Updates on activities.

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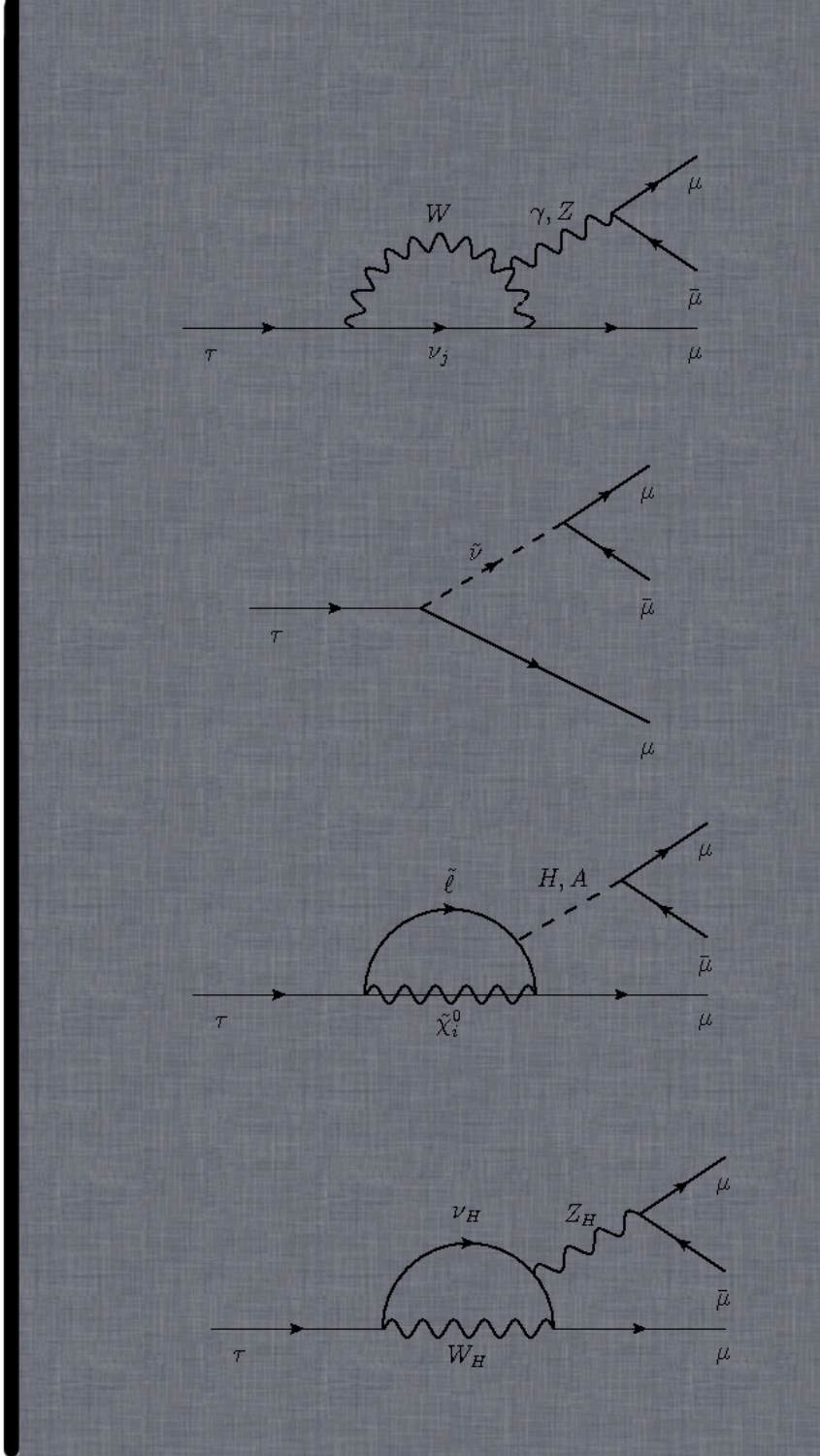
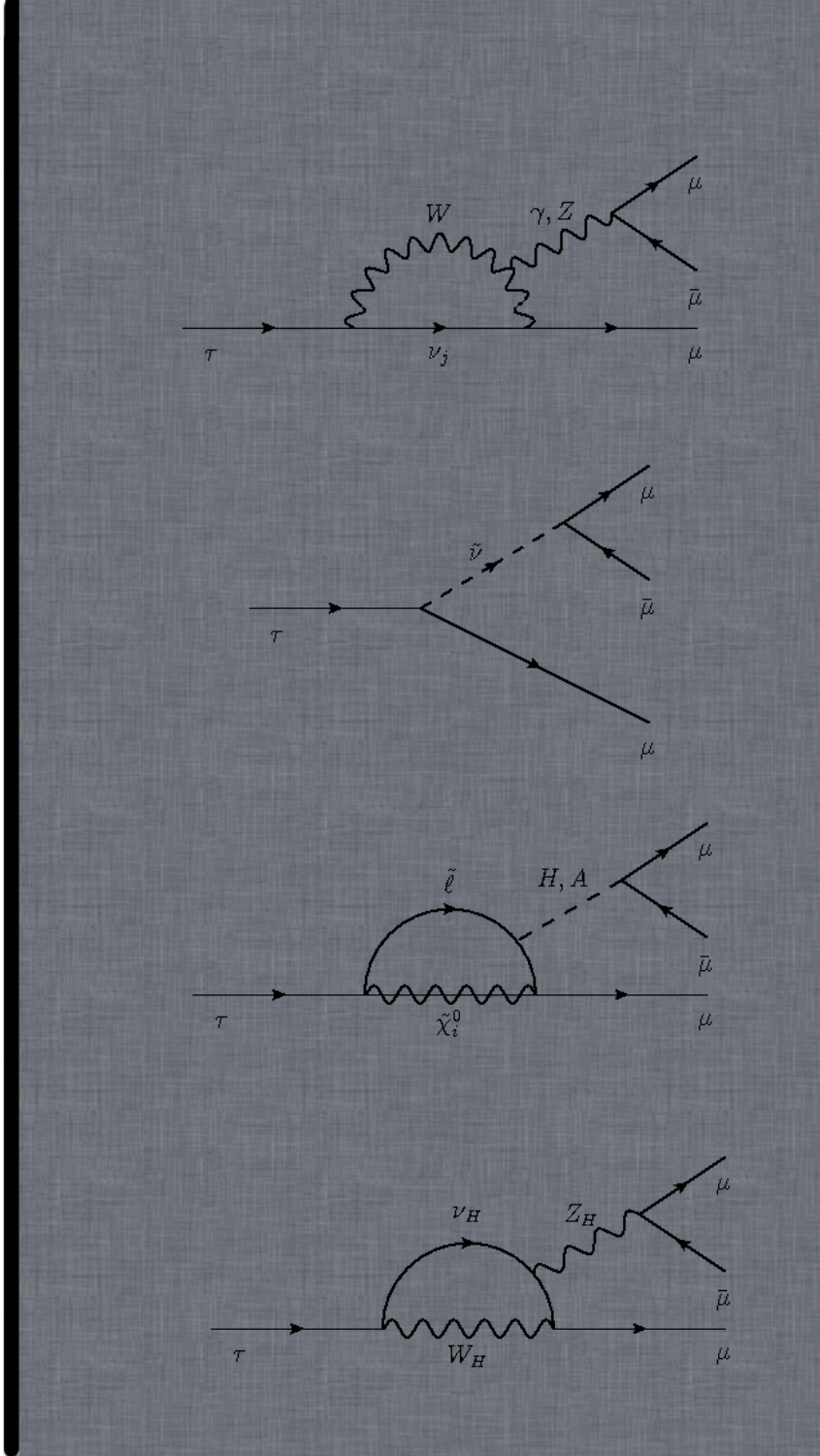
University of Zurich[UZH]



Inflaton analysis

- Introduction
- Simulation
- Resolution
- K_s FD



Inflaton analysis

Motivation:

- Probing low energy particle physics.

$$\mathcal{L}_{XSM} = \int \sqrt{-g} d^4x (\mathcal{L}_{SM} + \mathcal{L}_X + \mathcal{L}_{grav})$$

- Coupling to SM via scalar potential.
- Solves cosmological problems.
- Long lived particles. Life time $10^{-9} - 10^{-10} s$
- Mass $1 - 2 GeV$.
- Reheats the early universe.[1]

[1] arXiv:0912.0390, arXiv:1303.4395

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Work done so far

Work done:

- Prepare a decfile. v27r8 released
- Simulated 1.3*M* events, pythia8, siom08.
- Implemented isolation parameters in DecayTreeTuple package(extrnal c++ module).
- Started looking at signal efficiency.
- Signal is split into two samples: Downstream μ and "normal" μ.

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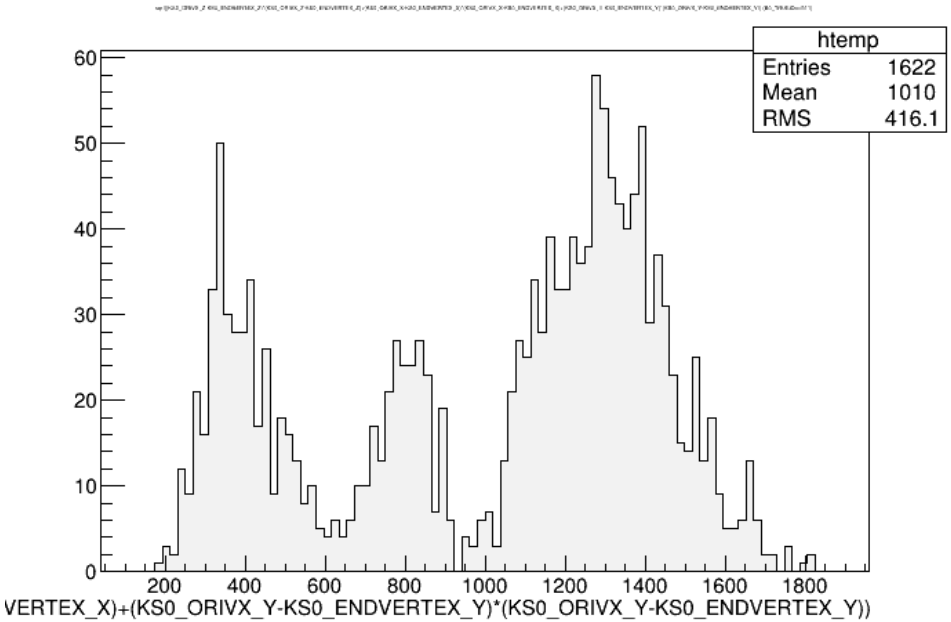
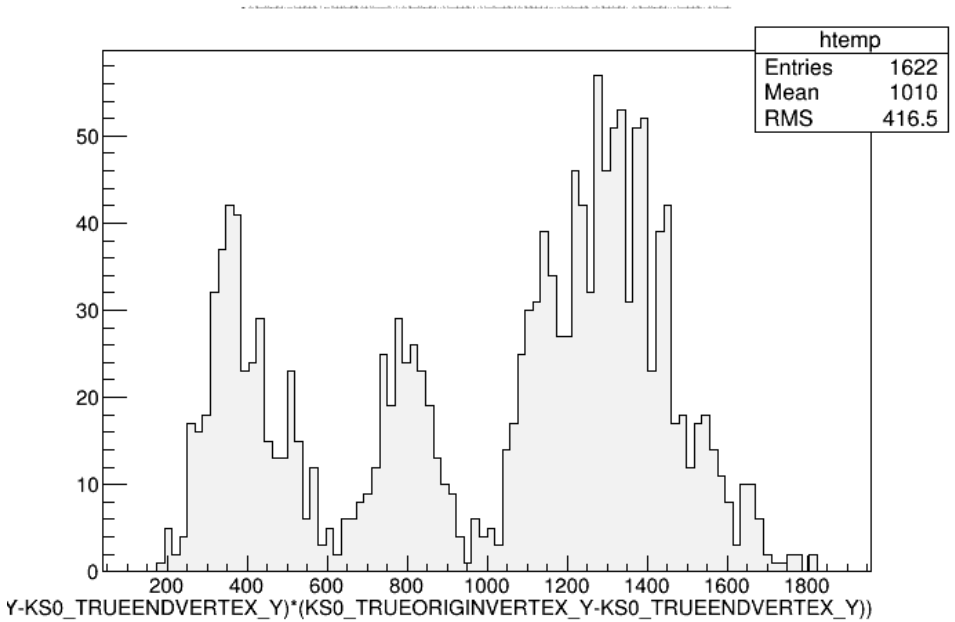
Flight distance of Inflaton

Reconstructed



Truth Matched



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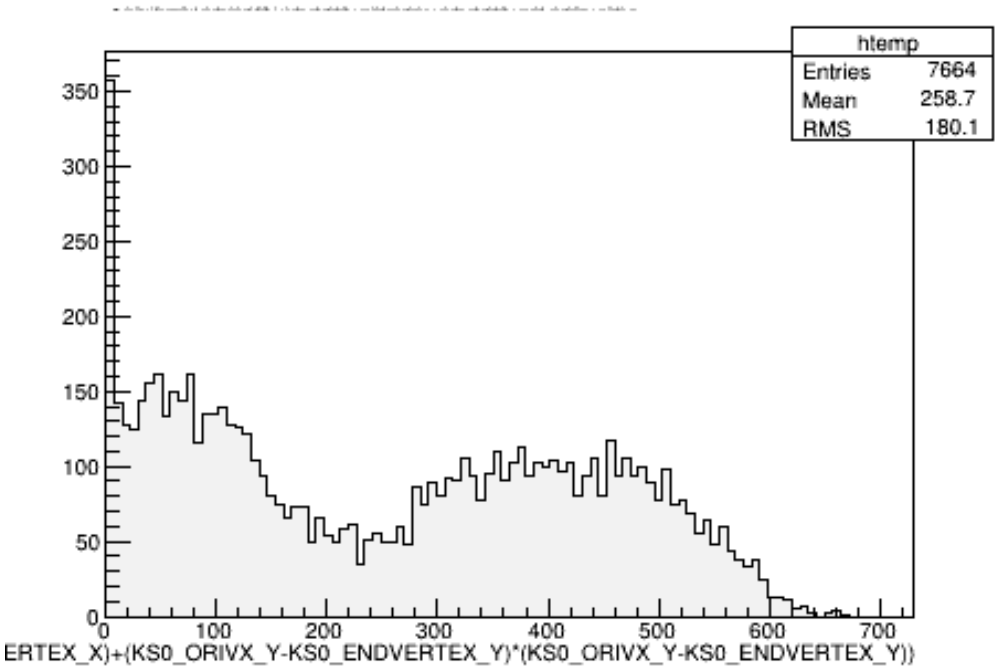
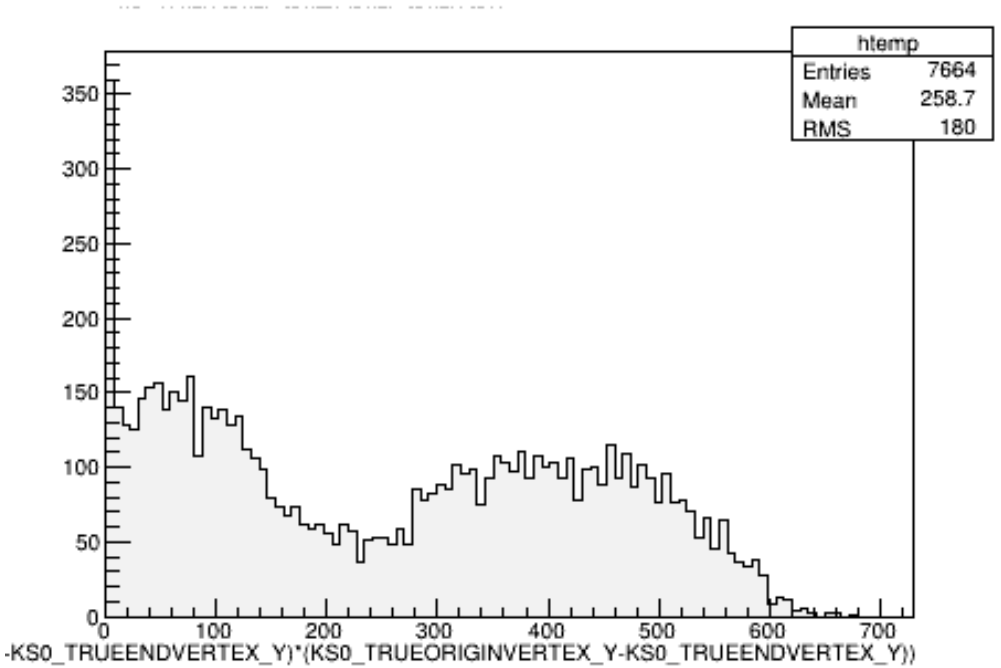
Flight distance of Inflaton, "normal" μ

Reconstructed



Truth Matched



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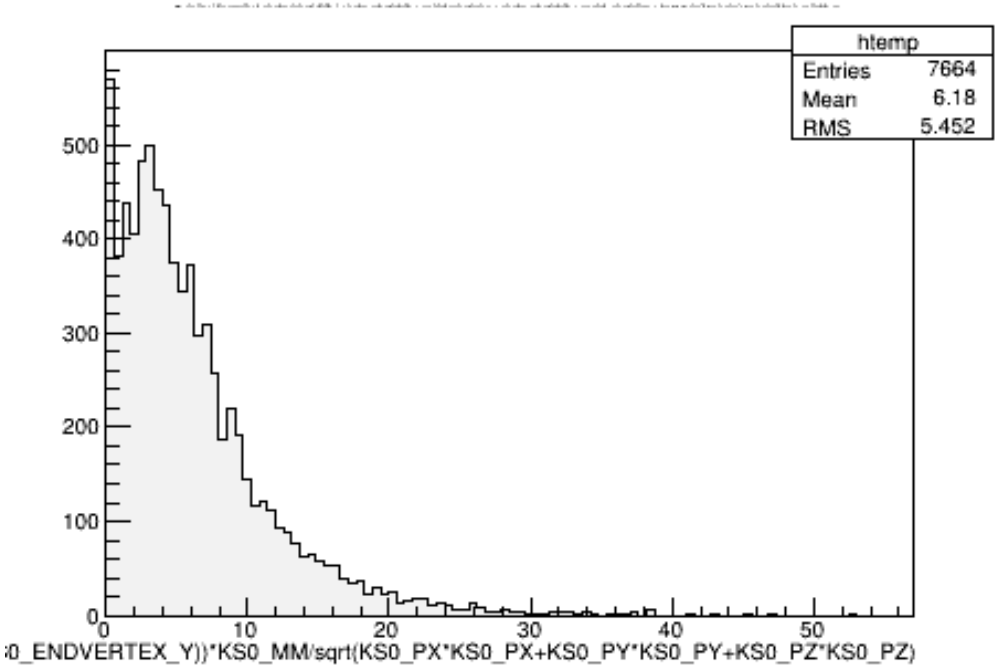
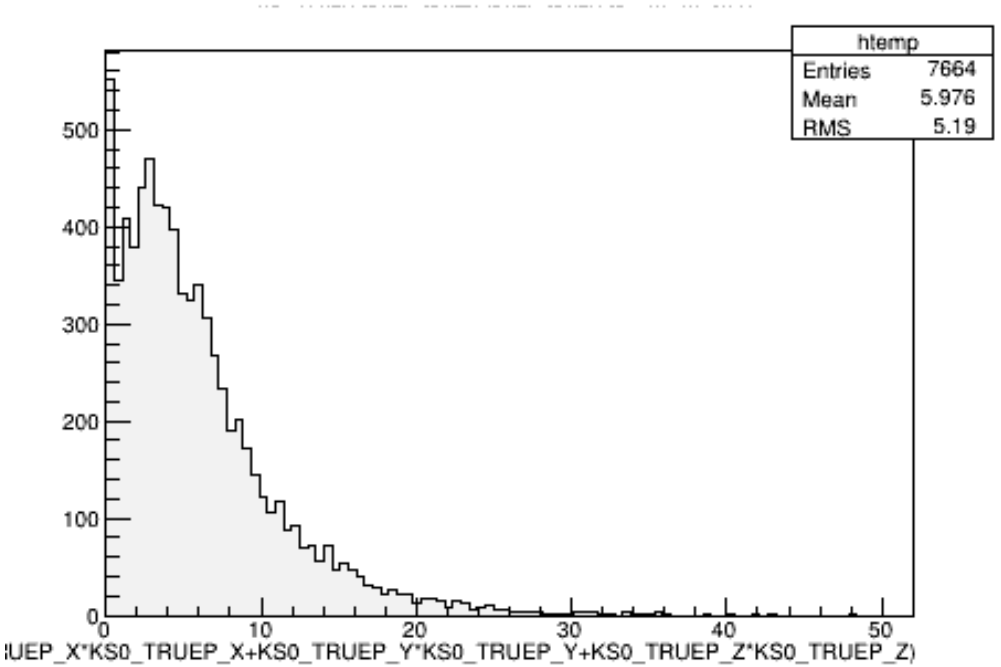
Life time of Inflaton, "normal" μ

Reconstructed



Truth Matched



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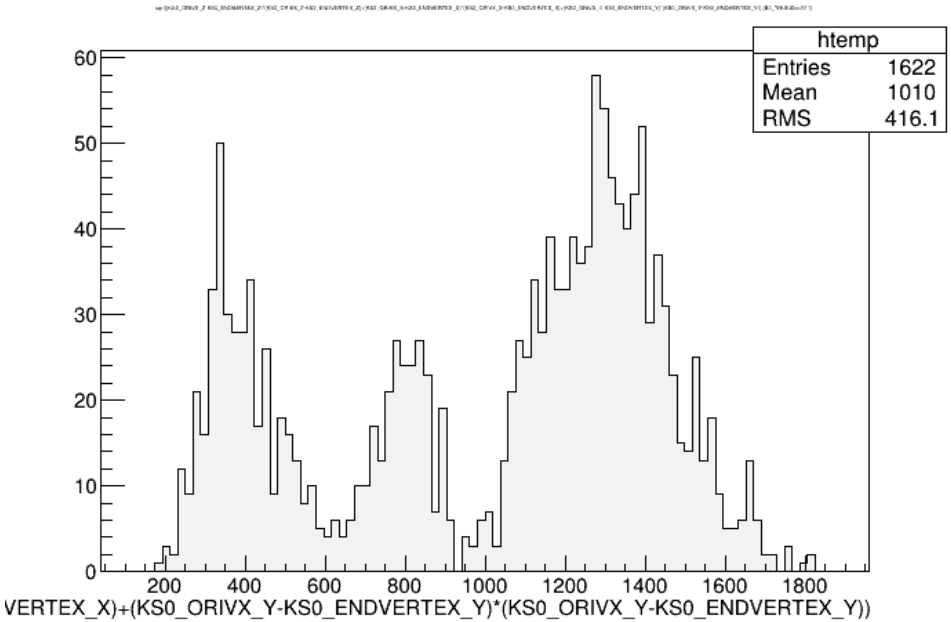
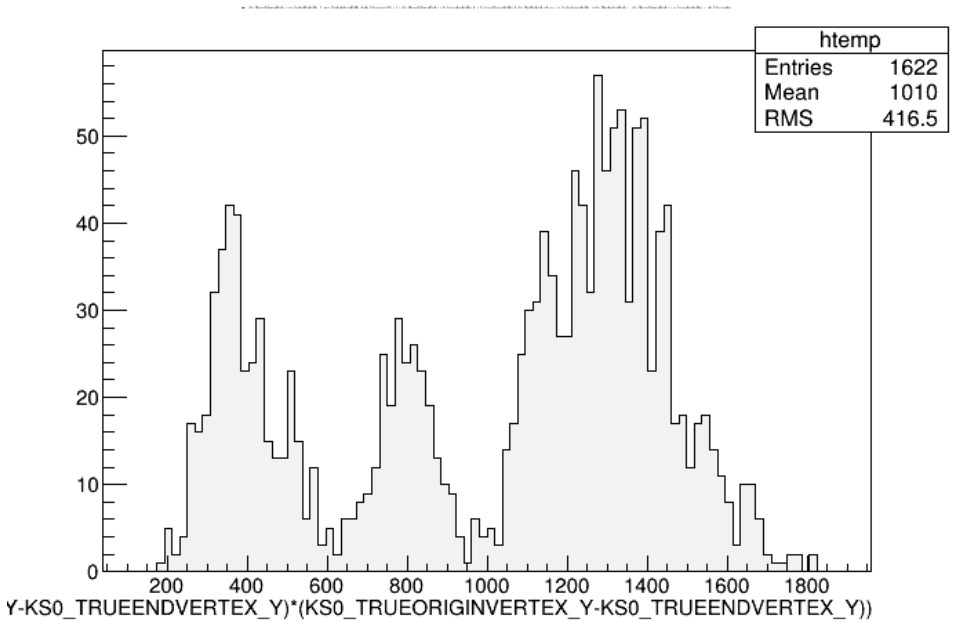
Flight distance of Inflaton, downstream μ

Reconstructed



Truth Matched



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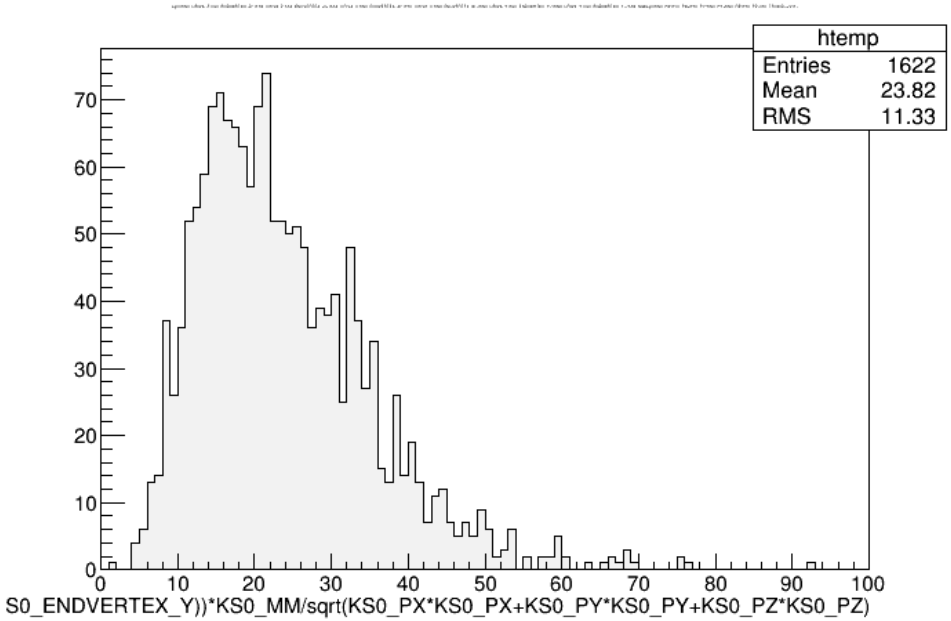
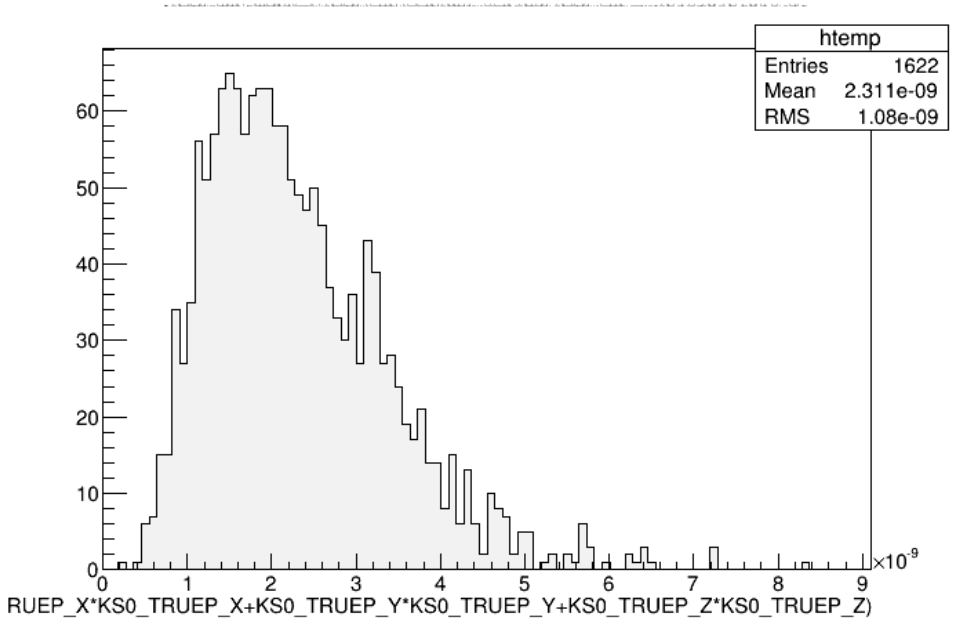
Life time of Inflaton, downstream μ

Reconstructed



Truth Matched



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Mass Resolution

- Fitted separately for $\mathrm{B}0$ and χ
- Fitting model: Double Gauss.
- Single Gauss didn't work.
- We will account for MC/DATA difference.

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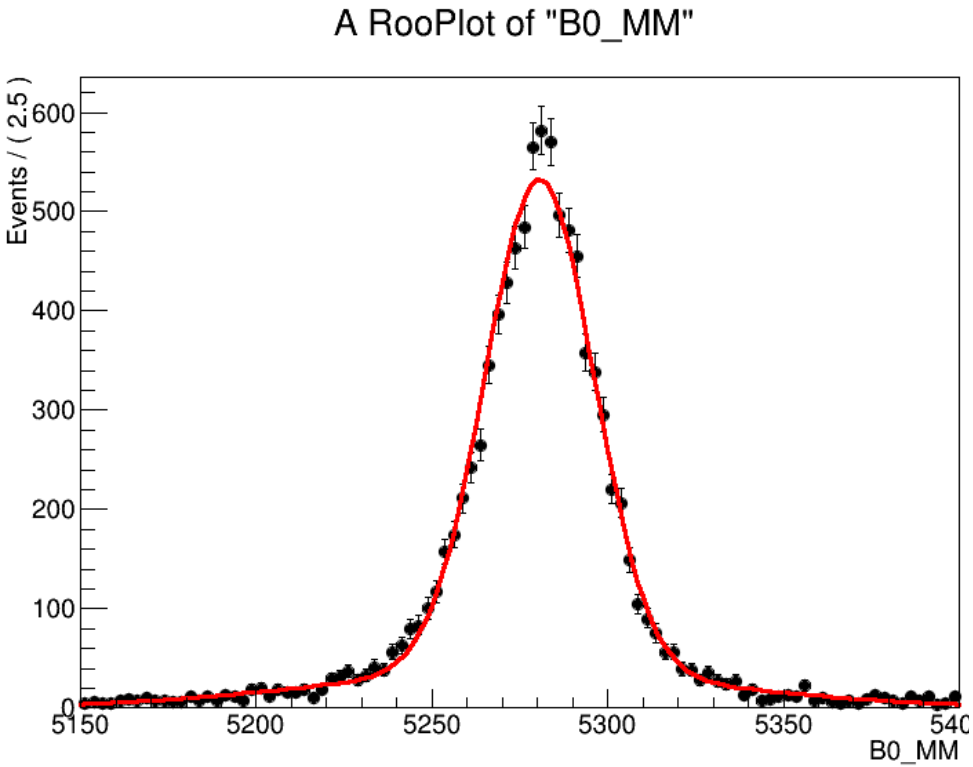
Mass Resolution

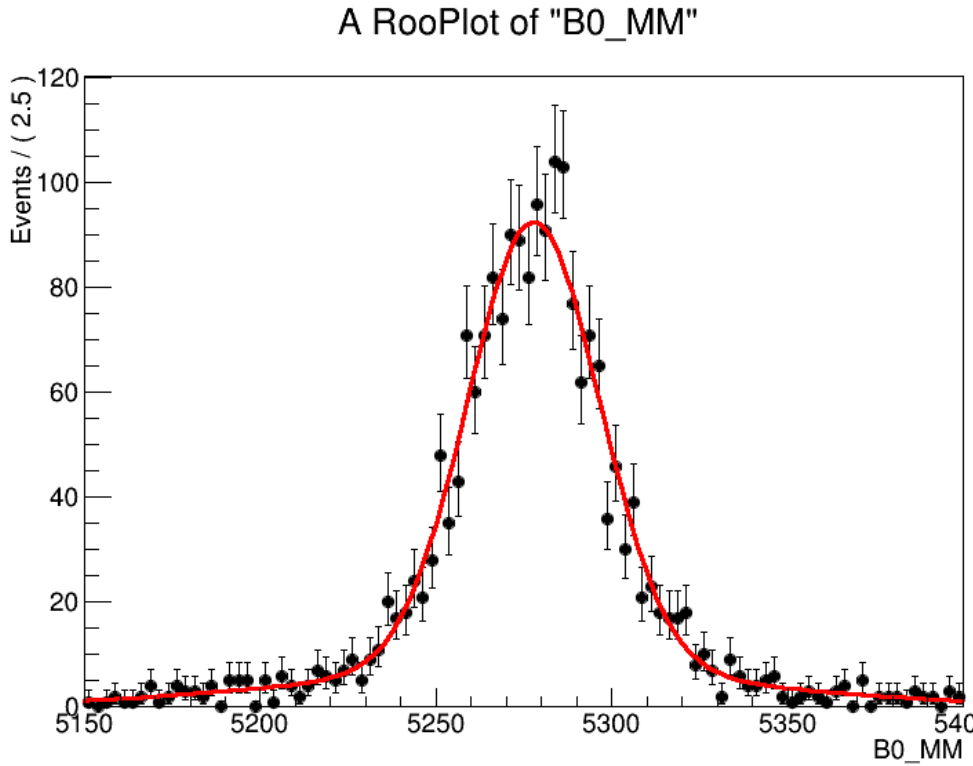
StdMuons



$mean_1 = 5.288 \times 10^{+03} \pm 0.21 MeV$,
$mean_2 = 5.27 \times 10^{+03} \pm 1.56 MeV$
$\sigma_1 = 58.8 \pm 2.24$, $\sigma_2 = 15.5 \pm 0.23$

$f = 0.79 \pm 0.01$

Downstream



$mean_1 = 5.28 \times 10^{+03} \pm 4.18 MeV$,
$mean_2 = 5.28 \times 10^{+03} \pm 0.56 MeV$
$\sigma_1 = 66.6 \pm 7.56$, $\sigma_2 = 18.7 \pm 0.65$

$f = 0.21 \pm 0.02$

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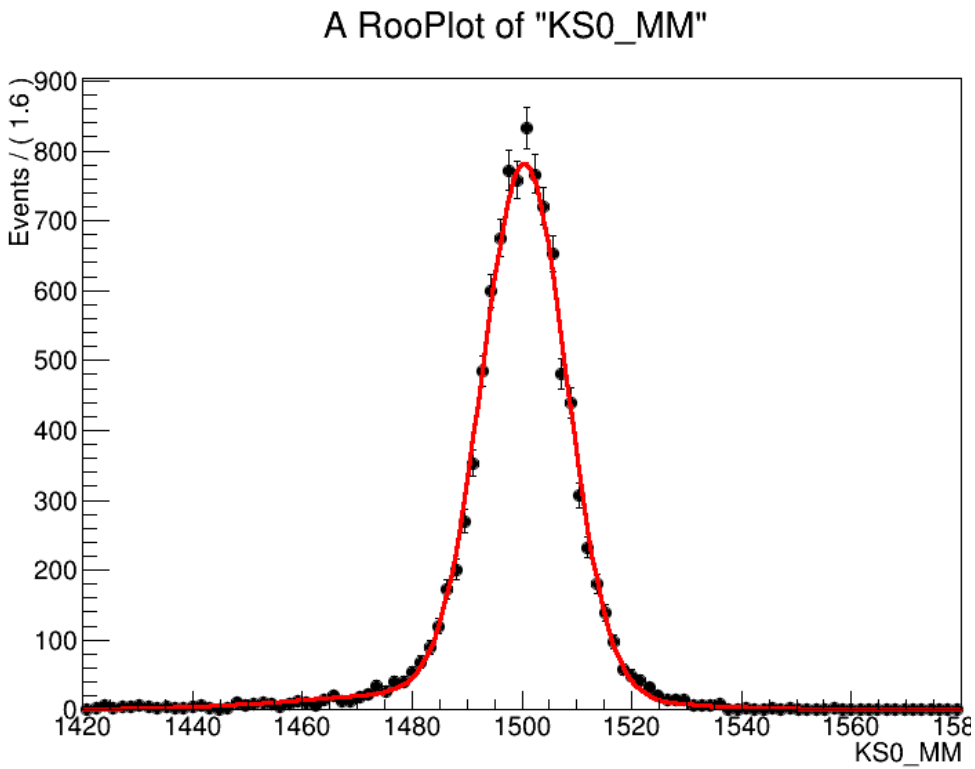
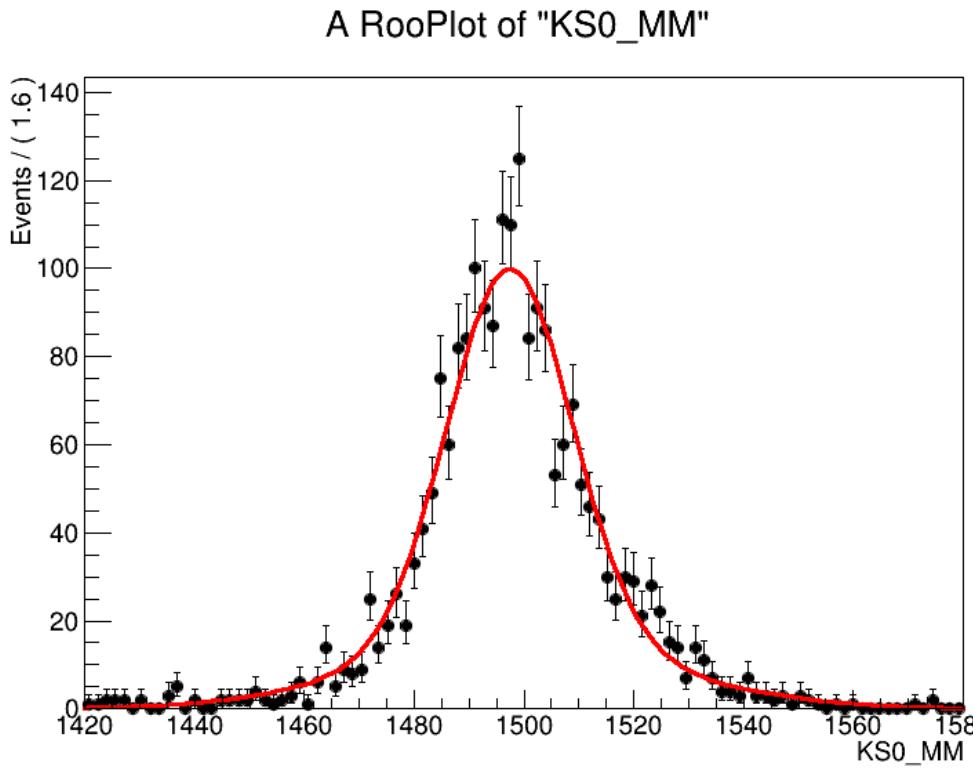
Mass Resolution

StdMuons



$mean_1 = 1.48893 \times 10^{+03} \pm 1.1 MeV$,
$mean_2 = 1.50046 \times 10^{+03} \pm 0.09 MeV$
$\sigma_1 = 25.7 \pm 0.83$, $\sigma_2 = 7.63 \pm 0.01$
$f = 0.104 \pm 0.007$

Downstream



$mean_1 = 1.49880 \times 10^{+03} \pm 1.41 MeV$,
$mean_2 = 1.49743 \times 10^{+03} \pm 0.51 MeV$
$\sigma_1 = 27.3 \pm 2.57$, $\sigma_2 = 11.34 \pm 0.88$
$f = 0.28 \pm 0.075$

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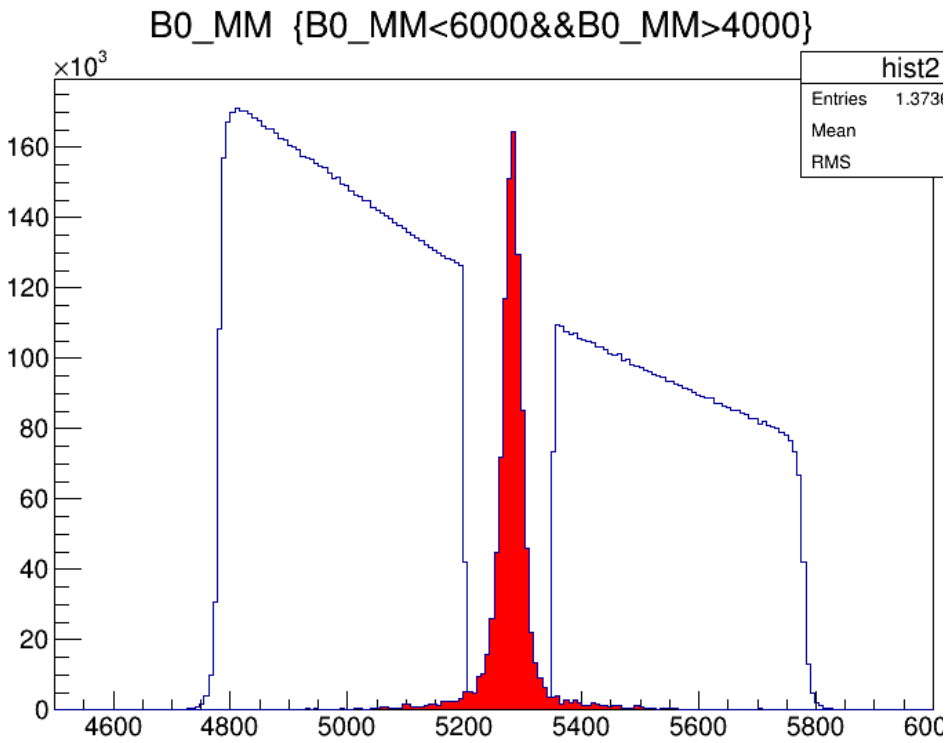
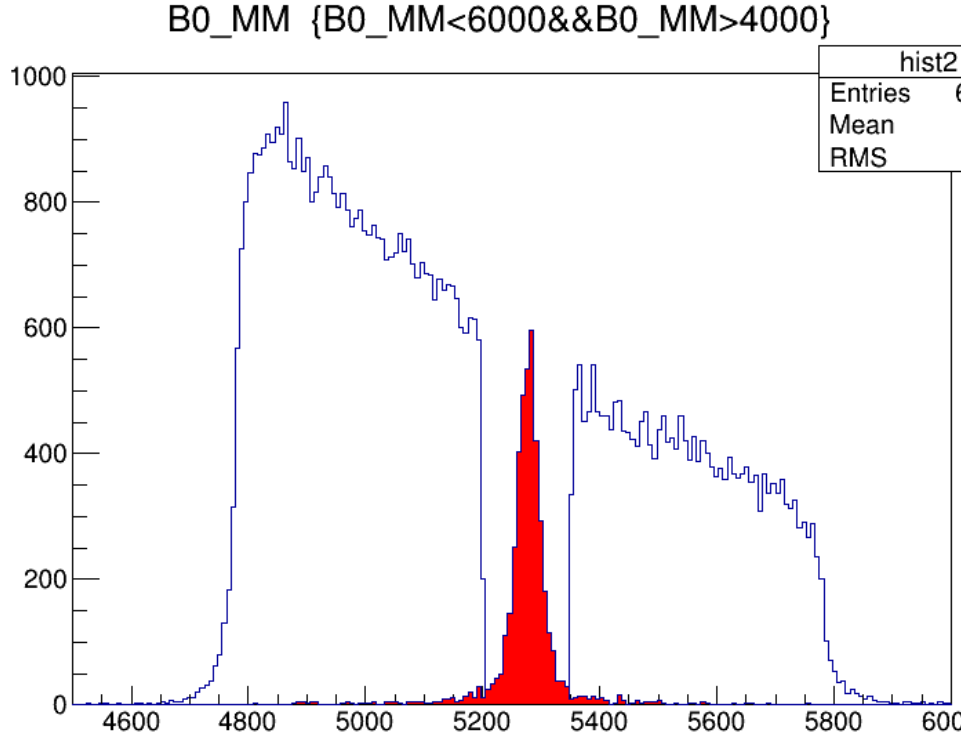
First look into data

UpStream



DownStream



Blinded: $[5200, 5350]$

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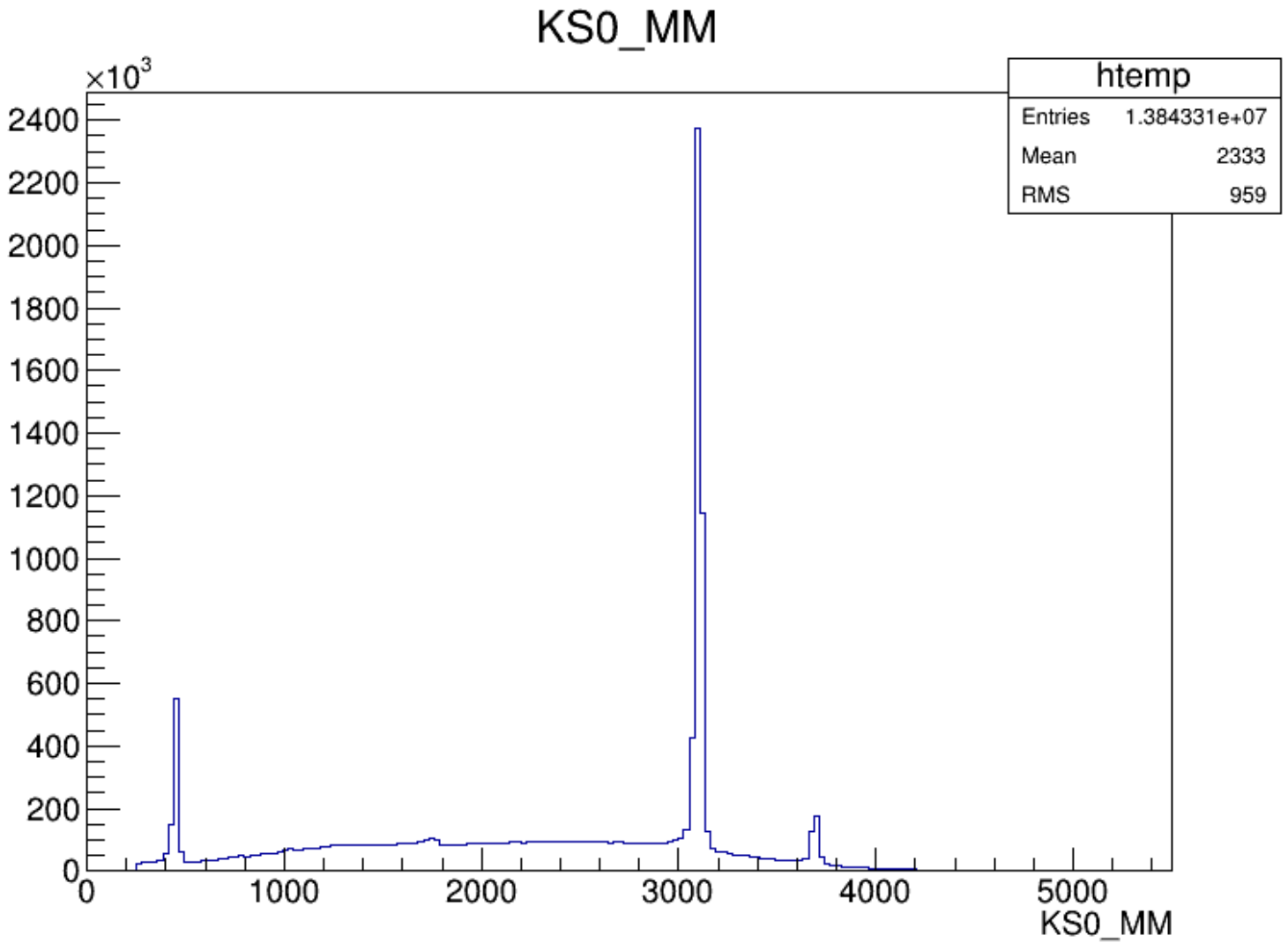
What do we have in the Inflaton mass; UPSTREAM



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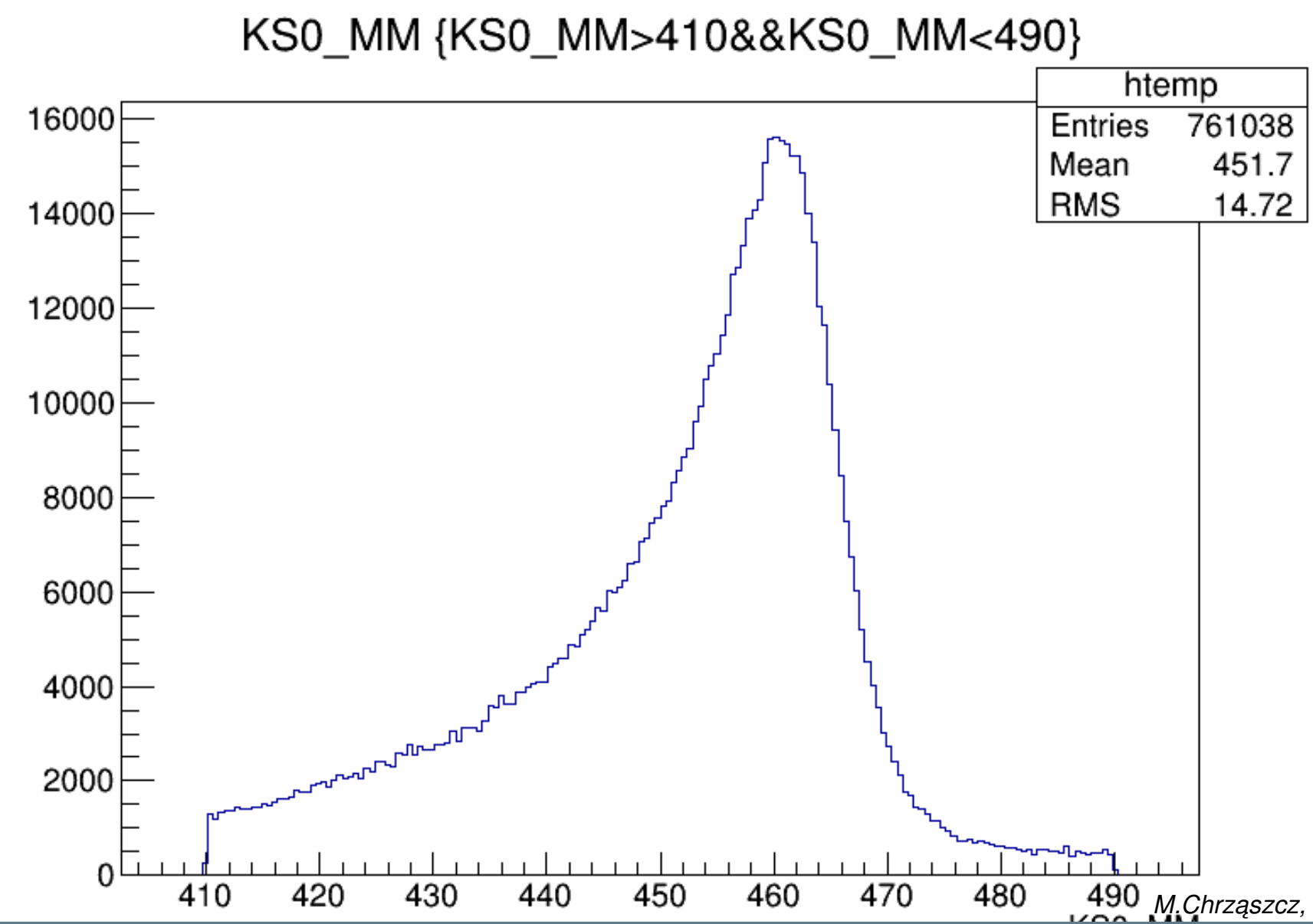
K_s



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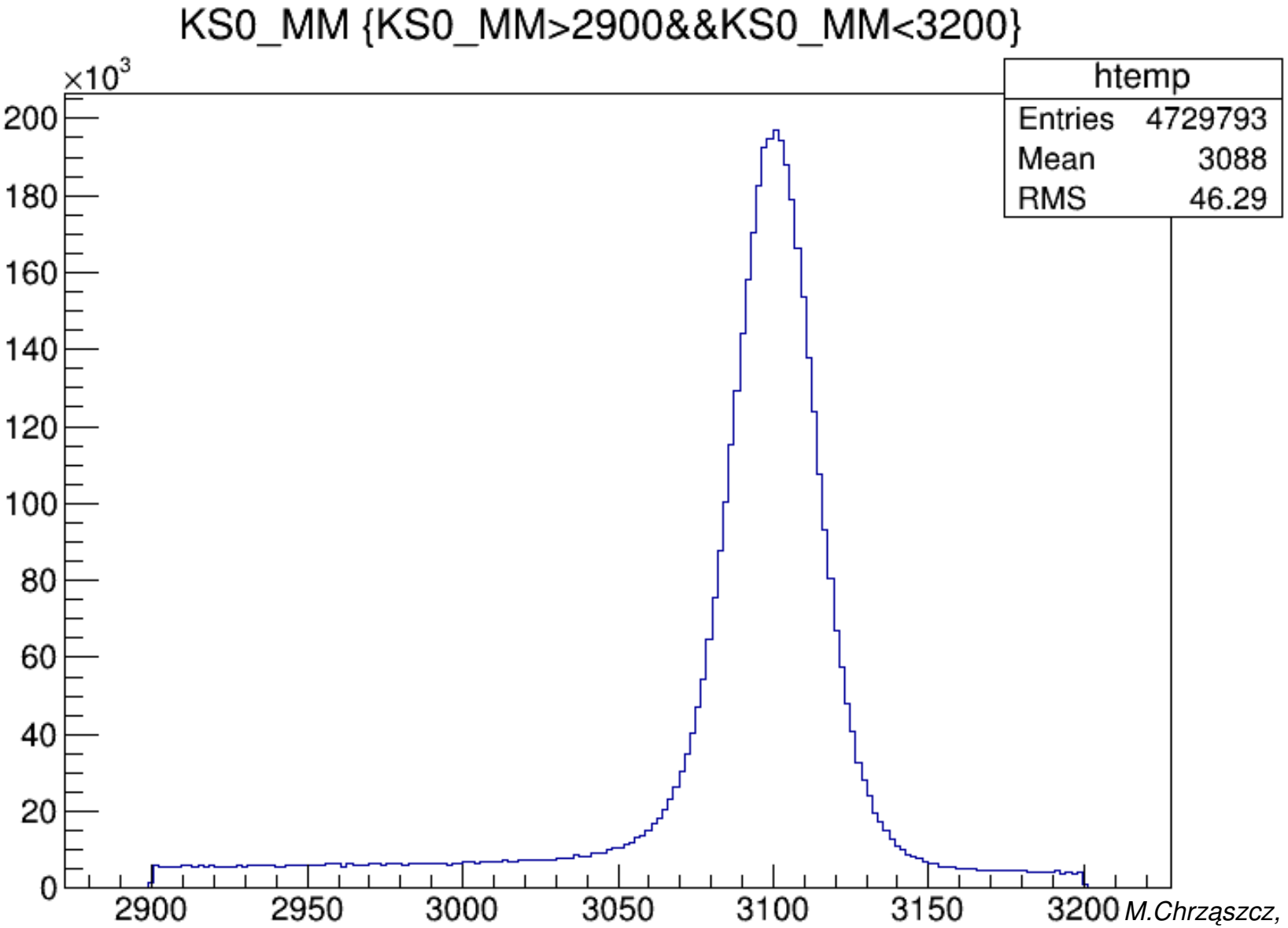
J/Ψ



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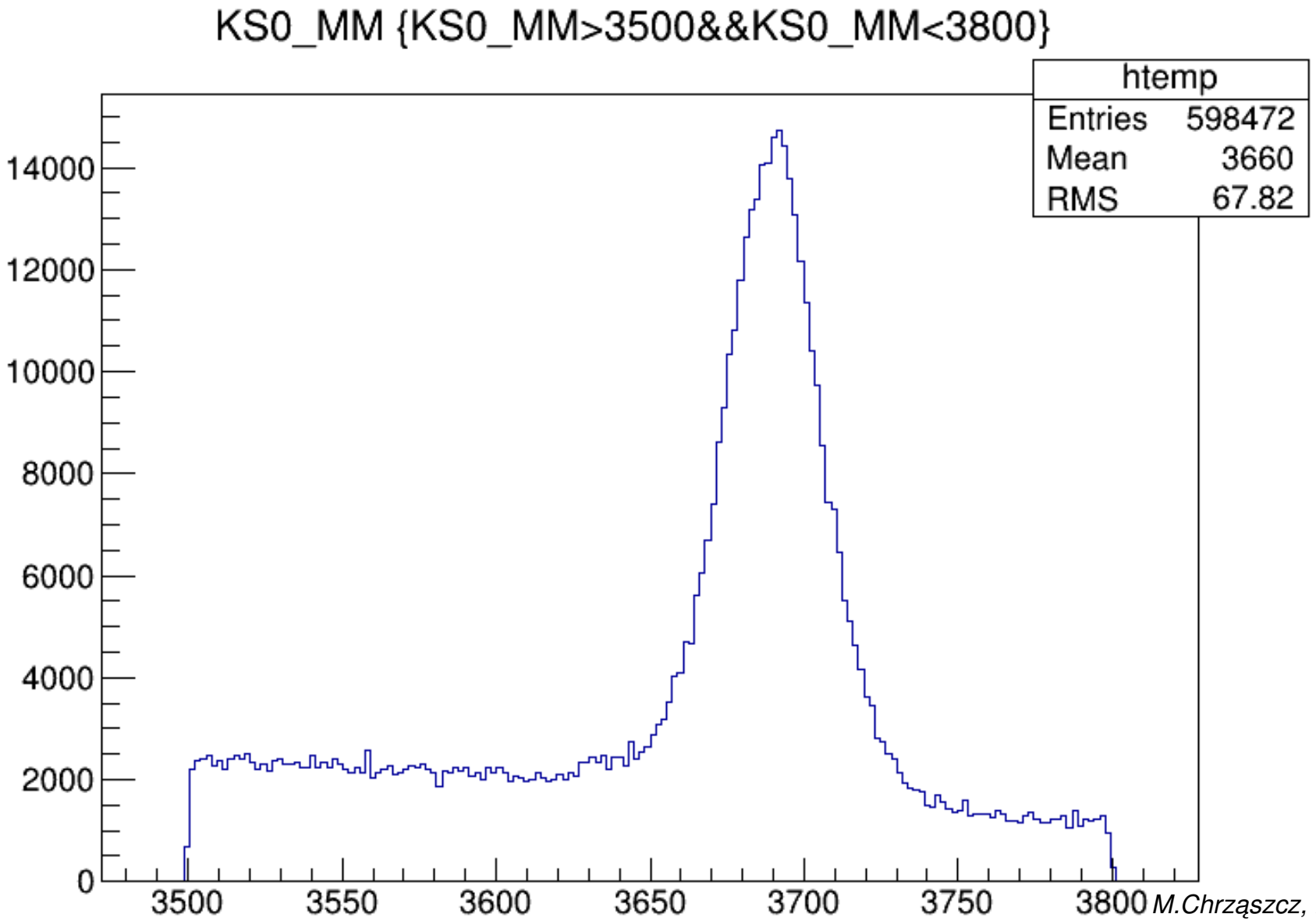
$\psi(2S)$



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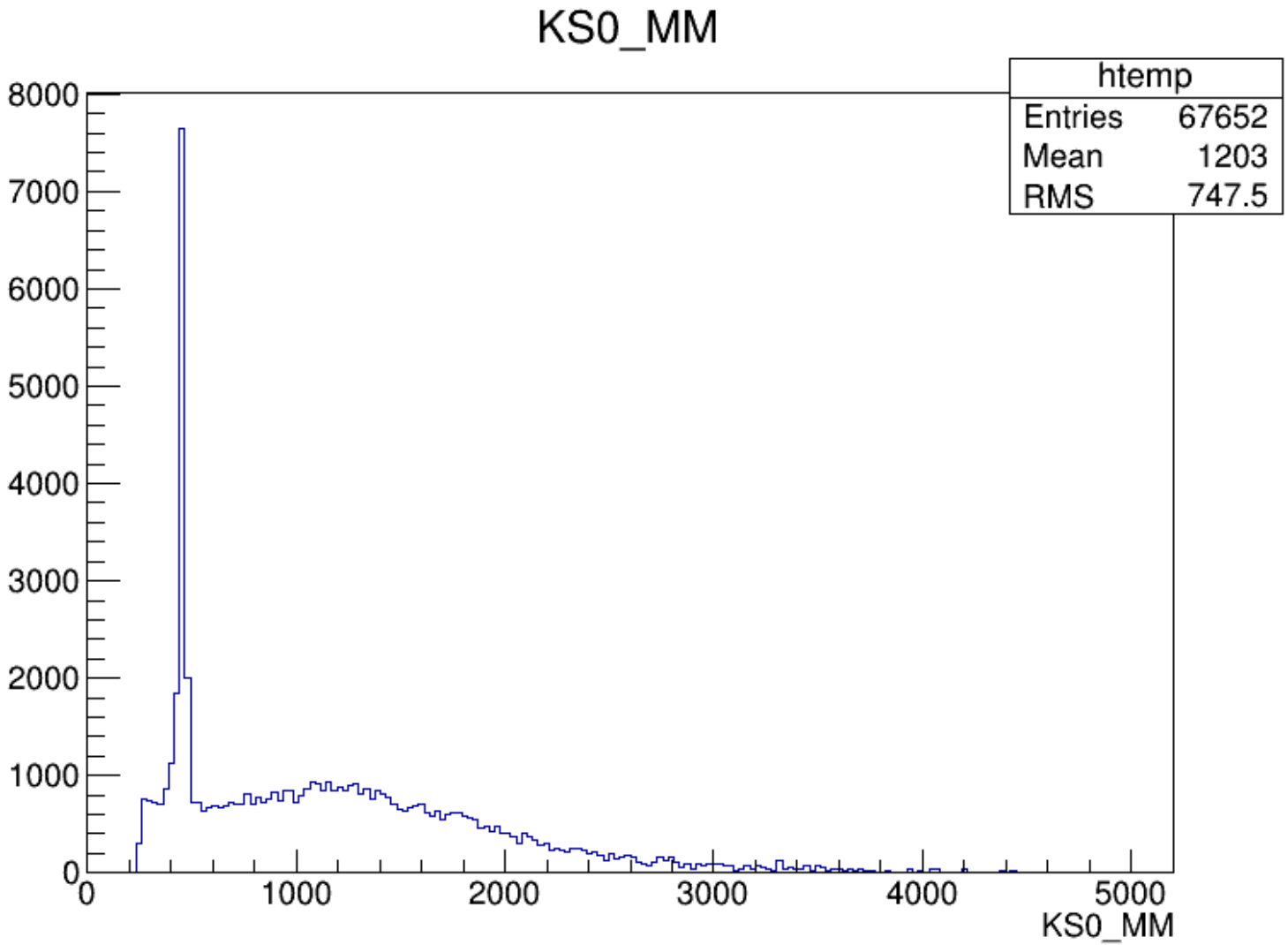
What do we have in the Inflaton mass; DOWNSTREAM



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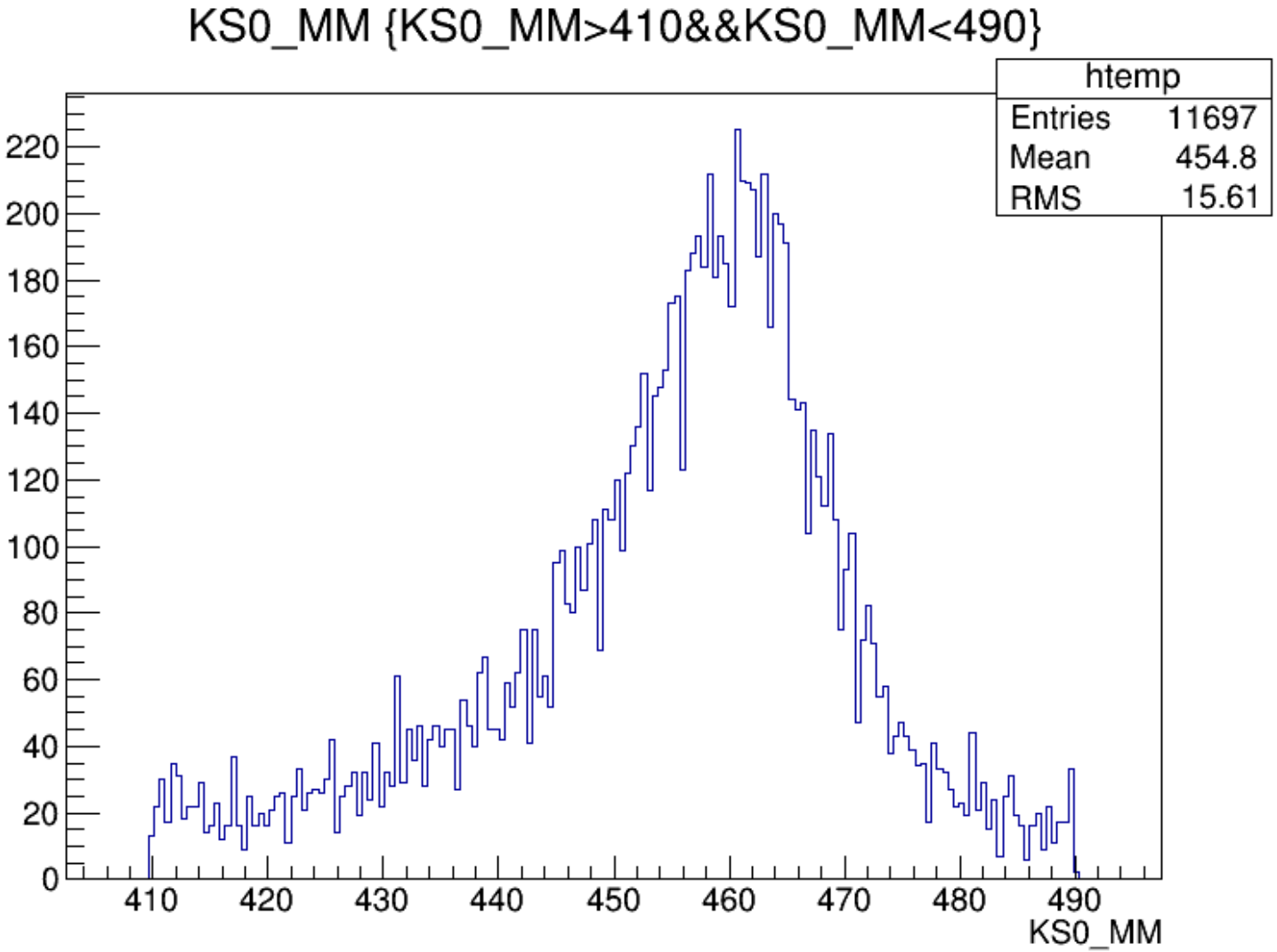
K_s



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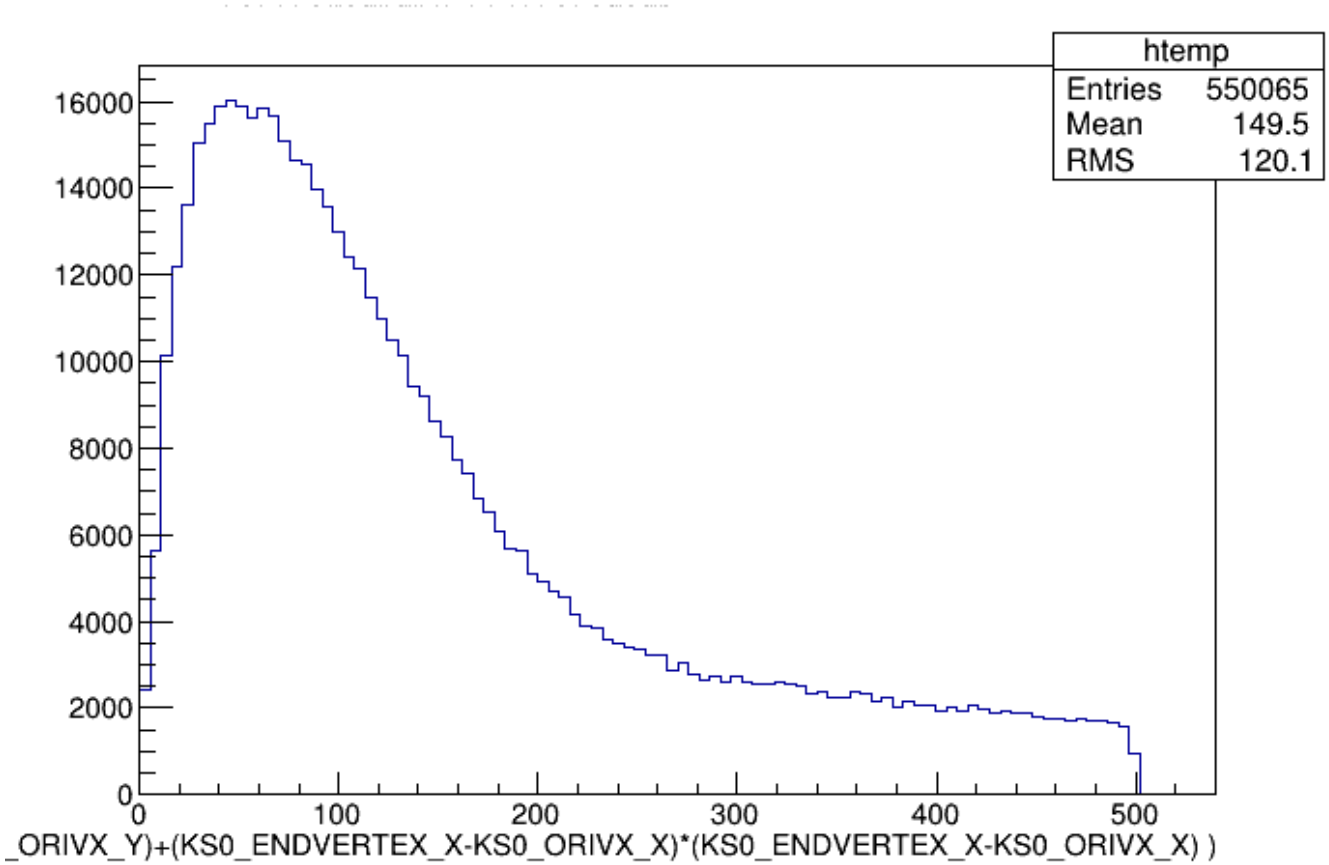
K_s FD



looks normal ☹

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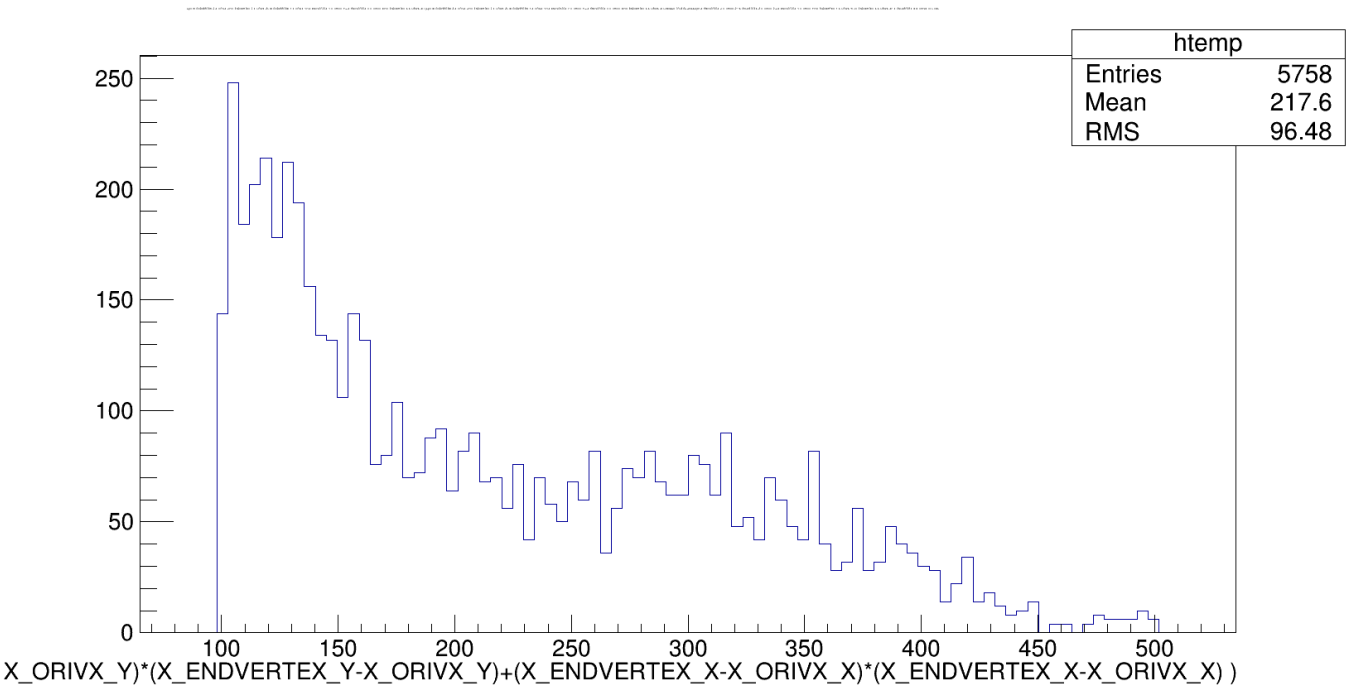
Let's make our inflaton more K_s like.



No bumps.Are we unlucky?

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First look into data

- We see big difference depending on life time of the inflaton.
- Since normalization channel is $B \to J/\psi K_s$ we need to reweigh depending on mass and life-time.
- We changed the stripping line. This should buy us some efficiency.
- Mayby put a BDT for next stripping.
- It's getting old but mayby again blending would work?

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