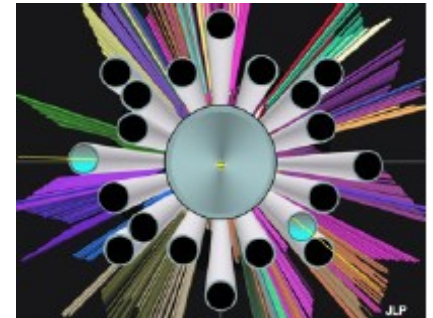




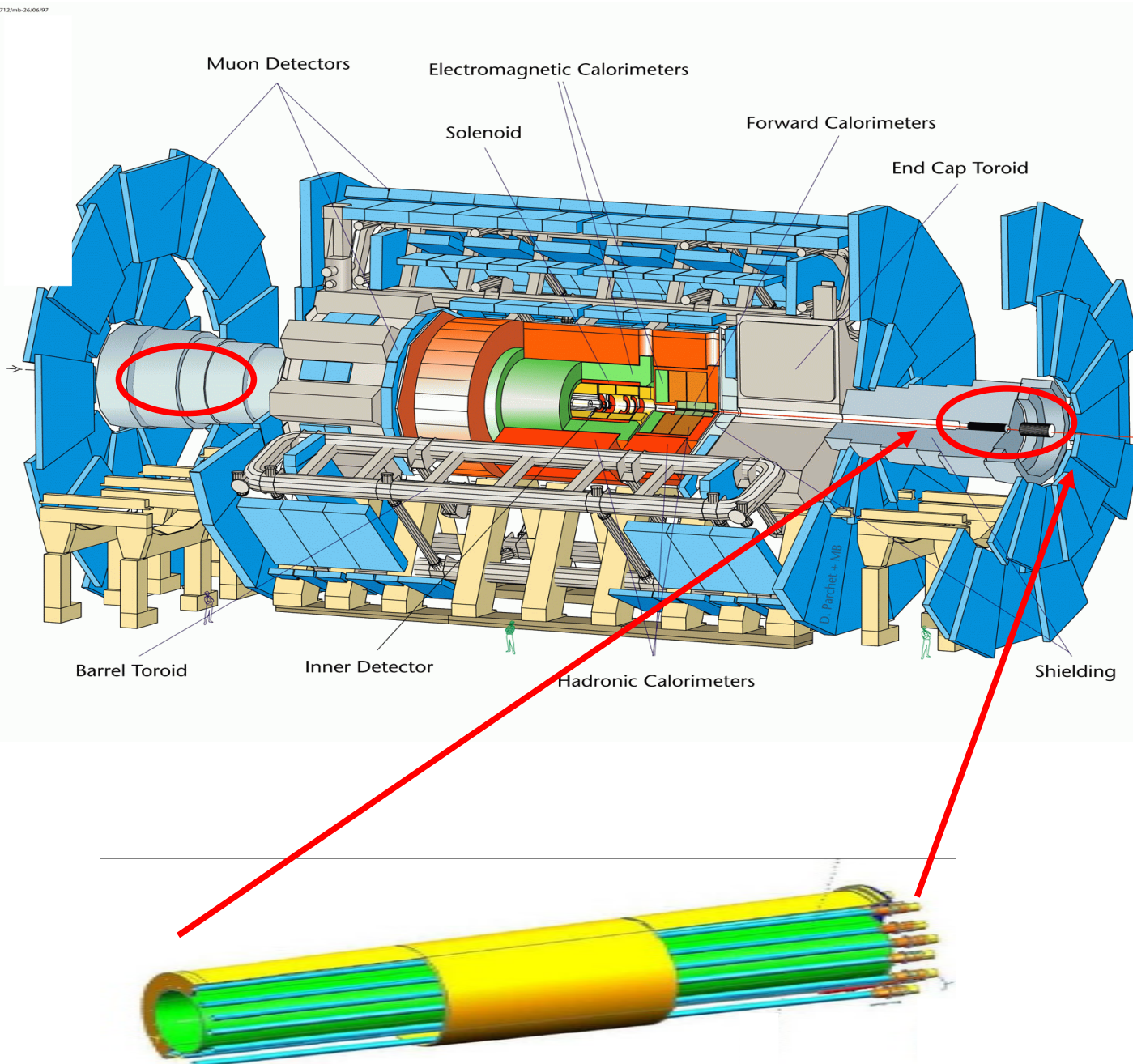
TEST SU FASCIO DEL LUMINOMETRO LUCID DI ATLAS

RISULTATI PRELIMINARI



- Descrizione del luminometro LUCID di ATLAS
- Test su fascio del luminometro
 - Motivazioni
 - Set up sperimentale
 - Analisi dei dati
- Conclusioni

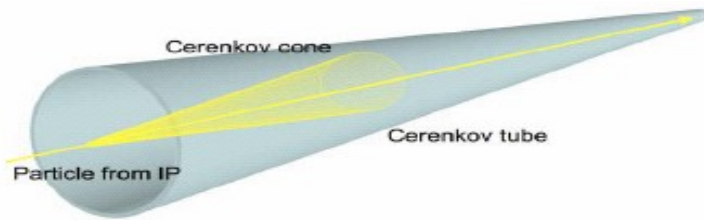
LUCID IN ATLAS



LUCID Luminosity measurements using Cherenkov Integrating Detector

- Forward detector ad effetto Cherenkov
- 2 moduli a 17 m di distanza dal punto di interazione a 20 cm dalla linea di fascio
- Sensibile a particelle **cariche** originate dalla collisione primaria pp
- Ideato per misurare luminosità fino
 $L \sim 4 \cdot 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

FUNZIONAMENTO DEL LUCID

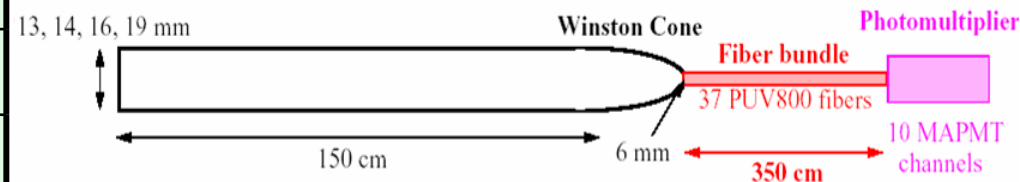
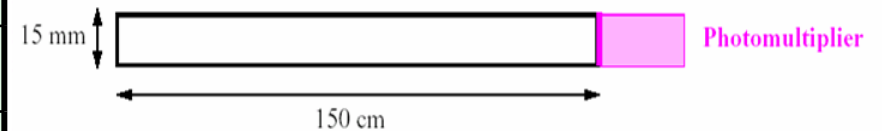
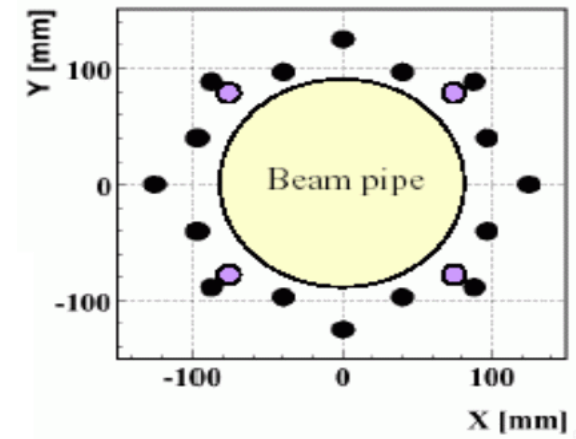


$$N_{p.e.} = N_0 \cdot L \cdot \sin^2 \theta_c$$

$$N_0 = 370 \text{ cm}^{-1} \text{ eV}^{-1} \int \epsilon_{coll}(E) \epsilon_{PMT}(E) dE$$

Principali caratteristiche

η (pseudo rapidità)	$\pm[5.6, 5.9]$
N. Tubi	20
Materiale	Mechanic. polished Al
Gas	C ₄ F ₁₀ (n=1.00137)
Pressione	1.1-1.5 bar
Angolo cherenkov	$\sim 3^\circ$
<N. riflessioni>	3
Soglia	e ⁻ : 10 MeV p: 2.8 GeV
Durata segnale	2 - 10 ns
Read-out	16 PMT + 4 fibre
Dose rad. attesa	7 Mrad/y @ $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$



TEST SU FASCIO

- Effettuato a Luglio 2009 presso il CERN (~ 80 M eventi acquisiti)
- Dati acquisiti:
 - diversi tipi di gas (C₄F₁₀, Azoto, Isobutano)
studiare le sistematiche sulla dipendenza dal gas
 - diversi valori di pressione
studiare le sistematiche per il confronto con le simulazioni
 - diversi valori dell'angolo di incidenza
studiare la risposta del LUCID per particelle primarie e secondarie
 - calibrazione dei PMT e dei tubi
verifica della stabilità dei valori trovati con caratterizzazione su banco

SET UP

Trigger

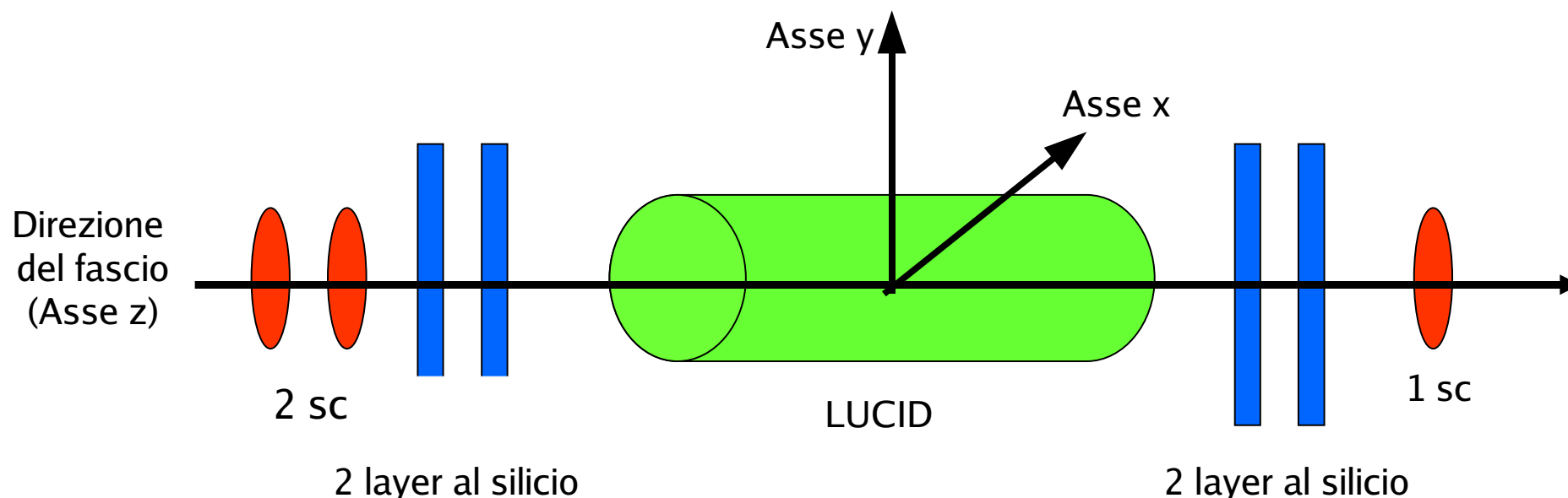
3 scintillatori plastici (forma circolare 20 mm diametro) in coincidenza

Tracciamento del fascio

4 layer di micro strip di silicio traccianti su entrambi i lati (50 μm passo)
(Collaborazione con SLIM5)

Rivelatore tracciante sottile: no scattering multiplo

Altamente performante studiato per nuove applicazioni (SuperB)



SET UP

Set up del Detector

LUCID con 7 tubi

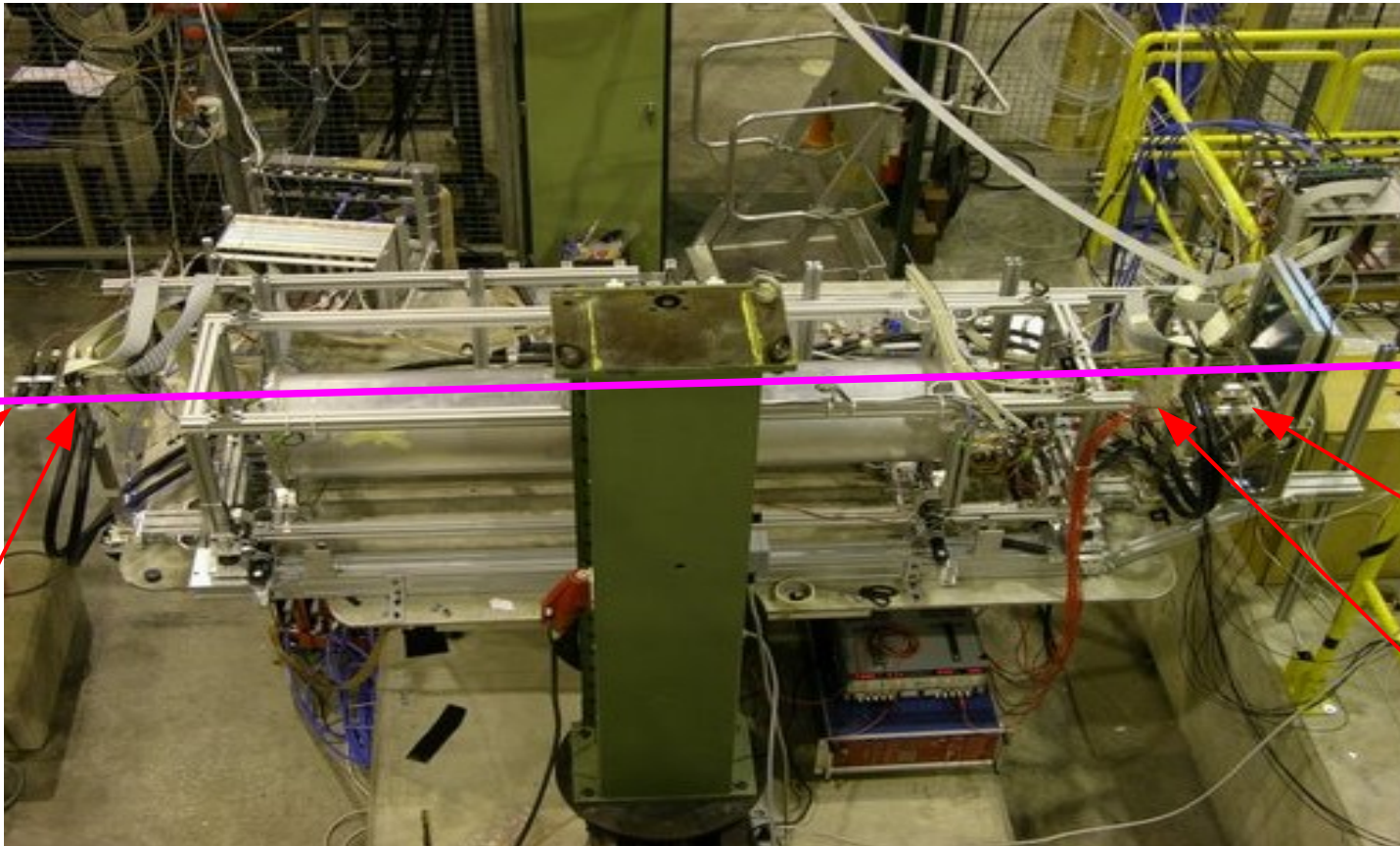
- 3 come quelli installati in Atlas
- 1 non lucidato internamente
- 1 rivestito internamente di mylar
- 1 meccanicamente polished
- 1 con bacchetta di quarzo (6 mm diametro, 30 cm lunghezza)

CERN 1-2-3
CERN RAW
DESY MY
DESY MP
QUARTZ ROD

Fascio

2 sc

2 layer di
silicio



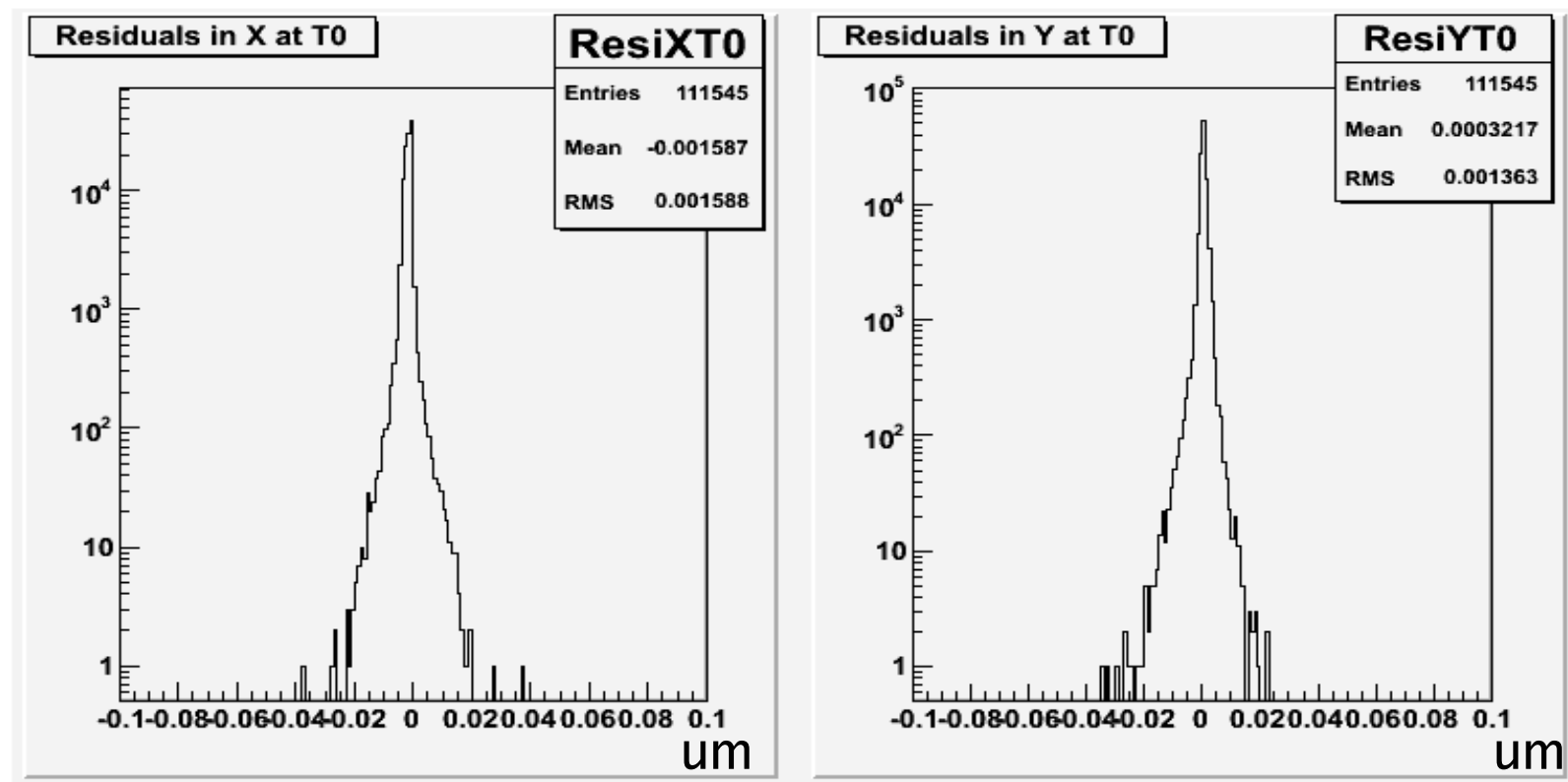
1 sc

2 layer di
silicio 6

TRACCIAMENTO

Tracce ricostruite se è trovato almeno un hit in ogni strato di silicio entro 0.5 mm della regione aspettata

Precisione dell'estrapolazione delle tracce nel LUCID $\sim 20 \mu\text{m}$



- Tracce ricostruite e fittate nei 4 strati di silicio
- Metodo dei residui:

coordinata X fittata nel primo strato di silicio – coordinata X ricostruita
→ informazioni su allineamento e risoluzione (ok per scopi LUCID)⁷

CONDIZIONI DEL FASCIO

Monitor di fascio

Direzione X:
“scatola” di ~ 2 cm di
larghezza

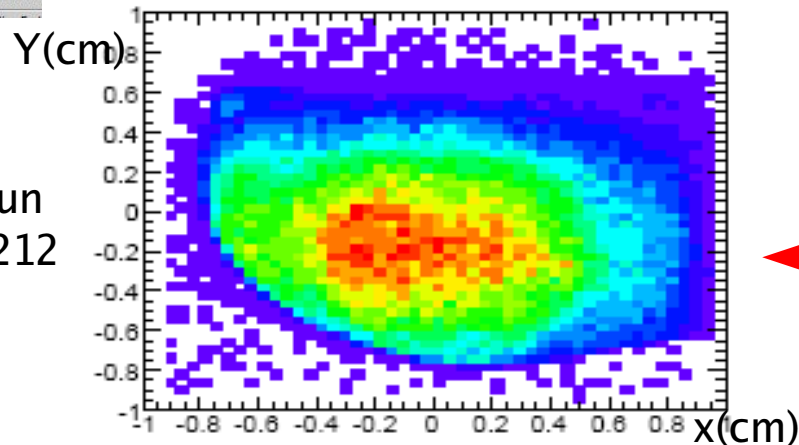
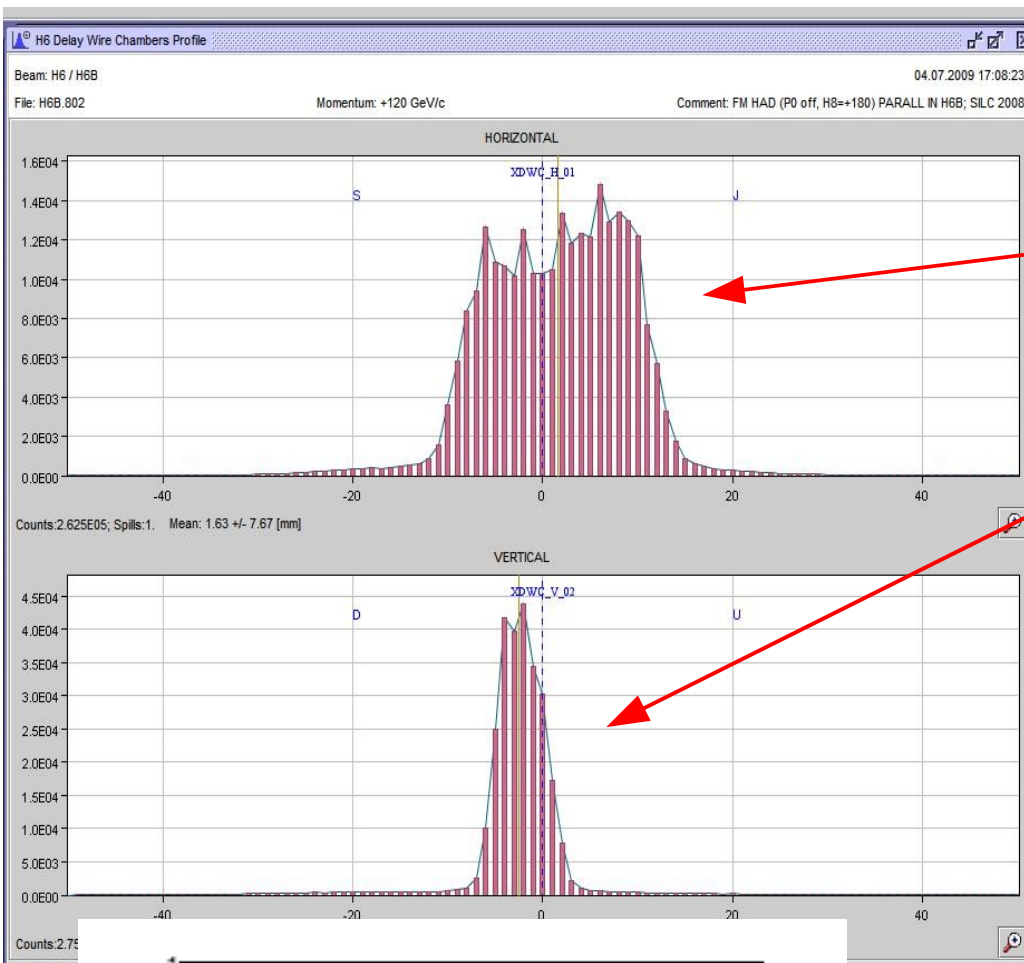
Direzione Y:
“gaussiana” di $\sigma = 5.7$ mm

$\sim 35 \times 10^{11}$ protoni per bunch
dal SPS

$\sim 2.2 \times 10^5$ pioni positivi
da 120 GeV sulla linea H6B

Bunch di 9s ogni 30s

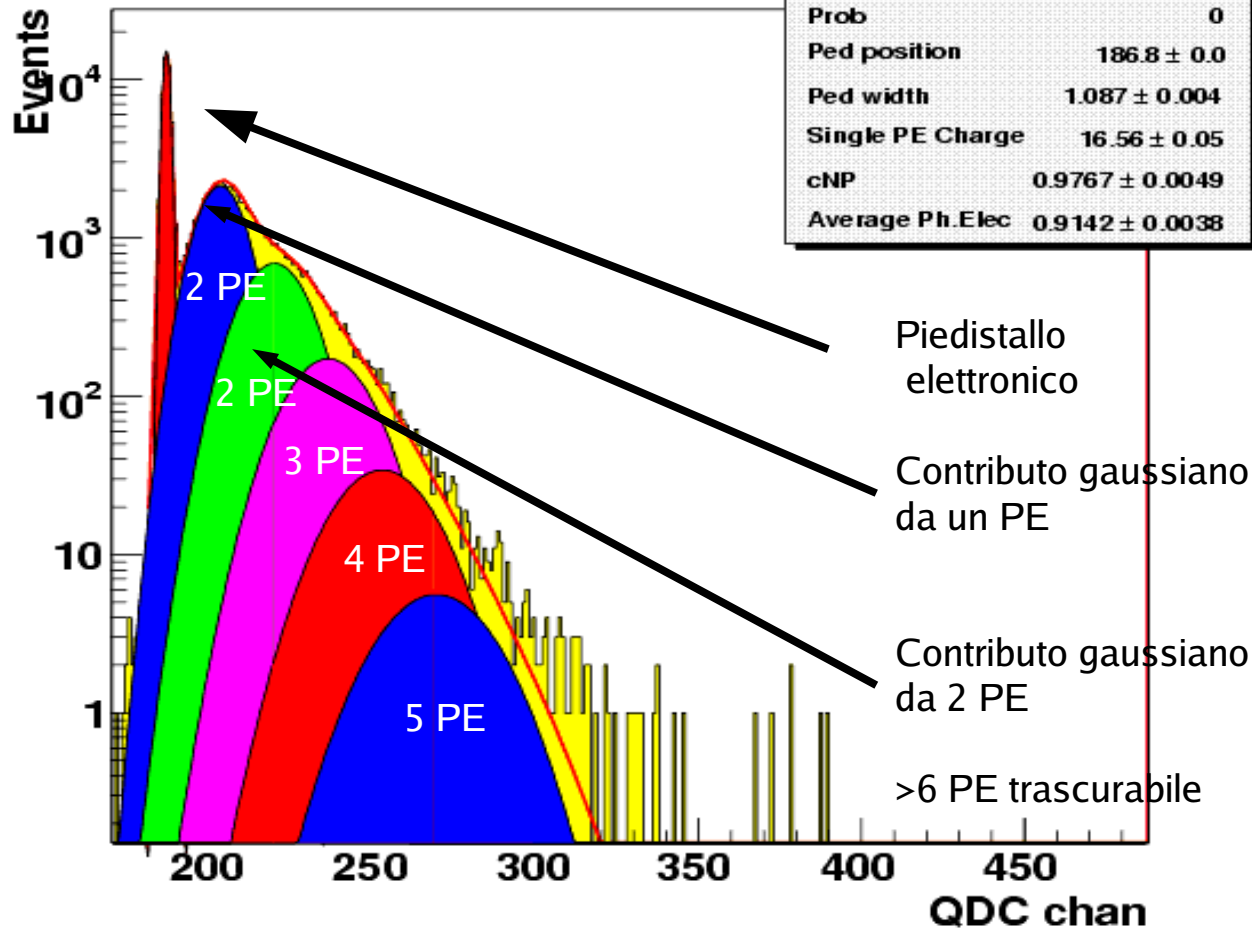
Fascio visto dai layer di
silicio



CALIBRAZIONE PMT

pmt: CERN3 run: 5525

Entries	103120
χ^2 / ndf	686.3 / 150
Prob	0
Ped position	186.8 ± 0.0
Ped width	1.087 ± 0.004
Single PE Charge	16.56 ± 0.05
cNP	0.9767 ± 0.0049
Average Ph.Elec	0.9142 ± 0.0038

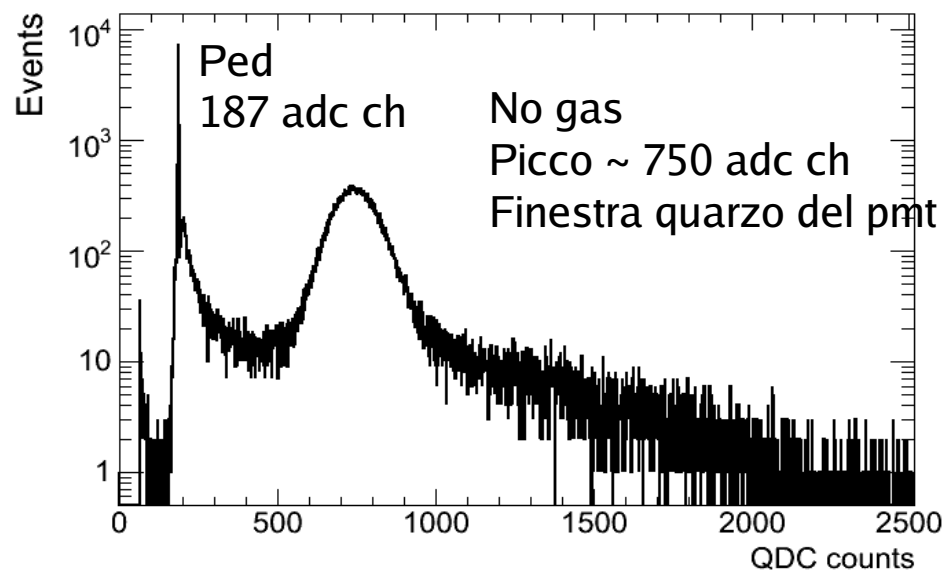


TUBO	CALIBRAZIONE
Cern 1	5.46 ± 0.05
Cern 2	3.63 ± 0.04
Cern 3	16.56 ± 0.05
Cern RAW	3.57 ± 0.04
MY	4.45 ± 0.05
MP	4.71 ± 0.05

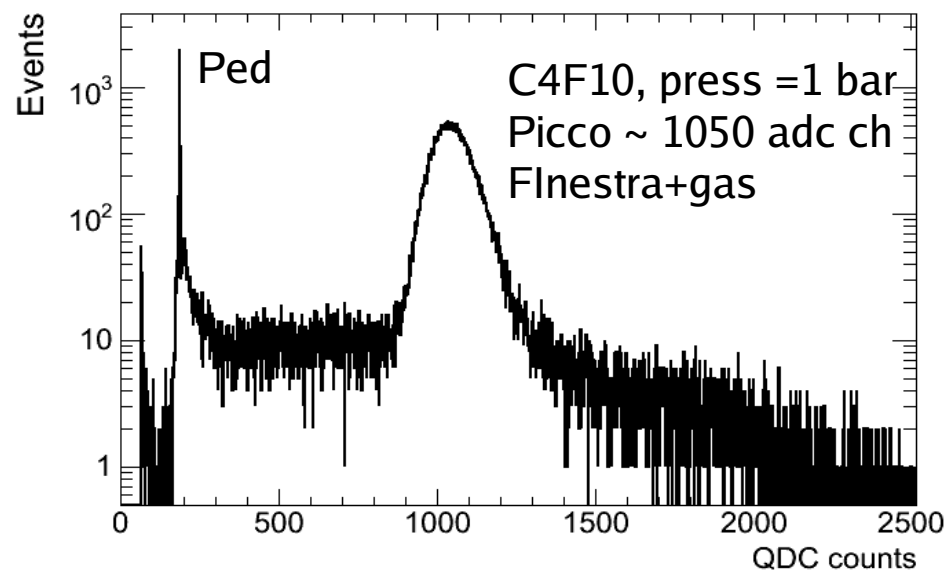
$$S(x) = \underbrace{G_{bk}(Q_0, \sigma_0)}_{\text{Piedistallo gaussiano}} + \underbrace{\sum_{n=0}^{+\infty} \frac{e^{-\mu}}{n!} \mu^n}_{\text{Poissoniana}} * \underbrace{G(Q_{nk}, \sigma_{nk})}_{\text{gaussiane da N PE}}$$

SEGNALI PER DIVERSI GAS

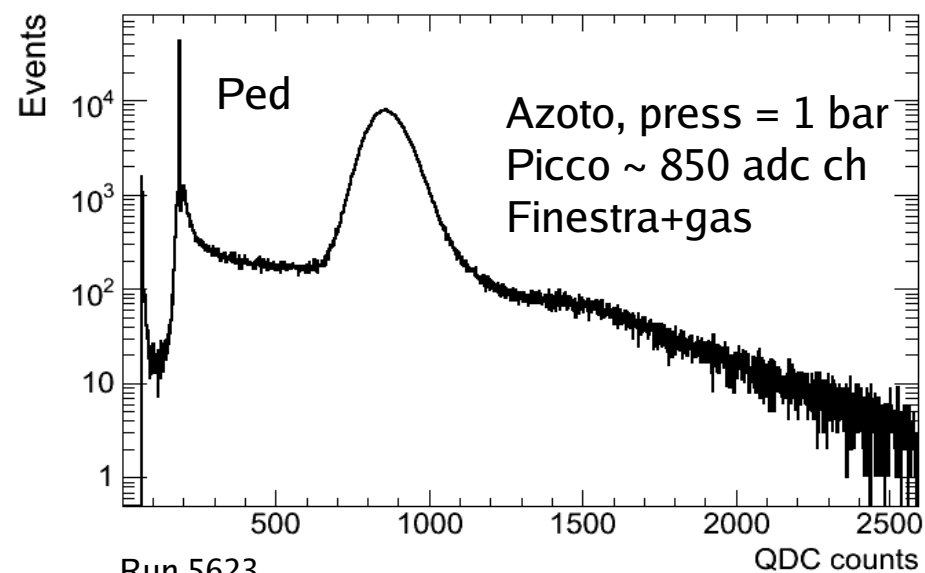
Tubo CERN 3



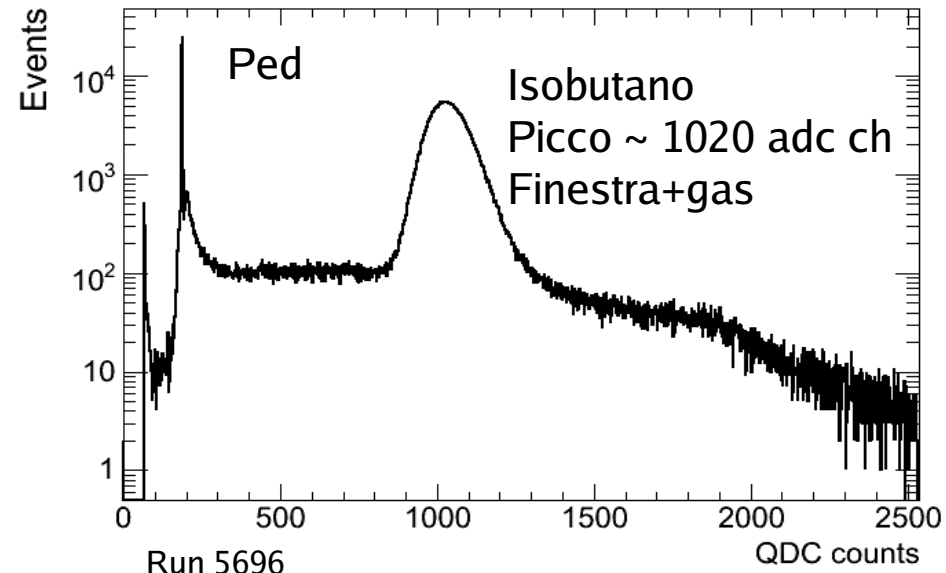
Run 5488



Run 5409



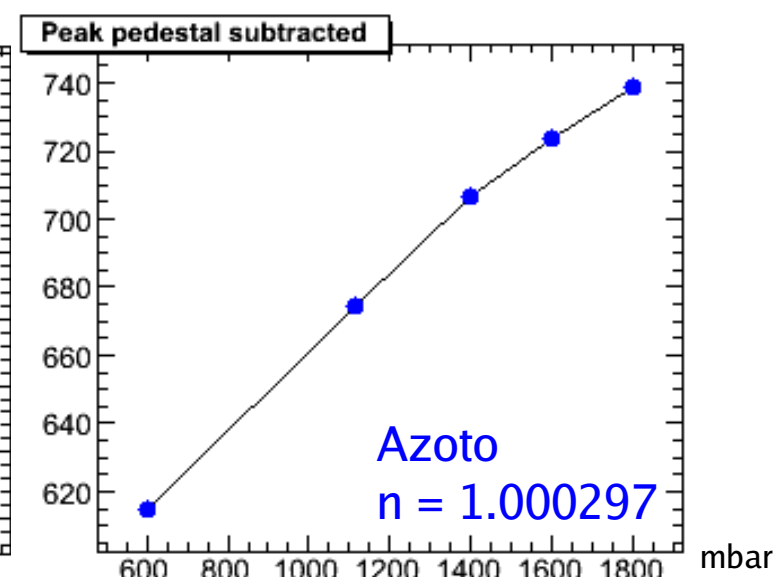
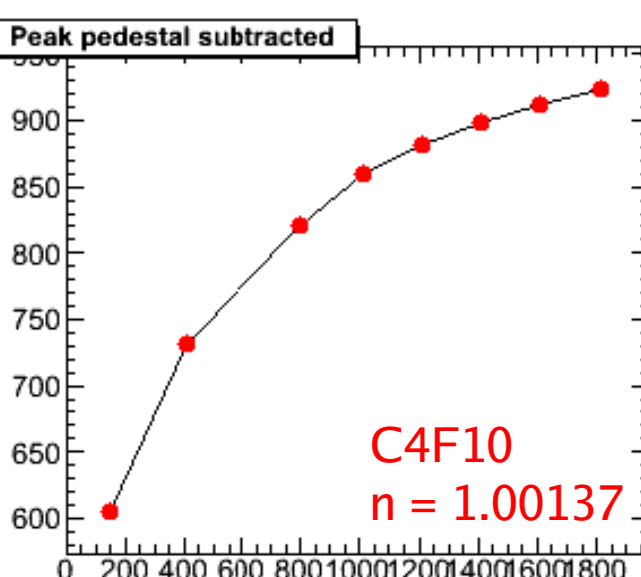
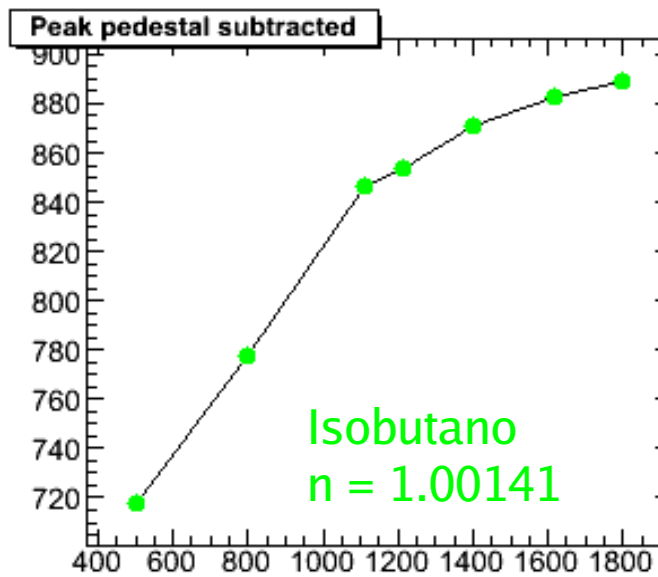
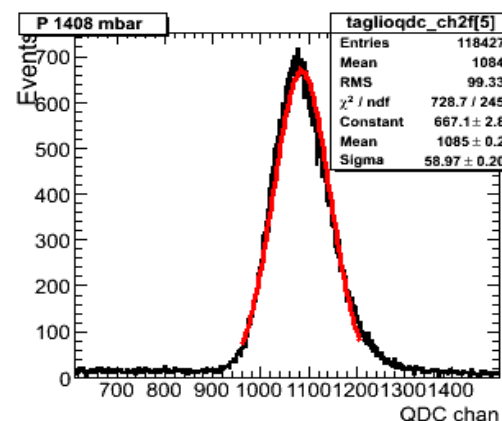
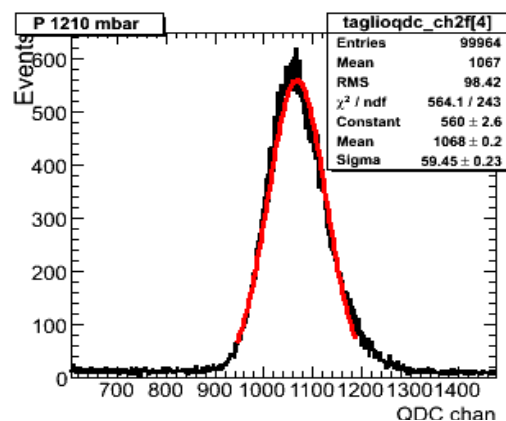
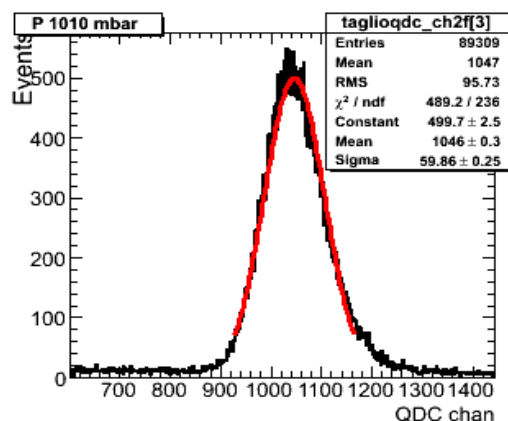
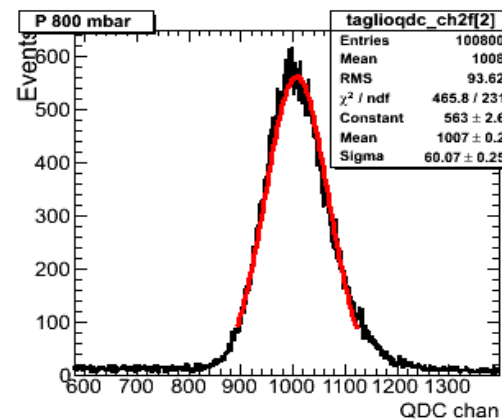
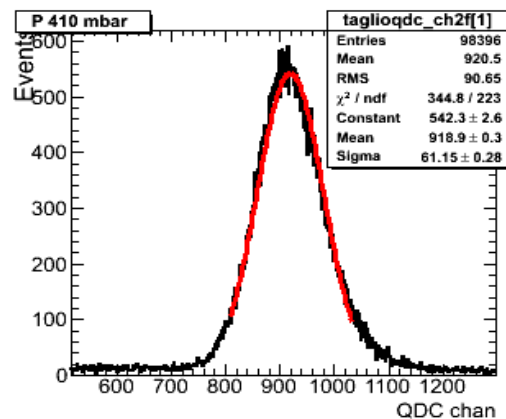
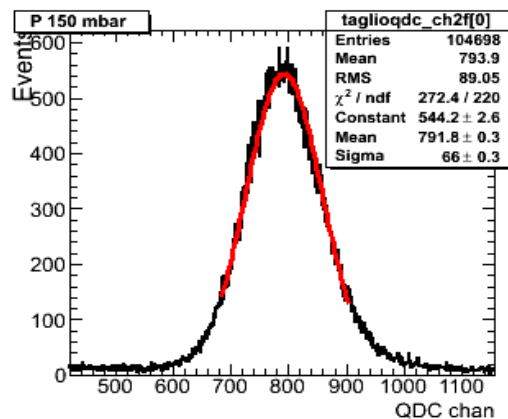
Run 5623



Run 5696

SCAN IN PRESSIONE

Cern 3
C4F10

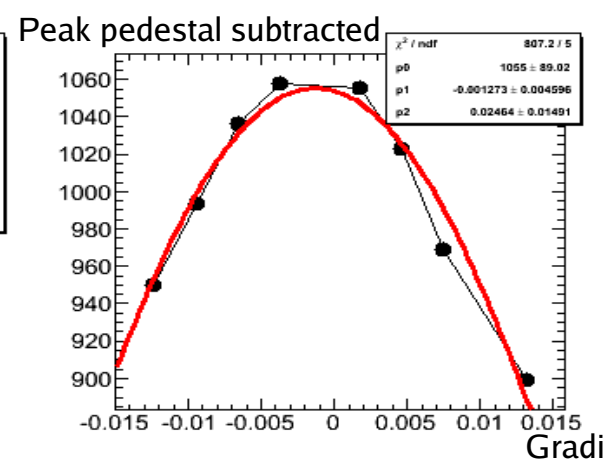
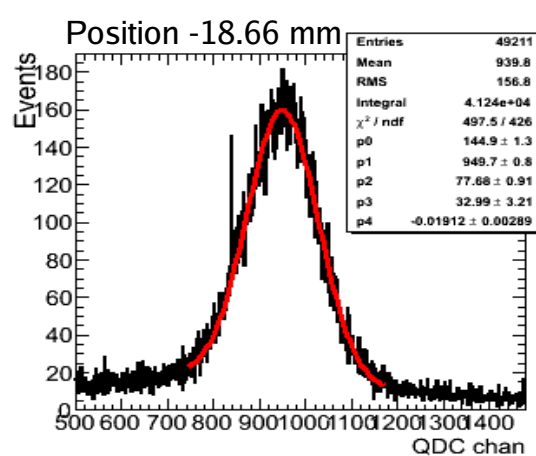
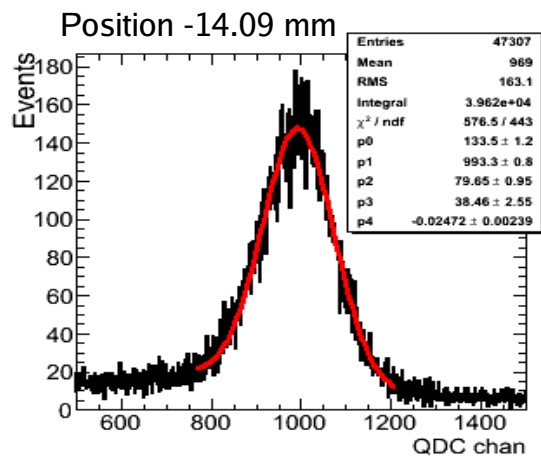
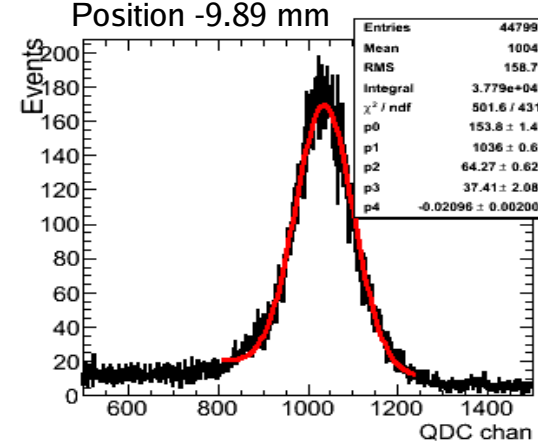
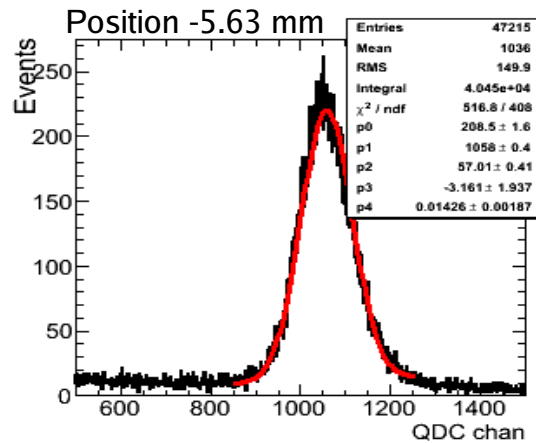
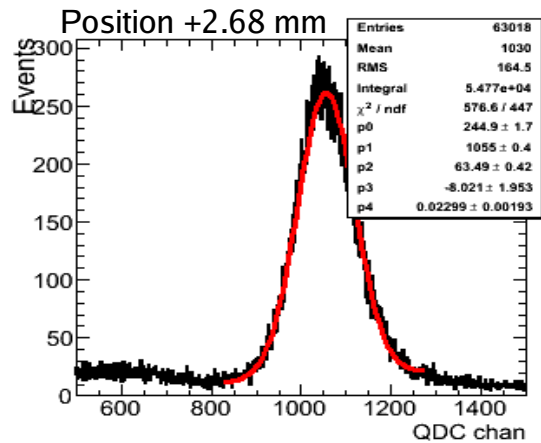
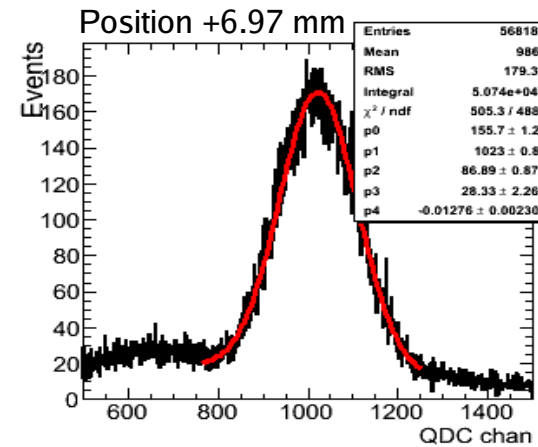
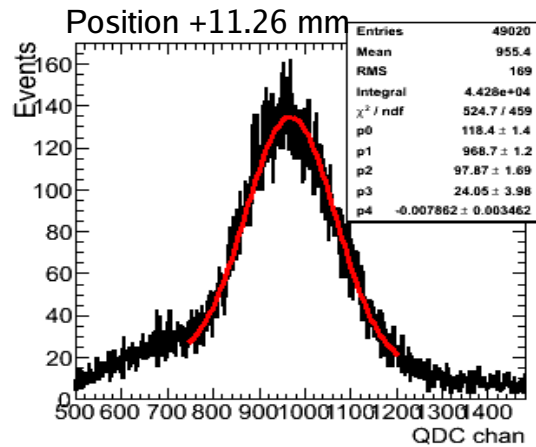
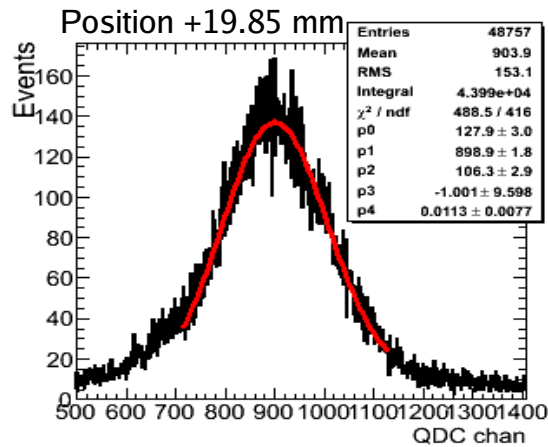


SCAN ANGOLARE

Cern 3

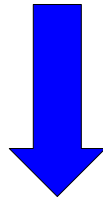
C4F10

P = 1 bar

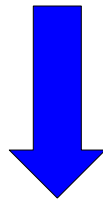


CONCLUSIONI

Effettuato test su fascio del luminometro LUCID di ATLAS
Estesa campagna di misure con diversi tubi e diversi gas



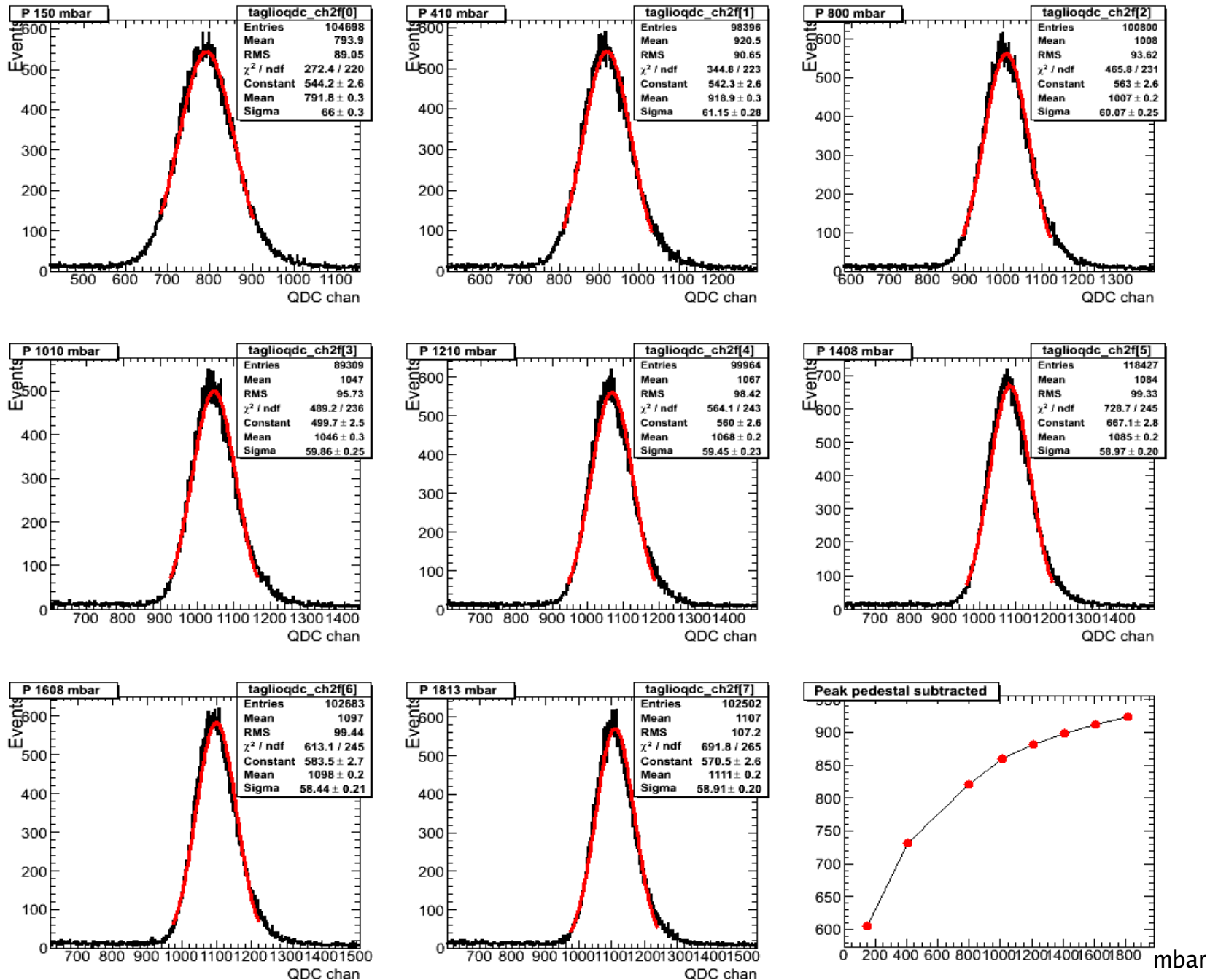
Studio approfondito delle sistematiche in pressione e in angolo in modo da avere un confronto preciso con la simulazione Monte Carlo (studio tuttora in corso)



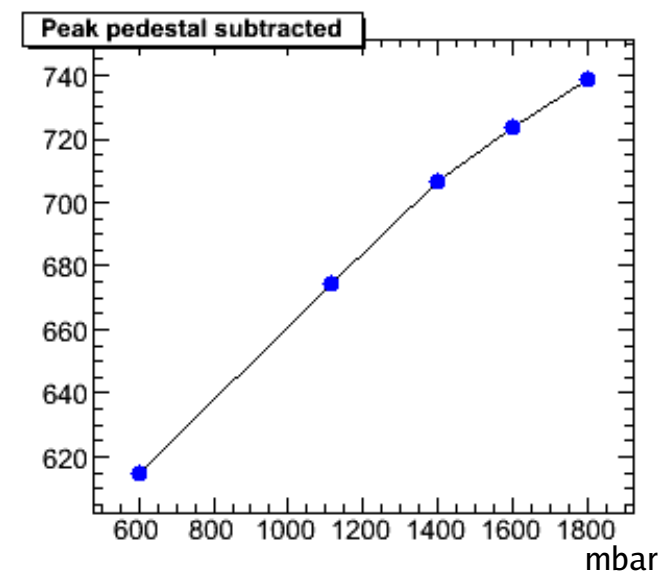
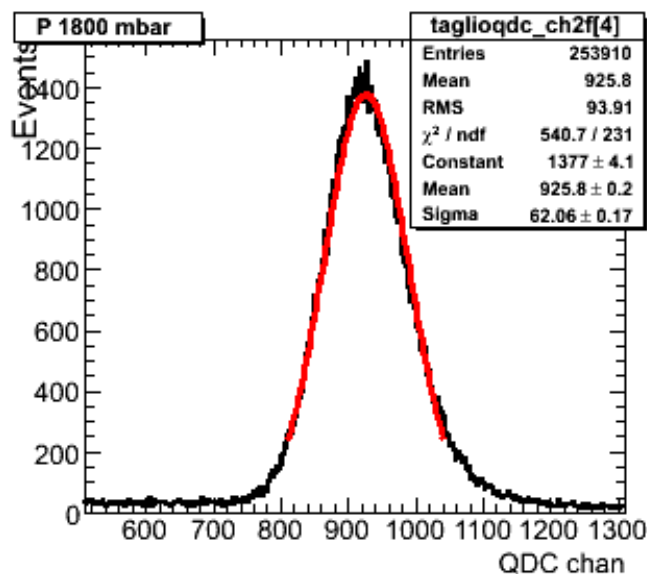
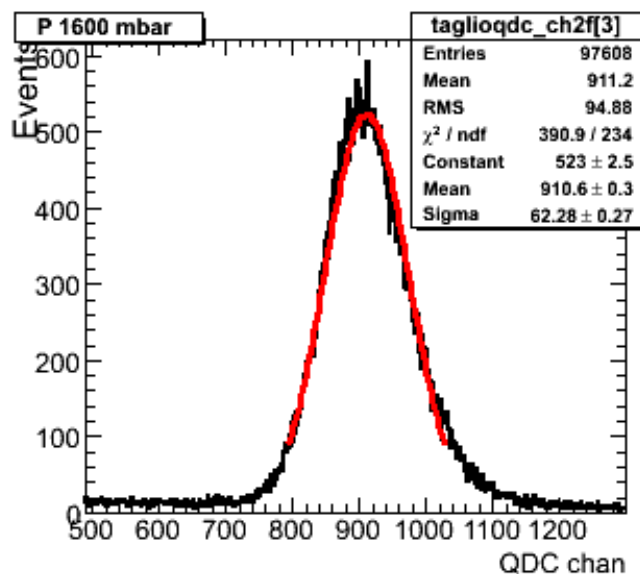
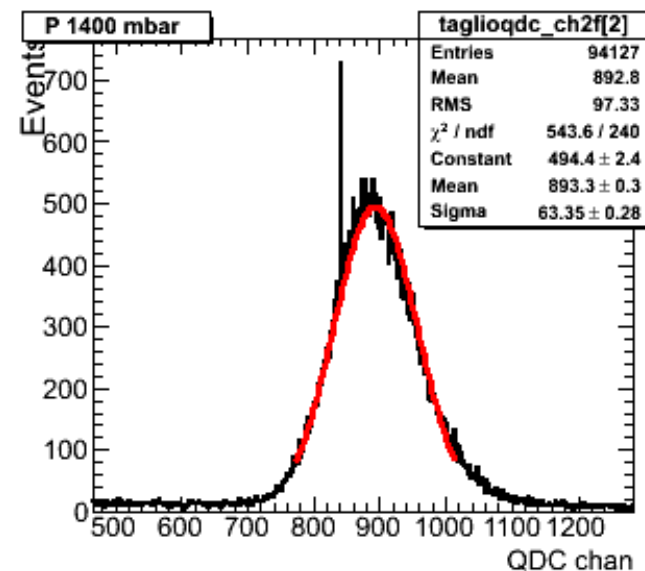
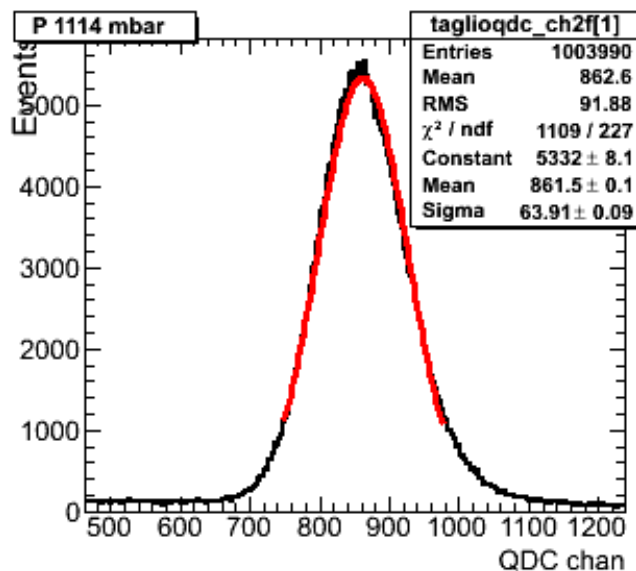
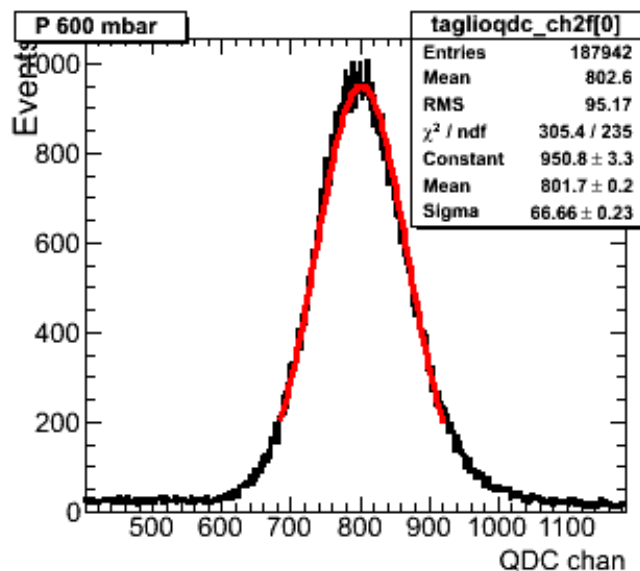
Dati tuttora sotto analisi ma
BUONA COMPRENSIONE del rivelatore installato

BACK-UP

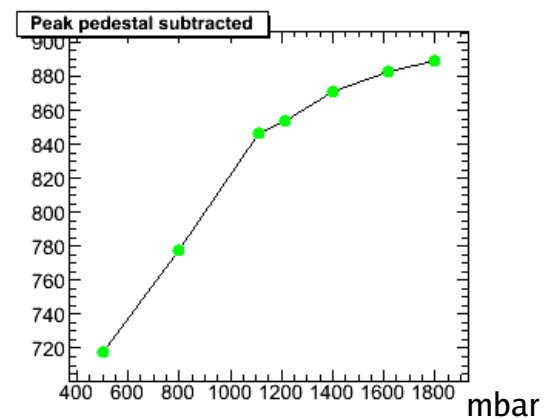
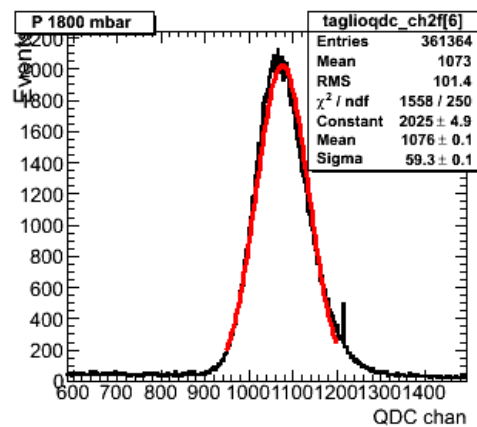
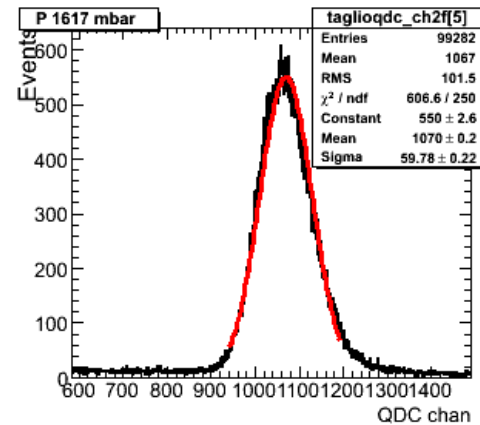
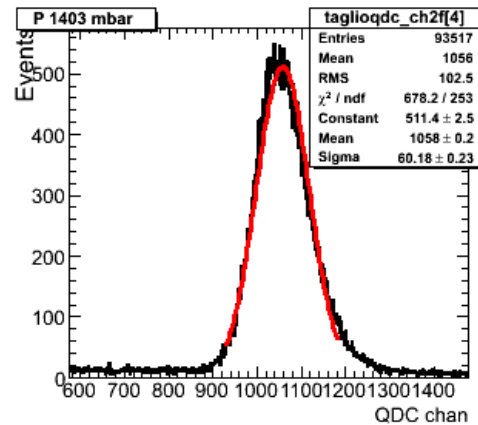
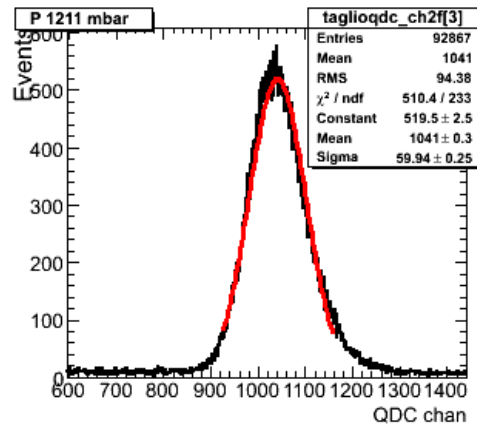
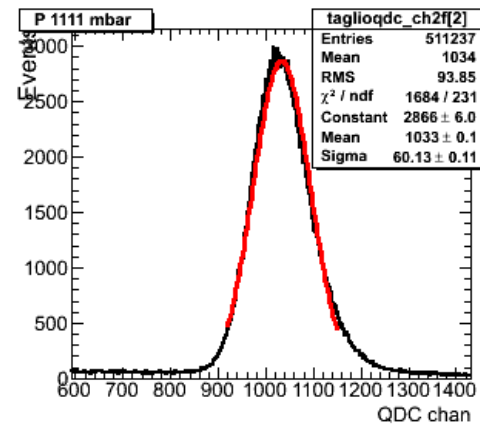
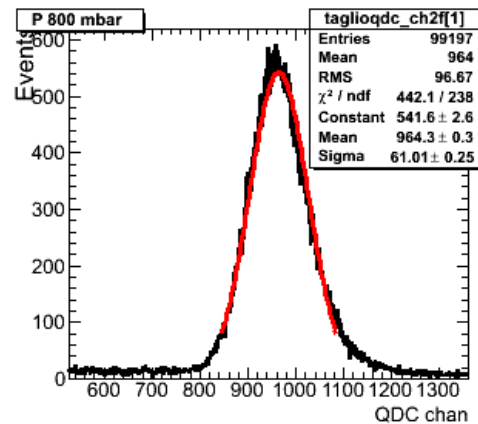
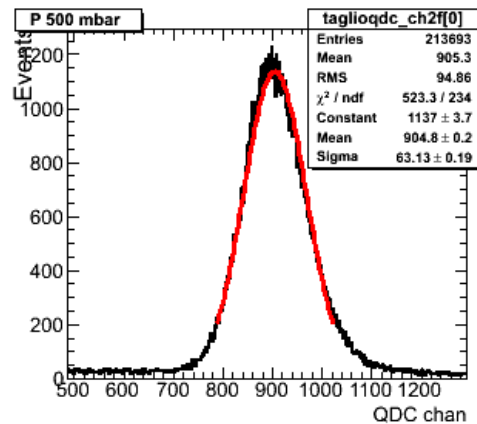
SCAN IN PRESSIONE C4F10



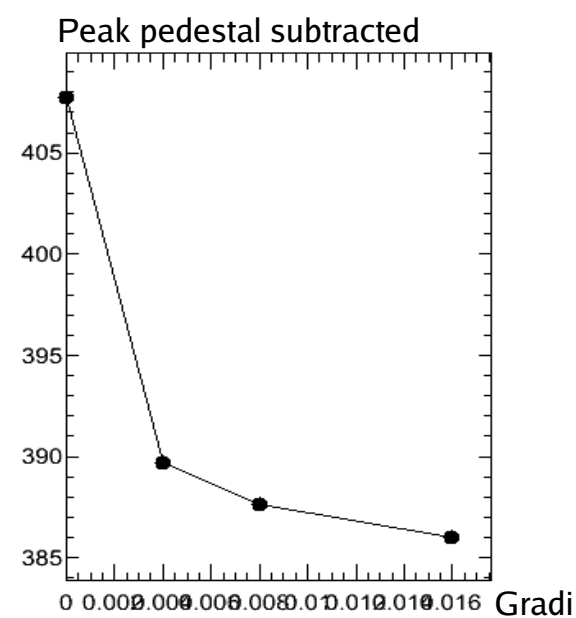
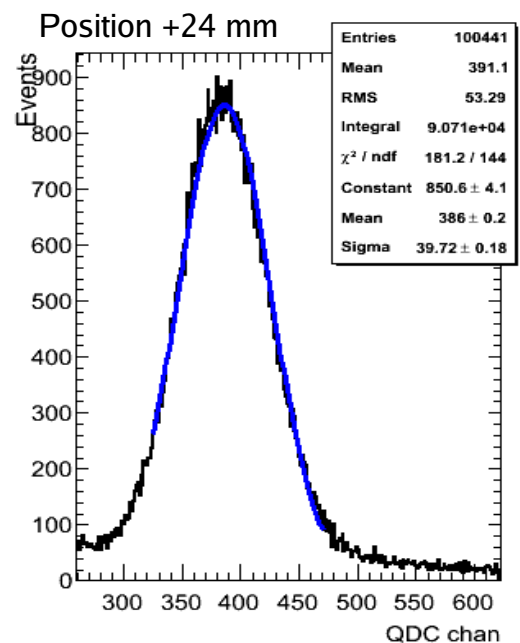
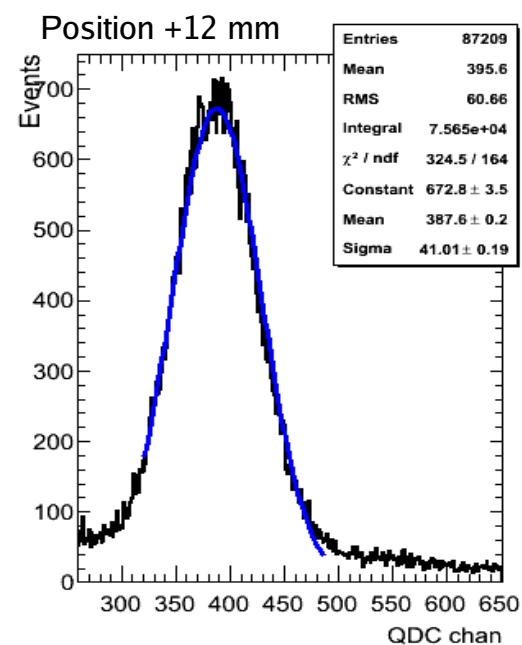
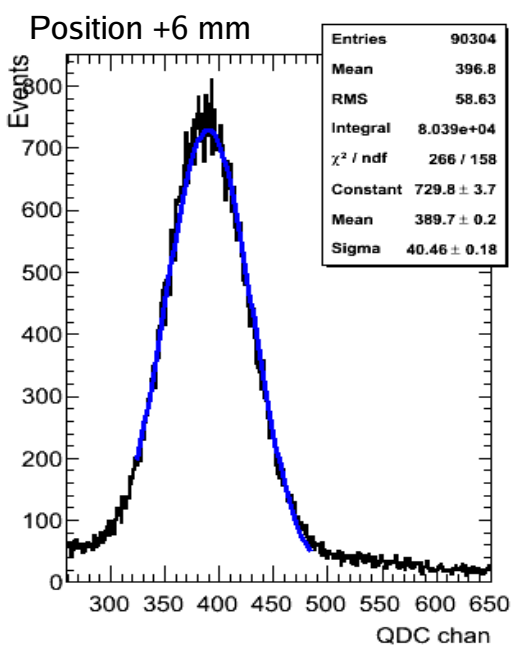
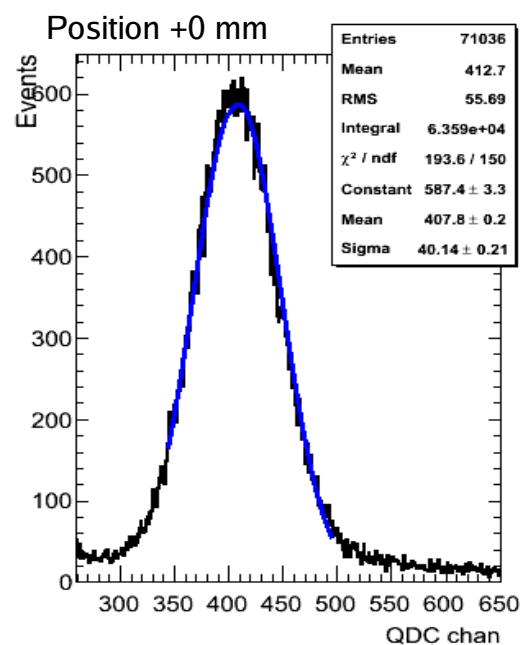
SCAN IN PRESSIONE CON N2



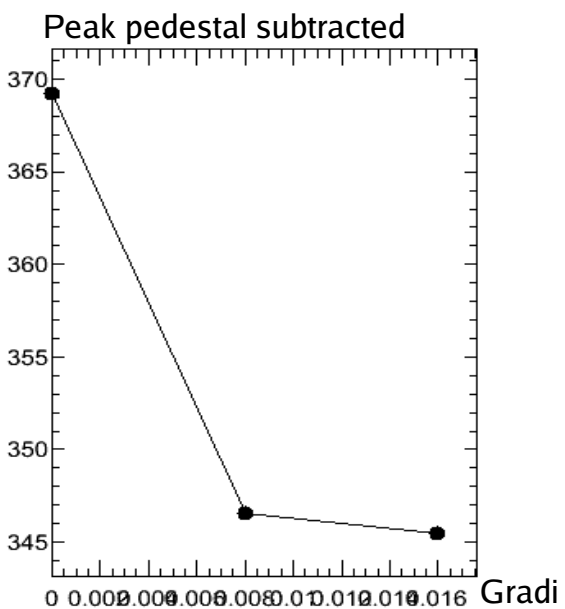
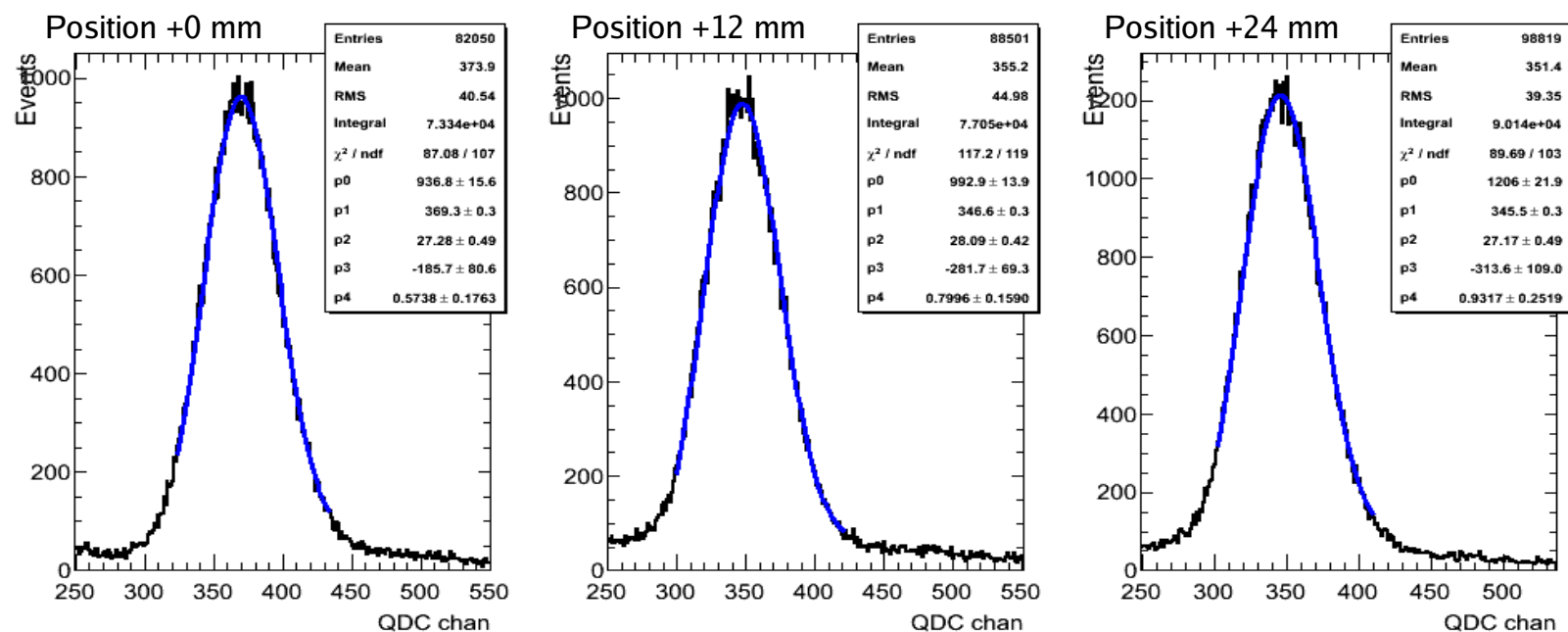
SCAN IN PRESSIONE CON ISOBUTANO



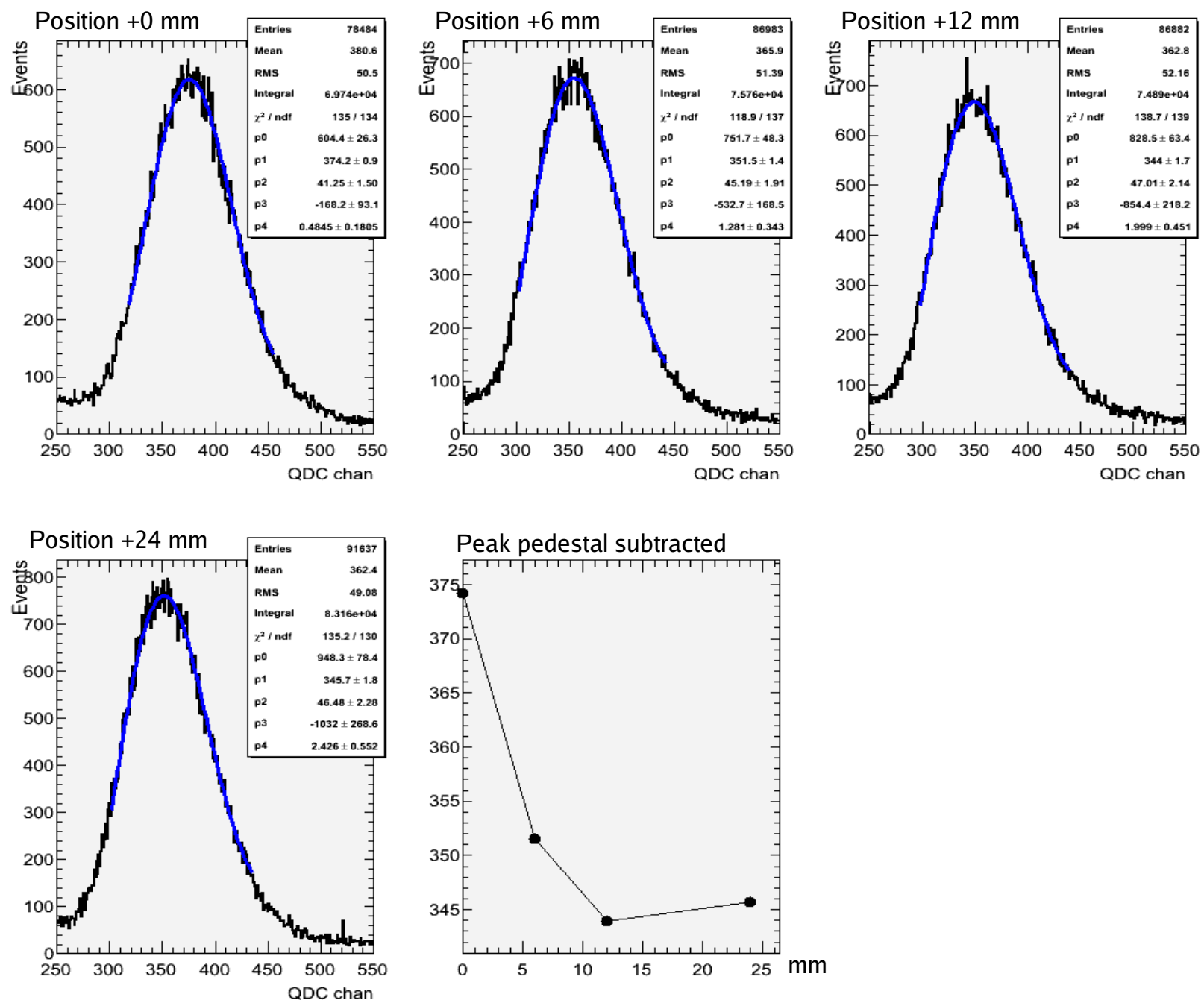
SCAN ANGOLARE CERN 1



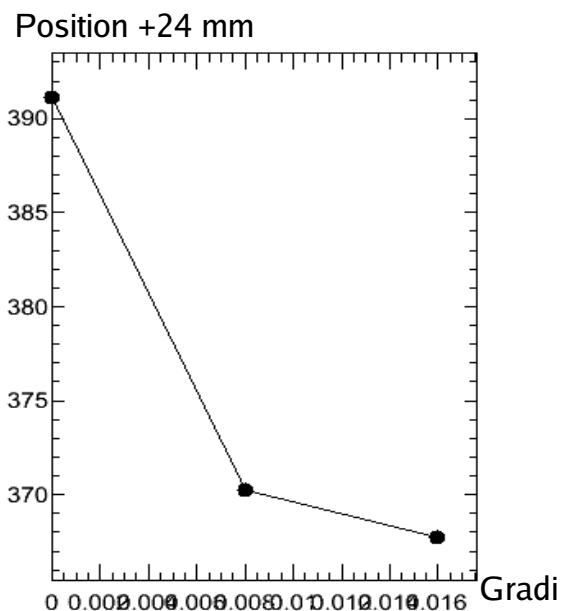
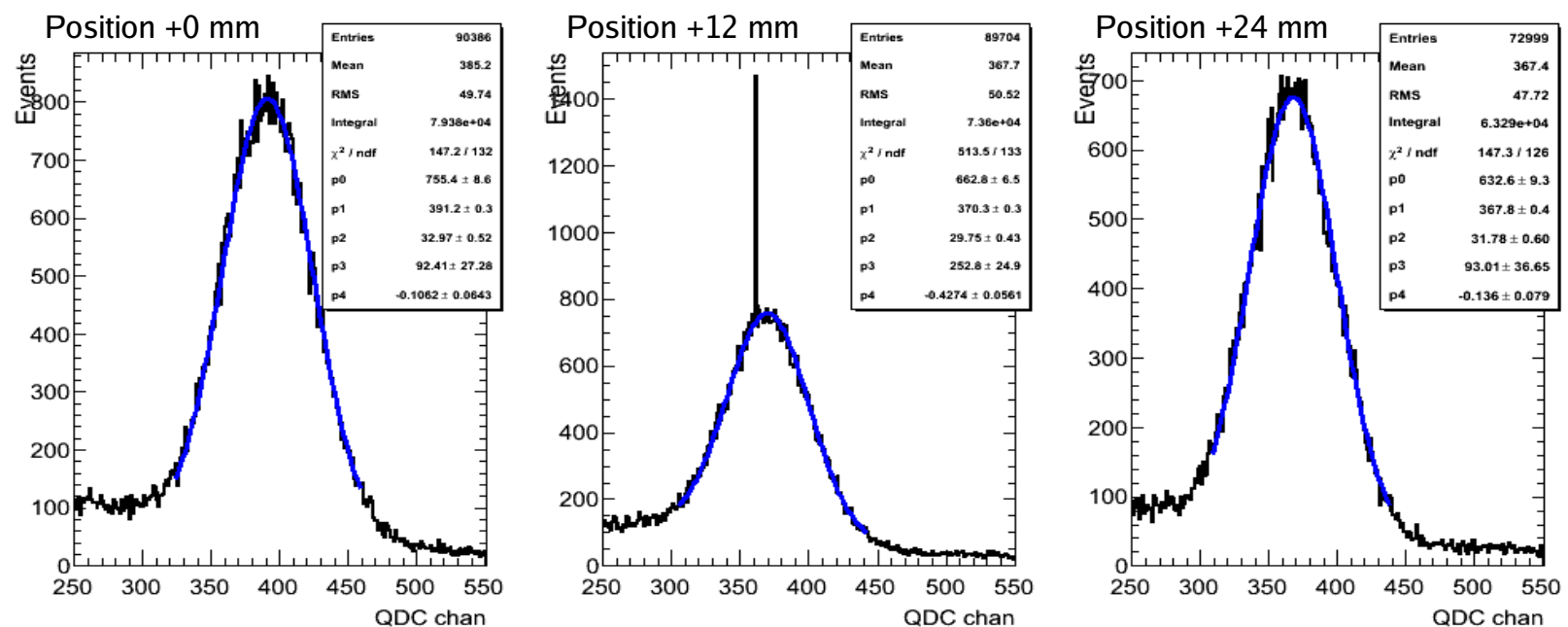
SCAN ANGOLARE CERN RAW



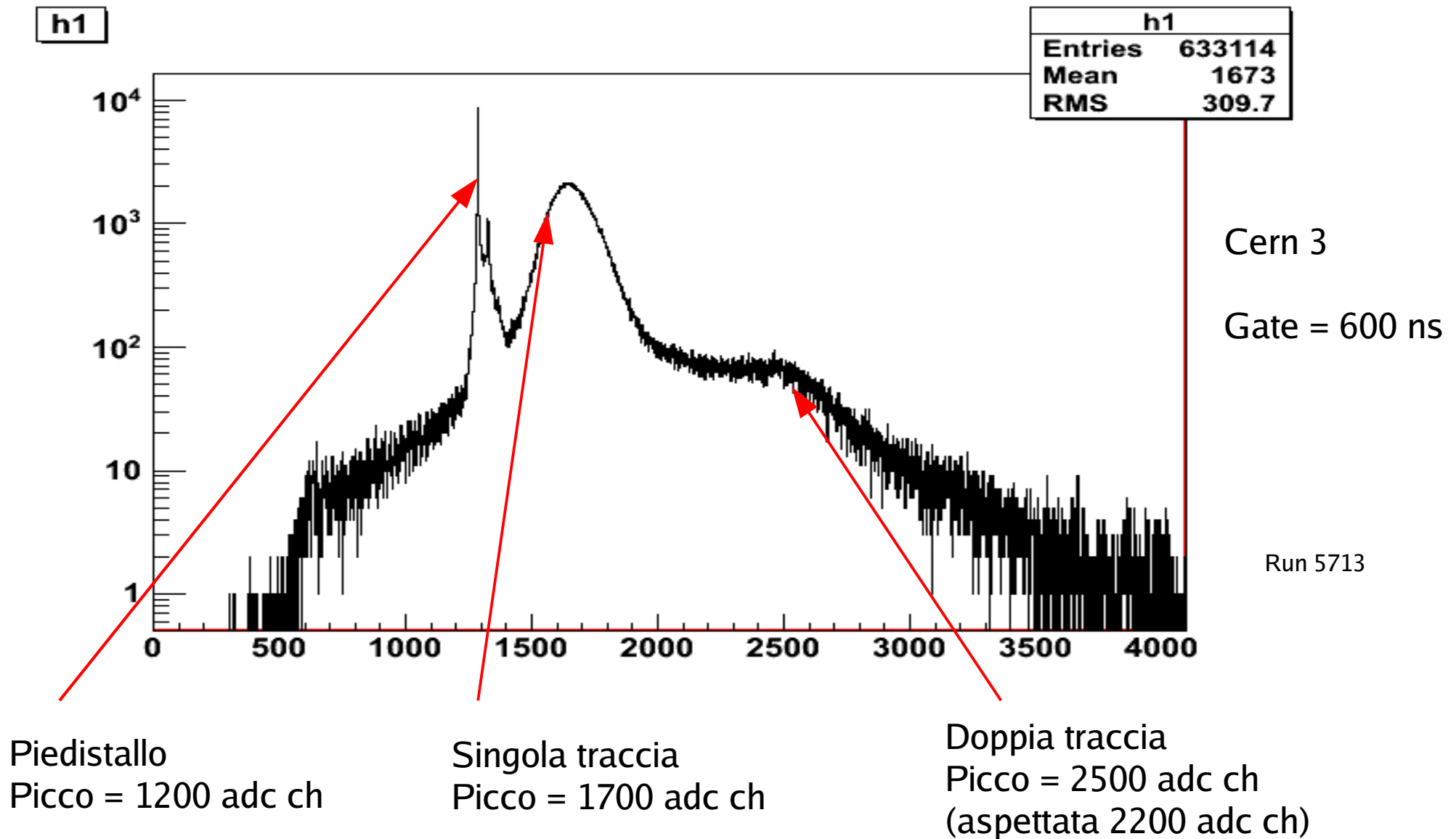
SCAN ANGOLARE CERN 2



SCAN ANGOLARE MYLAR



SEGNALE DOPPIA TRACCIA



Occupanza ~10%
Poche volte molteplicità > 1

SEGNALE DOPPIA TRACCIA

