Manage TPS in Research and Education

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Objectives:

- Understanding the different requirement for non-clinical
- Gain enough knowledge/skills for own practice
Outline:

- Special Requirement
- Typical setup
- Data Sharing
- Protocol and Template sharing
- Backup/Restore
- Upgrade

- Training Steps
- Clinical Protocol Accreditation and Submission
Why do we need it?

- **Education**
  - Medical physics graduate students
  - Medical physics residents
  - Medical physics PostDocs
  - Medical residents

- **Beta site**
  - Site visitors
  - New version/feature trials

- **Clinical Research**
  - Phantom study
  - Patient research
Special Requirement

- Not for clinical use
- No or limited service support

- Full functionality
- New technique trials
- Mimic/use real clinical environment
- Some degree of isolation from clinical

Access requirement
  - Large number of users
  - Simultaneous access in limited time
  - Error prevention
  - Crash frequently
Typical Setup

- Vendor supplied the research/education only workstations
  - Typically single workstation/server setup
  - Full functionality
  - No clinical patients can be planned and treated

- Dedicated partial isolation from clinical use
  - institution/department/patients level
  - commissioned machine level

- Mixed use
  - Same commissioned machine
  - Separate plan/trials or course/plans
User management

- Generic account
  - Easy to manage
  - Dedicated user for students
  - Student can easily share

- Individual account
  - Take time to manage users
  - Especially disable user after graduation
  - Student still can access other’s plan
Test Plan

Plan starting point
- Dicom Image + Contours
- Partially finished plan

Plan Evaluation
- Reference plan
- Dose constraint
- Evaluation discussion

Clean up
- Delete interim/non-ideal test plan
- Delete all plans after graduation
- Disable account or delete account
Backup and Recovery

**Dedicated system**
- System backup after upgrade
- Sample patient, plan or imaging data
- User plan can be deleted after completion
- Eclipse, clone the whole disk after setup
- Pinnacle, ufsdump/ufsrestore also works
- User should be responsible backup own plans

**Shared system**
- System backup as part of clinical use
- Only sample patient, plan or imaging data need to backup separately from clinical one
- User test plan should not be included in clinical backup, individual plan backup can be done by user.
Upgrade

- Dedicated system
  - Typically install fresh new system
  - Restore the commissioned machines
  - Restore the sample patients as needed

- Shared system
  - Test if the backup can be restored to new version
  - Finish clinical upgrade first
  - Create required isolation
  - Restore the machine and sample patient as needed
Patient Data Sharing

- Non-clinical to clinical
  - Not supported

- Clinical to non-clinical
  - Anonymize might be needed

- Same system different version
  - Eclipse
  - Pinnacle

- Different system
  - Pinnacle to Eclipse
  - Eclipse to Pinnacle
  - BrainLab to Pinnacle

- Same institution
  - Redundancy reduction

- Different institution
  - HAPPA issue
Protocol and Template Sharing

- **Pinnacle**
  - Protocol is a group of script,
  - Can be copied, edited and loaded

- **Eclipse**
  - Template is xml file
  - Can be exported and imported
  - Be aware of version difference, always double check.
Why do physicists need planning training?

- When short of dosimetrist staff
- Emergency case without dosimetrist support
- Difficult cases that dosimetrist have not time to handle
- New program setup
- Plan check/Chart Check
- Some junior physicist position with job duty as planner
Graduate Student Training Steps

- Didactic Lecture
  - Planning principles
    - Beam setup for conformance and gradient
    - Dose algorithms
    - Optimization algorithms
  - Planning process
    - Imaging, contour, Rx, plan, evaluation
  - Typical approach for disease site
    - Bilateral whole head, Tangential breast, CSI, etc

- Hand-on lab
  - TPS operation
  - Sample patient for typical disease sites

- HDR/SRS/TBI/TSEI planning?
- Commissioning?
Physics Resident Training Steps

- Phantom study --- find the TPS planning options and limitations
  - TG-119 test case
  - RTOG dry run case
  - RTOG phantom study

- Typical training test case --- clinical planning skill
  - Sequence: prostate, lung, brain, breast, head&neck
  - Case number: how many is enough?
  - planning need to consider simulation and treatment

- Uncommon training test case --- experience to handle difficult cases
  - Metal artifact: like prosthesis, breast expander, dental filling
  - Simulation mistake: arm in beam, non-bladder control, object on patient
  - Dose limiting: pacemaker/ICD, fetus, gonad
  - Electron: small field, large oblique, extended SSD, backscatter for keloid
  - Breast: Flash, breast expander
  - Nose/extremities: water, rice, bolus

- Real life patient plan --- under pressure
  - Simulation error
  - Non-ideal image quality
  - Non-realistic contour
  - Time pressure
  - Compromise of coverage and OAR
  - Interaction with MD

- Projects development --- integrated process
  - New program setup
  - New patient specific QA device
  - RTOG protocol accreditation
Physics Resident Training Steps

- Phantom study --- find the TPS planning options and limitations
  - TG-119 test case
  - RTOG phantom planning
  - RTOG dry run case

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Physics Resident Training Steps

- Uncommon training test case --- experience to handle unusual cases
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  - Dose limiting: pacemaker/ICD, fetus, gonad
  - Electron: small field, large oblique angle, extended SSD, backscatter for keloid
  - Breast: Flash, breast expander
  - Nose/extremities: water, rice, bolus
  - Simulation mistake: arm in beam, non-bladder control, object on patient, accessory/setup error
  - Treatment consideration: couch kick clearance, electron cone clearance, couch side rail/bar, gantry angle sorting
Physics Resident Training Steps

What is the bright object?

Pacemaker.

AAPM TG-34, Management of Radiation Oncology Patients with Implanted Cardiac Pacemakers
Physics Resident Training Steps

What is the bright object?

Prosthesis.

AAPM TG-63; Dosimetric considerations for patients with HIP prostheses undergoing pelvic irradiation.
Physics Resident Training Steps

What is the extra object on top of abdomen?

A bolus slab was put on patient abdomen, and RPM tracking reflector was taped on top.
Physics Resident Training Steps

What is the dark area?
Super stuff bolus?
Physics Resident Training Steps

- Real life patient plan --- under pressure
  - Simulation error
  - Non-ideal image quality
  - Non-realistic contour
  - Compromise of coverage and OAR
  - Time pressure
  - Interaction with MD
  - Schedule coordination with physicist and therapist

- Projects development --- integrated process
  - New program setup
  - New patient specific QA device
  - RTOG protocol accreditation
  - Commissioning
  - Upgrade QA
Clinical Protocol Accreditation

- **NRG Oncology**
  - **NSABP**
    - The National Surgical Adjuvant Breast and Bowel Project
  - **RTOG**
    - The Radiation Therapy Oncology Group
  - **COG**
    - The Children’s Oncology Group

- **ACOSOG**
  - American College of Surgeons Oncology Group

- **NCCTG**
  - North Central Cancer Treatment Group
Clinical Protocol Accreditation

- ATC
  - The Advanced Technology Consortium
- ITC
  - Image-Guided Therapy QA Center
  - Washington Univ
- RTOG
  - Radiation Therapy Oncology Group
- RPC
  - Radiological Physics Center
  - M.D. Anderson
- QARC
  - Quality Assurance Review Center
  - University of Massachusetts
Clinical Protocol Accreditation

- Typical RTOG Procedure
  - Facility Questionnaire
    - PART I (General Information for 3D-CRT and IMRT)
  - PART II (IGRT)
  - PART III (Heterogeneity Corrections and Motion Management)
  - RPC OSLD Machine Monitor Results
  - RPC Phantom Dosimetry Test
  - Dry Run Test Case
  - IGRT Credentialing
  - Rapid Review Case
  - Protocol Patient Case
RTOG Data Transfer

- ITC_DICOMpiler.exe can be downloaded from itc.wustl.edu, AE Title is ITC_STORESCP
- Setup export filter (DICOM Storage Service) in Eclipse or DICOMAddSCP in Pinnacle
- Export DICOM data as regular patient, include Dicom image, RT image, structure, plan, dose.
- Anonymize and rename to string constructed from Protocol Sponsor, ID, Case Number, Initials
- sftp to ITCsubmit.wustl.edu, each institution has separate sftp account
- Filled out DDSI form to inform ITC the data, http://atc.wustl.edu/forms/DDSI/ddsi.html
RTOG Data Transfer

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  - AE Title is ITC_STORESCP
  - port 104
RTOG Data Transfer

- Setup export configuration in Pinnacle
  - Binary directory
    - /usr/local/adacnew/PinnacleStatic/bin/common
  - list all available dicom node
    - DICOMRemoveSCP
  - Add one dicom node
    - DICOMAddSCP -rd ITC_STORESCPCU 156.145.34.196 104
  - Test dicom connection
    - Ping 156.145.34.196
    - DICOMEcho ITC_STORESCP 156.145.34.196 104
    - /usr/local/adacnew/DICOMStatic/bin/common/DICOMS end10 ITC_STORESCP *.dicom
RTOG Data Transfer

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RTOG Data Transfer

1 week of start of RT
- Digital Plan and DDSI $\rightarrow$ sftp to ITC
- T6 Hard copy isodose distributions for total dose plan $\rightarrow$ email or mail to ITC

1 week of RT end
- T1 RT Summary Form $\rightarrow$ on-line form to ITC and HQ
- T5 RT Treatment Record $\rightarrow$ email to ITC and HQ, mail to HQ
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