
Francesca Bisello

Dosepix

Midterm Review Preparatory Meeting

ARDENT Project
June 13th, CERN



Hello everybody!

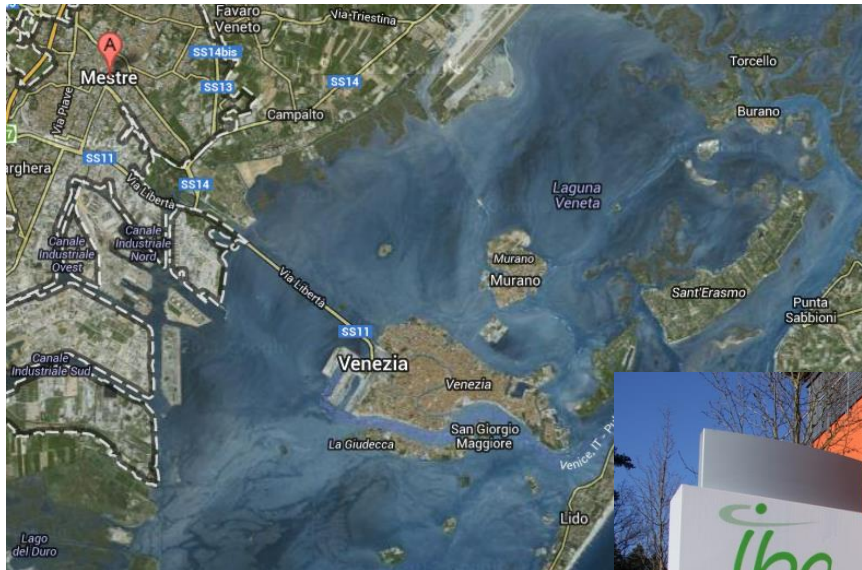
Outline

Dosepix

Training & Conferences

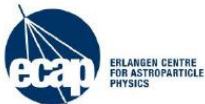
To do

About Me...



..where I come from

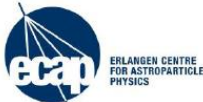
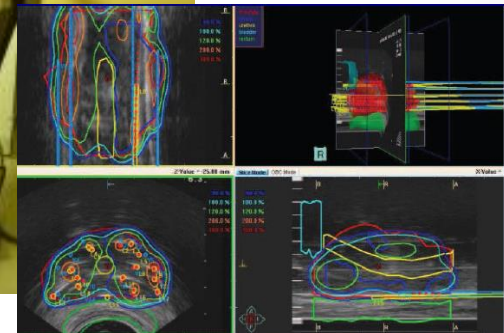
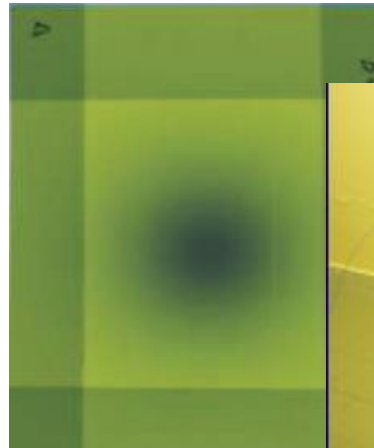
Where I am now...



About Me..

..in between:

- ▶ 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 ESR 10

► Goal

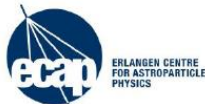
Development of a *medical Quality Assurance* for different Xray modalities devices with *Dosepix detector*

► Methods:

Chip evaluation at different radiation energy

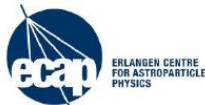
Reconstruction and analysis of Radiation Spectra

Optimization of the device in different design



Dosepix

► Few words about Dosepix ...



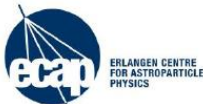
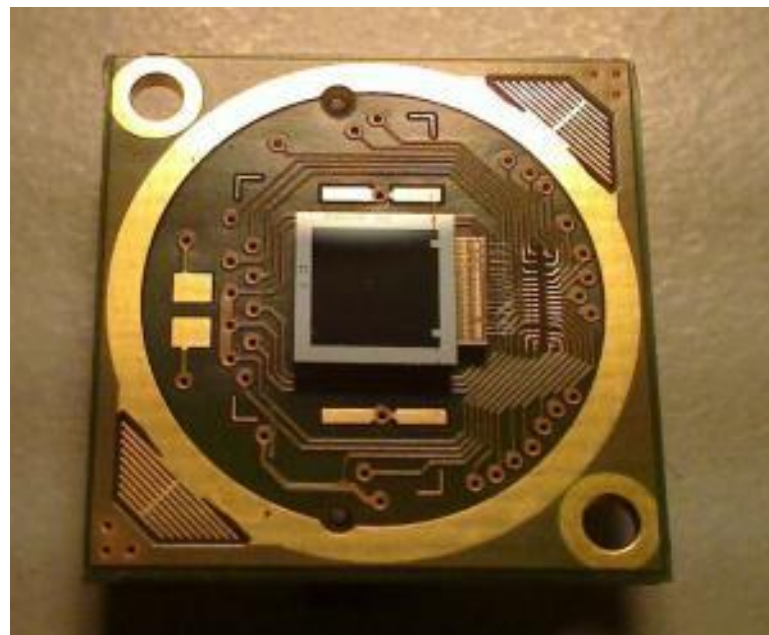
Dosepix – Hybrid Silicon Pixel Detector

Dosepix

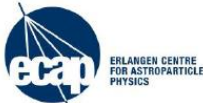
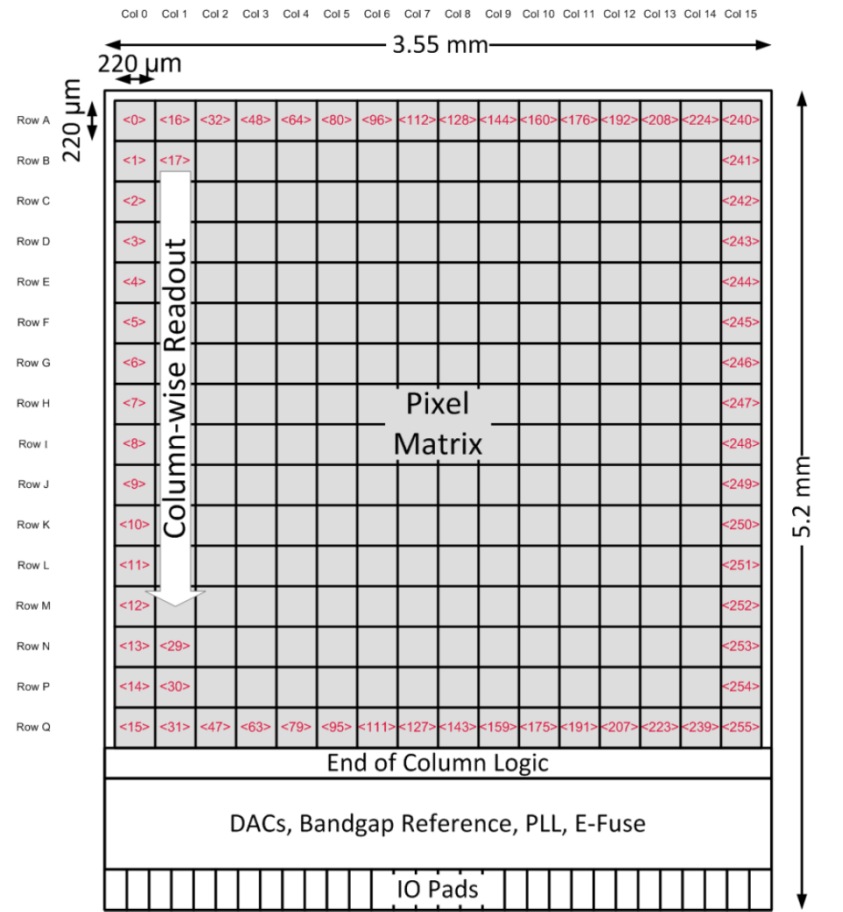
Read out
Electronics

Time-
Over-
Threshold

Hybrid
Silicon Pixel
Detector



| PARAMETER | SPECIFICATION |
|------------------|---------------------------------------|
| Pixel Pitch | 220 μm x 220 μm |
| No. of Rows | 16 |
| No of Columns | 16 |
| Sensitive Area | 3.52 mm x 3.52 mm |
| Sensor Thickness | 300 μm |
| Sensor Material | Silicon |



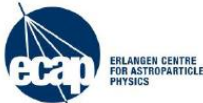
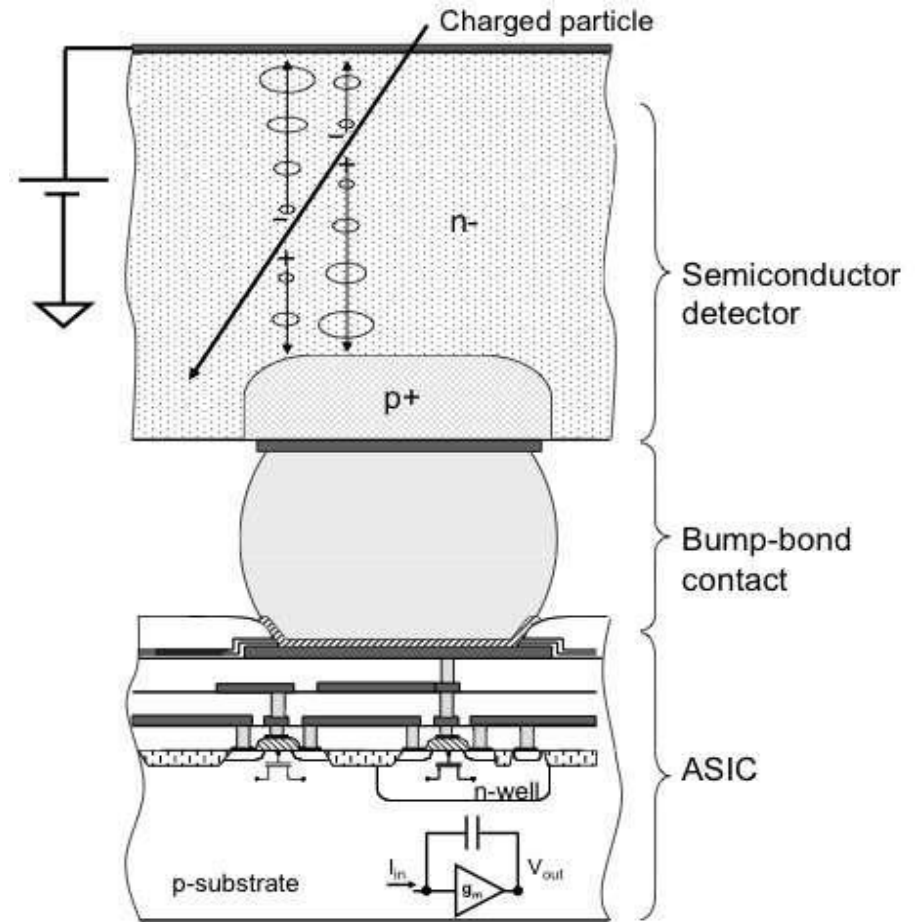
Dosepix – Read-out Electronics

Dosepix

Read-out
Electronics

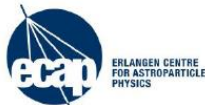
Time-
Over-
Threshold

Hybrid
Silicon Pixel
Detector



Three Operation Mode:

- ▶ **Integration-Mode:**
Measure the sum of energies of incoming radiation
- ▶ **Counting-Mode:**
Counts the number of events during the irradiation
- ▶ **Dosi-Mode:**
Counts the number of photon in each Energy Bin



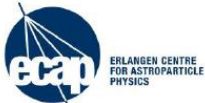
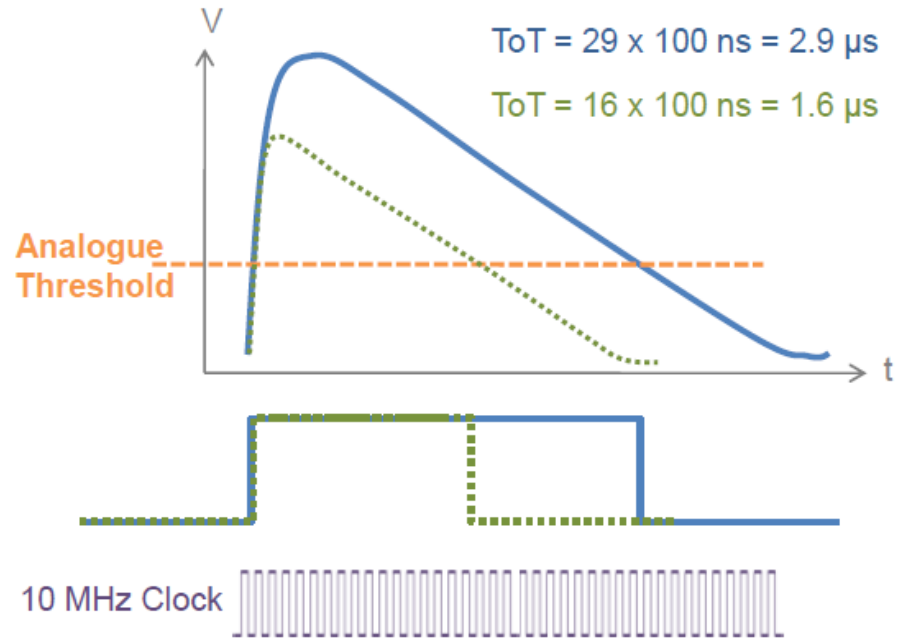
Dosepix – Time-Over-Threshold

Dosepix

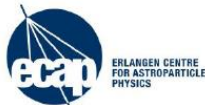
Read-out
Electronics

Time-Over-
Threshold

Hybrid
Silicon Pixel
Detector



► Before the measurements: Calibration Methods



ThS-Equalization

Analogue Test Pulse

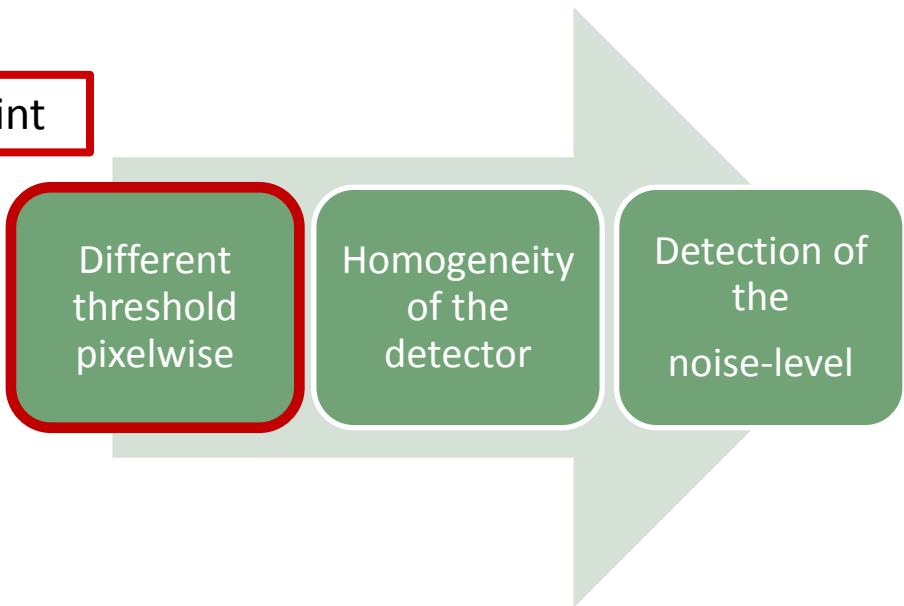
Energy Binning



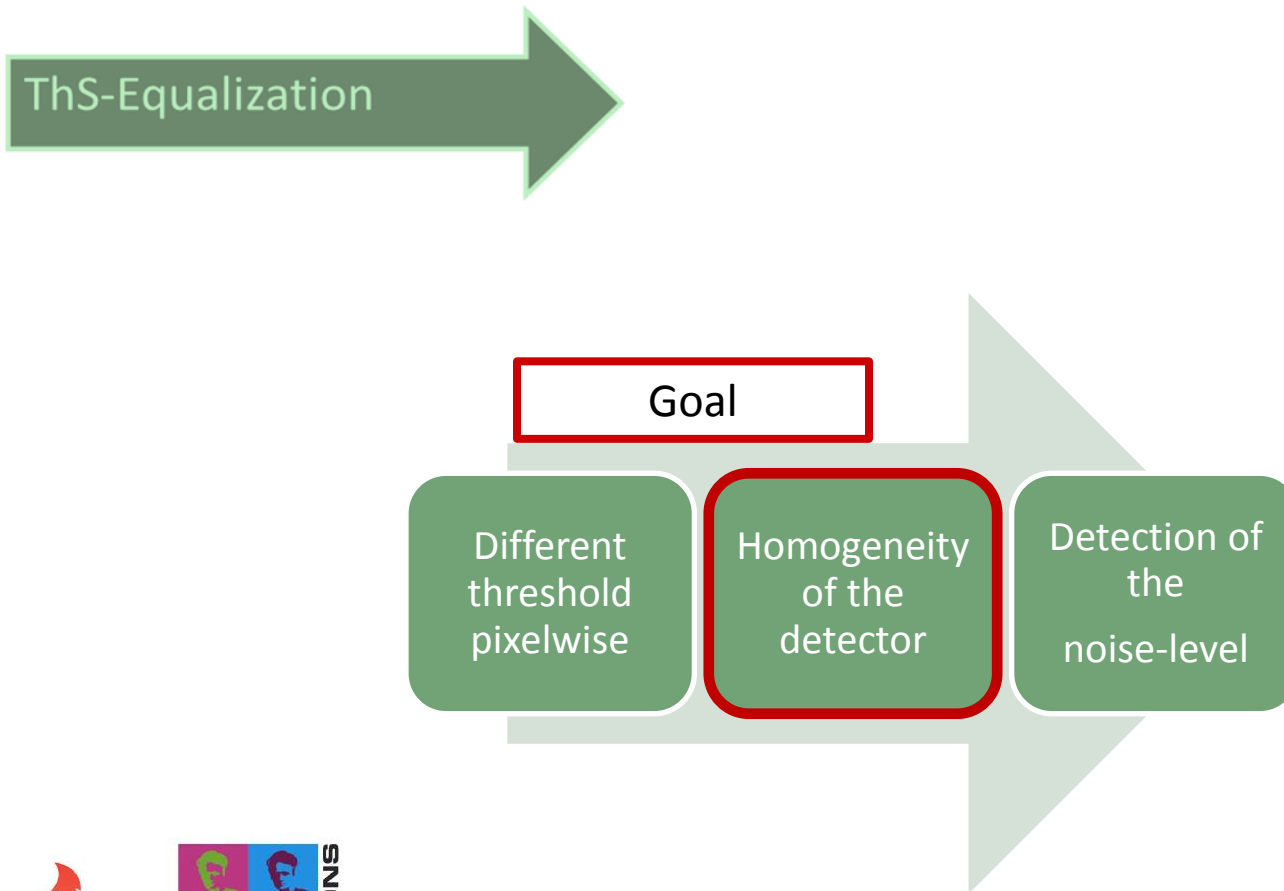
Dosepix – Threshold Equalization



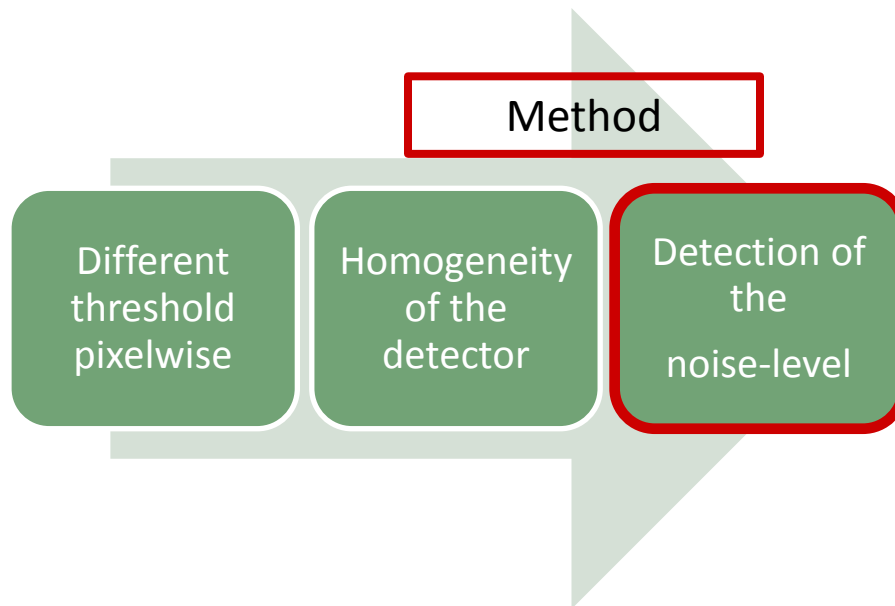
Starting Point



Dosepix – Threshold Equalization



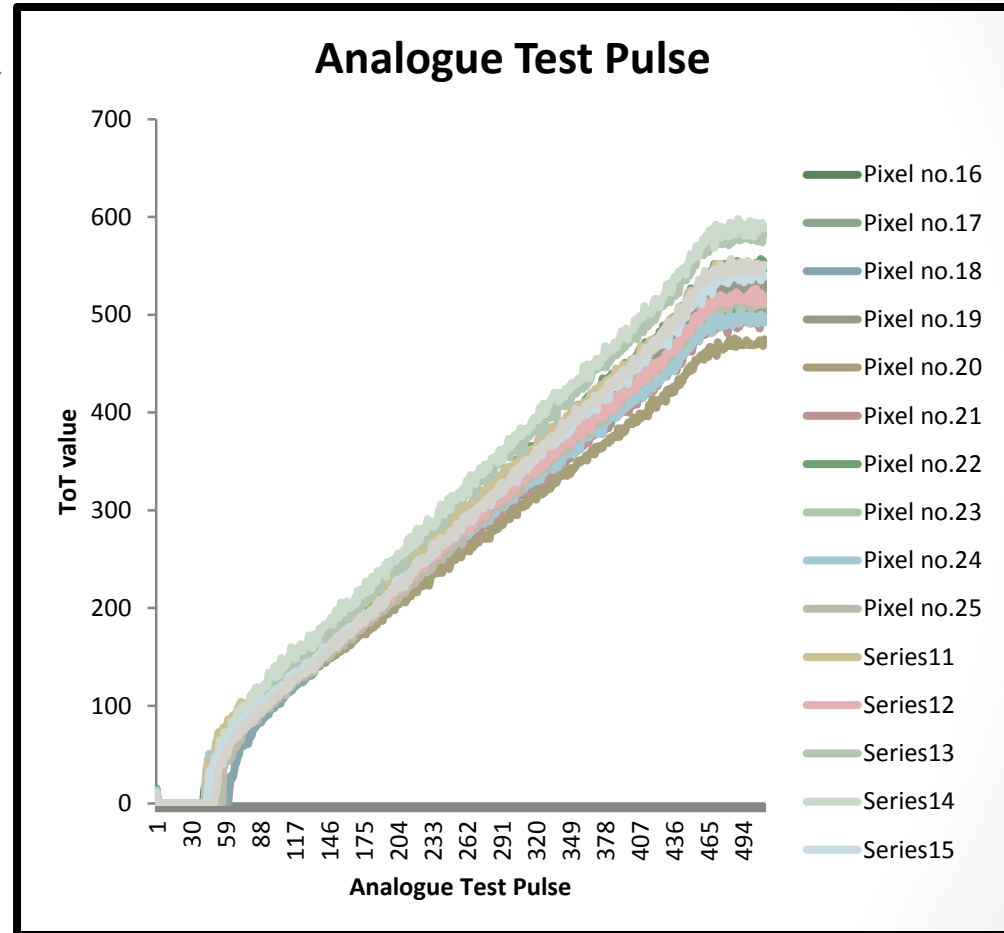
Dosepix – Threshold Equalization



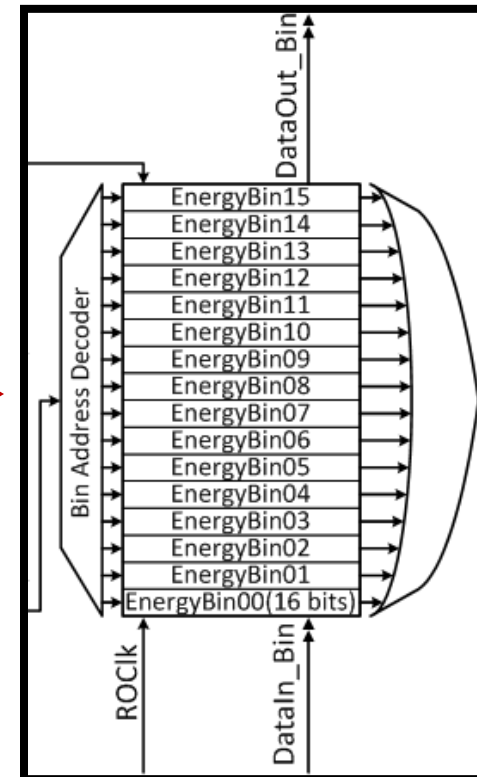
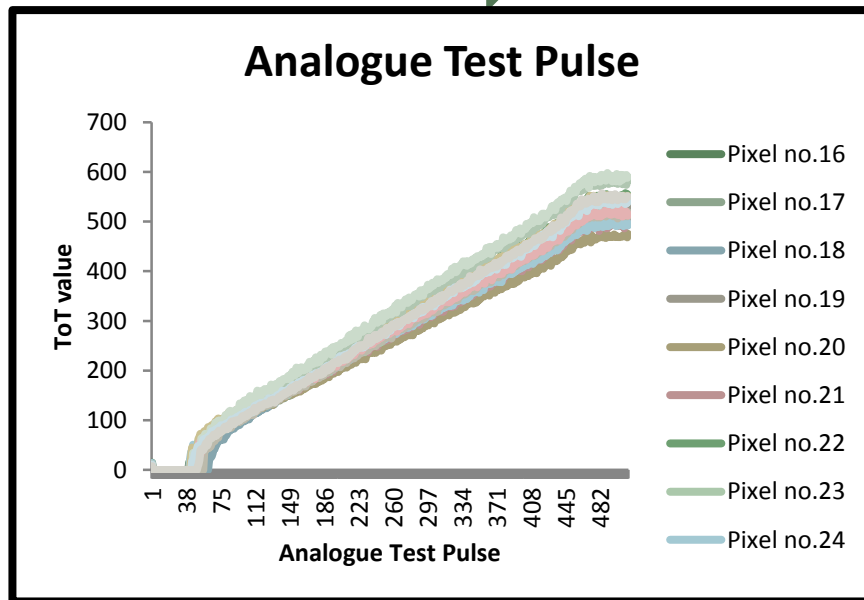
Dosepix – Analogue TestPulse Calibration

Analogue Test Pulse

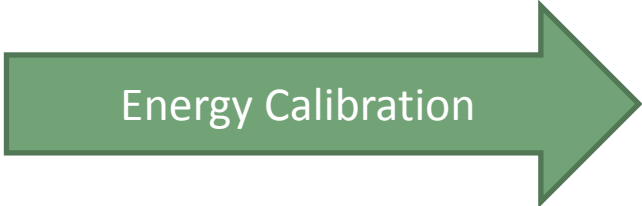
Calibration Curve:
Analogue Test Pulse - ToT



Dosepix – Energy Binning

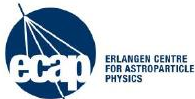
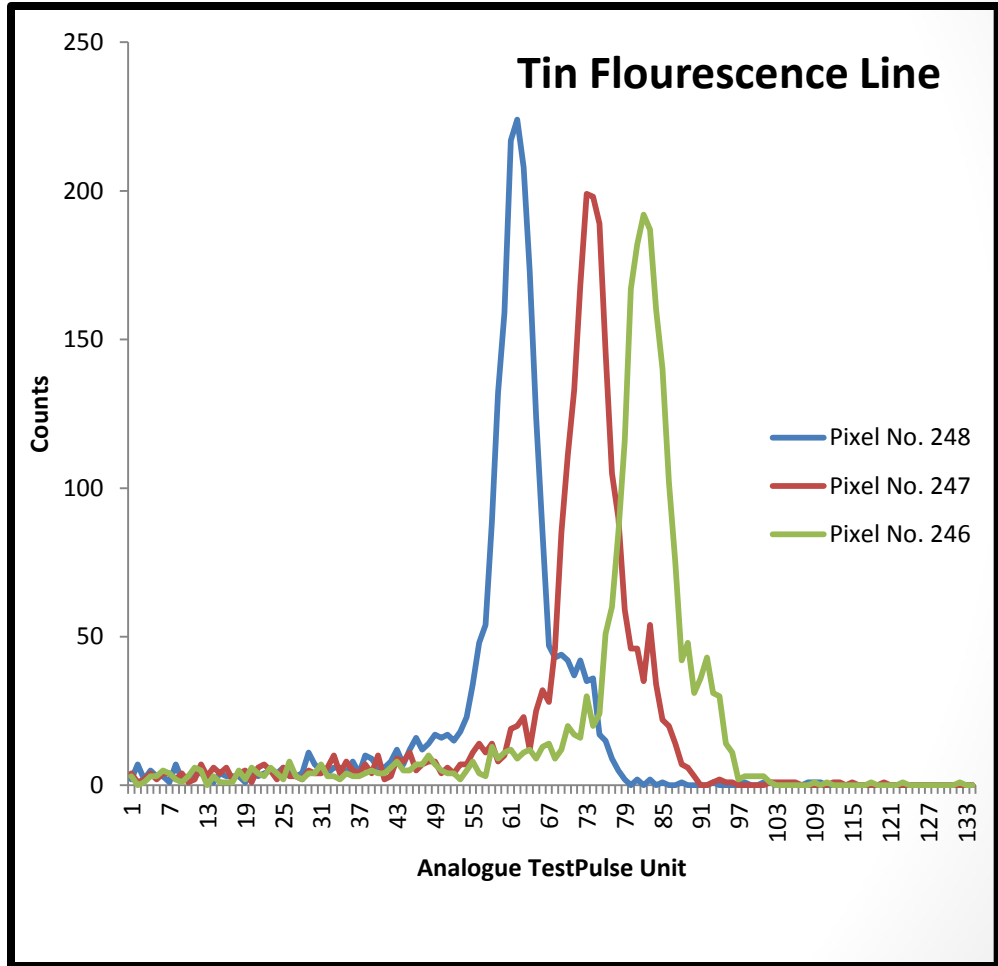


Dosepix – Energy Calibration



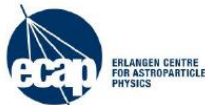
Energy Calibration:

- Fluorescence line of different material
- Different for each pixel



Dosepix - Measurements

► and then...measurements



Dosepix – Measurements

I – Mammo Device

IBA Dosimetry,
Schwarzenbruck

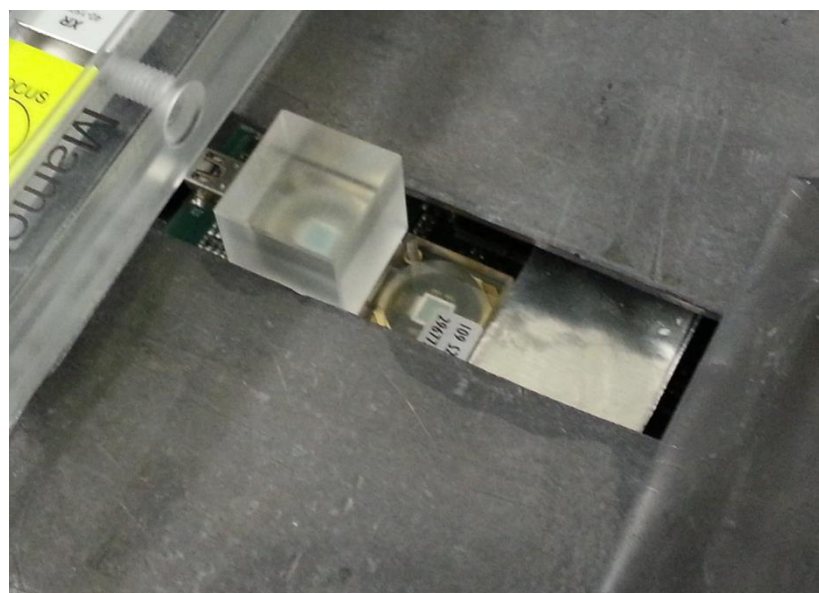
| | |
|---------|---------------------------------|
| Energy | 22-35 KeV |
| Anode | Mo |
| Filters | Mo Rh |
| Dosepix | Different experimental Setup |



Dosepix – Measurements

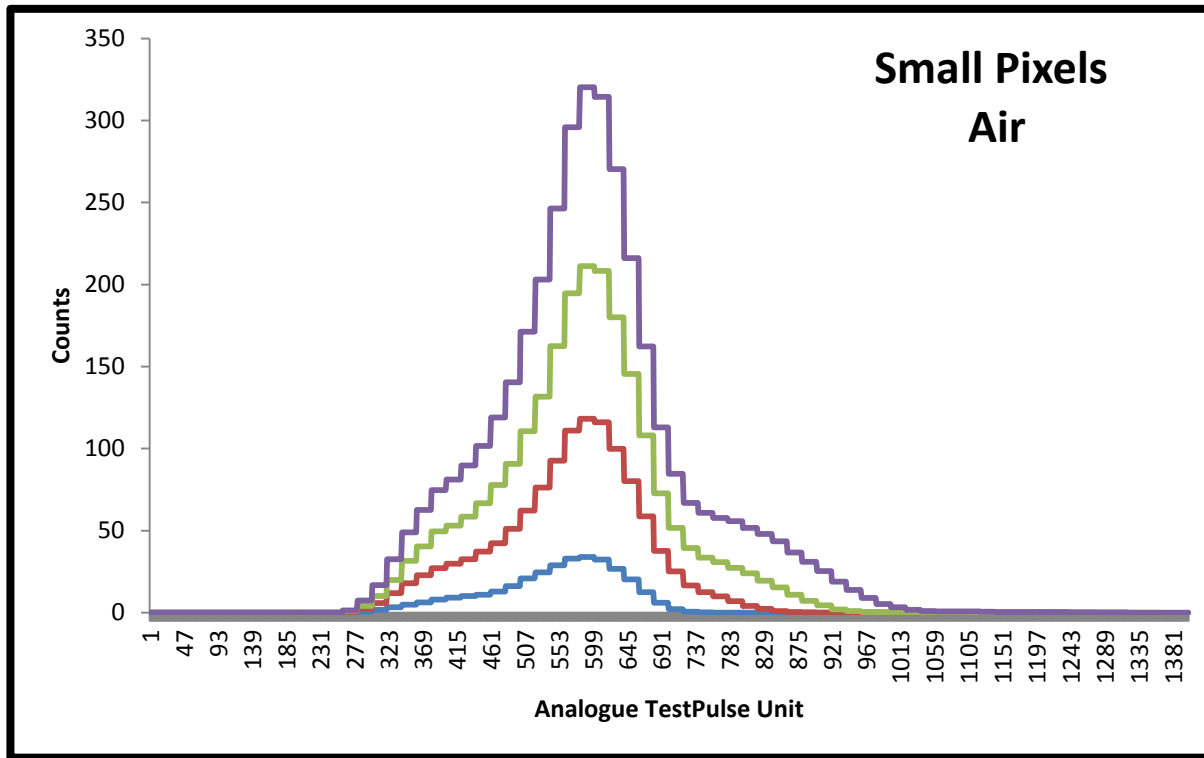
II – Xray Tube ECAP Erlangen University

| | |
|---------|--|
| Energy | 40-120 KeV |
| Current | 1-40 mA |
| Anode | W |
| Filters | 3,8 mm Al |
| Dosepix | Slot 1: 15mm PMMA Slot 2 : Free Slot 3: 200 μ m Sn |



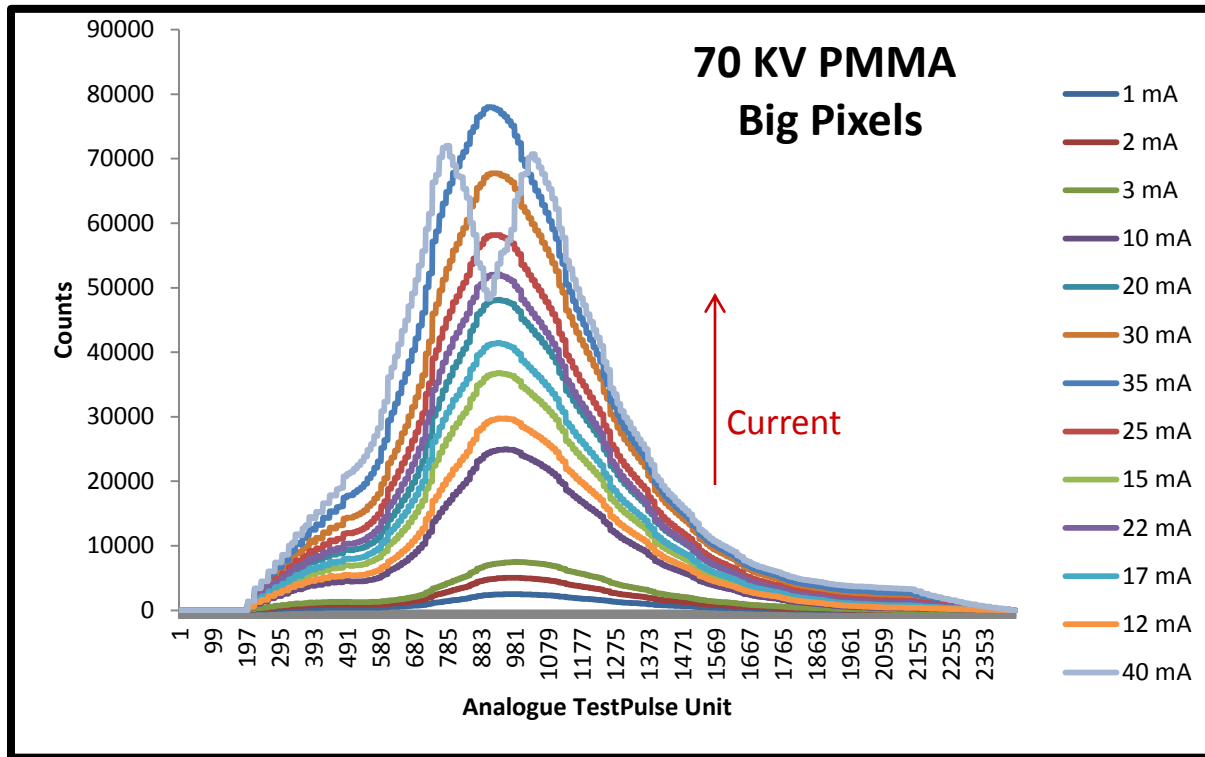
Dosepix – Measurements

▶ Informations about **Tube Energy**



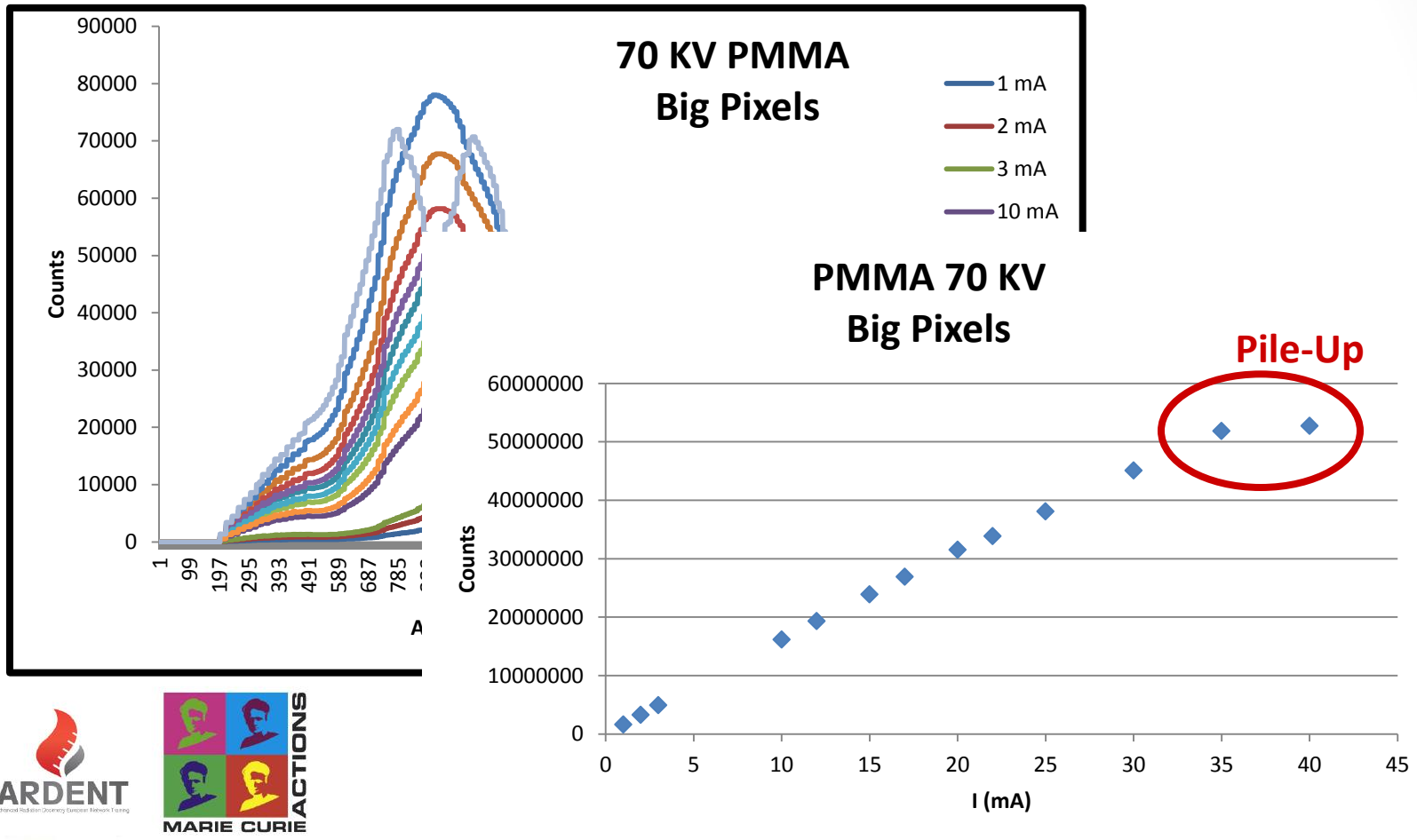
Dosepix – Measurements

► Define the region of use of the device : **Pileup Problem**



Dosepix – Measurements

▶ Informations about **Pile-up**



End...

To do and what I have done:

I – Fluorescence Calibration

II – Pileup Understanding : Analysis of spectra with different filters
MonteCarlo Simulation → Monte-Carlo with
EGSnrc (M.Birkner)
13 May 2013

III – Radiation Hardness Test → V National School INFN Padova,
15-19 April 2013

IV – Firmware Improvement : Modify the speed of read-out
New Setup

V – Participation to 2013 IEEE Nuclear Science Symposium and Medical
Imaging Conference, Seoul October 27- November 2

@ IBA Dosimetry: Training on Absolute and Relative Dosimetry (A. Giuliacci)



...Thanks!

