WIDE Field Survey Challenge to:

data management & data process

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On behalf of Collaboration Team

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2012.11.30 YI CHANG

- Project Background

- Challenge

- Preliminary work

- Future work

Ground Wide Angle Camera (GWAC)
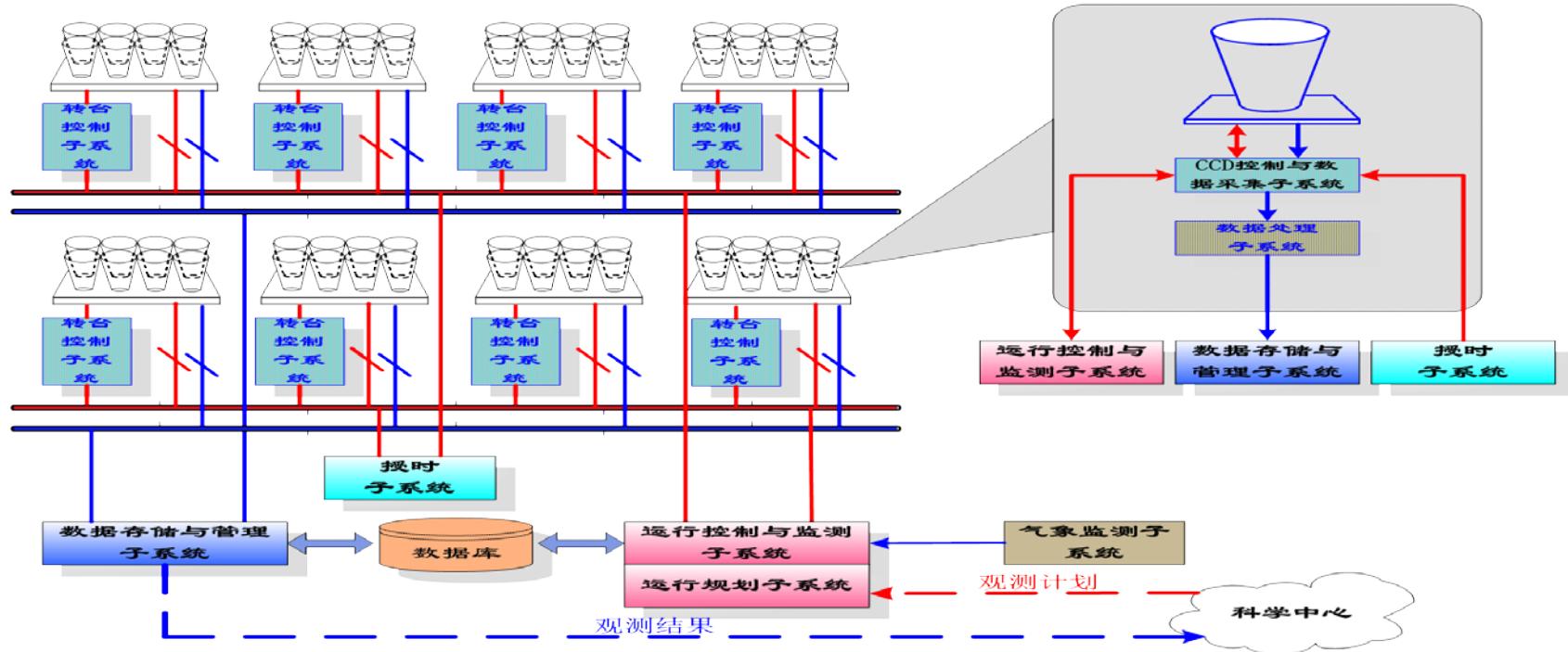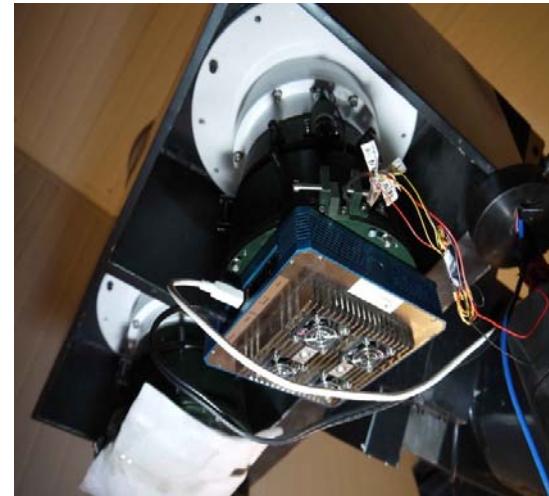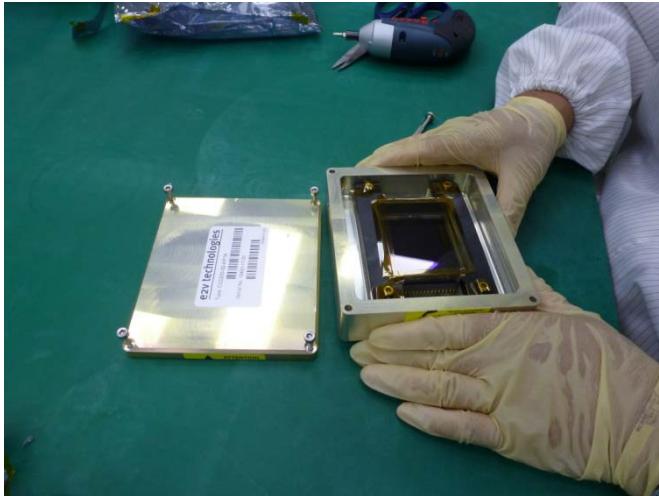
Camera	72	FOV/camera	160 deg^2	Total_FOV	~9000 deg^2
Aperture	18 cm	Mounts (4 camera/M)	18	sites	2 (one at Xinglong)
CCD	4KX4K	Pixel scale	12 Arcsec	Limit mag	16

SVOM mission architecture
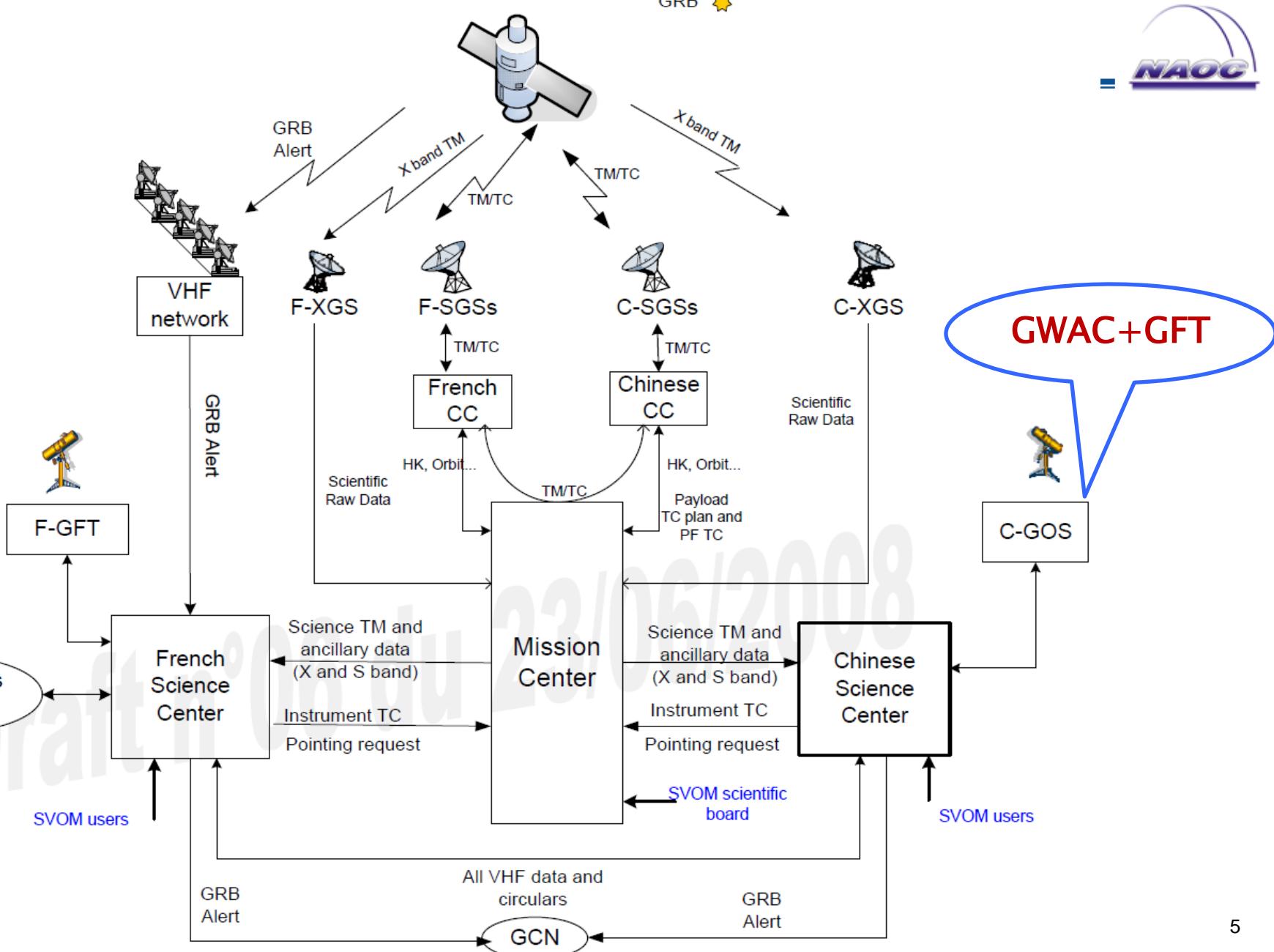
Main Scientific Goals:

✓ Search Optical Transient (OT) :
  (minutes to hours?).

✓ Search flare Stars.
  flux vary fast objects

✓ Shock breakout of CC SNe?

✓ Variable stars. Depends on
  data management ability
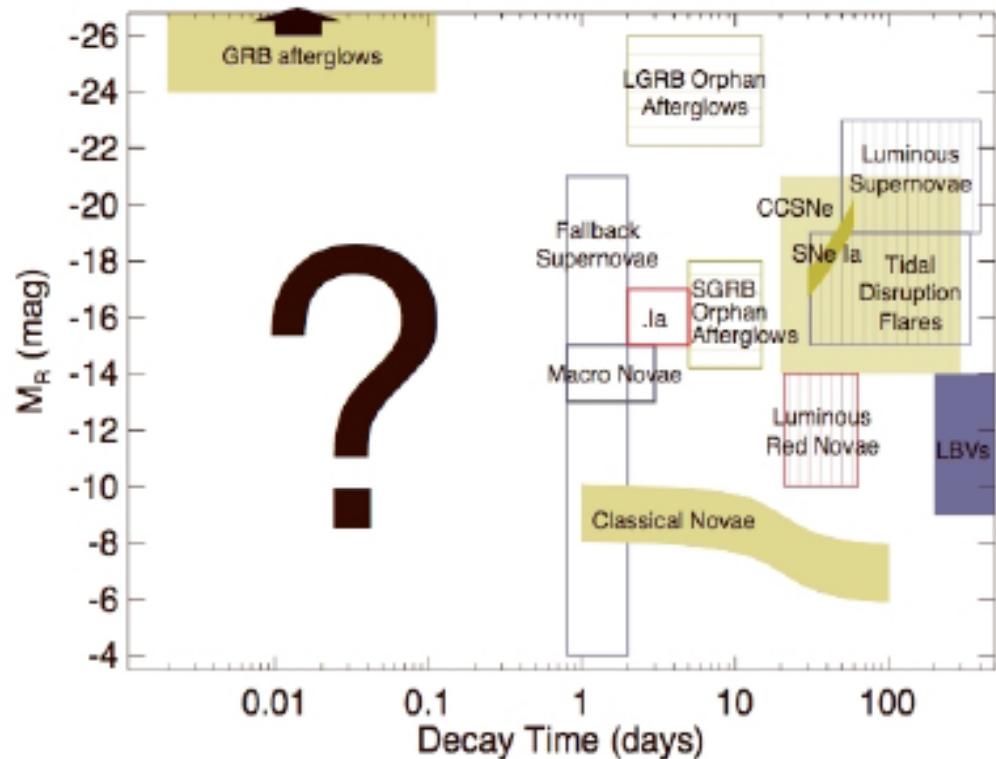
Fast candence: 15 seconds (10s exp+5s readout)

• Image data

GWAC: 1.1 Giga-Pixel images/15sec   LSST: 3.2 Giga-Pixel Image/10sec

~ 7.4 Tb/night

• DB requirements:

➢ Image records should have information of "image file path", "exposure time", "obs time", "object coordinates", and other astronomical parameters. (estimated to need 10~20 fields to describe)
➢ Query functions: coordinates and other astronomical parameters. Need relation to catalog data.

- catalog data

  1 image ➜ 100,000 objects ➜ 10^5 records(object informations)/15 sec

  Data volume : 1.7 X 10^8 records/camera, 6X10^9 records_total/site

- DB requirements:

  ➢ Light curve query, objects information query …
  ➢ trace to image from catalog data.

Challenge:

Image DATA:

✓ data storage strategy: No good idea so far.

  ➢ Keep a period (say one week), depends on storage ability.
  ➢ Truncate image to keep important one

✓ data management system: Monetdb, SciDB…, need test…

Catalog DATA:

✓ data volume larger: 6×10^9 records/night, relation query needed

✓ database management system??   SCIDB/MonetDB is solution?

✓ OT search challenge:

- Bad image quality

  ● resolution: 12arcsec/pix,deblending

  ● distortion: astrometry

  ● vignetting: flat field

- Process speed:

  Complete all process in 15 seconds

Instrument A1: distortion map
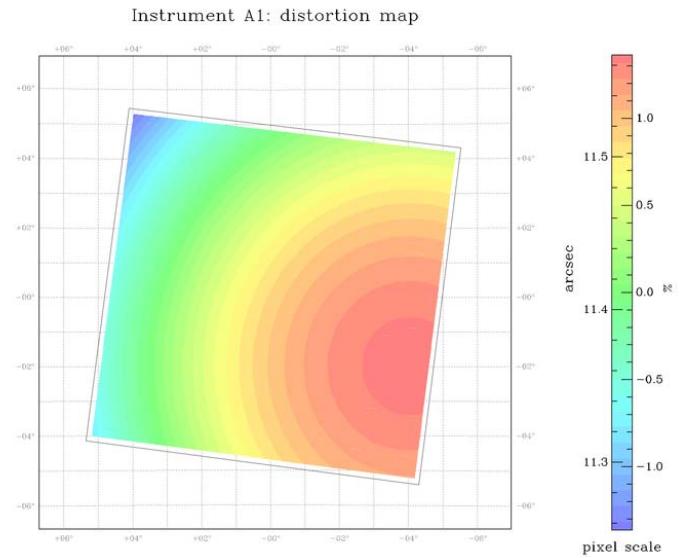
OT search flow chart:
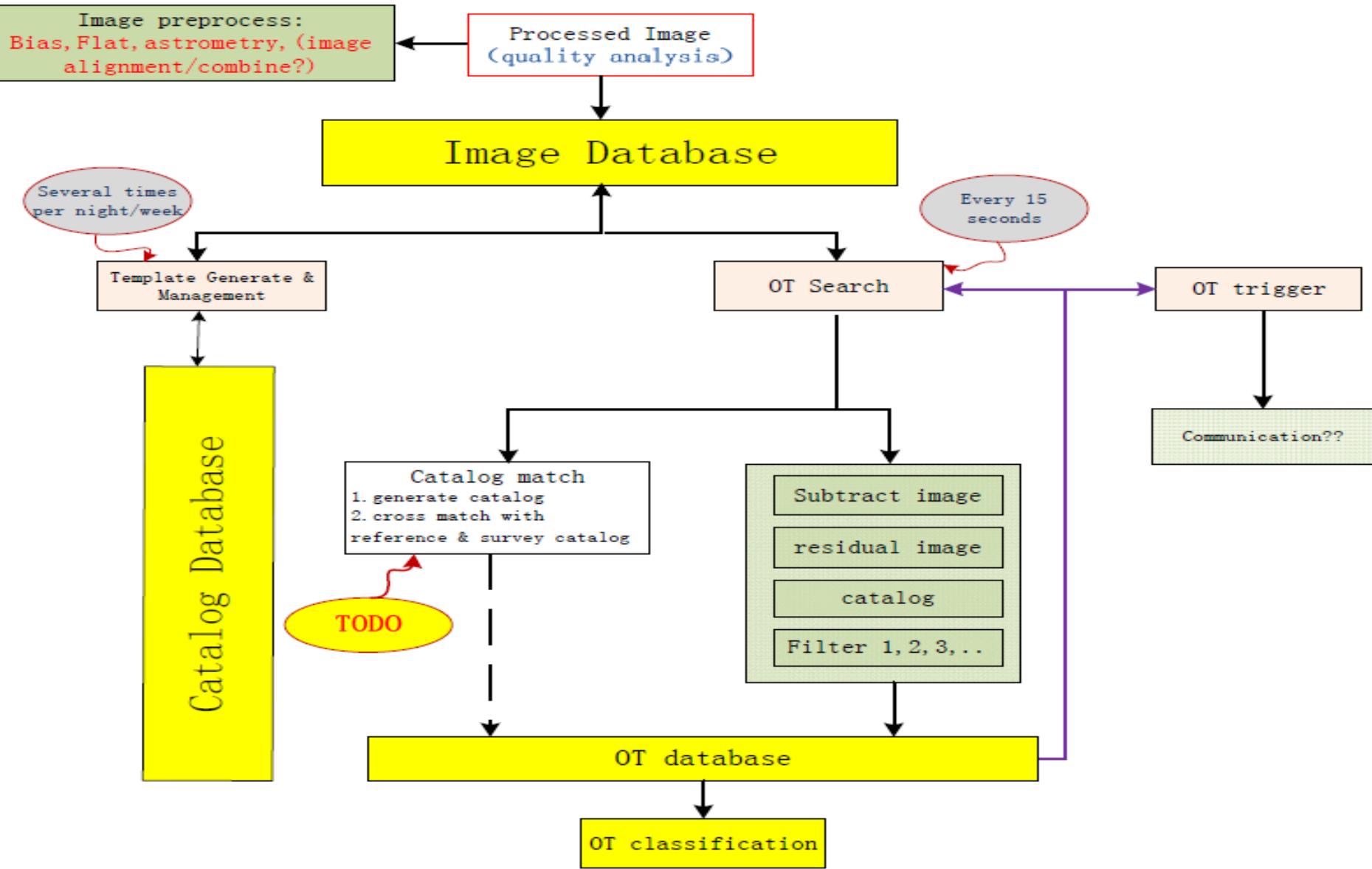
Pipeline I: Search OT pipeline based catalog crossmatch (other: subimage.).

Status : almost done for part I (get OT candidates)

Function :
1. Search OT candidates based on crossmatch with reference catalog, stars outside of reference is filtered.
2. Flux normalized to reference mag.
3. Light curves should be obtained.

Algorithm :
1. Sky index: modified zone
2. Space position projects to array model to speed-up

Technique :
1. GPU speed-up test

```
  ┌─────────────┐
  │  Raw data   │
  └─────────────┘
         │
         ▼
  ┌─────────────┐
  │ preprocess  │
  └─────────────┘
         │
         ▼
  ┌──────────────────┐
  │ Source Extractor │
  └──────────────────┘
         │
         ▼
  ( Target Catfile(fits) )
         │
         ▼
  ┌─────────────┐
  │ Astrometry  │
  └─────────────┘
         │
         ▼
  ( Target Catfile(fits) )    ( Reference Catfile(fits) )
```

Complete in 1sec

```
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐   ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│   ┌──────────────────┐       │   │                             │
│   │ Read fits catfile│       │   │                             │
│   └──────────────────┘       │   │                             │
│            │                 │   │                             │
│            ▼                 │   │                             │
│        ╱Ref in DB?╲──── No ──┼───┼──────┐                      │
│        ╲          ╱         │   │      ▼                      │
│            │                 │   │  ┌────────────┐             │
│            ▼                 │   │  │ CatTable_[id]│ ─────────────────►  ┌──────────────────┐
│   ┌──────────────┐           │   │  └────────────┘             │        │  OT Query Task   │
│   │ Cross Match  │           │   │                             │        └──────────────────┘
│   └──────────────┘           │   │                             │
│            │                 │   │                             │
│            ▼                 │   │                             │
│        ╱Matched?╲─ No+(outside?) ─┼►┌────────────┐             │
│        ╲        ╱            │   │  │ OTTable_[id] │             │
│            │ Yes             │   │  └────────────┘             │        ┌──────────────────────┐
│            ▼                 │   │                             │◄──────►│ OT Identification Task│
│ ┌──────────────────────────┐ │   │                             │        └──────────────────────┘
│ │Flux Normalization         │ │   │                             │
│ │1.get difference between   │ │   │                             │
│ │target and ref mag for each│ │   │                             │
│ │star.                      │ │   │                             │
│ │2.Calculate median of the  │ │   │  ┌────────────────┐         │
│ │flux ratio and transferred │ ├───┼─►│MatchedTable_[id]│        │
│ │to "diffmag"               │ │   │  └────────────────┘         │
│ │3.Normalized target mag to │ │   │                             │
│ │ref mag through correction │ │   │                             │
│ │with "diffmag"             │ │   │                             │
│ └──────────────────────────┘ │   │                             │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘   └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
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- ➤ More test for MonetDB performance

- ➤ Speed-up image reduction algorithm:

  image subtraction, SEXtractor, crossmatch, astrometry…
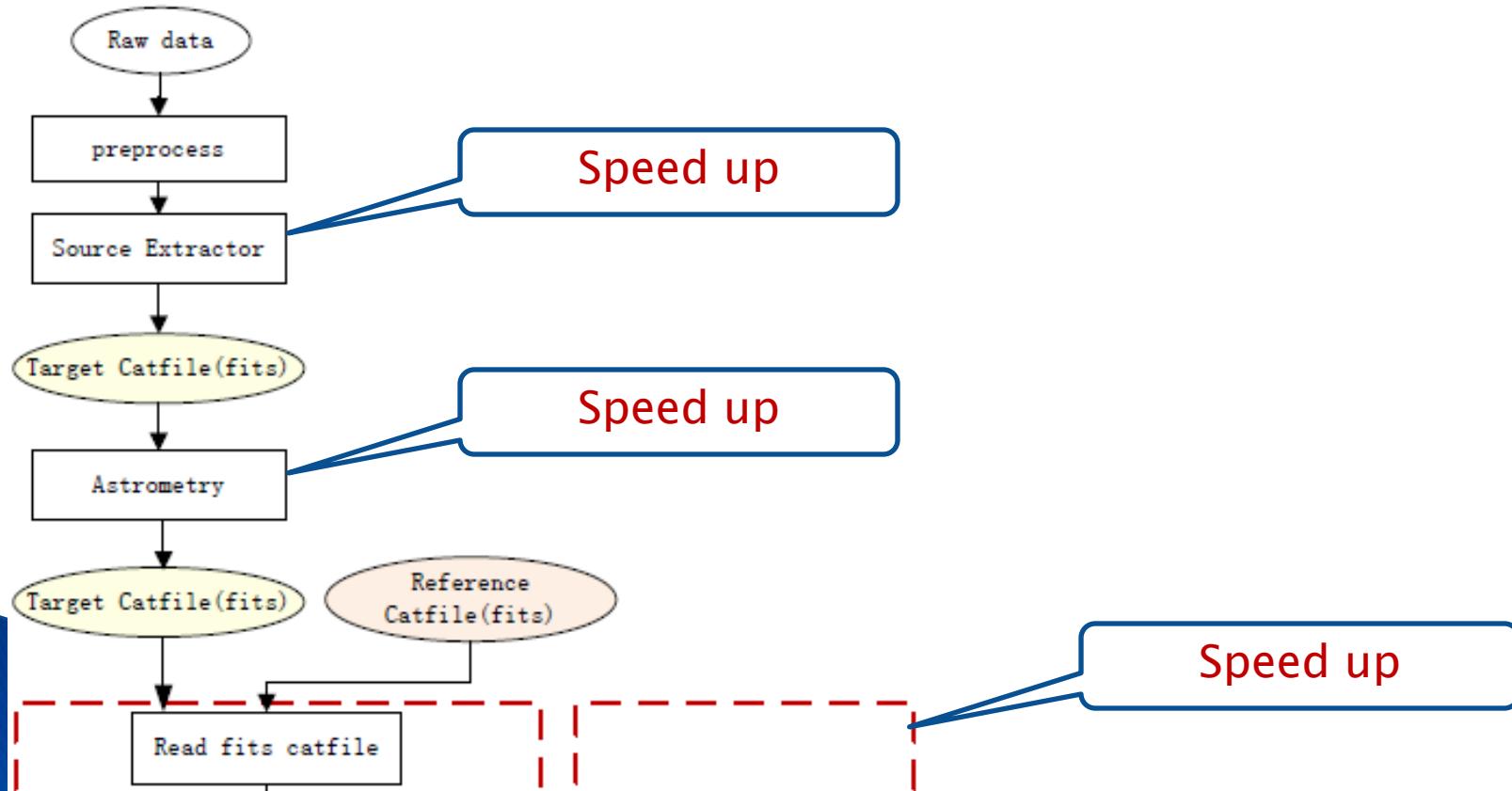
Thank you for your attention