

$\eta \rightarrow \pi^0 \gamma \gamma$, selection criteria

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for the GlueX and JEF experiments

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Selection criteria

10 possible variables identified (so far)

- χ^2
- Coplanarity between η and p
- Mass conservation
- Extra energy
- Unused tracks
- $\pi^0\gamma\gamma$ invariant mass
- Cluster number below 4.5°
- Vertex z and r
- Proton momentum

optimized by the Figure-Of-Merit (FOM), $N_{\text{sig}}/\sqrt{N_{\text{sig}} + N_{\text{bkg}}}$

- Signal, sig: $\eta \rightarrow \pi^0\gamma\gamma$, BR = 0.00027
 - ▶ genEtaRegge, 1M events thrown
 - ▶ $N_{\text{sig}} = N_{\text{rec}} \times BR(\eta \rightarrow \pi^0\gamma\gamma)/BR(\eta \rightarrow \pi^0\pi^0\pi^0)$
- Background, bkg: $\eta \rightarrow \pi^0\pi^0\pi^0$, BR = 0.3257
 - ▶ genEtaRegge, 1M events thrown
 - ▶ $N_{\text{sig}} = N_{\text{rec}}'$
- FOM for each $m_{\gamma\gamma}$

Selection criteria individual effect

• JEF

Selection criteria	$\pi^0\gamma\gamma$	$\pi^0\pi^0\pi^0$	0.01	0.05	0.1	0.2	0.3	0.4
χ^2	37.2939	0.0125739	42.912	49.6509	46.5465	49.3675	45.0621	40.9101
η mass	57.7636	0.29415	54.3901	61.6631	53.247	56.3289	54.349	57.0939
Extra energy	87.0665	3.50772	81.4739	87.2083	83.636	86.3082	86.2306	85.8524
Insert cluster #	13.4118	13.0171	7.26749	10.6096	10.319	12.7841	13.0609	7.22132
Coplanarity	77.079	27.290	73.8225	81.1225	77.2915	78.6463	76.7438	76.89078
Unused tracks	97.3437	94.1531	94.8914	97.6763	97.1152	97.5583	97.5463	97.6232
Vertex R	98.4515	99.1361	98.5727	98.5609	98.4881	98.4807	98.4593	98.3794
Vertex z	98.985	99.4657	99.0886	98.9905	99.0046	98.9819	98.9754	98.9266

• GlueX

Selection criteria	$\pi^0\gamma\gamma$	$\pi^0\pi^0\pi^0$	0.01	0.05	0.1	0.2	0.3	0.4
χ^2	43.672	0.0112184	37.2339	40.8227	38.847	41.2701	36.9526	31.8757
η mass	52.823	0.225907	59.969	65.3512	56.3317	59.335	58.5022	60.3857
Extra energy	84.7308	3.78774	86.5824	89.2825	85.5537	87.7503	87.9114	87.6146
Insert Cluster #	10.9807	12.0343	9.03417	12.6199	12.0863	13.7393	14.2095	8.9927
Coplanarity	76.832	27.6318	76.4711	81.2351	77.5681	78.5437	76.8432	76.5972
Unused tracks	97.1863	93.9026	94.4392	97.6277	97.0667	97.5946	97.4696	97.5548
Vertex z	98.4894	98.9763	99.0886	98.9905	99.0046	98.9819	98.9754	98.9266
Vertex R	98.6571	99.3196	98.5727	98.5609	98.4881	98.4807	98.4593	98.3794

Proposed logo version 2

