Minutes

Discrete Positioning and Delivery Workflow (DPDW)

Conference Call

May 22, 2018

10:30am – 12:00pm EST

DPDW Subgroup Chair:

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IHERO Task Force Co-Chairs

**Bruce Curran, MEng, FAAPM, FACMP, FACR**

Bridget Koontz, MD

**Mission Statement:** *The American Society for Radiology Oncology (ASTRO) has formed a multi-society Task Force to undertake an initiative to promote the Integration of the Healthcare Enterprise (IHE) – Radiation Oncology (RO), fostering seamless connectivity and integration of radiotherapy equipment and the patient health information systems. The Task Force will include members from ASTRO, RSNA, American Association of Physicists in Medicine (AAPM), the American College of Radiology (ACR) and the Medical Imaging and Technology Alliance (MITA). In addition, members of the International community have also been invited to participate in IHE-RO. The IHE-RO Task Force, in close collaboration with radiotherapy product manufacturers, will develop appropriate integration profiles for radiation therapy and setup a demonstration of seamless communication among the full array of radiotherapy products.*

**In Attendance:**

Jill Moton (AAPM)

Thomas Schwere (Varian)

Gergely Parditka (Brainlab)

Sanjay Bari (Elekta)

Harold Beunk (ICT)

# Call to Order

The meeting was started at 10:30am EST.

# Design Topics

## Monitorig Use Case

Gergely gathered and presented a list of information required in PPMS for the monitoring use cases (based on Brainlab ExacTrac which does more than monitoring only):

CT image data and RT Structure Set

* It is used to generate DRRs for a certain beam/isocenter position to compare them against the X-ray images (during treatment delivery)
* It is used for automatic marker detection and manual implanted marker detection (here the PTV could be interesting as well)

RT Plan

* The planned isocenter position
* The planned couch position and rotation
* The planned gantry rotation angle (start, stop, direction)

From pre-positioning step

* The actual isocenter position
* The actual couch position and rotation

Acquired from the LINAC

* Plan loaded/unloaded event
* Beam loaded/being treated/unloaded status
* LINAC is ready for radiation (starting the monitoring is only allowed after this event)
* The actual couch position and rotation
* Capabilities of the couch (4 or 6 Degrees of Freedom)
* The actual gantry rotation angle 🡪 to determine what X-Ray system to use for the acquisition (e.g. gantry blocks the view of X-Ray system1 for certain angles and vice versa)
* Gating information (beam hold/interrupted)
* MU delivered (Currently used as a safety check that the beam is really on hold, but it may also be interesting how much dose is remaining from the current beam)

Sent to the LINAC

* Approve beam
* Gating role request (the PPMS registers itself on the TSM/TDD as a monitoring device)
* Beam hold/unhold request
* Beam interlock set/release request
* Couch move request
* Gantry rotation request (outside beam delivery, to command the gantry to a certain angle to free the view of the X-Ray system)

There was discussion about how PPMS knows how the patient was positioned during the initial patient positioning step. PPMS needs to know this to set the reference for monitoring. Goal of the initial positioning step is to align the patient according to the planned isocenter position. This usually happens with manual user interaction by aligning acquired and reference image. Note that focus is on aligning the target, other landmarks could be off. PPMS somehow needs to know that initial registration, especially in the case where it acquires X-Rays and compares them against automatically created DRRs.

The roles/responsibilities between PPMS and PPDS seem to be unclear. How is it ensured that they don’t get out of sync? PPMS needs to know the capabilities of the couch (4DoF vs. 6DoF). PPDS is supposed to reduce the optimal result from the PPRS according to the capabilities of the couch (e.g. from 6DoF to 4DoF). This results in a different reference position for the PPMS.

Getting the actual gantry angle is out of scope of the UPS protocol. That’s on a similar level as the beam hold line and probably requires proprietary/manufacturer specific interfaces. The UPS only controls the task (beam by beam in the context of DPDW) to be performed by passing all required input parameters. Any other dynamic aspect required during execution of that task is out of scope of the UPS (this should be used as a guideline for what needs to be excluded from the UPS protocol).

If there are a lot of variations on the input information for the different monitoring systems (e.g. PPMS A creates DRR from the plan/structure set, PPMS B cannot create DRRs but rather needs them as input) we could consider using KOS (Key Object Selection) Document as an input parameter. Should we come up with different classes of PPMS? Every class would have a dedicated set of input information. Another approach would be to handle to this bilaterally between two vendors based on DICOM conformance statements. On the other hand, the monitoring instruction in Supplement 160 was supposed to cover all different monitoring scenarios. This is probably still too ambitious… In any case the TSM is transparently passing the information provided from the TMS in the monitoring UPS to the PPMS.

How to communicate monitoring tolerances from TMS to PPMS? Harold proposes to not explicitly model this in the UPS but rather use the concept of protocols instead, i.e. lookup configured tolerances (and potentially other parameters) locally at the PPMS based on protocol IDs.

Harold brought up how explicit the UPS workitem codes are. At the moment the workitem codes specified in the DICOM standard are very generic. Should we introduce more specific workitem codes (e.g. monitoring with X-Rays)? Every specific workitem code would then have a pre-defined set of required input parameters. Still very detailed monitoring parameters should be covered using monitoring protocol IDs (protocol is stored on the PPMS). TMS of course has to know the monitoring protocol IDs. During preparation the user can select from the available protocols (ID and description). Protocol IDs should be coded (Code Value, Code Meaning). There could also be two protocols (one for the overall monitoring part and one for the monitoring tolerances).

Do we need a dedicated actor for gating use cases? Or can this be considered as a sub use case of the PPMS? It certainly requires a dedicated workitem code. Gating also requires to first detect the breathing and the react on that. Both monitoring and gating first requires to detect motion (either because of respiration or anything else) and second perform a certain action (gating or beam-hold) based on that detected motion. Not all gating devices are patient position monitoring devices. DPDW currently doesn’t say anything about gating. ExacTrac is a special device that can do both monitoring and gating. Gating could be specified either by a dedicated workitem code or by a different protocol ID. Compared to monitoring, gating on ExacTrac doesn’t require additional input information.

Requests to move certain axes on the TDD/Linac could be done using the N-SET version of the N-GET service that we’re trying to introduce for the RD-DPD-201 (Retrieve Device Position Information).

Gergely mentioned that we should describe the role of the monitoring system more clearly. Where are the borders between the monitoring system and the positioning system? Harold argued that the role of the actor is clearly defined. This is more about what parts of ExacTrac belong to which actor as ExacTrac plays both actors.

The question came up again how to determine the reference position in PPMS (in particular if the patient was initially positioned differently compared to the planning situation because of limitations of the couch)? This should be handled through tolerances only. That’s exactly the role of the PPMS, it should compare the actual patient position against the planned position and prevent treatment if out of tolerance. Setting the reference position to the current position and then monitoring against that position is a different use case (different workitem code, monitoring from new reference position, reference position is acquired between positioning and monitoring). Output of the positioner could be the new reference that is forwarded as input to the PPMS. Usually the output of step 1 is the input for step 2.

# Adjournment

The meeting was adjourned at 12:00am EST.

Appendix A: Administration and Process Information

Documents are published at the following locations. If you have problems in accessing the document, please contact the Chair (thomas.schwere@varian.com).

## Process of Authoring:

Steps:

1. Download a local copy of the document from locations below
2. Open this copy and remove all change bars
3. Ensure, that Changes Bars are switched on
4. **Make your changes**
5. Provide the updated version to the Chair

##  Location of Documents:

DPDW Subgroup Minutes

<http://wiki.ihe.net/index.php?title=RO_DPDW_WorkingGroup>

DPDW Profile

The DPDW Profile is an IHE-RO document.

The current version is available in the IHE-RO Org Wiki:

<http://www.ihe-ro.org/>

Please find the current document under this page:

<http://www.ihe-ro.org/doku.php?id=doc:profiles>

Supp 160

DICOM Supplement 160 (Patient Positioning and Workflow) in s DICOM WG-07 document.

The current version is available at the DICOM ftp server:

ftp://d9-workgrps:goimagego@medical.nema.org/MEDICAL/Private/Dicom/WORKGRPS/WG07/Sup/Sup160\_PatientPositioningAndWorkflow

##  Mailing List:

The mailing list for the DPDW subgroup is:

2018.iherodpdw@aapm.org

Appendix B: Task Assignments

Per end this TCon (2015-01-27).

| **No** | **TX / Area** | **Old Number** | **Title** | **Group** | **Owner** |
| --- | --- | --- | --- | --- | --- |
| 1 | ./. | ./. | Use Case Delivery-Device Independent Imaging |   | David Wikler |
| 2 | RO-DPD-200 | RO-DPD-01 | Worklist Query for Positioning Acquisition | Acquisition | Martin Vonach |
| 3 | RO-DPD-201 | RO-DPD-02 | Retrieve Device Position Information | Acquisition | Martin Vonach |
| 4 | RO-DPD-202 | RO-DPD-03 | Request RT Patient Position Correction | Correction | Martin Vonach |
| 5 | RO-DPD-203 | RO-DPD-04 | Store RT Patient Position Modification Instruction | Correction | Martin Vonach |
| 6 | RO-DPD-204 | RO-DPD-05 | Store RT Repositioning Results to Object Storage | Correction | Martin Vonach |
| 7 | RO-DPD-205 | RO-DPD-06 | Worklist Query for Repositioning | Correction | Martin Vonach |
| 8 | RO-DPD-206 | RO-DPD-07 | Notify on Radiation Delivery Status Change | Delivery | Thomas Schwere, Sanjay Bari |
| 9 | RO-DPD-207 | RO-DPD-08 | Retrieve RT Patient Position Correction Instruction | Correction | Martin Vonach |
| 10 | RO-DPD-208 | RO-DPD-09 | Subscribe/Unsubscribe to Treat UPS Status | UPS Notification | Thomas Schwere |
| 11 | RO-DPD-209 | RO-DPD-10 | Notify on Radiation State | Delivery | Thomas Schwere, Sanjay Bari |
| 12 | RO-DPD-210 | RO-DPD-11 | Retrieve Positioning Acquisition Results | Registration | Chris Pauers |
| 13 | RO-DPD-211 | RO-DPD-12 | Worklist Query for Positioning Registration | Registration | Chris Pauers |
| 14 | RO-DPD-212 | RO-DPD-13 | Worklist Query for Position Monitoring | Monitoring | Stephen Phillips  |
| 15 | RO-DPD-213 | RO-DPD-16 | Store Monitoring Results to Object Storage | Monitoring | Stephen Phillips  |
| 16 | RO-DPD-214 | RO-DPD-17 | UPS Final Update at Session Termination | Framework | Thomas Schwere, Sanjay Bari |
| 17 | RO-DPD-215 | RO-DPD-18 | UPS Completed / Cancelled at Session Termination | Framework | Thomas Schwere, Sanjay Bari |
| 18 | RO-DPD-216 | RO-DPD-19 | Indicate Ready for Monitoring | Monitoring | Stephen Phillips  |
| 19 | RO-DPD-217 | RO-DPD-20 | Notify Device to start UPS | UPS Notification | Thomas Schwere, Sanjay Bari |
| 20 | RO-DPD-218 | RO-DPD-21 | Create Positioning Acquisition and Positioning Registration UPS | Workflow | Thomas Schwere |
| 21 | RO-DPD-219 | RO-DPD-22 | Create Treat UPS and Radiation Delivery Instruction for Continuation | Workflow | Thomas Schwere |
| 22 | RO-DPD-220 | RO-DPD-23 | Notify Treatment Session Actors on Starting Session | UPS Notification | Thomas Schwere, Sanjay Bari |
| 23 | RO-DPD-221 | RO-DPD-24 | Notify Device to stop UPS | UPS Notification | Thomas Schwere, Sanjay Bari |
| 24 | RO-DPD-222 | RO-DPD-25 | UPS Progress Update for Discrete non-Treatment Steps | UPS Notification | Thomas Schwere, Sanjay Bari |
| 25 | RO-DPD-223 | RO-DPD-26 | Worklist Query for Positioning Correction Reconciliation | Registration | Chris Pauers |
| 26 | RO-DPD-224 | RO-DPD-27 | External Verification | External Verification | Sanjay Bari |
| 27 | RO-DPD-225 | ./. | Notify Device to resume UPS  | Monitoring | Stephen Phillips  |
| 28 | RO-DPD-226 | ./. | Create new Positioning UPS | Monitoring | Stephen Phillips  |
| 29 | RO-DPD-227 | ./. | UPS Final Update after Positioning Information Acquisition | Workflow |  |
| 30 | RO-DPD-228 | ./. | UPS Final Update after Treatment Interruption | Workflow | Thomas Schwere |