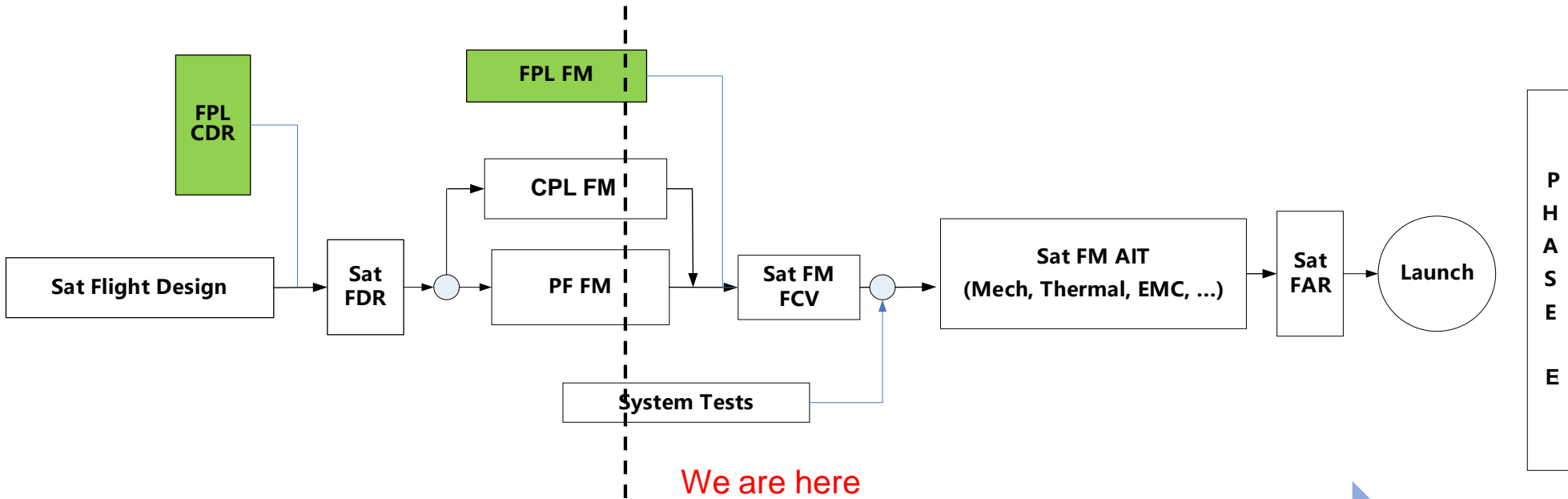


SVOM

Space-based multi-band astronomical Variable Objects Monitor



Logic of the phase D working plan



System Level Progress In Phase D

⇒ System Requirement

- ✓ Update of system level documents, including MRR, SRD, observation management, system parameter file
- ✓ Issue of system level documents, including Beidou system requirements in SVOM and VT data on-board processing requirements
- ✓ Close of CDR recommendations, findings and actions in progress

⇒ System Interfaces

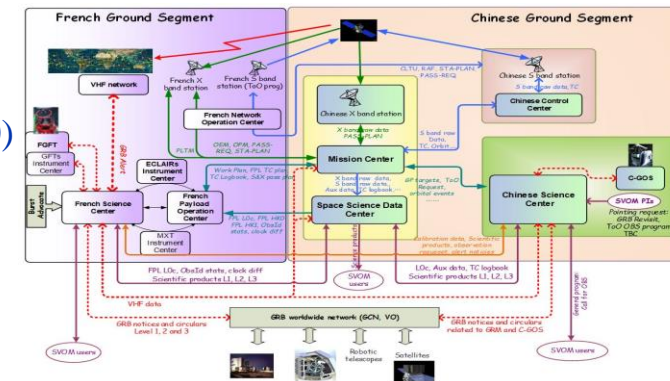
- ✓ Board to ground interface spec and budget was updated and conformed.(S,X,VHF),
- ✓ Beidou short message interface specification is in preparation.

⇒ System verification activities

- ✓ E2E QM system test (2020.9-2021.3, scenario #1 & #2 & complementary)
- ✓ Ground Programming Loop System Test (planning: 2021.4-2021.10, start:2021.10)
- ✓ Validation and compliance status check of requirements is on-going

⇒ System meeting

- ✓ Progress Meeting 2021.6.29~7.2
- ✓ **Key Point Meeting early 2022**



⇒ Satellite Design

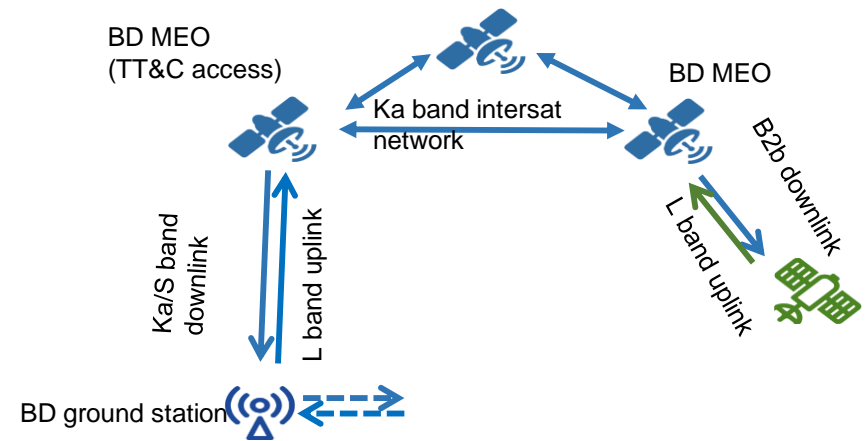
- ✓ Beidou short message detail design;
- ✓ LEOP optimal design
- ✓ Software requirement refinement (OBS management, VT On-Board Processing etc.)

⇒ Software Upgraded and Verification

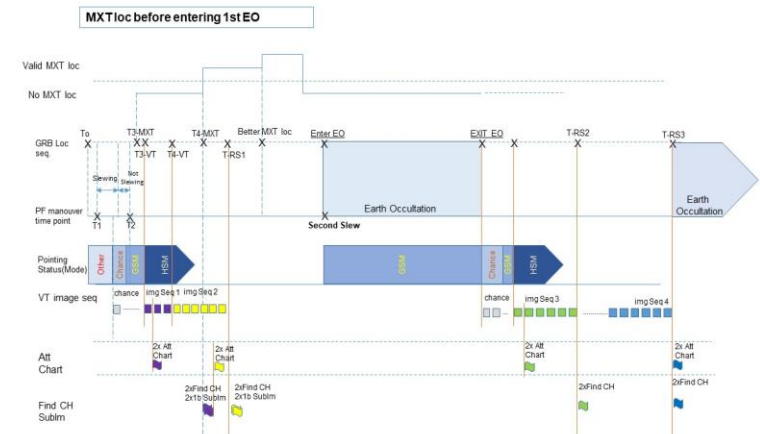
- ✓ Troubleshoot the NCRs in E2E QM test;
- ✓ OBS Management software update, test and verification;
- ✓ AOCS high stability software update, test and verification ;
- ✓ VT On-Board Processing software update, test and verification ;
- ✓ VHF software coverage test and verification.

⇒ Participation in System Test

- ✓ E2E QM system test (2020.9、2020.12、2021.3)
- ✓ Ground Programming Loop System Test in October 2021.



Beidou onboard-ground information flow



VT On-Board Processing Sequence

⇒ FM AIT Preparation

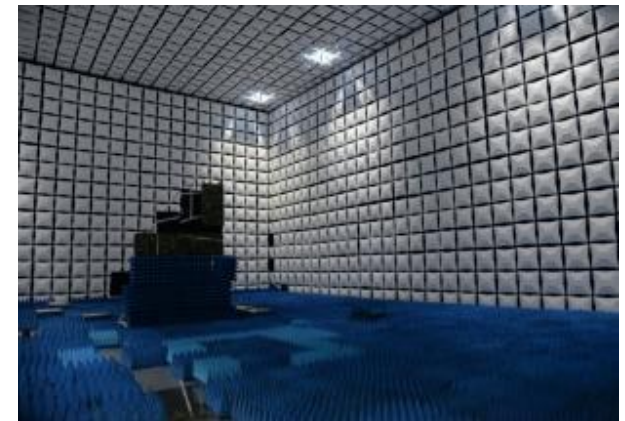
- ✓ FM AIT is located in #1 room of Lingang facility, the cleanliness can meet ISO 8 requirements;
- ✓ In order to reduce the risk, FM conduction test shall be arranged immediately after satellite installation;
- ✓ With the efforts of SECM, it is expected that the FM EMC test can be done in the SECM's EMC test room in Lingang.



AIT Room

⇒ FPL shipment and Acceptance

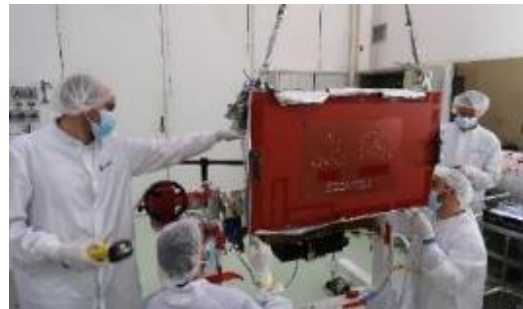
- ✓ FPL FM has confirmed that it can be imported from Shanghai.
- ✓ It has been confirmed that the return of FPL QM can be postponed until end of 2022;



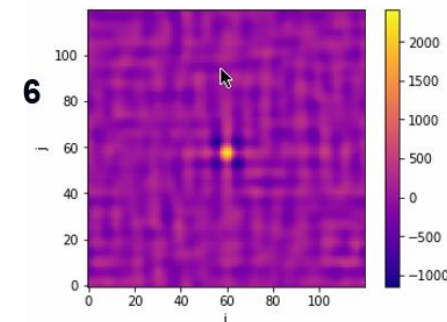
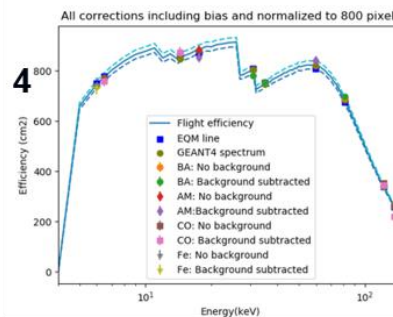
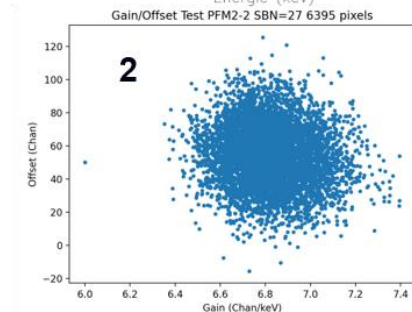
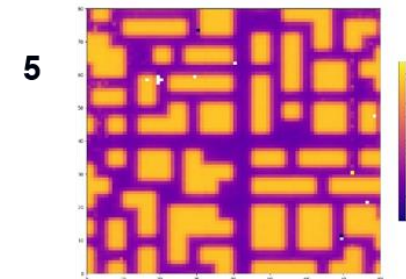
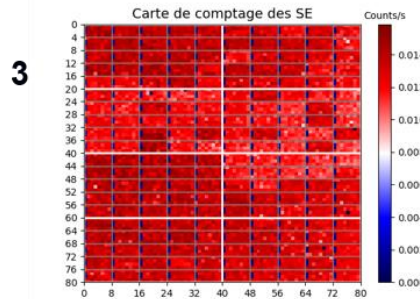
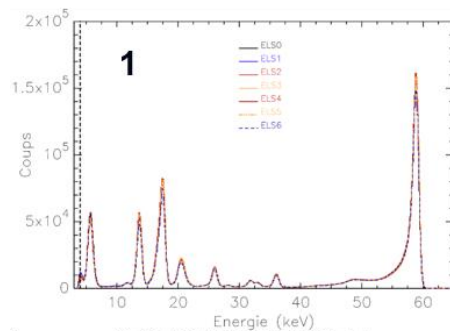
EMC Test Room

Phase D products: Telescope (PFM), UGTS (FM), Harness (PFM)

Milestones	Content
2020.12	DPIX totally integrated + first performance tests
2021.03	Integration DPIX/Shielding/coded mask
2021.05	Calibration campaign
2021.07	Instrument fully integrated
2021.09	<i>Mechanical (vibrations, schocks) & EMC testing</i>
2021.10	<i>Thermal test</i>
2021.12	<i>ECLAIRs PFM wait for delivery</i>



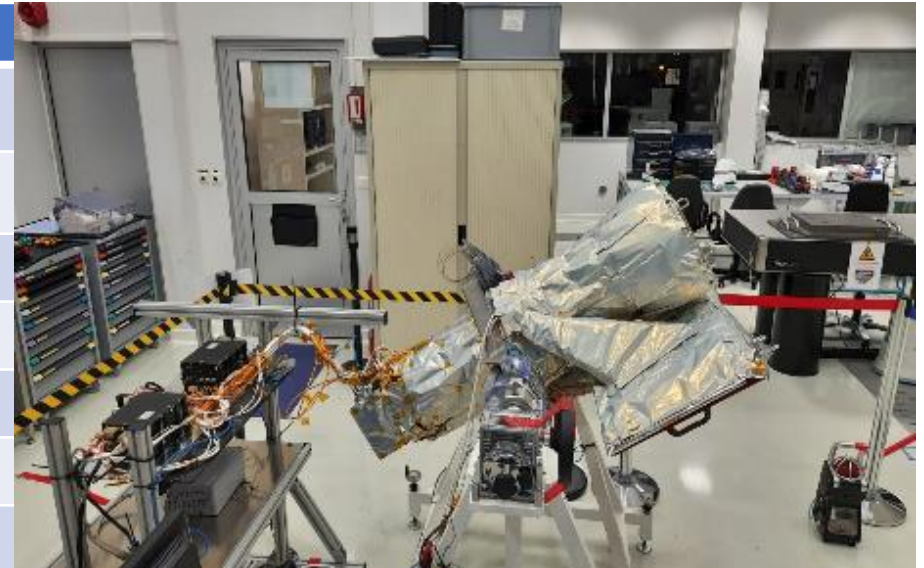
- The performance of the instrument has been measured, and shown to be compliant with the scientific specifications:
 - Spectral response (inc. energy threshold)
 - Imaging response
 - Timing response (inc. dead time)
 - Opacity to visible light, and opacity of the shield to X-rays
- Figures: (1) Response of the 8 sectors to radioactive sources ; (2) Homogeneity of the pixels (gain & offset); (3) Illumination of the detection plane by a source at 4.1 keV ; (4) Effective area computed after comparison of the response to radioactive sources with a Monte Carlo simulation ; (5) illumination of the detection plane with a source, through the mask ; (6) Reconstruction of image of the source.



FPL Progress In Phase D—MXT

Phase D products: Telescope (PFM), MDPU (FM), Harness (PFM)

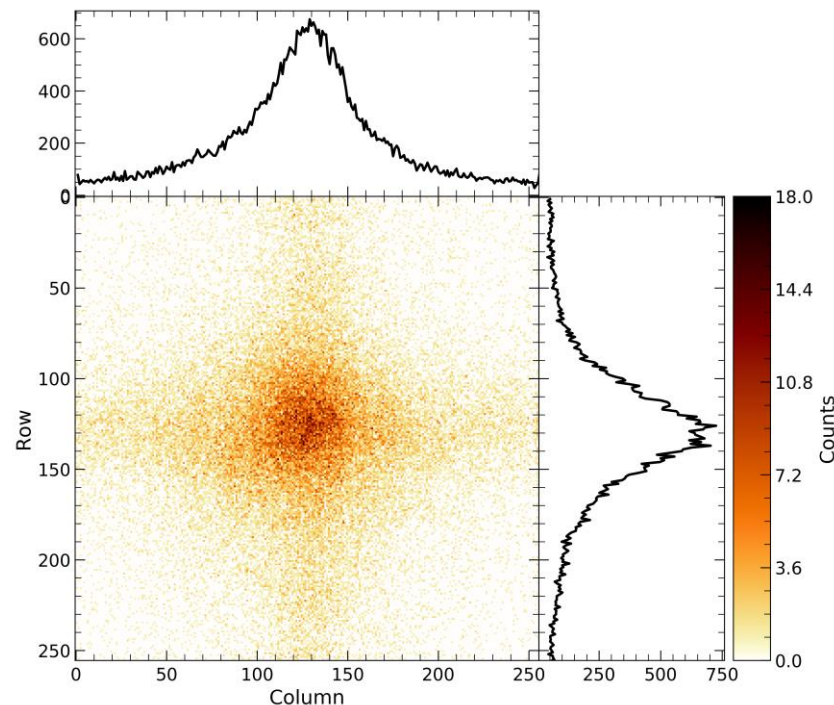
Milestones	Content
2020.12	MOP & MCAM Schock qualification
2021.04	First performance tests on FMdetection chain
2021.05	Instrument fully integrated
2021.07	<i>Mechanical & EMC testing</i>
2021.09	<i>Thermal test</i>
2021.11	<i>Performance testing (Panter / MPE)</i>
2021.12	<i>MXT PFM wait for delivery</i>



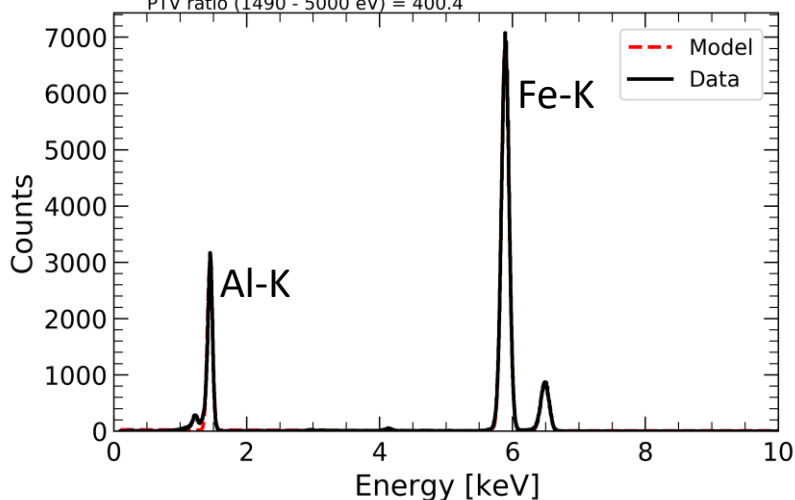
The MXT Telescope is being tested at MPE Panter facility



First image using Al-K source (19.10.2021)



FWHM (1490 eV) = (90.30 ± 0.30) eV
 FWHM (5890 eV) = (134.67 ± 0.28) eV
 FWHM (6490 eV) = (142.91 ± 0.88) eV
 PTV ratio (1490 - 5000 eV) = 400.4



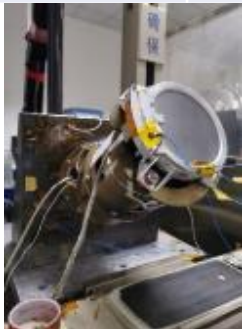
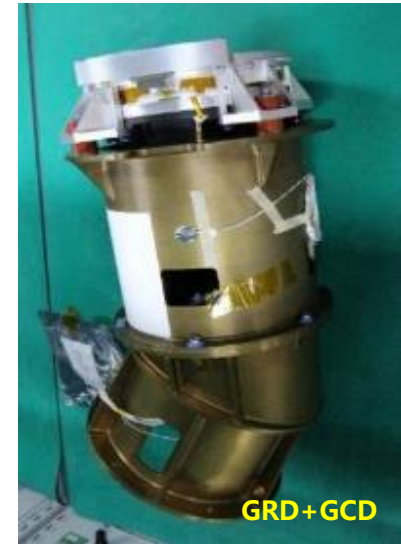
First combined spectrum using the Al-K and Fe-K (internal) source from the functional tests (19.10.2021)

The full telescope is working nominally. More functional tests are planned in the next days and the performance tests will start on **October 22 and continue until November 5.**

CPL Progress In Phase D-GRM

Phase D products: 3 GRD (FM), 1 GPM (FM), 1 GEB (FM), Harness (FM)

Milestones	Content
2020.11	Mechanical & thermal environment tests of GRM detectors were implemented
2020.12	Isotope calibration test of GRM FM was implemented
2021.04	Onboard firmware test was completed
2021.06	Environment test campaign of GRM FM was completed
2021.09	<i>GRM beam calibration</i>
2021.10	<i>GRM FM wait for delivery</i>



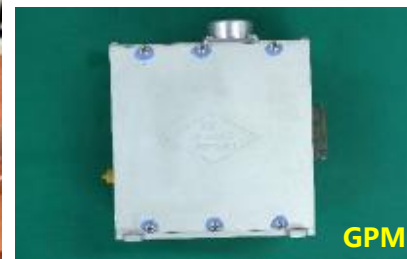
Mechanical test



Thermal test



EMC Test



GPM



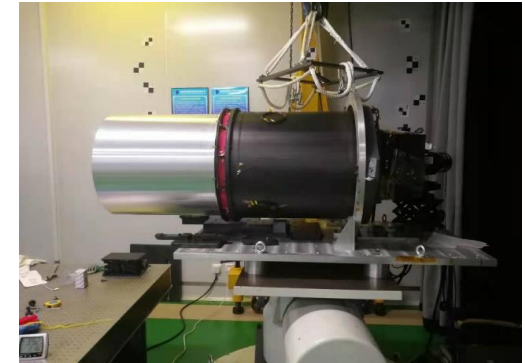
GEB

GRM FM

CPL Progress In Phase D-VT

Milestones	Content
2020.09	Accept all components, finish electronic test
2021.05	Finish mechanical & EMC test of VT-TEC and VT-TCB
2021.08	Finish the assembly of optical & mechanical
2021.10	Finish the calibration of CCD device
2022.03	Finish environmental, performance test and deliver

1. The first assembly of optical & mechanical, electrical test had finished, electrical box not assembly yet.
2. The optical & mechanical still need to add test and calibration to verify performance, the delivery time may be postponed 3~5 months.
3. More test and verification needed on QM, Next step: disassembly the VT QM from Satellite, need to evaluate feasibility with CNES side



VT Optical& Mechanical part



CCD Calibration Site

Ground Instruments : F-GFT, C-GFT



San Pedro Martyr
 $\Phi = 1.3 \text{ m}$
21'x21'
400-1700 nm

F-GFT

November 21, intensive test at the Observatoire de Haute-Provence

Dismounting, transportation and custom clearance to Mexico: April to August, 2022.

September 2022, Installation at the Observatorio Astronómico Nacional, Mexico

Visible channel, operational December 2022
IR channel, operational June 2023



Jilin
 $\Phi = 1.2 \text{ m}$
21'x21'
400-900 nm

C-GFT

December 2021, three channel imager installation

December 2021, Automatic control system

January 2022, Data processing

Spring 2022 Telescope operational

Ground instruments: GWAC system

- 2017-2018: the first run of 16-GWAC testing system at Xinglong Obs.;
- 2019-2021: run and update the 16-GWAC testing system at Xinglong Obs.;
- May 2022: add 4 GWACs at Xinglong Obs.
- Sept. 2022: the another 16-GWAC testing system at Muztagh Ata(慕士塔格)



About Muztagh Obs.

- Lat/Lon: 74.89964° E, 38.329203° N
- Elevation: 4520m



Ground Segment Progress In Phase D

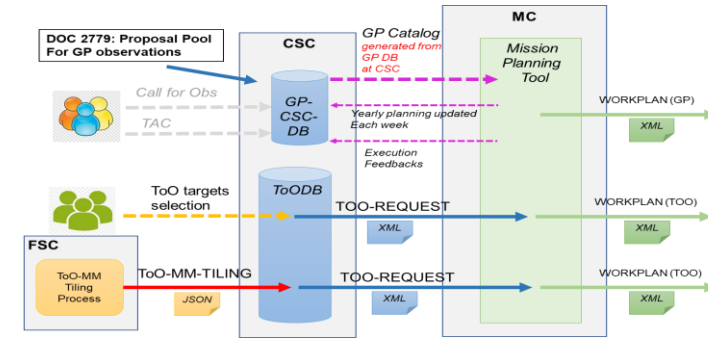
Ground support system progress

⇒ Development progress

- ✓ X-band ground station has been in operation
- ✓ MC and SSDC designed with common parts and dedicate parts
- ✓ The common parts of MC and SSDC have developed and been in operation
- ✓ The SVOM dedicate parts of MC and SSDC are under development
- ✓ The DCN between NSSC and CNES has been tested

⇒ Test and Validation -GSS organize and participate System Level Test

- ✓ End to End Test(2020.9-2021.3, Shanghai&Beijing)-Completed
- ✓ Compatibility Test(2021.6-2021.9,Beijing)-MC/FPOC,MC/NOC,MC/CSC-Completed
- ✓ Ground Programing Loop Test(2021.10-2021.11,Beijing)-Ongoing



E2E Test(Shanghai)

GSS Integration is expected to be completed by December 2022.

Chinese Science Center progress

⇒ Development progress

- ✓ Completed main development of internal and external interface between CSC and MC/SSDC/FSC
- ✓ BA data products were simulated, the BA web pages were designed
- ✓ Designed and developed database of BA tools, GP catalog and GP, and ToO tools
- ✓ Completed VT VHF, X-band L1 Processing Pipeline;
- ✓ Design and development of CGFT Instrumentation, automatic control system codes development, primary data processing software.

⇒ Test and Validation

- ✓ End-to end Test (2021.2-2021.6)-MC/CSC
- ✓ Compatibility Test (2021.6-2021.9,Beijing)-MC/CSC, FSC/CSC- Completed
- ✓ Ground Programming Loop Test(2021.10-2021.11,Beijing)-Ongoing



CGFT

CSC System is expected to be completed by December 2022.

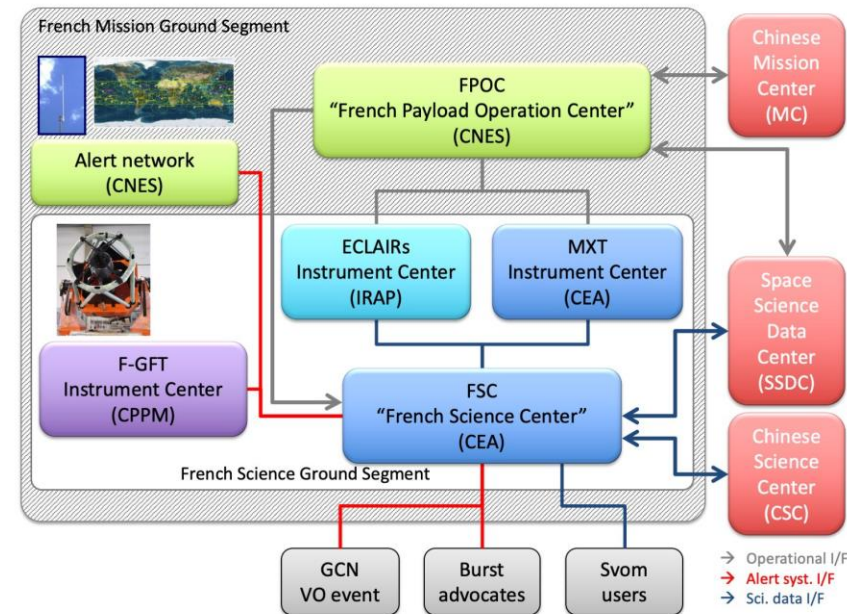
French Mission Ground Segment progress

⇒ Development progress

- ✓ All interfaces between French centers (FPOC/FSC/IC's) have been successfully tested
- ✓ Compatibility tests between French and Chinese centers have been successfully tested too
- ✓ Development status very mature (infrastructure, processing pipelines, VHF data flow)
- ✓ The DCN between NSSC and CNES has been tested

⇒ Test and Validation

- ✓ Once a year a « Data Challenge » is run to test thoroughly all components
- ✓ Compatibility Test MC/FPOC,MC/NOC - Completed
- ✓ Ground Programming Loop Test – Ongoing
- ✓ Colibri telescope under testing at OHP



System Tests : Ground system programming loop



The tests started on **2021 October 12** and are scheduled to last **3 weeks**
They involve several entities : Scientific centers, Mission center, FPOC,

Joint activities to test at system level the programming loop for:

- The General Program :
 - upload of a satellite programming over 15 days
- ToO program: Nominal ToO, Exceptional ToO, Multimessenger ToO
 - Satellite programming in response to a scientific alert

Scientific Satellite Cooperative Consultation Platform

10/19/2021 02:42:25 UTC time BertrandCordier quit

New message

Satellite name: Please select Plan type: please choos please choos Start and end time: Please select the start and end time Query Empty

choose	Satellite code	Plan type	Creation time	Confirm status	file name	operate				
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-19 08:03:23	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-19 07:17:20	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-19 07:08:10	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-18 11:48:33	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-15 12:08:19	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	GP	2021-10-15 11:50:01	To be initiated	SVOM_WORKPLAN_GP_20...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-15 11:00:03	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-15 11:00:02	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-15 11:00:01	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results
<input type="checkbox"/>	SVOM	ToO-NOM	2021-10-15 09:27:03	To be initiated	SVOM_WORKPLAN_ToO-N...	Create a plan meeting	Enter the planning meeting	Initiate plan confirmation	confirm	View Results

home Previous page 1 2 3 Next page end

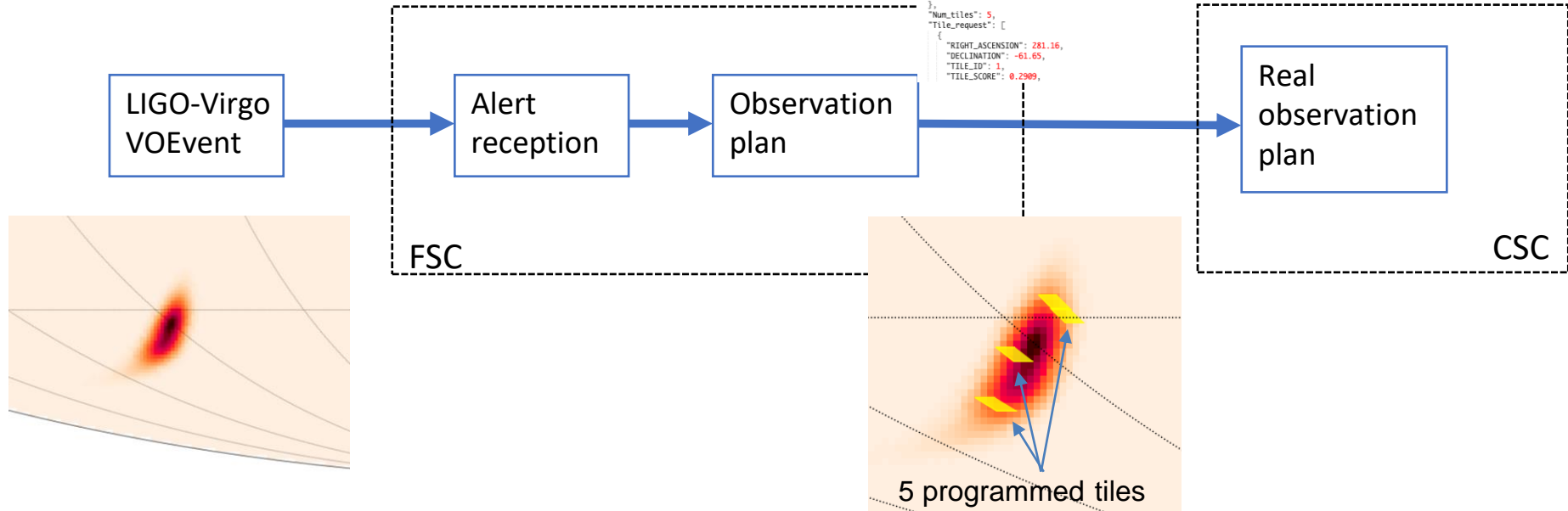
```
1 <WORKPLAN>
2 <HEADER>
3 <SATELLITE>SVOM/SATELLITE>
4 <INTERFACE_SPECIFICATION>
5 <SCHEMA_NAME>WORKPLAN.XSD</SCHEMA_NAME>
```

ToO-MM for Multimessenger Target of Opportunity in response to the detection of a gravitational wave source

Use GW170817 as example

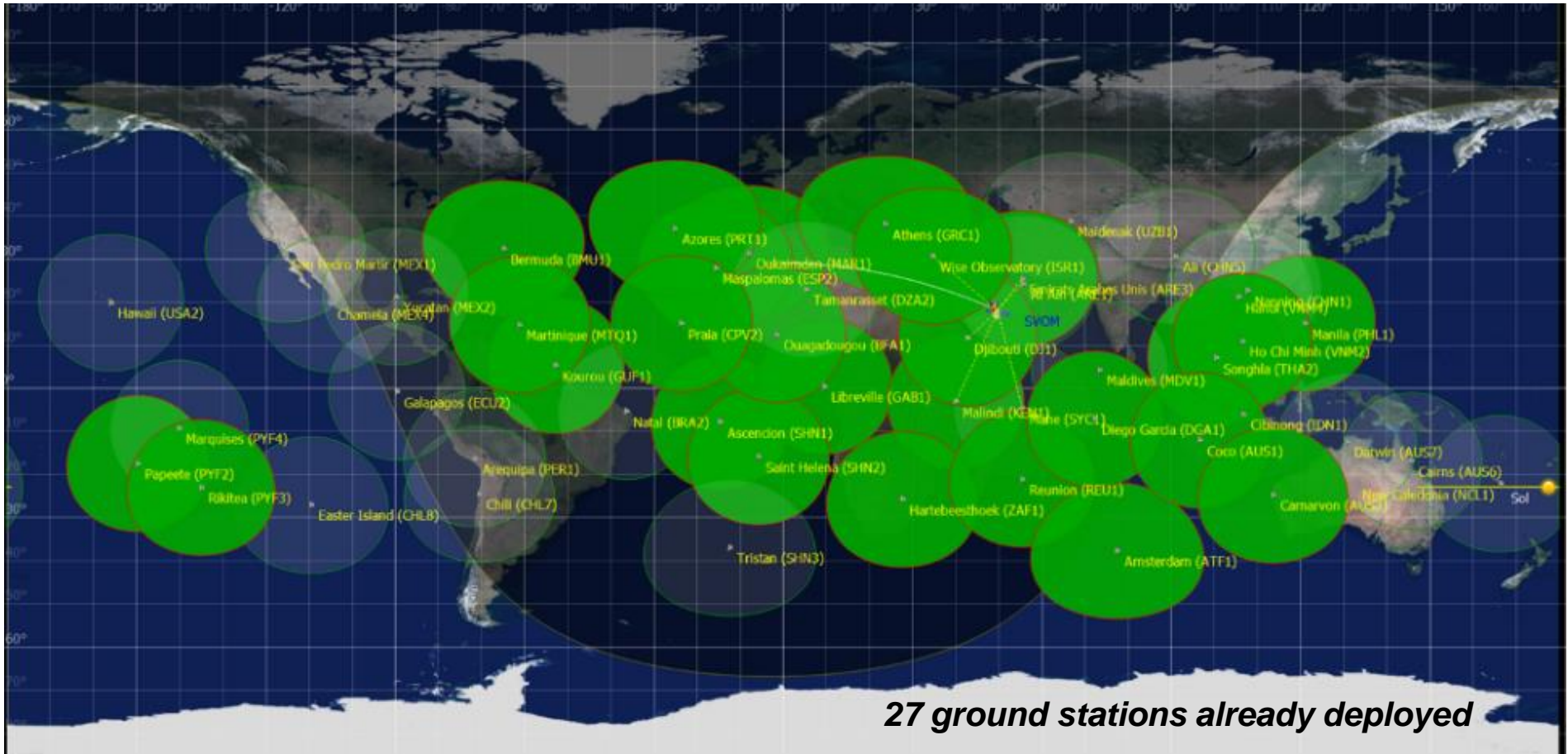
Simulation : from reception of alert to production of observation plan

```
Header: {
  schemaName: "To0",
  schemaVersion: "1.1"
},
To0_type: "To0-MM",
To0_MM_ID: "-1",
submitter: "FSC",
time_submit: "2021-07-03 16:00:57.069035",
time_approval: "",
To0_request: {
  origin: "GW",
  alert_id: "scenario_1",
  time_alert: "2023-06-05 07:22:46.654437+00:00",
  far: "9.11069936486e-14",
  remark: "At least one NS in the system"
},
catalog: {
  name: "mangrove",
  cat_id: "vi"
},
Num_tiles: 5,
Tile_request: [
  {
    "RIGHT_ASCENSION": 281.16,
    "DECLINATION": -61.65,
    "TILE_ID": 1,
    "TILE_SCORE": 0.2909,
  }
]
```



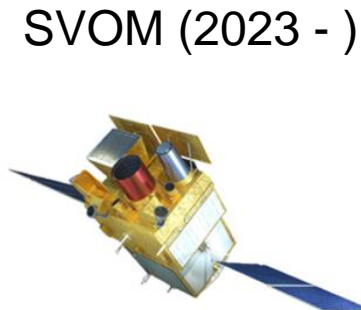
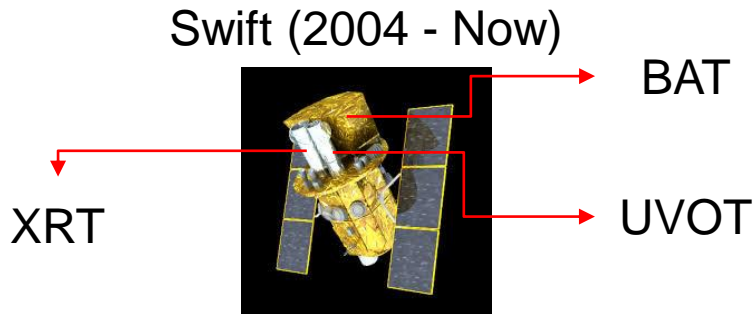
VHF Network Progress In Phase D

VHF Network deployment status





From real Swift GRB to SVOMsimulated GRBs



Swift alert sequence (notices) sent for GRB 210818A

GCN Date	Notice Type	parts
2021-08-18 01:02:22	Swift-BAT GRB Position	[body.txt]
2021-08-18 01:02:40	Swift-FOM Will_Observe	[body.txt]
2021-08-18 01:02:47	Swift-S/C Will_Slew	[body.txt]
2021-08-18 01:03:32	Swift-XRT Position	[body.txt]
2021-08-18 01:03:41	Swift-XRT Image	[body.txt][xrt_raw_image.fits.gz] [xrt_raw_image.ps][png]
2021-08-18 01:03:43	Swift-XRT Processed Image	[body.txt][xrt_proc_image.fits.gz] [xrt_proc_image.ps][png]
2021-08-18 01:03:47	Swift-XRT Thresholded-Pixels	[body.txt][xrt_raw_threshpix1.fits.gz]
2021-08-18 01:03:54	Swift-XRT Spectrum	[body.txt][xrt_raw_spec1.fits.gz]
2021-08-18 01:03:56	Swift-XRT Processed Spectrum	[body.txt][xrt_proc_spec1.fits.gz]
2021-08-18 01:03:56	Swift-XRT Processed Thresholded-Pixels	[body.txt][xrt_proc_threshpix1.fits.gz]
2021-08-18 01:06:39	Swift-XRT Spectrum	[body.txt][xrt_raw_spec2.fits.gz]
2021-08-18 01:06:40	Swift-XRT Processed Spectrum	[body.txt][xrt_proc_spec2.fits.gz]
2021-08-18 01:06:43	Swift-BAT GRB Lightcurve	[body.txt][bat_attitude.fits.gz] [bat_raw_lc.fits.gz]
2021-08-18 01:06:50	Swift-BAT GRB Lightcurve	[body.txt][bat_raw_lc.fits.gz] [bat_attitudex.fits.gz]
2021-08-18 01:07:53	Swift-UVOT Source List	[body.txt][uvot_raw_srclist.fits.gz]

BAT = ECLAIRs
alert sequence is
more or less similar

SVOM alert
sequence
(ECLAIRs to start,
MXT then and
UVOT if needed)



Scientific Ground Segment : SVOM Burst Advocate training using Swift alerts

The screenshot displays the Astro-COLIBRI web interface. At the top left is the logo and name 'Astro-COLIBRI'. A navigation bar includes 'select action', 'Latest transients', 'Cone search', 'personalize', and a status indicator 'logged in as bcordier@cea.fr'. Below this is a filter section with 'Filters' (From 2021-09-19 to 2021-10-19), 'SVOM', and 'LVC'. A 'Type of events' section lists FRB, TDE, GRB, burst, nuem, neutrino, and GW. The main content area features a star map on the left with a green circle highlighting a specific point. To the right is a list of events, with the top one being GRB 211019A. A yellow arrow points from the text 'last alert generated this week' to the green circle on the map and the GRB 211019A entry. Further right is a 'Detailed info about selected source' panel containing a link to the event, its name, RA/Dec coordinates, and observatory (Fermi). Below this are two plots: 'Visibility at H.E.S.S.' and 'Detailed monthly visibility at H.E.S.S.'.

Filters From 2021-09-19 to 2021-10-19 SVOM LVC

Type of events : FRB TDE GRB burst nuem neutrino GW

GRB 211019A
RA/Dec: 109.56° / -39.19°
error: 1°
2021-10-19 05:59:31

show RA/Dec: 168.27° / 68.67°
error: 0.137°
2021-10-19 13:12:15

show RA/Dec: 148.96° / 69.02°
error: 0.132°
2021-10-19 11:55:51

show RA/Dec: 148.71° / 69.05°
error: 0.149°
2021-10-19 09:28:15

Detailed info about selected source:
VoEvent : [Click here](#)
name: GRB 211019A
RA / Dec: 7h18m14.4s / -39d11m23.64s
observatory: Fermi

Visibility at H.E.S.S.
(long=16.5°, lat=-23.27°, height=1835m)

Detailed monthly visibility at H.E.S.S.

last alert generated this week

The tests started at the beginning of October and will continue throughout 2022

We have started to train the new generation of Burst Advocates



ANNEXES

SCIENCES – *SVOM*

Le Modèle de Qualification du satellite SVOM

