SITUATION BEFORE MY CODE, ATHENA v10.0.2

- **We have cluster containers (CBNT_CaloCluster) [CaloRec package]**
- **We have containers with calibration hits [CaloSimEvent package]**
- **In ATHENA ntuple are written clusters informations (energy of each cell in cluster separated according to sampling) (CBNT_CaloCluster)**
- **In ATHENA ntuple aren't any calibration informations related to clusters**

MY TASK

Create a code which obey ATHENA rules and make:

- **Take calibration informations (CaloCalibrationHitContainer)**
- **Pick up cells which are also in clusters (CaloClusterContainer)**
- **Sum all calibration variables for every cluster**
- **Write result sums to ATHENA ntuple file**

RESULTS, SITUATION AFTER MY CODE

- **Code is done and it is fully functional**

Code parts (CaloRec package):

- **CBNT_CalibrationInfo.h, CBNT_CalibrationInfo.cxx**
- **CalibrationInfo_CBNT_jobOptions.py**
- **CaloRec_entries.cxx - updated, my algorithm declared for ATHENA**
- **Code parts (Reconstruction package):**
- **CBNT_config.py - include CalibrationInfo_CBNT_jobOptions.py according to addCalibrationInfo flag**
- **RecExCommon_flags.py - added new flag: addCalibrationInfo (FALSE, by default)**

Code details:

Header file, new NTuples:

- **NTuple::Item nc; //Number of clusters (index)**
- **NTuple::Array energy_EM; //indexed array of EM part of energy in hit**
- **NTuple::Array energy_NonEM; //indexed array of hadronic part of energy in hit**
- **NTuple::Array energy_Invisible; //indexed array of invisible part of energy in hit**

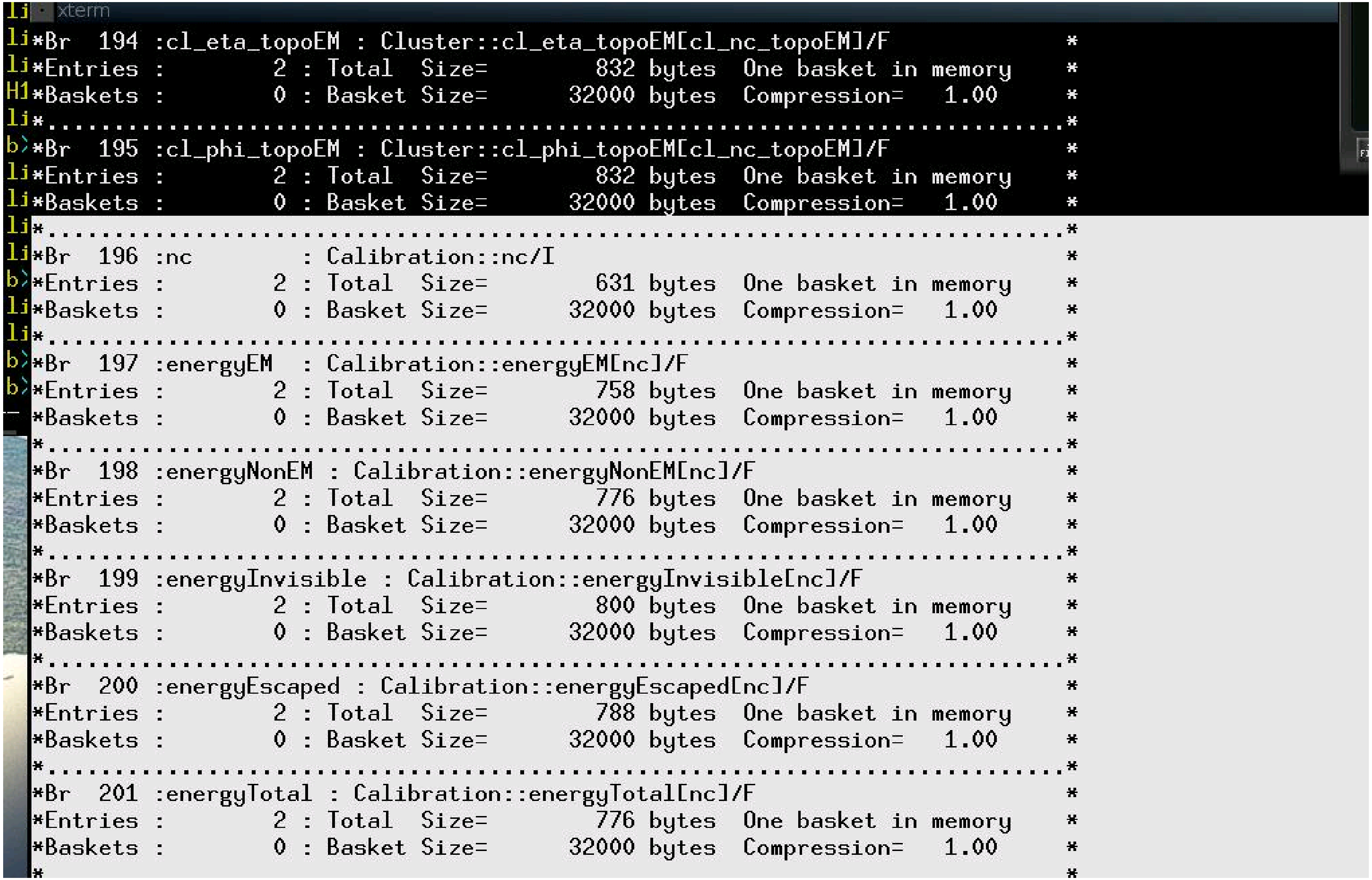
- NTuple::Array energy_Escaped; //indexed array of escaped part of energy in hit
- NTuple::Array energy_Total; //indexed array of total energy in hit

jobOption file, properties:

- CalibrationContainers = ["Container1", "Container2"]
- ClusterContainer = "LArClusterEM"
- Suffix = ""
- Suffix and CalibrationContainers are equal to CBNT_CaloCLuster jobOption file

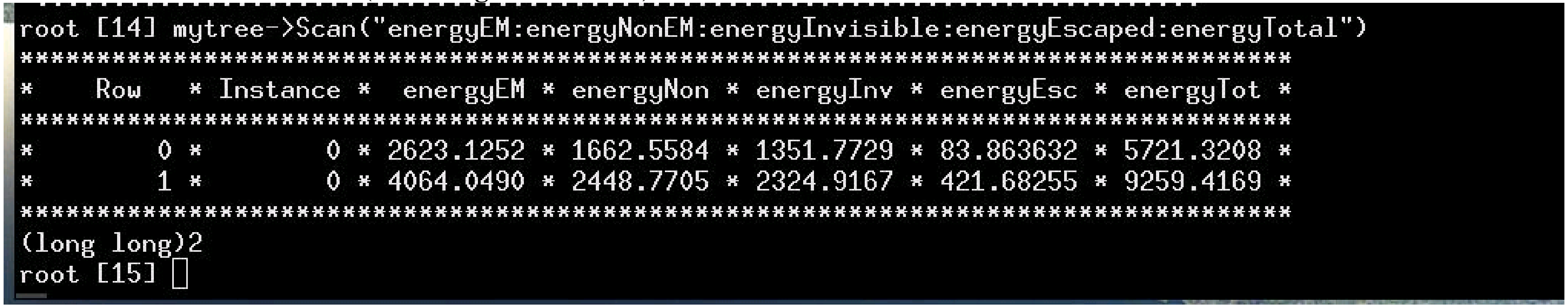
PART OF ntuple.root FILE

Calibration informations in ntuple.root (indexed arrays):



```
*Br  194 :cl_eta_topoEM : Cluster::cl_eta_topoEM[cl_nc_topoEM]/F          *
*Entries :        2 : Total  Size=        832 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  195 :cl_phi_topoEM : Cluster::cl_phi_topoEM[cl_nc_topoEM]/F          *
*Entries :        2 : Total  Size=        832 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  196 :nc        : Calibration::nc/I                                      *
*Entries :        2 : Total  Size=        631 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  197 :energyEM  : Calibration::energyEM[nc]/F                           *
*Entries :        2 : Total  Size=        758 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  198 :energyNonEM : Calibration::energyNonEM[nc]/F                      *
*Entries :        2 : Total  Size=        776 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  199 :energyInvisible : Calibration::energyInvisible[nc]/F              *
*Entries :        2 : Total  Size=        800 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  200 :energyEscaped : Calibration::energyEscaped[nc]/F                  *
*Entries :        2 : Total  Size=        788 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*............................................................................*
*Br  201 :energyTotal : Calibration::energyTotal[nc]/F                      *
*Entries :        2 : Total  Size=        776 bytes  One basket in memory    *
*Baskets :        0 : Basket Size=      32000 bytes  Compression=   1.00     *
*                                                                            *
```

Concrete values for 2 clusters (2 events generated due)



```
root [14] mytree->Scan("energyEM:energyNonEM:energyInvisible:energyEscaped:energyTotal")
************************************************************************************
*    Row   * Instance *  energyEM * energyNon * energyInv * energyEsc * energyTot *
************************************************************************************
*        0 *        0 * 2623.1252 * 1662.5584 * 1351.7729 * 83.863632 * 5721.3208 *
*        1 *        0 * 4064.0490 * 2448.7705 * 2324.9167 * 421.68255 * 9259.4169 *
************************************************************************************
(long long)2
root [15] 
```