Advanced Virgo
Work Breakdown Structure
- Dictionary -

VIR-0031B-09

The Virgo collaboration

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Introduction

This document gives the Advanced Virgo Work Breakdown Structure up to level 2 of the arborescence. The labs which are responsible of tasks at level 3 are listed in brackets behind the level 2 tasks. Only final task assignments to labs, decided by the VSC, are shown. The complete 3-level WBS is given in another document. This issue is an update, after the AdV planning review in October 2012, of the original version from 2009.

Subsystem overview

This section lists the Advanced Virgo organizational breakdown in subsystems, with the 2nd level tasks associated to each subsystem.

DAQ

The DAQ subsystem concerns the electronics and software related to the control of the ITF. The main tasks of DAQ are the modifications to the electronics, the upgrade of control loops (hardware, software and algorithms), automation, timing, data conversion, environment monitoring and control. Subsystem specific front end electronics is usually part of the subsystem. DAQ system shall give specifications for any piece of electronics hardware and software involved in the operation of AdV.

DAQ.01-p Subsystem management [LAPP]
DAQ.02-p Data Acquisition and Global Control [LAPP]
DAQ.03-p Data collection [LAPP]
DAQ.04-p Environmental Monitoring [Napoli]
DAQ.05-p Local Position Read-Out and Beam Imaging [LAPP]
DAQ.06-p Electronics Infrastructure [LAPP,EGO]
DAQ.07-p Software Framework [LAPP,EGO]
DAQ.08-p Calibration [LAPP]

DET

The DET subsystem concerns all the modifications of the detection system necessary for the AdV configuration. The main tasks are: the general layout of the optical benches, a new output mode cleaning system, new photodetectors (including their demodulation electronics), new and improved optical benches, new telescopes for beam reduction, tools for beam diagnostic and the software for the photodiode readout and the slow control of the whole system.

DET.01-p LAPP manpower [LAPP]
DET.02-p Subsystem management [LAPP]
DET.03-p General design of the detection system (specs) [LAPP]
DET.08-p Optical benches layout [LAPP]
DET.04-p Suspended detection benches body (5 benches) [LAPP]
DET.05-p Local controls for all benches [LAPP]
DET.06-p Photodiodes air boxes and supports [LAPP]
DET.07-p Cabling for in vacuum benches (6 benches) [LAPP]
DET.10-p SDB1 assembly and tests on site [LAPP]
DET.11-p SIB2 bench installation [LAPP]
DET.12-p SDB2 bench installation [LAPP]
DET.13-p SPRB bench installation [LAPP]
DET.14-p SNEB bench installation [LAPP]
DET.15-p SWEB bench installation [LAPP]
DET.09-p External bench [LAPP]

DET.19-p Quadrant air boxes and supports [NIKHEF]
DET.20-p Telescopes for end benches (including for auxiliary lasers) [APC]
DET.21-p Telescopes for pickoff beams [APC]
DET.22-p Telescope for dark fringe [APC]
DET.16-p Optical, mechanical and electronic components for benches (optics and camera mounts, fast shutter, motors,..) [EGO,LAPP]
DET.17-p Output mode cleaner [LAPP,LMA]
DET.18-p Photodiodes + demodulation boards (longitudinal control) [LAPP]
DET.23-p Quadrant photodiodes + demodulation boards (alignment) [NIKHEF]
DET.24-p Local oscillator distribution electronics [NIKHEF]
DET.25-p Galvanometers (new design for vac compatibility needed) [LAPP]
DET.26-p Phase camera (2 to be developed) [NIKHEF]
DET.28-p Photodiodes readout software upgrade [LAPP]
DET.29-p Detection system slow control software upgrade [LAPP]
DET.31-p Pre-commissioning (fine tuning with itf beam, global sub-system tests) [APC,NIKHEF,LAPP]
DET.32-p Commissioning [APC,LAPP,NIKHEF]
DET.30-p Adaptation of an experimental hall at LAPP [LAPP]

INF

The INF subsystem (formerly called IME) concerns all the infrastructural modification works to be done in the experimental buildings; these works are mostly caused by the need to adapt the laser and detection labs to the new minitowers containing suspended optical benches, requiring the increase of the lab surface and creation of clean rooms. Also the infrastructure modifications for relocating the (noisy) scroll pumps of the vacuum system are managed by INF.

INF.01-p Subsystem management [EGO]
INF.02-p Environmental noise mitigation [EGO]
INF.03-p Engineering contract [EGO]
INF.04-p CB HVAC system rebuild [EGO]
INF.05-p IMMS improvement [EGO]
INF.06-p Support works for vacuum installations [EGO]
INF.07-p Support works for electronics [EGO]
INF.08-p Power systems for new installations (minitowers, TCS, etc.) [EGO]
INF.09-p INJ Lab re-arrangements [EGO]
INF.10-p DET Lab realization [EGO]
INF.11-p End Buildings modifications for minitower installation [EGO]
INF.12-p Structural works for the 1500W PAY Test Facility [EGO]

INJ

The INJ subsystem concerns all the modifications of the injection system to make it compliant with AdV. The main tasks of INJ are: the design of the optical layout downstream the laser bench, the input optics (EOM and RF modulation, Faraday isolator, polarizers, mechanics), the suspended and fixed injection benches (mechanics, mode matching telescope, adaptive mode matching system), the input mode cleaner (optics and mechanics).

INJ.01-p Subsystem management [EGO]
INJ.02-p Preliminary design study, requirements definition and baseline design delivery [EGO]
INJ.03-p Electro optical modulation system (EOM) [EGO]
INJ.04-p Input Power Control (IPC) system [EGO]
INJ.05-p Beam Pointing Control [EGO]
INJ.06-p Input Beam Jitter Monitoring [EGO]
INJ.07-p Input Beam Monitoring system [EGO]
INJ.08-p Input Mode Cleaner cavity [EGO,NIKHEF,LMA]
INJ.09-p Faraday Isolators [EGO]
INJ.10-p Reference cavity (RFC) [EGO]
INJ.11-p IMC Mode Matching Telescope [EGO]

INJ.12-p ITF Mode Matching Telescope [APC,LMA,EGO]
INJ.13-p General opto-mechanical layout, common parts construction, Installation and pre-commissioning [EGO]
INJ.14-p Optical setup for ITF reflection (SIB2) [EGO]
INJ.15-p Suspended injection bench (SIB1) body [EGO]
INJ.16-p SIB1 and MC end mirror local controls (standardization of LC system for AdV) [EGO]
INJ.17-p High/medium power beam dumps [EGO]
INJ.18-p Baffles for INJ benches (SIB 1, SIB 2, EIB and IMC cavity) [EGO]

ISC

The ISC subsystem (Interferometer Sensing and Control) concerns the preparation of the complete control strategy (lock acquisition, robust steady state control, alignment). The main tasks of ISC are: the preparation of the lock acquisition, including radiation pressure effects; the definition of the steady state control, including a noise budget of the predictable control noise; the definition of the alignment scheme; the mitigation of the parametric instabilities. ISC.01-p Subsystem management [Pisa]

ISC.02-p Modulation frequencies and lengths definition [EGO]
ISC.03-p Alignment design requirements [Pisa]
ISC.04-p Alignment control scheme conceptual design [Pisa]
ISC.05-p Steady state design requirements [Pisa,EGO,Napoli]
ISC.06-p Steady state longitudinal control conceptual design [Napoli]
ISC.07-p Lock acquisition design requirements [EGO]
ISC.08-p Lock acquisition conceptual design [EGO]
ISC.09-p Lock acquisition: auxiliary lasers [LAL]
ISC.10-p Parametric instabilities [LKB]
ISC.11-p Sensing and control implementation [TBD]
ISC.12-p Simulation tools [Pisa]

MAN

The MAN subsystem is concerned with project management and contingency administration.

MAN.01-p Project management [EGO,Firenze]
MAN.02-p Safety [EGO]
MAN.03-p Quality [EGO]
MAN.04-p Contingency [EGO]
MAN.05-p Documentation [EGO]
MAN.06-p Systems engineering [EGO,Perugia]

MIR

The MIR subsystem concerns the procurement and preparation of the AdV test masses and spares. The main tasks of MIR are: the realization of the substrates (including spares), managing their polishing, and doing the coatings and the mirror metrology for achieving the best available optical and mechanical features.

MIR.01-p Subsystem management [LMA]
MIR.02-p Substrates Fabrication [LMA]
MIR.03-p Substrates Polishing [LMA,LAPP]
MIR.04-p Substrates Characterization [LMA]
MIR.05-p Coatings [LMA]
MIR.06-p Metrology upgrades [LMA]

OSD

The OSD (Optical Simulation and Design) subsystem concerns the finalization of the optical design and the coordination of the optical simulation efforts.

OSD.01-p Subsystem management [LMA]
OSD.02-p System design and simulations overview [APC]
OSD.03-p Development and maintenance of AdV Finesse simulation [EGO]
OSD.04-p Development and maintenance of AdV Optocad simulation [EGO]
OSD.06-p Development and maintenance of AdV DarkF simulation [Artemis]
OSD.07-p Development and maintenance of AdV FOG simulation [EGO]
OSD.08-p Development and maintenance of AdV OSCAR simulation [LMA]
OSD.05-p Software for AdV 3D simulation [APC]
OSD.09-p Compatibility of AdV with high-order Laguerre-Gauss modes [APC]
OSD.10-p Compatibility of AdV with squeezing [LKB]

PAY

The PAY subsystem concerns design and realization of the payload suspended from the superattenuators, holding the core optics, the actuation system, and baffles and compensation/ pick-off plates where needed. This includes the realization of the monolithic payload and the sensing/actuation for local controls.

PAY.01-p Subsystem management [Roma1]
PAY.02-p NI and WI Payloads [Roma1]
PAY.03-p CP Support for NI and WI Monolithic Payloads [Roma1]
PAY.04-p NE and WE Payloads [Roma1]
PAY.05-p Marionette for Monolithic Payloads (NI,WI,NE,WE) [Roma1]
PAY.06-p Fused Silica Interface with Marionette for Monolithic Payloads (NI,WI,NE,WE) [Perugia,Roma1]
PAY.07-p Silica Fibers for Monolithic Payloads (NI,WI,NE,WE) [Firenze]
PAY.08-p Silica Bonding Elements for Monolithic Payloads (NI,WI,NE,WE) [Perugia]
PAY.09-p Assembly Structure for Monolithic Payloads (NI,WI,NE,WE) [Roma1,EGO]
PAY.10-p Monolithic Payloads test and Integration (NI,WI,NE,WE) [Roma1]
PAY.11-p BS Payload [Roma1]
PAY.12-p PR Payload [Roma1]
PAY.13-p SR Payload [Roma1]
PAY.14-p Heating Rings for Payloads interface with cage [RomaTV,Roma1]
PAY.15-p Payloads Control [Roma1,EGO,Perugia,Napoli]
PAY.16-p PAY Test Facility [Roma1,EGO,Perugia,Napoli]

PSL

The PSL subsystem concerns the realization and installation of the new pre-stabilized laser, able to provide a power of about 200 W.

PSL.01-p SS management [Artemis]
PSL.02-p Short term characterizarion of Fiber Amplifier [Artemis]
PSL.03-p Long term characterization of FA [Artemis]
PSL.04-p Request for change of baseline solution [Artemis]
PSL.05-p Power stabilization of HP amplifier [Artemis]
PSL.06-p Frequency pre-stabilization of HP amplifier [Artemis]
PSL.07-p Change request of the baseline solution
PSL.09-p EOLITE prototype [Artemis]
PSL.08-p High Power fiber amplifier [EGO,Artemis]
PSL.10-p Characterization of fiber amplifiers in the lab [Artemis]
PSL.11-p Pre-mode-cleaner block [Artemis]
PSL.12-p Laser Bench setup [Artemis]
PSL.13-p Installation on site [Artemis,EGO]
PSL.14-p Commissioning of SS [EGO,Artemis]

SAT

The SAT subsystem concerns all the modifications to the existing superattenuators (SA) and the construction of the signal recycling SA. The main tasks of SAT are: the construction of the SA for the signal recycling mirror, the upgrade of the short SA (injection, detection, mode cleaner), the change of the inverted pendulum legs, the implementation of the tilt control and all the modifications to the inertial damping, the upgrade of the filter 0 on the long towers, the upgrades of the SA sensors, actuators and electronics.

SAT.01-p Subsystem Management [Pisa]
SAT.02-p Technical Management Support [EGO]
SAT.03-p GPisa in Virgo [Pisa,EGO]
SAT.04-p SAT Upgrades Validation in SAFE [Pisa,EGO]
SAT.05-p SAT Upgrades Construction & Procurement [Pisa,EGO]
SAT.06-p Suspension control upgrade [Pisa,EGO,Padova-Trento]
SAT.07-p NI (ex SR) Construction [Pisa,Padova-Trento,EGO]
SAT.08-p Short SAs Upgrade (MC,IB,DB) Construction [Pisa]
SAT.09-p Short SAs Upgrade (MC,IB,DB) Installation [Pisa,EGO]
SAT.10-p WI and NI SAs Preparatory works [Pisa,EGO]
SAT.11-p IVC Prototype Test in NE [Pisa,EGO]
SAT.12-p Long SAs Upgrade Installation (End Towers) [Pisa,EGO]
SAT.13-p Long SAs Upgrade Installation (Central) [Pisa,EGO]
SAT.14-p SAT Thermal Stabilization System [Pisa,EGO]

SBE

The SBE subsystem is responsible for design and construction of the suspensions of the optical benches, like the suspension system of the input optics bench (EIB-SAS) in the laser lab and the photodiode benches suspended under vacuum. SBE is also responsible for the control of these suspensions and for the construction of the vacuum enclosures (minitowers) of the benches under vacuum.

SBE.01-p Subsystem Management [NIKHEF]
SBE.02-p EIB-SAS construction and validation [NIKHEF,EGO]
SBE.03-p EIB-SAS first installation [NIKHEF,EGO]
SBE.04-p EIB-SAS pre-commissioning [NIKHEF,EGO]
SBE.05-p MultiSAS prototype construction and test at Nikhef [NIKHEF,EGO]
SBE.06-p MultiSAS for end benches construction [NIKHEF]
SBE.07-p MultiSAS for SPRB, SDB2, SIB2 construction [NIKHEF]
SBE.08-p MultiSAS controls [NIKHEF]
SBE.09-p MultiSAS for SPRB, SDB2, SIB2 installation [NIKHEF,EGO]
SBE.10-p MultiSAS for end benches installation [NIKHEF,EGO]
SBE.11-p MultiSAS for SPRB, SDB2, SIB2 pre-commissioning [NIKHEF,EGO]
SBE.12-p MultiSAS for end benches pre-commissioning [NIKHEF,EGO]
SBE.13-p Minitowers [LAPP]
SBE.14-p EIB-SAS final installation [NIKHEF,EGO]

SLC

The SLC subsystem is responsible of stray light control in the interferometer. This is achieved via a series of baffles in the critical parts of the interferometer; depending on the degree of criticality, they will be mounted on the ground or suspended.

SLC.01-p SS management [EGO]
SLC.02-p Requirement study [EGO]
SLC.03-p Design study [EGO]
SLC.04-p Preparation of SLC Technical Design Report [EGO]
SLC.05-p Construction [EGO]
SLC.06-p Installation [EGO]

TCS

The TCS subsystem concerns the design and installation of the new thermal compensation system compliant with the AdV power and sensitivity. The system must correct thermal effects in the critical core optics of the interferometer. Dedicated TCS sensors for monitoring the radius of curvature of all test masses and the wavefront distortion of the input test masses are part of this subsystem as well.

TCS.01-p Subsystem management [RomaTV]
TCS.02-p TCS studies actuation (simulations + experiments) [RomaTV]
TCS.03-p TCS studies sensing (simulations + experiments) [RomaTV]
TCS.04-p CO2 laser projector [RomaTV,EGO]
TCS.05-p Ring Heater [EGO,RomaTV,Roma1]
TCS.06-p CO2 viewports [EGO]
TCS.07-p Sensing beams layout [RomaTV]
TCS.08-p Wavefront sensing [RomaTV]
TCS.09-p High reflectivity face sensing [RomaTV]
TCS.10-p TCS control system [RomaTV]
TCS.11-p Cabling and auxiliary software [EGO]
TCS.12-p CP requirements definition [RomaTV]
TCS.13-p SS precommissioning [RomaTV]

VAC

The VAC subsystem concerns all the modifications to the vacuum pipes and tower vacuum chambers. The main tasks of VAC will be: the upgrades of the vacuum system needed to meet the AdV sensitivity target, the replacement of the vacuum links in the central area (compliant with the larger beam and the modified optical scheme), the realization of the vacuum chamber for the new signal recycling tower, the works for the displacement of the towers in the central area, and the installation of cryotraps at each end of the 3 km arm tubes for guaranteeing a better vacuum level.

VAC.01-p Subsystem management + engineering support [EGO]
VAC.02-p General electronics HW+SW coordination [EGO]
VAC.03-p Advisory on system performances [Pisa]
VAC.04-p Engineering studies [EGO]
VAC.05-p Cryotraps [NIKHEF,EGO]
VAC.06-p Large Valves 1st part [EGO]
VAC.08-p Large Valves 2nd part [NIKHEF]
VAC.09-p LN2 plant [Genova,EGO]
VAC.07-p Vacuum equipment [EGO]
VAC.11-p Thermal effects on TMs [RomaTV]
VAC.10-p Towers displacement [EGO]
VAC.13-p Enlarged Links [EGO,NIKHEF]
VAC.12-p New IVC [EGO]
VAC.15-p Towers upgrade [EGO]
VAC.14-p Control System [LAL,EGO]
VAC.16-p DT/IB cryotrap [EGO,TBD]
VAC.17-p Minitowers integration [EGO,LAPP]
VAC.18-p HWFS vacuum chambers [EGO,RomaTV]
VAC.19-p UHV Vacuum valves [Polgraw,EGO]