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# LHCb RICH Performance in DC04

## Introduction

This page presents the LHCb RICH detector performance data for the DC04 Monte Carlo productions. The results shown below were produced using a privately generated sample of 20K B inclusive (event type 10000000) events.

The software versions used where :-

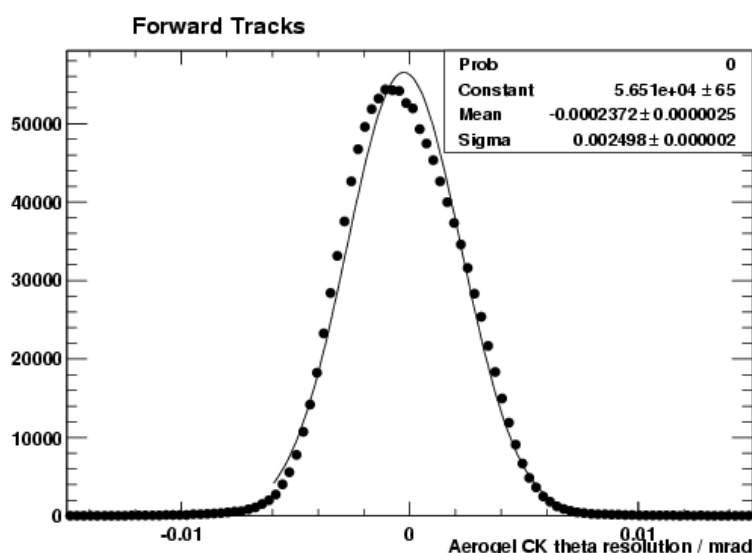
- Gauss v15r18 [↗](#)
- Boole v6r5 [↗](#)
- Brunel v24r5 [↗](#)

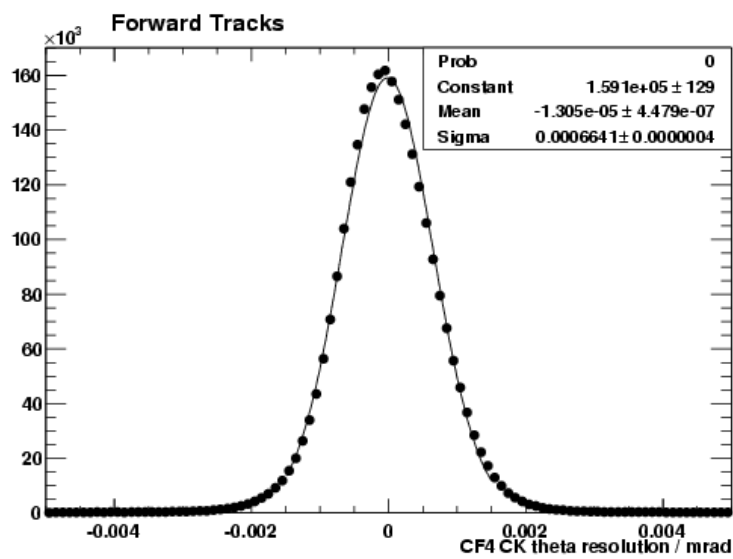
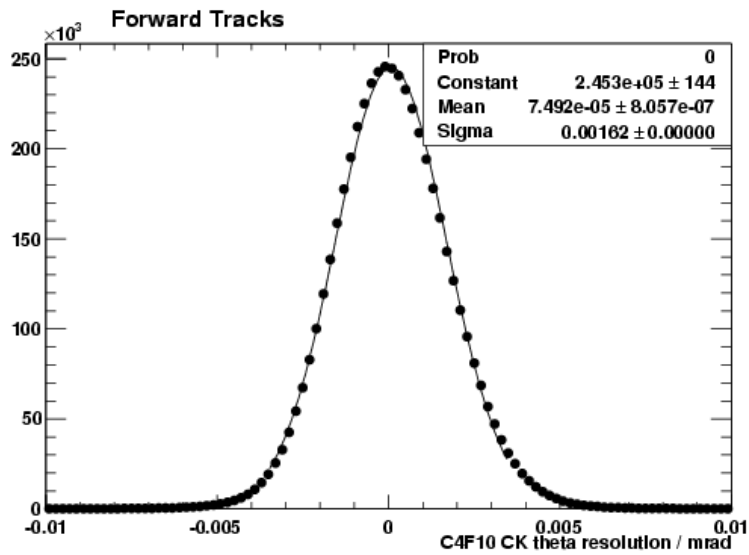
Only a selection of performance figures are shown on this page. All figures are though available for download, in both png and eps formats. In addition the raw ROOT histogram files are also available. See here for available data files. The ROOT macros used to produce the images are also available.

## Cherenkov Theta Angle Resolution

The following images show the Cherenkov theta resolutions obtained in the DC04 data production, for forward tracks only (for other track types, see the the attached data files available here). The resolution is defined as the difference between the reconstruction Cherenkov theta angle for a given track and pixel pair, and the expected Cherenkov angle for the given track in the radiator medium (based on the reconstructed track parameters).

*Note, if you require eps format images, these can be found in the image tar files available here.*

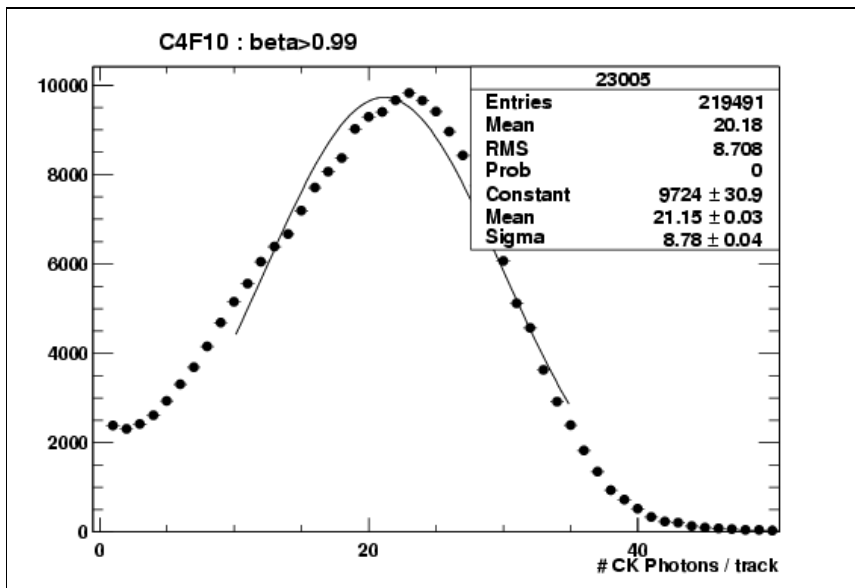
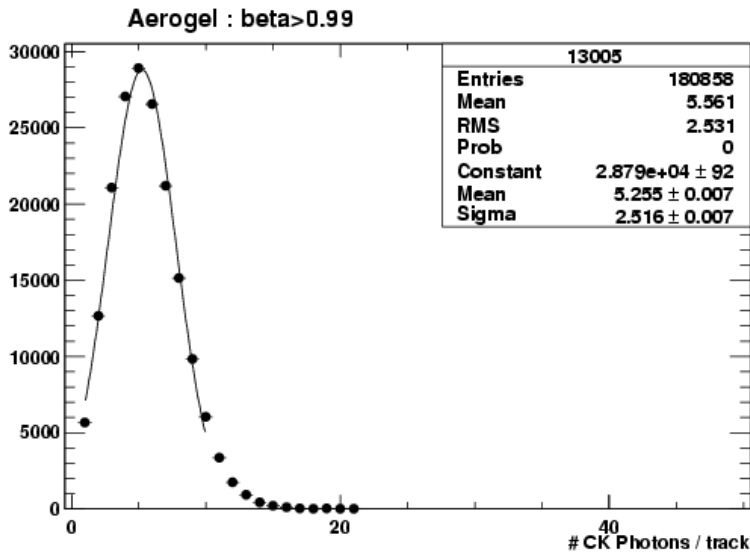




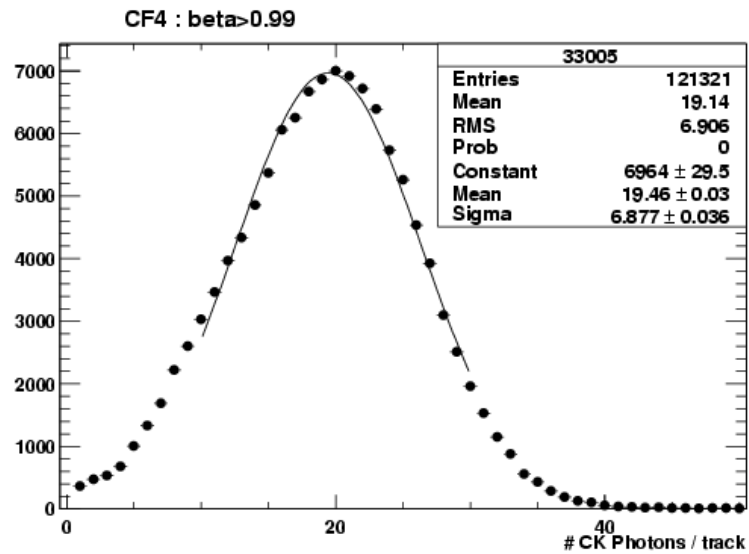
## Cherenkov Photon Yields

The following figures show the distributions for the number of detected unscattered Cherenkov photons in each of the radiator media. Only saturated tracks ( $\beta > 0.99$ ) were used.

*Note, if you require eps format images, these can be found in the image tar files available here.*



C4F10 photons per track for DC04"



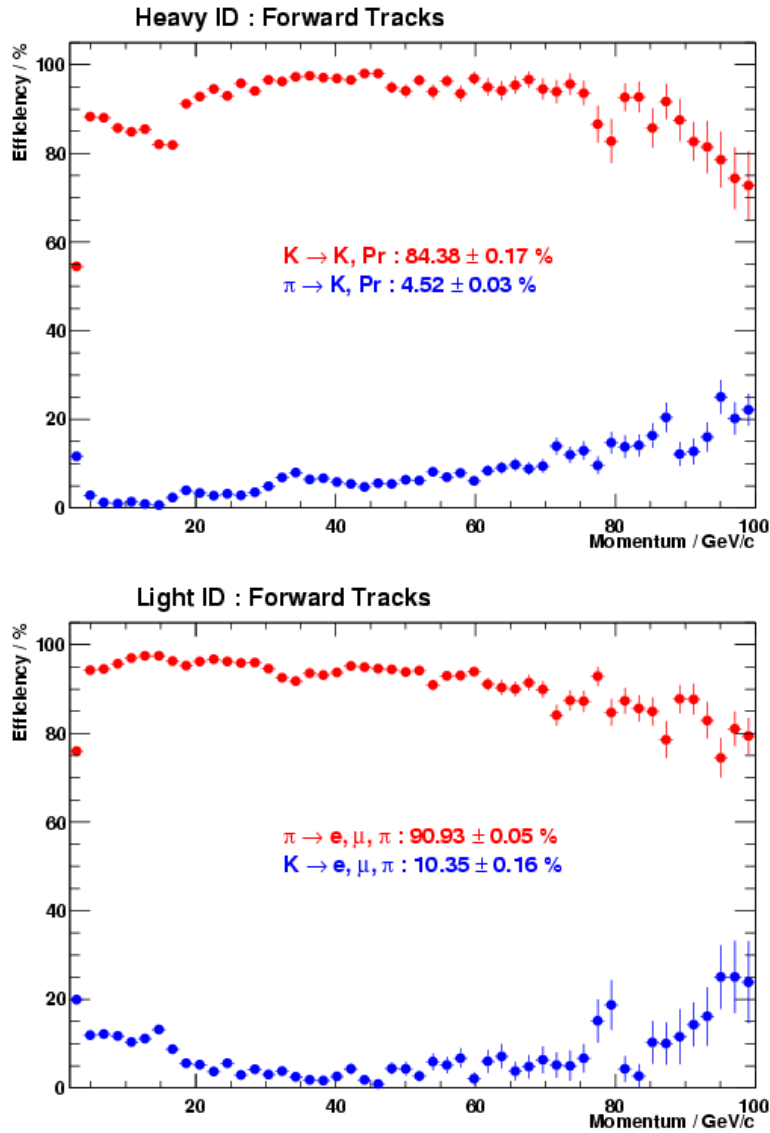
width="567" height="384" />

## PID Performance versus Track Momentum

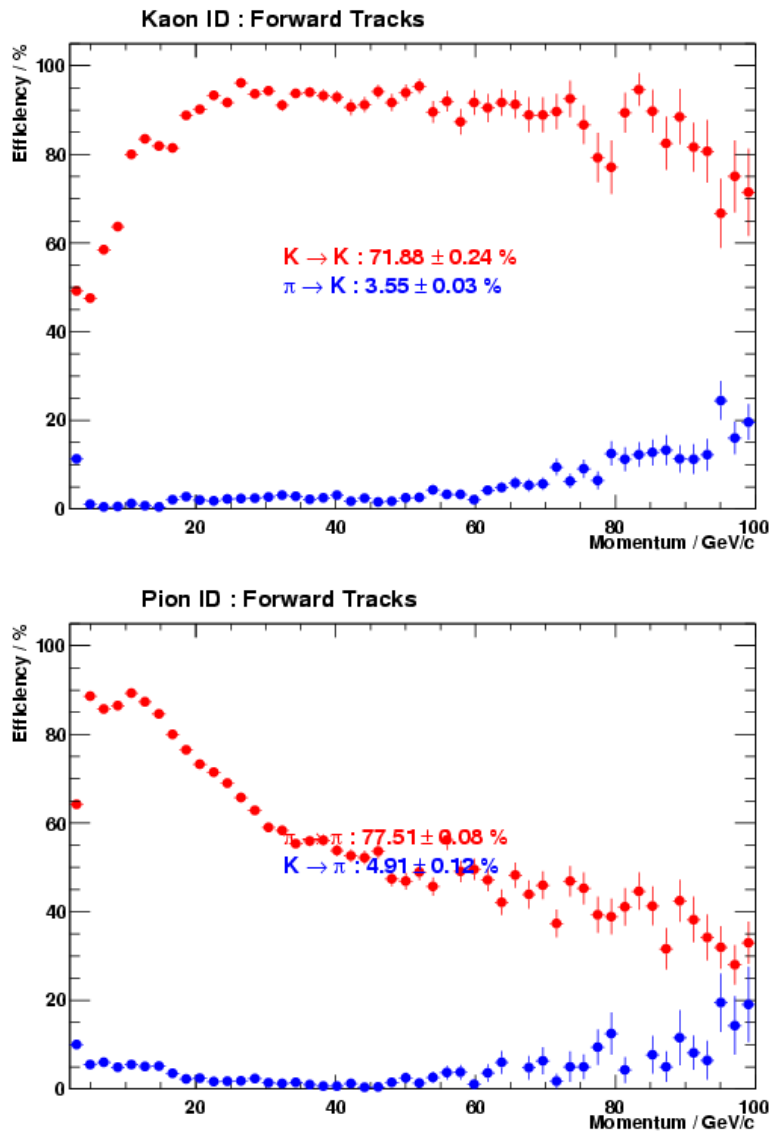
## Overall Forward Track Performance

The following figures show the RICH particle identification performance, as a function of momentum. No cuts on the delta Log-Likelihood values are applied; tracks are ID using the "best" measure, i.e. the mass hypothesis that gave the minimum overall likelihood. The figures of merit used are the RichHeavyID and RichLightID identifications for the 2 to 100 GeV momentum range, and only for forward tracks.

*Note, if you require eps format images, these can be found in the image tar files available here.*



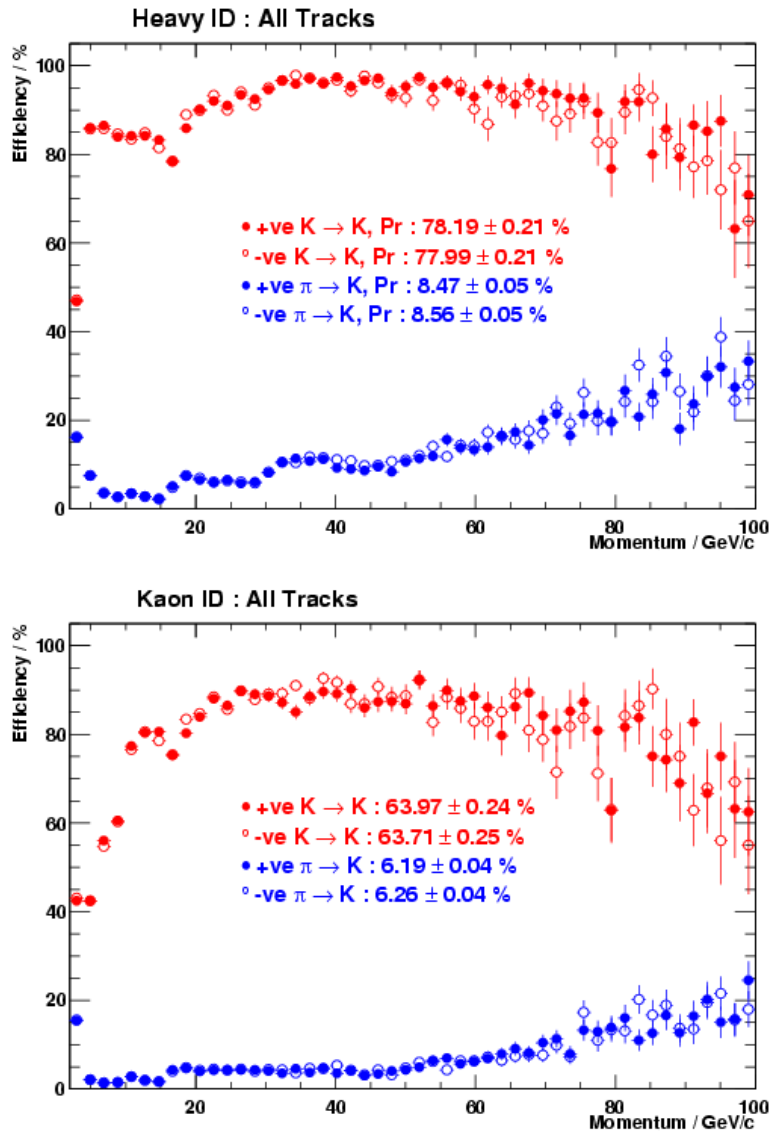
The following images are for explicitly identifying kaons as kaons and pions as pions.



## Positive and Negative Track Comparisons

The following images gives a comparison of the RichHeavyID and kaon performance for positive and negative tracks. The figures was produced for all track types combined. Currently the comparison is statistics limited; No difference can be seen between the positive and negative tracks. However, a small difference is expected and thus larger statistics studies will follow.

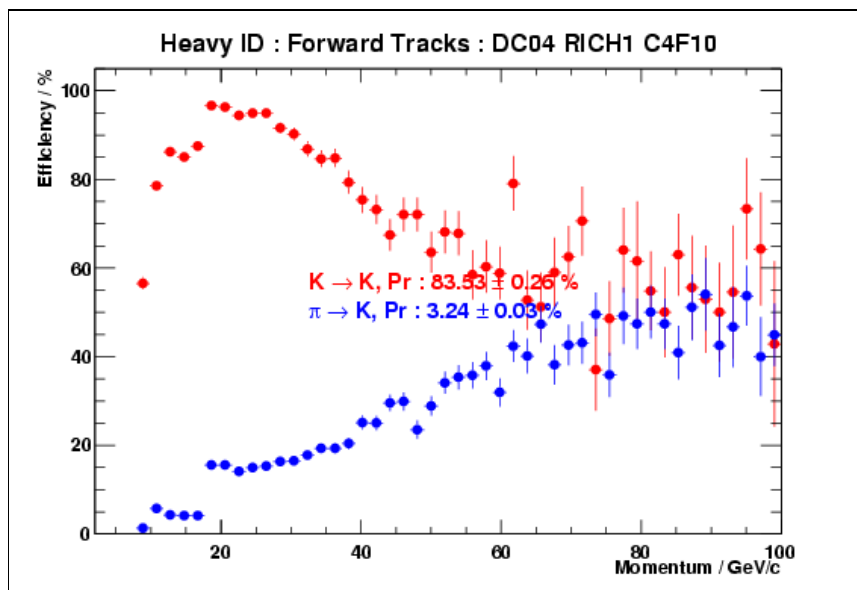
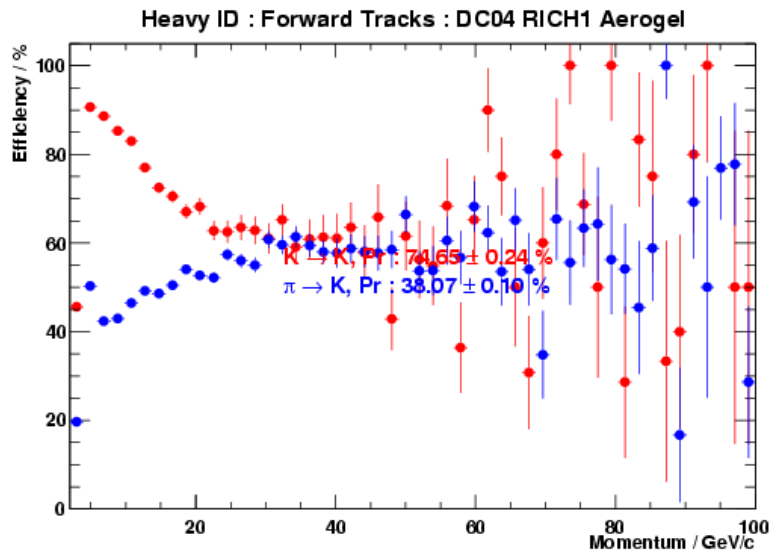
*Note, if you require eps format images, these can be found in the image tar files available here.*



## Individual Performance in each RICH Detector and Radiator Media

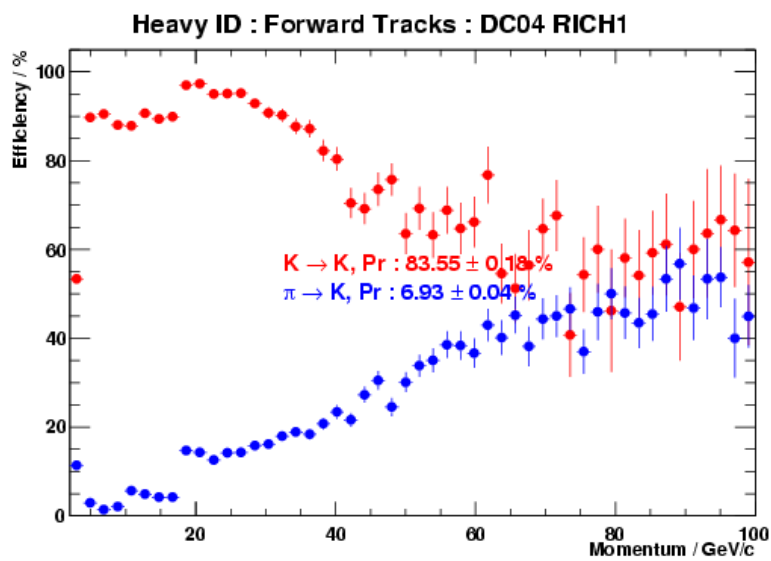
The following figures given the RichHeavyID performance as a function of track momentum when only one of the two RICH detectors are used and for RICH1 when only aerogel or the C4F10 radiators are considered. The information from the other radiators are simply ignored. As with the previous performance curves, only forward tracks are included.

*Note, if you require eps format images, these can be found in the image tar files available here.*

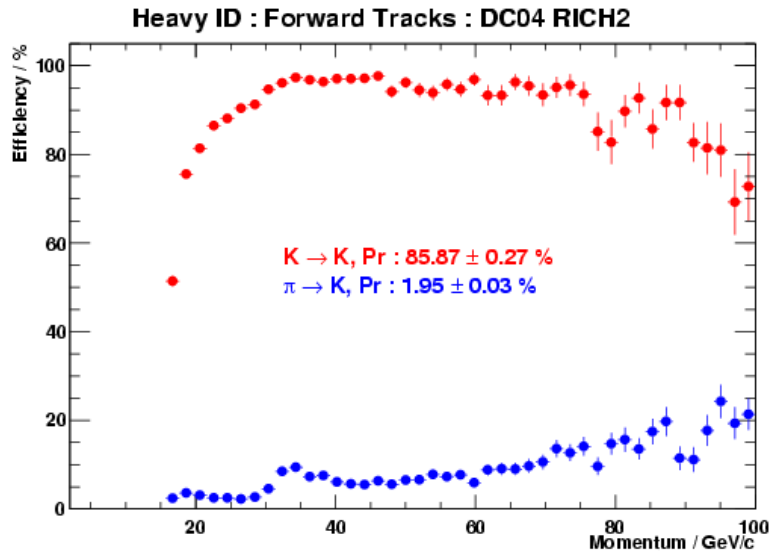


C4F10 radiator only, for forward

tracks in DC04" width="567" height="384" />





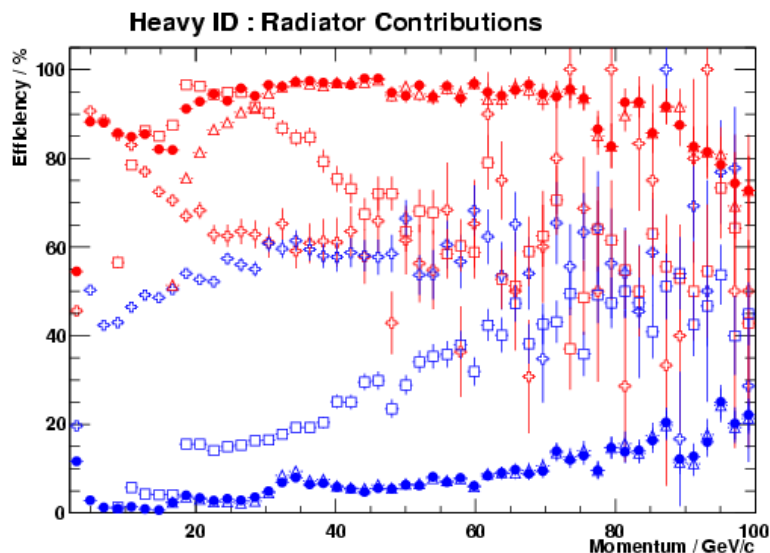


## Breakdown of Performance by Radiator Medium

The following figure compares the individual performance in each radiator medium with that obtained overall when the information from all radiators are combined.

The red points are the  $K \rightarrow K, Pr$  efficiency whilst the blue points represent the  $\pi \rightarrow K, Pr$  mis-identification rate. The solid points give the overall performance when all radiators are combined, whilst the open crosses, squares and triangles give the individual performance in the aerogel, C4F10 and CF4 radiators respectively.

*Note, if you require eps format images, these can be found in the image tar files available here.*



## Reference Log Files

The following are reference logs files from the RICH reconstruction.

- allrads-dc04-10000000.log: Log file for RICH reconstruction. All radiators DC04.
- rich1-dc04-10000000.log: Log file for RICH reconstruction. RICH1 only DC04.

- rich2-dc04-10000000.log: Log file for RICH reconstruction. RICH2 only DC04.
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ChrisRJones - 27 Jul 2005

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