Geometrical Trigger Acceptance

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Abstract

In the following note the acceptance of the different triggers is given as a function of y and Q^2 for a beam energy of 160 GeV. A pure calorimeter trigger is also discussed. Only the geometrical acceptance is considered, i.e. events are not weighted with the cross section.

Fig. 1 shows our playground, i.e. the kinematically allowed region in Q^2 and y for 160 GeV beam energy. In the upper left corner the allowed region is limited by the line $x = 1$ or $W = m_p$. In the lower right corner the limit is $\theta = 0$ and $\theta_\gamma = 0$. All the variables have their usual meaning. θ_γ is the angle of the virtual photon with respect to the incoming muon.

To determine the acceptance, scattered muons at a given (y, Q^2) were tracked at 100 different azimuthal angles ϕ. A scattered muon is in the acceptance if it passes both hodoscope planes (H4 and H5 for the Inner, Middle and Ladder, H3 and H4 for the Outer trigger) and if it passes the downstream end of SM2. The acceptance is then given by the ratio of accepted to generated tracks. The positions of the hodoscopes along the beamline are shown in fig. 2. More details about the exact positions of the hodoscopes and the number of elements are given in the trigger documentation [1]. Additional parameters used in the simulation are given in table 1. For these simulations all tracks originate from the position x=y=z=0 in the COMPASS coordinate system. The geometry of the different hodoscopes in the x-y plane are shown in Figs. 3-8.

Fig. 9 shows the acceptance for the different triggers as a function of y and Q^2 in percent. Fig. 10 shows the same for all four hodoscope triggers combined.

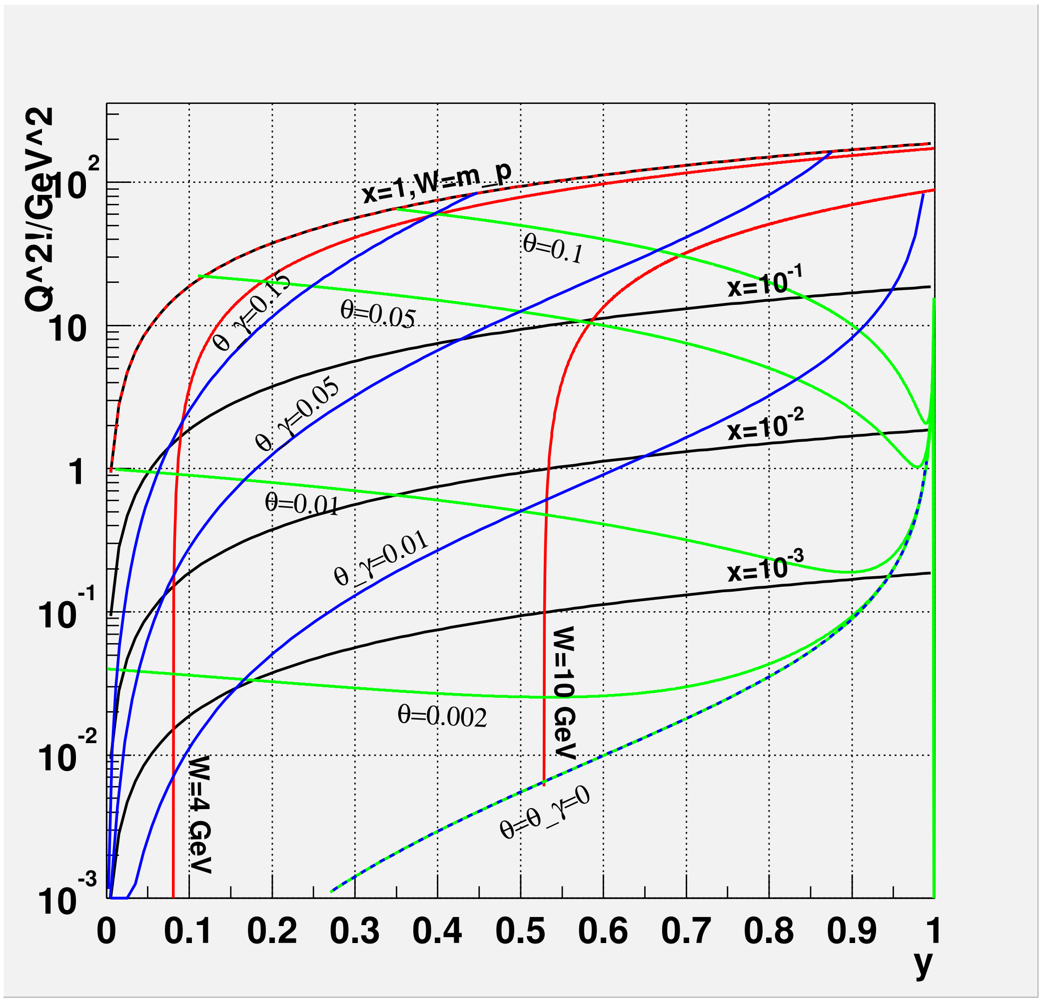

Figure 1: The kinematically allowed region in Q^2 and y for a beam energy of 160 GeV. The different lines show lines of constant x (black), W (red), θ (green) and θ_γ (blue). Good luck if you don't have a color printer.

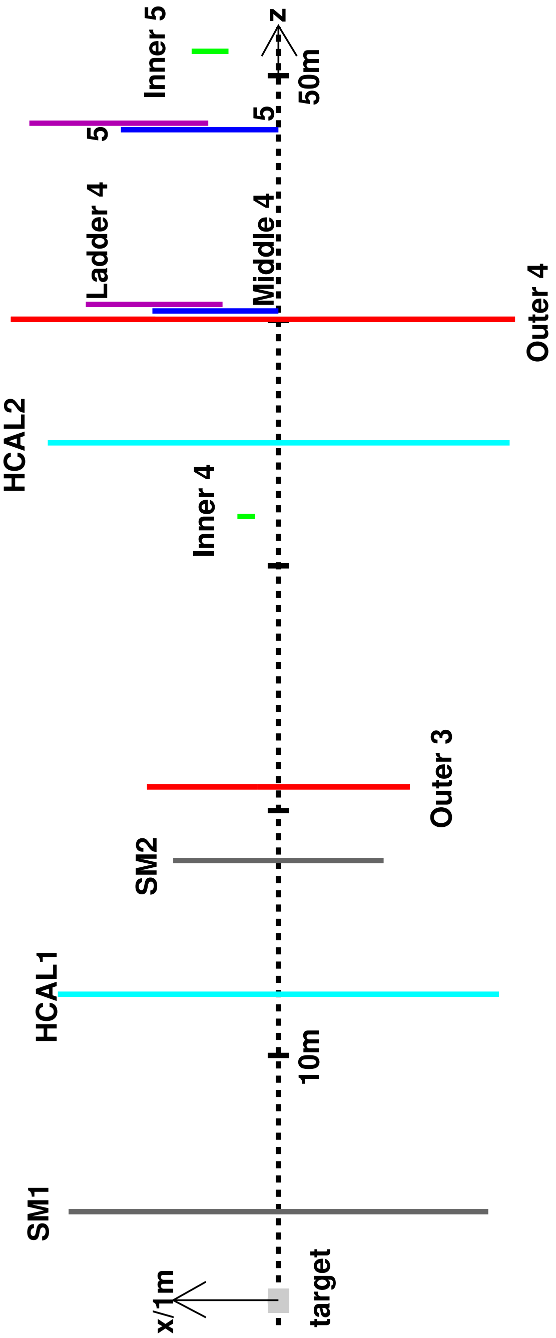

Figure 2: The locations of the hodoscopes along the beamline.

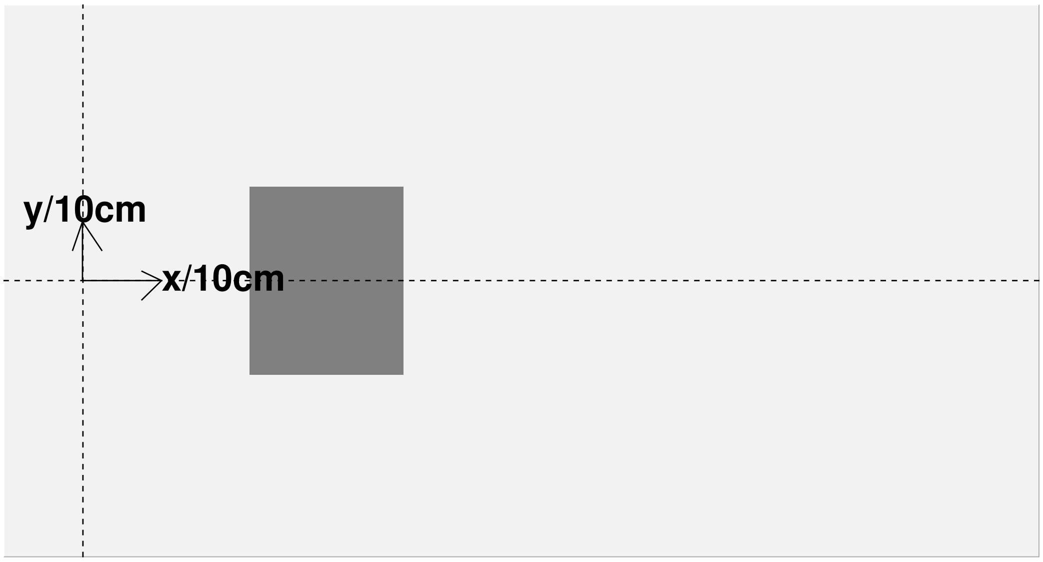

Figure 3: The hodoscope Inner 4.

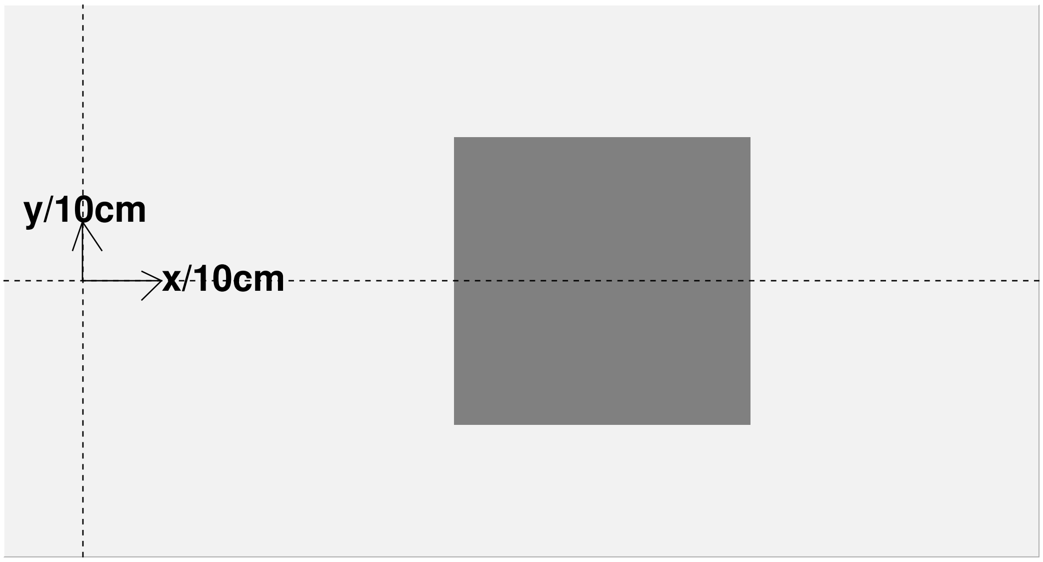

Figure 4: The hodoscope Inner 5.

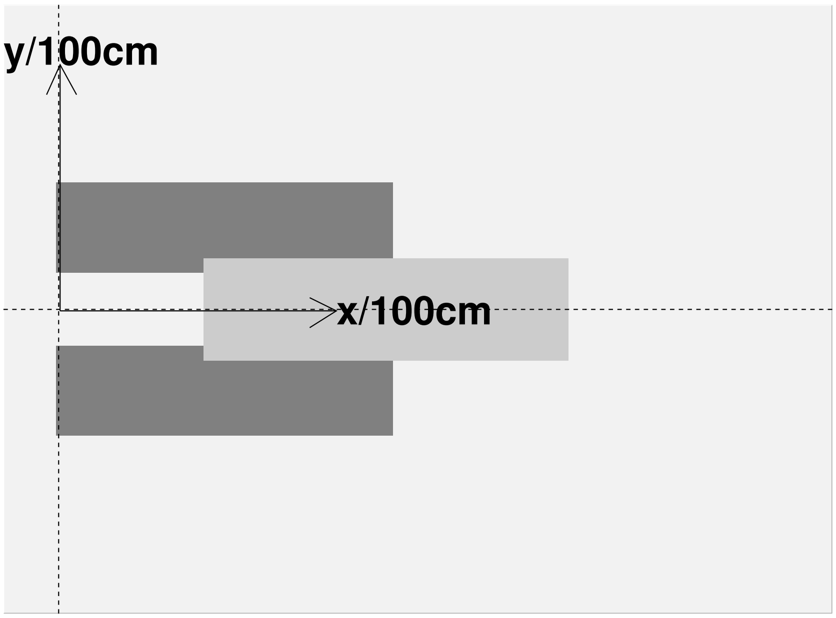

Figure 5: The hodoscopes Middle 4 (dark gray) and Ladder 4 (light gray).

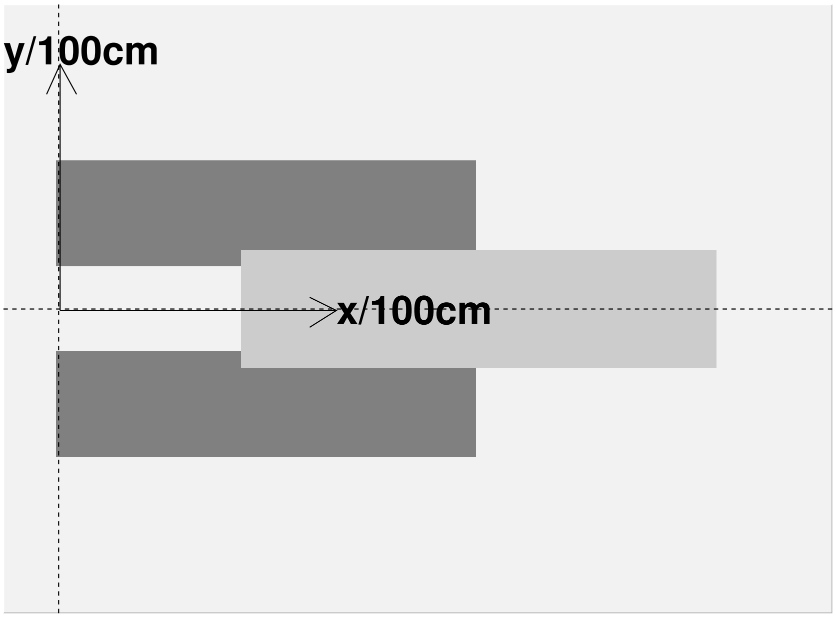

Figure 6: The hodoscopes Middle 5 (dark gray) and Ladder 5 (light gray).

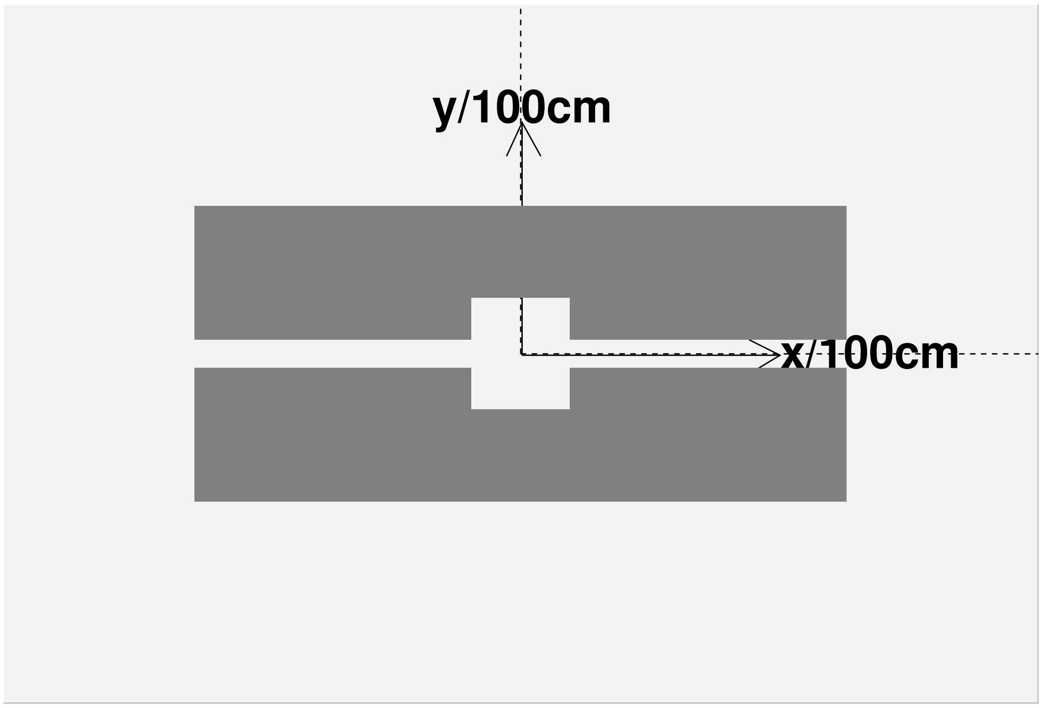

Figure 7: The hodoscope Outer 3.

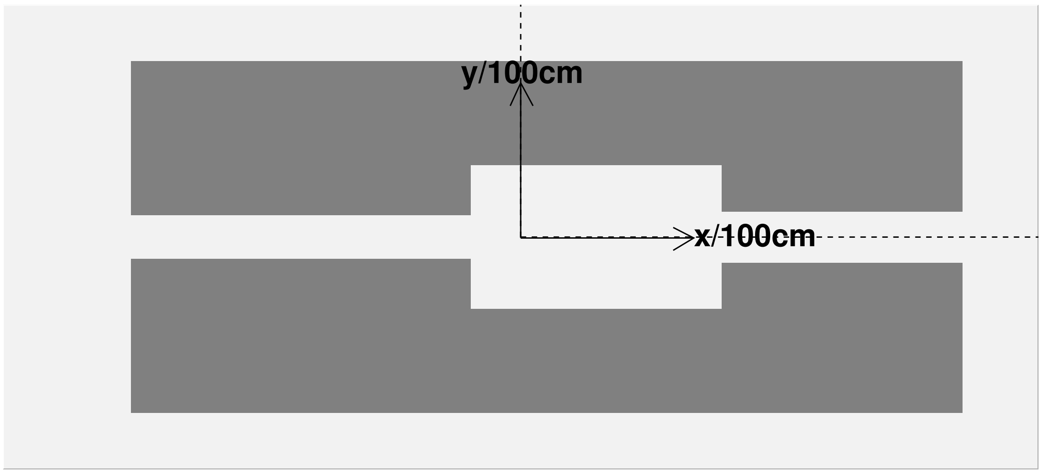

Figure 8: The hodoscope Outer 4.

beam momentum p_0	160 GeV	
	SM1	SM2
position/cm (center)	363	1797
beam deflection/mrad	0.0019	0.0082
	HCAL1	HCAL2
position/cm (upstream end)	1250	3500

Table 1: The parameters used in the simulation.

The kinematic of the scattered muon determines the direction and momentum of the virtual photon. Hadrons are produced along this direction according to a typical fragmentation function and typical transverse momentum (300 MeV). If at least one of these produced hadrons in an event with an energy above 12 GEV hits one of the HCALs the calorimeter trigger condition is fulfilled. The detection of the scattered muon is not required. The lower two plots in fig. 9 show the acceptances of HCAL1 and HCAL2.

References

[1] Muon Trigger Documentation, COMPASS homepage

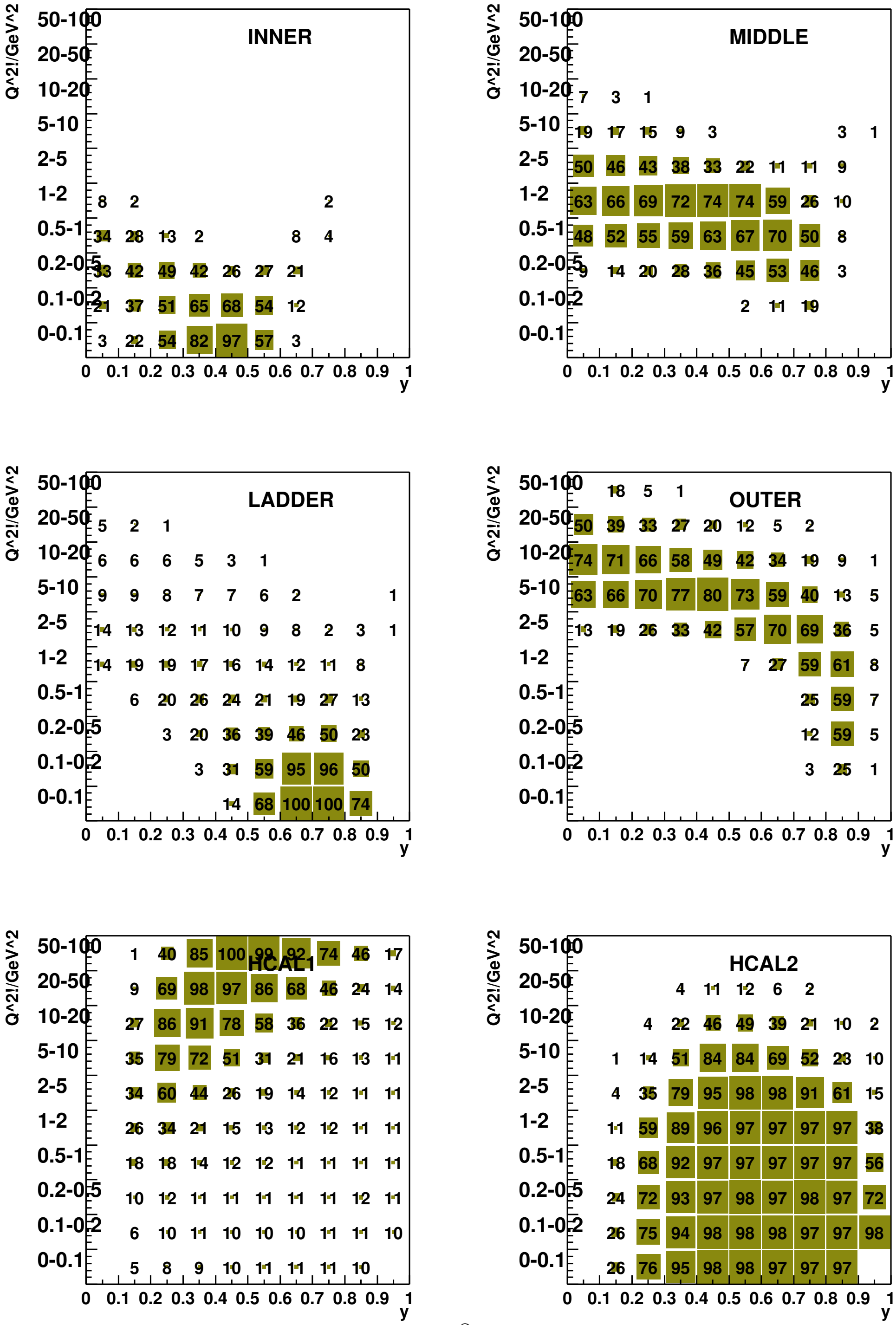

Figure 9: The geometrical acceptance of the different triggers as a function of y and Q^2 for an beam energy of 160 GeV.

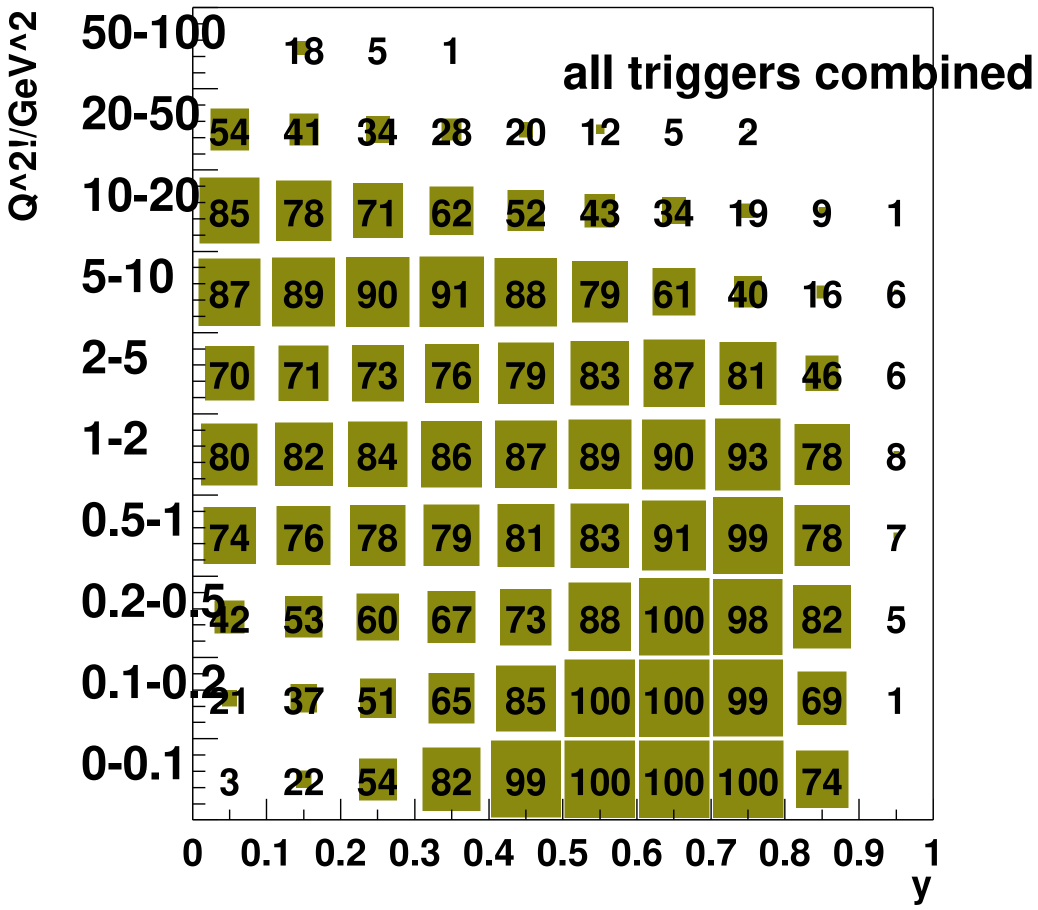

Figure 10: The geometrical acceptance of all four inclusive triggers combined as a function of y and Q^2.