5.3.2 ISDC

5.3.2.1 The ISDC Organisation

A consortium of a dozen institutes was formed in 1995 in order to fulfil the objectives of the ISDC. A team of scientists and engineers was established at the beginning of 1996 at Ecogia, Versoix, Switzerland.

Most of the ISDC team are financed by consortium institutes. They are working now on the data analysis system development and will maintain it during the INTEGRAL operational phase.

5.3.2.2 ISDC main tasks

The formal high level document which defines the scope of ISDC is the EID-A for ISDC. Below, however, an overview of what ISDC has to achieve is presented in order to demonstrate the wide variety of tasks that are involved.

The ISDC (Integral Science Data Centre) forms the link between the scientific output of the instruments and the scientific community.

To fulfil this position the ISDC has to:

- receive the data supplied as telemetry by the MOC (Mission Operations Centre);
- receive auxiliary data, mainly supplied by MOC, but some is received from ISOC;
- check, group, calibrate/correct and format the incoming data;
- detect and locate Gamma-Ray Bursts within 10's of seconds of telemetry arrival;
- detect and locate potentially new sources and/or unexpected behaviour of catalogued sources within several hours;
- detect out-of-limit conditions in instrument behaviour with several hours of telemetry arrival;
- ensure the detection of GRB's, new sources or sources with unexpected behaviour and out-of-limit instrument conditions lead to the necessary follow-up activities;
- perform a full set of analysis of the instruments data for each observation, producing a standard set of data products;
- notify observers when their data set is complete and deliver it or make it available for "collection";
- archive all the main data sets/groups at the various stages of processing at ISDC;
- provide adequate interactive software to allow testing, investigation of anomalies and special analysis of data to complement the mainly automatic data processing at the ISDC;
- provide data analysis tools and an interactive environment for their use to support further scientific study of the standard products by local (to ISDC) and remote scientists and observers.

5.3.2.3 Factors affecting the ISDC design and implementation

Before the main development of the ISDC could start, some main factors had to be considered. Some of the main influencing factors on the ISDC design are listed below:

- ISDC will be supplied with a continuous stream of telemetry throughout the spacecraft operational life. (Apart from times when the spacecraft is within the Earth's radiation belts, there will be a continuous stream every day, 365 days a year for 2 to 5 years);
- ISDC does not perform instrument safety critical monitoring, (MOC performs all critical monitoring);
- the continuous telemetry arriving at ISDC must be quickly checked for GRBs and relatively quickly checked for new sources or unexpected source behaviour;
- checks on instrument behaviour must also be performed relatively quickly;
- the continuous telemetry stream may contain gaps in data which may be recoverable by MOC and because of that, a consolidated period of telemetry is regularly assembled by MOC and forwarded to ISDC on a CD-ROM a week or so after the real-time events;
- observers will want the most complete set of standard data products from their observations and access to much of the raw and intermediate data which was used in producing the standard set and some software tools to aid them with repeat and further result analysis;
- detailed and in-depth knowledge of the instruments and their behaviour is best found at the instrument team sites, although information transfer to the ISDC team members will also take place;

5.3.2.4 The design concept of the ISDC

From the list of tasks ISDC are to fulfil and the constraints and conditions under which these tasks are to be performed, several main design decisions emerged.
An overview of the main design and implementation decisions follows:

- Automatic processing of the incoming telemetry stream and on the associated auxiliary data files;
- GRB detection and notification of a detection must take place very quickly and fully automatically;
- GRB detection is a special case, all other checking software will provide alerts which will be graded in significance, thus allowing low priority alerts to be dealt with on the next working day, high priority alerts to lead to some kind of call-out;
- the behaviour of the instruments against the observation timeline and the checking of instrument house-keeping parameters will be performed automatically on the near real time telemetry by a sub-system called OSM (Operations Status Monitoring), interactive tools will be supplied for follow-up investigations on any detected anomalies;
- the scientific (detector output) data will be monitored using a sub-system called Quick-Look-Analysis, QLA. As with OSM, alerts stemming from QLA can be graded

and interactive tools will be available for follow-up investigations on any detected anomalies;

- all important data will be archived at ISDC, but the processing of the data arriving in near real time will be able to make use of Repositories, which are local disk storage area with an archive compliant directory structure.
- Automatic processing will be achieved by grouping the ISDC sub-systems into pipelines.
- An automatic standard analysis pipeline, (including instrument specific pipelines), will produce the standard product set. The initial source of data for standard analysis pipeline runs will be the CD-ROM of consolidated telemetry supplied regularly by MOC;
- much of the instrument specific scientific analysis software will be written by the instrument teams and supplied to the ISDC as executables to be either used with processing pipelines or in/as interactive off-line tools;
- standardised data groups and data definitions are to be used throughout and ISDC supplies software libraries to aid developers access (read write) data files in an ISDC compliant fashion;
- the automatic pipelines, archive and associated software processes will be installed and operated on an "operational" network of computers located in a dedicated building close to the main ISDC office building;

A full overview of the ISDC design can be found in the ISDC top level design document.