2-point correlation

Analysis of 2-pt results

An illustration:

- An aim of this training camp is to calculate 2-point correlation functions, through which one can extract physical quantities.
- The first step of this demonstration is to learn how to analyze the results.
- Typical results are shown on the right.
  - The first column: configuration number
  - The seventh column: time separation
  - The eighth column: 2-pt results

1005	0	0	0	100001515	505050	0	0.95366	0.00000e+00
1005	0	0	0	100001515	505050	1	0.09861	0.00000e+00
1005	0	0	0	100001515	505050	2	0.03787	0.00000e+00
1005	0	0	0	100001515	505050	3	0.02357	0.00000e+00
1005	0	0	0	100001515	505050	4	0.01742	0.00000e+00
1005	0	0	0	100001515	505050	5	0.01374	0.00000e+00
1005	0	0	0	100001515	505050	6	0.01062	0.00000e+00
1005	0	0	0	100001515	505050	7	0.00812	0.00000e+00
1005	0	0	0	100001515	505050	8	0.00630	0.00000e+00
1005	0	0	0	100001515	505050	9	0.00501	0.00000e+00
1005	0	0	0	100001515	505050	10	0.00418	0.00000e+00
1005	0	0	0	100001515	505050	11	0.00364	0.00000e+00
1005	0	0	0	100001515	505050	12	0.00311	0.00000e+00
1005	0	0	0	100001515	505050	13	0.00260	0.00000e+00
1005	0	0	0	100001515	505050	14	0.00218	0.00000e+00
1005	0	0	0	100001515	505050	15	0.00179	0.00000e+00
1005	0	0	0	100001515	505050	16	0.00147	0.00000e+00
1005	0	0	0	100001515	505050	17	0.00120	0.00000e+00
1005	0	0	0	100001515	505050	18	9.49411e-04	0.00000e+00
1005	0	0	0	100001515	505050	19	7.45835e-04	0.00000e+00
1005	0	0	0	100001515	505050	20	5.83419e-04	0.00000e+00
1005	0	0	0	100001515	505050	21	4.61996e-04	0.00000e+00
1005	0	0	0	100001515	505050	22	3.65554e-04	0.00000e+00
1005	0	0	0	100001515	505050	23	3.01862e-04	0.00000e+00
1005	0	0	0	100001515	505050	24	2.61140e-04	0.00000e+00
1005	0	0	0	100001515	505050	25	2.25021e-04	0.00000e+00
1005	0	0	0	100001515	505050	26	1.96770e-04	0.00000e+00
1005	0	0	0	100001515	505050	27	1.77763e-04	0.00000e+00
1005	0	0	0	100001515	505050	28	1.63762e-04	0.00000e+00
1005	0	0	0	100001515	505050	29	1.53297e-04	0.00000e+00
1005	0	0	0	100001515	505050	30	1.47599e-04	0.00000e+00

i:
Configuration No.

t:
Time separation
In Lattice unit

Ci(t)
Results for 2-pt

Analysis of 2-pt results

An illustration:

- Step 1: Read the results as $C_i(t)$, in C++ or python,
  i can start from 0 instead of 1005.
- Step 2: Calculate the effective mass

$$m_i(t) = a_0 \ln \frac{C_i(t)}{C_i(t+1)}$$

$a_0 = 0.197/0.12$ is a unit-conversion factor, the unit for mi(t) is GeV

$\hbar c = 0.197\text{GeV} \times \text{fm};\ a = 0.12\text{fm}$

- Step 3: calculate the average and errors of the effective mass: $M(t), \Delta M(t)$
- Step 4: plot your results

```
1005    0    0    0 100001515    505050    0      0.95366  0.00000e+00
1005    0    0    0 100001515    505050    1      0.09861  0.00000e+00
1005    0    0    0 100001515    505050    2      0.03787  0.00000e+00
1005    0    0    0 100001515    505050    3      0.02357  0.00000e+00
1005    0    0    0 100001515    505050    4      0.01742  0.00000e+00
1005    0    0    0 100001515    505050    5      0.01374  0.00000e+00
1005    0    0    0 100001515    505050    6      0.01062  0.00000e+00
1005    0    0    0 100001515    505050    7      0.00812  0.00000e+00
1005    0    0    0 100001515    505050    8      0.00630  0.00000e+00
1005    0    0    0 100001515    505050    9      0.00501  0.00000e+00
1005    0    0    0 100001515    505050   10      0.00418  0.00000e+00
1005    0    0    0 100001515    505050   11      0.00364  0.00000e+00
1005    0    0    0 100001515    505050   12      0.00311  0.00000e+00
1005    0    0    0 100001515    505050   13      0.00260  0.00000e+00
1005    0    0    0 100001515    505050   14      0.00218  0.00000e+00
1005    0    0    0 100001515    505050   15      0.00179  0.00000e+00
1005    0    0    0 100001515    505050   16      0.00147  0.00000e+00
1005    0    0    0 100001515    505050   17      0.00120  0.00000e+00
1005    0    0    0 100001515    505050   18  9.49411e-04  0.00000e+00
1005    0    0    0 100001515    505050   19  7.45835e-04  0.00000e+00
1005    0    0    0 100001515    505050   20  5.83419e-04  0.00000e+00
1005    0    0    0 100001515    505050   21  4.61996e-04  0.00000e+00
1005    0    0    0 100001515    505050   22  3.65554e-04  0.00000e+00
1005    0    0    0 100001515    505050   23  3.01862e-04  0.00000e+00
1005    0    0    0 100001515    505050   24  2.61140e-04  0.00000e+00
1005    0    0    0 100001515    505050   25  2.25021e-04  0.00000e+00
1005    0    0    0 100001515    505050   26  1.96770e-04  0.00000e+00
1005    0    0    0 100001515    505050   27  1.77763e-04  0.00000e+00
1005    0    0    0 100001515    505050   28  1.63762e-04  0.00000e+00
1005    0    0    0 100001515    505050   29  1.53297e-04  0.00000e+00
1005    0    0    0 100001515    505050   30  1.47599e-04  0.00000e+00
```

i:
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Ci(t)
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Analysis of 2-pt results

An illustration:

- Step 4: plot your results, for an example:
- Step 5: Sometimes Ci(t)<0, what to do?

  Jacknife Resampling

  (to be discussed later)