

# Cavity Simulator in FPGA

Larry Doolittle, LBNL, June 2014

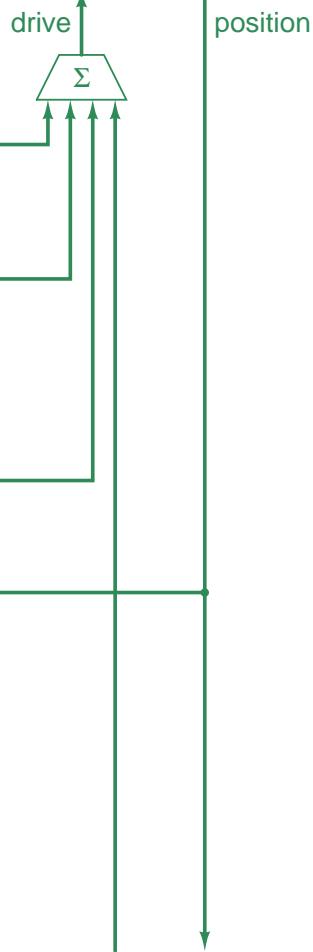
(abridged)

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*



Gaussian noise  
Environmental sources?

outer  
*outer\_prod.v*

Piezo control

Virtual Piezo

V  
outer  
*outer\_prod.v*

Beam timing

Cavity electromagnetics simulator

Electromagnetic eigenmode propagator ( $\pi$  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*

Drive

Forward

Reflected

Probe

Outputs at IF updated every 10 ns

upconvert  
*pair\_couple.v*

$\Sigma$

*cav\_elec.v*

to additional cavities