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Transition Jump Using ? ? Produced by the Polarized Proton Fast Quadrupoles

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Reported by L.G. Ratner

Subject Transition Jump Using $\Delta\nu$ Produced by the Polarized Proton Fast Quadrupoles

Observations and Conclusion

This method was successfully used at CERN many years ago at a level of a few 10^{12} protons. They produced a $(\Delta\nu_H)_{TR} \approx 0.2$ with about a 1-2 msec rise time. Since $\Delta\nu_H \approx \Delta\gamma$, this gave them a $(\Delta\dot{\gamma})_{TR}$ of 200/sec, an enhancement factor of 7, and allowed a clean jump at about 2-3 x 10^{12}.

The polarized proton fast quads are capable of producing a $\Delta\nu_H \approx$ 0.2 in 2 μsec or a $\Delta\dot{\gamma} \approx 10^5$/sec, an enhancement of 2000. However, it is not only rate that is necessary, but one must not destroy the beam by this non-adiabatic pulse.

In order to produce a $\Delta\nu_H \approx 0.2$, since the quads are located at vertical β-max positions, one has to apply a $\Delta\nu_V \approx 0.4$. This would drive the tune to cross $\nu_V = 9$ and so to prevent this, one must also energize the slow quads to compensate for this.

As we set up conditions for making these tests, it appeared that 2 μsec was too fast. We therefore turned off the HV 2 μsec pulse and used only the LV 50 μsec pulse from the fast quad modulators. This rise time factor will be reinvestigated in our next study. We used the vertical slow quads to compensate for the fast quad pulse and measured that our $(\Delta\nu_H)_{TR} = -0.17 \pm 0.01$ with about a 50 μsec rise time. This gives an enhancement of 68 which would be good for 2 x 10^{13} protons, but one must not only have crossing speed but also we think significantly higher $\Delta\gamma$. We were operating the AGS at this time with 2 x 10^{12} circulating protons and we were able to cross transition very smoothly with this technique. Our attempt to increase the intensity was masked by other problems and finally lack of time. It is not clear what the intensity limit of this method is and we will plan to continue this study during the next AGS operating period. The following pictures on Page 5 of the γ_{TR} Studies Book show the effect at transition produced by the fast tune shift. A much smoother passage is produced using the fast quads.

Measured with 9 Mods

	Bare	Slow-Q		Fast Q	
Q_V	8.780	−.20	= 8.580	+.30	= 8.88
	$\times \frac{10}{9}$	−.22	= 8.560	+.33	= 8.89
Q_H	8.713	+.10	= 8.813	−.16	= 8.66
		+.11	= 8.823	−.18	= 8.64
			±.01		±.01

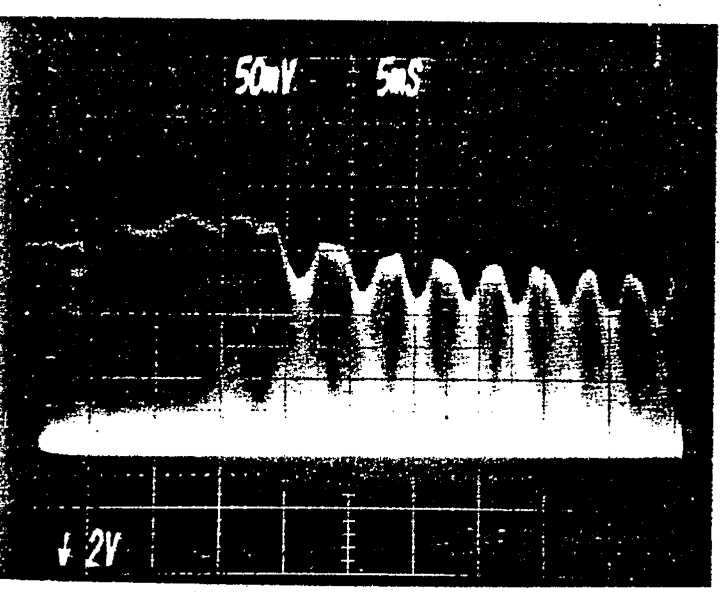
$$(\Delta \nu_H)_{fast} = -.17 \pm .01 \simeq (\Delta \gamma)$$

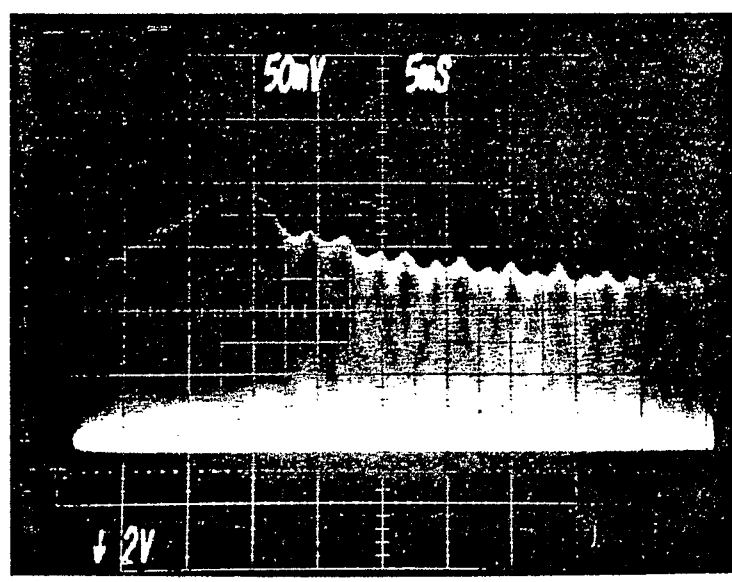
$$\Delta t = 50 \times 10^{-6}\ sec$$

$$\frac{\Delta \nu}{\Delta t} = \frac{.17}{50} \times 10^{6} = 3.4 \times 10^{3}$$

$$\left(\frac{\Delta \gamma}{\Delta t}\right)_0 = \frac{30}{.6\ sec} = 50/sec$$

$\Big\} f = 68$





FAST Q OFF. TIMING OF ϕ JUMP OPTIMIZED. NO RADIAL SHIFT.

$Q \simeq 2 \times 10^{12}$

FAST Q ON. TIMING OPTIMIZ
NO RADIAL SHIFT
ϕ JUMP @ 15650
FQ @ 15800