Check File Structure

General discussion

This check file contains all kinds of information depending on the print command used in the optns file. The general syntax is

```
print name number
```

which writes output from the module "*name*" using print level "*number*". The higher the number the more detailed is the output. This is essentially a tool for developers. However, the command

```
print * 2
```

may be useful for the "normal user". Here one produces several lists of partices (including their parent-children relations), at different stages of the simulation. The structure of the file is as follows

```
############ start event number 1 ############
.....
############ list before fragmentation ##########
...
############ list after fragmentation ##########
...
############ final decay ##################
...
############ list after bjinta ###############
...
############ start event number 2 ############
.....
```

where "..." refers to the particle list at that stage. A particle list contains the particles with one line per particle, with several columns, the most important ones being (these are actually the first 12 columns):

```
ior     - index of first parent of particle i
jor     - index of last parent of particle i
i       - index of particle
ifr1    - index of first child
ifr2    - index of last child
id      - particle id (EPOS code)
ist     - particle status
ity     - particle type of origin
pt      - particle transverse momentum
m       - particle mass
E       - particle energy
y       - particle rapidity
```

Concerning the particle id, we have

```
1 to 6        - quarks
-6 to -1      - antiquarks
    9         - gluons
3 digits      - mesons
4 digits      - baryons
```

The file **src/KWt/idt.dt** contains the EPOS particle id codes.

Concerning the particle status ist, we have

```
   20,21      - parton
    29        - string
     0        - last generation hadron
     1        - other hadron
```

A complete list of particle status values can be found in the file **src/KWt/istat.dt**.

Example 1 (electron-positron)

In the following we show an example for electron-positron annihilation.
For simplicity we only show the first 9 columns.

The first table (before fragmentation) showns the intial particles (electron, id=12 and positron, id=-12), the photon (id=10) produced from $e^+ + e^- \to \gamma$, and then the produced chain of partons from $\gamma \to s + \bar{s} \to s + g + g + \bar{s}$ with a strange quark (id=3) and a strange antiquark (id=-3) as well as two gluons (id=9).

```
##################################################################
############  list before fragmentation  #########################
##################################################################
ior jor i ifr1 ifr2 id ist ity   pt
------------------------------------------------------------------
 0   0  1  0    0   12  1   0  0.000E+00
 0   0  2  0    0  -12  1   0  0.000E+00
 1   2  3  4    7   10  1   0  0.000E+00
 3   3  4  0    0    3 20  30  0.109E+01
 3   3  5  0    0    9 20  30  0.778E+00
 3   3  6  0    0    9 20  30  0.446E+00
 3  -3  7  0    0   -3 20  30  0.000E+00
```

Next we look at the list after fragmentation. In our example, the chain of 4 partons $s - g - g - \bar{s}$ represents a kinky string, which decays into hadrons. In the list, one first maps the chain of partons to a string, with i=8, and with status ist=29 (=string). The string entry is only for bookkeeping, the properties of the string are known via the parent indices ior and jor, which allow to trace back to the partons which constitute the string.

```
##############################################################
##############  list after fragmentation  ####################
##############################################################
ior jor  i ifr1 ifr2     id     ist ity     pt
--------------------------------------------------------------
 4   7   8  9    22  800100010   29  30  0.225E-03
 8   0   9  0     0      -130     0  30  0.213E+00
 8   0  10  0     0       110     0  30  0.116E+00
 8   0  11  0     0       110     0  30  0.874E+00
 8   0  12  0     0       111     0  30  0.730E+00
 8   0  13  0     0       121     0  30  0.687E+00
 8   0  14  0     0       111     0  30  0.519E+00
 8   0  15  0     0       231     0  30  0.370E+00
 8   0  16  0     0      -231     0  30  0.210E-01
 8   0  17  0     0      2130     0  30  0.780E+00
 8   0  18  0     0     -1231     0  30  0.635E+00
 8   0  19  0     0      -120     0  30  0.162E+00
 8   0  20  0     0       120     0  30  0.215E+00
 8   0  21  0     0       230     0  30  0.672E+00
 8   0  22  0     0       330     0  30  0.389E+00
```

Directly following the string i=8, we see the string decay products, with i from9 to 22. All these particles have mother index 8 (the string) and status 0, because they are (at this moment) last generation. The resonances did not decay yet.

In the list, we see several resonances, which will finally decay:

```
i=12, id=111,   name=rho0
i=13, id=121,   name=rho+
i=14, id=111,   name=rho0
i=15, id=231,   name=K*0
i=16, id=-231,  name=K*0b
i=17, id=2130,  name=Lambda
i=18, id=-1231, name=Sigma*0
i=21, id=230,   name=K0
i=22, id=330,   name=eta'
```

The decay products will be seen in the following list, where the father index ior (the leftmost number) allows to identify the decaying particle.

```
#################################################################
############## final decay ######################################
#################################################################
 12  0  23  0  0   -120    0   30  0.880E+00
 12  0  24  0  0    120    0   30  0.337E+00
 13  0  25  0  0    120    0   30  0.328E+00
 13  0  26  0  0    110    0   30  0.447E+00
 14  0  27  0  0   -120    0   30  0.359E+00
 14  0  28  0  0    120    0   30  0.334E+00
 15  0  29  0  0   -120    0   30  0.193E+00
 15  0  30  0  0    130    0   30  0.508E+00
 16  0  31  0  0    120    0   30  0.268E+00
 16  0  32  0  0   -130    0   30  0.284E+00
 17  0  33  0  0   -120    0   30  0.231E+00
 17  0  34  0  0   1120    0   30  0.552E+00
 18  0  35  0  0  -2130    0   30  0.391E+00
 18  0  36  0  0    110    0   30  0.264E+00
 21  0  37  0  0    -20    0   30  0.672E+00
 22  0  38  0  0   -120    0   30  0.108E+00
 22  0  39  0  0    120    0   30  0.118E+00
 22  0  40  0  0    220    0   30  0.205E+00
 35  0  41  0  0    120    0   30  0.562E-01
 35  0  42  0  0  -1120    0   30  0.399E+00
```

We also see a decay of a decay product: particles 41 and 42 are decay products of 35, which is already decay product of 18. In principle we are done, particle production is finished, but it is nevertheless useful to consider one more list, namely the full list at the end with the complete parent-children relations for all particles. This is provided in the following list.

```
#################################################################
############  list after bjinta  ##############################
#################################################################
 ior jor  i ifr1 ifr2  id    ist  ity    pt
 ----------------------------------------------------------------
  0  0   1   0    0    12      1   0   0.000E+00
  0  0   2   0    0   -12      1   0   0.000E+00
  1  2   3   4    7    10      1   0   0.000E+00
  3  3   4   8    0     3     21  30   0.109E+01
  3  3   5   8    0     9     21  30   0.779E+00
  3  3   6   8    0     9     21  30   0.446E+00
  3 -3   7   8    0    -3     21  30   0.247E-04
  4  7   8   9   22 800100010 29  30   0.225E-03
  8  0   9   0    0  -130      0  30   0.213E+00
  8  0  10   0    0   110      0  30   0.116E+00
  8  0  11   0    0   110      0  30   0.874E+00
  8  0  12  23   24   111      1  30   0.730E+00
  8  0  13  25   26   121      1  30   0.687E+00
  8  0  14  27   28   111      1  30   0.519E+00
  8  0  15  29   30   231      1  30   0.370E+00
  8  0  16  31   32  -231      1  30   0.210E-01
  8  0  17  33   34  2130      1  30   0.780E+00
  8  0  18  35   36 -1231      1  30   0.635E+00
  8  0  19   0    0  -120      0  30   0.162E+00
  8  0  20   0    0   120      0  30   0.215E+00
  8  0  21  37   37   230      1  30   0.672E+00
  8  0  22  38   40   330      1  30   0.389E+00
 12  0  23   0    0  -120      0  30   0.880E+00
 12  0  24   0    0   120      0  30   0.337E+00
 13  0  25   0    0   120      0  30   0.328E+00
 13  0  26   0    0   110      0  30   0.447E+00
 14  0  27   0    0  -120      0  30   0.359E+00
 14  0  28   0    0   120      0  30   0.334E+00
 15  0  29   0    0  -120      0  30   0.193E+00
 15  0  30   0    0   130      0  30   0.508E+00
 16  0  31   0    0   120      0  30   0.268E+00
 16  0  32   0    0  -130      0  30   0.284E+00
 17  0  33   0    0  -120      0  30   0.231E+00
 17  0  34   0    0  1120      0  30   0.552E+00
```

```
  18   0   35   41    42 -2130       1   30    0.391E+00
  18   0   36    0     0   110       0   30    0.264E+00
  21   0   37    0     0   -20       0   30    0.672E+00
  22   0   38    0     0  -120       0   30    0.108E+00
  22   0   39    0     0   120       0   30    0.118E+00
  22   0   40    0     0   220       0   30    0.205E+00
  35   0   41    0     0   120       0   30    0.562E-01
  35   0   42    0     0 -1120       0   30    0.399E+00
```

Example 2 (proton-proton)

In the following, we show an example for proton-proton scattering.
For simplicity we only show the first 9 columns.

The first table (before fragmentation) shows the intial particles (protons, id=1120), then an invalid Pomeron (ist=32), not considered, insufficient energy, then a valid Pomeron (ist=31), which decays into objects with indices 126 to 136. The latter are chains of final state timelike (TL) partons (as explained earlier in the electron-positron example). The partons carry ist=20, in the final list shown later they have ist=21. All partons point back (via ior) to the Pomeron they are originating from. Just before the chains of partons one finds two entries with ist=25, referring to the first two partons directly produced from the Born process. The ist=25 partons are put into the list as additional information, however without parent/children relations.

Finally we see in the list the projectile and target remnant (ist=41), each one "decaying" into a string, given in terms of a parton chain composed of two soft partons.

We do not show the complete list, "..." refers to entries not being printed.

```
#####################################################################
############  list before fragmentation  ###########################
#####################################################################
     ior     jor      i     ifr1    ifr2       id  ist  ity     pt
---------------------------------------------------------------------
      -1       0       1       0       0      1120   1   0   0.000E+00
      -1       0       2       0       0      1120   1   0   0.000E+00
       1       2       3       0       0  -1000099  32  20   0.000E+00
       1       2      16     126     136   3111199  31  31   0.136E+01
...
       0       1     124       0       0         9  25  30   0.357E+01
       0       1     125       0       0         9  25  30   0.301E+01
      16       8     126       0       0        -2  20  30   0.113E+01
      16       9     127       1       0         9  20  39   0.223E+01
      16       7     128       0       0         1  20  30   0.231E+01
      16       8     129       0       0         3  20  30   0.525E+00
      16      -9     130      12       0         9  20  31   0.229E+01
      16      -9     131      12       0         9  20  31   0.107E+01
      16      -9     132      11       0        -1  20  31   0.837E+00
      16       7     133       0       0        -1  20  30   0.301E+01
      16      -9     134      11       0         9  20  31   0.337E+00
      16      -9     135      11       0         9  20  31   0.830E-01
      16      -9     136      11       0         1  20  31   0.210E+01
       1       0     137     139     140    112099  41  40   0.307E+01
       2       0     138     141     142    112099  41  50   0.109E+01
     137       0     139       0       0      1100  20  42   0.321E+01
     137       0     140       0       0         2  20  42   0.181E+00
     138       0     141       0       0      1200  20  52   0.941E+00
     138       0     142       0       0         1  20  52   0.245E+00
```

Attention: The values for jor and ifr1 for partons (ist=20) have a special meaning, mainly information for the developers, just ignore them.

Next we look at the list after fragmentation.

One first maps the chain of partons to a string, with status ist=29 (=string). The string entry is only for bookkeeping, the properties of the string are known via the parent indices ior and jor, which allow to trace back to the partons which constitute the string.

```
###############################################################
##############  list after fragmentation  #####################
###############################################################
    ior    jor     i    ifr1   ifr2       id ist ity    pt
---------------------------------------------------------------
    126    128    379    380    395 810000100 29 31  0.353E+01
    379      0    380      0      0       120  0 31  0.663E+00
    379      0    381      0      0       110  0 31  0.342E+00
    379      0    382      0      0       221  0 31  0.170E+00
    379      0    383      0      0      -120  0 31  0.260E+00
    379      0    384      0      0       120  0 31  0.581E+00
    379      0    385      0      0      -121  0 31  0.257E+00
    379      0    386      0      0       221  0 31  0.189E+00
    379      0    387      0      0      -231  0 31  0.457E+00
    379      0    388      0      0       231  0 31  0.533E+00
    379      0    389      0      0       120  0 31  0.235E+00
    379      0    390      0      0     -1121  0 31  0.948E+00
    379      0    391      0      0      1120  0 31  0.107E+01
    379      0    392      0      0       110  0 31  0.515E+00
    379      0    393      0      0     -1220  0 31  0.292E+00
    379      0    394      0      0      2223  0 31  0.149E+01
    379      0    395      0      0       120  0 31  0.127E+01
    129    132    396    397    405 800101000 29 30  0.316E+01
    396      0    397      0      0      -130  0 30  0.460E+00
    396      0    398      0      0       121  0 30  0.116E+01
    396      0    399      0      0       221  0 30  0.685E+00
    396      0    400      0      0      -120  0 30  0.362E+00
    396      0    401      0      0       111  0 30  0.111E+01
    396      0    402      0      0       121  0 30  0.812E+00
    396      0    403      0      0      -121  0 30  0.239E+00
    396      0    404      0      0       120  0 30  0.345E+00
    396      0    405      0      0      -120  0 30  0.790E+00
    133    136    406    407    410 810001000 29 30  0.367E+01
    406      0    407      0      0      -130  0 30  0.233E+01
    406      0    408      0      0     -1135  0 30  0.961E+00
    406      0    409      0      0      2115  0 30  0.178E+01
    406      0    410      0      0       121  0 30  0.557E+00
    139    140    411    412    415 821000000 29 42  0.307E+01
    411      0    412      0      0      2115  0 42  0.219E+01
    411      0    413      0      0       120  0 42  0.584E+00
    411      0    414      0      0       111  0 42  0.567E+00
    411      0    415      0      0      -120  0 42  0.376E+00
    141    142    416    417    422 821000000 29 52  0.109E+01
    416      0    417      0      0      1120  0 52  0.884E-01
    416      0    418      0      0       110  0 52  0.585E+00
    416      0    419      0      0      -120  0 52  0.623E+00
    416      0    420      0      0       220  0 52  0.100E+01
    416      0    421      0      0       111  0 52  0.675E+00
    416      0    422      0      0       120  0 52  0.128E+00
```

Directly following the string (i=379 for the first one considered), we see the string decay products.

All these particles have mother index 379 (the string) and status 0, because they are (at this moment) last generation hadrons. The resonances did not decay yet.

In the previous list, we have seen several resonances, which will finally decay.

The decay products are shown in the following list, where the father index ior (the leftmost number) allows to identify the decaying particle.

```
##################################################################
############## final decay #######################################
##################################################################
     ior    jor      i    ifr1   ifr2      id ist ity    pt
------------------------------------------------------------------
    382      0    680      0      0      -120  0 31  0.390E+00
    382      0    681      0      0       120  0 31  0.224E+00
    385      0    682      0      0      -120  0 31  0.386E+00
    385      0    683      0      0       110  0 31  0.405E+00
    386      0    684      0      0      -120  0 31  0.155E+00
    386      0    685      0      0       110  0 31  0.203E-01
    386      0    686      0      0       120  0 31  0.340E+00
    387      0    687      0      0      -230  0 31  0.338E+00
    387      0    688      0      0       110  0 31  0.353E+00
    388      0    689      0      0       230  0 31  0.495E+00
    388      0    690      0      0       110  0 31  0.150E+00
    390      0    691      0      0     -1220  0 31  0.988E+00
    390      0    692      0      0      -120  0 31  0.126E+00
    394      0    693      0      0      2221  0 31  0.154E+01
    394      0    694      0      0       110  0 31  0.642E-01
    398      0    695      0      0       120  0 30  0.328E+00
    398      0    696      0      0       110  0 30  0.838E+00
    399      0    697      0      0      -120  0 30  0.750E-01
    399      0    698      0      0       110  0 30  0.221E+00
    399      0    699      0      0       120  0 30  0.429E+00
    401      0    700      0      0      -120  0 30  0.101E+01
    401      0    701      0      0       120  0 30  0.193E+00
    402      0    702      0      0       120  0 30  0.775E+00
    402      0    703      0      0       110  0 30  0.276E+00
    403      0    704      0      0      -120  0 30  0.121E+00
    403      0    705      0      0       110  0 30  0.182E+00
    408      0    706      0      0     -1234  0 30  0.996E+00
    408      0    707      0      0      -120  0 30  0.144E+00
    409      0    708      0      0       121  0 30  0.119E+01
    409      0    709      0      0      1220  0 30  0.654E+00
    410      0    710      0      0       120  0 30  0.517E+00
    410      0    711      0      0       110  0 30  0.347E+00
    412      0    712      0      0       121  0 42  0.929E+00
    412      0    713      0      0      1220  0 42  0.131E+01
    414      0    714      0      0      -120  0 42  0.159E+00
    414      0    715      0      0       120  0 42  0.610E+00
    420      0    716      0      0        10  0 52  0.859E+00
    420      0    717      0      0        10  0 52  0.142E+00
    421      0    718      0      0      -120  0 52  0.147E+00
    421      0    719      0      0       120  0 52  0.628E+00
...
```

The list is not complete, there are also decays of decay products. In principle we are done, particle production is finished. It is nevertheless useful to consider one more list, namely the full final list at the end with the complete parent-children relations for all particles. This is provided in the following list.

```
##################################################################
############  list after bjinta  ##############################
##################################################################
     ior    jor      i    ifr1   ifr2      id ist ity    pt
------------------------------------------------------------------
     -1      0      1      0      0      1120  1  0  0.000E+00
     -1      0      2      0      0      1120  1  0  0.000E+00
      1      2      3      0      0  -1000099 32 20  0.000E+00
...
      1      2     16    126    136   3111199 31 31  0.136E+01
...
```

0	1	124	0	0	9	25	30	0.357E+01
0	1	125	0	0	9	25	30	0.301E+01
16	8	126	379	0	-2	21	30	0.113E+01
16	9	127	379	0	9	21	39	0.223E+01
16	7	128	379	0	1	21	30	0.231E+01
16	8	129	396	0	3	21	30	0.525E+00
16	-9	130	396	0	9	21	31	0.229E+01
16	-9	131	396	0	9	21	31	0.107E+01
16	-9	132	396	0	-1	21	31	0.837E+00
16	7	133	406	0	-1	21	30	0.301E+01
16	-9	134	406	0	9	21	31	0.337E+00
16	-9	135	406	0	9	21	31	0.830E-01
16	-9	136	406	0	1	21	31	0.210E+01
1	0	137	139	140	112099	41	40	0.307E+01
2	0	138	141	142	112099	41	50	0.109E+01
137	0	139	411	0	1100	21	42	0.321E+01
137	0	140	411	0	2	21	42	0.181E+00
138	0	141	416	0	1200	21	52	0.941E+00
138	0	142	416	0	1	21	52	0.245E+00

...

126	128	379	380	395	810000100	29	31	0.353E+01
379	0	380	0	0	120	0	31	0.663E+00
379	0	381	0	0	110	0	31	0.342E+00
379	0	382	680	681	221	1	31	0.170E+00
379	0	383	0	0	-120	0	31	0.260E+00
379	0	384	0	0	120	0	31	0.581E+00
379	0	385	682	683	-121	1	31	0.257E+00
379	0	386	684	686	221	1	31	0.189E+00
379	0	387	687	688	-231	1	31	0.457E+00
379	0	388	689	690	231	1	31	0.533E+00
379	0	389	0	0	120	0	31	0.235E+00
379	0	390	691	692	-1121	1	31	0.948E+00
379	0	391	0	0	1120	0	31	0.107E+01
379	0	392	0	0	110	0	31	0.515E+00
379	0	393	0	0	-1220	0	31	0.292E+00
379	0	394	693	694	2223	1	31	0.149E+01
379	0	395	0	0	120	0	31	0.127E+01
129	132	396	397	405	800101000	29	30	0.316E+01
396	0	397	0	0	-130	0	30	0.460E+00
396	0	398	695	696	121	1	30	0.116E+01
396	0	399	697	699	221	1	30	0.685E+00
396	0	400	0	0	-120	0	30	0.362E+00
396	0	401	700	701	111	1	30	0.111E+01
396	0	402	702	703	121	1	30	0.812E+00
396	0	403	704	705	-121	1	30	0.239E+00
396	0	404	0	0	120	0	30	0.345E+00
396	0	405	0	0	-120	0	30	0.790E+00
133	136	406	407	410	810001000	29	30	0.367E+01
406	0	407	0	0	-130	0	30	0.233E+01
406	0	408	706	707	-1135	1	30	0.961E+00
406	0	409	708	709	2115	1	30	0.178E+01
406	0	410	710	711	121	1	30	0.557E+00
139	140	411	412	415	821000000	29	42	0.307E+01
411	0	412	712	713	2115	1	42	0.219E+01
411	0	413	0	0	120	0	42	0.584E+00
411	0	414	714	715	111	1	42	0.567E+00
411	0	415	0	0	-120	0	42	0.376E+00
141	142	416	417	422	821000000	29	52	0.109E+01
416	0	417	0	0	1120	0	52	0.884E-01
416	0	418	0	0	110	0	52	0.585E+00
416	0	419	0	0	-120	0	52	0.623E+00
416	0	420	716	717	220	1	52	0.100E+01
416	0	421	718	719	111	1	52	0.675E+00
416	0	422	0	0	120	0	52	0.128E+00

...

In case of pseudosoft Pomerons, a given Pomeron may split into several sub-Pomerons, as shown in the following example.

```
###############################################################
############  list after bjinta  ##############################
###############################################################
     ior     jor      i     ifr1    ifr2       id ist ity     pt
---------------------------------------------------------------
      -1       0      1       0       0       1120   1   0  0.000E+00
      -1       0      2       0       0       1120   1   0  0.000E+00
       1       2      3       0       0   -1000099  32  20  0.000E+00
...
       1       2      4      19      37    3111199  31  30  0.138E+01
...
       0       0     17       0       0          9  25  30  0.373E+01
       0       0     18       0       0          9  25  30  0.103E+01
       4       8     19     143       0         -2  21  30  0.352E+01
       4      -9     20     143       0          9  21  31  0.566E+00
       4      -9     21     143       0          9  21  31  0.155E+01
       4      -9     22     143       0          9  21  31  0.253E+01
       4      -9     23     143       0          9  21  31  0.108E+01
       4       7     24     143       0          2  21  30  0.202E+01
       4       8     25     155       0          1  21  30  0.710E+00
       4       7     26     155       0         -2  21  30  0.243E+01
       0       0     27       0       0          9  25  30  0.952E+00
       0       0     28       0       0          9  25  30  0.731E+01
       4       7     29     160       0         -2  21  30  0.114E+01
       4      -9     30     160       0          1  21  31  0.557E+01
       4       7     31     168       0          2  21  30  0.242E+01
       4      -9     32     168       0          9  21  31  0.860E+00
       4      -9     33     168       0          9  21  31  0.627E+00
       4      -9     34     168       0          9  21  31  0.478E+00
       4       8     35     168       0         -3  21  30  0.232E+01
       4       8     36     178       0          3  21  30  0.176E+01
       4      -9     37     178       0         -1  21  31  0.127E+01
```

There is only one Pomeron entry (here i=4), but there are two pairs of ist=25 partons (i=17-18 and i=27-28), followed in each case by a list of ist=21 partons. So one has two sub-Pomerons.