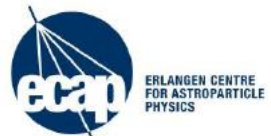


Dosepix – a detector for quality assurance in Medical Imaging

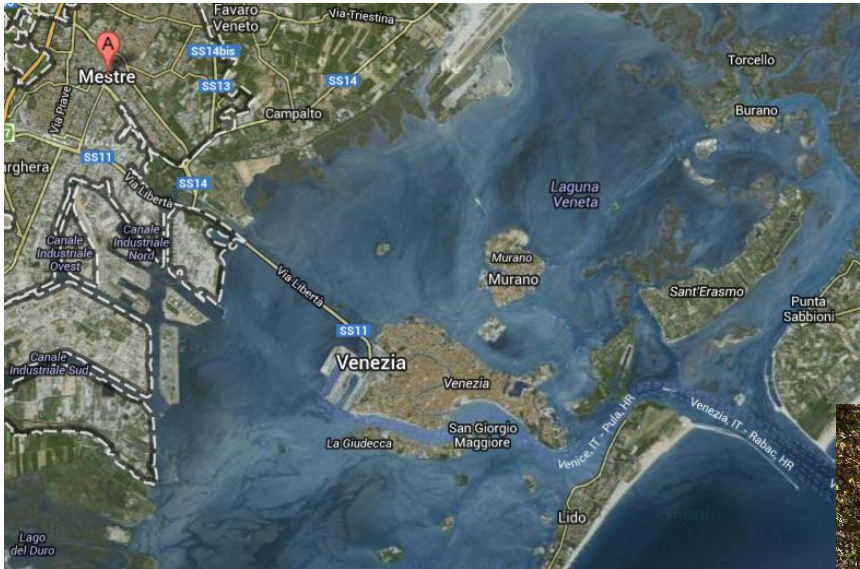
Francesca Bisello

Midterm Review Meeting

ARDENT Project
October 14th, Milan



About Myself



Venice (Italy)

Nürnberg
(Germany)



University Education

- ▶ University of Padua: Bachelor Degree
Erasmus at Ludwig Maximilians Universität München
- ▶ University of Bologna : Master Degree in Applied Physics
Master Thesis: „*Characterization of a radiochromic film Gafchromic EBT2 in relation to a Ir-192 source*“, Sant´Orsola-Malpighi hospital, Bologna

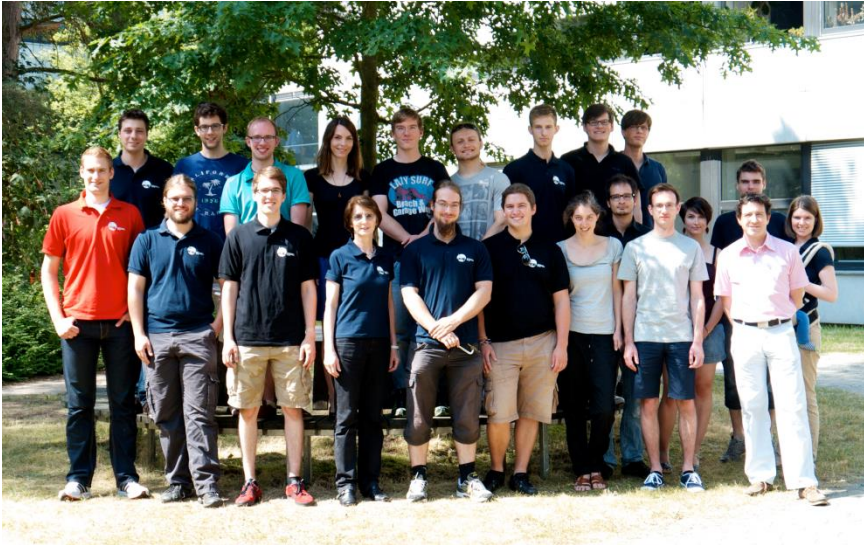


ARDENT Project

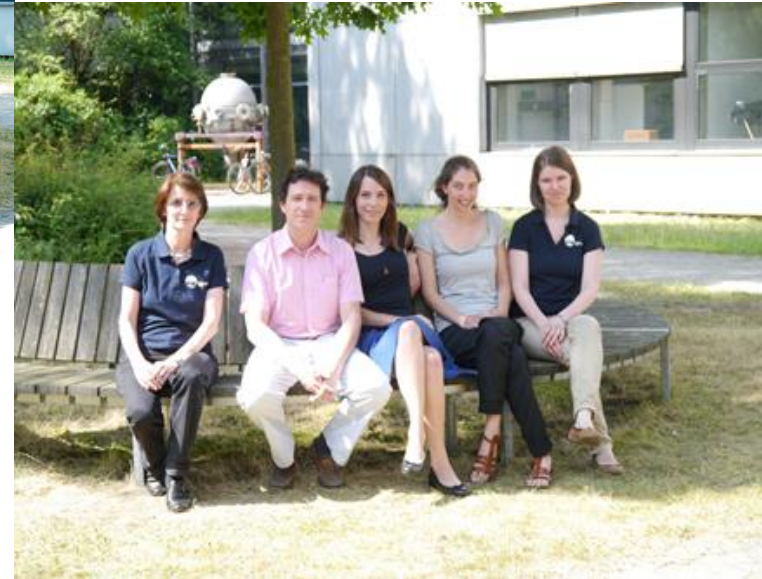
Physics and Innovation Group
IBA Dosimetry
Schwarzenbruck, Germany



ARDENT Project



ECAP, Radiation Physics
Group
FAU University Erlangen

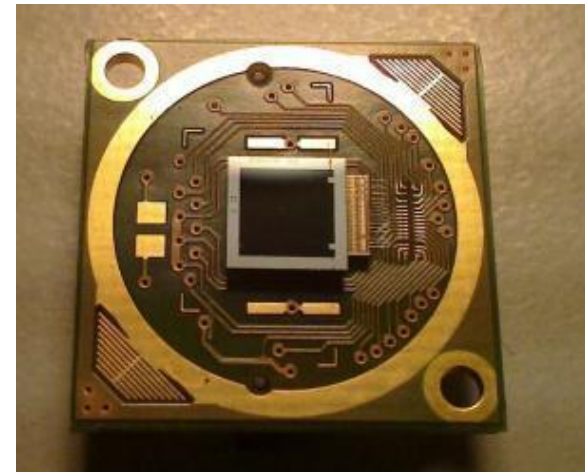


Dosepix Group
FAU University Erlangen

ARDENT ESR 10

► Goal

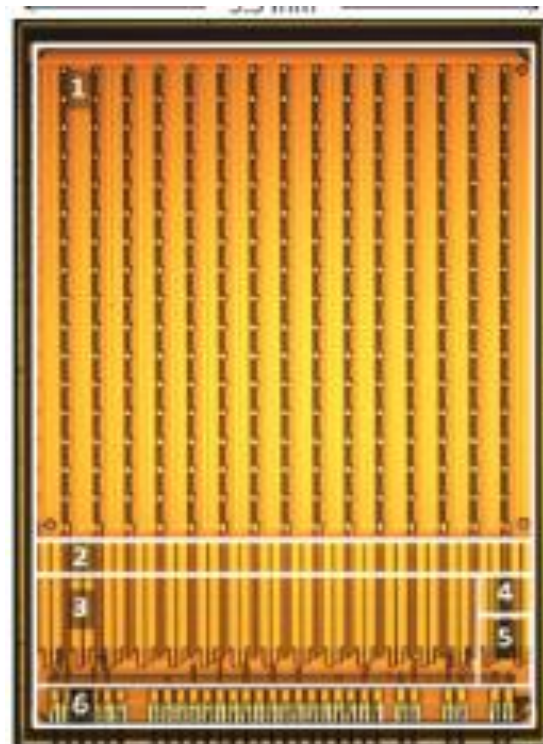
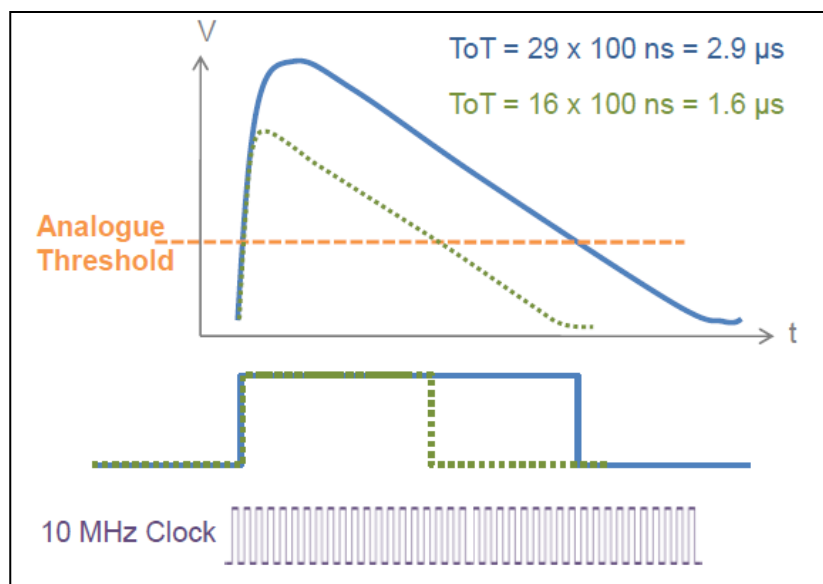
Development of a *Dosepix based Quality Assurance* detector for different X-rays modalities in Medical Imaging



Dosepix

**Hybrid Silicon
Detector
Matrix: 16x16 Pixels**

**Single Photon
counting : Time-Over-
Threshold method**



Dosepix

**Hybrid Silicon
Detector
Matrix: 16x16 Pixels**

**Single Photon
counting : Time-Over-
Threshold method**

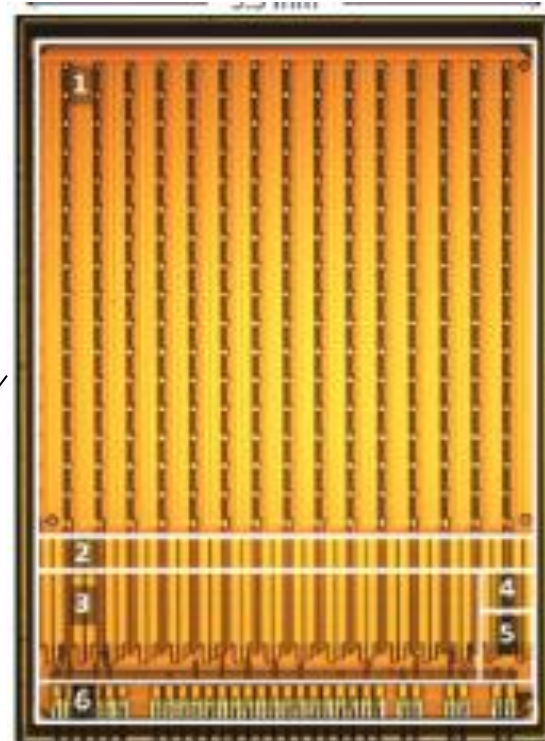
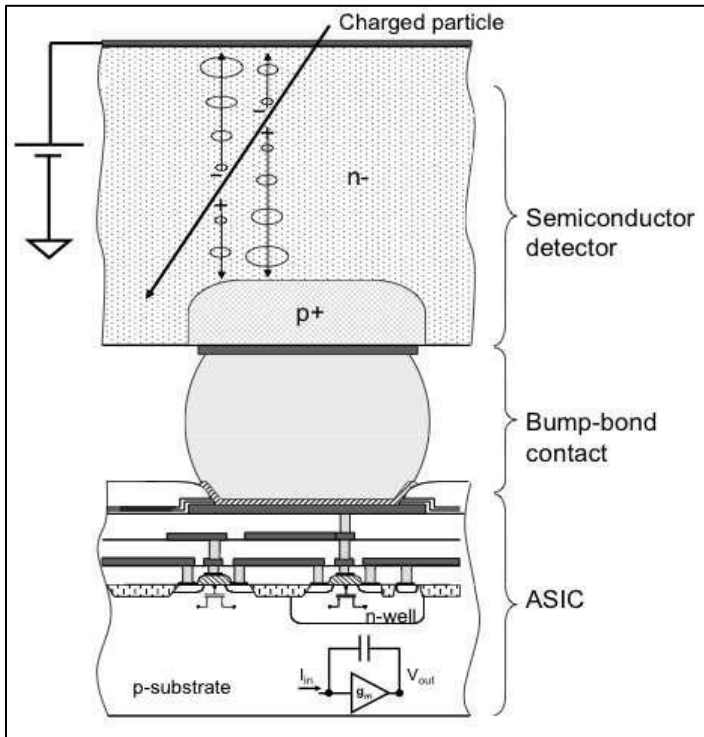
**128 bit Register
Periphery DAC Register**



Dosepix

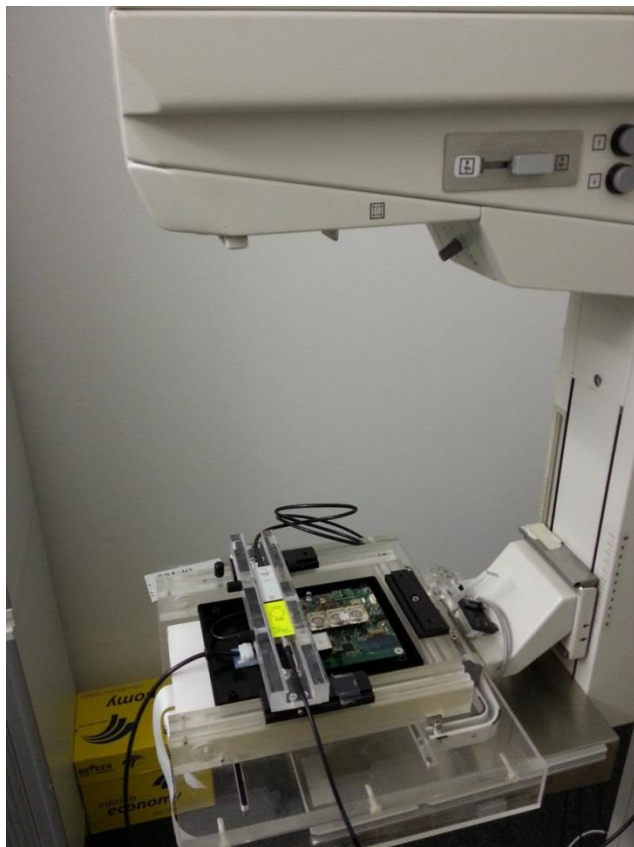
**Hybrid Silicon
Detector
Matrix: 16x16 Pixels**

**Single Photon
counting : Time-Over-
Threshold method**



Research Activities

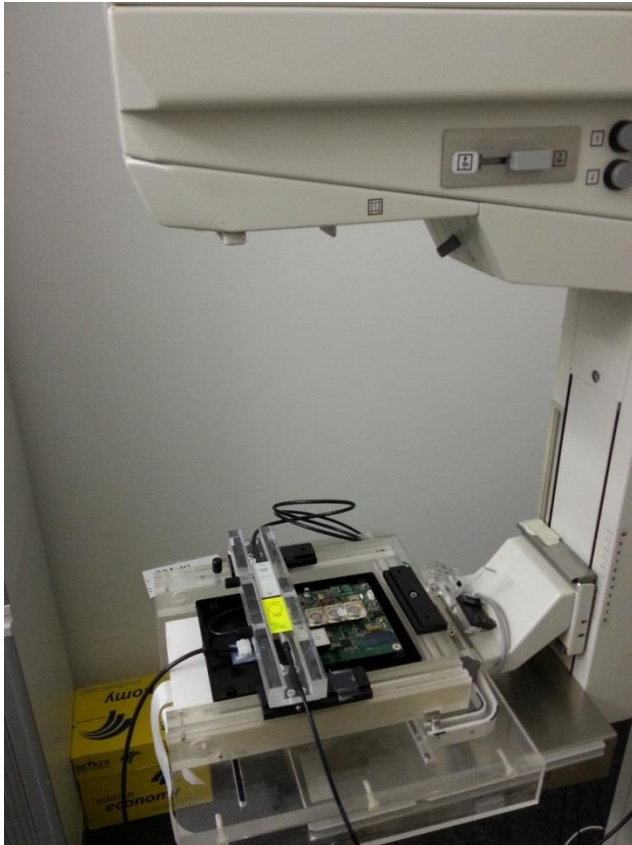
Diagnostic Quality Assurance Device for **Mammography**:



Mammo Tube
IBA Dosimetry,
Schwarzenbruck

Research Activities

Diagnostic Quality Assurance Device for **Mammography**:



Mammo Tube
IBA Dosimetry,
Schwarzenbruck

February 2013 – October 2013

❖ **Preliminary studies:**

Working Modes, DAC, Spectrum measurements, calibrations

❖ **Future:**

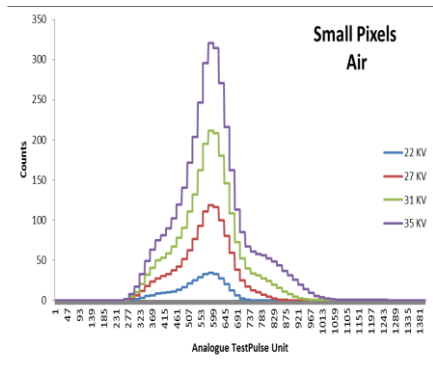
- Simulation of monoenergetic response functions
- Reconstruction of impinging spectra and dose calculation
- Determination of the Range of Work

❖ **Improving Energy Calibration**

Research Activities

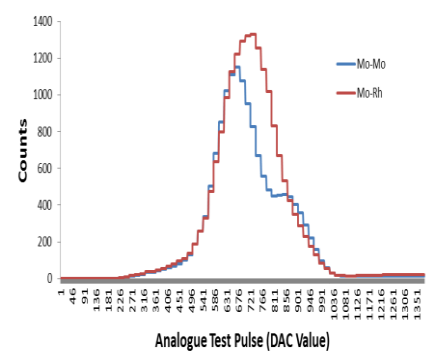
❖ Features :

Simulations



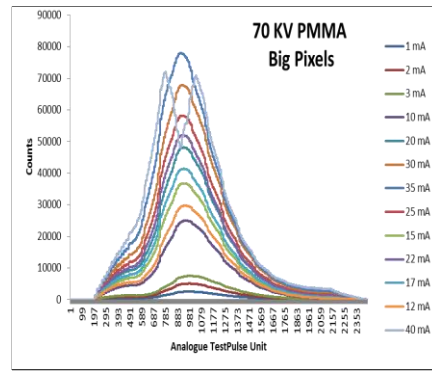
Future Activity:
Monte-Carlo
Simulation of
response and
comparison to
measurement (small
and big pixels)

Reconstruction



Future Activity:
Deconvolution to
reconstruct
impinging spectra
(small and big
pixels)
Dose Calculation

Range of Work



Future Activity:
Experimental
Activity with different
set-up and different
DAC settings



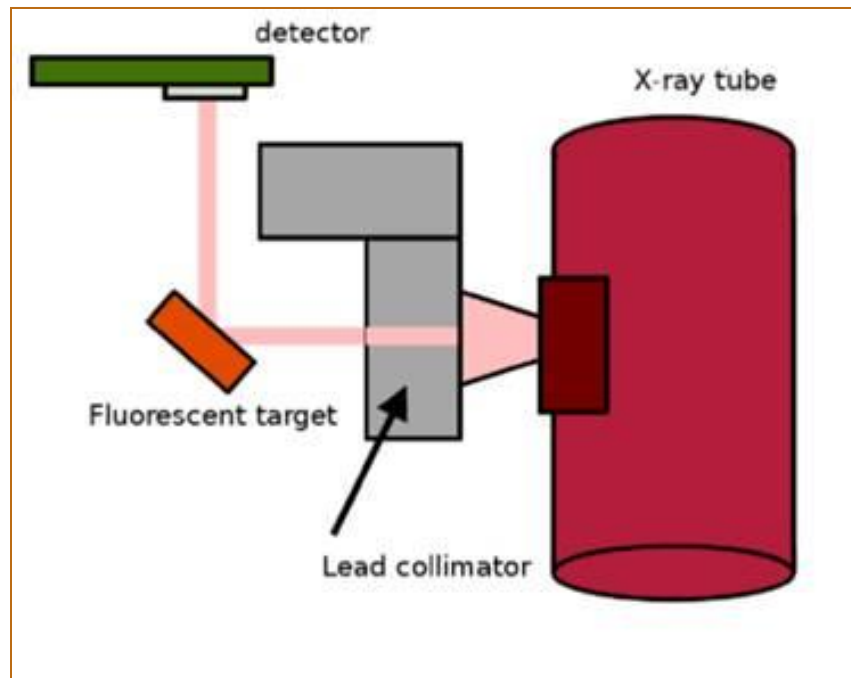
Research Activities

❖ Energy Calibration

- ✓ **Based on the use of Fluorescence lines from different materials**
- ✓ **Comparison between Energy Calibration and Analog Test Pulse Calibration**
- ✓ **Bremsstrahlung X-ray Spectra – kVp deduction**

Research Activities

❖ Energy Calibration of the detector: Experimental Set-up



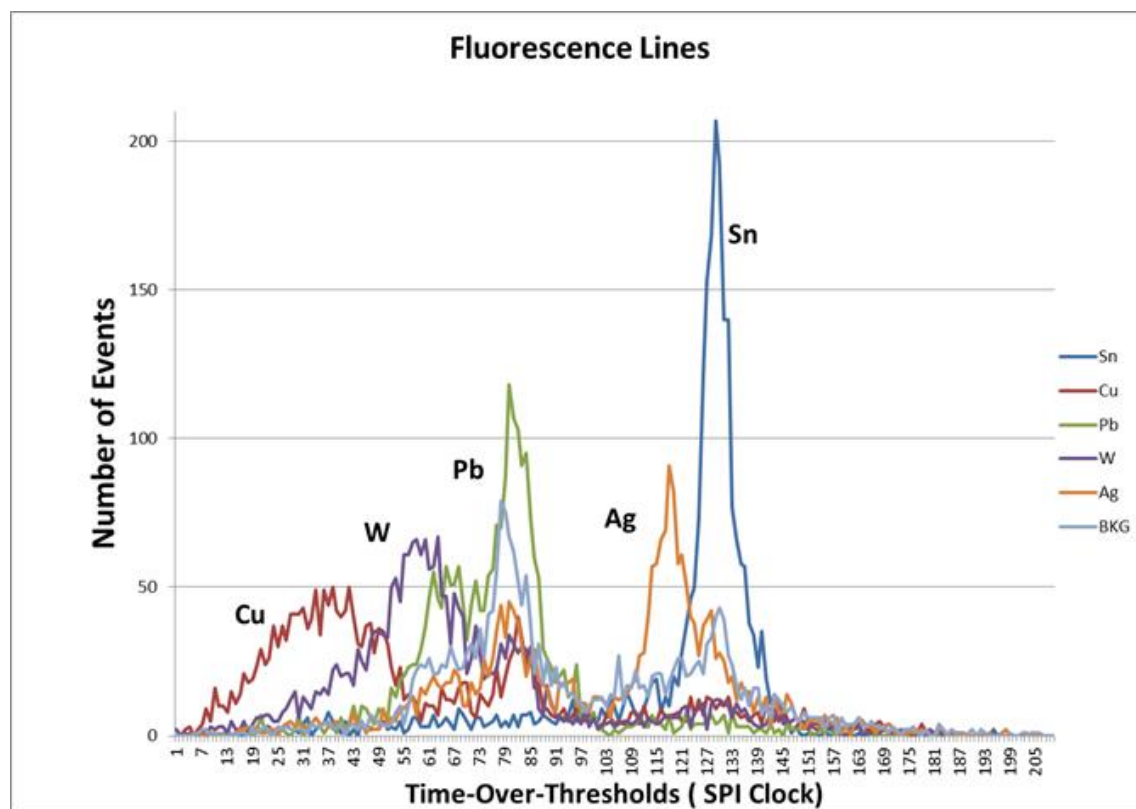
Xray Tube
ECAP, FAU University
Erlangen



Completed Research Activity

❖ Energy Calibration of the detector: Response of a single pixel to the fluorescence lines of different materials

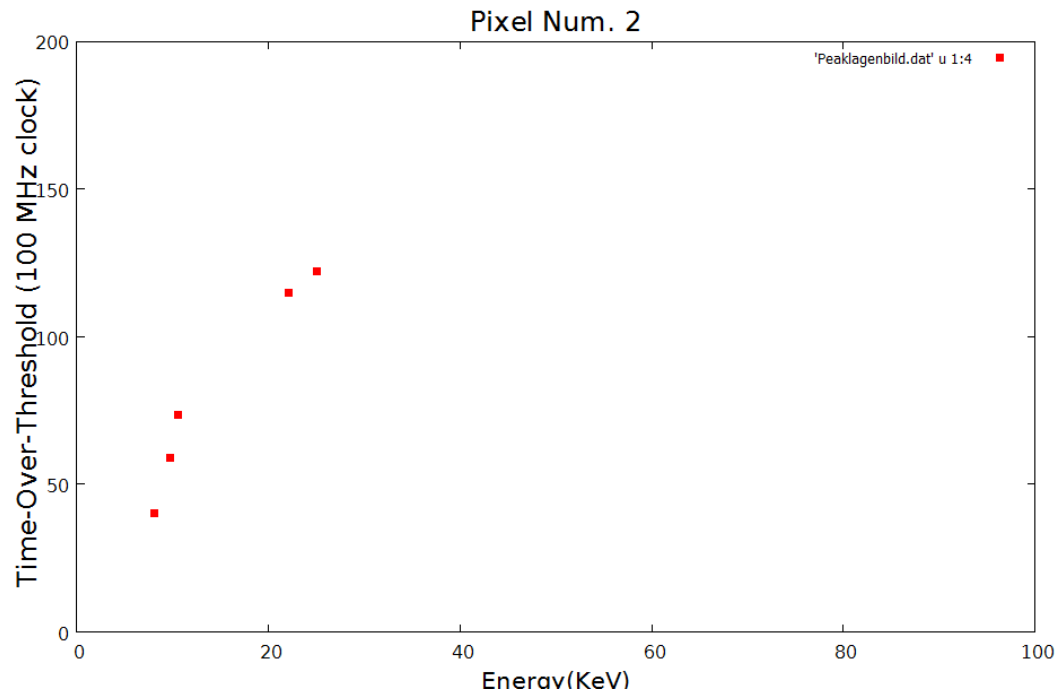
Xray Tube
ECAP, FAU University
Erlangne



Completed Research Activity

❖ Energy Calibration of the detector: Interpolation and Fitting of the peaks

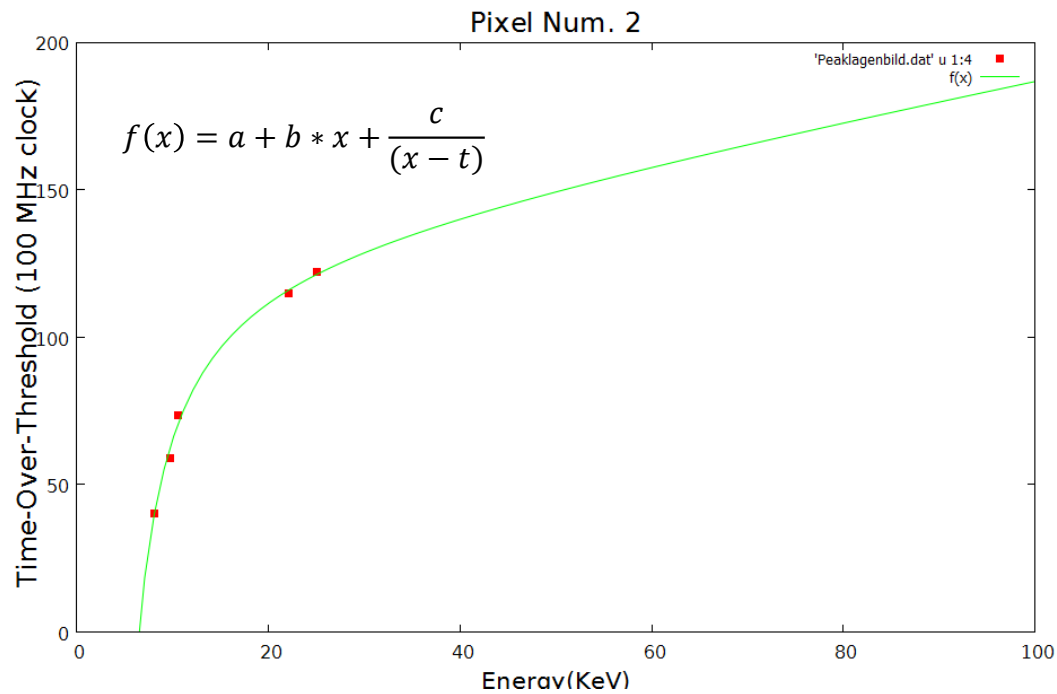
Xray Tube
ECAP, FAU University
Erlangne



Completed Research Activity

❖ Energy Calibration of the detector: Interpolation and Fitting of the peaks

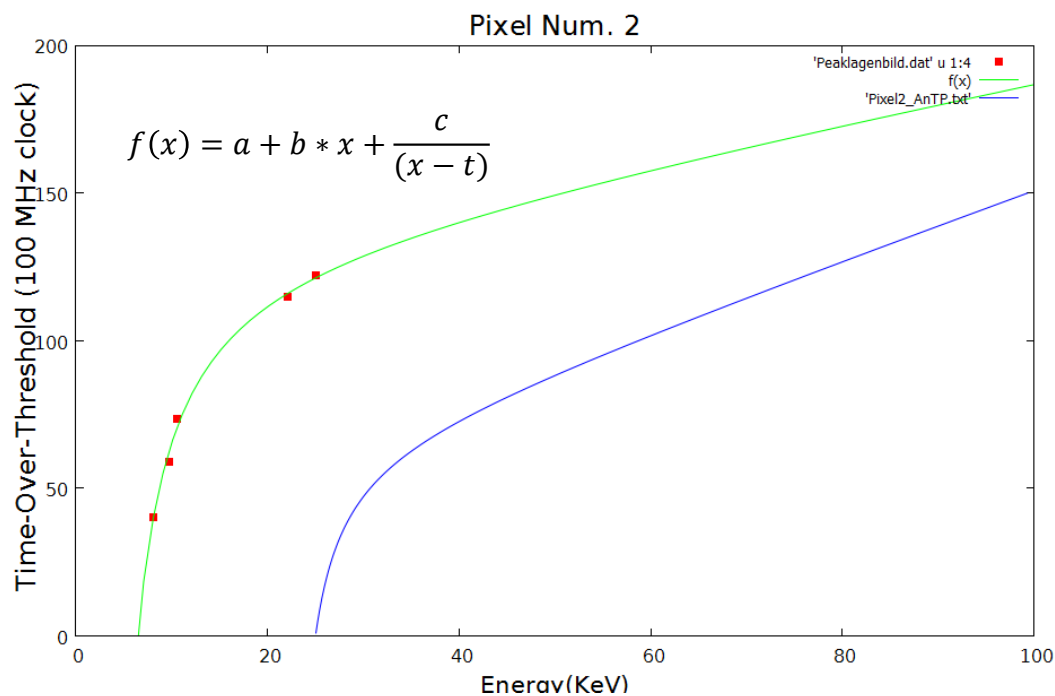
Xray Tube
ECAP, FAU University
Erlangne



Completed Research Activity

❖ Energy Calibration of the detector: Comparison between Analogue Test Pulse Calibration and XRF

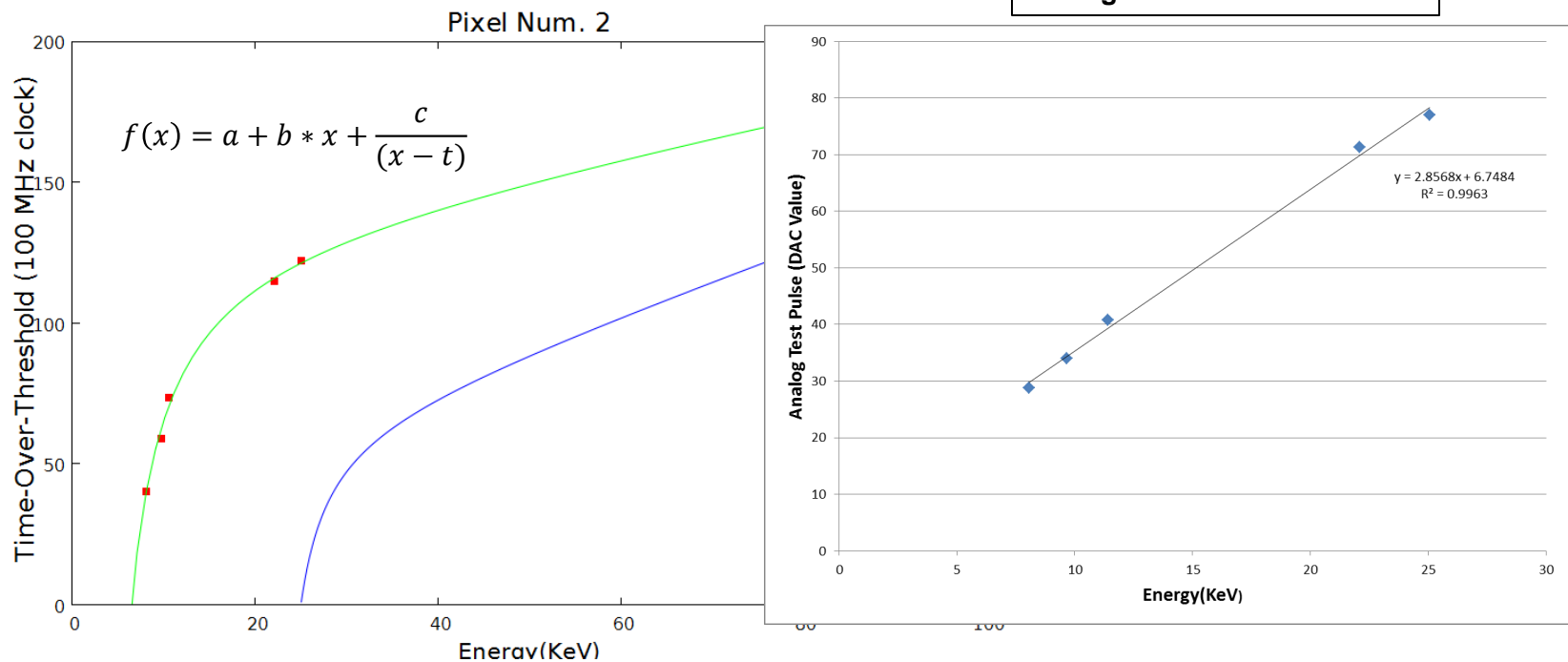
Xray Tube
ECAP, FAU University
Erlangne



Completed Research Activity

❖ Energy Calibration of the detector: Comparison between Analogue Test Pulse Calibration and XRF

Xray Tube
ECAP, FAU University
Erlangne

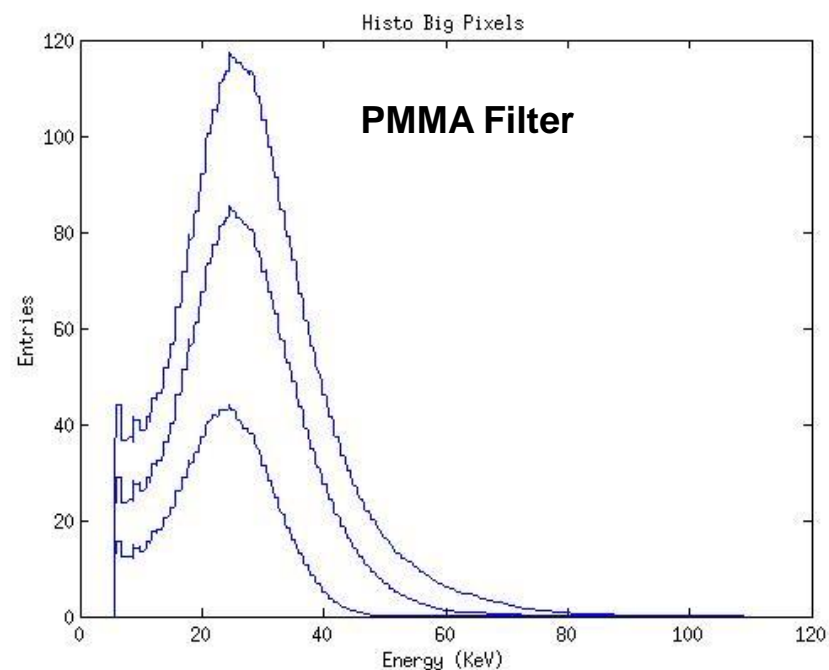
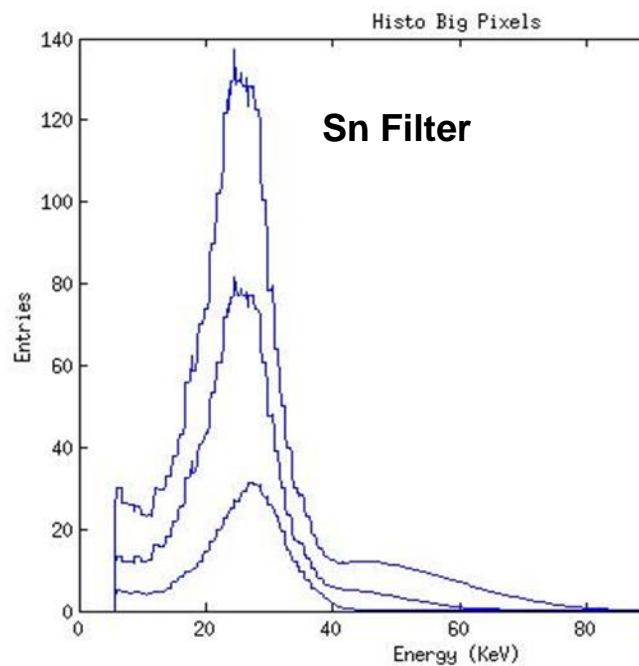


“Characterization of a new Photon counting Detector with XRF “,

F. Bisello , I. Ritter, F. Tennert, T. Gabor, M. Campbell, W.S. Wong, S. Wölfel, G.Anton, N.Michel and T. Michel, IEEE 2013, Seoul

Completed Research Activity

❖ Energy Calibrated Bremsstrahlung spectra from ECAP X-ray device:



Trainings, Schools and Conferences

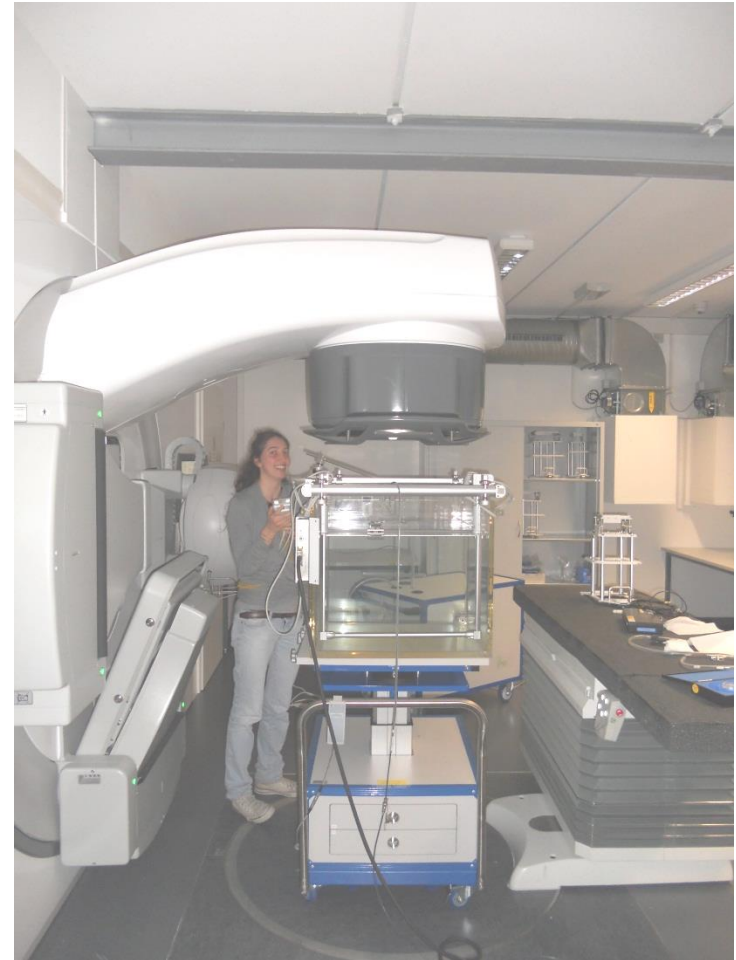
IBA Dosimetry Training

- ✓ Absolute and Relative Dosimetry
- ✓ Xray facilities Training
- ✓ Radiation Safety
- ✓ Monte Carlo simulation with EGS

- ✓ Company Data Protection
- ✓ Introduction to QM System
- ✓ Introduction into Working safety

Training at Neumarkt hospital

- ✓ Daily Quality Assurance at Radiotherapy Unit



Trainings, Schools and Conferences

Attended Schools

- ✓ V Nation School, INFN Padova (Italy) : „Electronics and Detector for High Energy Physics, Astrophysics, Space Application and Medical Physics“
 - ❖ Radiation damage in Semiconductor Detector
 - ❖ Front-end Electronics
 - ❖ Medical Application (Silicon photomultiplier, Proton Therapy)

Conferences

- ✓ IEEE Seoul 2013, Workshop „New Detector technologies in Radiation Dosimetry and its Application“, October 27- November 3

- ❖ **Characterization of a new Photon counting Detector with XRF**

F. Bisello^{1,2}, I. Ritter², F. Tennert², T. Gabor^{2,5}, M. Campbell³,
W.S. Wong³, S. Wölfel¹, G. Anton², N. Michel⁴ and T. Michel²

1- IBA Dosimetry GmbH, Bahnhofstraße 5, 90592 Schwarzenbruck, Germany

2-Erlangen Centre for Astroparticle Physics, Radiation and Detector Physics, Erwin-Rommel-Str. 1, 91058 Erlangen, Germany

3- Medipix Team, Microelectronics Group, CERN, 1211 Geneva, Switzerland

4- Customized Microelectronic Solutions, Bruckwiesenstr. 3, 91220 Schnaittach, Germany

5- Fraunhofer Institute for Solar Energy Systems ISE, Heidenhofstraße 2, 79110 Freiburg im Breisgau, Germany

Trainings, Schools and Conferences

Programmed Events

- ❖ National Congress of Medical Physics, AIFM Torino 16-19 November 2013
- ❖ ICTR-PHE 2014, Geneve February 10-14 2014



Thank you for your attention