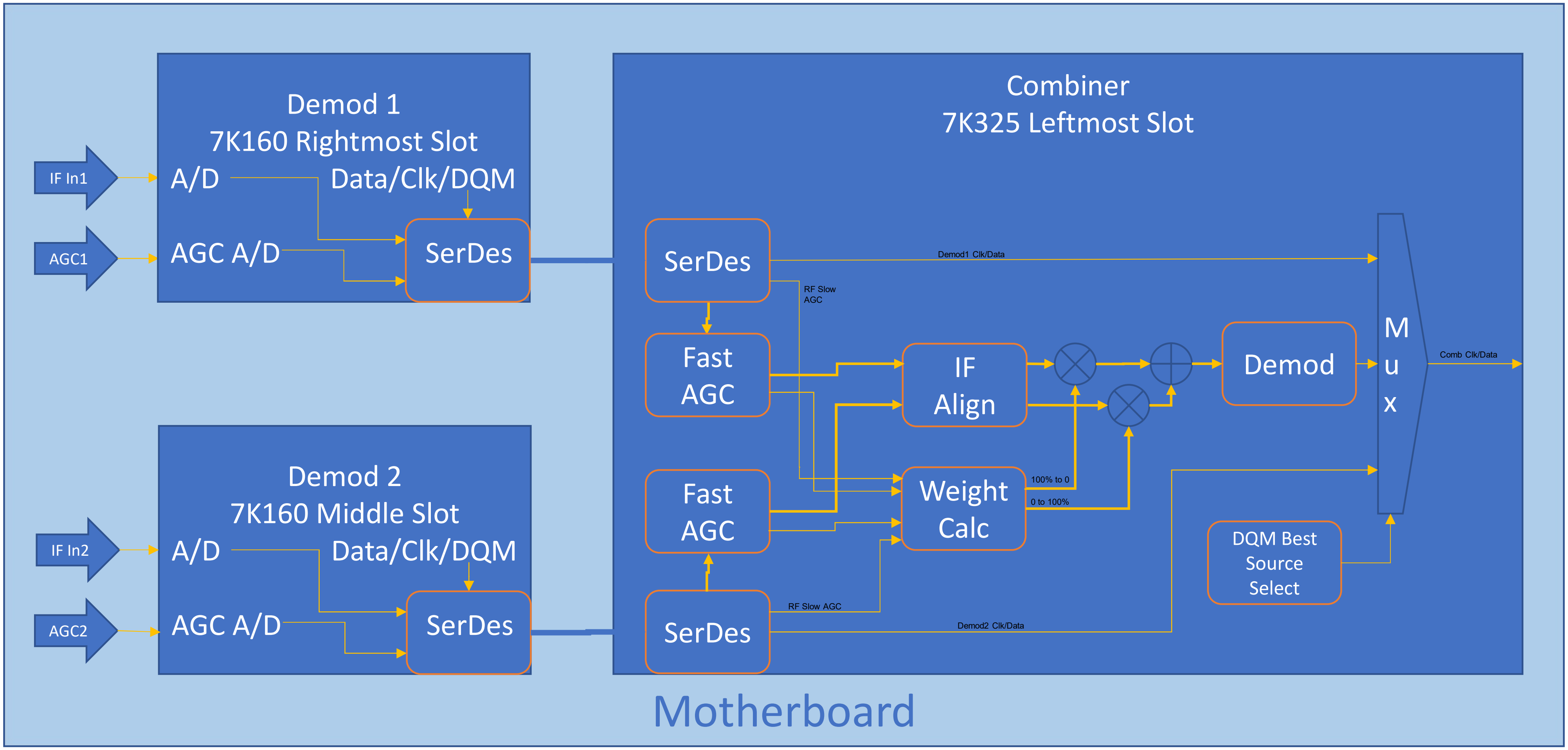
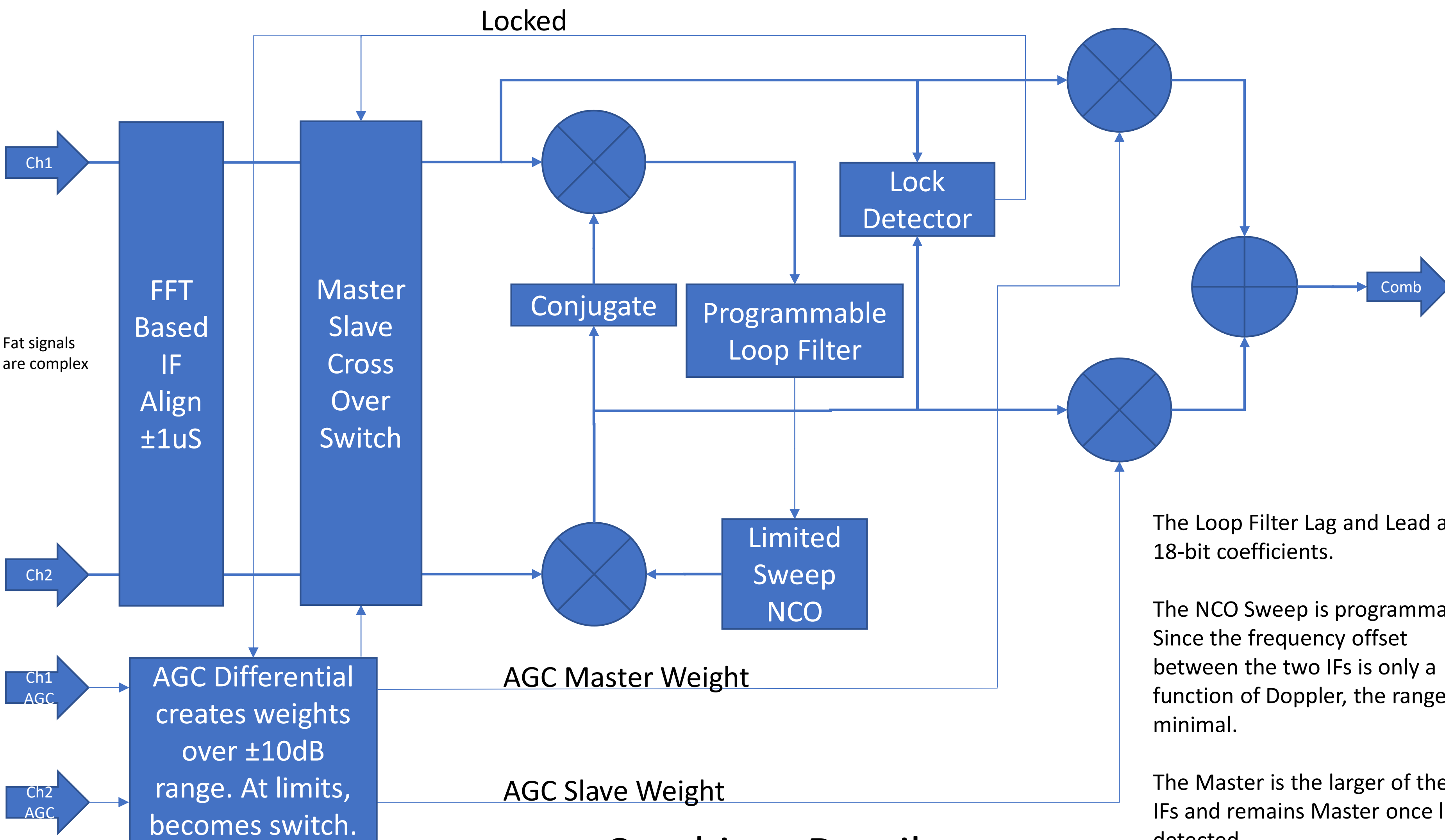
Digital Combiner Block Diagrams



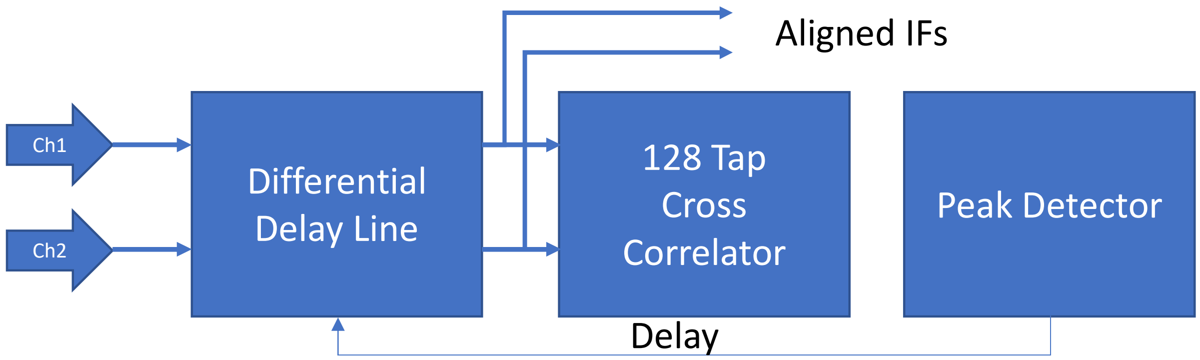


Combiner Details

The Loop Filter Lag and Lead are 18-bit coefficients.

The NCO Sweep is programmable. Since the frequency offset between the two IFs is only a function of Doppler, the range is minimal.

The Master is the larger of the two IFs and remains Master once lock is detected.



IF Alignment Details

- The two IFs are time aligned to compensate for differential path delays. An FFT based correlator is used to determine the maximum correlation of the two signals, similar to STC. At the 46.6Msps complex rate, the timing steps are in 21.4nS increments. The delay output is fed back to a differential delay line used to align the two IFs such that the delay line outputs are synchronous.

- The Channel 1 and Channel 2 AGC voltages from the IFs are 0 to 4V over an 80dB range. 4 is very strong, 0 is noise floor. The AGCs are sent to a 12-bit A/D with a 3.3V range. The input is resistively scaled from 4.0V to ±1.5V centered at 1.65V. Since we are only using 3/3.3=90.9% of the available A/D range and the digital inputs are in 12.11 format for ±1.0, the input signal range is ±0.909V to cover ±40dB.
- Note that the required range is 80dB, but the headroom of the A/D gives us an actual range of 80*3.3/3 = 88dB. This is beneficial as shown below.
- We take the difference in AGC voltage between the two channels to define the weighting system based on the stronger signals. If we take the differential and multiply by 8 with saturation this effectively gives a ±11dB differential maximum. We can use this to limit the range the combiner attempts to work over, since combining is only useful over a 10dB range. The nature of the saturation forces a best source select function automatically. We take the absolute value to determine the weight signals and the sign to define the larger channel. The absolute value addresses a look up table that does the log to linear conversion. The Log2Lin transposes the log nature of the AGC to a linear ratio of the two signals. If the two AGCs are the same, the differential is zero and the weights are set to 50-50 for optimal combining. As the difference approaches +1.0, the largest signal gets a weight of 100%.and the other is shut off with a weight of 0%.