TDA counting rates: comparing Mamen/Bernard/Jacques/Thierry calculations

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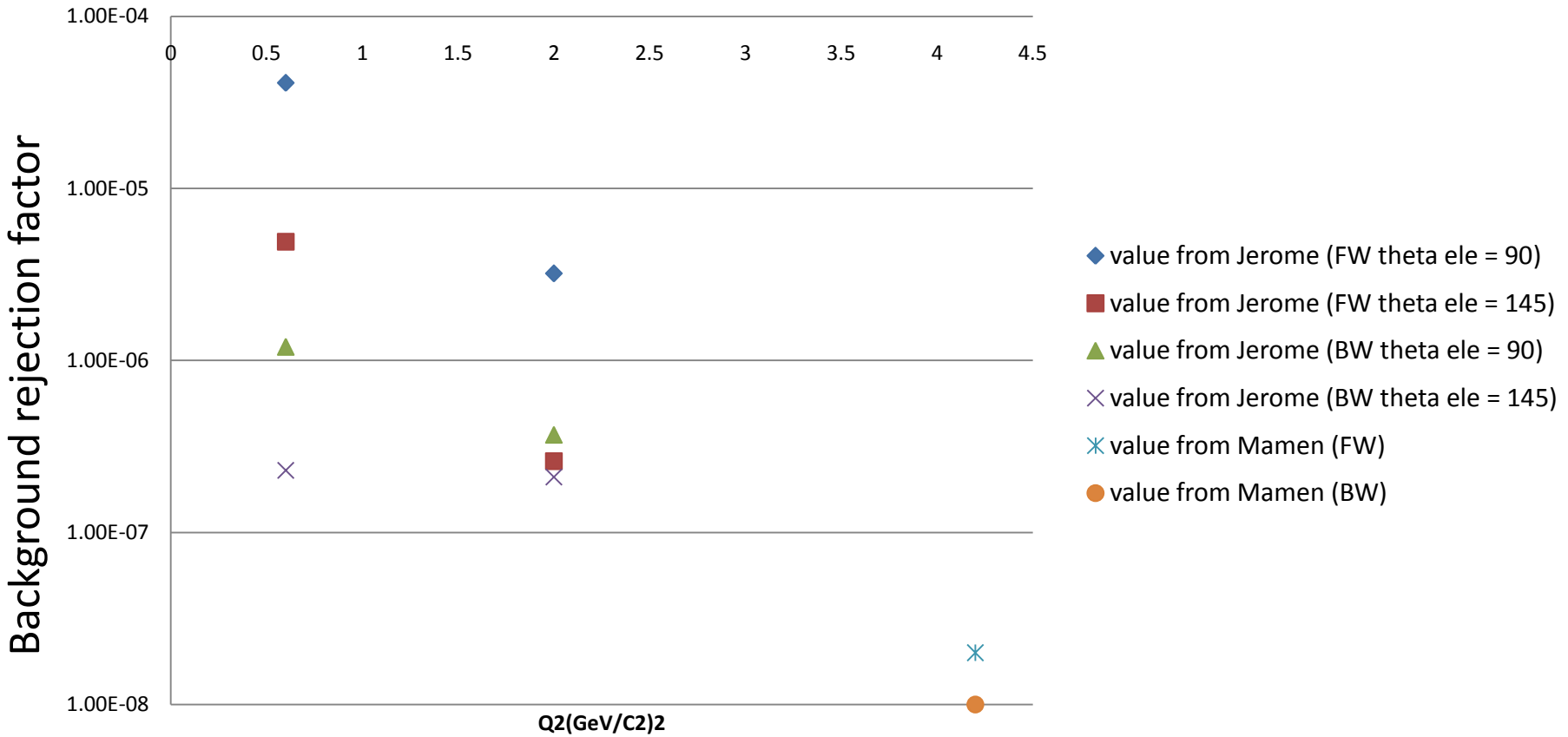
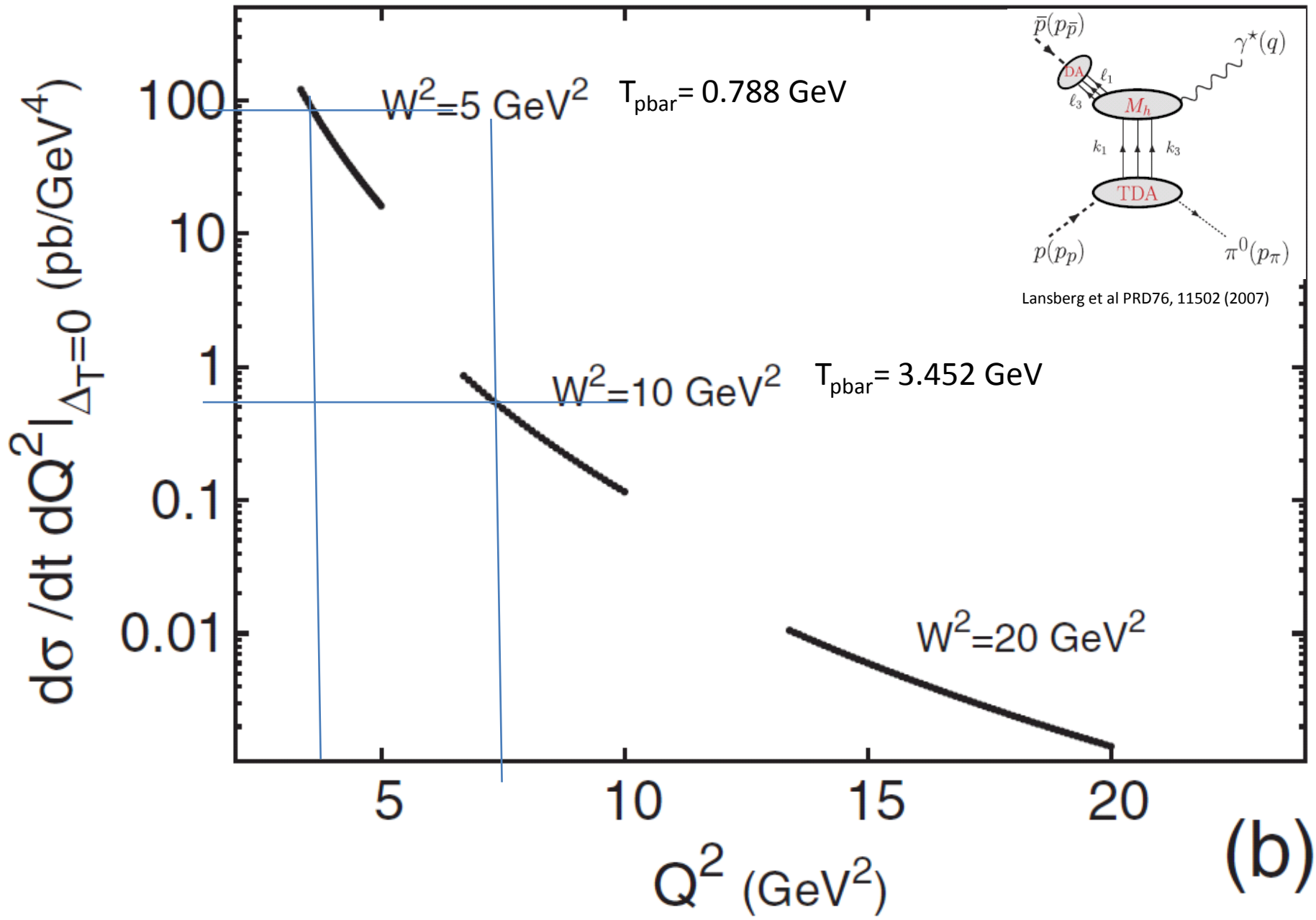
$\pi^+\pi^-\pi^0$ rejection factors

Q^2 ,



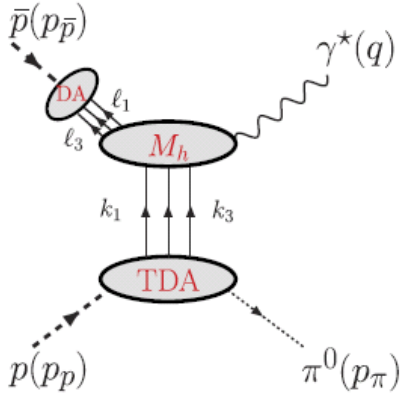


Lansberg et al PRD76, 11502 (2007)

formulae

$$\Delta_T^2 = \frac{1-\zeta}{1+\zeta}\left(t - 2\zeta\left[\frac{M_p^2}{1+\zeta} - \frac{M_\pi^2}{1-\zeta}\right]\right)$$

With $$t = (\tilde{p}_{\bar{p}} - \tilde{p}_{\gamma^*})^2 = (\tilde{p}_p - \tilde{p}_{\pi^0})^2$$



At W^2=10, Q^2=8 and
W^2=5, Q^2=4
$\zeta = Q^2/(2W^2-Q^2) = 2/3$

At θ_π=0° Δ_T=0. (t is maximum)

$\Delta_T < 0.5$ GeV $\leftrightarrow$ t_{max}-t_{min} = 1.25 GeV^2

t_{max} = 0.62 GeV^2 : almost independant on W

Counting rates

Assumed integrated luminosity = 2 fb^{-1} = 2000 pb^{-1} (4 months at full luminosity)

W^2 / Q^2	ζ	ΔQ^2	Δ_T (GeV)	Δt (GeV)	t_{max} (GeV^2)	$\Delta\theta_\pi$	% of 4π	$d\sigma/dtdQ^2$ $pb.GeV^{-4}$	$N_{orsay/Pire}$	N_{mamen}/N_{renor}
10 / 8	2/3	1	0.5	1.25	0.625	134°	85 %	0.5	1250 [1]	6000/ 1400 [3]
10 / 8	2/3	1	0.2	0.2	0.625	43°	13.4 %	0.5	200	
10 / 8	2/3	1	0.1	0.05	0.625	21°	3.3 %	0.5	50	
5 / 4	2/3	0.4	0.5	1.25	0.612	‡	>100%	70	70000	150000 / 50000 [3]
5 / 4	2/3	0.4	0.3	0.45	0.612	180°	100%	70	25200 [2]	
5 / 4	2/3	0.4	0.2	0.2	0.612	84°	45%	70	11200	
5 / 4	2/3	0.4	0.1	0.05	0.612	39°	11.1%	70	2800	
5 / 4	2/3	0.4	0.05	0.013	0.612	19°	2.7%	70	700	

‡ : Max value of Δ_T = 0.3 GeV

1 : B. Pire number of counts ≈ 200 → error ??

2 : Jacques model, integrated over all π^0 angles and rescaled to W^2 = 5 GeV^2 gives
$5.\ 10^{-5} * 0.4 * 2.\ 10^9 = 40000$

3 : N_{renor} is just the Mamen number renormalized to the correct Q^2 interval assuming a Q^{-6} dependence

conclusions

- TDA seems feasible at W^2=5, but most likely not at 10:
- About 15000 rec. events over full π^0 and e^+ acceptance at W^2=5, ~1000 events at W^2=10
- At W^2=10, only a few events per 0.1 cos(θ) bin to test 1+cos^2(θ) distribution.
- Mamen and Orsay estimates agree within a factor <2
- Jacques and Bernard gives compatible cross section at W^2 = 5 (Q^2=4) when integrated over pion angle and ΔQ^2= 0.4 (xs is 20 pb)
- Discuss with B. Pire about modelling of t dependance