SQUID Flux Balance vs Bridge Circuit Balance

The amount of error in the simpler equation for R_sample depends on the relative "gains" of the Internal Feedback circuit and the Bridge circuit. By gain I mean, per Volt of Feedback Signal offset from the point of exact bridge balance, how much change is there in the flux generated by the Internal Feedback path compared to the change in flux generated by Bridge's out of balance current.

Both of these circuits generate the same amount of flux per uAmp of current in their Input or RF coil. As used with the Quick Dipper the Quantum Design 2000 SQUID Controller always produces 1 uAmp of Internal Feedback current per Volt of Feedback Signal.

The amount of flux producing current generated by the Bridge circuit per Volt of Feedback Signal offset from the point of exact Bridge balance depends on the values of: R_sample, R_ref, R_fb, and the TTR. The typical values that I've used to estimate the operation of these circuits are:

Pratt samples: R_sample = 10 uOhm, R_ref = 100 uOhm, R_fb = 10k Ohm

Birge samples: R_sample = 20 mOhm, R_Ref = 100 uOhm, R_fb = 2k Ohm

If you plug in the numbers, and let's assume a Transformer Turns Ratio of 10:1 (I will ask Bill what it actually is) you get the following:

Pratt samples: 1 mA of flux generating current from the bridge

Birge samples: 25 uA of flux generating current from the bridge

Both of these currents are per Volt of Feedback Signal offset from the point of exact bridge balance and should be compared to the 1 uA per Volt of Feedback Signal that is generated by the Internal Feedback path. From the point of view of balancing the bridge one may be able to think of this as a loop gain of 1,000 vs 25.