NEW ISO 330-1 GeV DFD lattice:

CW to +/- 0.5%

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4/11/2012

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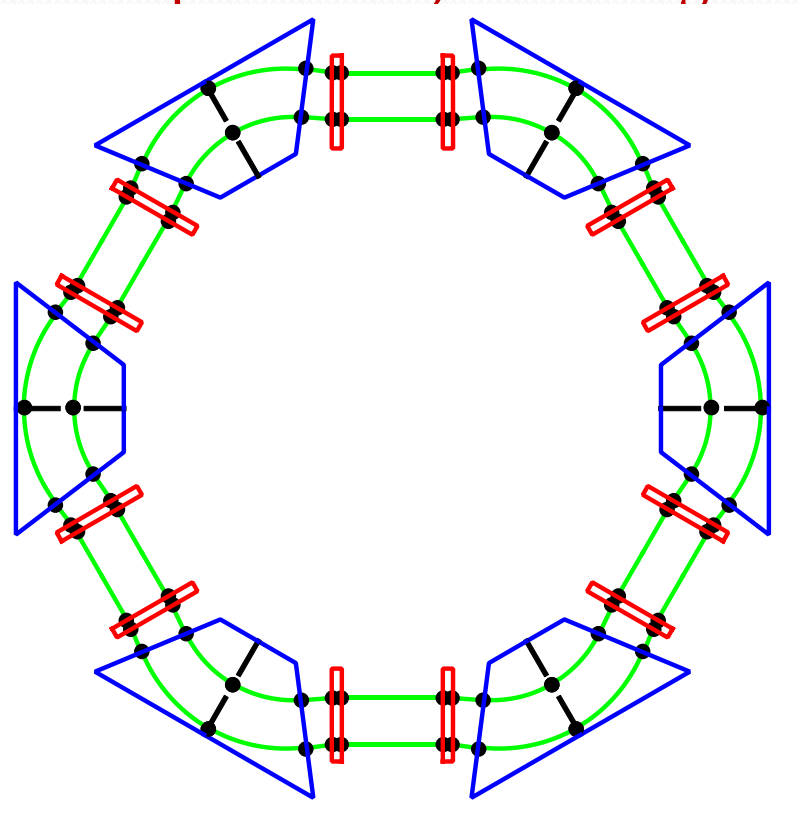
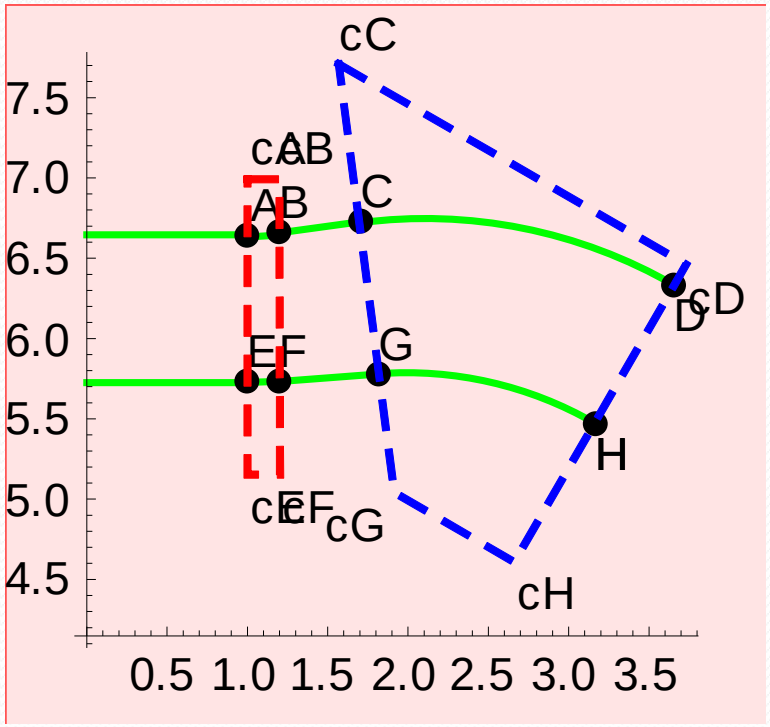
Isochronous 330 – 1000 MeV Layout

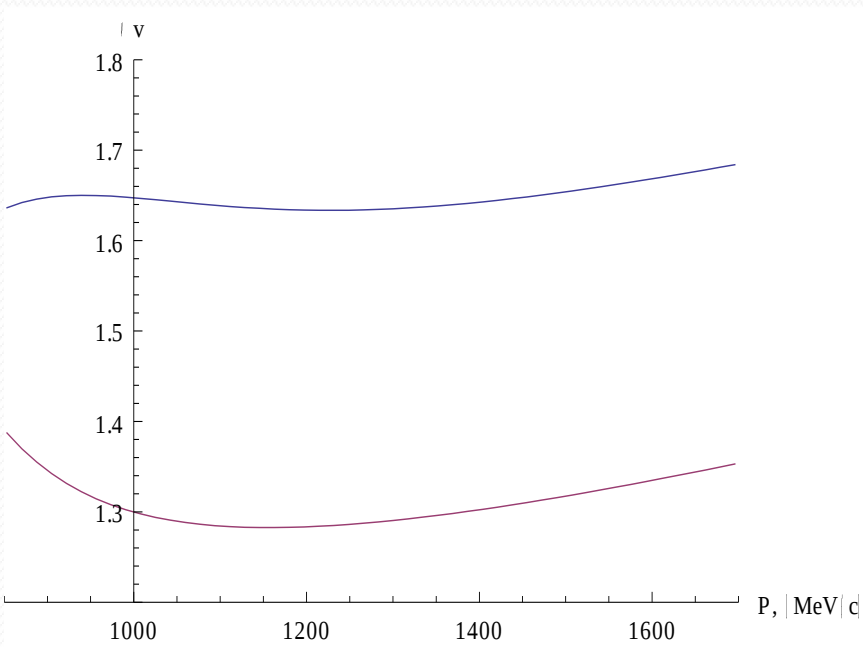
- Ring layout and half cell plotted (intermediate energy plotted: injection begins ~5.5 m radius)

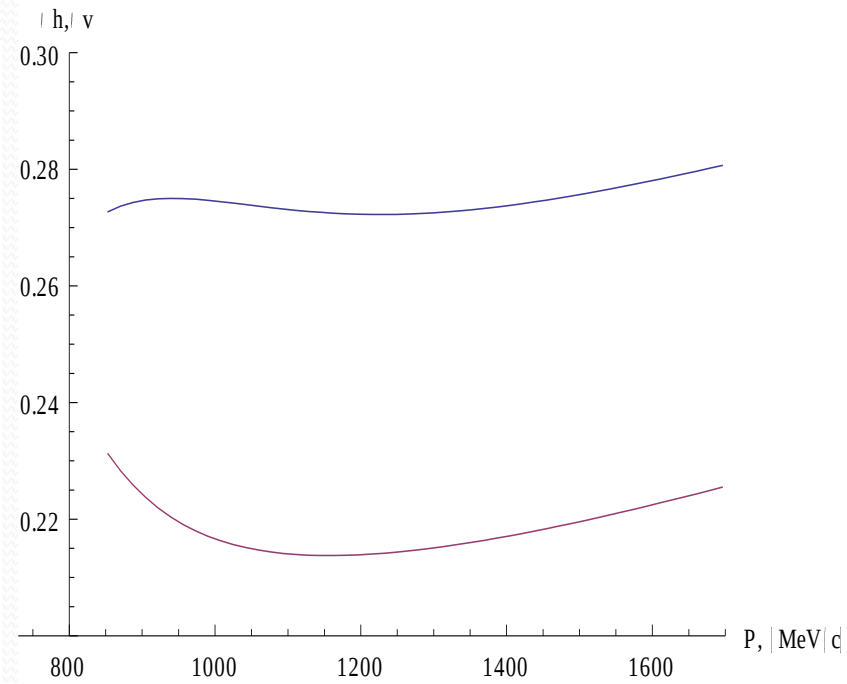




Isochronous 330 – 1000 MeV Machine Tunes

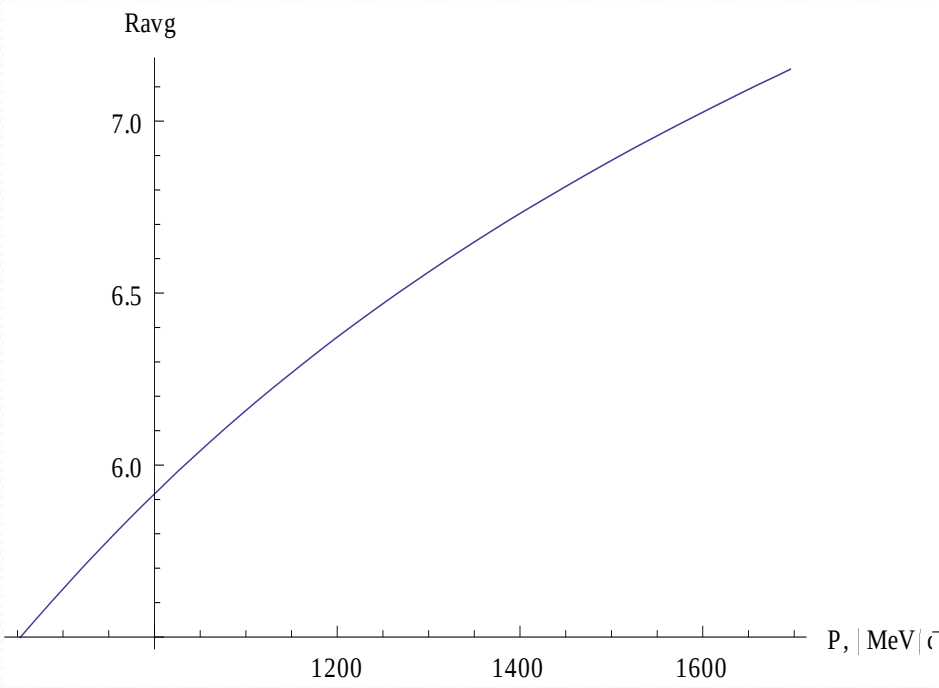
- Ring (left) and cell (right) tunes (vertical and horizontal close to 90 degrees); ring tune stable to +/-0.05 (2π rad)

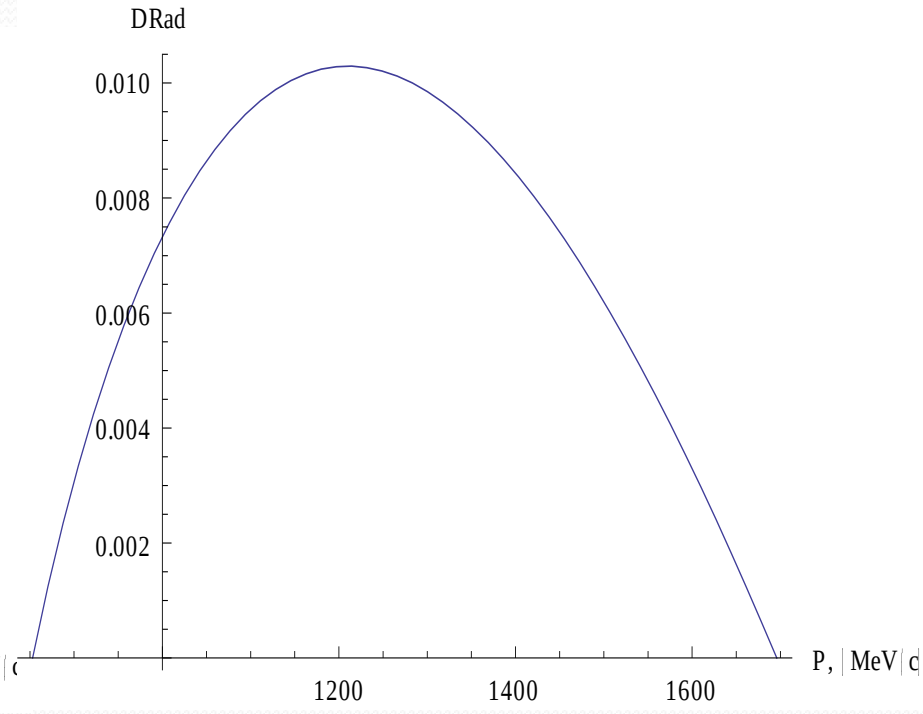




Isochronous 330 – 1000 MeV footprint and isochronous properties

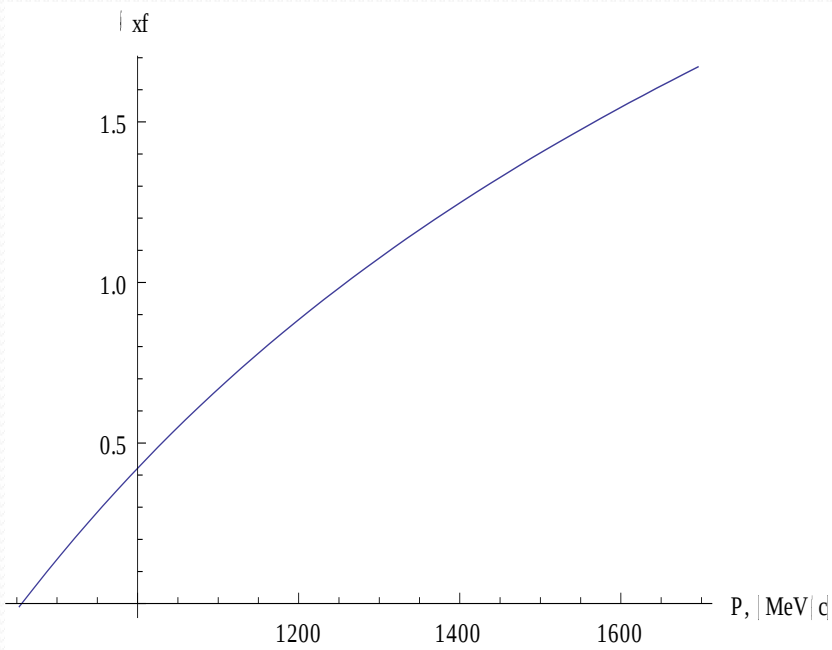
- Average radius (left) :5.5 – 7.2 m (inj to ext); deviation in percent from isochronous (right). Note transition ~1200 MeV/c (585 MeV)

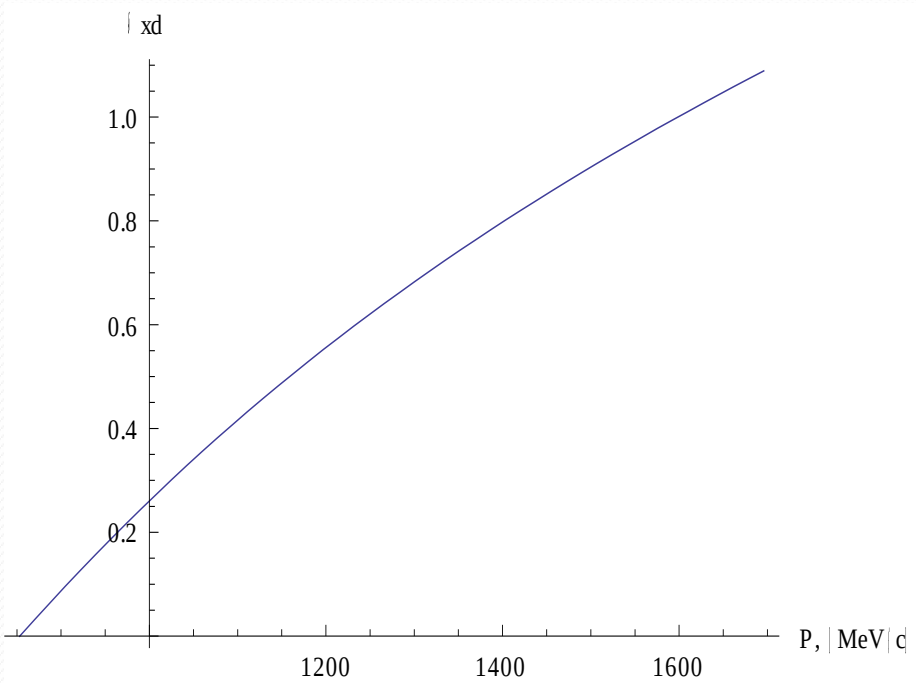




Isochronous 330 – 1000 MeV Apertures

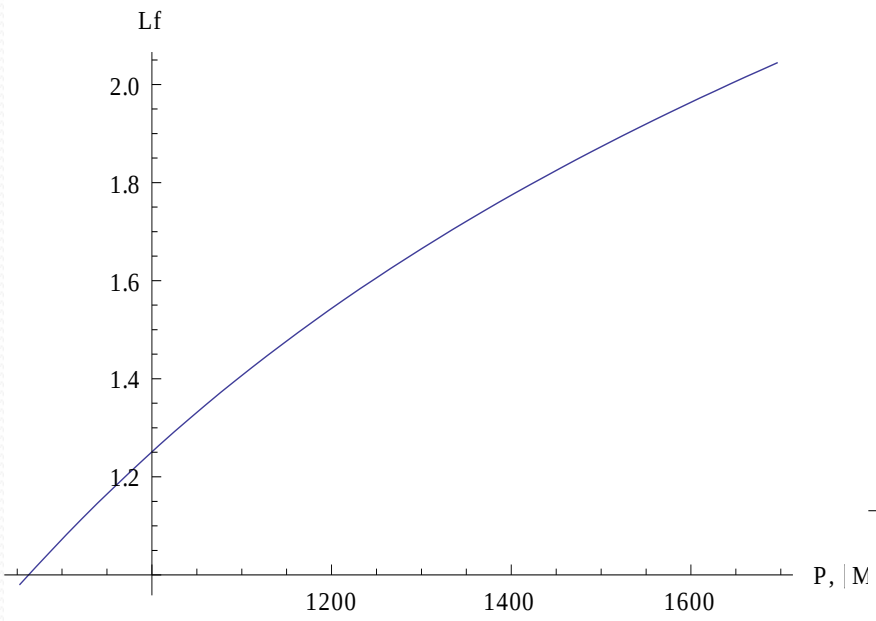
- Orbits in F (left) and orbits in D (right) in radial distance from injection

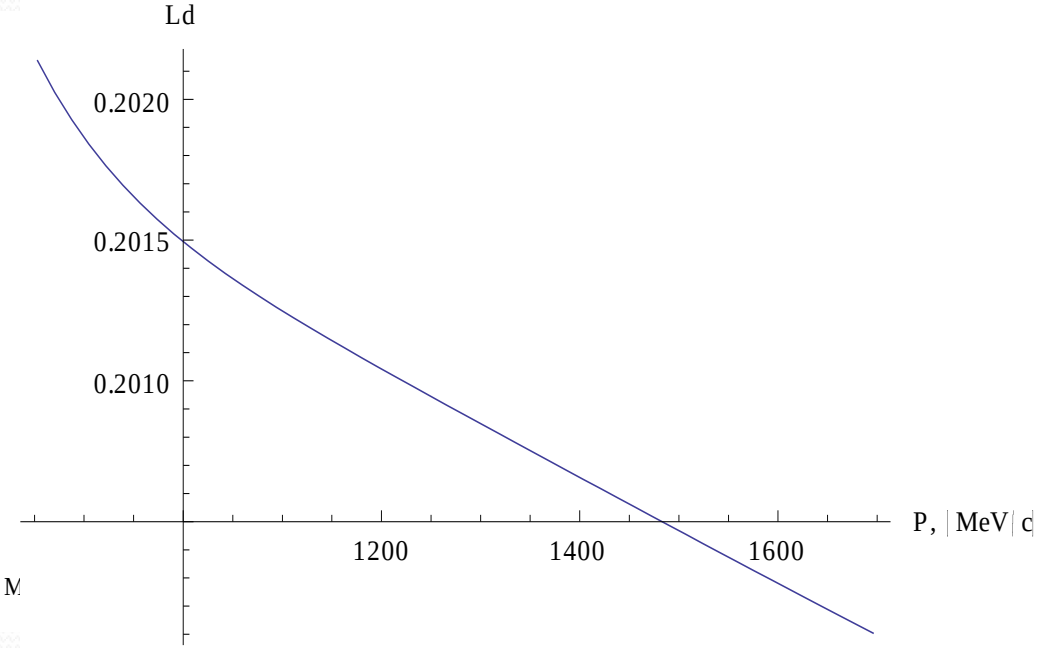




Isochronous 330 – 1000 MeV Magnet lengths

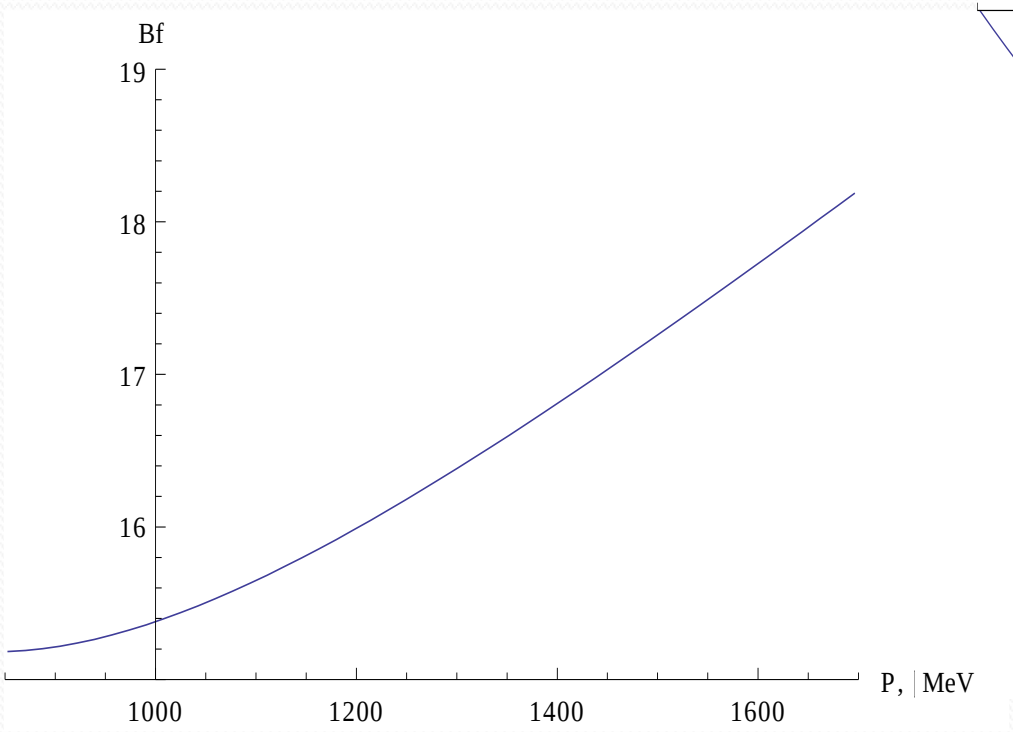
- Half lengths of F and D – Note that SC D magnet (3.8T extraction field) is only 0.4 m long and is basically rectangular – can be made completely rectangular. F is almost a sector magnet.

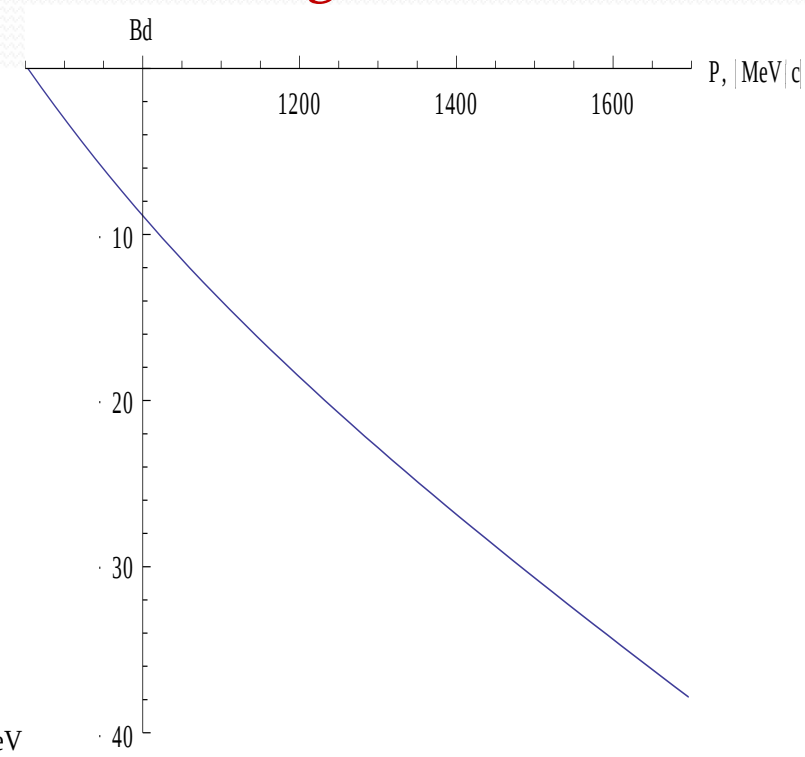




Isochronous 330 – 1000 MeV Magnetic Field Profiles

- F (left) and D (right) : D is almost a linear gradient





Isochronous 330-1000 MeV NS FFAG

CW operation with ....

- To +/- 0.05%
- Six 2m straights for RF, injection, extraction
- DFD layout : long straight at min horizontal beam size
- Will require max RF cavities for low-loss operation
- Need to develop 3D field map from COSY tools
- RF cavity conceptual design
- Upstream Booster lattice is next and needs to be matched to 1 GeV machine.

Isochronous 330-1000 MeV NS FFAG Machine Table

Ring		
Particle	H+	
Injection energy	330 MeV	
Extraction energy	1 GeV	
Injection B.rho	Alternating gradients	
Extraction B.rho		
Injection radius	5.50 m	
Extraction radius	7.15 m	
Variable extraction radius	Not needed	
Degree of isochronicity	0.05% preliminary	
Geometrical acceptance		
Dynamical acceptance	≥ 400 π mm-mr	
Injection method	H- Stripping – CW injection	
Extraction method	Field change/septum/single –turn resonance?	
Transition gamma	585 MeV	

Isochronous 330-1000 MeV NS FFAG Machine Table

Beam		
Injected emittance, normalized	≥ 200 π mm-mr (TBD from space charge and losses)	
Extracted emittance, normalized	≥ 200 π mm-mr	
Injected intensity		
Extracted intensity	7-10MW	
# ppb		
Momentum spread	What can we capture	
RF structure of injected beam	Min RF: 5.8 MHz	
Lattice		
Accelerator type	NS-FFAG	
Lattice type	DFD	
Number of cells	6	
Number of straight sections	6	
Straight section length, long	2 m	
Straight section length, short	0.70 – 0.50 m (inj. to ext.)	
Number of magnets	2 per cell	
Packing factor		
Horizontal tune radial-dependence	See graph	
Vertical tune radial-dependence	See graph	

Isochronous 330-1000 MeV NS FFAG Machine Table

Magnet, Warm	
Field index, F type	
Field index, D type	
Wedge angles, F	
Wedge angles, D	
I/O fringe field r-dependence, F	
I/O fringe field r-dependence, D	
Sector angle, F	Edge crossing varies
Sector angle, D	
Bend angle, F	0.523 / 0.657 rad
Bend angle, D	0.000 / -0.134
Radii on min/max orbits, F	
Radii on min/max orbits, D	
Magnetic field on R_min/max, F	1.5 / 1.8 T
Magnetic field on R_max/min, D	0.002 / -3.8T
Gap on R_max/min, F	1-2”
Gap on R_max/min, D	1-2”
Field profile, F	See graph
Field profile, D	See graph
Fringe fields, F	To be calculated
Fringe fields, D	“

Isochronous 330-1000 MeV NS FFAG Machine Table

RF system		
Number of cavities	6 (3 straights)	
RF gap shape	Straight	
RF gap length		
Cavity tilt		
RF voltage		
Energy gain per turn	> 4 MeV/turn - as large as possible	
Harmonic number		
RF wave shape	sinusoidal	