NAIA USER EXPERIENCE IN BOLOGNA

ANTIMATTER MONTECARLO ARE STRICTLY NEEDED

Flipping the sign of positive MC is not a good idea at low energies. The interaction CR-detector is not symmetric between matter and antimatter.

If we have antimatter, the annihilation cross section increases towards lower energies. In the antideuteron **analysis**, a mass-based analysis, low energies are **fundamental**. It's very important to simulate the detector response to the incoming **antiprotons** in a correct way, to understand in detail the spectral shapes of them.

 Antiproton MC in lxplus (starting from 2018):
/eos/ams/MC/AMS02/AntiPr.B1220
/eos/ams/MC/AMS02/AntiPr.B1236
/eos/ams/MC/AMS02/2022/ AntiPr.B1236
/eos/ams/MC/AMS02/2018/AntiPr.B1220

The antiproton MC is crucial for the ML training, to discriminate between good antiprotons and the high mass tails of the antiproton distribution, and how to improve the mass resolution for them.

TOF NCLUSTER PROBLEM

In the antideuterons analysis the following variable has been defined:

$$N_{cluster, TOF, total} = \sum_{i=layer} (N_{cluster, TOF, OnTime} + N_{cluster, TOF, OffTime})$$

event.TofPlus->Ncluster[layer i][NAIA::BetaClusterType::OffTime]

event.TofPlus->Ncluster[layer i][NAIA::BetaClusterType::OnTime]

For definition, this variable doesn't include the TOF cluster used for the Beta reconstruction (required = 4 in the selection)
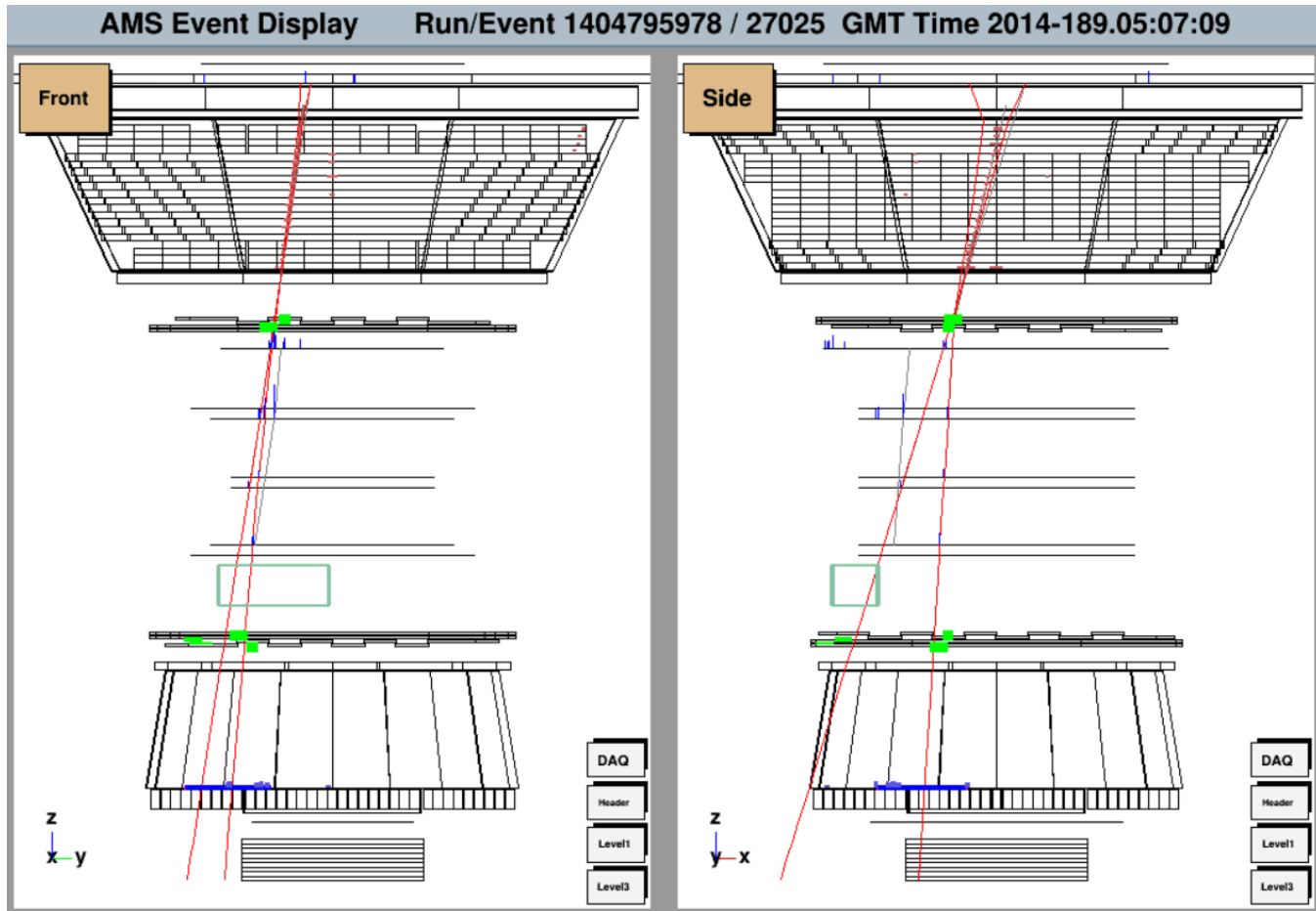
In the standard selection this cut has been applied: $N_{cluster, TOF, total} < 2$

⟶ Expected to see up to 5 clusters considering all the TOF planes

TOF NCLUSTER PROBLEM(?)

After the DNN application, on top of the standard selection, some antideuteron candidates remaining have been observed in the event display.

6 cluster on TOF but the limit of the selection in 5!

Why? ->Checking the NAIA variables

TOF NCLUSTER PROBLEM(?)

```
 84   for (int ip = 0; ip < 4; ip++) {
 85     LayerGoodPathl[ip] = betahPtr->IsGoodQPathL(ip);
 86
 87     float layer_charge = betahPtr->GetQL(ip);
 88     if (layer_charge > 0.0f) {
 89       LayerCharge[ip] = layer_charge;
 90     }
 91     if (betahPtr->GetClusterHL(ip)) {
 92       LayerEdep[ip] = betahPtr->GetClusterHL(ip)->GetEdep();
 93     }
 94
 95     // taken from dbar code
 96     if (betahPtr->TestExistHL(ip)) {
 97       float ltime = betahPtr->GetTime(ip); // ns
 98       for (auto &cluster : evPtr->TofClusterH()) {
 99         if (cluster.Layer != ip || (cluster.NBetaHUsed() > 0) || !cluster.IsGoodTime())
100           continue;
101
102         float dt = cluster.Time - ltime; // later cluster has positive dt
103         float tcut = ip < 2 ? 10 : 4;    // 10ns for top layers, 4 ns for bottom layers
104
105         int itm = -1;
106         if (std::fabs(dt) <= tcut)
107           itm = 0; // around-time hits ("in time")
108         else if (dt > tcut)
109           itm = 1; // later hits ("off time")
110
111         switch (itm) {
112         case 0:
113           NClusters[ip][BetaClusterType::OnTime]++;
114           AverageDTime[ip][BetaClusterType::OnTime] += dt;
115           AverageEdep[ip][BetaClusterType::OnTime] += cluster.GetEdep();
116           break;
117         case 1:
118           NClusters[ip][BetaClusterType::OffTime]++;
119           AverageDTime[ip][BetaClusterType::OffTime] += dt;
120           AverageEdep[ip][BetaClusterType::OffTime] += cluster.GetEdep();
121           break;
122         default:
123           break;
124         }
125       }
126     }
127   }
128   return true;
129 }
```

NAIA source code: src/Containers/TofFill.cpp

Is betahPtr a gbatch pointer(?)

Reference for the timing: betahPtr (?)

1) Loop on all TofClusterH of the evPtr (gbatch?)

2) Exclude clusters without goodtime (what does it mean?) or with NBetaHUsed() > 0 (?)

3) Define cluster timing (onTime/offTime discrimination)

4) Assign cluster timing. Off time cluster before reference not considered(?)

5) Fill TofPlus Cluster variables

Are steps 2) or 4) causing missing clusters?
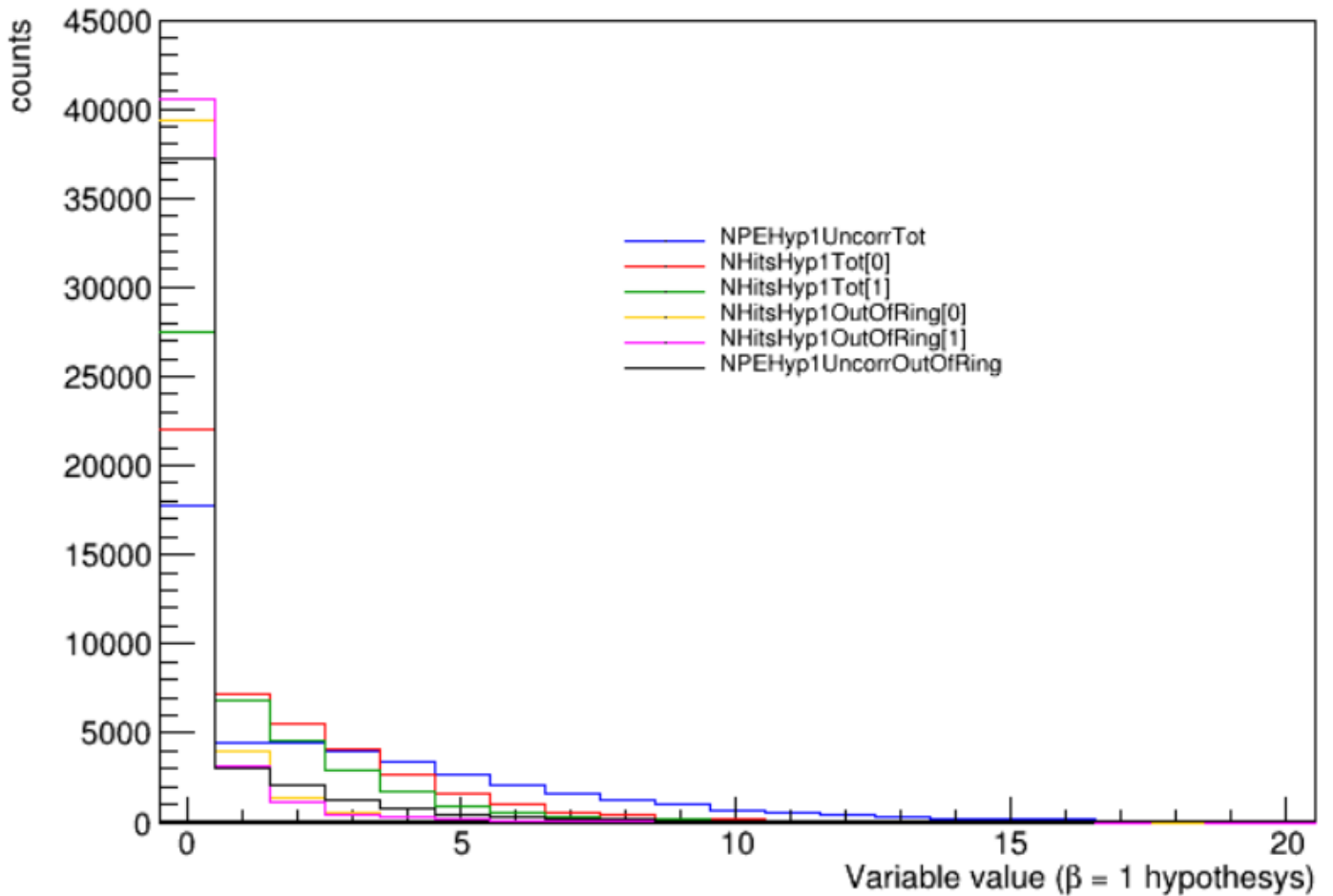
RICH BETAONE HYPOTHESIS VARIABLES

The richPlus variables involving the Beta = 1 hypothesis are not filled in the v1.1.0.
The problem has been fixed by Valerio.

Variables involved:
richPlus->GetData()

1. NPEHyp1UncorrTot
2. NHitsHyp1Tot
3. NHitsHyp1OutOfRing
4. NPEHyp1UncorrOutOfRing

Tested on the test ntupla /storage/gpfs_ams/ams/users/vformato/Analysis/naia/build/1305857186.root
Available in the NAIA v1.2.0 version.

RICH NEW EXPANSION GAP CORRECTION

Carlos said he will produce tables to calculate the expansion gap correction (corrections in the Cherenkov spectra of photons due to the variation of refractive index with frequency of produced Cherenkov photons).

This correction is actually a concern for the lithium analysis Yi Jia is publishing.

We don't know exactly when this table will be release. However, **are we ready to use it in NAIA?** Which variables are required (Francesca)?

RICH IMPROVEMENTS

Erwan is actually working on the RICH improvement in NAIA.

1. He's splitting the RICH variables that involve the NPMTs in direct and reflected (see his presentation today).

2. He updated the RingGeomTest, including all the bad tiles in the RICH and the corrected gaps between radiators and tiles (see Erwan presentation on 22 April 2024, last NAIA User Meeting).

CNAF PROBLEMS

Just to report recent CNAF problems:

- Why jobs that are running very fast on local, they can run very slow when submitted using condor?

- Why HTCondor doesn't create the log files since the migration on htc ver=23 ?

- Why do we have storage problems (I don't really worry about this but I'm in the complaining mood)?

- Why do we have this continue maintenance interventions?

- Why CNAF is switching to 2FA?

- Why jobs that are completed (with the output already created and usable) don't figure as completed in the job list (neither in the running, idle or holding lists)? In this way they are occupying slots in the 10000 works submission limit. They naturally disappears after one or days.