

ln[1]:= << im\_solver.m

## Matched Envelope Solution -- IM Method

3-5-2015 by lund on localhost

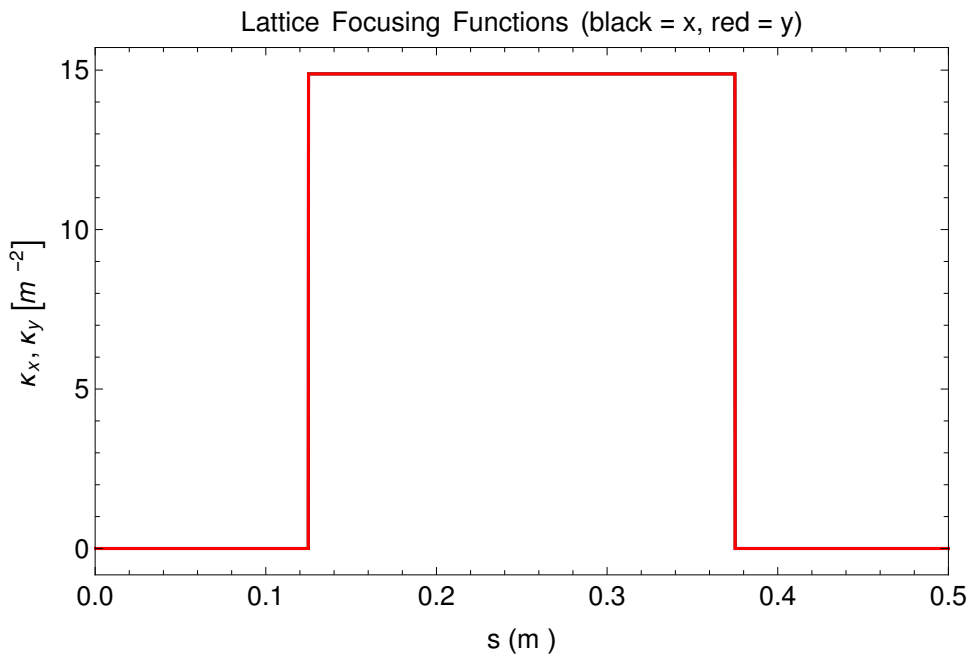
Code Provided by Steve Lund

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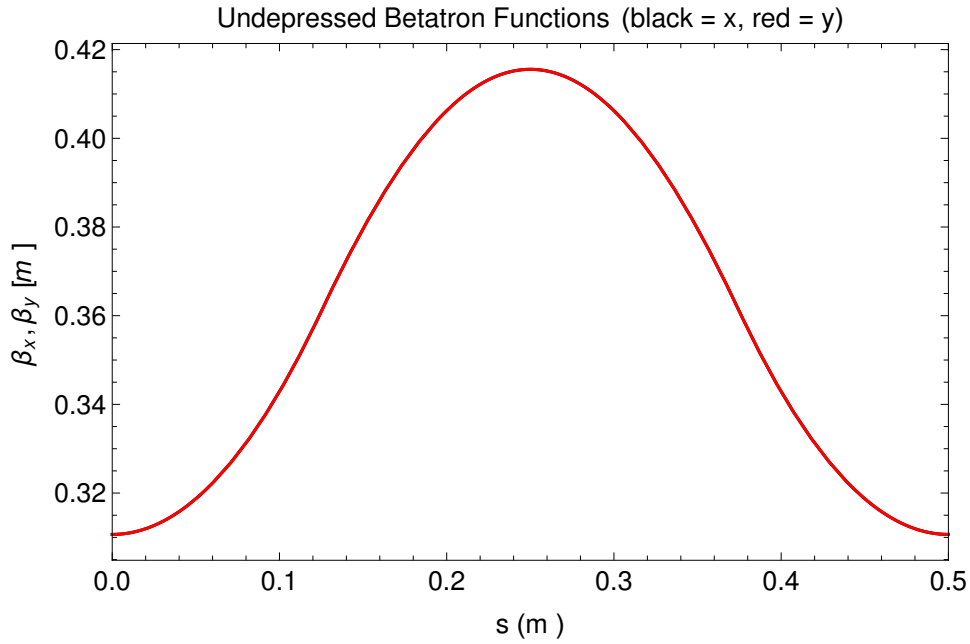
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## Transport Lattice

Lattice Type	Solenoid
Undepressed Phase Advances [deg/period]	
x-plane, $\sigma_{0x}$ [deg/period]	80.
y-plane, $\sigma_{0y}$ [deg/period]	80.
Lattice Period, $L_p$ [m ]	0.5
Occupancy, $\eta$	0.5
Syncopation Factor, $\alpha$ ( $\alpha = 1/2 \Rightarrow$ FODO)	NA
Max Focusing Strength, $\text{Max}[\kappa_x, \kappa_y]$ , [ $1/m^2$ ]	14.882



## Undepressed (Lattice) Betatron Function

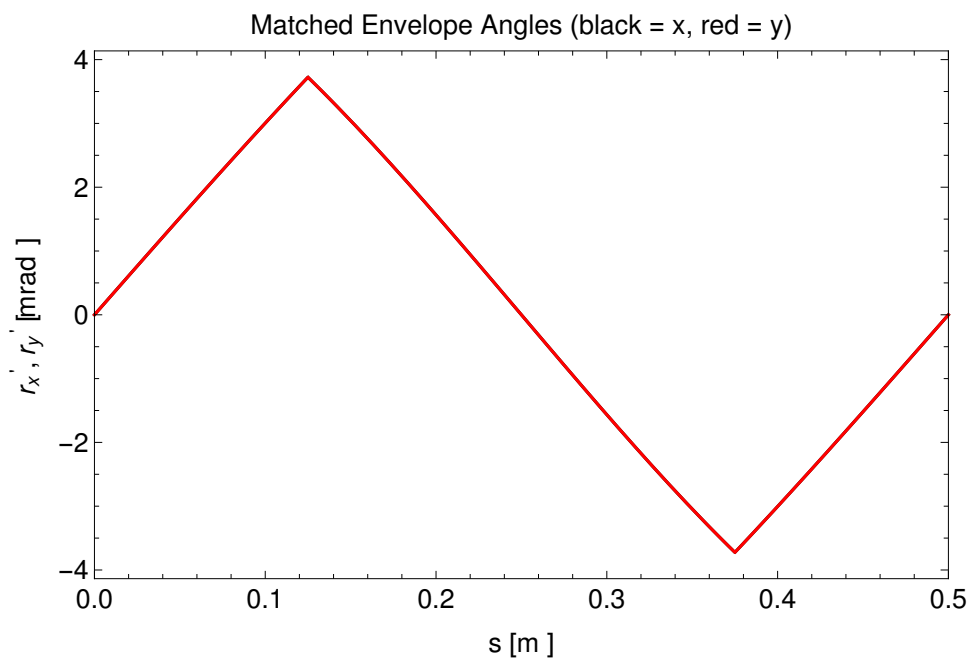
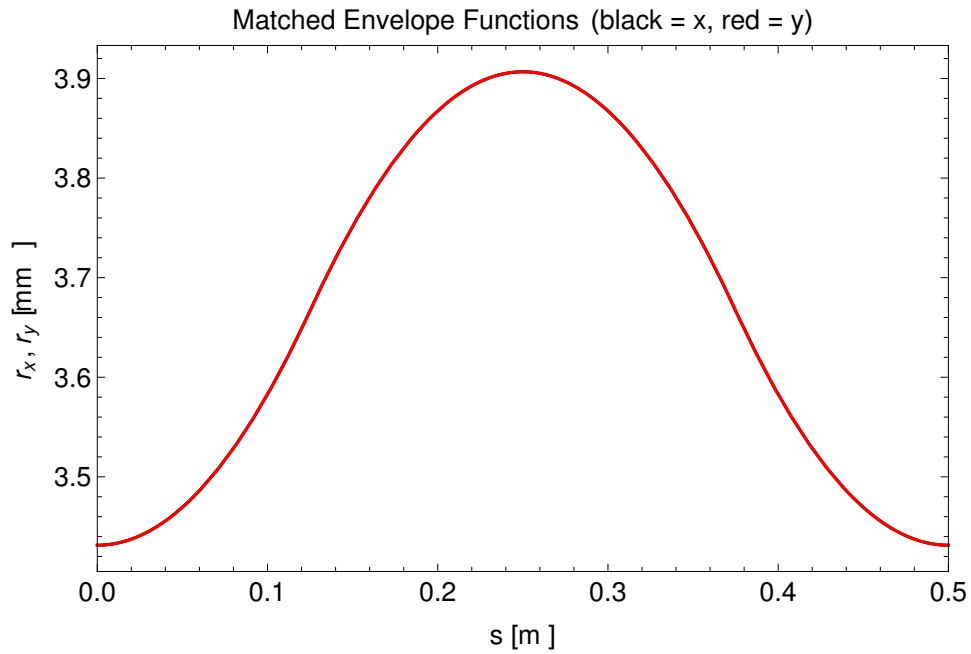


	x-Horizontal	y-Vertical
Max[ $\beta_x$ ], Max[ $\beta_y$ ] [m]	0.41556	0.41556
s-locations of Maxs [mm]	250.	250.
Min[ $\beta_x$ ], Min[ $\beta_y$ ] [m]	0.31067	0.31067
s-locations of Mins [mm]	500.	500.

## Beam Properties

Dimensionless Perveance, Q	$1. \times 10^{-4}$
RMS Edge Emittances [mm -mrad]:	
$\epsilon_x$	7.4643
$\epsilon_y$	7.4643
Depressed Phase Advances [deg/period]	
x-plane, $\sigma_x$ [deg/period]	16.
y-plane, $\sigma_y$ [deg/period]	16.
Tune Depressions:	
$\sigma_x / \sigma_{0x}$	0.2
$\sigma_y / \sigma_{0y}$	0.2

## Matched Solution



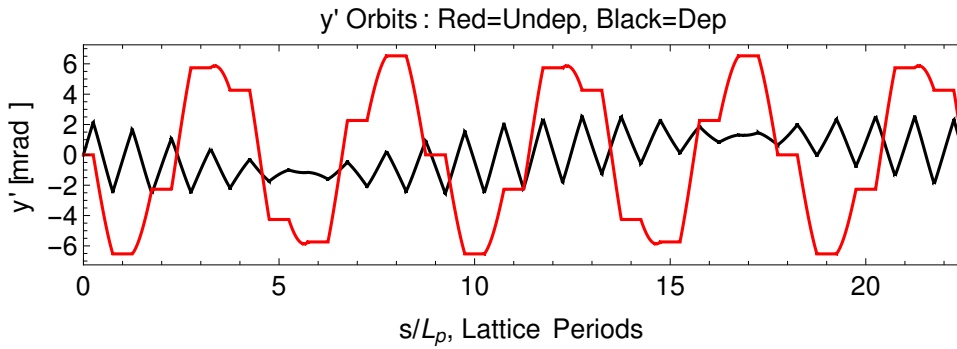
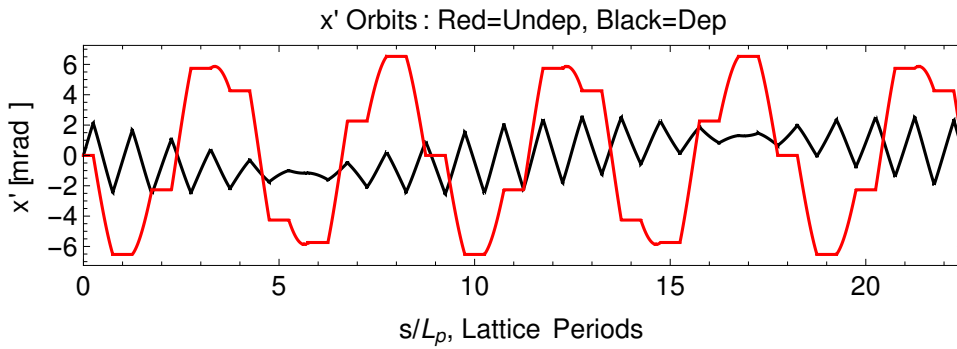
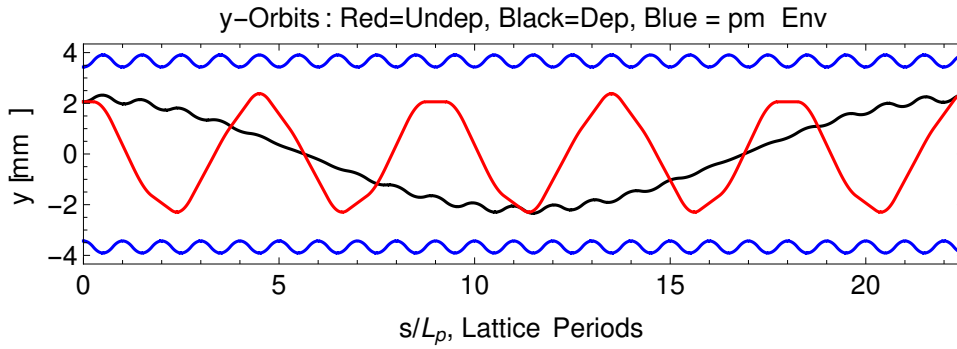
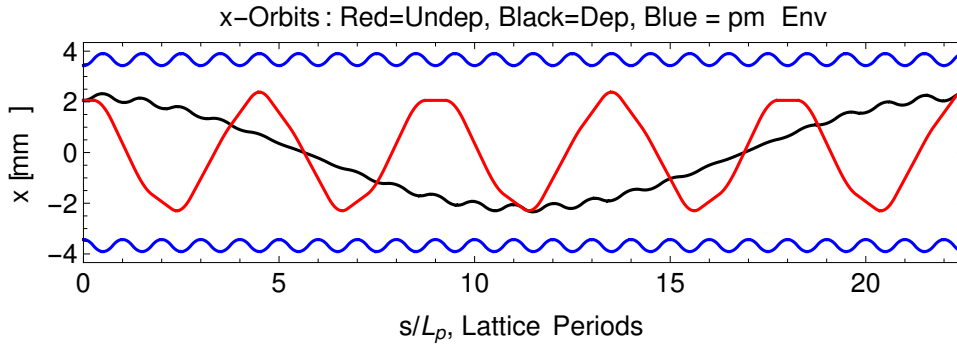
	x-Horizontal	y-Vertical
Radii, $r_x = 2 \langle x^2 \rangle^{1/2}$ , $r_y = 2 \langle y^2 \rangle^{1/2}$ :		
Avg (Lattice Period), $\overline{r_x}$ , $\overline{r_y}$ [mm ]	3.668	3.668
Max, Max[ $r_x$ ], Max[ $r_y$ ] [mm ]	3.9067	3.9067
s-locations of Maxs [mm ]	250.	250.
Min, Min[ $r_x$ ], Min[ $r_y$ ] [mm ]	3.4313	3.4313
s-locations of Mins [mm ]	0.000025836	0.000025836
Angles, $r_x'$ , $r_y'$ :		
Max, Max[ $r_x'$ ], Max[ $r_y'$ ] [mrad ]	3.7238	3.7238
s-locations of Maxs [mm ]	125.	125.
Min, Min[ $r_x'$ ], Min[ $r_y'$ ] [mrad ]	-3.7238	-3.7238
s-locations of Mins [mm ]	375.	375.
Matching Conditions		
Radii, $r_x[0]$ , $r_y[0]$ [mm ]	3.4313	3.4313
Angles, $r_x'[0]$ , $r_y'[0]$ [mrad ]	$7.7098 \times 10^{-7}$	$7.7098 \times 10^{-7}$
Average Radius Measures:		
$\sqrt{\overline{r_x r_y}}$ [mm ]	3.6721	
$(\overline{r_x} + \overline{r_y})/2$ [mm ]	3.668	

## Matched Solution -- Numerical Parameters

Parameterization Case	1
Specified Fractional Tolerance	$1. \times 10^{-6}$
Achieved Fractional Tolerance	$3.3201 \times 10^{-7}$
Iterations Needed	4
CPU Time for Solution [sec]	8.43389

## Characteristic x- and y-Plane Orbits

Single Particle CS Invariants (includes space-charge):	
$\epsilon_x$ [mm -mrad ]	2.6871
$\epsilon_y$ [mm -mrad ]	2.6871
Axial Coordinates:	
Initial $s_i$ [m ]	0.
Final $s_f$ [m ]	11.25
Initial Conditions Undep and Dep	
x-plane	
$x[s_i]$ [mm ]	2.0588
$x'[s_i]$ [mrad ]	$4.9066 \times 10^{-7}$
y-plane	
$y[s_i]$ [mm ]	2.0588
$y'[s_i]$ [mrad ]	$4.9066 \times 10^{-7}$
Final Conditions Undepressed	
x-plane	
$x[s_f]$ [mm ]	2.3811
$x'[s_f]$ [mrad ]	$2.0675 \times 10^{-6}$
y-plane	
$y[s_f]$ [mm ]	2.3811
$y'[s_f]$ [mrad ]	$2.0675 \times 10^{-6}$
Final Conditions Depressed	
x-plane	
$x[s_f]$ [mm ]	2.344
$x'[s_f]$ [mrad ]	-0.00004741
y-plane	
$y[s_f]$ [mm ]	2.344
$y'[s_f]$ [mrad ]	-0.00004741



# Envelope Linear Stability

Continuous Limit Mode Phase Advances:  
(x-y plane averages)

$\sigma_+$  [deg/period] 115.38  
 $\sigma_-$  [deg/period] 84.664

Linear Eigenvalues  $\{|\lambda|, \text{Arg}[\lambda]\}$   $\{[1], [\text{deg}]\}$ :

$\lambda_1$  1. 84.665  
 $\lambda_2$  1. -84.665  
 $\lambda_3$  1. 115.43  
 $\lambda_4$  1. -115.43

Mode Symmetry [Lund and Bukh, PRSTAB (2004)]: Class A

Eigen Modes:

Mode 1:  
 $\sigma_1$  [deg/period] {275.34, 244.57, 115.43, 84.665}  
 $\gamma_1$  1  
Mode 2:  
 $\sigma_2$  [deg/period] {275.34, 244.57, 115.43, 84.665}  
 $\gamma_2$  1

Linear Perturbation Eigenvalues

