Update on net-K C_4/C_2

w.j. llope, 5/7/2014

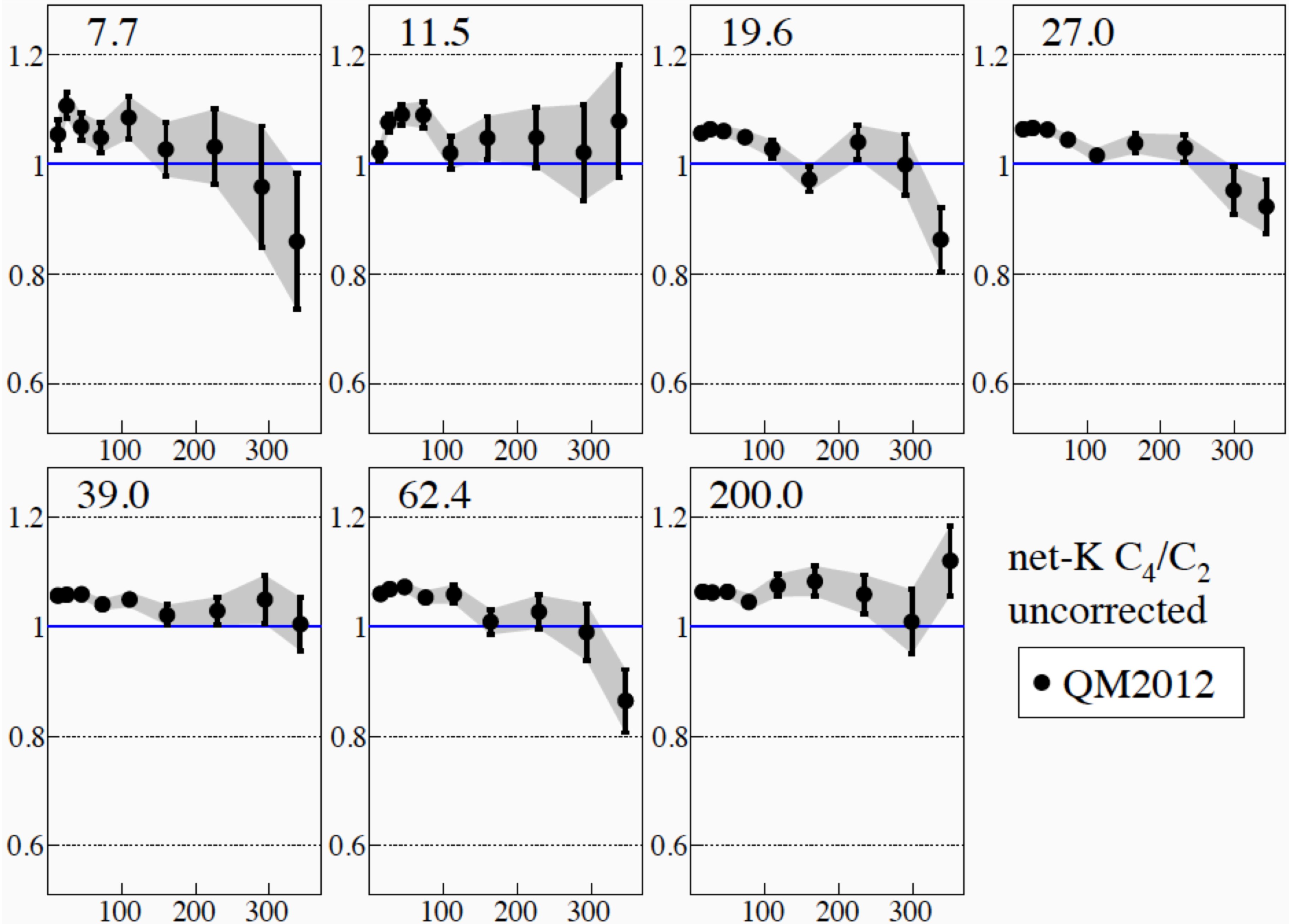
"STAR Preliminary" results (QM2012, D. McDonald):
http://arxiv.org/abs/1210.7023

Previous presentations w/ my results:
http://wjllope.rice.edu/fluct/protected/bulkcorr_20140423_updated.pdf

Here: A quick comparison to Amal's latest results for:
- Uncorrected C_4/C_2
- Corrected C_4/C_2, using Amal's total efficiencies

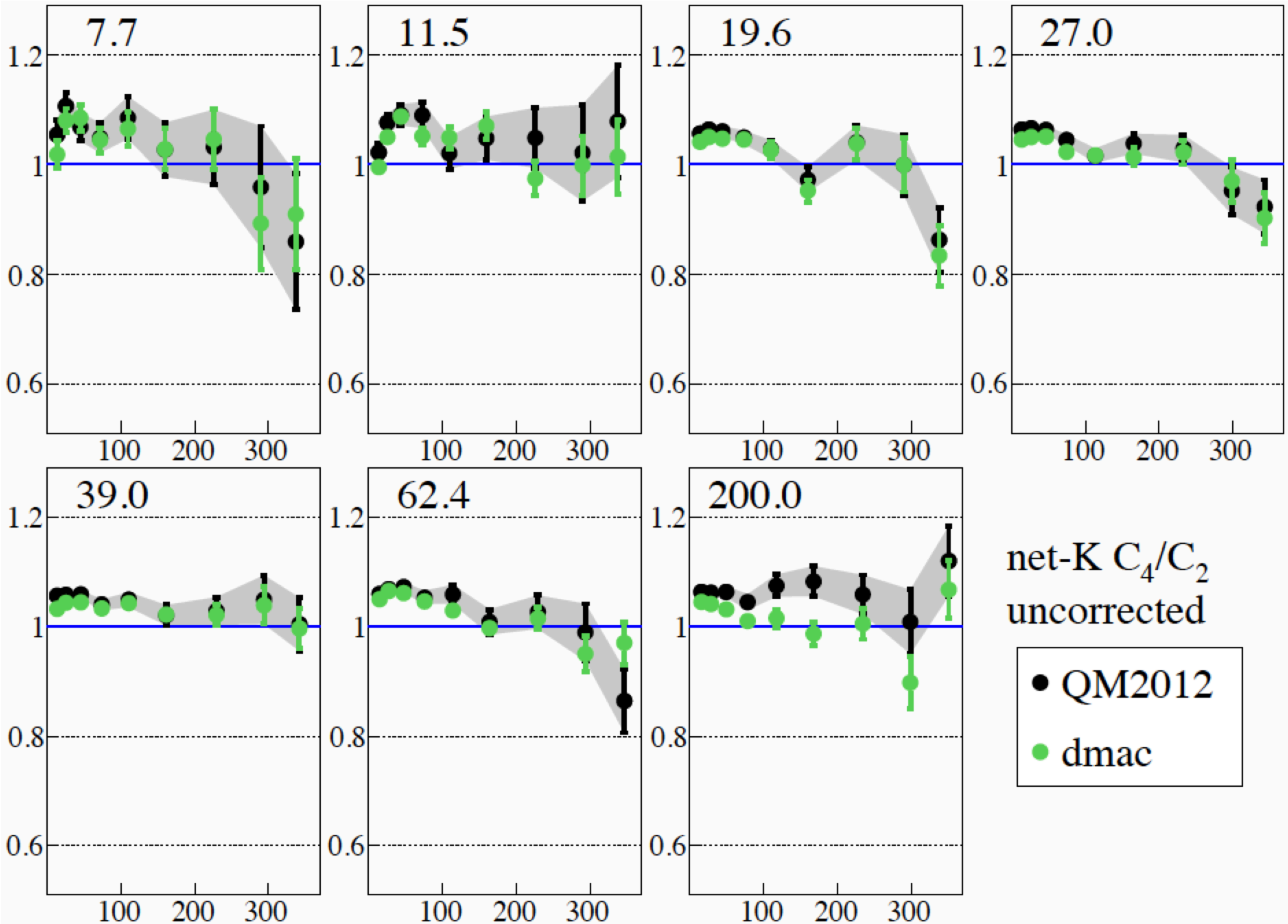
Results from my codes include 14.5 GeV, and (N)BD & sampled singles

"Star Preliminary" uncorrected net-K C_4/C_2 shown at QM2012



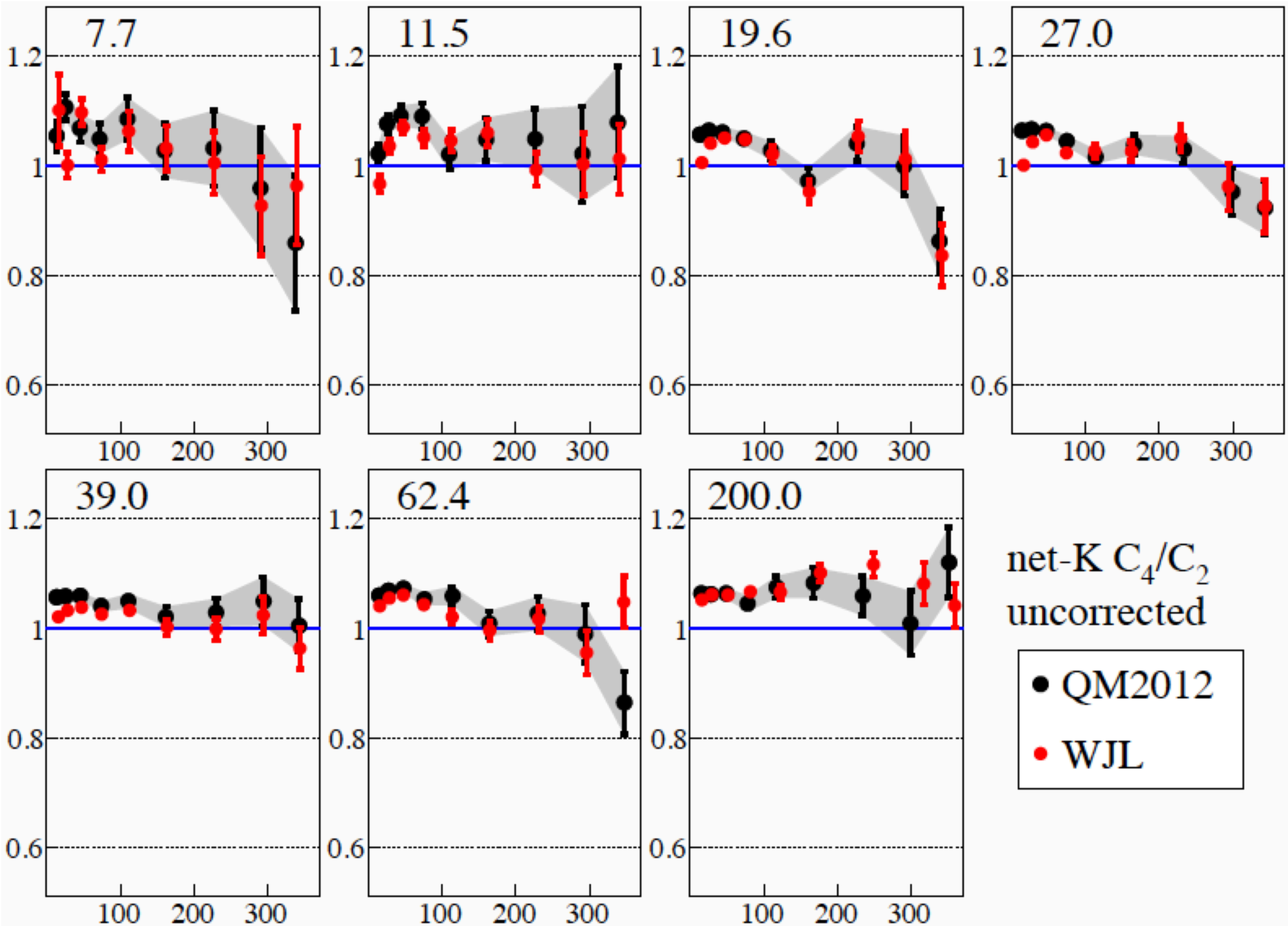
QM2012 results are the official "STAR Preliminary" and are avg(Gary,dmac)

net-K QM2012 avg(Gary,dmac) C_4/C_2 compared to dmac part of average



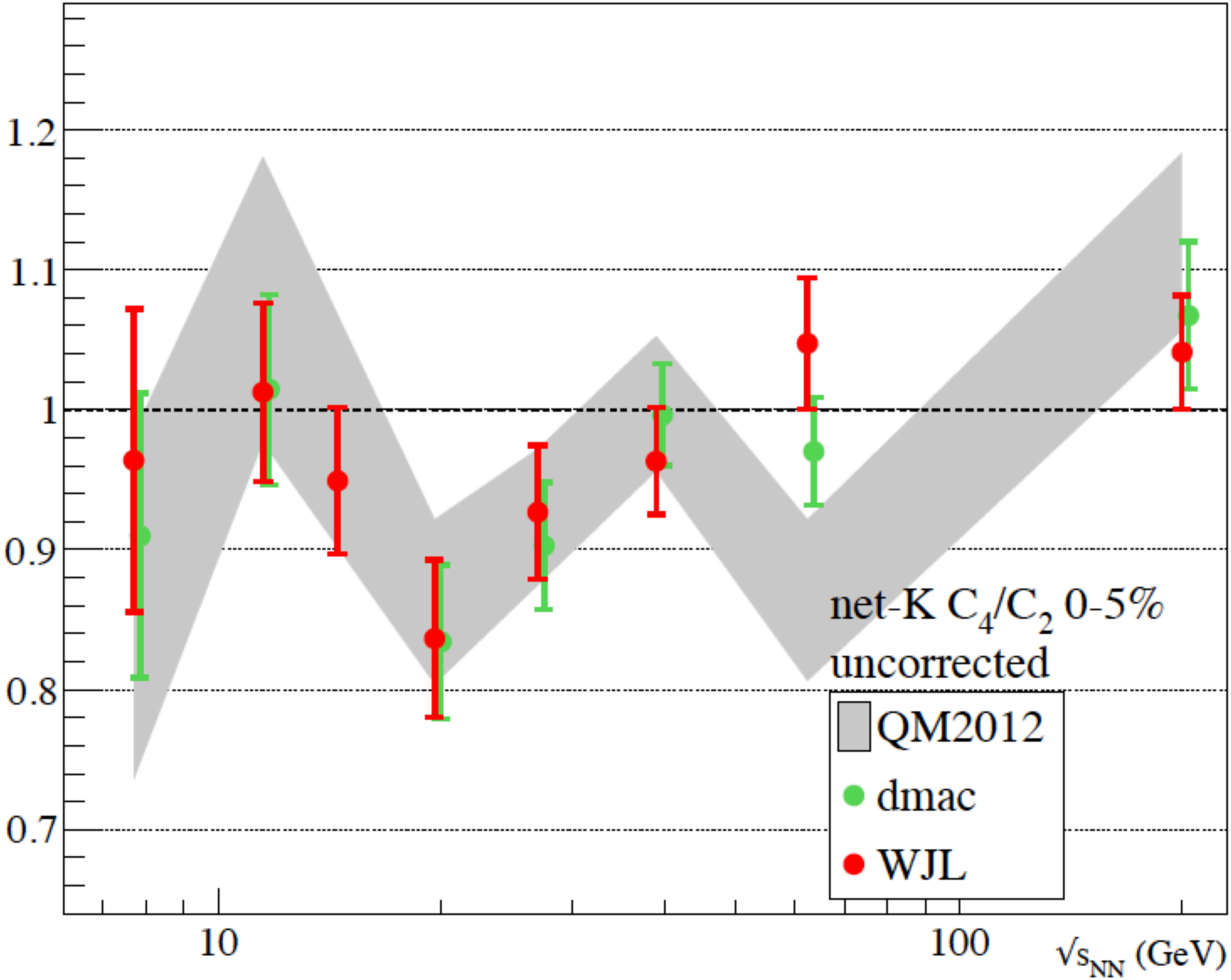
Gary and dmac results are very consistent, except 62.4 GeV 0-5% and 200 GeV

My net-K C_4/C_2 results compared to QM2012 results

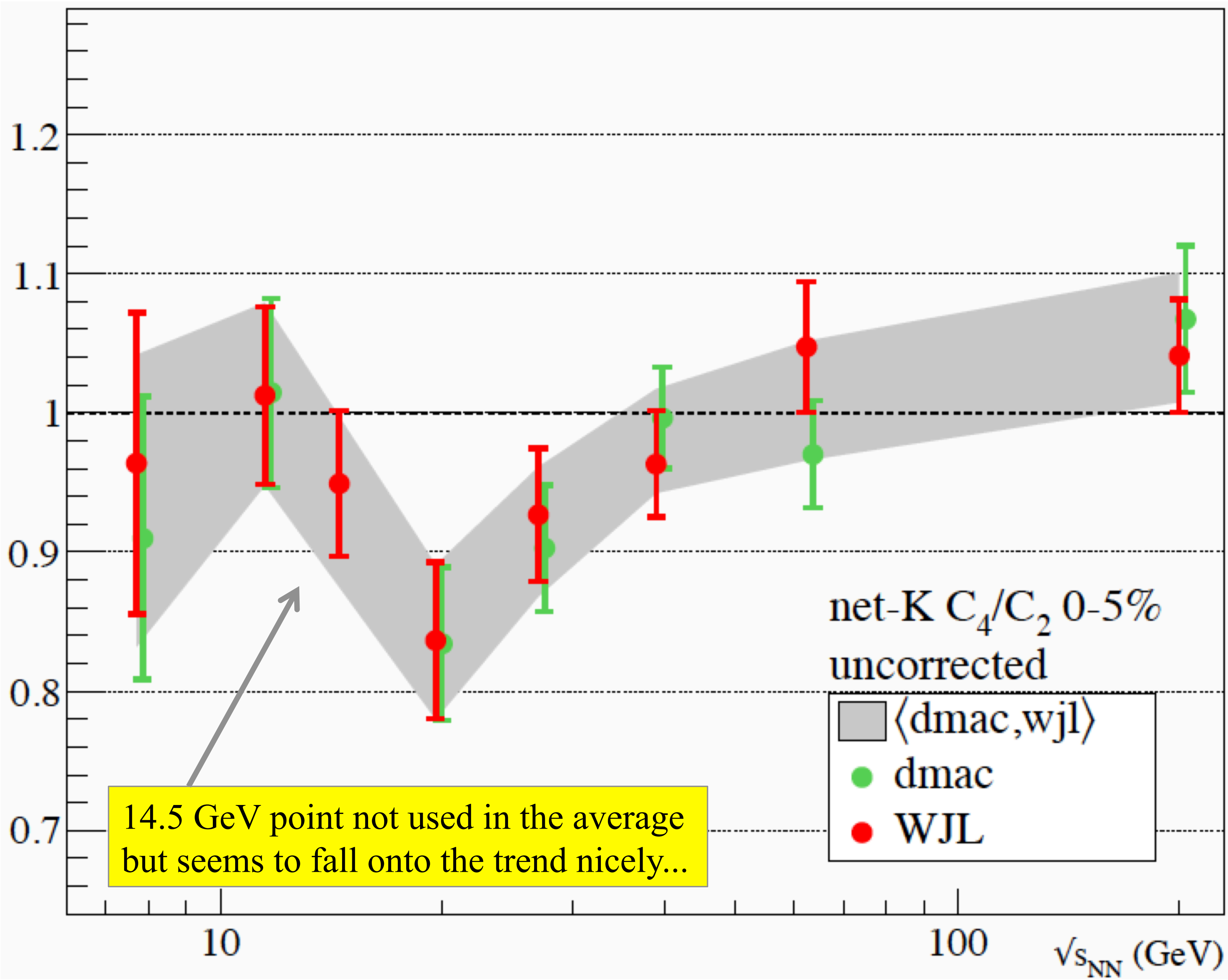


My values agree rather well with QM2012 results, I use bootstrap errors

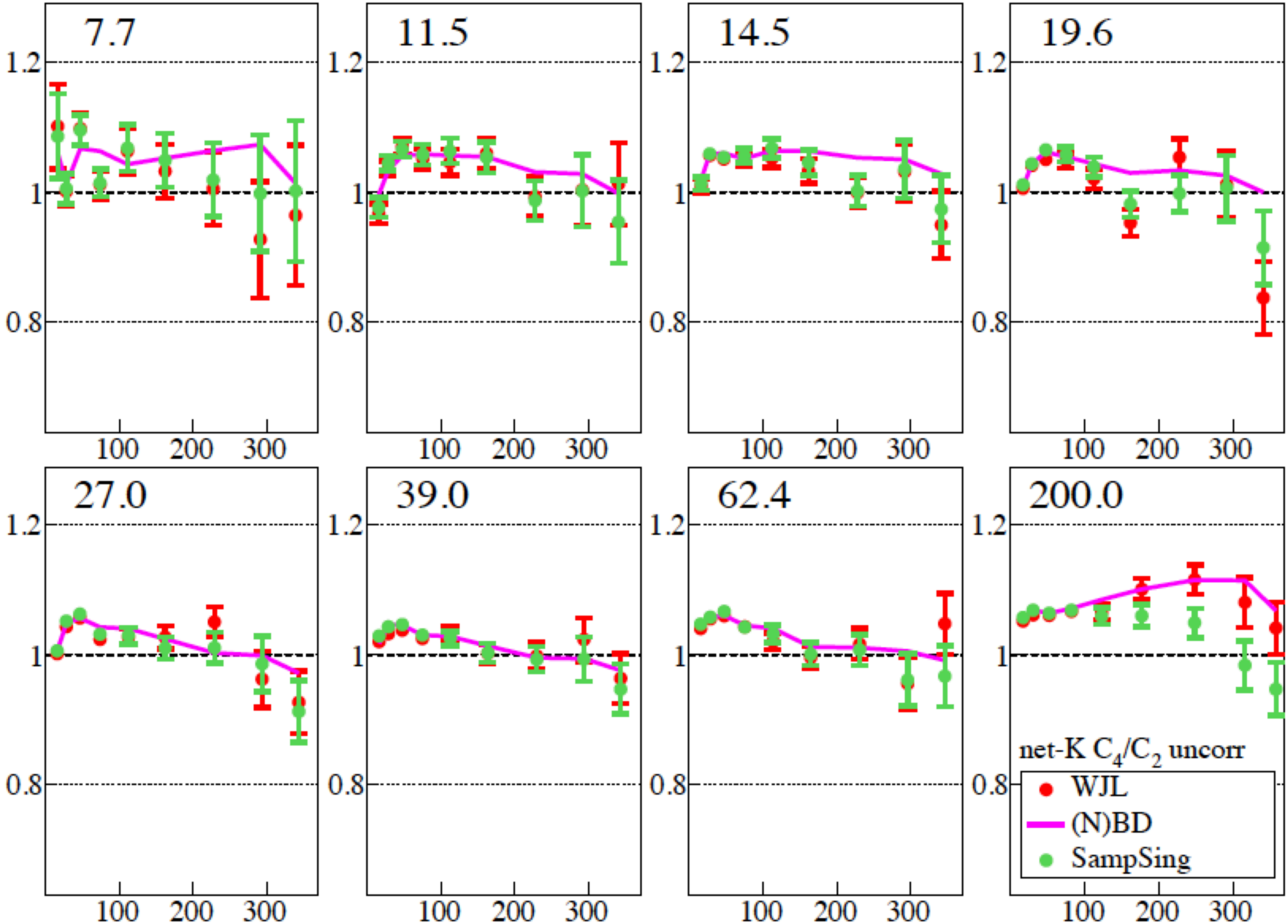
net-K C_4/C_2 comparison 0-5%



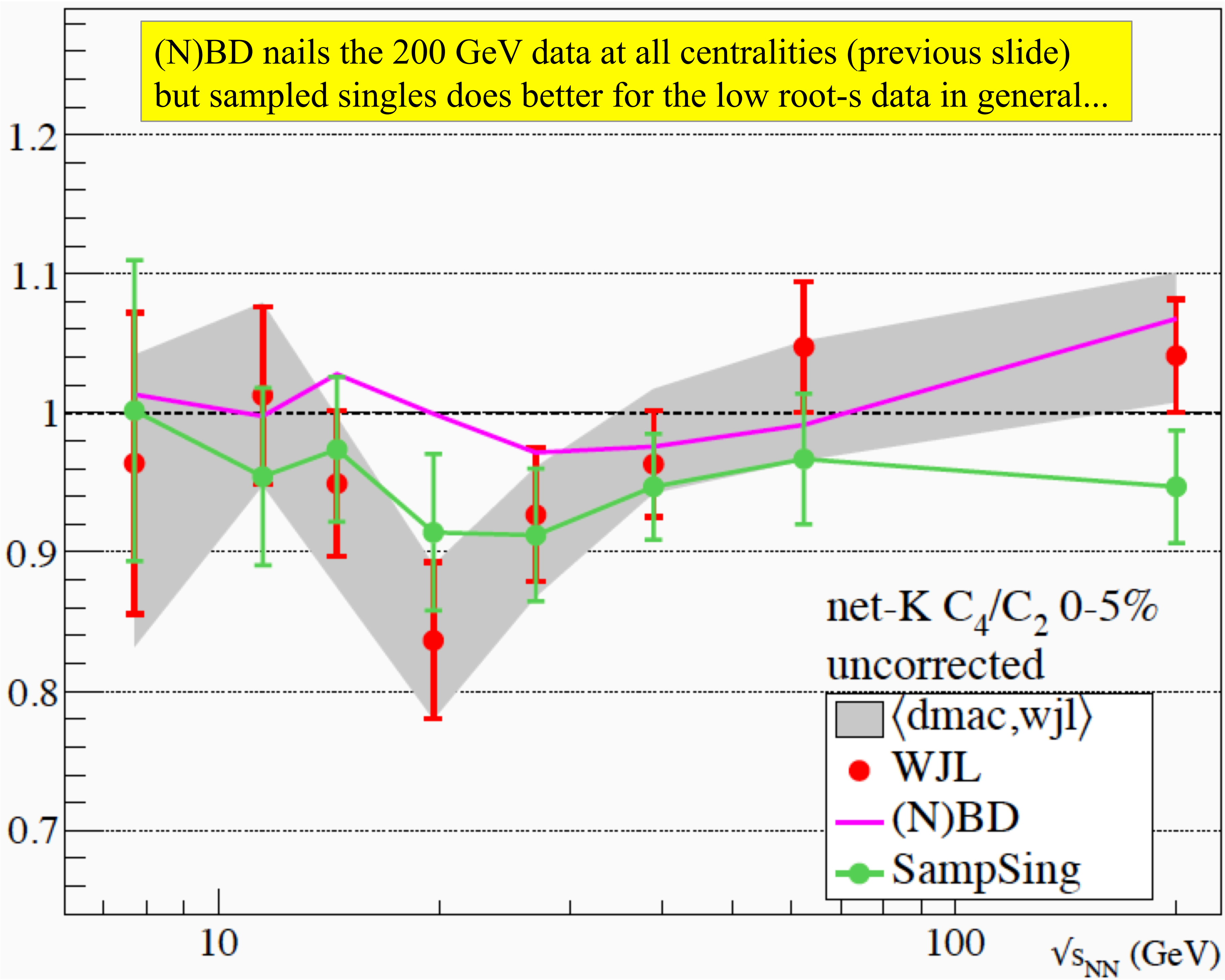
net-K C_4/C_2 comparison 0-5%, Modified average



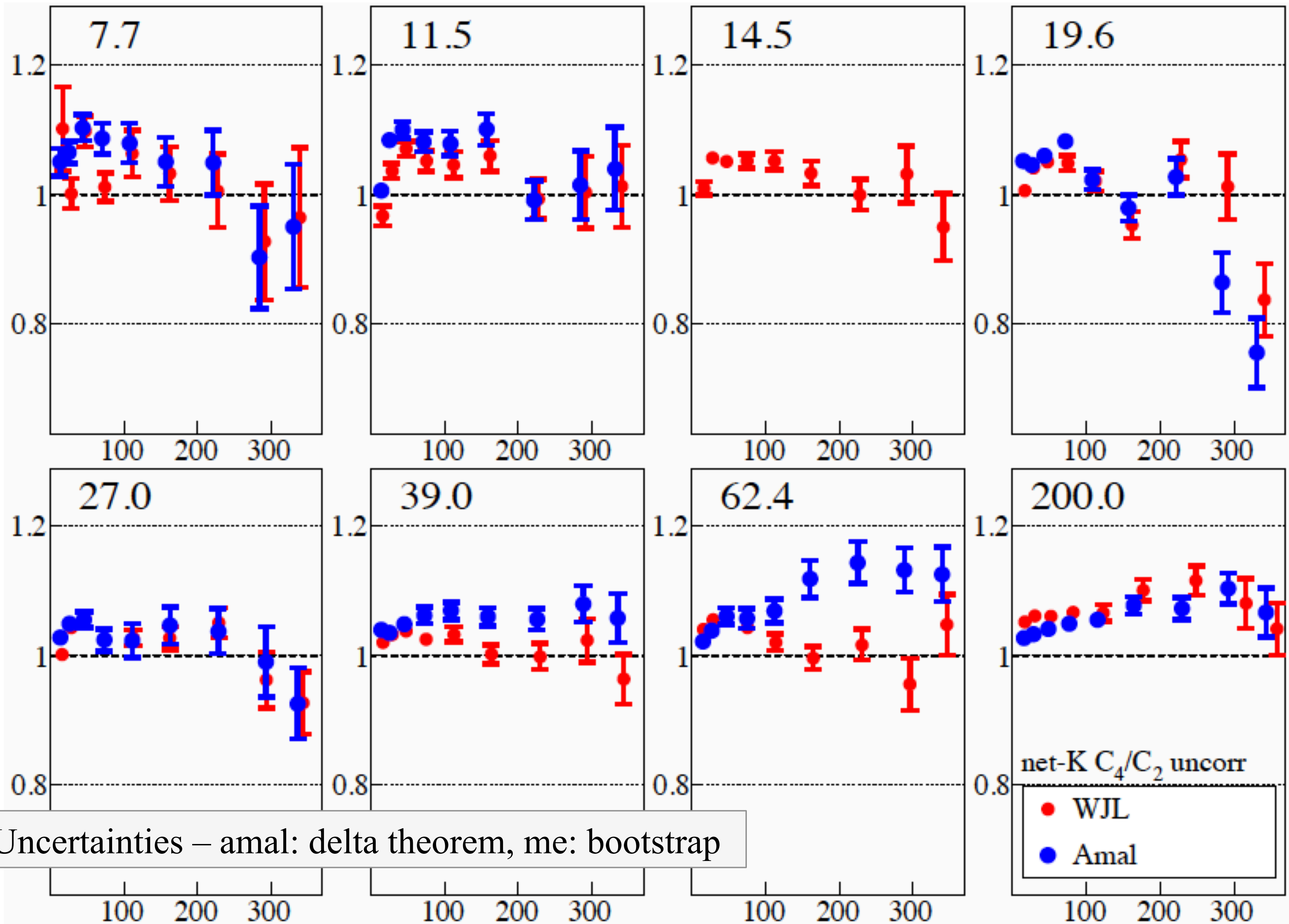
my uncorrected net-K C_4/C_2 with (N)BD and Sampled Singles



my uncorrected net-K C_4/C_2 with (N)BD and Sampled Singles, 0-5%

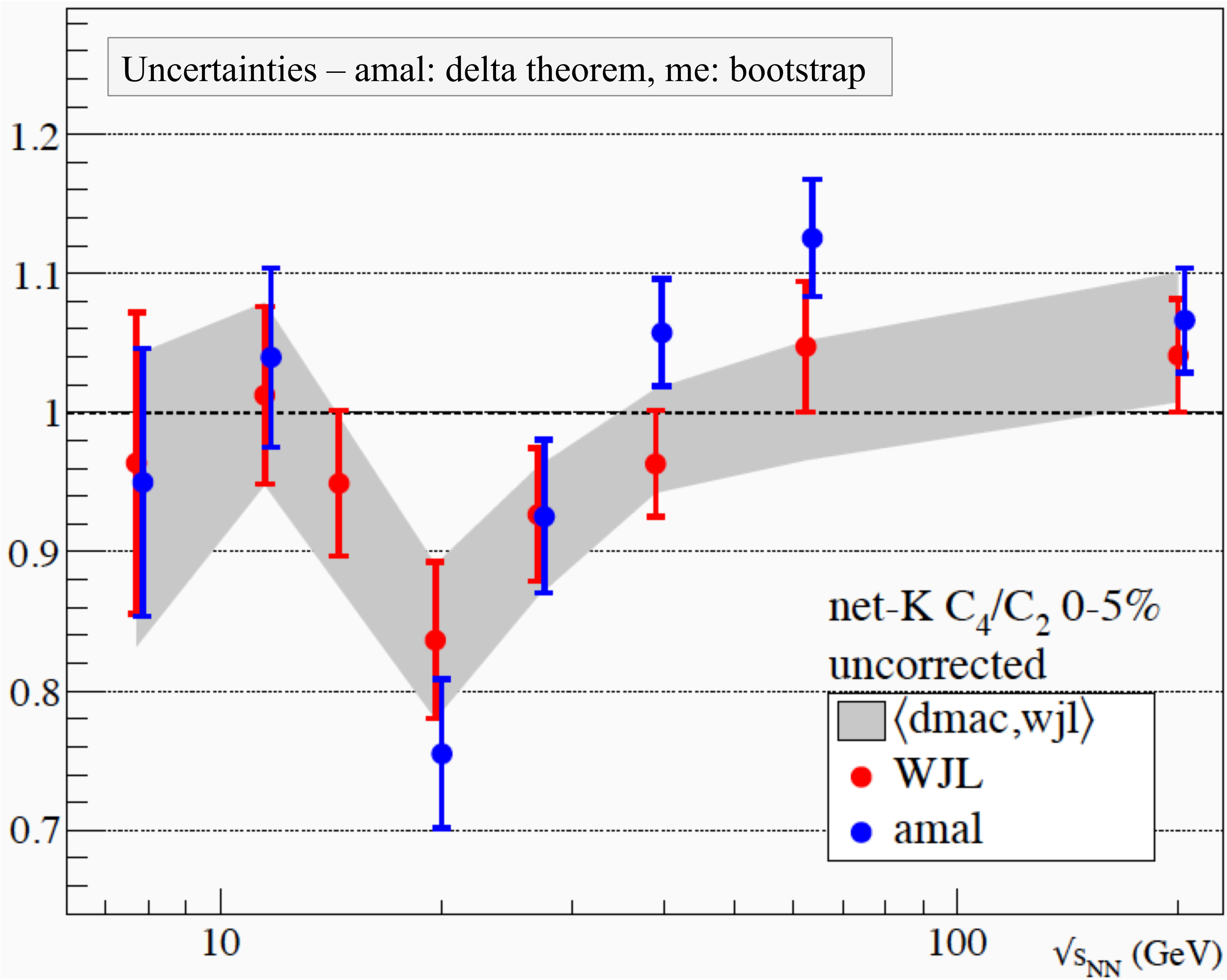


uncorrected net-K C_4/C_2 comparison vs. centrality and root-s



Uncertainties – amal: delta theorem, me: bootstrap

uncorrected net-K C_4/C_2 comparison vs. root-s for 0-5%



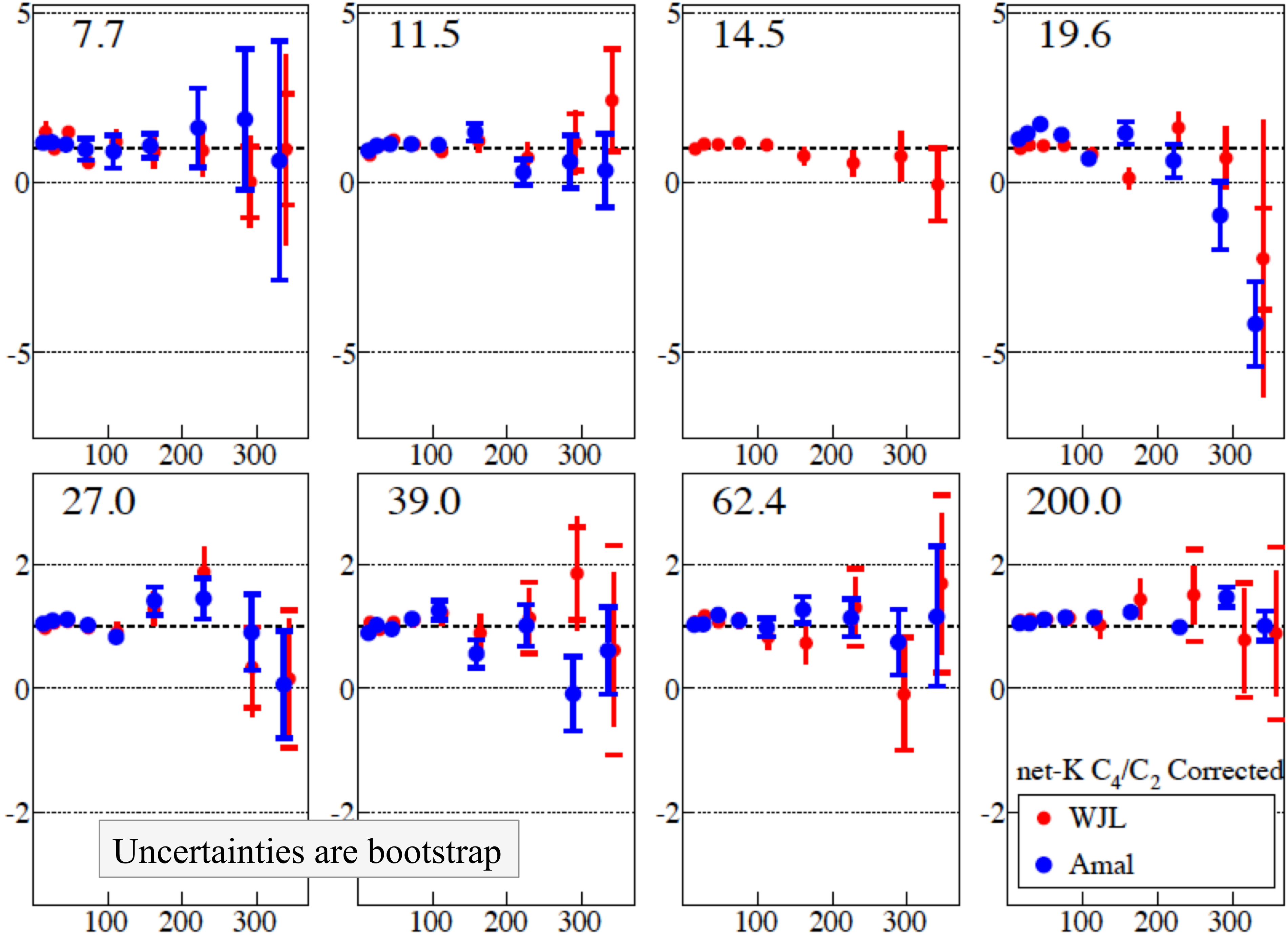
Amal's efficiency values...

```
        //---- K embedding&TOFmatch ...
        //---- weighted by raw tpc spectrum, and w/ weighted tofmatch
//      double effk007[NCentUse] = {0, 0.43,0.42,0.425,0.422,0.42,0.415,0.395,0.392,0.384    };
//      double effk011[NCentUse] = {0, 0.46,0.465,0.45,0.435,0.430,0.42,0.405,0.3906,0.3844};
//      double effk015[NCentUse] = {0, 0.46,0.45,0.45,0.445,0.44,0.43,0.43,0.42,0.40          };   // =19.6
//      double effk019[NCentUse] = {0, 0.46,0.45,0.45,0.445,0.44,0.43,0.43,0.42,0.40          };
//      double effk027[NCentUse] = {0, 0.47,0.46,0.45,0.445,0.44,0.43,0.425,0.415,0.41        };
//      double effk039[NCentUse] = {0, 0.43,0.435,0.43,0.428,0.42,0.415,0.395,0.395,0.384    };
//      double effk062[NCentUse] = {0, 0.42,0.408,0.392,0.388,0.382,0.38,0.375,0.37,0.35     };
//      double effk200[NCentUse] = {0, 0.43,0.435,0.425,0.415,0.40,0.395,0.387,0.385,0.38    };
        //
        //---- newer values
        double effk007[NCentUse] = {0, 0.390,0.390,0.381,0.371,0.370,0.373,0.370,0.364,0.359      };
        double effk011[NCentUse] = {0, 0.402,0.41,0.405,0.398,0.392,0.372,0.365,0.358,0.350       };
        double effk015[NCentUse] = {0, 0.428,0.410,0.395,0.388,0.382,0.373,0.365,0.362,0.359      };  // =19.6
        double effk019[NCentUse] = {0, 0.428,0.410,0.395,0.388,0.382,0.373,0.365,0.362,0.359      };
        double effk027[NCentUse] = {0, 0.408,0.40,0.395,0.388,0.382,0.373,0.365,0.364,0.359       };
        double effk039[NCentUse] = {0, 0.374,0.365,0.36,0.35,0.342,0.334,0.326,0.318,0.312        };
        double effk062[NCentUse] = {0, 0.3844,0.38,0.374,0.368,0.360,0.352,0.346,0.342,0.336      };
        double effk200[NCentUse] = {0, 0.3844,0.38,0.374,0.368,0.360,0.352,0.346,0.342,0.336      };  // =62.4
```

updated efficiencies are 4-5% lower than those he used last week...
these efficiencies are a lot lower than those in the net-p and net-q papers
resulting in much larger corrections and hugely increased uncertainties...

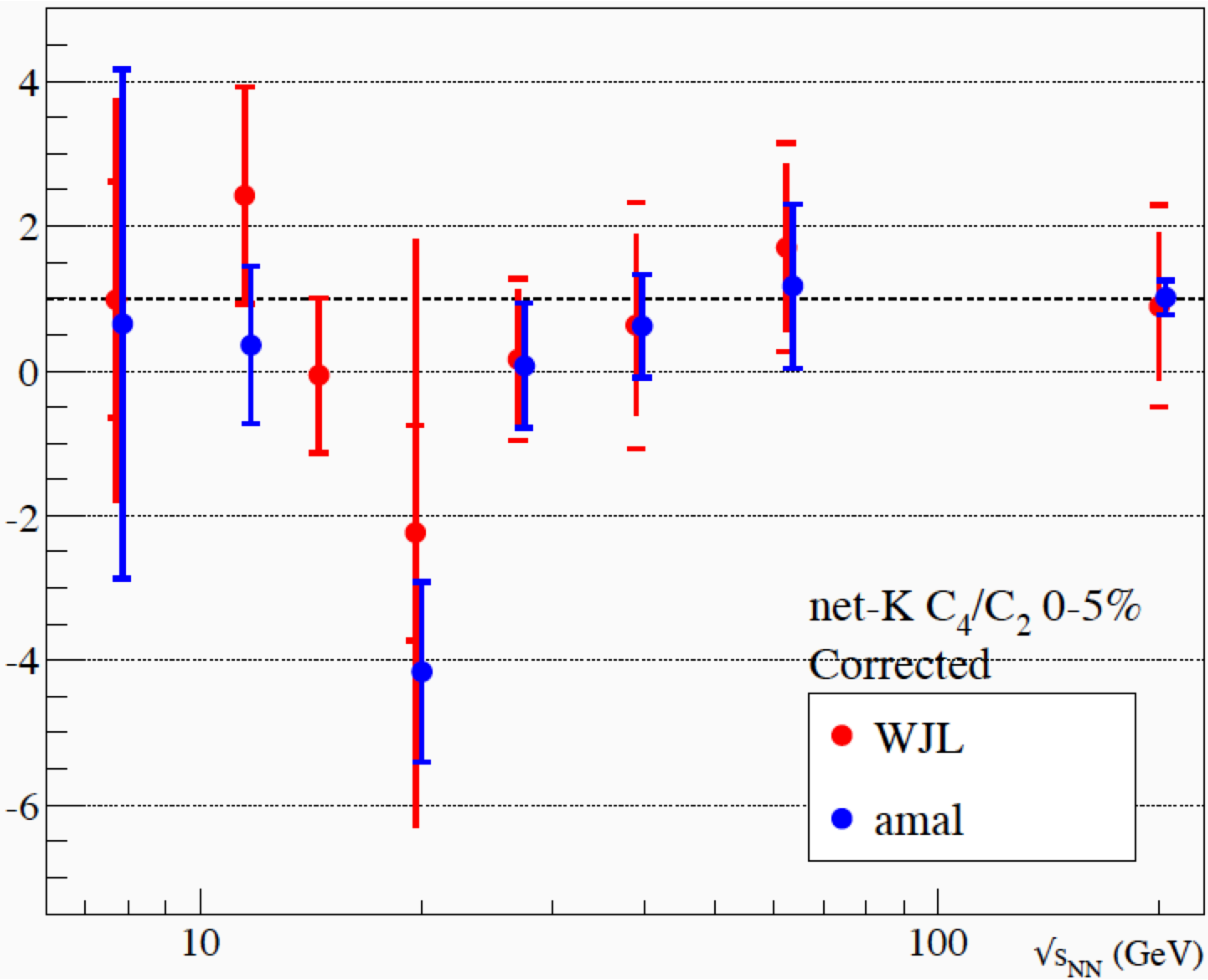
corrected net-K C_4/C_2 comparison vs. centrality and root-s

Hugely Wider Y-axis scale!!! (and different scales in the two rows)



Corrected net-K C_4/C_2 comparison vs. root-s for 0-5%

Hugely Wider Y-axis scale!!!



Comparison overview...

Presented my results on net-K C_4/C_2 using data from 2010, 2011, and 2014 (14.5 GeV)

Uncorrected and corrected...

Comparisons to (N)BD and Sampled singles...

One difference in cuts: Amal uses $0.2<p_T<1.6$, and I use $0.2<p<1.6$...

...comparisons to Amal's results:

Slide 9: uncorrected C_4/C_2 vs. centrality and root-s

uncertainties generally look quite similar

largest differences for <~50% central at 39 and 62.4 GeV

Slide 10: uncorrected C_4/C_2 vs. root-s, 0-5%

Generally good agreement except perhaps 39 and 62.4 GeV (~2σ)

~1.5σ difference at 19.6 GeV

Slide 12: corrected C_4/C_2 vs. centrality and root-s

uncertainties "similar" but there are some differences of ~50% or so

big differences in uncertainties at 200 GeV

corrected values at 39 and 62.4 seem closer than uncorrected ones were... *(?!?)*

Slide 13: uncorrected C_4/C_2 vs. root-s, 0-5%

Generally decent agreement, values at 19.6 GeV within ~1.5σ

Really low efficiency values (Tracking+TOF) result in large corrections and uncertainties!

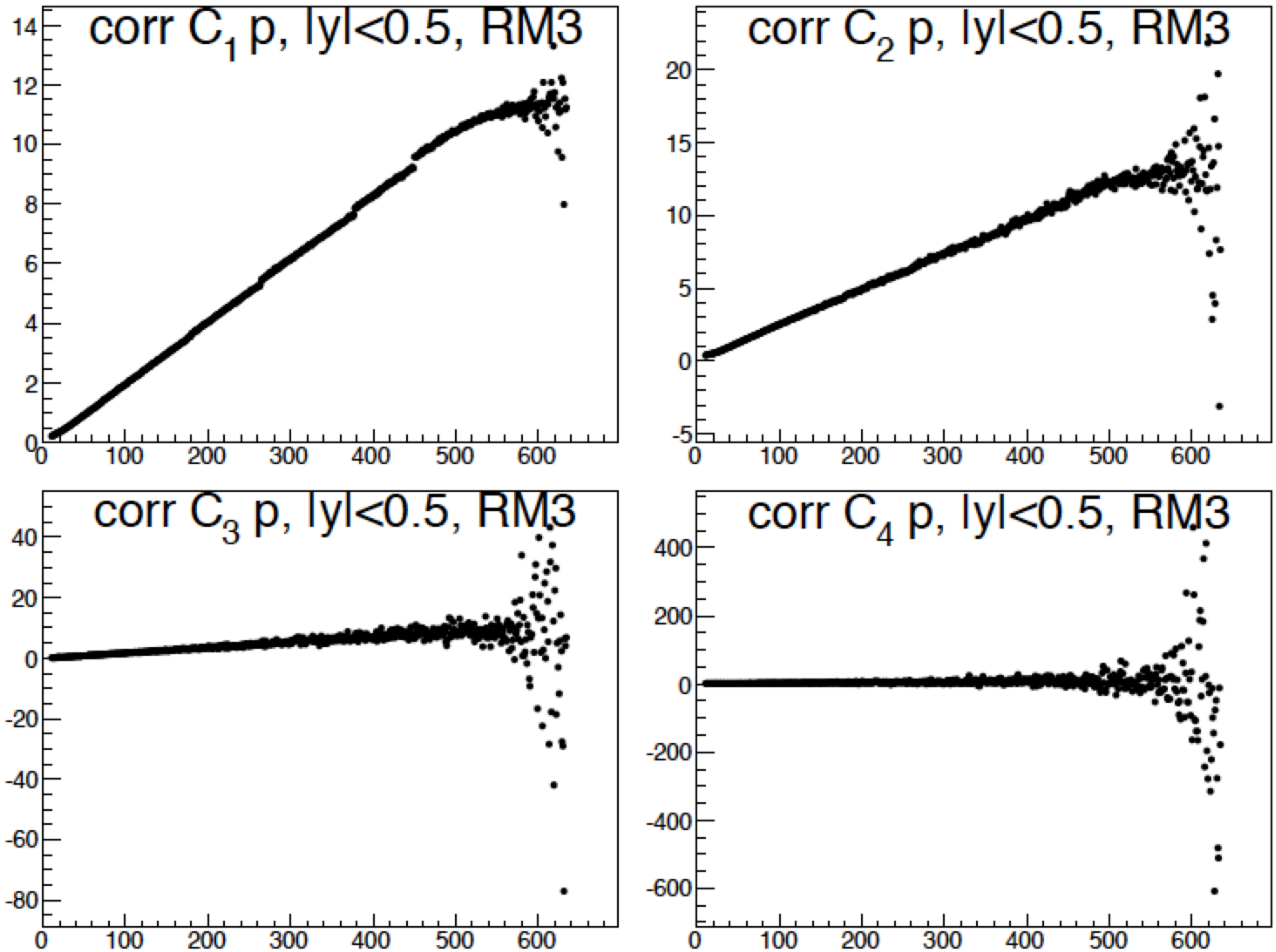
Correction equations...

```
//- - - - -
C1corr        = C1net;
C1corr       /= e;
//
//- - - - -
C2corr        = C2net
              + (e-1.)*(C1pos+C1neg);
C2corr       /= e*e;
//
//- - - - -
C3corr        = C3net
              + 3.*(e-1.)*(C2pos-C2neg)
              + (e-1.)*(e-2.)*(C1pos-C1neg);
C3corr       /= e*e*e;
//
//- - - - -
C4corr        = C4net
              - 2.*(e-1.)*C3tot
              + 8.*(e-1.)*(C3pos+C3neg)
              + 0.5*(5.-e)*(e-1.)*(C2tot-C2net)
              + (7.*e-11.)*(e-1.)*(C2pos+C2neg)
              + (e*e-6.*e+6.)*(e-1.)*(C1pos+C1neg);
C4corr       /= e*e*e*e;
```

Corrected cumulants $C_k \sim 1/e^k$ where e=efficiency & depend on C_j^{net}, C_j^{tot}, C_j^{pos}, C_j^{neg} with $j \leq k$

Individual terms can be positive or negative...

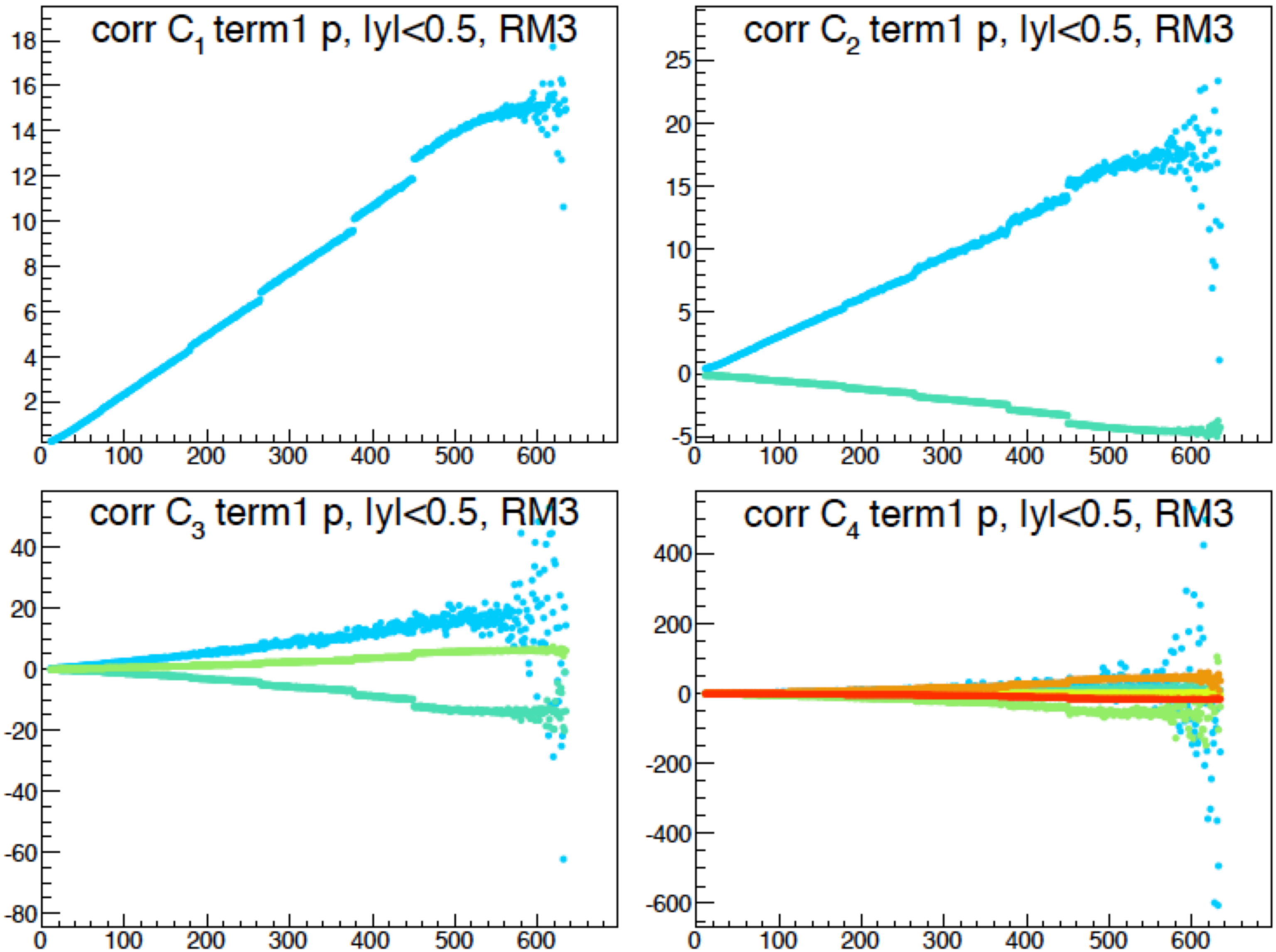
Deconstructing the corrections - Corrected cumulants vs centvar, **net-p 19.6**



One CBW-averages each of these to produce the final corrected cumulants...

the individual correction terms resulting in these plots are shown on the next page...

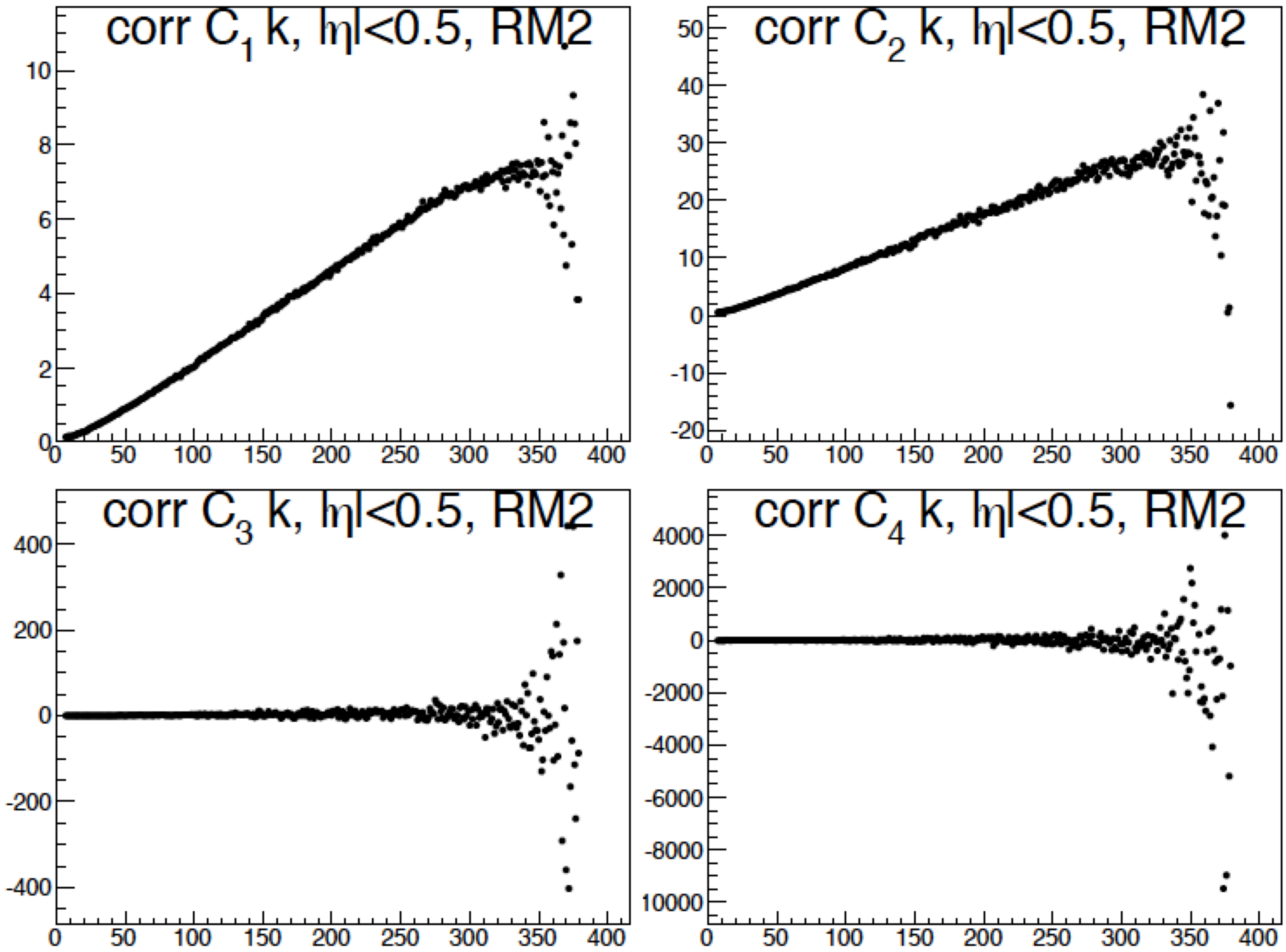
Deconstructing the corrections - Individual terms vs. centvar... **net-p 19.6**



C_1: 1 term, C_2: 2 terms, C_3: 3 terms, C_4: 6 terms

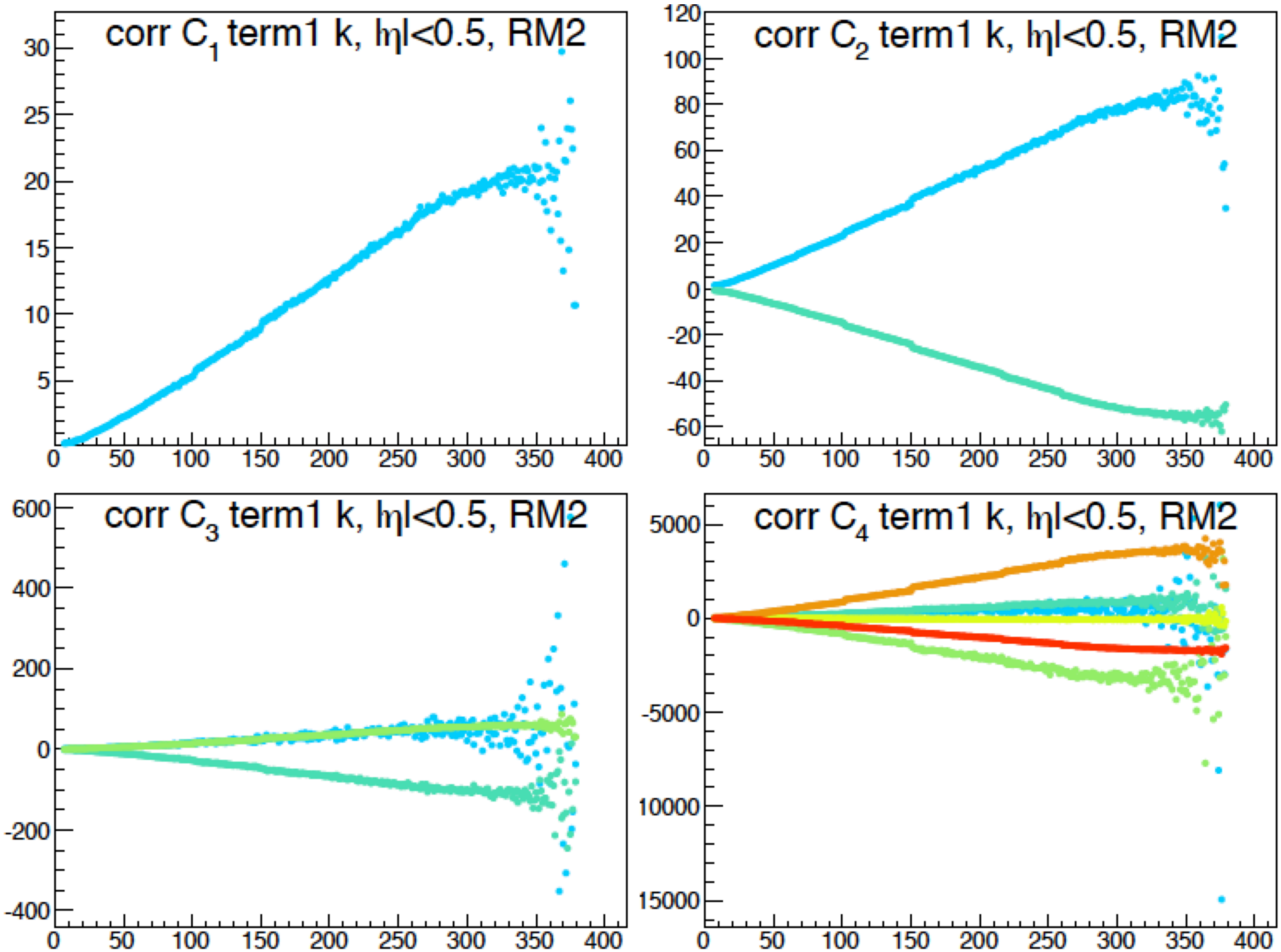
Note all terms are in the range ~ ±20

Deconstructing the corrections - Corrected cumulants vs centvar, **net-K 19.6**



same plot for net-K...

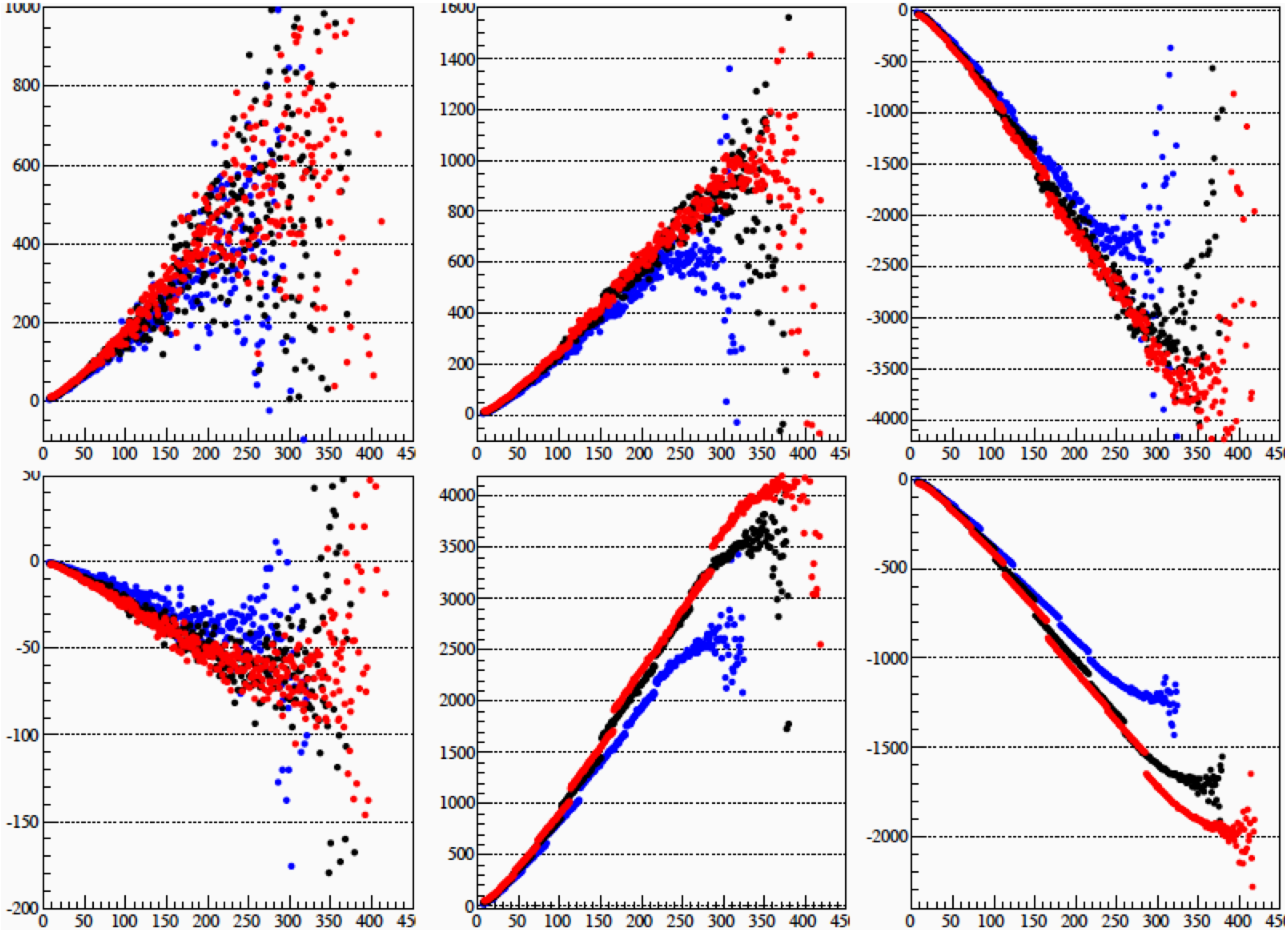
Deconstructing the corrections - Individual terms vs. centvar... **net-K 19.6**



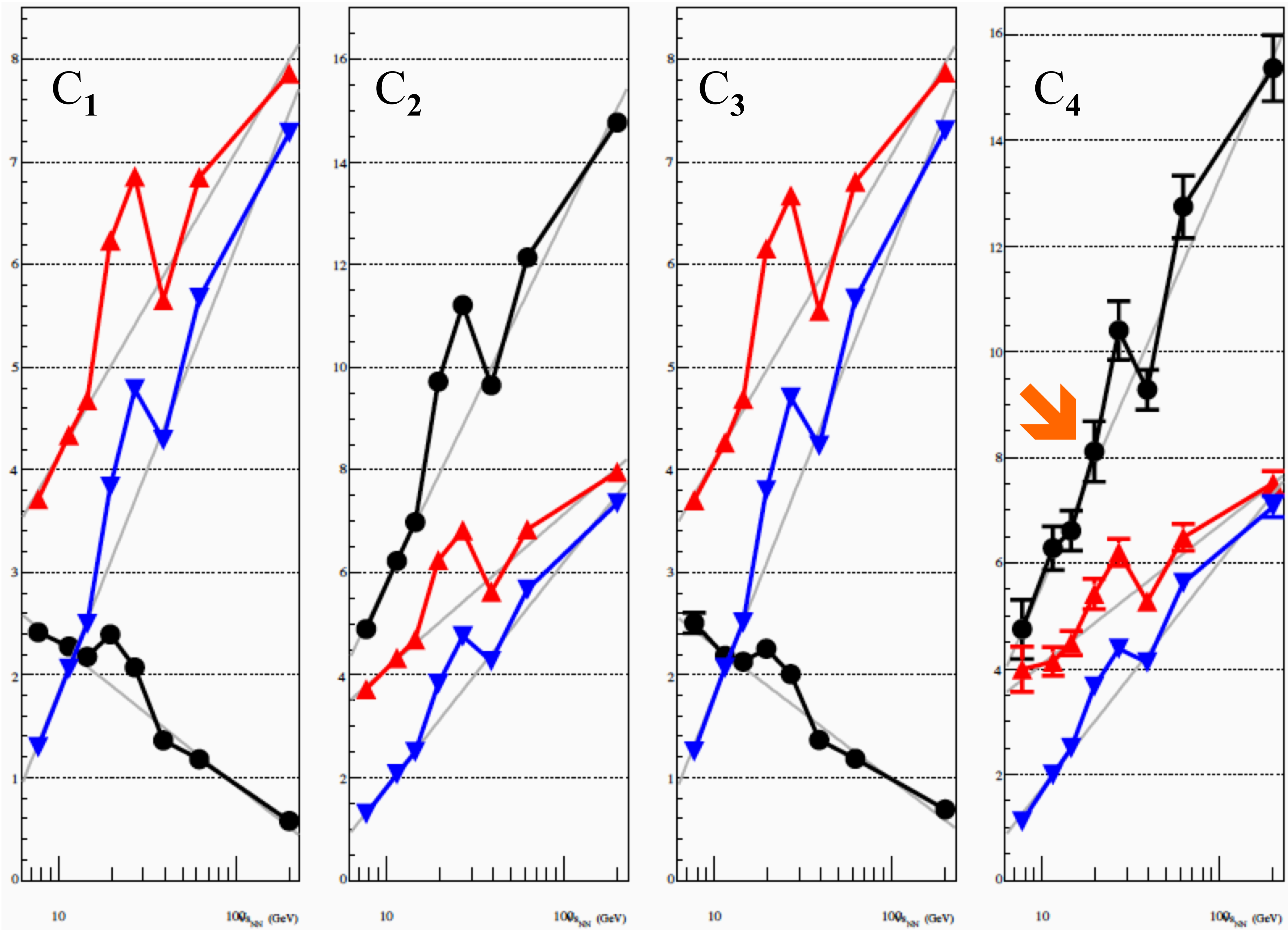
C_1: 1 term, C_2: 2 terms, C_3: 3 terms, C_4: 6 terms

Note all terms are in the range ~ ±*few thousand*

Individual terms vs. centvar... **net-K at 14.5, 19.6, 27**



uncorrected C_1-C_4 net-K 19.6 0-5% – net, pos, neg



uncorrected cumulants increase with root-s logarithmically...
higher values for run-11's 19.6 and 27 GeV (improved tracker)...