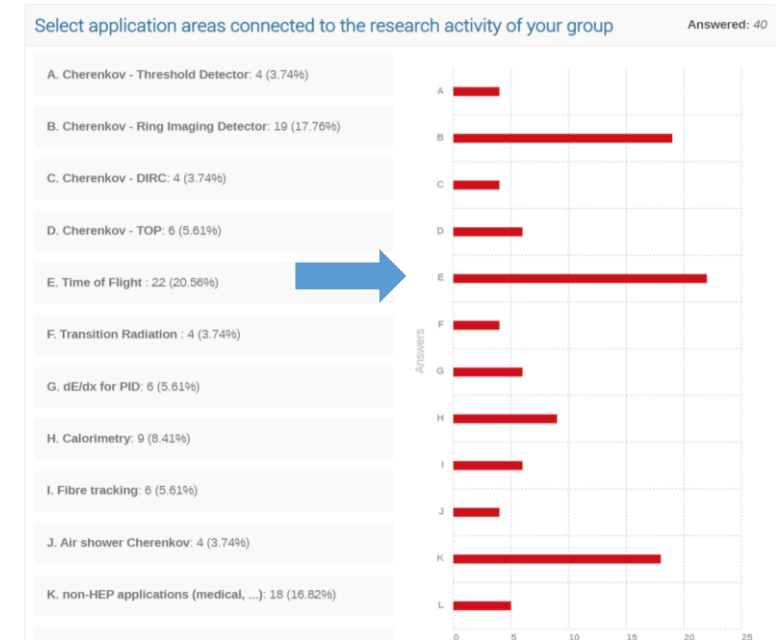# DRD4 Work Package on TOF

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The final Detector R&D Theme in the field of *Photon Detectors and Particle ID* is to **Develop compact high performance time-of-flight detectors**

We have put together the material submitted in the survey to suggest joint projects (WP4.4.x), for discussion and possible adjustments or additions

We should then determine whether groups will be interested to join those projects for the DRD4 collaboration to be successful

Interest expressed

- TOF was most popular application area in survey of groups' interests

- R&D focused specifically on fast photon detectors for TOF applications belongs in the Photon Detector themes (1&2)

- At the Community meeting in May there were presentations on:
  - TORCH (Tom Blake)
  - Combined RICH+TOF detector (Eugenio Nappi)
  - Direct detection of charged particles with SiPMs (Pietro Antonioli)

- Other R&D mentioned in the survey:
  - Belle II TOP upgrade
  - TOF-PET developments for medical imaging

- Groups registering interest in TOF applications (but often not yet in a position to be able to propose joint projects):

  - Bari, Bologna, Bristol, CERN, GSI, IRFU, Melbourne, Monash, Oxford, Padova, Grenoble, Warwick
    (Please let us know of corrections/additions to this list)

Select application areas connected to the research activity of your group — Answered: 40

A. Cherenkov - Threshold Detector: 4 (3.74%)
B. Cherenkov - Ring Imaging Detector: 19 (17.76%)
C. Cherenkov - DIRC: 4 (3.74%)
D. Cherenkov - TOP: 6 (5.61%)
E. Time of Flight : 22 (20.56%)
F. Transition Radiation : 4 (3.74%)
G. dE/dx for PID : 6 (5.61%)
H. Calorimetry: 9 (8.41%)
I. Fibre tracking: 6 (5.61%)
J. Air shower Cherenkov : 4 (3.74%)
K. non-HEP applications (medical, ...): 18 (16.82%)

Proposed joint projects for TOF

Comments

4.1 Study the coupling of a thin Cherenkov radiator to a SiPM array, or using the sensor window, for fast timing of charged particles

Common interest from ALICE upgrade and EIC, possibly also for FCC-ee

4.2 Develop a SiPM array suitable for TOF (or RICH) detectors, with mm-scale pixellization and fast timing, including the system aspects such as appropriate readout electronics and cooling, for common use in prototypes and beam tests

This could be a common project with the RICH theme, for many future experiments considering SiPMs in Particle ID detectors Clear overlap with WP4.1.1 & WP4.1.4

4.3 Develop lightweight mechanical supports for DIRC-type TOF detectors, supporting the polished quartz radiator and services

Added because the previously planned DRD8 on integration will now not go ahead, and the individual DRD projects will have to take care of their own mechanics etc.

4.4 Develop techniques for measuring the optical properties of polished quartz radiators, and the coupling of optical elements in DIRC-style TOF detectors