

Chained SQUID Amplifier

- The open-loop response of the system is the composition of the SA, SQ2 and SQ1 V-phi curve forms:

$$\text{error} = f_{\text{SA}}(f_{\text{SQ2}}(f_{\text{SQ1}}(I_{\text{TES}} - \text{FB}_{\text{SQ1}}) - \text{FB}_{\text{SQ2}}) - \text{FB}_{\text{SA}}) - X_0$$

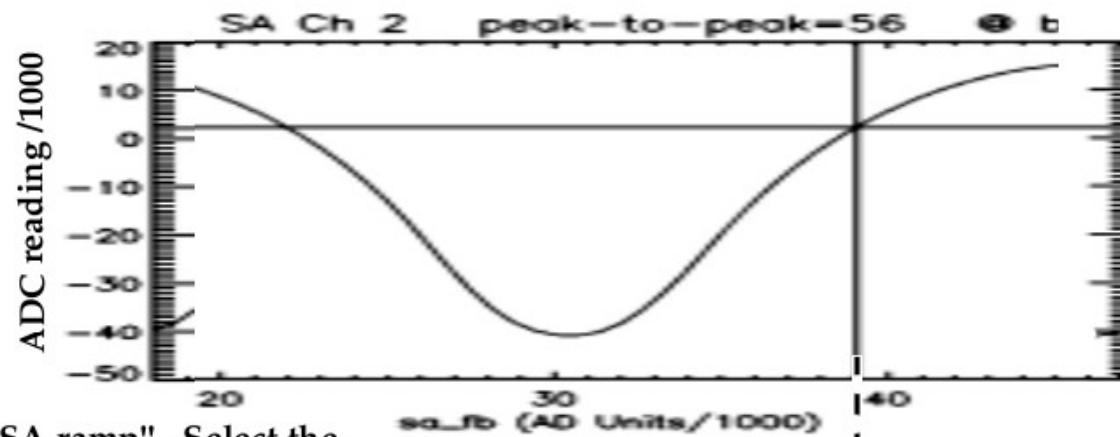
↑ ↑ ↑
V-phi functions

↑ ↑ ↑
Constant when locked

↑
ADC_offset

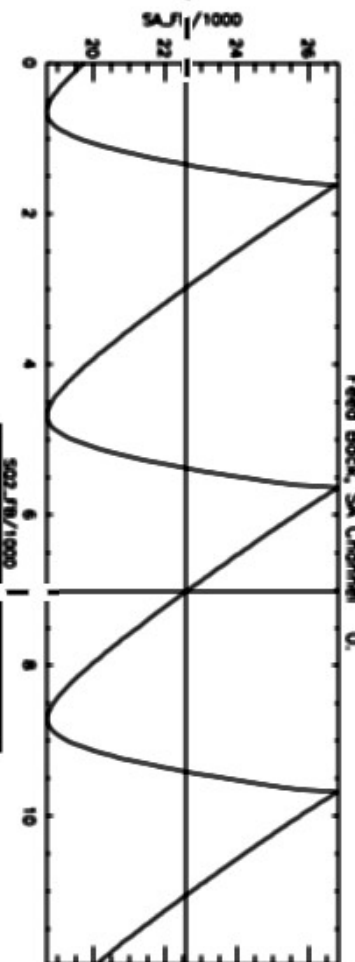
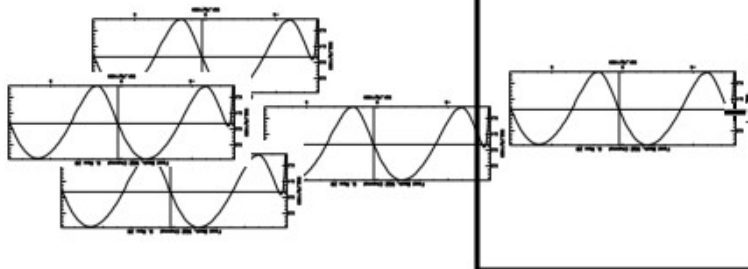
MCE Auto-tuning

- Sets up squid amplifier stages; characterizes lock points.
- Four steps:
 1. SA FB ramp (with optional SA bias selection)
 - Finds SA set-point and sets “ADC_offset”
 2. “SQ2 servo” - ramp SQ2 FB, adjust SA FB to keep error = 0.
 - Finds SQ2 set-point, sets SA FB
 3. “SQ1 servo” - ramp SQ1 FB (1 row per col.), adjust SQ2 FB to keep error = 0.
 - Finds SQ1 set-point, sets SQ2 FB
 4. SQ1 FB ramp – ramp SQ1 FB to see final open-loop amplifier response
 - Finds SQ1 lock-point, updates “ADC_offset”



"SA ramp" - Select the
SA set-point ADC value.

"SQ1 servo" - select
compromise S2_FB
set-point using a
"typical" row.



"SQ2 servo" -
select SA_FB

Runfile data...

<SQUID>

<SQ_tuning_completed> 1

<SQ_tuning_date> 20090518

<SQ_tuning_dir> 1242727060

<Col0_squid_vphi_p2p> 15111 15373 14902 15611 14733 14619 14155

13332 14306 1959 14242 13998 14536 14039 13628 1733 1725

14430 14585 15104 14549 14199 14584 14481 14679 14562 15368

15298

15864 16256 16177 16161 15750

...

<Col0_squid_lockslope_down> -7.04114 -7.05614 -7.30932 -7.87591

-6.85091 -7.31182 -6.77500 -7.08182 -7.27273 0.00000 -6.28614 -6.76591 -

6.99364 -5.92227 -6.16295 -0.272273 0.461591 -6.19545 -6.65455 -6.99636

-6.45477 -6.05318 -7.14023 -6.43000 -6.48045 -7.02545 -7.30568 -7.71591

-8.49045 -7.54432 -7.08750 -7.91409 -7.57841

...

<Col0_squid_lockslope_up> 5.00886 5.29341 5.06136 5.19250 4.90364

4.80000 4.86432 4.94136 4.75864 0.00000 5.17364 4.82432 5.14023 4.77932

4.29182 0.916591 0.754773 4.72273 4.74205 4.67977 4.94682 5.26455

4.62818 4.786

82 4.62227 4.42000 5.17523 4.93000 5.39886 5.43932 5.44568 5.46568

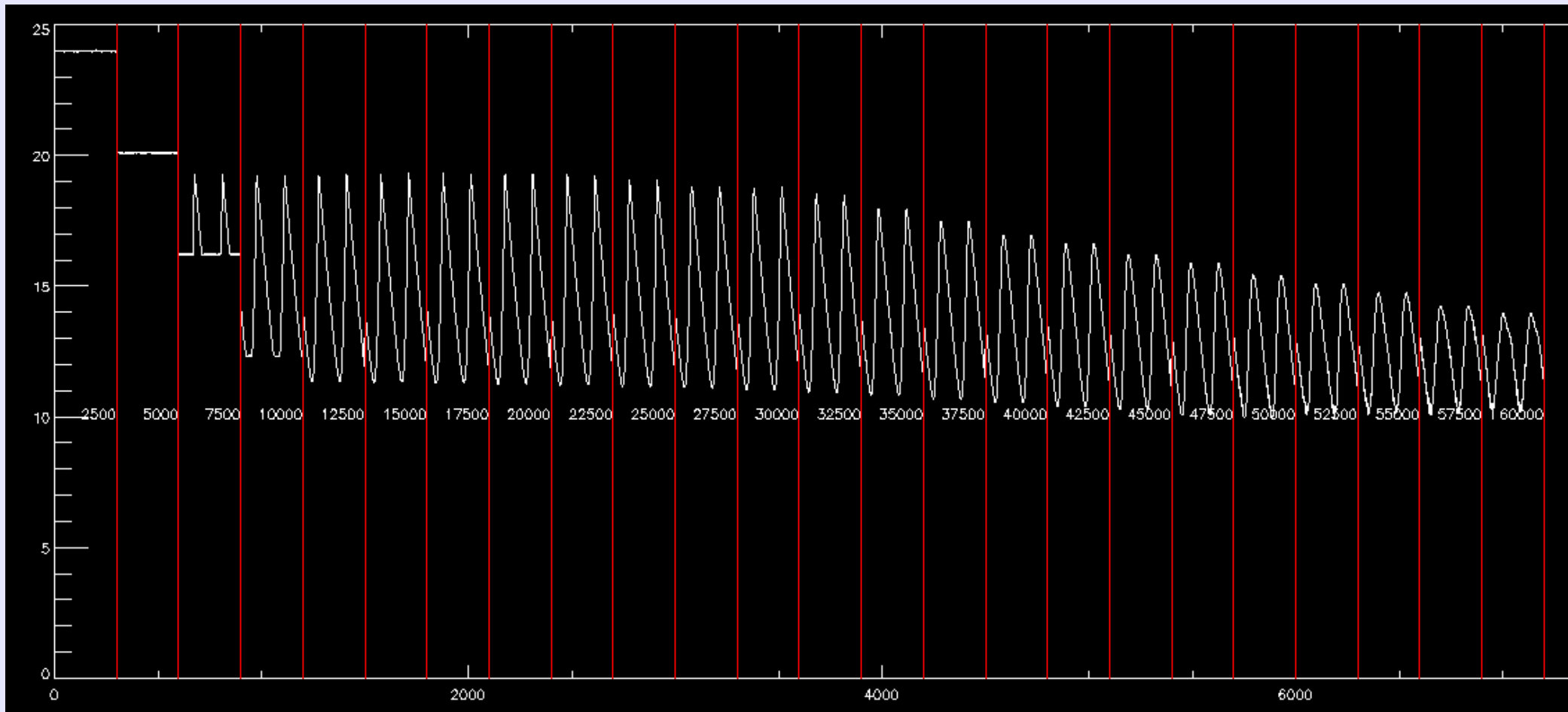
5.27773

...

</SQUID>

SQ2 Bias selection...

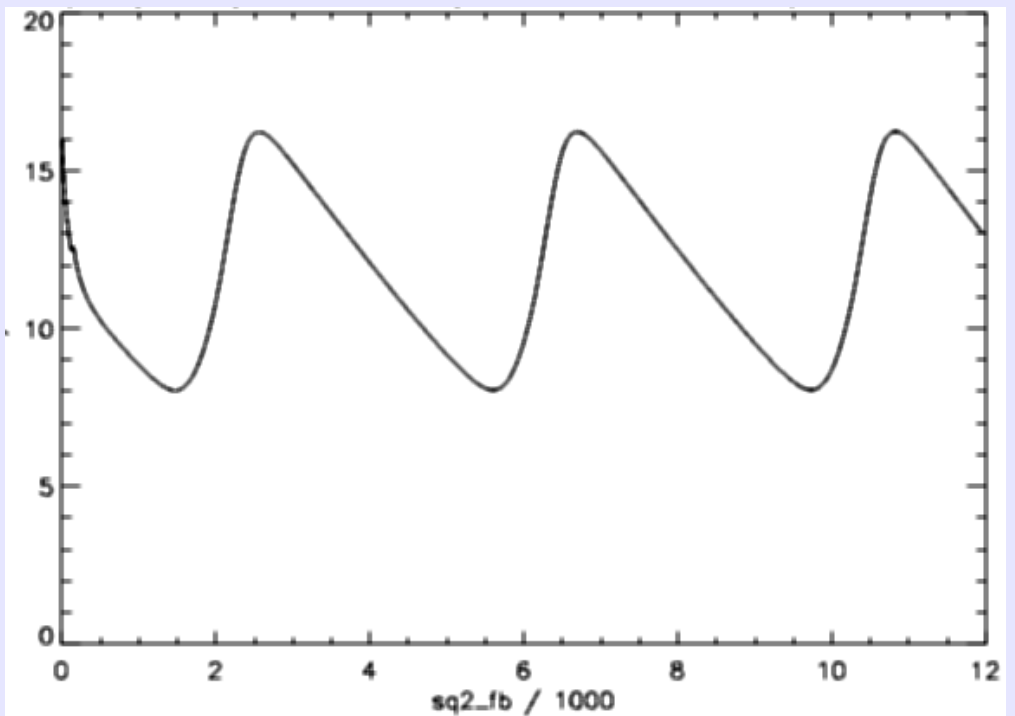
- Setup SA...
- Run SQ2 servo at several biases.



Representative Row selection

“SQ2 servo” curve;
SA FB vs. SQ2 FB

SA FB



SQ1 amplitudes
in SQ2 FB space

SQ1 ROW

