

MX-10: Pixel Particle Detector

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**IEEE-NSS: New Detector Technologies in Radiation Dosimetry
and its Applications Workshop**



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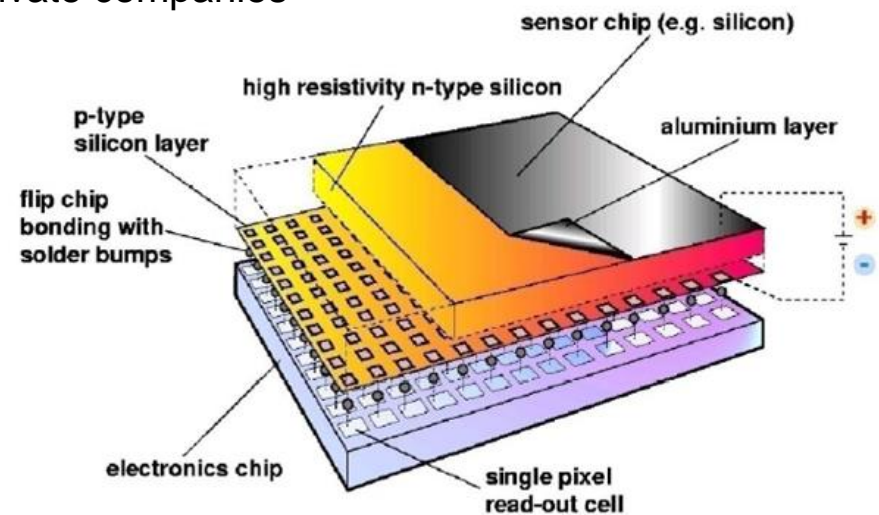
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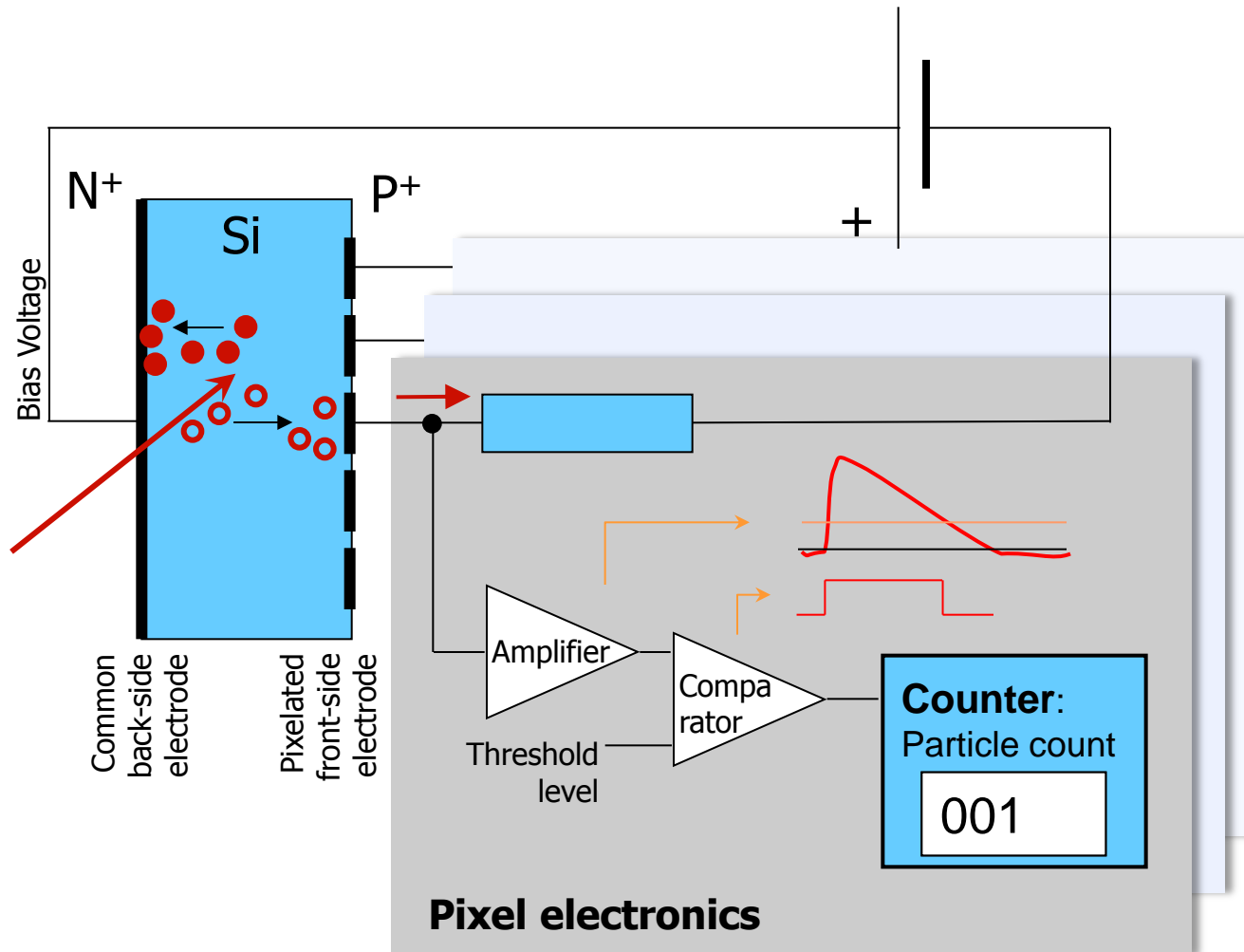
- Introduction
- Challenges
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► Introduction

- Medipix/Timepix technology
 - Successful initiative by CERN
 - Hybrid silicon pixel detector
 - Outcome of more than 10 years of research
 - Technology
 - High energy physics to other fields
 - Collaboration with
 - Universities, research centers and private companies
 - Radiation detecting device

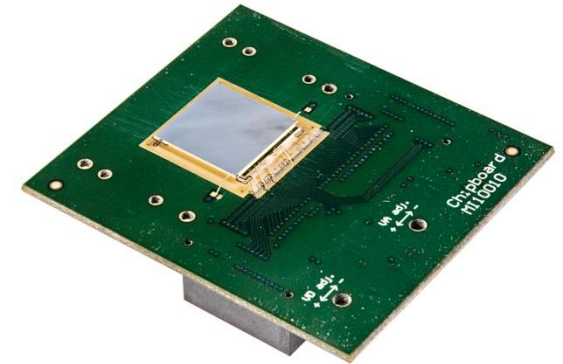


Source: CERN knowledge transfer



Source: Tracking and radiation field measurement, Dr.Zdenek Vykydal, ARDENT workshop, Vienna , November2012

► Challenges



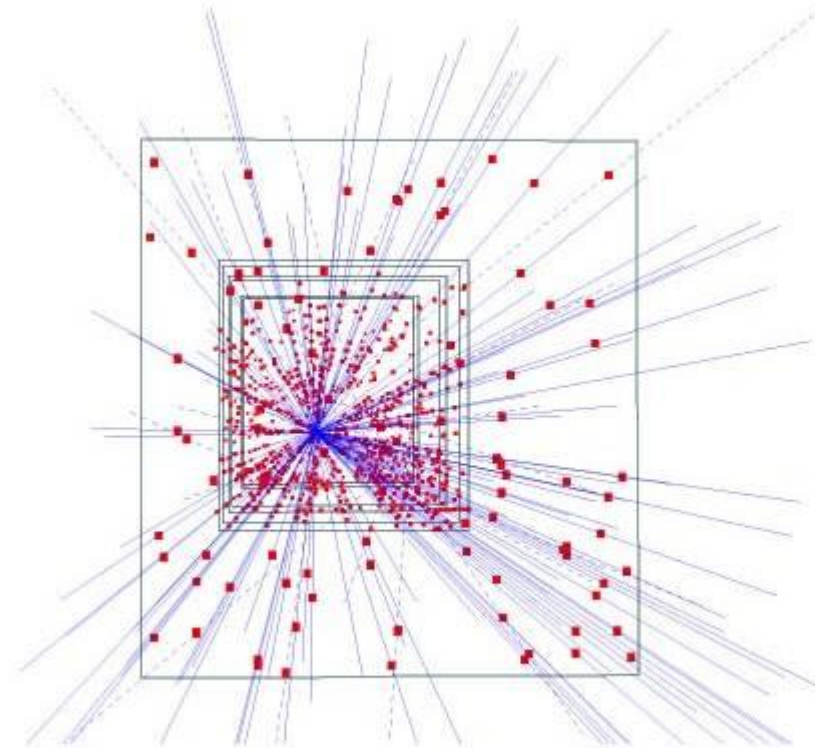
- Goal: Take research outcome to society
- JABLOTRON ALARMS a.s.
 - Acquired the license from CERN
- To develop and deploy
 - Educational and homeland security products
- Market needs
 - Better accessibility
 - Portability
 - Flexibility
 - Ease of use

► Application

- Unique educational aid for students
- Developed at JABLOTRON ALARMS a.s
- Collaboration: CERN/IEAP/Medipix/ARDENT
- Recently product launched in the market

Chip features

- 256 x 256 pixels
- Pixel size: 55 x 55 μm^2
- Active area 14 x 14 mm^2
- Recognition of particles ($\alpha, \beta, \gamma, \text{MIP}$)
- Real time display using Pixelman
- Portable



Source: Medipix website

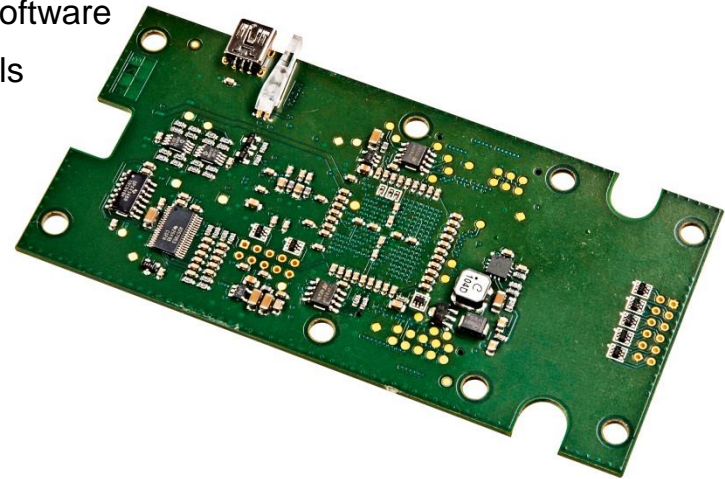
▶ Chipboard

- Composed of
 - Timepix detector
 - Readout interface
- Detector
 - 256 x 256 pixels
 - Each pixel connected to lower layer
 - Amplifier, comparator and counter
 - Bump bonding technology
- Earlier version namely FITPIX @ IEAP
- Redesigned chipboard
 - ~28% reduction in area
 - Elimination of wide-connector coaxial cable
 - Adjustable voltage settings
 - Any chipboard can be connected to any baseboard
 - Portability, manufacturability and reliability
 - Parallel readout to baseboard improving overall readout speed
 - 6 layer PCB



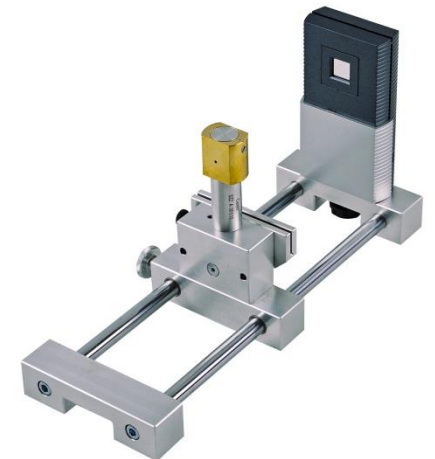
▶ Baseboard

- Composed of
 - Altera FPGA
 - Power supply circuitry
 - USB 2.0 hi-speed interface
- Improvements
 - 150fps compared to 80fps
 - Dedicated FTDI channel for EEPROM updates
 - Firmware upgrades in the field
 - Better power management
 - Flexibility in bias voltage configuration using software
 - Capability to measure currents from power rails
 - Better testing possibility
 - Increased usability
- 8 layer PCB
- Powered by Mini-USB connector



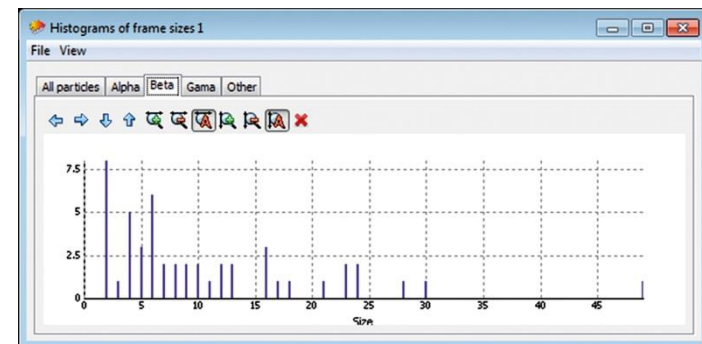
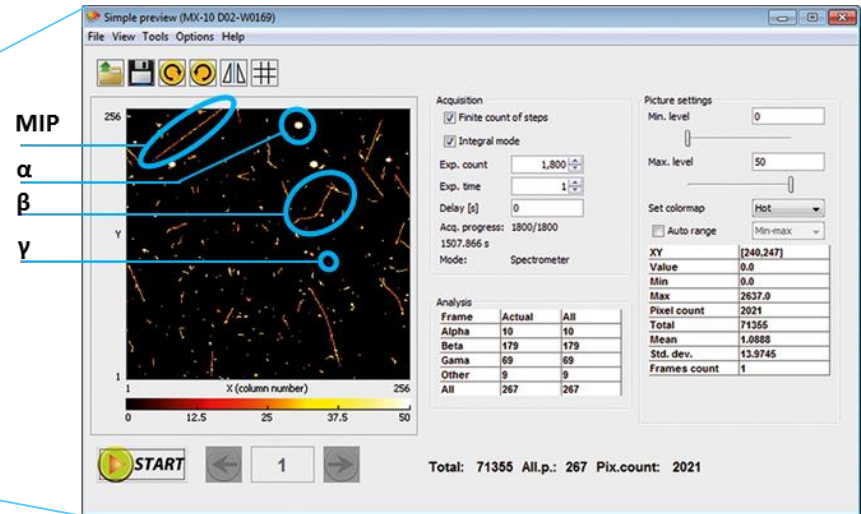
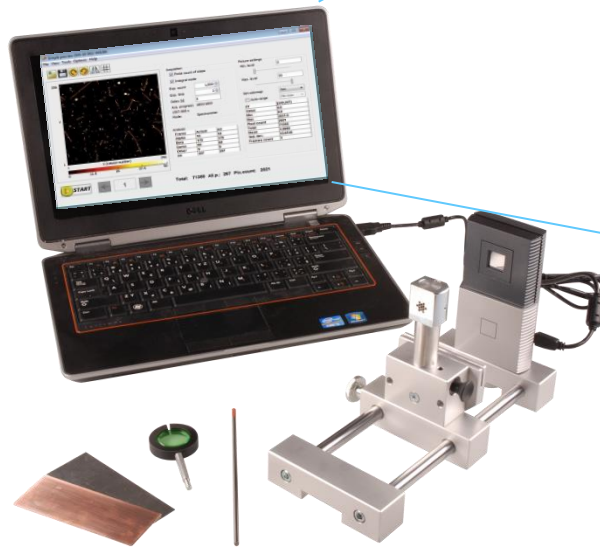
▶ Mechanical design

- Mechanical design
 - Safety of sensor and electronics
 - Durability, accessibility
 - Portability
- Early design decision
 - Placement of Mini-USB
 - Placement of LED
 - Green – Ready
 - Red – Busy
- Sliding flip
 - Safety of sensor
 - Experiments without alpha
- Mount
 - Standard tripod screw
- Device weight – 160g
- Certified with EN 61000-6-1 and EN 61000-6-3 standards
- Test bench for experiments



▶ Educational kit setup

- MX-10 – digital particle camera
- Test bench with source
- Pixelman software



Pixelman software output

► Conclusion

- Key accomplishments
 - Improved performance
 - Area
 - Speed
 - Design modification to
 - Bring research to market
 - Meet the market requirement
- Future
 - Improving the speed
 - Timepix technology for
 - Homeland security
 - Industrial applications



► Acknowledgment

- Colleagues at Jablotron Alarms
 - CEO Mr. Dalibor Dedek
 - Pavel Hubner, Stepan Martinek , Martin Honig
 - Vladimir Stanislav, Stefan Vanco
- IEAP
- ARDENT
- Medipix
- CERN



**To play with MX-10
Please visit us at Industrial exhibition:**

Booth no: 18