# Status of HLT/AlCaRaw/AlCaReco calibration streams

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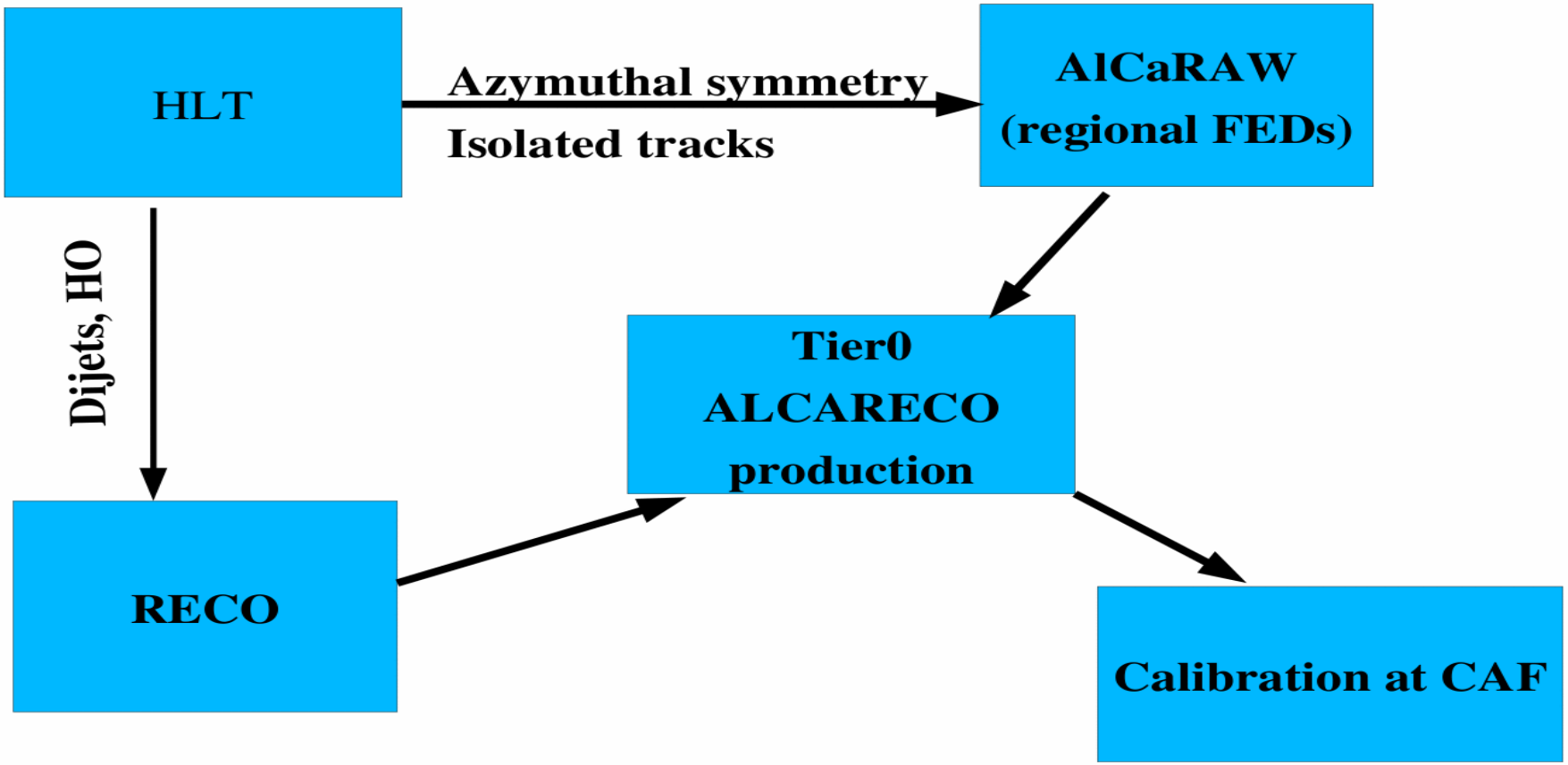
# Reminder: HCAL calibration workflows

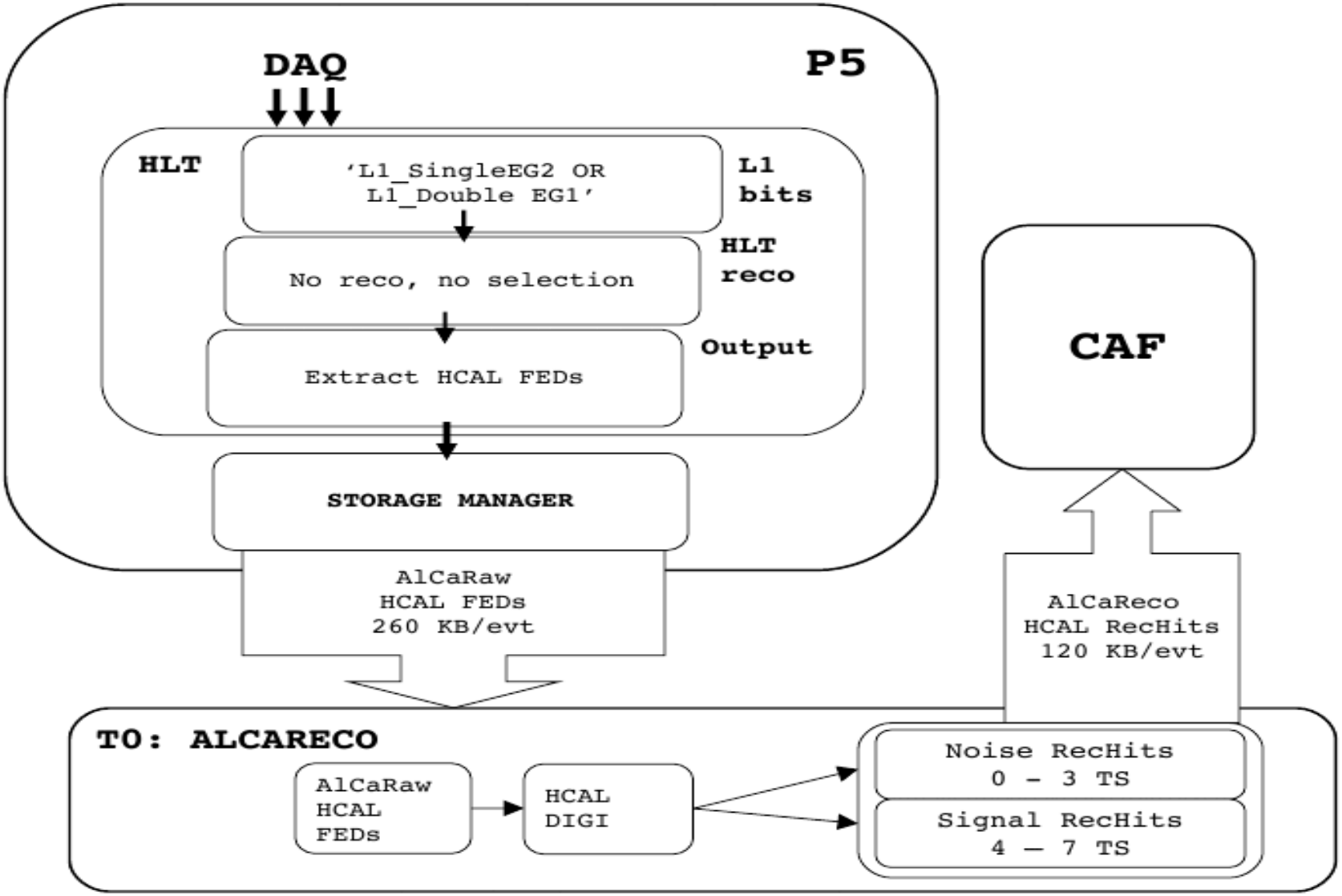
- Azymuthal symmetry of HCAL response with MinBias events
- HB/part_of_HE energy scale with isolated tracks
- HE/HF energy scale with dijet balancing
- HO calibration with muons

**Workflow streaming (picture from Olga):**



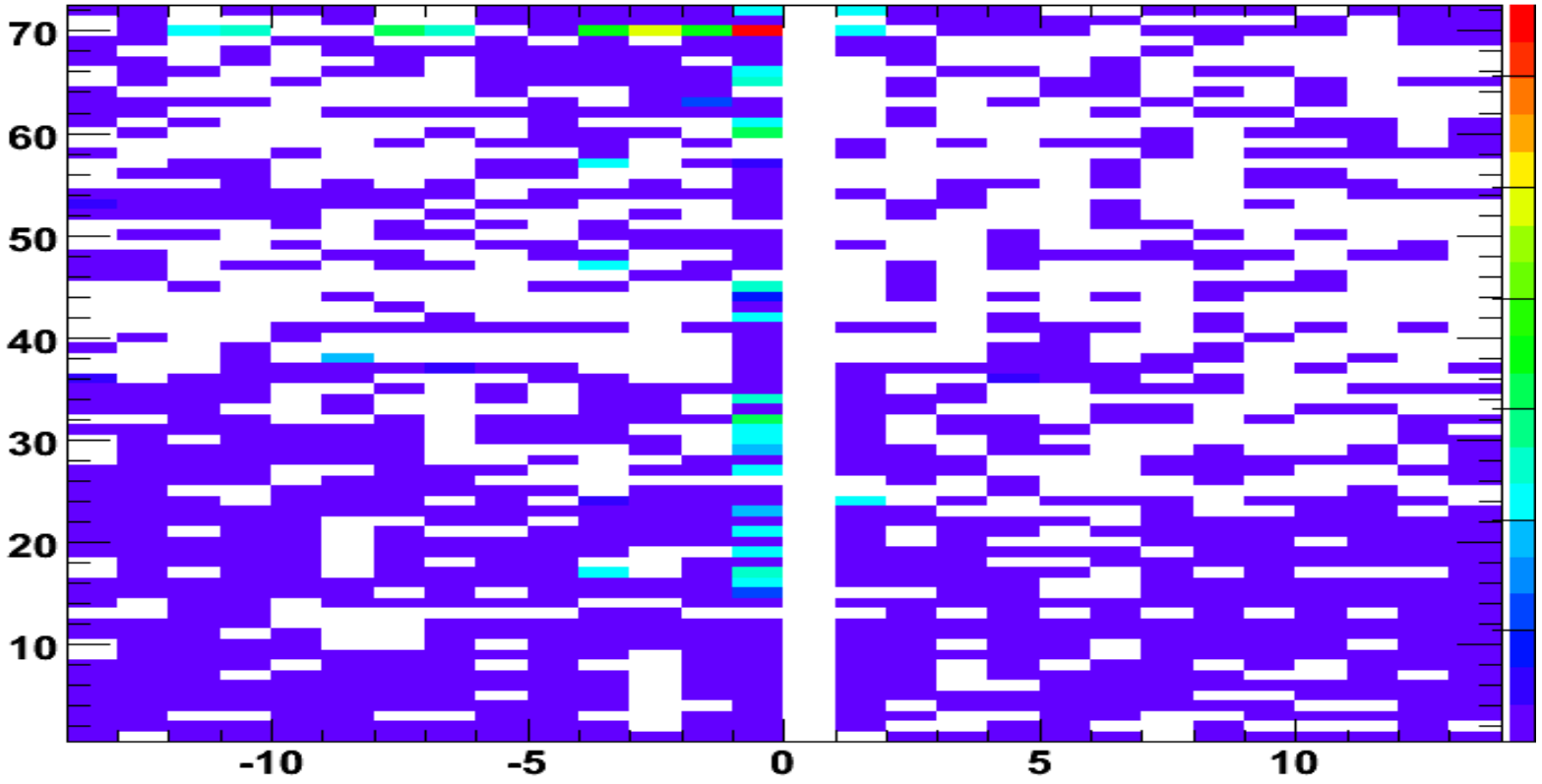
# Azymuthal symmetry workflow

## HCAL NZSP runs only

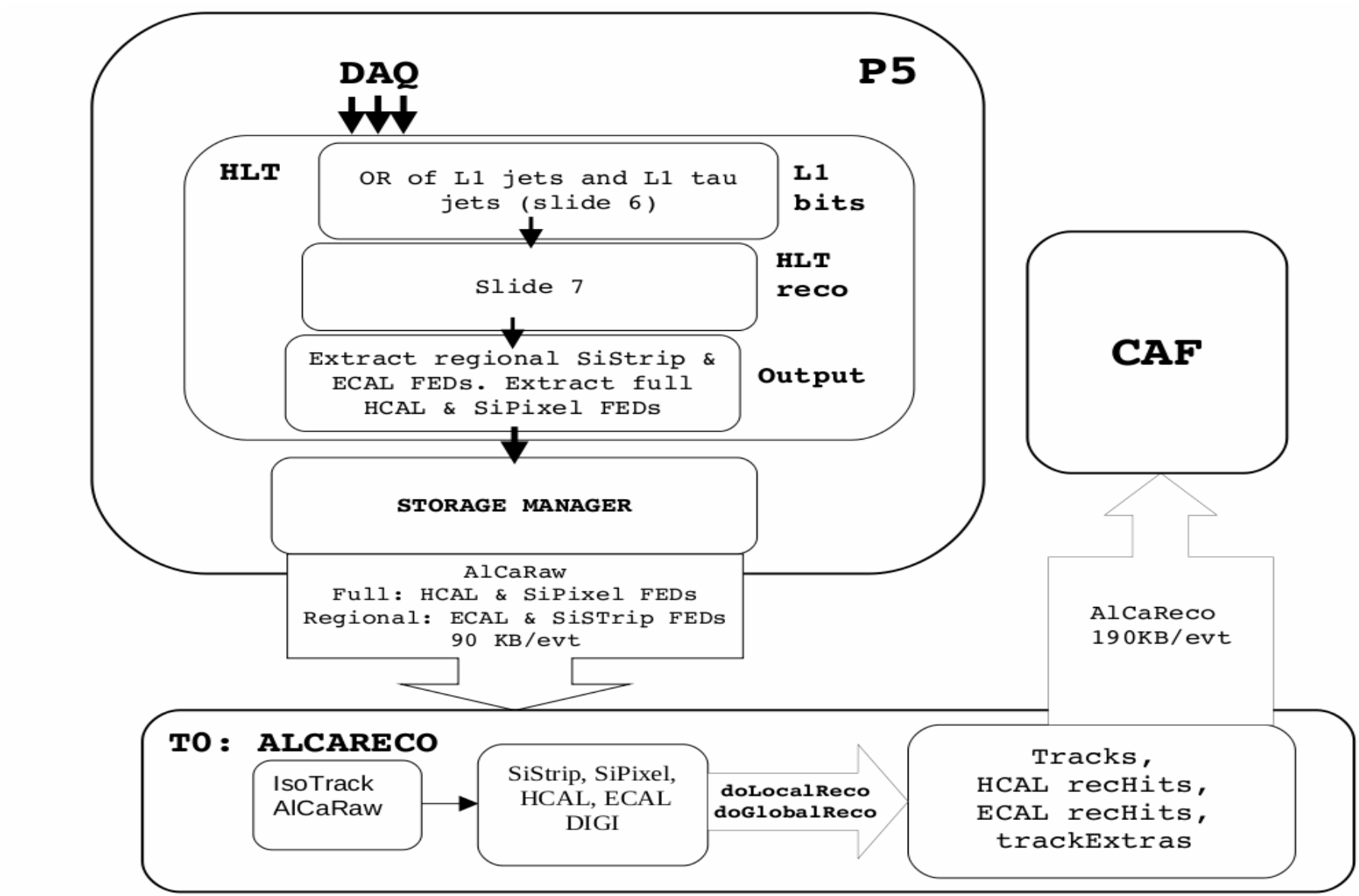


# Azymuthal symmetry status

- Development is stable since 210_preX
- AlCa_HcalPhiSym HLT path was tested in global runs
- AlCaRaw->AlCaReco chain was also tested
- 163486939 events were recorded during CRAFT
- HB $\eta$-$\varphi$ distribution of signal variance ($\sigma$) for variance > 0.07 is shown (plot from Olga)



# Isolated track workflow



# HLT logic

## L1 selection

- Need to select high-pT events and do not need a calorimeter response bias from L1 trigger
- Thus trigger on L1 jets or L1 tau jets and perform HLT selection with region not overlapping with region of L1 triggered object: R($\eta$,$\varphi$)>1.2
- L1 seeds:

```
'L1_SingleJet30    OR L1_SingleJet50    OR
 L1_SingleJet70    OR L1_SingleJet100   OR
 L1_SingleTauJet30 OR L1_SingleTauJet40 OR
 L1_SingleTauJet60 OR L1_SingleTauJet80'
```

# HLT selection

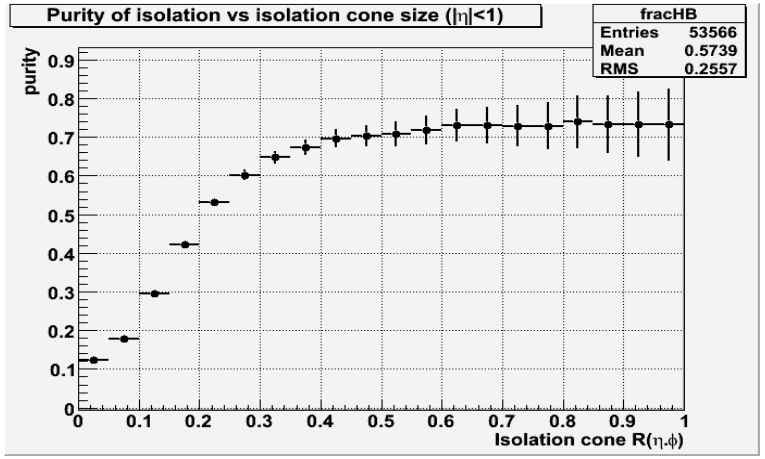
| | Current | Proposed |
|---|---|---|
| L2 reco | do pixel reco | do pixel reco |
| L2 selection | | dXY to vertex < 0.05; pixel track pT > 3.5 GeV; isolation pT** < 0.9 GeV; pixel track $\|\eta\|$< 2.0 |
| L3 reco | | do on demand tracking seeded by L2 candidates: seeding cone 0.05 |
| L3 selection | dR to L1 tau jet < 0.5; pixel track pT > 20Gev; isolation pT** < 2GeV | require single track with p>14 GeV in unpacked cone |

In both configurations region with R($\eta$,$\varphi$)<1.2 to triggered L1 jet is excluded from the search of isolated pixel tracks

** Isolation pT is maximum pT of tracks in cone of R($\eta$,$\varphi$)<0.3 in HB region and R($\eta$,$\varphi$)<0.5 in HE region (see next slide).

# HLT selection optimization

- Isolation cone at L2 was fixed at value which corresponds to ~40cm at ECAL surface at $\eta$~0 for HB region and $\eta$~2.0 for HE region, which is 0.3 and 0.5 respectively

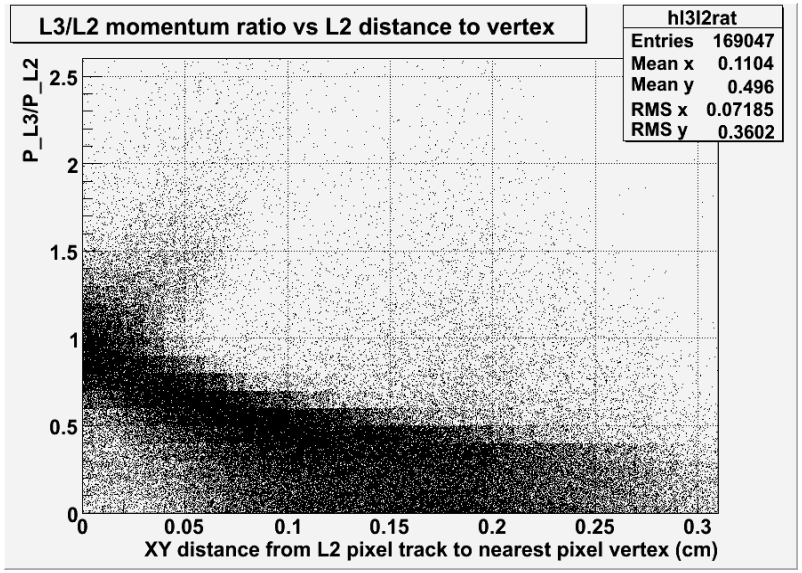


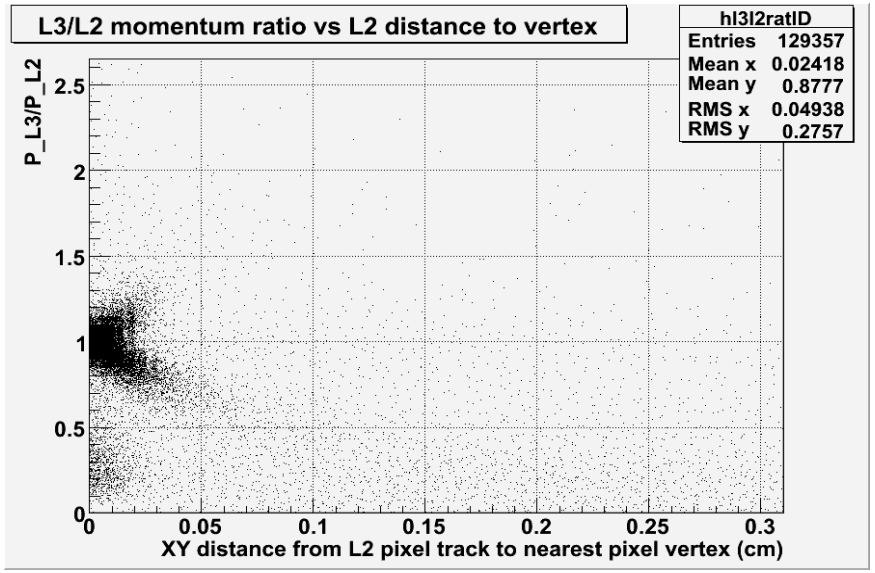

- Purity of pixel-based isolation with isolation pT < 0.9 with respect to tracks that do not have tracks with p>2 GeV hitting calorimeter closer than 40cm is shown on the left, **HLT cut is set to 0.3**

- The timing performance of the path is sensitive to fraction of L1 accepts passed through L2 to L3 track reconstruction
- Average timing consumption of L3 track reconstruction for event passed L2 is O(10ms)
- Configuration parameters were optimized to obtain maximum yield of L3 accepts at a fixed L2/L1 accept ration, thus fixed timing, aim for L3 track reconstruction was O(1ms) average per L1 accept

# HLT selection optimization (continue)

- Efficiency of L2 selection, due to pixel misalignment, significantly depends on conditions used:




- To achieve path robustness against any conditions cut on dXY was added to L2 producer
- Isolation pT cut, dXY cut and L2 pT cut were varied according to mentioned scheme (slide 5), you may see results at slide 4.

# HLT rates

HLT and L1 emulator were run in CMSSW_2_1_7 on CMSSW_2_1_2 STARTUP_V5 MinBias RAW

| STARTUP_V5 | | | | |
|---|---|---|---|---|
| Sample | L1 rate** (Hz) | New HLT rate (Hz) | Old HLT rate (Hz) | Luminosity |
| MinBias | 2415 | 15±1 | 27±1 | 2.90E+030 |
| PpEleX | 18.7 | 0.101±0.006 | --- | |
| PpMuX | 11.6 | 0.04±0.03 | --- | |
| MinBias | 680 | 4.2±0.3 | 7.6±0.3 | 8.00E+029 |

****By L1 rate total rate from AlCa_IsoTrack L1 seeds is meant**

L1 and HLT rates calculated as: **rate=(N_pass/N_tot)*xsec*L** are shown for different samples.

xsec(MinBias)=$7.53*10^7$(nb)
xsec(ppEleX)=$4.706*10^4$(nb)
xsec(ppMuX)=$3.658*10^4$(nb)

- For luminosities shown L1 rate is dominated by L1_SingleJet30
- **Basing on these results we may say:**
- Contamination of output sample with electrons and muons is negligible
- Fraction of L1 rate which passes through HLT is ~0.6%

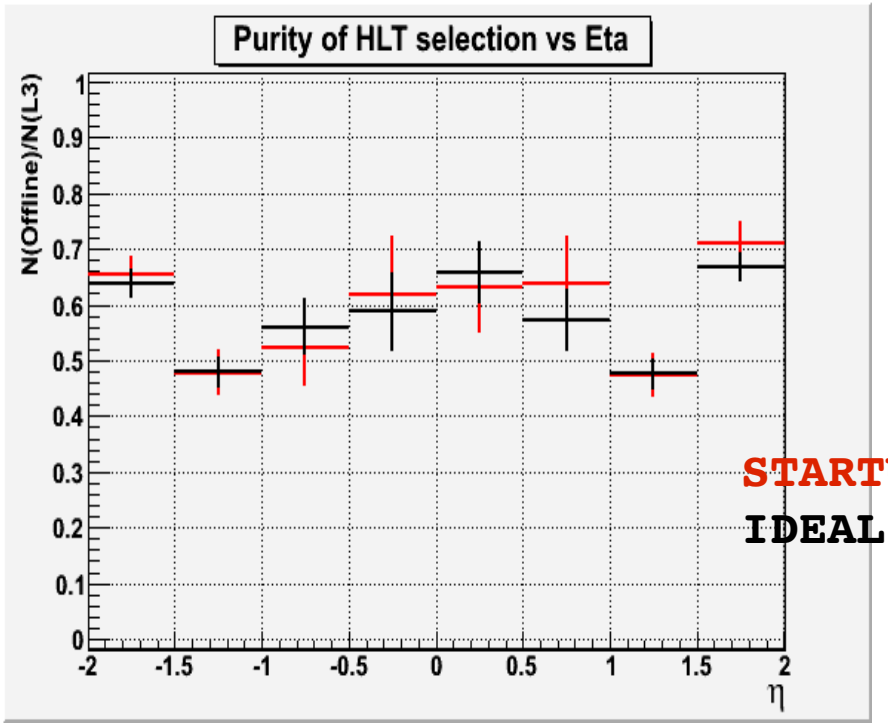
# IsoTrack AlCaReco

- Latest tag: Calibration/HcalAlCaRecoProducers **V00-03-04**
- Contains nessesary fixes to IsoTrack AlCaReco event content for monitoring with DQM, and more flexible configuration of offline isolation
- Current offline selection:

**Track p > 15 GeV**
**Track $|\eta|$ < 2.0**
**No tracks with p>2GeV in cone of R=40cm at ECAL surface**
**Energy deposition in ECAL ring E(R<35cm)-E(R<15cm)<8GeV**

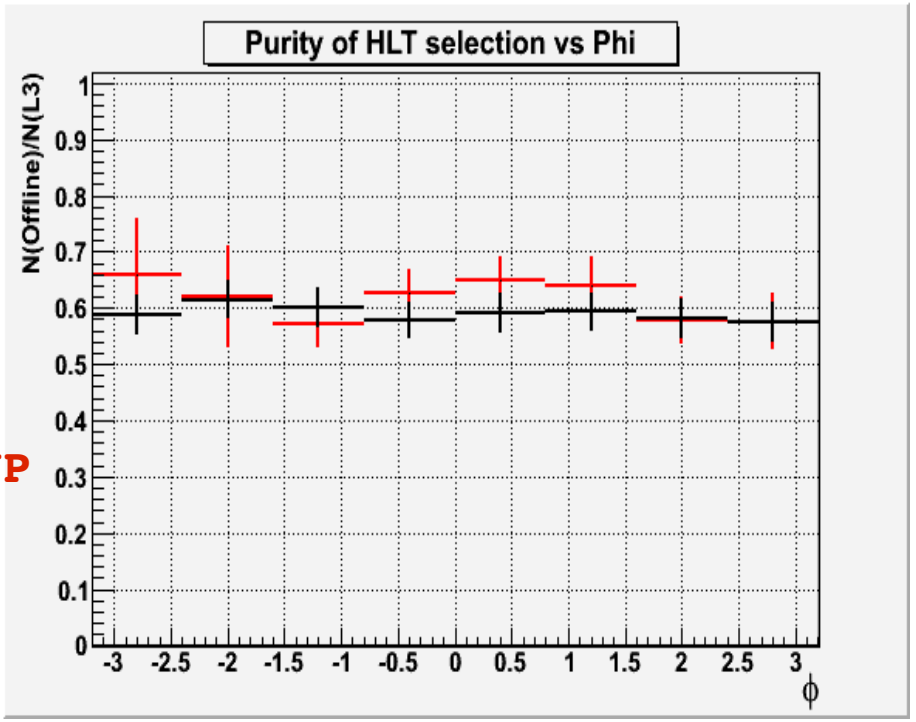
# AlCaRaw sample purity

- Purity of AlCaRaw sample with respect to offline selection vs. $\eta$ and $\varphi$ is shown here for the proposed HLT configuration (slide 7)
- **Purity of HLT selection with the old HLT configuration is not shown due to extremely low averaged purity with STARTUP conditions: 0.07 (short in statistics)**
- Average purity for the proposed HLT configuration is ~0.6



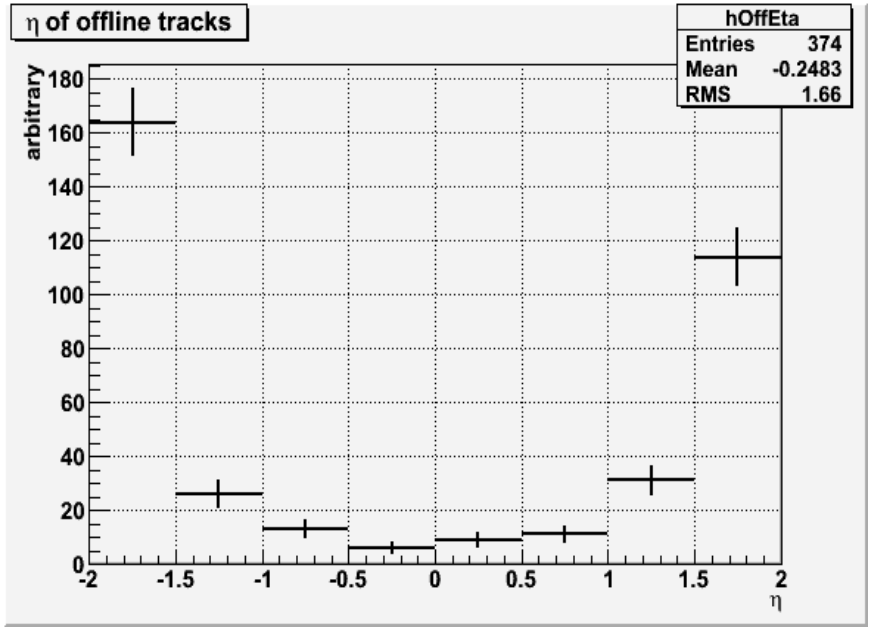

**STARTUP**

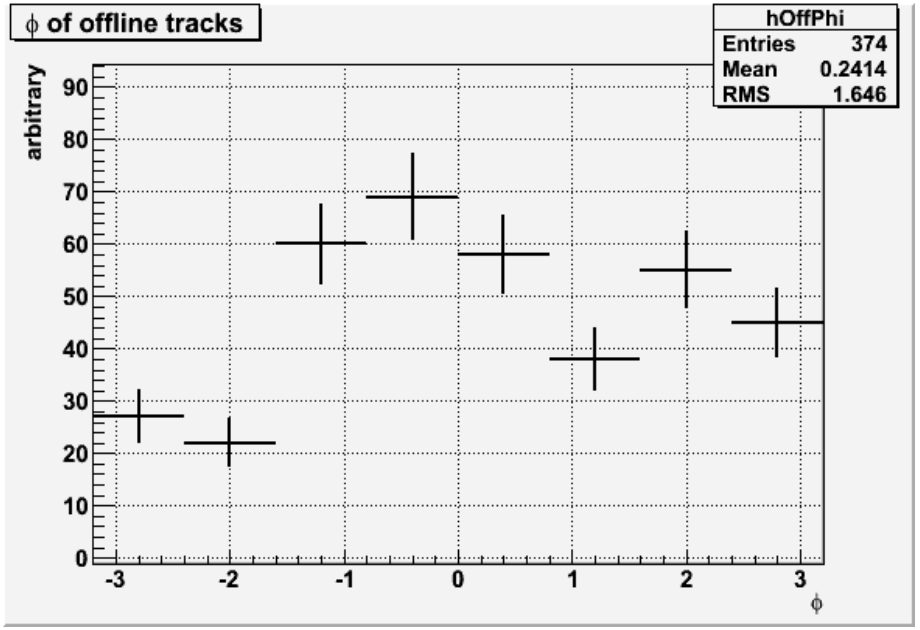
**IDEAL**



# Content of AlCaReco sample

- STARTUP_V5 minBias sample was used for the plots shown
- Due to extremely low selection performance of current HLT with STARTUP conditions (slide 12) only results for proposed new HLT configuration are shown
- Significant nonuniformity of statistics on $\eta$ is seen
- Also it is seen that phi distribution is nonuniform this is due to varying with $\varphi$ efficiency of vertex cut applied during HLT selection, this nonuniformity is connected to varying with $\varphi$ efficiency of vertex cut applied at HLT level with pixel misalignment conditions introduced for MC

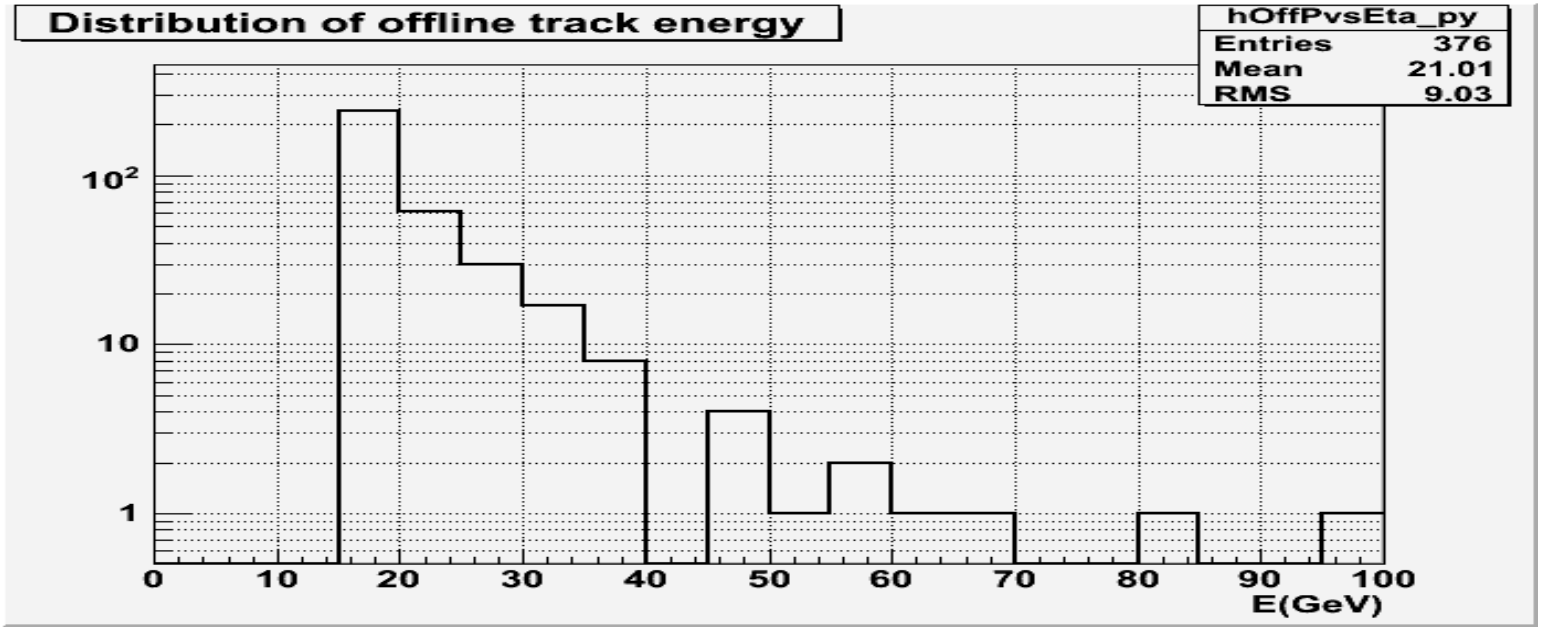


# Statistics for $1pb^{-1}$

| | |
|---|---|
| 0.0-0.5 | 150±30 |
| 0.5-1.0 | 210±30 |
| 1.0-1.5 | 510±60 |
| 1.5-2.0 | 2500±150 |

- Number of ALL (not only MIP) tracks with P>15GeV per tower is shown for $1pb^{-1}$ at $2.9*10^{30}$ luminosity
- Energy ditribution of offline tracks from STARTUP MinBias sample is shown on the bottom



# Monitoring of AlCaReco

- First version of module performing monitoring of IsoTrack AlCaReco sample exists in DQMOffline/CalibCalo V00-00-06 (see http://indico.cern.ch/getFile.py/access?contribId=42&sessionId=4&resId=0&materialId=slides&confId=46352)
- Currently it performs plotting of:

  HLT↔Offline matching
  AlCaRaw sample purity
  $\eta$, $\varphi$, P distributions for offline tracks

- It is planned to add:

  Tower-by-tower map of statistics for P>15GeV tracks
  Tower-by-tower map of statistics for 40<P<60GeV tracks
  Track quality
  ECAL/HCAL energy deposition

# Test on real data

- No good test was done so far
- Special configuration of AlCa_IsoTrack for cosmics which uses HLTTrackerCosmicsCTF sequence developed for tracking with cosmics by tracker group exists but wasn't included into global runs so far
- Due to very low pixel detector acceptance only 1 event was recorded using current AlCa_IsoTrack configuration
- AlCaReco was run on top of this event with no crashes

## Documentation

- Documentation and instruction on AlCa_HcalPhiSym and AlCa_IsoTrack HLT is now available on https://twiki.cern.ch/twiki/bin/view/CMS/HlTrigger
- Documentation and instructions on HcalPhiSym and IsoTrack AlCaReco are available on https://twiki.cern.ch/twiki/bin/view/CMS/HcalAlCaRaw

# Summary

- HcalPhiSym workflow is stable and well-tested
- Priority is to get an approval of new HLT configuration for IsoTrack workflow to have a good selection performance with misaligned tracker at startup
- A study of statistics which we may get with AlCa_IsoTrack is needed for calibration trigger reviews ($10^{th}$ february) with new 8e29 and 1e31 menus L1 and HLT menus (STARTUP conditions)
- We need to define strategy of processing of AlCaRaw samples

**Big thanks to Olga Kodolova for much help**