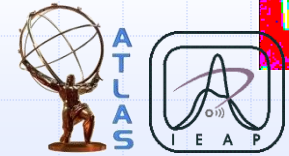


Early Stage Researcher 9: Activities November 2013 – September 2014

Benedikt Bergmann

Institute of Experimental and Applied Physics, Czech Technical University in Prague, Czech Republic





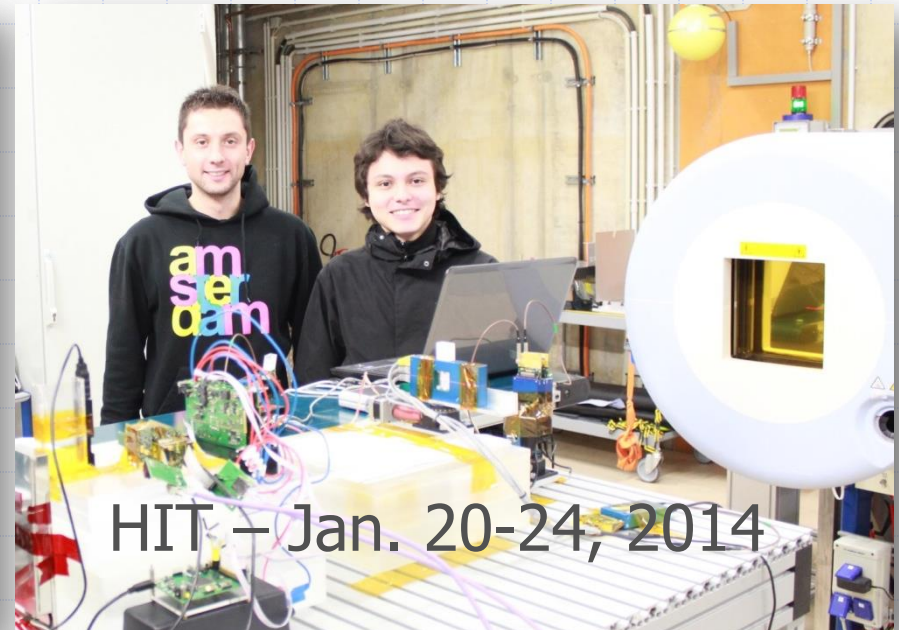
EXPERIMENTAL ACTIVITIES

“All life is an experiment. The more experiments you make the better.”

- Ralph Waldo Emerson



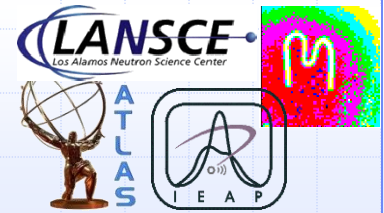
LANSCCE – Dec. 1-8, 2013



HIT – Jan. 20-24, 2014

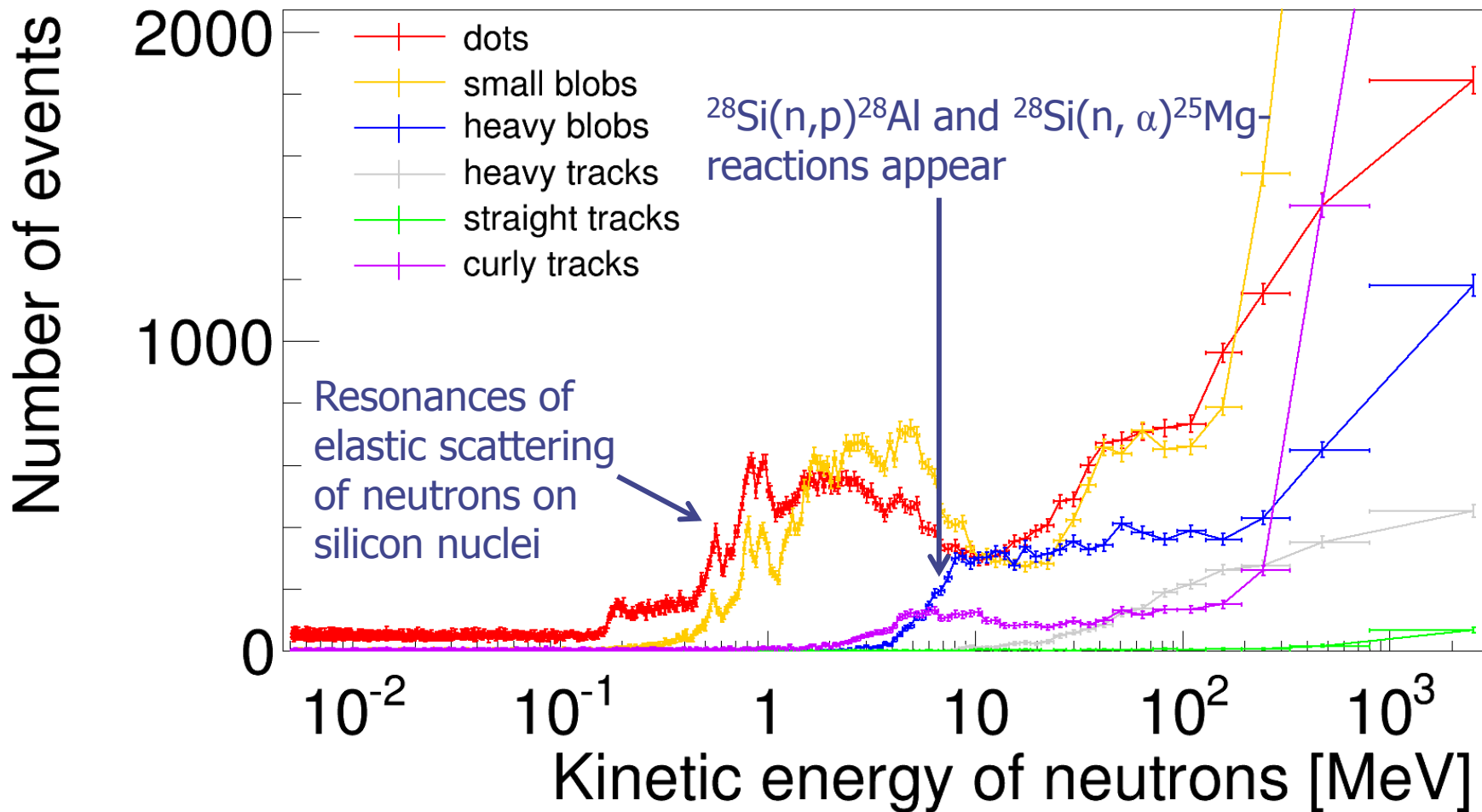
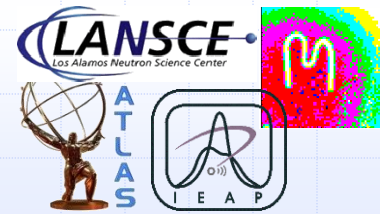
Reminder:

Pattern Recognition – Definition of Cluster Categories

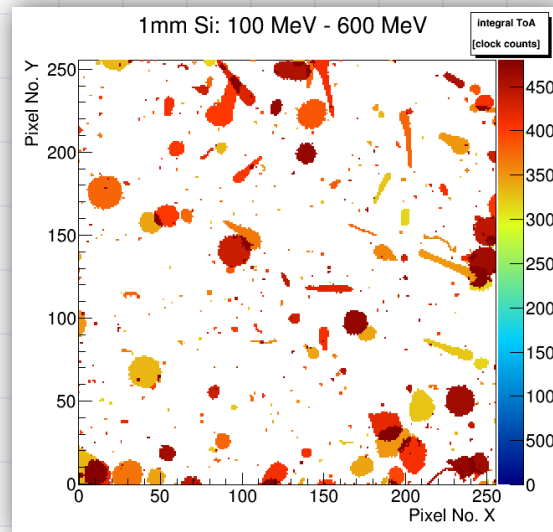
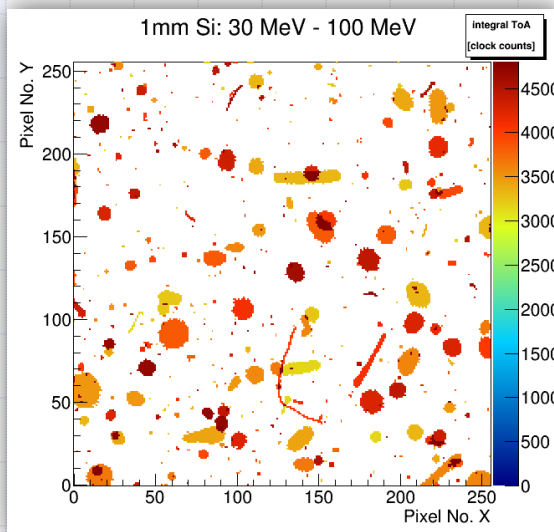
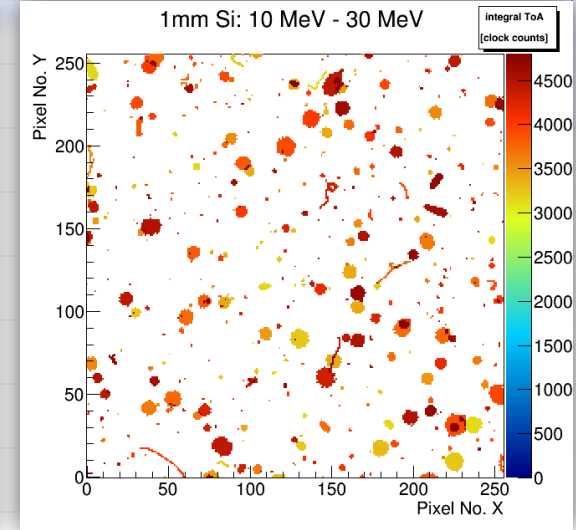
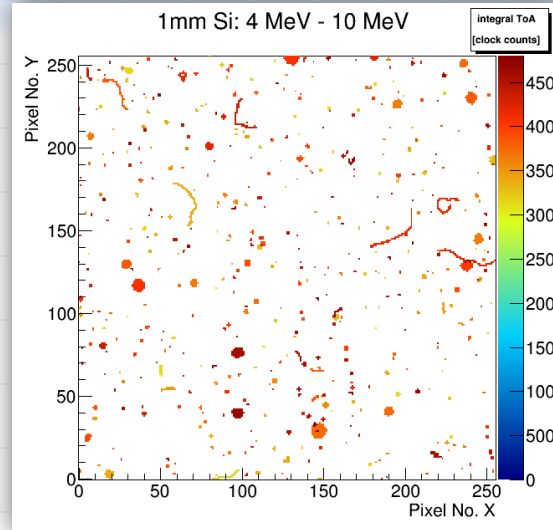
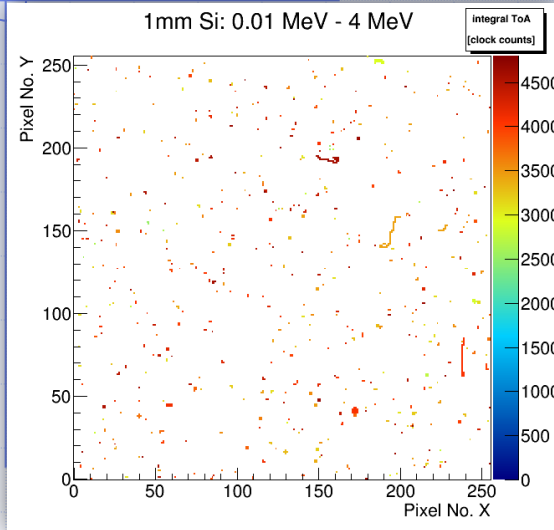
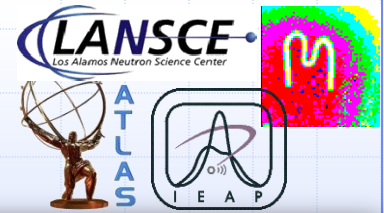


Dot		Photons and electrons (10keV)
Small Blob		Photons and electrons
Curly Track		Electrons (MeV range)
Heavy Blob		Heavy ionizing particles with low range (alpha particles,...)
Heavy Track		Heavy ionizing particles (protons,...)
Straight Track		Energetic light charged particles (MIP, Muons,...)

Experimental Activities: Los Alamos Neutron Science Center – Detector Response

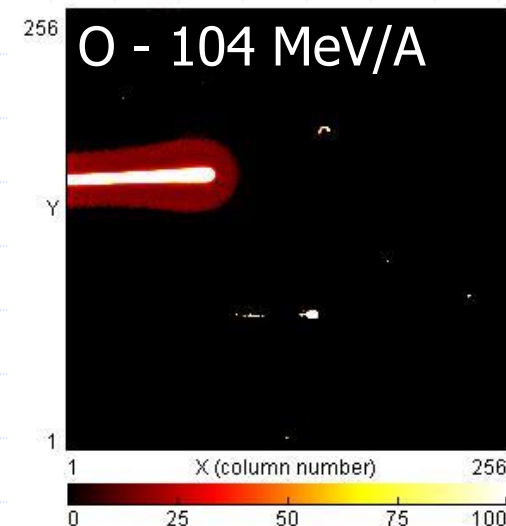
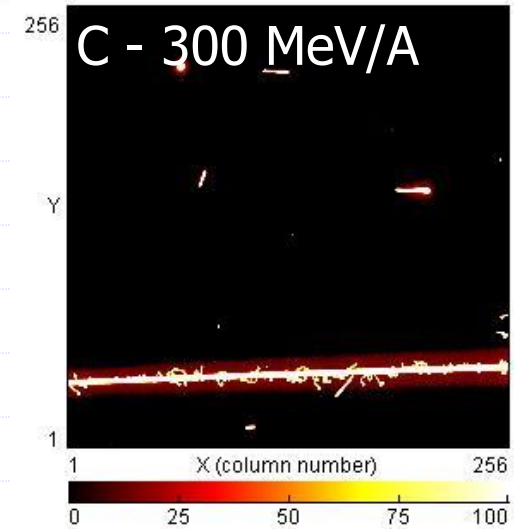
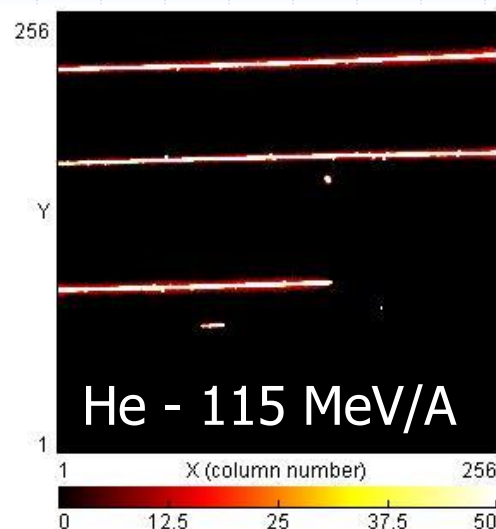
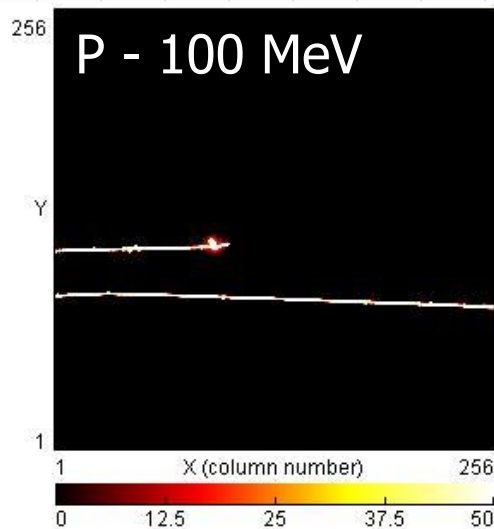
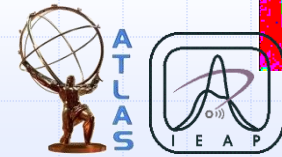


Experimental Activities: Los Alamos Neutron Science Center – Representative Events



- Above **4 MeV**: nuclear interaction appear
- Above **30 MeV**: HETP are getting more and more asymmetric and bigger with increasing energy
- Above **10 MeV**: tracks with delta electrons are detected

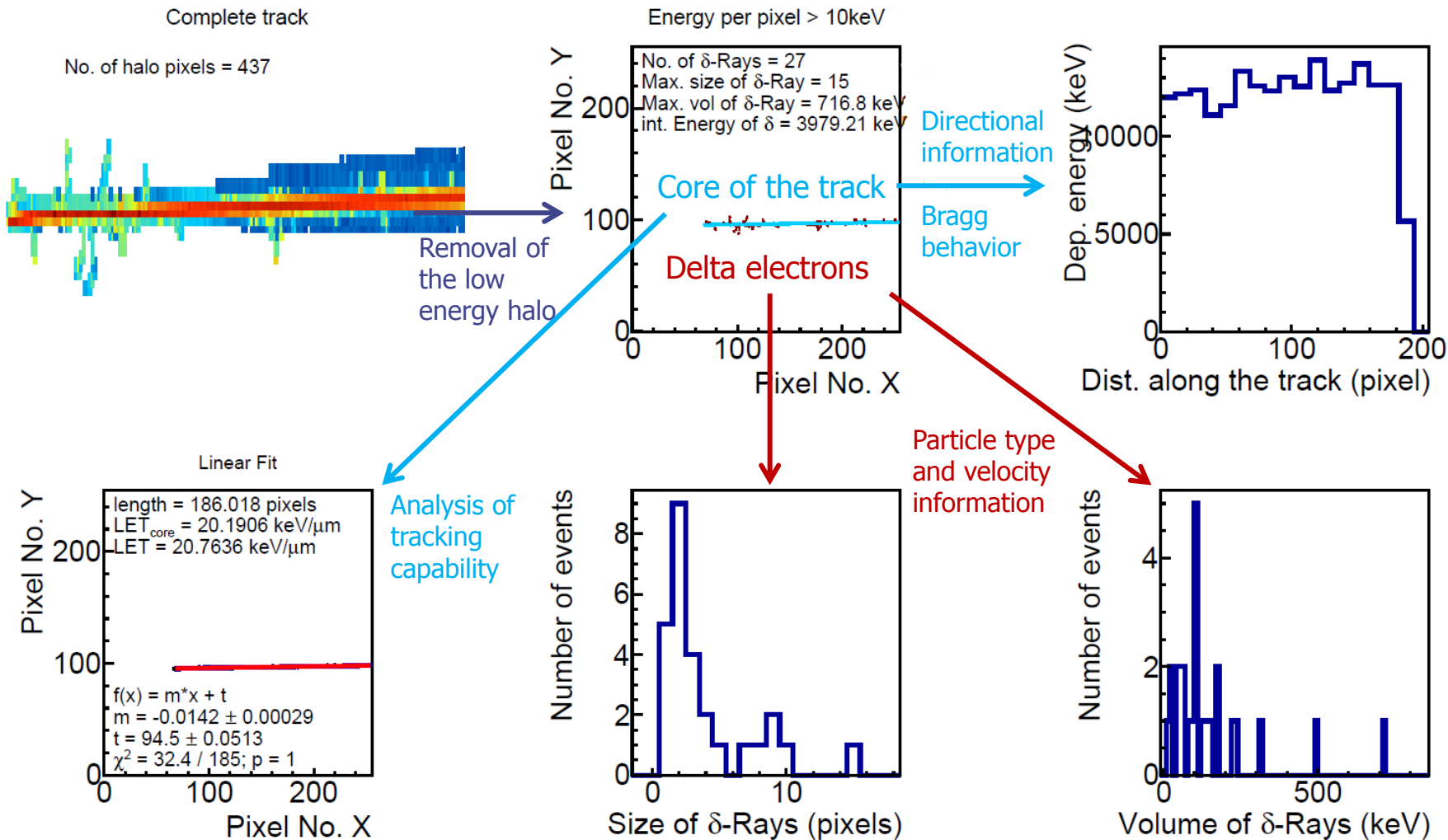
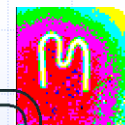
Experimental Activities: German Center for Cancer Research (DKFZ) in Heidelberg



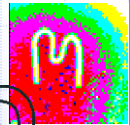
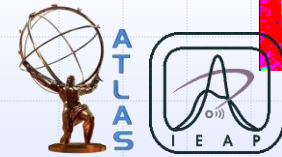
Beam time organized by ARDENT framework
(~ 17 h used)

- **Protons, Carbon ions, Oxygen ions, Helium ions**
- LET range: 1.3 keV/ μm to 85.3 keV/ μm
- For each particle type the detector has been irradiated under 0° , 60° and 90°

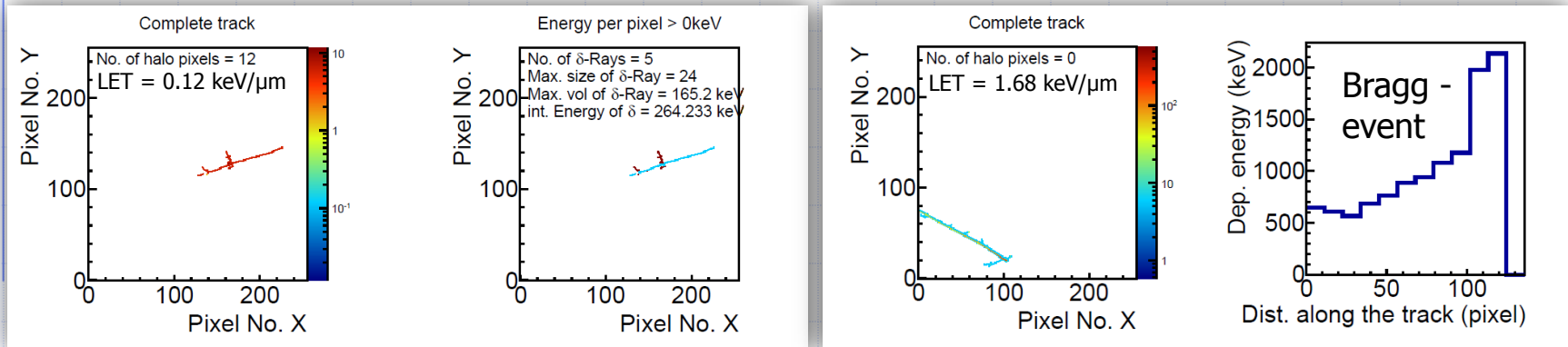
Experimental Activities: German Center for Cancer Research (DKFZ) in Heidelberg



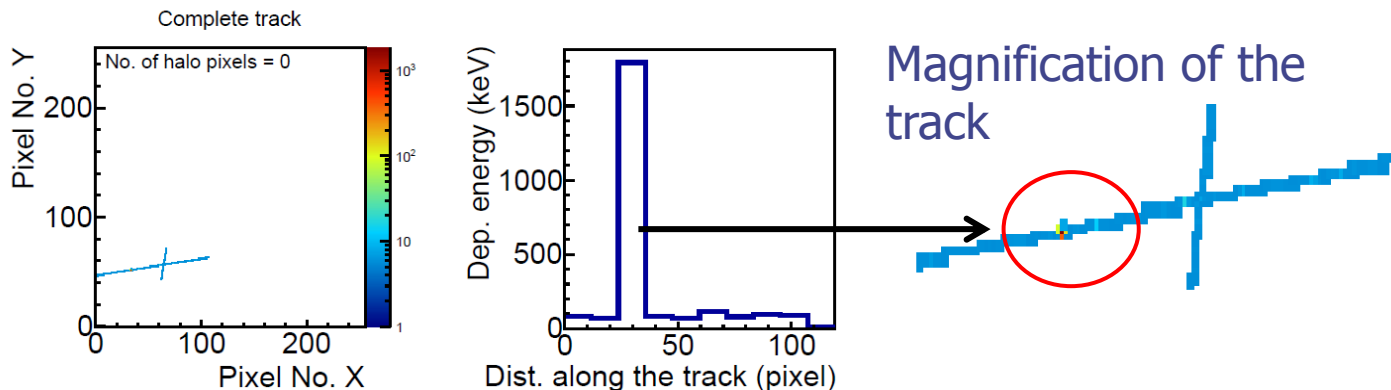
MoEDAL data evaluation: Application of the Event-by-Event Data Analysis

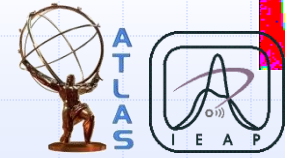


- Typical events:
 - Low LET (MIPs, highly energetic electrons), more or less accompanied by delta electrons



- Identification of delta electrons in the xz-plane





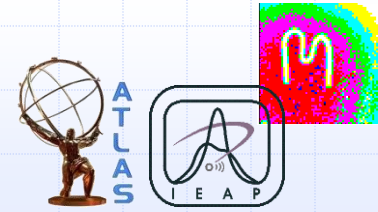
SECONDMENT AT ESA-ESTEC

Simulations with the GRAS package (GEANT4 Radiation Analysis for Space Applications)

Noordwijk, Oct. 28 – Nov. 29, 2013



Secondment in ESA-ESTEC: Simulations for Heavy Ions – Output and Comparison

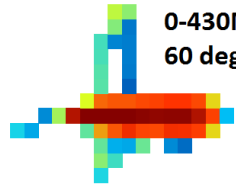


- Examples of simulated tracks

O-104MeV/A
0 degree



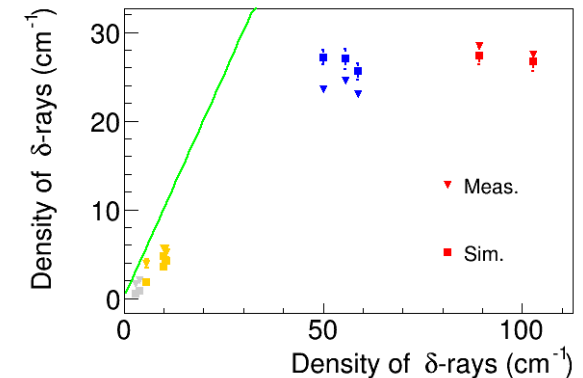
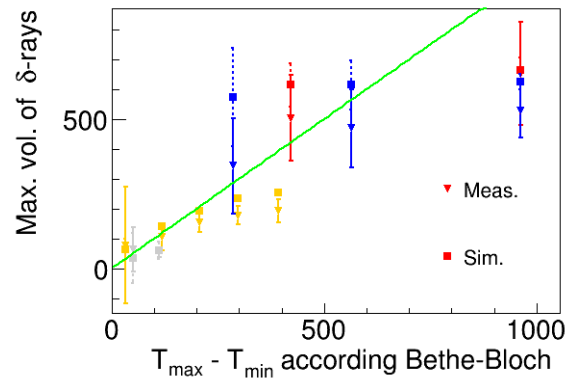
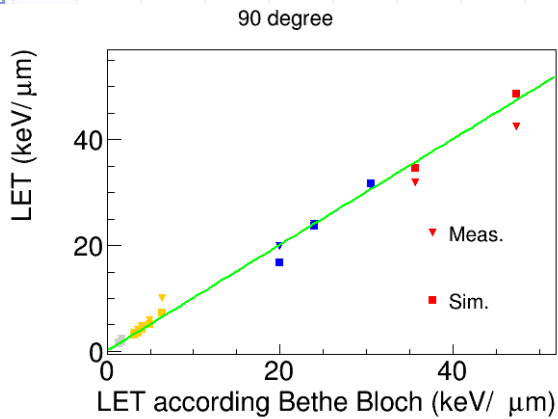
O-430MeV/A
60 degree

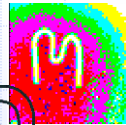


O-250MeV/A - 90 degree



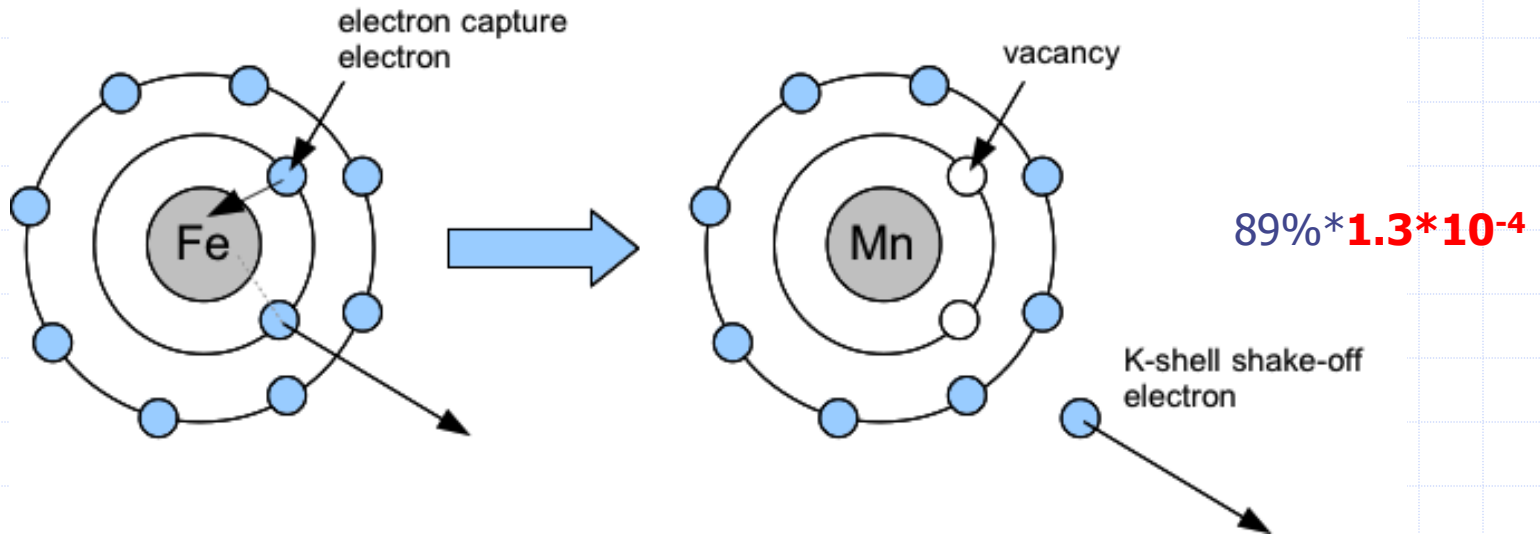
- Comparison with the measurement (LET responses, delta electron properties)

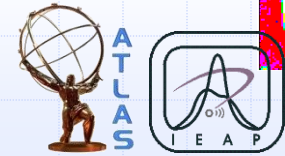




DOUBLE VACANCY CREATION IN FE-55 ELECTRON CAPTURE DECAY

Project together with Thilo Michel: Data evaluation and simulations with ROSI (LSCAT, EGS4)



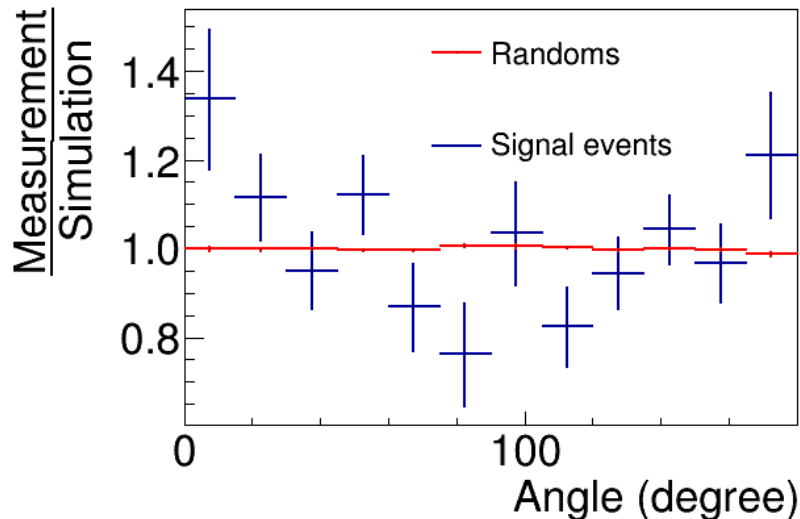


What Do We Want to Measure?

- Probability of the creation of 2 K-shell vacancies (first results published in Phys. Rev. C in January 2014):

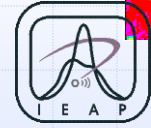
$$P_{KK} = (1.531 \pm 0.079 \pm 0.007) \cdot 10^{-4}$$

- With the TPX-pixel detectors - for the first time - also the angular correlation function between the subsequently emitted X-rays (hypersatellite, satellite) can be measured:



Coincident experiment: Events outside the coincidence window (not correlated) were used to test the evaluation (**Randoms**) and the accuracy of the simulation and set-up.

Attended Trainings, Conferences, Business Trips, ...



- ❑ Medipix meeting, Febr. 19-20
 - Presentation: "Neutron Time-of-Flight, Proton and Heavy Ion Measurements with a Timepix Detector"

- ❑ Training course on Business and Administration, May 19 – 23, 2014

- ❑ Czech Language Training – ongoing

- ❑ Publications:
 - T. Michel, B. Bergmann, J. Durst, M. Filipenko, T. Gleixner, and K. Zuber, "[Measurement of the double K-shell vacancy creation probability in the electron-capture decay of \$^{55}\text{Fe}\$ with active-pixel detectors](#)", Phys. Rev. C 89, 014609, 2014

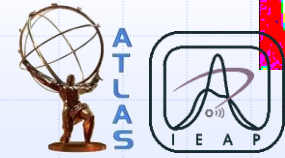
 - B. Bergmann, R.O. Nelson, J.M. O'Donnell, S. Pospisil, J. Solc, H. Takai, Z. Vykydal, "[Time-of-Flight Measurement of Fast Neutrons with Timepix Detectors](#)", JINST 9 C05048, 2014

“... whatever you do you have to keep moving forward!” – M.L. King Jr.




FUTURE PLANS

Trainings, conferences, business trips, ...



- ❑ MMND conference in Port Douglas, Oct. 20 – 25, 2014
- ❑ Poster presentation at IEEE in Seattle, Nov. 8 – 15, 2014
- ❑ Business and administration secondment at IBA (dates not yet fixed - beginning 2015)
- ❑ (secondment or travel at/to ESA-ESTEC)
- ❑ Beam time in Los Alamos Neutron Science Center (proposal prepared and submitted by our colleagues from Brookhaven National Lab)
- ❑ Anticipated publications:
 - „Measurement of the Angular Distribution of the Coincident Hypersatellite Satellite X-ray Emission in the Electron Capture Decay of Fe-55“
 - IEEE proceeding
 - Paper on tracking with TPX detectors
 - **Ph.D. thesis**

The background features a light blue grid. A vertical blue line is on the left, and a horizontal blue line is near the top. A small blue circle is at the intersection of these two lines. Another vertical blue line is on the right, and another horizontal blue line is near the bottom. A small blue circle is at the intersection of these two lines. The text "Thank you for your attention!" is centered in the upper half of the page.

Thank you for your attention!