

= 40m LSC model design =

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== 40m upgrade ==

- Purpose:

To address control issues for aLIGO LSC

- Status:

Completed the first round of the in-vacuum installation

Constructing/testing the ALS system with the IR/green beams

- We need the LSC CDS model sooner or later

Considering the functions required

Could be a springboard for the aLIGO LSC

= *LSC philosophies* =

- Definition of the LSC model

Receives length/power-mon signals

Passes feedback signals to the length actuators.

In between, the signals are **manipulated** by operators and logics (matrices, normalization, linearization, gating, servo filters, etc)

- Avoid channel-specific hard-coding

Let all length signals have **equal algorithms**

- Eliminate complicated polling in EPICS scripts

Realize automatic servo **switching in the real-time model**

Ideally, the locking scripts only need to wait for the mode status being updated.

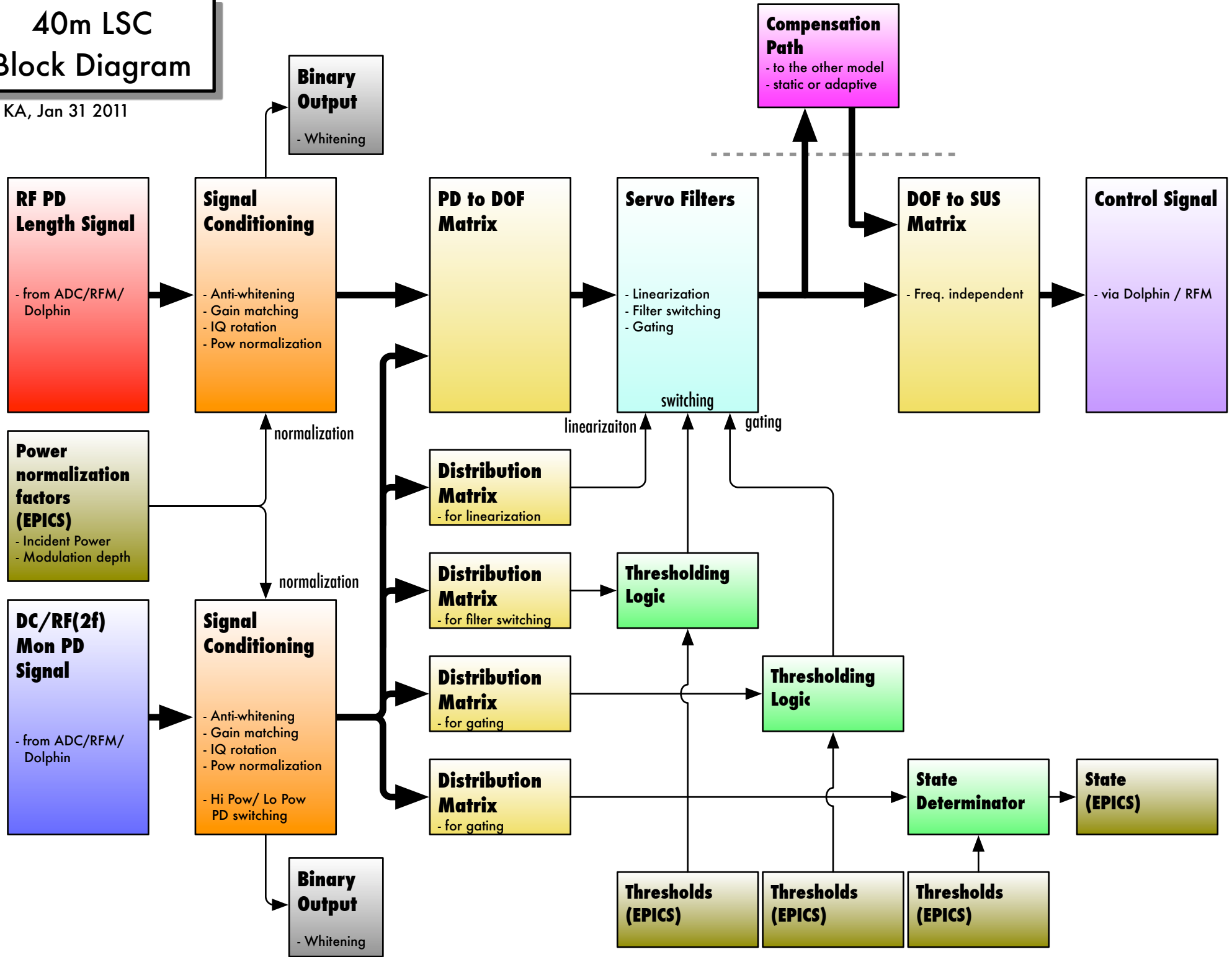
- Make it sufficiently flexible for the various IFO conditions

DCMI, RFMI, PRMI, SRMI, DRMI, X/YARM, Full IFO

Intermediate modes during the lock acquisition (c.f. ALS)

40m LSC Block Diagram

v1 KA, Jan 31 2011



= Input stages =

== Functions ==

- Anti-whitening synchronized to the binary outputs
- Gain matching between I and Q

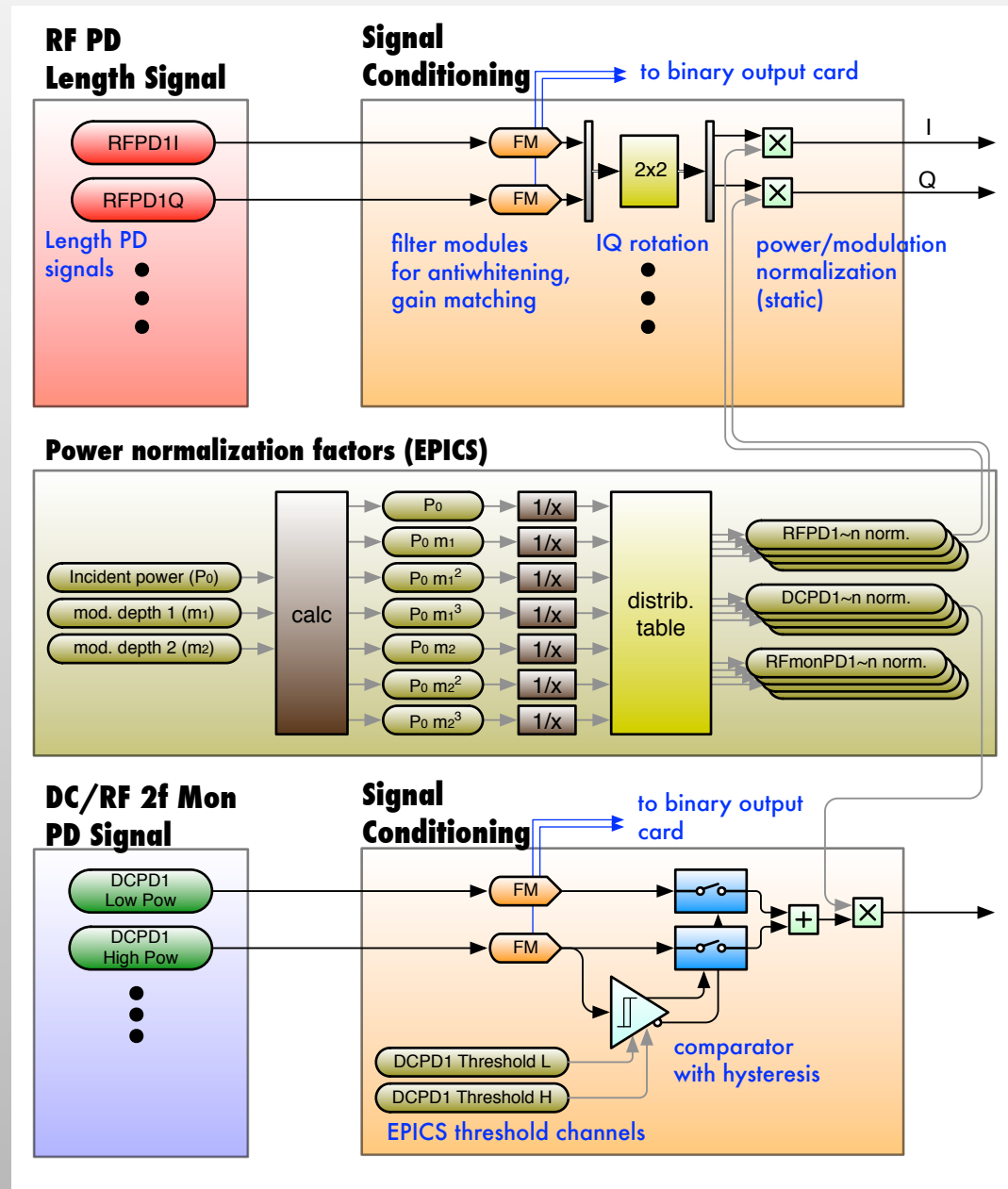
- I/Q rotation

- Normalization

by the incident power (P_0) and mod depth (m_1, m_2)

- P_0 for DC
- $P_0 * m_1$ for 1f demod.
- $P_0 * m_1^2$ for 2f demod.
- $P_0 * m_1^3$ for 3f demod.

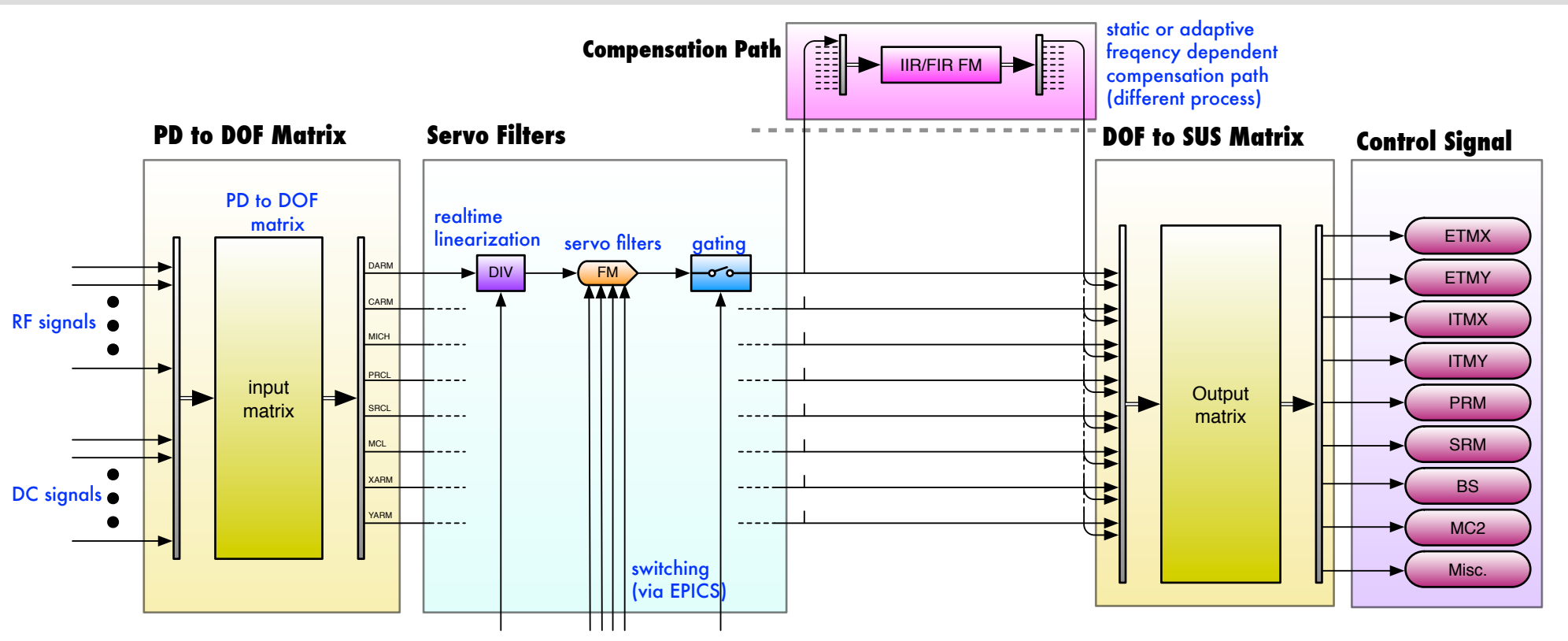
- Switching between high-pow DC mon and low-pow DC mon



= Feedback stages =

== Functions ==

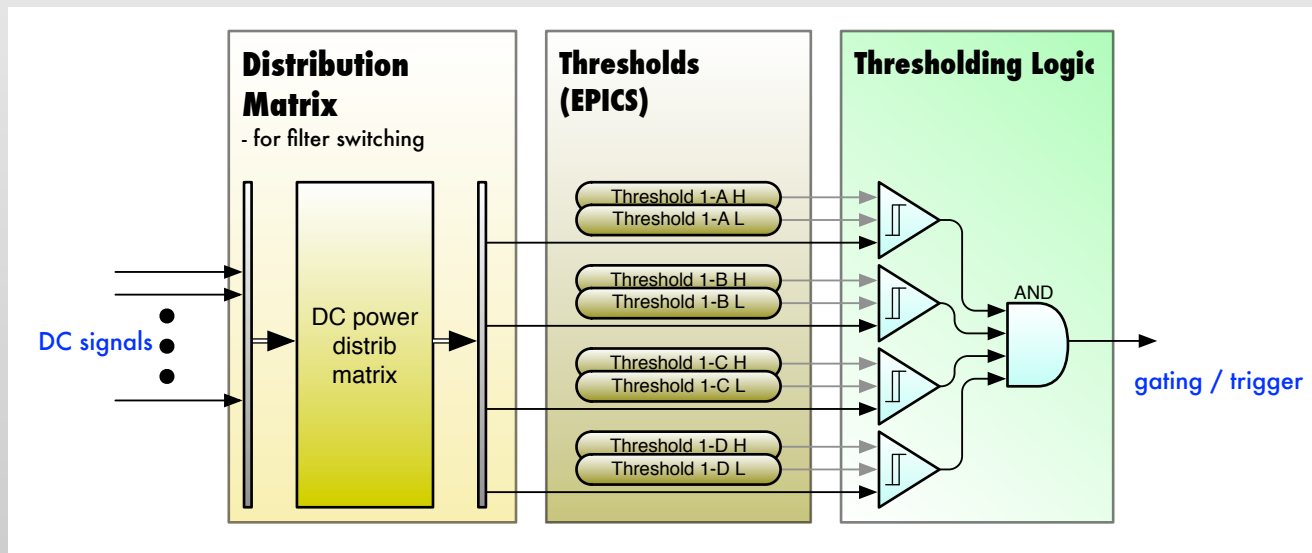
- Static input/output matrix
 - Use DC signals as well for DCMI, offset locking, etc
- Realtime linearization
- Switching servo filters
- Gating at the filter outputs
- Freq dependent compensation (mich/prcl/srcl compensations, etc)
 - Use external process
 - Put together with the PEM noise cancellation?



= Control Logic =

== Functions ==

- Compartment banks
- Distribution matrix to select the mon channels
- Provide the reference numbers vi EPICS



= Considerations =

== Missing Functions ==

- Time varying input matrix hope we don't need it anymore...
- Some math functions for offset locking like $1/x$, \sqrt{x}
- We may want some of the features disabled/enabled manually
gating, normalization, linearization, etc
- Logics for locking sequence
 - Details of state determination
 - Unlock detector
 - Intermediate modes (e.g. between DRMI locked and Full arm power level)
- Delayed logic
 - "We like to turn on the boost 3 sec after the lock is acquired"
- Hierarchal actuation (for aLIGO only)
 - Add output chans

= Plan =

- Start the coding for the 40m
- Determine what amount of simplicity/complexity we do need
- MEDM screens