SEARCH FOR 2γ EVENTS ON FOTON-2 DETECTOR

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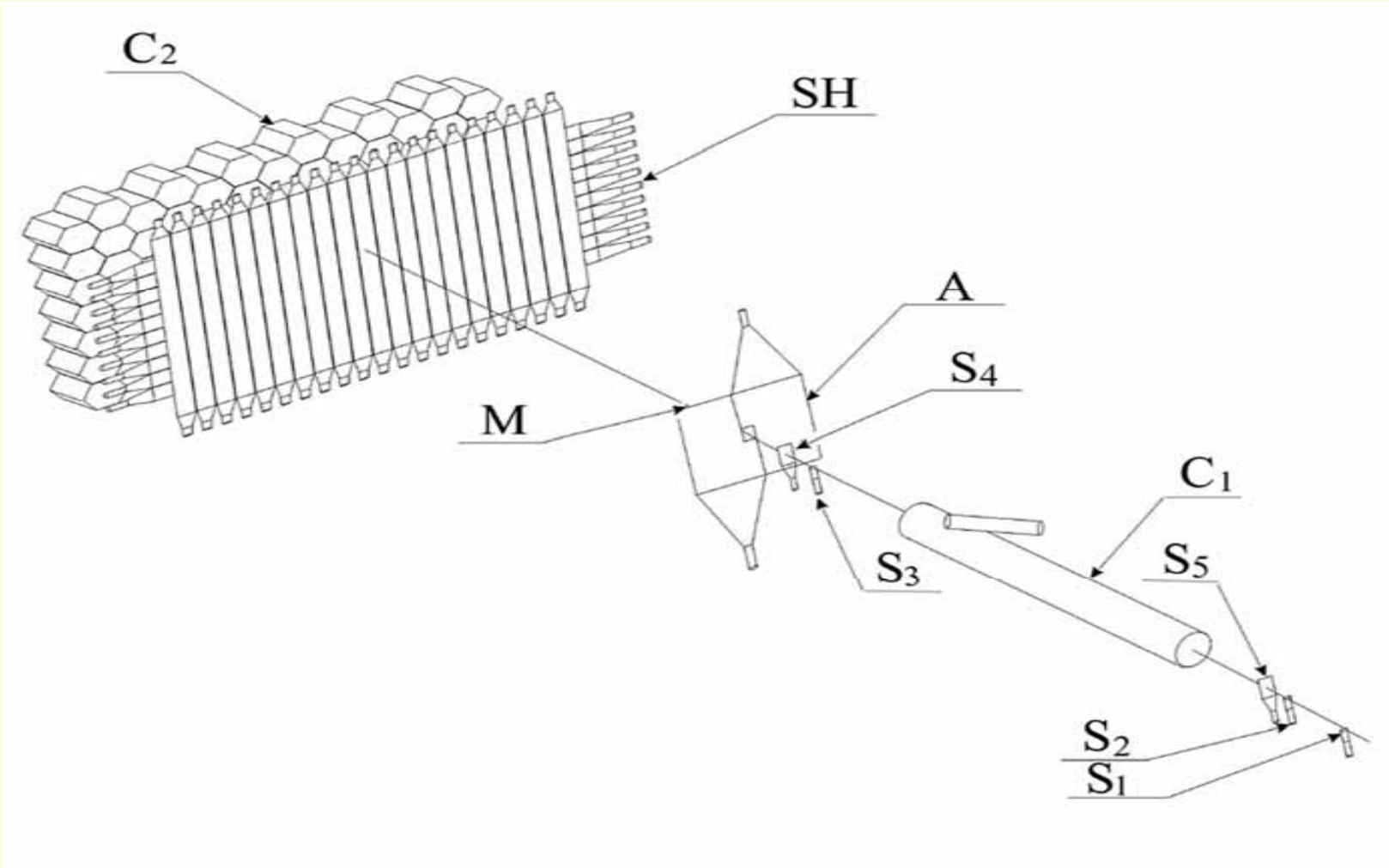
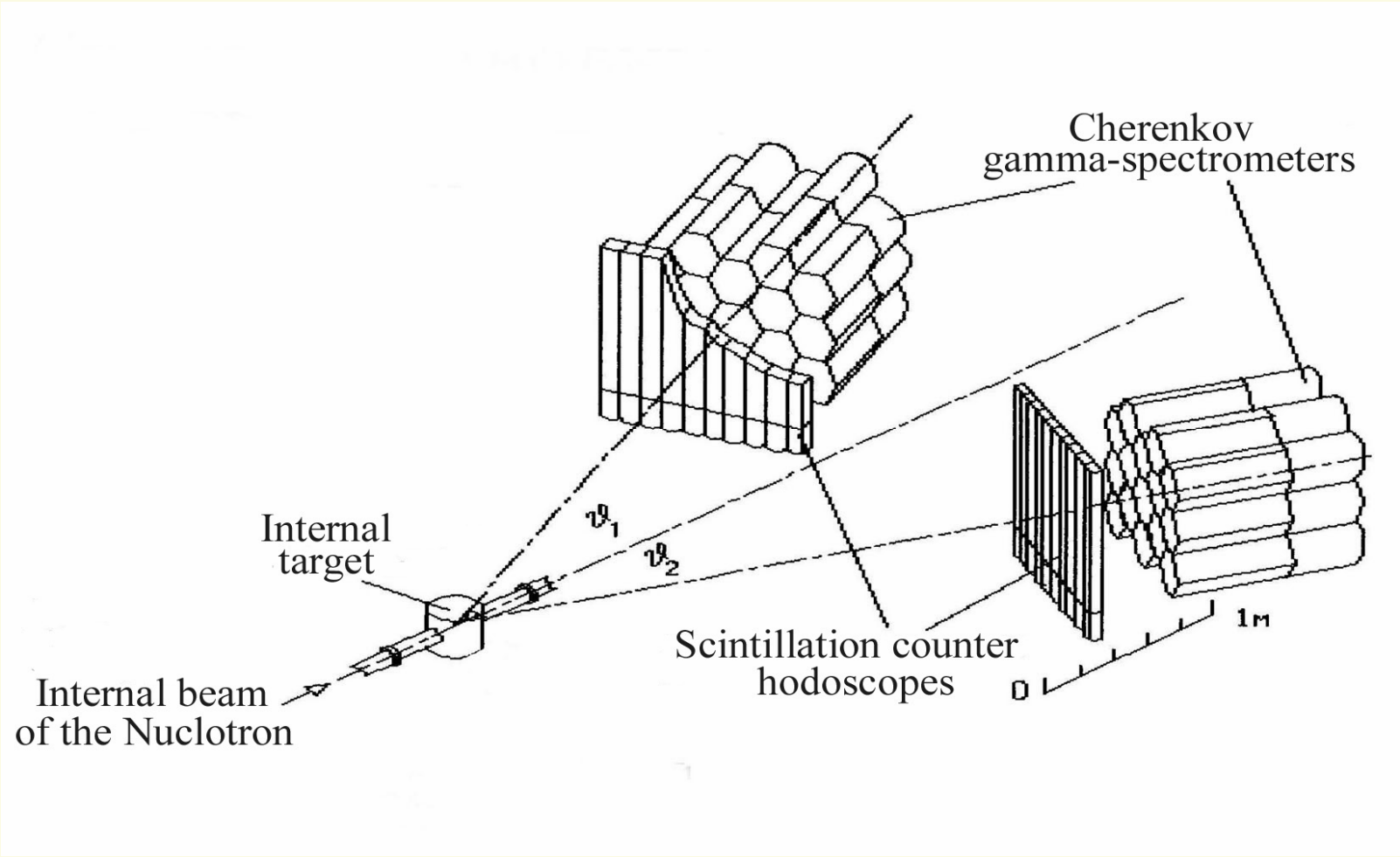
Abstract

- Results of the experiments on neutral pion and eta meson production at forward angles in nucleus-nucleus collisions are presented. The experiments are performed on the LHE 90-channel lead glass Cherenkov spectrometer using relativistic deuteron, helium and carbon beams of the LHE synchrophasotron and Nuclotron. The ability of the setup for neutral pion and eta meson identification over a wide interval of energies is shown. The list of the planned measurements on the spectrometer is given.

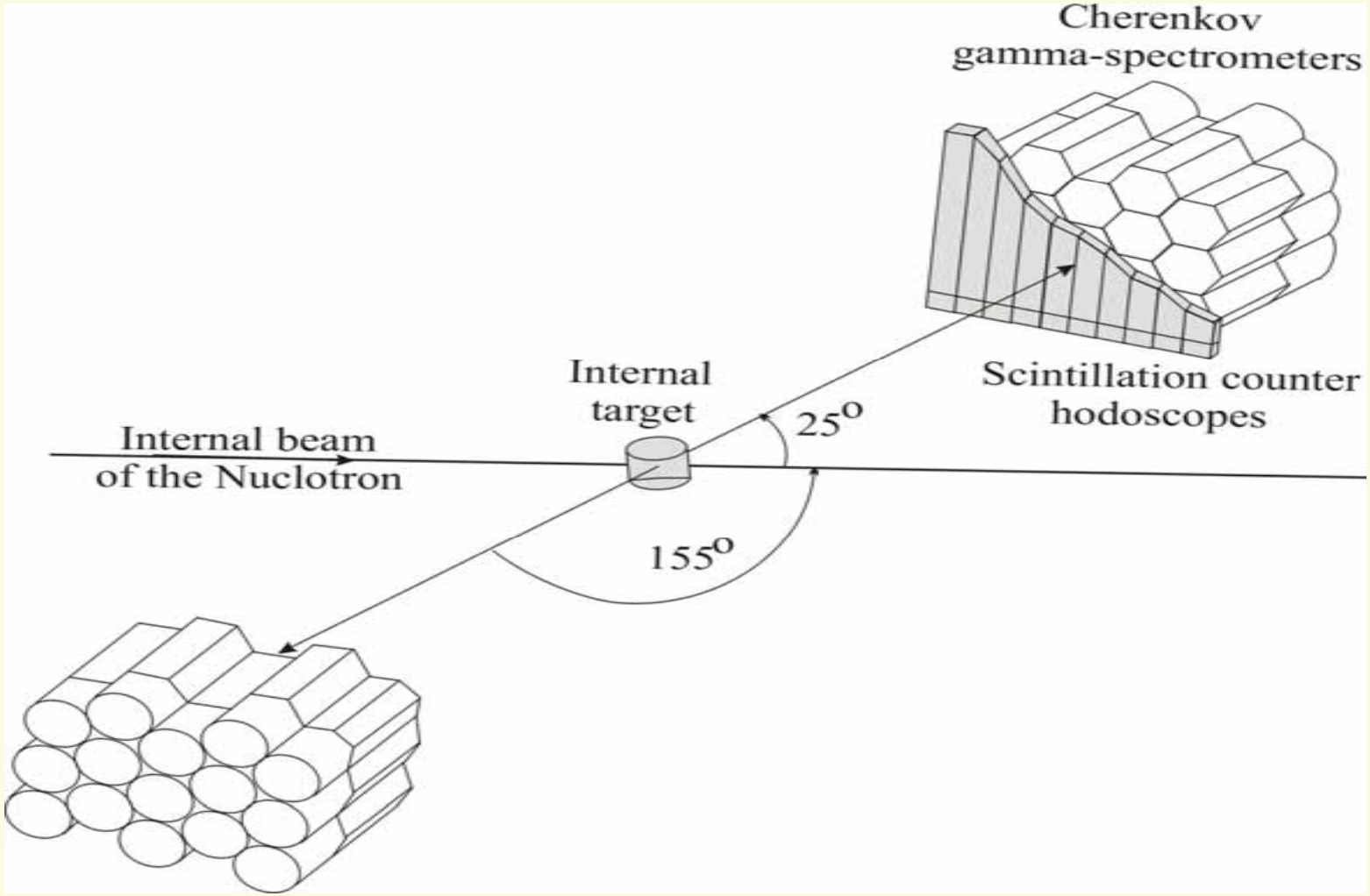
PHOTON setup on beams of the Synchrophasotron



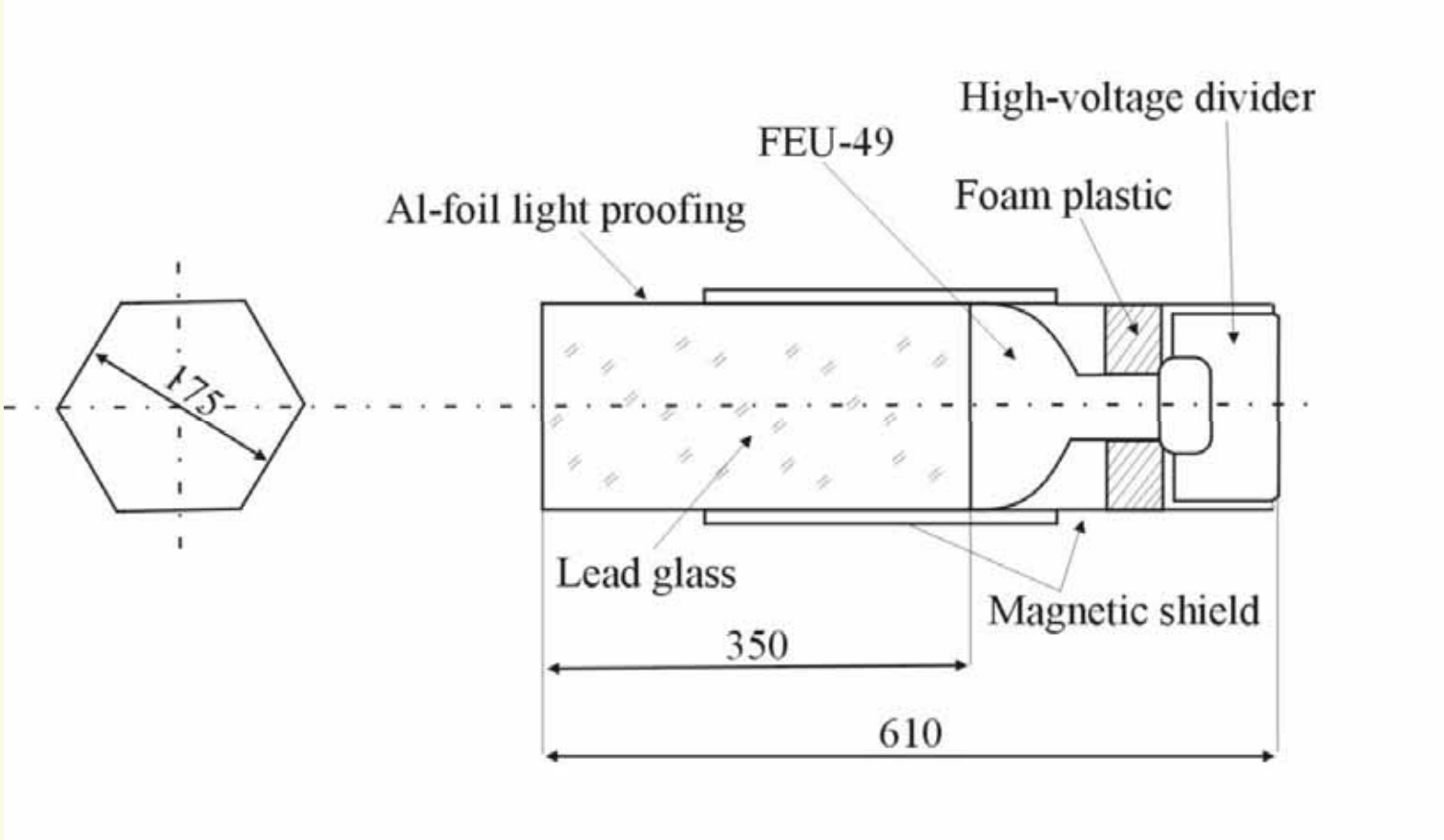
PHOTON-2 setup on internal beams of the Nuclotron



PHOTON-2 setup on internal beams of the Nuclotron

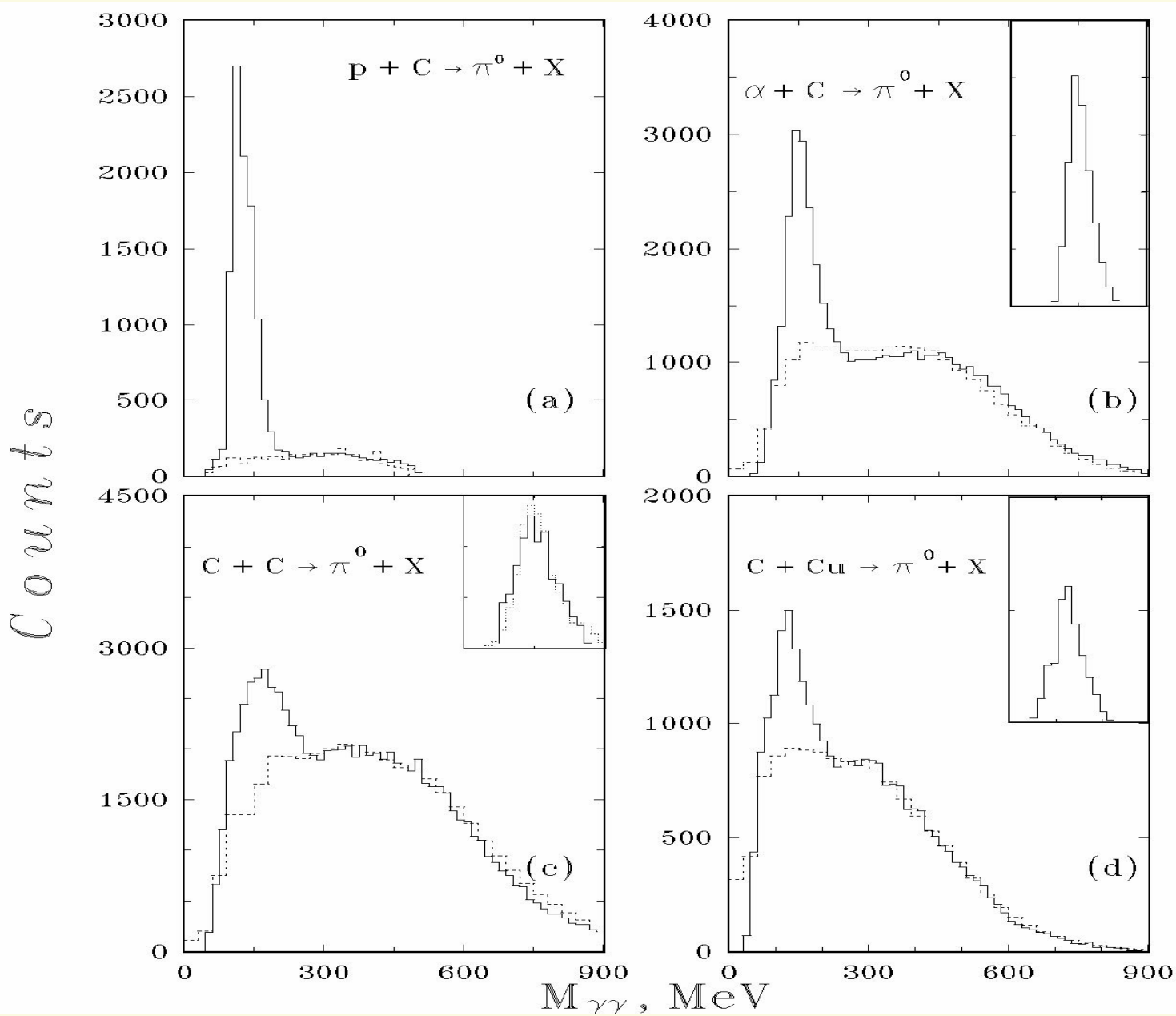


A module of the γ-spectrometer



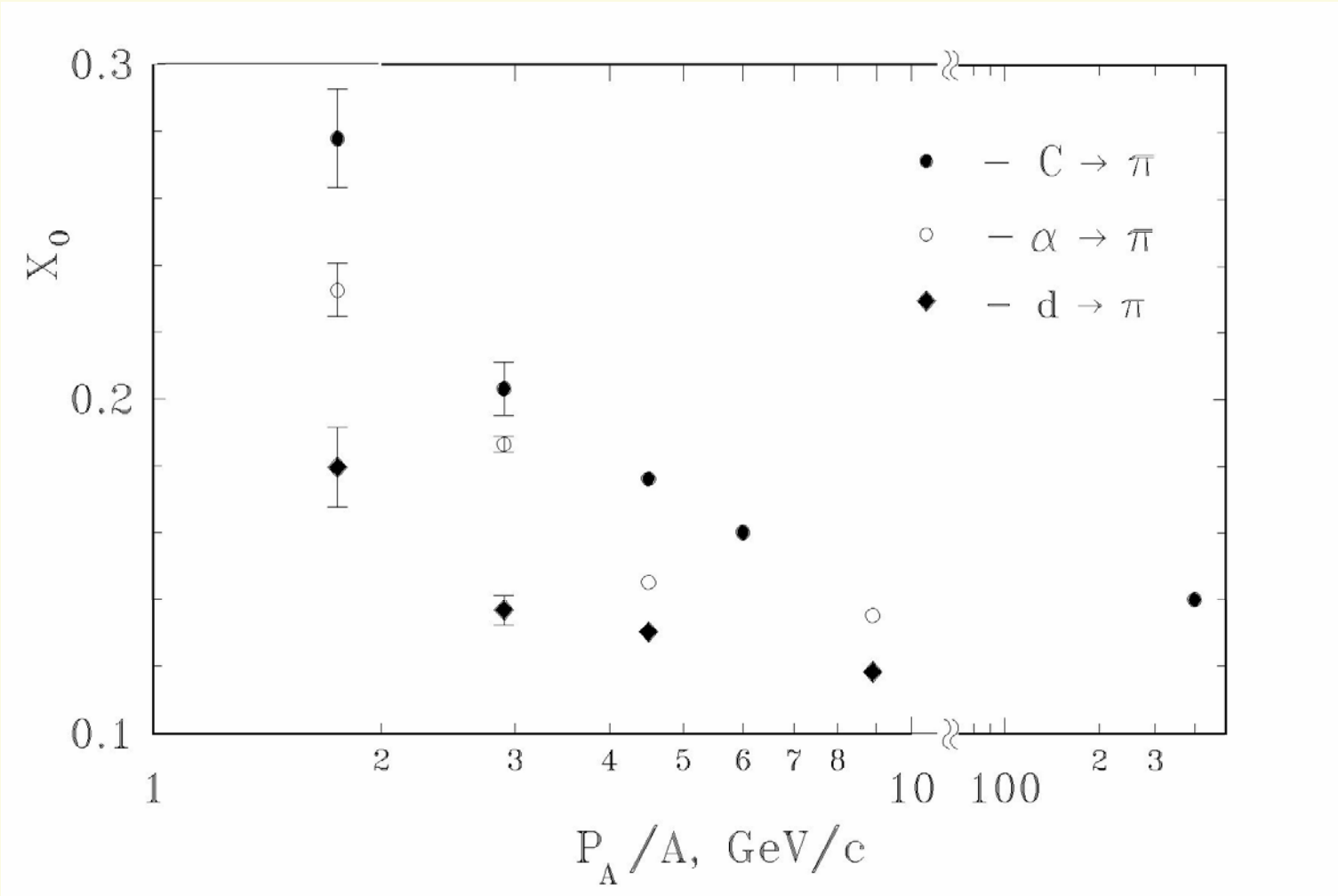
The basic parameters of the lead glass hodoscope.

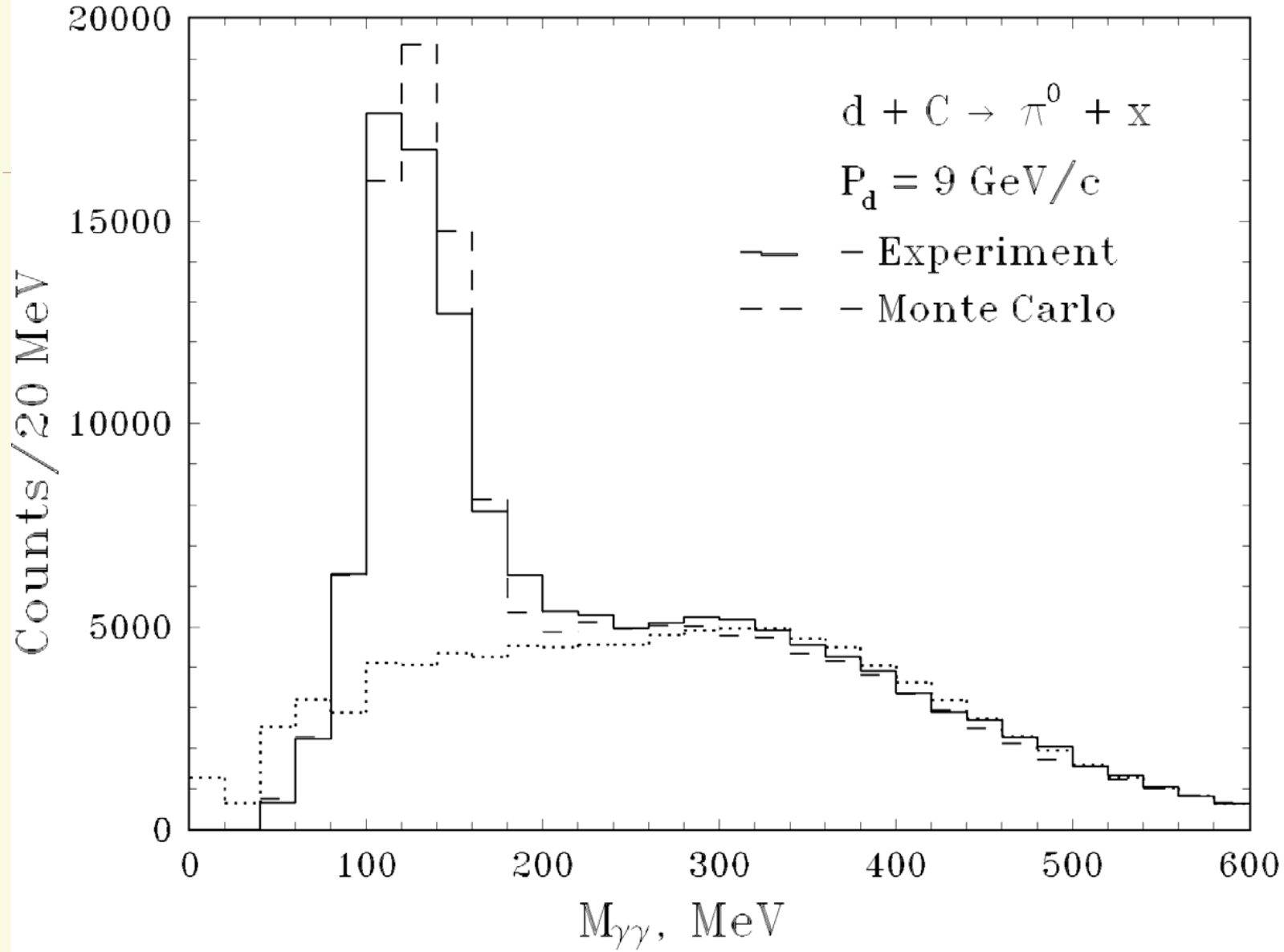
number of lead glasses	90 TF-1, total weight 4000 kg
module cross section	r = 9 cm insert circumference
module length	35 cm, 14 R.L.
spatial resolution	3.5 cm
angular resolution	0.7º at L = 3 ; 1.2º at L=1.6 m
energy resolution	$(3.9/\sqrt{E} + 0.3)\%$, (E(GeV))
gain stability	(1-2)%
dynamic range	50MeV - 6 GeV
minimum ionizing signal	384 MeV photon equivalent
total area	2.6 m^2

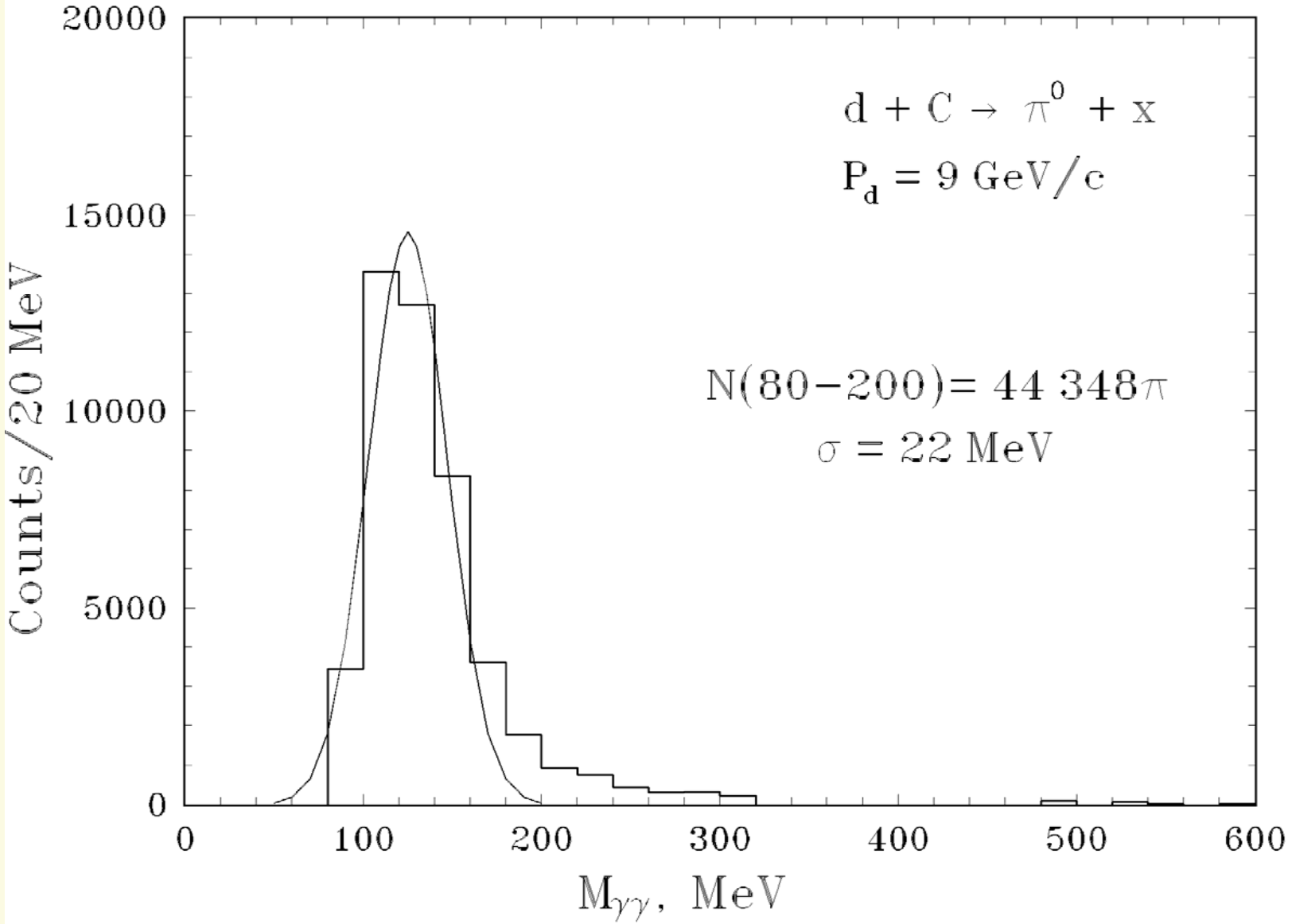

p + C → π° + X
α + C → π° + X
C + C → π° + X
C + Cu → π° + X
(a)
(b)
(c)
(d)
Counts
M γγ , MeV
0
300
600
900
500
1000
1500
2000
2500
3000
4000
4500

The experimental values of X_0 in:

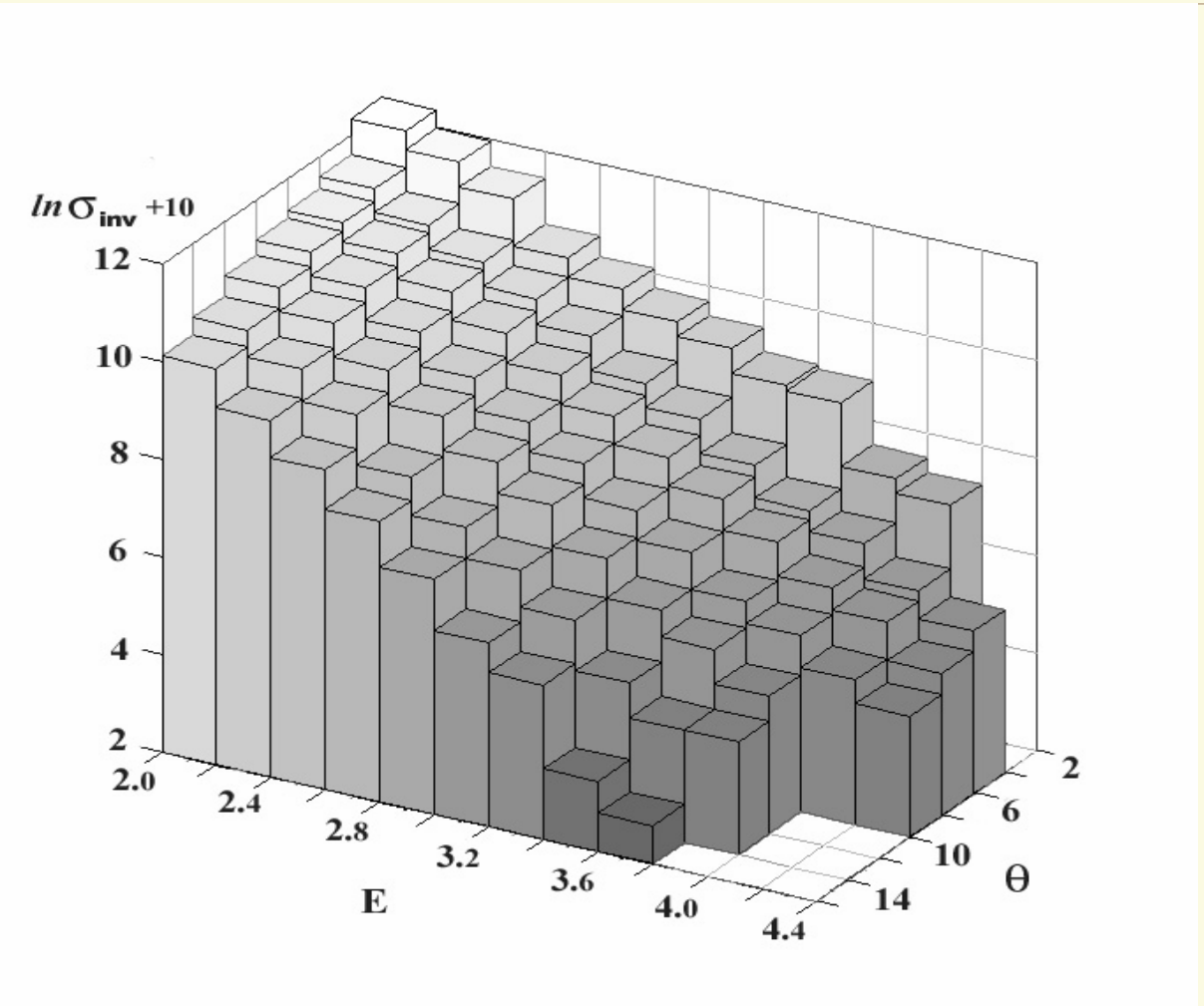
$$Ed^3\sigma/d^3p \sim exp(-X/X_0)$$




20000
15000
10000
5000
0
Counts/20 MeV
0
100
200
300
400
500
600
$M_{\gamma\gamma}$, MeV
$d + C \rightarrow \pi^0 + x$
$P_d = 9$ GeV/c
– Experiment
– Monte Carlo


d + C → π⁰ + x
P_d = 9 GeV/c
N(80−200)= 44 348π
σ = 22 MeV
Counts/20 MeV
M_γγ, MeV
0
5000
10000
15000
20000
0
100
200
300
400
500
600

The double differential cross-section of the $d+C \rightarrow \pi^{\circ}+X$



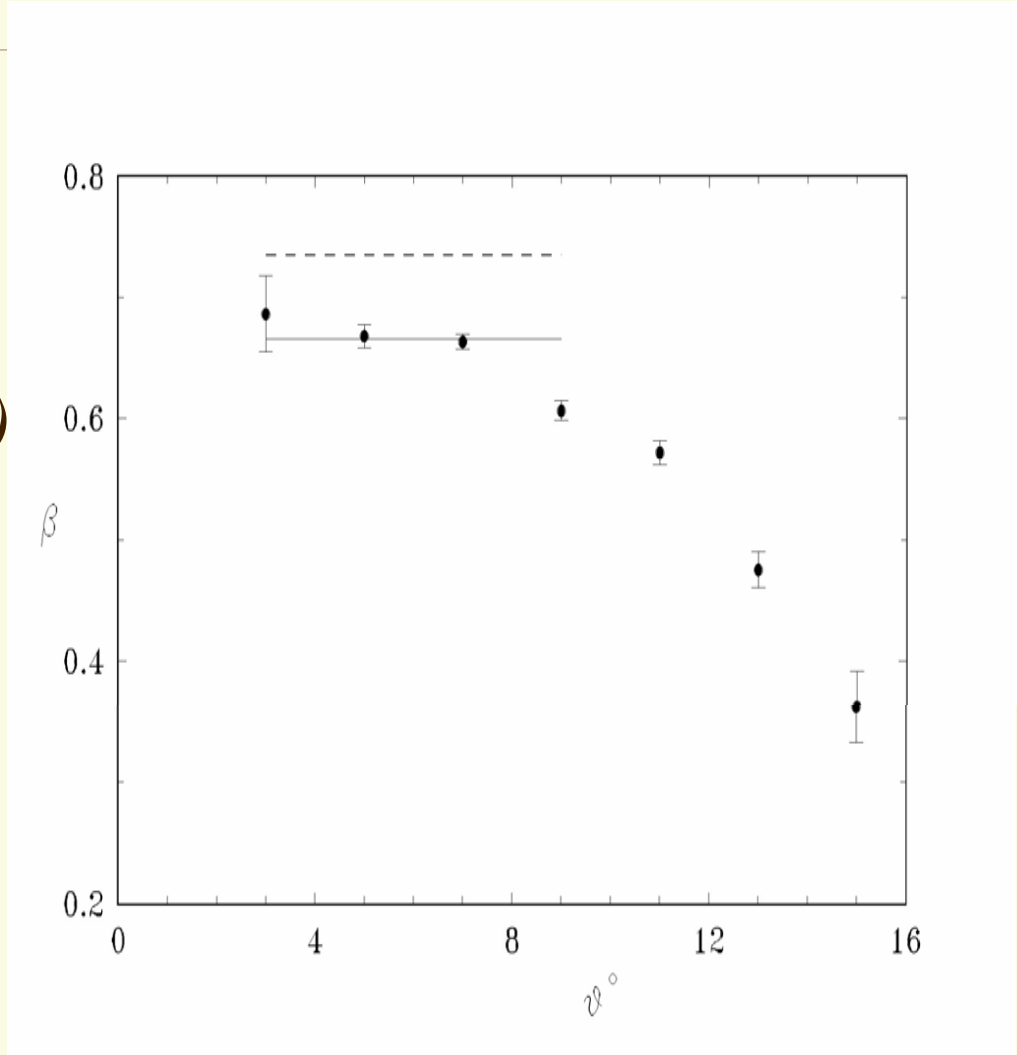
The velocity β of supposed intermediate cluster

- β obtained from expression

$Ed^3\sigma/d^3p\ (E, \theta\text{-}fixed) \sim exp(E/T_\theta)$,

where

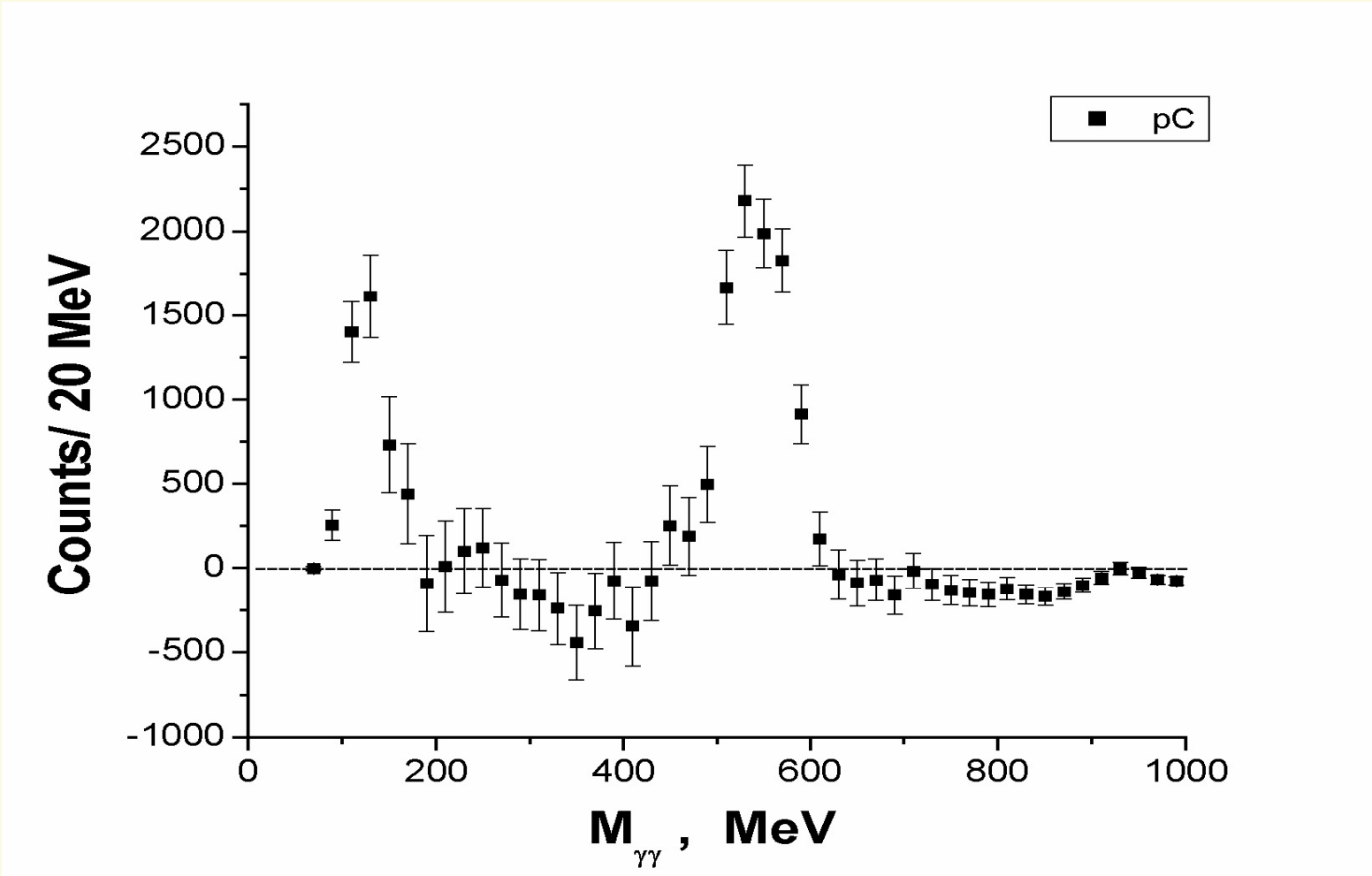
$T_\theta = T_0\ (1-\beta^2)^{1/2} / (1-\beta \cdot Cos\theta_\pi)$.



The experiment on the Nuclotron

$p + C \rightarrow \gamma + \gamma + X$, P = 5.5 GeV/c

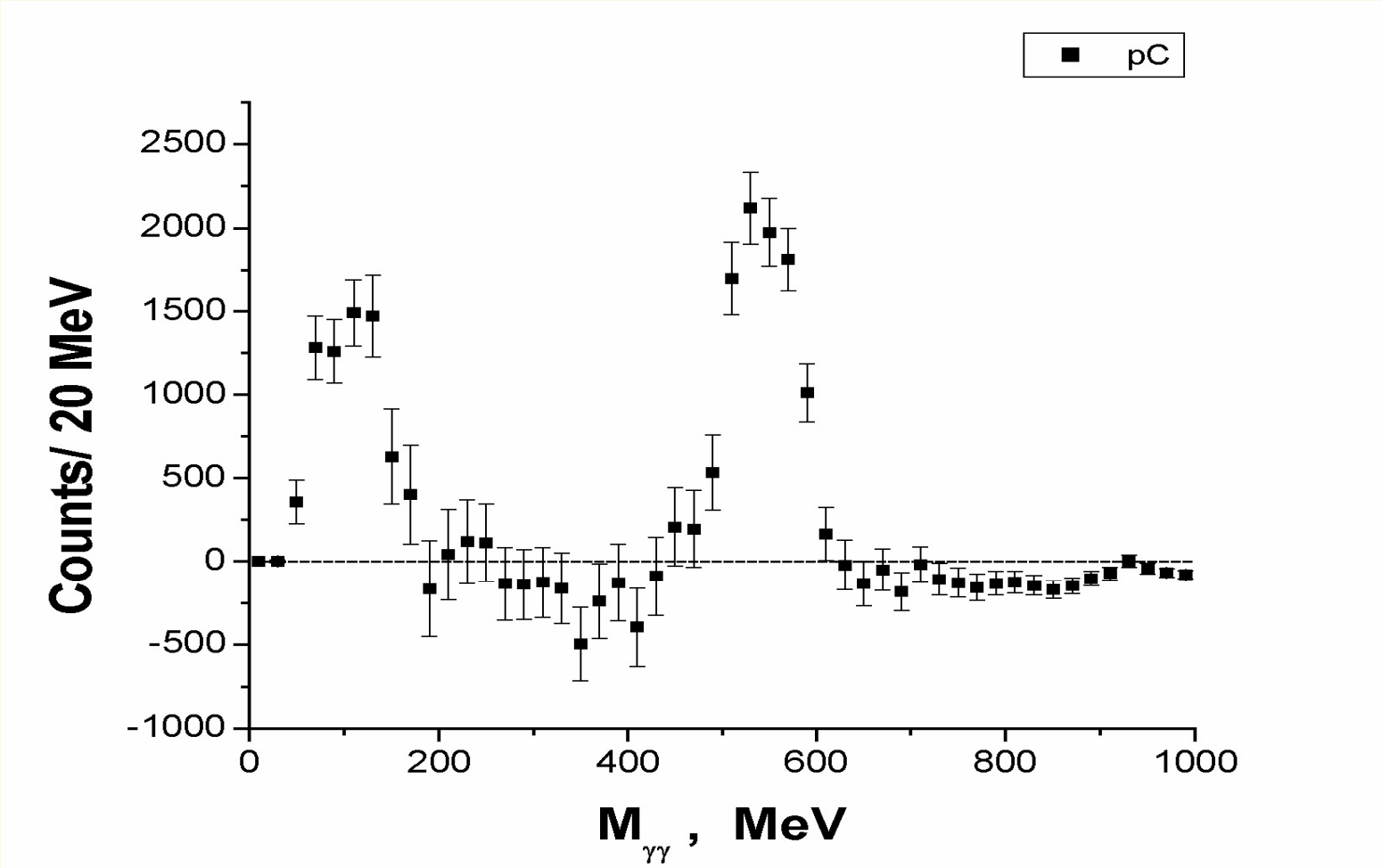
Selection criteria: $E_\gamma > 50$, $E_{\gamma 1} + E_{\gamma 2} > 250$ MeV



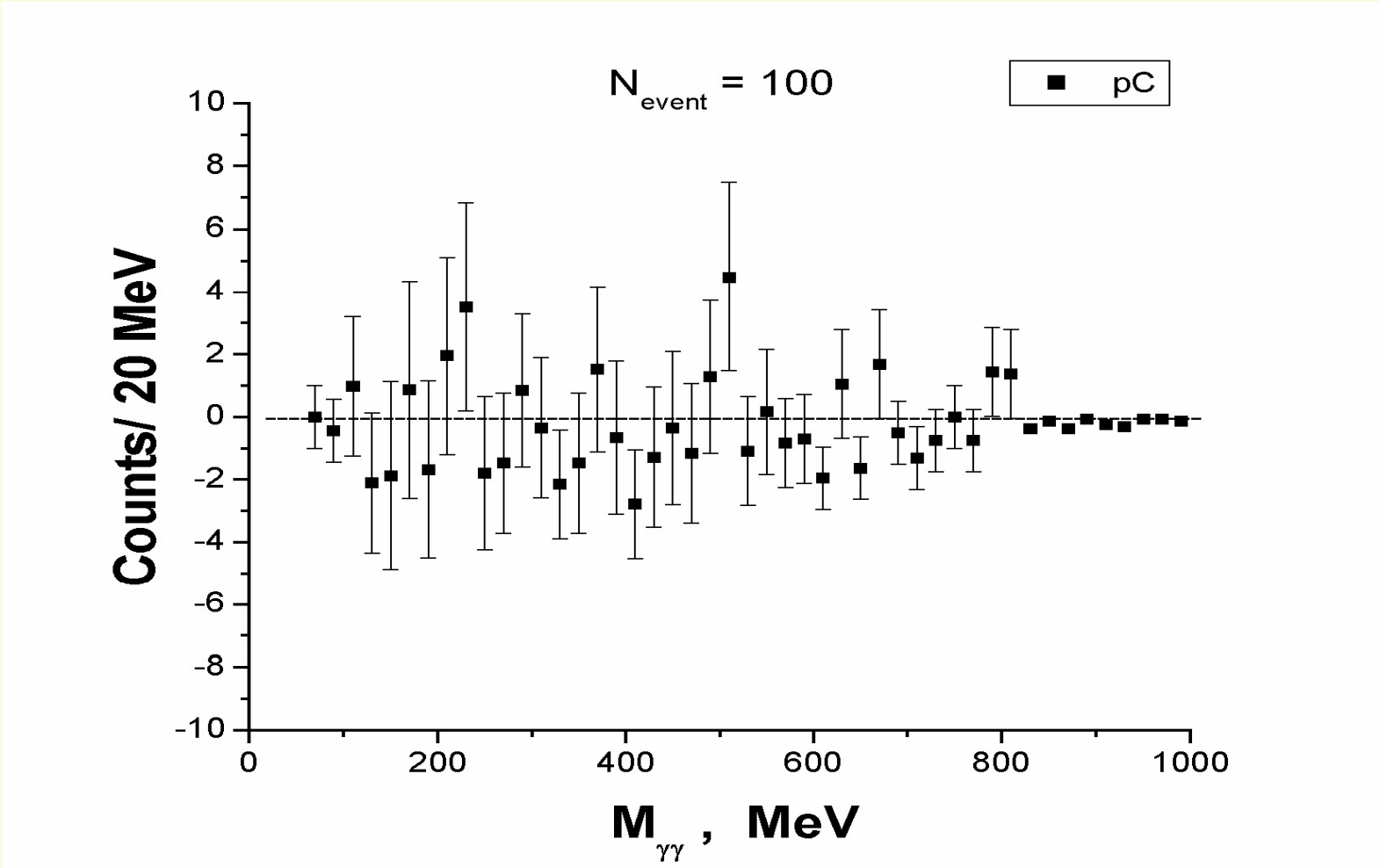
The experiment on the Nuclotron

$p + C \rightarrow \gamma + \gamma + X$, P = 5.5 GeV/c

Selection criteria: E_γ > 50 MeV only



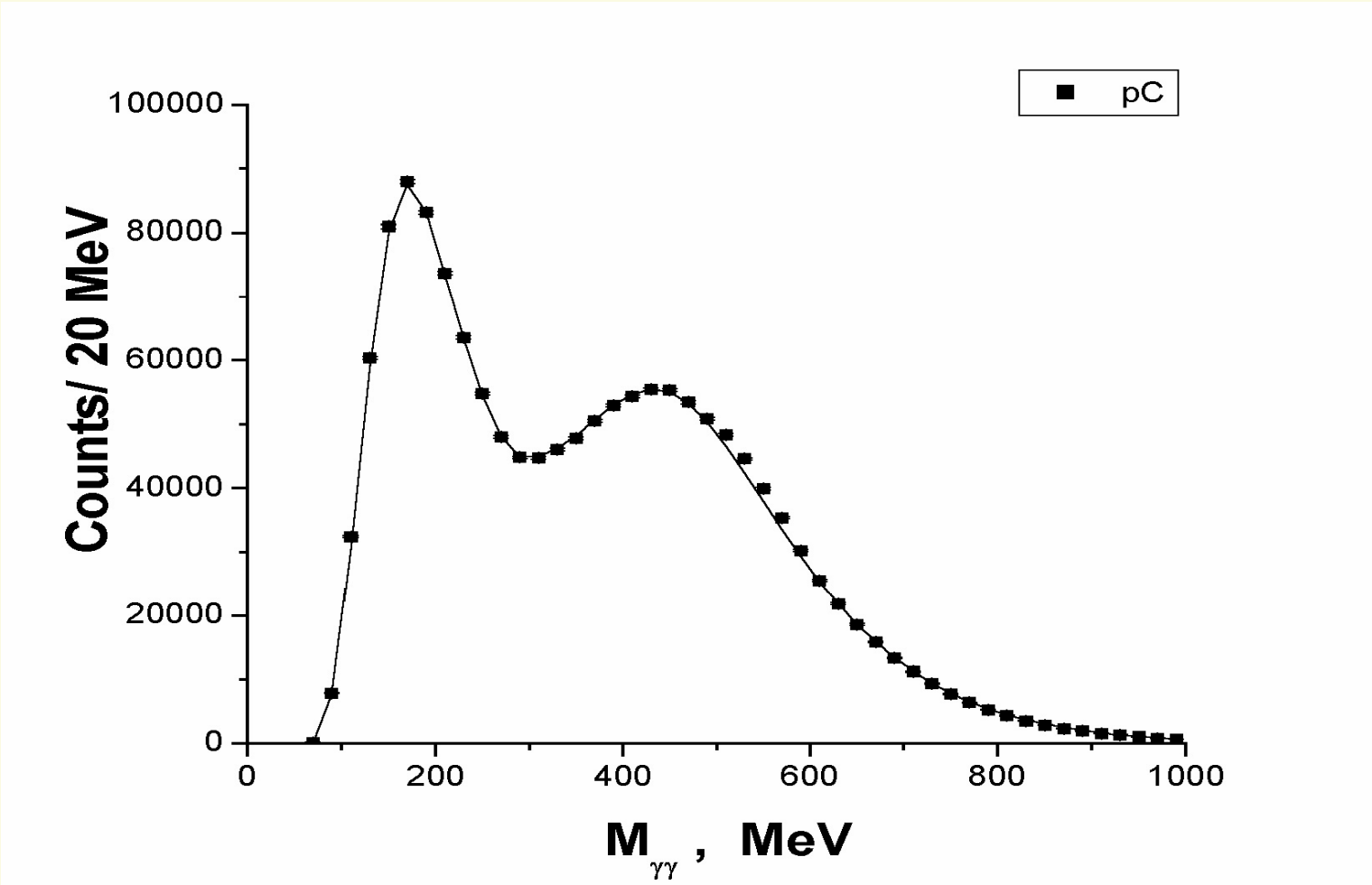
Influence of statistics



The experiment on the Nuclotron

$p + C \rightarrow \gamma + \gamma + X$, P = 5.5 GeV/c

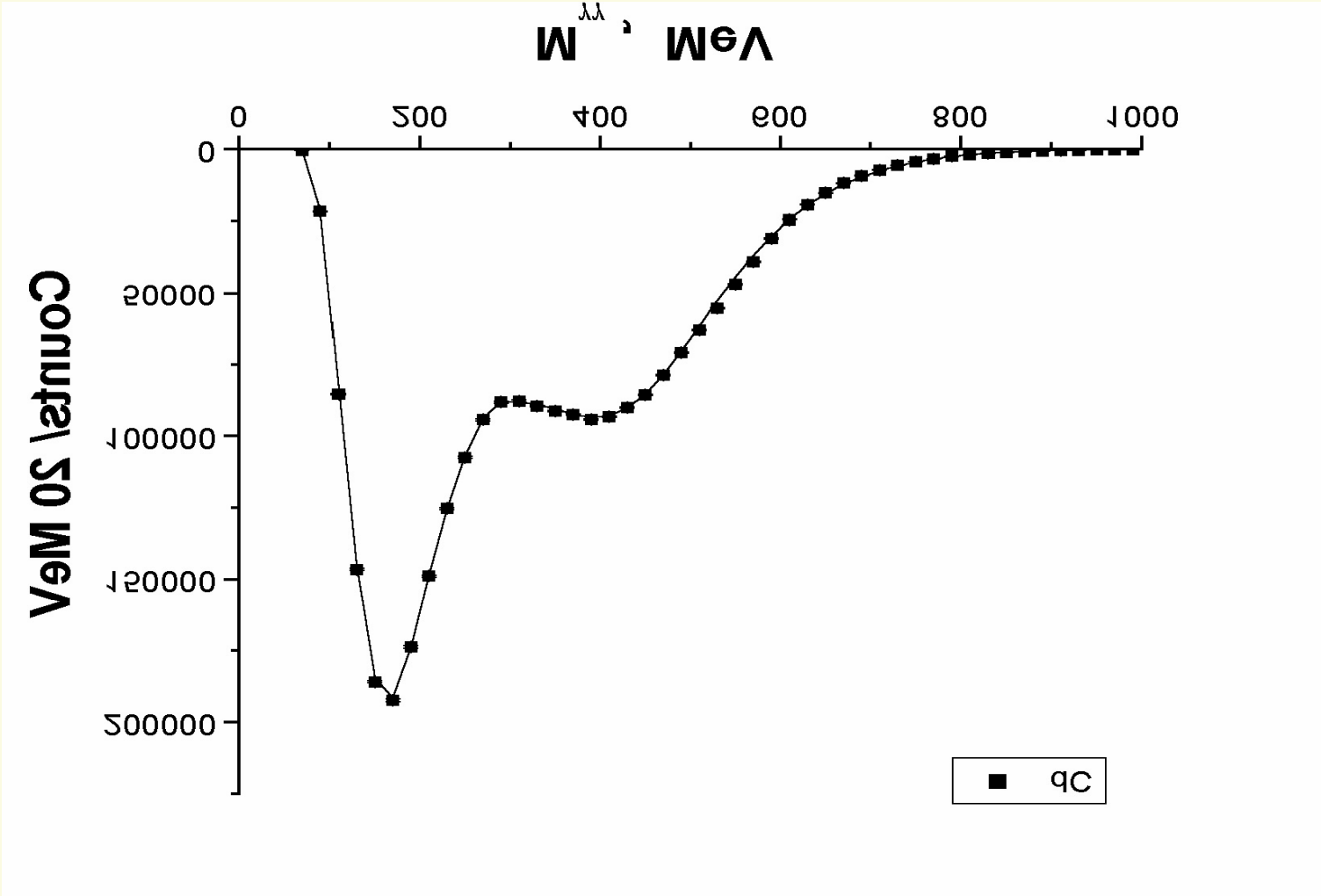
Selection criteria: $E_\gamma > 50$, $E_{\gamma 1} + E_{\gamma 2} > 250$ MeV



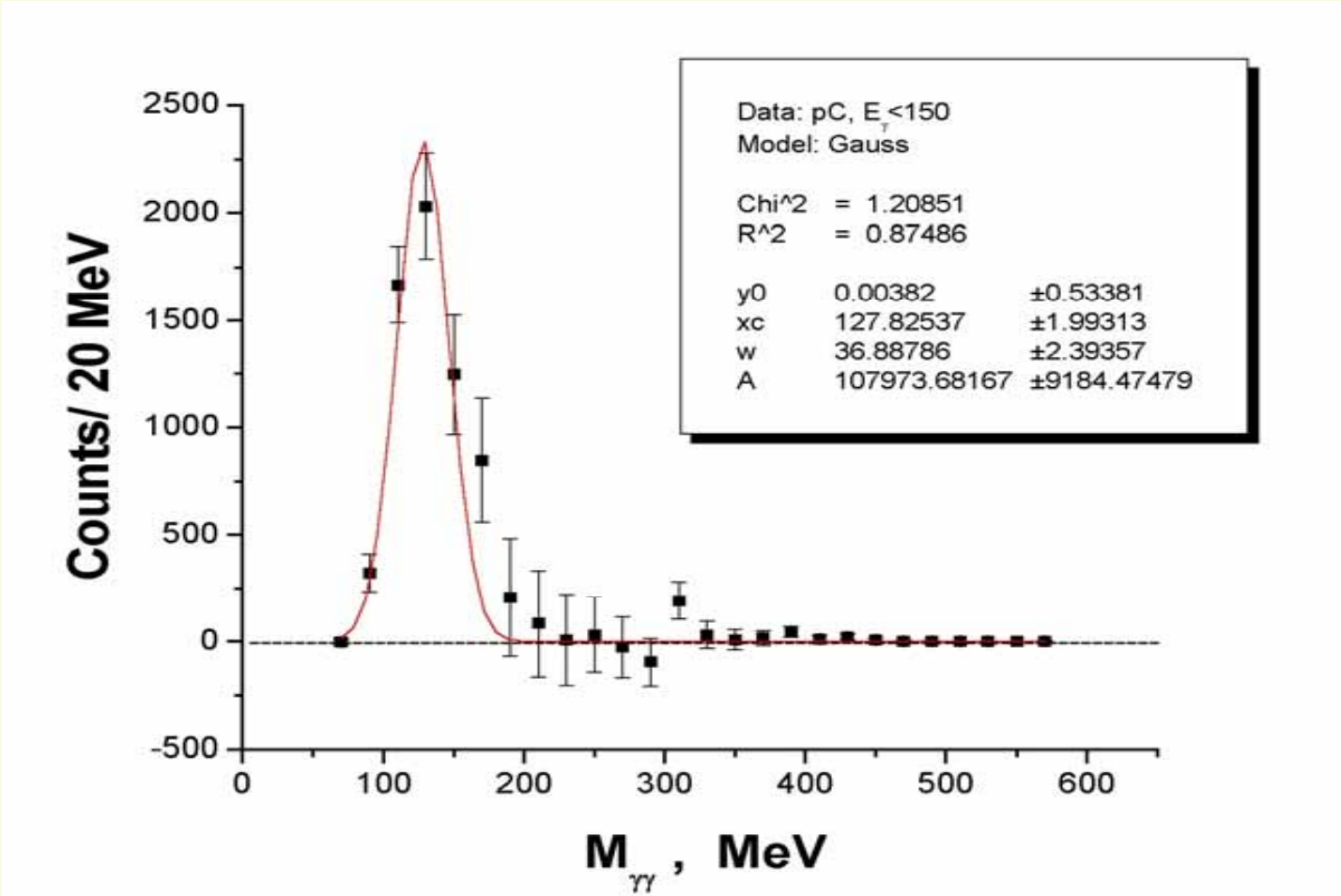
The experiment on the Nuclotron

$d + C \rightarrow \gamma + \gamma + X$, P_d = 2.8 GeV/c per nucleon

Selection criteria: $E_\gamma > 50$, $E_{\gamma 1} + E_{\gamma 2} > 250$ MeV



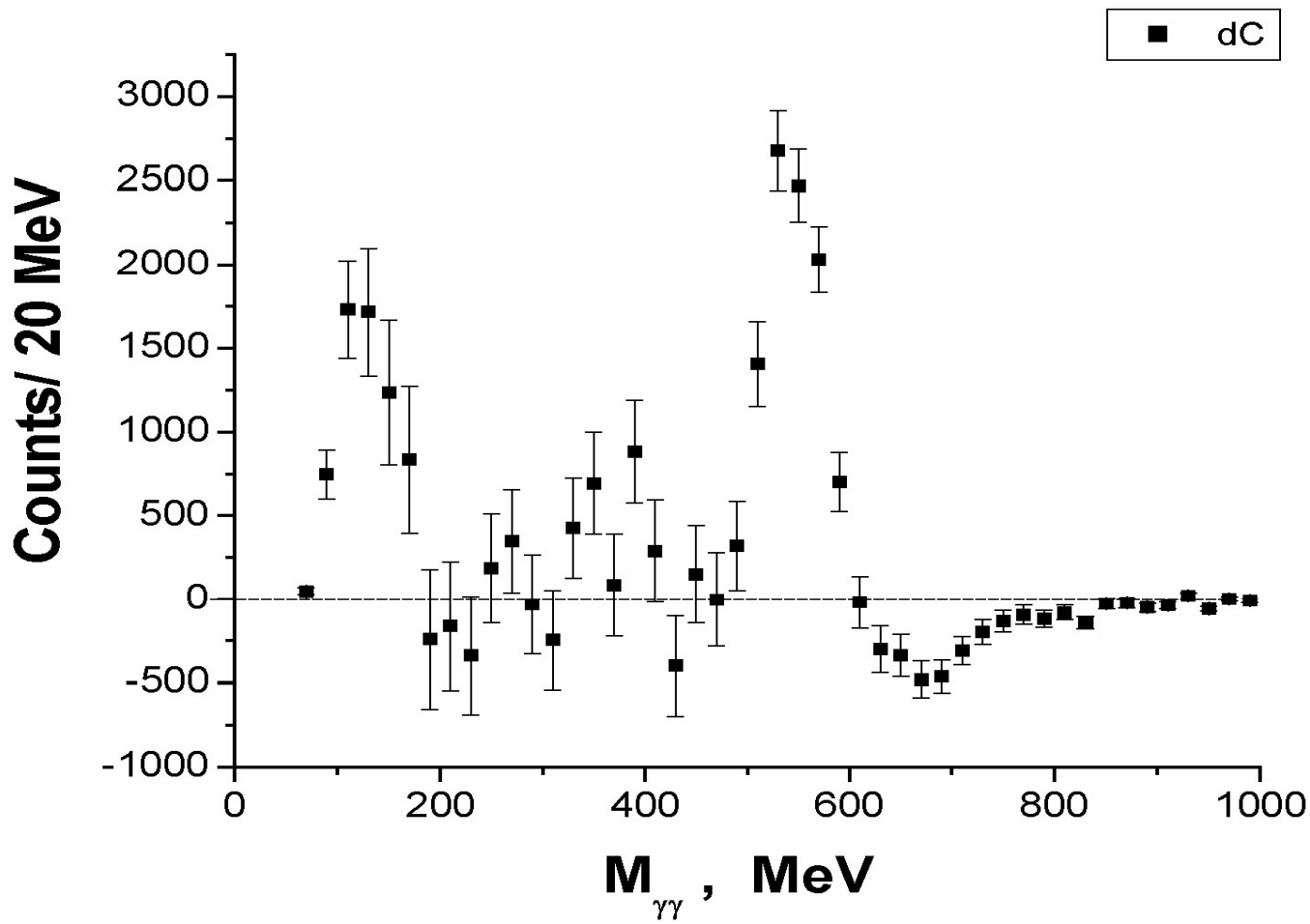
Registration of low energy γ-quanta



The experiment on the Nuclotron

$d + C \rightarrow \gamma + \gamma + X$, P_d = 2.8 GeV/c per nucleon

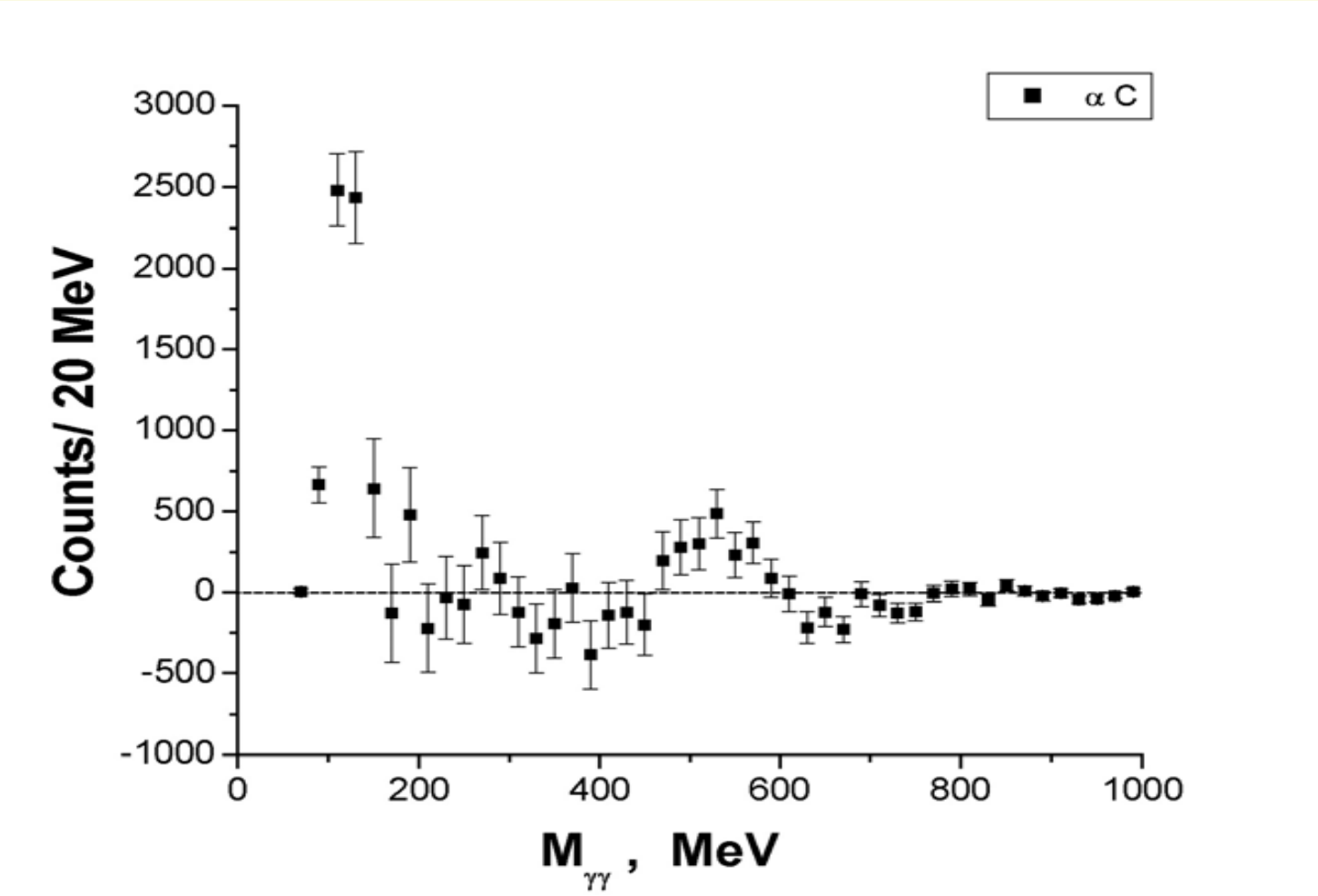
Selection criteria: $E_\gamma > 50$, $E_{\gamma 1} + E_{\gamma 2} > 250$ MeV

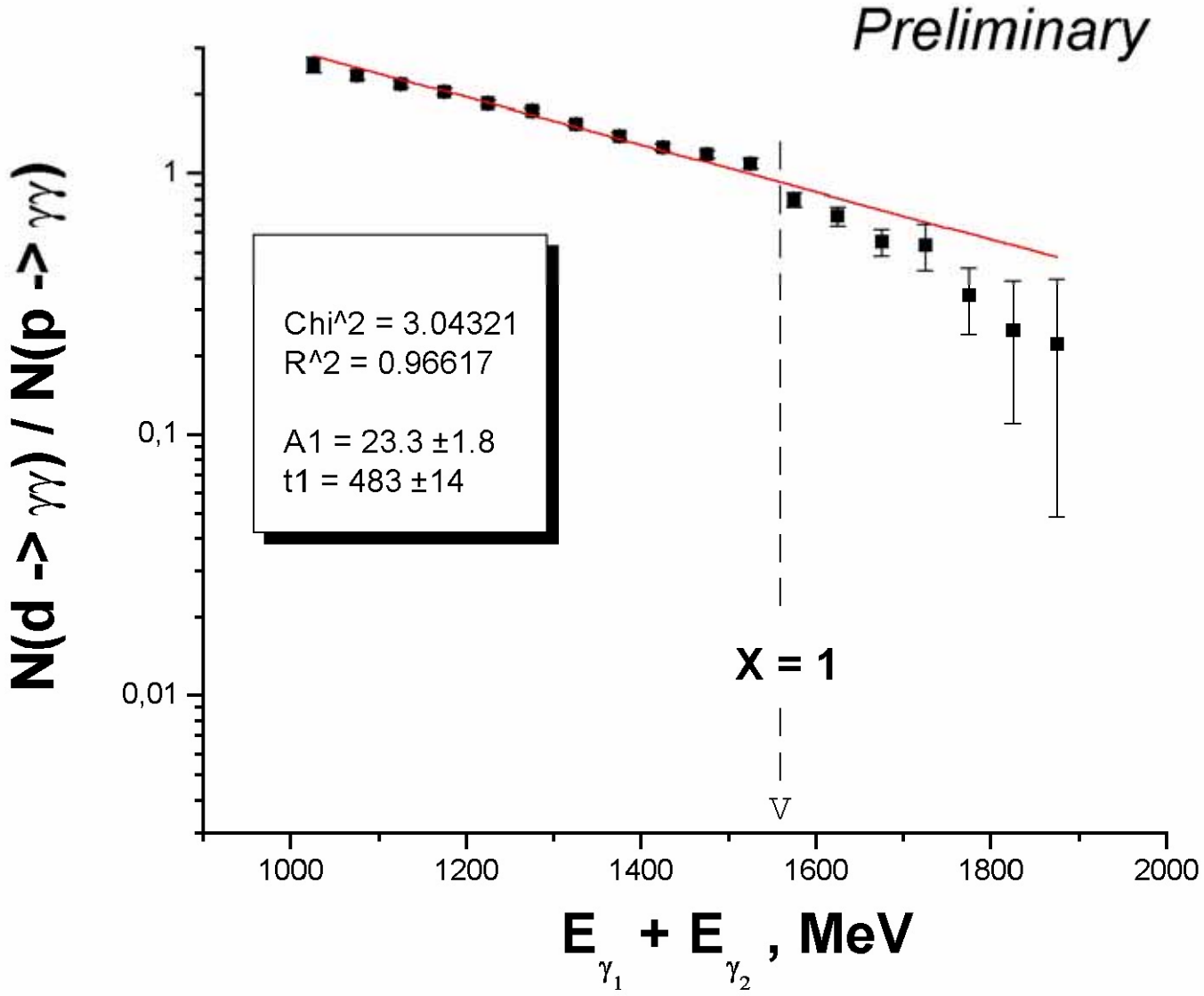


The experiment on the Nuclotron

$d + C \rightarrow \gamma + \gamma + X$, P = 5.5 GeV/c

Selection criteria: $E_\gamma > 50$, $E_{\gamma 1} + E_{\gamma 2} > 250$ MeV

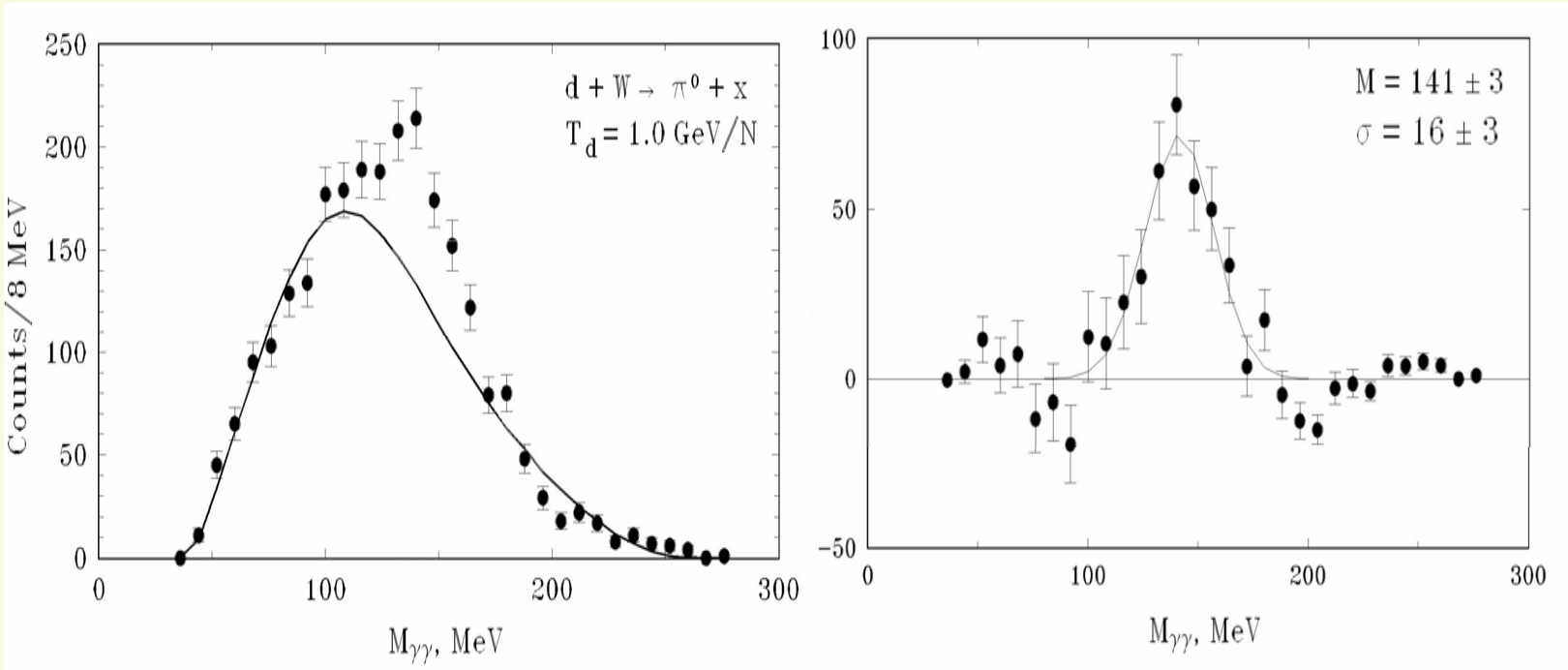



Preliminary
N(d -> γγ) / N(p -> γγ)
1
0,1
0,01
Chi^2 = 3.04321
R^2 = 0.96617
A1 = 23.3 ±1.8
t1 = 483 ±14
X = 1
1000
1200
1400
1600
1800
2000
E γ1 + E γ2 , MeV

The experiment on the Nuclotron

$d + W \rightarrow \gamma + \gamma + X$,

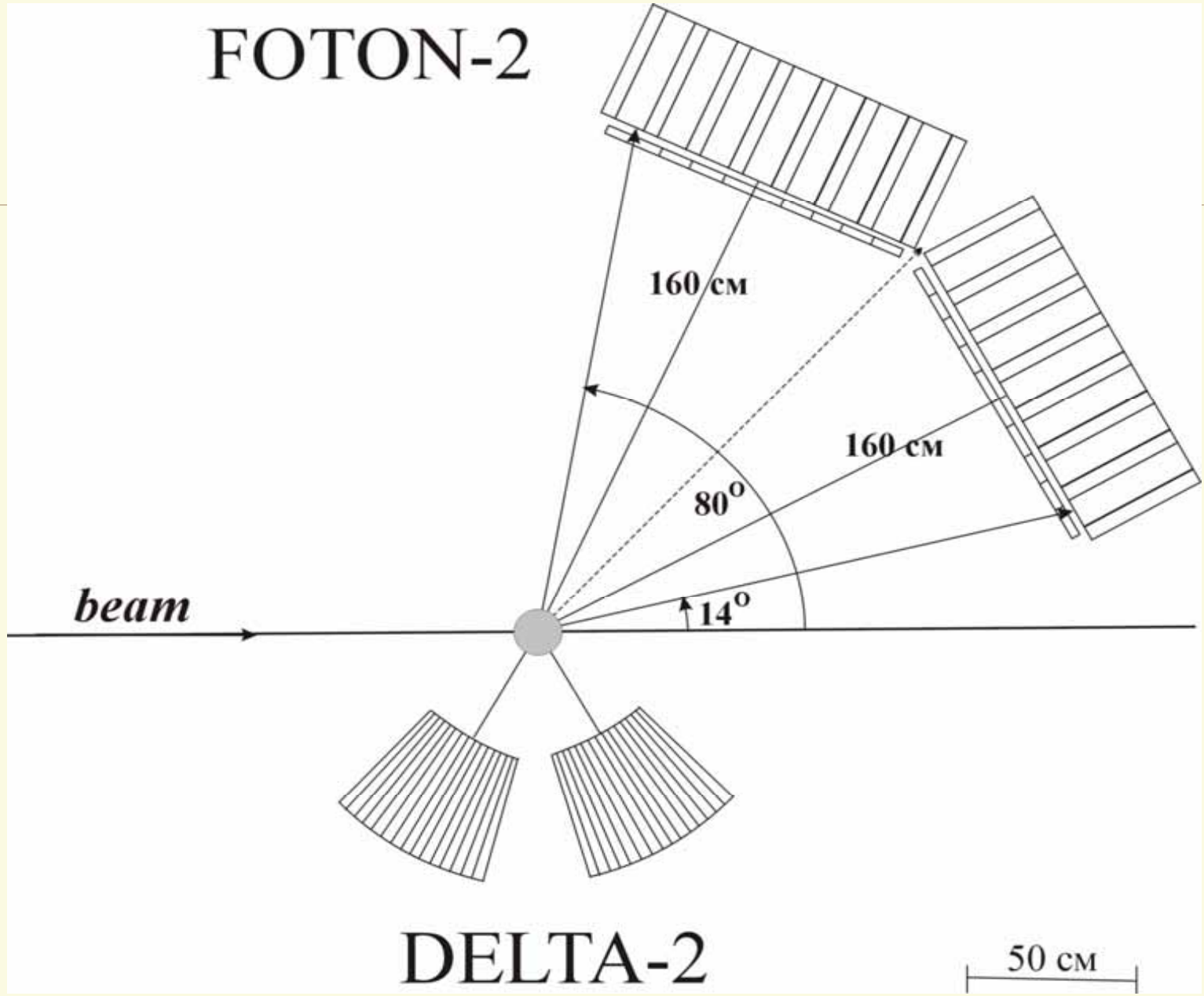
P_d = 1.7 GeV/c per nucleon



- Distance W from the internal target: 1m.

The Research Program

- To investigate η production in relativistic nucleus-nucleus collisions near the threshold.
- To study multiple neutral pion production and to compare the average transverse momenta of particles in the final state with the results for inclusive processes.
- To search for a possible π-condensation in central nucleus-nucleus collisions when the critical densities of nuclear matter can be formed with pion vacuum violations.
- To investigate the state of hot and dense nuclear matter formed in nucleus-nucleus collisions: joint experiments with setup DELTA-2.


FOTON-2
160 см
160 см
80°
14°
beam
DELTA-2
50 см

Thank you for attention!