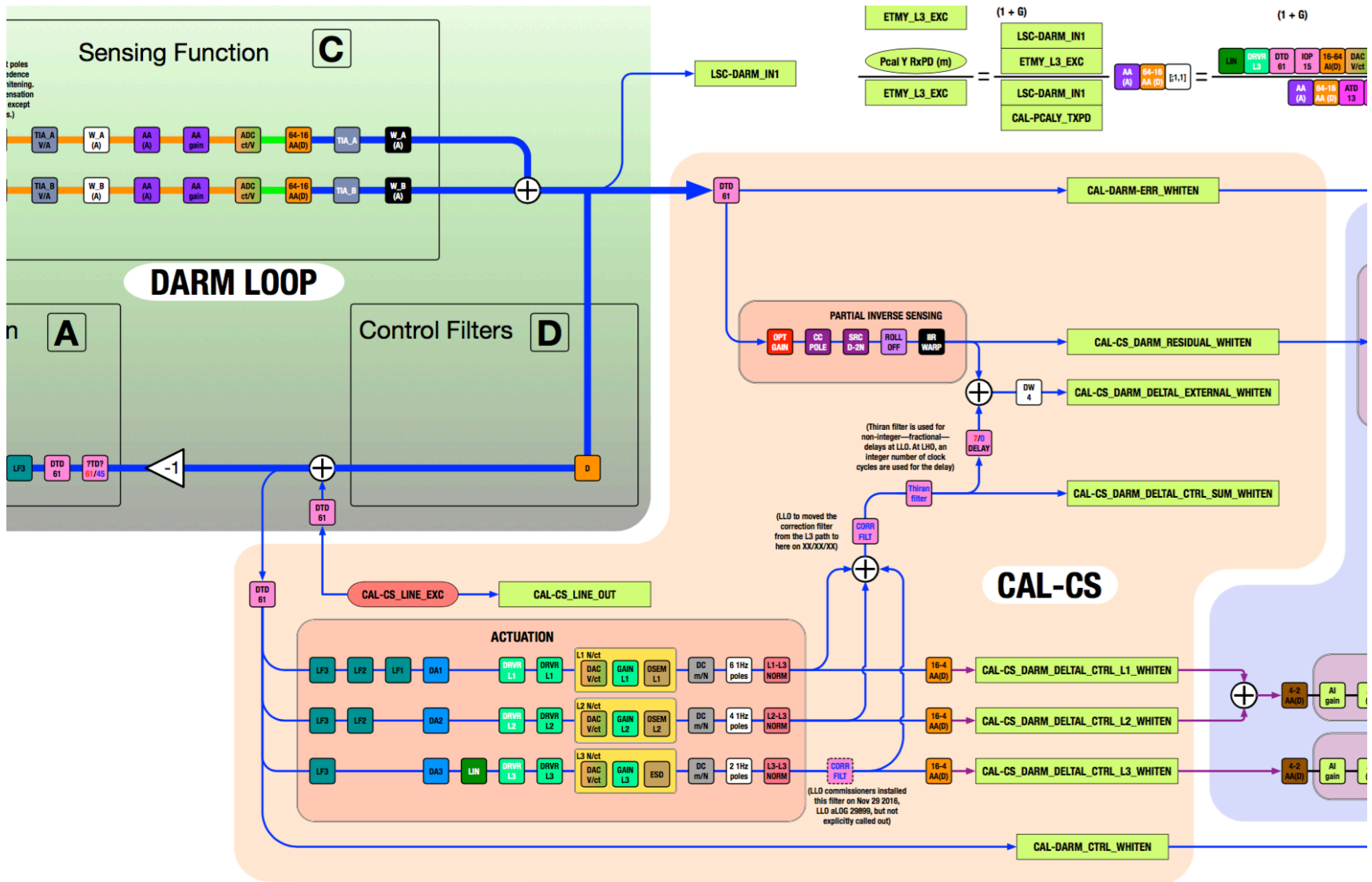


Calibration Front-end Model Mid-Update Check-in

J. Kissel, J. Betz, E. Goetz, A. Viets
for the Calibration Group

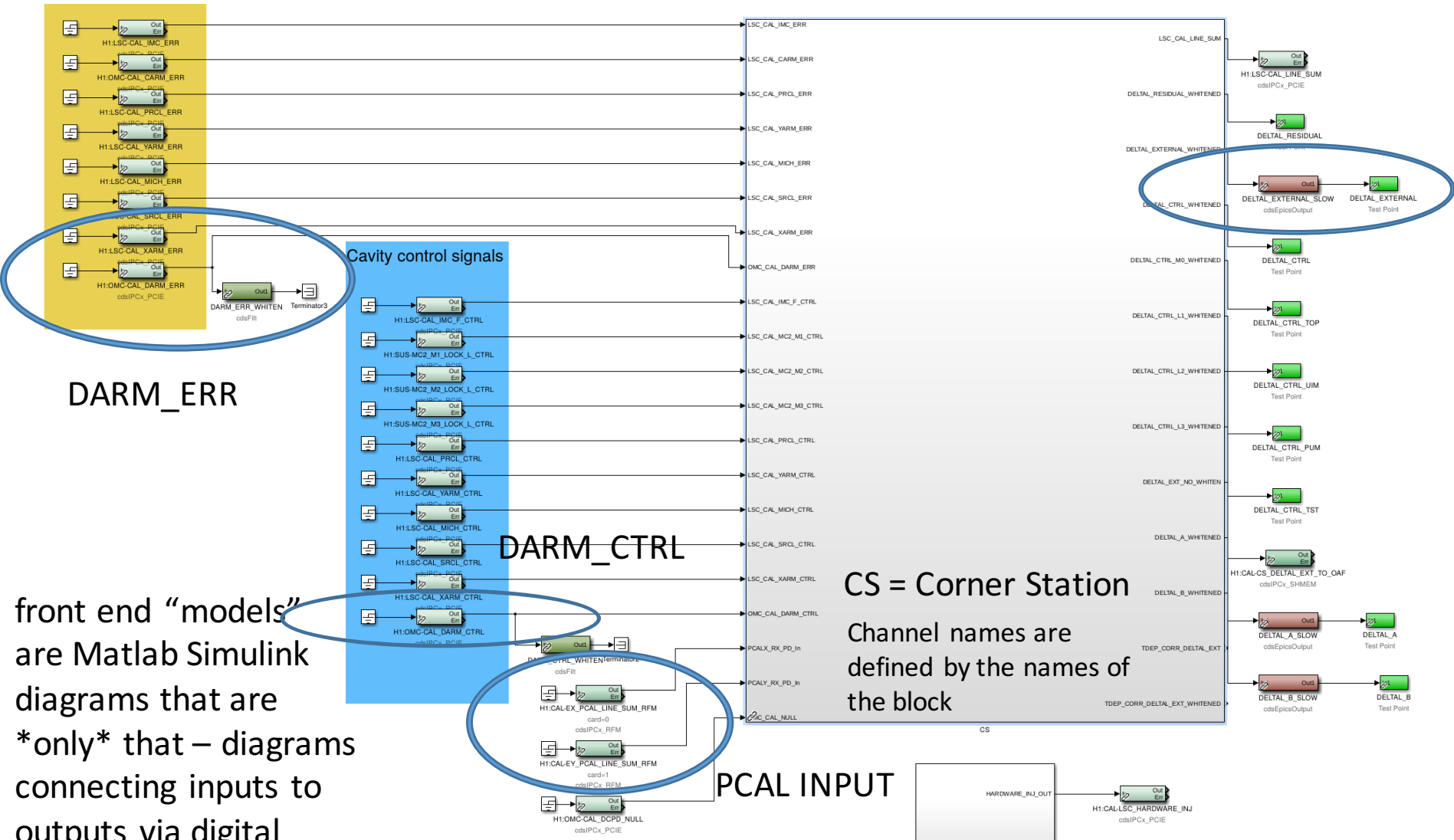
What are we changing?



Why?

- Upgrades for O3:
 - We will now be correcting for time dependence in the front-end.
 - We will now have individual calculations of the time-dependence of the actuator gains for all stages, i.e. κ_{PU} into κ_P and κ_U
 - We will now be doing gating, medianing, and averaging of TDCF in the front end
 - We may need to use a different end-station's PCAL for our reference
 - We will begin to implement a subtraction scheme in the front-end
 - We're cleaning up and pruning out old stuff as we're approaching a "final" method for calibrating the aLIGO interferometers

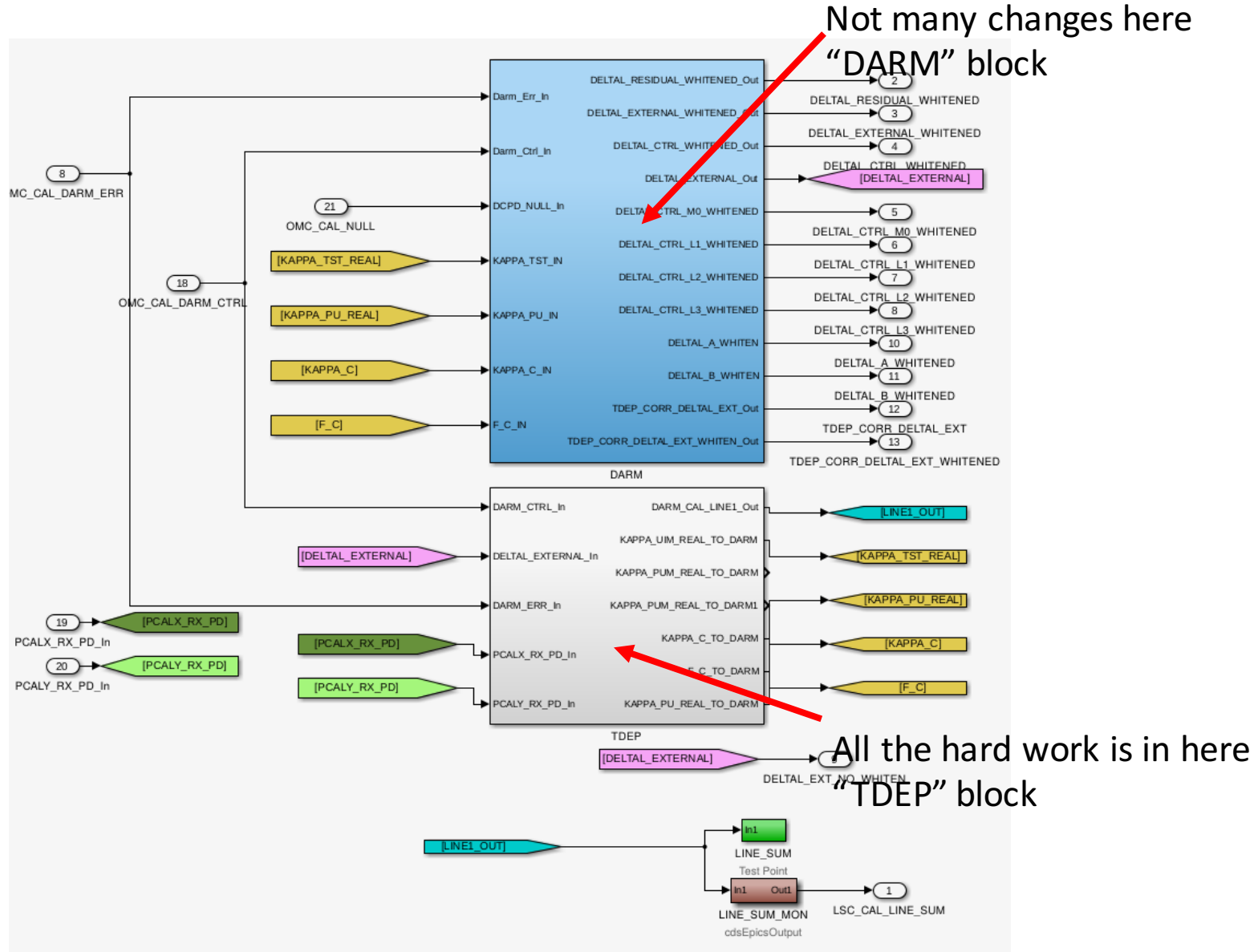
From the top!



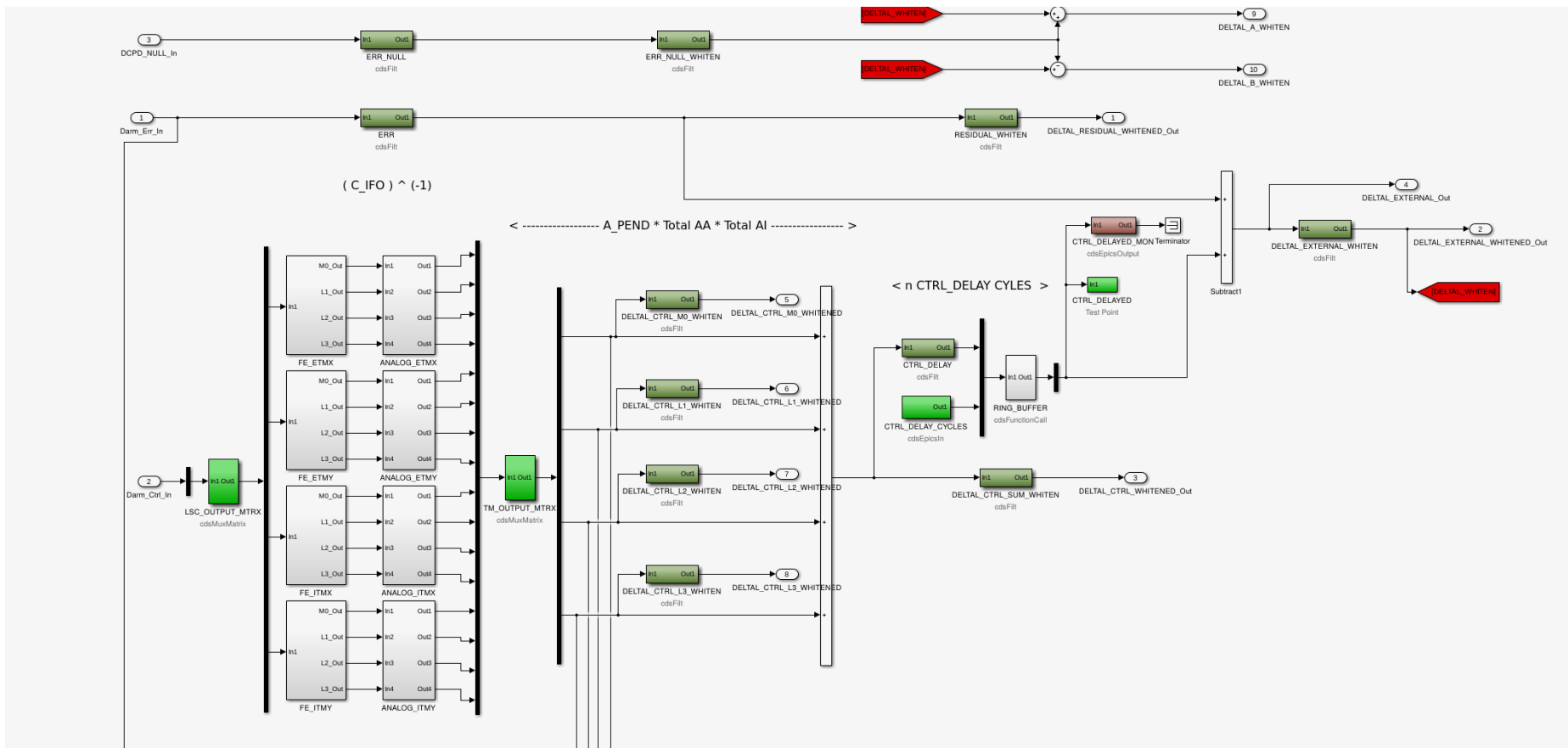
front end “models” are Matlab Simulink diagrams that are *only* that – diagrams connecting inputs to outputs via digital processing filters

The “Real-time Code Generator” (RCG) takes care of turning it all into c-code

Into the CS Block

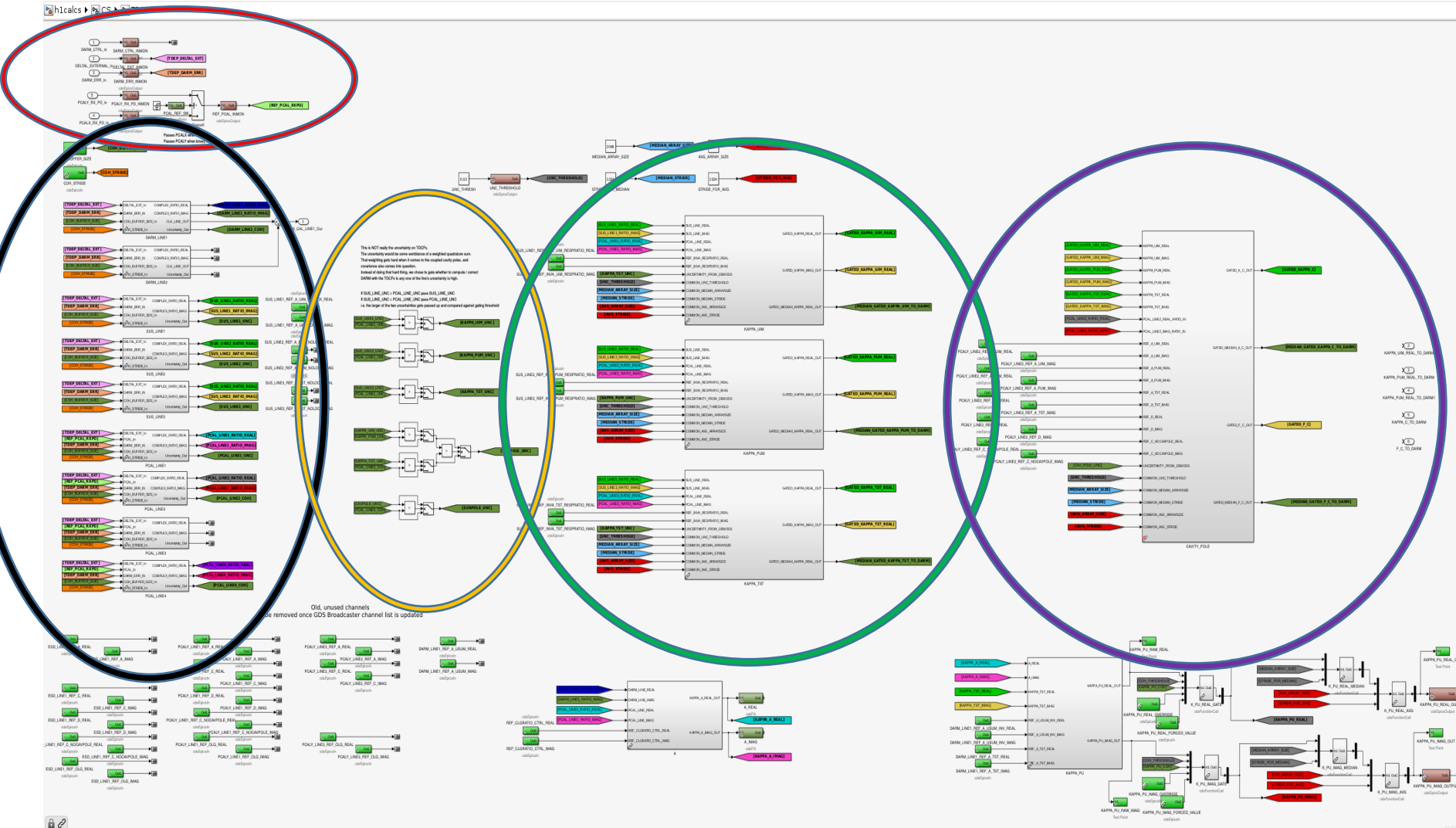


Into the DARM Block

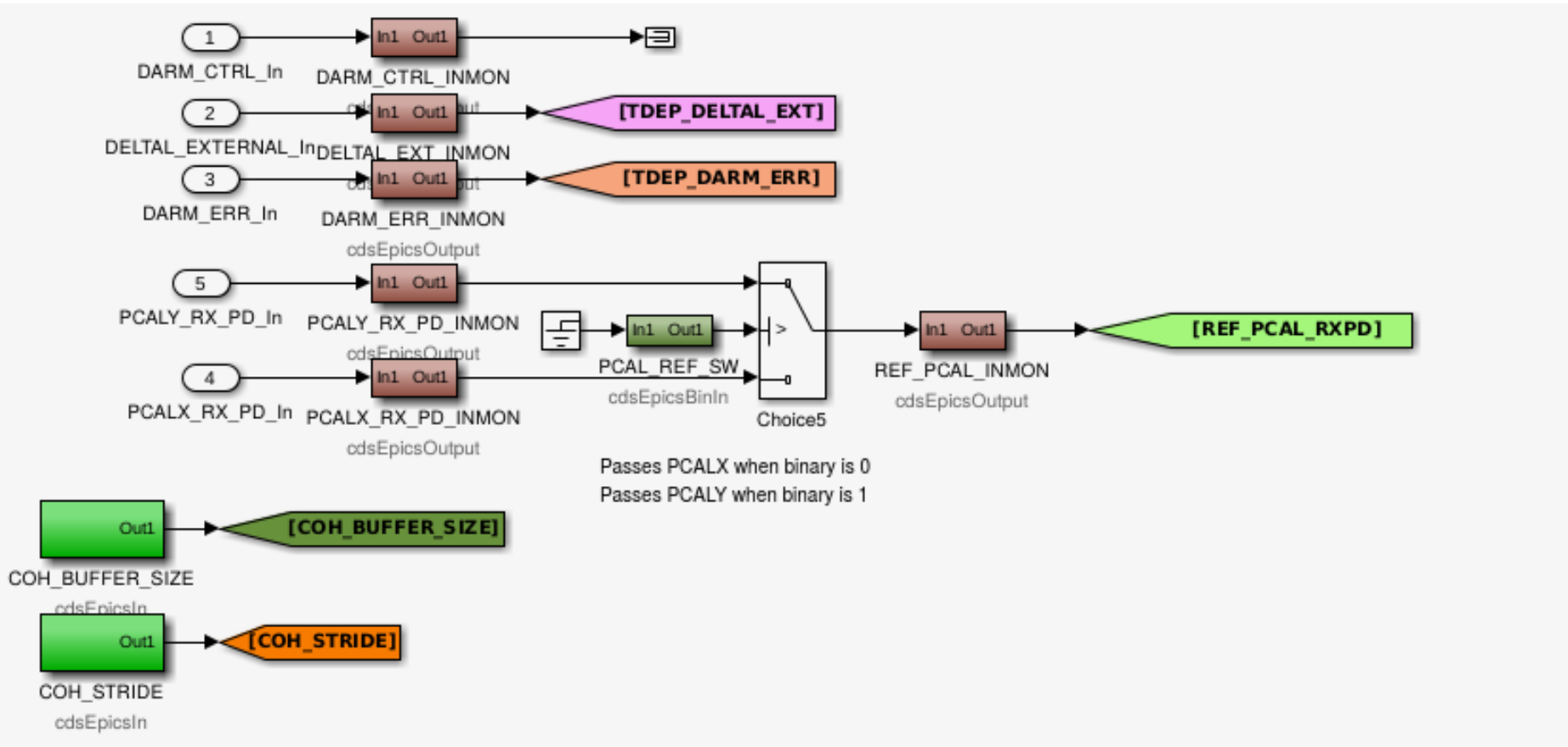


This is what we had already in O1 and O2.
Most of the hard work is not going to be in here...
(I'll show the new stuff at the end)

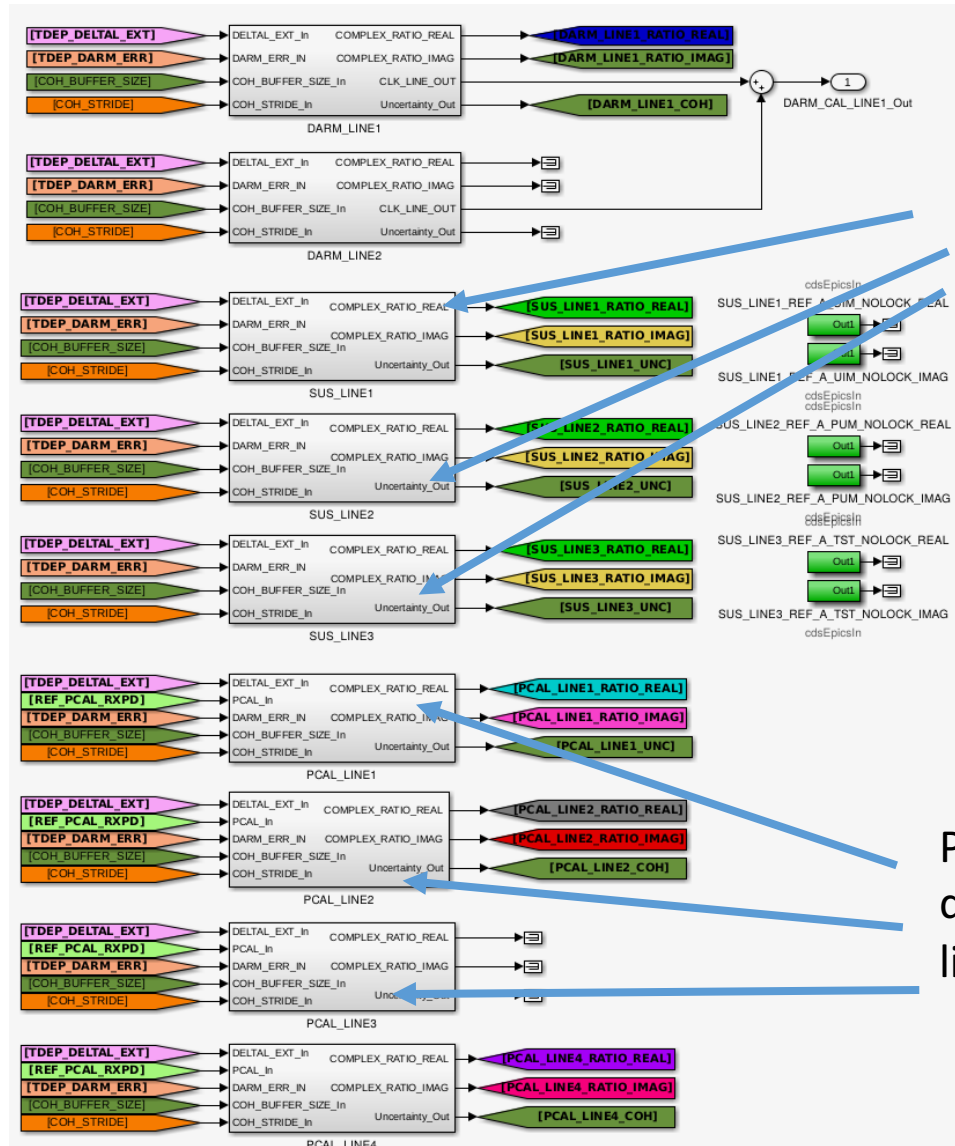
Into the TDEP Block



New Choice of Reference PCAL



New Demodulators

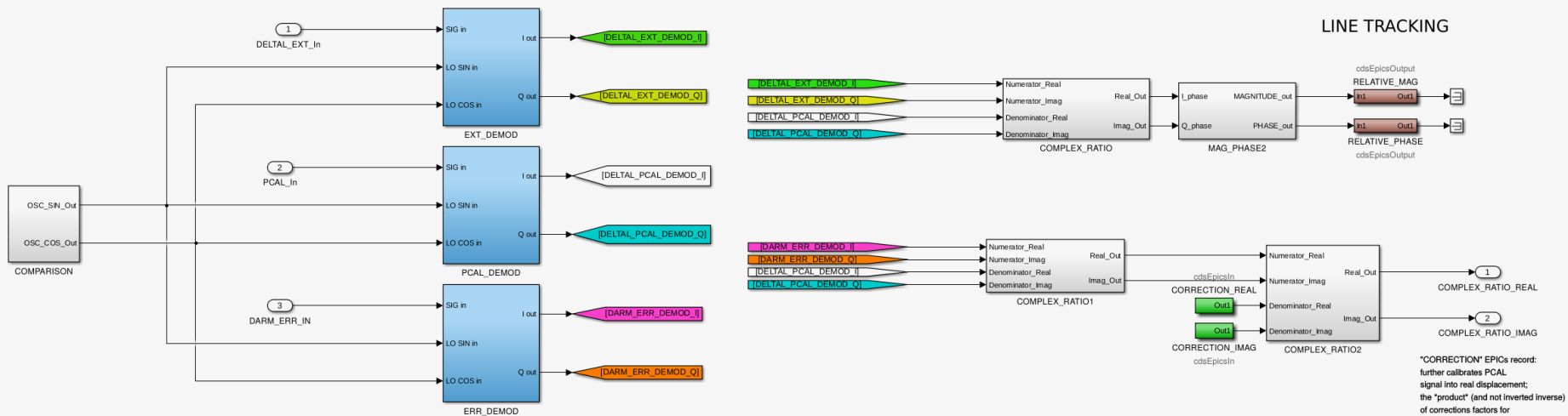


SUS line
demod
library part

PCAL line
demod
library part

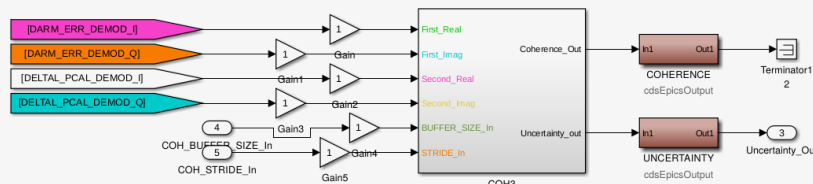
These are “library
parts”
identical inside, only
difference is channel
name (defined by
block name)

Inside the PCAL DEMOD



*"CORRECTION" EPICs record:
 further calibrates PCAL
 signal into real displacement;
 the "product" (and not inverted inverse)
 of corrections factors for
 - Two 1Hz pole whitening
 - Analog AA response
 - 64-16k digital AA response
 at given line frequency
 See Subway Map G1501518
 and T1700106

The "PCAL Correction Factor" is changed from a filter bank to a set of EPICs Records



Aaron asks "there wasn't an EPICs record for detuning PCAL line uncertainty..."
 there was... ?

Coherence / Uncertainty for Gate Triggers

This is NOT really the uncertainty on TDCFs.

The uncertainty would be some semblance of a weighted quadrature sum.

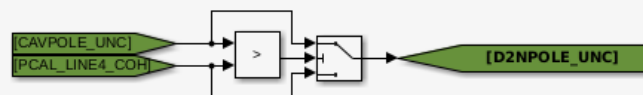
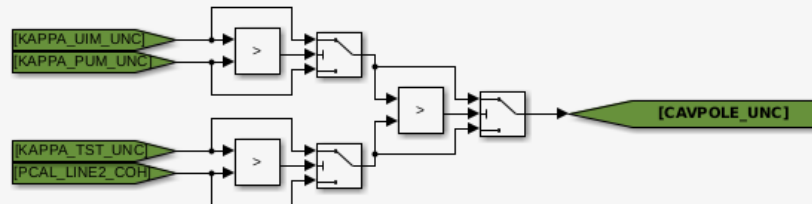
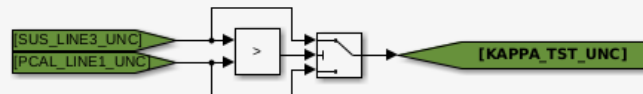
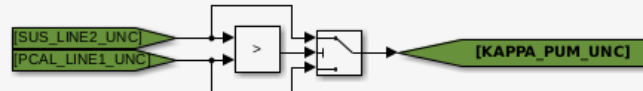
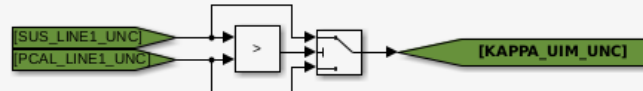
That weighting gets hard when it comes to the coupled cavity poles, and covariance also comes into question.

Instead of doing that hard thing, we chose to gate whether to compute / correct DARM with the TDCFs is any one of the line's uncertainty is high.

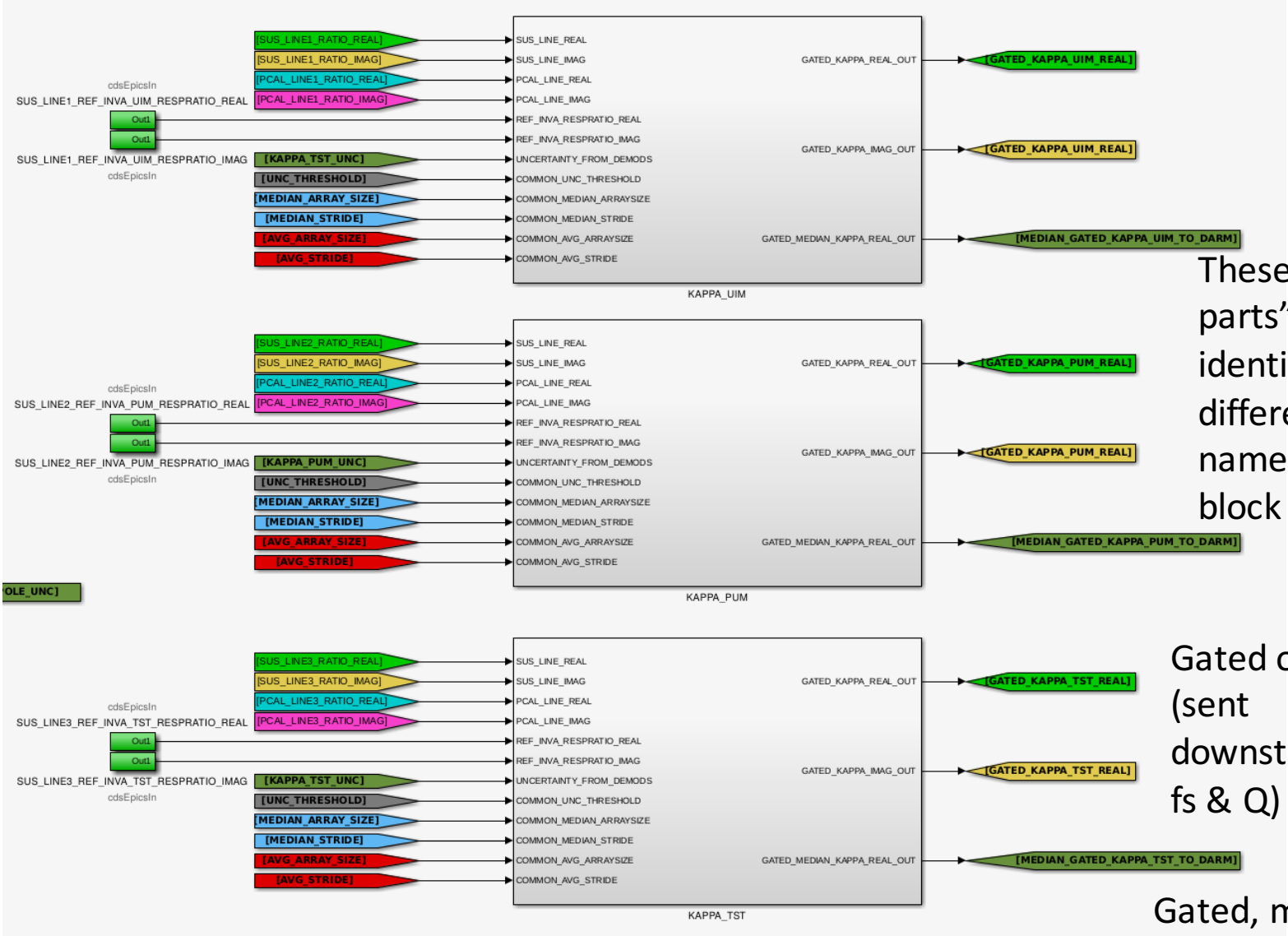
If $SUS_LINE_UNC > PCAL_LINE_UNC$ pass SUS_LINE_UNC

If $SUS_LINE_UNC < PCAL_LINE_UNC$ pass $PCAL_LINE_UNC$

i.e. the larger of the two uncertainties gets passed up and compared against gating threshold



New Individual Actuator Kappas

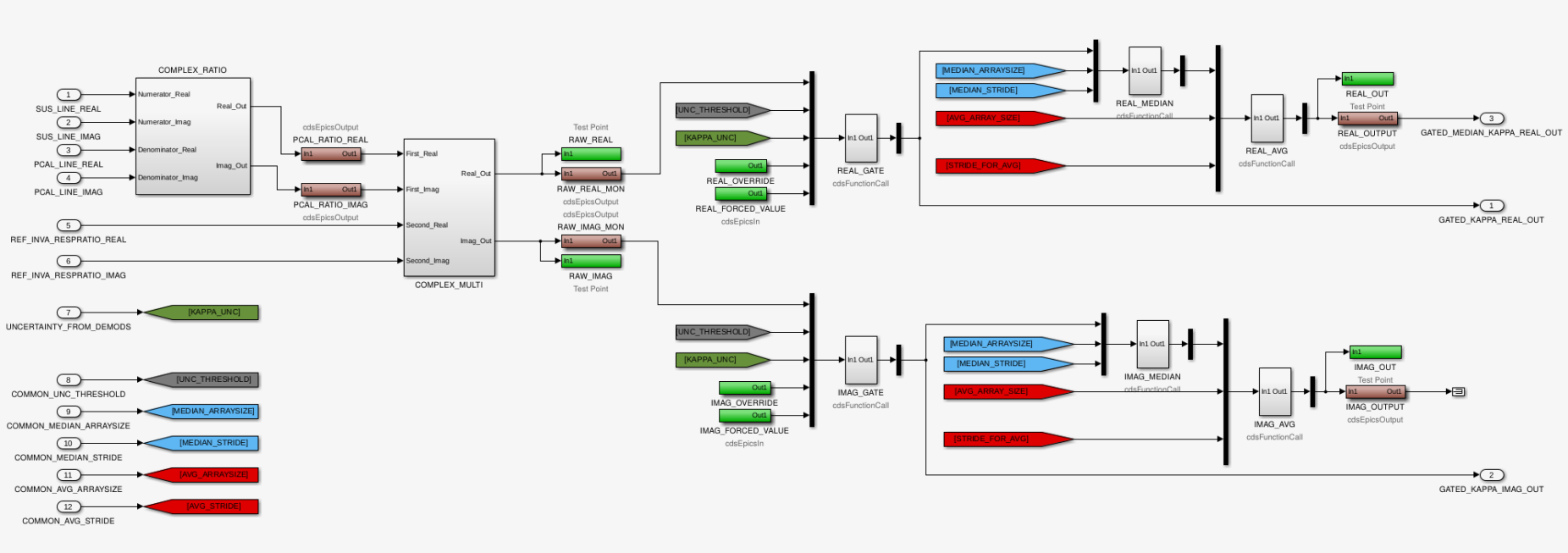


These are “library parts” identical inside, only difference is channel name (defined by block name)

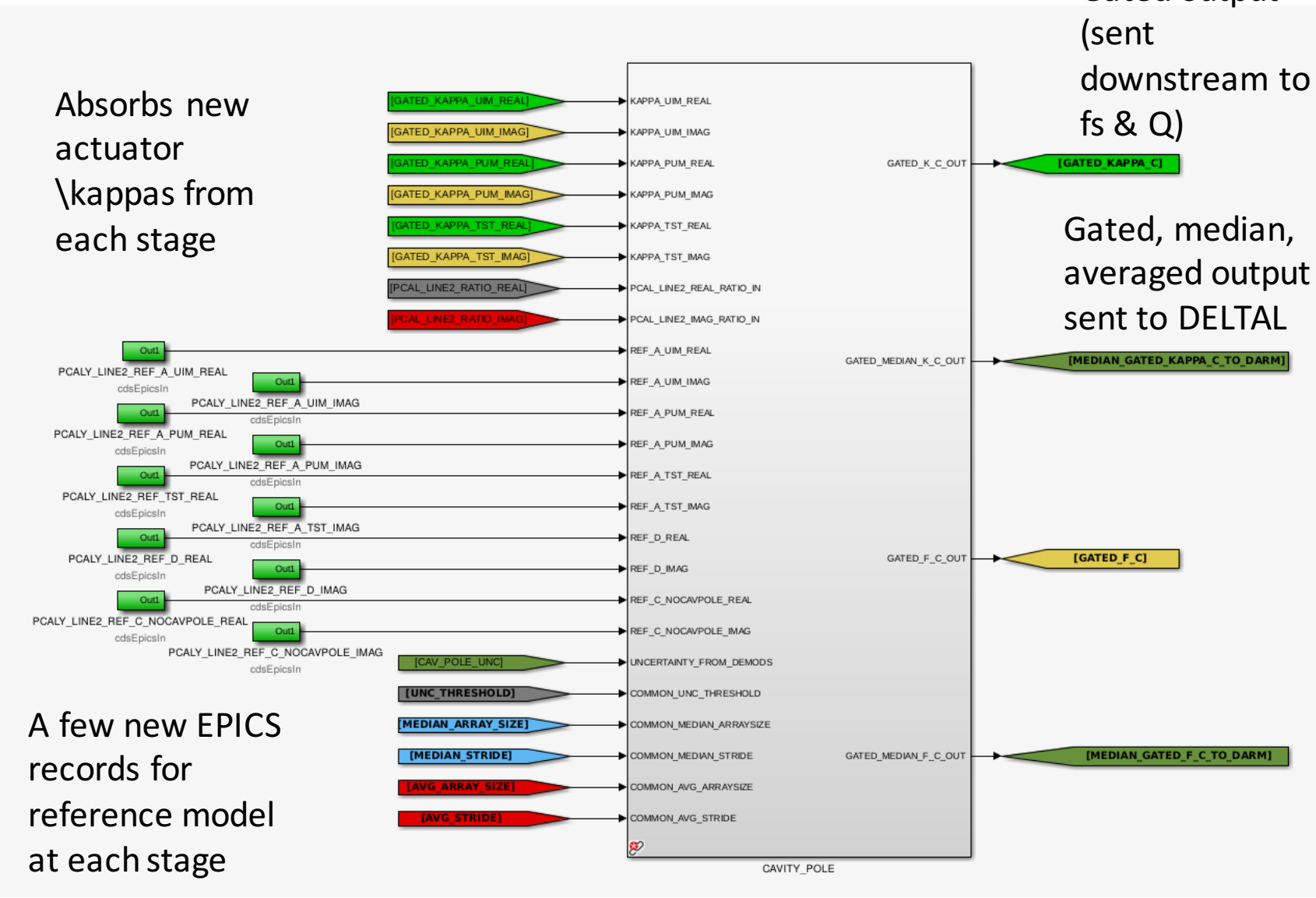
Gated output (sent downstream to fs & Q)

Gated, median, averaged output sent to DELTAL

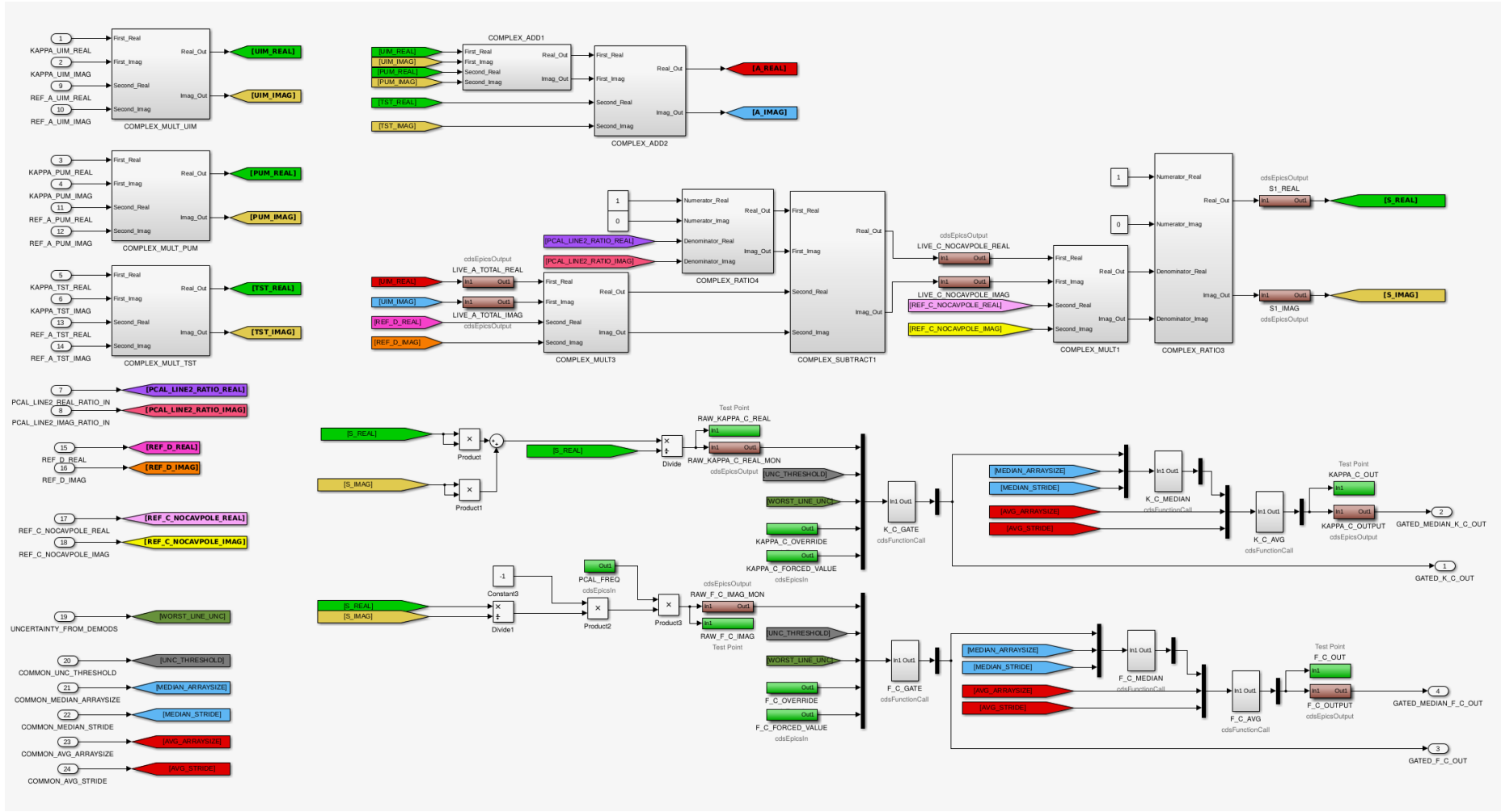
Inside an Actuator Kappa



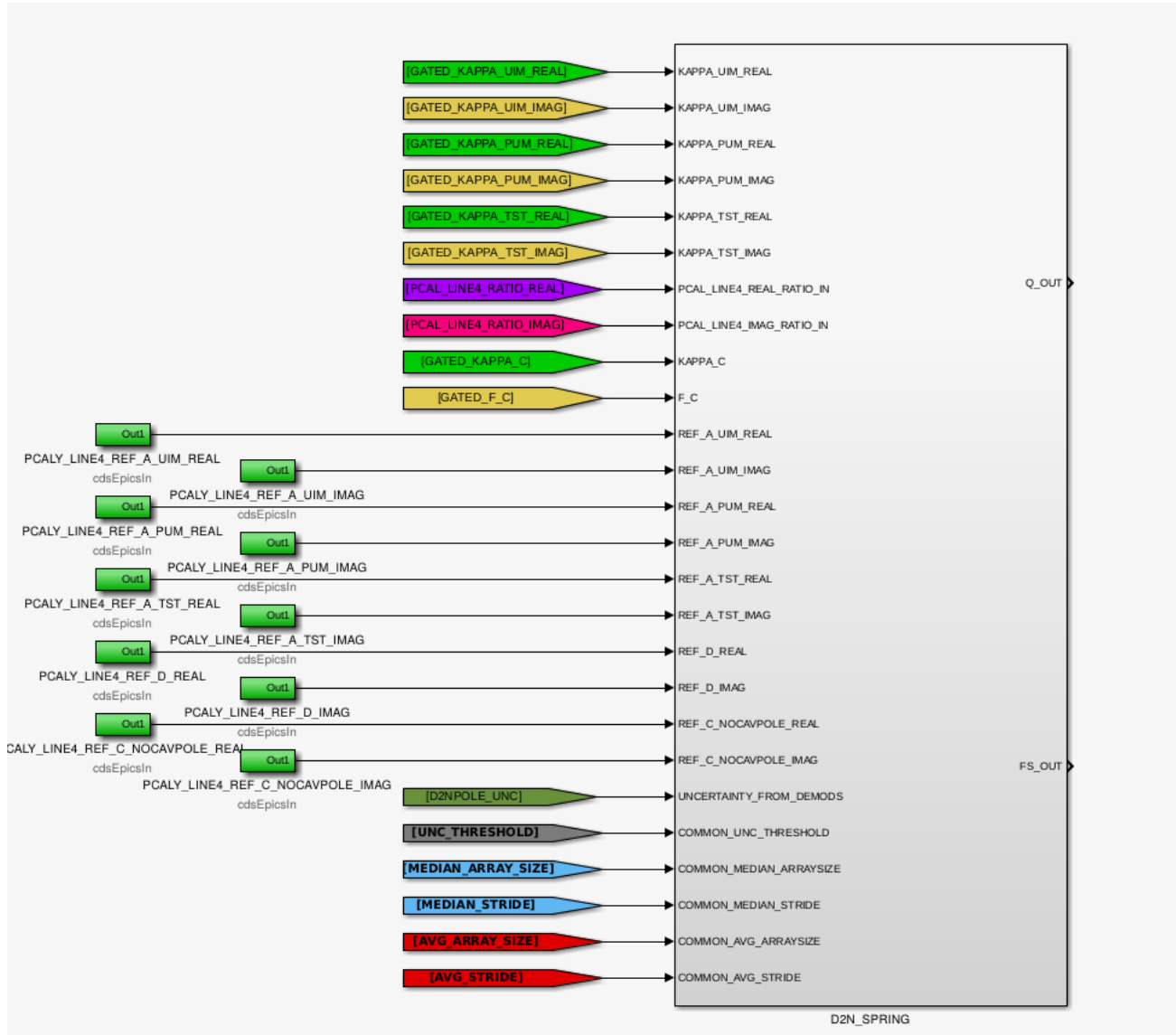
Updated \kappa_C and f_C Calculation



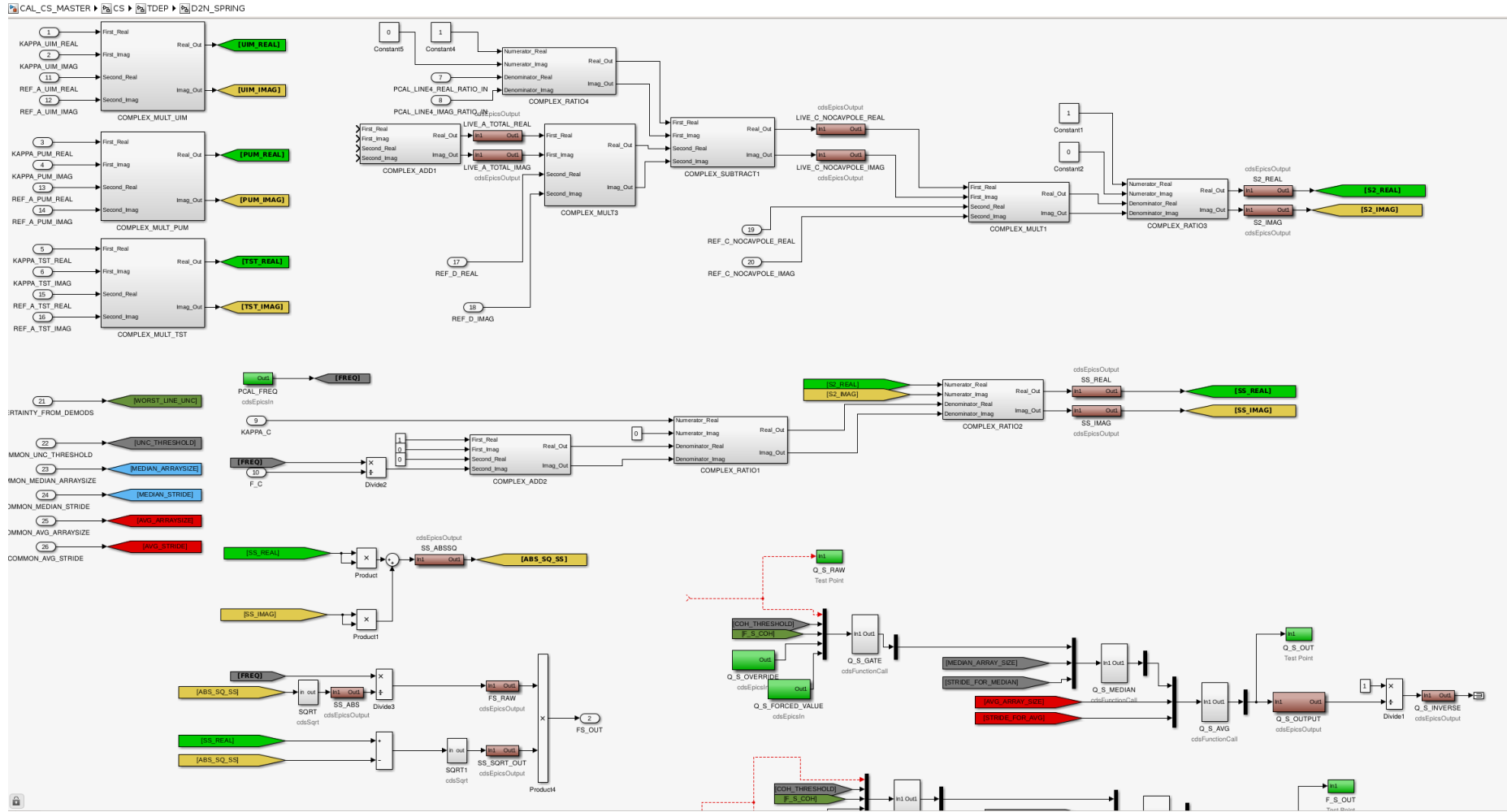
Inside CAVITY_POLE



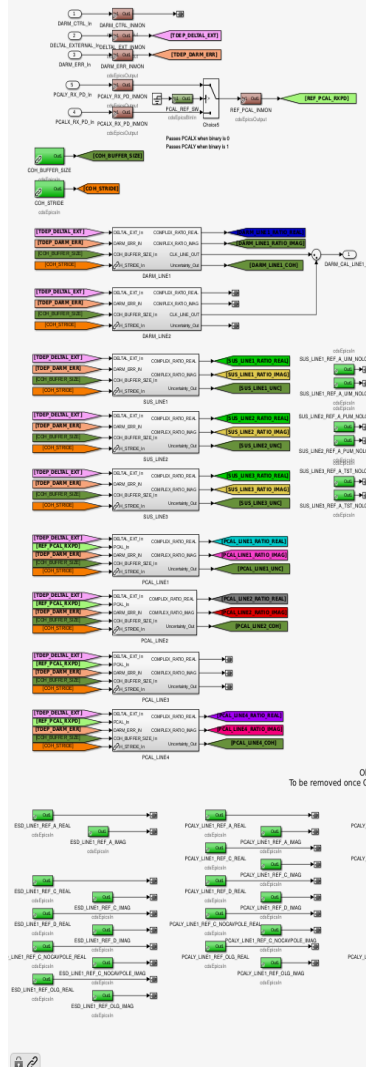
Updated f_s and Q Block WORK IN PROGRESS



Updated f_s and Q Block WORK IN PROGRESS

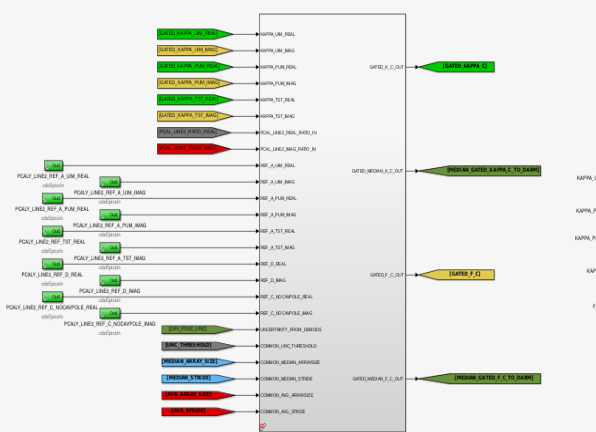
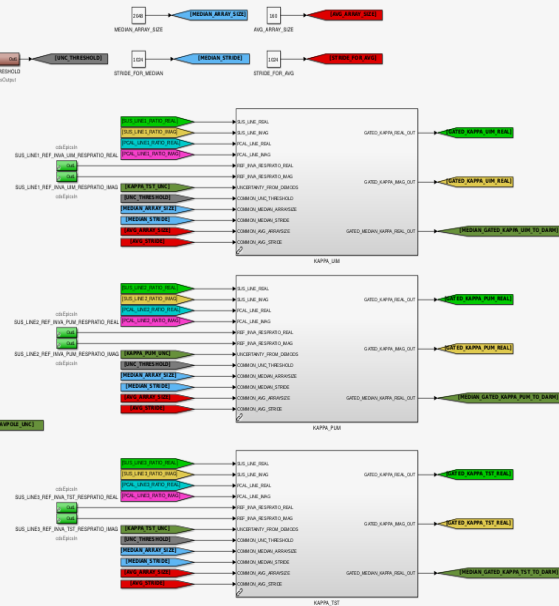


That's it so far... hope to install next week

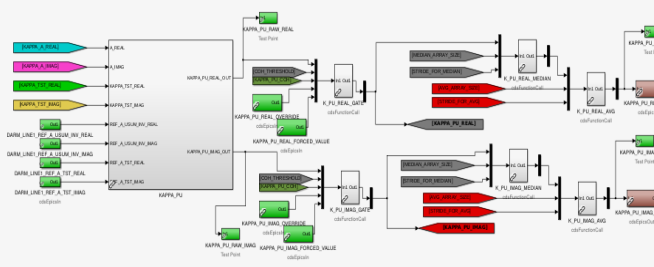
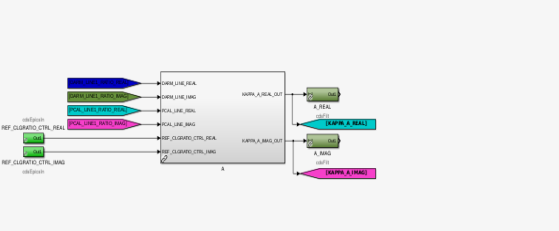
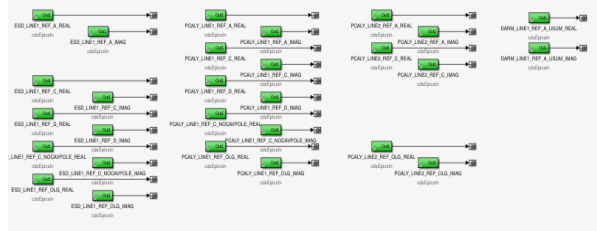


This is NOT valid for wirelists on TCDFs.
The connectivity would be some combination of a weighted quadrature sum.
The weighting factor would depend on the frequency of the signal and the connectivity along the quadrature axis across the quadrants.
Instead of being a flat weighting, we have a gain structure as complex as that of a TCDF with the TCDFs in any one of the four quadrants to high.

If BUS_LINES, POW_LINE, UNC, and BUS_LINE are used, the BUS_LINE, POW_LINE, UNC, and BUS_LINE signals are to be used in the quadrants and placed in an unsorted signal path through the GDS.

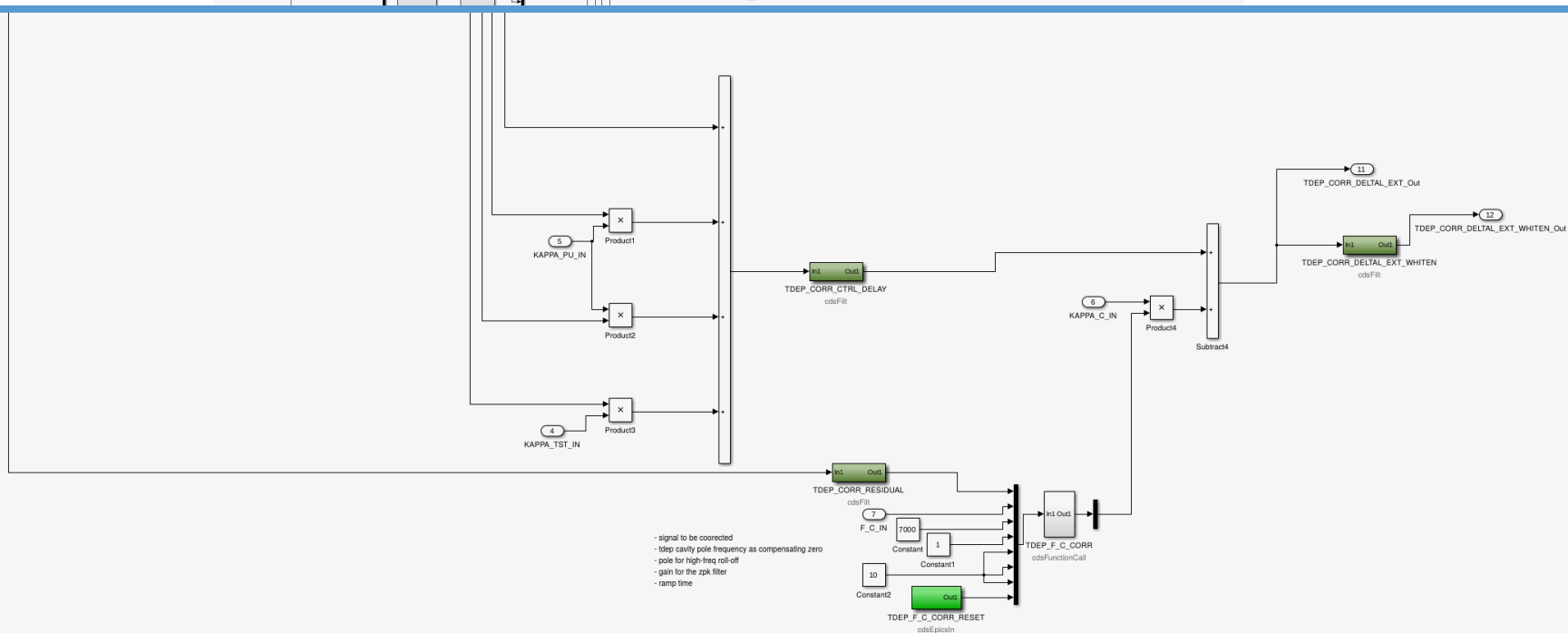
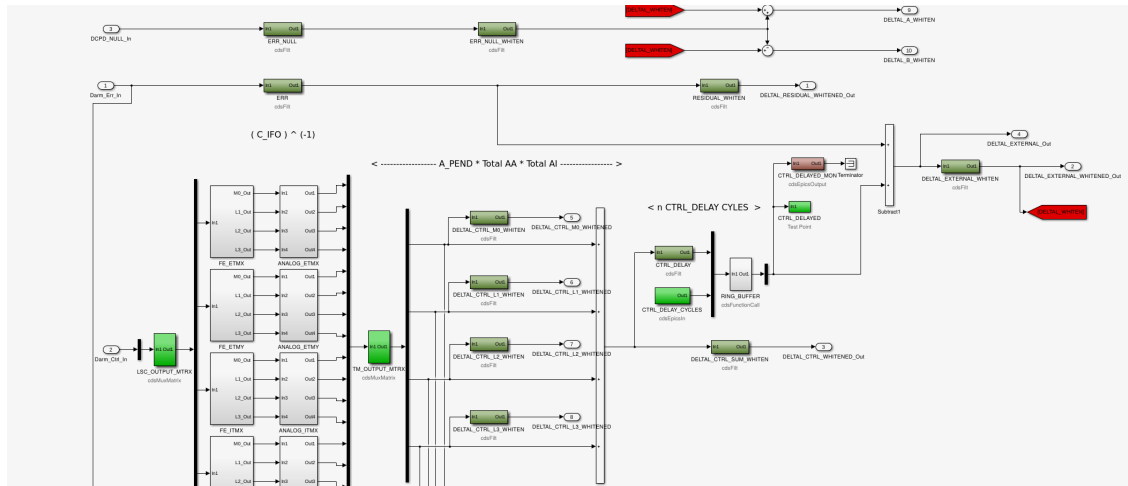


Old, unused channels
To be removed once GDS Broadcaster channel list is updated



Next step – hook it back into DELTAL

WORK IN PROGRESS



- signal to be corrected
- loop cavity pole frequency as compensating zero
- pole for high-freq roll-off
- gain for the zpk filter
- ramp time