## PERK STATION Workflow/Usage Tutorial

- 1. Before start, make sure:
  - 1.1. Secondary monitor is powered on, and is connected to the laptop via DVI/VGA cable
  - 1.2. Set up multiple monitors (laptop screen and secondary monitor) in 'Dual view' (independent) mode
  - 1.3. External keyboard is plugged in
- 2. Start SLICER by double clicking exe file. SLICER will load, will take a couple of minutes, and when it is loaded up, it should look like Snapshot 1 below:



3. Select 'PerkStation' module from module drop down list, as shown in next three snapshots

* Help & Acknowledgement		<b>^</b>					
Display & Modify Scene							
MRML Tree		×_					
Scene		<u></u>					
		-					
MRML Node Inspector		X					
ID.							
Name							
		-					
* Manipulate Slice Views							
		[m]					
		<b>U</b>					
Manipulate 3D View							
		1					
		<u> </u>					
Data							8
3D Slicer Version 3.3	Alpha						E 6 🛛
File Edit View Window F	All Modules						
Modules:	Color						
	1 1 Notes -						
	✓ Data J Editor					Hoss	
3DSlicer	Data     Editor     Fiducials     Conditional States	Coloct DI				Noe Hoe	
3DSlicer	Cetta     Editor     Fiducials     GradientAnisotropicFilter     Models	Select Pl	Rock: P ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (			Wole Hole	
3DSIIcer	Vota     Editor     Fiducials     GradientAnisotropicFilter     Models     PERK Station     OktoMukdis	Select Pl drop-dov	ERK Station from vn list	800 ♥ 2 ■ D E 22 ↑ ↑ 42 300 Nov		ikon Kon	
3DSIIcer     Help & Acknowledgement     Display & Modify Scene	Vonte     Editor     Fickucials     GradientAnisotropicFilter     Models     PERK Station     OdecModule     GueryAttas	Select Pl drop-dov	ERK Station from vn list			Kon Kon	- 6 - 6 0
Balance Street Str	Data     Estor     Fiducisis     GradientAnisotropicFilter     Models     PERK Station     GdetModule     GueryAtlas     ROI	Select Pl drop-dov	ERK Station from vn list		  	Kan Kan	1 1 0
Beplay & Modify Scene	Data     Eator     Fiducials     GradentAnisetropicFiter     Models     PERK Station     GeterModule     GueryAtlas     ROI     Sices     Transforme	Select Pl drop-dow	ERK Station from vn list			Ku Ka	] ] ] 0
Balance State     Acknowledgement     Help & Acknowledgement     Daplay & Modify Sciene     MRML Tree     Gene	Data     Eator     Fiducials     Graderfinitoripoi/Fitter     Models     PERK Station     Gedetficulae     Courty-Atlas     ROI     Stoces     Transforme     Volumes	Select Pl drop-dow	المعند التي المنظل الله الله الله الله الله الله الله ال			Na Ka	] ] ] 0
Boglay & Modify Sorre     MRML Tree     Scene	Data     Eator     Fulculate     Eator     Fulculate     CondentAnotropioFilter     Models     PERK Station     QueryAlass     ROI     Stoces     Transforms     Volumes     Converters     Converters	Select Pl drop-dow	init		1 1 1 1 1 1 1	ion Itar	0 L 0 L 0
Bello & Acknowledgement     Heljo & Acknowledgement     Gregoly & Modify Scene     MRML Tree     Gene	Data     Eator     Fulculat     Constraints     Constrain	Select Pl drop-dow	RFK Station from			ica ica	0 1 0
Acknowledgement     Heb & Acknowledgement     Opplay & Modify Scene     MRM, Tree     Scene	Jose     Sator     Foldcals     Sator     Foldcals     Conderd.Anistorpoin/Ber     Models     PEK/Saton     Qed-Ktocale     QuaryAtlas     Rol     Sices     Transforms     Volumes     Converter     P     Demostration     DEmusion Terrior     Diffusion Terrior	Select PI drop-dow	RK Station from n list			Kai Dar	9 C 9 T 9
Bell & Actinovédgenent     Help & Actinovédgenent     Otepisy & Modry Scrre     Mikt. Tree     Scare	Data     Eator     Fold.table     Eator     Fold.table     OrdertModule     OdertModule	Select PI drop-dov	ERK Station from In list			Kut Kas	9 9 1
Beg & Adrowledgement     Beg & Adrowledgement     Orgelay & Modify Serre     MRM, Tree     Scene	Data     Eator     Fold.cals     Eator     Fold.cals     Conderd.fals     Conderd.fals     Conderd.fals     Courty.Allas     Rol     Courty.Allas     Rol     Converters     Converters     Converters     Converters     Pering     Meeting     Model Generation     Model Generation	Select Pl drop-dov				Boa Itau	1 0 00 1 1 0
Bog S Adhrowledgenert     Heb S Adhrowledgenert     Otoplay & Modify Sciene     MRM, Tree     Sciene	Data     Eator     Fulcuists     Eator     Fulcuists     CondentAntoropol/Pier     Models     PERK Station     QueerAtas     Rol     QueerAtas     Rol     QueerAtas     Rol     Converters     Pomonstration     Converters     Pomonstration     PUtrusion Terrorer     Petering     Model Queeration     PRefering     Model Queeration     Prefering     Model Queeration     Podel     Model Queeration     Podel	Select Pl drop-dov	RFK Station from			Box Box	1 0 0
Bog Store     Help & Acknowledgement     Copply & Modify Scene     MRM, Tee     Scene	Joan     Sator     Fold-sats     Sator     Fold-sats     CondentAnabordopoPiter     Models     PERK Staton     Qode-Module     Query-Atlas     Roi     Transforma     Volumes     Converters     Person     Converters     Potrusian Velopited     PErtrag     Model Generation     Pagistration     Pagistration     Satementation     Sat	Select Pl drop-dov	RK Station from n list			ica Ica	- 0 
Big S Actrowedgenerit     Big S Actrowedgenerit     Display 8 Modify Scree     MRM. Tree     Scare	Data     Eator     Fulculate     Eator     Fulculate     Eator     Fulculate     CondertAnatorpop/Eter     Models     PEKK Staton     QueryAttas     Rol     Suces     Converters     Pomonstation     Datasinvesters     Datasinvesters     Datasinvesters     Petering     Pete	Select P1 drop-dov	RK Station from n list			Kai Dor	
Beg & Actrowedgement     Beg & Actrowedgement     Degelay & Modify Sorre     MRM, Tree     Scene     MRM, Inde Inspector     D:     Name:	Data     Eator     Fold.cold     Eator     Fold.cold     Condert.ch.rischropicFiber     Models     PERK Station     Gedert.Kodule     Guery.Atlass     Rol     Guery.Atlass     Rol     Converfers     Converfers     Converfers     Converfers     Converfers     Permon     Converfers     Permon     Pretma	Select PI drop-dov	ERK Station from n list			tos Itos	
Be & Actrowedgenert     Gogley & Modify Serre     MRM, Tree     Scene     MRM, Node Inspector     E:     Name:	Data     Eator     Fulculat     Eator     Fulculat     Eator     Fulculat     CondentAntorpoinFilter     Models     PERK Station     QueryAtas     Rol     QueryAtas     Rol     Converters     Pomonstration     Converters     Pomonstration     Converters     Pomonstration     Pothulation Velogited     PEtering     Model Generator     Patering     Model Generator     Satistics     Postation Tencer     Tractography	Select PI drop-dov	RFK Station from			box bar	1 1 0
Backnowledgenerit     Heb & Acknowledgenerit     Oordey & Modify Sciene     MRML Tree     Gene     MRML Node Inspector     Dr.     Name:	Data     Eator     Fulculat     Eator     Fulculat     CondentAutoropol/Rer     Models     PERK Staton     QueryAtas     Rol     QueryAtas     Rol     QueryAtas     Rol     Converters     Pemontarian     Converters     Pemontarian     Pethilian Velopted     Polifulation     Persitiantion     Petering     Model Constantion     Pesignification     Pesignification     Pasting     Trackography	Select PI drop-dov	RFK Station from n list			lon low	
Big S Actinovidigenerit     Big S Actinovidigenerit     Orgiley 8 Modify Scree     MRM. Tree     Scare     MRM. Node Inspector     Dr.     Name:	Data     Eator     Fulculat     Eator     Fulculat     Eator     Fulculat     CondentAnotropoPRer     Models     PERK Station     Qedentocale     QueryAtlas     Rol     Transforms     Volume     Converters     P     Demonstration     PUtrusion Transer     PUtrusion Vergitted     PErking     PRestittation     Pagistration     Pagistration     Tractography	Select Pl drop-dov	RK Station from n list			ion	0 1 1 1 1 1 1
Big & Actrowedgement     Beg & Actrowedgement     Degelys & Modify Sorre     MRNL Tree     Scene     MRNL Node Inspector     D:     Name:	Data     Eator     Fold.cold     Eator     Fold.cold     Condert.ch.nis.ch.cold     Condert.ch.nis.ch.cold     Condert.ch.nis     Condert.ch.nis     Convertiens     Conv	Select PI drop-dov	RK Station from n list			tor	
3DS II cer       Yele 8 Actrowedgenert       Oogley 8 Modify Some       MRM. Tree       Scene	Data     Eator     Fulculat     Eator     Fulculat     CondentAncipue/Fleer     Models     PErK/Station     QueryAtlas     Rol     QueryAtlas     Rol     Converters     Pomonstration     Pothission/Veignted     Performed     Petring     ModelOenoratorn     Fitering     ModelOenoratorn     Saturcis     Tractography	Select Pl drop-dov	ERK Station from I list			los	1 0 0 0
MBML Node Inspector	Data     Eator     Fulculat     Eator     Fulculat     Eator     Fulculat     CondentAutoropol/Filer     Models     PERK Station     Queer/Allas     Rol     Queer/Allas     Rol     Queer/Allas     Rol     Converters     Pomontariation     Volumes     Converters     Pomontariation     PErtrainer     Teractorer     Model Operation     PSeguint ration     PSeguint ration     PSettrainer     Teractography	Select Pl drop-dov	RFK Station from n list			loa bar	
Big S Action/Magenerit     Big S Action/Magenerit     Display 8 Modify Scree     MRM. Tree     Scare     MRM. Node Inspector     D:     Name:	✓ Data   Bator   Policials   GradentAnistropol/Paer   Models   PERK Station   Qelectrocale   Course/Allas   Rol   Ro	Select Pl drop-dov	RK Station from n list			ion Ion	
Big & Actrowedgement     Beg & Actrowedgement     Degelys & Modify Sorre     MRM, Tree     Scene     MRM, Tree     Scene     MRM, Node Inspector     B:     Name:	Data     Eator     Fukush     Eator     Fukush     Eator     Fukush     Eator     Fukush     Eator     Fukush     CondertAbis     CondertAbis     Rol     Converters     Converters     Converters     Converters     Converters     Converters     Pering     Particitation Vegited     Portiation Tenor     Portiation Tenor     Portiation Tenor     Portiation     Patering     Model Generation     Sagamentation     Sagamentat	Select PI drop-dov	RK Station from n list			100 Itar	
MRML Node Inspector	Data     Eator     Fuiculat     Eator     Fuiculat     ContentAction     Conten	Select PI drop-dov	RFK Station from n list			100 Itar	
Actionwindgeneri     Ligits & Actionwindgeneri     Orgiby & Modify Sorre     MFML Tree     Scene     MFML Node Inspector     D:     Name:	Data     Eator     Fulculat     Eator     Fulculat     CondentAnistropol/Filer     Models     PERK Station     QueerAdas     Rol     QueerAdas     Rol     QueerAdas     Rol     Converters     Pomortanton     Converters     Pothulan	Select Pl drop-dov	RFK Station from n list			ία	
Big S Action/Velgenerit     Big S Action/Velgenerit     Orgby S Modify Scree     MRM. Tree     MRM. Tree     MRM. Node Inspector     Dr.     Name:	Data     Eator     Fulculat     Eator     Fulculat     CondentAutoropol/Rer     Models     PERK Staton     QedentAulas     QueryAtlas     Rol     QueryAtlas     Rol     Converters     Persons     Converters     Persons     Converters     Persons     Converters     Persons	Select Pl drop-dov	RK Station from n list			Бα Вия	
Big S Actrowedgement     Big S Actrowedgement     Display & Modify Sorre     MRM, Tree     Score     MRM, Node Inspector     D:     Name:     Manuality Silce Views	Data     Eator     Fukusis     Eator     Fukusis     Eator     Fukusis     Conderd.NationCooperFleer     Models     CourtyAtlas     Roi     CourtyAtlas     Roi     Converters     Converters     Converters     Converters     Perint, Station     Converters     Perints	Select PI drop-dov	RK Station from n list			DO Ital	
Bes & Actrowedgement     Bes & Actrowedgement     Orgaby & Modify Serre     MRM. Tree     MRM. Node inspector     B.     Nene     Nene	Defa     Eador     Fold.cold     Eador     Fold.cold     Conderd.fold.color.cold     Conderd.fold.color.cold     Cold.cold     Cold.cold.cold     Cold.cold.cold     Cold.cold.cold     Cold.cold.cold     Cold.cold.cold     Cold.cold.cold.cold.cold.cold     Cold.cold.cold.cold.cold.cold.cold.cold.c	Select PI drop-dov	RFK Station from n list			DO Bai	
Big S Acknowledgenert      Help S Acknowledgenert      Gogley 8 Modify Some      MRM, Node Inspector      D:      Name:      Manpulate Size Views	Data     Eator     Fuichais     Eator     Fuichais     CondentAnistropoinFilter     Models     PERK Station     QueerAllas     Rol     QueerAllas     Rol     Converters     Pointainn resor     Converters     Pointainn resor     Christian resor     Christian resor     Christian resor     Pointainn Veigited     Pointainn Veigited     Patrix     Sattatics     Pointainn Veigited     Pointainn Veigited     Pointainn Veigited     Patrix     Sattatics     Pointainn Veigited     Pointainn Veigited     Pointainn     Sattatics     Pointainn     Sattatics     Pointainn     Sattatics     Pointainn     Po	Select Pl drop-dov	RFK Station from n list			Бα Ва Ва Ва Ва Ва Ва Ва Ва Ва Ва Ва Ва Ва	
Big S Actrowedgenerit     Display & Modify Scree     MRM, Tree     MRM, Tree     MRM, Tree     MRM, Node Inspector     D:     Name:     Name:     Manpulate Size Views     Manpulate Size Views     Manpulate Size Views	Data     Eator     Fukciski     Eator     Fukciski     CradentAnistorpoinFiber     Models     PERK Station     QueryAtas     Rol     QueryAtas     Rol     Converters     Person     Transforms     Youmes     Converters     Person     Transform     Pothild Converters     Person     Transform     Pothild Converters	Select Pl drop-dov	RFK Station from n list				
Big S Actrowedgement     Big S Actrowedgement     Digsby S Modify Sorre     MRNL Tree     MSNL Tree     MSNL Node Inspector     D:     Name:     P:     Name:     Manpulate Sice Views     P:     Manpulate Sice Views     P:     Manpulate Sice Views     P:     Manpulate Sice Views     P:     Manpulate Sice Views	Data     Eator     Fold.cols     Eator     Fold.cols     Conderd.cols     Conderd.cols     Conderd.cols     Converters	Select PI drop-dov	ERK Station from Ist				
	Data     Eator     Fold.cals     Eator     Fold.cals     Eator     Fold.cals     Content.cals     Conte	Select PI drop-dov	RFK Station from n list				
	Data     Eator     Fuix-sis     Eator     Fuix-sis     CondentAnctropicFilter     Models     PERK Station     QueryAtas     Rol     QueryAtas     Rol     Convertiers     Pomortarion     Convertiers     Pomortarion     Convertiers     Pomortarion     PEring     Mesting     Model Operation     Partialized     Pering	Select Pl drop-dov 	RFK Station from Ist				



4. Select 'Clinical' mode from mode drop down list, as shown in next two snapshots below



🥵 3D Slicer Version 3.3 Alpha											
File £dk Vew Window Help Feedback											
Rouke: PERCERA - 4 P - C mark		2 🖩 5 d 🛄 🕴 🕯 🥺									
3DSLicer		Adat		Hone	- 4						
Clinical mode GUI		Note		Boar							
* Help & Acknowledgement	Bg I: 0										
* Mode Frame	Bg J: O										
Mode CLINICAL	Bg K: U	Note all con	trols will stay disabled	until an image is							
* Work Phase Frame		loaded!!!									
Calibrate Plan Insert Validate Evaluate											
Experiment Frame											
PERK Parameters None											
E Load experiment											
* Wizard											
1/4. Calibrate	Load a previously sa	aved calibration									
Trade overlag system caux autor											
	Ability to reset calib	ration									
Vertical Filp: Horizontal Filp:	Flip required on ima	ige due to monitor se	tup								
Scale X											
Monitor physical size (mm):	Information about	monitor physical size									
Monitor pixel resolution. Update	and nivel resolution	monitor physical size									
Translate	and pixer resolution	18									
First make sure that the secondary monitor image window has 'focus'.											
You can click in that window to get focus, das arrow keys on the keyboard to movethranslate image. Use corresponding numeric keypad with Numl oek 'On' for face movement.	Instructions on how	w to use keyboard for									
	aligning fiducials										
- Rotate											
Center of rotation:											
First make sure that the secondary monitor image window has 'focus'.											
<ul> <li>Manipulate Slice Views</li> </ul>	Lb: None				R: 109.4						
▼ Manipulate 3D View	Bg: None				A: 59.4 S: 0.0						
Middle Button: Pan; Right Button: Zoom					8						

5. Add 'Planning' image to software, as shown in next five snapshots. Note, at the end of this step, the secondary monitor should have corresponding image displayed!! If it doesn't then try switching off/on the monitor!!







6. Adjust 'Contrast', if you can't see the image properly, as explained in following four snapshots. Adjusting contrast here should reflect both in laptop, and on the secondary monitor inside scanner room.





- 7. Start experiment!!
  - 7.1. First step, calibration:

Note, here one person is required to work on laptop outside scanner room, and the other person should be inside the MR scanner room to do system calibration.

7.1.1. Flip: Compensate for monitor arrangement! In our setup we need "Horizontal" flip, see snapshot below.

This step is done by the user working on laptop outside scanner room! After performing this step, this person should communicate with person inside the scanner room, to verify that Up/Down and Left/Right is correct as seen through the mirror!. To both users, the image should look identical in terms of axis, as seen on laptop and as seen through mirror.



7.1.2.Scale related: Make sure, all the information about the secondary monitor, its' physical size in millimeters, and its' pixel resolution is correct. This information is used to calculate correct scale needed to display image in correct physical dimensions. If the information is not correct, edit it, and press "Update". See snapshot below This step is done by user on laptop outside the scanner room. After this step, the image should be displayed in correct scale, and should be verified by communication with person inside the scanner room!



7.1.3.Translational alignment: To align fiducials on image, and fiducials as seen through mirror, translation may be required. Read the instructions carefully. I print them again here: "First make sure that the secondary monitor image window has 'focus'; you can click anywhere in that window to get focus. Now, use arrow keys on the keyboard to move the image in four possible directions. Use corresponding numeric keypad keys for finer movement". See snapshot below

In this step make sure at least one fiducial is very-well aligned; in the next step, this fiducial will be used as hinge point for correction of rotational mis-alignment.

This step is performed using external keyboard, by the person inside the MR scanner room looking through the mirror.



7.1.4.Rotational alignment: To align fiducials on image, and fiducials as seen through mirror, further minor rotation may be required. Read the instructions carefully. I print them again here: "First make sure that the secondary monitor image window has 'focus'; you can click anywhere in that window to get focus. Use Page-up key for clockwise rotation, and Home key for anti-clockwise rotation. Use keys 9 and 7 correspondingly for finer rotation. Note that the center of rotation must be specified prior to performing rotation". See two snapshots below

This is actually two steps: First, the person in MR scanner room communicates to person outside working on the laptop, the fiducial best aligned after translation e.g. 3<sup>rd</sup> fiducial from left. This fiducial will be used as hinge point for rotational alignment. The person outside the scanner room, working on laptop, clicks on the corresponding fiducial in the image on the laptop screen to mark it as center of rotation. The corresponding GUI control should be populated. Subsequently, the laptop user clicks back in secondary monitor window to give it focus. The second step: the person inside the scanner room can now use the external keyboard to perform rotational alignment looking through the mirror.



7.1.5.Save Calibration (optional): Now the system has aligned very well, you might want to save the calibration settings of the system. This might be very useful, in case you wish to perform multiple entry-target insertions on same planning image. You can save the calibration (above 4 steps) you just did on a file, which can later 'loaded' back using 'Load calibration'. See two snapshots below

This step is performed on the laptop outside MR scanner room. After saving the calibration file, press 'Next'. Otherwise too, if you don't want to save calibration, press 'Next' to move to planning step.





7.2. Planning/Targeting:

In this step, the person on laptop specifies the desired entry point and target point. The laptop user can zoom in/out to have better look at the image, without affecting/changing the display on mirror inside the MR scanner room.

First click specifies the 'Entry', second click specifies the 'Target'. At the end of second click, the software calculates and displays the insertion depth and insertion angle w.r.t. vertical. Also, a visual needle guide is overlaid on the image, both on laptop screen and on the mirror inside the scanner room.

The user can do 'Reset' in case, he/she changes his/her mind on entry and target points. And after reset, can re-specify those points.

After the user is 'happy' about planning, he can click 'Next' to move to 'Insert' step.

See four snapshots below





## 7.3. Insert:

When you enter this step, additional depth perception lines are overlaid on the mirror alongwith the needle guide overlay. The person inside the MR room, uses the visual cues to perform the needle insertion.

After the insertion is complete, press 'Next' to move to next step.



See two snapshots below

Secondary monitor/mirror display, showing overlay of needle guide and depth perception lines



## 7.4. Validate:

After insertion is complete, confirmation/validation images will be acquired with needle inside the phantom/patient.

In this step, performed outside the scanner room on the laptop, first, the 'Validation' image/volume should be loaded using 'Add Volume' as shown in next five snapshots.









After the 'Validation' image/volume has been correctly added, now the user can click and specify actual entry point, and target point as seen in validation image.



See two snapshots below

Middle Button: Pan; Right Button: Zoom

8



## 7.5. Save experiment!!!

This is very important and mandatory step, which must be performed after each insertion/validation.

This step is again performed at the laptop. The person clicks 'Save experiment' button, and specifies the file name, descriptive of the experiment. A text file is saved consisting of image information, calibration, planning, and validation.

See three snapshots below.





8. New experiment!!

Two options:

8.1. First option: Do another entry/target insertion with current calibration and same 'planning' image

This is done in three steps:

- 8.1.1. Reset Validation, click 'Back' to go to 'Insert' step, click 'Back' to go to 'Plan' step
- 8.1.2. In 'Plan' step, make 'Plan' image as active selected
- 8.1.3. In 'Plan' step, do 'Reset plan', and now you are ready to specify Entry/Target again!

See six snapshots below







Manipulate 3D View
10022\_1-Plan

Γ

8



8.2. Second option: New planning image, hence new calibration, and completely new everything!

This is done in following steps:

- 8.2.1. Click 'Start over' in Validation step, will reset everything, and bring you back to Calibration step
- 8.2.2. Now add new planning image, using Add volume from file menu
- 8.2.3. Make this planning image as active selected planning image, and perform your experiment!

See six snapshots below









