fusion imaging-εφαρμογή στην κλινική πράξη

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HISTORY AND CLINICAL NEEDS

Fusion Imaging is the outcome of the work and commitment between medical industries and scientific partners, who put at our disposal competence and passion for research, to reach common goals and improved healthcare within everyday clinical practice, interventional procedures, research, teaching and further development may draw a promising future driven by Ultrasound

Interventional procedures

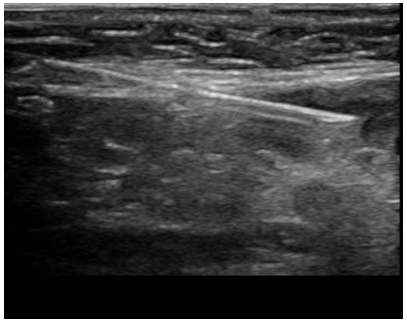
Current Limitations

Many lesions invisible or inaccessible

US

Highly operator dependent

Poor global visibility

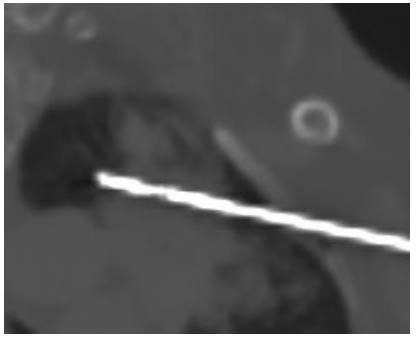


CT

Radiation exposure exponential

Off axis approach is often challenging

Lesions transiently visible with contrast

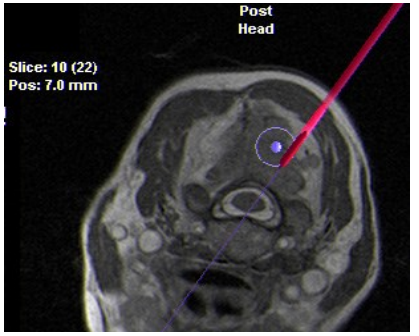


MR

Complicated procedural environment

Limited availability

Costly procedure



Fusion Imaging

Purpose

To enhance the images produced by an Ultrasound Scanner by means of combining them with a second modality in real-time.

- Define organ conspicuity
- Confirm contrast uptake
- Delineate and Follow up lesion
- Confirm ablation pattern

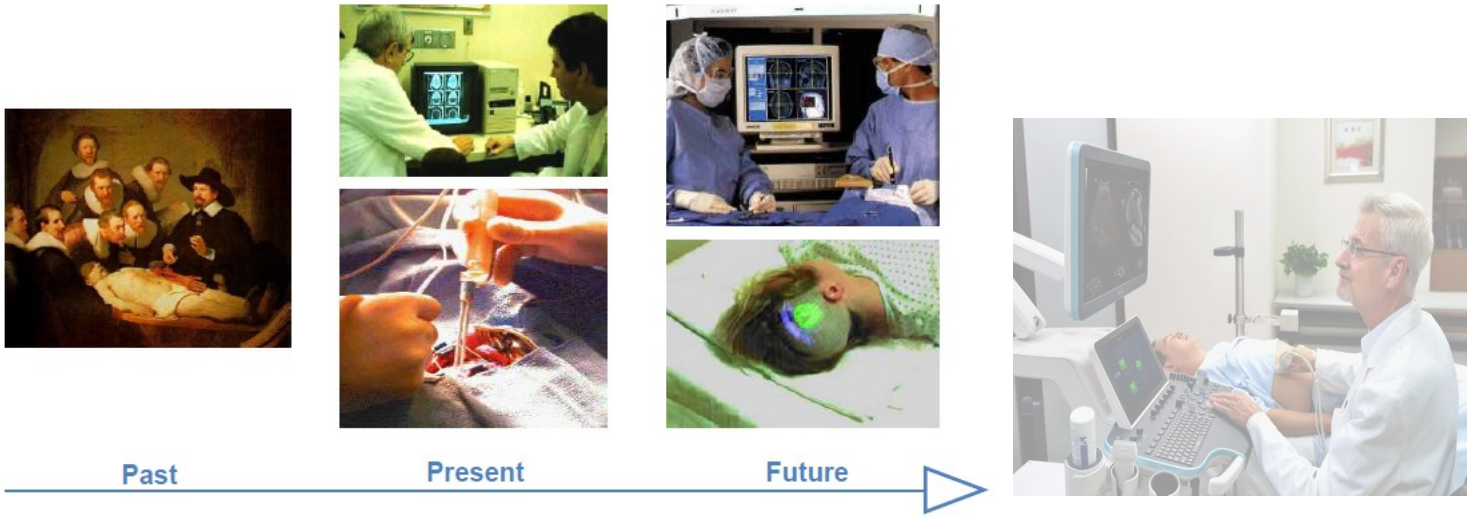
Fusion Imaging

Why Fusion Imaging ?

- Detect lesions through CT/MRI/PET (inconspicuous to ultrasound)
- Suggest best scan approach to better identify the Target and Identification of safest pathway (complex angle of insertion, dome lesions, lesions under ribs, etc)
- Easily drive the operator in the region of interest
- Localizing specific part of tumor for biopsy (e.g.: hot on PET)

Fusion Imaging

CT and MRI side-by-side with real-time Ultrasound



In the present era of multimodality imaging of human body, the present emphasis is on the fusion of information achieved from different imaging modalities.

This involves structural as well as functional information about the human body parts and various physiological/pathological processes related to it.

Fusion Imaging

takes all the advantages
coming from different Imaging Modalities

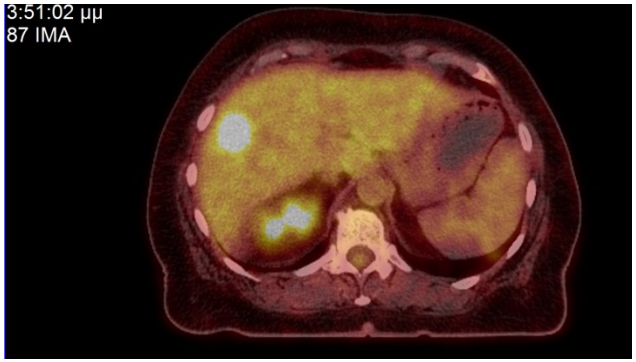
US Real-Time- Low cost examination - No patient irradiation

MR
CT Extended field of view-Not patient depending-Easy image interpretation

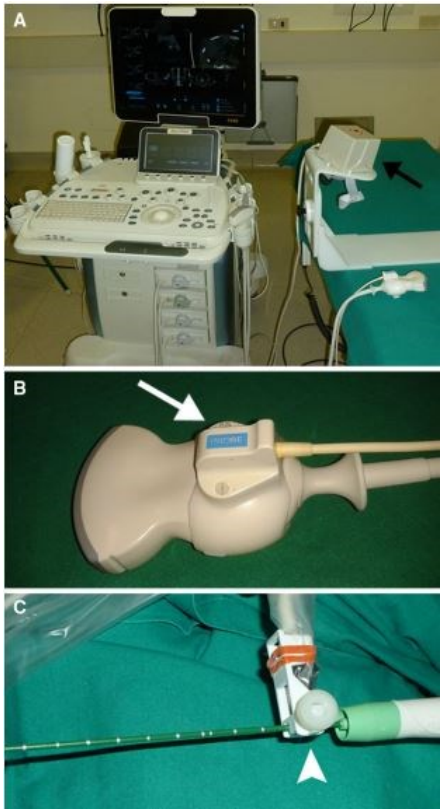
and it combines them to increase diagnostic ***confidence!***

Fusion Imaging

Two static modalities



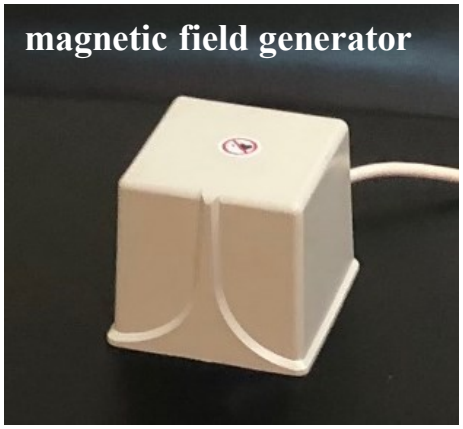
One static + one dynamic
For interventional procedures



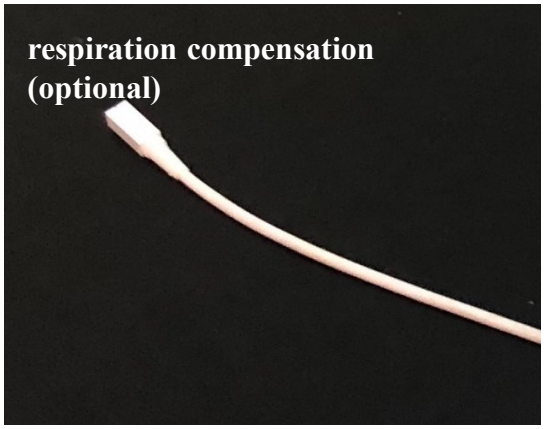
Fusion Imaging

Equipment

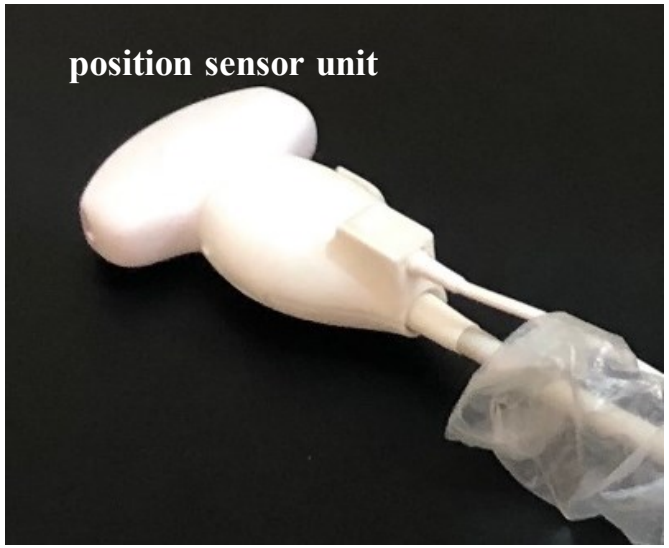
magnetic field generator



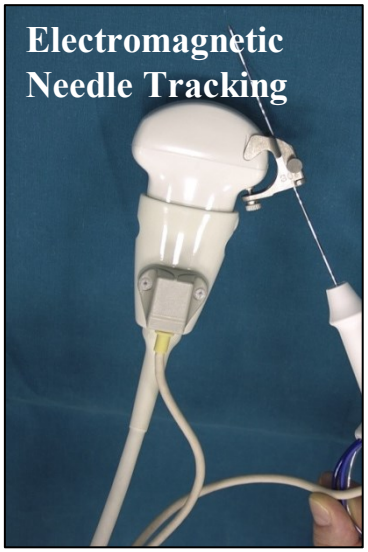
respiration compensation (optional)



position sensor unit



Electromagnetic Needle Tracking

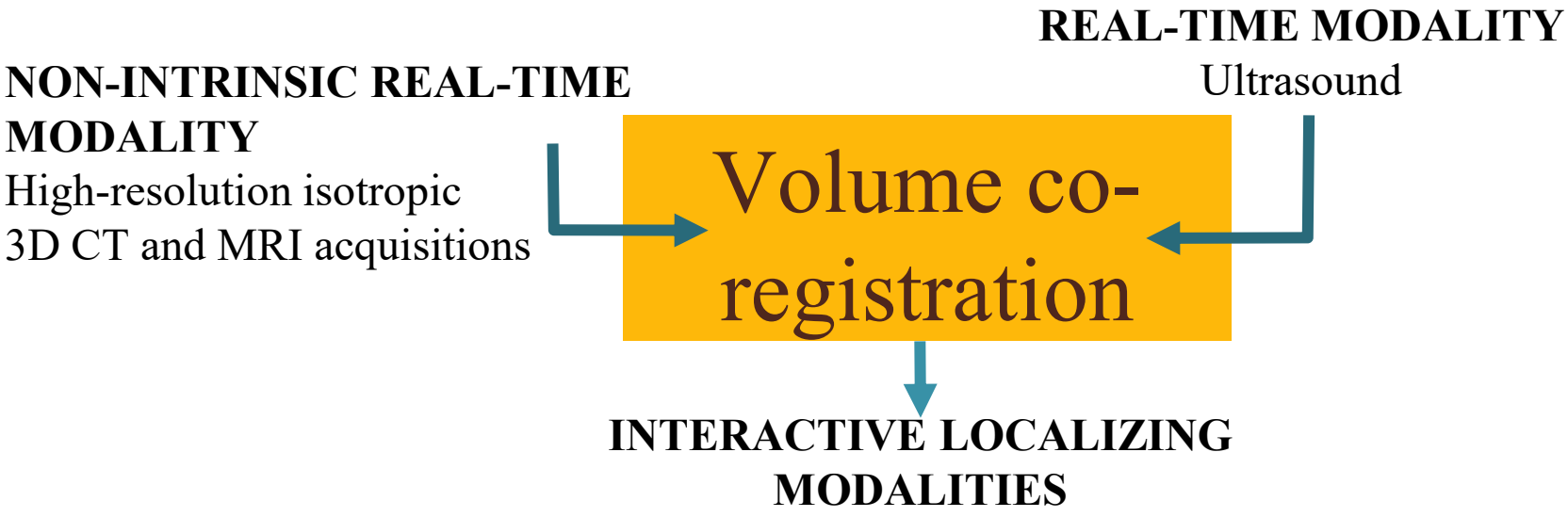


Fusion Imaging

Background

Different Imaging modalities could be used with intrinsic, real-time modalities, such as Ultrasound, to enhance localization capabilities:

- mentally by the physician ("Cognitive Fusion")
- by automatic co-registration, overlapping and simultaneous display



What is wrong with this picture ?

Fusion Imaging
Procedures

Standard

1
- **CT/MRI data loading**

Place target markers (optional)

2
- **Registration and fine tuning**

3
- **Real-time combined scanning and navigation**

Respiration compensation

1
- **CT/MRI data loading**

2
- **Registration and fine tuning**

3
- **Capture a cine with extra sensor for respiration compensation**

4
- **Real-time combined scanning and navigation**

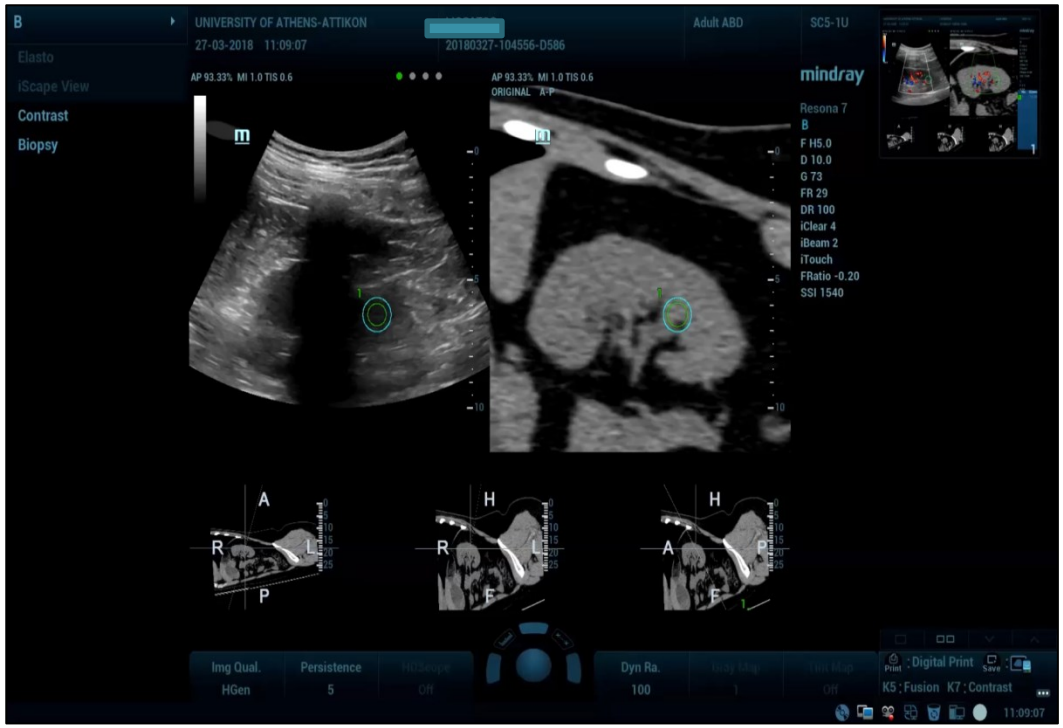
Fusion Imaging

cases

In our department A total of 16 patients underwent percutaneous fusion guided techniques (13 biopsies/ drainages 3 ablations), during the last 12 months. Biopsy targets included MSK (n=5), renal (n=2) and liver lesions (n=6). Both drainage sessions involved renal cysts. All ablation sessions were performed in the liver including 2 metastatic lesions and one ecchinoccocal cyst. Results: Mean patient age was 57.3 years (male-female: 11 -3). Technical success was feasible in all cases (100%); there were no complications reported. Bioptic samples provided lesion characterization in all cases. Comparing the fusion guided results with those of biopsies under ultrasound guidance performed in the same period there was no statistical significant difference in terms of technical success and complications.

Fusion Imaging

Targeting

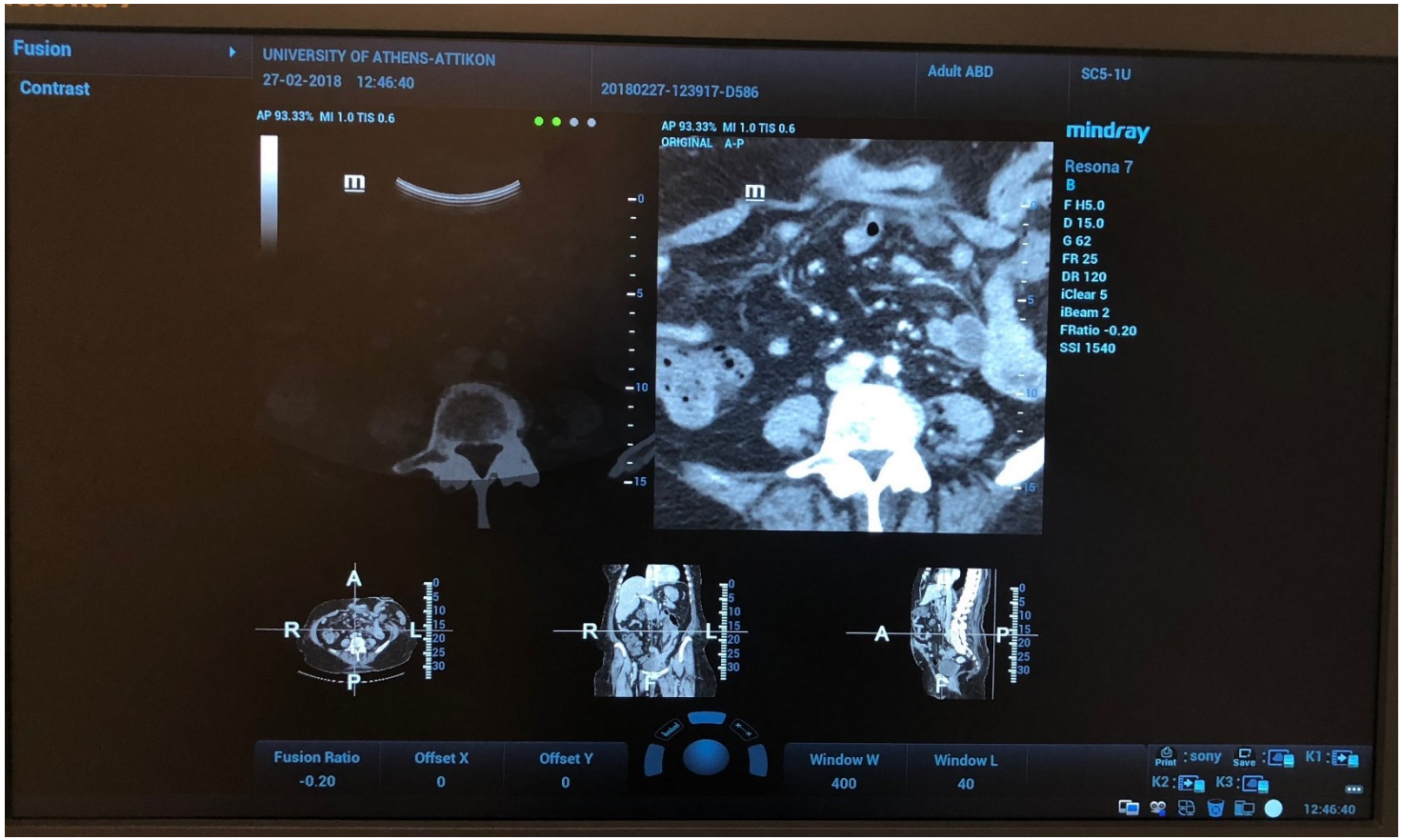


Once the correlation has been performed the target can be reached with the easiest scanning approach

Fusion Imaging

Future Developments

- Faster and Seamless Registration
- Reliable and Easy Reproducible Registration



Fusion Imaging

Lymph Nodes

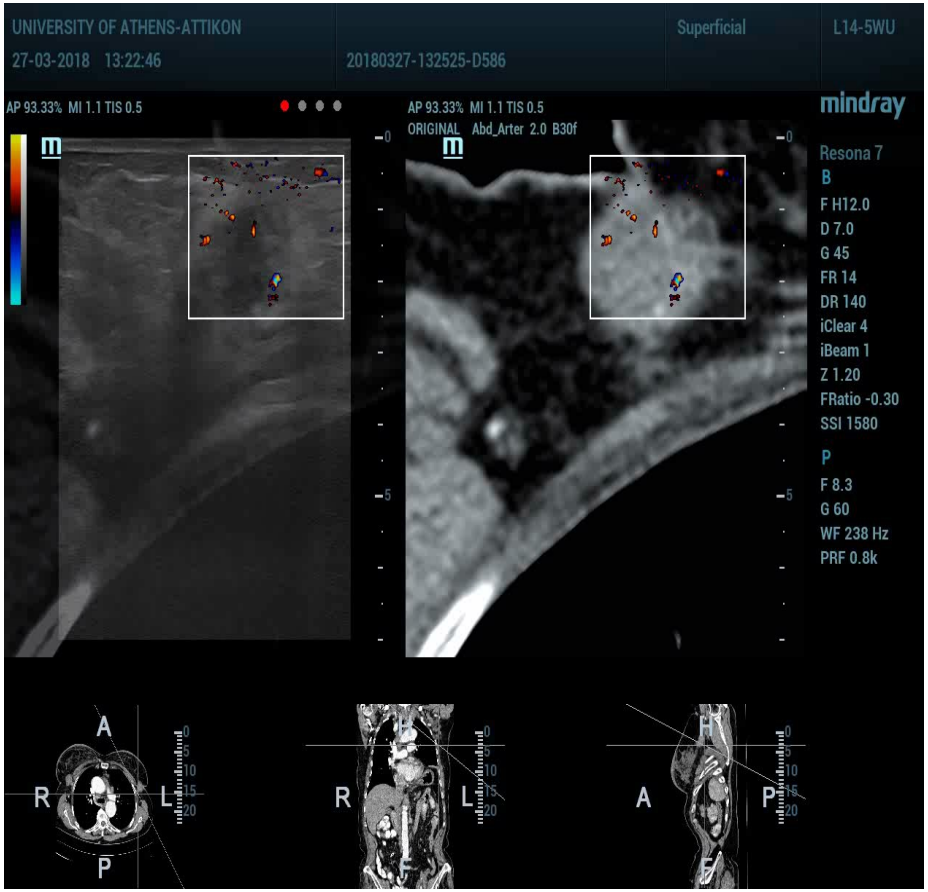
Breast is an organ with very high deformation since it is highly dependent on density itself

The axilla is instead an “easier” access point to reach lesions

Once the one plane registration is performed it is possible to fine tune with manual rotation of the second modality

iFusion Case : AXILLA

iFusion on Axillary Lymph node

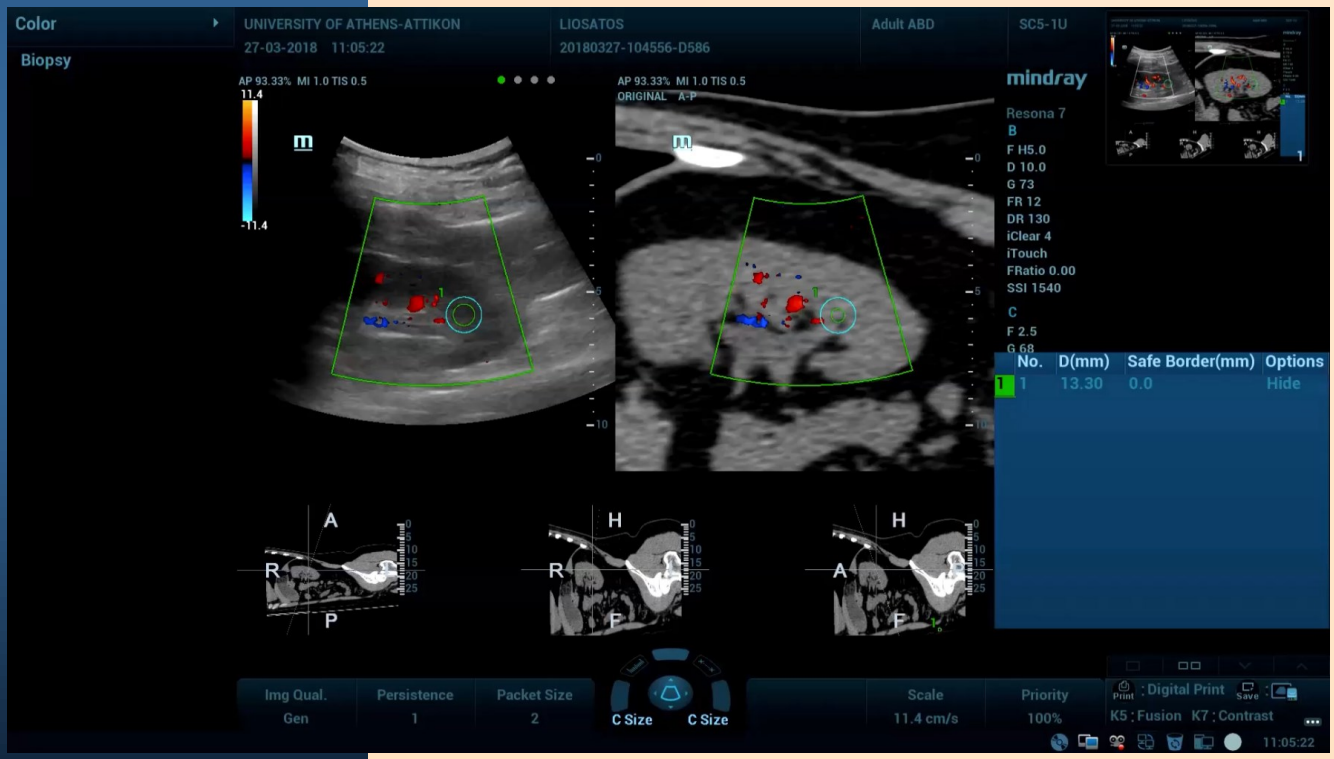


The real-time hemodynamic evaluation and CFM overlapping features help to confirm the quality of the registration and eventually apply a further tuning before approaching the target.

Fusion Imaging

Color Doppler

correlation evaluation with color Doppler

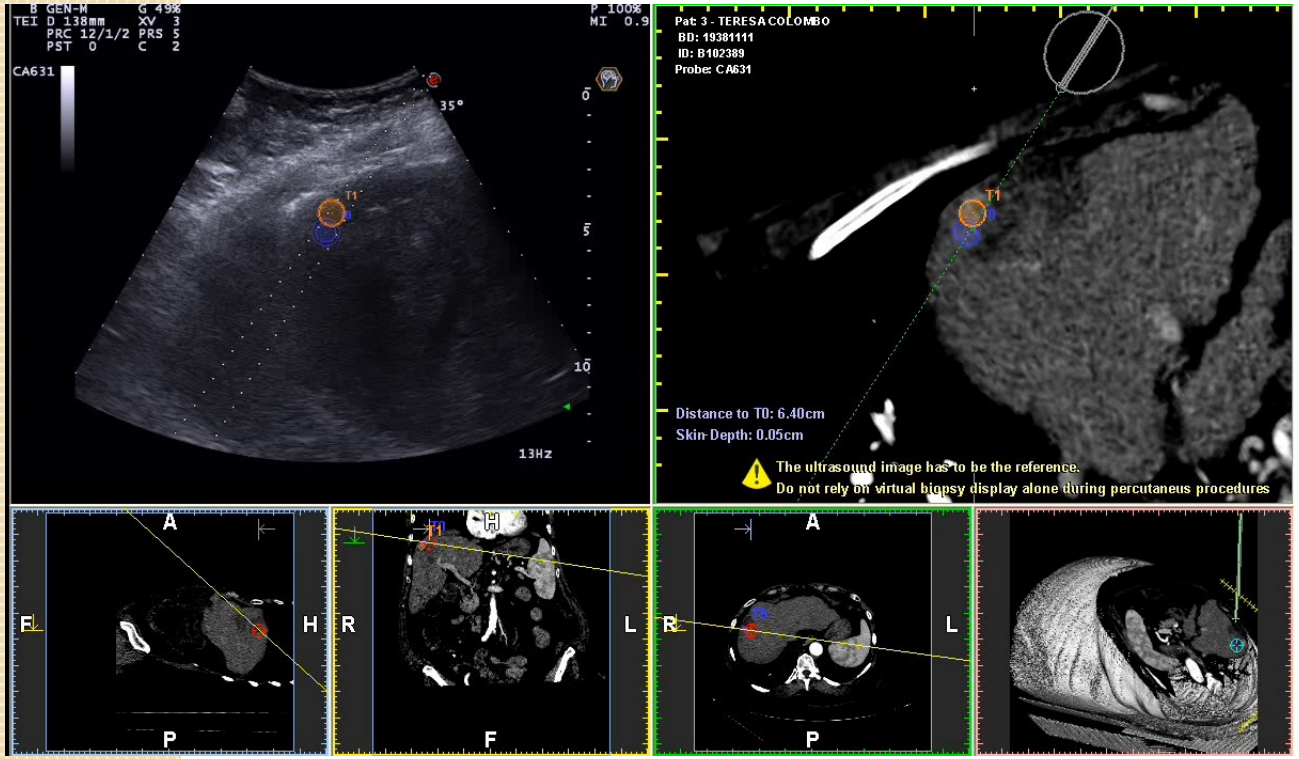


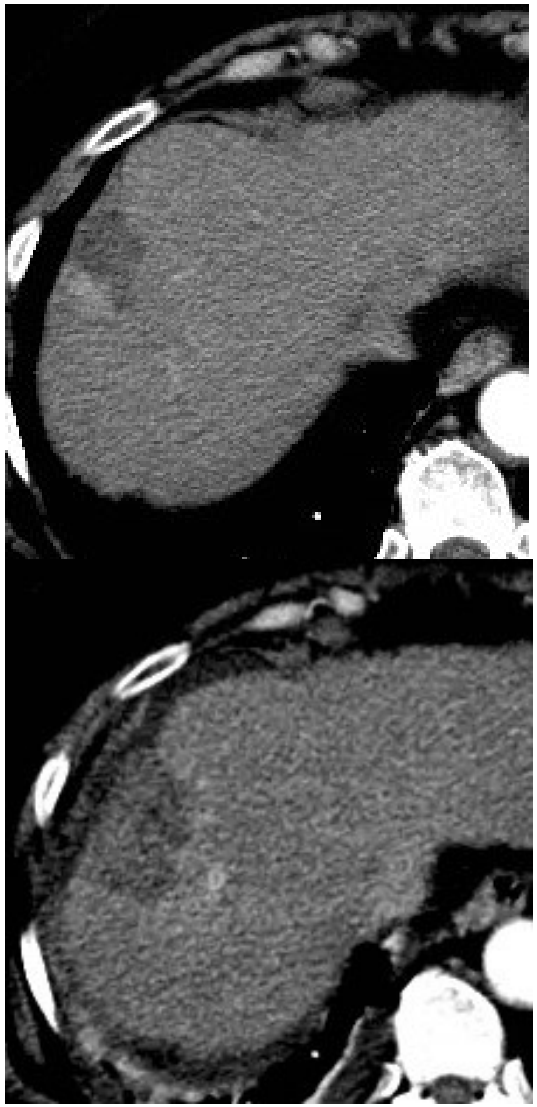
CFM allow to correlate RT hemodynamic information on high-definition MRI/CT imaging

Precision can be assessed by overlapping RT Color Doppler on CT/MRI Imaging

Fusion Imaging

Reccurence

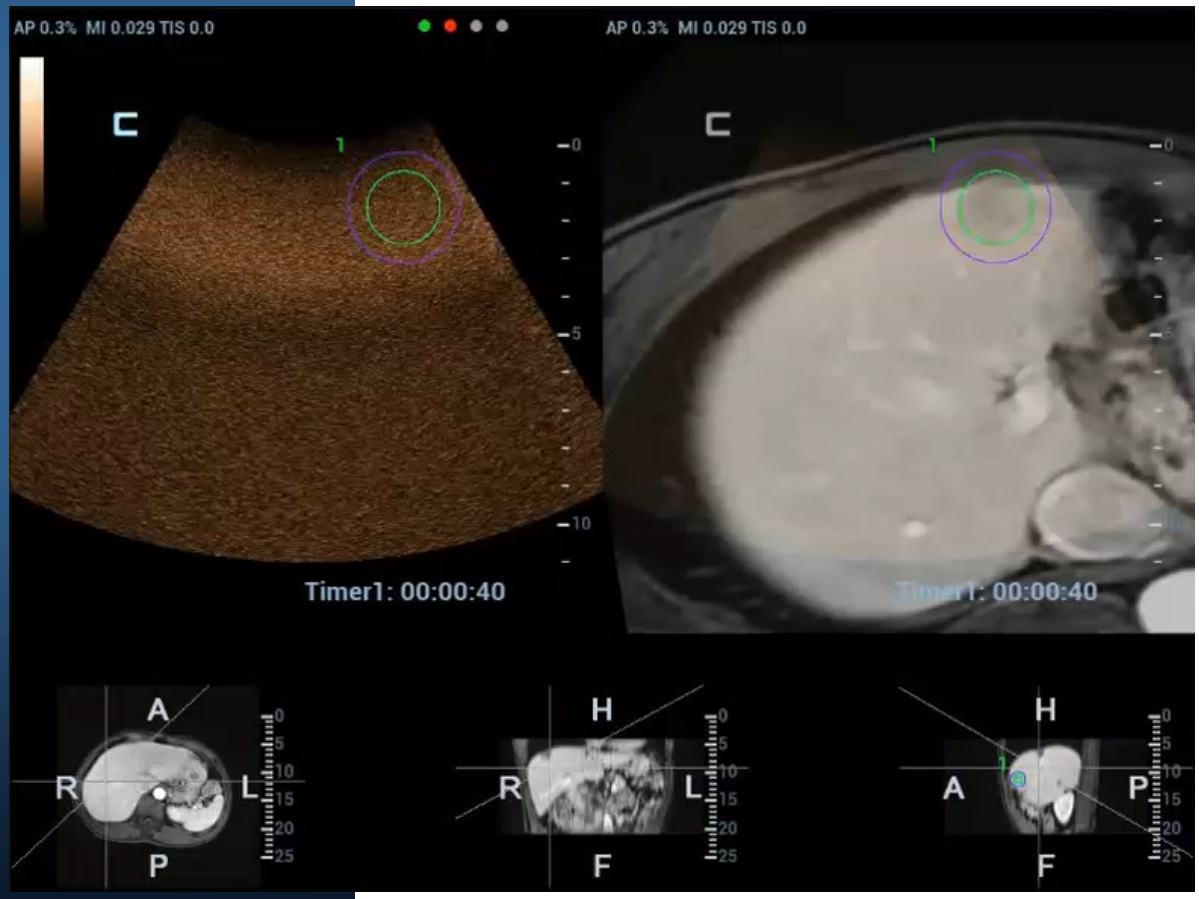




Fusion Imaging

Treatment Evaluation

Safety margin for treatment evaluation

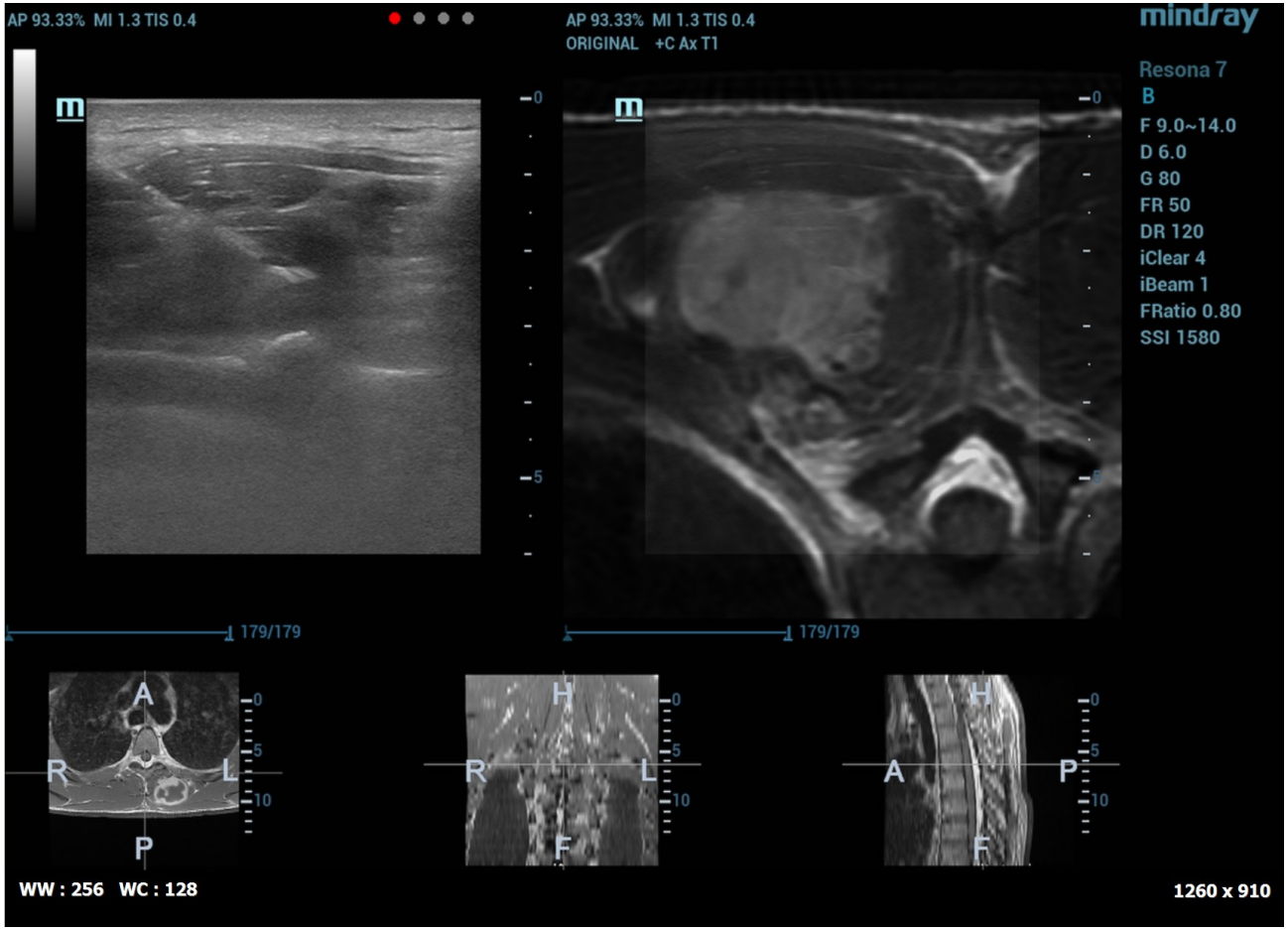


Safety margin indicates the ablative margin of the tumor (0~10mm bigger than target marker)

Used as a guide of minimum ablation size(normally ≥ 5mm than the target)

Useful tool for treatment evaluation

iFusion case:biopsy



Fusion Imaging

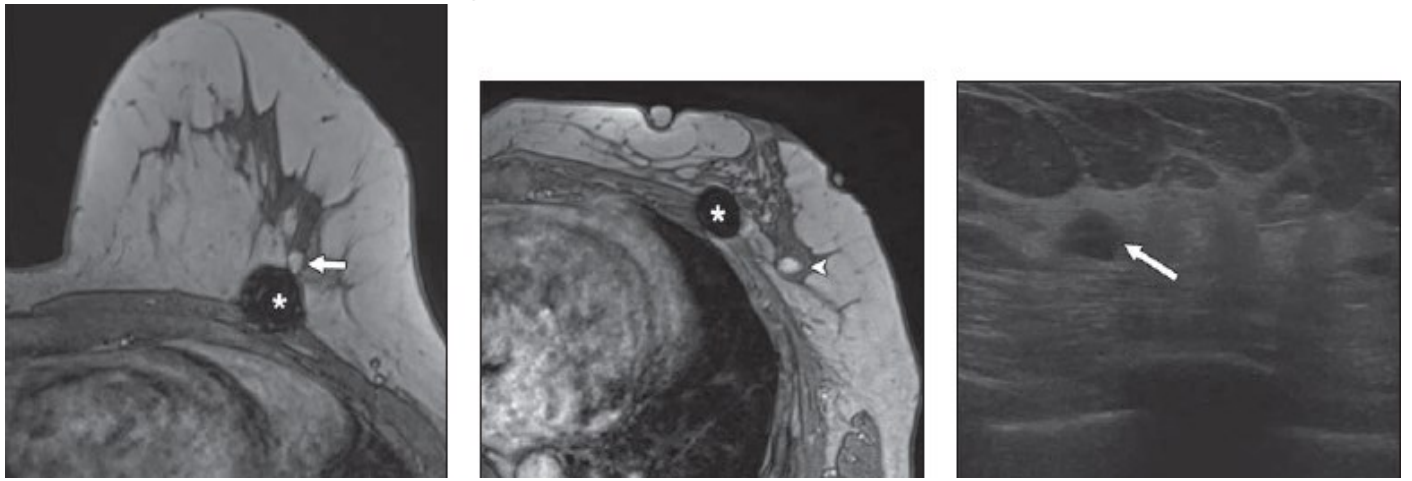
Occult Breast Lesions (MRM only)

AJR 2017;
209:1–10

Volume Navigation Technique for Ultrasound-Guided Biopsy of Breast Lesions Detected Only at MRI

Erkin Aribal[1]
Derya Tureli[2]
Fikret Kucukkaya[1]
Handan Kaya[3]

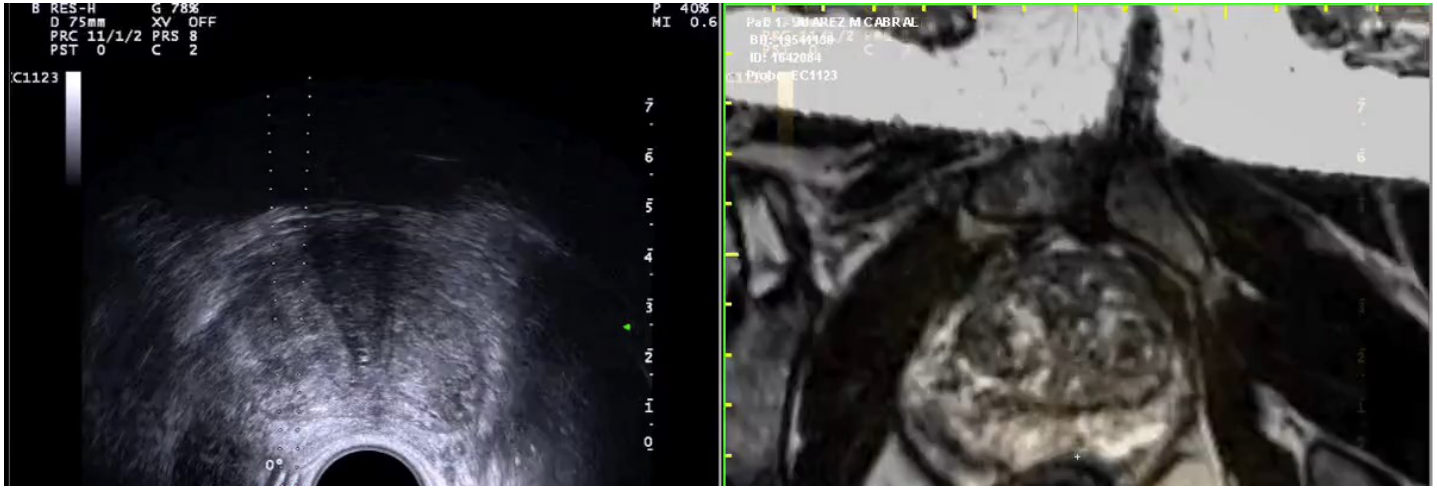
OBJECTIVE. The purpose of this study is to assess the utility of a volume navigation technique (VNT) for ultrasound-guided biopsy of MRI-detected, but sonographically ambiguous or occult, breast lesions.



CONCLUSION. Coregistration of MRI and real-time ultrasound enables sonographic localization of breast lesions detected at MRI only. VNT is a feasible alternative to MRI-guided biopsy of ultrasound-occult breast lesions.

Fusion Imaging

Prostate Biopsy- mpMRI



Conclusions and Relevance—Among men undergoing biopsy for suspected prostate cancer, targeted MR/ultrasound fusion biopsy, compared with standard extended-sextant ultrasound-guided biopsy, was associated with increased detection of high-risk prostate cancer and decreased detection of low-risk prostate cancer. Future studies will be needed to assess the ultimate clinical implications of targeted biopsy.

. C. Mariotti ,P. M. Falsarella , R. G. Garcia et al

CIRSE 2017, 709.2 - A prospective, intra-patient, blinded study comparing 14-fragment random prostatic biopsy with mpMRI–TRUS fusion biopsy (ID 74850)

Fusion Imaging

- ADVANTAGES:
  - Precision and reliability (esp + CEUS)
  - Flexibility
  - Low complexity
  - Low cost
  - Teaching tool (*GREAT POTENTIAL*!)
  - No radiation exposure

- LIMITATIONS:
  - Need for US training
  - Co- registration occasionally challenging

Fusion Imaging
Take Home Points

- Fast, easy-to-use & low-cost tool
- Real-time imaging + high spatial/contrast resolution of CT / MRI
- Increased precision and accuracy of procedures
- Reduced duration & number of ablation sessions

Thank you for your attention