

# Updates

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Thomas Jefferson National Accelerator Facility

for the GlueX Collaboration

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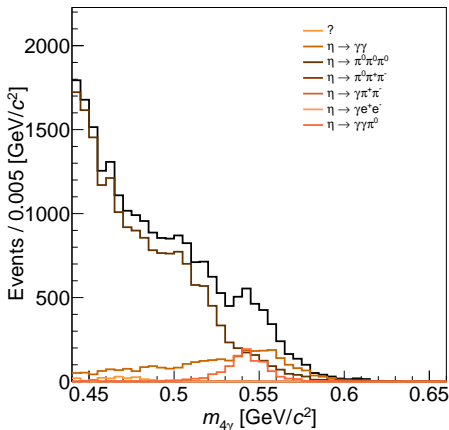


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- 2 Default vs Island cluster algo. and COG vs LOG
- 3 Thrown distance between neutral clusters at FCAL2 face
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# Selection criteria

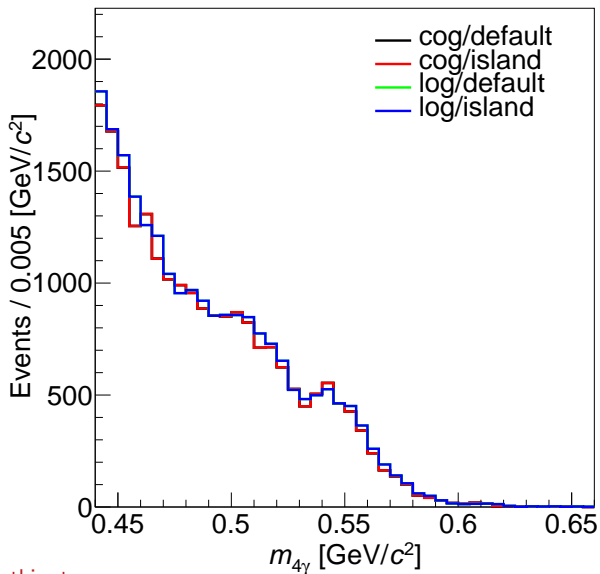
- 10M (tagged and un-tagged)  $\eta$  thrown decaying in 10 different modes according to their  $\mathcal{B}$
- Select events corresponding to  $\gamma p \rightarrow \eta p$  with  $\eta \rightarrow \gamma\gamma\pi^0$
- FCAL2 with default cluster algo. with COG



- Default ReactionFilter selection criteria applied +
- 4 neutrals and 1 track in sync. with RF
- Track originates from within the target
- 1 photon pair with invariant mass corresponding to  $\pi^0$
- Other pair of bachelor photons with invariant mass outside  $\pi^0$ -window

Large peaking  $\eta \rightarrow \gamma\gamma$  and non-peaking  $\eta \rightarrow \pi^0\pi^0\pi^0$  backgrounds

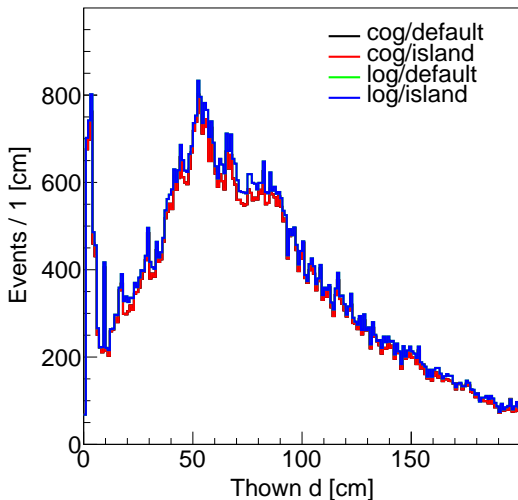
# Default vs Island cluster algo. and COG vs LOG



No difference at this stage

# Thrown distance between neutral clusters at FCAL2 face

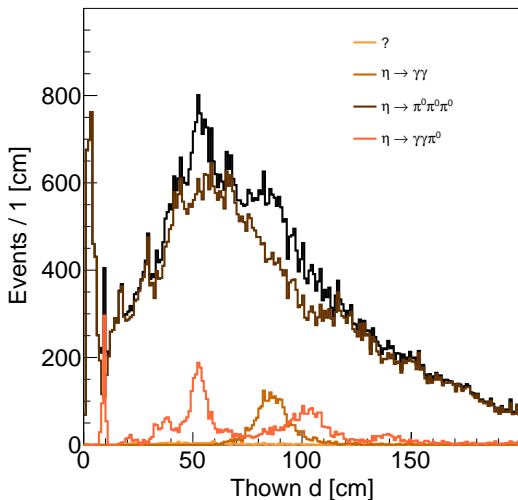
Same selection criteria +  $\eta$  mass cut



No difference at this stage

# Thrown distance between neutral clusters at FCAL2 face

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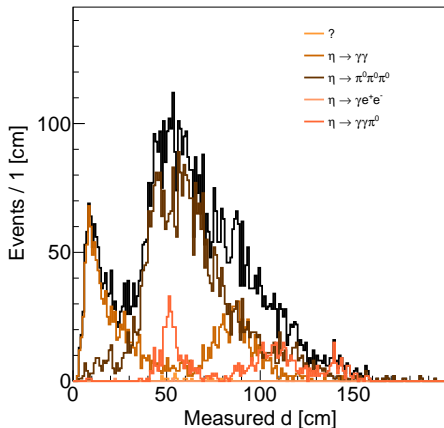
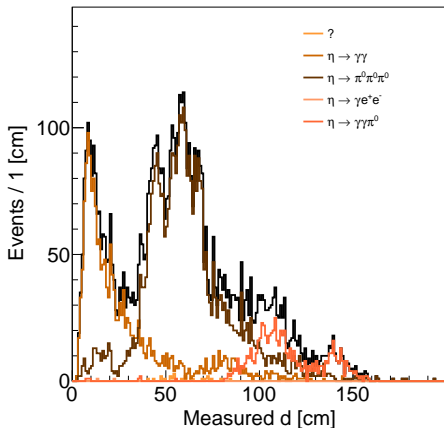
$3\pi^0$  backgrounds coming from cluster merging together

$2\gamma$  backgrounds coming from cluster splitting and gamma conversion

# Measured distance between neutral clusters at FCAL2 face

Same selection criteria +  $\eta$  mass cut

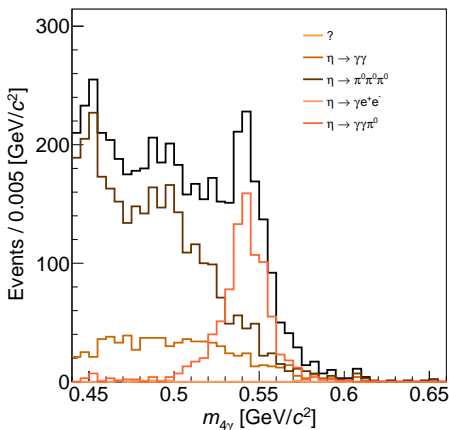
- Left: between two  $\gamma$  of  $\pi^0$
- Right: between two bachelor photons



Good separation between signal and background

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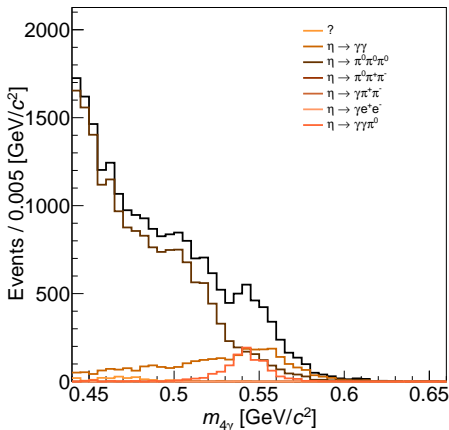
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- $d_{\gamma}^{\pi^0} \geq 100$  cm

Non-peaking  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^0\pi^0\pi^0$  backgrounds



# Selection criteria

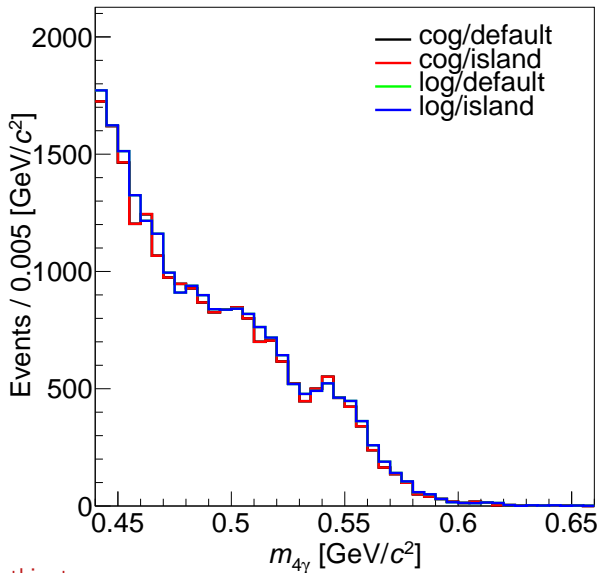
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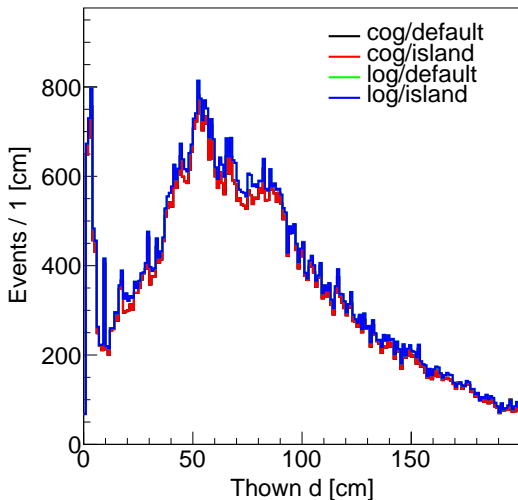
# Default vs Island cluster algo. and COG vs LOG



No difference at this stage

# Thrown distance between neutral clusters at FCAL2 face

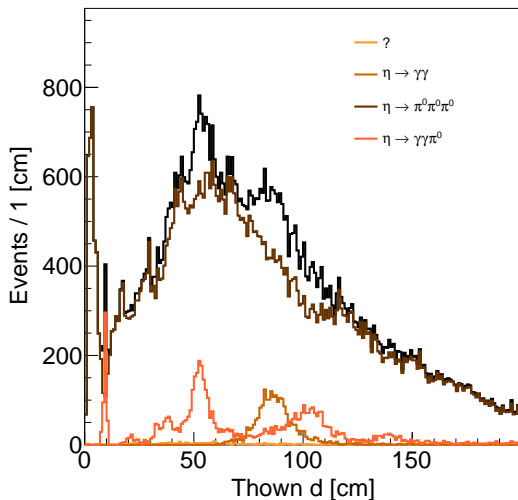
Same selection criteria +  $\eta$  mass cut



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Same selection criteria +  $\eta$  mass cut

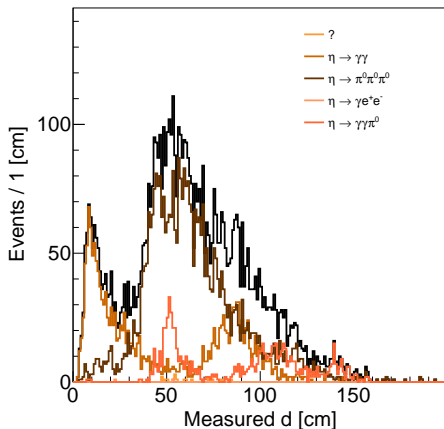
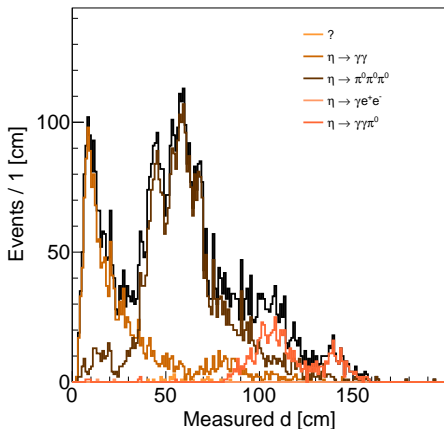


$3\pi^0$  backgrounds coming from cluster merging together

$2\gamma$  backgrounds coming from cluster splitting and gamma conversion

# Measured distance between neutral clusters at FCAL2 face

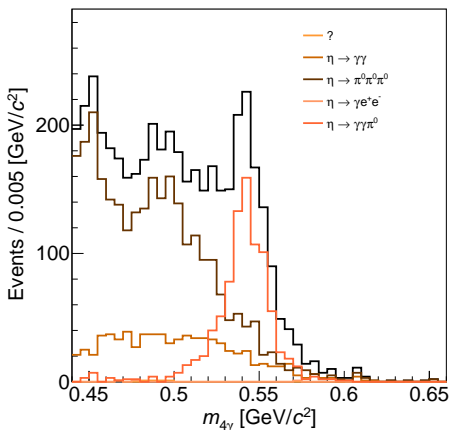
- Left: between two  $\gamma$  of  $\pi^0$
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Good separation between signal and background

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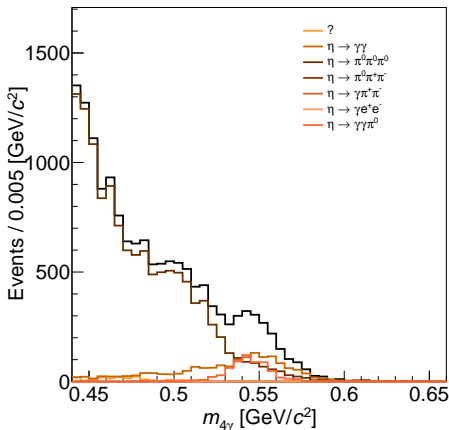


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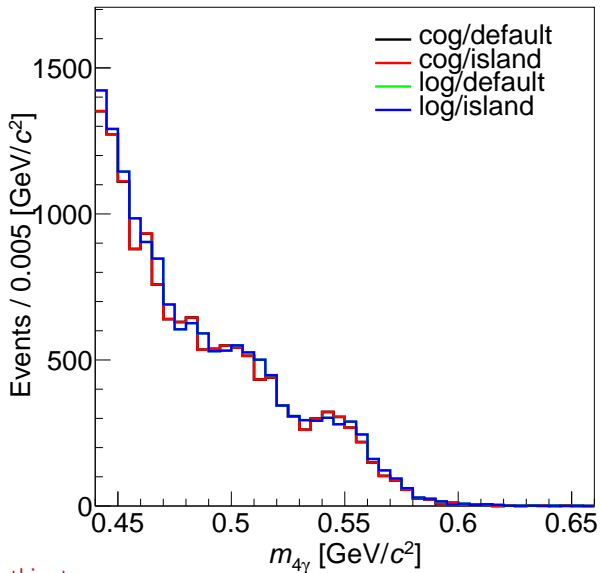
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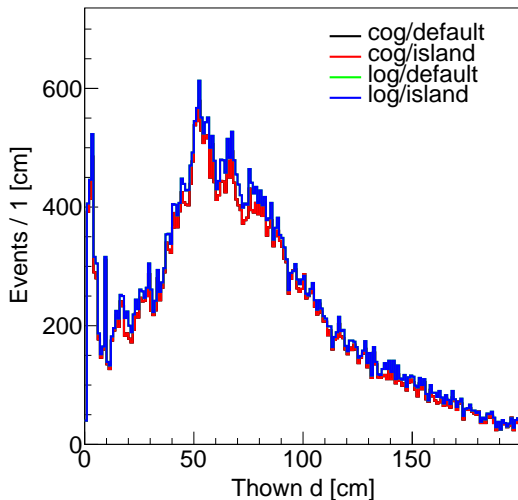


No difference at this stage



# Thrown distance between neutral clusters at FCAL2 face

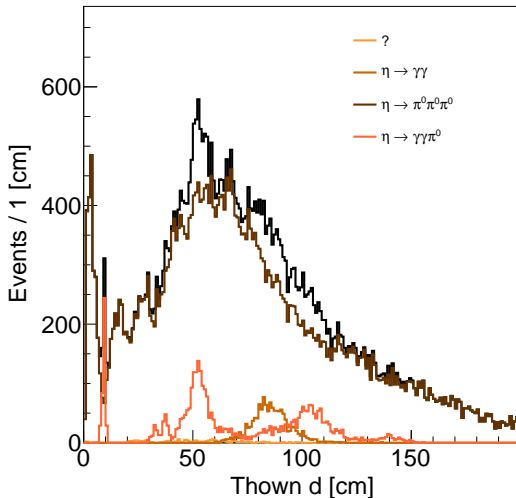
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Same selection criteria +  $\eta$  mass cut



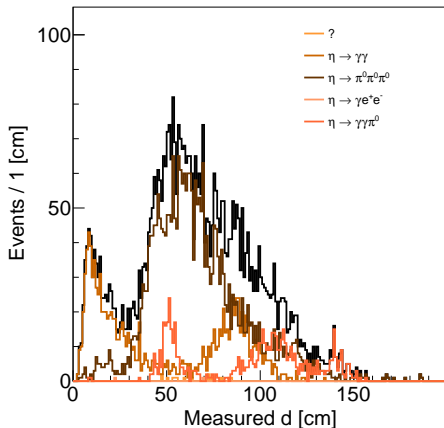
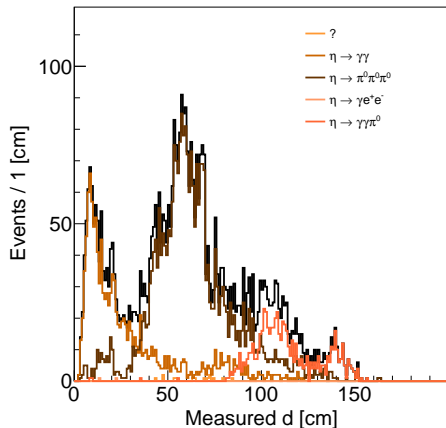
$3\pi^0$  backgrounds coming from cluster merging together

$2\gamma$  backgrounds coming from cluster splitting and gamma conversion

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Same selection criteria +  $\eta$  mass cut

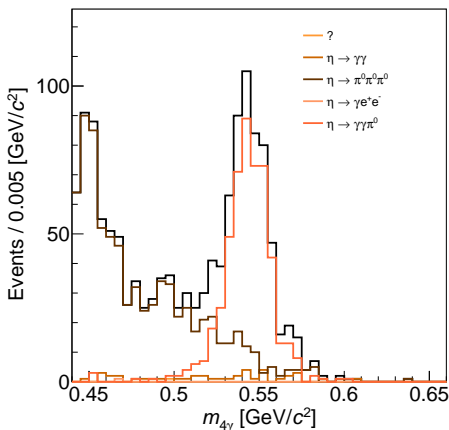
- Left: between two  $\gamma$  of  $\pi^0$
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Good separation between signal and background

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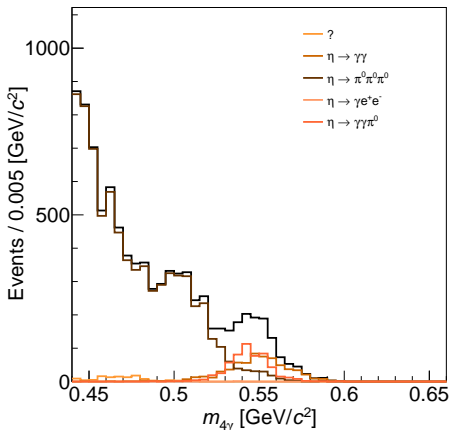


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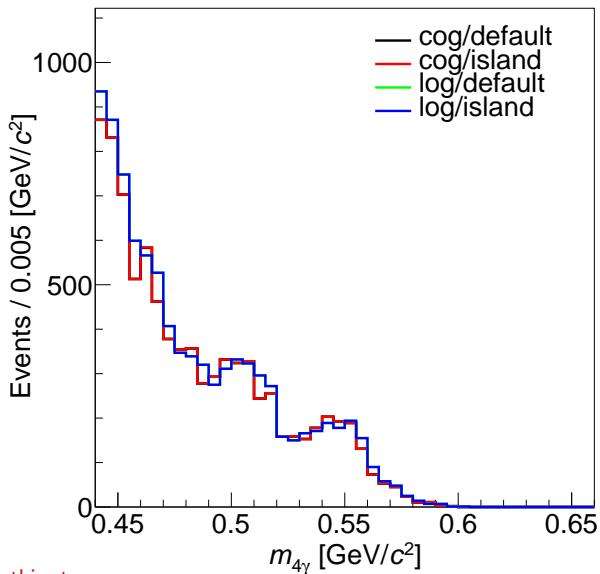
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- Kin. fit  $\chi^2 \leq 5$

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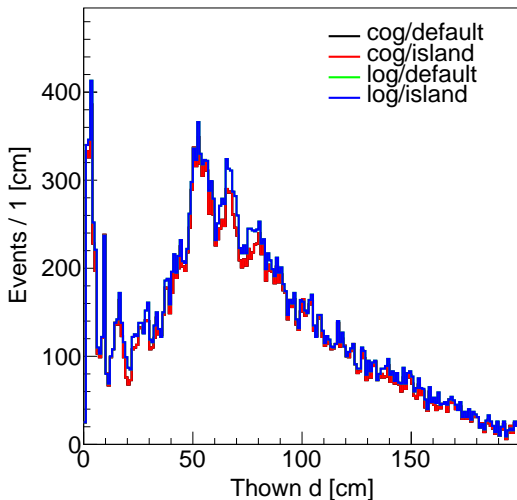
# Default vs Island cluster algo. and COG vs LOG



No difference at this stage

# Thrown distance between neutral clusters at FCAL2 face

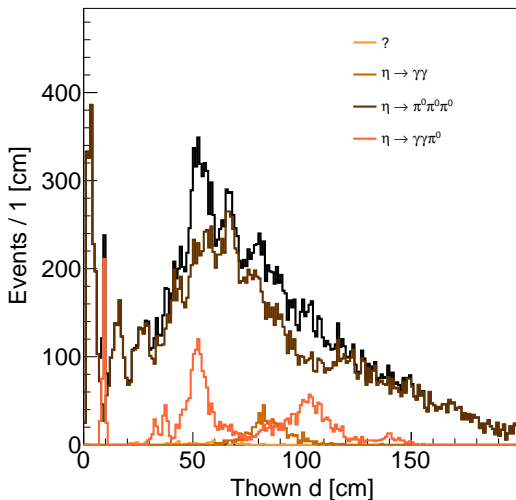
Same selection criteria +  $\eta$  mass cut



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Same selection criteria +  $\eta$  mass cut



$3\pi^0$  backgrounds coming from cluster merging together

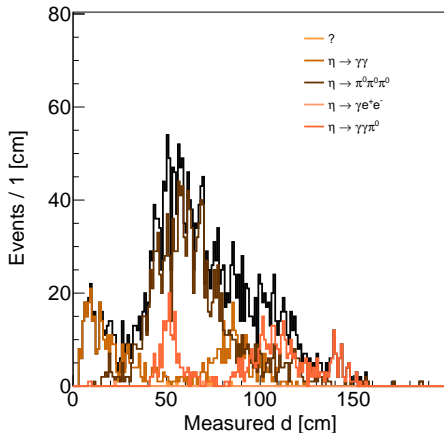
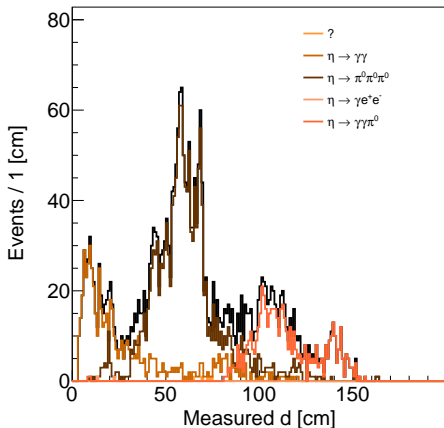
$2\gamma$  backgrounds coming from cluster splitting and gamma conversion



# Measured distance between neutral clusters at FCAL2 face

Same selection criteria +  $\eta$  mass cut

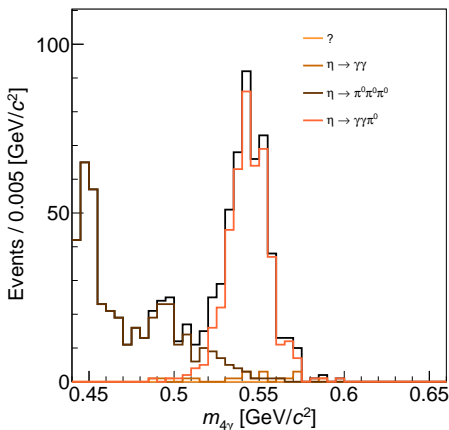
- Left: between two  $\gamma$  of  $\pi^0$
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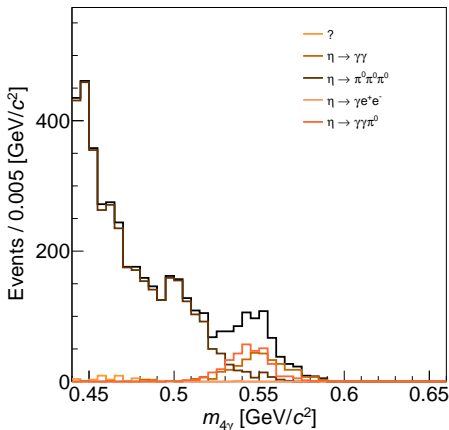


Non-peaking  $\eta \rightarrow \gamma\gamma$  and  $\eta \rightarrow \pi^0\pi^0\pi^0$  backgrounds

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- Kin. fit  $\chi^2 \leq 5$
- $d_{\gamma}^{\pi^0} \geq 100$  cm

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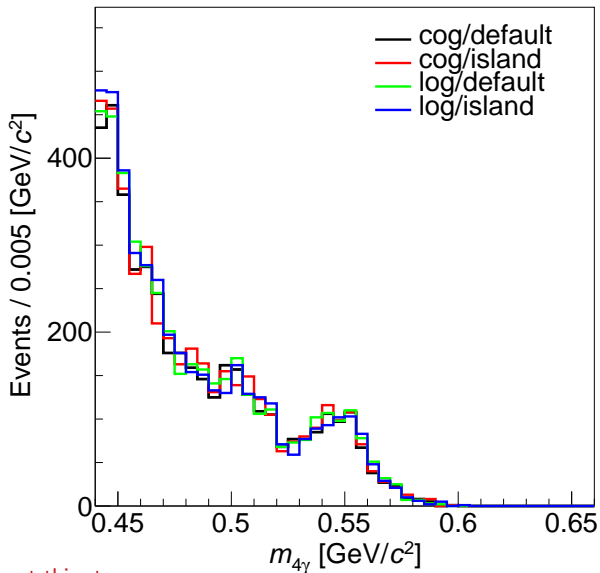
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- Coplanarity between  $\eta$  and p

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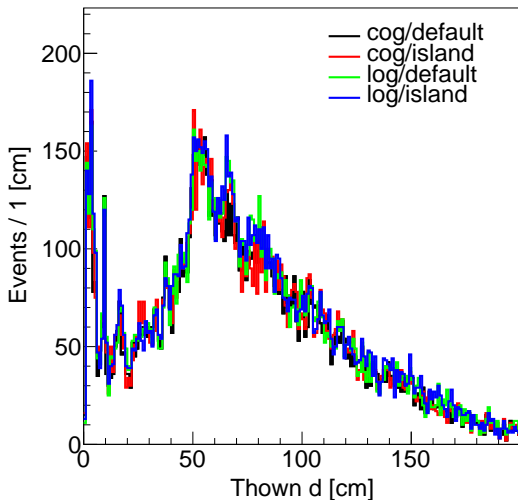
# Default vs Island cluster algo. and COG vs LOG



Small differences at this stage

# Thrown distance between neutral clusters at FCAL2 face

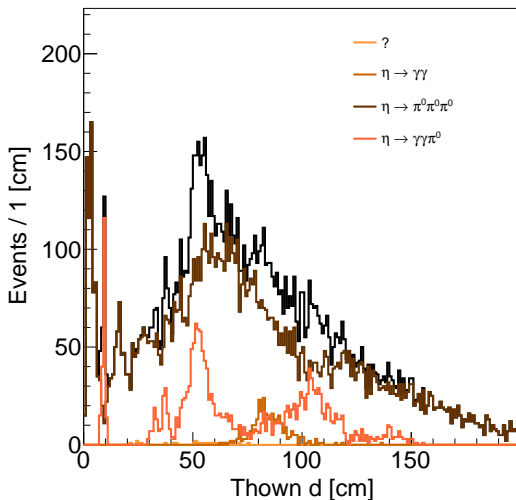
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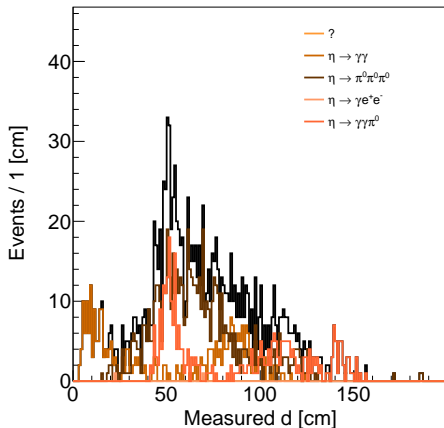
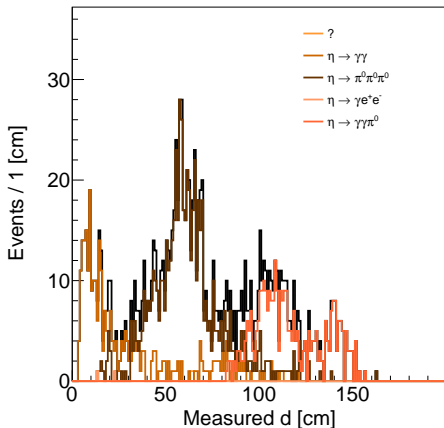
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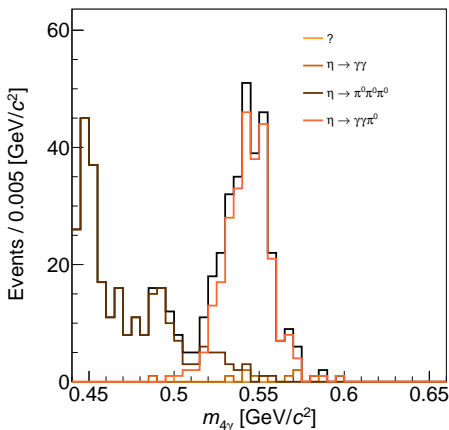
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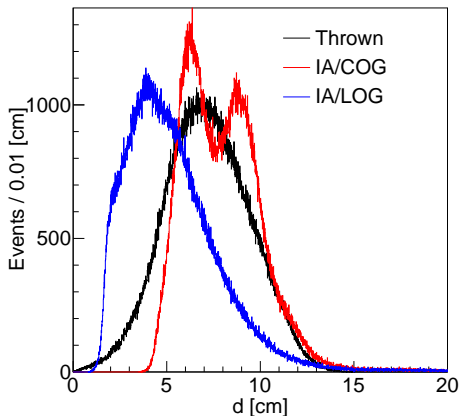
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# Conclusion

- Cluster algo. is doing a great job below 15 cm
- Luckily, reaction kinematic is favorable



- Two photons of 2 and 3 GeV thrown simultaneously into FCAL2
- Two clusters (only) events