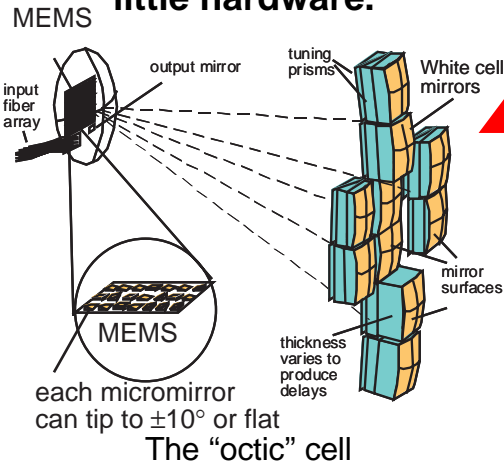


# Optical True-Time Delays

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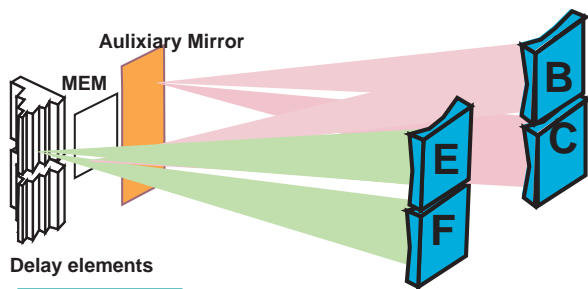
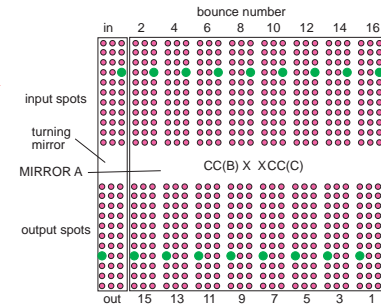
**Goal: to provide thousands of time delays for thousands of antennas in a phased array radar for non-mechanical steering of radar beams. With very little hardware.**



- Our approach based on the White cell (groups of spherical mirrors)
- A MEMS switches light beams between White cells of different lengths
- Current design: octic cell
- 6399 delays in 17 bounces for 900 light beams
- Thus 6,399 delays for 900 antenna elements

**The key is the spot pattern produced by a White cell**

- Spot pattern on the MEMS for 33 beams shown here
- Each beam bounces 16 times here
- Can switch any beam on any bounce



The "binary" cell



**Next generation: binary cell**

- 16 bits of delay in 16 bounces on the MEMS (65,526 delays)
  - Still can support hundreds or thousands of antenna elements with very little hardware
- Experimental apparatus

**Experiment:**

- An older generation binary cell
- Uses liquid crystal as switch
- Produces 7 bits of delay

