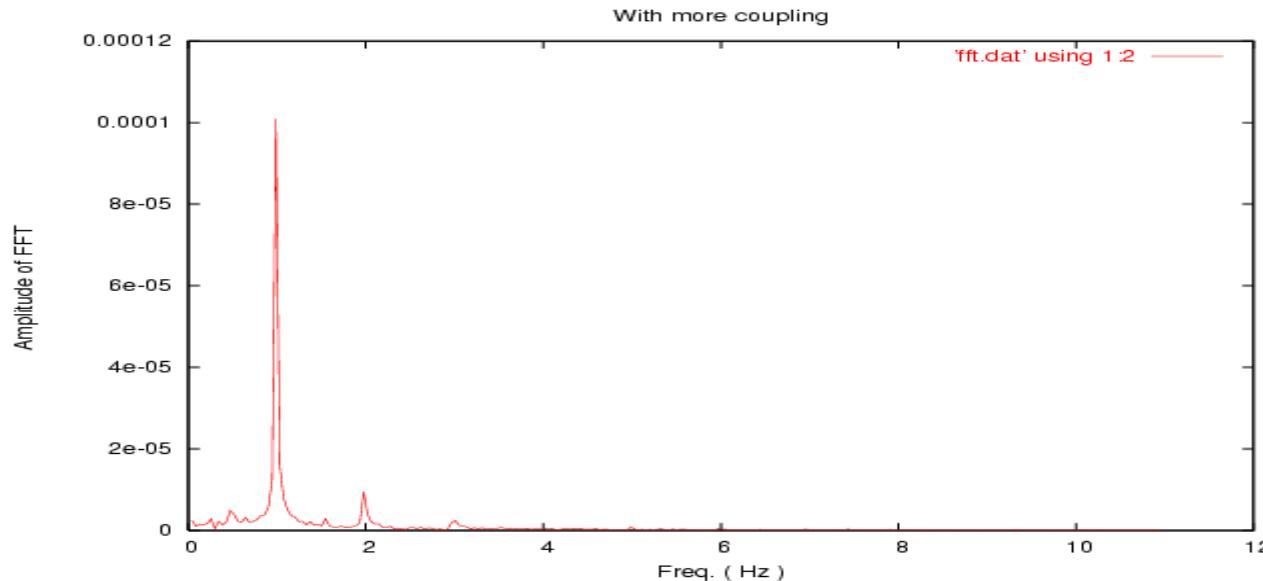


Data taken List and Processing (Jan. 13-14 session)

Ex. Condition	Data List	Peak_1.0Hz	Peak_2.0Hz	Projection Ratio	Sign of Projection (need check)
Normal	2301	4.46e-07	1.67e-06	0.067	
Injection	2305	4.94e-07	1.16e-06	0.106	
DQmin=0.005	2307	9.26e-07	4.80e-06	0.048	
SkewQ F2: +0.0004	2321	5.77e-05	2.32e-05	0.621	+ (bi1.ps)
	2324	1.01e-04	1.03e-05	2.436	-(b03.ps)
DQmin=0.018	2327	8.70e-05	1.40e-05	1.549	-(bi5.ps)
SkewQ F3: -0.0004	2339	1.15e-04	1.41e-05	2.037	+(bi1.ps)
	2341	6.06e-05	1.65e-05	0.918	-(b03.ps)
DQmin=0.025	2345	6.63e-05	2.40e-06	6.903	-(bi5.ps)
Normal	2358	1.48e-06	1.73e-06	0.2143	
Injection	0000	3.30e-07	1.91e-06	0.0432	
DQmin=0.006	0002	4.74e-07	4.90e-07	0.2419	

How to Get the Projection Ratio

FFT of $(q1-q2)^{2.0}$ when more coupling in the machine



$$(Q1-Q2-p)^2 =$$

$$|\Delta|^2 + |C^-_{\text{residual}}|^2 + \frac{1}{2} |C^-_{\text{modulating_amp}}|^2 + 2 |C^-_{\text{residual}}| \cdot |C^-_{\text{modulating_amp}}| \cdot \cos \psi \cdot \sin(2\pi f t + \phi_0) + \\ - \frac{1}{2} |C^-_{\text{modulating_amp}}|^2 \cos(2\pi \cdot 2f t + \phi_0)$$

Projection Ratio: $\frac{|C^-_{\text{residual}}| \cdot |\cos \psi|}{|C^-_{\text{modulating_amp}}|} = (\text{peak_1f} / \text{peak_2f})/4$

How to Get the Right Signs of Projection

- *Assuming:*

Modulation skew quadrupole power supply current: $i = I_0 \sin(2\pi ft + \phi_0)$

The induced coupling coefficients: $C^- = C^-_{\text{modulating_amp}} \sin(2\pi ft + \phi_0)$

In our experiments, we set $\phi_0 = 0$

- $(Q1-Q2-p)^2 =$

$$|\Delta|^2 + |C^-_{\text{residual}}|^2 + \frac{1}{2} |C^-_{\text{modulating_amp}}|^2 + 2 |C^-_{\text{residual}}| \cdot |C^-_{\text{modulating_amp}}| \cdot \cos \psi \cdot \sin(2\pi ft + \phi_0) + \\ - \frac{1}{2} |C^-_{\text{modulating_amp}}|^2 \cos(2\pi \cdot 2f \cdot t + \phi_0)$$

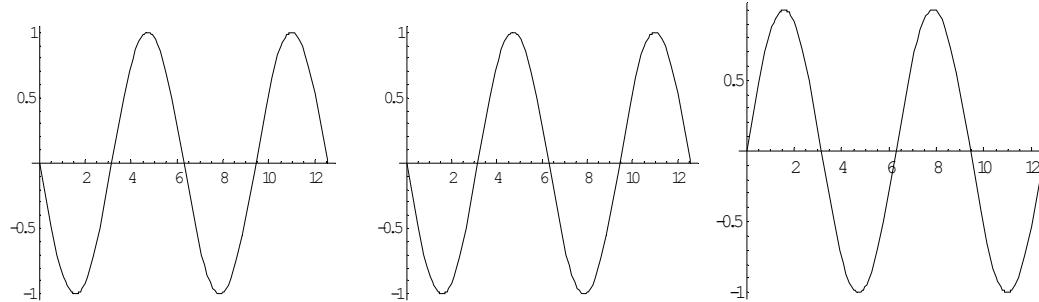
- **do FFT of [$(Q1-Q2-p)^2 i$]**

$$(C + B \sin x + A \cos(2x)) * I \sin x = I_0 C \sin x + B I_0 (\sin x)^2 + A I \sin x \cos(2x) \\ = B I_0 / 2 - B I_0 \cos(2x) / 2 + I_0 C \sin x + A I \sin x \cos(2x)$$

The constant part's sign is decided by $\cos \psi \cdot I_0$

Coupling Measurement Results

1) For the case with more coupling by setting SQ F3 strength to -0.0004



F1, PS: bi1-qs10

F2, PS: b03-qs10

F3, PS: bi5-qs10

$C^-_{modulating_amp}$ Direction: (109.5°)

Projection Ratio: 2.037

Projection Sign: -

(49°)

0.9181

+

(169.7°)

3.45

-

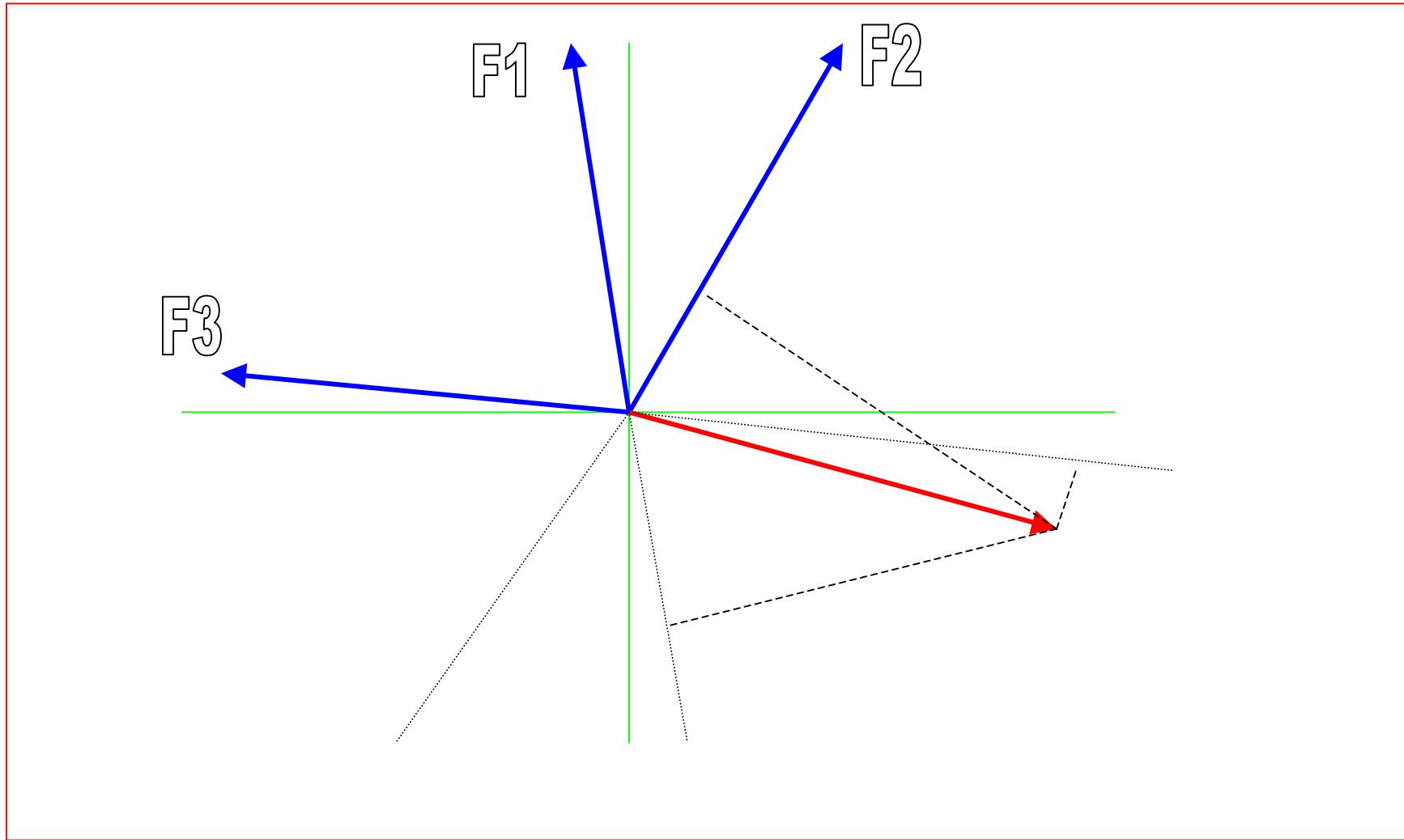
$C^-_{residual}$:

From (F1, F2) $3.00/336.80^\circ$

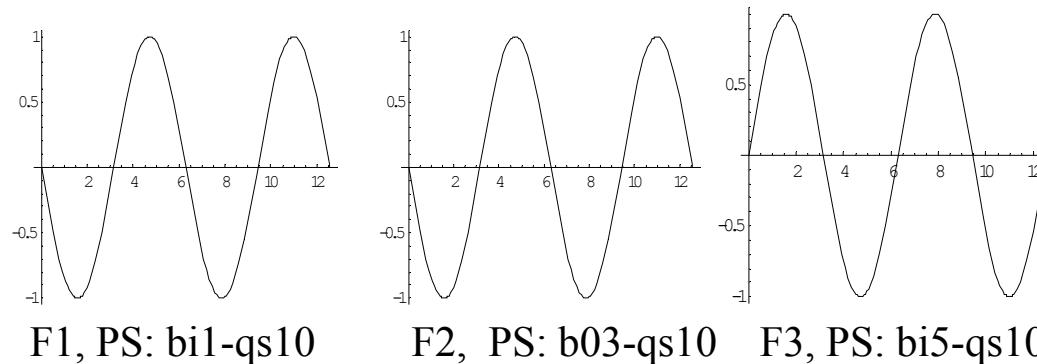
From (F2, F3) $3.59/333.83^\circ \implies \frac{\Delta |C^-_{residual}|_{\max}}{|C^-_{residual}|} = 10.5\%, \Delta |\psi|_{\max} = 5.5^\circ$

From (F3, F1) $3.47/343.55^\circ$

Skematic Plot:



2) For the case with more coupling by setting SQ F2 strength to 0.0004



$C^-_{\text{modulating_amp}}$	Direction:	(109.5°)	(49°)	(169.7°)
Projection Ratio:		0.6214	2.436	1.549
Projection Sign:		- (+ ?)	+	-

C^-_{residual} :

From (F1, F2) : $3.21/8.34^\circ$ From (F2, F3) : $2.46/40.70^\circ$ From (F3, F1) : $1.558/356.0^\circ$

If we change the sign of F1 projection to positive

From (F1, F2) $2.52/33.75^\circ$

From (F2, F3) $2.46/40.71^\circ \implies \frac{\Delta |C^-_{\text{residual}}|_{\max}}{|C^-_{\text{residual}}|} = 4.7\%, \Delta |\psi|_{\max} = 3.99^\circ$

From (F3, F1) $2.23/35.69^\circ$

Plan for next beam experiment:

- 1) checking the power supplies polarization
- 2) measurement on ramp
- 3) measurement at store
- 4) feasibility for two frequencies modulation at same time

Time: 1.5 ~ 2.0 hrs.

Question 1 *Is it time for us to write an on-line application script for this technique?*

Question 2 *could we modify the sorting of skew quadrupole families from three to two? Easy to do , just software work.*