HERMES TOF experience application for OLYMPUS

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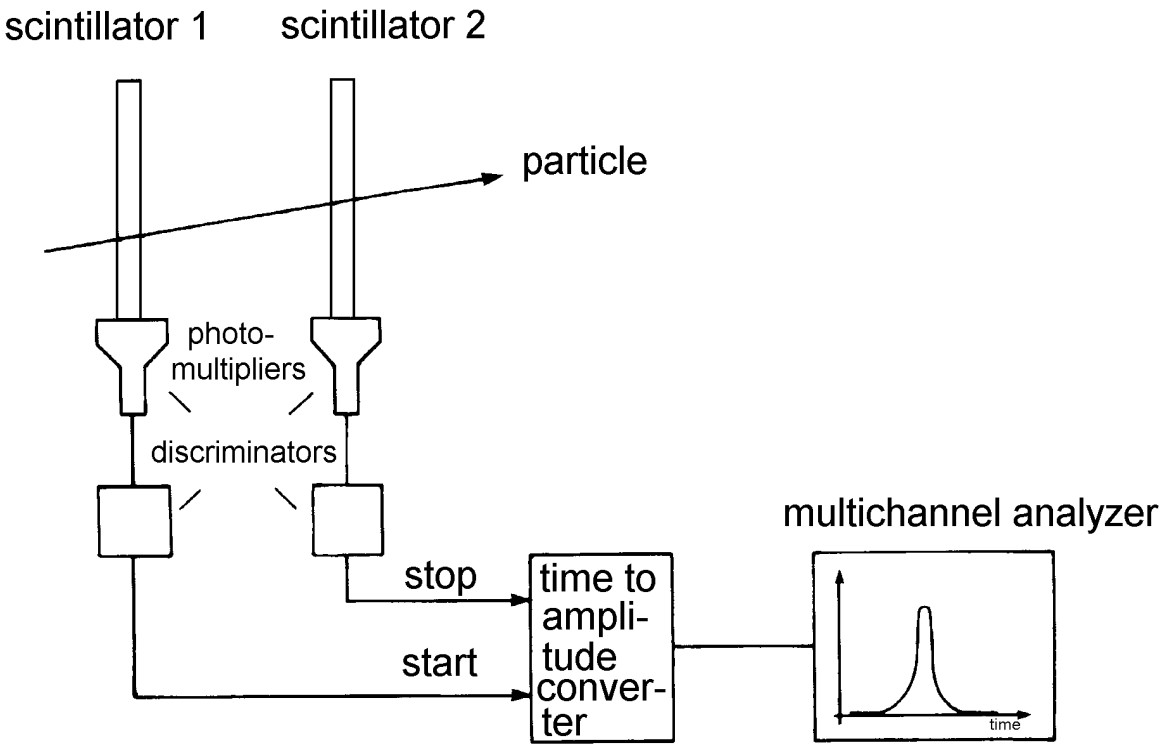
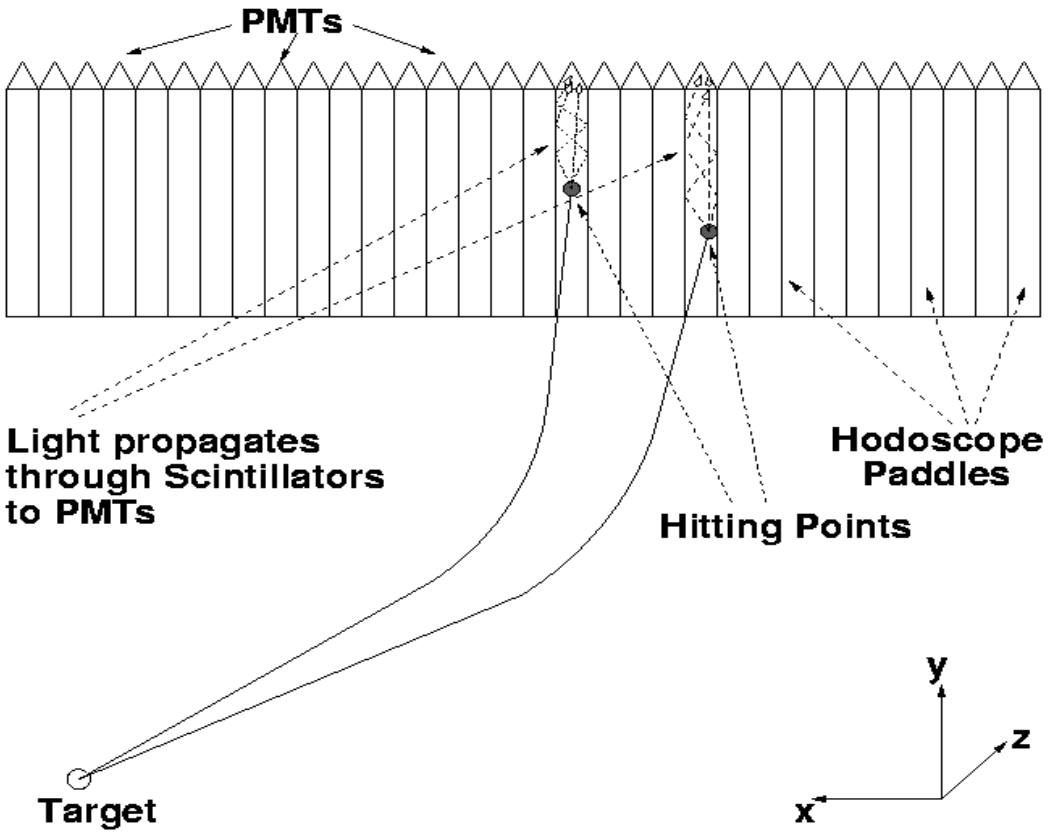
TOF PID simple description - alphabet of method



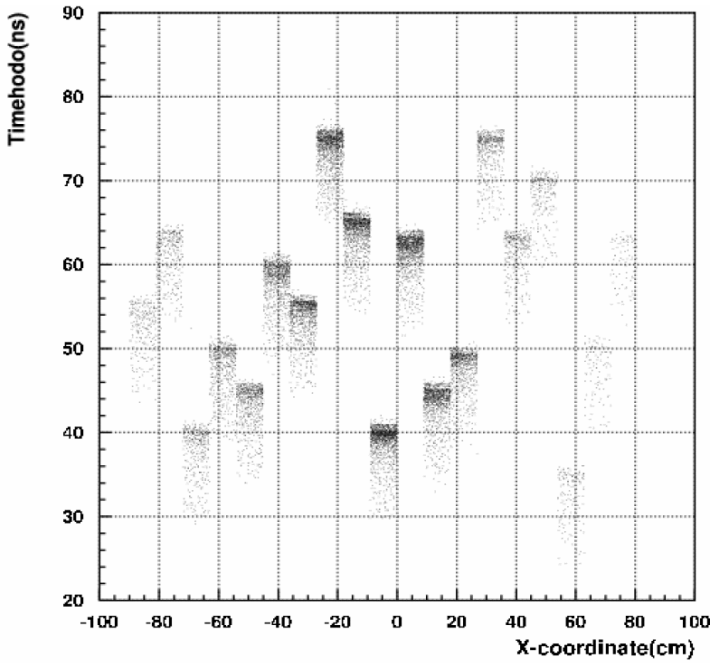
- If –
- All particles are in a narrow momentum region, or-
- The momentum of each particle is known with enough high accuracy;
- Path lengths for all of them are the same (small size counters)
- Then – the time measurement is QUITE ENOUGH! to determine the type of particle!!!

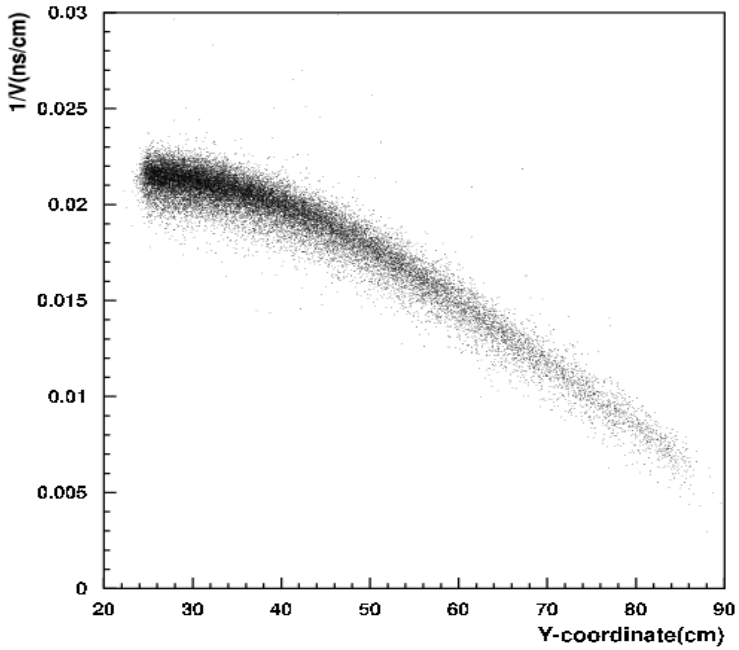
The real life is – as usually – much more complicate!



$$T=t_{pf}+t_{lf}+t_o$$

TOF calibration and tuning

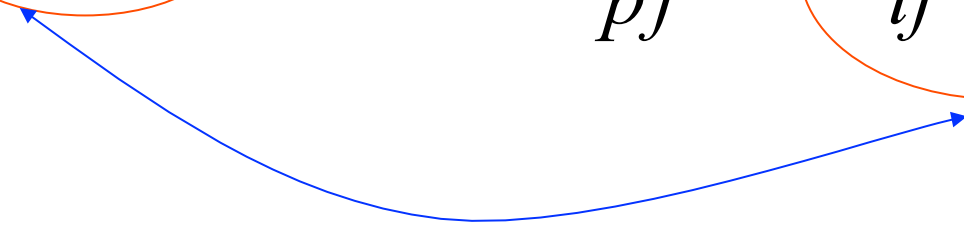




Rest mass reconstruction

$$M^2 = P^2\left(\frac{1}{\beta^2} - 1\right) = P^2\left(\frac{c^2}{V^2} - 1\right)$$

$$\frac{1}{V_e} = \frac{t}{l_H} + P_3(y) \qquad T = t_{pf} + t_{lf} + t_0$$



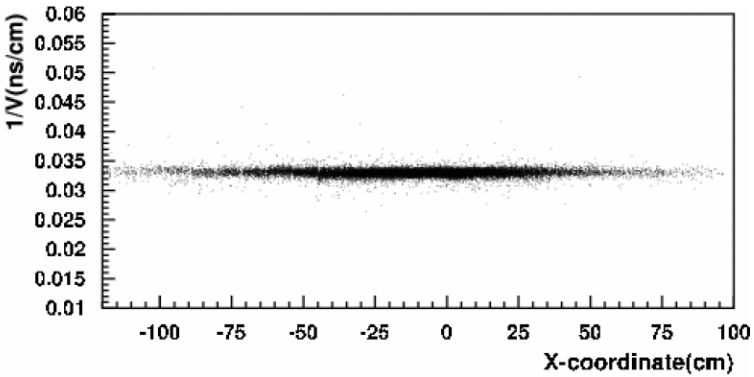
- The calibrating – or equalizing – parameter should be $1/V^2$ – *only this case simple mathematic procedures will effect linearly!*

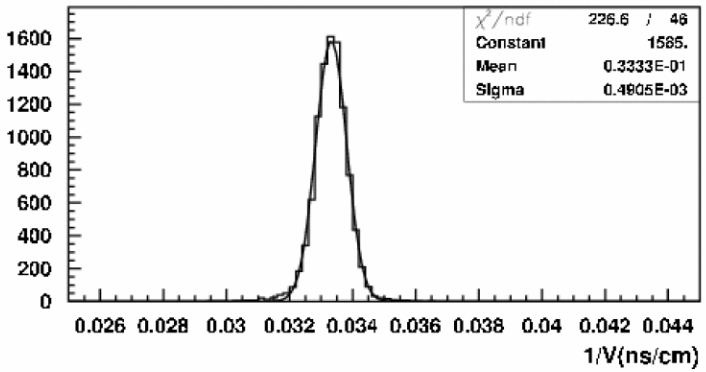
Example: if the second and third components will be subtracted from T – this will affect to the rest mass nonlinearly!

What we need to do this equalization?

- Sample of leptons identified using non-TOF method.
- Precise reconstructed path length for each of them

What will be the result of equalization?





$$\sigma = 4.9 \cdot 10^{-4}$$

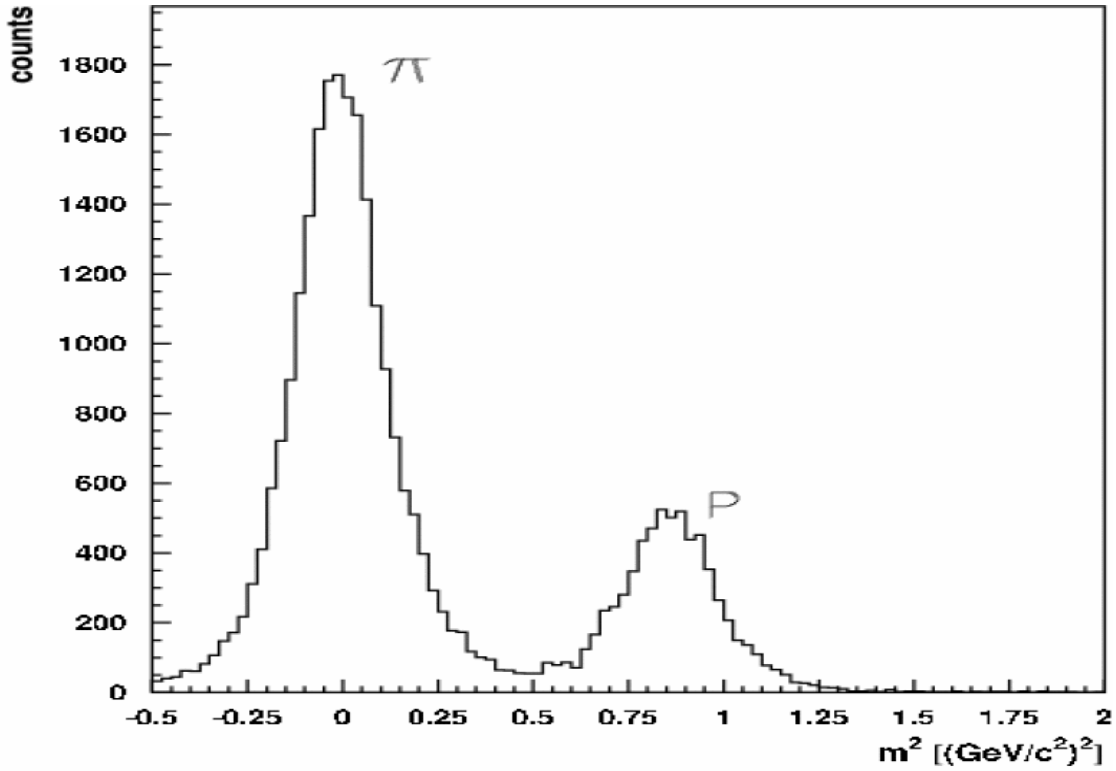
$$\left\langle \frac{1}{\beta} \right\rangle = \frac{1}{c} = 3.3(3) \cdot 10^{-2}$$

Resolution of ~1.5%

More detailed explanation in paper

- **The Time-of-Flight Technique for the HERMES Experiment** *A. Airapetian, N. Akopov, M. Amarian, H. Avakian, A. Avetissian, E. Avetisyan, B. W. Filippone, R. Kaiser, H. Zohrabian*Nucl. Instr. Meth. A 540 (2005) 305-310 (also available as hep-ex/0301010, DESY 02-174)

Example of pion-proton identification TOF spectra



Application for OLYMPUS

- Check – what has been done at BLAST TOF in details?
- If all above mentioned procedures were applied – simply use the same.
- If no – start preparation of calibration procedures using data samples from BLAST.
- Correct it using new geometry for OLYMPUS.

- Tune all calibration programs so that just the first real data sample from the OLYMPUS experiment will be used for the final mass reconstruction and lepton-hadron separation very fast – e.g. in e few days after starting of data collection!