

Tracking radiation using TimePix



Best Khoza, Thabo Masuku, Pulane Mokoena, Dawid Boesak

Content:

- **Nuclear radiation overview -> TimePix technology ->Experimental results ->Conclusion**

Nuclear radiation overview

- Nuclear radiation refers to propagation of energy through space or a medium in form of electromagnetic waves or particles.

Ionizing radiation

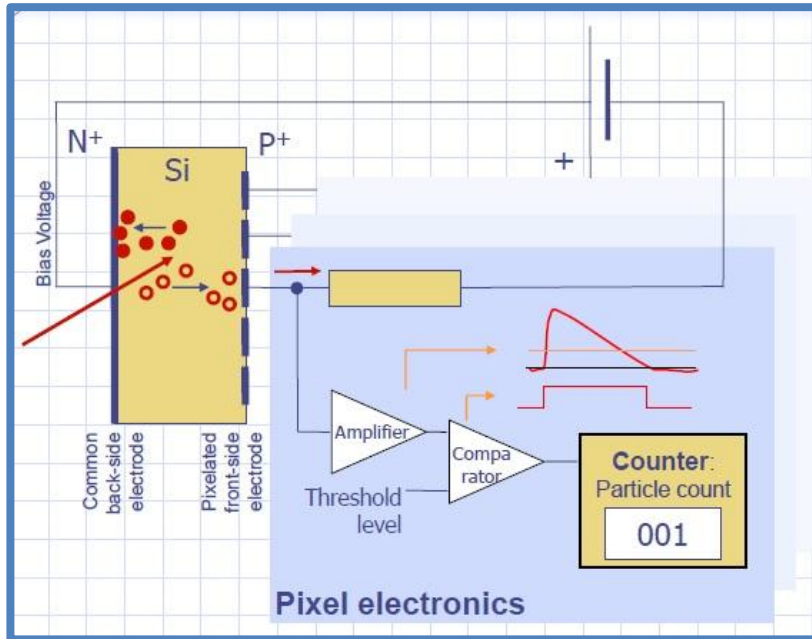
- Charged particles
- Alpha, beta,

Non-ionizing radiation

- Neutral particles
- Gamma, neutron

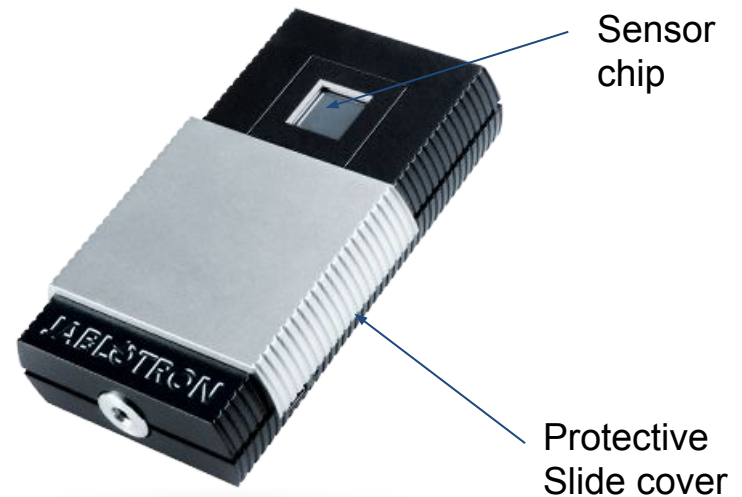
Detection, measurement and control of such particles is important

TimePix Technology



- Digital particle camera
- Real time display
- Display and detect characteristics traces of individual
- Covers a wide range of spectrum
- Uses Pixelman software

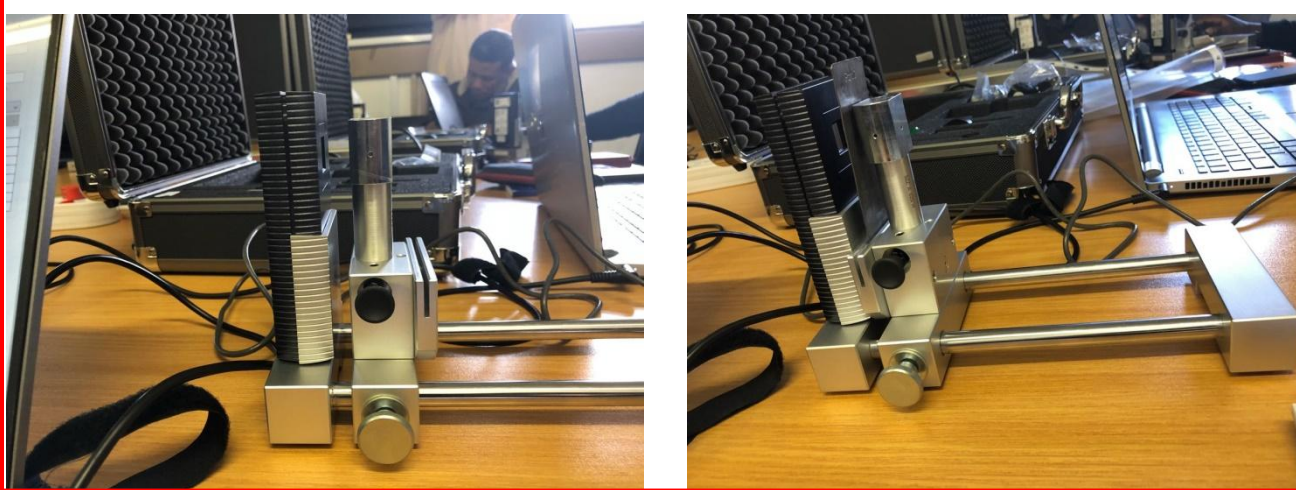
1) Dot		Photons and electrons (10keV)
2) Small blob		Photons and electrons
3) Curly track		Electrons (MeV range)
4) Heavy blob		Heavy ionizing particles with low range (alpha particles,...)
5) Heavy track		Heavy ionizing particles (protons,...)
6) Straight track		Energetic light charged particles (MIP, Muons,...)



Experimental results:

Objectives: Detection of particles in air and when subjected to aluminium.

Experimental setup:



Acquisition

Continuous measurement

Integral mode

Exp. count: 60

Exp. time: 1

Delay [s]: 0

Acq. progress: 45/60
47.38 s

Mode: Spectrometer

Picture settings

Min. level: 0

Max. level: 20

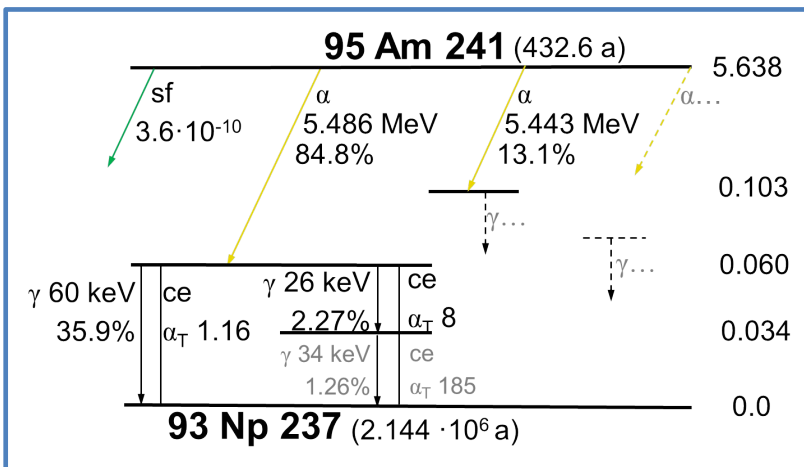
Set colormap: Hot

Auto range: Min-max

XY: [255,65]

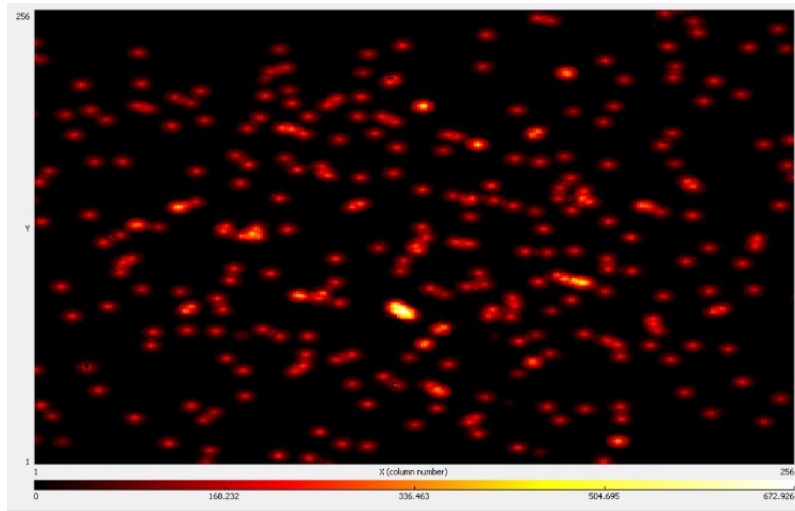
Value	0.0
Min	0.0
Max	4914.0633
Pixel count	2375
Energy - frame	51978
Energy - selecti...	51978
Frames count	45
Radiation source	Other

Frame	Current	All
Alpha	0	3
Beta	8	246
Gamma	1	49
Other	0	1
All	9	299

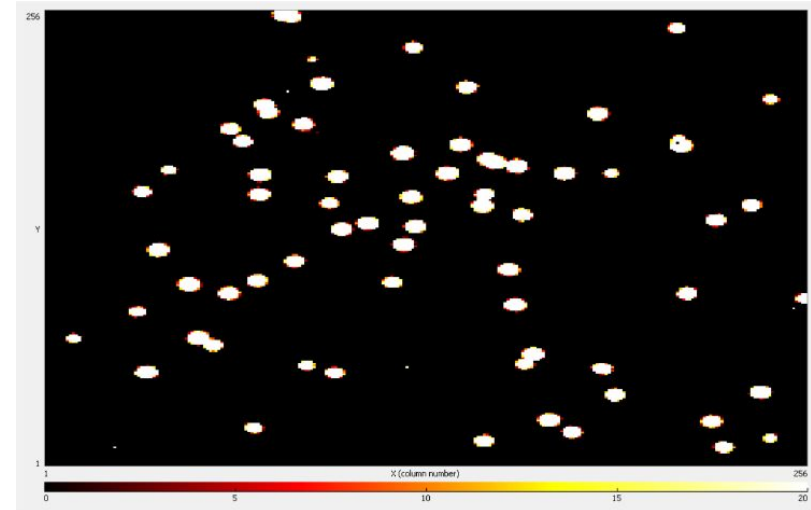


- Americium-241 (9.5kBq)
- Emit alpha particles in the range of 5MeV

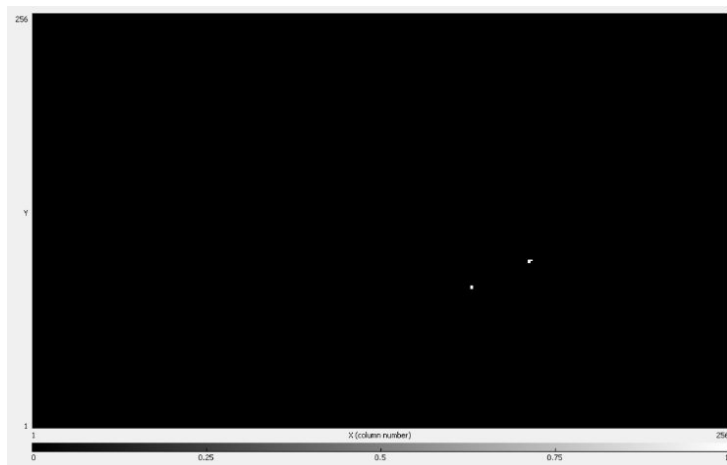
Experimental results cont:



1. Particles from decay of Am-241



2. Particles from decay of Am-241 (Auto range unchecked)



3. Particles from decay of Am-241 with Aluminium medium before the detector (1cm)

Conclusion:

- Auto range enables us to select the energy range and hence that determines the type of particles we observe. Lower range we observe beta and gamma rays and higher we observe alpha rays.
- TimePix is a good tool to track radiation particles
- 21st century and beyond requires multidisciplinary knowledge

Acknowledgements

1. https://www.nucleonica.com/Application/ReducedDecaySchemes/Am241_TXT.htm