



**I-SEE**  
Internet  
Simulation  
Evaluation  
Envision

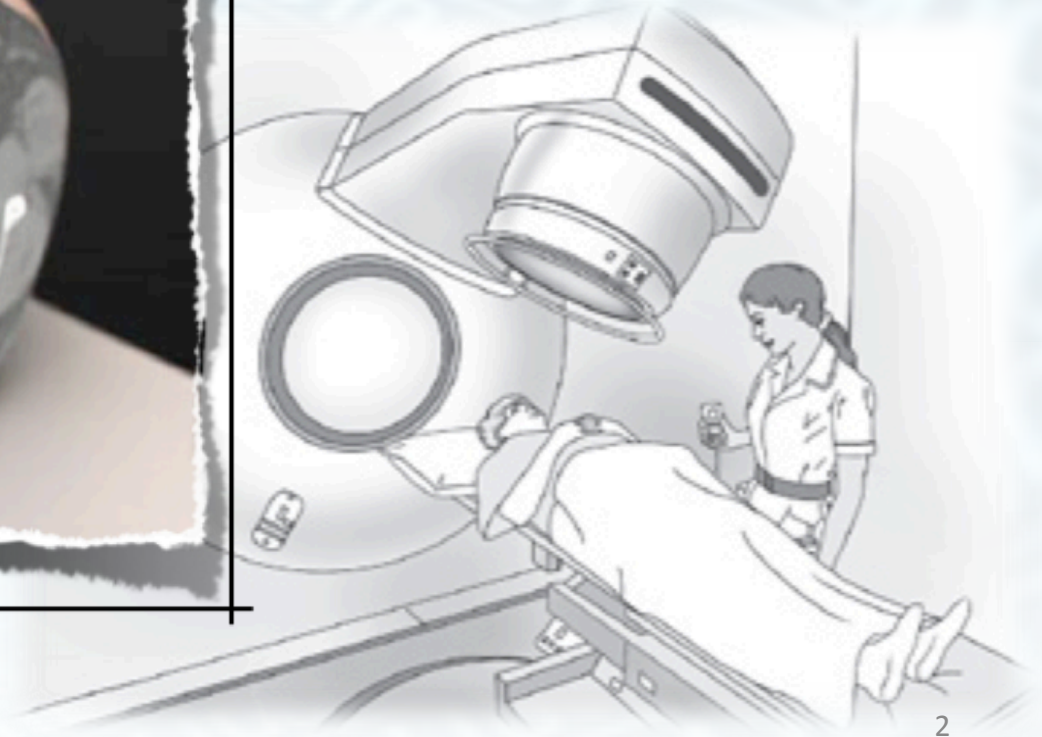
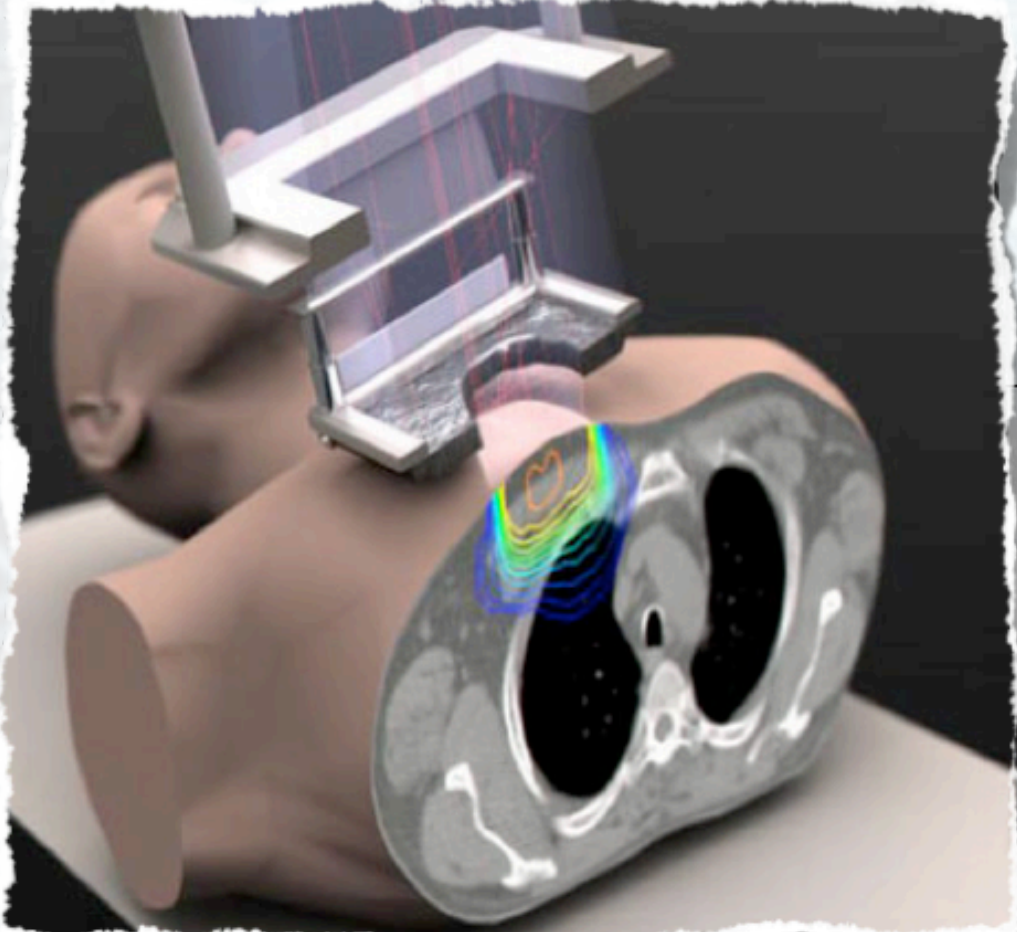
# web apps in Medical Physics on the cloud with I-SEE

Faiza Bourhaleb, Ph.D

CEO I-See Company

# The context

## Radiation therapy



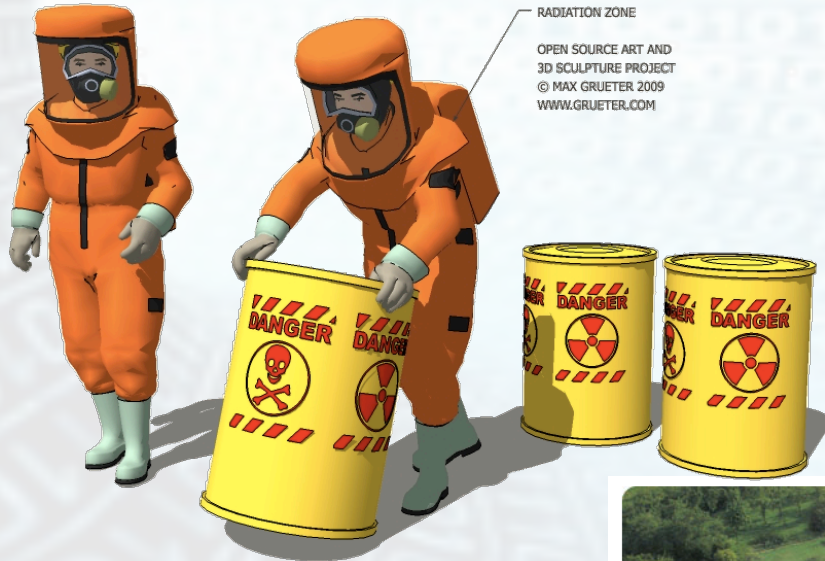


# Radiation Protection in exposed zone



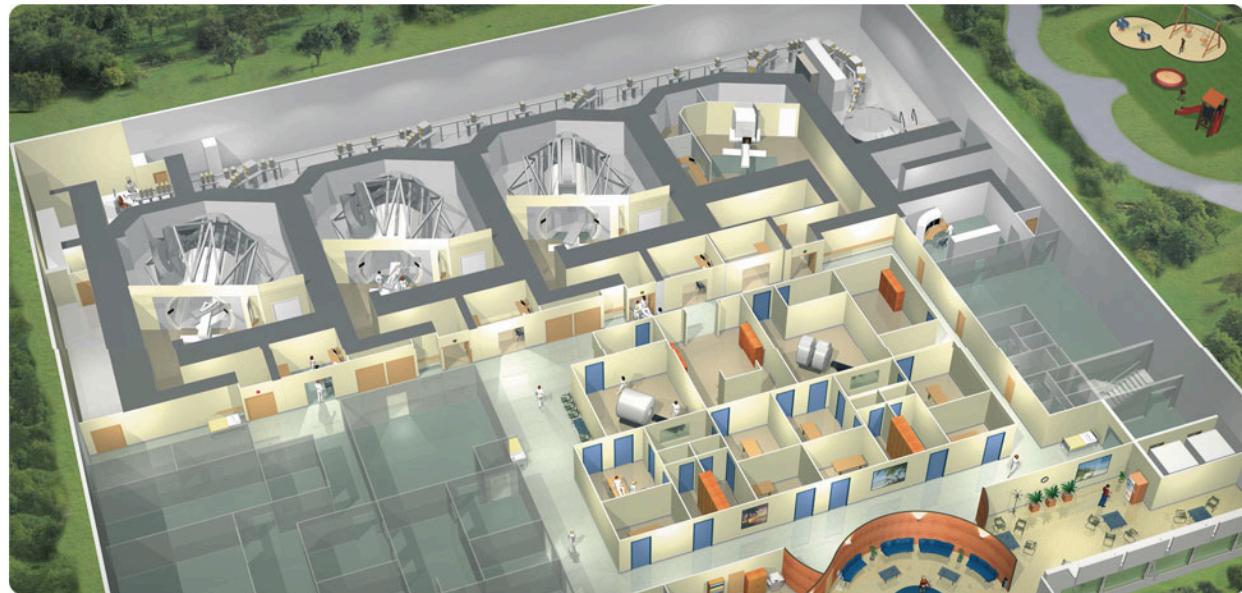


# Radiation Protection and Shielding



RADIATION ZONE

OPEN SOURCE ART AND  
3D SCULPTURE PROJECT  
© MAX GRUETER 2009  
WWW.GRUETER.COM

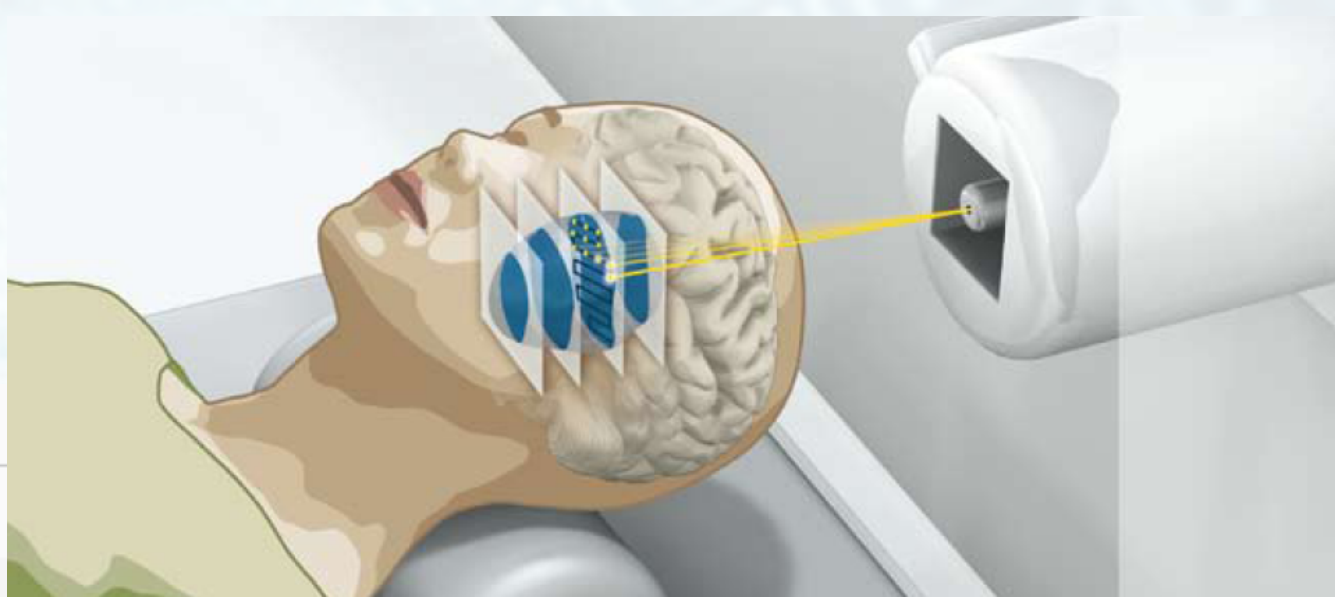


- Geometry
  - Treatment/Imaging room
- Parameters
  - Energy spectrum
  - Or a single beam
- Output
  - Plots
  - Data Files



# WEB APPLICATIONS ON MainWall





### Details of Simulation: ProvaDemo



Simulation: **ProvaDemo** (id: 110)  
 Simulation Type: Bragg Peak  
 Submitted by: Faiza  
 Datetime: 2011-04-11 15:11:29  
 Number of Events: 30000  
 Tool: Geant4 (v9.3)

Main Status Parameters Geometry Plots Data

#### Global Status

Simulation Status	<b>completed</b>	Plots and Data available
Total Simulated Events	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100%	30000/30000
Total Runs	6 (Running: 0, Completed: 6, Paused: 0, Errors: 0)	

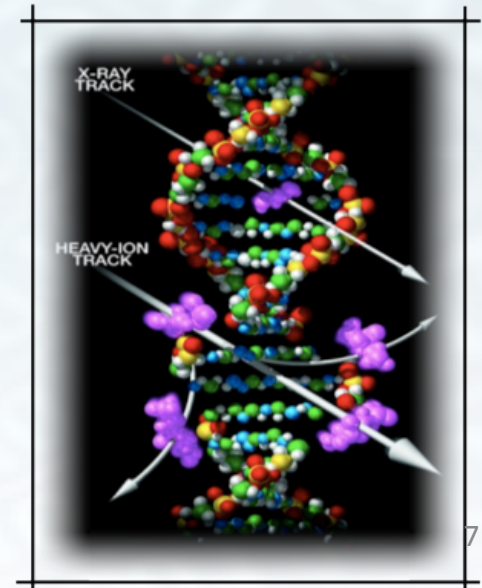
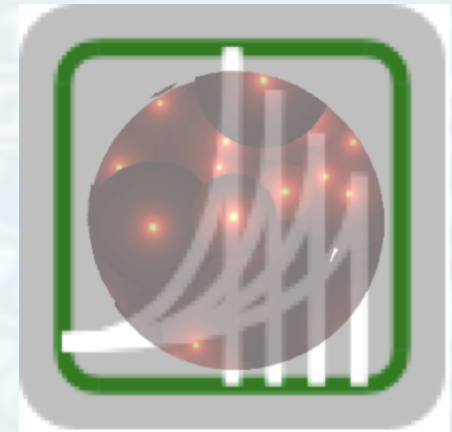
#### Runs of the Simulation

Run#	% of simulated events	Submission time	Start time	End time	Node	Status
0	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:30	2011-04-11 15:20:40	1	completed
1	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:30	2011-04-11 15:20:19	1	completed
2	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:33	2011-04-11 15:18:55	1	completed
3	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:37	2011-04-11 15:18:53	1	completed
4	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:37	2011-04-11 15:18:48	1	completed
5	<div style="width: 100%;"><div style="width: 100%;"></div></div> 100% (5000/5000)	2011-04-11 15:11:29	2011-04-11 15:11:39	2011-04-11 15:19:28	1	completed



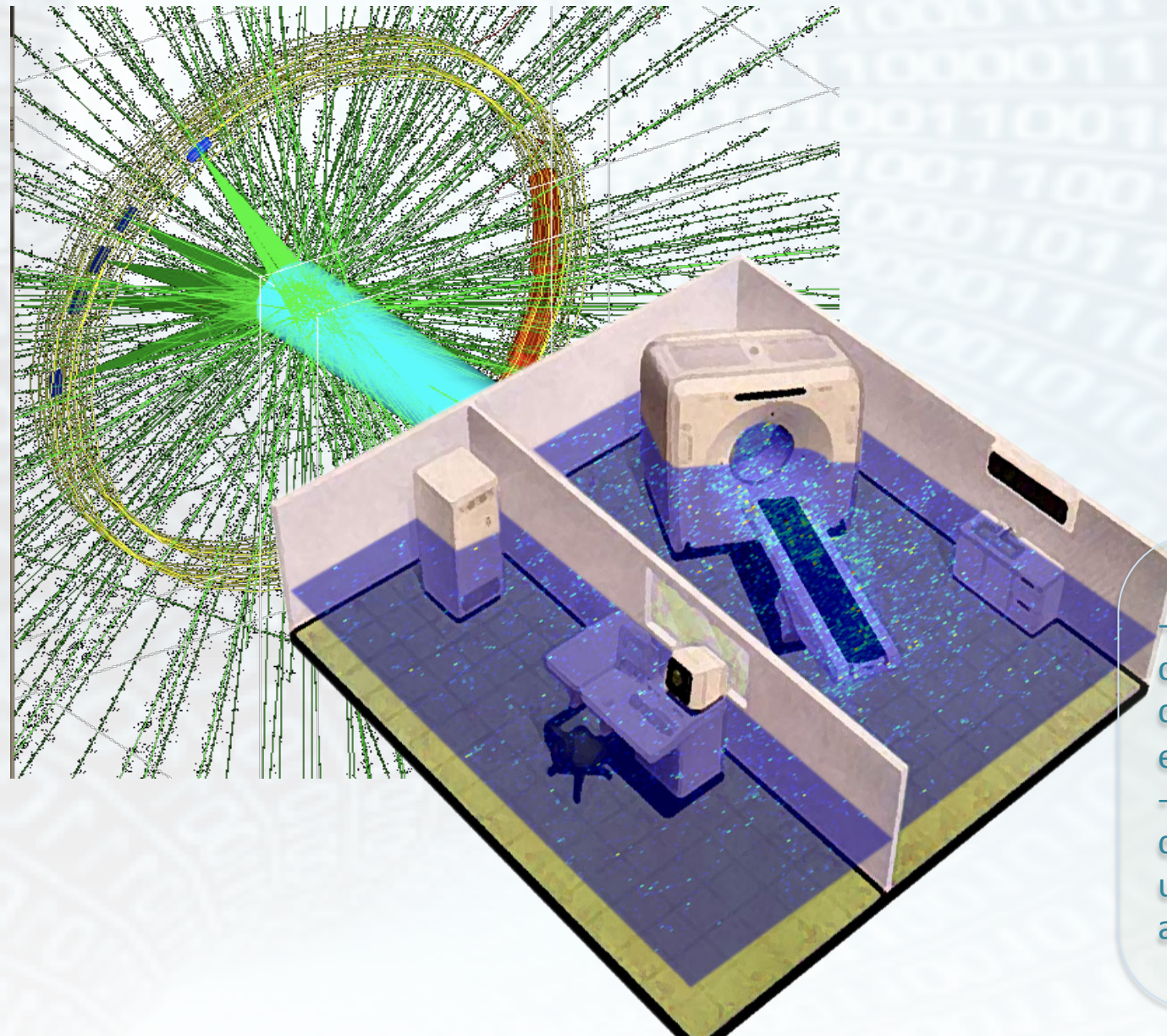
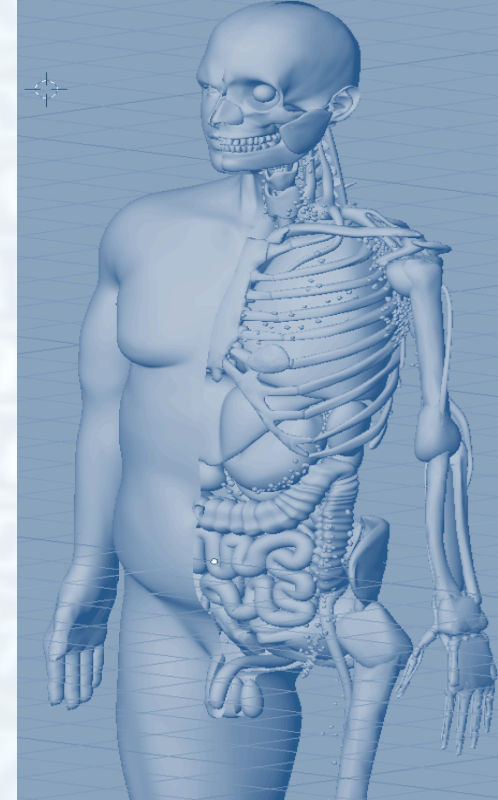
# RADIOBIO APP

- Radiobiological models implemented:
  - LEM (M.Scholz, T.Elsasser et al)
  - MKM (Y.Kase et al.)
- Possible parameters:
  - Cell lines from database
    - Cell dimension
    - Alpha/beta
  - Dose level
  - Beam particle type  
(proton Helium, Boron, Carbon ion, etc.)
- Output
  - Cell survival, LQ parameter alpha and beta, RBE.
  - Format: Graphs, ASCII data Files





# Radiation Protection



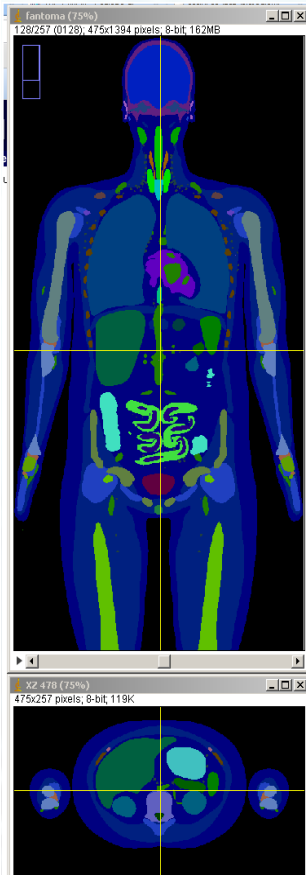
- Simulation of the 3-dimensional dose distribution in radiology examination rooms.
- Simulation of delivered dose for exposed personal using last generation of anthropomorphic models.



# Virtual Patient



MASH



Creation of an artificial CT images database of head, neck and sacral region cases.

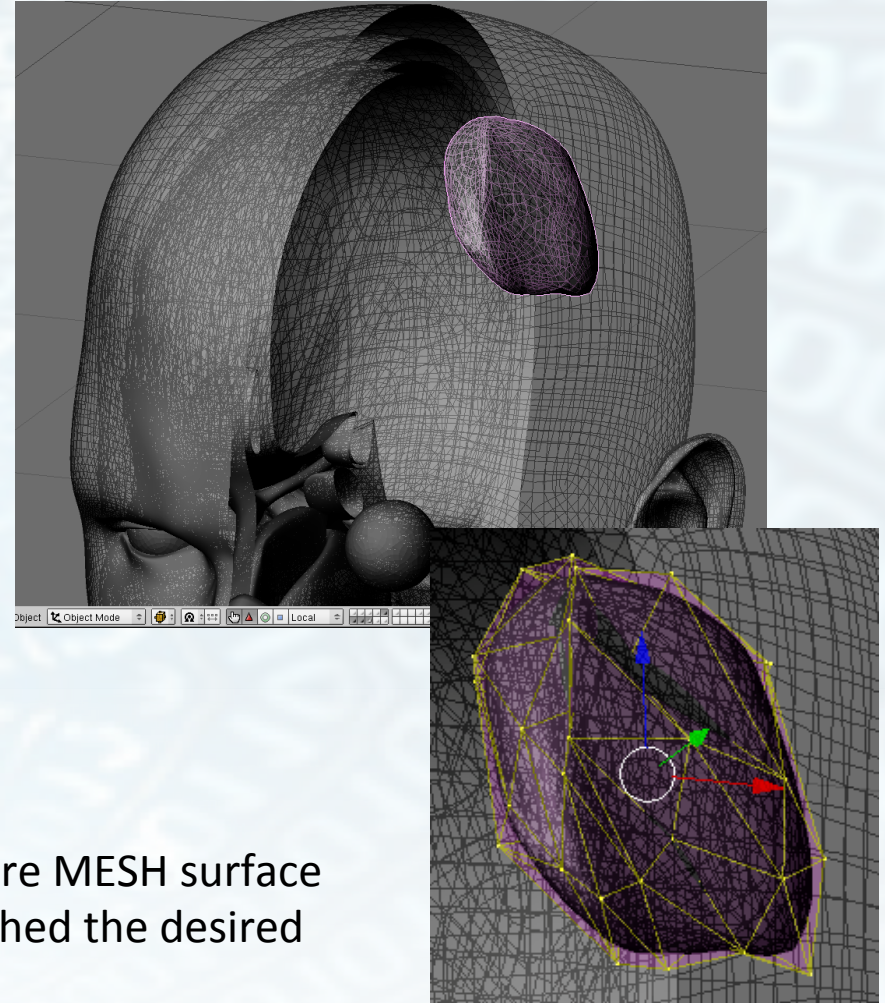
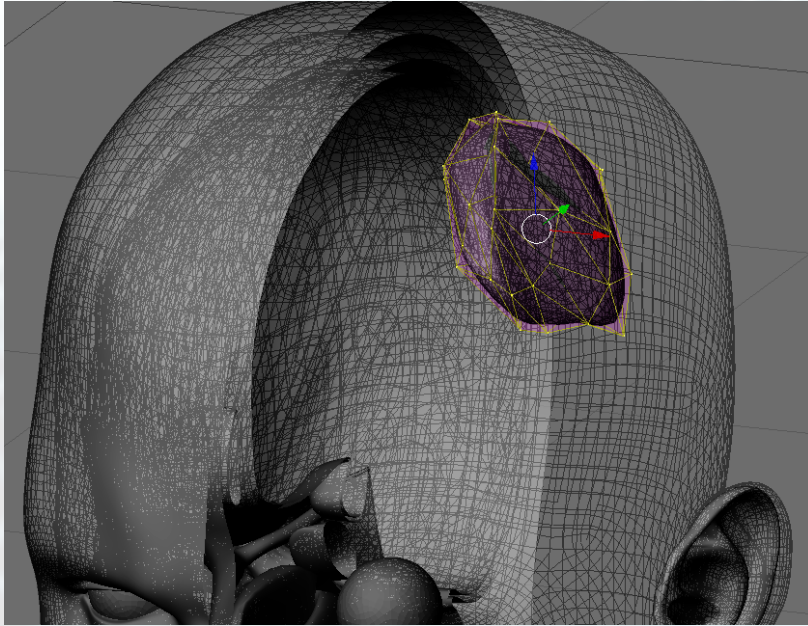
The selected BREP base model was MASH3 (Cassola 2010).

All its organs are segmented in volumes following ICRP89 recommendations.

478 x 258 x 1468 voxels (1.2 x 1.2x 1.2) mm<sup>3</sup> size.

# Example of virtual use

We started developing a brain tumor case. The first step is the definition of the tumors shapes and locations inside the model .

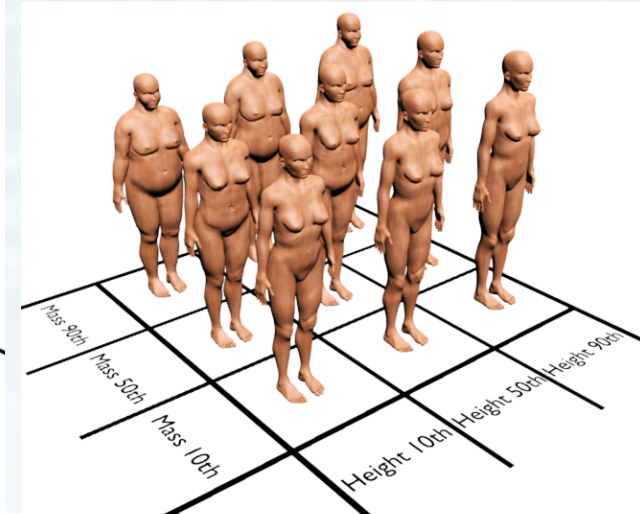
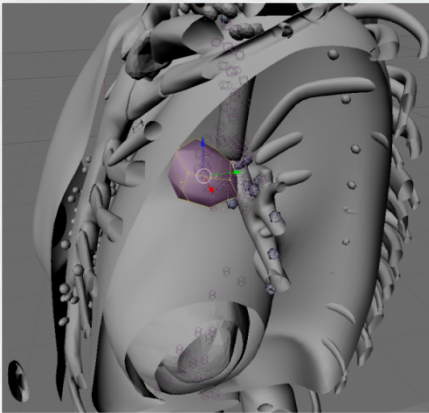


The tumor region was modeled using a sphere MESH surface and changing its vertices positions until reached the desired shape .



# Virtual Patient

- Conversion in CT DICOM images.
- Forward planning.
- Monte Carlo simulations of the TPS forward planning for benchmarking.
- Construction of the patient database with different tumors.
- Extend for others kind of BREP based models (Cassola et al 2011)



Reference: Cassola V, Milian F M, Kramer R, Oliveira Lira C.A. B., Khoury H. 2011 Standing adult human phantoms based on 10th, 50th and 90th mass and height percentiles of male and female Caucasian populations. *Physics in Medicine and Biology*, v.56, p. 3749 – 3772.

- Web 2.0
- Grid
- Virtual Reality
- Email/chat

- Web 3.0
- Cloud
- Augmented Reality
- Social net





**I-SEE**  
Internet  
Simulation  
Evaluation  
Envision

cloud

computing

Simulation

mc

Tesi di laurea triennale e/o specialistica nel campo di simulazioni Monte Carlo e cloud computing per:

- Fisica medica
- Radioprotezione
- Radiobiologia

La tesi viene realizzata presso la società I-See in un contesto di orientamento e formazione verso le richieste professionale del mercato.

**Contatti:**

[faiza@i-seecomputing.com](mailto:faiza@i-seecomputing.com)

<http://www.i-seecomputing.com>



UNIVERSITÀ  
DEGLI STUDI  
DI TORINO

ALMA UNIVERSITAS  
TAURINENSIS



# Contact

I-SEE S.r.l

[www.i-seecomputing.com](http://www.i-seecomputing.com)

[info@i-seecomputing.com](mailto:info@i-seecomputing.com)

[faiza@i-seecomputing.com](mailto:faiza@i-seecomputing.com)

**WEB APPS  
MC SIMULATIONS FOR A  
BETTER TREATMENT  
QUALITY TOGETHER**

