Implementation of Earned Value Management (EVM) in HLLHC Project

R. Martins

12/12/2018

Goal of HL-LHC as fixed in 2010

From FP7 HiLumi LHC Design Study application

The main objective of HiLumi LHC Design Study is to determine a hardware configuration and a set of beam parameters that will allow the LHC to reach the following targets:

A peak luminosity of L_{peak} = **5×10^{34} cm^{-2}s^{-1} with levelling**, allowing:

An integrated luminosity of **250 fb^{-1} per year**, enabling the goal of **L_{int} = 3000 fb^{-1}** twelve years after the upgrade.

This luminosity is more than ten times the luminosity reach of the first 10 years of the LHC lifetime.

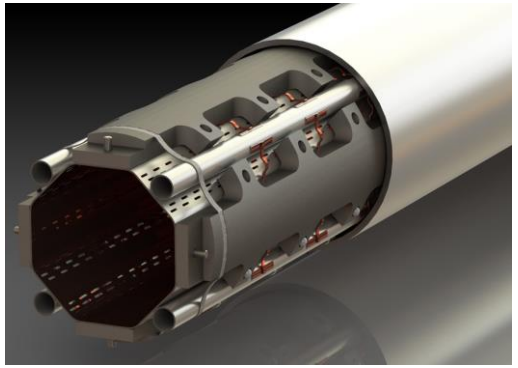
Ultimate performance established 2015-2016: with same hardware and same beam parameters: use of **engineering margins:**

$L_{peak\ ult} \cong 7.5\ 10^{34}$ cm^{-2}s^{-1} and **Ultimate Integrated $L_{int\ ult} \sim 4000$ fb^{-1}**

LHC should not be the limit, would Physics require more…

Project approved by CERN Council in June 2016

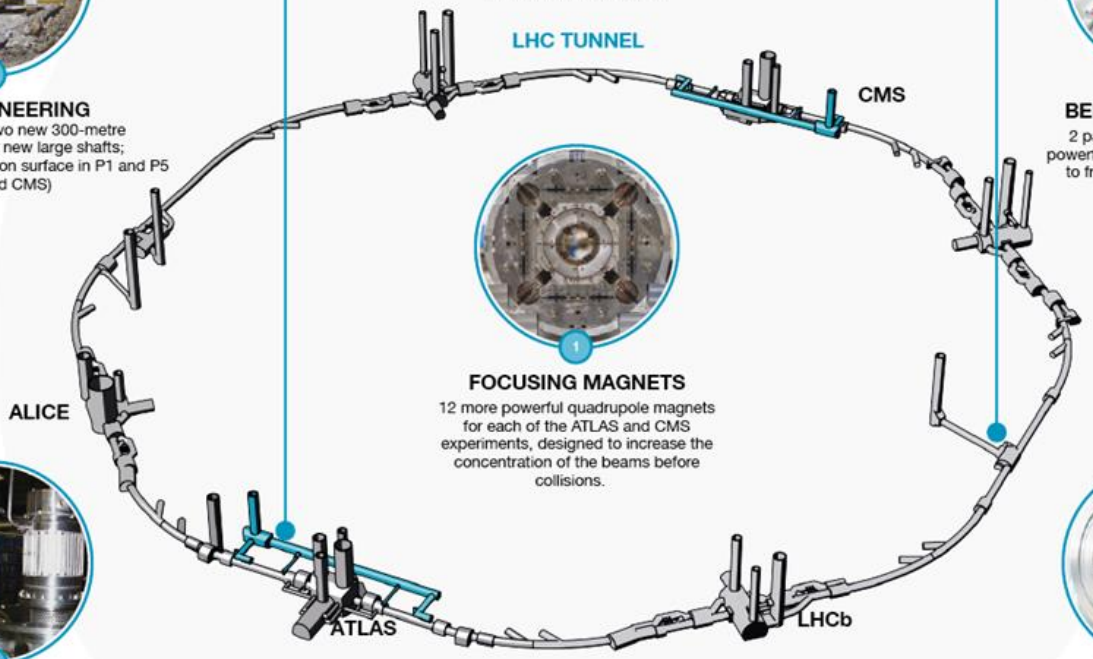
Technology landmarks



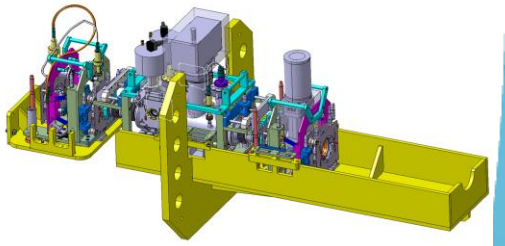
"CRAB" CAVITIES
8 superconducting "crab" cavities for each of the ATLAS and CMS experiments to tilt the beams before collisions.

CIVIL ENGINEERING
2 new caverns and two new 300-metre service galleries, two new large shafts; 10 new technical buildings on surface in P1 and P5 (ATLAS and CMS)

BENDING MAGNETS
2 pairs of shorter and more powerful dipole bending magnets to free up space for the new collimators.



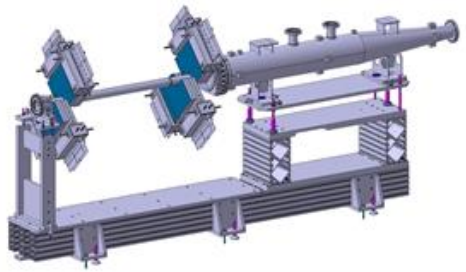
FOCUSING MAGNETS
12 more powerful quadrupole magnets for each of the ATLAS and CMS experiments, designed to increase the concentration of the beams before collisions.

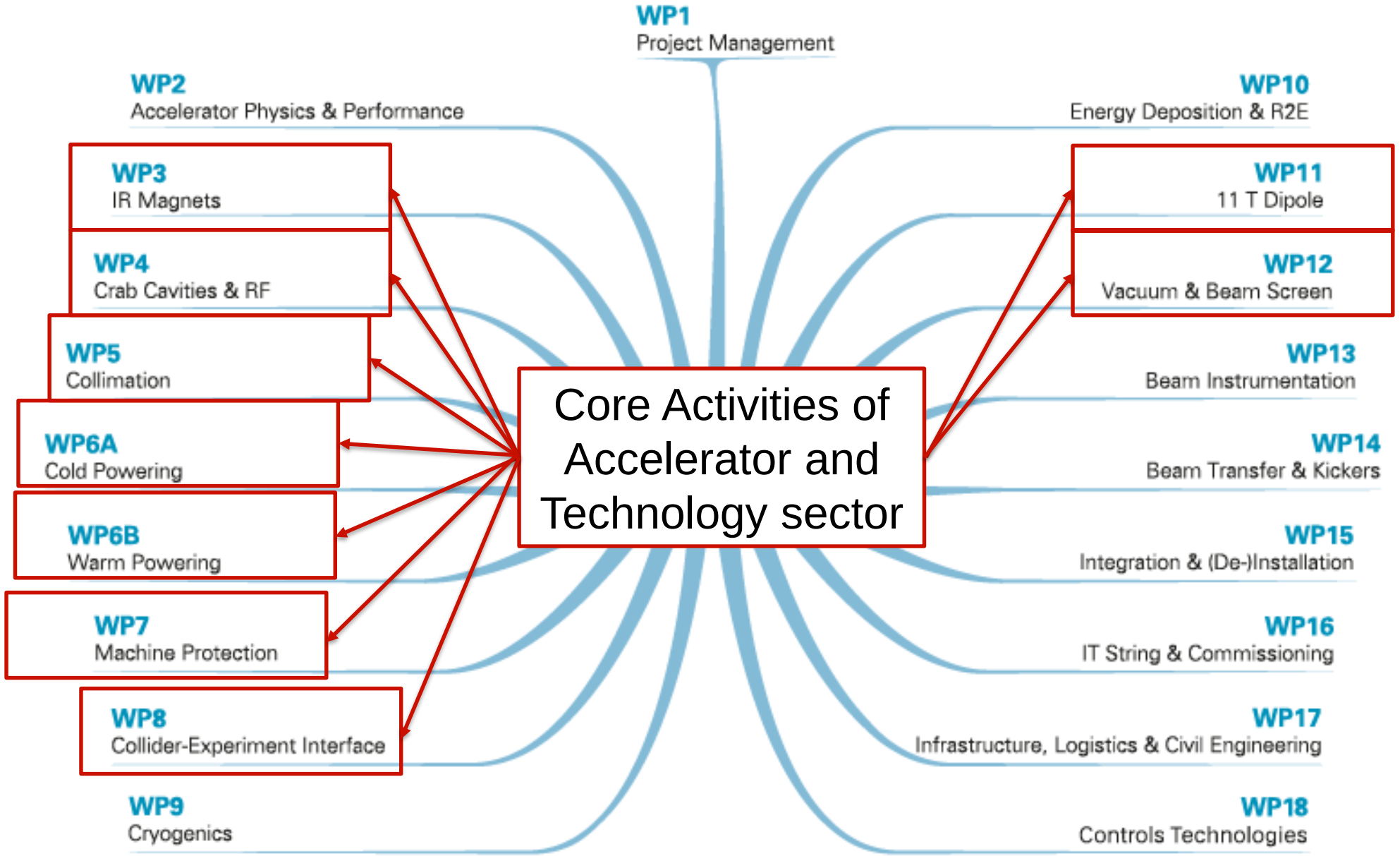


CRYOGENICS
2 new large 1.9 K helium refrigerators for HL-LHC near ATLAS and CMS

COLLIMATORS
15 to 20 new collimators and 60 replacement collimators to reinforce machine protection.

SUPERCONDUCTING LINKS
Electrical transmission lines based on a high-temperature superconductor to carry current to the magnets from the new service galleries to the LHC tunnel.

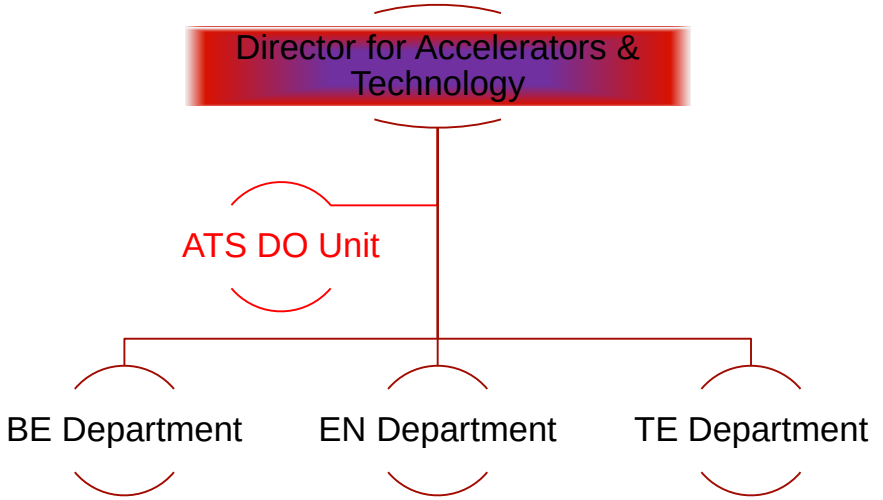


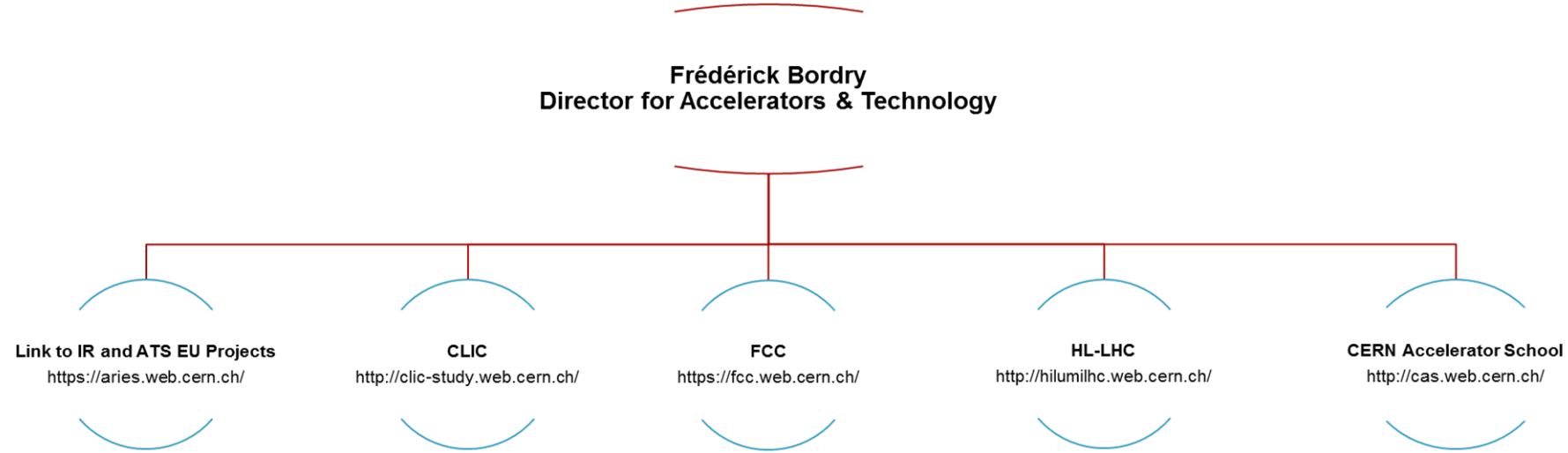

WP1
Project Management
WP2
Accelerator Physics & Performance
WP3
IR Magnets
WP4
Crab Cavities & RF
WP5
Collimation
WP6A
Cold Powering
WP6B
Warm Powering
WP7
Machine Protection
WP8
Collider-Experiment Interface
WP9
Cryogenics
Core Activities of Accelerator and Technology sector
WP10
Energy Deposition & R2E
WP11
11 T Dipole
WP12
Vacuum & Beam Screen
WP13
Beam Instrumentation
WP14
Beam Transfer & Kickers
WP15
Integration & (De-)Installation
WP16
IT String & Commissioning
WP17
Infrastructure, Logistics & Civil Engineering
WP18
Controls Technologies

Accelerator and Technology Sector Directorate Office (ATS-DO)

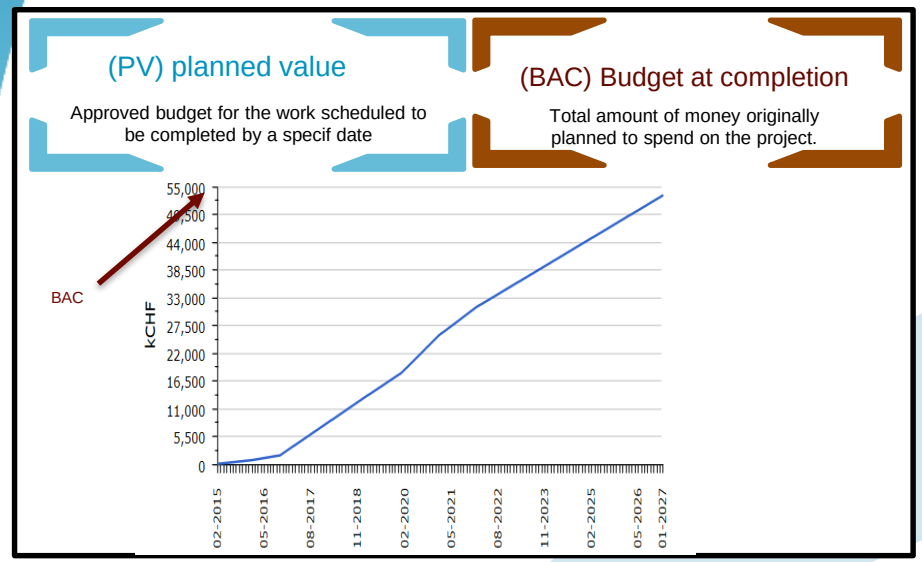
- Unit of the Accelerator and Technology (A&T) sector
- Staffed by persons working on main projects or studies such as HL-LHC, FCC, CLIC and EU Activities.
- No hierarchical functions within the departments of the A&T sector.
- Project and Study leaders report directly to the Director for Accelerators and Technology.

Source
https://espace.cern.ch/acc-tec-sector/mandate.aspx





EVM Guidelines



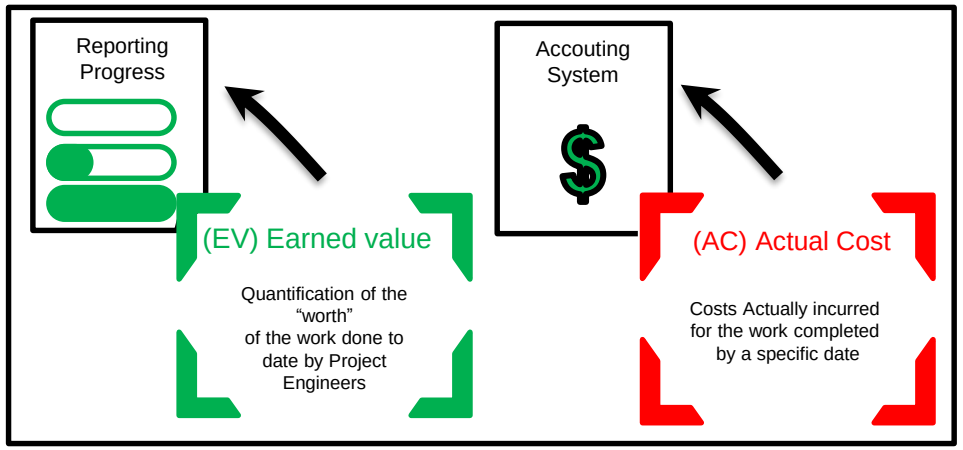
Revision / data maintenance
(5 criteria)

EVM Analysis / Reports
(6 criteria)

Accounting Considerations
(6 criteria)

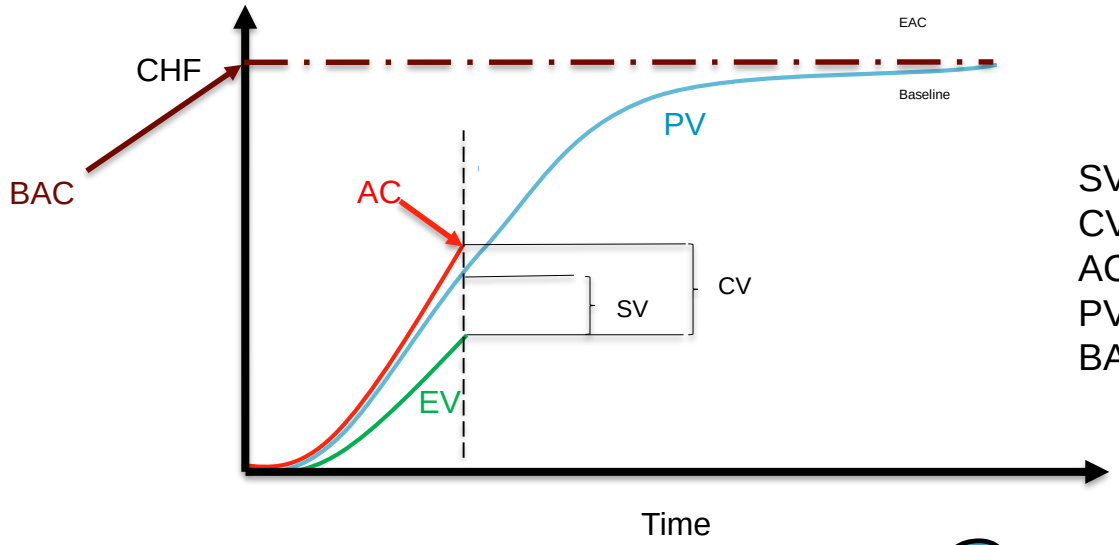
Planning / Schedule / budgeting
(10 criteria)

Organization
(5 criteria)



EIA – 748 Standard for Earned Value Management
(32 criteria)

Analyzes and Management reports

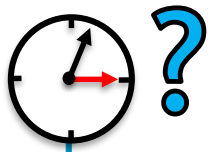


SV – Schedule variance
CV – Cost variance
AC – Actual cost
PV – Planned value
BAC – Budget at Completion

Am I spending more than I expected?

$$CV = EV - AC$$

EV < AC	EV = AC	EV > AC
(-) CV	(0) CV	(+) CV
Over	On	Under



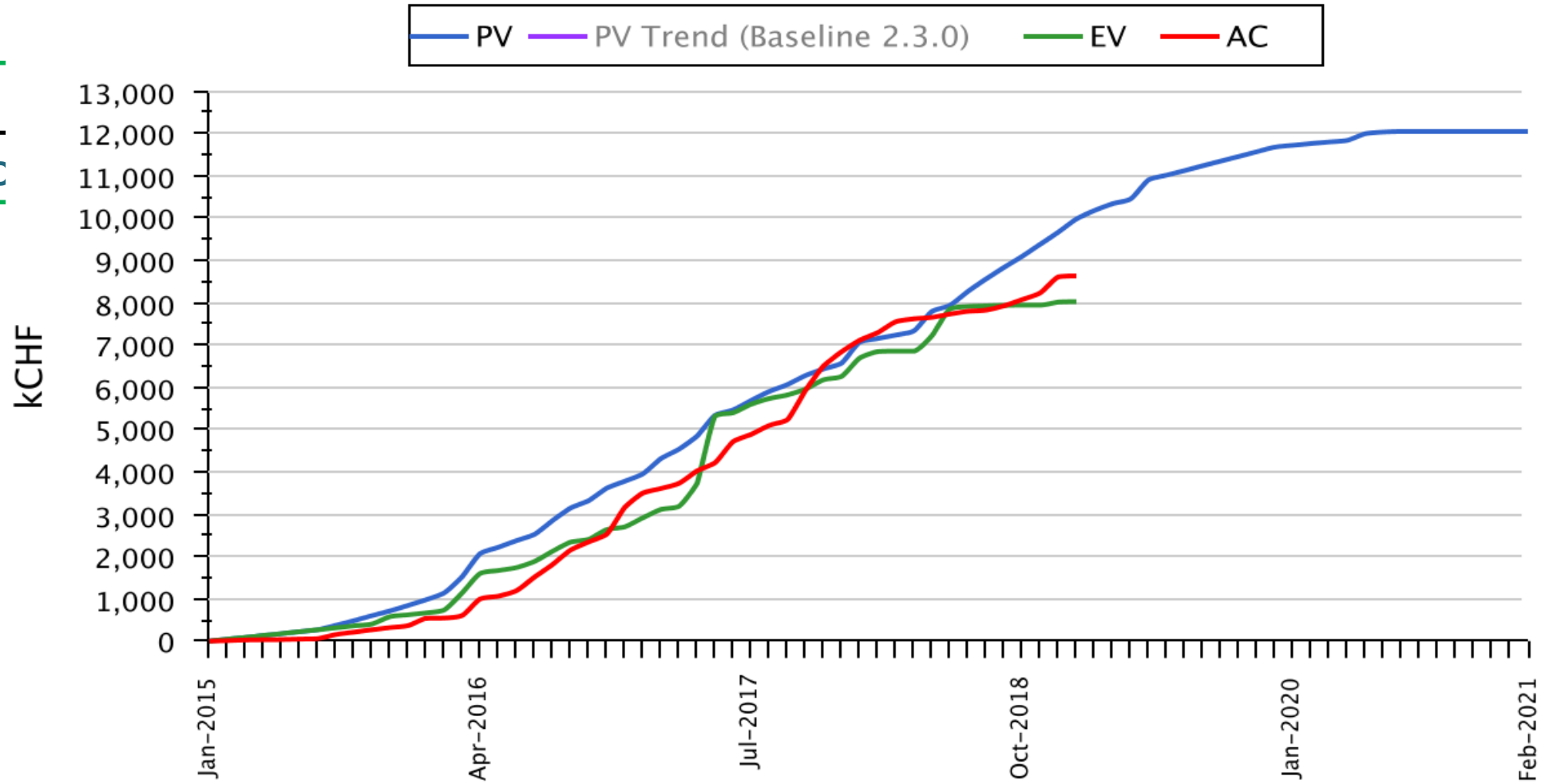
Am I on schedule?

$$SV = EV - PV$$

EV < PV	EV = PV	EV > PV
(-) SV	(0) SV	(+) SV
Behind	On	Ahead

EVM & Planned value evolution since 2016
950 MCHF (Material)

HL-LHC
180 MCH
>350 MC



Project: LRD-PRJ
Workpackage: HLLHC 4.1.1
Baseline: Baseline 2.3.0

EVM in the context of the HL-LHC project
ng input to

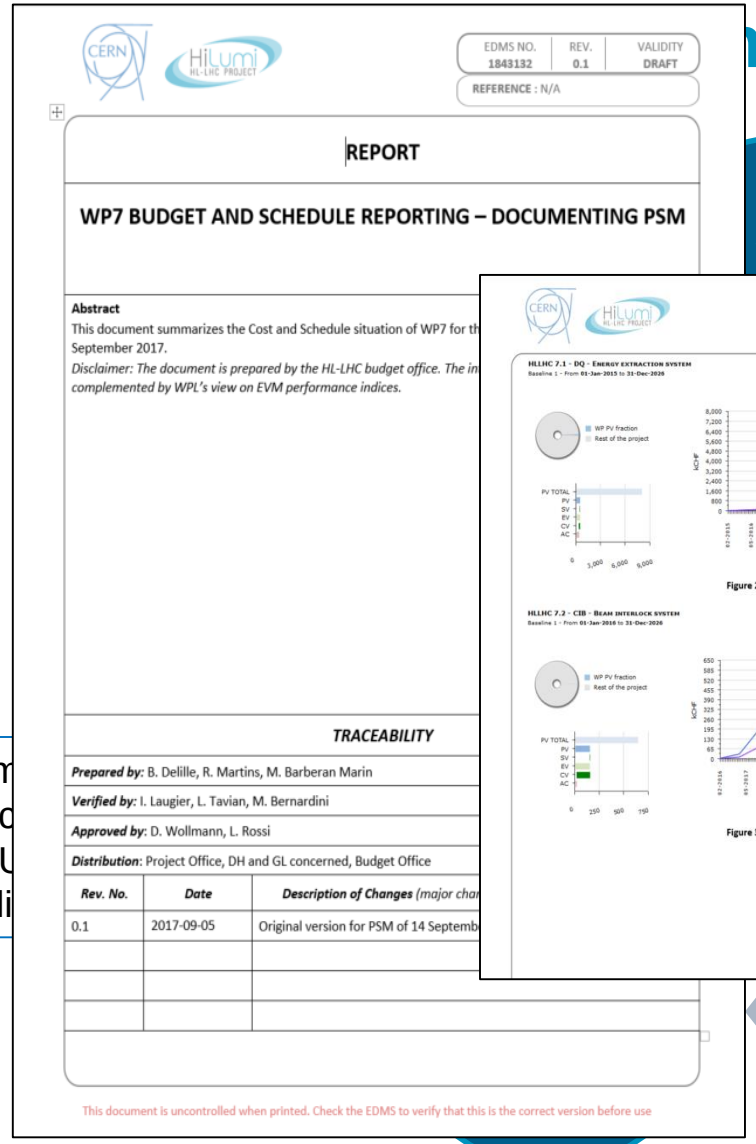
WP

- In general weekly
- Technical updates
- WP Progress monitoring

- Comm
- Projec
- C&S U
- Baseli

ear
nitoring

nitoring



EDMS NO. 1843132 | REV. 0.1 | VALIDITY DRAFT
REFERENCE : N/A

REPORT

WP7 BUDGET AND SCHEDULE REPORTING – DOCUMENTING PSM

Abstract

This document summarizes the Cost and Schedule situation of WP7 for th
September 2017.
Disclaimer: The document is prepared by the HL-LHC budget office. The in
complemented by WPL's view on EVM performance indices.

TRACEABILITY

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Approved by: D. Wollmann, L. Rossi

Distribution: Project Office, DH and GL concerned, Budget Office

Rev. No.	*Date*	*Description of Changes (major char*
0.1	2017-09-05	Original version for PSM of 14 Septemb

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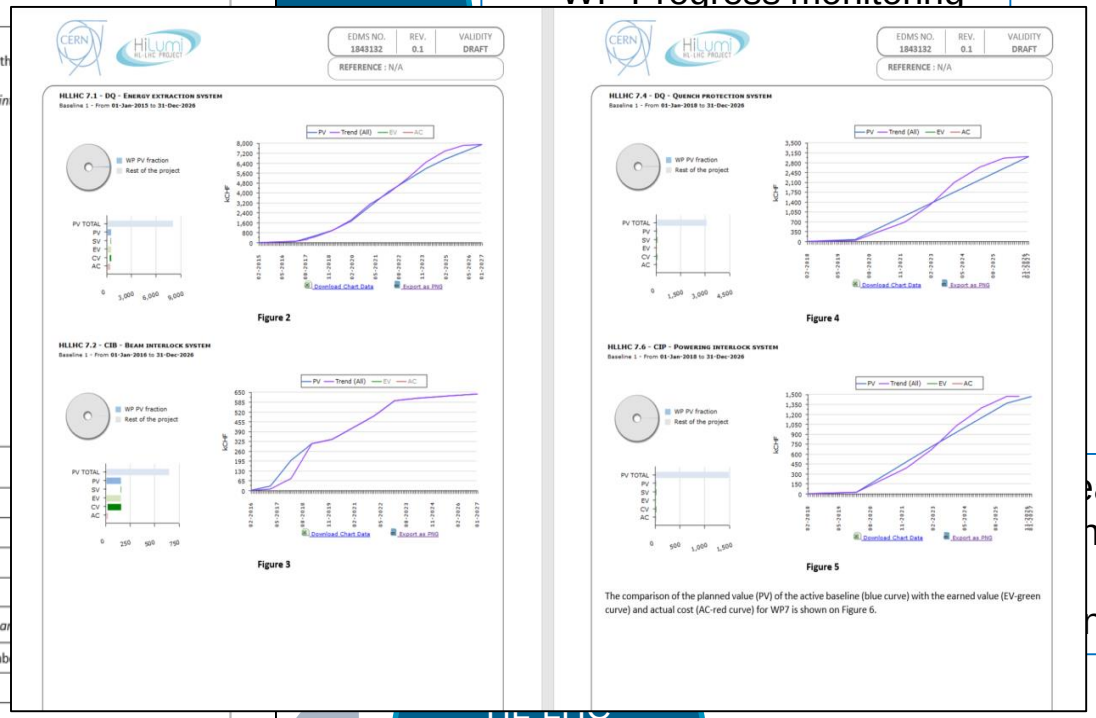

HLLHC 7.1 - DQ - Energy extraction system

Figure 2

HLLHC 7.2 - CIB - Beam interlock system

Figure 3

HLLHC 7.4 - DQ - Quench protection system

Figure 4

HLLHC 7.6 - CIP - Powering interlock system

Figure 5

The comparison of the planned value (PV) of the active baseline (blue curve) with the earned value (EV-green curve) and actual cost (AC-red curve) for WP7 is shown on Figure 6.

Project C&S Reviews

- Every 18 months
- Project Progress reporting
- C&S Update
- Savings/Loss reporting
- Baseline changes proposal

Training

- PMI Project Management course

- 2 French courses

- AXEL course

Thank you!