Web-based 3D Planning Tool for Radiation Therapy Treatment

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Outline

1. What is radiation therapy?
2. Treatment planning issues
3. Web-3D & the treatment plan
4. Assessment plan
5. Conclusions
What is Radiation Therapy?

- Radiation therapy is the careful use of high-energy radiation to treat cancer.

- “About 50-60% of cancer patients are treated with radiation at some time during their disease” ([www.radiologyinfo.org](http://www.radiologyinfo.org))

- A radiation oncologist may use:
  - radiation generated by a machine outside a patient's body (external beam radiation therapy)
  - radioactive sources that are put inside the patient (brachytherapy)
Cell Killing By Ionizing Radiation

Radiation destroys the cancer cells' ability to reproduce and the body naturally gets rid of these cells.
Among responsibilities …

- Calibration of radiation sources
- Planning of patient procedures
- Calculation of patient dose (dosimetrists)
Responsibilities (cont)

- Management of special procedure: stereotactic radio-surgery
- Calibration and quality assurance
General Flow of External Radiation Therapy Treatments

CT scanner

Linac:

external beam treatment

CT Slices +
Radiation Therapy (RT) info

Treatment Planning System (TPS):
dose calculation and visualization

Record and Verify System (RV):
makes sure all parameters are properly transferred to/from linac

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Planning issues

- LINear ACcelerator main components
Planning issues

- Hardware Collisions
- Beam intersection external objects
Planning issues

- Current solution: “Dry runs”
  1. Time consuming
  2. If “dry run” fails re-planning is necessary (patient is recalled next day)
  3. Tissues change meanwhile, sometimes CT/MRI must be redone

(!) Some patients require more than 30 sessions.
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Web-3D & the treatment plan

- MDs, Physicists, Medical Staff about software:
  - OpenGL, C, JSP... “we do NOT want to hear new acronyms, Med. School was enough ...”
  - Keep it simple “simpler than reading e-mail if possible”
  - The radiation therapist, radiation oncologists etc. all want to have access to the application from different offices.
Web-3D & the treatment plan

• Solution:
  - Simulation of the treatment plan using X3D
  - Remote access using JAVA Server Pages (JSP)
Web-3D & the treatment plan

- LINAC (rough) 3D Model (from VARIAN’s CAD files ... )
User interface(s) ... trials

VRML & JAVA stand-alone
VRML & JAVA applets
VRML & JSP
Keep it simple for now ...
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Assessment Plan

- Tool available online
  1. Remote access
  2. Availability
  3. Ease of deployment

- Medical Physicists at M.D. Anderson Cancer Center Orlando are using the tool and providing feedback.

http://hyperion.armstrong.edu:8080/3DRTT
Conclusions

• We identified a real problem and proposed a simple VRML(X3D) solution.

• And “YES” MedX3D working group keep rushing ... , MDs need ways to convert the available data in 3D.
Work in progress

- Full migration to X3D
- Large scale assessment
- Automating the process of 3D models generation for the planning tool (a library of LINAC hardware accessories and auxiliary components) => refining the 3D model.
- Automatic generation of 3D patient body parts from CT scans and registration of the tumor tissue with the LINAC’s isocenter.
Opening new directions
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