NEUTRON DETECTOR FOR «GAMMA-400» SPACE OBSERVATORY

Trieste, 2-4 May, 2013
AC - anticoincidence detectors (AC top, AC lat)

C - Converter-Tracker - total 1 Xo

8 layers W 0.1 Xo + Si (x,y) (pitch 0.1 mm)
2 Si(x,y) no W

S1, S2 - TOF detectors

S3, S4 - calorimeter scintillator detectors

CC1 - imaging calorimeter (2Xo)
2 layers: CsI(Tl) 1Xo + Si(x,y) (pitch 0.1 mm)

CC2 - electromagnetic calorimeter
CsI(Tl) 23 Xo 3.6x3.6x3.6 cm³ - 28x28x12 = 9408 crystals

LD - 4 lateral calorimeter detectors
ND - neutron detector

“GAMMA-400” space observatory design scheme
Trieste, 2-4 May, 2013
The neutron detector is designed as an additional instrument for separating electron and proton cascades.

Trieste, 2-4 May, 2013
SCHEMATICS OF THE NEUTRON DETECTOR

Trieste, 2-4 May, 2013
CALCULATED ENERGY SPECTRA OF NEUTRONS FOR PROTON AND ELECTRON CASCADES

Proton (1 TeV)

Electron (400 GeV)

Number of neutron difference between proton and electron showers (for 10 events of initiated charged particle)

Trieste, 2-4 May, 2013
TIME DEPENDENCE OF CHARGED PARTICLE OCCURRENCE IN THE SCINTILLATORS

Time distribution of particles in the scintillator for proton cascade (energy 1000 GeV)

Trieste, 2-4 May, 2013
Fitting parameters obtained by using $Y = ax^{-b}$ fit-function

For the electron cascade:

$a = 114 \pm 7 \times 10^3$, $b = 1.09 \pm 0.01$

For the proton cascade:

$a = 249 \pm 4 \times 10^5$, $b = 1.410 \pm 0.002$

Trieste, 2-4 May, 2013
SPATIAL DISTRIBUTION OF PARTICLE DETECTION COORDINATES IN THE LAYERS OF BORON SCINTILLATOR

Proton cascade (energy 1000 GeV, 10 events)

Electron cascade (energy 400 GeV, 10 events)

Trieste, 2-4 May, 2013
Approximation of particle detection coordinates on Y and Z axes by the Gaussian distribution.

Trieste, 2-4 May, 2013
DETECTION EFFICIENCY DEPENDENCE AS A FUNCTION OF REFERENCE TIME

<table>
<thead>
<tr>
<th>Protons/Electrons energy (GeV)</th>
<th>25/10</th>
<th>250/100</th>
<th>1000/400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of detected neutrons for cascade (10 events)</td>
<td>2912/56</td>
<td>9185/620</td>
<td>39530/2720</td>
</tr>
<tr>
<td>p/e separation factor</td>
<td>52.0</td>
<td>14.8</td>
<td>14.5</td>
</tr>
</tbody>
</table>

Trieste, 2-4 May, 2013
COMPLETE DETECTOR WITHOUT ELECTRONICS PERIPHERY (3D MODEL)

Trieste, 2-4 May, 2013
SCHEME OF THE DETECTOR ELECTRONICS

Trieste, 2-4 May, 2013
Two strips. Dimensions of sensitive area of strip:
400 x 100 x 40 mm
Trieste, 2-4 May, 2013
THANK YOU FOR YOUR ATTENTION