PHY397K - NUCLEAR PHYSICS - 13

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Spring 2015, Unique numbers: 57115
RLM 5.116, TTH 12:30 - 2:00 pm

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. Koch, B. Müller, J. Rafelski (1986). "Strangeness in relativistic heavy ion collisions". Physics Reports 142 (4): 167. Bibcode:1986PhR...142..167K. doi: 10.1016/0370-1573(86)90096-7.

Homework II

number charge px py pz
0 1 0.464102 0.264722 -1.24016
1 1 0.446524 0.275066 0.582579
2 1 0.196947 -0.0297039 -0.396095
3 1 0.0237435 0.112199 0.172602
4 1 0.705675 0.181663 0.66665
5 1 0.0732284 0.139458 0.20041
6 1 0.150761 0.111825 -0.118535
7 1 0.196296 0.329958 0.238096
8 1 0.632848 0.237168 1.03834
9 1 0.695853 0.27376 -0.227177
10 1 0.311155 -0.000994248 0.0337615
……

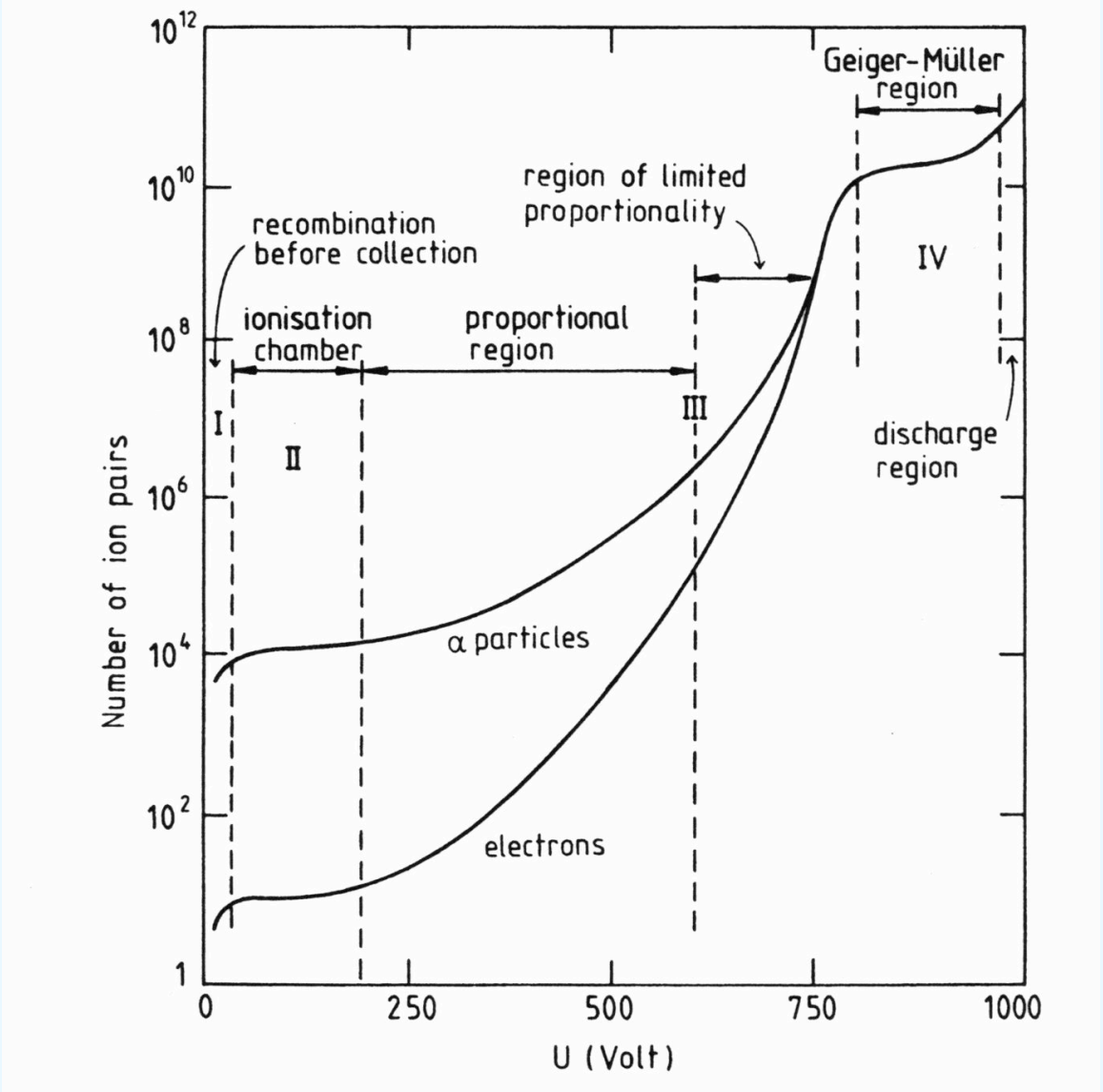
100 pions: (50 positive and 50 negative pions)
Question: How many K0 are in this sample

macro: read in ascii file basic.C

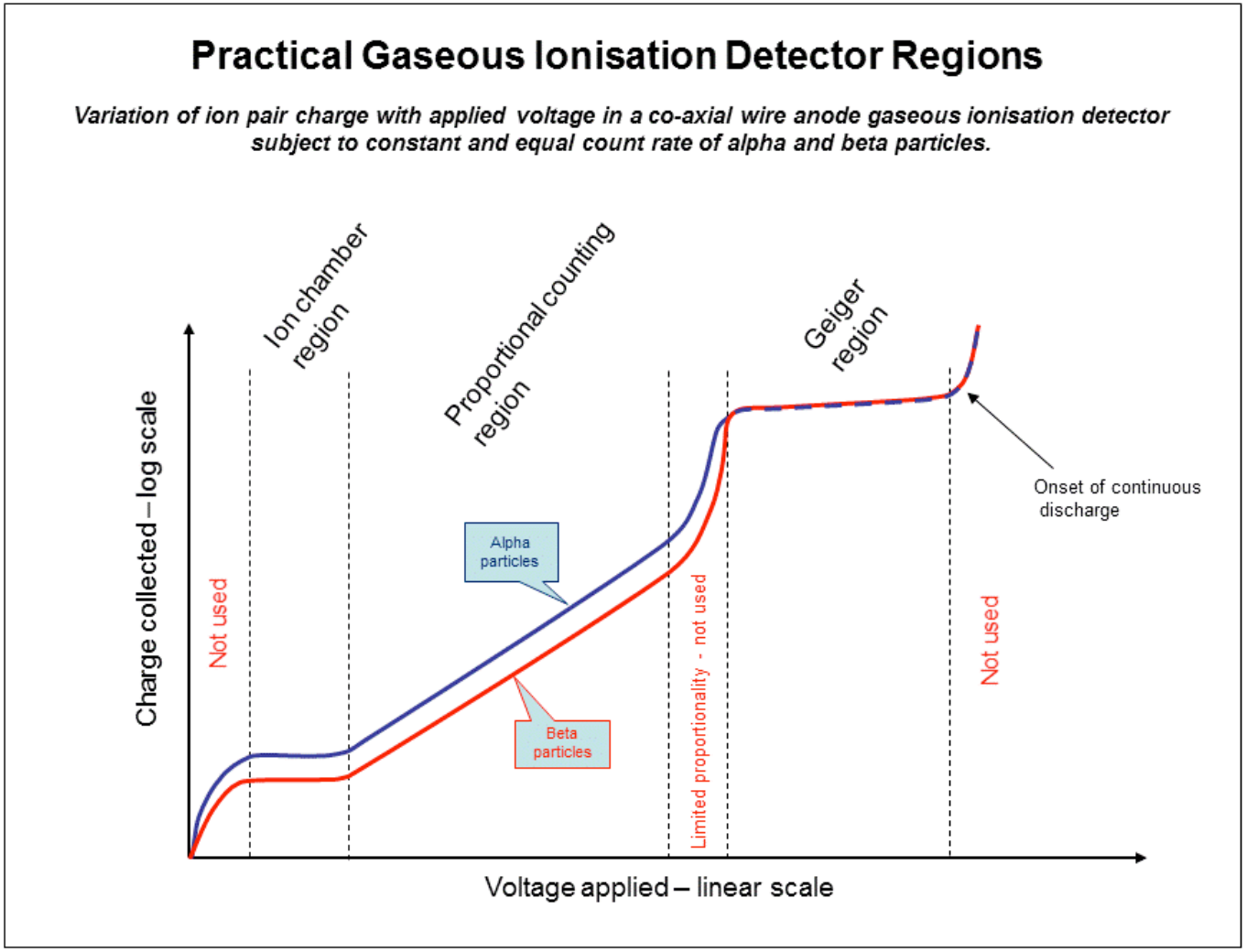
Strangeness

. Koch, B. Müller, J. Rafelski (1986). "Strangeness in relativistic heavy ion collisions". Physics Reports 142 (4): 167. Bibcode:1986PhR...142..167K. doi: 10.1016/0370-1573(86)90096-7.

Ionization Detectors – Operation range

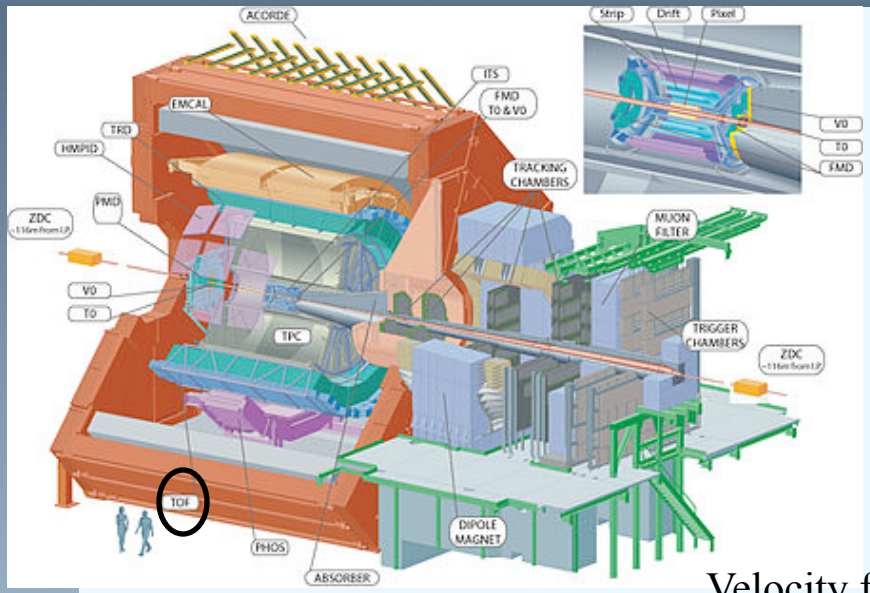


Ionization Detectors –Operation range



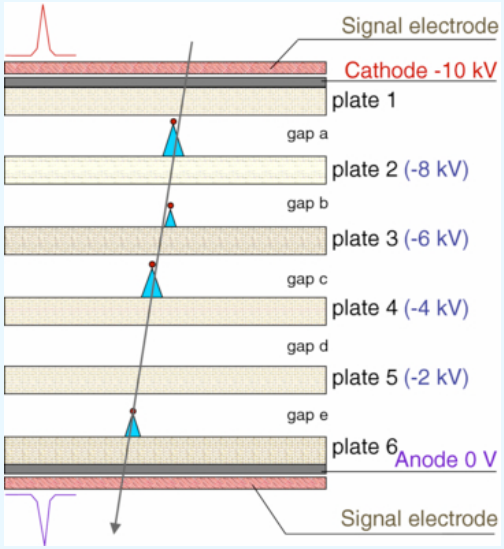
Other Ionization detector – Spark counter - MRPC

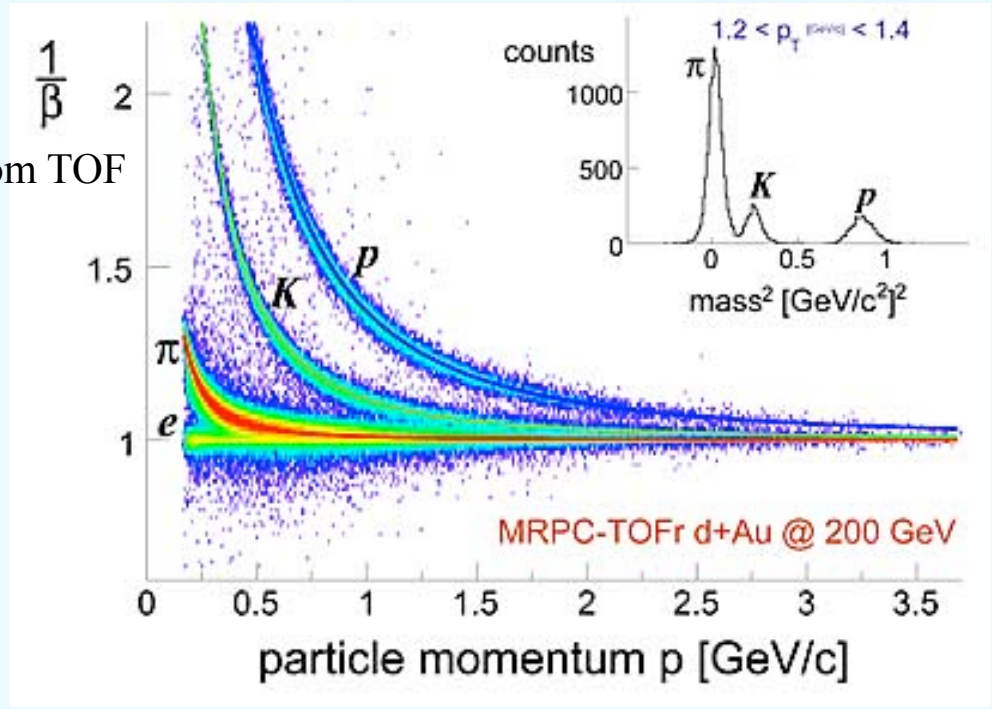
Multigap Resistive Plate Chamber (MRPC) (measures stop time)



Time of Flight detector (ToF) system
Start and stop time
Resolution ~ 100 ps (ps = 10^{-12} of a **second)**
travel at c : distance = 3 cm ~ 1 inch

Velocity from TOF

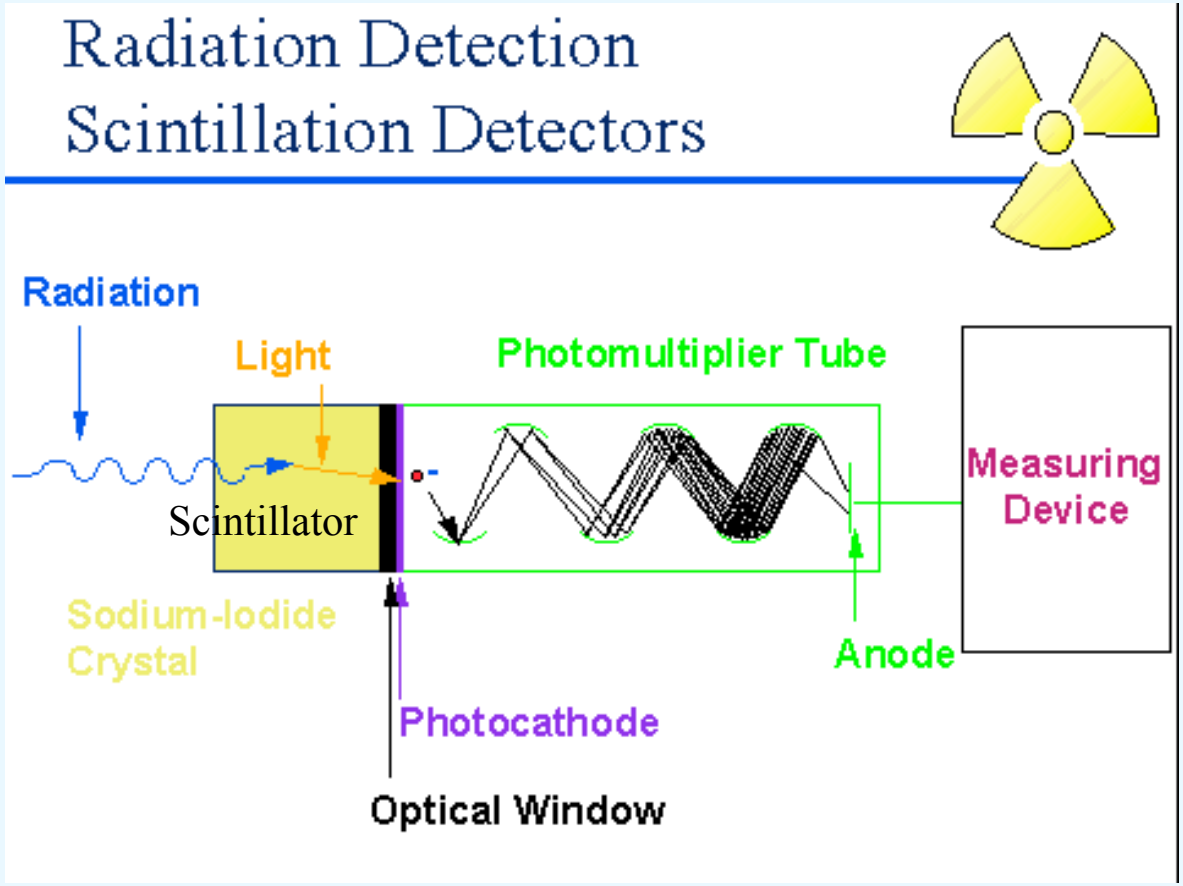




Momentum from TPC

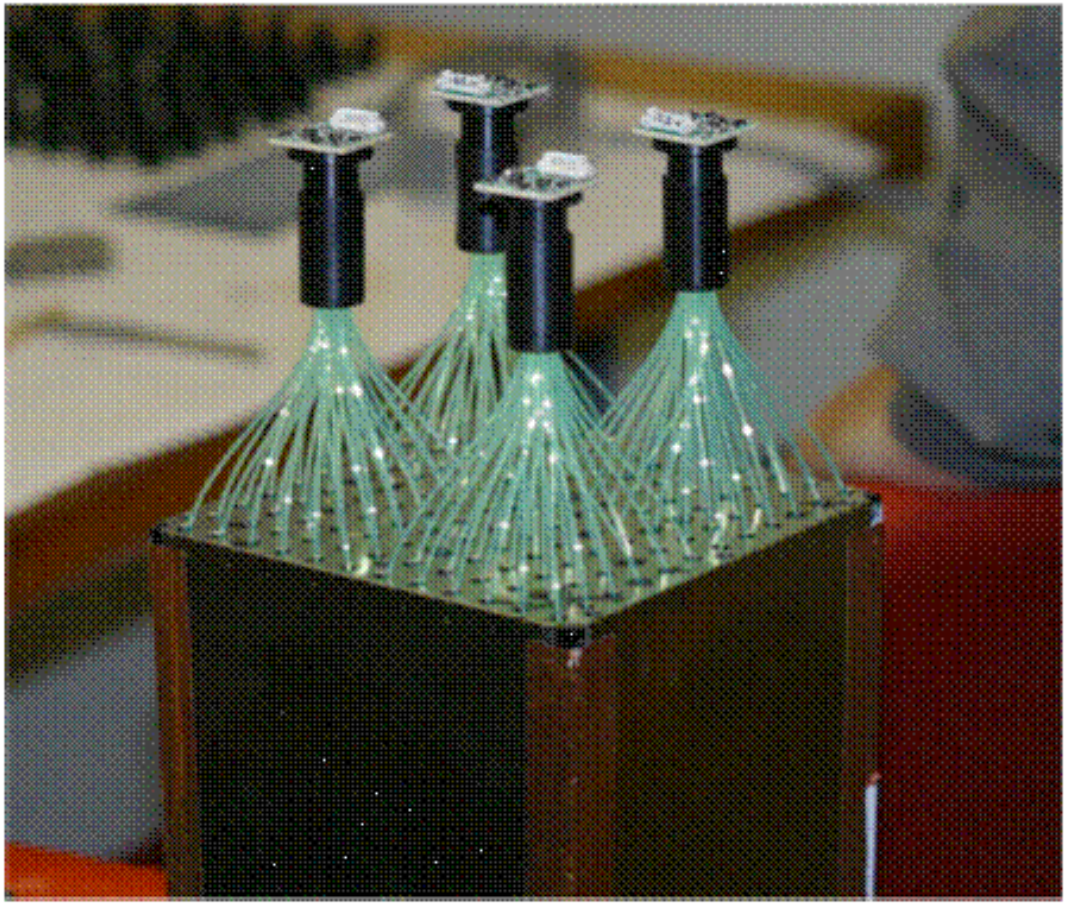
Scintillation Detector

Charged particles (and photons) can excite atoms and molecules to higher energy level. When they de-excite they emit photons (light)

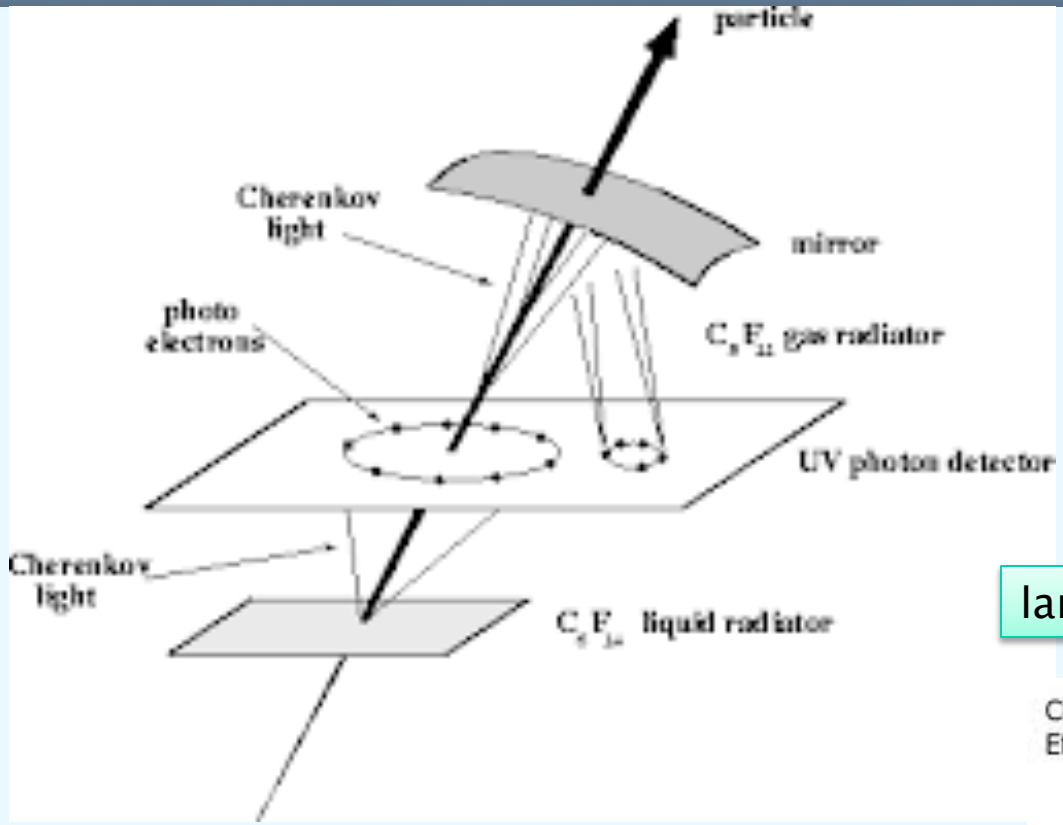


Scintillation Detector –EMCal in ALICE

EMCal in ALICE – Electromagnetic Calorimeter
http://iopscience.iop.org/1742-6596/293/1/012043/pdf/1742-6596_293_1_012043.pdf

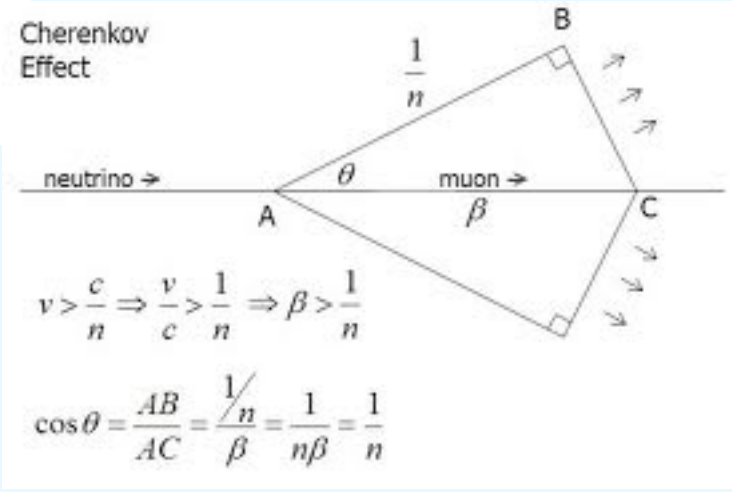


Cherenkov Detectors



P = 1 GeV/c
Proton: beta = 0.73
Kaons:beta = 0.89
Pions: beta = 0.99

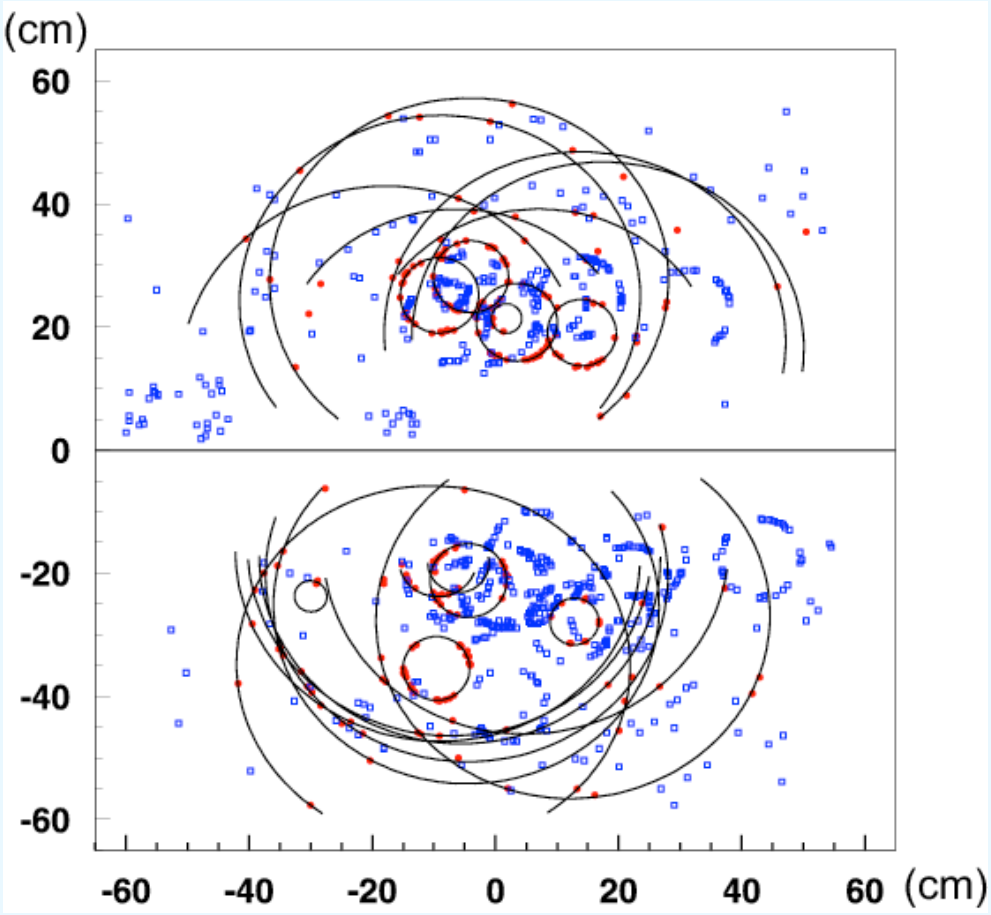
larger velocity → larger angle



When a particle moves with uniform velocity in vacuum, it does not emit radiation. However, if it enters a Dielectric medium of index of refraction n>1, with a speed Greater than the speed of light in medium v>c/n then it Emits Cherenkov radiation (photons)
(Same as "shock" front from supersonic aircraft)

Ring Image Cherenkov (RICH) Detectors

ALICE HMPID Detector



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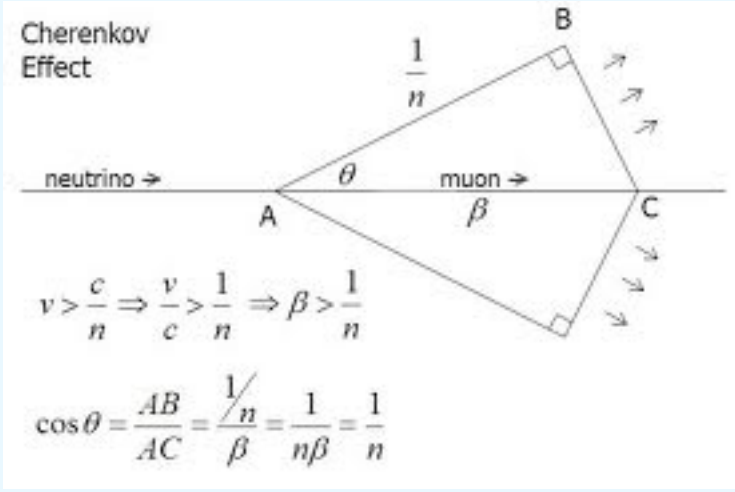

$$v > \frac{c}{n} \Rightarrow \frac{v}{c} > \frac{1}{n} \Rightarrow \beta > \frac{1}{n}$$

$$\cos\theta = \frac{AB}{AC} = \frac{1/n}{\beta} = \frac{1}{n\beta} = \frac{1}{n}$$

Ring Image Cherenkov (RICH) Detectors

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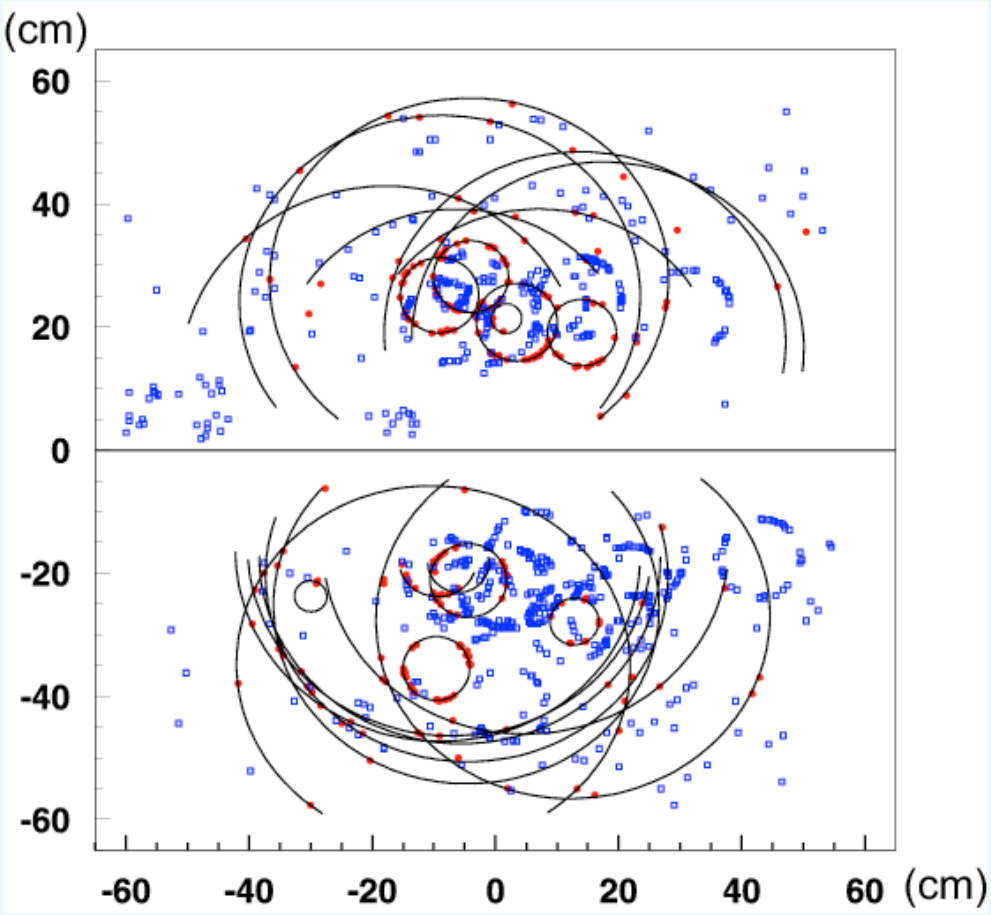
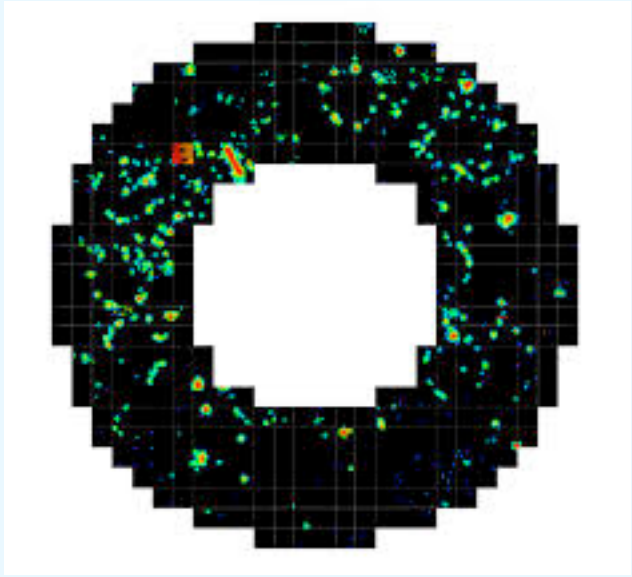
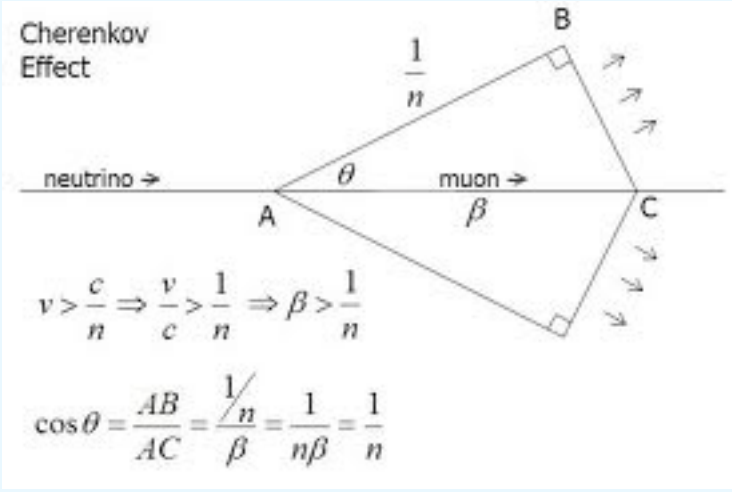
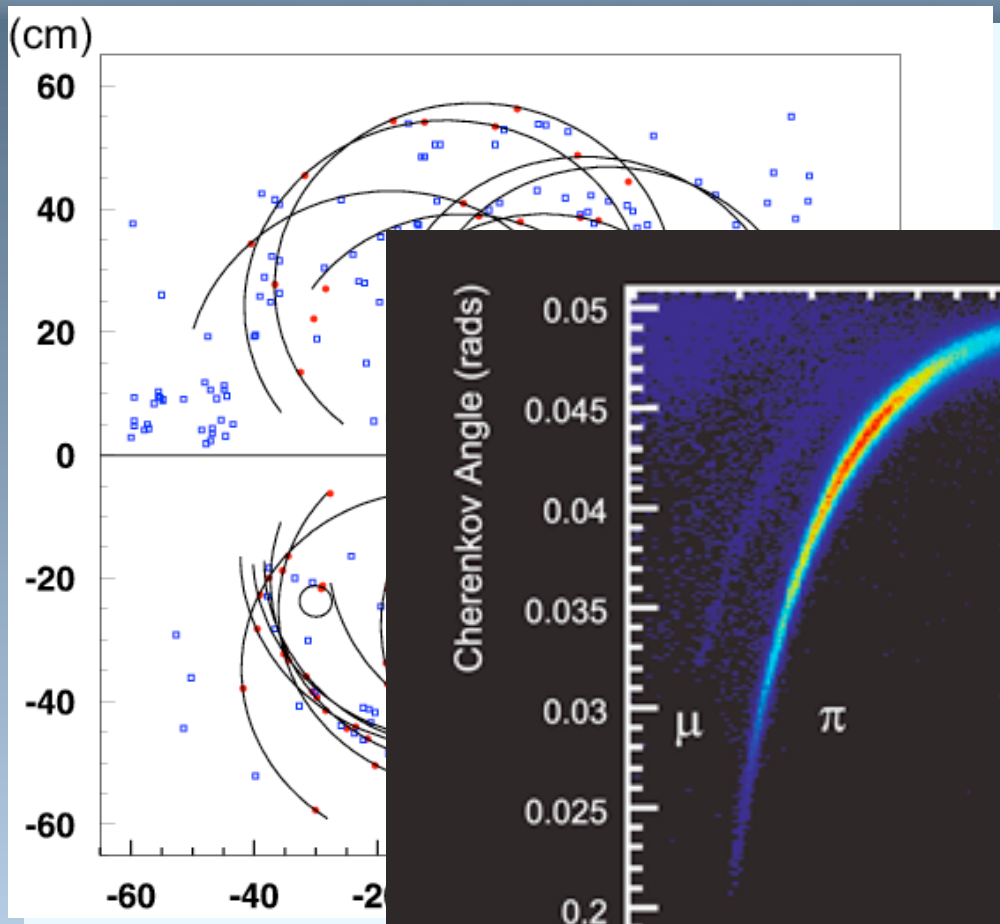


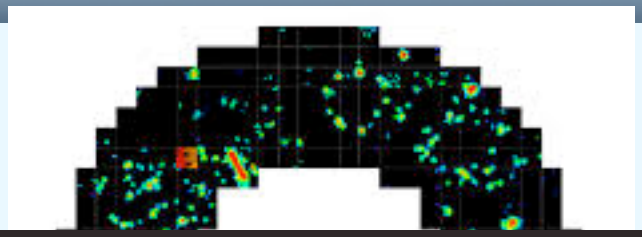


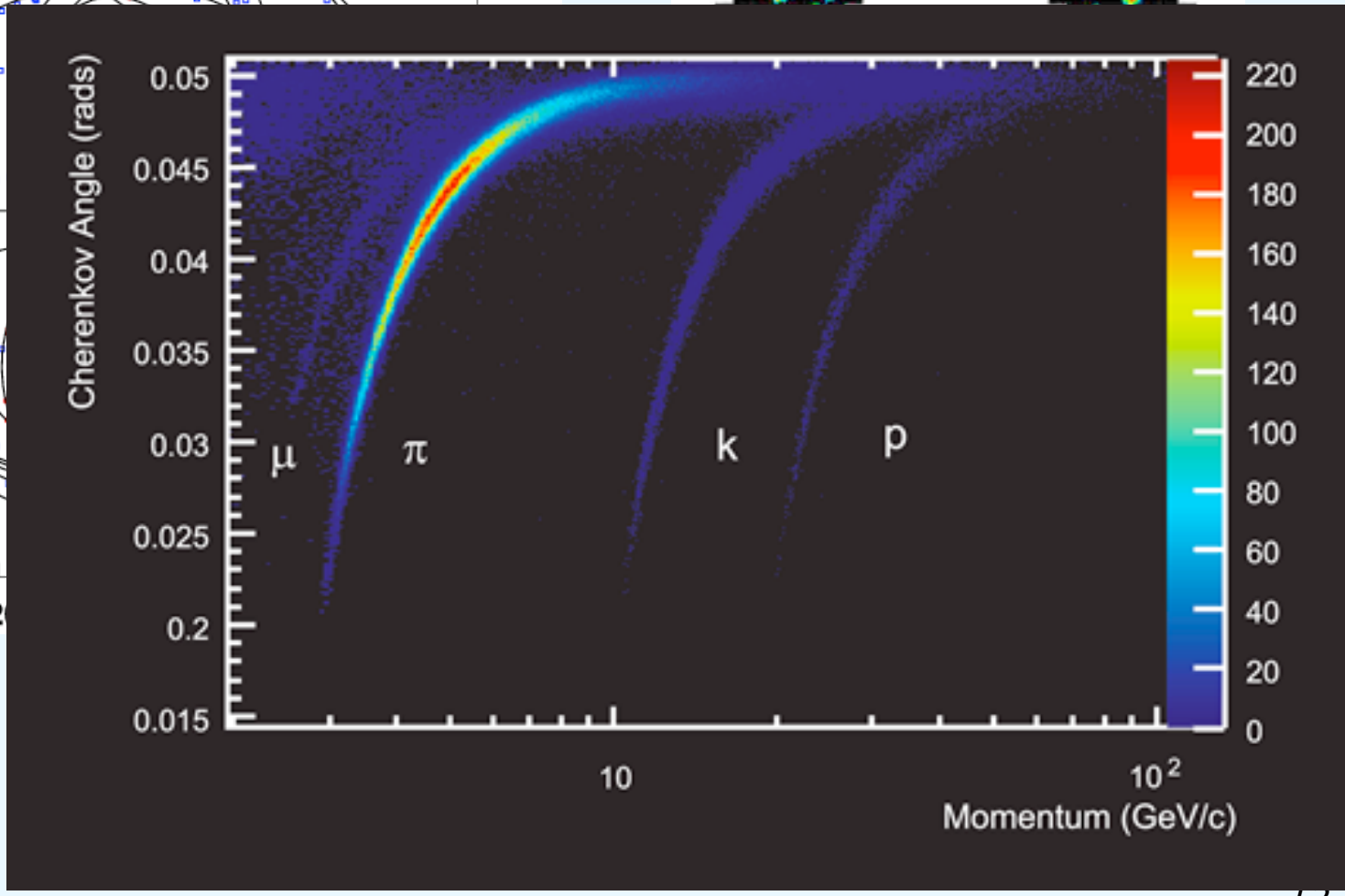


Ring Image Cherenkov (RICH) Detectors

ALICE HMPID Detector (for high momentum particles)







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