

MILO VERMEULEN 25-4-2019

MC-RECO MATCHING

MOTIVATION

- ▶ Comparison between Monte Carlo and reconstructed objects is often useful
- ▶ Rigorous link between the two seemed to be missing
- ▶ A start had been made in Leigh's ProtoDUNETruthUtils and the BackTracker service

PREVIOUSLY, IN PROTODUNE TRUTH UTILITIES

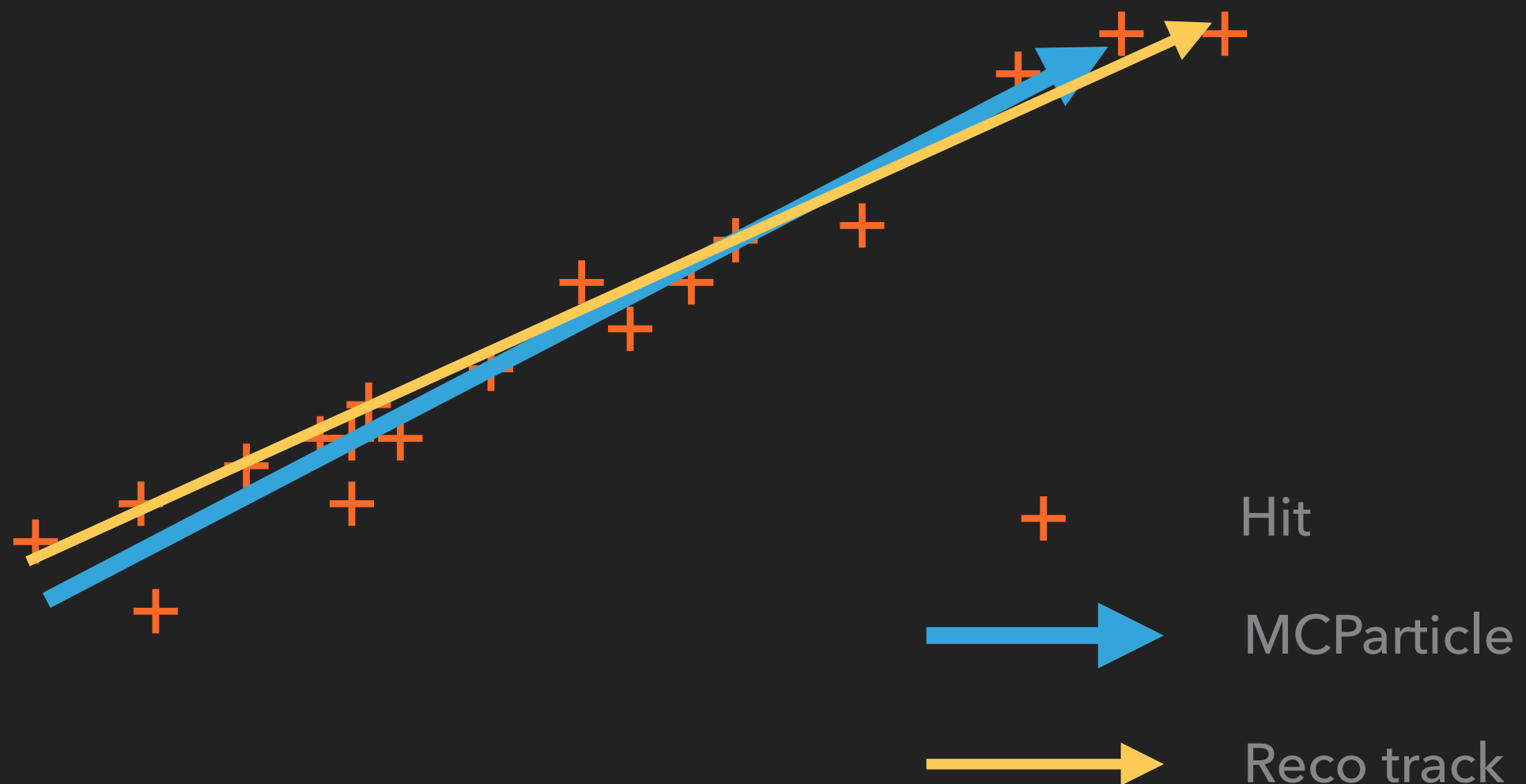


NEW DEVELOPMENT



MAIN PRINCIPLE

- Find biggest overlap on hit-level, using the BackTracker service



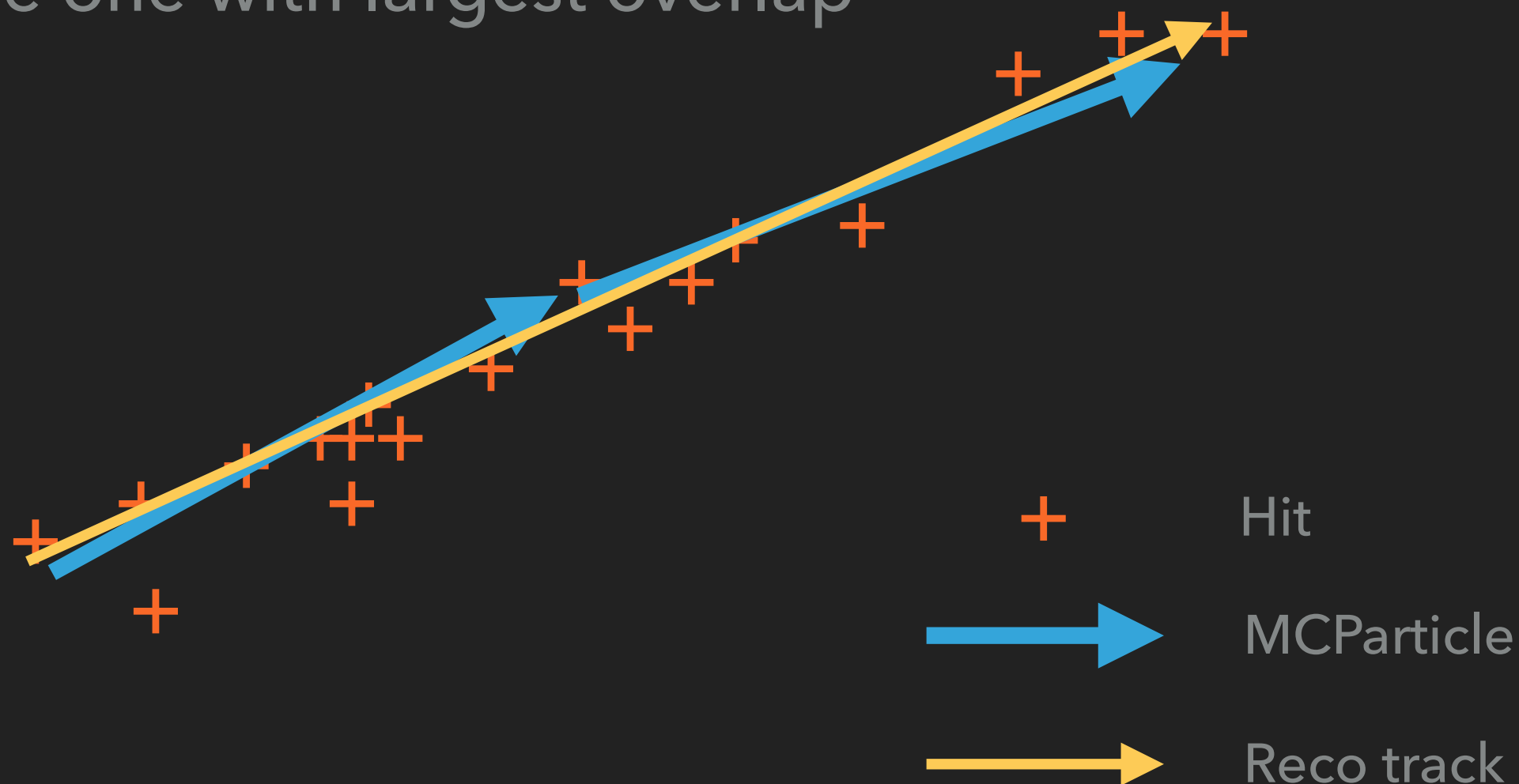
SUBTLETIES IN

TRACK

GetMCParticleFromRecoTrack

MCPARTICLE

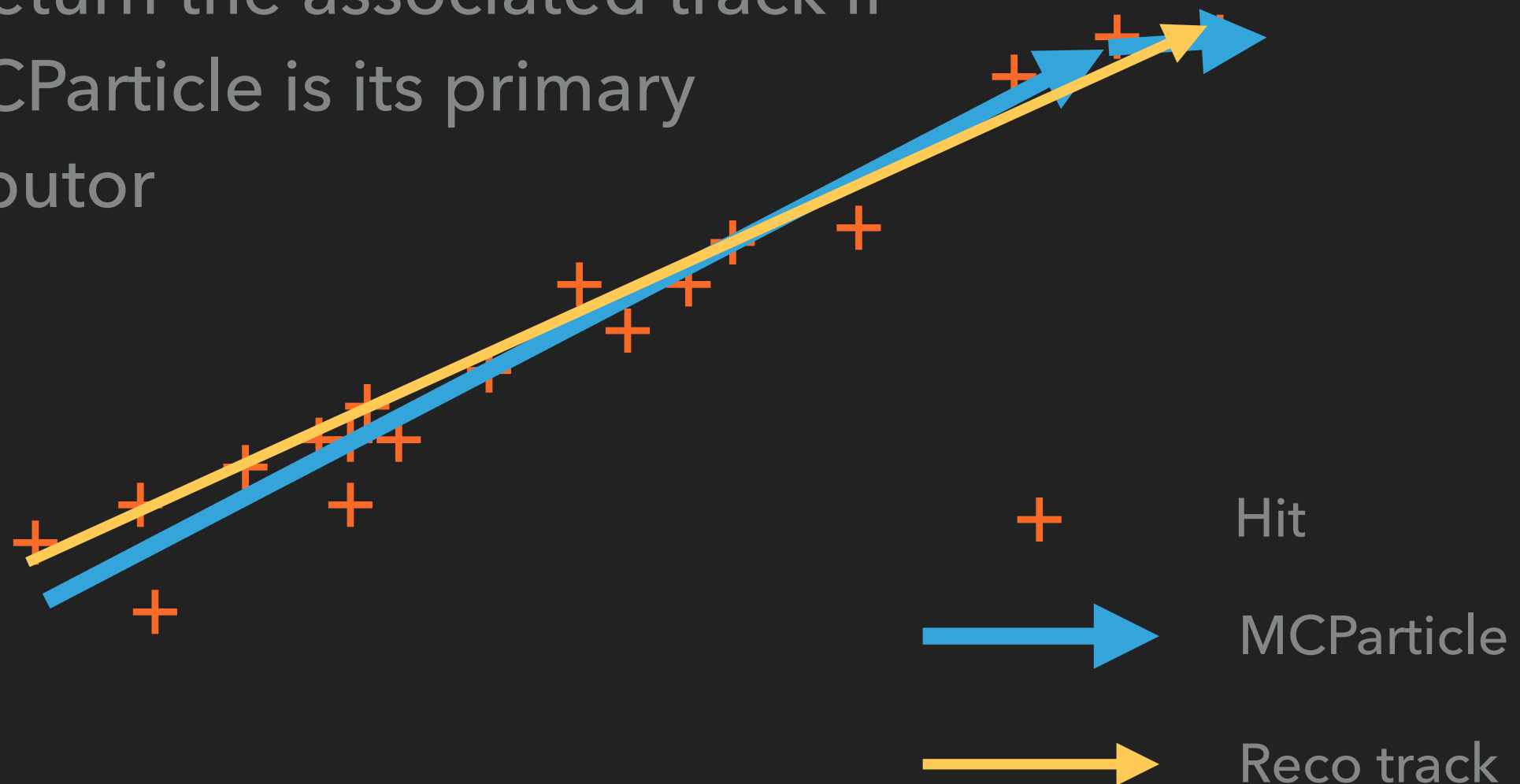
- ▶ Multiple MCParticles may contribute to a single track
- ▶ Pick the one with largest overlap



SUBTLETIES IN



- ▶ Multiple MCParticles may contribute to a single track
- ▶ Only return the associated track if the MCParticle is its primary contributor

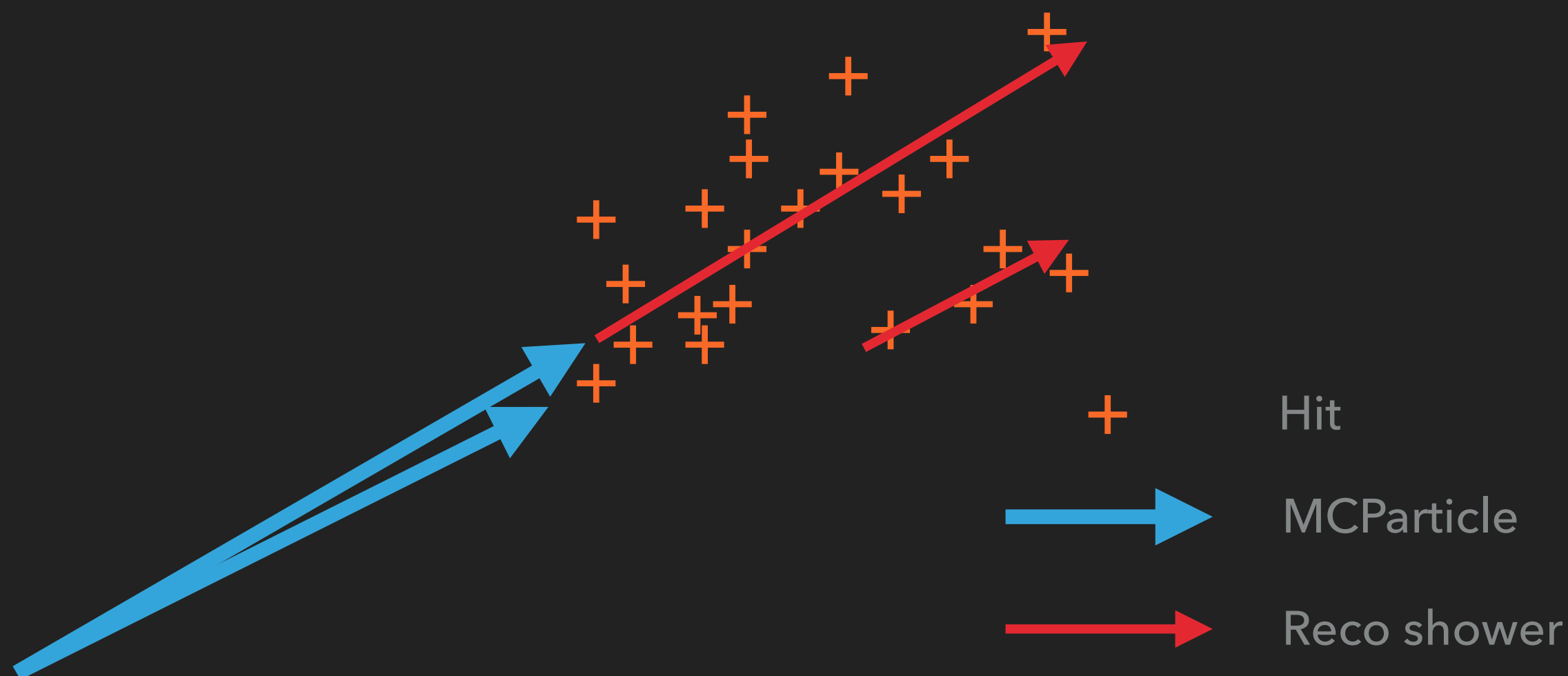


SUBTLETIES IN

SHOWER

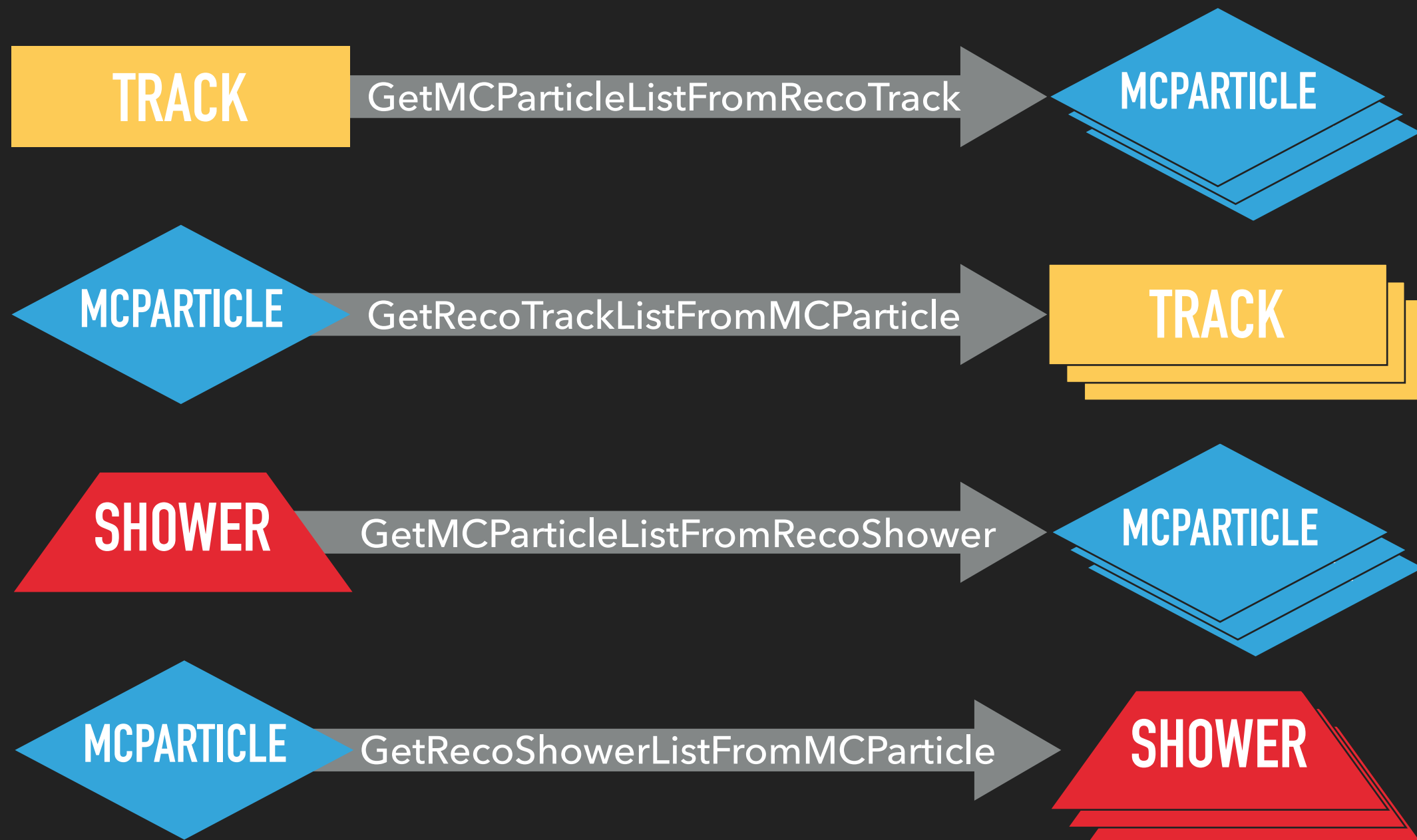
MCPARTICLE

- ▶ Identical to the track case
- ▶ Underlying methods differ slightly



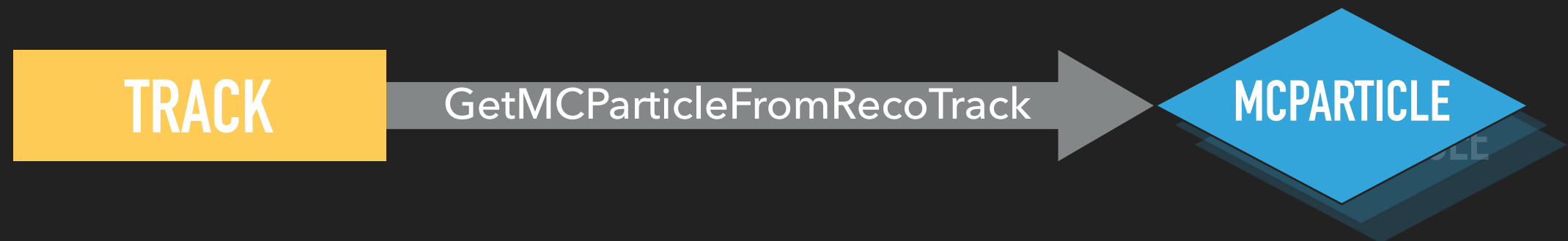
NEW DEVELOPMENT

- ▶ Get a sorted vector of weighted contributions to object



NEW DEVELOPMENT

- ▶ Get a sorted vector of weighted contributions to object
- ▶ Single object functions simply return the first element in the list (with a few exceptions)



CODE LOCATION

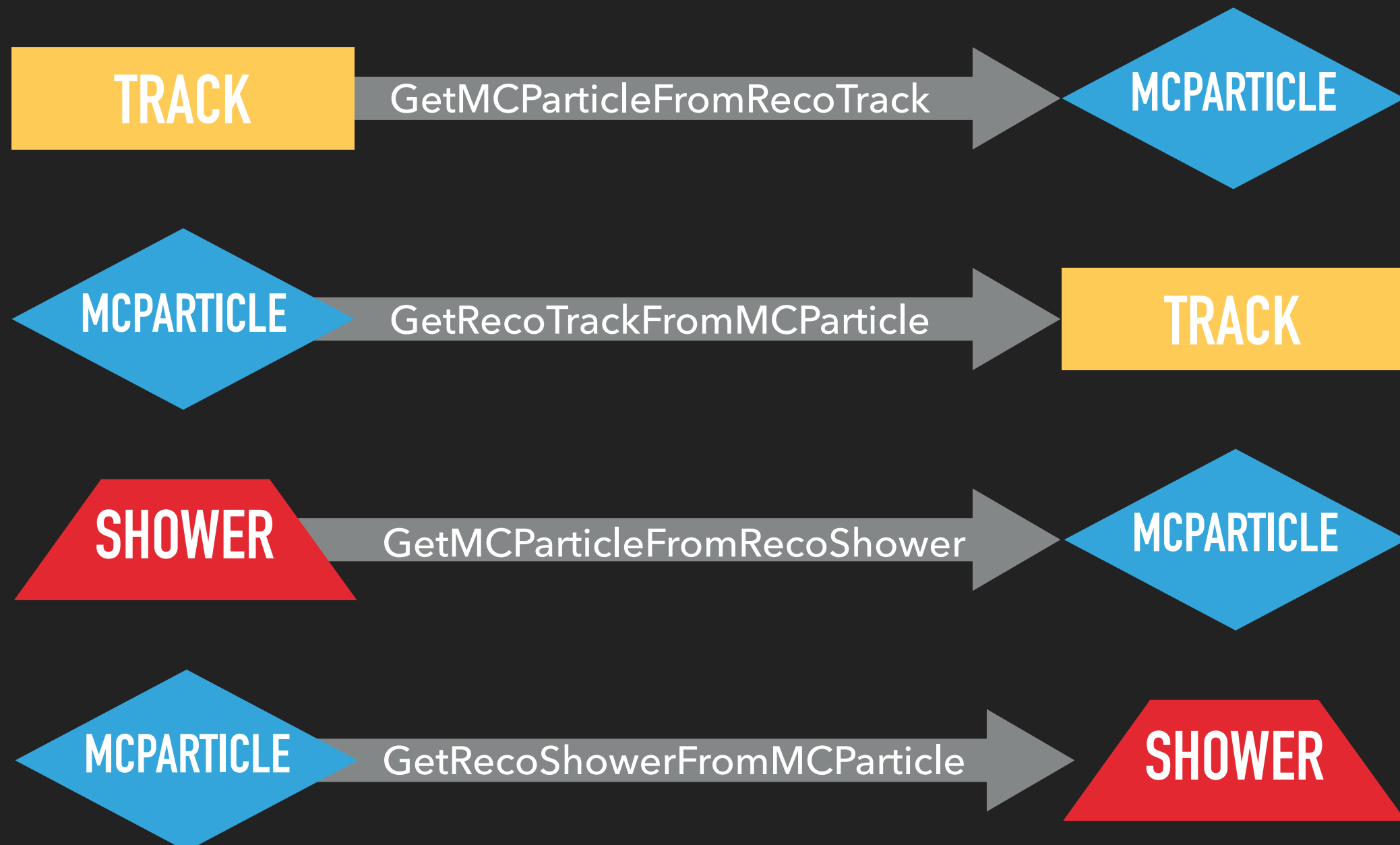
- ▶ ProtoDUNE utilities by Leigh
- ▶ Best documentation: the header file of the truth utilities

`dunetpc/dune/Protodune/Analysis/ProtoDUNETruthUtils.h`

- ▶ Code is not ProtoDUNE-specific! Could be used for general DUNE analyses

CONCLUSION

- ▶ The following functions now exist



BACKUP

THE UNDERLYING PICTURE

- Overlap table for all MCParticles - tracks/showers

	Reco track 1	Reco track 2	Reco track 3	Reco track 3	...
MCParticle 1	X_{11}	X_{12}	X_{13}	X_{14}	...
MCParticle 2	X_{21}	X_{22}	X_{23}	X_{24}	...
MCParticle 3	X_{31}	X_{32}	X_{33}	X_{34}	...
MCParticle 4	X_{41}	X_{42}	X_{43}	X_{44}	...
⋮	⋮	⋮	⋮	⋮	

THE UNDERLYING PICTURE

- Visualisation of GetRecoTracksFromMCParticle

	Reco track 1	Reco track 2	Reco track 3	Reco track 3	...
MCParticle 1	X_{11}	X_{12}	X_{13}	X_{14}	...
MCParticle 2	X_{21}	X_{22}	X_{23}	X_{24}	...
MCParticle 3	X_{31}	X_{32}	X_{33}	X_{34}	...
MCParticle 4	X_{41}	X_{42}	X_{43}	X_{44}	...
⋮	⋮	⋮	⋮	⋮	

THE UNDERLYING PICTURE

- Visualisation of GetMCParticlesFromRecoTracks

	Reco track 1	Reco track 2	Reco track 3	Reco track 3	...
MCParticle 1	X_{11}	X_{12}	X_{13}	X_{14}	...
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MCParticle 3	X_{31}	X_{32}	X_{33}	X_{34}	...
MCParticle 4	X_{41}	X_{42}	X_{43}	X_{44}	...
⋮	⋮	⋮	⋮	⋮	

IN AN IDEAL WORLD: THE ASSIGNMENT PROBLEM

- Find best match for all tracks based on whole picture

	Reco track 1	Reco track 2	Reco track 3	...	
MCParticle 1	X_{11}	X_{12}	X_{13}	X_{14}	...
MCParticle 2	X_{21}	X_{22}	X_{23}	X_{24}	...
MCParticle 3	X_{31}	X_{32}	X_{33}	X_{34}	...
MCParticle 4	X_{41}	X_{42}	X_{43}	X_{44}	...
⋮	⋮	⋮	⋮	⋮	⋮

IN AN IDEAL WORLD: THE ASSIGNMENT PROBLEM

- ▶ Find best match for all tracks based on whole picture
- ▶ Takes a lot longer (5-25 times as long)
- ▶ User perspective: overkill for a single track or MCParticle per event