



ECHOGRAPHIE DE L'APPAREIL GENITAL DE LA VACHE

V. Gayrard

Ecole Nationale Vétérinaire de Toulouse

UMR 1331 Toxalim

31076 TOULOUSE cedex

Organisation des séances

- TD1.2. Séance théorique d'échographie de l'appareil génital de la vache
 - Principes de l'échographie et principaux artéfacts lors de l'examen de l'appareil génital
 - Application de l'échographie à l'examen de l'utérus et au diagnostic de gestation
 - Application de l'échographie à l'identification des organites ovariens et au suivi ovarien
- TD1.3. Physiologie comparée du cycle oestral
- TD1.5: Echographie de l'appareil genital de la vache
 - Examen écrit de TD
 - Echographie des appareils génitaux de vache dans des bassines d'eau
- TD1.6: Séance pratique d'échographie de l'appareil génital de la vache (1/2 groupe)

Introduction

- **Echographie: technique d'imagerie médicale, US**
- **Visualisation non invasive des organes génitaux**
- **Historique: Premières tentatives examen tissus biologiques (1952), première image échographique transrectale organes génitaux de la jument (1980)**
- **Réalisations possibles en physiologie de la reproduction**
- **Palpation rectale et échographie**
- **Echographie: technique exigeante sur le plan intellectuel**
- **Sécurité de l'échographie (énergie US: 1-10 mWatt/cm²)**

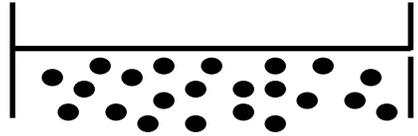
Principes de l'échographie

- **Nature physique des ultrasons**
 - **Vibration mécanique, même nature que les ondes sonores**
 - **Fréquence sons audibles: 20- 20 000 Hz
(1Hz=1cycle/s)**
 - **Fréquence ultrasons > 20 000 Hz**
 - **Fréquence US imagerie médicale : 2-10 MHz
(1MHz= 1 million de cycles/s)**

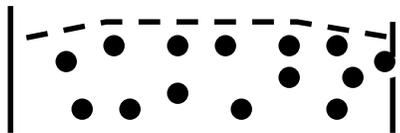
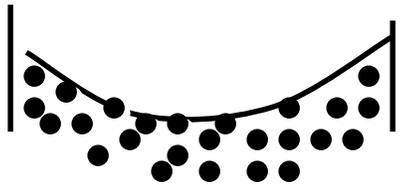
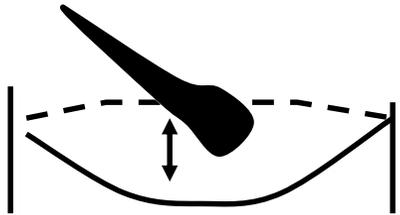
Genèse d'un son et d'un ultrason

tambour

Son audible



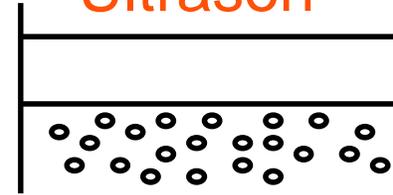
Activation



Compression

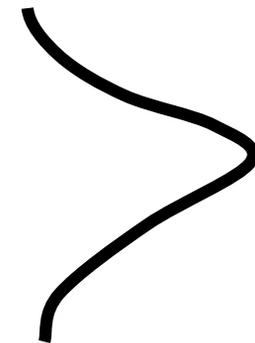
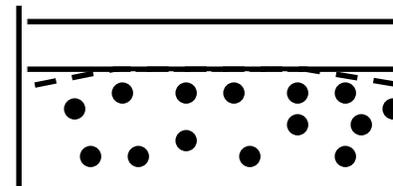
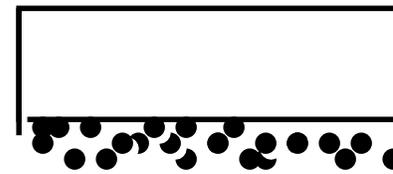
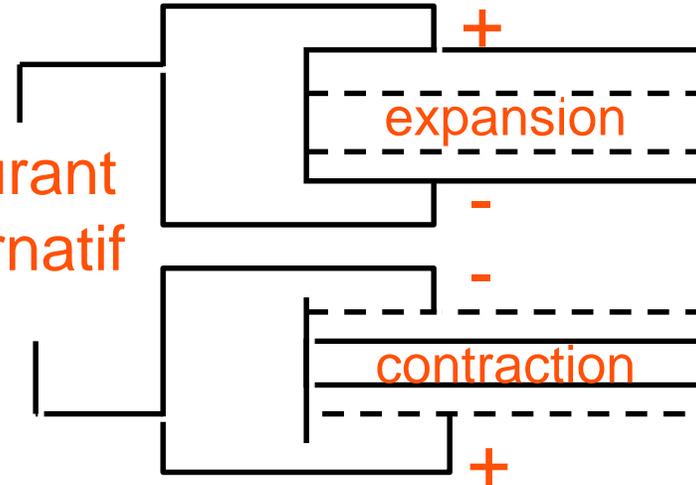
Décompression

Ultrason

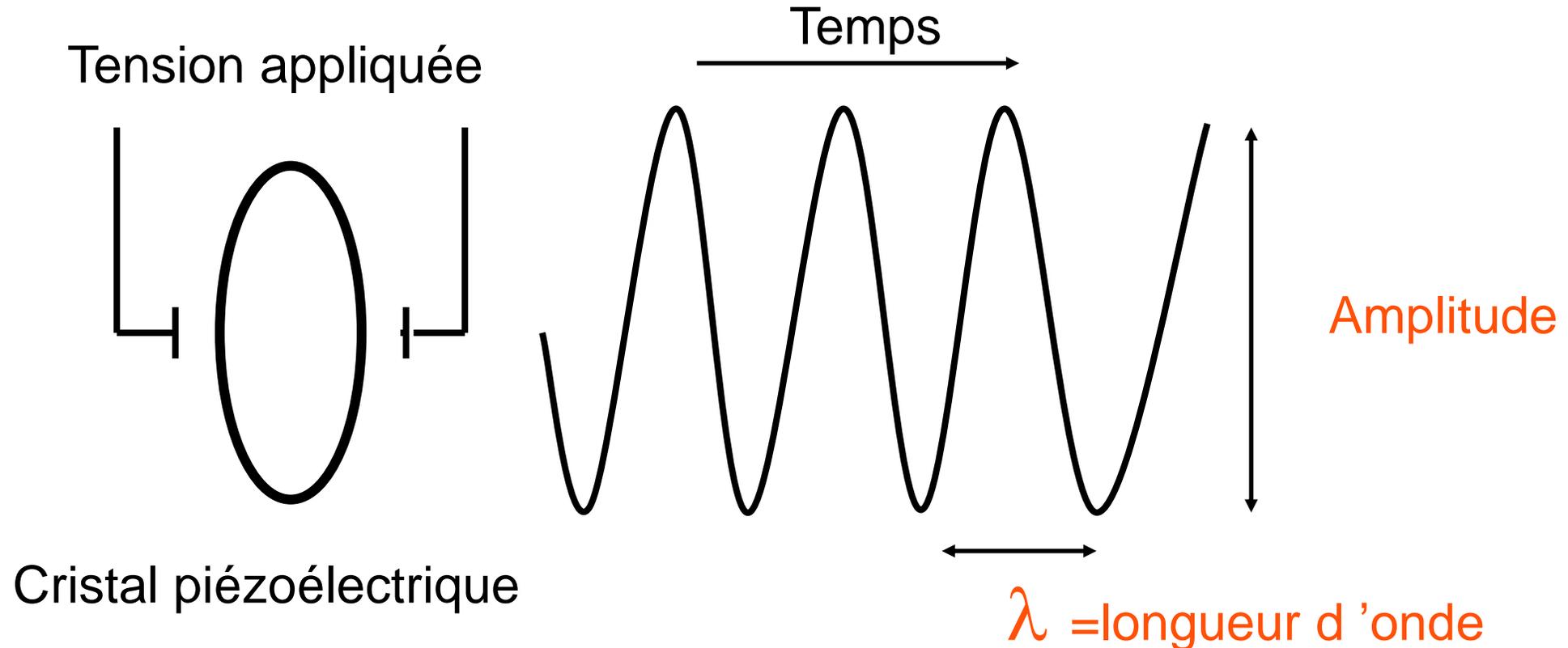


Cristal piézo-électrique

Courant alternatif



Propriétés physiques des US



Fréquence: nombre de cycles par unité de temps

Propriétés physiques des US

$$\lambda = C/f$$

f = fréquence

C = célérité ou vitesse de l'onde

λ = longueur d'onde

C = 1540 m/s = constante dans les tissus mous

$\uparrow f \quad \Rightarrow \quad \downarrow \lambda$

1 MHz

1.5 mm

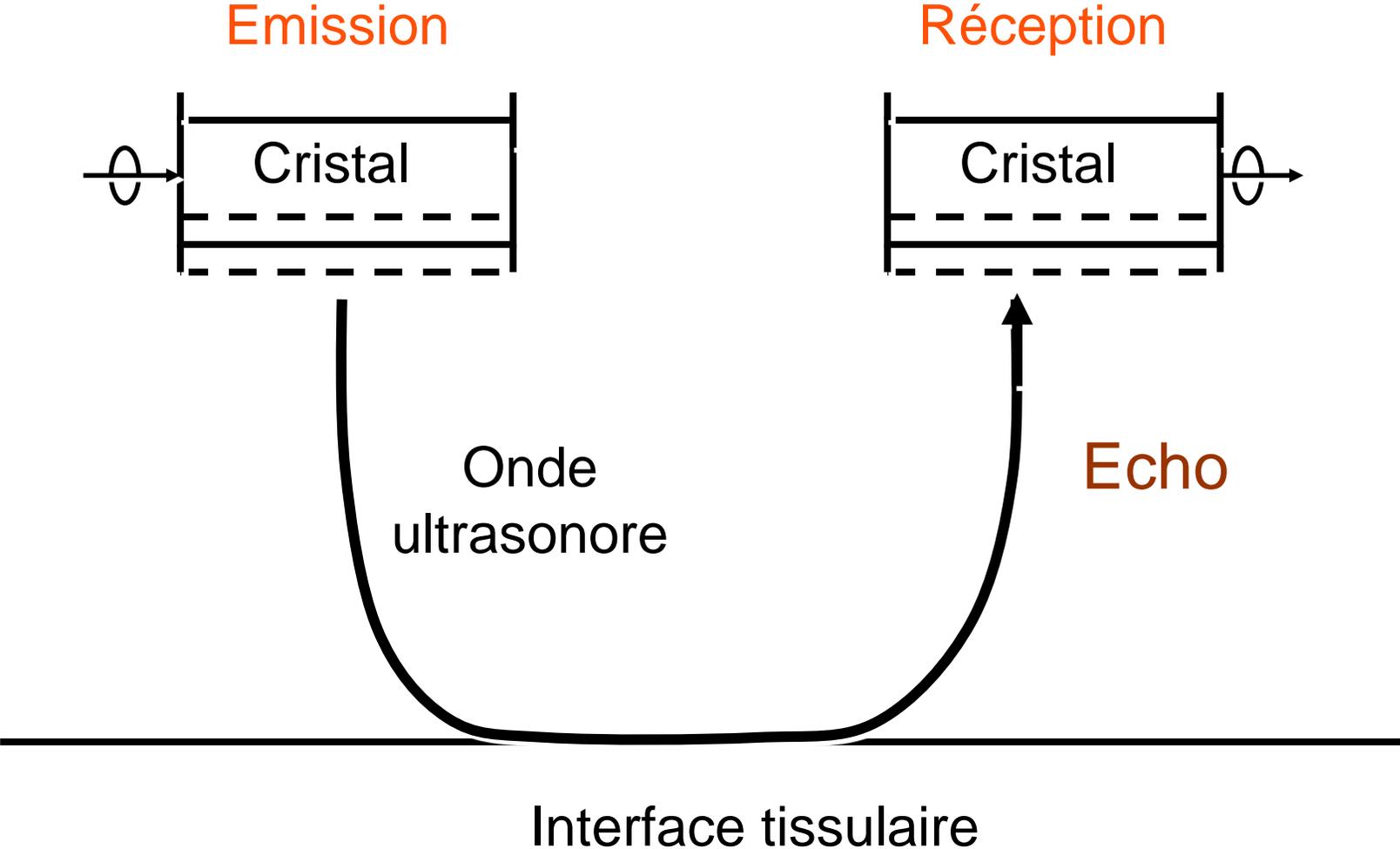
10 MHz

0.15 mm

Propriétés physiques des US

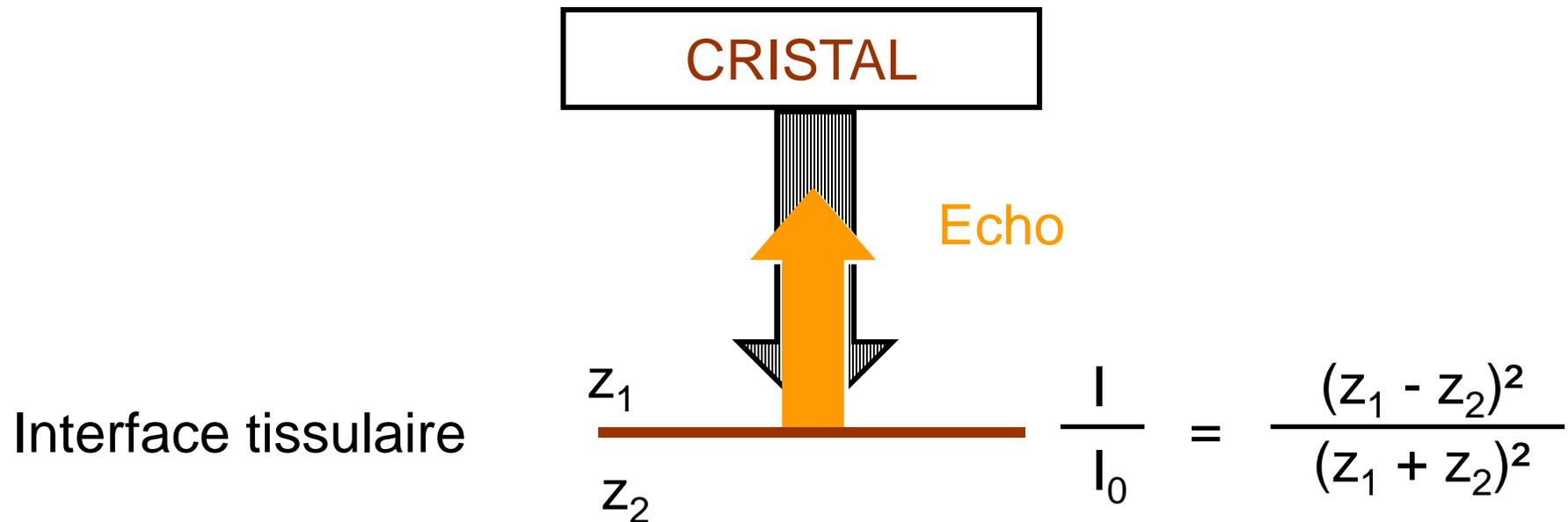
Tissus	Vitesse de propagation des US (m/s)
Poumons	650
Graisse	1460
Eau	1482
Foie	1535
Rein	1500
Collagène	1680
Os	2700-4000
Air	330
Lait	1540
Muscle	1545-1630

Genèse des échos



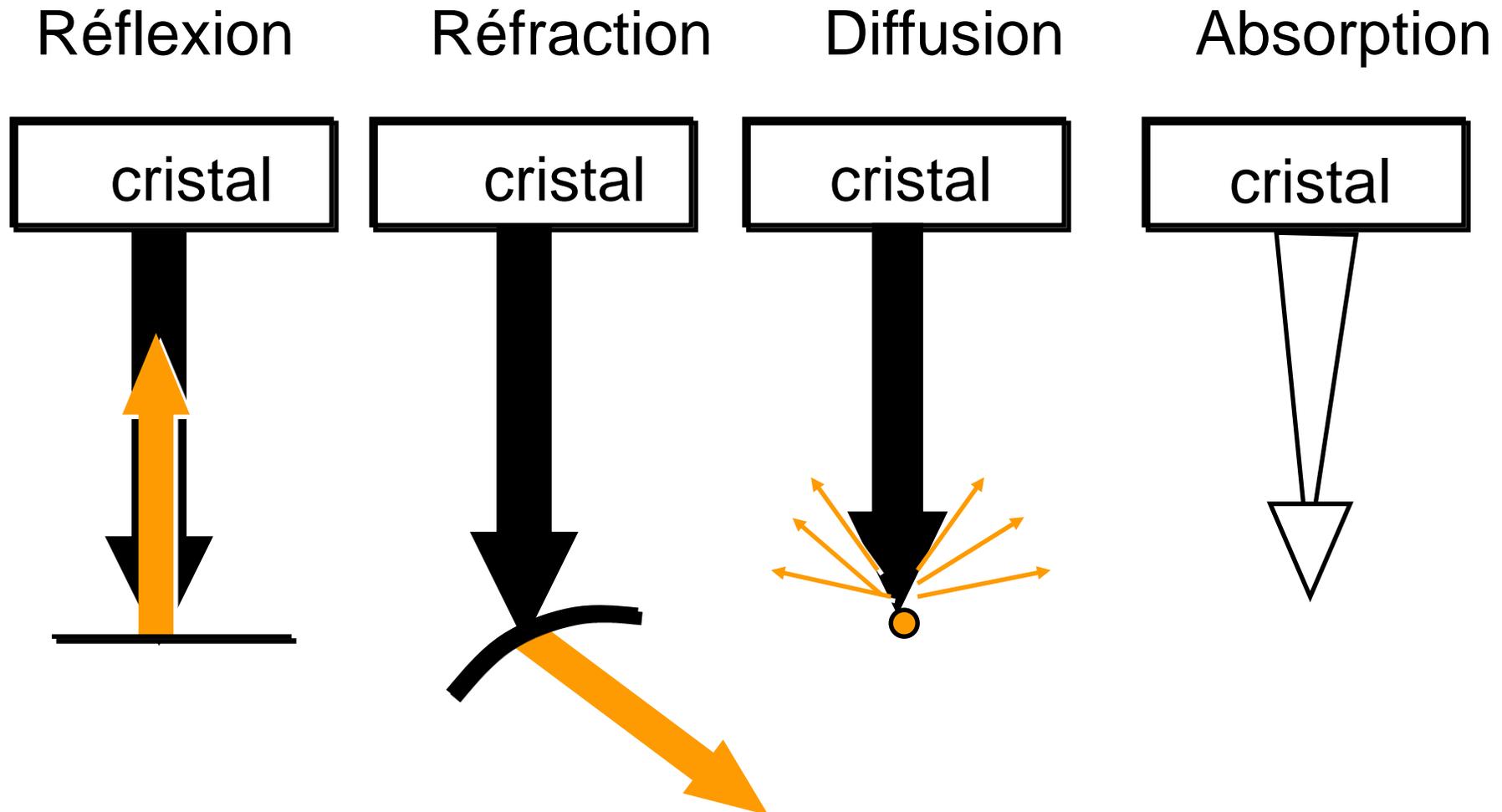
Réflexion

Z=Impédance acoustique=
vitesse propagation US x densité

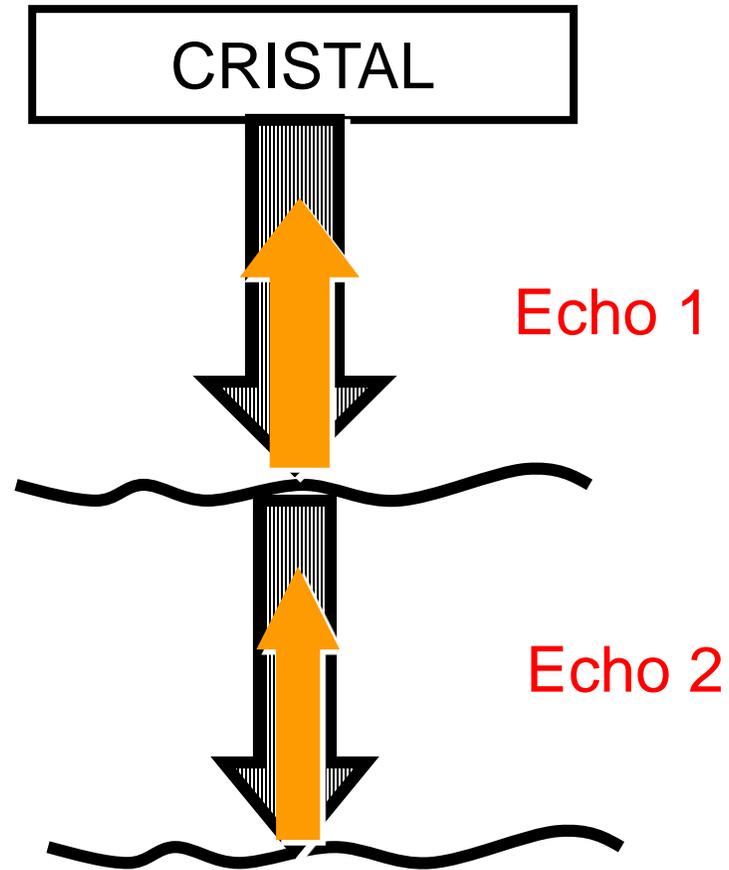


Ex: Interface graisse ($z=1.33 \cdot 10^6$)-muscle ($z=1.7 \cdot 10^6$): 1.5% énergie incidente réfléchie

Interaction US-tissu



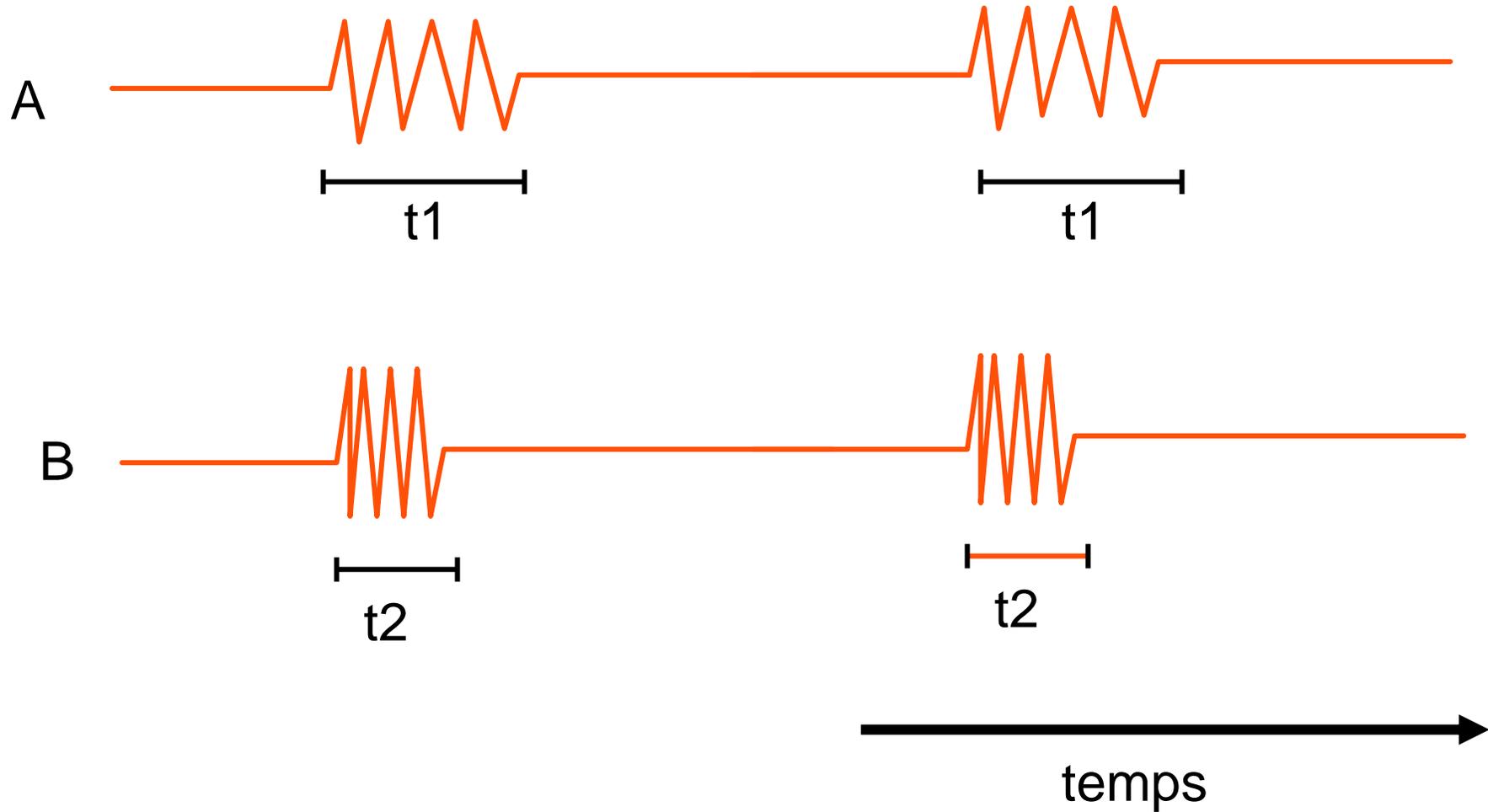
Atténuation



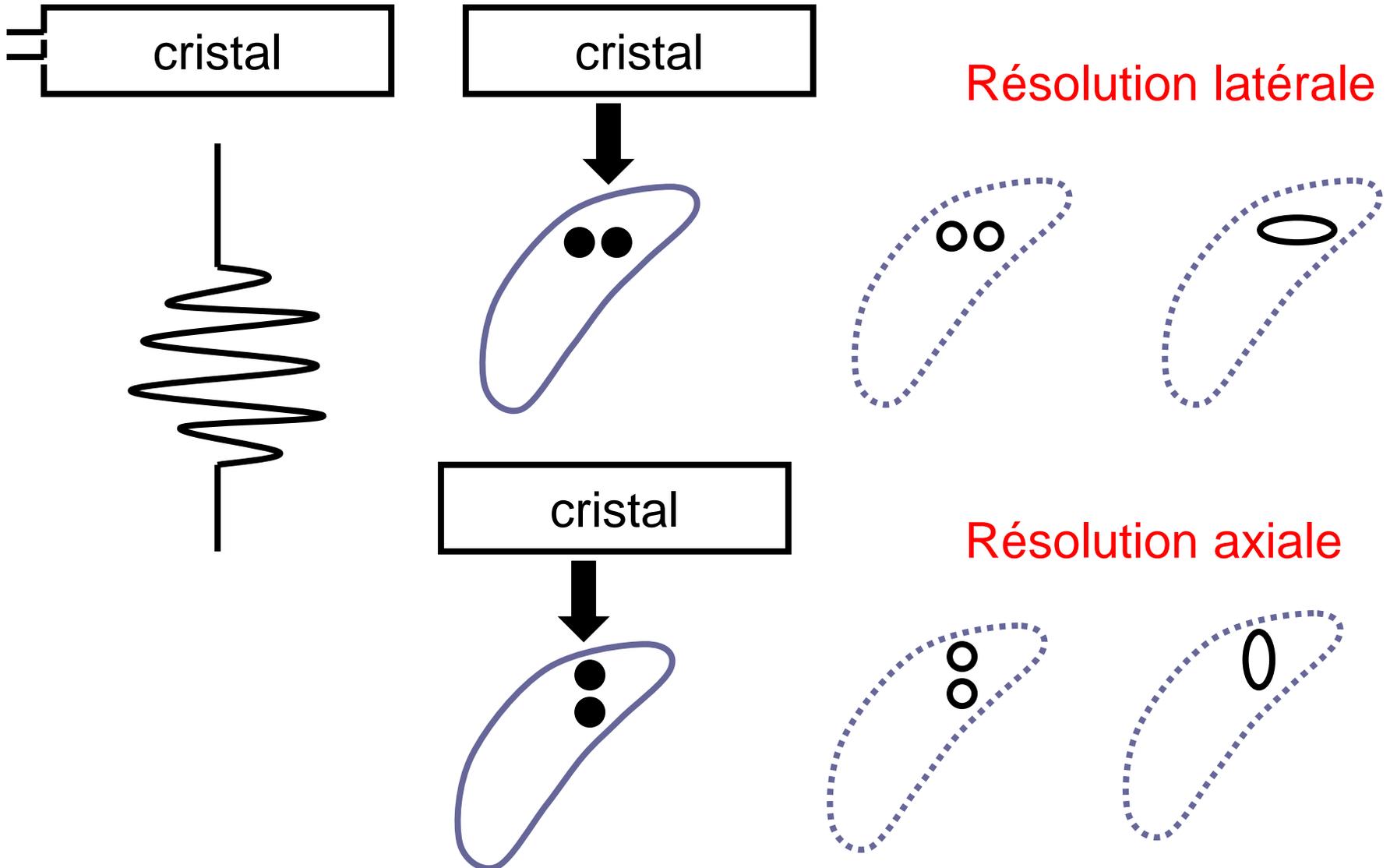
Capacité d'atténuation
(dB par MHz par cm)

Eau	0.002
Air	10
Tissu mou	0.3-1.5
Os	10
Poumon	40

Génération de salves d'ultrason



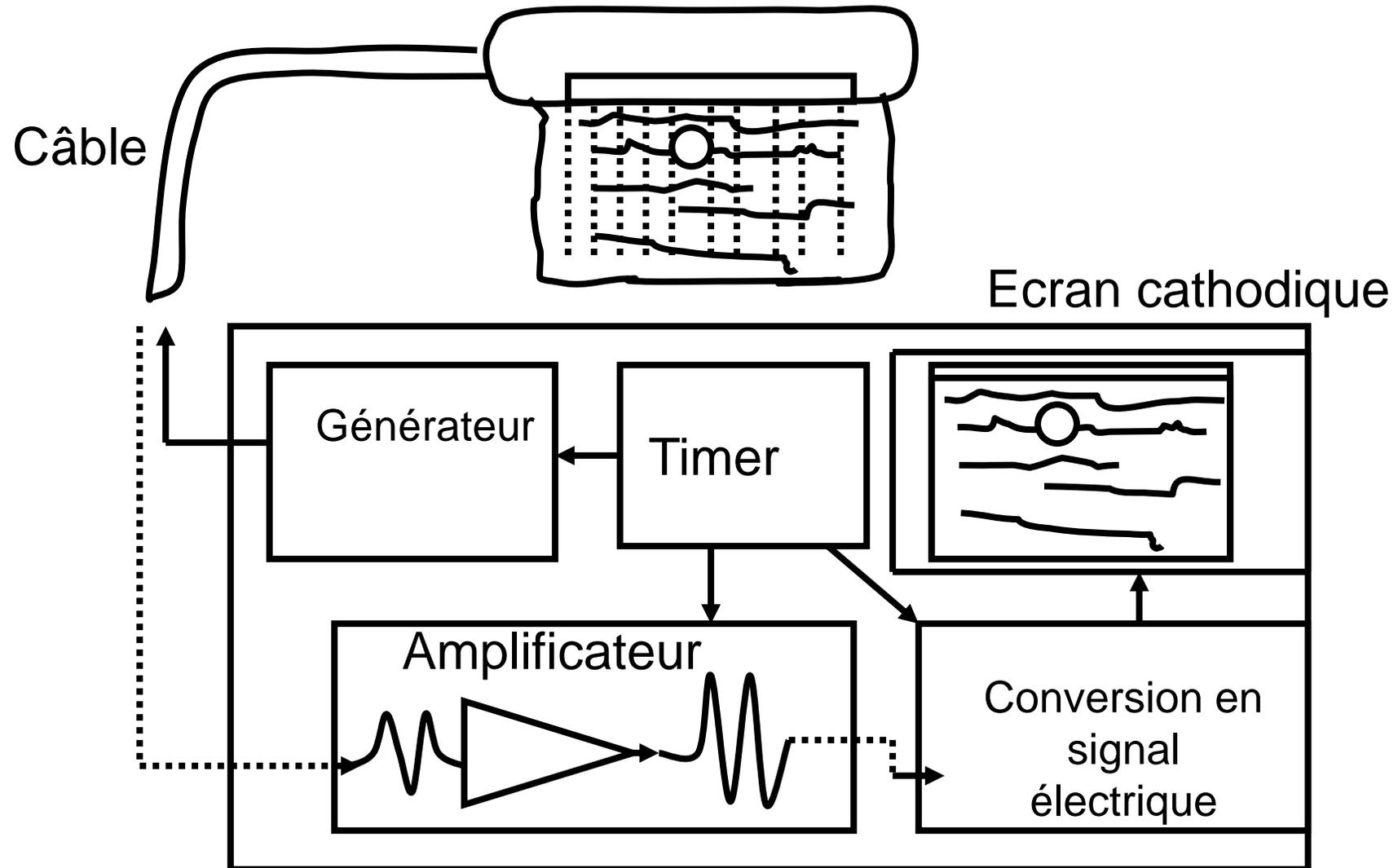
Résolution axiale - Résolution latérale



Impact de la fréquence sur la résolution, la distance focale et la profondeur de pénétration

Fréquence (MHz)	1	6	10
Profondeur de pénétration (cm)	20	8	5
Distance focale (cm)	8	3	1.5
Résolution (taille structures visualisées en mm)	5-10	2.-5	1-2

Formation des images



1913, 58j, N:No., ID: 2012-11-28-00.

28 NOV 2012 14:39



F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



SV3513

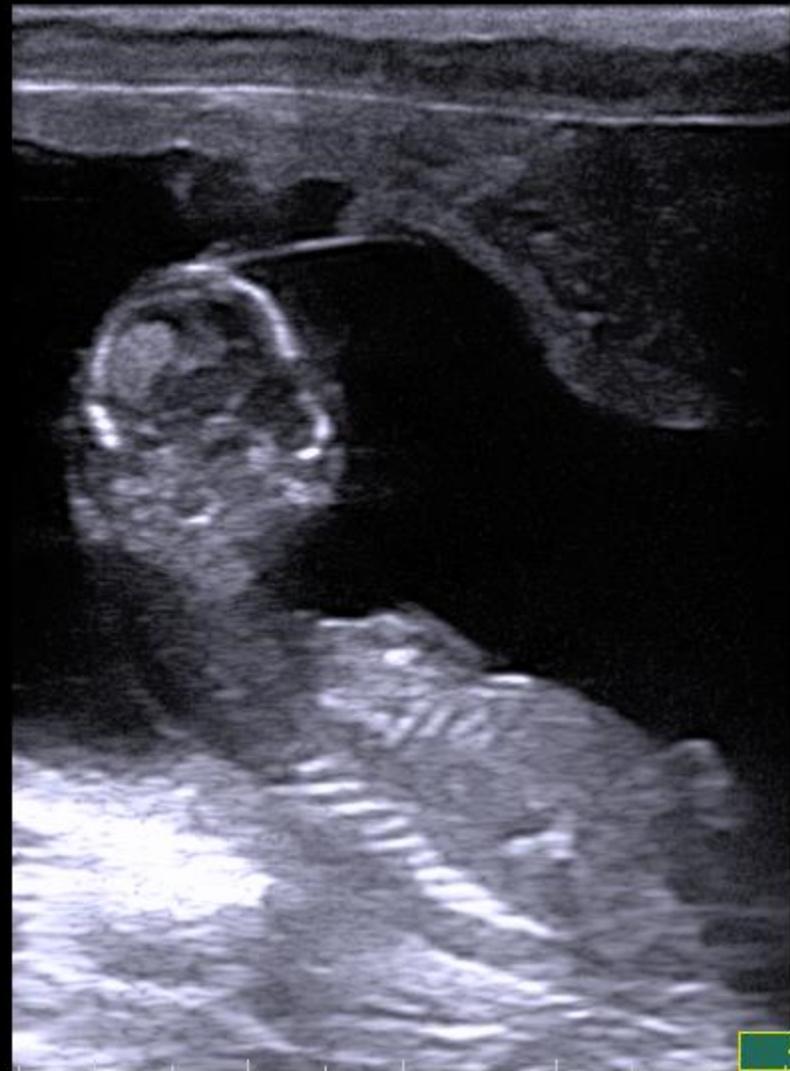
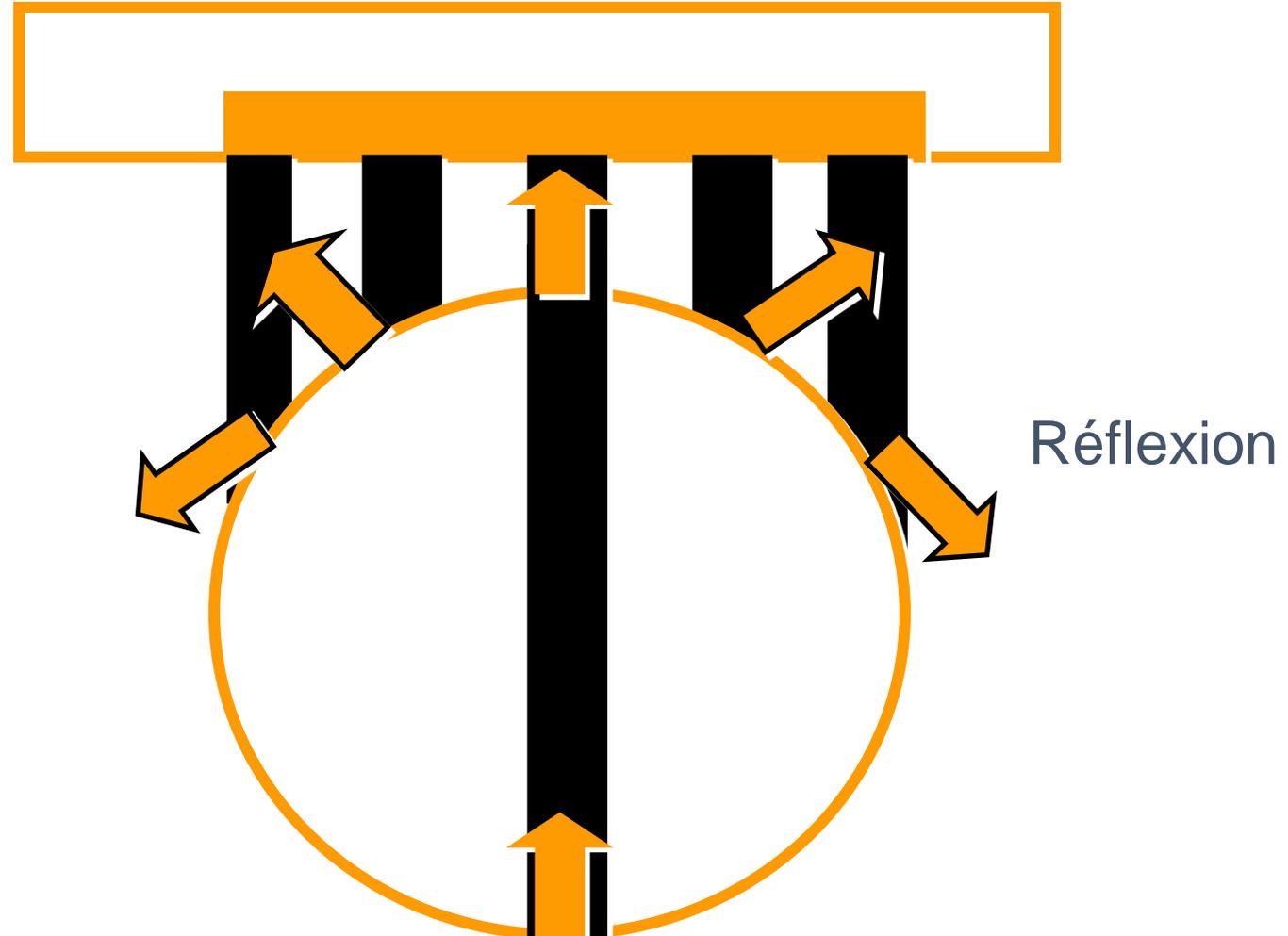
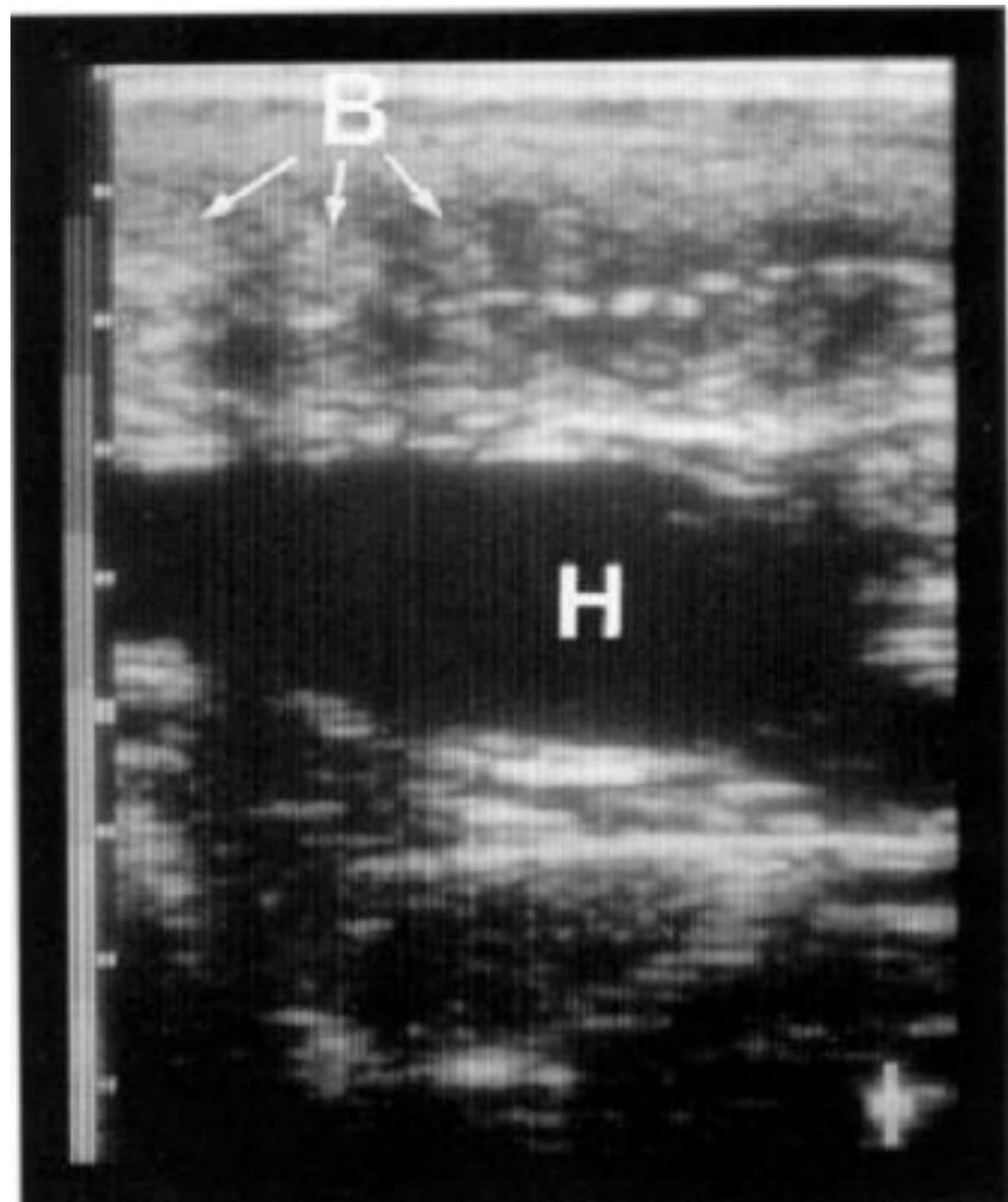


Image spéculaire





19/02/08
18:22:06
L 8.0 MHz



fab G R→

18 Ips

Memoire 1

Standard

Attender s.v.p.
r

Id patient :
HOSPIMEDI FRANCE

106 1 106



N:No, ID: 2012-09-03-00,

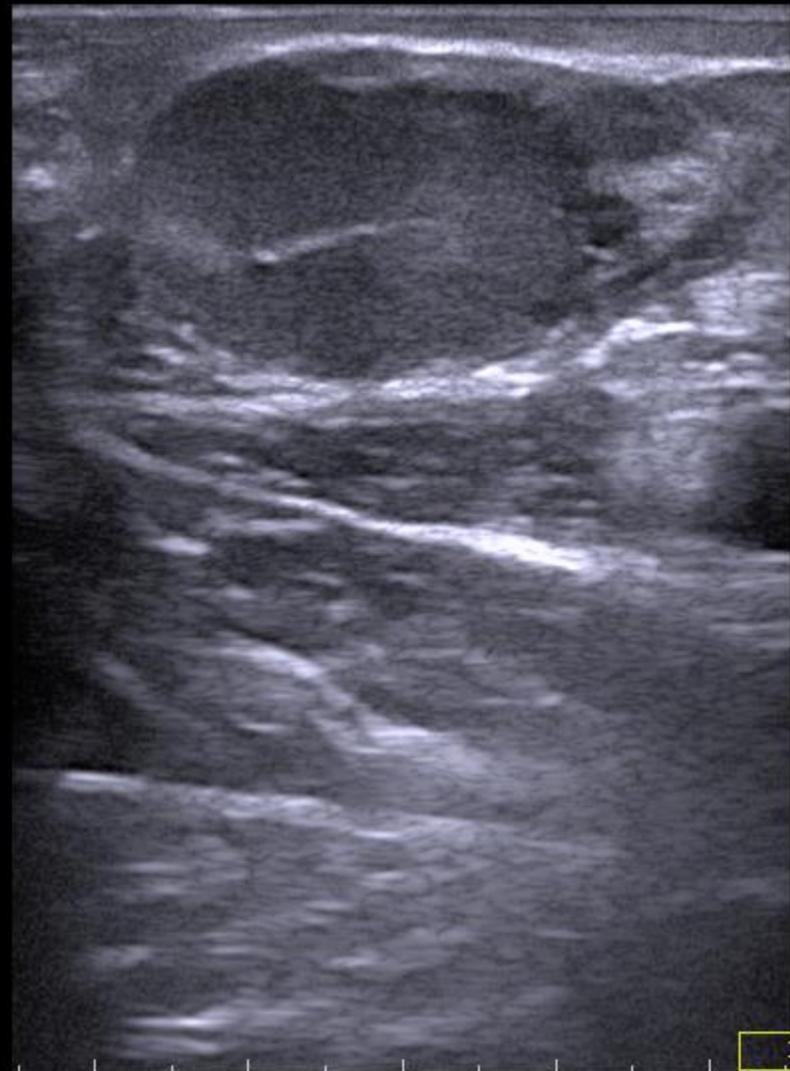
03 SEP 2012 08:26



F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



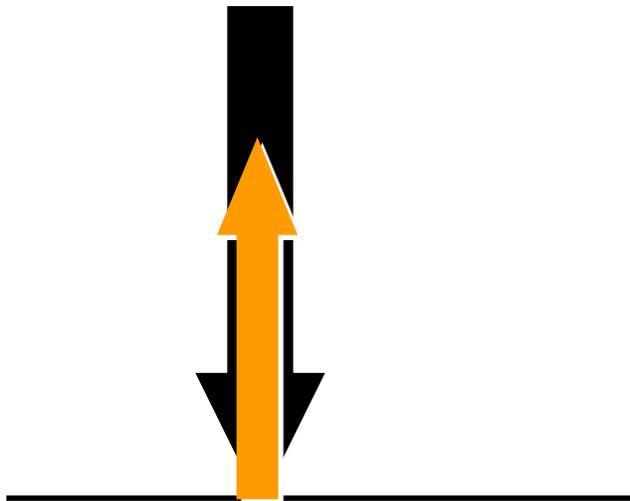
SV3513



0
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6

Image non spéculaire

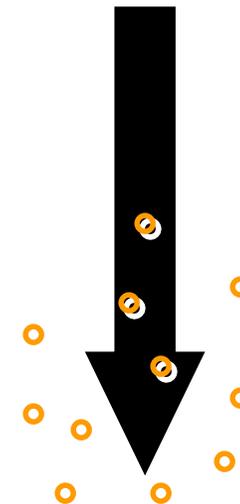
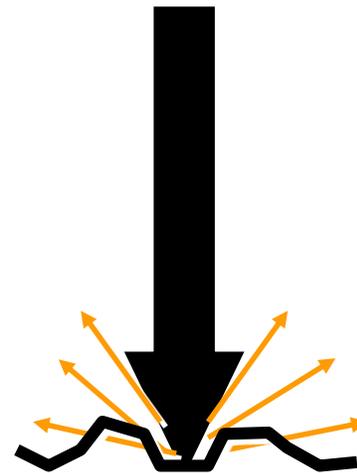
Réflecteur
spéculaire



Réflecteurs non
spéculaires

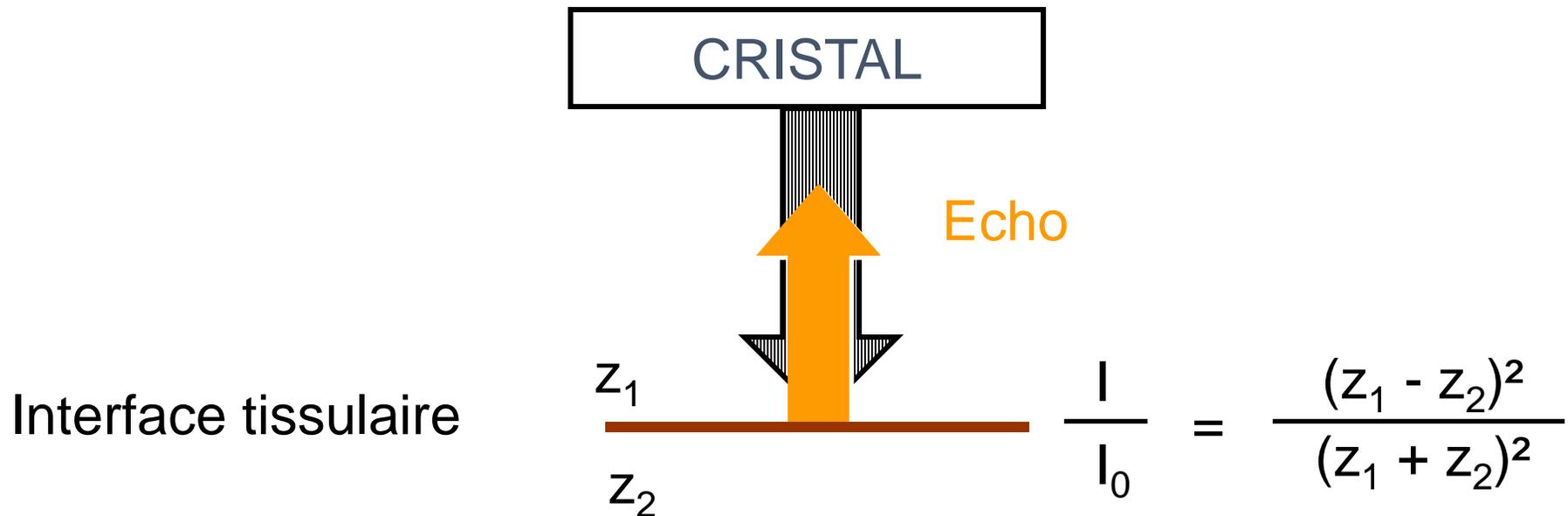
Surface non lisse

Petites interfaces



Réflexion

Z =Impédance acoustique=
vitesse propagation US x densité



Ex: Interface tissu mou-os, tissu mou-gaz: 99% énergie incidente réfléchie

14/02/08
10:46:55
L 8.0 MHz

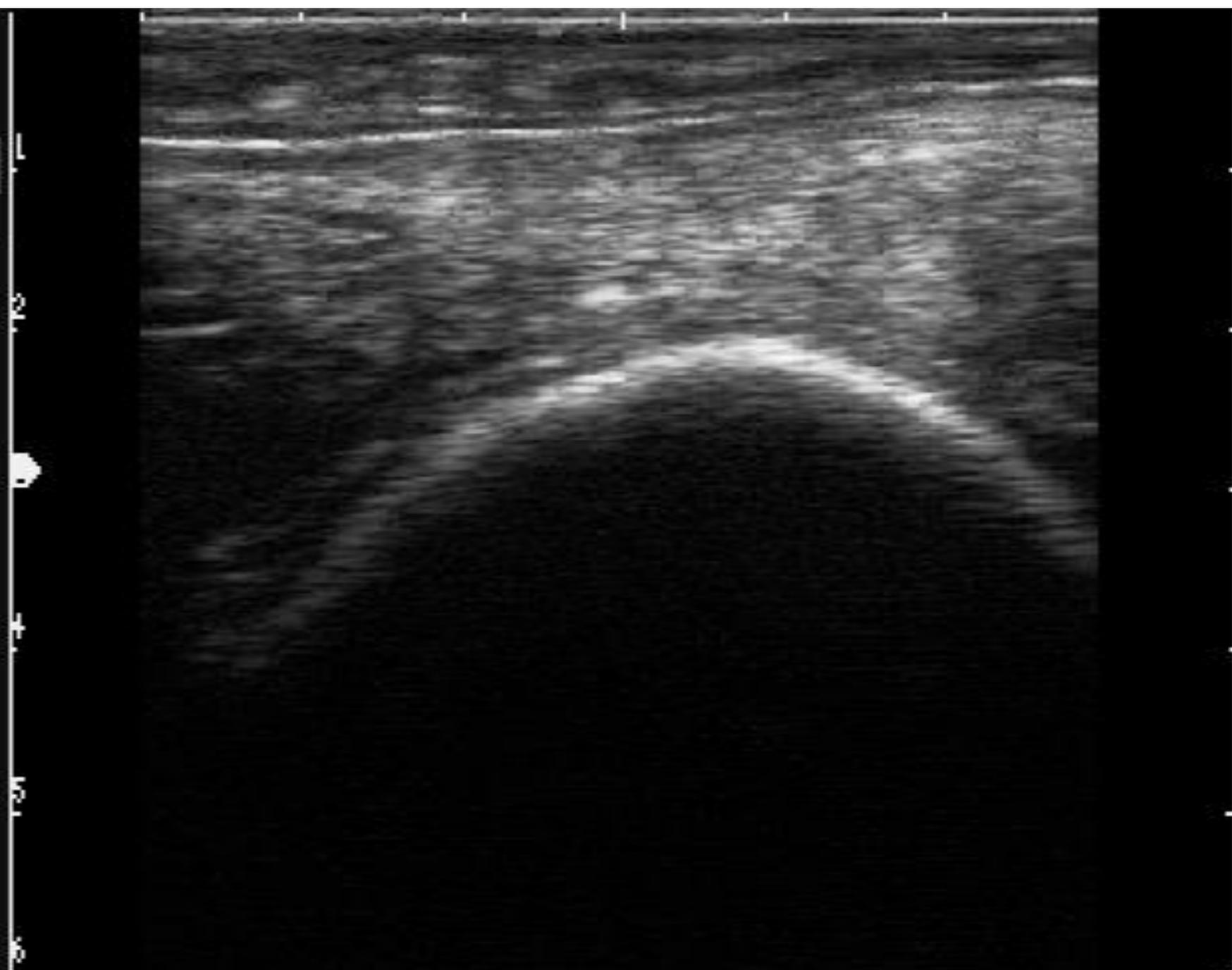


fab G R→

17 Ips

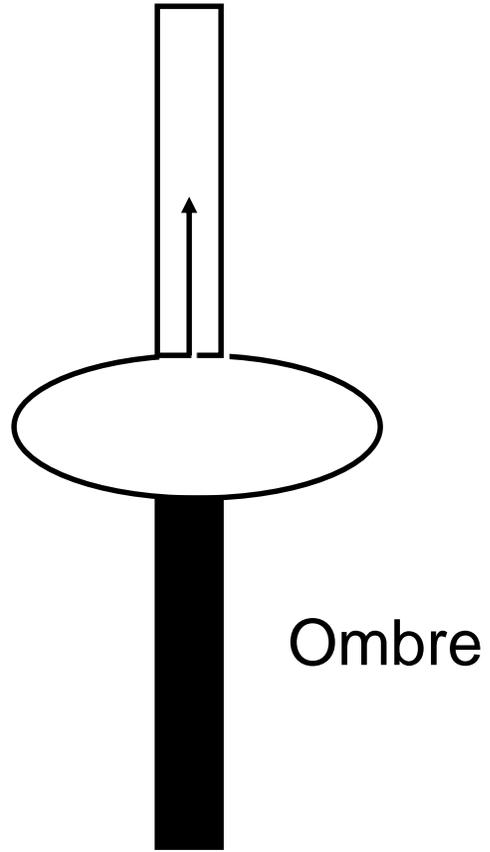
Memoire 1

Standard

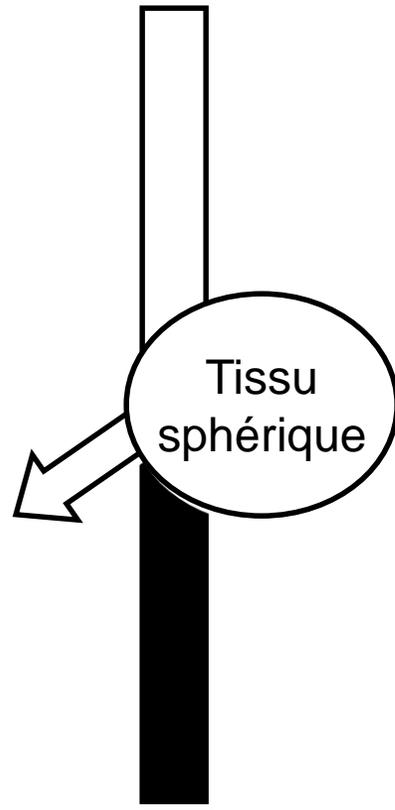


Ombres artefactuelles

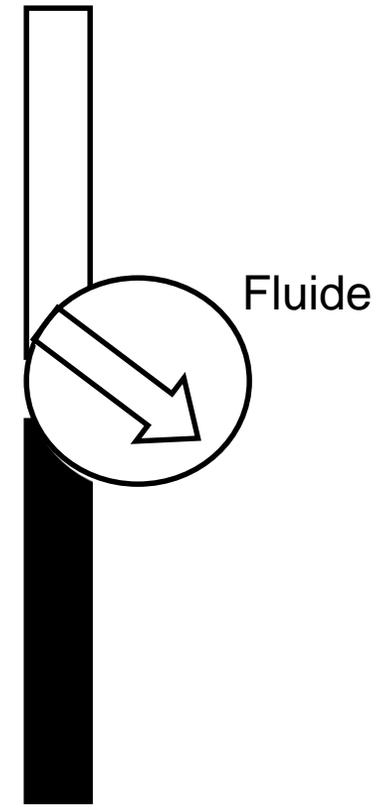
Objet dense



Réflexion



Réfraction



15/02/08
16:38:25
L 8.0 MHz



fab G R→

17 Ips

Memoire 1

Standard

Attender s.v.p.
r

Id patient :
HOSPIMEDI FRANCE

102 1 102



17/12/07
10:36:55
L 10. MHz



fab G R→

18 Ips

Memoire 1

Standard

Attendez s.v.p.



Id patient :
HOSPIMEDI FRANCE

106 1 106

3236 kyste, N.No., ID: 2012-10-18-00,

18 OCT 2012 07:09



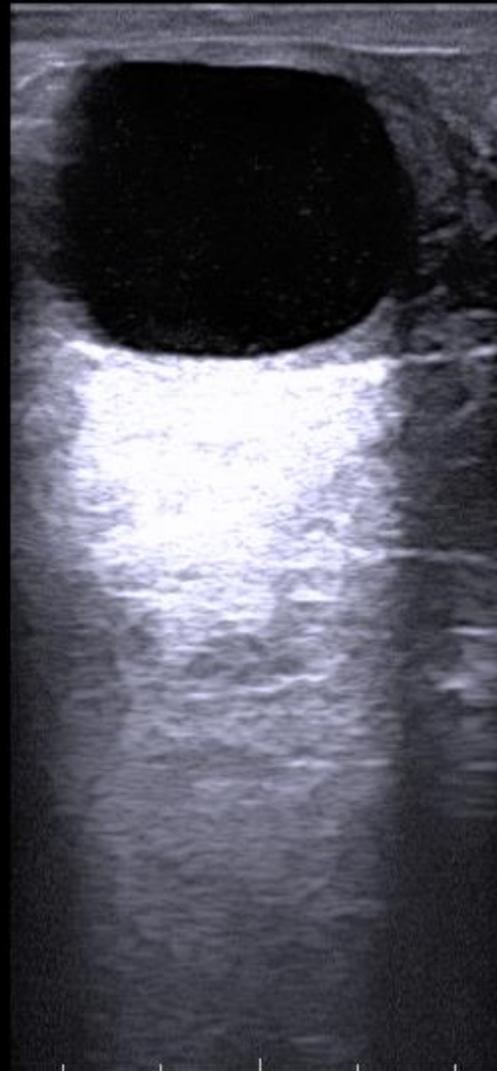
F 10.0MHz G 78%
D 11cm
PRC 7/1/H PRS 5
PST 1/2



4

SV3513

13



0

5

10

14/02/08
11:01:44
L 8.0 MHz



fab G R→

18 Ips

Memoire 1

Standard

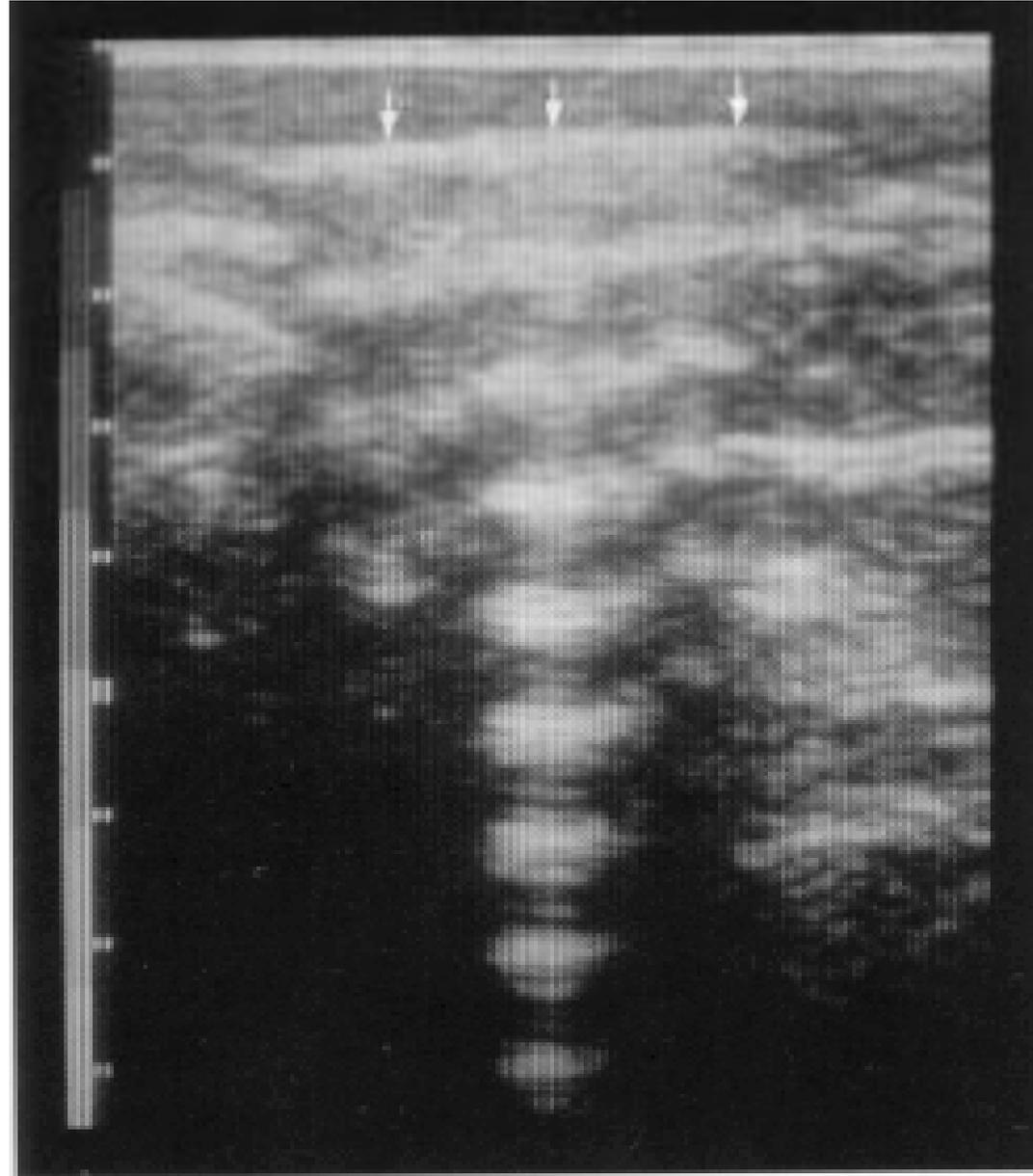
Attender s.v.p.

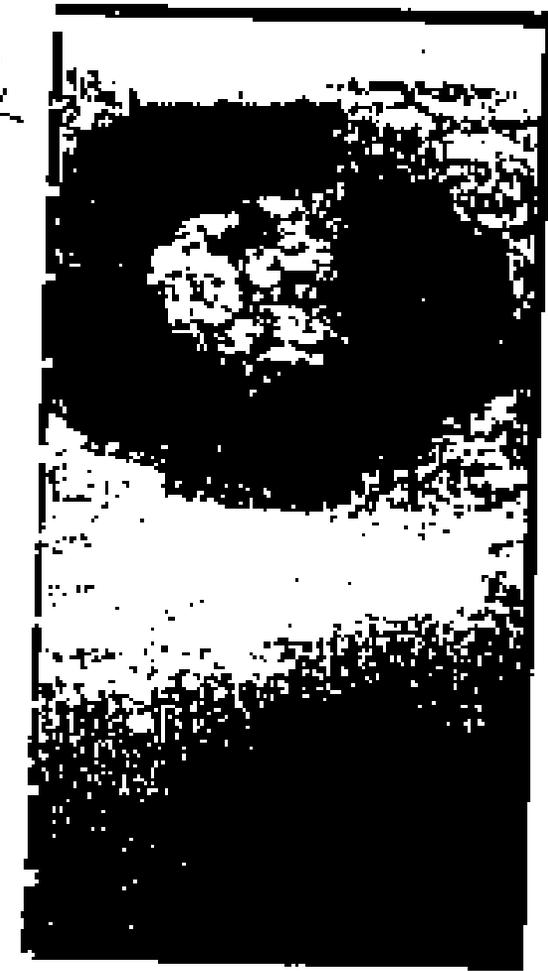
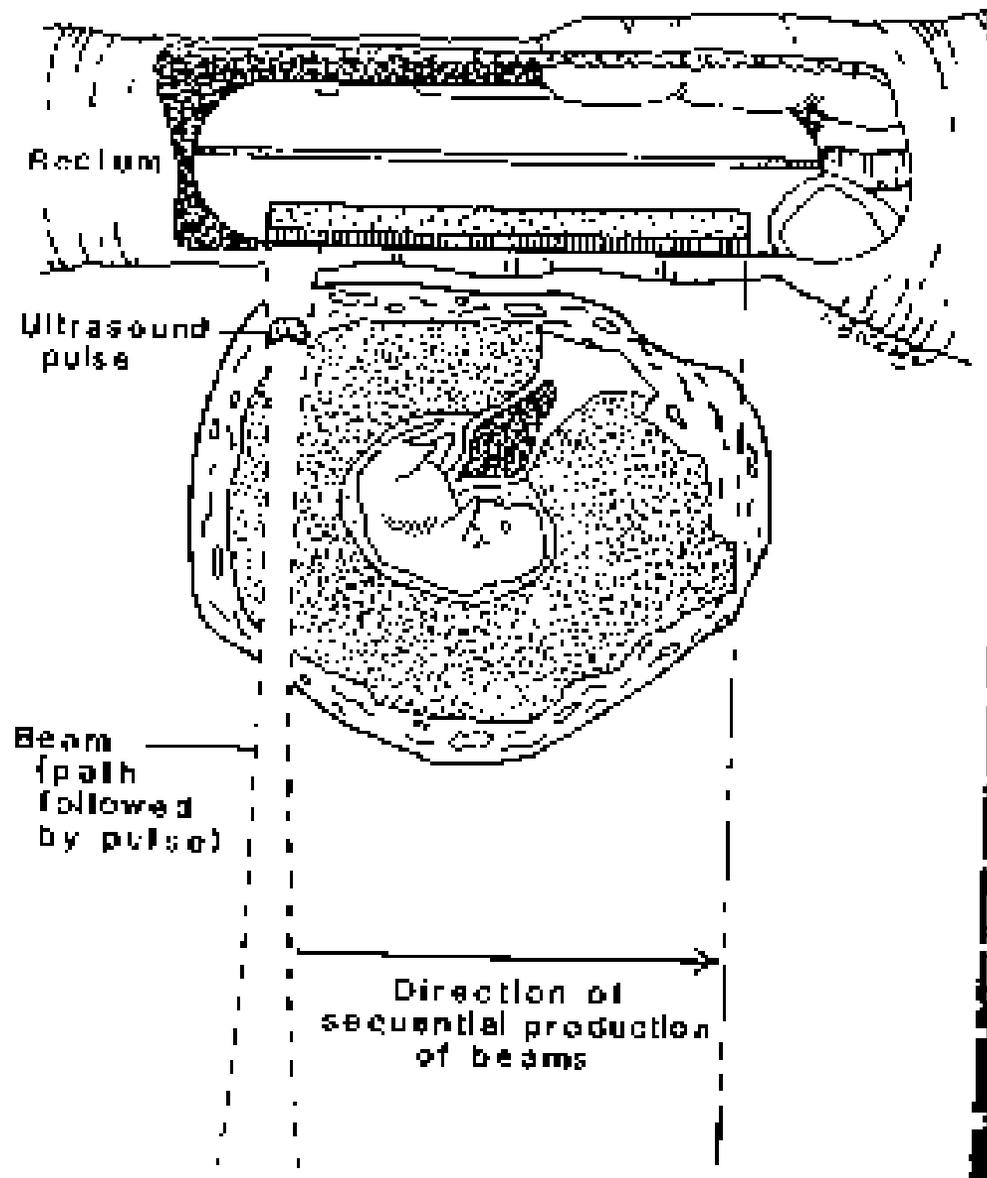


Id patient :
HOSPIMEDI FRANCE

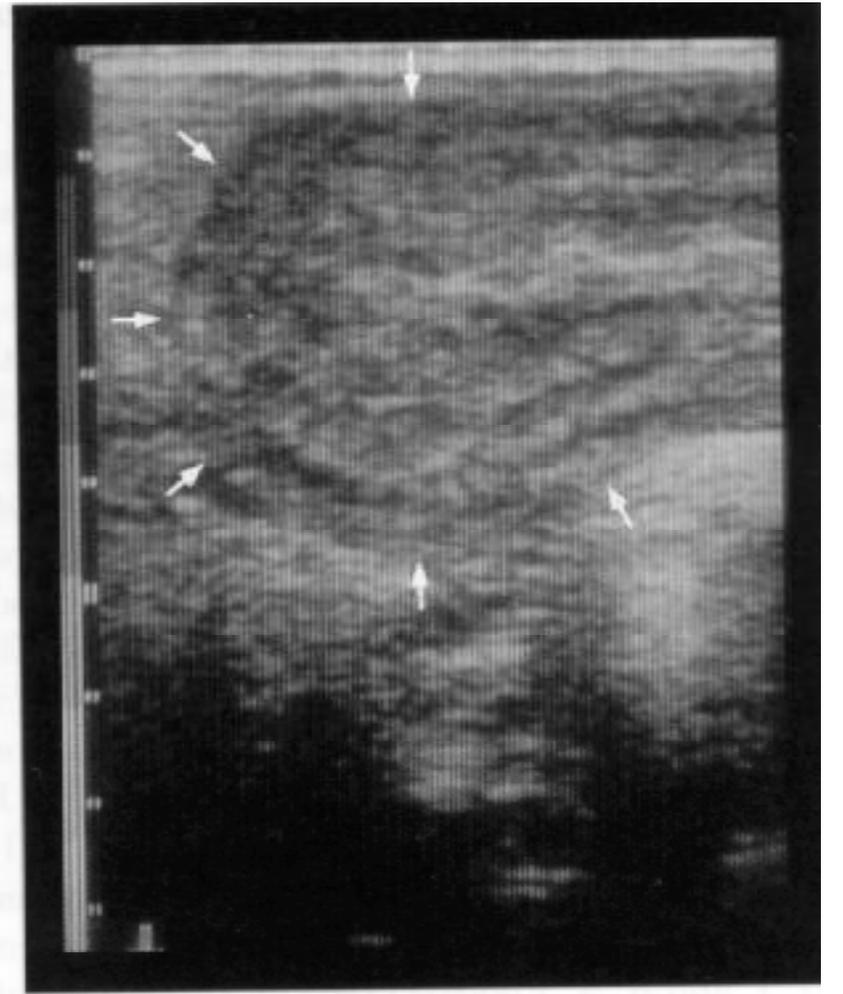
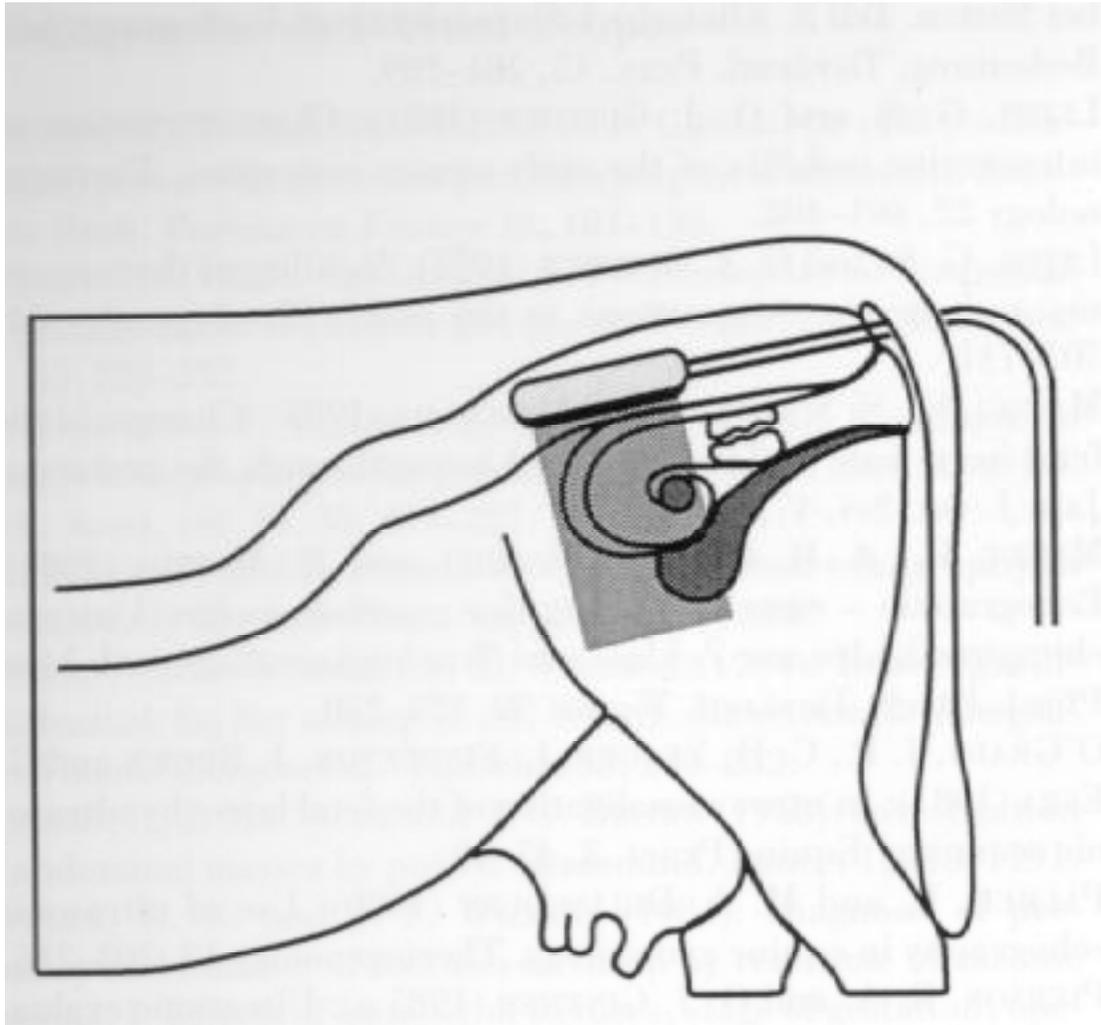
104 1 106

Artéfact de réverbération









N:No, ID: 2011-09-22-00,

22 SEP 2011 11:00



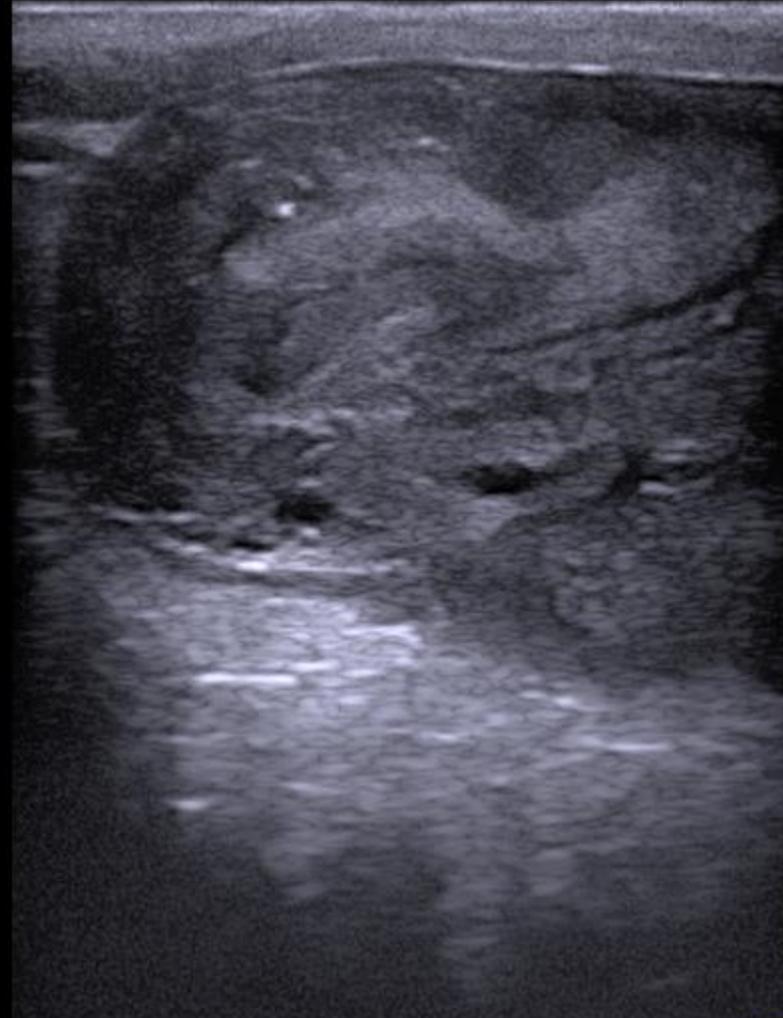
REPRO

F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2

USINE



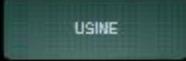
SV3513



0
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6



REPRO



USIME

F 10.0 MHz G 89%
D 7 cm XV C
PRC 7/1/H PRS 5
PST 1/2 MV -

SV3513

UTERUS B



0
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5
6

1917-13, N.No., ID: 2012-11-20-05,

20 NOV 2012 15:20



F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



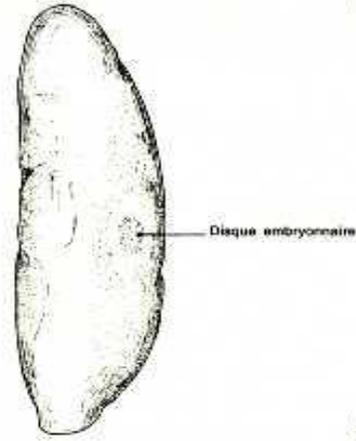
4

SV3513

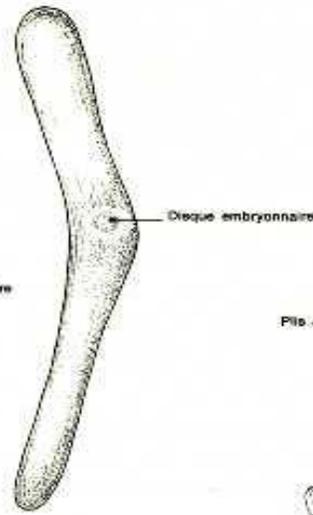
13



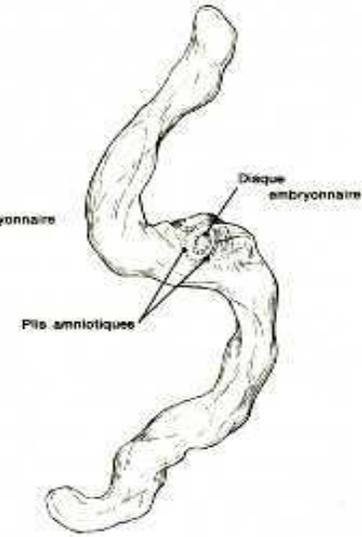
233 / 500



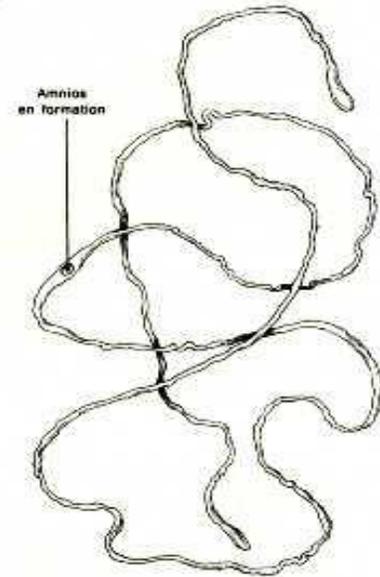
BLASTOCYTE DE 12 JOURS (Gr. x 5)



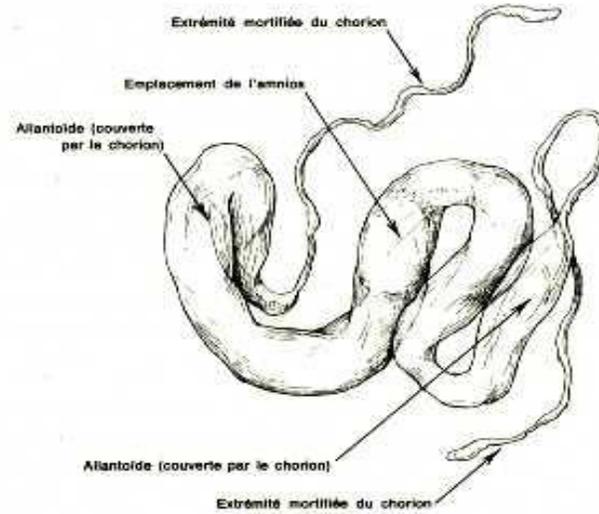
BLASTOCYTE DE 14 JOURS (Gr. x 4)



BLASTOCYTE DE 16 JOURS (Gr. x 4)



BLASTOCYTE DE 16 JOURS (Gr. x 40x)



CONCEPTUS DE 30 JOURS (Gr. x 0,5)

Développement du blastocyste bovin

Stade (jours de gestation)	Diamètre VE (mm)	Longueur embyon (mm)
20	2-3	3
22	3-5	5
25	10	8-9
30	18-20	12
40	25	22
50	35-40	32
60	50-60	69

1921, dg +29j, N:No., ID: 2012-10-13-01,

13 OCT 2012 10:18



REPRO

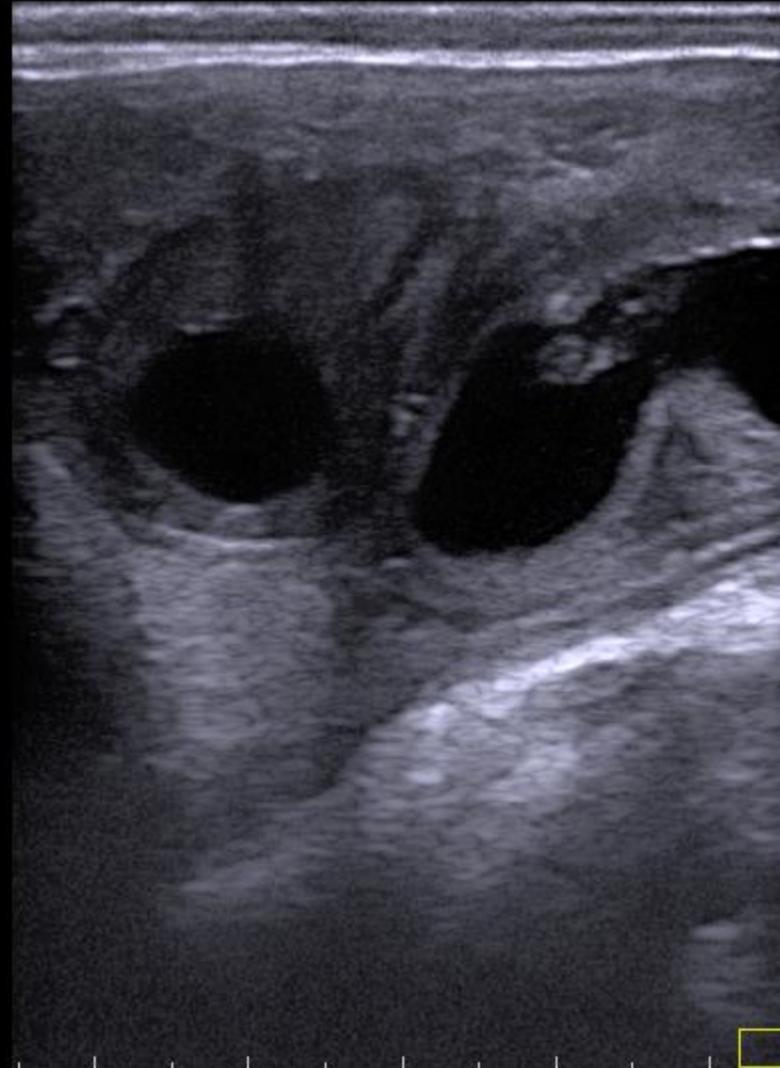
F 10.0MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2

USINE

4

SV3513

13



0
1
2
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4
5
6

1882, 40jrs, N:No., ID: 2012-10-24-02,

24 OCT 2012 15:30



REPRO

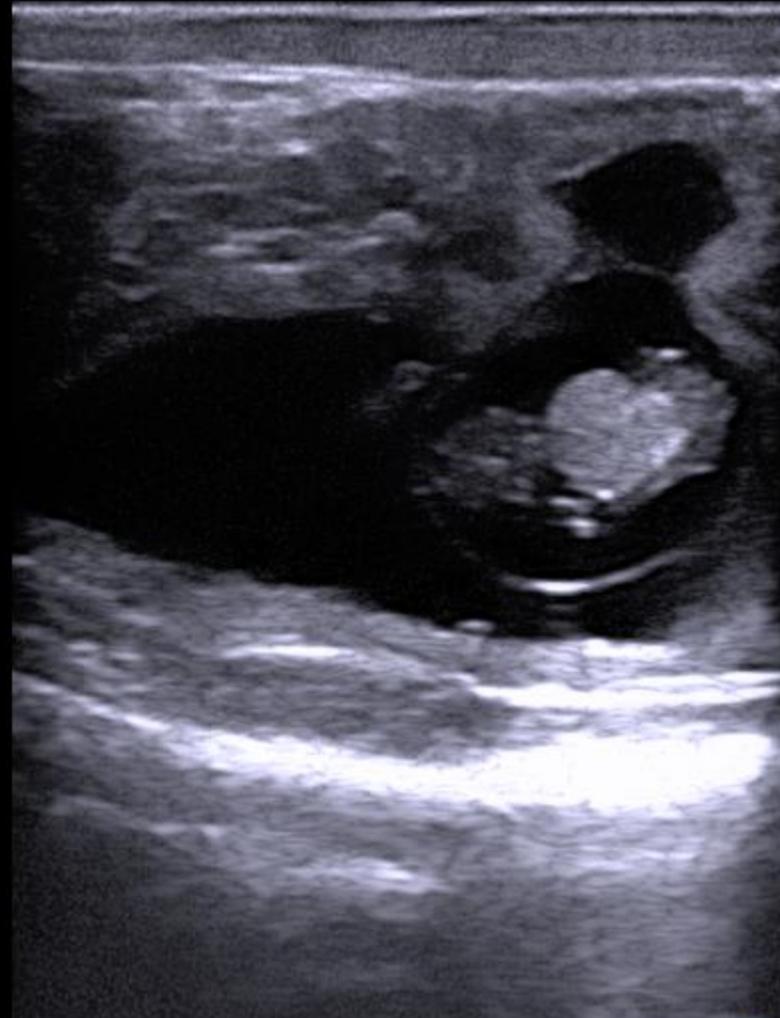
F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2

USINE

4

SV3513

13



0
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6

500 / 500

Conceptus bovin de 45 jours





F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



SV3513





F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



SV3513



17/12/07
10:28:57
L 8.0 MHz



fab G R→

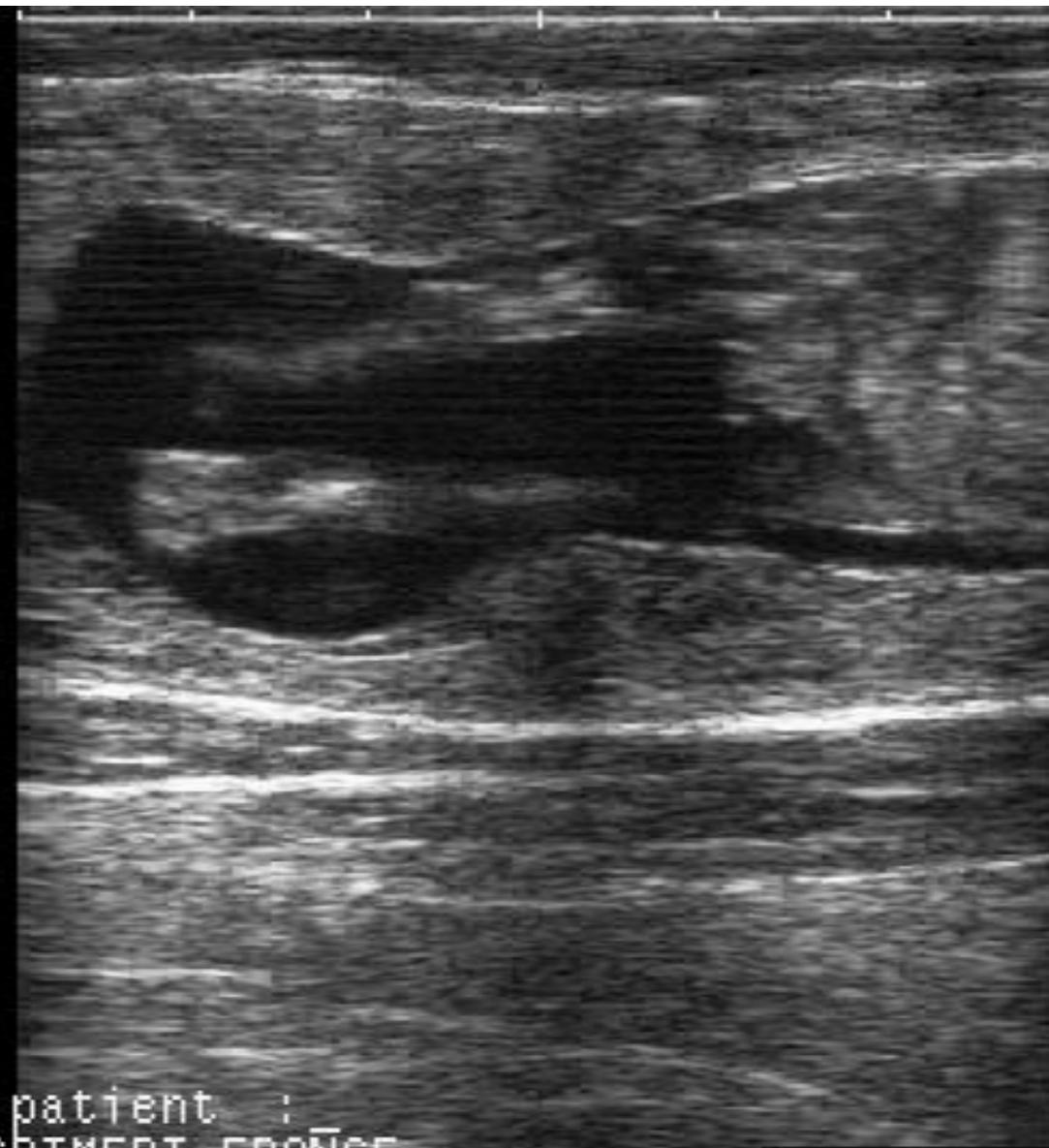
17 Ips

Memoire 1

Standard

Attender s.v.p.
r

Id patient :
HOSPIMEDI FRANCE



86 1 102

1913, N:No, ID: 2012-11-20-02

20 NOV 2012 14:55



REPRO

F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2

USINE

4

SV3513

13



120 / 500



04/12/07
11:05:30
L 10. MHz



fab G R→

18 Ips

Memoire 1

Standard

Attendez s.v.p.



Id patient :
HOSPIMEDI FRANCE

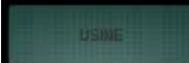
100 1 106

1918, N:No, ID: 2012-12-10-02

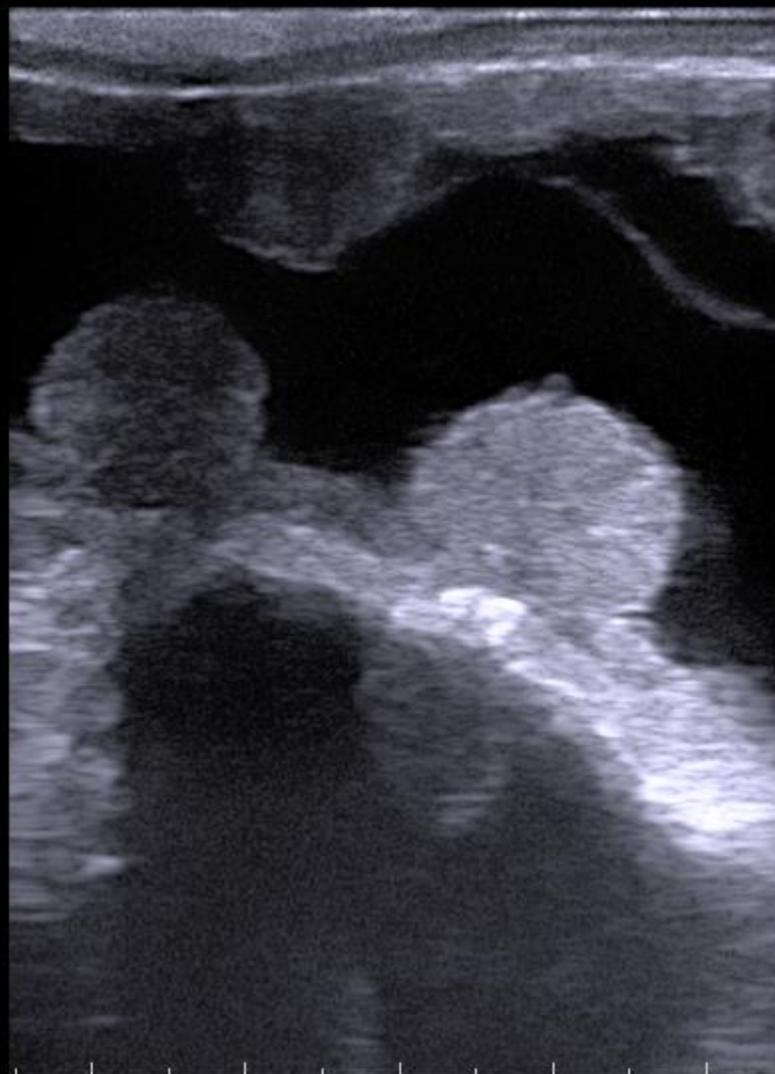
10 DEC 2012 09:40



F 10.0 MHz G 78%
D 7 cm
PRC 7/1/H PRS 5
PST 1/2



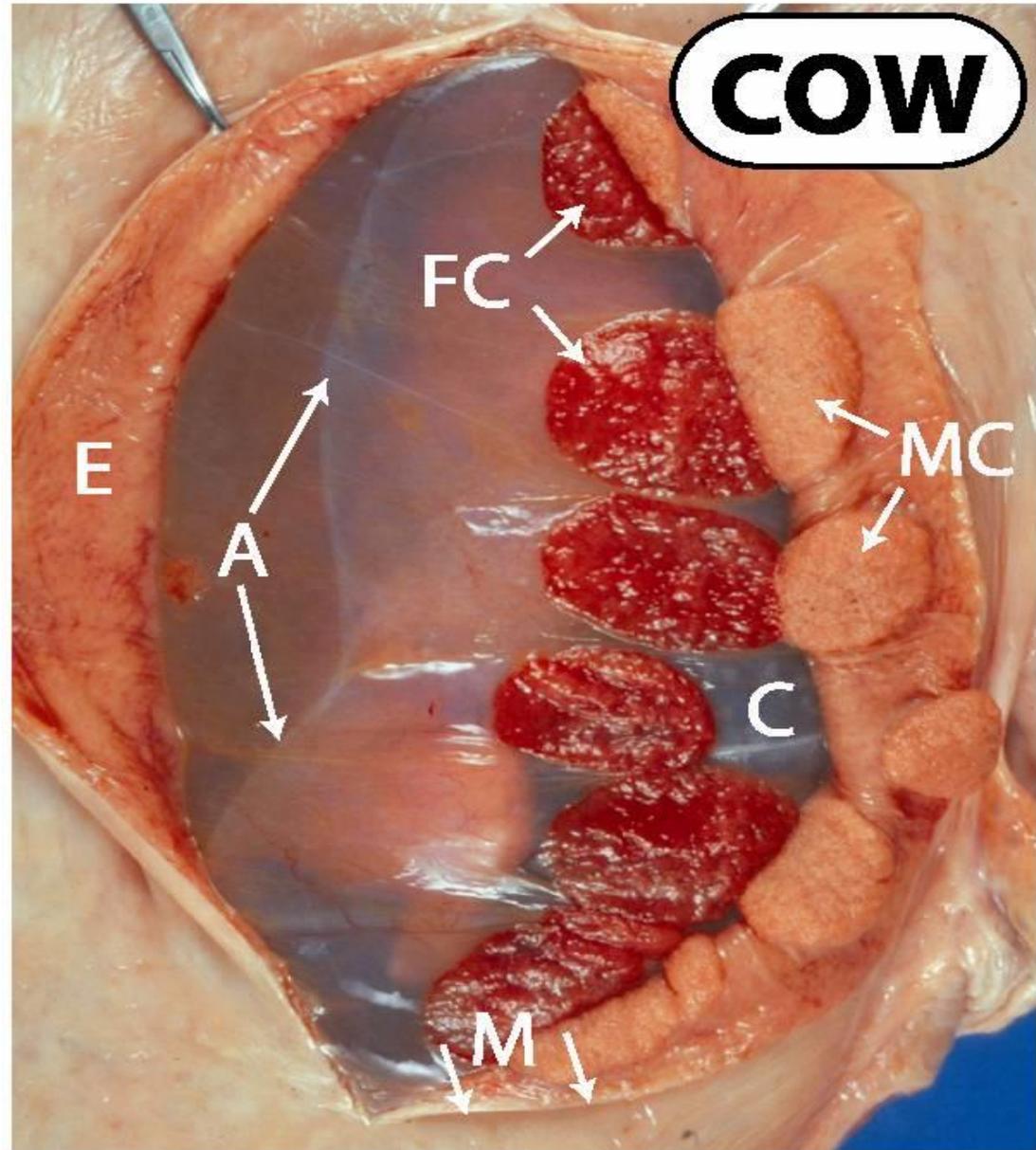
SV3513



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Placenta cotylédonnaire de la vache

A	Amnios
C	Chorion
E	Endomètre
FC	Cotylédon foetal
MC	Caroncule maternel
M	Myomètre



Hoechst

