MidTerm Review

3rd MC-PAD training event

Ljubljana 27 – 29 September 2010

Paolo Beltrame

ER at CERN since April 2009

Advanced Photodetectors

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No details... only descriptions and feelings

My background

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3. PhD in particle physics at the University of Karlsruhe (2/2009)

   High precision measurement on hadronic contribution to $(g-2)_\mu$

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Bit earlier than my Ph.D. thesis defense, my supervisor…

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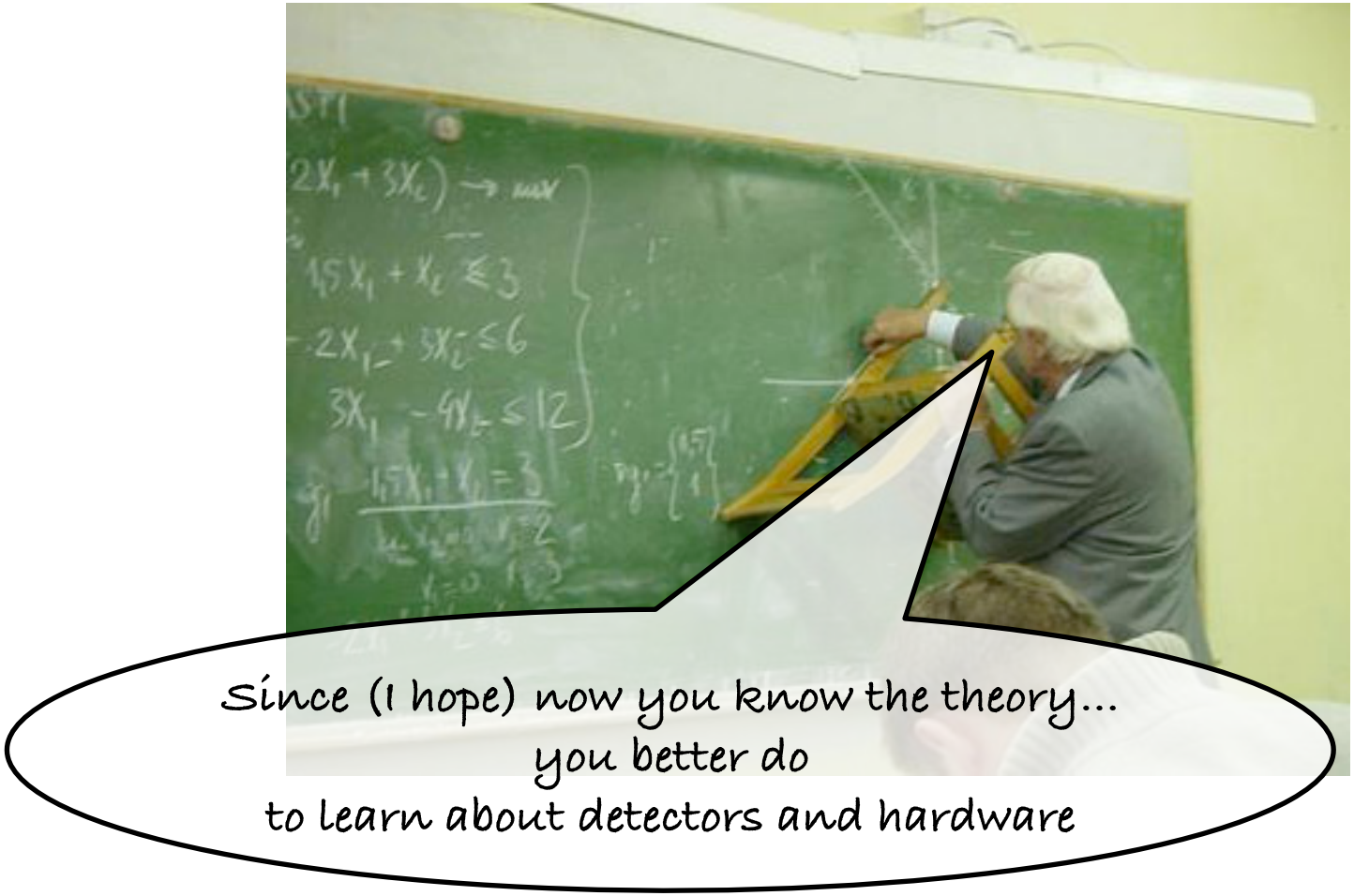

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  - ✧ detector R&D
  - → Axial PET
  - → ATLAS-ALFA

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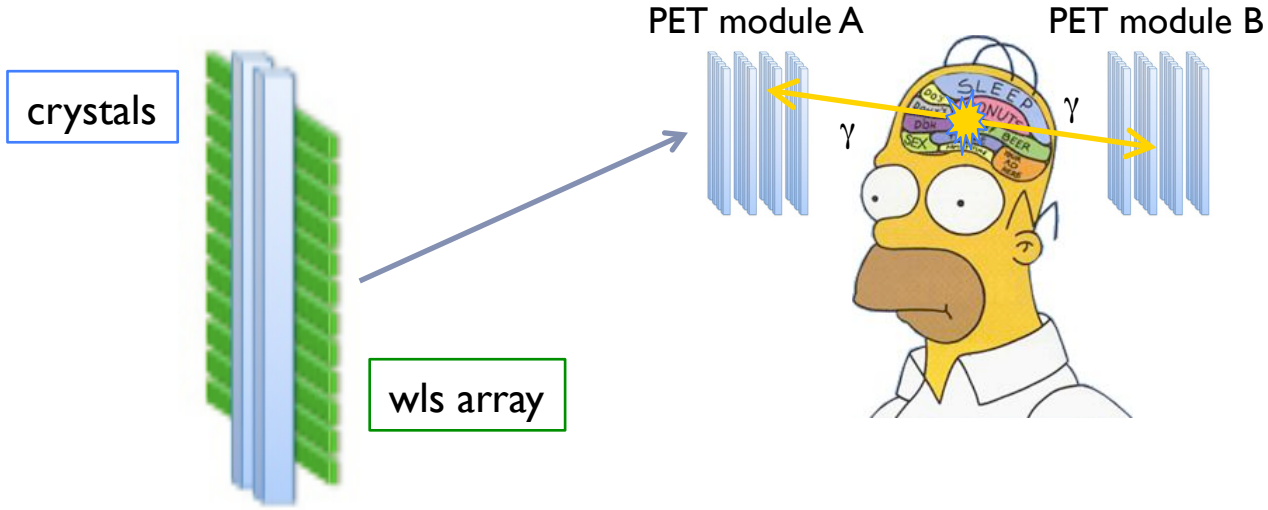
For physiognomy's sake

AX-PET

Axial - Positron Emission Tomography

PET camera based on a new geometry employing silicon photomultipliers

- Axially displaced LYSO crystals bars along the patient axis interleaved by WLS arrays perpendicularly oriented



3D localization
of the photon interaction
inside the PET camera

Photo detection:
Hamamatsu "MPPC"
silicon photomultipliers

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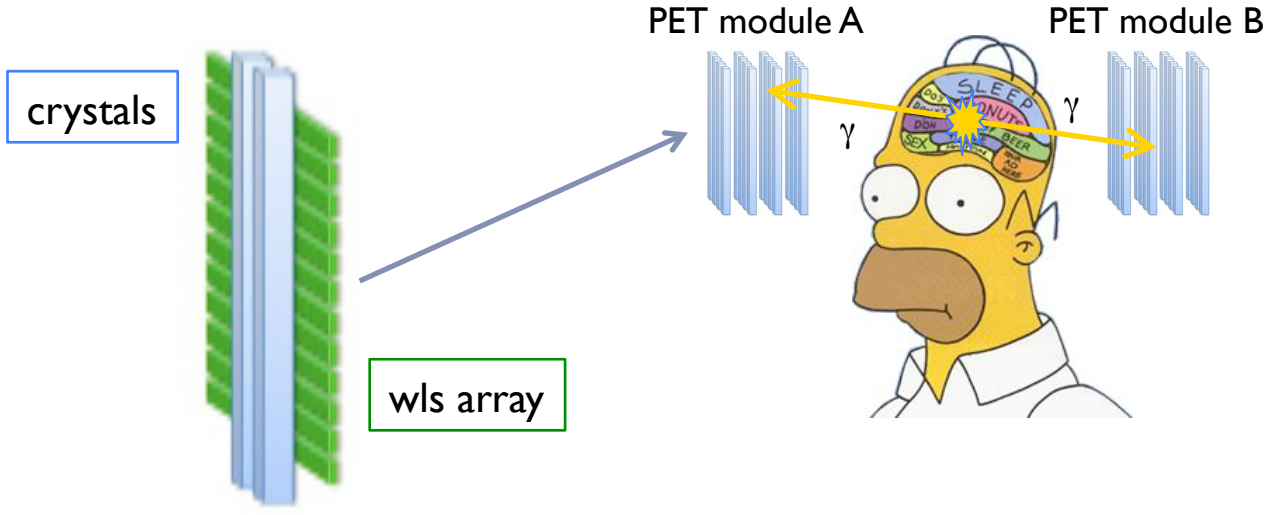

3D localization
of the photon interaction
inside the PET camera

Photo detection:
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✧ 3D localization of the photon inside the module → one can deal with the Compton events

✧ Lattice structure of the module → sensitivity and resolution can be independently increased

AX-PET

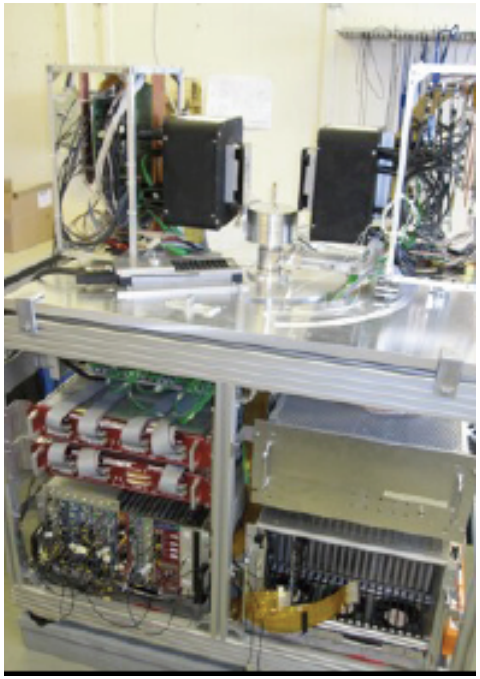
Axial - Positron Emission Tomography

PET camera based on a new geometry employing silicon photomultipliers

Characterization of

the two-module demonstrator:

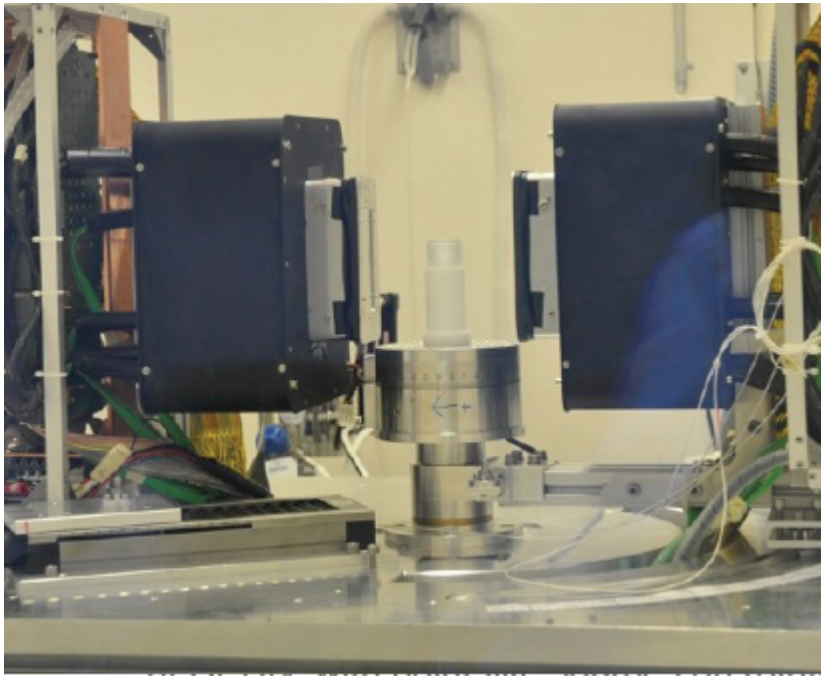
temperature monitoring, event displayer, analysis software, energy calibration



Phantom tests

in April (@ ETH) and July (@ AAA) 2010

(Ruben Verheyden from Ljubljana)



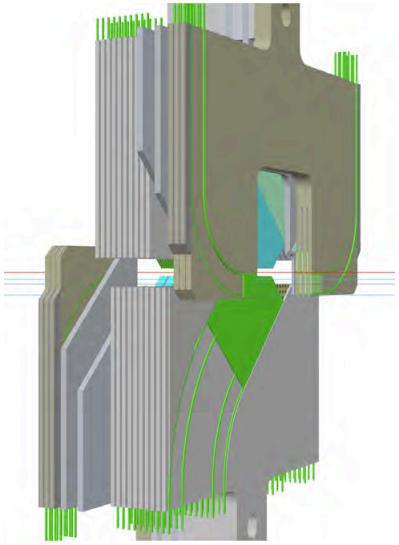
ATLAS-ALFA

Absolute luminosity for ATLAS

Scintillating fiber tracker with multi anode photomultiplier readout

- Detecting proton – proton elastic scattering in the Interaction Point 1 (ATLAS)

240 m far away from IP1



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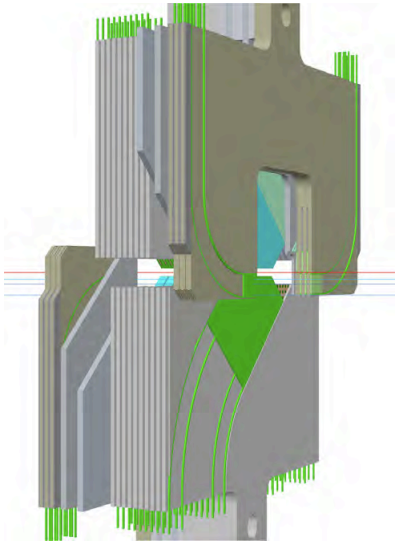

Main tracker of
scintillating fiber
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Feasibility study for a possible ATLAS-ALFA upgrade

using silicon photomultiplier readout

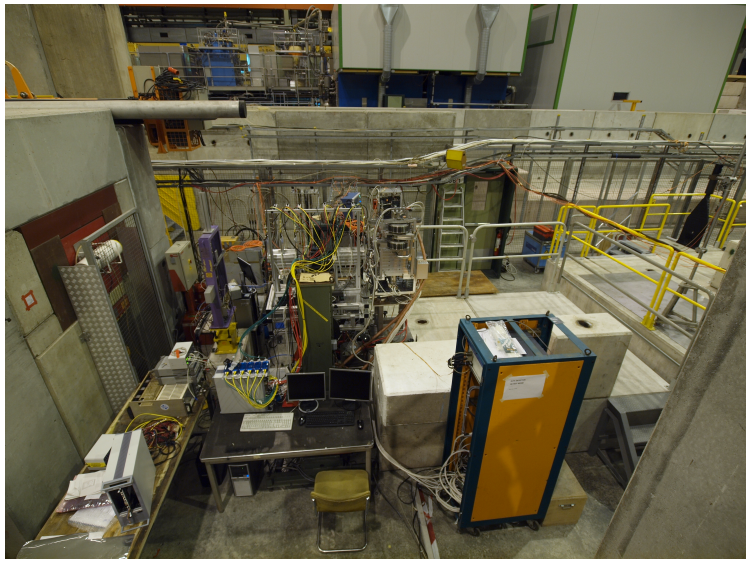
- Designing and building a two plate scintillating fibers with silicon photomultiplier readout tracking detector

ATLAS-ALFA

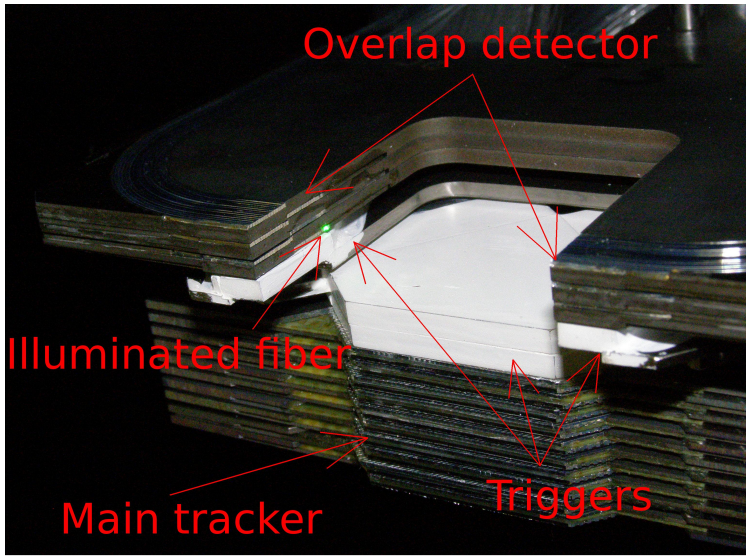
Absolute luminosity for ATLAS

Scintillating fiber tracker with multi anode photomultiplier readout

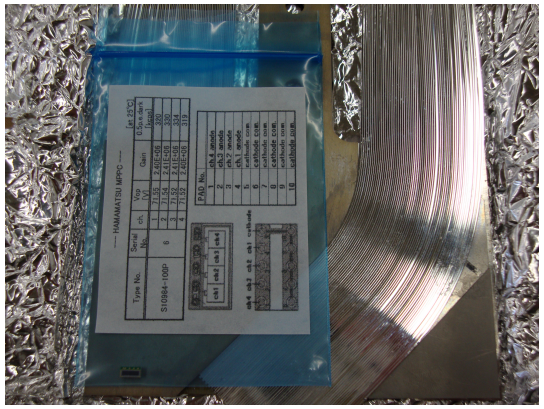
Test beam in 2009 and 2010 at CERN



Mapping of the Overlap Detector



Feasibility study for a possible ATLAS-ALFA upgrade using silicon photomultiplier readout



Training

- **Language**:
  - French courses up to the *IV level* at CERN
- **Programming**:
  - LabView *II level* at CERN
  - C++ *Hands-On Introduction* and *Object Oriented and Generic Programming* at CERN
- **MC-PAD Trainings**:
  - *Readout Electronics* at 1st Meeting in Krakow
  - *General and poster presentations* at CERN
  - *Geant4 Simulation and ROOT Analysis of a Si Beam Telescope* at 2nd Meeting in Hamburg
- **Lectures at CERN**:
  - *The use of Radiation Detectors in Medicine: Radiation Detectors for Morphological Imaging*
  - *1st EIROforum School on Instrumentation*
  - Several courses for *Summer Students* and various seminars and lectures
- **Supervising student for the ATLAS-ALFA collaboration**

Publications and Presentations

❑ Publications

- ✧ Several proceeding publications for the AX-PET collaboration
- ✧ *Demonstration of an Axial PET concept for brain and small animal imaging*, proceedings for Vienna Conference of Instrumentation 2010 (http://dx.doi.org/10.1016/j.nima.2010.07.017)
- ✧ *Determination ATLAS-ALFA Overlap Detectors mapping,* report for the ATLAS-ALFA collaboration

❑ Presentations

- Group collaboration meetings
  - ✧ **15 July 09:** 13th AX-PET Collaboration Meeting at CERN
  - ✧ **30 Sept – 3 Oct 09:** 14th AX-PET Collaboration Meeting in Catania
  - ✧ **24 Nov 09:** 15th AX-PET Collaboration Meeting at CERN
  - ✧ **5 Feb 10:** 16th AX-PET Collaboration Meeting at CERN
- Conferences
  - ✧ **15 – 20 Feb:** 12th Vienna Conference of Instrumentation, talk *Demonstration of an Axial PET concept for brain and small animal imaging*
- MC meetings
  - ✧ **17 – 19 Sep:** 1st MC-PAD Network Training on Readout Electronics in Krakow, poster *Concept for an AX-PET Demonstrator*
  - ✧ **1 – 2 July:** MC Conference 2010 - Satellite event of ESOF2010, poster *Demonstrating the AX-PET concept for a brain novel imaging*

Milestone/Deliverable

- M1 (m6): X-HPD characterization in lab
  - Collaboration with the industrial partner *Photonis*: because of economical difficulties the company has terminated the complete photomultiplier activity…
- M2 (m22): Scintillating fiber tracker prototype with silicon photomultiplier readout
  - On the way:
    - 2 scintillating fiber plates from the ATLAS-ALFA experiment
    - 5 silicon photomultiplier arrays already delivered by Hamamatsu

- D1 (m12): Test results of X-HPD lab test
  - See above
- D2 (m18): Characterization of PET based camera
  - Accomplished
- D3 (m24): Scintillating fiber characterization results
  - On the way

Conclusion

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TO "SAIL" TOWARD
NEW "IDEAS" AND
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... BUT ALSO DETECTOR DEVELOPMENT,
TO KNOW THE "POTENTIALITY"
AND THE "ACTUALITY" OF THE TOOLS
YOU EMPLOY IN THE INVESTIGATION!

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    - More experienced… I am feeling the issue in thinking out and in building a detector
    - Enjoying the cooperation with different persons
    - Probably still too much "Platonic"
  - Training and courses great and useful
  - Great possibilities with conferences, meetings and contacts
  - Happy of having got this unique opportunity… I feel privileged

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Hoping to be enough "appealing"