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NA46 experiment (Darmstadton Hunting in the Interaction γ- Crystal)

G. Bassompierre, D. Boget, J. Dufournaud, M. Gouanère, M. Richard, D. Sillou* and M. Spighel, LAPP (Annecy)

M. Chevallier**, B. Farizon-Mazuy, M. Farizon, M.J. Gaillard, R. Genre, B. Ille, R. Kirsch and P. Lautesse, I.P.N. (Lyon)

G. Bologna[1], E. Rossetta, S. Costa[3], A. Feliciello[2] and R. Garfagnini[2], (Torino)

[1]Istituto di Fisica Generale, [2]I.N.F.N., [3]Dip. di Fisica Sperimentale
*contactman, **spokesman

In the interaction of 100 GeV photons, with the strong field of a cristal [Ge<110>, 400 μm, 100°K], we observed 3 new experimental facts:

i) Indications of the production of 2 neutral particles which decays into e^+e^-

$m_1 \simeq 2{,}2$ MeV/c^2 $\quad \tau_1 \lesssim 10^{-13}$ sec $\quad$ B.R.$_1$ (m_1/e^+e^- pairs) $\simeq 2 \times 10^{-3}$

$m_2 \simeq 3{,}5$ MeV/c^2 $\quad \tau_2 \gtrsim 2\times10^{-12}$ sec $\quad$ B.R.$_2$ (m_2/e^+e^- pairs) $\simeq 2 \times 10^{-5}$

The line at 1,8 MeV/c^2 observed at Darmstadt, is seen only as a 2,8 σ signal in our data;

ii) the production of the e^+e^- pairs in strong field, as well this of the new particles are associated with a shower of low energy photons (≤ 3 GeV) which carry 15% to 25% of the energy of the incoming photon;

iii) the e^+e^- left-right distribution in the horizontal plane shows an asymmetry (Ne^+ left - Ne^- right)/(Ne^+ left + Ne^- right) = 0.64 (80% of the pairs are created in the strong field).

This strong asymmetry is independent of the momentum of the pairs. It looks to be created in the crystal, after the multiple scattering, and in the presence of a residual horizontal magnetic field of 1-3 gauss (in contradiction with the parity conservation in QED, even in strong field).

We ask for a beam period of 2 months, starting in July 1991, in order to confirm these surprising results, connected, as we believe, to the physics of the strong fields. For data taking, the necessary conditions on the beam H2 are: i) production angle 0 mrad; ii) 60 or

The program study will be as follow:

i) study of the asymmetry Δy (e^+e^-);

ii) mass spectra in "short life" mode (TRIM 5 "OFF");

iii) mass spectra in "long life"mode (TRIM 5 "ON"), measurement in function of different magnets $A_{1\text{-}4}$ (see technical addendum), in order to measure the life time;

iv) measurement on W crystal (100° K - 50 μm) in order to increase the mass productions and the branching ratios;

v) mass spectra in "long life" mode (TRIM 5 "ON") with a beam of 150 GeV/c e^- (instead of photons);

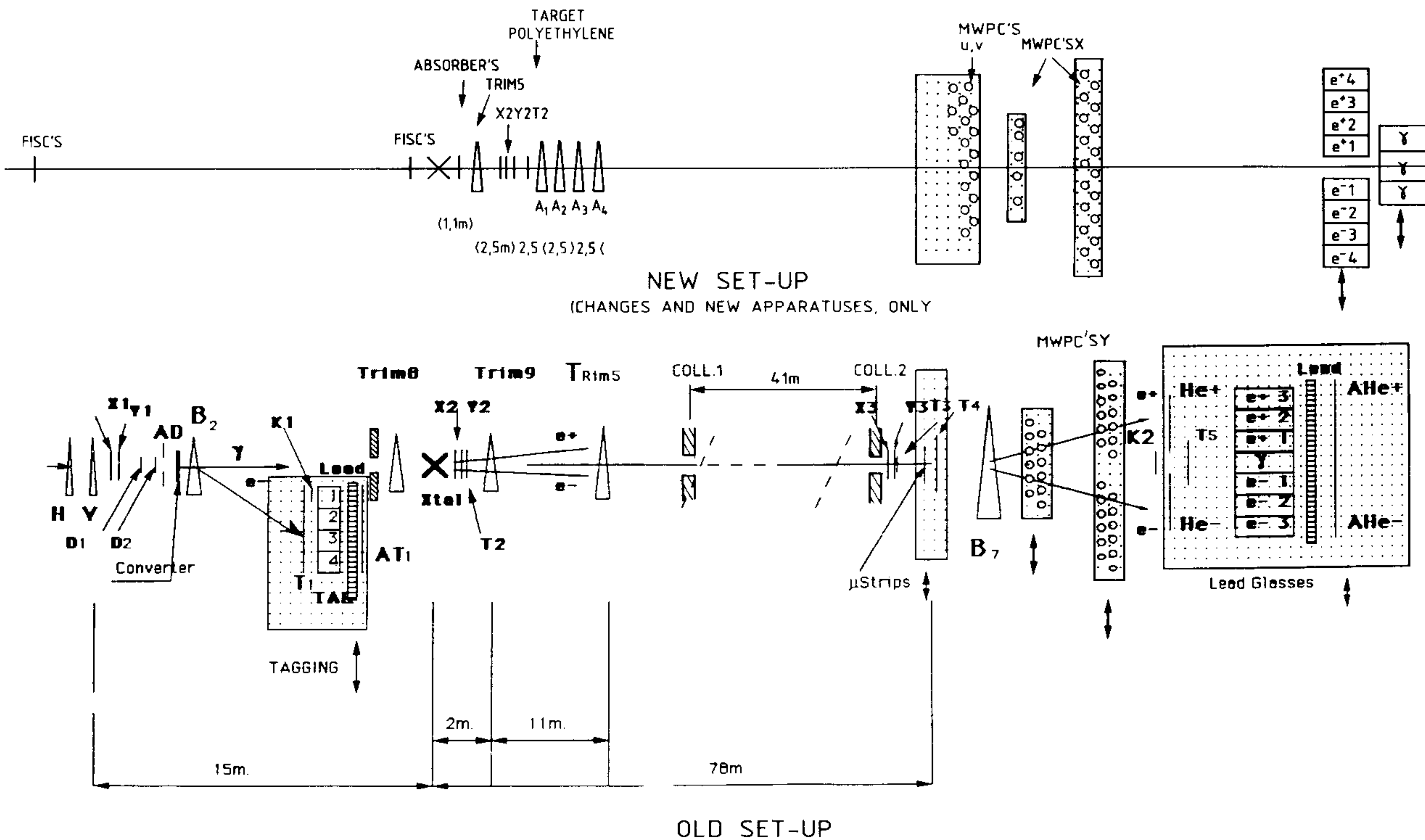
vi) measurements in random angular position of the crystal, in order to evaluate the background and systematic errors;

vii) measurements of absorption cross-section in materials of the X^{o}'s after its confirmation.

NA46 Experiment - TECHNICAL ADDENDUM

List of modifications of the set-up

1) Active crystal of Ge, i.e. detection of the e^+e^- pairs produced in the crystal. After 2 unsuccessfull attempts, the active crystal proposed in P241 addendum 1 was not usable in June 1990.
2) W crystal (100° K - 50 μm) in order to increase the mass productions and branching ratios.
3) Magnets: i) MDXH (TRIM 5) should replace MCV (TRIM 9); ii) construction of 4 small magnets A_{1-4} of 3×10^{-2} T.m, one is used to replace TRIM 5, the others will subdivide the path between TRIM 9 and TRIM 5.
4) Our control station BC2 (T2, X2, Y2) will be moved after TRIM 5 and will be provided with a movable 1 mm thick polyethylene target. This target will simulate a mass of about 2 MeV which decays between TRIM 5 and A_1.
5) The FISC's on both sides of the H_2 CEDAR will be moved, one at the output of the H_2 tunnel, the other between TRIM8 and our crystal.
6) Degaussing control (< 0,1 gauss) of the magnets MDXH and A_{1-4} :
   i) the zero of the control system should be adjustable without beam interruption; ii) the current delivered to these magnets should be adjustable by step of ± 2 mA; iii) the magnet MDXH should also be supplied up to 200 A.
7) Two wire chambers (1mm pitch) one shifted by 0.5 mm with respect to the other, will be installed in u,v direction, 1 m after the μ strips and before B7. This will have two purposes: i) resolve the ambiguity of e^+e^- in vertical position on the μ strips; ii) eliminate the pairs created on the tubes outside the beam axes (halo, etc...).
8) The end calorimeter will be divided in three parts, in order to measure separately the energy of e^+, e^- and γ. The photon calorimeter will be removable separately, due to the radiation damage in the beam axis.
9) Wire chambers with horizontal wires will be added in order to improve the correlation between wire chambers and μ strips.
10) The distance between the μ strips and the last detector (γ calorimeter) will be increased up to 6.9 meters (1.0 m for MWPC u,v - 4.8 m for e^+, e^- calorimeter - 1.1 m for γ calorimeter). In order to do this modification, the last collimator, BC3 and the μ strips will be moved upstream by 4.6 m (distance Xtal to μ strips reduced to 74 m), B7 by 3.6 m and the separation between NA46 and NA35 will be moved downstream by 0.4 m. If a shielding is necessary between NA35 and NA46 during our period, it should be put in the NA35 area before the FISC's.



FISC'S
FISC'S
ABSORBER'S
TRIM5
X2Y2T2
TARGET
POLYETHYLENE
A1 A2 A3 A4
(1,1m)
(2,5m) 2,5 (2,5) 2,5 (
MWPC'S
u,v
MWPC'SX
e+4
e+3
e+2
e+1
e-1
e-2
e-3
e-4
NEW SET-UP
(CHANGES AND NEW APPARATUSES, ONLY
X1
Y1
AD
B2
H
V
D1
D2
Converter
γ
e-
K1
Lead
1
2
3
4
T1
TAG
AT1
TAGGING
Trim8
Trim9
TRim5
X2
Y2
Xtal
T2
e+
e-
COLL.1
41m
COLL.2
X3
Y3
T3
T4
μStrips
B7
MWPC'SY
K2
e+
e-
He+
He-
T5
e+ 3
e+ 2
e+ 1
γ
e- 1
e- 2
e- 3
Lead
AHe+
AHe-
Lead Glasses
2m.
11m.
15m.
78m
OLD SET-UP