

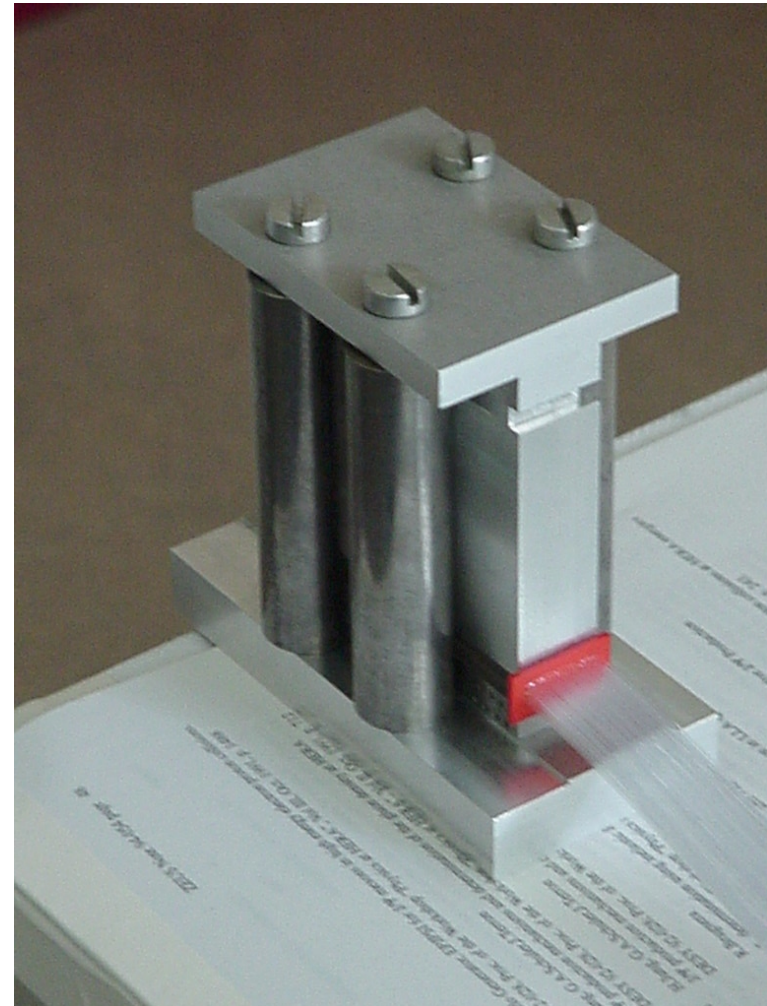
CALOR2000 Annecy (France). October 9-14 2000

A new W/Scintillator Electromagnetic Calorimeter for ZEUS.

- Introduction.
- Prototype.
- Test Results.
- Summary.

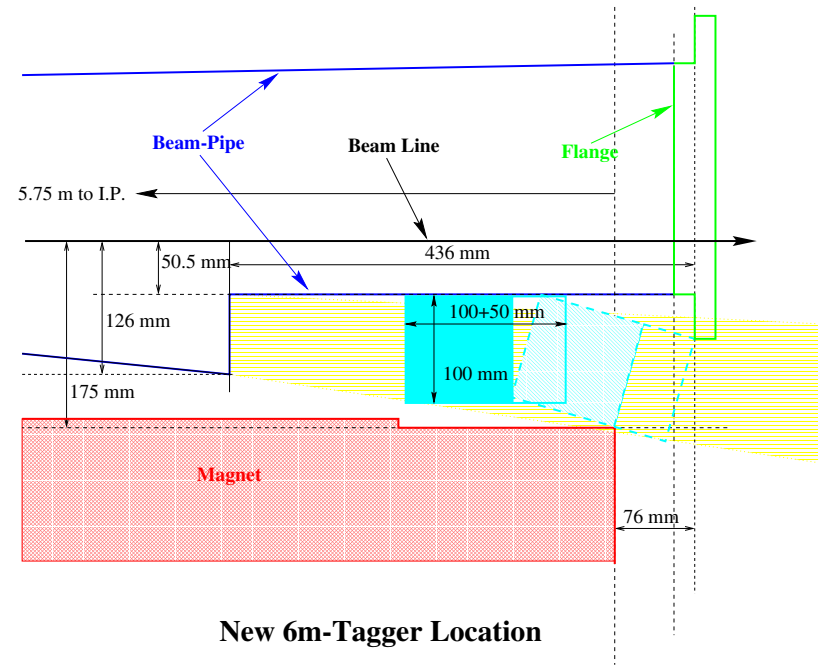


Ricardo Graciani Díaz (DESY).

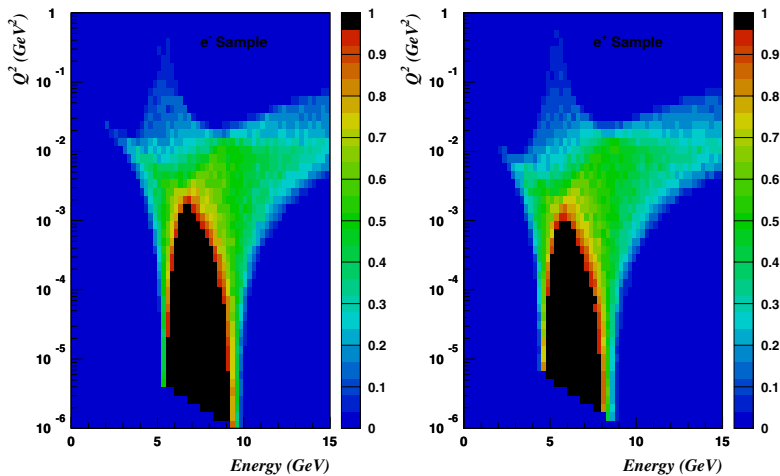


Introduction

- New e -Tagger @ ~ 6 m from IP.
- Inside quadrupole magnet.
- Constrains: **100x100x30 mm³**
- Radiation: upstream e -gas.

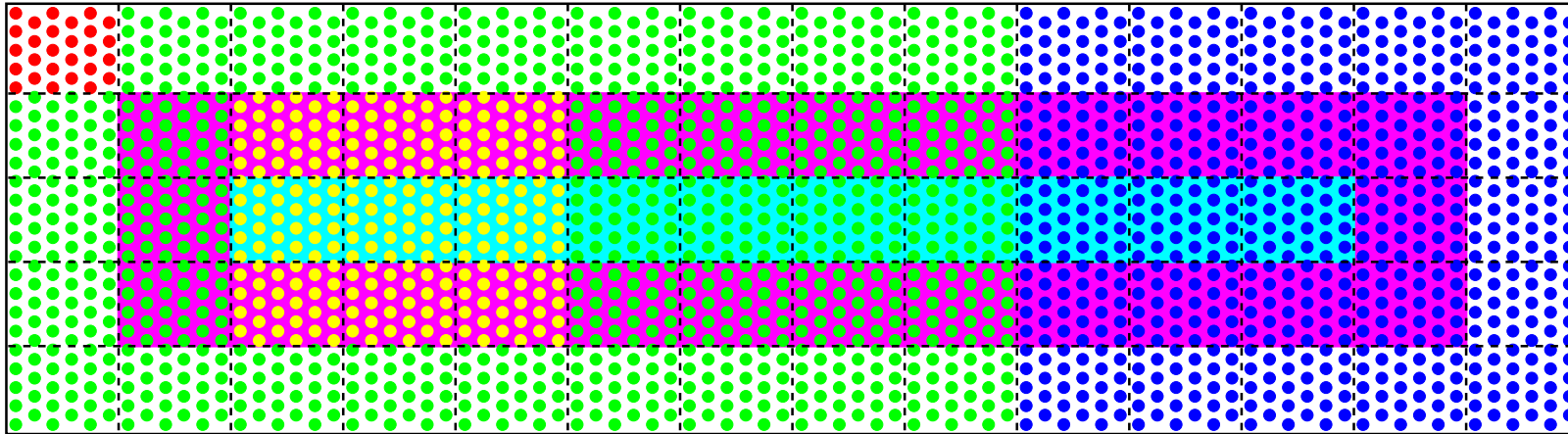


6-m Tagger Photoproduction Acceptance



- Energy leaks can not be avoided.
- Bremsstrahlung: 4 - 9 GeV (3-7°).
- Photoproduction: + KP (27.5 GeV).

Choice: **W/Scintillator Spaghetti Calorimeter** (0.5 mm D and ~ 1 mm spacing).

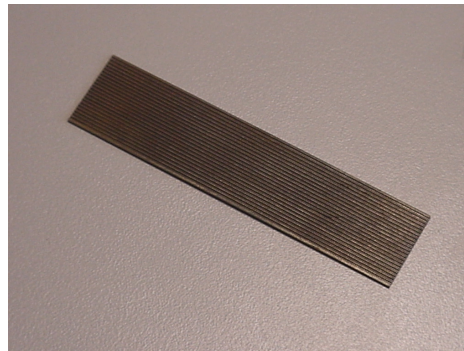


● Readout Cell

■ 3x3 Fiducial Volumen

■ 5x5 Fiducial Volumen

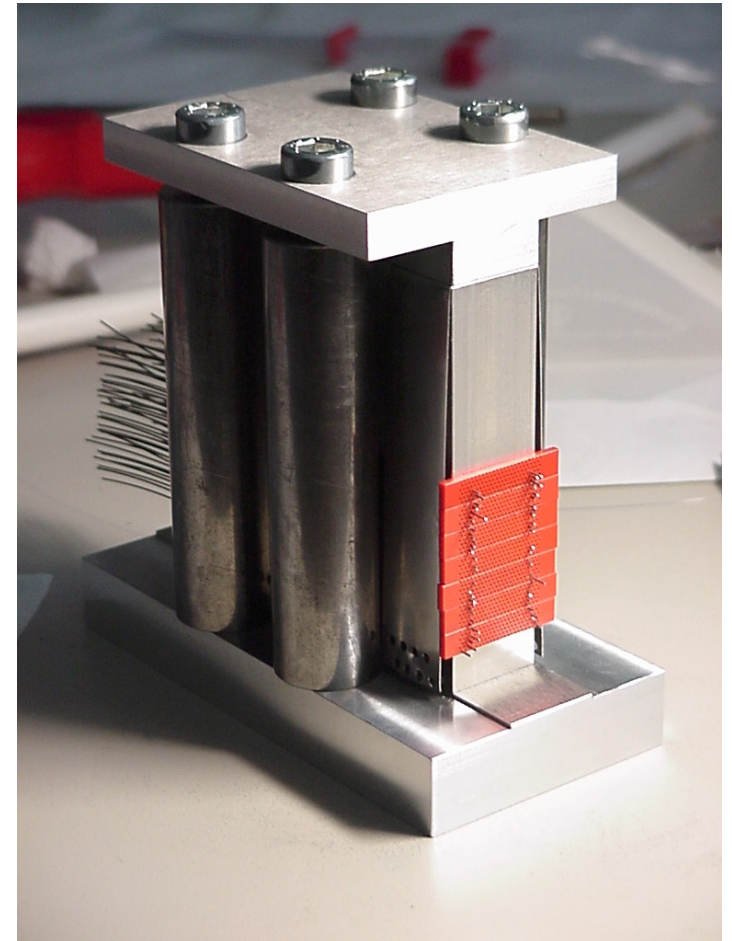
- Height = 24 mm
- Width = 85 mm
- Depth = 100 mm
- 70 Readout Cells

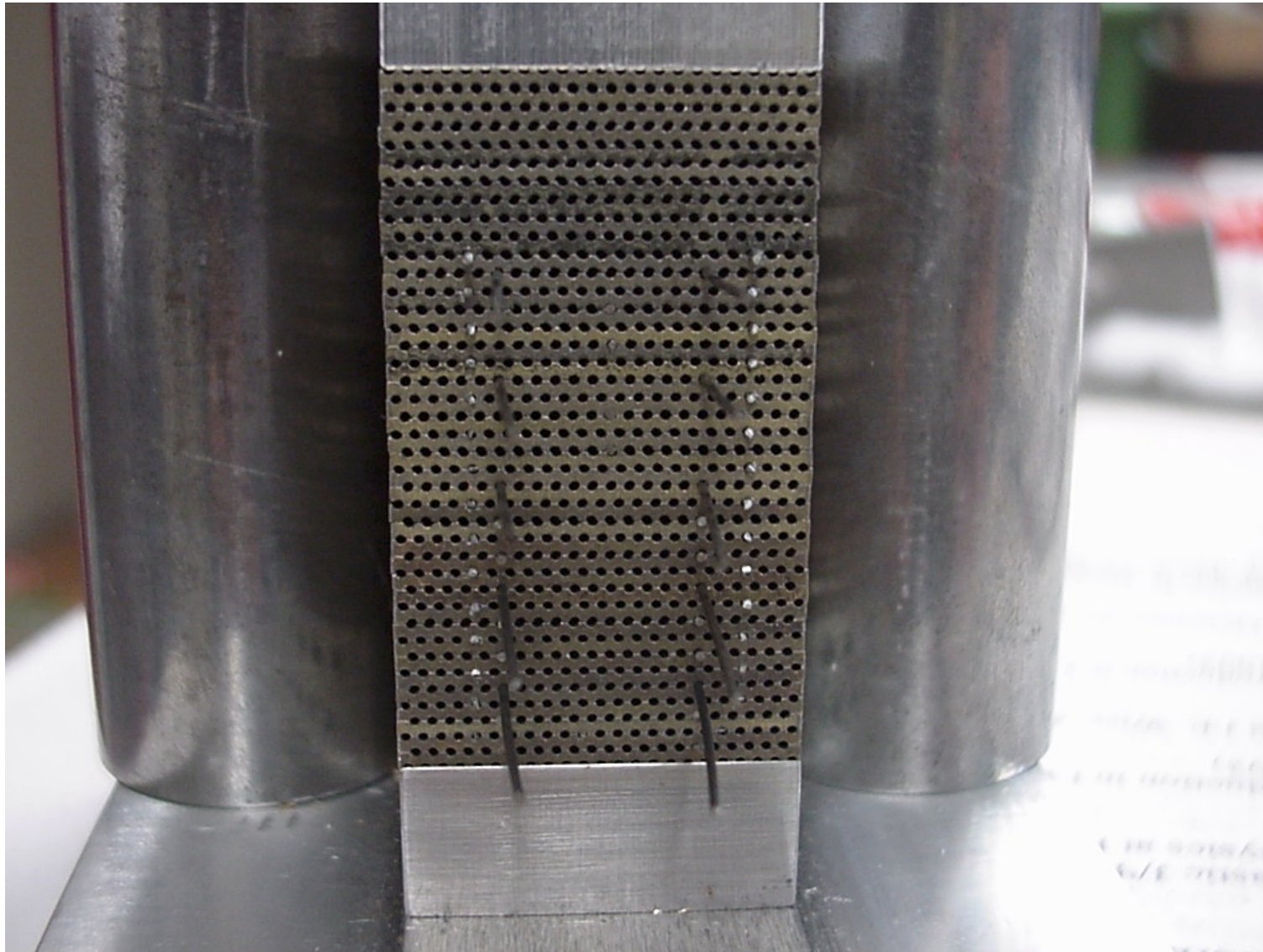


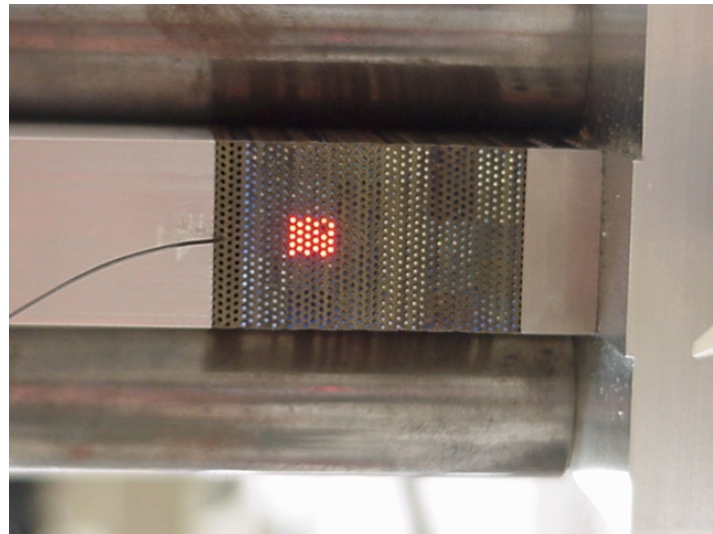
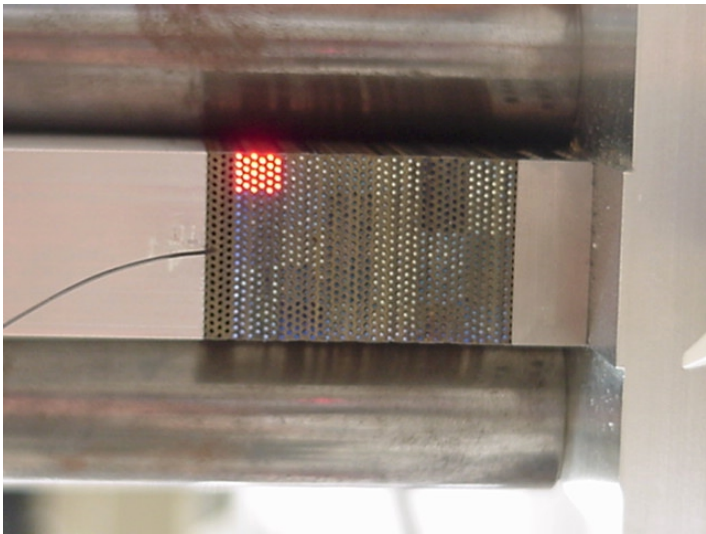
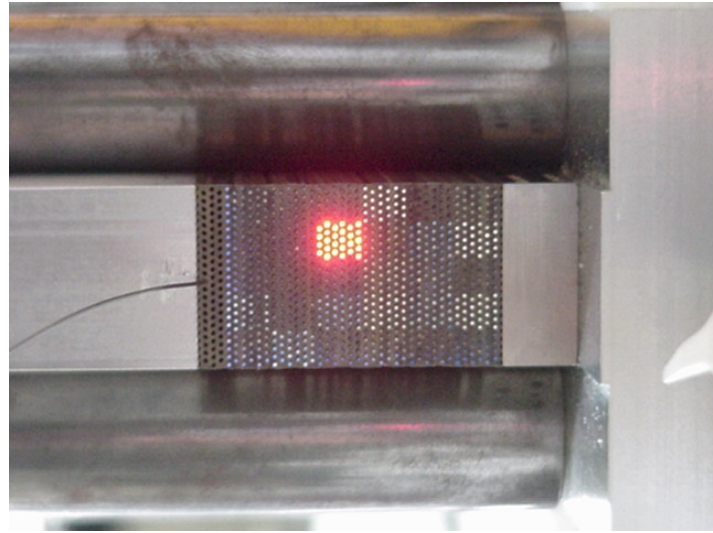
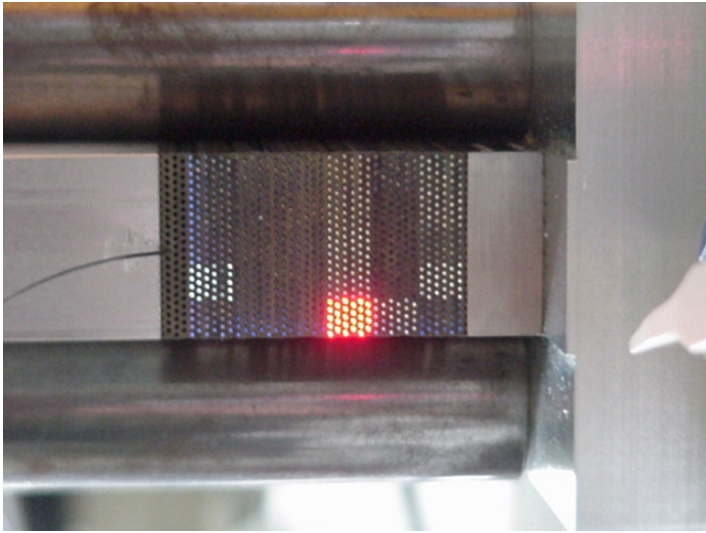
- 85x1 mm W plates.
- 2 faces machined.
- 1890x0.5 mm fibers.
- 1 m to PMT.

Prototype

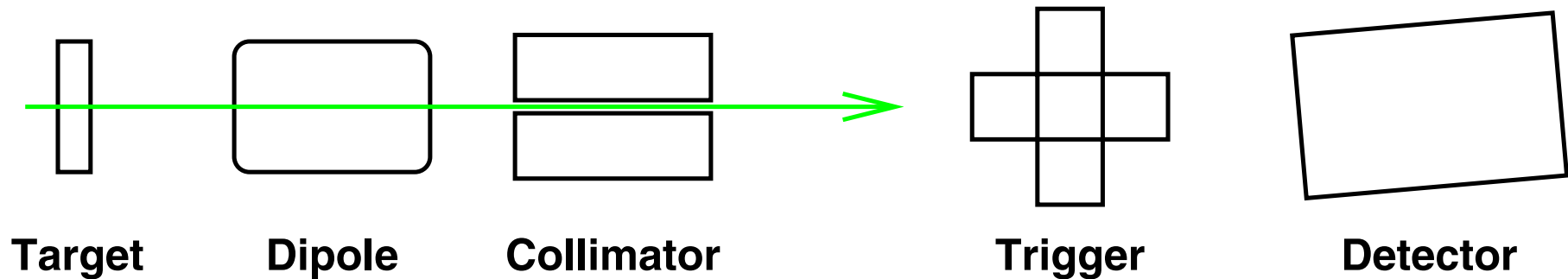
- 40 W plates.
- 30 cells equipped (= 810 fibers).
- 1m SCSF81, 0.5 mm D, double clad.
- Glued to a mask at back of calorimeter.
- fibers from a cell (27) are bundled.
- PMT: Hamamatsu 5600.







Test Results



Test Beam Set-Up (DESY beam-21)

- 5° rotation wrt Beam.
- Beam Energy up to 6 GeV.
- Calibration runs @ 4 GeV:
5x5 mm² Trigger counter.
- Resolution studies:
20x20 mm² Trigger counter.

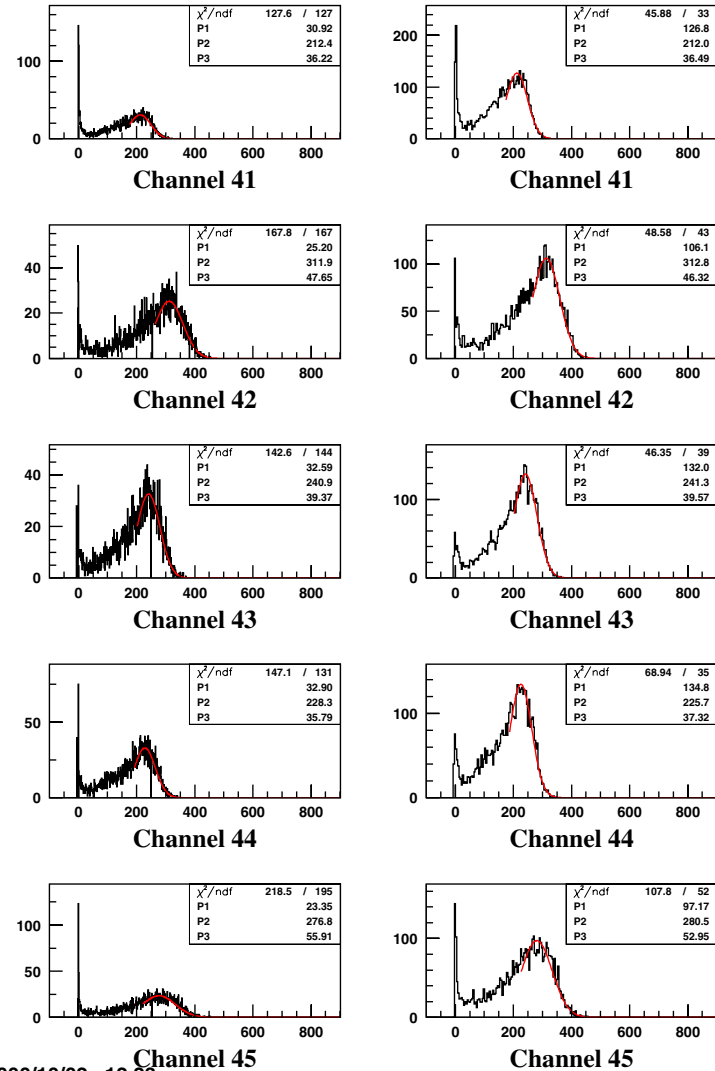
65	55	45	35	25	15
64	54	44	34	24	14
63	53	43	33	23	13
62	52	42	32	22	12
61	51	41	31	21	11

Prototype Cells

Calibration

- Runs @ 4 GeV.
- 5x5 mm² trigger.
- Move each cell to beam spot.
- Fit signals.
- Determine calibration factor.

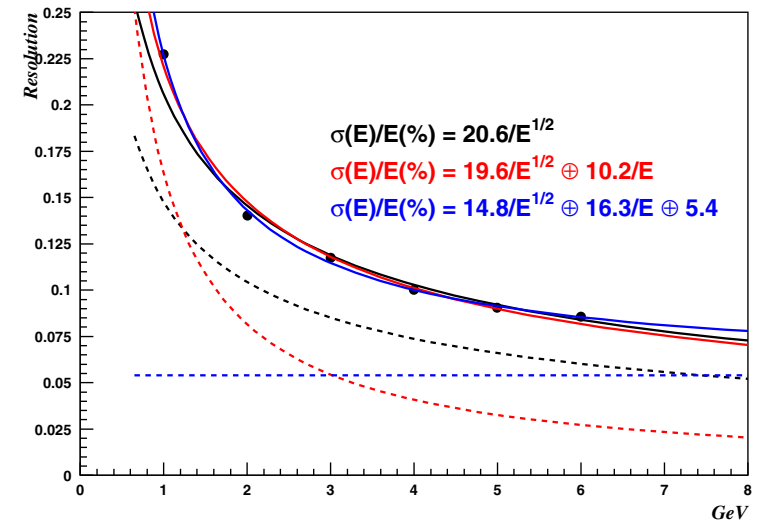
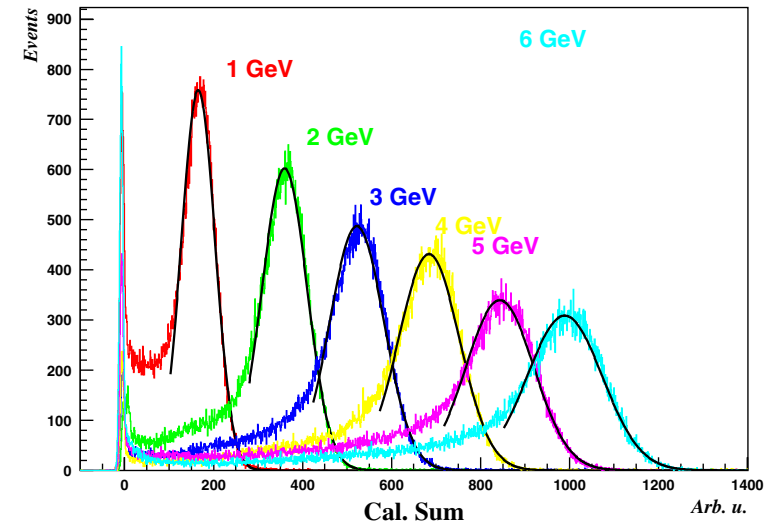
Calibration 6m-Tagger Test Beam



Resolution

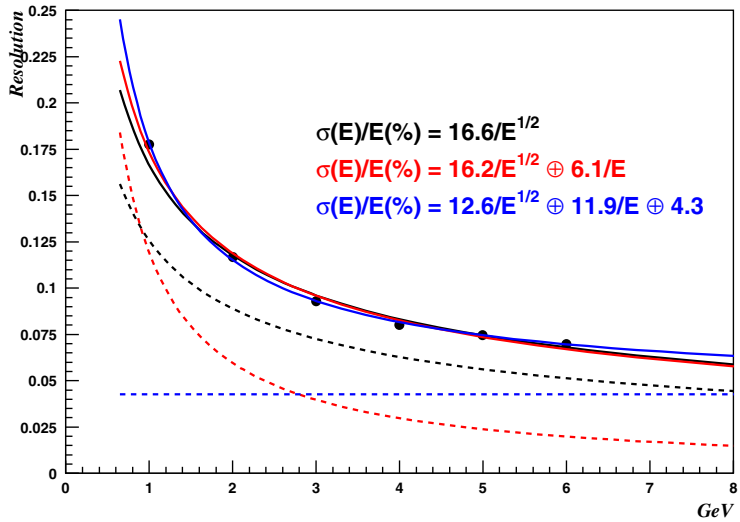
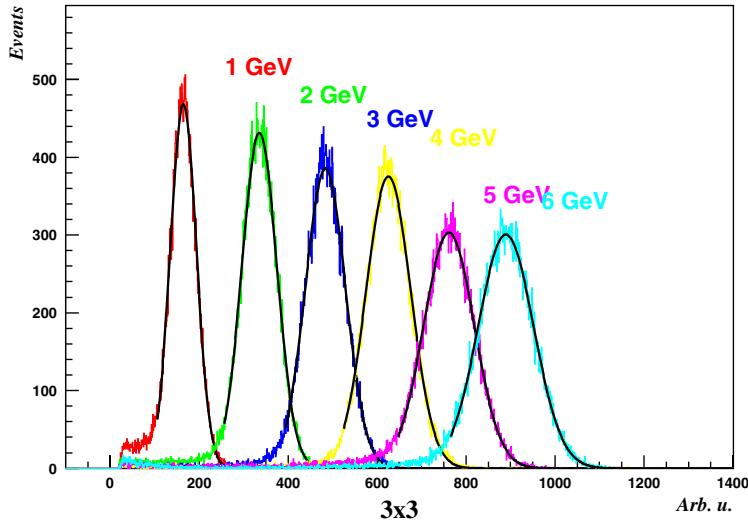
- Runs @ 1, 2, 3, 4, 5, and 6 GeV.
- 20x20 mm² trigger.
- 2 runs/Energy to cover prototype.
- Apply calibration.
- I: All events - All cells.
- III: Fiducial cut - 3x3 cells (next page).
- IV: Fiducial cut - 5x5 cells (next page).

6m Tagger Test Beam: Resolution I (0)



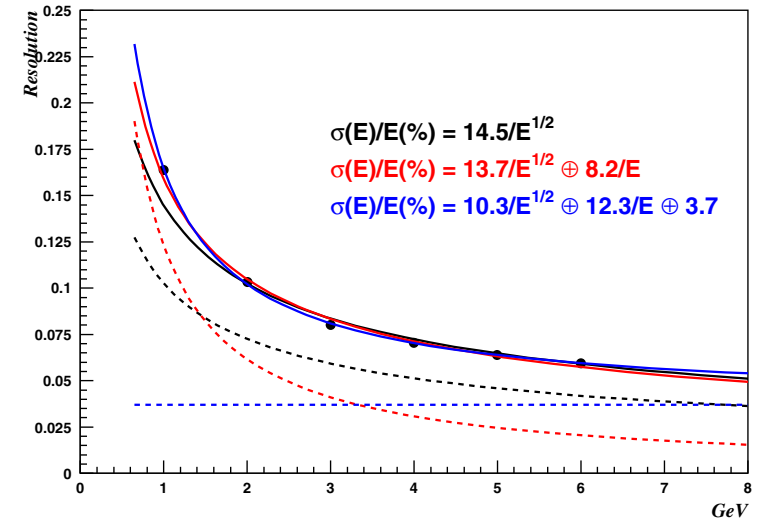
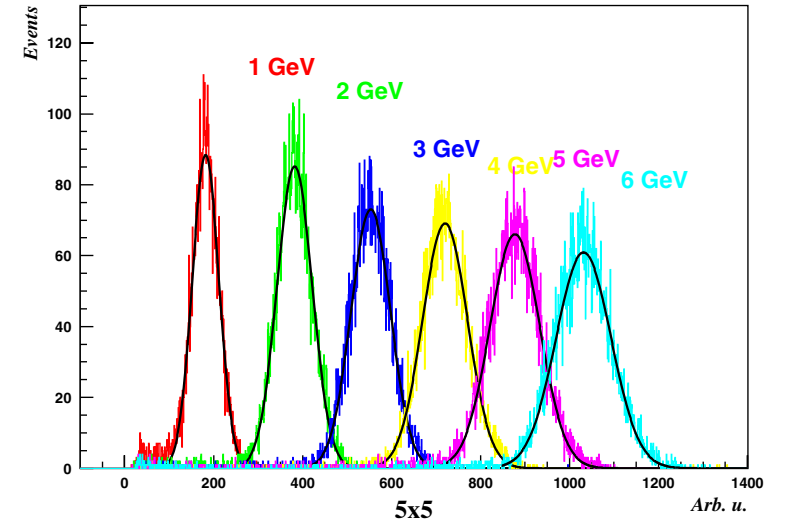
2000/10/10 12.15

6m Tagger Test Beam: Resolution III (0)



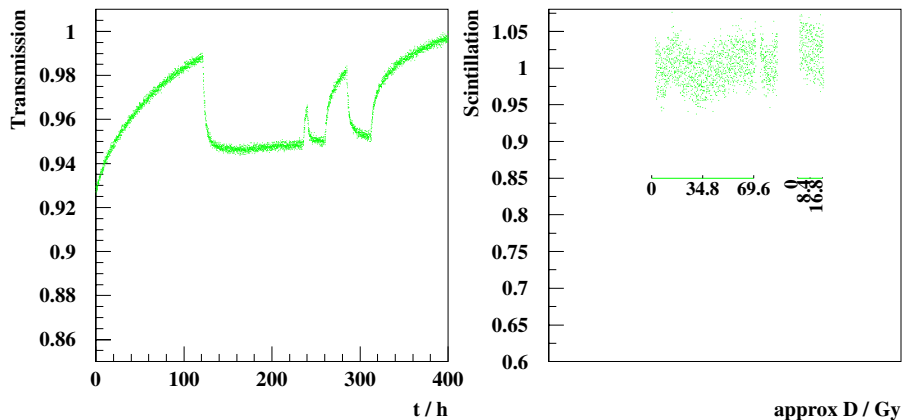
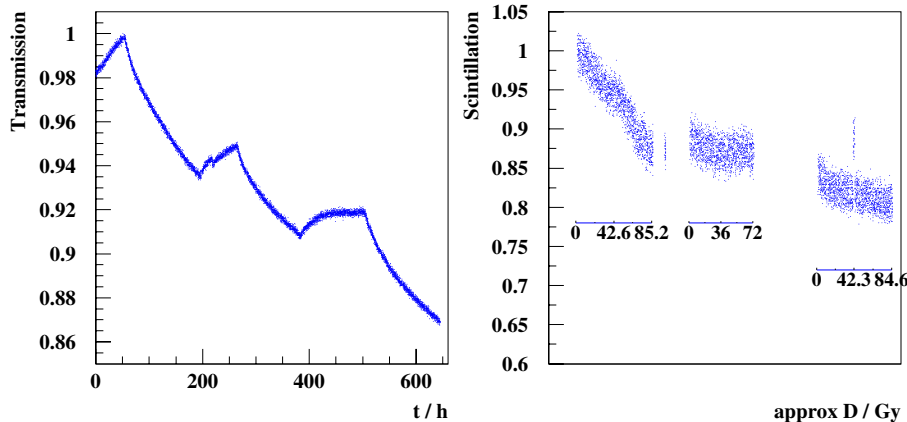
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6m Tagger Test Beam: Resolution IV (0)



2000/10/10 12.16

Radiation Hardness



- Max. foreseen dose ~ 1 Gy/h.
- **SCSF38**, **SCSF81**, and **BC60-3HF** fibers have been tested.
- Permanent damage in transmission and scintillating light observed for **blue** fibers at realistic doses.
- Non-Permanent damage in **3HF** fiber, with fast recovery after irradiation.
- With higher doses permanent damage is also observed for **BC60-3HF**.
- Expected ~ 1 % effect on calorimeter response over 1 month operation.

Summary

- A new small Electromagnetic calorimeter is under construction for ZEUS.
- A W/Scintillator Spaghetti design has been chosen due to the strong space constraints.
- The detector will consist on 70 cells of $\sim 6 \times 5 \text{ mm}^2$, and measure:
 - Bremsstrahlung e in the range 4-9 GeV.
 - Scattered e for low Q^2 ep events up to Beam Energy.
- A prototype with 30 cells has been built and tested at DESY Test Beam.
- Thanks to the high granularity good resolutions have been achieved, in spite of the unavoidable lateral energy leaks.
- Radiation Hard, SCSF-3HF fibers will be used for the final construction.
- Effect of non-containment of showers needs further studies.