



eigen

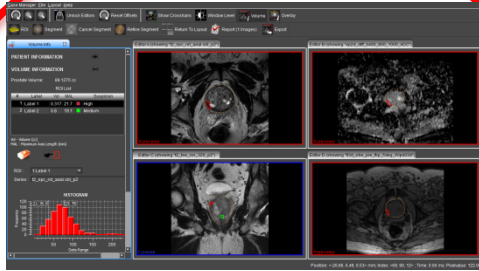
**3D Semi Robotic Real-time  
Targeted MR/Ultrasound Fusion Platform**

**Artemis<sup>TM</sup>/ProFuse<sup>TM</sup>/ProFuse Bx<sup>TM</sup>**

**Sarad Sarkar, PhD  
Principal Scientist, Eigen**

# Real-time MRI/Ultrasound Fusion Platform

## 1 mpMRI Planning Software



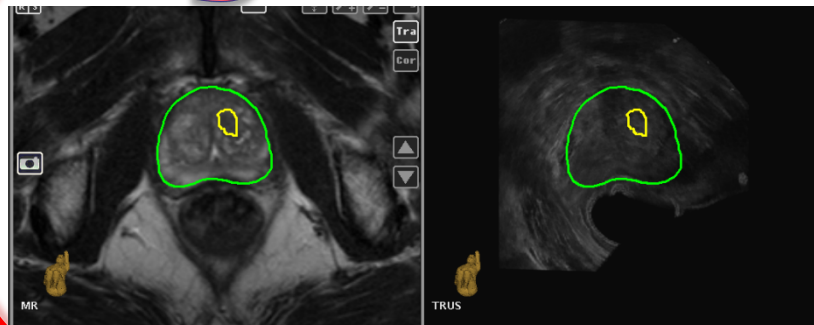
ProFuse<sup>T</sup>  
M

## 2 Semi robotic prostate navigation



Artemis<sup>TM</sup>

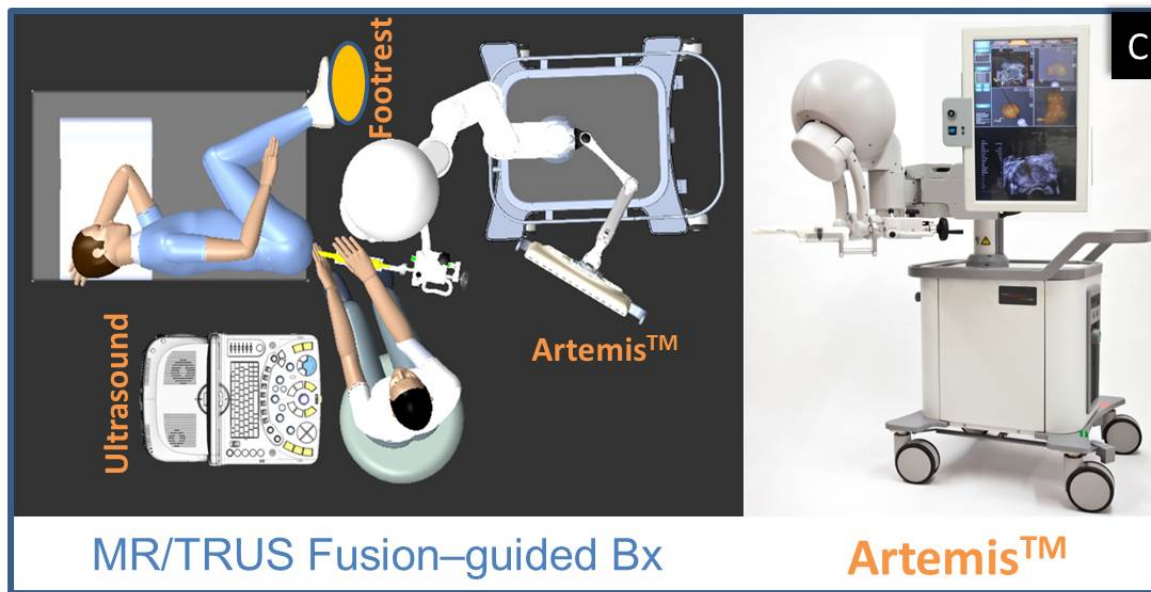
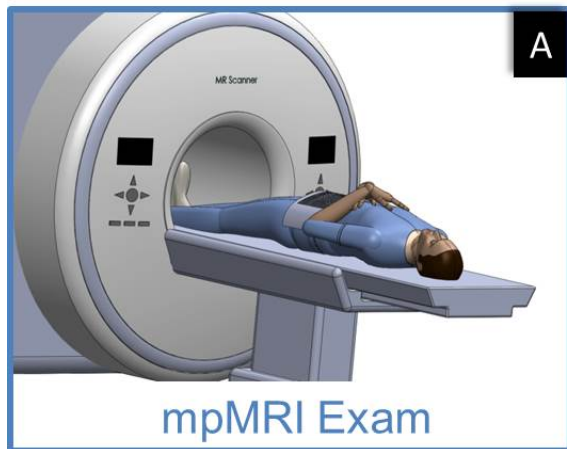
## 3 MR - TRUS fusion software



ProFuse  
Bx<sup>TM</sup>

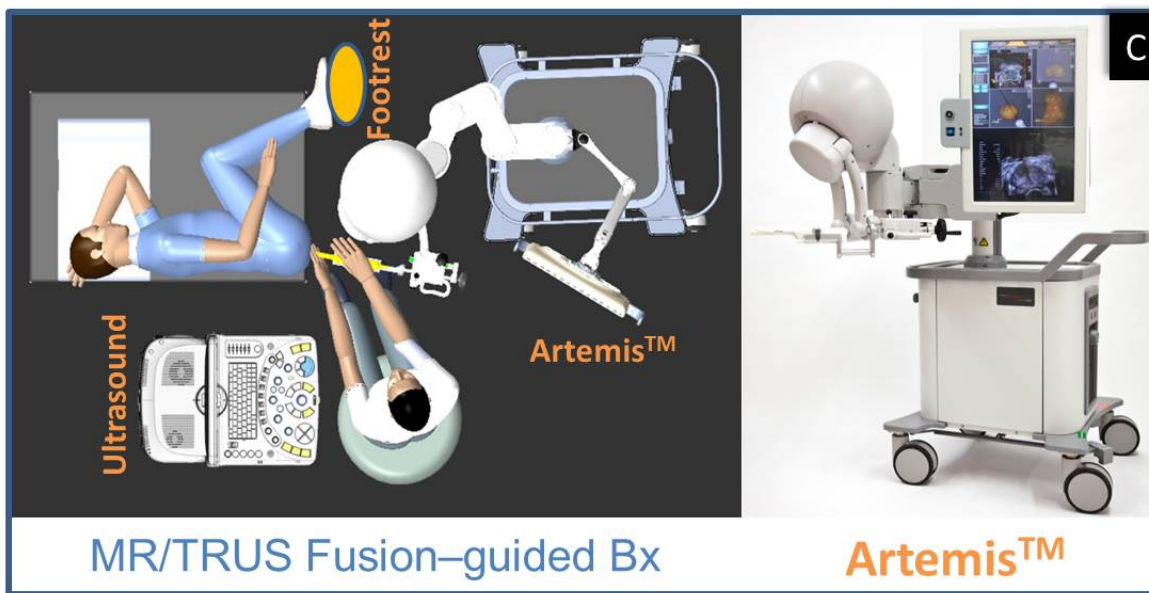
# MR/Ultrasound Fusion Biopsy Workflow using Artemis and ProFuse

## 3 Step Process



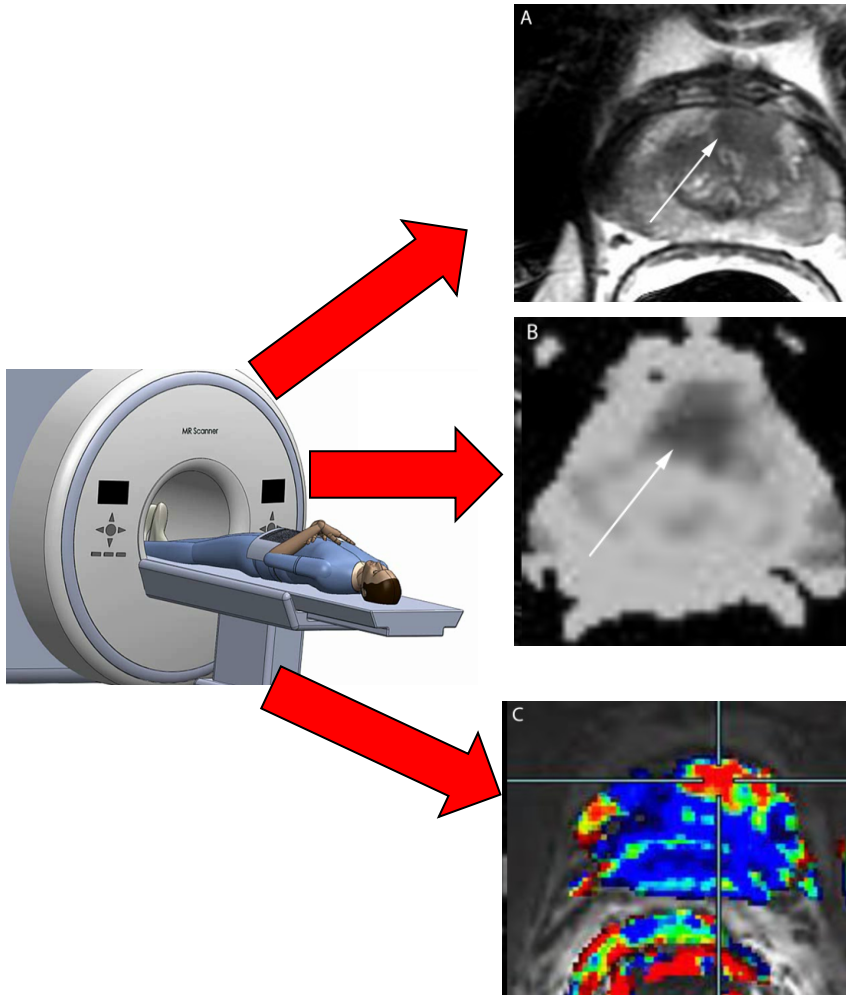
# MR/Ultrasound Fusion Biopsy Workflow using Artemis and ProFuse

## 3 Step Process



# Step A: Multiparametric MRI (mpMRI)

**mp-MRI guidelines: ESUR Prostate MR guidelines 2012. Barentsz, et al. Eur Radiol (2012) 22: 746-757**

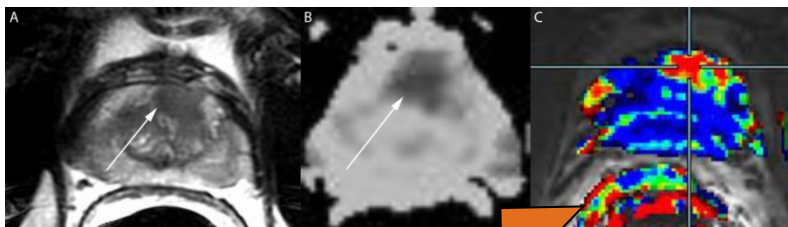


**T2-Weighted MRI:** High sensitivity, cancers seen as dark regions

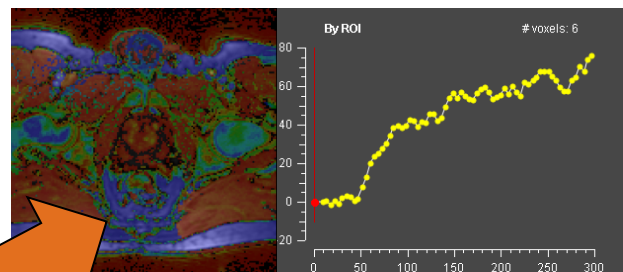
**Diffusion-weighted Imaging (DWI):** Measures water diffusion. Apparent diffusion map computed from this shows dark spots (high density, restricted diffusion)

**Dynamic Contrast-Enhanced Imaging:** Angiogenesis of tumors. Tumors show early enhancement and early washout.

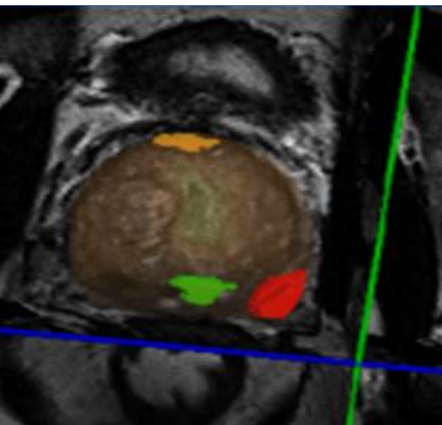
# ProFuse Tools for mpMRI Biopsy Planning



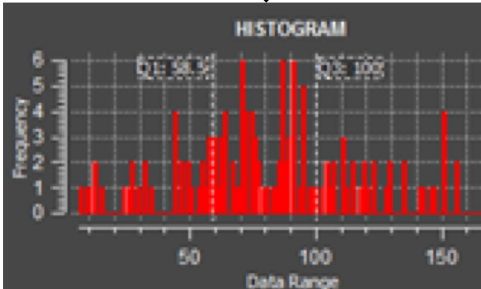
mpMRI Visualization



Perfusion/Diffusion Analysis



Prostate and ROI Contouring



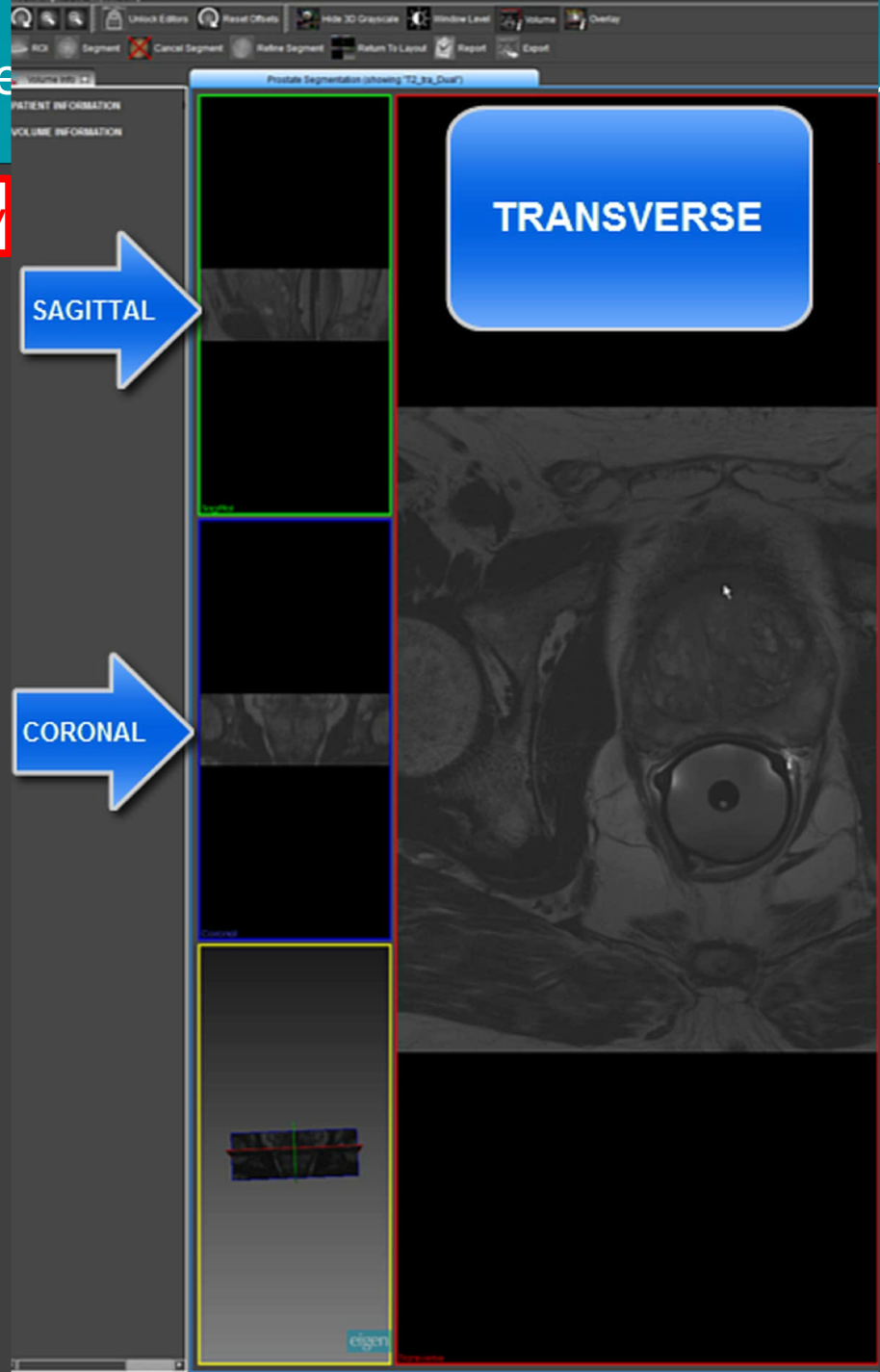
mpMRI Histogram Analysis

PIRADS Reporting

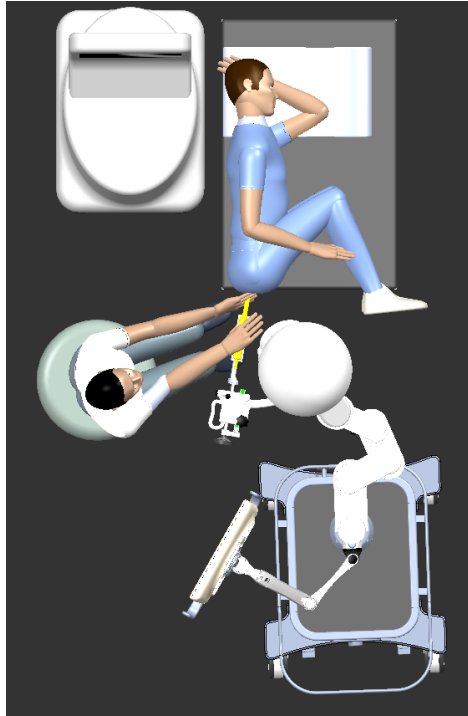
Step

Use

Video (Click to play)



# Artemis for 3D Image Guided Biopsy

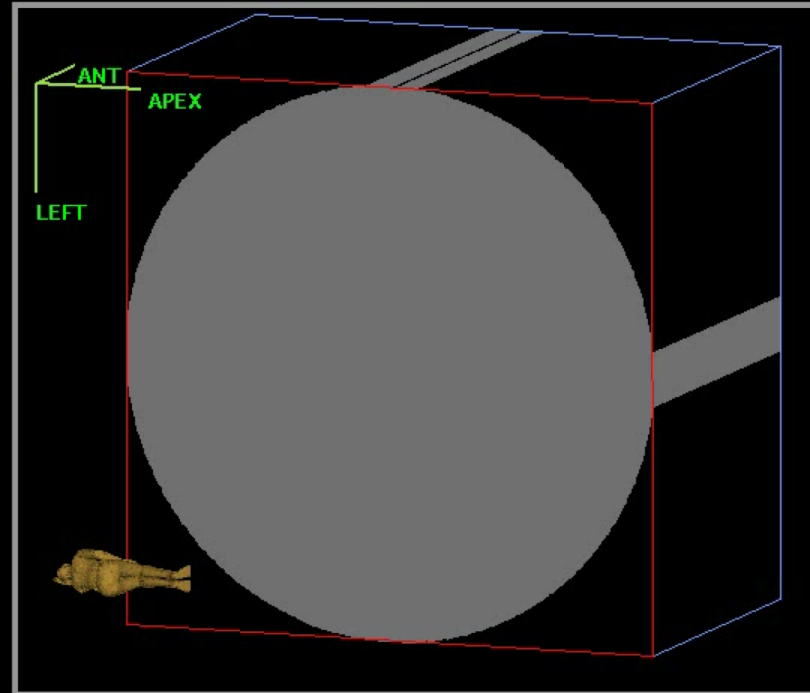


- ❑ Urologist performs MR/TRUS fusion-guided biopsy using Artemis.
- ❑ Procedure time about 20 minutes from start to finish.
- ❑ Removes inter - procedure variability with robotic arm.
- ❑ Increased targeting accuracy wrt cognitive fusion



# Artemis » Salient features

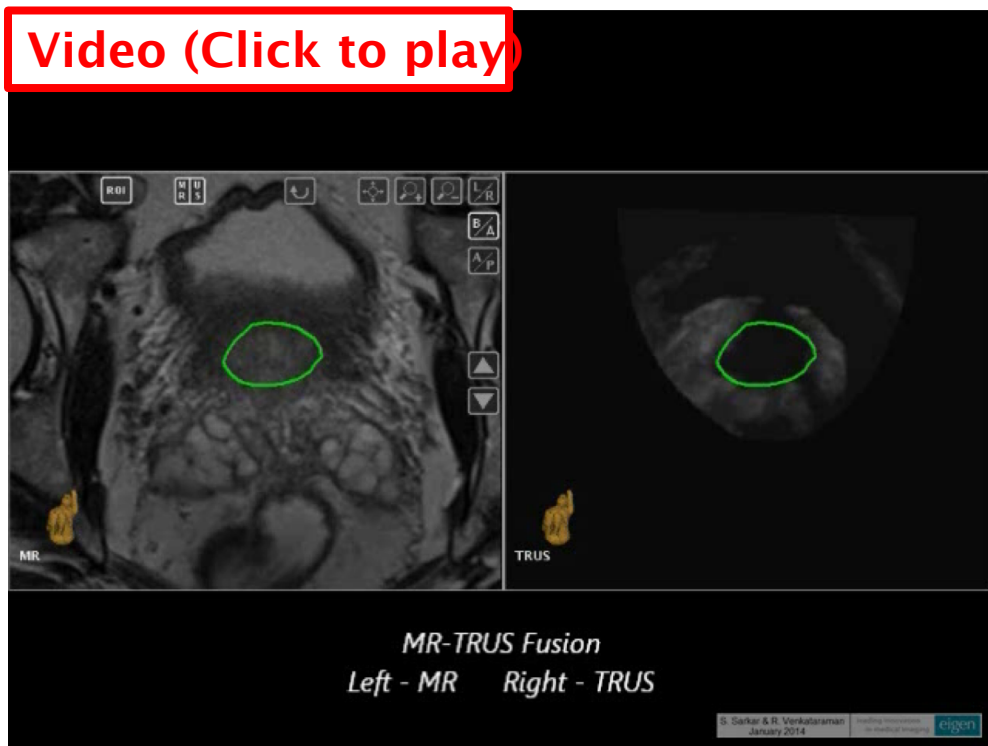
[Video \(Click to play\)](#)



3D Image Reconstruction

# ProFuse BX » MRI/TRUS Fusion Plan

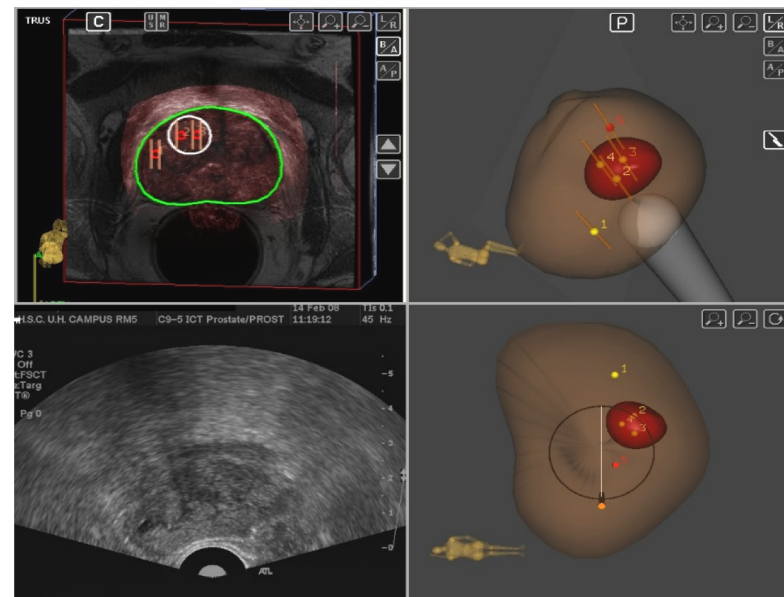
**Video (Click to play)**



Video showing side-by-side view of  
MRI and TRUS after fusion

**MRI** **TRUS**

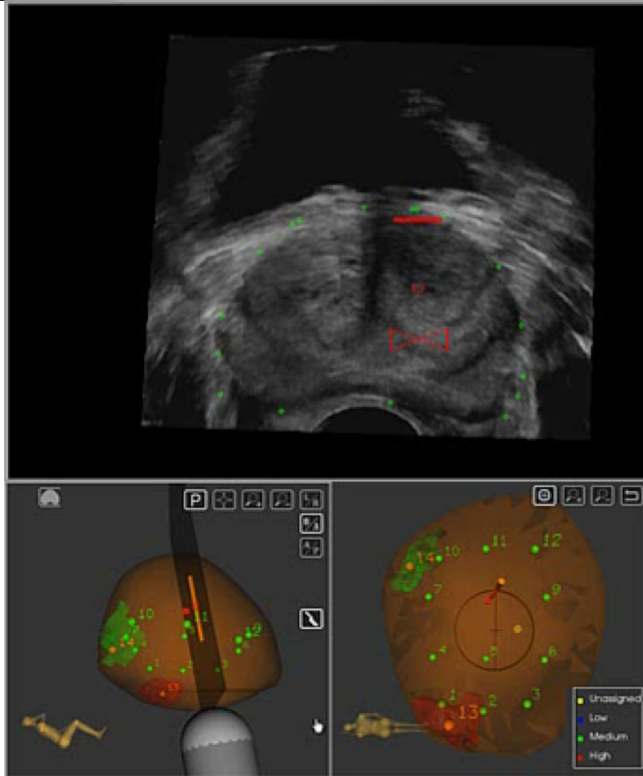
Fused Images: MRI (Grayscale)/TRUS (Red)



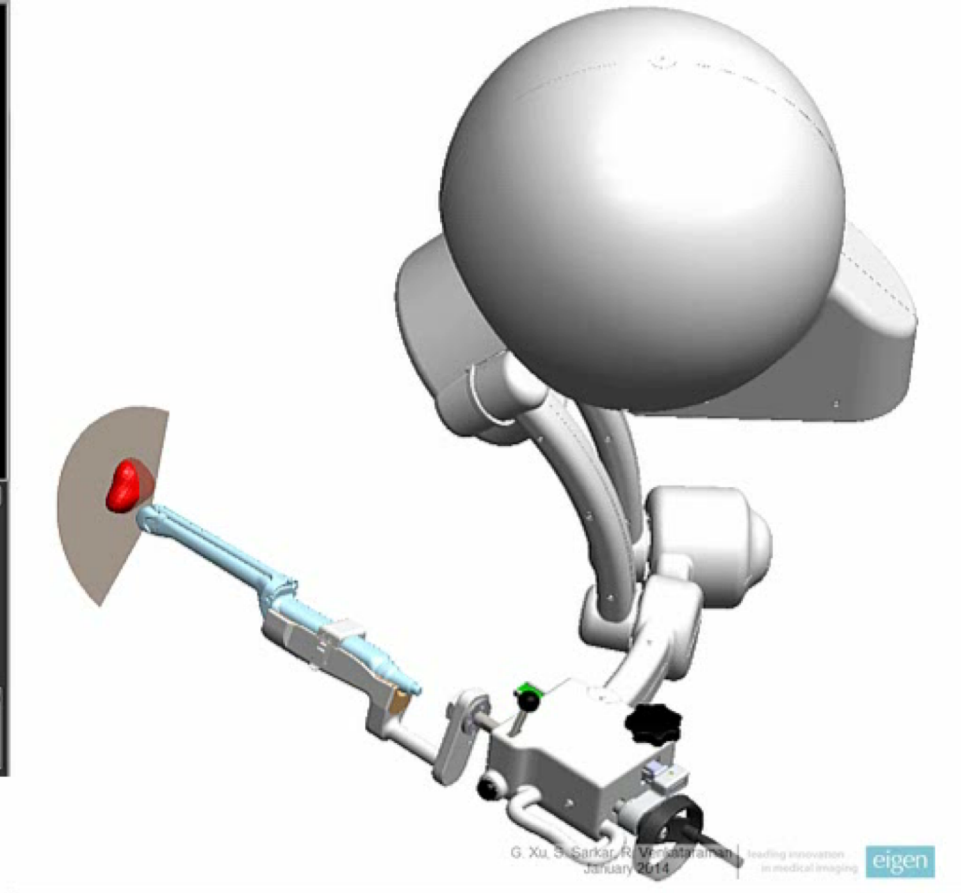
Deformable (Rigid + Elastic) MR/TRUS Fusion accounts for prostate shape changes caused by:

- endorectal coil
- patient orientation
- bladder filling

# ARTEMIS: 3D Semi-Robotic Navigation Device



[Video \(Click to play\)](#)

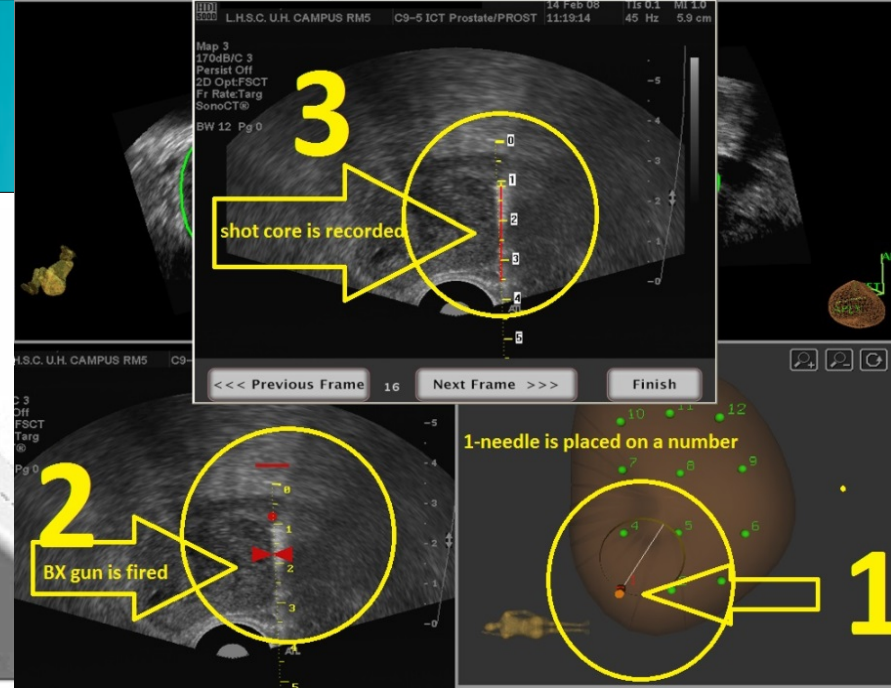
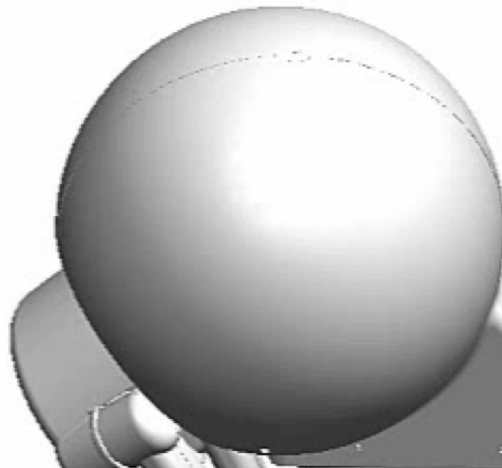


Removes negative variables that affect accuracy:

- Freehand deformation

No Virtual Hierarchy (Progressive Telemetry)

# ARTEMIS: 3D Semi-Robotic Navigation Device



Shot core

[Video \(Click to play\)](#)

G. Xu, S. Sarkar, R. Venkataraman | *Leading innovation in medical imaging* 

3D locations of the biopsies are automatically detected and

recorded



# ARTEMIS: 3D Semi-Robotic Navigation Device

Return to Case Manager | 1. Scan | 2. Plan | 3. Biopsy | 4. Report | Artemis by eigen

Training, Eigen ID: 291241 Study ID: 00007421 Review Vol Seg: 61.15 cc Vol Max: N/A Hardware Status: [Green]

**Patient Information:**  
 Patient Name: Training, Eigen  
 Date of Birth: 1918-10-10  
 Physician Name: Marcus Walby  
 Ethnicity:  
 Number of Visits: 3  
 Date of Visit: 2012-11-30 15:57:43  
 Patient ID: 291241  
 Study ID: 00007421  
 Accession Number:  
 Procedure Type: 3D Rendering  
 Needle Type: Bard MN1520 16 g  
 TRUS Probe Type: 8667  
 Ultrasound Machine: BK FlexFocus  
 Depth Setting: 5.9 cm  
 Current PSA:  
 DRE Result: Positive

**Medical History Pathology Data Navigation Data Show Sites**  
**Pathology Data at 2012-11-30 15:57:43 (Current)**

Biopsy Section	a	b	c	d	e	f	g	h	i	j
Site 13-1	No	No	No	No	No	No	No	No	No	No
Cancer (Y%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary Gleason	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Secondary Gleason	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distances from Prostate Ex.	0-2	2-4	4-6	6-8	8-10	10-11	11-13	13-15	15-17	17-19
Distances from Prostate Ex.	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100

Virtual Keyboard: [1-0], [Tab], [Q-W-E-R-T-Y-U-I-O-P-V], [Caps Lock], [A-S-D-F-G-H-J-K-L-Enter], [Shift], [Z-X-C-V-B-N-M- / - ?], [Space], [Arrow Keys]

Planned Biopsies | Selected Planned Biopsies | Actual Biopsies

1. Scan | 2. Plan | 3. Biopsy | 4. Report | Artemis by eigen

Training, Eigen ID: 291241 Study ID: 00007421 Review Vol Seg: 61.15 cc Vol Max: N/A Hardware Status: [Green]

**Pathological Marked Sites**

- 13-1: Biopsy Site
- 1-1: Biopsy Site
- 2-1: Biopsy Site
- 3-1: Biopsy Site
- 5-1: Biopsy Site
- 8-1: Biopsy Site

Planned Site Legend

- Unassigned
- 2
- Medium
- Medium-High
- High
- 6

**Biopsy Core Length**

Section: j i h g f e d c b a

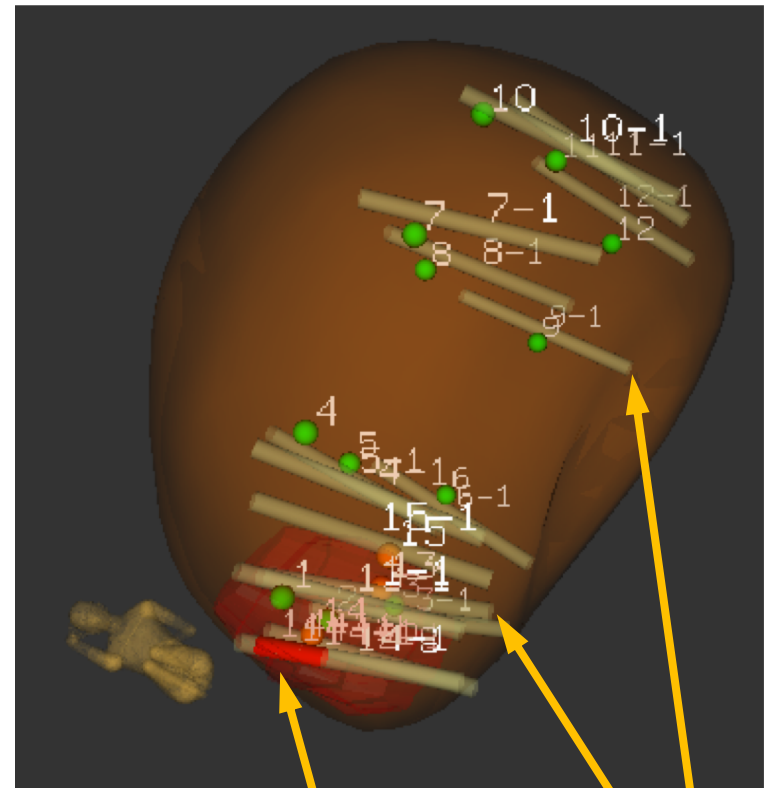
100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0%

18 mm, 17 mm, 15 mm, 13 mm, 11 mm, 8 mm, 6 mm, 4 mm, 2 mm, 0 mm

Distal End | Biopsy Needle | Proximal End

Biopsy Core Length: 13 mm

Close



Cancerous core

Shot Cores



THANK YOU

[www.eigen.com](http://www.eigen.com)