The Logging and Data Retrieve System for the GW Detector AURIGA

A. Ortolan[#], L. Baggio[*], M. Cerdonio[*], V. Martinucci[§], G.A. Prodi[§],
L. Taffarello[*], S.Vitale[§], G.Vedovato[#], J.P. Zendri[*]

[#]INFN Nat. Laboratory of Legnaro, Via Romea 4, Legnaro (PD) Italy.
[*]Department of Physics and INFN sez. of Padova, via Marzolo 8, Padova, Italy.
[§]Department of Physics and INFN gr. coll. Trento, Povo (TN) Italy.

Abstract. We have created a logging and data retrieve system for the AURIGA g.w. detector by means of the commercial software ORACLE RDBMS (Relational DataBase Management System). The system is able to manage and correlate efficiently many years of analyzed data relative to g.w, candidate events and to the detector noise estimates and calibrations.

AURIGA is a gravitational wave detector[1] located at INFN Nat. Lab. of Legnaro designed to search for millisecond bursts from the Local Group of Galaxies: to this aim a coordinate coincidence program with similar detectors (NAUTILUS, EXPLORER, ALLEGRO, NIOBE), to form the first gravitational wave observatory, has been started too (see the IGEC agreement at http://igec.lnl.infn.it/igec). The performances and capabilities of AURIGA in searching g.w. events depend on many experimental factors, including environmental conditions, hardware setting, working temperature of the bar, etc. and these parameters often interact in unexpected ways. In addition, AURIGA data acquisition system produces ~ 3 Gbytes per day of raw data (including the auxiliary data which ensure that the detector is working properly) which are first reduced by the on-line analysis to 20 Mbytes per day of flat files[2]. These data, together with the detector calibrations and data diagnostics, have to be efficiently stored for years in order to recover any information necessary to the search of g.w. signals. To manage rapidly and correlate efficiently such a large amount of data we have created a logging and data retrieve system by mean of the commercial software ORACLE RDBMS. A dedicated UNIX workstation runs the Oracle Server 8; suitable tools (ProC, ODBC) allow to insert data into the database and to fetch them for application programs (Paw++, Excel, etc.) for their graphical representation. For the database design an Entity/Relationship (E-R) diagram was used. In this diagram are represented the types of data produced by the on-line analysis (entities), the relations among them and the relevant information they can provide. Each type of data is characterized by the set of attributes used. In fig. 1 we report a simplified version of the complete AURIGA E-R diagram. Entities (rectangles) represent a collection of homogeneous data with the same attributes. Relationships (rhombs) point out the relation among entities. We put in parentheses the relation cardinality, i.e. the maximum and minimum number of objects belonging to the entities in relation. To give an example, an event can be in relation with almost one calibration but a

calibration is in relation with many events. Data and Setup are generalized entities, i.e. they consist of entities that can be aggregated. The Events entity is the main entity as it collects the gravitational wave candidate events, which are described by amplitude, arrival time, signal-to-noise ratio, χ^2 and other attributes.
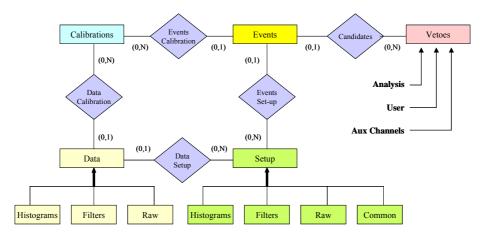

FIGURE 1: Entity/Relationship diagram for the AURIGA database.

When we retrieve a gravitational wave candidate event, we have to recover the experimental setup and the detector calibration as well to check if the detector was working properly in that period of time (non-vetoed event). The data produced by the on-line analysis are also related to the entities Calibration and Setup; they have been grouped according to their characteristic as Histograms data, Filtered data and Raw data. Each data type is produce by the on-line analysis by means of the corresponding set-up and by the Global setup parameters. The Vetoes entity stores the time information about the detector faulty operation. The vetoed time intervals can be due to detector cryogenic maintenance or to the failure of self-consistency tests of the on-line data analysis (see L. Baggio *et al*. in these proceedings). Other vetoed time intervals could be determined from the auxiliary channels, which monitor the environmental activity. As a consequence of the long term operation of the AURIGA detector we decided to organize the database in space units (each one containing one year of data) that can be taken off-line and recovered independently. The annual tablespaces have the same logical structures and are composed of a set of tables containing the relevant information about the detector output, the hardware and software set up, and the auxiliary instrumentation channels. This data organization occupies about 80 Mbytes per year for storage and management. It is worth to notice that the database keeps track also of the location of the flat files produced by the on-line analysis allowing the recover of the original information stored in these files.

REFERENCES

1. G. A. Prodi *et al*, in Proc. of the 2nd E. Amaldi Conference on Gravitional Waves, E. Coccia G. Veneziano an G. Pizzella Eds. (World Scientific 1998 Singapore) p. 148.
2. A. Ortolan *et al*, in Proc. of the 2nd E. Amaldi Conference on Gravitional Waves, E. Coccia G. Veneziano an G. Pizzella Eds. (World Scientific 1998 Singapore) p. 204.