# Effect of the Cherenkov detector on PVDIS Figure-of-Merit

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# Outline

Goal: determine the effect of the Cerenkov detector efficiency on the total statistics for PVDIS;

- Method;

- Preliminary results;

- TO DO;

# Method: description

Steps:

- Set a threshold on the number of photoelectrons;

=>

- extract the efficiency of the detector at “each” point of the phase space $\theta$, $k'$, and at each point of the target, depending on the number of photoelectrons at this point; integrate over the target;

=>

- inject this efficiency in the program that computes the FOM;

# Photoelectron threshold

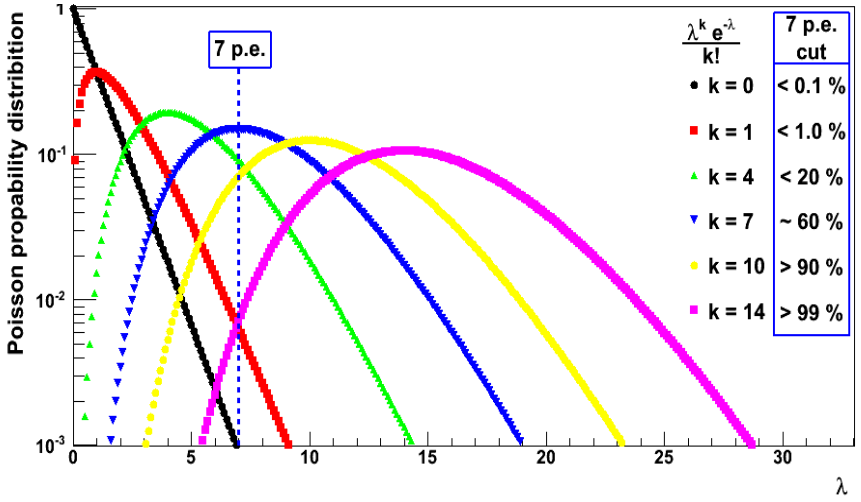
A further tuning of the detector design (gas refraction index was lowered by setting a gas pressure of 0.75 atm) was necessary to suppress the signal given by pions between 2.7 and 3 GeV momentum => lower than 1 p.e. AT MOST;

To reject 99% (**enough ? too low ? too high ?**) of a 1 p.e. signal, a 7 p.e. threshold is needed:

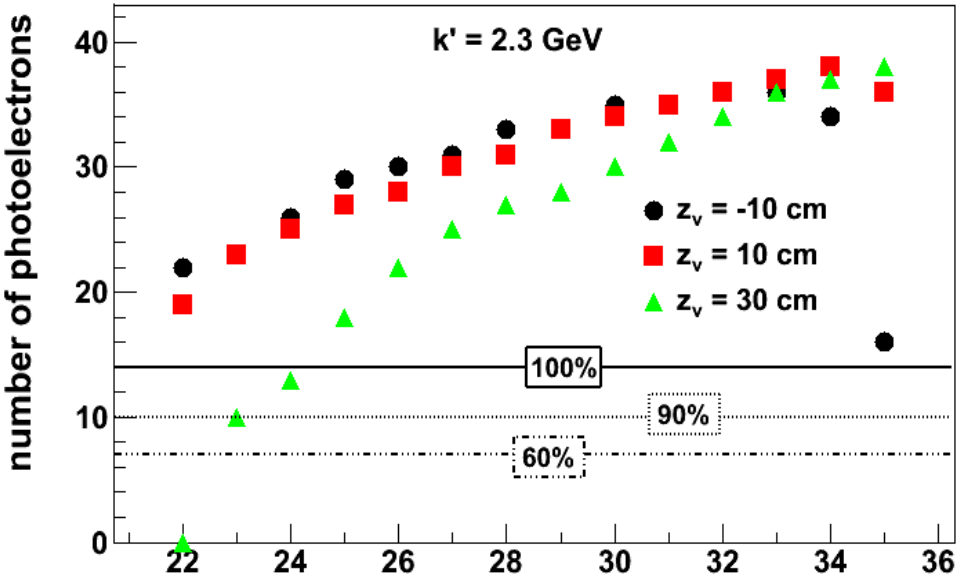
Keeps ~60 % of 7 p.e. signal

>90 % of 10 p.e. signal

>99 % of 14 p.e. signal




Effect on signal




**< 7 p.e. => 0%**

**7 - 10 p.e. => 60%**

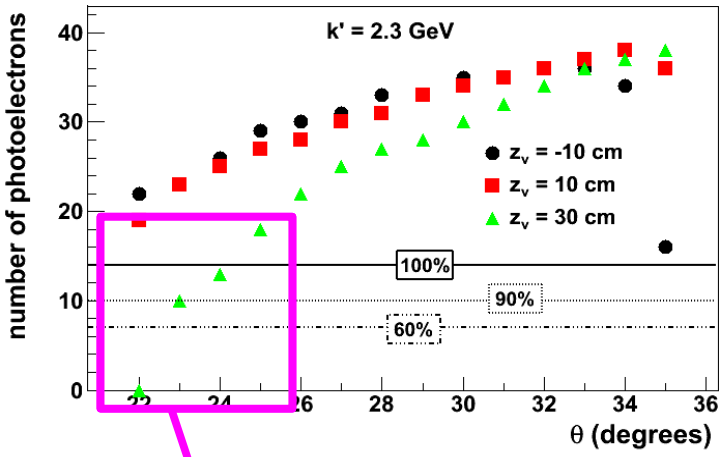
**10 - 14 p.e. => 90 %**

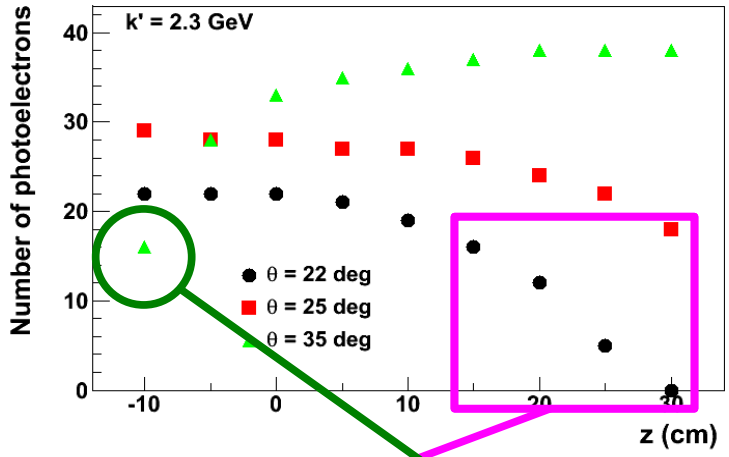
**> 14 p.e. => 100 %**

# Efficiency over phase space

Effect of the p.e. threshold on signal:

*Where is the number of photoelectrons critical ?*

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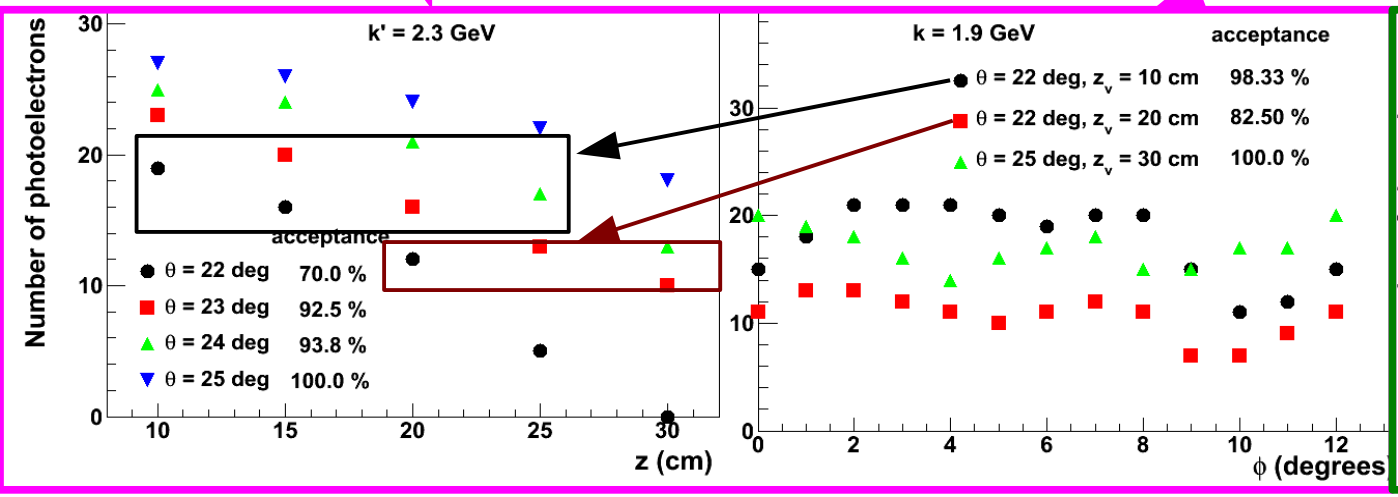
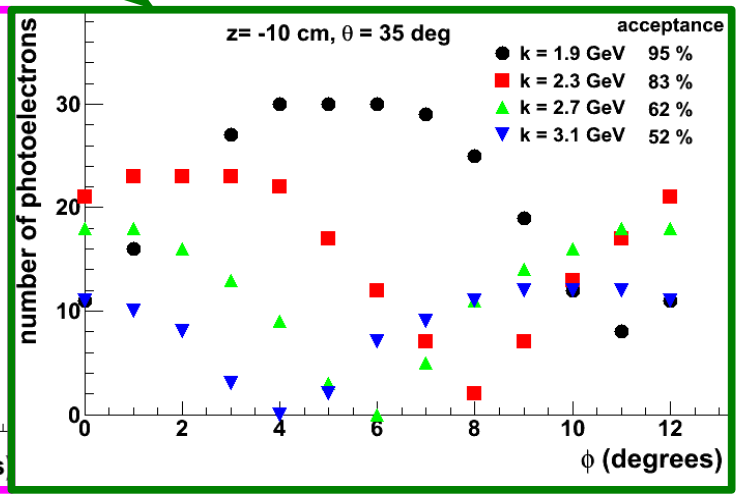
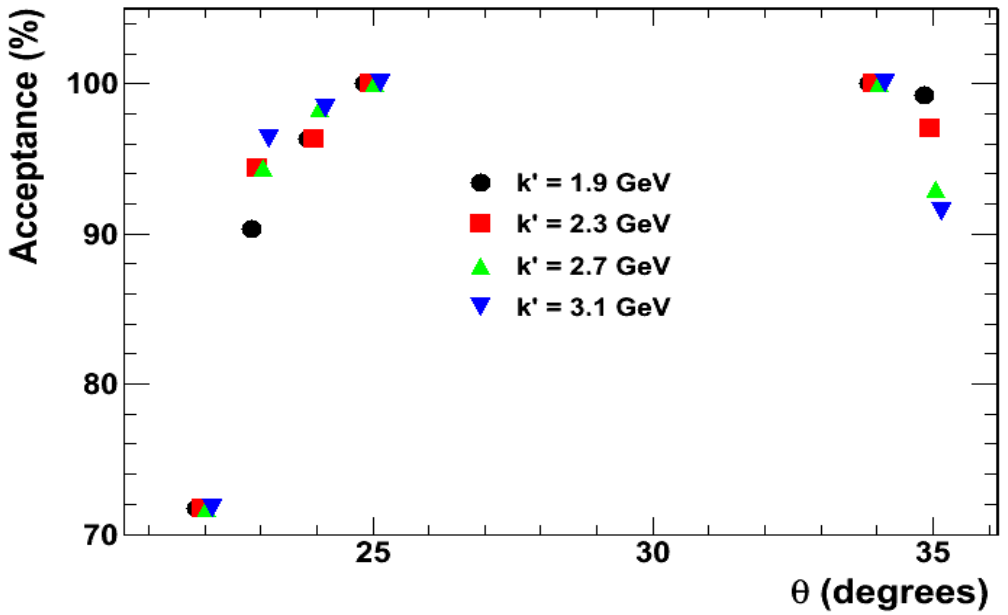


# Efficiency over phase space

Resulting efficiency integrated over target:




Perfect for 25 deg ≤ θ ≤ 34 deg;

>90 % for 35 deg => decreases with increasing k';

>90 % for 23 deg ≤ θ < 25 deg => increases with increasing k';

~70 % for 22 deg;

# Results (preliminary)

FOM (Baffles):

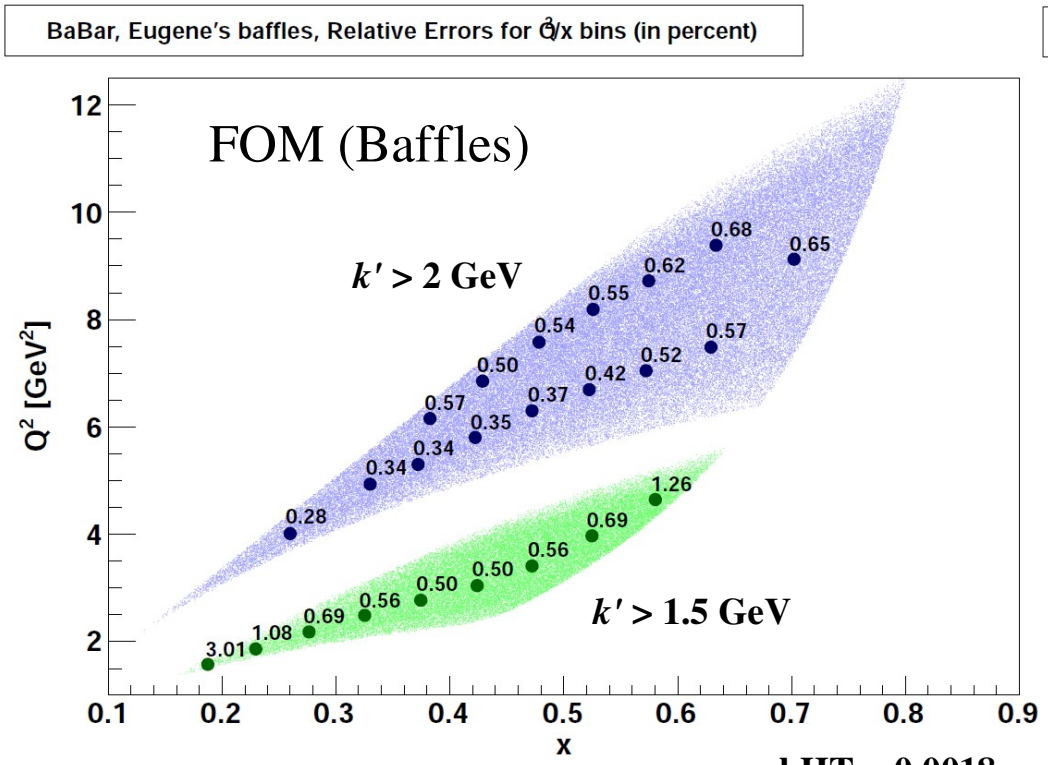
=> includes all electrons which make it through the baffles;

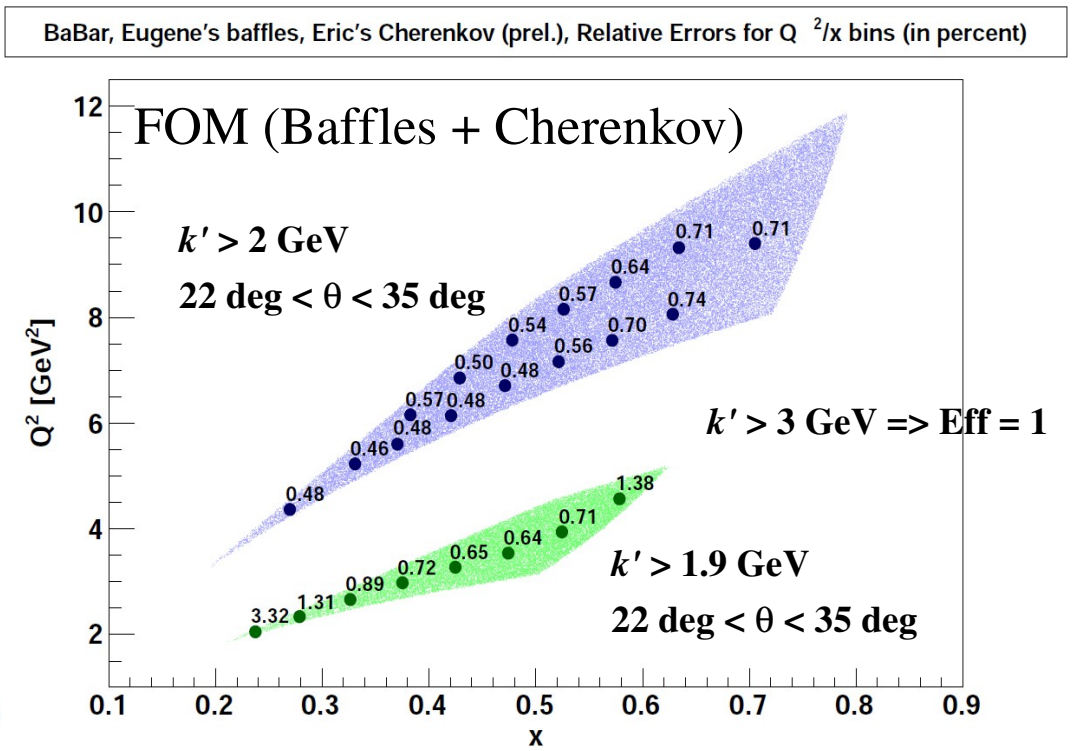
(may include θ < 22 deg or θ > 35 deg)

Vs FOM (Baffles + Cherenkov):

=> includes Cherenkov efficiency + additional cuts;

(θ, $k'$ optimization range)




bHT = 0.0018
bCSV = 0.013

→

bHT = 0.0023
bCSV = 0.018

# TO DO

- Determine detector efficiency outside of the optimization range (same thing has to be done for GEM option, even if, presumably, efficiency will be perfect in the optimisation range);

- still with BaBar design, and with $C_4F_{10}$...

=> have to switch to $C_4F_8O$;

=> have to switch to CLEO (which implies a new design...)