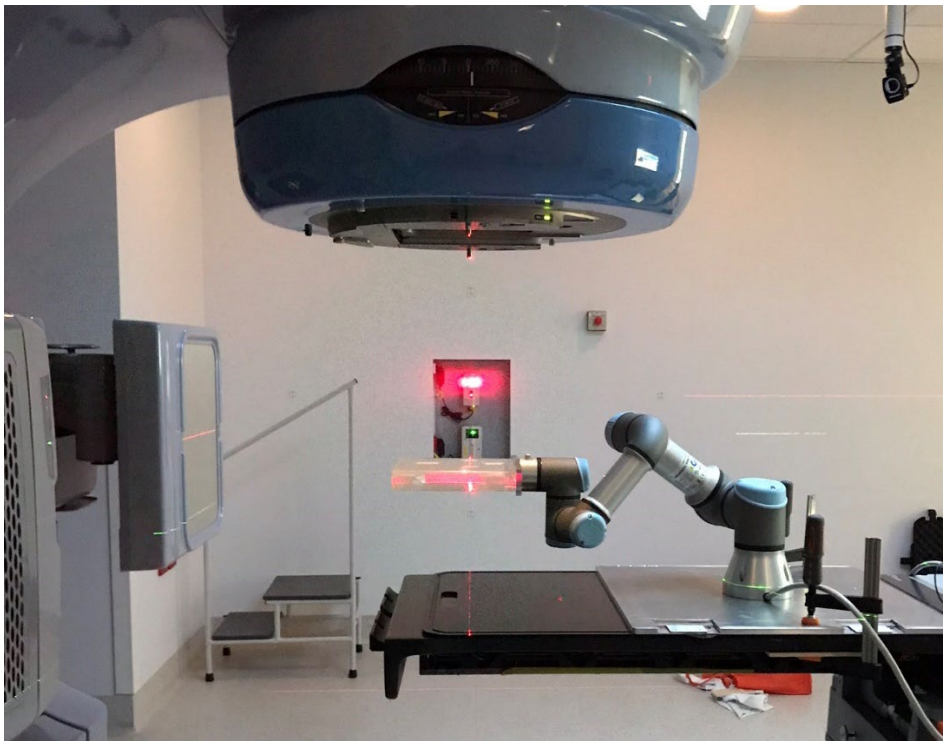
KIM QA Instructions

Frequency of the KIM QA tests: KIM QA tests should be performed every month at each KIM site or after any KIM/CDOG/hardware update.

Experimental setup:

1. Remove any filter attached to the OBI source.
2. Move couch LAT to 0.0.
3. Follow ‘Getting Started’ robot manual to setup the robot and run the robot software.
4. Place the robot on the treatment couch and mount the phantom on the robot to align the indicated black line to room lasers as shown below.
5. Connect the robot to the laptop containing the software and launch the software. Run a trace to make sure that there is enough room for the robot to move.



Common procedures for all QA tests:

Position the phantom

1. Deploy OBI detector to 80cm VRT and track.
2. Rotate gantry 360° to check the gantry clearance

3. Select a patient plan
4. Perform kV/kV match in clinical mode: one image at Pelvic-LAT Large and the other at Pelvis-AP Normal. 2D analysis -> apply shift

Activate intrafraction kV Imaging

1. OBIPC -> Start the OBI Application (if it is not already open)
2. OBIPC -> OBIApp -> Switch from Verification to Maintenance Mode (username and password required)
3. OBIPC -> OBIApp -> On the Maintenance Mode screen:
    a. Select fluoroscopy mode (eye button)
    b. Deselect Track
    c. Reset timer
    d. Set exposure parameters to: kV = 120; mA = 80; ms = 13
    e. Set the kV field size to 6cm × 6cm
    f. Check that the SAD = 100cm; VRT = 80cm
    g. Check that the imaging frequency is 10.0 fps
4. Switch to the iTools PC by pressing the Input button on the OBI monitor
5. ResearchPC -> Activate iTools
6. ResearchPC -> iTools -> On CH1:
    a. Select the save only when triggered button.
    b. Select the record button.
7. ResearchPC -> iTools -> Make sure that:
    a. The Save Path is D:\KIMImages.
    b. The fps is 10 fps.
8. ResearchPC -> Activate the KIM Gating software
9. ResearchPC -> KIMGating -> The patient file selection window will pop up. Select the correct patient file – rophkim11_centroid.txt.
10. ResearchPC -> KIMGating -> Enter current couch position. Double-check this with the RT at the linac console and click OK.
11. Move the gantry to the correct starting angle for the pretreatment arc.
12. Acquire a single kV image (foot pedal or handheld button). Check if the red crosses are inside the green squares for each marker. If not, then restart the KIM software and load the correct patient file. If yes, proceed to the next step

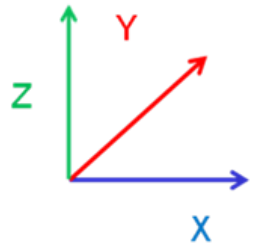
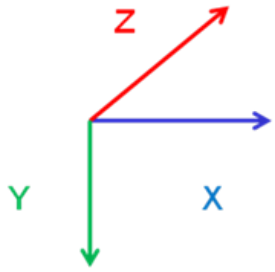
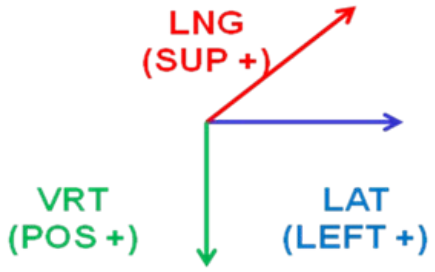
1. Static localization form

Date	
Physicist	
Linac	
KIM software version	
Initial couch position	VRT: LNG: LAT:

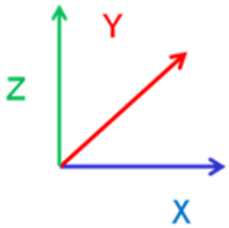
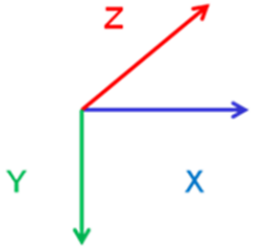
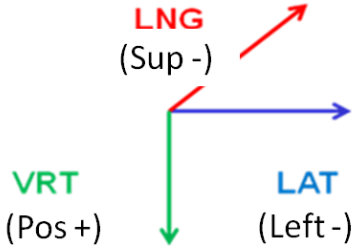
Direction (5mm)	**Robot position (mm)**			**Comments**
	X	Y	Z	
Initial	0.0	0.0	0.0	
+5mm Sup	0.0	5.0	0.0	
-5mm Sup	0.0	-5.0	0.0	
+5mm Left	5.0	0.0	0.0	
-5mm Left	-5.0	0.0	0.0	
+5mm Ant	0.0	0.0	5.0	
-5mm Ant	0.0	0.0	-5.0	

Notes:

KIM/Robot and Varian coordinate systems

Poulsen for KIM / IEC /Robot	Varian Eclipse TPS / DICOM	Varian Couch Coordinates
		

KIM/Robot and Pinnacle/Elekta coordinate systems

Poulsen for KIM / IEC /Robot	Pinnacle (DICOM)	Elekta Couch Move Assistant
		

Static localization procedure

Need:

- Robot and its components
- Phantom
- Scheduled arc plan

Process:

Acquire pretreatment arc and treatment arc with KIM for Initial position, Superior, Inferior, Left, Right, Anterior and Posterior directions (move Robot 5 mm towards each direction from original position).

Pretreatment arc

1. Linac Console
   a. Mode up
   b. Position the gantry at 300°
   c. Press kV imaging button simultaneously with the two motion enable keys and rotate the gantry to 181°
2. Once gantry hits treatment starting position, release kV imager button

Treatment Arc (full arc)

1. Linac Console
   a. Key Enable
   b. Press Image then the kV imager button
   c. When the kV imaging beep is heard, immediately press Beam ON
2. ResearchPC -> KIMGating -> See if KIM detected tumour motion is as expected. Continue the beam even it says beam off.
3. After each acquisition, rename the CH1 folder and create a new empty CH1 folder

Criteria:

Mean and SD of difference between programmed and detected amplitude of motion is < 1mm and 2 mm respectively.

2. Dynamic localization form

Date	
Physicist	
Linac	
KIM software version	
Initial couch position	VRT: LNG: LAT:

Trajectory	Gating event?	Comments
Stable		
Continuous		
Persistent Excursion		
Transient Excursion		
High-frequency Excursion		
Erratic Behaviour		

Notes:

Dynamic localization procedure

Need:

- Robot
- Phantom
- Scheduled arc plan
- Trajectories

Process:

Acquire pretreatment arc and treatment arc with KIM for all the motion trajectories.

Pretreatment arc

1. Linac Console
   a. Mode up
   b. Position the gantry at 10°
   c. Press kV imaging button
   d. When the kV imaging beep is heard, simultaneously start robot trace and rotate the gantry to 250°
2. Once gantry hits treatment starting position, release kV imager button

Treatment Arc

1. Linac Console
   a. Key Enable
   b. Press Image then the kV imager button
   c. When the kV imaging beep is heard, immediately press Beam ON, gantry returns at 110°
2. ResearchPC -> KIMGating -> Pay close attention to the Action status during treatment. Tick the table if there is a gating event but continue the treatment till the end of the arc.
3. Rename the CH1 folder and create an empty CH1 folder.
4. Reset time and iTools

Criteria:

Mean and SD of difference between programmed and detected amplitude of motion is <1 mm and < 2 mm respectively.

3. Treatment interruption form

Date	
Physicist	
Linac	
KIM software version	
Trajectories folder	
Initial couch position	VRT: LNG: LAT:

Trajectory	Acquired?	Couch position	VRT (cm)	LNG (cm)	LAT (cm)
Continuous Drift		1			
		2			
		3			
		4			
Persistent Excursion		1			
		2			
		3			
		4			
Transient Excursion		1			
		2			
		3			
		4			
Erratic Behaviour		1			
		2			
		3			
		4			
		5			

Notes:

Treatment interruption procedure

Need:

- Robot
- Phantom
- Scheduled arc plan
- Trajectories
- Activate remote couch shifts. An authorized ROMP is required for this.

Process:

Pretreatment arc

1. Linac Console -> Do the following:
   a. Mode up
   b. Position the gantry at 10°
   c. Press kV imaging button
   d. When the kV imaging beep is heard, simultaneously start robot trace and rotate the gantry to 250°
2. Once gantry hits treatment starting position, release kV imager button

Treatment Arc

1. Linac Console
   a. Key Enable
   b. Press Image then the kV imager button
   c. When the kV imaging beep is heard, immediately press Beam ON, gantry returns at 110°
2. Linac Console
   a. Key Enable
   b. Press Image then the kV imager button
   c. When the kV imaging beep is heard, immediately press Beam ON
3. ResearchPC ->KIMGating -> Continue: Pay close attention to the Action status during treatment. This should normally be Continue.
4. ResearchPC ->KIMGating -> Warning: Prepare to Beam Off and pause kV acquisition.
5. ResearchPC -> KIMGating -> Beam Off:
   a. Beam Off then key off.
   b. Pause kV acquisition.
6. ResearchPC -> KIMGating -> Double-click on the image on the UI. The couch shift screen below will pop up. New couch positions (orange) will be displayed.
7. Linac Console ->
   a. Press F2 and enter current gantry angle.
   b. Enter new couch position.
   c. Double check new couch position with KIMGating UI in step 5.
8. ResearchPC -> KIMGating:
   a. Click on Couch Moved.
   b. Then click on Yes.
9. Acquire kV for 5 seconds and monitor KIMGating Action.
   a. If Action is Continue, key enable and Beam On.
   b. If Action is Warning, go to Step 3.

c. If Action is Beam Off, go to Step 4.
d. Continue this indefinitely until another gating event is reached. Then repeat step 4 onwards.

10. ResearchPC -> KIMGating -> At the end of treatment, close KIMGating.

Criteria:

1. KIM software does not crash during the entire procedure
2. Mean and SD of difference between programmed and detected amplitude of motion is < 1 mm and <2 mm respectively.

Packing up

Gantry at 0º, retract arms

Packing up robot

Gantry rotate to 120º and collimator at 90º

Rotate MV beam machine key to vertical

MLC power to off

Turn off 4DTC

Turn off OBI