Calibration for the Pulsar Frequency-Domain Analysis

$$R_0(f),\ \alpha \rightarrow R_t(f)$$

Initial response function

Calibration update parameter calculated once every minute using an injected line

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-Our SFTs are calculated for minute-long stretches of AS_Q data. The start times are based on the start of science mode stretches

$$\longrightarrow AS\_Q(f)$$

-The epochs (GPS times) for which we have the $\alpha's$ do not generally coincide with the epochs of the SFTs that we have

$\longrightarrow$ linear interpolation to calculate $\alpha's$ at SFT epoch $\longrightarrow R_t(f)$

$$\Rightarrow s(f) = R_t(f) \times AS\_Q(f)$$

-We have done this with our own stand-alone codes using the calibration files available from the calibration webpage

-For future analyses (S2) we will generate the SFTs only at the epochs where the calibration parameters are available and use the LAL routines for the calibration.

Effect of Calibration Errors on the Pulsar Search

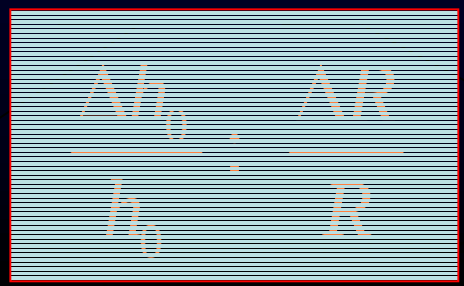
-In the case of a pulsar signal with strain h_0 the value of our statistic

$$F : \frac{h_0^2 T_{OBS}}{S_h} \Rightarrow h_0 \propto \sqrt{F S_h}$$

-The noise has two powers of the response function: $S_h = R^2 S_c$

$$\Rightarrow \frac{\Delta h_0}{h_0} = \frac{\Delta R}{R} + \frac{\Delta F}{F}$$

Errors dominated by the errors in the estimation of the noise floor



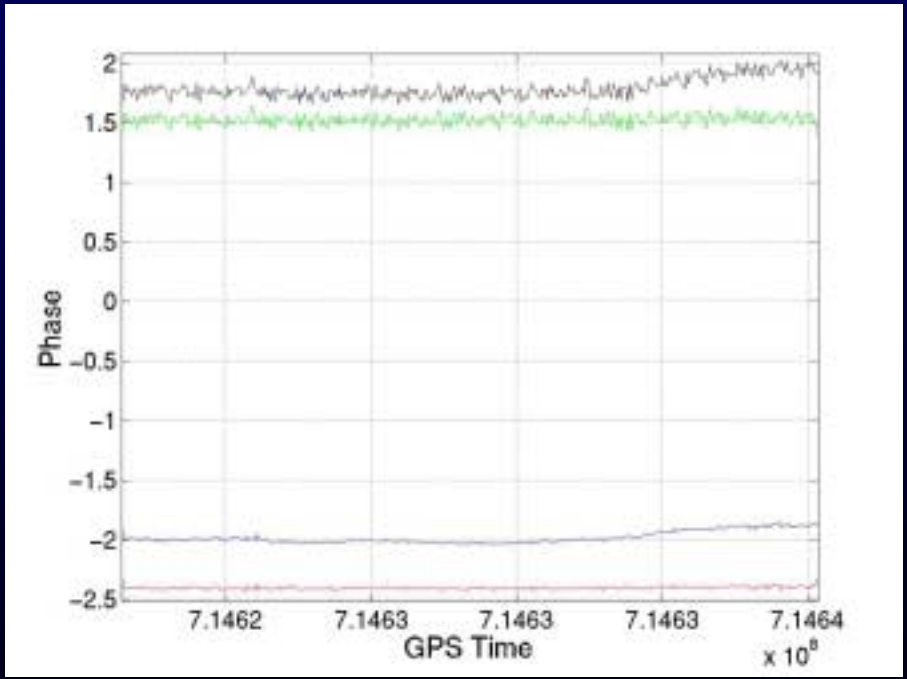
For a calibration error of 10% our upper limit error on is 10%

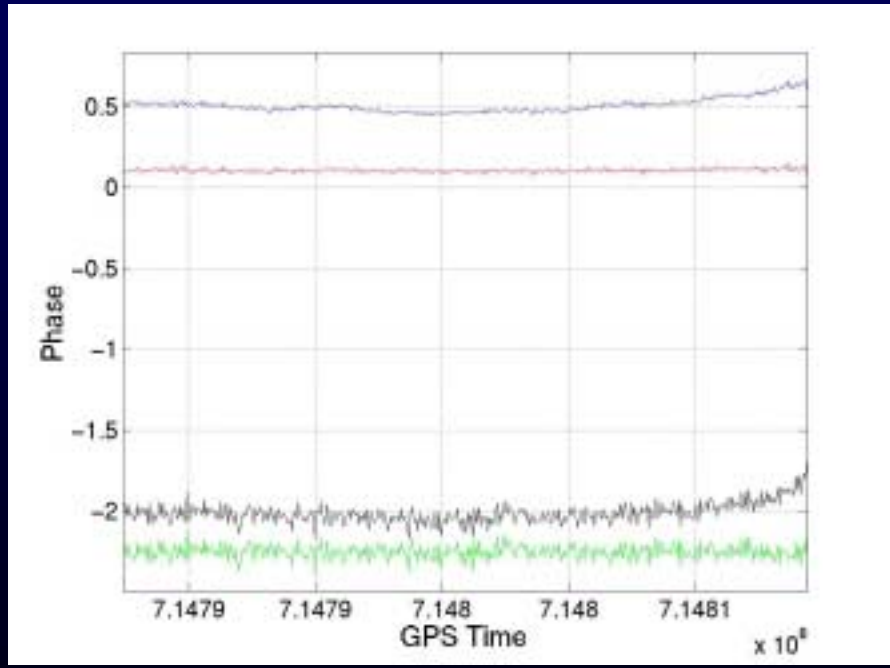
What about drifts in the phase?

Plot of Phase of 51.3 and 972.8Hz calibration line vs. GPS time at LLO.

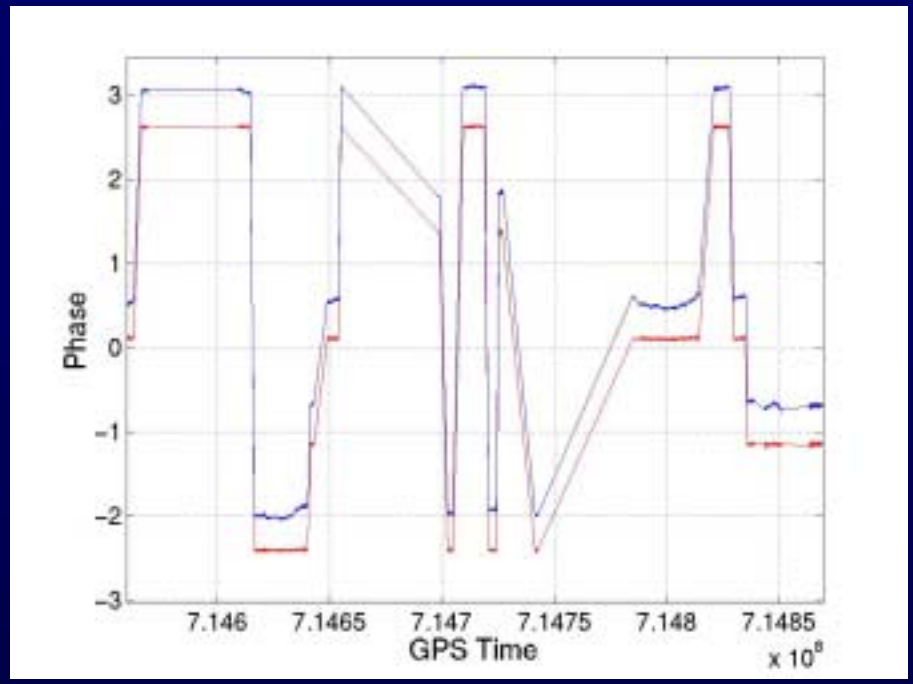
972.8 Hz -- Blue is un-calibrated, red is calibrated.

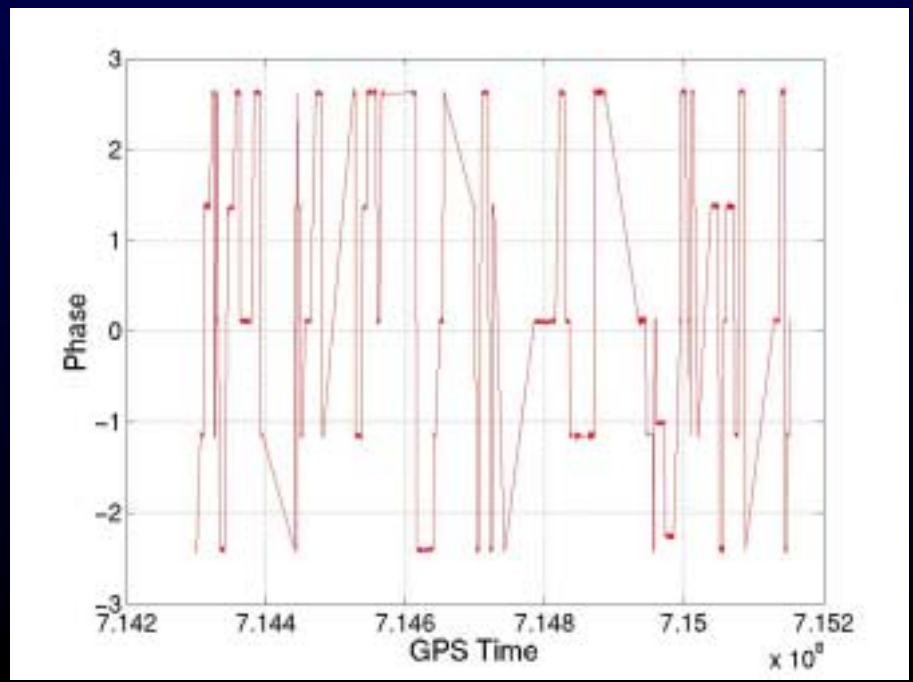
51.3 Hz -- Black is un-calibrated, green is calibrated.





It seems we're OK!


Phase
3
2
1
0
−1
−2
−3
7.146
7.1465
7.147
7.1475
7.148
7.1485
GPS Time
x 10^8


Phase
3
2
1
0
−1
−2
−3
7.142
7.144
7.146
7.148
7.15
7.152
GPS Time
x 10^8