LHC Context

Luminosity

- **2021**: high-lumi setup period, ~20/fb
  - most standard analyses will not improve much from this year
  - ideal for LLP dedicated trigger menu

- **2022-2023**: high-lumi production, ~100/fb/y
  - will have to share bandwidth more
  - still many opportunities: put into effect lessons learned from 2021

Energy

- **14 TeV**, at some point; but when?
  - depends on magnet training
  - not clear when we will know how much when
  - experiments are asked for input

- LLPs prefer **13 TeV**? no need for trigger for SM xsec measurements yet
Run3 trigger menu discussions started

- in physics groups, then CMS wide
- “crazy ideas” explicitly welcome!
  - LLP's are on the map
  - which signatures are “last time possible”? 
- important point will be to how to justify bandwidth
  - physics justification → theoretical interest?
    - open signature triggers...?
  - rates as a function of inst.lumi and/or PU?
    - can use data
  - trigger purity → does the trigger collect lots of useless events?
  - signal efficiency → does the trigger work? need simulations
- personpower plays a role too
  - are there people to develop the trigger? prioritize?
  - are there people to do the analysis? does that even matter?
L1 trigger

- opportunities to improve existing or propose new algorithms
  - CalRatio trigger à-la-ATLAS → we have the capabilities now
  - displaced muons → can go to low thresholds asking for 2 muons
    - hit clustering in MU? (RoI)
    - what else?
  - add cross triggers
    - combine with prompt objects, eg. with ISR jet/photon
    - combine 2 displaced objects
      - push down on thresholds assuming 2 LLPs decaying in 2 subdetectors
      - only for short lifetimes
  - are there significant shifts in rates from big triggers worth pushing for?
    - eg. eat up large part of bandwidth to keep MET trigger as low as possible?
  - correlations among different bunch crossings possible
    - useful for very massive LLPs
  - advantage: can develop on data, also with high PU
  - not much time for novelties...
• maximize **ISR+LLP coverage**
  ▪ monojet + LLP, monophoton + LLP, MET trigger ; what is better?

• **cross triggers**
  ▪ combine single LLP with “prompt” object
  ▪ catch two LLP's decaying in two different subdetectors
  ▪ correlate LLPs, eg. vertex fitting (or not)

• **new or adapted reconstruction algorithms**
  ▪ eg. tracking at HLT != offline, in particular for LLP
  ▪ how soft can we go, reliably? calibrations?
  ▪ Machine Learning?

• **extend the LLP scope**: explore more (displaced) photons, taus, b's...

• **cases where L1 seed could be every L1 event?**
  ▪ probably for soft signatures, case-by-case
• golden age for scouting
  ▪ store less event content to reach high rate output (ATLAS: TLA, LHCb: Turbo)
  ▪ go beyond current dijet and dimuon, staying inclusive for LLPs
  ▪ hard to prepare in advance what information to save, without knowing all potential customers of a signature
  ▪ think ahead of trigger efficiency measurements → hard after the facts!
    backup triggers, eg. with full event content
  ▪ be creative, eg. hybrid scouting with regional-raw, then regional reconstruction
• a case for more B or other parking? [store events for later reconstruction]
• profit from potential HLT hardware changes