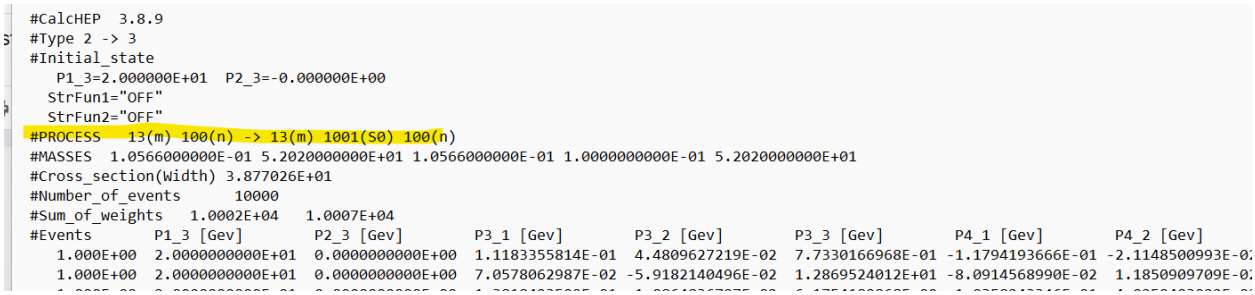
Your process and enumeration: m (1) n (2) -> m (3) S0 (4) n (5)
Note that this is the process without the muon decay. Also note that your enumeration order is slightly different from what my parser is currently set up for. For some reason, my events were enumerated like:
m (1) n (2) -> m (3) n (4) S0 (5), so that affects some of the indexing of my code.
Additionally, my python code decays the mediator in its rest frame to a muon pair and then boosts those muons back to the lab frame.



```
#CalcHEP  3.8.9
#Type 2 -> 3
#Initial_state
   P1_3=2.000000E+01  P2_3=-0.000000E+00
  StrFun1="OFF"
  StrFun2="OFF"
#PROCESS   13(m) 100(n) -> 13(m) 1001(S0) 100(n)
#MASSES  1.0566000000E-01 5.2020000000E+01 1.0566000000E-01 1.0000000000E-01 5.2020000000E+01
#Cross_section(Width) 3.877026E+01
#Number_of_events      10000
#Sum_of_weights   1.0002E+04   1.0007E+04
#Events       P1_3 [Gev]        P2_3 [Gev]        P3_1 [Gev]        P3_2 [Gev]        P3_3 [Gev]        P4_1 [Gev]        P4_2 [Gev]
   1.000E+00  2.0000000000E+01  0.0000000000E+00  1.1183355814E-01  4.4809627219E-02  7.7330166968E-01 -1.1794193666E-01 -2.1148500993E-02
   1.000E+00  2.0000000000E+01  0.0000000000E+00  7.0578062987E-02 -5.9182140496E-02  1.2869524012E+01 -8.0914568990E-02  1.1850909709E-02
```

Header files in the events look like this. P1 corresponds to the incoming muon and P1_3 means it's the 3rd value of particle 1's 3-momentum. So the events look like:
Incoming muon pz, incoming nucleus pz, outgoing muon px, outgoing muon py, outgoing muon pz, etc..
For my parser, I always delete the header files and start reading in the events at the line starting with 1.00 E + 00. This isn't amazing since I hard-code the cross section instead of reading it in from the file, and I plan to fix this sometime soon.

Num of events: 10k events

Nucleus: iron

Mediator mass [GeV]: 0.1, 0.3, 0.5, 0.7, 0.9

| Mass S0 [GeV] | eBeam [GeV] | Cross Section [pb] | Filename |
|---|---|---|---|
| 0.1 | 15 | 34.244 | 15beam0.1mass.txt |
| 0.1 | 20 | 38.770 | 20beam0.1mass.txt |
| 0.3 | 15 | 12.664 | 15beam0.3mass.txt |
| 0.3 | 20 | 15.693 | etc. |
| 0.5 | 15 | 5.9979 | |
| 0.5 | 20 | 8.1359 | |

| | | | |
|---|---|---|---|
| 0.7 | 15 | 2.9329 | |
| 0.7 | 20 | 4.386 | |
| 0.9 | 15 | 1.4305 | |
| 0.9 | 20 | 2.3719 | 20beam0.9mass.txt |

Here are the gS couplings I used from the bottom of the g-2 band for each mediator mass. I.e., for a mass of S0 = 0.1 GeV, gS = 4.49203E-4 etc.

31]:= **ScientificForm[gminS[0.1]]**

]//ScientificForm=

$4.49203 \times 10^{-4}$

32]:= **ScientificForm[gminS[0.3]]**

]//ScientificForm=

$7.48811 \times 10^{-4}$

33]:= **ScientificForm[gminS[0.5]]**

]//ScientificForm=

$1.02159 \times 10^{-3}$

34]:= **ScientificForm[gminS[0.7]]**

]//ScientificForm=

$1.28057 \times 10^{-3}$

35]:= **ScientificForm[gminS[0.9]]**

]//ScientificForm=

$1.53042 \times 10^{-3}$