

ERIK FRÖJDH – ESR 2

Mid Sweden University, CERN

OUTLINE

- Introduction
- Hybrid Pixel Detectors
- Training activities
- Presentations
- Conferences
- Secondments
- Measurement activities and shorter trips
- Publications
- Summary and conclusions

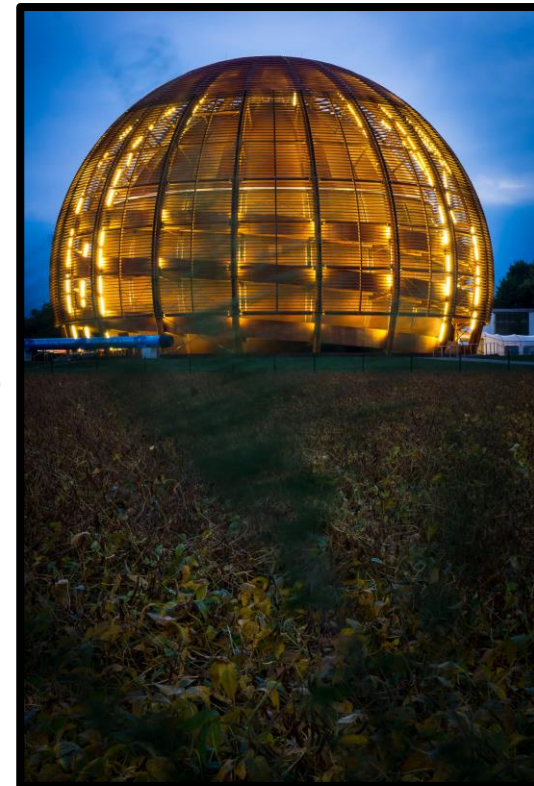
ERIK FRÖJDH

- 29 years old
- From Sundsvall, Sweden
- Master of Science Degree in Physics, Mid Sweden University (2005-2009)



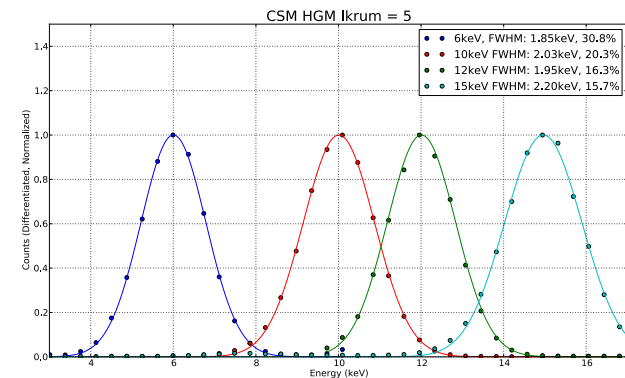
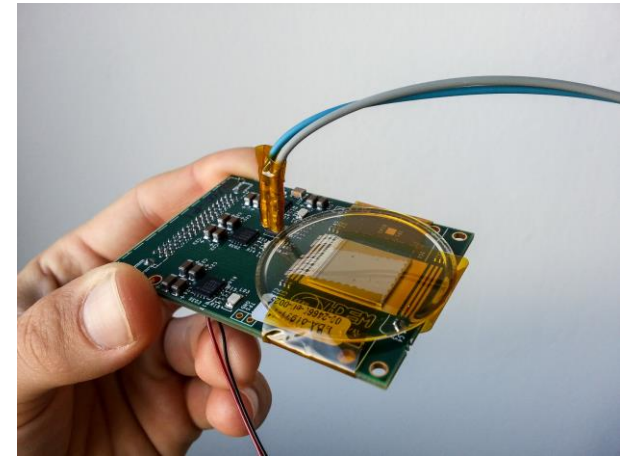
ERIK FRÖJDH

- Started as a PhD Student Feb 2010
- Joined ARDENT in Sept 2013
- Still enrolled in Sundsvall
- Based at CERN
- Working together with the Medipix Group



MEDIPIX

- Hybrid Pixel Detector
- Single Particle Processing
- Targeted for X-ray imaging, particle tracking and dosimetry
- ASIC Designed at CERN but in the framework of an international collaboration
- Working on characterization and development as well as applications with dosimetry



EXAMPLES OF ACTIVITIES

- Energy resolution measurements
- Characterization of CdTe sensors bump bonded to Timepix
- Count rate linearity and energy resolution under high flux conditions
- Noise performance of Timepix during cooling with liquid Nitrogen
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TRAINING ACTIVITIES

Courses at Mid Sweden University

- Scientific Writing and Presentations 3 ECTS
- Higher Education and Flexible learning, 15ECTS
- Semiconductor Devices, 15 ECTS
- Pixel Detectors 15ECTS, (Planned)
- Radiation Protection and Dosimetry 7.5 ECTS, (Planned)

Courses at CERN

- French Level 1

TRAINING ACTIVITIES

Seminars and Short Courses

- Particle Therapy using Proton and Ion Beams - From Basic Principles to Daily Operations and Future Concepts (CERN)
- Introduction to Physics at CERN
- Pixel detectors and ASIC's for synchrotron light experiments and correlated technology issues, (CERN)
- Semiconductor Materials Simulation Workshop, Didcot UK
- Medipix Collaboration Meetings

- **Plus extensive lectures during the 1st ARDENT Workshop, Wien, Austria**

PRESENTATIONS

- Medipix Technology Introduction for the Swiss Radioprotection Expert Course, CERN
- Medipix3RX Update, Medipix Meeting, CERN
- An overview of the Medipix ASICs and Collaboration, SMU, Dallas, TX USA
- PhD Mid Time Seminar at Mid Sweden University
- Medipix3RX Count Rate Measurements, Freiburg, Germany

CONFERENCES

- IEEE Nuclear Science Symposium, Anaheim, USA, October 2012
 - **Oral Presentation:** Probing Defects in a Small Pixellated CdTe Sensor Using an Inclined Mono Energetic X-Ray Micro Beam
- 2nd Workshop on Medical Applications of Spectroscopic X-ray Detectors, April 2013, CERN, Switzerland
- 15th International Workshop on Radiation Detectors, June 2013
 - **Poster Presentation:** Count Rate Linearity and Spectral Response of the Medipix3RX Chip Coupled to a 300um Silicon Sensor Under High Flux Conditions
- IEEE Nuclear Science Symposium Seoul, Korea October --- 2013
 - Oral Presentation: Measurements of Background Scatter Radiation in CT Scan Room Using Energy Resolving Hybrid Pixel Detectors
 - Oral Presentation: Spectral Resolution and Optimized Threshold Equalization of a Charge Summing Hybrid Pixel Detector

SECONDMENTS

Two secondments planned

- IEAP CTU Prague, Czech Republic
- University of Houston, USA

MEASUREMENT ACTIVITIES

- Timepix measurements with protons. Bern, Switzerland
- Characterization of CdTe Sensors, Diamond Light Source, Didcot, UK 18-22 March 2013
- Noise performance of Timepix cooled with LiN Dallas, USA 4-10 May 2013
- Count rate linearity and spectral performance of Medipix3RX under high flux conditions. ANKA Synchrotron, Karlsruhe, Germany 13-16 May 2013
- Characterization of Medipix3RX and the Merlin read out system. Diamond Light Source, Didcot, UK 25+31 September 2013

PUBLICATIONS

1. Frojdh, E.; et al., *Probing Defects in a Small Pixellated CdTe Sensor Using an Inclined Mono Energetic X-Ray Micro Beam*, *Nuclear Science, IEEE Transactions on* , vol.PP, no.99, pp.1,1, 0 doi: 10.1109/TNS.2013.2257851
2. D Krapohl et al, *Investigation of charge collection in a CdTe-Timepix detector* 2013 *JINST* **8** C05003 [doi:10.1088/1748-0221/8/05/C05003](https://doi.org/10.1088/1748-0221/8/05/C05003)
3. FRÖJDH, C.; NORLIN, B.; FRÖJDH, E. Spectral X-ray imaging with single photon processing detectors. *Journal of Instrumentation*, 2013, 8.02: C02010.
4. BALLABRIGA, R., et al. The Medipix3RX: a high resolution, zero dead-time pixel detector readout chip allowing spectroscopic imaging. *Journal of Instrumentation*, 2013, 8.02: C02016.

OUTREACH ACTIVITIES

- Practical presentations of the Medipix chips for high schools for UK high school classes visiting Cern. Multiple occasions.
- Presenting Cern and Medipix in the science and innovation fair at the UN in connection to the ECOSOC meetings.
- Supervised an UK high school student for a two week work experience project involving Medipix.
- Planned: Presentations and hands on activities at the high school in Sundsvall

SUMMARY AND CONCLUSIONS

- During one year within ARDENT I have:
 - Presented at two international conferences
 - One publication as first author and in total four publications
 - Participated and presented my research at several Medipix Collaboration meetings.
- Relevant and interesting training activities at Mid Sweden University and in ARDENT
- Learning a lot from the daily work with my colleagues in the Medipix Group at CERN and I have routinely participated in international collaborations.