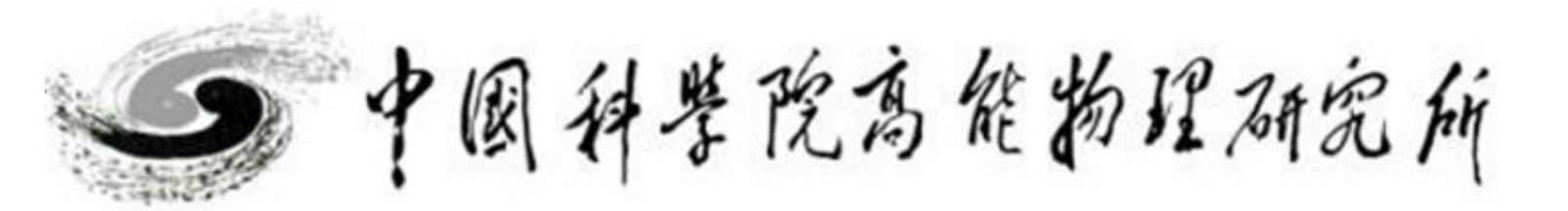


# The Data Analysis of Insight-HXMT Observation

Zhao Haisheng, zhaohs@ihep.ac.cn

Key Laboratory of Particle Astrophysics, Institute of High Energy Physics,  
Chinese Academy of Sciences, Beijing 100049, China



## Abstract

The Insight-HXMT Data Analysis Software package (HXMTDAS) is to achieve the HXMT data analysis processing and extract scientific products. Its purpose is to achieve scientific products, such as energy spectra, light curves, Ancillary Response Files (ARF), Redistribution Matrix Files (RMF) and background files. It provides several tasks with each task is to accomplish a step of data analysis. These tasks are written in ftools style and are fully compatible with the HEASoft software. A pipeline processing is also designed automatically to perform some of these analytic steps with the standard event criteria. This work will introduce the data analysis processing of HXMTDAS and software architecture.

## Introduction

The Hard X-ray Modulation Telescope (HXMT) is a large X-ray astronomical satellite with a broad band in 1-250 keV. It was successfully launched on 15th June 2017 in China. It is a low earth orbit telescope with altitude of 550km and inclination of 43 degrees. Three payloads are configured on-board HXMT, which are, High Energy X-ray telescope (HE), Medium Energy X-ray telescope (ME), and Low Energy X-ray detector (LE). Table 1 shows the summary of HXMT instrumental characteristics.

Payload	HE	ME	LE
Energy Band	20-250keV	5-30keV	1-12keV
Detector Type	NaI(Tl)/CsI(Na)	Si-PIN	SCD
Detector Area	5096cm <sup>2</sup>	952cm <sup>2</sup>	384cm <sup>2</sup>
Energy Resolution	(14%-15%)@60keV	3keV@20keV	140eV@5.9keV
Collimator FOV	1.1° × 5.7°; 5.7° × 5.7°;	1° × 4°; 4° × 4°	1.6° × 6°; 4° × 6°
Time Resolution	8μs	255 μs	1ms

Table 1: Summary of HXMT instrumental characteristics.

## HXMT Data Files

HXMT data (always called Level 1 data) can be downloaded from <http://hsuc.ihep.ac.cn/web/hxmtdata/>. The file name format for HXMT files uses the following convention:

HXMT\_obsID\_payload-type\_FFFFFFFF\_version\_L1P.FITS  
HXMT\_obsID\_type\_FFFFFFFF\_version\_L1P.FITS

where:

- obsID: digits number to identify the observation.
- payload: HE/ME/LE.
- version: a version number for file.
- type: an identifier for file. This is set to Evt for event file, TH for temperature file, HV for high voltage file, DTime for deadtime file, InsStat for instrumental status file, Att for the attitude file, Orbit for orbit file, EHK for extended housekeeping file.

## HXMT Software and CALDB

The Insight-HXMT Data Analysis Software package (HXMTDAS) is to achieve the HXMT data analysis processing and extract scientific products. Its input is a observation data (always called an exposure number data) from the HXMT Level 1 data products and has FITS format. Now, HXMTDAS version is 2.01.

The HXMTDAS package and CALDB can be downloaded from Insight-HXMT web:  
<http://www.hxmt.org/upl/soft/hxmtsoftv2.01.tar.gz>  
<http://www.hxmt.org/upl/caldb/CALDB2.01.tar.gz>.

The installation and initialization of the software and CALDB can be seen in "The HXMT Data Reduction Guide": [http://newshxmt.ihep.ac.cn/upl/doc/HXMT\\_data\\_reduction\\_guide\\_2.01.pdf](http://newshxmt.ihep.ac.cn/upl/doc/HXMT_data_reduction_guide_2.01.pdf)

## HXMTDAS Overview

The HXMTDAS package provides several tasks with each task is to accomplish a step of data analysis. These tasks are written in ftools style and are fully compatible with the HEASoft software. Figure 2 shows the HXMT data reduction flow diagram. It provides an unambiguous data processing for the data analysis of three payloads: HE, ME and LE.

## HXMTDAS architecture

The software architecture is designed in architectural layers (shown in Figure 1): the "BaseLIB" constitutes a common data objects, algorithms and I/O for all the payloads; the "libs" constitutes a series of common algorithms library and data objects of a payload, while the "modules" constitutes some special functions to the individual task of a payload; the task layer achieves the process of data analysis. More important, the pipeline inherited from "libs" and "modules" (such as pipeline(A), pipeline(B)) of each payload runs faster, compared to run each payload's tasks in sequences (such as pipeline(C)).

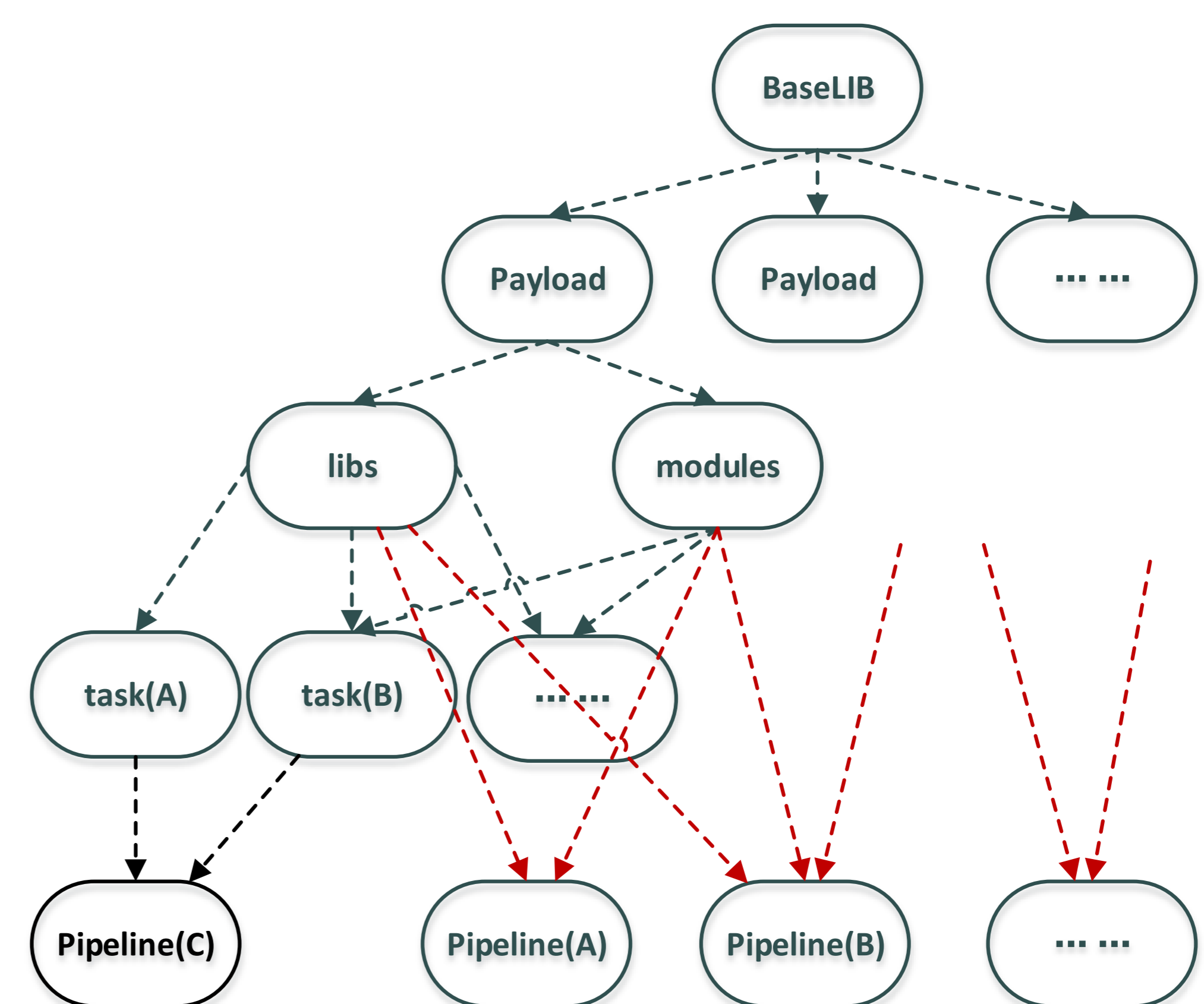


Figure 1: The software architecture of the HXMTDAS.

## Summary

The HXMTDAS v2.01 and CALDB have been released by HXMT team and are extensively used for HXMT data analysis now.

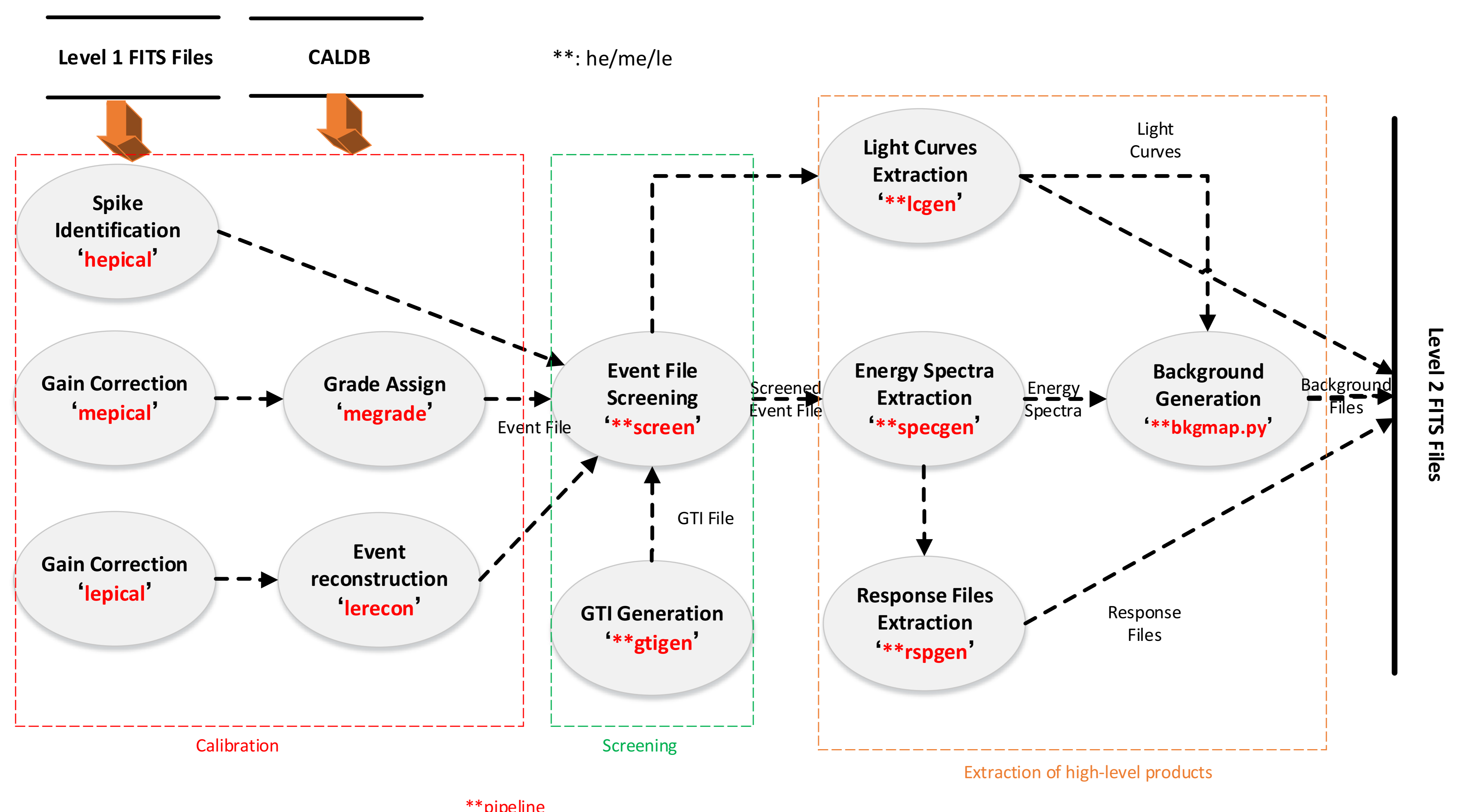


Figure 2: The flow diagram of the HXMTDAS.