

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

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

Forward

Reflected

Probe

Outputs at IF
updated every 10 ns

Electromagnetic
eigenmode
propagator
(π mode)
cav_mode.v

v^2

outer

outer_prod.v

$\Delta\omega$

dot

dot_prod.v

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

v^2

outer

outer_prod.v

$\Delta\omega$

dot

dot_prod.v

Σ

Σ

Σ

cav_elec.v

m time-multiplexed complex
values in eigen-coordinates

Σ

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

drive

position

to additional cavities