Quad Ring Cooler Progress

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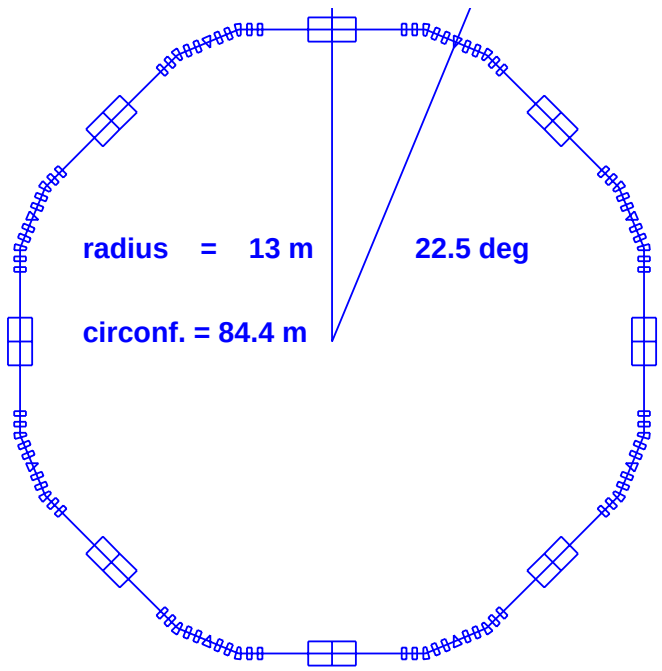
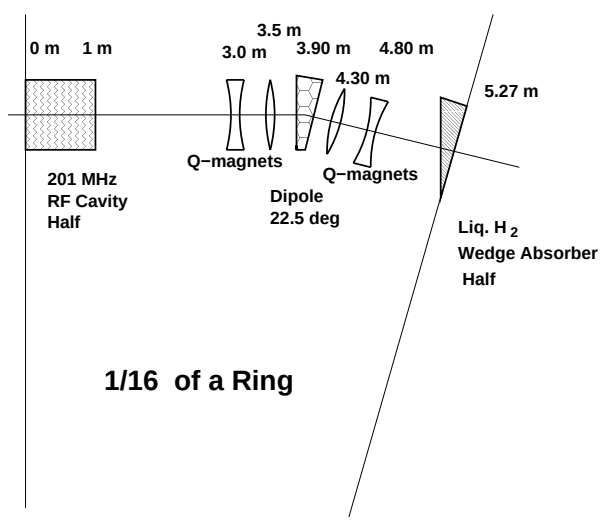
Outline

1. 8 Bend Cell model
2. 16 Bend Cell Model

Overall Layout of the Muon Ring Cooler

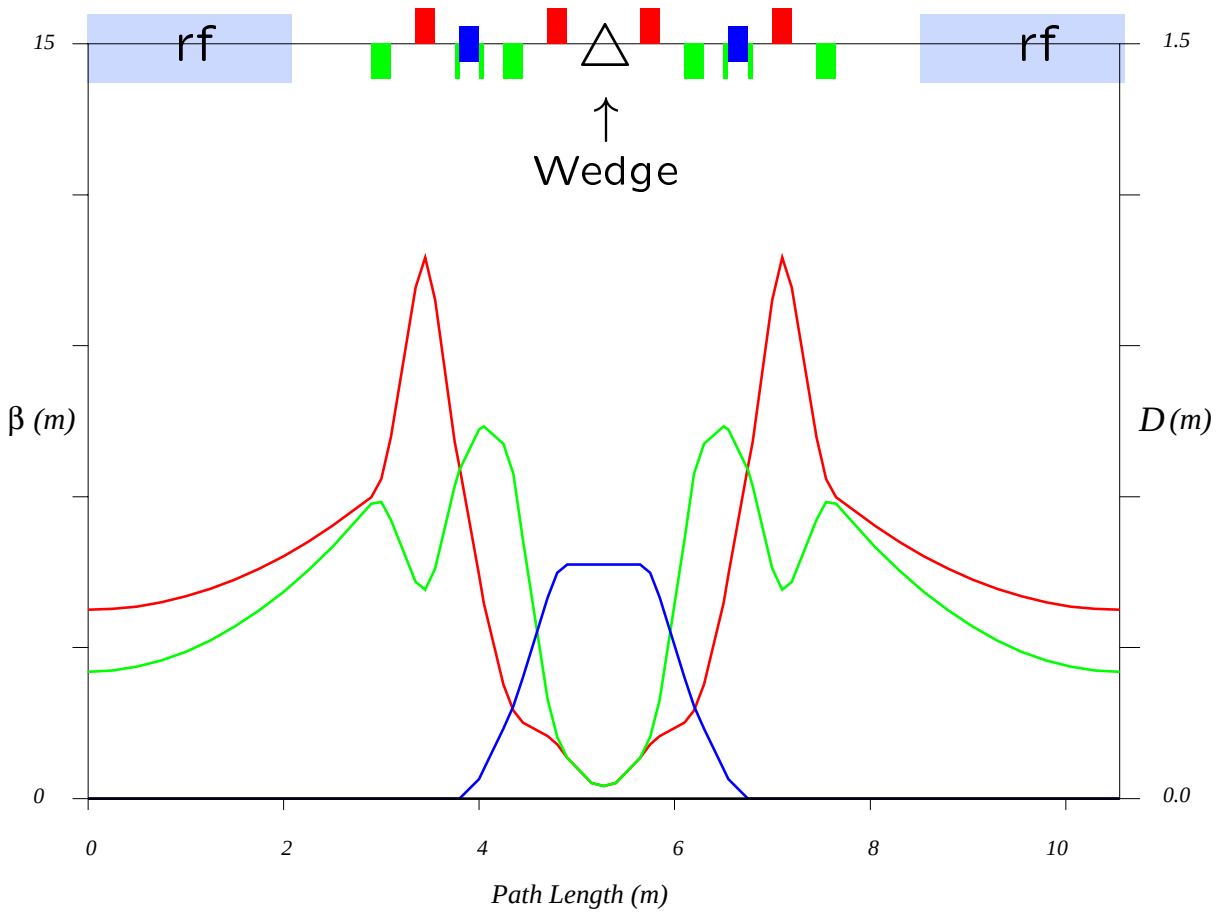




Half Section of Bending Cell

Muon Cooling Ring

Bending Cell

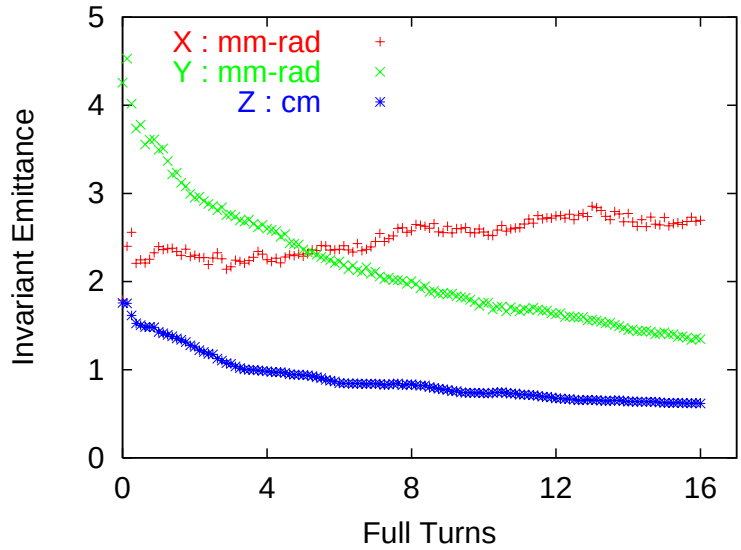


500 MeV/c Cooling Ring

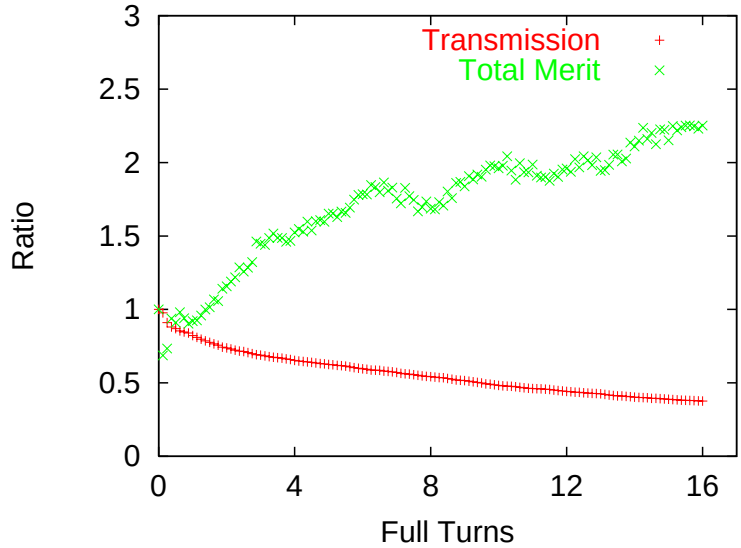
Eight Bend Cells/Turn – 10° Wedges

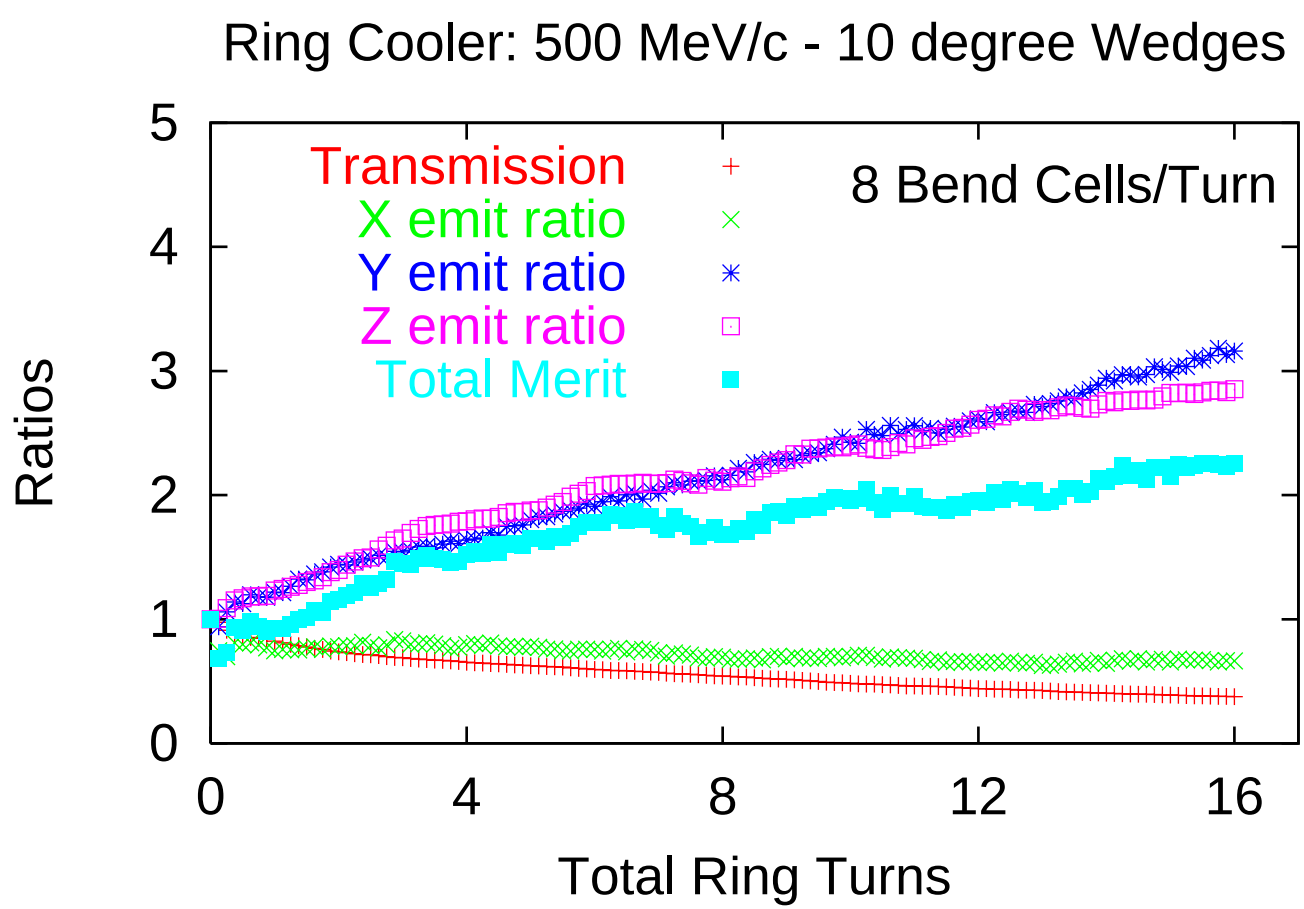
With Multiple Coulomb Scattering and Straggling

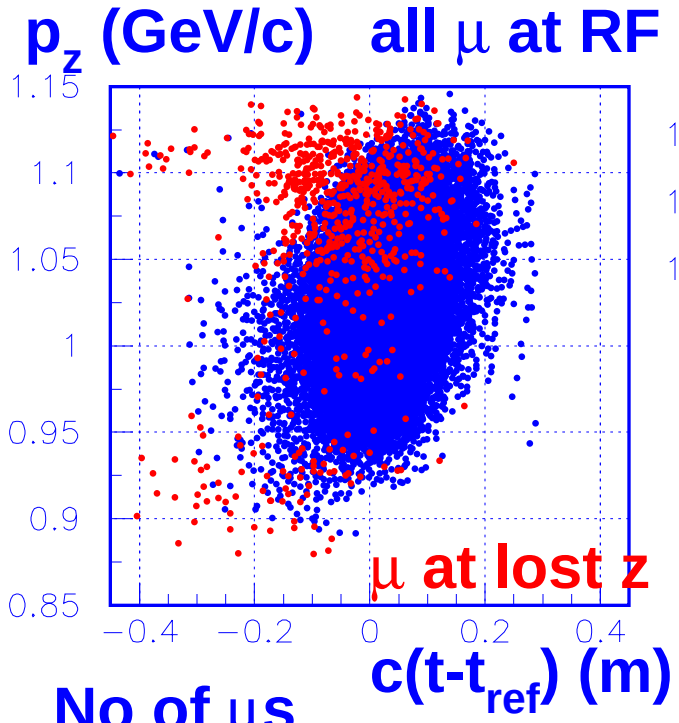
$$\gamma\beta\epsilon_{x_i} = 1.8mm;\ \gamma\beta\epsilon_{y_i} = 4.4mm\ ;\ \gamma\beta\epsilon_{z_i} = 18mm$$

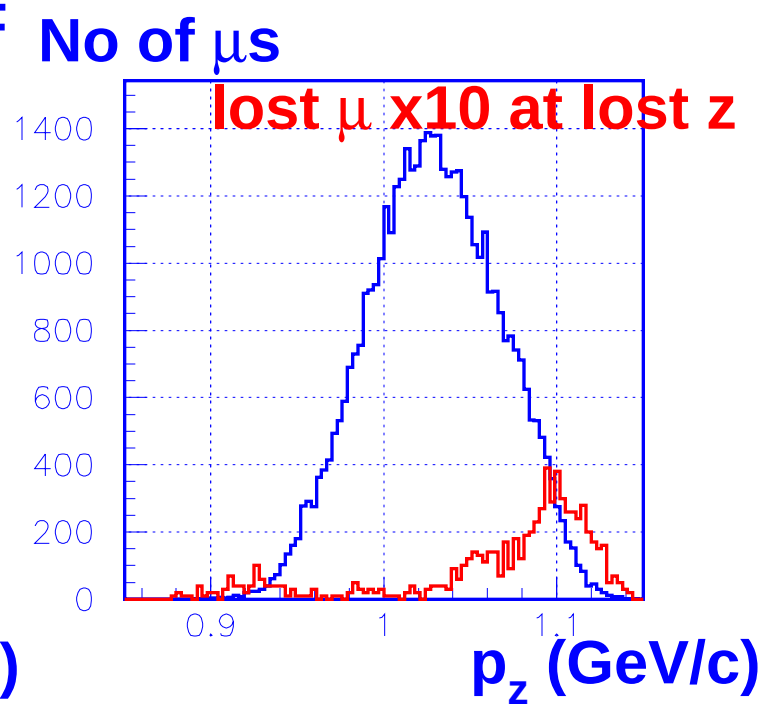


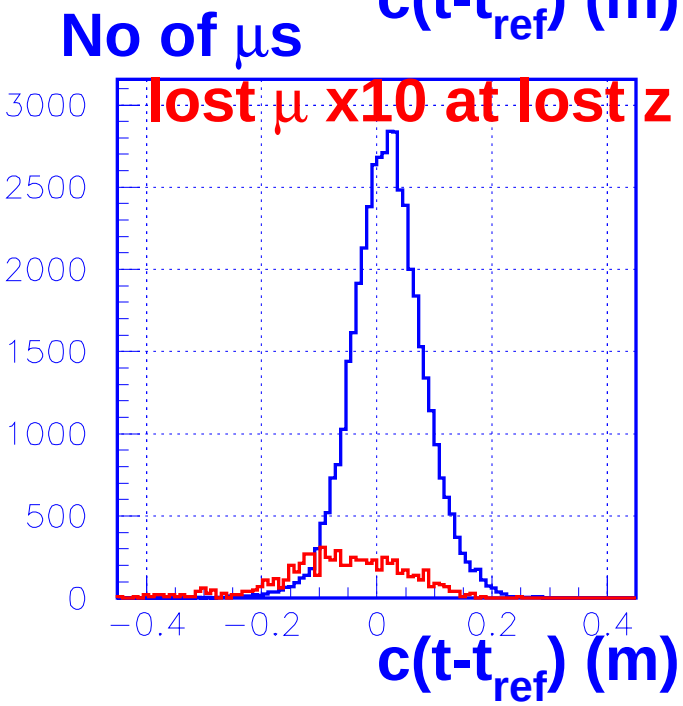
$$\text{Total Merit} = \text{Transmission} \times \frac{\epsilon x_i}{\epsilon x_f}\frac{\epsilon y_i}{\epsilon y_f}\frac{\epsilon z_i}{\epsilon z_f}$$

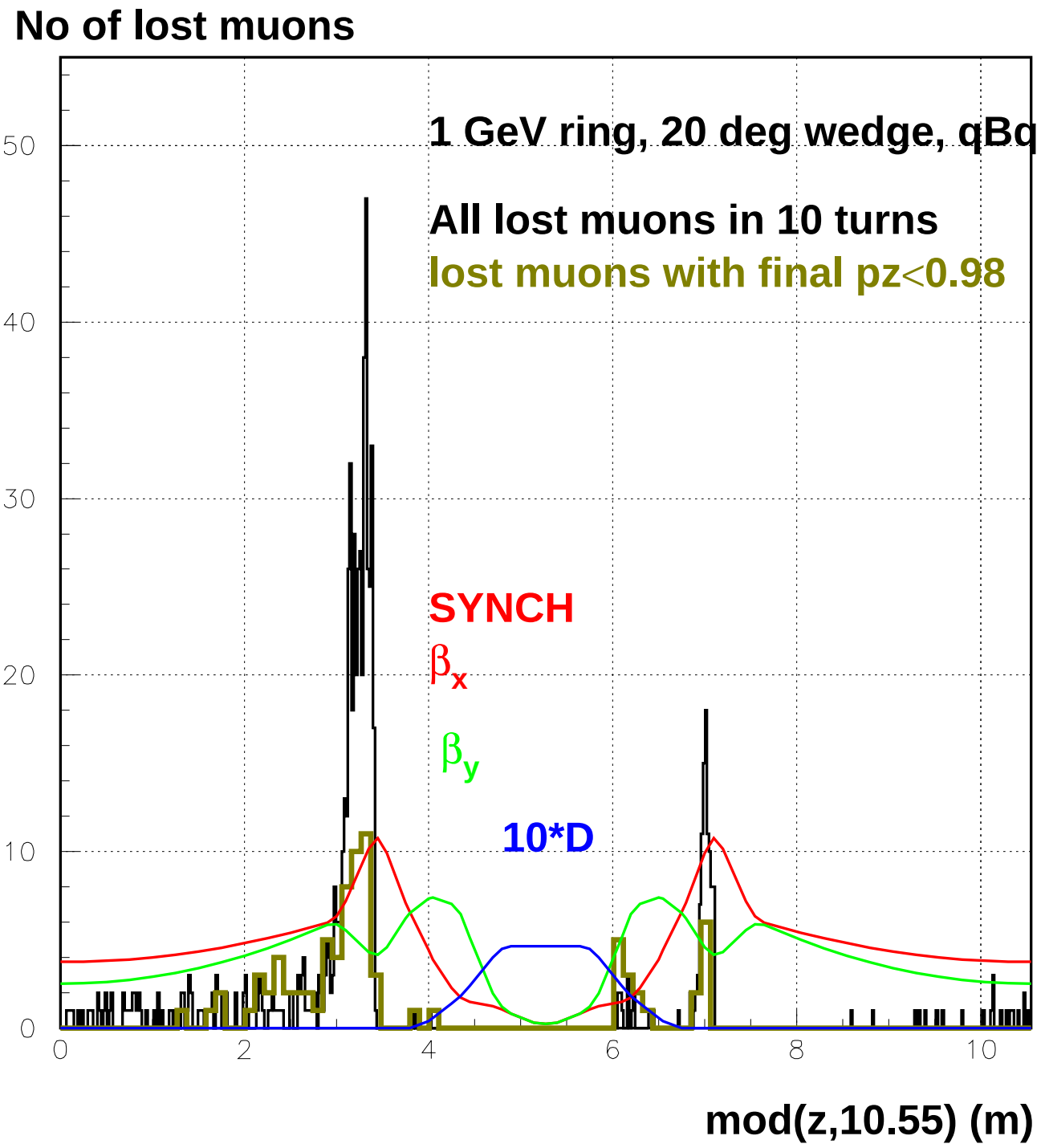



Ring Cooler: 500 MeV/c - 10 degree Wedges
Transmission
X emit ratio
Y emit ratio
Z emit ratio
Total Merit
8 Bend Cells/Turn
Ratios
Total Ring Turns
0
1
2
3
4
5
0
4
8
12
16

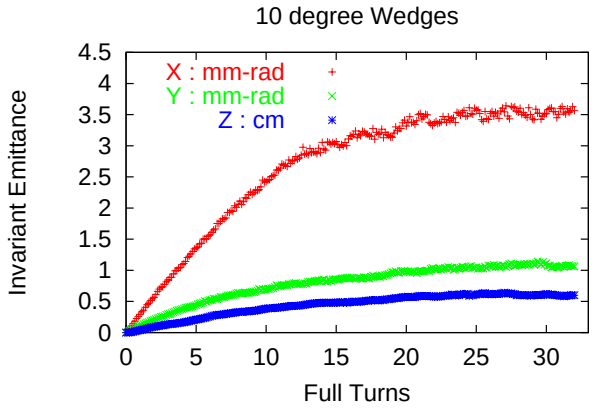

p_z (GeV/c)
all μ at RF
μ at lost z
1.15
1.1
1.05
1
0.95
0.9
0.85
−0.4
−0.2
0
0.2
0.4
$c(t-t_{ref})$ (m)

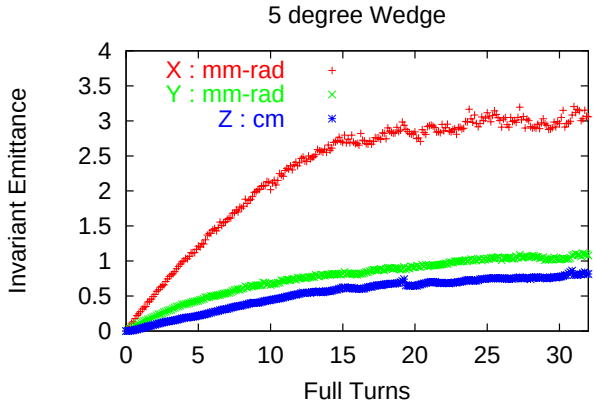

No of μs
lost μ x10 at lost z
1400
1200
1000
800
600
400
200
0
0.9
1
1.1
p_z (GeV/c)

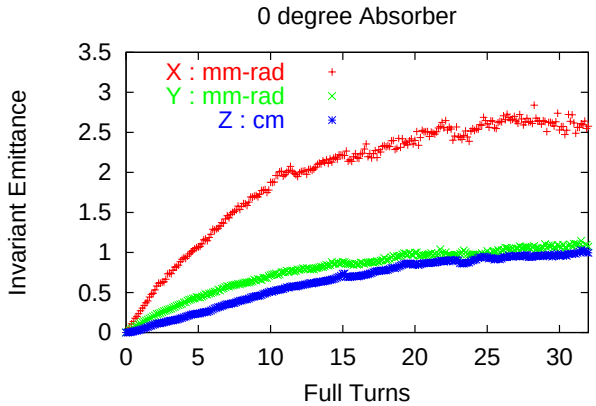

No of μs
lost μ x10 at lost z
3000
2500
2000
1500
1000
500
0
−0.4
−0.2
0
0.2
0.4
$c(t-t_{ref})$ (m)

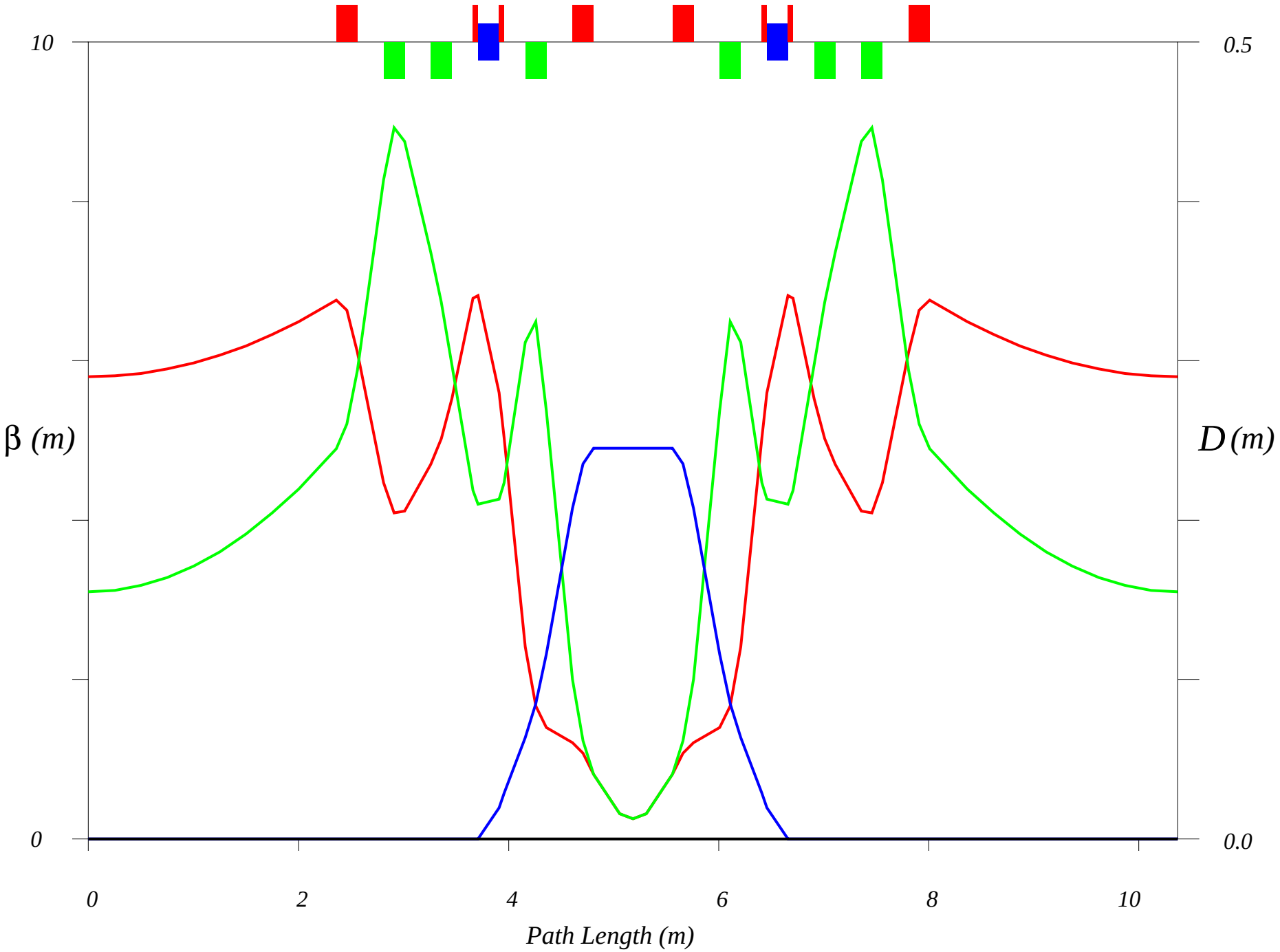

No of lost muons
1 GeV ring, 20 deg wedge, qBq
All lost muons in 10 turns
lost muons with final pz<0.98
SYNCH
βx
βy
10*D
0
10
20
30
40
50
0
2
4
6
8
10
mod(z,10.55) (m)

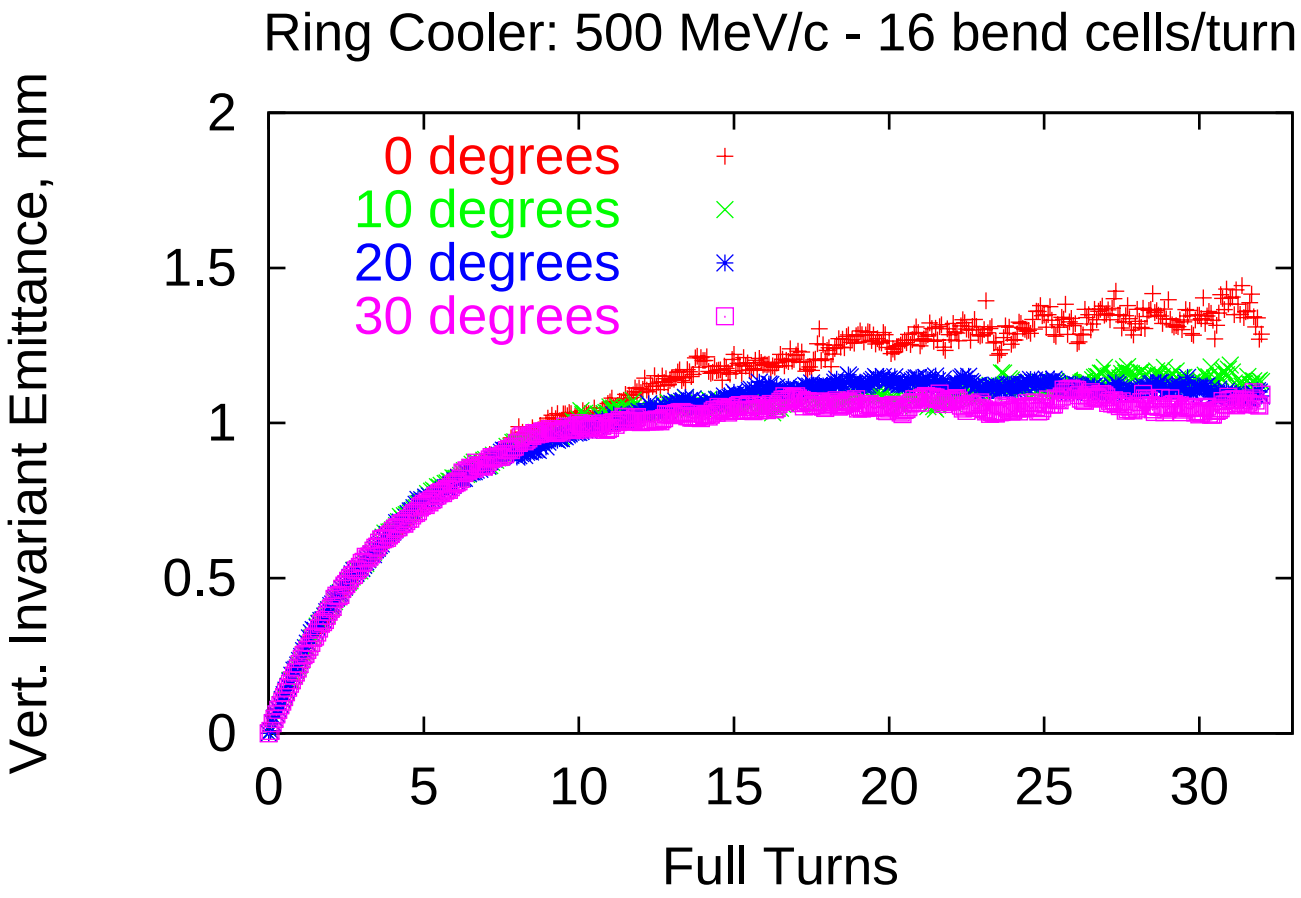
500 MeV/c Cooling Ring: 8 Bend Cells/Turn

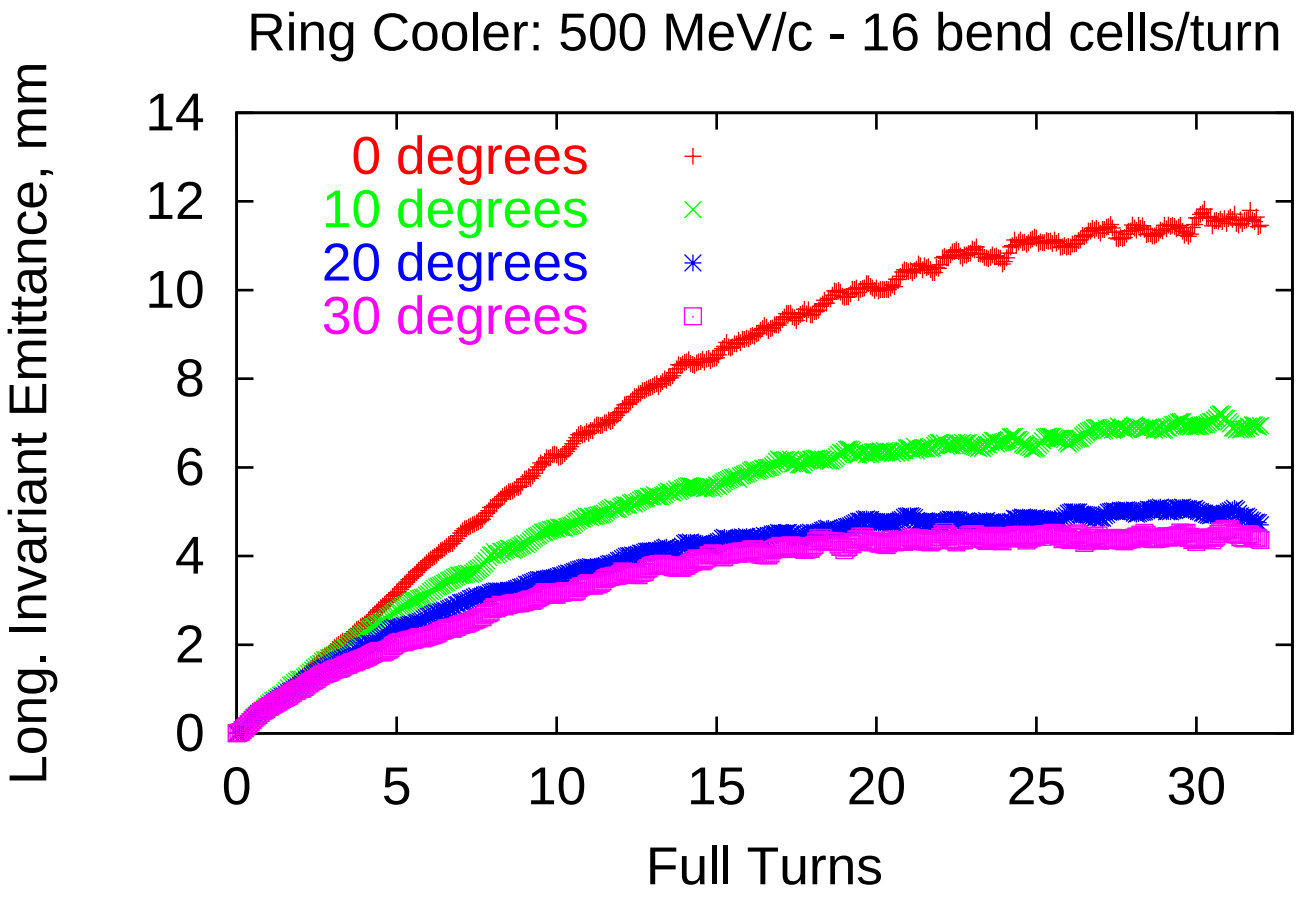


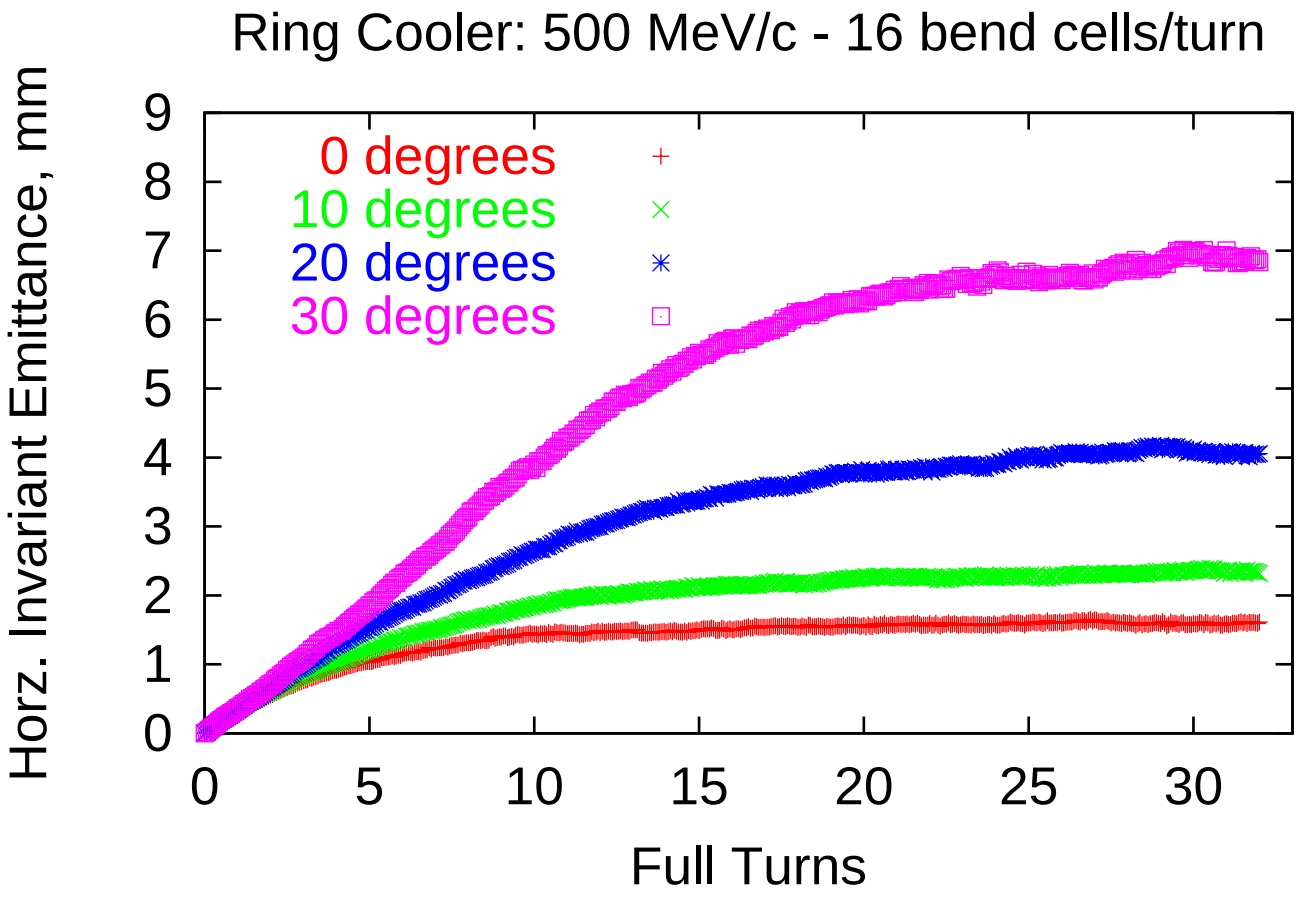


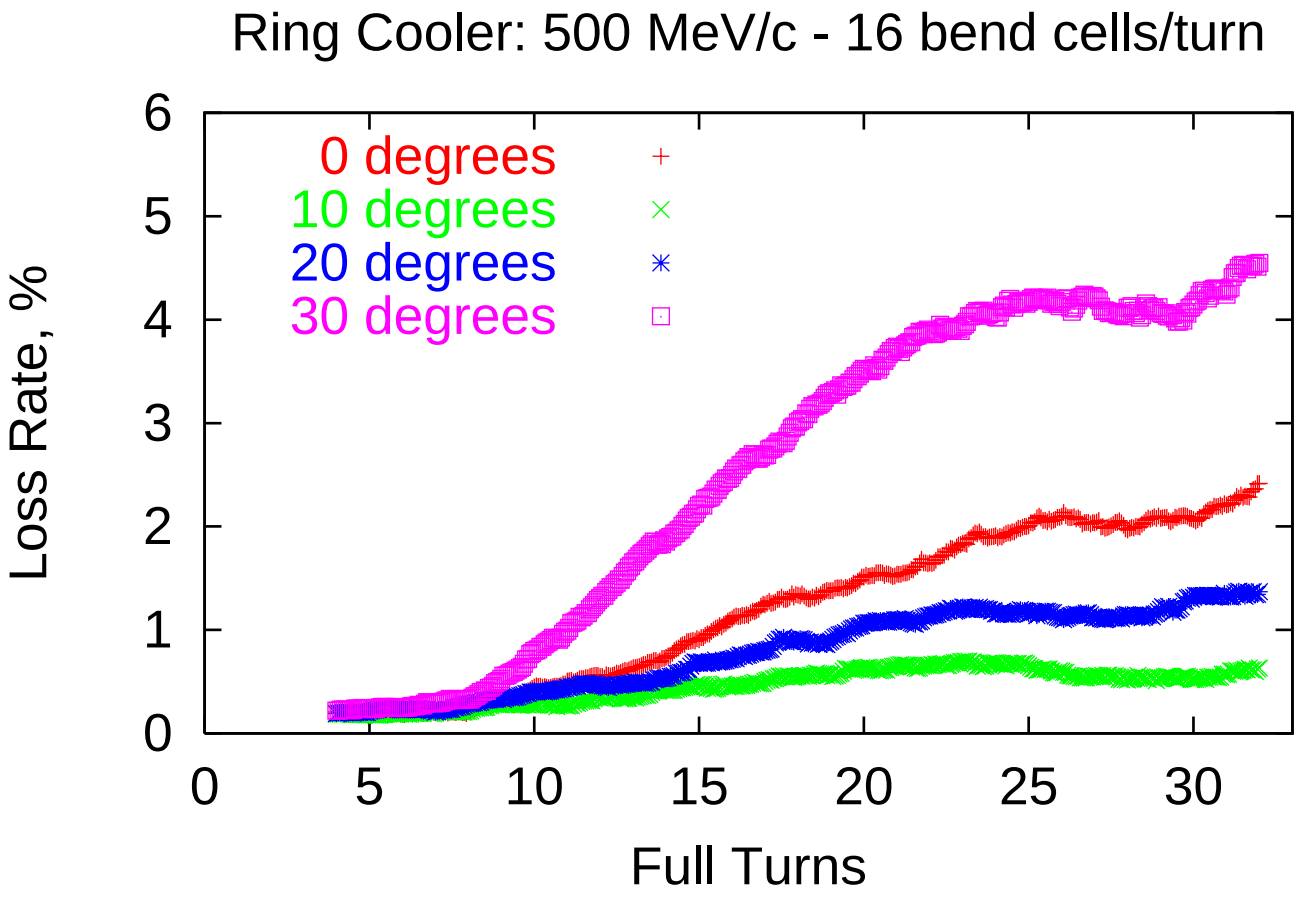


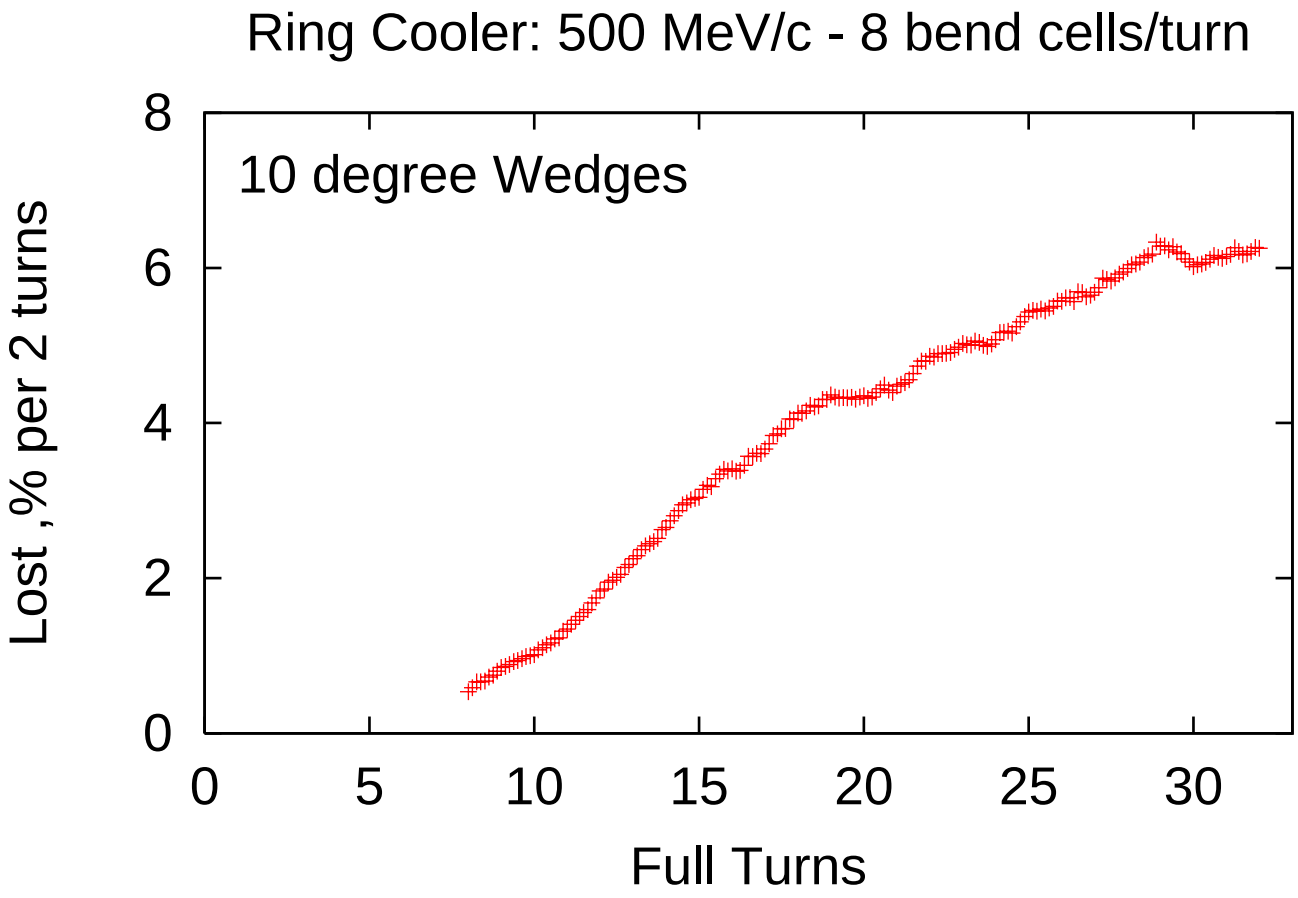

10
0
0.5
0.0
β (m)
D (m)
0
2
4
6
8
10
Path Length (m)


Ring Cooler: 500 MeV/c - 16 bend cells/turn
0 degrees
10 degrees
20 degrees
30 degrees
Vert. Invariant Emittance, mm
Full Turns
0
0.5
1
1.5
2
0
5
10
15
20
25
30


Ring Cooler: 500 MeV/c - 16 bend cells/turn
Long. Invariant Emittance, mm
Full Turns
0 degrees
10 degrees
20 degrees
30 degrees
0
2
4
6
8
10
12
14
0
5
10
15
20
25
30


Ring Cooler: 500 MeV/c - 16 bend cells/turn
Horz. Invariant Emittance, mm
Full Turns
0 degrees
10 degrees
20 degrees
30 degrees
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30


Ring Cooler: 500 MeV/c - 16 bend cells/turn
0 degrees
10 degrees
20 degrees
30 degrees
Loss Rate, %
Full Turns
0
1
2
3
4
5
6
0
5
10
15
20
25
30

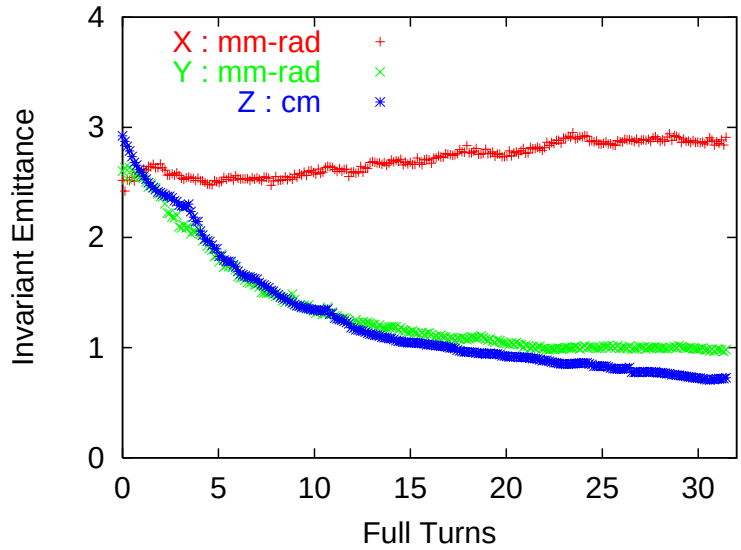

Ring Cooler: 500 MeV/c - 8 bend cells/turn
10 degree Wedges
Lost ,% per 2 turns
Full Turns
0
2
4
6
8
0
5
10
15
20
25
30

500 MeV/c Cooling Ring

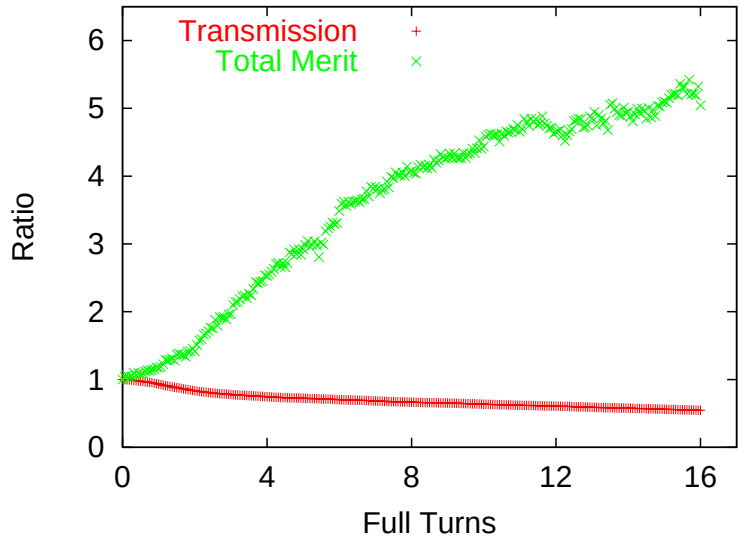
Sixteen Bend Cells/Turn – 20° Wedges

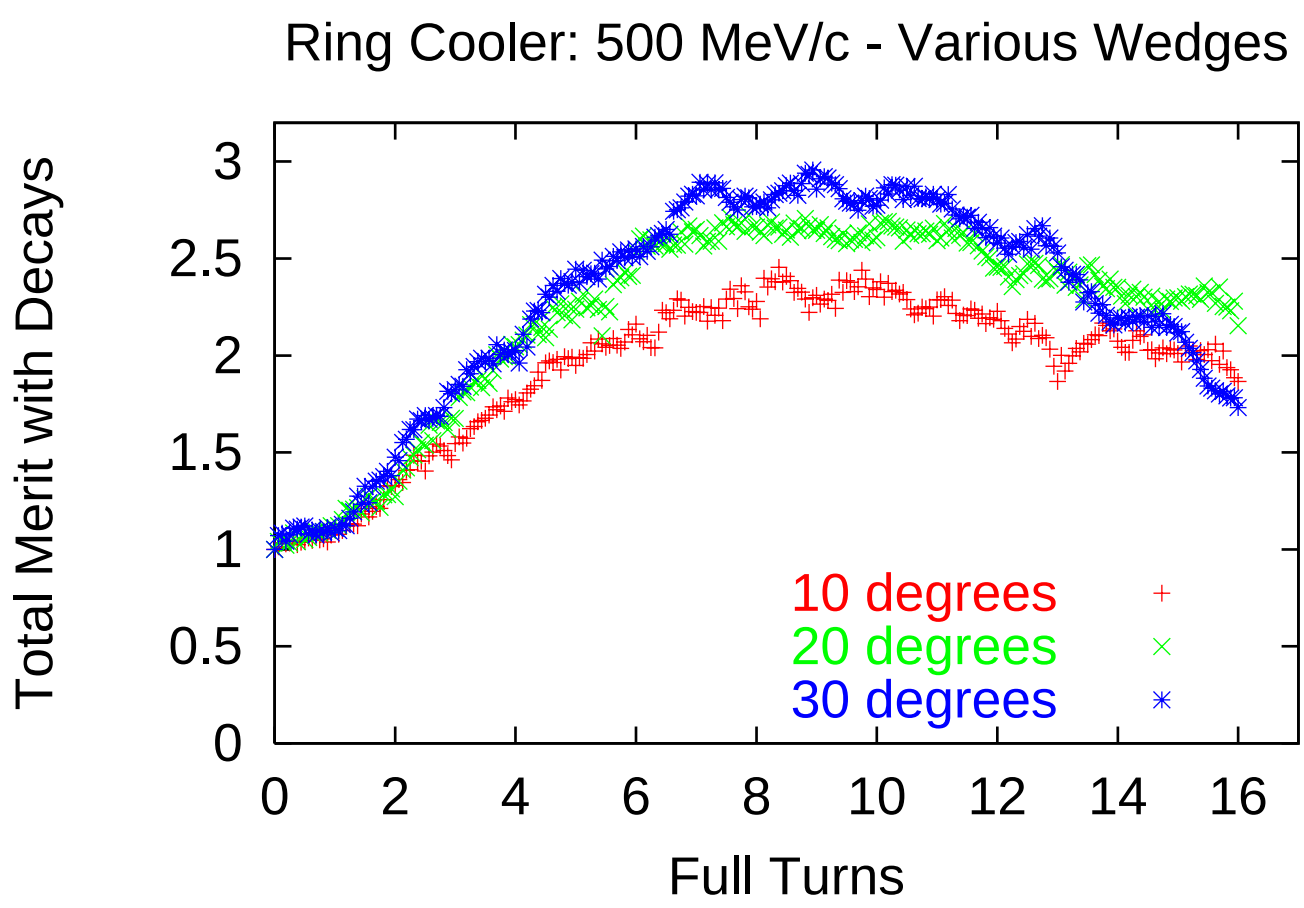
With Multiple Coulomb Scattering and Straggling

$$\gamma\beta\epsilon_{x_i} = 2.5mm;\ \gamma\beta\epsilon_{y_i} = 2.6mm\ ;\ \gamma\beta\epsilon_{z_i} = 29mm$$



$$\text{Total Merit} = \text{Transmission} \times \frac{\epsilon x_i}{\epsilon x_f}\frac{\epsilon y_i}{\epsilon y_f}\frac{\epsilon z_i}{\epsilon z_f}$$




Ring Cooler: 500 MeV/c - Various Wedges
Total Merit with Decays
Full Turns
0
0.5
1
1.5
2
2.5
3
0
2
4
6
8
10
12
14
16
10 degrees
20 degrees
30 degrees