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# Ferrenberg Swendsen Analysis of LLNL and NYBlue BG/L p4rhms Data

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# Ferrenberg Swendsen Analysis of LLNL and NYBlue BG/L p4rhmc Data

## Background

These results are from the continuing Lattice Quantum Chromodynamics runs on BG/L. These results are from the Ferrenberg-Swendsen analysis [?] of the combined data from LLNL and NYBlue BG/L runs for  $32^3 \times 8$  runs with the p4rhmc v2.0 QMP\_MPLX (semi-optimized p4 code using qmp over mpi). The jobs include beta values ranging from 3.525 to 3.535 with an alternate analysis extending to 3.540. The NYBlue data sets are from 9k trajectories from Oct 2007, and the LLNL data are from two independent streams of  $\sim 5$ k each, taking from the July 2007 runs.

The following outputs are produced by the fs\_2+1\_chiub.c program. All outputs have had checksums produced by addCks.pl and checked by the checkCks.pl perl script after scanning.

## fs.beta output

```
1: 742:# fs.beta
2: 5457:# Ferrenberg Swensen fuer beta_c aus der Suszeptibilitaet
3: 870:# PlaQ Sus:
4: 1259:3.525100 0.052454 0.001192
5: 838:3.524560 0.000449
6: 771:# Pol Sus:
7: 1270:3.525000 1.754450 0.108901
8: 811:3.525000 0.000000
9: 1716:# Chiral Sus (light):
10: 1296:3.528600 1.797024 0.188393
11: 835:3.523560 0.003831
12: 1721:# Chiral Sus (heavy):
13: 1278:3.527200 0.541569 0.043057
14: 848:3.506590 0.006558
```

## histos output

```
1: 618:# histo
2: 894:0.845849 0.224983
3: 891:0.845909 0.224983
4: 900:0.845999 0.224983
5: 882:0.846029 0.326842
6: 889:0.846059 0.382817
7: 888:0.846089 0.326842
8: 886:0.846119 0.382817
9: 888:0.846149 0.157834
10: 891:0.846179 0.157834
11: 882:0.846209 1.261483
12: 878:0.846239 0.642510
13: 897:0.846269 2.793832
14: 901:0.846299 0.484676
15: 891:0.846329 1.475293
16: 887:0.846359 1.103649
```

17: 896:0.846389 0.315669  
18: 887:0.846419 3.288600  
19: 900:0.846449 0.867493  
20: 887:0.846479 0.607800  
21: 903:0.846509 1.867867  
22: 893:0.846539 3.425169  
23: 905:0.846569 3.244989  
24: 893:0.846599 1.858110  
25: 903:0.846629 3.469972  
26: 892:0.846659 3.063617  
27: 884:0.846689 4.325100  
28: 891:0.846719 3.095830  
29: 899:0.846749 6.625356  
30: 905:0.846779 2.587617  
31: 892:0.846809 5.392622  
32: 889:0.846839 5.442305  
33: 889:0.846869 6.035132  
34: 903:0.846899 5.784115  
35: 896:0.846929 7.400964  
36: 906:0.846959 6.676561  
37: 913:0.846989 7.927952  
38: 885:0.847019 6.851530  
39: 895:0.847049 7.408448  
40: 888:0.847079 9.214054  
41: 878:0.847109 9.244101  
42: 886:0.847139 8.320526  
43: 900:0.847169 5.459653  
44: 907:0.847199 9.855365  
45: 899:0.847229 5.268819  
46: 900:0.847259 9.629191  
47: 910:0.847289 7.088984  
48: 925:0.847319 10.031750  
49: 903:0.847348 9.736556  
50: 901:0.847378 8.315757  
51: 885:0.847408 8.451017  
52: 904:0.847438 8.961945  
53: 893:0.847468 9.030394  
54: 913:0.847498 9.647838  
55: 901:0.847528 6.442959  
56: 892:0.847558 7.740450  
57: 901:0.847588 9.032955  
58: 933:0.847618 10.210289  
59: 936:0.847648 11.263145  
60: 946:0.847678 11.691615  
61: 903:0.847708 7.828547  
62: 902:0.847738 8.696530  
63: 899:0.847768 8.159251  
64: 920:0.847798 9.999382  
65: 930:0.847828 11.313332  
66: 906:0.847858 7.114889

67: 961:0.847888 11.599557  
68: 910:0.847918 6.989553  
69: 946:0.847948 12.079236  
70: 906:0.847978 8.407268  
71: 898:0.848008 8.467881  
72: 893:0.848038 7.923427  
73: 941:0.848068 11.658442  
74: 895:0.848098 8.902803  
75: 889:0.848128 9.129081  
76: 948:0.848158 11.997632  
77: 930:0.848188 10.422143  
78: 946:0.848218 14.408967  
79: 942:0.848248 12.940097  
80: 947:0.848278 11.355595  
81: 893:0.848308 9.642724  
82: 905:0.848338 9.890647  
83: 936:0.848368 12.070634  
84: 943:0.848398 10.109358  
85: 930:0.848428 12.145511  
86: 943:0.848458 16.311684  
87: 945:0.848488 12.931229  
88: 942:0.848518 14.785322  
89: 940:0.848548 12.549033  
90: 953:0.848578 15.739903  
91: 942:0.848608 10.776506  
92: 954:0.848638 13.334999  
93: 957:0.848668 12.859547  
94: 947:0.848698 12.278080  
95: 948:0.848728 13.473728  
96: 904:0.848758 8.947071  
97: 961:0.848788 13.968933  
98: 928:0.848818 10.702320  
99: 934:0.848848 11.352303  
100: 903:0.848878 9.837311  
101: 944:0.848908 12.037639  
102: 942:0.848938 11.465243  
103: 946:0.848968 11.943711  
104: 956:0.848998 11.665942  
105: 907:0.849028 7.889763  
106: 937:0.849058 12.271176  
107: 921:0.849088 11.003003  
108: 889:0.849118 8.335407  
109: 885:0.849148 8.851010  
110: 907:0.849178 9.758706  
111: 935:0.849208 10.306864  
112: 894:0.849238 8.741363  
113: 899:0.849268 7.101997  
114: 911:0.849298 7.155889  
115: 894:0.849328 7.742840  
116: 902:0.849358 6.973534

117: 903:0.849388 8.626283  
118: 904:0.849418 5.576874  
119: 900:0.849448 6.873731  
120: 902:0.849478 7.028476  
121: 887:0.849508 7.432702  
122: 897:0.849537 8.954403  
123: 896:0.849567 4.447190  
124: 901:0.849597 6.243538  
125: 884:0.849627 7.215410  
126: 900:0.849657 5.921934  
127: 912:0.849687 7.381797  
128: 900:0.849717 6.884037  
129: 899:0.849747 5.345951  
130: 906:0.849777 8.328726  
131: 906:0.849807 7.595457  
132: 900:0.849837 8.484027  
133: 935:0.849867 10.215701  
134: 912:0.849897 7.524993  
135: 939:0.849927 10.032990  
136: 907:0.849957 6.714829  
137: 947:0.849987 10.265840  
138: 886:0.850017 7.725439  
139: 880:0.850047 6.170743  
140: 898:0.850077 7.839628  
141: 879:0.850107 7.164552  
142: 883:0.850137 7.811824  
143: 888:0.850167 6.837126  
144: 887:0.850197 5.760614  
145: 883:0.850227 6.191833  
146: 878:0.850257 7.251026  
147: 888:0.850287 6.812049  
148: 880:0.850317 6.425209  
149: 884:0.850347 4.926152  
150: 891:0.850377 6.632529  
151: 879:0.850407 5.106681  
152: 869:0.850437 6.300320  
153: 889:0.850467 4.177192  
154: 885:0.850497 5.365005  
155: 878:0.850527 3.005654  
156: 885:0.850557 4.715802  
157: 892:0.850587 4.451827  
158: 887:0.850617 5.514791  
159: 877:0.850647 4.330801  
160: 879:0.850677 3.711420  
161: 890:0.850707 3.339791  
162: 884:0.850737 1.808153  
163: 888:0.850767 1.708308  
164: 884:0.850797 1.430822  
165: 878:0.850827 2.923040  
166: 895:0.850857 0.826792

167: 887:0.850887 0.721157  
168: 883:0.850917 0.865204  
169: 881:0.850947 1.176320  
170: 887:0.850977 1.320368  
171: 878:0.851007 0.743258  
172: 888:0.851037 0.942948  
173: 876:0.851067 0.615522  
174: 884:0.851097 0.227582  
175: 876:0.851127 0.455163  
176: 884:0.851187 0.227582  
177: 880:0.851307 0.371629  
178: 875:0.851337 0.144047  
179: 893:0.851367 0.265994  
180: 887:0.851397 0.227582  
181: 887:0.851427 0.288095  
182: 881:0.851457 0.121946  
183: 884:0.851487 0.121946  
184: 877:0.851816 0.144047

## fs.out output

1: 2603:#Ferrenberg Swendsen fs.out  
2:11205:#beta Action error Sus(Action) error Wline error Sus(Wline) error Pbp\_1 error Sus(Pbp\_1) e  
3:11395:3.525000 8.472027e-01 2.071667e-05 5.243209e-02 1.123886e-03 1.836045e-02 2.793156e-04 1.7  
4:11344:3.525100 8.472341e-01 2.035013e-05 5.245382e-02 1.191743e-03 1.834852e-02 2.749201e-04 1.7  
5:11375:3.525200 8.472656e-01 1.992266e-05 5.245201e-02 1.271445e-03 1.833731e-02 2.710849e-04 1.7  
6:11401:3.525300 8.472970e-01 1.943881e-05 5.242838e-02 1.356940e-03 1.832699e-02 2.678471e-04 1.6  
7:11392:3.525400 8.473285e-01 1.890454e-05 5.238460e-02 1.443278e-03 1.831774e-02 2.652348e-04 1.6  
8:11442:3.525500 8.473599e-01 1.832774e-05 5.232228e-02 1.526546e-03 1.830969e-02 2.632634e-04 1.6  
9:11386:3.525600 8.473912e-01 1.771744e-05 5.224301e-02 1.603700e-03 1.830299e-02 2.619324e-04 1.6  
10:11504:3.525700 8.474225e-01 1.708419e-05 5.214839e-02 1.672393e-03 1.829776e-02 2.612246e-04 1  
11:11425:3.525800 8.474538e-01 1.643974e-05 5.204002e-02 1.730837e-03 1.829411e-02 2.611056e-04 1  
12:11512:3.525900 8.474850e-01 1.579659e-05 5.191954e-02 1.777681e-03 1.829214e-02 2.615256e-04 1  
13:11480:3.526000 8.475161e-01 1.516815e-05 5.178858e-02 1.811944e-03 1.829194e-02 2.624207e-04 1  
14:11473:3.526100 8.475471e-01 1.456767e-05 5.164876e-02 1.832936e-03 1.829356e-02 2.637167e-04 1  
15:11461:3.526200 8.475780e-01 1.400866e-05 5.150172e-02 1.840216e-03 1.829709e-02 2.653320e-04 1  
16:11458:3.526300 8.476089e-01 1.350360e-05 5.134900e-02 1.833553e-03 1.830256e-02 2.671806e-04 1  
17:11440:3.526400 8.476396e-01 1.306273e-05 5.119212e-02 1.812905e-03 1.831003e-02 2.691754e-04 1  
18:11438:3.526500 8.476703e-01 1.269413e-05 5.103248e-02 1.778400e-03 1.831953e-02 2.712310e-04 1  
19:11412:3.526600 8.477008e-01 1.240251e-05 5.087142e-02 1.730340e-03 1.833108e-02 2.732652e-04 1  
20:11440:3.526700 8.477313e-01 1.218811e-05 5.071012e-02 1.669208e-03 1.834470e-02 2.752016e-04 1  
21:11512:3.526800 8.477617e-01 1.204758e-05 5.054965e-02 1.595688e-03 1.836039e-02 2.769699e-04 1  
22:11502:3.526900 8.477919e-01 1.197294e-05 5.039096e-02 1.510694e-03 1.837816e-02 2.785072e-04 1  
23:11490:3.527000 8.478221e-01 1.195347e-05 5.023486e-02 1.415425e-03 1.839798e-02 2.797581e-04 1  
24:11409:3.527100 8.478522e-01 1.197637e-05 5.008208e-02 1.311418e-03 1.841984e-02 2.806752e-04 1  
25:11428:3.527200 8.478822e-01 1.202736e-05 4.993323e-02 1.200649e-03 1.844368e-02 2.812186e-04 1  
26:11493:3.527300 8.479121e-01 1.209228e-05 4.978888e-02 1.085668e-03 1.846947e-02 2.813560e-04 1  
27:11482:3.527400 8.479419e-01 1.215797e-05 4.964954e-02 9.698232e-04 1.849713e-02 2.810627e-04 1  
28:11477:3.527500 8.479717e-01 1.221255e-05 4.951570e-02 8.575948e-04 1.852658e-02 2.803209e-04 1  
29:11467:3.527600 8.480013e-01 1.224641e-05 4.938789e-02 7.550444e-04 1.855773e-02 2.791194e-04 1

|                   |              |              |              |              |              |              |   |
|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|---|
| 30:11474:3.527700 | 8.480309e-01 | 1.225175e-05 | 4.926663e-02 | 6.701918e-04 | 1.859046e-02 | 2.774539e-04 | 1 |
| 31:11468:3.527800 | 8.480604e-01 | 1.222325e-05 | 4.915251e-02 | 6.124998e-04 | 1.862465e-02 | 2.753262e-04 | 1 |
| 32:11505:3.527900 | 8.480899e-01 | 1.215765e-05 | 4.904613e-02 | 5.900837e-04 | 1.866015e-02 | 2.727445e-04 | 1 |
| 33:11456:3.528000 | 8.481193e-01 | 1.205460e-05 | 4.894820e-02 | 6.049976e-04 | 1.869682e-02 | 2.697231e-04 | 1 |
| 34:11499:3.528100 | 8.481486e-01 | 1.191494e-05 | 4.885945e-02 | 6.512670e-04 | 1.873448e-02 | 2.662821e-04 | 1 |
| 35:11464:3.528200 | 8.481779e-01 | 1.174239e-05 | 4.878062e-02 | 7.184587e-04 | 1.877295e-02 | 2.624478e-04 | 1 |
| 36:11462:3.528300 | 8.482071e-01 | 1.154207e-05 | 4.871252e-02 | 7.963886e-04 | 1.881205e-02 | 2.582528e-04 | 1 |
| 37:11508:3.528400 | 8.482363e-01 | 1.132057e-05 | 4.865589e-02 | 8.771694e-04 | 1.885158e-02 | 2.537356e-04 | 1 |
| 38:11472:3.528500 | 8.482655e-01 | 1.108616e-05 | 4.861149e-02 | 9.552177e-04 | 1.889134e-02 | 2.489411e-04 | 1 |
| 39:11493:3.528600 | 8.482946e-01 | 1.084781e-05 | 4.857997e-02 | 1.026686e-03 | 1.893112e-02 | 2.439208e-04 | 1 |
| 40:11464:3.528700 | 8.483237e-01 | 1.061552e-05 | 4.856189e-02 | 1.088947e-03 | 1.897072e-02 | 2.387327e-04 | 1 |
| 41:11511:3.528800 | 8.483529e-01 | 1.039868e-05 | 4.855771e-02 | 1.140244e-03 | 1.900996e-02 | 2.334417e-04 | 1 |
| 42:11513:3.528900 | 8.483820e-01 | 1.020649e-05 | 4.856768e-02 | 1.179473e-03 | 1.904862e-02 | 2.281199e-04 | 1 |
| 43:11480:3.529000 | 8.484111e-01 | 1.004704e-05 | 4.859193e-02 | 1.206046e-03 | 1.908655e-02 | 2.228460e-04 | 1 |
| 44:11476:3.529100 | 8.484403e-01 | 9.926165e-06 | 4.863035e-02 | 1.219812e-03 | 1.912357e-02 | 2.177057e-04 | 1 |
| 45:11501:3.529200 | 8.484695e-01 | 9.848612e-06 | 4.868267e-02 | 1.221003e-03 | 1.915953e-02 | 2.127905e-04 | 1 |
| 46:11497:3.529300 | 8.484987e-01 | 9.815245e-06 | 4.874838e-02 | 1.210211e-03 | 1.919432e-02 | 2.081973e-04 | 1 |
| 47:11483:3.529400 | 8.485279e-01 | 9.825191e-06 | 4.882682e-02 | 1.188373e-03 | 1.922782e-02 | 2.040260e-04 | 1 |
| 48:11473:3.529500 | 8.485573e-01 | 9.875201e-06 | 4.891707e-02 | 1.156784e-03 | 1.925997e-02 | 2.003769e-04 | 1 |
| 49:11460:3.529600 | 8.485866e-01 | 9.959794e-06 | 4.901810e-02 | 1.117110e-03 | 1.929071e-02 | 1.973476e-04 | 1 |
| 50:11452:3.529700 | 8.486161e-01 | 1.007295e-05 | 4.912872e-02 | 1.071429e-03 | 1.932002e-02 | 1.950281e-04 | 1 |
| 51:11444:3.529800 | 8.486456e-01 | 1.020754e-05 | 4.924757e-02 | 1.022266e-03 | 1.934791e-02 | 1.934961e-04 | 1 |
| 52:11536:3.529900 | 8.486751e-01 | 1.035692e-05 | 4.937324e-02 | 9.726358e-04 | 1.937444e-02 | 1.928118e-04 | 1 |
| 53:11427:3.530000 | 8.487048e-01 | 1.051515e-05 | 4.950420e-02 | 9.260255e-04 | 1.939965e-02 | 1.930137e-04 | 1 |
| 54:11483:3.530100 | 8.487345e-01 | 1.067713e-05 | 4.963889e-02 | 8.862836e-04 | 1.942367e-02 | 1.941152e-04 | 1 |
| 55:11467:3.530200 | 8.487643e-01 | 1.083914e-05 | 4.977568e-02 | 8.573091e-04 | 1.944662e-02 | 1.961034e-04 | 1 |
| 56:11513:3.530300 | 8.487942e-01 | 1.099921e-05 | 4.991296e-02 | 8.425105e-04 | 1.946864e-02 | 1.989396e-04 | 1 |
| 57:11473:3.530400 | 8.488242e-01 | 1.115659e-05 | 5.004907e-02 | 8.441144e-04 | 1.948993e-02 | 2.025622e-04 | 1 |
| 58:11484:3.530500 | 8.488543e-01 | 1.131181e-05 | 5.018237e-02 | 8.626264e-04 | 1.951068e-02 | 2.068911e-04 | 1 |
| 59:11460:3.530600 | 8.488844e-01 | 1.146680e-05 | 5.031120e-02 | 8.967318e-04 | 1.953110e-02 | 2.118325e-04 | 1 |
| 60:11482:3.530700 | 8.489146e-01 | 1.162502e-05 | 5.043392e-02 | 9.437163e-04 | 1.955142e-02 | 2.172842e-04 | 1 |
| 61:11429:3.530800 | 8.489449e-01 | 1.179000e-05 | 5.054884e-02 | 1.000130e-03 | 1.957186e-02 | 2.231411e-04 | 1 |
| 62:11469:3.530900 | 8.489752e-01 | 1.196577e-05 | 5.065430e-02 | 1.062389e-03 | 1.959266e-02 | 2.292989e-04 | 1 |
| 63:11410:3.531000 | 8.490056e-01 | 1.215702e-05 | 5.074862e-02 | 1.127154e-03 | 1.961404e-02 | 2.356580e-04 | 1 |
| 64:11436:3.531100 | 8.490361e-01 | 1.236705e-05 | 5.083009e-02 | 1.191507e-03 | 1.963623e-02 | 2.421260e-04 | 1 |
| 65:11461:3.531200 | 8.490666e-01 | 1.259889e-05 | 5.089700e-02 | 1.252987e-03 | 1.965944e-02 | 2.486193e-04 | 1 |
| 66:11440:3.531300 | 8.490971e-01 | 1.285483e-05 | 5.094767e-02 | 1.309573e-03 | 1.968385e-02 | 2.550639e-04 | 1 |
| 67:11459:3.531400 | 8.491277e-01 | 1.313497e-05 | 5.098043e-02 | 1.359638e-03 | 1.970964e-02 | 2.613960e-04 | 1 |
| 68:11417:3.531500 | 8.491582e-01 | 1.343890e-05 | 5.099367e-02 | 1.401907e-03 | 1.973695e-02 | 2.675615e-04 | 1 |
| 69:11470:3.531600 | 8.491888e-01 | 1.376392e-05 | 5.098589e-02 | 1.435421e-03 | 1.976589e-02 | 2.735155e-04 | 1 |
| 70:11482:3.531700 | 8.492194e-01 | 1.410666e-05 | 5.095573e-02 | 1.459515e-03 | 1.979656e-02 | 2.792211e-04 | 1 |
| 71:11453:3.531800 | 8.492499e-01 | 1.446207e-05 | 5.090201e-02 | 1.473803e-03 | 1.982902e-02 | 2.846483e-04 | 1 |
| 72:11429:3.531900 | 8.492804e-01 | 1.482457e-05 | 5.082381e-02 | 1.478171e-03 | 1.986328e-02 | 2.897725e-04 | 1 |
| 73:11447:3.532000 | 8.493108e-01 | 1.518740e-05 | 5.072050e-02 | 1.472783e-03 | 1.989933e-02 | 2.945734e-04 | 1 |
| 74:11423:3.532100 | 8.493412e-01 | 1.554402e-05 | 5.059183e-02 | 1.458089e-03 | 1.993716e-02 | 2.990337e-04 | 1 |
| 75:11436:3.532200 | 8.493715e-01 | 1.588740e-05 | 5.043792e-02 | 1.434830e-03 | 1.997668e-02 | 3.031377e-04 | 1 |
| 76:11400:3.532300 | 8.494017e-01 | 1.621089e-05 | 5.025932e-02 | 1.404053e-03 | 2.001780e-02 | 3.068705e-04 | 1 |
| 77:11406:3.532400 | 8.494317e-01 | 1.650779e-05 | 5.005705e-02 | 1.367111e-03 | 2.006041e-02 | 3.102176e-04 | 1 |
| 78:11446:3.532500 | 8.494617e-01 | 1.677267e-05 | 4.983259e-02 | 1.325657e-03 | 2.010436e-02 | 3.131641e-04 | 1 |
| 79:11465:3.532600 | 8.494915e-01 | 1.700013e-05 | 4.958787e-02 | 1.281620e-03 | 2.014951e-02 | 3.156949e-04 | 1 |



80:11464:3.532700 8.495211e-01 1.718634e-05 4.932525e-02 1.237145e-03 2.019567e-02 3.177949e-04 1  
81:11492:3.532800 8.495506e-01 1.732777e-05 4.904748e-02 1.194508e-03 2.024268e-02 3.194488e-04 1  
82:11470:3.532900 8.495800e-01 1.742249e-05 4.875763e-02 1.155976e-03 2.029034e-02 3.206424e-04 1  
83:11442:3.533000 8.496091e-01 1.746940e-05 4.845904e-02 1.123618e-03 2.033846e-02 3.213623e-04 1  
84:11434:3.533100 8.496381e-01 1.746845e-05 4.815523e-02 1.099102e-03 2.038686e-02 3.215975e-04 1  
85:11444:3.533200 8.496669e-01 1.742105e-05 4.784981e-02 1.083501e-03 2.043534e-02 3.213392e-04 1  
86:11407:3.533300 8.496955e-01 1.732900e-05 4.754640e-02 1.077165e-03 2.048374e-02 3.205817e-04 1  
87:11455:3.533400 8.497239e-01 1.719569e-05 4.724853e-02 1.079726e-03 2.053186e-02 3.193230e-04 1  
88:11474:3.533500 8.497522e-01 1.702472e-05 4.695958e-02 1.090231e-03 2.057955e-02 3.175649e-04 1  
89:11472:3.533600 8.497803e-01 1.682095e-05 4.668268e-02 1.107363e-03 2.062667e-02 3.153133e-04 1  
90:11429:3.533700 8.498082e-01 1.658936e-05 4.642070e-02 1.129701e-03 2.067305e-02 3.125782e-04 1  
91:11460:3.533800 8.498360e-01 1.633550e-05 4.617616e-02 1.155958e-03 2.071859e-02 3.093737e-04 1  
92:11459:3.533900 8.498636e-01 1.606515e-05 4.595124e-02 1.185135e-03 2.076317e-02 3.057176e-04 1  
93:11392:3.534000 8.498911e-01 1.578425e-05 4.574776e-02 1.216627e-03 2.080668e-02 3.016313e-04 1  
94:11460:3.534100 8.499185e-01 1.549875e-05 4.556722e-02 1.250235e-03 2.084903e-02 2.971389e-04 1  
95:11429:3.534200 8.499458e-01 1.521454e-05 4.541084e-02 1.286139e-03 2.089016e-02 2.922671e-04 1  
96:11452:3.534300 8.499731e-01 1.493720e-05 4.527958e-02 1.324828e-03 2.093002e-02 2.870440e-04 1  
97:11459:3.534400 8.500002e-01 1.467239e-05 4.517427e-02 1.367003e-03 2.096855e-02 2.814985e-04 1  
98:11431:3.534500 8.500273e-01 1.442552e-05 4.509565e-02 1.413484e-03 2.100573e-02 2.756596e-04 1  
99:11440:3.534600 8.500544e-01 1.420147e-05 4.504448e-02 1.465120e-03 2.104156e-02 2.695556e-04 1  
100:11365:3.534700 8.500814e-01 1.400523e-05 4.502166e-02 1.522742e-03 2.107606e-02 2.632132e-04 1  
101:11448:3.534800 8.501085e-01 1.384153e-05 4.502829e-02 1.587163e-03 2.110924e-02 2.566574e-04 1  
102:11434:3.534900 8.501355e-01 1.371517e-05 4.506579e-02 1.659235e-03 2.114118e-02 2.499110e-04 1  
103:11434:3.535000 8.501626e-01 1.363041e-05 4.513599e-02 1.739971e-03 2.117195e-02 2.429952e-04 1

## fs.info output

1: 758:# fs.info  
2: 1315:# 4 32 8 1.666667 -0.166667  
3: 1718:# 3.525000 0.000100 100 1 10 200 20000  
4: 8841:# files: ../test/plaq\_b3.525000.dat ../test/rect\_b3.525000.dat ../test/wline\_b3.525000.dat  
5: 2113:# tau\_int 6.3358 6.335758e+00  
6: 3354:# 1: Beta(0) = 3.525000, 615 Daten, Wirkung = 0.847268  
7: 2361:# 1: S\_min = 0.846061, S\_max = 0.848473  
8: 7342:3.525000 8.472678e-01 8.472678e-01 5.106896e-02 1.000001e+00 1.739921e-02 7.079246e-01 2.9  
9: 9137:# files: ../../data/p4c3.525/plaq.dat ../../data/p4c3.525/rect.dat ../../data/p4c3.525/wl  
10: 2110:# tau\_int 3.0596 3.059586e+00  
11: 3355:# 2: Beta(1) = 3.525000, 337 Daten, Wirkung = 0.847158  
12: 2364:# 2: S\_min = 0.846043, S\_max = 0.848448  
13: 7293:3.525000 8.471576e-01 8.471576e-01 4.591146e-02 1.000001e+00 1.991358e-02 2.569928e+00 3  
14: 9157:# files: ../../data/p4h3.525/plaq.dat ../../data/p4h3.525/rect.dat ../../data/p4h3.525/wl  
15: 2113:# tau\_int 4.4448 4.444787e+00  
16: 3352:# 3: Beta(2) = 3.525000, 290 Daten, Wirkung = 0.847155  
17: 2370:# 3: S\_min = 0.845834, S\_max = 0.848356  
18: 7265:3.525000 8.471550e-01 8.471550e-01 5.697326e-02 1.000001e+00 1.851091e-02 2.388449e+00 3  
19: 8869:# files: ../test/plaq\_b3.527500.dat ../test/rect\_b3.527500.dat ../test/wline\_b3.527500.da  
20: 2099:# tau\_int 3.9062 3.906181e+00  
21: 3381:# 4: Beta(3) = 3.527500, 772 Daten, Wirkung = 0.847989  
22: 2366:# 4: S\_min = 0.846510, S\_max = 0.849790  
23: 7358:3.527500 8.479886e-01 8.479886e-01 4.946770e-02 1.000001e+00 1.769498e-02 7.515619e-01 2

```
24: 8825:# files: ../test/plaq_b3.530000.dat ../test/rect_b3.530000.dat ../test/wline_b3.530000.d
25: 2103:# tau_int 4.5373 4.537263e+00
26: 3360:# 5: Beta(4) = 3.530000, 775 Daten, Wirkung = 0.848712
27: 2371:# 5: S_min = 0.847214, S_max = 0.849954
28: 7304:3.530000 8.487125e-01 8.487125e-01 5.078489e-02 1.000001e+00 1.829317e-02 6.748898e-01 2
29: 9121:# files: ../../data/p4c3.530/plaq.dat ../../data/p4c3.530/rect.dat ../../data/p4c3.530/w
30: 2099:# tau_int 2.2650 2.264955e+00
31: 3360:# 6: Beta(5) = 3.530000, 305 Daten, Wirkung = 0.848658
32: 2381:# 6: S_min = 0.847476, S_max = 0.849908
33: 7282:3.530000 8.486578e-01 8.486578e-01 5.112970e-02 1.000001e+00 2.133409e-02 2.772633e+00 2
34: 9141:# files: ../../data/p4h3.530/plaq.dat ../../data/p4h3.530/rect.dat ../../data/p4h3.530/w
35: 2095:# tau_int 3.2482 3.248152e+00
36: 3360:# 7: Beta(6) = 3.530000, 271 Daten, Wirkung = 0.848735
37: 2379:# 7: S_min = 0.847642, S_max = 0.849973
38: 7257:3.530000 8.487353e-01 8.487353e-01 4.841971e-02 1.000001e+00 2.004915e-02 2.303156e+00 2
39: 8853:# files: ../test/plaq_b3.532500.dat ../test/rect_b3.532500.dat ../test/wline_b3.532500.d
40: 2105:# tau_int 4.9351 4.935119e+00
41: 3380:# 8: Beta(7) = 3.532500, 578 Daten, Wirkung = 0.849483
42: 2369:# 8: S_min = 0.848304, S_max = 0.850785
43: 7317:3.532500 8.494831e-01 8.494831e-01 4.608832e-02 1.000001e+00 1.981860e-02 7.888368e-01 2
44: 8845:# files: ../test/plaq_b3.535000.dat ../test/rect_b3.535000.dat ../test/wline_b3.535000.d
45: 2101:# tau_int 4.3940 4.394028e+00
46: 3358:# 9: Beta(8) = 3.535000, 642 Daten, Wirkung = 0.850135
47: 2376:# 9: S_min = 0.848760, S_max = 0.851388
48: 7293:3.535000 8.501354e-01 8.501354e-01 4.774162e-02 1.000001e+00 2.031882e-02 6.718136e-01 2
49: 9141:# files: ../../data/p4c3.535/plaq.dat ../../data/p4c3.535/rect.dat ../../data/p4c3.535/w
50: 2081:# tau_int 8.2003 8.200331e+00
51: 3392:# 10: Beta(9) = 3.535000, 311 Daten, Wirkung = 0.850153
52: 2413:# 10: S_min = 0.849047, S_max = 0.851485
53: 7246:3.535000 8.501532e-01 8.501532e-01 4.725325e-02 1.000001e+00 2.204067e-02 2.570313e+00 2
54: 9161:# files: ../../data/p4h3.535/plaq.dat ../../data/p4h3.535/rect.dat ../../data/p4h3.535/w
55: 2110:# tau_int 6.9422 6.942159e+00
56: 3439:# 11: Beta(10) = 3.535000, 284 Daten, Wirkung = 0.850240
57: 2398:# 11: S_min = 0.849120, S_max = 0.851801
58: 7272:3.535000 8.502405e-01 8.502405e-01 4.221993e-02 1.000001e+00 2.303828e-02 2.569770e+00 2
59: 535:# init
60: 1858:# N = 5180 , 11 Datensatze
61: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
62: 1127:# DIFF = 0.000000e+00
63: 2741:# Iteration ist konvergiert !!!
64: 1433:# beta_c: 3.525100e+00
65: 1432:# beta_c: 3.525000e+00
66: 1441:# beta_c: 3.528600e+00
67: 1436:# beta_c: 3.527200e+00
68: 1366:# Alle Daten - ENDE
69: 1646:# anf ber. hist vor
70: 535:# init
71: 1858:# N = 5180 , 11 Datensatze
72: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
73: 1127:# DIFF = 0.000000e+00
```

```
74: 2741:# Iteration ist konvergiert !!!
75: 1305:# ber. hist vor
76: 1435:# beta_c: 3.525300e+00
77: 1432:# beta_c: 3.525000e+00
78: 1435:# beta_c: 3.528000e+00
79: 1432:# beta_c: 3.532200e+00
80: 1646:# anf ber. hist vor
81: 535:# init
82: 1858:# N = 5180 , 11 Datensaeetze
83: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
84: 1127:# DIFF = 0.000000e+00
85: 2741:# Iteration ist konvergiert !!!
86: 1305:# ber. hist vor
87: 1435:# beta_c: 3.525300e+00
88: 1432:# beta_c: 3.525000e+00
89: 1437:# beta_c: 3.528200e+00
90: 1436:# beta_c: 3.527200e+00
91: 1646:# anf ber. hist vor
92: 535:# init
93: 1858:# N = 5180 , 11 Datensaeetze
94: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
95: 1127:# DIFF = 0.000000e+00
96: 2741:# Iteration ist konvergiert !!!
97: 1305:# ber. hist vor
98: 1432:# beta_c: 3.525000e+00
99: 1432:# beta_c: 3.525000e+00
100: 1432:# beta_c: 3.531300e+00
101: 1436:# beta_c: 3.531700e+00
102: 1646:# anf ber. hist vor
103: 535:# init
104: 1858:# N = 5180 , 11 Datensaeetze
105: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
106: 1127:# DIFF = 0.000000e+00
107: 2741:# Iteration ist konvergiert !!!
108: 1305:# ber. hist vor
109: 1436:# beta_c: 3.525400e+00
110: 1432:# beta_c: 3.525000e+00
111: 1436:# beta_c: 3.528100e+00
112: 1442:# beta_c: 3.526900e+00
113: 1646:# anf ber. hist vor
114: 535:# init
115: 1858:# N = 5180 , 11 Datensaeetze
116: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
117: 1127:# DIFF = 0.000000e+00
118: 2741:# Iteration ist konvergiert !!!
119: 1305:# ber. hist vor
120: 1432:# beta_c: 3.525000e+00
121: 1432:# beta_c: 3.525000e+00
122: 1443:# beta_c: 3.528800e+00
123: 1439:# beta_c: 3.527500e+00
```

```
124: 1646:# anf ber. hist vor
125: 535:# init
126: 1858:# N = 5180 , 11 Datensaeetze
127: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
128: 1127:# DIFF = 0.000000e+00
129: 2741:# Iteration ist konvergiert !!!
130: 1305:# ber. hist vor
131: 1433:# beta_c: 3.525100e+00
132: 1432:# beta_c: 3.525000e+00
133: 1436:# beta_c: 3.529000e+00
134: 1429:# beta_c: 3.530100e+00
135: 1646:# anf ber. hist vor
136: 535:# init
137: 1858:# N = 5180 , 11 Datensaeetze
138: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
139: 1127:# DIFF = 0.000000e+00
140: 2741:# Iteration ist konvergiert !!!
141: 1305:# ber. hist vor
142: 1435:# beta_c: 3.525300e+00
143: 1432:# beta_c: 3.525000e+00
144: 1439:# beta_c: 3.528400e+00
145: 1435:# beta_c: 3.527100e+00
146: 1646:# anf ber. hist vor
147: 535:# init
148: 1858:# N = 5180 , 11 Datensaeetze
149: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
150: 1127:# DIFF = 0.000000e+00
151: 2741:# Iteration ist konvergiert !!!
152: 1305:# ber. hist vor
153: 1432:# beta_c: 3.525000e+00
154: 1432:# beta_c: 3.525000e+00
155: 1436:# beta_c: 3.529000e+00
156: 1438:# beta_c: 3.528300e+00
157: 1646:# anf ber. hist vor
158: 535:# init
159: 1858:# N = 5180 , 11 Datensaeetze
160: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
161: 1127:# DIFF = 0.000000e+00
162: 2741:# Iteration ist konvergiert !!!
163: 1305:# ber. hist vor
164: 1434:# beta_c: 3.525200e+00
165: 1432:# beta_c: 3.525000e+00
166: 1438:# beta_c: 3.531900e+00
167: 1431:# beta_c: 3.532100e+00
168: 1646:# anf ber. hist vor
169: 535:# init
170: 1858:# N = 5180 , 11 Datensaeetze
171: 4554:# Ave_Action = 0.848699 , Ave_Beta = 3.530000, Ave_ActBet = 2.995907
172: 1127:# DIFF = 0.000000e+00
173: 2741:# Iteration ist konvergiert !!!
```

```
174: 1305:# ber. hist vor
175: 1432:# beta_c: 3.525000e+00
176: 1432:# beta_c: 3.525000e+00
177: 1444:# beta_c: 3.528900e+00
178: 1437:# beta_c: 3.531800e+00
```

### fs.beta output for extended 3.540 range

```
1: 2438:# fs_ext.beta (with beta=3.54)
2: 5457:# Ferrenberg Swensen fuer beta_c aus der Suszeptibilitaet
3: 870:# Plaq Sus:
4: 1254:3.525100 0.052593 0.001210
5: 838:3.524560 0.000449
6: 771:# Pol Sus:
7: 1258:3.540000 2.732621 0.100363
8: 743:3.540000 nan
9: 1716:# Chiral Sus (light):
10: 1321:3.528600 1.799498 0.188869
11: 833:3.523650 0.003910
12: 1721:# Chiral Sus (heavy):
13: 1274:3.527200 0.541774 0.042911
14: 836:3.501910 0.006384
```

### histos for extended 3.540 range

```
1: 1050:# histo_ext
2: 888:0.845852 0.224983
3: 887:0.845923 0.224983
4: 896:0.845995 0.224983
5: 874:0.846030 0.326842
6: 887:0.846066 0.382817
7: 885:0.846102 0.709659
8: 887:0.846173 0.315669
9: 883:0.846209 1.419317
10: 889:0.846244 1.746159
11: 890:0.846280 1.859191
12: 888:0.846316 0.923468
13: 878:0.846351 1.813307
14: 894:0.846387 0.315669
15: 882:0.846423 3.288600
16: 892:0.846458 1.092476
17: 891:0.846494 1.766008
18: 877:0.846530 3.583004
19: 890:0.846565 3.571831
20: 879:0.846601 2.240927
21: 888:0.846637 4.833314
22: 908:0.846672 3.896399
23: 886:0.846708 4.428151
24: 895:0.846744 7.039195
25: 895:0.846779 3.072293
```

26: 880:0.846815 6.035132  
27: 897:0.846851 7.547743  
28: 901:0.846886 6.063657  
29: 893:0.846922 8.611576  
30: 915:0.846958 7.988915  
31: 910:0.846993 9.662938  
32: 894:0.847029 8.185149  
33: 935:0.847065 10.307828  
34: 931:0.847100 11.299526  
35: 883:0.847136 9.511172  
36: 892:0.847172 7.808507  
37: 916:0.847207 10.108200  
38: 897:0.847243 8.579138  
39: 900:0.847279 9.074870  
40: 939:0.847314 11.447379  
41: 939:0.847350 11.467854  
42: 902:0.847386 9.871643  
43: 928:0.847421 10.990025  
44: 900:0.847457 9.323497  
45: 945:0.847493 11.671486  
46: 894:0.847528 8.129453  
47: 957:0.847564 10.778996  
48: 905:0.847600 8.846998  
49: 946:0.847635 13.761982  
50: 940:0.847671 13.595134  
51: 919:0.847707 11.000080  
52: 899:0.847742 9.079347  
53: 938:0.847778 11.357220  
54: 944:0.847814 13.267467  
55: 904:0.847849 9.204849  
56: 936:0.847885 13.206044  
57: 892:0.847921 8.525580  
58: 945:0.847956 14.834415  
59: 895:0.847992 8.227540  
60: 902:0.848028 9.994427  
61: 942:0.848063 12.938464  
62: 940:0.848099 10.640591  
63: 925:0.848135 13.632410  
64: 926:0.848170 11.026192  
65: 934:0.848206 16.326840  
66: 947:0.848242 16.237969  
67: 945:0.848277 13.267473  
68: 931:0.848313 11.876131  
69: 937:0.848349 12.542434  
70: 934:0.848384 13.158032  
71: 928:0.848420 13.425533  
72: 945:0.848456 18.612493  
73: 947:0.848491 13.724686  
74: 935:0.848527 18.444103  
75: 934:0.848563 18.070530

76: 939:0.848598 13.341720  
77: 939:0.848634 15.901716  
78: 945:0.848670 14.659047  
79: 937:0.848705 14.456090  
80: 931:0.848741 13.912070  
81: 947:0.848777 14.243349  
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