# Correlations of total energy in sPHENIX calorimeter systems

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## 1 Introduction

These plots show the correlations between the raw energy in the three sPHENIX calorimeter subsystems: electromagnetic calorimeter, inner hadronic calorimeter, outer hadronic calorimeter.

## 2 Data

The data used are from run 7210. This run was taken with the EMCal and HCals concurrently using the gtm in global mode. Two of the seb machines for the EMCal are not included due to startup issues, resulting in only 3/4 of the EMCal being included. The HCal was taking data in normal gain, while the EMCal was set to high gain. The trigger used was a coincidence of at least 10 hits in both the North and South sides of the MBD. The timing used for the EMCal was a l1delay of 153, and the HCal used a l1delay of 156. All subsystems read out 31 time samples. The raw data files used are:

- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/HCal/junk/junk_East-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/HCal/junk/junk_West-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb01-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb02-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb03-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb04-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb05-00007210-0000.prdf`
- `/sphenix/lustre01/sphnxpro/rawdata/commissioning/emcal/calib/junk_seb07-00007210-0000.prdf`

This run corresponds to 28,960 events.

## 3 Analysis

The raw data were reconstructed into calorimeter towers using the CaloTowerBuilder module with template waveform processing. The EMCal reconstruction used the software zero suppression with a cut of 50 ADC while the HCal reconstruction did not use this suppression.

Reconstructed towers were required to have a peak time sample between 4 and 10 for the EMCal and 9 and 15 for the HCals to cut out noise from out of time signals. These cuts were determined from the time sample position of the peaks found in each subsystem as shown in Figures 1 and 2. This cut is necessary to remove noise from out of time signals, as seen in Figure 1 which compares the time of the signal for all channels to those above an energy threshold of 1000 ADC. The large value at time sample zero results from the software zero suppression applied to the EMCal.

No calibration was applied to the reconstructed towers, which are at the ADC level. The total ADC values of all towers in a given subsystem were summed and normalized arbitrarily such that the scale of the figures is between zero and one. The totals in each subsystem are then correlated in Figures 3, 4, and 5.

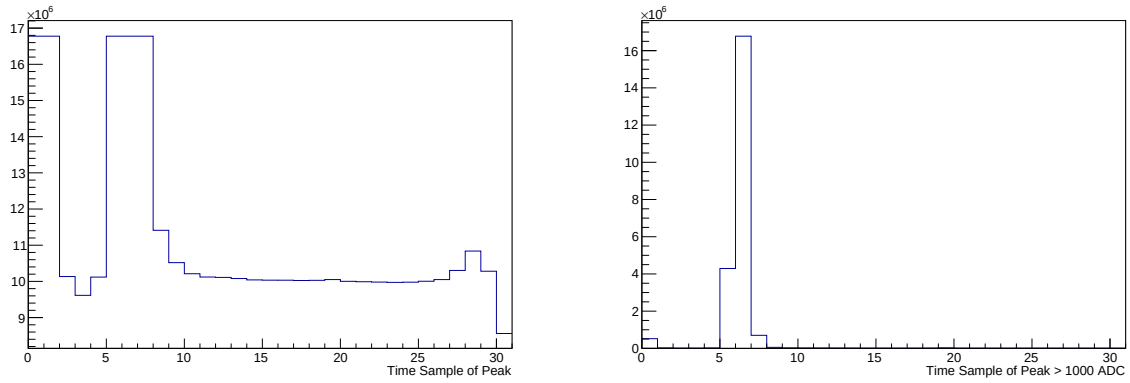


Figure 1: The time sample for the peak the waveform in each channel in the EMcal (left) and for channels with ADC values above 1000 (right). The timed in peaks are found around time sample 6.

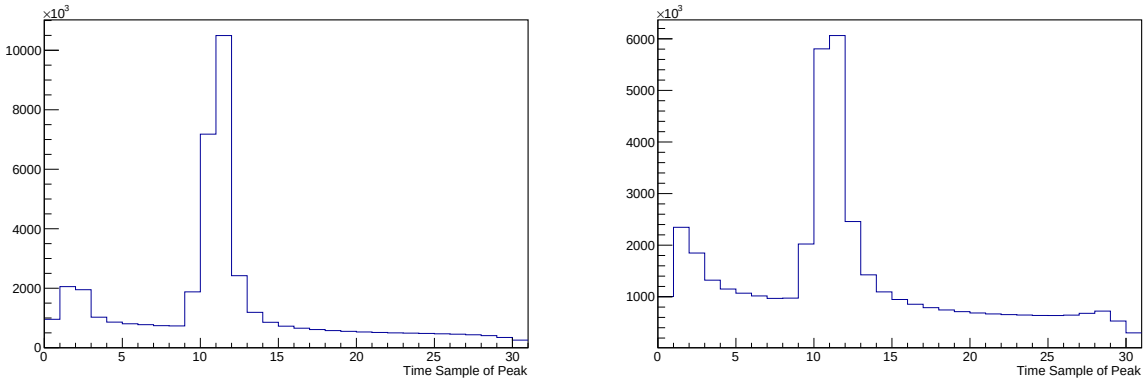


Figure 2: The time sample for the peak of each waveform in the inner HCal (left) and outer HCal (right). The timed in peaks are found around time sample 10 for both HCals.

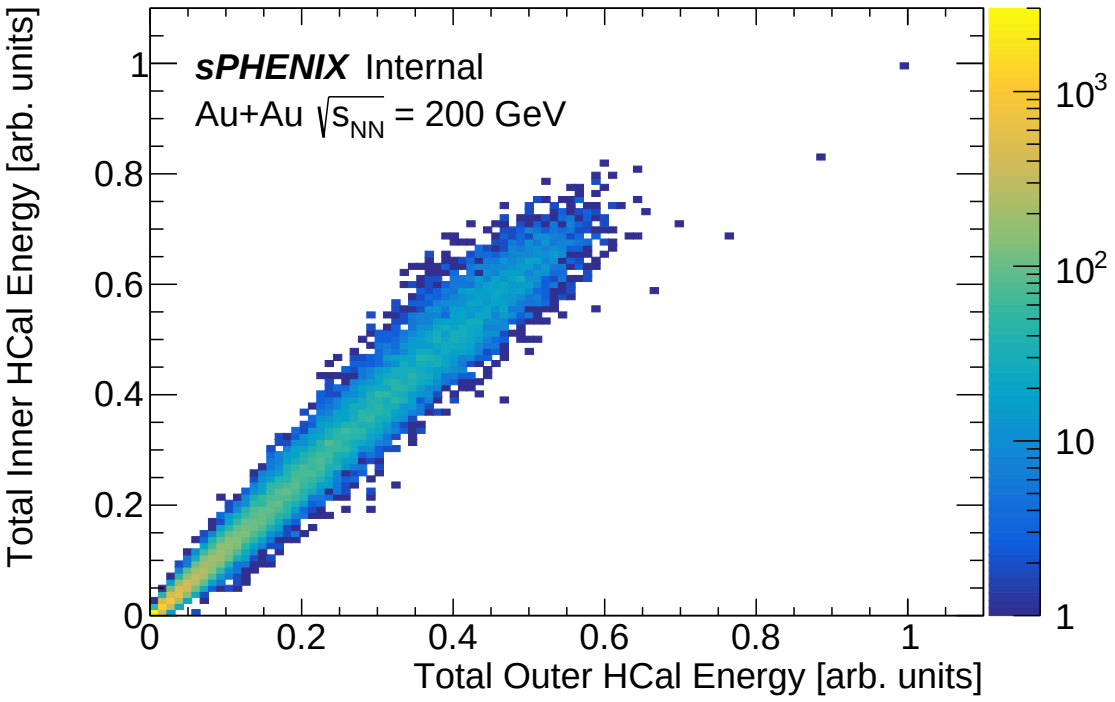


Figure 3: The correlation between the total amount of energy in the inner and outer hadronic calorimeters in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV.

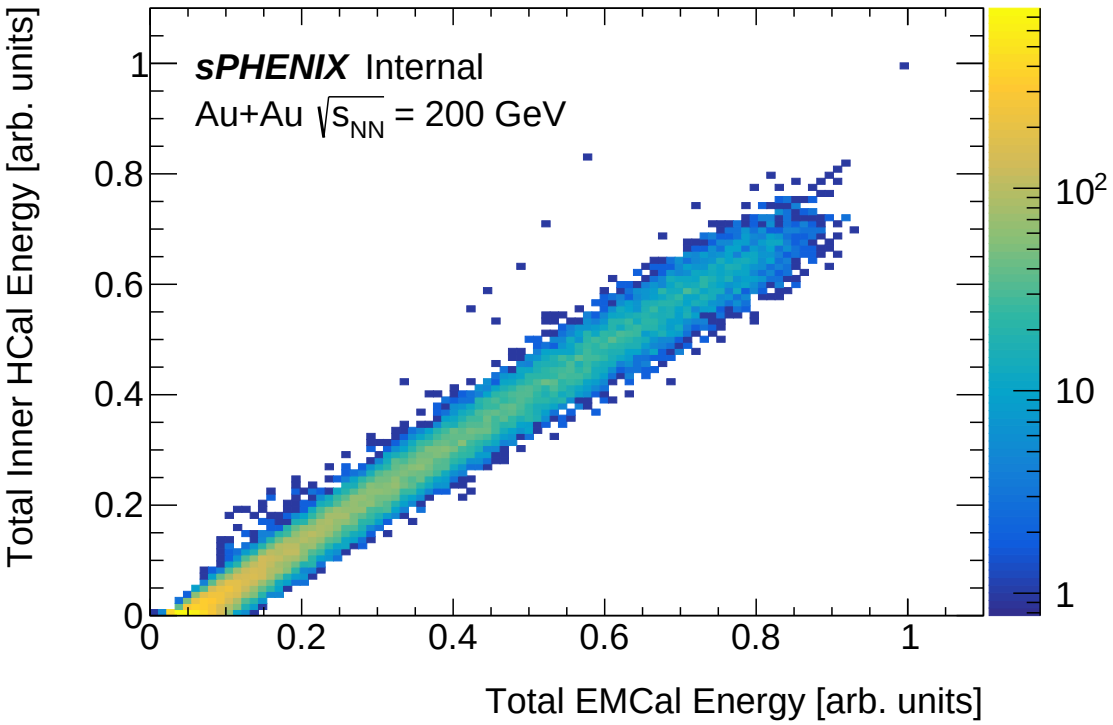


Figure 4: The correlation between the total amount of energy in the electromagnetic and inner hadronic calorimeters in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV.

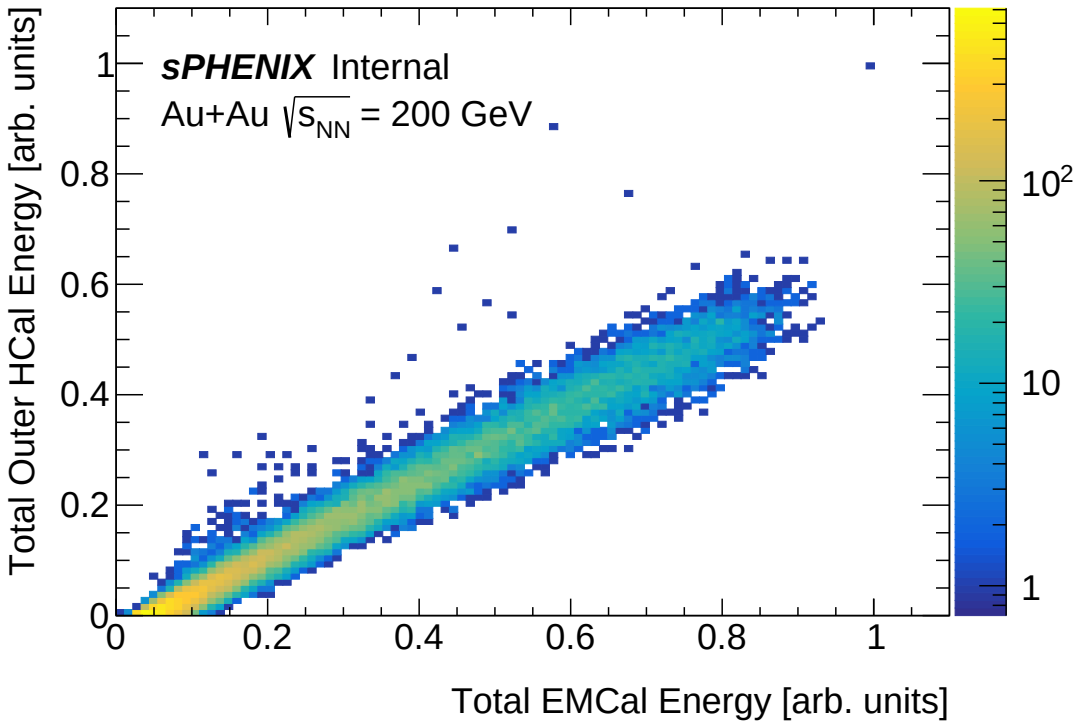


Figure 5: The correlation between the total amount of energy in the electromagnetic and outer hadronic calorimeters in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV.