RDC9 R&D plans

Introductory remarks

Marina Artuso

The big questions

- We seek technologies with transformative power on:
  - the energy resolution of calorimeters,
  - ultra-fast light collection
  - high spatial and time resolution in harsh environments.
  - Efficient light collection with fast photon detectors
  - Front-end electronics to optimize energy/time resolution
  - Efficient use of waveform sampling for time stamp/pile-up suppression
  - Overall system optimization [lightweight support structures, cooling, power distribution, data concentration and transmission]

Areas of interest

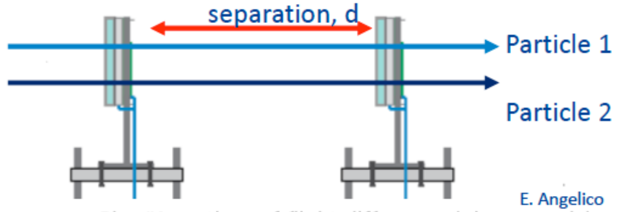
1. New materials for calorimetry, and how they can be tailored to a specific application (including prospects from nanotechnology)
2. Front-end electronics needs for high energy resolution
3. Front-end electronics needs for picosecond timing calorimetry
4. System aspects (mechanical): low mass support & cooling
5. System aspects (electronics): powering scheme & interconnections
6. System aspects (data processing): “intelligent calorimeter”
7. Concepts from the above lines of investigation that can be adapted to hadron identification (time-of-flight, RICH…)

Emerging technologies – PID

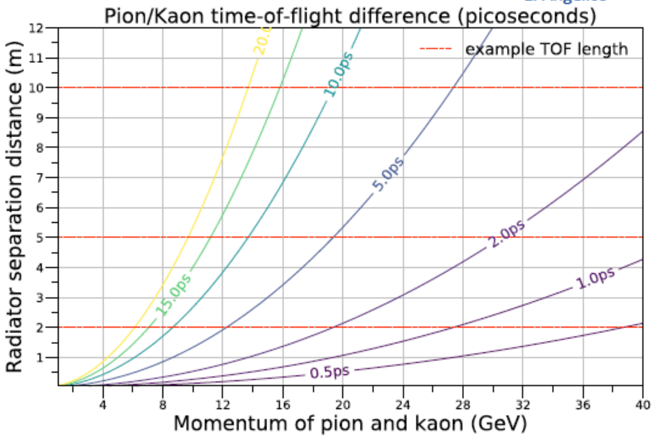
- Synergies with MCPs now developed for medical applications [see presentations by Kepler Domurat-Sousa and Cameron Poe]: construction of MCPs that are less expensive and more suitable to “industrial-scale” production.

fermilab FBTF PID

Time-of-flight particle ID measurement principle



E. Angelico



Single particle TOF

$$\Delta t = d/\beta$$

$$\Delta t = d\sqrt{1+\frac{m^2}{p^2}}$$

$$\Delta t = \frac{dE}{p}$$

TOF difference of two particles

$$\tau_{12} = \Delta t_1 - \Delta t_2$$

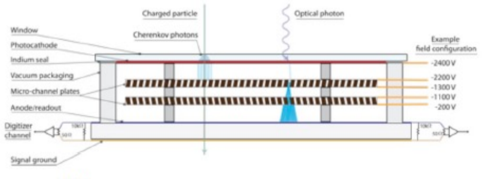
$$= d\left(\sqrt{1+m_1^2/p_1^2} - \sqrt{1+m_2^2/p_2^2}\right)$$

$$\tau_{12} \approx \frac{d}{2p^2}(m_1^2 - m_2^2)$$

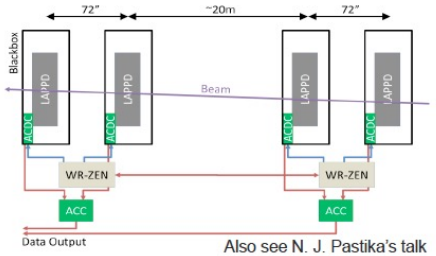
(when relativistic and p1=p2)

Jinseo Park

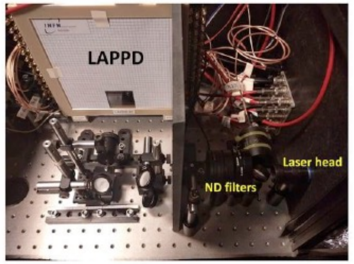
On PSEC5 chip



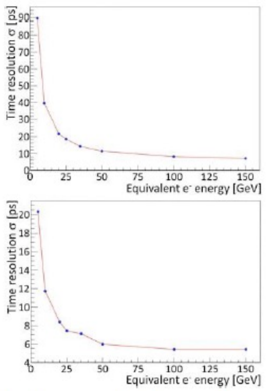
LAPPD^{TM}, psec.uchicago.edu



Also see N. J. Pastika's talk



Perazzini S, Ferrari F, Vagnoni VM, on behalf of the LHCb ECAL Upgrade-2 R&D Group. Development of an MCP-Based Timing Layer for the LHCb ECAL Upgrade-2



Timing resolution ~5ps