MANTRA - BES III

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Outline

1. Quick recap
2. $J/\psi \to p\bar{n}\pi^-$ event selection & data
3. mass of $\bar{n}$ in $J/\psi \to p\bar{n}\pi^-$
4. $\Delta T_{\bar{n}/\gamma}$ for MC and Real data
5. 2D histograms with ΔT
6. Future work

Quick recap

- We resolved the bump beyond 1.1 Gev in anti-neutron mass. Using KinFit MDCKalTrack.
- 2D - plots between various variables and $\Delta T_{\bar{n}}$.
- Compare data with MC simulation.

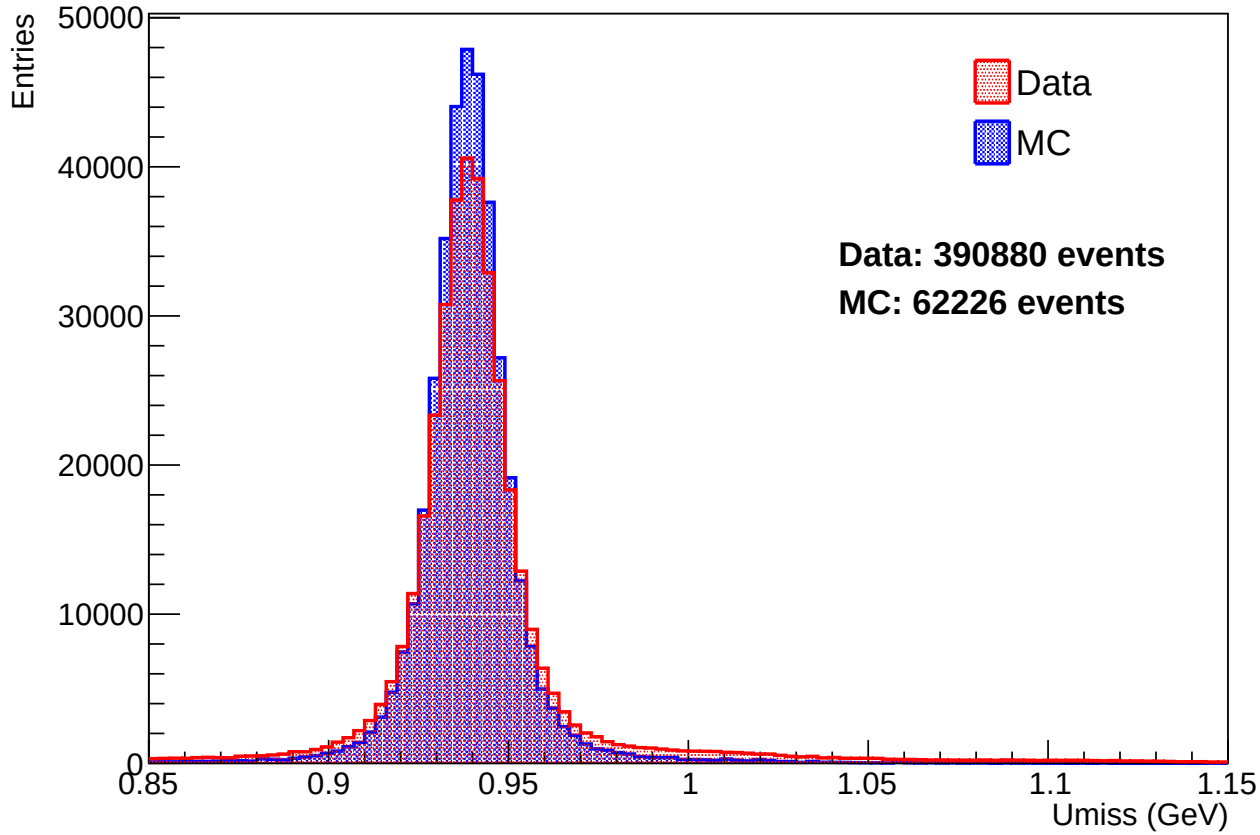
$J/\psi \to p\bar{n}\pi^-$ event selection

Name of the selection cut	Range
Rvxy0	$[-1.0, 1.0]$
Rvz0	$[-10.0, 10.0]$
$\cos\theta_{\text{mdctrack}}$	$[-0.93, 0.93]$
Good charge tracks	$= 2$
MdcKalTrack charge > 0	pid→ProbProton > pid→ProbPion and Kaon
MdcKalTrack charge < 0	pid→ProbPion > pid→ProbProton and Kaon
Net charge	$= 0$
$\cos\theta$ EMC track allowed	$[0.86, 0.92]$
EMC track energy allowed	≥ 0.05 GeV
Time window	0-14 ns

Sample Type	Channel	Size	Period/Run
SimulatION	$J/\psi \to p\bar{n}\pi^-$	200k events	Simulated with v7.0.8
Data	$J/\psi \to p\bar{n}\pi^-$	round02	090611-090629
Data	$J/\psi \to p\bar{n}\pi^-$	round02	090701-090728

mass of $\bar{n}$ in $J/\psi \to p\bar{n}\pi^-$

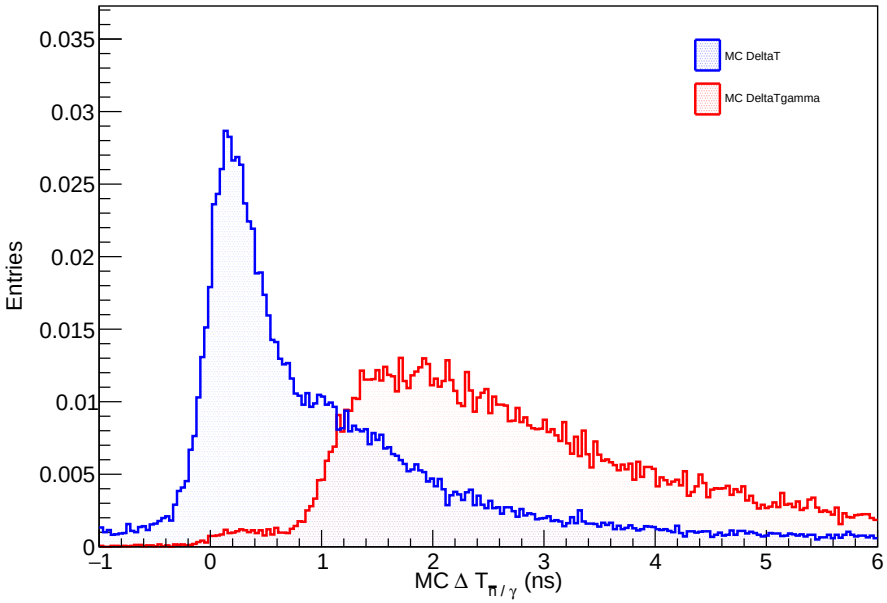
Recoil mass of $\bar{n}$



Blue: Simulation; Red: Data.

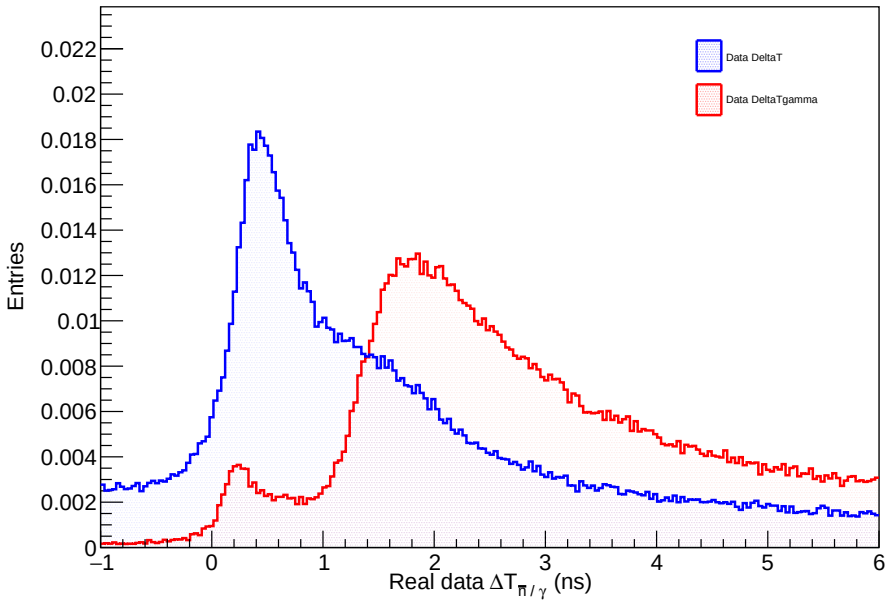
$\Delta T_{\bar{n}/\gamma}$ for MC and Real data

Simulation $\Delta T_{\bar{n}/\gamma}$



Blue: $\Delta T_{\bar{n}}$; Red: ΔT_{γ}.

Data $\Delta T_{\bar{n}/\gamma}$



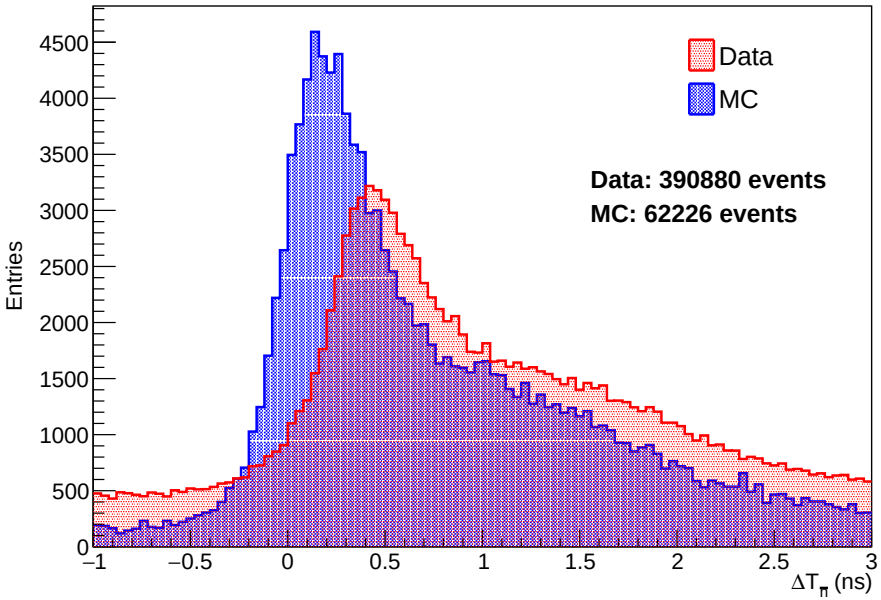
Blue: $\Delta T_{\bar{n}}$; Red: ΔT_{γ}.

Δt distribution

- $\Delta t_n = t_{TOF} - t_{exp(n)}$
- $\Delta t_\gamma = t_{TOF} - t_{exp(\gamma)}$
  - $t_{exp}=L/(\beta c)$, $\beta=p/\sqrt{(p^2c^2+M^2c^4)}$
    - L is the path of flight by extrapolating the corresponding shower from EMC to TOF
    - p is momentum of neutral track from recoiling charged tracks

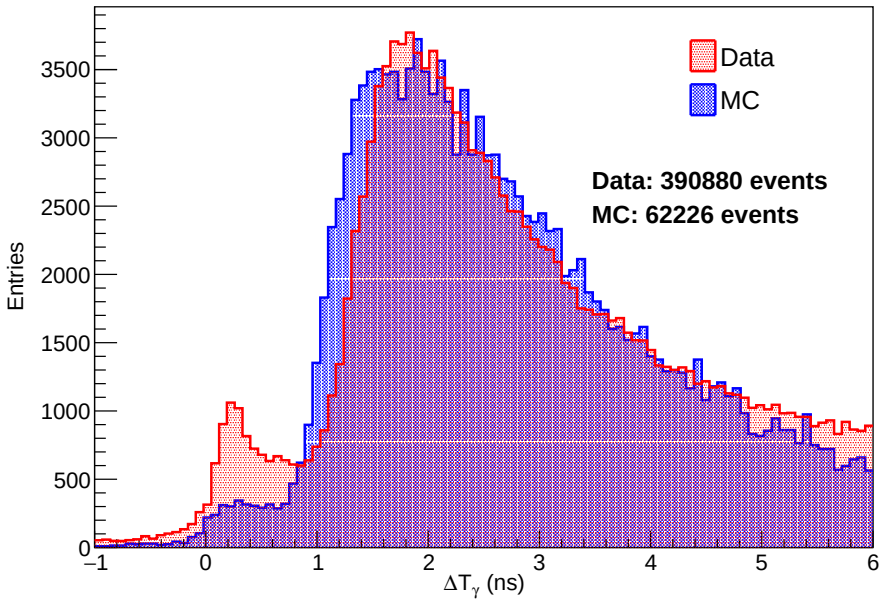
Simulation and Data ΔT comparison for $\bar{n}$, γ

$\Delta T_{\bar{n}}$



$\Delta T_{\bar{n}}$ Data vs Simulation.
Blue: Simulation; Red: Data.

ΔT_{γ}

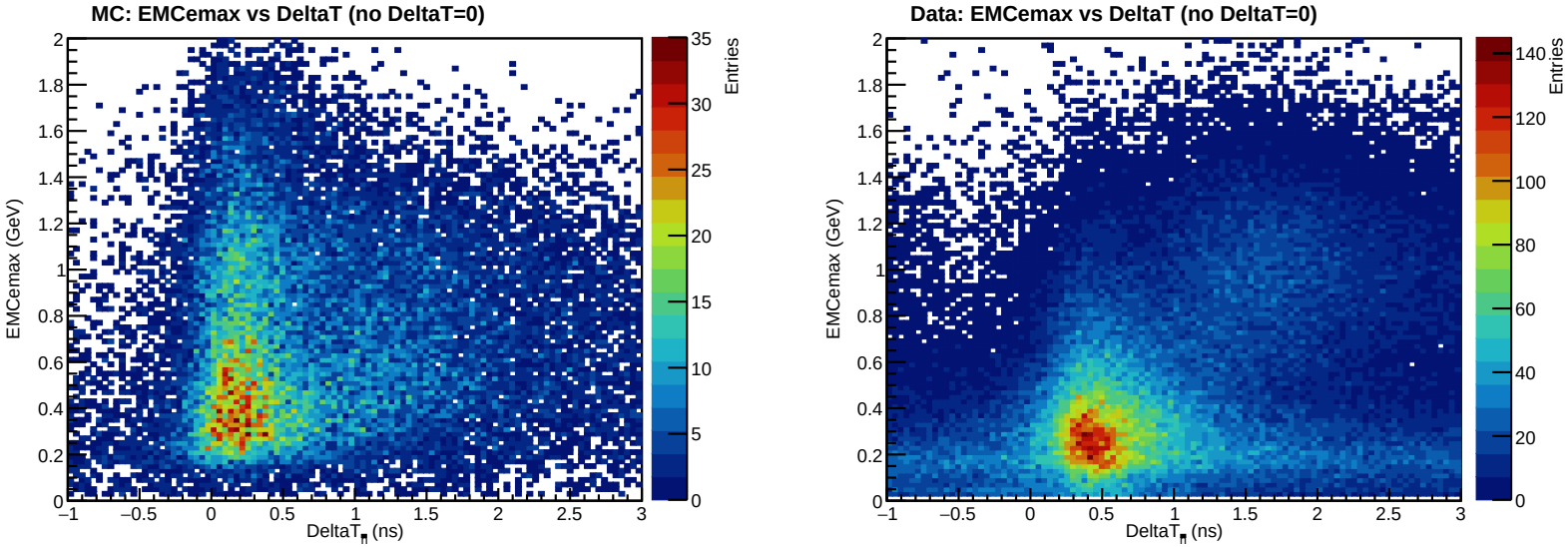


Blue: Simulation; Red: Data.

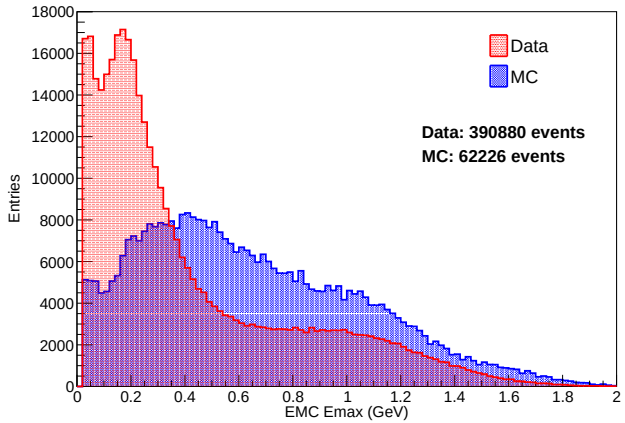
Ref: Dr.Pelian talk1: TOF neutral reconstruction

Ref: Dr.Pelian talk2: TOF neutral reconstruction

EMC emax vs ΔT



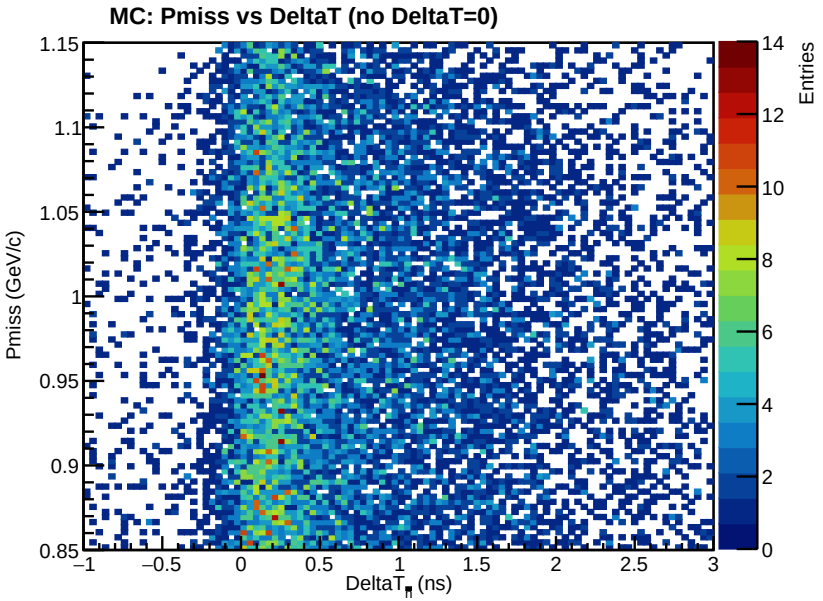
EMC emax vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

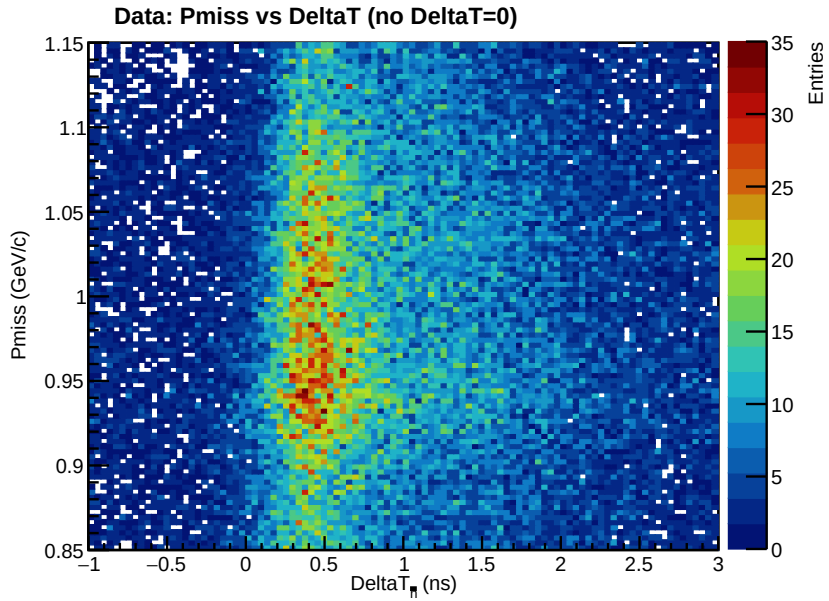


EMC emax is the max energy deposited in EMC .

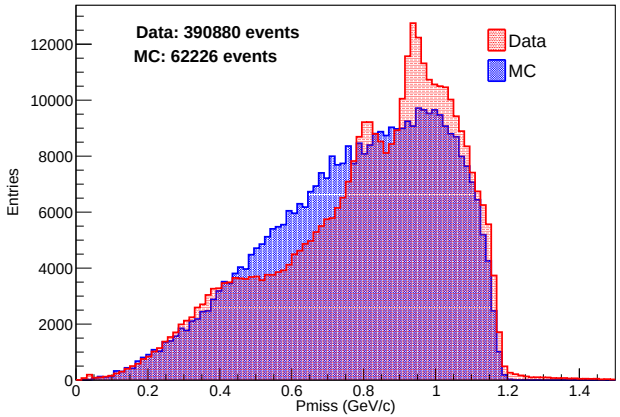
Blue: Simulation; Red: Data.

P_{miss} vs ΔT





P_{miss} vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

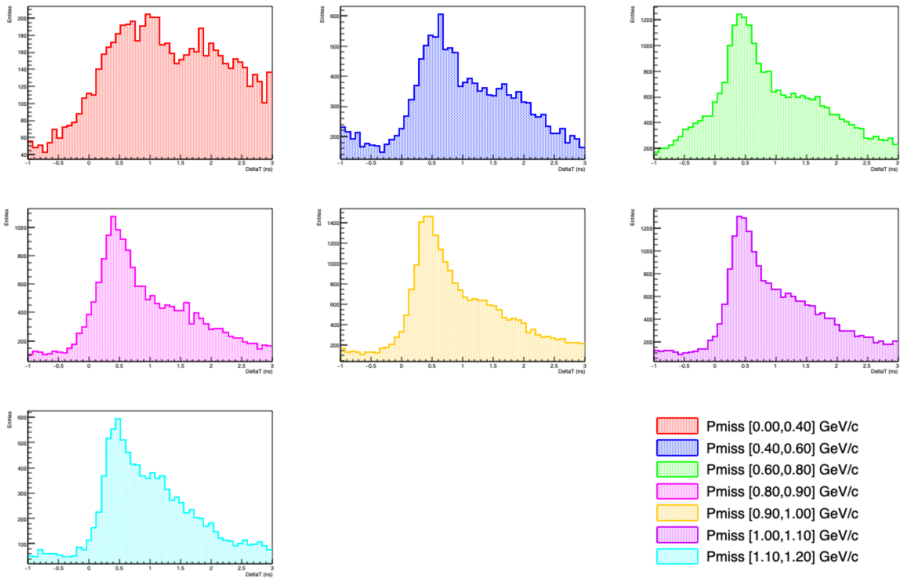


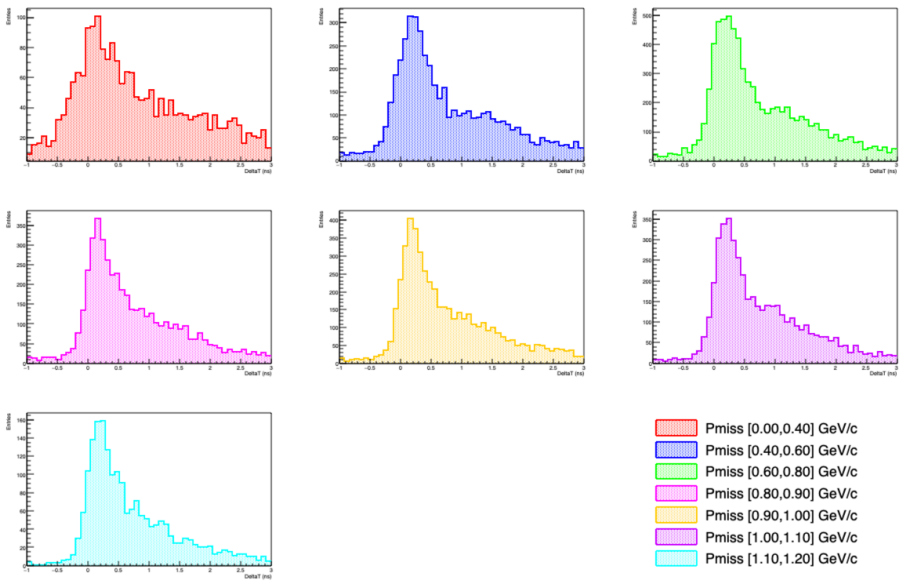
P_{miss} is the recoil momentum of $\bar{n}$.

Blue: Simulation; Red: Data.

Data

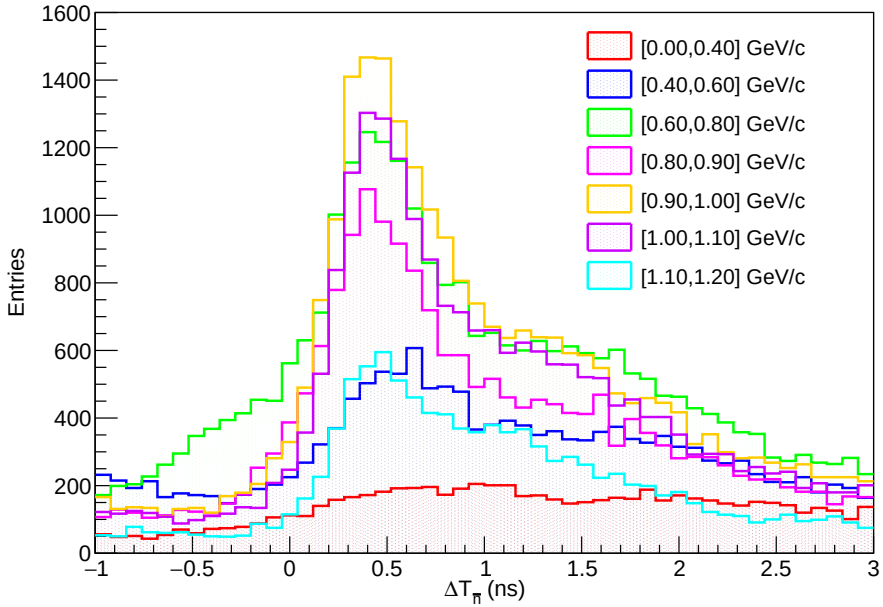
Simulation



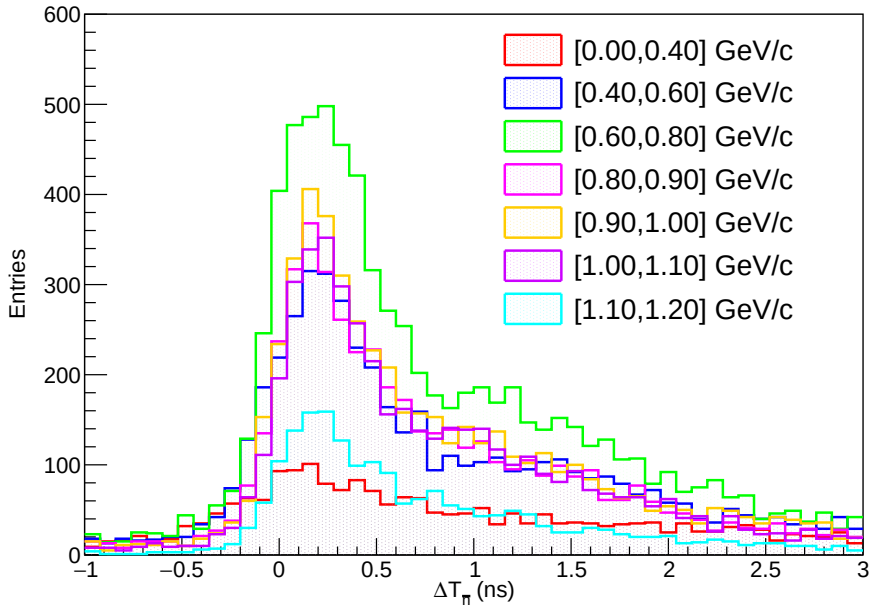


P_{miss} bin bounds[] = 0.0, 0.4, 0.6, 0.8, 0.9, 1.0, 1.1, 1.2

Data

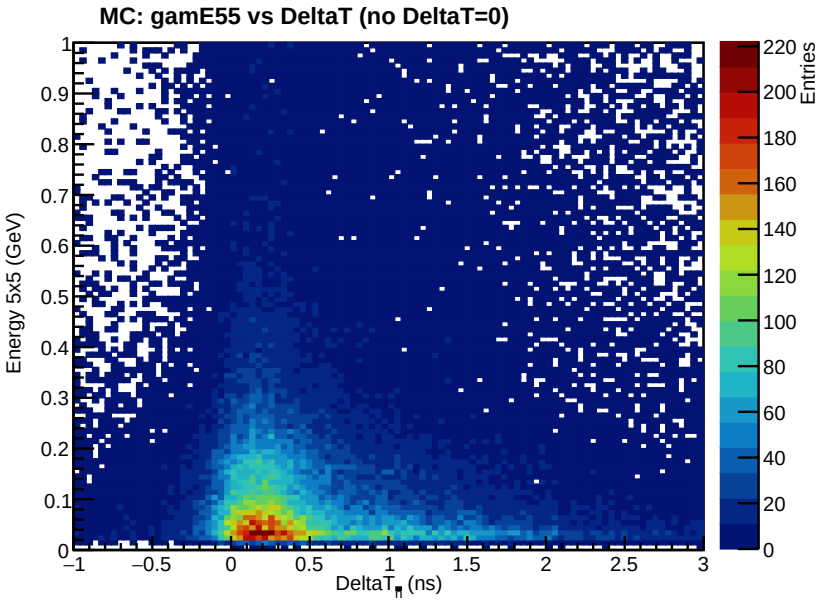


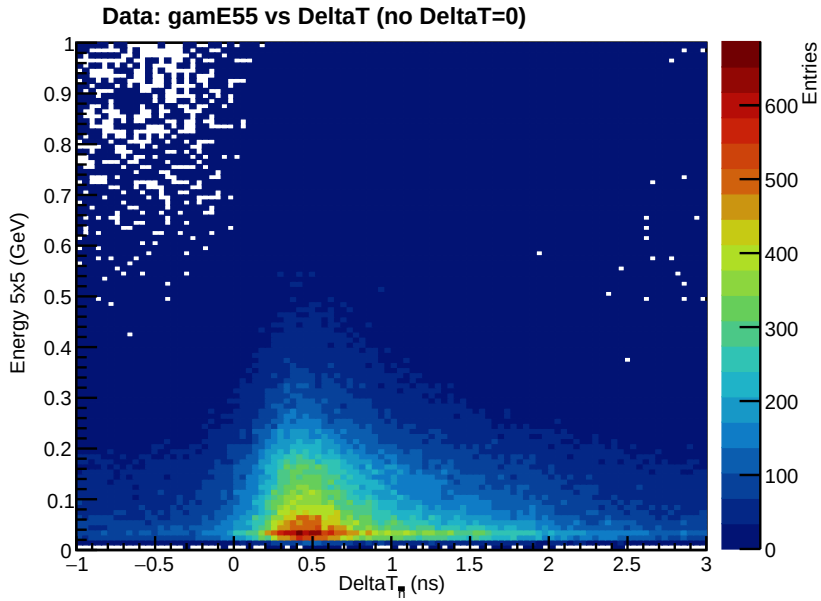
Simulation



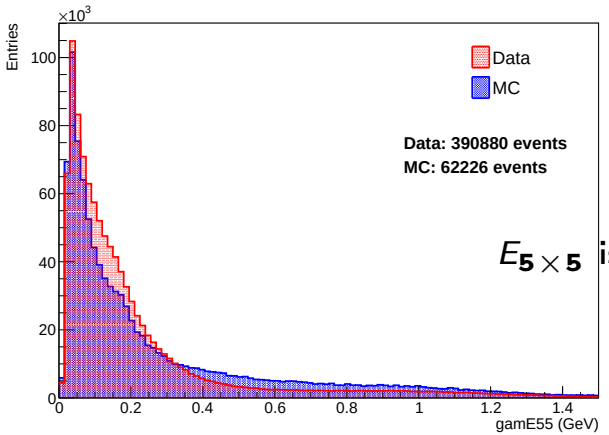
P_{miss} bin bounds[] = 0.0, 0.4, 0.6, 0.8, 0.9, 1.0, 1.1, 1.2

Energy 5×5 vs ΔT





$E_{\mathbf{5\times5}}$ vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

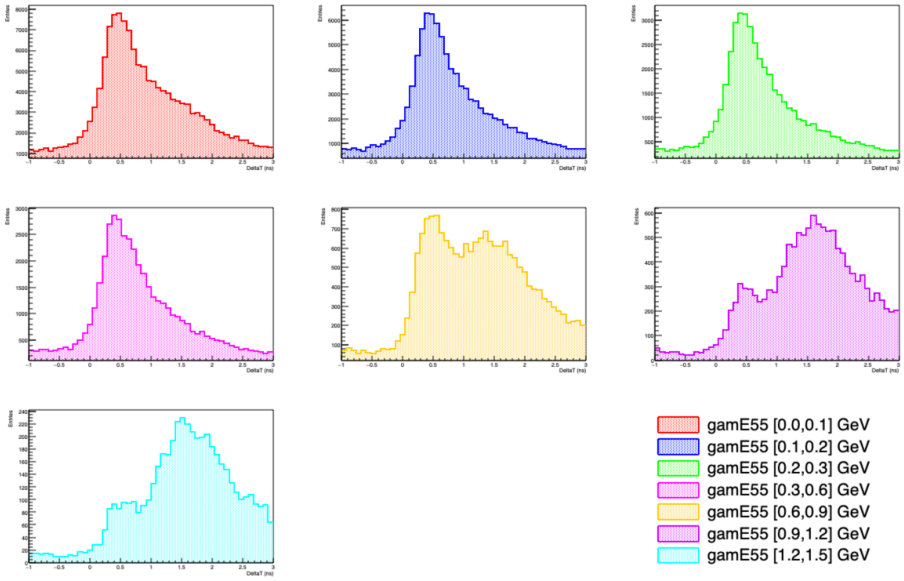


Blue: Simulation; Red: Data.

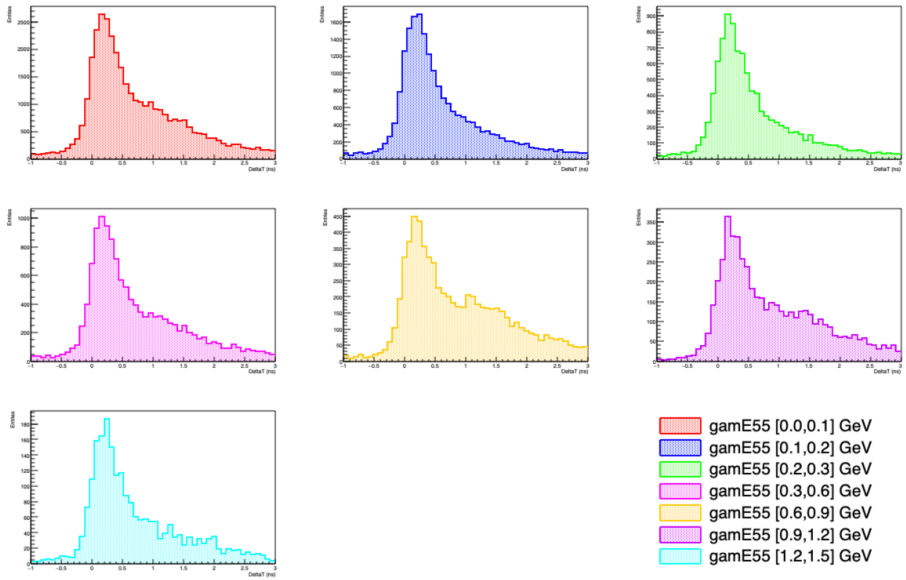
$E_{\mathbf{5\times5}}$ is energy deposited in the 5×5 crystal around the seed.

$\Delta T_{\bar{n}}$ for Different $E_{5\times5}$ bins

Data



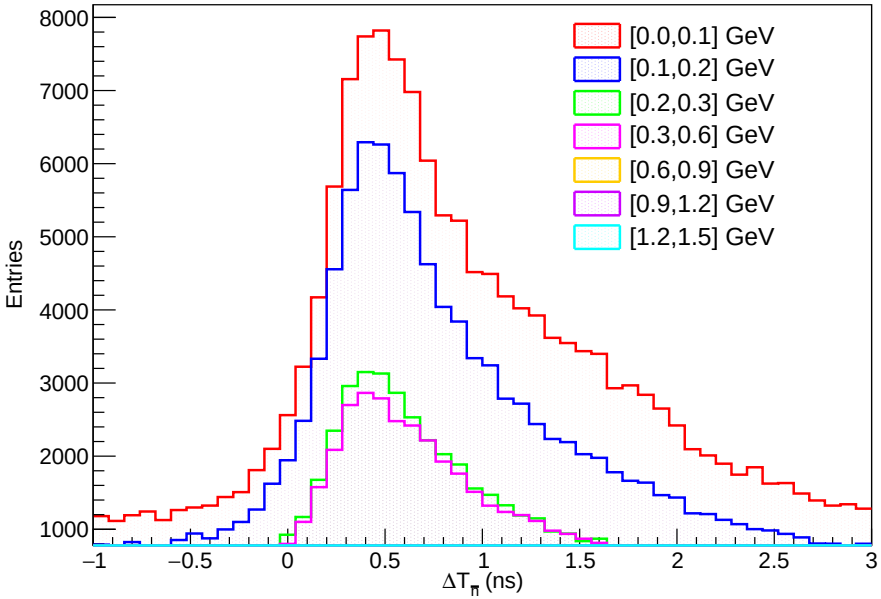
Simulation



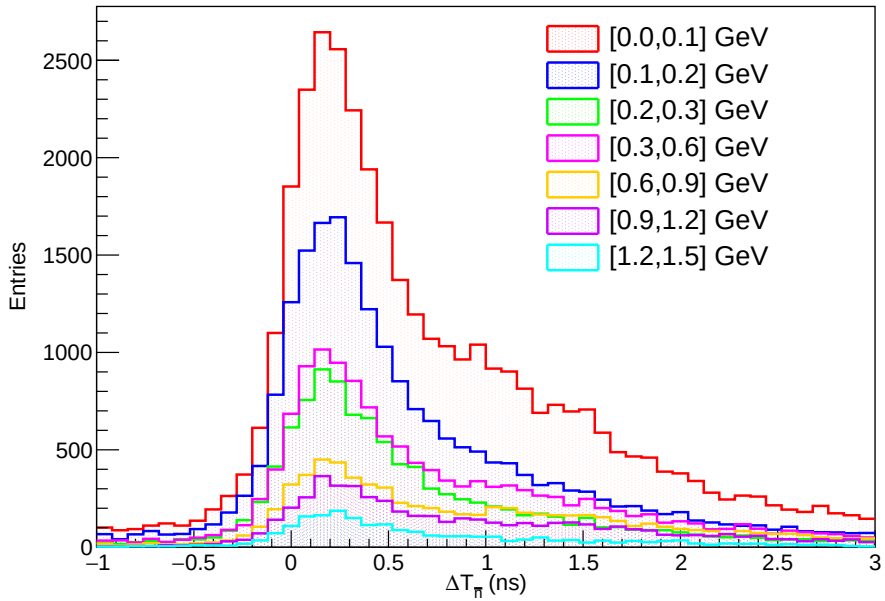
$E_{5\times5}$ bin bounds[] = 0.0, 0.1, 0.2, 0.3, 0.6, 0.9, 1.2, 1.5

MC Data comparison of $\Delta T_{\bar{n}}$ for Different $E_{5\times5}$ bins

Data

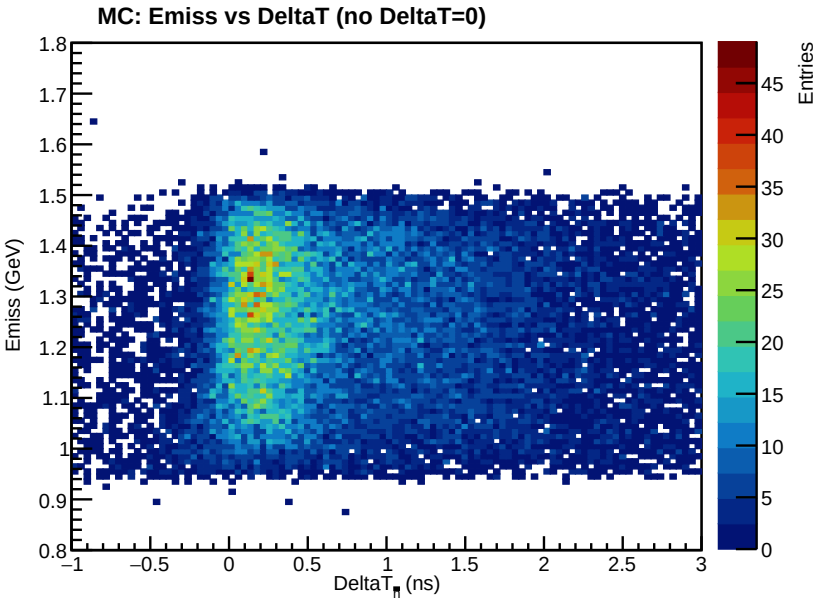


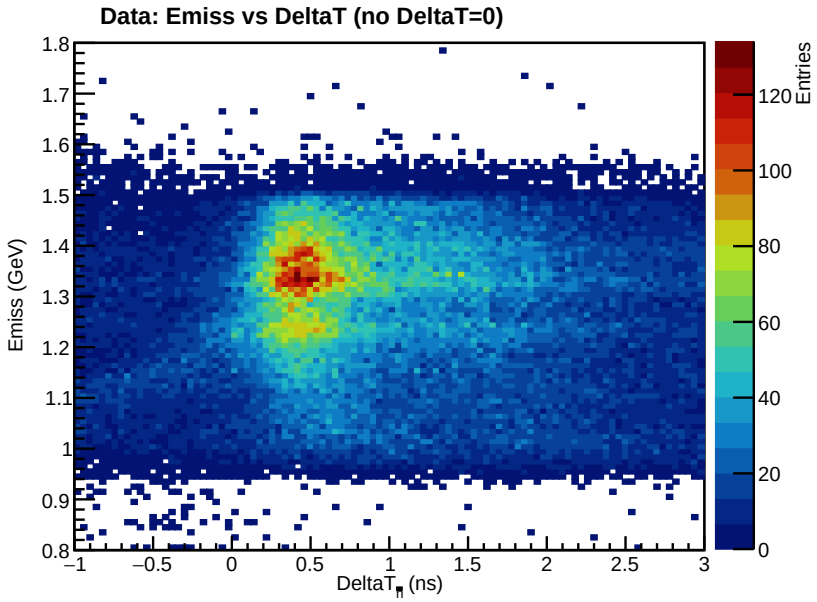
Simulation

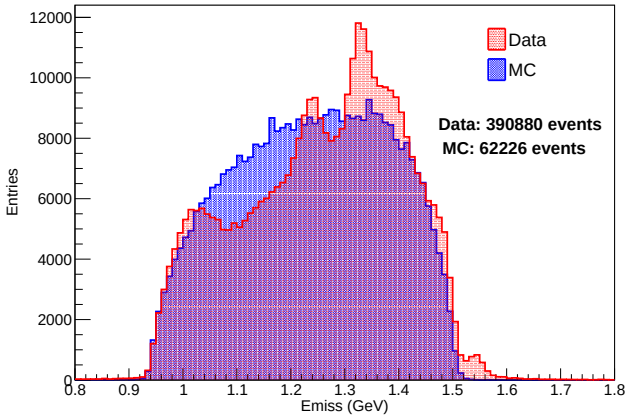


$E_{5\times5}$ bin bounds[] = 0.0, 0.1, 0.2, 0.3, 0.6, 0.9, 1.2, 1.5

E_{miss} vs ΔT





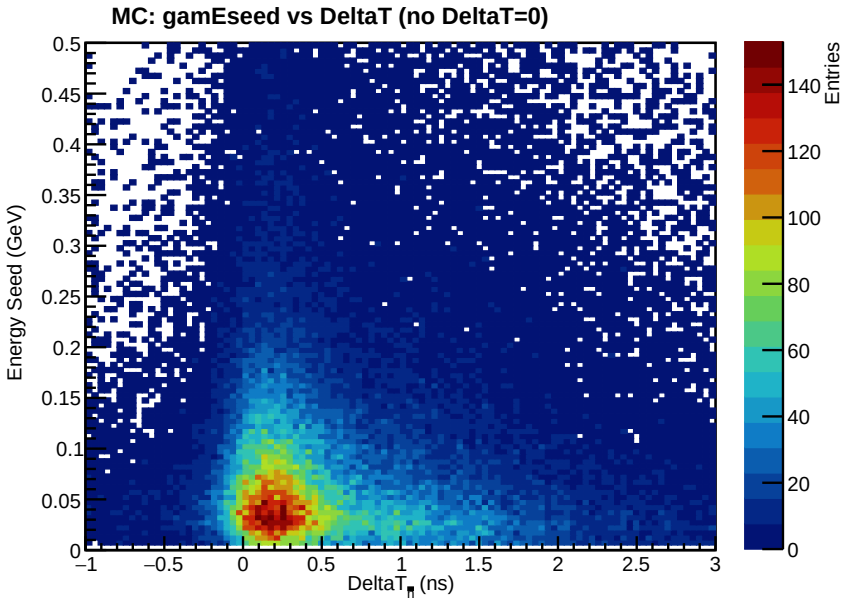


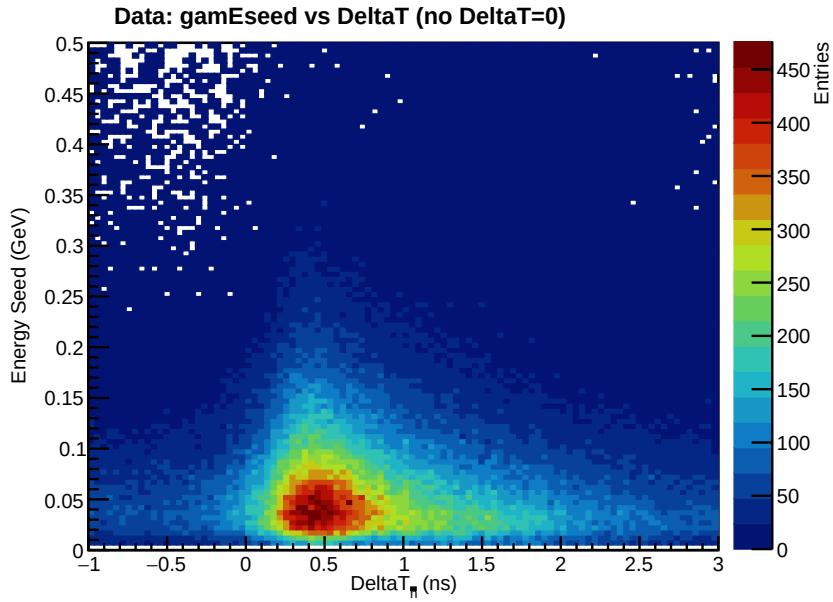
E_{miss} vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

Missing Energy .

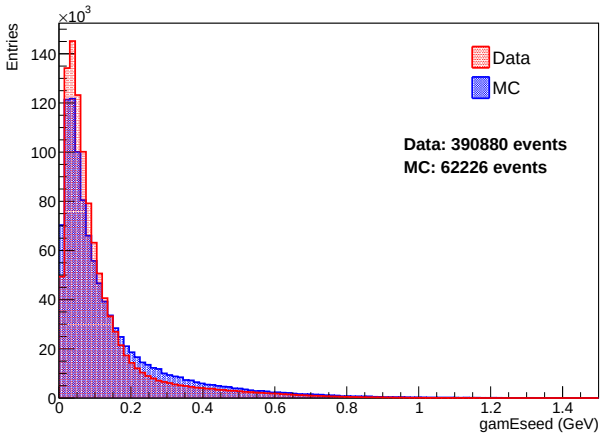
Blue: Simulation; Red: Data.

E seed vs ΔT





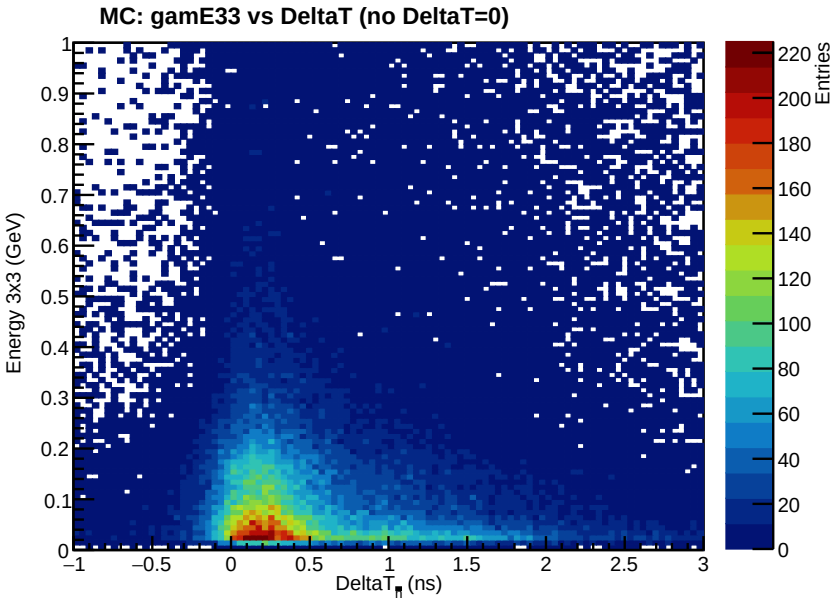
seed Energy vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

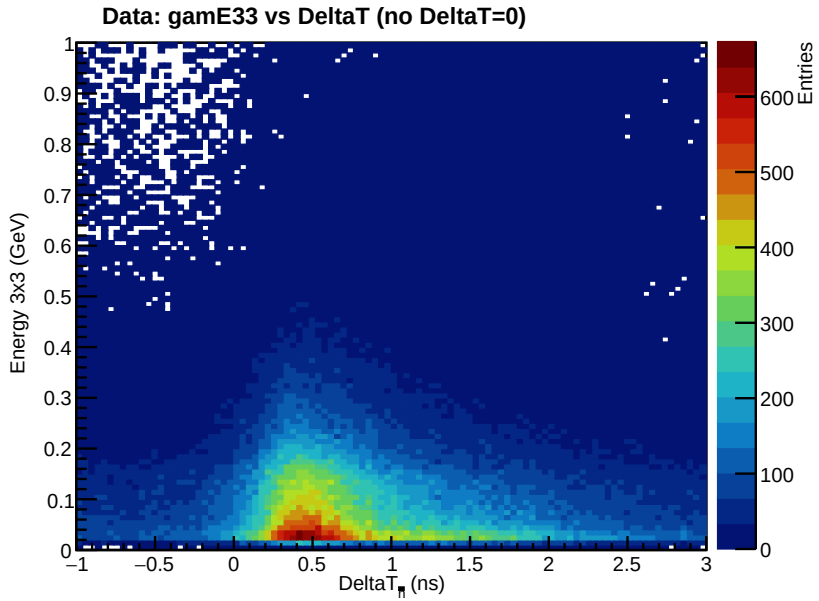


Energy deposited in the seed crystal .

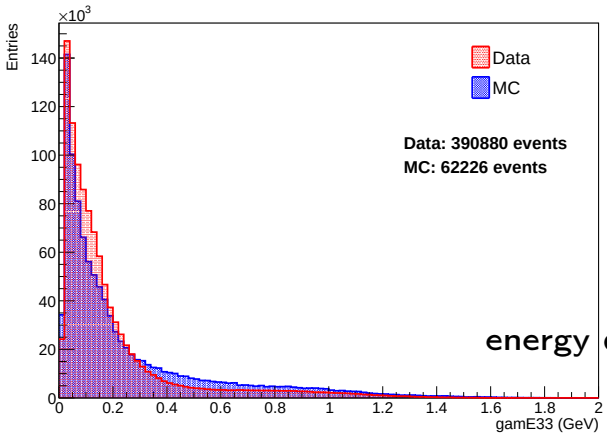
Blue: Simulation; Red: Data.

Energy 3×3 vs ΔT





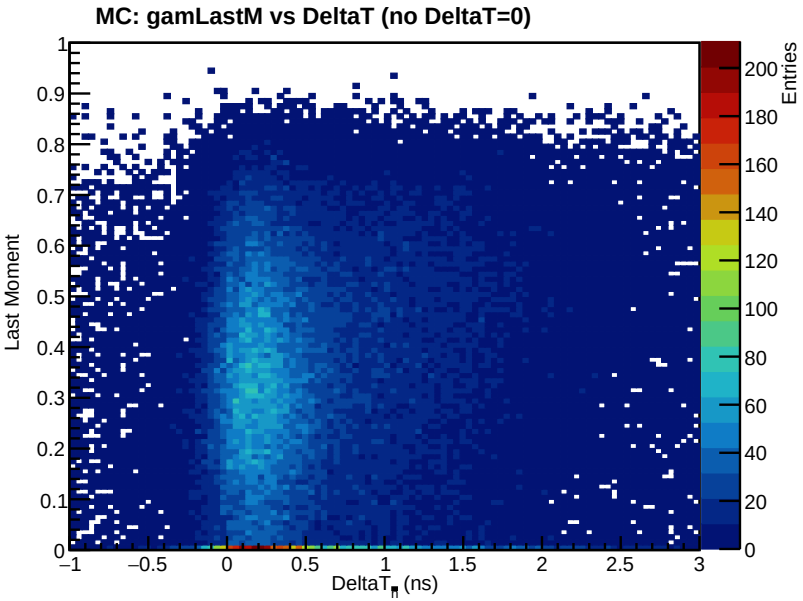
$E_{\mathbf{3\times 3}}$ vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

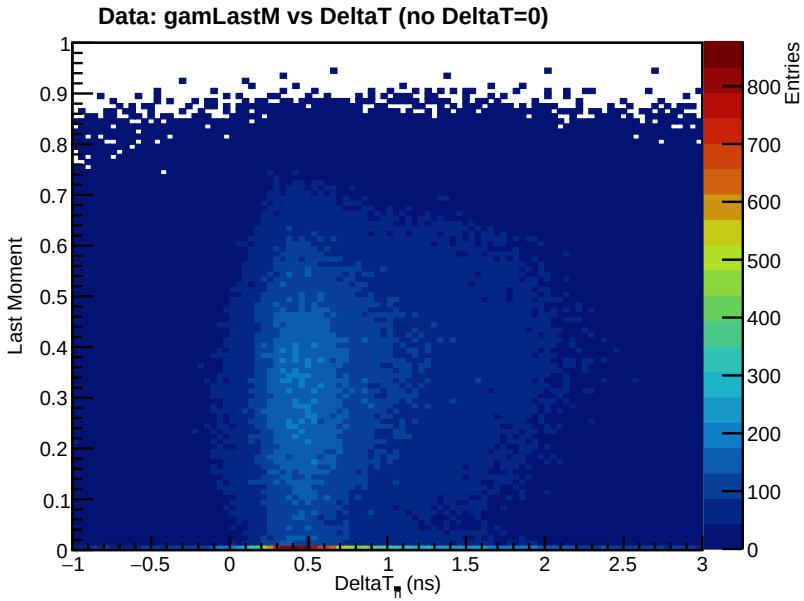


Blue: Simulation; Red: Data.

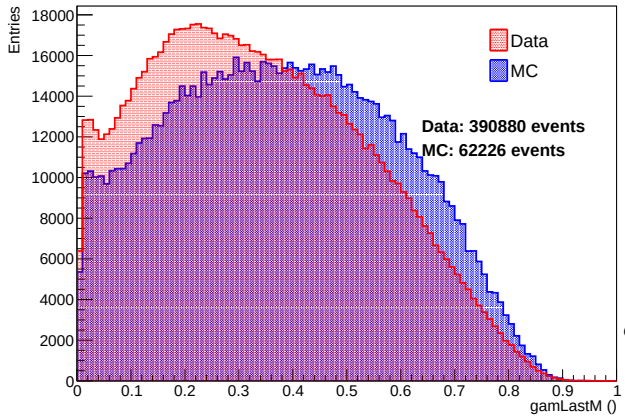
energy deposited in the 3×3 crystalcentered on the seed crystal.

Lateral moment vs ΔT





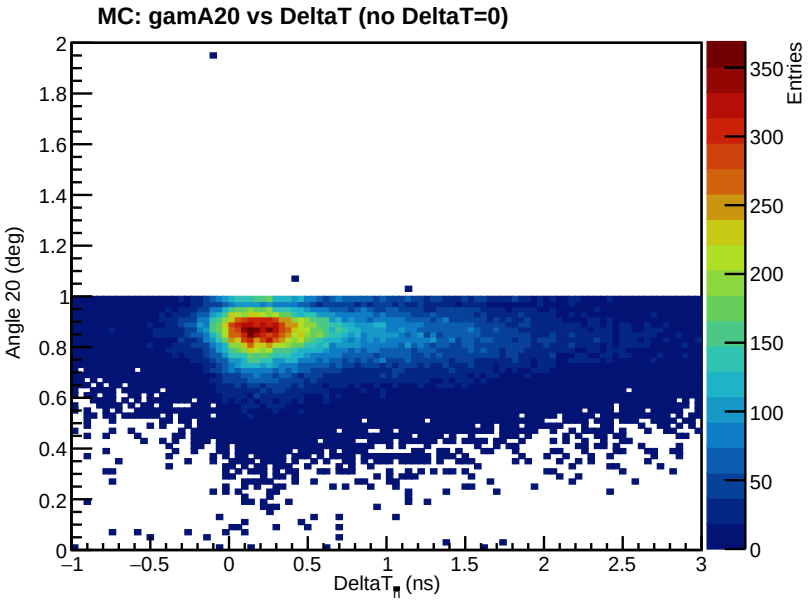
Lateral moment vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

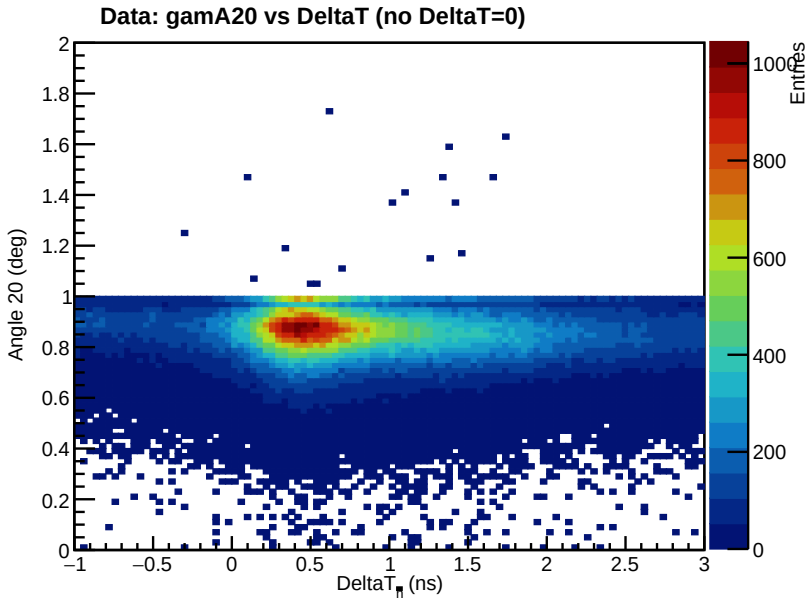


Blue: Simulation; Red: Data.

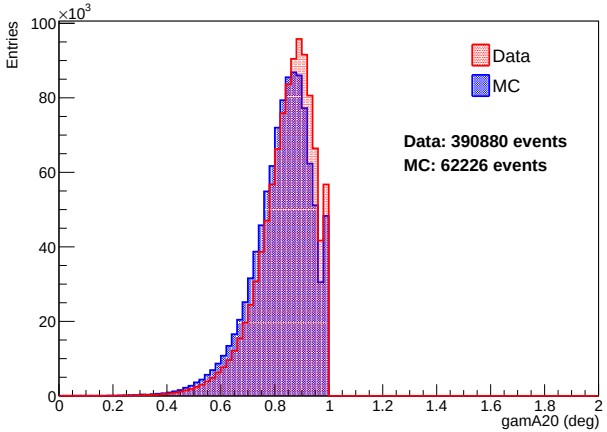
The lateral moment measures how the shower energy spreads sideways in the EMC crystals perpendicular to the shower direction.
one of the strongest γ/e^-–hadron discrimination variables at BESIII

A20 angle vs ΔT





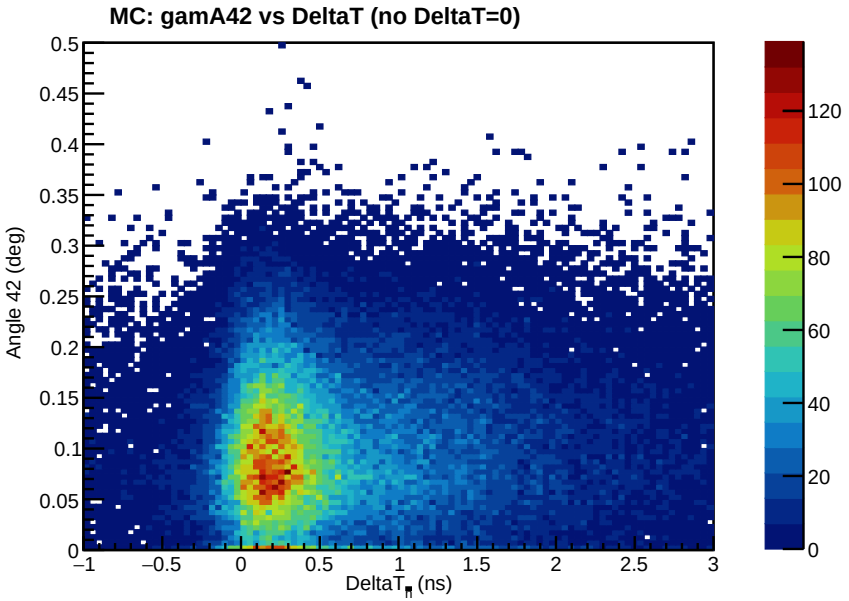
A20 angle vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.

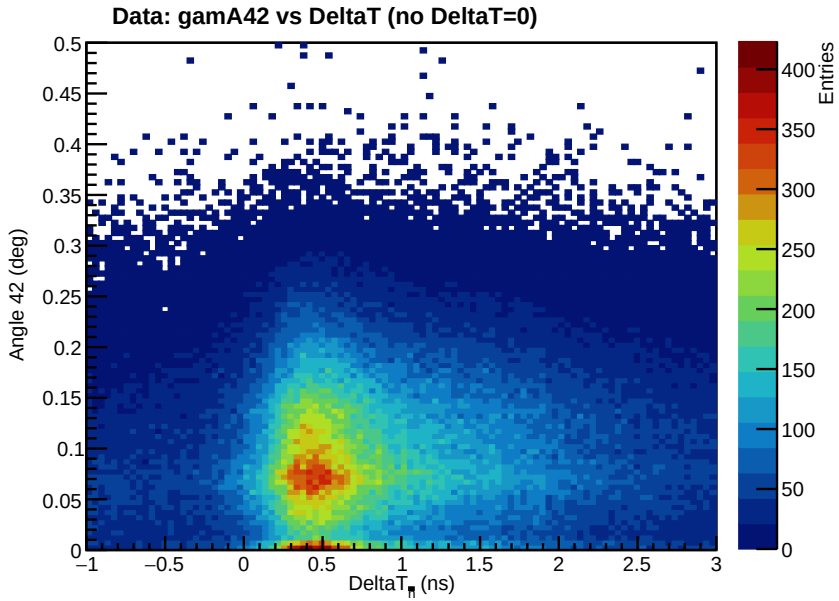


Blue: Simulation; Red: Data.

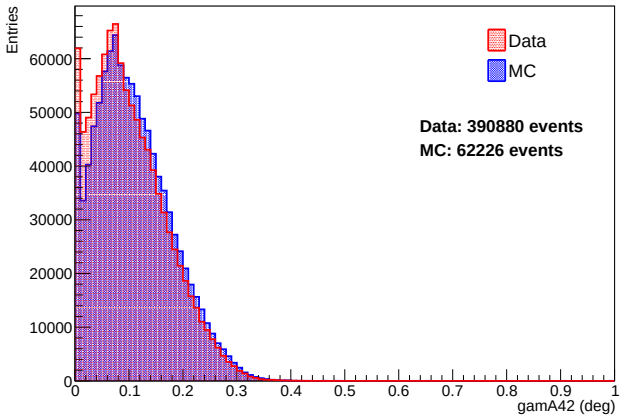
The angle between the vector from the interaction point to the seed crystal and the vector from the interaction point to the center of energy deposited in the 3×3 array.

A42 angle vs ΔT





A42 angle vs $\Delta T_{\bar{n}}$.
Left: Simulation; Right: Data.



Blue: Simulation; Red: Data.

Similar to A20 but calculated using a larger crystal array (typically 5×5 or similar).

Summary and Future work

- Future Work:
- submitted round05 run for more stats in data.
- fitting $\Delta T_{\bar{n}}$ for different Pmiss , E5x5 bins.
- Suggestions are welcome