

# **RF Crosstalk**

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# RF Sources

- ❑ All Oscillators are locked to GPS
  - Probably some rogues ones around...
  - Interface to timing distribution system
  - Diagnostics available through epics (locked, frequency readback, control voltage, etc)
  - Phase can still drift a little since we lock at 1 pps ( $BW < 0.1$  Hz)
  - RF distribution at similar levels (10 dBm to 13 dBm)
  - Baluns are used for DC decoupling
- ❑ Fixed frequency fiber AOM at 79.2 MHz
  - Compensate for IMC VCO frequency shift

# Voltage Controlled Oscillators

- ❑ Probably the main cause of RF crosstalk
  - All of them operate near 79 MHz
  - All frequencies are read back through timing system
  - Single frequency difference divider: IMC, EX PLL, EY PLL
  - Double frequency difference divider: COMM PLL, DIFF PLL
- ❑ Most dangerous path:
  - Anyone of them into IMC VCO
  - Will show up in common mode path and couple to AS port
- ❑ Solutions:
  - Exact frequencies (requires tidal feedback)
  - Park or turn off ALS units after lock is achieved
  - Move doubler for ALS fiber AOM (ECR in prep)
    - ❖ Order of magnitude improvement



# Exact Frequencies

Location	Freq. (MHz)	Deviation	Comment
Main Laser	0	$2\Delta f_{main}$	set by main laser VCO
Reference Cavity	316.8	fixed	frequency reference
Fiber	0	fixed	shifted back
X-arm laser	-78.92	$\Delta f_x$	down-shifted
Y-arm laser	78.92	$\Delta f_y$	up-shifted
Differential beat note	157.84	$\Delta f_y - \Delta f_x$	controlled to zero
Common beat note	-78.92	$2\Delta f_{main} - \Delta f_x$	offset from resonance

- ❑ All frequency measured  $\pm 1$  Hz
- ❑ Ambiguous: 1 IR resonance for 2 GR resonances
- ❑ Depends somewhat on green alignment