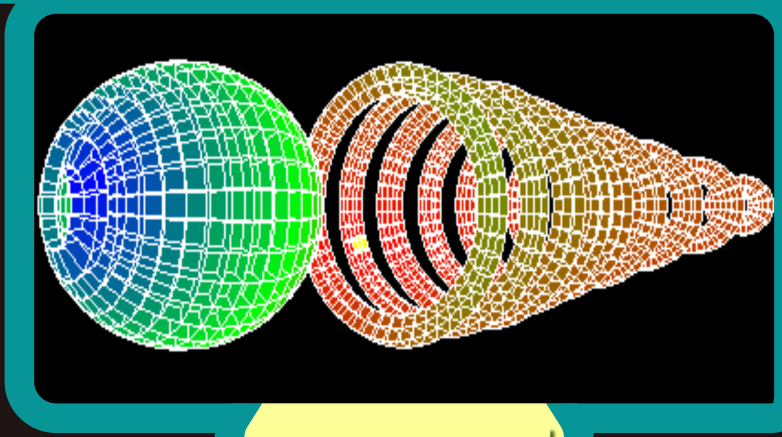
# A general ideal multifragmentation kinematics algorithm for nuclear physics, a binary reaction approach



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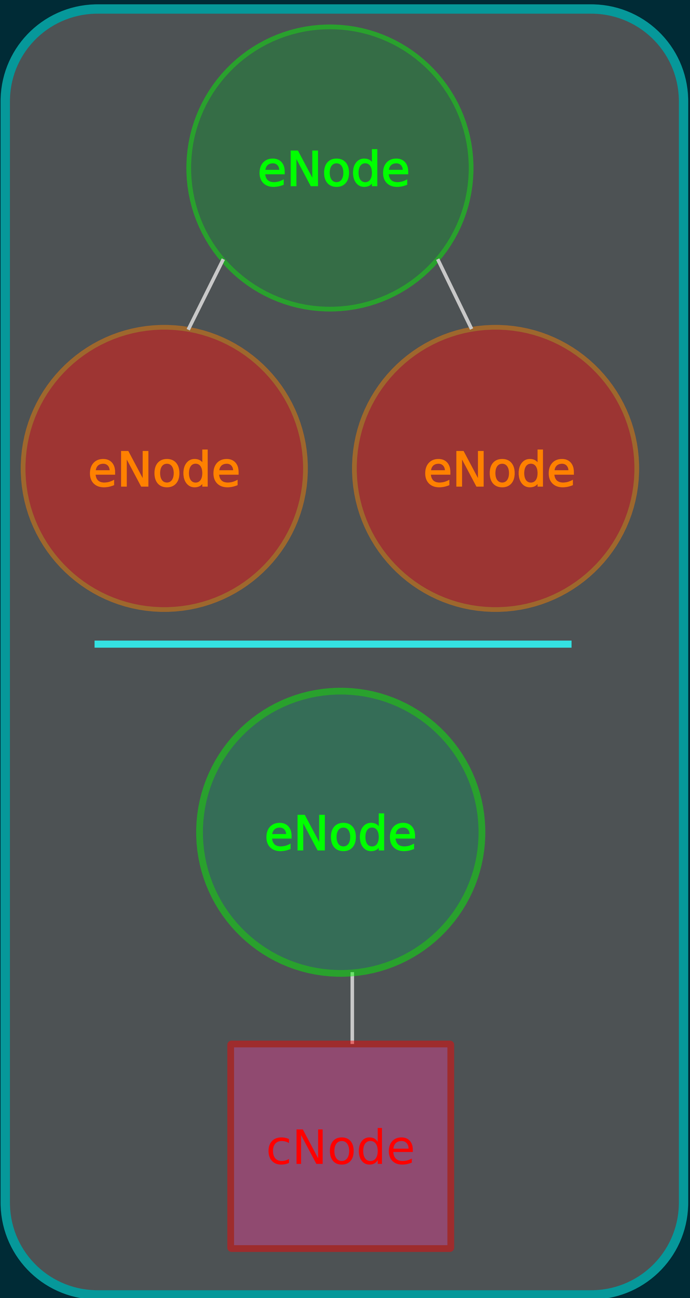
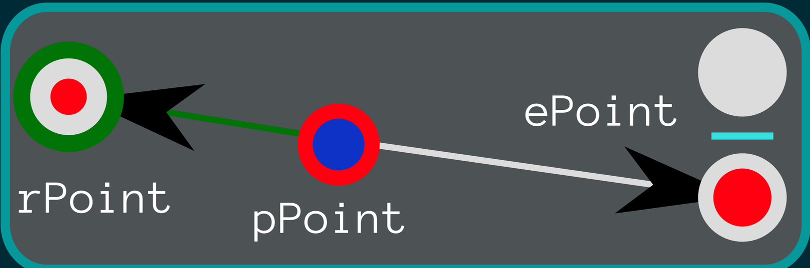
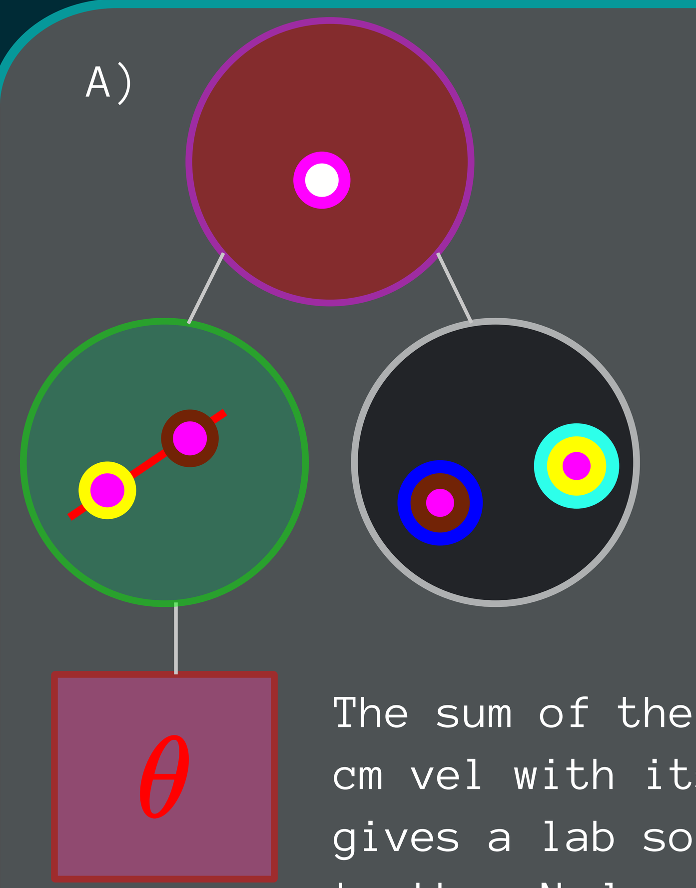



## Introduction:

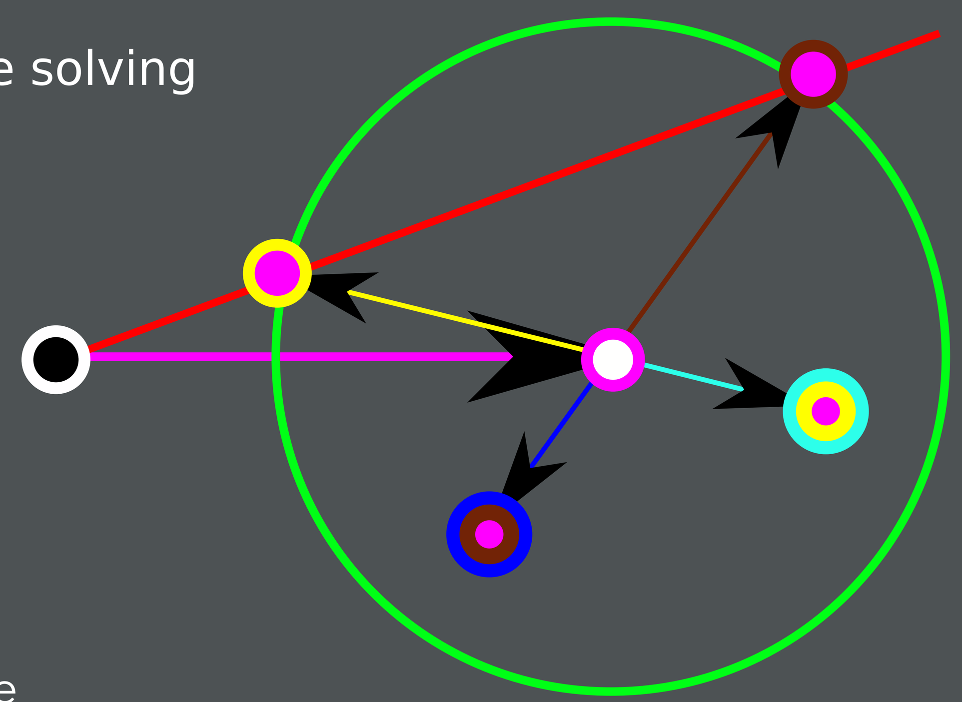
We present a description of the binary reaction tree (BRT). Each node has to be initially filled with the mass and excitation energy of the described particle. Afterwards it can be solved in the center of mass system. The algorithm will assume this step was priorly performed. Prefixes are the first letters of; initial, ejectile, recoil, parent, constricted and final.

A)

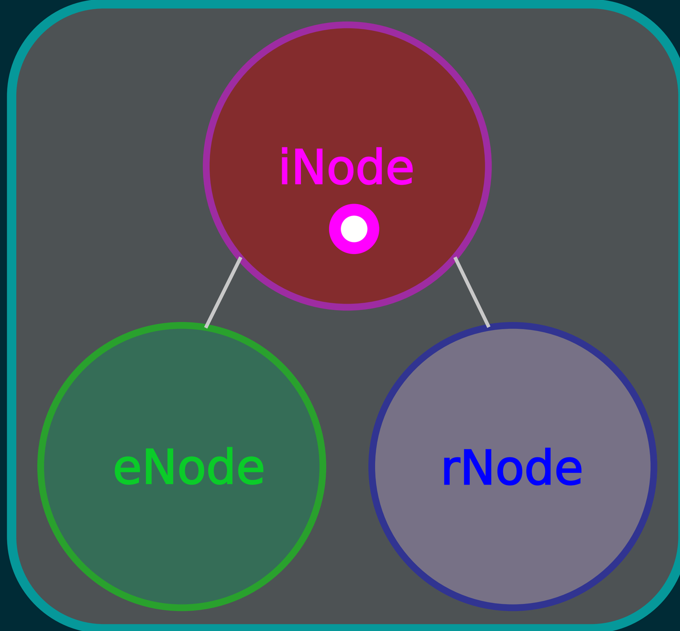


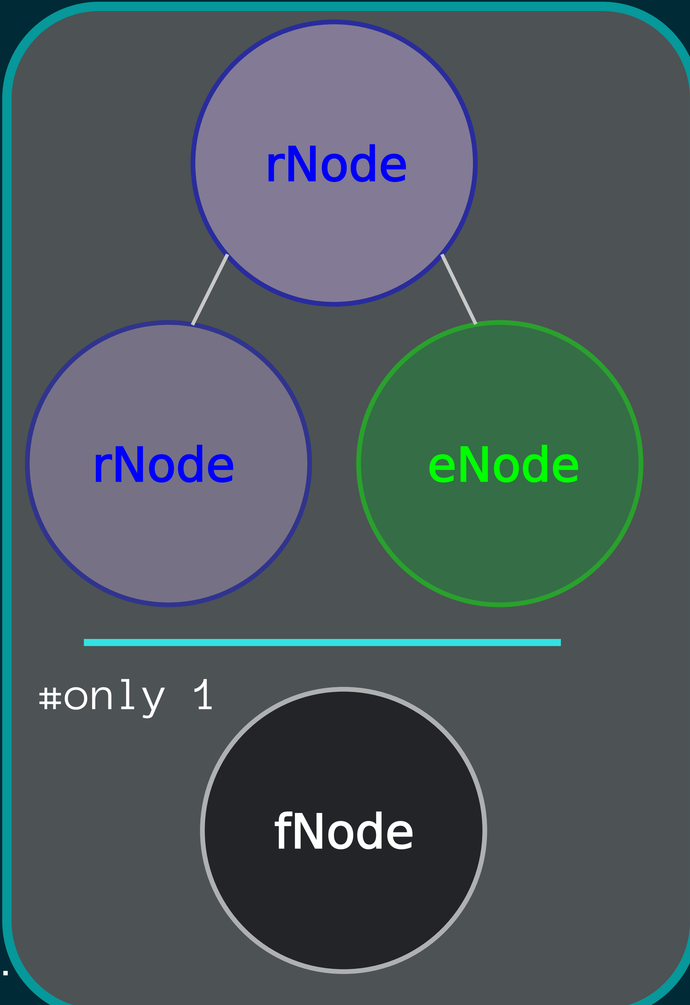

The sum of the rNode cm vel with its parent gives a lab solution to the rNode.

rNode solving



For every solution in the eNode (circle, line intersection), there is a corresponding rNode solution.

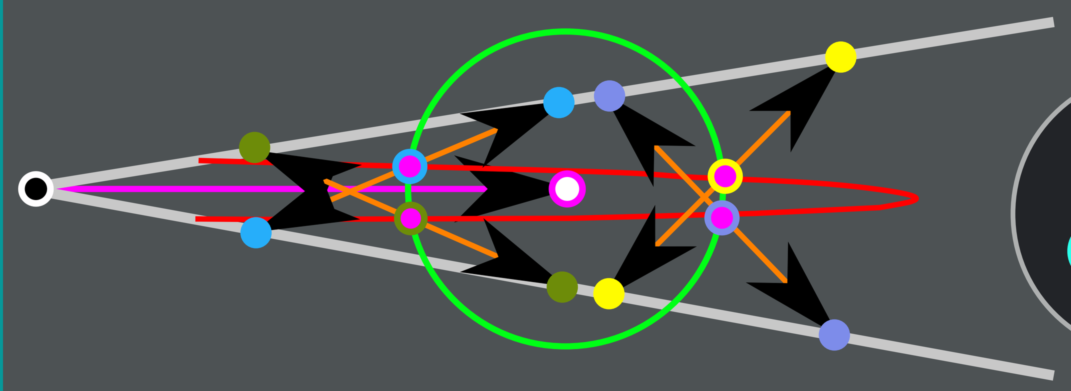


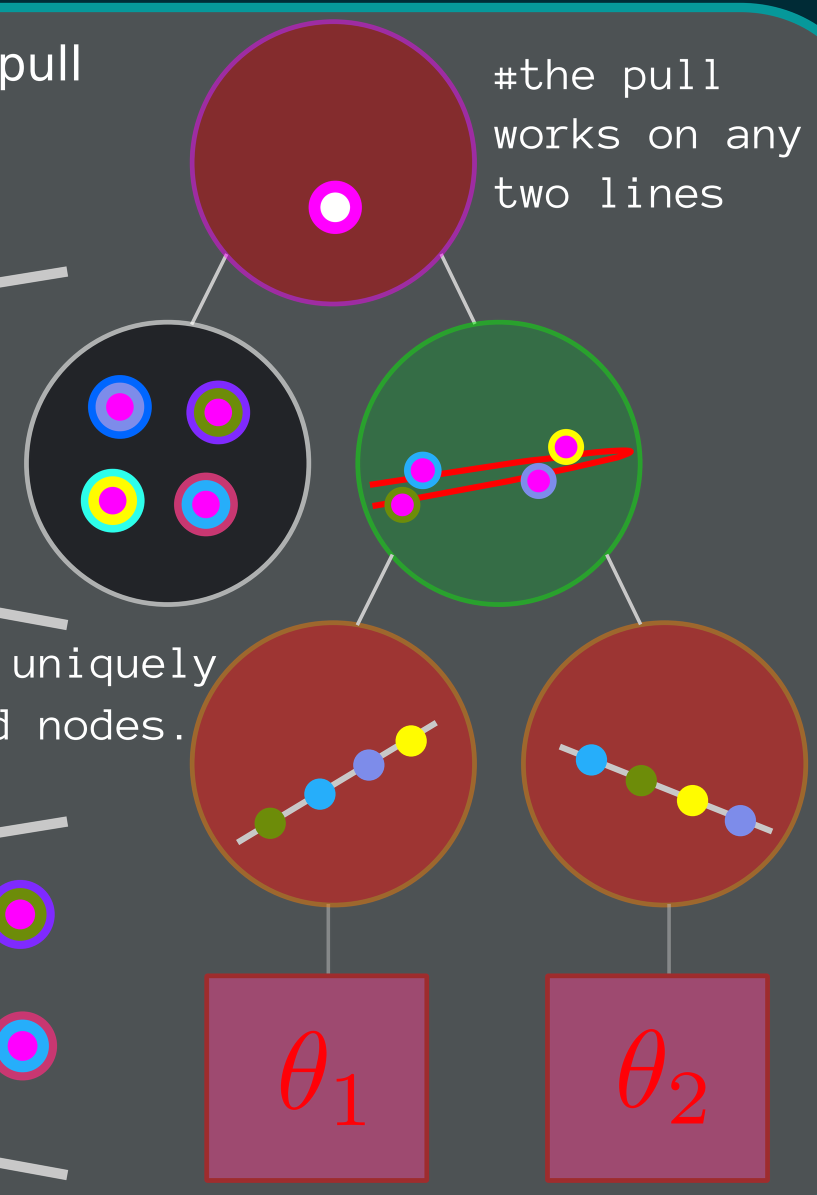

B)

Line pull

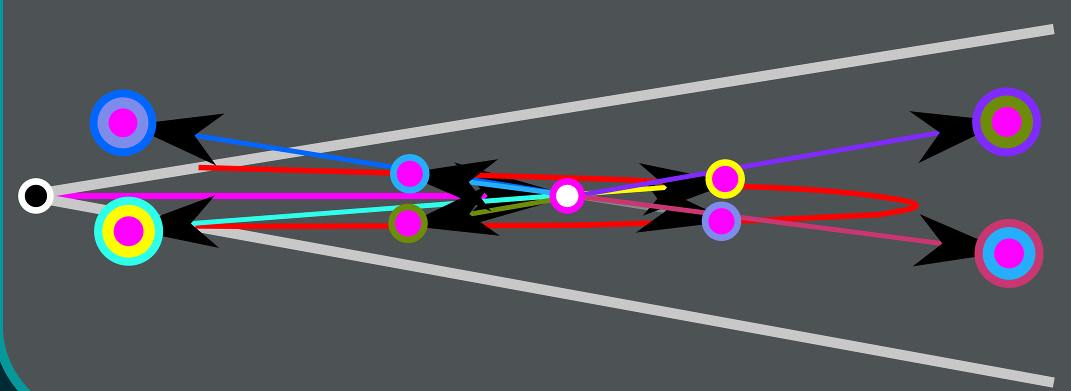
Line pull while standing on the root ejectile node.



#the pull works on any two lines



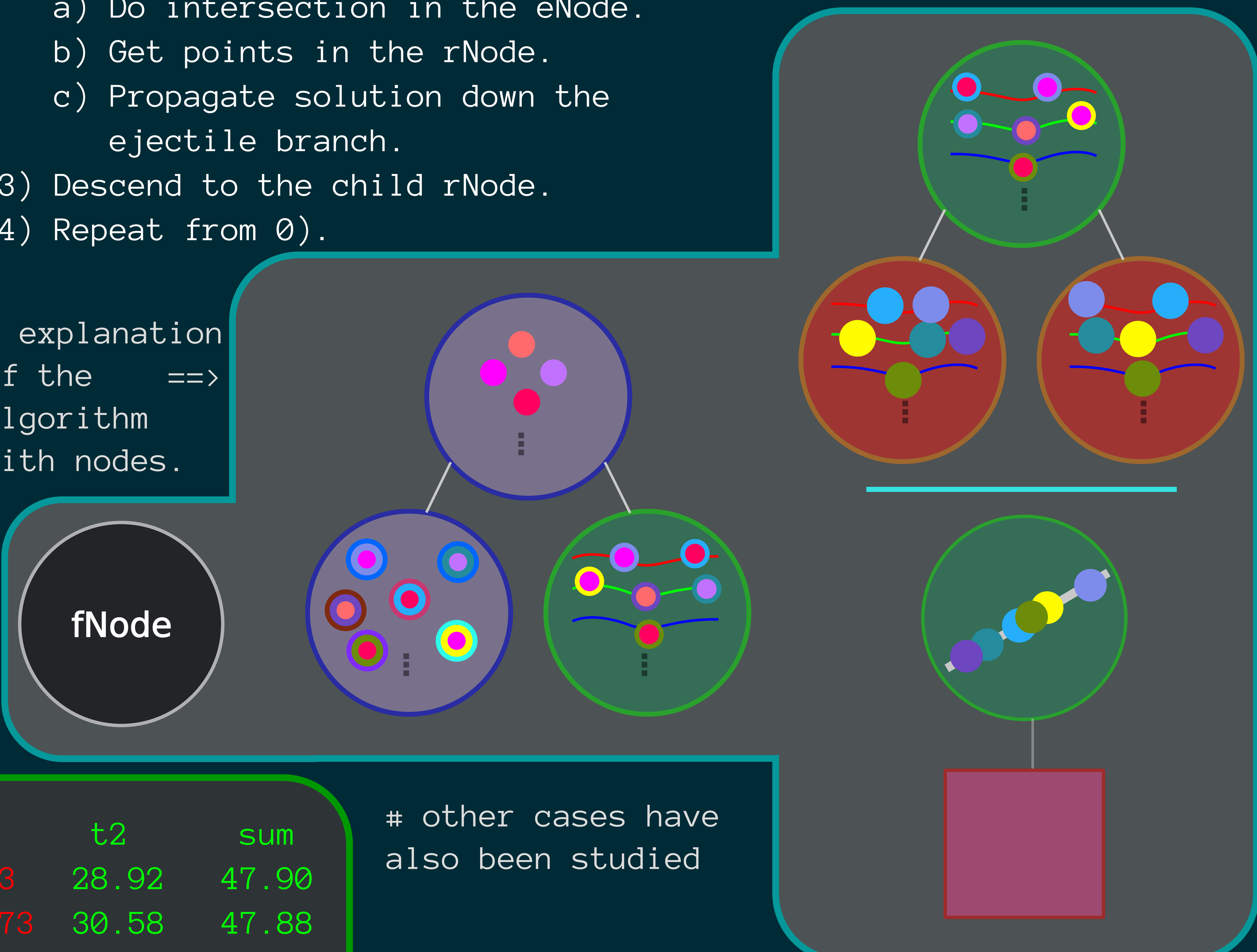

Every point in the pulled line can be uniquely traced back to each of the constricted nodes.



## Algorithm:

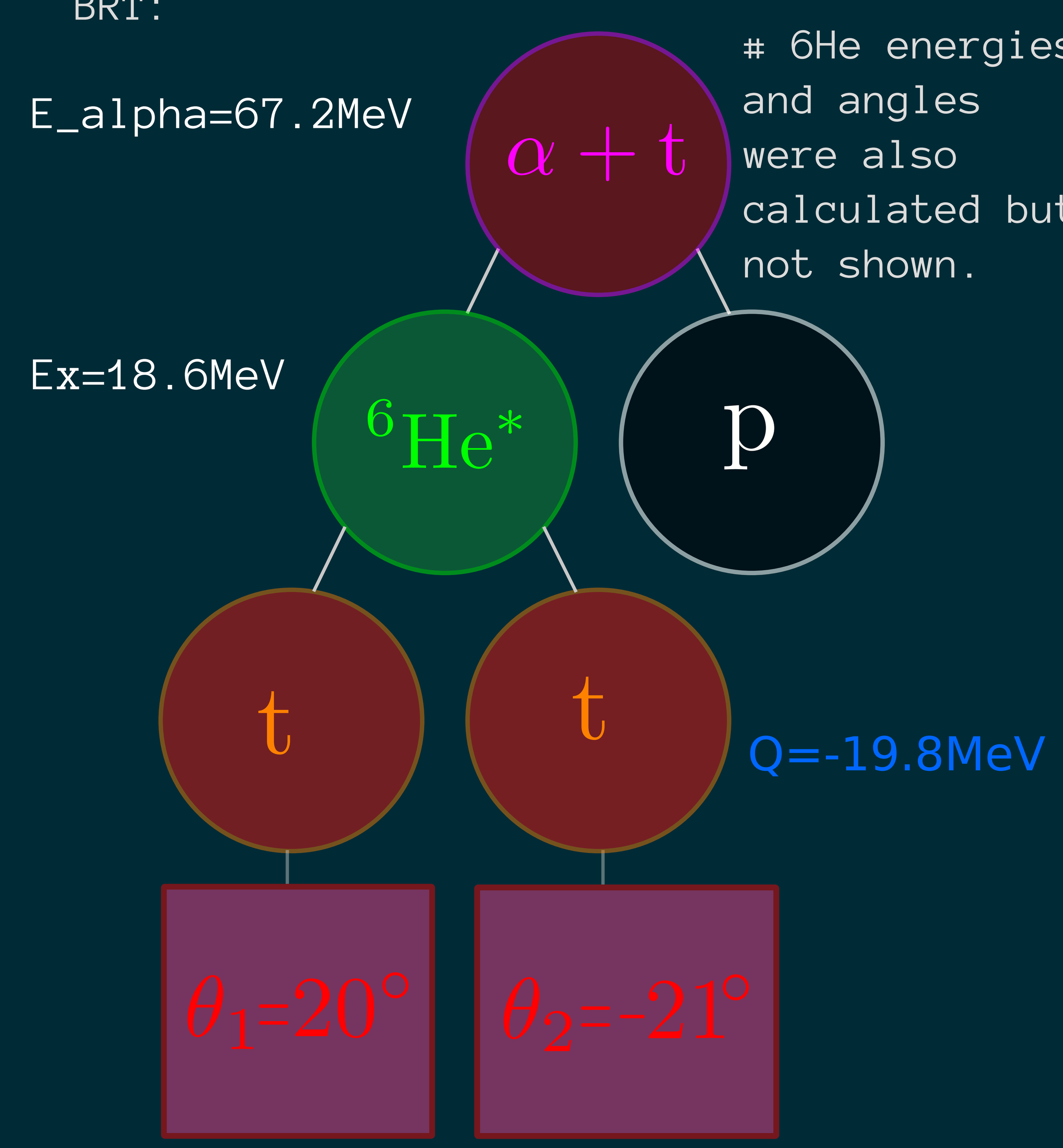
0) If we are @ the fNode we have finished.
1) Pull the lines in the eNode.
2) For every point in the current node:
   a) Do intersection in the eNode.
   b) Get points in the rNode.
   c) Propagate solution down the ejectile branch.
3) Descend to the child rNode.
4) Repeat from 0).

# explanation of the ==> algorithm with nodes.




## Experimental confront:

Reference [1] studies the following BRT:




# 6He energies and angles were also calculated but not shown.

| p angles |
|---|
| -29.30 |
| -40.92 |
| 23.50 |
| 39.12 |

| p | t1 | t2 | sum |
|---|---|---|---|
| 9.44 | 9.53 | 28.92 | 47.90 |
| 3.56 | 13.73 | 30.58 | 47.88 |
| 11.39 | 28.18 | 8.32 | 47.90 |
| 1.93 | 30.86 | 15.07 | 47.88 |

# other cases have also been studied

Table 1: shows the energies [MeV] of the different particles as well as the angles [deg] of the protons.

E_final=E_init+Q=(67.2-19.8)MeV=47.4MeV

Running an example of multifrag-test [2]:

```
$ python helium6Example.py # still BUGGY!!
```

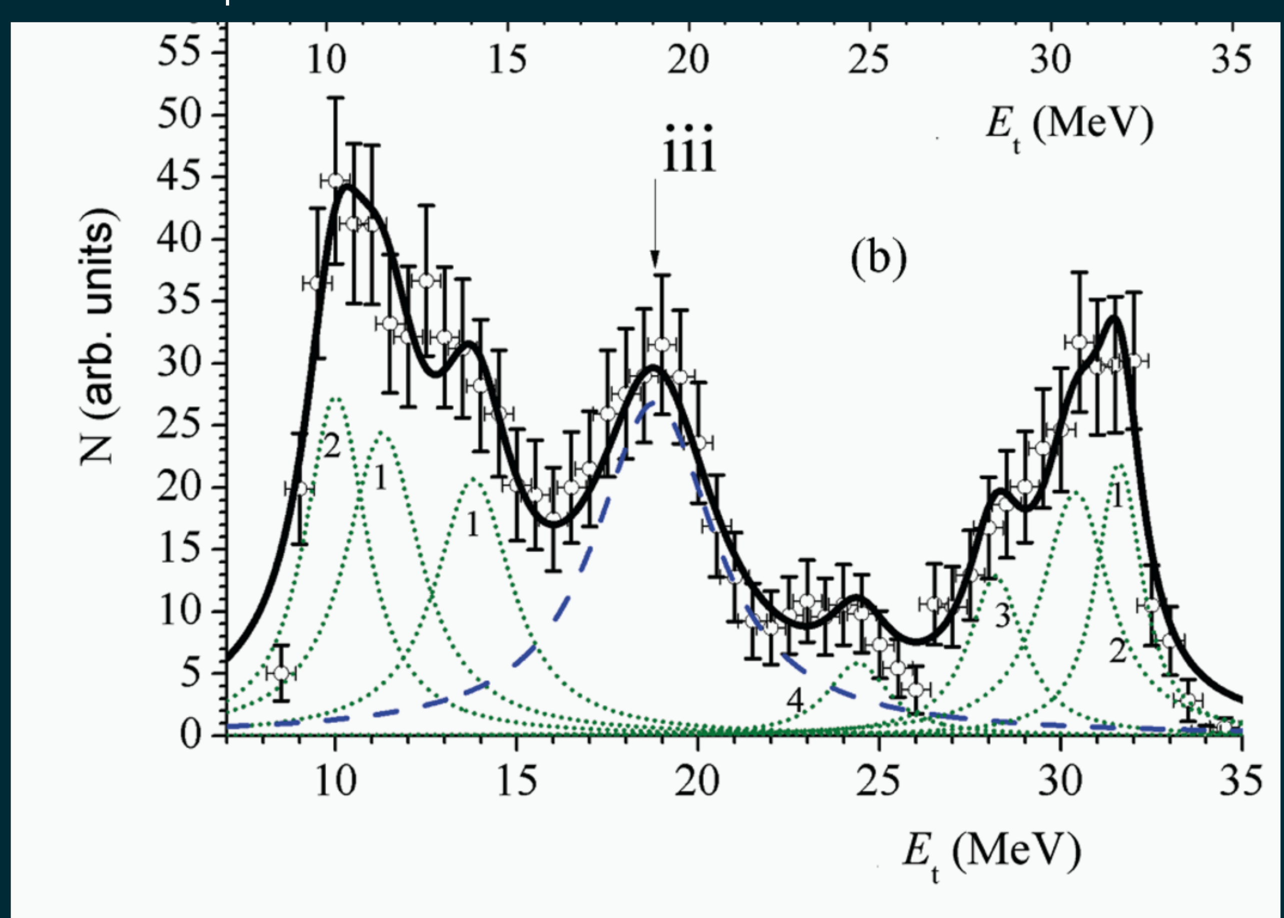



Figure 1 (Fig 4 in [1]): Spectra at theta_1, the values at Table 1 explain 4 of the peaks. The iii (E_t=18.6) peak seems to come from Ex=15.5MeV.

## Conclusions:

It is useful; is simple provides insight and is able to explain at least simple cases. Both qualitatively and quantitatively. Further generalizations can be performed easely using node notation.

## References:


[1] O. Povoroznyk et al.,Physical Review C 85, 064330 (2012).
[2] https://github.com/ffavela/multifrag-test


[1] [2]