

Track3P Sample Outputs

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A Complete Example for multipacting field level scan

h3. 1. the block example for field level scan in the input file:

```
FieldScales:
{
  Type: FieldGradient
  ScanToken: 1 // 1: scan, 0: no scan
  Minimum: 1.44e+6
  Maximum: 1.7e+6
  Interval: 0.010e+06
}
```

h3. 2. Information related all particles with resonant trajectories are in the file ./job/OUTPUT/resonantparticles, the format of resonantparticles shows below:

Field Level Phase	ID RF	X Impact_num	Y	Z	Energy	
16000000	4310	-0.00079	0.100003	-0.00017	10.58931	1.48E-08
19.41	39					
16000000	4310	-0.00079	0.100003	0.000168	10.50246	1.52E-08
19.91	40					
16000000	4440	-0.00079	0.100003	-0.00017	10.58718	1.48E-08
19.41	39					
16000000	4440	-0.00079	0.100003	0.000168	10.50515	1.52E-08
19.91	40					
...						
17000000	4500	-0.00078	0.100008	-0.00017	15.45694	1.48E-08
19.39	39					
17000000	4500	-0.00078	0.100008	0.000175	15.46824	1.51E-08
19.89	40					
17000000	4630	-0.00078	0.100008	-0.00017	15.43081	1.48E-08
19.39	39					
17000000	4630	-0.00078	0.100008	0.000175	15.38785	1.51E-08
19.89	40					
17000000	4760	-0.00078	0.100008	-0.00017	15.36465	1.48E-08
19.39	39					
17000000	4760	-0.00078	0.100008	0.000175	15.45242	1.51E-08
19.89	40					
...						
18000000	10901	-0.00078	0.100005	-0.00017	20.42707	1.47E-08
19.37	38					
18000000	10901	-0.00078	0.100006	0.000178	20.46064	1.51E-08
19.87	39					
18000000	11021	-0.00078	0.100005	-0.00018	20.49802	1.47E-08
19.37	38					
18000000	11021	-0.00078	0.100006	0.000178	20.46099	1.51E-08
19.87	39					
18000000	11141	-0.00078	0.100006	-0.00018	20.42072	1.47E-08
19.37	38					
18000000	11141	-0.00078	0.100005	0.000177	20.4386	1.51E-
08	19.87	39				
19000000	3460	-0.00078	0.100016	-0.00017	24.09866	1.47E-08
19.36	39					
...						

Explanation:

First colum: Field level;

Second colum: particle ID;

Third colum: the x coordinator of particle's impact position;

Fourth colum: the y coordinator of particle's impact position;

Fifth colum: the z coordinator of particle's impact position;

Sixth colum: particle's impact energy in eV;
Seventh colum: particle's impact phase;
Eighth colum: particle's impact time in RF cycle;
Ninth colum: particle's impact number;
For example, from first two lines in the above example output data, we know that at field level 16MV/m, the particle's (ID 4310)last two impacts' (39, 40) impact energies are 10.58931 and 10.50246, we also know their corresponding impact positions. For details of each resonant particle's information, see the file in ./job /OUTPUT/MPParticles*

h3. 3. Information related all particles with resonant trajectories at a single field level is in the file ./job /OUTPUT/MPParticles*, the format of the file shows below:

Particle ID 47001 total 51 impacts

```
0 -1.21169903e-01 2.59999000e-01 -1.10533933e-01 2.00000000e+00 4.60000000e-01
1 -1.20286001e-01 2.60014656e-01 -1.10919628e-01 1.65458514e+02 1.23000000e+00
2 -1.21815314e-01 2.60075499e-01 -1.12468337e-01 2.00254221e+02 2.16000000e+00
3 -1.17494040e-01 2.60168428e-01 -1.09433448e-01 5.31140075e+02 3.33000000e+00
4 -1.20069099e-01 2.60014500e-01 -1.11640855e-01 7.07904283e+01 4.15000000e+00
5 -1.21872443e-01 2.60055470e-01 -1.13187720e-01 1.54175170e+02 5.13000000e+00
6 -1.15927695e-01 2.60106057e-01 -1.08433821e-01 5.91315164e+02 6.37000000e+00
7 -1.18458881e-01 2.60129450e-01 -1.10663427e-01 5.39523370e+01 7.16000000e+00
8 -1.20625111e-01 2.60152822e-01 -1.12498558e-01 7.83412829e+01 8.13000000e+00
9 -1.20982466e-01 2.60050997e-01 -1.13368367e-01 2.15465202e+02 9.18000000e+00
10 -1.20145835e-01 2.60199572e-01 -1.13260591e-01 3.81278009e+02 1.02300000e+01
11 -1.21081954e-01 2.60209524e-01 -1.14354168e-01 2.96273552e+02 1.11800000e+01
12 -1.18728446e-01 2.60127100e-01 -1.13069714e-01 5.30929865e+02 1.22700000e+01
13 -1.20875235e-01 2.60133494e-01 -1.15022549e-01 1.49115895e+02 1.31400000e+01
14 -1.18077892e-01 2.60001701e-01 -1.13265186e-01 4.78813806e+02 1.42800000e+01
15 -1.20298504e-01 2.60145823e-01 -1.15279976e-01 1.19531080e+02 1.51400000e+01
16 -1.19283032e-01 2.60261229e-01 -1.14922126e-01 3.71941381e+02 1.62300000e+01
17 -1.20626039e-01 2.60137910e-01 -1.16301477e-01 2.86617076e+02 1.71600000e+01
18 -1.26545724e-01 2.56247874e-01 -1.19998098e-01 2.94209998e+01 1.79000000e+01
19 -1.13254396e-01 2.60410214e-01 -1.11854058e-01 9.17291745e+02 1.83100000e+01
20 -1.16216727e-01 2.60006064e-01 -1.14613063e-01 6.06629977e+01 1.91500000e+01
21 -1.18181022e-01 2.60141588e-01 -1.16514923e-01 7.16122961e+01 2.01300000e+01
22 -1.19455437e-01 2.60197068e-01 -1.17765165e-01 1.78624164e+02 2.11400000e+01
23 -1.16661134e-01 2.60219134e-01 -1.15335359e-01 5.55110182e+02 2.22900000e+01
24 -1.19013362e-01 2.60005150e-01 -1.17530757e-01 1.19042630e+02 2.31300000e+01
25 -1.18060882e-01 2.60144940e-01 -1.16745516e-01 4.04362017e+02 2.42300000e+01
26 -1.19495663e-01 2.60121237e-01 -1.18219764e-01 2.81250204e+02 2.51500000e+01
27 -1.24685415e-01 2.55970645e-01 -1.22821171e-01 4.42499046e+01 2.58900000e+01
28 -1.12511919e-01 2.60104032e-01 -1.12167073e-01 1.01041046e+03 2.63000000e+01
29 -1.15350471e-01 2.60059797e-01 -1.14952432e-01 6.19635677e+01 2.71500000e+01
30 -1.17335755e-01 2.60099282e-01 -1.16863940e-01 6.37315316e+01 2.81300000e+01
31 -1.18941468e-01 2.60010636e-01 -1.18486082e-01 1.41659527e+02 2.91200000e+01
32 -1.15912019e-01 2.60229438e-01 -1.15483606e-01 5.45095116e+02 3.03000000e+01
33 -1.18120098e-01 2.60041808e-01 -1.17699454e-01 1.01173353e+02 3.11400000e+01
34 -1.18760197e-01 2.60142979e-01 -1.18302103e-01 2.97733684e+02 3.21700000e+01
35 -1.17946438e-01 2.60144149e-01 -1.17407052e-01 5.20894363e+02 3.32400000e+01
36 -1.18972829e-01 2.60056485e-01 -1.18449114e-01 3.43538106e+02 3.41700000e+01
37 -1.18249097e-01 2.60303235e-01 -1.17635259e-01 5.53380420e+02 3.52400000e+01
38 -1.18519568e-01 2.60211948e-01 -1.17860002e-01 4.44891396e+02 3.62100000e+01
39 -1.18466696e-01 2.60286228e-01 -1.17725106e-01 4.75773402e+02 3.72200000e+01
40 -1.18702774e-01 2.60114358e-01 -1.17894782e-01 4.67737859e+02 3.82100000e+01
41 -1.18561070e-01 2.60127665e-01 -1.17680567e-01 4.92410647e+02 3.92200000e+01
42 -1.18683590e-01 2.60201748e-01 -1.17790259e-01 4.54332311e+02 4.02100000e+01
43 -1.18590345e-01 2.60203845e-01 -1.17668108e-01 4.88547811e+02 4.12200000e+01
44 -1.18774894e-01 2.60157822e-01 -1.17832953e-01 4.67193251e+02 4.22100000e+01
45 -1.18659842e-01 2.60089707e-01 -1.17682719e-01 5.00522149e+02 4.32200000e+01
46 -1.18760866e-01 2.60163027e-01 -1.17781515e-01 4.61325010e+02 4.42100000e+01
47 -1.18652996e-01 2.60206130e-01 -1.17666973e-01 4.91540232e+02 4.52200000e+01
48 -1.18819730e-01 2.60072496e-01 -1.17824145e-01 4.75822042e+02 4.62100000e+01
49 -1.18659769e-01 2.60214521e-01 -1.17666950e-01 4.91700497e+02 4.72200000e+01
50 -1.18825841e-01 2.60058104e-01 -1.17823183e-01 4.78194137e+02 4.82100000e+01
```

 Particle ID 42001 total 51 impacts

```
0 -1.21169903e-01 2.59999000e-01 -1.10533933e-01 2.00000000e+00 4.10000000e-01
1 -1.19717870e-01 2.60078718e-01 -1.10396950e-01 2.29748826e+02 1.27000000e+00
2 -1.21626815e-01 2.60171944e-01 -1.12180022e-01 1.55856256e+02 2.16000000e+00
3 -1.18380325e-01 2.60108270e-01 -1.10149169e-01 4.49658586e+02 3.31000000e+00
```

```

4 -1.20812024e-01 2.60100620e-01 -1.12234595e-01 9.30324517e+01 4.15000000e+00
5 -1.21070594e-01 2.60130196e-01 -1.12987526e-01 2.49027462e+02 5.19000000e+00
6 -1.20041714e-01 2.60203443e-01 -1.12791026e-01 4.05999735e+02 6.24000000e+00
7 -1.21337140e-01 2.60171838e-01 -1.14070497e-01 2.58355081e+02 7.17000000e+00
8 -1.18376238e-01 2.60032235e-01 -1.12356484e-01 5.66913680e+02 8.28000000e+00
9 -1.20610667e-01 2.60059309e-01 -1.14360934e-01 1.13629350e+02 9.14000000e+00
10 -1.20088283e-01 2.60008309e-01 -1.14447177e-01 3.43602211e+02 1.02100000e+01
11 -1.20769554e-01 2.60066577e-01 -1.15233935e-01 3.28152116e+02 1.11800000e+01
12 -1.19073090e-01 2.60106117e-01 -1.14365911e-01 5.12065738e+02 1.22500000e+01
13 -1.20685281e-01 2.60064625e-01 -1.15835253e-01 2.13176558e+02 1.31500000e+01
14 -1.18277477e-01 2.60087515e-01 -1.14257214e-01 5.43008579e+02 1.42700000e+01
15 -1.20476288e-01 2.60037643e-01 -1.16257849e-01 1.54201757e+02 1.51300000e+01
16 -1.17388872e-01 2.60165414e-01 -1.14039364e-01 5.26629438e+02 1.62900000e+01
17 -1.19734173e-01 2.60183272e-01 -1.16151330e-01 1.15992116e+02 1.71400000e+01
18 -1.19000807e-01 2.60228824e-01 -1.15888864e-01 3.61963392e+02 1.82200000e+01
19 -1.20261893e-01 2.60015653e-01 -1.17098927e-01 3.21737896e+02 1.91600000e+01
20 -1.25827427e-01 2.56157759e-01 -1.21187823e-01 4.54170936e+01 1.98900000e+01
21 -1.13109491e-01 2.60288425e-01 -1.12227070e-01 9.48625096e+02 2.03000000e+01
22 -1.15987437e-01 2.60022222e-01 -1.14970732e-01 6.14881131e+01 2.11500000e+01
23 -1.17935509e-01 2.60136698e-01 -1.16836908e-01 7.20874106e+01 2.21300000e+01
24 -1.19248827e-01 2.60019236e-01 -1.18281619e-01 1.77513855e+02 2.31300000e+01
25 -1.16472021e-01 2.60233169e-01 -1.15657858e-01 5.66740418e+02 2.42900000e+01
26 -1.18787381e-01 2.60020176e-01 -1.17887913e-01 1.23569898e+02 2.51300000e+01
27 -1.17607739e-01 2.60150432e-01 -1.16757938e-01 4.19837359e+02 2.62400000e+01
28 -1.19283114e-01 2.60115125e-01 -1.18495326e-01 2.39178714e+02 2.71400000e+01
29 -1.24366967e-01 2.55948066e-01 -1.23175697e-01 2.92332483e+01 2.79000000e+01
30 -1.12942763e-01 2.60015484e-01 -1.12666143e-01 9.64364448e+02 2.83000000e+01
31 -1.15612580e-01 2.60008597e-01 -1.15288293e-01 6.06920203e+01 2.91500000e+01
32 -1.17568462e-01 2.60126685e-01 -1.17163137e-01 7.07355384e+01 3.01300000e+01
33 -1.18930168e-01 2.60136415e-01 -1.18641507e-01 1.79147123e+02 3.11300000e+01
34 -1.16107438e-01 2.60013381e-01 -1.15898158e-01 5.97637027e+02 3.22900000e+01
35 -1.18216705e-01 2.60153276e-01 -1.18029486e-01 1.13940087e+02 3.31400000e+01
36 -1.17987820e-01 2.60235956e-01 -1.17675404e-01 3.56535906e+02 3.42100000e+01
37 -1.18790059e-01 2.60165498e-01 -1.18428150e-01 3.73035619e+02 3.51800000e+01
38 -1.18359891e-01 2.60024533e-01 -1.17914088e-01 5.46924437e+02 3.62300000e+01
39 -1.18445276e-01 2.60216168e-01 -1.17952010e-01 4.44574962e+02 3.72100000e+01
40 -1.18365373e-01 2.60197599e-01 -1.17731690e-01 4.80906956e+02 3.82200000e+01
41 -1.18746611e-01 2.60042218e-01 -1.18062952e-01 4.42132549e+02 3.92000000e+01
42 -1.18550546e-01 2.60066400e-01 -1.17759540e-01 4.99081539e+02 4.02200000e+01
43 -1.18635329e-01 2.60207745e-01 -1.17827420e-01 4.53189934e+02 4.12100000e+01
44 -1.18539204e-01 2.60217526e-01 -1.17692910e-01 4.86772805e+02 4.22200000e+01
45 -1.18733981e-01 2.60163207e-01 -1.17853133e-01 4.65522750e+02 4.32100000e+01
46 -1.18614947e-01 2.60074546e-01 -1.17686311e-01 4.98291037e+02 4.42200000e+01
47 -1.18708470e-01 2.60208878e-01 -1.17774663e-01 4.54374656e+02 4.52100000e+01
48 -1.18611960e-01 2.60157058e-01 -1.17650795e-01 4.90332007e+02 4.62200000e+01
49 -1.18760267e-01 2.60185775e-01 -1.17791781e-01 4.61096091e+02 4.72100000e+01
50 -1.18662943e-01 2.60149916e-01 -1.17668177e-01 4.97097101e+02 4.82200000e+01
...

```

Explanation: This file records all the resonant particles' all impact information at this field level. For example, for particle ID 47001, it has 51 impacts,

Impact number RF cycle)	impact position (x, y, z)			impact energy(eV)	impact time (in
0	-1.21169903e-01	2.59999000e-01	-1.10533933e-01	2.00000000e+00	4.60000000e-01
1	-1.20286001e-01	2.60014656e-01	-1.10919628e-01	1.65458514e+02	1.23000000e+00
2	-1.21815314e-01	2.60075499e-01	-1.12468337e-01	2.00254221e+02	2.16000000e+00
...					
48	-1.18819730e-01	2.60072496e-01	-1.17824145e-01	4.75822042e+02	4.62100000e+01
49	-1.18659769e-01	2.60214521e-01	-1.17666950e-01	4.91700497e+02	4.72200000e+01
50	-1.18825841e-01	2.60058104e-01	-1.17823183e-01	4.78194137e+02	4.82100000e+01

According to above information, we have the conclusion: at this field level, there are resonant trajectories: one point first order and the impact energies is around 470eV ~500eV

A Complete Example for particles trajectories at a given field level

h3. 1. the block example for particles trajectories in the input file:

FieldScales:

```
{
  Type: FieldGradient
  Scale: 0.15e+06 //field scale for particle trajectory
}
```

By default, the code will save all particles locations at each time step, there are other options for only save information at some time steps, see the examples below:

ParticlesTrajectories: // record particles' trajectory, only for running single
//field case

```
{
  ParticleFile: p      // file name
  Skip: 10             // write file each 10 steps
  Start: 10            // start time step for writing file
  Stop: 100000         // stop time step for writing file
}
```

h3. 2. Output files saved in the directories ./job/PARTICLE/*/p*_ts*, the file is in ncdf format, can be viewed through paraview. The particle's ID, location, momentum... is saved in these files.