

# The Decay Ring, FODO Racetrack

Alex Bogacz

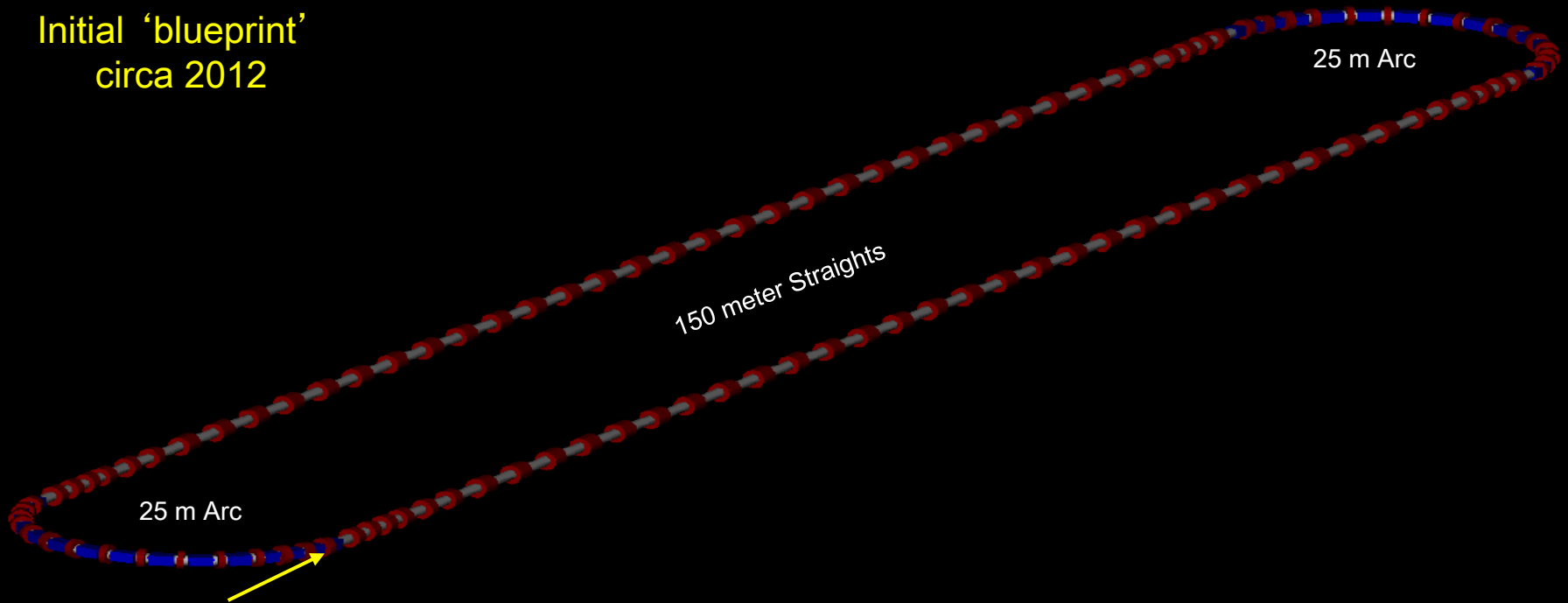
in collaboration with

Ao Liu and David Neuffer

# Capture/Decay Ring – 5/3.8 GeV $\pi/\mu$

Muons recirculated at central momentum:  $p = 3.8 \text{ GeV}/c$

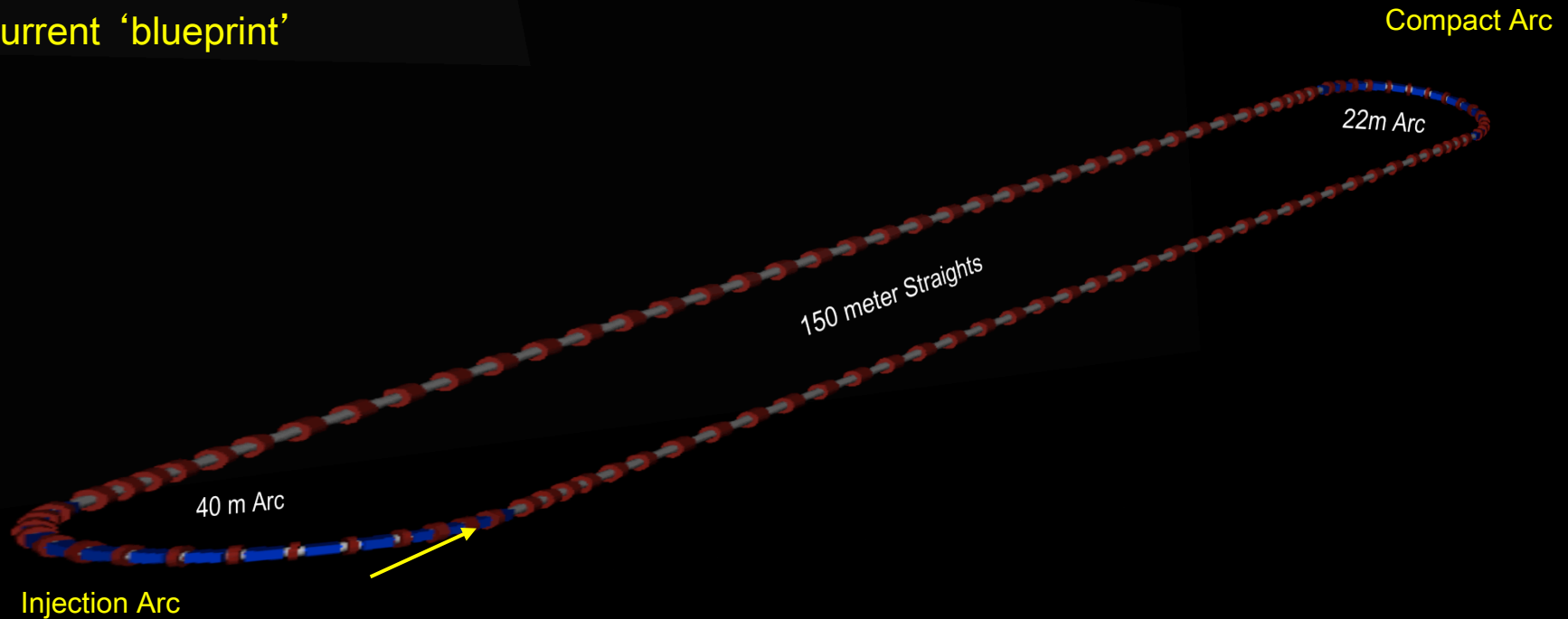
Initial 'blueprint'  
circa 2012



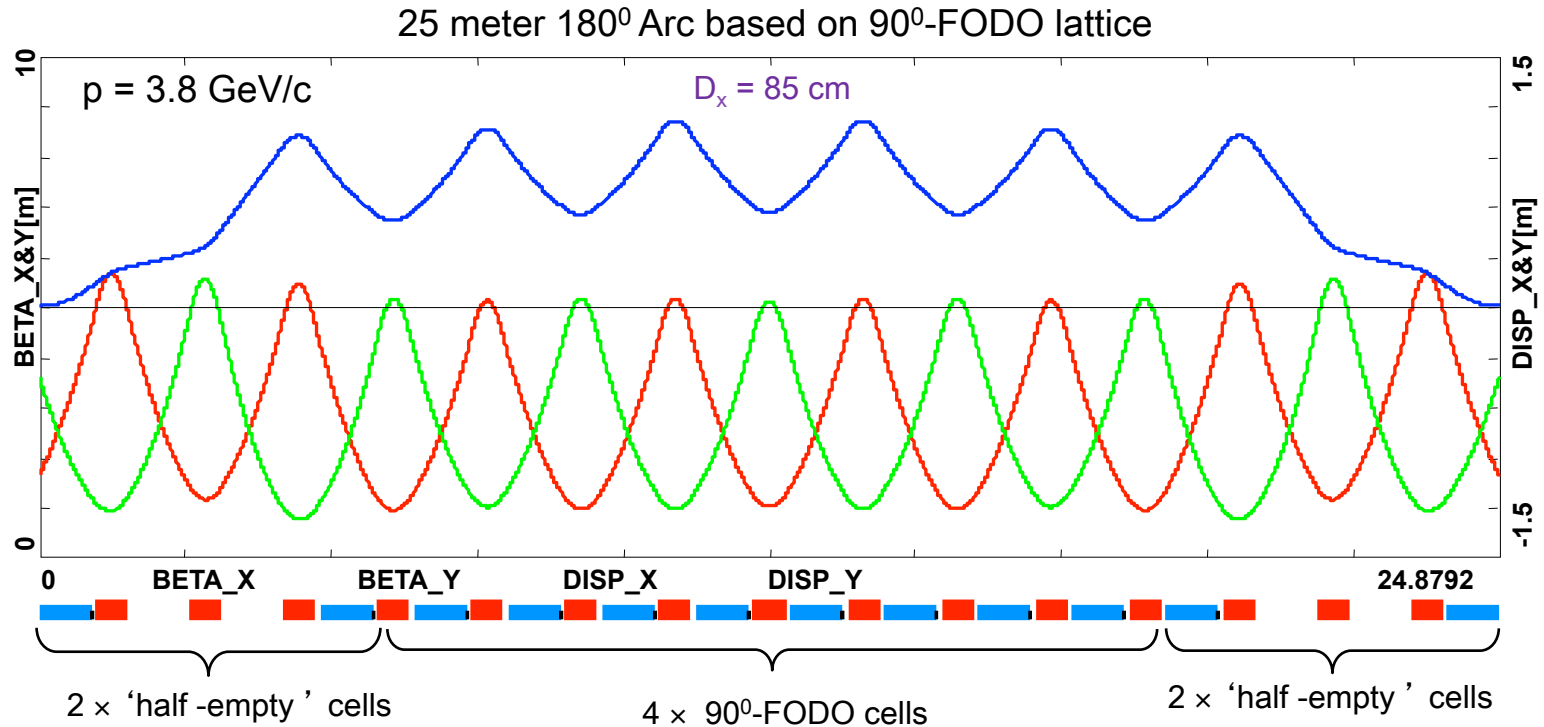
# Decay Ring with non parallel straights

Muons recirculated at central momentum:  $p = 3.8 \text{ GeV}/c$

Current 'blueprint'

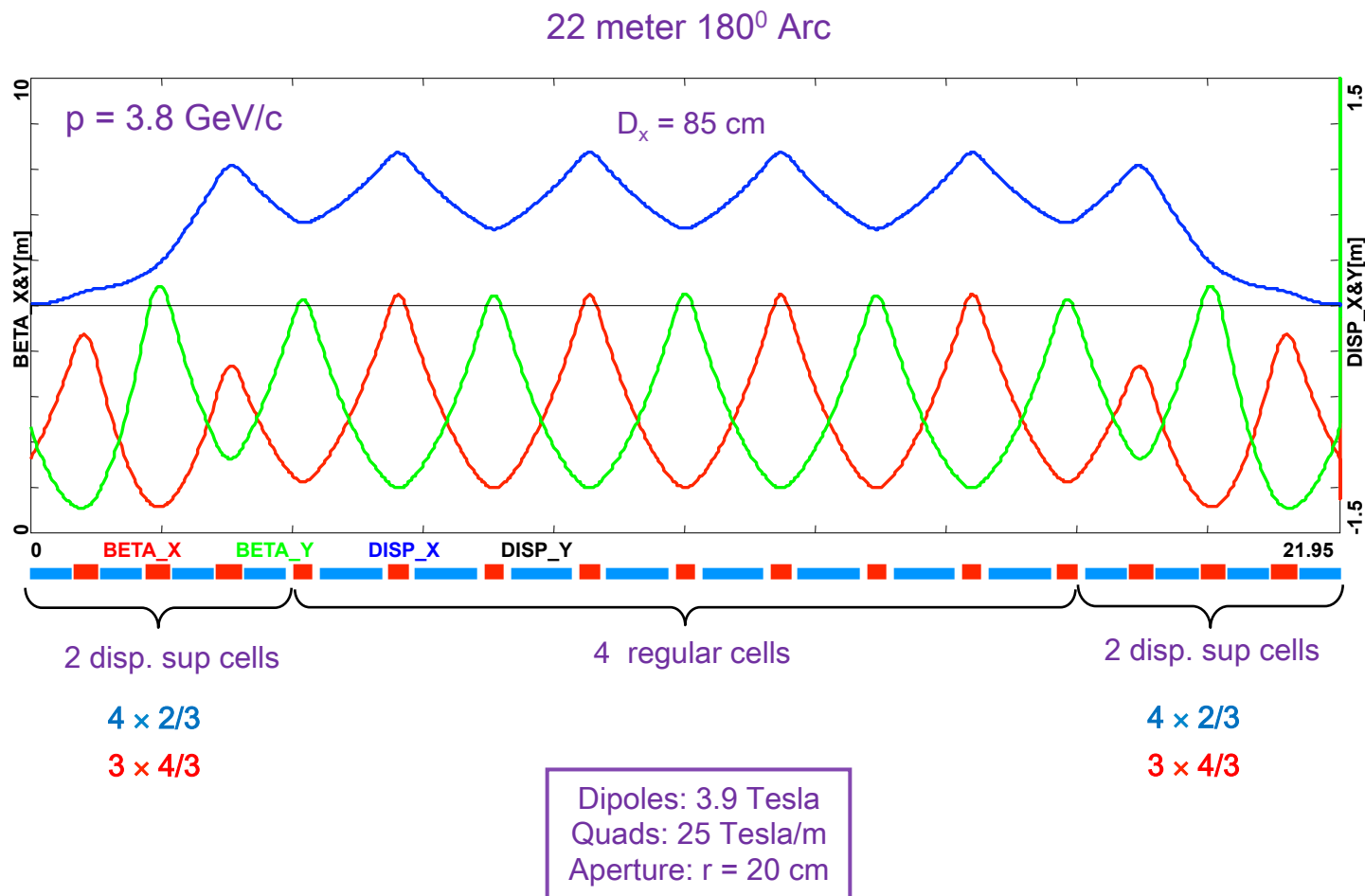


# Arc Optics – 90° FODO with ‘missing dipoles’

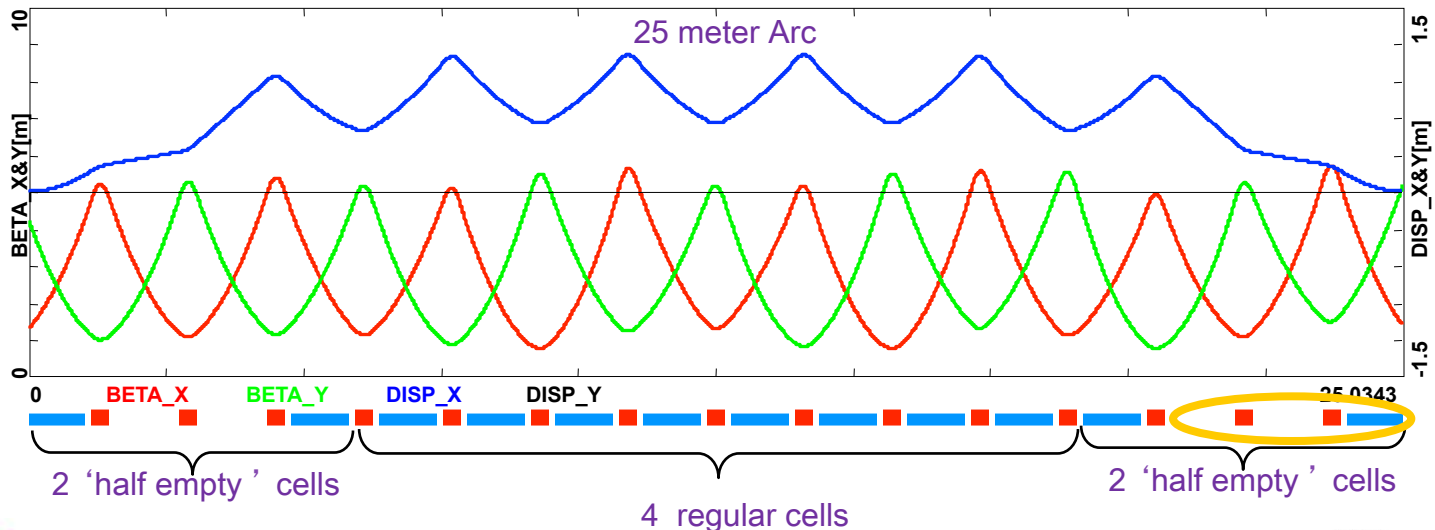
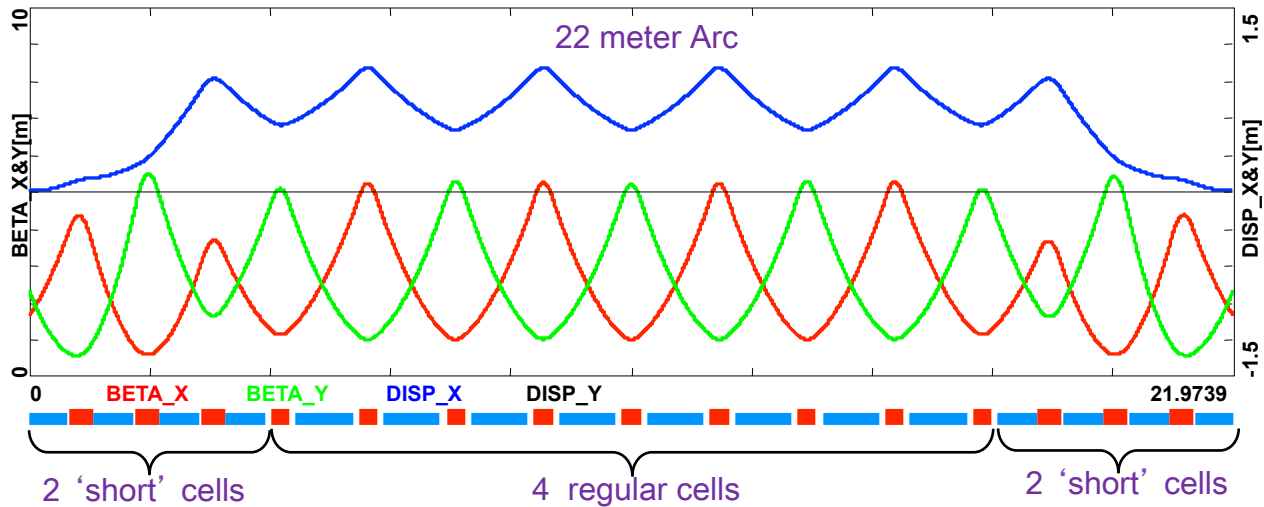


Dipoles: 3.9 Tesla  
 Quads: 25 Tesla/m  
 Aperture:  $r = 20 \text{ cm}$

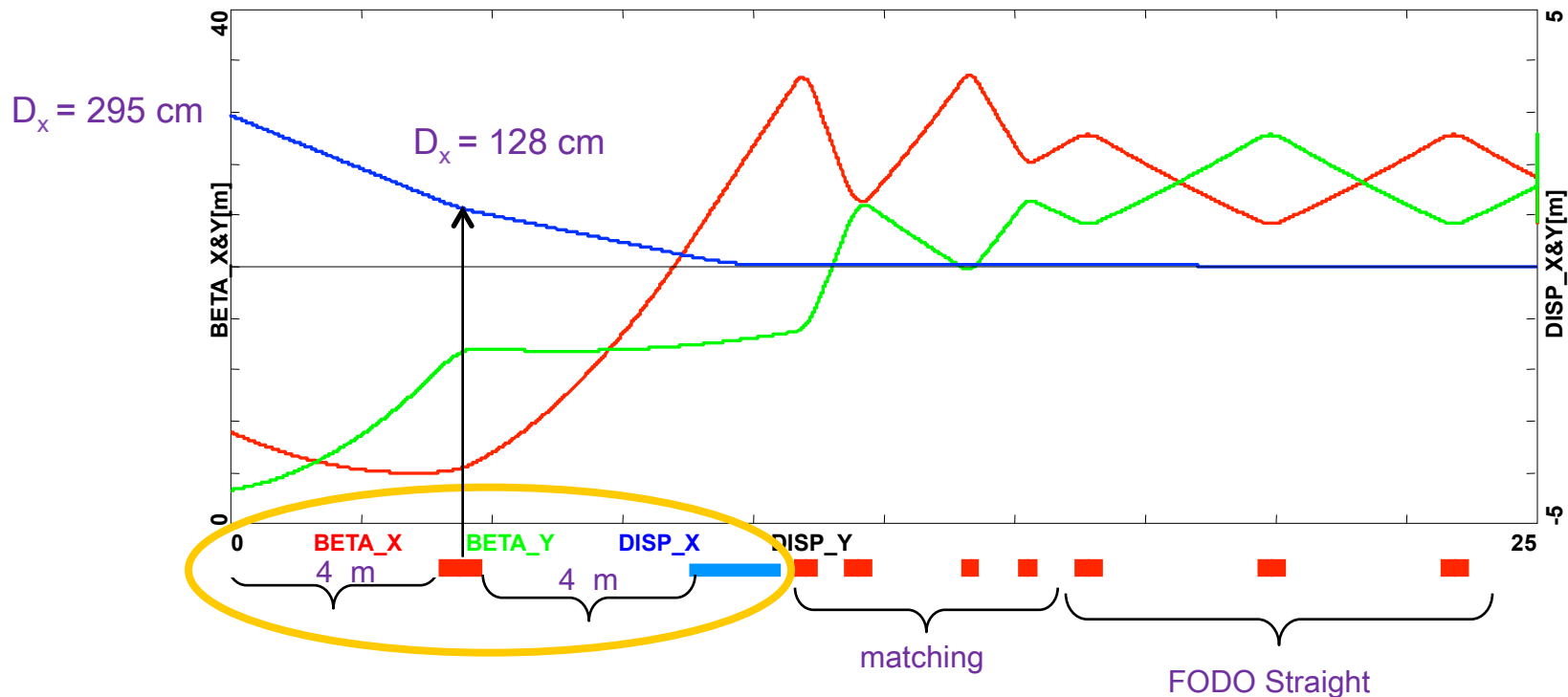
# 'Compact' 90° FODO Arc a la Al Garren



# 90° FODO Optics – Arc Options

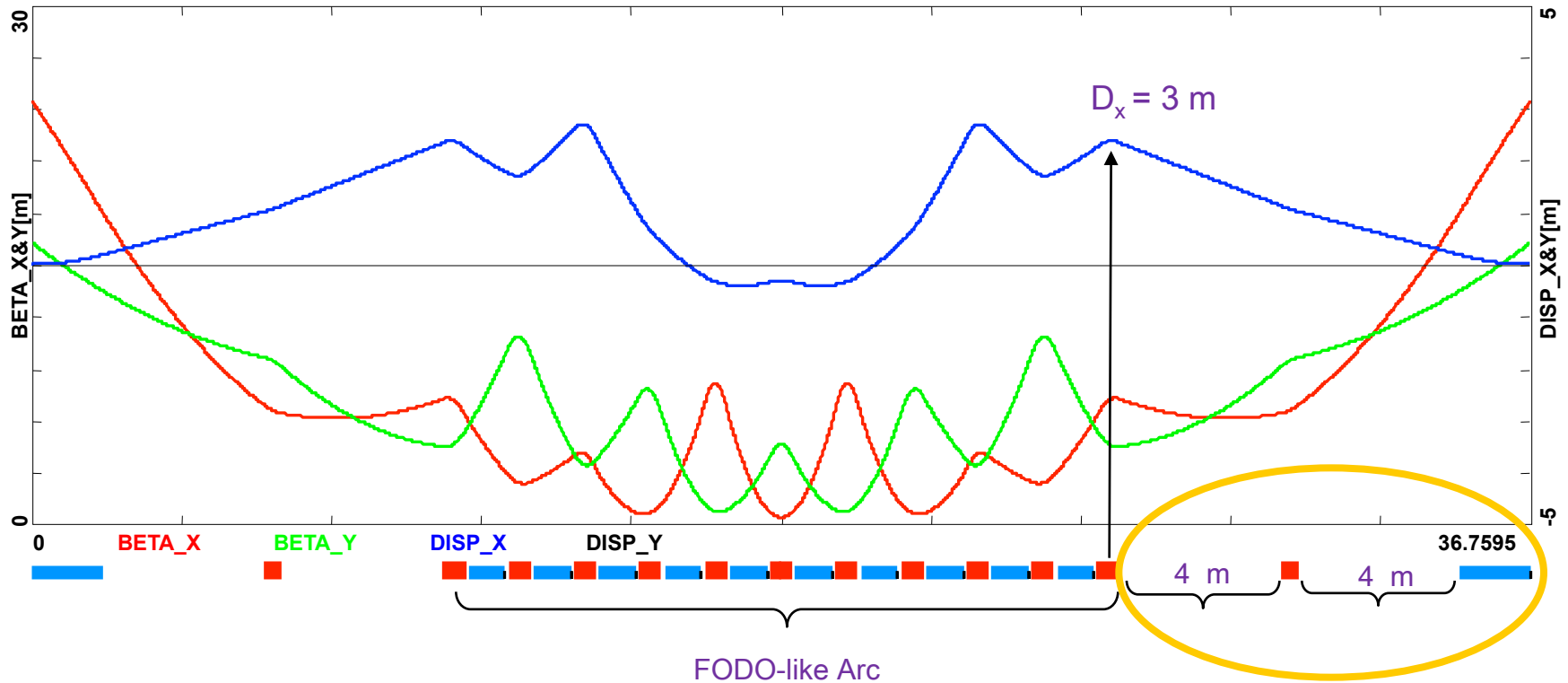


# Ao's Injection Optics



Ao Liu

# Injection Arc – 90° FODO Optics



FODO-like Arc

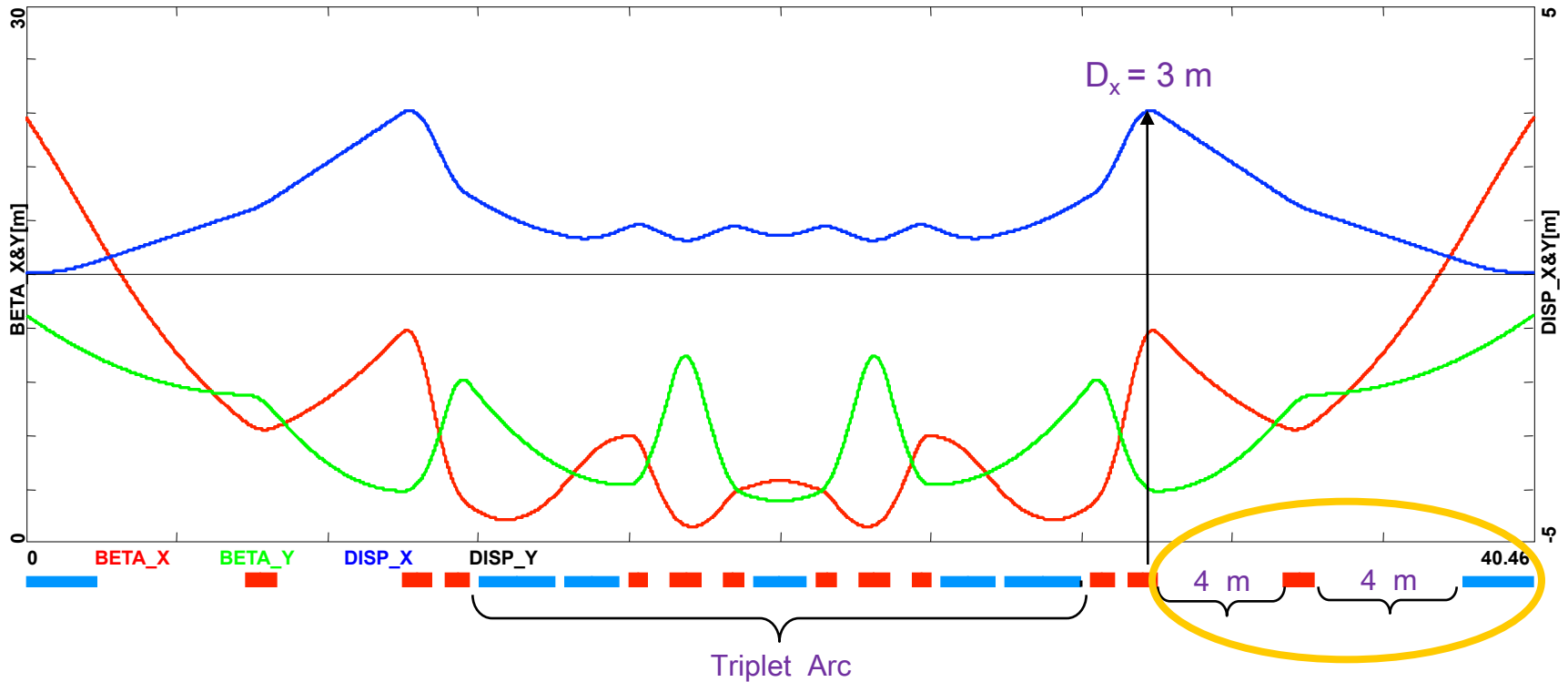
Second Order Achromat



Large Long. acceptance



# Injection Arc – Triplet Optics

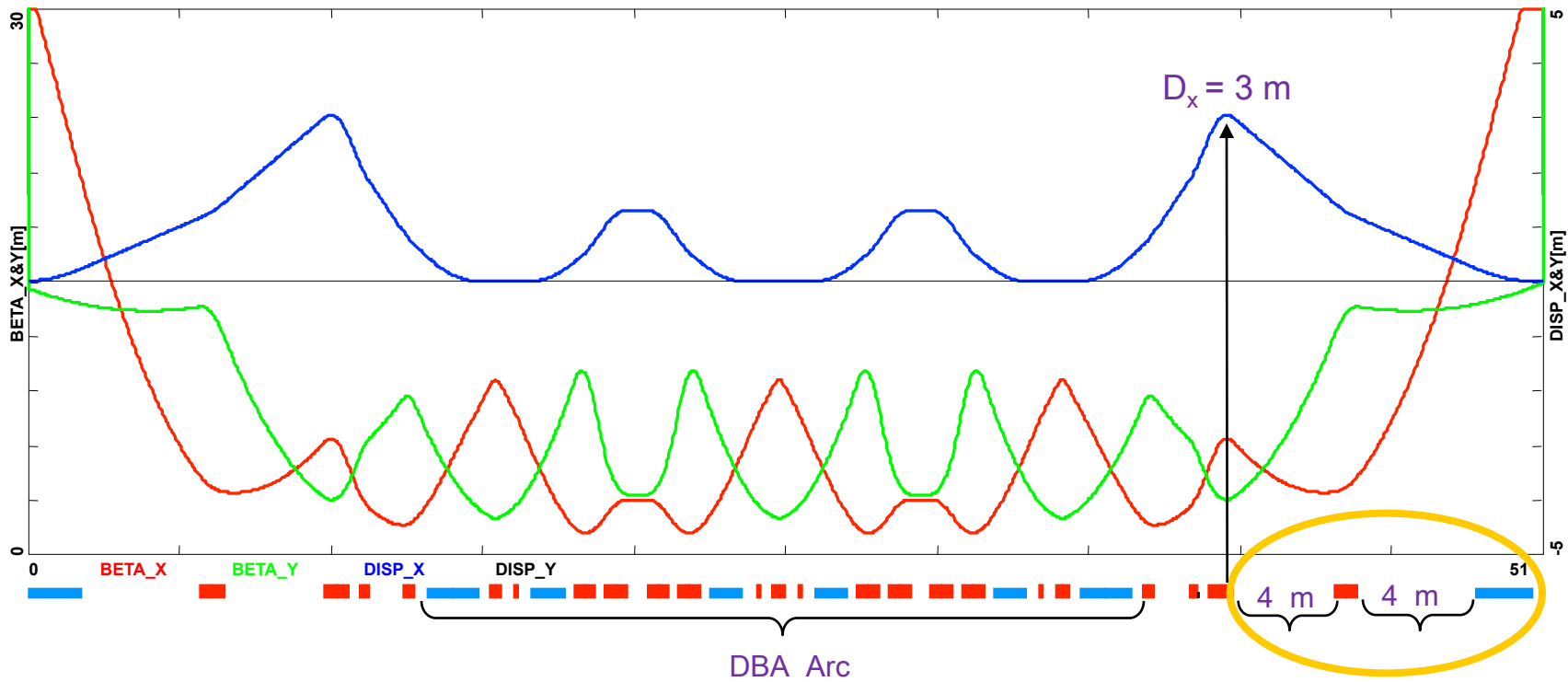


Stronger beta chromaticity  
Larger transverse acceptance



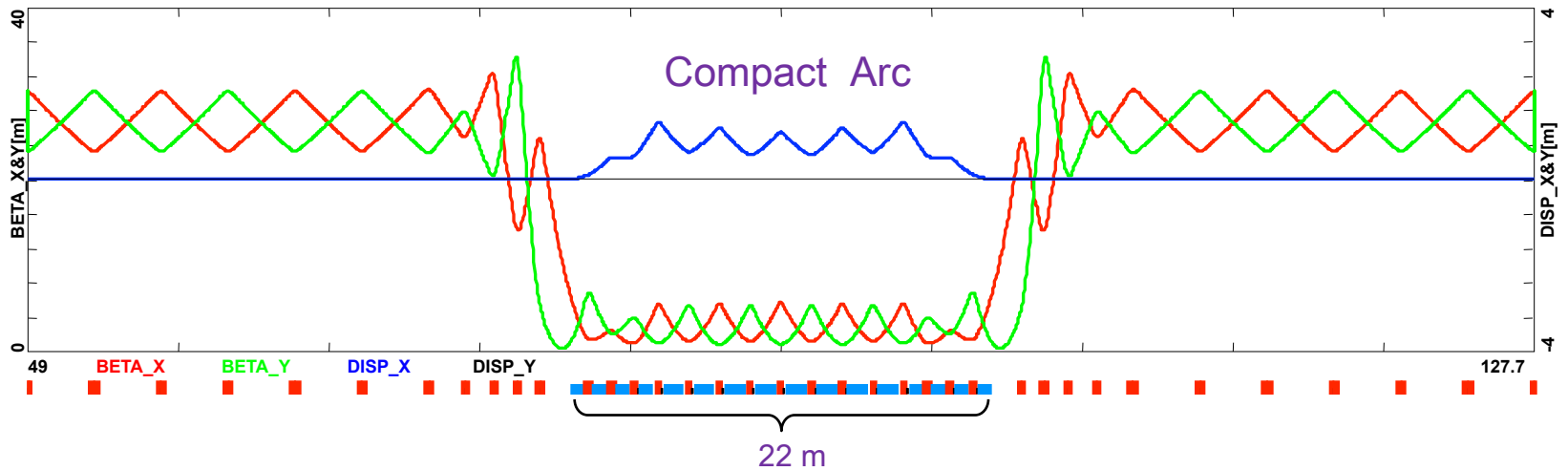
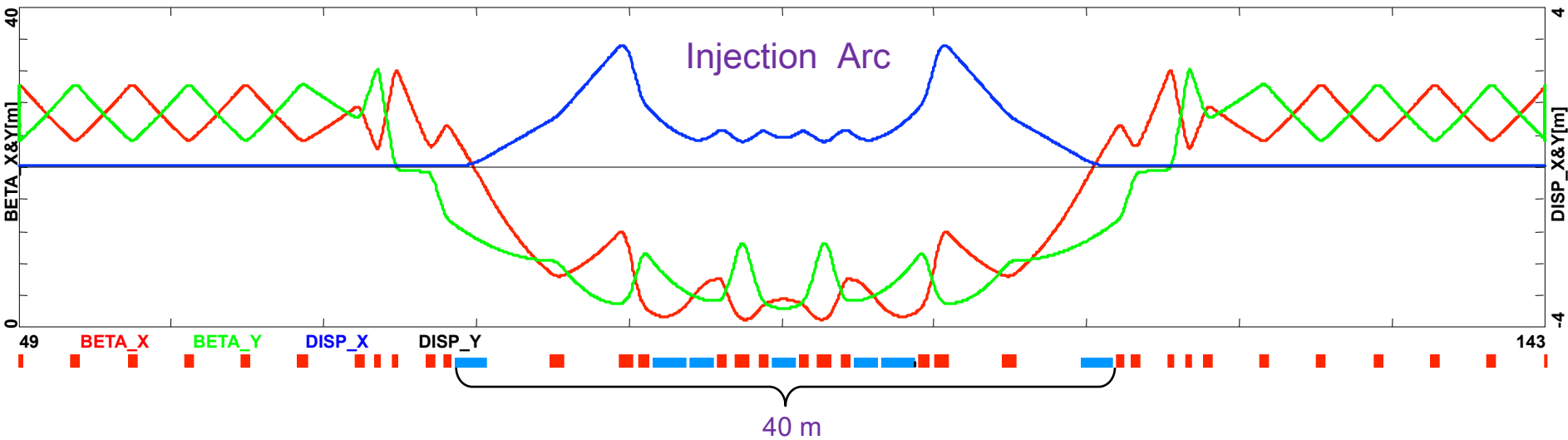
Long/Tran acceptance trade-off

# Injection Arc – DBA Optics

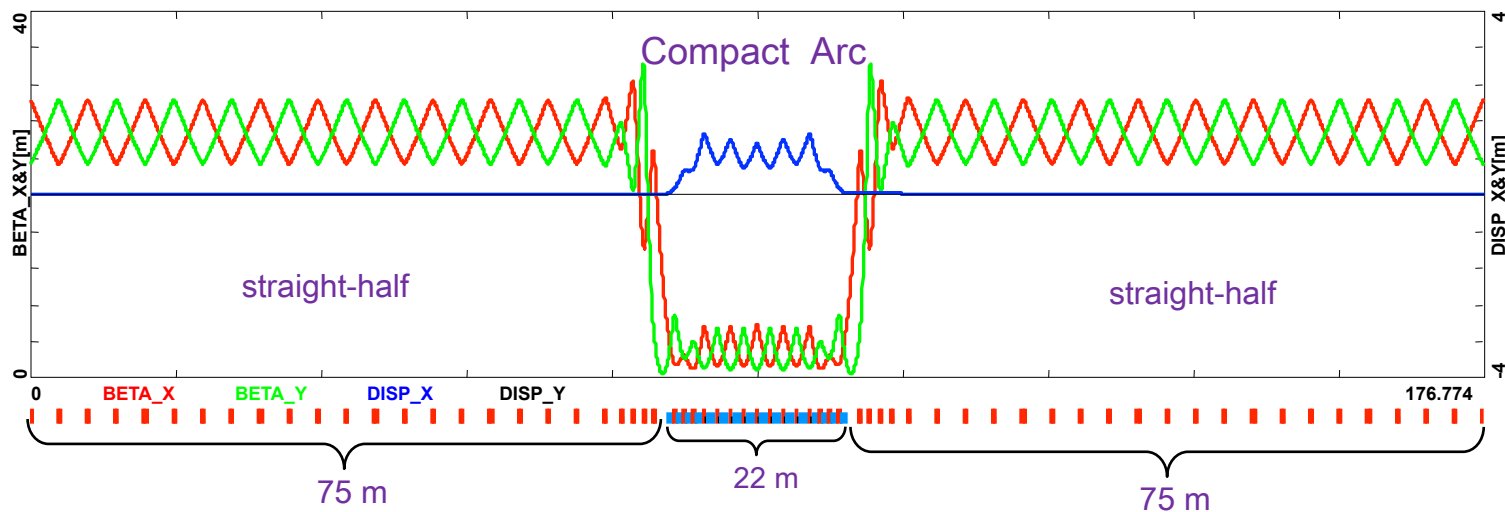
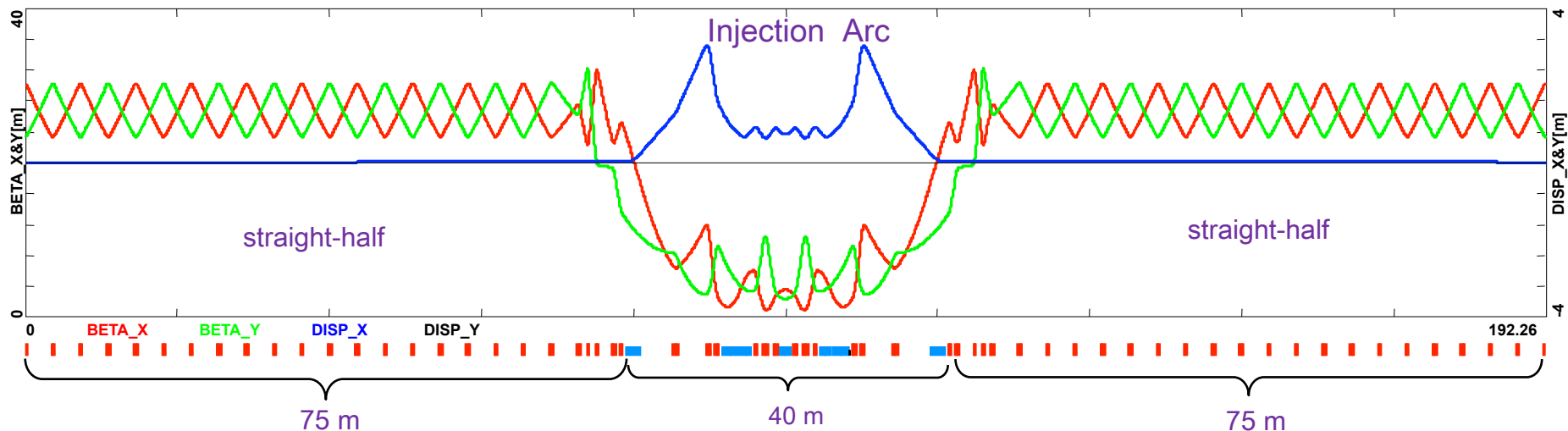


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# Ring Lattice – Arc Choices

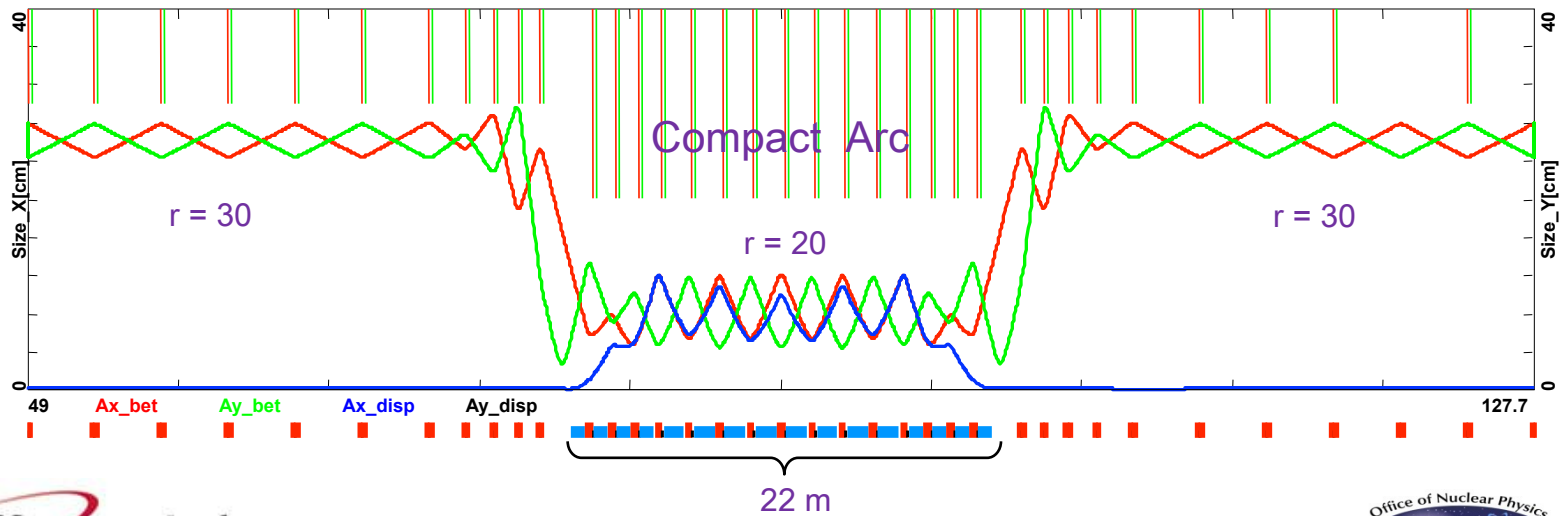
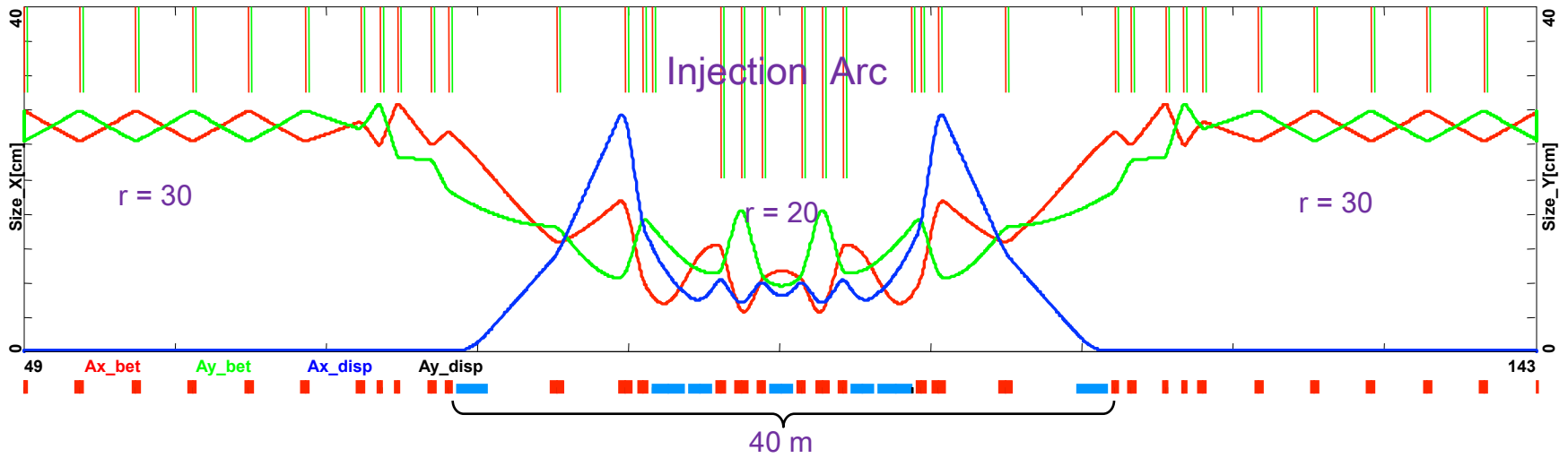


# Ring Optics



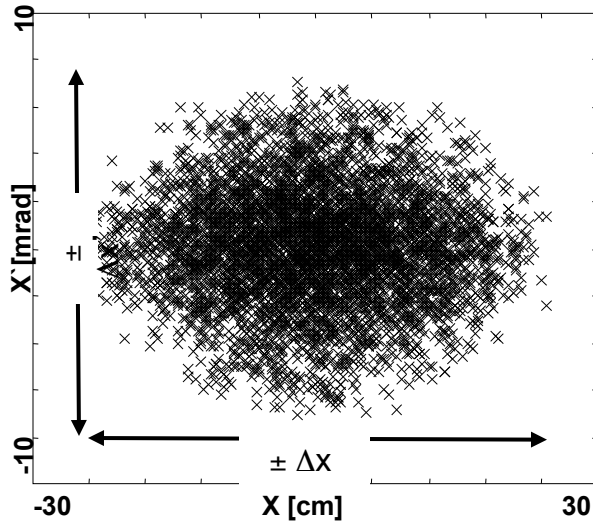
# Ring Acceptance – Beam Envelopes

$\epsilon_N = 95 \text{ mm rad}$      $\Delta p/p = 0.09$

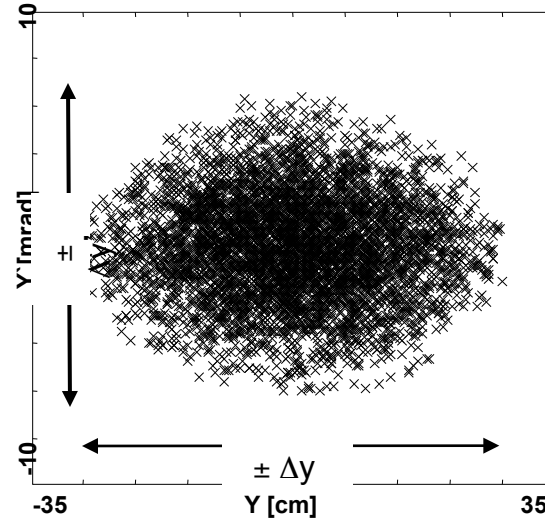


# Dynamic Aperture – tracking for 70 turns

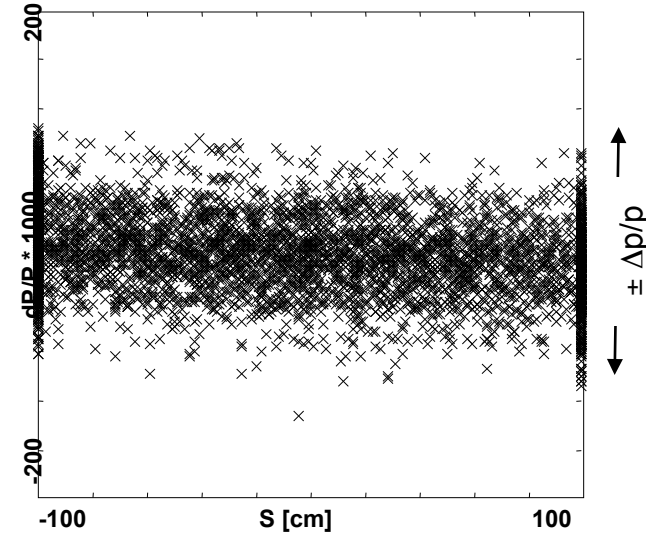
Phase –space after turn 70  
 25000 muons tracked  
 65% muons left (no muon decay accounted for)



$\Delta x = 25 \text{ cm}$   
 $\Delta x' = 8 \text{ mrad}$



$\Delta y = 28 \text{ cm}$   
 $\Delta y' = 7 \text{ mrad}$



$\Delta p/p = 8 \%$

Acceptance (geometric)  $p = 3.8 \text{ GeV}/c$   
 $A = \Delta x \Delta x' = \Delta y \Delta y' = \mathbf{2 \text{ mm rad}}$

Acceptance (normalized)  $\beta\gamma \approx 37$   
 $A_N = A \beta\gamma = \mathbf{74 \text{ mm rad}}$

# Summary

- Decay Ring (3.8 GeV Racetrack of 362 meter circumference)
  - ~10 m betas in the Arcs
  - ~30 m betas in the Straight
- Acceptance - Dynamic Aperture Study
  - transverse:  $\varepsilon_N = 74$  mm rad
  - momentum:  $\sigma_{\Delta p/p} = 0.08$
  - Physical aperture:  $r = 20$  cm (Arc) and  $r = 30$  cm (Straight)
  - 35% dynamic lost after 70 turns