APD MIP Timing Work Package

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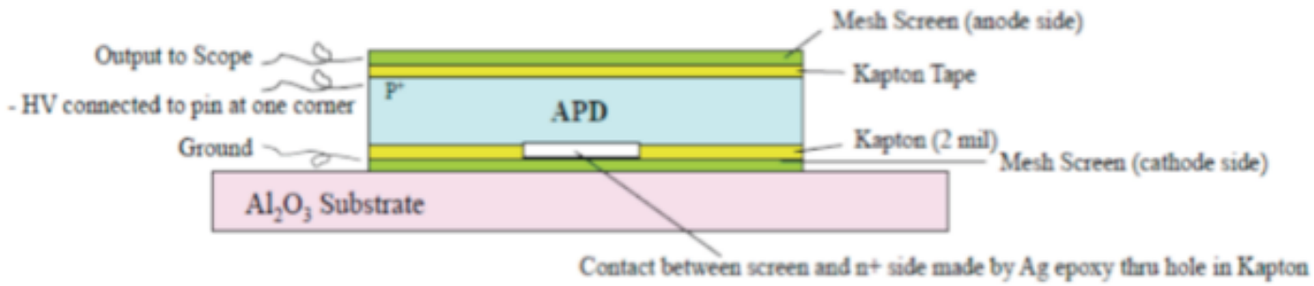
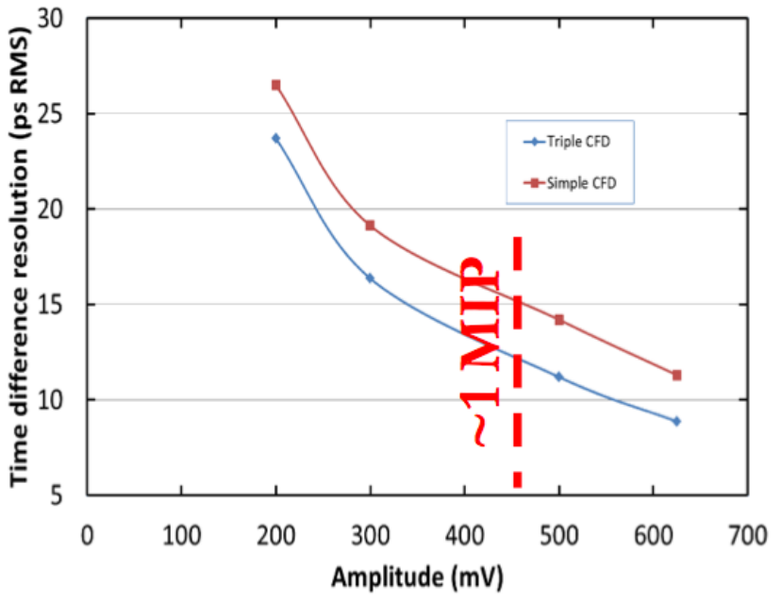
Please read supporting materials WP first!

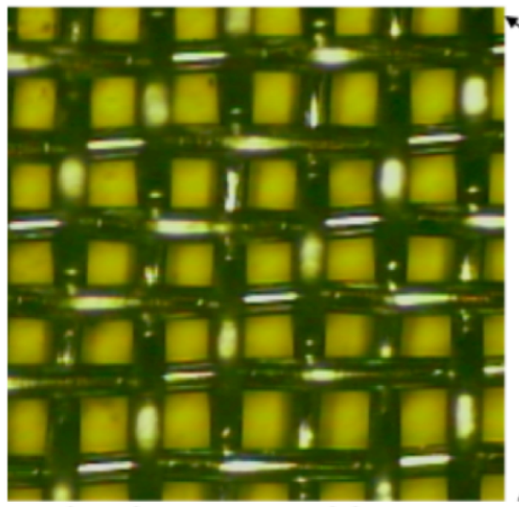
Technology Recap

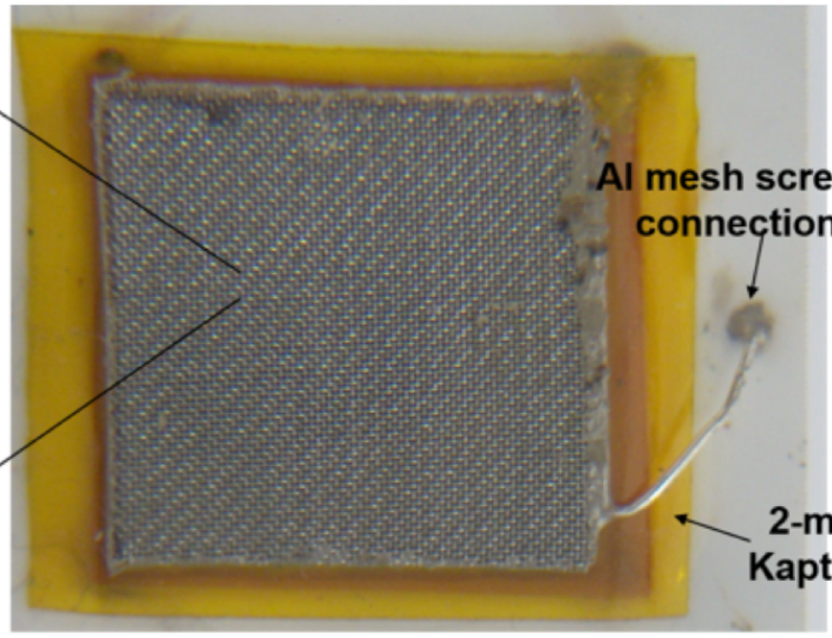
Capacitively coupled readout of APD charge through mesh.
16ps timing resolution in test beams.

Need to further understand issues of scaling and radiation hardness.









(note: also being considered as a photosensor in crystal + APD option)

(recap)

Rough Estimate of Materials Cost 1

- Gathering some numbers from technology experts…
- SiPM/APD + Crystal - Rad Damage
  - 8x 2x2mm Hybrid-APDs (+1 free) = $4,200 (no overhead)
  - 9x Wenteq amps = $1,620
  - $5820 in total for a suite of radiation tests, coordinate with Chris, LG
- Hybrid-APD
  - HAPD: Radiation Damage
    - 8x 2x2mm^2 APDs (+ spares) = $4,200, separate from sensors above
    - 2x 8x8mm^2 APDs (+ spares) = $2,000
    - 3x Prototype high gain devices with alternate structure = $2,500
  - HAPD: Towards arrays
    - 4x 8x8mm^2 APDs (+ spares) = $3,900
    - 2x Indium Tin Oxide Coating (easier to produce at scale) runs = $1,950
    - 2x Nickle-mesh (instead of Al, easier to produce) runs = $1,400

Exploring larger-scale sensors. Different fabrication techniques.

Total: $15950

Detail of Work Package

- **Summer, 2016** testbeams and laser studies
  - Profit from AIDA, RD50, CERN, FNAL testbeams
  - Try to be part of CMS fast-timing test beams where possible
  - Continuation of laser studies at CERN
- APD setup from CERN 2015 testbeam: [similar to slide 16: https://goo.gl/ckbEbR]
  - Additional option of 1x Lindsey pictured, but not included
- Assembled at CERN by ???? (RD50?)
  - Cost of assembly of shielding, support structures?
- Data analyzed to understand performance of mesh-readout APD as a MIP detector, explore new options in fabrication and detector scale
  - Exploring radiation hardness of alternative gain structures, and possibility of more production-scalable mesh variants
- Results available in Fall
  - analysis by FNAL/Princeton/CERN
- Total M&S: **$15950**, Total Labor: **$????** (overhead on M&S?)