CDF Run2b:

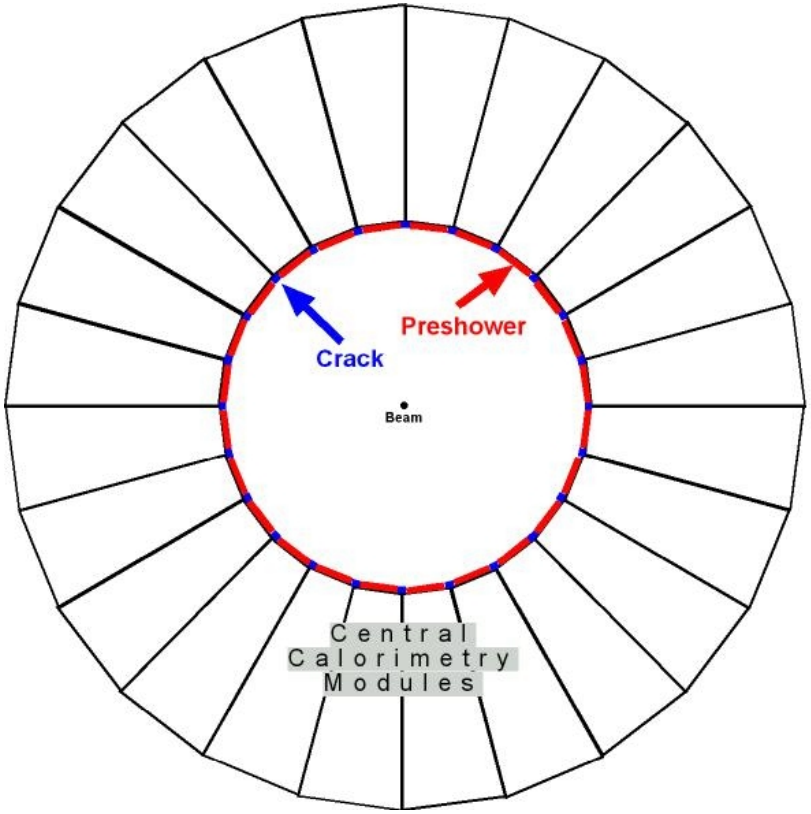
CCR and CPR Upgrade

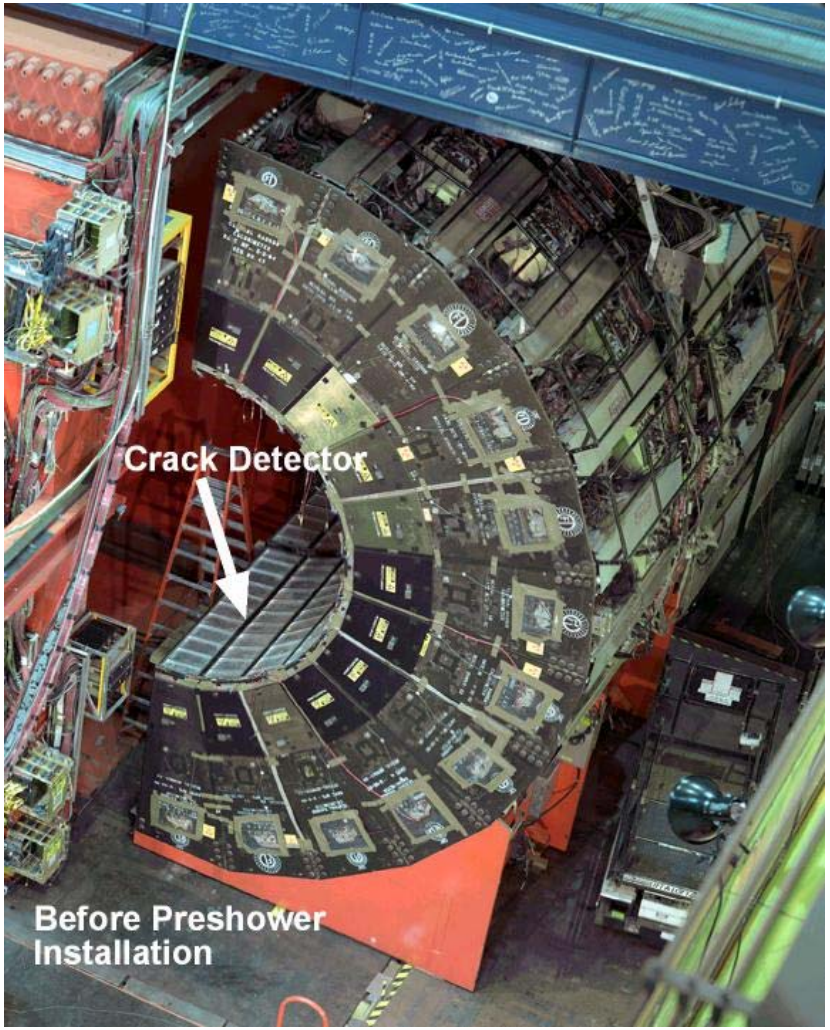
status

Bologna_22_04_2005

Michele_Giunta_INFN-Pisa_&_Università_di_Siena

Position in the CDF detector is between Solenoid coil and calorimeter

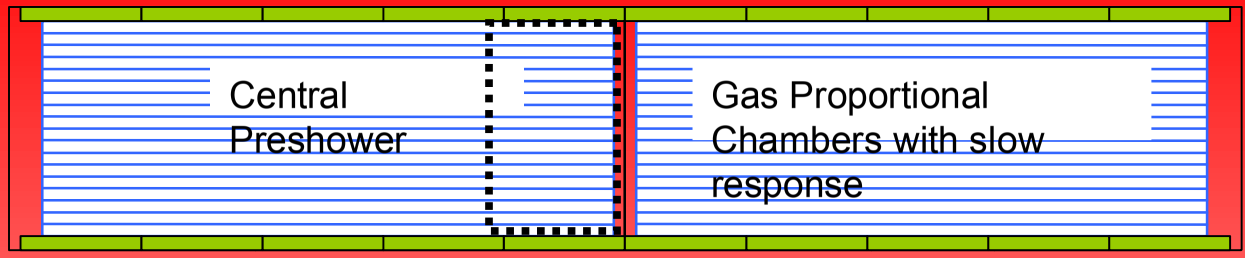




- **CDF preshower used in >100 papers, about 1/2 of all Run I publications, including:**
  - **Higgs searches**
  - **High p_T photons**
  - **Top quark**

- **CPR2 helps separating e/γ from π^{+-}/π^0**

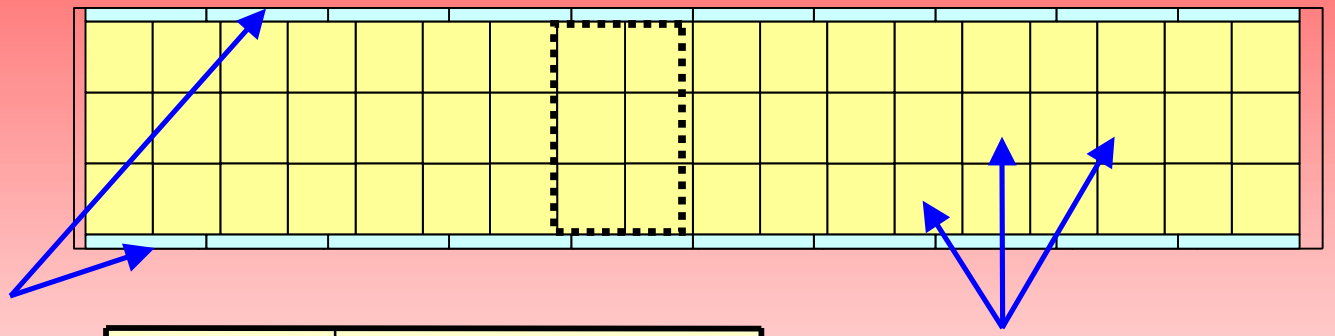
OLD CPR/CCR



Central Crack Detectors
behind 8 X_0 Tungsten bar

More Gas Proportional
Chambers with slow response

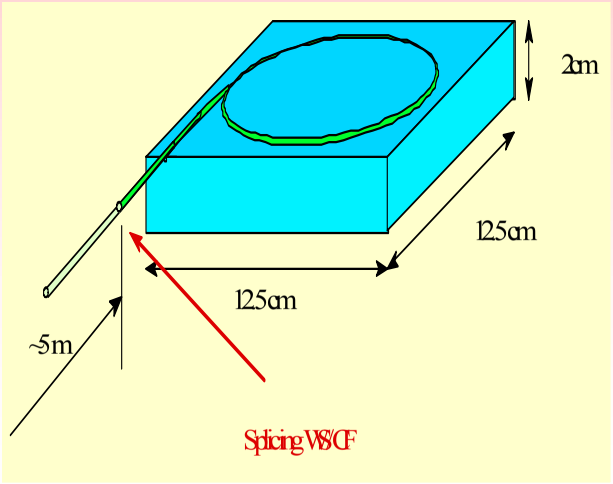
NEW CPR/CCR



CCR

CPR2 Scintillator Tiles

TILES	Per Wedge	Total
CPR	54	2,592
CCR	10	480



Total n. of channels = **3,072**

CPR tile: 12.5 x 12.5 x 2 cm 2x3 ($\eta-\phi$)/tower

CPR2_Goals

1) **Restore/mantain CPR performances (aging effects).**

2) **Overcome occupancy problems due to higher luminosity / avoid pileups**

3) **Improvement: finer segmentation, better S/N.**

4) **Shower Max detector only resolves single photons from meson decay till 35 GeV.**
CPR extends this limit by ~100 GeV. (Photon background subtraction)

5) **CPR could improve jet energy resolution:**

- **by correcting EM information for dead material losses (magnet coil, ...)**
- **by measuring charged tracks energy *before* they enter the CEM**
- **being more segmented than CEM**

The Upgrade timetable

- **CPR/CCR upgrade was first planned for autumn 2005**
- **We did complete it <u>one year in advance</u> !!**

- **Oct-dec 2003 : Almost Hardware Material Ordered**
- **March 2004 : Internal fibers Kuraray ready**
- **May 2004 : All scintillator Tiles ready (From Dubna)**
- **June 2004 : Pol.Hi.Tech delivers external fibers**
- **May-July 2004 : CPR2 assembly at Argonne**
- **First week Sept. 2004 : CDF is opened, installation begins**
- **Third week Nov. 2004 : CDF is closed, start CR test**
- **Second week Dec. 2004 : Re-start collisions**
- **Summer 2005 :There will be a NIM article**

UPGRADE parts , institutions & contributions

Fibers :

HV system & Control : *INFN*

R&D materials and PMT test : *INFN*

GEANT simulations : *INFN*

CPR2/CCR assembly and installation : ANL, *INFN* , KCHEP, MSU, Rockefeller, FNAL

Signal cables & transition cards : ANL

PMTs : Tsukuba

PMT boxes & optical cables : MSU

Scintillator Tiles : Dubna & *INFN*

UPGRADE_PEOPLE

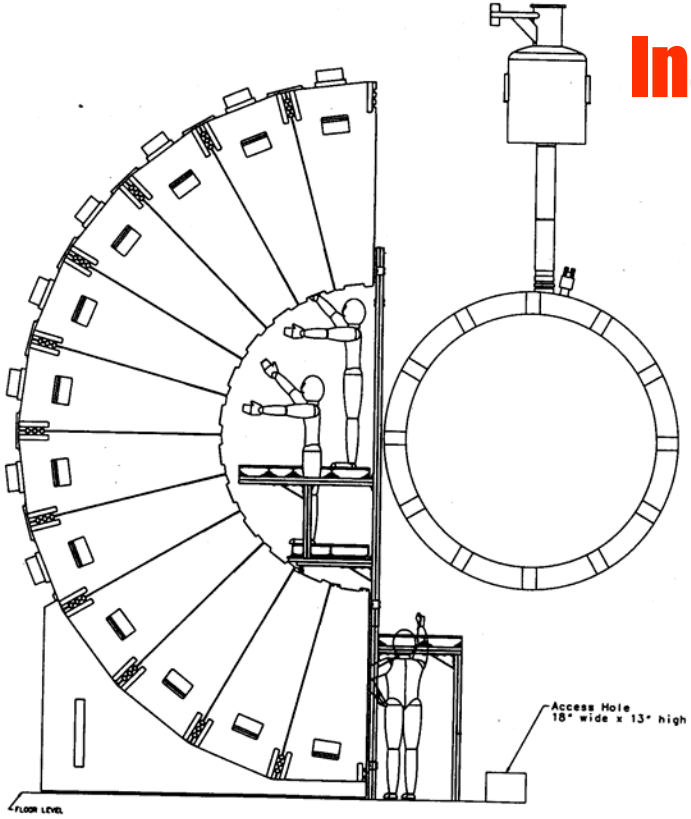
INFN Pisa (7 tecnici per un totale di 4 MU tra assembl. e montaggio)
S. Lami A. Menzione
R. Paoletti A. Scribano
N. Turini M. Giunta

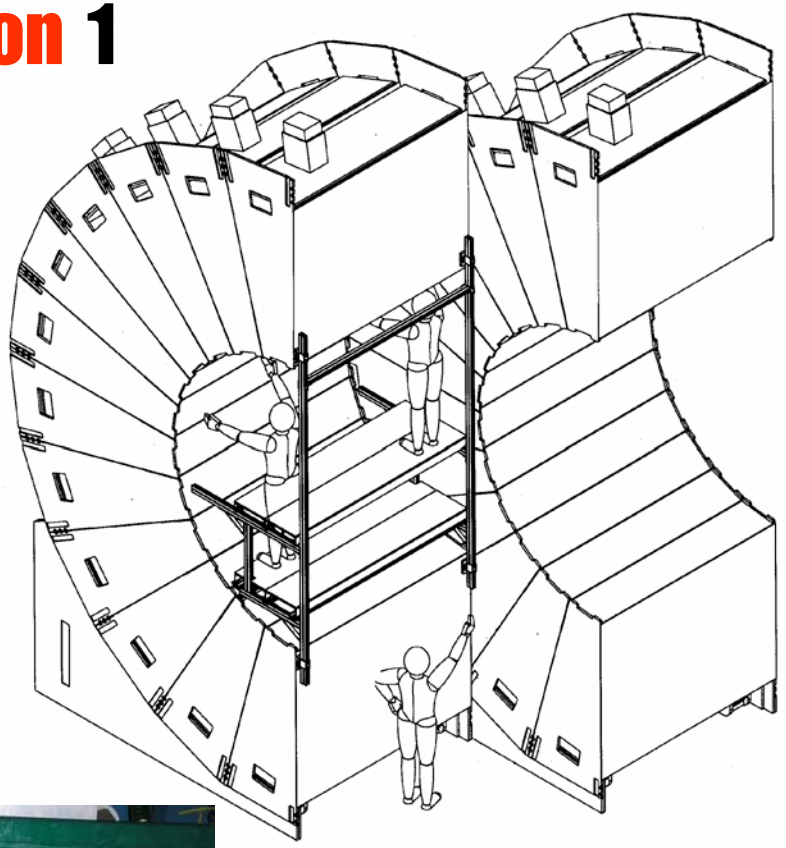
Univ. Roma 1 (1 tecnico per un totale di circa 1 MU tra assembl. e montaggio)
M. Iori

INFN Pavia
G. Introzzi

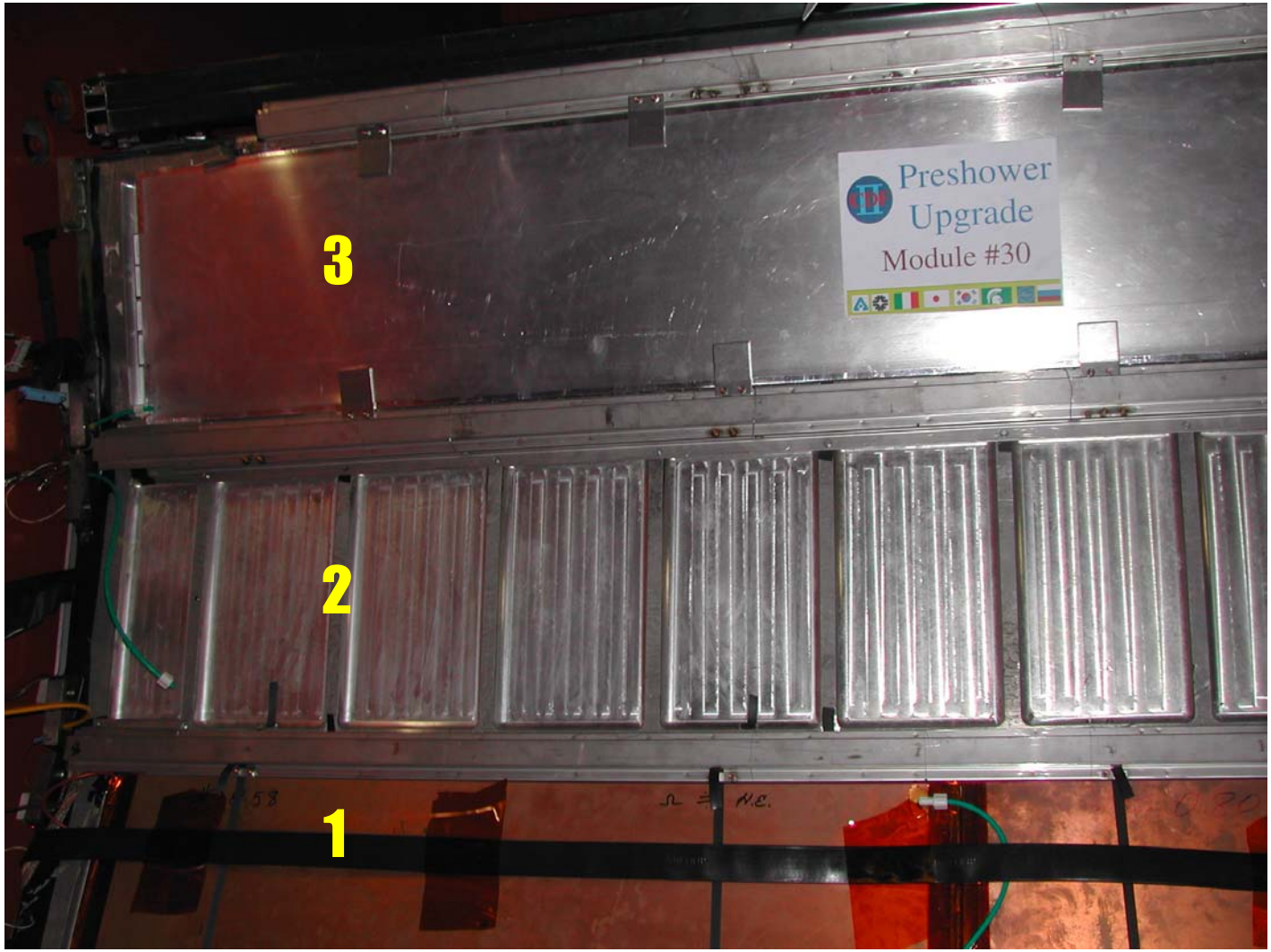
Univ. Trieste & Udine (3 tecnici per un tot. di 2 MU tra assembl. e montaggio)
A. Penzo G. Pauletta

Installation 1

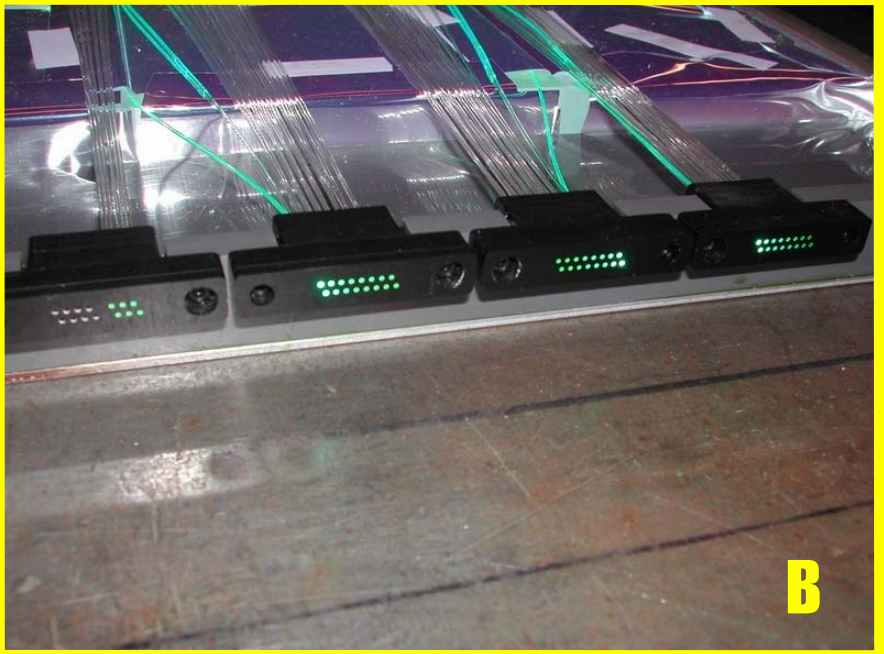


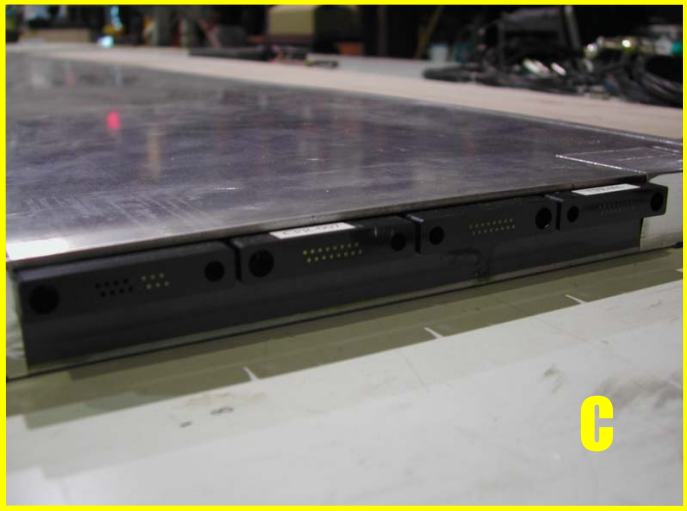


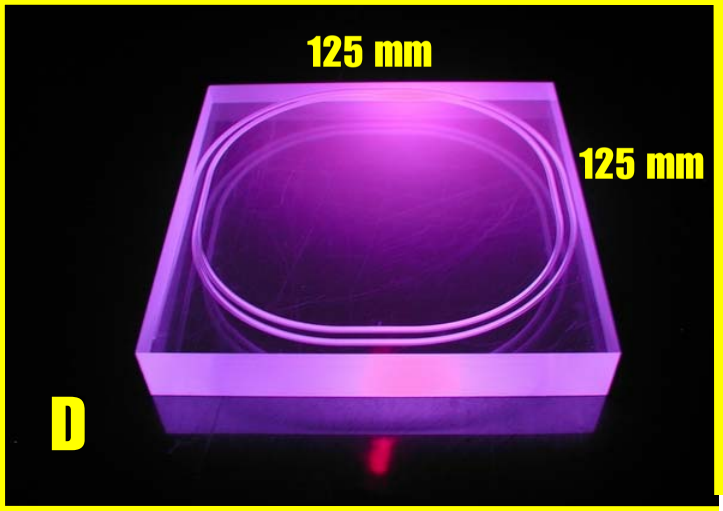
Installation 2



CPR2 detector :: photos

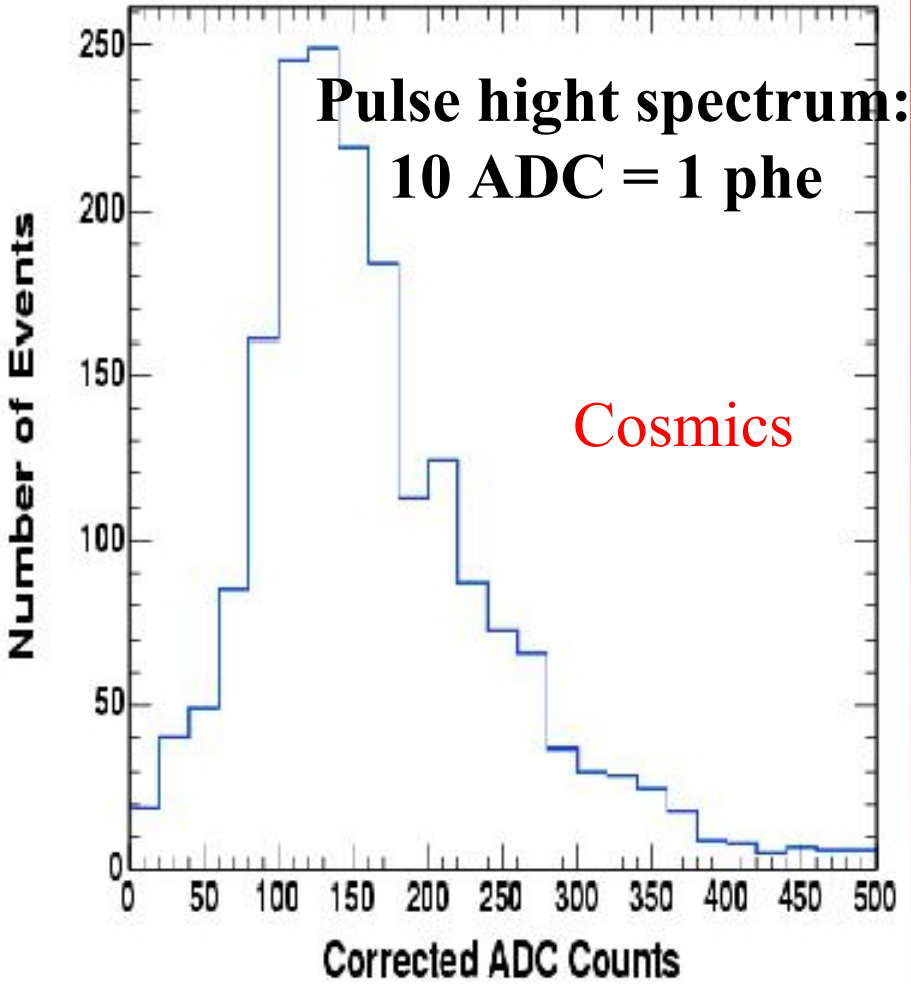






NEW CPR

Delivered Photoelectrons

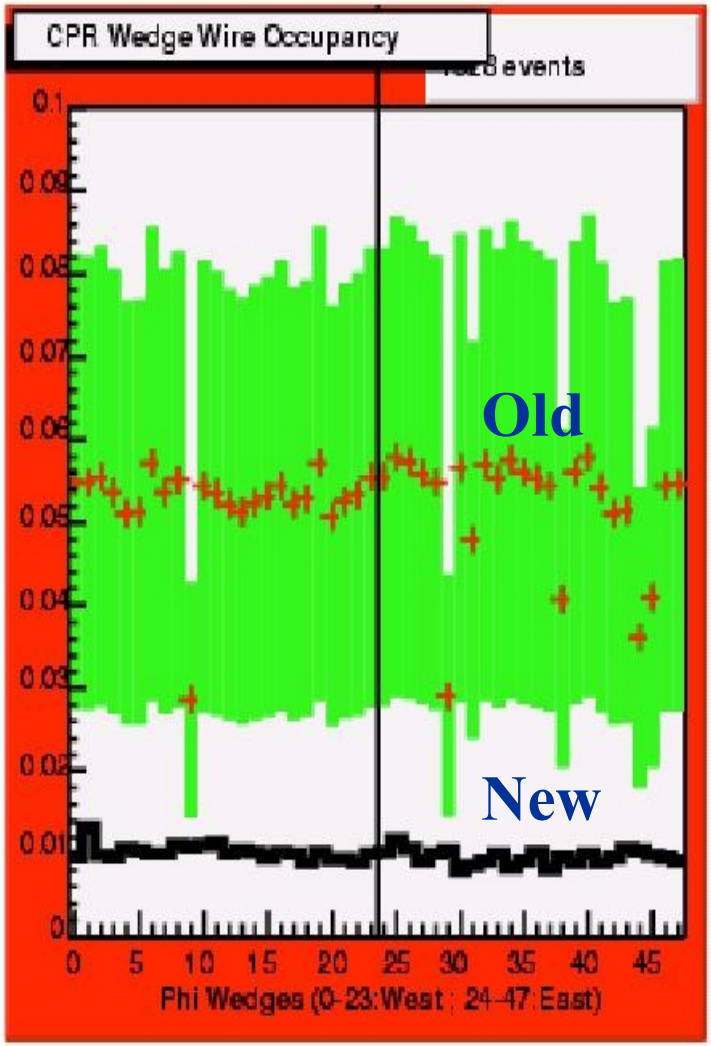


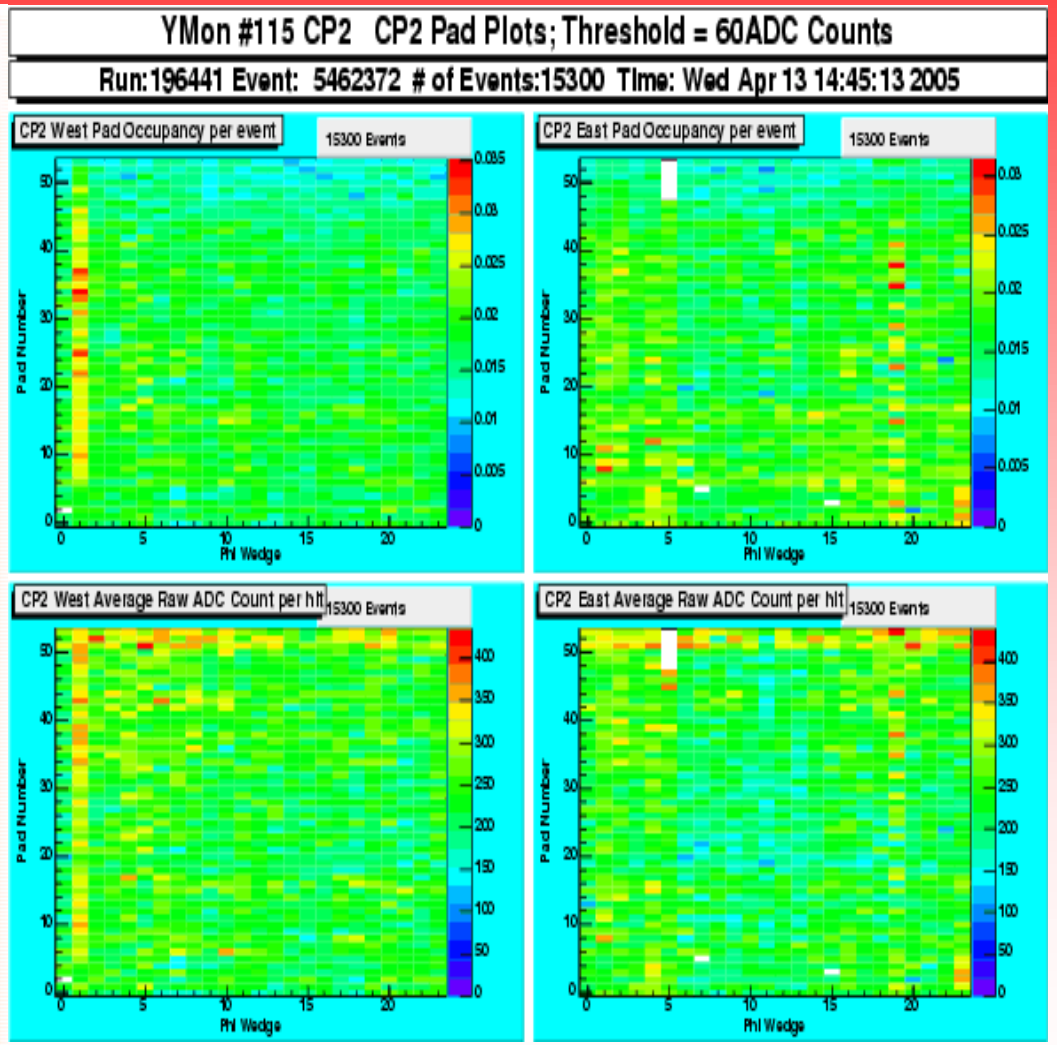
- Specification for phe delivery was to get at least 5 phe/MIP

- After scintillatior, green fiber (glued for farest tiles), splicing, clear fibers, cables, PMT we get in average ~ 14 phe/MIP

Occupancy

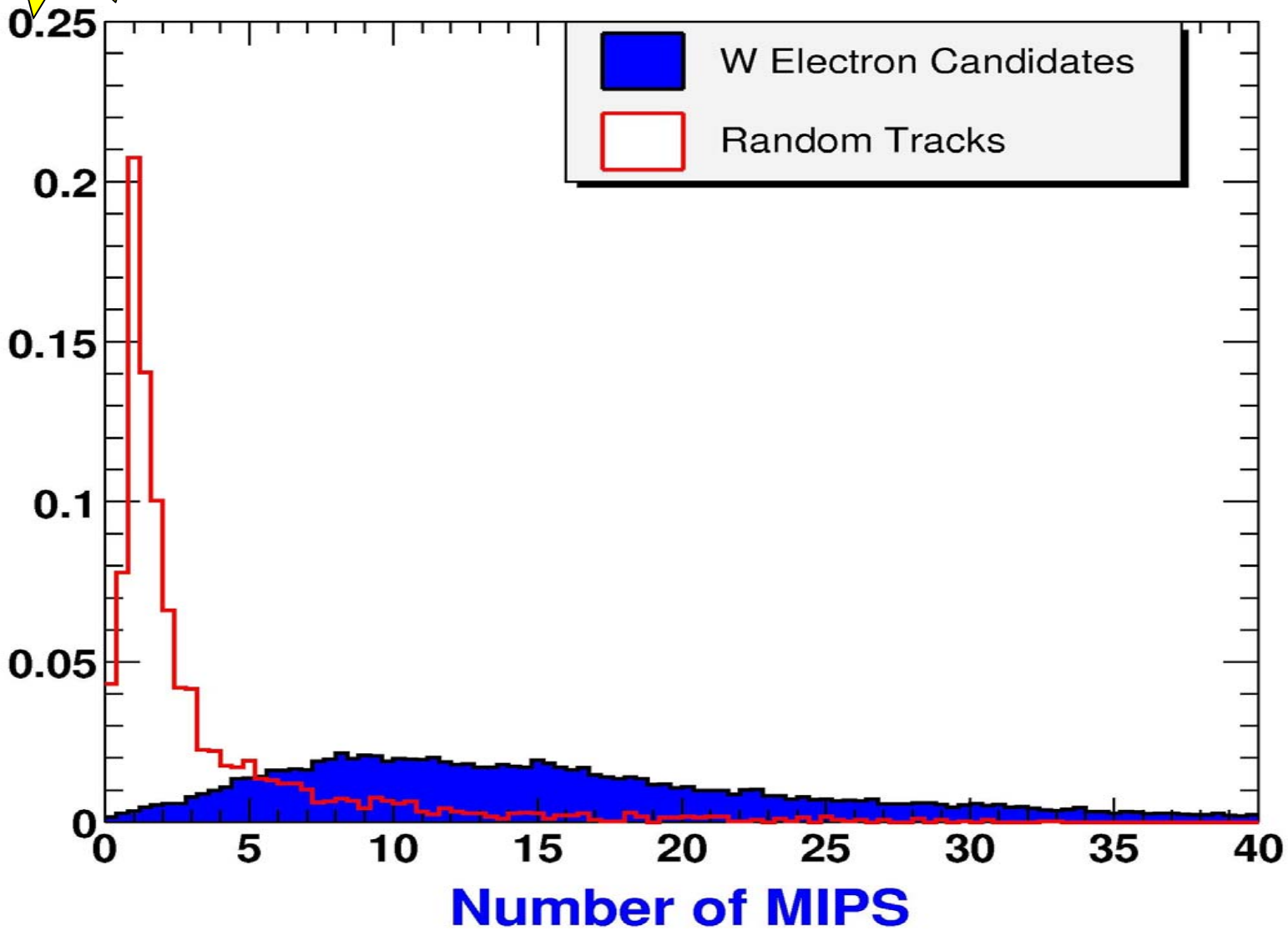
NEW CPR





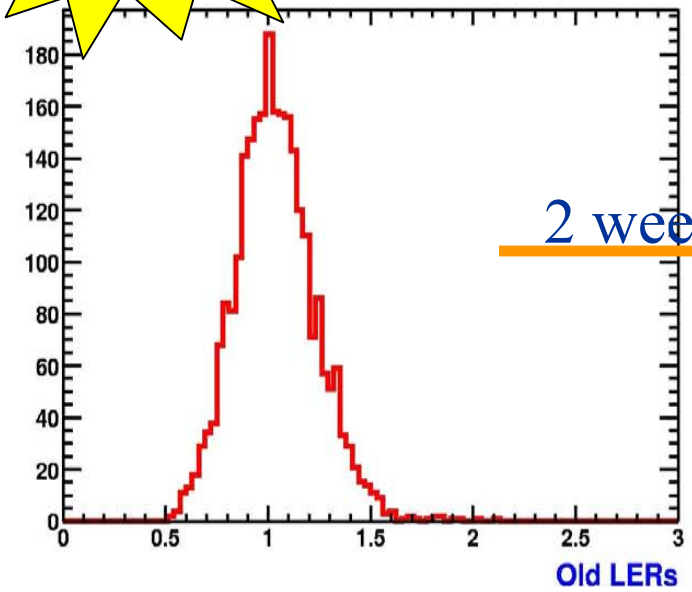
NEW CPR

e/π separation

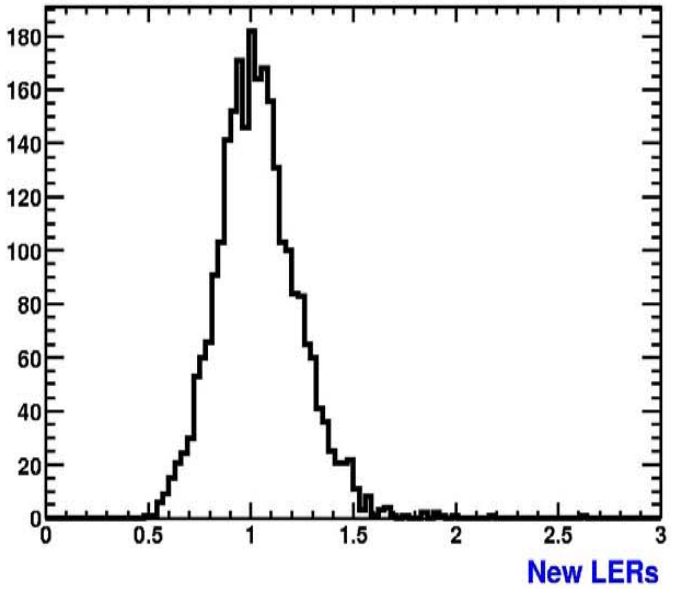


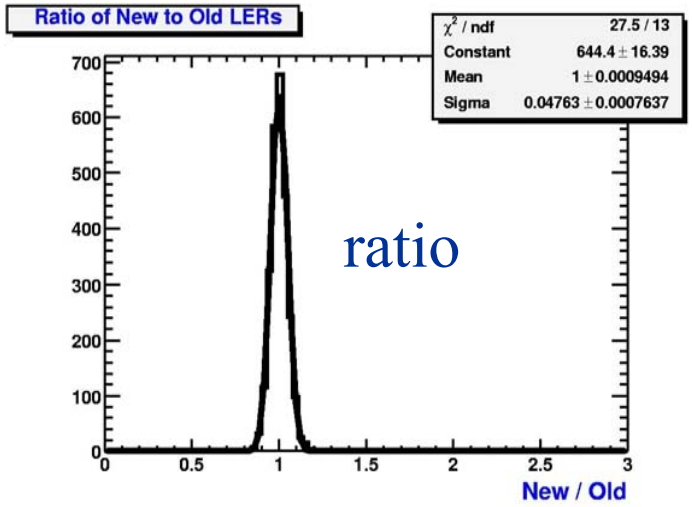
Linear Energy Response channel equalisation for tile gain

NEW CPR



2 weeks





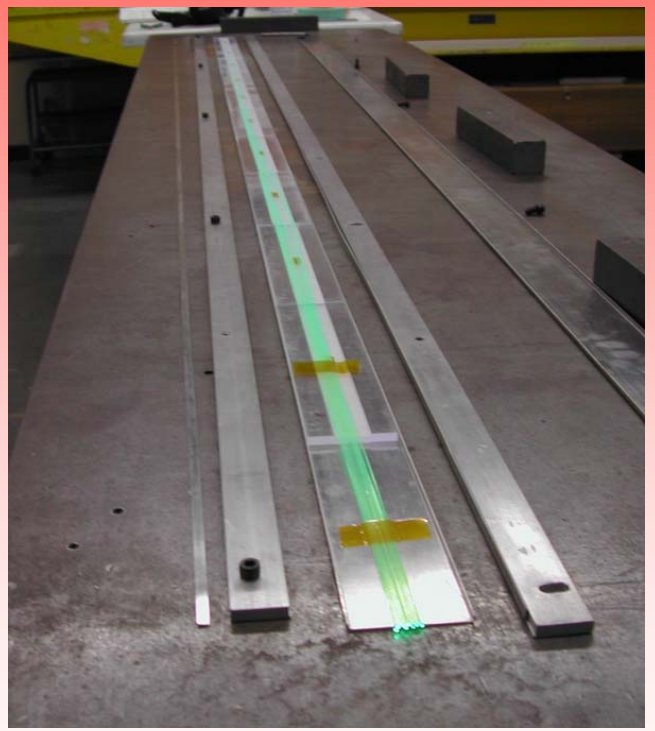
ratio

The End

BK slides begin now

New_CCR

<u>Crack Detector</u> detects photons in cracks (8% of ϕ coverage) that generates "fake" missing energy.



- Scintillator-based, has 1 tile / CEM tower.
- Each CCR module has 225 x 50 x 5 mm tiles
- Uses the same tungsten bar (8.5 X_0).
- 80% of 50 GeV electrons energy from test-beam is lost in coil+tungsten bar
- <u>Not yet calibrated nor simulated</u> (CPR2 had priority in commissioning)

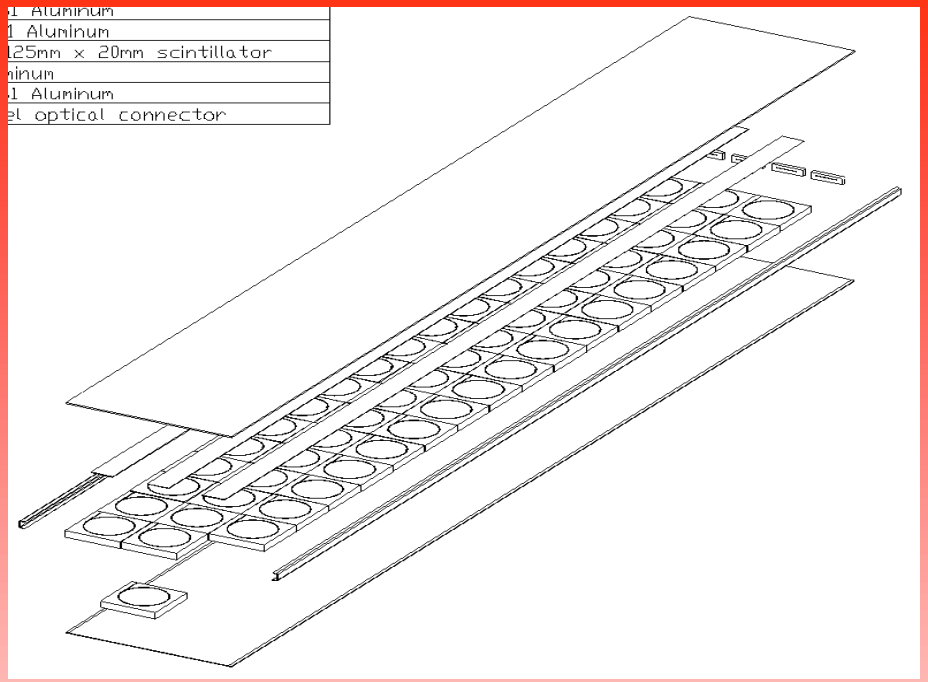
CPR2 Overview

Total n. of channels = **3,072**

CPR tile: 12.5 x 12.5 x 2 cm

⇨ 2x3 (η–ϕ)/tower

TILES	Wedge	Total
CPR	54	2,592
CCR	10	480

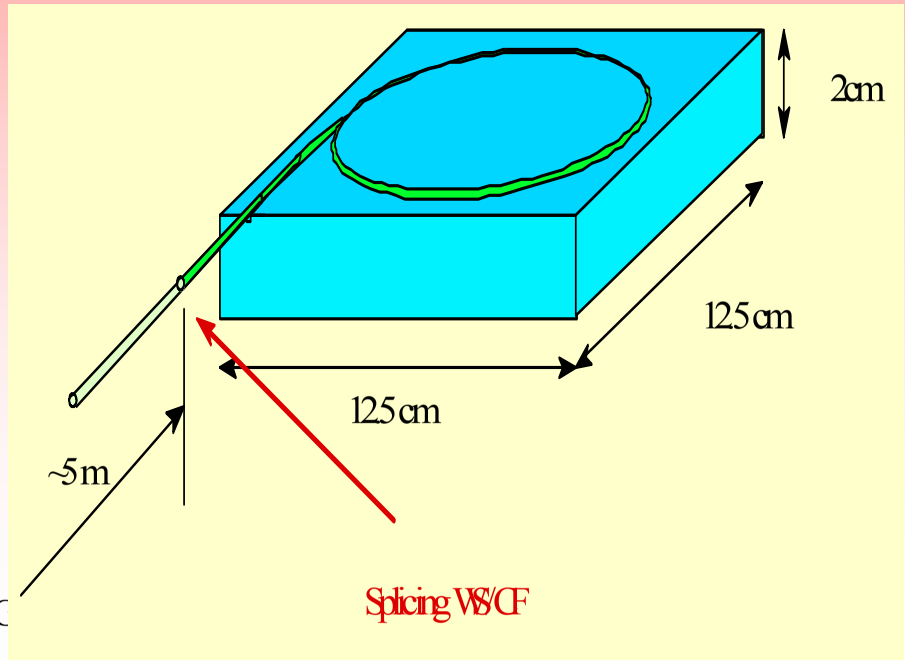


Photomultipliers

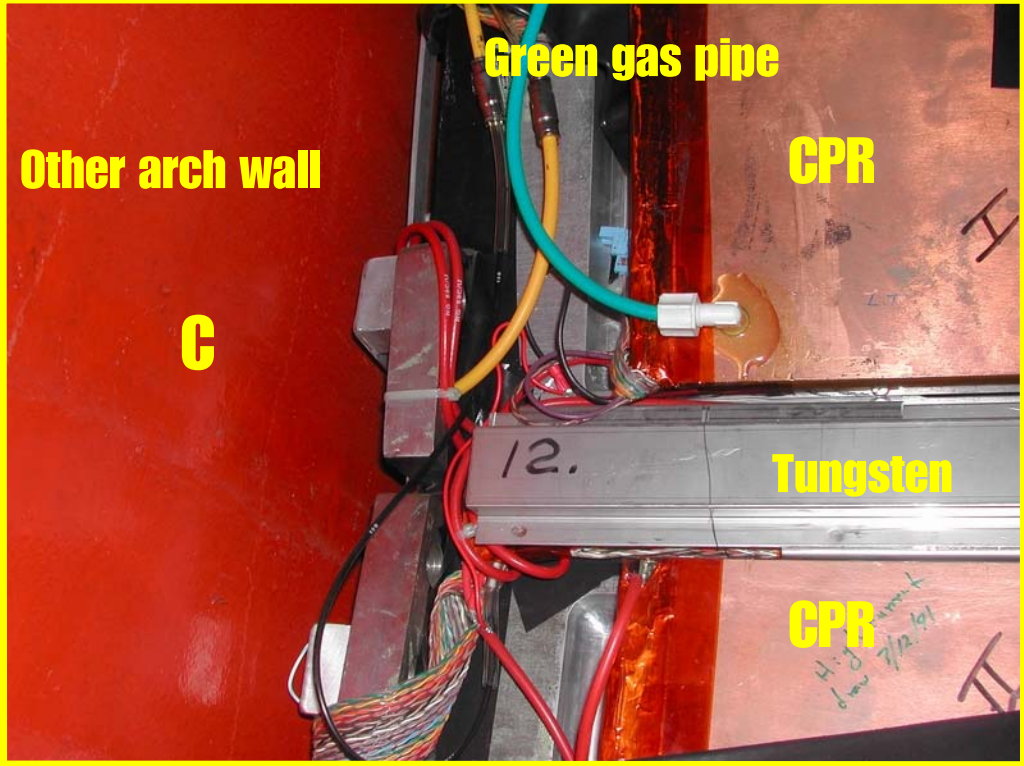
- 16 channels per PMT (R5900)
- 192 HV channels
- CAEN HV SY527

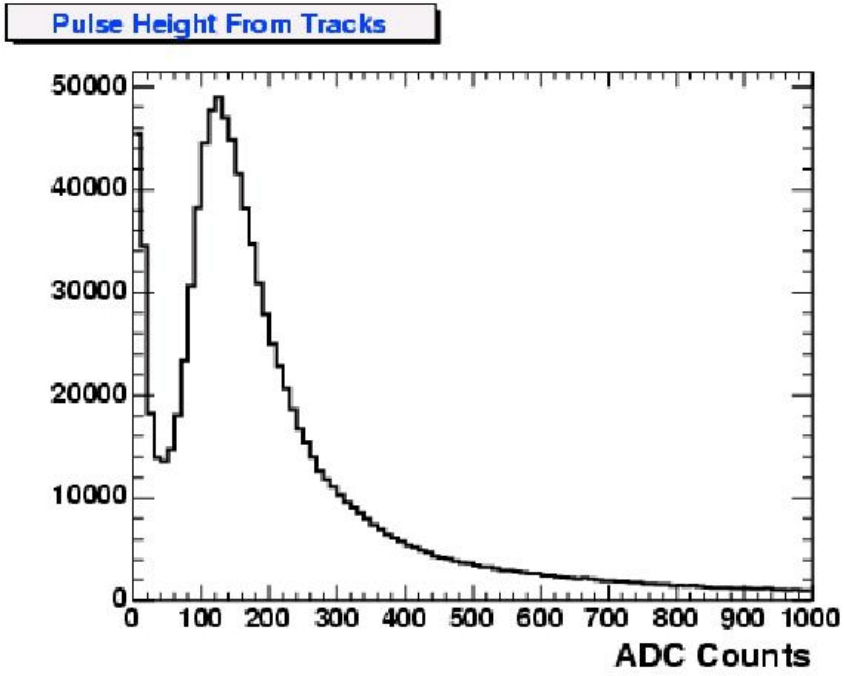
WLS fiber into groove, spliced to clear fiber at tile exit, routed to optical connector

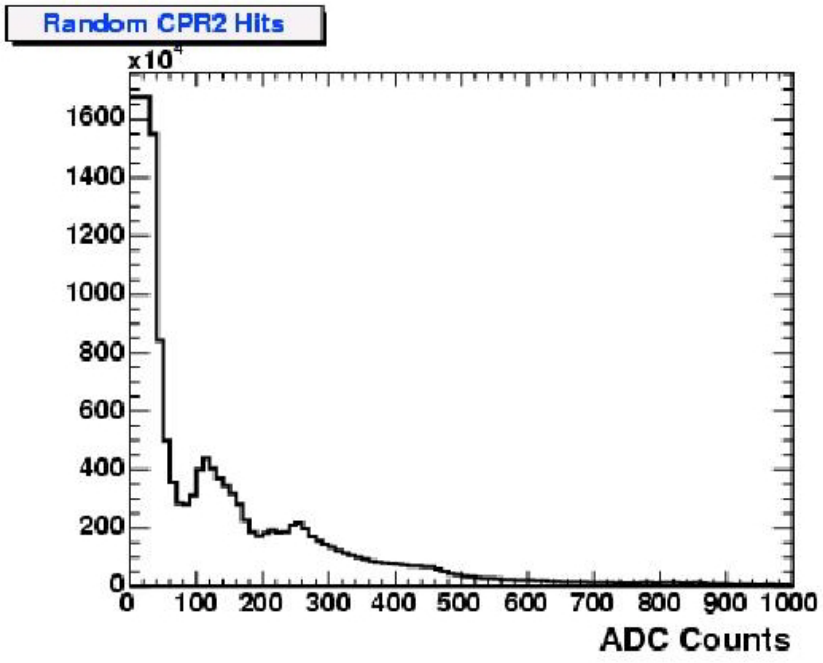
Specs want CPR to give **>5** pe per MIP at PMT (>10 pe at tile exit due to splicing + connector + 5m clear fiber) **We get 16,**



The OLD CPR detector




Pulse Height From Tracks
50000
40000
30000
20000
10000
0
0 100 200 300 400 500 600 700 800 900 1000
ADC Counts

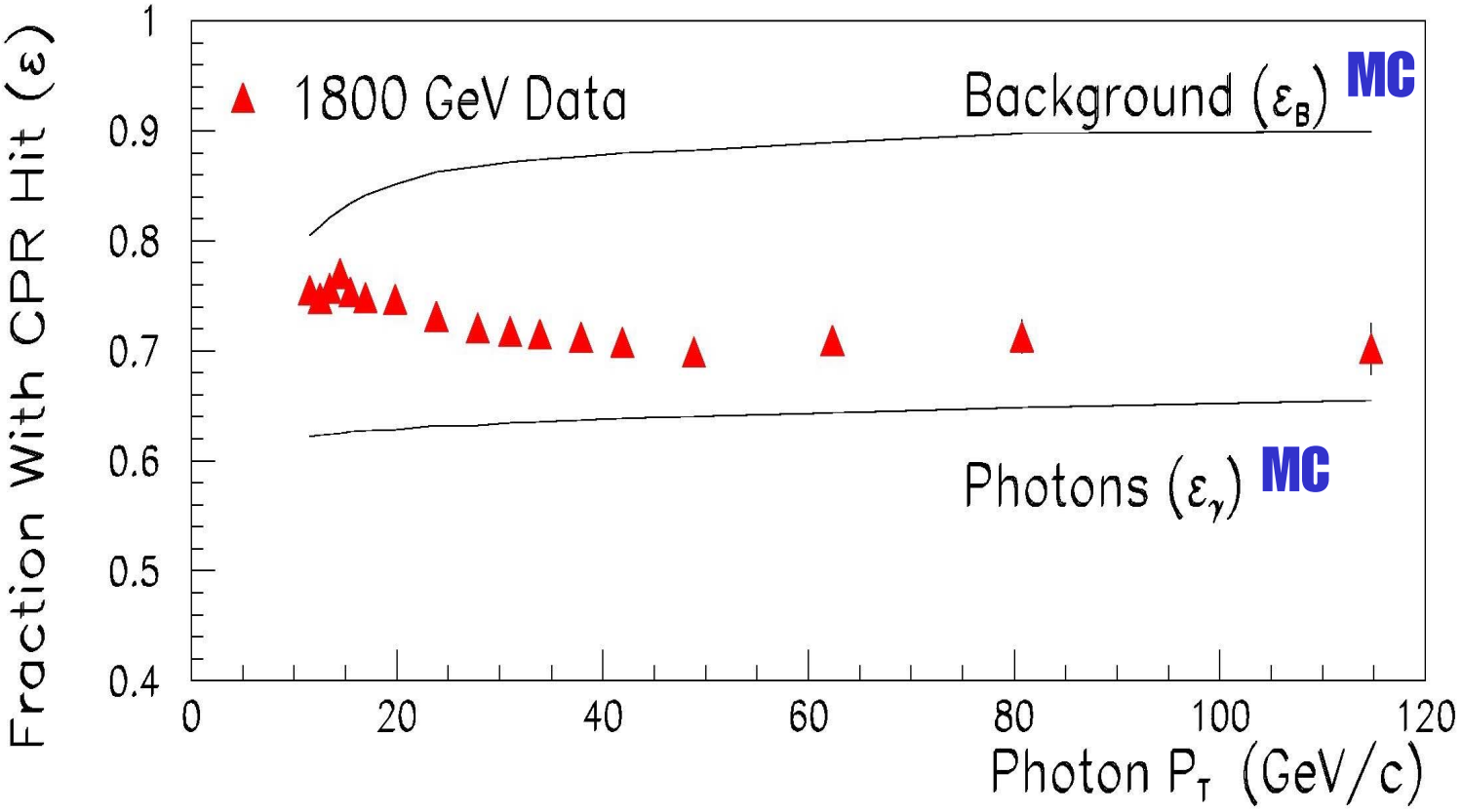

Random CPR2 Hits
x10
1600
1400
1200
1000
800
600
400
200
0
0 100 200 300 400 500 600 700 800 900 1000
ADC Counts

CPR2 _ Calibration_1

LERS: (linear energy response)

Equalizes tiles for uniform output to same signal

Absolute calibration: done, but there is no analisys using CPR2 because Production is not yet updated.

Eache tile il easily calibrated with MIP in 5 minutes of collider data.

γ/π_0 separation