Progress in the PHQMD model simultions for a big production

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MPD PWG2 meeting
2020-08-12

1 - JINR, Dubna, Russia

Available data sets

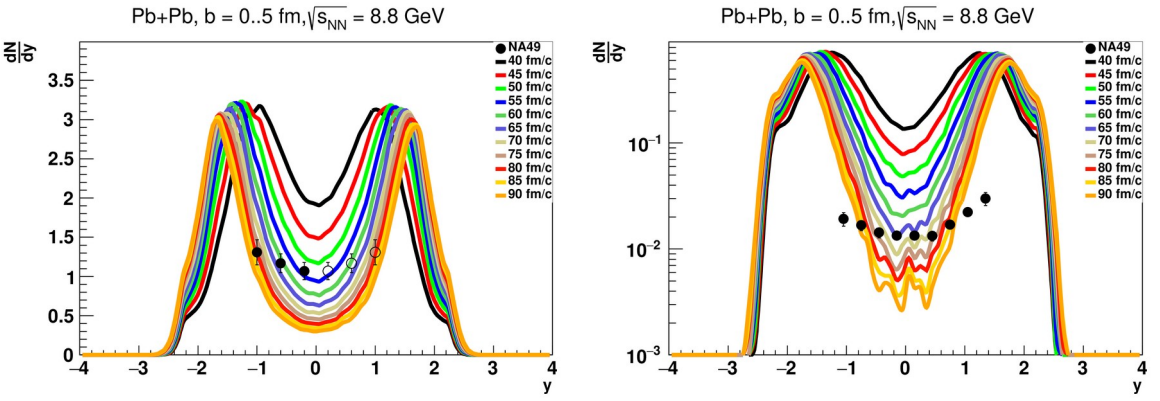
MPD:
Pb+Pb @ $\sqrt{s_{NN}}$ = 8.8 GeV, b = 0..5 fm, MST radius = 4 fm, time = 60 fm/c, 1M events
~ 43 GB of the gzipped data.

BM@N:
Au+Au @ Tkin = 4.0 A GeV, b = 0..5 fm, MST radius = 2.5 fm, time = 30 fm/c, 1M events
~ 18 GB of the gzipped data

Ongoing simulations

Bi+Bi @ $\sqrt{s_{NN}}$ = 8.8 GeV, b = 0..16 fm, MST radius = 4 fm, clusterization time = 65 fm/c

200k events ≈ 3,5 hours
1M ≈ 18 hours
10M ≈ 1 week of *continuous simulations* and about **0.5 TB of the gzipped data.**



Hypernuclei multiplicity / event

Pb+Pb @ $\sqrt{s_{NN}}$ = 8.8 GeV, central events:

H3L	H4L	He4L	He5L	H4LL	H5LL	He5LL	He6LL
0.3769	0.1155	0.1107	0.0575	0.0179	0.0083	0.0080	0.0054

Bi+Bi @ $\sqrt{s_{NN}}$ = 8.8 GeV, min.bias events (200k analyzed):

H3L	H4L	He4L	He5L	H4LL	H5LL	He5LL	He6LL
0.0612	0.0175	0.0161	0.0079	0.0020	0.0009	0.0008	0.0005

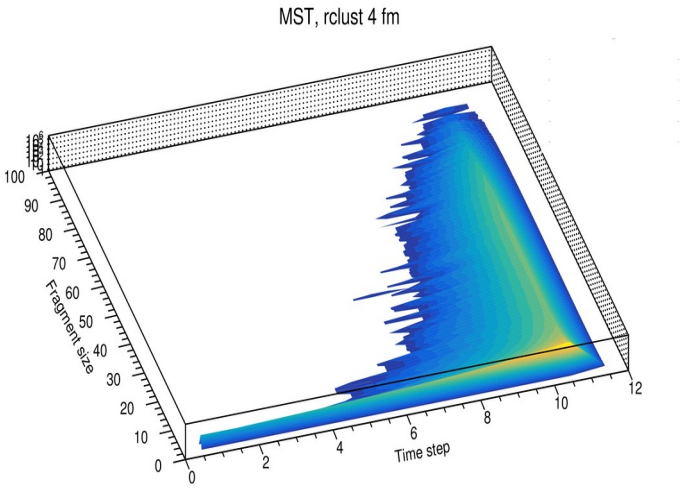
Difference is about one order of magnitude

Hypernuclei multiplicity / event

Au+Au @ Tkin = 4.0 A GeV, central events:

H3l	H4L	He4L	He5L	H4LL	H5LL	He5LL	He6LL
0.1644	0.0575	0.0509	0.0255	0.0016	0.0008	0.0007	0.0004

Some technical stuff



MST produces too many fragments and GEANT does not know them.

It’s possible to choose only “allowed”.

```
AllowedFragments = {2212, 2112, 3122, 3212,
                    1000010020, 1000010030,
                    1000020030, 1000020040,
                    1000030060, 1000030070,
                    1000040090,
                    1010010030, 1010020040,
                    1010010040, 1020010040,
                    1010020050, 1020020050,
                    1020010050, 1020020060};
```

No need to re-generate statistics to add or remove “allowed” clusters.
This procedure can be done fast.

Some technical stuff

https://git.jinr.ru/nica/mpdroot/-/blob/dev/gconfig/UserDecay.C

```
80          p = db->GetParticle("Deuteron");
81          if (p) deut = p->PdgCode();
82          else { deut = 1000010020; db->AddParticle("Deuteron","Deuteron",2*kAu2Gev+8.071e-3,kTRUE,0,3,"Ion",deut); }

87        p = db->GetParticle("Triton");
88        if (p) H3 = p->PdgCode();
89        else { H3 = 1000010030; db->AddParticle("Triton","Triton",3*kAu2Gev+14.931e-3,kFALSE,khShGev/(12.33*kYear2Sec),3,"Ion",H3); }

91        p = db->GetParticle("He4L");
92        if (p) He4L = p->PdgCode();
93        else { He4L = 1010020040; db->AddParticle("He4L","He4L",3.92501,kFALSE,khShGev/(12.33*kYear2Sec),6,"Ion",He4L);
94                gMC->DefineParticle(He4L, "He4L", kPTHadron, 3.92501 , 2.0, 2.632e-10,"Ion", 0.0, 0, 1, 0, 0, 0, 0, 0, 4, kFALSE);}
109         p = db->GetParticle("He3");
110         if (!p) p = db->GetParticle("HE3");
111         if (p) He3 = p->PdgCode();
112         else { He3=1000020030; db->AddParticle("HE3","HE3", 2.80923,kFALSE,0,6,"Ion",He3); }

116       if (He3)
117       {
118               p = db->GetParticle("H3L");
119               if (p) H3L = p->PdgCode();
120               else { H3L = 1010010030; gMC->DefineParticle(H3L, "H3L", kPTHadron, 2.99131 , 1.0, 2.632e-10,"Ion", 0.0, 0, 1, 0, 0, 0, 0, 0, 3, kFALS
```

Summary

1) 10M of Bi+Bi @ $\sqrt{s_{NN}}$ = 8.8 GeV min.bias events will take about 10 days of simulations and about 0.5 TB of the disc space.

2) Set of clusters can be modified.