

XE DOPING STATUS

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March 16, 2022

REMINDER: KEY EFFECTS OF XE DOPING

- Scintillation wavelength: 128 nm \rightarrow 174 nm
- Scintillation time structure:

$$I(t) = I_f e^{-t/\tau_f} + I_s e^{-t/\tau_s} \quad \text{LAr}$$

$$I(t) = I_f e^{-t/\tau_f} + I_s e^{-t/\tau_s} - I_d e^{-t/\tau_d} \quad \text{XeDLAr}$$

with $\tau_f = 6\text{ns}$ for both, $\tau_s = 1300\text{ns} \rightarrow \sim 450\text{ns}$ for XeDLAr,
and $\tau_d \sim 200\text{ns}$ (XeDLAr only)

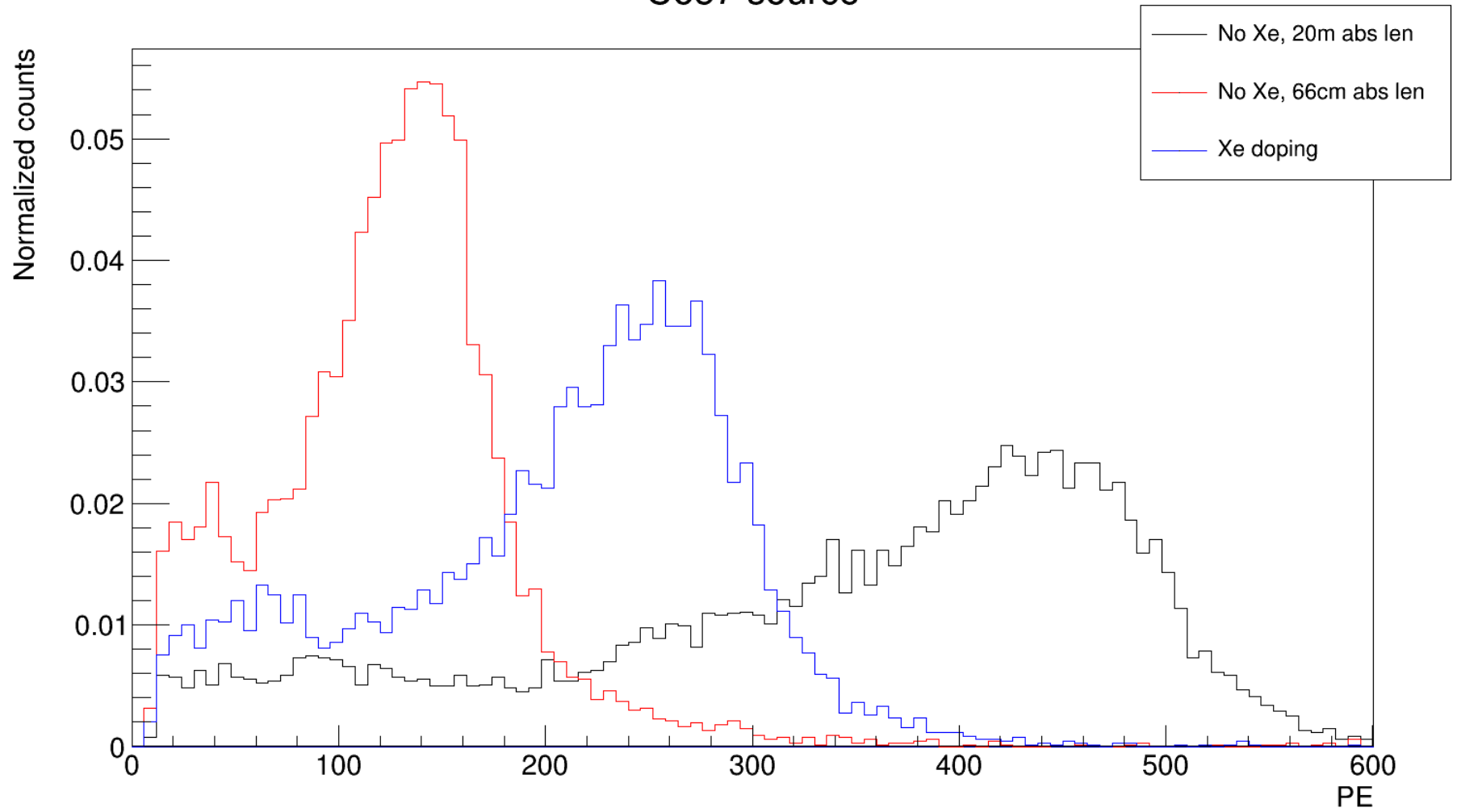
- Absorption length in the scintillator increases from 66 cm to 150 cm (was previously set to 20 m for undoped LAr)

XE DOPING IMPLEMENTATION IN `cenns10geant4`

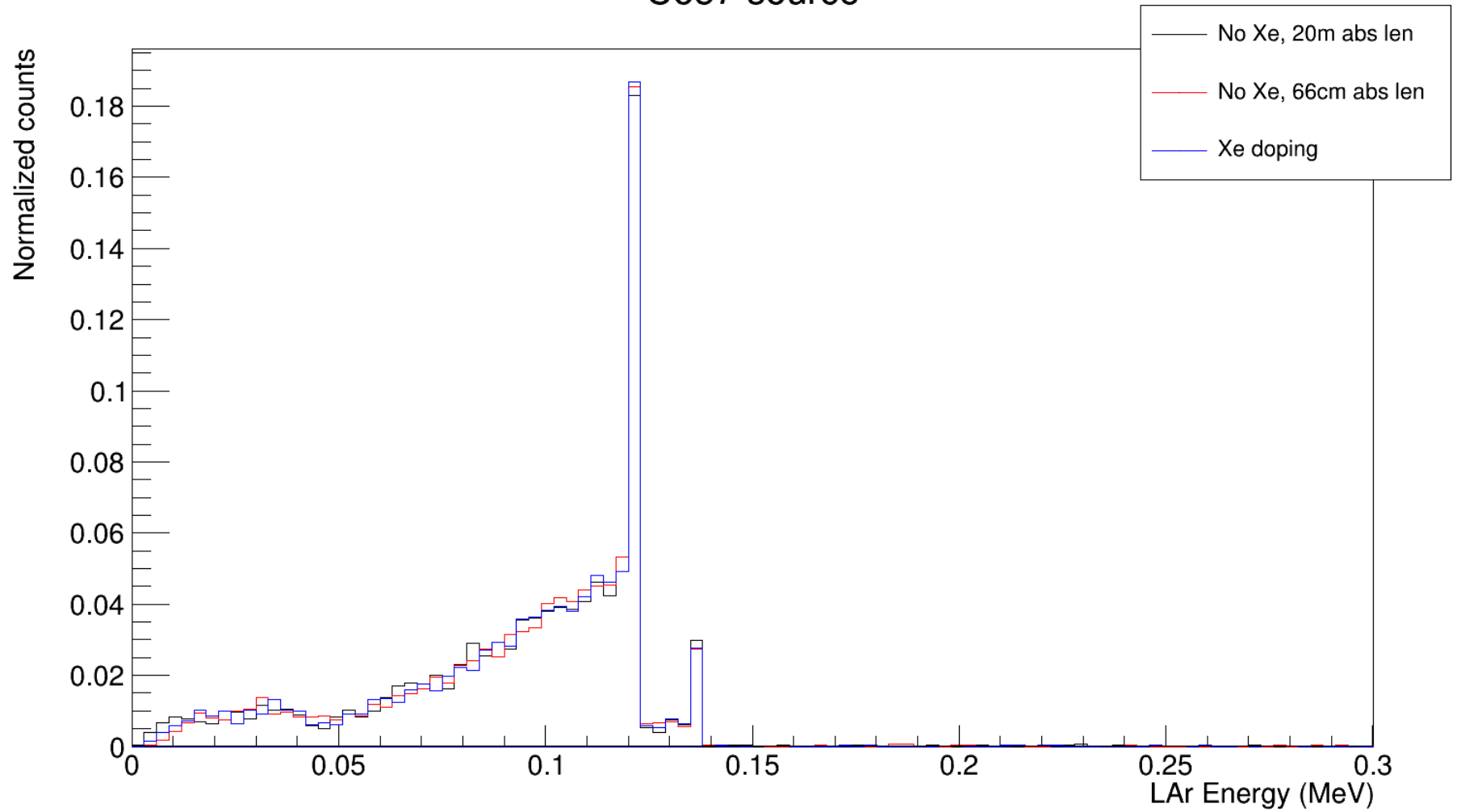
- A new GDML file specifies the values of scintillation wavelength, time constants, and absorption length for XeDLAr
- `CENNSScintillation` has been modified to accommodate the more complicated scintillation time structure
- Caveats:
 - There is no correlation between scintillation time and wavelength (probably incorrect)
 - Finite rise time not supported
 - I have guessed a value of $I_d/I_s = 0.4$, will need to be tuned

COMPARISON PLOTS

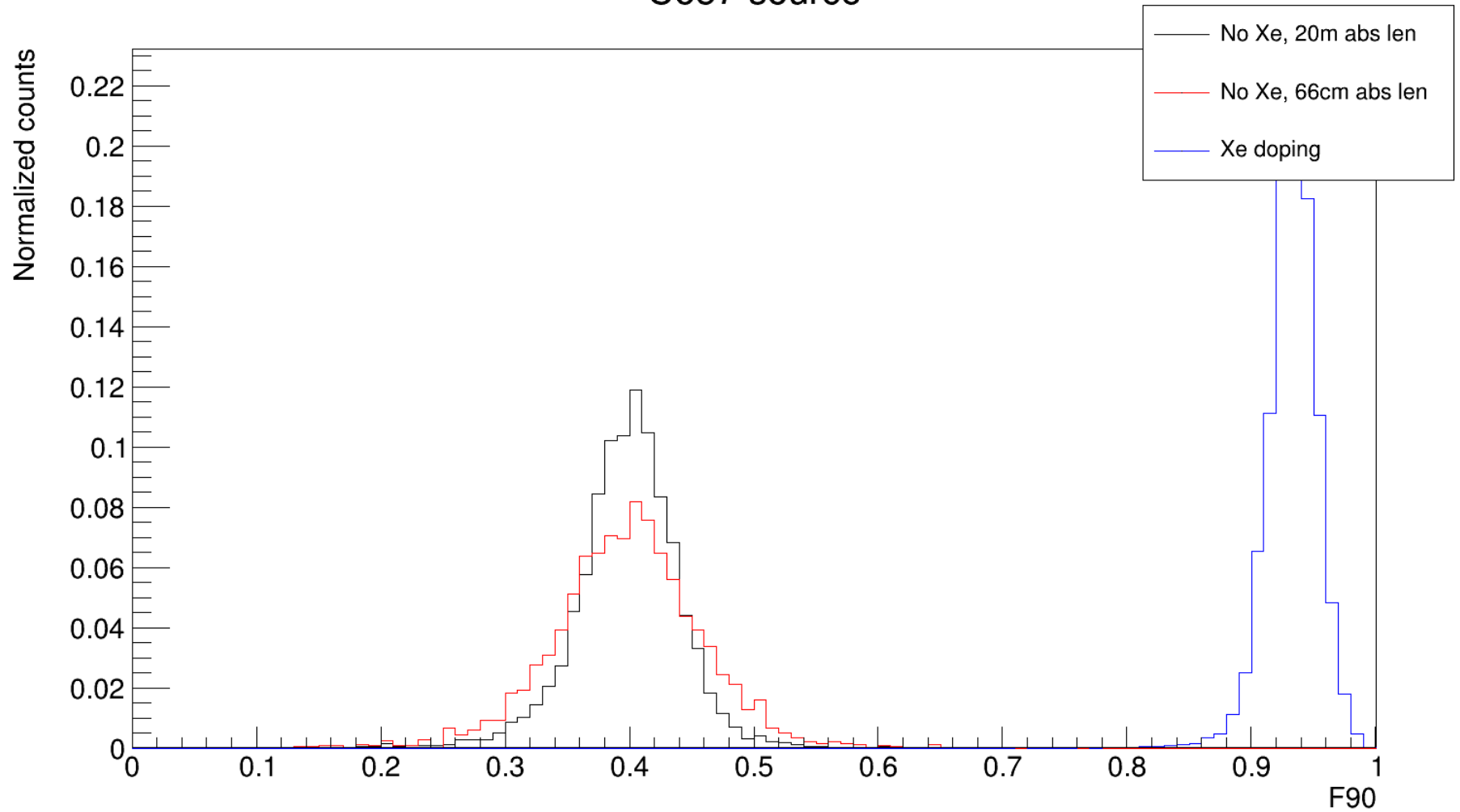
Co57 source



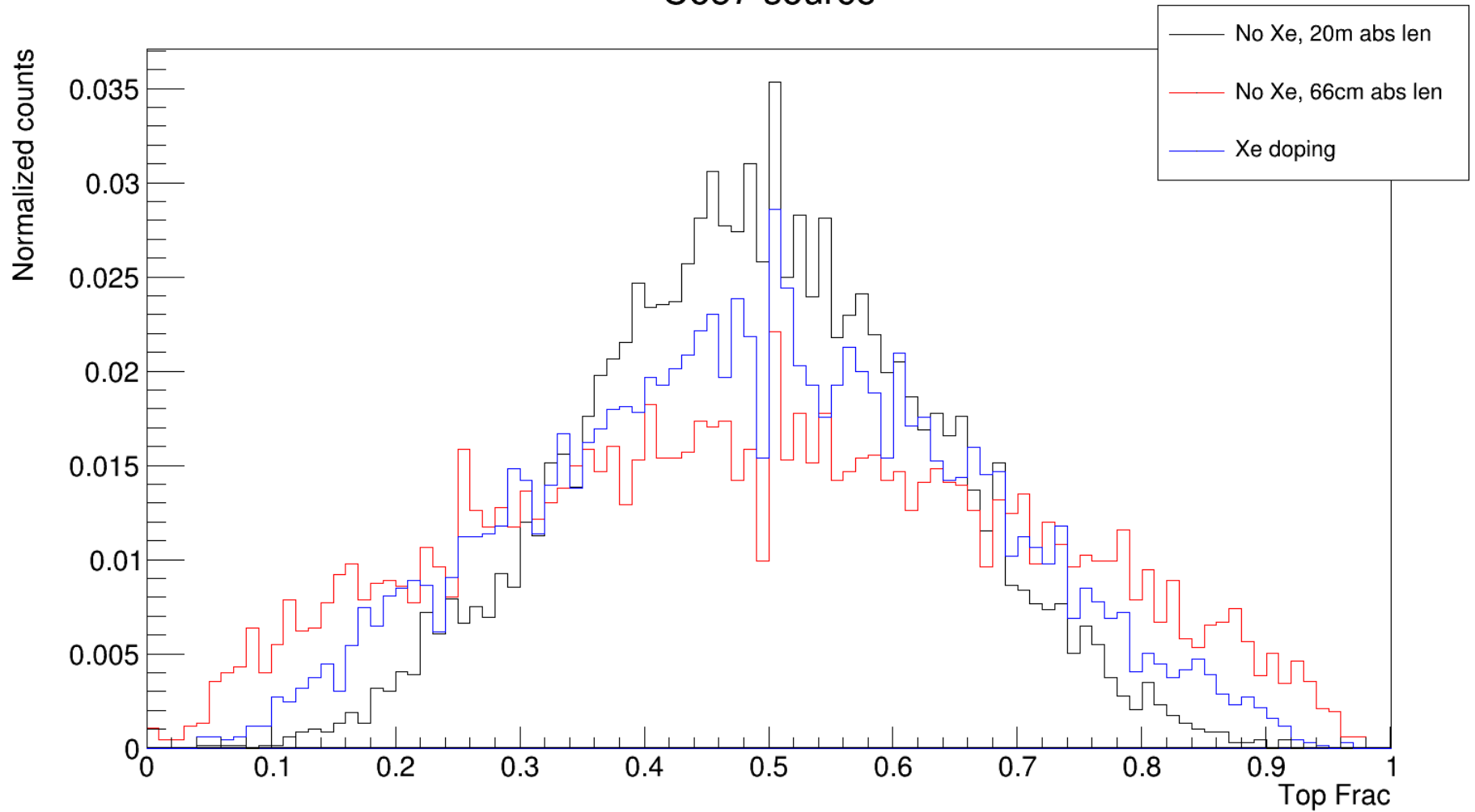
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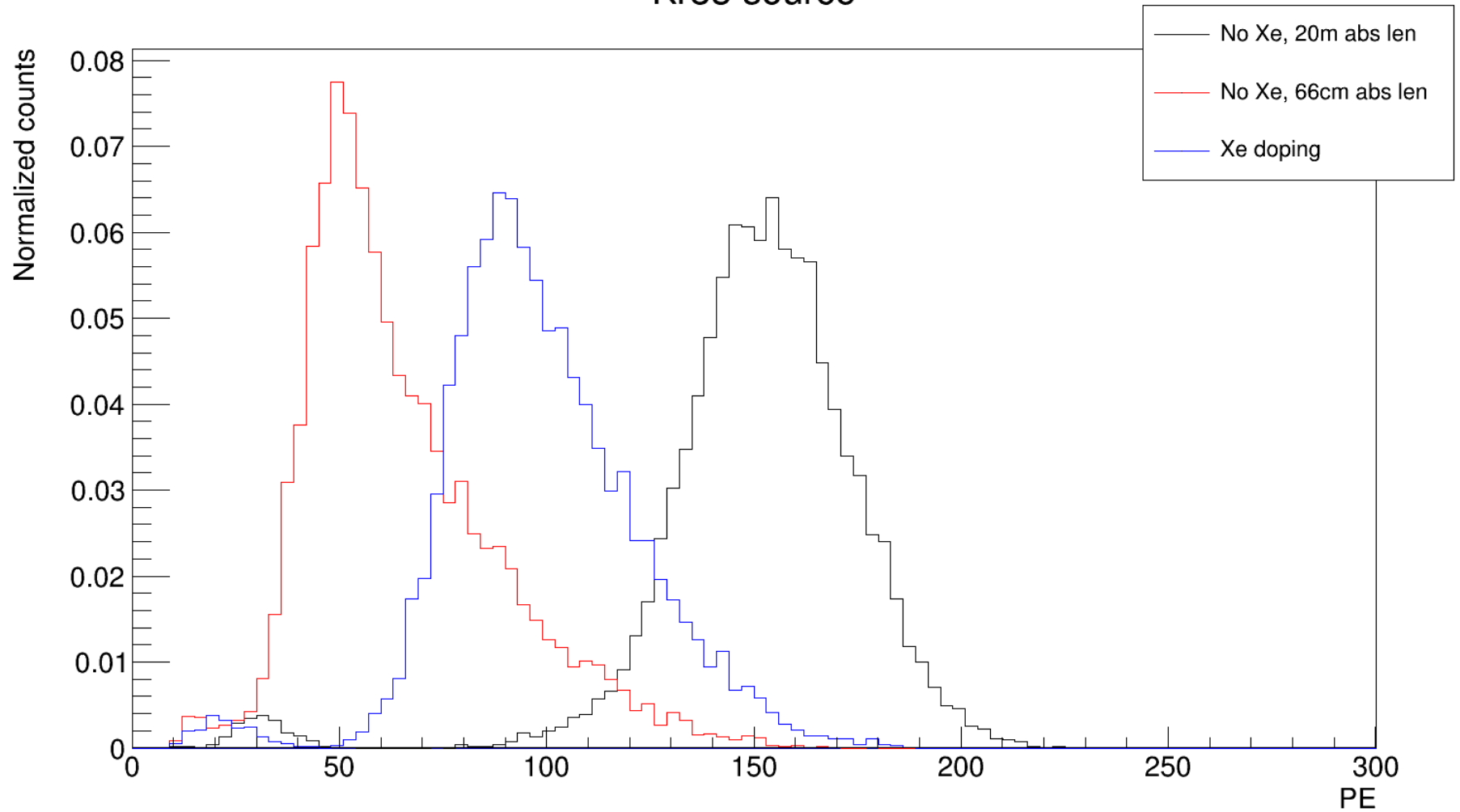
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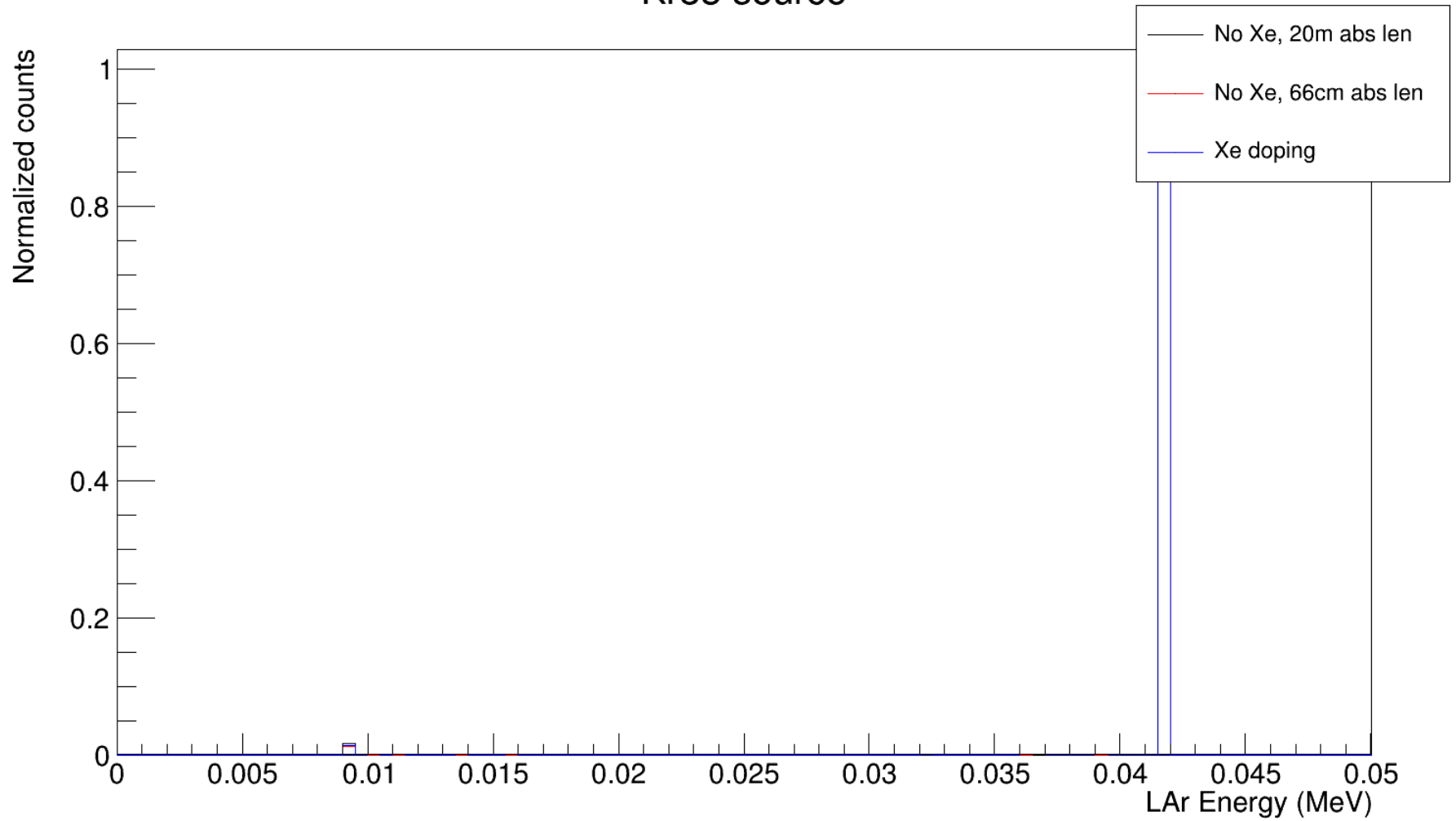
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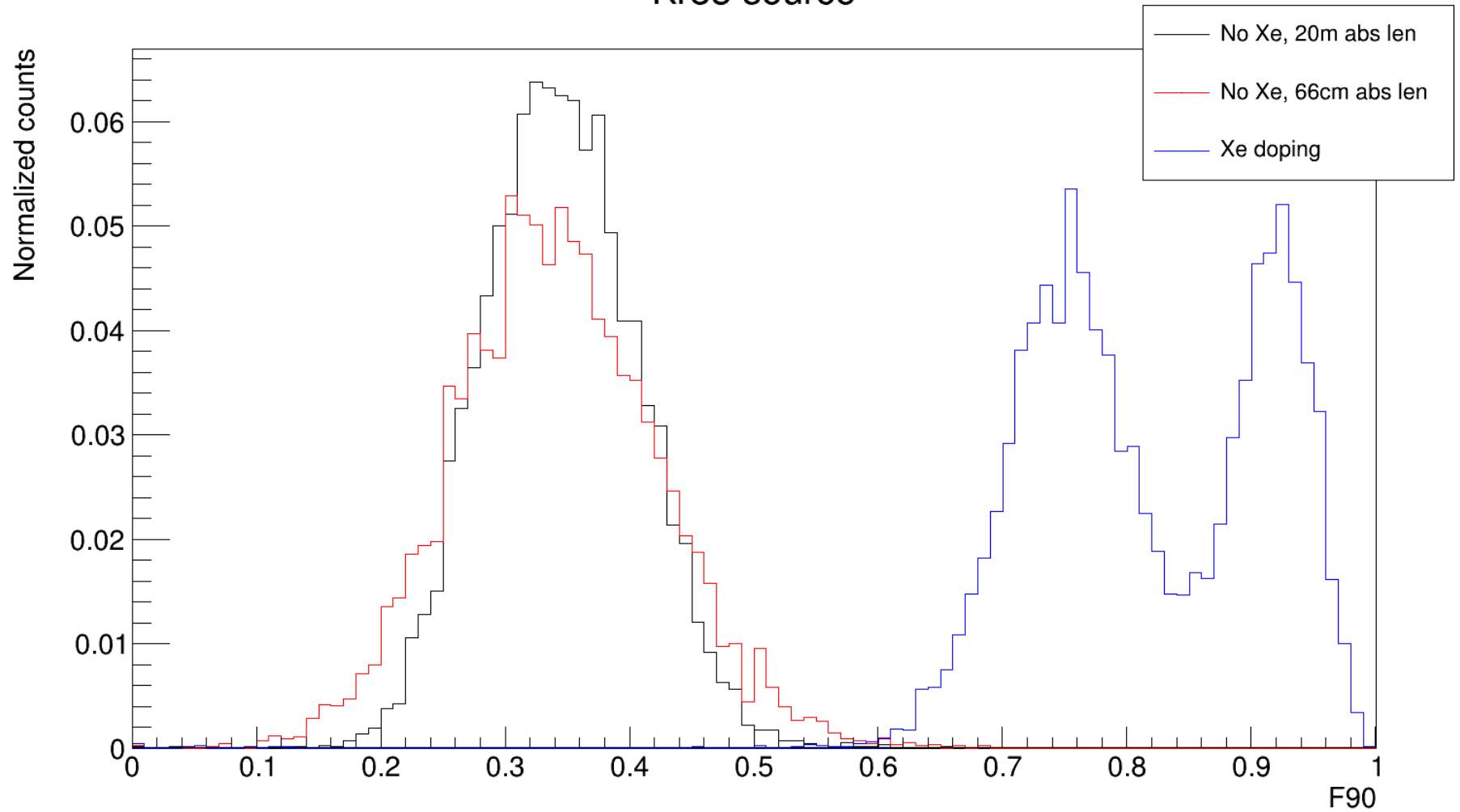
Kr83 source



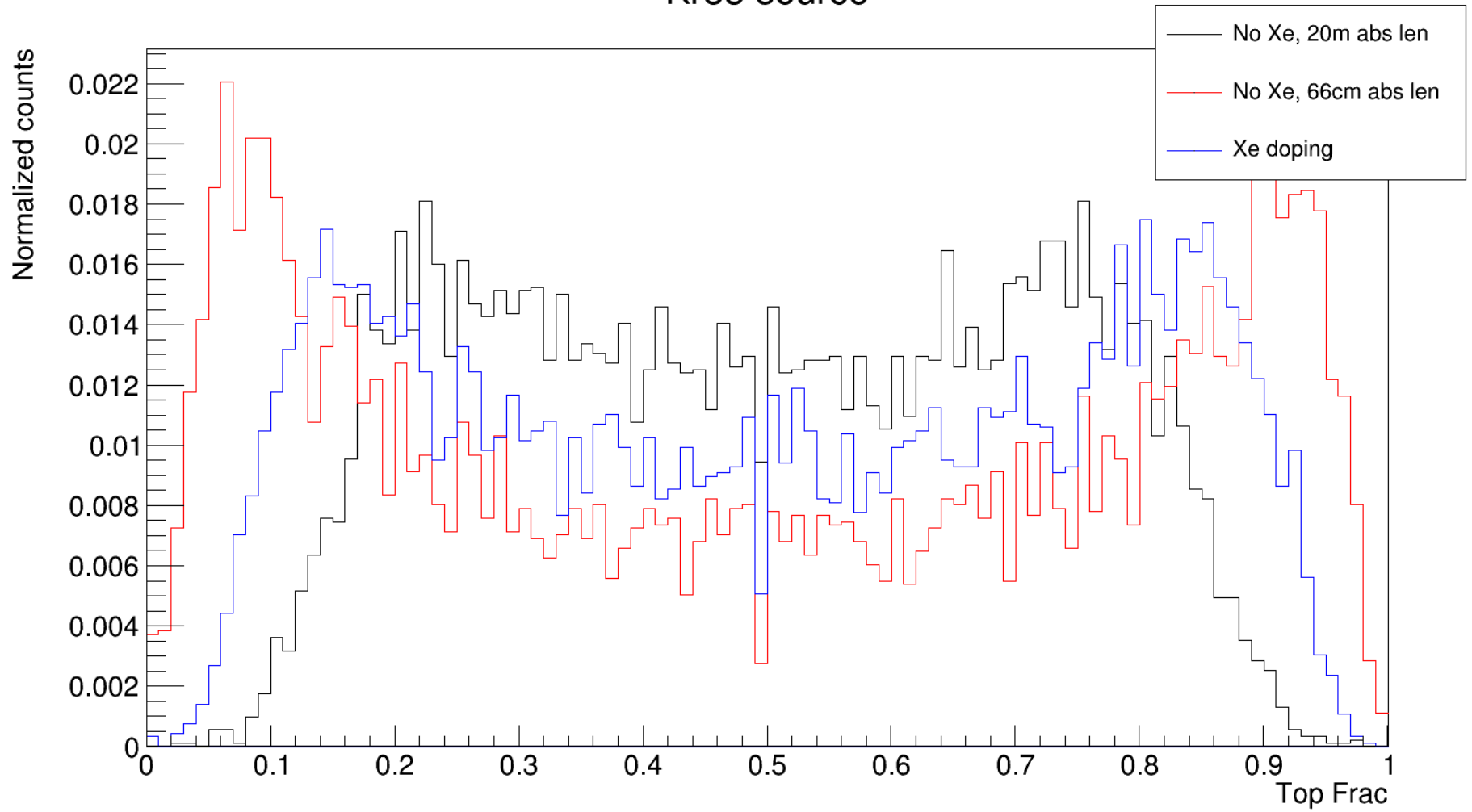
Kr83 source



Kr83 source

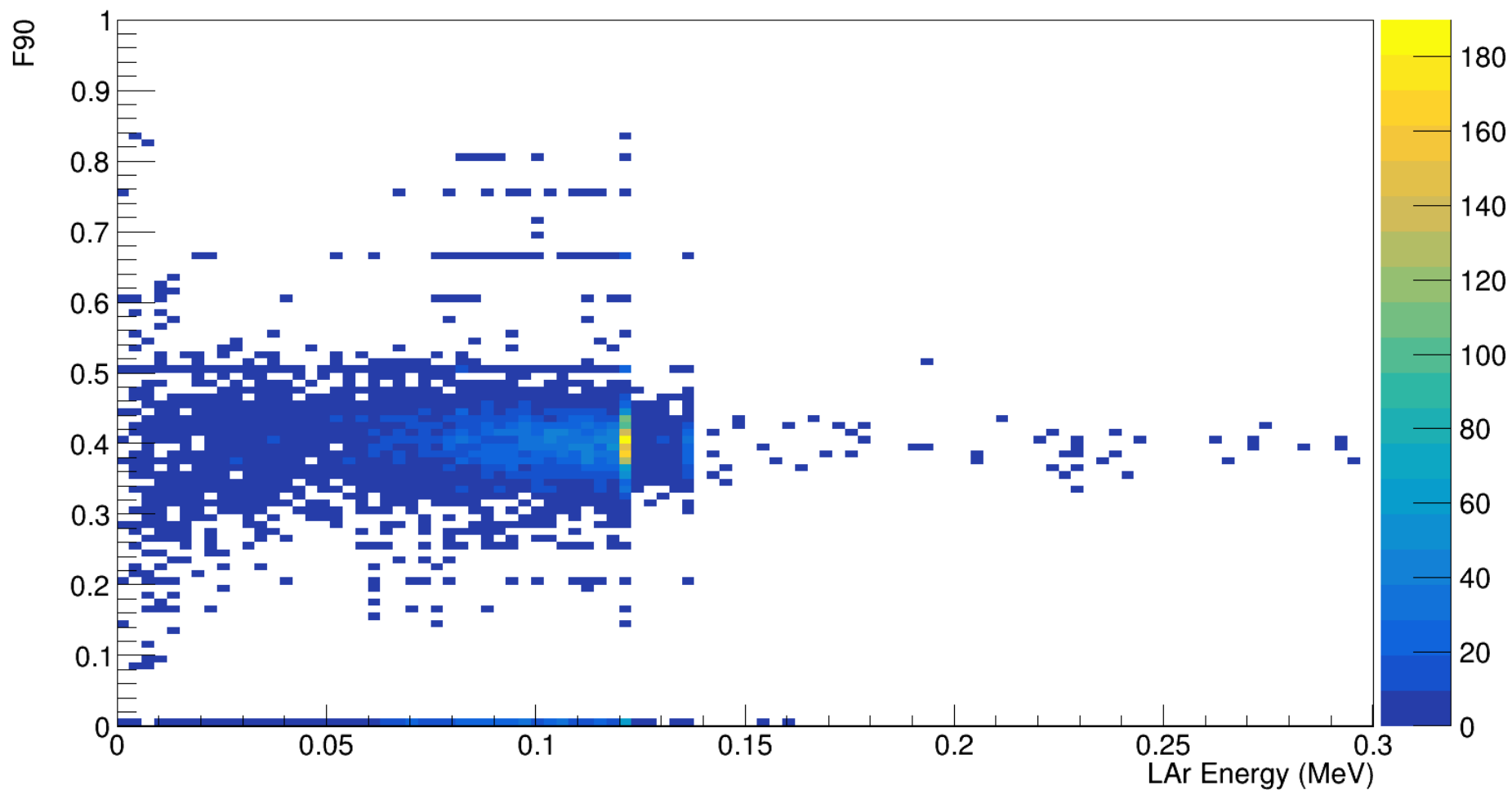


Kr83 source

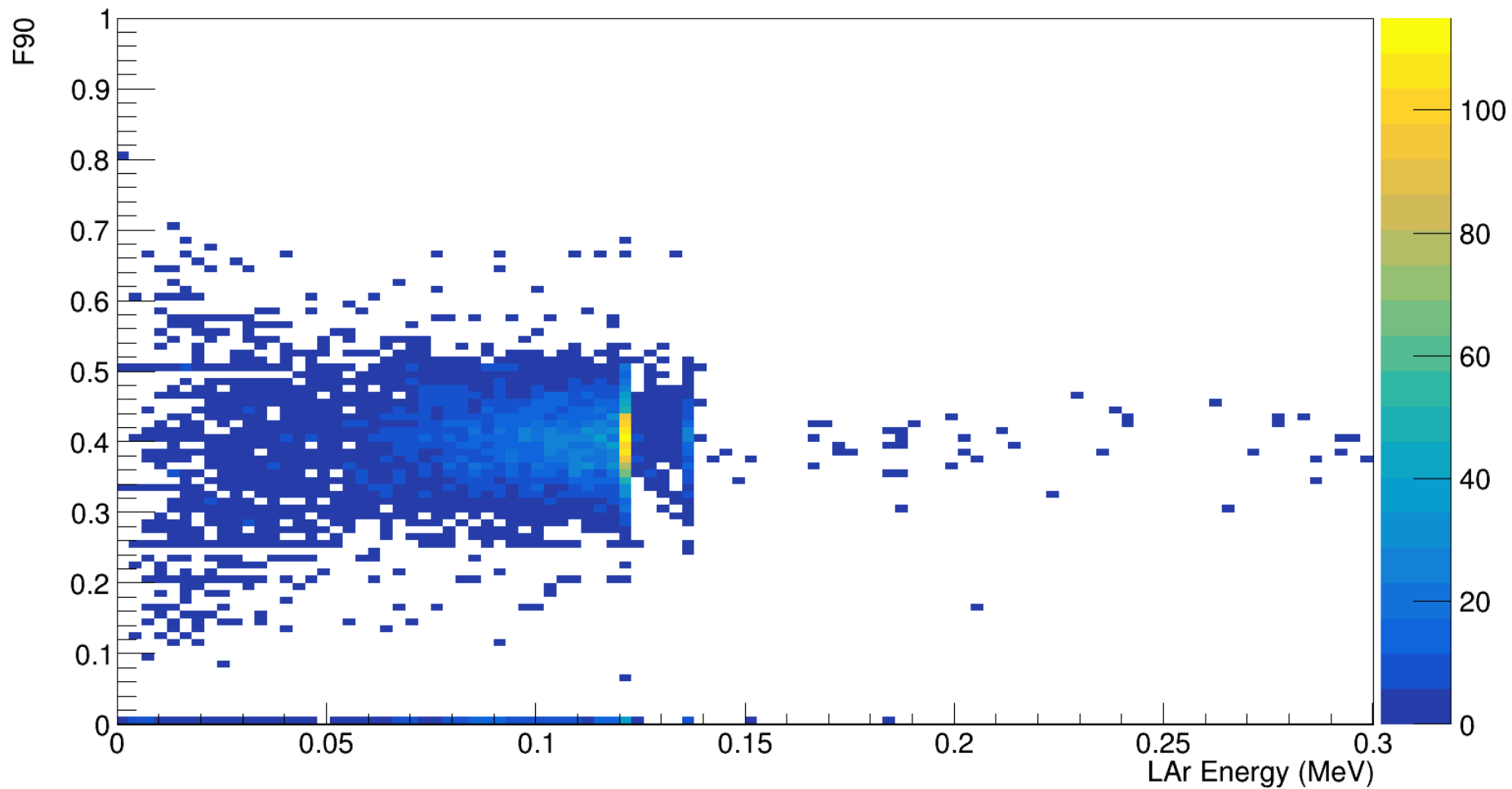


ENERGY VS F90 PLOTS

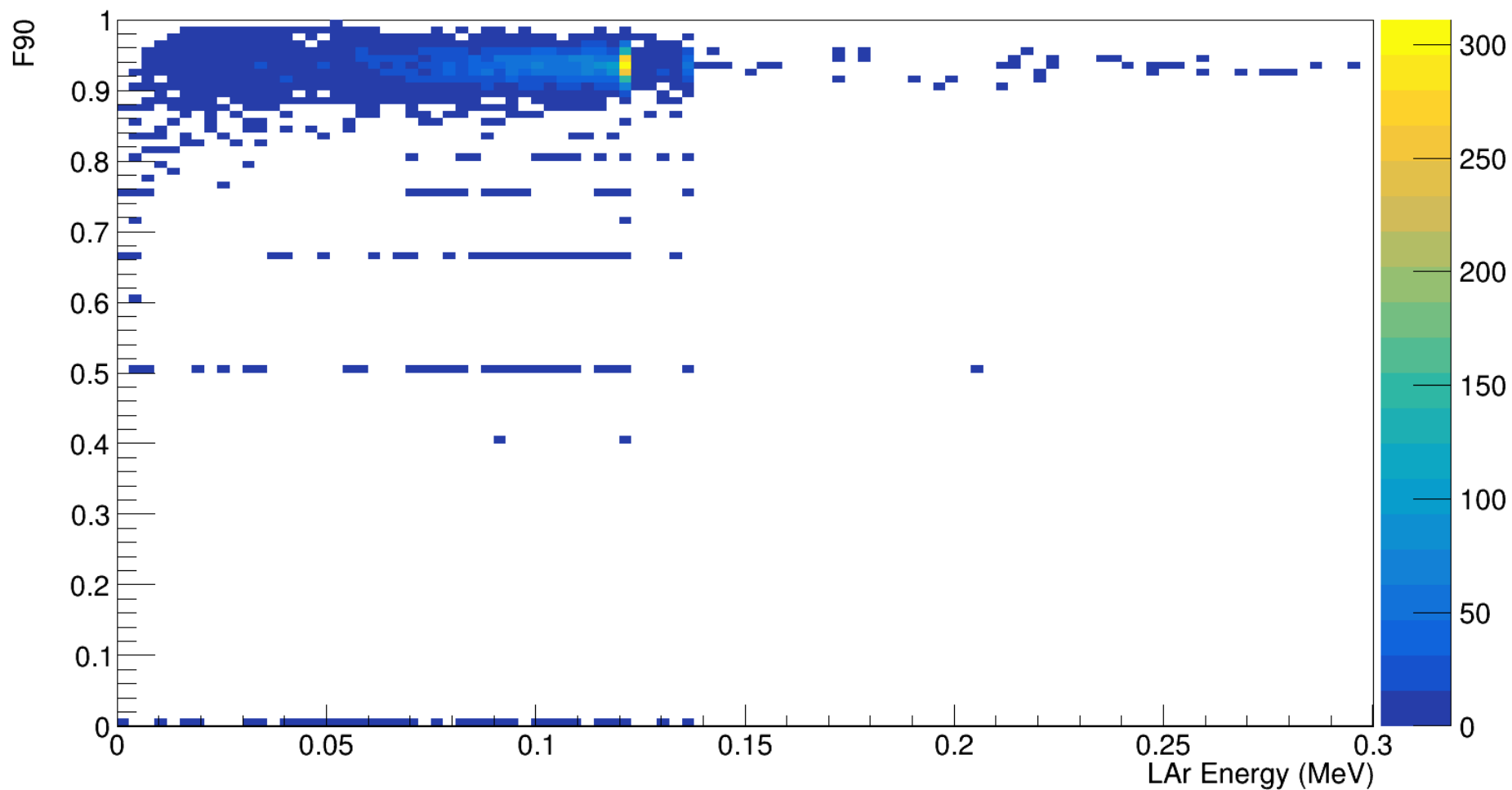
Co57 source, no Xe, 20m abs length



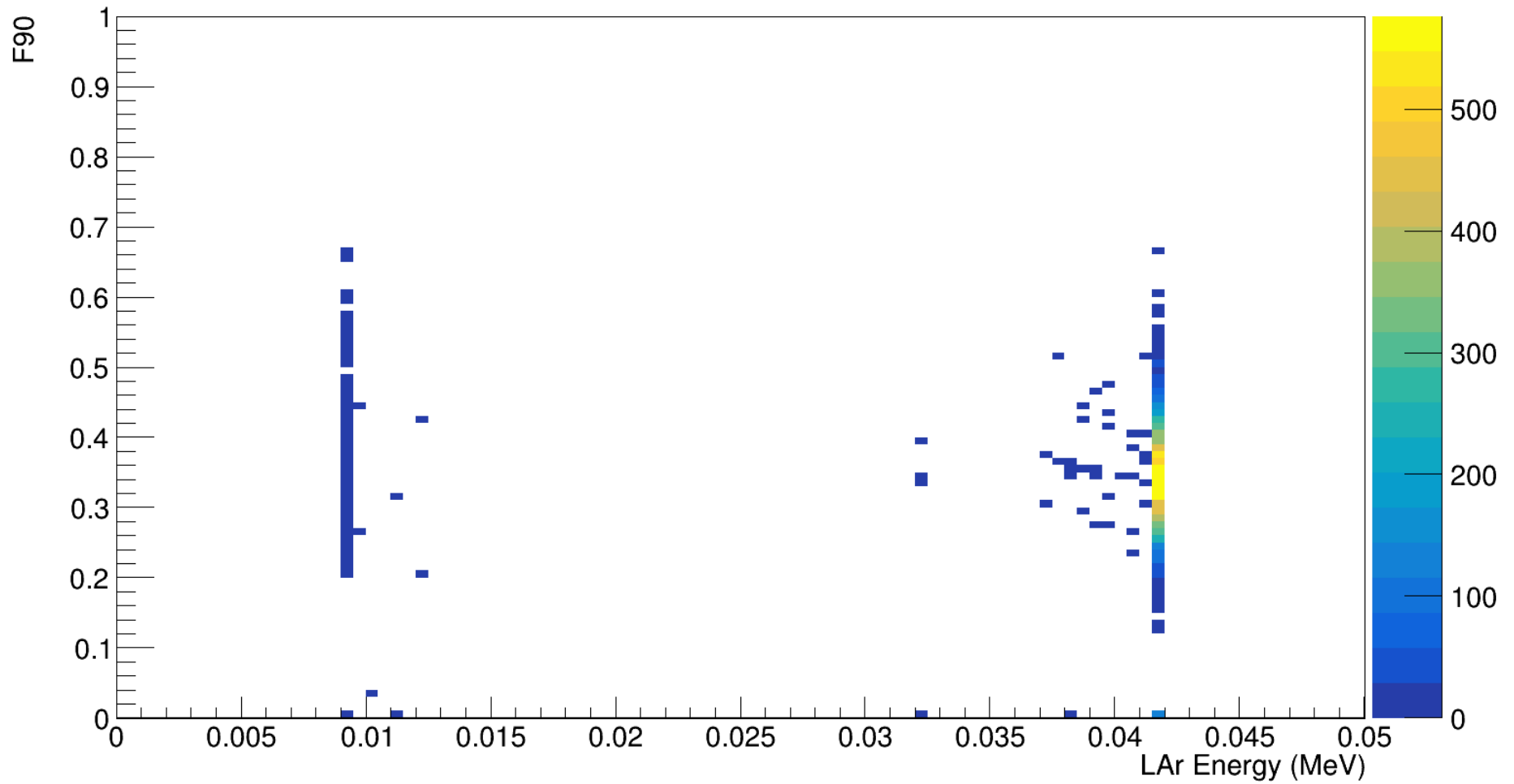
Co57 source, no Xe, 66cm abs length



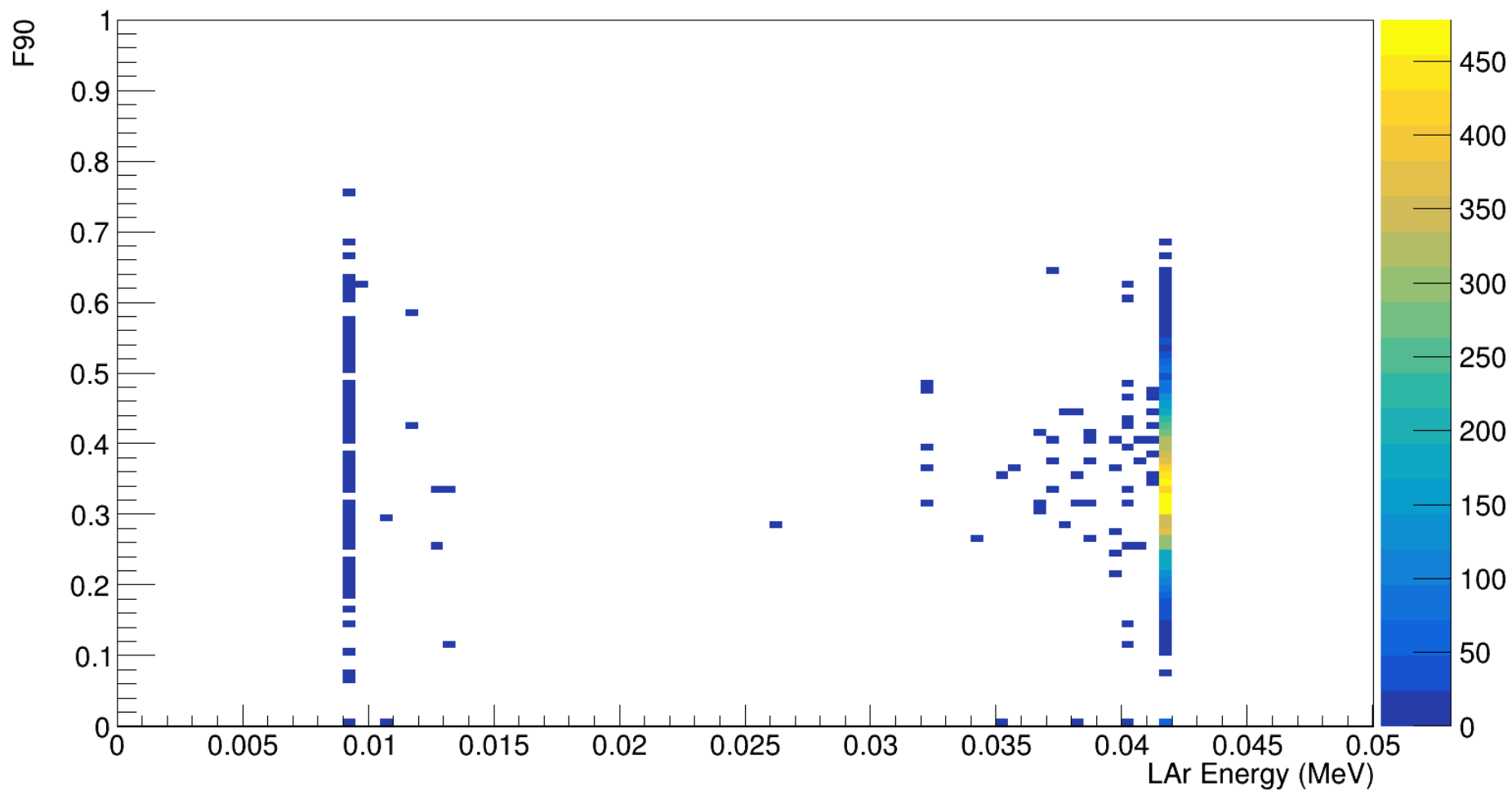
Co57 source, Xe doping, 20m abs length



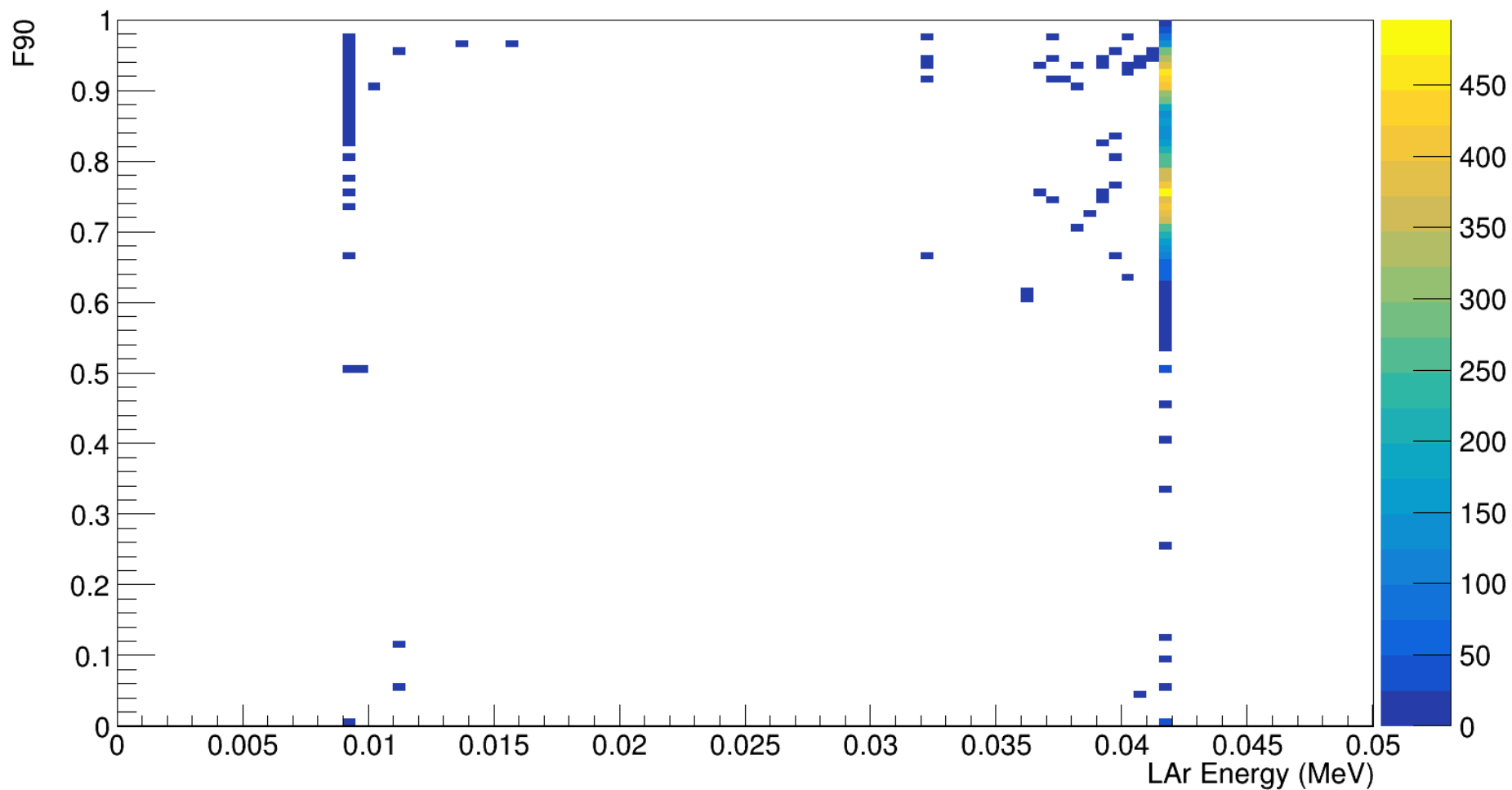
Kr83 source, no Xe, 20m abs length



Kr83 source, no Xe, 66cm abs length



Kr83 source, Xe doping, 20m abs length

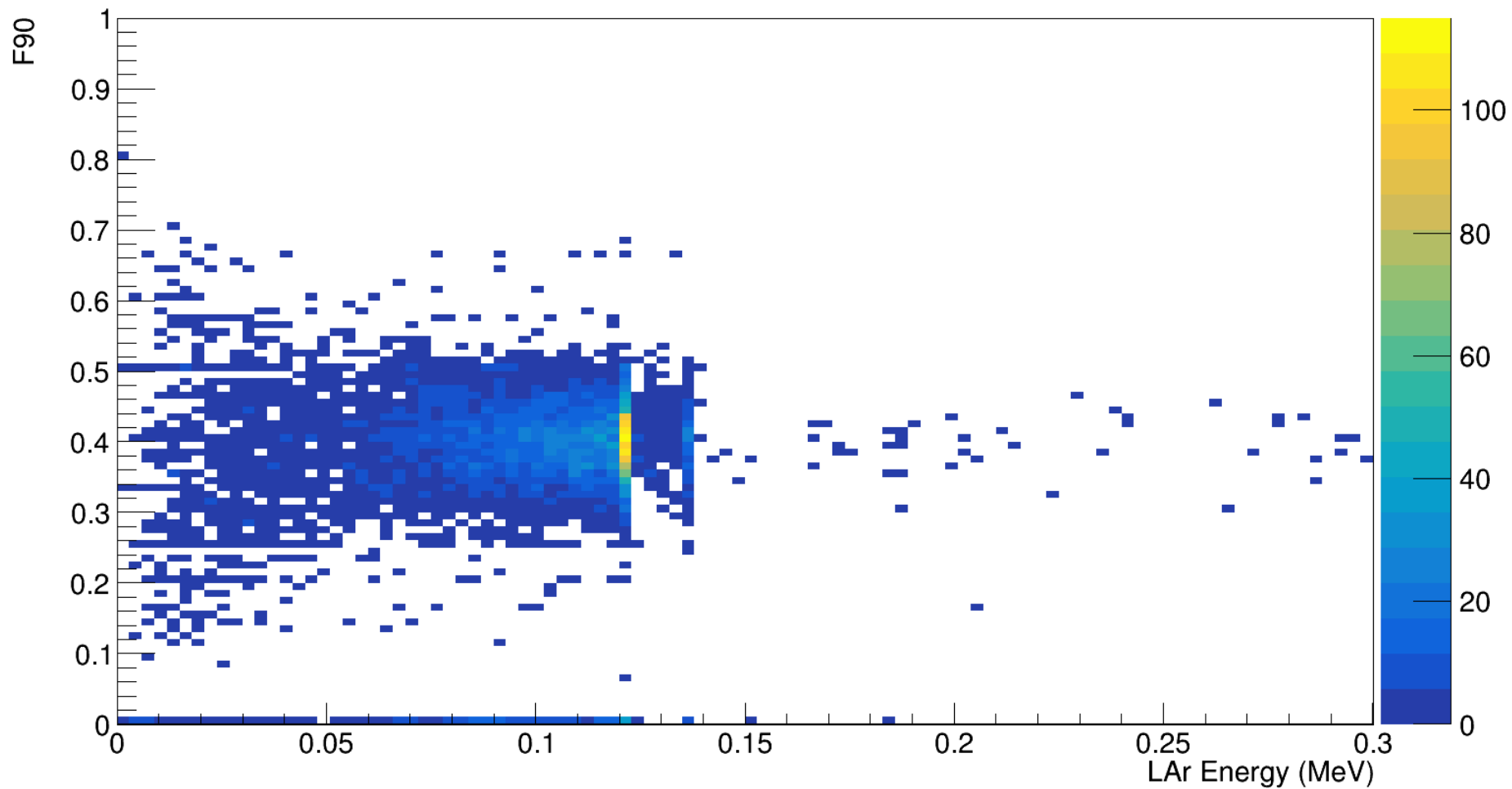


TO-DO

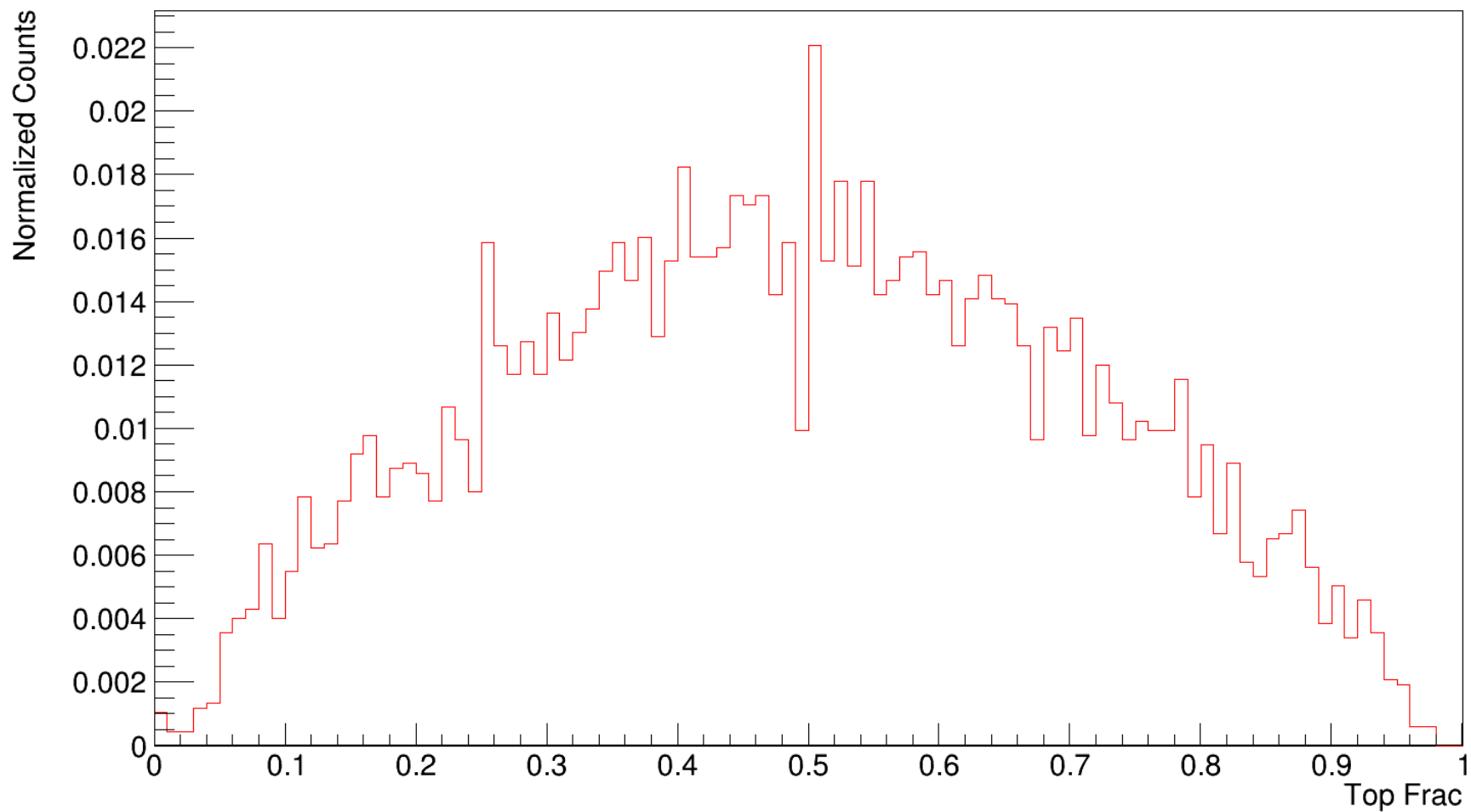
- Try adjusting other sim parameters to accomodate reduced light yield from shorter absorption length
- Look at a smaller F parameter (e.g. F40)
- Consider correlation between scintillation time and wavelength
- Look for literature results to compare with

**SOLO PLOTS (FOR
COMPLETENESS)**

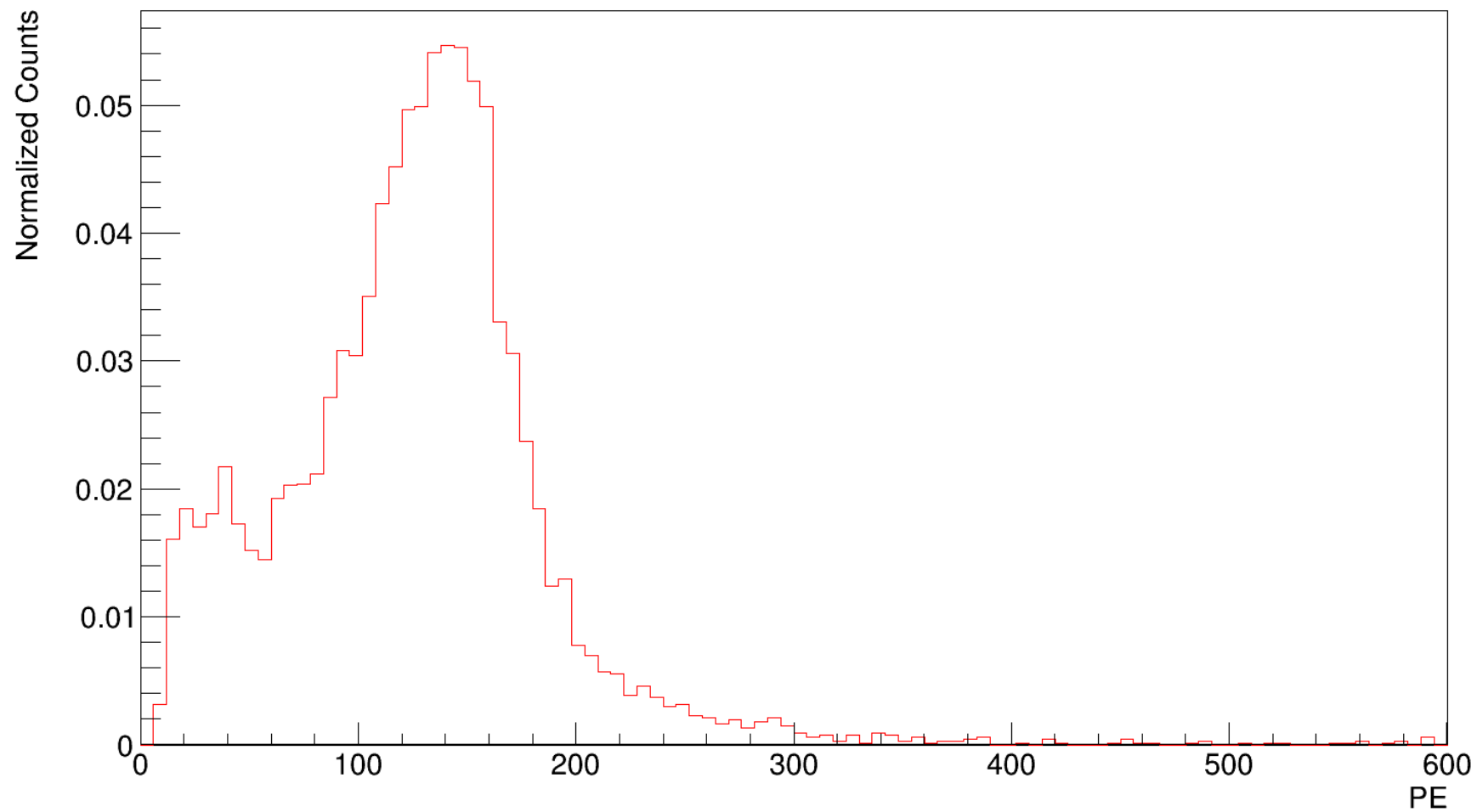
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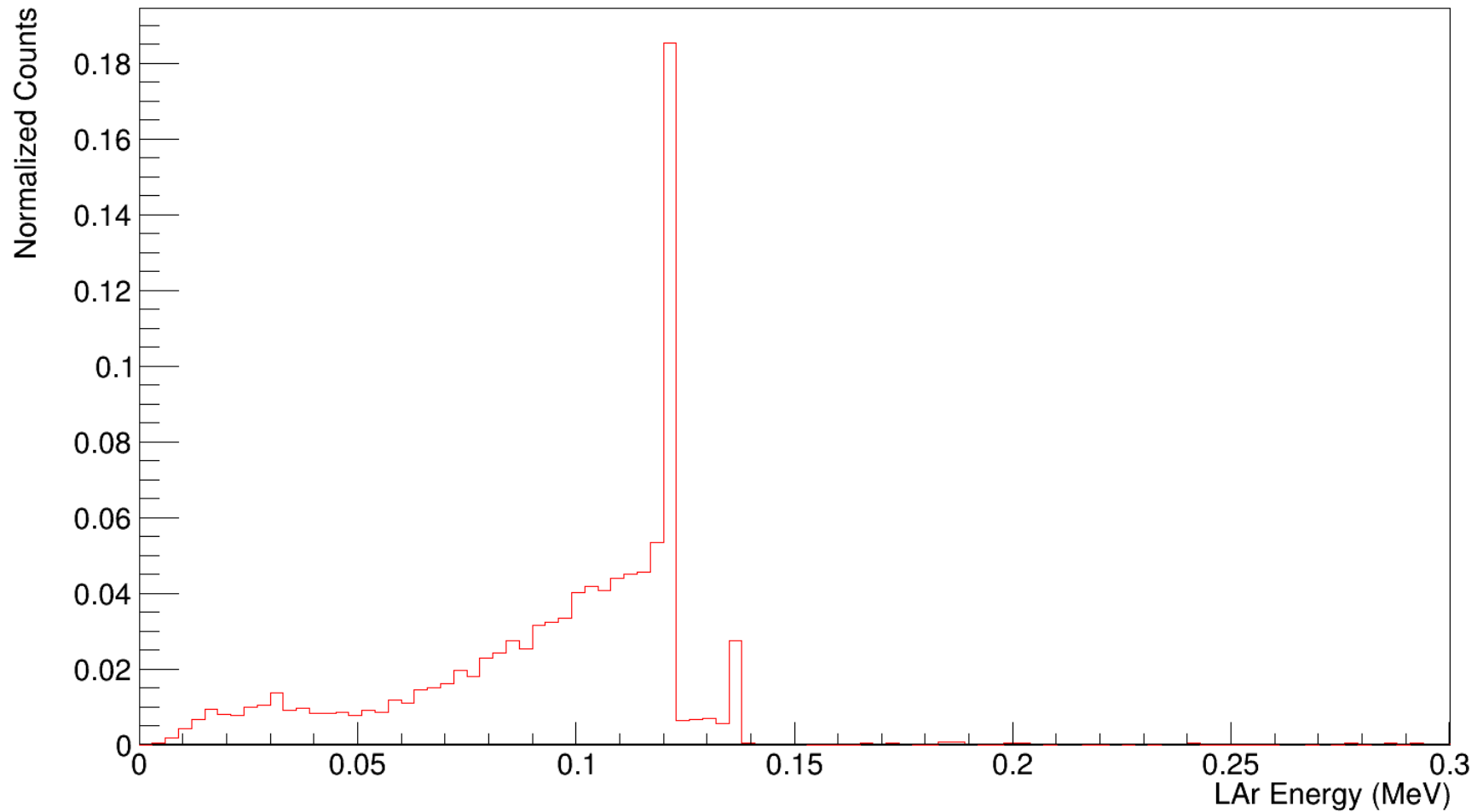
Co57 source, no Xe, 66cm abs length



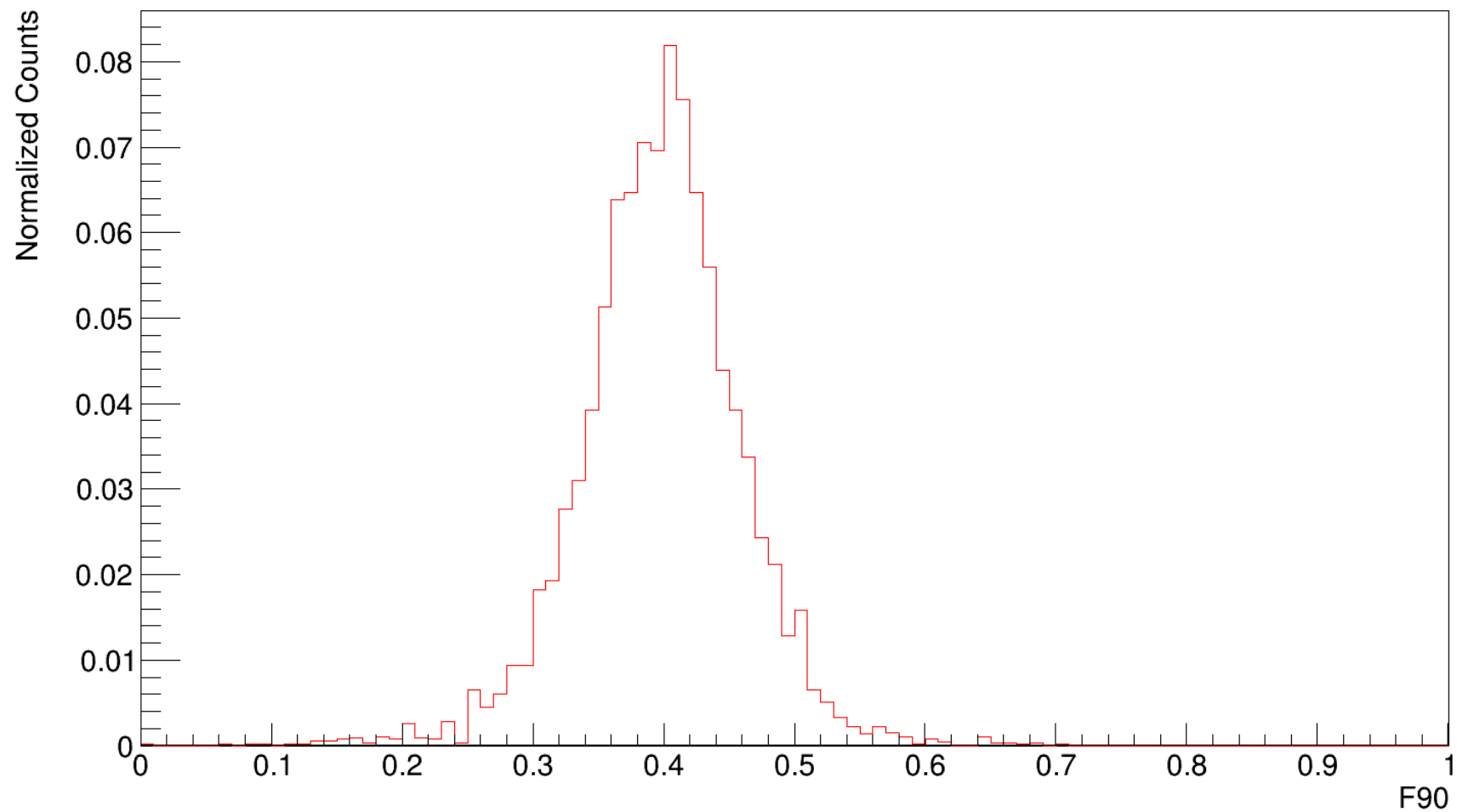
Co57 source, no Xe, 66cm abs length



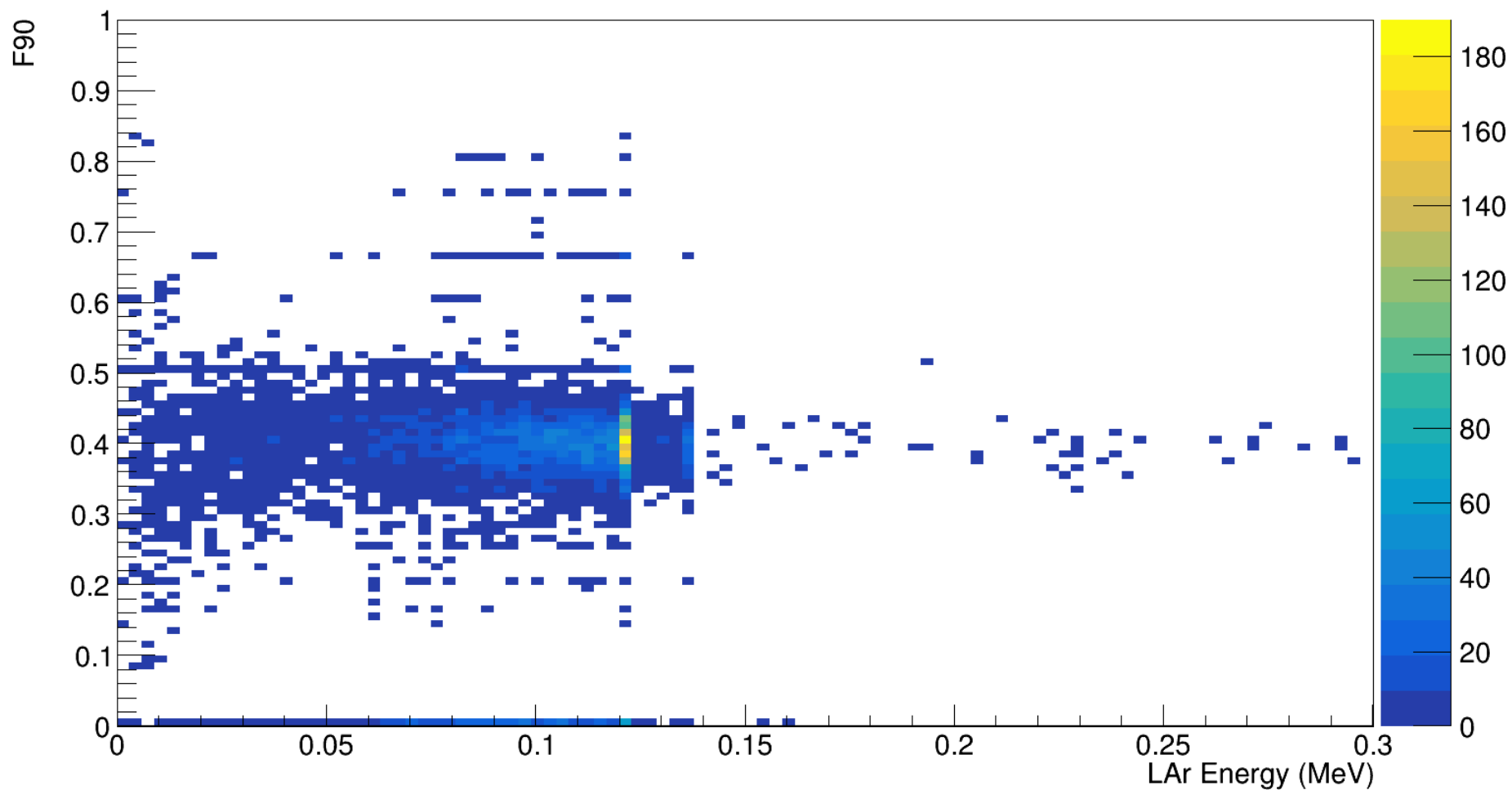
Co57 source, no Xe, 66cm abs length



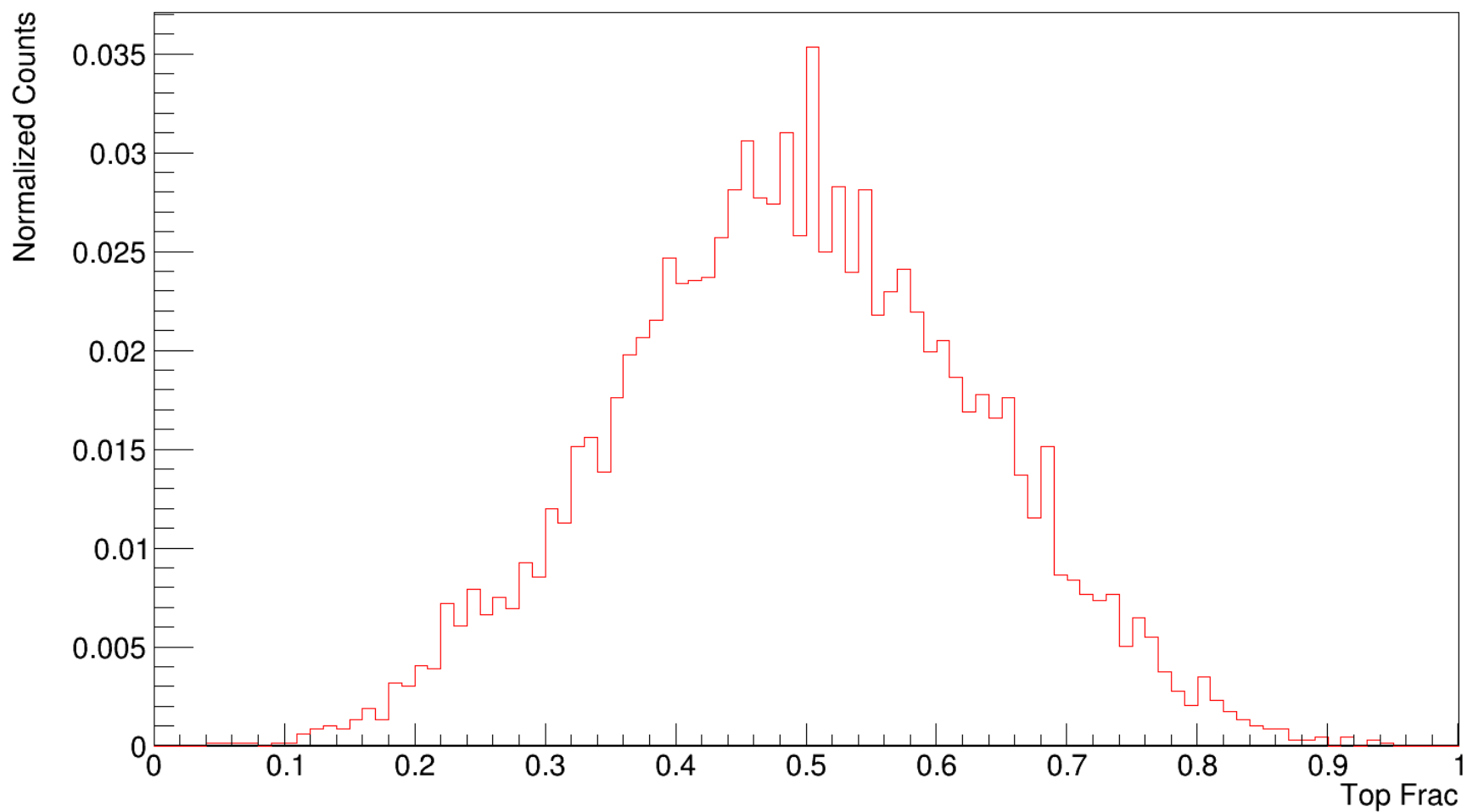
Co57 source, no Xe, 66cm abs length



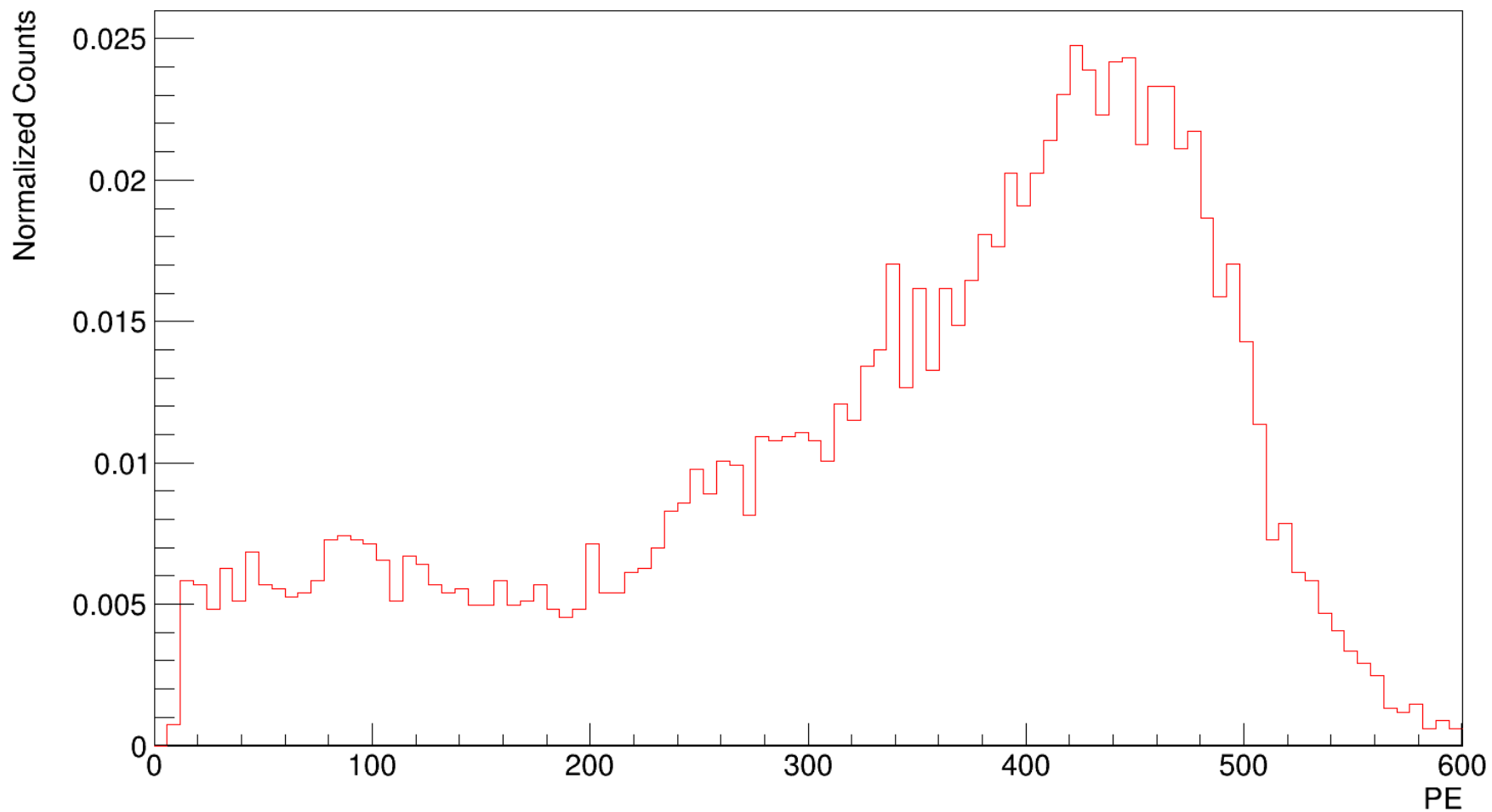
Co57 source, no Xe, 20m abs length



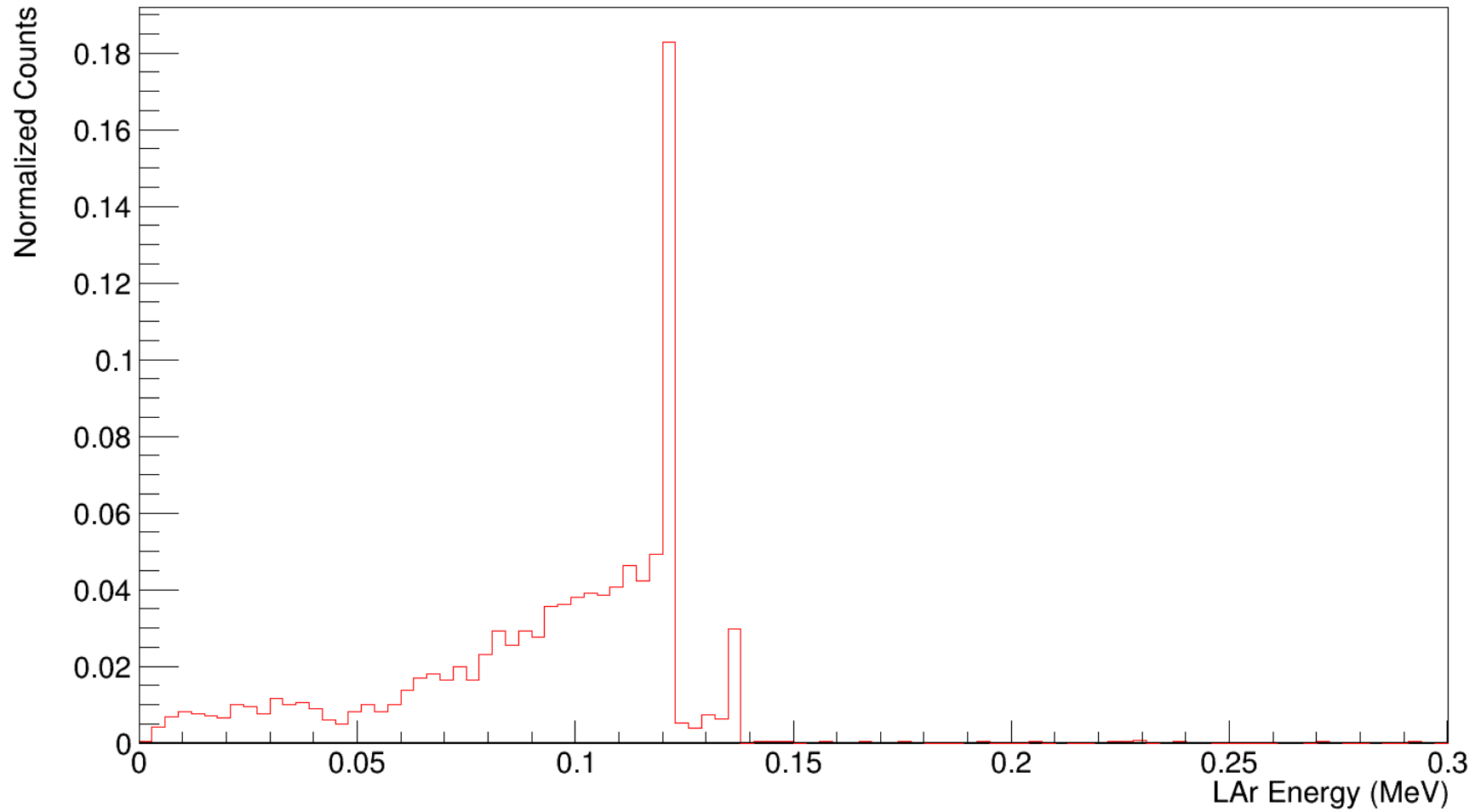
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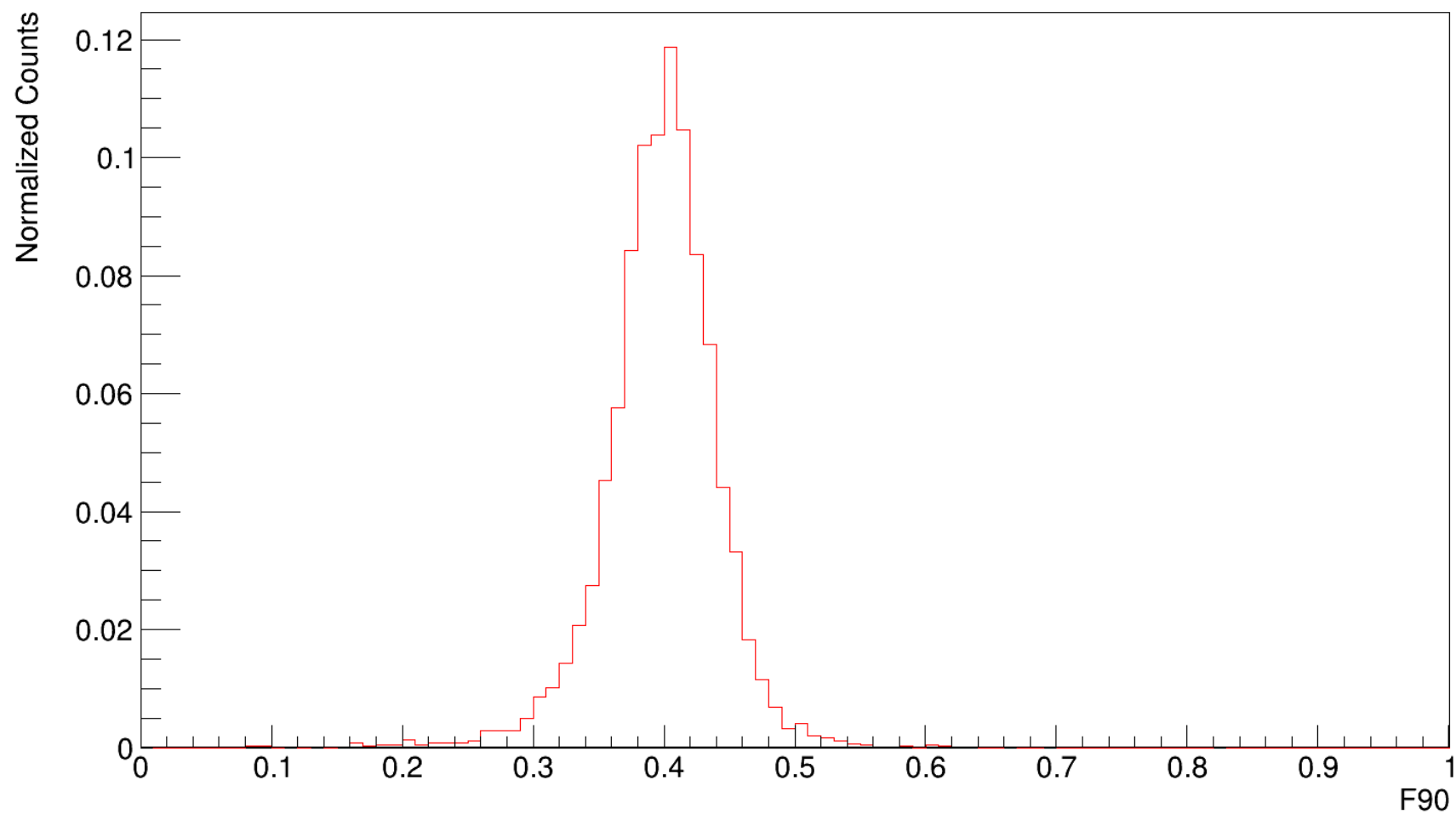
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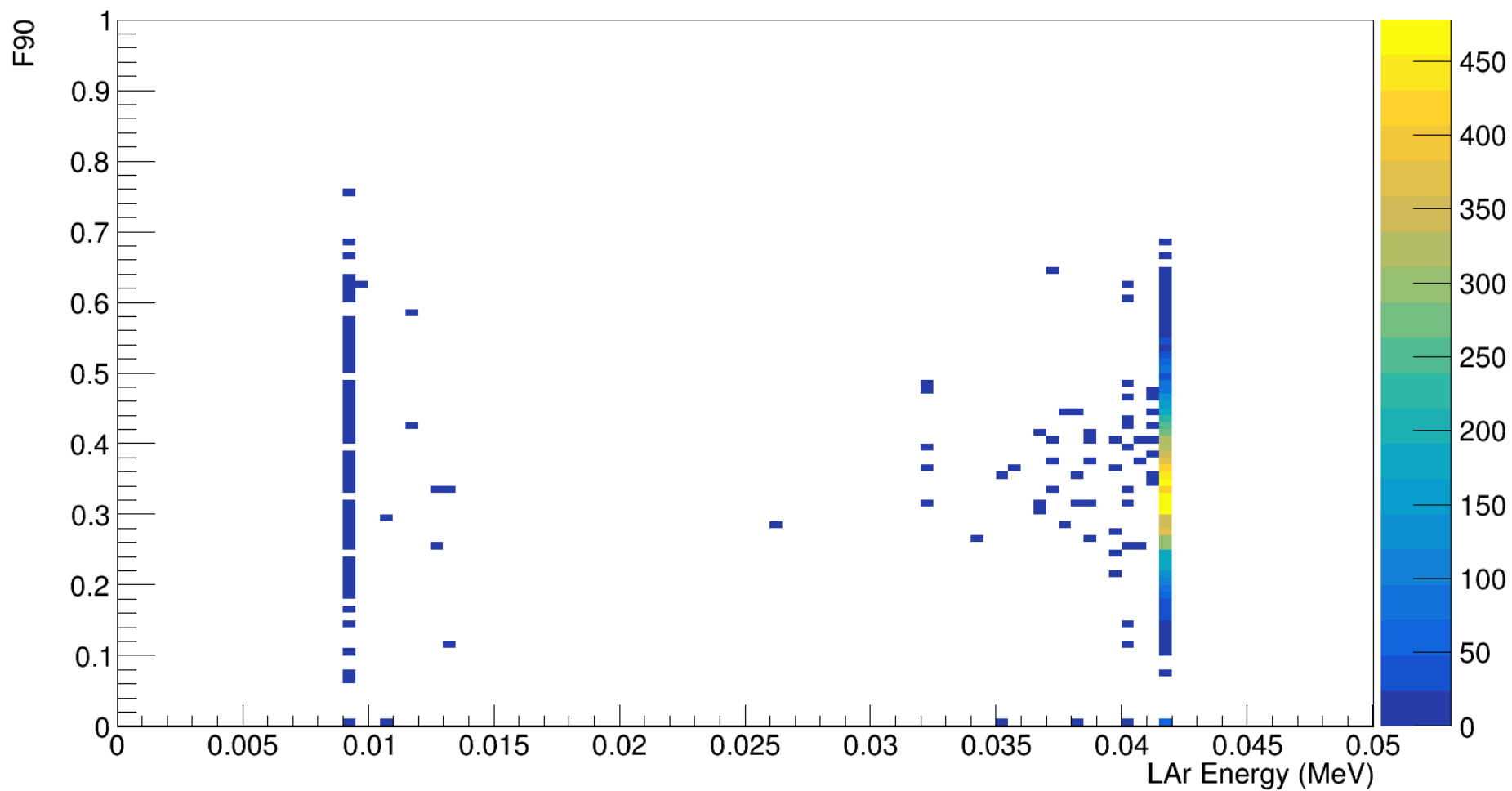
Co57 source, no Xe, 20m abs length



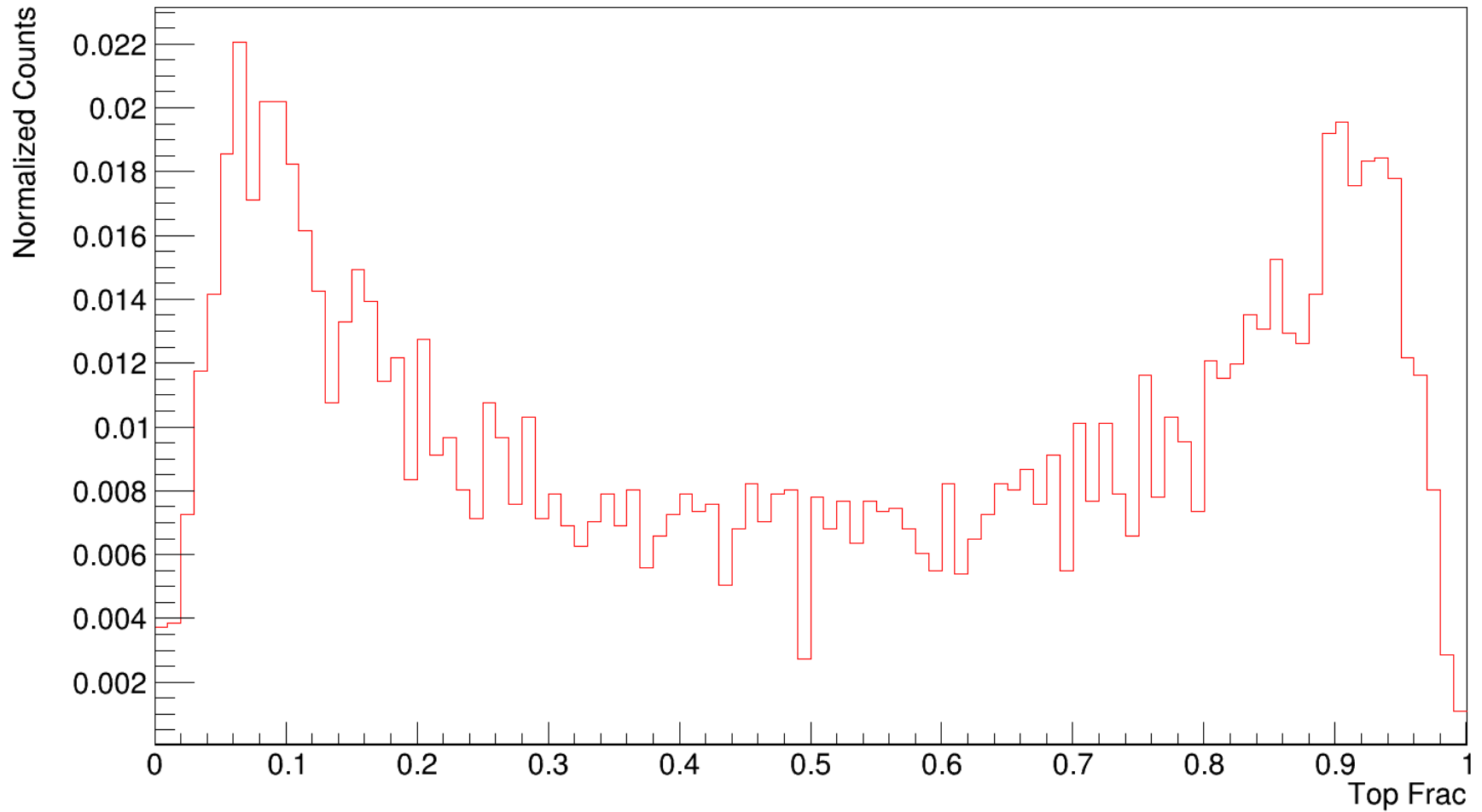
Co57 source, no Xe, 20m abs length



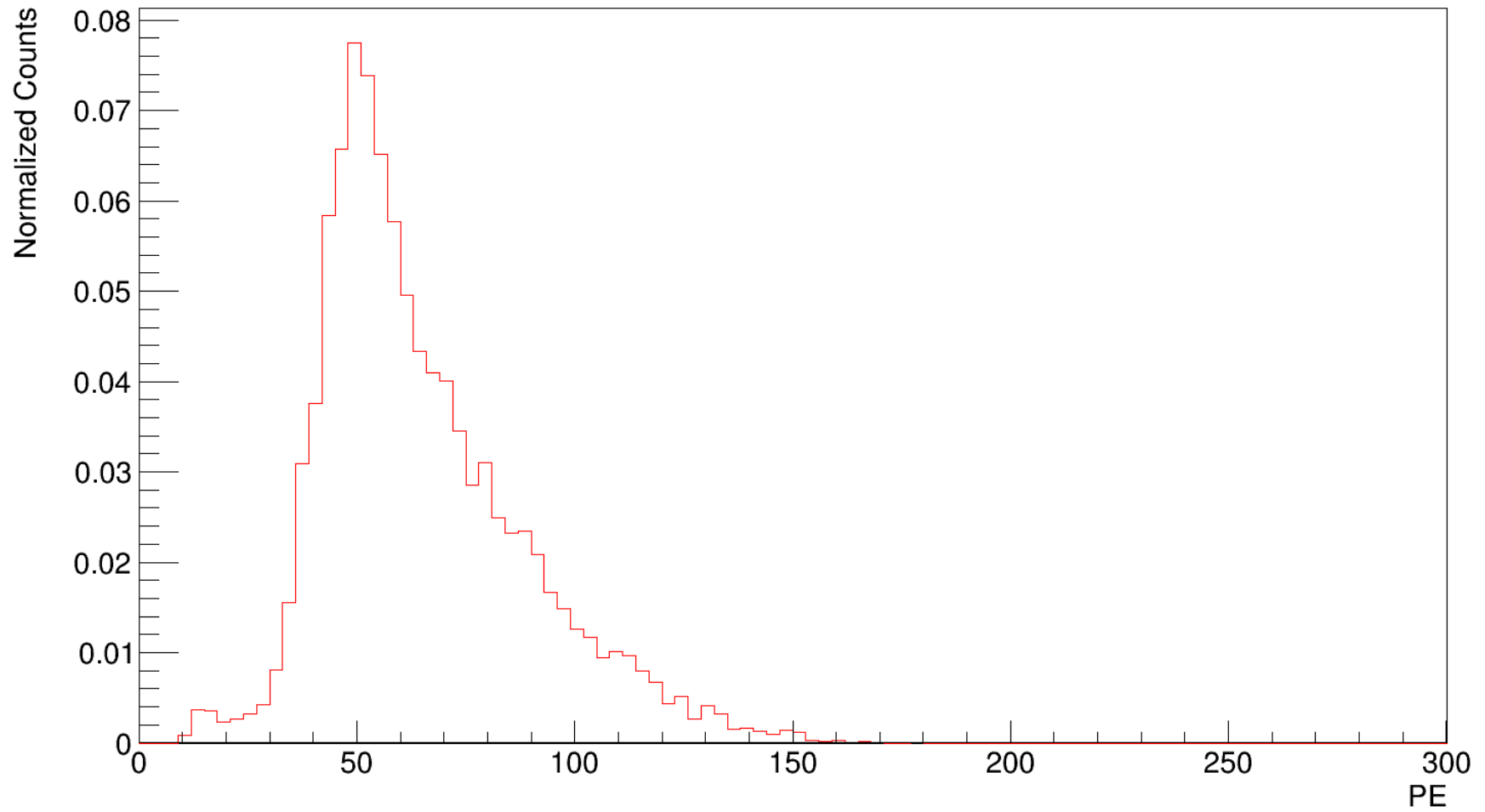
Kr83 source, no Xe, 66cm abs length



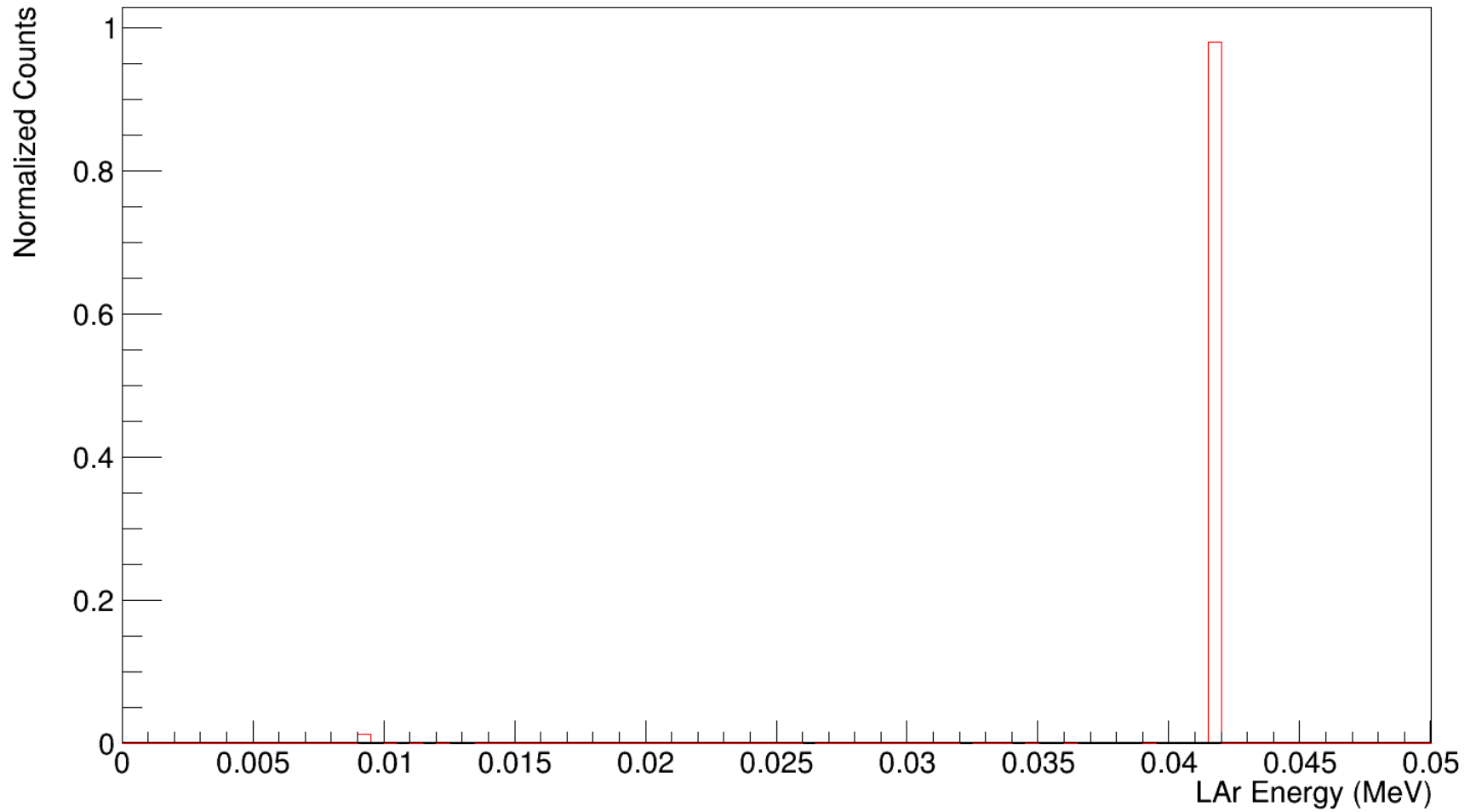
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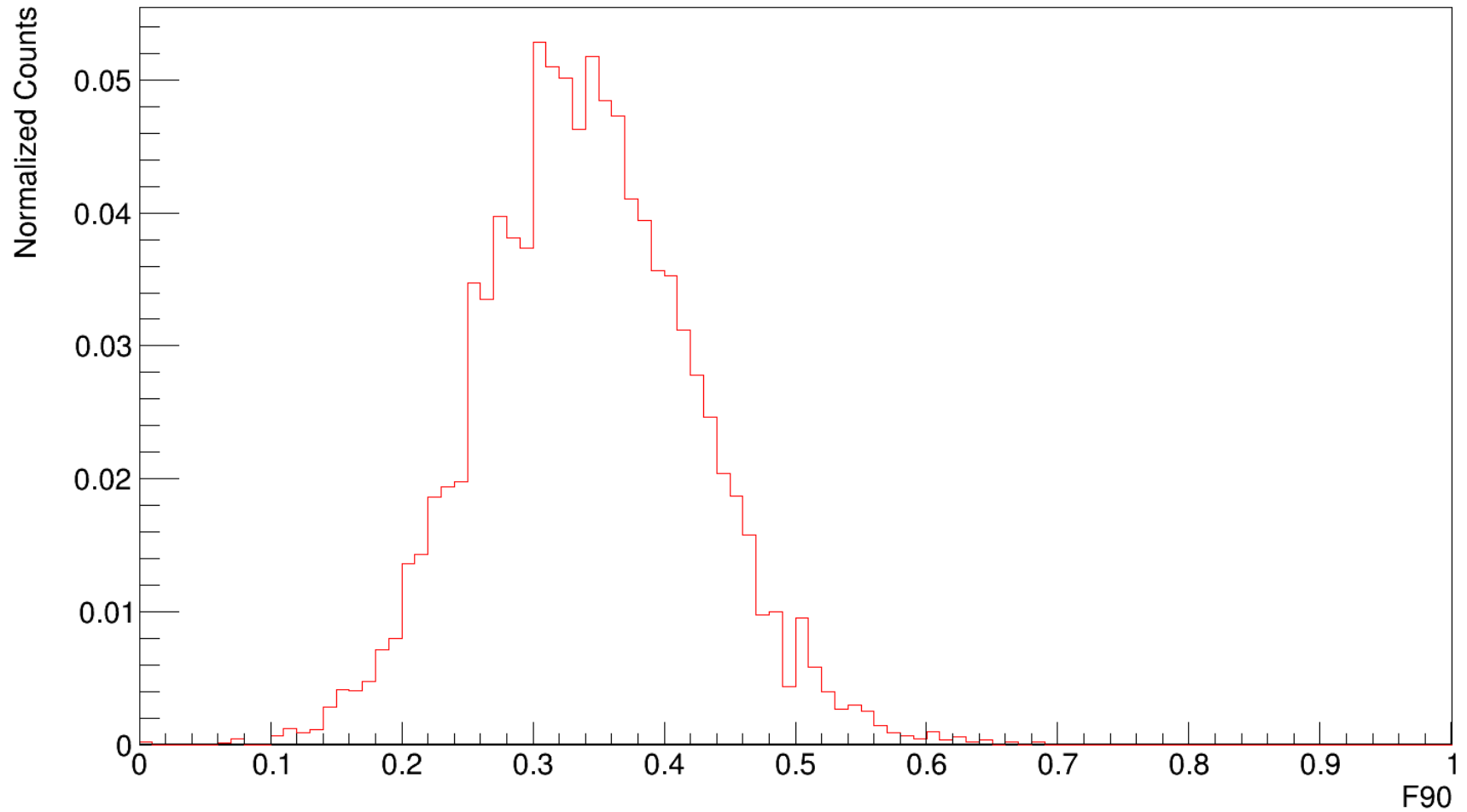
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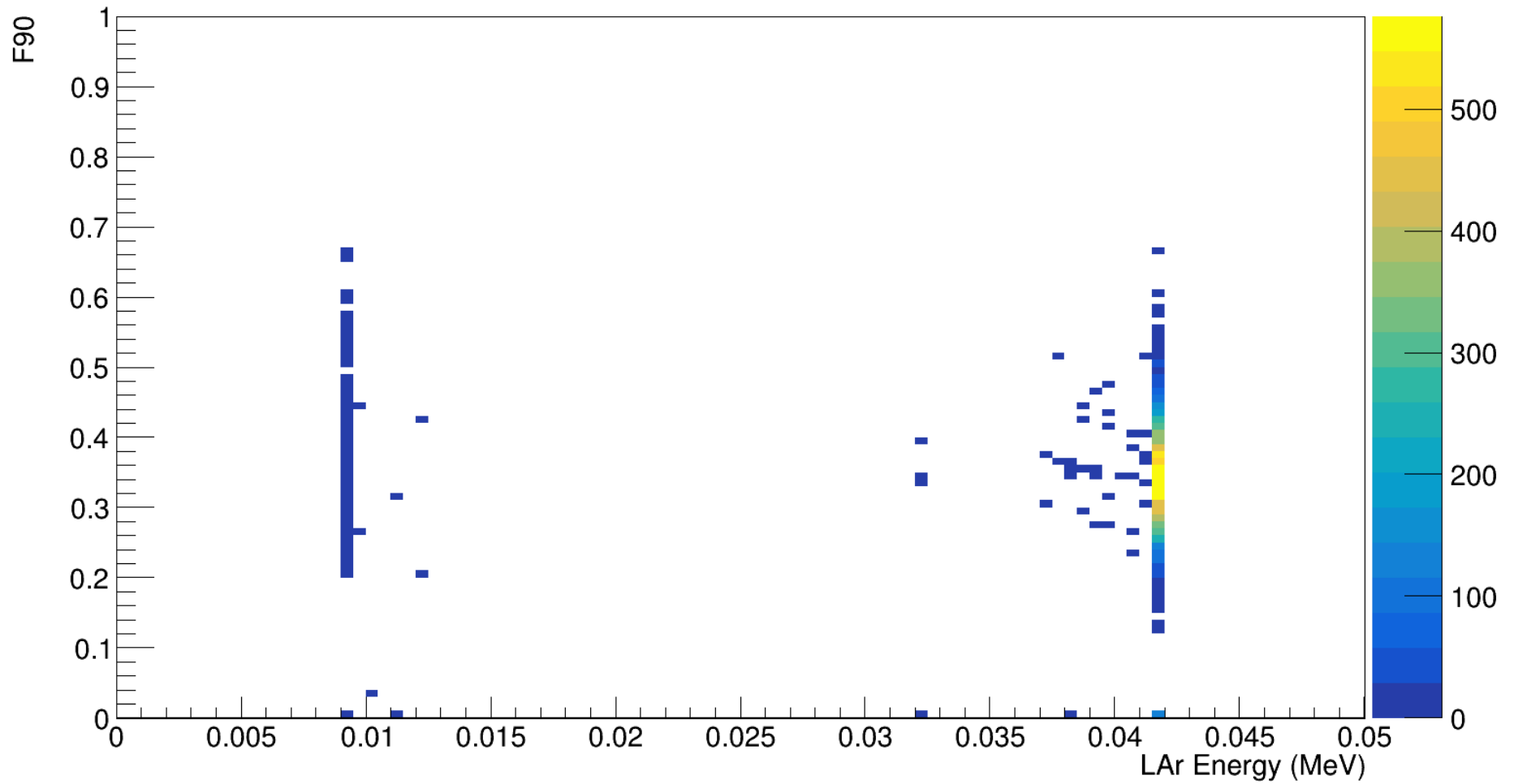
Kr83 source, no Xe, 66cm abs length



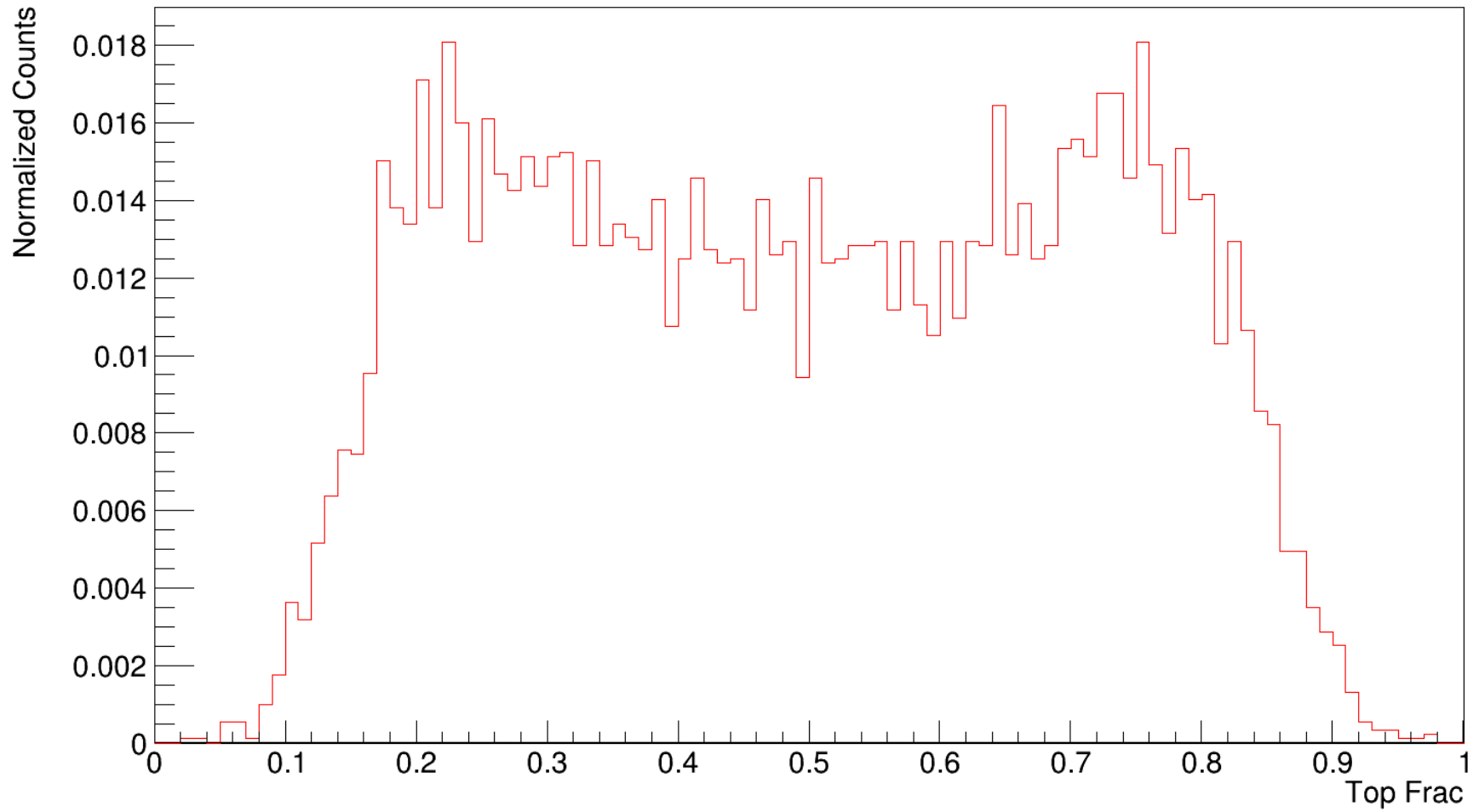
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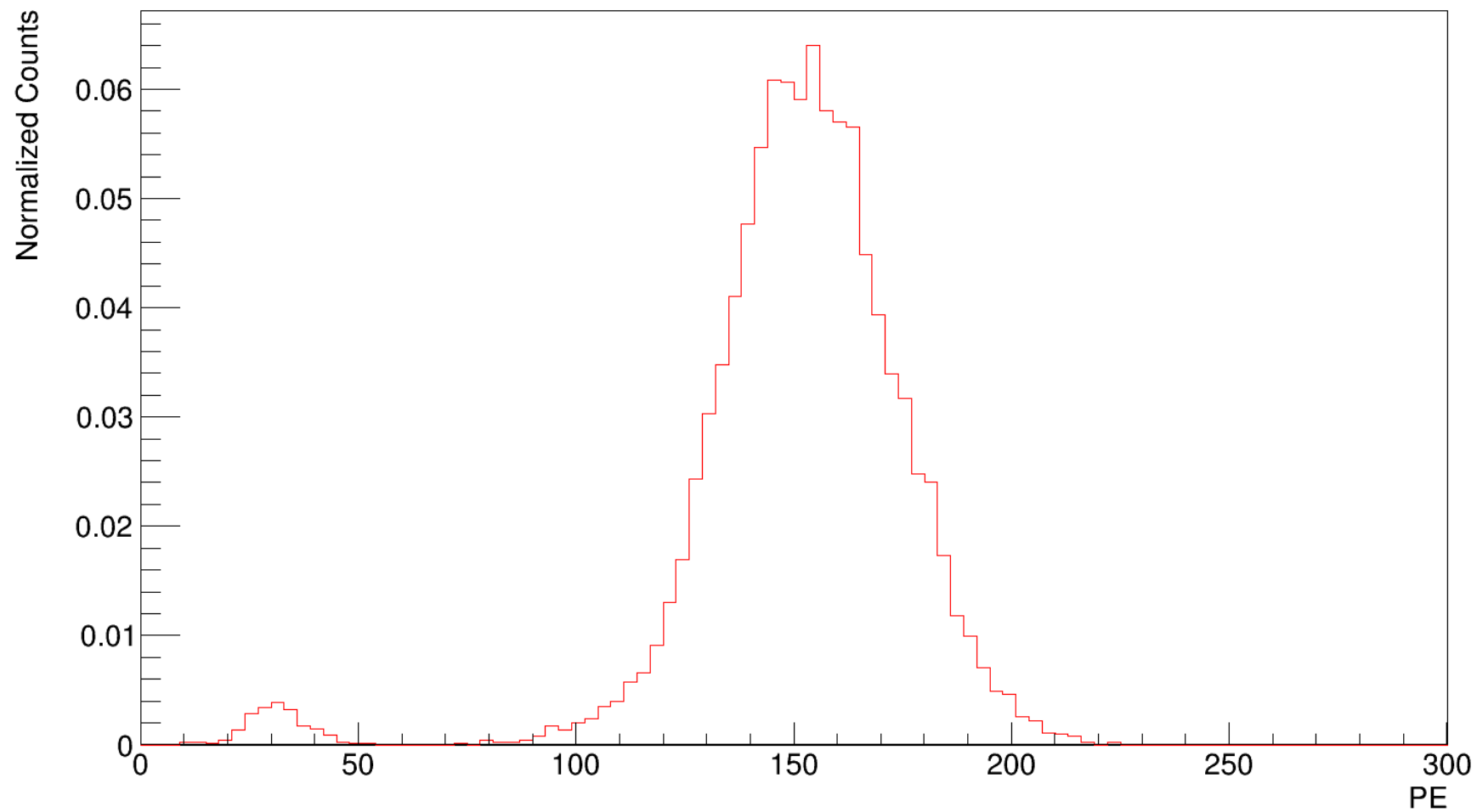
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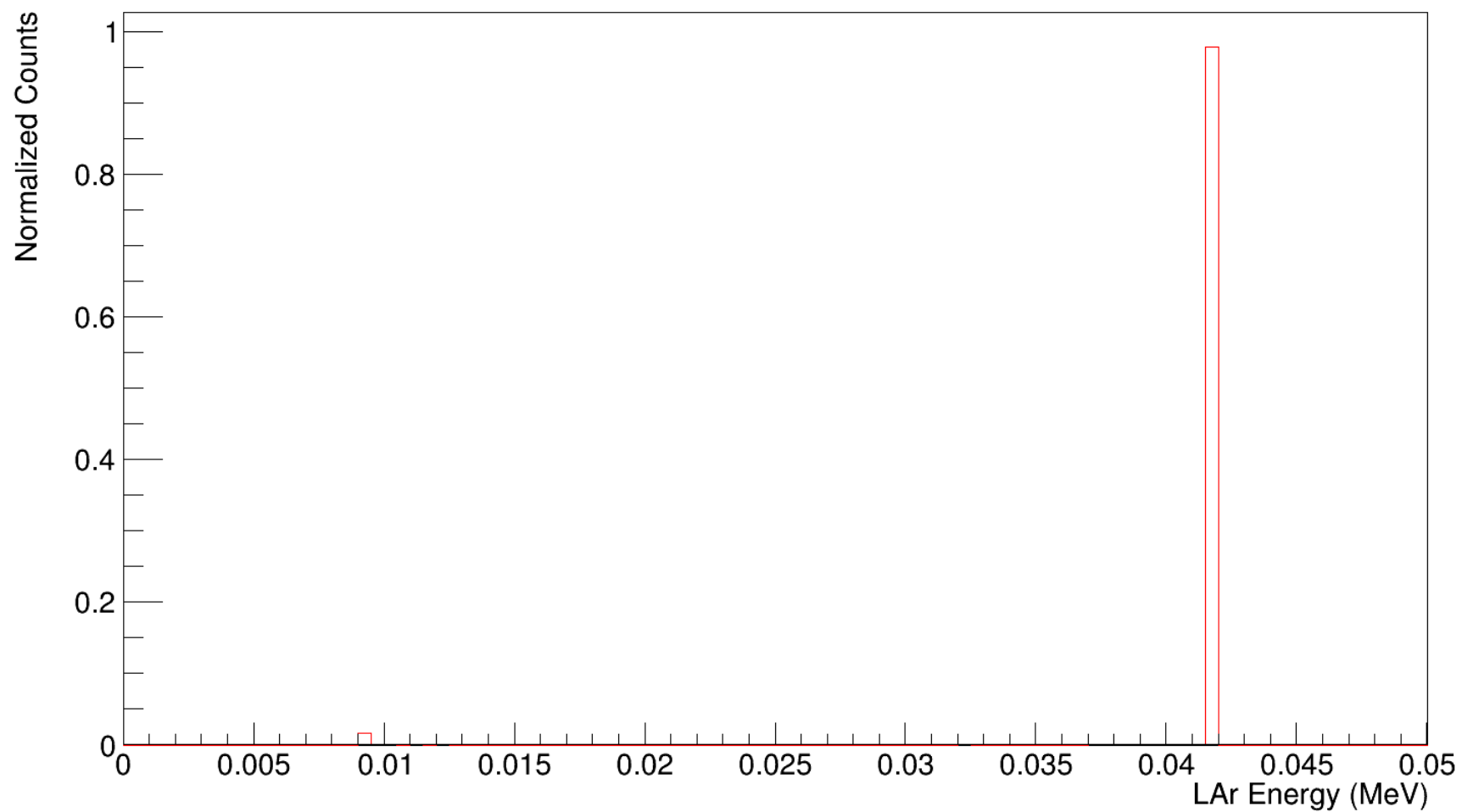
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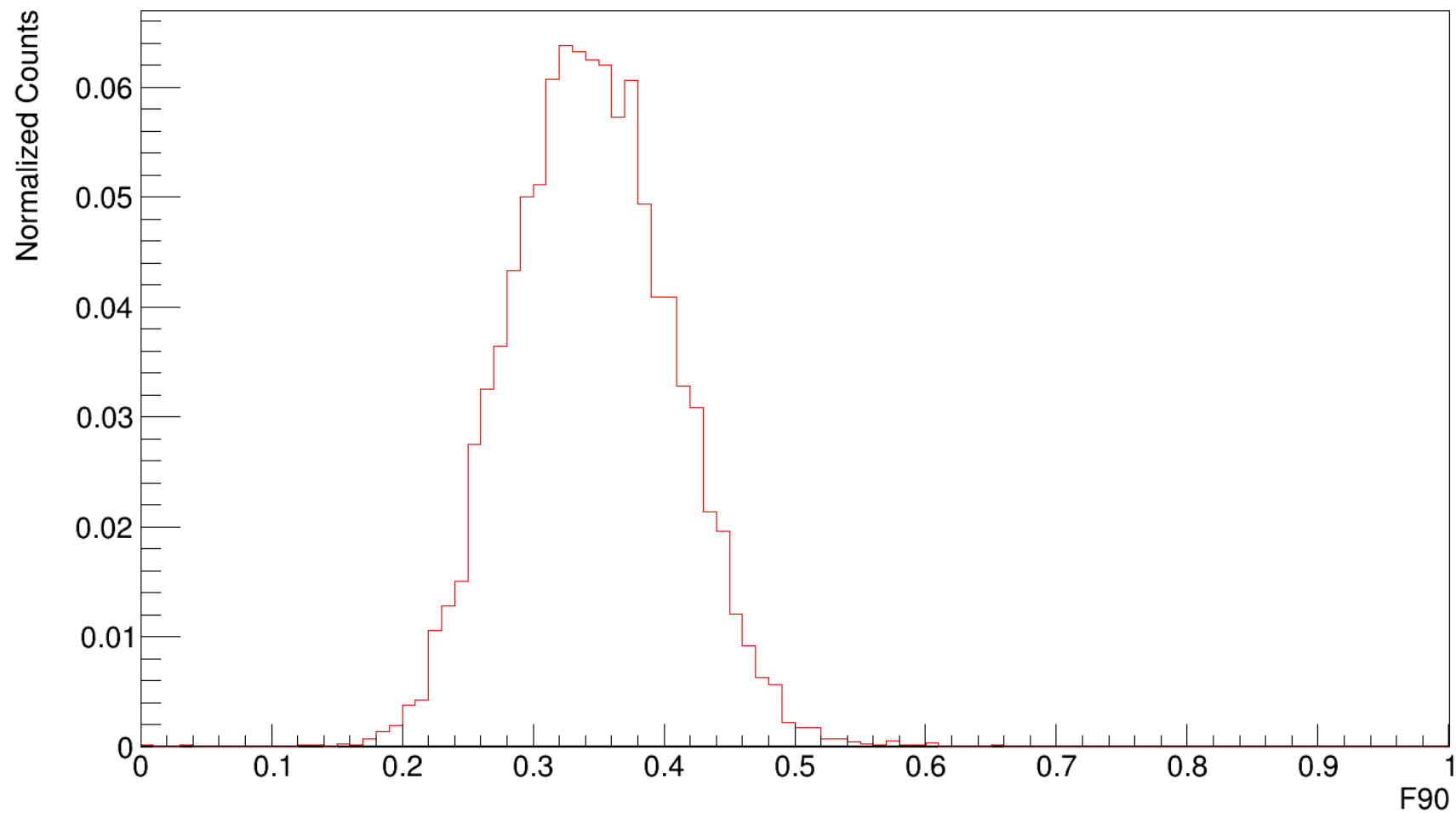
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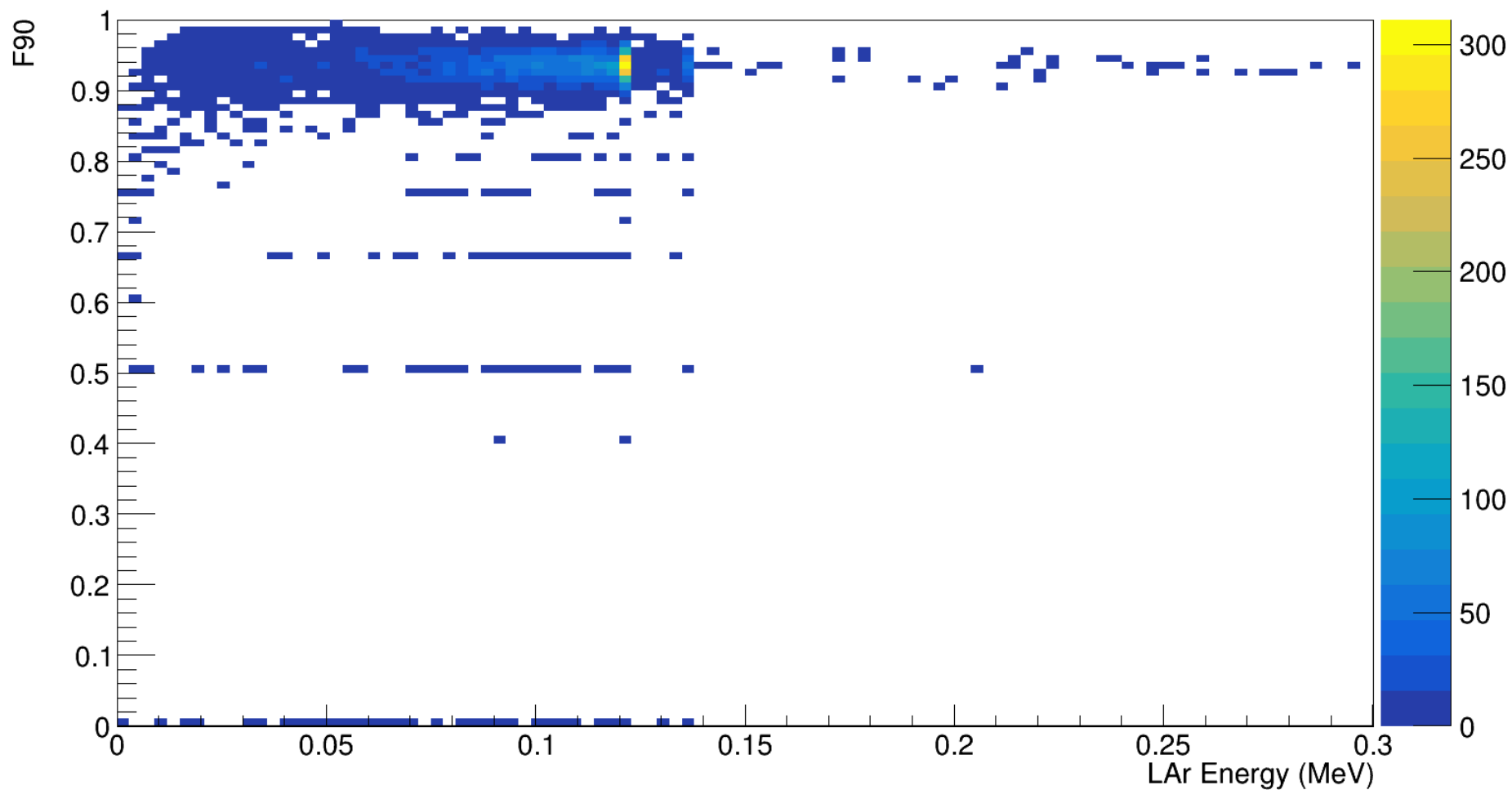
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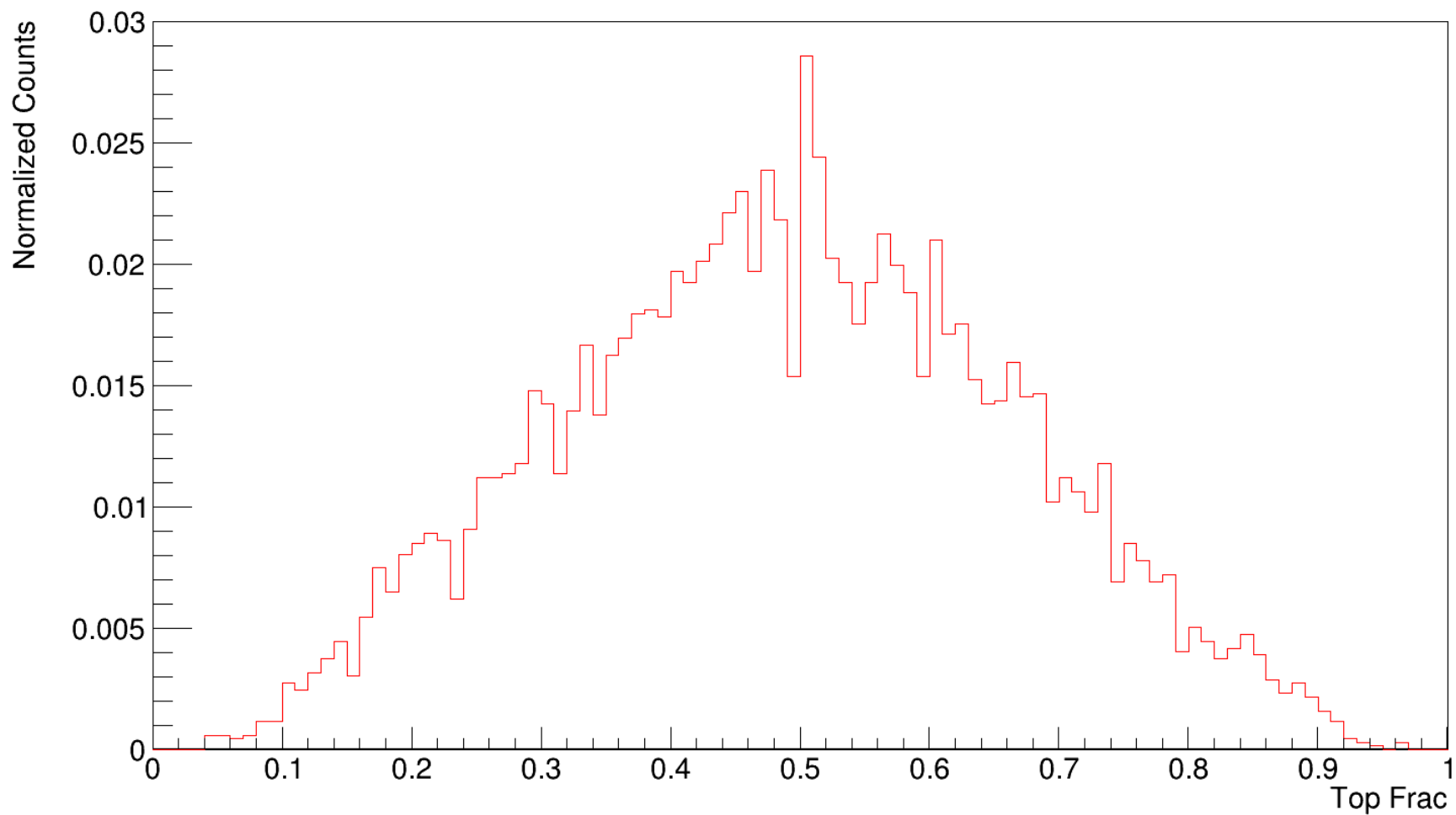
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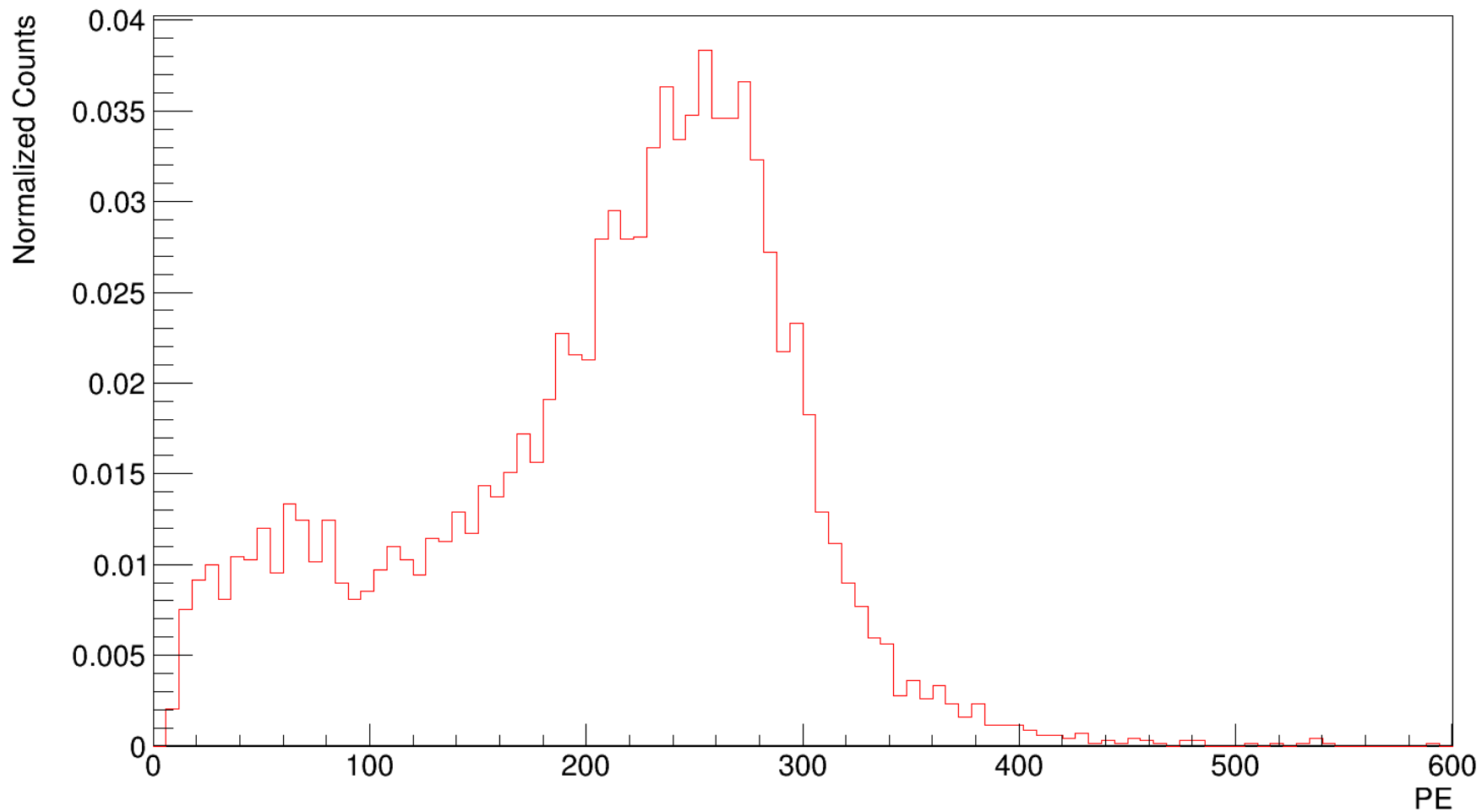
Co57 source, Xe doping, 20m abs length



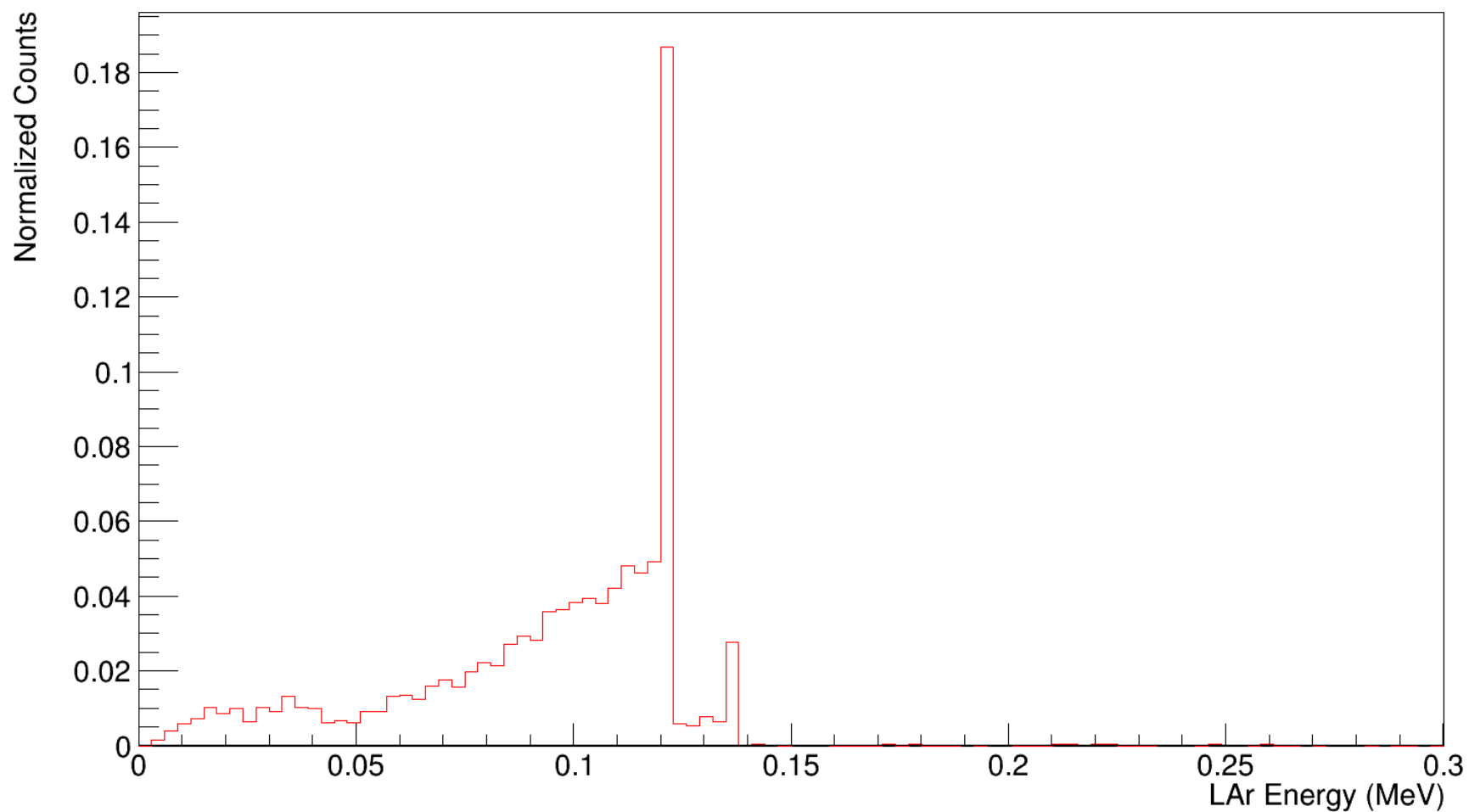
Co57 source, Xe doping, 20m abs length



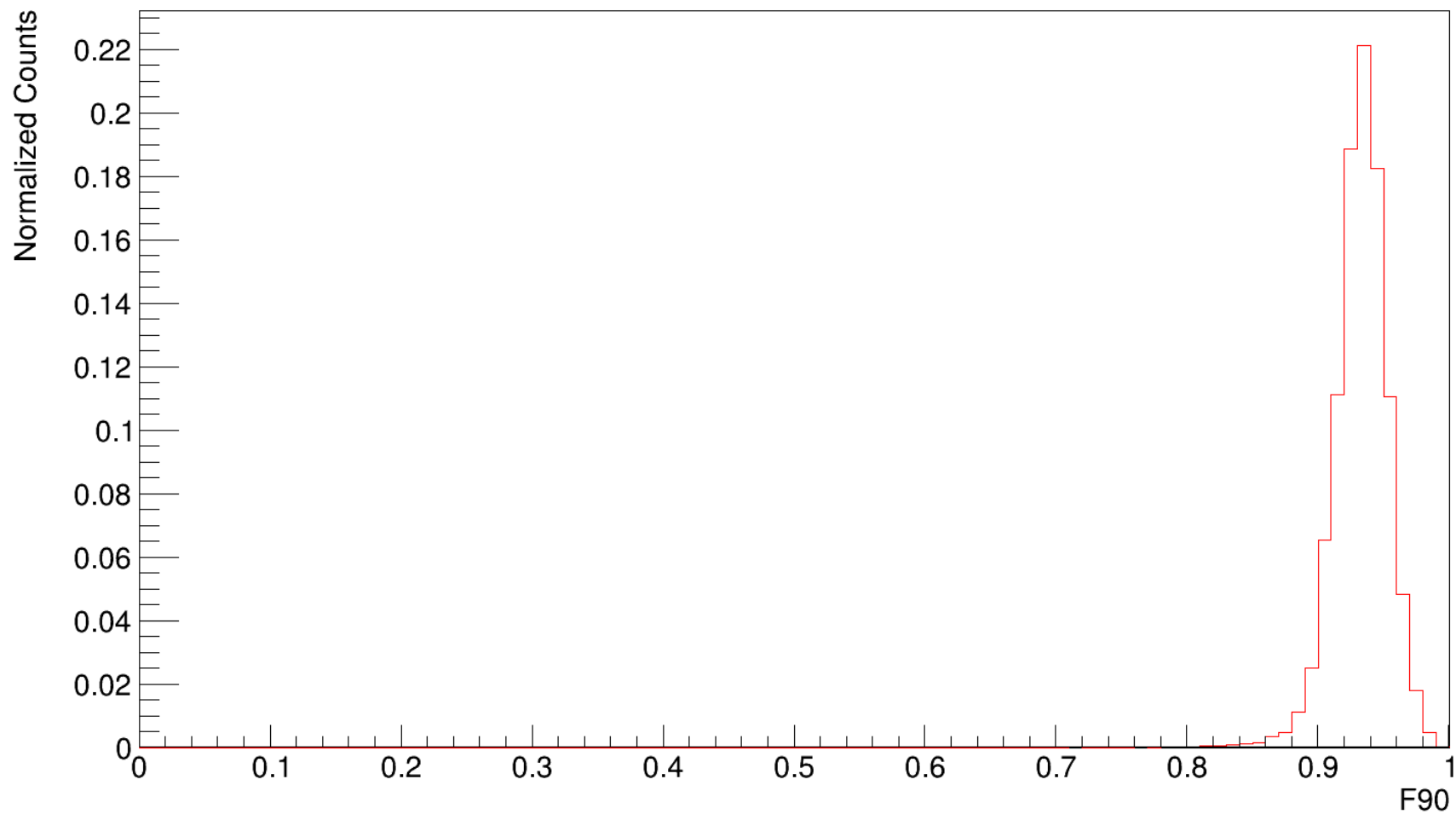
Co57 source, Xe doping, 20m abs length



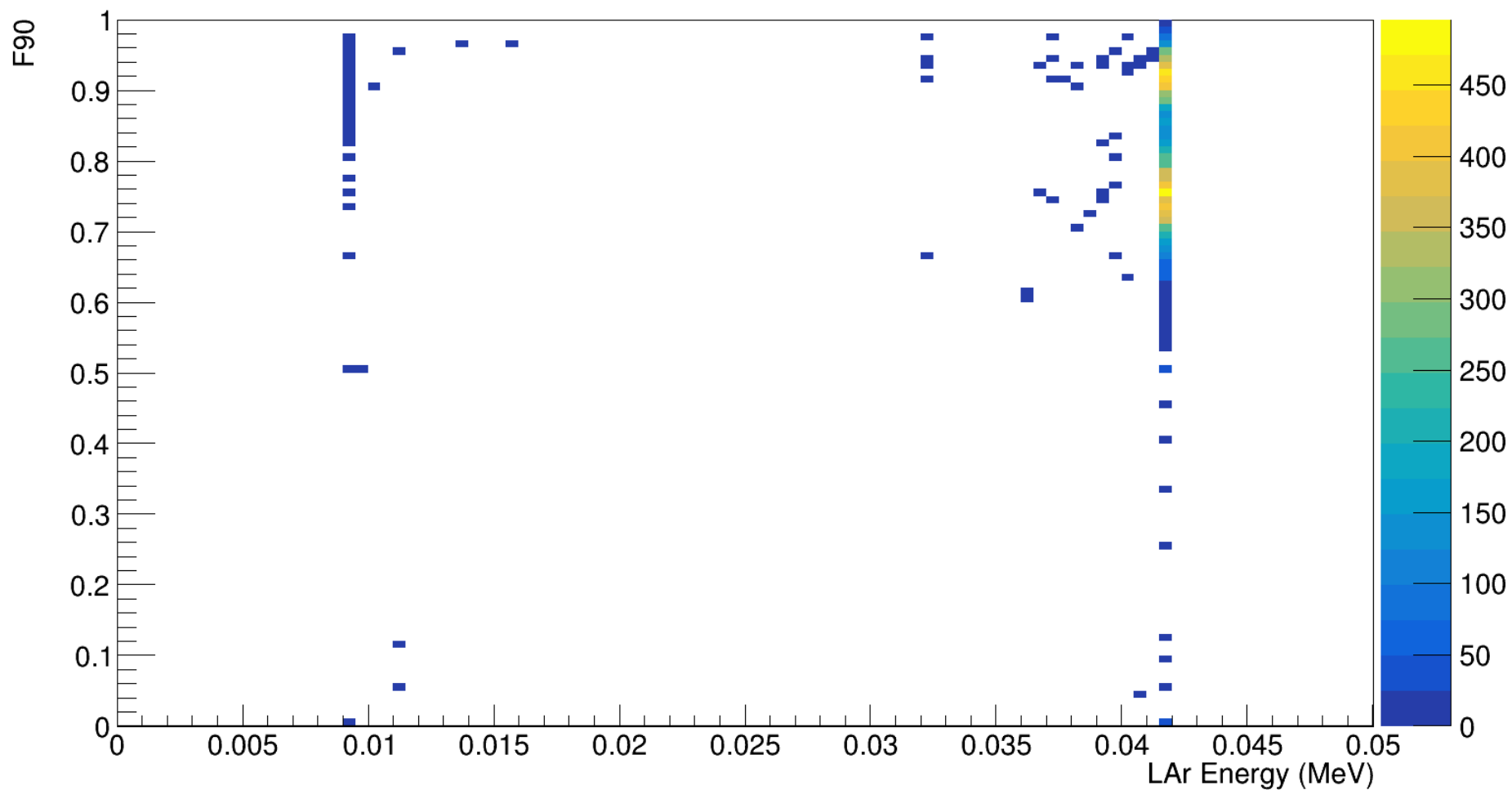
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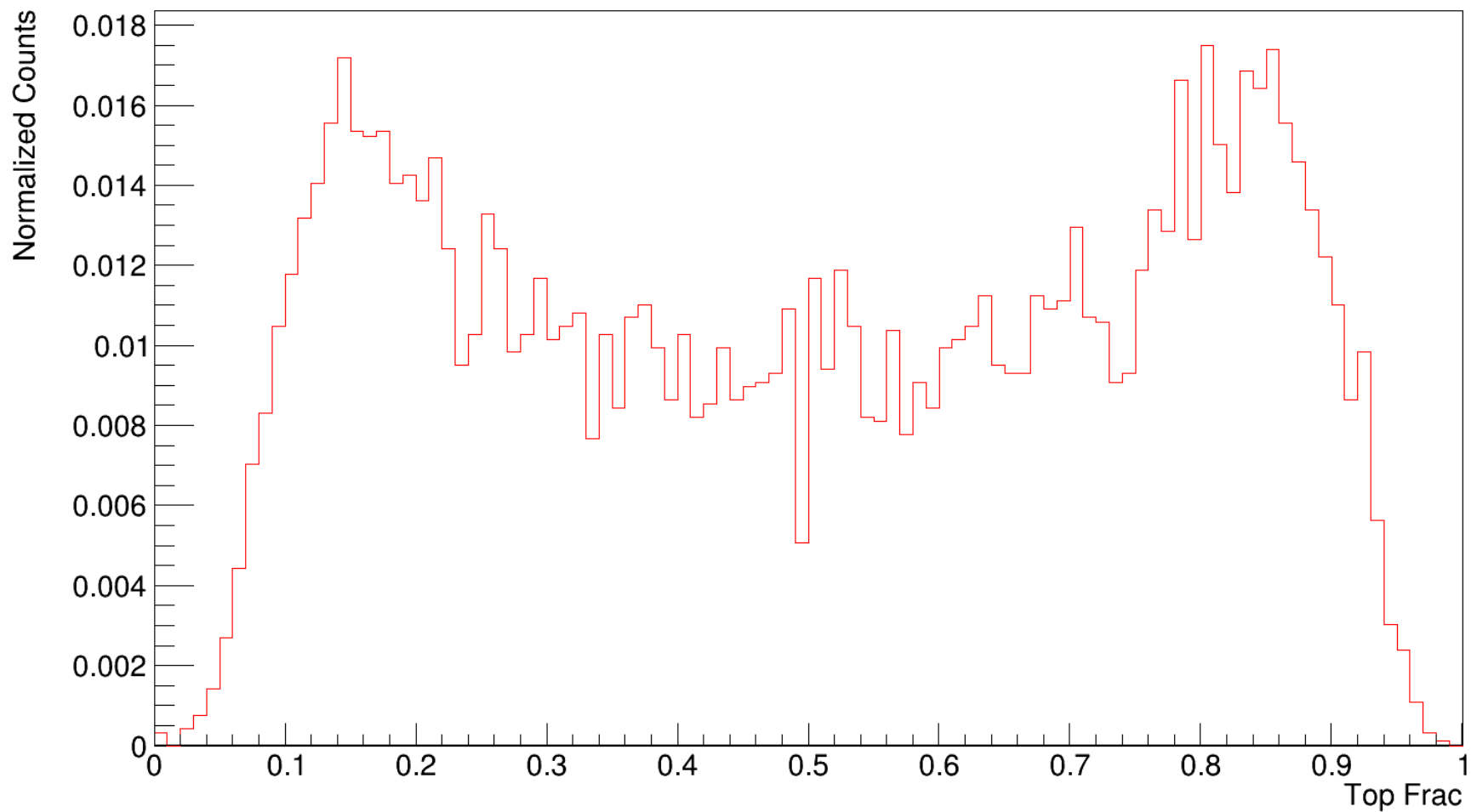
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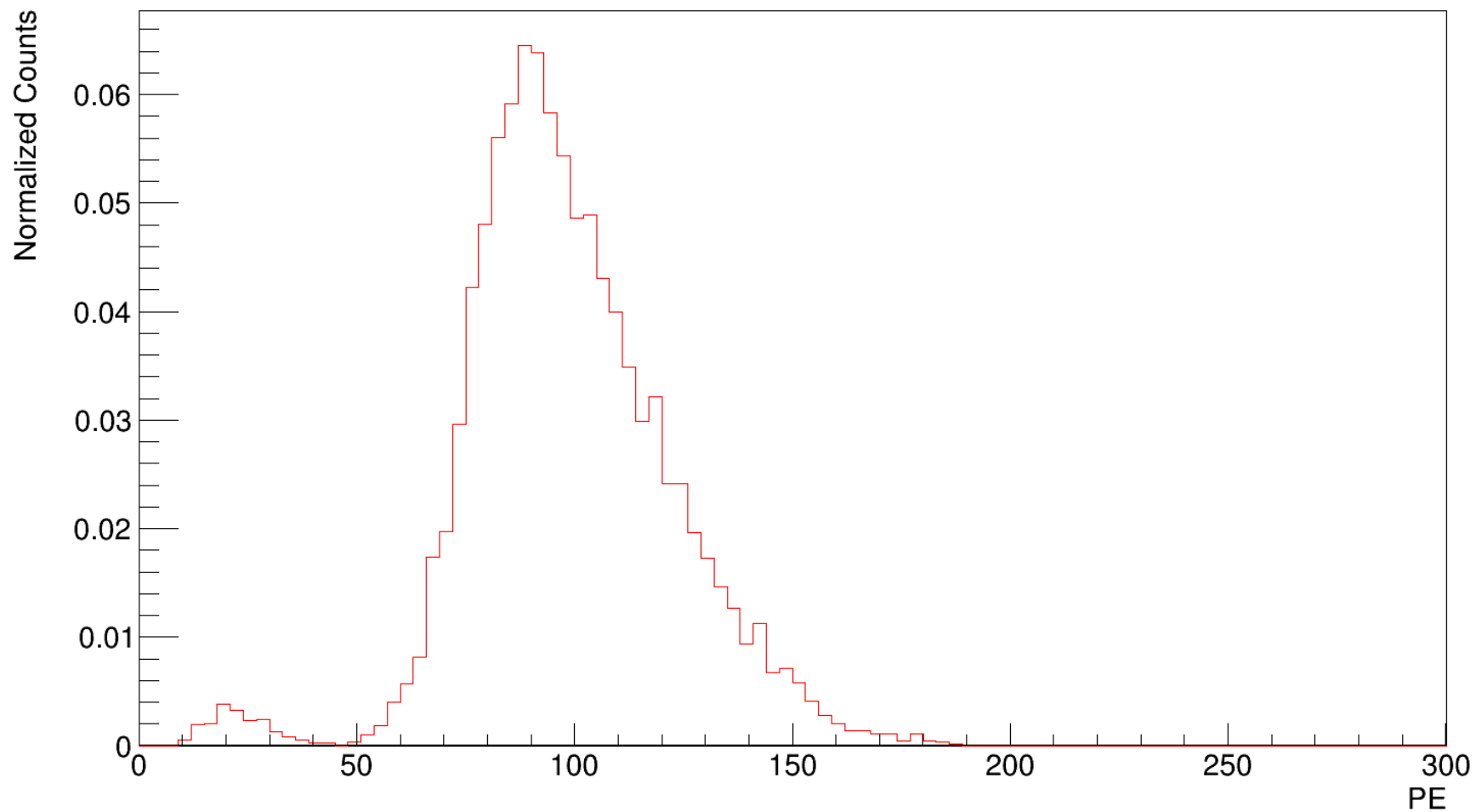
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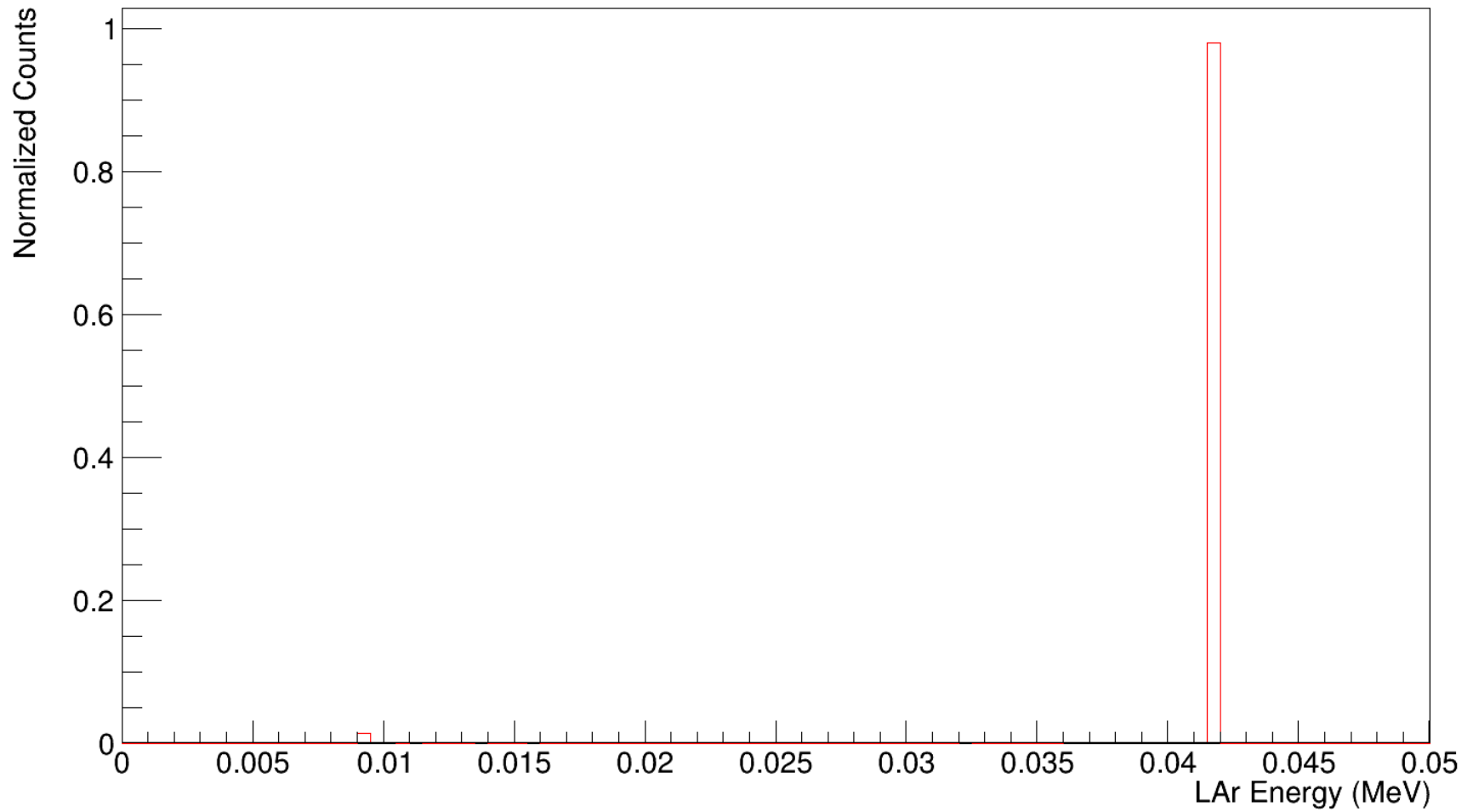
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