Team Validation

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2018 **Workfest**, Day 1

Team Validation

- Big Questions:
  - How do we know our reconstruction is working correctly?
  - How do we quantify the improvement (or reverse) in our reconstruction?
- Currently we use yields of $\gamma p \rightarrow \pi^+\pi^-$ (ρ) p and $\gamma p \rightarrow \pi^+\pi^-\pi^0$ (ω) p
  - Doesn't cover full detector phase space ☹️
  - Doesn't reflect realistic physics analysis 🙃
  - Need to extend suite of tests 👍💪
  - Plan to run per week — per month

Proposed Studies

- Branching fraction ratios (incl. data and efficiency)
  - $\omega \rightarrow \pi^0 \gamma$ / $\omega \rightarrow \pi^+\pi^-\pi^0$
  - $\eta \rightarrow \gamma\gamma$ / $\eta \rightarrow \pi^+\pi^-\pi^0$
  - $\eta' \rightarrow \pi^+\pi^- \eta$ / $\eta' \rightarrow \pi^0\pi^0 \eta$
- Cross sections determination: $\rho \rightarrow \pi^+\pi^-$
  - Evaluate all ingredients: yield, efficiency, flux
- Rare channel studies: J/ψ, Ξ, …
- Comparison of data and weighted MC
  - SDME extraction using AmpTools
  - Other statistical tests

Framework

- Goal: Produce turn-key analysis package
  - How much data is needed? What are desired results?
    - Numbers, number, numbers!
  - Suggested starting point: recon_test_example
    - Runs over 1 file of data with DANA plugin on farm, generates histograms and images
    - *cmd_exec.sh* — Run script: *./cmd_exec.sh 30780 1*
    - *script.sh* — where all the action happens
    - *jana_recon_test.config* — hd_root configuration
    - Other files are bonus points

Visualization

- Outputs
  - Figures for monitoring (PNG format)
  - Text file containing quantitative results
  - Package it all up into a directory

- Pass on details to experts
  - Monitoring webpages (Thomas)
  - Monitoring DB (Sean)
  - Need: description of quantitative results
    metadata (“configuration”) for dashboard

Offline Data Monitoring: Reconstruction Test

Select Run Period/Run number

RunPeriod-2016-02/011529

Select Test Dates:

Start Date 10/05/2016 **End Date** 05/14/2018 Select plot to display: Recon. Event Info Select number of columns to display: 3

Note: Click on figure to open larger image in new tab, or click on a date to take you to the reconstruction test webpage for that specific date

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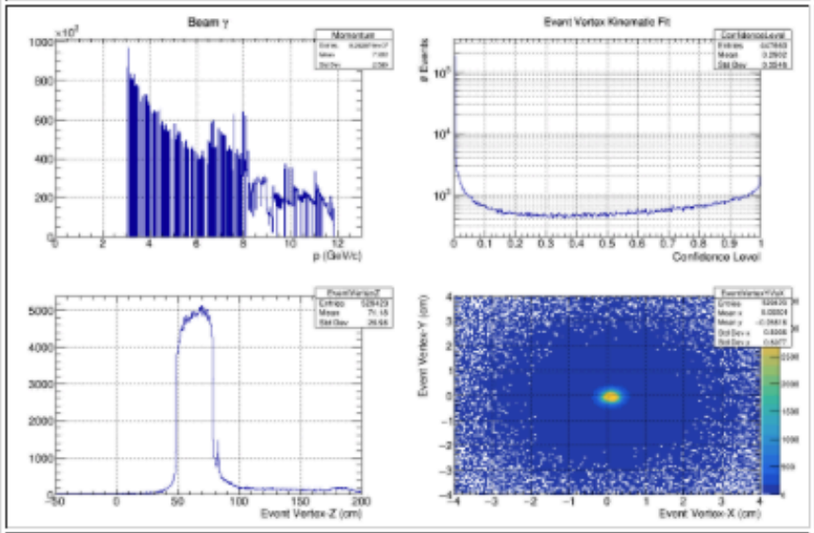
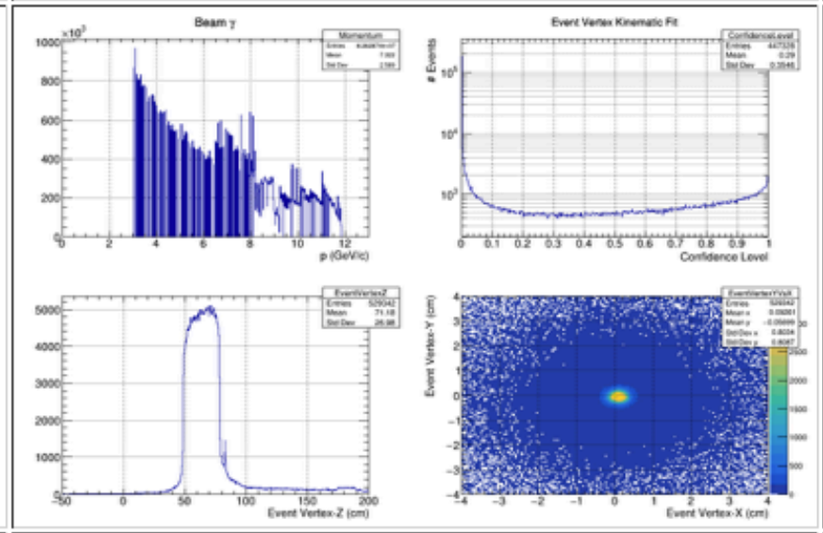
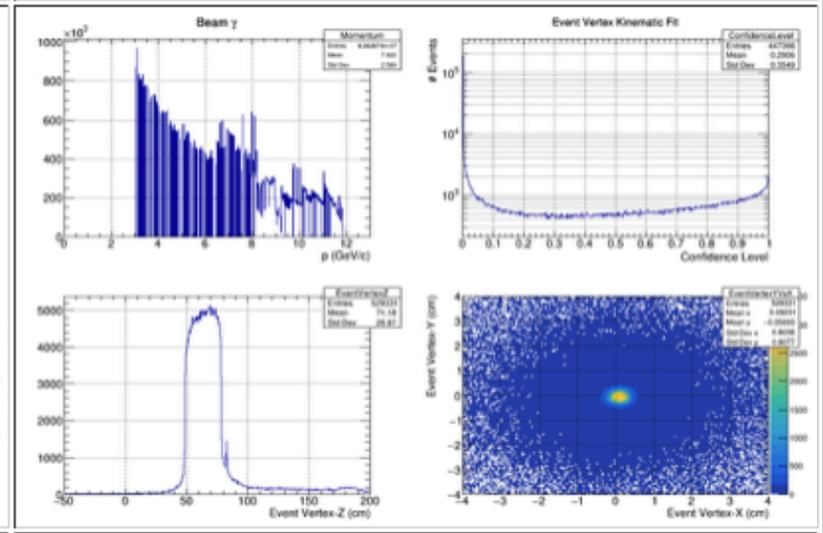
2018-05-13



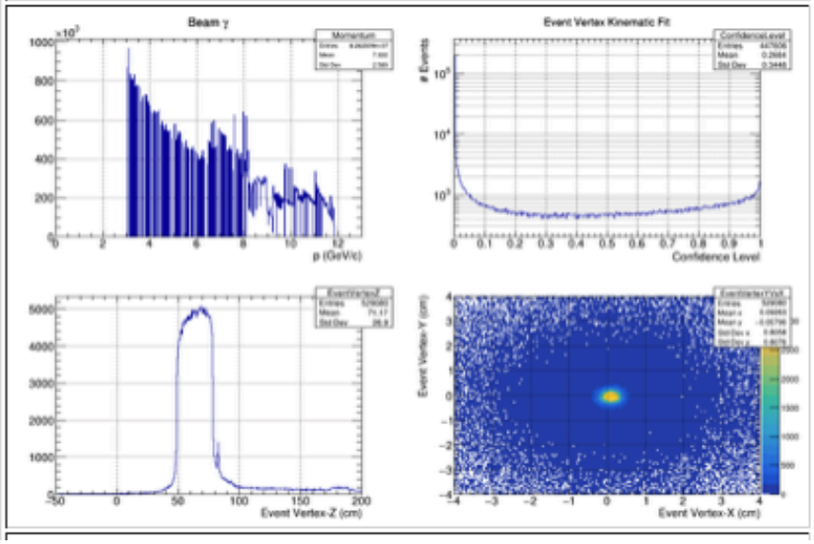
2018-05-10



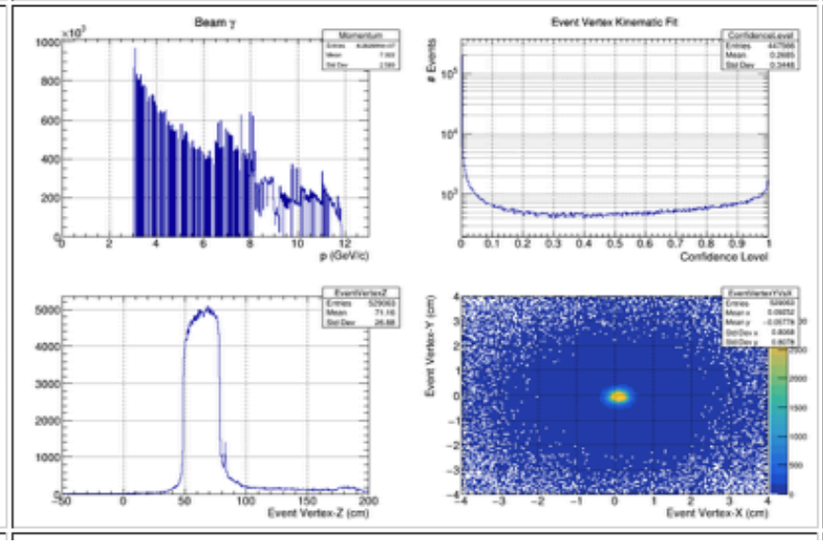
2018-05-07



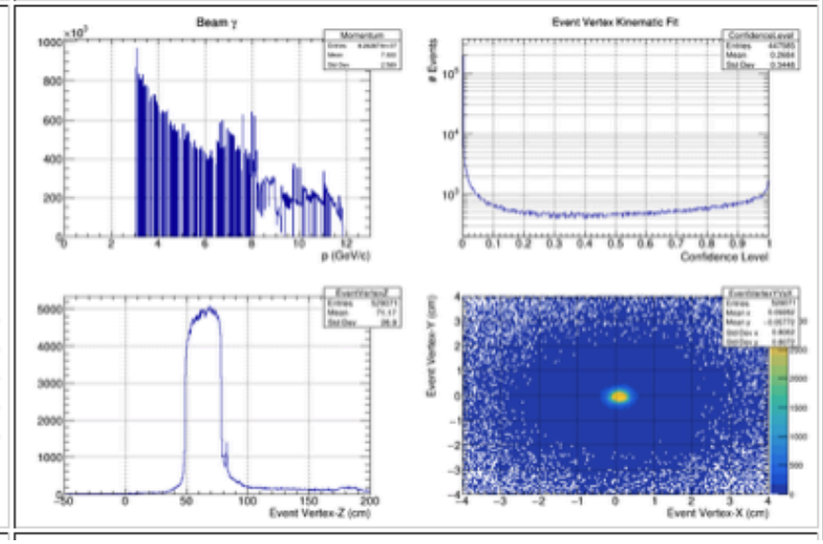
2018-05-04

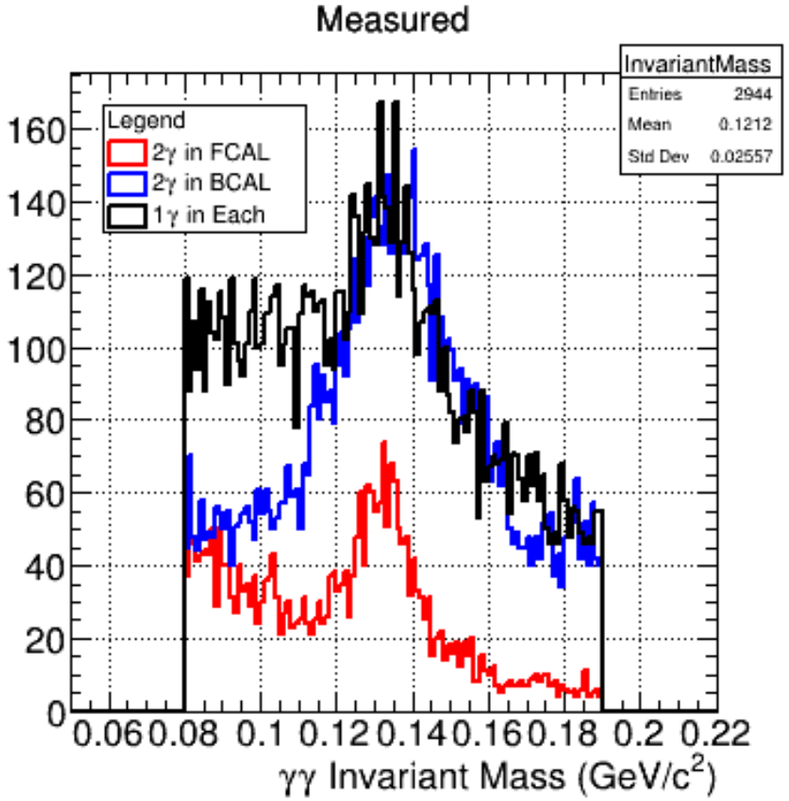


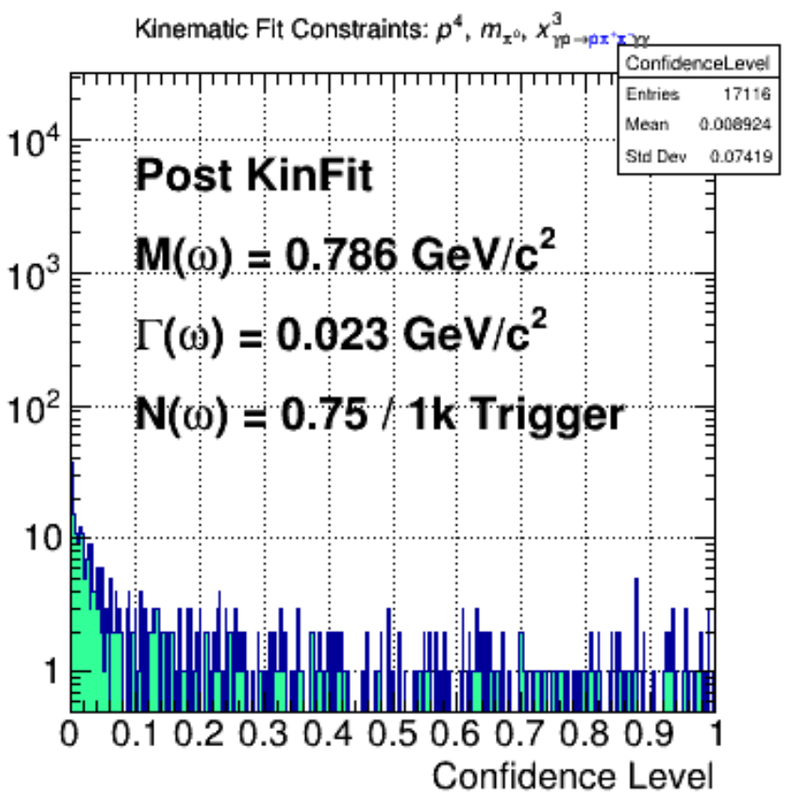
2018-05-01

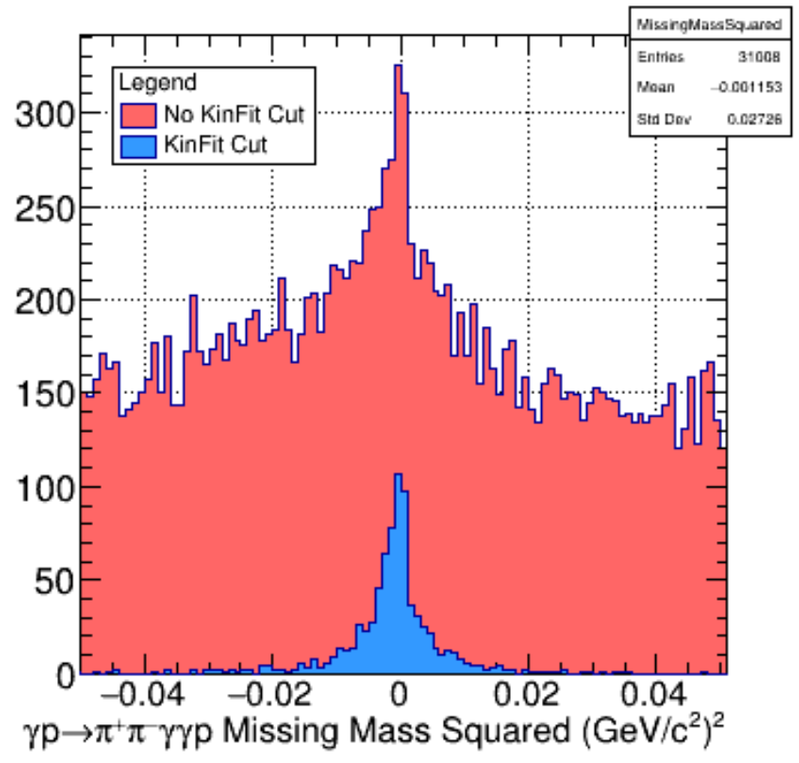


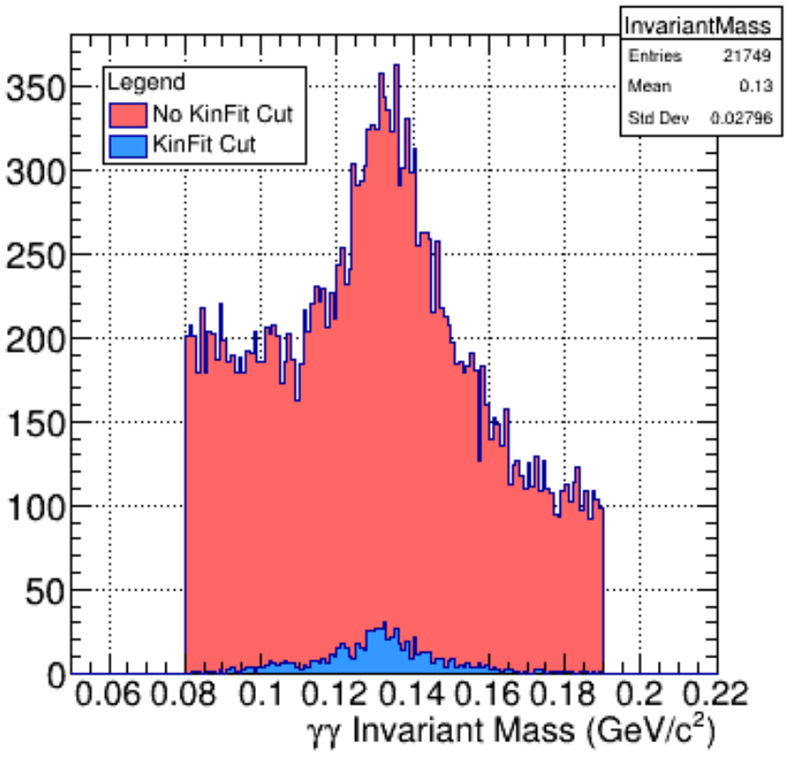
2018-04-28

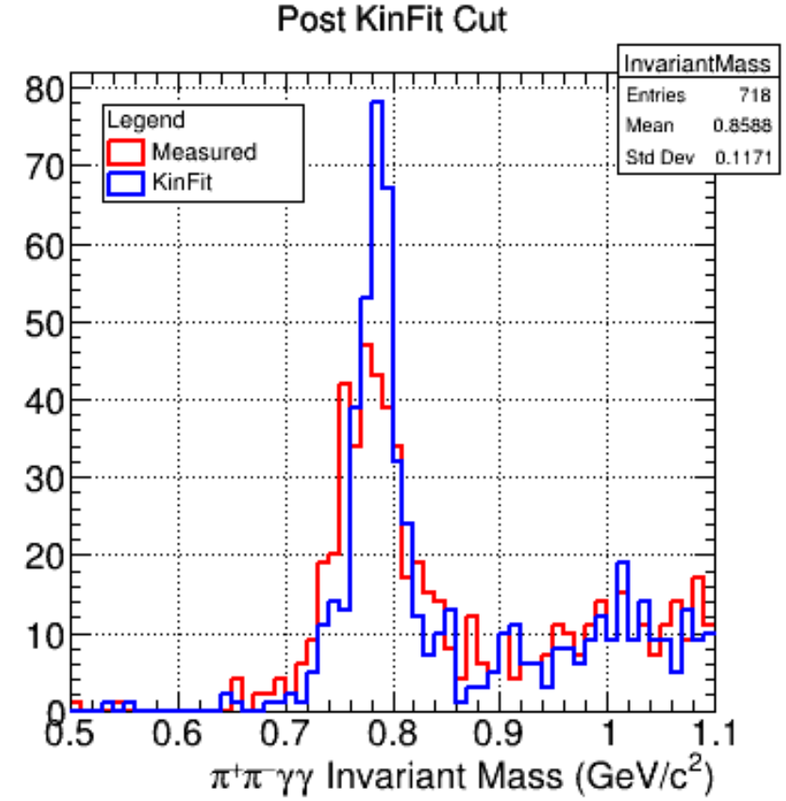


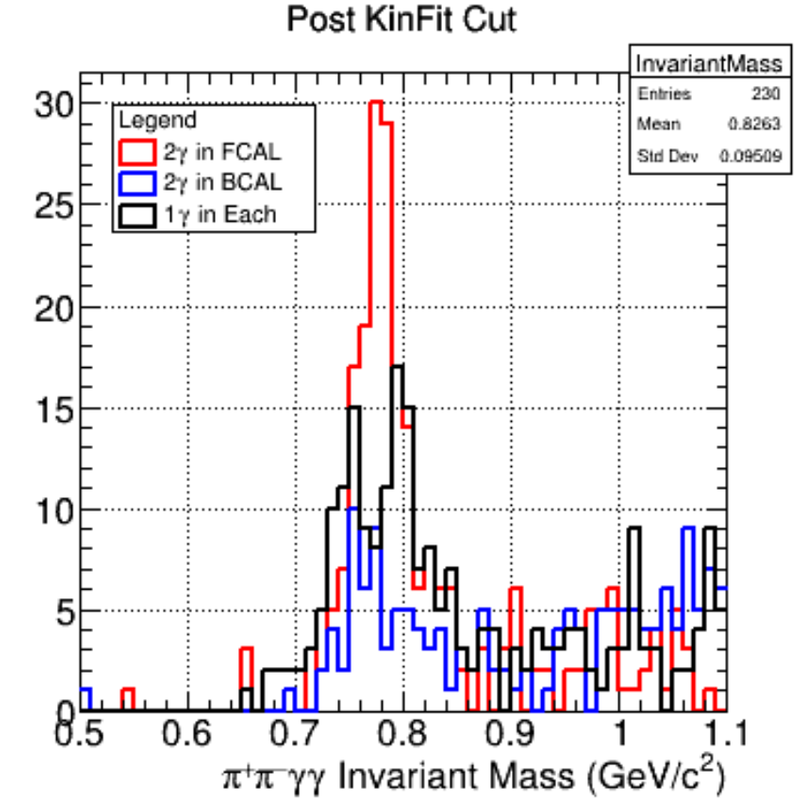

Measured
InvariantMass
Entries 2944
Mean 0.1212
Std Dev 0.02557
Legend
2γ in FCAL
2γ in BCAL
1γ in Each
γγ Invariant Mass (GeV/c²)


Kinematic Fit Constraints: p⁴, m_π⁰, x³_γp→pπ⁺π⁻γγ
ConfidenceLevel
Entries 17116
Mean 0.008924
Std Dev 0.07419
Post KinFit
M(ω) = 0.786 GeV/c²
Γ(ω) = 0.023 GeV/c²
N(ω) = 0.75 / 1k Trigger
Confidence Level


MissingMassSquared
Entries 31008
Mean −0.001153
Std Dev 0.02726
Legend
No KinFit Cut
KinFit Cut
γp→π⁺π⁻γγp Missing Mass Squared (GeV/c²)²


InvariantMass
Entries 21749
Mean 0.13
Std Dev 0.02796
Legend
No KinFit Cut
KinFit Cut
γγ Invariant Mass (GeV/c²)


Post KinFit Cut
InvariantMass
Entries 718
Mean 0.8588
Std Dev 0.1171
Legend
Measured
KinFit
π⁺π⁻γγ Invariant Mass (GeV/c²)


Post KinFit Cut
InvariantMass
Entries 230
Mean 0.8263
Std Dev 0.09509
Legend
2γ in FCAL
2γ in BCAL
1γ in Each
π⁺π⁻γγ Invariant Mass (GeV/c²)

Dashboard Configuration Params

- An array of JSON Objects indexed by column name with the following properties:
  - “lowLimit”: [lower limit]
  - “highLimit”: [high limit]
  - “bounding”: [bounding type]
- The bounding type can be:
  - “atLeast” — warn if less than lowLimit
  - “within” — warn if less than lowLimit or greater than highLimit
  - “atMost” — warn if above highLimit
  - “exactly” — warn if not lowLimit = highLimit
  - “typical_low” — warn if above highLimit. Give good indicator if lower than lowLimit

Example JSON Configuration


```
{
    "recon_pi0": {"lowLimit": 900, "highLimit": -1, "bounding": "atMost"},
    "recon_omega": {"lowLimit": 2800, "highLimit": -1, "bounding": "atMost"},
    "recon_b1": {"lowLimit": 3000, "highLimit": -1, "bounding": "atMost"},
    "recon_b1pi": {"lowLimit": 3000, "highLimit": -1, "bounding": "atMost"},
    "gen_photons": {"lowLimit": 300000, "highLimit": 300000, "bounding": "exact"},
    "gen_protons": {"lowLimit": 150000, "highLimit": 150000, "bounding": "exact"},
    "gen_pip": {"lowLimit": 300000, "highLimit": 300000, "bounding": "exact"},
    "gen_pim": {"lowLimit": 300000, "highLimit": 300000, "bounding": "exact"},
    "recon_photons": {"lowLimit": 340000, "highLimit": -1, "bounding": "atMost"},
    "recon_protons": {"lowLimit": 400000, "highLimit": -1, "bounding": "atMost"},
    "recon_pip": {"lowLimit": 55000, "highLimit": -1, "bounding": "atMost"},
    "recon_pim": {"lowLimit": 48000, "highLimit": -1, "bounding": "atMost"}
}
```

Next Steps

- If you have a project, go for it!
  - If not, ask me or someone else who looks like they have a bright idea (but eventually tell me)
  - Choose a project which may not be completely done by the end of the workfest, but has some concrete goal
- Ask questions!
- Keep informal discussions informal
  - Send me a progress update by the end of Wednesday!
- Have fun!