

Data Challenge 1

Goal & scientific Scenario

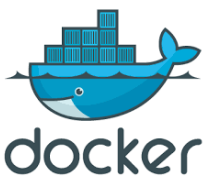
A.Claret & B.Cordier

4th Svom Scientific Workshop - Nanning, 2019 October 16th

Introduction

What is 'Data Challenge' (DC) at FSC?

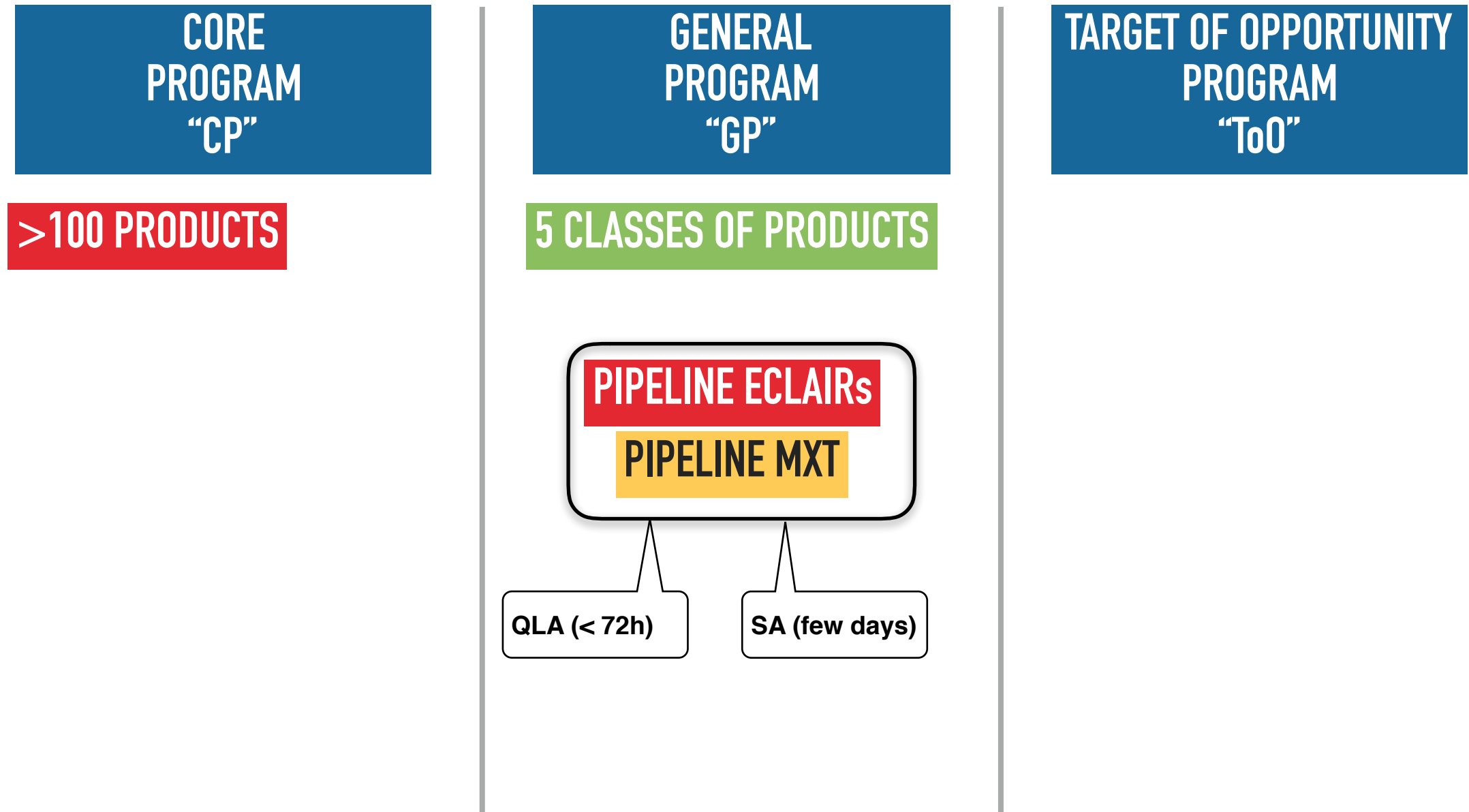
- Yearly software releases: 2018 (DC0, pre-alpha version), 2019 (DC1, alpha version), 2020 (DC2, version beta), 2021 (flight version)
- DC0 goal was to validate the FSC architecture based on micro services



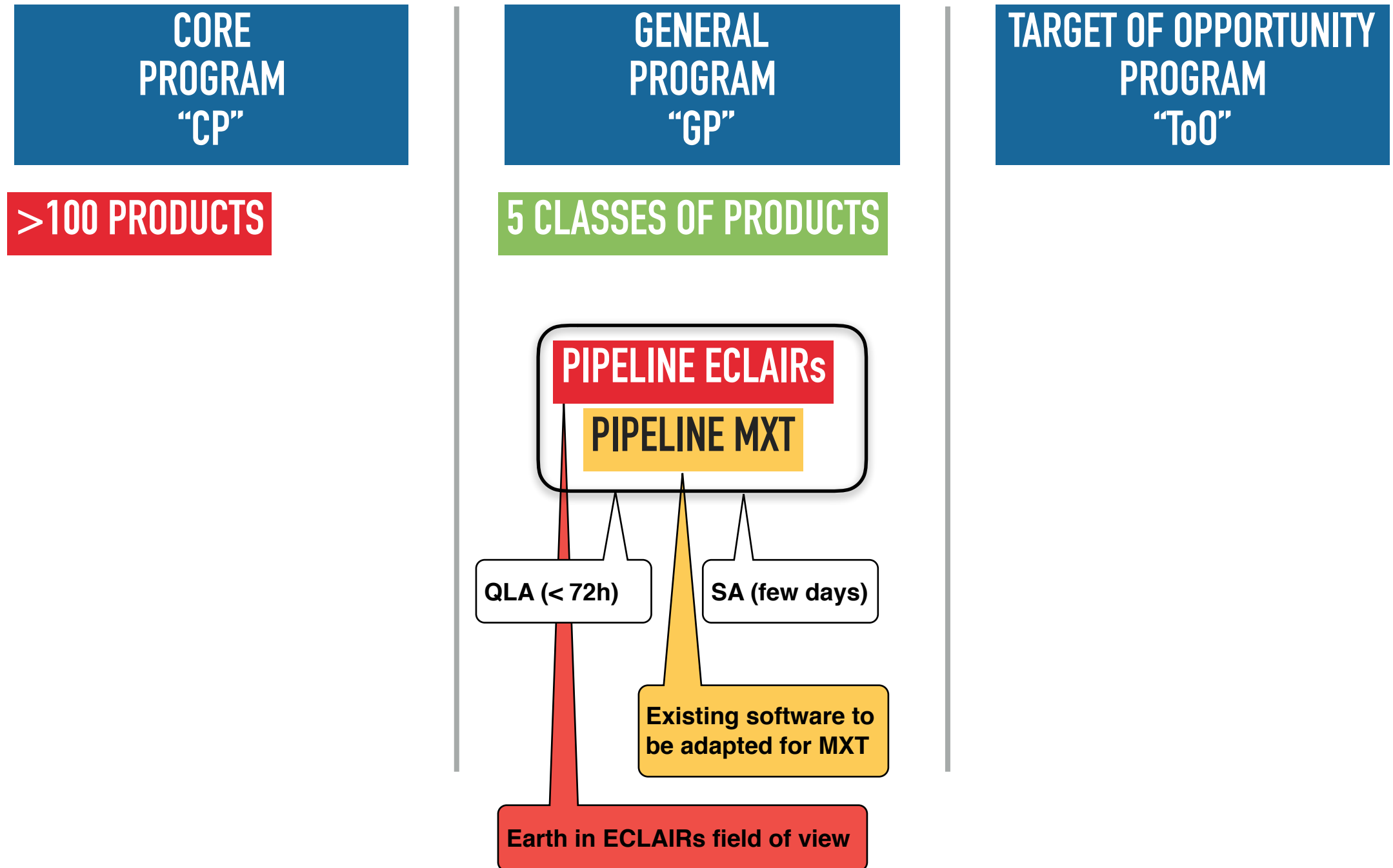
The goal of DC1 is to go further on **pipelines deployment in the FSC architecture**

- DC1 shall include some contributions from CSC for GRM and VT instruments (for core program)
- The representativeness of data is NOT the main goal
- Architecture, interfaces, messaging are more important

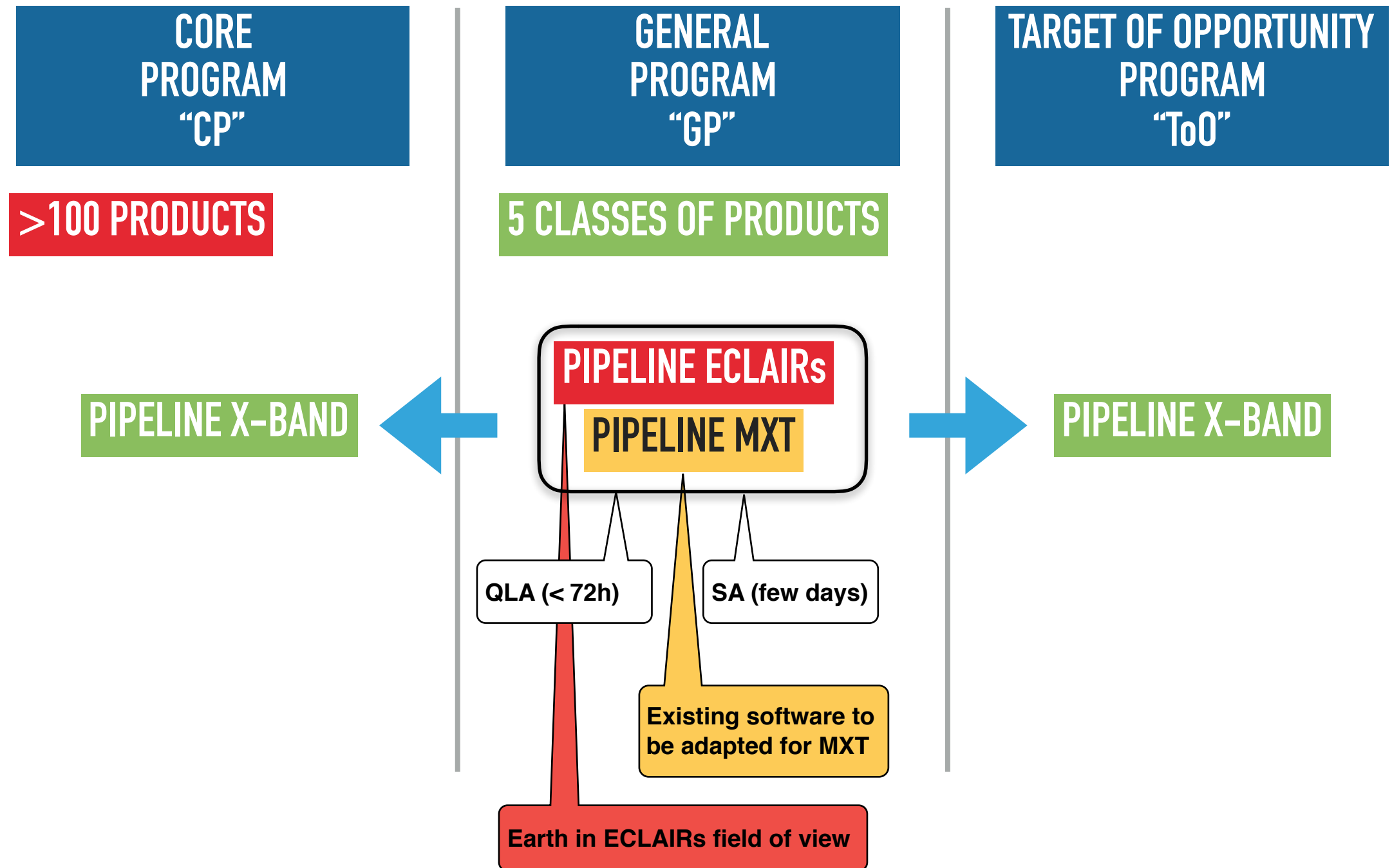
Development plan at FSC



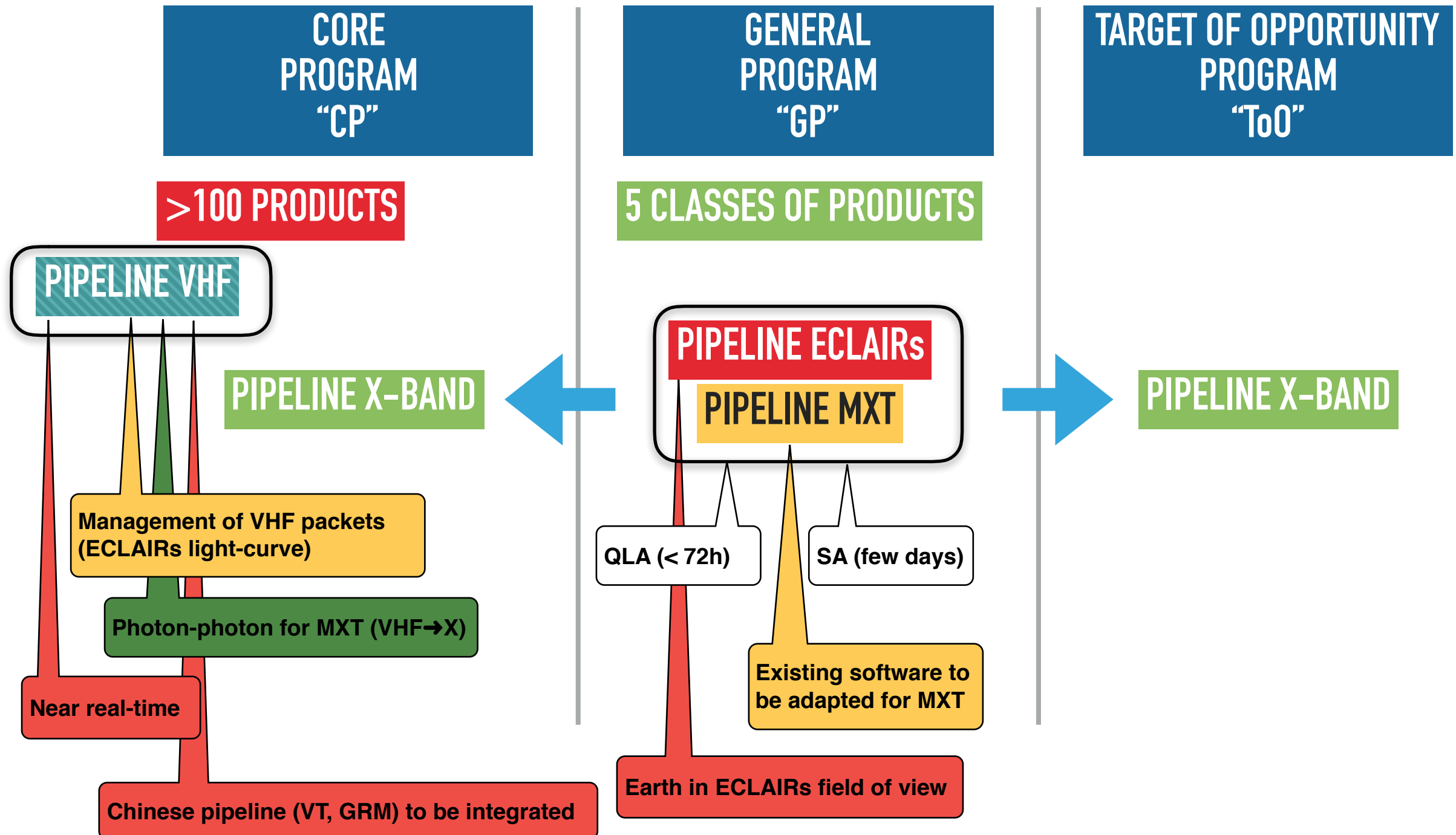
Development plan at FSC



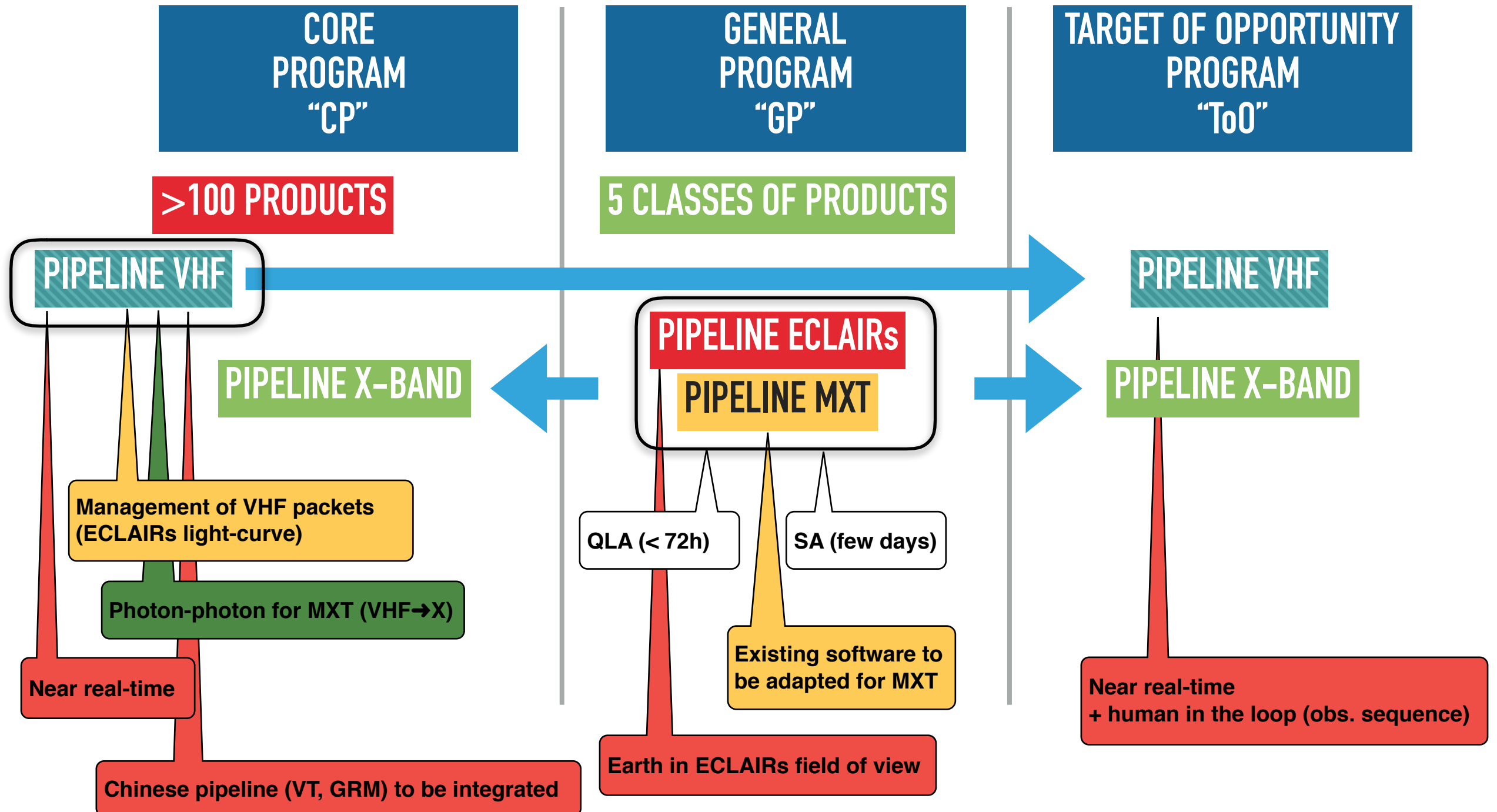
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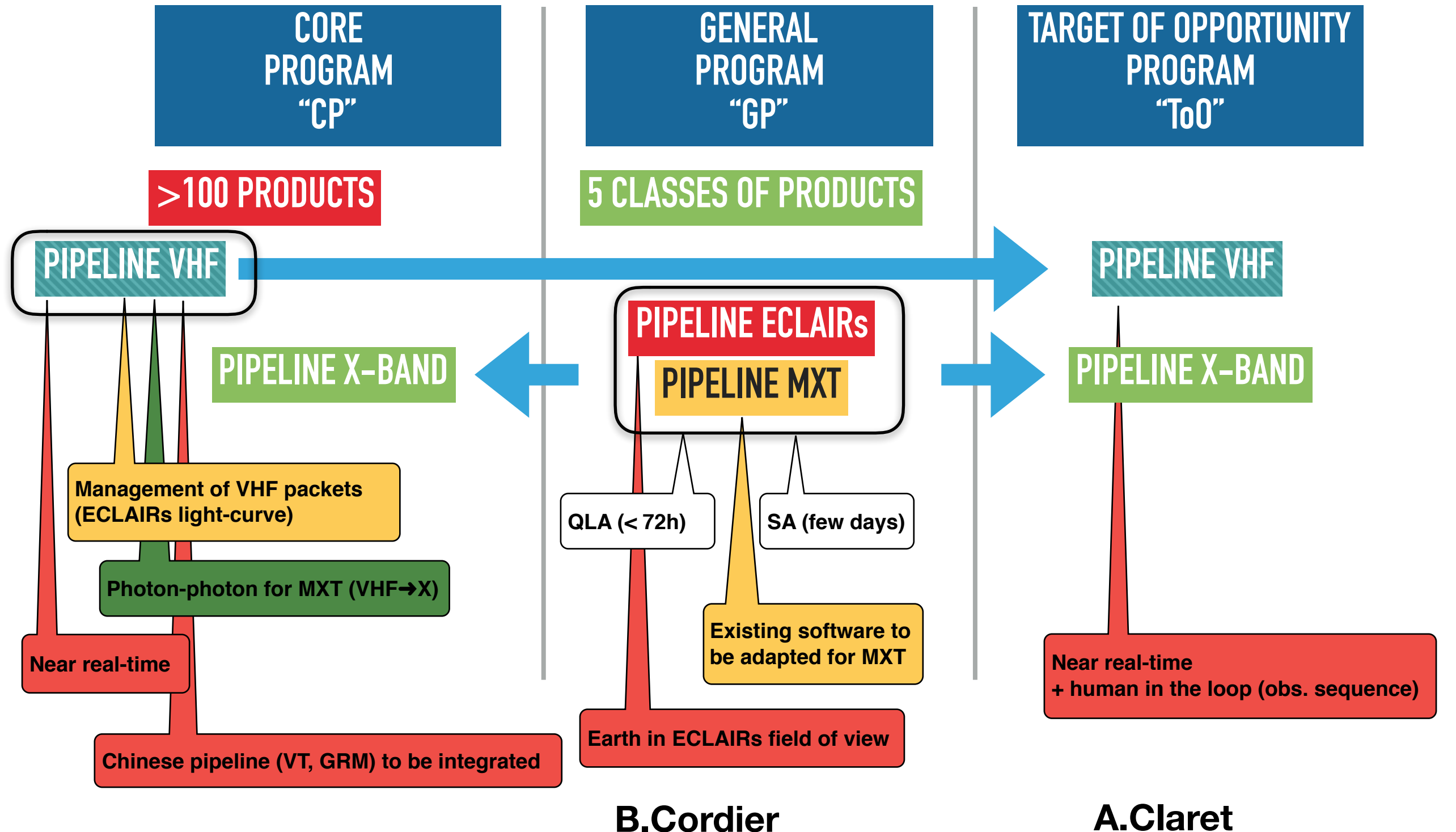
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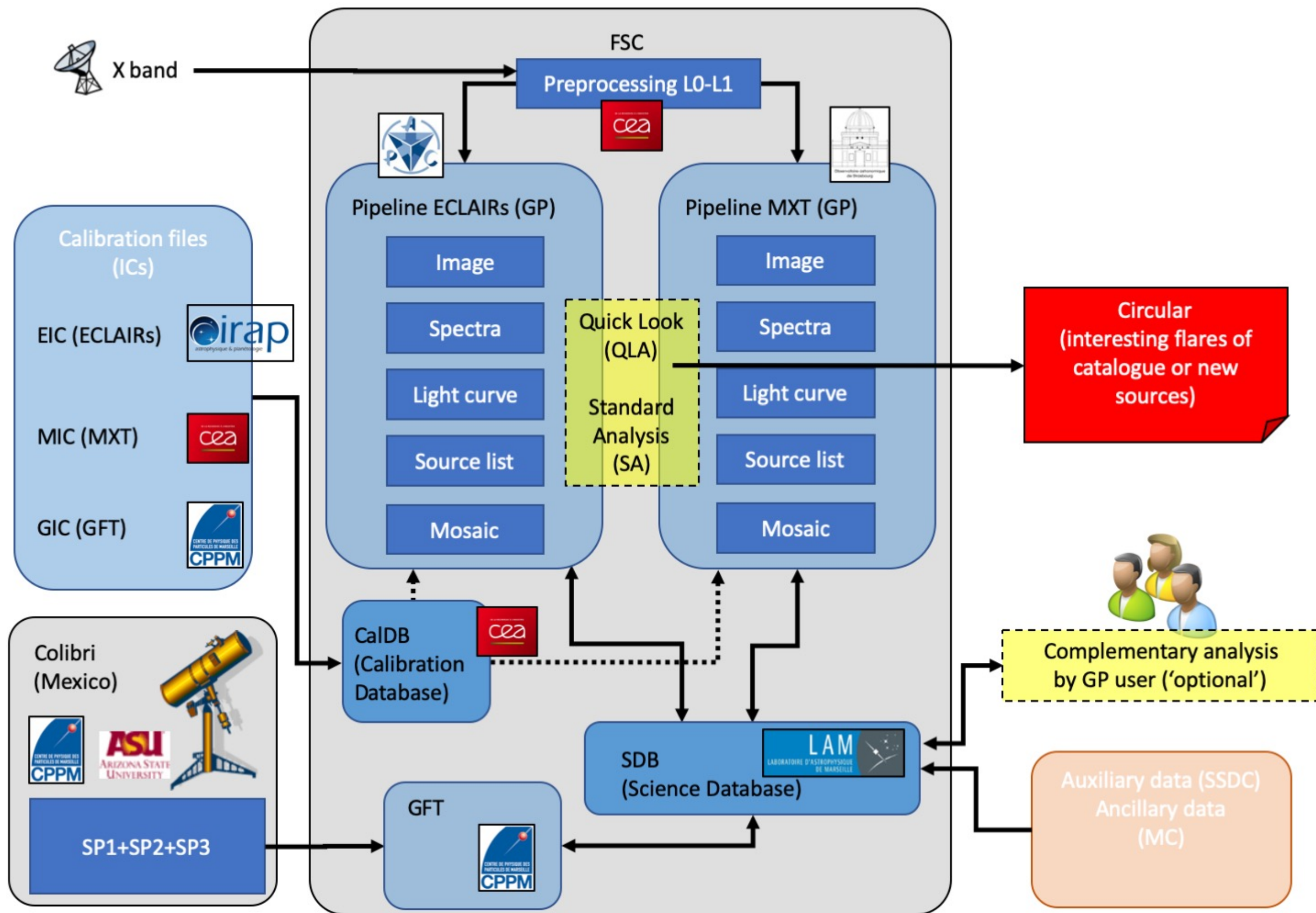


Development plan at FSC

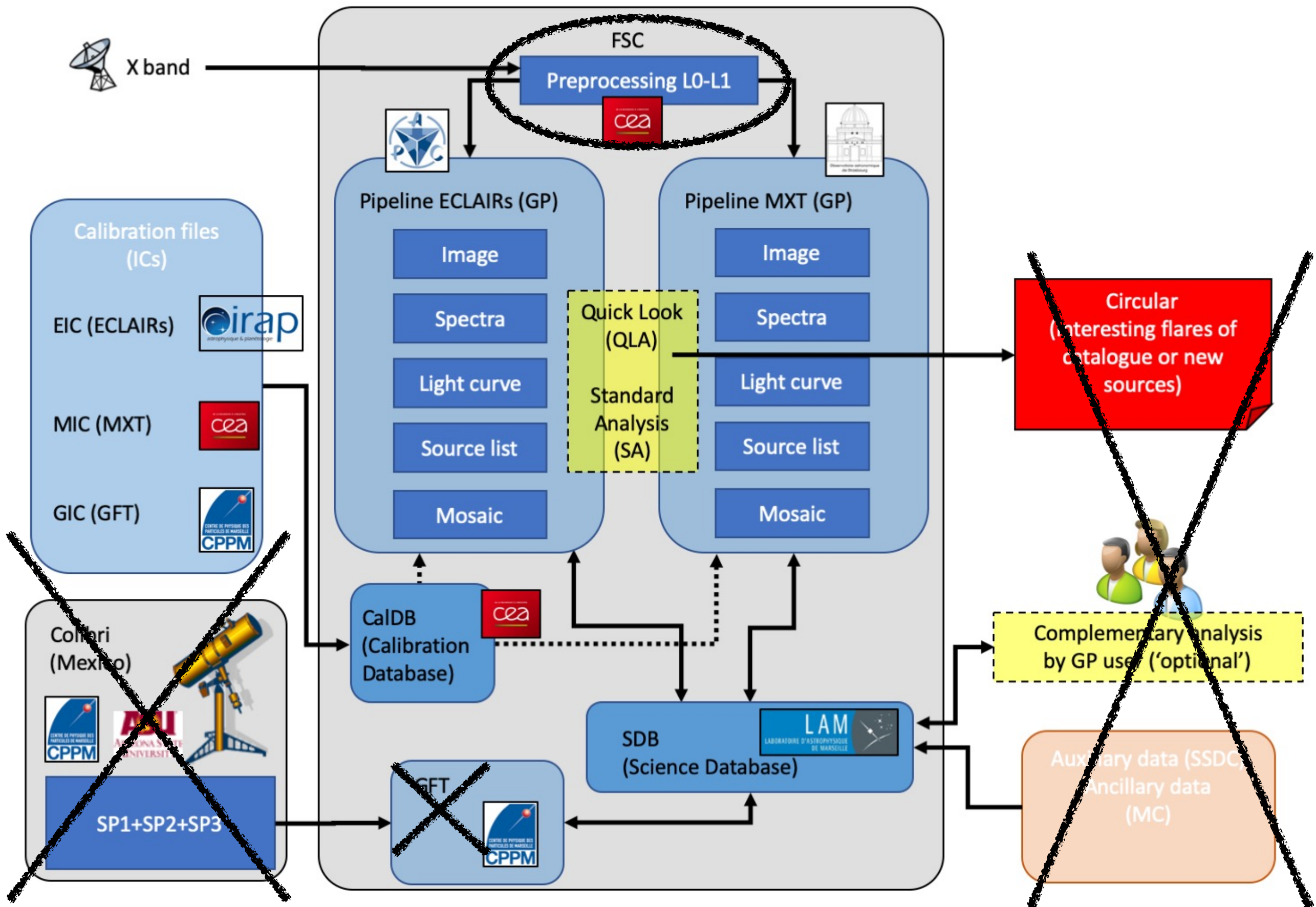


→ Two separate objectives for DC1: **VHF data** for the Core Program, **X-band data** for the General Program

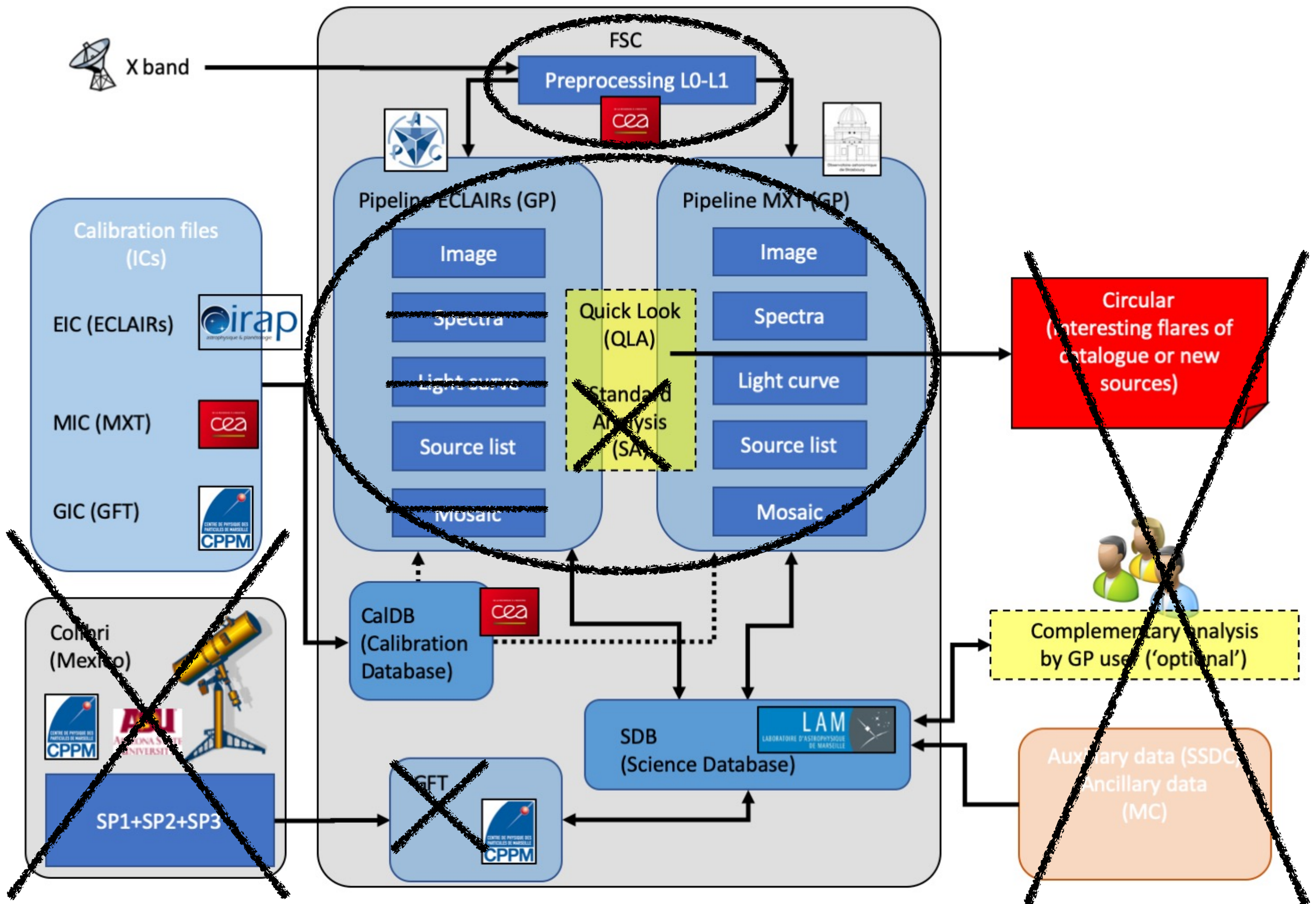
General Program (GP) + TO program (TO-MM excluded)



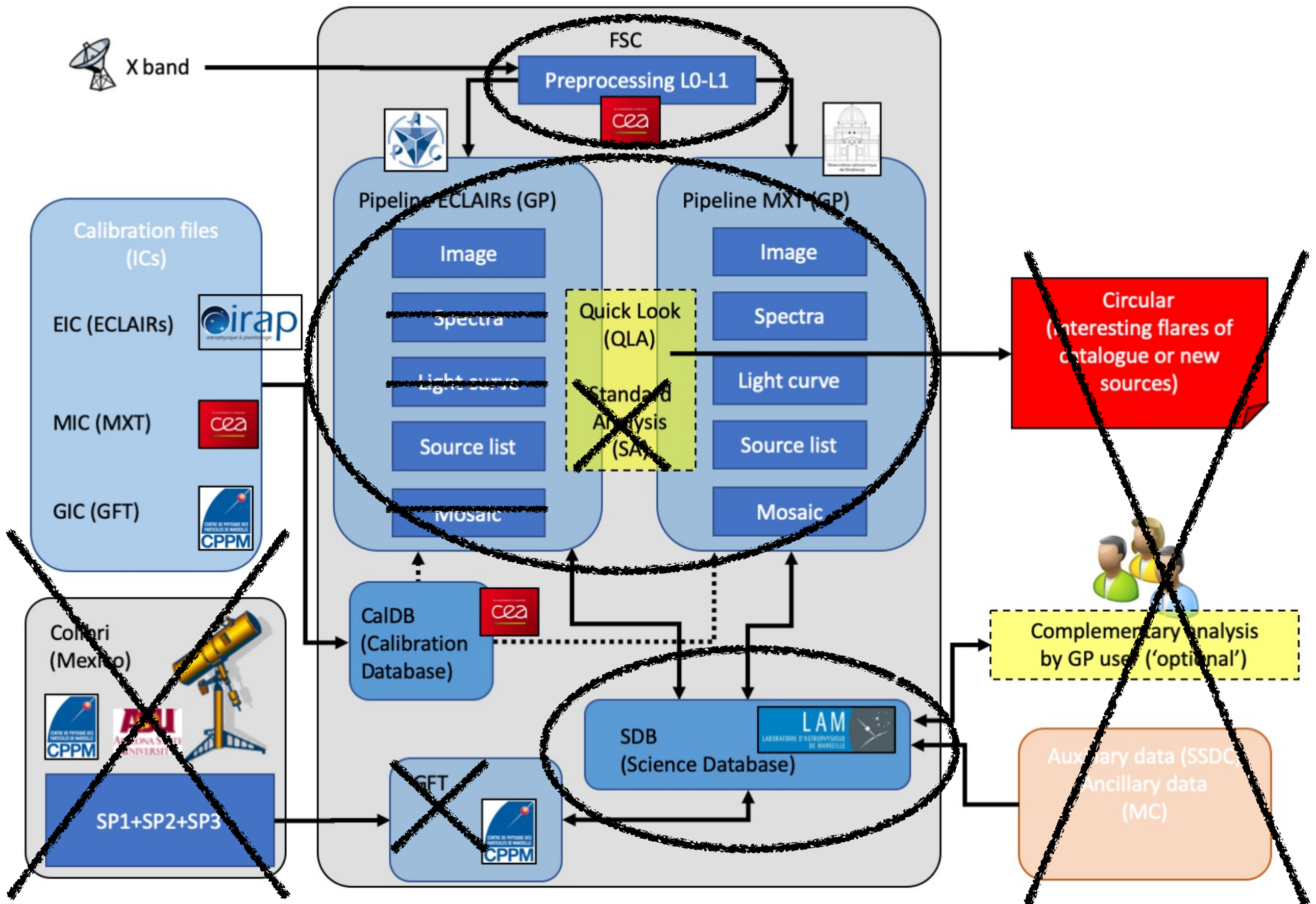
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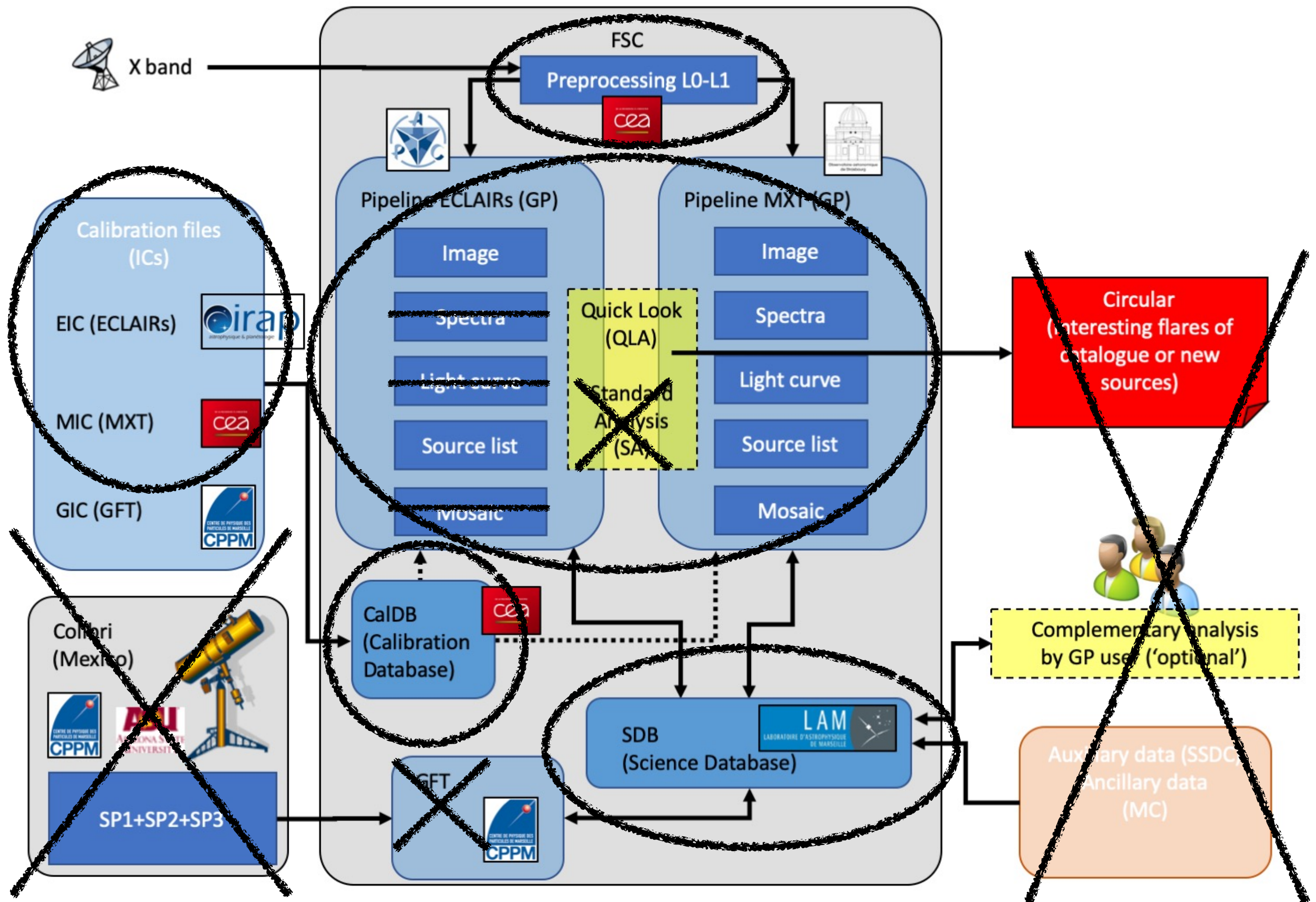
General Program (GP) + TO program (TO-MM excluded)



General Program (GP) + TO program (TO-MM excluded)

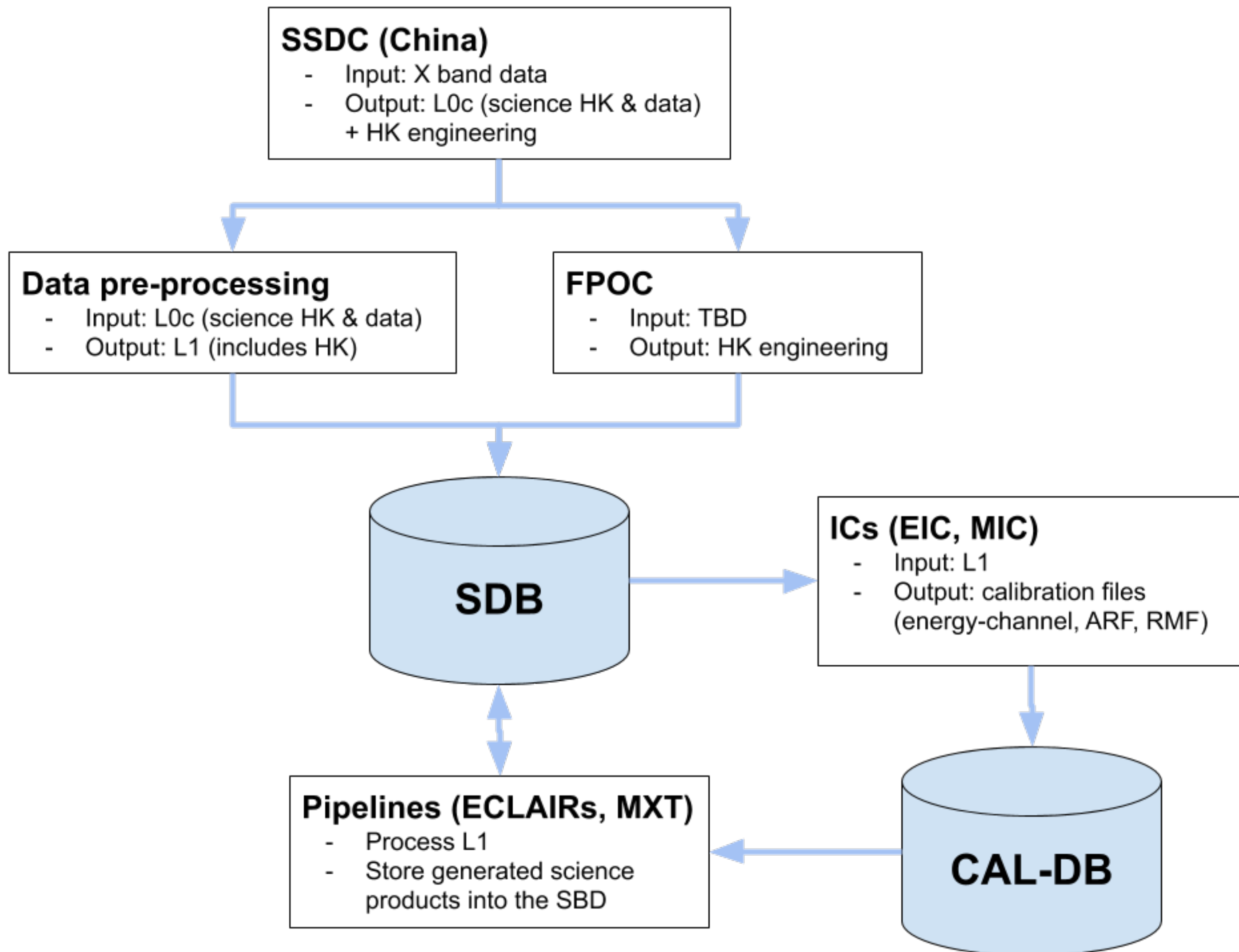


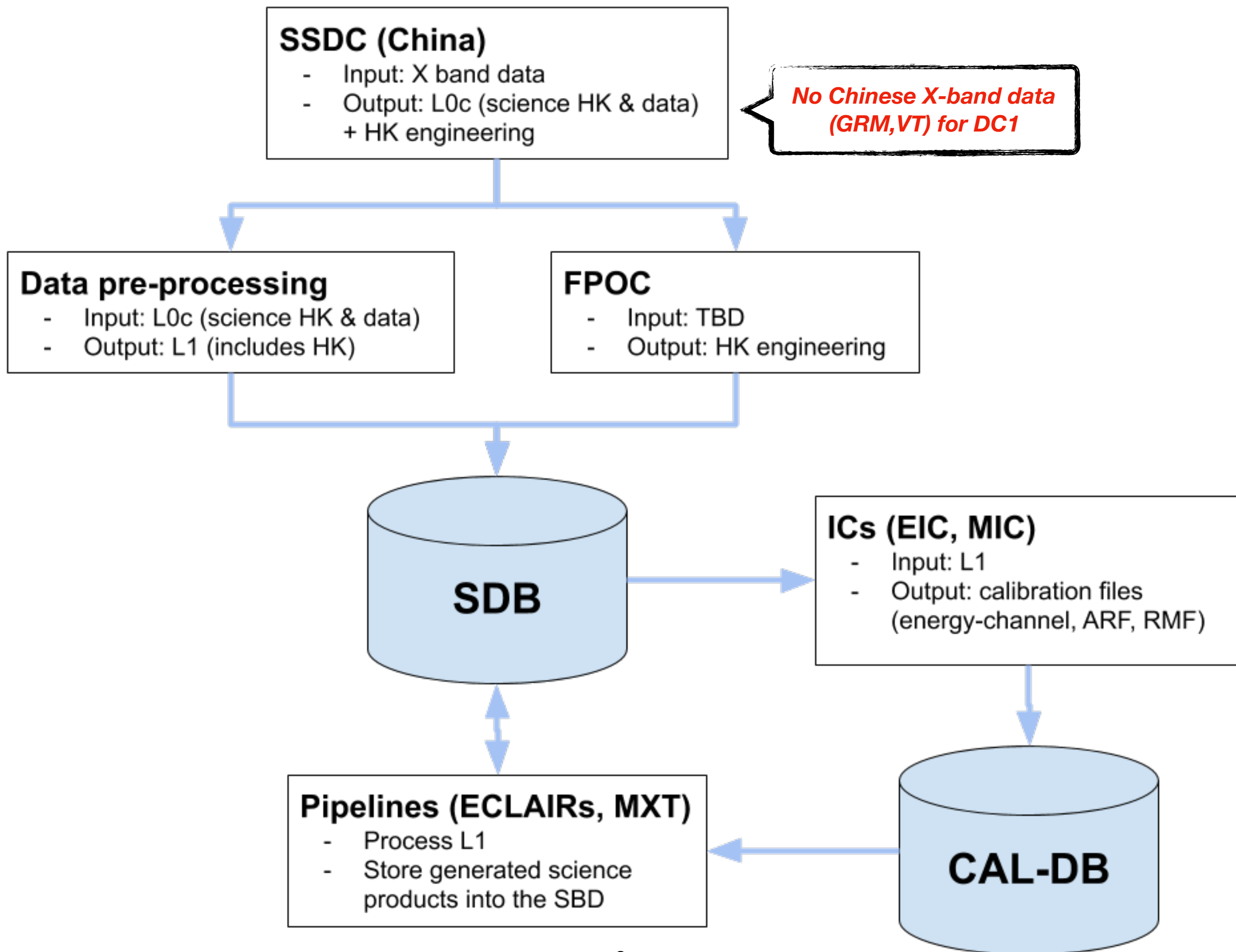
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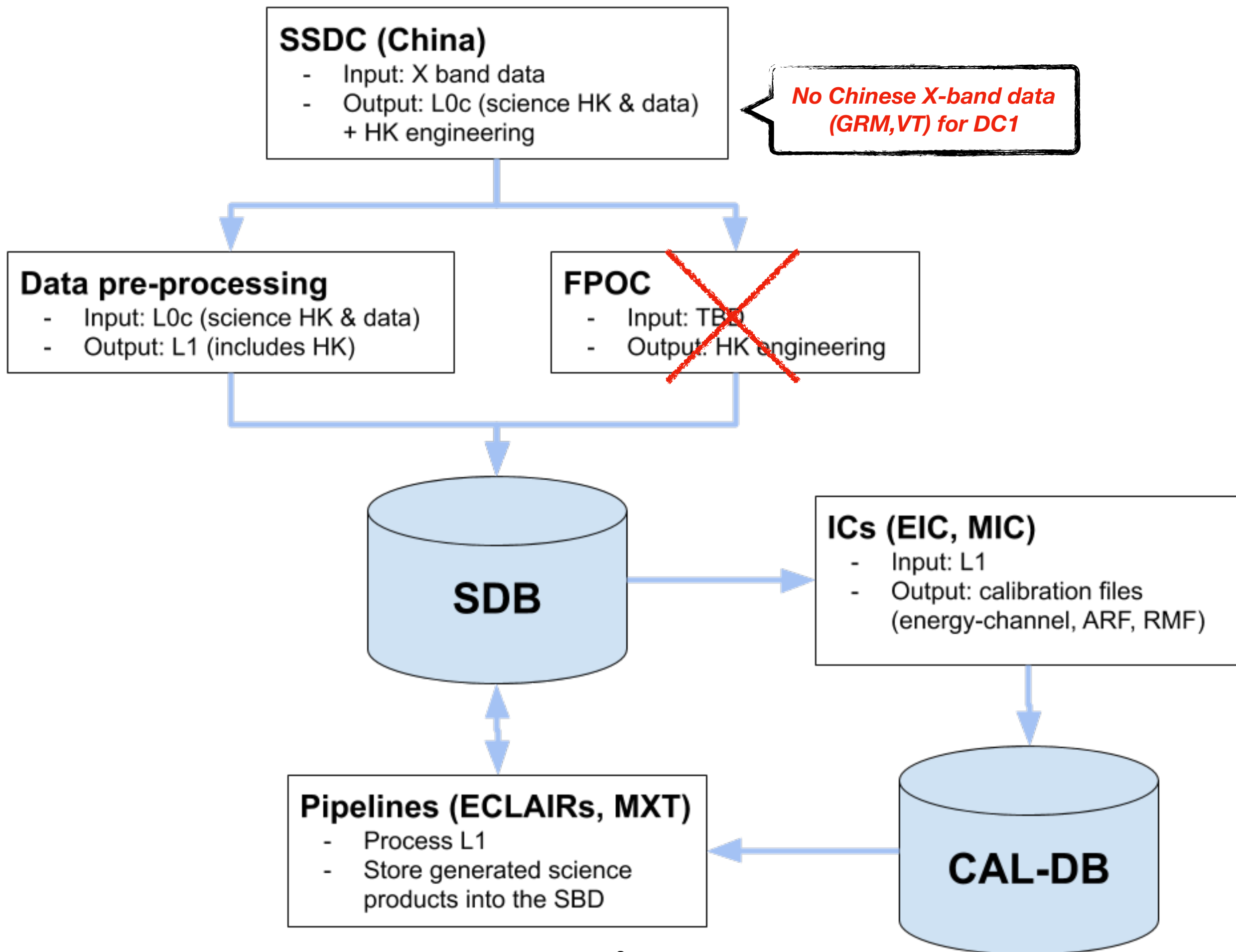


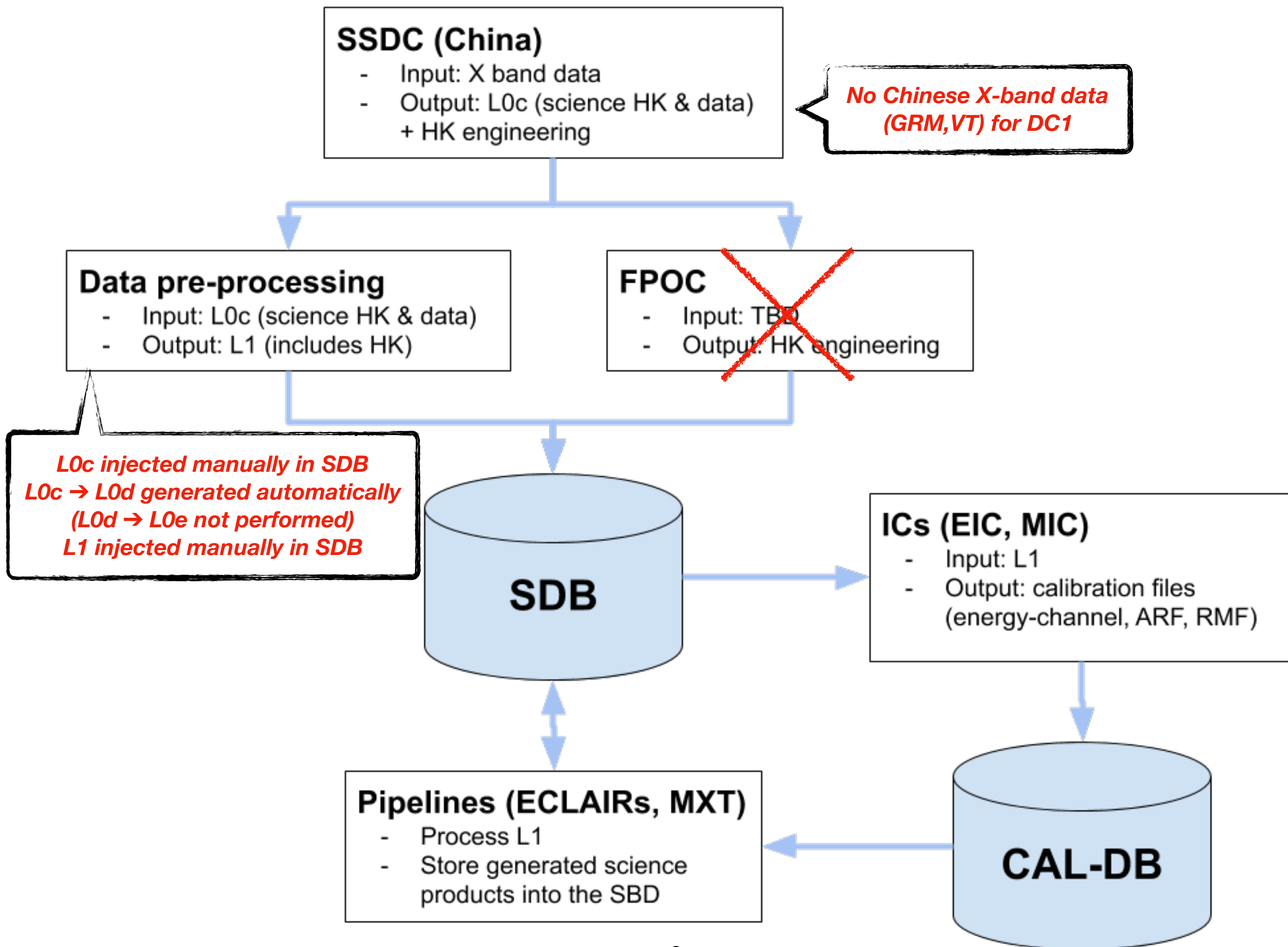
Scientific Scenario for GP

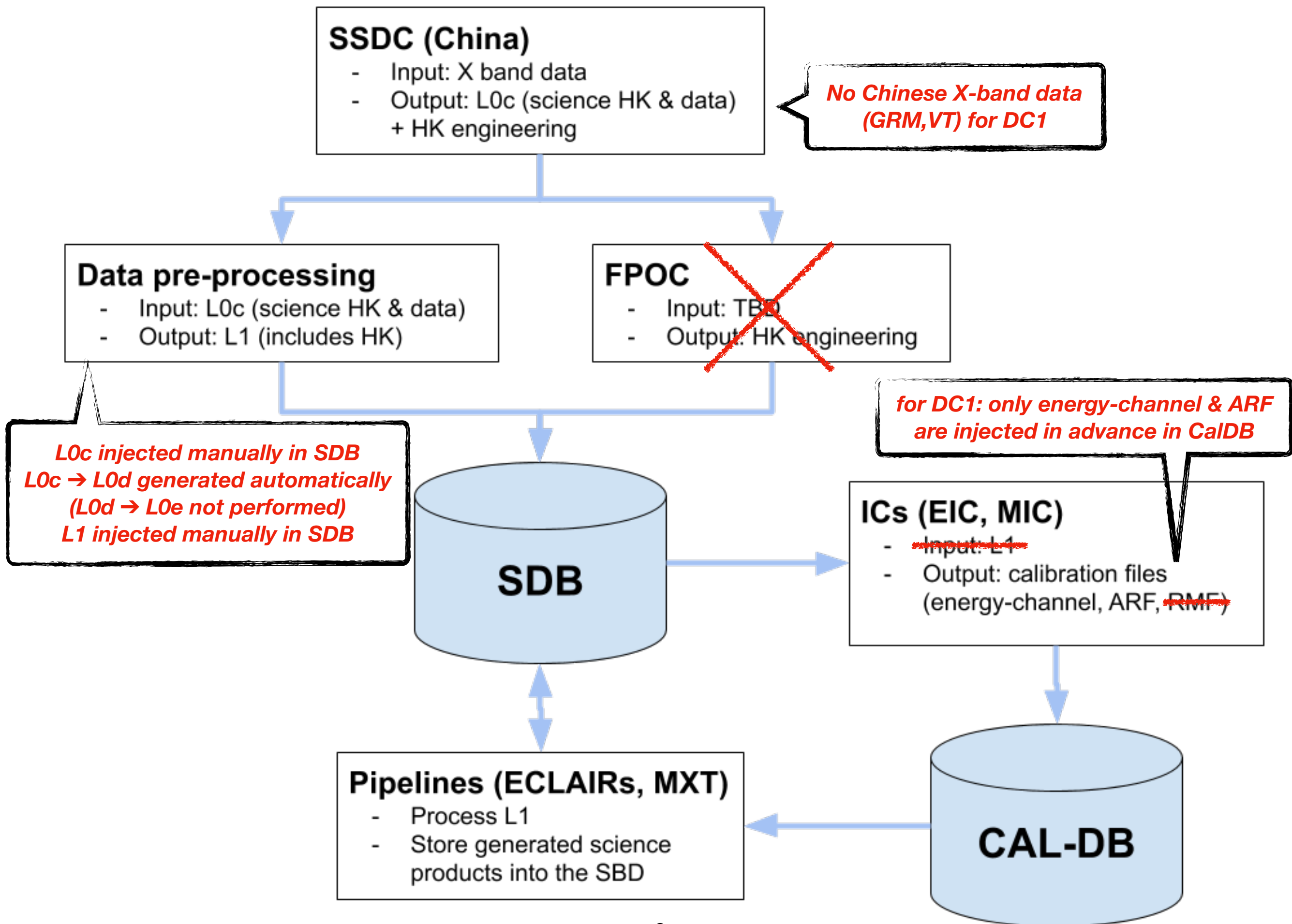
- ▶ **Scenario GP:** based on the CNES file, observation of the Crab Nebula (calibration source for ECLAIRs, strong source for MXT ; duration 30 min ; simple background noise)
- ▶ **Practical goal:** representative exchanges between the different modules (pipelines, calibration files, database)
 - ➡ implementation of SDB (see presentation by C.Moreau)
 - ➡ implementation of CalDB
 - ➡ implementation of orchestrator (for L0c → L0e processing)

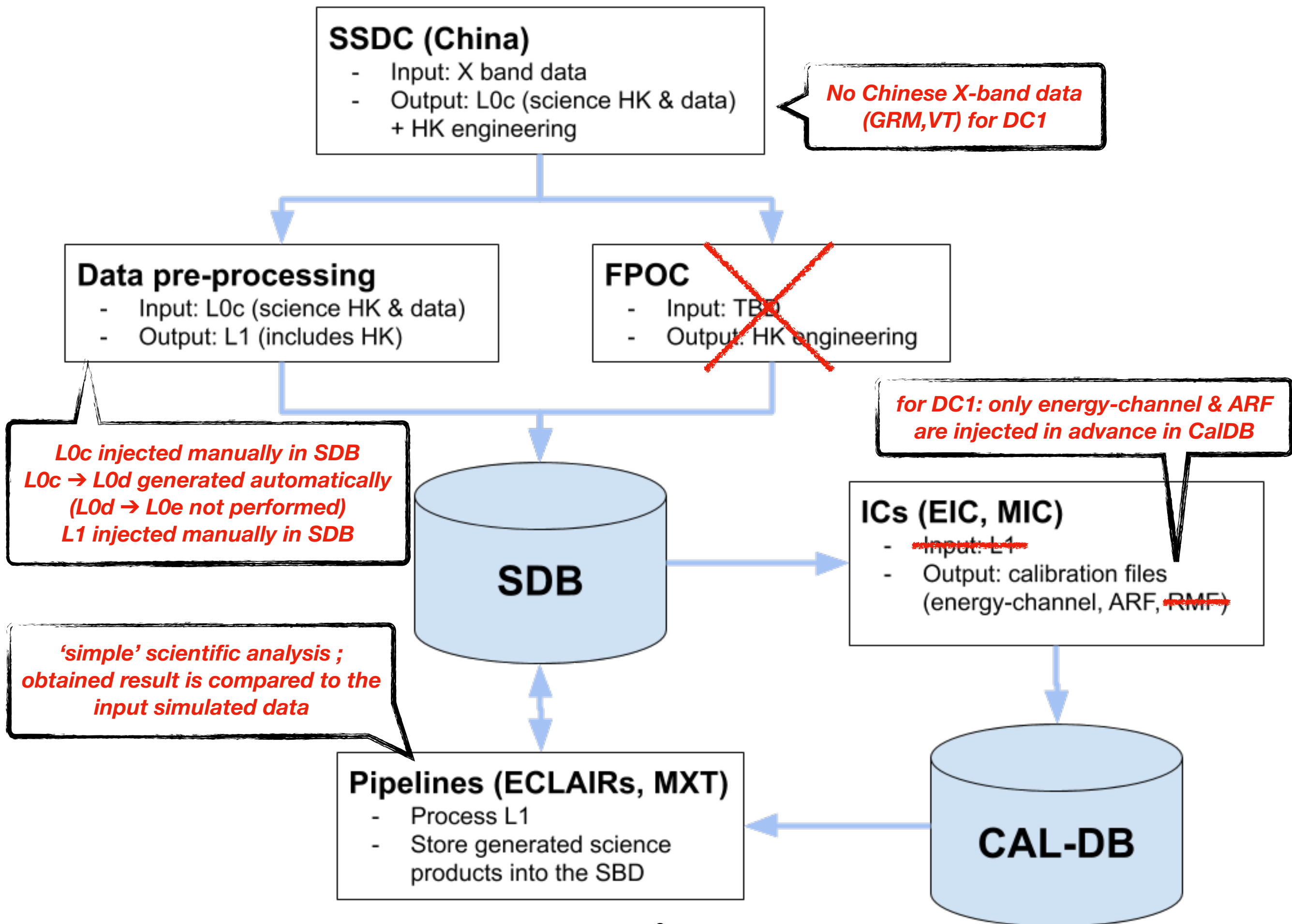












ToDo list for DC1/GP

(Summary for French/Chinese actions)

- ▶ **No action for GP since no Chinese X-band data (GRM,VT) are used for DC1**
- ▶ **Optional, test access to the SDB (only useful for DC1/ Core Program)**

CP (B.Cordier)



VHF band



X band

FSC

GRM countrates
("ECLAIRs first" trigger)

N1 (ECL high SNR)
N1a (ECL low SNR)
N1b (GRM only)

N2a (ECL & GRM)
N2b (MXT)
N2c (VT)
N2d (Colibri)

N3 (ECL & GRM)
N3 (MXT)
N3 (Colibri)

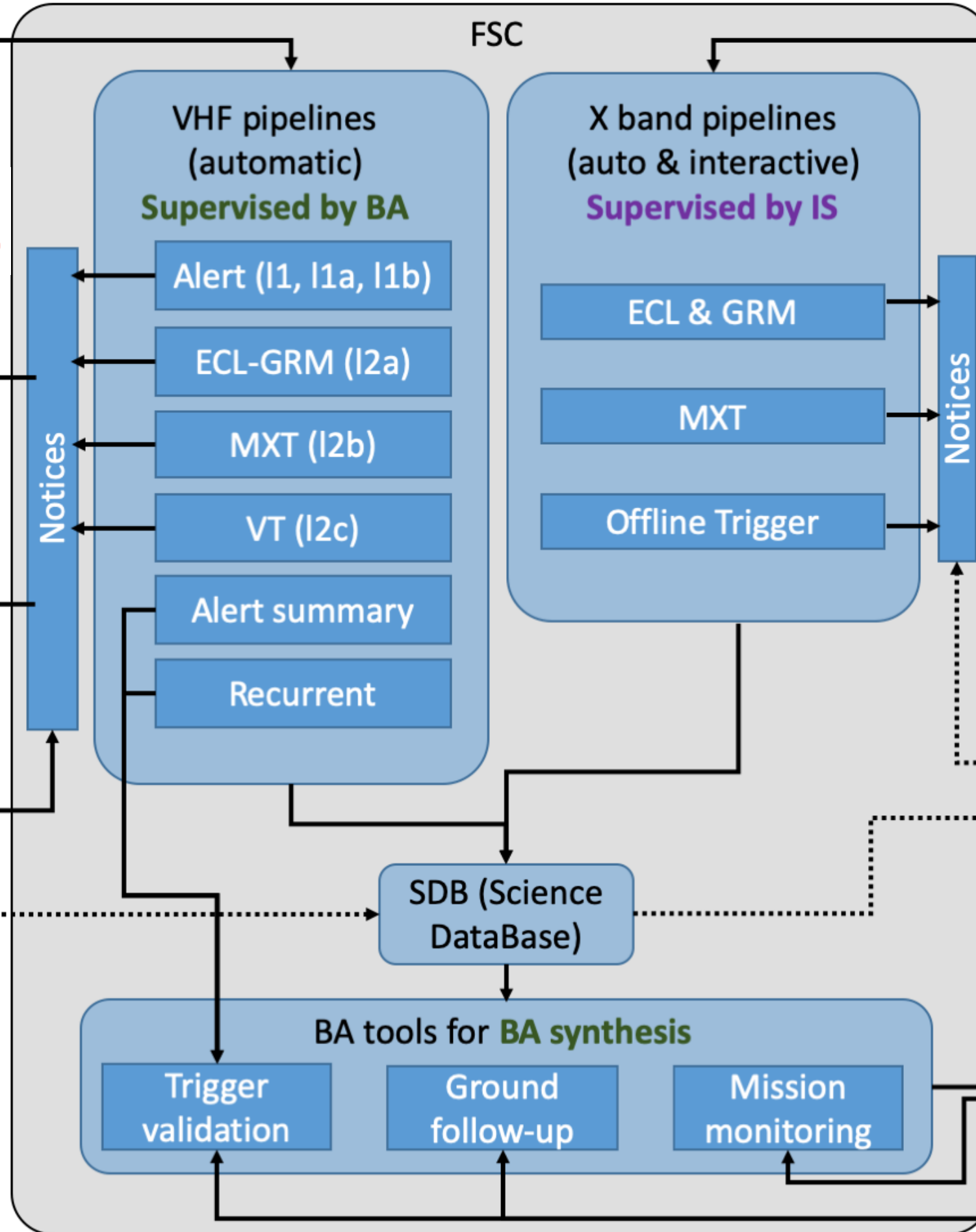
Colibri pipeline
(interactive)
Supervised by IS

SP L3
GIC (Marseille)

Circular

Operation plan
(from FPOC)

External data
(from web site)



Functional diagram for Core Program (CP)



VHF band

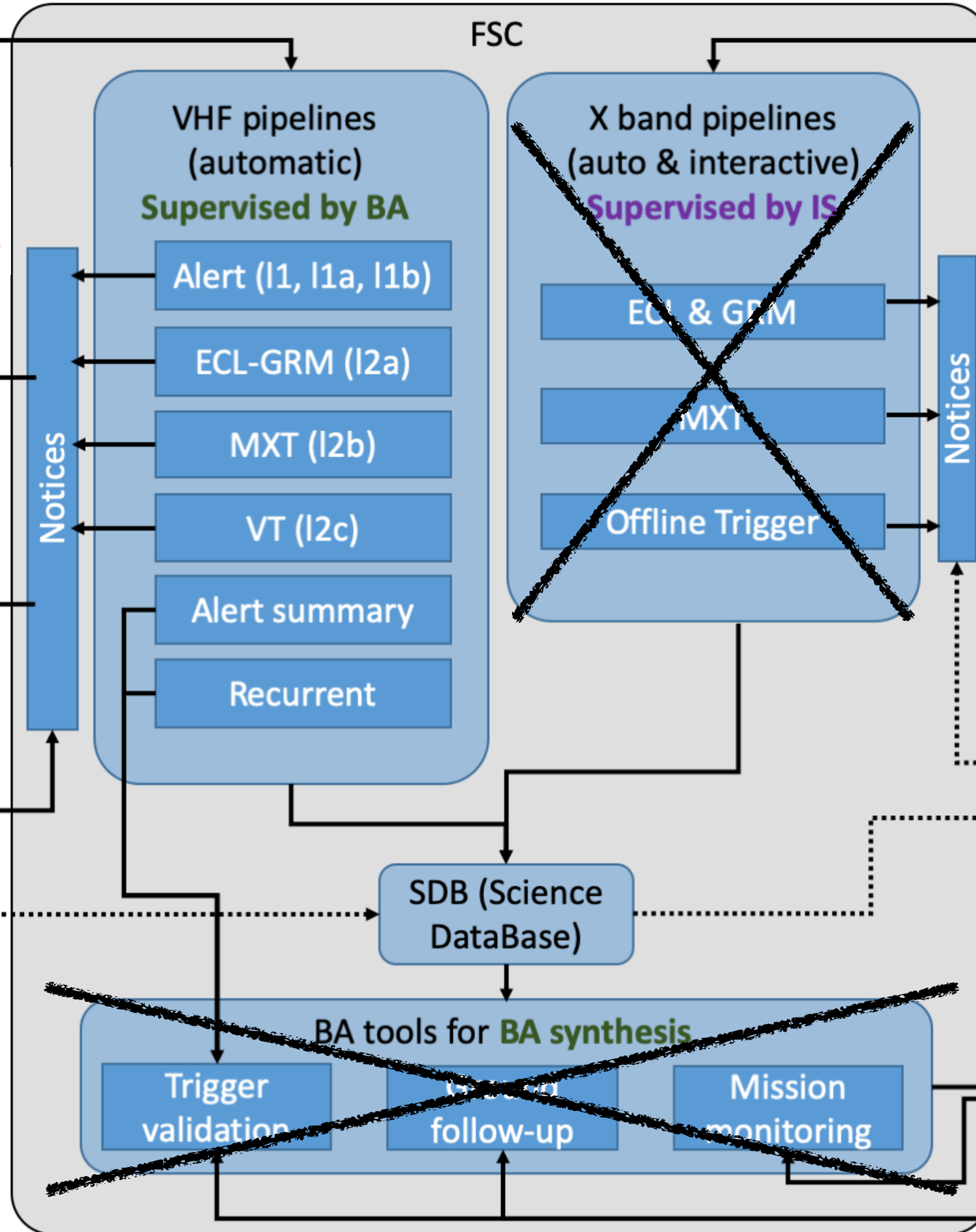
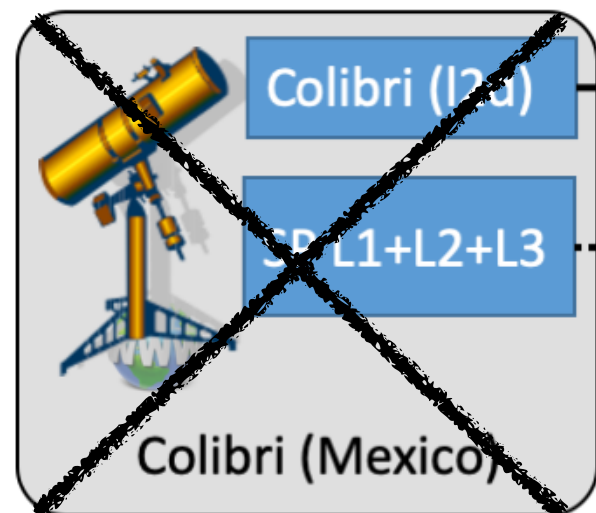


X band

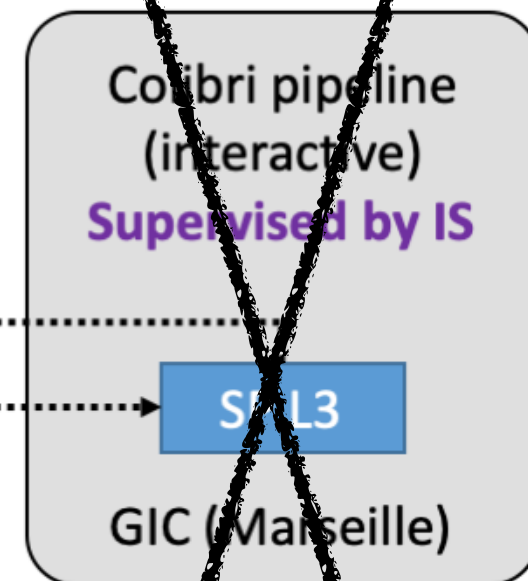
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N2c (VT)
N2d (Colibri)



~~N3 (ECL & GRM)
N3 (MXT)
N3 (Colibri)~~



~~Circular~~

~~Operation plan (from FPOC)~~

~~External data (from web site)~~

Functional diagram for Core Program (CP)



VHF band

FSC

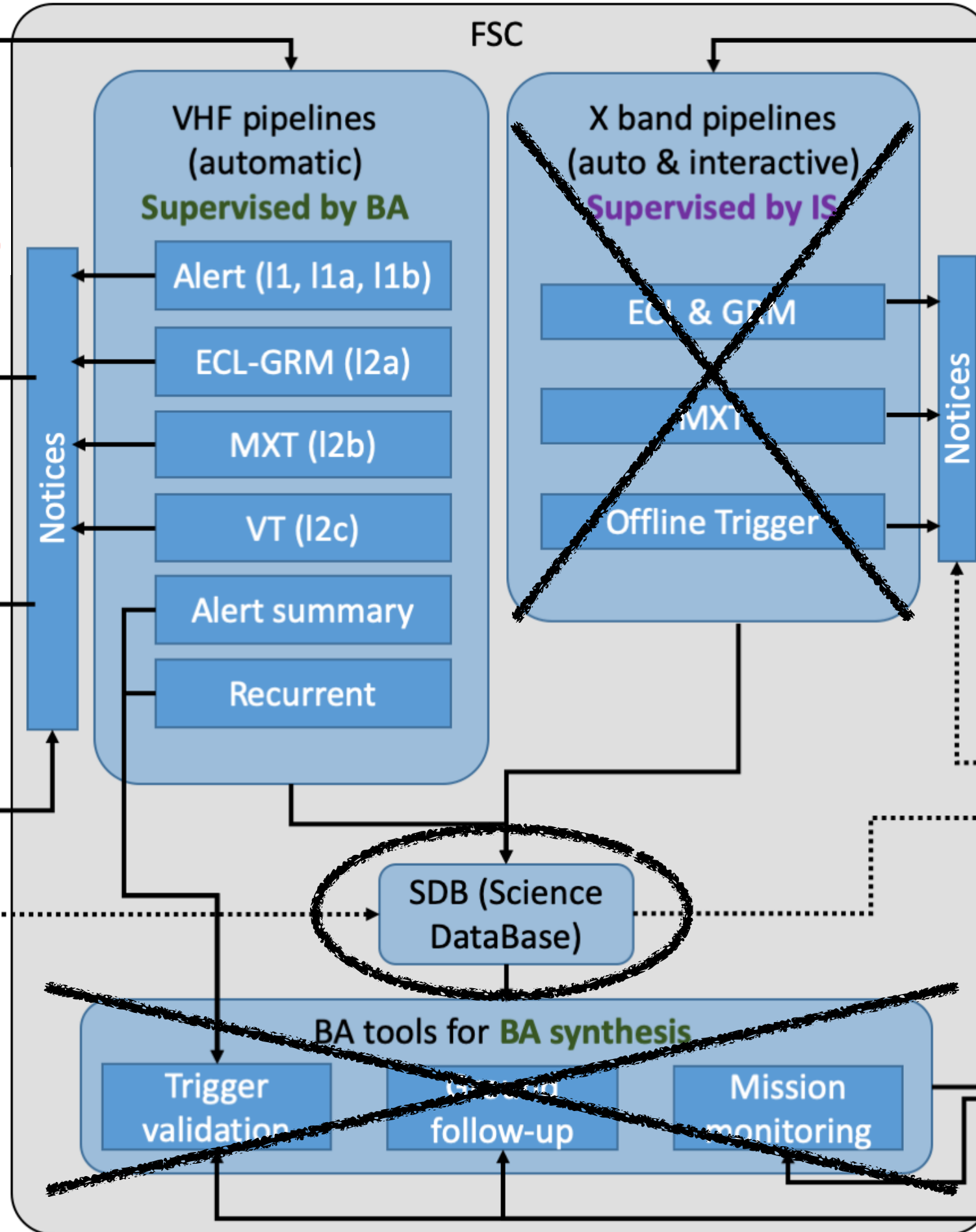
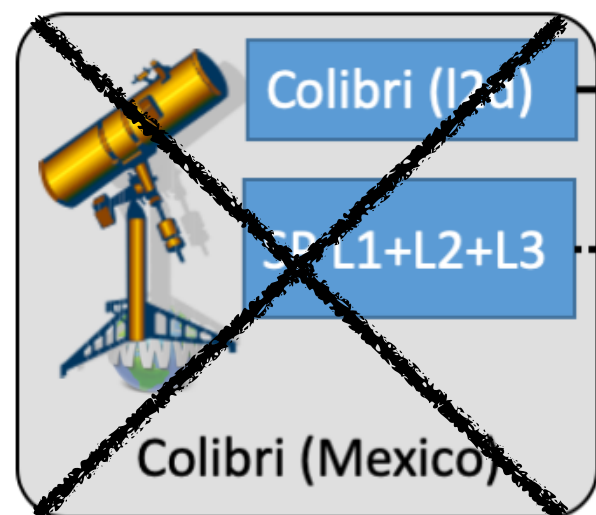


X band

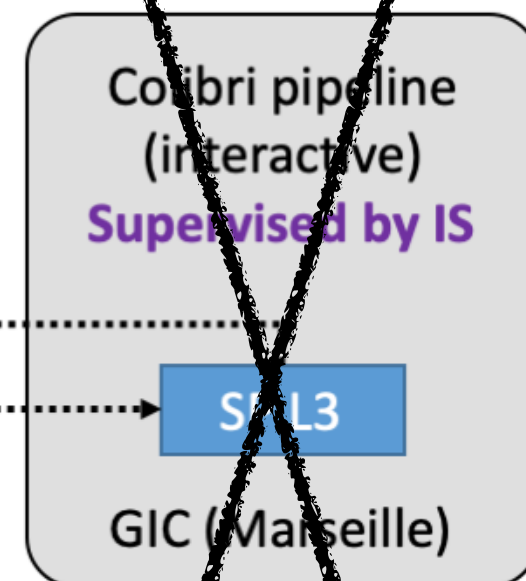
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~~N3 (ECL & GRM)
N3 (MXT)
N3 (Colibri)~~



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~~External data (from web site)~~

Functional diagram for Core Program (CP)



VHF band

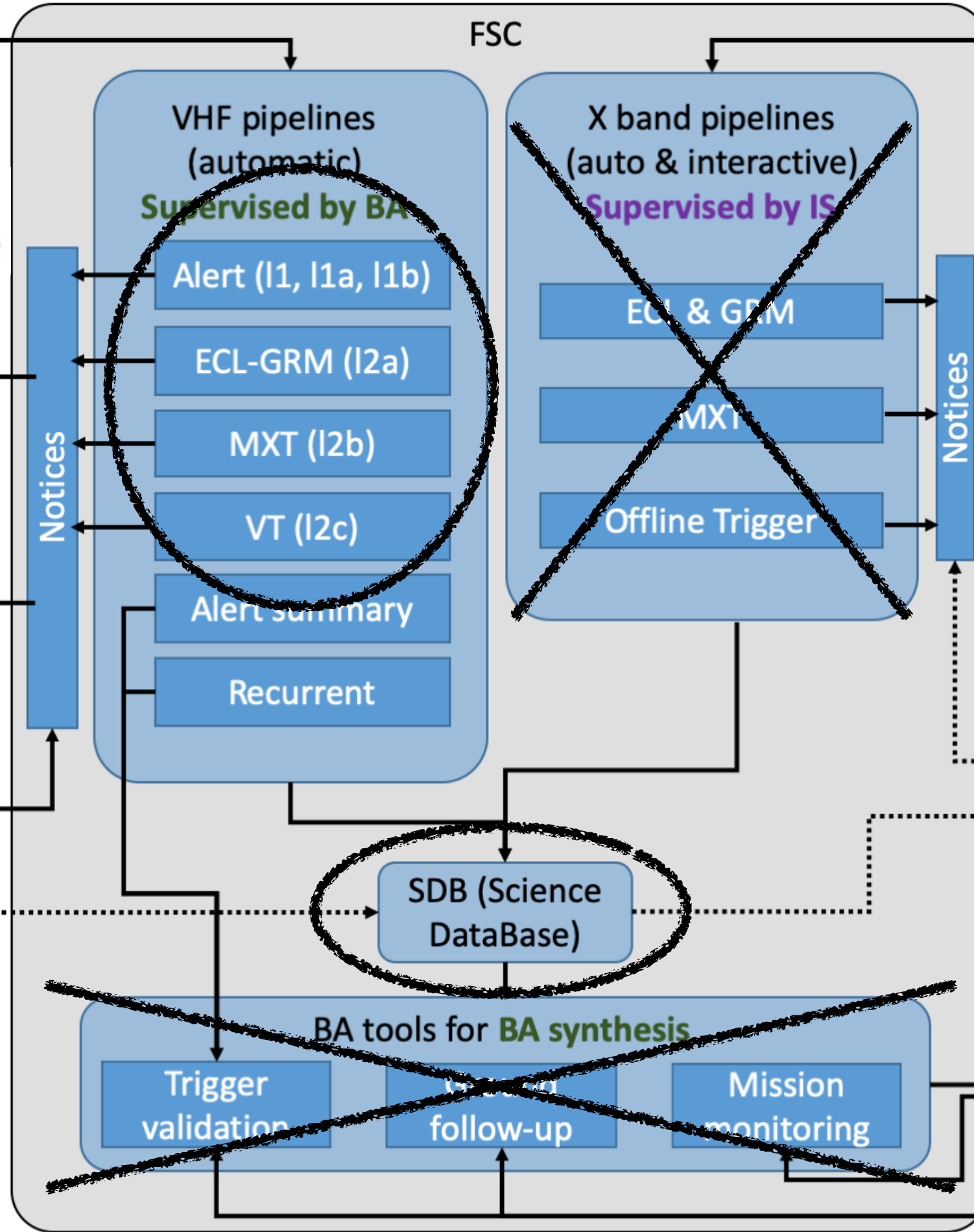
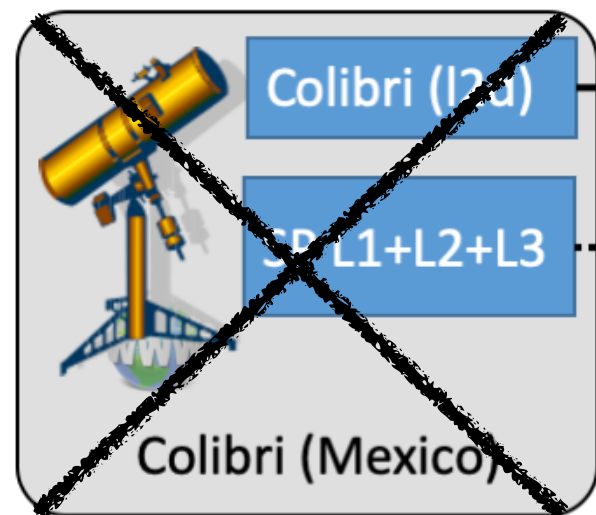


X band

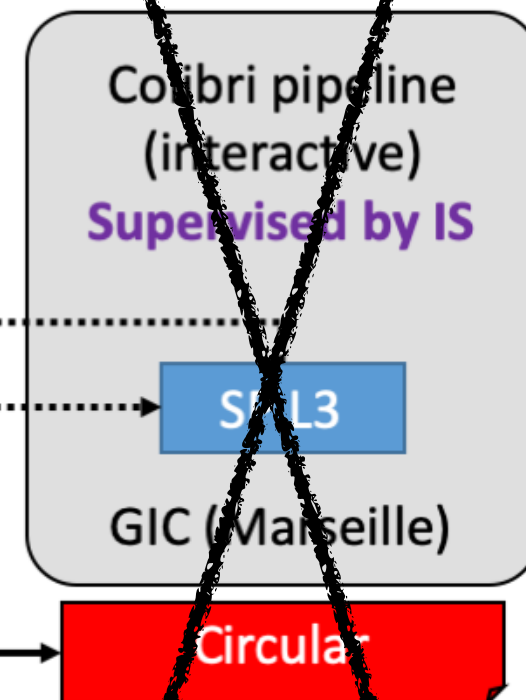
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~~N3 (ECL & GRM)
N3 (MXT)
N3 (Colibri)~~



~~Operation plan (from FPOC)
External data (from web site)~~

Functional diagram for Core Program (CP)

Scientific Scenario for CP

- ▶ **Scenario CP:** based on the CNES file, observation of a GRB (duration 30 min with the Earth outside the field of view) ; the GRB initiates the time sequence of VHF packets for ECLAIRs, GRM, MXT and VT ; packets representative of arrival time, volume and headers
- ▶ This scenario could be used as a reference for system tests
- ▶ **Practical goal:** representative exchanges between the different modules (pipelines, calibration files, database)
 - ➡ implementation of local DB for VHF (VHF-PKT-DB on FSC side)
(see [T.Sadibekova slides presented by B.Cordier](#))
 - ➡ implementation of SDB (see [presentation by C.Moreau](#))
 - ➡ implementation of orchestrator (for data analysis chain)
 - ➡ implementation of sending VOEvent

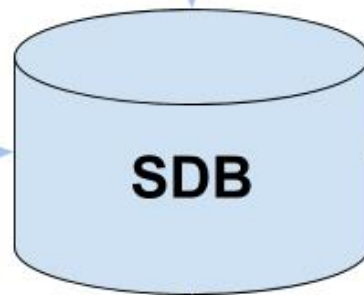
VHF packet management

- Input: VHF raw data packets received at FSC
- Output: sorted and decoded packets (json)



VHF Alert & Recurrent

- Loading packed GRB alert data from VHF DB
- Pre-processing to create ECL and GRM I1, I2 data product (fits)
- Refresh data regularly in the SDB



Pipeline MXT

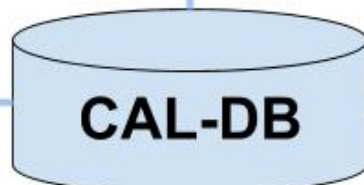
- Loading from VHF DB
- Process VHF I2b data
- Store generated science products into the SDB

Pipeline VT

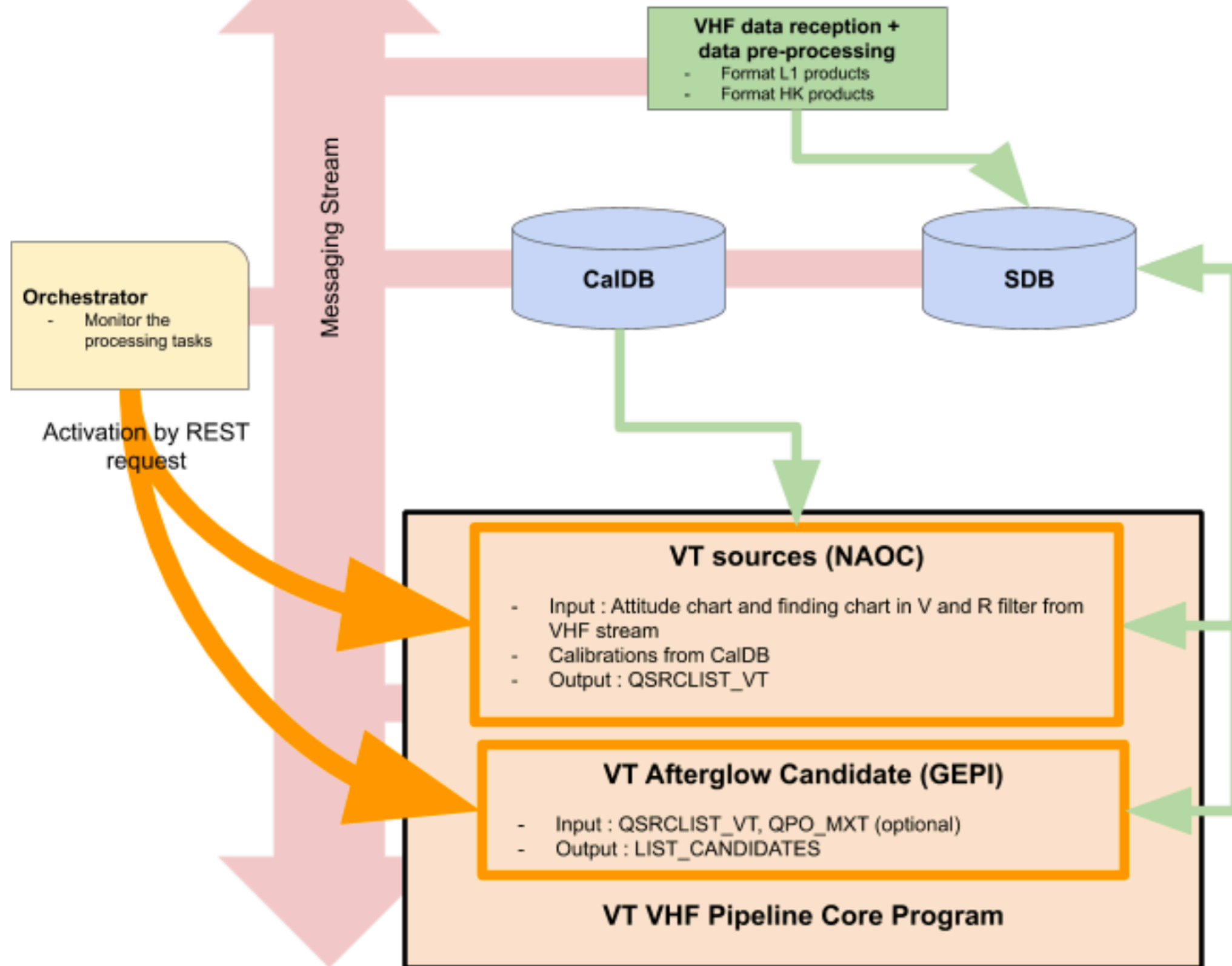
- Loading from VHF DB
- Process VHF I2c data
- Store generated science products into the SDB

Pipeline ECLGRM

- Process VHF I2a data
- Store generated science products into the SDB



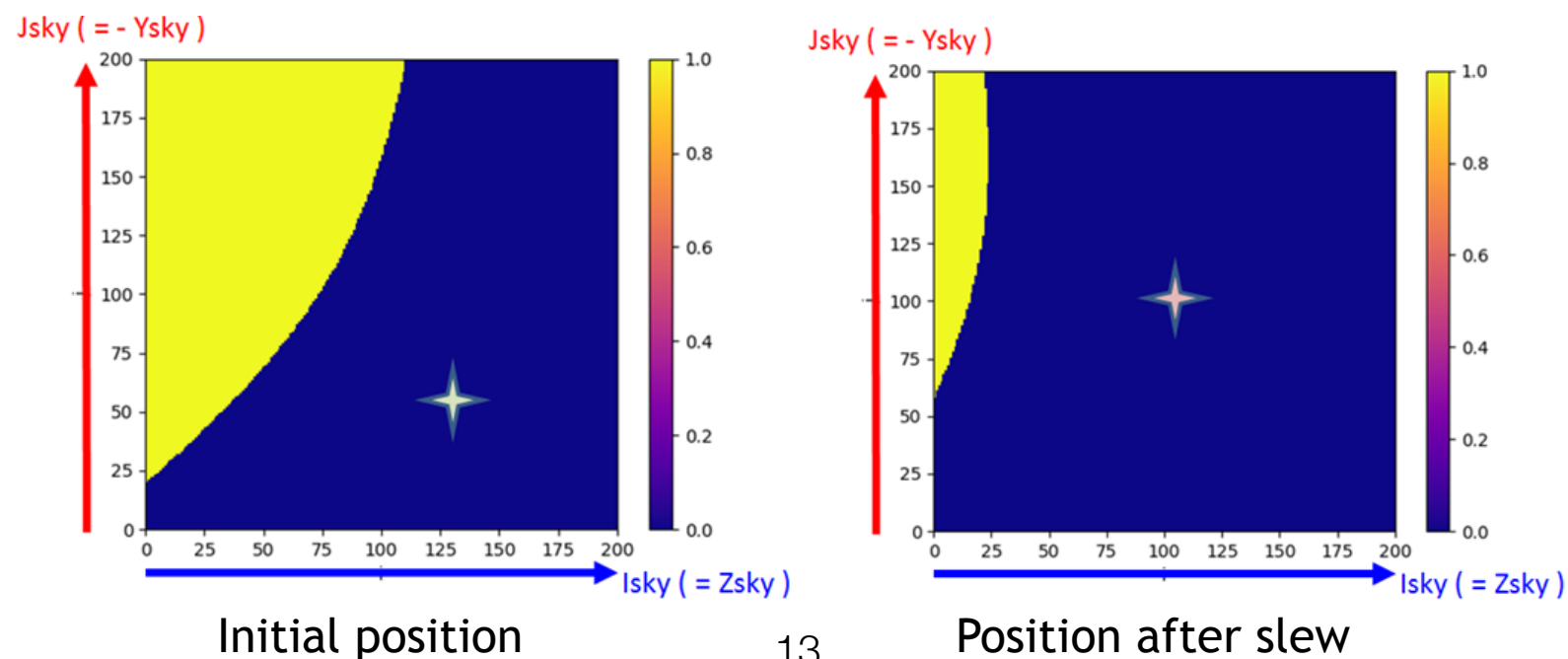
VT VHF Pipeline



Workflow of the VT VHF pipeline at FSC.

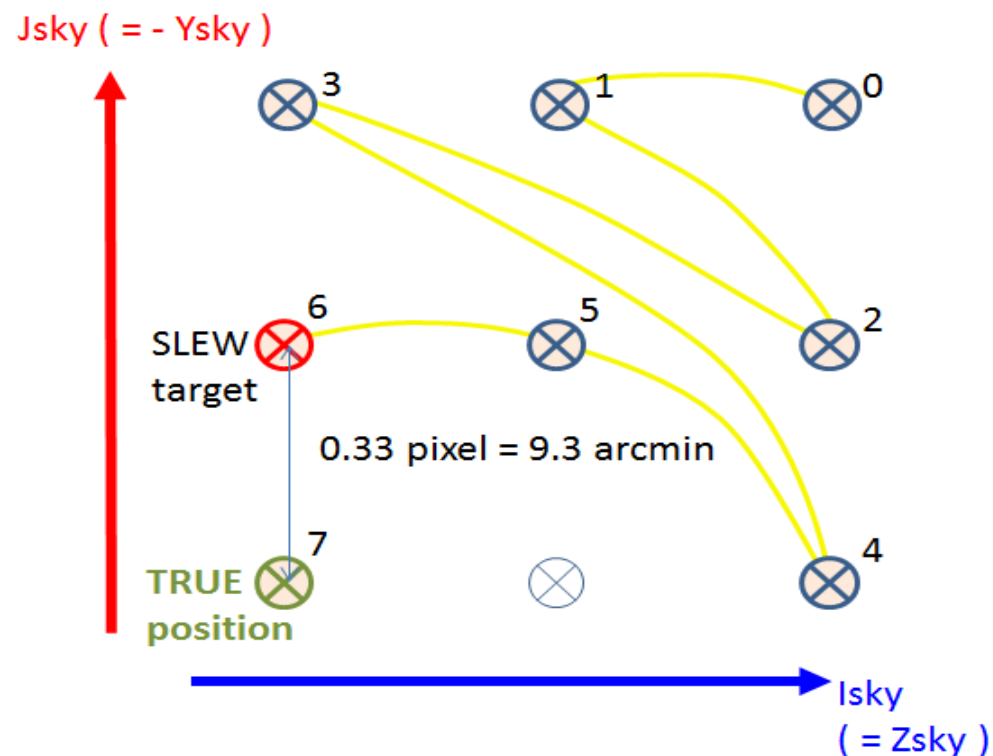
Definition of CP sequence

- ▶ The test sequence will be representative of an orbit (90 minutes). We will place the GRB (for 10 minutes) in a period of at least 30 minutes without the Earth in the FOV of MXT and VT.
- ▶ We refer to the mission scenario file 2021_2023 produced by Jean jaubert.
- ▶ The sequence will therefore be composed of
 - ▶ 8 minutes of GP observation with Earth in the FOV of VT and MXT
 - ▶ 88 seconds of slew starting
 - ▶ 42 minutes of GRB observation
 - ▶ 41 minutes of Earth occultation for VT and MXT (in GRB observation)



Definition of CP sequence

- ▶ We have placed the GRB at the following position (true position):
 $\alpha_{\text{GRB}} = 51.867934049087815$, $\delta_{\text{GRB}} = 46.8115245245158153434$
 (the source is located in the constellation of Perseus)
- ▶ Over an interval of 30s ECLAIRs emits 7 packets with 7 different positions.
- ▶ In the 7th packet, a slew is requested by the platform.
- ▶ We artificially introduced an error between the ECLAIRs position and the true position of the GRB. This error is equal to 9.3 arcmin.



Isky,Jsky= 128.63, 57.15 pix
 theta,phi = 26.83°, 33.75° (CAMf)

- ▶ The location provided by MXT will be positioned 50 arcsec from the true position of the GRB. The associated error box will be 60 arcsec.
- ▶ This location will be repeated every 30 seconds for 20 minutes then every 5 minutes until the Earth occultation.
- ▶ The VT will produce its finding chart using the MXT position and the associated 60 arcsec error box.
- ▶ A new source will be inserted in the VT finding chart at 2 arcsec from the true GRB position.

Definition of CP sequence

Example of file for data injection

first alert packet

[illegible]

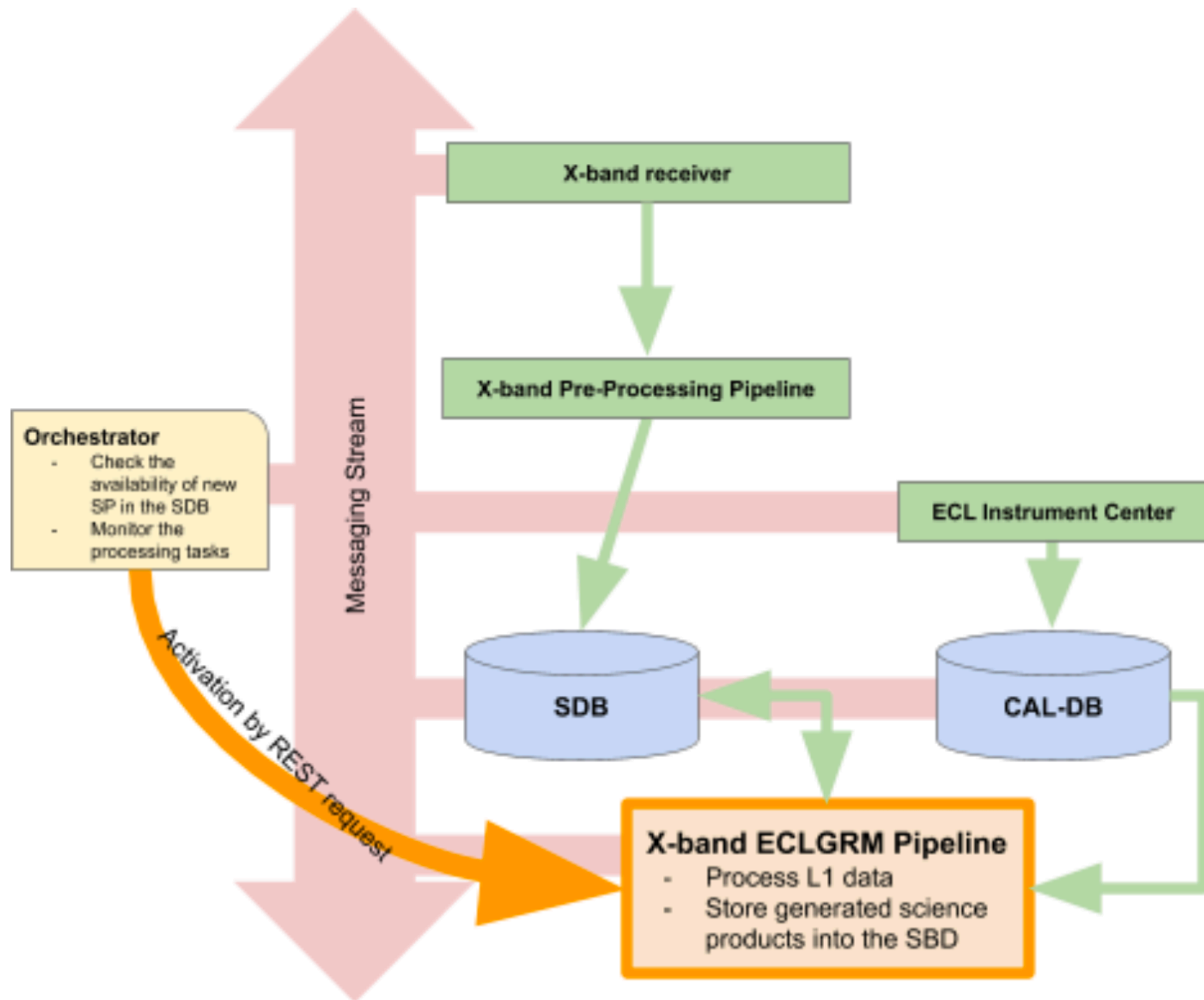
slew request

ToDo list for DC1/CP

(Summary for French/Chinese actions)

- Y.Qiu, to provide the content of the VT packets to be injected into the simulator
 - attitude charts + finding charts + 1 bit sub-image
→ contact person is T.Sadibekova (CEA)
- M.Huang, to provide the container that will be integrated into the FSC architecture and process VHF data
 - one interface with the VHF-PKT-DB → contact person is A.Formica (CEA)
 - one interface with the SDB → contact person is C.Moreau (LAM)
 - one interface with the orchestrator → contact person is H.Louvin (CEA)

Backup slides



Functional diagram of the X-band ECLGRM pipeline at FSC.

Definition of CP sequence

Scenario for data reception

no hole

with hole

ECLAIRs/GRM

	Délais de réception en s après le Slew request	
	Scénario sans trou	Scénario nominal
ECLLCURHP1	(-22)-30	(-22)-30
GRMLCURHP1L	28-72	28-72
ECLLCURLP1	84-376	84-2648
GRMLCURLOP	178-378	2650-2768
ECLALDESCX	74-82	74-82

MXT

	Délais de réception en s après le Slew request	
	Scénario sans trou	Scénario nominal
MXTPOSITIO	110	890
MXTPHOTONL	112-130	1072-1092

VT

	Délais de réception en s après le Slewrequest	
	Scénario sans trou	Scénario nominal
VTATTCHART	222-226	1182-1186
VTFCHARTR	422-480	902-960
VTFCHARTB	482-540	962-1020

Definition of CP sequence

Current status

ETAPES	DESCRIPTION	RESPONSABLE	
1	Définition de la séquence d'envoi des paquets ECLAIRS+GRM de L'UGTS -> PDPU	CEA	OK
2	Création du fichier d'interface décrivant la séquence des paquets et la visibilité des stations VHF	CNES	OK
3	Insertion dans le fichier d'interface des éphémérides : Temps, Quaternions, Positions satellite	CNES	OK
4	Insertion dans le fichier d'interface des données scientifiques MXT : MXTPOSITO, MXTPHOTONL	CNES	OK
5	Insertion dans le fichier d'interface des données scientifiques ECLAIRs : ECLALERT1, ELLCURHIP, ELLCURLP1, ECLSUBIMAG	CEA	On going
6	Insertion dans le fichier d'interface des données scientifiques GRM : GRMLCURHIP, GRMLCURLOP	CEA	On going
7	Insertion dans le fichier d'interface des données scientifiques VT : VTATTCHART, VTFVHARTR, VTFCHARTB, VTSUB1ALLR, VTSUB1ALLB	CEA	On going