ICOOL Energy loss injection in Harold's Ring

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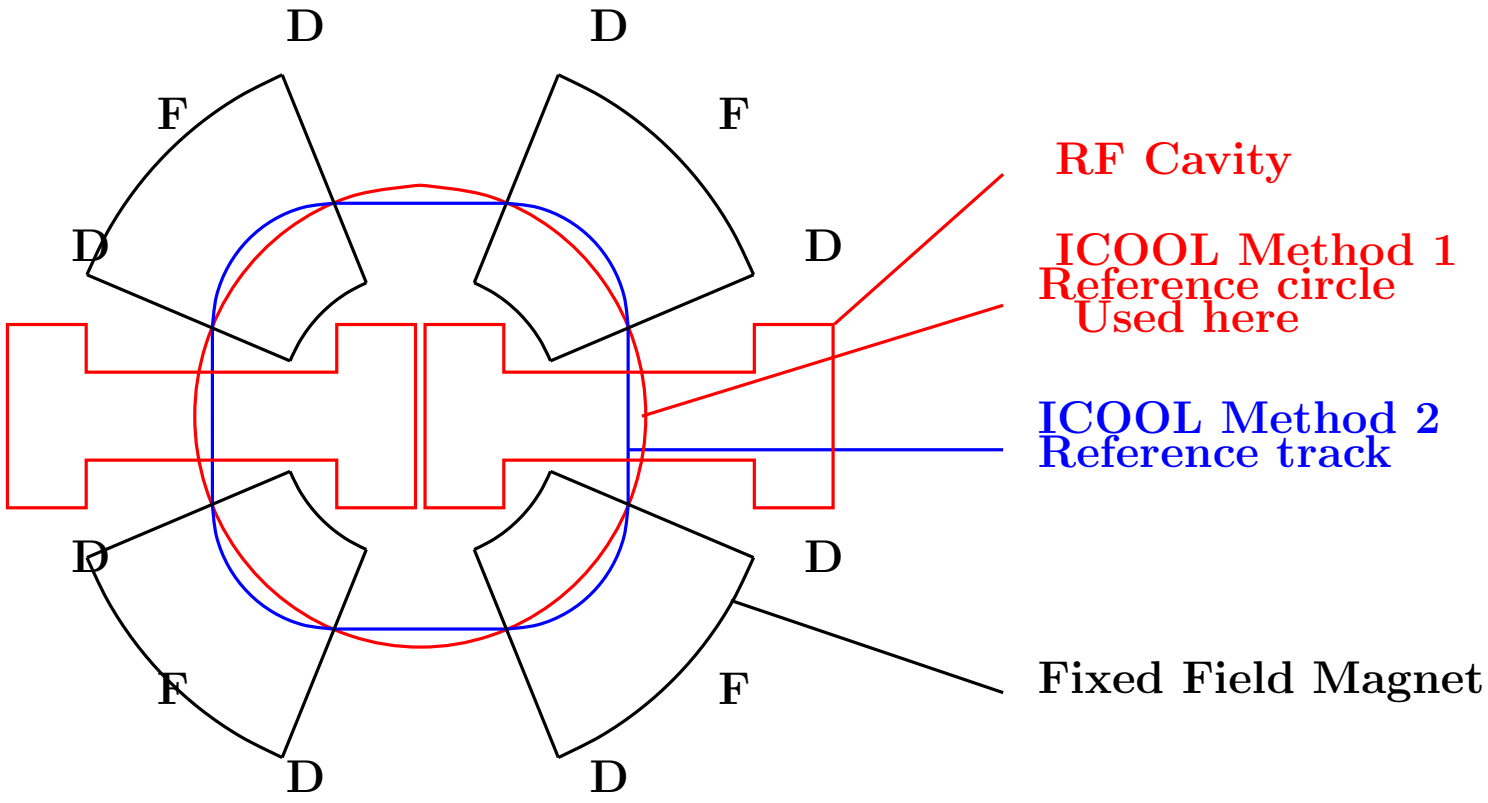
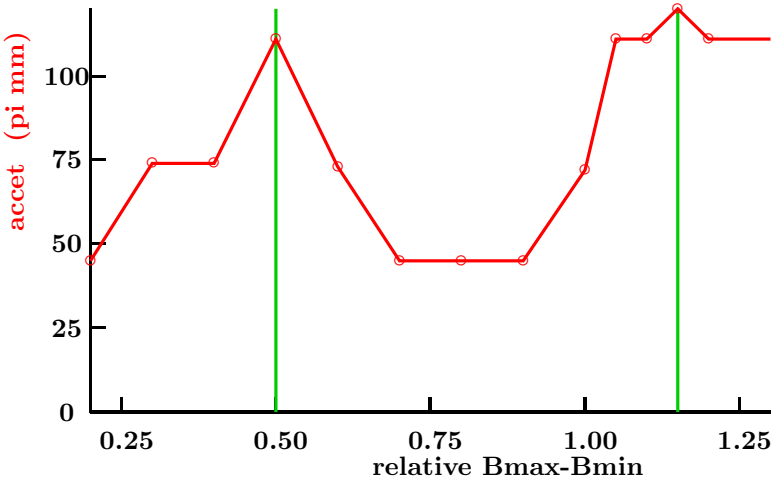
12/16/04 Miami

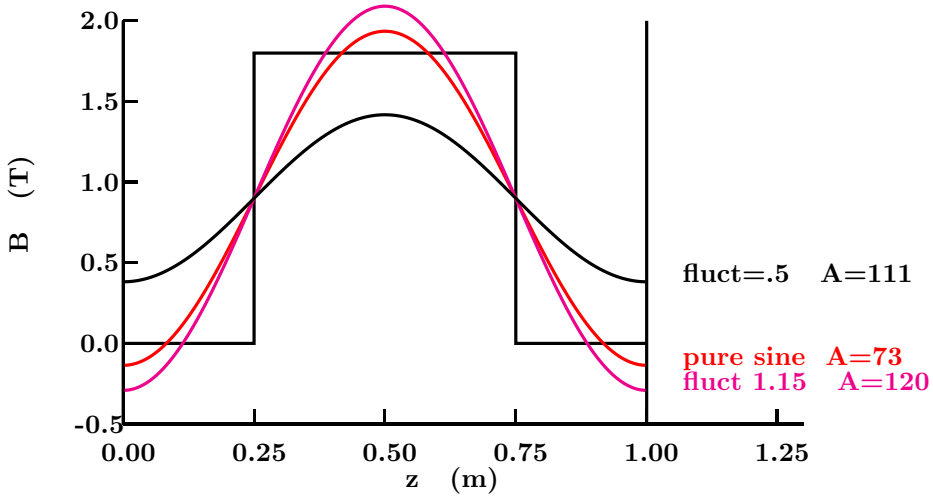


- H2 gas filled
- Pole angles ≡ D focus
- A "Scaling" FFAF, almost a scaling FFAG

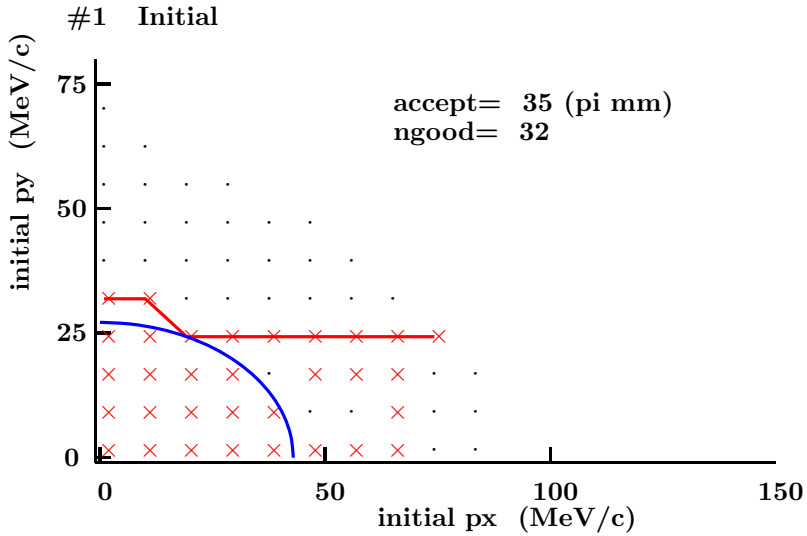
4b) Vary amplitude of sine variation

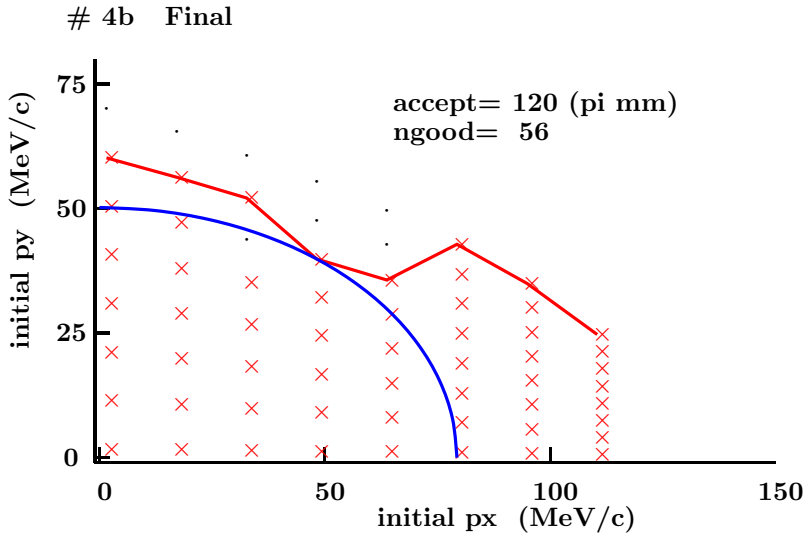
But keep gradient=0



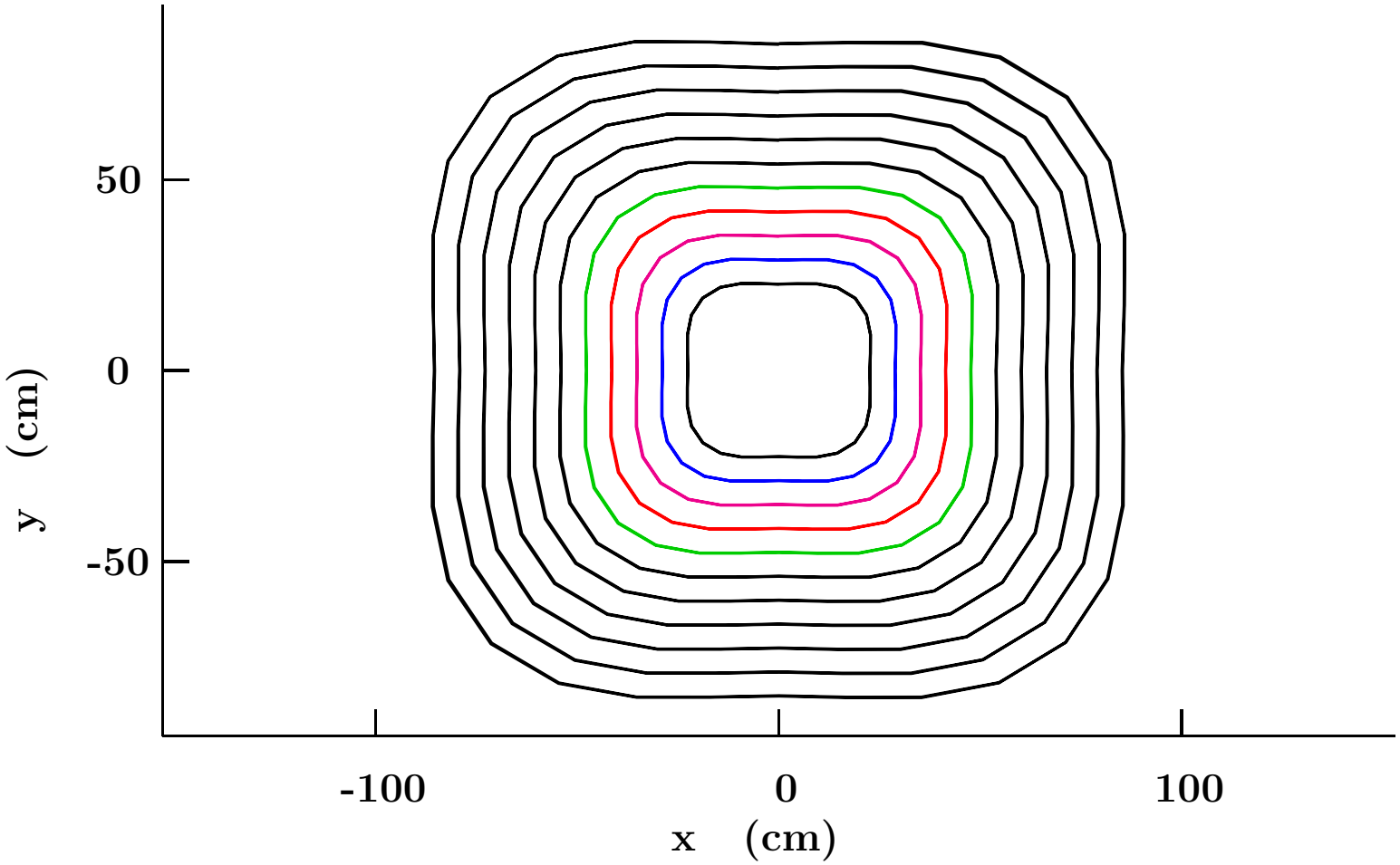


2 solutions, but lower has low ν & high β (bad for cooling)

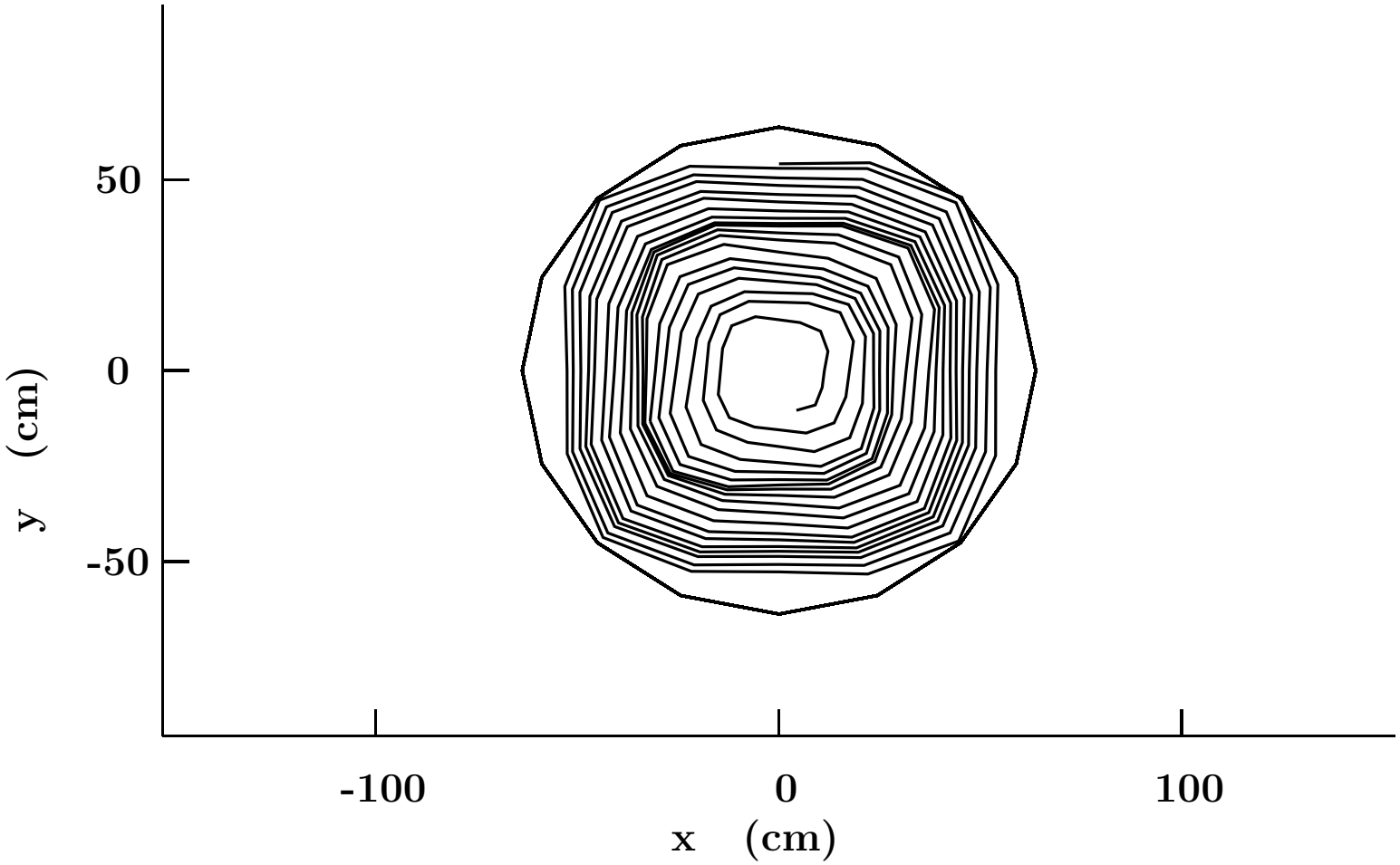


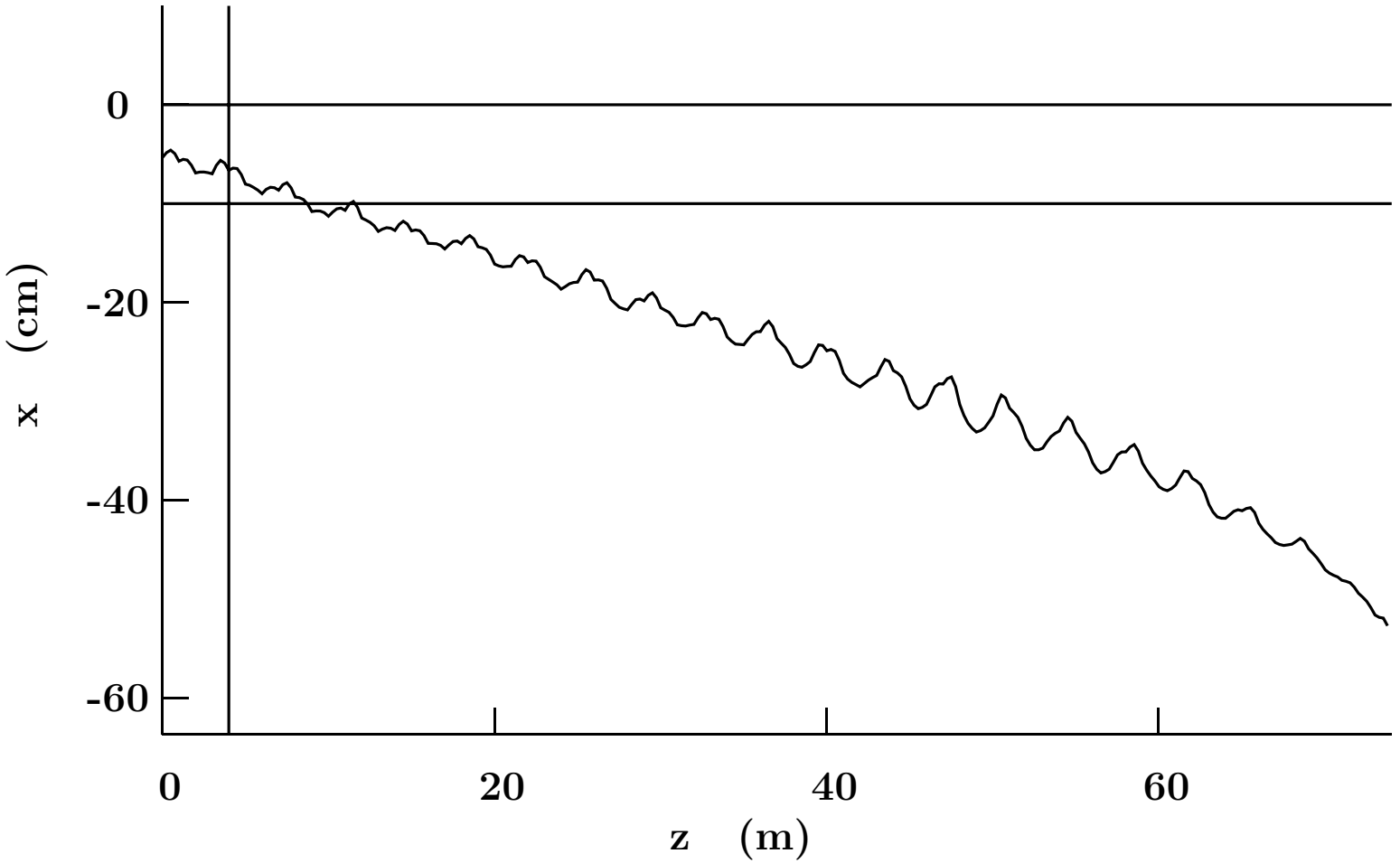


No gas, different momenta

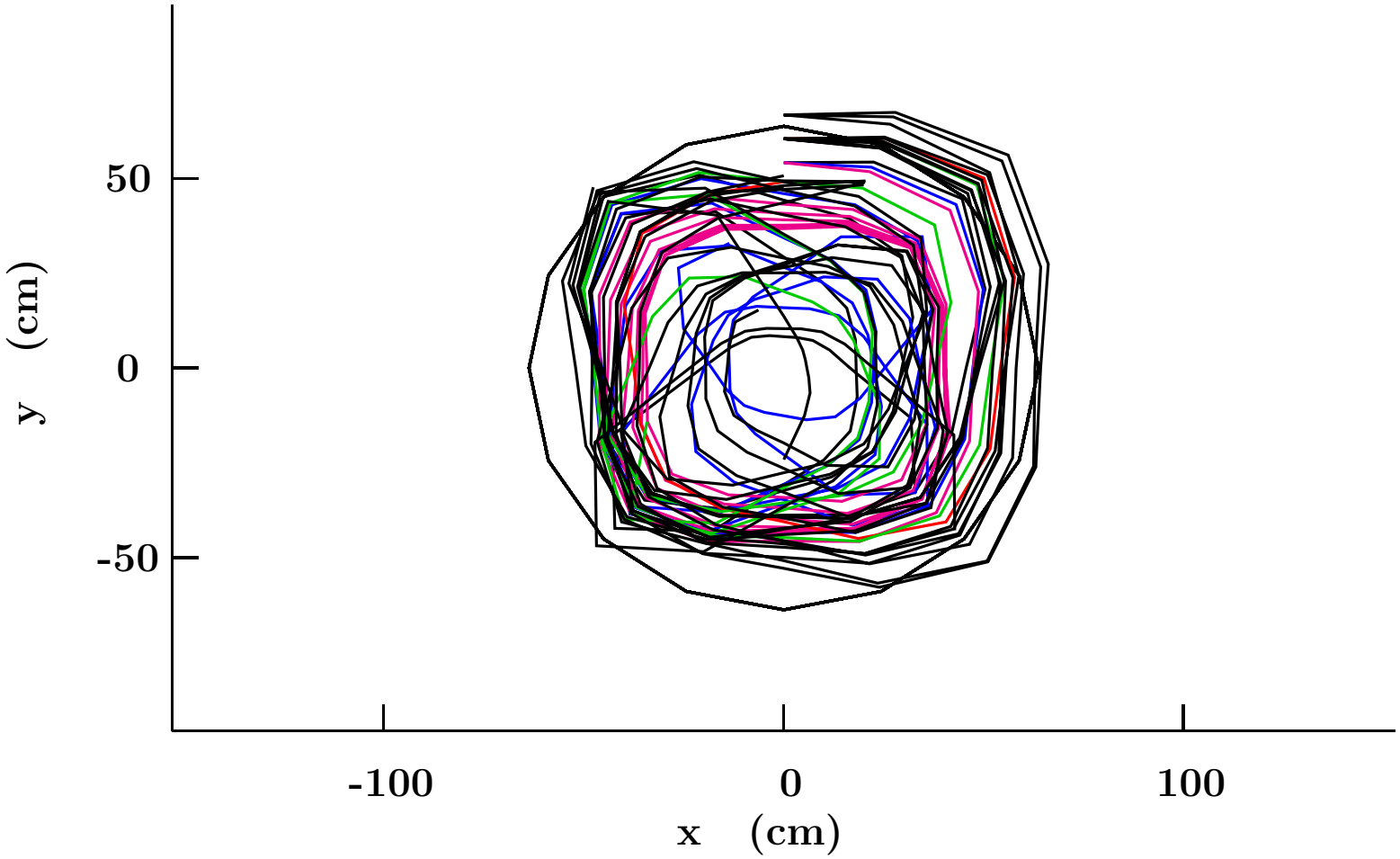


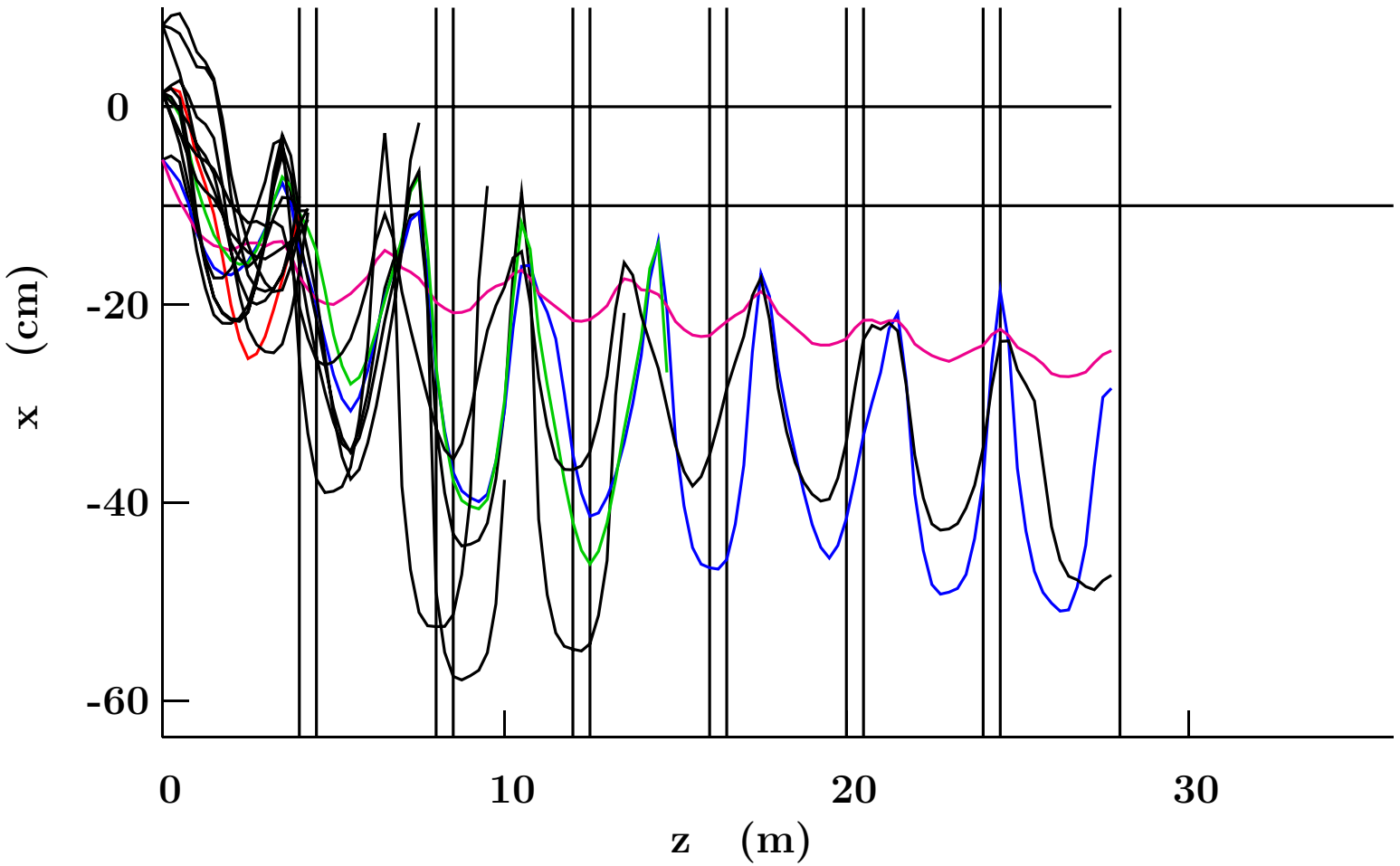
With H2 gas



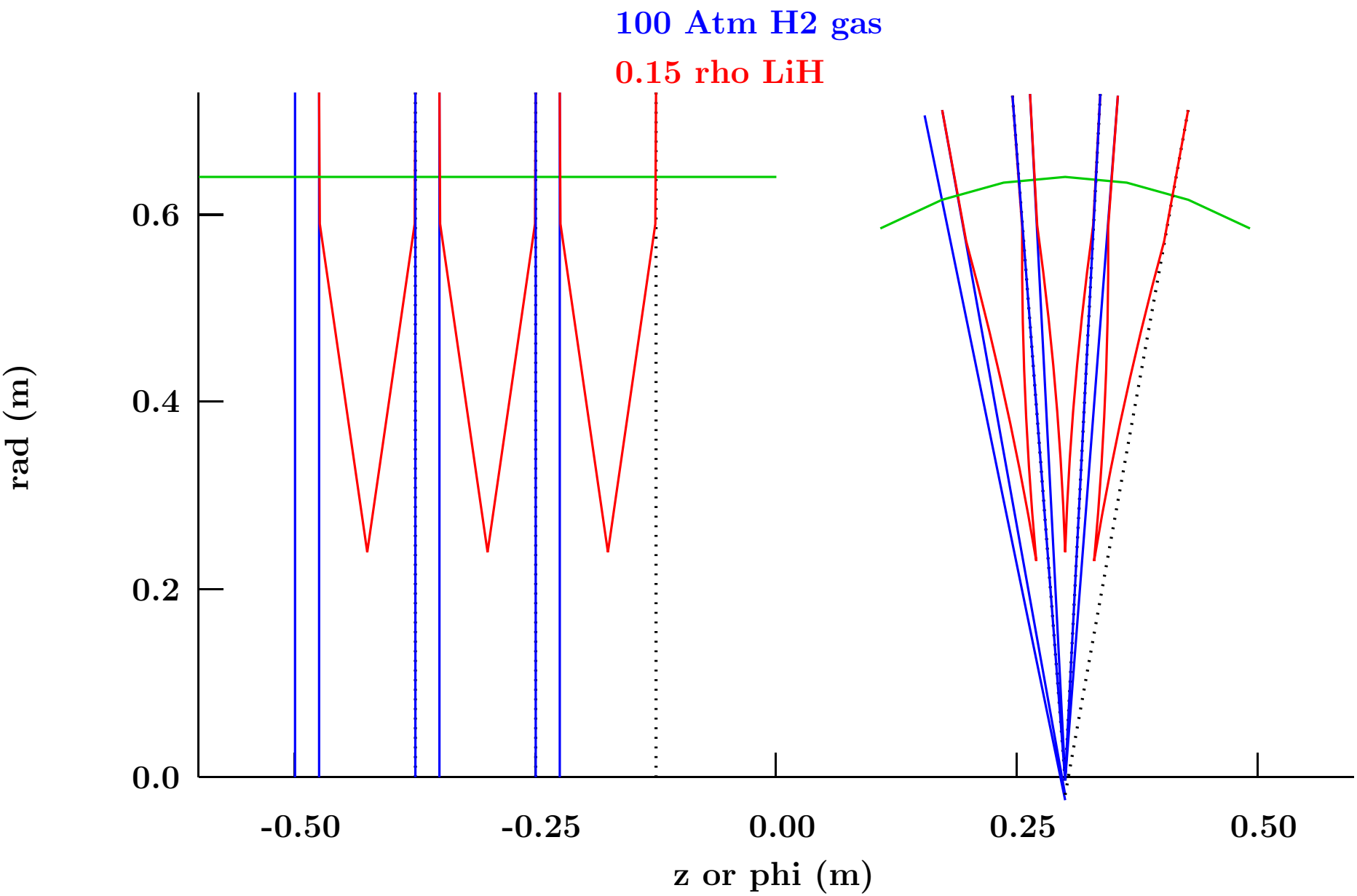

0
-20
-40
-60
x (cm)
0
20
40
60
z (m)

0.15 LiH at large r, gas in center

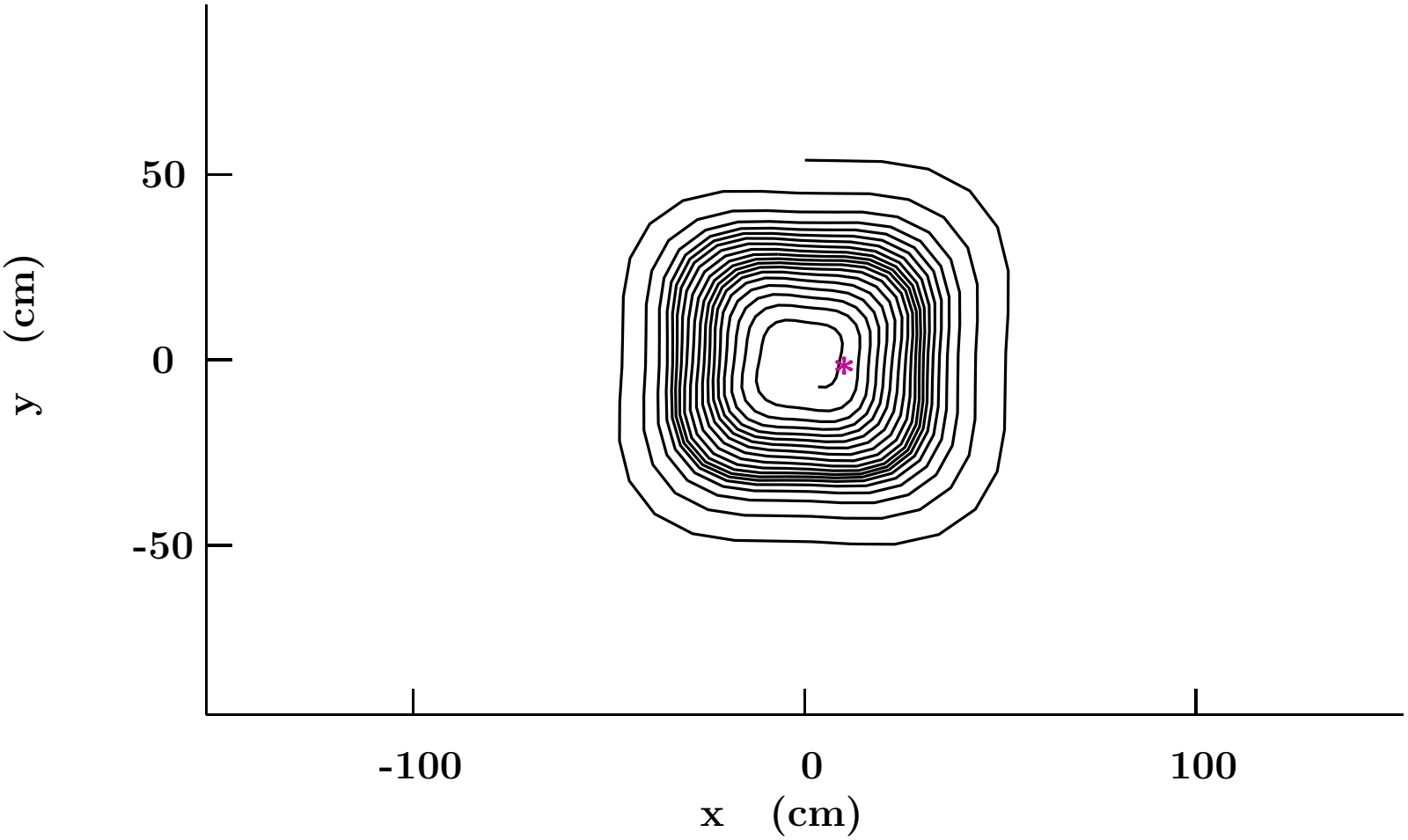


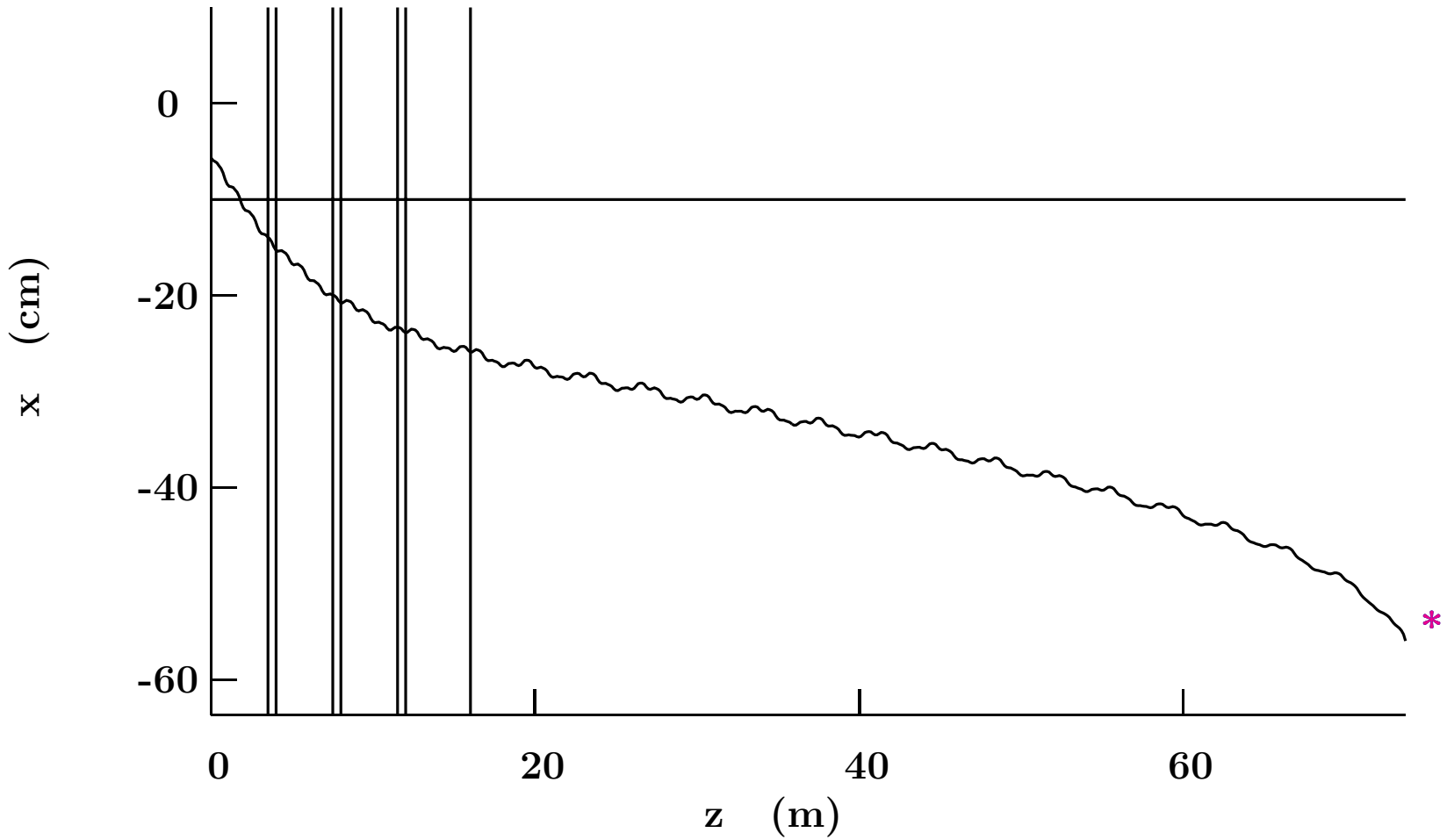

0
-20
-40
-60
x (cm)
0
10
20
30
z (m)

Grade density smoothly with Wedges

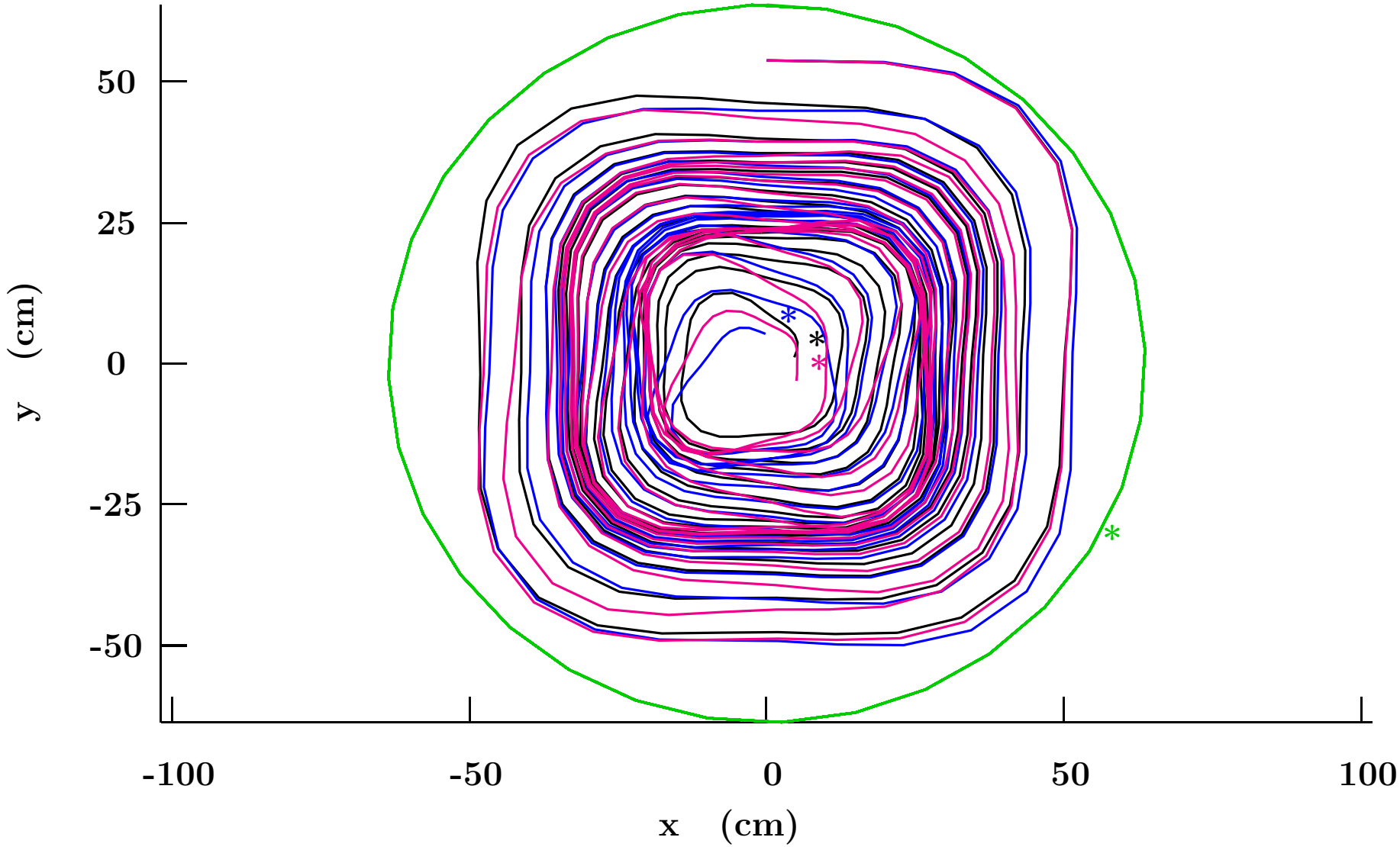


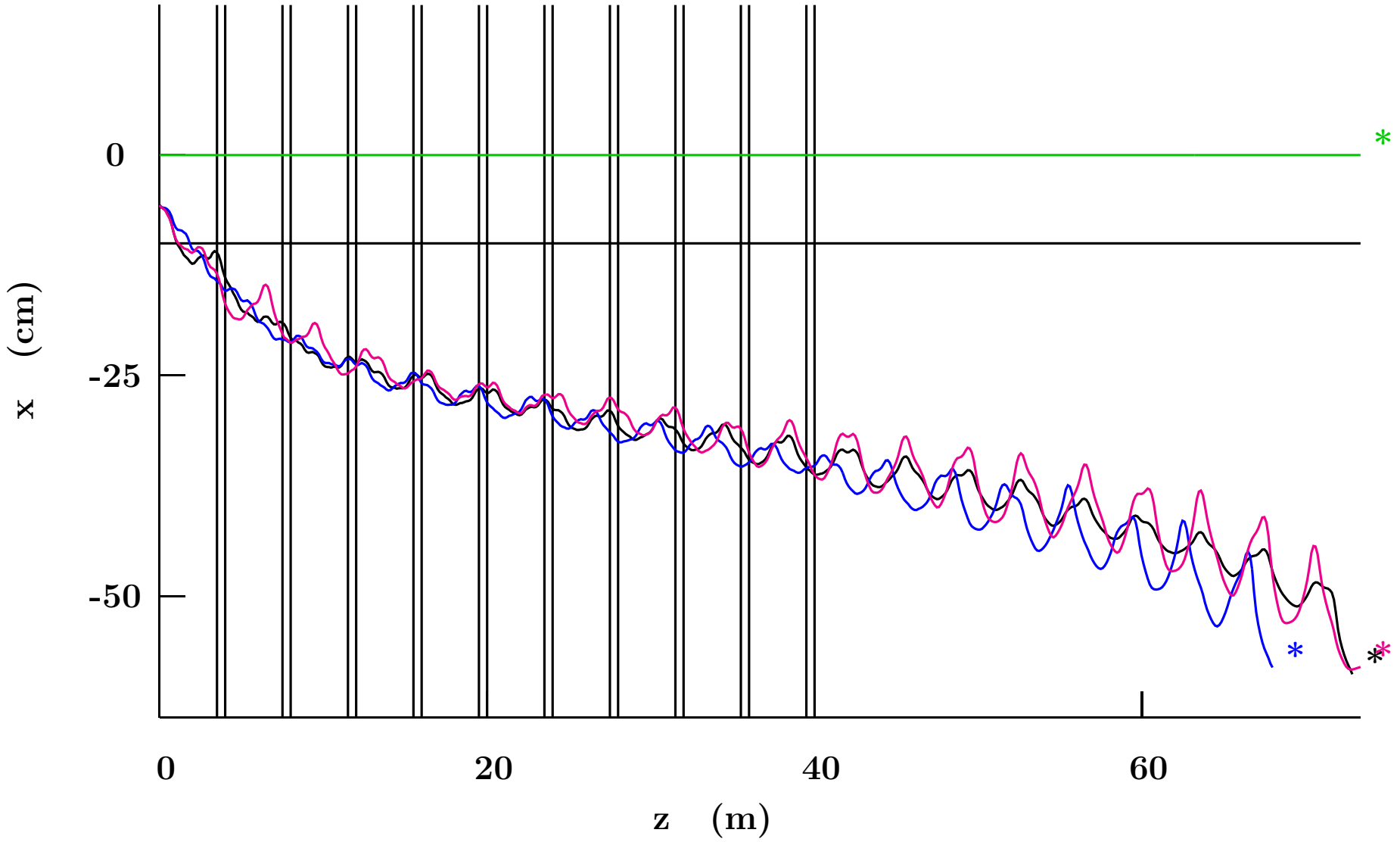
Scatter & Straggle off

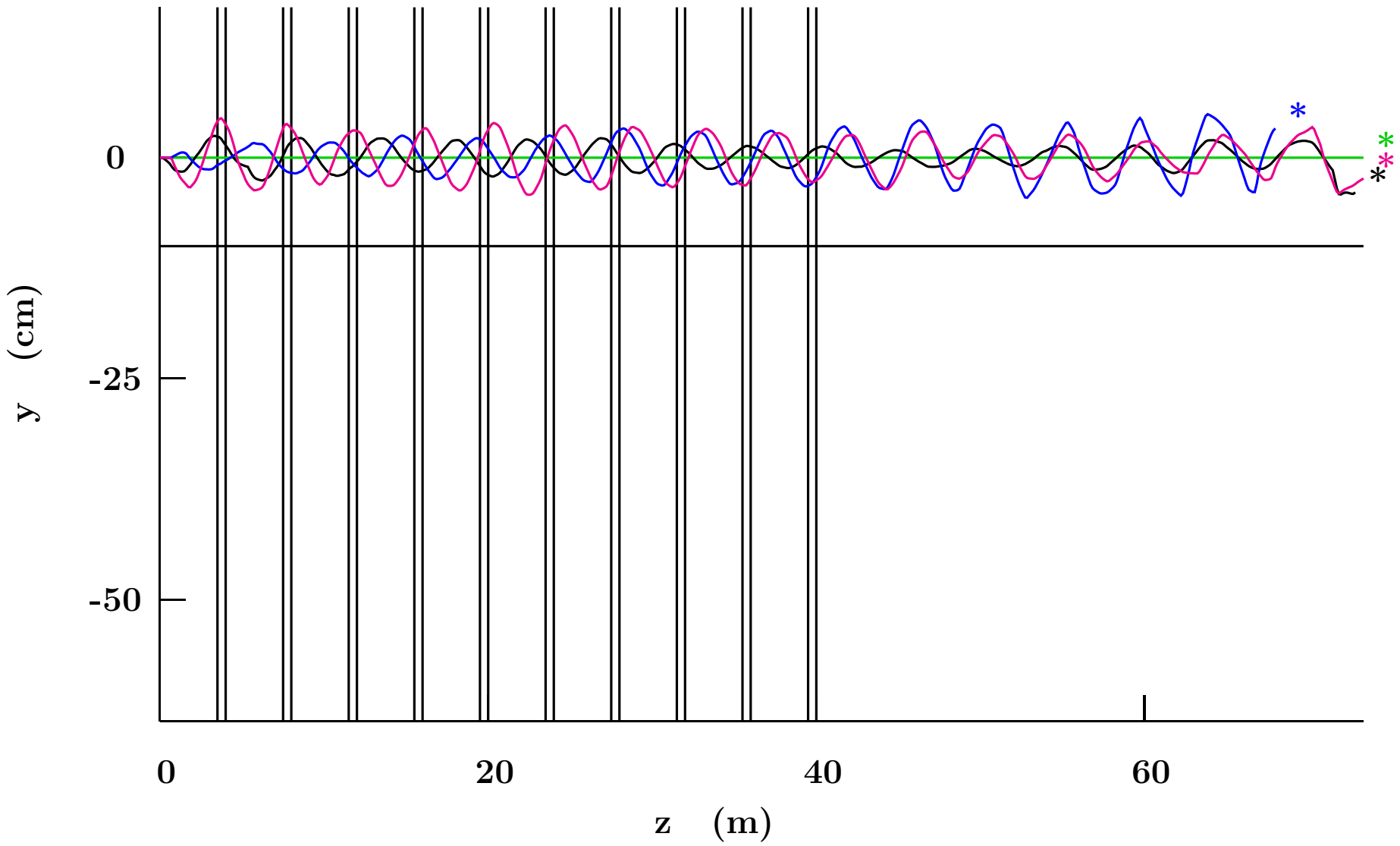


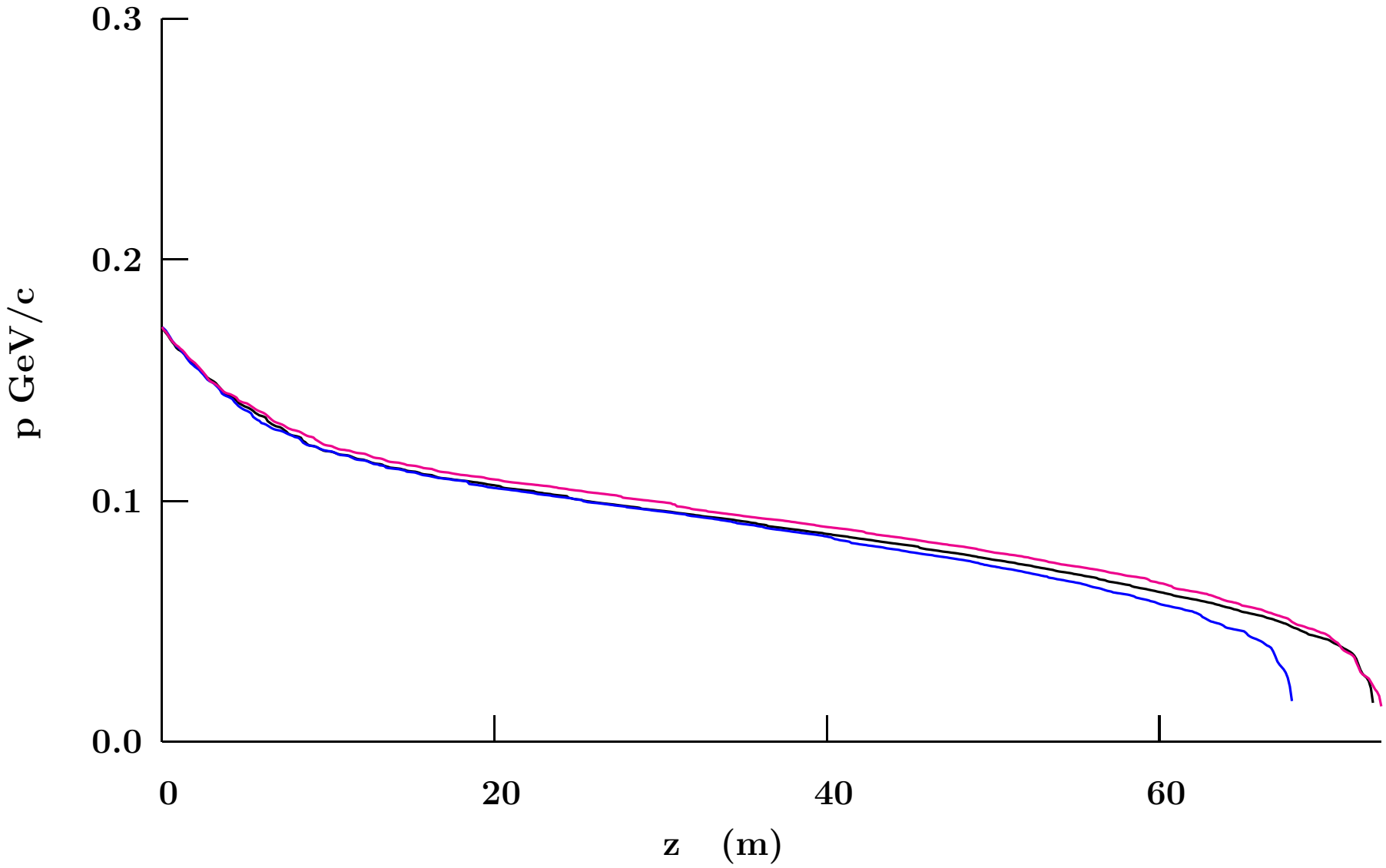

0
-20
-40
-60
x (cm)
0
20
40
60
z (m)

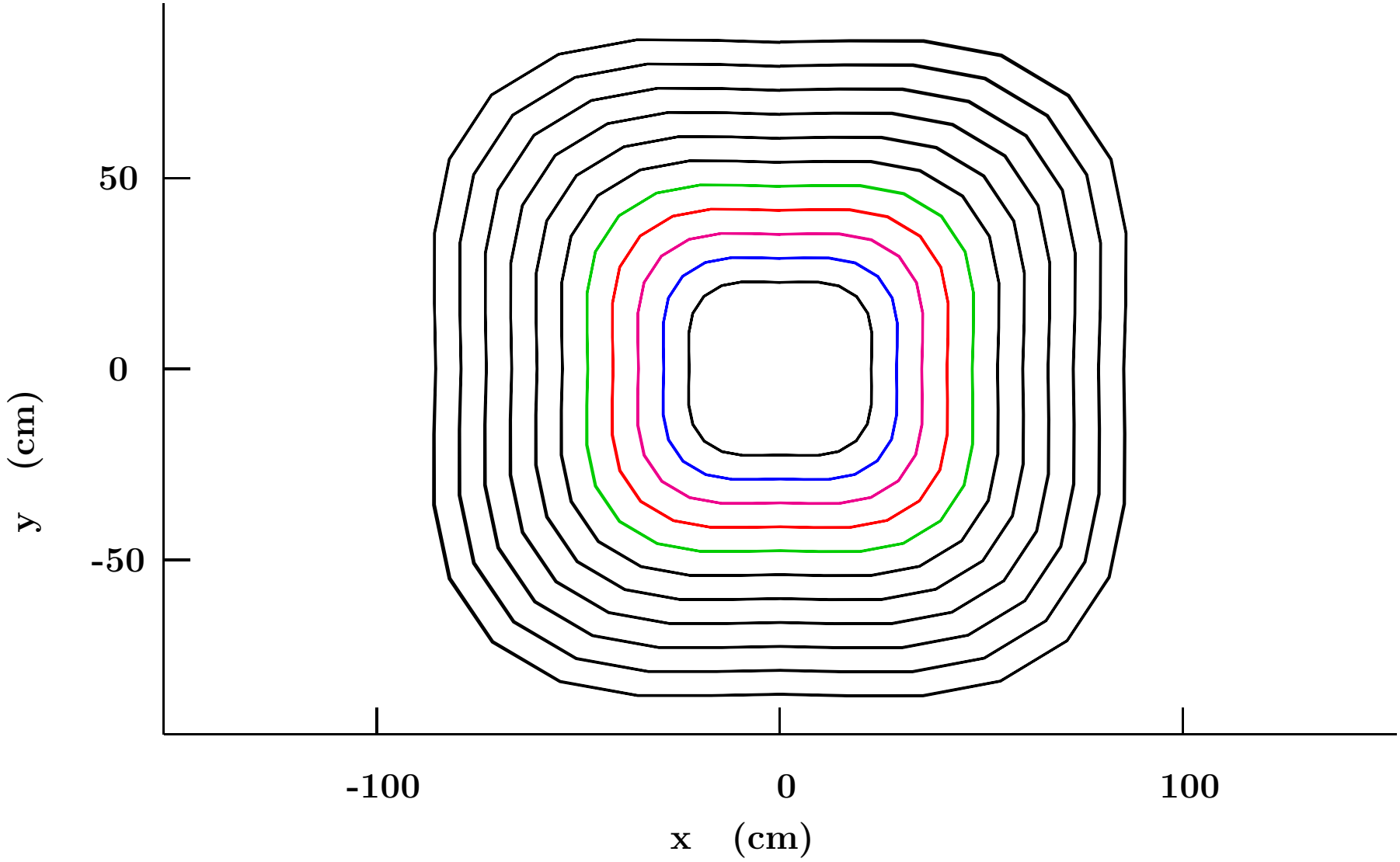
Scatter & Straggle on




0
-25
-50
x (cm)
0
20
40
60
z (m)


0
-25
-50
y (cm)
0
20
40
60
z (m)


0.3
0.2
0.1
0.0
p GeV/c
0
20
40
60
z (m)


50
0
-50
y (cm)
-100
0
100
x (cm)

Conclusions

- Energy loss injection seems to work
- But density changes must be smooth
- Acceptance needs study
- This could be cooling demo without rf ?
- But need to simulate useful larger version

Main file for001.dat

```
Harold ring 172 MeV (H5b)

$cont npart=200 nsections=1 varstep=.false. nprnt=-3 prlevel=1
ntuple=.false. rtuple=.false. rtuplen=1 output1=.true. phasemodel=3
fsav=.false. fsavset=.true. izfile=140 bgen=.false.  $

 $bmt $
1 2 1. 1              !ntyp typ(1e 2mu 3pi 4K 5p) frac dist(1=gauss 2=ring)
-0.010  0.019   0.  0.   0.   0.203  !means: x y z px py pz
0.0425  0.0425 .18 .030 .030  0.024    !sigmas:     "
1                                    !correlations
2  .19  .40  0                       !palmer  GeV/A^2 beta

 $ints ldecay=.false.  declev=1  ldedx=.true. lstrag=.true. lscatter=.true.
  delev=2 straglev=4 scatlev=4  $

 $nhs  $
 $nsc  $
 $nzh  $
 $nrh nrhist=0 $
 $nem  $
 $ncv  $

SECTION

REFP
2  .1  0. 0. 3             !typ refp t0 grad0 mode (3=const p 4=with acc)
```

```
DENS
GH 100
DENS
LIH 0.15
BEGS

!========================================================================

CELL      !-------------------- regular cell
1
.FALSE.

BSOL                                    ! multipole field input
4. 56 .172 5 1.5697675  1 1 1 1 1 1 1 1 1 0. !mode file ? order 1/r scale-factors

!------------------------------------------------------------------------

REPEAT
600

OUTPUT
SREGION                       ! define a region
.1 1 0.001                   ! length, 1 radial subregion, step
1 0. 10                      ! radial extent
NONE                          ! no associated field
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
LIH                           ! LiH material
WEDGE
20  0.4  0.125  180  10   10  0. 0. 0. 0.      !angle RVERT ZVERT Azymuth Apx Apy
```

```
SREGION                          ! define a region
.025 1 0.003                     ! length, 1 radial subregion, step
1 0. 2                         ! radial extent
NONE                             ! no associated field
0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
GH                             ! gas hydrogen material
CBLOCK                         ! cylindrical block geometry
0. 0. 0. 0. 0. 0. 0. 0. 0. 0.

ENDR

ENDCELL
ENDSECTION
```

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File for056.dat: field data

```
hx5 pure sine amp=1.15
 1.000655  1  1  1  1  1  1  1  1  1  1  1  1  1
1
 n  s      dipole
 0  0  0  .8997238  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
 1  0  0 -1.190977  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

==========

File fortran003.dat: track data

```
title
```

```
 0  0  0  0  0  0  0  0
    1 0 2 0   0.0000E+00 1.0
-0.9900E-01  0.0000E+00  0.0000E+00 -6.00E-03  0.0000E+00  1.7200E-01 0 0 0 0 0 0
    2 0 2 0   0.0000E+00 1.0
-0.9900E-01  0.0000E+00  0.0000E+00 -6.00E-03  0.0000E+00  1.7200E-01 0 0 0 0 0 0
    3 0 2 0   0.0000E+00 1.0
-0.9900E-01  0.0000E+00  0.0000E+00 -6.00E-03  0.0000E+00  1.7200E-01 0 0 0 0 0 0
```