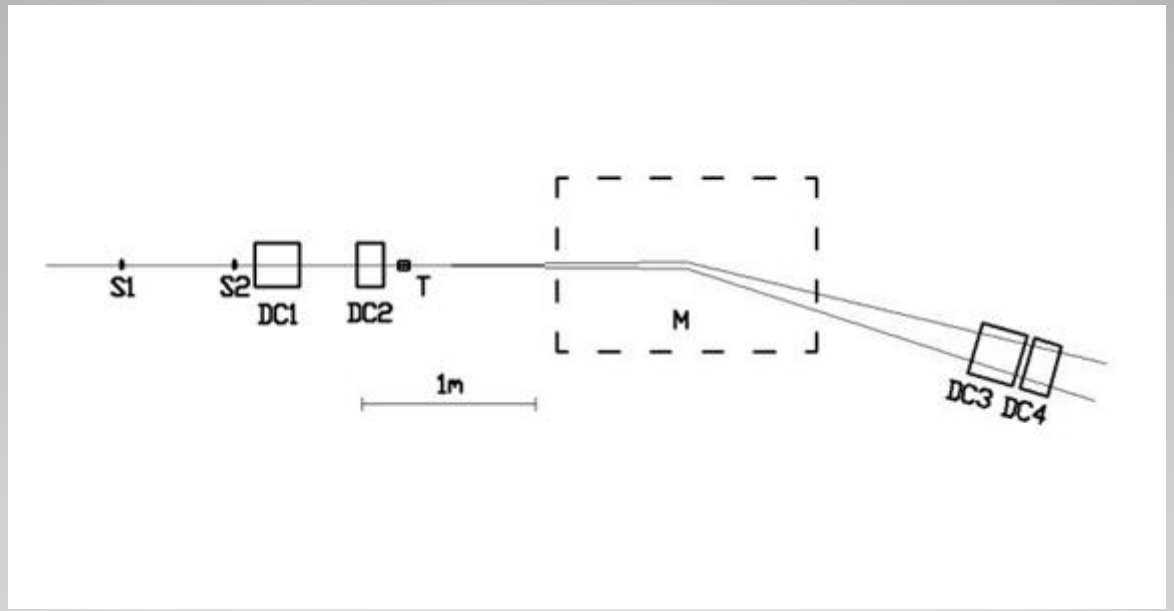
High precision measurements of cross-sections in A(d,p)X reactions at small internal proton momenta

S. N.Basilev, Yu.P.Bushuev, V.V.Glagolev, S.A.Dolgiy, D.A.Kirillov, N.V.Kostyaeva, A.D.Kovalenko, A.N.Livanov, P.K.Manyakov, G.Martinska, J.Musinsky, N.M.Piskunov, A.A.Povtoreiko, P.A.Rukoyatkin,R.A.Shindin, I.M.Sitnik, V.M.Slepnev, I.V.Slepnev, J.Urban

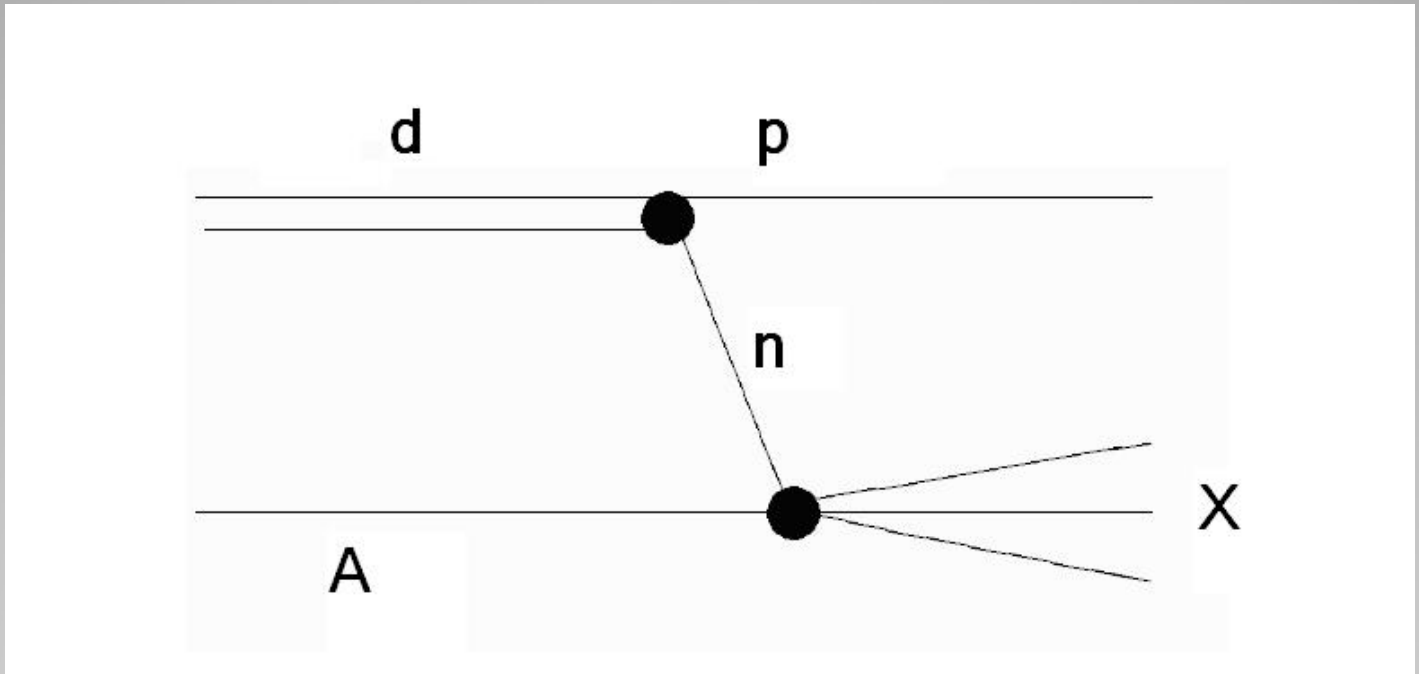
Joint Institute for Nuclear Research, Dubna, Russia
University of P.J. Safarik, K-04154 Kosice, Slovak Republic
Institute of Experimental Physics, Watsonova 47,SK-04001 Kosice, Slovak Republic



DCi – drift chambers

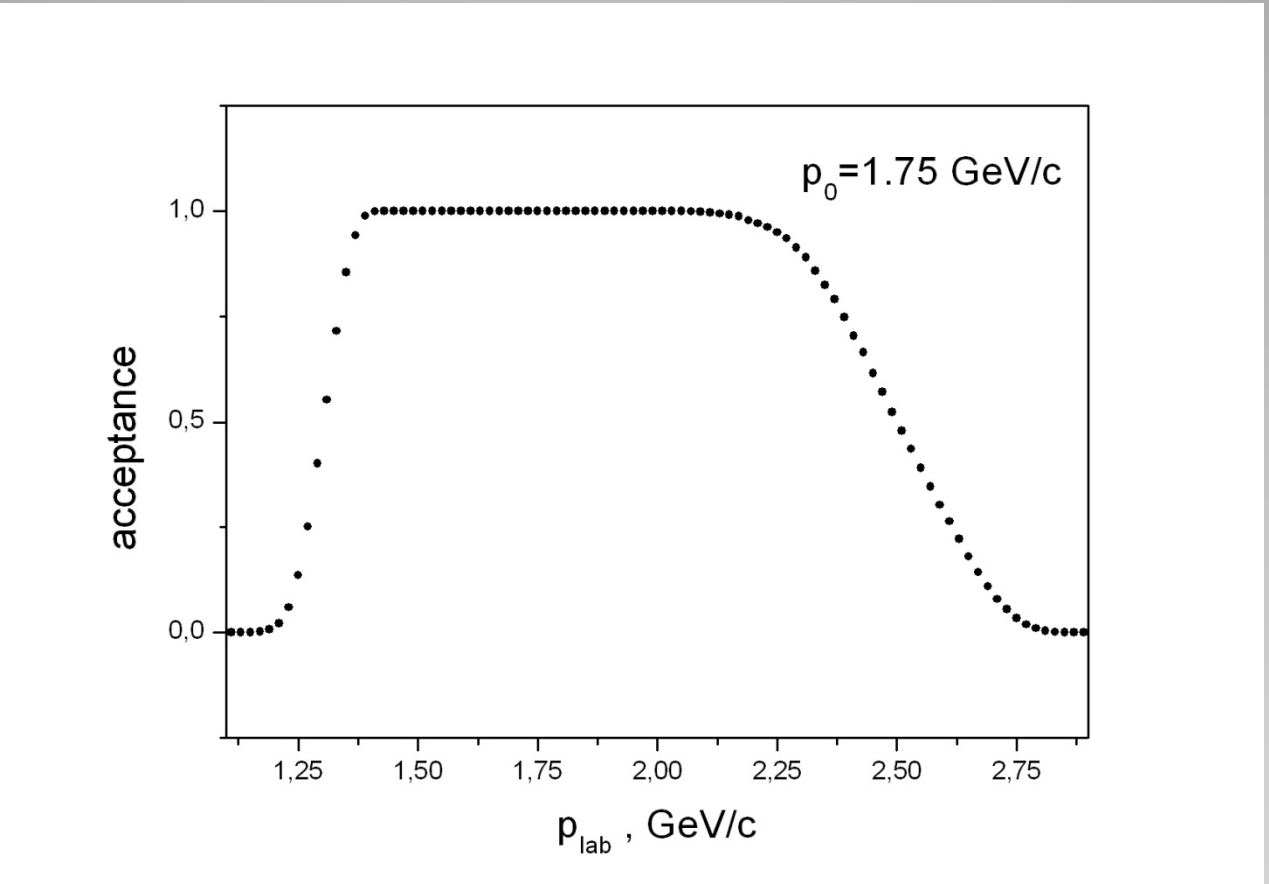
- V.G. Ableev et al.,
- Nucl.Phys. A393 (1983) 491.

- V.G.~Ableev et al.,
- JINR Rapid. Com., 1[52]-92 (1992) 10.

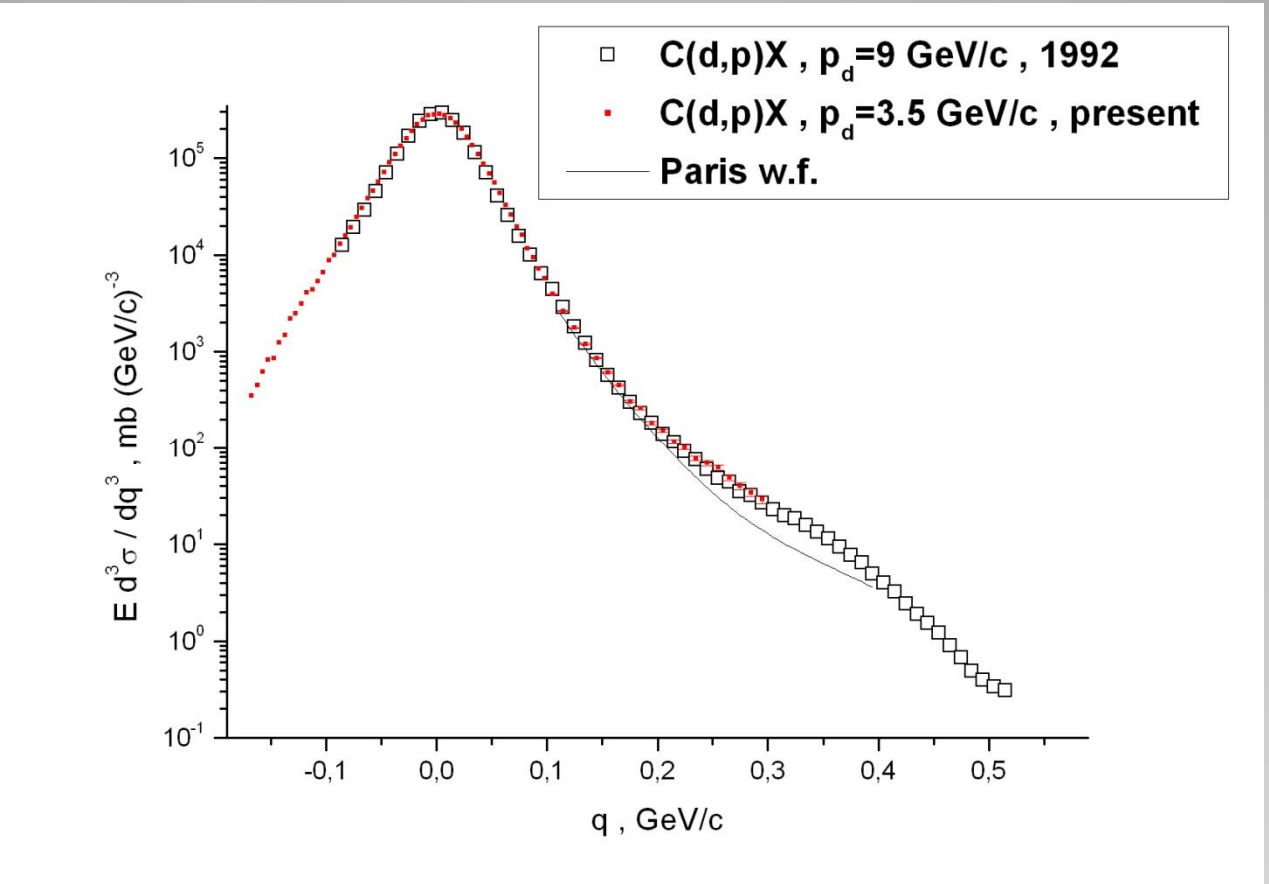


Impulse Approximatin graph

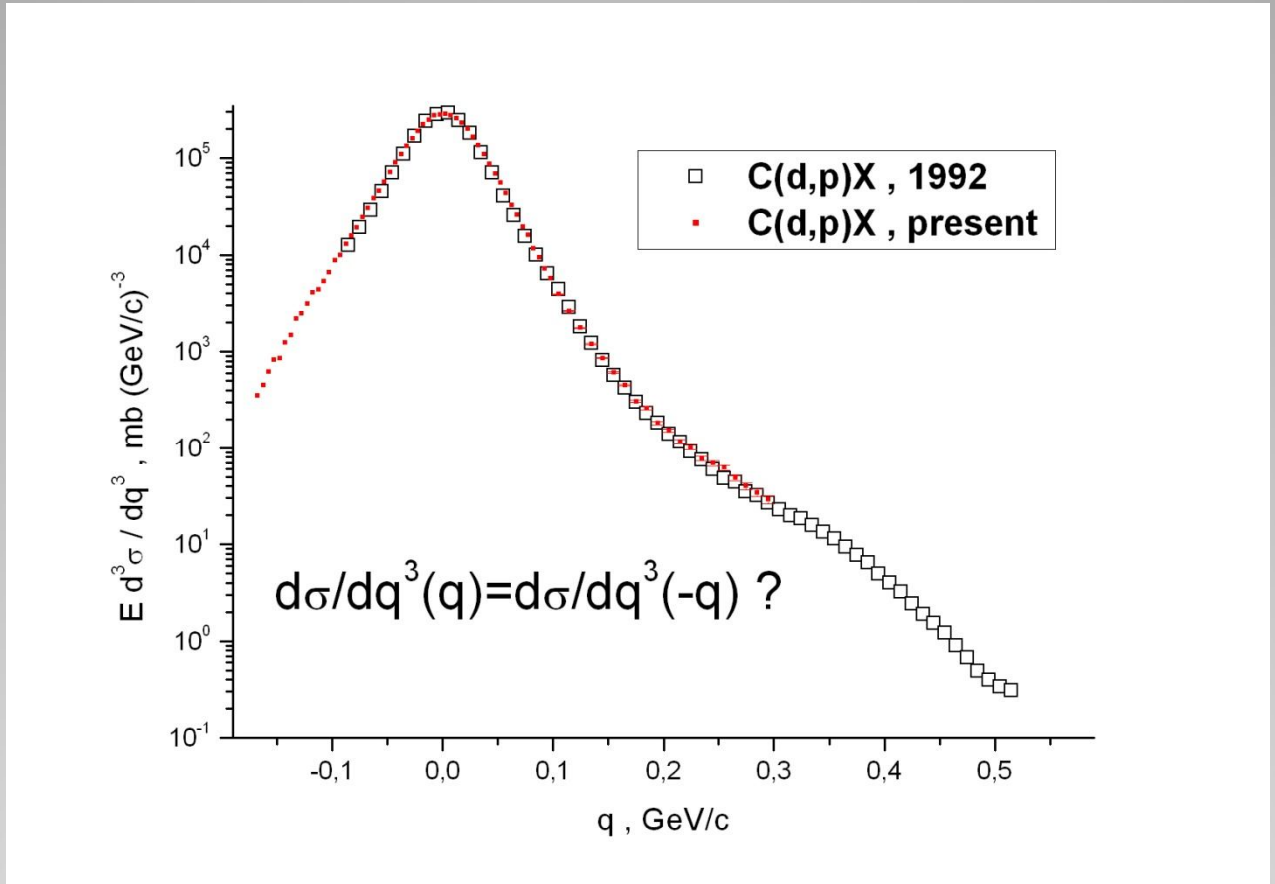
bottom vertex – total nA cross-section

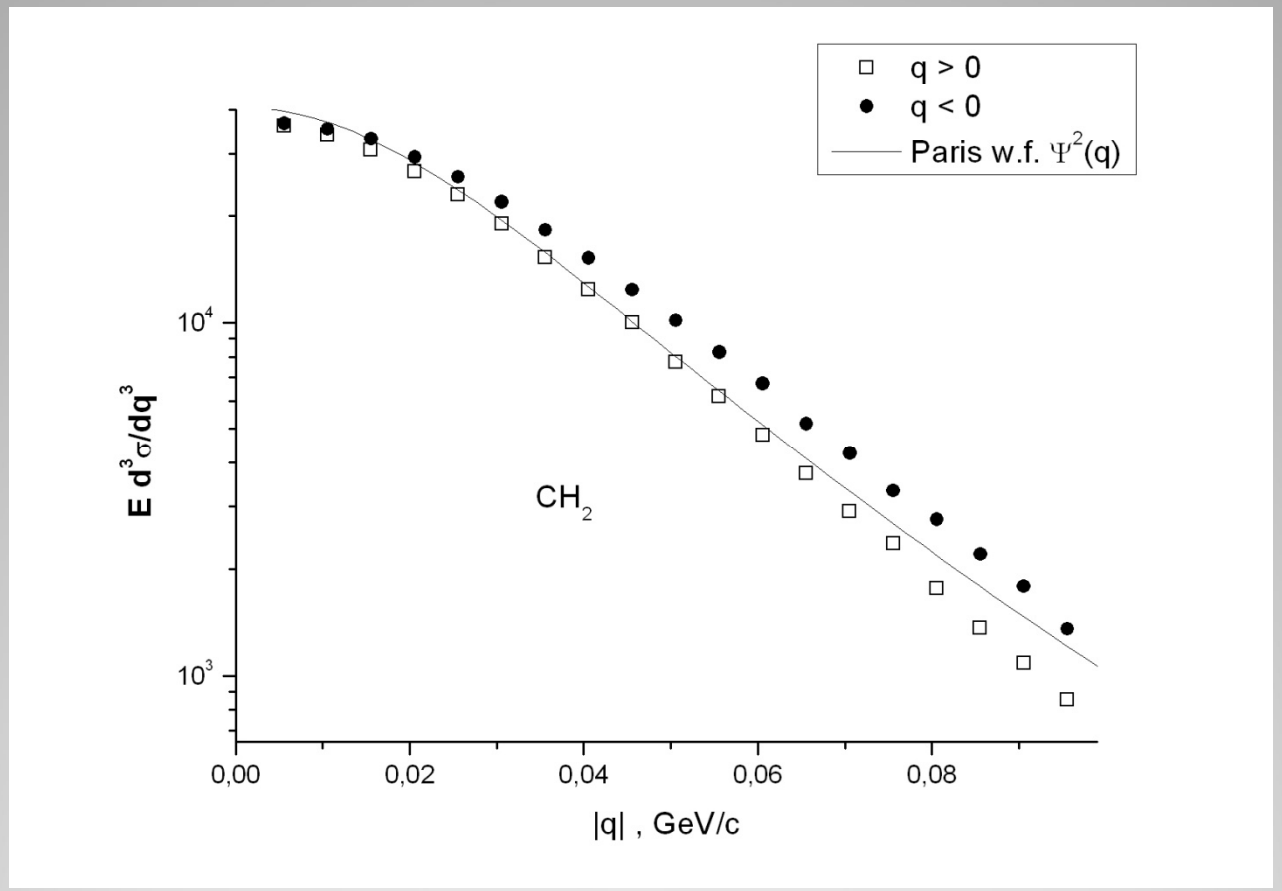


Eff > 0.9 at -0.21 < (p-p0)/p0 < 0.27



Azhgirey et al., Z.Phyz. A 1992 343 – wrong paper
A.P. Ierusalimov, G.I. Lykasov, M.Viviani, arXiv:1002.0249, 2010 – questionable paper


C(d,p)X , 1992
C(d,p)X , present
$E\,d^3\sigma / dq^3$, mb $(GeV/c)^{-3}$
$d\sigma/dq^3(q)=d\sigma/dq^3(-q)$?
q , GeV/c
10^5
10^4
10^3
10^2
10^1
10^0
10^{-1}
-0,1
0,0
0,1
0,2
0,3
0,4
0,5


q > 0
q < 0
Paris w.f. $\Psi^2(q)$
$E\,d^3\sigma/dq^3$
10^4
10^3
CH_2
0,00
0,02
0,04
0,06
0,08
|q| , GeV/c

$$
\begin{aligned}
\alpha &= \frac{\sqrt{m_s^2 + q^2} + \ q_{\|}}{m_A} \\
M_{sf}^2 &= \frac{q_\perp^2 + m_s^2(1-\alpha) + m_f^2\alpha}{\alpha(1-\alpha)} \\
k_{\|} &= (\alpha - \frac{1}{2})M_{sf} - \frac{m_s^2 - m_f^2}{2M_{sf}} \\
k_\perp &= q_\perp \\
k &= \sqrt{k_\perp^2 + k_{\|}^2}
\end{aligned}
$$

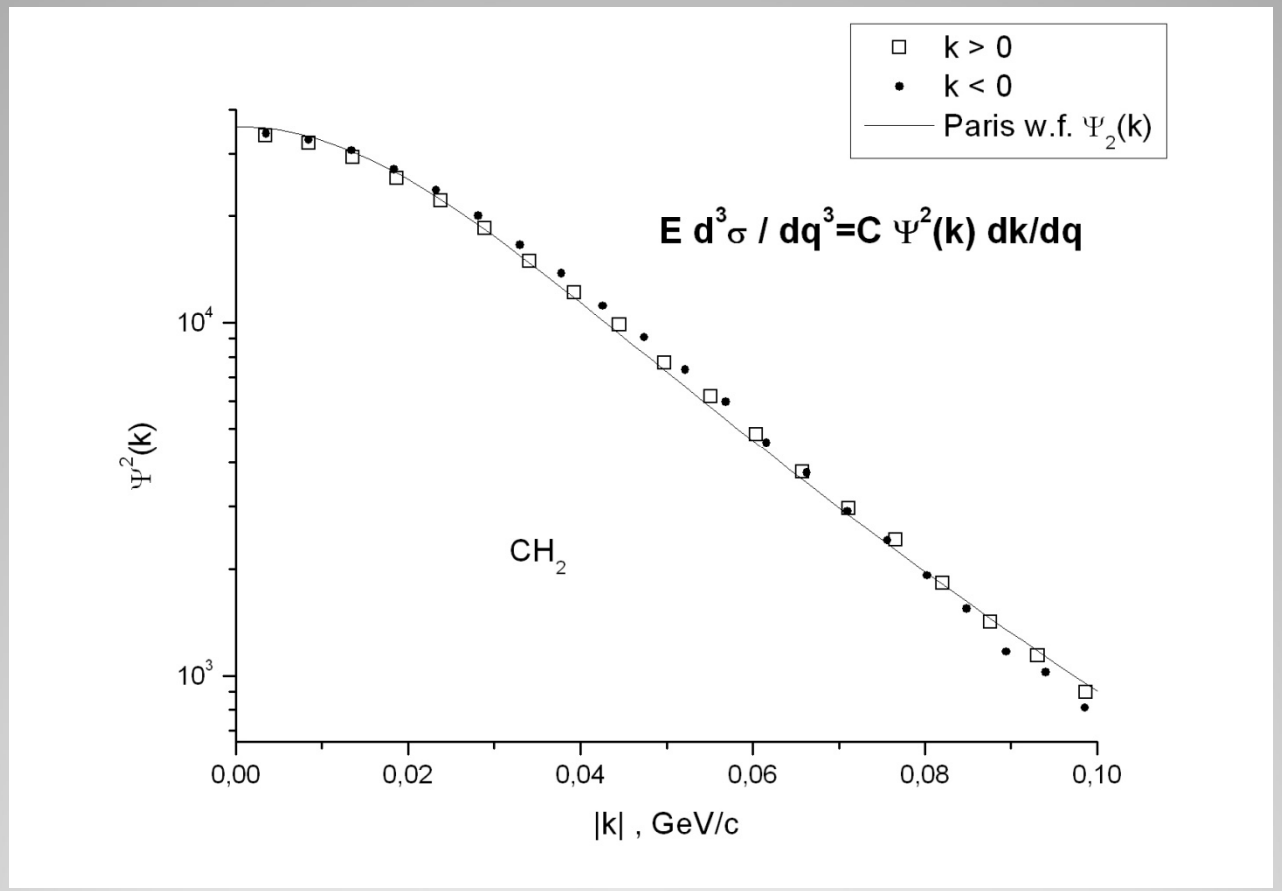
$$q = \sqrt{q\perp^2 + q\|^2}$$

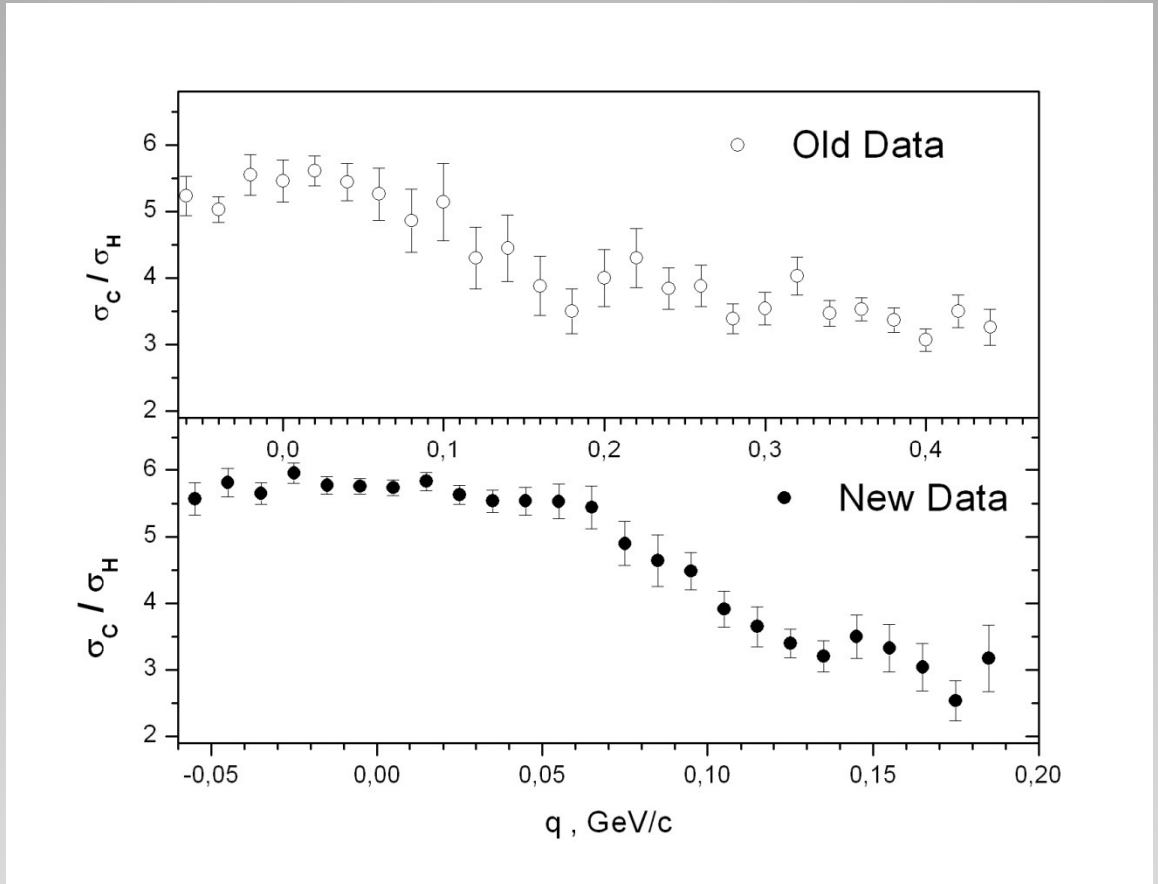
To provide $q \simeq q\|$ $(q\perp << q\|)$, *the* restrictions on $q\perp$ were as follows (GeV/c)

$$q\perp < 0.01 \; at \; q\| < 0.1 \; (\langle q^2\perp \simeq 0.003^2 \rangle)$$

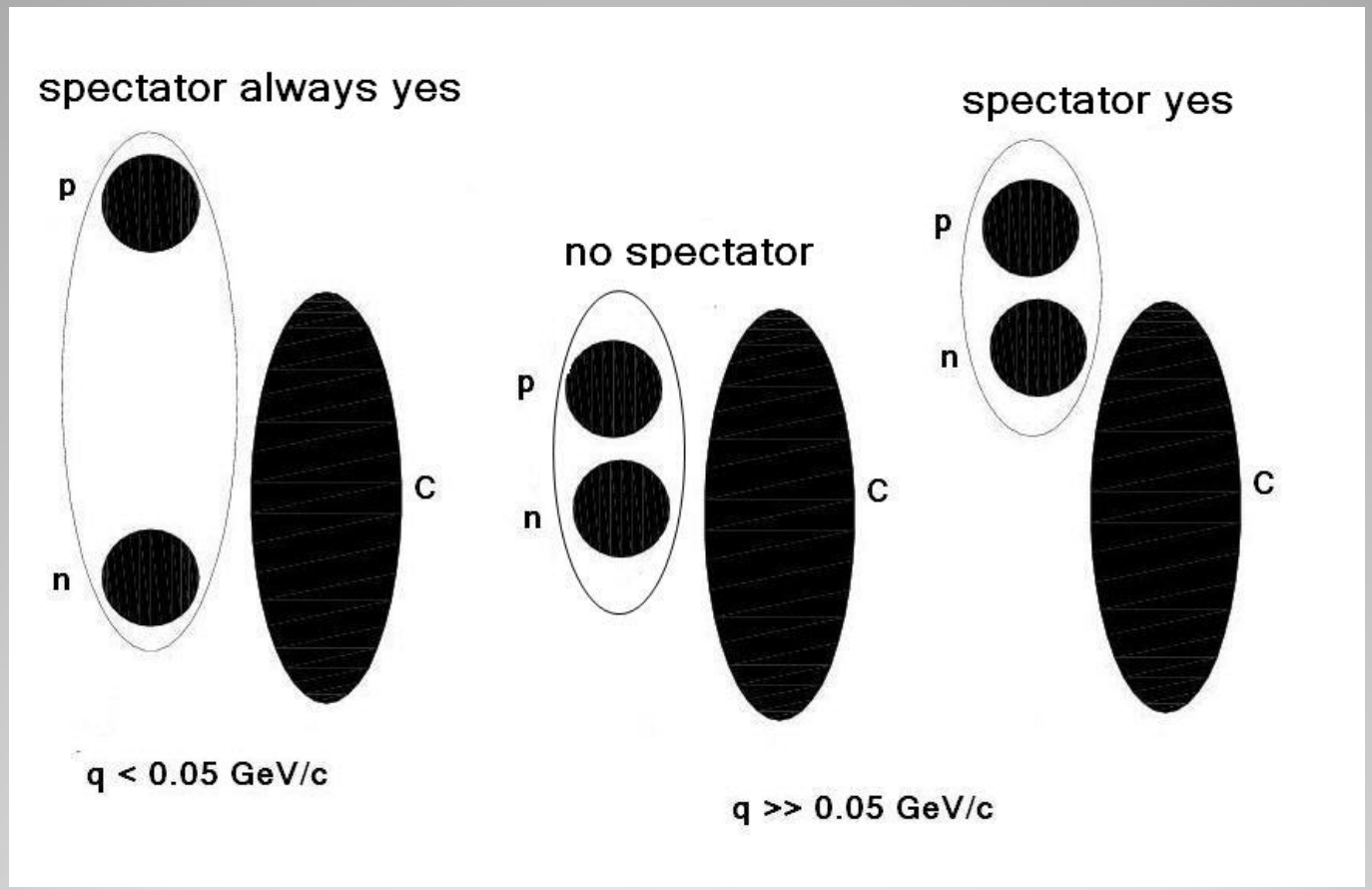
$$q\perp < 0.04 \; at \; q\| < 0.3 \; (\langle q^2\perp \simeq 0.01^2 \rangle)$$

$$q\perp < 0.07 \; at \; q\| > 0.2 \; (\langle q^2\perp \simeq 0.02^2 \rangle)$$

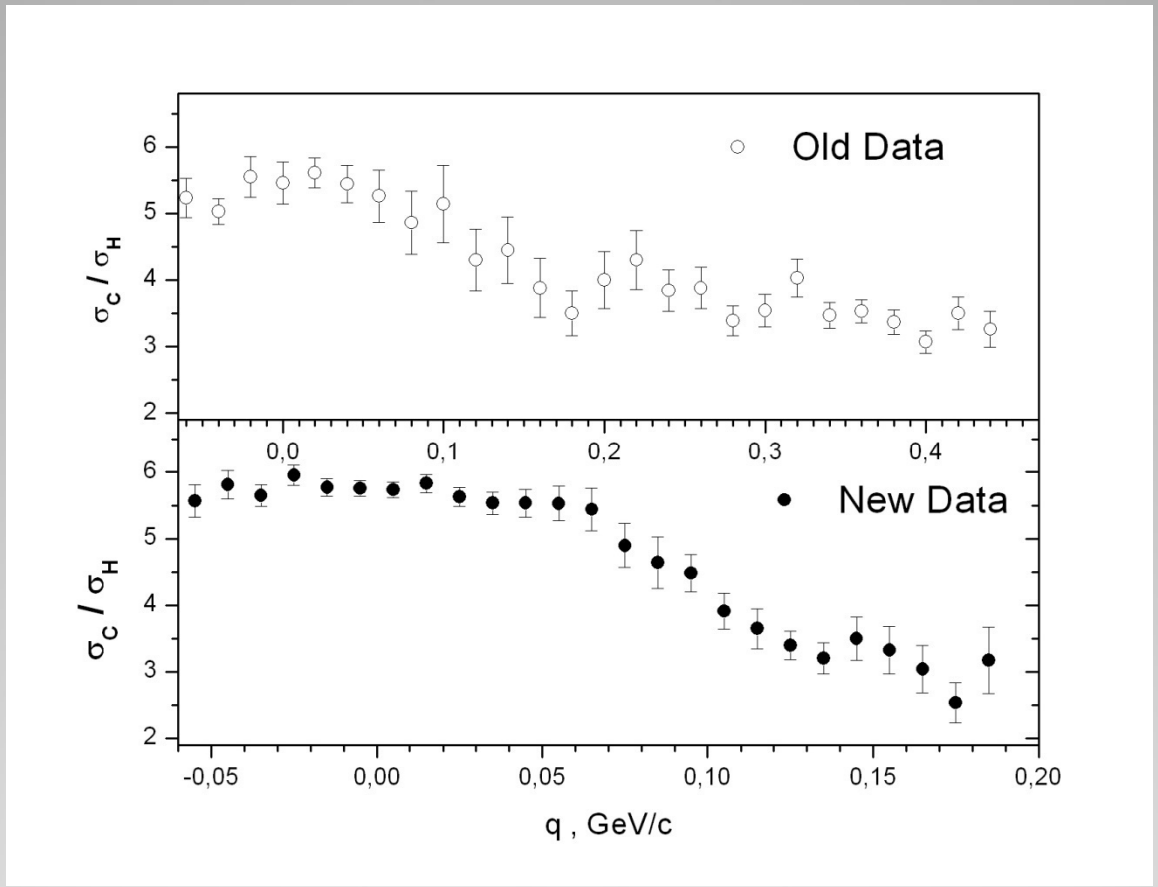

k > 0
k < 0
Paris w.f. $\Psi_2(k)$
$E\, d^3\sigma / dq^3 = C\, \Psi^2(k)\, dk/dq$
10^4
10^3
$\Psi^2(k)$
CH_2
0,00
0,02
0,04
0,06
0,08
0,10
|k| , GeV/c



Ratio of breakup- cross sections on C and H



At q > 0.05 transition from total cross section to peripheral interaction for nC take place



At q > 0.05 transition from total cross section to peripheral interaction for nC take place

Conclusions

- 1. Breakup cross-sections show energy independence in GeV region.
- 2. Light front variable is preferable for comparison experiment with theory in all region of changing.
- 3. Ratio of breakup cross-sections on carbon and hydrogen targets demonstrate an interesting dependence on q.
- 4. More precise values of cross-sections in maximum on carbon and hydrogen will be ready soon.