



# SLHC-PP

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The Preparatory Phase of the Large Hadron Collider upgrade (SLHC-PP) is a project co-funded by the European Commission in its 7th Framework Programme under the Grant Agreement n° 212114. SLHC-PP began in April 2008 and will run for 3 years.

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## 1. EXECUTIVE SUMMARY

The ATLAS upgrade plans are implemented as closely coordinated projects. These projects undergo three phases; first the R&D phase and feasibility/performance studies, then the prototype phase developing the project into a construction project, and ultimately the construction phase where the project execution is carried out within a defined scope, technical specifications, cost-estimates and schedule. In the ATLAS experiment the upgrade project definition and approval process is now agreed and established (ref 1), and the main upgrade project that is scheduled for installation during the LHC shutdown in 2013-14 is already in the construction phase, namely the Insertable B-Layer (IBL) project (ref 2). Several other smaller projects are also being studied but the IBL project remains the reference project for the initial upgrade, and the main topic of this report. An Interim MoU and cost-books for the phase I pixel system upgrades foreseen for this shutdown (IBL) have been produced (ref 3), and have been presented to and agreed by the Collaboration.

## 2. UPGRADE PROJECTS AND THE FORMAL STEPS TOWARDS IMOU AND COSTBOOKS

The first significant LHC machine shutdown is currently foreseen for 2013-14 and the major upgrade the ATLAS collaboration has foreseen for this shutdown is the insertion of a new PIXEL layer including replacement of the current central beampipe (IBL). Other upgrade projects considered are: [FTK \(Fast Track Trigger\)](#) (ref 4), new small muon wheels, new topological trigger at L1, possibly new calorimeter electronics and possibly a new warm FC. Among these the largest and most significant project, the IBL, has prepared a Technical Design Report, an Interim Memorandum of Understanding and a detailed Cost Book, including the installation work. The FTK project has the similar steps in progress, while the other projects mentioned is being considered.

The organization of the ATLAS upgrade projects is shown in figure 1. Note that the establishment of key parts of this organization is described in [milestone report 3.2](#).

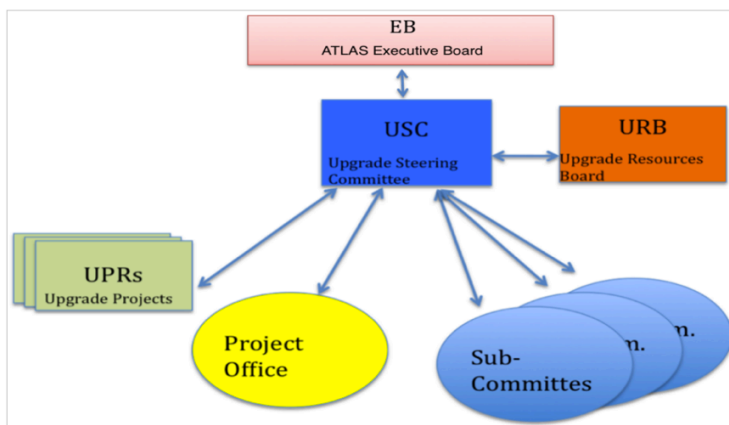


Figure 1: The ATLAS upgrade organization, showing the various bodies that are involved in setting up, costing, defining and approving the cost estimates and Interim Memorandum of Understanding for the upgrade projects (from ref 1).

Every major project that is intended as a part of the ATLAS upgrade has to pass through several steps. The process is illustrated in figure 2 (from ref 1) below where the steps are numbered from 1 to 6:

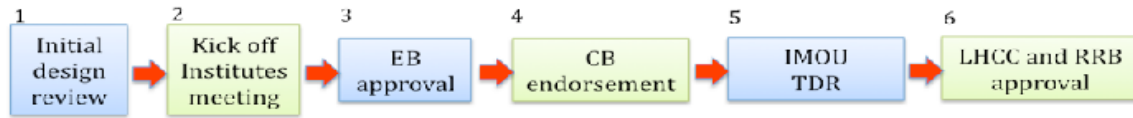


Fig. 2: Stages in Upgrade Project approval process

The key scientific, technical and resource documentation is a Technical Design Report (TDR), written by the main responsible groups in the upgrade project. The [Technical Design Report for the IBL upgrade project](#) was written in the Spring 2010. It is a 200 page document containing a full technical description of the project, a cost estimate (table 43, page 200), the organization structure, and a list of the participating institutes (see table 1 below). The schedule and detailed planning are also included in the document.

The ATLAS CB (Collaboration Board) consisting of one member per institute of the collaboration provides the final approval of the upgrade plans for the experiment – based on the TDR, before it is presented the LHC Committee (LHCC). LHCC is the external scientific programme committee installed by CERN to review the LHC experiments at regular intervals, and also major upgrade projects are reviewed by this committee. The IBL TDR was presented to the LHC Committee (LHCC) in 2010 at two occasions, once initially and the second time to provide answers to a list of the questions by the review committee.

The Interim Memorandum of Understanding, included a detailed cost estimate, was prepared in parallel (August 2010), and presented the Resource Review Board (RRB) in October 2010. The Resources Review Board (RRB) comprises the representatives of each Experiment's Funding Agencies and the managements of CERN and of each Experiment's Collaboration. It is chaired by the CERN Director for Research and Computing.

The role of the RRB includes:

- reaching agreement on the Memorandum of Understanding
- monitoring the Common Projects and the use of the Common Funds
- monitoring the general financial and manpower support
- reaching agreement on a maintenance and operation procedure and monitoring its functioning
- endorsing the annual construction and maintenance and operation budgets of the detector.

The management of the Collaboration reports regularly to the RRB on technical, managerial, financial and administrative matters, and on the composition of the Collaboration.

### 3. COSTBOOKS

The costbook for the IBL project is an annex of the Interim Memorandum of Understanding (ref 3) and is discussed in deliverable report 3.1.3: <https://edms.cern.ch/document/1133534/1>

#### 4. INTERIM MEMORANDUM OF UNDERSTANDING (IMOU)

The Interim Memorandum of Understanding for the IBL upgrade project consists of three parts:

- 1) A first part outlining the partners of the agreement, the purpose, the scope, the cost and the cost oversight, the cost sharing and procedures. This is the most formal part of the Interim Memorandum of Understanding that the partners have to sign.
- 2) Part two is the costbook as referred to in chapter 3 above. The key work-sharing can also be illustrated as shown in table 1 below from the TDR (ref 2).

Institutions in the IBL Construction		IBL MoU Deliverables										
		1	2	3	4	5	6	7	8	9	10	11
Institution	Country	Sensor	FE-14	Bump-bonding	Stave	Mod.Load	R/O Chain	PS Chain	Integration	Cooling plant	BP & Interfaces	Installation
Anney LAPP	France			1								
Barcelona	Spain	1		1				3	2			
Bergen	Norway	1										
Berkeley LBNL	United States of America		1				1					1
Berlin HU	Germany											
Bologna	Italy						1					
Bonn	Germany	1	1	1		1			2			
Brandeis	United States of America											1
CERN	Switzerland	1		1	1	1			1	2		
DESY	Germany						1	1				
Dortmund	Germany	1										
Geneva	Switzerland		1			1			1			1
Genova	Italy		1			1	3	3				
Glasgow	United Kingdom	1										
Göttingen	Germany		2				1		2			
Grenoble LPSC	France											1
Heidelberg ZITI	Germany											1
Iowa	United States of America							1	2			
KEK	Japan	1		1								
Liverpool	United Kingdom	1										
Ljubljana	Slovenia	1										
LPNHE Paris	France	1			2							
Manchester	United Kingdom	1										
Marseille CPPM	France		1		1	1						
Milano	Italy			1	1			1				
Munich MPI	Germany	2										
New Mexico	United States of America	1										
Nikhef	Netherlands		1		2					2		
Ohio State University	United States of America	1					1					
Oklahoma	United States of America						1		2			
Oklahoma SU	United States of America						1					
Orsay LAL	France	1										
Oslo	Norway	1				2			2			
Prague AS	Czech Republic	1										
Santa Cruz UC	United States of America	1				1			2			
Siegen	Germany						1					
SLAC	United States of America	1			2	1	2		2	2		
Stony Brook	United States of America	1					2		2			
Taipei AS	Taiwan						1					
Toronto	Canada	1										
Udine	Italy	1										
Wuppertal	Germany				1		1	1	2			
ATLAS TC	World Wide									1	1	1

Table 1: The responsibilities of the various partners of the IBL upgrade projects. The numbers illustrate various levels of commitment, 1) material + personnel, 2) personnel only, 3) additional resources.

- 3) A description of the IBL organisation, including the management, the organisation of work, the institute board, the role of the partners. As an example the organisational structure is shown below in figure 5.

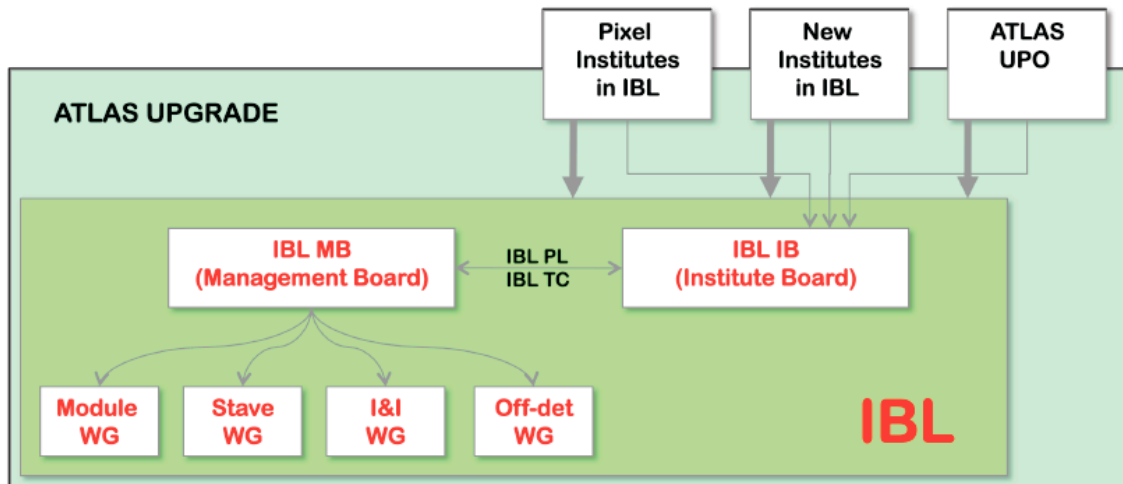


Figure 5: The organizational structure of the IBL projects, from an annex of the IMoU.

## 5. CONCLUSIONS

The procedure for agreeing on, approving and initiating upgrade projects in ATLAS is set up. The first of these projects and the main project foreseen for the installation in the shutdown in 2013-14, the Insertable B-Layer, has produced its Technical Design Report, and has a signed IMoU including a detailed costbook. Other projects will follow in the same path.

## 6. REFERENCES

- 1) ATLAS upgrade organization definition: <https://edms.cern.ch/document/1093133/3>
- 2) CERN-LHCC-2010-013, ATLAS-TDR-019 ATLAS Insertable B-Layer Technical Design Report: <http://cdsweb.cern.ch/record/1291633>
- 3) Interim Memorandum of Understanding including costbook as annex (CERN-RRB-2010-118)
- 4) Proposal to prepare a technical design report for FTK, a hardware track finder upgrade to the ATLAS trigger: <https://edms.cern.ch/document/903426/1>