Final Efficiency in 2nd R Scan

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1 Efficiency by AreaLaw

Great effort has been made by Haiming in tunning LUND AreaLaw generator, which is expected to give better description of hadronization in low energy region. From many sets of efficiencies by AreaLaw, the most favored one is shown in Fig. 1. The only imperfect thing is that the shape between $3.7-4.0$ GeV is not good.

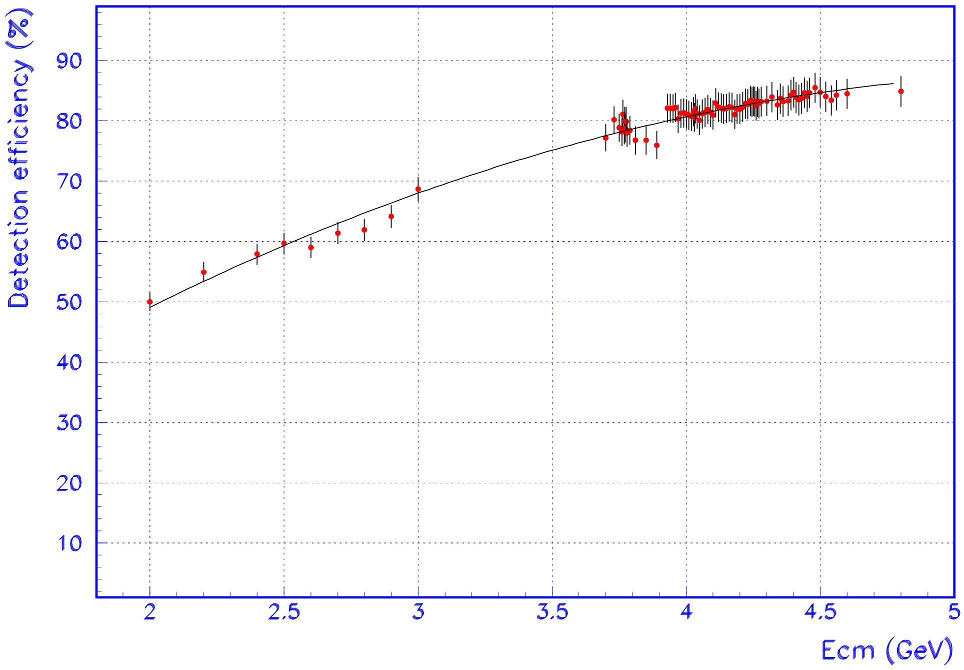

Figure 1: Efficiencies by AreaLaw

2 Efficiency by JETSET

With LUND JETSET74 generator, we also obtained efficiencies for energy points above 3.7 GeV. Correction is made to compensate the difference between real data and Monte Carlo, please refer memo titled 'Efficiency Correction in R Measurement' written by Guangshun for detail. The corrected efficiencies are shown in Fig. 2.

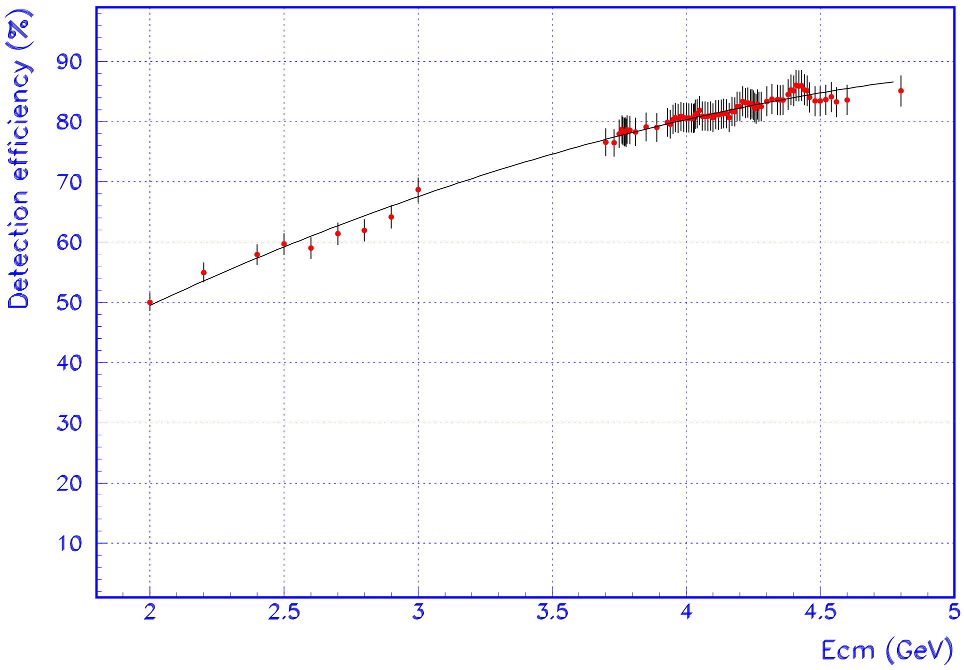

Figure 2: Corrected efficiencies above 3.7 GeV by Jetset74

3 Conclusion

In overall, the efficiencies by AreaLaw are very near to those by Jetset74. Fig. 3 gives fitted efficiency curves by Jetset74, Jetset74 with correction and AreaLaw with 3 different sets of parameters. From the curves, one can conclude, no matter which generator is used and which set of parameters is chosen, the difference is less than 2%, whcih can be taken into systematic errors.

For a better first look, we decide to choose AreaLaw between $2-3$ GeV and Jetset74 with correction between $3.7-4.8$ GeV, and use the fitted values

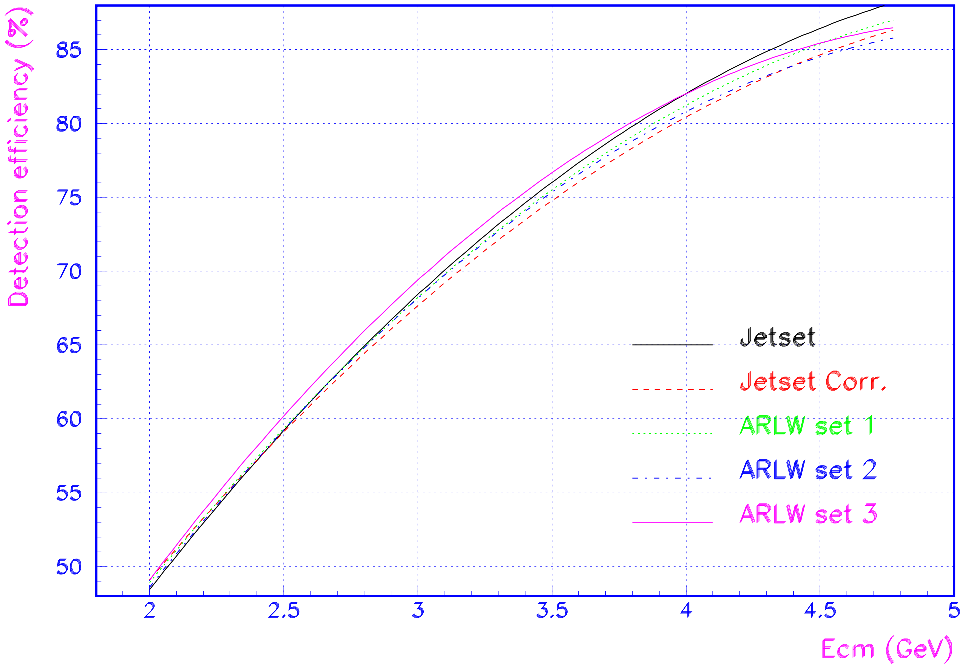

Figure 3: Comparison between efficiency curves

as final efficiencies, which are expressed by

$$\varepsilon_{had} = a + b \cdot E_{cm} + c \cdot E_{cm}^2,$$

in which $a = -2.4005 \pm 1.7850$, $b = 31.211 \pm .96948$, and $c = -2.6312 \pm .15103$, just as shown in Fig. 2.

The uncertainty of efficiency is $\sim 2\%$ for both Jetset and AreaLaw, by varying their parameters. The fitting error can be obtained by uncertainties of a, b, c and their correlation coefficients, which are,

	a	b	c
a	1.000	-.880	.662
b	-.880	1.000	-.935
c	.662	-.935	1.000

and this error is found to be very small, about $0.3\% \sim 0.4\%$ for most points.

The efficiency difference between Jetset and AreaLaw is also taken into systematic error, and it is less than 1% at most points, but may be up to $3\% \sim 4\%$ at several points. In overall, the systematic error of detection efficiency is about 3%.