

# Cavity Simulator in FPGA

Larry Doolittle, LBNL, June 2014

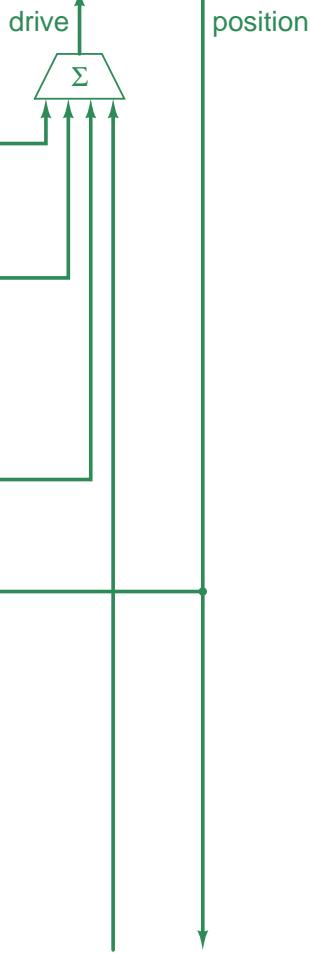
(abridged)

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

$cav\_elec.v$

pair\_couple.v

upconvert

$\Sigma$

$\Sigma$

$\Sigma$