



Nouvelles formes d'énergie en Urologie

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14 Septembre 2015



Déclaration de liens d'intérêts

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Journées Euro-Pharmat NICE 13-14-15 Octobre 2015

Les différents types d'énergie utilisé en Urologie

Au 18^{ème} siècle

Les lithotriteurs mécaniques intra vésicaux

Au 19^{ème} siècle

L'électricité et cystoscope

Au 20^{ème} siècle

1950 : La résection endoscopique

1970 : L'énergie balistique

1980 : Les lasers à fragmentation

1990 : Les lasers à vaporisation

Fin 1990 : L'HIFU

Au 21^{ème} siècle

L'utilisation quotidienne des ultrasons focalisés et du laser à vaporisation



HIFU ??



High

Intensity

Focused

Ultrasound

History of HIFU development

- 1st Ablatherm Hifu tx for Prostate Cancer done in 1993
- Team :
 - Hôpital Edouard Herriot Lyon
 - Inserm Lyon
 - Edap Tms
- Up to Dec 2013 :
 - 35000 Hifu tx done worldwide (3500 per year)
 - **Dynamic Focusing Ultrasound (> 200 procedures done)**
 - In > 30 different countries
 - 120 Ablatherm & **3 Focal One®** manufactured
 - 250 sites (Mobile and Fixe)

Ultrasound in medicine

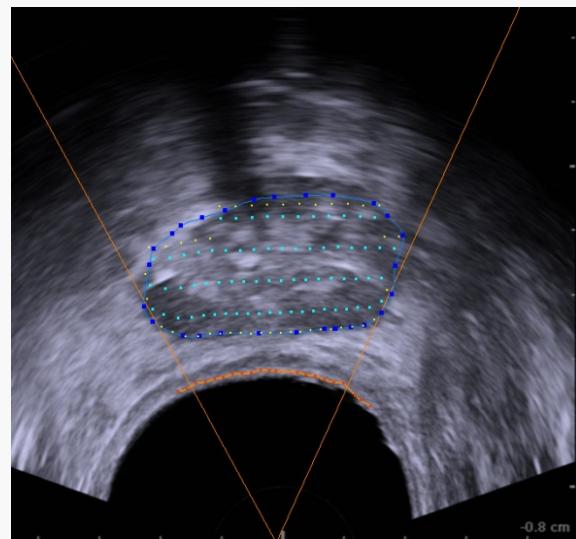
Imaging

- beam « parallel »
- very low energy (0.02 Watts)
- 3-10 Mhz

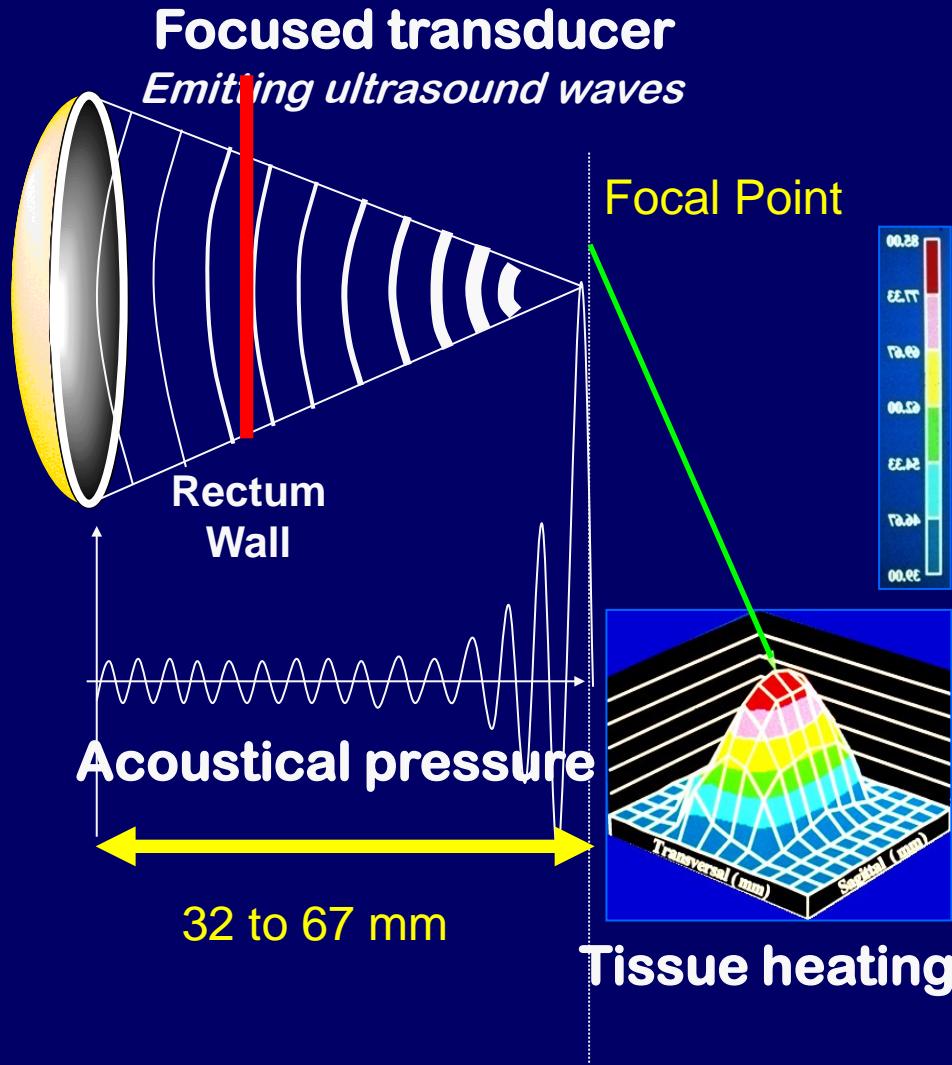


Therapy (HIFU)

- focused
- very high energy 200 Watts
(10,000 times greater output than imaging signal!)
- 3 Mhz



HIFU principles



- **Spherical transducer**

Ultrasound waves are emitted by electromechanical vibrations of transducer and propagate throughout the tissue

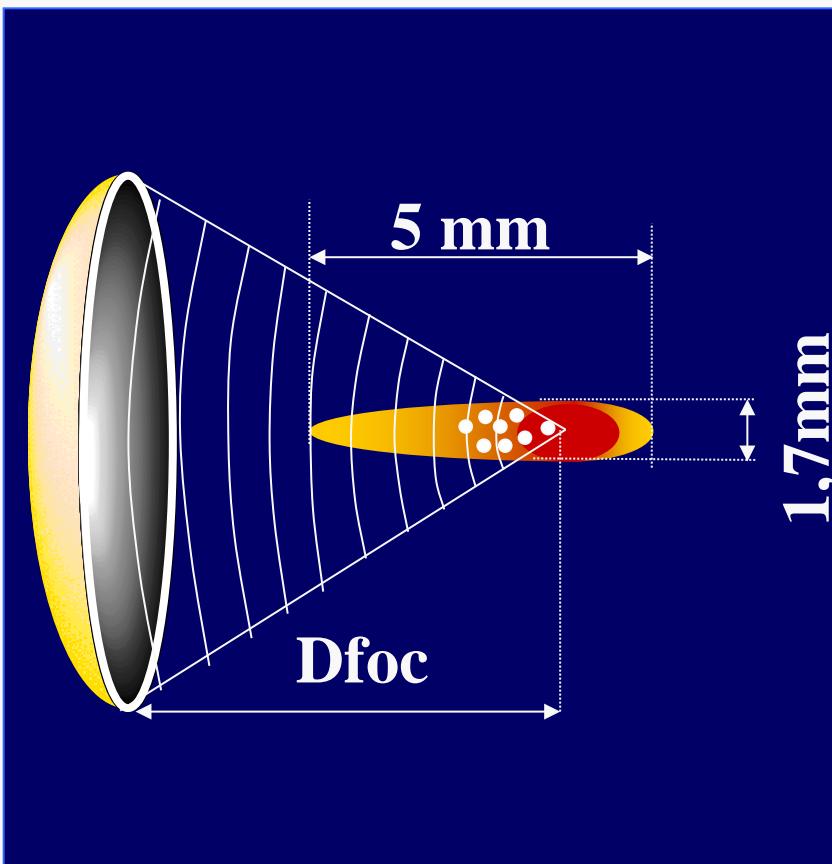
- **Acoustical effect :**

- Alternation of positive and negative pressure
- Tissue displacement (compression/dilation)

=> Heating of tissue

=> Coagulation necrosis
(elementary lesion)

Elementary lesion generation



Cigar-shape elementary lesion of a of **1.7 mm** diameter **and 5 mm** long

This elementary lesion can be generated at different depth within the prostate (dynamic focusing)

Dynamic focusing allows 8 focusing depth
(32-37-42-47-52-57-62-67 mm)

Every prostate size is accessible!

Focal One®



Focal One®

Module

+

Probe

+

Consumable

User interfaces



Treatment screen:
Treatment Planning and
follow-up

Imaging screen:
Prostate contouring
MRI/Ultrasound Fusion

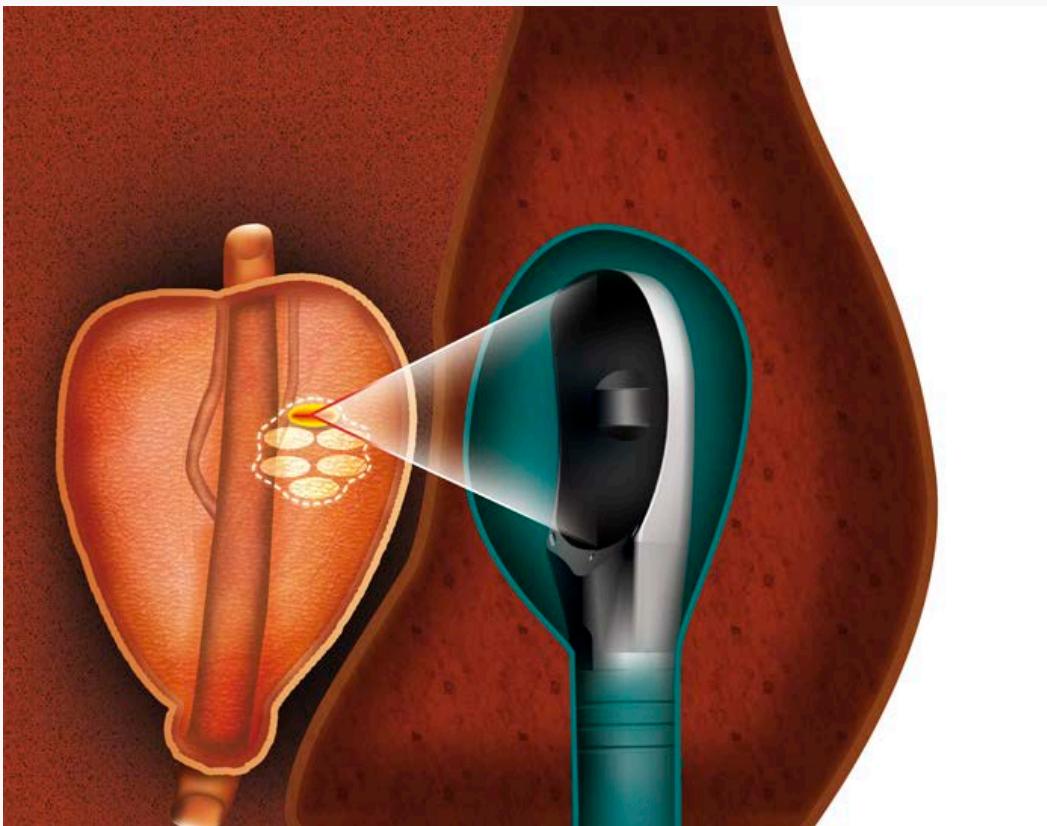
User interfaces



Your own OR Table

Treatment Probe
and Probe Support

Purpose of Ablasonic



- Cools down rectum wall
- Transmits ultrasound waves (interface)
- Get a flat contact to rectum wall
- Thinner rectum wall
- Bring closer or move away the rectum wall so that it matches the orange dot line

Treatment Probe



Imaging Transducer

- Frequency 7.5 MHz
- Transversal Axis
- Both B Mode and CEUS
- 192 elements

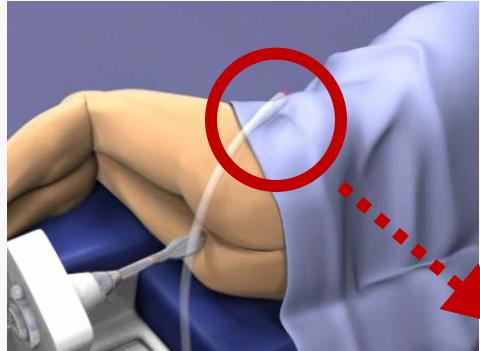
Therapy Transducer

- Frequency 3 MHz
- 16 concentric rings = 16 outputs
- Natural Focalisation 60 mm
- Electronic Dynamic Focusing
- 8 focal points from 32 mm to 67 mm ($\Delta f = 5 \text{ mm}$)

Safety features

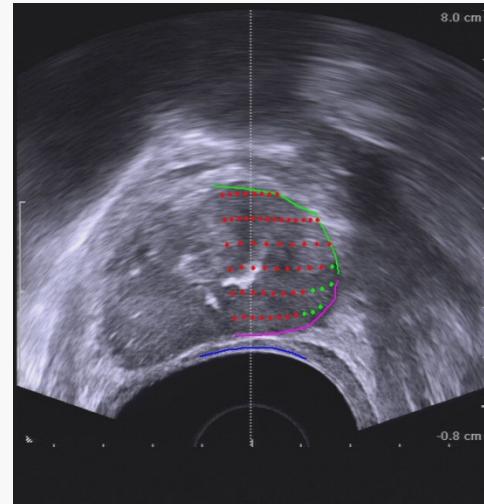
Rectal cooling:

Probe temperature is monitored in real time
(Peltier effect dry cooling)



Patient movement detection:

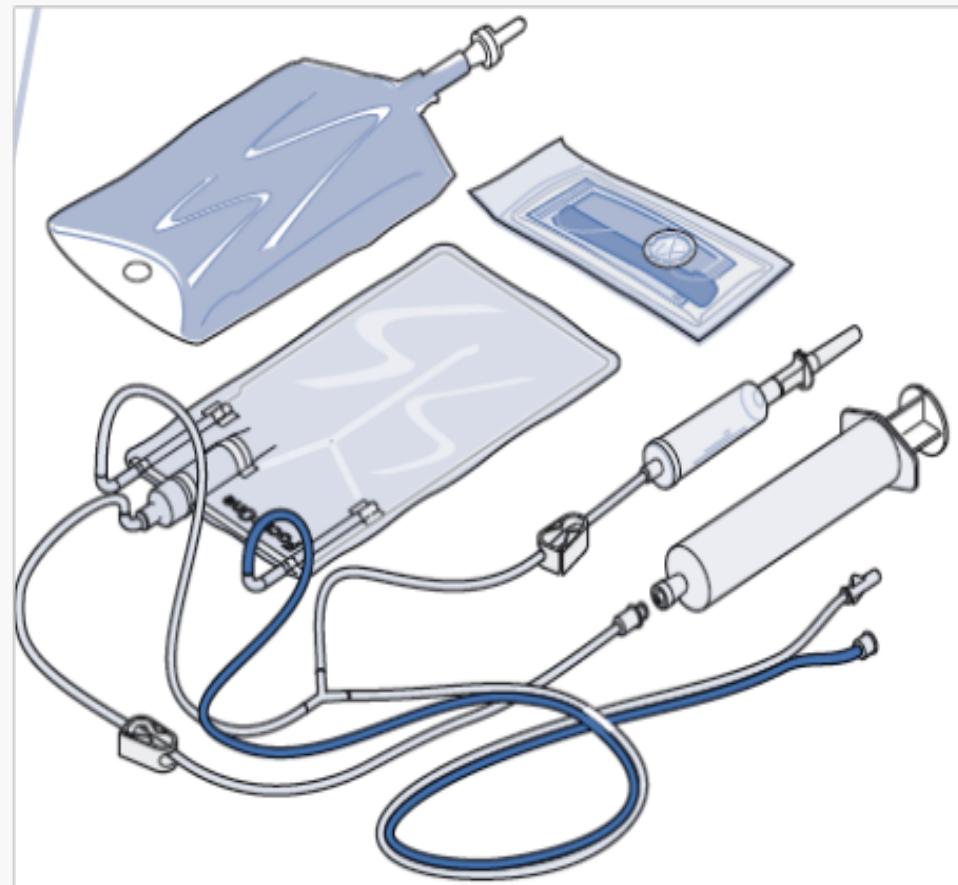
Patient movements are detected in real time and stop the treatment



Rectal Wall monitoring:

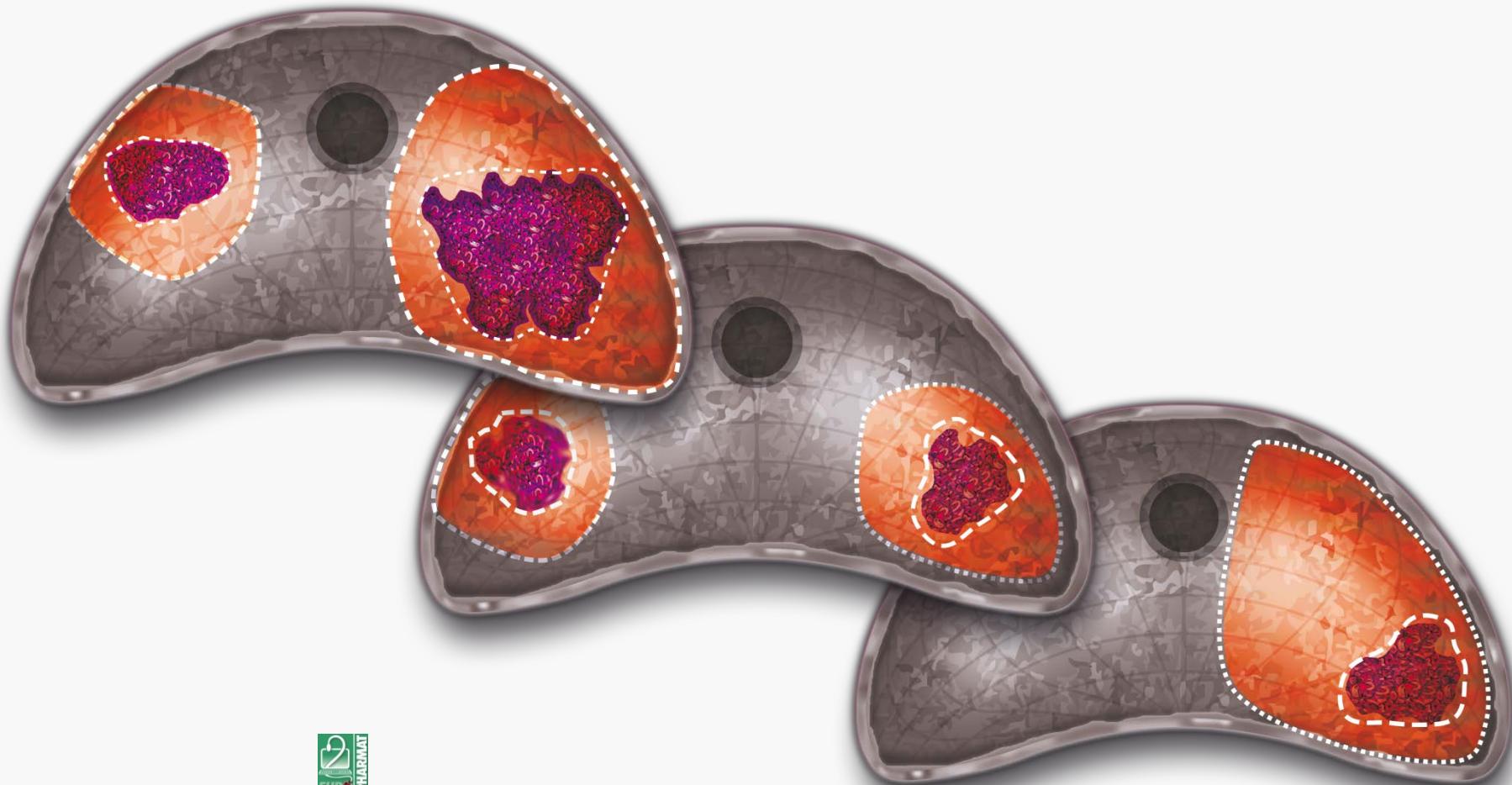
Rectal wall is monitored in real time on ultrasound image

FocalPak and Ablasonic



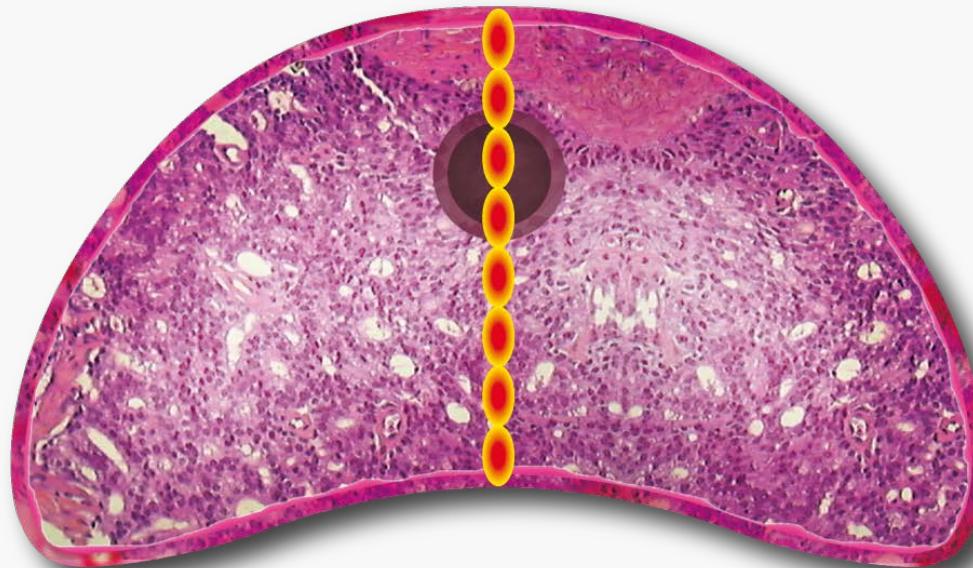
GLOSSARY

- **Contour:** For each slice, it's the area which will be treated



GLOSSARY

- **Trajectory** : For each slice, it's a stack of up to 8 (5mm) lesions in the anterior - posterior axis



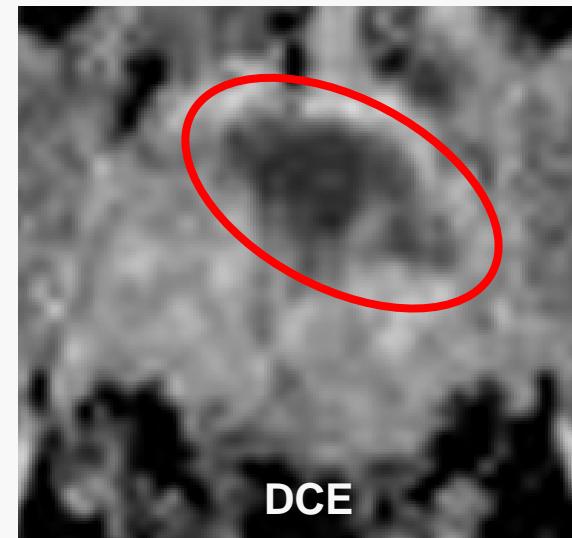
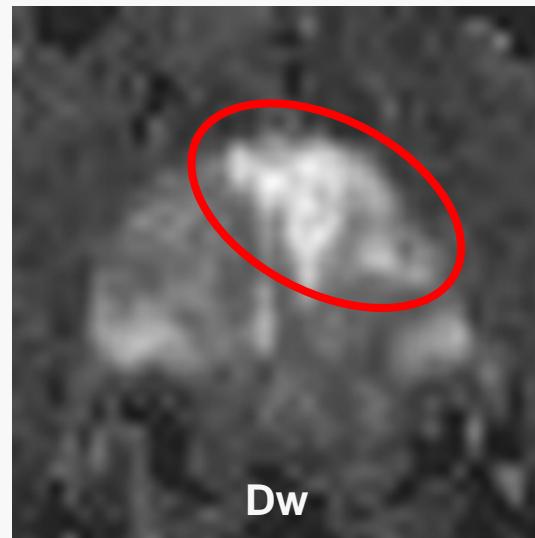
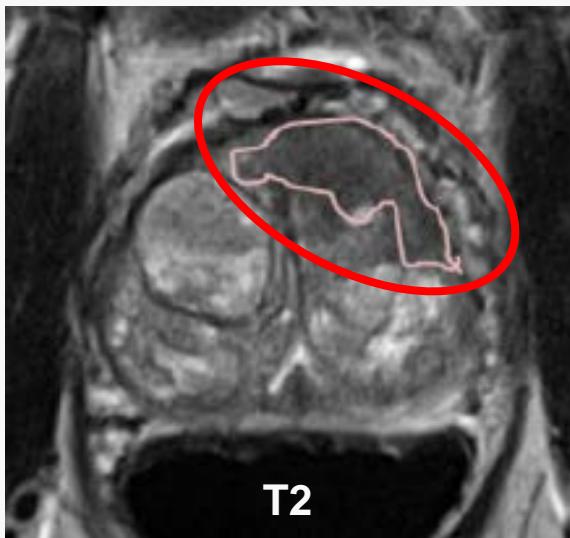
GLOSSARY

- **CEUS** : Contrast agent that uses sulphur hexafluoride micro bubbles for contrast-enhanced ultrasound imaging.



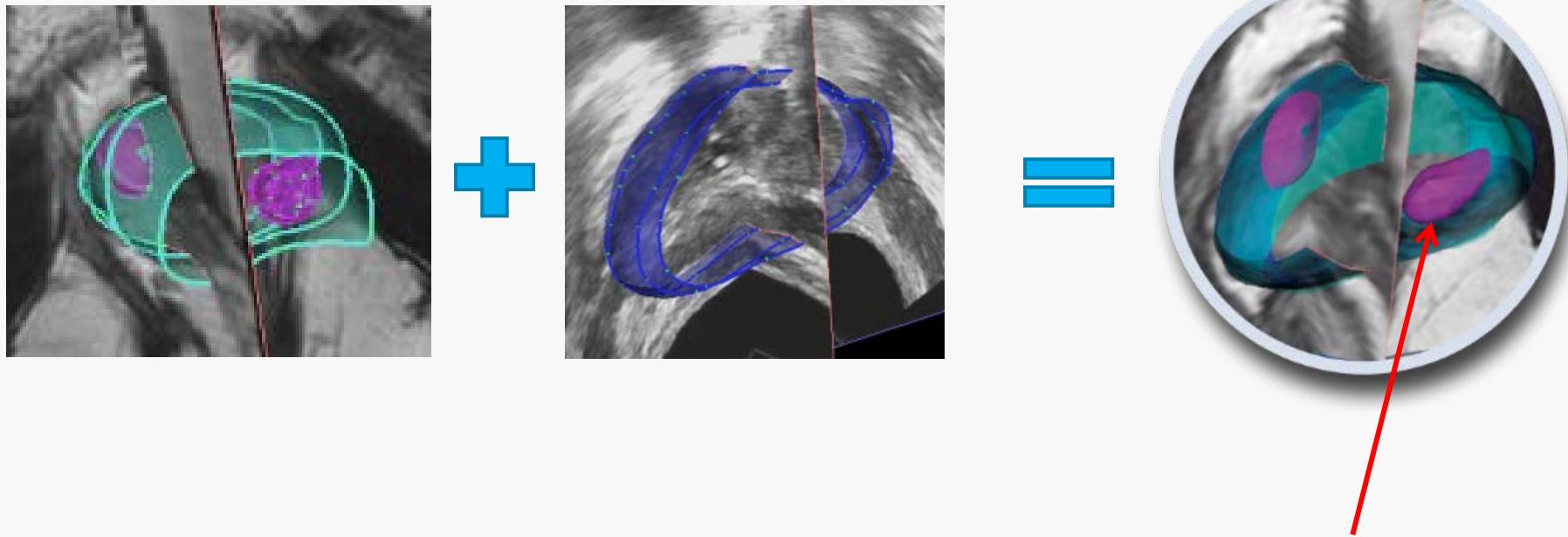
GLOSSARY

- **Multiparametric MRI or mpMRI :**The goal is to increase the accuracy of the identification of tumors within the prostate



GLOSSARY

- **(Elastic) Fusion** : A combination of magnetic resonance imaging (MRI) images with real time high-resolution ultrasound.
The MRI prostatic volume will be adapted to the US-volume..

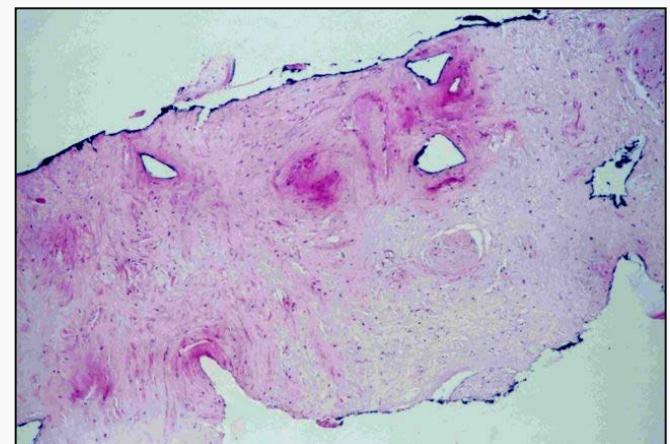


Histopathology

- Complete destruction of glandular tissue corresponding to the lesion of coagulation necrosis reaching the capsule and periprostatic fat.
- Necrotic prostatic tissue is replaced by fibrotic tissue (including capsule).



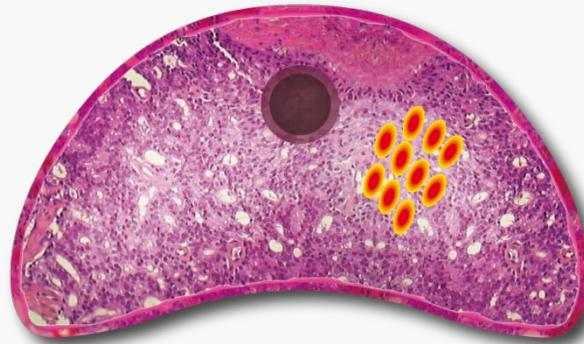
48 hours



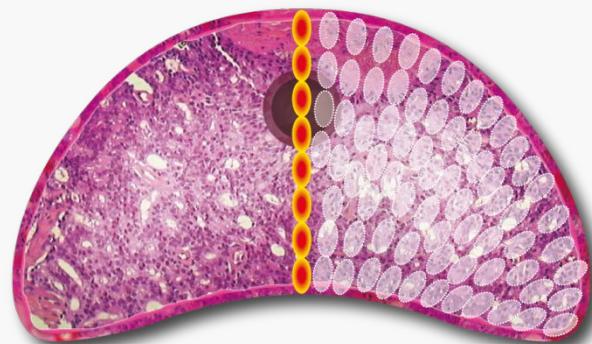
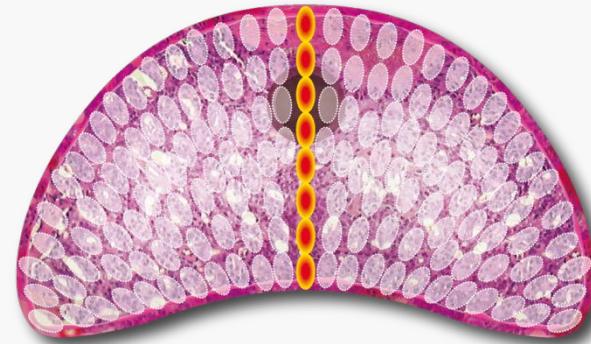
3 months

Treatment strategies

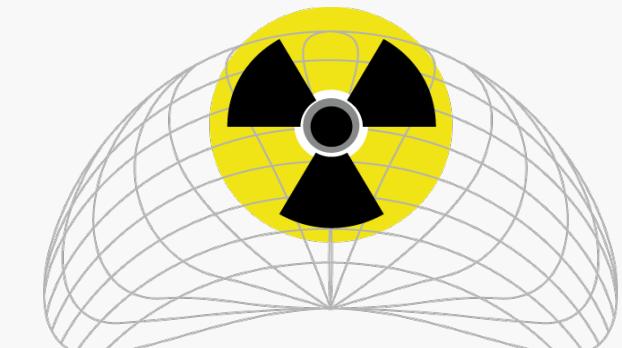
FOCAL



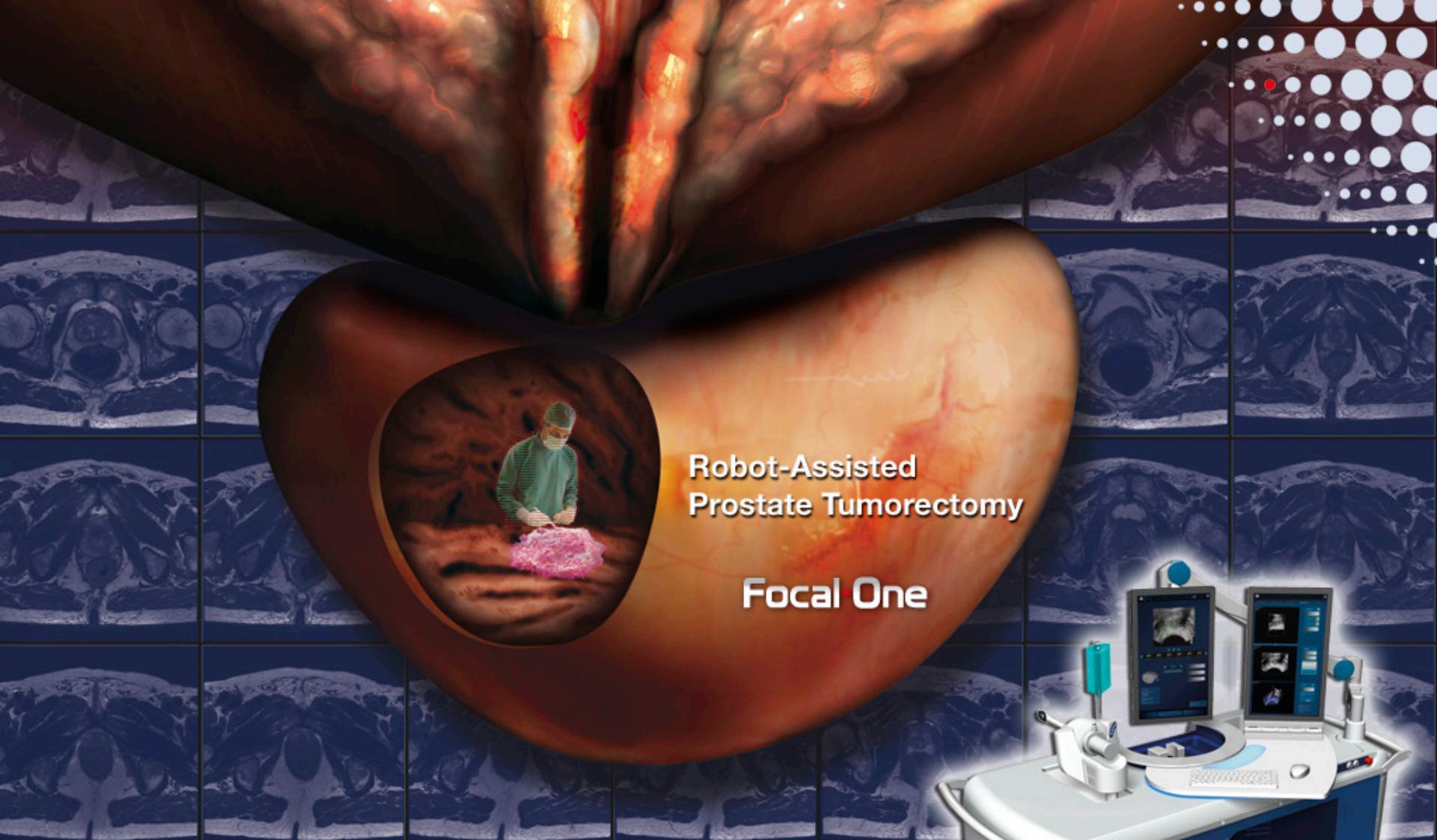
RADICAL



HEMIABLATION



**SALVAGE HIFU
after EBRT**



Robot-Assisted Prostate Tumorectomy

Focal•One



Bringing New Horizons to Therapy