PROSTATE BRACHYTHERAPY
UK & Ireland Conference 2022

Cambridge 2022

Cambridge Prostate mpMRI & Biopsy Course

MRI-based Prostate Biopsies

Techniques & Technologies

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Cambridge

This talk

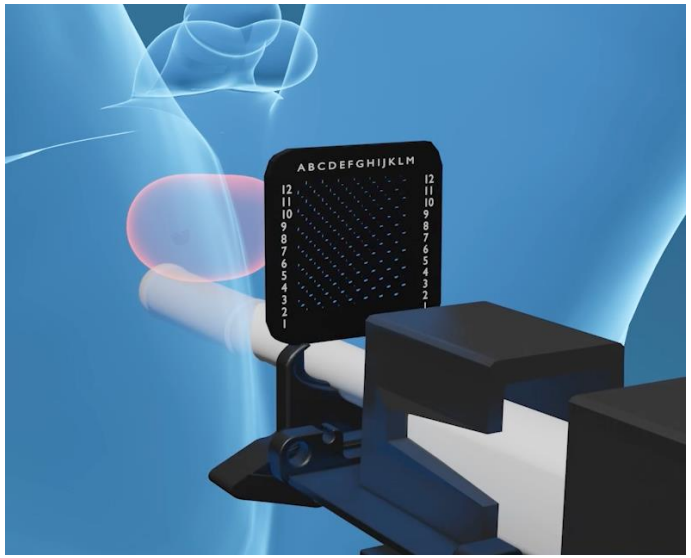
Approaches – Transperineal vs Transrectal

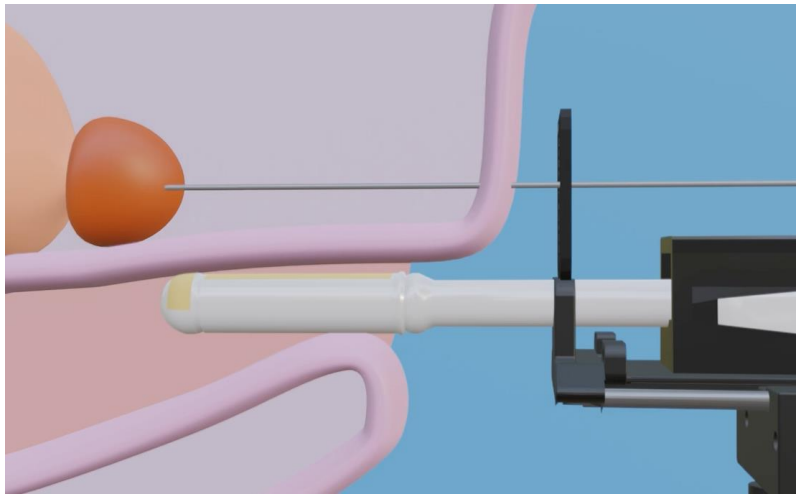
Biopsy core distribution

Transfer of MRI information to the biopsy process

Technologies using fusion

Biopsy approach: Transperineal & Transrectal





Transperineal Template biopsies

Cancer detection (PSA 4-10)

- Primary – 55%
- Secondary – 40-45%**

Minimal sepsis rate

Prostatectomy specimen concordance

Side-effects

- usually requires GA
- Acute retention rate 6.5%

TRUS Biopsy

40-45%

25%

Limitations

- Access anterior / apical
- 30% cancers are missed
- Uncertainty

- Acute retention rate 5%
- UTI 10% - Sepsis 1-2%

*Wadhwa et al BJUi 2013 **Nelson PLOSone 2013 ***EAU + NICE Guidance

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Transperineal biopsy approaches

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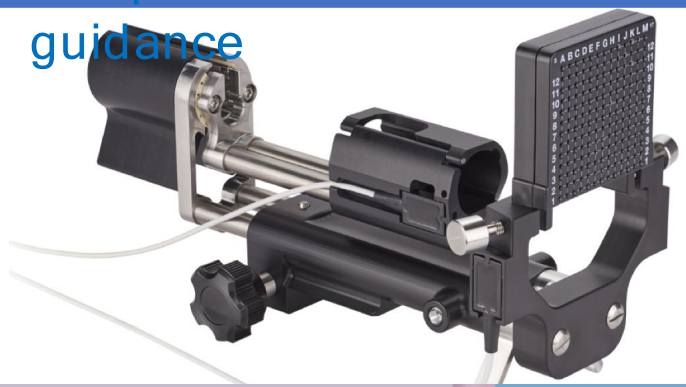
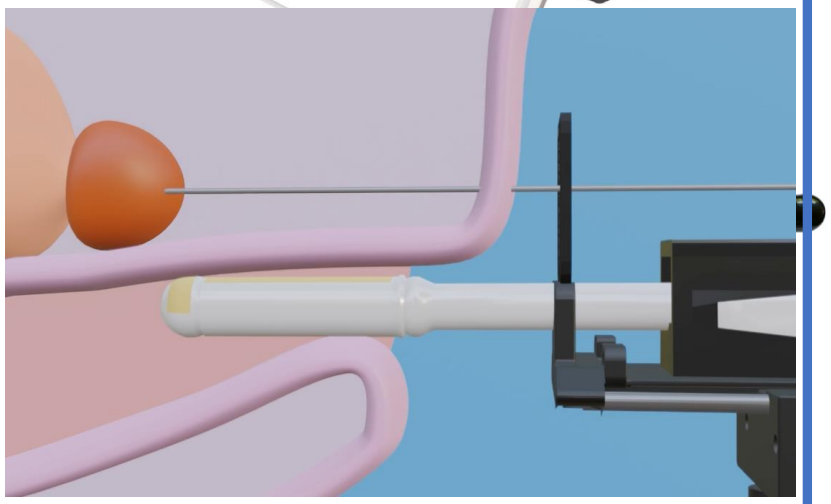
General anaesthetic

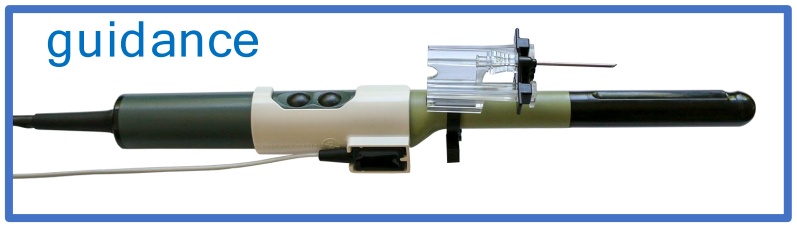
Template needle guidance





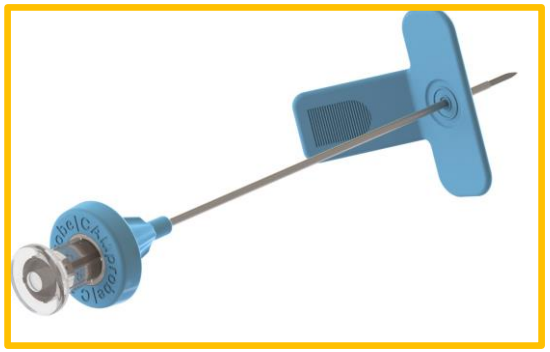
Inline Needle Guides

Probe-mounted needle guidance



Local anaesthetic

Co-axial Needle Guides



CamPROBE

- Freehand alignment
- Visual targeting

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	No.	Overall cancer detection (TB and SB)	Cancer detection per lesion	Cancer detection per core (TB)	Cancer detection per core (SB)	Targeted cores demonstrate superiority to standard cores?	Missed cancers with each technique
	555	302/555 (54%)	NR	NR	NR	Yes: Greater representation of disease burden and Gleason grade	Standard missed 12 cancers (12 significant); targeted missed 66 cancers, (13 significant)
Park, 2011	85[CG1]	MRI group 13/44 (30%); no MRI 4/41 (10%)	NR	14/37 (38%) from MR targets; 0/6 from US targets	38/490 (8%) in MRI group; 11/450 (2%) in non MRI group	Yes – increased cancer detection from 10% to 30%	NR but if a target lay within a systematically sampled region, the core was counted as systematic
Sciarra, 2010	180[CG2]	A= 22/90 (24%), B= 44/90 (49%)	NR	NR	NR	Yes: Greater detection accuracy, high detection rate of clinically significant disease from group B to A	NA (comparison between cohorts rather than within patients)
Labanaris, 2010	260	Group A =				56%	NA (comparison between cohorts rather than within patients)
Prando, 2005	42					in oup	NR
Lee, 2011	87	46/87 (53%)	lesion; 19/30 (63%) for apical lesions.	149/518 (29%)	32/903 (4%)	vere also found on systematic biopsy	2 cancers found in men with no lesion on MR
Hambrock, 2010	71	40/68 (59%) vs				Yes: Greater detection accuracy (Biopsy 0/65 ort)	NA (historical cohort comparison)
Singh, 2008	13					son n 6	1/2 missed with standard; 1/2 missed with targeted
Miyagawa, 2010	85						Standard missed 18/52; targeted missed 7/52
Hadaschik, 2011	106	63/106 (59%)	63/142 (44%)	101/410 cores (25%)	179/2951 (9%)	systematic cores	NR
Rastinehad, 2010	101	55/101 (55%)	24/34 (71%) strong suspicion; 29/72 (40%) moderate suspicion; 23/158 (15%) low suspicion	20.6% overall (54%, 21% and 5% for strong, moderate and low suspicion on MRI)	11% overall (30%, 12% and 4% for strong, moderate and low suspicion on MRI)	Yes: Mean 2.6 cores vs 12 cores required for equal performance	Standard missed 10/55; targeted missed 10/55.
Natarajan, 2011	47						Modified technique: standard missed 4/12, targeted missed 3/12.
Park, 2008	43	17/43 (40%)	NR	30/38 (79%)	35/140 (25%)	Yes	5/17 missed with standard; none missed with targeted.

Data synthesis: cancer detection per core: 376/1252 (30%) of targeted cores detected cancer versus 368/5441 (7%) standard cores

Data synthesis: cancer detection per patient: 650/1345 (48%) of men with targeted biopsy versus 526/1442 (36%) men for standard biopsy

Image-guided Prostate Biopsy Using Magnetic Resonance Imaging-Derived Targets: A Systematic Review
Moore, CM et al. Eur Urol 2013 Jan;63(1):125-40.

Target core number

Histopathology assessment of MRI lesions

MRI significantly underestimates the final histo-pathological tumour volume

Mazaheri Y, Hricak H, Fine SW, et al. Radiology. 2009 Aug;252(2):449-57.
Cornud F, Khoury G, Bouazza N, et al. J Urol. 2014 May;191(5):1272-9.
Rud E, Klotz D, Rennesund K, et al. BJU Int. 2014 Dec;114(6b):E32-42.

Target core numbers n=507

	any cancer	GI 7-10
2-core/target	57%	35%
4-core/target	61-77%	49-67%

Multi-centre analysis - Heidelberg Melbourne Cambridge (BJUi in press))

First biopsy patients undergoing Template-grid guided TP biopsies under GA

	Detection rates % any cancer	p	Detection rates % GS 7-10	p
PI-RADS 4-5 (n=370):				
SB vs. TB	80% vs 73%	0.0377	61% vs 59%	0.6520
Combination vs. TB	88% vs 73%	0.0001	71% vs 59%	0.0020
Combination vs. SB	88% vs 80%	0.0052	71% vs 61%	0.0104

Multi-centre analysis of MRI TPBx in biopsy-naïve patients - Heidelberg Melbourne Cambridge (BJUi 2017)

‘Systematic’ core distribution

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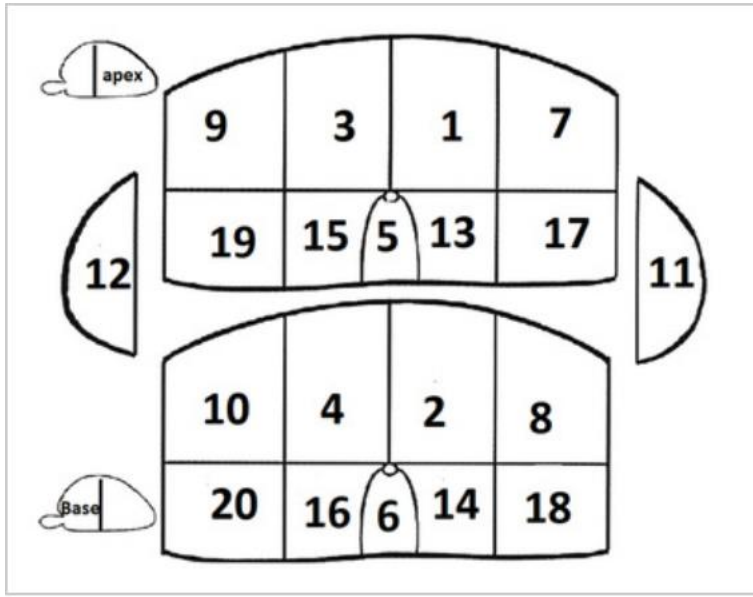
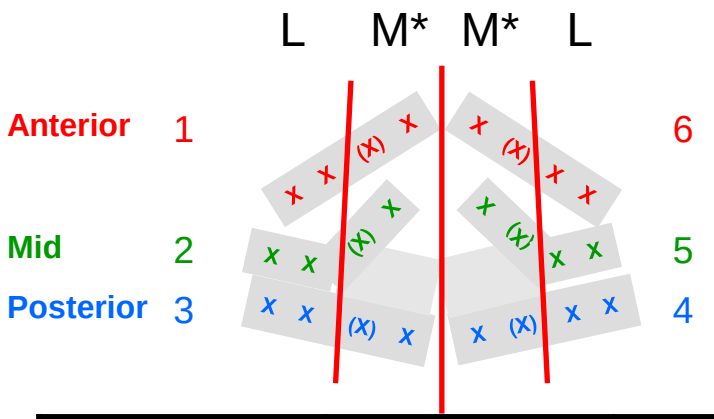
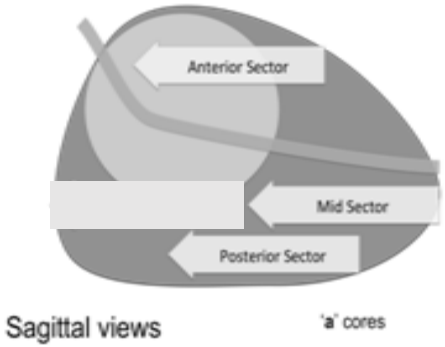
Mapping - 30+ based on Barzell zones



Ginsburg protocol 18-24 biopsies (PZ)

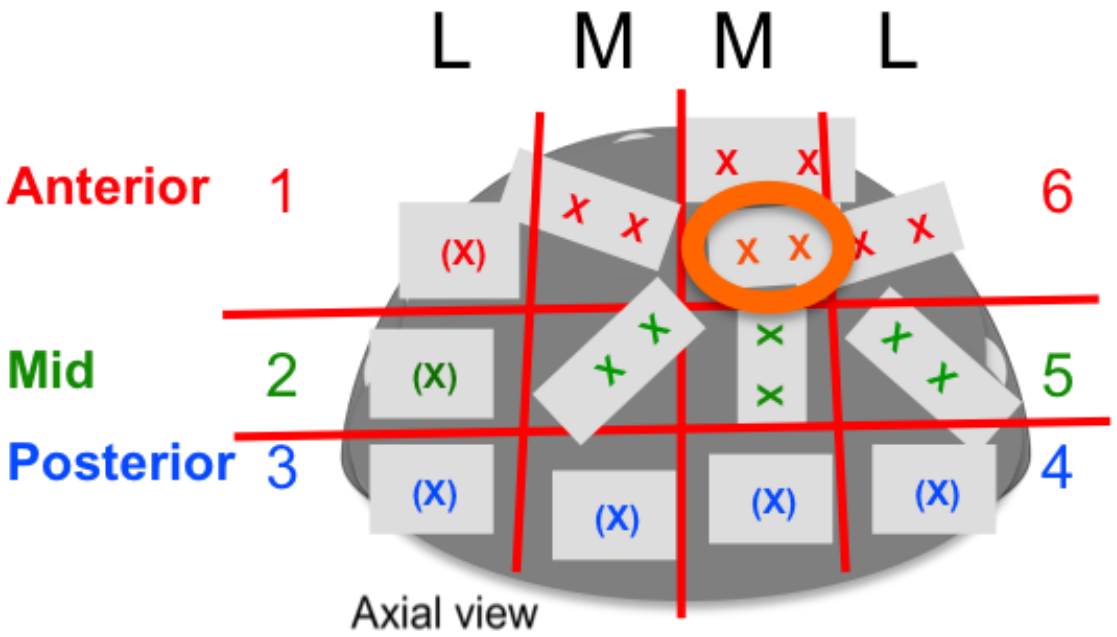




Specimen name	Description	No of Bx	MRI mapping equivalent	Order
1M	Rt anterior med	*1-2	13/14/15asr 1/3/5a(TZ)	1
1L	Rt anterior lat	2-3	2/4/6a(PZ)	2
2M	Rt mid med (apex)	*1-2	5/3/(1)ap (TZ)	5
2L	Rt mid lat	2-3	6/4/2a or p(PZ)	6
3M	Rt post med	*1-2	5/3/1p (PZ)	9
3L	Rt post lat	2-3	6/4/2p(PZ)	10
4M	Lt post med	*1-2	11/9/7p (PZ)	11
4L	Lt post lat	2-3	12/10/8p(PZ)	12
5M	Lt mid med (apex)	*1-2	11/9/(7)p (TZ)	7
5L	Lt mid lat	2-3	12/10/8a or p(PZ)	8
6M	Lt anterior med	*1-2	13/14/15asl 7/9/11a(TZ)	3
6L	Lt anterior lat	2-3	8/10/12a(PZ)	4

Reducing biopsy core numbers

'Saturation' distribution

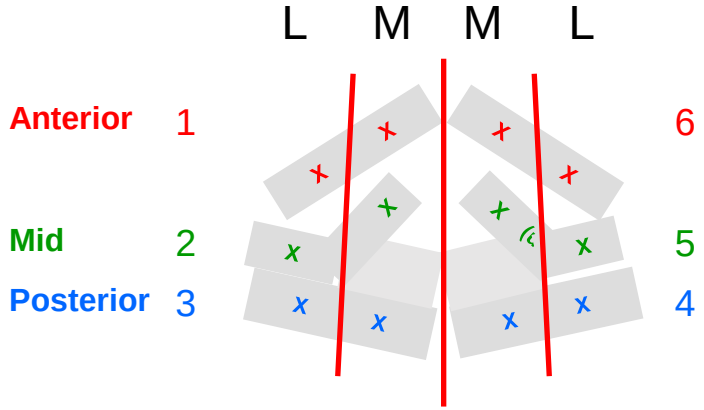


Modelling of optimal distribution and numbers

- 12-15 target saturation biopsies
- Ipsilateral side to lesion or extending from lesion
- No less than 91% of detection of 24 core Gold standard

Hansen et al , BJUi 2019

12-core Ginsburg distribution

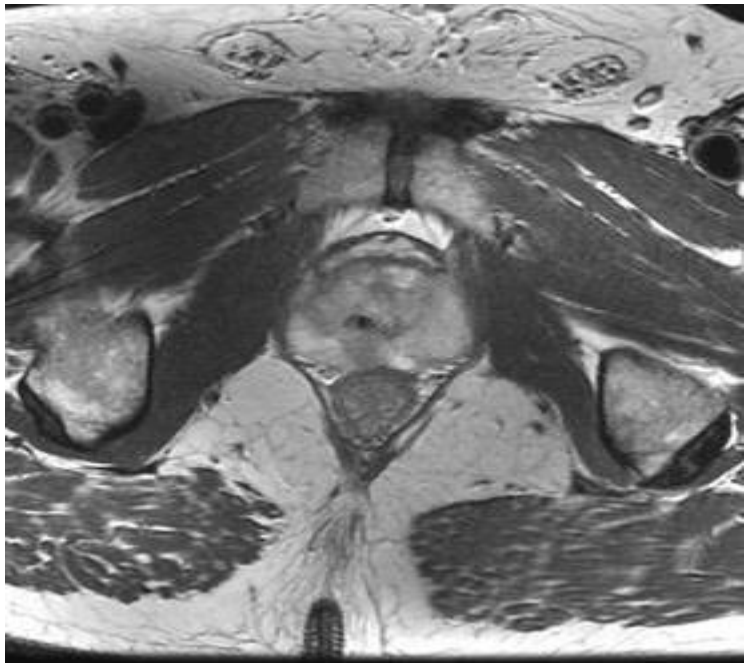


Retrospective analysis (Essen, Germany)

- 9 Target saturation biopsies
- Detection of 95% of cancers detected by TP fusion

Radtke, EurUrol suppl 2021

MRI & Biopsy - How



Cognitive / Visual

- The clinician taking biopsies can see the MRI image +/- markings drawn
- Increase in core numbers in respective area visualised on TRUS

Fusion

- The clinician fuses the MRI image onto the live TRUS image using software
- Targeted biopsies

In-bore

- Biopsies are taken in the MRI scanner
- Allows direct visualisation of biopsies from target

Fusion vs Cognitive / Visual

Comparison:		
Visual and Image-Fusion Targeted Transperineal Prostate Biopsy	No difference	Khoo CC, Eldred-Evans et al, JUrol Nov 2020
Multi-centre study:		
Cognitive vs Fusion using TRUS (47%/53%)	No difference	Puech, P. et al. Radiology, 2013; 268(2): 461-9.
Single centre studies:		
Cognitive vs Fusion	Fusion superior to Cognitive	Oderda et al. Uril Int 2016 Jun 4. Oberlin et al. Urology 2016; 92:75-9.

NICE 2014

- observational studies
- cognitively targeting **TRUS** biopsies
- 2% increase in prostate cancer detection rate
- extra cases identified not micro focal

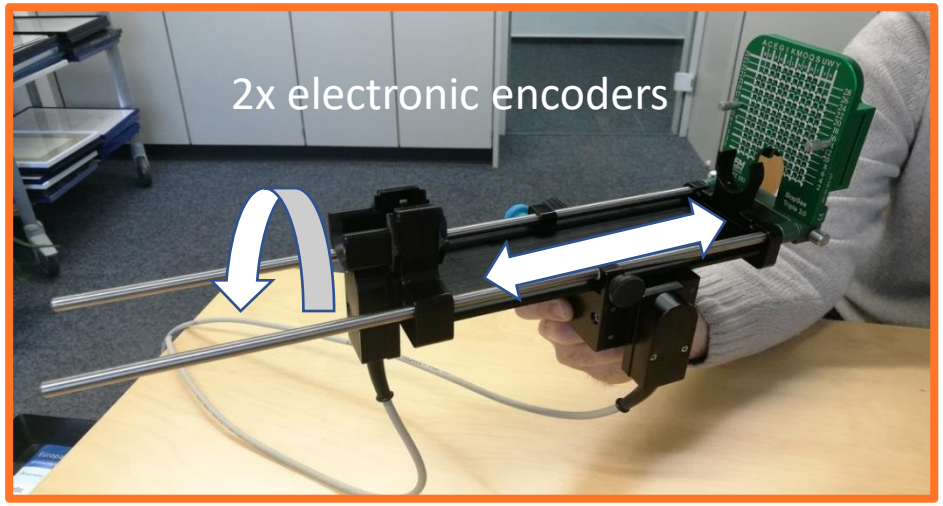
Fusion vs Cognitive / Visual

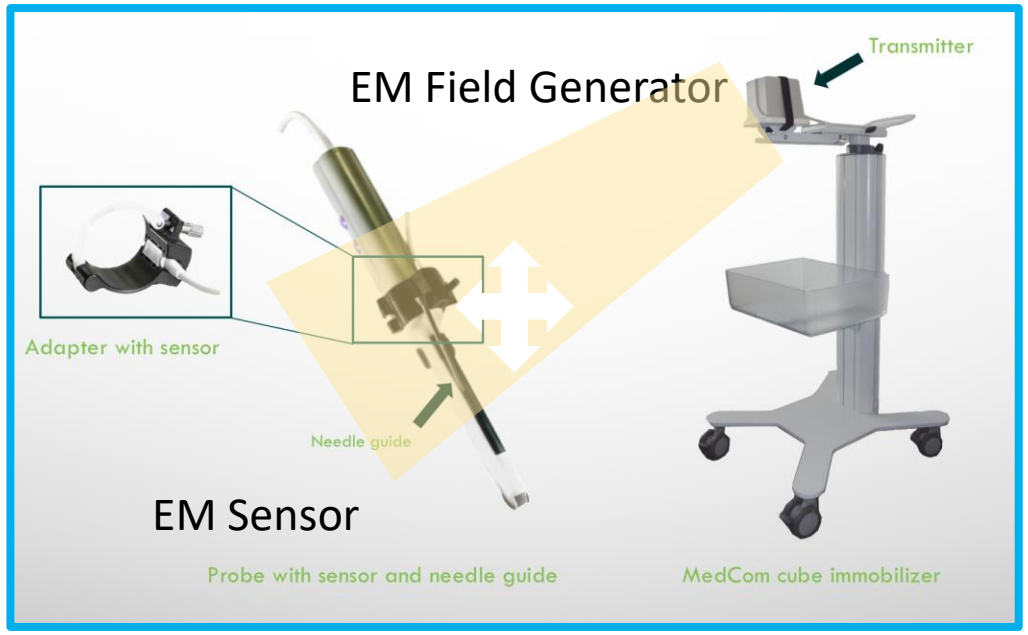
- Cognitive sufficient in experienced hands with known expertise of radiologists
- Fusion favourable in a training environment or with high turnover for standardisation
- Both in combination with systematic biopsies

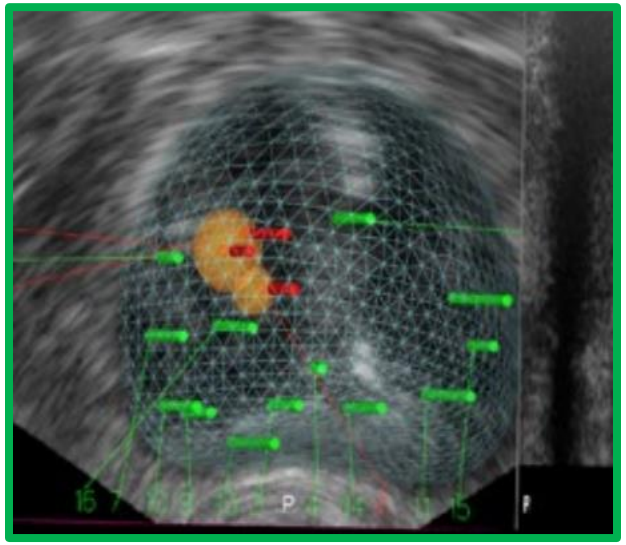
Tracking technology for Fusion devices

Tracking mechanism

- Mechanical (Stepper)
- Electromagnetic (EM)
- Organ-based tracking





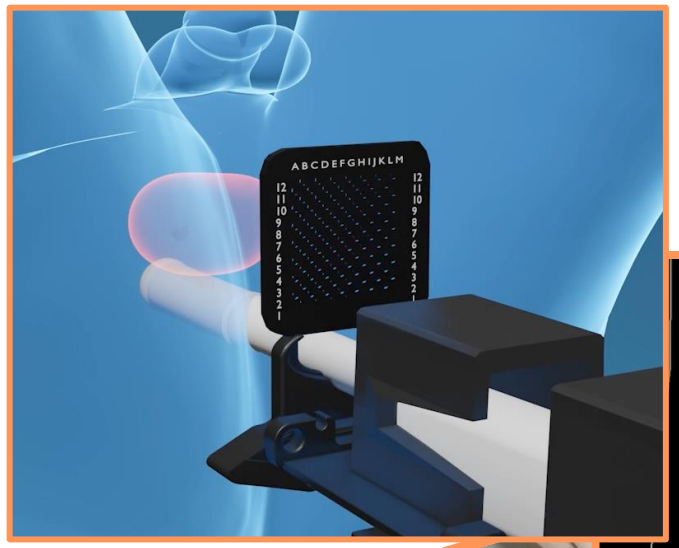


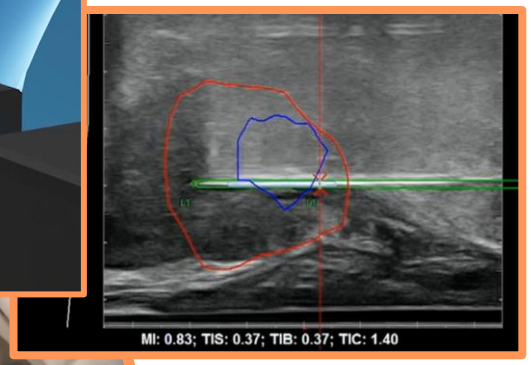
In-line needle guides - Template

Mechanical tracking

-Fujifilm MedCom BiopSee

-BK Mims





Published: Best target and overall detection rates
Usually requires GA

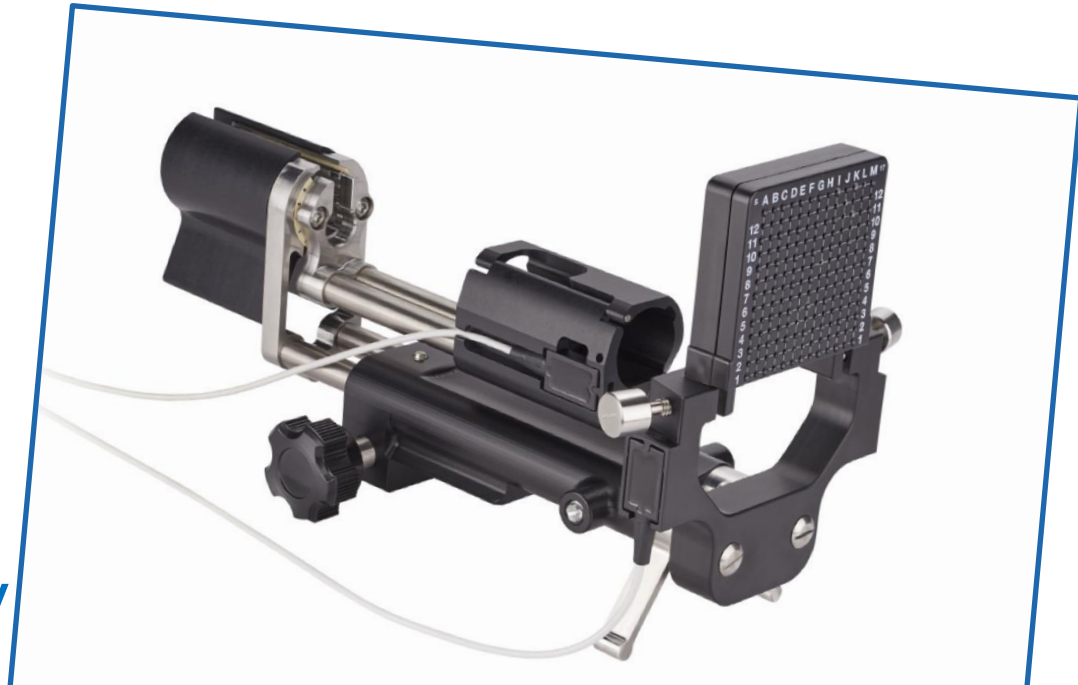
Advantage: Stable probe on stepper unit

- accurate fusion
- little prostate distortion

Indication: Larger gland especially with anterior lesions
Repeat biopsies

EM – tracking

URONAV



In-line needle guides – Probe-mounted

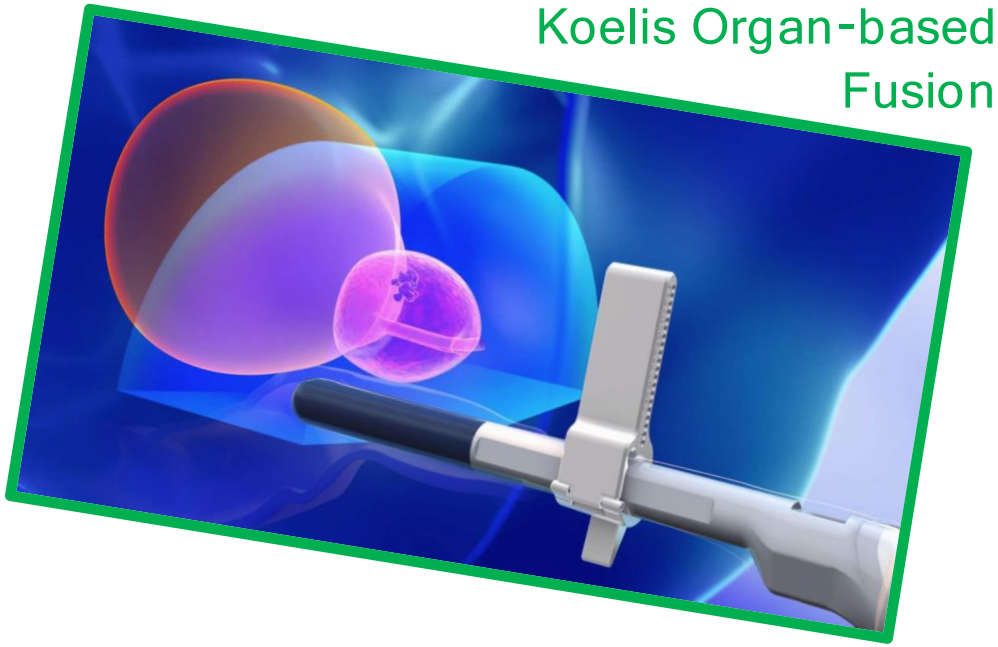
Reported: Acceptable target and overall detection rates

Advantage: Allows LA approach

Comment: Possible limited accuracy of fusion due to probe deformation
- cognitive or elastic fusion adjustment esp anteriorly

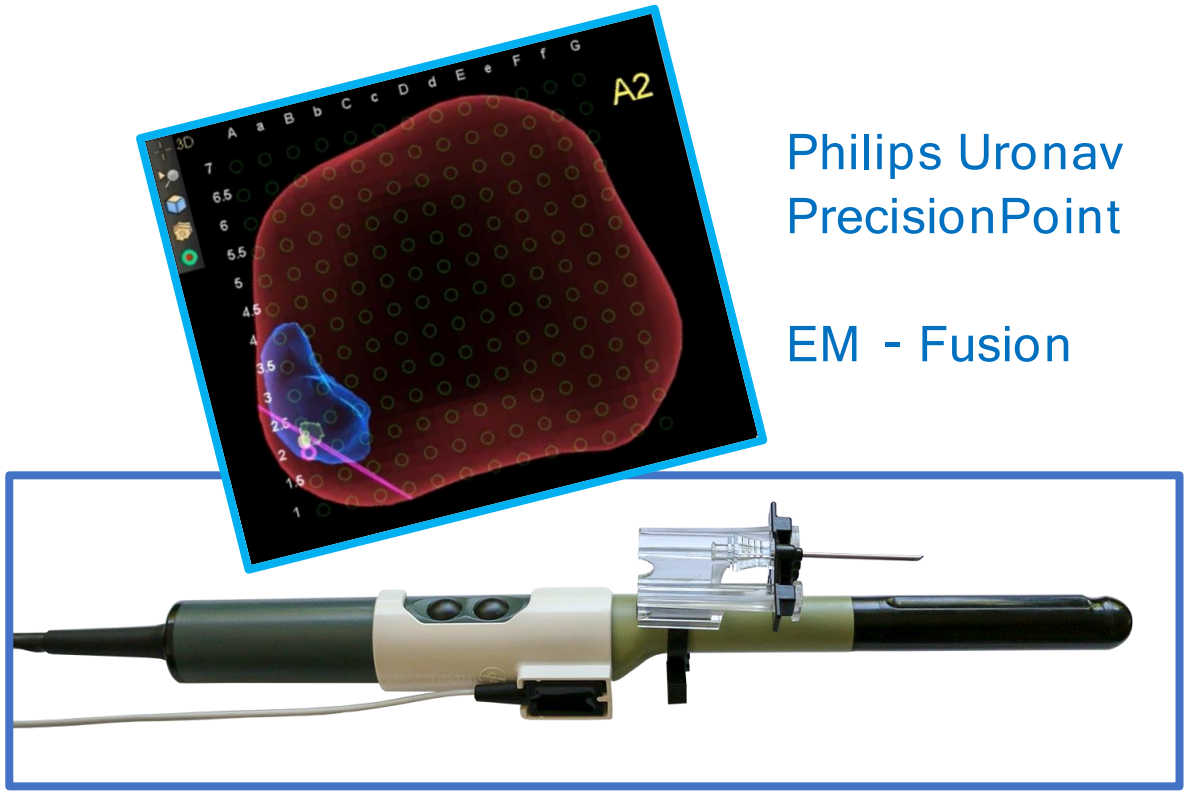
Indication: All glands, but anterior access may be limited in larger glands
First biopsies

Koelis Organ-based Fusion

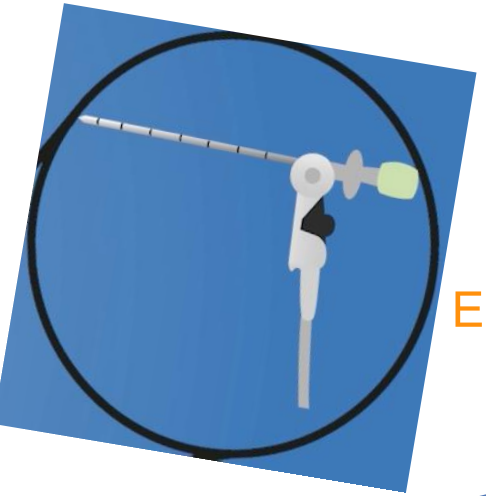


Philips Uronav PrecisionPoint

EM - Fusion



Co-axial needle guides

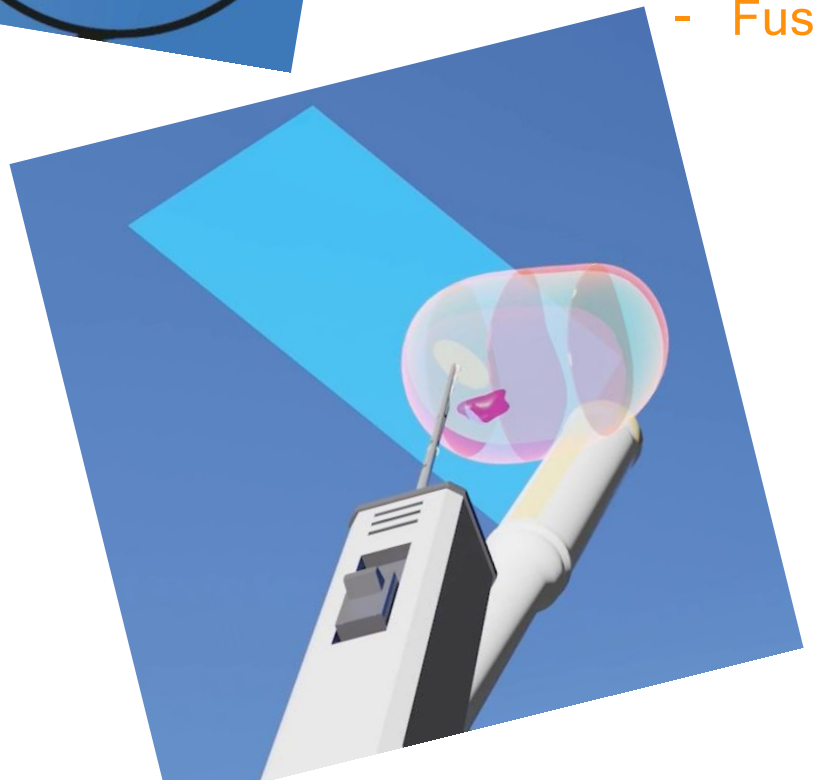


Medcom BiopSee

Vector prostate biopsies

Electro-magnetic needle tracking

- Use of stepper
- Fusion targeting



Reported: High target and overall detection rates

Advantage: Allows LA approach

Use of stepper to maintain fusion

Indication: All glands

CAMBRIDGE FRONT DOOR-MRI PATHWAY

379 consecutive patients — First presentation

			%all	%significant cancers
Normal MRI				
No biopsy	n=142	**37%**	*	*
TRUSP 12-core	n=82		28	15
Positive MRI posterior				
TRUSP +visual target	n=24		75	66
+URONAV fusion target	n=71		83	66
Positive MRI anterior				
Template TP + fusion target	n=60		85	55

Local anaesthetic transperineal

Positive MRI any location				
PrecisionPoint URONAV fusion target / visual	n=61		77	47
Vector fusion target	n=53		95	83

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Summary

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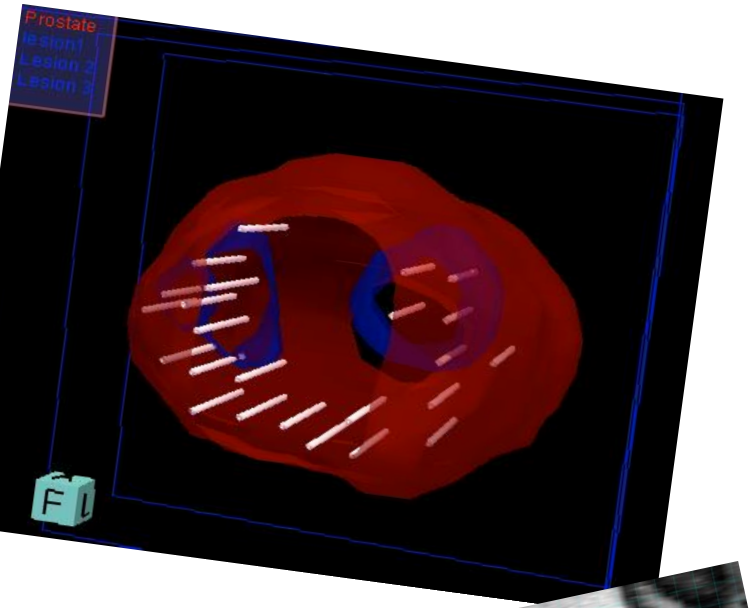

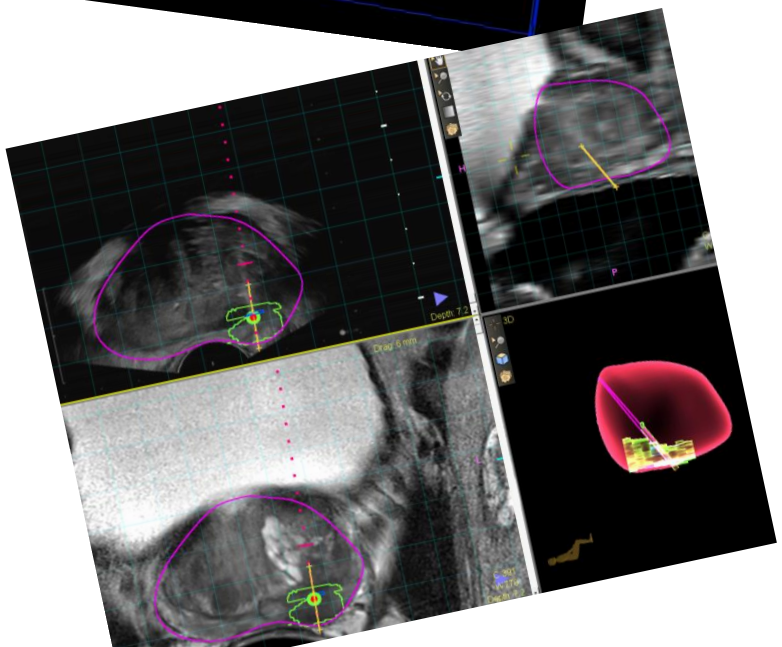

- Biopsies should be guided by MRI
- Transperineal approaches using fusion software are preferable
- Targeted+Systematic or Saturation targeting

Still to be defined:

- Spectrum of techniques applicable to various scenarios
- Role, detection rates and standards for Local anaesthetic approaches

Cambridge Prostate mpMRI & Biopsy Course