



# Introducing a larvecutils package for vectorized code

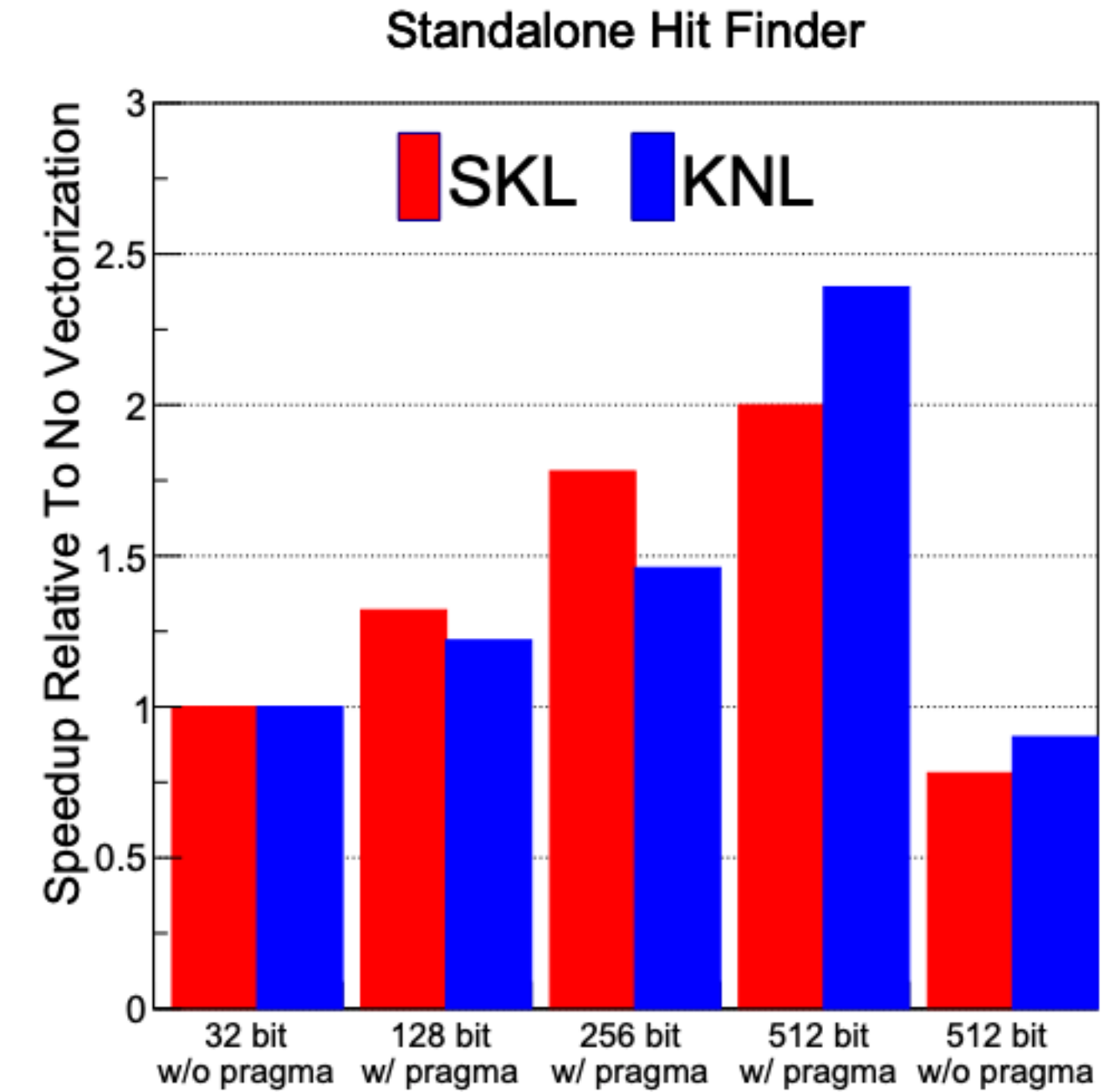
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LArSoft Coordination Meeting

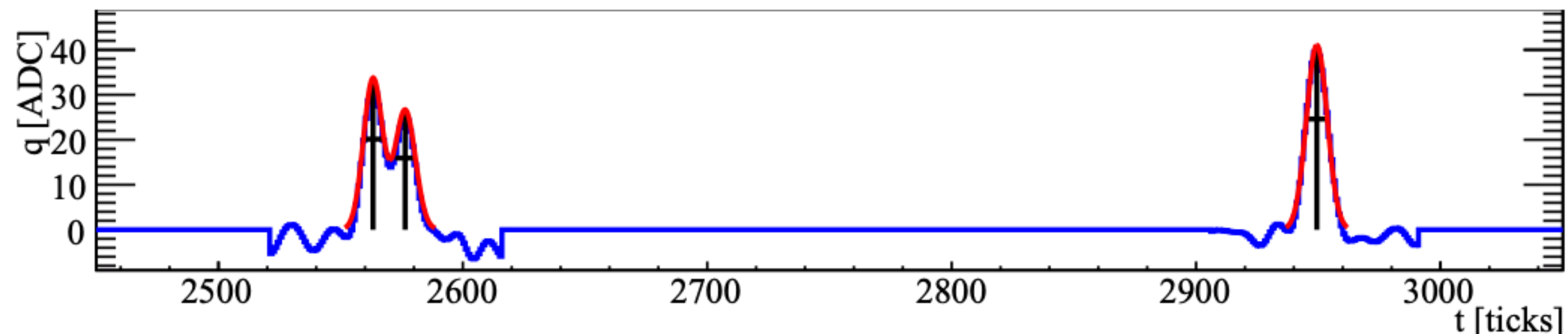
Nov. 30, 2021

# Motivation

- The LArSoft GausHitFinder module has been parallelized at multiple levels
  - when `PeakFitterMrqdt_tool` is used
  - multi-threading at sub-event level (over wires and ROIs) uses TBB (same as art - already available in LArSoft)
  - vectorization over waveform data bins gives best performance  $\geq 2x$  speedup when using intel compiler and AVX512
- In order to exploit these features, a way to custom-compile the vectorized code in LArSoft is needed
  - on platforms that support them, e.g. current-generation HPC



[arXiv:2107.00812](https://arxiv.org/abs/2107.00812)



# Implementation

- LArSoft is enabling building with spack, which provides a simple way to customize compilation at package level
  - attempts were done to do this at a finer-grain level but without success
- The idea is then to create a new package larvecutils where all vectorized code is moved
  - right now only MarqFitAlg, but more can be added in the future
- The solution has been tested and works based on icaruscode v09\_35\_00
  - both with ups (nominal gcc) and spack (both gcc and icc+AVX512) build
    - [https://github.com/cerati/larvecutils/tree/v09\\_35\\_00](https://github.com/cerati/larvecutils/tree/v09_35_00)
  - it also requires small updates to related code lardata (where MarqFitAlg currently lives) and larreco
    - branches are also available for these packages

# Summary

- Spack can help custom-compile vectorized code
- A new package larvecutils can be used to collect code that is vectorized
- Feedback on this idea is welcome!
- After consensus is reached, request creation of new package and make PR