

Kick-off Meeting - Projeto Temático FAPESP "Física e Instrumentação de Altas Energias com o LHC-CERN"



Participação do GDRFM no Working Group 5.1

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GRUPO DE
**DOSIMETRIA
DAS RADIAÇÕES**
e FÍSICA MÉDICA

IFUSP - Instituto de Física da USP

Nossas contribuições ao projeto



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- ❑ Development of a photon-counting Computed Tomography (CT) using GEM (or thick-GEM) based detectors;
- ❑ Development of a hyperspectral system for contrast-enhanced mammography using GEM (or thick-GEM) based detectors.

Photon counting CT



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□ O que é?

– Nova técnica de tomografia computadorizada

- Imagens monoenergéticas virtuais
- Decomposição de materiais da amostra
- Melhor resolução espacial ($\sim 150\text{-}340\mu\text{m}$) e menor ruído
- ... E muito mais

□ Por que é importante?

– Imagens quantitativas de alta qualidade

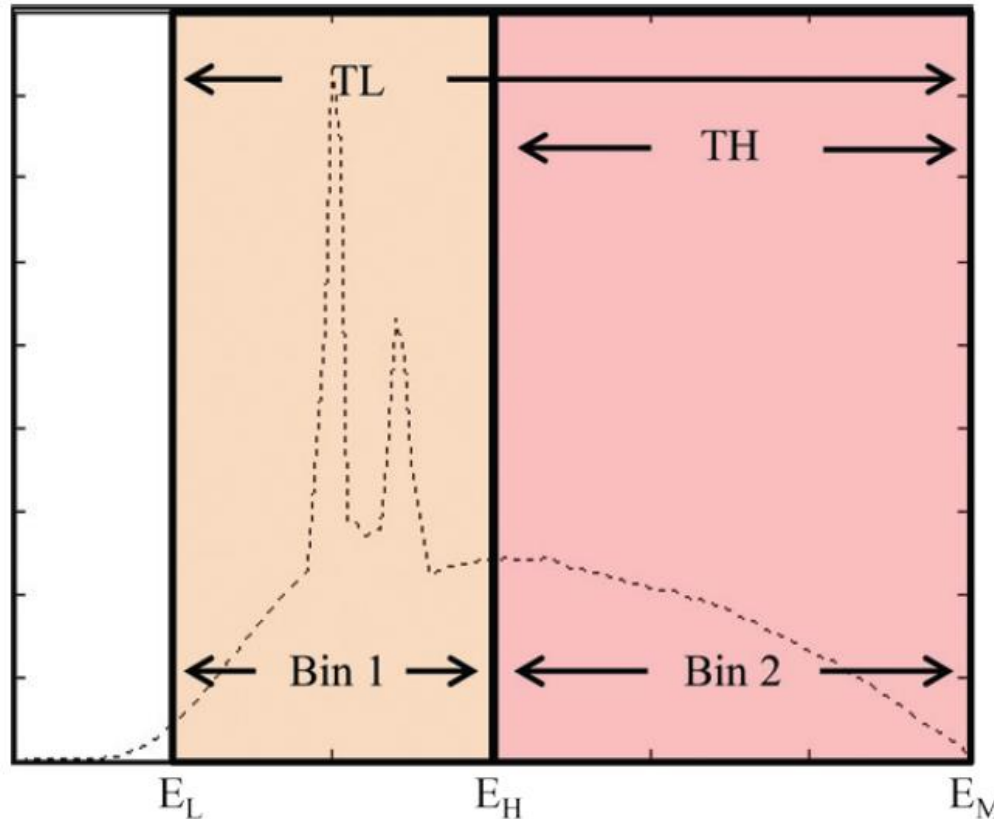
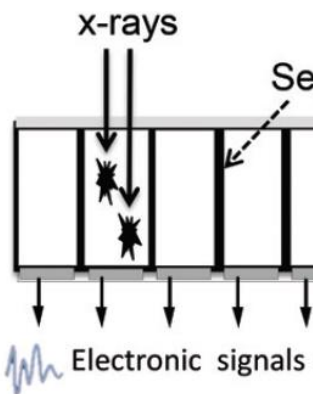
– Redução de artefatos

– Redução de dose sem perda de qualidade

Como funciona?

Tecnologia

CT



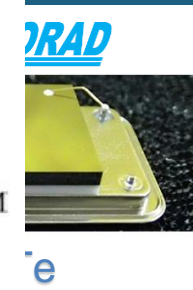
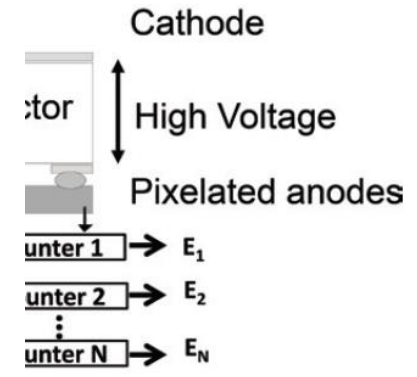
Bin 1: $E_L \rightarrow E_H$

Bin 2: $E_H \rightarrow E_M$

TL: $E_L \rightarrow E_M$

TH: $E_H \rightarrow E_M$

~2 cm



<https://www.youtube.com/watch?v=9Kz7CxtqXw0>

GOS

Heismann, B.J, 2012

Shuai Leng, et al. RadioGraphics 2019 39:3, 729-743

Photon-counting CT

Radiology



ORIGINAL RESEARCH • MEDICAL PHYSICS

First Clinical Photon-counting Detector CT System: Technical Evaluation

Kishore Rajendran, PhD • Martin Petersilka, PhD • André Henning, PhD • Elisabeth R. Shanblatt, PhD •
Bernhard Schmidt, PhD • Thomas G. Flohr, PhD • Andrea Ferrero, PhD • Francis Baffour, MD • Felix E. Diehm, MD •
Lifeng Yu, PhD • Prabbakar Rajiah, MD • Joel G. Fletcher, MD • Shuai Leng, PhD • Cynthia H. McCollough, PhD

From the Department of Radiology, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (K.R., A.F., F.B., F.E.D., L.Y., P.R., J.G.F., S.L., C.H.M.); Siemens Healthineers, Forchheim, Germany (M.P., A.H., B.S., T.G.F.); and Siemens Medical Solutions, Malvern, Pa (E.R.S.). Received October 13, 2021; revision requested November 11; revision received November 20; accepted December 21. Address correspondence to C.H.M. (e-mail: mccollough.cynthia@mayo.edu).

Supported by the National Institutes of Health under award number R01-EB028590 and supported in kind by Siemens Healthineers, which owns the evaluated system under the terms of a sponsored research agreement with the Mayo Clinic.

Conflicts of interest are listed at the end of this article.

See also the editorial by Willemink and Grist in this issue.

Radiology 2022; 303:130–138 • <https://doi.org/10.1148/radiol.212579> • Content code: CT

Radiology 2022; 303:130–138

Input

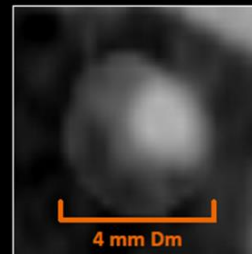
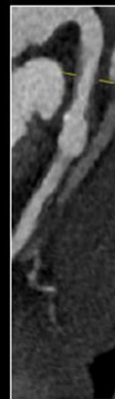
Highly resolved spectral CT data

→ Decomposition of materials and fine resolution

Severe degree of coronary artery disease with calcifications
• Cardiac symptoms persisting



Calcification mask the pathology and “distorts” severity of the stenosis
→ No value delivered

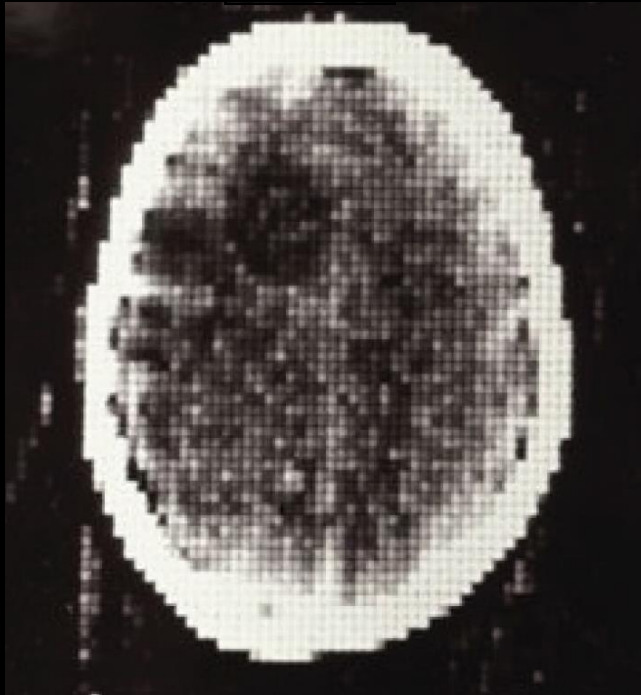


Pure Lumen

Reveals the underlying reality of the pathology
→ Able to guide the cardiologist with non-invasive imaging in advanced CAD

real lumen pathologic wall with different composites

1971

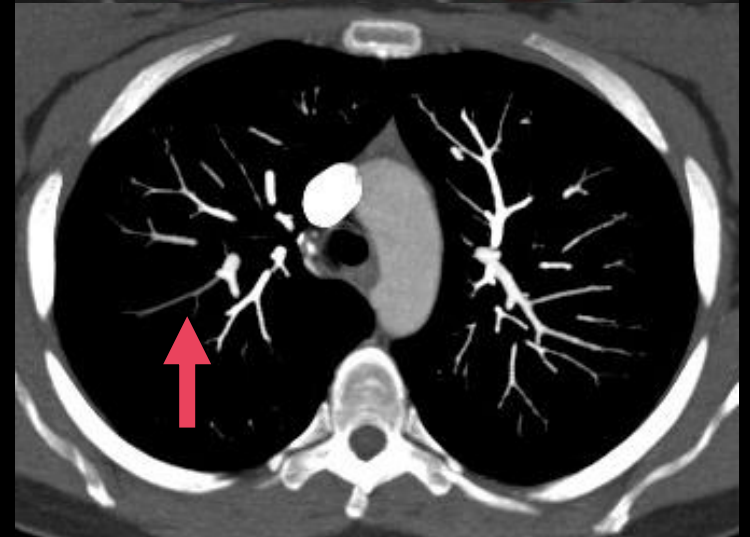


2021

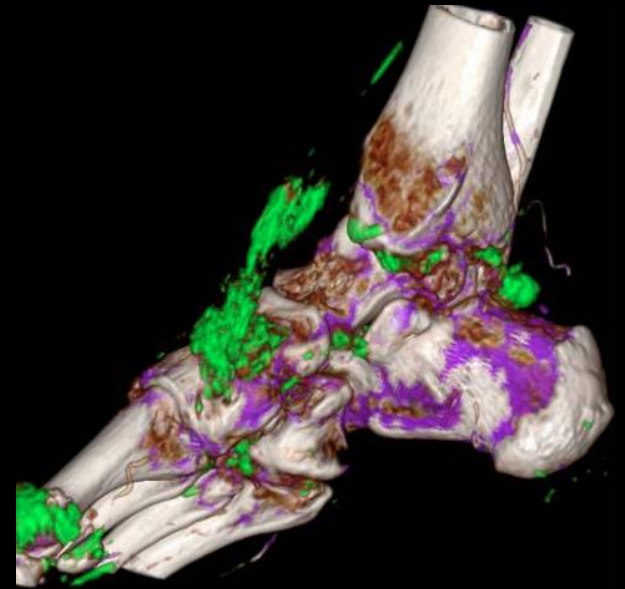
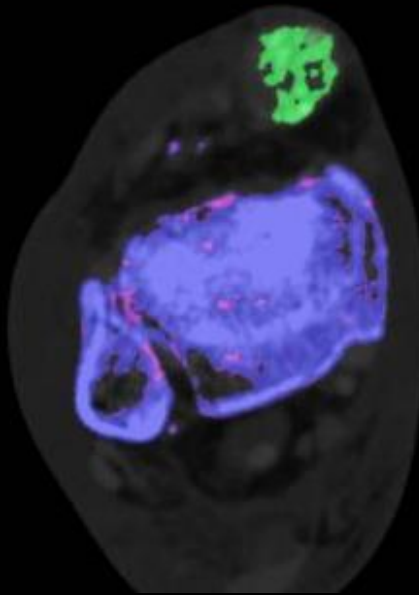
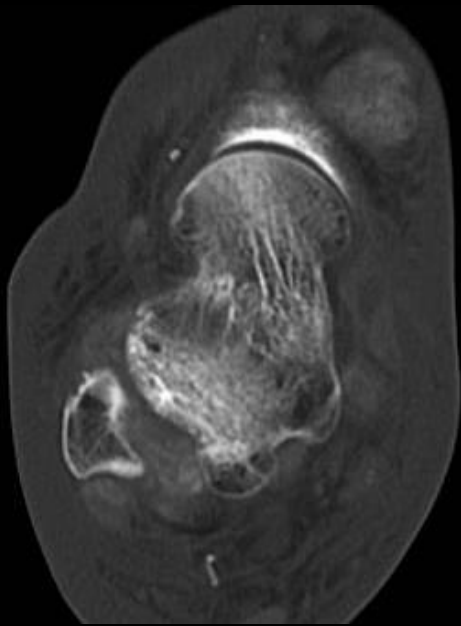


<https://www.siemens-healthineers.com/perspectives/lung-cancer-screening-programs>

Cortesia: Dr. Márcio Sawamura



Cortesia: Dr. Márcio Sawamura



Cortesia Dr. Paulo Victor Helito/Dr. Márcio Sawamura

Contrast-enhanced mammography

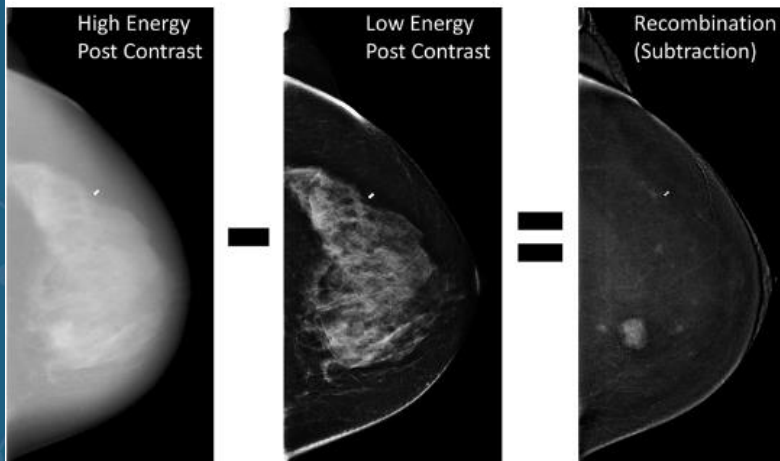
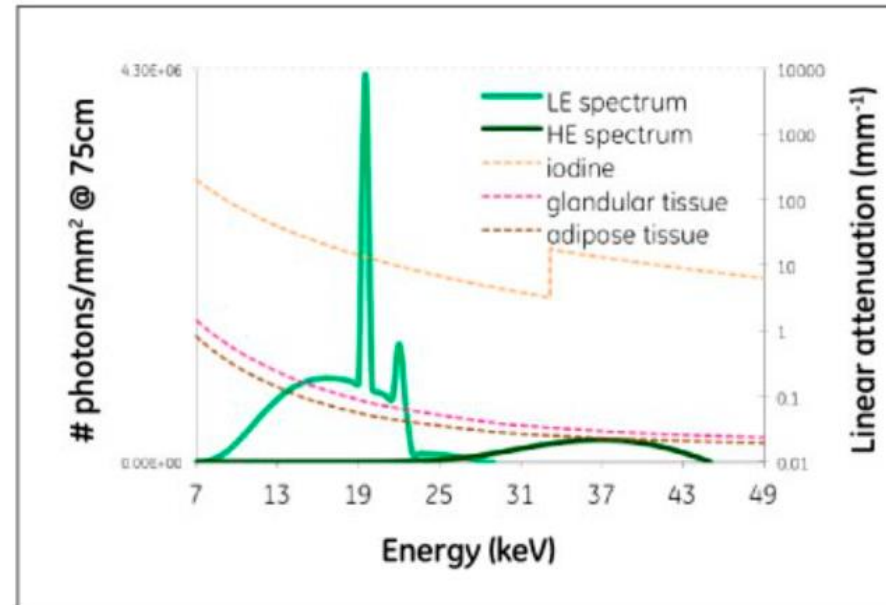
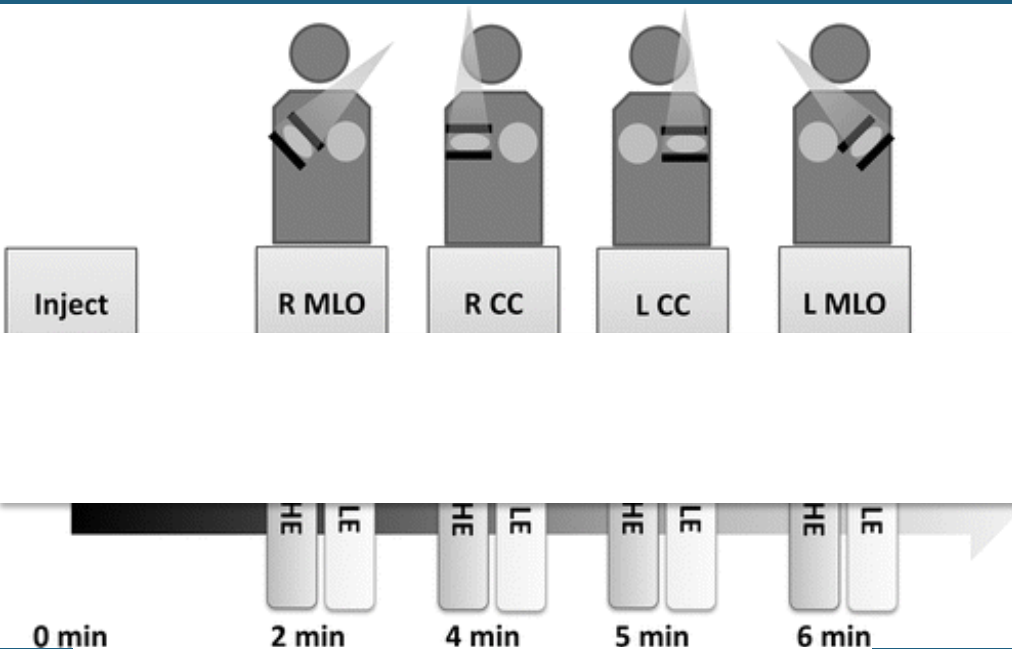
□ O que é?

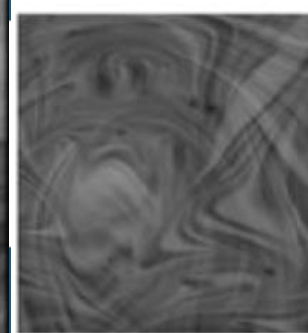
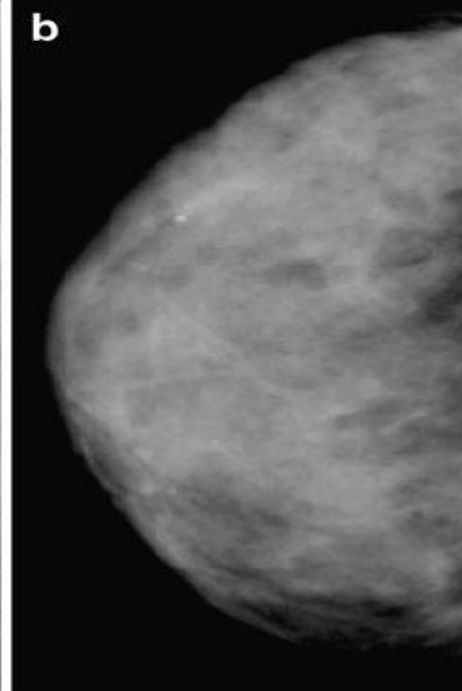
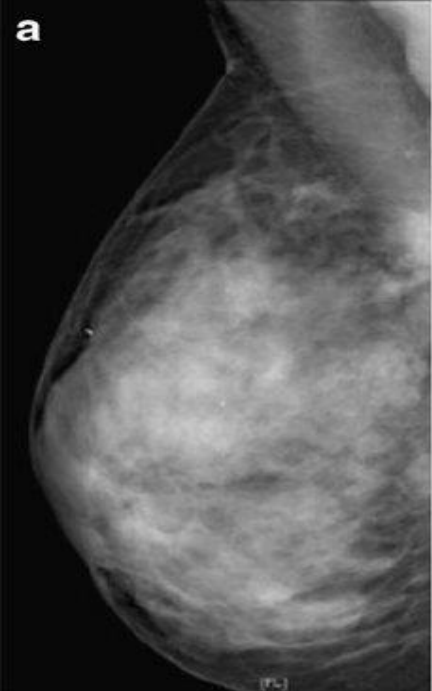
- Nova técnica de mamografia digital
 - Imagens com injeção de contraste intravenoso
 - Realce do contraste usando técnicas de subtração
 - Realce de lesões com alta vascularização
 - Avaliação das dimensões das lesões da amostra
 - ... E muito mais

□ Por que é importante?

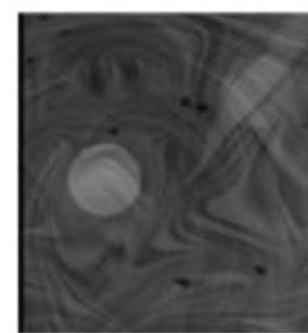
- Melhorar capacidade de identificação e classificação de lesões
- Redução do ruído anatômico
- Monitoração de lesões durante tratamentos

Como funciona?

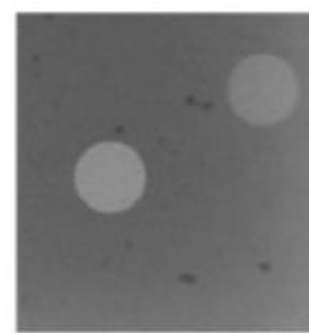




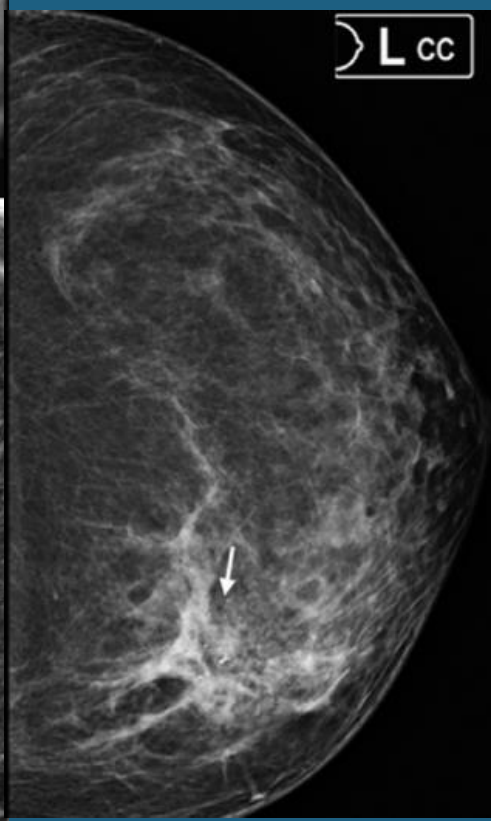
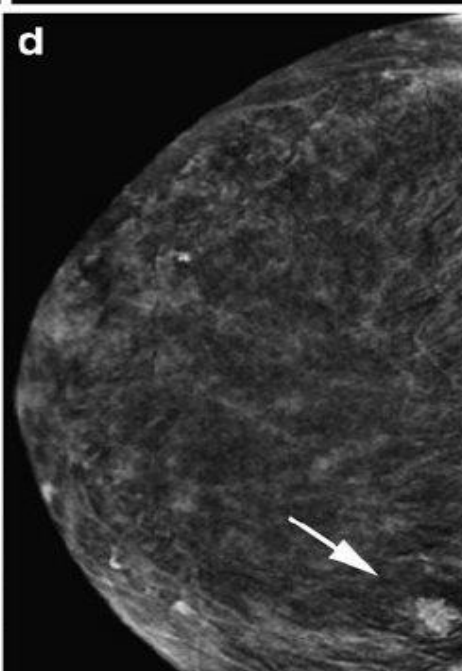
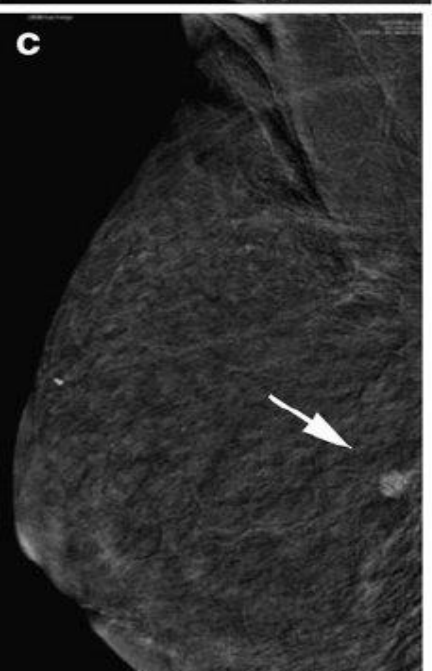
Low energy image (a)



High energy image (b)



Iodine image (c)



O que ...

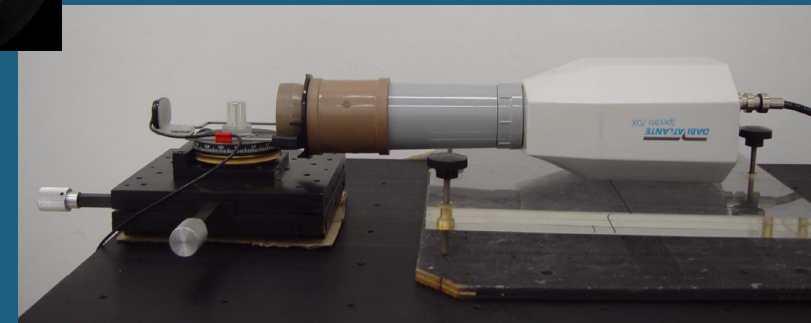
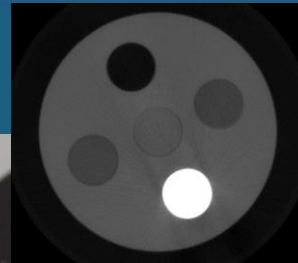
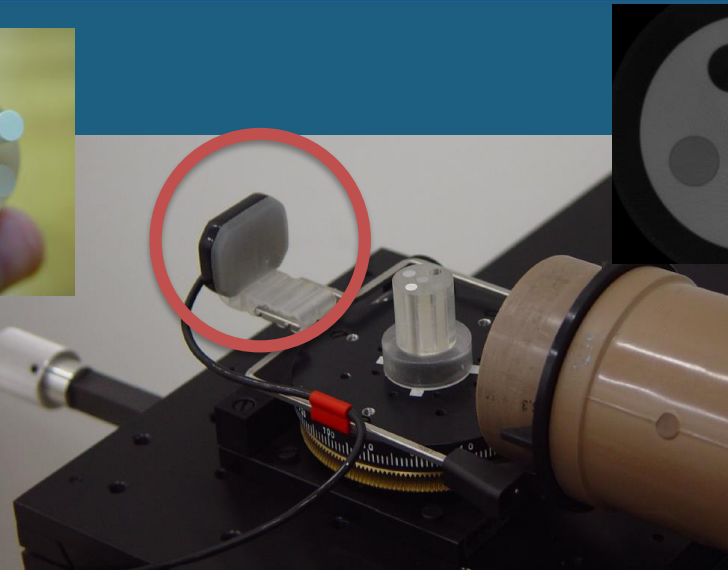
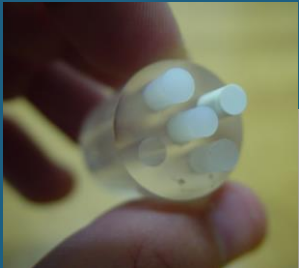
☐ PRETENDEMOS fazer:

- PCT e CEM de bancada usando o GEM para ensino/pesquisa
 - Processamento/reconstrução de imagens
 - Produção e testes de *phantoms*
 - Avaliação quantitativa de materiais (se funcionar bem)

☐ NÃO PRETENDEMOS fazer:

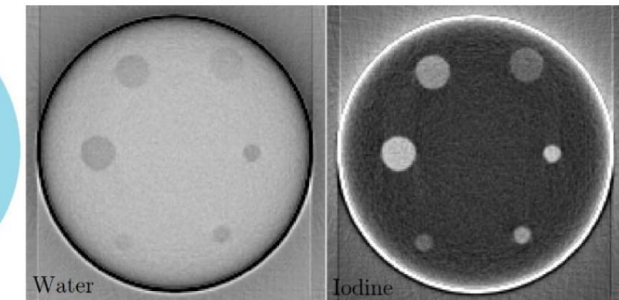
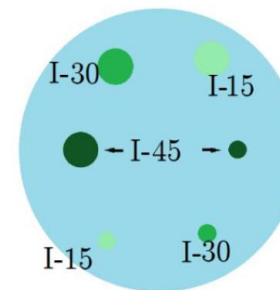
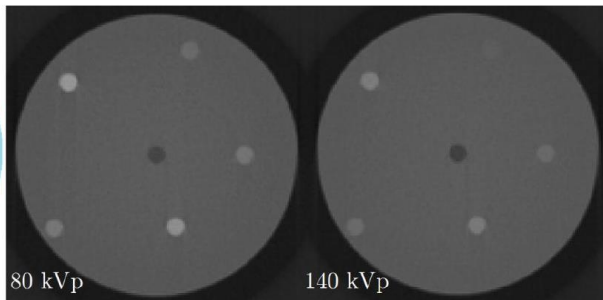
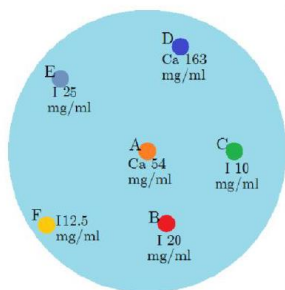
- PCT e CRM de uso clínico
- Equipamentos de grande porte

O que pretendemos fazer?



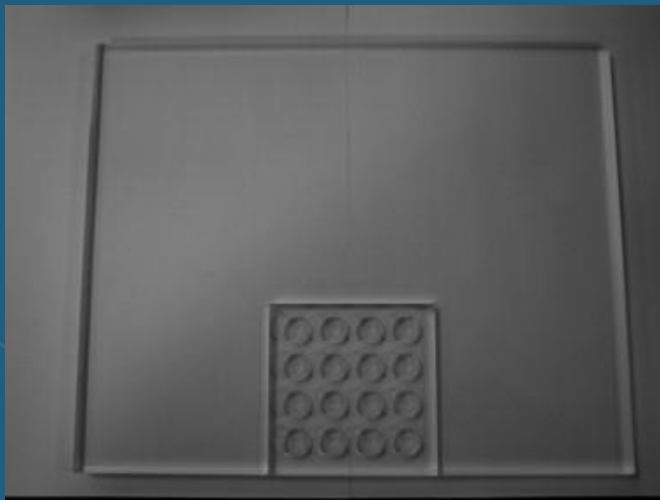
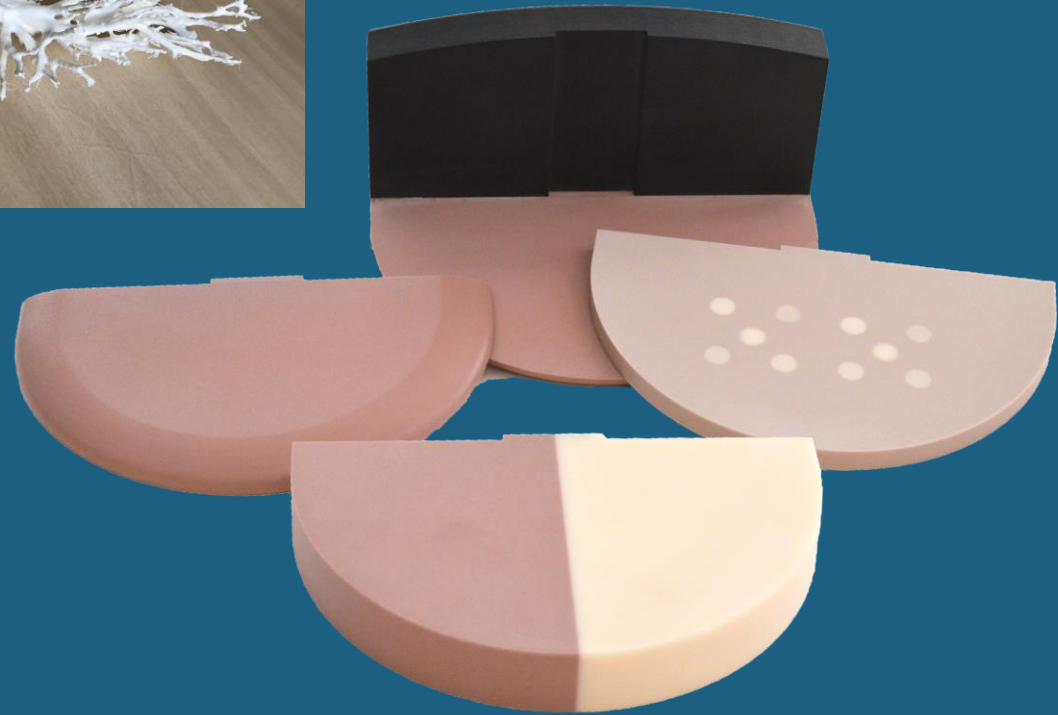
Araujo, 2008 - mestrado

GEM



Puerto, 2018 - mestrado

O que pretendemos fazer?

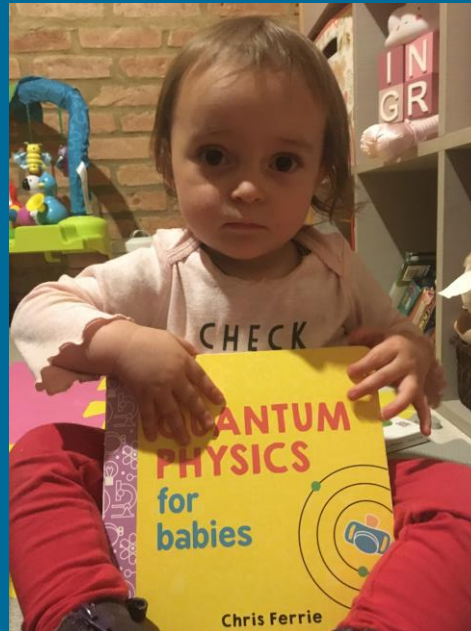


Cronograma preliminar



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ATIVIDADE	PERÍODO
ENCONTRAR ALUNO(S)	1º SEM 23
REVISÃO BIBLIOGRÁFICA	1º SEM 23
DESENHO DOS SISTEMAS	1º SEM 23
DEFINIÇÃO DA(S) FONTE(S) DE RX	2º SEM 23
AQUISIÇÃO DE SISTEMAS MECÂNICOS	2º SEM 23
MONTAGENS PRELIMINARES (BANCO ÓPTICO)	2º SEM 23
DESENVOLVIMENTO DO SOFTWARE DE AQUISIÇÃO/RECONSTRUÇÃO	1º SEM 24
TESTES PRELIMINARES E AJUSTES/VALIDAÇÕES	2º SEM 24
FINALIZAÇÃO DOS SISTEMAS	2º SEM 24
PUBLICAÇÕES/RELATÓRIOS	FLUXO CONTÍNUO

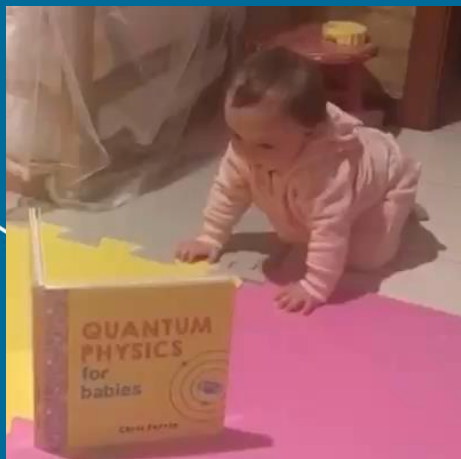


Em parceria com a **filhos no currículo**

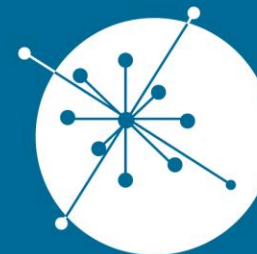
Lançamos a campanha
FILHOS NO CURRÍCULO LATTES

VISTA A CAMISETA DESTA CAUSA!

#maternidadenolattes
#paternidadenolattes
#parentinscience



Thank you
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