

# Implementing Prostate SBRT in Your Department

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CARTI

# Patient Size and Clearance



- There are certain size requirements for this treatment.
- During CT a ruler is used to measure the dimensions of the patient.
- According to Accuray there must be 33 cm of clearance
- In instances some patients' bellies were large and not able to achieve this number.
- Pads are placed underneath the patient for comfort. However, for bigger patients a thinner pad may be needed, or pad may need to be removed altogether.
- In that case we send them to a different machine for treatment to avoid possible collisions at treatment.

# Treatment Times

- Did not have MLC commissioned when we started treating patients.
- Initially our Prostate Treatments were delivered with IRIS.
- In order to meet strict dose constraints plans were around 40-45 minutes in delivery.
- Once MLC was commissioned our treatment times are typically 30 minutes.
- Patients will have issues when treatment times are long due to bladder and bowel prep issues.
- Doing these plans with IRIS is certainly possible but it makes much harder on everyone due to the extended treatment time.

# Bowel/Bladder Prep

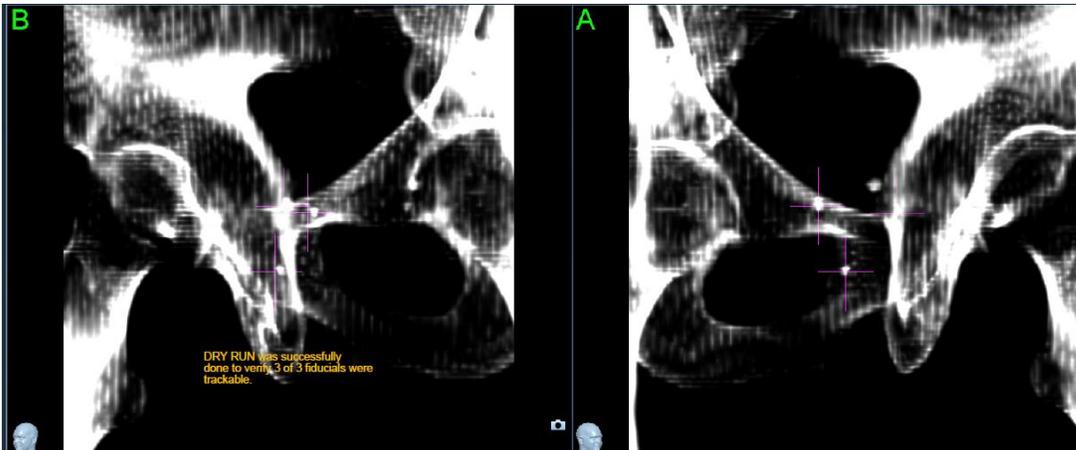
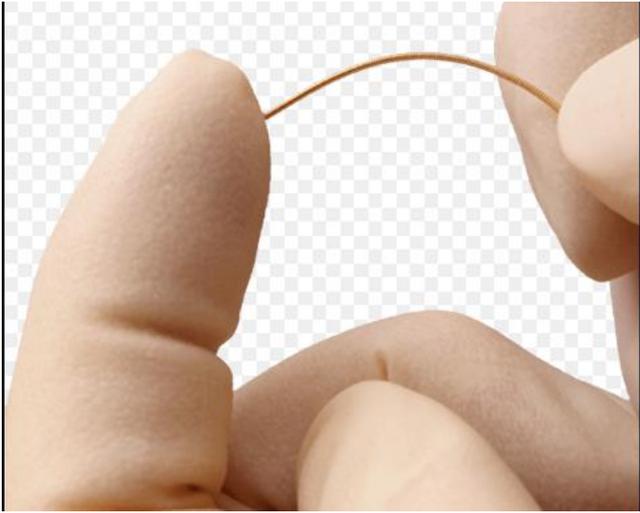
- On day of CT/MRI simulation and Treatment
- Patient is told to do an Enema an hour before they leave the house.
- They are told to urinate and then drink one 12 ounce bottle of water.
- Patient Communication is key:
  - Given written instructions by nursing staff before CT simulation.
  - CT sim therapist calls the patient before hand and gives instructions over the phone.
  - Treatment therapists calls and gives instructions over the phone as well.
  - Patients not following instructions can cause a lot of problems during CT and treatment.

# Bowel/Bladder Prep Issues

- Failure to follow instructions can cause tracking issues during treatment.
- If the patient's bladder is empty, they will have to drink water and wait to be treated.
- If they drink too much water. The patient may not stay still for the full 30-minute treatment or worse may urinate during treatment.
- Due to the bladder filling not being the same as it was at CT can cause the therapists to have to adjust pitch.
- If the rectum/bowel is not empty, it may not track properly.
  - It is common for the therapists to ask the patient to pass gas to help tracking.
  - A patient passing gas during treatment can cause the system to lose track momentarily.
  - Patient may have to get up and use bathroom.
- 30 Minute treatment times are only possible when everything goes right.

# Fiducials

- Currently use Visicoil Fiducials
- CyberKnife System tracks the fiducials in real time by taking x-rays periodically during treatment.
- The robot head can adjust for the movement of the prostate.
- 4 Fiducials are placed. Only 3 are needed. The 4<sup>th</sup> one is extra in case one don't work.



# Fiducial Issues

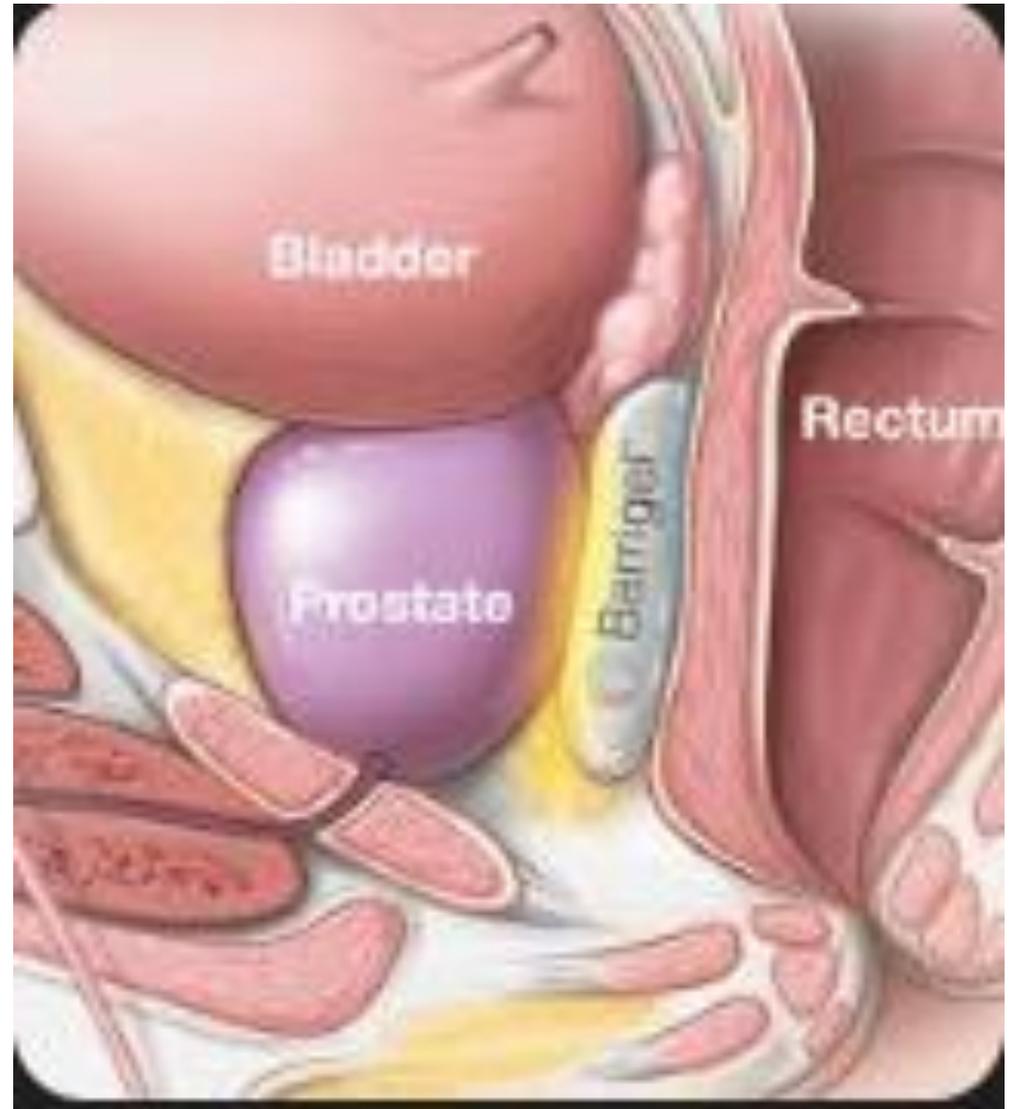
- Number of fiducials: Need at least 3 in order to get 6D corrections. If we have less than 3 we can track we will not proceed.
- Training and Instructions for physicians on how to place fiducials.
  - At our center all our Radiation Oncologists and some Urologists are trained to put these in. However only a select few do these routinely in order to ensure good fiducial placement.
  - Have had issues with outside physicians placing fiducials incorrectly preventing treatment on CyberKnife.
- Had wrong fiducials placed. Example: They were too long and system thought they were 2 fiducials
- To many fiducials placed: A lot of them were to close together.
- Incorrect spacing.
- Fiducial Migration:
- If we have any concerns about the fiducials not being tracked correctly we perform a dry run before treatment.

# Dry Runs

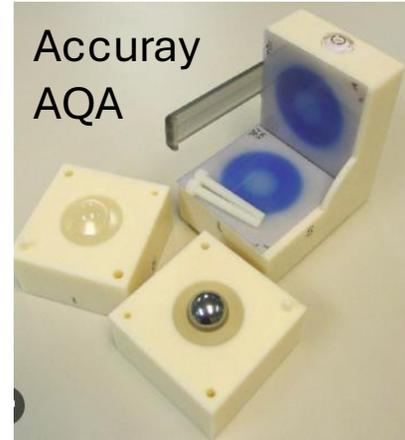
- Immediately after CT. In treatment planning Dosimetry localizes the fiducials.
- If fiducials are improperly placed the Precision Treatment planning system gives a warning or if there are only 3 fiducials.
- In those cases the patient is sent for a dry run.
  - This can wreck the therapists treatment schedule if there aren't openings.
- The patients can get irritated with the dry run.
  - Bowel Prep and CT, Bowel Prep Dry Run, if things don't go well another CT so they can be treated on different machine.
- It is rare, but there has been instances where everything tracked on dry run but didn't track when it came time for treatment.

# Barrigel

- Is a hyaluronic gel, placed between the prostate and rectum.
- The gel helps to displace the rectum away from the high dose treatment area.
- Our physicians like this compared to other products because they are able sculpt and fit this gel better in the patients unique anatomy.
- This is placed at the same time as fiducials.
- The Ct/MRI are then scheduled a week later after this procedure.
- Would be very difficult to achieve PTV and rectum dose constraints without this.
- Bad placement of the barrigel can sometimes cause the rectum to push into the prostate even more.
- In some cases the barrigel can go into Rectal wall.
- However these issues are rare with an experienced physician.



# Daily QA Devices – Targeting Tests



- At CARTI we perform the following Daily Targeting Tests
  - Fixed Panda: Stereochecker
  - IRIS Panda: Stereochecker
  - MLC AQA: SRS Mapcheck
- Currently Stereochecker does not have an MLC Panda test.
- Prefer the Panda tests over AQA because it tests an actual clinical path used for treatment. AQA does not use a clinical path
- The Accuray recommended tests are using a Ballcube phantom with film
  - This test uses film which requires time for placing, scanning, and analyzing film. Not Cool
  - Does not verify targeting of a clinical path.
- If Stereochecker is not working. We use the SRS mapcheck to do AQA for fixed, iris, and MLC.

# Daily QA: Gardenfence Delivery



- Deliver Gardenfence Daily on Stereochecker to get Quantitative Analysis.
- Do not deliver Picketfence because we do not believe in visual inspection.
- Same amount of time to deliver.



Difference Image (with Errors)

Clinic: CARTI  
 Machine: CyberKnife  
 Serial: C0540  
 Study Date: 202601210710  
 Baseline File: Baseline\_GF\_20241118.his

Table 1. Results

Error Number	Leaf Location	Mean Pixel Value
1	BankDefinitionError_Leaf26	276

TG 135.B/3.5.3 MLC Leaf position test (Picket fence test) Visual examination  
**Daily Test**

TG 135.B/3.5.3 MLC Leaf position test (Garden fence test) **Monthly Test**  
 >90% deviations < 0.5 mm, mean deviation < 0.2 mm, all < 0.95 mm

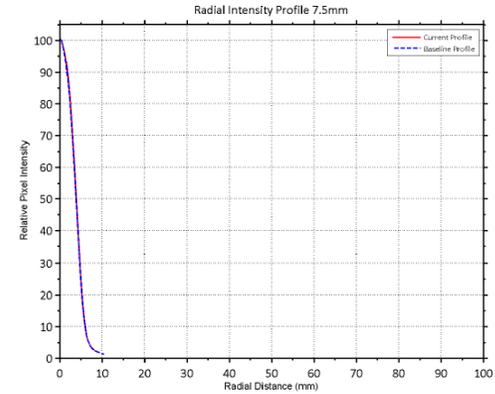
MLC Tests							22 Jan	21 Jan	20 Jan	19 Jan	16 Jan
Mechanical	Garden Fence :: # of leaves 0.004 bw cutuoff	<input type="text"/>	<input type="checkbox"/>	Not Done		0	0	2	1	0	0
Mechanical	Garden Fence :: # of leaves 0.0073 bw cutuoff	<input type="text"/>	<input type="checkbox"/>	Not Done		0	0	0	0	N/A	
Mechanical	Garden Fence	<input type="radio"/> Fail <input type="radio"/> Pass	<input type="checkbox"/>	Not Done		Pass	Pass	Pass	Pass	Pass	

# IRIS field Size Check

- Test is recommended to be done monthly.
- However we were doing in Daily because it was quick and easy to do on Stereochecker.
- We have recently backed off and are only doing it once a week.
- 1 plan with multiple field sizes is delivered to this devices and analysis is automatically done.
- We can also perform this test on the SRS mapcheck.
- The SRS mapcheck is our backup in case the Stereochecker is not working.

Iris - 7.5 mm

Figure 2.1. Radial Intensity Profile



Baseline Image: 20231111421\_07\_5mm

Table 2.1. Results

	Current	Baseline	Difference	Tolerance	Pass/Fail
Field Width (mm)	7.68	7.63	0.05	0.5	Pass
Penumbra (mm)	2.75	2.83	-0.08	0.3	Pass
Flatness (%)	7.00	7.40	-0.40	1.00	Pass

Clinic: CARTI  
Machine: CyberKnife  
Serial: C0540

Table 1.1. Results

Nominal Diameter (mm)	Field Width	Penumbra	Flatness
7.5mm	Pass	Pass	Pass
10.0mm	Pass	Pass	Pass
12.5mm	Pass	Pass	Pass
15.0mm	Pass	Pass	Pass
20.0mm	Pass	Pass	Pass
25.0mm	Pass	Pass	Pass
30.0mm	Pass	Pass	Pass
35.0mm	Pass	Pass	Pass
40.0mm	Pass	Pass	Pass
50.0mm	Pass	Pass	Pass
60.0mm	Pass	Pass	Pass

# Daily QA – Output SRS Profiler

- Measurements done with SRS Profiler mounted in bird cage.
- Allowed us to measure Output and Flatness/Symmetry
- Initially values were entered and tracked in an excel spreadsheet.
- They are now tracked in our Radmachine software.
- Had temperature/pressure issues with this device.
  - Room temperature was not stable.
  - Caused failures that weren't failures. Physics had to come in early in the morning and run the monthly setup many times.
- Therapists did not like taking this device on and off.

# Daily QA – Output SRS Mapcheck

Hospital:

Physicist: CC1CK1

Date: 22 Jan 2026 Time: 07:05:51



## Beam QA Analysis

Beam QA movie file: 22-Jan-2026-A.smcm

	Current	Baseline	Difference	Alert	Error	Pass/Fail
Flatness (Area)(%)	4.98	4.88	0.10	1.50	2.00	Pass
Symmetry (Area)(%)	0.14	0.48	-0.34	1.50	2.00	Pass
CAX Output (cGy)	99.29	99.14	0.14	1.00	2.00	Pass
	Flatness (%)		Symmetry (%)			
X	4.18		0.22			
Y	3.93		0.19			
Positive Diagonal	6.13		0.03			
Negative Diagonal	5.67		0.13			

- A couple of years ago SNC updated their software to allow output and flatness/symmetry checks to be done with this device.
- We recently switched to using this device.
- Advantages.
  - 1 less device: Therapists were already using it for MLC AQA.
  - Same setup as MLC AQA.
  - No longer had to install in bird cage.
  - Does Temperature Pressure corrections.
  - Better detector resolution than SRS profiler.

TG 135/III.C.1

AQA test (alternate through existing collimator systems.)

<0.95 mm from  
baseline

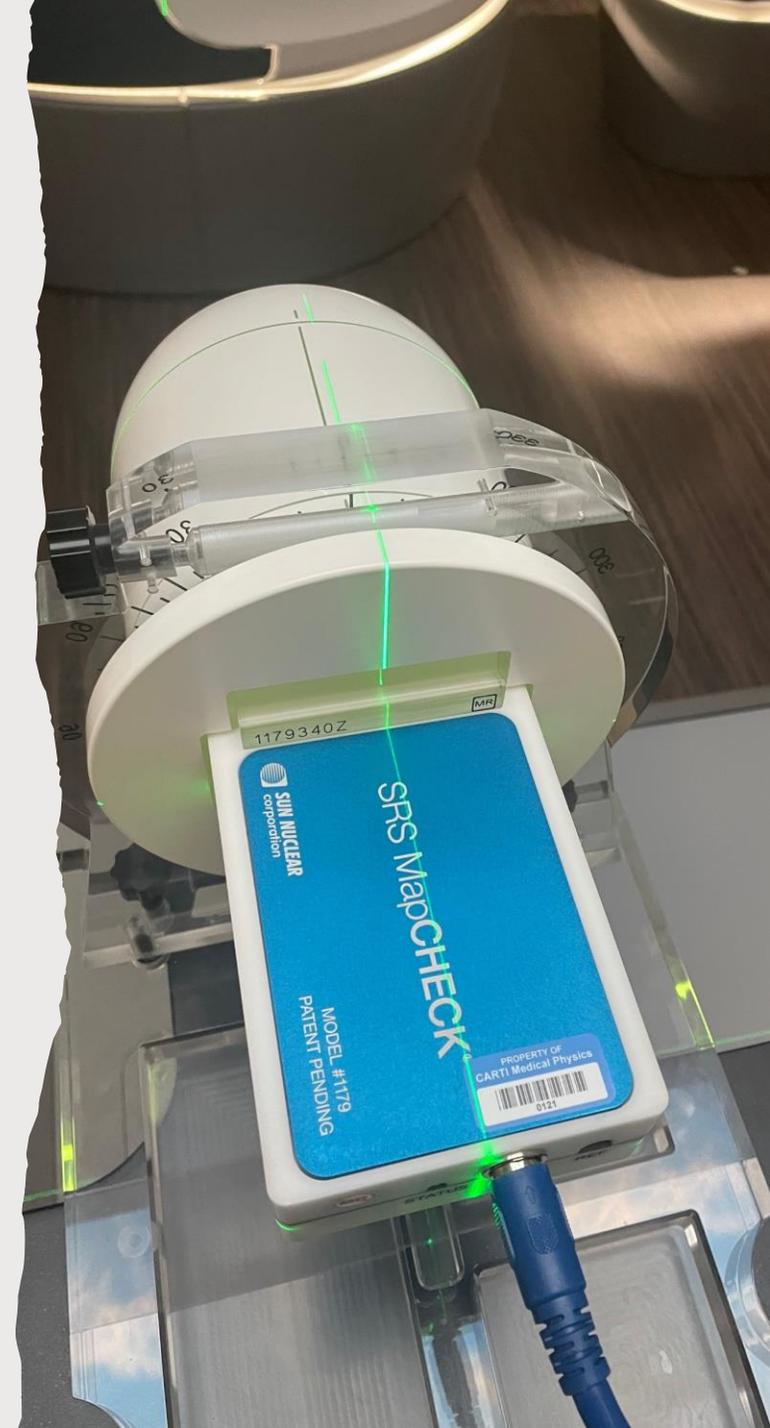
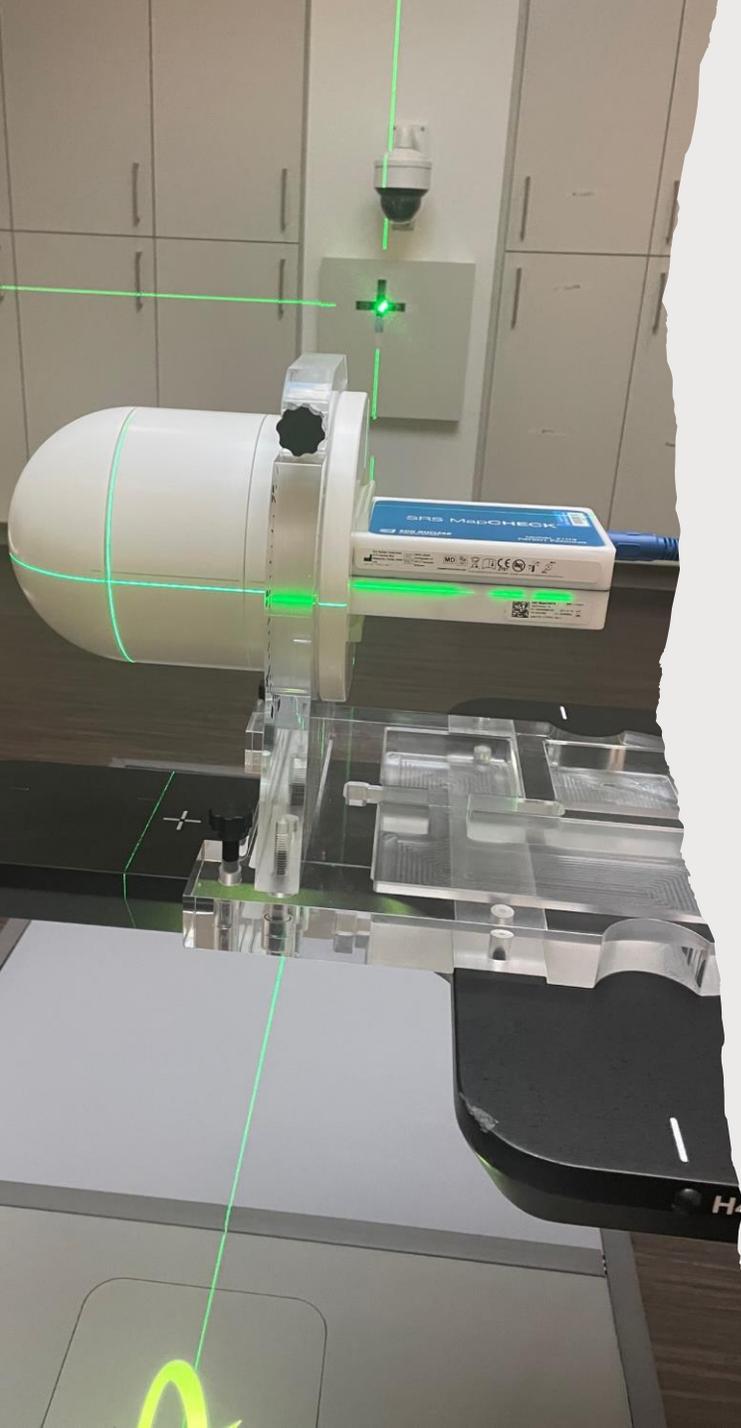
TG 135 B/2.6

# Therapists complained Morning QA was to long

- Typically we will use a fixed, iris, and MLC everyday for treatment.
- To be safe we had the therapists run targeting tests for each of these everyday as long as they were being used for treatment that day.
- However after a couple of years of data showing the machine was stable we now only QA 1 head per day.
- Reduced QA time by 30 minutes
- We had backing from TG-135b to do this is as well.
- The therapists hates Physics less now. LOL

# Prostate IMRT QA

- All our Prostate treatments are planned with MLC.
- They are modulated treatments which require Patient Specific QA.
- Requires a lot of machine time.
- QA is typically 30-40 minutes per patient.
- Not all QA devices are compatible.
  - Has fiducials for tracking
  - Resolves Angular dependence.
- Our Qas pass extremely well.
- 100% of points passing 2%/2mm criteria in most cases



# Conclusion

- The purpose of this talk was to show you some issues CARTI has faced when performing SBRT Prostate with CyberKnife System such as:
  - Patient size
  - Fiducial and Barigel Placement
  - Treatment Times
  - How important Bladder and Bowel Prep is for successful treatment
  - How the Therapists run Daily QA here at CARTI which is much different then doing the Standard Accuray way.
  - Discussed IMRT QA of Prostate SBRT treatments