Real Time Ultrasound Guidance for Optimizing High Dose Rate Prostate Brachytherapy

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Conflicts of Interest

- Royalties from UpToDate.com
- Shareholder in Varian, Inc.
- Non-disclosure agreement with Varian Brachytherapy

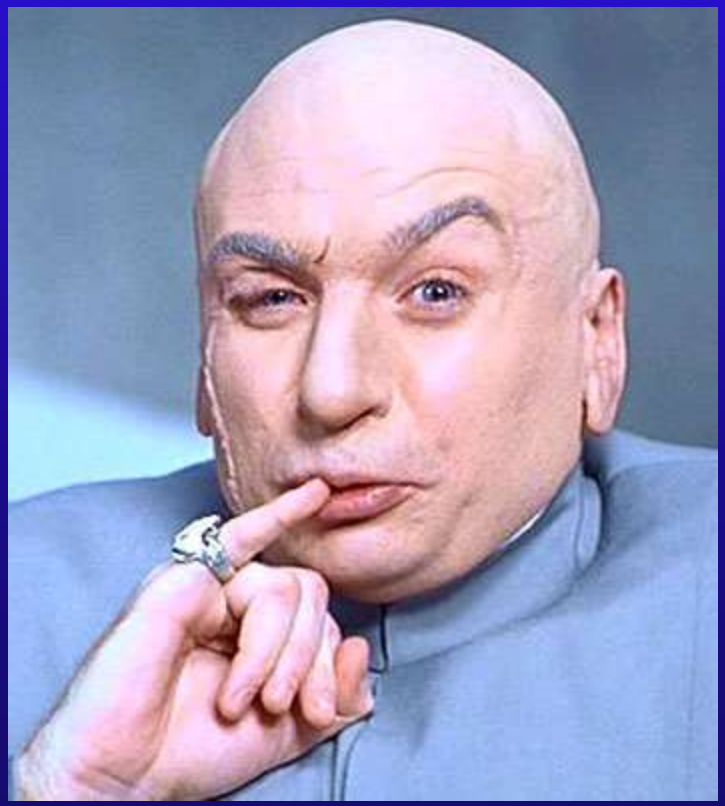
My neighborhood bear

Timeline of Events

August 1, 2012- Timothy Showalter, MD starts at UVa

"I want to do partial prostate brachytherapy

~~with sharks with lasers~~ with HDR"



Timeline cont'd

- Varian introduces Vitesse 3.0- Dec 2012
- Invitation to give this talk- Feb 2013
- Receive Vitesse 3.0- March 2013
- Acceptance testing, commissioning, dry runs, "buttonology"- April- August 2013
- First treatment ???????

IGBT Suite at UVa

anesthesia equipment

OR lights

Siemens Somatom Sliding Gantry CT

Trumpf OR table

Scan-Plan-Treat Workflow at UVa

(time from CT scan to initiation of treatment)

- vaginal cylinder ~ 13 minutes
- T&O ~ 25 minutes
- Gyn Interstitial ~ 1 hour
- (Contura-can place, scan, plan, & treat within ~2 hours)
- HDR Prostate Brachytherapy-????

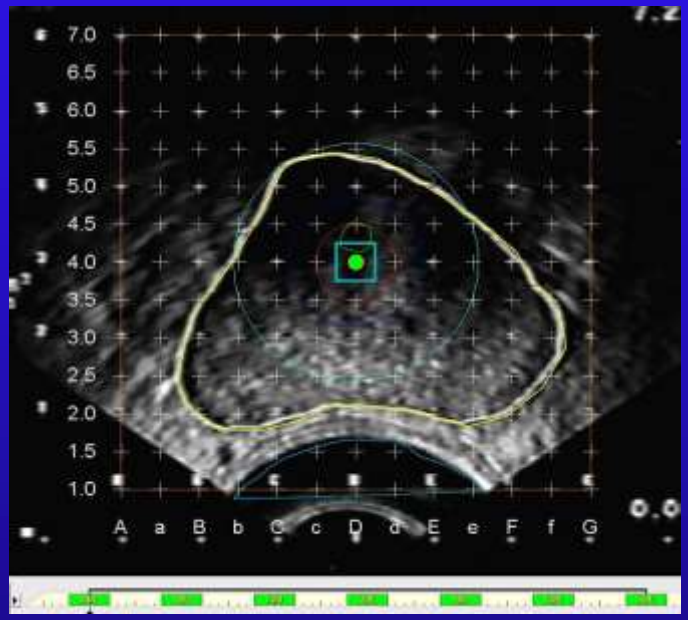
Why prostate HDR?

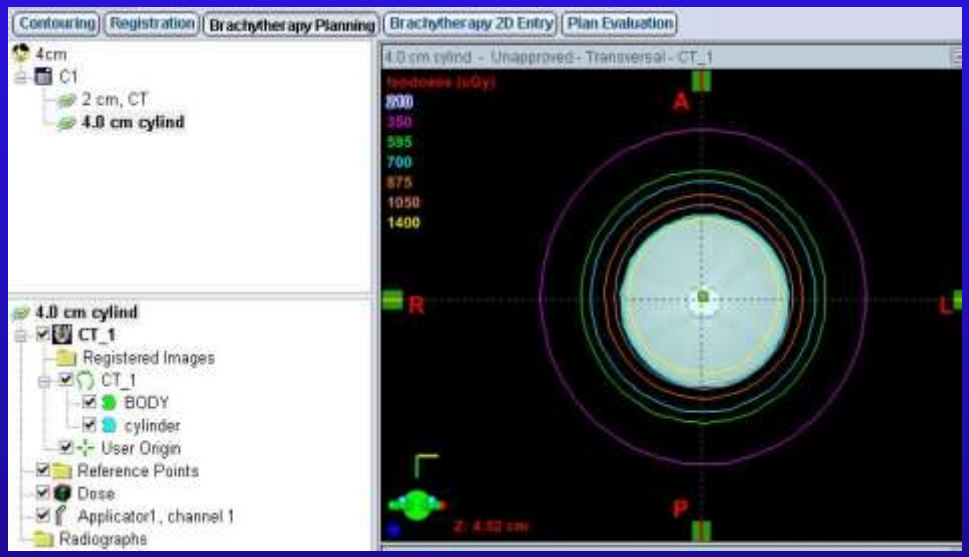
- optimization (can compensate for poor placement of the needles)
- fewer radiation safety concerns
- no post plan

Why Ultrasound Based Treatment Planning?

- WYSIWYG (better visualization of base and apex of the prostate)
- Real time visualization of needle insertion
- Obviate the need to move the patient for CT or MR
- Works well in a scan-plan-treat environment (we have experience in maintaining patients under anesthesia during planning and treatment)

Intro to Vitesse 3.0





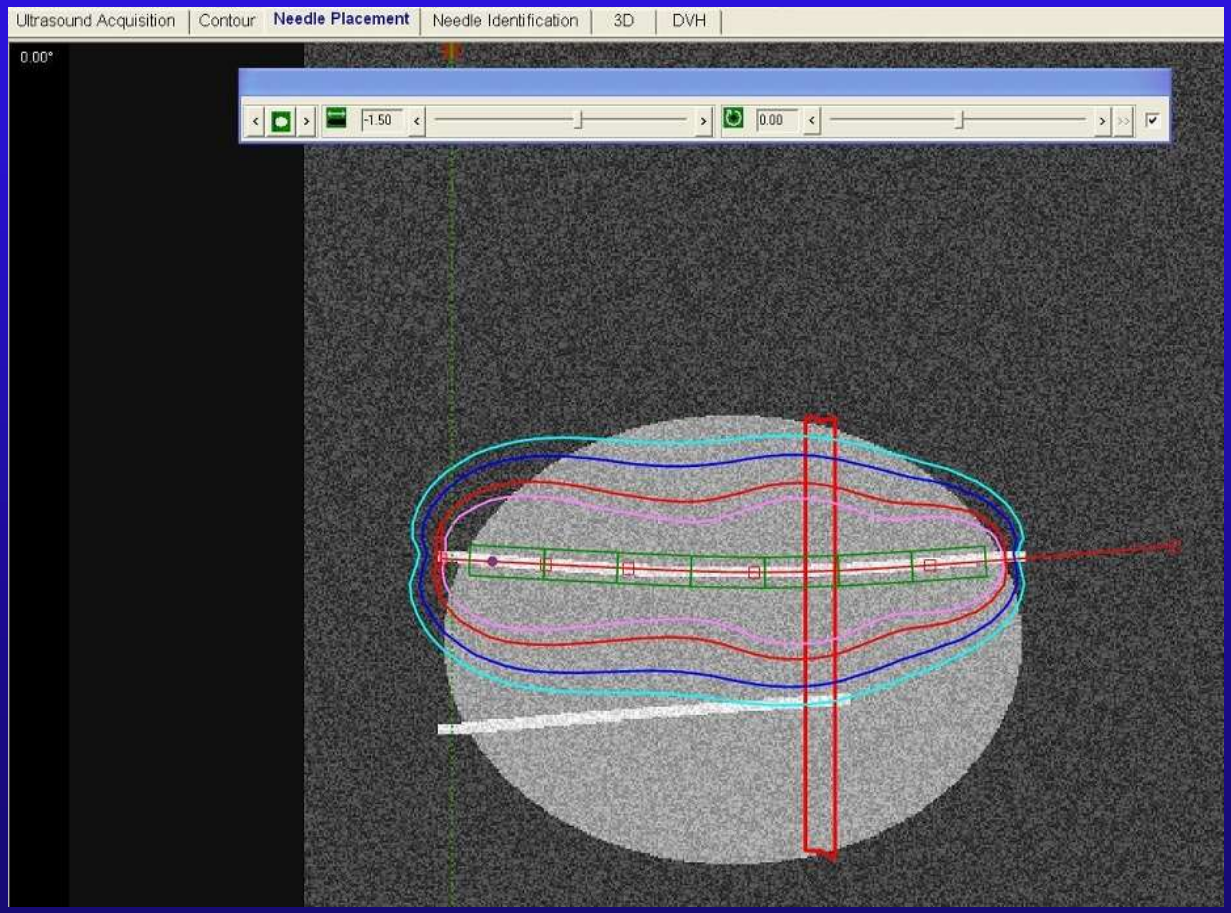
Variseed

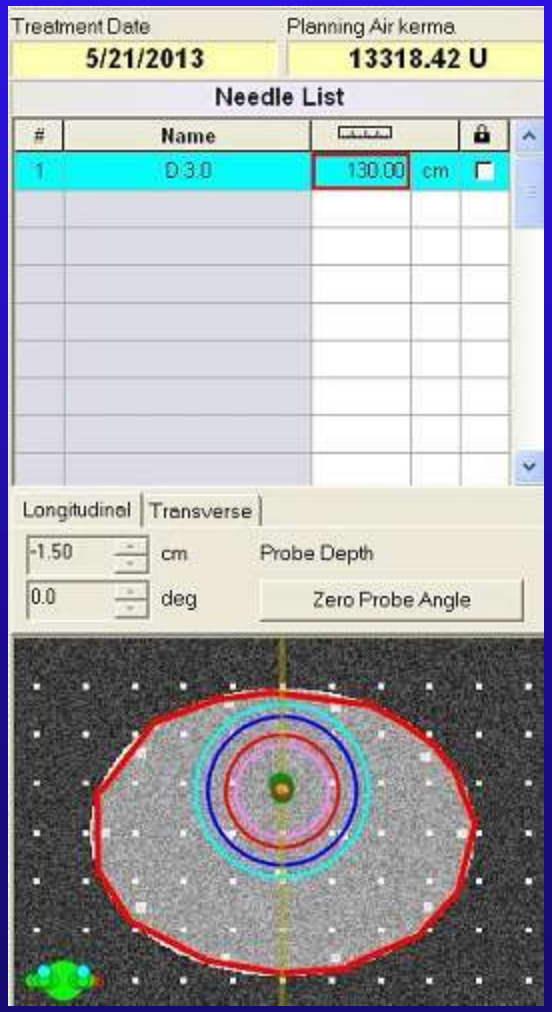
BrachyVision

Vitesse

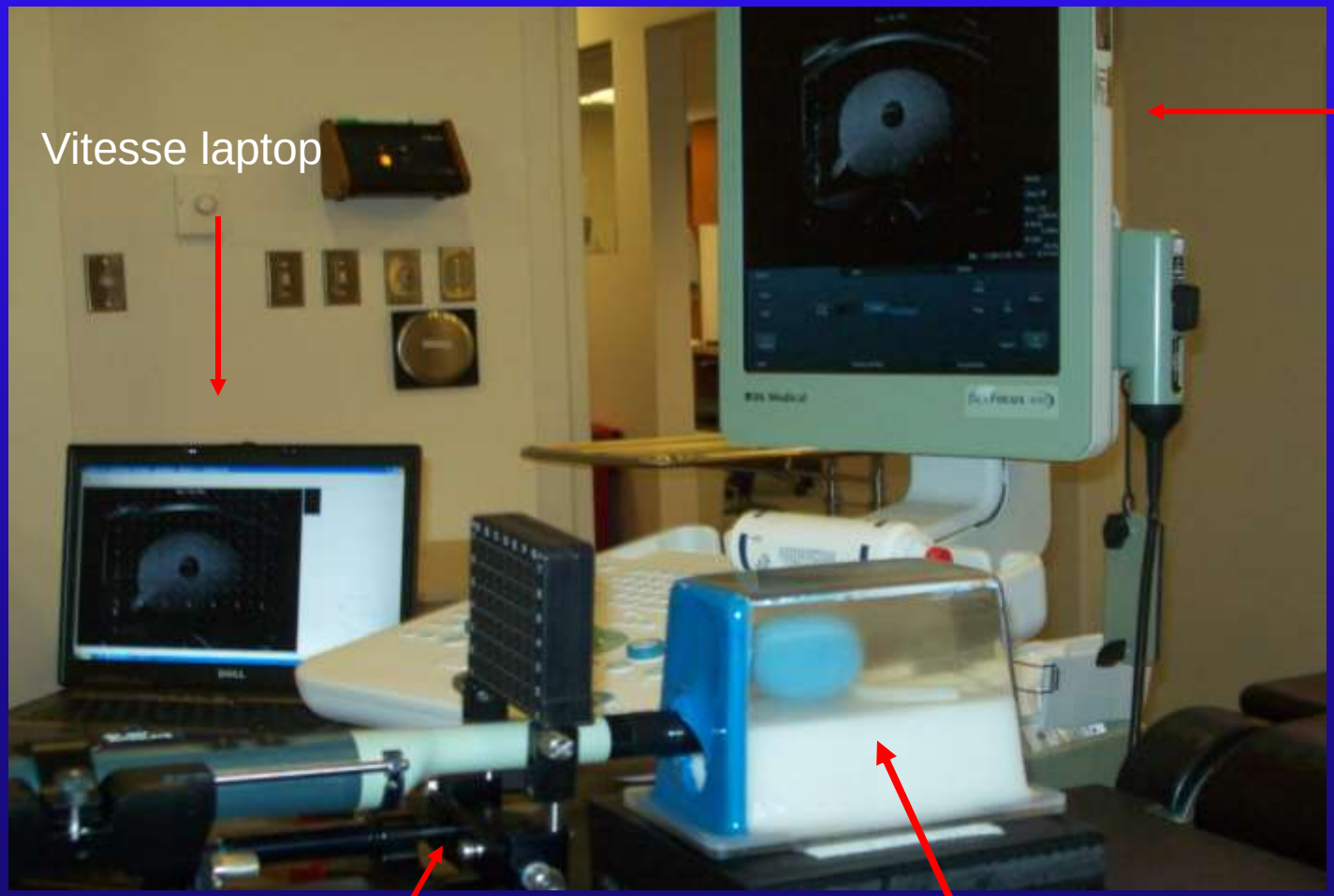
Variseed-like menu

HDR source activity

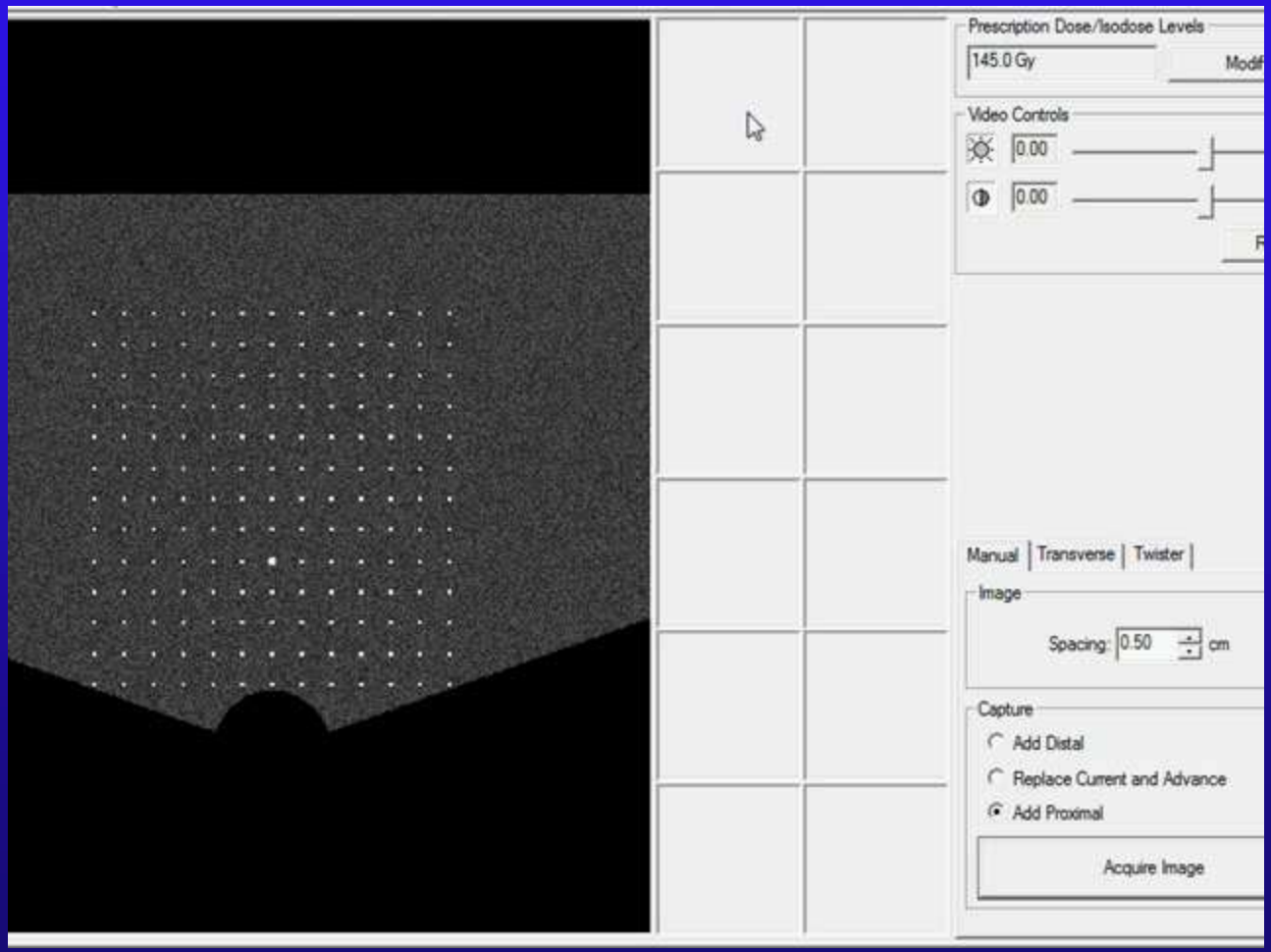




Dry-run set up

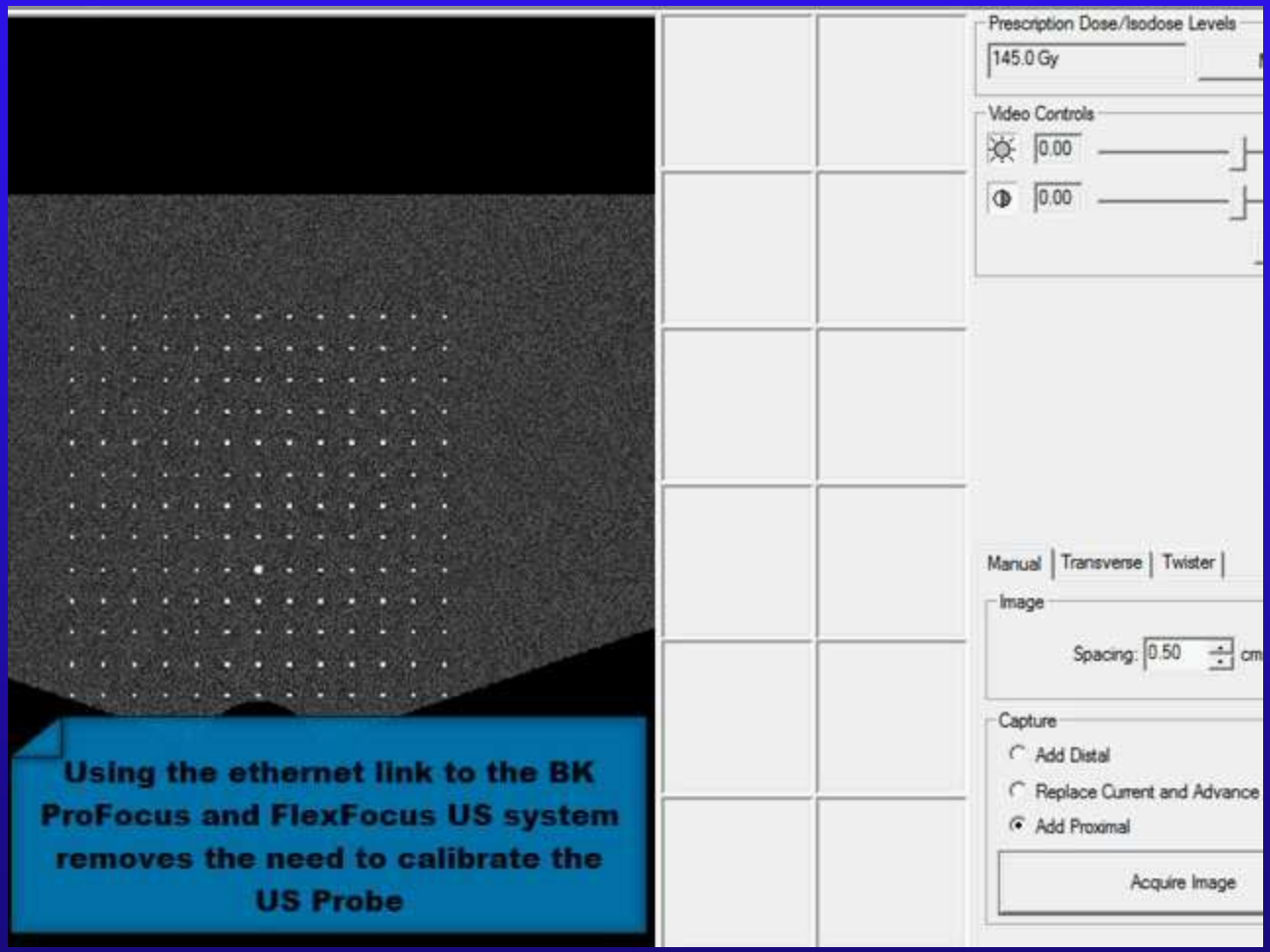


Ultrasound Capture



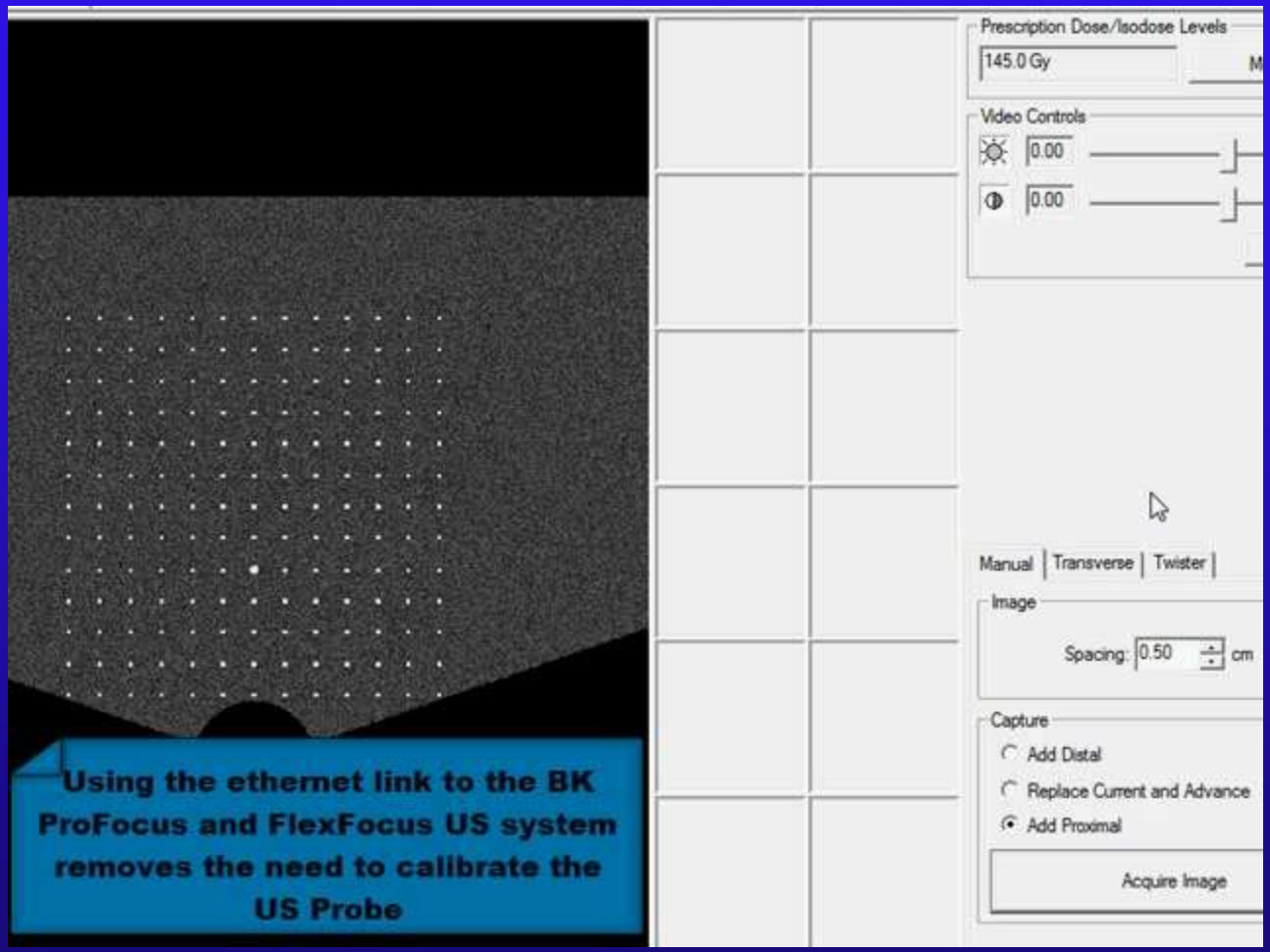
manual capture

Ultrasound Capture



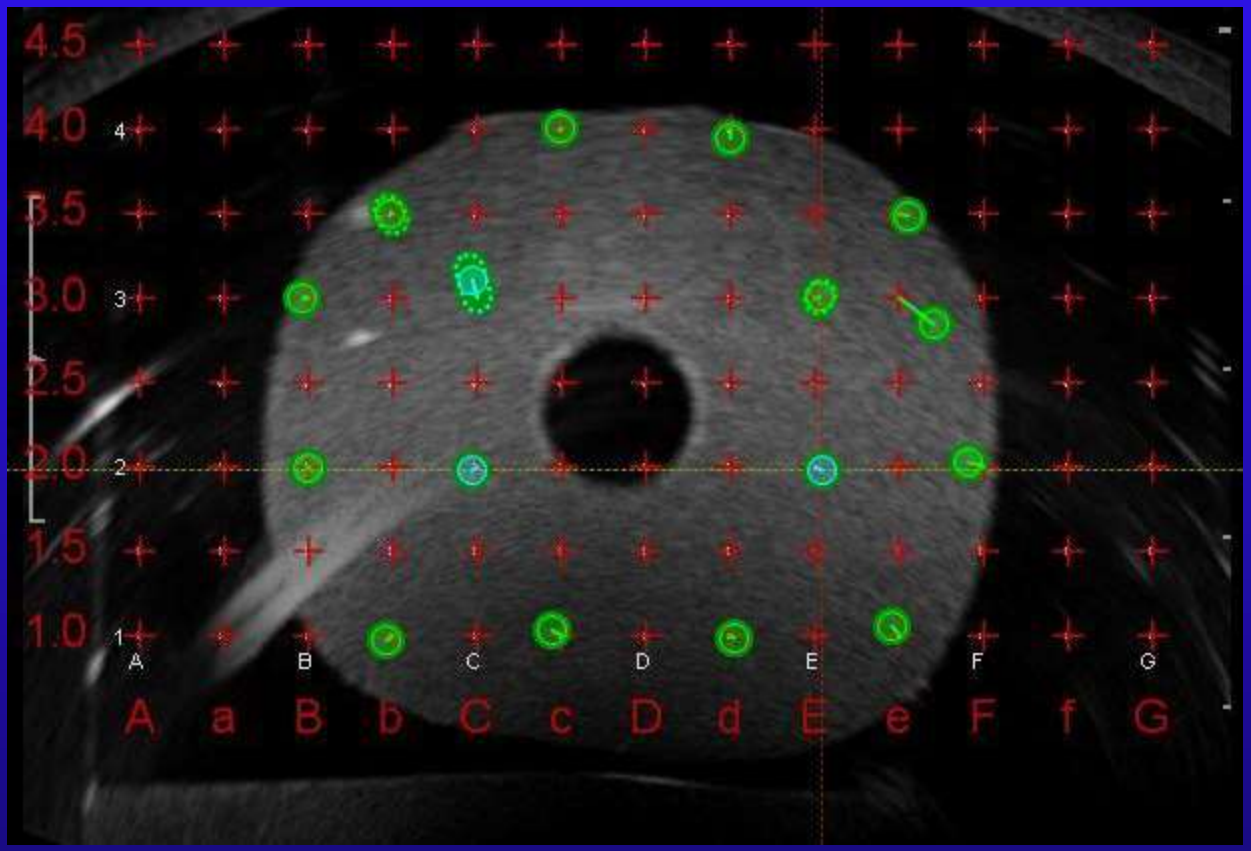
Tracked stepper capture

Ultrasound Capture



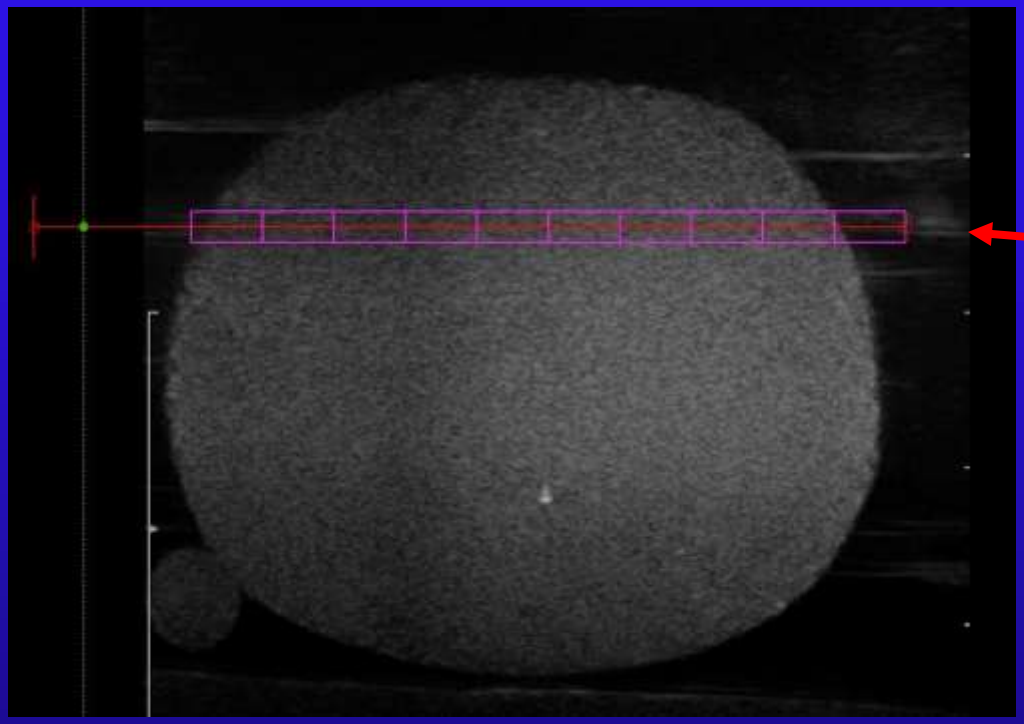
twister capture

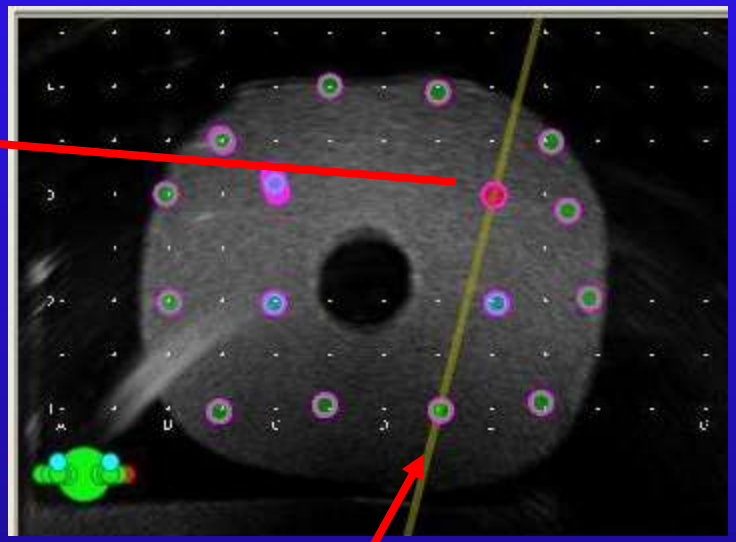
Needle Identification



Place needles in plan where you think they may be used

Preinsertion of Needle (live display)





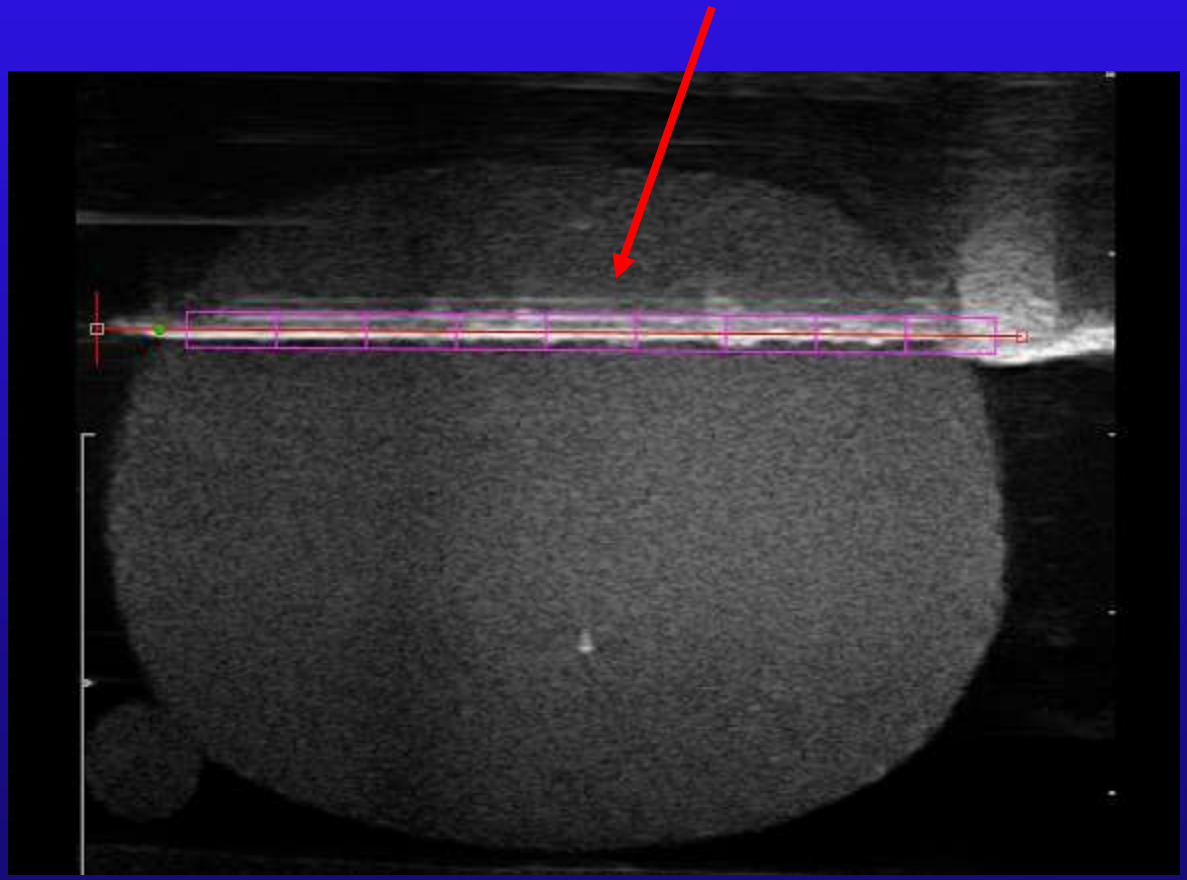
scan plane

Sagittal View (live)

transverse view-focus on needle of interest

Needle Inserted

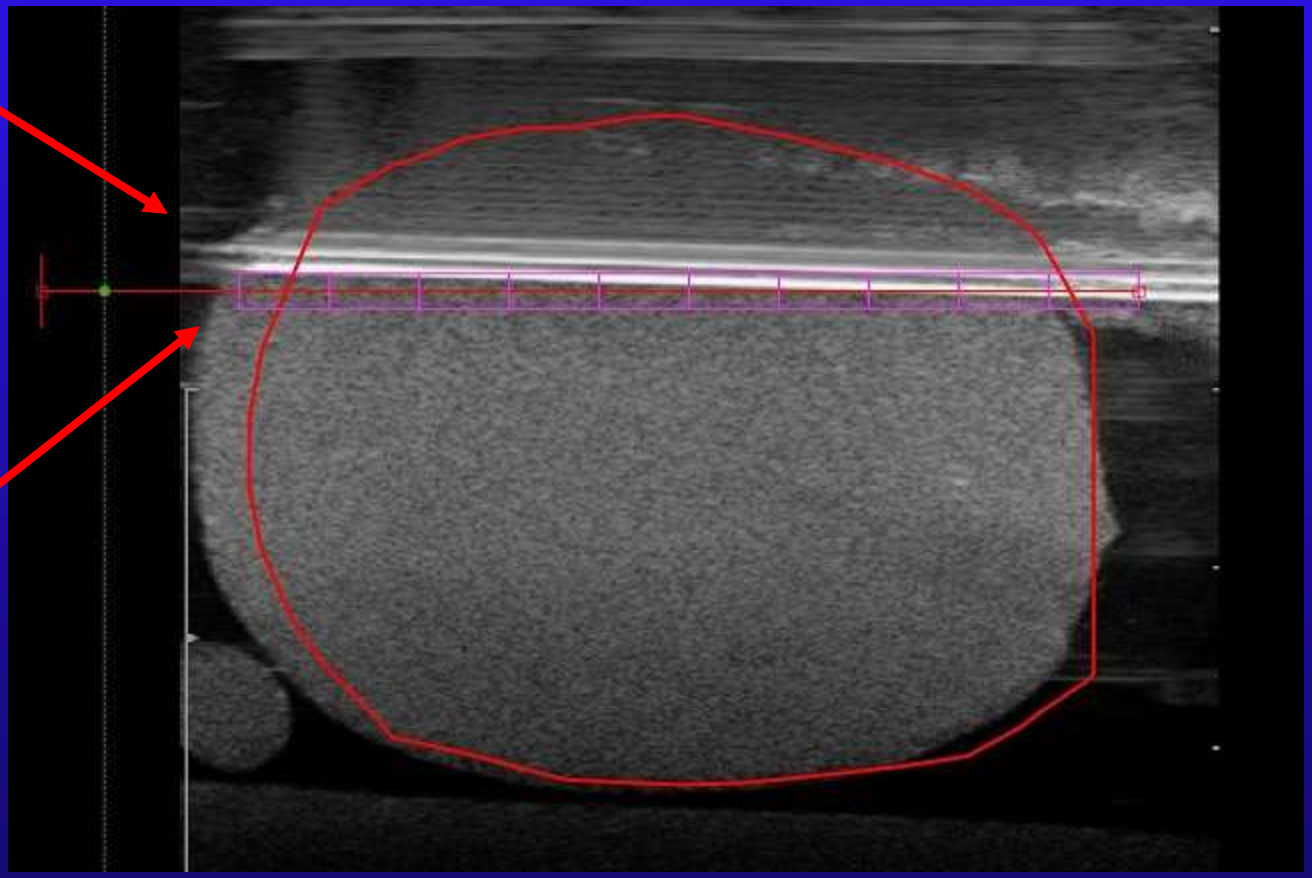
needle flash is within the planned path



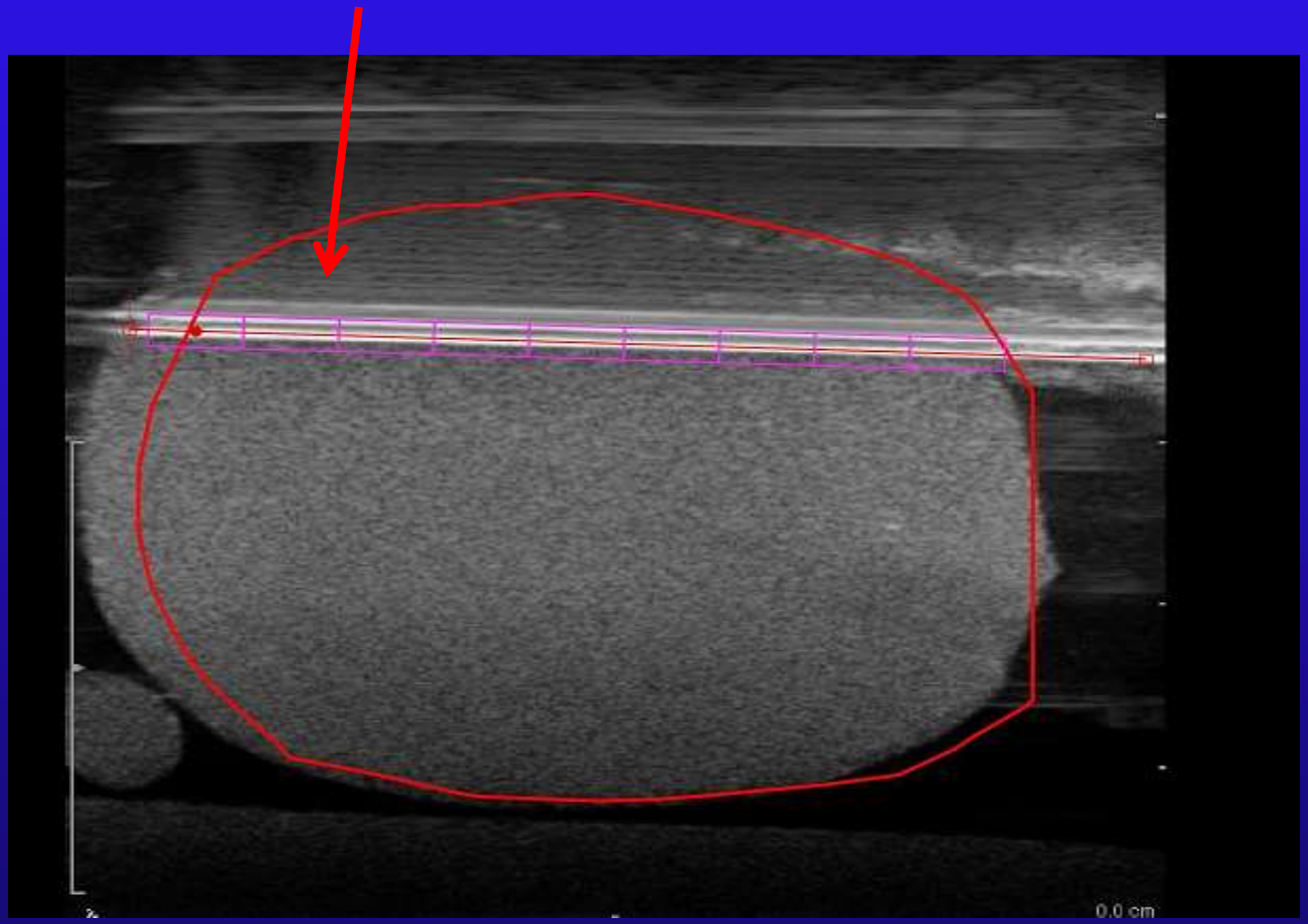
What if inserted needle does not overlie the planned needle?

inserted

planned



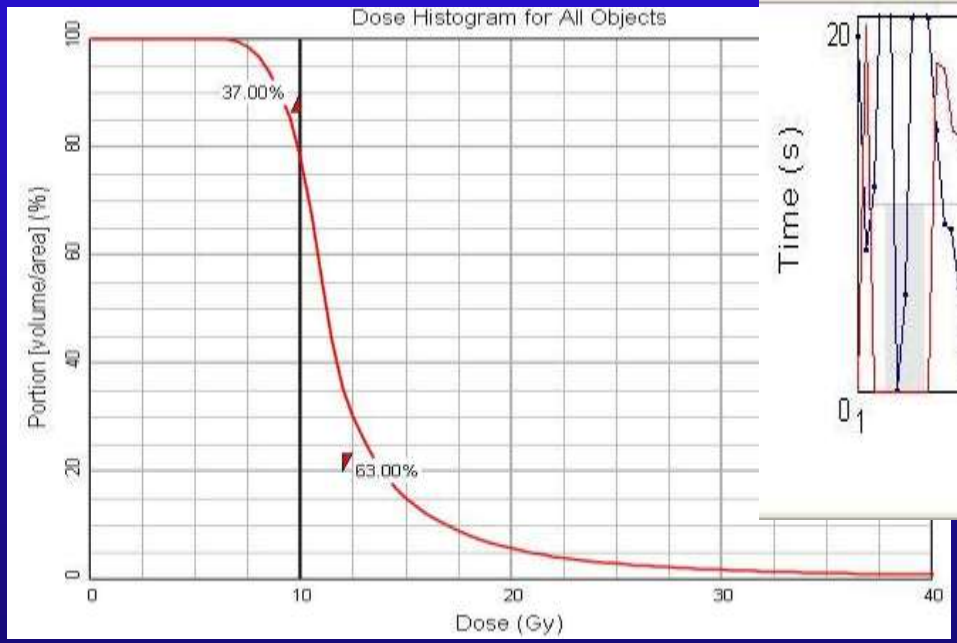
adjust the planned position (can be done with bent needles as well)

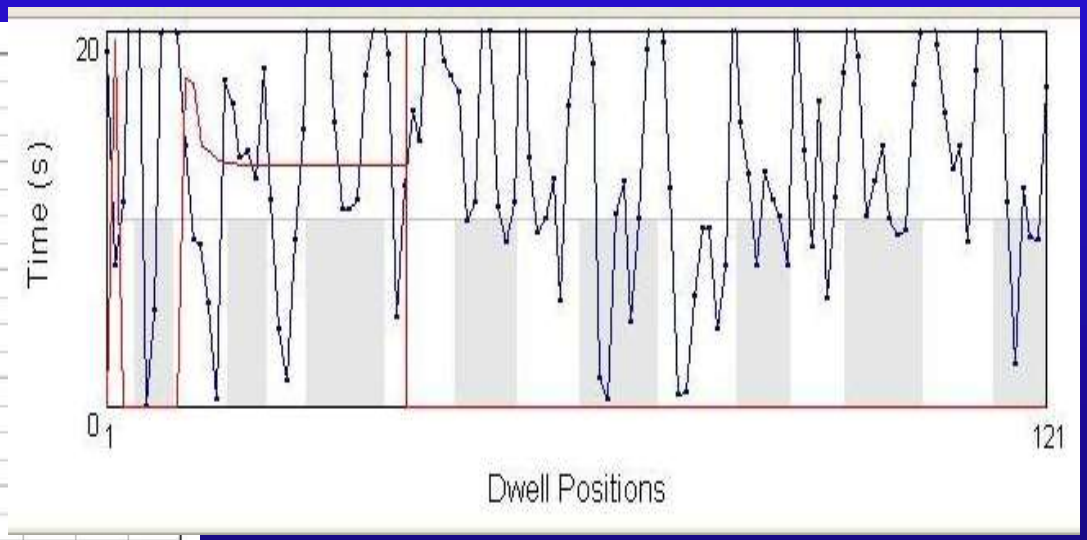


Optimization

Optimization Parameters similar to BrachyVision

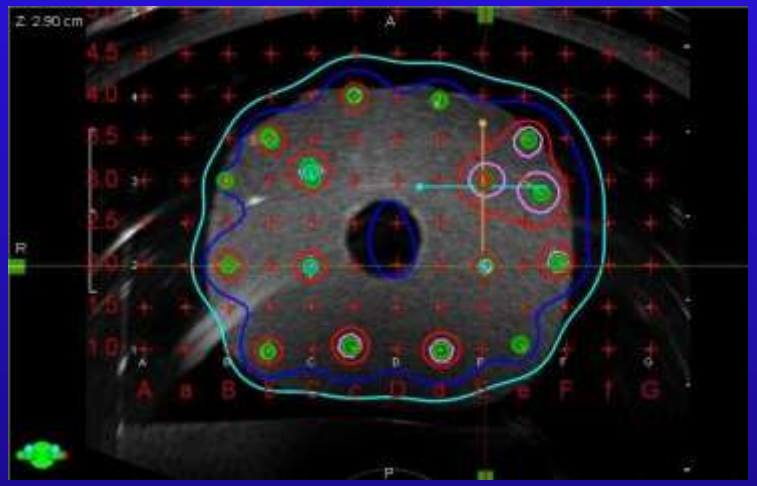
	Region	Coverage	Priority	Portion		< > =	Dose	
☑	Prostate	Volume	1.00	90.00	%	>	100.00	%
☑	Prostate	Volume	1.00	20.00	%	<	120.00	%



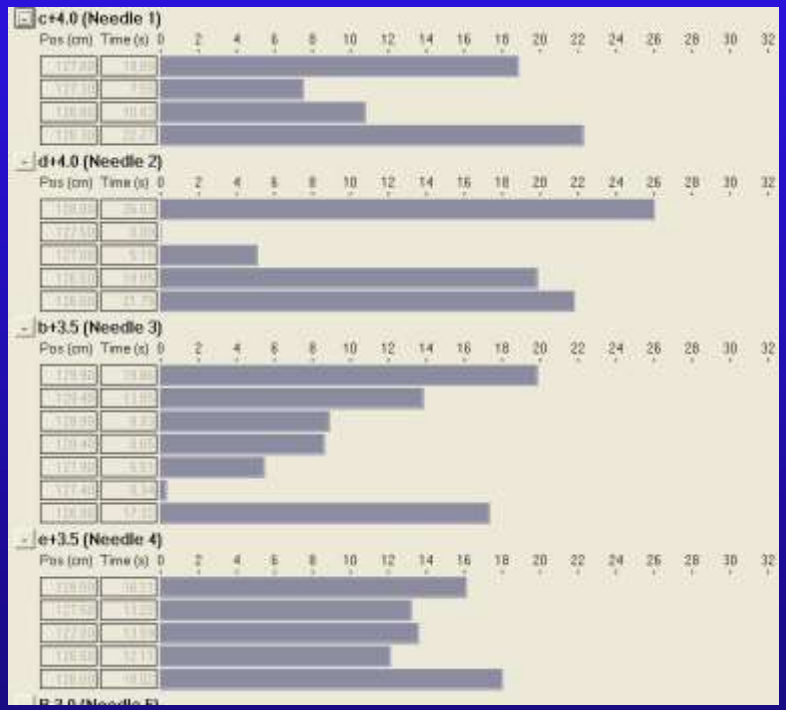


Live DVH and dwell time display

Isodose and Dwell Control Window



Variseed-like



BrachyVision-like

QA

- Ensure proper transfer guide tube placement
- Measure needle + transfer tube lengths
- Dose second check
- Transfer plan to HDR Treatment Console
- Check treatment parameters

Dose second check

Second Check

Make sure the macro is enabled on your Excel 2003 : Tools-->macro-->security level--> medium; in Excel 2007 after get the security warning, enable it in the options

1. At the Brachytherapy Planning server, Go to File-->Print-->Report-->choose the Generic/Text Only as the printer and QAExportPlain.tml as the layout (already set as default) -->OK-->name it as "c:\PATIENTNAME.txt"
Please specify the full path of it
2. Go to the desktop where the AUTO_CAL.xls is at
3. Two ways to activate the macros: a. use short cut key: ctrl+shift+A or b. under excel go to tools -->macros-->macro-->Run the sheet1.Auto_CAL

Dose Rate Constant for Source	1.1 cGy/hU
Activity to Kema Conversion	4.03 U/mCi
Source Treatment Activity	4213.27 mCi

Position [cm]	DwellTime [s]	X [cm]	Y [cm]	Z [cm]
120.3	5.5	2.07	-10.91	-42.88
120.1	0.5	2.07	-10.87	-42.68
119.3	0.1	2.07	-10.69	-41.9
119.1	0.7	2.07	-10.65	-41.71
118.9	1.9	2.06	-10.6	-41.51
118.7	2.8	2.06	-10.56	-41.32
118.5	2	2.06	-10.51	-41.12
118.3	0.5	2.06	-10.47	-40.92
118.1	0.1	2.06	-10.43	-40.73

REFPOINT DATA

Id	X [cm]	Y [cm]	Z [cm]	TG43Dose	SecondCalcDose	Pct Error [%]
F1						
dose pt	4.9	-12.05	-42.4	463.9	456.40	-1.62

X

Approval_____Date_____

Excel spreadsheet reads in dwell positions and times, recalculates dose to dose points

Partial prostate HDR

- used for low risk patients
- dosimetry can be optimized to spare adjacent structures
- CTV can be based on MRI
- US guided partial prostate HDR can be used to spare urethra, rectum

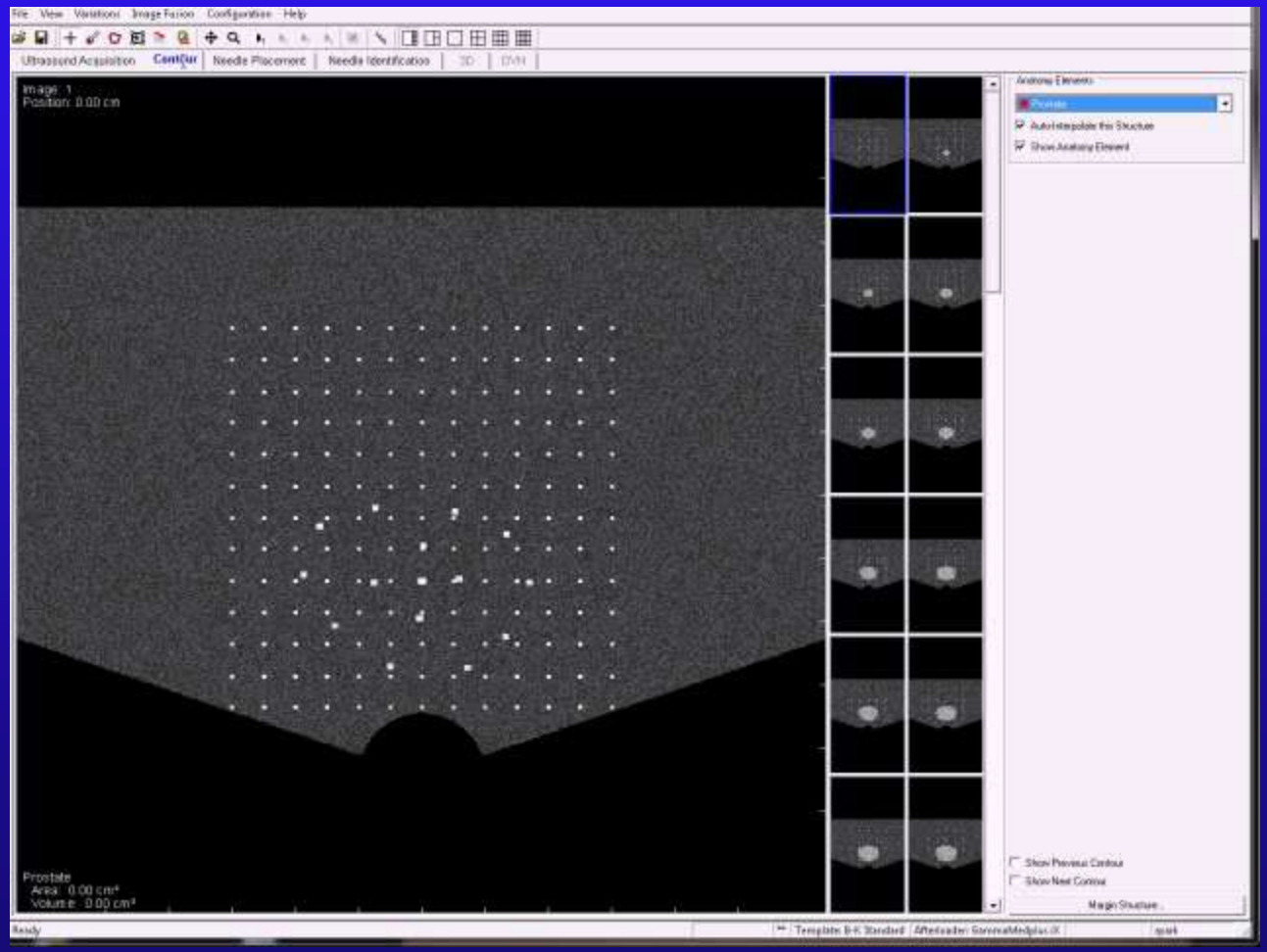
Grant to be Submitted

Ultrasound

~~CT-on-Rails~~-Guided Partial Prostate HDR Brachytherapy: A Therapeutic Alternative to Reduce Morbidity and Overtreatment for Low-Risk Prostate Cancer

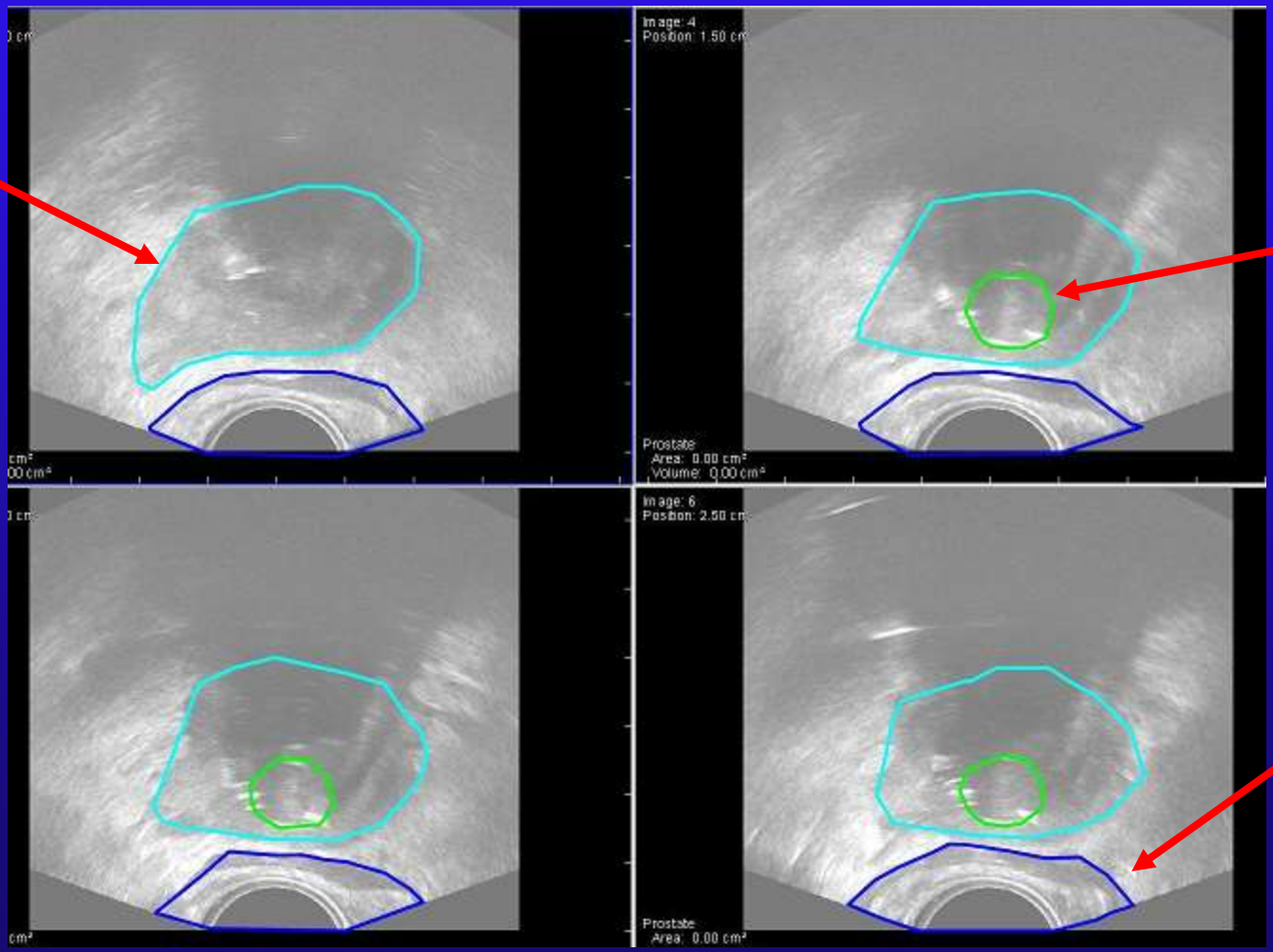
PI: Timothy N. Showalter, MD (Department of Radiation Oncology)

Ultrasound/MR fusion



Other Uses

Syed Implant



Points to Ponder

Points to Ponder (cont'd)

- Patient Selection
- Ultrasound in place for treatment?
- Database Management

Brachytherapy Planning Systems

BrachyVision VariSeed Vitesse BeBig Eye Plaque


DANGER
WILL
ROBINSON!!

Vitesse User's Guide:

"Vitesse is intended for use by an expert user....Besides having professional certification, users shall be fully trained in HDR brachytherapy procedures, transrectal ultrasound brachytherapy, and the Vitesse application"

In case of problems...

do a CT scan and plan in BrachyVision

Conclusions

- Vitesse 3.0 is a full treatment planning system for ultrasound guided prostate HDR
- optimized for use with existing equipment (B&K ultrasound, Civco tracked steppers)
- can be integrated into a scan-plan-treat IGBT workflow
- all caveats are presumed- correct source activity, acceptance testing, commissioning and training
- can fuse with MR for partial prostate HDR
- some utility for gynecological treatments (???)

Acknowledgements

- Varian Brachytherapy- Wayne Lajoie, Karen Kigin, Rebecca Park, Sophie Weatherall
- Multiple Varian Webinars on MyVarian.com
- Paul Bagli- Civco
- Jerry Fiddes- B&K Medical

“A boy loves his dog”- Harlan Ellison