Cavity Simulator in FPGA

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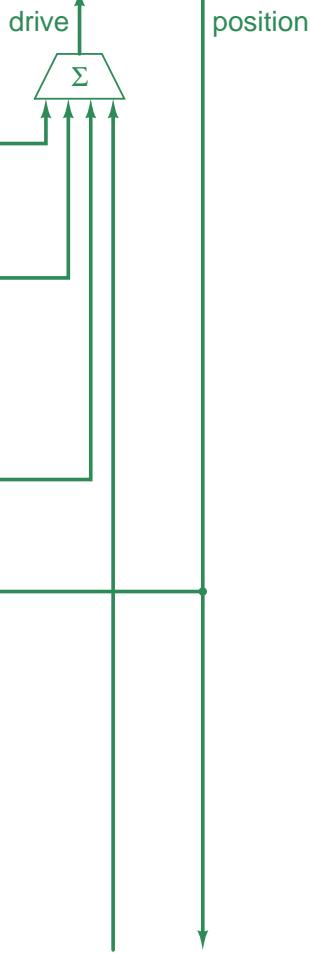
(abridged)

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

m mechanical modes
updated every 2m cycles

Mechanical eigenmode propagator

$zy=My+d$

resonator.v

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

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
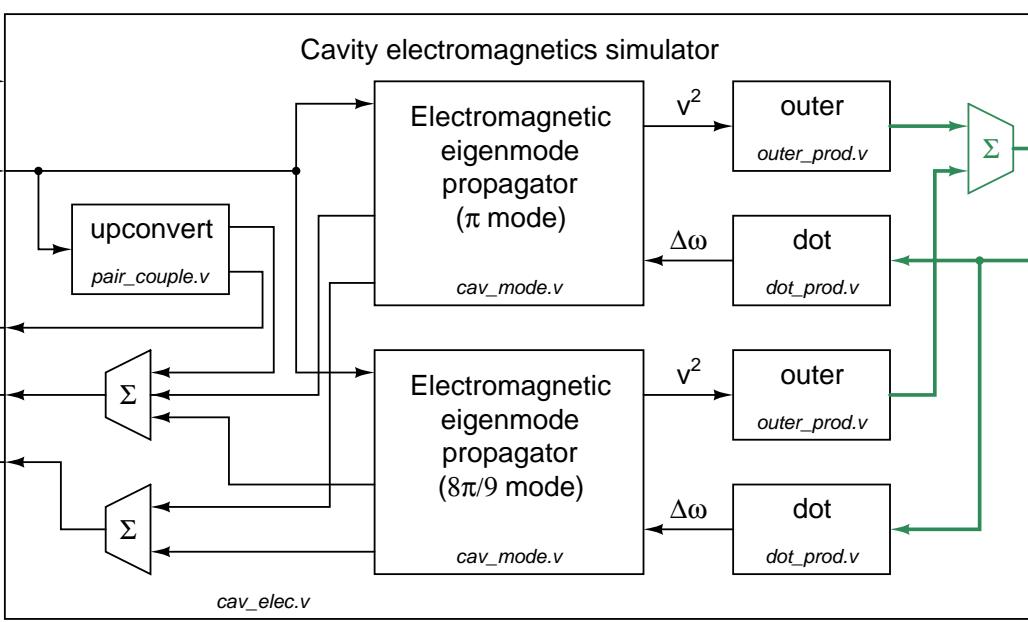
Forward

Reflected   Σ

Probe   Σ

Outputs at IF
updated every 10 ns

Electromagnetic eigenmode propagator (8π/9 mode)
cav_mode.v

v^2 outer
outer_prod.v

$\Delta\omega$ dot
dot_prod.v

cav_elec.v

to additional cavities