Hunting for the positively charged excess
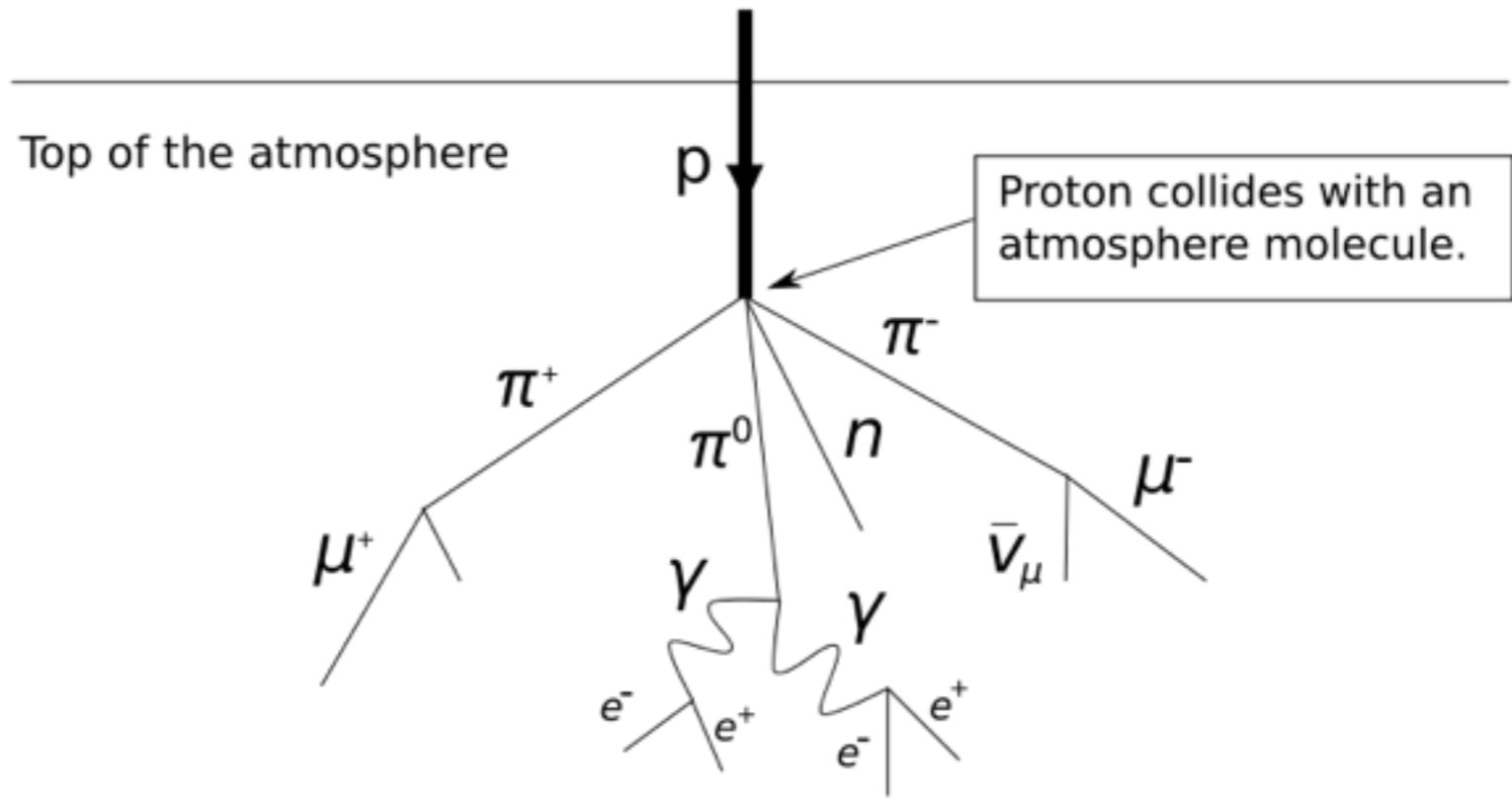
Group 7:
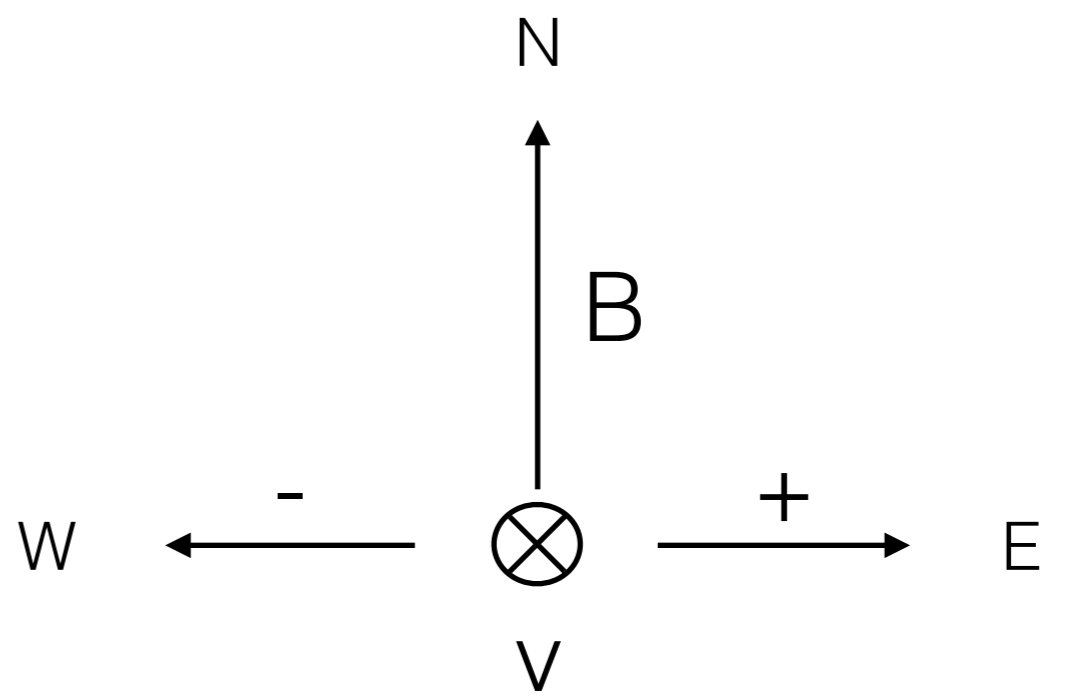Giuseppe De Mauro - Naghmeh Mohammadi - Mick Mulder - Tim Wolf

Top of the atmosphere
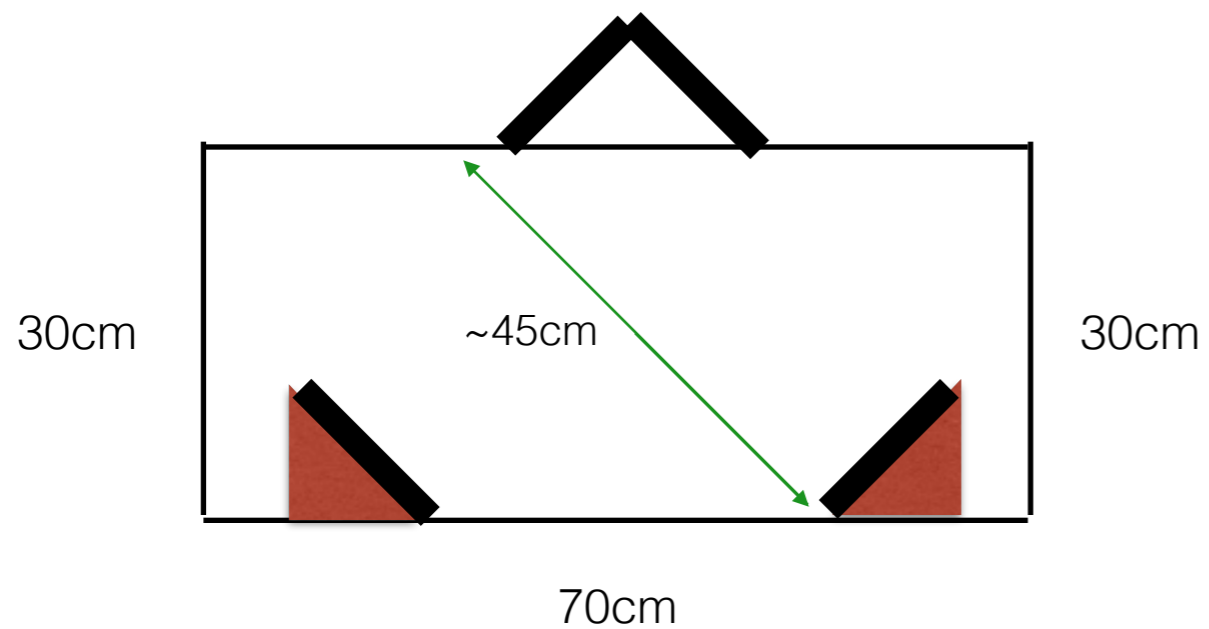
p

Proton collides with an atmosphere molecule.

π^-

π^+

π^0

n

μ^-

μ^+

γ

$\bar{v}_\mu$

γ

e^-

e^+

e^-

e^+

Lorentz force: f=q(vxB)

positively charged -> east

negatively charged -> west

N

B

W

-

+

E

V

1

30cm

~45cm

30cm

70cm
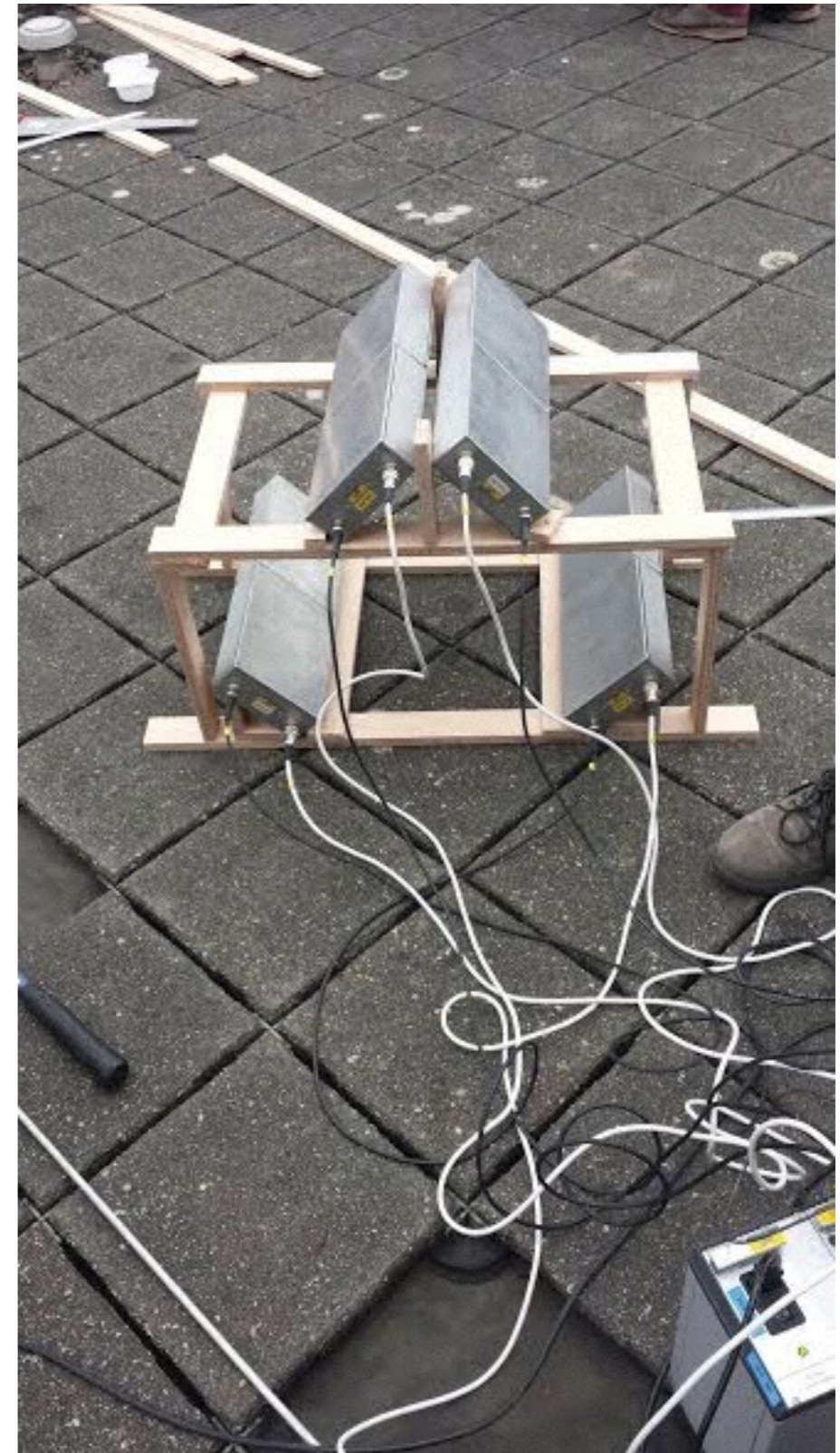
Declination angle: 45 deg

Distance between the scintillators: 45 cm

Opening angle: 18.4 deg

2

$$A = \frac{N_{east} - N_{west}}{N_{east} + N_{west}}$$

$$\Delta A = \frac{2}{(N_{east} + N_{west})^2} \sqrt{(N_{east} \Delta N_{west})^2 + (N_{west} \Delta N_{east})^2}$$

Error: $\Delta A_{tot} = \frac{1}{2} \sqrt{(\Delta A_1)^2 + (\Delta A_2)^2}$

Combination: $A_{tot} = \frac{A_1 + A_2}{2}$

Systematic check:

Average relative efficiency difference ΔA/A = 3%

	# measurement 1	# measurement 2
N(east)	1020	1060
N(west)	974	935
N(tot)	1994	1995

Charge asymmetry:

measurement 1: $\qquad A_1 = (2.3 \pm 2.2)\%$

measurement 2: $\qquad A_2 = (6.3 \pm 2.3)\%$

average of both measurements: $A_{tot} = (4.3 \pm 1.6)\%$

2,7σ = 99,7% certainty excess of positively charged particles

Conclusions and outlook

- An excess of 4,3% has been seen with ~3σ significance

- Limited by statistics

- More measurements foreseen

- Background check needed: for random events