

## BNL-101727-2014-TECH RHIC/AP/72;BNL-101727-2013-IR

## ?-Splitting Due to Random Skew Quadrupole Fields

G. Parzen

November 1988

Collider Accelerator Department Brookhaven National Laboratory

## **U.S. Department of Energy**

USDOE Office of Science (SC)

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 $\nu\text{-}\mathsf{Splitting}$  Due to Random Skew Quadrupole Fields

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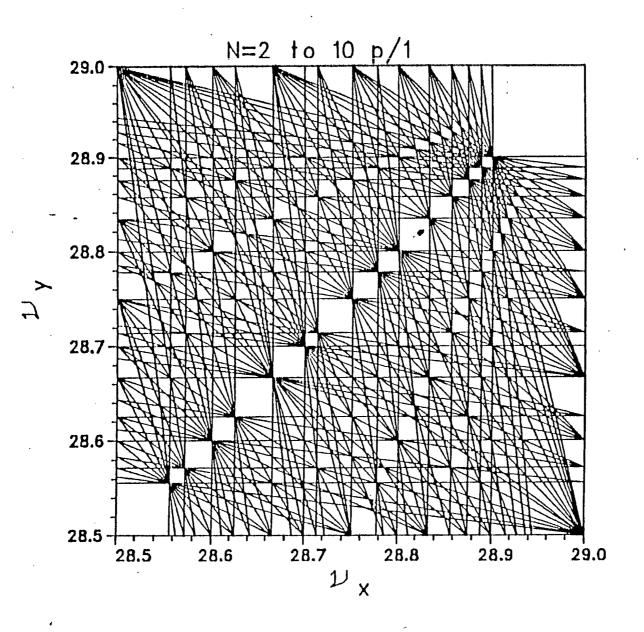
G. Parzen

BNL

November 28, 1988

Random a, and V-splitting Random a, in magnets Causes Coupling and N- splitting. V-splitting is important beause V-values are required to lie between ,8000 and ,8333 (the box beteen the 415 and 5/6 resonances which is 33×10-3 wide) (re Fig IB) The coupling introduces 2 modes of oscillation with the V-values V, and V2. Both V-values are present in the X and y oscillations. 15 V, and V2 are given by  $\overline{Y_{,}} = \overline{Y_{x}} + |SY|,$  $y_2 = y_{\gamma} - |\beta\gamma|$  $\Delta v = \frac{1}{4\pi} \int ds \left(\beta_x \beta_y\right)^{\prime 2} \frac{q_1}{Q_1} e^{-\frac{1}{2}(\psi_x - \psi_y)}$ provided -- Vy ~ Vy, and correct to first order in Q1; and 101/22/12-14-1. For q = 17×10 /cm in dipoles rus q = 40 × 10-5/cm in guads rms (30=1mm rotation error) tracking rung for 10 different set of random errors geves  $(\Delta \mathcal{V}_{splitting})_{mex} = (\mathcal{V}_{1} - \mathcal{V}_{2})_{mex} = 97 \times 10^{-3} \quad \beta^{*} = 6$  $= 260 \times 10^{-3} \quad \beta^* = 2$ 

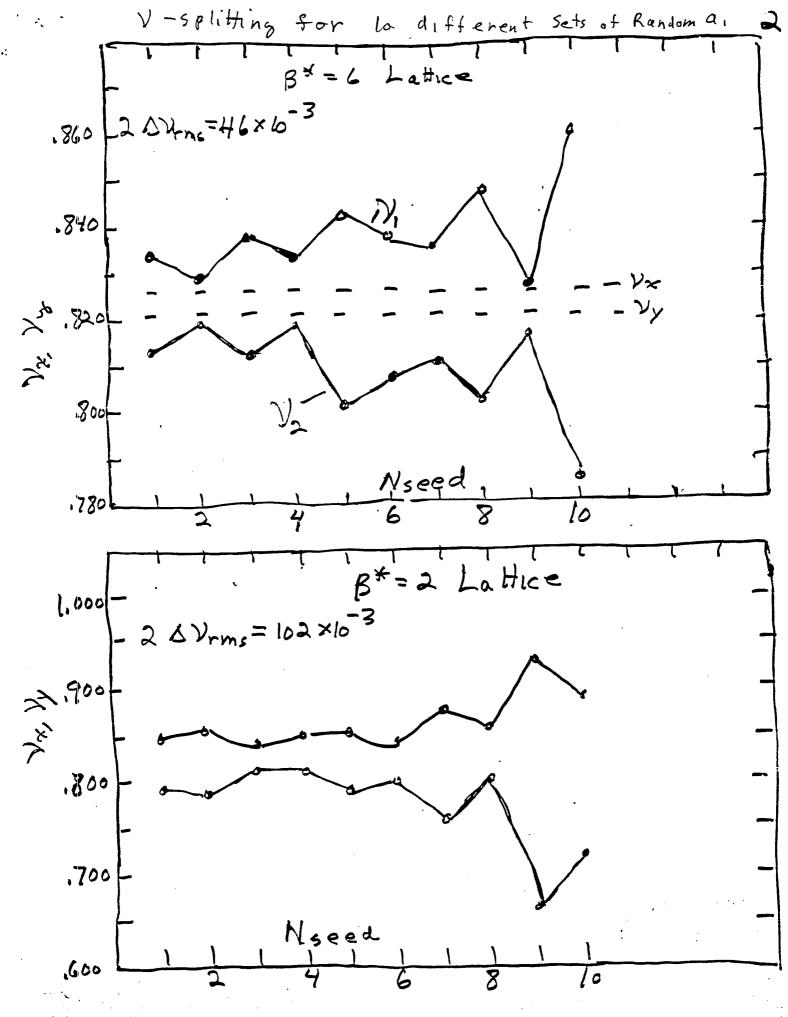
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Magnet Sources of V-splitting 2. AVrms B\*=2 B\*=6 B .028 ,028 GF ,006 1006 QD 1006 ,006 Q3I , o'o 8 .025 1Q2I ,018 ,052 Q1I .,009 1025 010 1025 009 Q20 018 ,052 Q30 1008 1025 Total 2 DYrms 10-46 .102 A V splitting max 97 × 15 260 ×10-3 Alligning Q27, Q20 more accurately than SO=1 mrrms would help.

Correction of Y-splitting X-Splitting determined by SV  $DV = \frac{1}{4\pi} \int ds \left( \beta_x \beta_y \right)^{1/2} \frac{q_1}{p} O^{-\frac{1}{2}} O^{-\frac{1}{2}}$ at the guads QD and QF in the aves, 4x - ty ~ constant on the -ty ~ 0  $\Delta(t_x-t_y) = \int ds(\frac{t}{\beta_x}, \frac{t}{\beta_y}) \stackrel{=}{=} o between guads.$ If the guadrupoles were the only source of qi, then systeal, and a 1-power supply Correction system to make <9,>= would be Sufficient. For the dipoles in the arcs 4-4, ~±,03(2T) ~ ±.2 rad. For Q2 when B\*=2 4x-4n == 18 (2T) = = 1 red DV is Complex with an appreciable Imaginary part. 2 family power supply Correction System 15 required. 

Where to put Q, Correctors At Q2, Q3 where Pr, By are large But two a, families need to have different values of 4x-4y. B\* = 6 Lattice Near Q2, Q3, 4x-4y = 5×10 4 (2T) =,003 only I family can be near Q2,Q3 Q5 よる QH Bt=6 Lattice Q6, S Cm) Q3 Q7 Q3 Near Q5, 4x-4y 2 + 16(27) Second family can be hear Q5.

a, Correctors Location (Continued) B\* = 2 Lattice 4x - 4y ~ + 18 (277) hear Q2 alternates between Crossing Points I family near Q2 at Inner arc t. outer arc crossing points. Second family hear Q2 at outer are to Inner arc Crossing points. 

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Coupling Correction - B\*=6 lattice

						Covrect ed				
	Nseed	$\Delta \gamma / lo^{-2}$	<u> </u>	V2	V,-V2/10	allen	a11(2)	Vi,	72	14-42/1
	1	-1.1, -,03		.813	16	.004		.826	.821	5558
	2	58,04	729	.819	5 .	- 028	-,10	.826 .829	.821 .821	<u> </u>
	ų	1.50,.41	333	.819	9	- 213	,029	. 829	,822	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	5	-2.22,41	. 843	,801	37	-,262		.822	.717	5
	1	1,24 -,24	929	1808	25	.152	-,108	. 825	.819	
	1 7	1.3915		311	20	.104	-,116	. 826	1820	6
	. 8	1-2.621	848	, 802	41	1083	194	828	1819	9
	1 9	45, 35	. 827	817	5	193	-, 021	.824	.819	5
	<u>to</u>	<u>  3, 9ī, -, 33</u>	. 861	. 815	70	.242	321	.821	.814	7
	i	e	-	1		· · · · · · · · · · · · · · · · · · ·	• • • • • • • • • • • • • • • • • • •		1	1
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		all	= [ds	<i>a</i> ,	= A1L	-/B.	, AIL	= Jas I	Bod,	
	1		i 	:						
·		Maxim	iun Corv	ection	,A1L	= . 32	x (97/	70) × 34	5 KG	
			 	1		= 15	КG			
		2-5p1	Hinc	<u> </u>	N21 5	70 × 10-	3			
						1 V		9 × 10	- 3	
				orrec	1				->	
			La	0550f	4×10-3	of bo	2 Width	= 33	XID	
		V-Valu	es (9,	=•)	, 826	, 82	1 IV	$ -y_2  =$	5 × 10	3
			1							
		   	l		:					
	:* 	Corvec	1	,	,2I,	Q5I	o <del>f</del>	,	t	
~	<u>،</u>		inhi	er arc	to 00	ter a	rc 1	n sert	1-hS	
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Coupling Correction BX=2 lattice

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í		Un Covrected						Corrected					
	Nseed	6×/10-2	· Y,	2	14,-12/10	<sup>3</sup> a12(1)	Q12(2)	ν,	Y2	V1-V2 /10			
	4 <b>[</b>	-1,29,2,21		,796	49	(۲0)	,000	.728	,320	8			
· · · · · · · · · · · · · · · · · · ·		-19, 3,25	.860	,789	66	.053	043	,828	,821	7			
	<u> </u>	-1.16, 173	- 840 851	<u>819</u> 818	<u>16</u> 28	-,027	-,046	- 933 842	. 827 . 828	<u> </u>			
·	5	-2,52,2.19		, 791	60	.108	1045	.826	. 819	7			
********	.6	1,72,.56	.842	. 802	35	044	-,062	. 825	. 816	9			
	7	1,46,-5.16	. 878	.759	114	-,120		, 825	,819	6			
		-2.78,48	. 857	805	47	.076	. 0 93	. 236	,827	9			
<u></u>	:10	.71 -11.3	. 930	. 1066	259	-,187	. 149	827	. 320 -	7			
		1.09 ,-5,14	1010	, , , , , , , , , , , , , , , , , , , ,		-,108	,047	,837	, 823	· 11			
		······································				1		;		• <u>•</u> ••••••••••••••••••••••••••••••••••			
			·		•			: ;	····	· ·			
-		Maximu	h Grres	tion	A1L:	= (.19)(	34.5) =	6,6 KG	·				
; }					:								
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(;;;	1	1V-3plit		Y, -Y,	1295	4 × /0	-3						
		V-5P11	-y )	1,-12	i		ŧ	2	_				
		•	Corr	ected t	0 V,-	1/2/5	14 ×15						
			oss of	9 × 10 -3	inf + h	e har	width	33×	1-3				
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		D-Valu	es (q,	==)	, 826,	,821	I IV,	$-V_{2}$	= 5 ×10				
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Saggested Conclusions 1) 3 families of 9, Correctors with 3 peperate power supplies. 2) family one before Q2I in inner and to outer arc insertions 3) fomily two before Q20 in outer arc to Inner arc in Sertions 4) family three before Q50 in outer 1 nnen arc in sertions (to avoid Q57 at 6 Oclock (. J. Claus)) 5) Required strenth A1L=15KG  $A_{1L} = \int ds B_{o} a_{1}$ 

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