



# 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

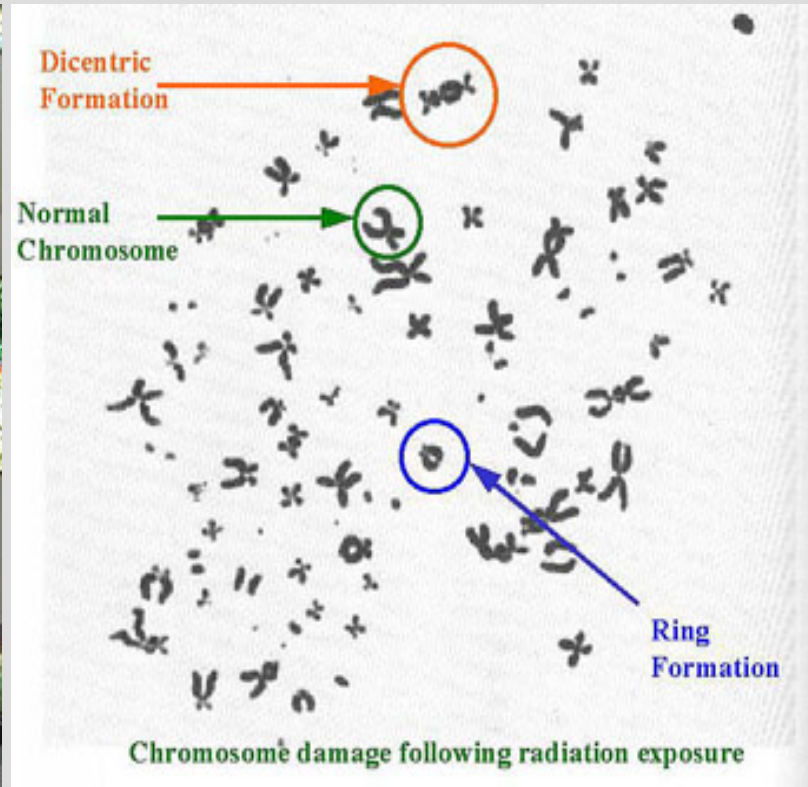


# What is Radiation Therapy ?

- 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](#))

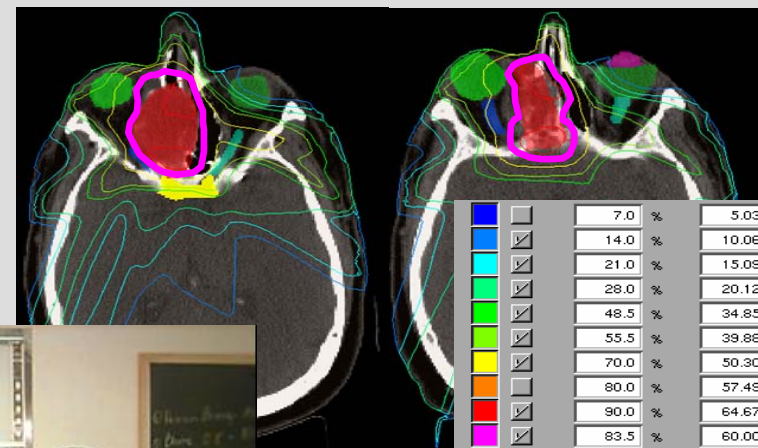
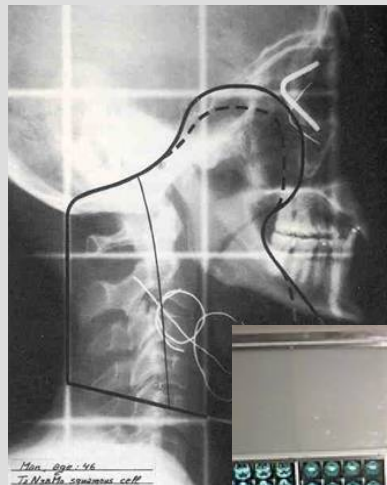
# Cell Killing By Ionizing Radiation

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



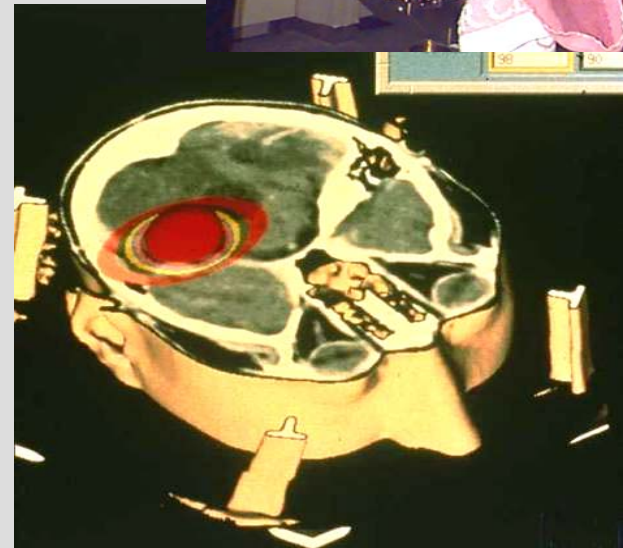
# Among responsibilities ...

- 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

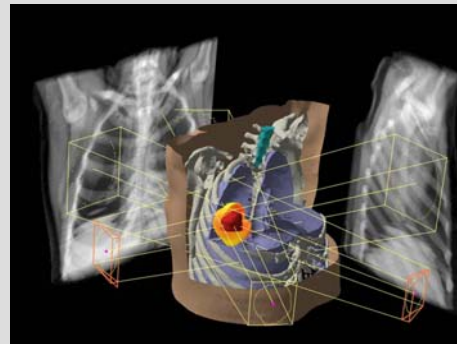
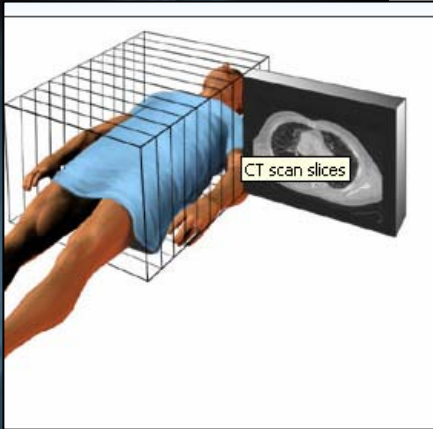


CT scanner

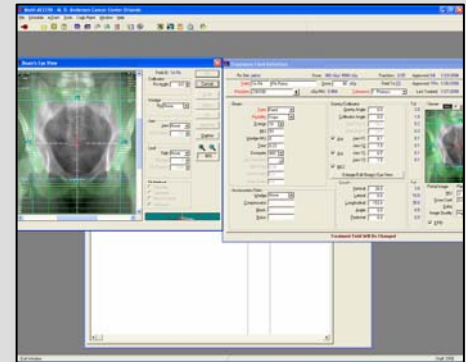


Linac:  
external beam  
treatment

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

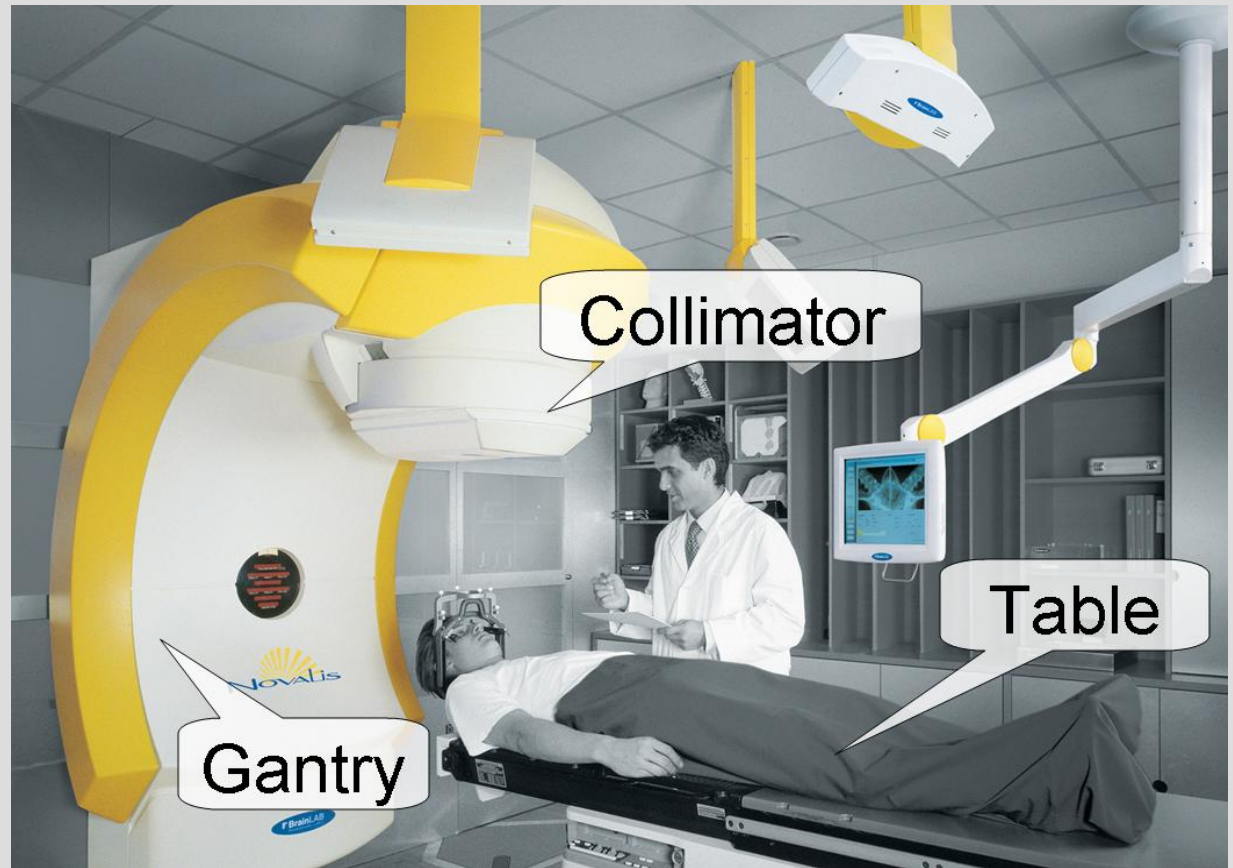


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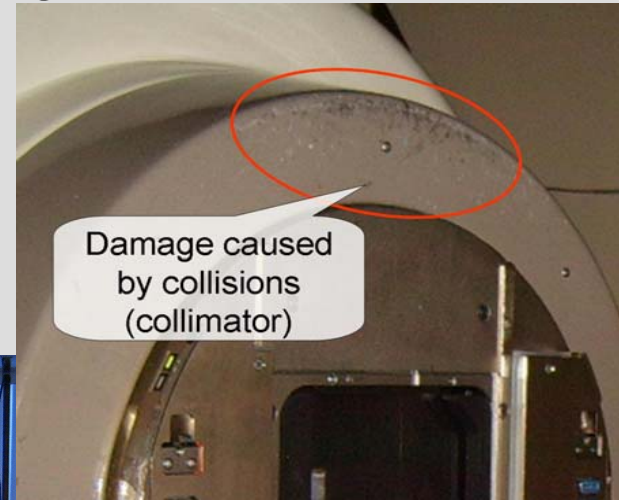
# Planning issues

- 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.

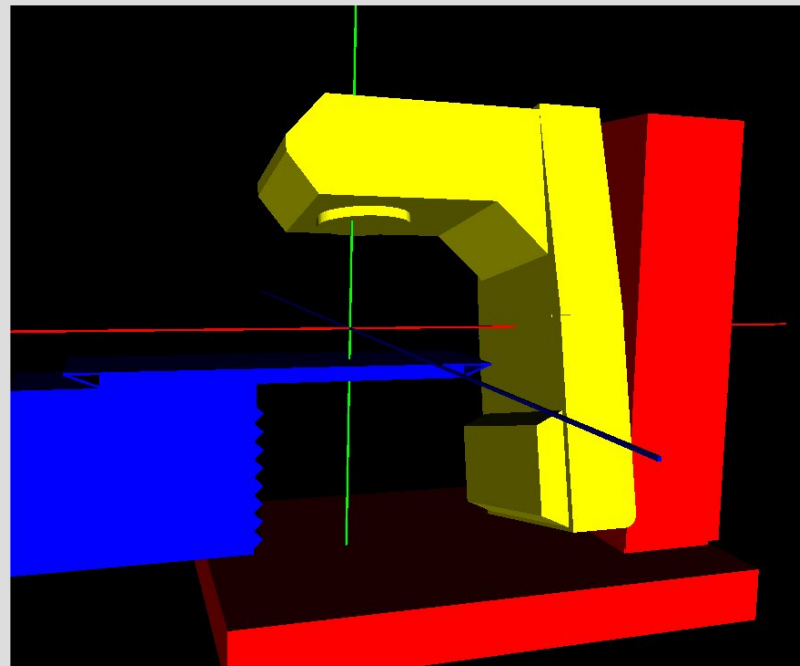


# Web-3D & the treatment plan

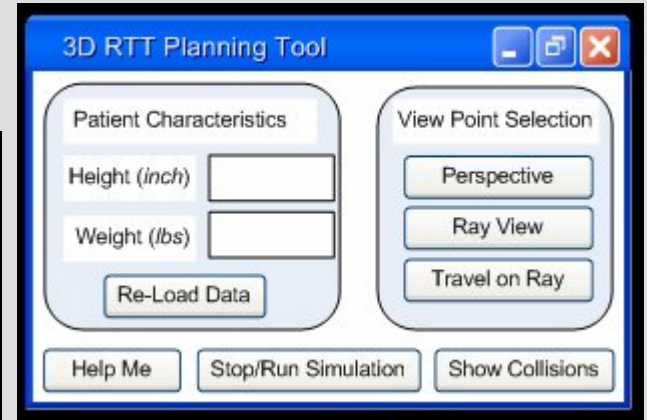
- Solution:
  - Simulation of the treatment plan using X3D
  - Remote access using JAVA Server Pages (JSP)

# Web-3D & the treatment plan

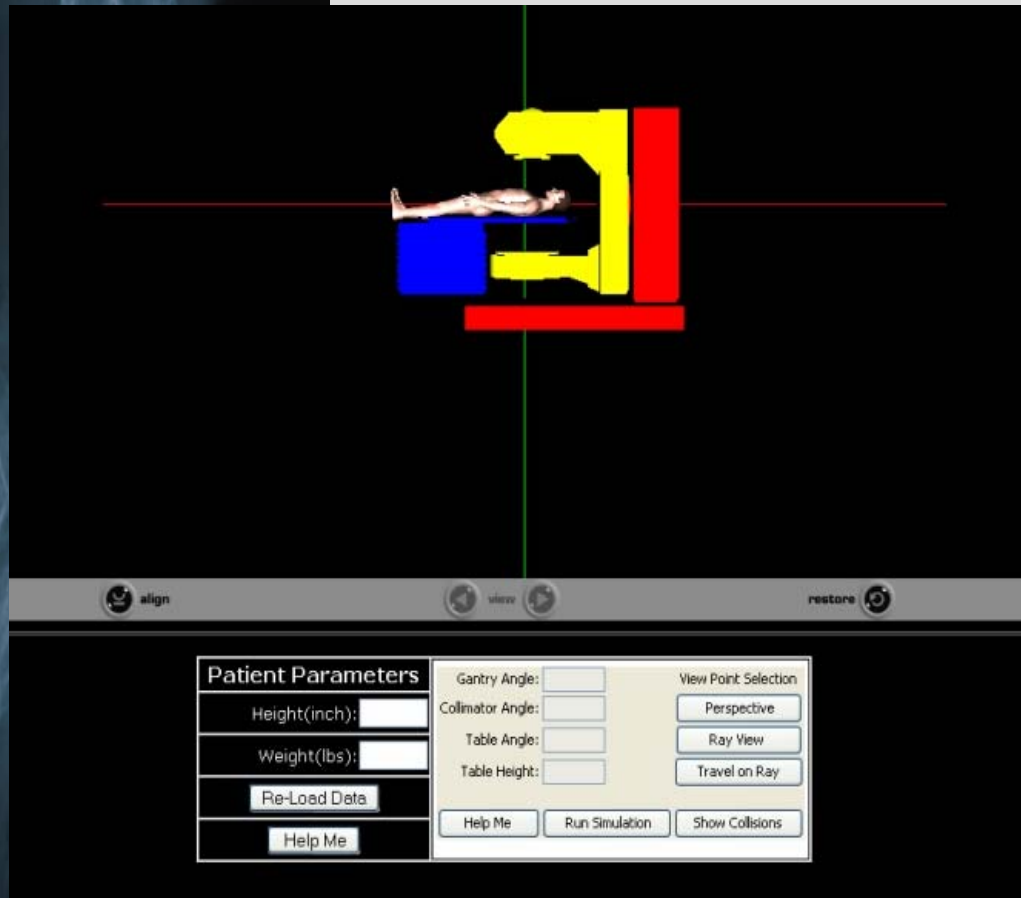
- LINAC (rough) 3D Model (from VARIAN's CAD files ... )



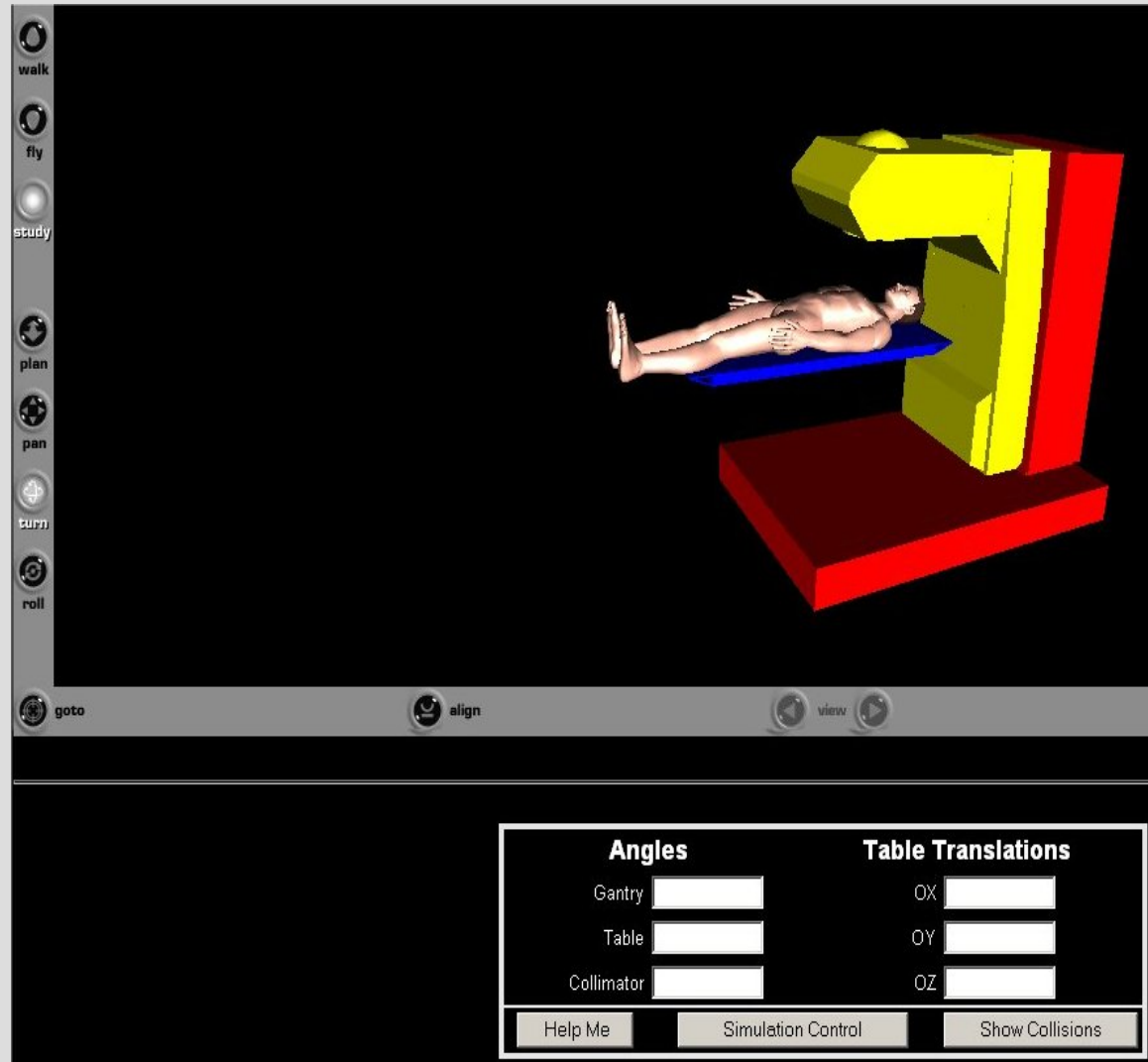
# User interface(s) ... trials



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

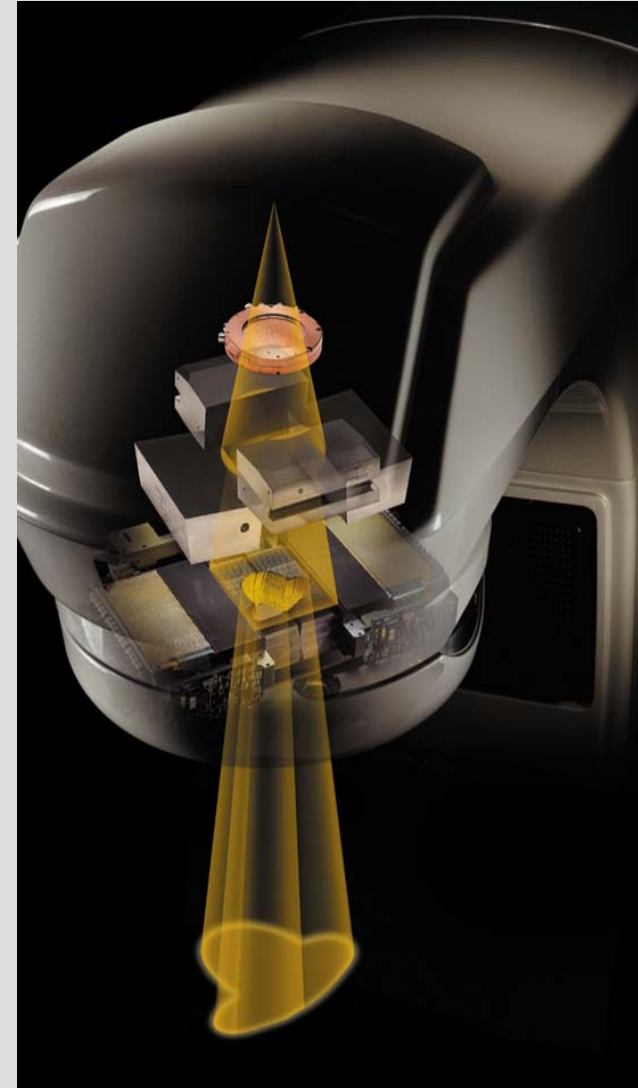
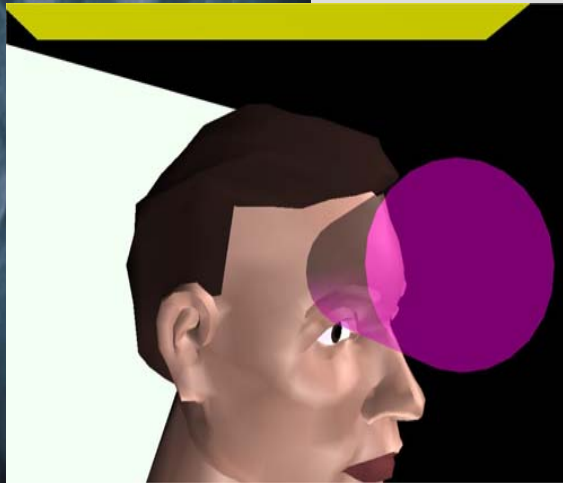
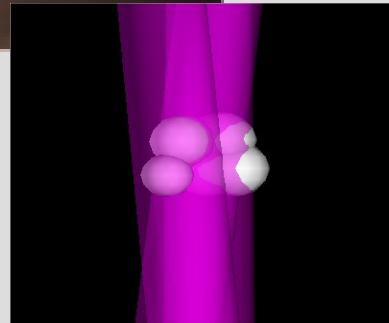
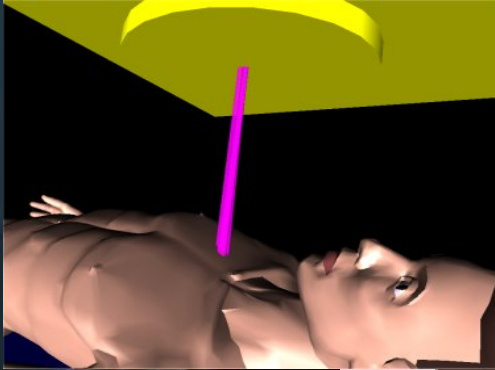
- We identified a real problem and proposed a simple VRML(X3D) solution.
- And “YES” MedX3D working group keep rushing ... , MDs need ways to convert the available data in 3D.



# 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



# Acknowledgments

- M.D. Anderson Cancer Center  
Orlando, Florida.

