Curso de Verão 2018 – IF-USP

INTRODUÇÃO À FÍSICA MÉDICA

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Bloco F – Conjunto Alessandro Volta

Laboratório de Dosimetria das Radiações e Física Médica
GDRFM - IFUSP

Curso de Verão 2018 – IF-USP

INTRODUÇÃO À FÍSICA MÉDICA

Programa básico:

- Breve Histórico sobre a Física Médica
- Efeitos biológicos da radiação e Proteção Radiológica
- **Diagnóstico por imagens: radiologia e medicina nuclear**
- Radioterapia: Introdução, teleterapia e braquiterapia
- O Físico Médico: formação e campo de trabalho atual e futuro

Curso de Verão 2018 – IF-USP

3ª. Aula: 21.02.2018

Diagnóstico por imagens

Paulo Roberto Costa
pcosta@if.usp.br

Bloco F – Conjunto Alessandro Volta – sl. 109
GDRFM - IFUSP

Sumário – 3ª. aula

- **Conceitos gerais**
- **Técnicas atuais de DI**

→ **Com radiações ionizantes**

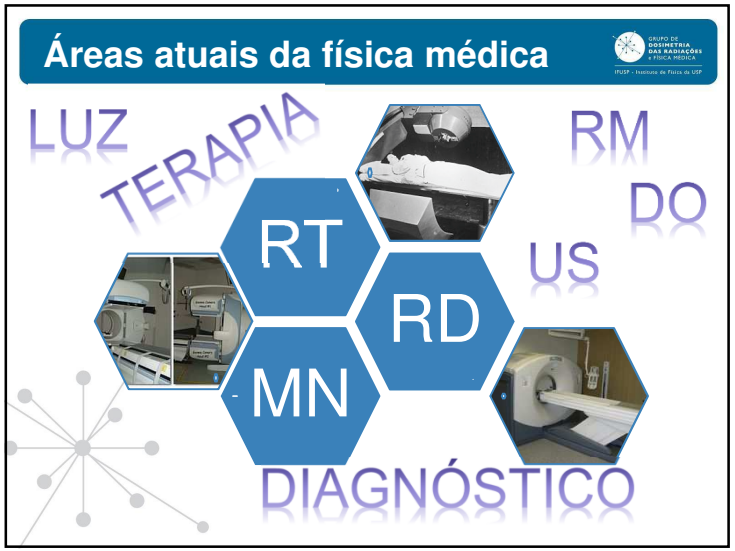
→ Radiologia convencional e digital
→ Mamografia
→ Radiologia intervencionista
→ Medicina nuclear
→ Densitometria óssea

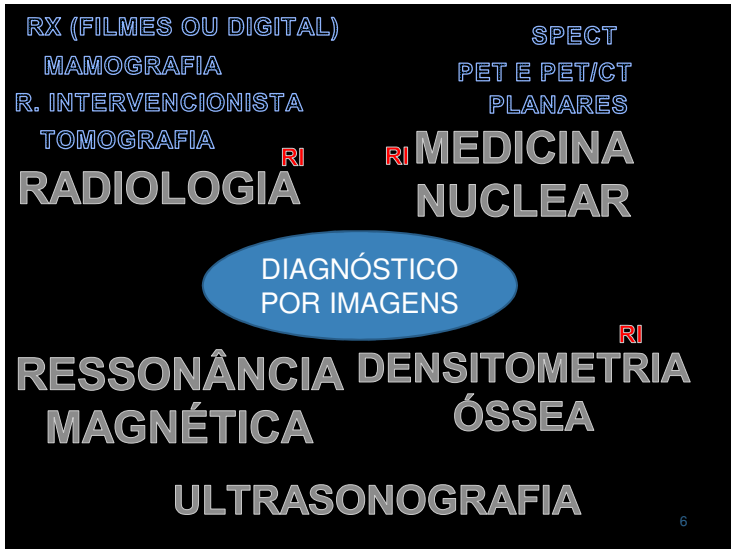
→ **Sem radiações ionizantes**

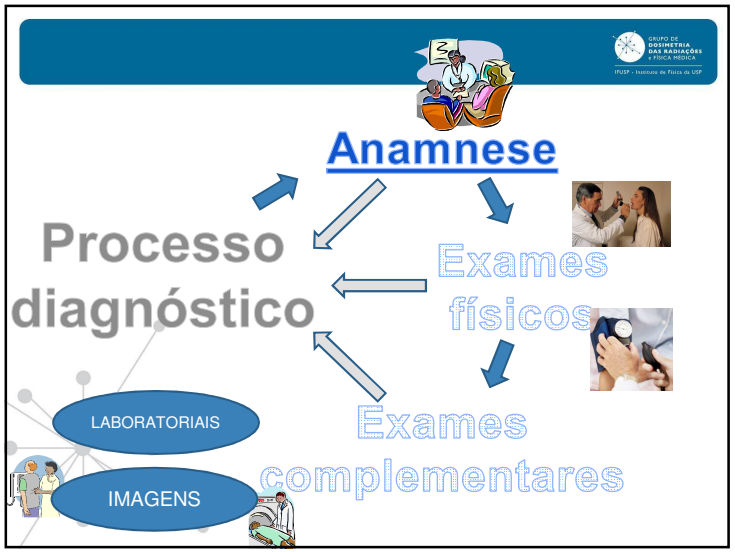
→ Ultrassonografia
→ Imagens por Ressonância Magnética

3


Mas o que vem a cabeça quando se fala de Diagnóstico por Imagem?


Áreas atuais da física médica
LUZ
TERAPIA
RM
DO
US
RT
RD
MN
DIAGNÓSTICO


RX (FILMES OU DIGITAL)
MAMOGRAFIA
R. INTERVENCIONISTA
TOMOGRAFIA
RI
RADIOLOGIA
SPECT
PET E PET/CT
PLANARES
RI
MEDICINA NUCLEAR
DIAGNÓSTICO POR IMAGENS
RI
RESSONÂNCIA MAGNÉTICA
DENSITOMETRIA ÓSSEA
ULTRASONOGRAFIA
6


Anamnese
Processo diagnóstico
Exames físicos
LABORATORIAIS
IMAGENS
Exames complementares

Mas raios X não podem causar danos???

Enhance the implementation of the principle of justification

Enhance the implementation of the principle of optimization of protection and safety

Increase availability of improved global information on medical exposures and occupational exposures in medicine

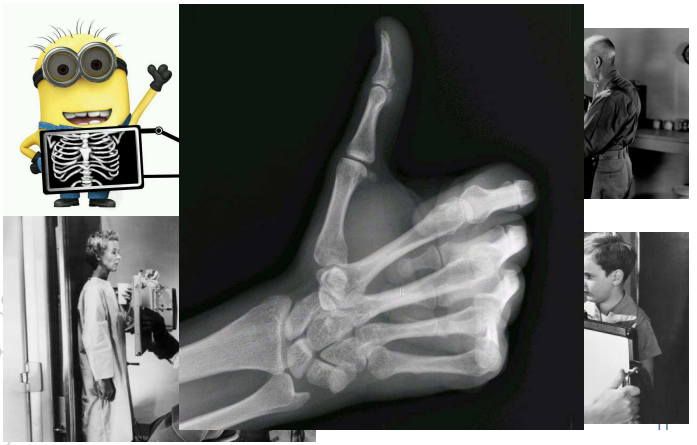
E sempre foi assim??

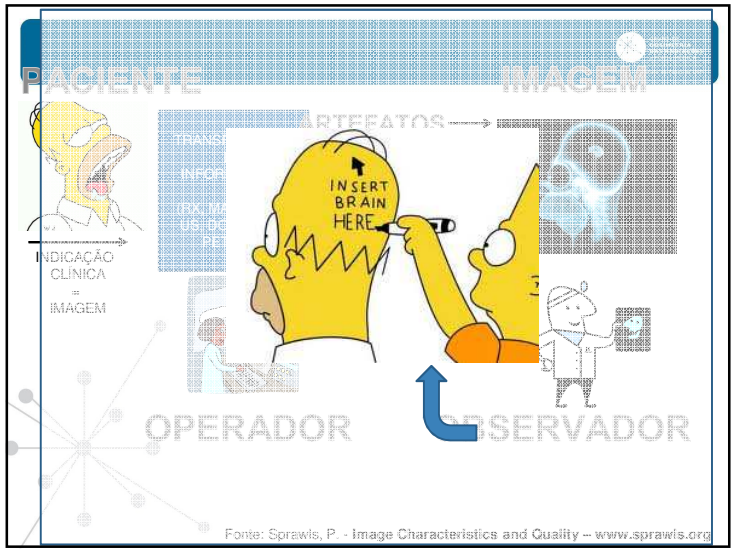
9

E sempre foi assim??

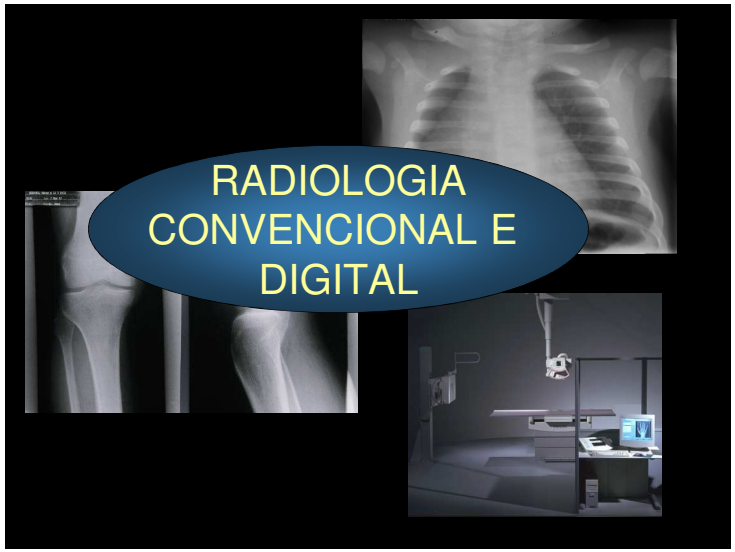
10

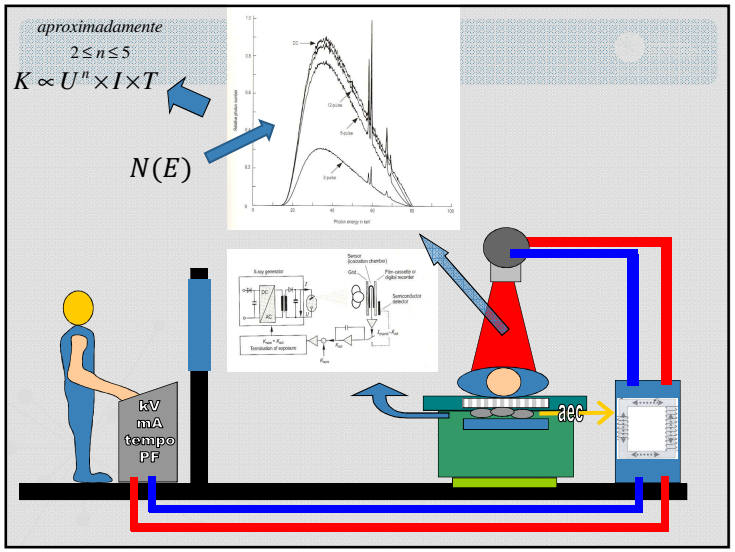
E sempre foi assim??

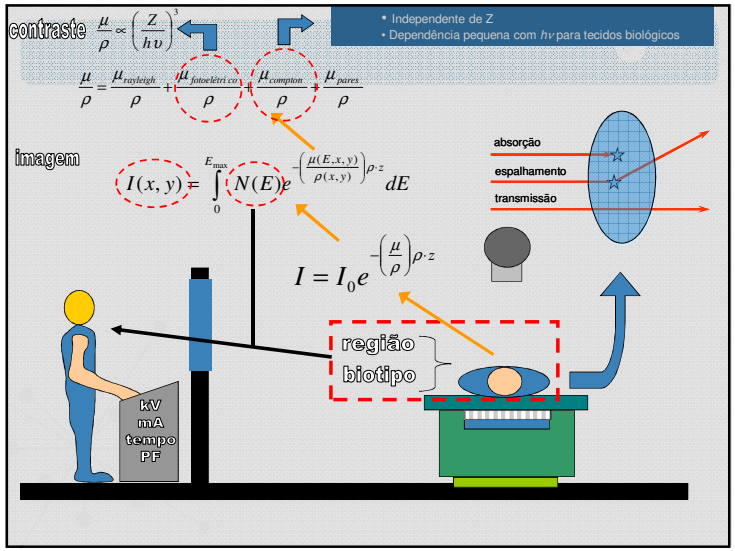


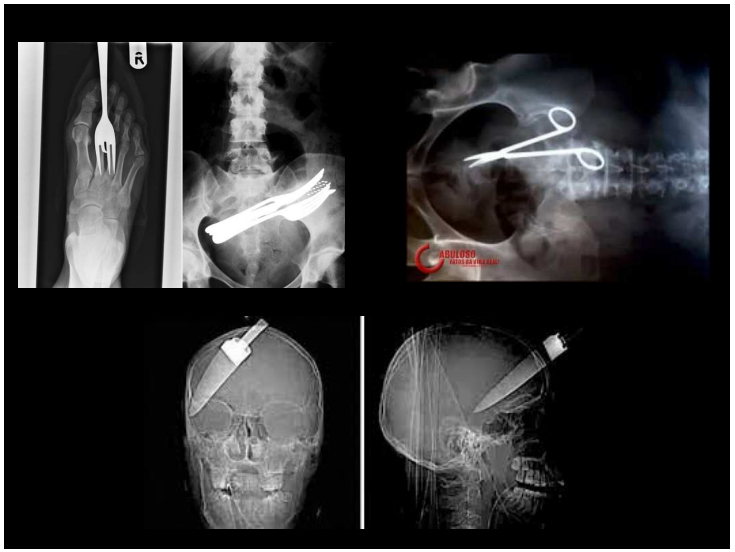

PACIENTE
IMAGEM
ARTEFATOS
INSERT BRAIN HERE
INDICAÇÃO CLÍNICA = IMAGEM
OPERADOR
OBSERVADOR
Fonte: Sprawls, P. - Image Characteristics and Quality – www.sprawls.org

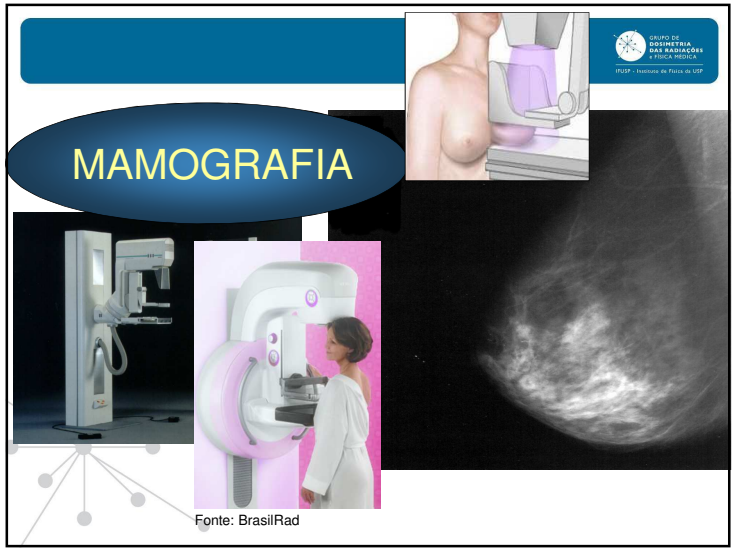

ANAMNESE
REQUISITOS PARA UM DIAGNÓSTICO ADEQUADO
DOSE VS QUALIDADE
PACIENTE
IMAGEM
TRANSFERÊNCIA DE INFORMAÇÕES
(RX, MAMO, RMI, US, DO, SPECT, PET, etc.)
ARTEFATOS
CONTRASTE
DETALHES
RUÍDO
DISTORÇÕES
INDICAÇÃO CLÍNICA = IMAGEM
INDICAÇÃO CORRETA
CONTROLE DE QUALIDADE
OPERADOR
OBSERVADOR
TREINAMENTO
Fonte: Sprawls, P. - Image Characteristics and Quality – www.sprawls.org

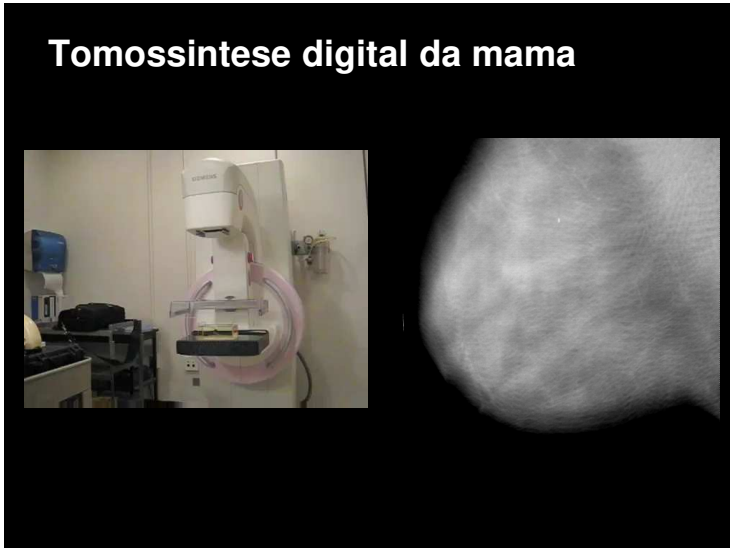

RADIOLOGIA CONVENCIONAL E DIGITAL


aproximadamente
$2 \le n \le 5$
$K \propto U^n \times I \times T$
$N(E)$
kV
mA
tempo
PF
aec


contraste
• Independente de Z
• Dependência pequena com hν para tecidos biológicos
imagem
absorção
espalhamento
transmissão
região
biotipo
kV
mA
tempo
PF

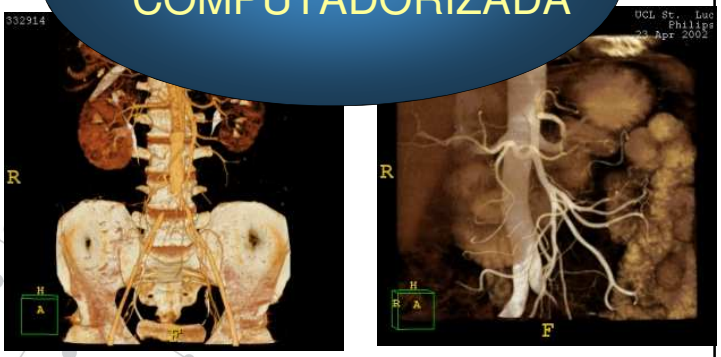



MAMOGRAFIA
Fonte: BrasilRad

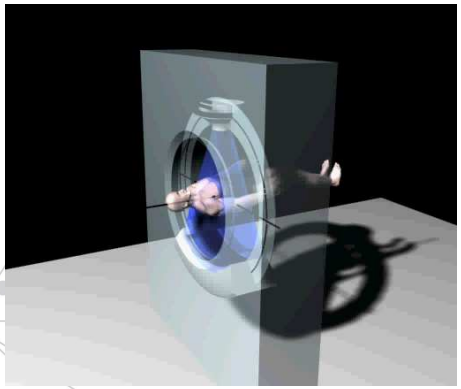

Tomossintese digital da mama

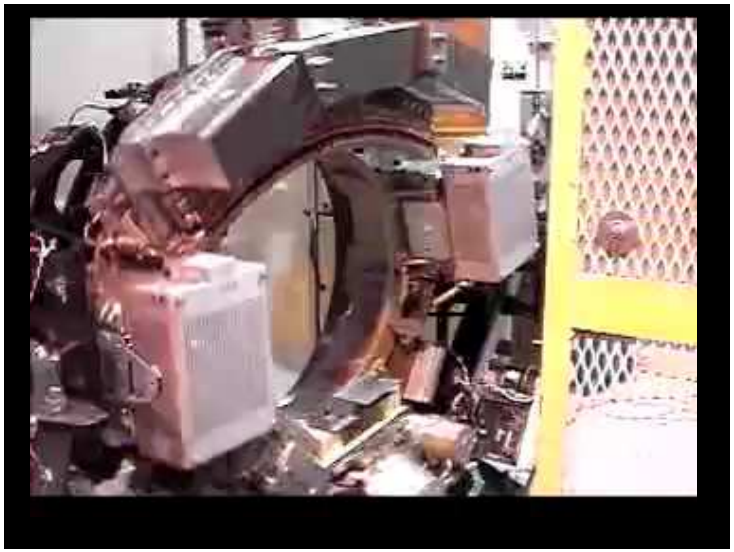
FLUOROSCOPIA E INTERVENCIONISTA

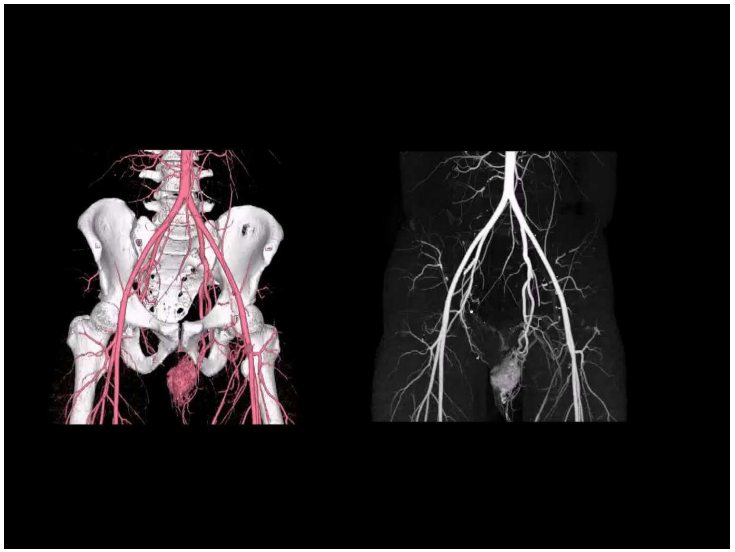
TOMOGRAFIA COMPUTADORIZADA



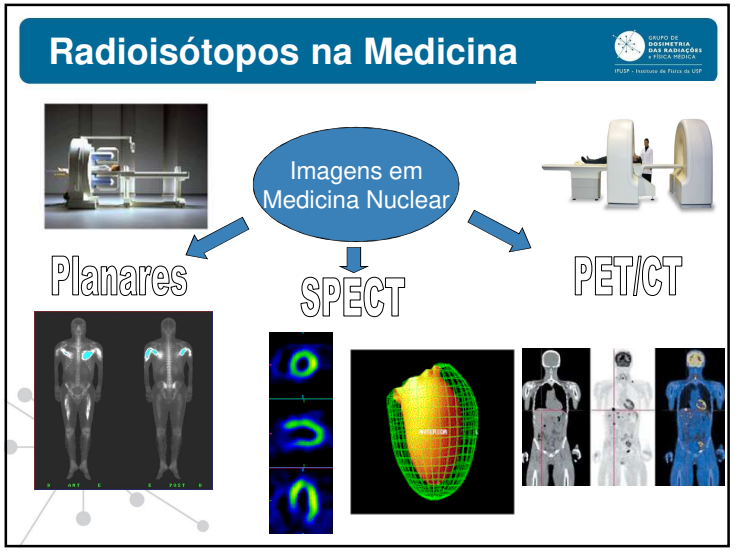
Tomografia multicortes



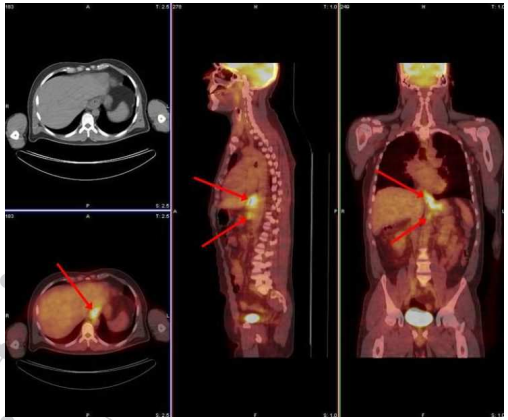





MEDICINA
NUCLEAR
Imagens:
- morfológicas
- funcionais
Terapia com radionuclídeos

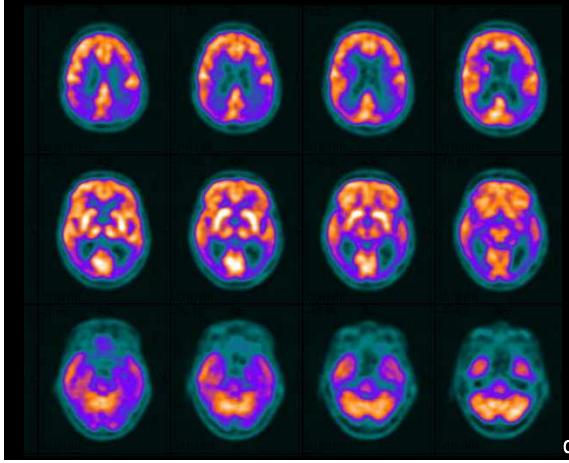

Radioisótopos na Medicina
Imagens em
Medicina Nuclear
Planares
SPECT
PET/CT

PET/CT na Prática Clínica



Cortesia: CB

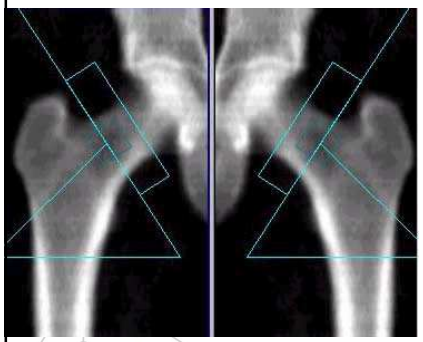
DEMÊNCIA DE ALZHEIMER

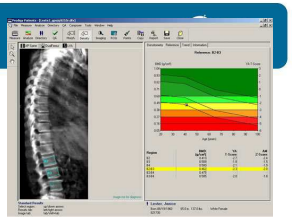


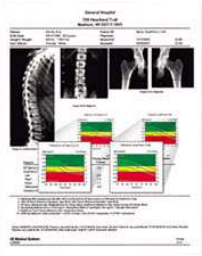
Cortesia: CB

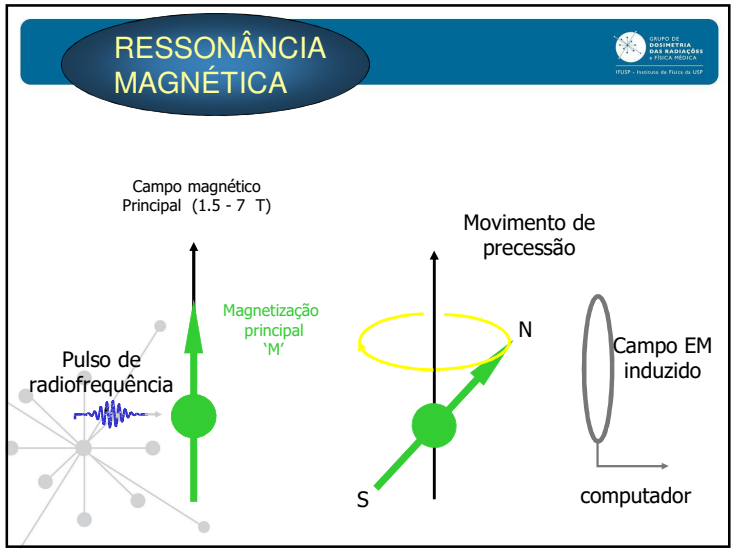
DENSITOMETRIA ÓSSEA

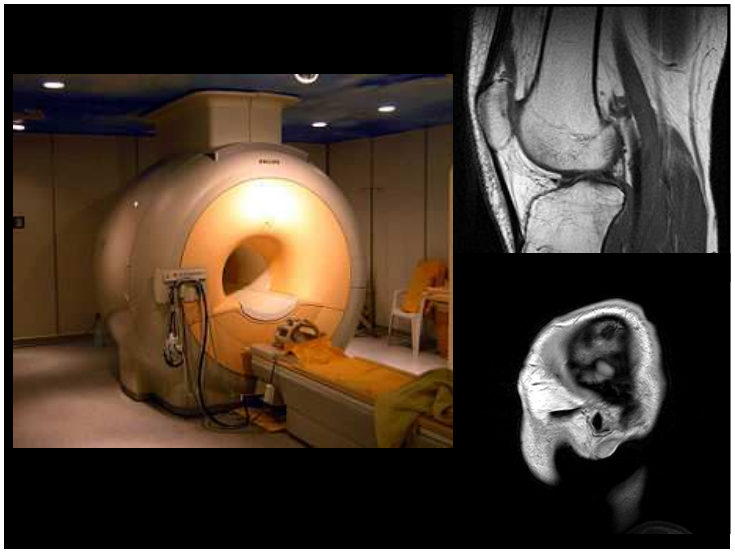
DENSITOMETRIA ÓSSEA

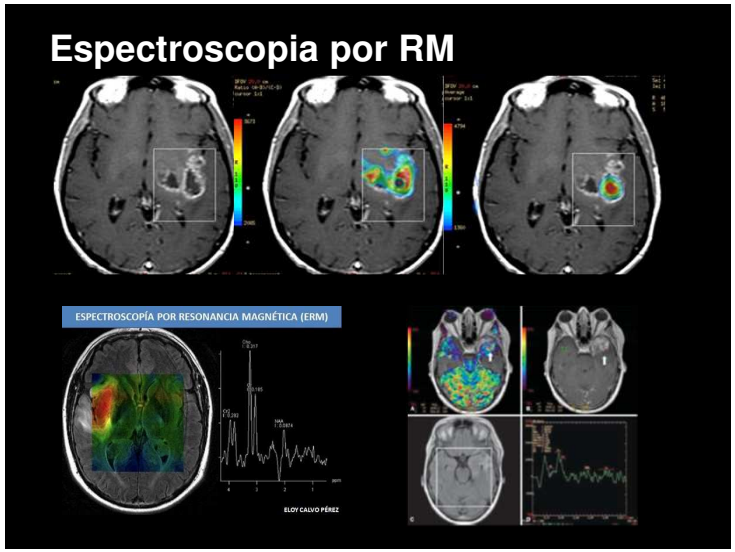


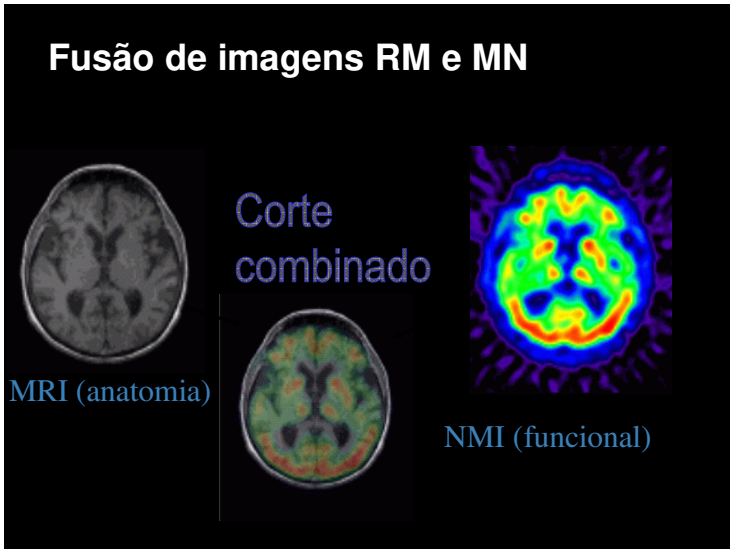





RESSONÂNCIA MAGNÉTICA
Campo magnético Principal (1.5 - 7 T)
Movimento de precessão
Magnetização principal 'M'
Pulso de radiofrequência
N
S
Campo EM induzido
computador



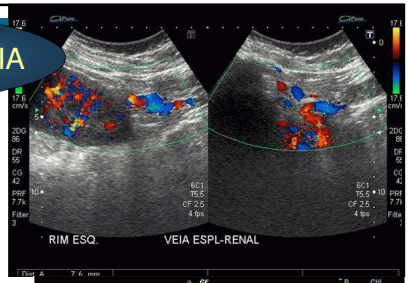

Espectroscopia por RM
ESPECTROSCOPÍA POR RESONANCIA MAGNÉTICA (ERM)
ELOY CALVO PÉREZ

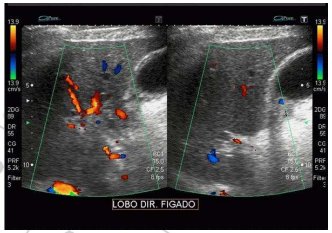

Fusão de imagens RM e MN
Corte combinado
MRI (anatomia)
NMI (funcional)

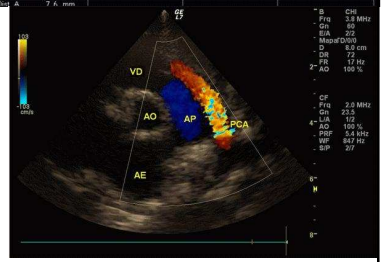
ULTRASSONOGRAFIA

ULTRASSONOGRAFIA

ULTRASSONOGRAFIA





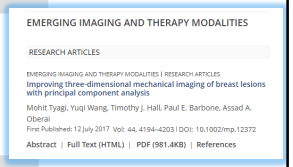


Tendências em Física Médica

Medical Physics
The International Journal of Medical Physics Research and Practice

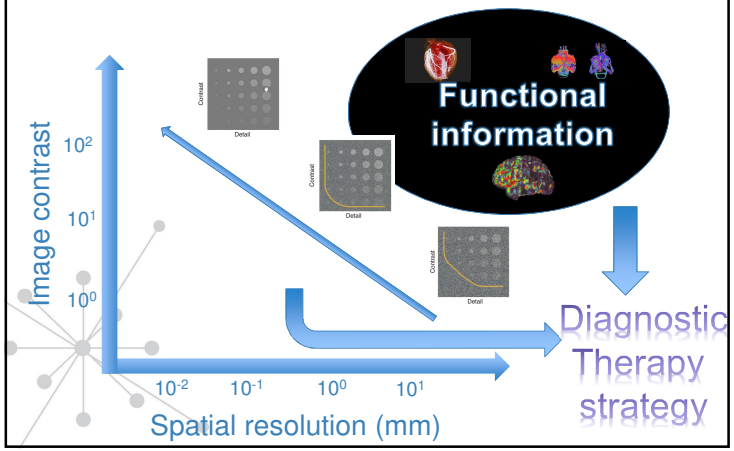
Vision 20/20

Future of Medical Physics

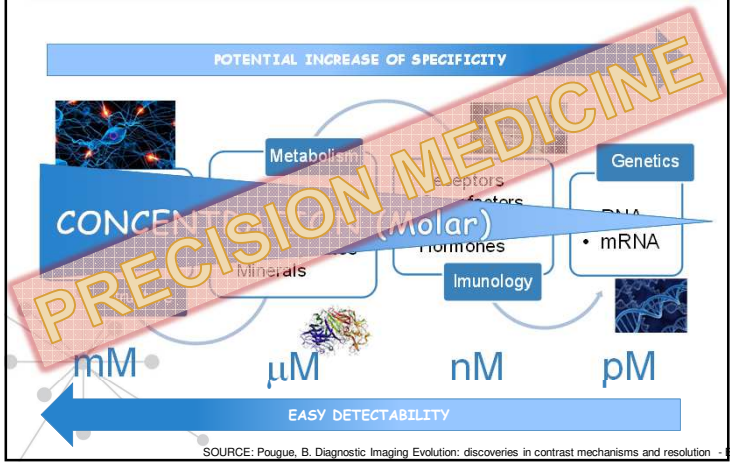


What do we have today?

What the inovations search?

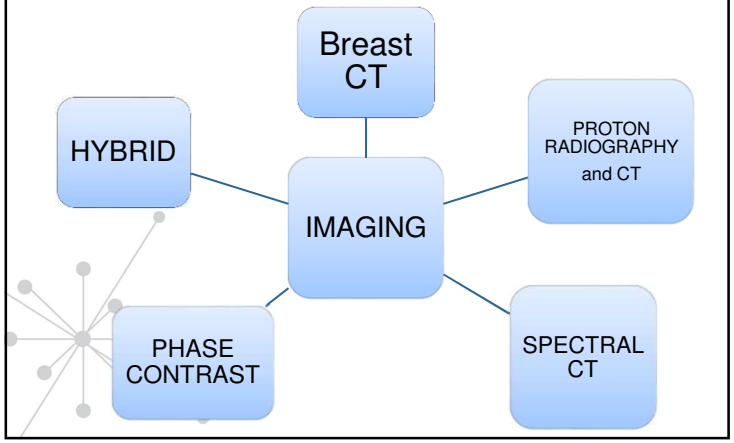


Chalenges: new contrast agents

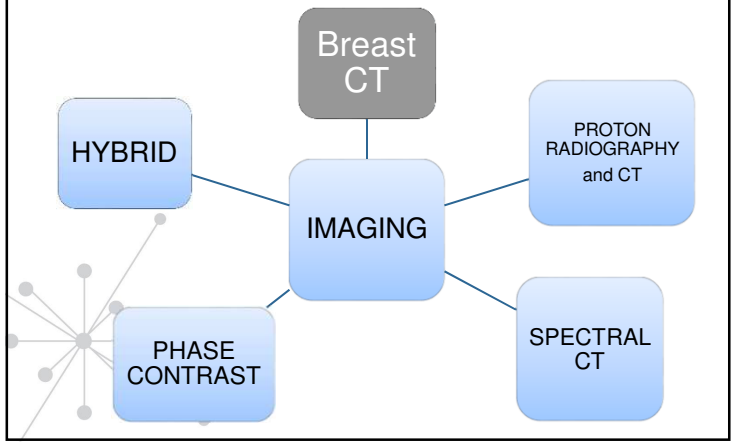


SOURCE: Pougue, B. Diagnostic Imaging Evolution: discoveries in contrast mechanisms and resolution

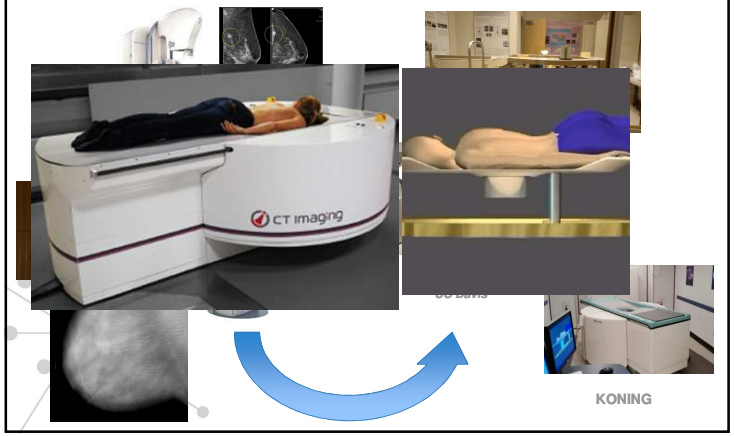
Only some highlights

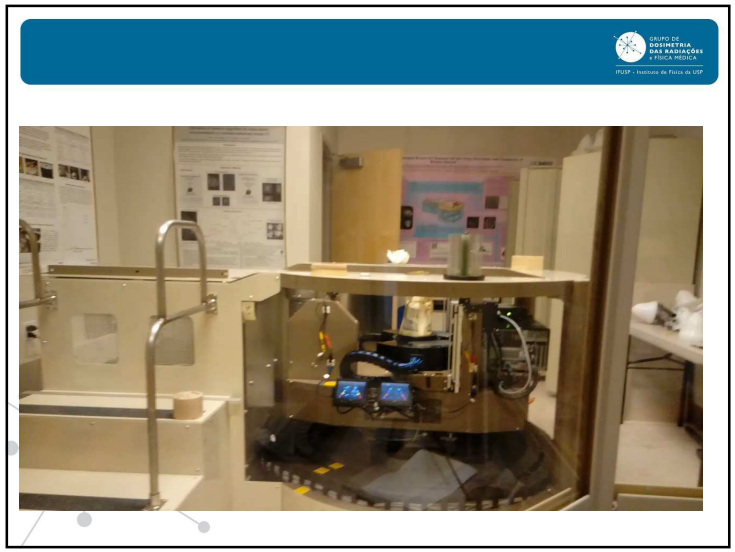


Only some highlights

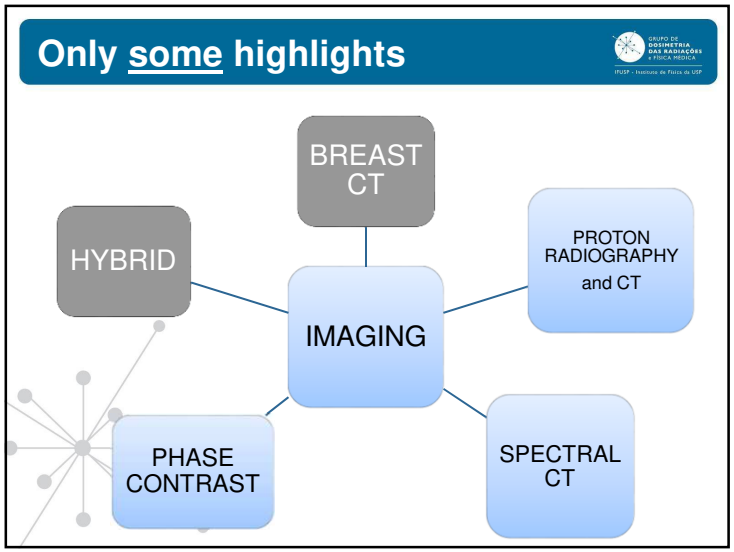


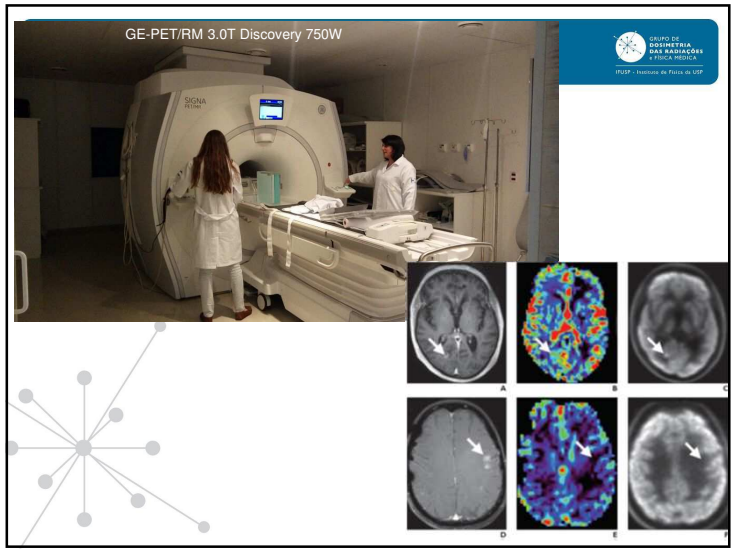
Breast CT



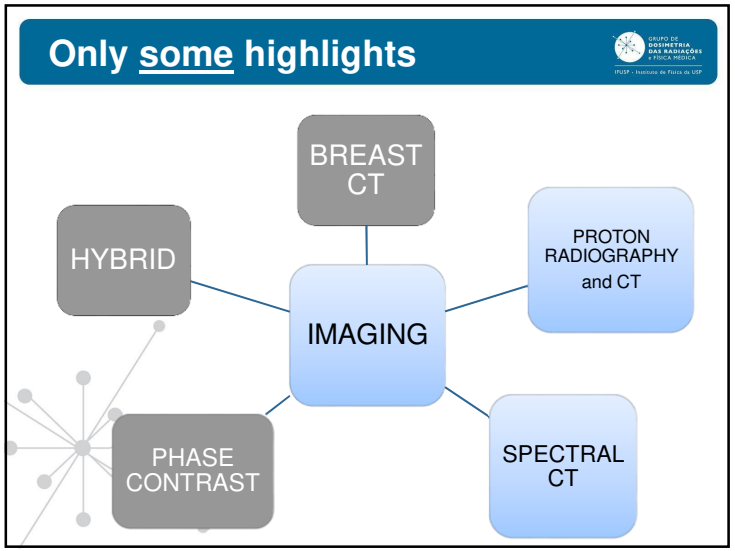


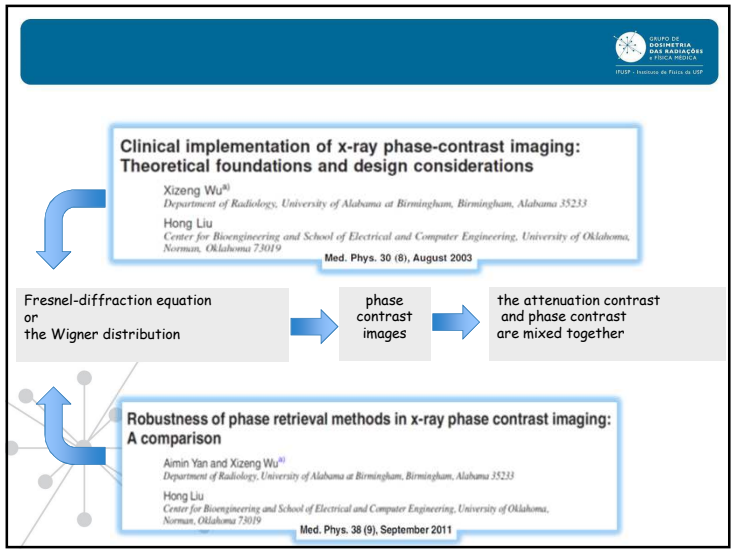
Only some highlights



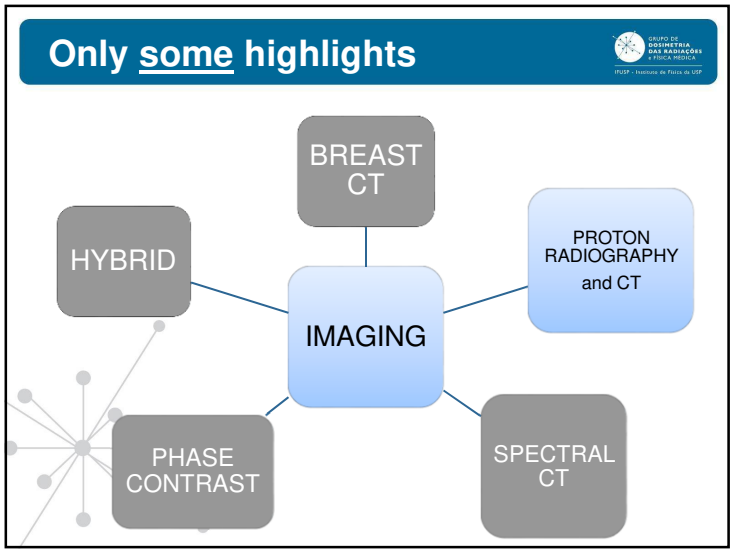


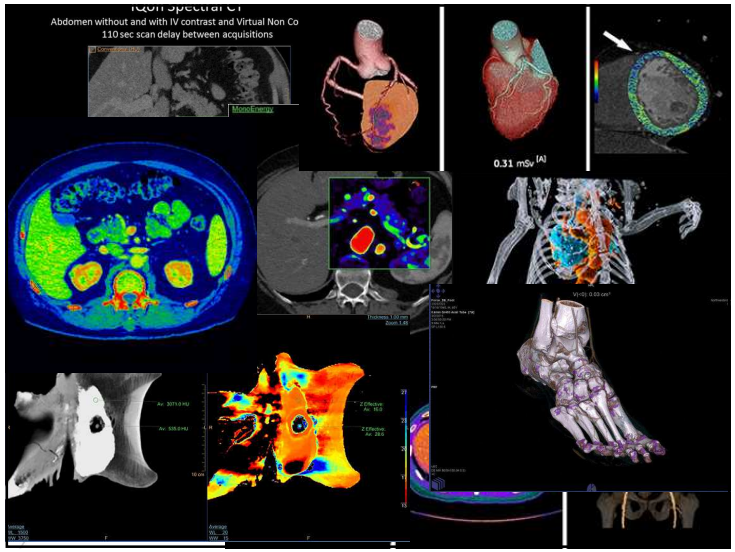
Only some highlights



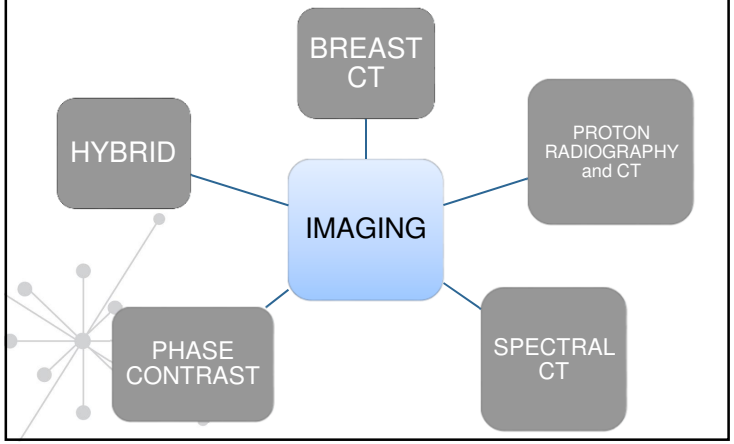


Only some highlights





Only some highlights



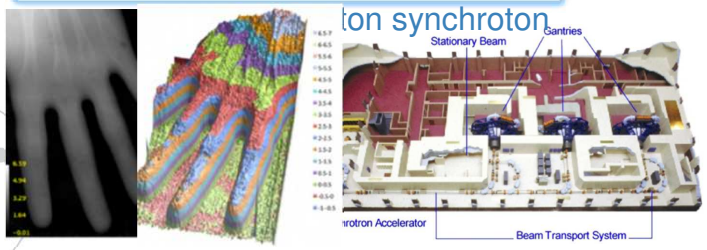
If x-rays are so good... Why someone needs proton radiography?

IEEE Trans Med Imaging. 2014 April ; 33(4): 875–881. doi:10.1109/TMI.2013.2297278.

LOMA LINDA UNIVERSITY HEALTH

200 MeV Proton Radiography Studies with a Hand Phantom Using a Prototype Proton CT Scanner

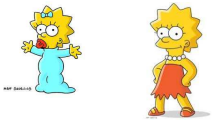
Tia Plautz, *Et al*
Santa Cruz Institute for Particle Physics, University of California Santa Cruz, Santa Cruz, CA 95064 USA

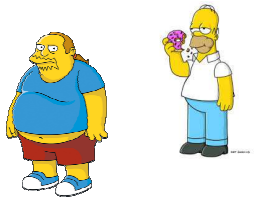


Pediatric imaging

Children are not just small adults

but





Must adults are BIG BABYES

image gently®

LATIN SAFE

2017 AAPM Spring Clinical Meeting

Protocol Review and Optimization: (Optimization) Improvement of Pediatric DR

Keith J. Strauss, FAAPM, FACR
Clinical Imaging Physicist
Cincinnati Children's Hospital
Associate Professor
University of Cincinnati School of Medicine

Cincinnati Children's — University of Cincinnati


Física das Radiações
The Phantoms of Medical and Health Physics
PET E PET/CT EM ONCOLOGIA
HANDBOOK OF X-RAY IMAGING
PHYSICS AND TECHNOLOGY
GRUPO DE
DOSIMETRIA
DAS RADIAÇÕES
e FÍSICA MÉDICA
IFUSP - Instituto de Física da USP
Obrigado!
pcosta@if.usp.br