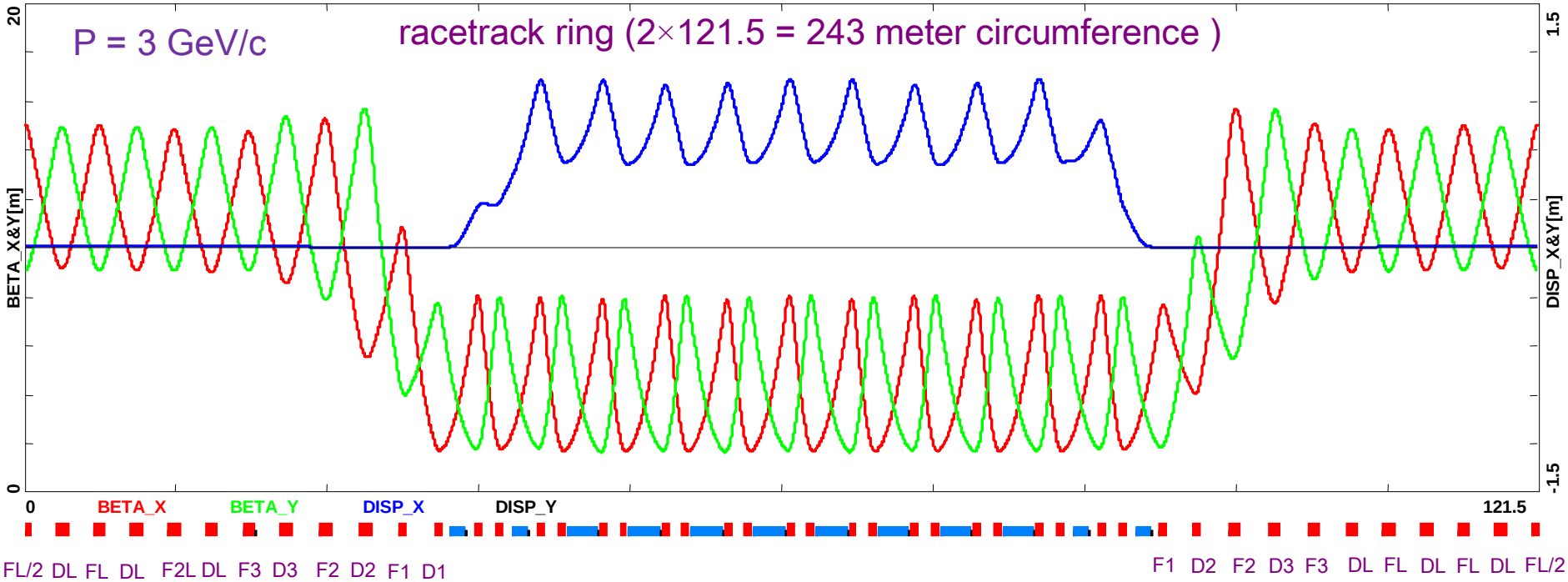
3 GeV Decay Ring Design - Options

Alex Bogacz

Ring Optics (90^0 doublets + 30^0 FODO)



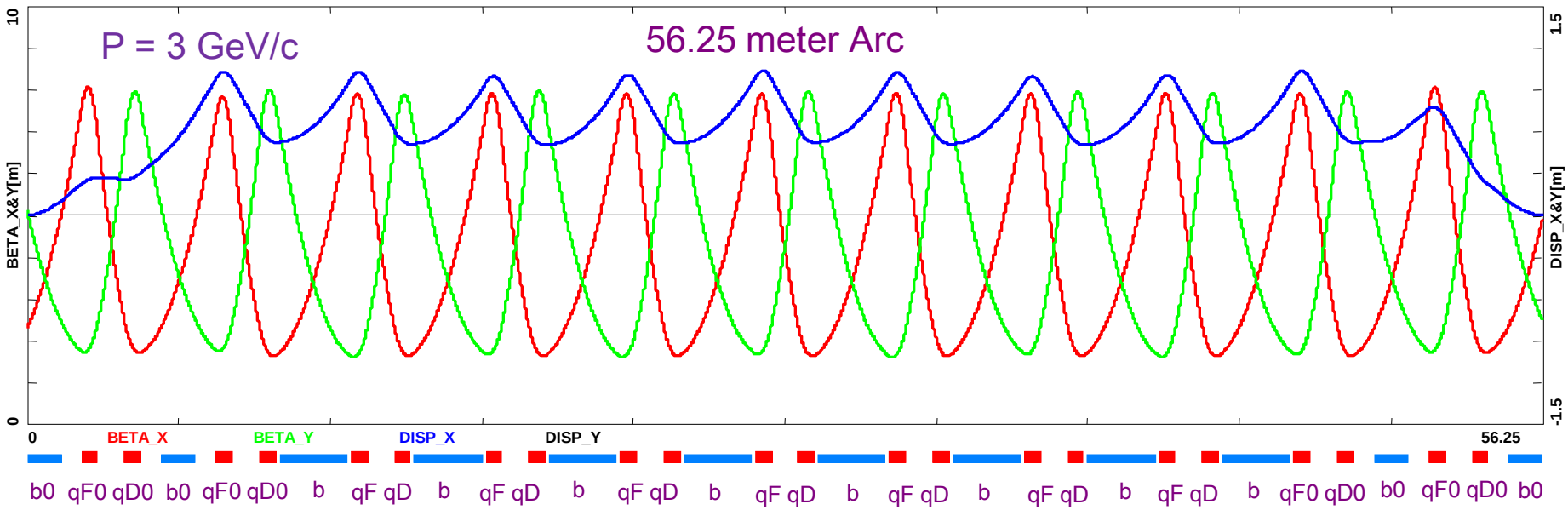
qF1	L[cm]=60	G[kG/cm]=0.677
qD1	L[cm]=60	G[kG/cm]=-0.653
qF2	L[cm]=100	G[kG/cm]=0.320
qD2	L[cm]=100	G[kG/cm]=-0.264

qF3	L[cm]=100	G[kG/cm]=0.217
qD3	L[cm]=100	G[kG/cm]=-0.202
qFL	L[cm]=100	G[kG/cm]=0.196
qDL	L[cm]=100	G[kG/cm]=-0.196

drift between quads in a FODO L[cm]=200

Magnet aperture radius L[cm]=25

Arc Optics (90^0 doublets)



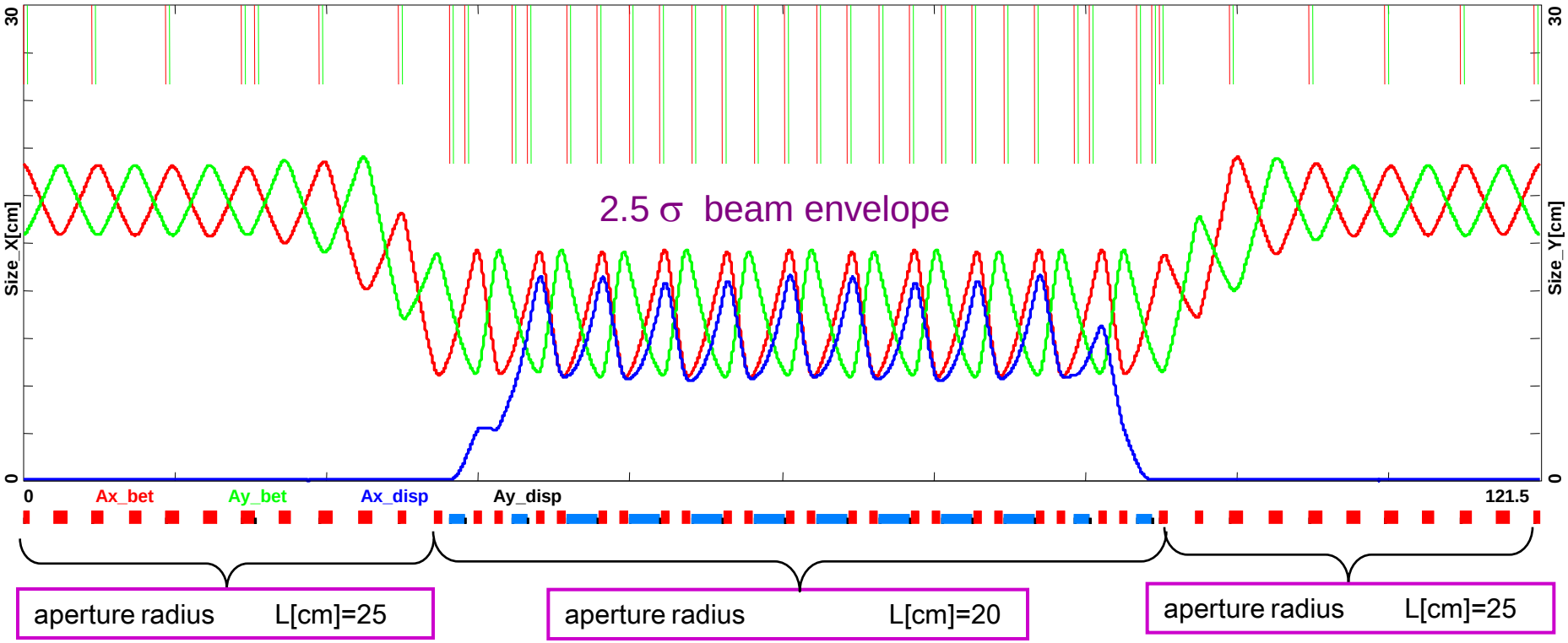
qF0	L[cm]=60	G[kG/cm]=1.100
qD0	L[cm]=60	G[kG/cm]=-1.075
qF	L[cm]=60	G[kG/cm]=1.124
qD	L[cm]=60	G[kG/cm]=-1.089
drift between quads in a doublet		L[cm]=100
drift between a quad and a bend		L[cm]=15

b0	L[cm]=125	B[kG]=12.575
b	L[cm]=250	B[kG]=12.575

Magnet aperture radius	L[cm]=20/15

Ring (half) – Beam Envelope

P = 3 GeV/c



ε_N = 30 mm rad

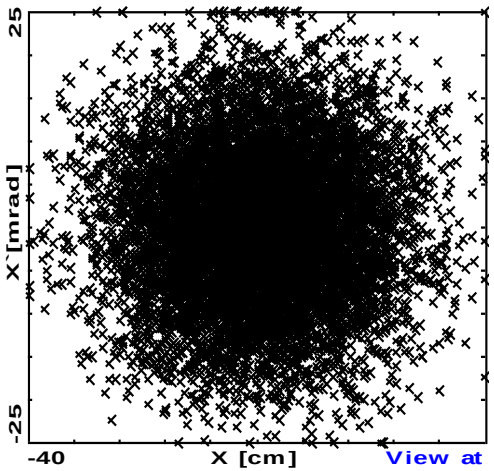
$\sqrt{\beta\varepsilon}$

$\sigma_{\Delta p/p}$ = 0.05

$D_x \sigma_{\Delta p/p}$

Dynamic Aperture – 80 turns

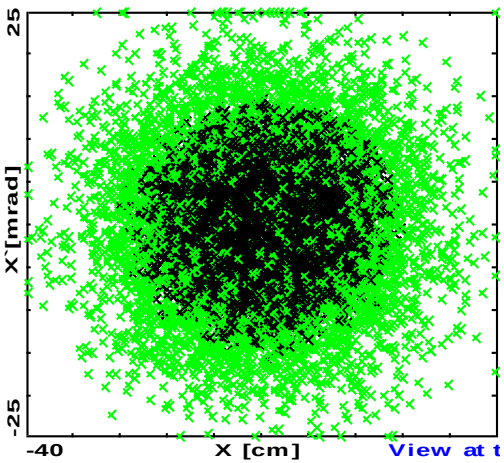
initial 1.000000



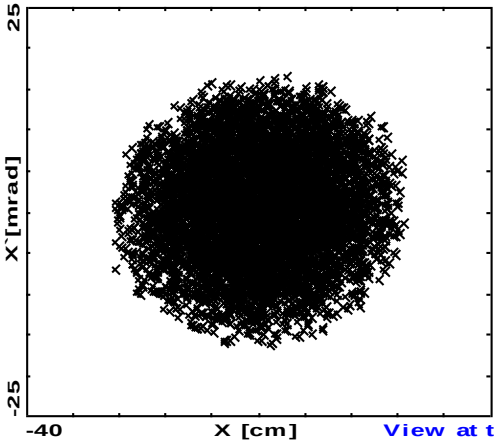

```
$MuDecay=2.2e-6;  =>    2.2e-06
$C=12150*2;  =>      24300
$NTurn=$gamma*$MuDecay*$beta*$c/$C;  =>  77
```

ε_N = 30 mm rad $\sqrt{\beta\varepsilon}$

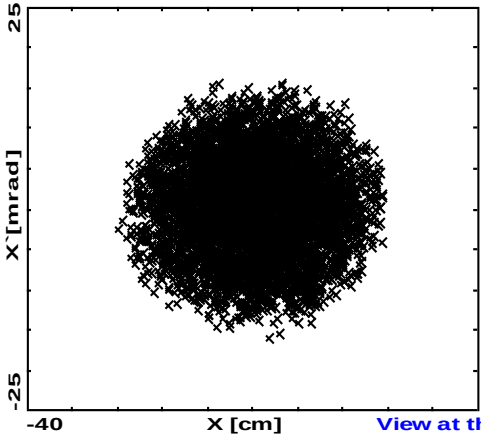
$\sigma_{\Delta p/p}$ = 0.05 $D_x\sigma_{\Delta p/p}$



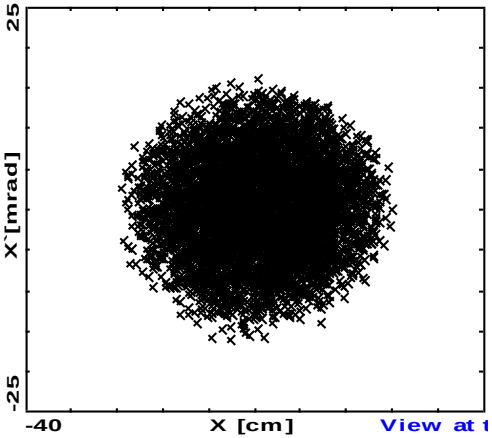
turn 1 0.720300



turn 30 0.569300



turn 80 0.540900



Scaling FFAG Option

VLENF: storage ring proposal (Preliminary)

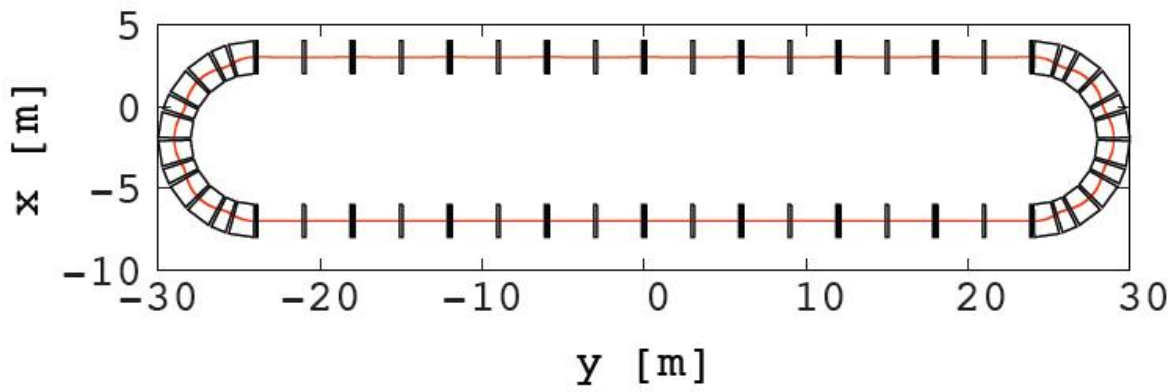
Beam momentum : 1 GeV/c (3 GeV/c)

Momentum acceptance ~± 50%

J-B Lagrange, NuFact'11

Transverse acceptance ε_N > 30 000 π mm.mrad

Scallop in the straight part < 5 mrad



Bmax ~ 1.5 T

m ~ 8 m^{-1}

k ~ 2.5

r ~ 5 m

cf. T. Roberts, VLNEF July 2011: 6D acceptance > 100 times bigger

Summary

- Decay Ring (3 GeV Racetrack of 243 meter circumference)
  - 7 m betas, 90 cm hor. dispersion in the Arcs
  - 15 m betas in the Straight
- Acceptance - Dynamic Aperture Study
  - transverse: ε_N = 30 mm rad
  - momentum: $\sigma_{\Delta p/p}$ = 0.05
  - Physical aperture: r = 20/15 cm (Arc) and r = 25 cm (Straight)
  - 46% dynamic lost after 80 turns
- Compact Ring Optics – Linear lattice
  - Dipole bends (2.5 m long, 12.6 kGauss) $\times$ 20
  - Doublet focusing - Quads (0.6 m long, 1.1 kGaus/cm) $\times$ 44
  - FODO focusing - Quads (1 m long, 0.2 kGaus/cm) $\times$ 38