Low x Contribution to d_2

Matthew Posik

[1] Temple University
Philadelphia, PA 19122

03/07/2013

Outline

Calculate d_2 at Low x

Overview

- Approach 1:
  1. Fit structure functions g_1 and g_2 from world data
  2. Compute d_2 via $\int_0^{0.275} x^2 \left(2g_1 + 3g_2\right) dx$
- Approach 2:
  1. Compute g_2^{WW} using models at constant Q^2 equal to E06-014 mean Q^2
  2. Subtract g_2^{WW} from fitted g_2 values
  3. Compute d_2 via $\int_0^{0.275} x^2 \, \overline{g_2} \, dx$, where $\overline{g_2} = g_2^{WW} - g_2$

$x^2 g_1$ on ^{3}He

- Fit world data with 3-order polynomial function
- Mean Q^2 (weighted by statistical g_1 errors) of fitted data = 2.96 GeV^2

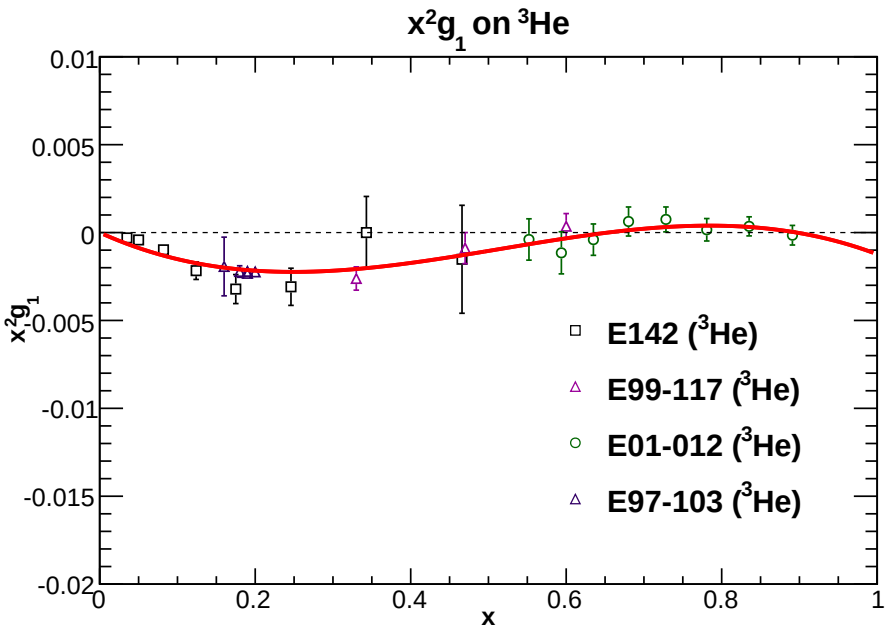

Figure: Fit to world $x^2 g_1$ ^{3}He data. $< Q^2 >$ = 2.96 GeV^2.

x^2g_2 on ^{3}He

- Fit world data with 3-order polynomial function
- Mean Q^2 (weighted by statistical g_1 errors) of fitted data = 2.96 GeV^2

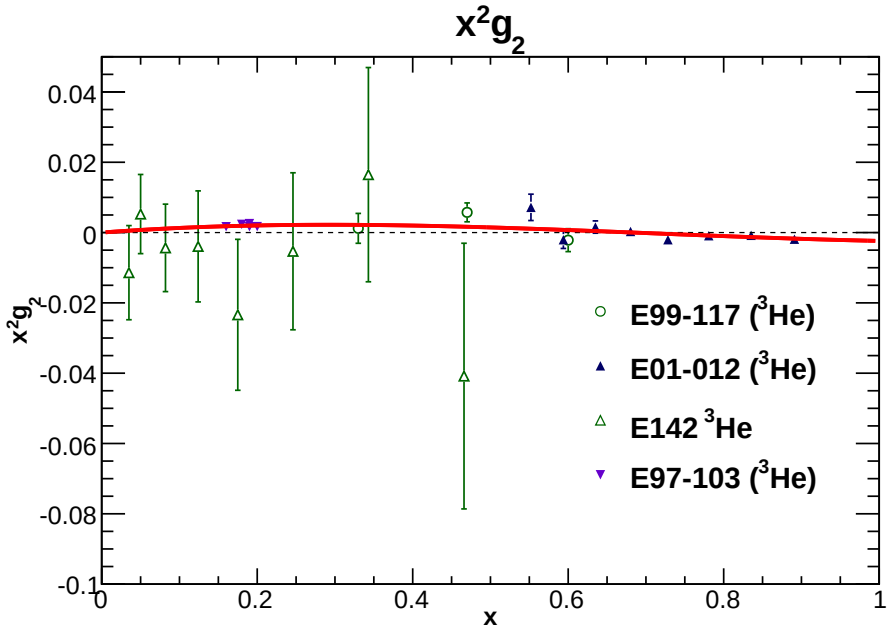

Figure: Fit to world x^2g_2 ^{3}He data. $< Q^2 >$ = 2.96 GeV^2.

$\int x^2 (2g_1 + 3g_2)\, dx$

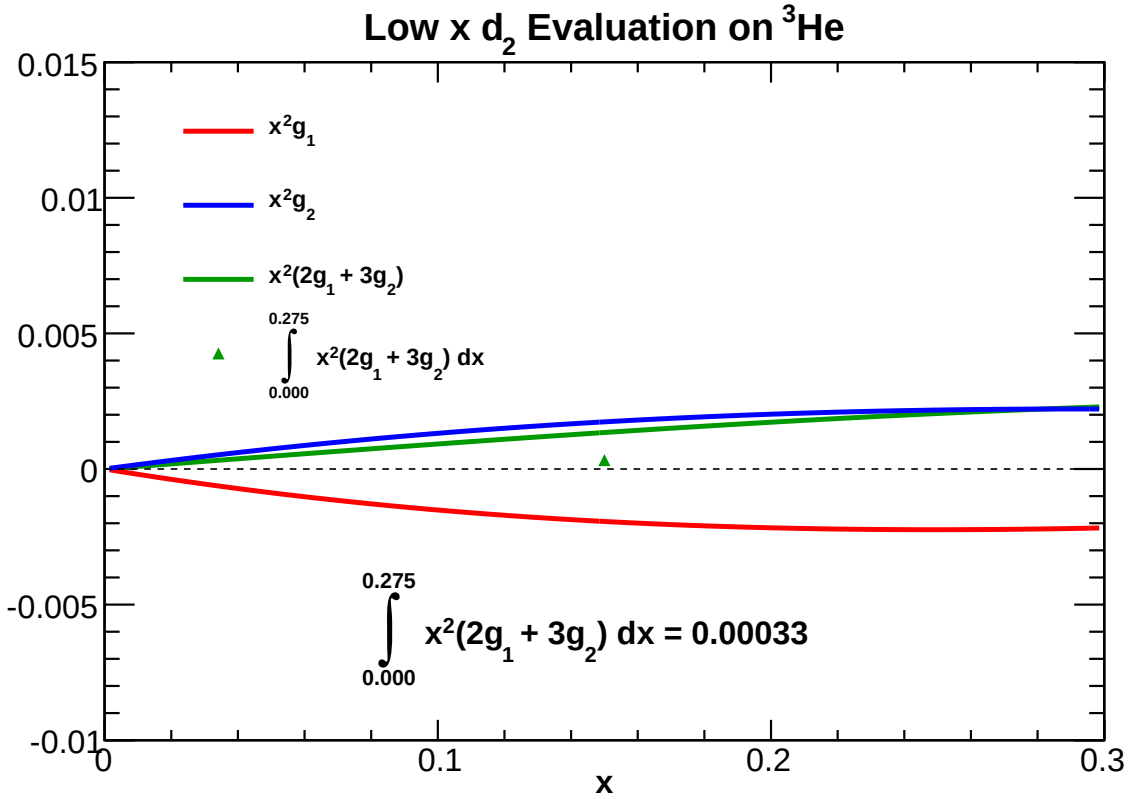

Figure: Calculation of d_2 on ^{3}He.

- $\int_0^{0.275} x^2 (2g_1 + 3g_2)\, dx$ = 0.00033

g_2^{WW}

- Several models were used:
  1. DSSV
  2. BB
  3. GS
  4. DNS2005
- Constant Q^2 values of 4.09 and 3.02 GeV^2 were used

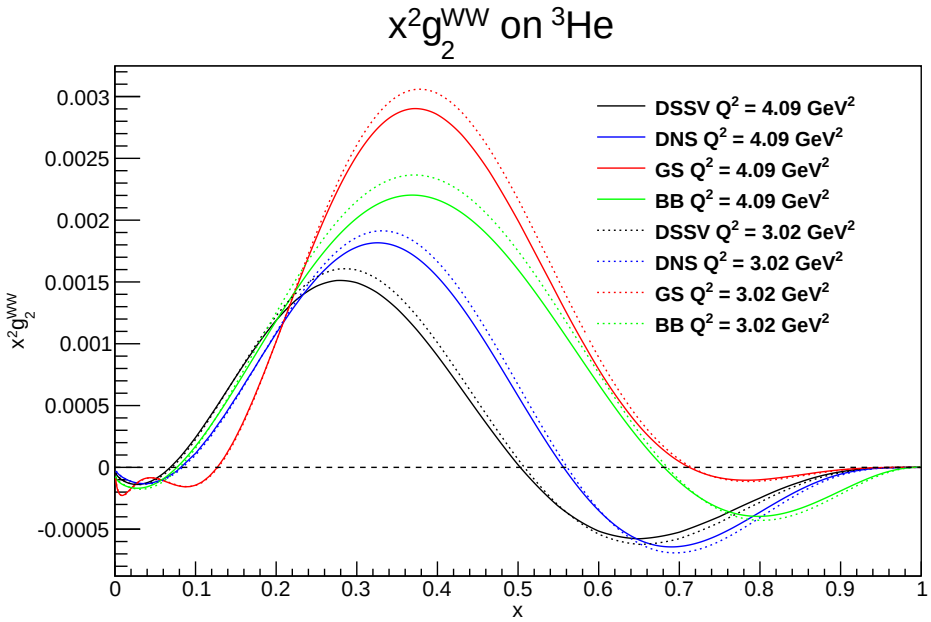

Figure: Results for different constant Q^2 values and models.

$\int x^2\ \overline{g_2}\ dx$

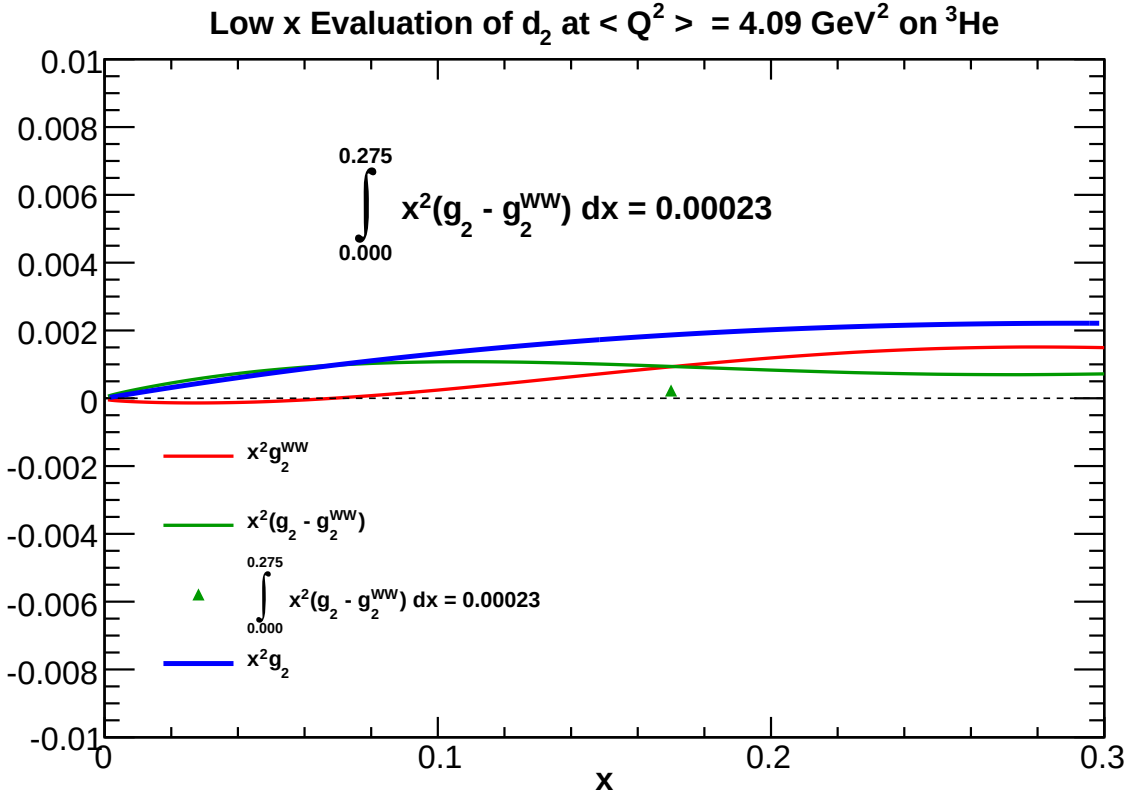

Figure: Calculation of d_2 on ^{3}He using DSSV and g_2^{WW} constant Q^2 of 4.09 GeV^2.

- $\int_0^{0.275} x^2 \overline{g_2} dx$ = 0.00023

d_2 Results Using Other Models

Table: d_2 Results at Low x

Model	Q^2 = 4.09 GeV^2	Q^2 = 3.02 GeV^2
DSSV	0.000229	0.000225
GS	0.000262	0.000261
BB	0.000229	0.000221
DNS2005	0.000246	0.000245

Table: Q2 values here are the E06-014 mean Q^2 values for 5 and 4 pass data and the value at which g_2^{WW} was computed.

Summary

- Difference between the two approaches is on the order 10^{-4}
- Both approaches compute the low x d_2 to be positive and on the order 10^{-4}
- Differences between the low x d_2 value computed in approach 2 using different models and g_2^{WW} Q^2 value is on the order 10^{-5}
- Error on low x d_2 ?

- Work on contamination
- Apply several systematics to asymmetries:
  - Target/Beam Pol. (computed)
  - Cross-Section
  - Nitrogen Dilution (computed)
  - Positron Dilution (computed)