MAID update

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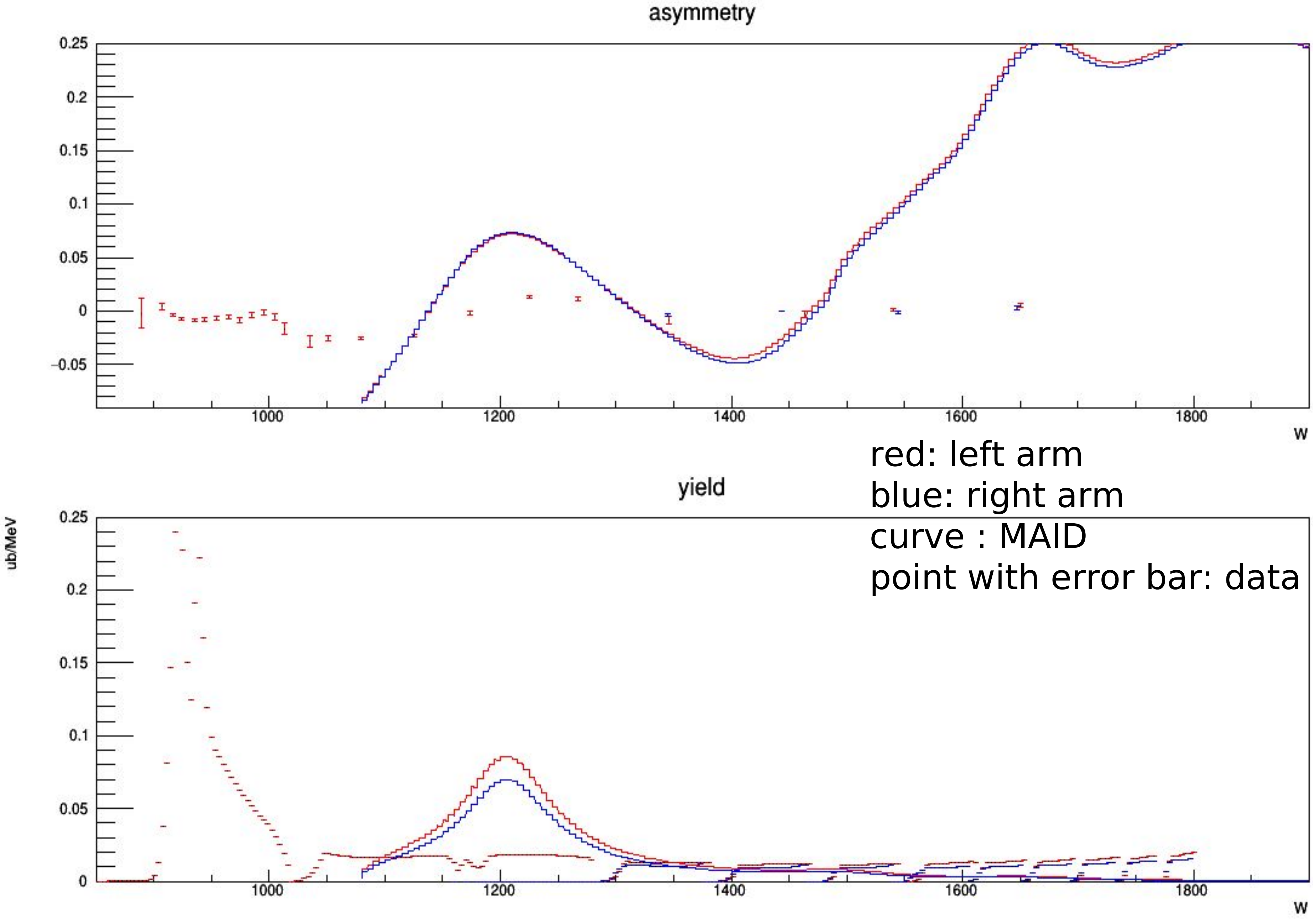
Last time: MAID asymmetry 6 times larger than data



red: left arm
blue: right arm
curve : MAID
point with error bar: data

Theory equations -- two way to calculate differential cross section (unpol) from virtual photon cross section

Method 1: Calculate directly from virtual photon cross section

$$\frac{\mathrm{d}\sigma}{\mathrm{d}\Omega\,\mathrm{d}E'} = \Gamma_{\mathrm{V}}\sigma(\nu, Q^2) \ ,$$

$$\sigma = \sigma_{\mathrm{T}} + \epsilon\sigma_{\mathrm{L}} + hP_x\sqrt{2\epsilon(1-\epsilon)}\ \sigma'_{\mathrm{LT}} + hP_z\sqrt{1-\epsilon^2}\ \sigma'_{\mathrm{TT}} \ ,$$

with the photon polarization

$$\epsilon = \frac{1}{1 + 2(1 + \nu^2/Q^2)\tan^2\theta/2} \ ,$$

and the flux factor

$$\Gamma_{\mathrm{V}} = \frac{\alpha_{\mathrm{em}}}{2\pi^2}\frac{E'}{E}\frac{K}{Q^2}\frac{1}{1-\epsilon} \ .$$

Method 2: Get F1,F2,g1,g2 first, then calculate diff xs from F1,F2,g1,g2

$$\sigma_{\mathrm{T}} = \frac{4\pi^2\alpha_{\mathrm{em}}}{MK}F_1 \ ,$$

$$\sigma_{\mathrm{L}} = \frac{4\pi^2\alpha_{\mathrm{em}}}{K}\left[\frac{1+\gamma^2}{\gamma^2}\frac{F_2}{\nu} - \frac{F_1}{M}\right] \ ,$$

$$\sigma_{\mathrm{TT}} = \frac{4\pi^2\alpha_{\mathrm{em}}}{MK}(g_1 - \gamma^2 g_2) \ ,$$

$$\sigma_{\mathrm{LT}} = \frac{4\pi^2\alpha_{\mathrm{em}}}{MK}\gamma(g_1 + g_2) \ ,$$

$\Longrightarrow$

$$\frac{d^2\sigma_{unpol}}{d\Omega dE'} = \left(\frac{d\sigma}{d\Omega}\right)_{Mott}\left[\frac{2}{M}F_1(x,Q^2)tan^2\frac{\theta}{2} + \frac{1}{\nu}F_2(x,Q^2)\right],$$

$$\left(\frac{d\sigma}{d\Omega}\right)_{Mott} = \frac{\alpha^2 cos^2\frac{\theta}{2}}{4E^2 sin^4\frac{\theta}{2}},$$

$$\frac{d^2\sigma^{\rightrightarrows}}{d\Omega dE'} - \frac{d^2\sigma^{\rightleftarrows}}{d\Omega dE'} = -\frac{4\alpha^2 E'}{MQ^2E\nu}[(E + E'cos\theta)g_1(x,Q^2) - 2Mxg_2(x,Q^2)],$$

$$\frac{d^2\sigma^{\rightarrow\Uparrow}}{d\Omega dE'} - \frac{d^2\sigma^{\rightarrow\Downarrow}}{d\Omega dE'} = -\frac{4\alpha^2 E'^2}{MQ^2E\nu}sin\theta[g_1(x,Q^2) + \frac{2E}{\nu}g_2(x,Q^2)],$$

Theory equations -- two way to calculate asymmetry from virtual photon cross section

Method 1: Calculate using A1 and A2

$$A_1(x, Q^2) = \frac{\sigma_{TT}}{\sigma_T},$$
$$A_2(x, Q^2) = \frac{\sigma_{LT}}{\sigma_T},$$

$\Rightarrow$

$$A_{\parallel} = D(A_1 + \eta A_2),$$
$$A_{\perp} = d(A_2 - \xi A_1),$$

Method 2: Calculated from differential cross section

$$A_{\parallel} \equiv \frac{d\sigma^{\overset{\rightarrow}{\Leftarrow}} - d\sigma^{\overset{\rightarrow}{\Rightarrow}}}{2\, d\sigma_{unpold}}$$

$$A_{\perp} \equiv \frac{d\sigma^{\rightarrow\Uparrow} - d\sigma^{\rightarrow\Downarrow}}{2 d\sigma_{unpold}}.$$

Equation conflict between Phys.Rep.378.99 and arXiv:hep-ph/9810480 (both from Drechsel)

Equation 1:
from arXiv:hep-ph/9810480
or from Phys.Rev.D.63.114010

$$\sigma_T = \frac{4\pi^2\alpha}{mK} F_1 ,$$

$$\sigma_L = \frac{4\pi^2\alpha}{K}\left[\frac{F_2}{\nu}(1+\gamma^2) - \frac{F_1}{m}\right] ,$$

$$\sigma'_{LT} = -\frac{4\pi^2\alpha}{mK}\gamma\,(g_1 + g_2) ,$$

$$\sigma'_{TT} = -\frac{4\pi^2\alpha}{mK}\left(g_1 - \gamma^2 g_2\right) ,$$

Equation 2:
Phys.Rep.378.99

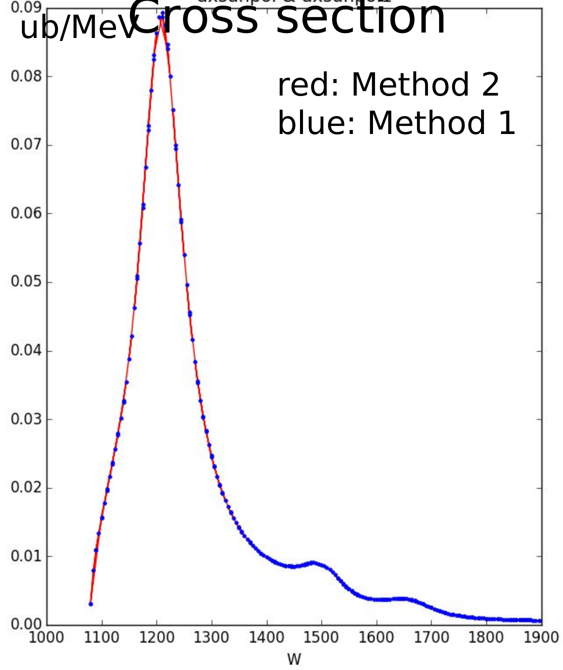
$$\sigma_T = \frac{4\pi^2\alpha_{em}}{MK} F_1 ,$$

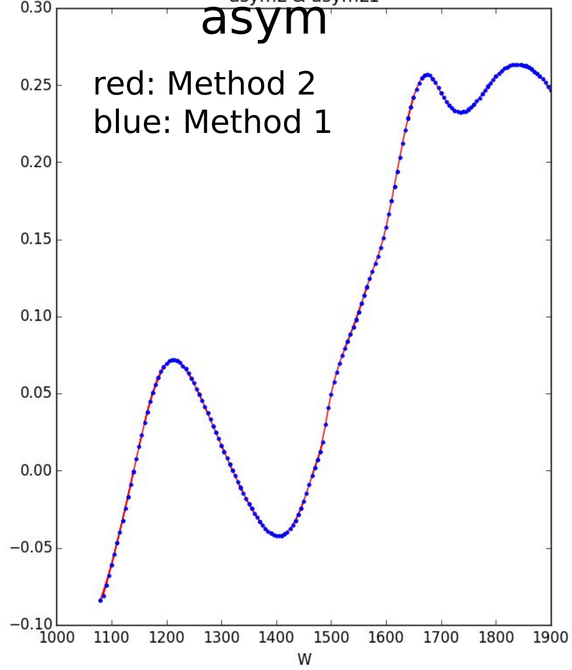
$$\sigma_L = \frac{4\pi^2\alpha_{em}}{K}\left[\frac{1+\gamma^2}{\gamma^2}\frac{F_2}{\nu} - \frac{F_1}{M}\right] ,$$

$$\sigma_{TT} = \frac{4\pi^2\alpha_{em}}{MK}(g_1 - \gamma^2 g_2) ,$$

$$\sigma_{LT} = \frac{4\pi^2\alpha_{em}}{MK}\gamma(g_1 + g_2) ,$$

The author noted in this paper that the factor γ^2 in the denominator of σ_L is missing in the previous paper.
So the equation 1 should be incorrect.



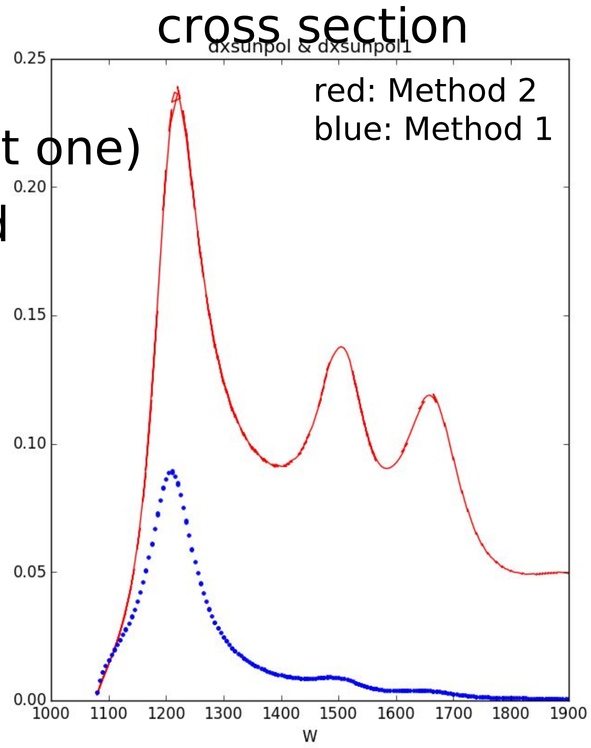


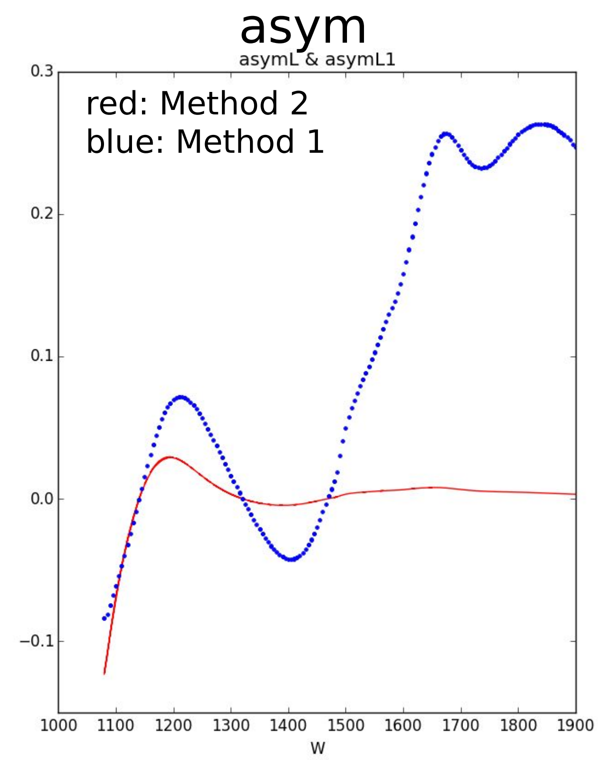
Using equation 2 (correct one)

Two methods matched very well

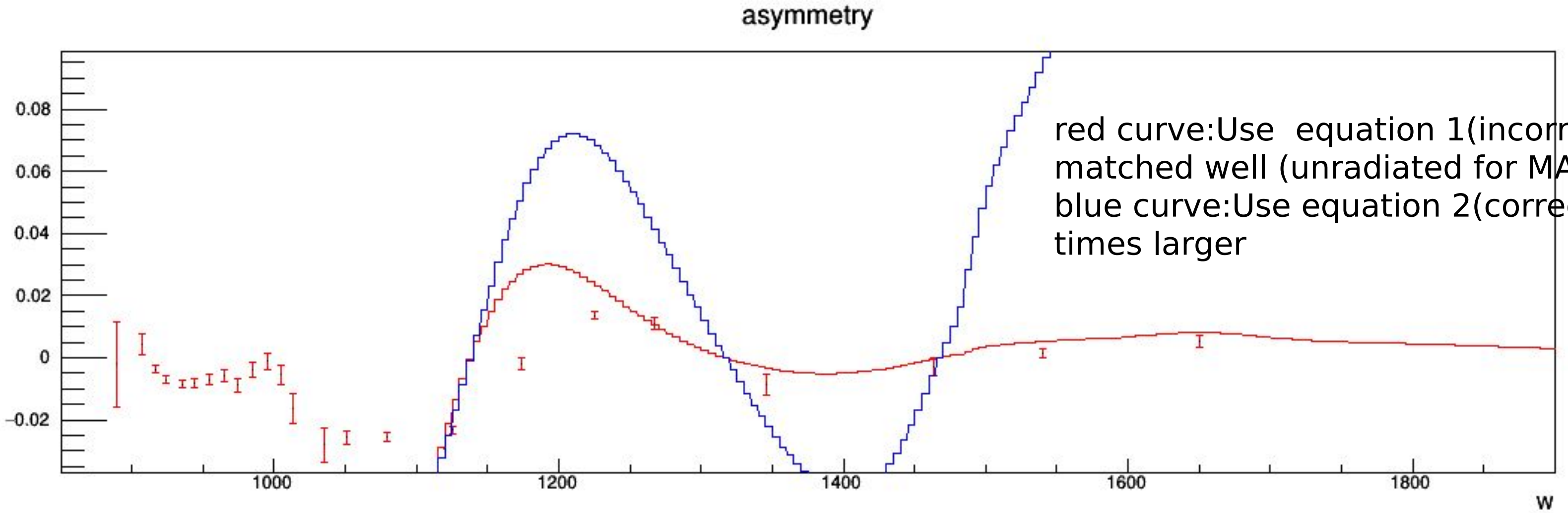
Using equation 1 (incorrect one)

Two methods not matched

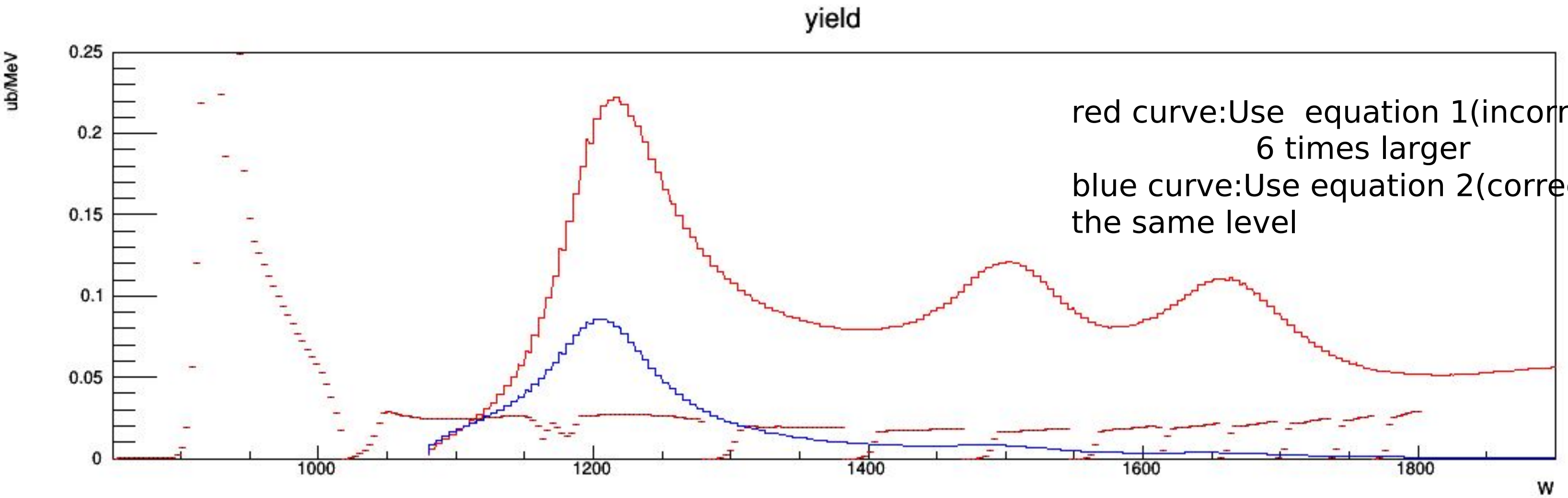




Using equation 1 (incorrect one)



red curve:Use equation 1(incorrect one), matched well (unradiated for MAID)
blue curve:Use equation 2(correct one), 6 times larger



red curve:Use equation 1(incorrect one), 6 times larger
blue curve:Use equation 2(correct one), at the same level

cross section from data(NH3): (very rough result,no background subtraction)
Set
dp=70MeV, ΔZ=pf(0.531)*2.827cm
Δth=120mrad, ρ_H=0.97g/cm^3*3/18*N_A
Δph=56mrad,

Any suggestion please send me email.
Thanks!