# Status of TMS studies

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### Introduction

- Areal density fix is in
  - Thank you reviewing the PR, Liam
- After last meeting, I posted reference plots using geom v3 with the areal density fix here
  - Something to compare with
  - Includes info about how files were generated in case of questions
- Code, Wiki
  - How to make plots, datasets
  - Please add info as needed



This is true muon KE vs KE estimate for all muons that start in TMS

### My Schedule

- Traveling back from Cern Dec 14<sup>th</sup> Need chair
- Do we want to meet Dec 21<sup>st</sup>? Last Thursday before break 2024

JANUARY 2024								FEBRUARY 2024						MARCH 2024						APRIL 2024							
Su	Мо	Tu	We	Th	Fr	Sa	Su	Мо		We		Fr	Sa	Su	Мо		We		Fr	Sa	Su	Мо	Ти	We	Th	Fr	Sa
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<b>Su</b> 28 5 12 19 26	Mo 29 6 13 20 27	M. Tu 30 7 14 21 28	AY 202 We 1 8 15 22 29	4 7h 2 9 16 23 30	Fr 3 10 17 24 31	<b>Sa</b> 4 11 18 25	Su 26 2 9 16 23	Mo 27 3 10 17 24	JU Tu 28 4 11 18 25	NE 202 We 29 5 12 19 26	24 Th 30 6 13 20 27	Fr 31 7 14 21 28	Sa 1 8 15 22 29	Su 30 7 14 21 28	Mo 1 8 15 22 29	<b>Tu</b> 2 9 16 23 30	<b>We</b> 3 10 17 24 31	4 4 11 18 25 1	Fr 5 12 19 26 2	Sa 6 13 20 27 3	Su 28 4 11 18 25	Mo 29 5 12 19 26	AUG Tu 30 6 13 20 27	We 31 7 14 21 28	024 Th 1 8 15 22 29	Fr 2 9 16 23 30	Sa 3 10 17 24 31

# Things I'm working on

- Fix spill simulation for production
  - Explained next slide
- Add per-reco-track truth information
  - Explained in 2 slides
- Finish det simulation
  - Fiber simulation needs to be a bit more complex
- Make samples with variations of det sim
  - At least make configs for production to use
- TMS framework and core software workshop next week
- TMS calibration

# Fix spill simulation for production

- edep sim and prod spill builder handled pileup differently
  - Pileup = multiple possibly overlapping events in the same spill
- Spill builder way can load portions only of hits at a time for LAr sim
  - Full spill < 1GB in TMS
- TMS code needs to understand spill builder way

#### Edep sim way

ttree entry 1:

- interaction 1, spill 1, t=0ns
- interaction 2, spill 1, t=10ns
- interaction 3, spill 1, t=30ns
- ...

. . .

ttree entry 2:

- interaction n+1, spill 2, t=0ns
- interaction n+2, spill 2, t=10ns
- interaction n+3, spill 2, t=30ns

#### Spill Builder way

- interaction 1, three entry 1, spill 1, t=0ns
- interaction 2, ttree entry 2, spill 1, t=10ns
- interaction 3, ttree entry 3, spill 1, t=30ns
- ...
- interaction n+1, ttree entry n+1, spill 2, t=0ns
- interaction n+2, ttree entry n+2, spill 2, t=10ns
- interaction n+3, ttree entry n+3, spill 2, t=30ns
- ...

# Add per-reco-track truth information

• Time slicer and muon truth info don't play well together

- Time slicer splits spill with multiple interactions into "slices"
  - Tries its best to split into single events but you're going to have pileup
- Study scripts use Muon\_TrueKE branch and some others
  - Only filled when the time slicer is not run
  - With pileup, you can have 2 or more muons
- Save truth information per reco track instead
  - Also fill Muon\_TrueKE with most energetic true muon in slice to keep some backward compatibility

<sup>-</sup> See issue 42

### TMS Projects I'm aware of

- Asa Nehm
  - per-view track reconstruction  $\rightarrow$  3D track reconstruction
- Lukas Koch
  - ND geometry
- Liam O'Sullivan
  - dune-tms git owner and caf integration
- Sushil Shivakoti
  - Muon energy resolution
- Xiaoyan Huang
  - Muon reco efficiency and detector simulation comparisons
- Michael Dolce
  - Possible B-field studies

## Style Guides

- We should start following the style guides
  - https://github.com/DUNE/dune\_plot\_style/tree/main
  - https://github.com/DUNE/dune\_plot\_style/blob/main/guidelines.md
- Make our plots from make\_hist.py follow them
  - Ideally make a separate plotting script that plots from root file
- Nice small project
  - Learn more about root

### Conclusion

- Lots of work to do
- Goals
  - help with design decisions, PDR, TDR
  - make code that works long-term for actual detector
  - develop skills of the graduate students
- I'm going to be gone super soon
  - We made a lot of progress in short time
  - Hoping to get things fully on track before I go