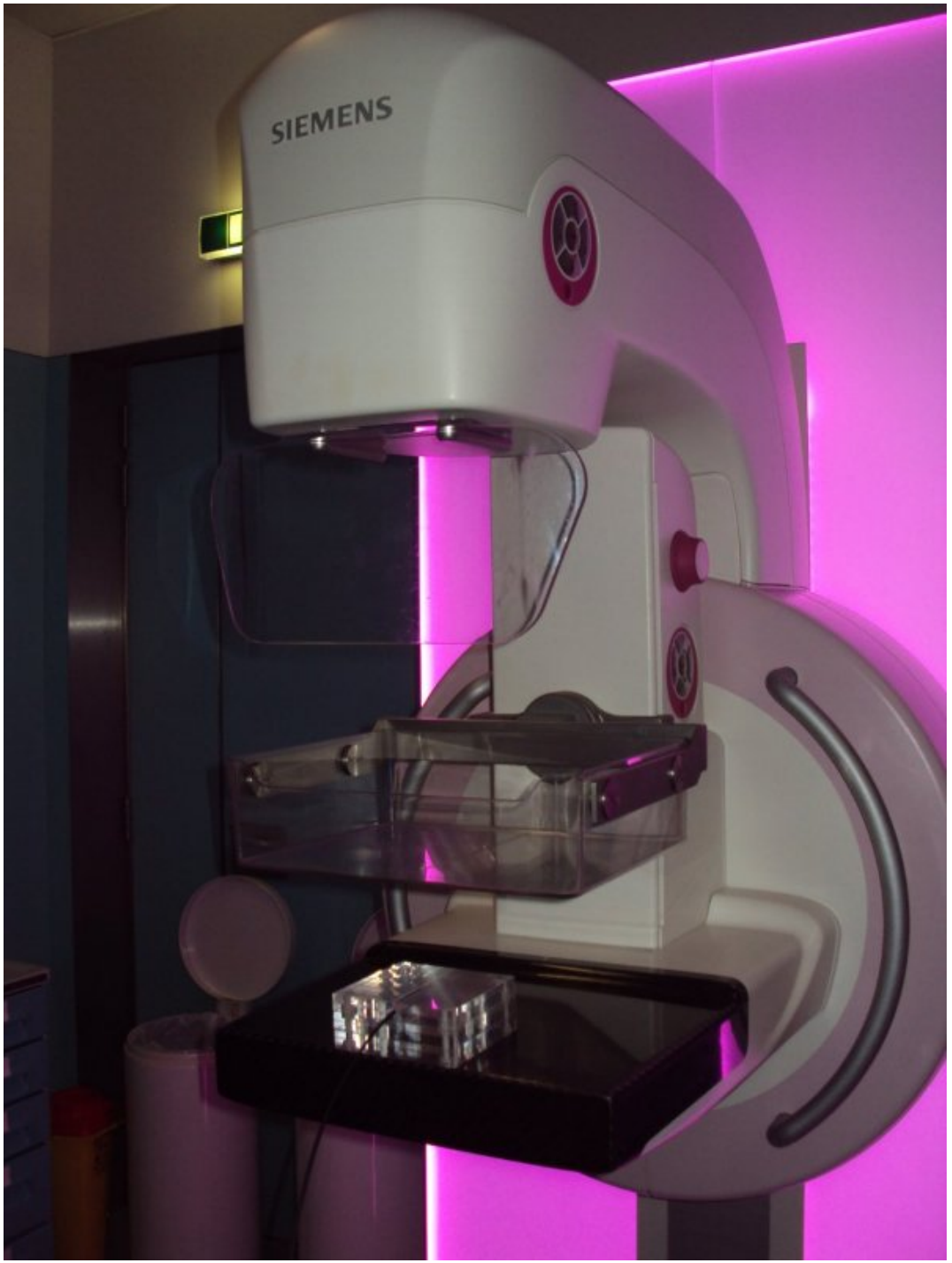


Clinical and environmental dosimetry

Luis Peralta, Alina Louro, Conceição Abreu, Florbela Rego, Jorge Sampaio, Patrick Sousa, Sandra Soares

Main topics

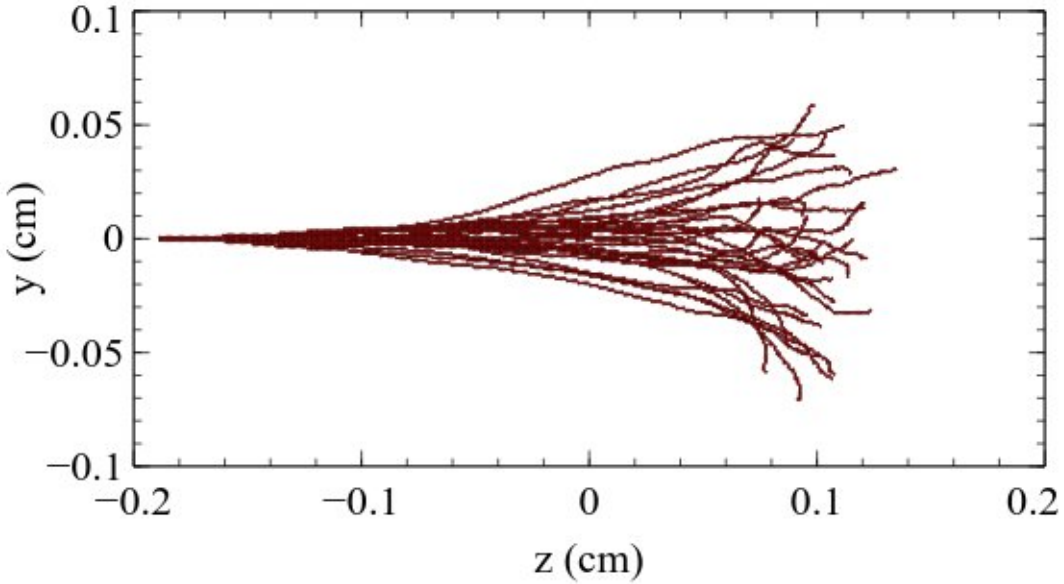
1) Environmental alpha particle dosimetry

2) Optimization of Radiological protection barriers

3) Development of new detectors for Digital Breast Tomosynthesis dosimetry

1. Environmental alpha particle dosimetry

Development of the AlfaMC alpha particle fast transport simulation program.



The code is presently being adapted and included in the

COG: A High Fidelity Multiple-Particle Transport Code

(Lawrence Livermore National Laboratory)

AlfaMC: A fast alpha particle transport Monte Carlo code, Luis Peralta and Alina Louro, NIM A 737 (2014) 163-169

This year:

radiobiological study of

neoplasic lung patients

@ Hospital da Guarda

Study of the patient concentrated breath

This analysis will provide the content on Pb in the breath

Study of the patients lung cells

The lung tissue is removed by biopsy and it will be assessed the presence of Pb traces using a suitable proton activation reaction.

The CTN (Sacavém) proton tandem accelerator will be used

2. Optimization of Radiological protection barriers

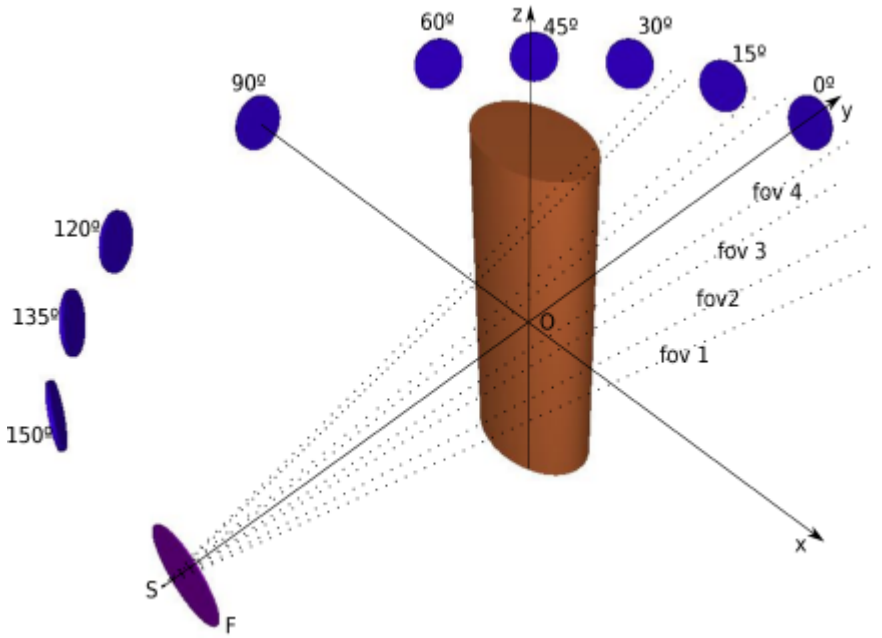
Reassessment of radiation scatter values in x-ray imaging installations

Current values are based on early measurements made by Trout and Kelly in 1972 (NCRP 49) , revised Simpkin and Dixon in 1998 (NCRP 147):

Workloads assumed at a single (maximum) operating voltages;

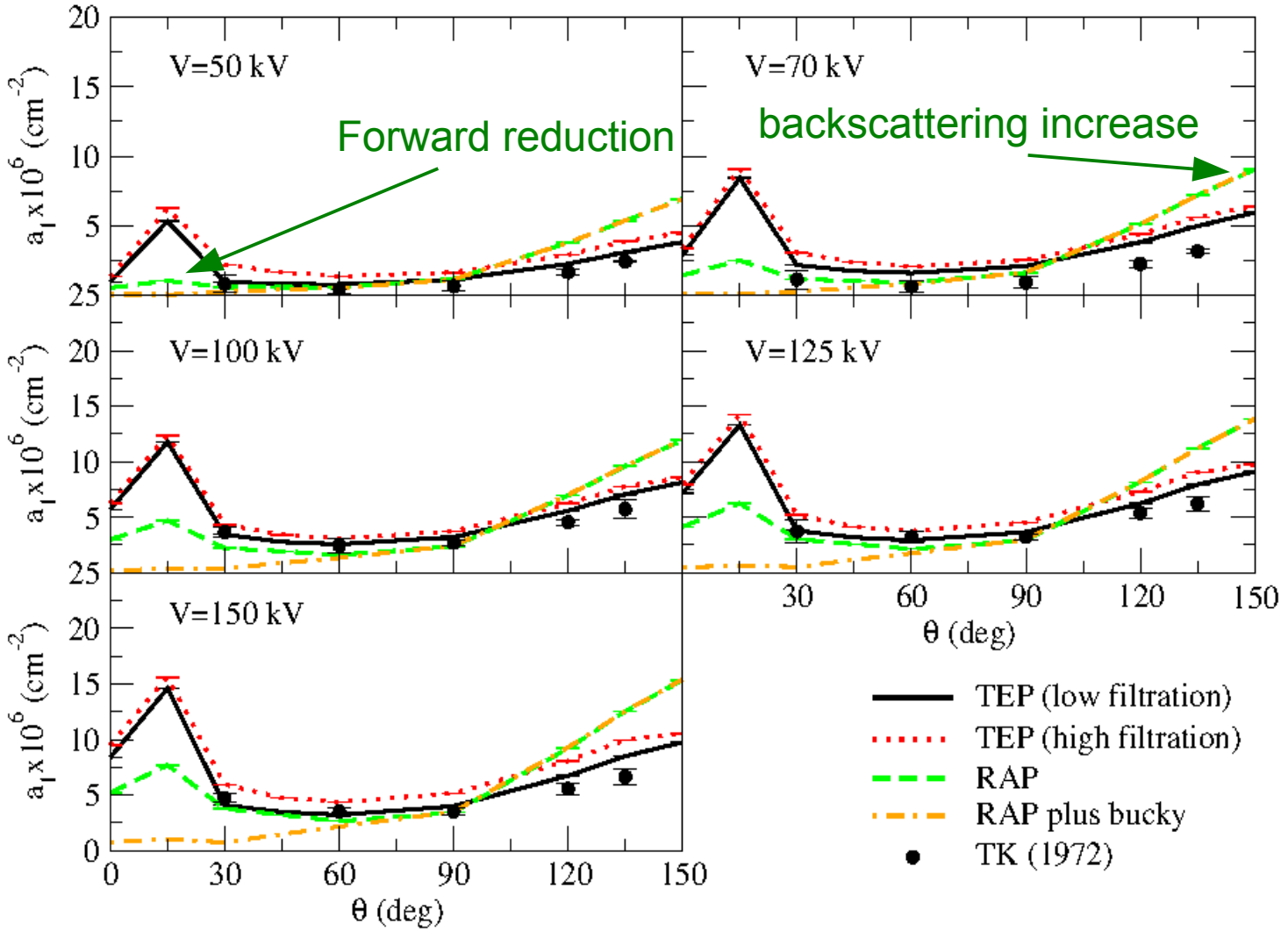
Filtrations too low for modern equipments;

Does not include the effect of the bucky (cassette holder).



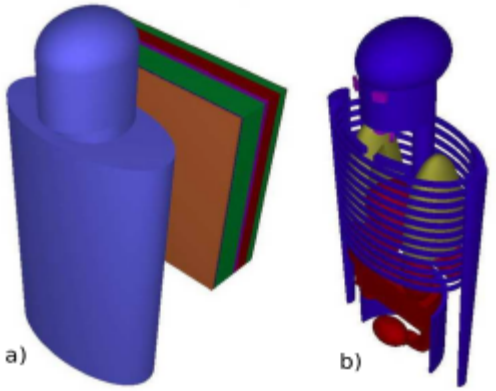
Trout and Kelley geometry implemented in PENELOPE

Simulation Results



TEP – TK phantom made of tissue-equivalent plastic

RAP – Realistic phantom:



Significant increase of backscattering by the RAP relatively to the TEP;

Effect of the patient and bucky can not be neglected in an optimized design of primary barriers (transmitted beam).

MC is a useful tool to obtain systematic results;

Inhomogeneities of a real patient might have a more important effect on the transmitted and scattered radiation than assumed so far.
This clearly must be further investigated;

Future shielding methodologies should include the effect of the patient in the transmitted beam.

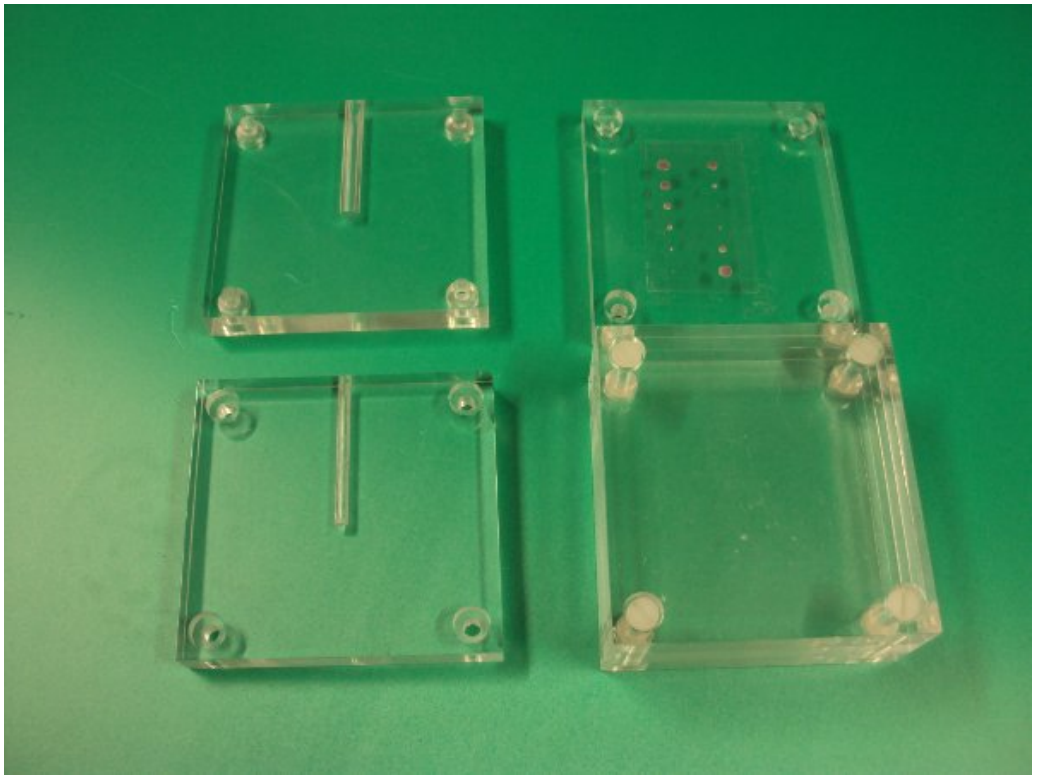
Scatter Fraction With Simulations – Revisiting Radiation Scatter In X-Ray Imaging Radiation Prot. Dosimetry, submitted (2014)

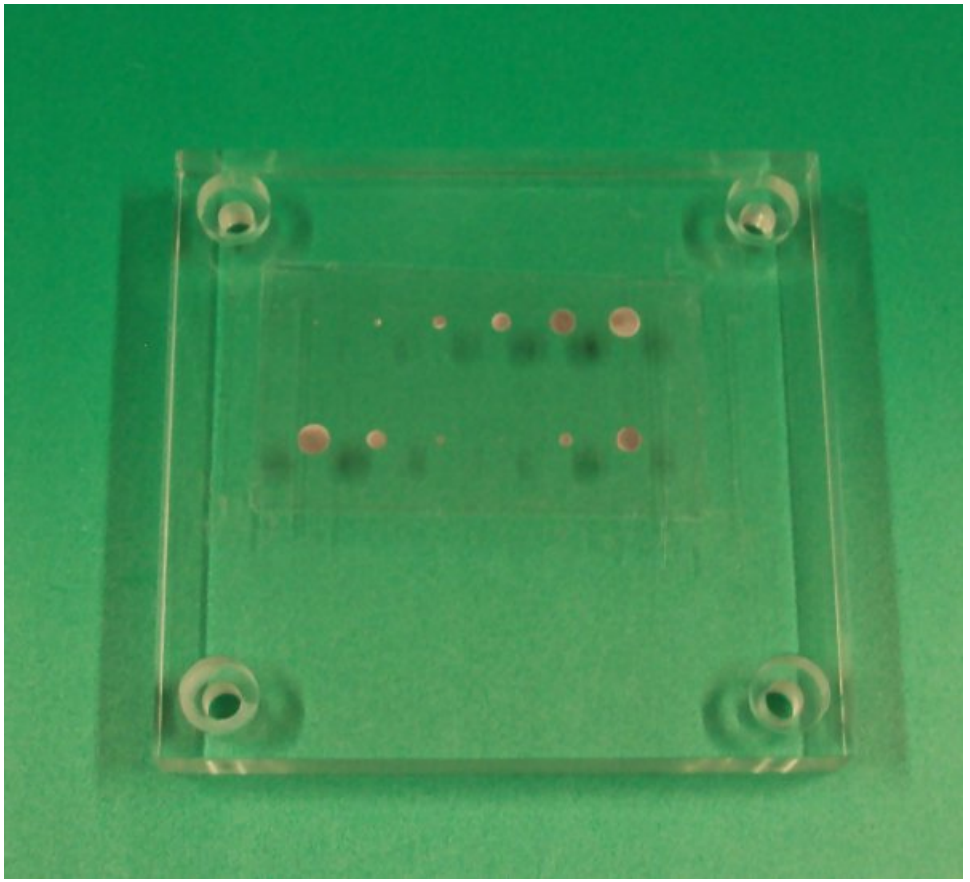
3. Development of new detectors for Digital

Breast Tomosynthesis dosimetry

PMMA breast phantom

(Coimbra workshop)



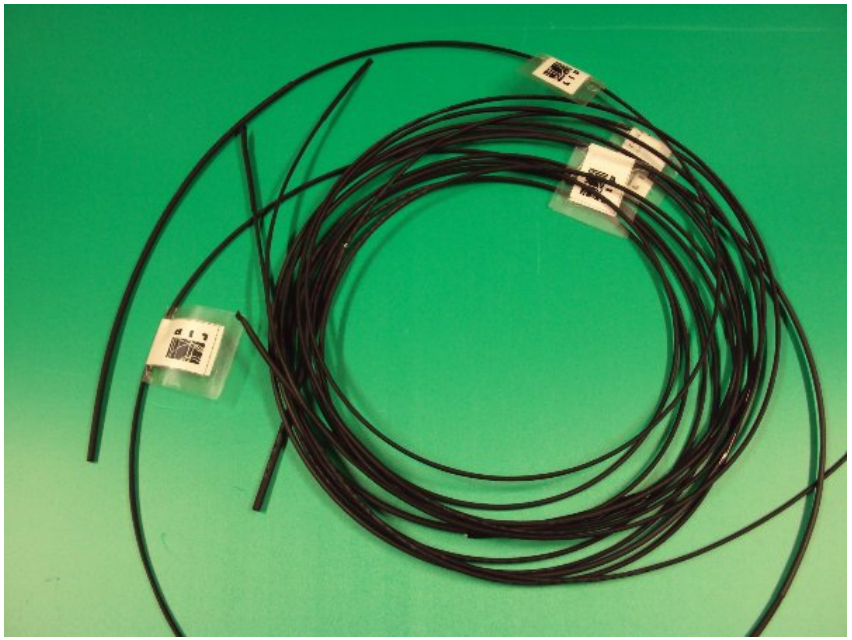


Set of simulated lesions

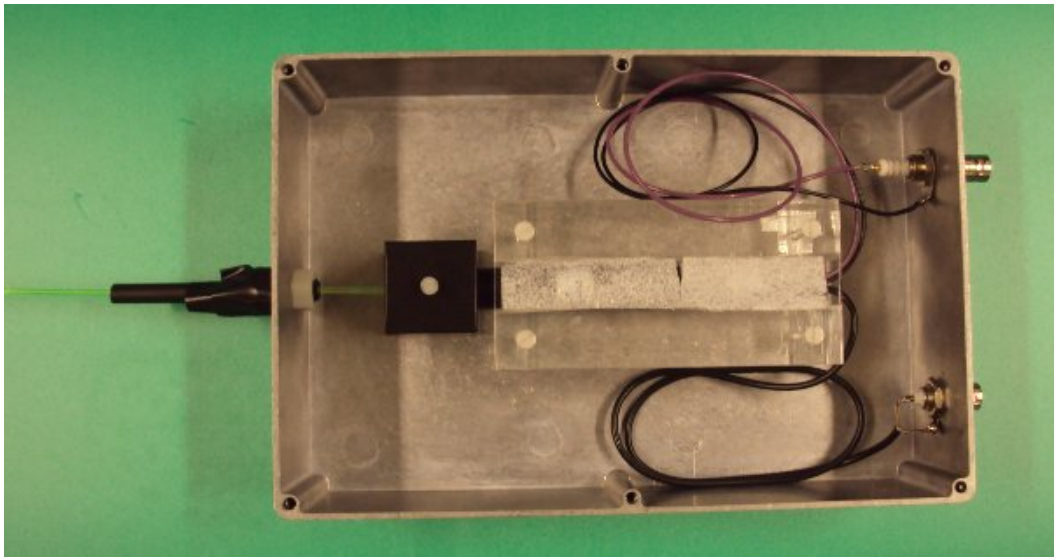
(Al precision disks)

Scintillator dosimeter

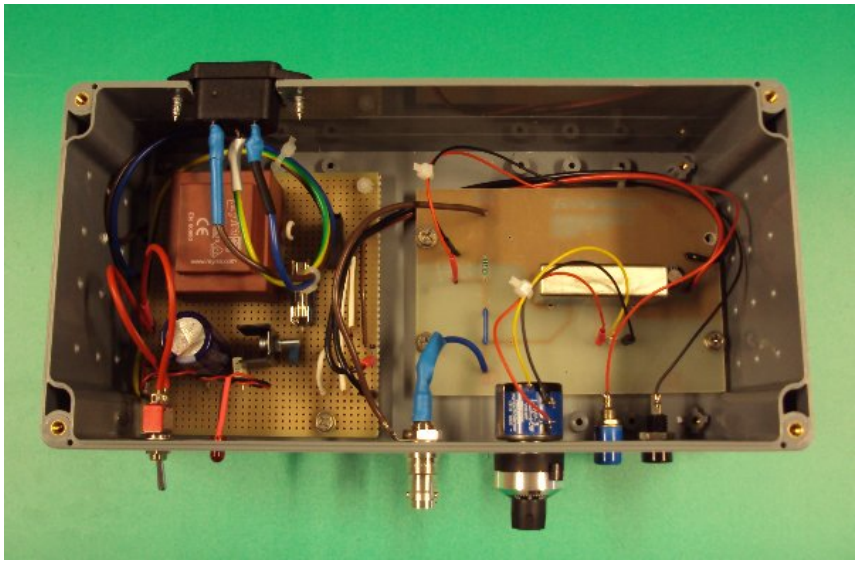
BC-404 (PVT) 8mm / 3mm Ø



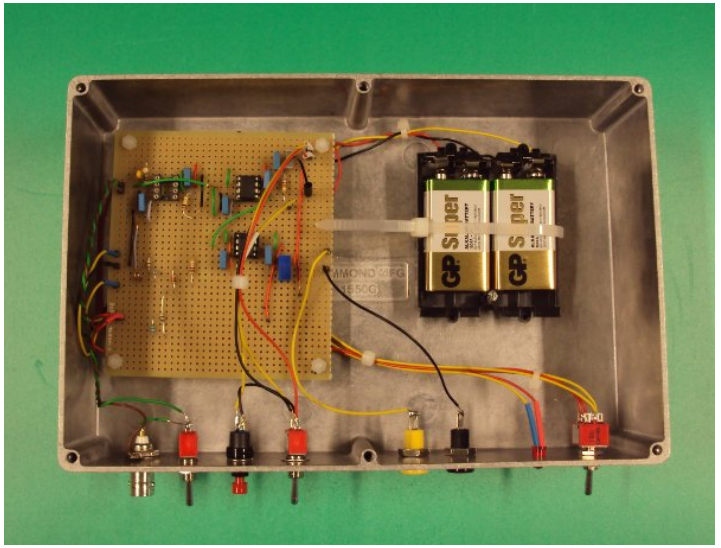
PMT Hamamatsu R647P



HV portable module



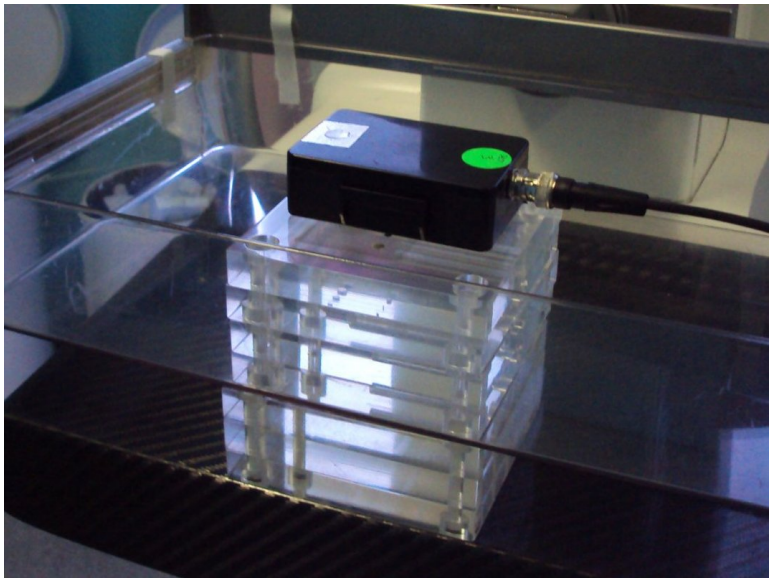
Portable charge amplifier

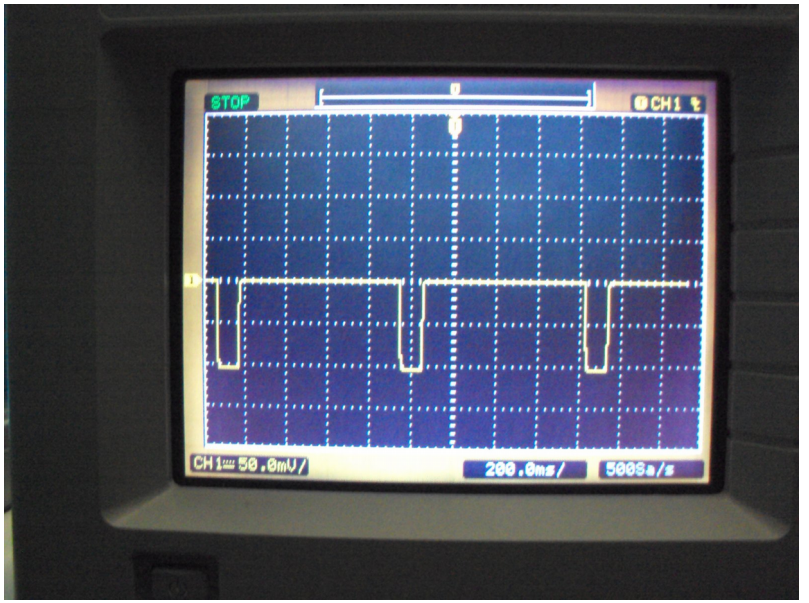


Hospital da Luz, Lisboa

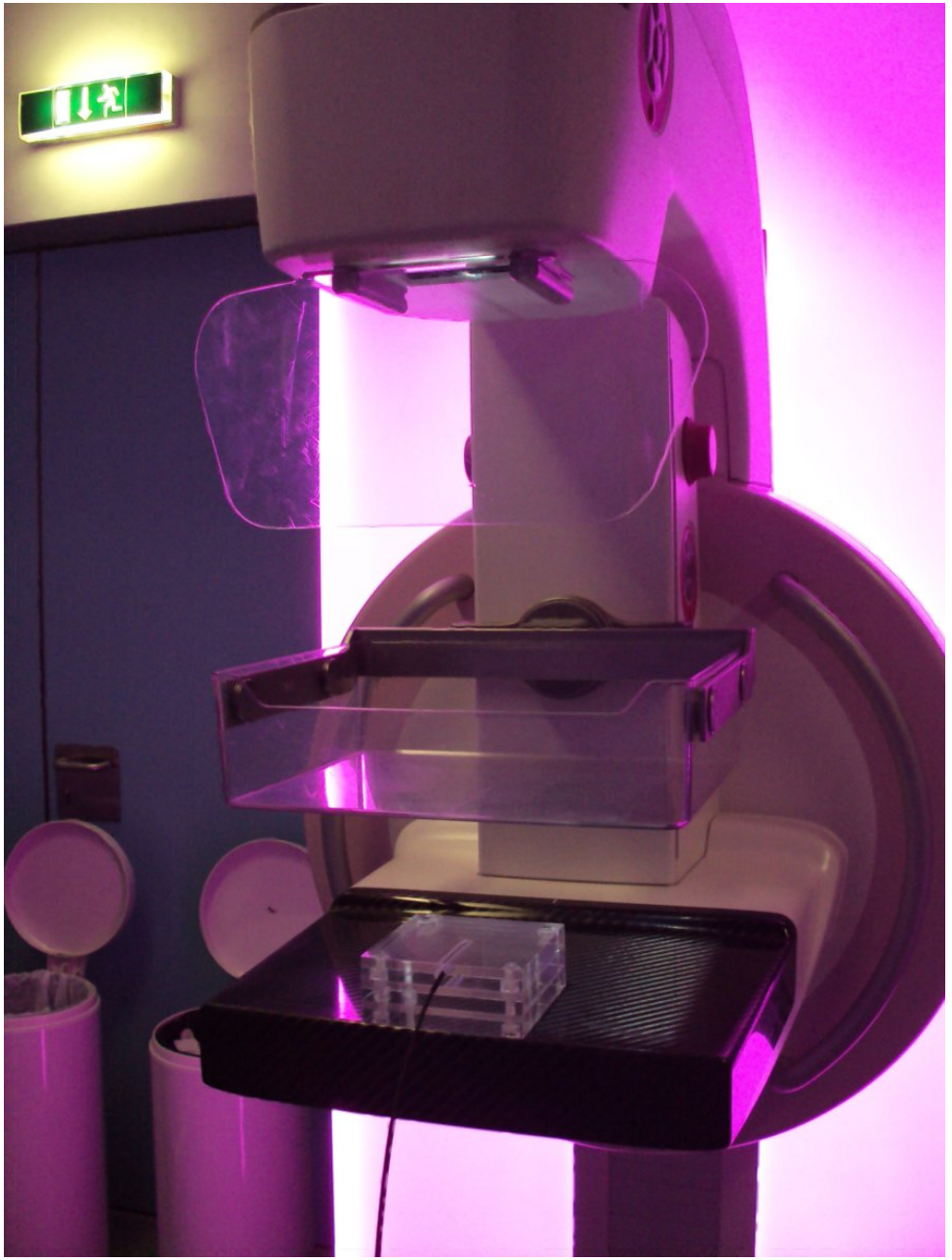
Siemens Mammomat

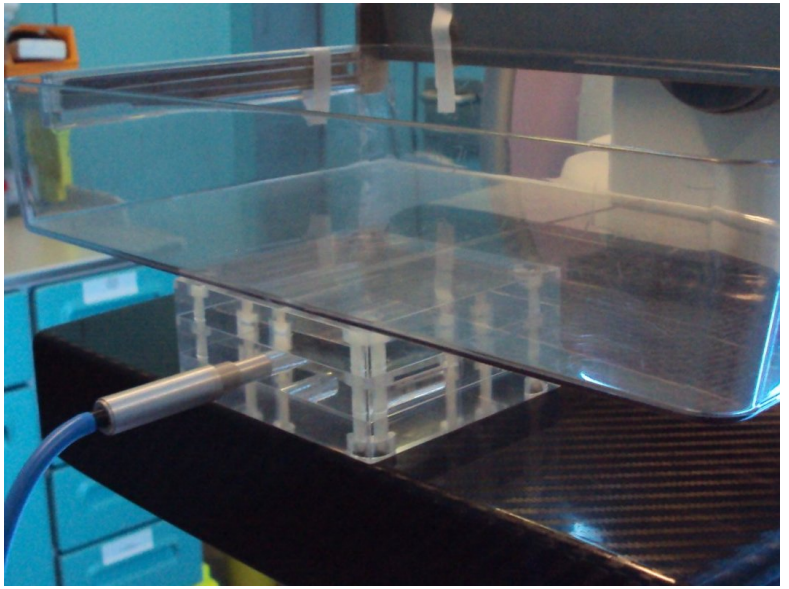
Mammomat Beam study with Si-PIN detector

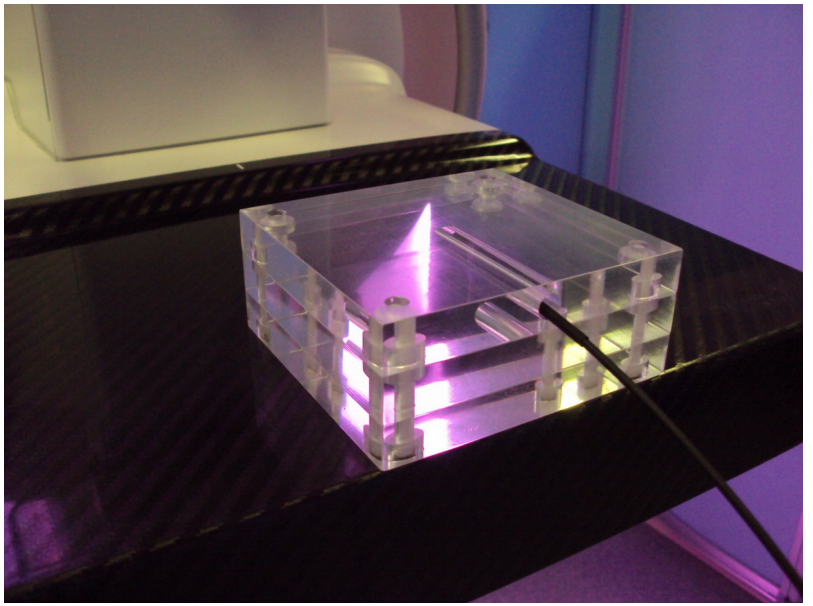




Dose study with breast slice phantom

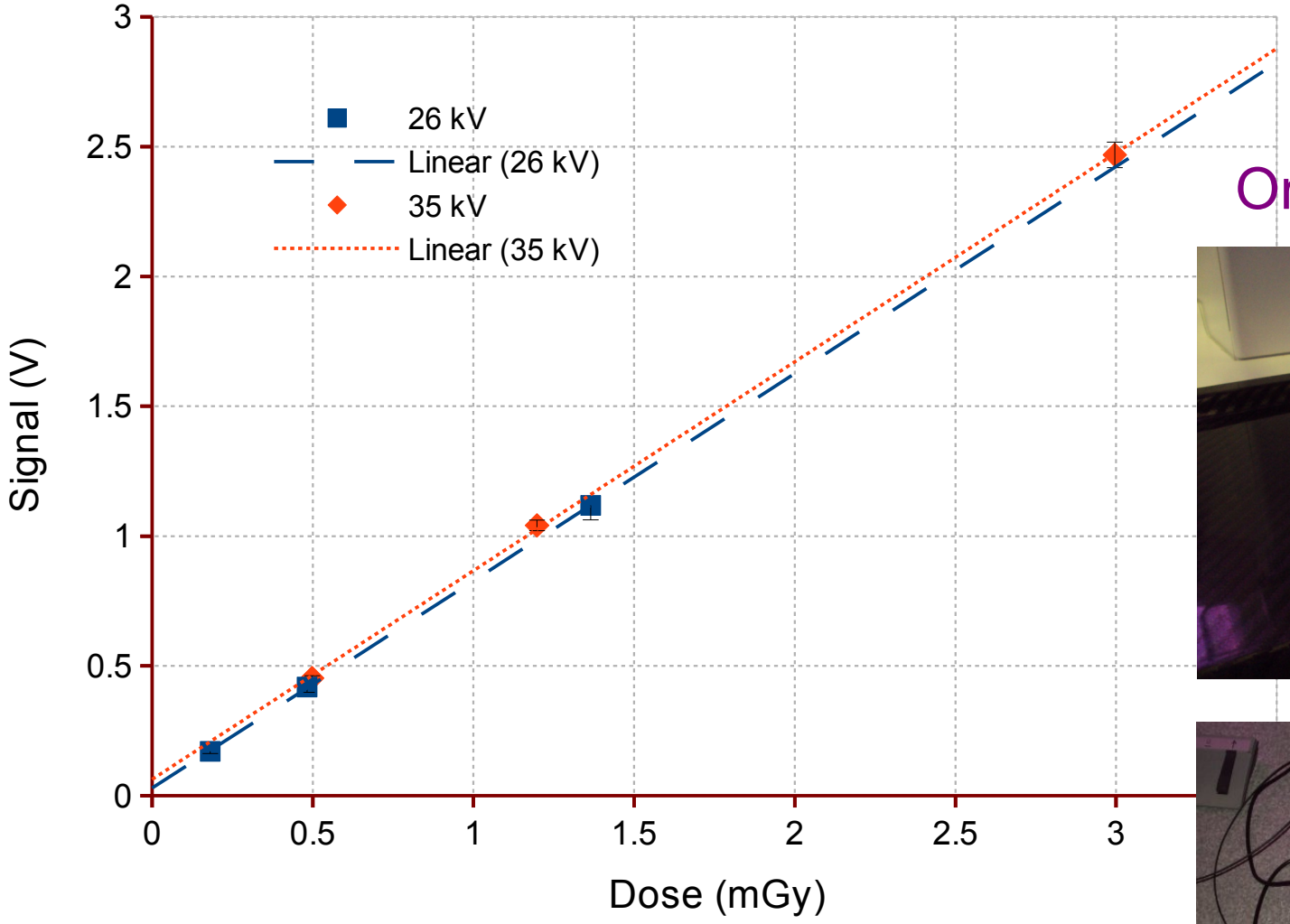




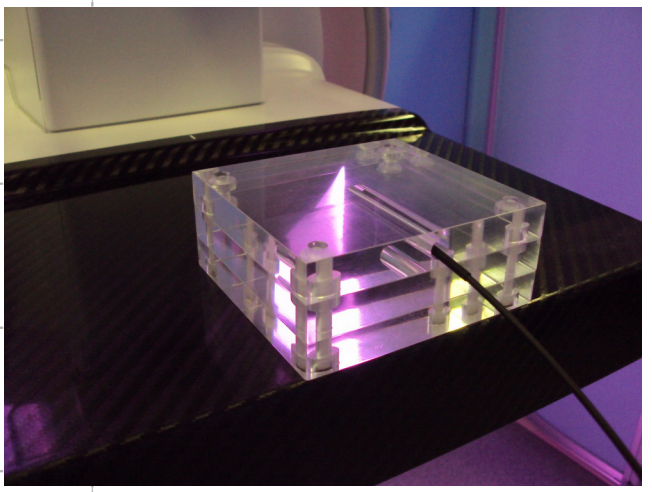


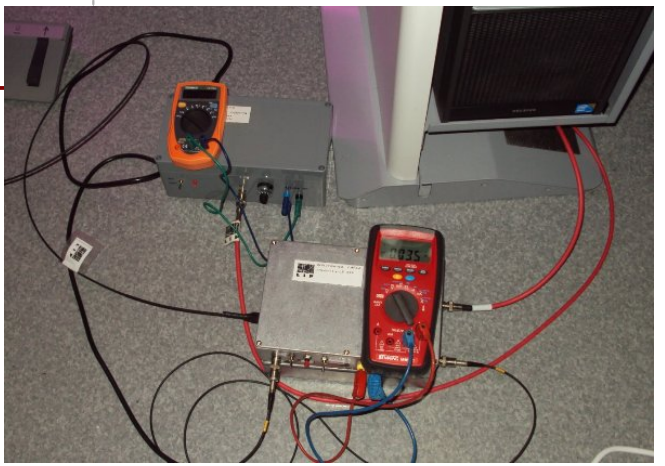
Siemens - Mammomat

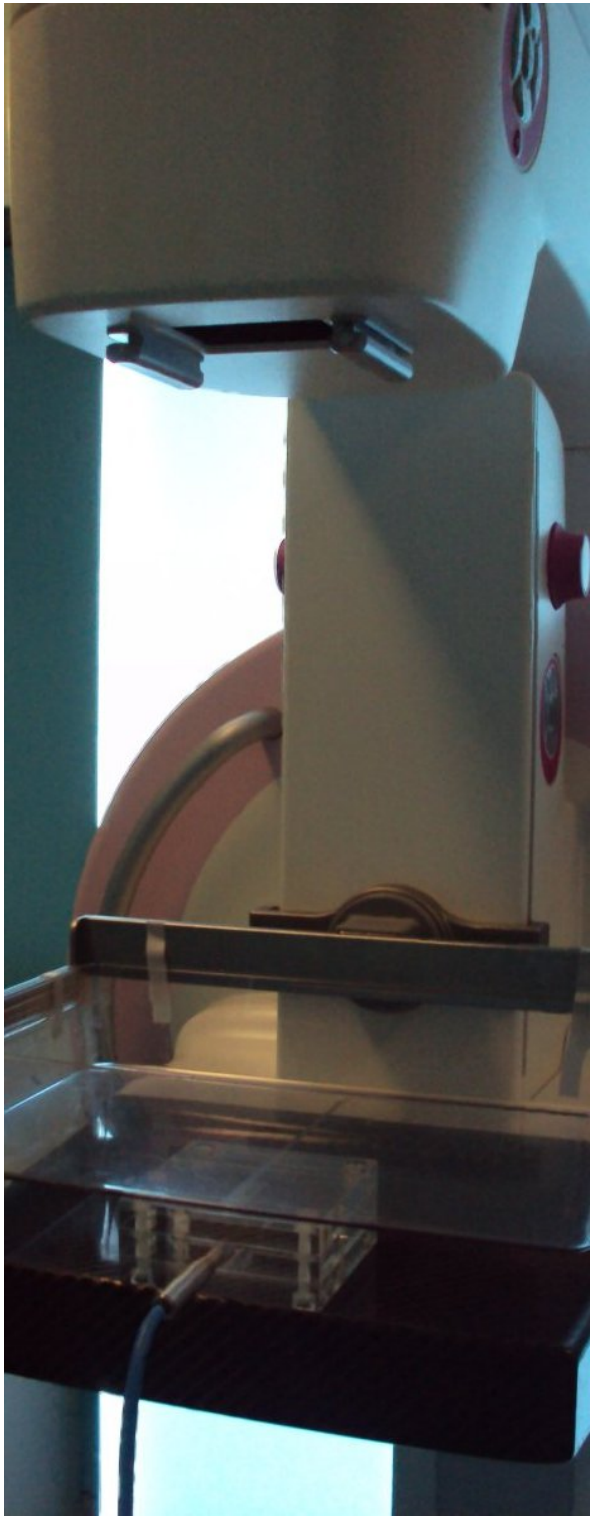
Sc Dosimeter vs Ionization Chamber



One point per slice







Thank You