# Detector→Optical Coupling R&D (1/2)

- Feedhorn-standard
  - Baseline for feedhorn R&D
  - Mature technology, spline-profiled designs
- * Feedhorn-advanced profile design
  - Includes improved optimization, complex geometries
  - Gains: 5% mapping speed, systematic decrease of ~10x
  - Cost: 1 FTE for design
  - 75% likelihood of success (LOS), development path well-defined, target date: 2019
- * Feedhorn-dielectric feeds
  - Dielectrically-loaded feedhorns
  - Gains: 5% mapping speed, systematic decrease of ~10x, increase bandwidth from 2.3:1 to 3:1
  - Cost: 1 FTE for design (but could be same FTE as above)
  - 50% LOS, concept developed but some TD needed, target date: 2020

* Highest rate of success and most bang for your buck

# Detector→Optical Coupling R&D (2/2)

- Feedhorn-LF quadridge waveguide
  - Low frequency is only tenable band right now and would benefit most since the pixels are the largest
  - Gains: increase bandwidth from 2.3:1 to 3.5:1 with current designs, could push to 6:1 with further design work
  - Cost: 1 FTE for design, 0.5 FTE fab, 0.5 FTE testing
  - 50% LOS, some preliminary designs but need to protoype, target date: 2020
  - For this to be successful, we'd need to invest time and money in it now
- Feedhorn-improved coupling to microstrip
  - Better impedance matching between horn and microstrip could eliminate CPW and CPW-MS transition, slightly increase throughput (like Goddard detectors), requires Si vs SiN
  - Gains: <5% mapping speed
  - Cost: 1 FTE for design
  - 100% LOS, demonstrated on CLASS, target date: 2019
  - Not a high payoff for effort and difficulty of Si fab

# I&T→Assembly Production→Horn Material/Production Testing (1/2)

- Si horn-Standard (Baseline)
  - DRIE+Photolithography production of stacked Si Arrays
  - 100 um horn to horn spacing
  - $60k/array (includes labor of two full-time FTE)
  - Production rate: 7 weeks/6" array , ~5 wafers/day (single etch)
- * Si horn-laser machining
  - Stacked Si array with laser-machined holes
  - Gains: production cost goes down to $10k/array, could move to 12" array production, 10 wafers/day with only 1 FTE (saves several weeks/array and thus 2+ years in schedule)
  - R&D Cost: $30k for test Si, 1 FTE
  - 75% likelihood of success (LOS), development is underway, target date: 2019

* Highest rate of success and most bang for your buck

# I&T→Assembly Production→Horn Material/Production Testing (2/2)

- Al horns
  - Direct-machined, need to be careful about DTE between Si detector array, test machining tolerances, and test how closely horns can be spaced
  - Gains: production cost is $10k/array, no FTE, 6 weeks for reamers then a few weeks/array to machine (saves several weeks/array and thus 2+ years in schedule), not limited to Si sizes, easy mounting
  - R&D Cost: $10k for horn spacing and tolerancing tests
  - 100% likelihood of success (LOS), demonstrated on BLAST, target date: 2018
- Molybdenum horns
  - Direct-machined, test tolerances
  - Gains: All blue and red gains of Al, less DTE than Al, may allow closer horn spacing, production cost is $40k/array for 1st array $15k for identical arrays
  - R&D Cost: $20k for horn spacing and tolerancing tests
  - 100% likelihood of success (LOS), demonstrated on BLAST, target date: 2018
- Alloy horns
  - Si-Al alloy, direct-machined (machining proprietary), only for LF, can't machine small enough for HF, MF+ more expensive than baseline
  - Gains: All blue gains of Al, less DTE than Al, 8 weeks/array, production cost is $20k/array
  - R&D Cost: $0, unless want to push outside of LF band
  - 100% likelihood of success (LOS), demonstrated on AdvACT LF, target date: 2018