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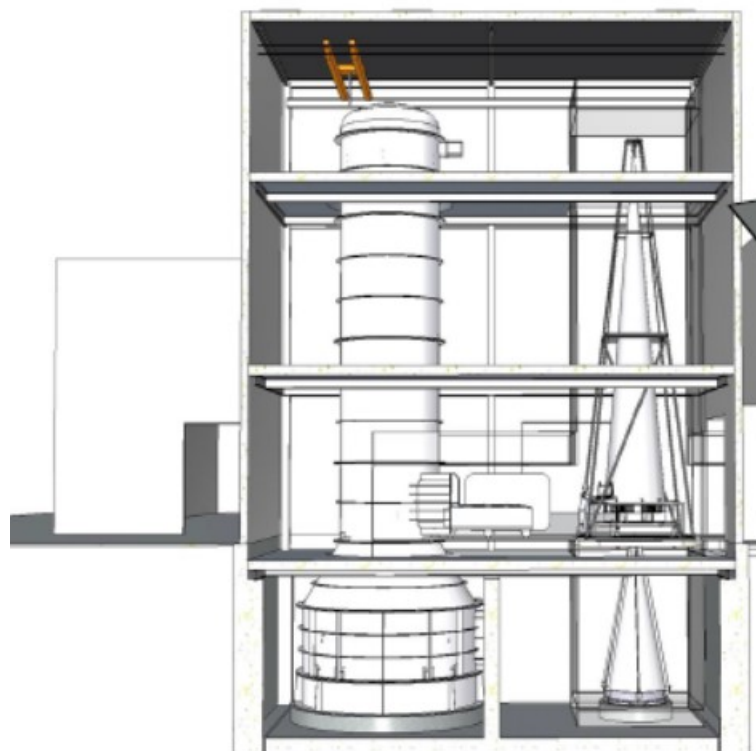


VERT-X Design of Vertical X-Ray Test Facility for ATHENA

TN17 SCHEDULE ESTIMATE FOR THE XRS FACILITY DEVELOPMENT

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1. INTRODUCTION

1.1. SCOPE

The scope of the present document is the illustration of the schedule estimate for the VERT-X facility development, following the outcomes of the Detailed Design Review (DDR) and the study activities up to the Final Review (FR).

1.2. APPLICABILITY

The present document is one of the deliverables related to the FR milestone.

It is intended to describe the schedule estimate for the building of VERT-X facility, providing a reference for the future studies and activities about it.

1.3. ROADMAP

Document section	Content description
Section 2 (Applicable and reference documents)	List of applicable documents and reference documents.
Section 3 (VERT-X development schedule estimate)	Details of schedule estimate for VERT-X facility development.

Table 1-1: Roadmap of the document

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2. APPLICABLE AND REFERENCE DOCUMENTS

2.1. APPLICABLE DOCUMENTS

AD1	AO/1-9549/18/NL/AR – SOW	X-ray Raster Scan Facility for the ATHENA Mirror Assembly SOW
AD2	VERT-INAFOAB-001	VERTICAL X-Ray (VERT-X) Technical Proposal
AD3	ESA-TECMMO-RS-014713	Updated Requirements for the ATHENA VERT-X following the System Requirements Review

2.2. REFERENCE DOCUMENTS

RD1	VTX-OAB-ISE-REP-003	D5 Detailed Design Document
RD2		

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2.3. GENERAL SPECIFICATIONS AND STANDARD DOCUMENTS

SD1	ECSS-M-40°	Configuration management
SD2	ECSS-M-50°	Information/documentation management

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2.4. LIST OF ACRONYMS

AD	Applicable Document
AIT	Assembly, Integration and Testing
DDR	Detailed Design Review
DRW	Drawing
EIE	European Industrial Engineering
ESA	European Space Agency
FR	Final Review
GPAP	GP Advanced Projects
I/F	Interface
IASF	Istituto di AstroFisica Spaziale (INAF, Milano)
INAF	Istituto Nazionale di AstroFisica
ITT	Invitation To Tender
MA	Mirror Assembly
MLS	Media Lario S.r.l.
MM	Mirror Module
OAB	Osservatorio Astronomico di Brera (INAF, Milano)
PDR	Preliminary Design Review
RD	Reference Document
RS	Raster Scan
SD	Standard Document
SOW	Statement of Work
SRR	System Requirements Review
TBA	To Be Assessed
TBC	To Be Controlled
TBD	To Be Defined
TEC	Technical Note
TVC	Thermal Vacuum Chamber
VERT-X	VERTICAL X-Ray
VTX	VERT-X
XRS	X-ray Raster Scanner
XSA	X-ray Source Assembly
XYZS	(x, y, z) stage

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3. VERT-X DEVELOPMENT SCHEDULE ESTIMATE

The VERT-X development schedule is split in two main phases. In the first phase the most critical parts of the systems will be realized and tested. These are the X-ray source assembly (**XSA**), including both the x-ray source and mirror, and the raster scan mechanism (**RS**), including the tip/tilt metrology. This phase of the plan coincides with the activities proposed in response to the RFQ Request for Quotation RFQ/3-16555/20/NL/IB/gg, with title *Demonstration of critical items for x-ray scanning facility*.

In the second phase the plan foresees the realization the Thermal Vacuum Chamber together with the remaining elements of the testing system, namely the completion of the RS, the camera and its stage. The integration of the facility in the ML AIT building is the final task of the second phase.

From the point of view the schedule, first phase is expected to start in Oct 2020 and lasting for 20 months, ending June 2022. As reported in the development plan, for the second phase we foresee a duration of 18 months. If we assume to start in Sep 2022 the VERT-X development should be completed by Apr 2024, almost 12 months before the start of the QM verification phase (Apr 2025).

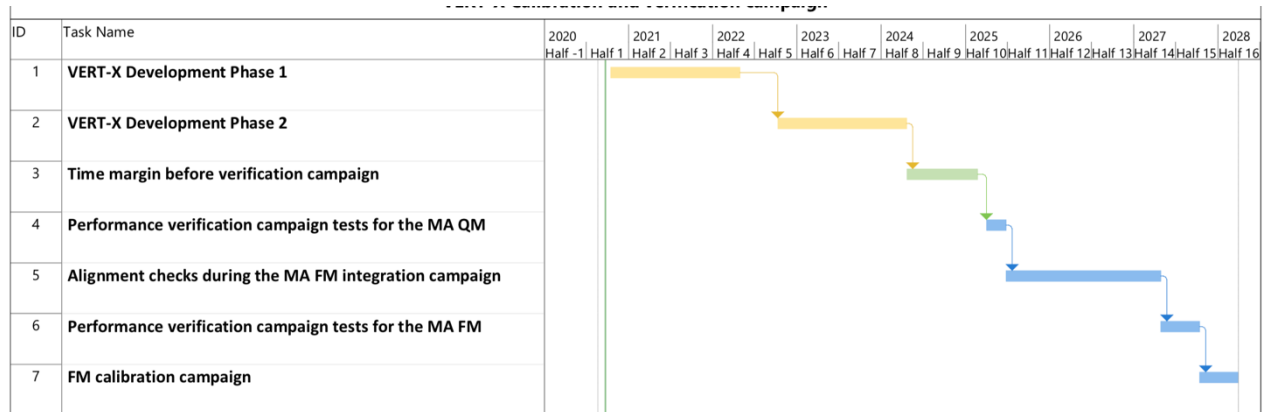


Figure 3-1 VERT-X development schedule compared to verification schedule.

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3.1. FIRST PHASE

In Figure 3-2 we report a detailed schedule of the phase 1 of the VERT-X development plan.

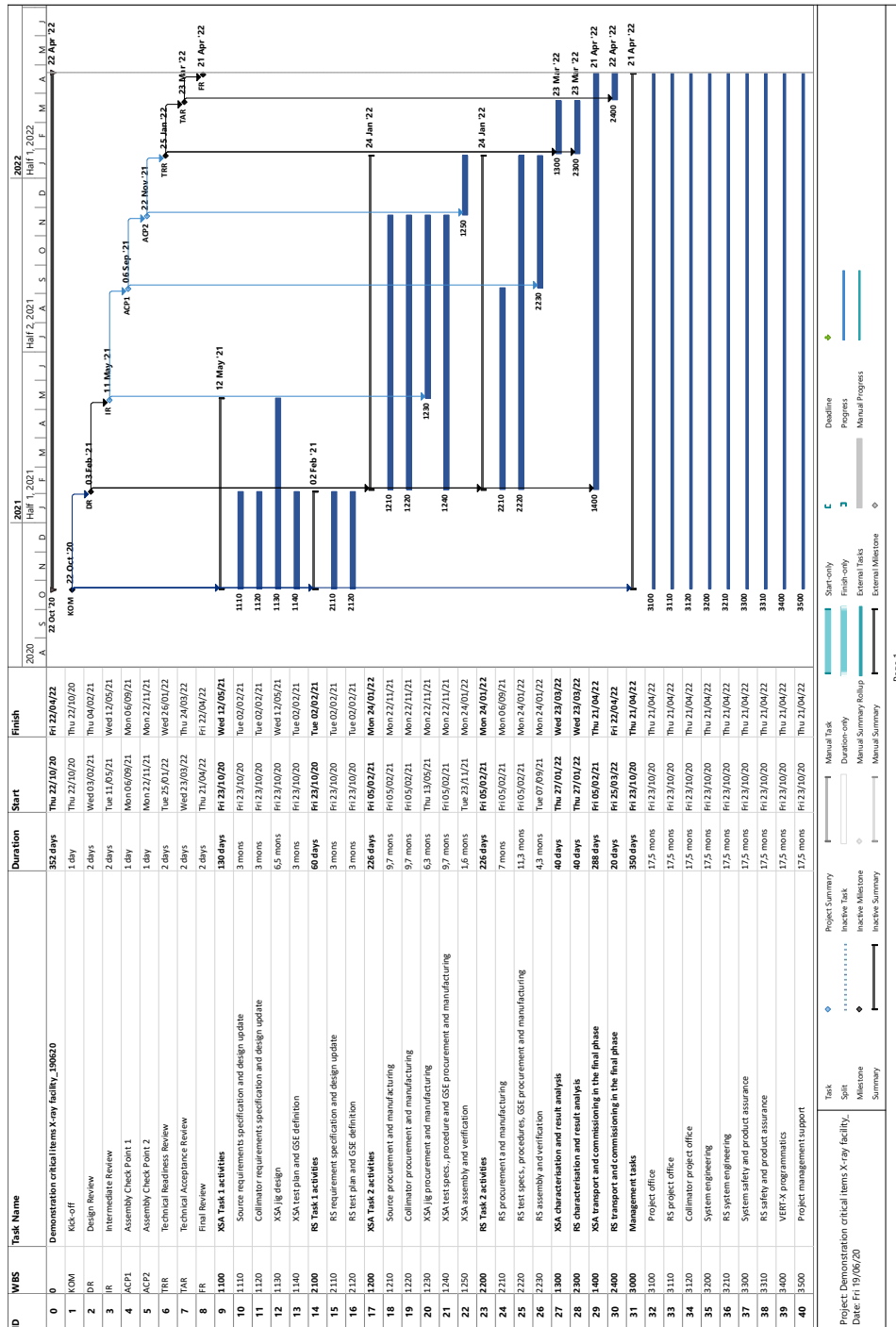


Figure 3-2 A detailed schedule for the phase 1 .

The activities in **the first phase** are divided in four main tasks and implemented with logic described as follows.

First, the design output of the VERT-X design activity [RD1] will be updated and optimized (**task 1-1.1, 1-1.2**). The design update and their impact on the general design of the VERT-X facility will be caught and traced by a specific activity (**task 1.4**). In parallel to this activity, two specific test plans for XSA and RS respectively will be defined together with the necessary equipment (GSE) for the test set-ups. In particular the XSA test will require the availability of ad-hoc structure providing the vacuum and the X-ray detector (**task 1-1.3**).

Then XSA and RS single parts defined by the product tree will be manufactured or purchased (**task 1-2.1, 1-1-2.2, 1-2.3**). In parallel, the test plan procedure will be finalized and the necessary GSE will be realized (**task 1-2.4**). VERT-X design and relevant documentation will be updated correspondingly (**task 1-2.5**). Furthermore, an Intermediate Review (IR) is foreseen, to characterize the tilt-meter noise figure and defining the selection of the tip-tilt metrology (**task 1-2.1, 1-2.2**).

The third task consists in the test campaigns (**task 1-3.1, 1-3.2**) performed independently at the EIE premises for the RS and Panter laboratory for the XSA.

The fourth and final activity will include the update of the VERT-X documentation and the storage of the systems (**task 1-4.1, 1-4.2, 1-4.3**).

Error! Reference source not found. shows the block diagram describing the development plan of VERT-X, with more details on the second phase of the project.

3.2. SECOND PHASE

The activities in the **second phase** are divided in six main tasks and implemented with logic described as follows.

First, the Project Office of VERT-X is established, having in charge not only the coordination of the activities for the implementation of VERT-X itself, the development of the relevant documentation, and all the usual project Management, System Engineering and Product Assurance activities; it also has the important task of coordinating with the analogous project office of SPO-AIT, in order to harmonize the development of the two facilities. All of these activities are included in the **task 2-1**.

The requirements of the thermal vacuum chamber, of the camera and its stage will be reviewed and their design will be updated and optimized accordingly (**task 2-2**). This activity will exploit the output of the tasks 1-1.4, 1-2.5, 1-4.1, and 1-4.2 of the first phase.

The Figure 3-3 shows the current definition of the VERT-X development. The arrows show the relationship between the activity, while their positioning along the time (shown on the bottom). Red arrows are used to give more evidence to the interactions between the construction of the building and the integration of the vessel.

For what concerns the source and the collimator, it is assumed that during phase 2 they will be integrated into the XTA and installed on board the raster scan. An alternative approach consists in integrating the raster scan *and* the XTA inside the vacuum vessel and then to install the X-ray source and the collimator on the XTA.

The former approach simplifies the integration, since the installation of the source and the collimator on the XTA can be performed without any possible interference with the raster scan structure. The latter is safer, since the installation of the source and of the collimator is performed after the integration of the raster scan.

The selection of the integration sequence should not impact significantly over the schedule, but only on the selection of the required GSE.

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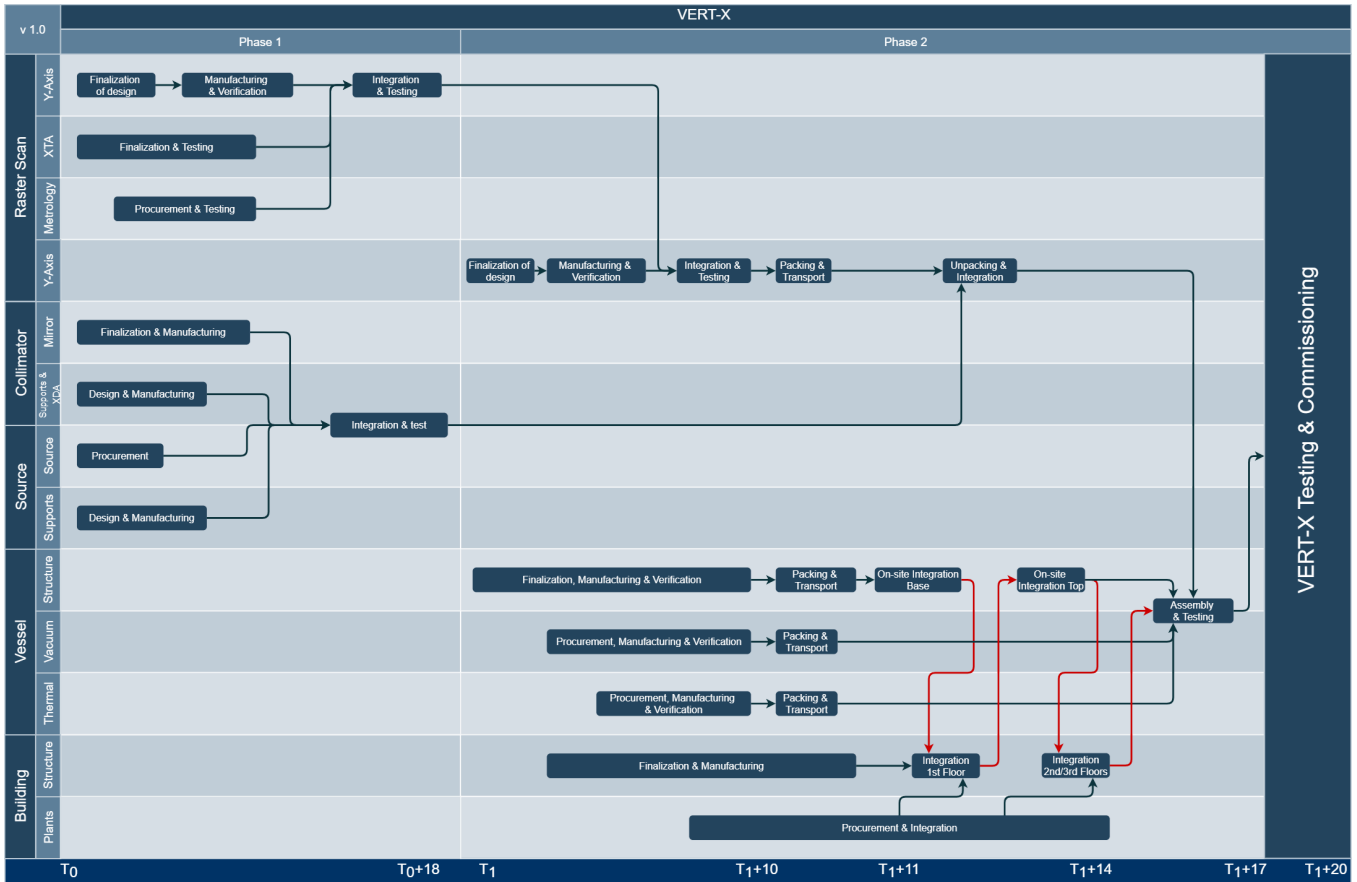


Figure 3-3 Vert-X development scheme