CM distribution

email from Robert Wiringa:

"I made a first pass on the paper. I notice that at lines 236-240 you refer to a simulation assuming that an electron scatters off a moving SRC pair with a Gaussian CM momentum distribution from Ref.[17]. We have calculated this rho_12(Q) distribution directly and it was added to our web page in December at the same time as we posted an expanded version of our arXiv:1309.3794 paper. The table and figure are at:

http: //www.phy.anl.gov/theory/research/momenta2/he4_QNN.table
http: //www.phy.anl.gov/theory/research/momenta2/he4_QNN.pdf

This should be a more accurate representation than a Gaussian, but whether it would make any practical difference in your analysis, I do not know."

We assumed that the electron scatters from a moving pair with a 3D Gaussian CM momentum distribution (following Ciofi *et.al. PRC 53, 1689 (1996))*. We found that in this model the CM motion in each axis is ~ 100 +/- 20 MeV/c. We used this assumption to correct for the acceptance of the recoil detectors in the triple/double ratios.
Here we would like to compare our assumption to Wiringa calculations. In figure 1 pair density is plotted vs CM momentum

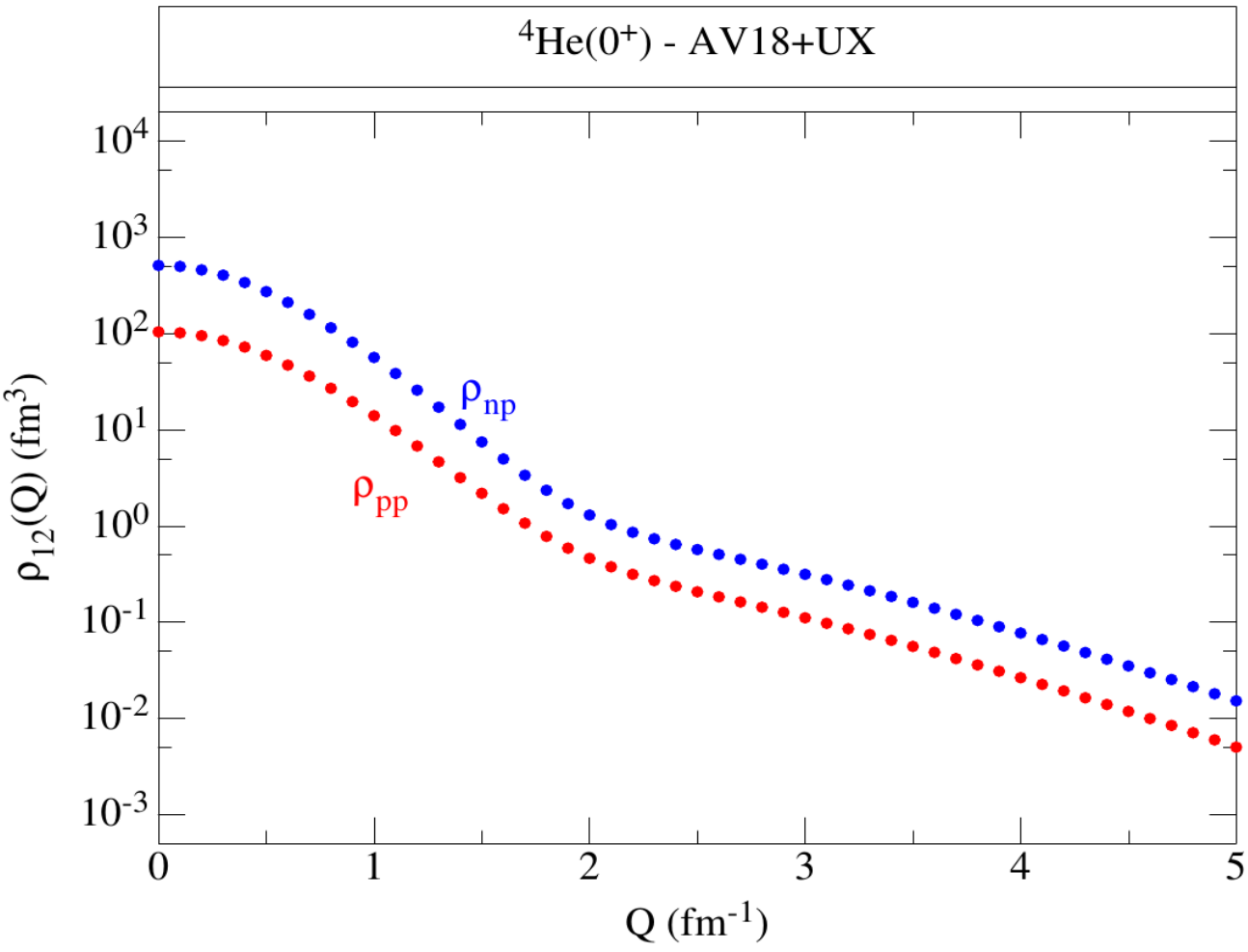

Fig 1

Based on this density we calculate the number of events by integration over all CM values:

$$\frac{4\pi}{(2\pi)^3}\int dQ\cdot Q^2\cdot\rho_{12}$$

The normalization for pp pairs is 1 and for np pairs is 4 as it should be.

Now we want to compare the actual calculation with our assumption. In order to do so, we simulate the CM events distribution by assuming Gaussian motion with 100 ± 20 MeV/c in each direction and comparing it to the integration. We normalize to the same number of events.

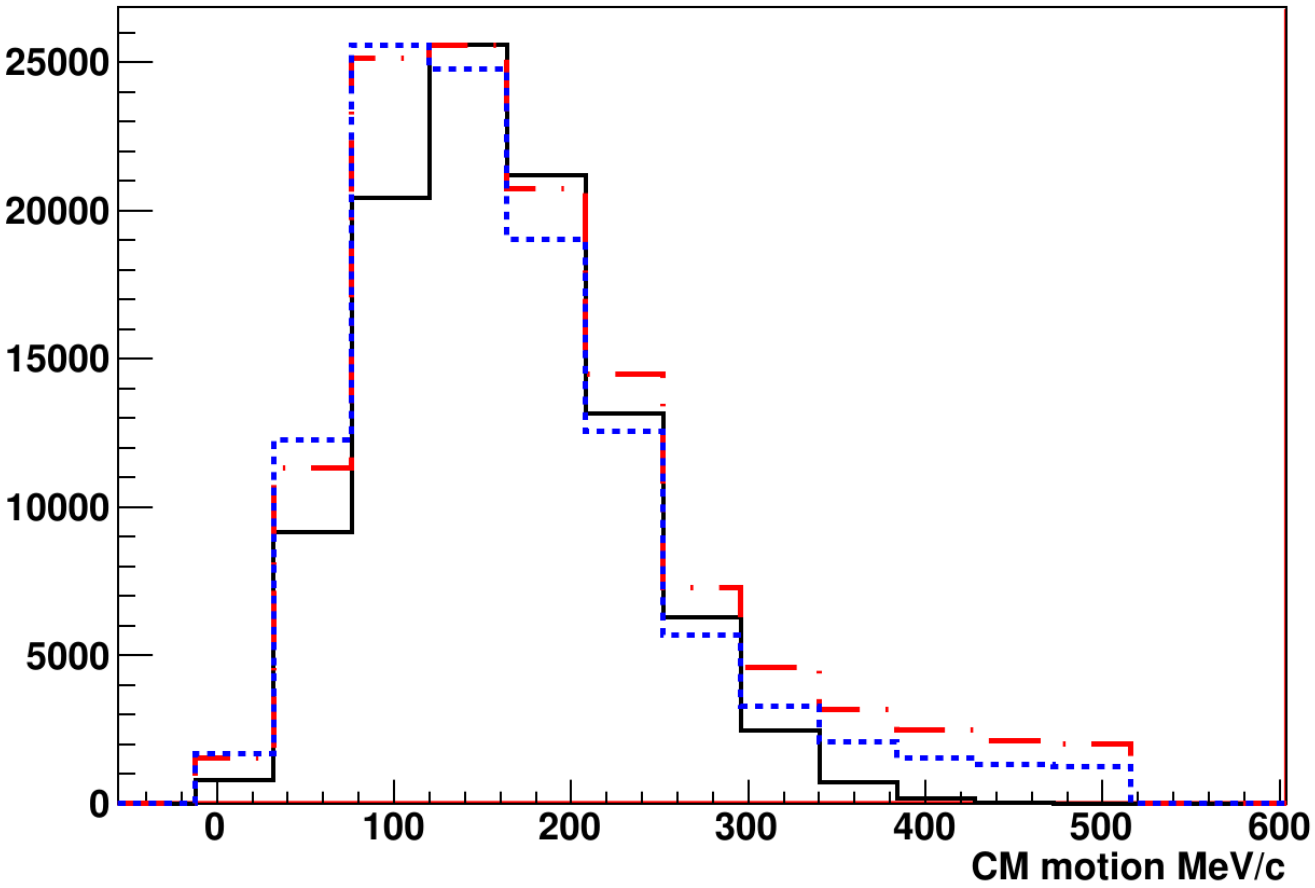

Figure 2: Black- Gaussian distribution. Red and Blue actual Wiringa *et.al.* calculations for pp and np pairs respectively.

Except for a tail of Q>300 MeV/c the Gaussian and the full calculation agrees. What is the meaning of large Q? Ate these SRC pairs?

The calculated distributions for the pairs in figures 1 and 2 is done over full range of relative momenta of the pairs (from 0 up to ~ 1GeV) and our distribution is calculated for SRC pairs having the relative momenta > 0.3 GeV/c.
In order to check if there is no difference due to lower relative momenta region we took the published tables from the website:
www.phy.anl.gov/theory/research/momenta2/

and performed the integration over relevant range of relative q. In the first place I check that the integrations over q and Q (CM) give the expected values: 4 for np pairs and 1 for pp pair. The result that I get is 4.05 and 1.01.
After the consistency check, I compare two calculations: with cut on minimal q and without. The results for np pairs is shown on figure 3 and 4. Figures 5 and 6 are for pp pairs.

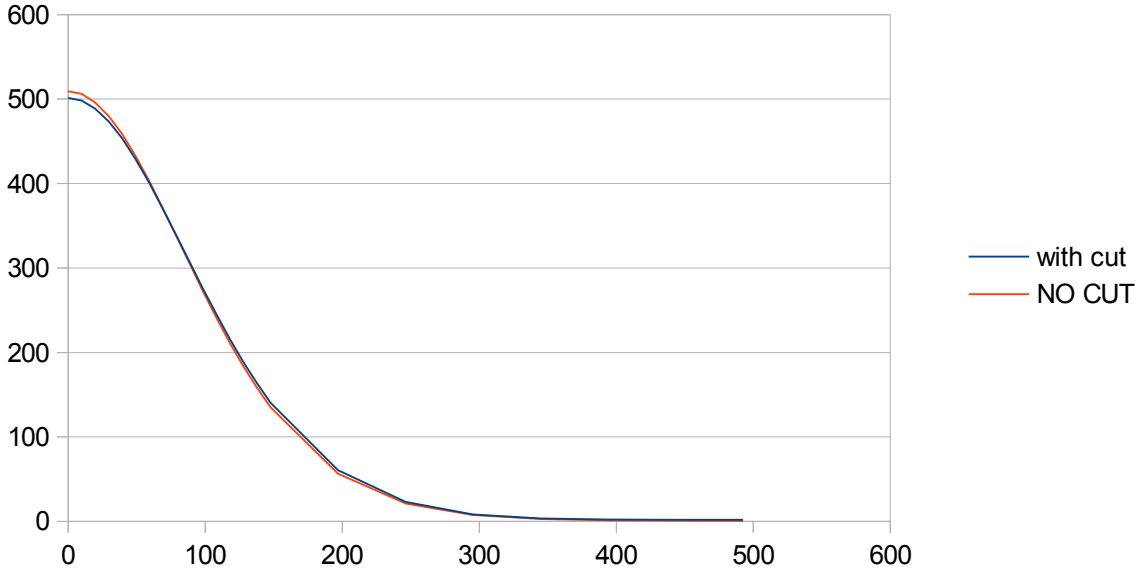

Figure 3: Density distribution for np pairs. Blue line with minimal q. Orange is for full q range

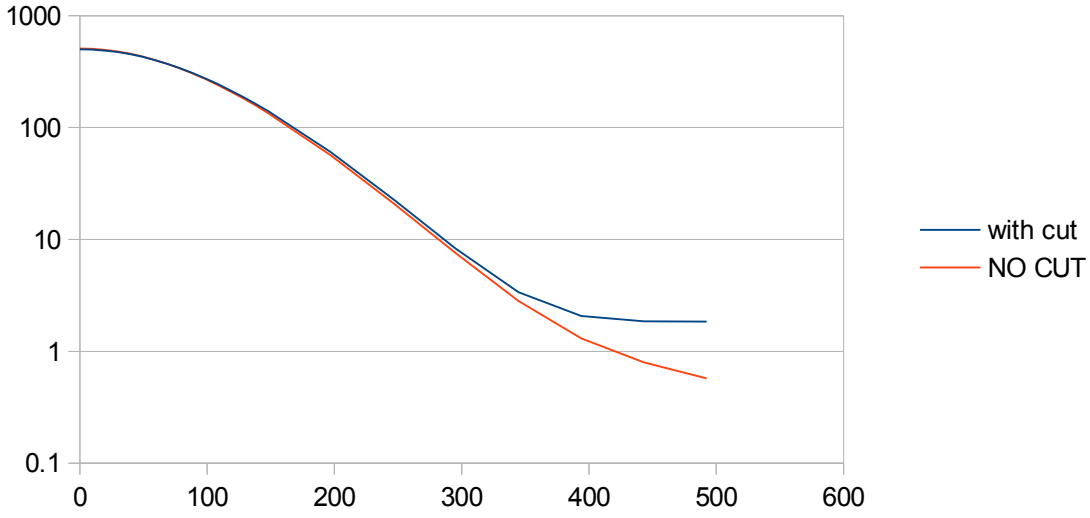

Figure 4: Density distribution for np pairs. Blue line with minimal q. Orange is for full q range. Logarithm scale.

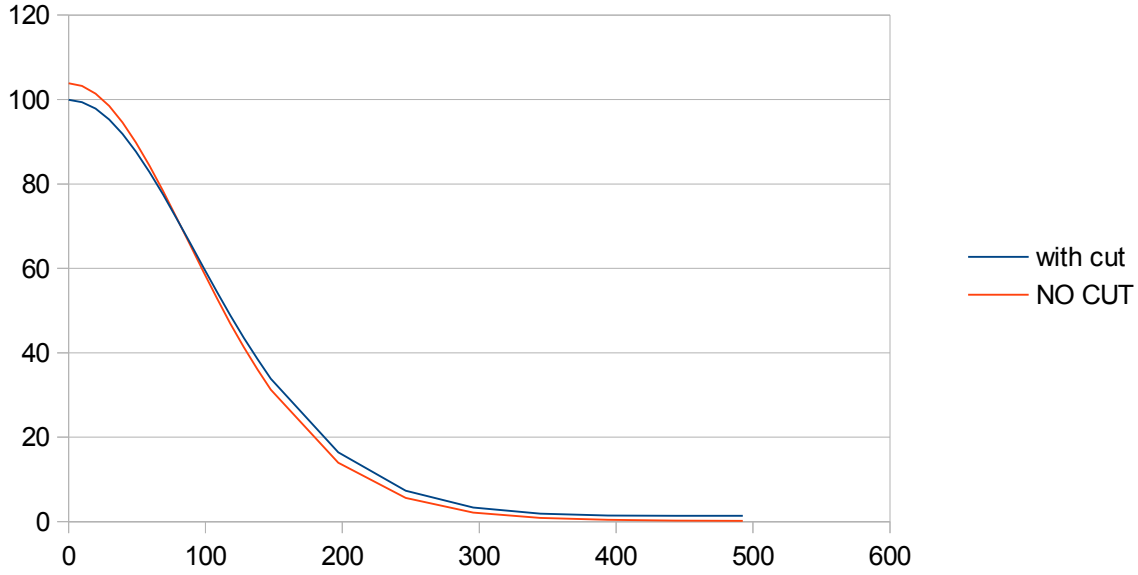

Figure 5: Density distribution for pp pairs. Blue line with minimal q. Orange is for full q range

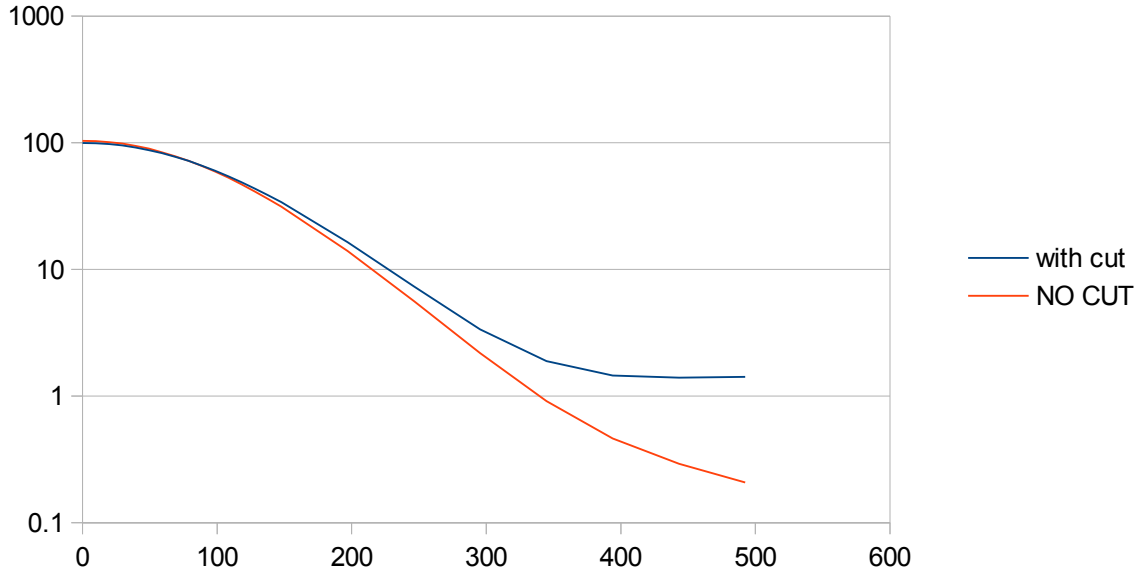

Figure 6: Density distribution for pp pairs. Blue line with minimal q. Orange is for full q range. Logarithm scale.