Analysis Tools and GLD prime performance

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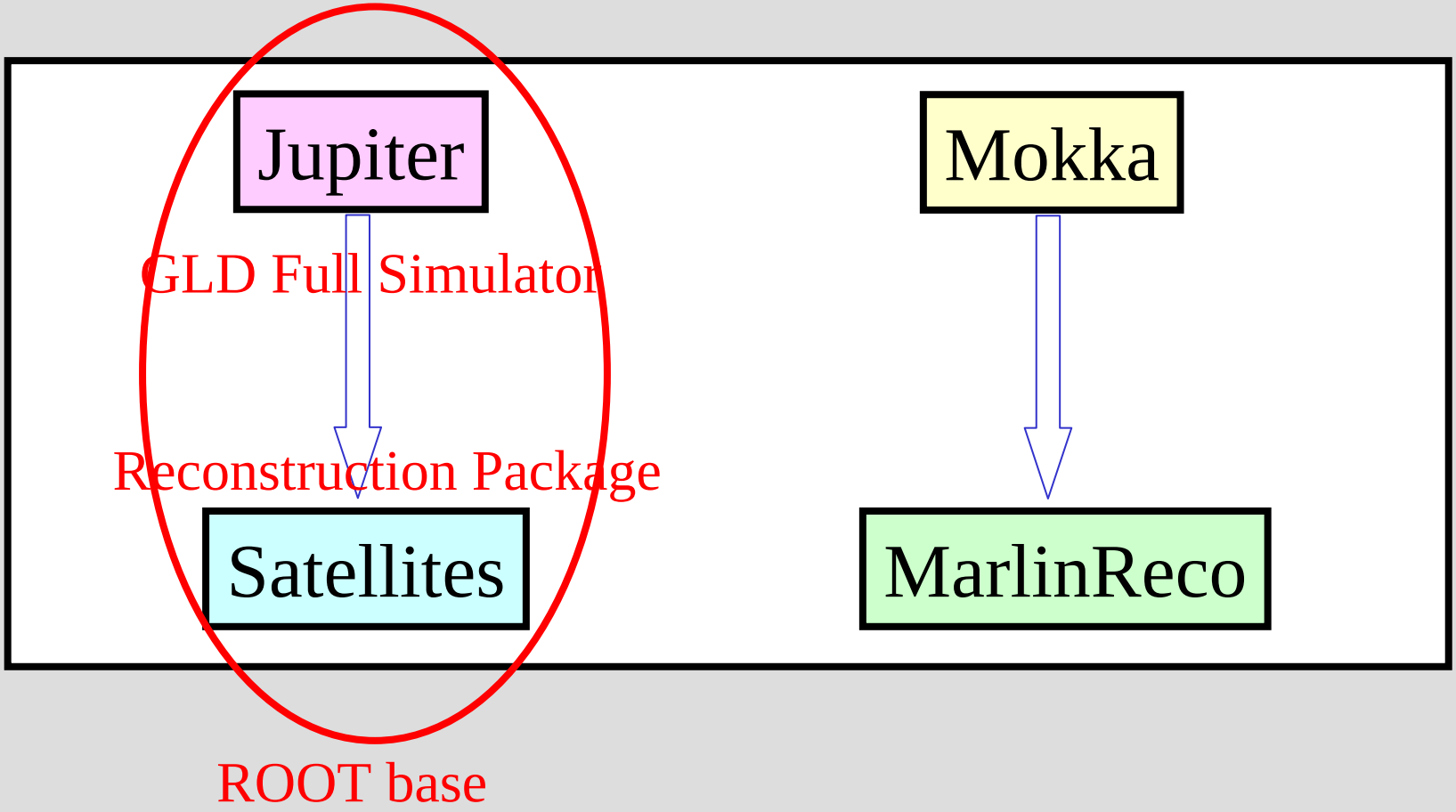
Introduction

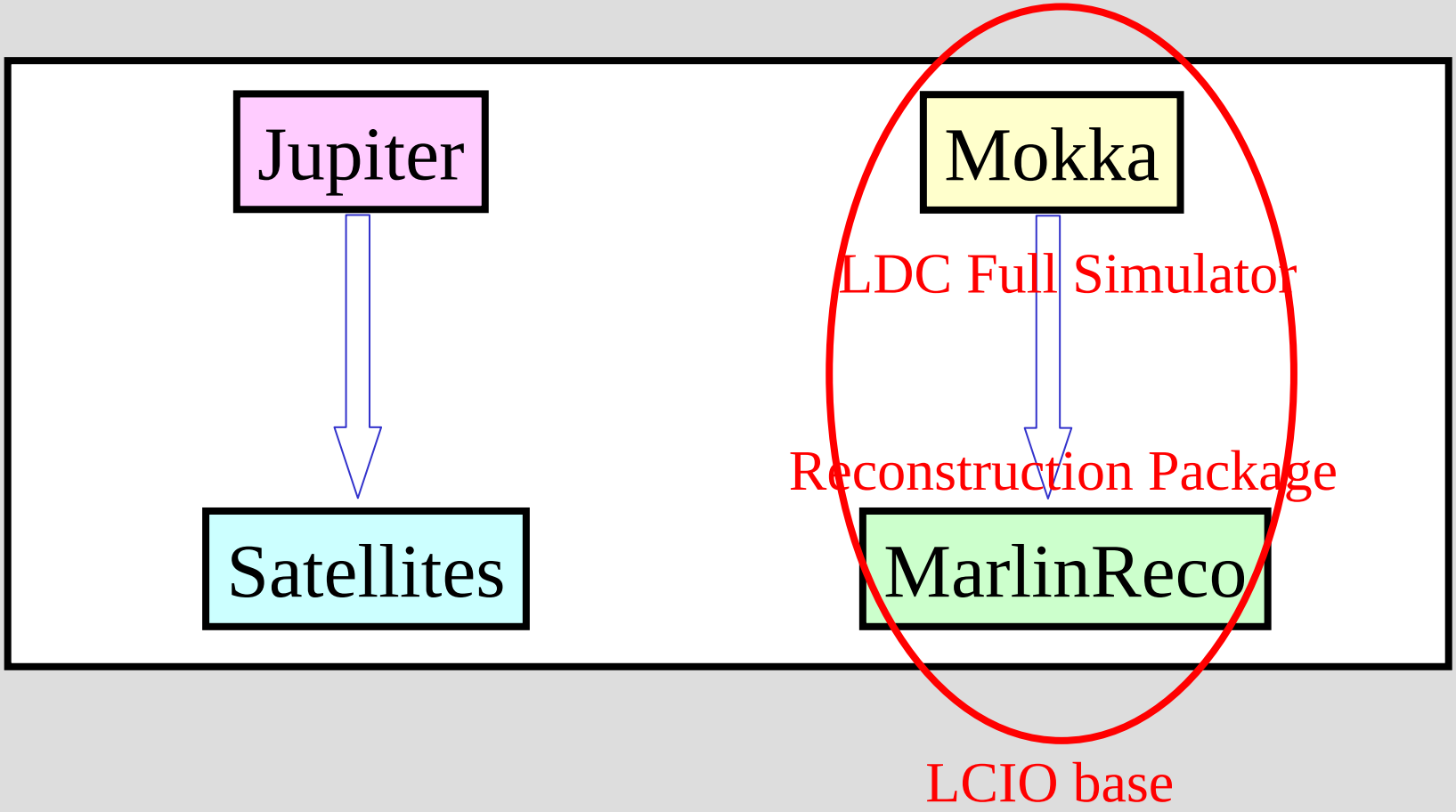
- Optimization Strategy:
  - Aim to parameterize physics performance vs. Detector parameters (R_TPC, B, etc…).
  - Studies should be as realistic as possible:
    - Study signal + background Monte Calro
  - Use full detector simulation and reconstruction
    → the tools exist for both LDC and GLD
  - Currently LDC and GLD use different Geant4 simulation/ reconstruction frameworks.
  - Given LoI timescale, decided to perform ILD detector studies in context of both GLD and LDC.

  → Connected only by common data format (LCIO).

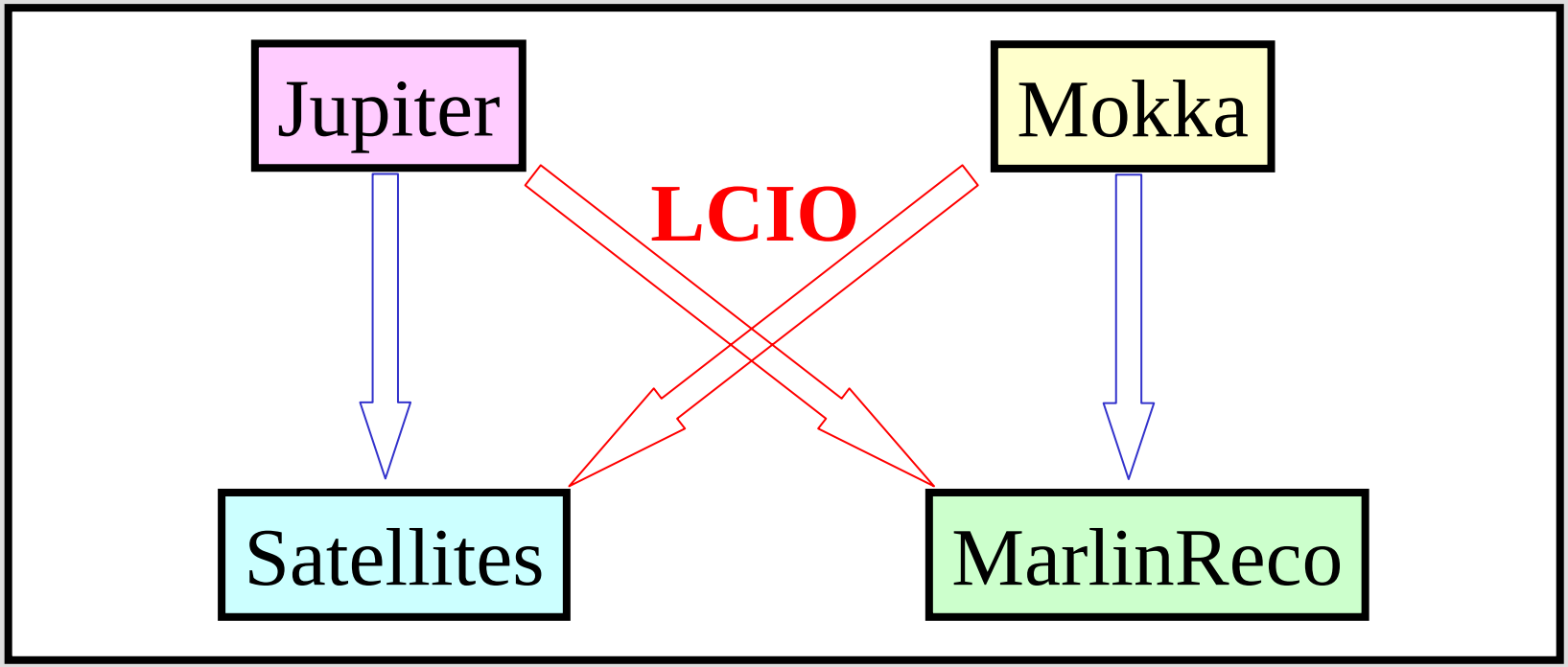
LCIO Interface



LCIO Interface

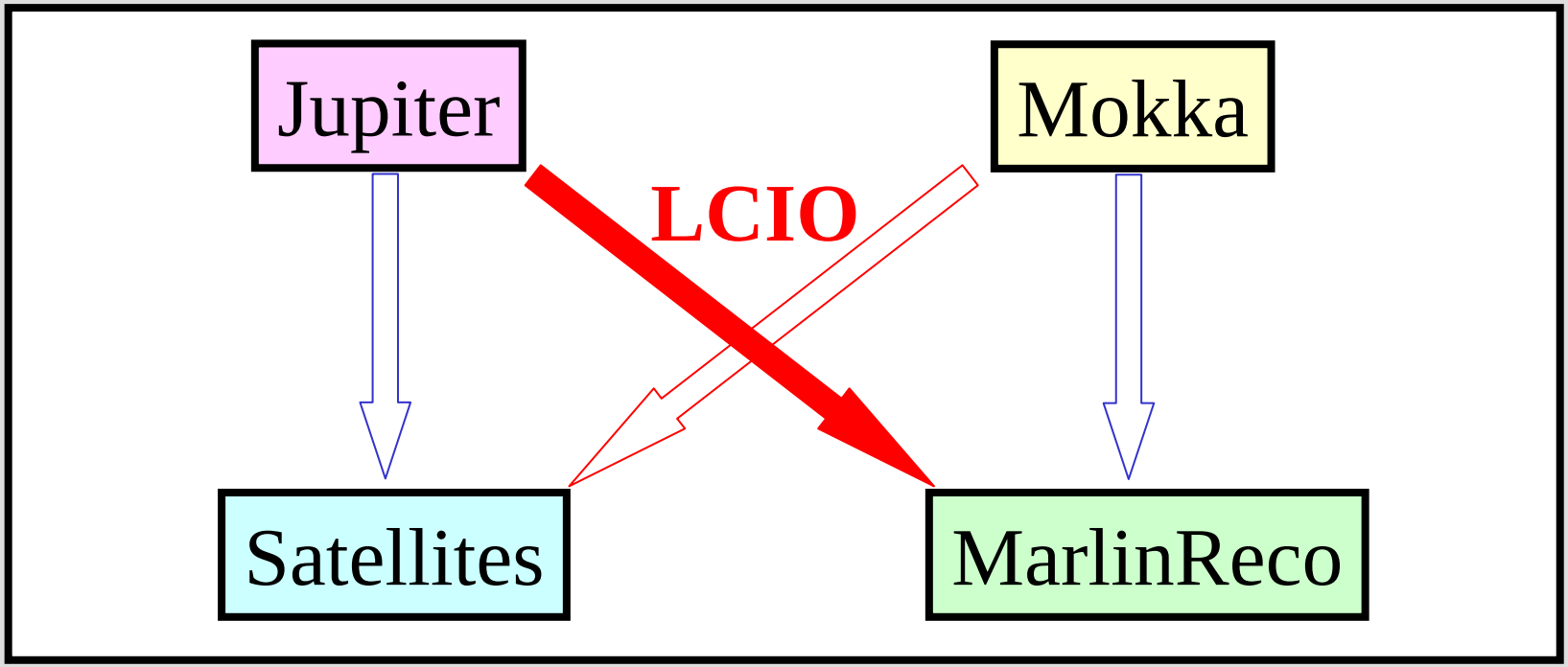


LCIO Interface



LCIO Interface

- An interface which converts Jupiter output to LCIO format has been successfully implemented.



Performance of single particles and Z→qqbar events were checked by using the MarlinReco and PandoraPFA.

Performance Check

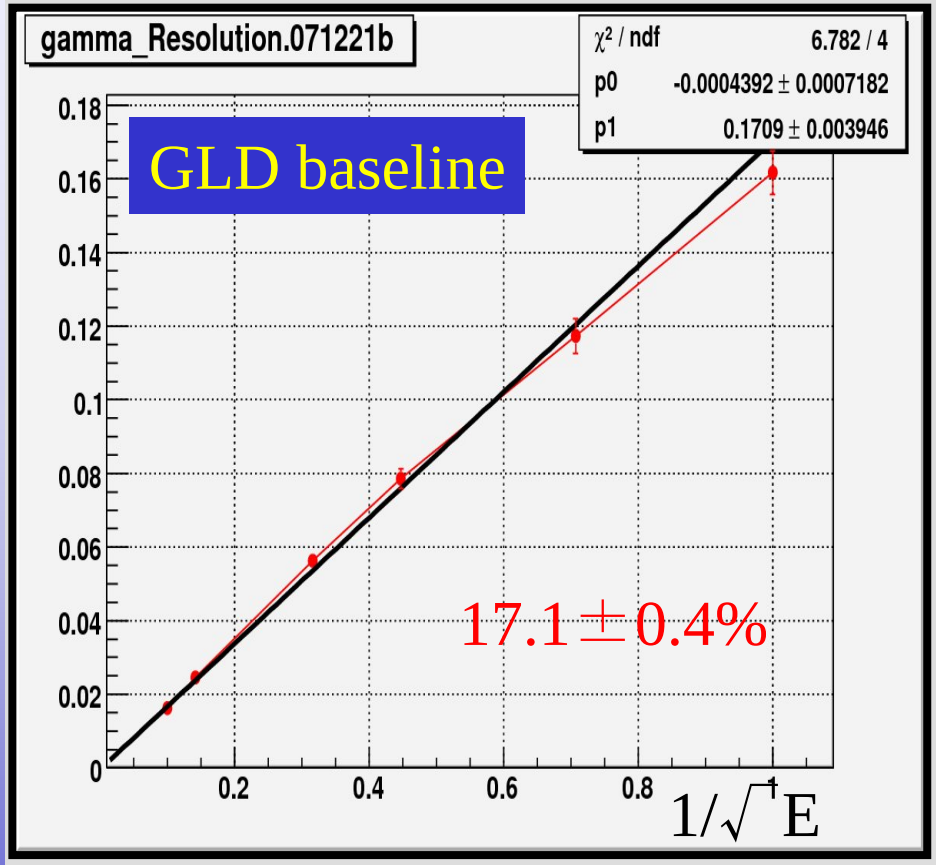
- Analyzed Jupiter LCIO data by MarlinReco/PandoraPFA.
  - Single gamma : ECAL resolution
  - Single Kaon0L : HCAL resolution
  - Z-pole : PFA performance

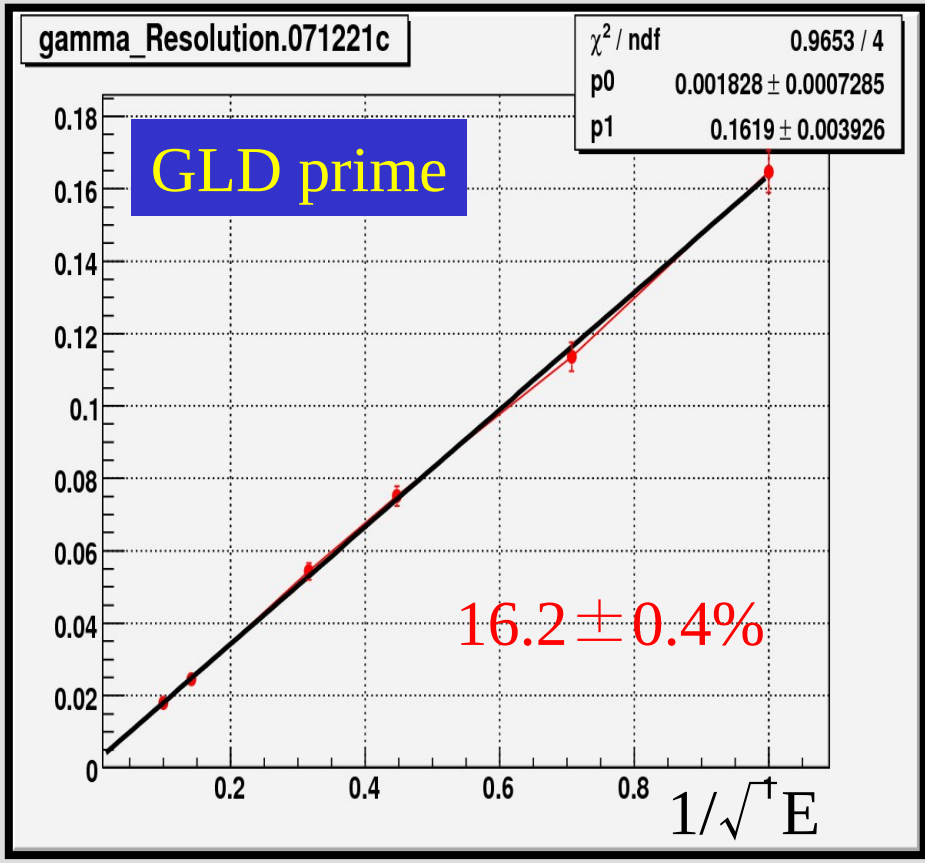
  Note : These studies based on Pandora v01, not the latest version.

- Detector Model
  - GLD baseline and GLD prime.
  - Same generation event. Can perform event-by-event consistency check.

- Physics list : LCPhysicsList

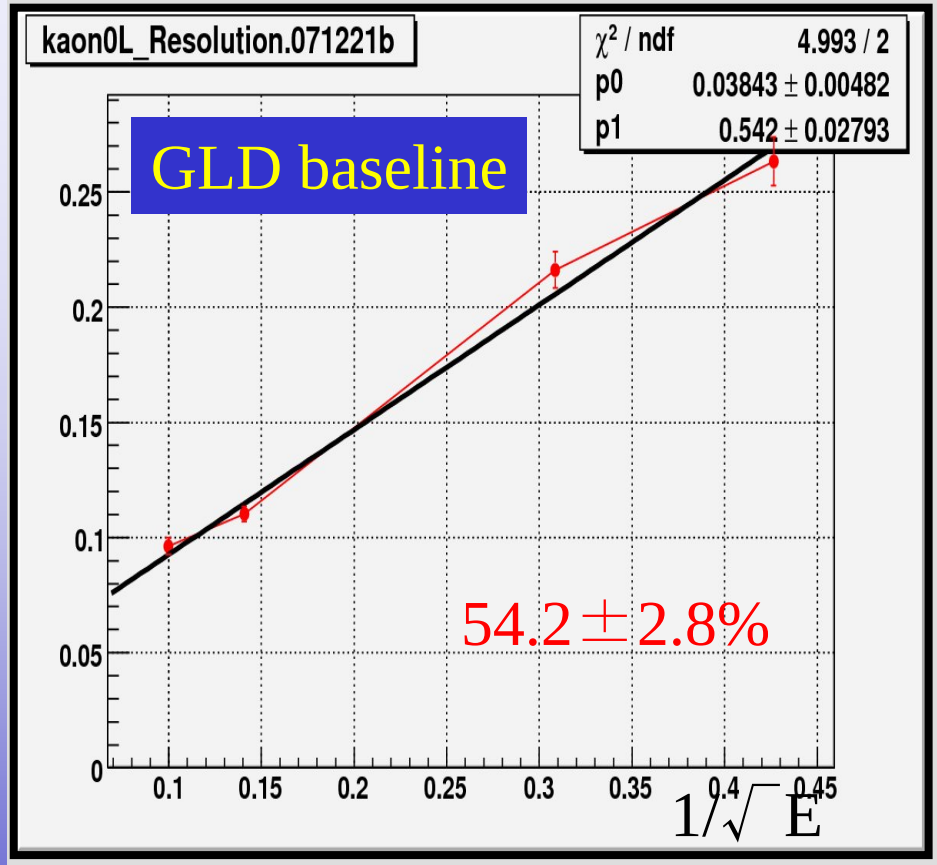
Single Gamma - Resolution

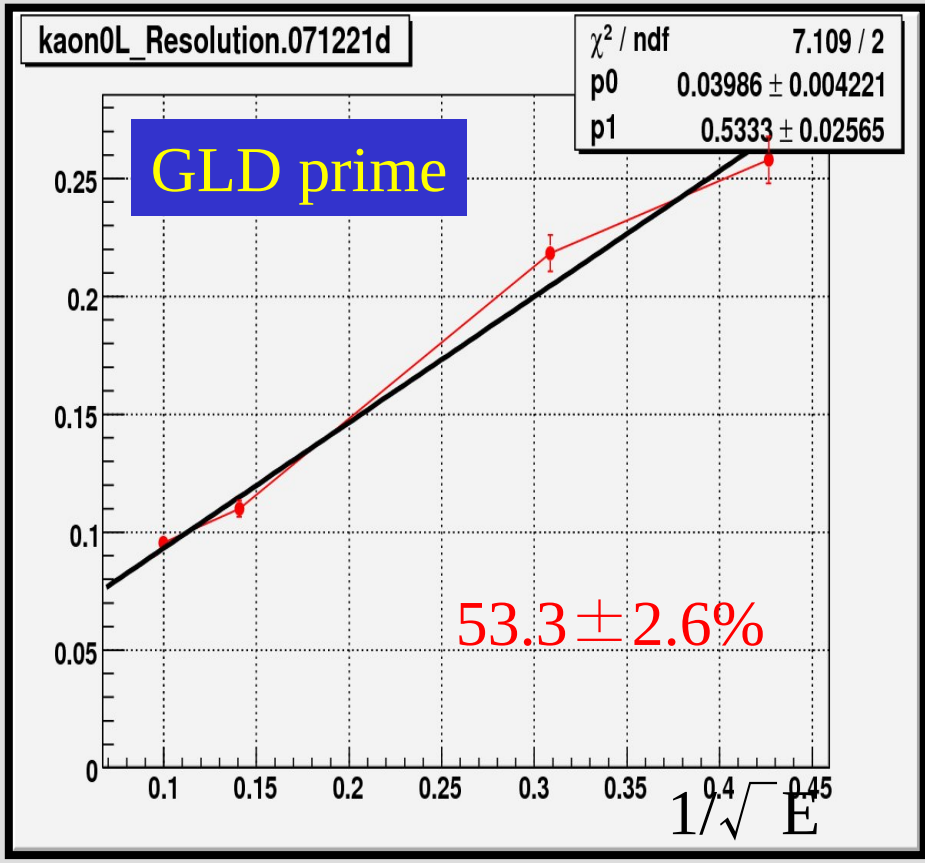




- Analyzed same Jupiter single-gamma events by MarlinReco.
- Resolutions of GLD baseline and GLD prime are consistent.

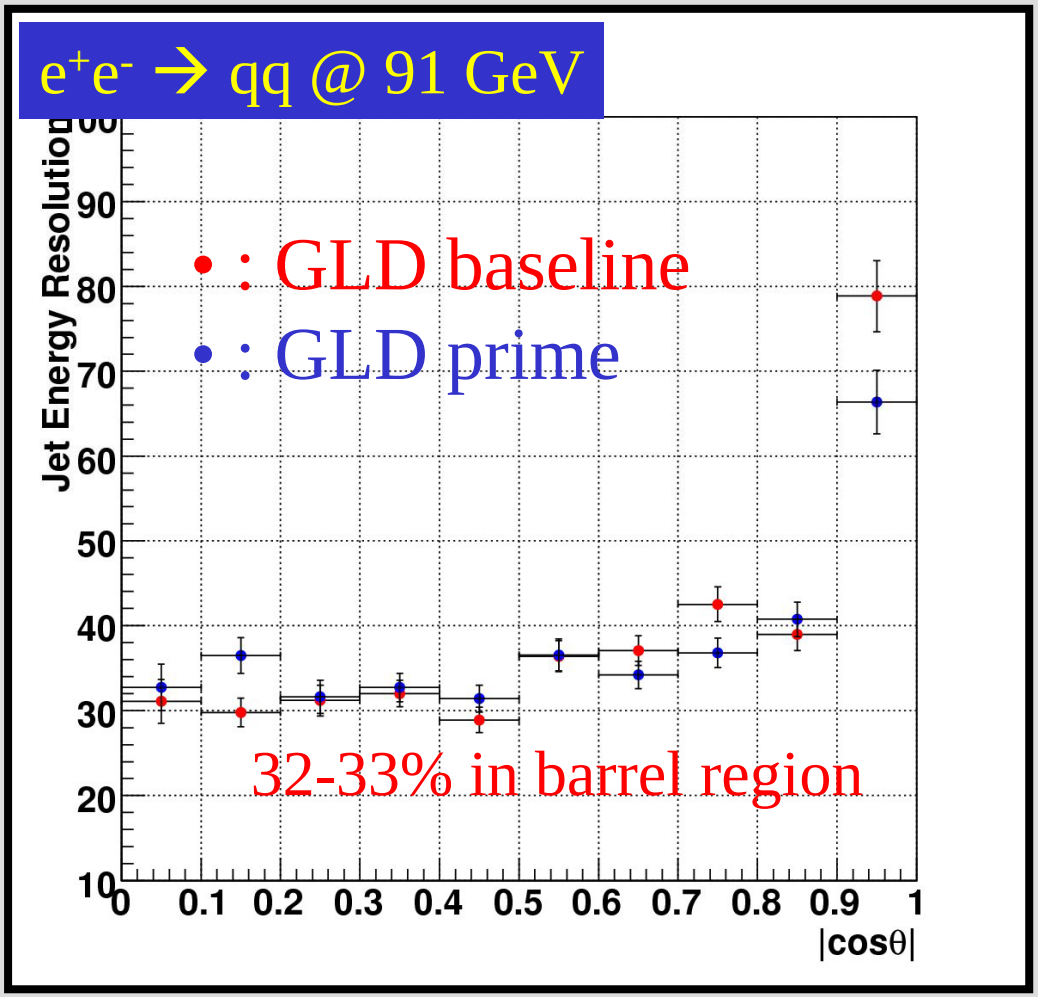
Single Kaon0L - Resolution





- Analyzed same Jupiter single kaon0L events by MarlinReco.
- Resolutions of GLD baseline and GLD prime are consistent.
- Resolutions are significantly worse than previous results (~45%)

Z-pole Events

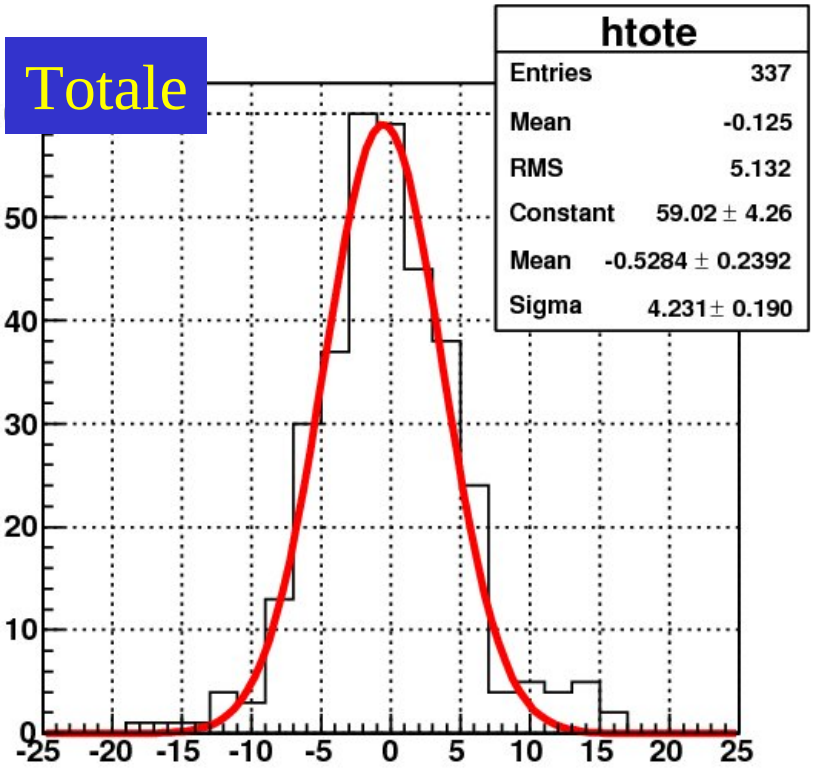


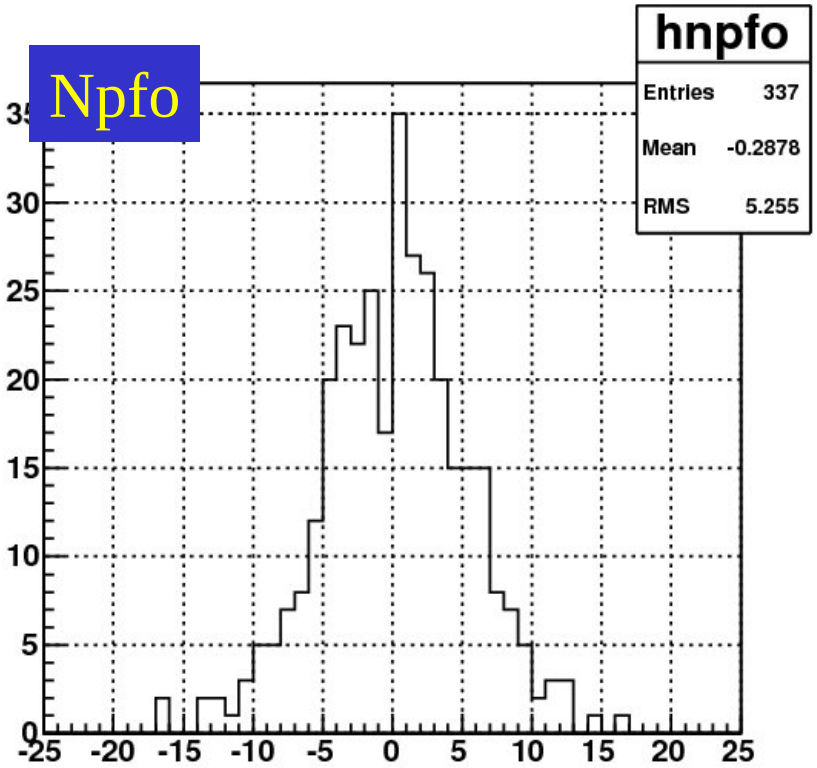
- Analyzed same Jupiter Z-pole events by MarlinReco/PandoraPFA.

- Resolutions of GLD baseline and GLD prime are consistent.

- Consistency check of event-by-event basis is also performed.

Consistency Check





- Width of total energy difference is consistent with energy resolution.

Analysis Strategy

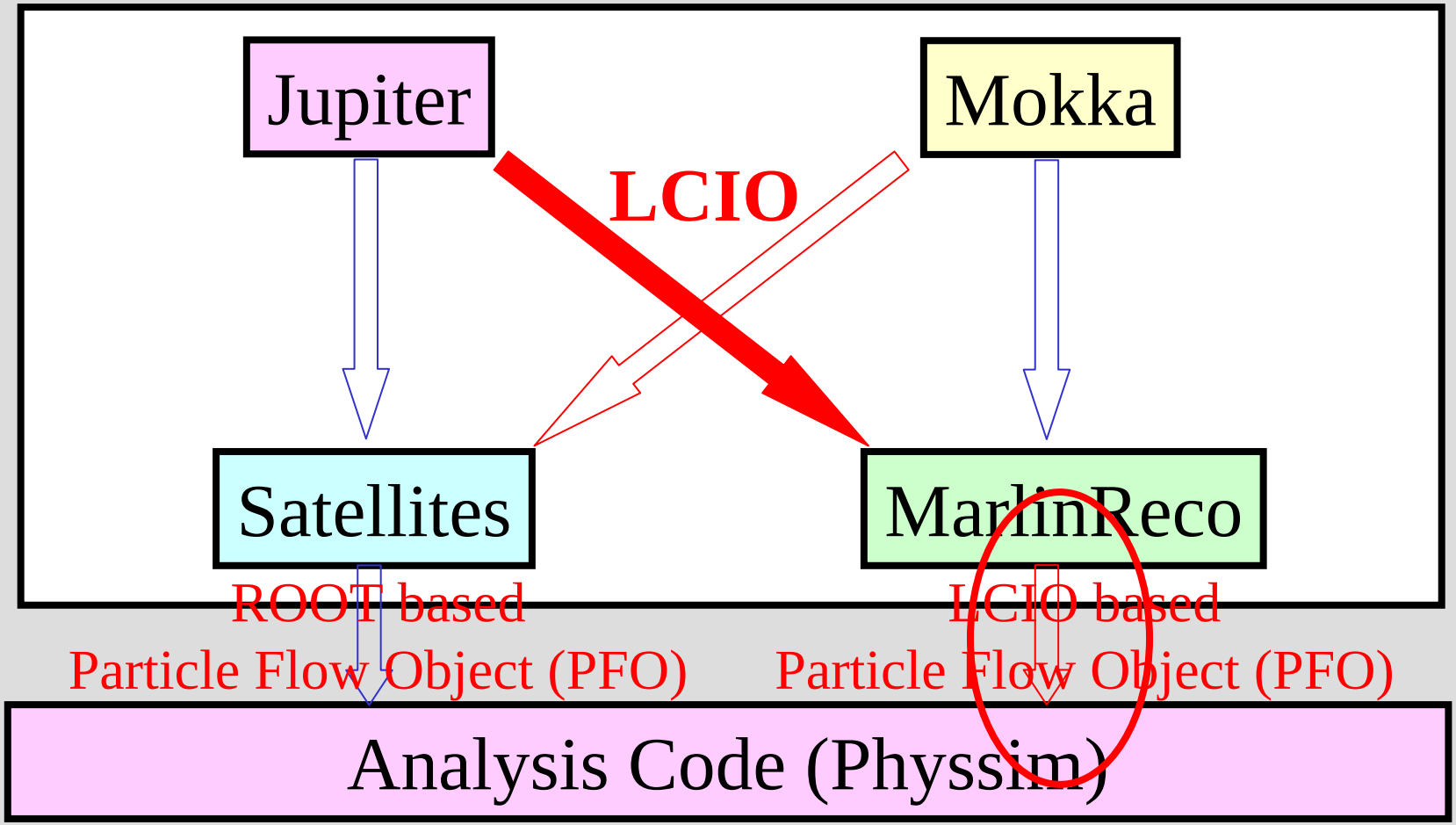
- A lot of physics studies are expected for the optimization study.

  - Development of analysis code is time-consuming job especially for those who have no experience to use our software tools so far.

  - On the other hand, we have a lot of analysis codes (physsim) for QuickSim study developed at the JLC/GLD era.

Analysis Strategy

- An interface which converts MarlinReco output has been successfully implemented.



Physsim Package

- Physsim Package for full simulation
  - Analysis codes
    - ZH → llX
    - ZH → 2jets, 4jets
    - sfermion pair
    - chargino pair
    - ttbar
    - ZHH (now on-goin)
    - ttH (now on-going)
    - …
  - Novice user can start physics analysis by using information of a PFO class.

→ Some preliminary results are shown tomorrow.

Summary

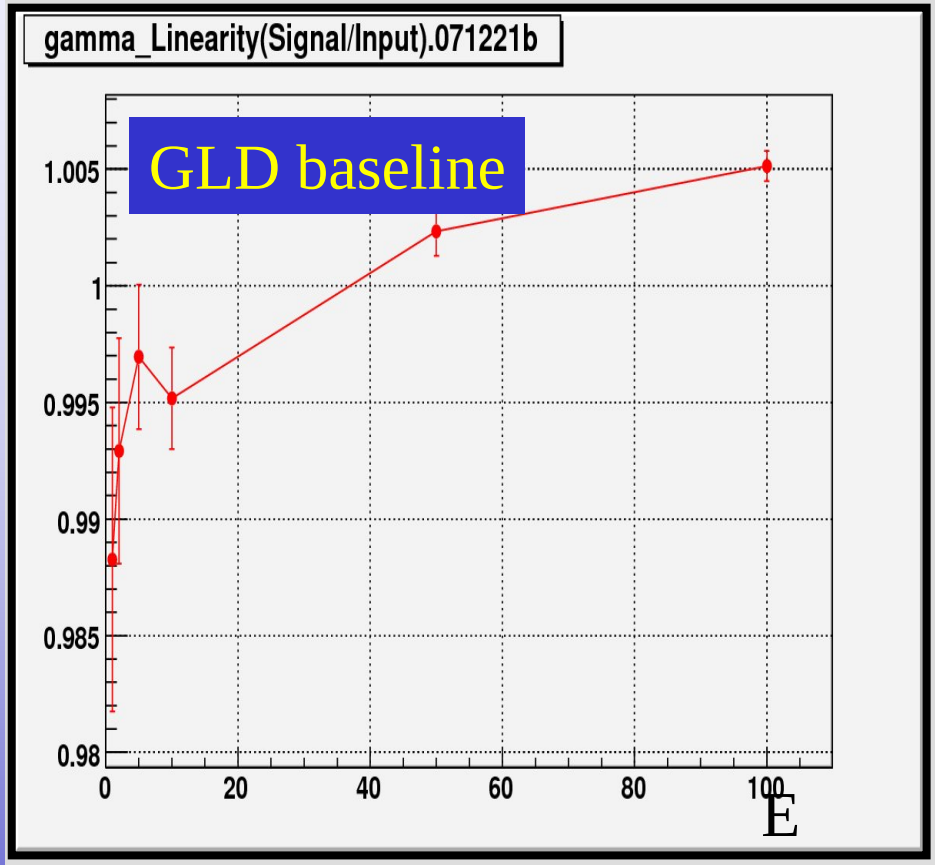
- LCIO interface has been implemented.
  → Can directly compare Jupiter with Mokka.
- Physsim interface has been implemented.
  → Analysis codes are in hand.

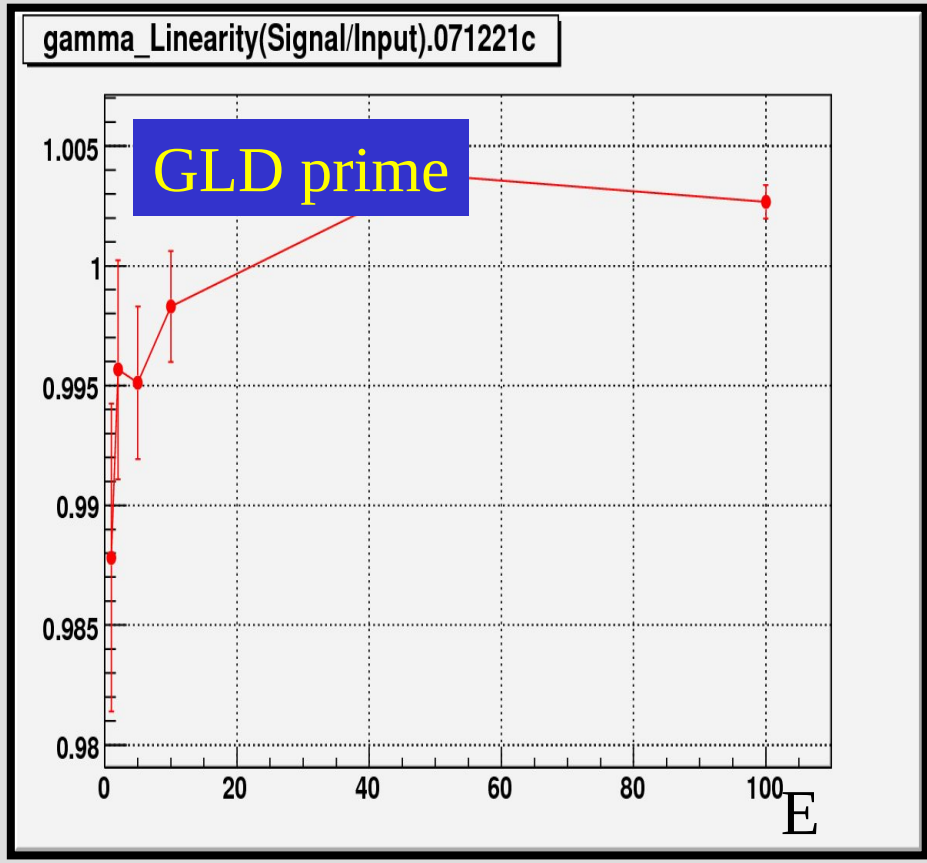
→ Analysis path is established.
(Jupiter → MarlinReco/PandoraPFA → Physsim)

- Performance of single gamma, single kaon0L and Z-pole are checked, and found to be consistent between GLD baseline and GLD prim.
- Next step :
  - Try the latest MarlinReco/PandoraPFA.
  - Try high energy jets
  - Try LDC like detector model (data already exist)

Backup

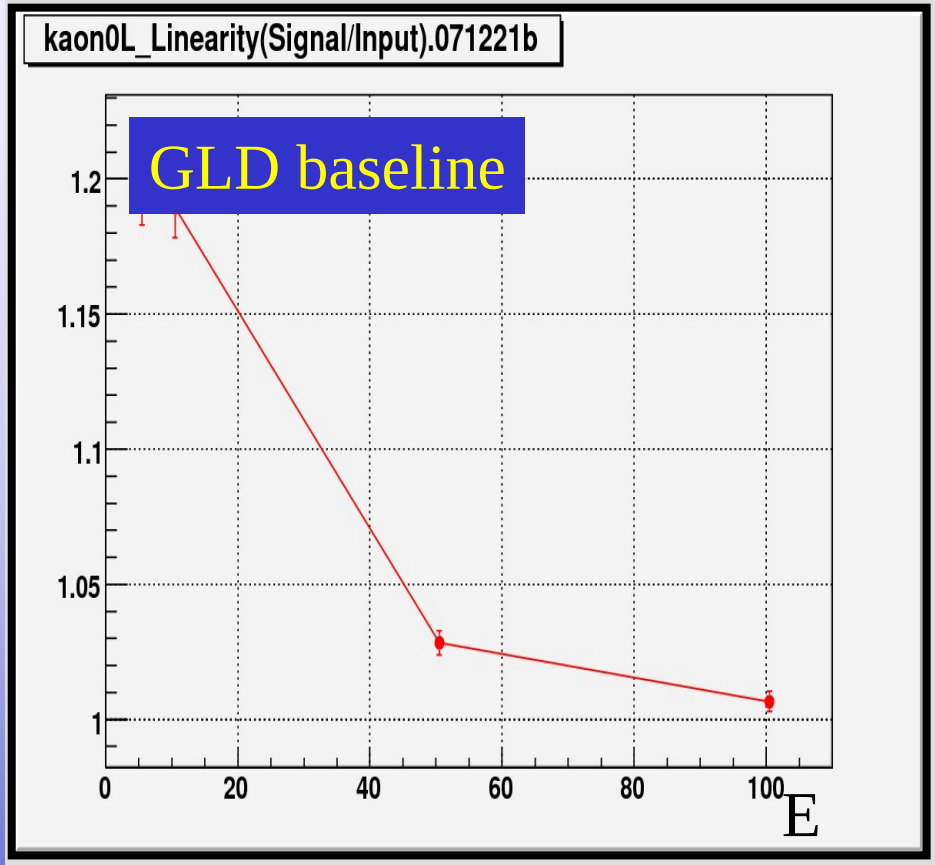
Single Gamma - Linearity

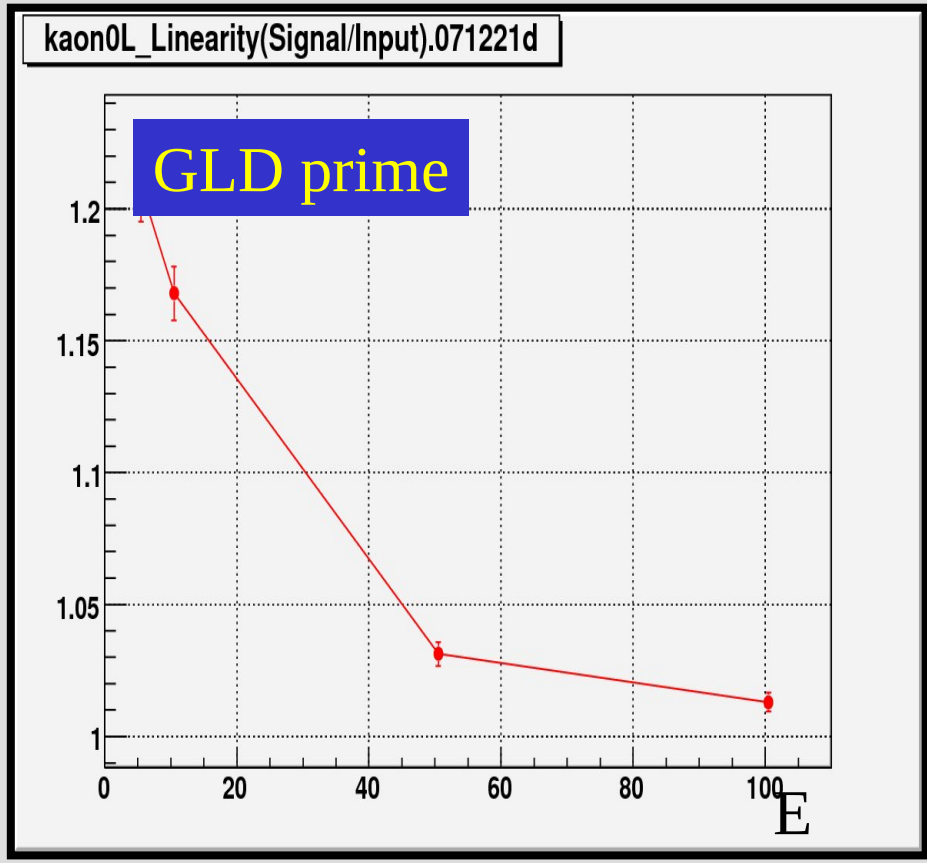




- Analyzed same Jupiter single-gamma events by MarlinReco.
- Resolutions of GLD baseline and GLD prime are consistent.

Single Kaon0L - Linearity





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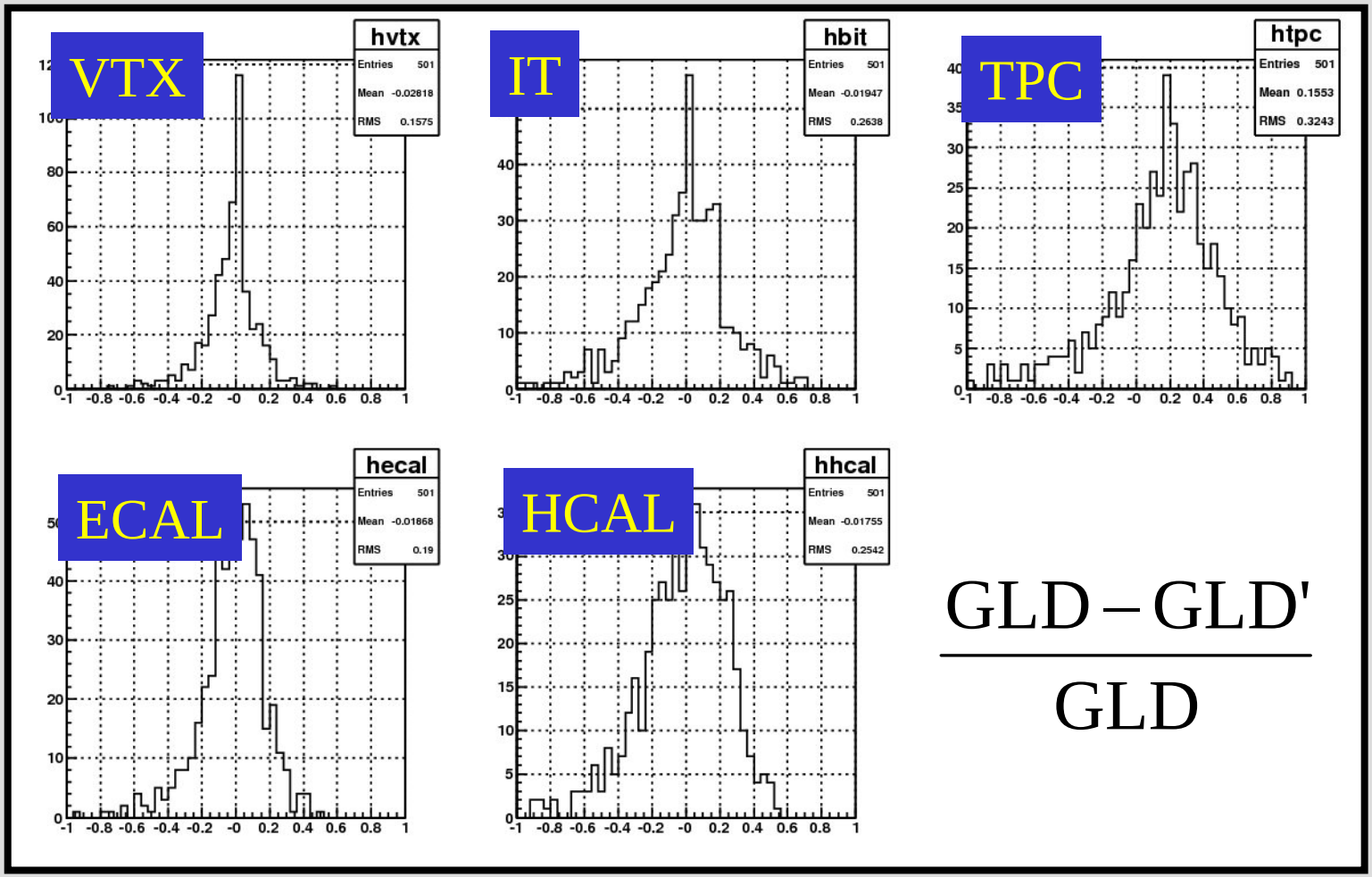
Consistency Check - Hits



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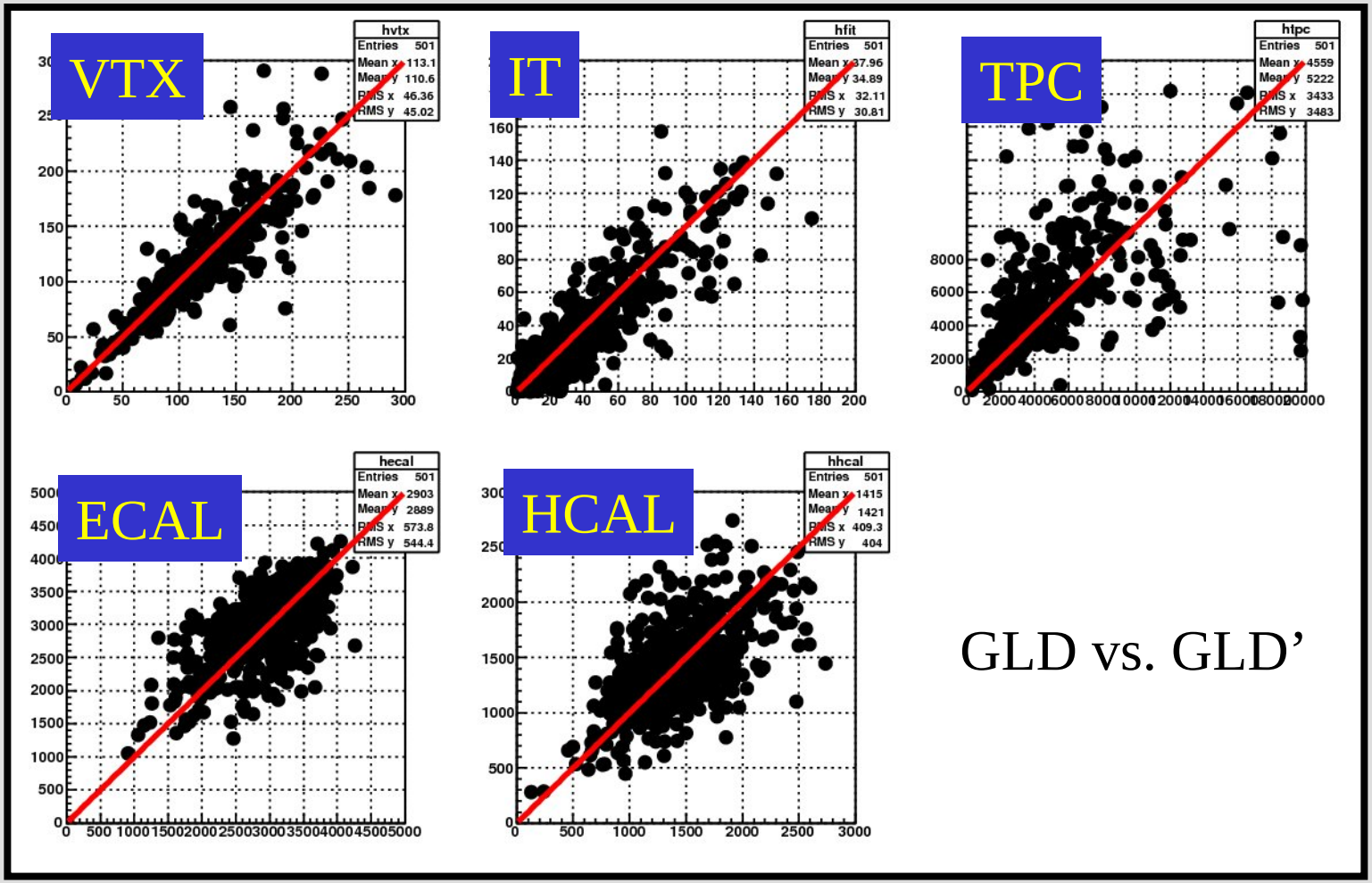
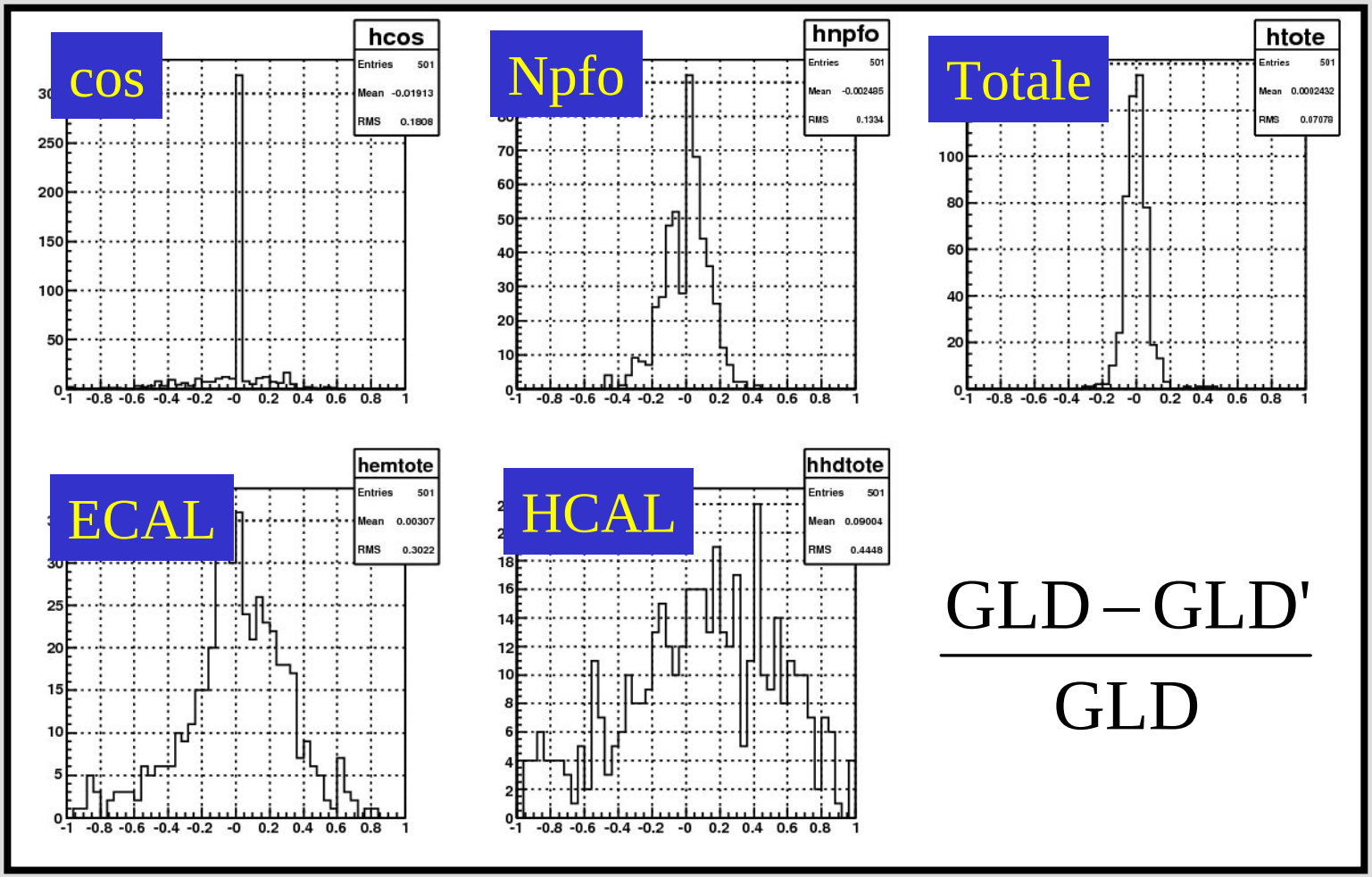


Consistency Check - PFOs



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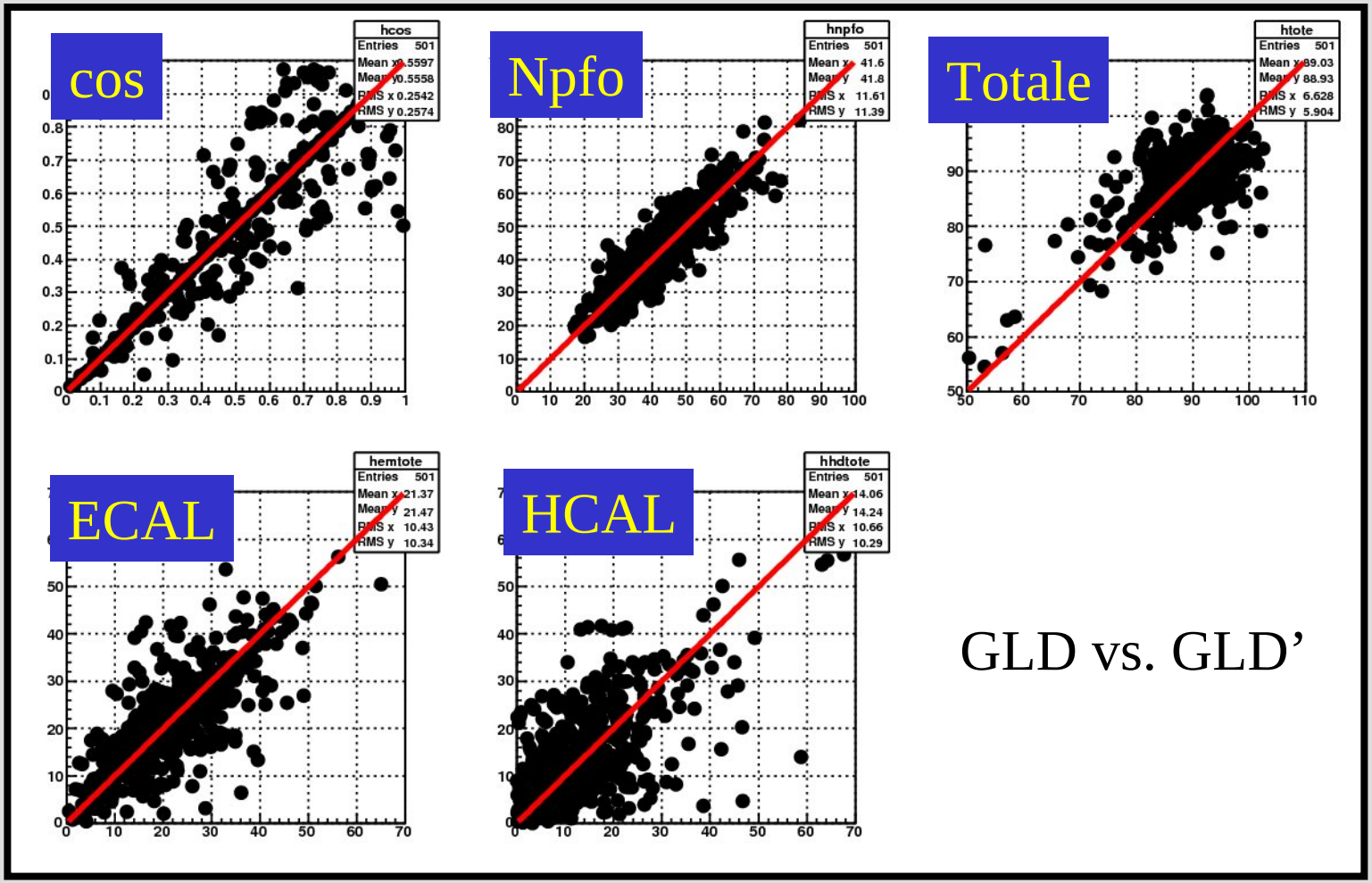

Common Parameters

			GLD	LDC	GLD'	LDC'
TPC		Rin (m)	0.45	0.3	0.45	0.3
		Rout (m)	2.0	1.58	1.8	1.8
		Zmax (m)*	2.5	2.16	2.35	2.35
Barrel	ECAL	Rin (m)**	2.1	1.6	1.85	1.82
		Material	Sci/W	Si-W	Sci/W	Si-W
	HCAL	Material	Sci/W	Sci/Fe	Sci/W	Sci/Fe
EndCap	ECAL	Zmin (m)***	2.8	2.3	2.55	2.55
B-Field (T)			3	4	3.5	3.5
VTX		Inner Layer (mm)	20	16	18	18

- Region between VTX and TPC unchanged in both cases.
* Note for GLD Zmax = 2.3 + 0.2 m for TPC readout. This is included in the standard LDC TPC Zmax
** LDC allows less space between TPC and ECAL than GLD – here let TPC outer radius fix ECAL Rin and all subsequent radii
*** propose to fix ECAL Zmin and let this define the exact details of the TPC endplate region.