

Performance evaluation of CT Scanner Somatom go.Open Pro with GATE

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**GEANT 4 International User
Conference**

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CT Scanner : working objectives



Dosimetry reduction

Public Health issue

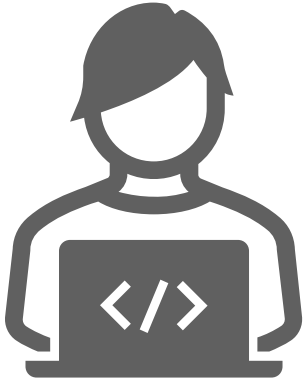
Image quality improvement

Impact on radiotherapy treatment tools

Multicentric measurements

Data consistency

QA protocols unification



Monte-Carlo GATE
simulation

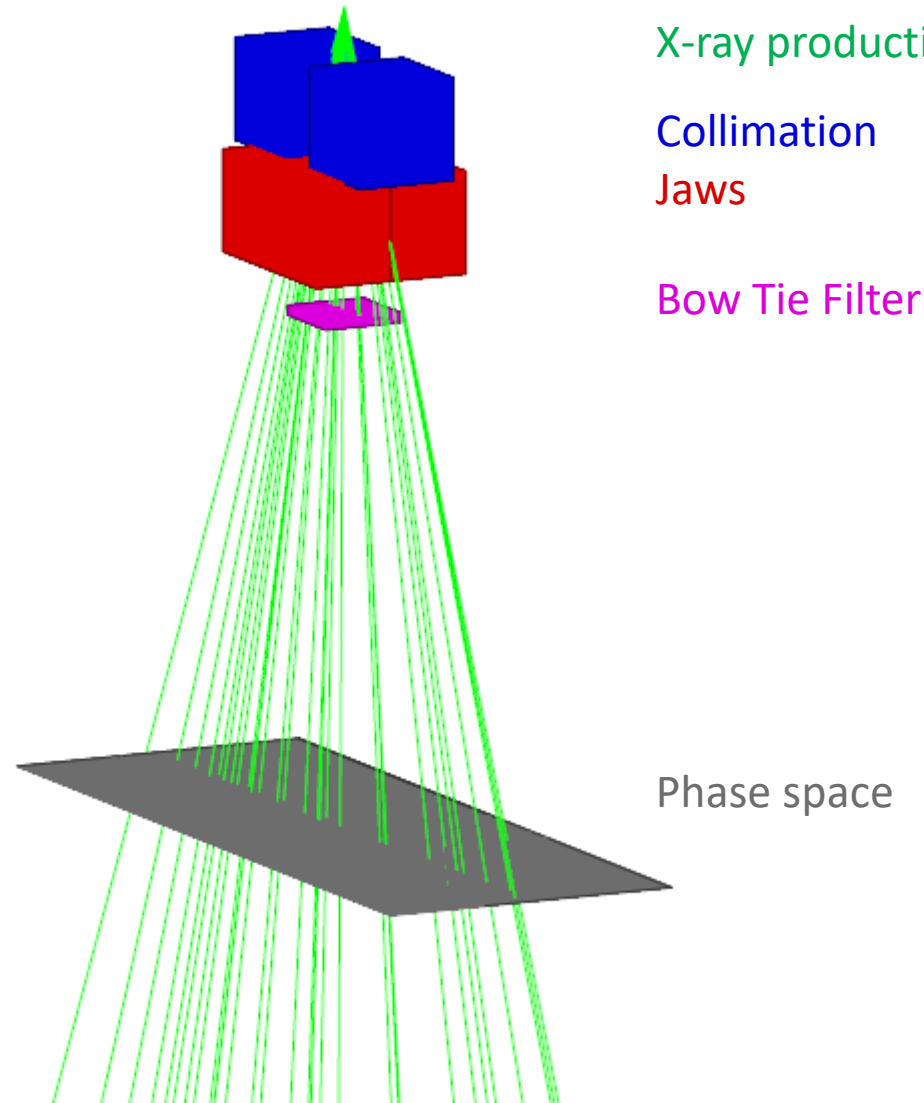
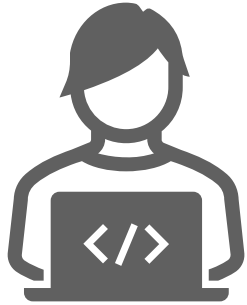


Measurements



Comparison and
optimisation

GATE geometry: first approximation ... Siemens Healthineers data missing



X-ray production + filtration

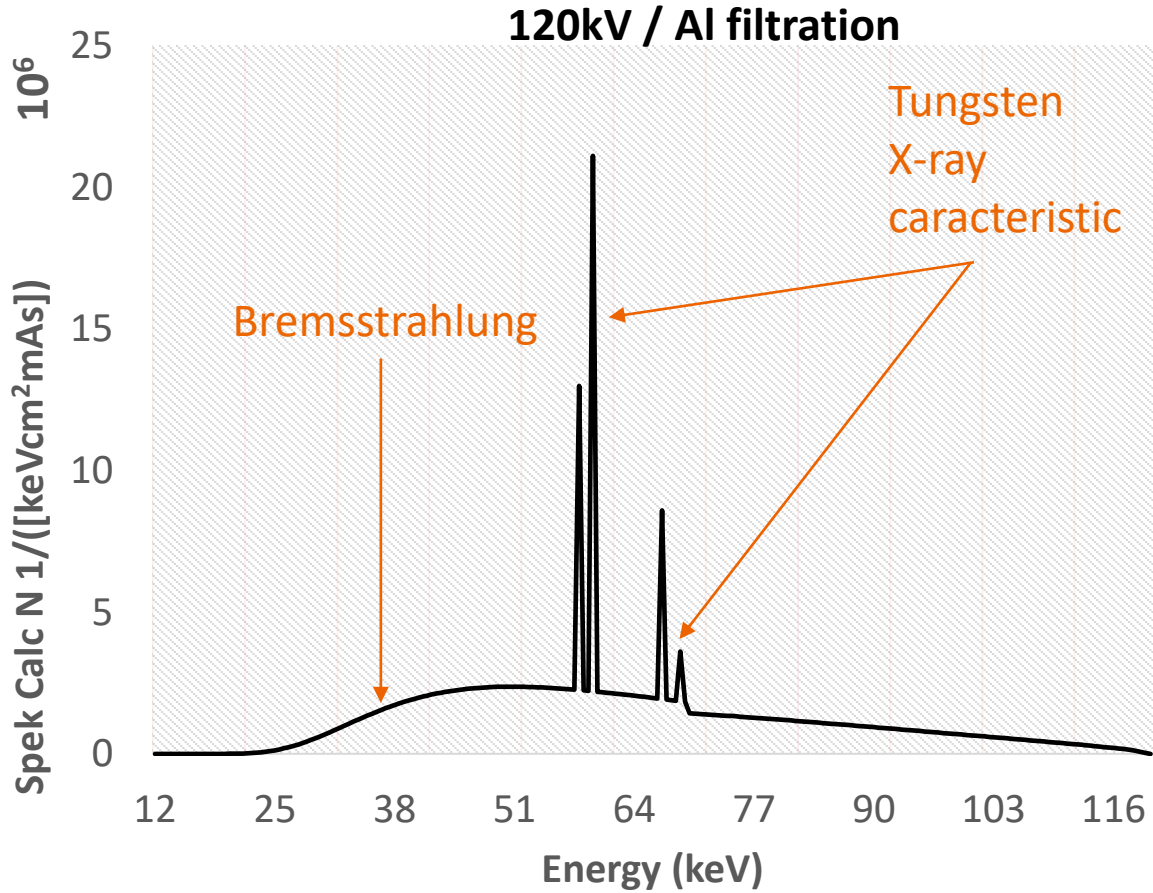
Collimation

Jaws

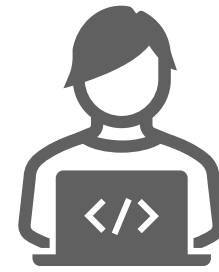
Bow Tie Filter

Phase space

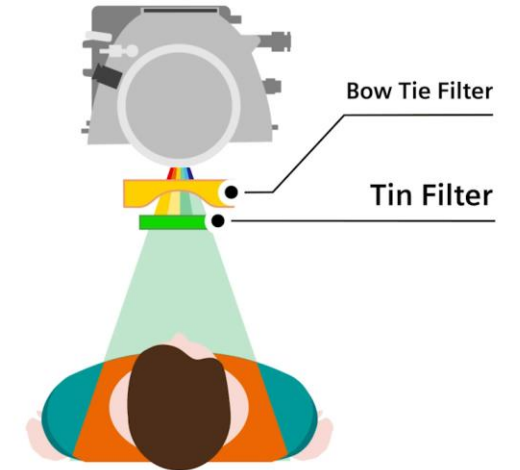
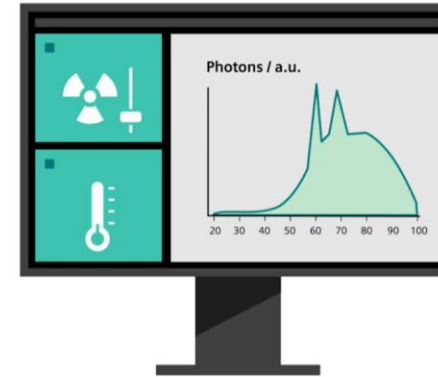
X-Ray Spectrum



Modeling X-Ray Spectra :



100 kV / Sn filtration

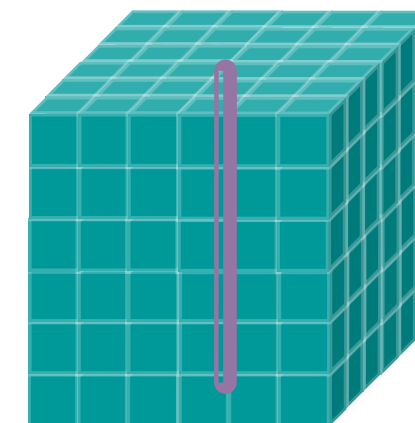
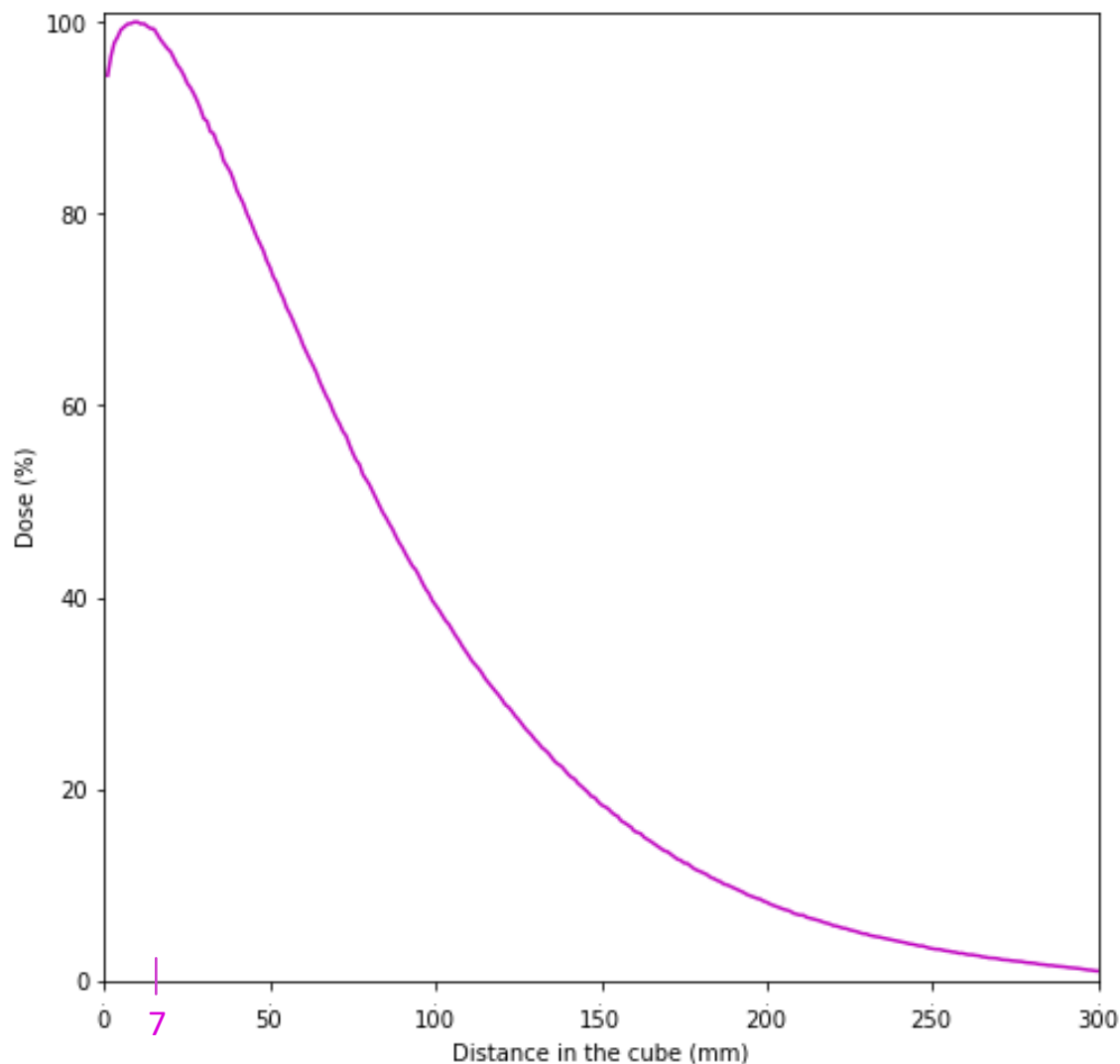
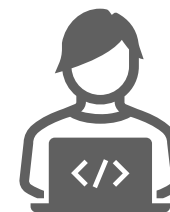


SpekCalc^{1,2,3}

Siemens Healthineers data missing

[1] Med Phys. 2007 34(6):2164-74
 [2] Med Phys. 2007 34(6):2175-86
 [3] Phys Med Biol. 2009 54(19):433-38

Depth dose profile for 30 cm water cube :



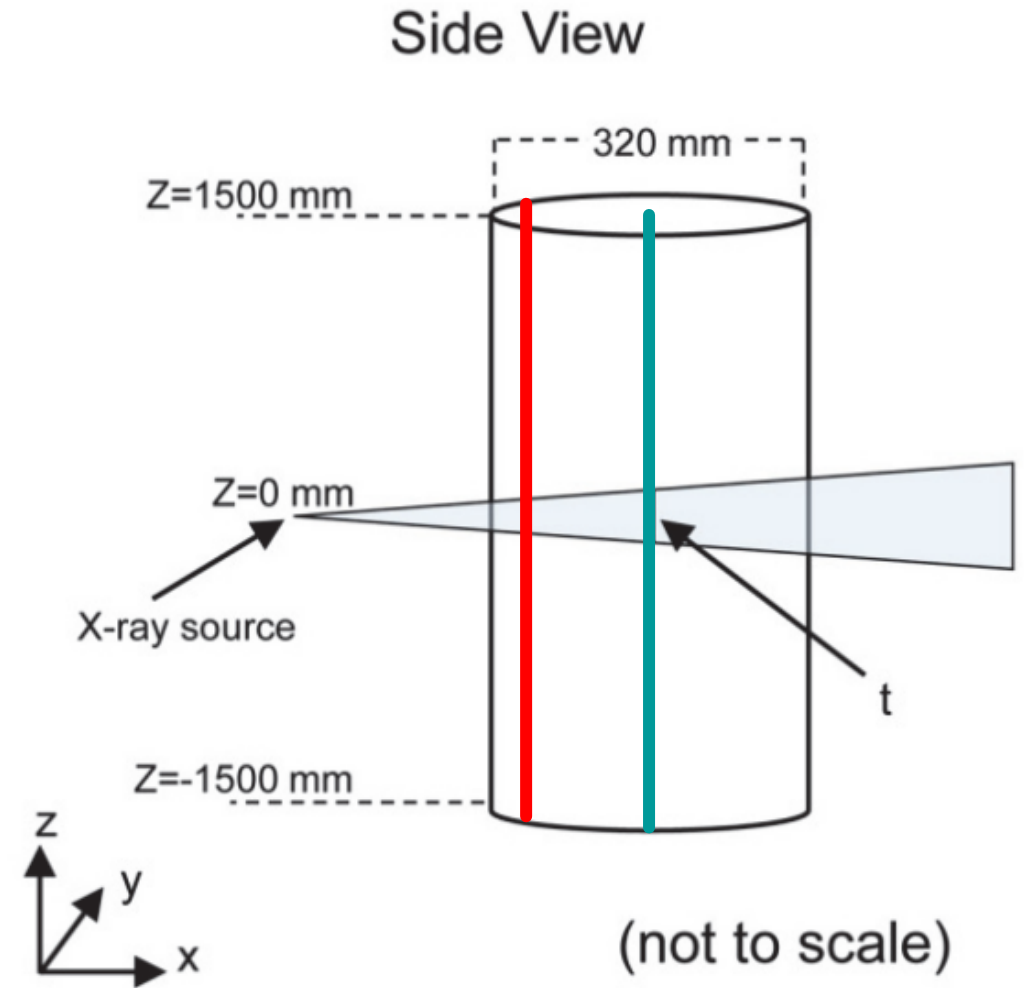
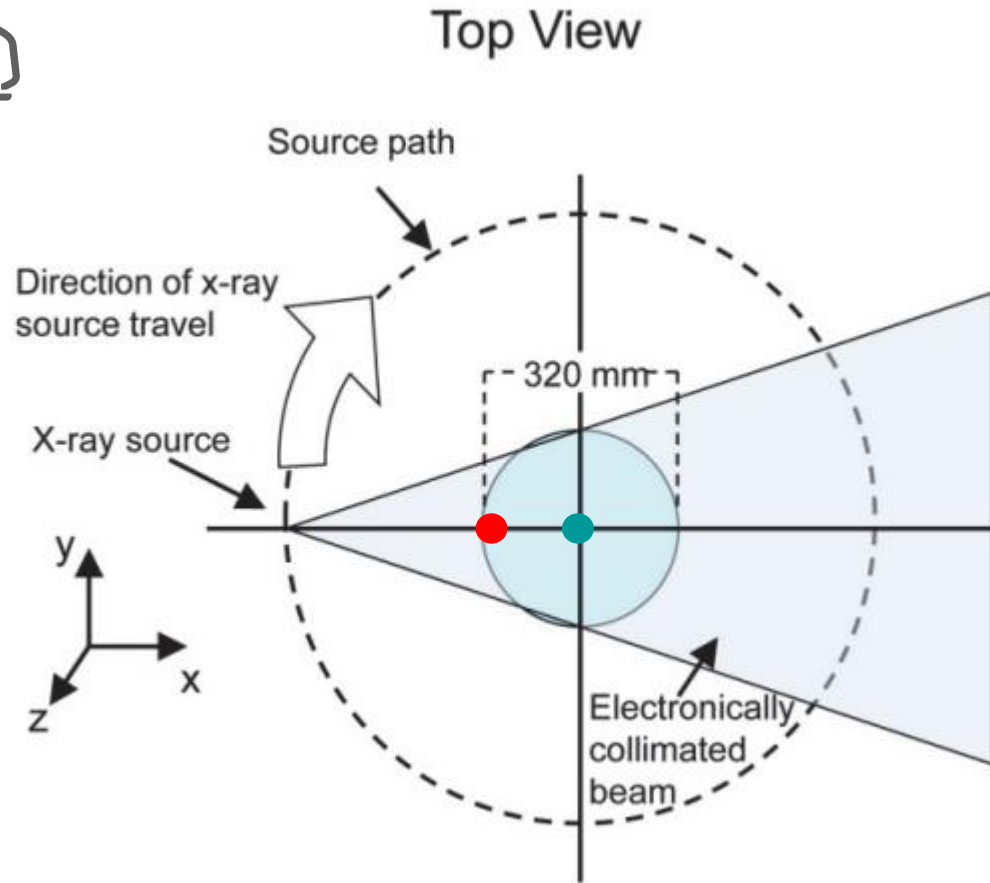
Modeling Dose deposition
30 cm water cube with 1 mm voxels

Cutoff inside the cube
Gamma : 10 μm / 2.5 keV
Electron : 10 μm / 14.1 keV

Physics_list
emstandard_opt4

Benchmark

AAPM report 195 (2015) : CTDI phantom

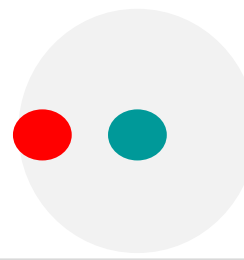


Benchmark

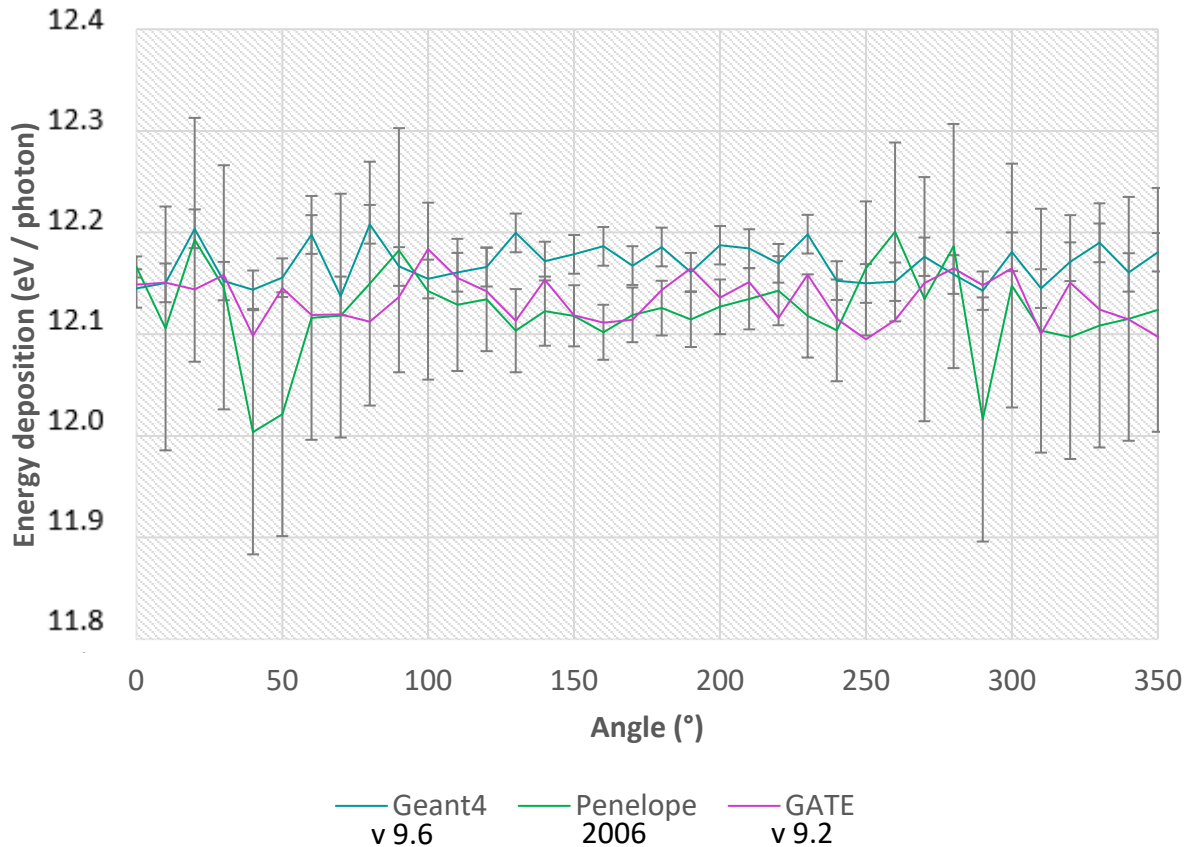
Energy deposition results



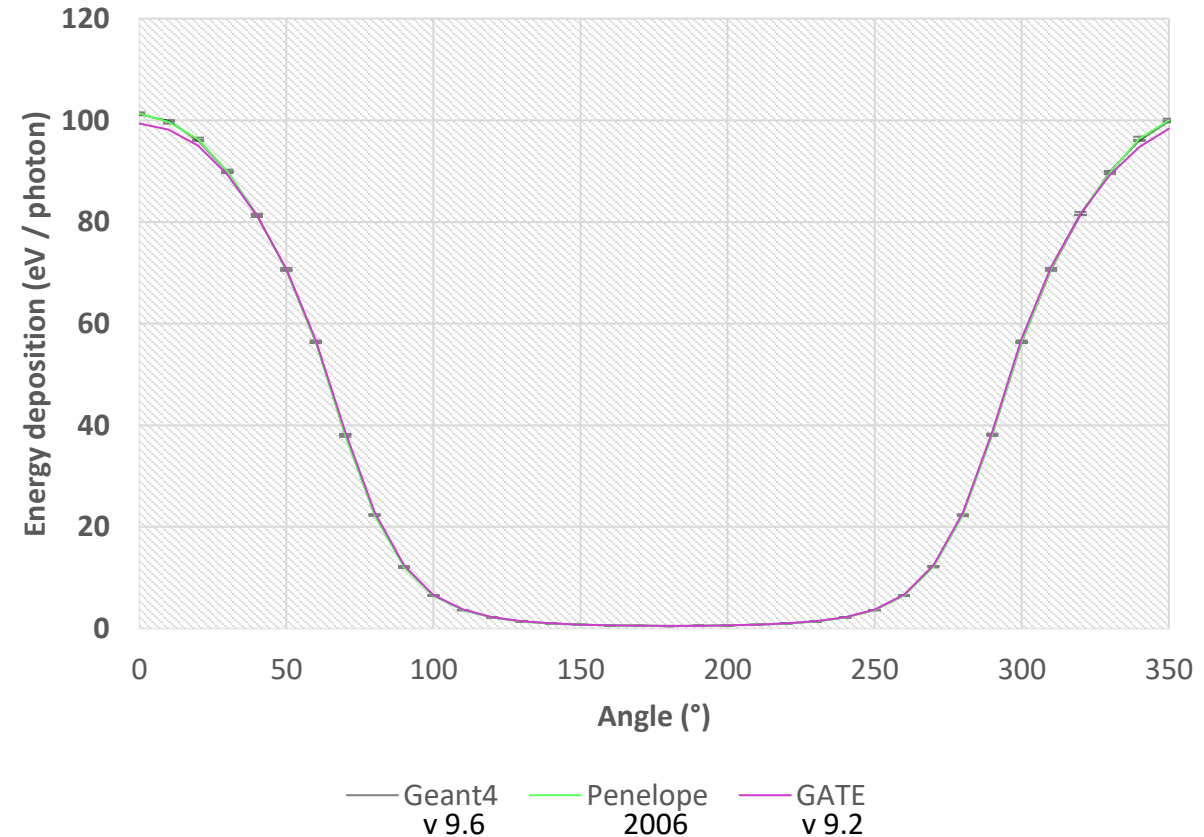
0°



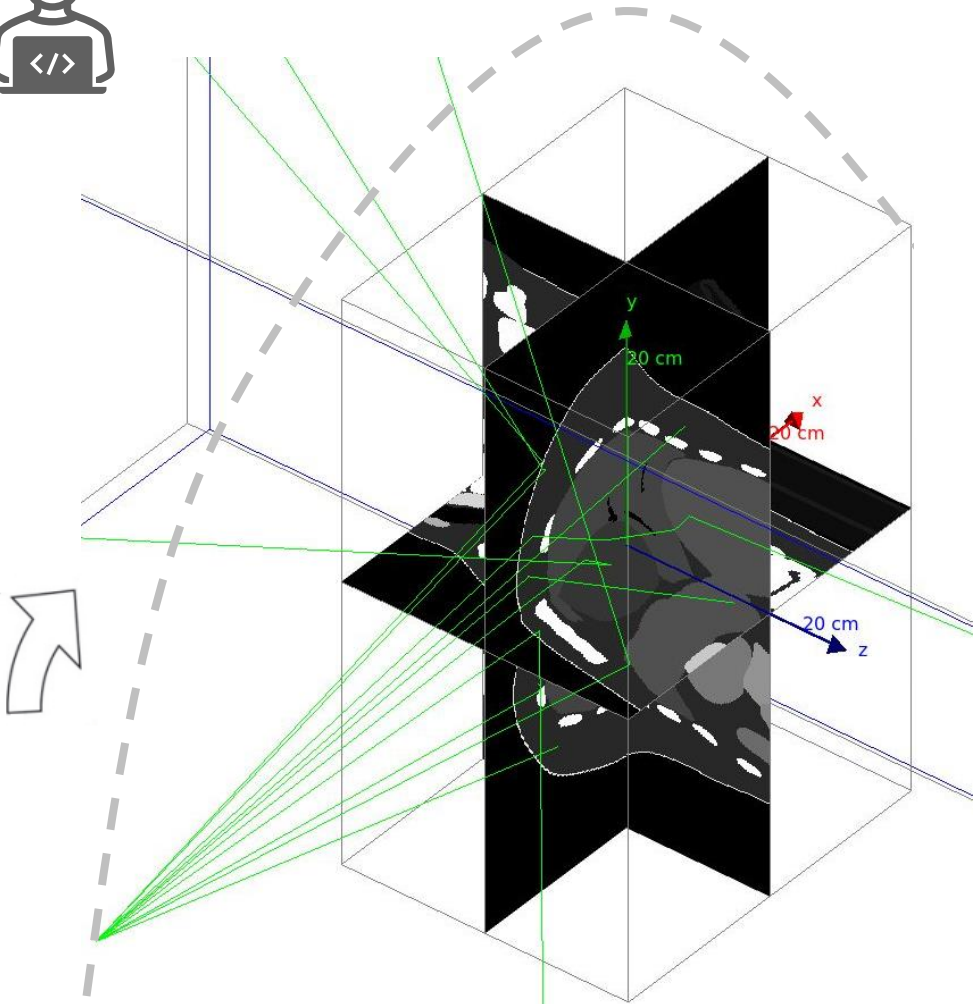
Blue loge
t= 10 mm , 56.4 keV



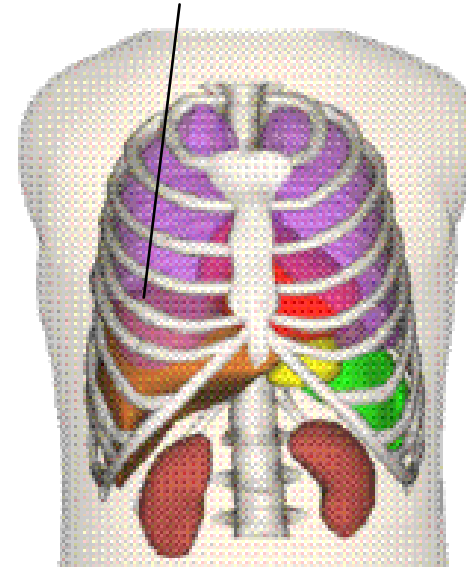
Red loge
t=10 mm , 56.4 keV



Anthropomorphic phantom and patients : Work In Progress



Dose to organs



**French multicentric CT
Study for Dose calculation
with CTE expo v1.6**

Organs	D_{mean} (mGy)
Breast	30
Testicles	10
Organs inside the scanned area	25

IRSN, report DRPH/SER
N°2010-12 p 19

An-example-of-a-4D-XCAT-phantom-activity-map-left-and-attenuation-map-right-for_fig2_225034139

<https://www.medicalexpo.fr/prod/kyoto-kagaku/product-69057-830785.html>

Conclusion and perspectives

- Benchmark validation with accurate geometrical data
- Radiotherapy tools modelling in GATE
- Image reconstruction with CASTOR
Automated script for CT scanner data conversion
from GATE to CASTOR (WIP)
- Multicentric measurements in French Comprehensive
Cancer Centers (Unicancer)
- Comparisons between GATE and measurements
(Python)



Thanks !



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