The 2nd part

LARG HEC TestBeam software in Athena framework

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CERN

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Purpose for LARG HEC Tutorial

hat we can do in the Athena Framework?

he Athena Framework, one can reconstruct signal and produce a standard ntuple, ich is the same as the one produced by the hec_adc framework.

d also, you can add your own code to LArHEC TB software, and get the togram / ntuple you want.

the end of this tutorial, you should know

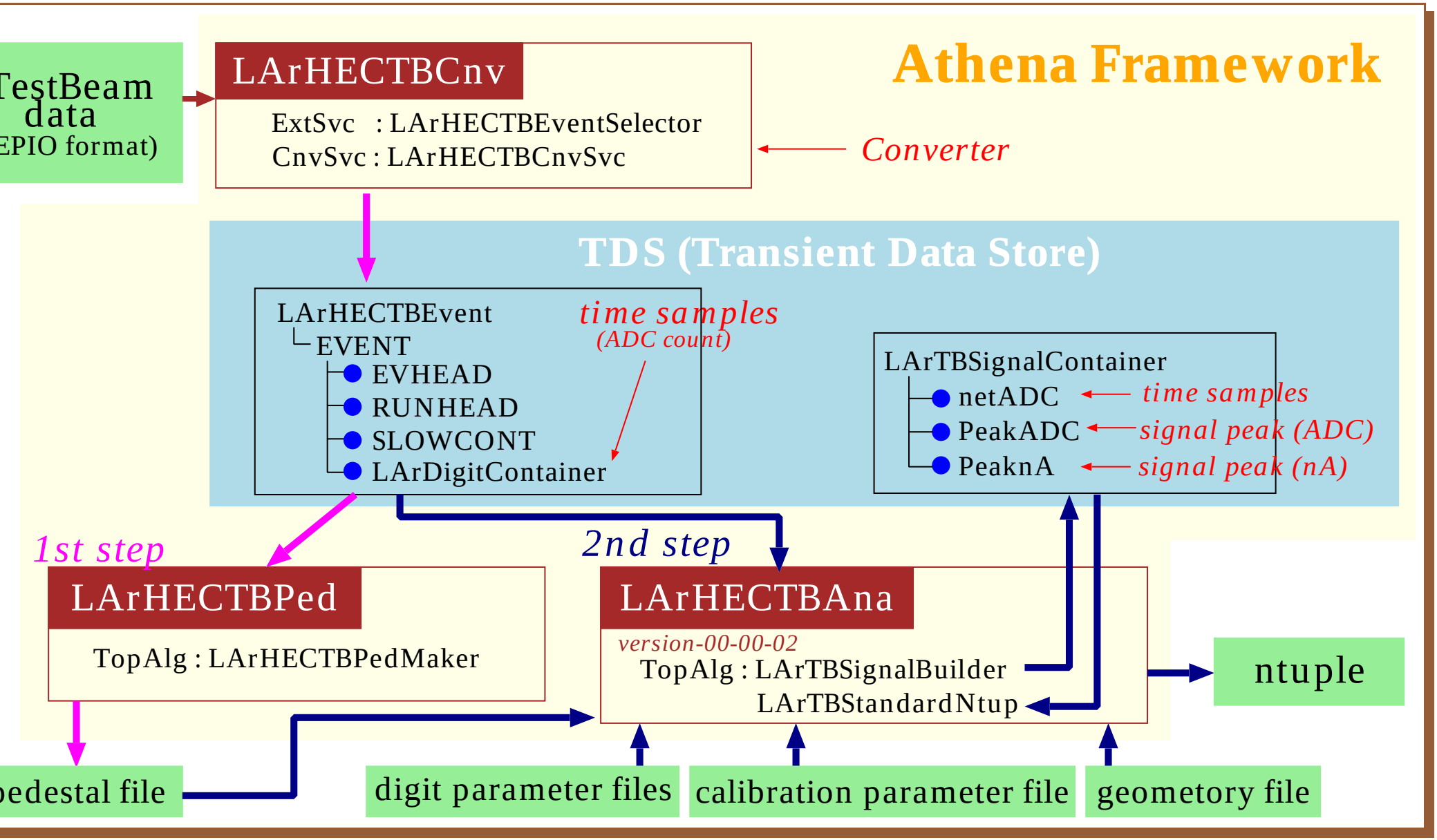
- **How to execute LArHEC TB software**
- **About HEC TB software and data structure in Athena.**
- **How to add your own analysis code in LArHEC TB software**

Contents

Section 1

About LArHEC TestBeam Software in athena

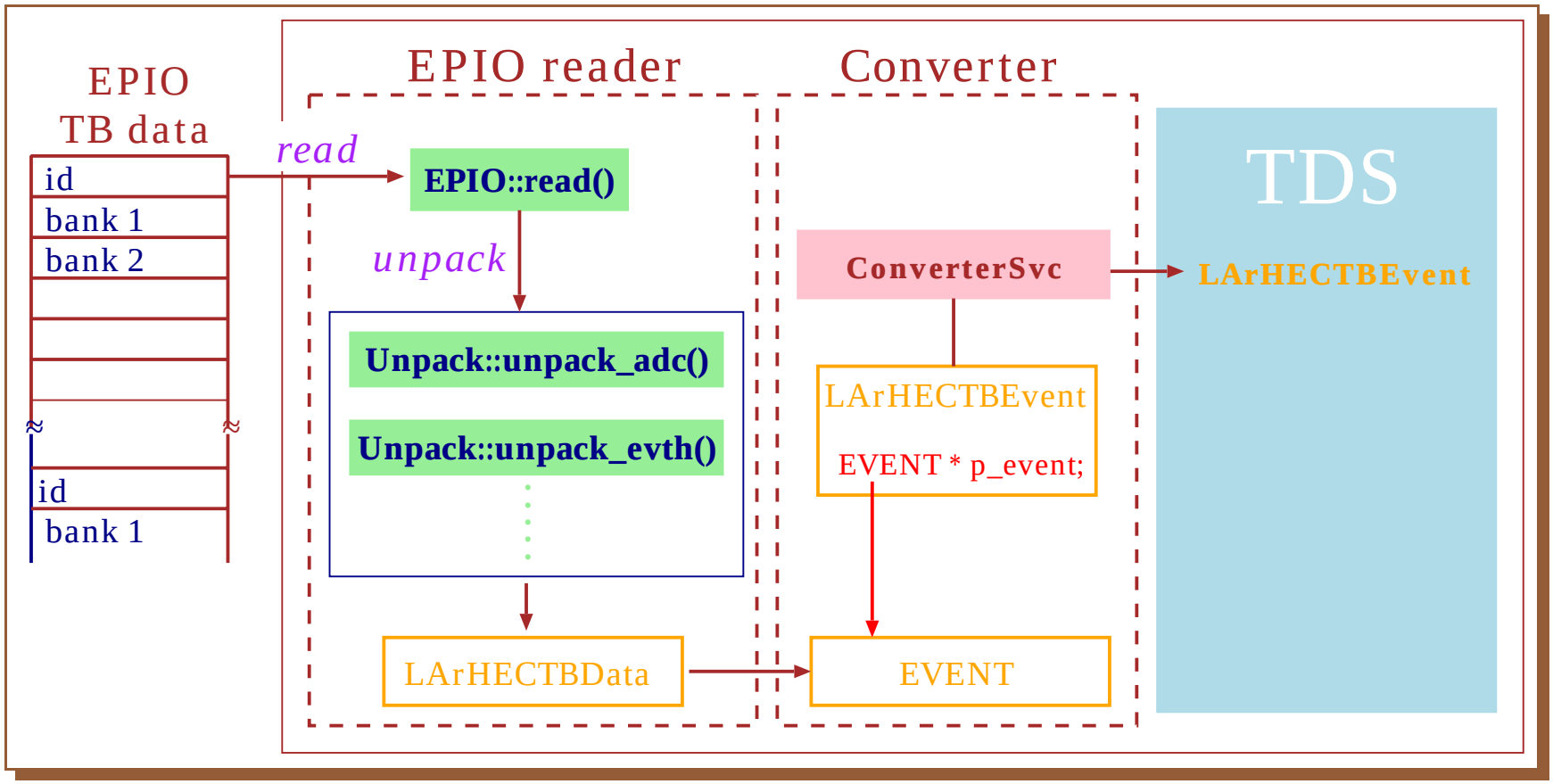
LAr HEC TestBeam packages in athena



LArHECTBCnv

Convert TB data from EPIO format to TDS

- Read EPIO data
- Unpack bank
- Create a data object to be recorded in TDS
- Record it in TDS



LARHECTBEvent

TB data recorded in TDS by LArHECTBCnv

onsists of the **EVENT**-type pointer and member functions.

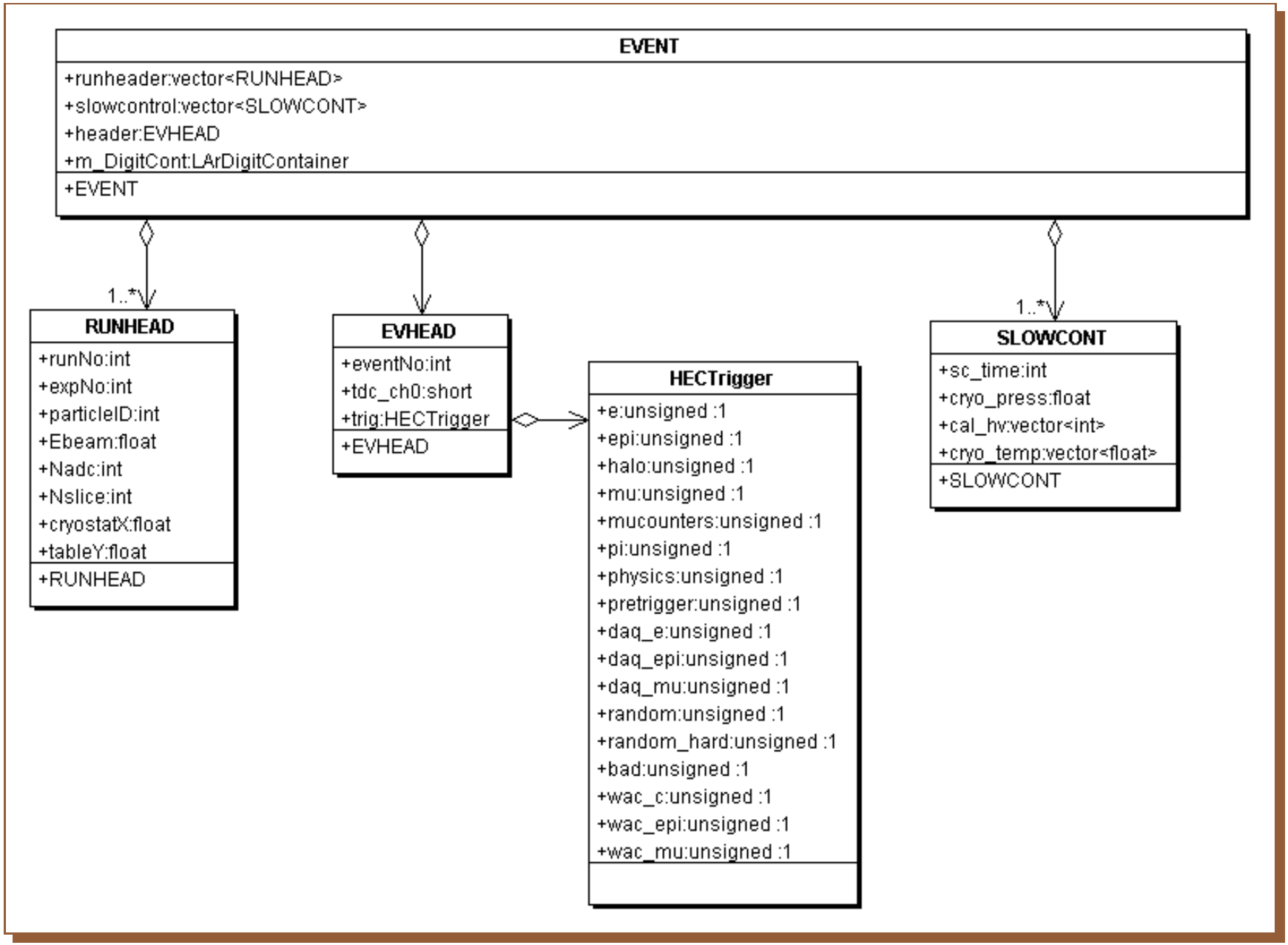
LArHECTBEvent.h

```
ublic :
inline int event_number() const { return p_event->header.eventNo; }
inline short tdc_count() const { return p_event->header.tdc_ch0; }
inline HECTrigger * trigger_status() const { return p_event->header.trig; }
inline RUNHEAD * run_header() const { return p_event->runheader; }
inline SLOWCONT * slow_control() const { return p_event->slowcontrol; }
inline EVENT * LArHECTB_event() const { return p_event; }
rivate :
EVENT * p_event;
```

Comments

RUNHEAD and SLOWCONT are usually included in the first event only.

Class Diagram in LARHECTBEvent



LArHECTBPed

Calculate pedestals and write them in an ascii file

p Algorithm : LArHECTBPedMaker.cxx

produce pedestals and their rms for each cell.

calculate mean and rms using all events in a given run.

possibility to apply σ_{cut} in order to skip noisy channel in pedestal calculation.

Done using the first N events.

<LArHECTBPedMaker.cxx>

execute ( )

retrieve LArDigitContainer

or (ifirst != ilast ; ifirst ++) {

f (nevents < N) {

calculate σ_{cut} , μ_{cut} using the first N events

}

else {

calculate σ , μ using the remainning events with $|x - \mu_{cut}| < \sigma_{cut} * n$

}

finalize ( )

ostream out ;

out $\ll \mu \ll \sigma \ll N_{used} \ll \mu_{cut} \ll \sigma_{cut} \ll$ endl;

- Following variables can be changed by *jobOptions.txt*.
  - The first time sample # to be used.
  - The last time sample # to be used.
  - The number of events used for cut condition
  - The number of sigma for event selection
  - File name
- Output format

μ , σ , N , μ_{cut} , σ_{cut} for each cell

About jobOptions.txt

jobOptions.txt

```
#include "jobOptions_PedMaker.txt"
MessageSvc.OutputLevel      = 2;
ApplicationMgr.EvtMax = 10;
```

Message Stream Ouput Level

Number of events processed

jobOptions_PedMaker.txt

```
ApplicationMgr.DLLs += { "StoreGate", "LArHECTBPed" ,
LArHECTBCnv","LArBookkeeping" };  (1)

pplicationMgr.TopAlg += { "LArHECTBPedMaker/LArHECPed" };(2)

pplicationMgr.ExtSvc += { "StoreGateSvc", "LArHECTBCnvSvc" ,
ArBookkeepingSvc" , "LArHECTBEventSelector/EventSelector" };  (3)

ventPersistencySvc.CnvServices     = { "LArHECTBCnvSvc" };  (4)

ArHECPed.FirstSlice = 0;
ArHECPed.LastSlice = 0;
ArHECPed.Nsigma = 3;
ArHECPed.Nevent = 500;
ArHECPed.OutputFileName = "ped_r10053.dat" ;

ventSelector.RunNb = { "10053" };
```

properties

(5)

Run number

(1) **Shared libraries used**

(2) **Top Algorithm name(*.cxx)**

mandatory

(3) **Service names executed**

(4) **Converter service name**

(5) Properties in LArHECTBPed

- the first slice used for pedestal calculation
- the last "
- The number of sigma used for event selection
- The number of events used for μ_{cut} and σ_{cut}
- Output file name

LArBookkeepingSvc

~nkanaya/maxidisk/uvic/data/run_10053.dat

LArHECTBAna

Reconstruct signal

ere are two TopAlgorithms and four subAlgorithms.

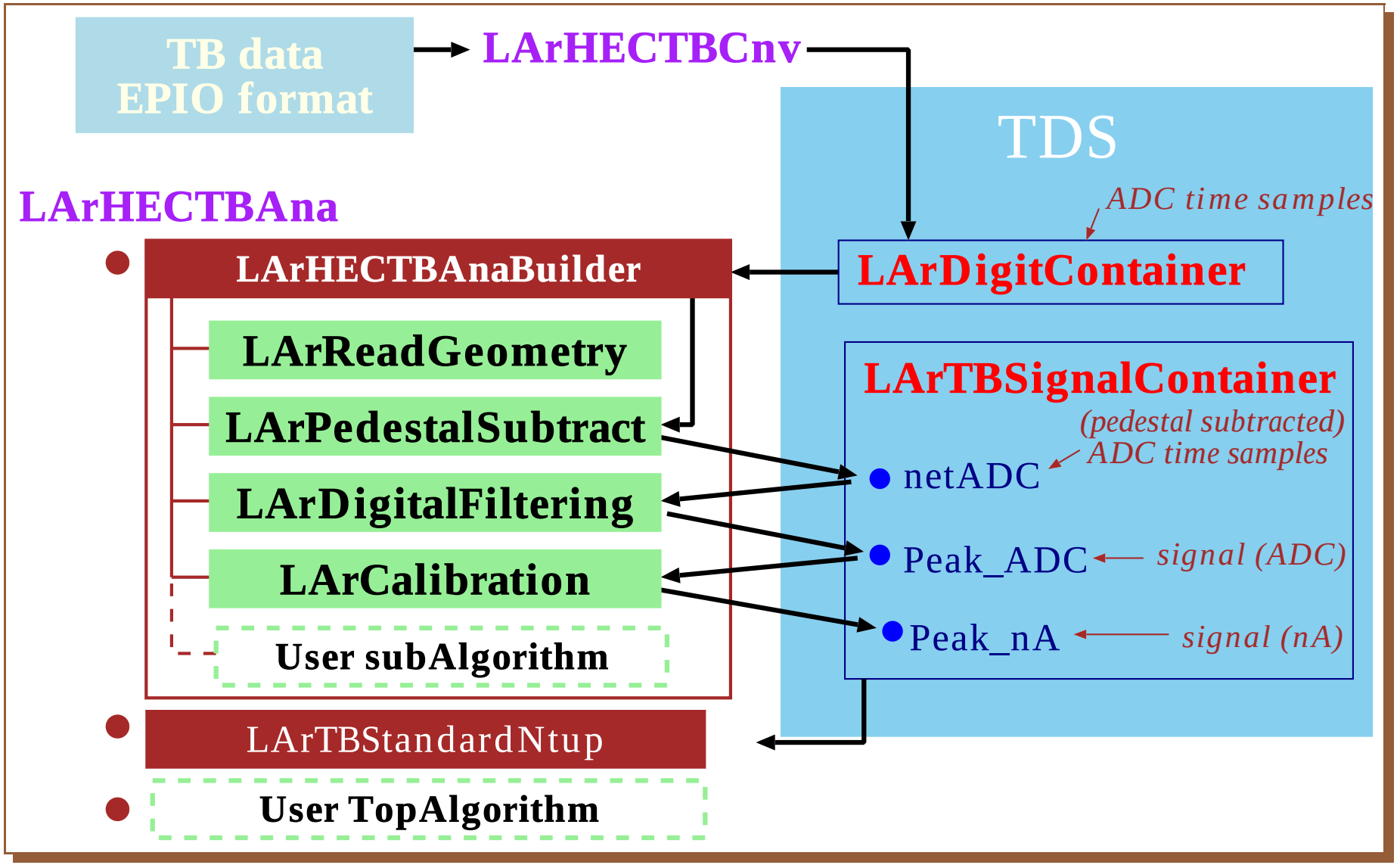
p Algorithm : LArTBSignalBuilder.cxx

→ *reconstruct a signal*

b Algorithm

LArReadGeometry.cxx	*read geometry file*
LArPedestalSubtract.cxx	*do pedestal subtraction*
LArDigitalFiltering.cxx	*find signal peak and its time for given cell*
LArCalibration.cxx	*convert adc to nA*

LArHECTBAna (continue)



LArHECTBAna (continue 2)

o Algorithm : LArTBStandardNtup.cxx

n header ntuple (ID = 100)

able	contents
runno	run number
runpd	run period number
beame	beam energy
noevt	number of event
parttype	article type (1=e, 2=μ, 3=π)
ctyox	cryostat position in x
tabley	table position in y
peakf	peak finding method (2=degital filtering)
eunit	units of energy (1 = energy)
cells_used	the number of cells used
ped_rms	run pedestal rms for each channel
ieta	eta value for each channel
iphi	phi value for each channel
iz	z value for each channel
ic	adc channel number

- event ntuple (ID = 101)

variable	contents
hec_evetno	event number
hec_trig	tirgger flag array
hec_nchan	number of good channels
hec_signal (hec_nchan)	signal for each channel

- slow control ntuple (ID = 102)

variable	contents
hec_adc_used	number of used channels
hec_lartemp	liquid argon temperature
hec_press	pressure

About jobOptions.txt

LArHECTBAna_jobOptions_SignalBuilder.txt → LArHECTBAna_jobOptions.txt

```
ApplicationMgr.DLLs += { "StoreGate", "LArHECTBPed" ,
LArHECTBCnv","LArBookkeeping" , "HbookCnv" };                    (1)

pplicationMgr.TopAlg += { "LArTBSignalBuilder/LArBuilder" ,
                          "LArTBStandardNtup/ LArNtup" };        (2)
pplicationMgr.ExtSvc += { "StoreGateSvc", "LArHECTBCnvSvc" ,
ArBookkeepingSvc" , "LArHECTBEventSelector/EventSelector" };
ventPersistencySvc.CnvServices     = { "LArHECTBCnvSvc" };
ventSelector.RunNb = { "10053" };
-------------------------------------------------------------
ArBuilder.ProcessNames = { "LArReadGeometry/LArGeo" ,
                           "LArPedestalSubtract/LArPed" ,
                           "LArDigitalFiltering/LArDig" ,      (3)
                           "LArCalibration/LArCal" };
ArPed.PedestalFileName = " ...../ped_r10053.dat";              (4)
-------------------------------------------------------------
plicationMgr.HistogramPersistency="HBOOK";
upleSvc.Output  = { "FILE1 DATAFILE='hec_adc.ntp' OPT='NEW'"};  (5)
rNtup.Energy_unit = "nA";      (6)
```

(1) **For a histgram/ntuple**

(2) **Top Algorithm name(*.cxx)**) mandatory

(3) **subAlgorithm name(*.cxx)**

(4) **input file name**

(5) **for ntuple**

(6) **fill signal in unit of "nA"**

LArBookkeeping

Tasks

- manage data stored at different places (HPSS, Castor).
- visualize and edit run information.

LArBookkeeping based on mySQL

web interface available in *http://larbookkeeping.in2p3.fr*

- shifter interface
- user interface

nterface to Athena available via

LArBookkeepingSvc

you only have to select run in jobOptions.txt

ntSelector.RunNb = { *"10053"* } ;

a file staged according to run number.

Section 2

How to execute LArHEC TB software

How to execute a package?

ere are two ways to execute Athena, which depends on what you want to do.

Execute Athena without building

ou don’t modify any existing package, you should not check out the package you nt to use. Binding necessary shared libraries at run time is sufficient.

ch a work is performed by CMT according to *requirements* file.)

Execute Athena with building

ou want to change a package, you have to check out the package you want to dify. You can produce your shared library in your own directory, and bind it at run e.

Exercise 1

Execute LArHEC code without building

eral setup for LArHEC

mplate package (TestRelease) is prepared for users.

execute LArHECTB code without building

```
tlas> goto_build [1]
tlas> vi requirements [2]
tlas> cmt config [3]
tlas> source setup.sh [4]
tlas> gmake [5]
tlas> goto_run [6]
tlas> cp $LARHECTBPEDROOT/share/*.txt . [7]
```

omments

2] add the following lines

```
use LArHECTBPed LArHECTBPed-00-* LArCalorimeter/LArTestBeam
use LArHECTBAna LArHECTBAna-00-* LArCalorimeter/LArTestBeam
```

7] `$LARHECTBPEDROOT` is set automatically by setup.sh script.

Exercise 2

Produce a pedestal and a standard ntuple

un LArHECTBPed to create pedestal file

```
athena LArHECTBPed_jobOptions.txt
```

o you see the pedestal file?

xecute LArHECTBAna, and

Produce the standard ntuple

```
athena LArHECTBAna_jobOptions.txt
```

Have a look at the standard ntuple “hec_adc.ntp”

Section 3

How to add your code

Exercise 3

Execute LArHECTBAna with building

ou want to change LArHECTBAna :

- add your own analysis code
- modify existing code

should check it out, edit code and build the package.

copy LArHECTBAna package without building

```
tlas> .  $LArTutorial/scripts/Setup_HECexample.sh [1]
oto your work area : $HOME/maxidisk/Tutorial/LArCalorimter
tlas> cp -r $LArTutorial/code/LArCalorimeter/LArTestBeam . [2]
tlas> goto_build [3]
tlas> cmt broadcast cmt config [4]
tlas> cmt broadcast gmake [5]
tlas> goto_source [6]
```

) Edit LArHECUserHist.cxx

- Search FIXME (two parts)
- book a histogram and fill the average of first 3 samples

Congratulations !

You successfully finished the tutorial