MONTE CARLO SIMULATION OF $\bar{\nu}_\mu A$ EVENTS

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THREE MAJOR REACTION TYPES :

- QUASIELASTIC SCATTERING Q
- RESONANT SCATTERING R
- DEEP INELASTIC SCATTERING D

CONSIDER : $\bar{\nu}_\mu Al^{27}_{13} \longrightarrow \mu^+ X$

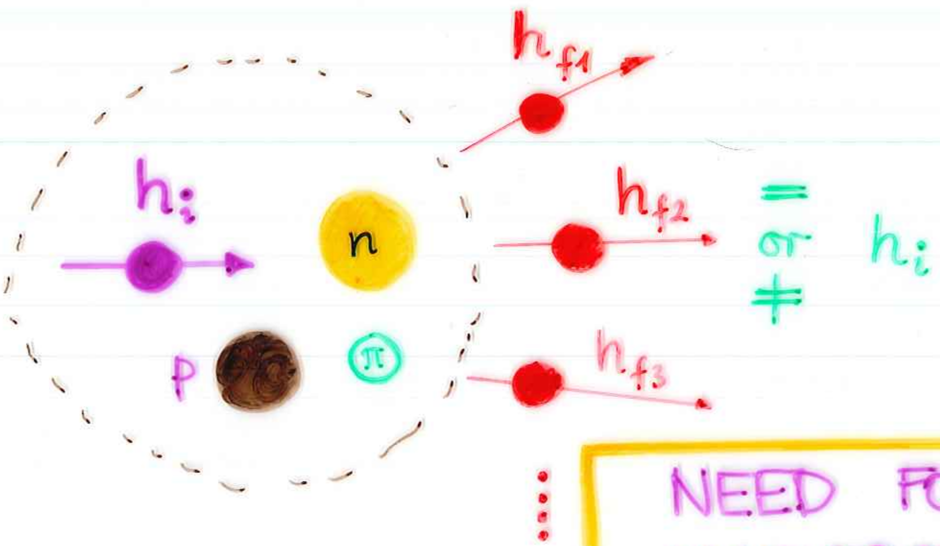
THE FOLLOWING PRIMARY REACTIONS ARE POSSIBLE :

Q : $\bar{\nu}_\mu p \longrightarrow \mu^+ n$, $n \to A \rightrightarrows h_i$

R : $\bar{\nu}_\mu n \longrightarrow \mu^+ \Delta^-$, $\Delta^- \to A \ldots$

$\bar{\nu}_\mu p \longrightarrow \mu^+ \Delta^0$, $\Delta^0 \to \ldots$

D : $\bar{\nu}_\mu \binom{n}{p} \longrightarrow \mu^+ X$, $X \to \ldots$



NEED FOR A NUCLEAR MC

→ KMC. 1.05

THIS TALK :

HOW DO MC EVENTS LOOK LIKE ?
SEPARABILITY ?

FRIDAY : HER → REGISTRATION EFFICIENCY OR
HOW IS GRAND VIEWING THE WHOLE
SCENE ?

WE WILL DEMONSTRATE TOO THAT THE SIMULATION OF PHYSICS (E.G. DIS) IS PROBABLY NOT SUFFICIENT.

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a) KINEMATICAL DISTRIBUTIONS

- x_B
- y_B
- Q^2
- W^2
- $E_\mu = (1-y)E_\nu$

b) MULTIPLICITIES

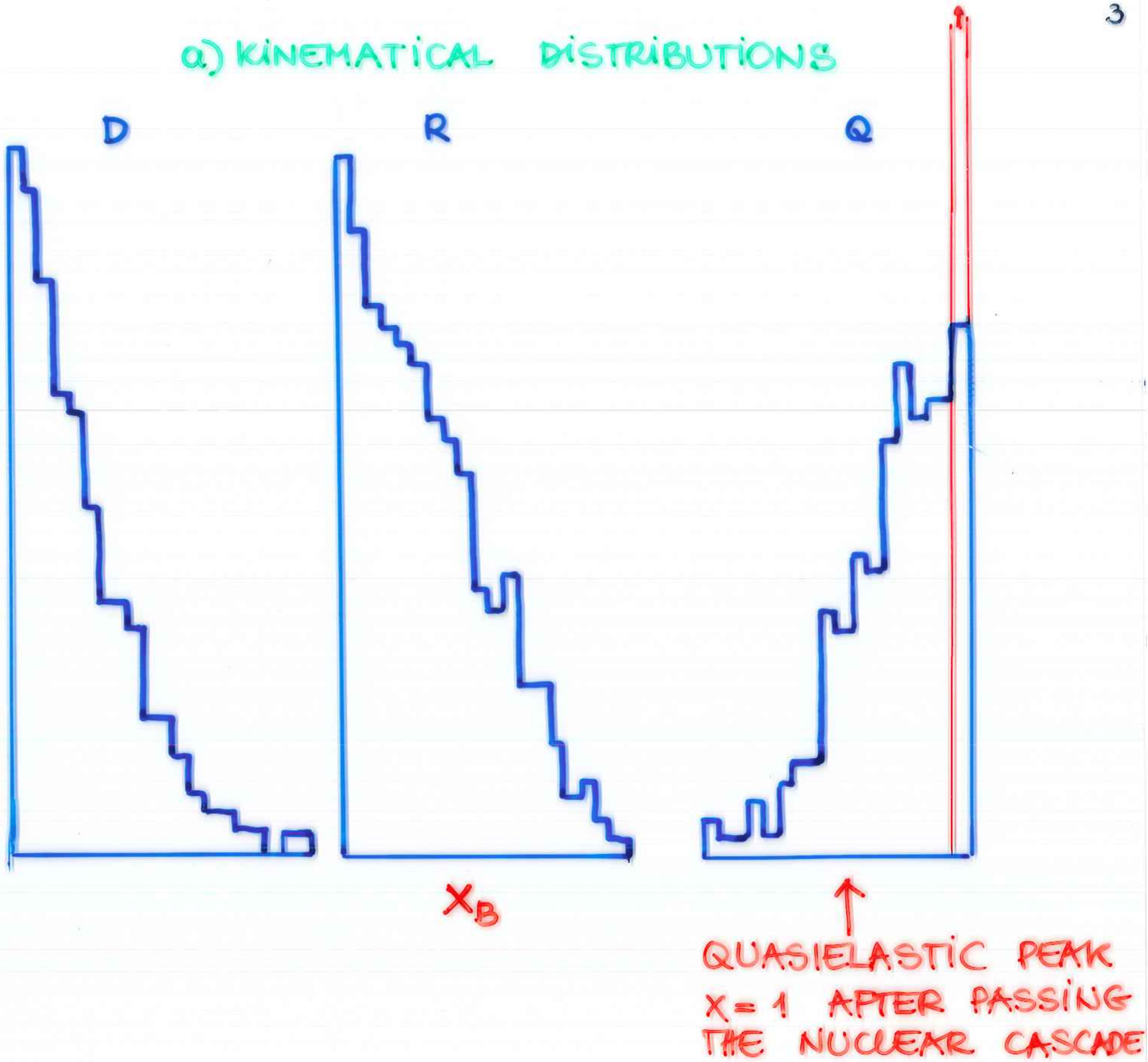
- π^+, π^-, π^0
- n, p

DISTRIBUTIONS, AVERAGES etc.

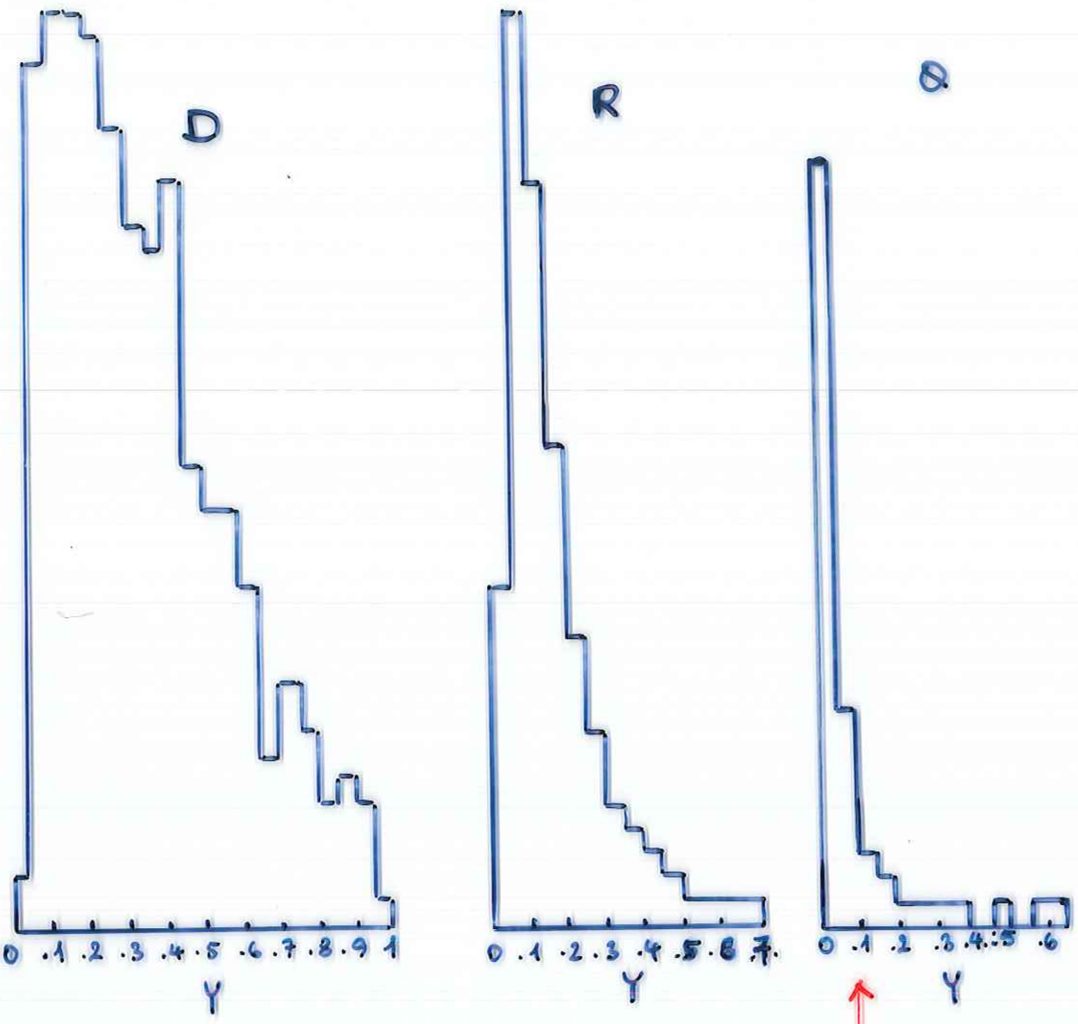
c) DIS : KMC ⟷ CATAS

{a), b)} as above

a) KINEMATICAL DISTRIBUTIONS

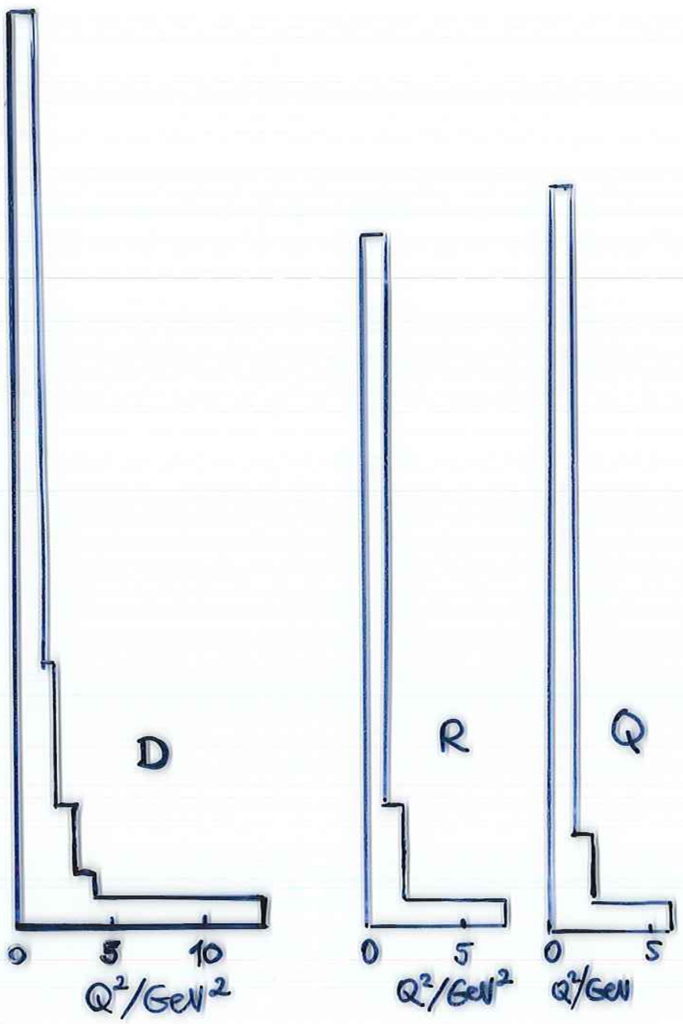


Y_B



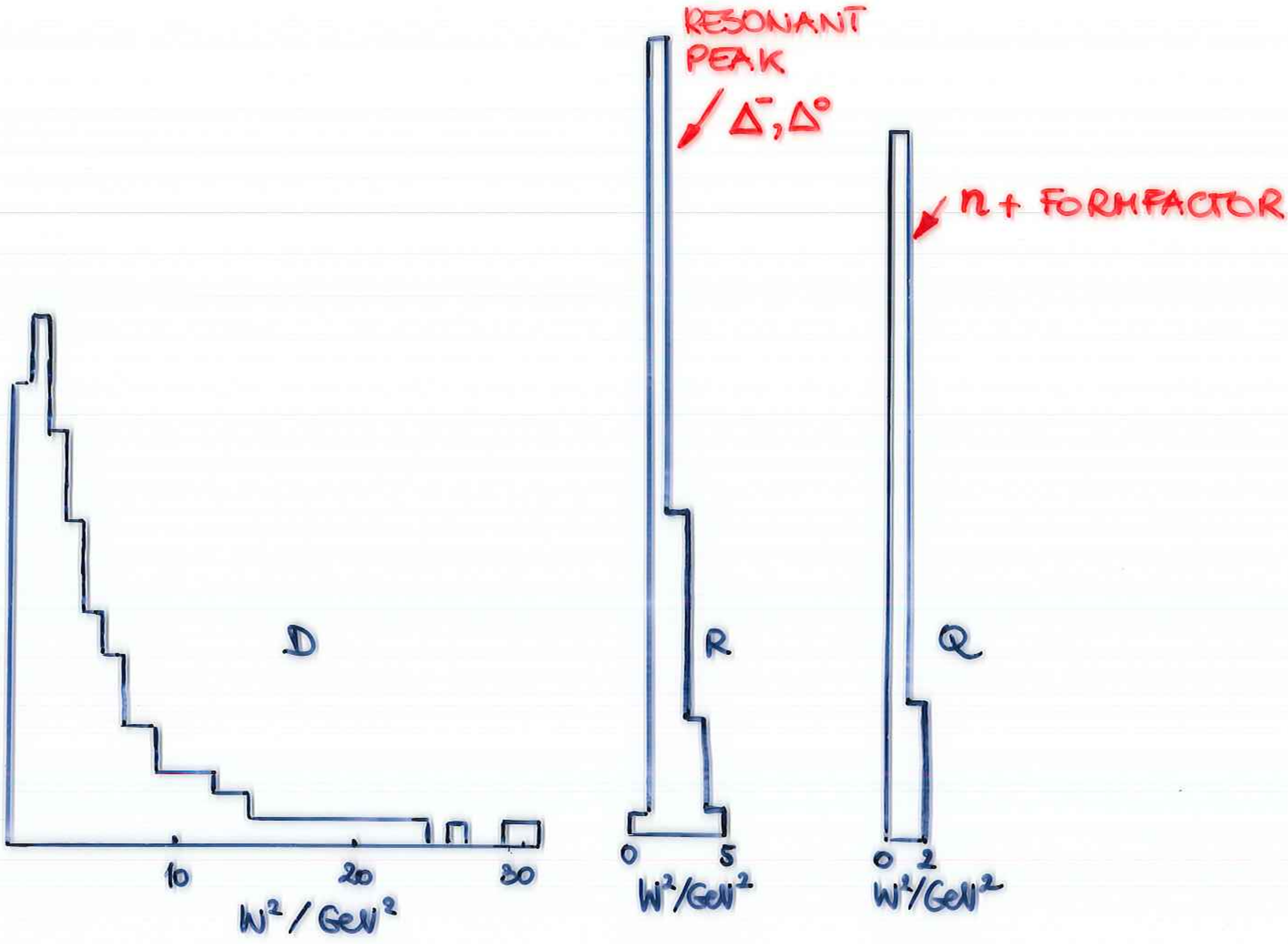
↑ low energy transfer to the hadronic system

Q^2



	D	R	Q
$\langle Q^2 \rangle / GeV^2$:	1.2	.71	.68

W^2



	D	R	Q
$\langle W^2 \rangle / GeV^2$:	5.04	1.95	.64

NUCLEAR TRANSMUTATION OF EVENTS

QUASIELASTIC : $\bar{\nu}_\mu p \rightarrow \mu^+ n$

$E_\nu = 7.4$ GeV $p_F = .125$ GeV $\theta_F = -.081$ $\varphi_F = .202$

$x_B = 1.0$ $y_B = .169$

	P_L	$P_{\perp 1}$	$P_{\perp 2}$
μ^+	6.102	−.789	−1.155
n	1.428	+.789	+1.155

NUCLEUS (FERMIMOTION + CASCADE)

μ^+	6.133	1.310	−.538	
(p)	.935	−.396	−.377	leading hadron
n	−.275	−.374	.426	
n	.395	−.389	.047	
p	.175	.175	.235	
n	−.166	−.181	.247	

(similar for resonant events)

b) MULTIPLICITIES

QUASIELASTICS: $\bar{\nu}_\mu p \to \mu^+ n$

	$\langle p \rangle$	$\langle n \rangle$	$\langle \pi^+ \rangle$	$\langle \pi^- \rangle$	$\langle \pi^0 \rangle$
PRIMARY TRACKS	0	1	0	0	0
SECONDARY TRACKS	.39	.675	.006	.031	.020

↑ STILL LEADING ($\langle n \rangle$)

↑ CHARGE SUPPRESSED ($\langle \pi^+ \rangle$)

RESONANTS : $\bar{\nu}_\mu p \to \mu^+ \Delta^0$ or $\bar{\nu}_\mu n \to \mu^+ \Delta^-$

$\Delta^0 \to n\pi^0$, $p\pi^-$

$\Delta^- \to n\pi^-$

	$\langle p \rangle$	$\langle n \rangle$	$\langle \pi^+ \rangle$	$\langle \pi^- \rangle$		$\langle \pi^0 \rangle$
SECONDARY TRACKS	.839	1.043	.053	.675	>	.237

↑ CHARGE SUPPRESSED BUT CAN BE PRODUCED BY A p !

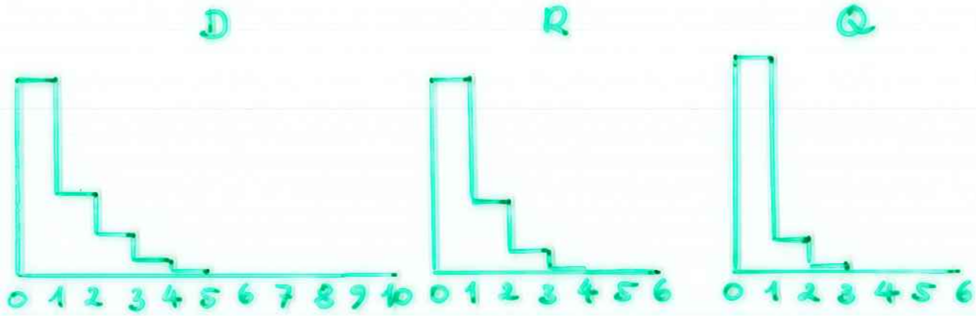
DEEP INELASTICS: $\bar{\nu}_\mu N \to \mu^+ X$

	$\langle p \rangle$	$\langle n \rangle$	$\langle \pi^+ \rangle$	$\langle \pi^- \rangle$	$\langle \pi^0 \rangle$
SECONDARY TRACKS	1.61	1.51	.688	1.215	1.014

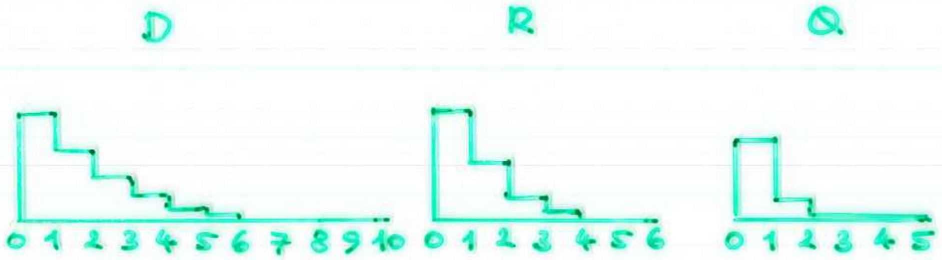
$\bar{\nu}_\mu N$: FAVOURS π^-, π^0 IN CC (μ^+)

MULTIPLICITY DISTRIBUTIONS

#n

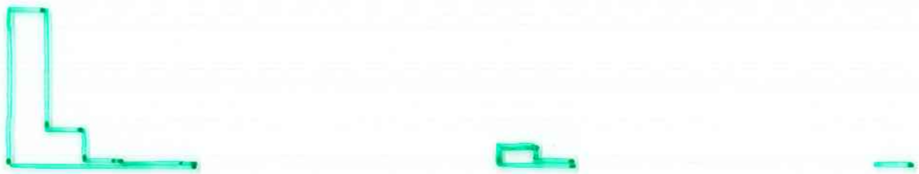


#p



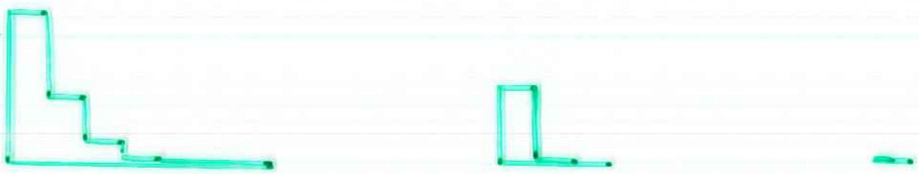
$\# \pi^+$

D R Q



$\# \pi^-$

$\# \pi^0$



c) KMC and CATAS - DIS

CATAS : $\nu_\mu p \rightarrow \mu^+ X^0$ { either 1p OR 1n ! only. / π's

KMC : $\langle p \rangle = 1.61$, $\langle n \rangle = 1.51$ } up to 10 p's or n's.

COMPARISON OF $\pi^\pm$ AND π^0 MULTIPLICITIES:

$Q^2 > 1 GeV^2$, $p_\mu > 500$ MeV.