Reach Estimates (May 2018 Update)

Matt Graham
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U.S. DEPARTMENT OF ENERGY
Office of Science

SLAC NATIONAL ACCELERATOR LABORATORY

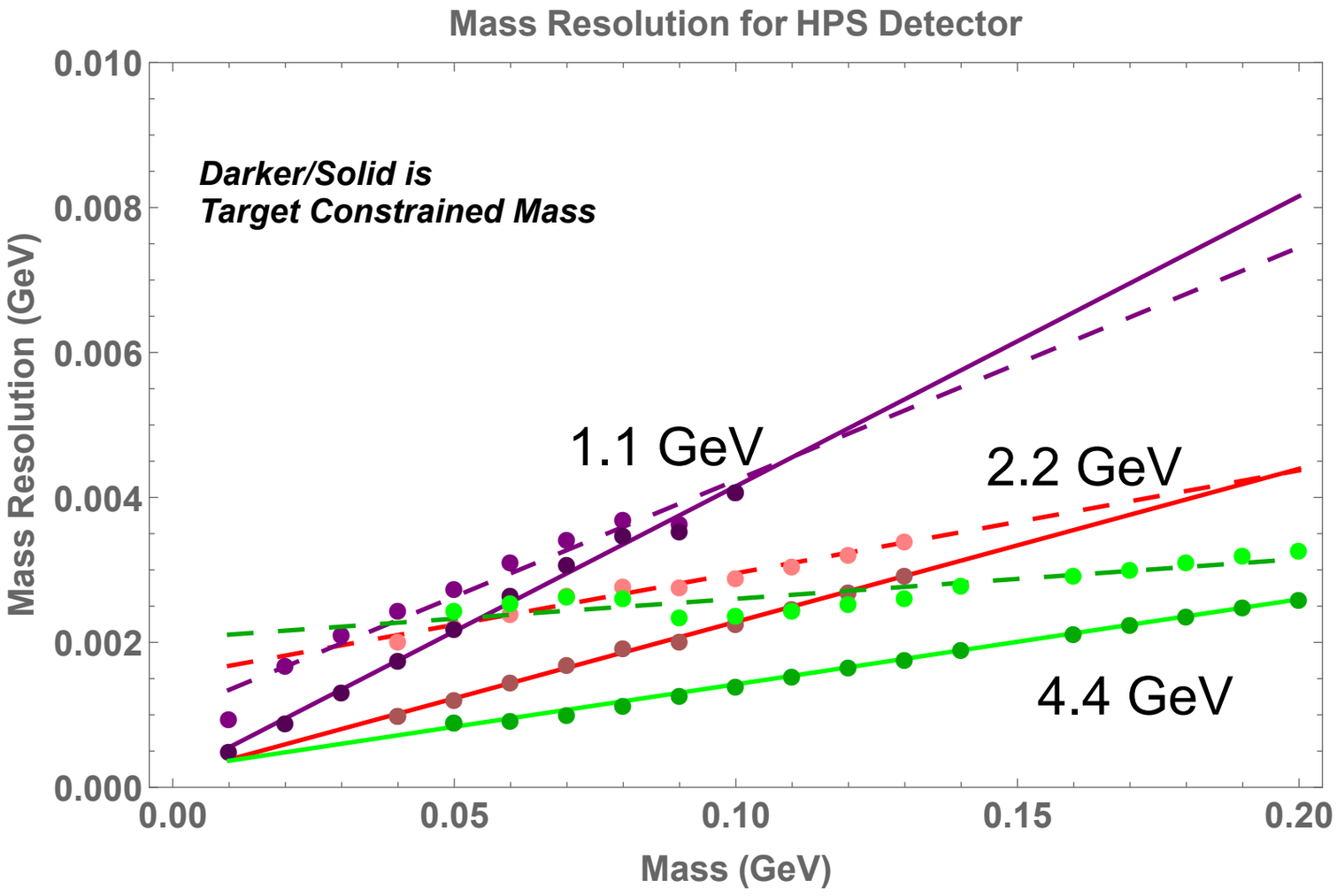
What's going on in this talk

- I gave a long talk on the reach estimate last year (some of these slides may even be taken from there):
  May 31 Wednesday Meeting Talk
- The only new thing is that we have a new-new, final(ish) result on the bump-hunt…here I'll compare my estimates to the result and (not) scale the BH estimates
- I won't show any updates to vertexing estimates…haven't changed them and won't until we get a preliminary result for 1.05 GeV data to compare/improve against
  - will show a bit on it though, just to remind people

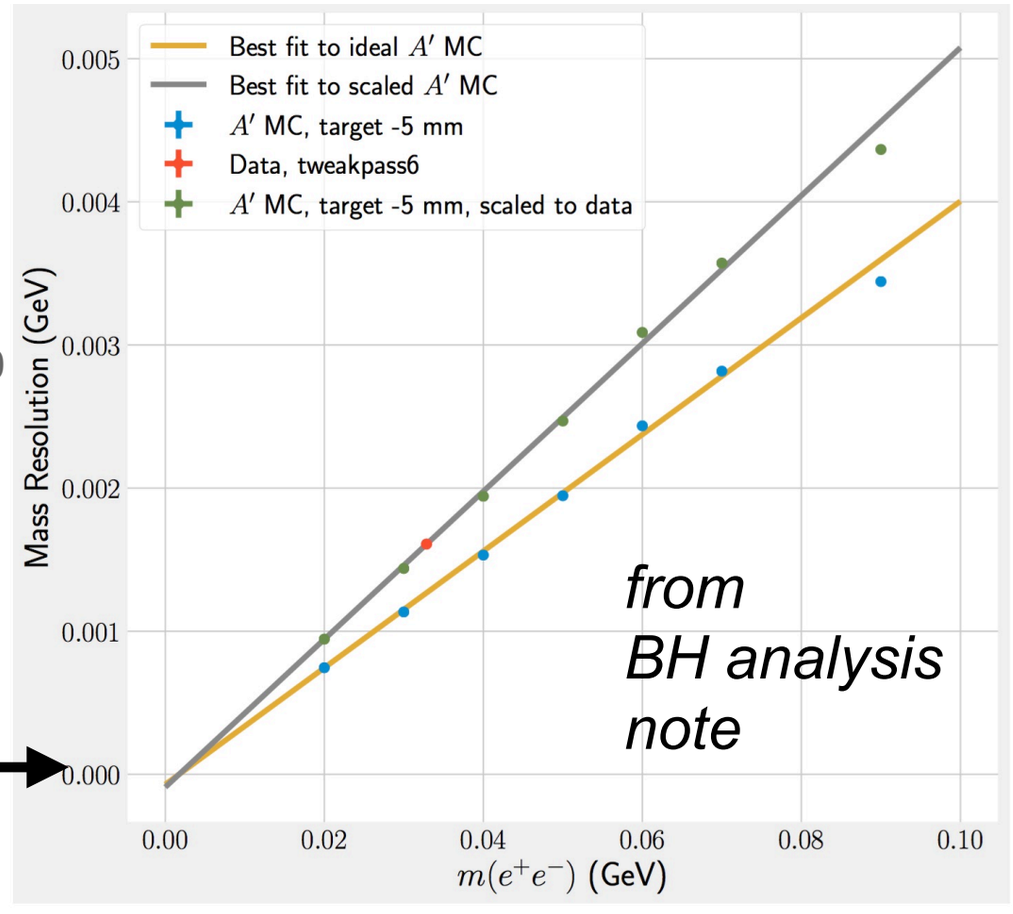
Matt's Reach Estimates: Starters

- My reach estimates are supposed to be estimates of the reach
  - Take full-diagram tridents and radiative tridents from (MG4) MC to estimate the rates & acceptance
    - not full MC…use the generated particles and test whether events pass # of layers hit and trigger cuts
  - Prompt A' MC to estimate mass resolution
    - this does use fully re-conned MC, but I haven't redone this with latest detectors
  - Vertexing tails estimated by taking generating huge samples of prompt A' at a few masses…plot at rejection factor vs z-cut vs mass and inter/extra-polate (order=1) to all masses & z-cut
    - I also haven't redone this with latest MC/detector…
- Some of these plots will show the nominal detectors plus L0 and positron-only trigger detectors
- We should start to move away from this approach! We have data, MC samples and the real, mature analyses that we can extrapolate from!

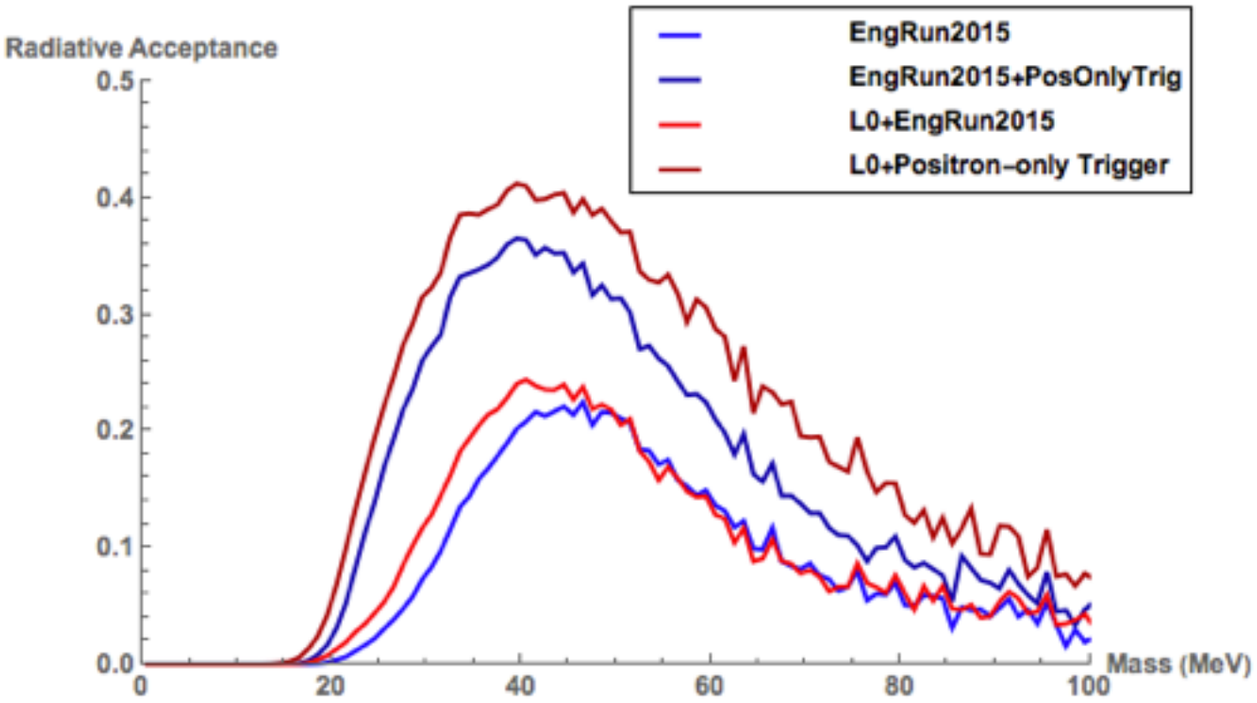
Mass resolution used for reach estimate



This is what Omar found in the real 2015 BH analysis (compare to solid dark purple)…my assumption is slightly optimistic after Omar scales up to Moller mass resolution

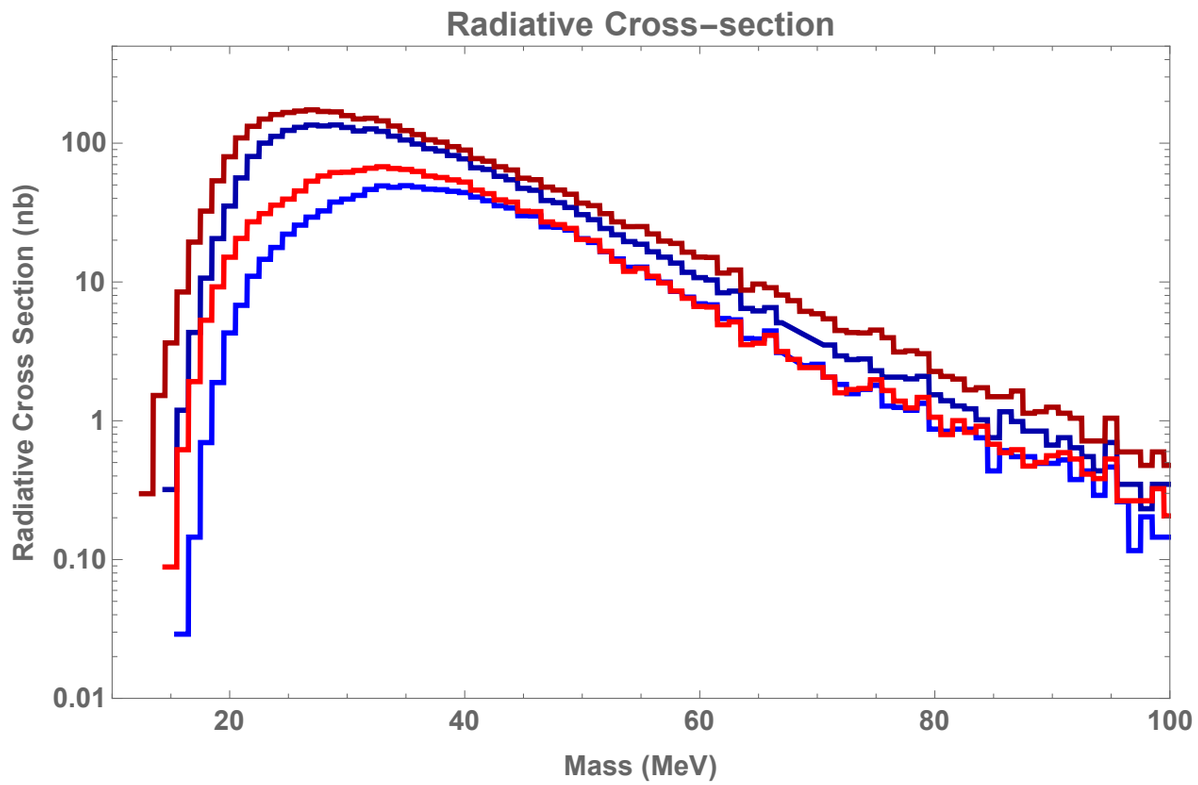


Acceptance and Radiative Cross-sections @ 1.1 GeV

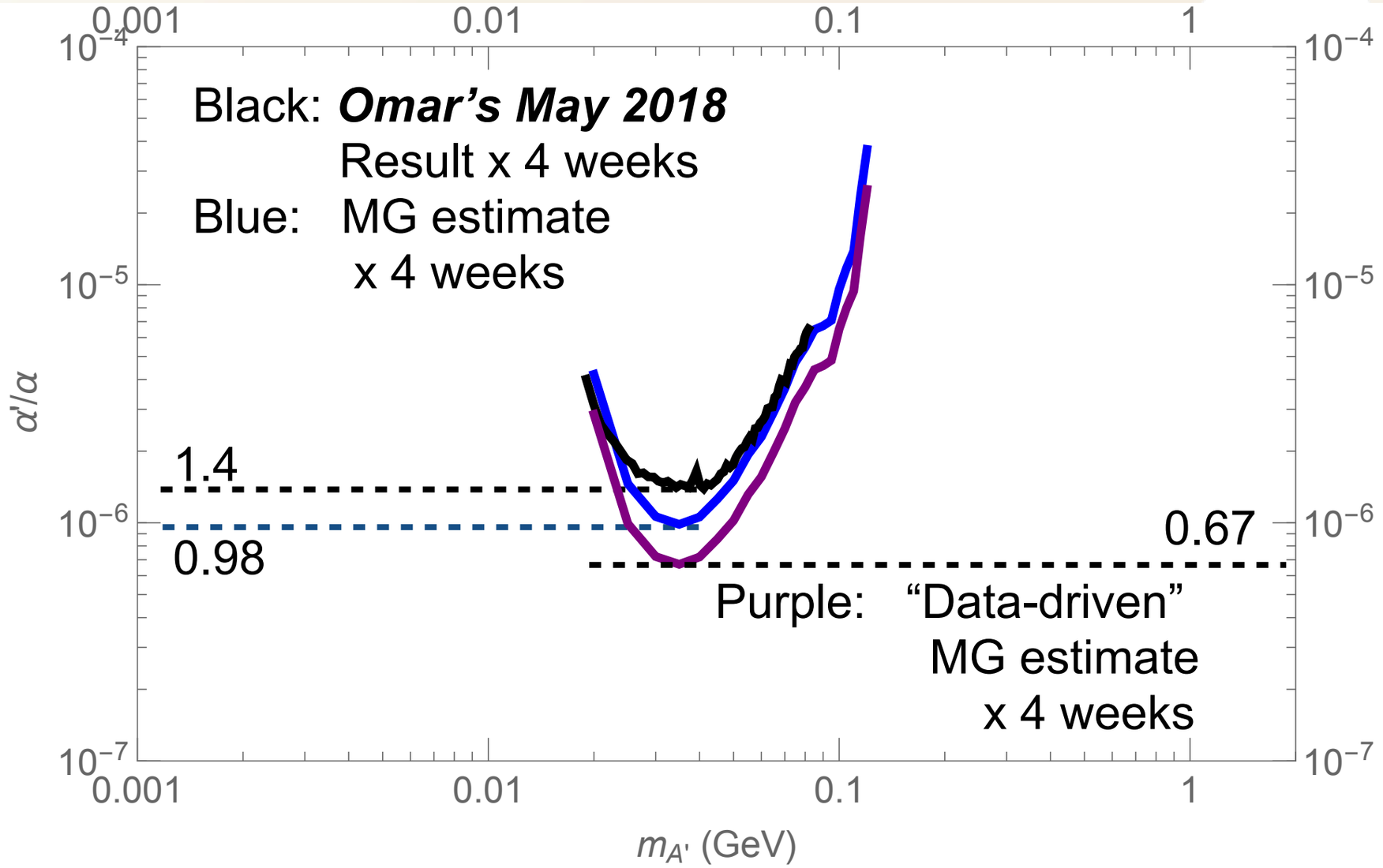


The acceptance for radiative events after the generator cuts (θ_y >10mrad, $E(e^{\pm})$>50 MeV, E_{sum}>0.8*E_{beam})…not quite the same as the A' acceptance.

More important for reach calculation is the cross-section….



1.1* GeV Estimated vs Extrapolated Reach Comparison



Decent agreement between Omar's result (projected to 4 weeks) and my estimate…

- minimum reach ~1.4x lower for estimate…optimistic about mass, no systematics, etc
- somewhat different shape: low mass cutoff sharper in estimate (mass resolution effect??), no reach above ~80 MeV (run out of *reliable* stats in data)
- The purple is takes the observed XS in data (using MC to get rad fraction)…BUT, doesn't include all cuts included in Omar's search+all other stuff. This is what's being shown in the wild with the hope that this will be achievable with more optimization (that looks unlikely now).

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