Cavity Simulator in FPGA

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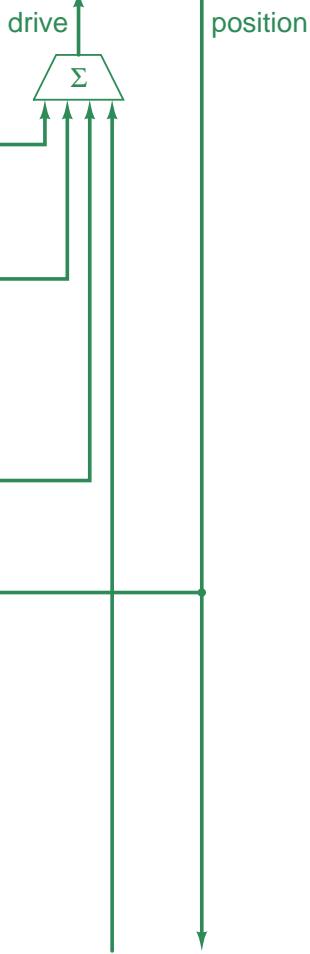
(abridged)

Clocks at ~200 MHz in Xilinx 7Axxx
8 cavity-controller pairs could fit on AC701?

Mechanical eigenmode propagator

$zy=My+d$

resonator.v

m mechanical modes
updated every 2m cycles

m time-multiplexed complex
values in eigen-coordinates

drive

position

Gaussian noise
Environmental sources?

outer

outer_prod.v

Piezo control

Virtual Piezo

V

outer

outer_prod.v

Σ

Cavity electromagnetics simulator

Beam timing

Drive

IQ

upconvert

pair_couple.v

Electromagnetic
eigenmode
propagator
(π mode)

cav_mode.v

v^2

outer

outer_prod.v

Σ

$\Delta\omega$

dot

dot_prod.v

Forward

Reflected

Σ

Electromagnetic
eigenmode
propagator
($8\pi/9$ mode)

cav_mode.v

v^2

outer

outer_prod.v

$\Delta\omega$

dot

dot_prod.v
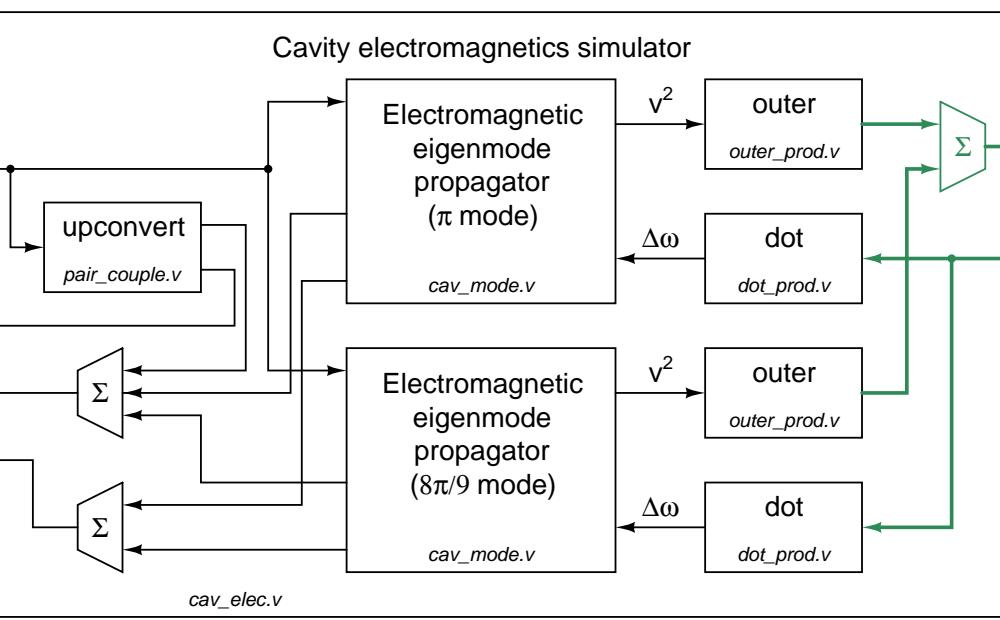
Probe

Outputs at IF
updated every 10 ns

Σ

cav_elec.v

to additional cavities