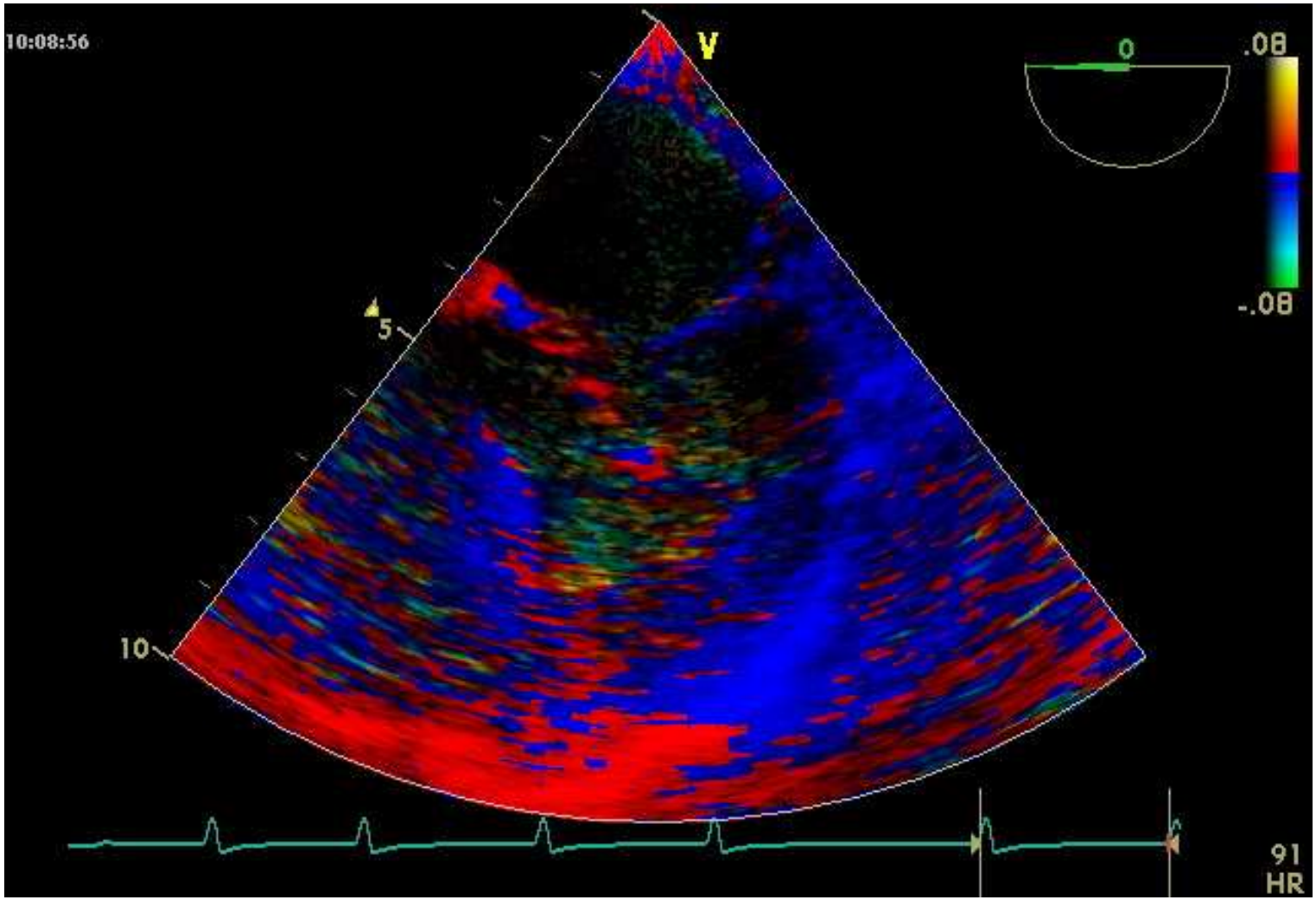
!! ECG !! : flux diastolique

doppler pulsé :

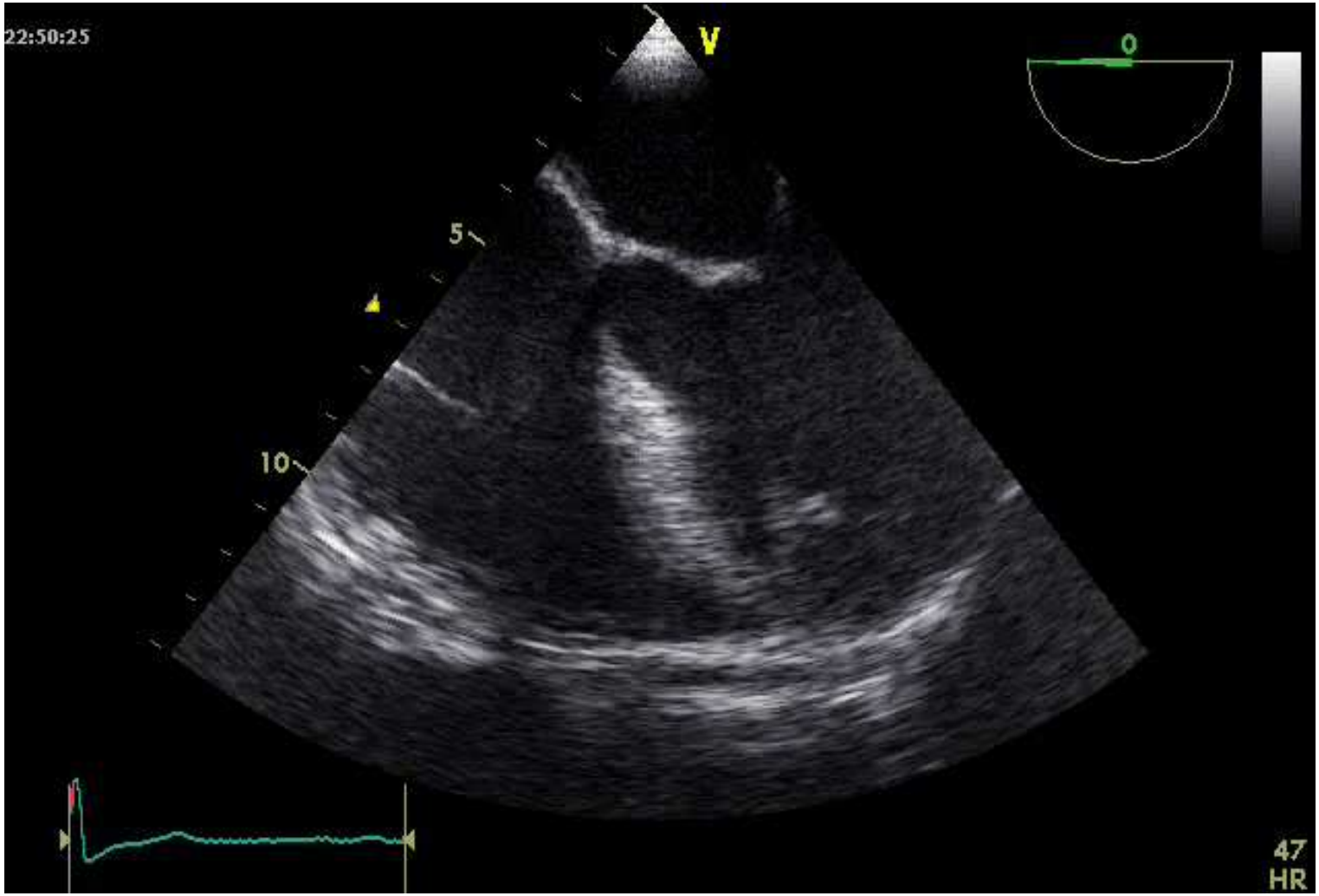
- E= 80 ± 20 cm/s
- A= 50 ± 20 cm/s (contraction OG)
- E/A = 1-2
- gradient mitral < 4 mmHg (4 v^2)

ML Felten
DIU 2009

La fonction diastolique du VG : déplacement de l’anneau mitral.
(Doppler tissulaire : sous-fonction du doppler pulsé)

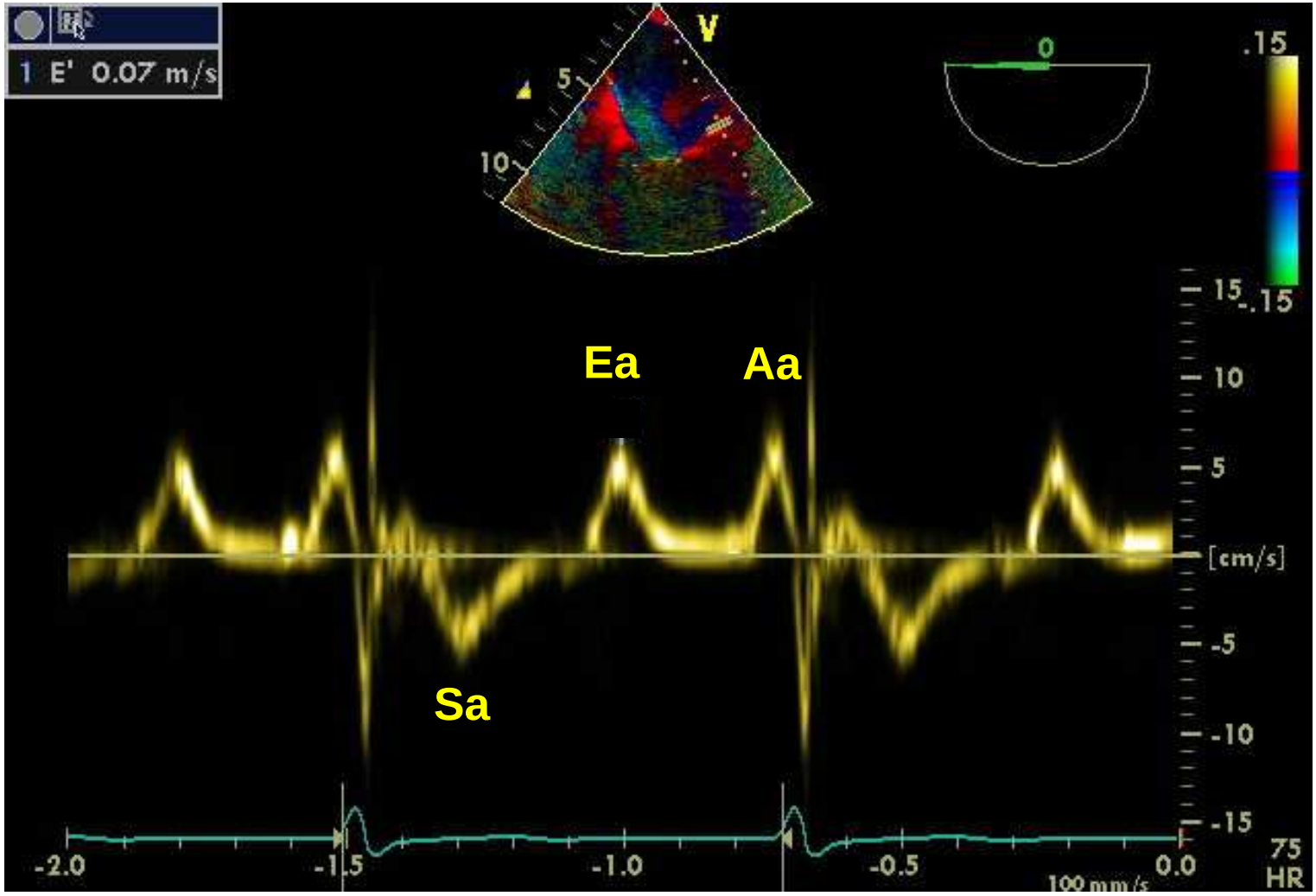


ML Felten
DIU 2009



L’anneau mitral descend pendant la contraction du VG et remonte pendant la diastole. Les ondes diastoliques Ea et Aa du doppler tissulaire seront donc en-dessous de la ligne de base.

ML Felten
DIU 2009

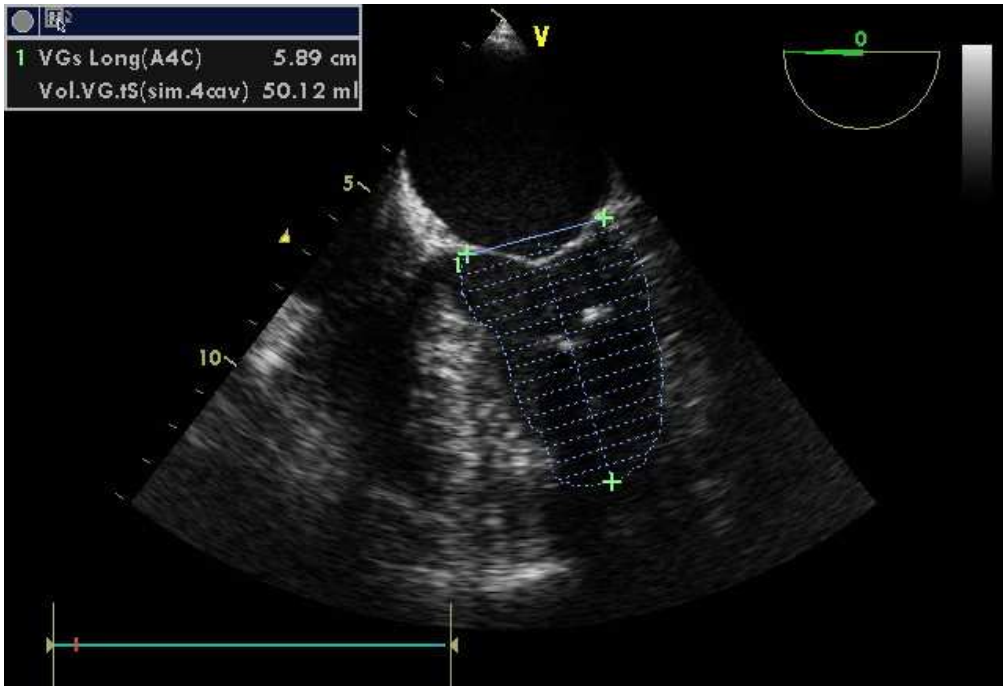


Ea et Aa ont un profil de flux inversé de E/A, Ea > Aa.

E ann = 10 ± 2 cm/s => E/Eann = 8 (80/10)

ML Felten
DIU 2009

ML Felten
DIU 2009



Dimensions du VG (4 cav) :

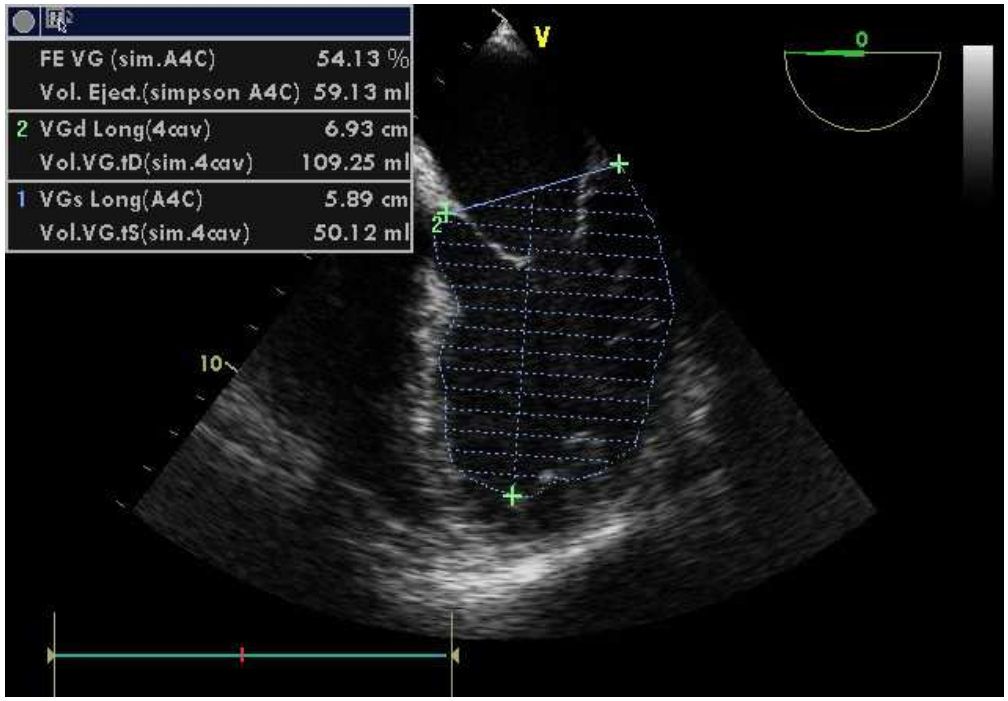
- systole : 3,2 x 4,8 cm (± 0,8 cm)
- diastole : 4,8 x 6,1 cm (± 0,8 cm)

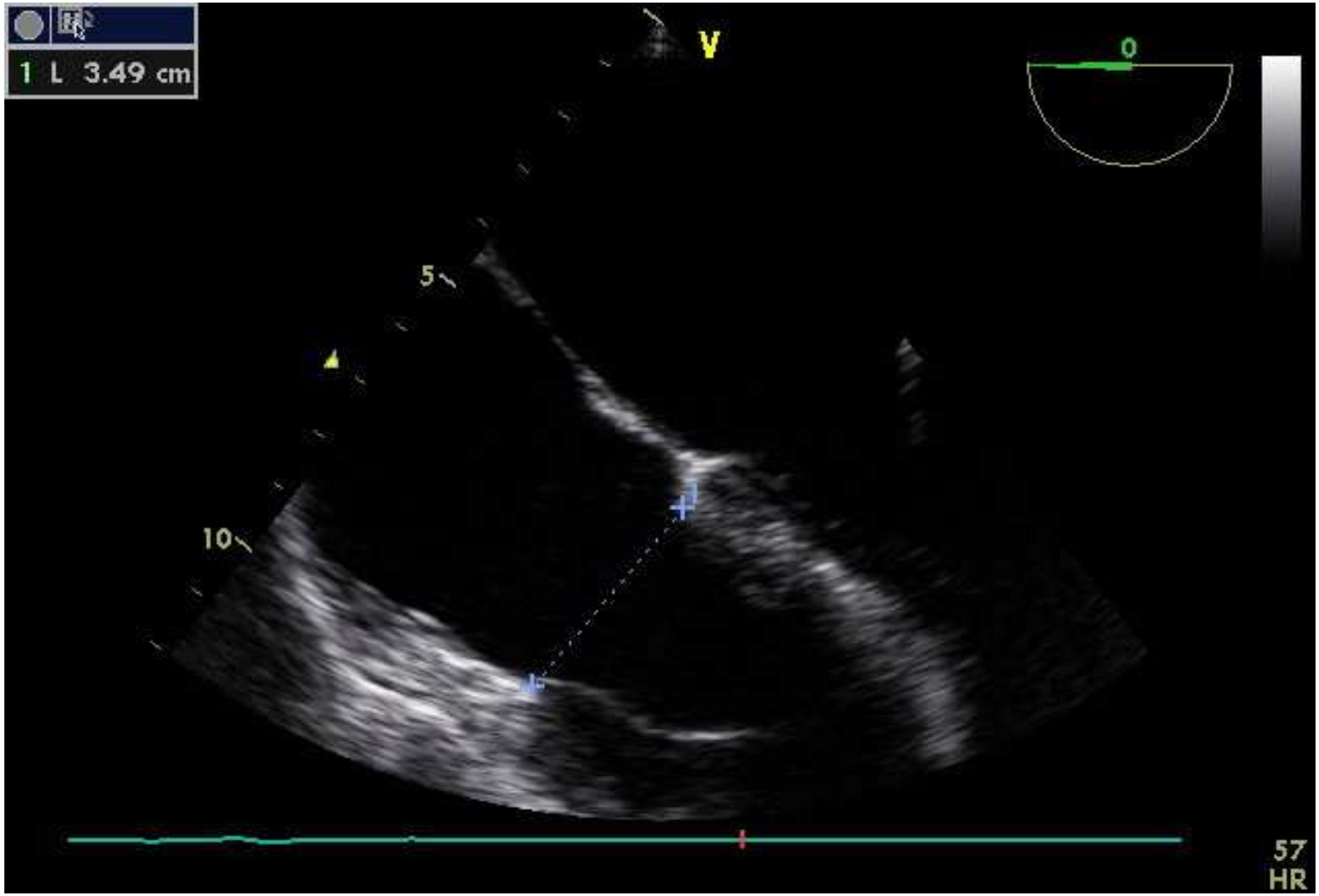
La fonction systolique du VG :

Comparaison de volumes **(Simpson)** :

FEVG = (VTD - VTS/ VTD) x 100

= 55 – 75 %



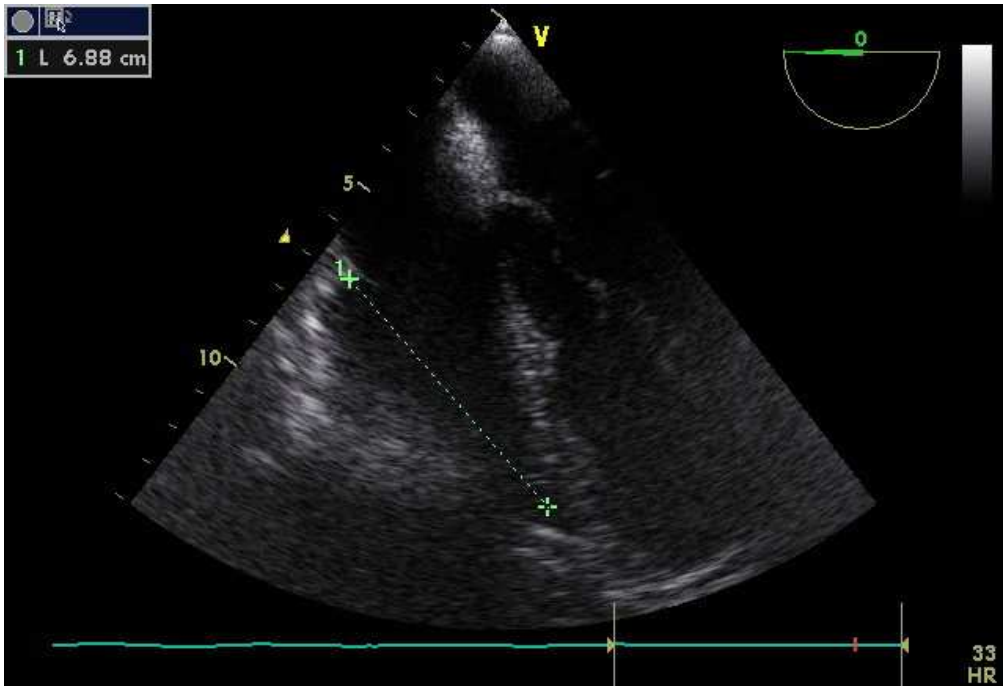


anneau tricuspide : 2,8 ± 0,5 cm

surface : 7- 9 cm^2

ML Felten
DIU 2009

ML Felten
DIU 2009

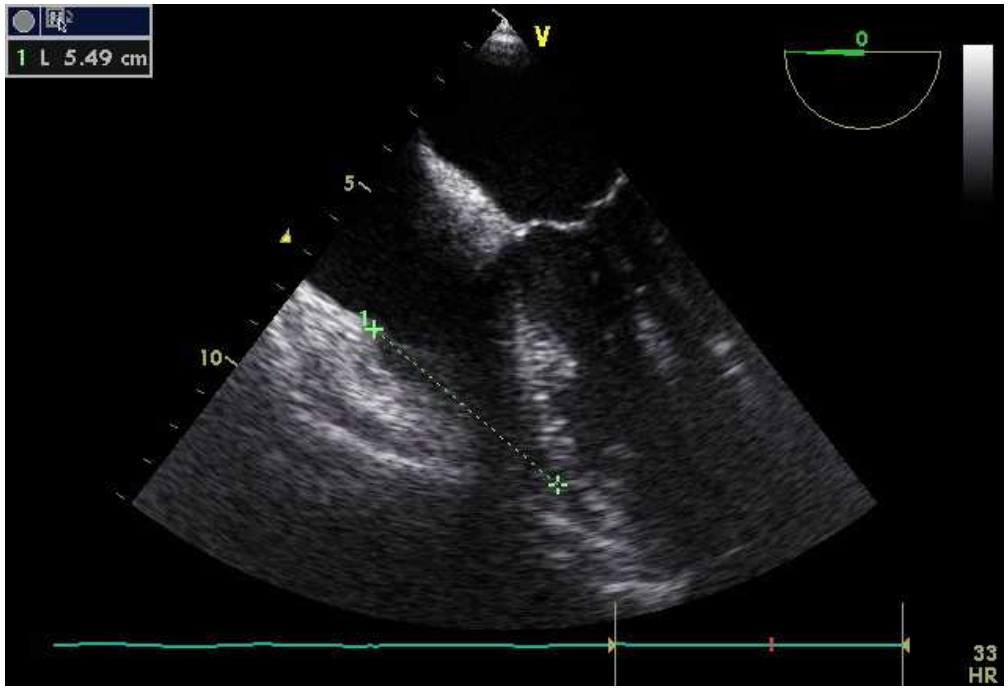


Dimensions du VD (4 cav) :

- systole : 1,8 x 4,1 cm (± 0,5 cm)
- diastole : 2,9 x 5,0 cm (± 0,5 cm)

La fonction systolique du VD :

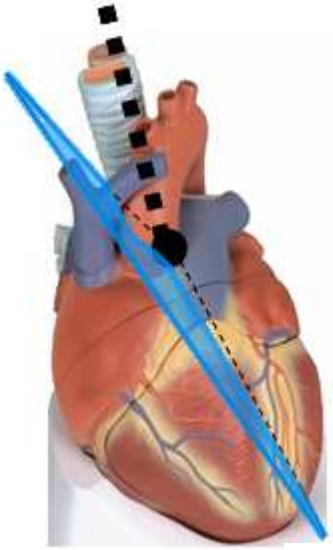
- raccourcissement = 2 – 2,5 cm

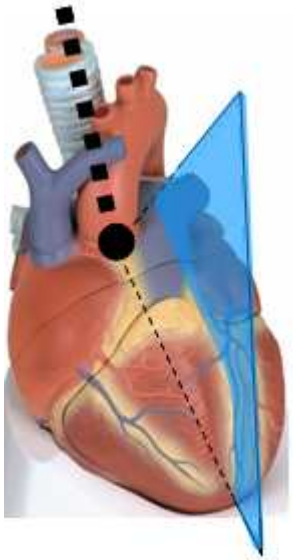


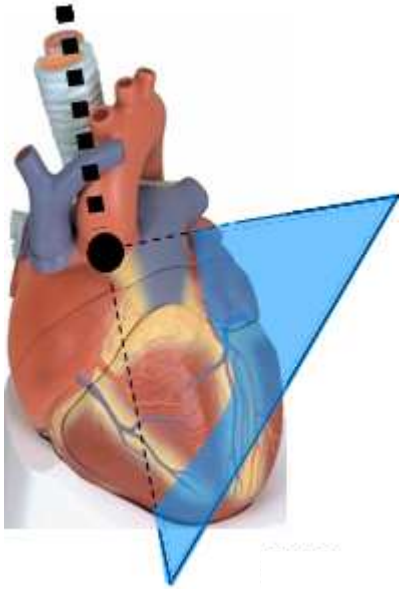
La rotation du plan d'ultrasons à partir de la coupe 4 cavités : les 8 coupes oesophagiennes moyennes

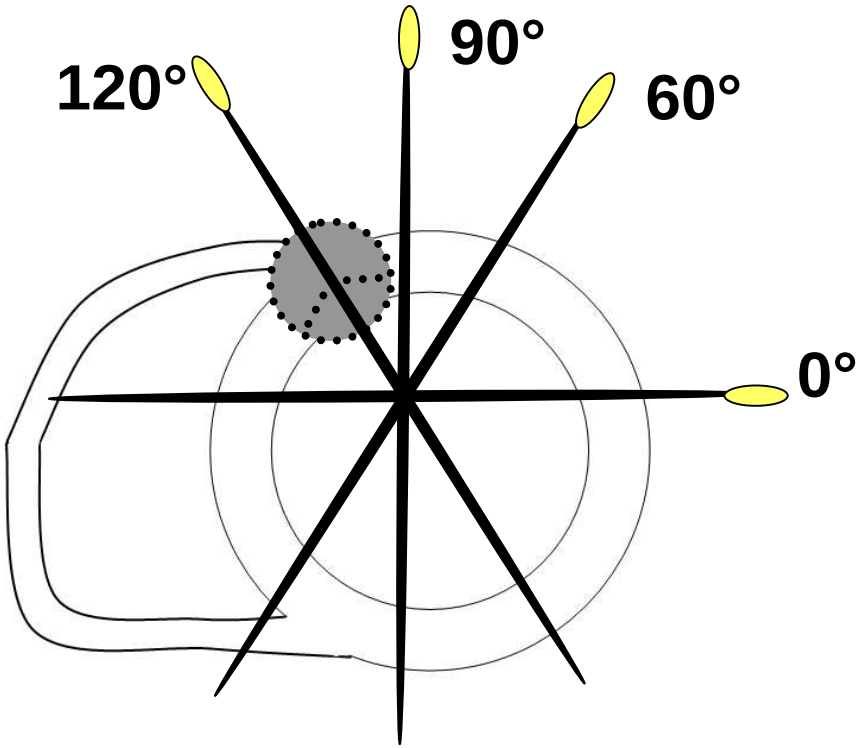
ML Felten
DIU 2009

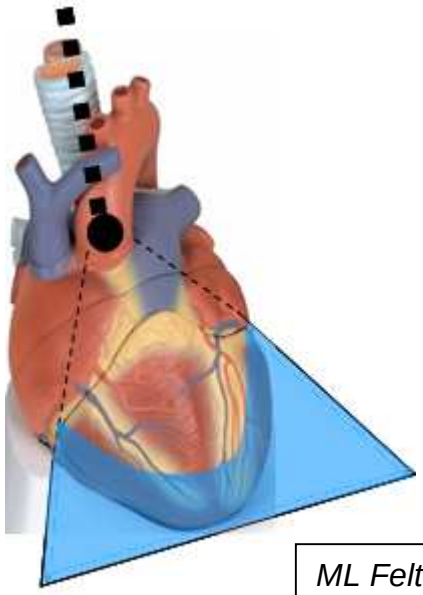
Les 4 premières coupes : l'aller







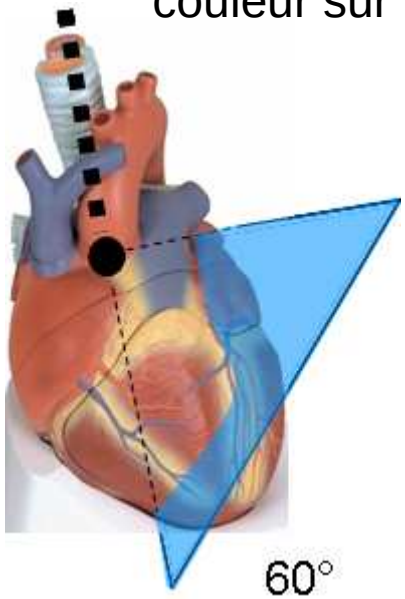


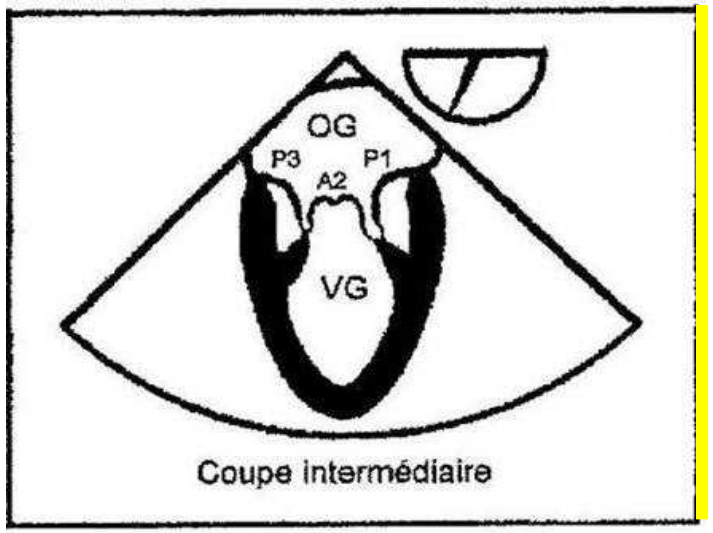


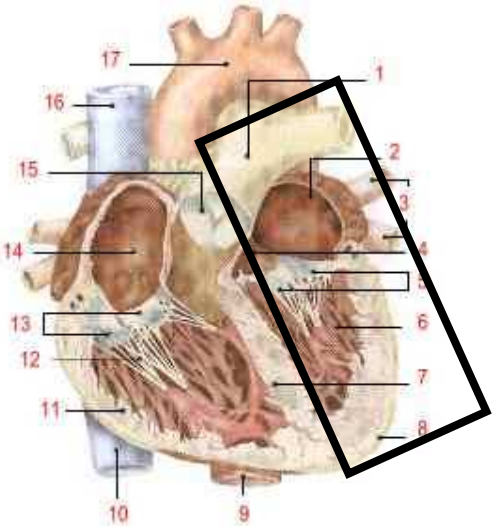
ML Felten
DIU 2009

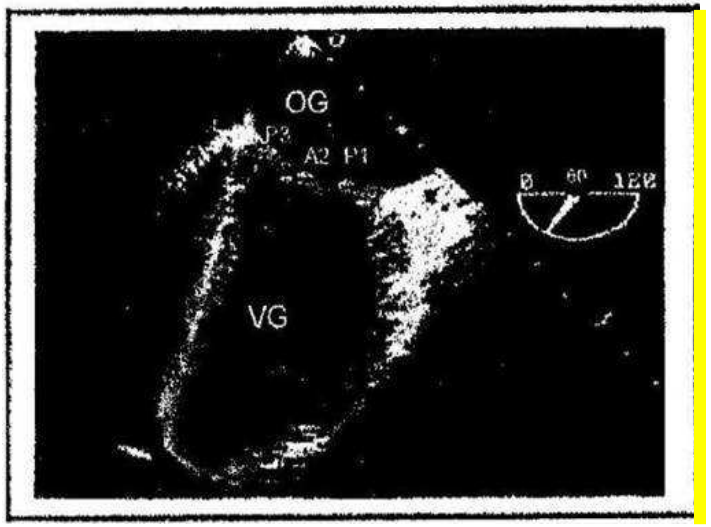
Coupe oesophagienne moyenne intermédiaire : 60°

couleur sur la valve mitrale : ? fuite





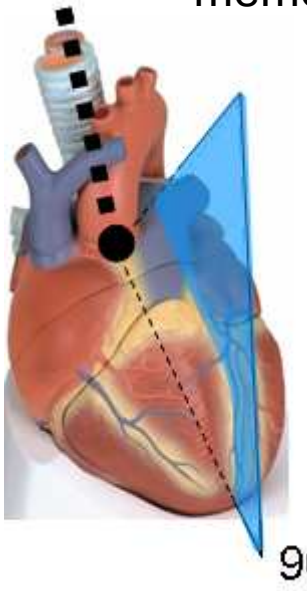


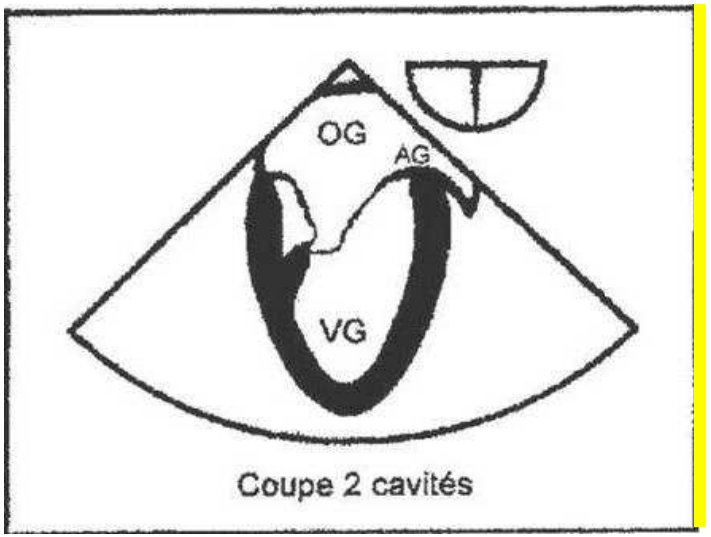


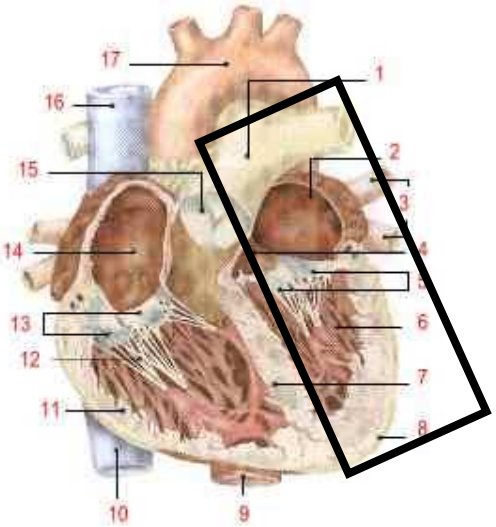
ML Felten
DIU 2009

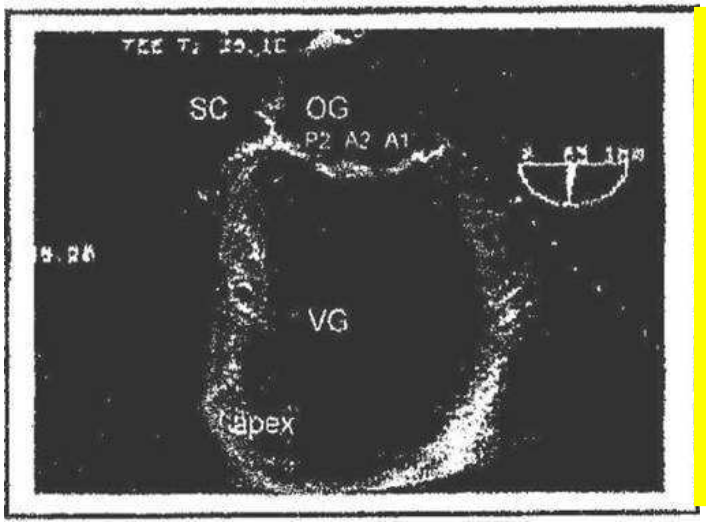
Coupe oesophagienne moyenne 2 cavités : 90°

mêmes mesures que sur la coupe 4 cavités 0°





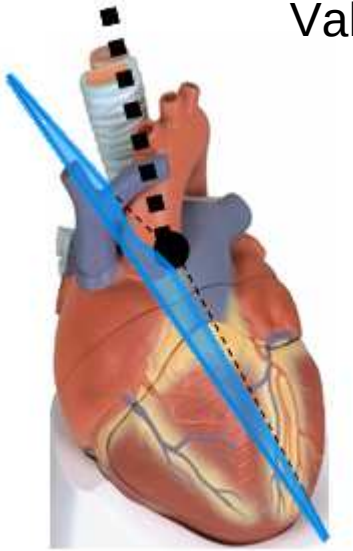




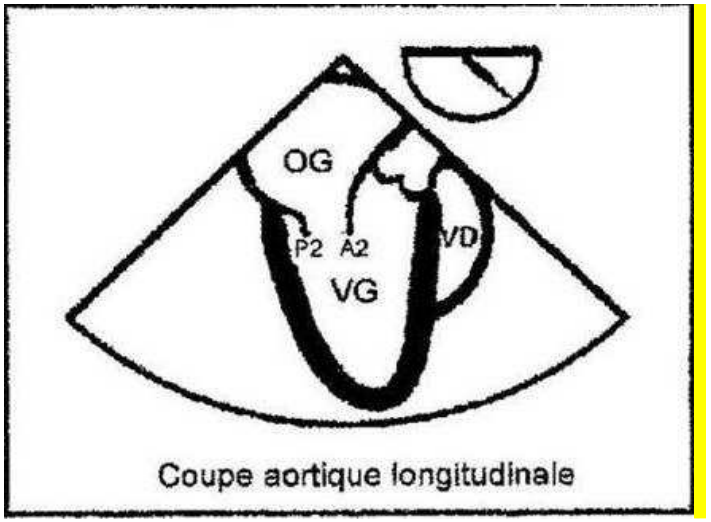
ML Felten
DIU 2009

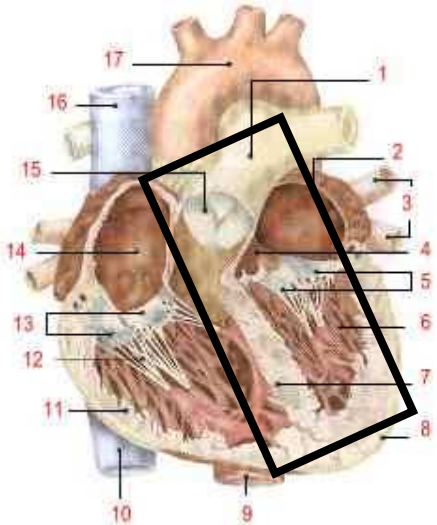
Coupe oesophagienne moyenne aortique longitudinale : 120°

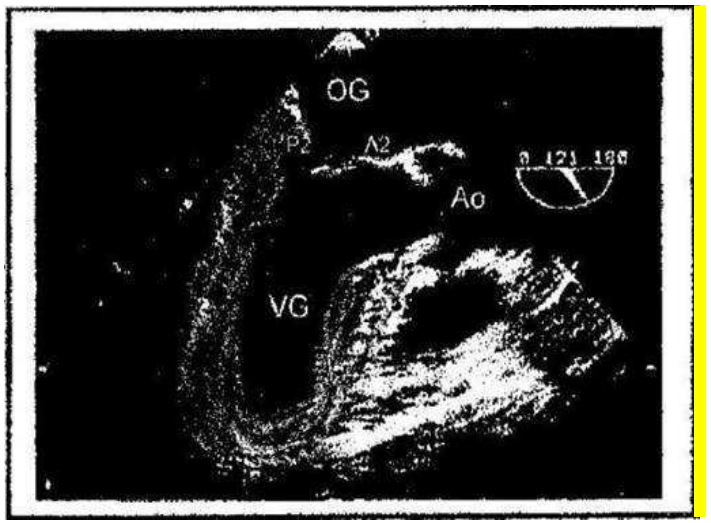
Valve mitrale : recherche SAM / bourrelet septal



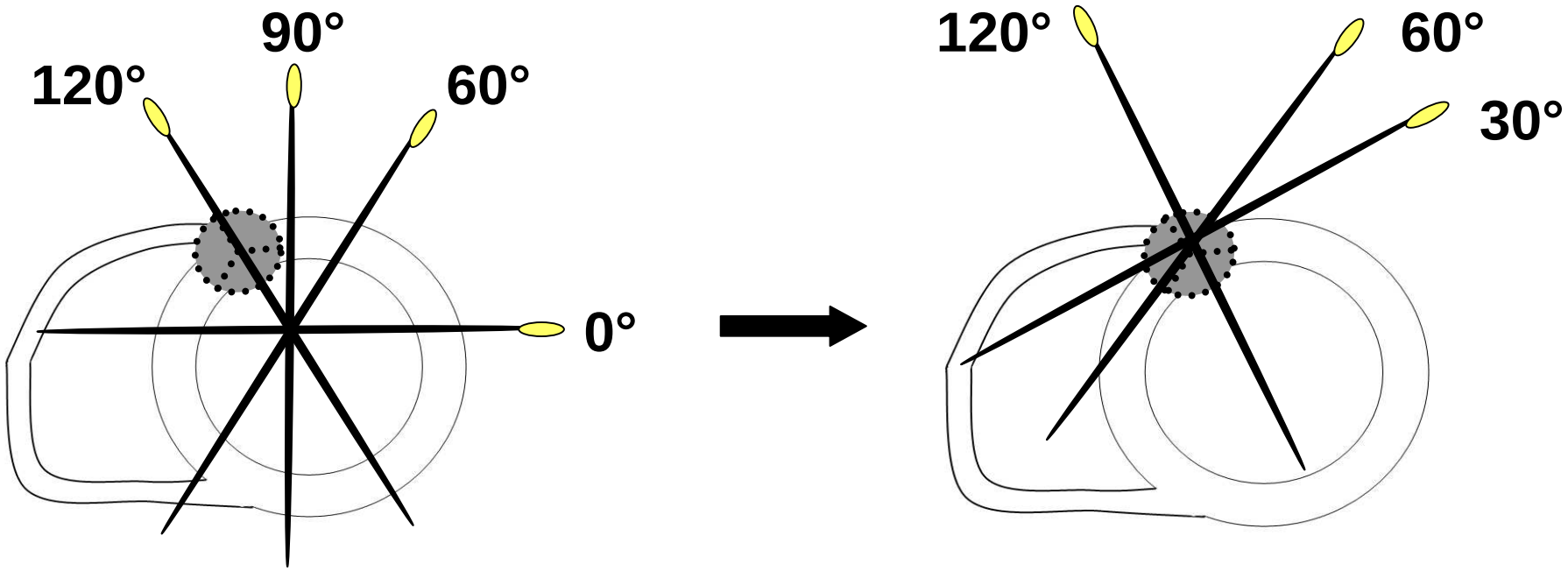
120°

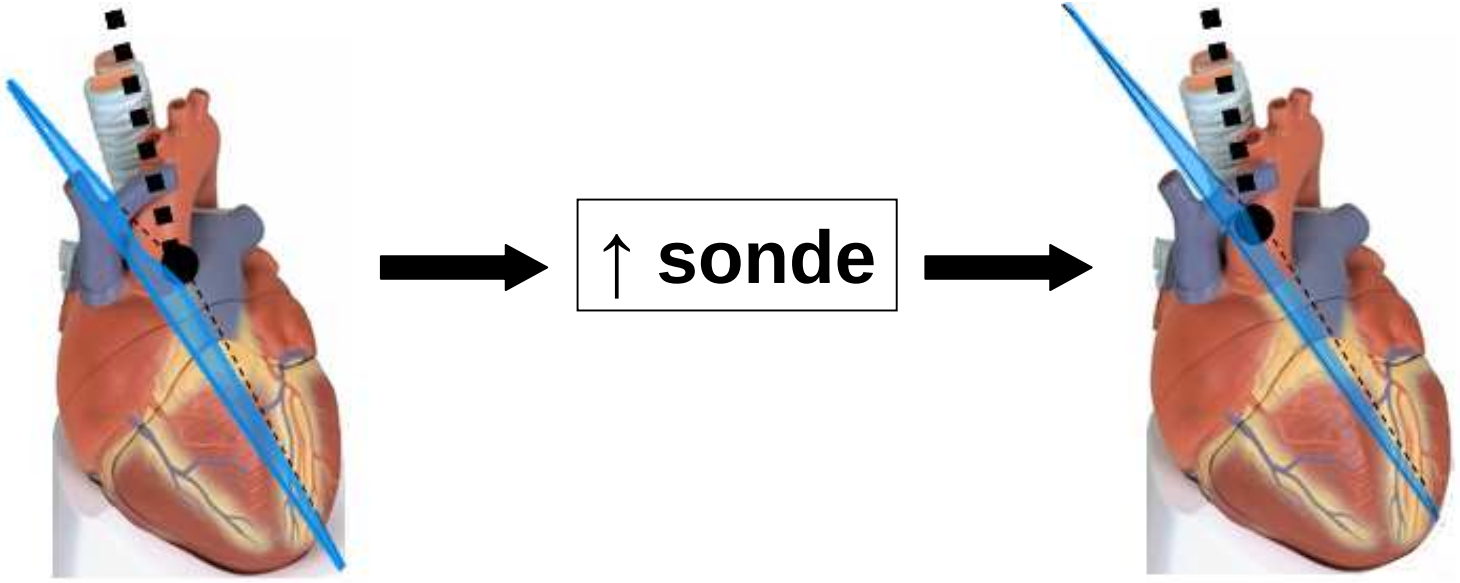






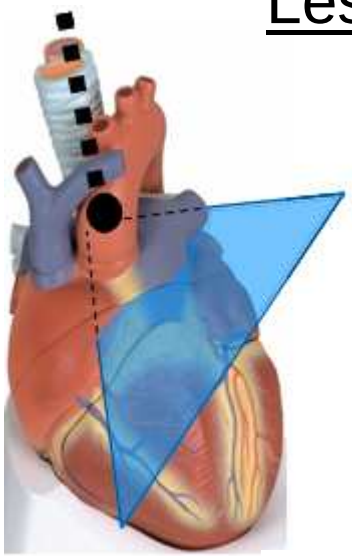
ML Felten
DIU 2009

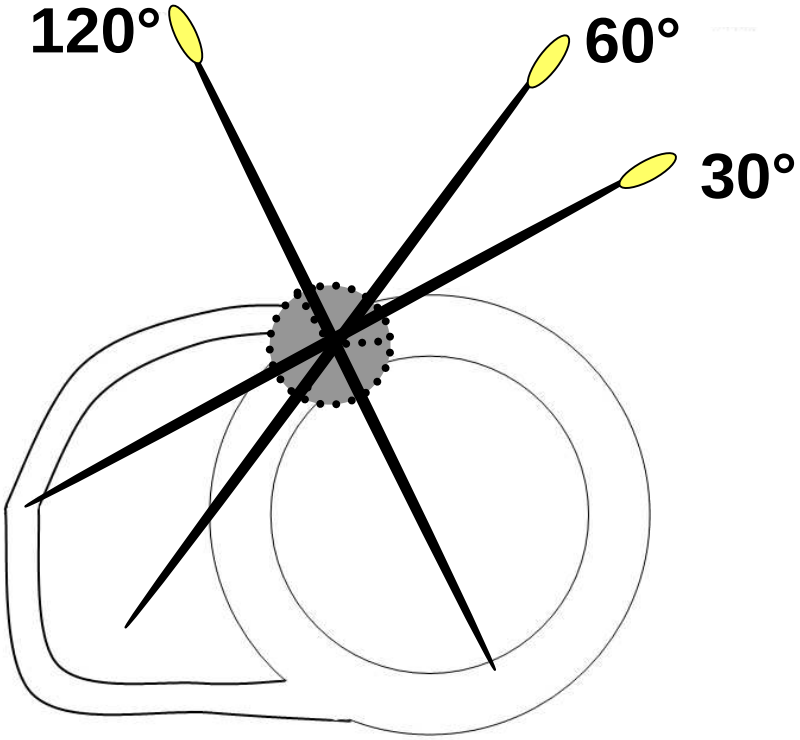


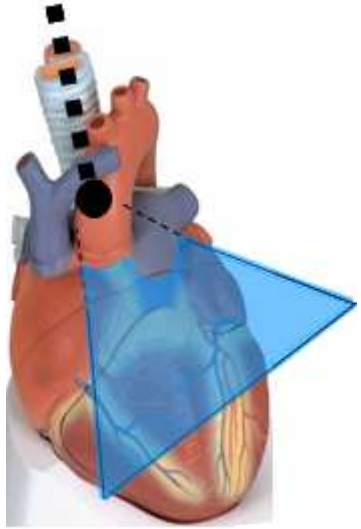


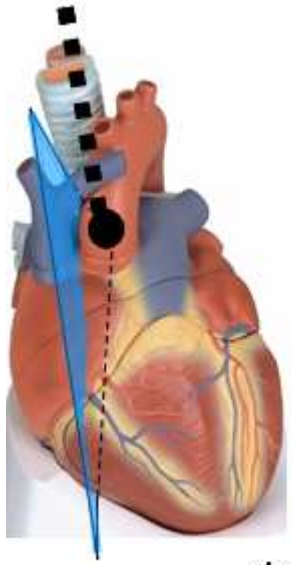
ML Felten
DIU 2009

Les 4 coupes suivantes : le retour







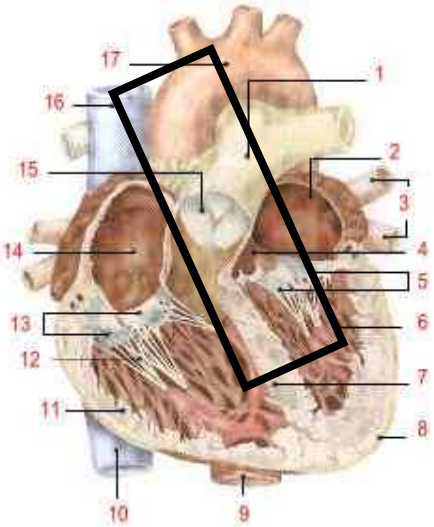


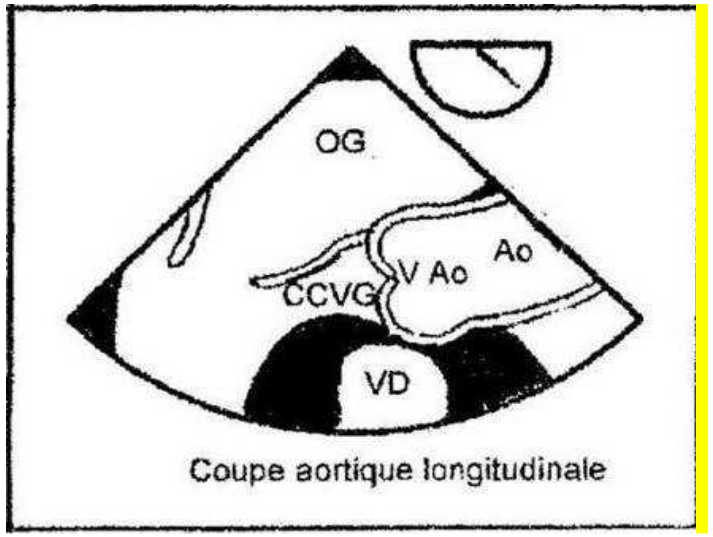
110°

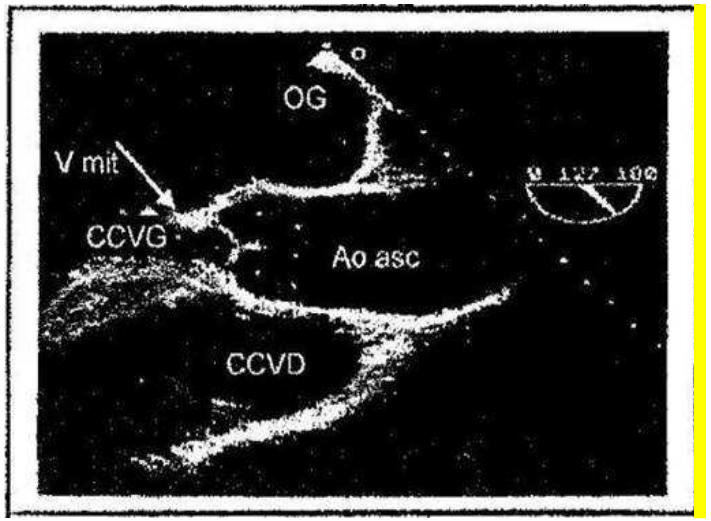
ML Felten
DIU 2009

Coupe oesophagienne moyenne aortique longitudinale : 120°

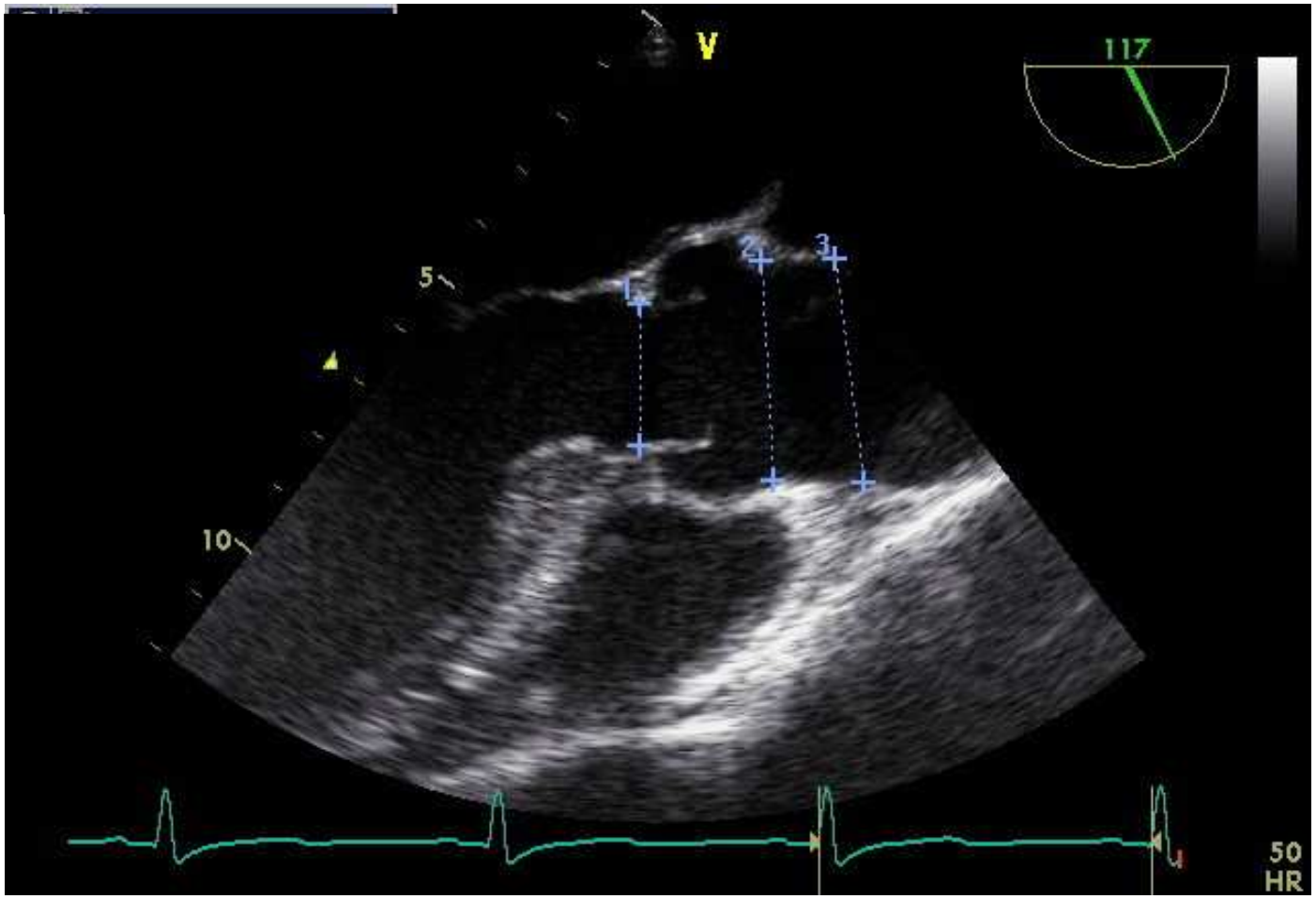
120°







ML Felten
DIU 2009



Couleur sur la valve aortique : ? fuite

Aorte ascendante : diamètre de l'anneau (valve ouverte) : 2,1 ± 0,3 cm

diamètre des sinus de Valsalva : 2,8 ± 0,2 cm

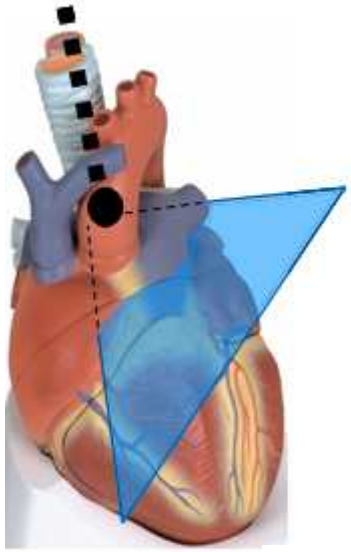
diamètre de la jonction sino-tubulaire : 2,4 ± 0,4 cm

diamètre de la racine de l'aorte : 2,8 ± 0,3 cm

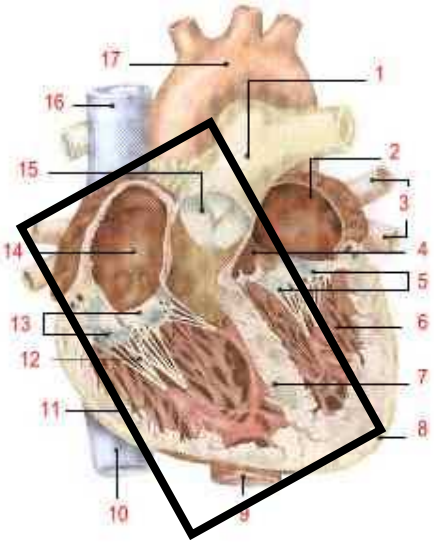
ML Felten
DIU 2009

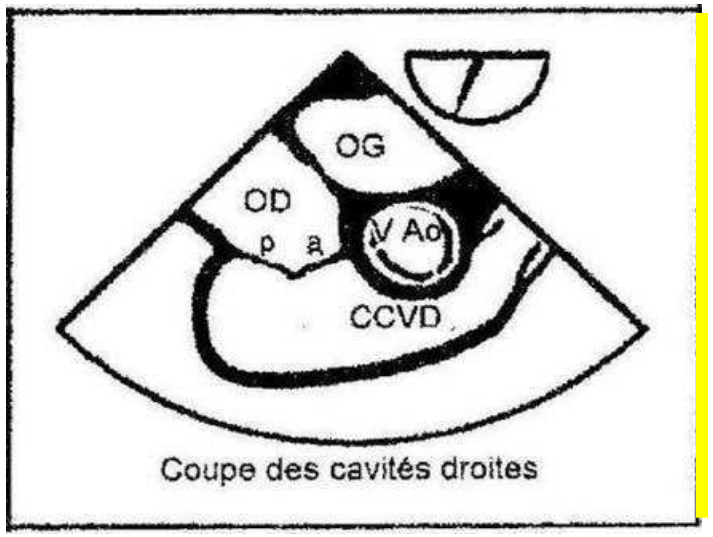
Coupe des cavités droites : 60°

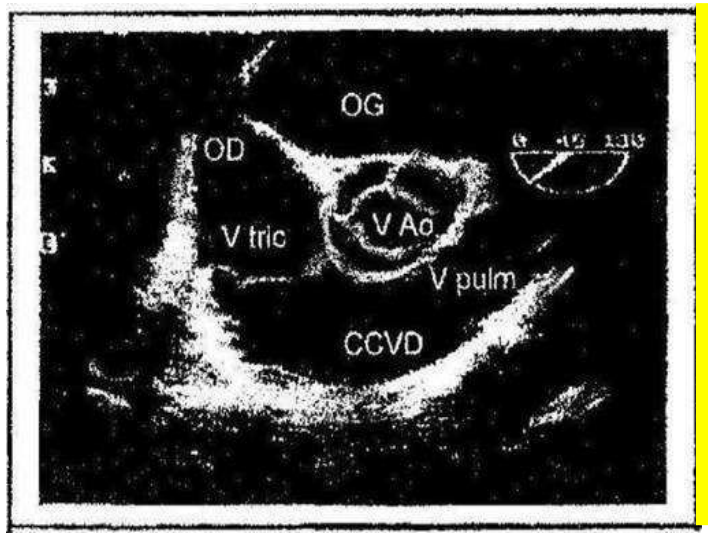
Evaluation VD : visuelle



60°

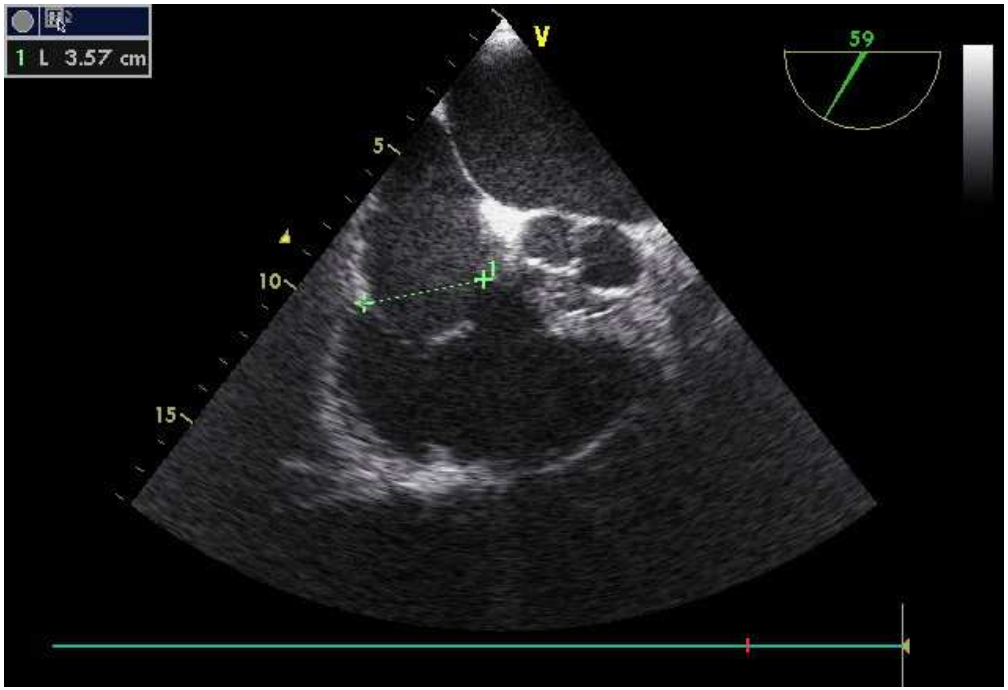






ML Felten
DIU 2009

ML Felten
DIU 2009

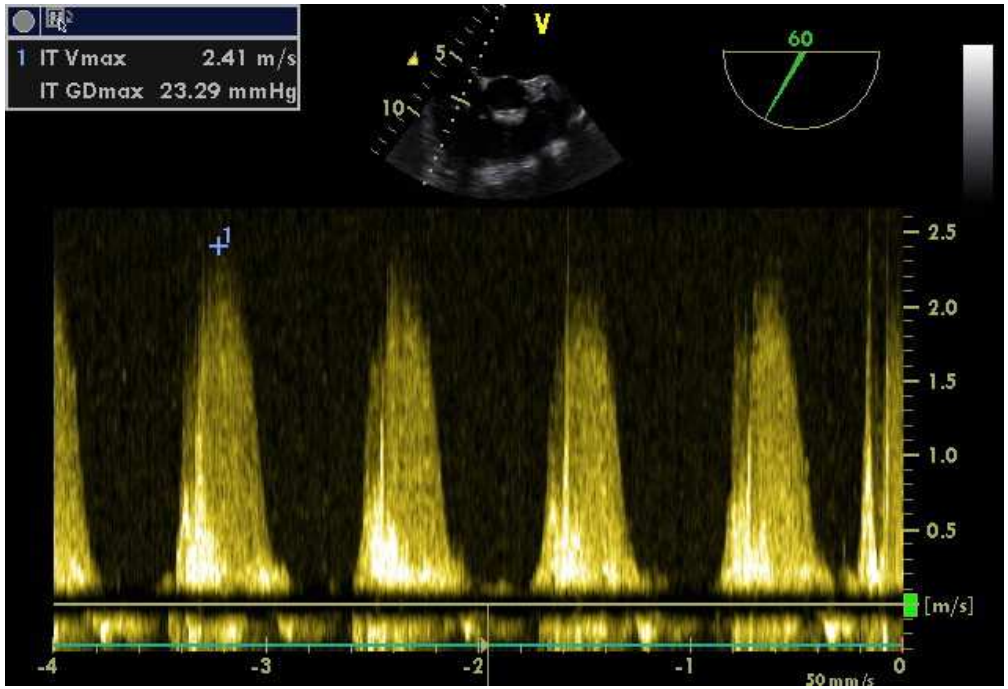


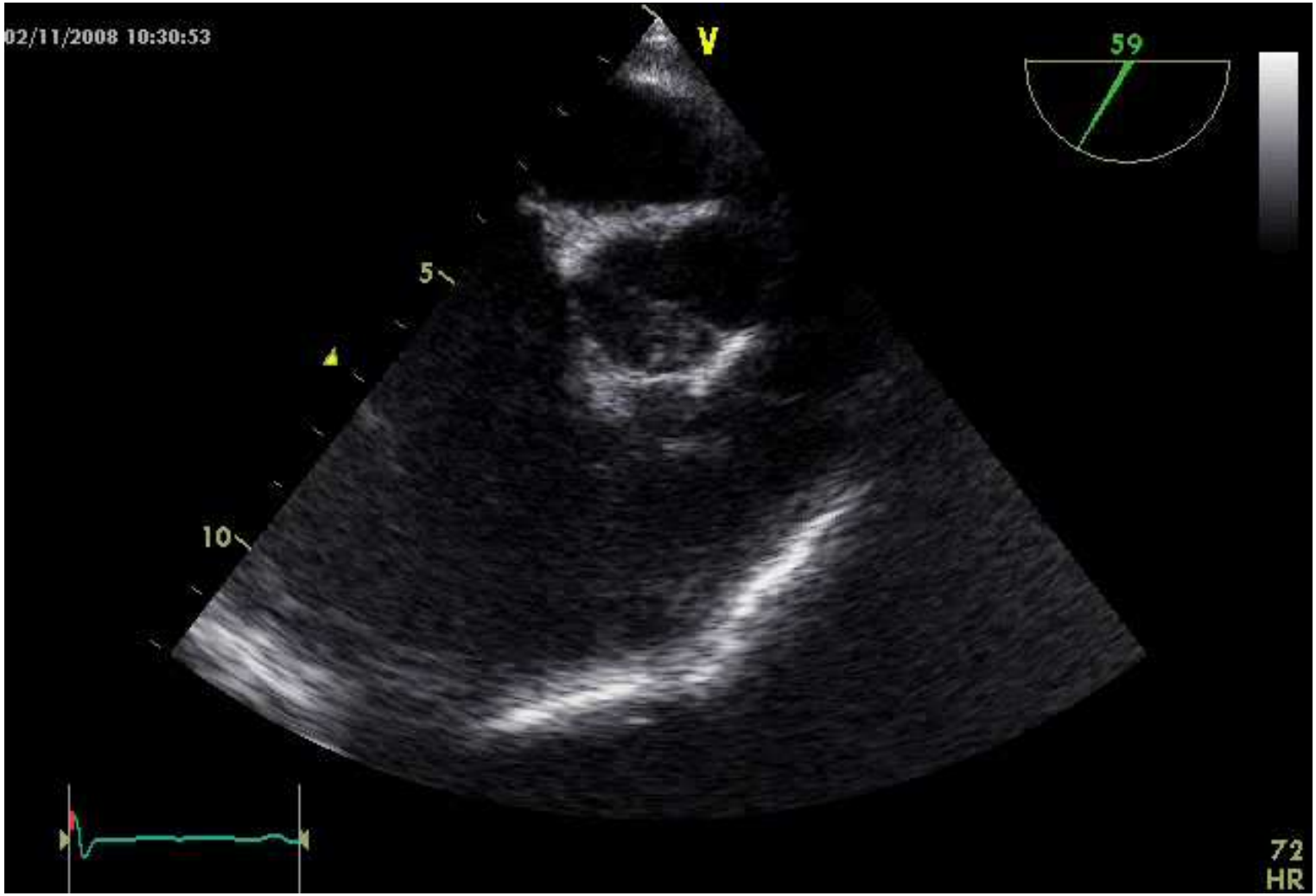
Evaluation de la valve tricuspide :

- diamètre de l'anneau : 2,8 ± 0,5 cm
- doppler : vitesse ≤ 70 cm/s (PW)
- gradient max ≤ 2 mmHg (4 v^2)

- couleur : ? fuite tricuspide

=> CW : évaluation de la PAP



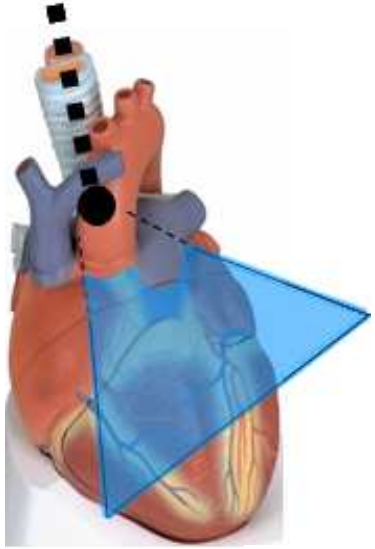


Valve pulmonaire :

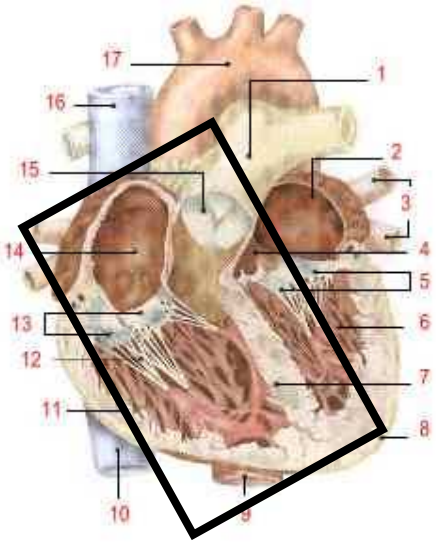
- diamètre de l'anneau : 2,1 ± 0,3 cm
- flux pulmonaire : < 1 m/s (gradient < 4 mmHg)

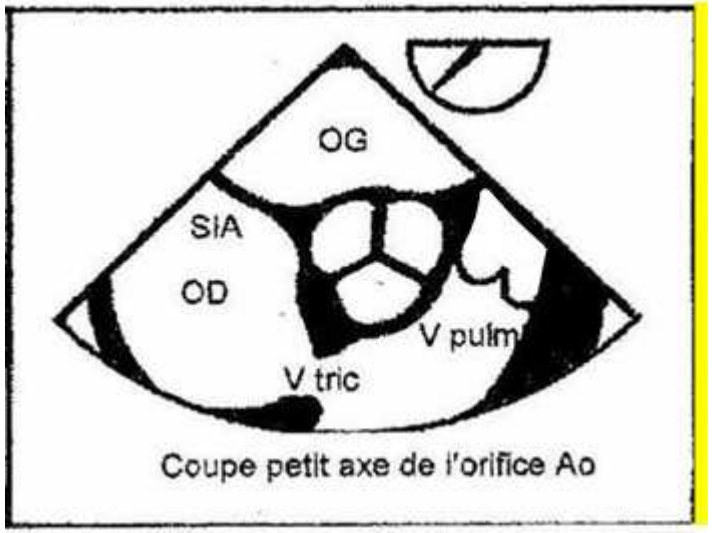
ML Felten
DIU 2009

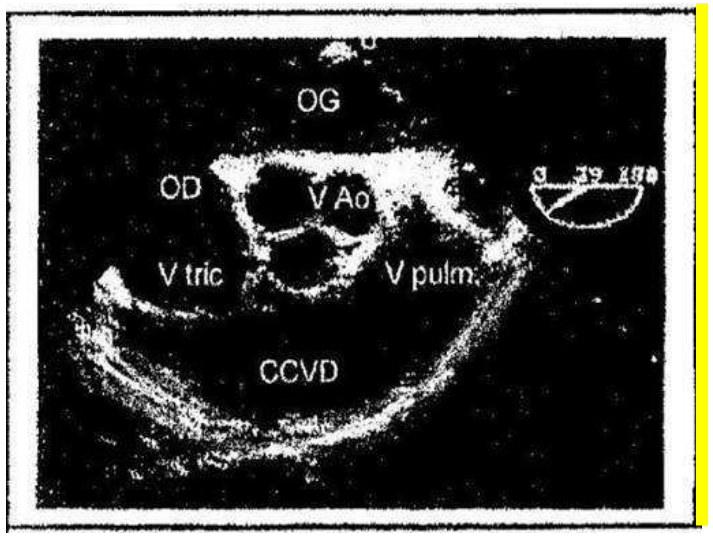
Coupe aortique petit axe : 30° (Mercedes)



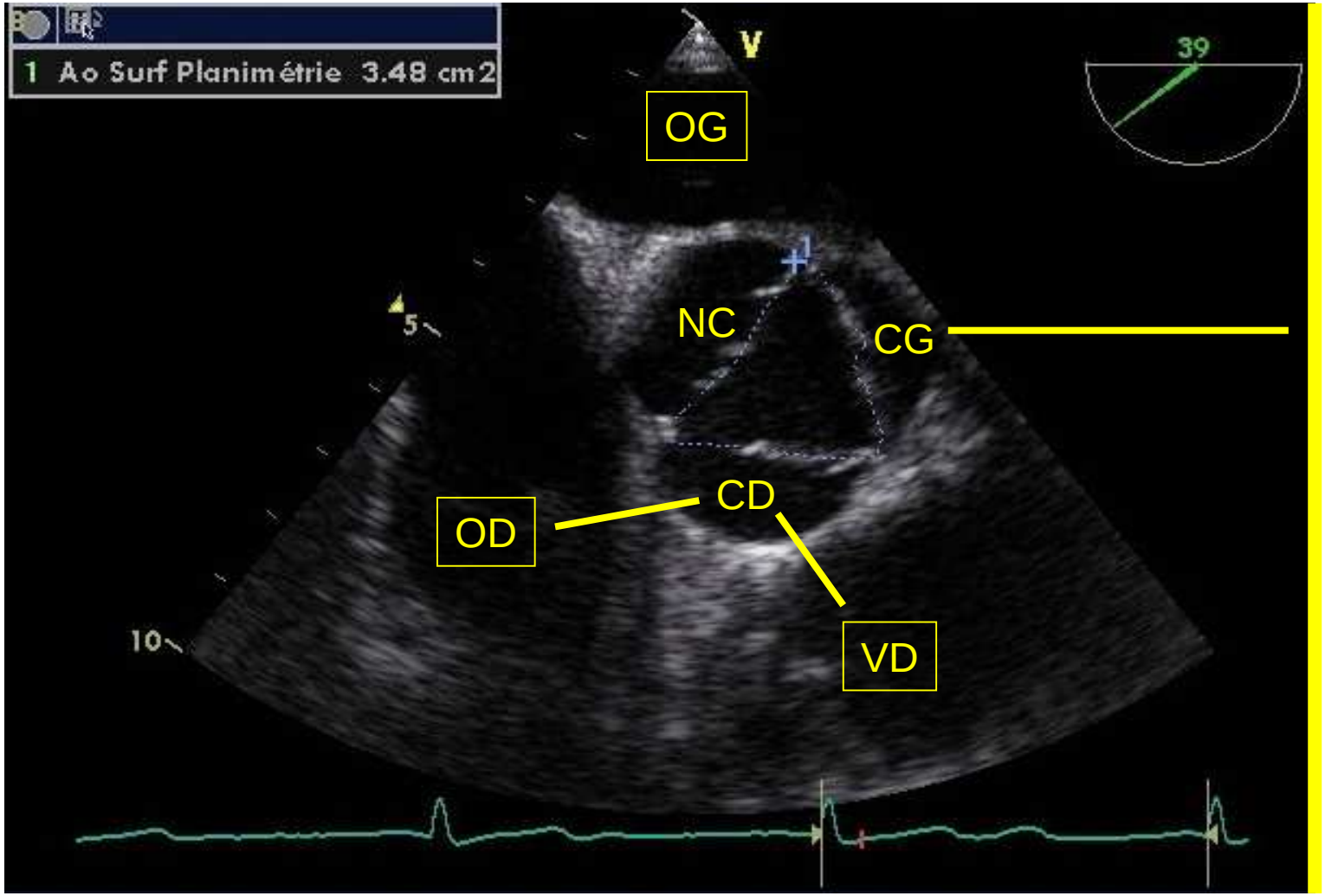
30°







ML Felten
DIU 2009



Valve aortique : morphologie des cusps

couleur : ? fuite aortique

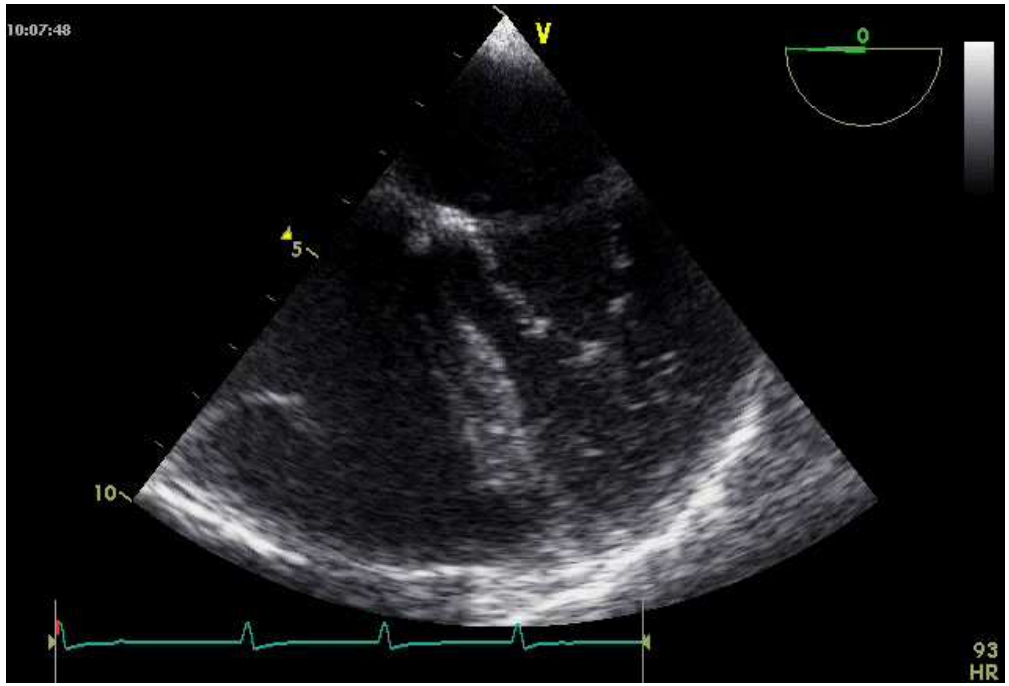
Planimétrie aortique : surface : 3 - 4 cm^2

ML Felten
DIU 2009

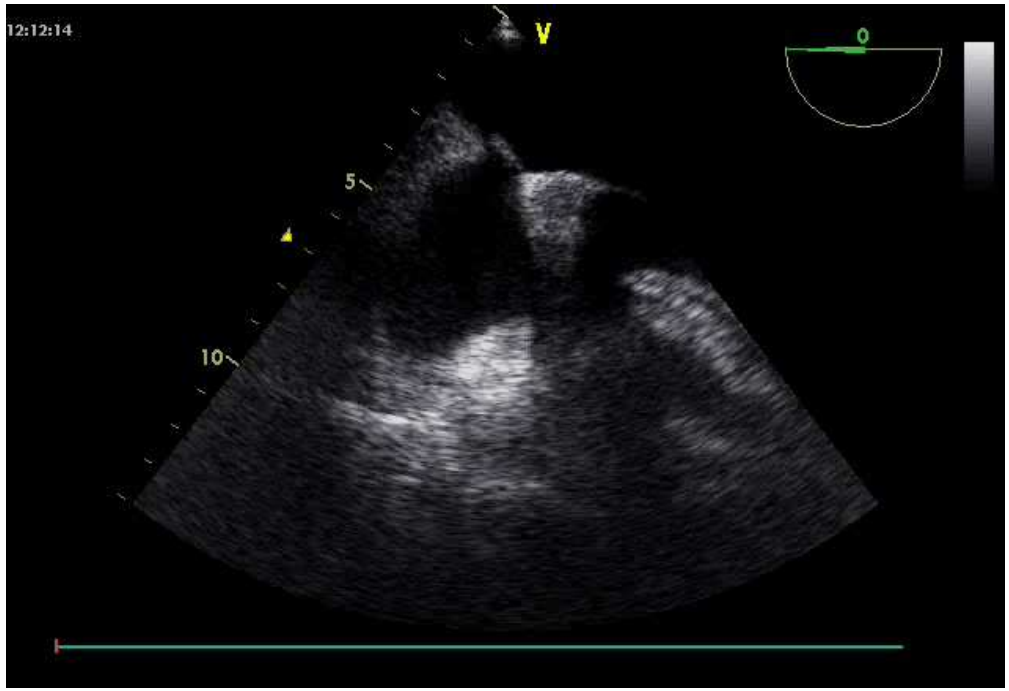
1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres

3. SIA et la coupe bicavale

ML Felten
DIU 2009



Mise en évidence du septum interauriculaire à partir de la coupe 4 cavités.
Evaluation du SIA (de 0° à 110°) (2D, couleur, test aux bulles) :
? foramen ovale perméable

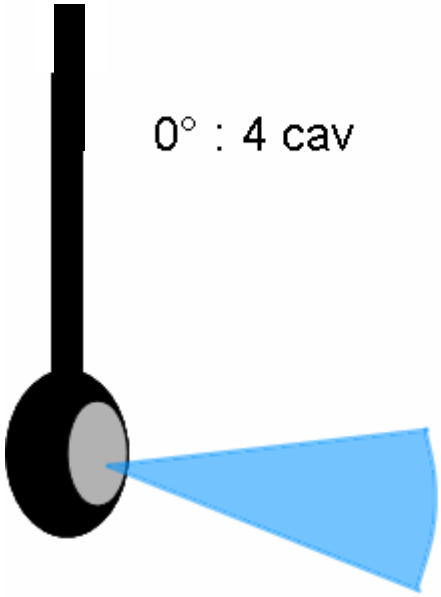


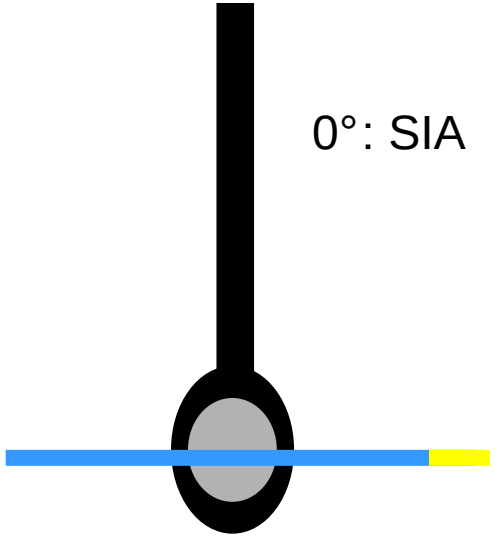
septum interauriculaire normal :
absence de passage de bulles

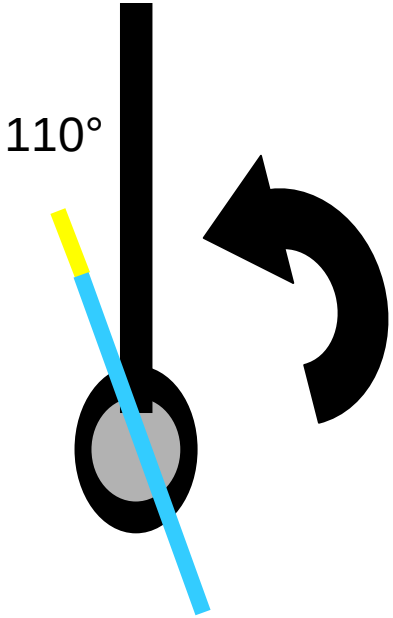
ML Felten
DIU 2009

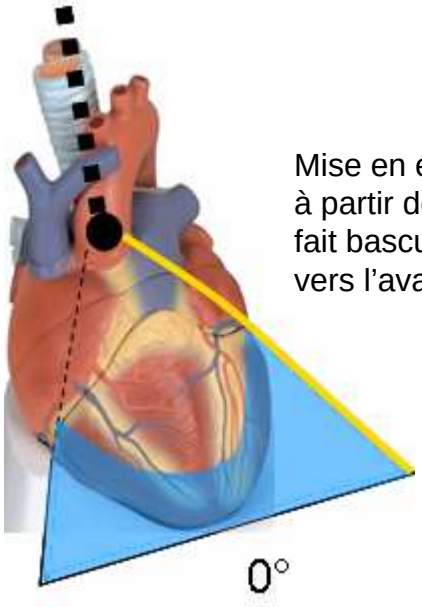
Obtention de la coupe bicavale

ML Felten
DIU 2009

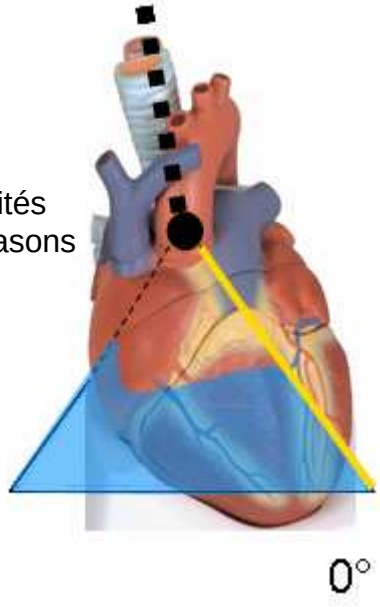


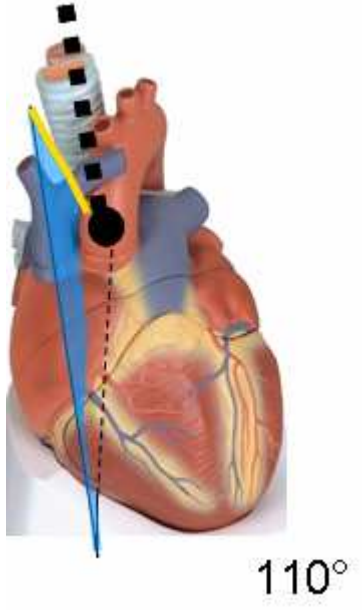




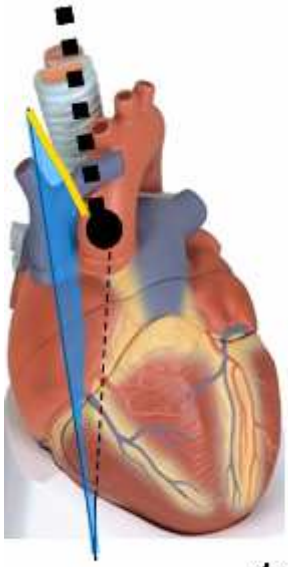


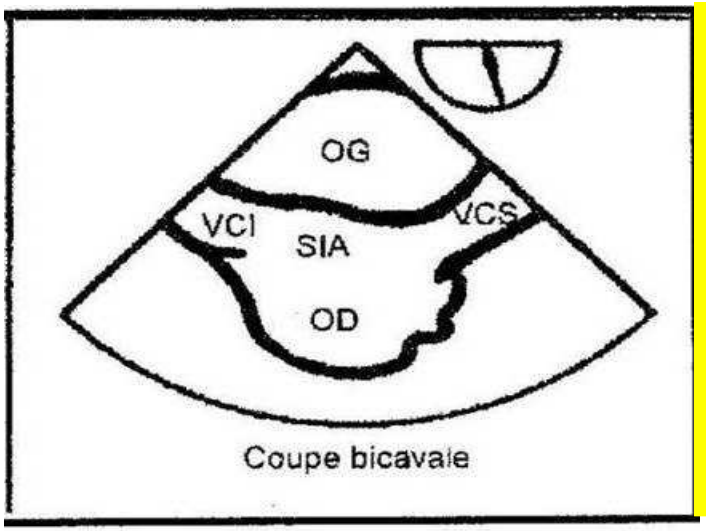
Mise en évidence du SIA
à partir de la coupe 4 cavités
fait basculer le plan d'ultrasons
vers l'avant du patient.

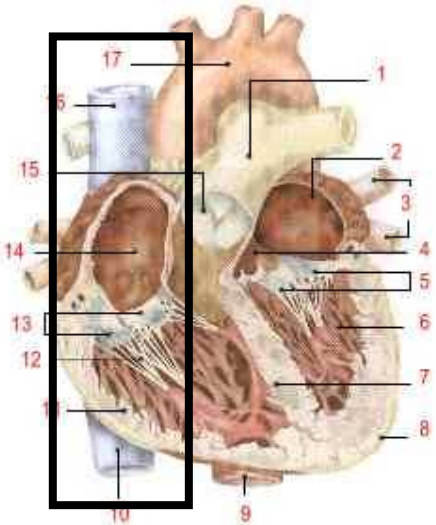


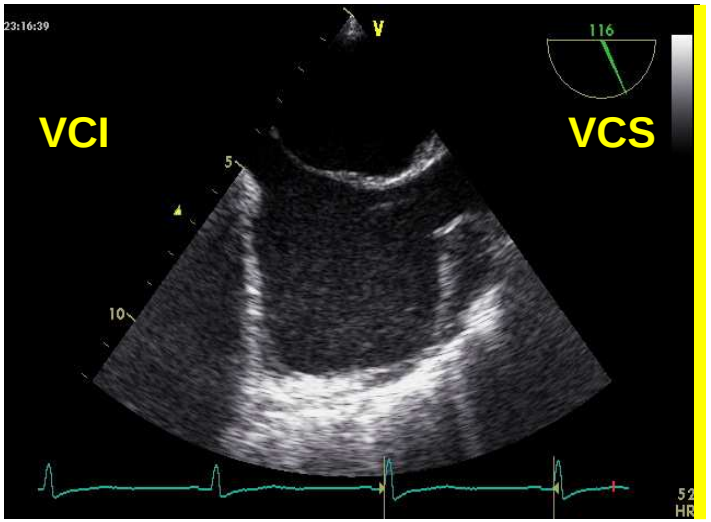


Coupe oesophagienne moyenne bicavale (110°)

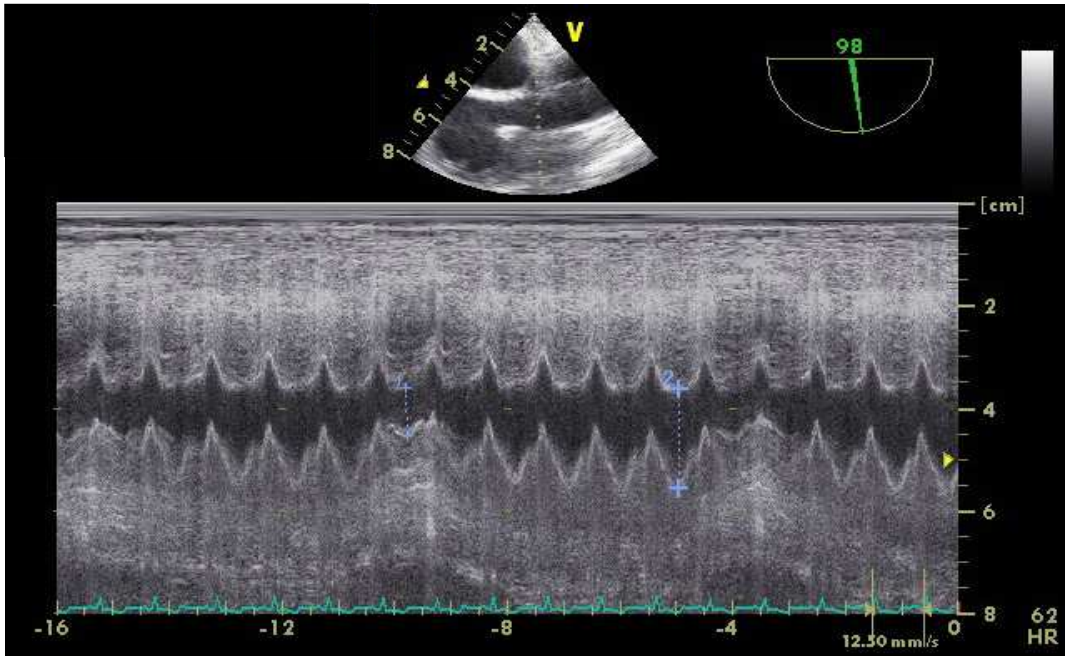








ML Felten
DIU 2009



TM sur la VCS

ML Felten
DIU 2009

1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres
3. SIA et la coupe bicavale

4. Coupes transgastriques : la rondelle et les autres

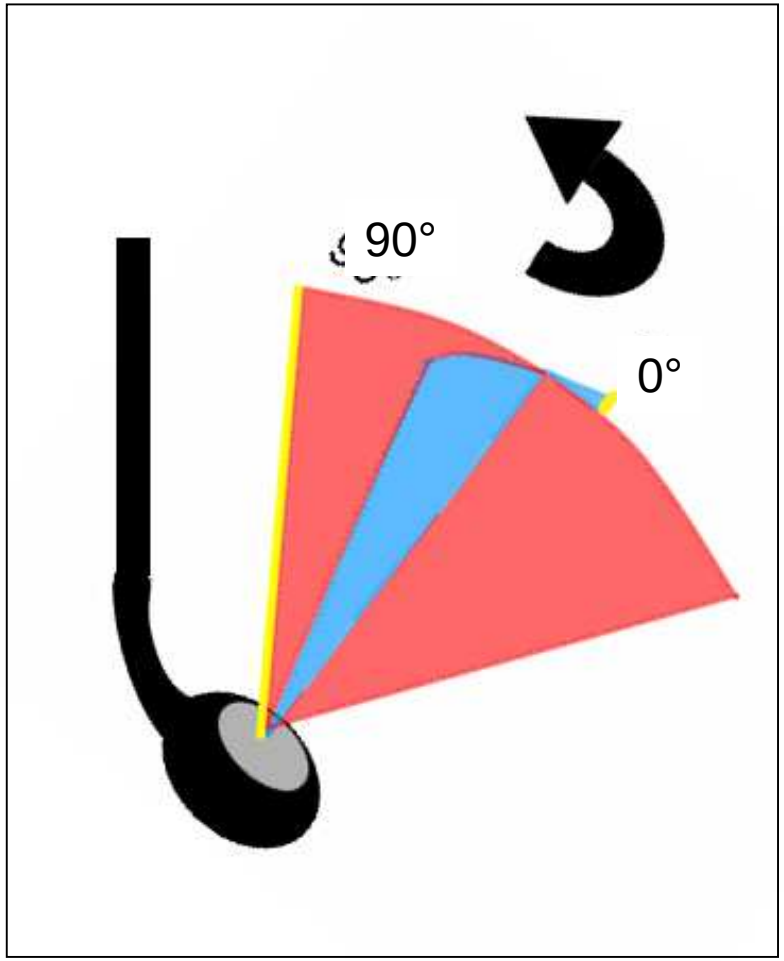
ML Felten
DIU 2009

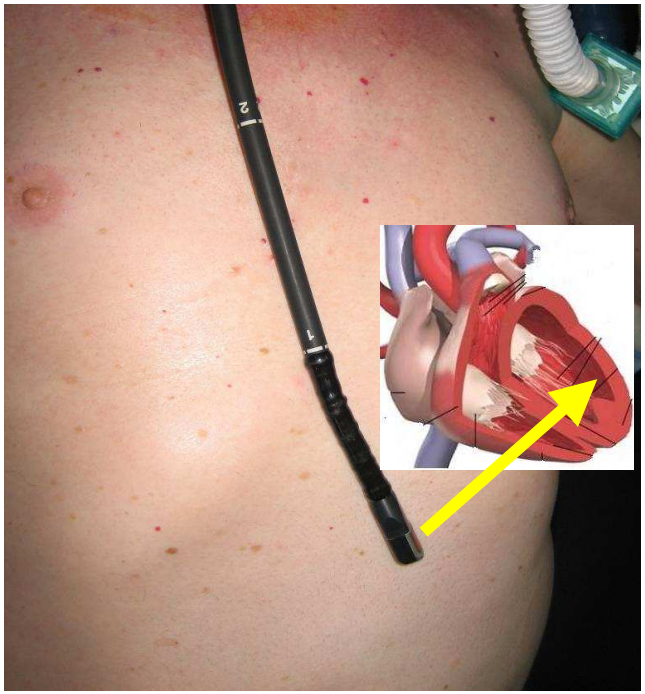
0° est perpendiculaire à la tête de la sonde

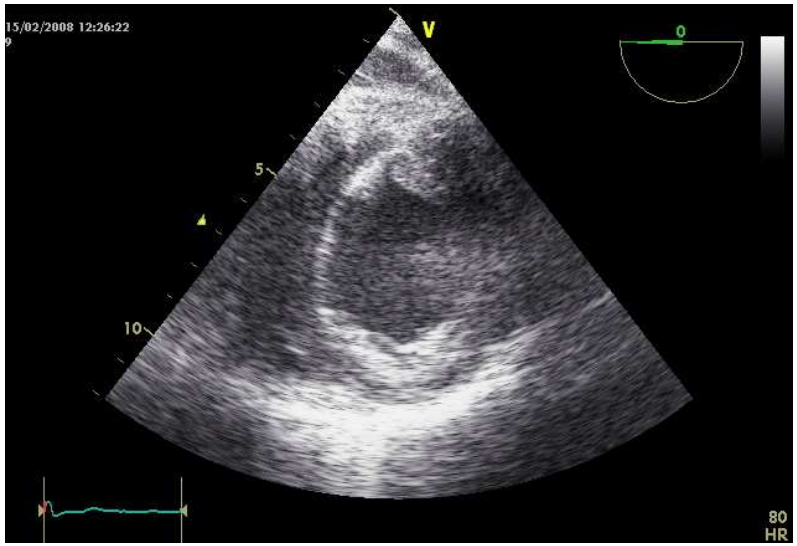
ML Felten
DIU 2009

La sonde d'ETO suit la courbure des structures digestives.

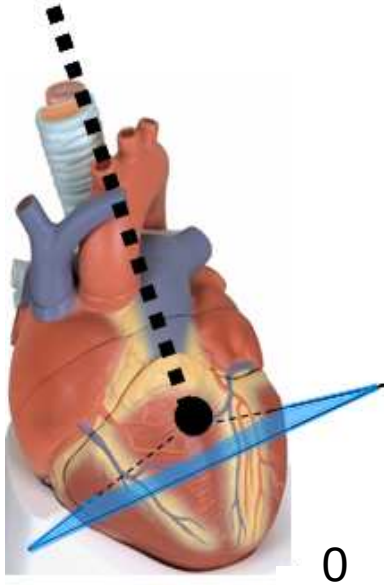
En position transgastrique : la rondelle



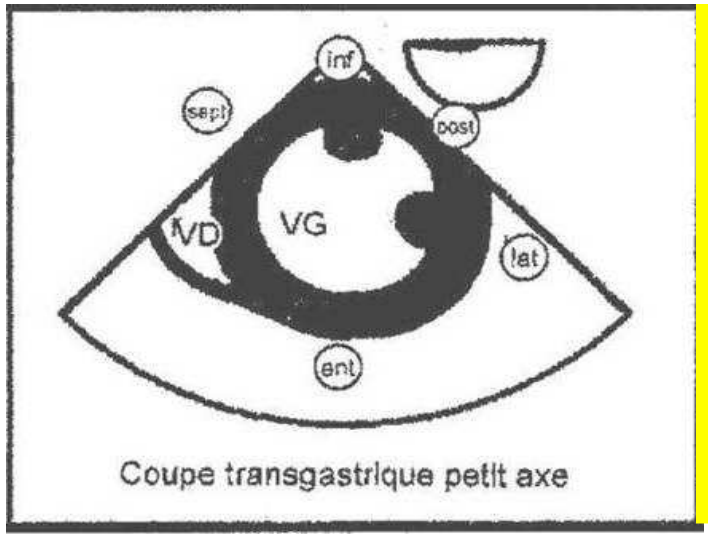


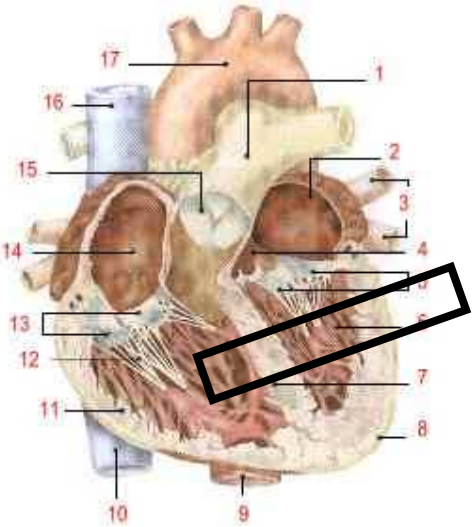


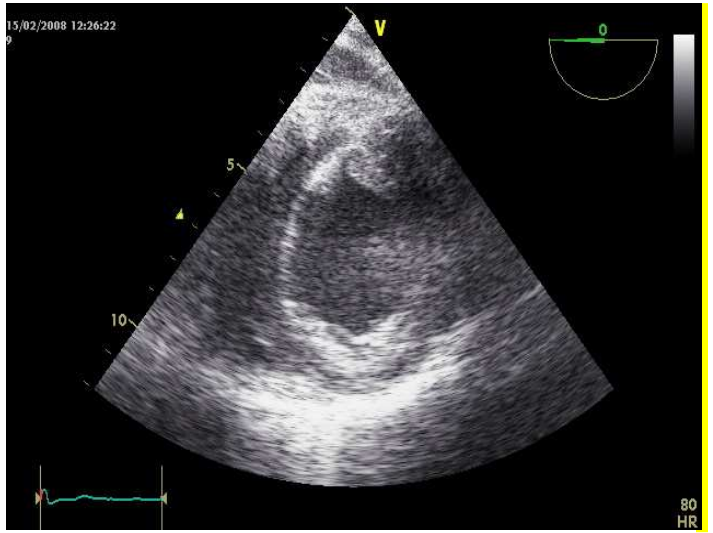
Coupe transgastrique petit axe (rondelle)



0°

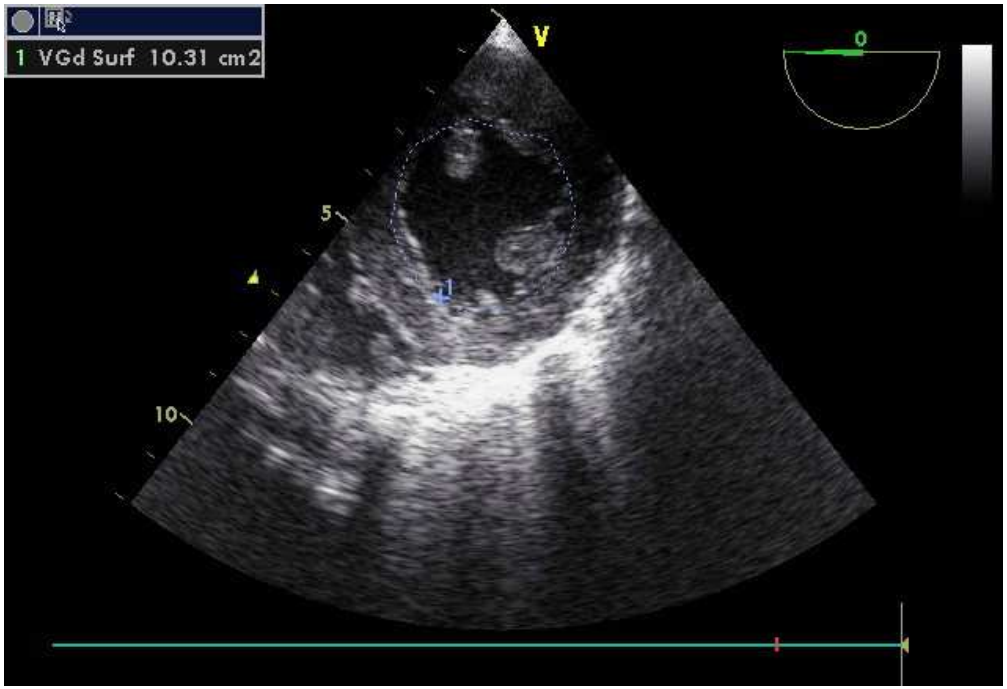






ML Felten
DIU 2009

ML Felten
DIU 2009



Evaluation du VG :

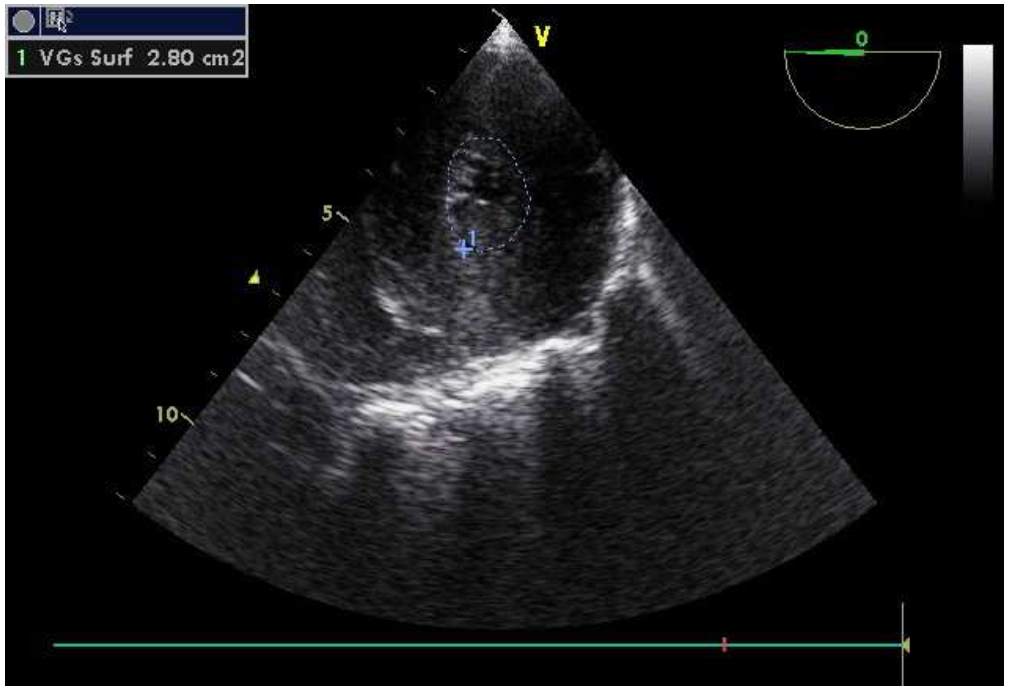
- évaluation visuelle des parois
- index d'excentricité

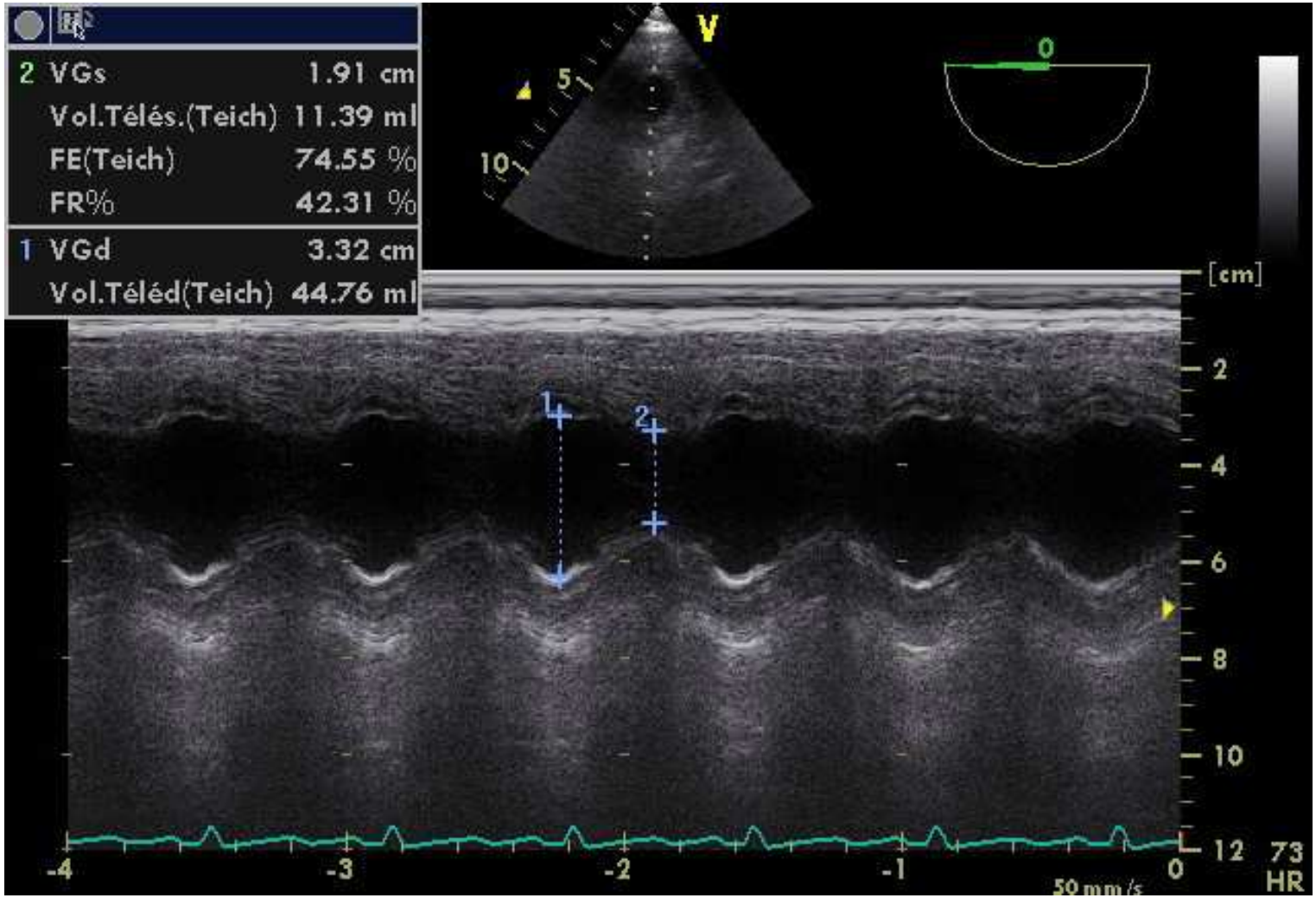
mode 2D :

FRS en ETO (%)

= (STDVG – STSVG/ STDVG) x 100

= 50 - 70 %





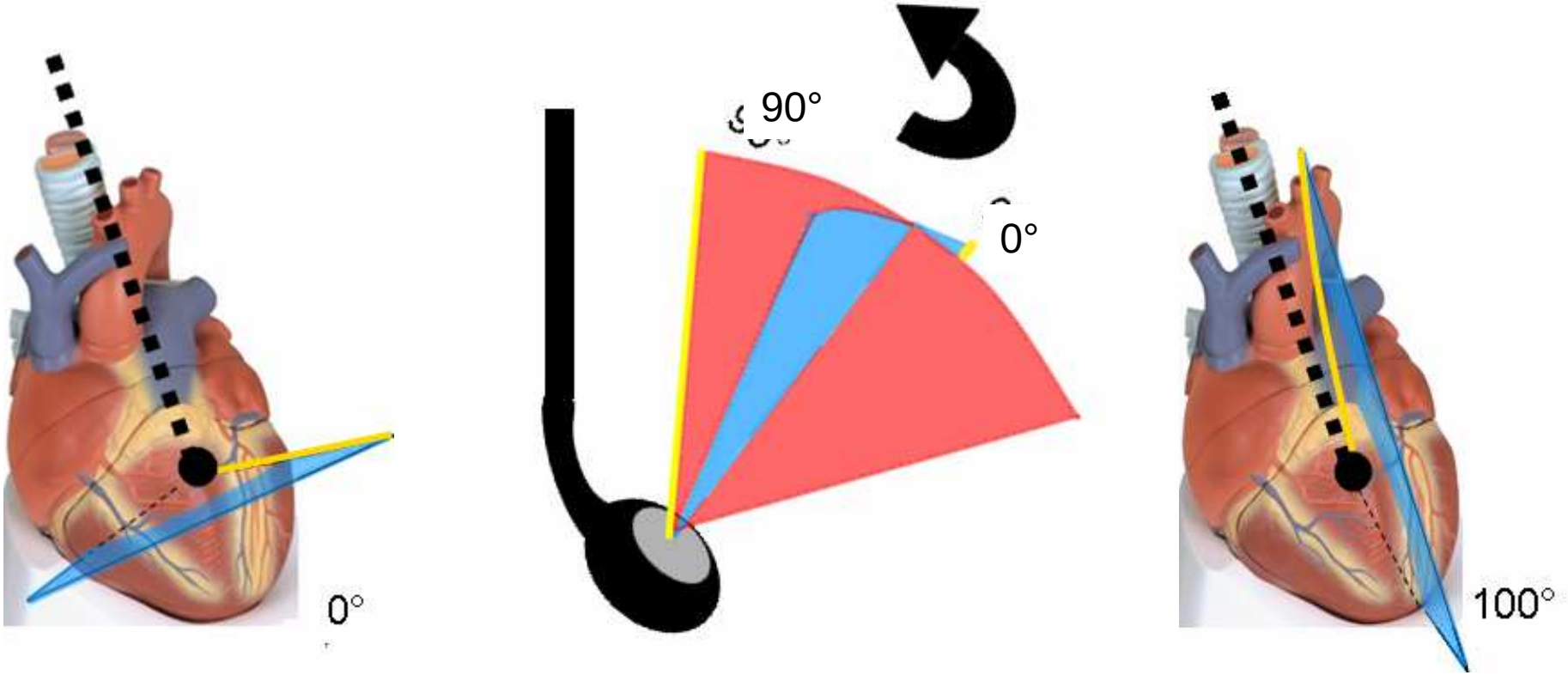
Evaluation de la fonction VG par un TM sur la rondelle :

FR = (DTDVG – DTSVG / DTDVG) x 100 (%) = 30%

! FEVG par la méthode de Teichholz

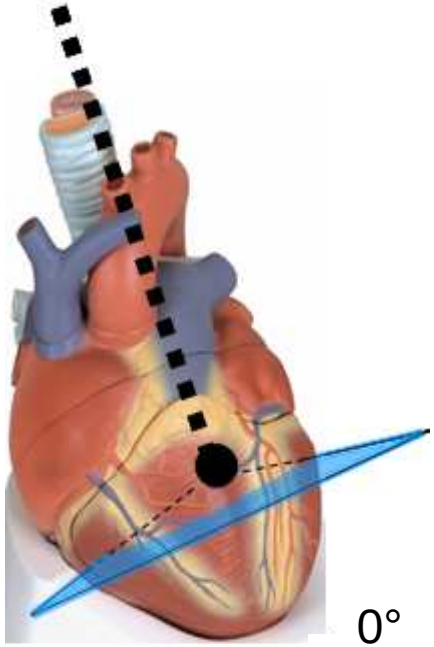
ML Felten
DIU 2009

Les coupes transgastriques : la suite

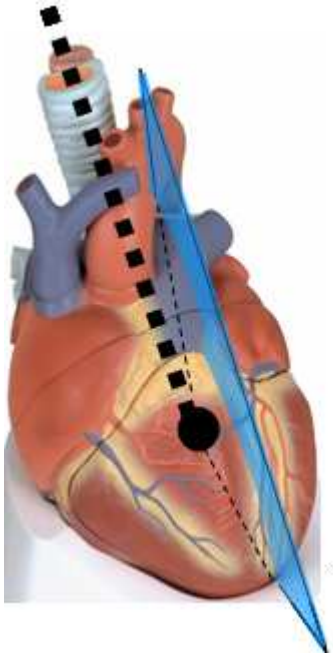


ML Felten
DIU 2009

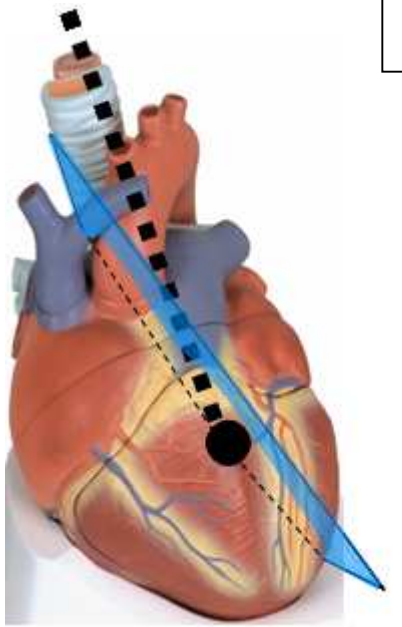
ML Felten
DIU 2009



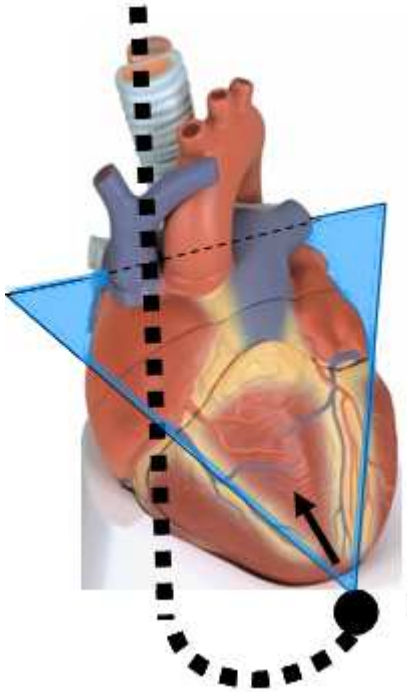
0°



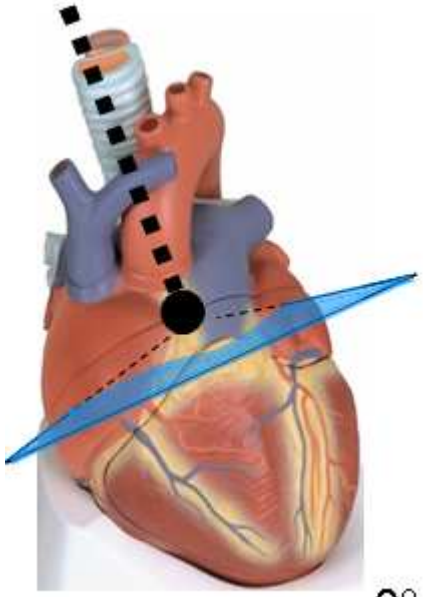
100°
« côté VG »



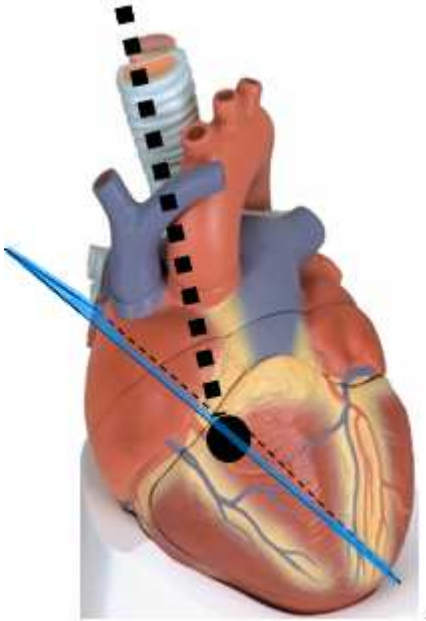
120°
« côté VG »



0°

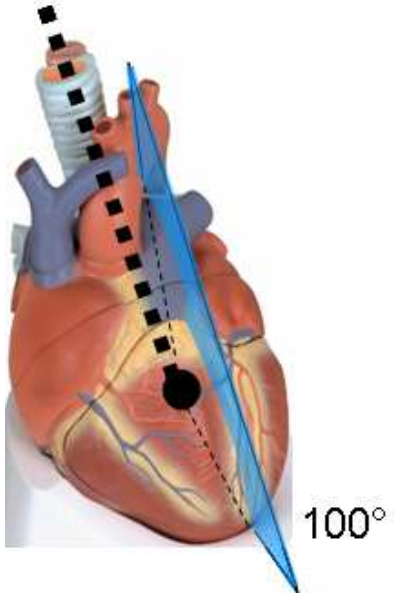


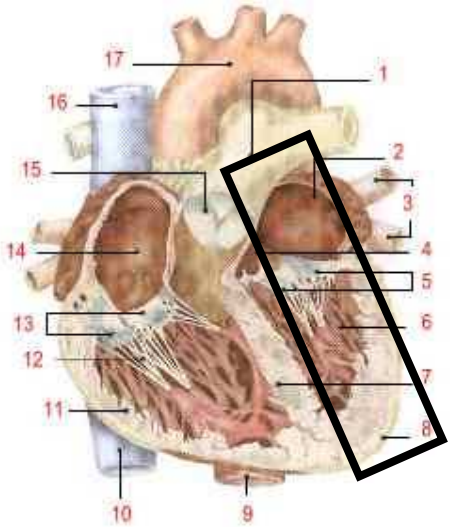
0°

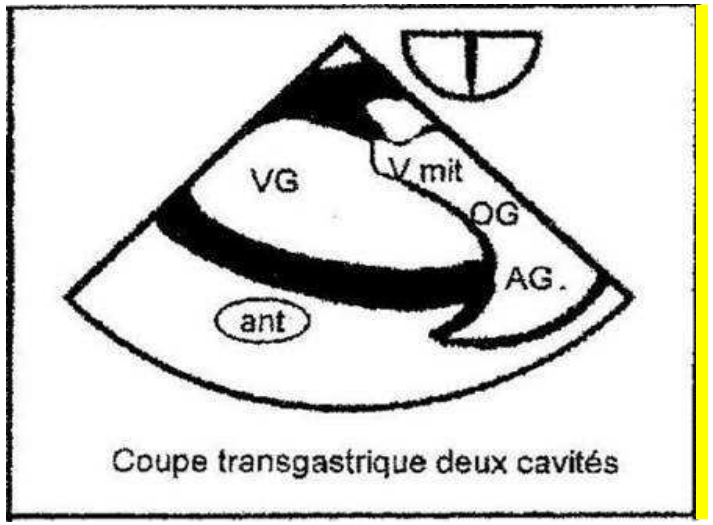


100°
« côté VD »

Coupe transgastrique deux cavités (100°)

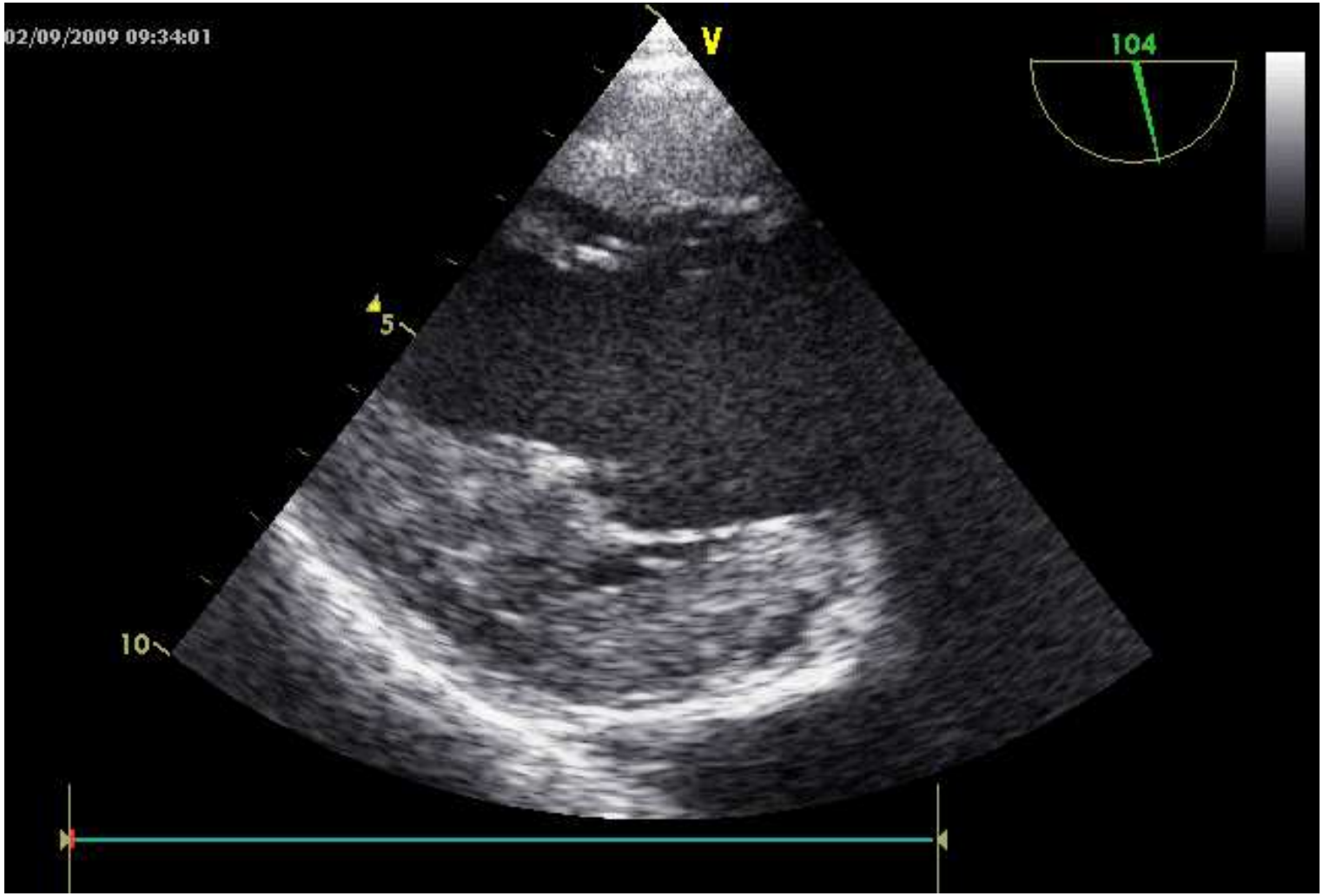






ML Felten
DIU 2009

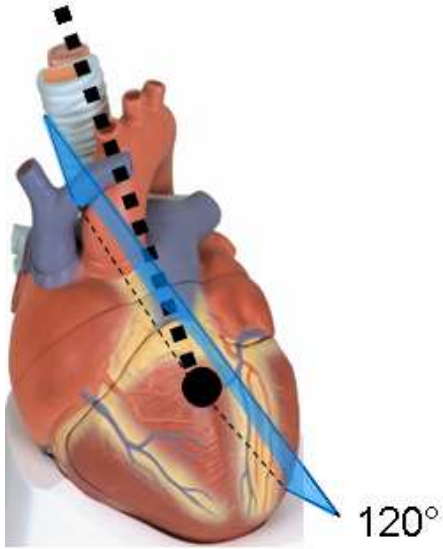
Coupe transgastrique : paroi inférieure en haut de l'écran

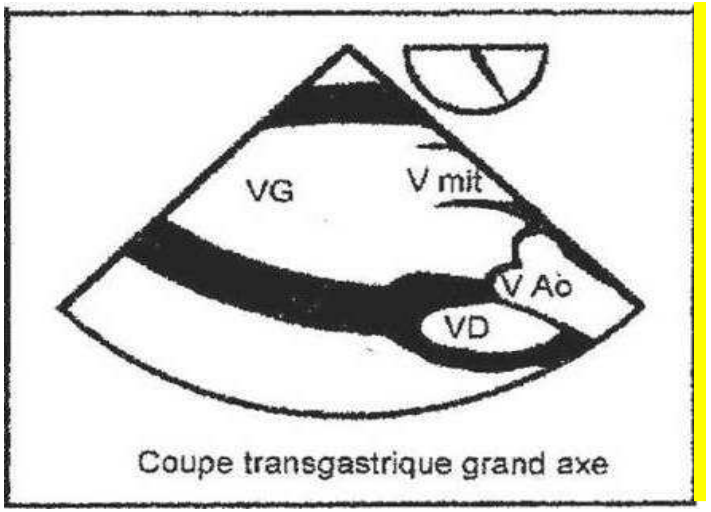


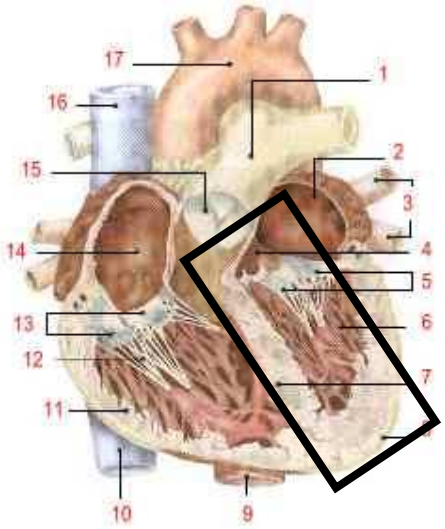
analyse de l'appareil sous-valvulaire mitral
parois inférieure et antérieure du VG

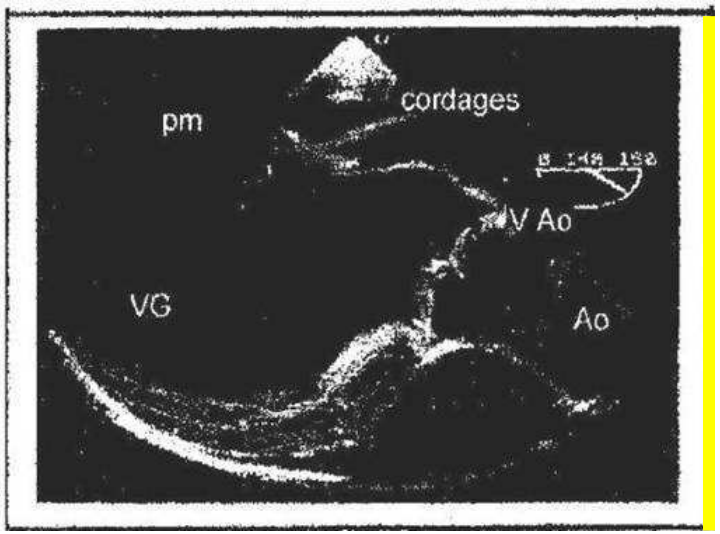
ML Felten
DIU 2009

Coupe transgastrique grand axe (120°)

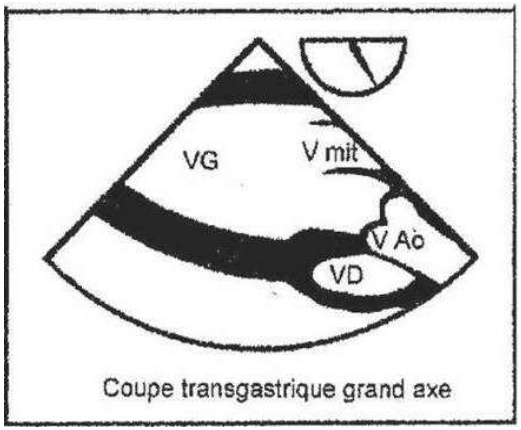








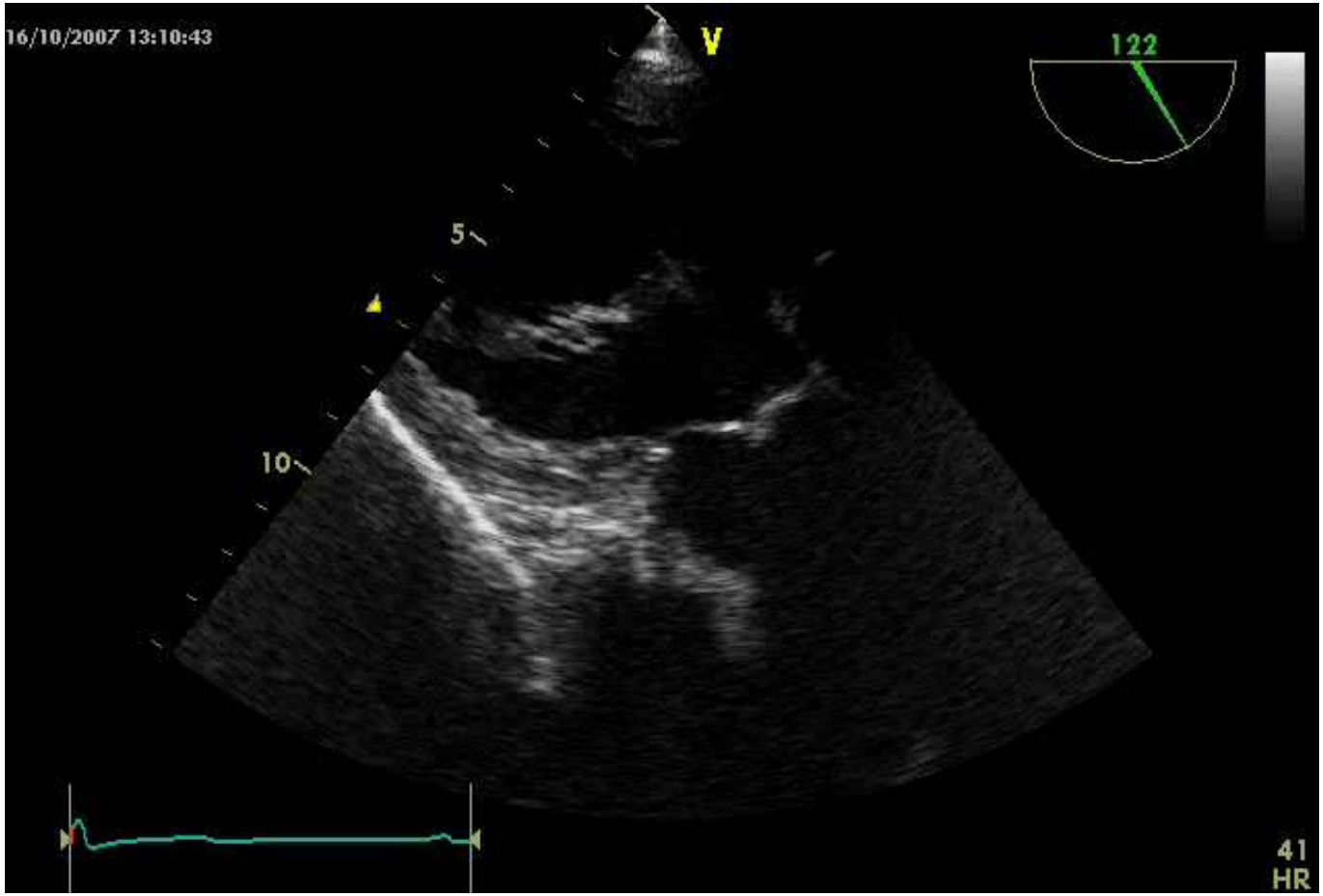
ML Felten
DIU 2009



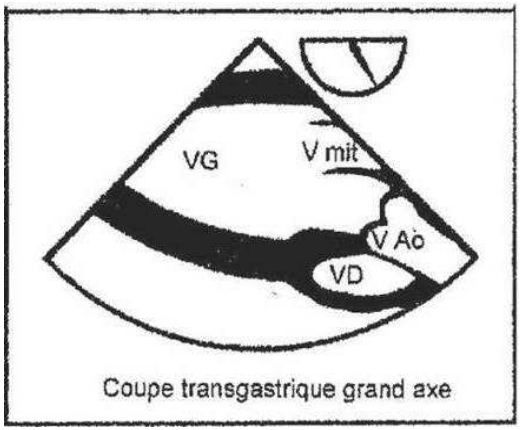
ML Felten
DIU 2009

Evaluation du débit cardiaque :

doppler : ITV aortique

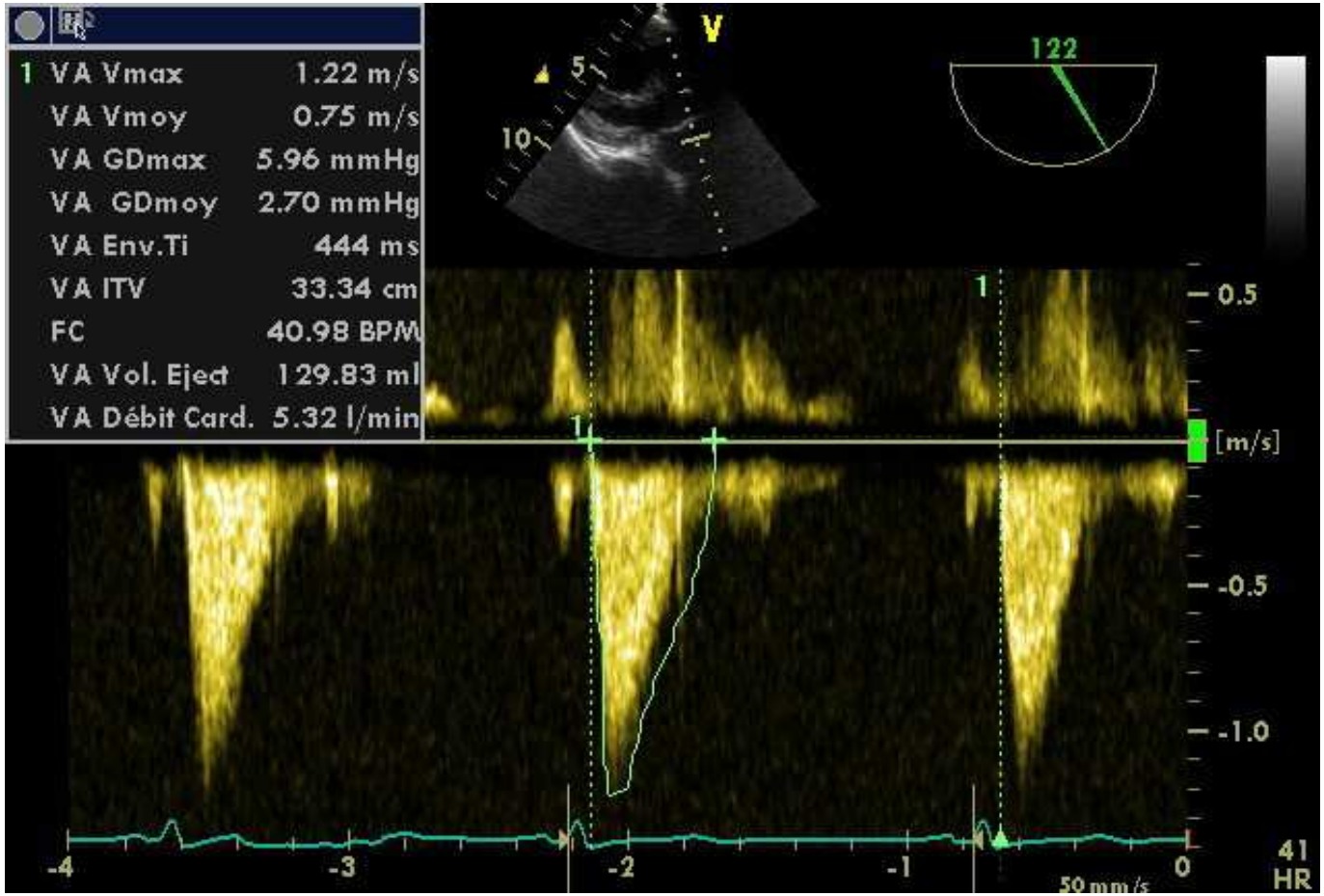


ML Felten
DIU 2009

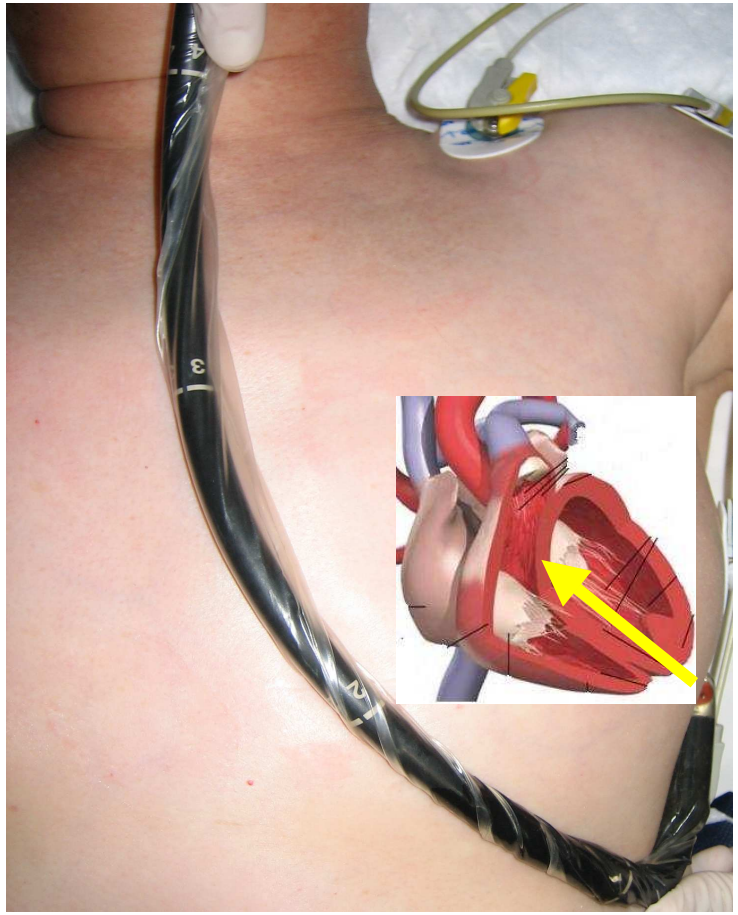


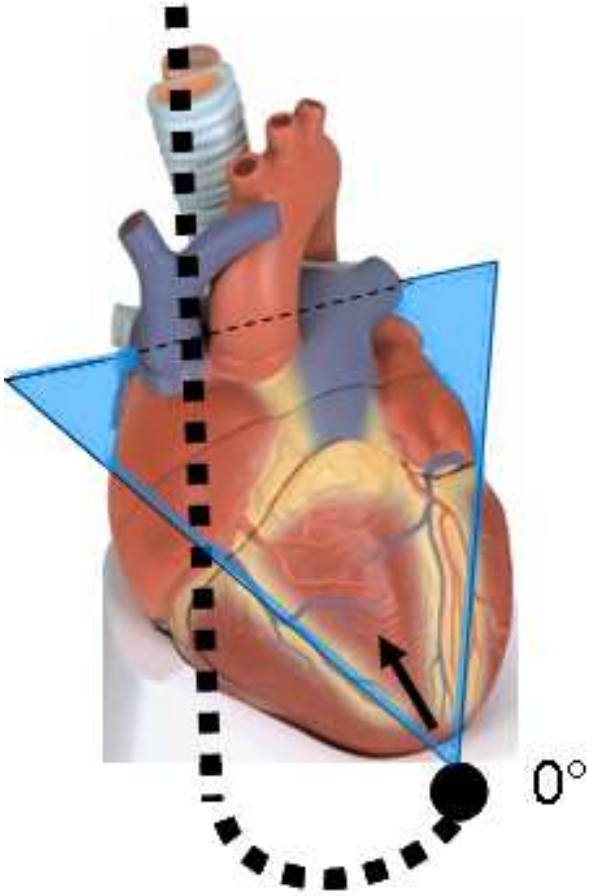
Vitesse aortique : 1,4 – 2,2 m/s

Doppler : ITV aortique : 18 – 22 cm



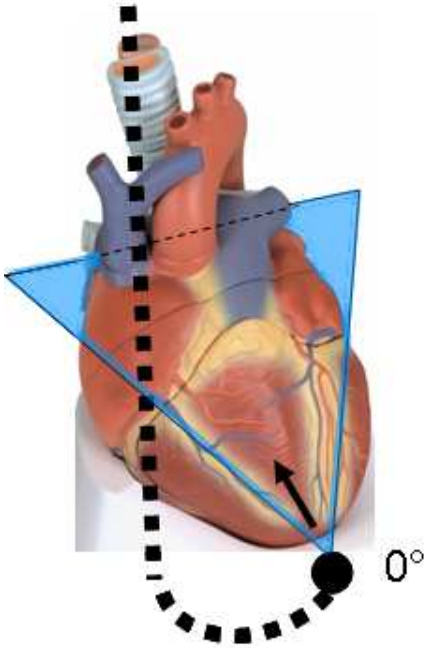
Coupe transgastrique profonde

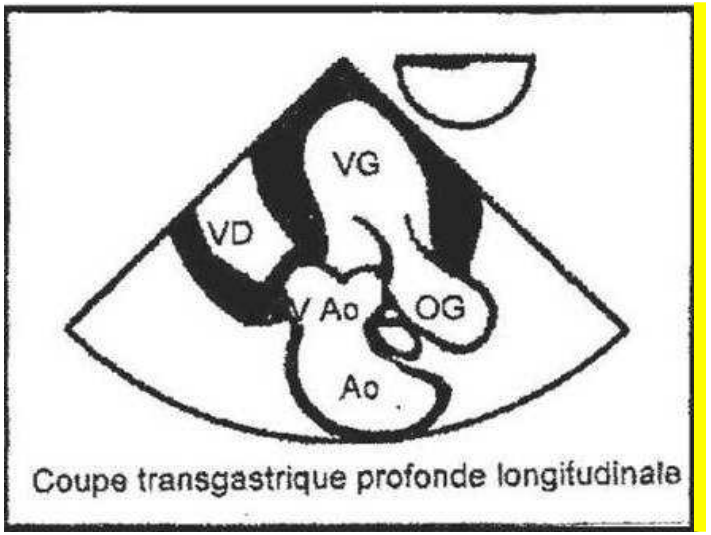


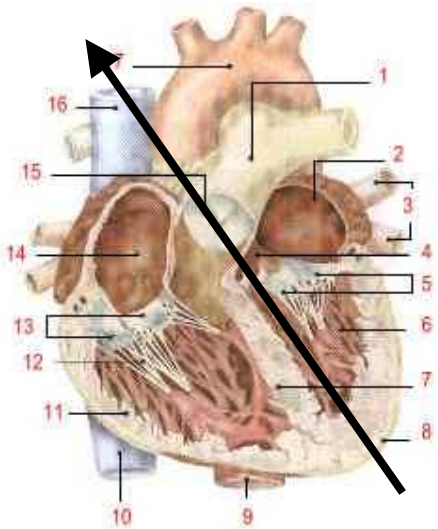


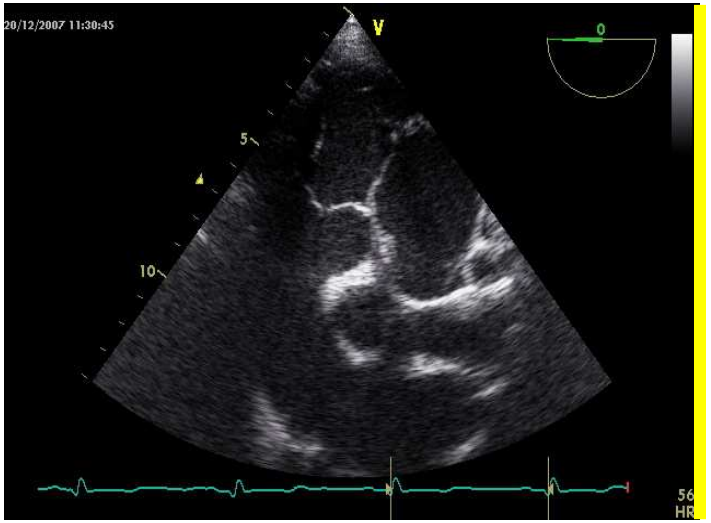
ML Felten
DIU 2009

Coupe transgastrique profonde





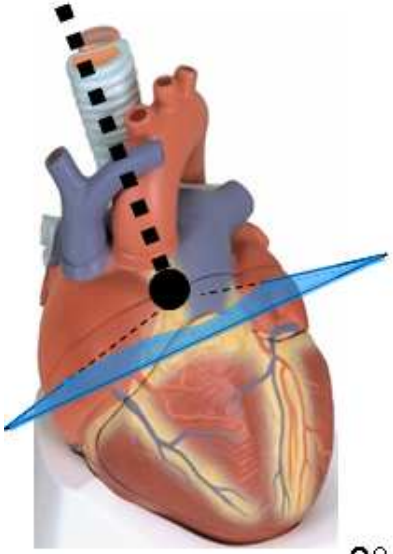


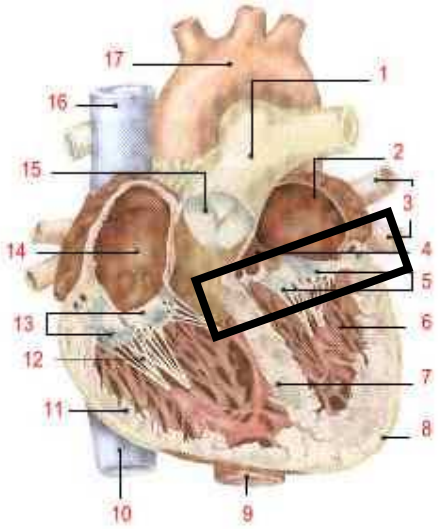


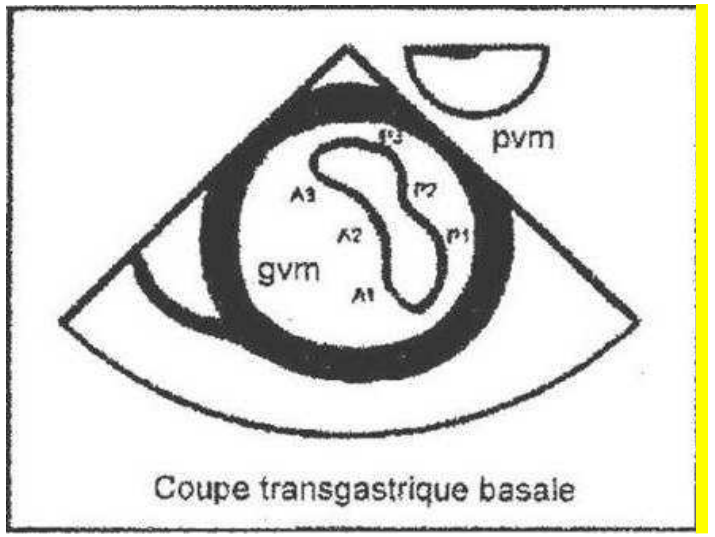
ML Felten
DIU 2009

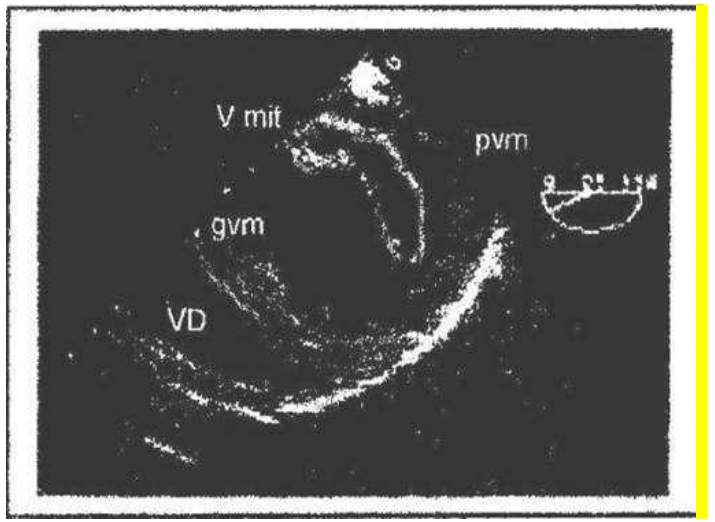
Coupe transgastrique basale

« fish-mouth » view de la valve mitrale
(localisation des feuillets mitraux)

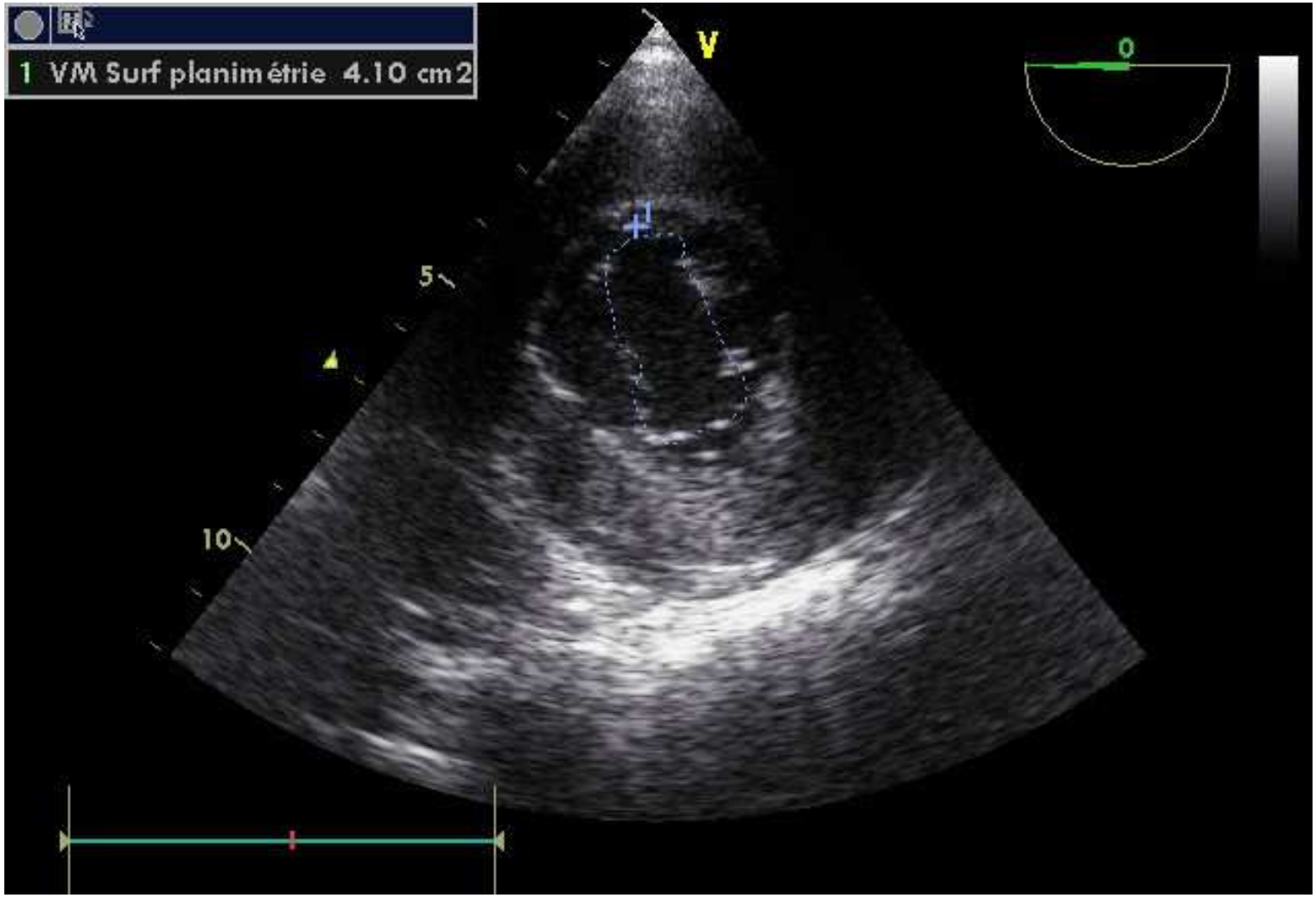








ML Felten
DIU 2009



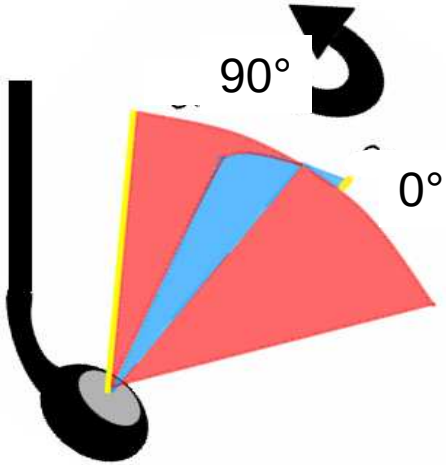
Planimétrie de la valve mitrale :

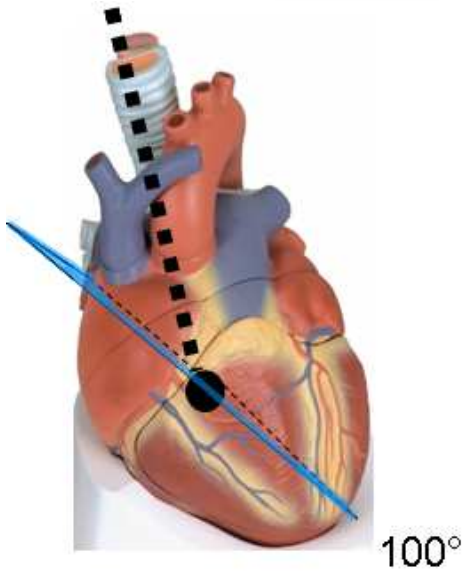
surface mitrale = 4 – 6 cm^2

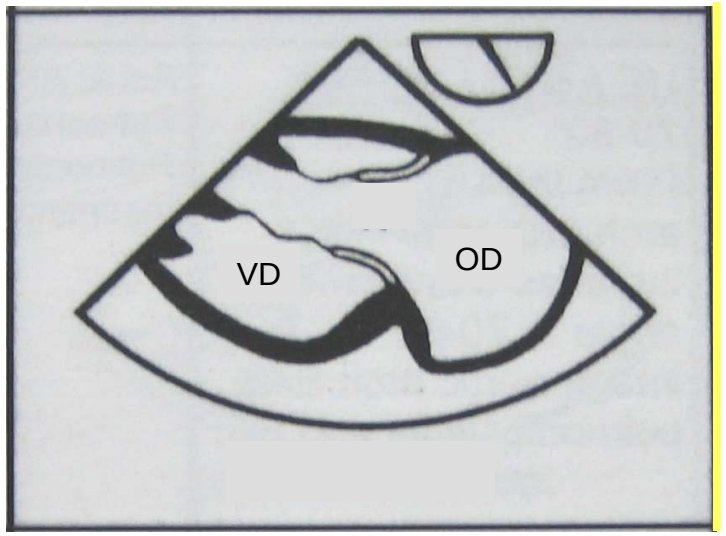
ML Felten
DIU 2009

Coupe transgastrique longitudinale du VD

rotation à partir de la « rondelle VD »







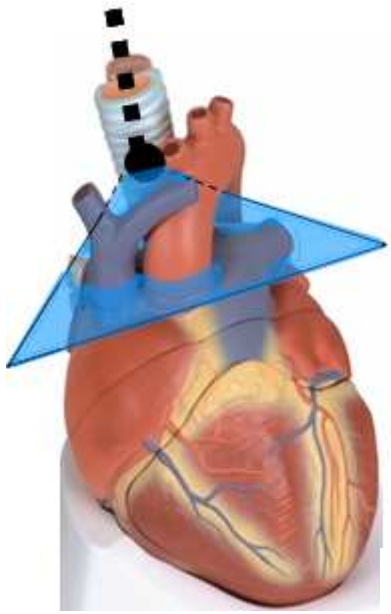
ML Felten
DIU 2009

1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres
3. SIA et la coupe bicavale
4. Coupes transgastriques : la rondelle et les autres

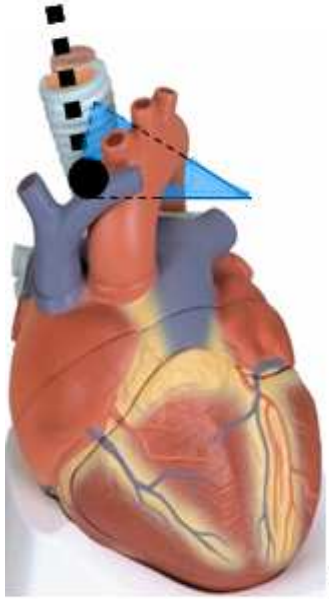
5. Coupes hautes :
les gros vaisseaux (Ao, VCS)

ML Felten
DIU 2009

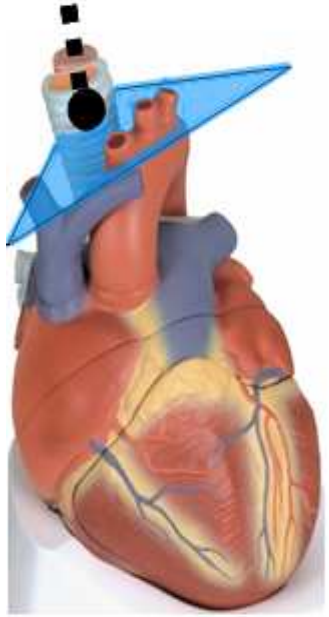
ML Felten
DIU 2009



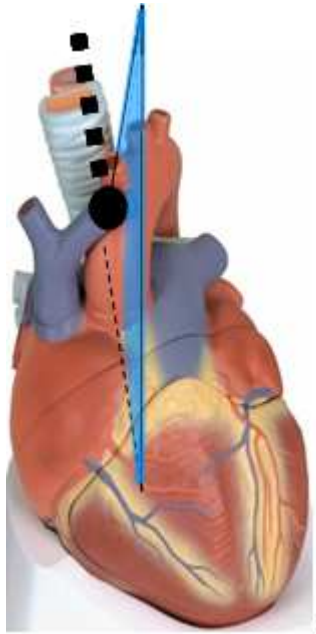
0°



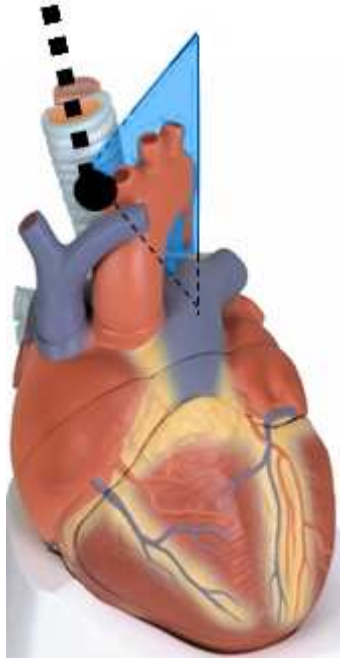
0°



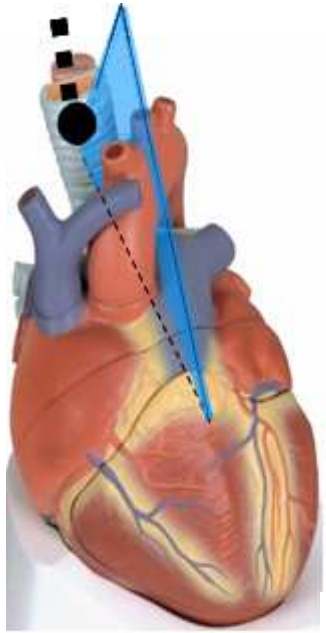
0°



90°



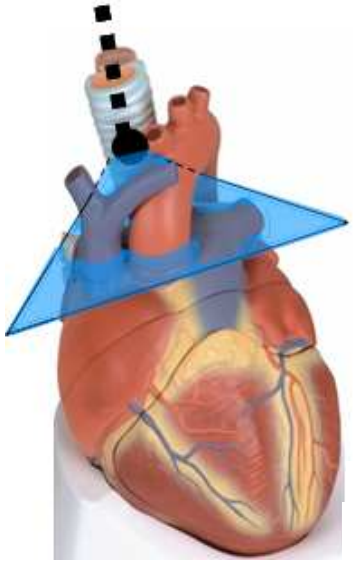
90°



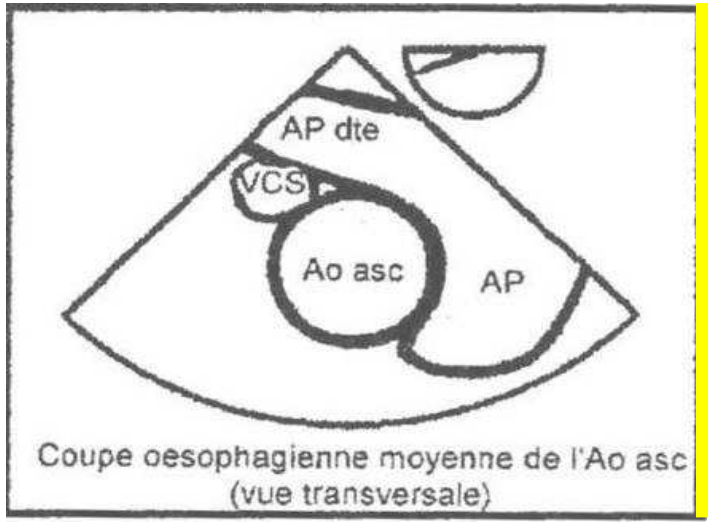
90°

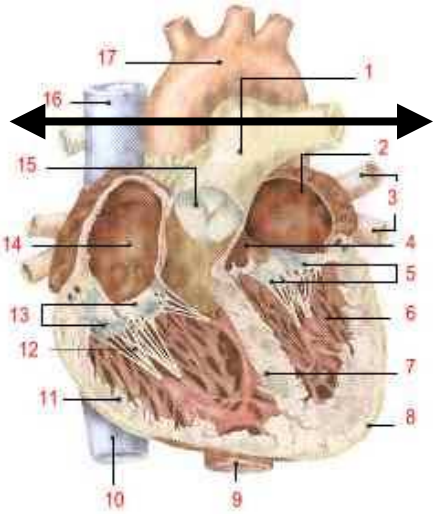
ML Felten
DIU 2009

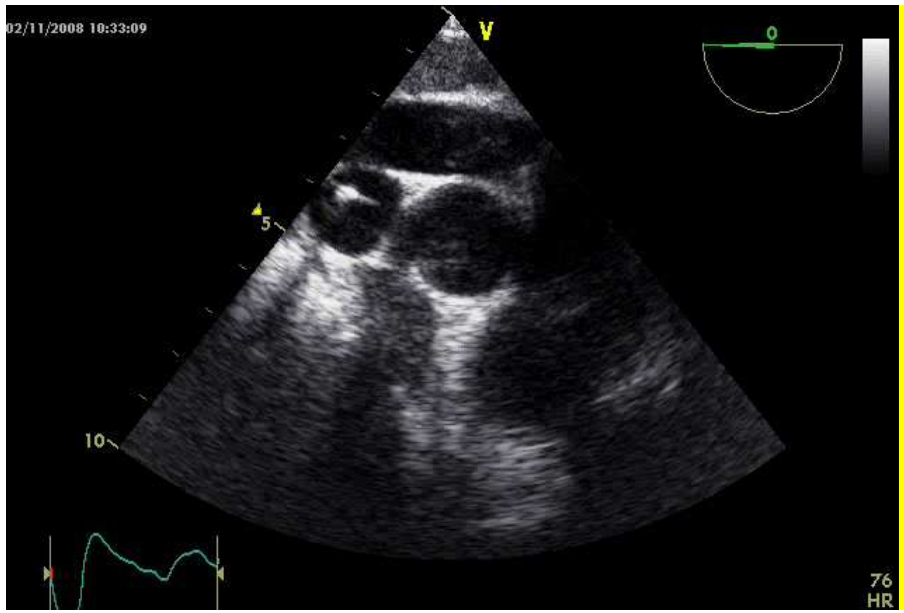
Coupe transversale de l'aorte ascendante (0°/20°)



0°

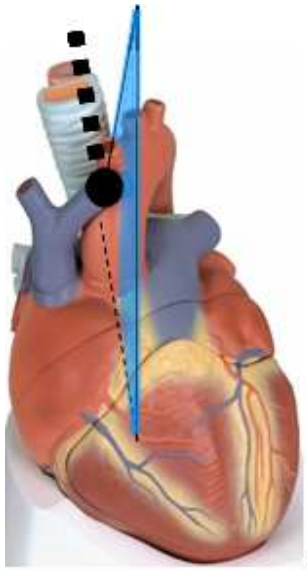


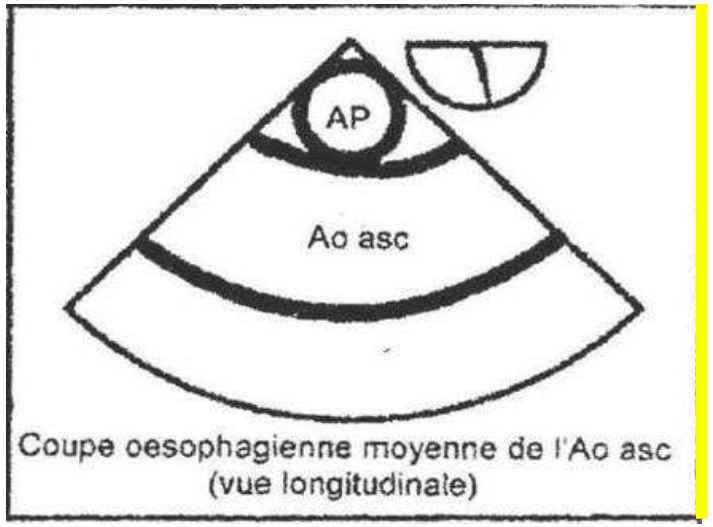


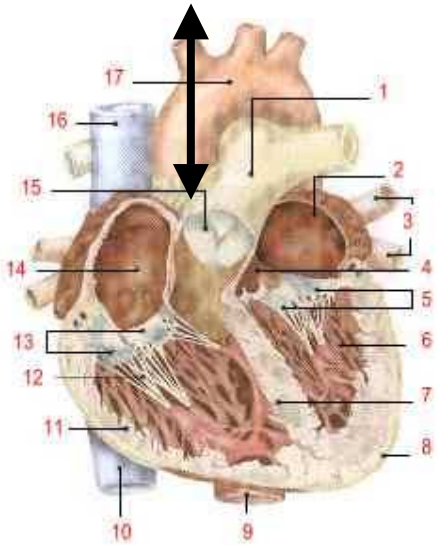


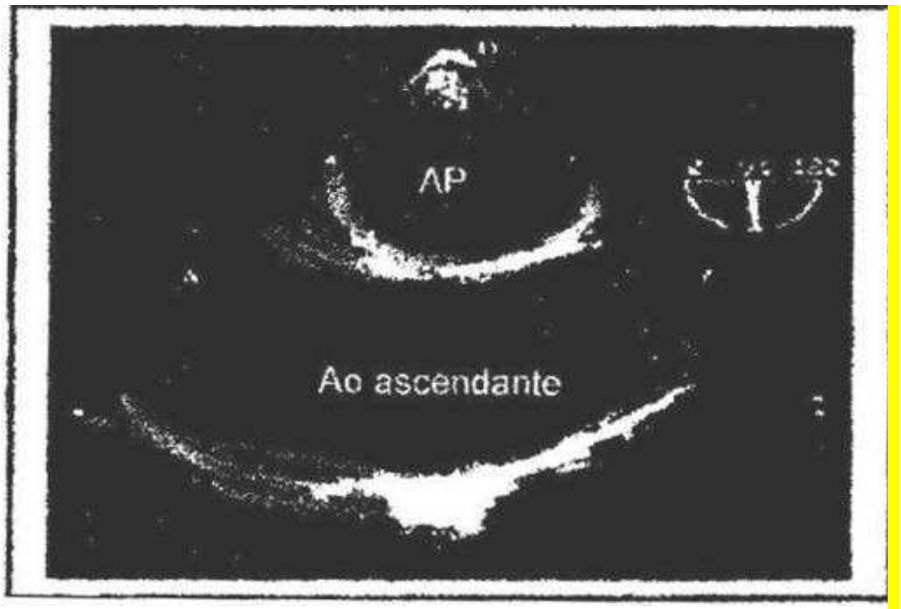
ML Felten
DIU 2009

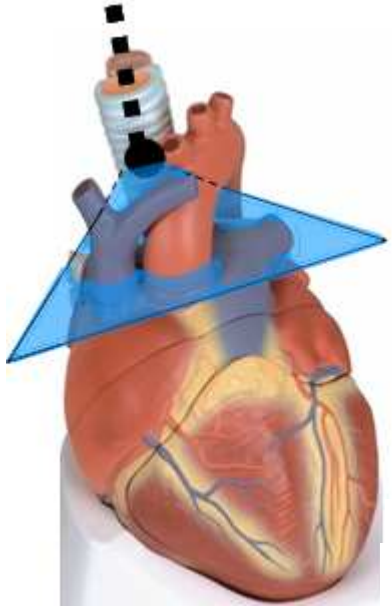
Coupe longitudinale de l'aorte ascendante (90°)

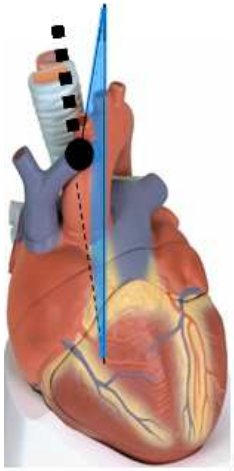








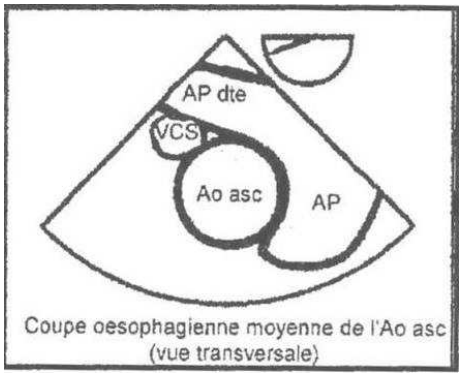




90°

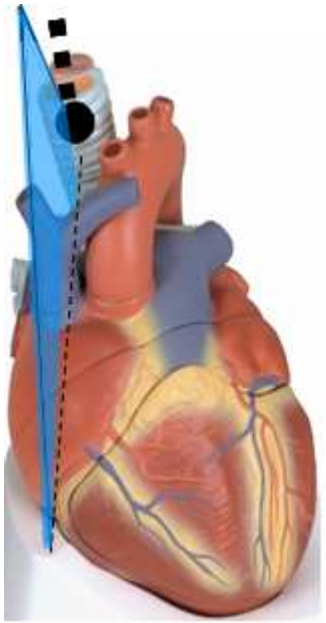
coupe longitudinale
de l'aorte ascendante

0°



Coupe oesophagienne moyenne de l'Ao asc
(vue transversale)

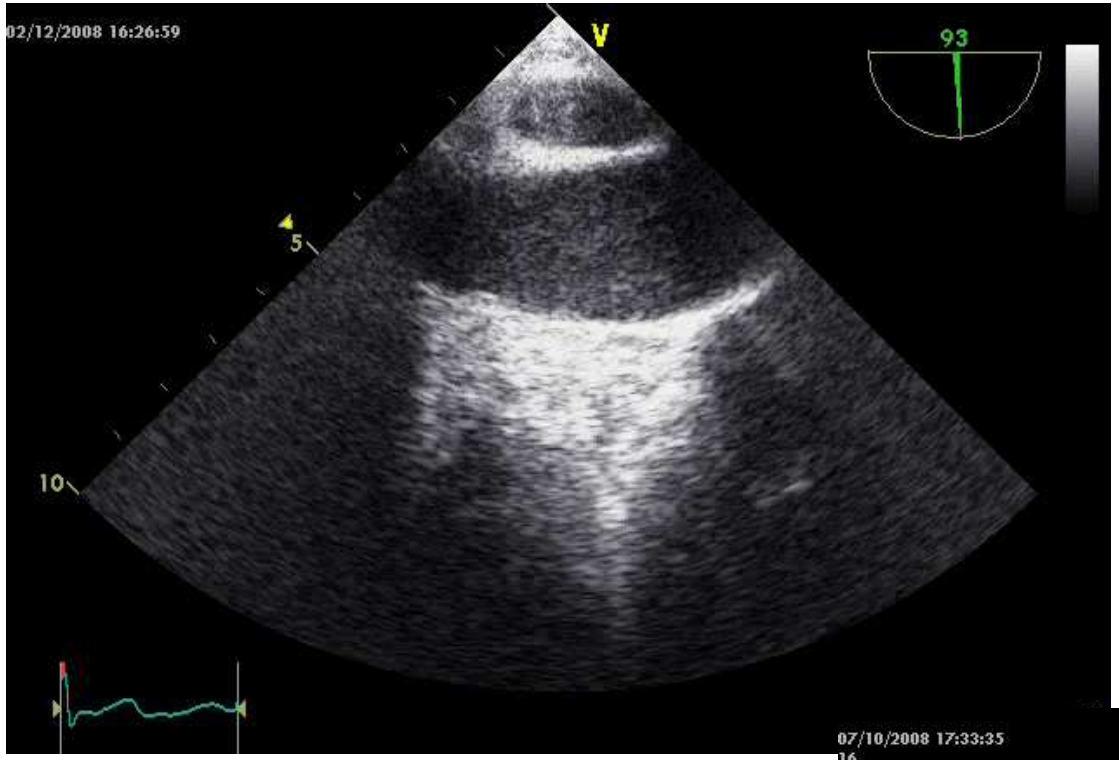
VCS

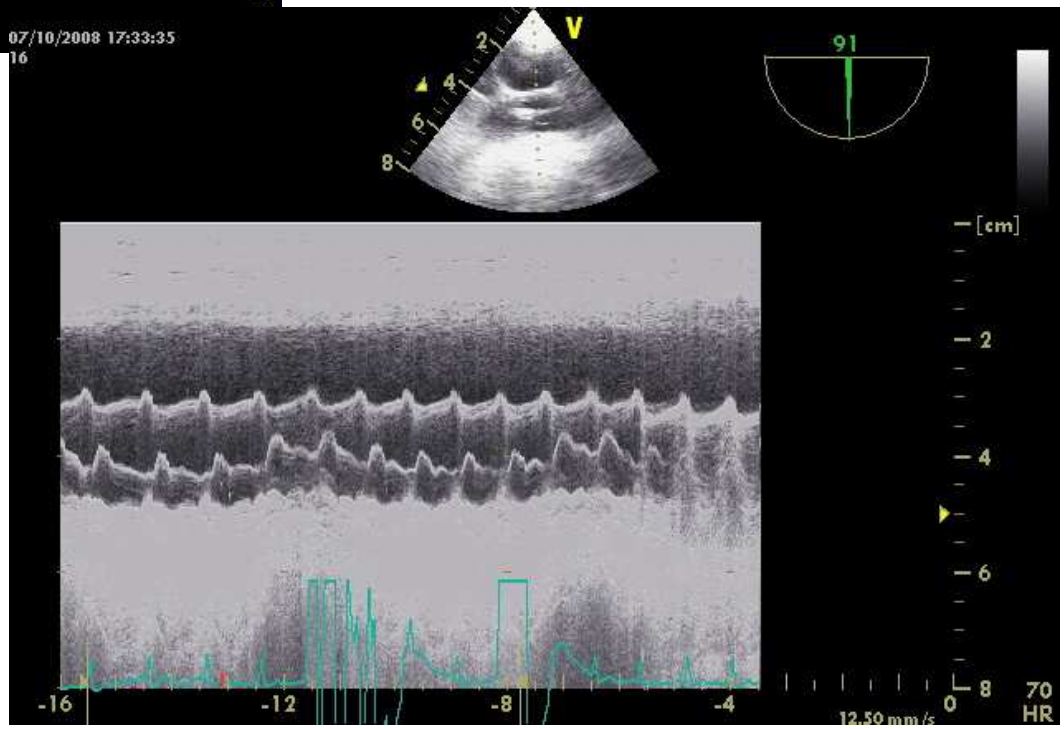


90°

ML Felten
DIU 2009

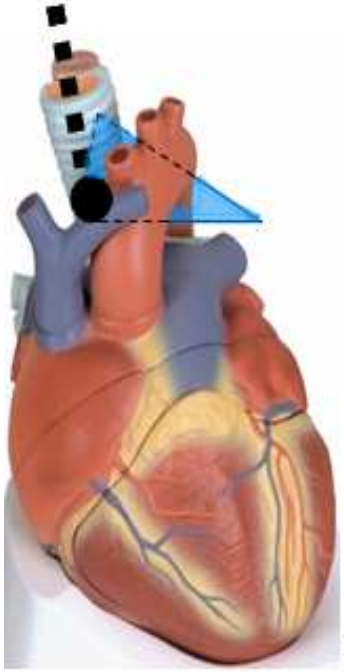
ML Felten
DIU 2009

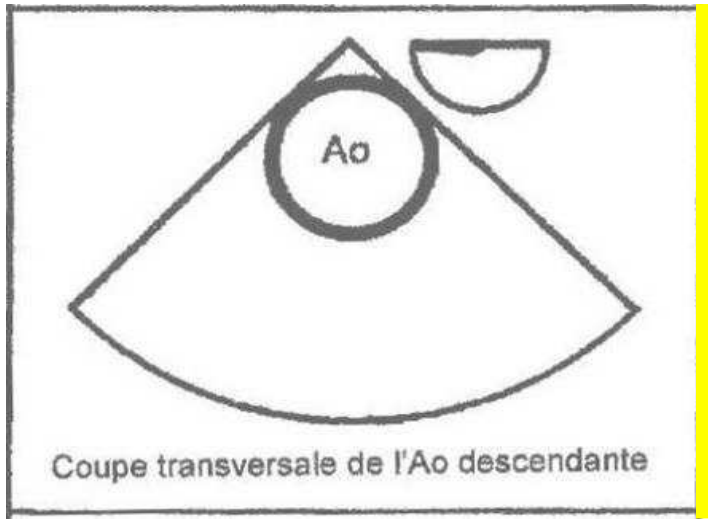




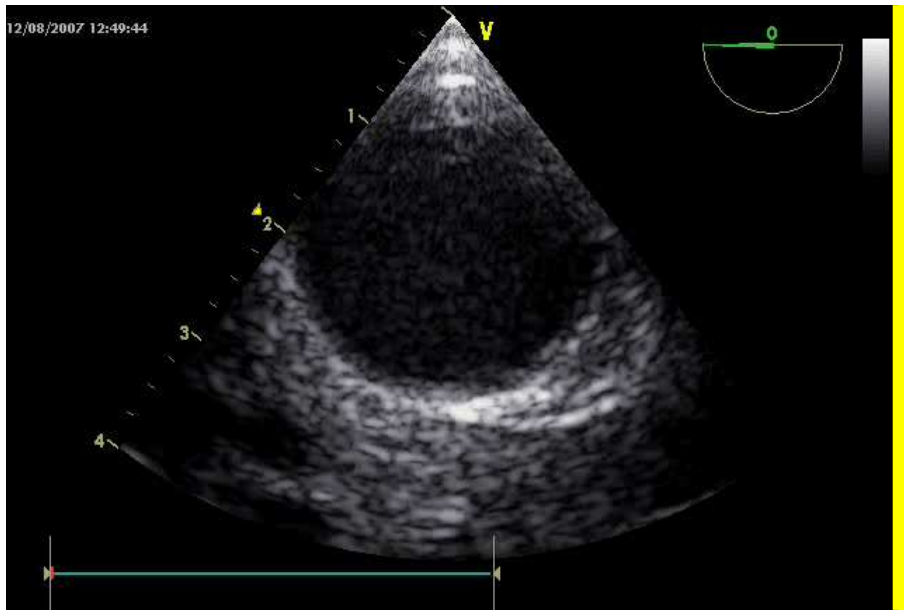
Coupe oesophagienne transversale de l'aorte descendante (0°)

ML Felten
DIU 2009



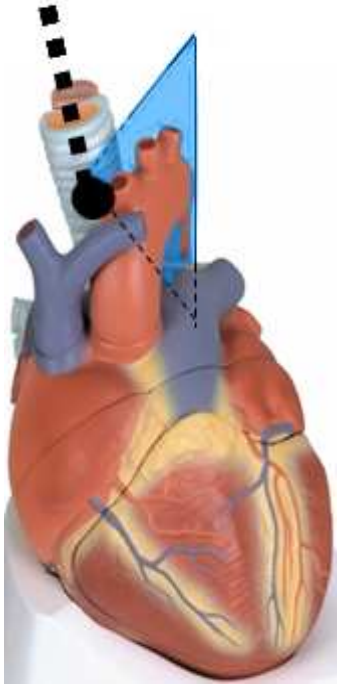


athérome, dissection Ao

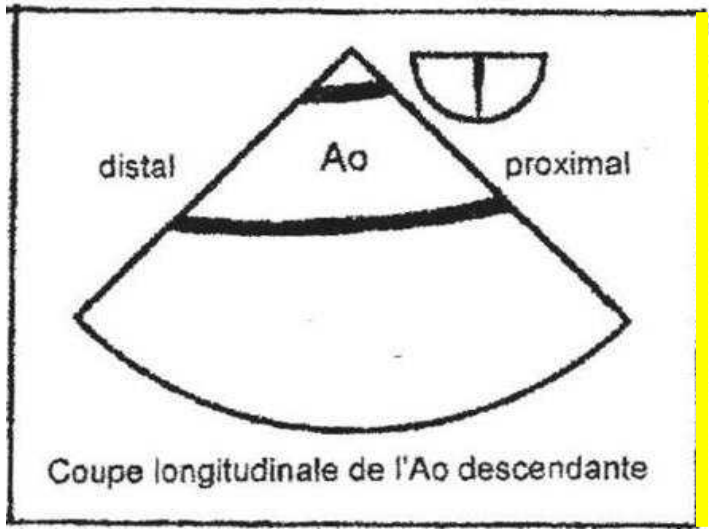


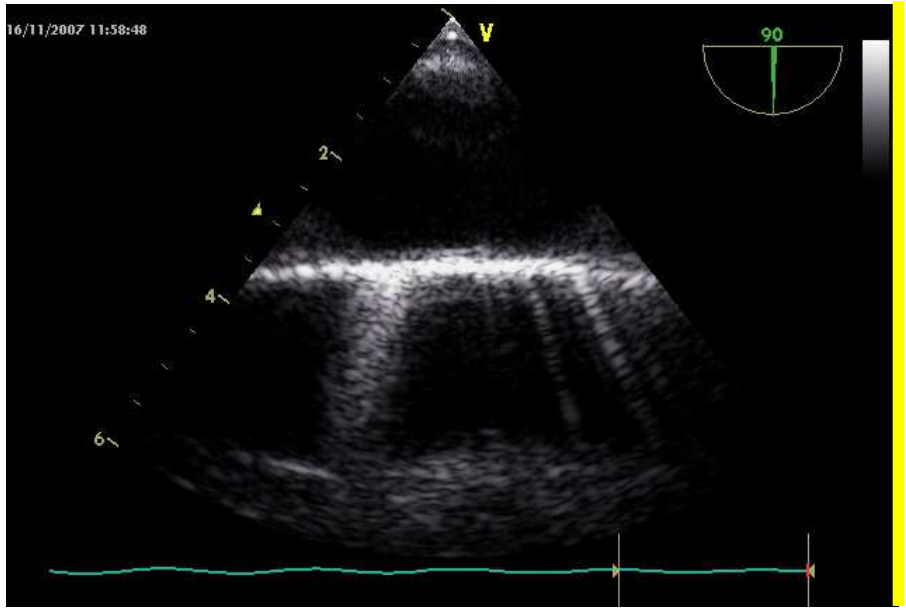
ML Felten
DIU 2009

Coupe longitudinale de l'aorte descendante (90°)



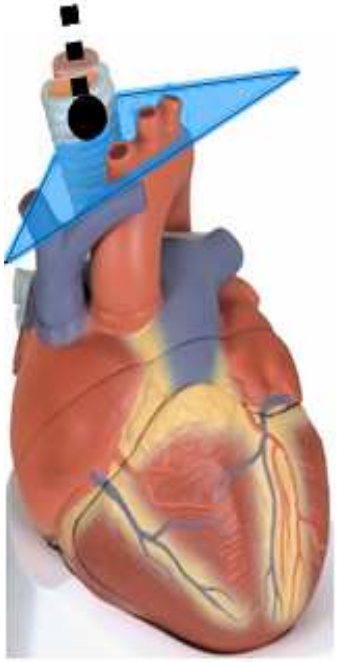
90°

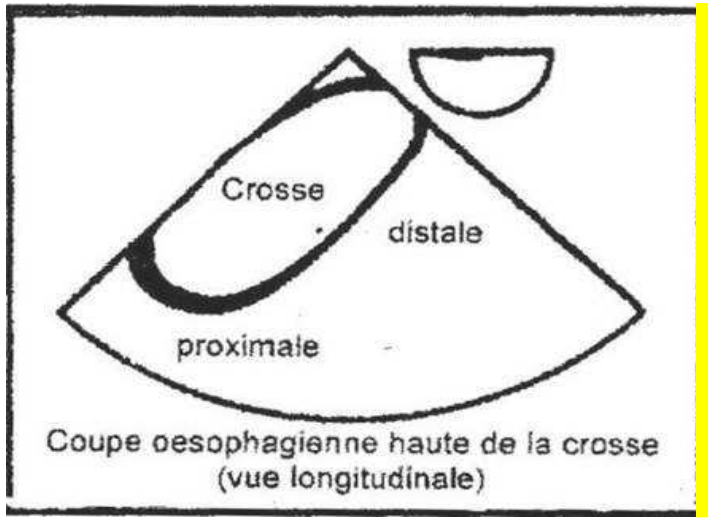


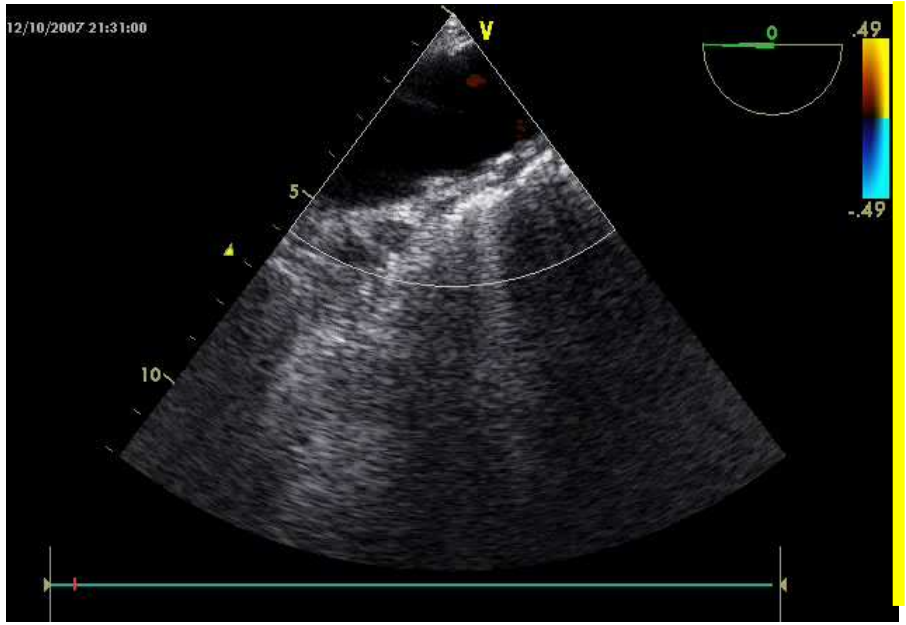


Coupe oesophagienne haute longitudinale de la crosse aortique (0°)

ML Felten
DIU 2009

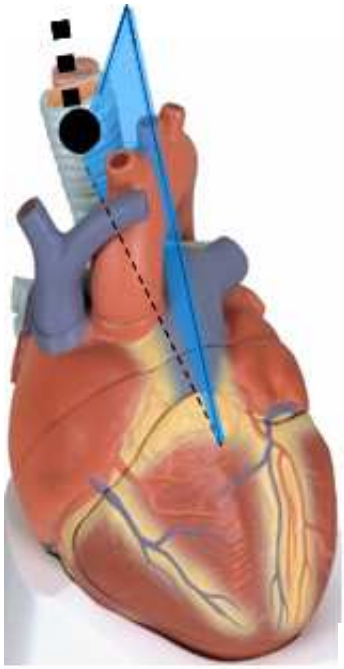




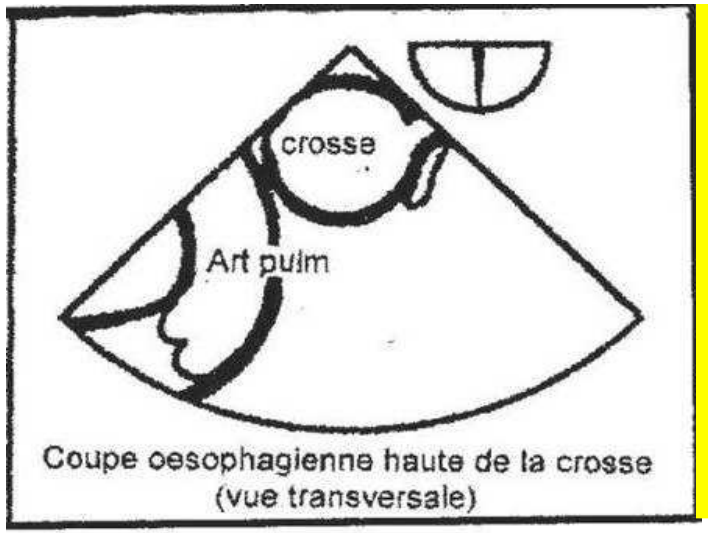


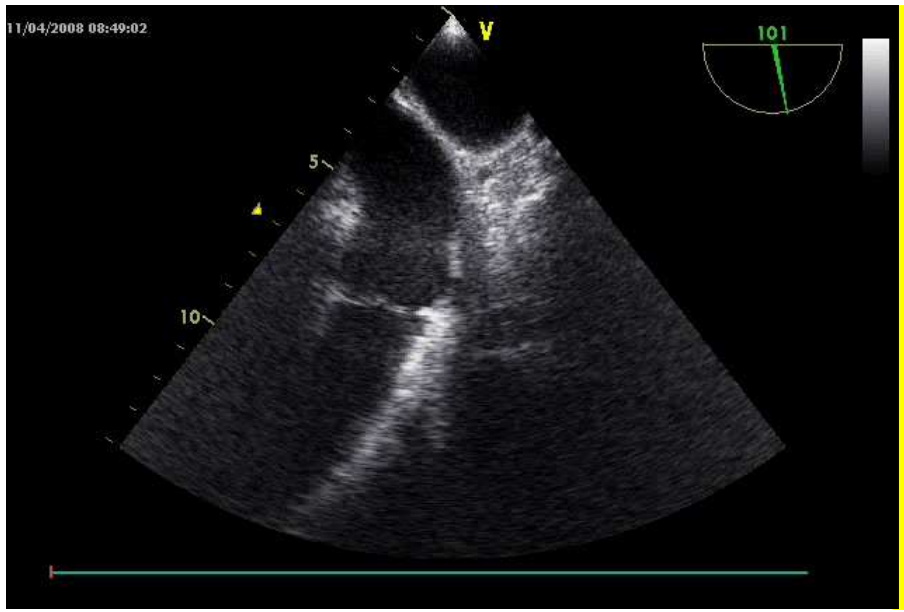
Coupe oesophagienne haute transversale de la crosse aortique (90°)

ML Felten
DIU 2009

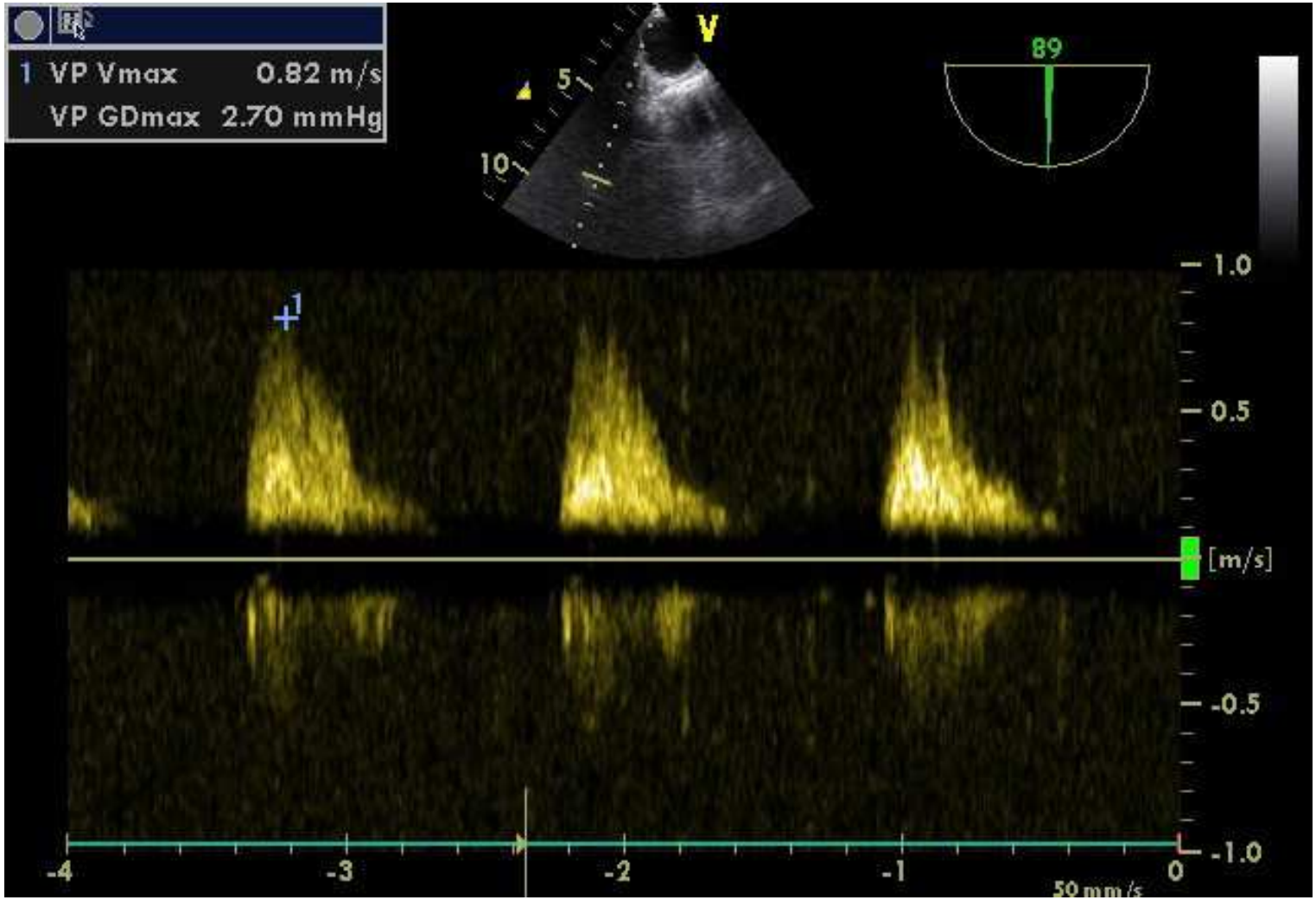


90°





Diamètre du tronc de l'AP = 2 ± 0,5 cm



Evaluation du flux pulmonaire (éjection du VD) :

- vitesse ≤ 1 m/s
- ITV pulmonaire : 11 ± 2 cm

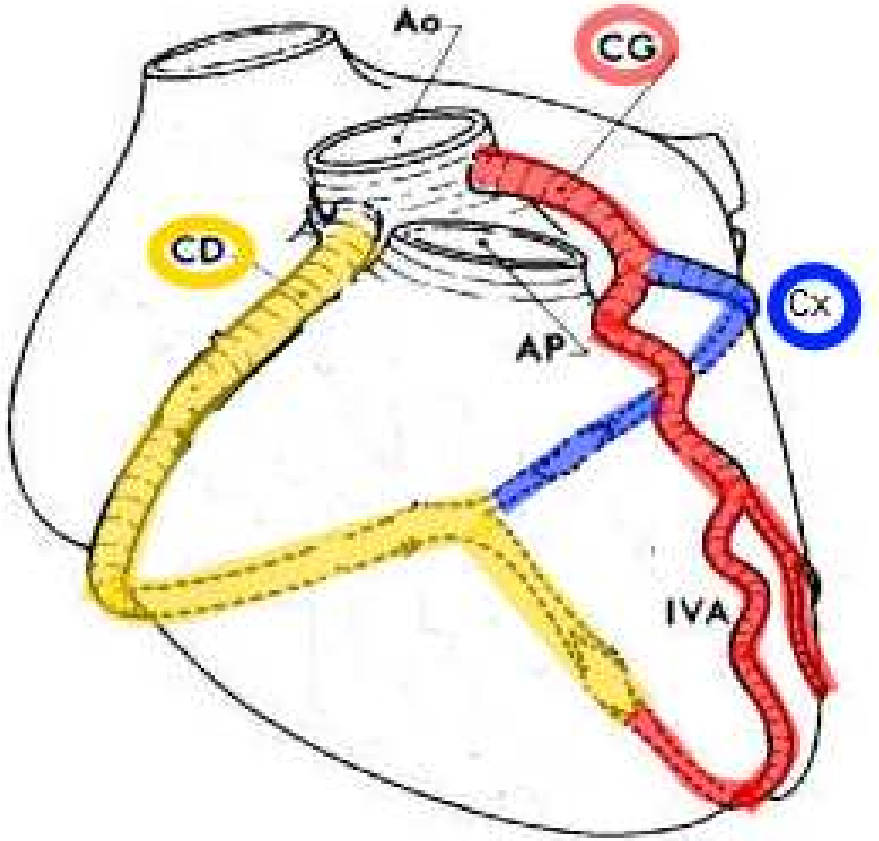
ML Felten
DIU 2009

1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres
3. SIA et la coupe bicavale
4. Coupes transgastriques : la rondelle et les autres
5. Coupes hautes : les gros vaisseaux (Ao, VCS)

6. Les territoires coronariens

ML Felten
DIU 2009

réseau droit dominant (= l'IVP part de la coronaire droite) dans 80 - 90% des cas



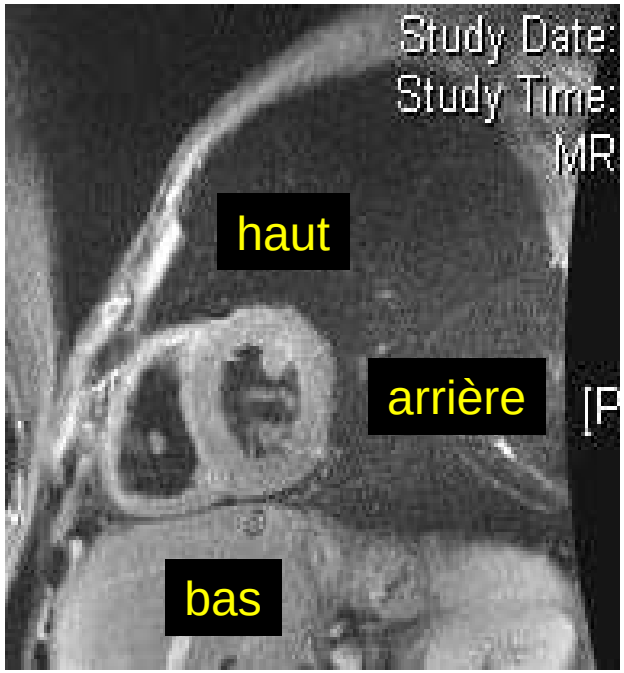
Coronaire droite

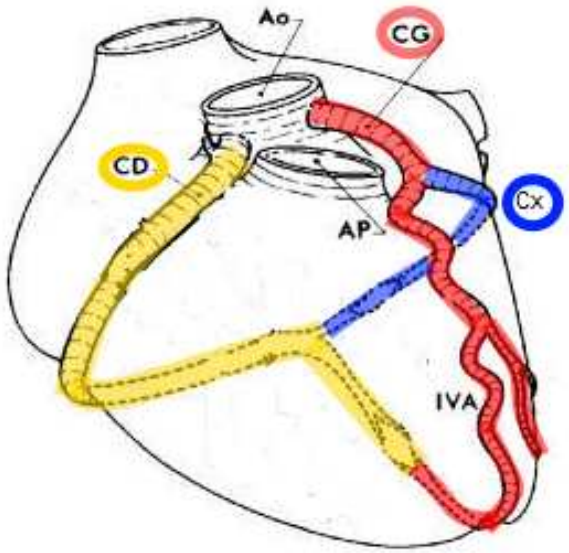
Coronaire gauche / IVA

Circonflexe

ML Felten
DIU 2009

Thorax de profil

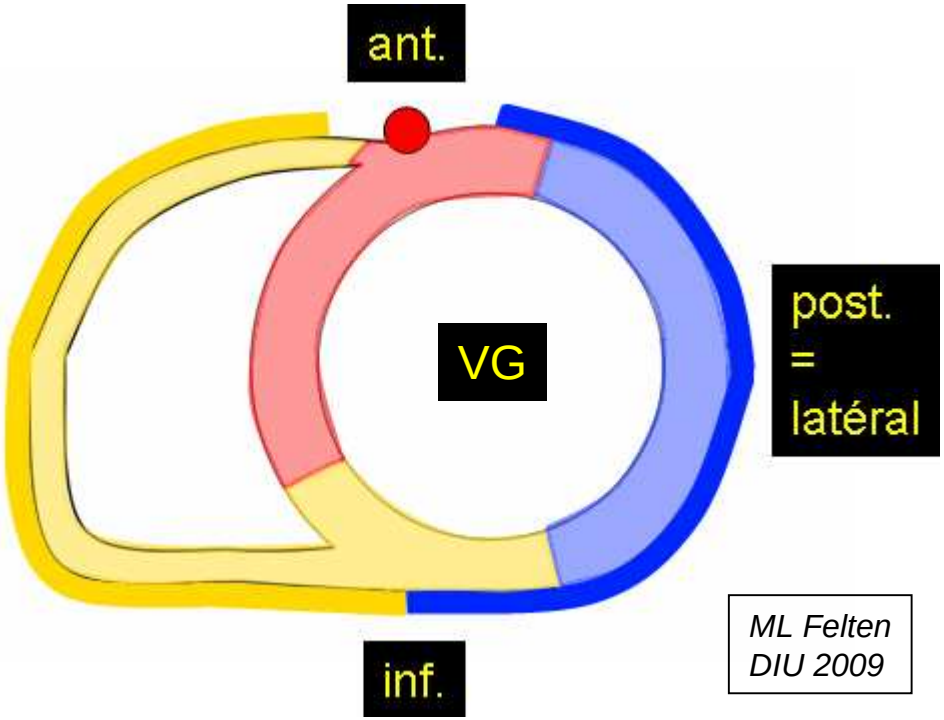




Coronaire droite

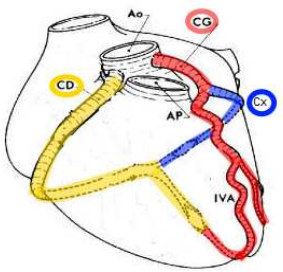
Coronaire gauche / IVA

Circonflexe

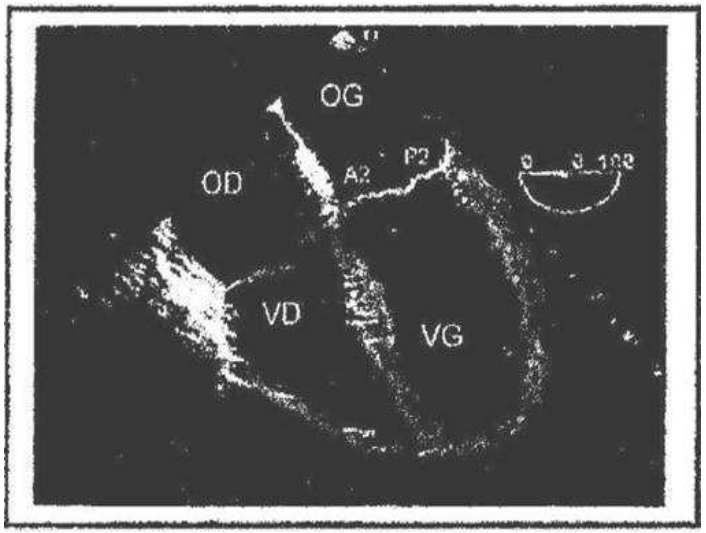


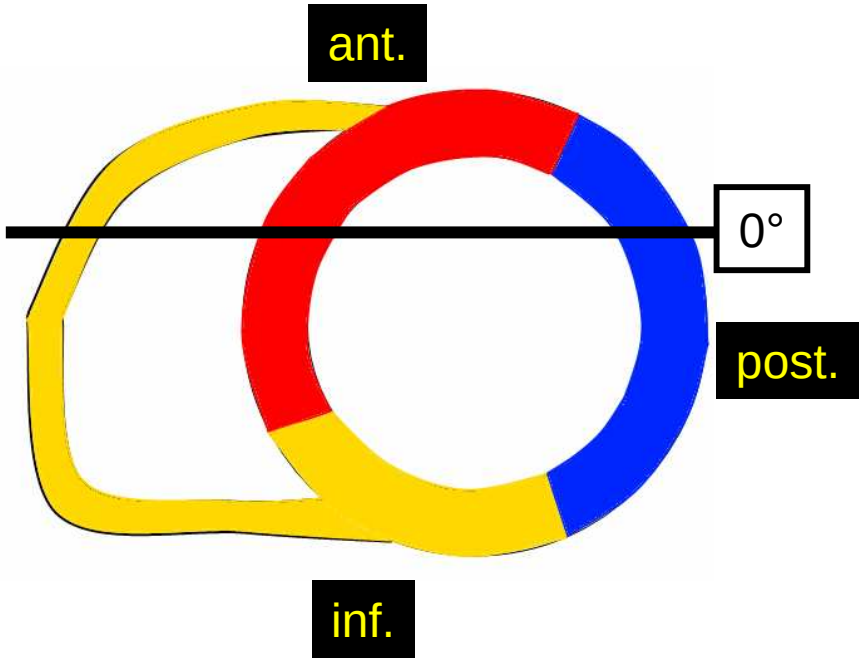
ML Felten
DIU 2009

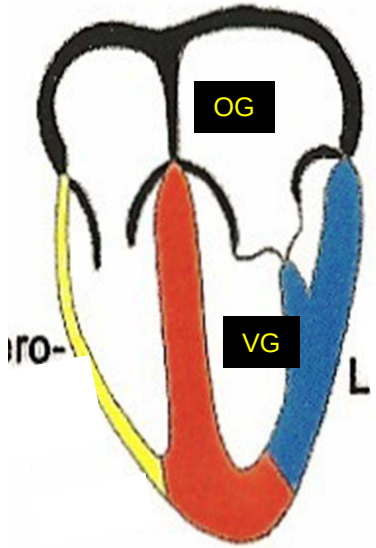
Coupe 4 cavités (0°) :



Coronaire droite
Coronaire gauche
Circonflexe

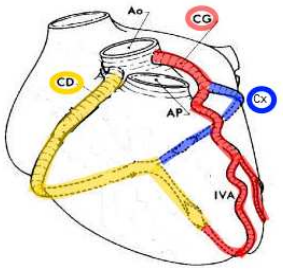




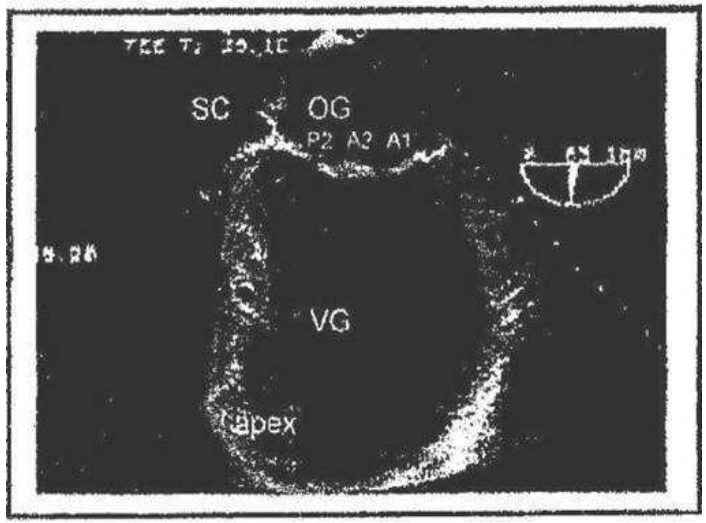


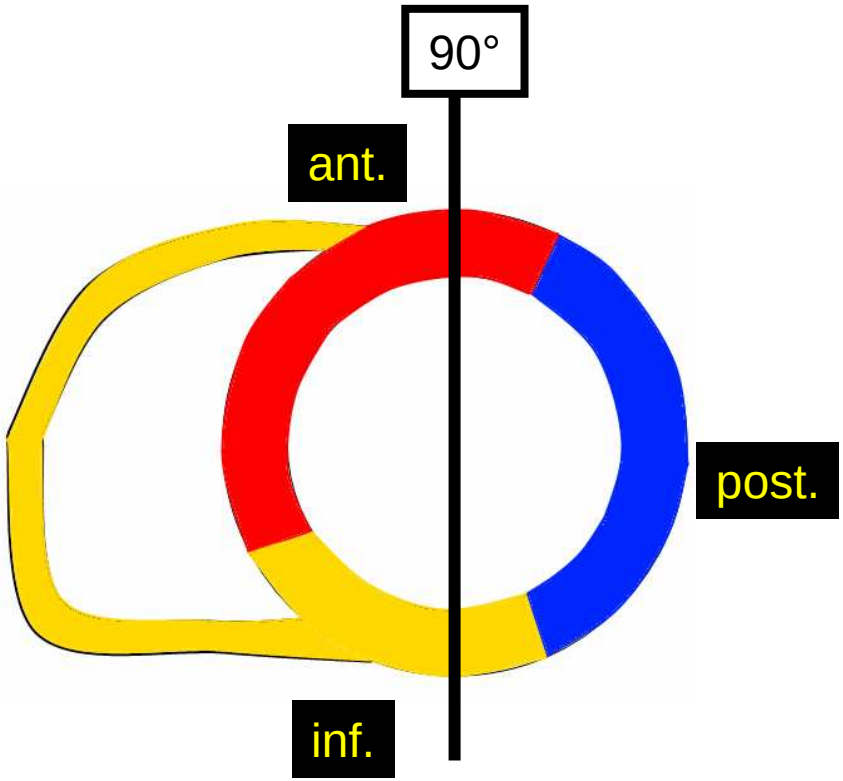
ML Felten
DIU 2009

Coupe 2 cavités (90°) :



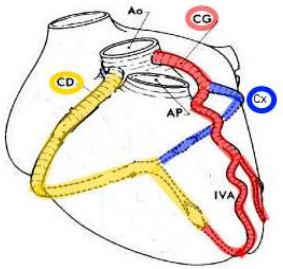
Coronaire droite
Coronaire gauche
Circonflexe



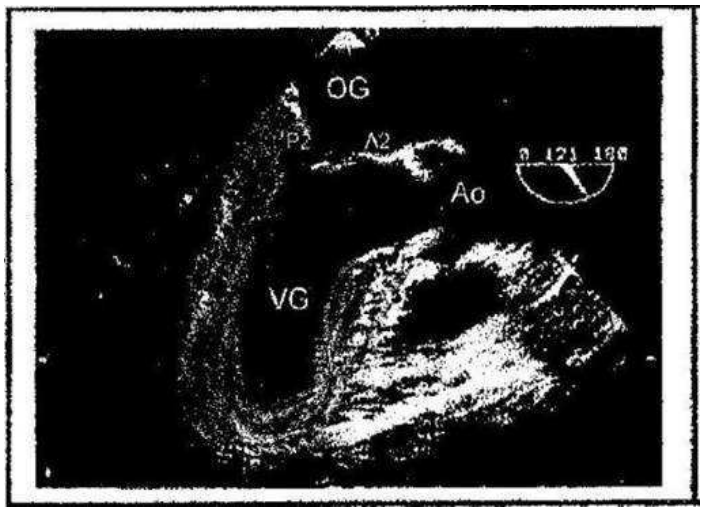


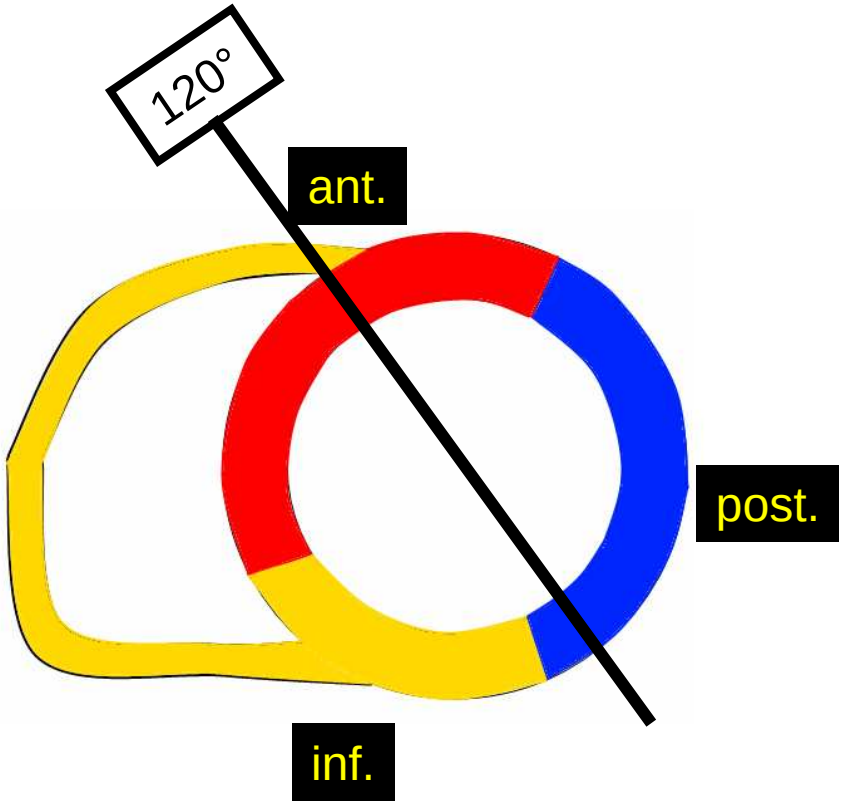
ML Felten
DIU 2009

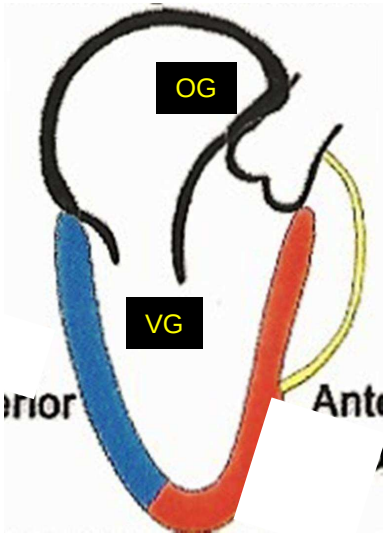
Coupe aortique longitudinale (120°) :



Coronaire droite
Coronaire gauche
Circonflexe

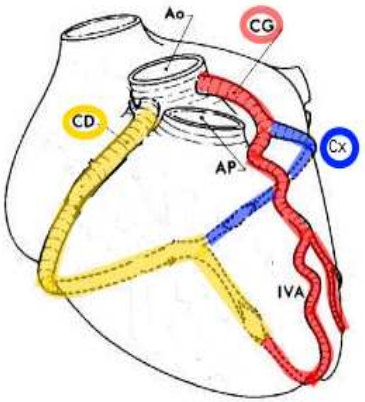




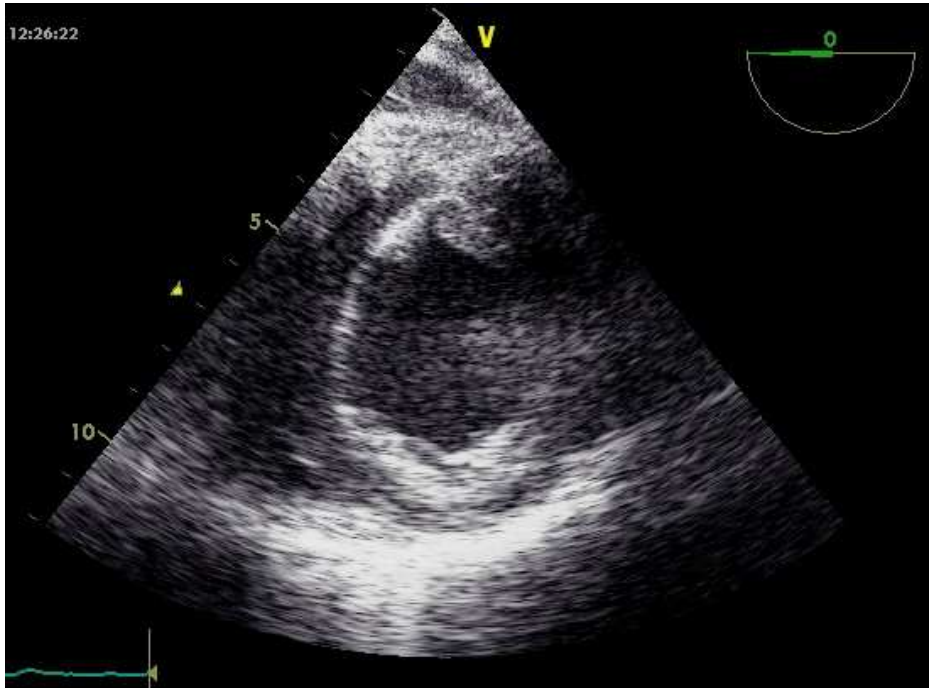


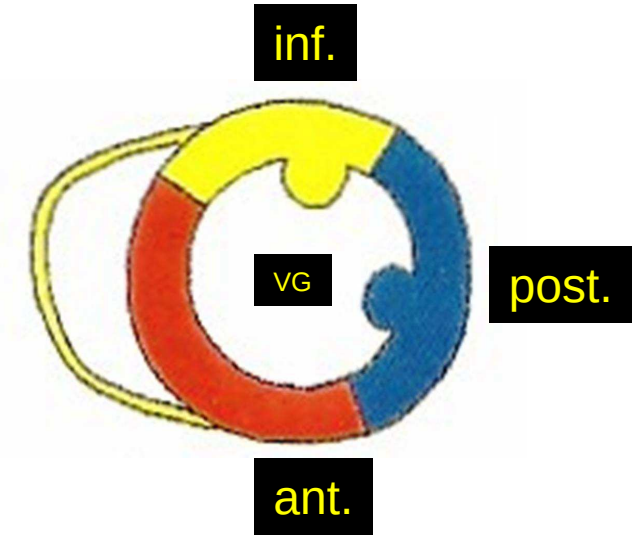
ML Felten
DIU 2009

Rondelle transgastrique (0°) :



Coronaire droite
Coronaire gauche
Circonflexe





ML Felten
DIU 2009

1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres
3. SIA et la coupe bicavale
4. Coupes transgastriques : la rondelle et les autres
5. Coupes hautes : les gros vaisseaux (Ao, VCS)
6. Les territoires coronariens

7. Les valeurs normales

ML Felten
DIU 2009

VG : fonction systolique :

évaluation visuelle

dimensions (4 cav) : systole : 3,2 x 4,8 cm (± 0,8 cm)
diastole : 4,8 x 6,1 cm (± 0,8 cm) } ! > 6 cm

FEVG : 55 – 75 %
FRS : 36 – 64 % } 60 %

FR (diamètres VG) : 18 – 42 %

ITV aortique : 18 – 22 cm

fonction diastolique :

E/A : 1-2

Ea : 10 cm/s

E/Ea : 8

VD : évaluation visuelle

dimensions (4 cav) : systole : 1,8 x 4,1 cm (± 0,5 cm)

diastole : 2,9 x 5,0 cm (± 0,5 cm)

} ! > 5 cm

raccourcissement : 2,0 – 2,5 cm

ITV pulmonaire : 11 ± 2 cm

OG : systole : 2,7 x 4,3 cm (± 1 cm)

diastole : 1,6 x 2,9 cm (± 1 cm)

OD : systole : 3,8 x 4,3 cm (± 0,8 cm)

diastole : 3,2 x 3,8 cm (± 0,8 cm)

} ! > 4 cm

ML Felten
DIU 2009

Aorte thoracique : sinus de Valsalva : 2,8 ± 0,2 cm
jonction sino-tubulaire : 2,4 ± 0,4 cm
aorte ascendante : 2,6 – 3,1 ± 0,3 cm
aorte descendante : 1,6 x 2,3 cm (± 0,5 cm)
absence d'athérome aortique

} ! si > 3 cm

Valves : mitrale : fine, mobile
anneau : 3,1 cm ± 0,5 cm
surface : 4 – 6 cm^2
gradient transvalvulaire : 4 mmHg

tricuspide : fine, IT ?
anneau : 2,9 cm ± 0,5 cm
surface : 7 – 9 cm^2
gradient transvalvulaire : 2 mmHg

} valves atrio-ventriculaires = 3 cm

ML Felten
DIU 2009

Valves : aortique : tricuspide, sans calcifications
anneau : 2,1 cm ± 0,3 cm
surface : 3 - 4 cm^2
gradient : 8 - 20 mmHg

pulmonaire : anneau : 2,1 ± 0,3 cm
gradient : < 4 mmHg
tronc de l'AP : 2 ± 0,5 cm

} valves de sortie ventriculaire = 2 cm

Veine cave supérieure : 1,4 cm ± 0,2 cm

Veine cave inférieure : 1,6 cm ± 0,2 cm

} 2 cm

ML Felten
DIU 2009

Résumé mnémotechnique des mesures :

VG : < **6** cm

VD : < **5** cm

OG et OD : < **4** cm

Aorte thoracique : < **3** cm

Valves atrio-ventriculaires : **3** cm

Valves de sortie ventriculaires : **2** cm

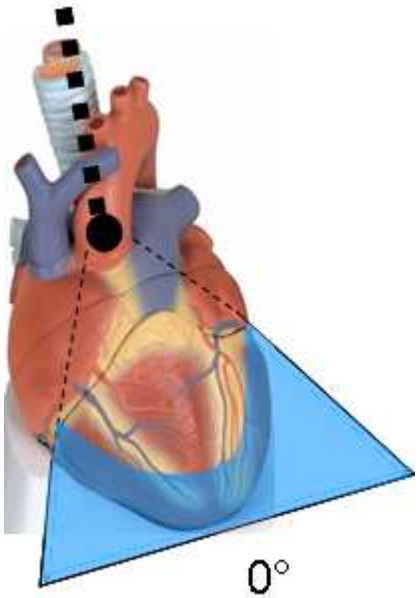
Veines caves : < **2** cm

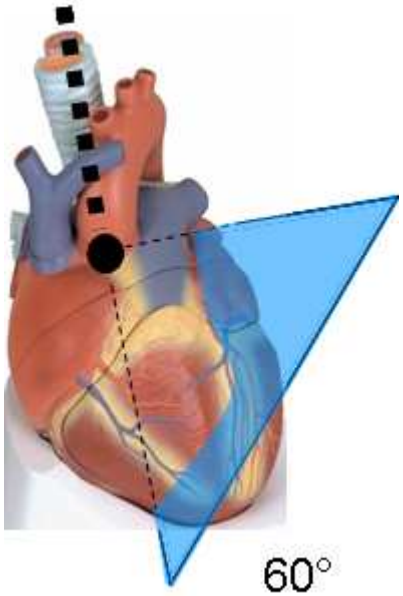
ML Felten
DIU 2009

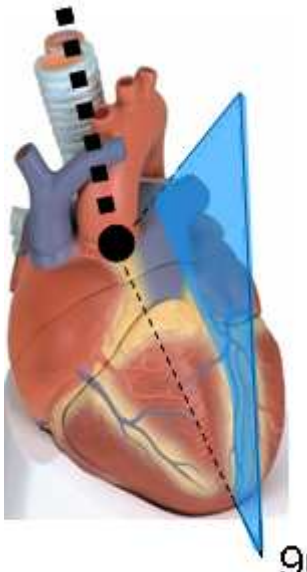
1. Notions générales
2. Coupes oesophagiennes :
   4 cavités / Mercedes et les autres
3. SIA et la coupe bicavale
4. Coupes transgastriques : la rondelle et les autres
5. Coupes hautes : les gros vaisseaux (Ao, VCS)
6. Les territoires coronariens
7. Les valeurs normales

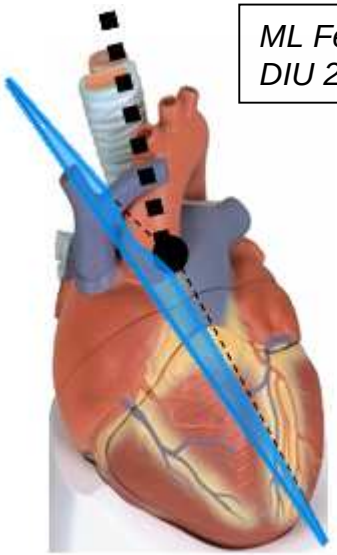
8. 20 coupes de l'ETO standard : Résumé et conclusions

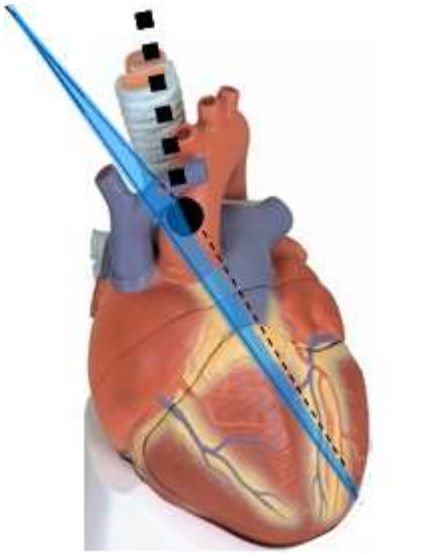
ML Felten
DIU 2009

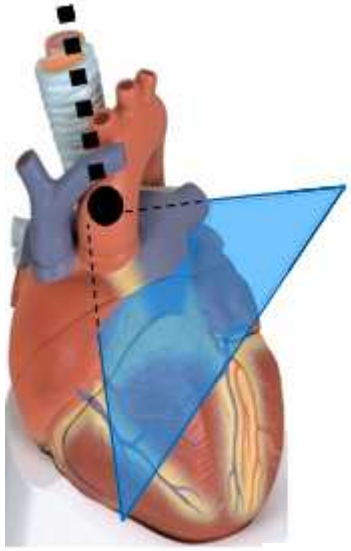


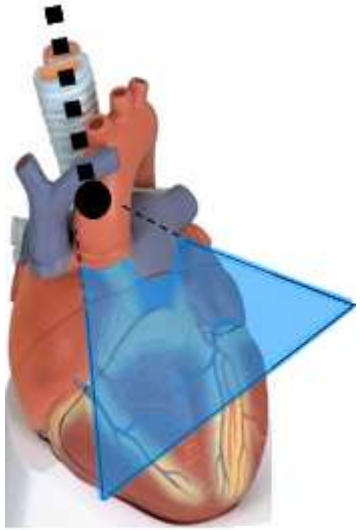


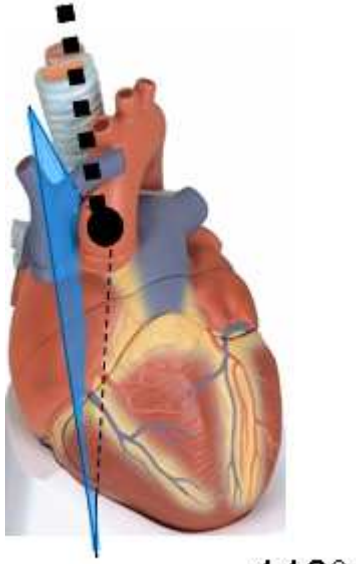


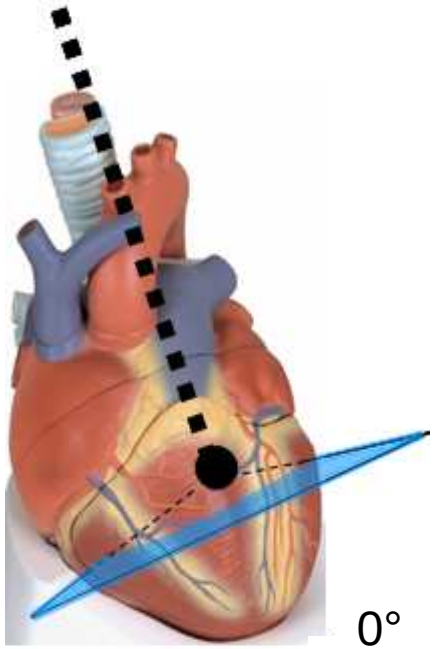


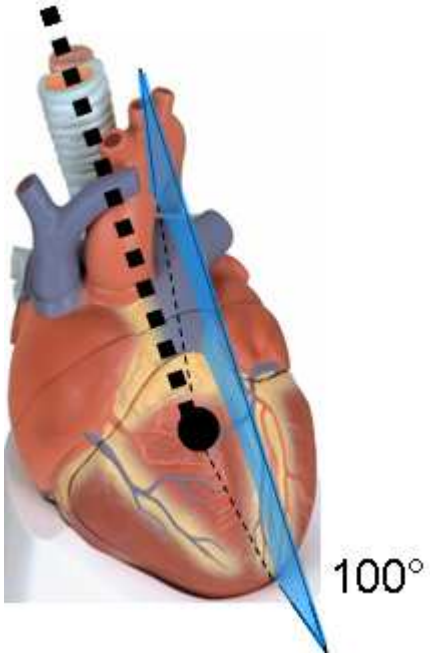


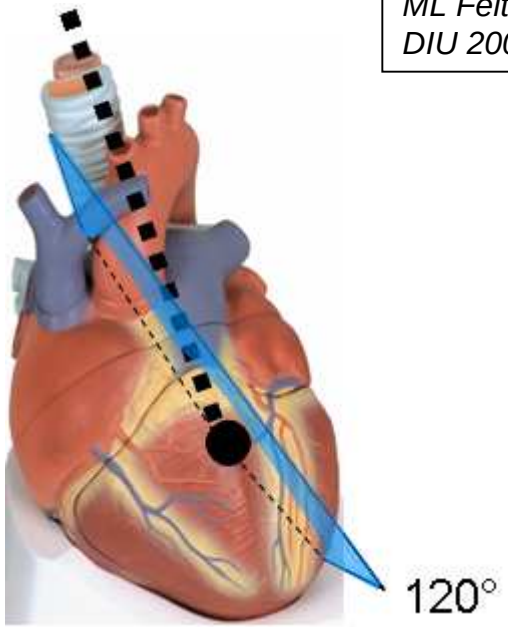


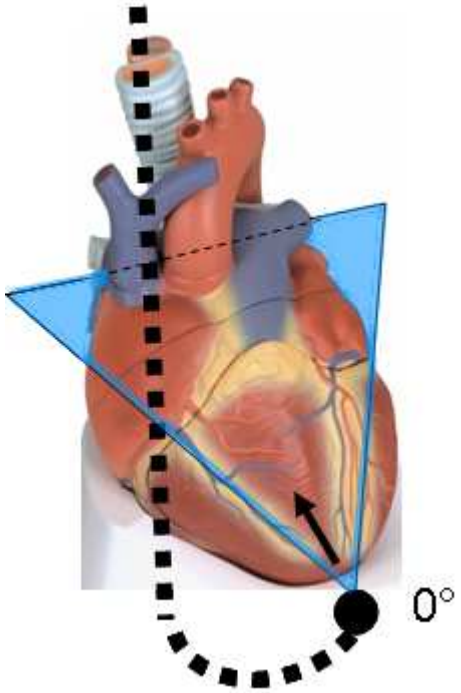


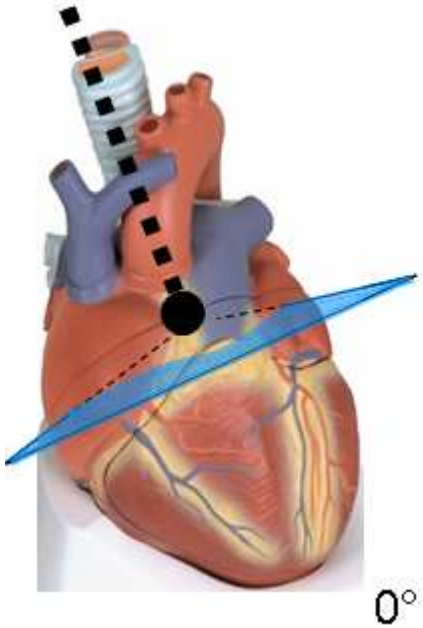


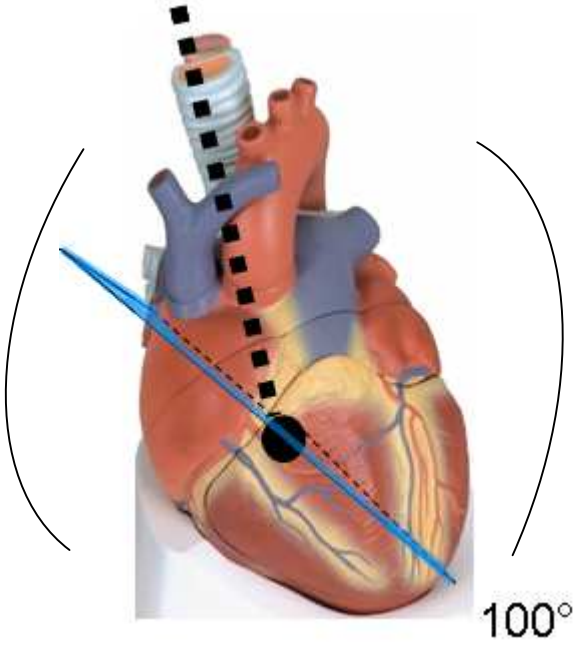




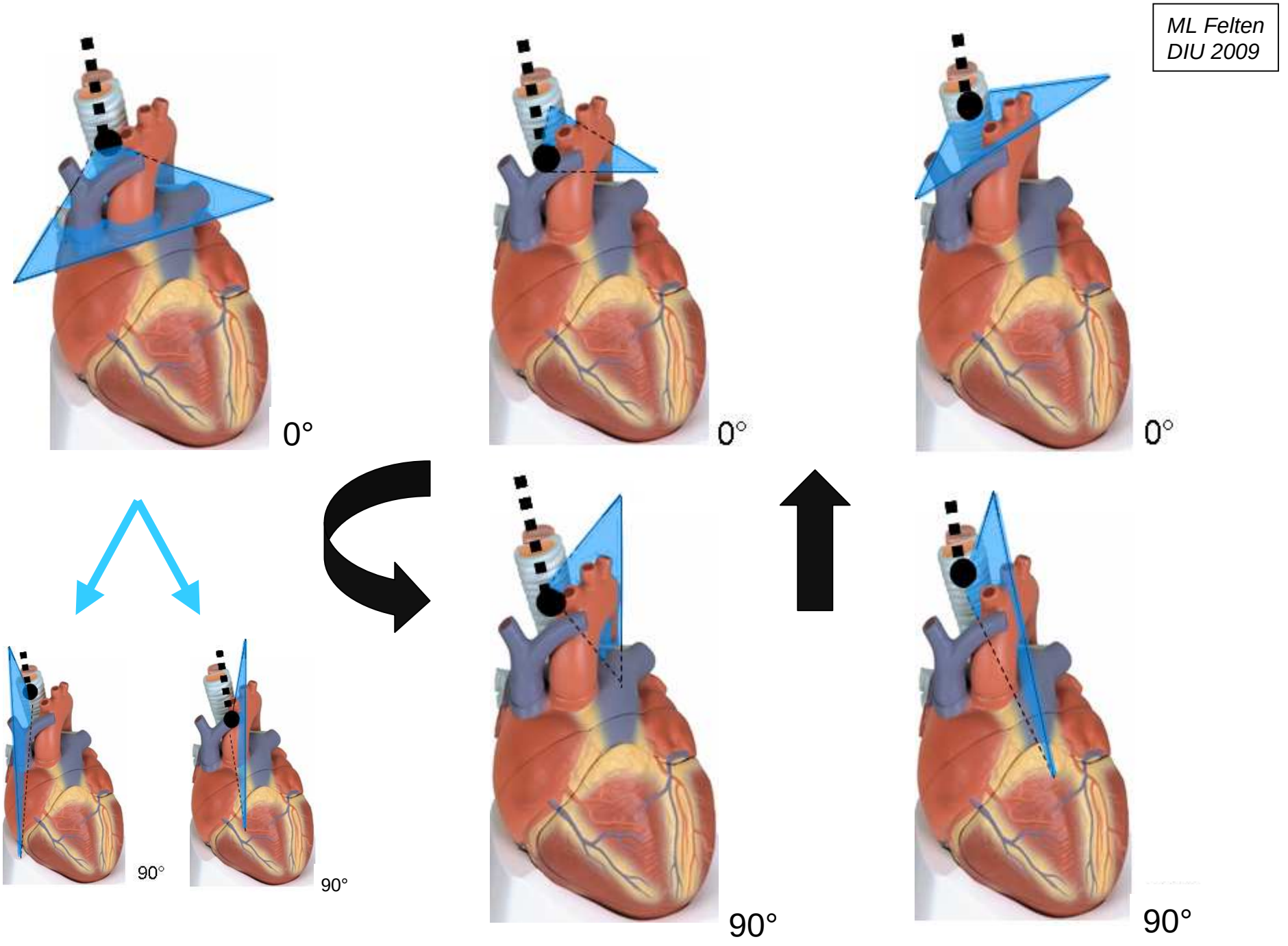




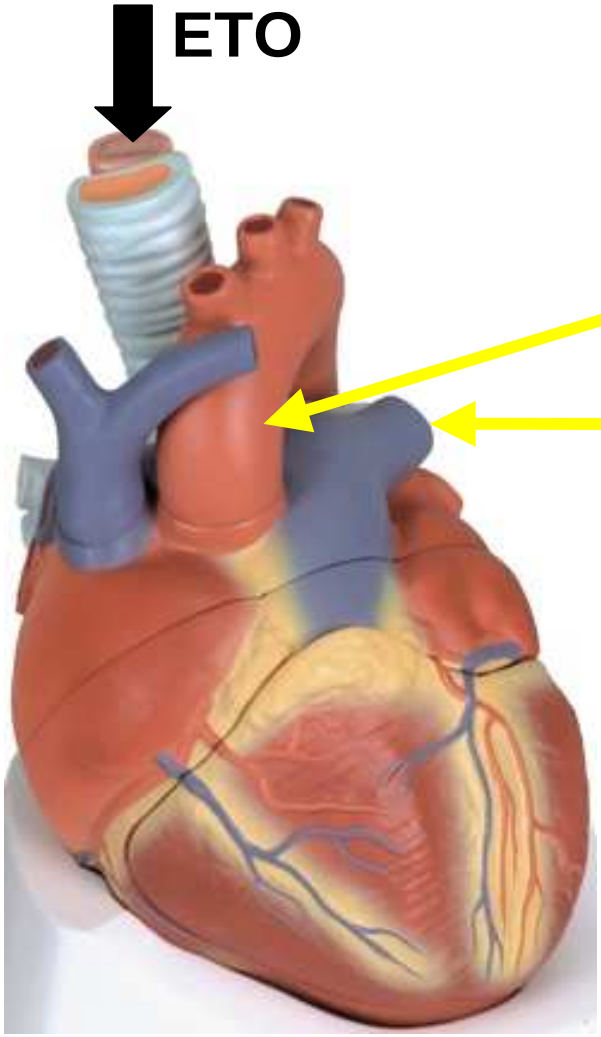




ML Felten
DIU 2009


ML Felten
DIU 2009
0°
0°
0°
90°
90°
90°
90°

ATTENTION: angles morts échographiques liés à la trachée



ML Felten
DIU 2009

Conclusions :

- respecter les contre-indications et mettre l'ECG

- plan d'ETO : 20/21 coupes (4 coupes pour les coronaires)

- Comment est le plan d'ultrasons par rapport au cœur ?

- répéter les mesures

- Attention : il existe des structures invisibles en ETO