

Recycler Corrector Status
 Dave Johnson
 September 9, 2000

Current Corrector Status:

We currently have 27 horizontal and 28 vertical correctors in the Recycler ring. Out of this set of correctors most have a specific function of controlling the orbit around Lambertsons, between Lambertsons and kickers, and controlling the orbit through stochastic cooling tanks (102-103, 103-104, 211-212, and 212-213) and high beta insert*. This leaves only a few for general orbit smoothing.

All of these correctors run DC and are controlled by 053 cards. There are a small number that are normally off or DC but NEED to be ramped during injection or extraction for the Kicker compensation.

H326	LAM328 bump		
H328	LAM328 bump		
H330	LAM328 bump	K400 comp (ramped)	
H340		K400 comp (ramped)	
H400	LAM402 bump	K400 comp (ramped)	
H402	LAM402 bump		
H404	LAM402 bump		
H406			
H430			
H502			
H512			
H514			
H628			
H630			
H100	Cooling bump		
H102	Cooling bump		
H104	Cooling bump		
H106	Cooling bump		
H130		K130 comp (ramped)	
H210		K130 comp (ramped)	Cooling bump
H212	LAM214 bump	K130 comp (ramped)	Cooling bump
H213	LAM214 bump		Cooling bump
H216	LAM214 bump		
H230	position thru high beta*		
H232	position thru high beta*		
H310	position thru high beta*		
H312	position thru high beta*		

The vertical correctors were not explicitly included in the "ideal" design. They were included to control the orbit through known aperture restrictions such as Lambertsons and cooling tanks.

V325	LAM328	
V327	LAM328	
V329	LAM328	
V401	LAM402	
V403	LAM402	
V405	LAM402	
V429		
V501		
V513		
V515		
V629		
V631		
V641		
V101	COOLING	
V103	COOLING	
V105	COOLING	
V107		
V209		
V211	LAM214	COOLING
V213	LAM214	COOLING
V215	LAM214	COOLING
V217		
V231	HIGH BETA	
V301	HIGH BETA	
V309	HIGH BETA	
V311	HIGH BETA	

Additional Correctors:

An additional 12 horizontal and 14 vertical correctors have been found for installation in the Recycler. This still produces a sparse population of correctors in 81 out of 208 cells. The location of additional correctors should be based upon two criteria: 1) the optimization for global smoothing and 2) for controlling position and angle at strategic locations. Most of the locations where the orbit must be controlled have been addressed by the original corrector placement. The one area that we would like to better control the orbit is through the RR30 phase trombone tuning section. If the orbit is not controlled through this region an orbit distortion will be generated as the tune is adjusted with quad

currents. This requirement takes 4 or the additional correctors in each plane. This leaves 8 horizontal and 10 vertical correctors to spread about for global smoothing.

For local orbit control one would like to have two families of correctors that are (modulo) 90 degrees in phase with the members of each family (modulo) 180 degrees in phase advance. This paring will allow for local orbit and aperture measurements, although it may not be optimal for global smoothing. Using these criteria, a list of recommended additional correctors is given in the following spreadsheet.

Simulations:

The program MAD was used to test the smoothing ability of both the original and new corrector configurations. The Recycler lattice Version 20 which includes the measured quadrupole and sextupole fields of the gradient magnets, the gradient magnet end-shim feeddown correction from the sextupole and octupole, and the measured gradients of all quads was used for this procedure. The measured misalignments for the gradient magnets and quadrupoles along with the dipole and skew quad error in the gradient magnets were added to the lattice to produce a closed orbit error as seen in Figure 1. These errors produced an orbit with a maximum distortion in the x(y)-plane of approx. +/-10mm (+/-6mm) and an rms of 4mm (2.7mm). Figure 2 shows the result of the correction using the original corrector configuration. This produced an orbit with a rms of .58mm (.65mm) and a maximum of approximately +/-2mm in each plane. . The maximum corrector strength was 107ur (69ur) in the x(y)-plane and an rms strength of 38ur (30ur) . Figure 3 shows minimal improvement to the global smoothing. Here, the after correction rms orbit was .52mm (.54mm) for the x(y)-plane with little change in the maximum distortion. The corrector strengths were slightly reduced.

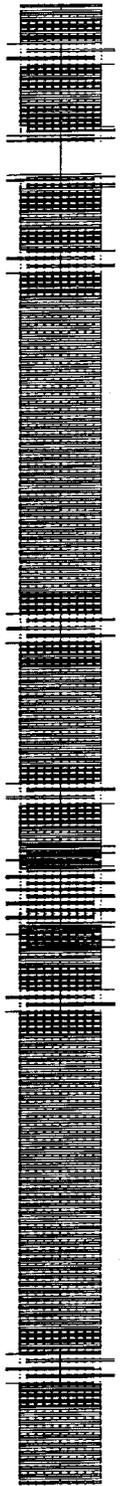
Installation:

The new corrector stands and correctors will be installed during the September shutdown. Due to the lack of cable and control cards the final implementation will occur when the cable and control cards become available.

Current and Proposed Recycler Corrector Locations

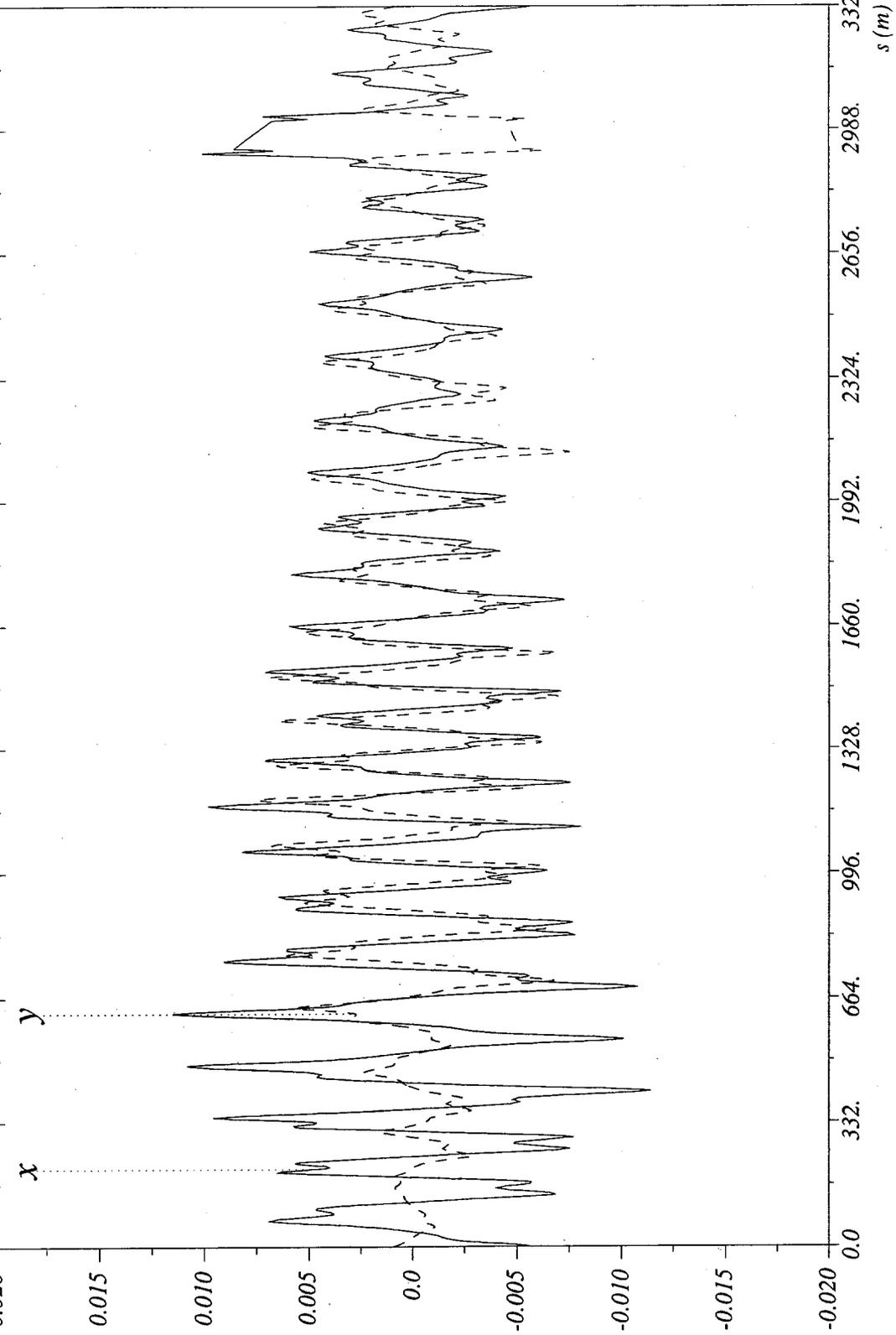
CELL	I CURRENT	I MODIFICATION 1	CELL	I CURRENT	I MODIFICATION 1	CELL	CURRENT	MODIFICATION 1	CELL	CURRENT	MODIFICATION 1
406			106			407			107	V	V
408			108			409			109		
410			110			411			111		
412			112			413			113		
414			114			415			115		
416			116		H	417	V	V	117	V	V
418		H	118		H	419	V	V	119	V	V
420		H	120			421			121		
422			122			423			123		
424			124			425			125		
426			126			427			127		
428			128			429	V	V	129	V	V
430	H	H	130	H	HR	501	V	V	201	V	V
502	H	H	202			503			203		
504			204			505			205		
506			206			507			207		
508			208			509			209	V	V
510			210	H	HR	511			211	V	V
512	H	H	212	H	HR	513	V	V	213	V	V
514	H	H	214	H213	H	515	V	V	215	V	V
516			216	H	H	517			217	V	V
518			218			519			219		
520			220			521		V	221		
522			222		H	523		V	223		
524			224		H	525			225		
526			226			527			227		
528			228			529		V	229		
530		H	230	H	H	531		V	231	V	V
532		H	232	H	H	601			301	V	V
602			302			603			303		
604			304			605			305		
606			306			607			307		
608			308			609		V	309	V	V
610		H	310	H	H	611		V	311	V	V
612		H	312	H	H	613			313		
614			314			615			315		
616			316			617			317		
618			318			619			319		
620			320		H	621		V	321		
622			322			623		V	323		
624			324		H	625			325	V	V
626			326	H	H	627			327	V	V
628	H	H	328	H	H	629	V	V	329	V	V
630	H	H	330	H	HR	631	V	V	331	V	V
632			332			633			333		
634			334			635			335		
636			336			637			337		
638			338			639			339		
640			340	H	HR	641	V	V	341	V	V
100	H	H	400	H	HR	101	V	V	401	V	V
102	H	H	402	H	H	103	V	V	403	V	V
104	H	H	404	H	H	105	V	V	405	V	V

New corrector locations



SUN SunOS 5.X version 8.21/0

08/09/00 10.00.35



$\delta e/p_{oc} = 0.$

Table name = TWISS

$(u) \kappa'(u) x$

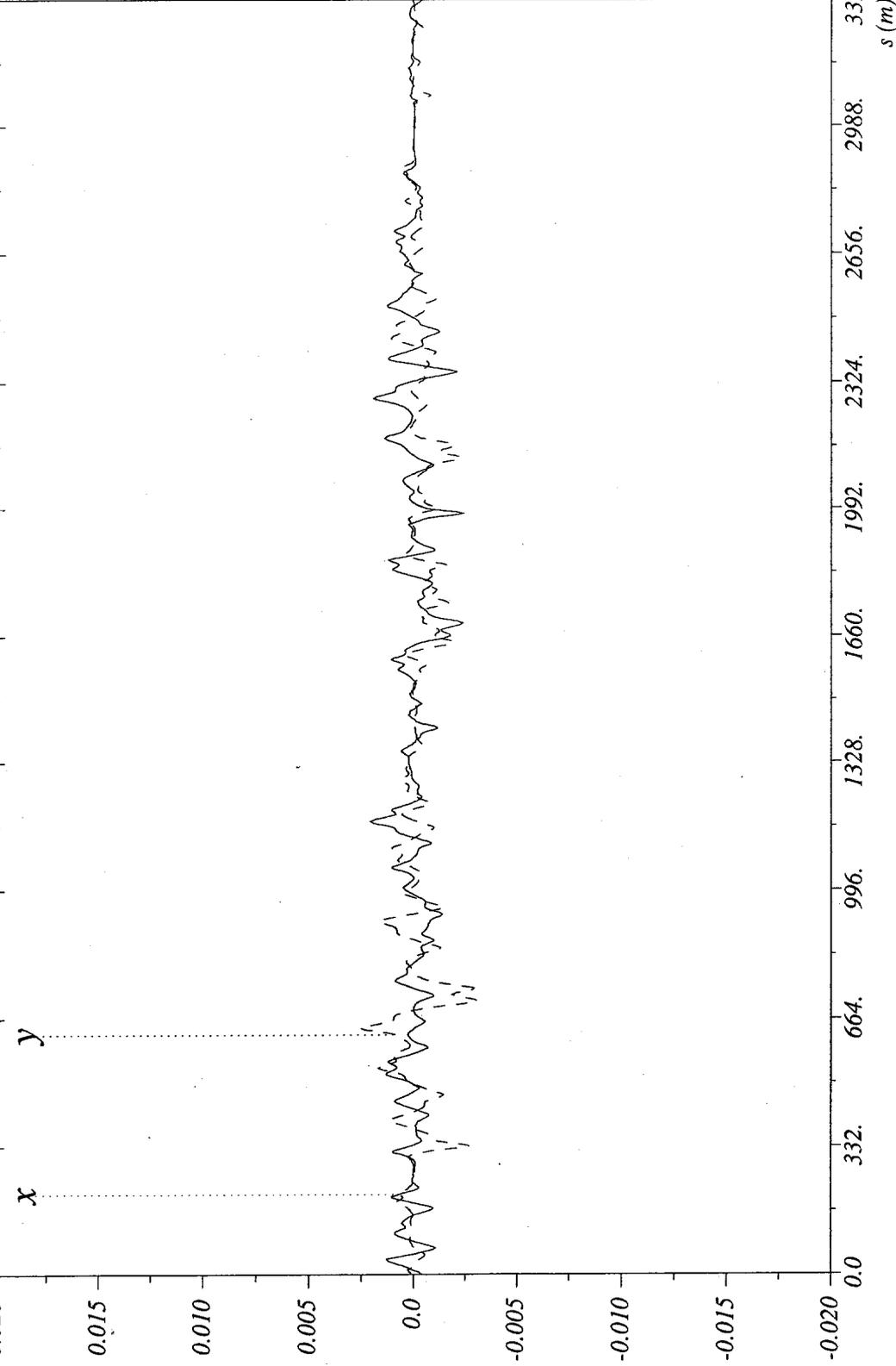


file: rrv20 Orinional CORR config

SUN_SunOS 5.X version 8.2.1/0

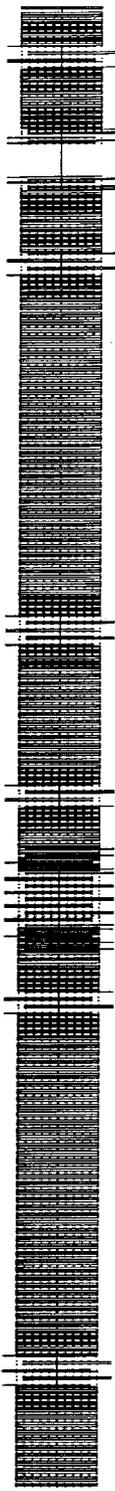
08/09/00 10.00.35

$(u) \lambda '(u) x$



$\delta \neq p_{oc} = 0.$

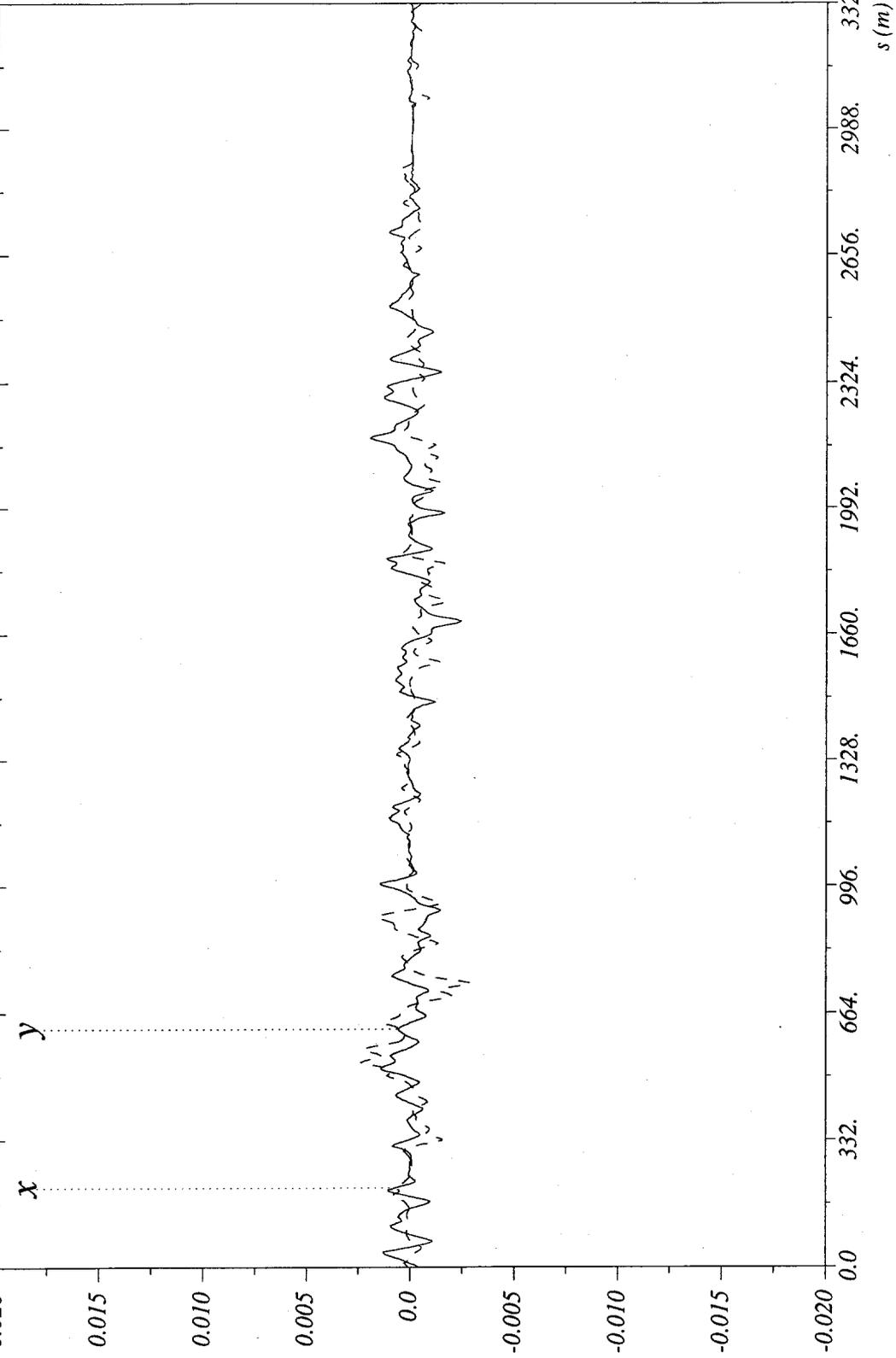
Table name = TWISS



file: rrv20 NEW CORR config

SUN SunOS 5.X version 8.21/0

08/09/00 10.17.10



$\delta_{\neq p_{oc}} = 0.$

Table name = TWISS