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Correction and Additions to CA/AP/33

E. D. Courant

January 2001

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy
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Coupling Matrices in AGS with different types of partial snakes

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Coupling Matrices in AGS with different types of partial snakes

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January 9, 2001

A computational error led to incorrect numbers for the "4-dipole" cases in the above referenced report[1]. In addition, computations have now been carried out for the partial snakes utilizing five and six tilted dipoles as described in Spin Note 75[2].

Here we present the corrected results for injection energy (1.5 GeV; $\gamma G = 4.659$). The raw AGS, and AGS with solenoidal and helical snakes are the same as in AP/33, the 4-dipole results are different. The four-dipole scheme exhibits coupling distinctly stronger than with the solenoid, as indicated in C-A/AP/33. The five-dipole scheme (dipole fields at 135°, 0°, -90°, 180°, 45°) exhibits somewhat less coupling, and in the six-dipole case the coupling is again weaker, but still stronger than in the solenoid case (at injection energy).

For higher energy the coupling parameters decrease inversely proportionally to $(\beta\gamma)^2$ just as in Ref. 1. Therefore the dipole snakes have coupling similar to that of the solenoid by the time the first strong resonance ($\gamma G = 8.749$) is reached, but the helical snake is definitely better – both because of the lower coupling and because of the smaller orbit excursions. At higher energies, which is where coupling is really troublesome, the dipole snakes are better than the solenoid,

[1] E. D. Courant, Coupling Matrices in AGS with Different Types of Partial Snakes, C-A/AP/33, Dec. 2000

[2] E. D. Courant. Partial Snake for AGS using Dipole Magnets, Spin Note 75, August 1988

AGS with different types of partial snakes:

AGS without snakes

-1.31324	-11.2107	0	0	0	2.08681
0.167845	0.671359	0	0	0	-0.318092
0	0	1.57424	-19.7498	0	0
0	0	0.177118	-1.58682	0	0
-0.06747	-2.16502	0	0	1.	-11.5419
0	0	0	0	0	1.

Tunes 8.698, 8.749

AGS with solenoid snake

-1.31093	-11.1934	0.0442375	-0.554929	0	2.08299
0.168355	0.675285	0.00497101	-0.0444856	0	-0.318932
0.0368755	0.31486	1.57265	-19.7279	0	-0.0585927
-0.0047357	-0.0189952	0.176721	-1.58147	0	0.0089713
-0.06747	-2.16502	0	0	1.	-11.5419
0	0	0	0	0	1.

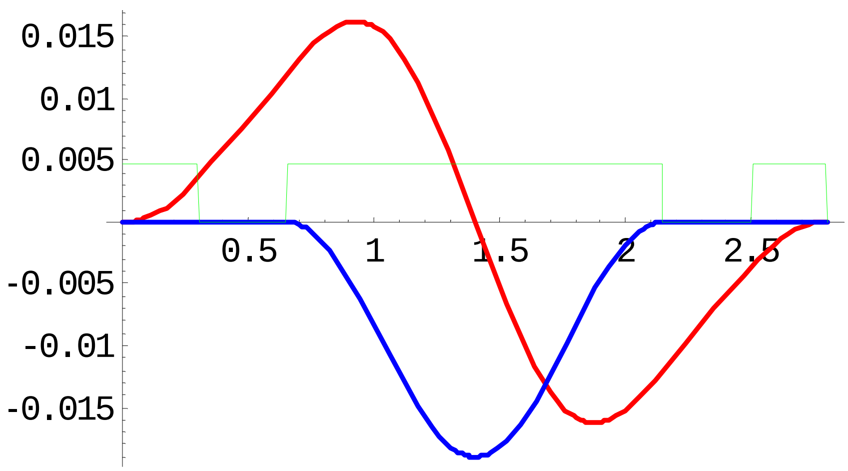
Minimum tune split = 0.0144566; coupling angle 8.08129°;
tunes 8.69744, 8.75032

Injection energy (1.5 GeV, γG=4.659)

AGS with helical snake

-1.22928	-10.5597	-0.0130534	0.163223	0	1.89077
0.225534	1.12394	-0.00109317	0.00787587	0	-0.411239
-0.0107148	-0.0920354	1.50408	-18.8079	0	0.0164241
0.00189643	0.00923171	0.133967	-1.01039	0	-0.00368262
-0.0791047	-2.21763	0.000304224	-0.00384195	1.	-11.5189
0	0	0	0	0	1.

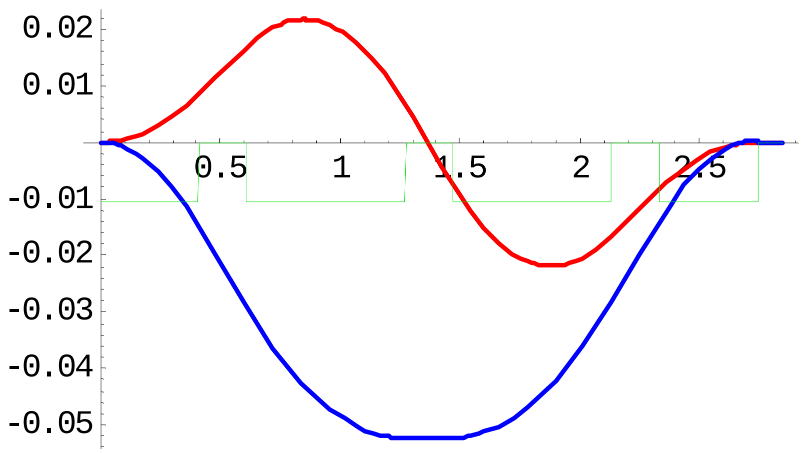
Minimum tune split = 0.00442775; coupling angle 2.65338 °;
tunes 8.74151, 8.7898



AGS with 4-dipole snake

-1.16851	-10.0816	-0.0159327	0.18963	0	1.84956
0.243827	1.2475	-0.0351435	0.44673	0	-0.443225
0.00648536	0.0692911	1.51749	-19.0392	0	-0.00780593
0.0301393	0.252109	0.12114	-0.860595	0	-0.0469726
-0.0668694	-2.1598	-0.00172722	0.0227037	1.	-11.5333
0	0	0	0	0	1.

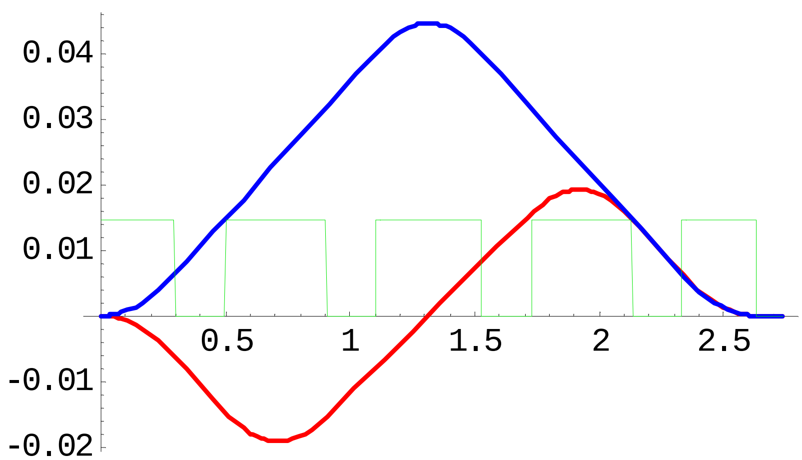
Minimum tune split = 0.0539474; Coupling angle = 24.7769 °;
tunes 8.74383, 8.81666



AGS with 5-dipole snake

-1.16253	-10.0703	-0.0195133	0.266297	0	1.83811
0.245695	1.26825	-0.0159469	0.210162	0	-0.446139
0.026667	0.202203	1.54064	-19.3094	0	-0.0446274
0.0175521	0.138552	0.139071	-1.09404	0	-0.0292231
-0.0670372	-2.16185	0.000798171	-0.0103494	1.	-11.5361
0	0	0	0	0	1.

Minimum tune split = 0.0277217; Coupling angle = 22.8109 °;
tunes 8.75258, 8.79185



AGS with 6-dipole snake

-1.2312	-10.5832	0.0136121	-0.1888	0	1.95039
0.219129	1.07145	0.0105641	-0.139712	0	-0.402887
-0.020312	-0.151786	1.51209	-18.9092	0	0.0336297
-0.0123794	-0.0970729	0.134372	-1.0191	0	0.0202742
-0.0686509	-2.17425	-0.0000490434	0.000538244	1.	-11.5343
0	0	0	0	0	1.

Minimum tune split = 0.0189688; Coupling angle = 10.0308 °;
tunes 8.73559, 8.79137
°°