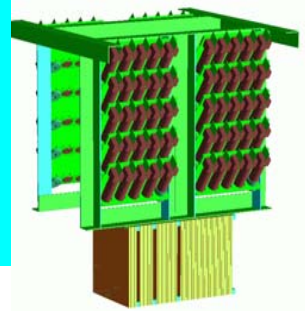
Status report of the tile-Si Lccal* project



TALK SUMMARY

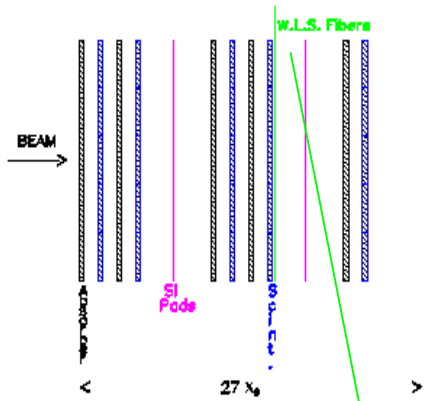
- Prototype description
- Production
- Beam test results
- Future plans

* Official INFN R&D project, official DESY R&D project PRC R&D 00/02
Contributors (Como, LNF, Padova, Trieste): M. Alemi, A.Anashkin, M.Bettini, S.Bertolucci, E. Borsato, M. Caccia, P.C, C. Fanin, G. Fedel, S. Miscetti, M. Nicoletto, M.Paganoni, M. Prest, R. Peghin, L. Ramina, E. Vallazza ….

Prototype description

Pb/Sc + Si

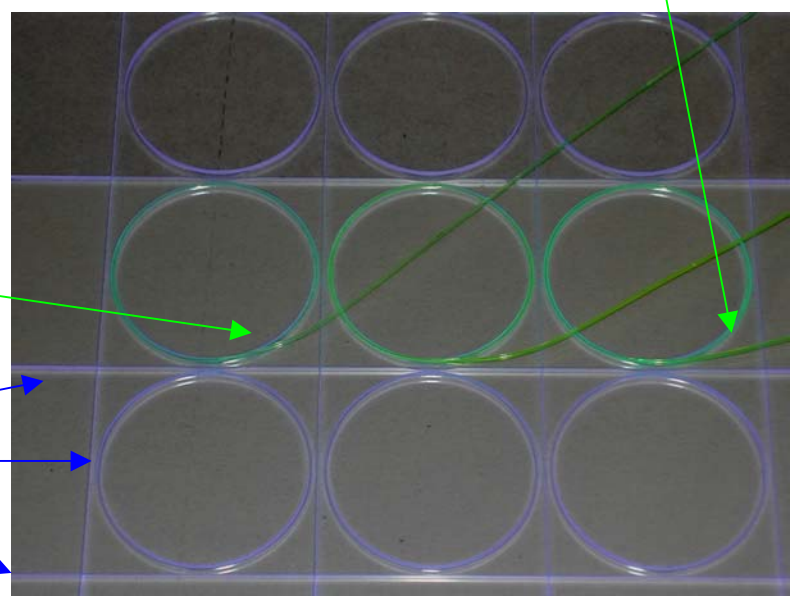
- 50 layers: (Slightly reduced to cope with budget:45)
- $25 \times 25 \times 0.3$ cm^3 Pb
- $25 \times 25 \times 0.3$ cm^3 Scint.: 25 Cells 5×5 cm^2
- 3 planes:
- 625 1×1 cm^2 Si Pads (Reduced to cope with budget:252)
- at: 2, 6, 12 X_0



Scintillation light transported with WLS σ tail fibers:

Coupled with clear fibers (to PM):

Cell separation with grooves in Sc. plates with Tyvec strips inside



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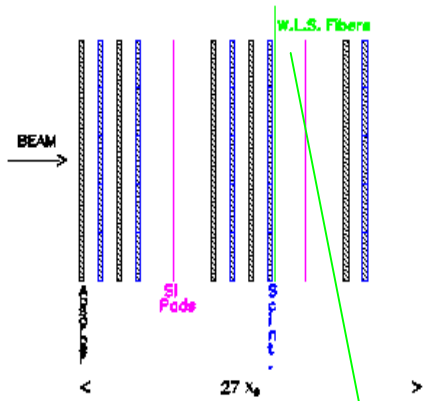

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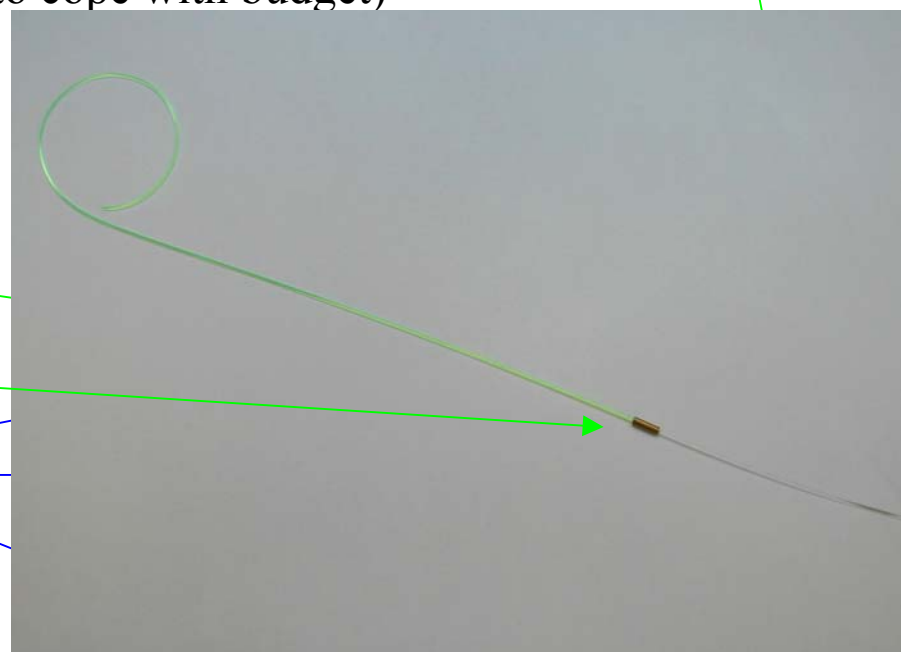

Scintillation light transported with WLS σ tail fibers:

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Cell separation with grooves in Sc. plates with Tyvec strips inside

Prototype (cntd)

3 Si planes

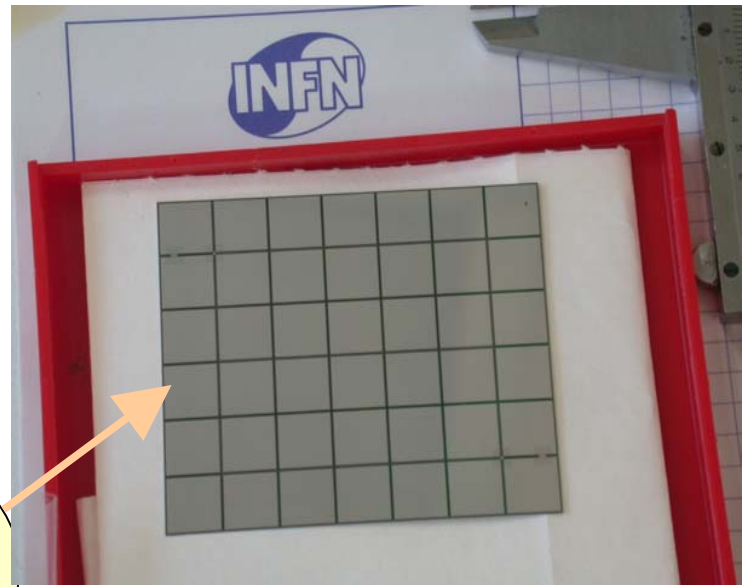
:**Goal: shower-shower separation:**

:**Pad dimension< shower dimension:**
0.9x 0.9 cm^2

:**Longitudinal sampling:** **3 planes**

:**Analogic RO VA hdr9c from IDEas**

:**Next year: shower dimension reduction W absorber**



Pad diode ac coupled

Actual design:

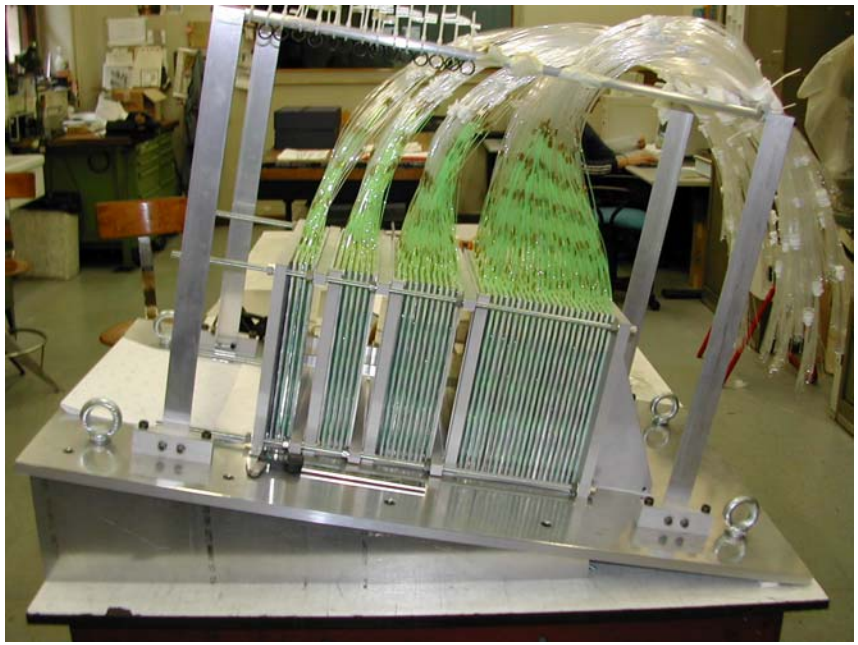
:**Detector: 6x7 pads**

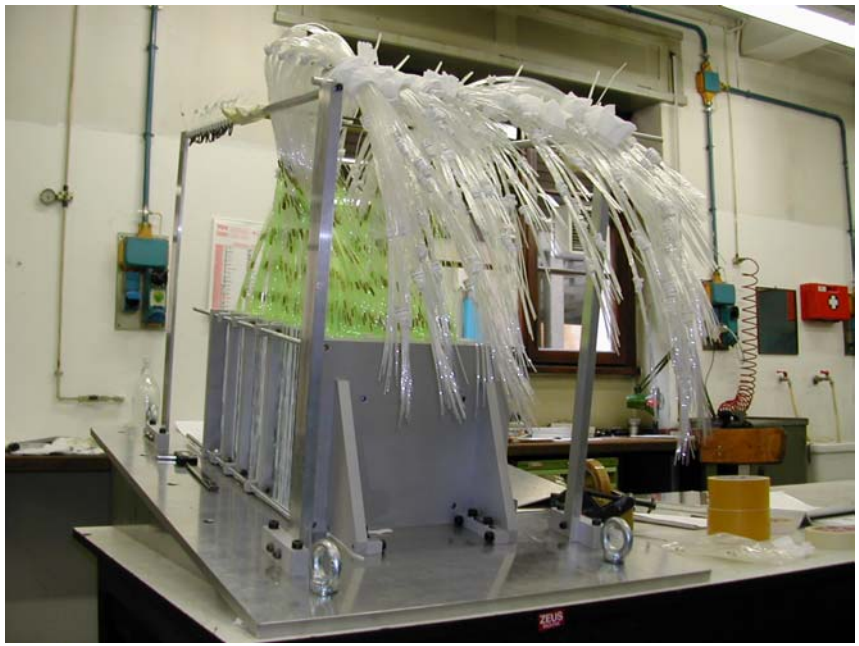
:**Plane: 3x2 detectors**

pcb contact with conductive glue

Production

The tile-Pb calorimeter is fully mounted!



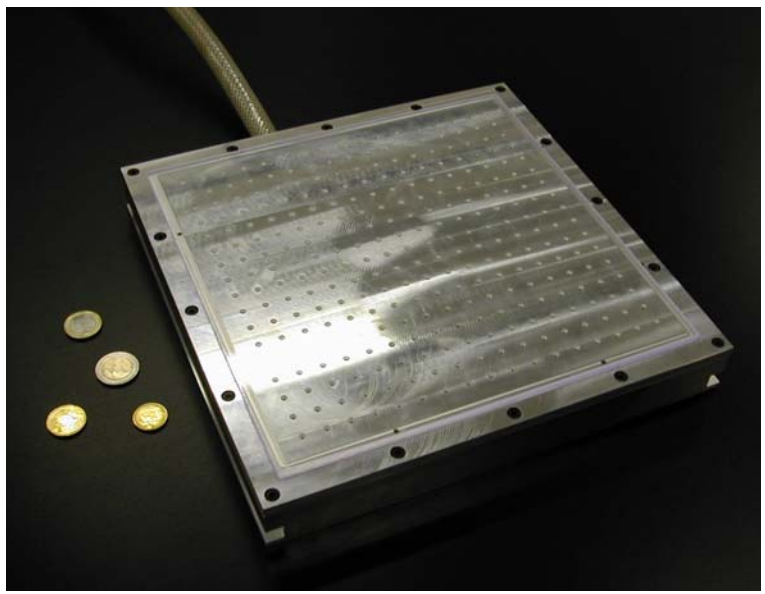


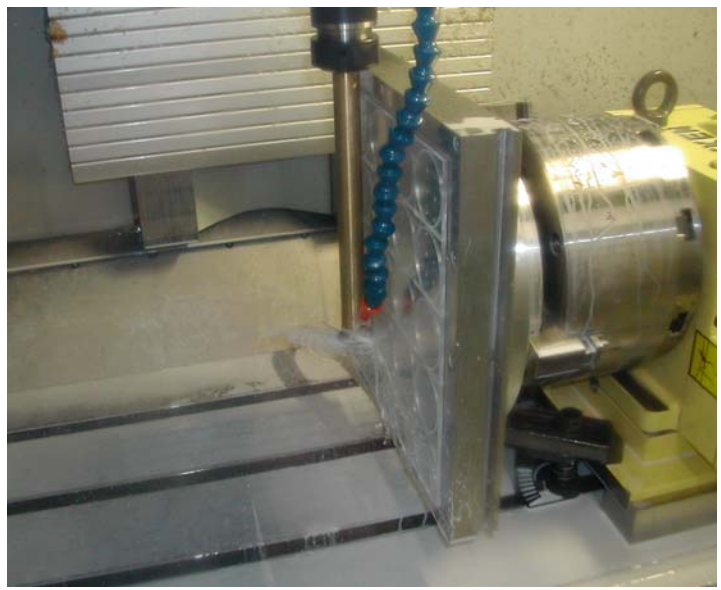
Steps and status:

Scintillator tiles **Fibres** **Si pad detectors** **Detector assembling**

- **3 mm Kuraray SCSN-61 (25x25 cm^2)**
- **3 mm Bicron BC-408 (25x25 cm^2)**

Machined with vacuum plate as holder

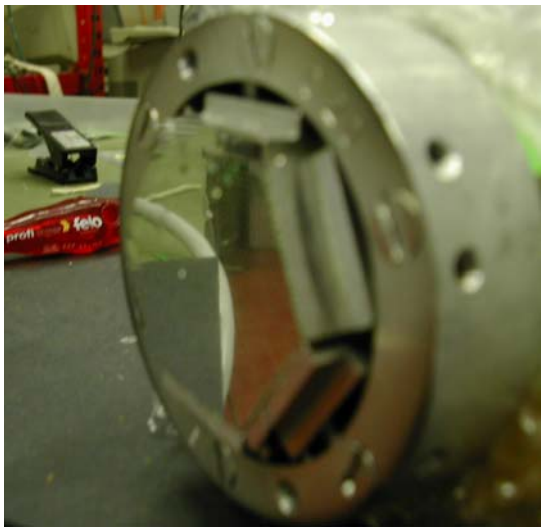




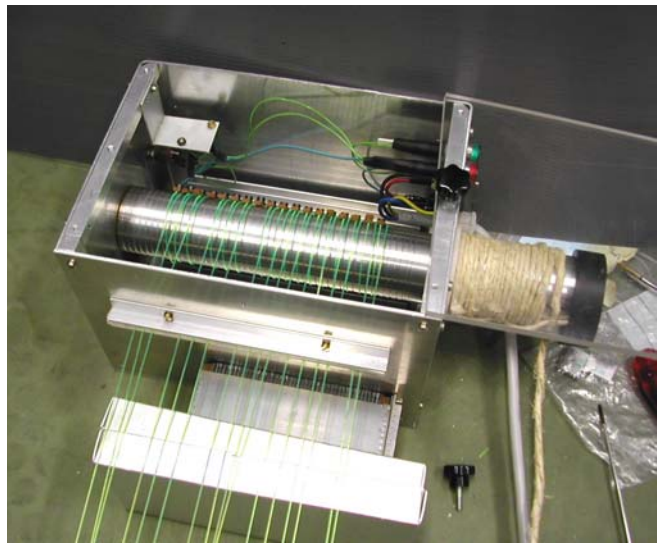
Whole Production (>50 tiles) done

Kuraray 1mm d. Y11 300 ppm multicladding

Face polished and aluminized by sputtering

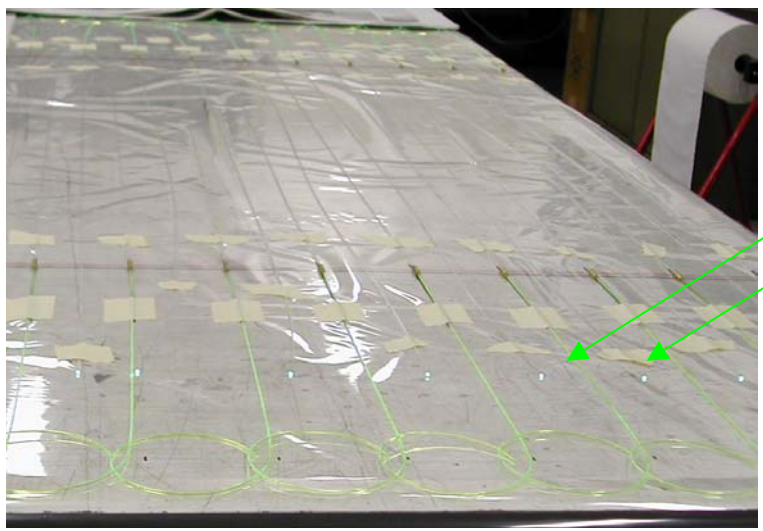


To make the 2.4 cm radius curvature : middle temperature(50^0-70^0) oven



Splicing with optical glue

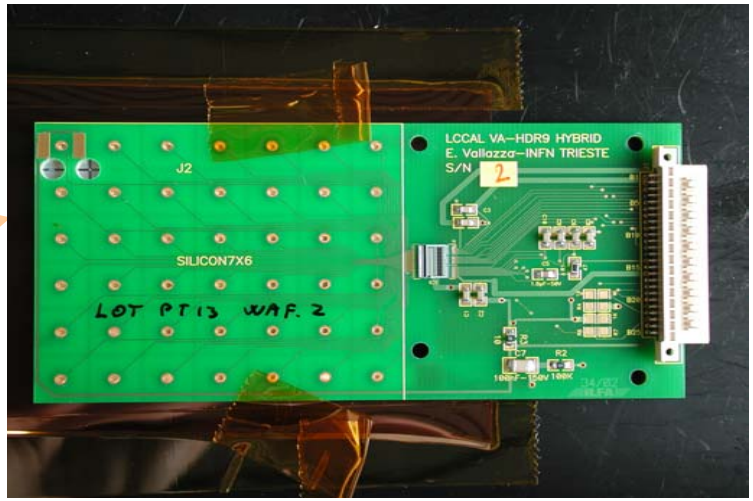
and a supporting tube :



stable in >30 day time

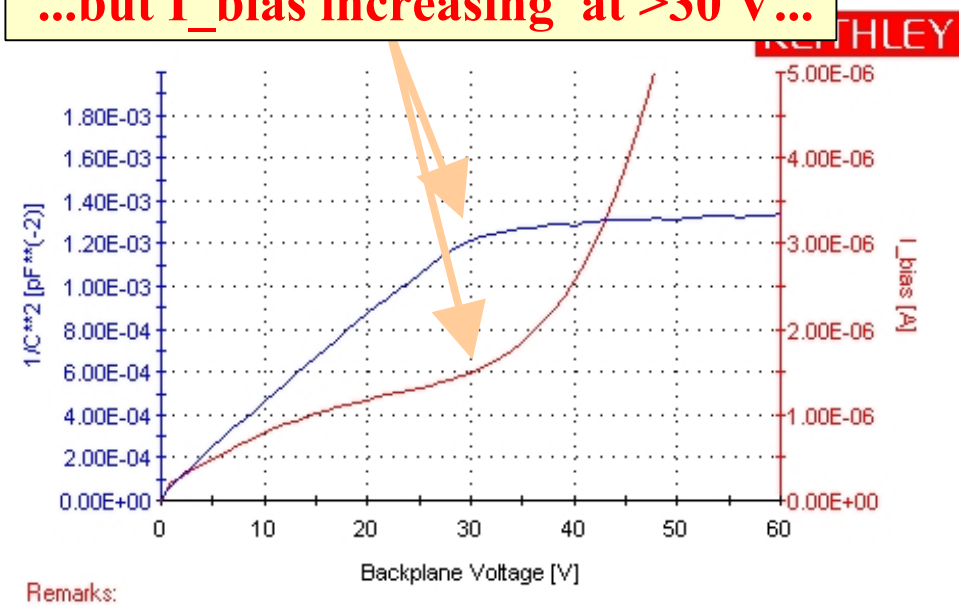
:Si Pad detectors:

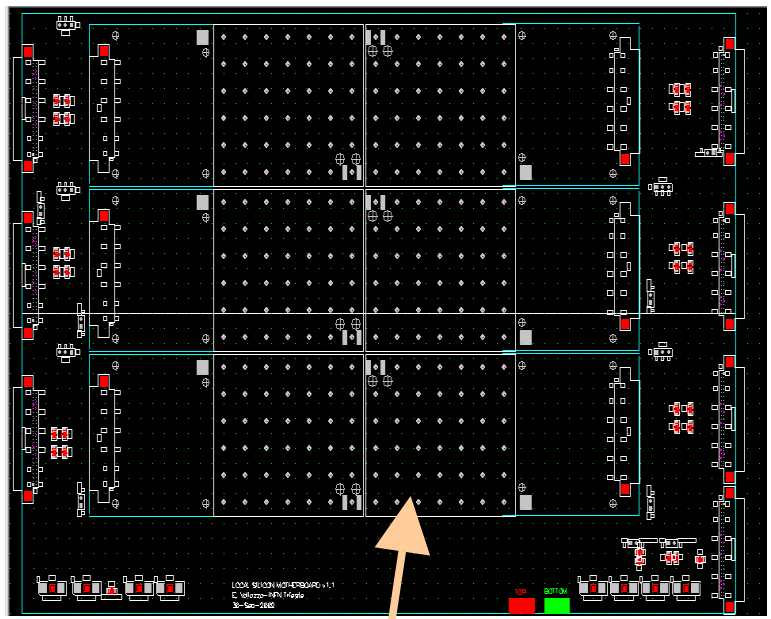
:20 detectors produced by IET (Warsaw) out of which: 1 fully mounted and tested on beam, 7 mounted and ready to be assembled in the prototype, 13 mounting in progress.



Full depletion at <30 V

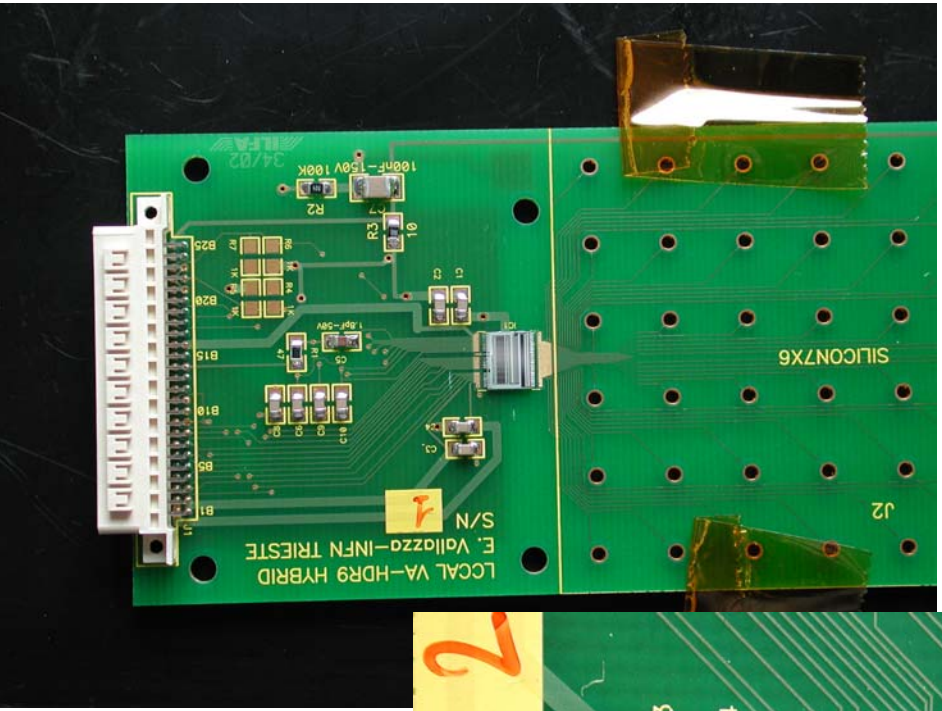
...but I_bias increasing at >30 V...

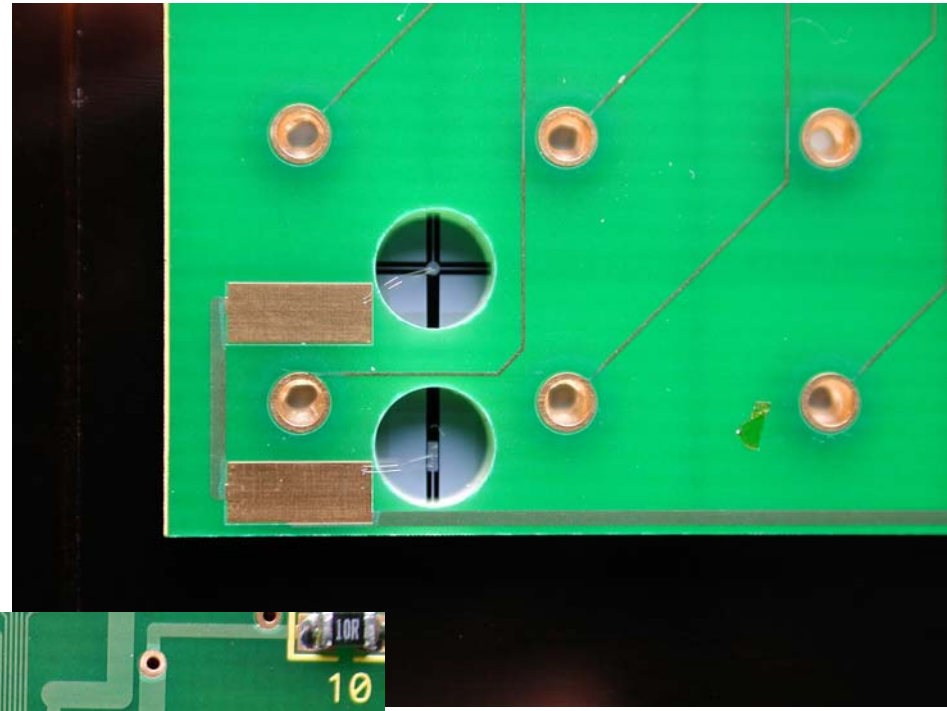


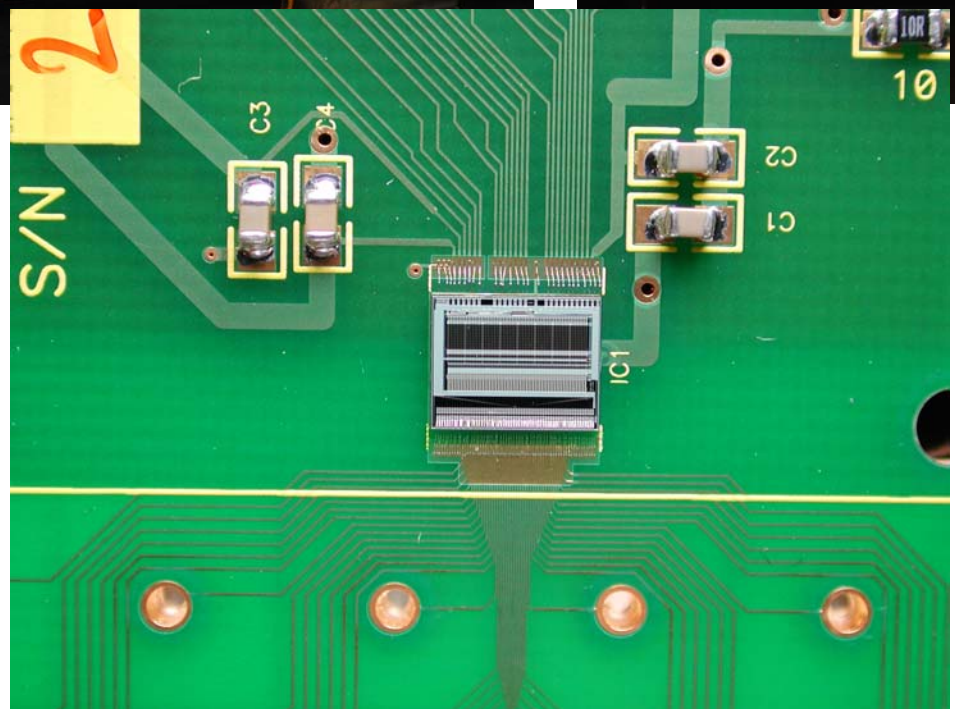


Si pad plane Mother Board

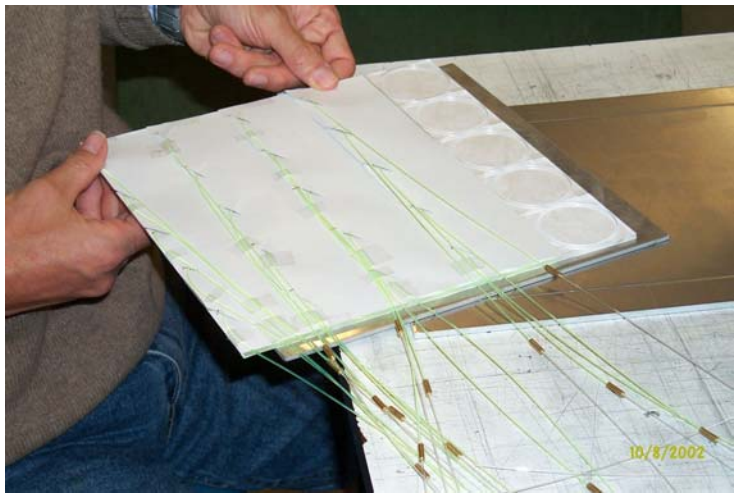
Si Pad detectors (details):

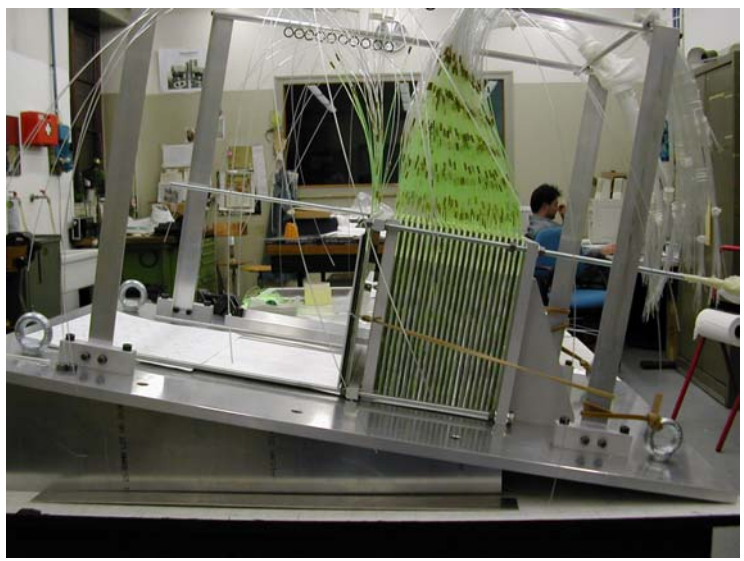






Detector Assembling:



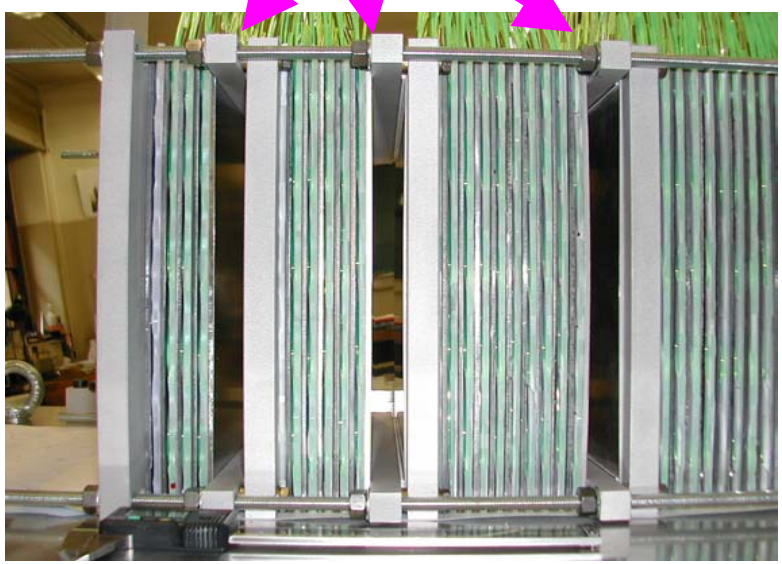


Detector Assembling:

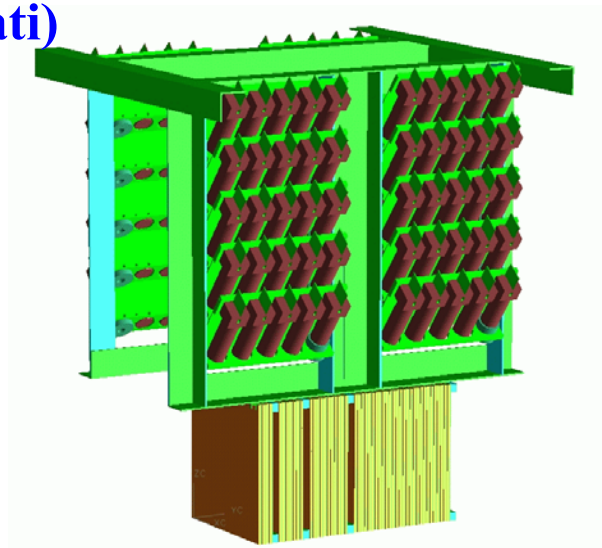
45 Layers calorimeter prototype completely built and ready for test

Fibres grouped into 25x4 bundles making a 4-fold longitudinal segmentation.

Slots for the insertion of the 3 Si pad planes (Motherboard).



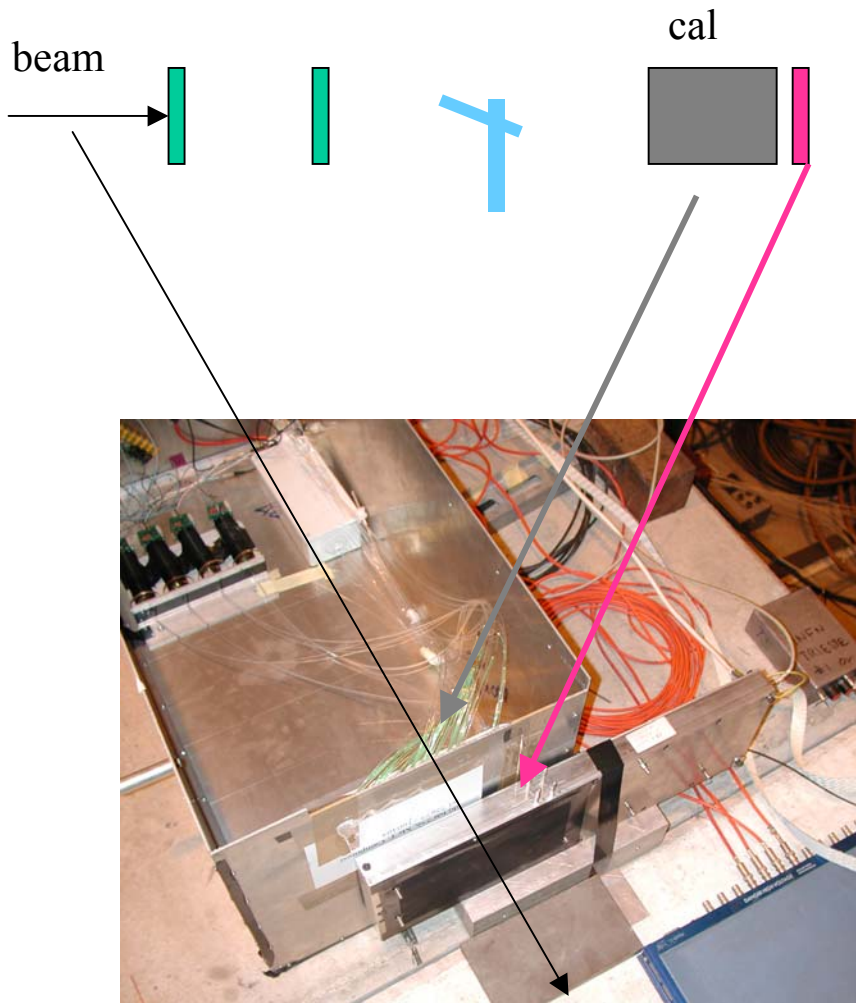
Mechanical support for photodetectors almost ready (Frascati)



Test beam* results

Set up:

- **2 planes Si μstrip telescope**
- **2 trigger Scintillators**
- **Calorimeter first segment (2 X_0) read by PM**
- **1 Si pad detector**



e^- 40 / 50 GeV

π 50/150 GeV (used as m.i.p.)

*CERN SPS H4

Test beam results CALORIMETER (2.1 X_0)

4 layers

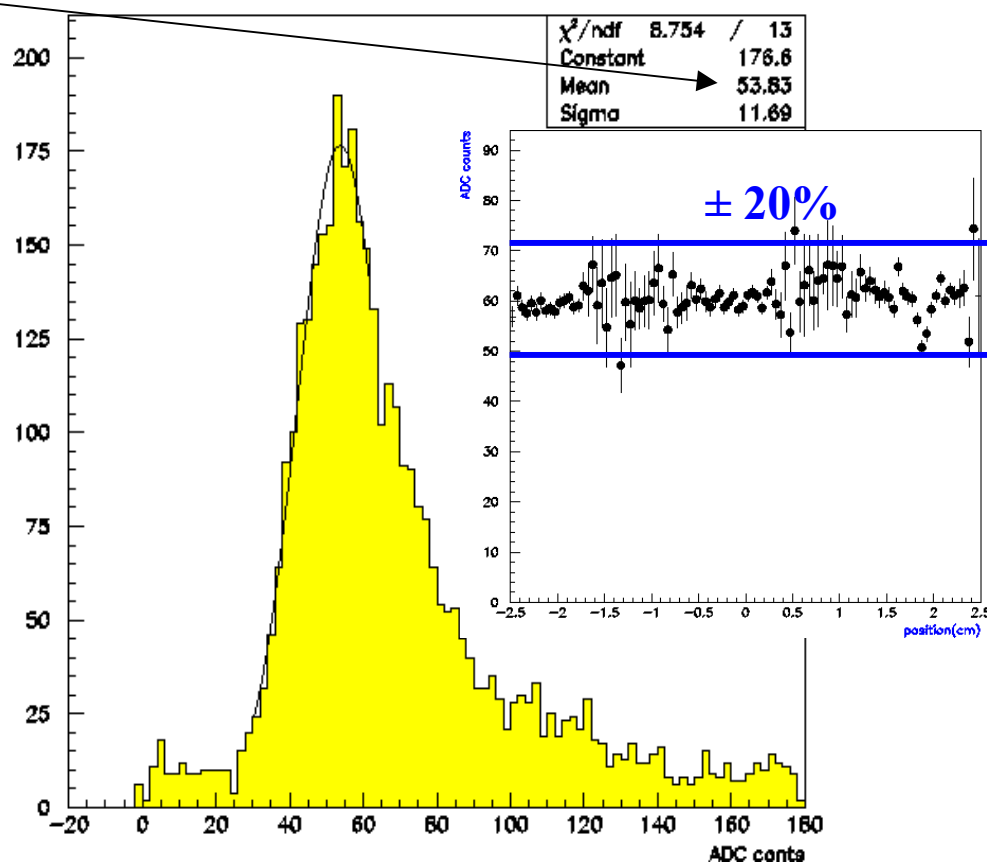
m.i.p.→check light output and uniformity in Light collection:

Ratio signal/sigma →lower limit for photoelectrons

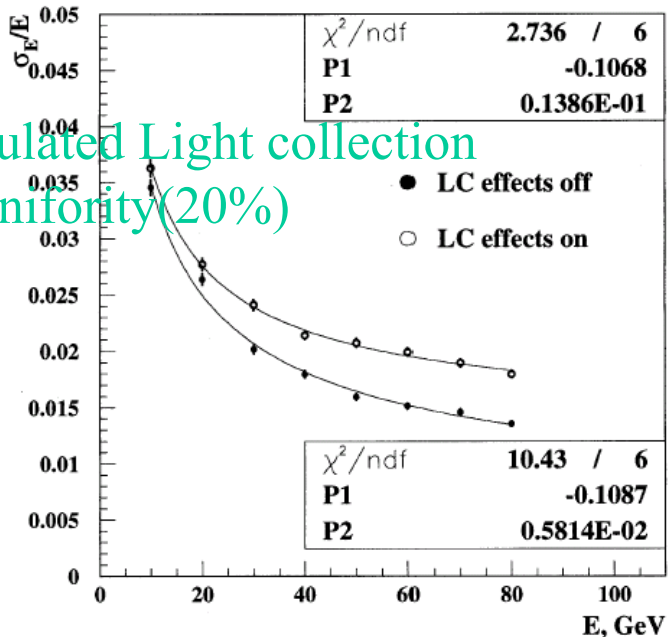
N_{phe}>5.1 /layer

→ cal(45layers):>220 phe/m.i.p.

good uniformity:

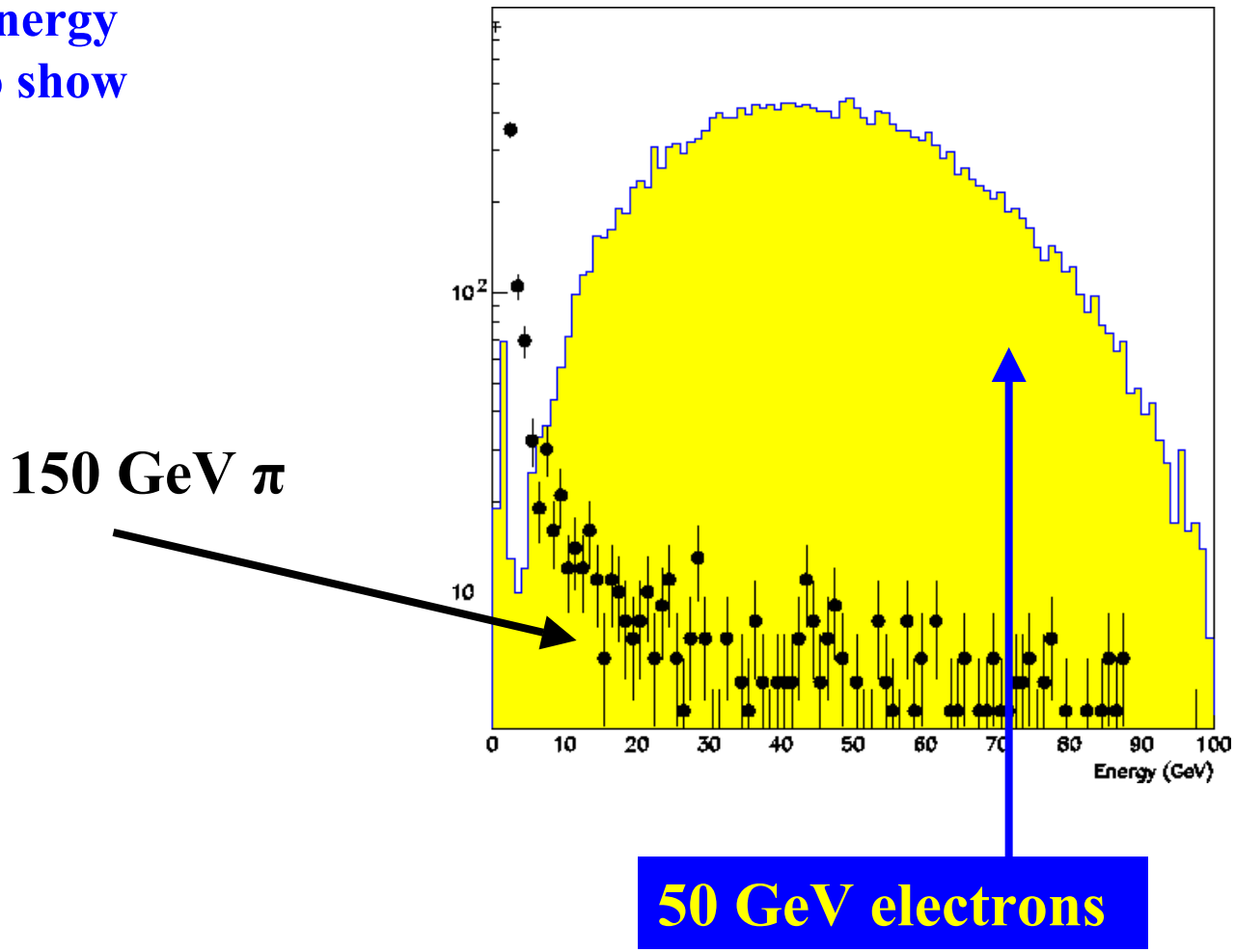


Simulated Light collection disuniformity(20%)

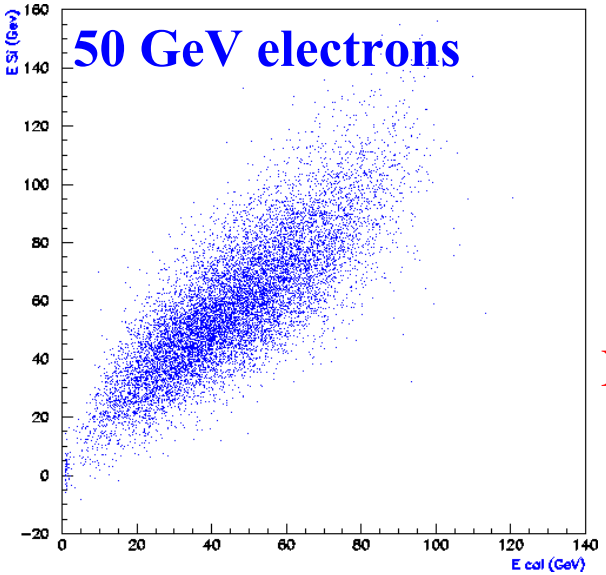


Test beam results: CALORIMETER (2.1 X_0)

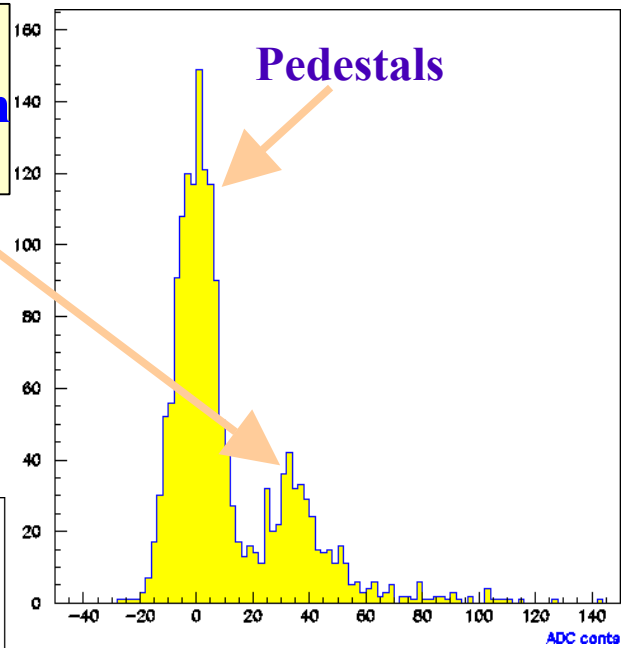
Too few layers to give Energy resolution but enough to show e/π separation



Test beam results: Si pad detector (Energy Measurement)



m.i.p. Signal >4 sigmas (coherent noise subtraction not optimized)

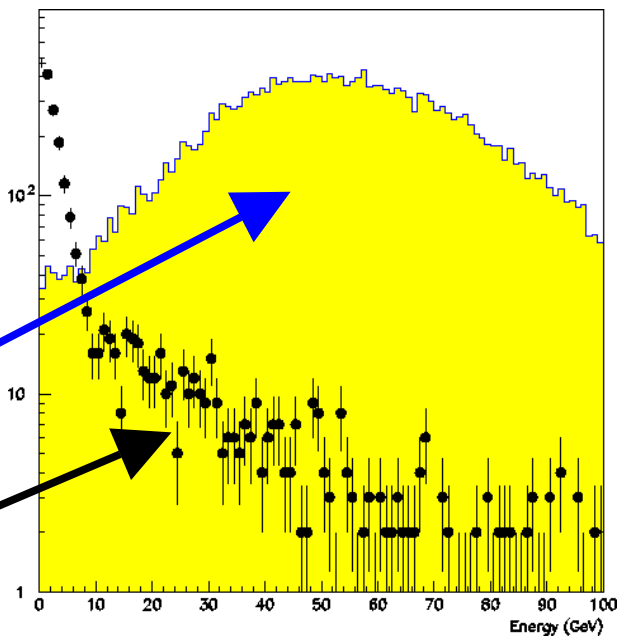


No saturation!

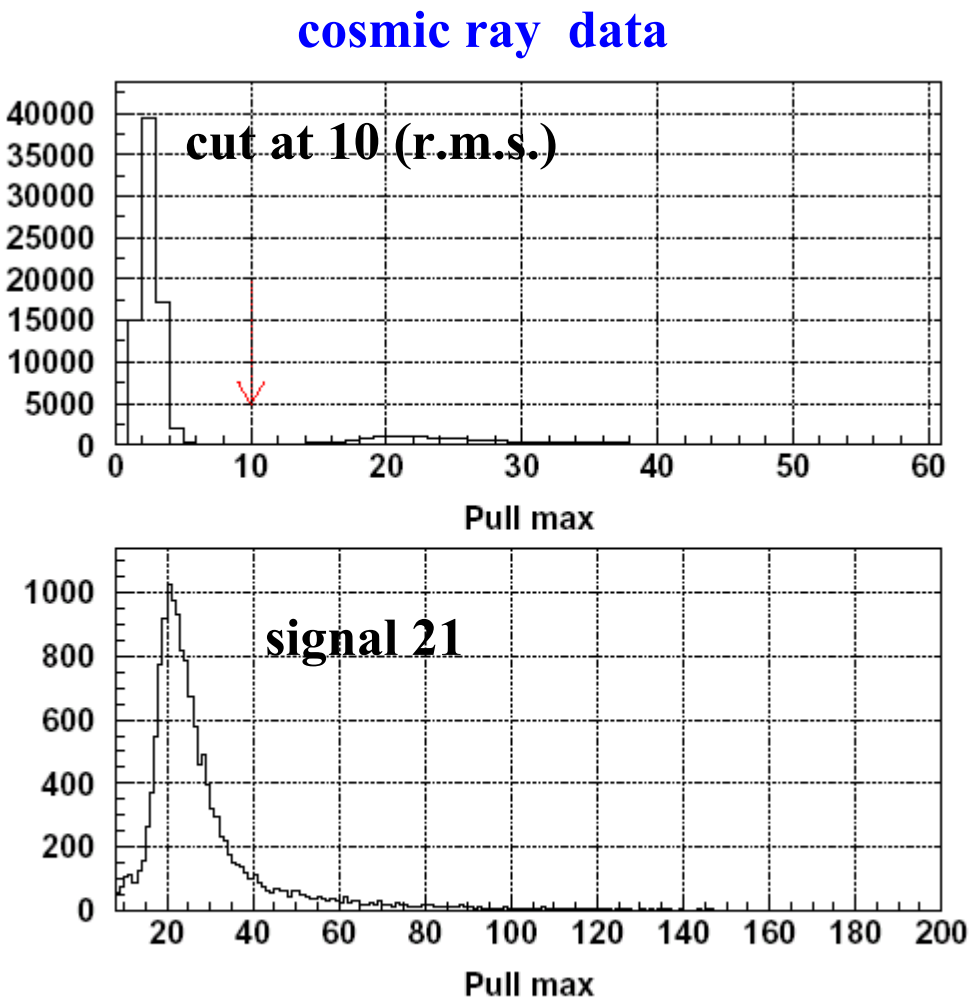
e/π behaviour clearly different

50 GeV electrons

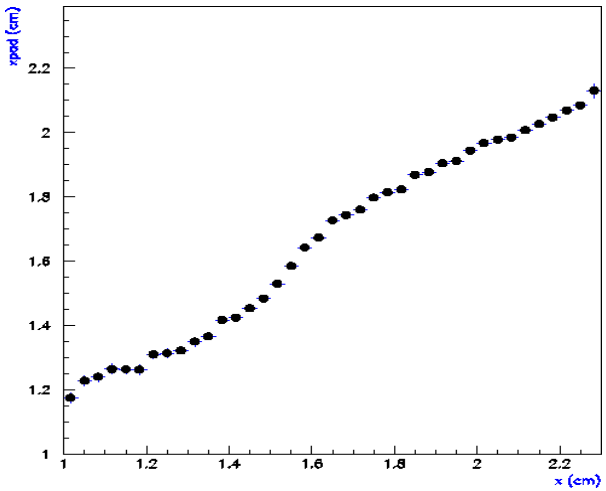
150 Gev π



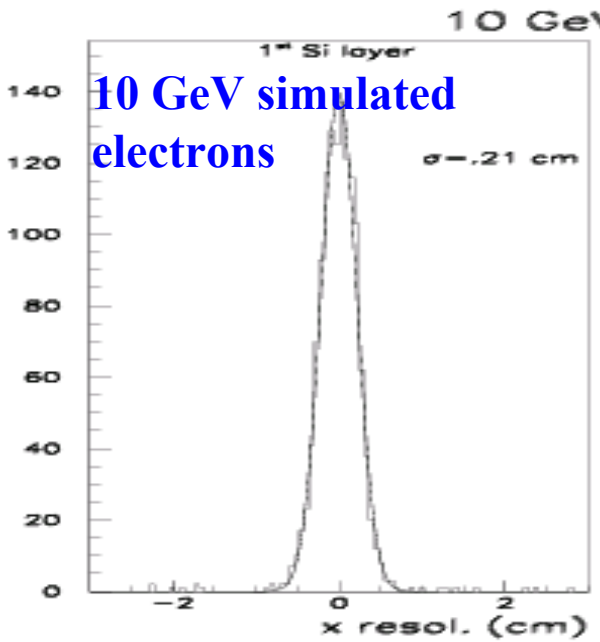
….but new detectors show a much better s/n:

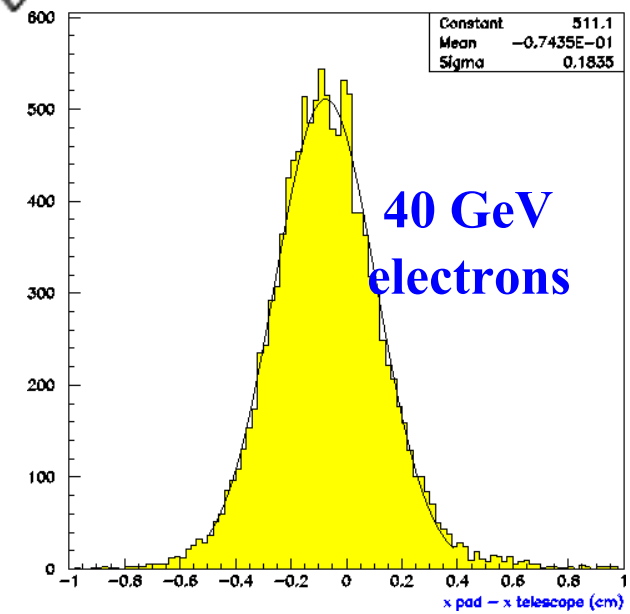


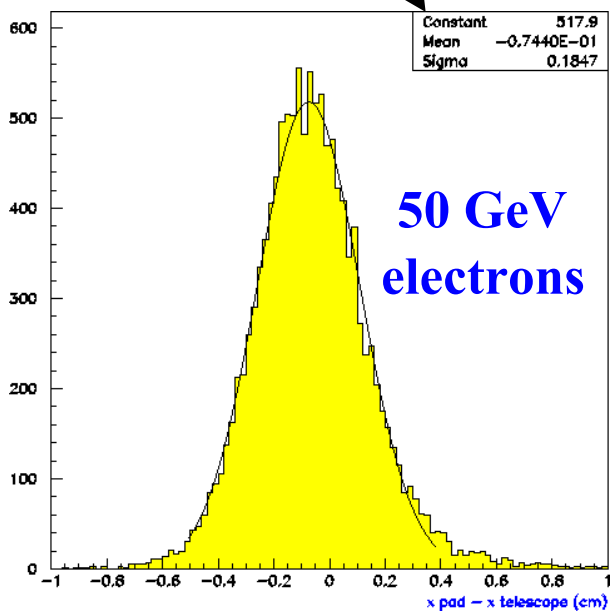
Test beam results: Si pad detector (Position Meas.)



Position resolution < 2mm in agreement with Monte Carlo







Future Plans

- **insert Si planes (this month)**
- **go to test beam (low energy Frascati, high energy DESY/CERN)**
- **analyse two particle impact**
- **substitute the absorber: Pb to W (next year)(?)**
- **study new optical device (i.e. multianod PM's)**
- **combined test with HCAL(?!)**
- **Why do not insert other (Prague) Si detectors(?)**

Conclusions

- The proposed prototype is going to be completed (just insert Si planes)
- A preliminar beam test at CERN with a partial set up gave reasonable and incouraging results
- Tests with the complete detector are necessary to answer to all questions (be patient for some months)
- …. but it they will be successfully answered, why do not include a calorimeter made following this technique into the general LC simulation and Pattern recognition? (this is also a PRC recommendation)