Jeopardy!

What we need from 2019 data and 2019 detector MC

Via SS

- Calibrate and process enough data to be able to show that the vertex resolution is what was expected/promised with L0 upgrade. Need a vertex distribution of e+e- pairs with a fit to the core of the distribution
- Show the invariant mass distribution of e+e- pairs to demonstrate mass coverage of 2019 data
- Show Esum for e+e- pairs with and without e- cluster to demonstrate that the single arm trigger worked and we gain x2 more pairs
- Validate MC setup using the Esum, vertex, the invariant mass, … distributions of e+e- pairs using the 2019 data
- Run simulations for 4.55 GeV to show preliminary agreement between the data and MC
- Simulated long leaved A's to show increased acceptance after moving L1, L2, L3 towards the beam
- Estimate 2019 reach
- Estimate reach for a 4 PAC weeks of running at 3.7 GeV (2021 run)
- Estimate reach for two more energies, ~2 GeV, ~4.4 GeV – after 2021 we will be left with 105 PAC days

Plots for jeopardy doc/presentation: 2019 Run

- General points on plots
  - It would be good if they were all made with coherent set of data and MC
    - Same detector, calibrations, recon etc…
  - More important though is they should have a coherent story, which is, hopefully: “We collected a lot of good data in 2019 and, while alignment/calibration is not perfect yet, the detector performed reasonably close to how we expected”

Plots for jeopardy doc/presentation: 2019 Run

- Calibrate and process enough data to be able to show that the vertex resolution is what was expected/promised with L0 upgrade. Need a vertex distribution of e+e- pairs with a fit to the core of the distribution

  - Well...we're off to a bad start...see PF's talk yesterday; vertex resolution is ~x3 too high
    - BUT, it's very likely due to misalignment; MC looks as we expect … should be able to get the data down with upcoming effort effort on alignment
    - I think we should give alignment team until collab meeting (~1 month) to get a set of alignment constants to use for jeopary document; not final, just good first pass
      - Just show for L0L0 events
    - I liked the info showed in PF's slide 25 (apart from KF vs GBL points)...show current performance and MC (design performace, hopefully we can get close); also show that old plot comparing old and new detectors

Plots for jeopardy doc/presentation: 2019 Run

- Show the invariant mass distribution of e+e- pairs to demonstrate mass coverage of 2019 data
  - Simple, BUT the difference between KF and GBL distributions give pause
    - Should check with MC
  - Compare to 2015/2016 coverage?

Plots for jeopardy doc/presentation: 2019 Run

- Show Esum for e+e- pairs with and without e- cluster to demonstrate that the single arm trigger worked and we gain x2 more pairs

  - Good idea! While we are at it, we should check timing distributions to see how much higher rate of accidentals we get (not necessarily to be shown in jeopardy).
  - Again, comparing this with MC would be interesting (though need to add WAB/tridents appropriately which is pretty rough at this point)

Plots for jeopardy doc/presentation: 2019 Run

- Any other plots we should include?
  - Anything specific to new trigger (i.e. x-vs-energy)
  - L0/L1 performance, other SVT performance?
  - Other analysis-level things (track efficiency? FEEs, WABs?)
  - X17 potential reach?

Reach Estimates: What?

- 2019 Run: golden data set Lumi @ 4.5 GeV
- “2021” Run: 4 PAC weeks at 3.7 GeV
- Far Future Runs … 105 PAC days = 15 PAC weeks
  - 2.2 GeV … 4 PAC weeks? 6?
  - 4.4 GeV … 4 PAC weeks? 6?
  - 6 GeV ? 1.1 GeV ?
    - Do these if we have time

Reach Estimates: Plan of attack

- MC Sample Generation/Reconstruction:
  - Agree mostly with MattS list; generate for 4.5, 3.7, 2.2 GeV with current detector
    - Need to scale B-field by energy
    - Also need prompt A’ for bump-hunt
    - MOUSE cuts need to be scaled!
  - Need to decide on # events sample
  - A’-beam ???
  - Who: Tongtong?
- Event Selection
  - Scale cuts by energy for both bump-hunt & vertexing
  - I suggest using hpstr for this…
  - Who?: CB/PF/MG?

Reach Estimates: Plan of attack

- Mass Resolution:
  - Getting the mass resolution from MC is ~easy
  - Big question is how we scale the MC to account for expected data difference
  - Different constraints for vertex vs BH
  - Who: ??
- Radiative Fraction vs Mass
  - This is pretty easy after selection of MC
  - Who: CB?
- Efficiency vs. Z vertex:
  - Use displaced A’ at different masses
  - Isolation cut efficiency?
  - MattS has script that puts these together
  - Who: ???+MattS

Reach Estimates: Plan of attack

- Zcut values:
  - Use fitting ala MattS
  - Should scale these as MC likely underestimates...how much?
  - MattS has script for this
  - Who: ??+MattS
- A’ yields vs mass/epsilon and limits
  - This is just turn crank after above
  - MattS has script for this
  - Who: ??+MattS
- Bump-hunt limits
  - Potentially just do cut-and-count vs mass
  - Who: CB?

Someone Needs to Learn MattS’ Scripts

Beyond Jeopardy for 2019 Data

- SVT alignment!
  - Norman, PF, Alessandra
  - First pass expected for CM
- Track Efficiency
  - MattG
  - Begin now so that we get an idea of where we are at
- Trident & WAB rates Data/MC
  - MattG
  - pre-jeopardy
- Kalman implementation and seedtracker phase out
  - PF, Robert
  - See next slide
- SVT calibrations
  - Alic, Cameron, Tim

Beyond Jeopardy

- ECal position/energy corrections
  - Andrea, Nathan, Norman
- SVT phase adjustments per run
  - ???
- trigger efficiencies
  - From pulsar data
  - ???
- strategy for correcting the SVT hit errors
  - this is complicated
  - PF

Document, document, document….

SeedTracker → Kalman Transition

- MC is working well...still some issues in data that need to be understand
  - Refit data GBL tracks with kalman (same hit content)
  - Fiducialize so that we compare same kinematic regions
  - Refit kalman tracks to GBL (need this for millepede)
- Understand nonGBL tracks and nonKF tracks
- Tune which KF tracks go into vertex fitter (far out tracks give errors)
- Tune KF track finding strategies
- Track efficiency analysis (MattG)
- Test extrapolation through non-uniform B-field