Sharpening the sight of the MAGIC telescopes

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The Idea

Sum T analysis led to development of an improved image cleaning optimizing the performance of the system below 100 GeV. Early attempts showed that this cleaning can also be successfully applied to data taken with standard trigger. MAGIC gathered a large database of standard observations of sources where a very soft spectrum with signal concentrated only around the energy threshold of the system is expected, but no signal was found with standard analysis. Thus, some solid detections of potential TeV sources might be already at hand in archival data, waiting only for the application of a more performant analysis. On the other hand, this cleaning is computationally much demanding (in terms of storage and CPU) and mass application to the whole database is not viable with standard systems.

The Quest

Achieving the lowest possible energy threshold is crucial in order to detect sources characterized by a soft gamma-ray spectrum and/or far enough to suffer a significant extinction due to absorption of gamma rays against Extragalactic Background Light. To improve the performance of MAGIC lowering the threshold a new trigger system called Sum Trigger (SumT) was installed. Together with the SumT a dedicated new image cleaning (NIC) algorithm that increases the fraction of low energy (meaning E < 100 GeV) events surviving the cleaning, at the price of some losses at high energies was necessary.

My work

I selected small data samples taken observing extragalactic sources expected to be detectable only around the energy threshold, that were observed with standard trigger under good weather and technical conditions, and where hints of signal were found with standard analysis. Thus, some solid detections of potential TeV sources might be already at hand in archival data, waiting only for the application of a more performant analysis. On the other hand, this cleaning is computationally much demanding (in terms of storage and CPU) and mass application to the whole database is not viable with standard systems.

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