

Check of Vertex Fit of K_S^0

- Tag mode
- Event selection
- Comparison of Vertex Fit
- Comparison of Refine Vertex Fit
- Comparison between Vertex Fit and Refine Vertex Fit
- Data quantity

Tag mode

➤ Tag mode:

$$\text{➤ } D^0 \rightarrow K^- \pi^+$$

$$\text{➤ } D^0 \rightarrow K^- \pi^+ \pi^0$$

$$\text{➤ } D^0 \rightarrow K^- \pi^+ \pi^+ \pi^-$$

$$\text{➤ } D^+ \rightarrow K^- \pi^+ \pi^+$$

➤ Signal mode:

$$\text{➤ } D^0 \rightarrow K_S^0 \pi^+ \pi^-$$

$$\text{➤ } D^0 \rightarrow K_S^0 \pi^+ \pi^- \pi^0$$

$$\text{➤ } D^0 \rightarrow K_S^0 \pi^0$$

$$\text{➤ } D^+ \rightarrow K_S^0 \pi^+$$

$$\text{➤ } D^+ \rightarrow K_S^0 \pi^+ \pi^0$$

$$\text{➤ } D^+ \rightarrow K_S^0 \pi^+ \pi^+ \pi^-$$

Event Selection

Based on DTagAlg Package in BOSS 710

➤ Good charged tracks:

- $|V_z| \leq 10cm, |V_{xy}| \leq 10cm, |\cos\theta| \leq 0.93$

➤ Good Photons:

- Barrel : $E_\gamma > 0.025GeV, |\cos\theta| \leq 0.8$
- Endcap : $E_\gamma > 0.05GeV, 0.84 \leq |\cos\theta| \leq 0.92$
- Time cut: $0 \leq T \leq 14$ (in unit of 50 ns);
- $|\text{dang}| > 10^\circ$;

➤ PID (Particle ID Package):

- TOF + dE/dx
- Pion : $\text{prob}(\pi) > \text{prob}(K)$;
- Kaon: $\text{prob}(K) > \text{prob}(\pi)$;

➤ π^0 Candidates :

- $\pi^0 : 0.115 < M(\gamma\gamma) < 0.150 \text{ GeV}/c^2, X^2_{1c} < 200$;

➤ Tag D Reconstruction:

- $\Delta E = E_D - E_{beam}, M_{bc} = \sqrt{E_{beam}^2 - \vec{P}_D^2}$
- ΔE cut: no π^0 : $(-0.025, 0.025) \text{ GeV}$
with π^0 : $(-0.055, 0.040) \text{ GeV}$
- $D^0: 1.86 \leq M_{bc} \leq 1.87 \text{ GeV}/c^2$
 $D^+: 1.865 \leq M_{bc} \leq 1.875 \text{ GeV}/c^2$

➤ Missing K_S^0 Candidates :

- $P_{sigD} = \sqrt{E_{beam}^2 - M_D^2}; \hat{P}_{sigD} = -\hat{P}_D$;
- P_{trk} : track in signal mode except K_S^0 (such as $\pi^\pm\pi^0$)
- $M_{miss} =$

$$\sqrt{\left(E_{beam} - \sum E_{trk}\right)^2 - \left(\vec{P}_{sigD} - \sum \vec{P}_{trk}\right)^2}$$

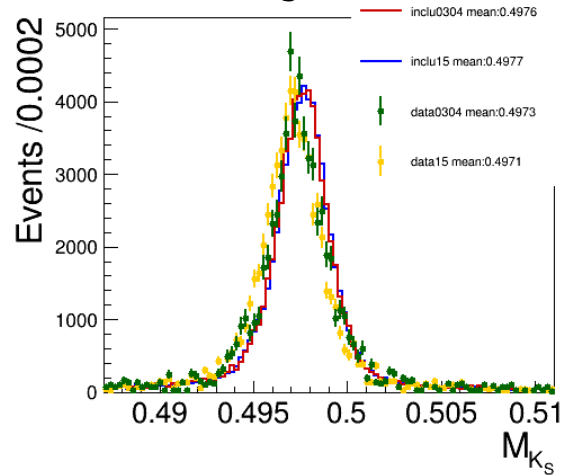
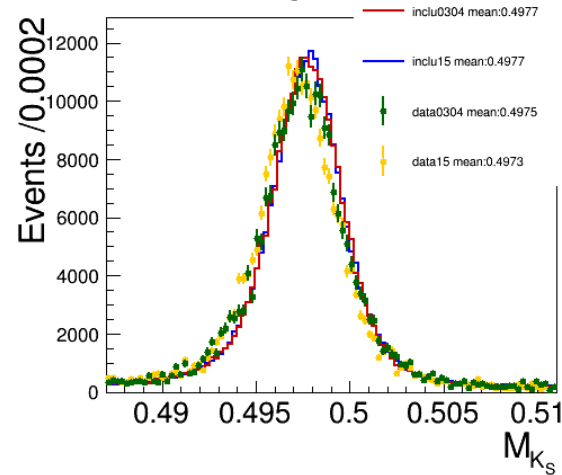
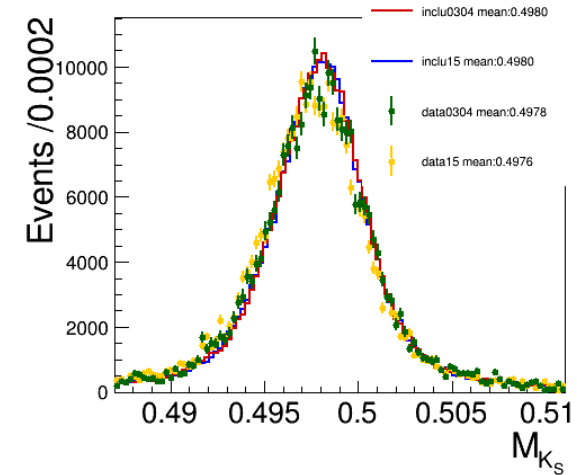
- $\Delta M = M_{miss} - M_{K_S^0}$
- Minimum ΔM is used to select best candidate

➤ Vertex Fit Candidates of K_S^0 :

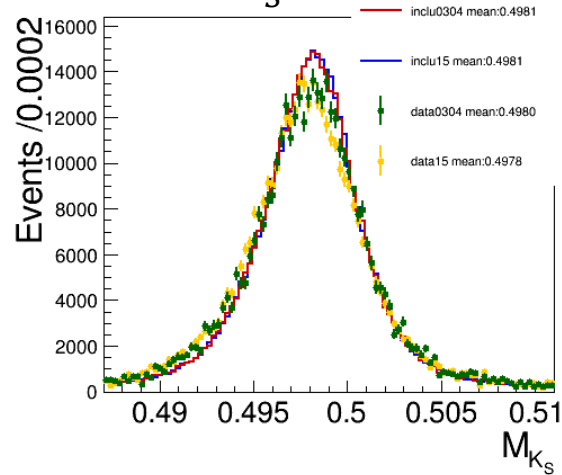
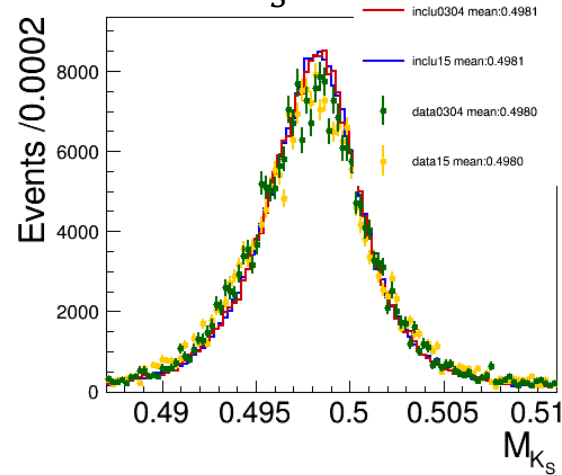
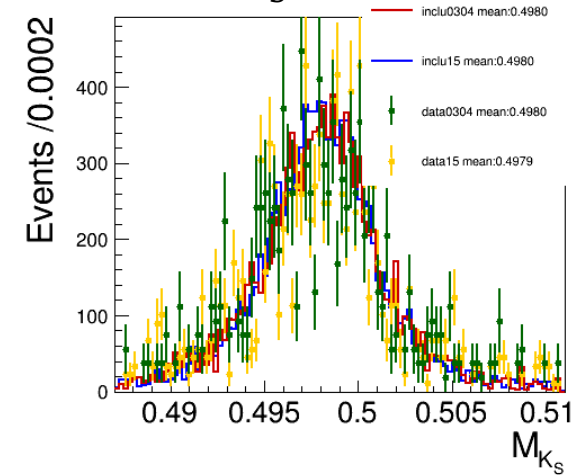
- Reconstructed by $\pi^+\pi^-$;
- $\Delta E_{sig} = E_{sigD} - E_{beam}, M_{bcsig} = \sqrt{E_{beam}^2 - \vec{P}_{sigD}^2}$
- Minimum ΔE_{sig} is used to select best candidate
- ΔE_{sig} cut: no π^0 : $(-0.025, 0.025) \text{ GeV}$
with π^0 : $(-0.055, 0.040) \text{ GeV}$
- $D^0: 1.86 \leq M_{bcsig} \leq 1.87 \text{ GeV}/c^2$
 $D^+: 1.865 \leq M_{bcsig} \leq 1.875 \text{ GeV}/c^2$

Vertex fit

Vertex Fit

 M_{K_S} $0.0 \leq P_{K_S^0} \leq 0.2 \text{ GeV}/c^2$  $\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \ L/err > 2$ $0.2 \leq P_{K_S^0} \leq 0.4 \text{ GeV}/c^2$  $0.4 \leq P_{K_S^0} \leq 0.6 \text{ GeV}/c^2$ 

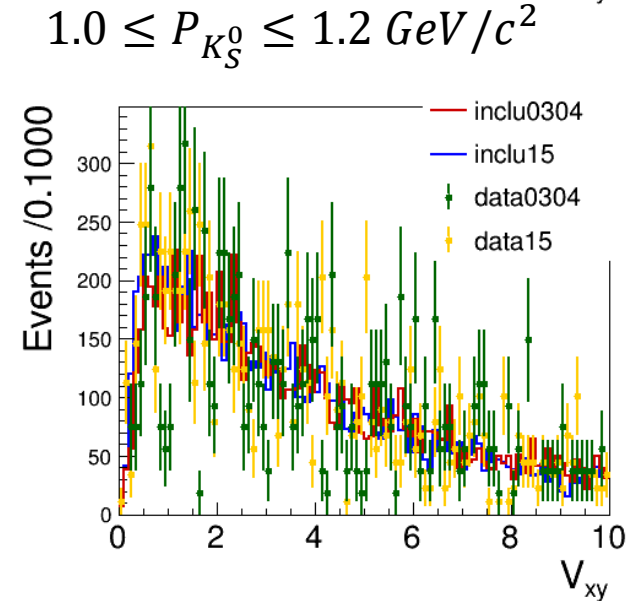
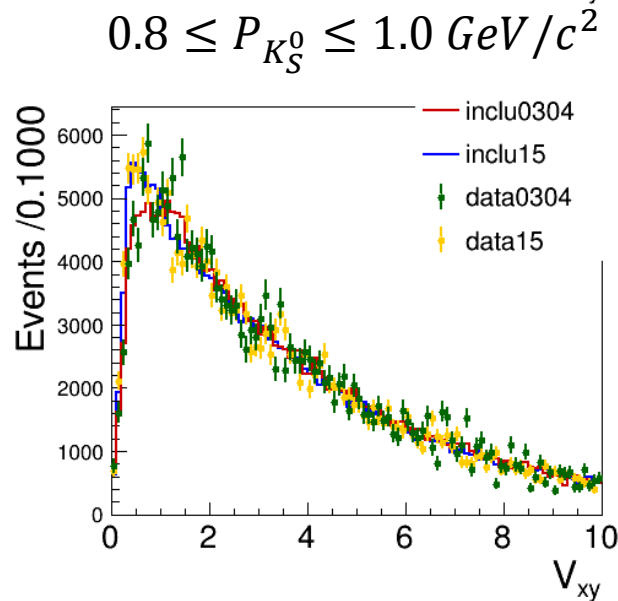
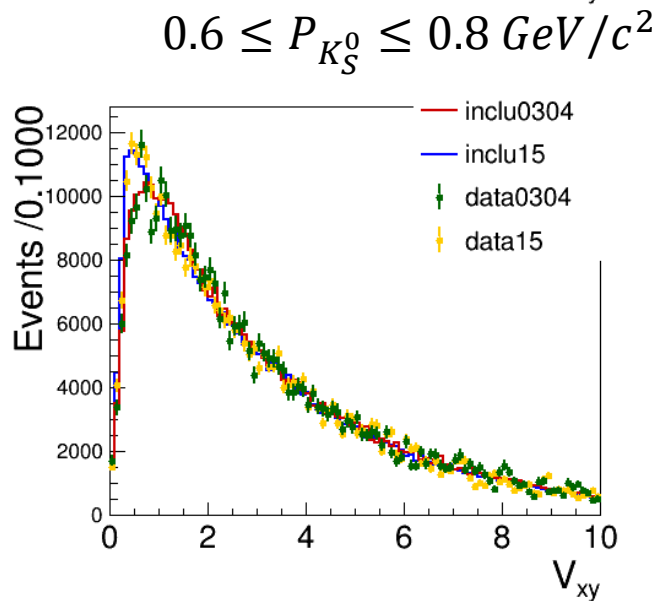
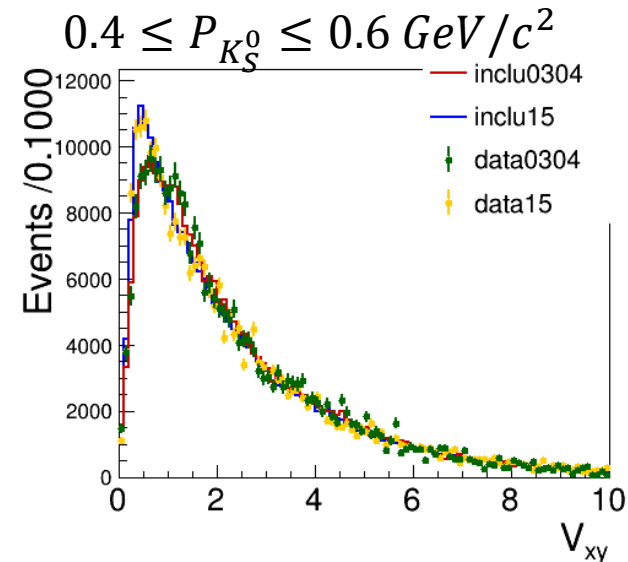
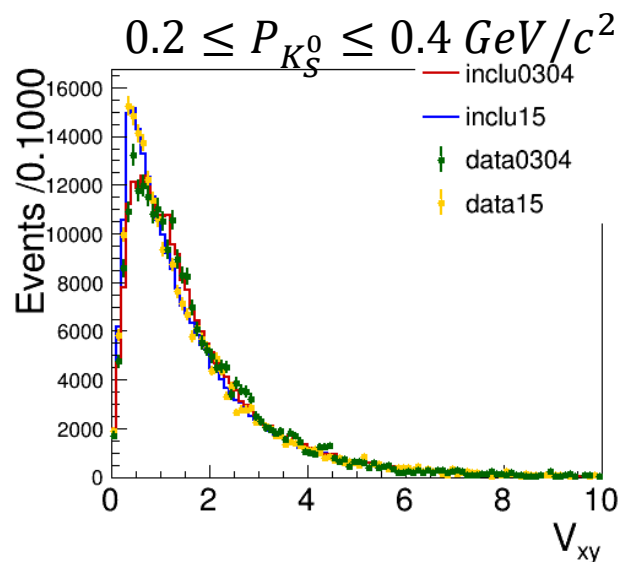
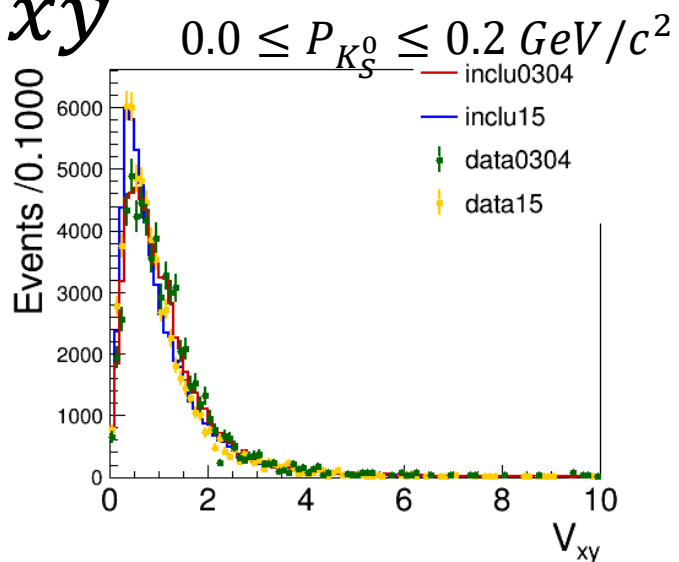
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— inclu15
— data0304
— data15

 $0.6 \leq P_{K_S^0} \leq 0.8 \text{ GeV}/c^2$  $0.8 \leq P_{K_S^0} \leq 1.0 \text{ GeV}/c^2$  $1.0 \leq P_{K_S^0} \leq 1.2 \text{ GeV}/c^2$ 

Vertex Fit

V_{xy}

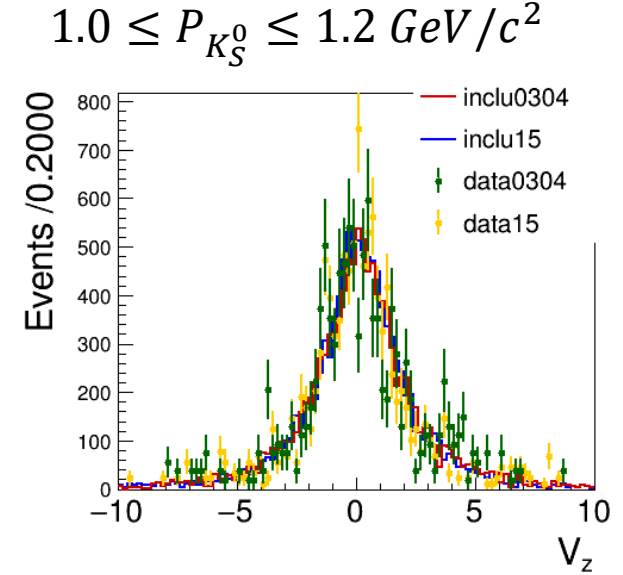
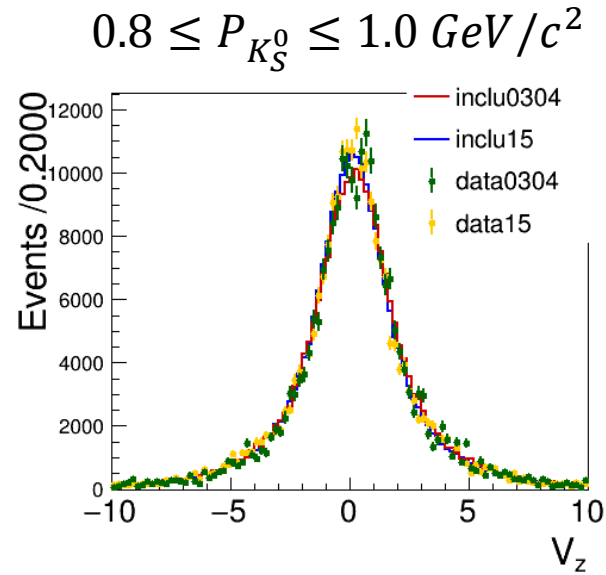
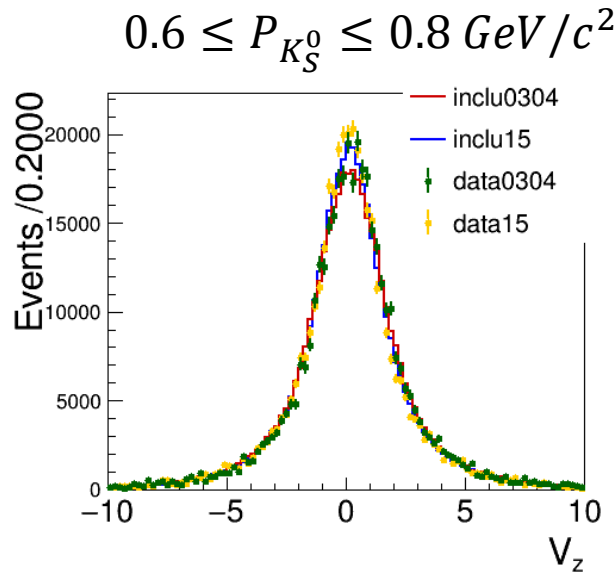
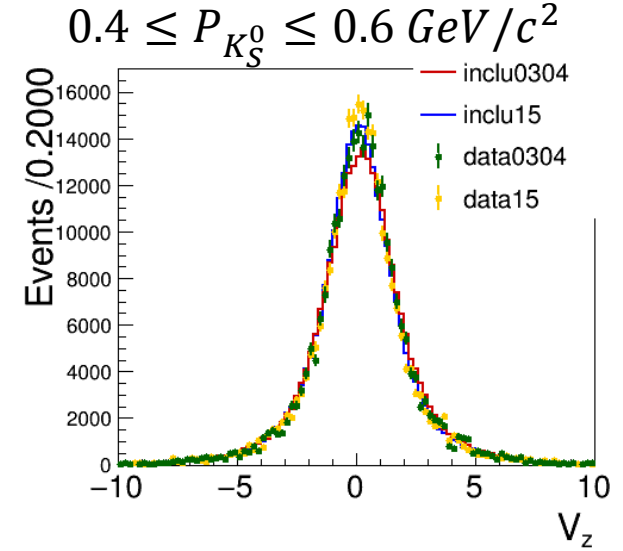
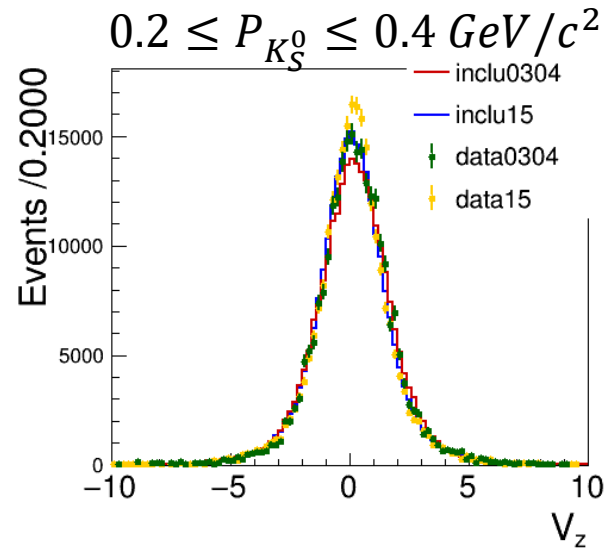
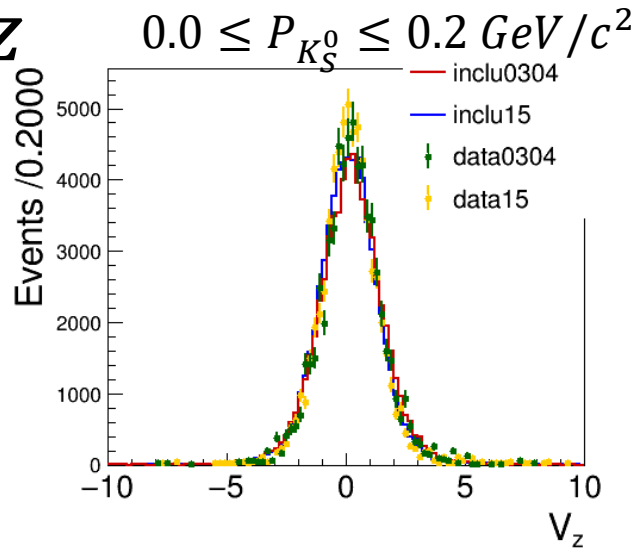
$$\chi^2_{1st} & \chi^2_{2rd} < 200 \quad 0.511 > M_{K_S} > 0.487 \quad L/err > 2$$



Vertex Fit

V_z

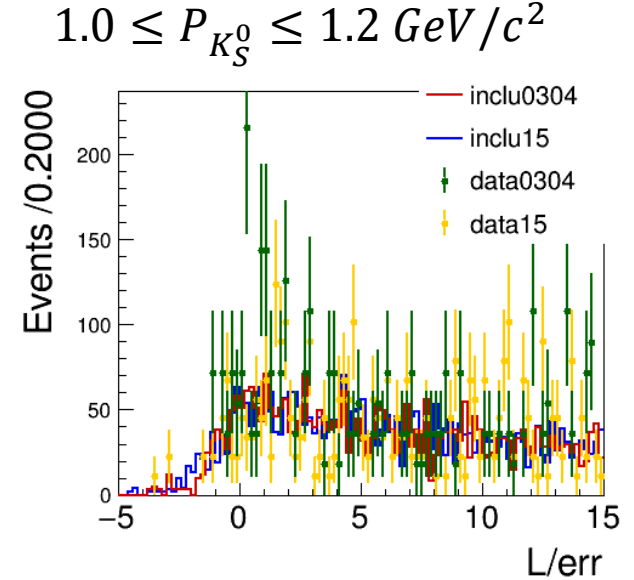
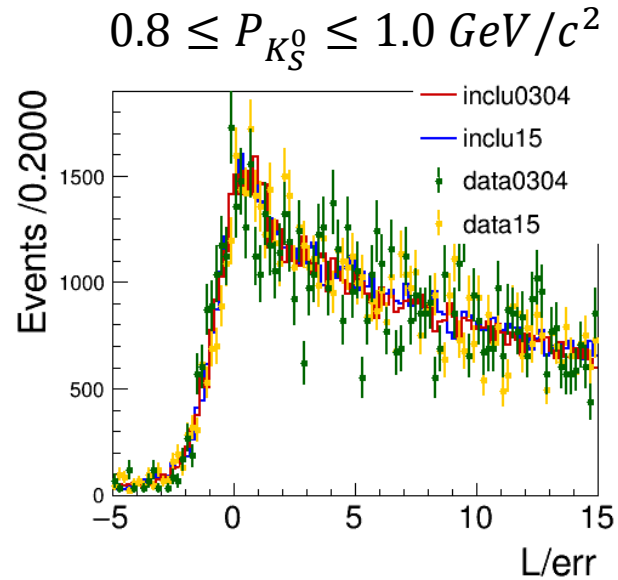
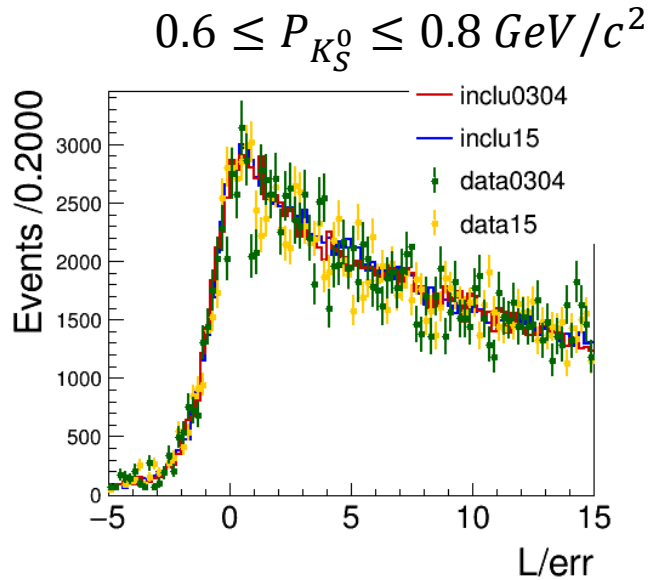
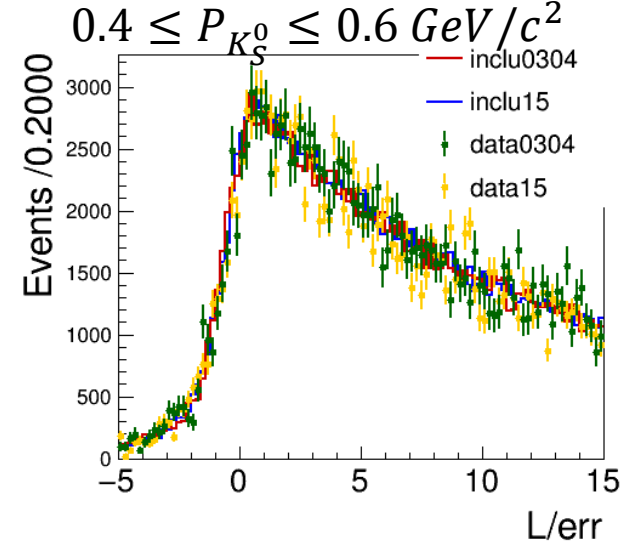
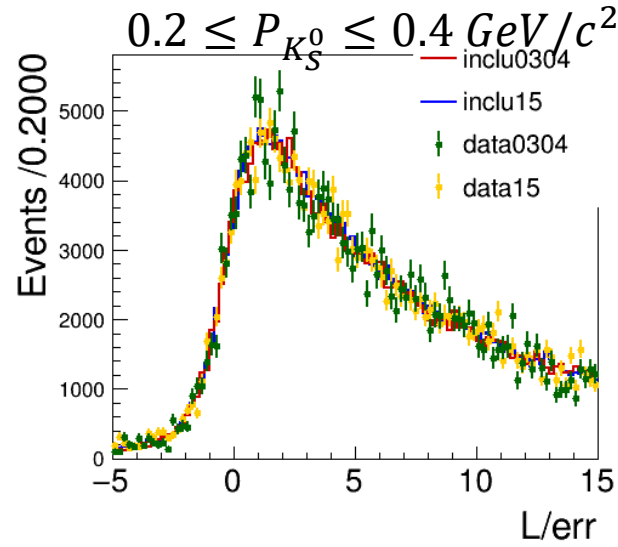
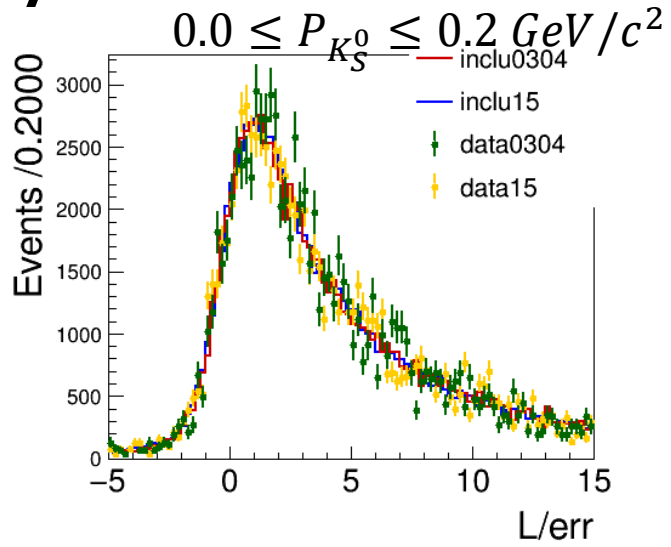
$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487 \quad L/err > 2$$



Vertex Fit

$$\chi_{1st}^2 \& \chi_{2nd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487$$

L/err

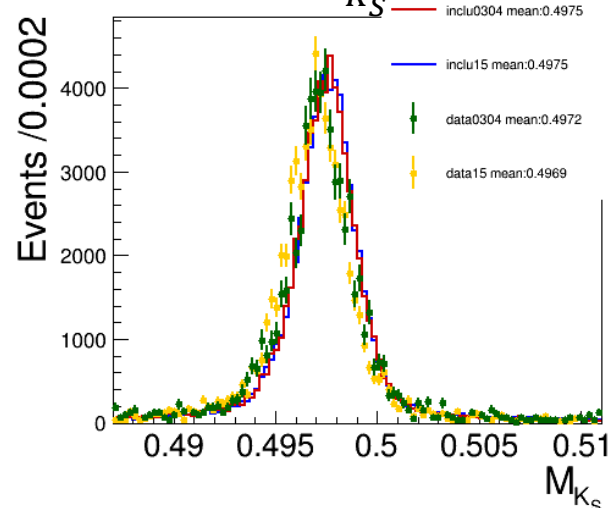


Refine Vertex fit

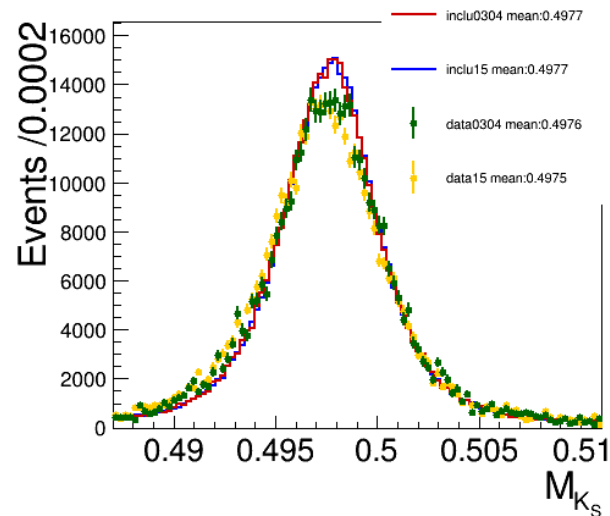
Refine Vertex Fit

$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad L/err > 2$$

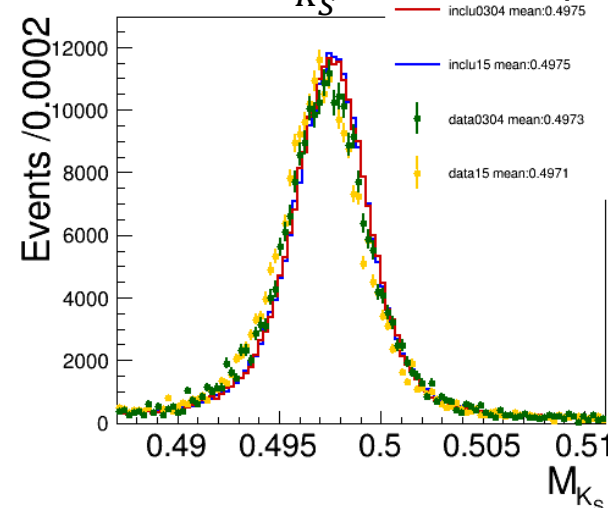
M_{K_S} $0.0 \leq P_{K_S^0} \leq 0.2 \text{ GeV}/c^2$



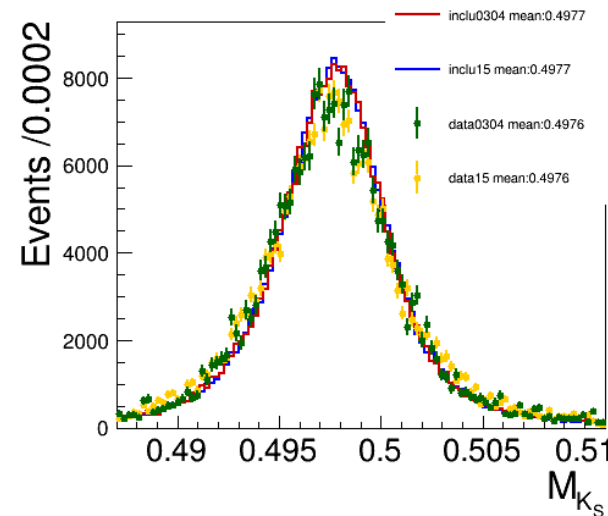
$0.6 \leq P_{K_S^0} \leq 0.8 \text{ GeV}/c^2$



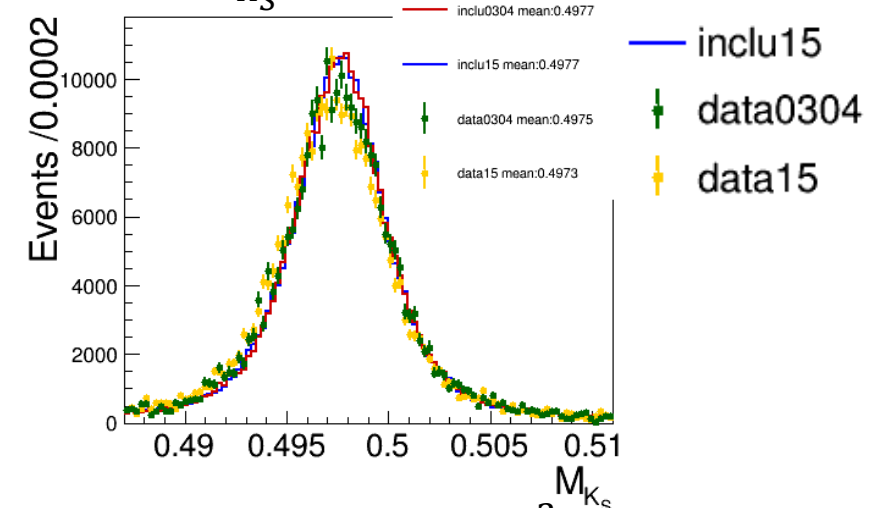
$0.2 \leq P_{K_S^0} \leq 0.4 \text{ GeV}/c^2$



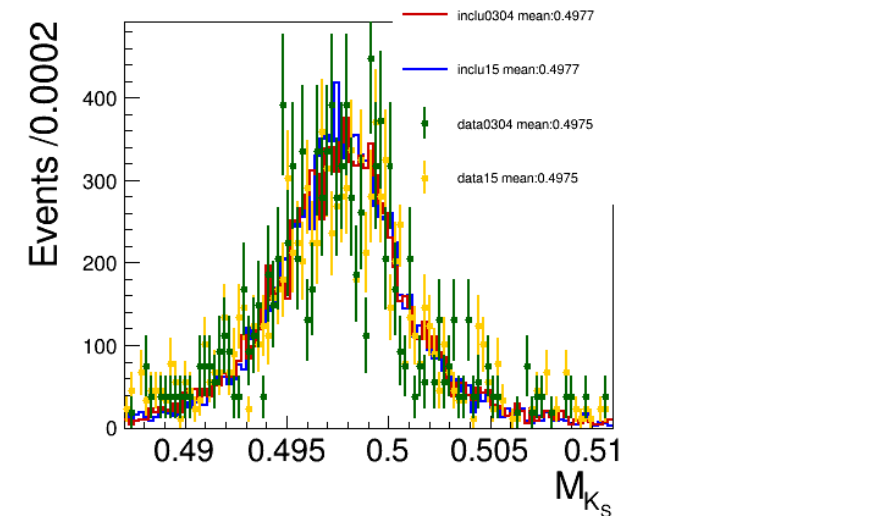
$0.8 \leq P_{K_S^0} \leq 1.0 \text{ GeV}/c^2$



$0.4 \leq P_{K_S^0} \leq 0.6 \text{ GeV}/c^2$



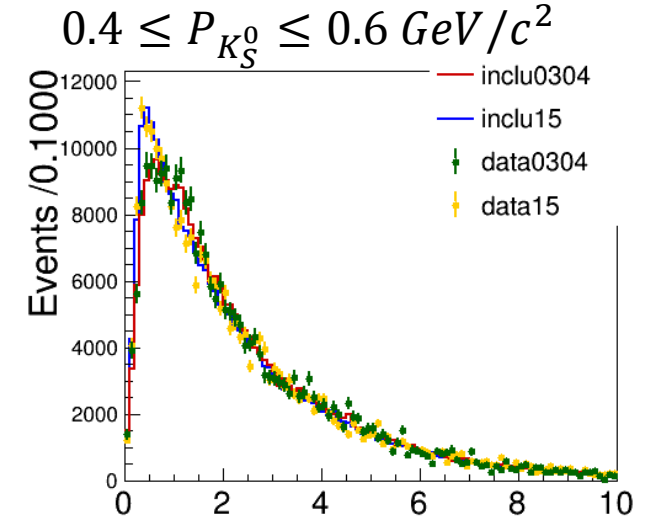
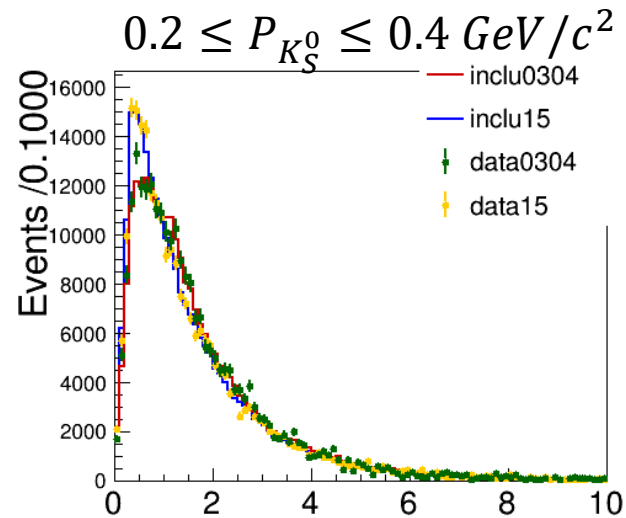
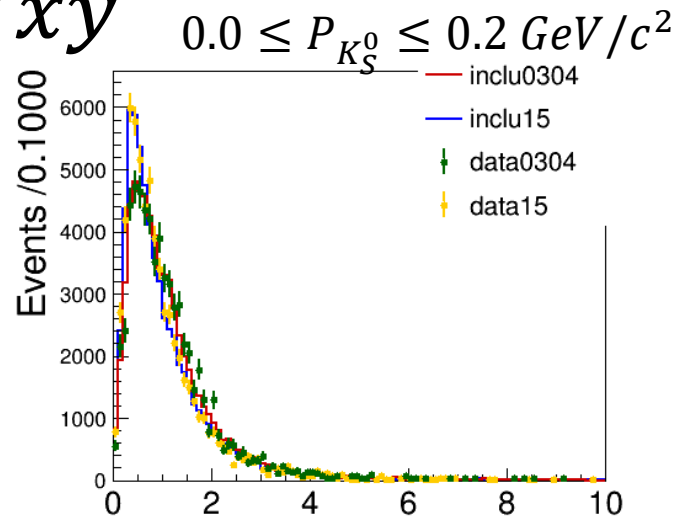
$1.0 \leq P_{K_S^0} \leq 1.2 \text{ GeV}/c^2$



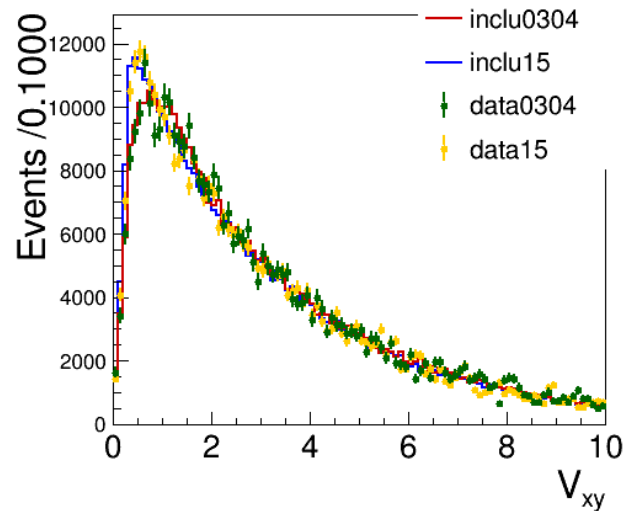
Refine Vertex Fit

V_{xy}

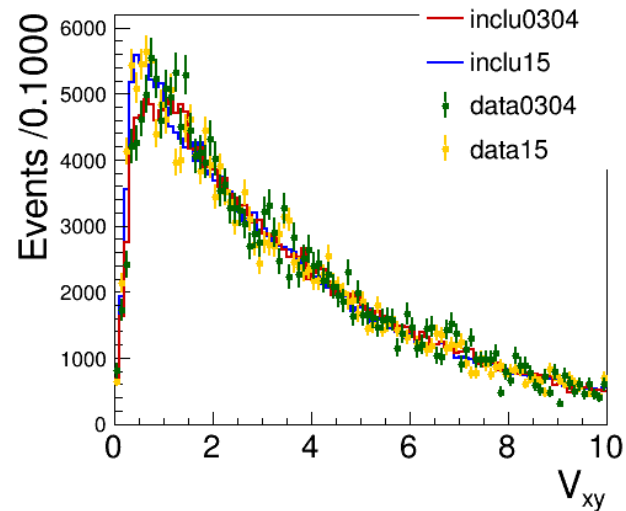
$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487 L/err > 2$$



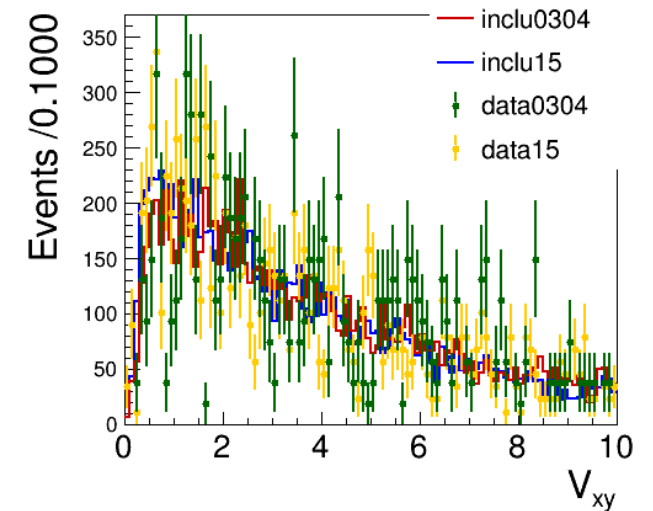
$0.6 \leq P_{K_S^0} \leq 0.8 \text{ GeV}/c^2$



$0.8 \leq P_{K_S^0} \leq 1.0 \text{ GeV}/c^2$



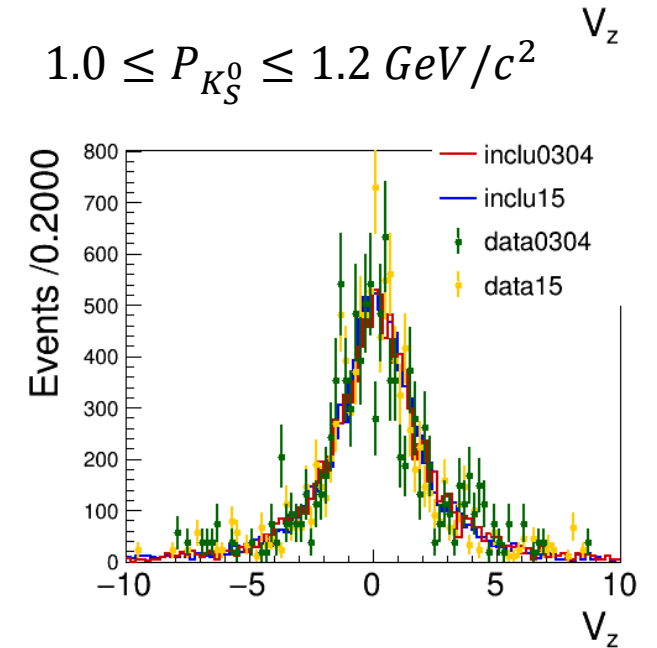
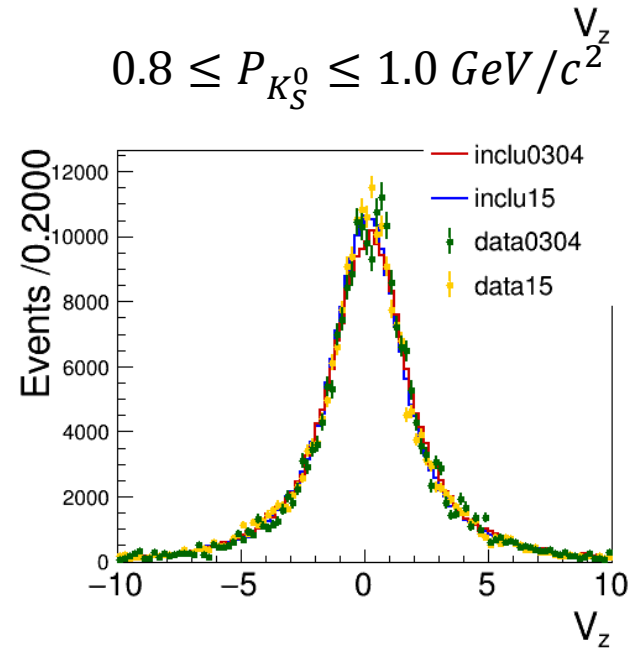
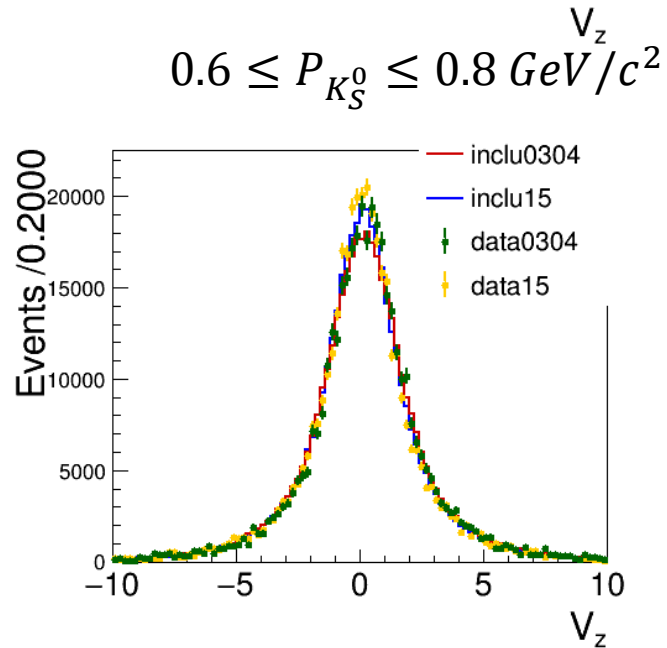
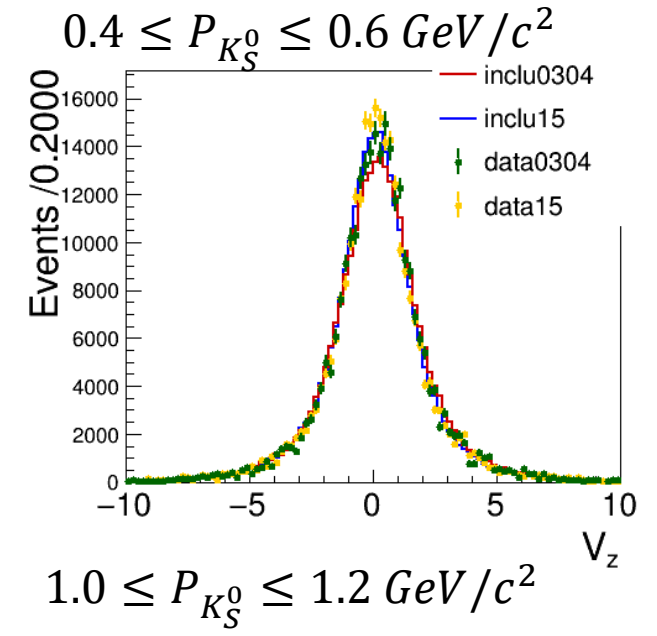
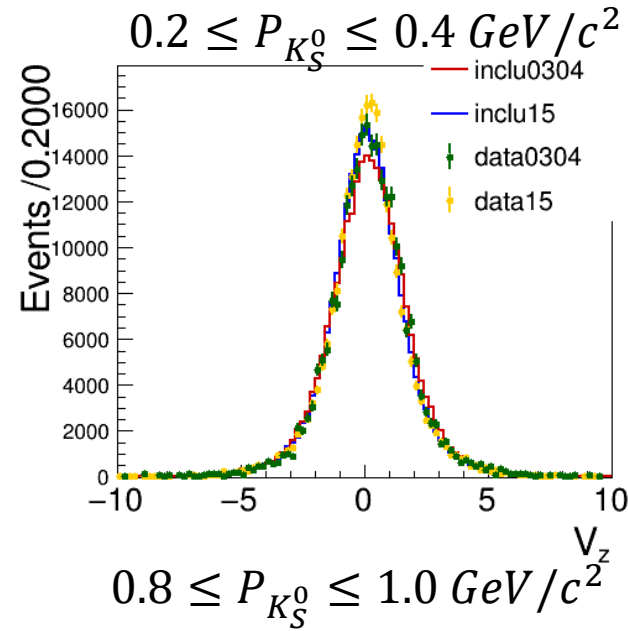
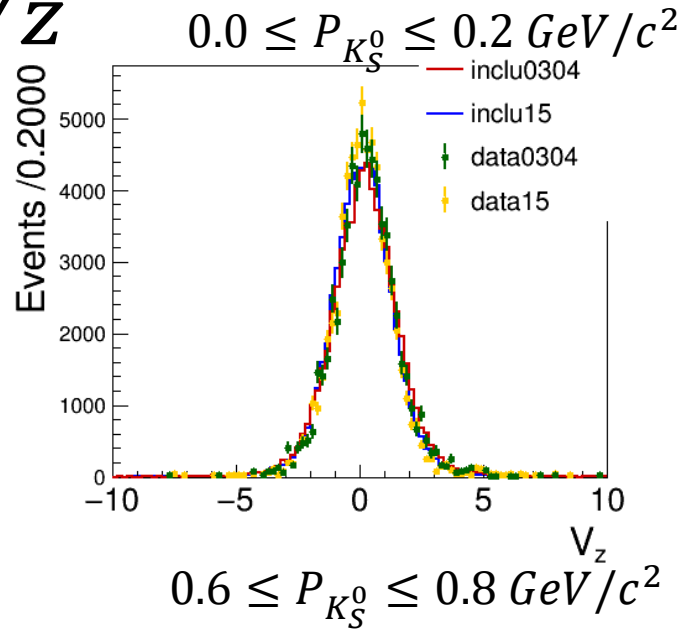
$1.0 \leq P_{K_S^0} \leq 1.2 \text{ GeV}/c^2$



Refine Vertex Fit

V_z

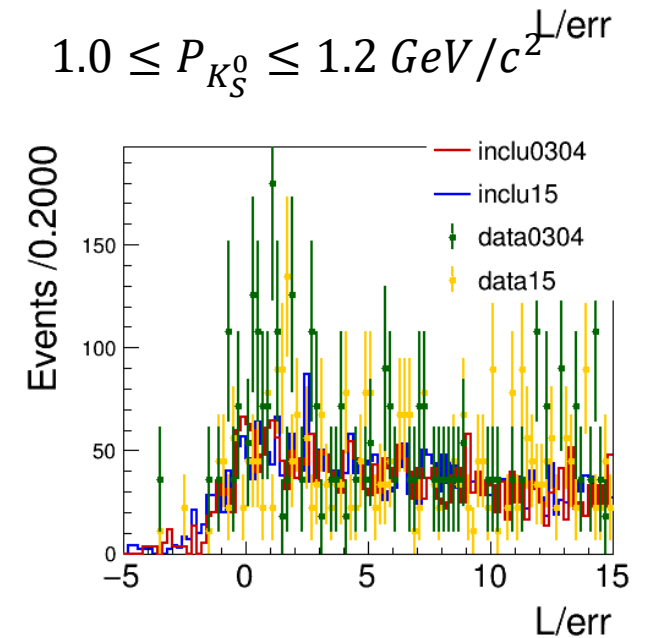
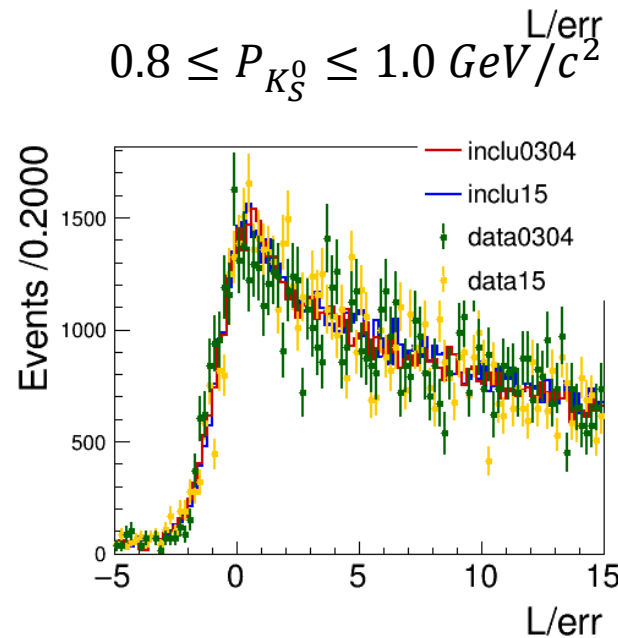
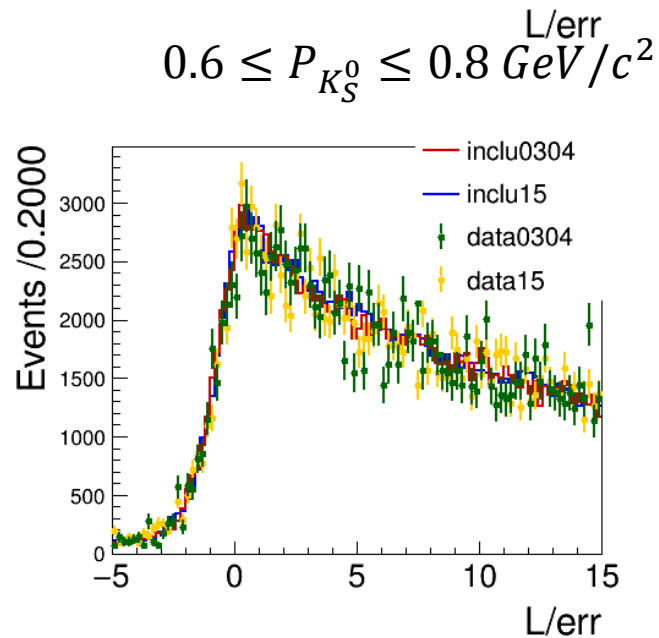
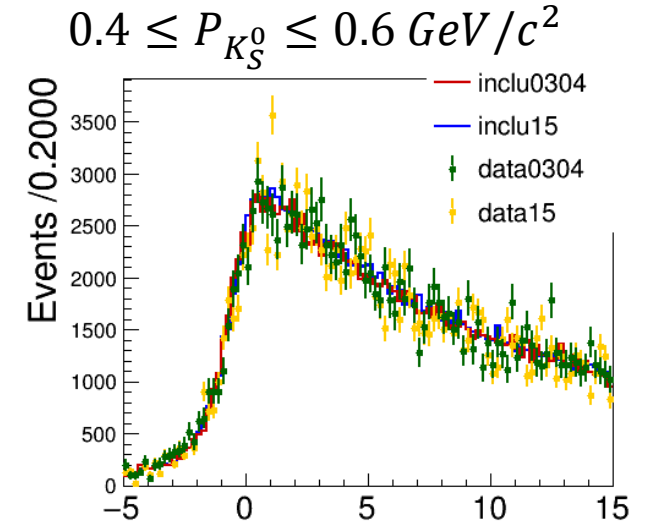
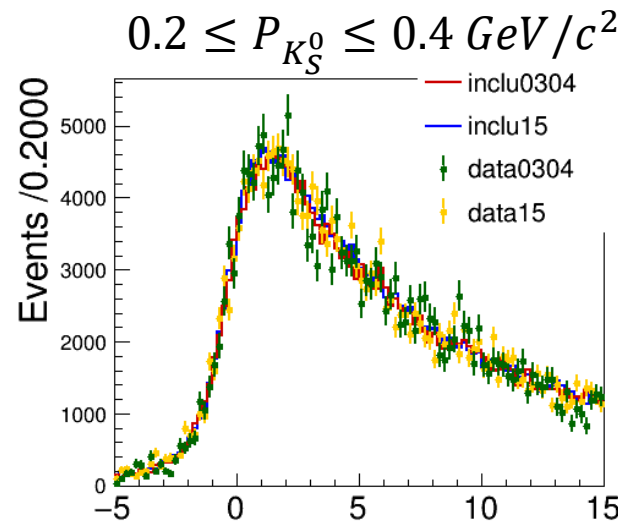
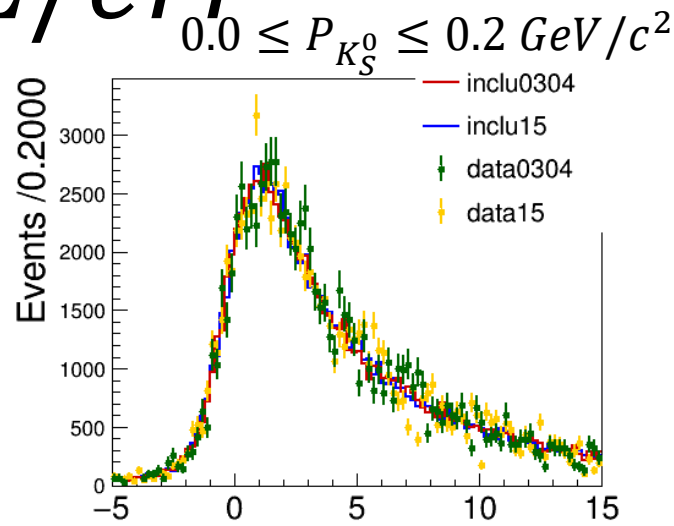
$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487 \quad L/err > 2$$



Refine Vertex Fit

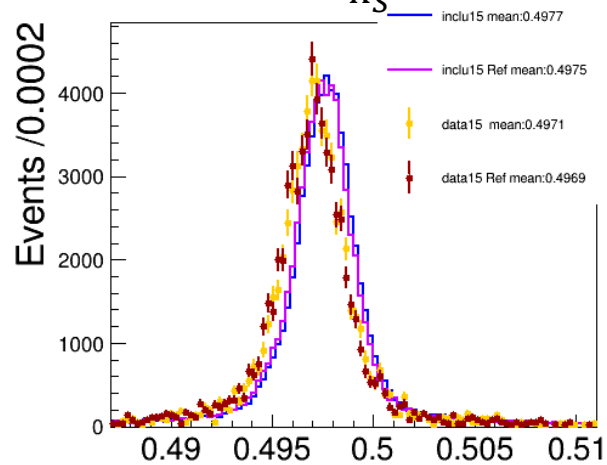
L/err

$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487$$

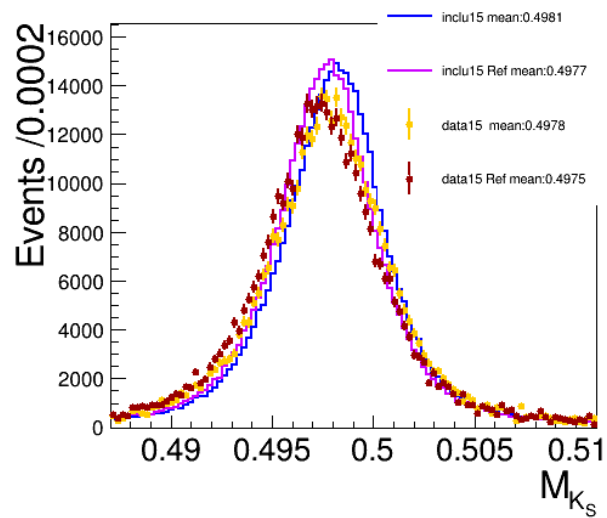


Vertex fit with Refine Vertex fit

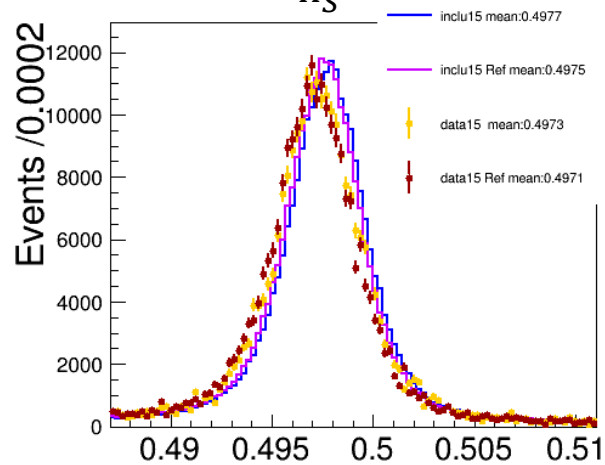
M_{K_S} $0.0 \leq P_{K_S^0} \leq 0.2 \text{ GeV}/c^2$



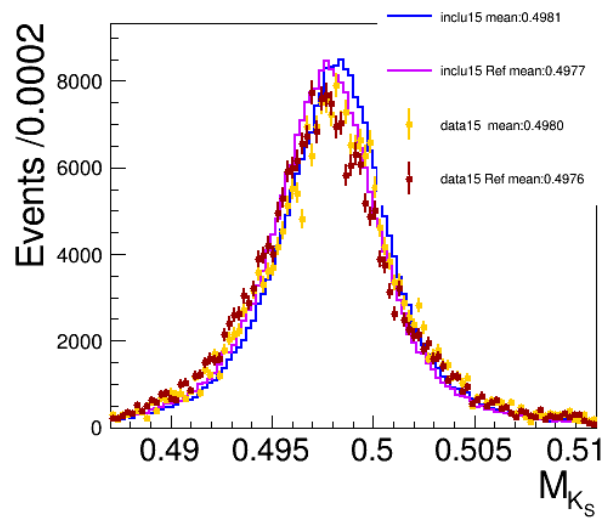
$0.6 \leq P_{K_S^0} \leq 0.8 \text{ GeV}/c^2$



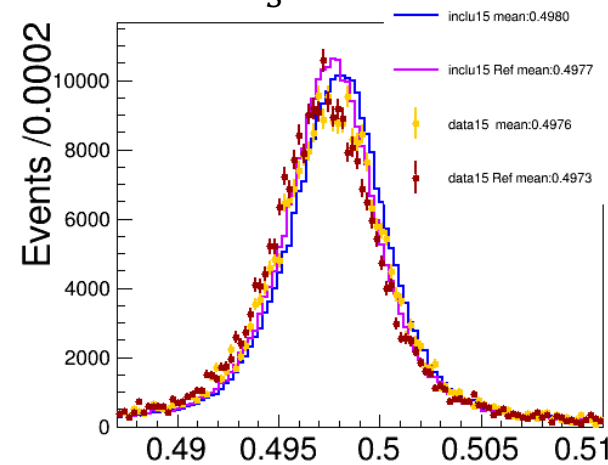
$\chi_{1st}^2 \& \chi_{2rd}^2 < 200$ $L/err > 2$
 $0.2 \leq P_{K_S^0} \leq 0.4 \text{ GeV}/c^2$



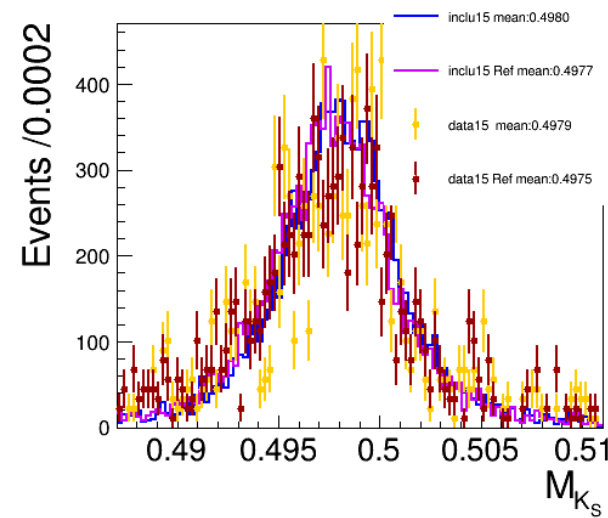
$0.8 \leq P_{K_S^0} \leq 1.0 \text{ GeV}/c^2$



$0.4 \leq P_{K_S^0} \leq 0.6 \text{ GeV}/c^2$



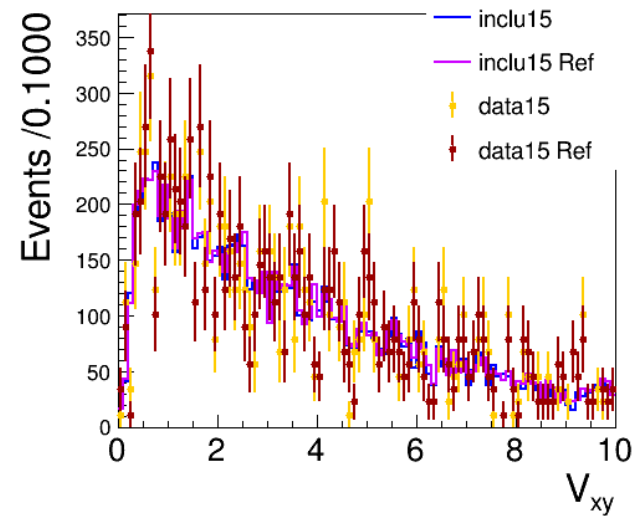
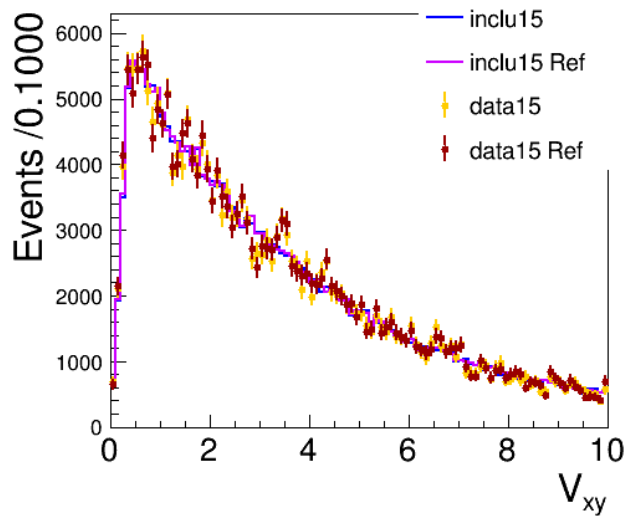
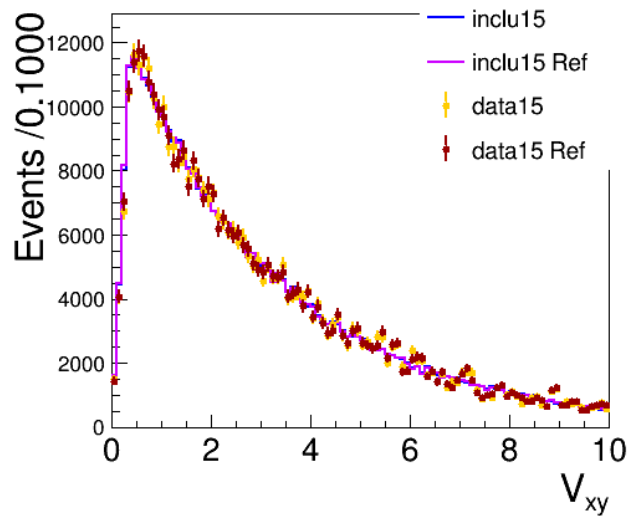
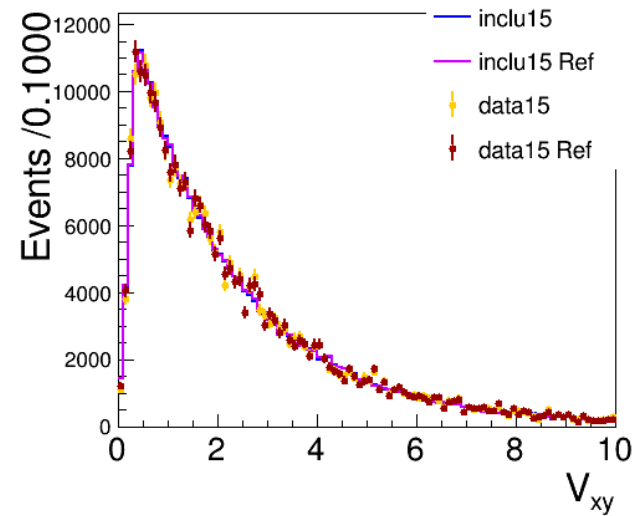
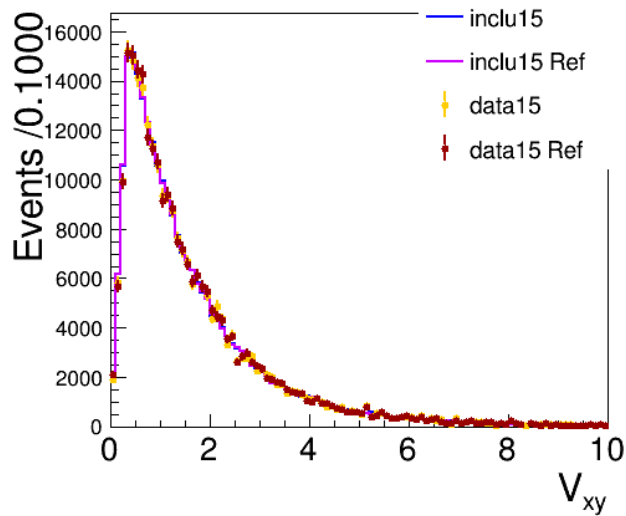
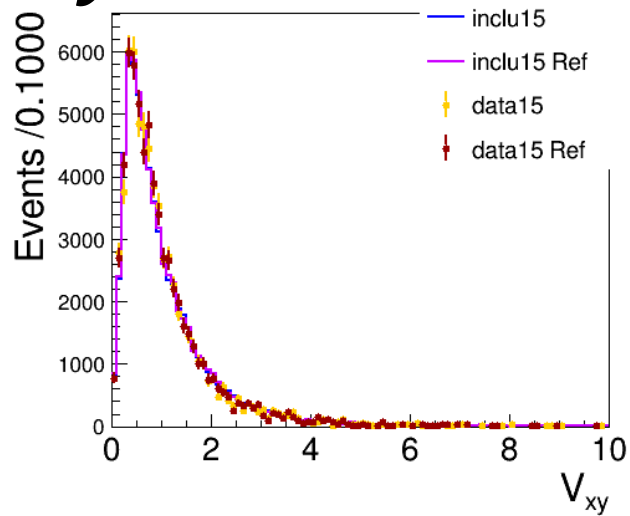
$1.0 \leq P_{K_S^0} \leq 1.2 \text{ GeV}/c^2$



— inclu15
 — inclu15 Ref
 ● data15
 ● data15 Ref

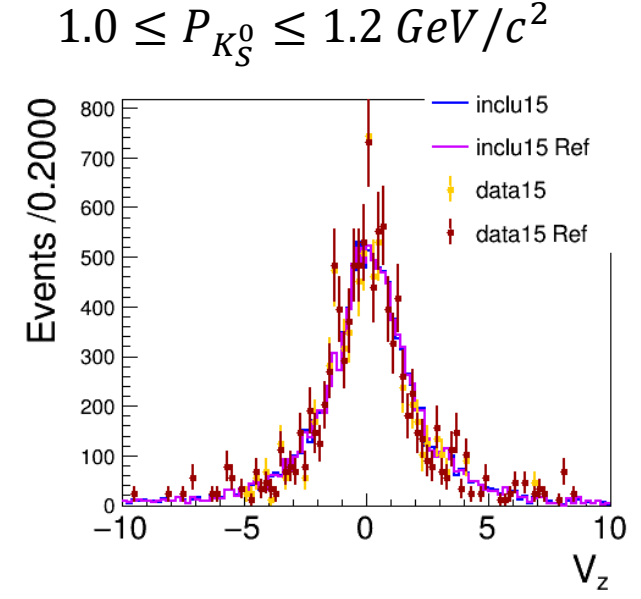
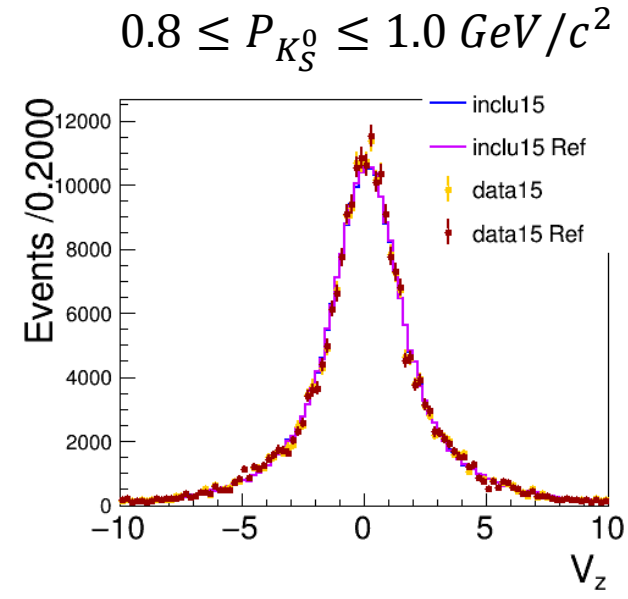
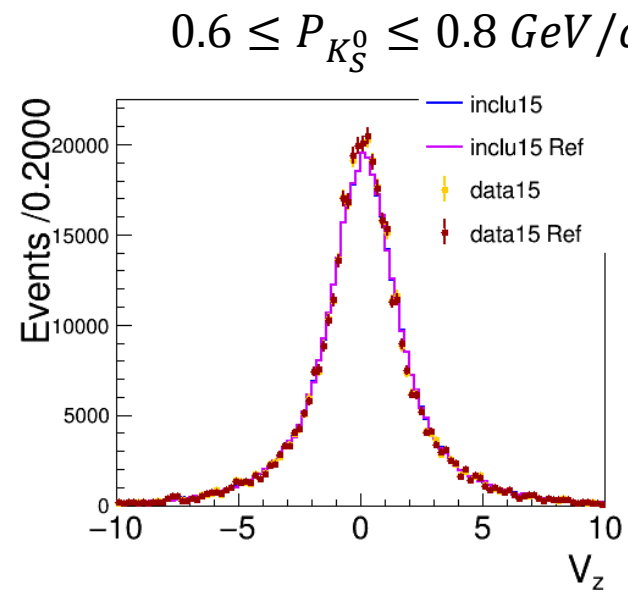
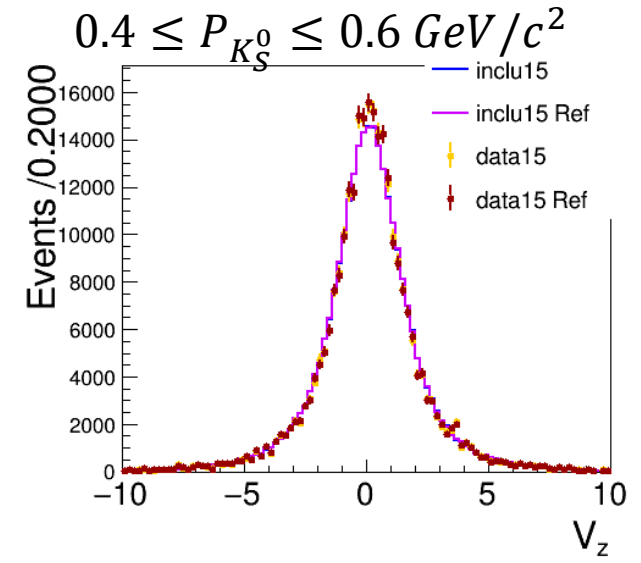
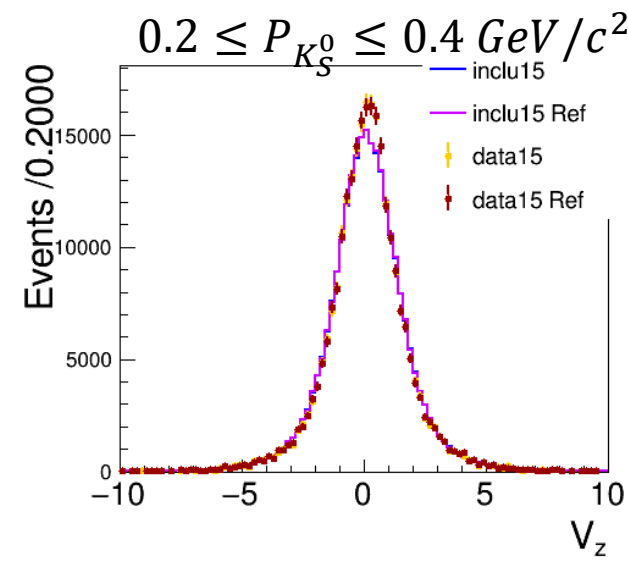
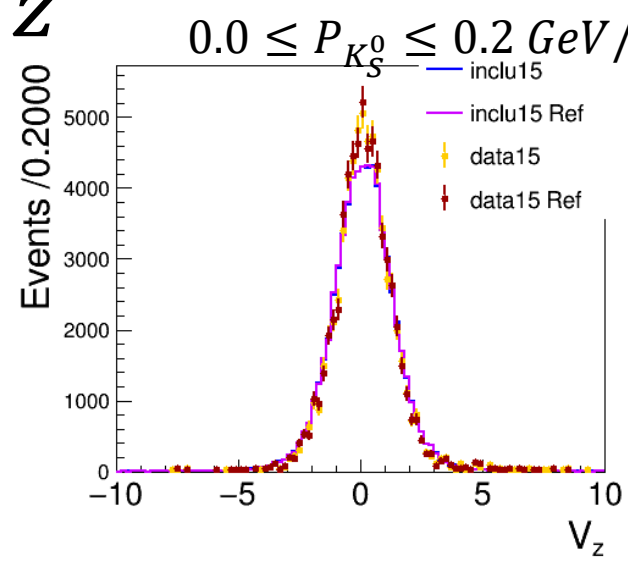
V_{xy}

$$\chi^2_{1st} & \chi^2_{2rd} < 200 \quad 0.511 > M_{K_s} > 0.487 \quad L/err > 2$$



V_z

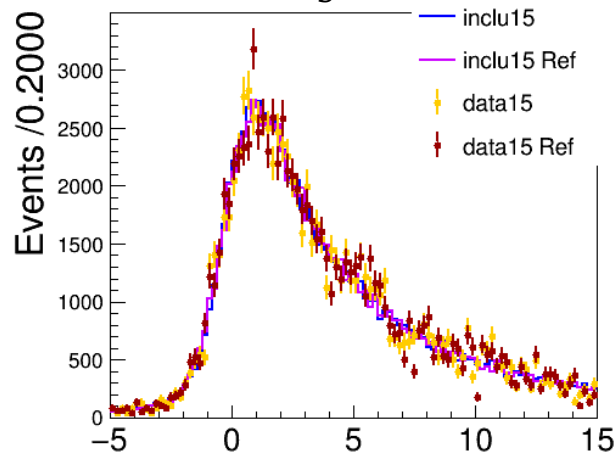
$\chi^2_{1st} & \chi^2_{2rd} < 200$ $0.511 > M_{K_S} > 0.487$ $L/err > 2$



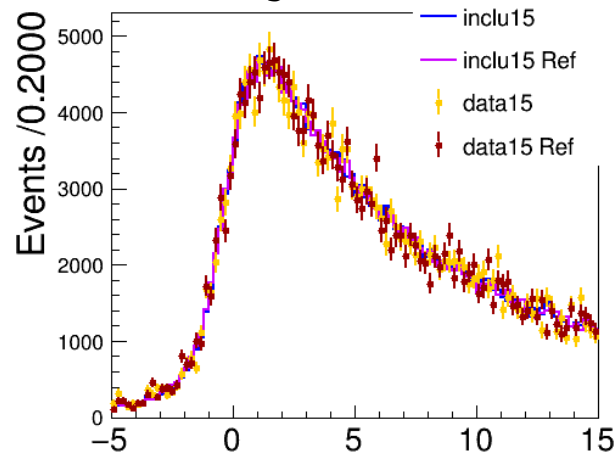
L/err

$$\chi_{1st}^2 \& \chi_{2rd}^2 < 200 \quad 0.511 > M_{K_S} > 0.487$$

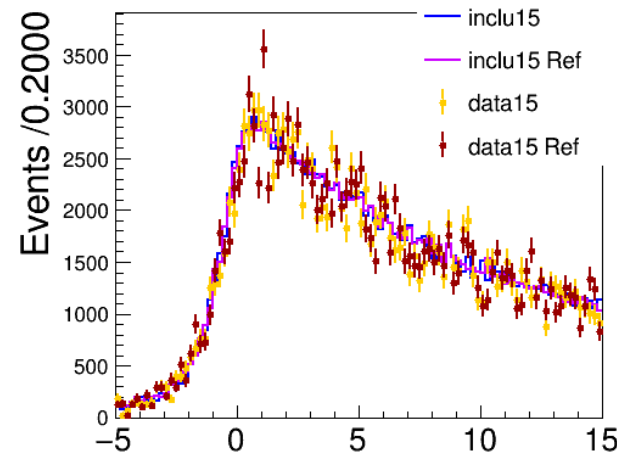
$$0.0 \leq P_{K_S^0} \leq 0.2 \text{ GeV}/c^2$$



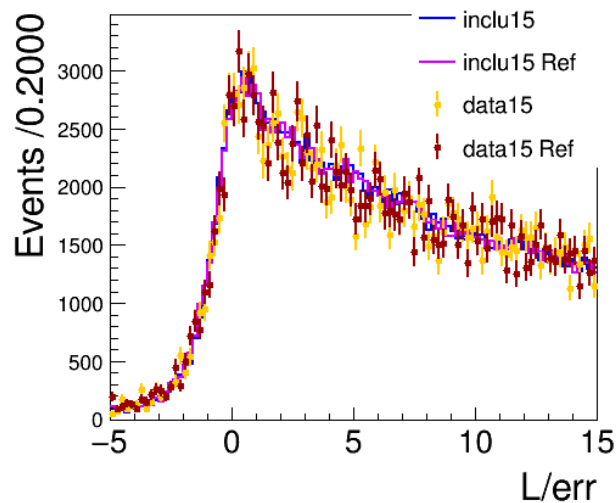
$$0.2 \leq P_{K_S^0} \leq 0.4 \text{ GeV}/c^2$$



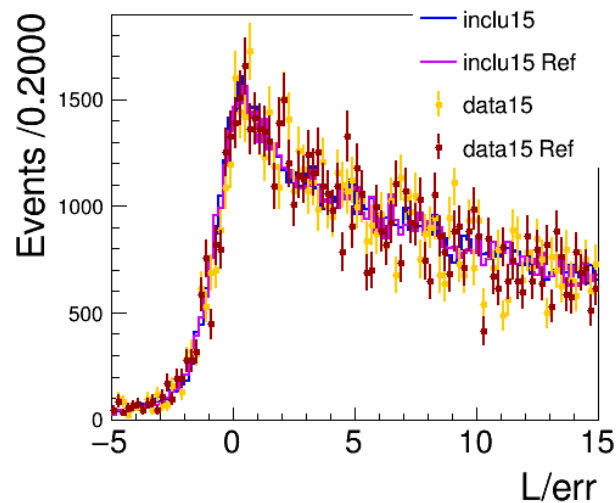
$$0.4 \leq P_{K_S^0} \leq 0.6 \text{ GeV}/c^2$$



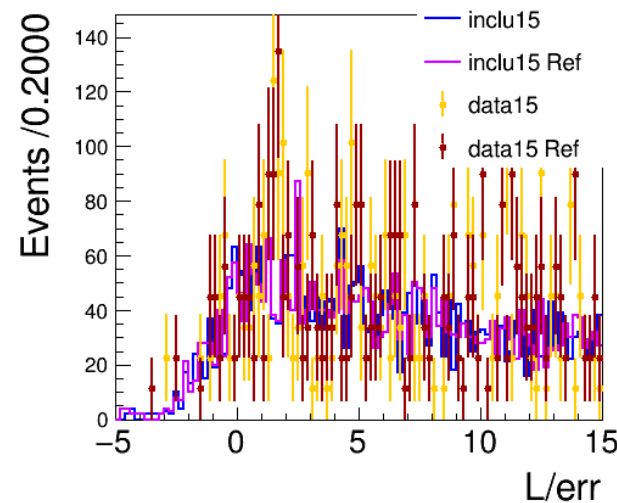
$$0.6 \leq P_{K_S^0} \leq 0.8 \text{ GeV}/c^2$$



$$0.8 \leq P_{K_S^0} \leq 1.0 \text{ GeV}/c^2$$



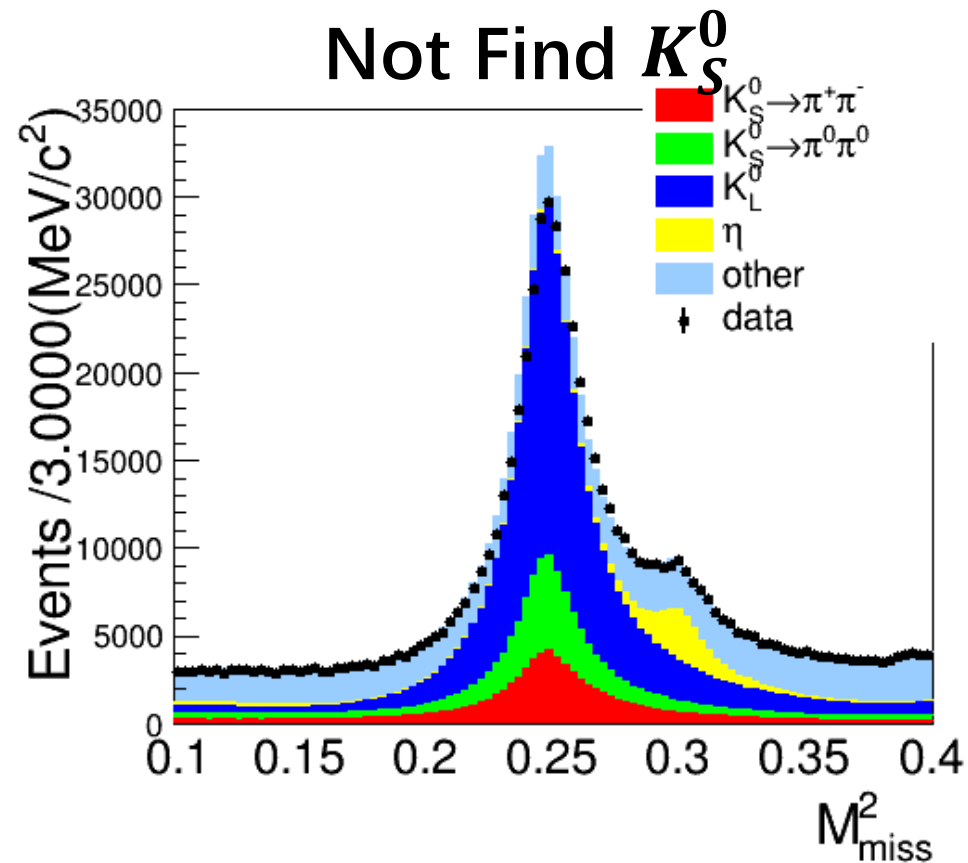
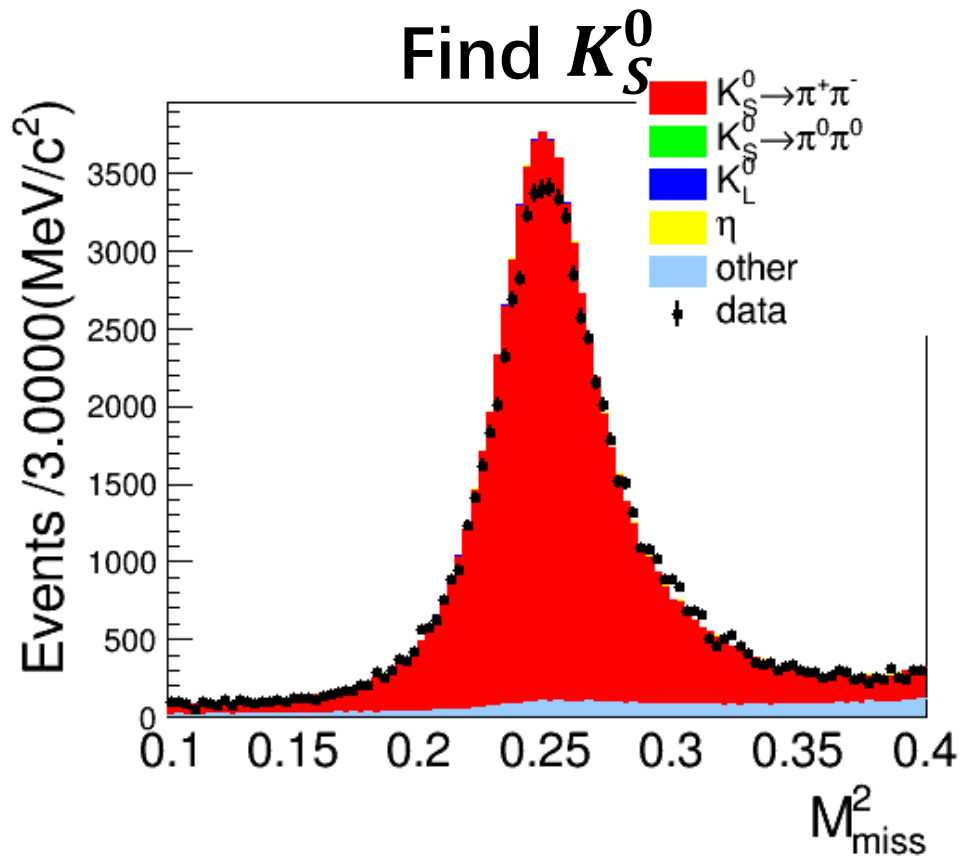
$$1.0 \leq P_{K_S^0} \leq 1.2 \text{ GeV}/c^2$$



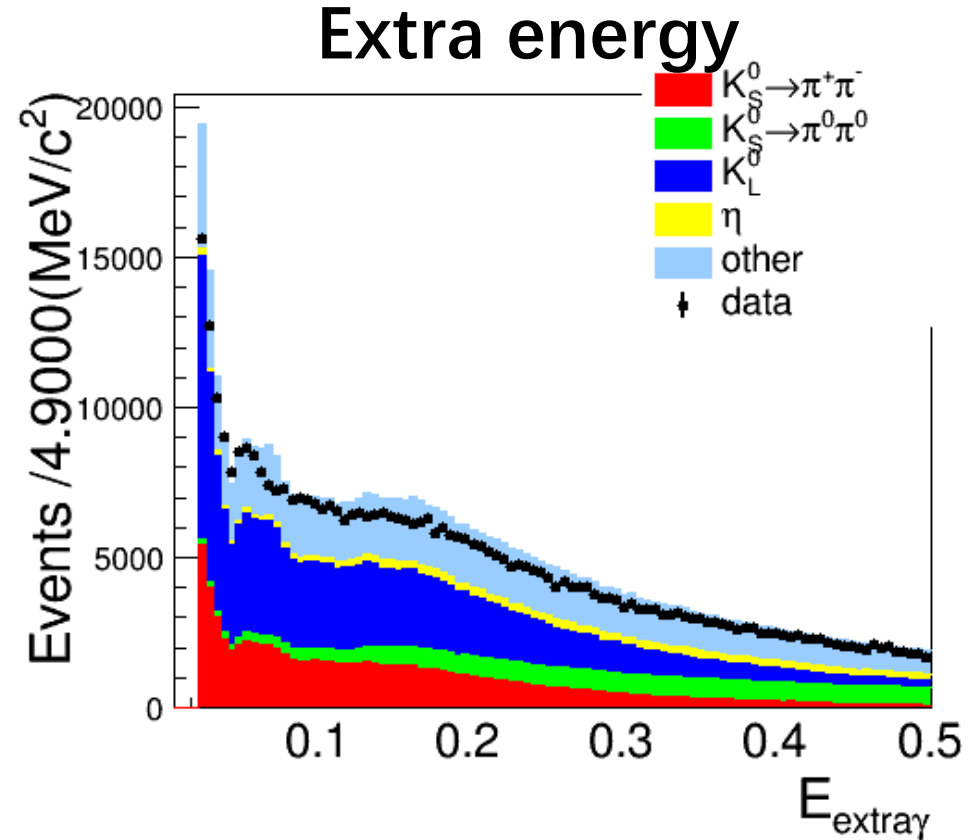
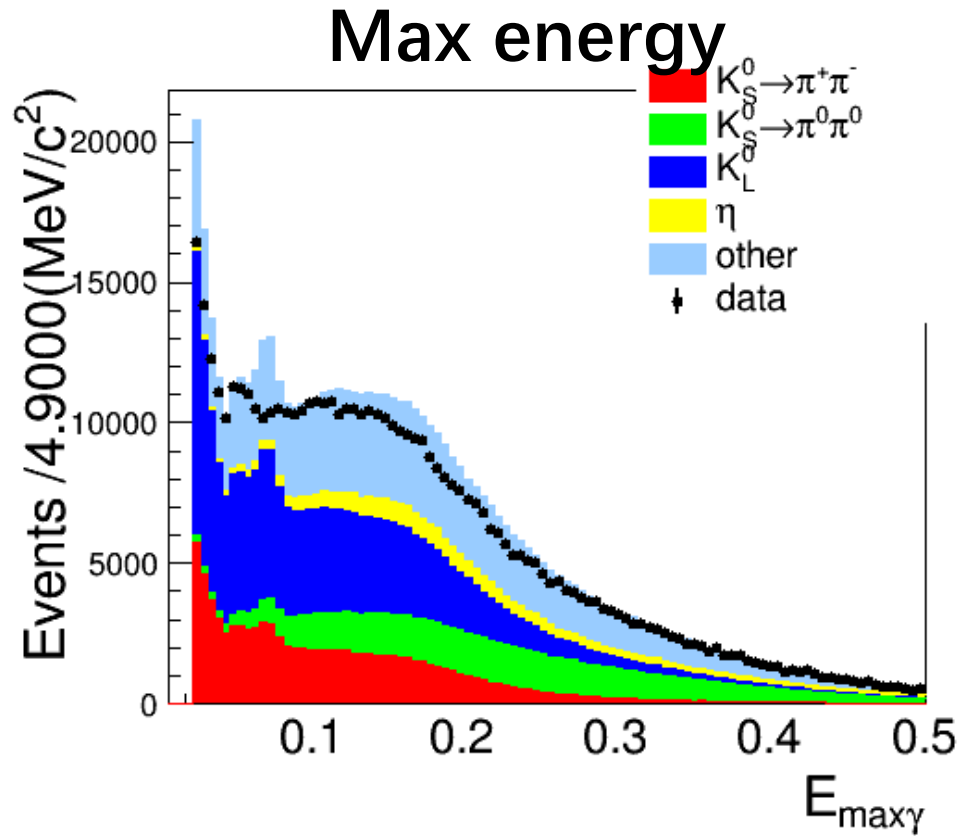
Data quantity by P_{K_S}

P_{K_S}	(0.0,0.2)	(0.2,0.4)	(0.4,0.6)	(0.6,0.8)	(0.8,1.0)	(1.0,1.2)
Data Round 0304	4089	15453	16604	23058	13971	576
Data Round 15	6685	24763	26517	36749	22150	953
Data Round 0304 (Refine)	4138	15479	16673	13073	13955	574
Data Round 15 (Refine)	6686	24776	26620	36802	22064	954

$D^+D^- M_{miss}^2$



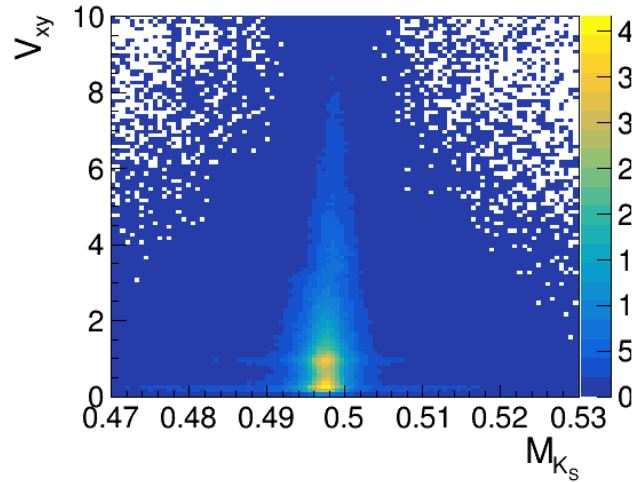
D^+D^- the max and extra energy of photon



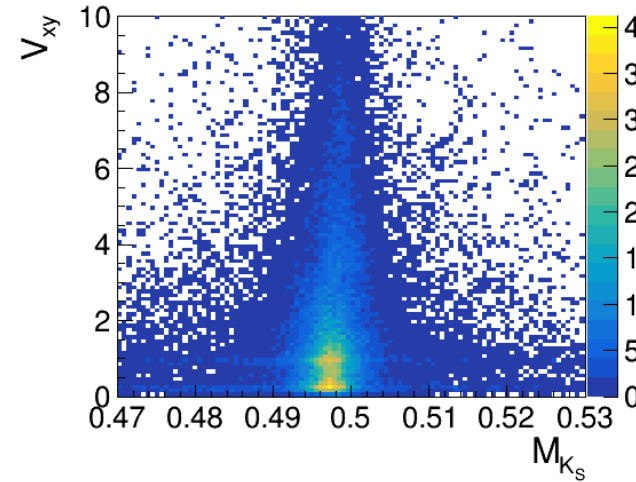
Back up

2D distribution between V_{xy} and M_{K_S}

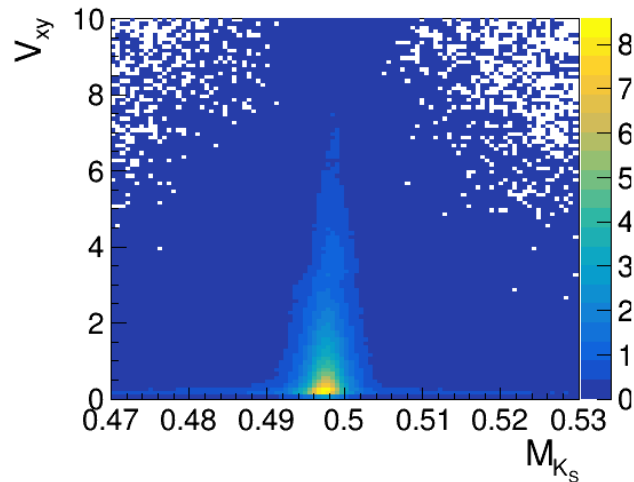
Inclusive mc round0304



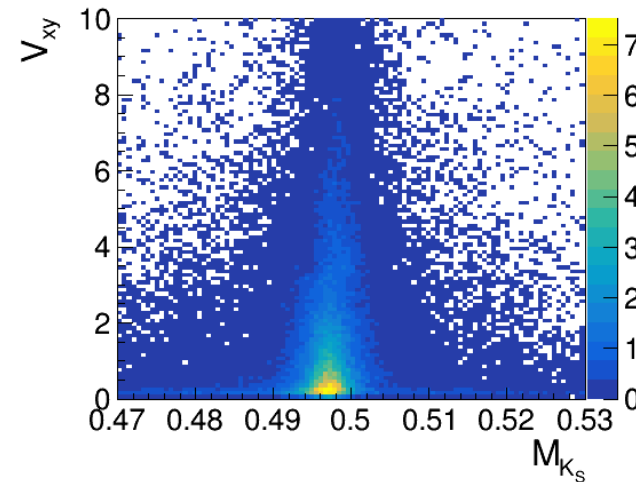
Data round0304



Inclusive mc round15



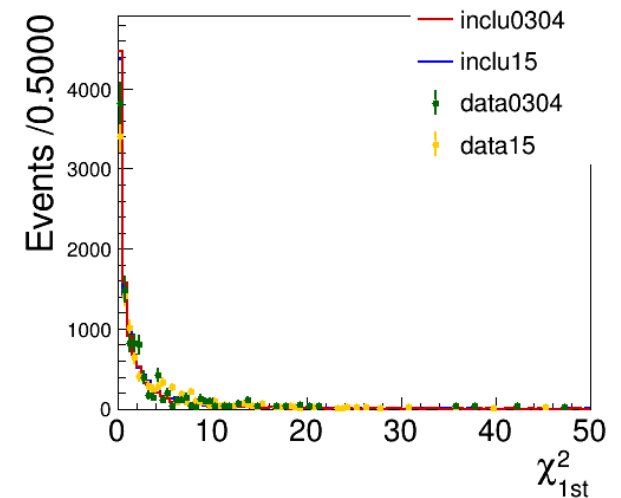
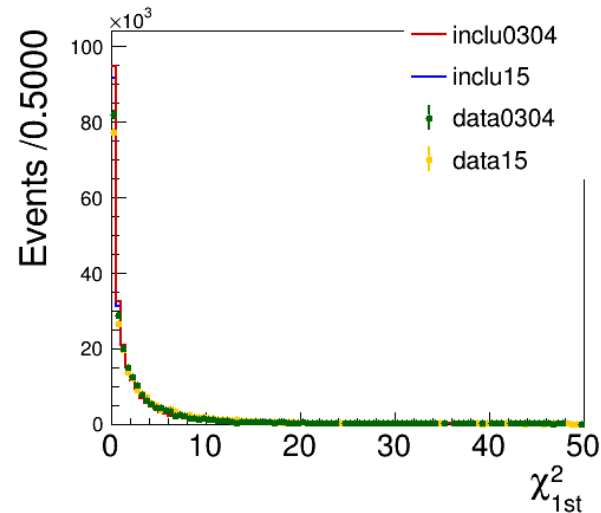
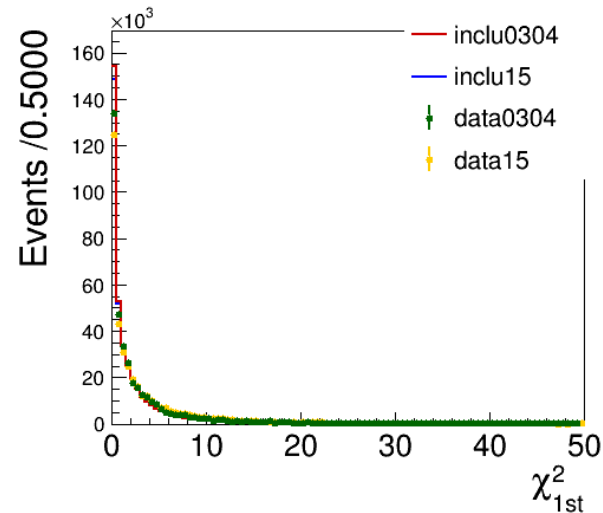
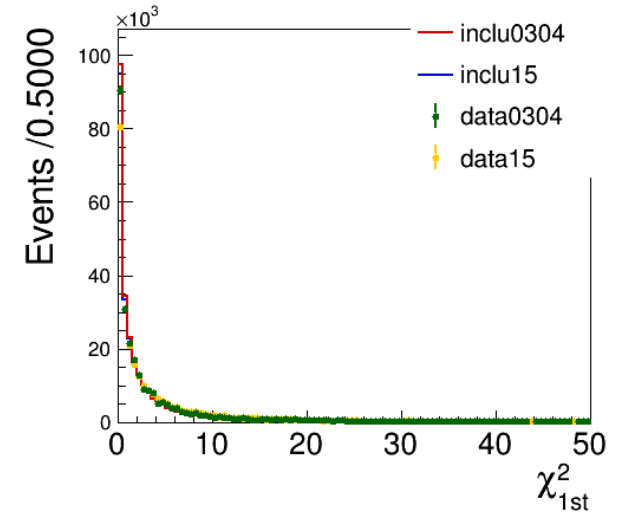
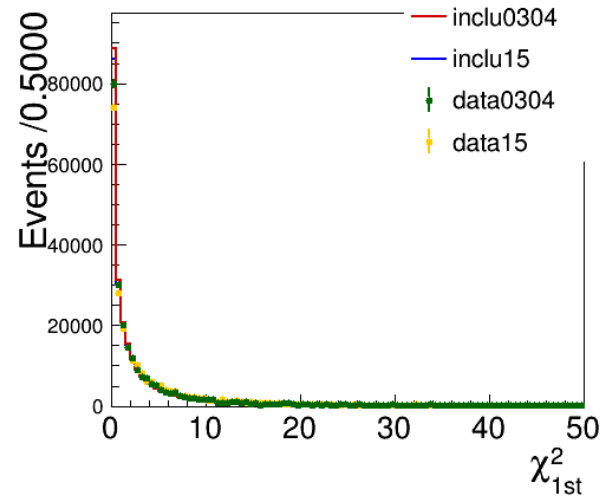
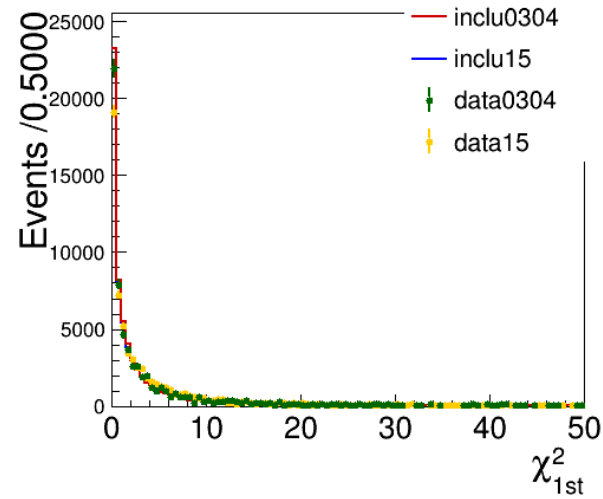
Data round15



Vertex Fit

 χ^2_{1st}

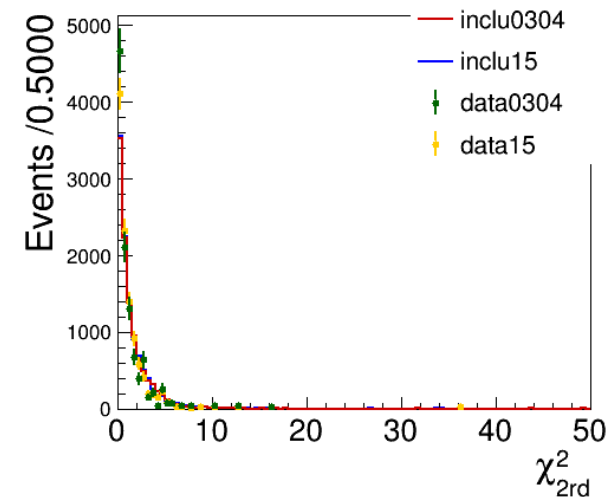
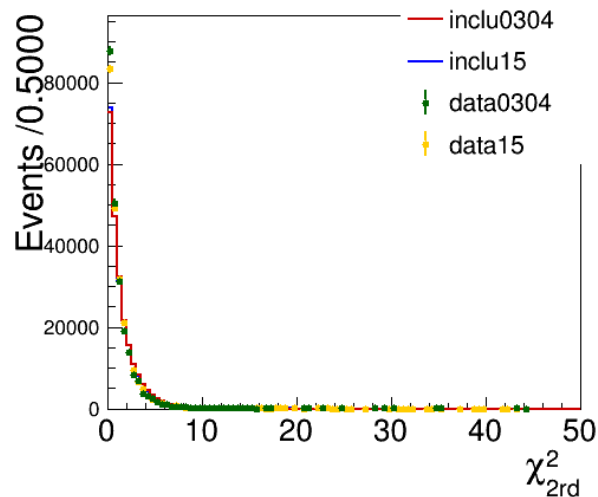
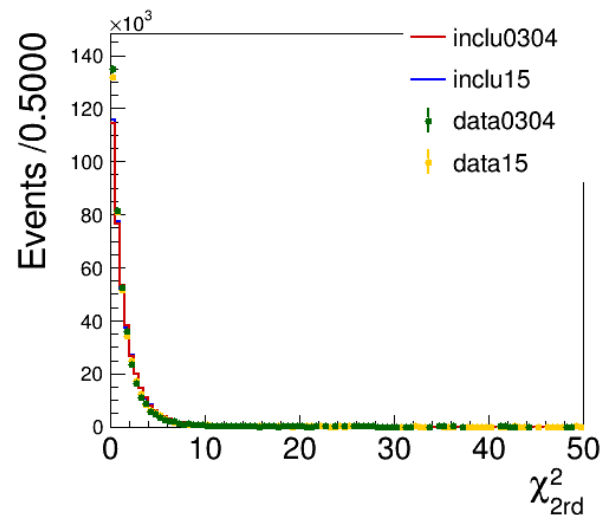
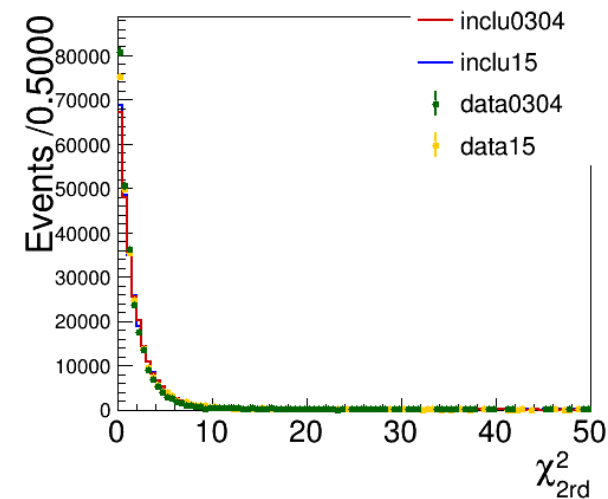
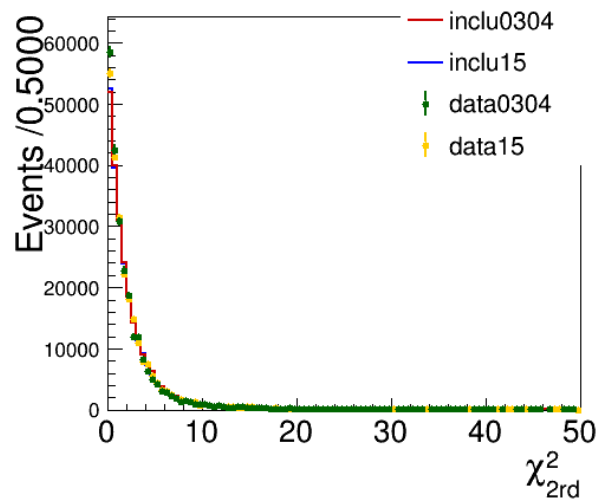
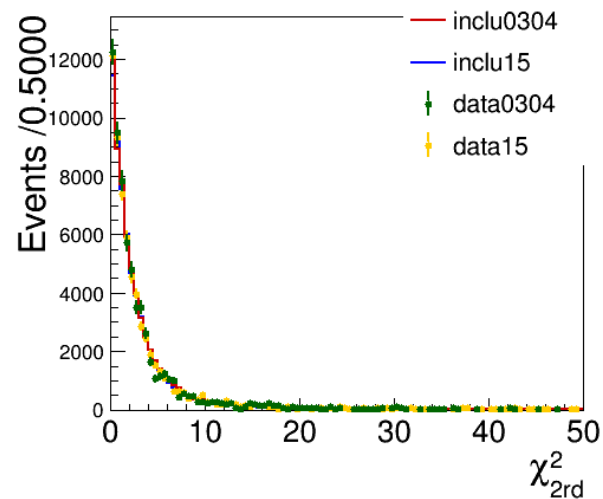
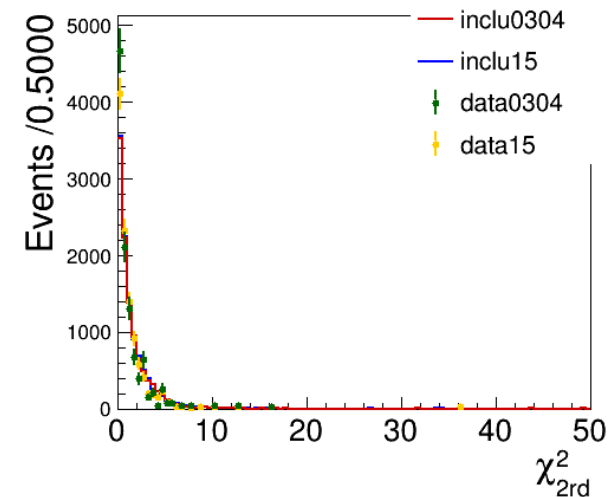
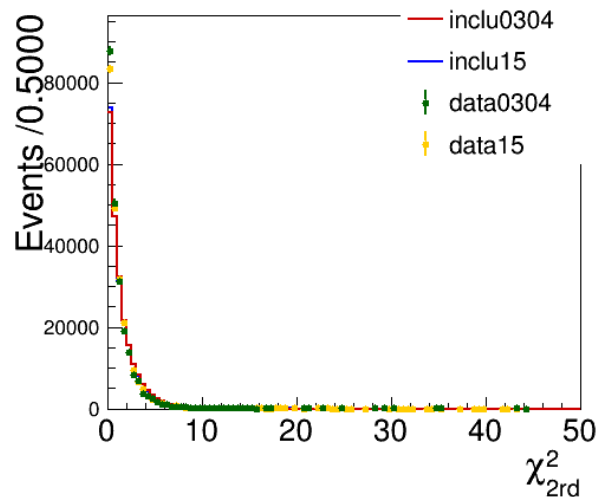
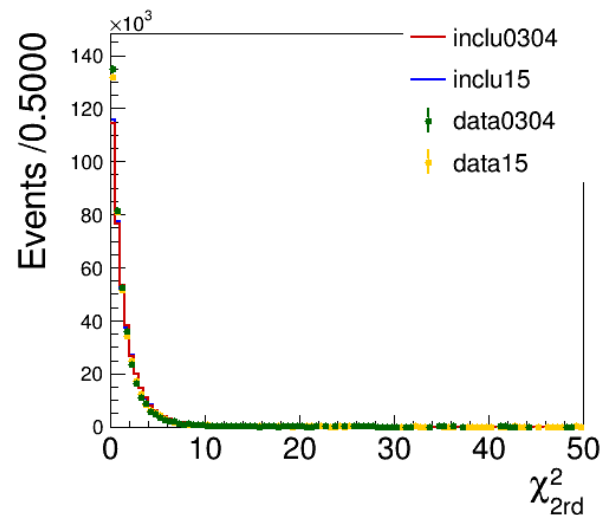
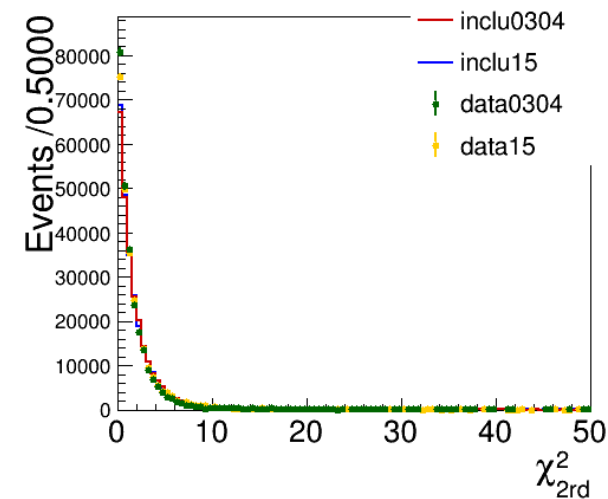
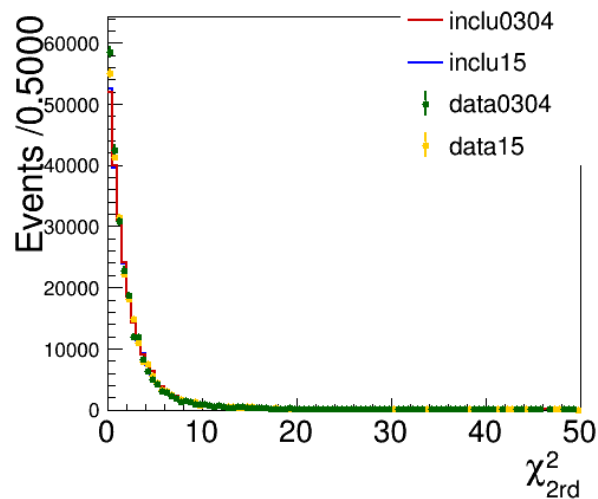
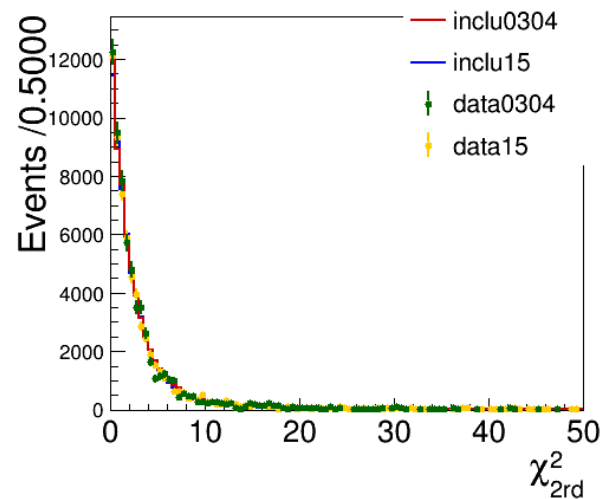
$$0.511 > M_{K_S} > 0.487 \text{ L/err} > 2$$



Vertex Fit

χ^2_{2rd}

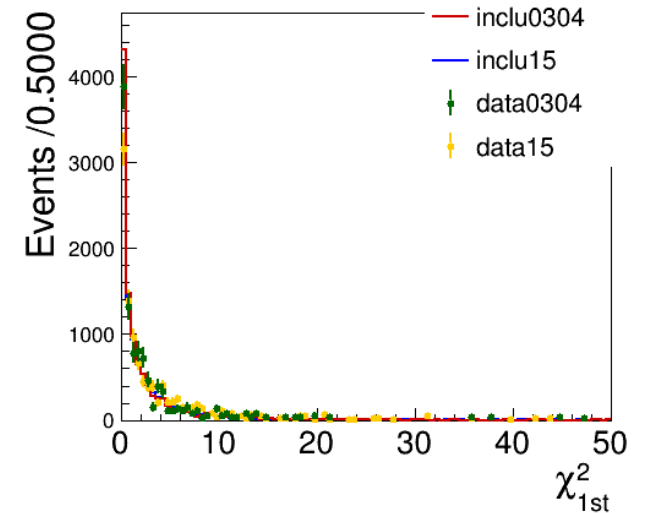
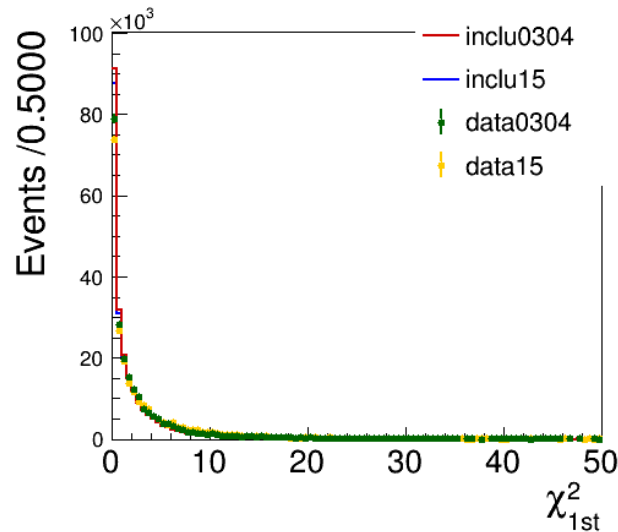
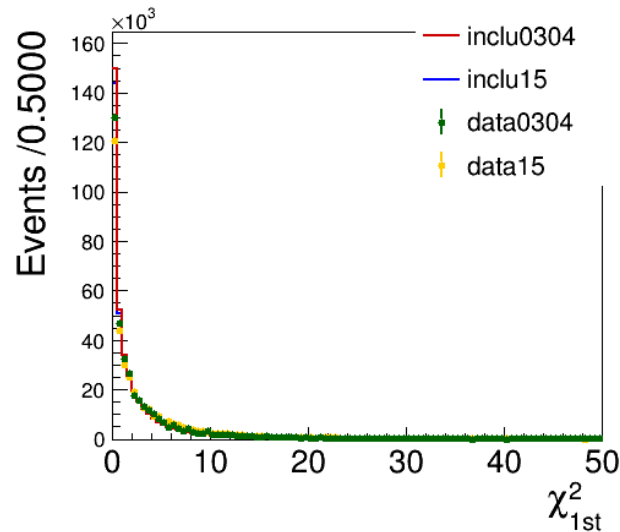
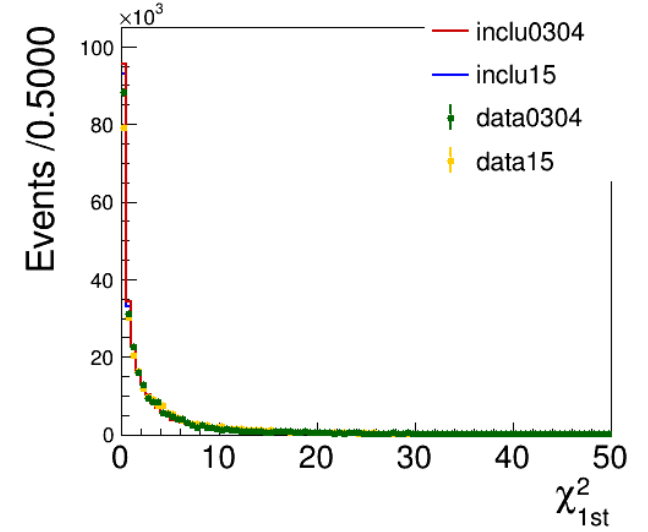
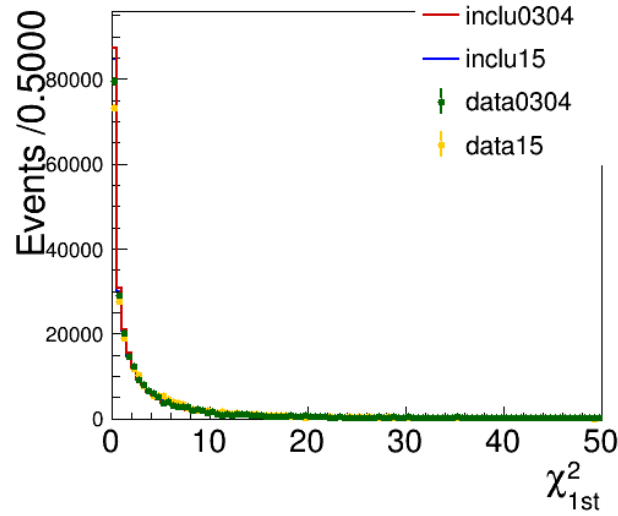
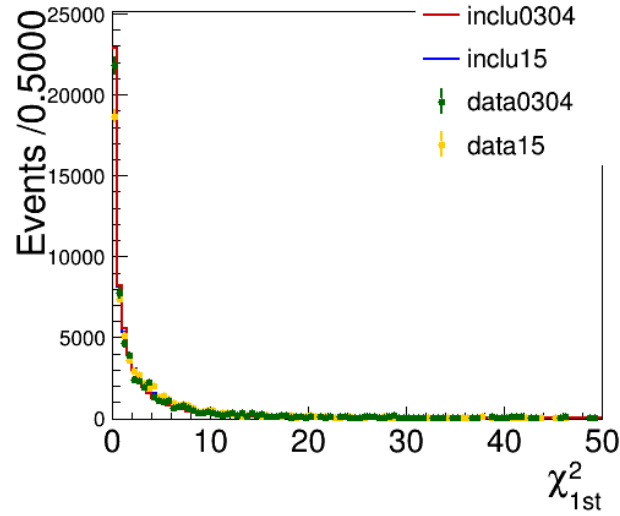
$$0.511 > M_{K_S} > 0.487 \text{ L/err} > 2$$



Refine Vertex Fit

χ^2_{1st}

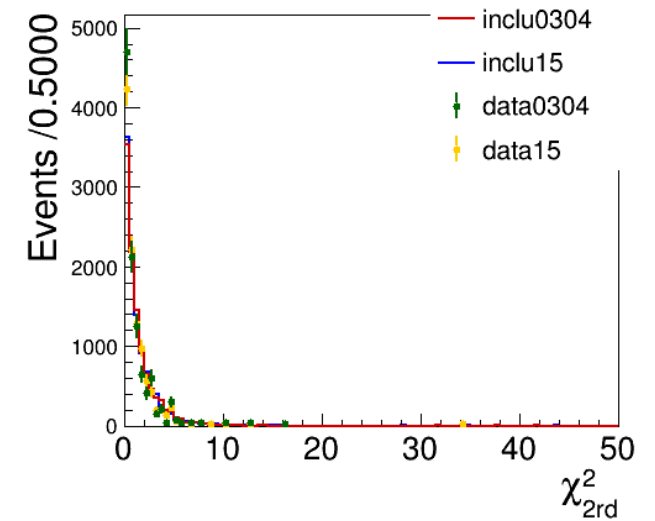
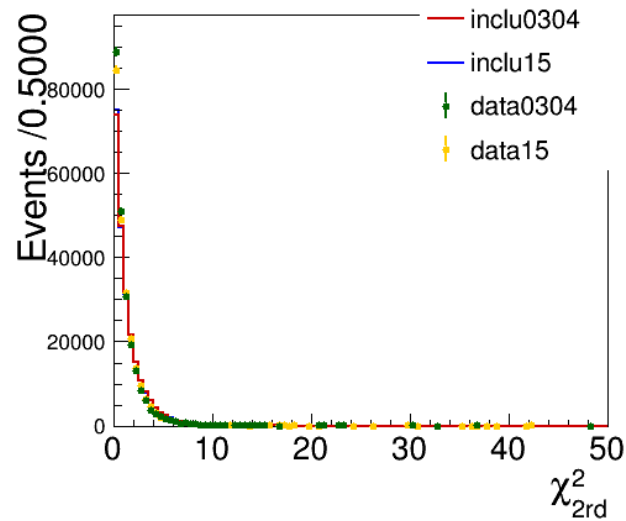
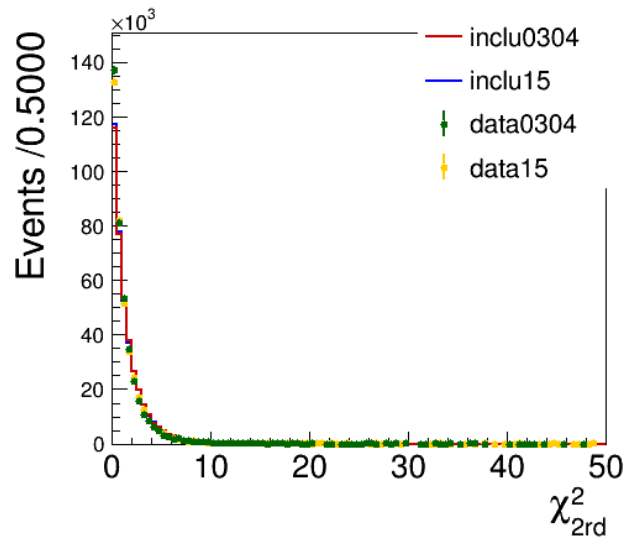
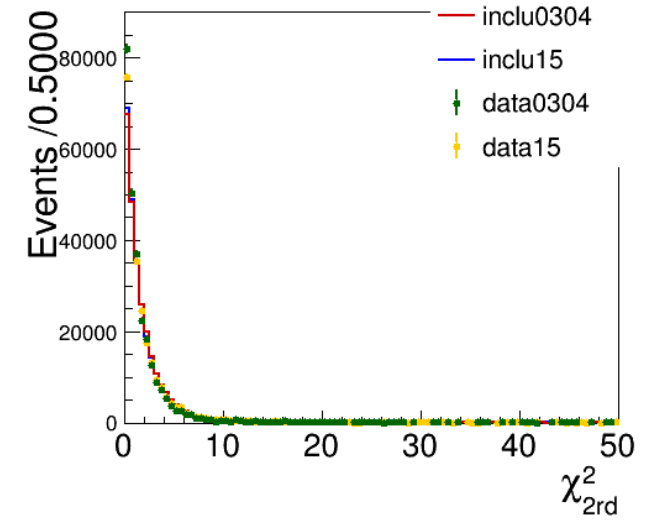
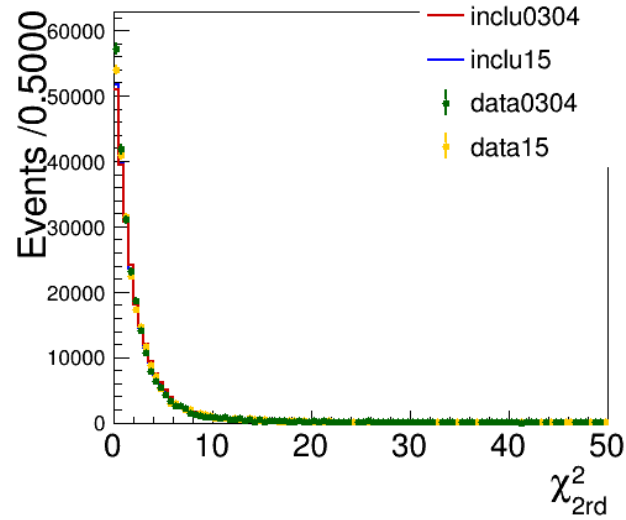
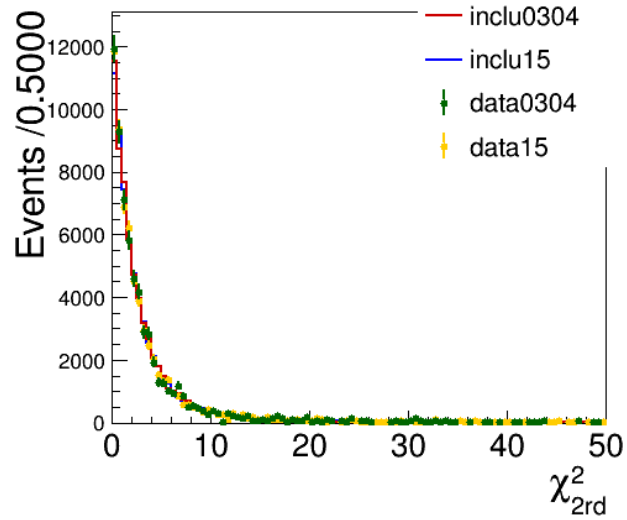
$$0.511 > M_{K_S} > 0.487 \quad L/err > 2$$



Refine Vertex Fit

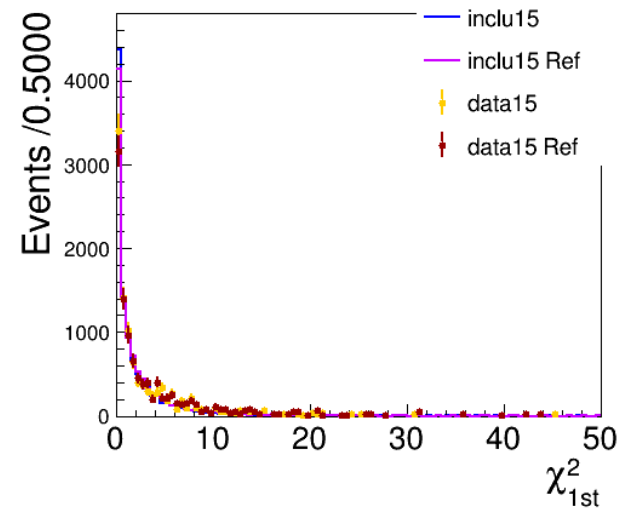
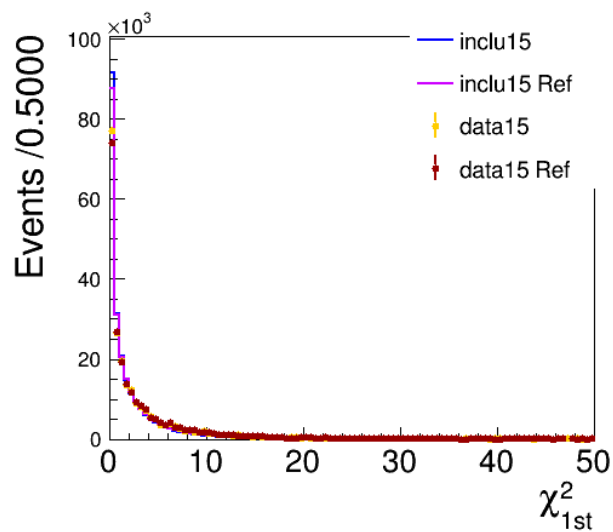
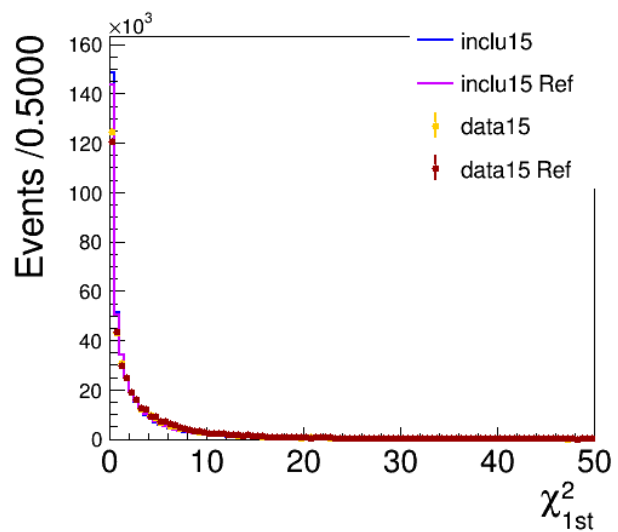
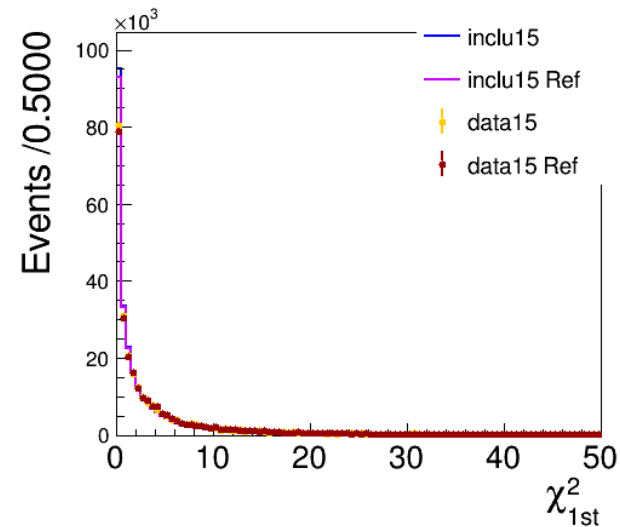
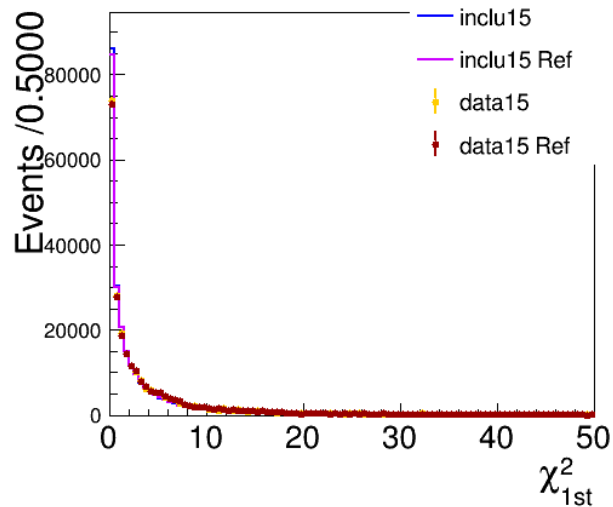
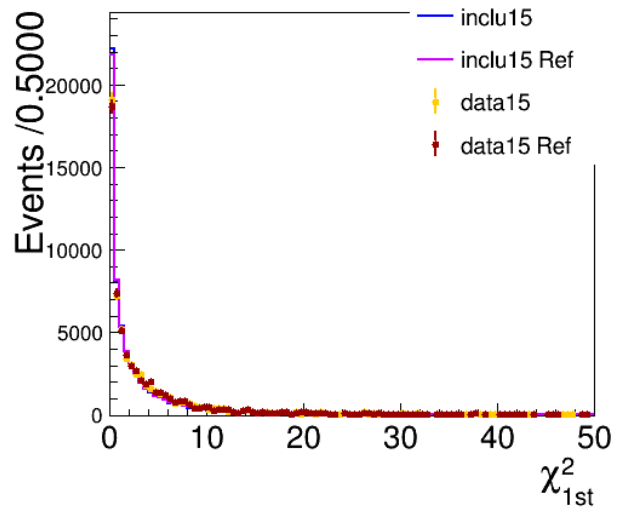
χ^2_{2rd}

$$0.511 > M_{K_S} > 0.487 \text{ L/err} > 2$$



χ^2_{1st}

$$0.511 > M_{K_S} > 0.487 \text{ L/err} > 2$$



χ^2_{2rd}

$$0.511 > M_{K_S} > 0.487 \text{ L/err} > 2$$

