Detection of Early Markers in Mammography
QLK3-2001-01318

Dear Mama Project

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Low Dose X-ray Mammography

Quality of Life and Management of Living Resources

Fifth Framework Programme

Detection of Early Markers in Mammography

Development of Low Dose X-ray Mammography System Based on Pixellated CdZnTe Detectors Coupled to Photon Counting Front-end Electronics

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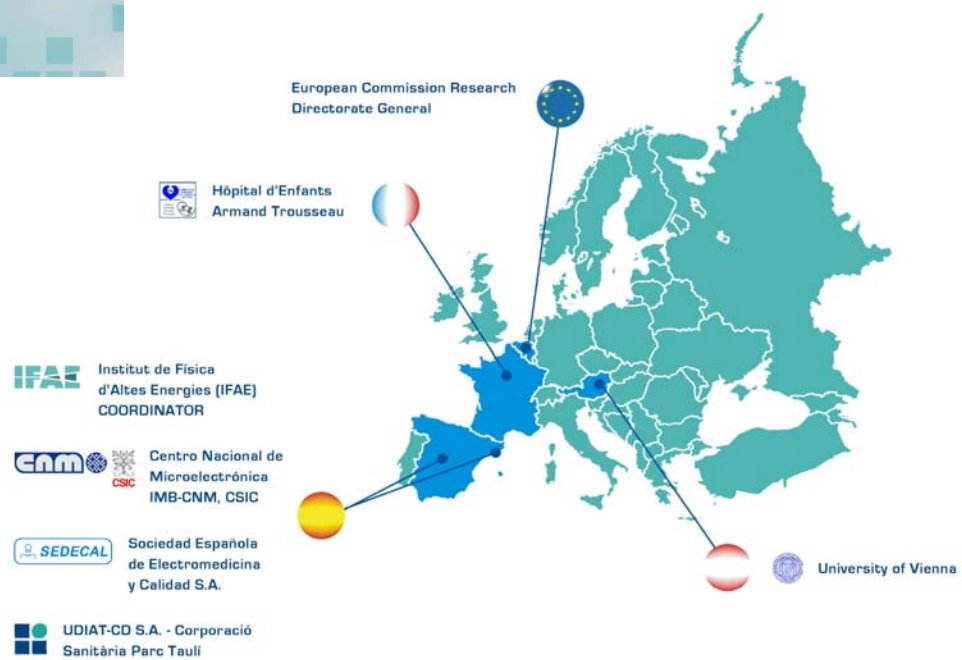

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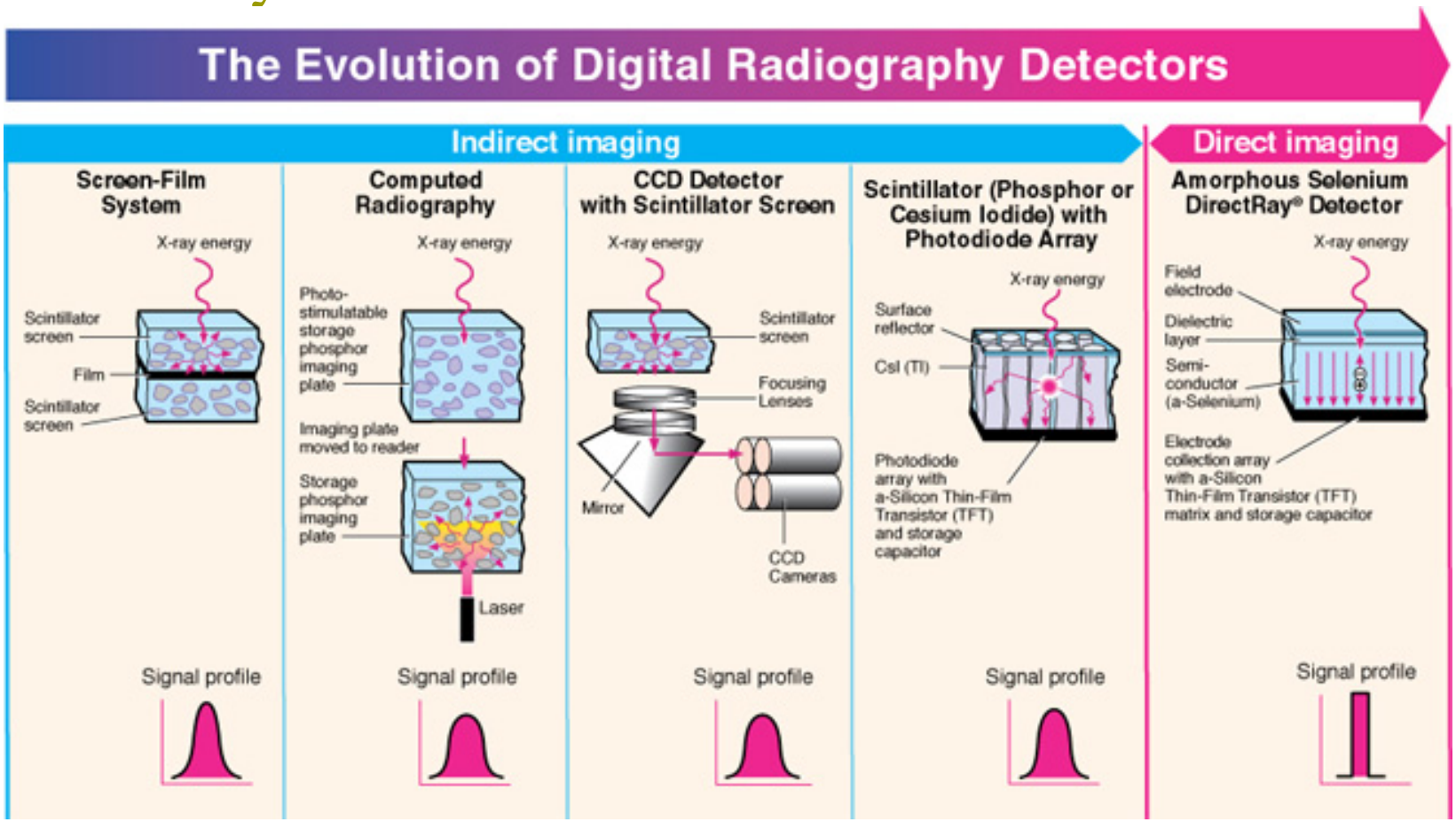
X-Ray Evolution



From www.hologic.com

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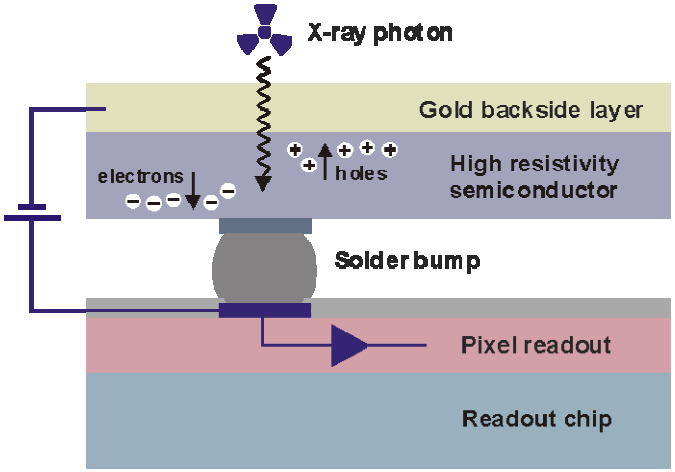
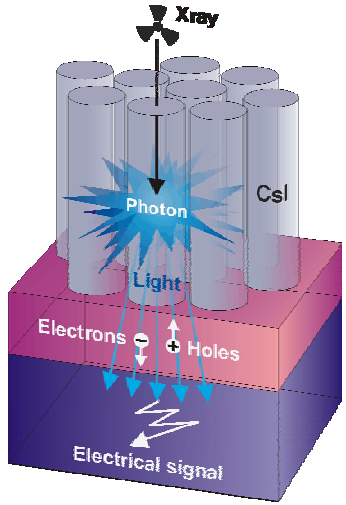
Direct vs. Indirect X-ray Photon Capture



Direct mode

≅4000e- for 20KeV



Indirect mode

≅100e- for 20KeV

Signal (direct-mode) >> Signal (indirect-mode)

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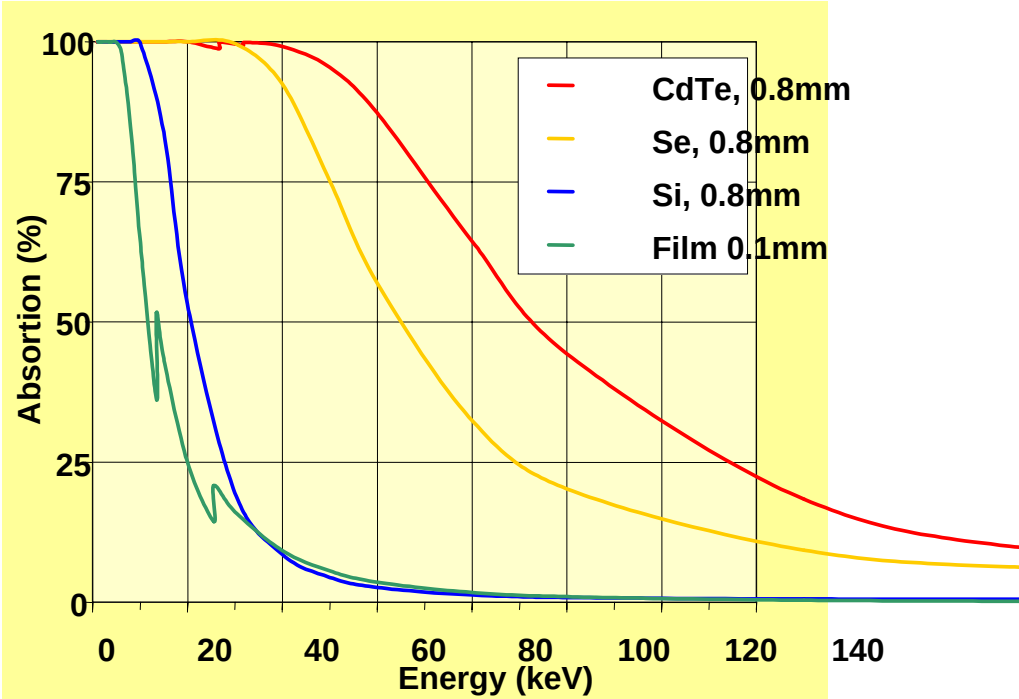
Advantages of CdTe

- CdTe is plainly more efficient in the range of energies for general radiology (40-120 KeV) and mammography (20-40 KeV)



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- Subsystems
  - Detector
  - X-Ray Source
  - Generator
  - Cooling System
  - Scan table

System Overview

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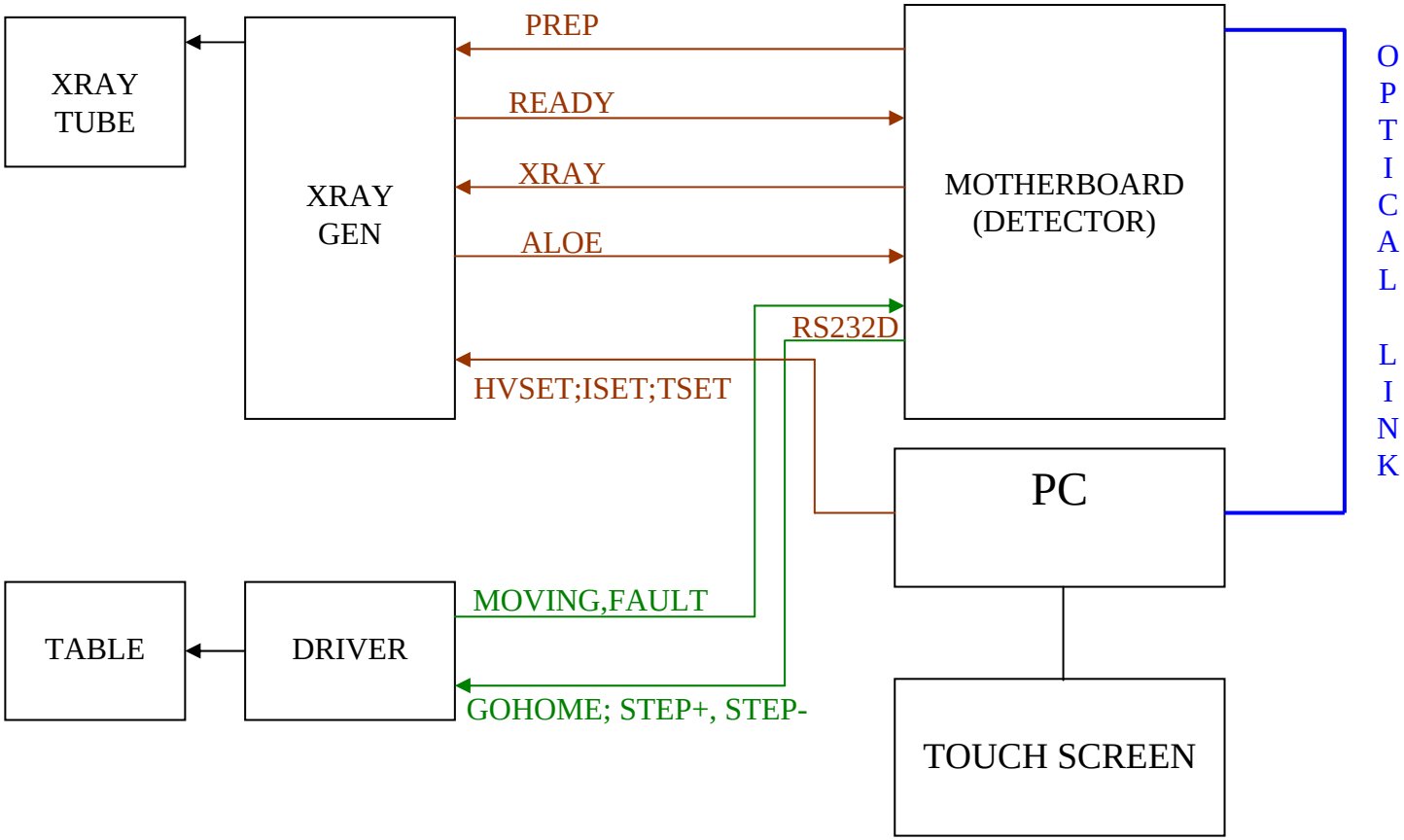

MOTHERBOARD: Introduction

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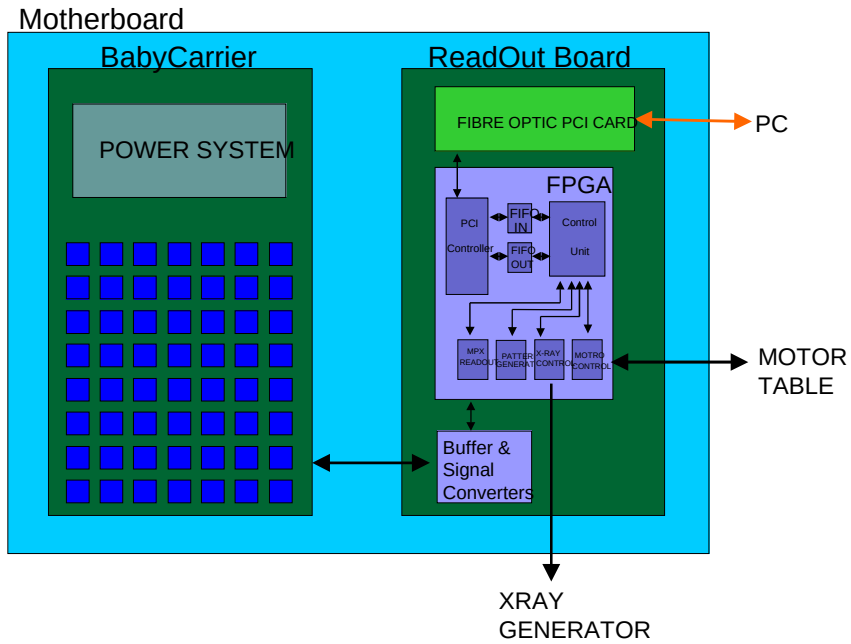
- PCB designed for controlling and reading 56 MPXII chips.
- Two different parts:
  - MPXII Chip carrier
  - Readout+Control Board
- FPGA based design
  - Reusability of HW blocks
  - PCI Interface
  - MPX Control
  - Sensors
    - Temperature
    - Inclinometer
    - DAC,ADC
- Fibre optics communication



MOTHERBOARD : Specifications

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- 8x7 MPX Array
- Mammography effective area=196x252mm2
- Operation Frequency
  - 66 MHz
- 2 Gbps Optical link

Dear-Mama Unit Sensor

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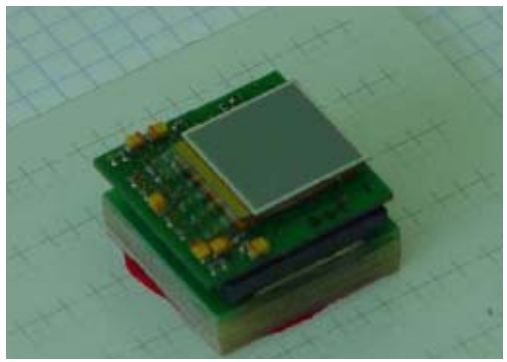
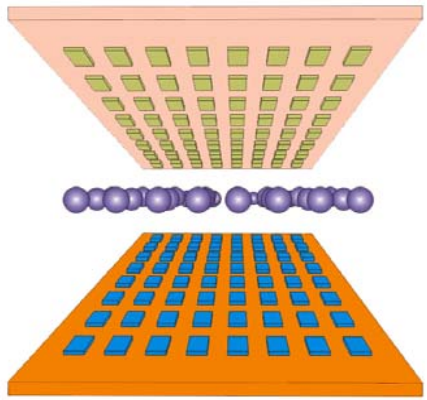
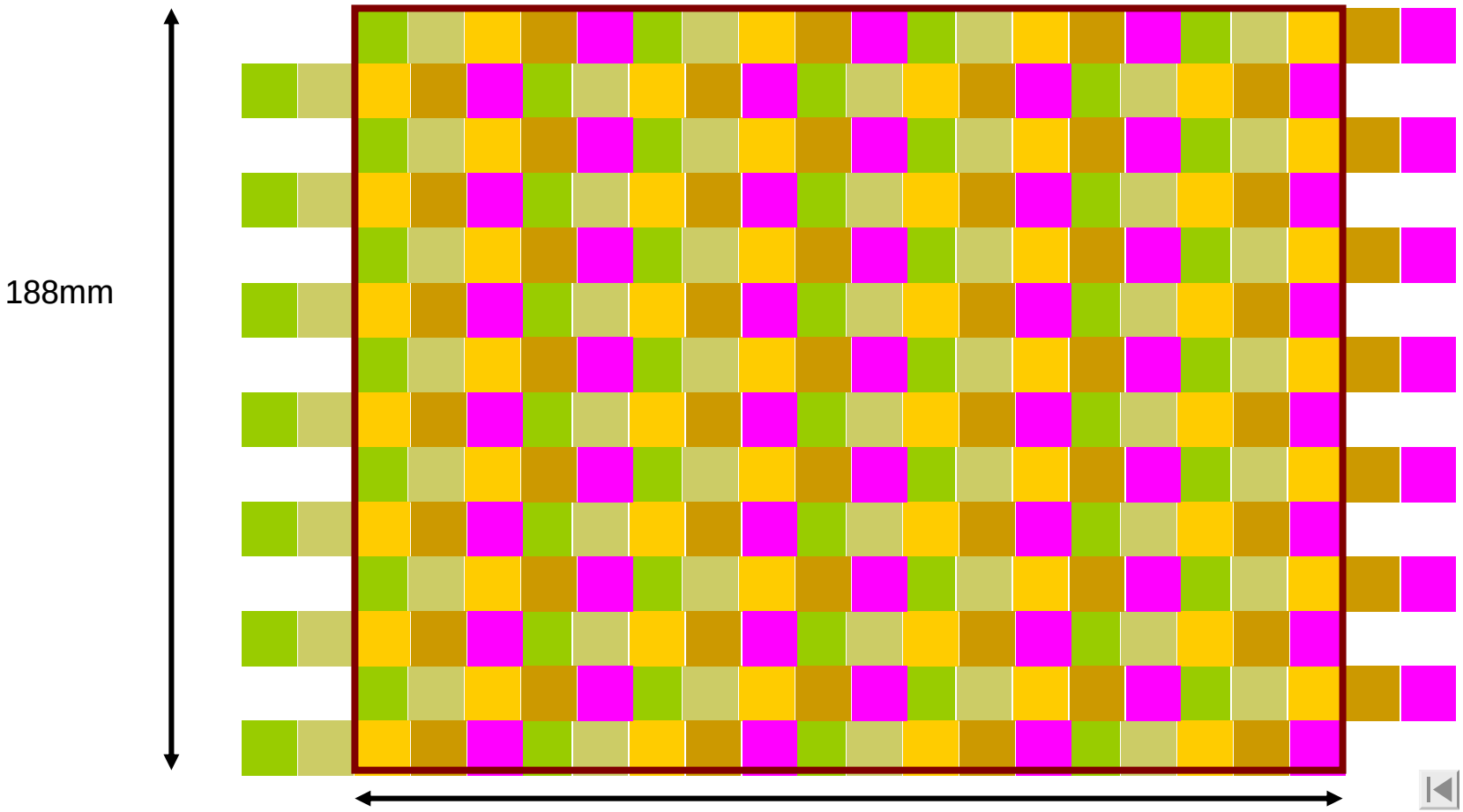
- Dear-Mama unit sensor is a hybrid of room temperature solid state detector (CdTe or Si) coupled to Medipix2 readout electronics via bump-bonds





1-D, 5 Steps and 56 detectors



Mammography System

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- 1ST prototype use Silicon detectors (700 μm)
  - Capture time: <3 seg
  - Image processing: 20 seg
  - Pixel pitch: 55 μm
  - Active area: 18x24 cm
  - 213 grey level
  - X-Ray Energy Range (20-35 KeV)

General Radiology System

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- Based on the mammography system
  - CdTe Sensor (800 μm)
  - 40-120 X-Ray source

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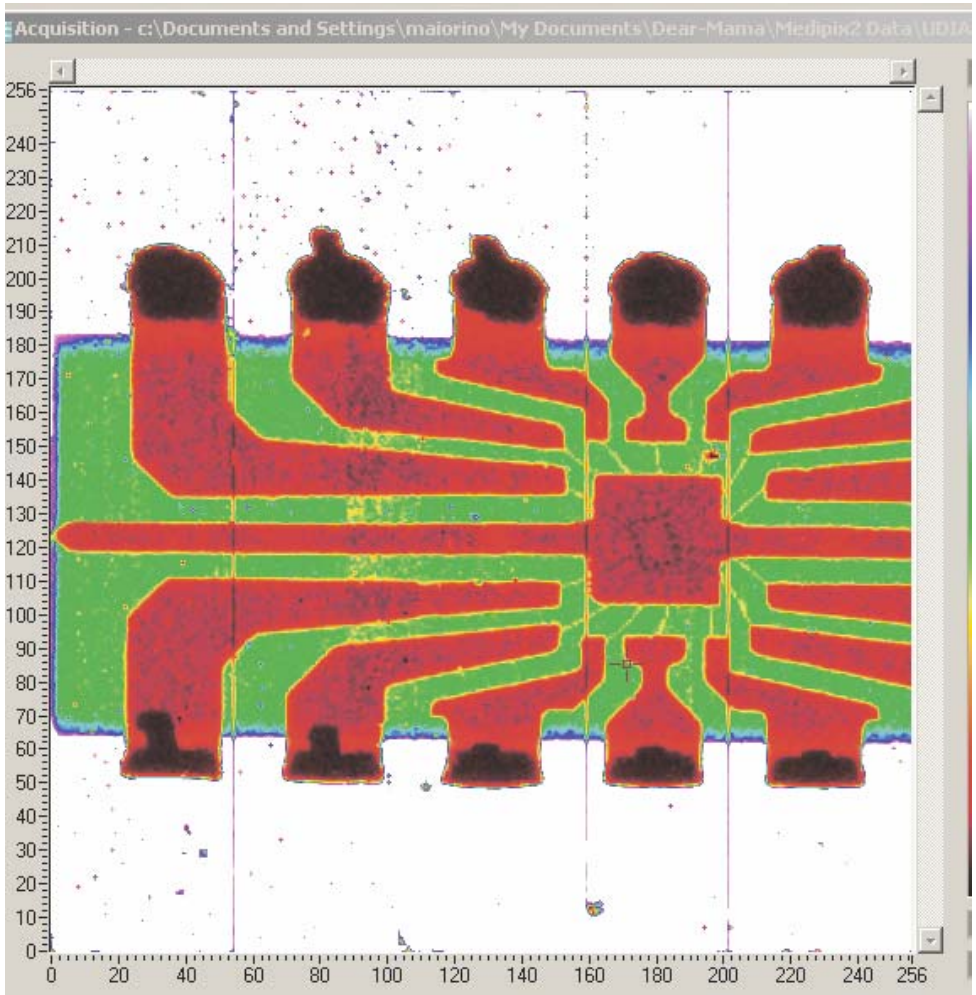
Image with single CdTe hybrid



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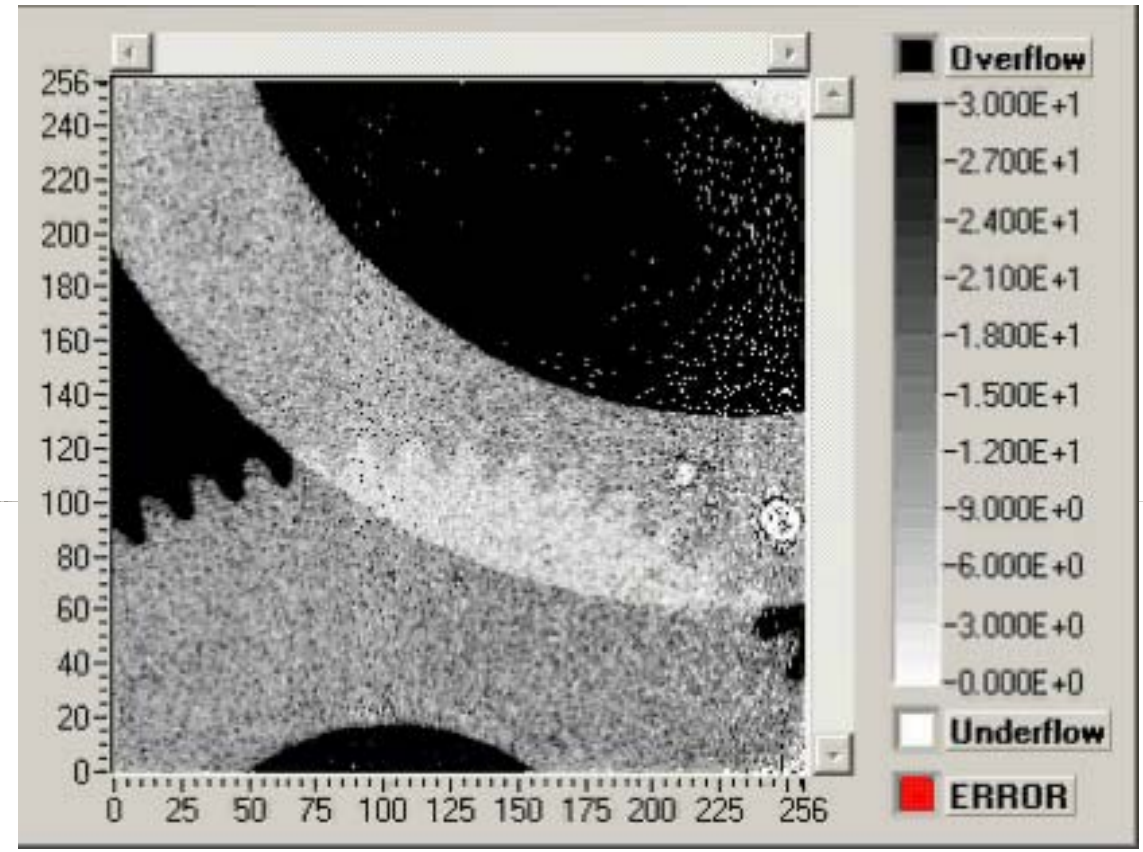
500 frames/second



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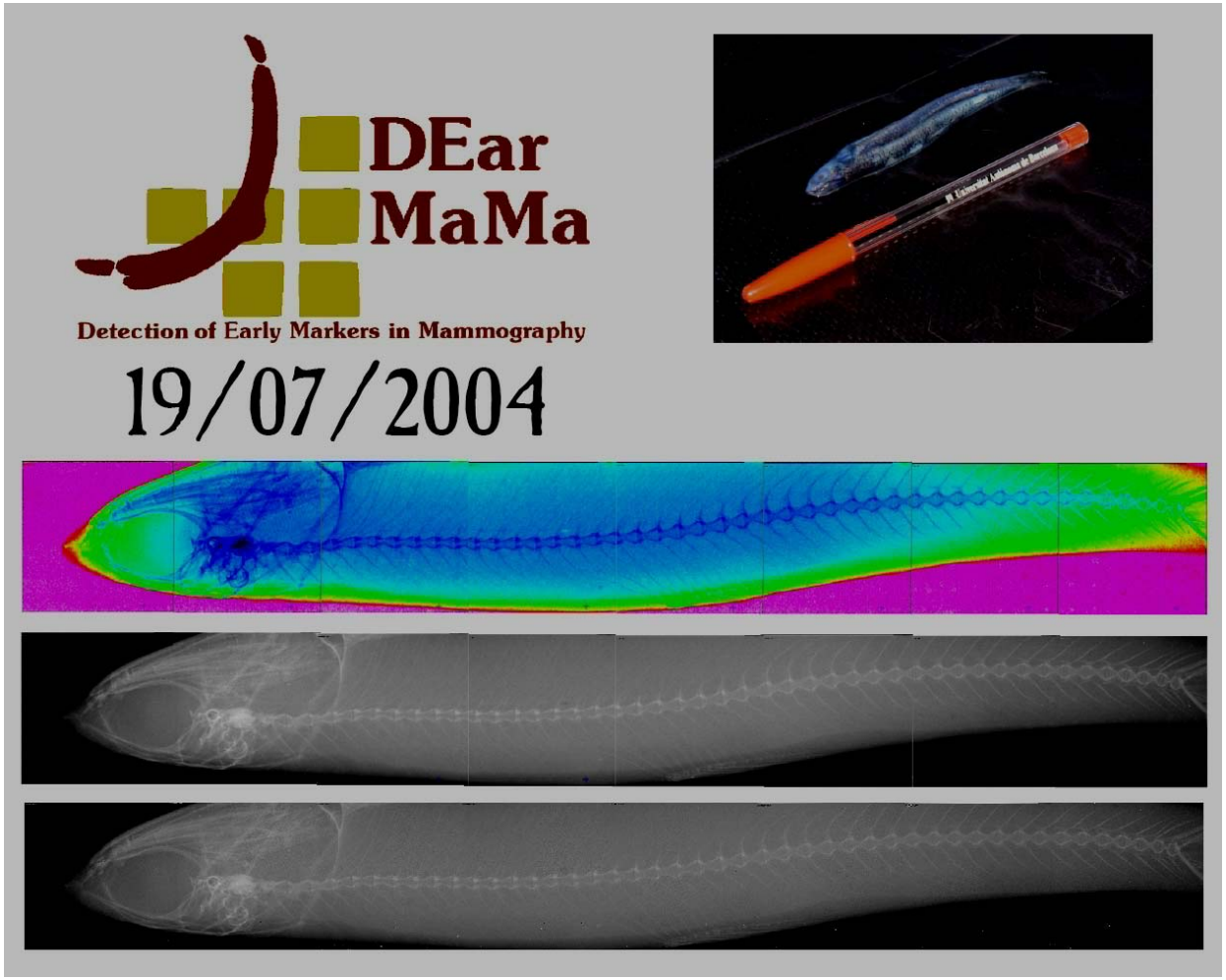
Linear scan with single Si hybrid



Linear scan with multi-CdTe hybrids

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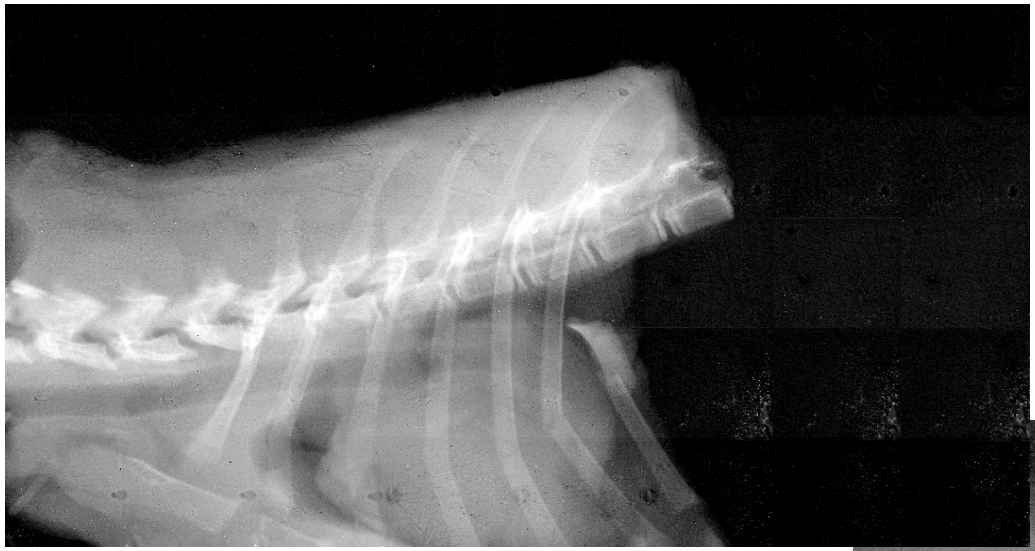

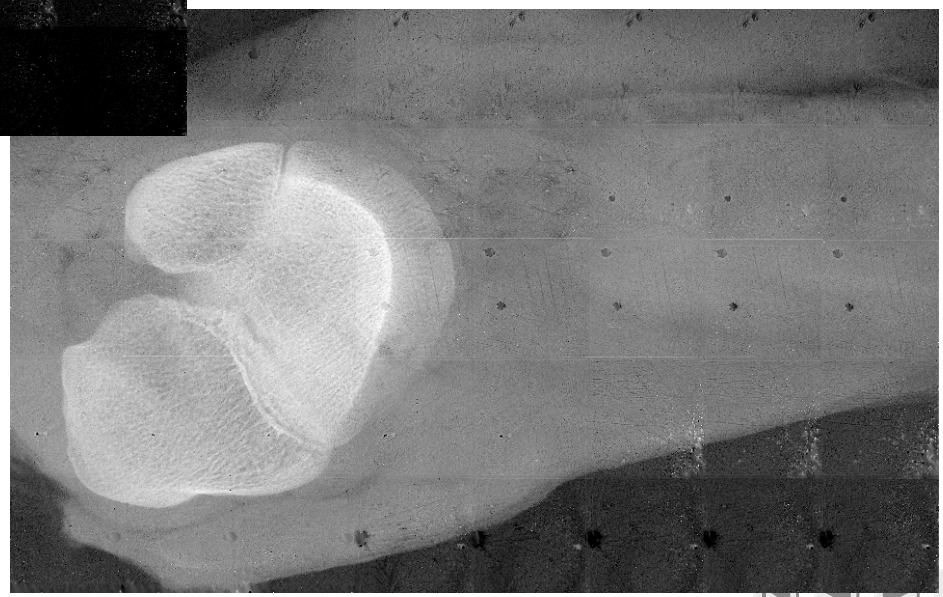

Linear scan with multi-Si hybrids

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Finger radiography with Si

Phantom Image

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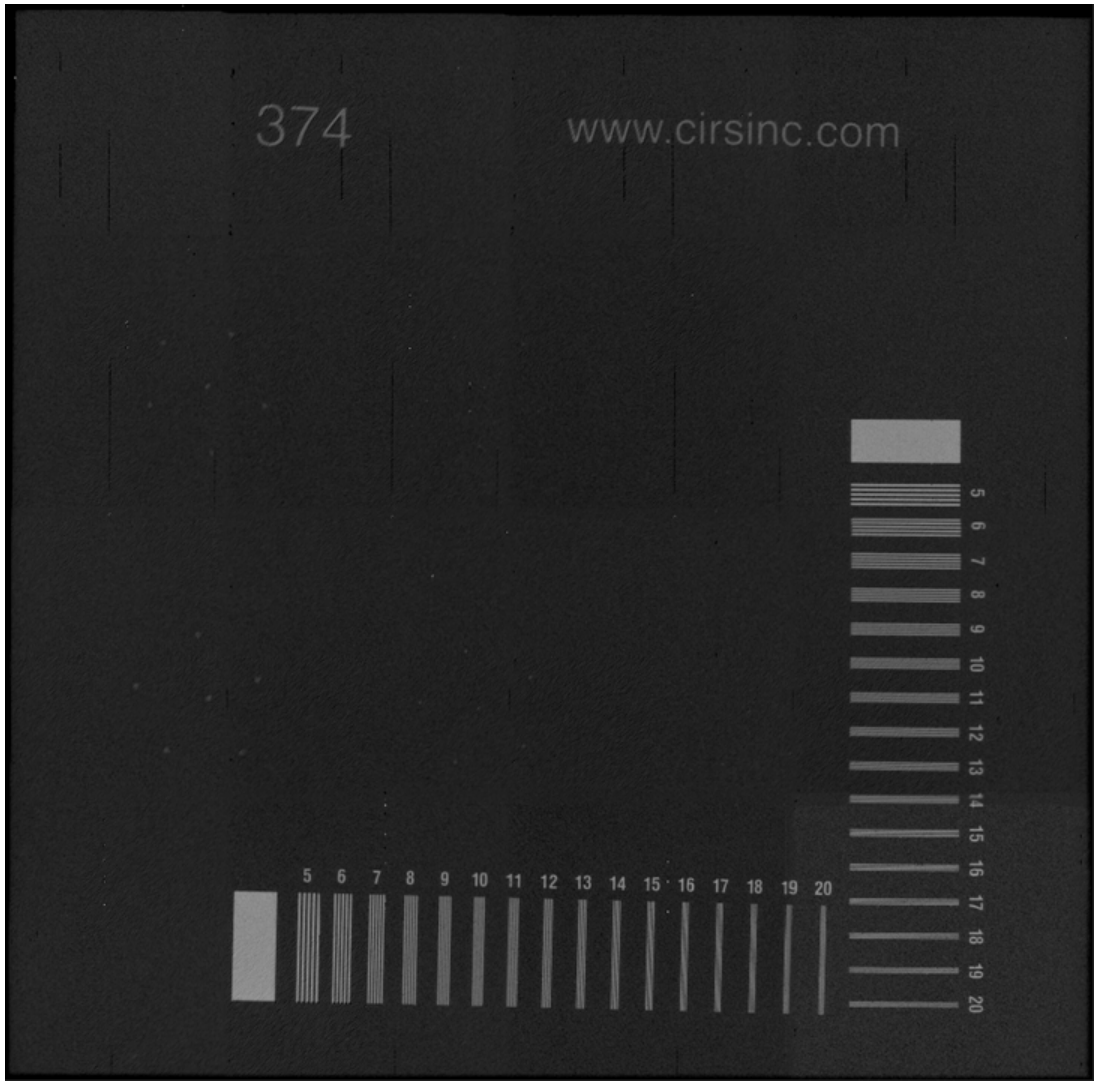

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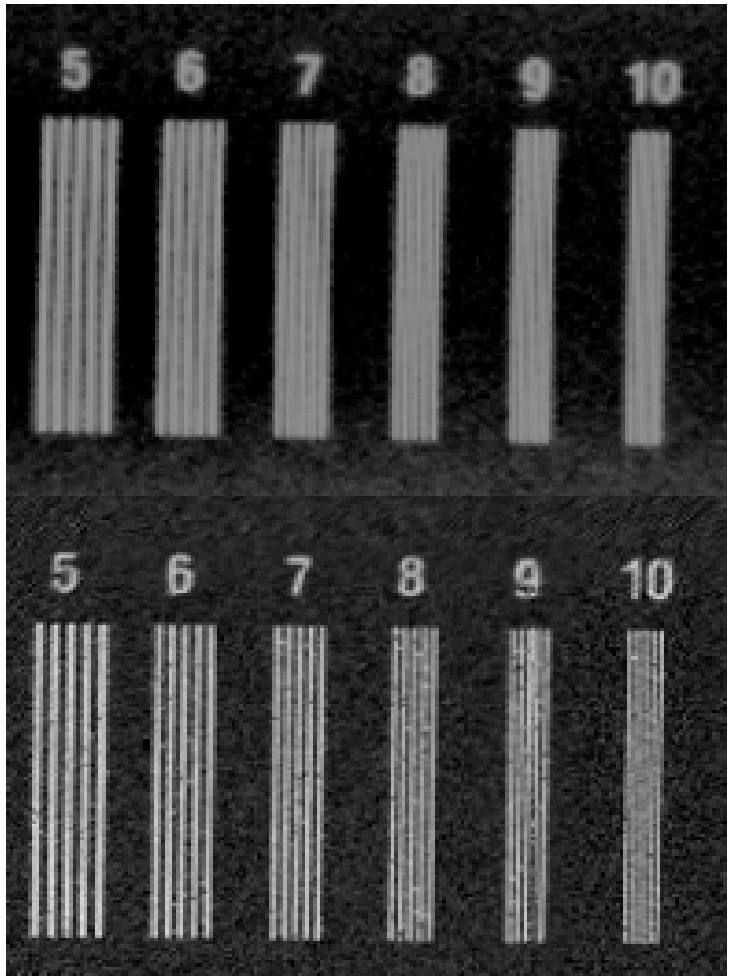
Image resolution

- Comparison between a-selenium (top) and DM Machine (bottom) phantom images



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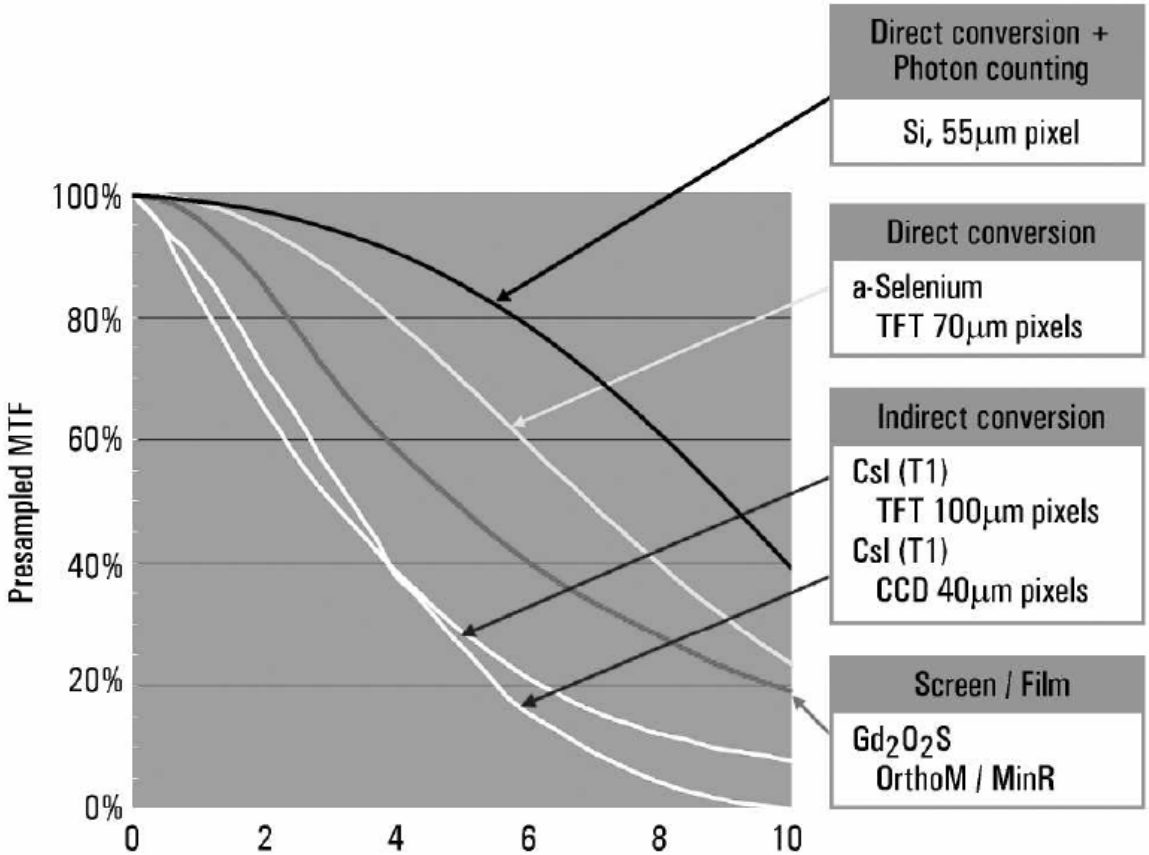
MTF Comparison



Conclusions

- General radiology & mammography prototypes have been presented using CdTe and Silicon sensors
- Some results of the two developed machines have been shown. The comparison with the available commercial equipments is promising
- Nowadays the three hospitals involved in the project are carrying out clinical trials

THANK YOU!!!!