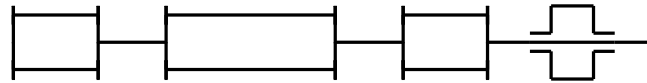# Electron Model of FFAG Ring for Muon Acceleration

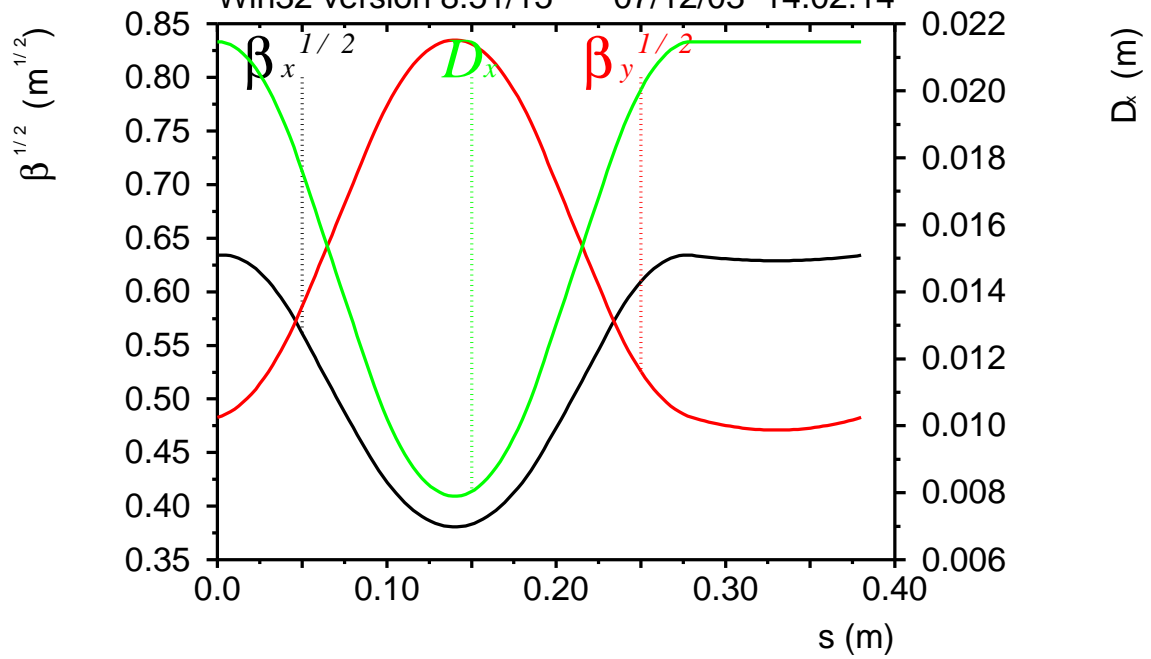**E. Keil**

Video Conference 9 Mar 2004

See: `http://keil.home.cern.ch/keil/`
`MuMu/Doc/FFAG04/TV09Mar04/talk.pdf`

# Electron Model Lattice dec06f

Design of Model Lattice

- Combined-function F and D magnets

- Transition centred between 10 and 20 MeV

- F magnet length not smaller than aperture

- Enough space between magnets for coil overhangs

- Fields much lower than in Scott Berg's lattice in Oct 2003

- Choice between two magnet styles

  - Room-temperature steel-copper magnets

  - Permanent magnets

- 45 periods with $L_p = 0.38$ m in 17.1 m circumference

- See http://slap.web.cern.ch/slap/NuFact/NuFact/nf137.pdf

Model Parameters at 15 MeV

| Magnet	F	D	
Length	50	100	mm
Bending angle	-37.459	214.545	mrad
Gradient G	5.638	-4.746	T/m
Magnetic field B	-37.464	107.285	mT
Char. length B/G	6.6	22.6	mm
Hor. half aperture A_x	± 19	± 19	mm
Vert. half aperture A_y	± 12	± 12	mm
Hor. aperture range x	$-12.4 \ldots 25.6$	$3.6 \ldots 41.6$	mm
Bore radius r	24.8	31.6	mm
Poletip field $B(r)$	0.14	0.15	T

Tunes q_x and q_y vs. $\Delta p/p$

qx and qy for model dec04e
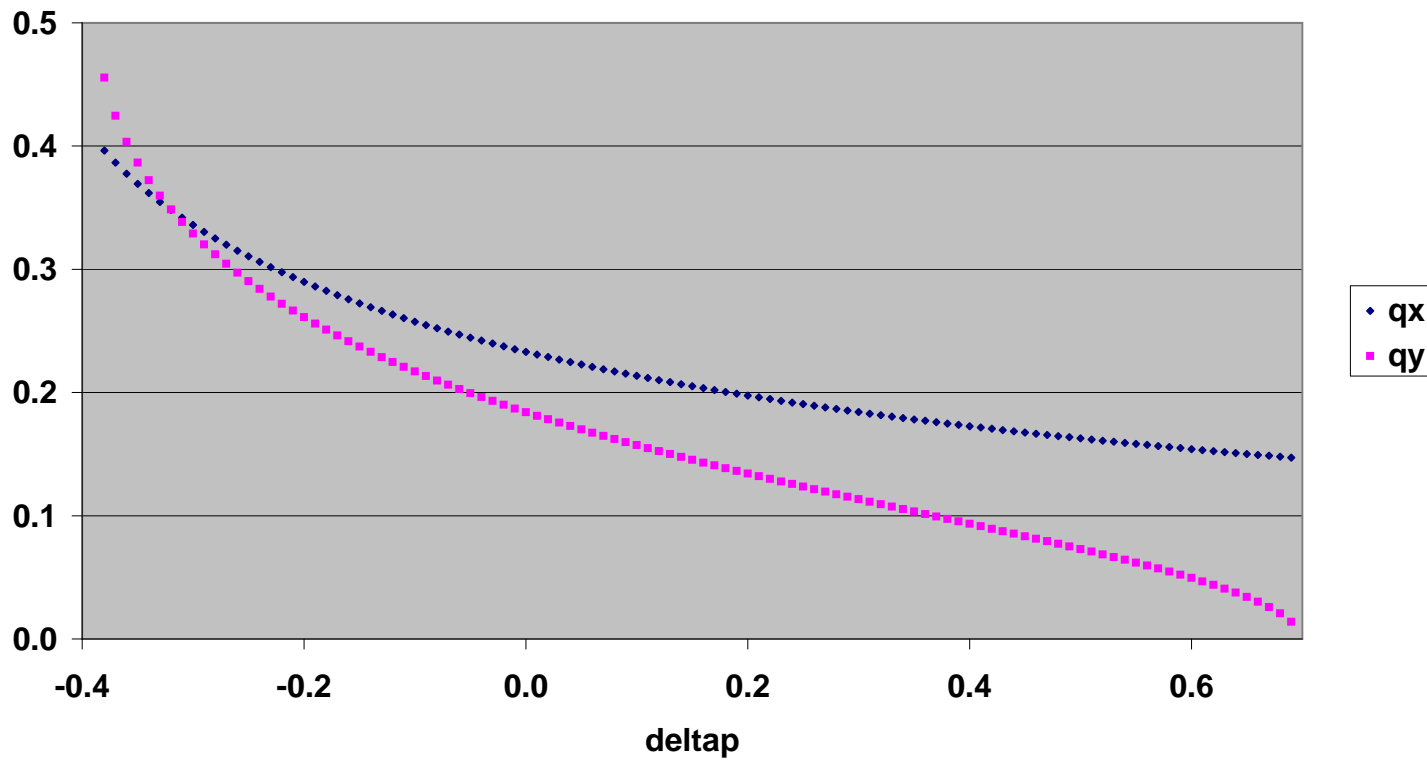
Orbit length δs and flight time ct vs. $\Delta p/p$
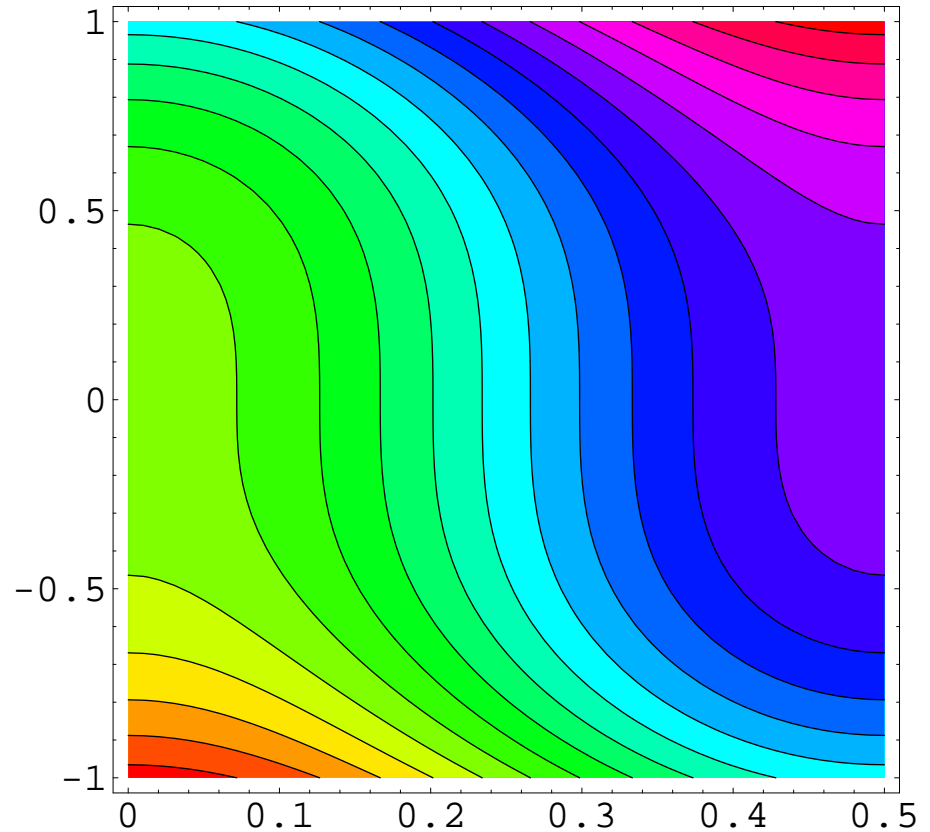

delta(s) and ct in mm for model nov03e
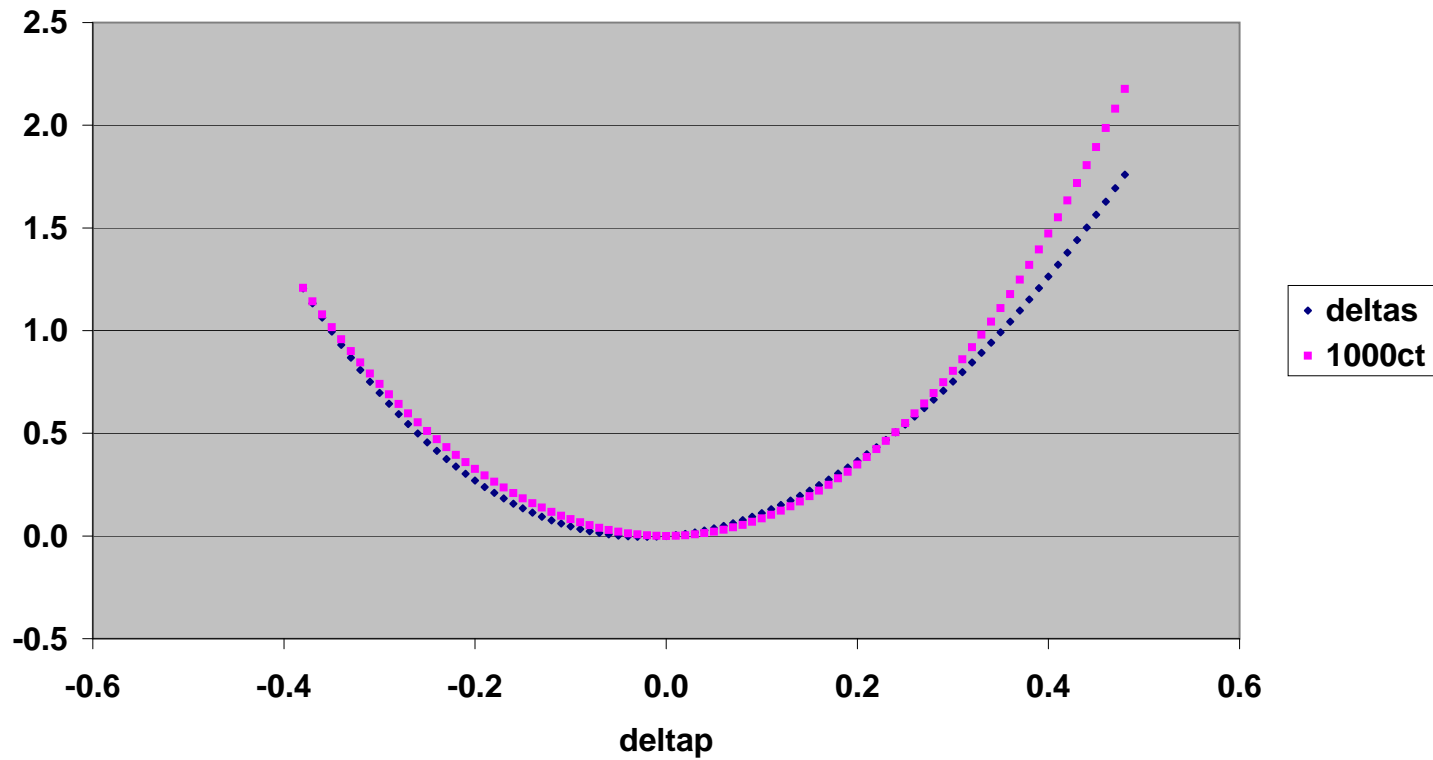
Contour plot of Hamiltonian $H_5(\varphi, y)$

- Acceleration in bright blue band from lower right corner at $(0.5, -1)$ to upper left corner at $(0, +1)$
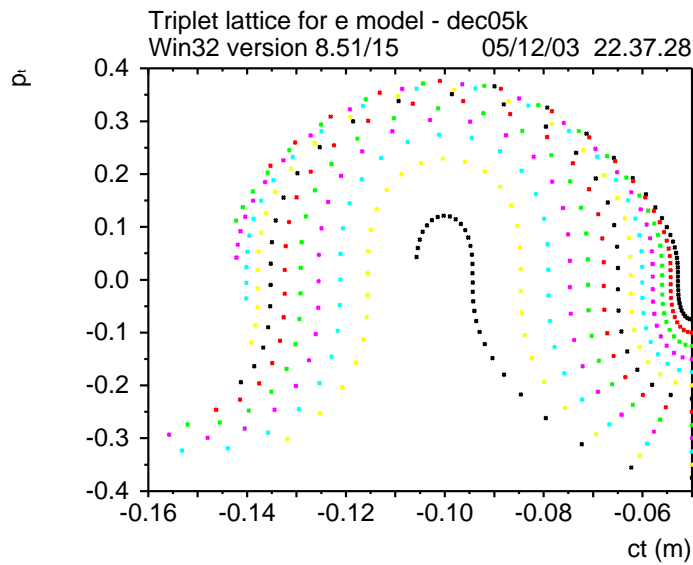
- $p_t = \left(\dfrac{3 e V N_c}{2 \pi \beta_0^2 E_0 h \eta_1} \right)^{1/3}$
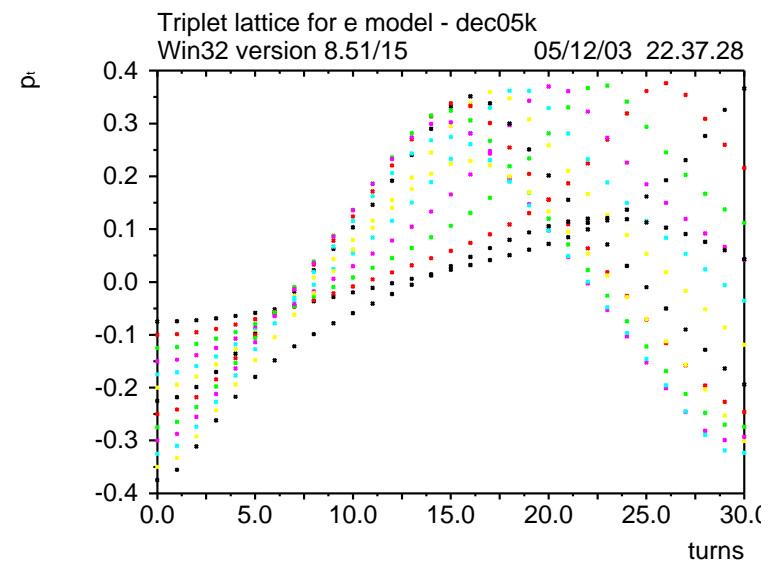
RF System Parameters of the Electron Model

Slip factor η_1	0.0149	0.0149	
Number of cavities N_c	45	45	
Frequency f_{RF}	3	3	GHz
Harmonic number h	171	171	
Accelerating voltage V	20	50	kV
Peak RF voltage U	31.4	78.5	kV
RF power P	230	1440	W
Stored energy W_s	0.216	1.35	mJ
Initial p_t	-0.2233	-0.3011	
Final p_t	0.2234	0.3012	
Number of turns n	9	5	
Beam current I	$\ll 21.1$	$\ll 94.9$	mA

Acceleration in Model with $V = 50$ kV

Triplet lattice for e model - dec05k
Win32 version 8.51/15   05/12/03 22.37.28

Triplet lattice for e model - dec05k
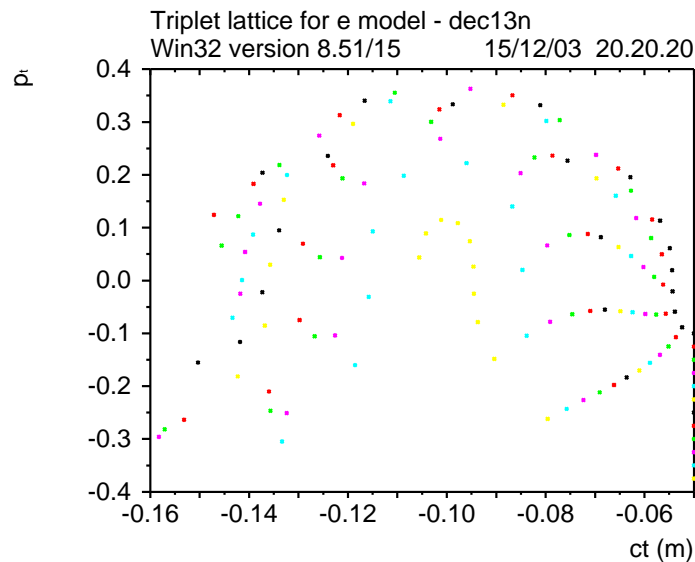Win32 version 8.51/15   05/12/03 22.37.28

Longitudinal phase space (ct, p_t)

p_t recorded every 1/5 of a turn

Acceleration in Model with $V = 50$ kV and Misalignments

Triplet lattice for e model - dec13n
Win32 version 8.51/15   15/12/03 20.20.20

Triplet lattice for e model - dec13n
Win32 version 8.51/15   15/12/03 20.20.20

Longitudinal phase space (ct, p_t)

p_t recorded every turn

The dipole triplets are installed on girders displaced with 0.03 mm standard deviation