JABLOTRON
CREATING ALARMS

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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ARDENT is a Marie Curie Initial Training Network funded by the European Commission 7th Framework Programme, Grant Agreement 289198.

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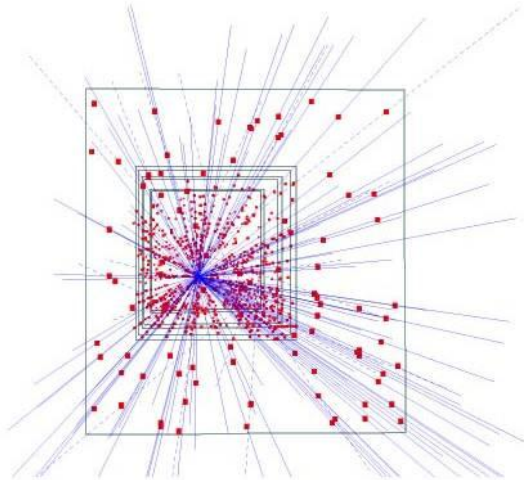

Picture source: CERN knowledge transfer

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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
- Educational application
  - Portability
  - Flexibility
  - Easy of use

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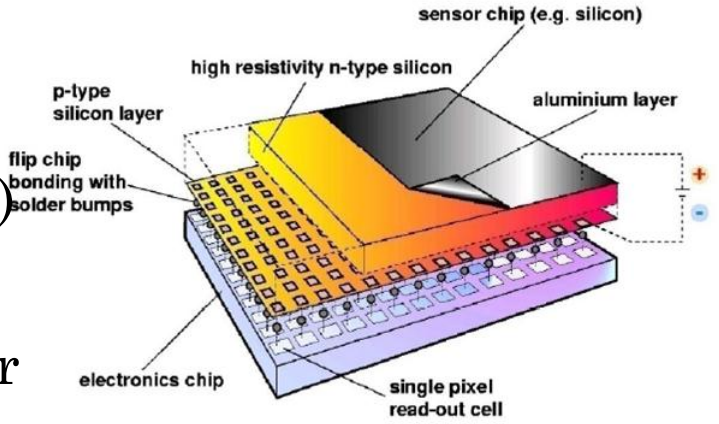
MEDIPIX/TIMEPIX

Chip features

- 256 x 256 pixels
- Pixel size: 55μm x 55μm
- Active area 14mm x 14mm
- Recognition of particles (α,β,γ,MIP)
- Real time display using Pixelman
- Each pixel connected to lower layer
  - Amplifier, comparator and counter
  - Bump bonding technology



Picture source: Medipix website

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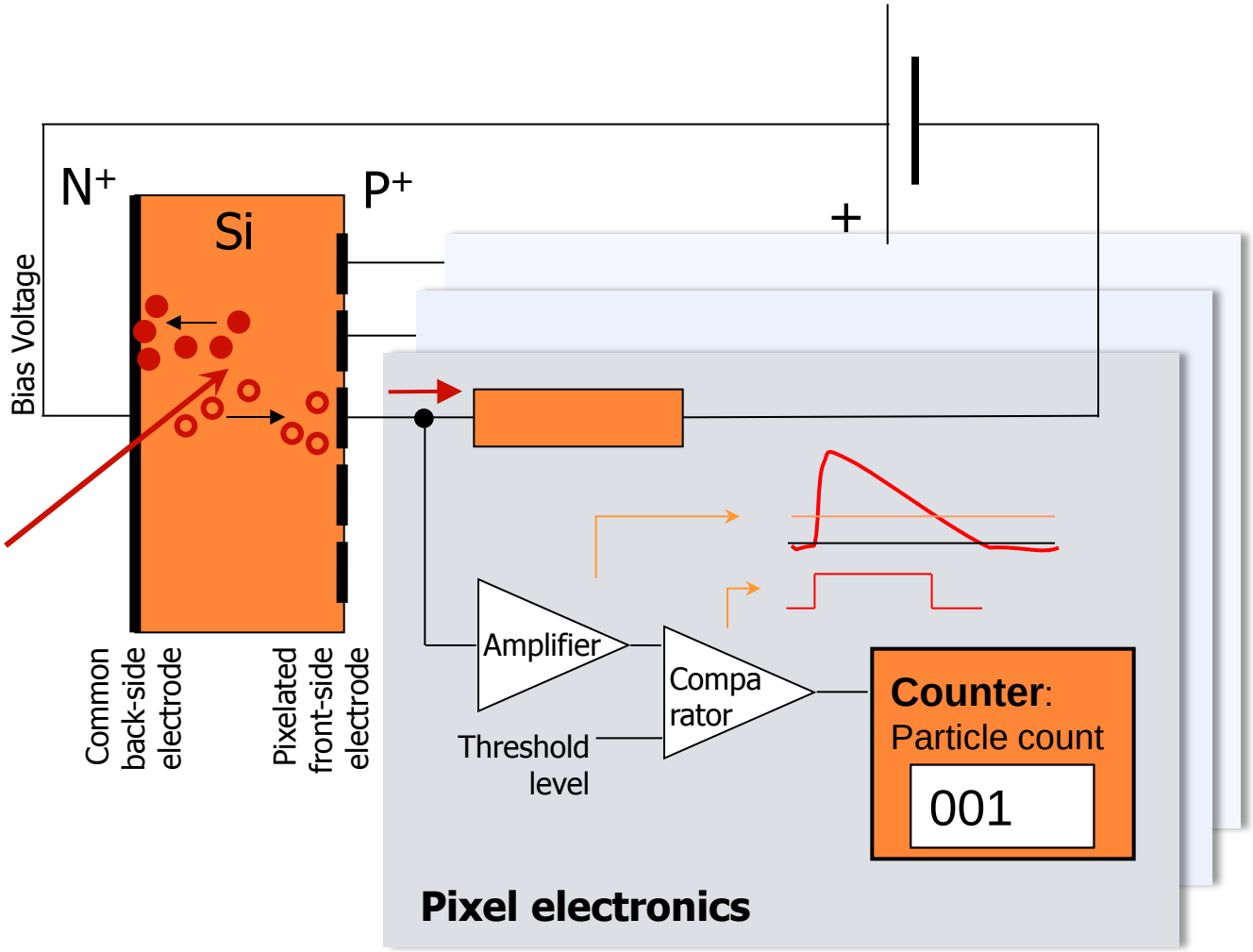
Principle



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

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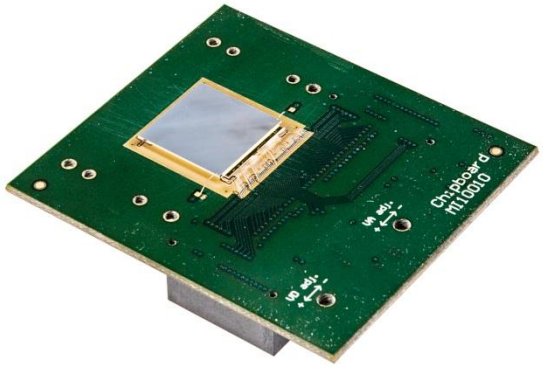
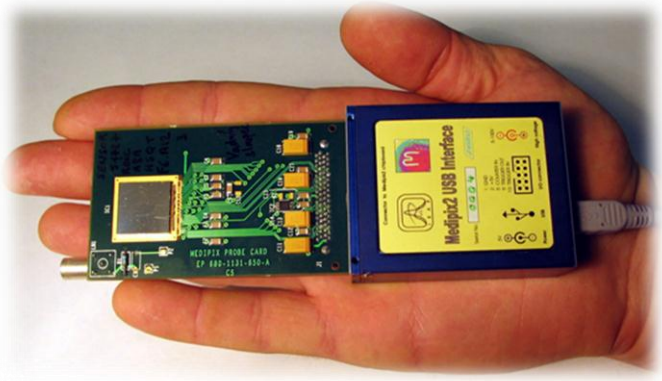
Chipboard

- Composed of
  - Timepix detector
  - Readout interface
- Redesigned chipboard
  - Chip placement
    - Top layer – Chip - Manufacturability
    - Chip covering – Wire bond protection
- Earlier version – Fitpix @IEAP





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

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Chip board

- Interface
  - Serial flash
    - 1MB
    - Store configuration files
      - Freedom of connection to any baseboard
  - Potentiometer
    - Voltage fine tuning
  - 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
  - ~28% reduction in area
  - 6 layer PCB

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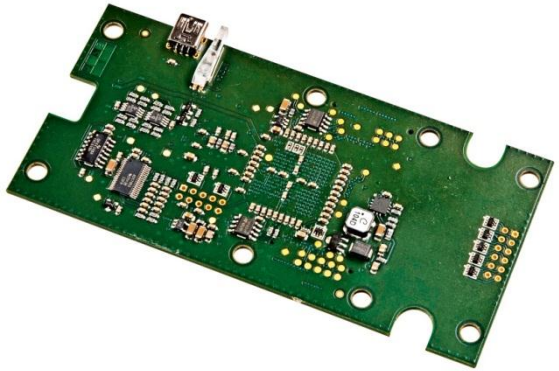
Base board

- 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
    - Voltage configuration – software based
    - Measure currents from power rails
    - Better testing capability
    - Increased usability



- 8 layer PCB
- Powered by Mini-USB connector

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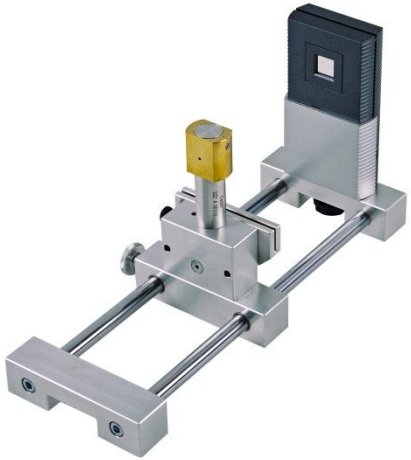
Mechanical design

- Housing
  - 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



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Mechanical design

- Mount
  - Standard tripod screw
- Device weight – 160g
- Certified with
  - EN 61000-6-1 and EN 61000-6-3 standards
- Test bench for experiments

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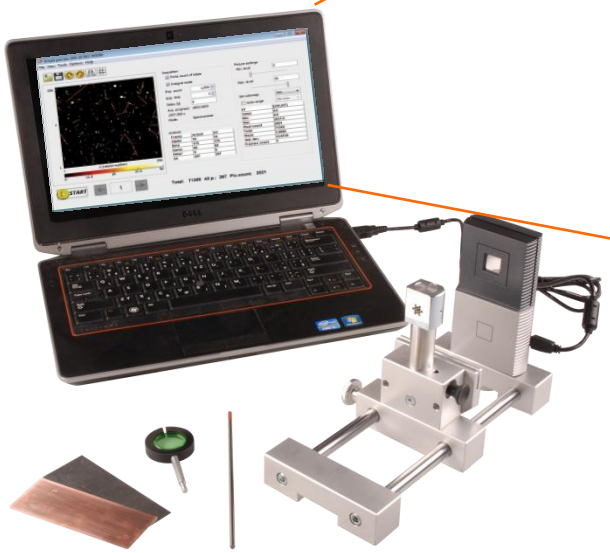
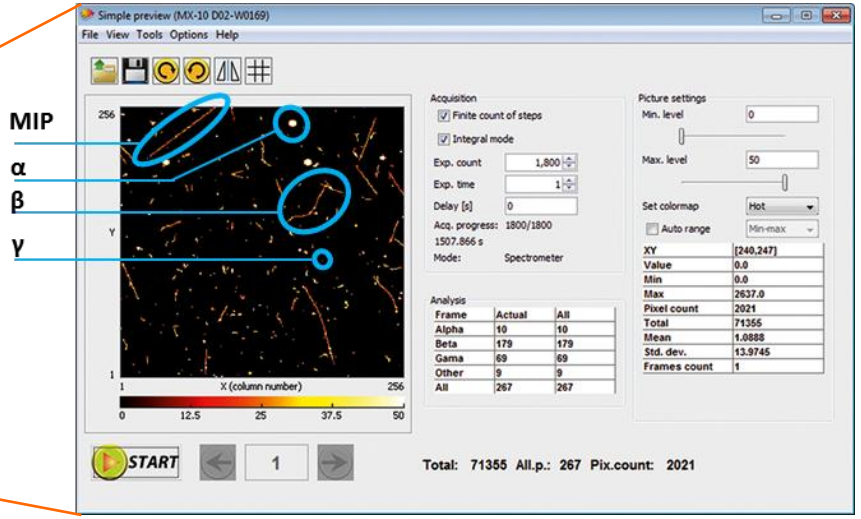
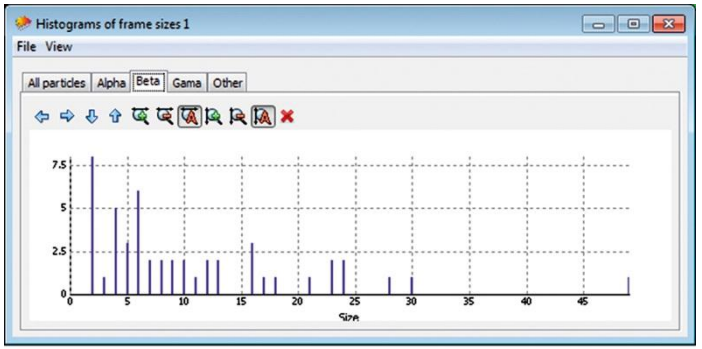
Educational kit setup

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







Pixelman software output

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Conclusion

- Key accomplishments
  - Improved performance
    - Area
    - Speed
  - Design modification to
    - Bring research to market
    - Meet the market requirement
  - Ready for parallel readout

- Future
  - Improving the speed
  - Timepix technology for
    - Homeland security
    - Industrial applications

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Acknowledgement

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  - CEO Mr.Dalibor Dedek
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  - Vladimir Stanislav, Stefan Vanco
- IEAP
- ARDENT
- Medipix
- CERN

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

Booth no: 18

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