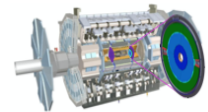
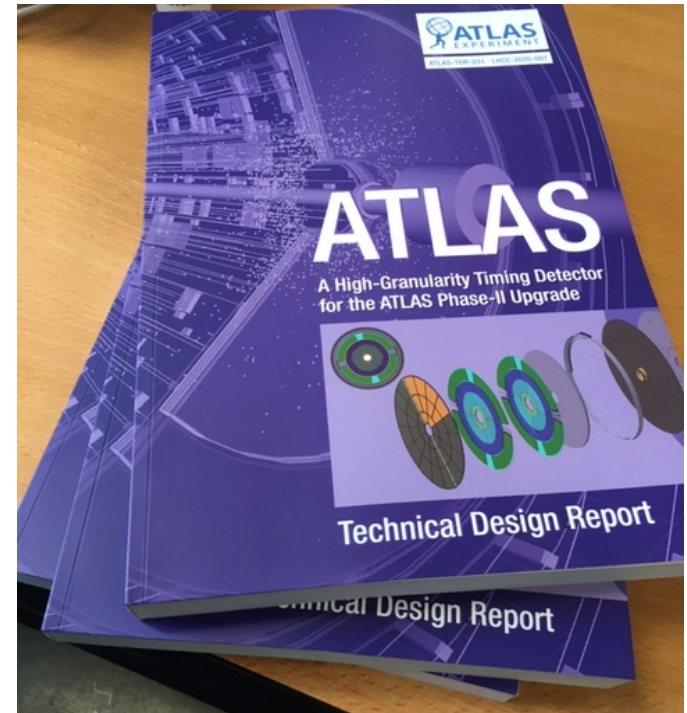
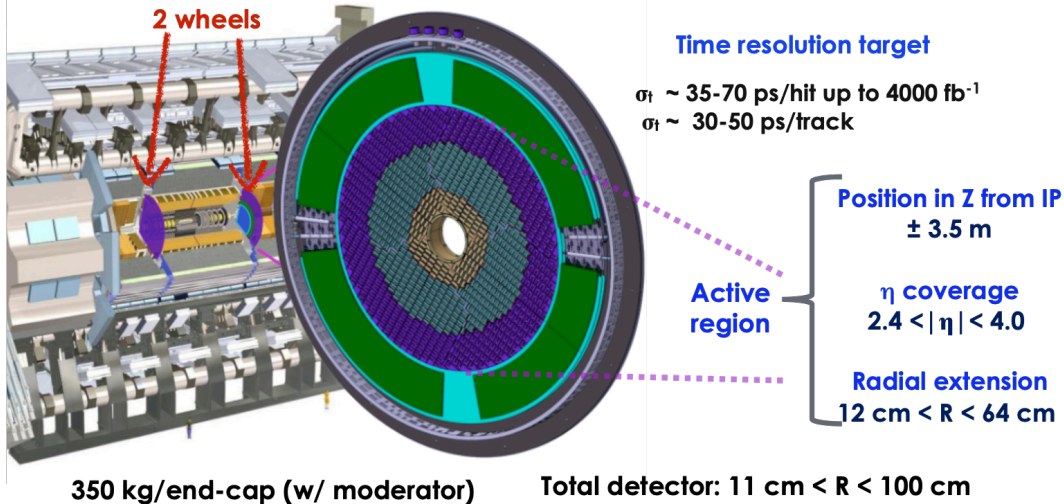


HGTD – Réunion Ressources

1. Financement et ressources
2. Activités au LPNHE
3. Ressources globales pour module assembly and loading
4. Schedule and Milestones
5. Production : support units and detector units
6. Evaluation des besoins - Demandes



ATLAS
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Core funding by Funding Agency

> **97.8%** CORE cost coverage

Major funding agencies:

France (IN2P3 + CEA)

ASIC Design
Module assembly
Mechanics design

China

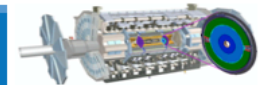
Sensor development and testing
Module assembly
Periphery electronics and DAQ

CERN

Demonstrator
CO₂ cooling
Assembly and Integration

CORE Costs ¹⁾ [kCHF]	11,133
Funding Agency	
Brazil	230
China NSFC+MSTC	2,100
France IN2P3	2,700
France CEA	543
Germany BMBF	300
Morocco	200
Russia	100
JINR	600
Slovenia	120
Spain	440
Sweden	800
Taipei	500
Turkey	250
CERN	2,006
TOTAL (kCHF)	10,888
% of CORE Costs	97.8%
Δ (Total - CORE Costs)	-245

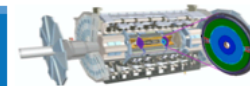
30



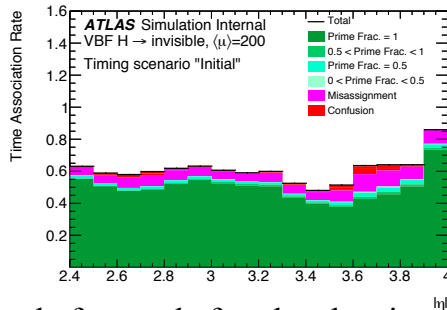
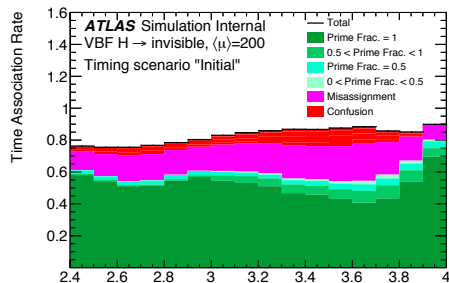
Institute effort available (result from Survey)

Up to
2027

Institute	Country	Physicists	Engineers	Technician	Students	Total
IHEP cluster, Beijing	China	30.95	22.7	16.7	48.4	118.75
Univ. Hassan II, Casa Blanca	Morroco	7.5	2	3	7	19.5
LPC, Clermont Ferrand	France	10.5	13.5	1.6	4	29.6
JIRN, Dubna	Russia	1.8	12.9	4.6	0	19.3
IFAE, Barcelona	Spain	4.3	13.5	11.5	17.5	46.8
CERN		14.1	4.2	11.8	8.3	38.4
National Tsing Hua Univ.	Taiwan	11.4	0	9	2.1	22.5
JSI, Ljubjana	Slovenia	2.8	1.9	0	4	8.7
LPNHE, Paris	France	9.9	6.5	10	1.5	27.9
Univ. Sao Paulo	Brazil	3.6	3.7	6.7	4.5	18.5
USTC cluster, Hefei	China	7.6	2.7	5.5	20.7	36.5
KTH, Stockholm	Sweden	4	2	0.2	6.3	12.5
MEPhI, Moscow	Russia	6.7	6	0	1.5	14.2
Joh.-Gutenberg Univ., Mainz	Germany	7	3.1	3.1	7.2	20.4
IJCLab, Orsay	France	13.3	17.5	17.9	2	50.7
Justus-Liebig Univ, Giessen	Germany	5.6	0	0	3	8.6
IRFU, CEA	France	0.7	0	3	0	3.70
Academica Sinica, Taipei	Taiwan	Included in NTHU				-
Total		132.4	111.1	103	139.5	486



Simulation P&P; Beam test data analysis; Detector R&D construction and tests

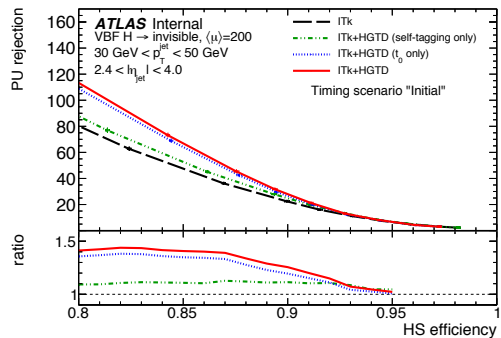
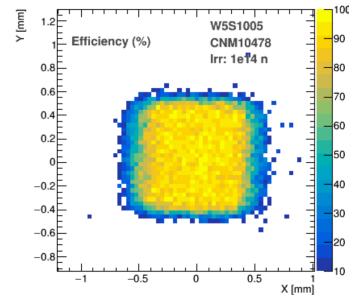
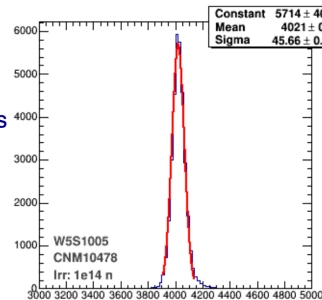


Time association rate versus eta before and after the cleaning procedure

$$\sigma = (45.6 \pm 0.2) \text{ ps}$$

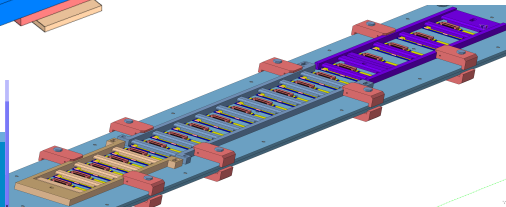
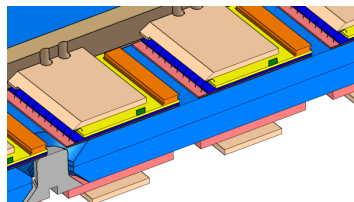
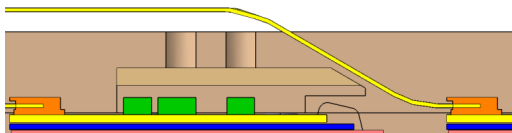
$$\sigma_{\text{SIPM}} = 30 \text{ ps}$$

$$\sigma = 29 \text{ ps}$$

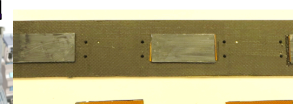
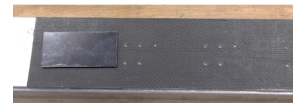
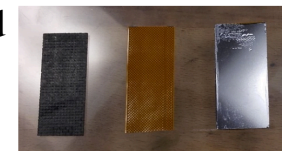
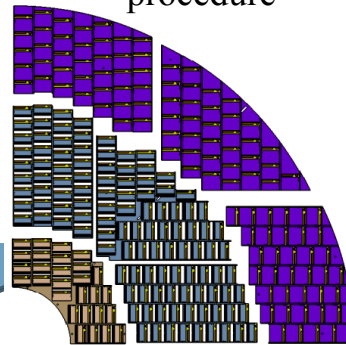


ROC curves showing the improvements in pile-up rejection for the low jet pt range

Detector design – modules placement and loading

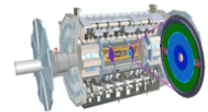


Gluing tests and procedure



WBS 8.4 : Modules and Detector units – Dictionary

8.4	Modules and Detector Units	Didier Lacour, Lucia Masetti, Sebastian Grinstein	Detector elements, assembled sensing modules and flex cable connectivity
8.4.1	Bare module hybridization	Sebastian Grinstein, Zhijun Liang	Sensors and ASIC bump-bonded module
8.4.1.1	Bumps deposition on ASIC wafer		Deposit UBM and solder bump on ASIC wafer
8.4.1.2	UBM on sensor wafer		Deposit under metal bump (UBM) on sensor wafer
8.4.1.3	Dicing		Wafer dicing
8.4.1.4	Flip-chip		Interconnection of sensor and ASIC
8.4.1.4.1	Flip-chip process		Process to interconnection sensor and ASIC
8.4.1.4.2	Flip-chip quality test		Shear tests and X ray imaging
8.4.2	Module Flex	Jie Zhang, Marisol Robles	Flexible PCB to be glued to the bare module
8.4.2.1	Assembled module flexes		Flex PCB assembled with standard components and connector to flex tail
8.4.2.1.1	Module flexes with standard components		Flex PCB, standard components and assembly process
8.4.2.1.2	Connectors to flex tails		Separate connectors for HV and other lines
8.4.2.2	Certification test benches		Adapter board to connect to module assembly test bench
8.4.3	Modules assemblies	Sebastian Grinstein, Zhijun Liang	Sensor, ASIC and module flex assembly
8.4.3.1	Tooling for assembly		Vacuum jigs tools for pick-and-place process
8.4.3.2	Glue		Glue for gluing bare module on flex
8.4.3.3	Wire bonding		Wire and wedges for wire-bonding
8.4.3.4	Module assembly tests		Module tests for 5 sites (FPGA and carrier boards)
8.4.3.5	Storage protection enclosures		Module enclosure for storage and handling protection
8.4.4	Detector units	Didier Lacour, Lucia Masetti	Detector elements fully equipped with assembled modules
8.4.4.1	Support units		Structures housing the modules
8.4.4.2	Glue		Araldite 2011 - Standard product
8.4.4.3	Electrical test benches		System for electrical tests before and after loading
8.4.4.4	Tooling for loading		Tooling for positioning and gluing
8.4.4.5	Packaging and shipping		Packaging and shipping the detector units to CERN
8.4.5	Flex cable tails	Lucia Masetti, Maria Soledad Robles Manzano	Flex cables from modules to PEB
8.4.5.1	Flex PCB		Flex PCB (no assembly necessary)
8.4.5.2	Certification test benches		Adapter board to connect to module assembly test bench



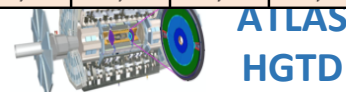
WBS 8.4.3 – 8.4.4 Resources for module assemblies and detector units

Activities supported by institutes requiring significant resources. The assembly and loading of the module will be done on the same sites. It will be shared by six production sites: 3 primary sites (larger, faster, 6 modules/day) and 3 secondary sites (smaller, slower, 4 modules/day). IHEP; IFAE; LPNHE/IJCLab/IRFU; Mainz; USTC SINANO; MAscIR Morocco

The resources for these two tasks can be considered together:

- Physicists coordinating the activities
- Engineers providing technical support
- Technicians in charge of the gluing and wire bonding operations and loading
- Students helping out with the simpler parts of the gluing and loading procedure and in charge of tests, analysis of the results and documentation

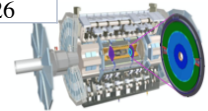
Professional categories	WBS item	Responsible Person	Total [FTE-years]	2020	2021	2022	2023	2024	2025	2026
8.4.3	Modules assemblies	Sebastian Grinstein, Zhijun Liang	55,70	0,4	4,5	9,0	9,7	10,0	19,6	2,5
	Physicists		8,6	0,1	0,9	1,2	1,5	1,5	3,0	0,4
	Engineers		10,9	0,1	0,6	1,8	2,2	1,9	3,8	0,5
	Technicians		16,4	0,1	1,5	3,0	3,0	2,8	5,3	0,7
	Students		19,8	0,1	1,5	3,0	3,0	3,8	7,5	0,9
8.4.4	Detector units	Didier Lacour, Lucia Masetti	49,30	0,4	1,9	9,6	10,3	9,5	15,1	2,5
	Physicists		8,6	0,1	0,3	1,2	1,9	1,6	3,0	0,5
	Engineers		11,6	0,1	0,6	1,8	2,4	2,3	3,8	0,6
	Technicians		18,2	0,1	0,5	3,6	3,9	3,9	5,3	0,9
	Students		10,9	0,1	0,5	3,0	2,1	1,7	3,0	0,5



WBS 8.4.4 - Schedule for detector units

- R&D and prototyping: 09/20 – 05/23
- Prototypes
- Demonstrator
- Specifications definition
- **SPR 10/02/22:**
Requirements, design of the support unit, glue qualification, support for demonstrator
- **PDR 20/10/22:**
Pre-prototype, prototype design, demonstrator with heaters and modules (ALTIROC1 / 2) loaded
- **FDR 15/05/23:**
Prototype and tests, support units prototypes (real size and shape), dummy modules loaded
- **PRR 18/03/24:**
Pre-production
- **Sites qualification: 18/09/23 - 20/10/23**
- Pre-production 16/05/23 - 05/02/24
- Support units production in company and qualification: 19/03/24 - 11/10/24
- Production: 8 batches by 6 institutes

Design and manufacturing of demonstrator support units		01/10/20	01/03/21
Manufacturing of a prototype of each type of support unit		01/03/22	30/09/22
Definition of acceptance criteria of support units		03/10/22	31/01/23
Controls of specification on support unit prototypes		01/02/23	31/05/23
Choice of glue - preliminary laboratory tests		01/09/20	30/10/20
Tests with the selected glue on samples		02/11/20	15/01/21
Gluing test of dummy modules on prototype support		18/01/21	12/03/21
Glue radiation hardness test		15/03/21	31/05/21
Loading of heaters and modules onto the demonstrator		02/03/21	01/10/21
Definition of the procedure of loading		04/10/21	01/11/21
Definition of the acceptance criteria of detector units		02/11/21	01/12/21
Module removal procedure		04/10/21	02/06/22
Detailed procedure of loading and testing		01/02/22	01/09/22
Definition of the needs for the packaging, drawings and prototyping		02/06/22	01/09/22
Production (0- 12.5%)	59 days	18/07/24	09/10/24
Production (12.5- 25%)	55 days	17/10/24	08/01/25
Production (25- 37.5%)	51 days	15/01/25	26/03/25
Production (37.5- 50%)	48 days	01/04/25	10/06/25
Production (50-62.5%)	44 days	12/06/25	12/08/25
Production (62.5-75%)	43 days	14/08/25	14/10/25
Production (75-87.5%)	43 days	16/10/25	15/12/25
Production (87.5-100%)	42 days	17/12/25	19/02/26



Detector units: Milestones until end R&D

• Glue qualification

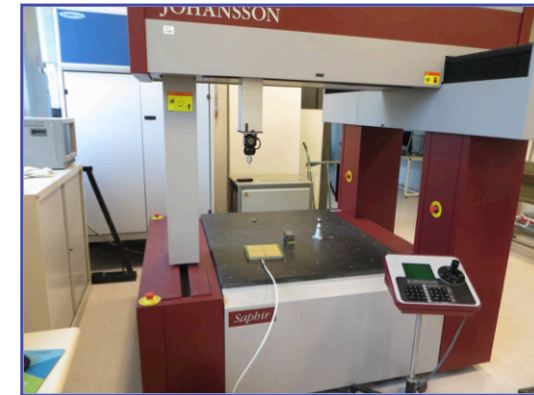
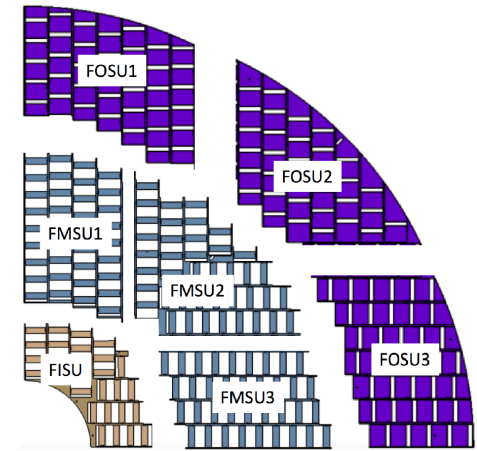
1. Choice of glue - preliminary laboratory tests: -> 30/10/20
2. Tests with the selected glue on samples: 02/11/20 - 15/01/21
3. Gluing test of dummy modules on prototype support: 18/01/21 - 12/03/21
4. Glue radiation hardness test: 15/03/21 - 31/05/21

• Design and control of the support unit

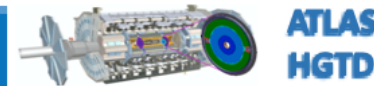
1. Design and manufacturing of demonstrator support units: -> 01/03/21
2. Manufacturing of a prototype of each type of support unit: 01/03/22 - 30/09/22
3. Definition of acceptance criteria of support units: 03/10/22 - 31/01/23
4. Controls of specification on support unit prototypes: 01/02/23 - 31/05/23
5. Support unit pre-production: 02/06/23 - 31/07/23
6. Control of specification of support unit pre-production: 01/08/23 - 15/09/23

• Loading procedure and tests

1. Loading of heaters and modules onto the demonstrator: 02/03/21 - 01/10/21
2. Module removal procedure; 04/10/21 - 02/06/22
3. Definition of the tooling: 02/11/21 - 01/09/22
4. Detailed procedure of loading and testing: 01/02/22 - 01/09/22

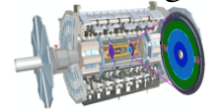


3D metrological machine used to control the support units (size, flatness)



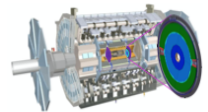
WBS 8.4.4 – Support units production : LPNHE

- Production carried out by one or more companies.
- Total duration of the production: 60 working days.
- Pre-production: 14 pieces, one of each type.
- It is not planned to manufacture more supports than necessary but additional pre-cut carbon fibre sheets will be produced and stored, ready to be machined for a given type.
- A single institute (LPNHE) responsible for production, monitoring and control. A 3D metrological machine available in the lab.
- Controls done as “acceptance criteria”.
- Support units sent to the loading sites.
- Control and acceptance phase sequenced in eight batches, according to the needs of the loading sites.
- The goal is to have the supports available as soon as possible, for each step (demonstrator, prototypes, pre-production, production).
- Orders placed as soon as the designs are validated and the previous step passed.
- With the current schedule, there is no margin between the delivery of the first batch and the start of loading.
- From the second batch, we have a delay of 4 months between the delivery of supports and the start of loading.



WBS 8.4.4 – Detector units production

- Production will be done in HGTD institutes (6 productions sites)
- 224 detector units for eight disks.
- Production divided into eight batches, each corresponding to a disk.
- Each disk, therefore each batch, contains 7 different types of detector units.
- Types are different between the front and the back disks, so there is a total of 14 types of detector units.
- Considering six loading sites, on average, each site should produce 38 detector units.
- The total duration to produce one detector unit is ten days.
- The 6 sites will not produce exactly the same quantities.
- Loading sites are also module assembly sites which will not produce the same quantity of modules. Thus, the sites will not have the same number of modules available for loading.
- 3 sites will produce 6 modules per day while 3 others will produce 4 modules per day.

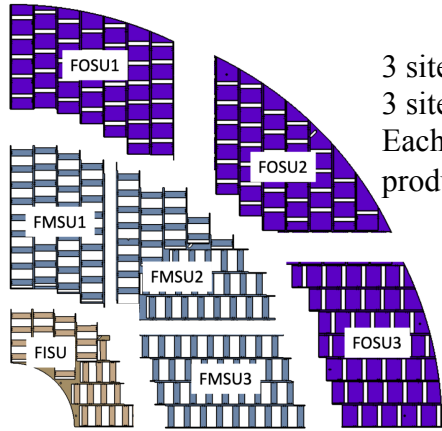


WBS 8.4.4 – Detector units production

3 sites assembling 6 modules = primary loading site

3 sites assembling 4 modules = secondary loading site

Each site produces four different types of detector units, except one that produces two. All sites must be able to produce any type of detector (positioning plates available and glue robot software installed and tested)



Batch 1 = 28 units = 1 **Front** disk = 4x7 different **Front** types = 1000 modules

Primary site1: 2 FISU(28 modules) + 4 FMSU1(36 modules) -> 200 modules loaded / 6 units

Primary site2: 1 FISU(28 modules) + 4 FMSU2(42 modules) -> 196 modules loaded / 5 units

Primary site3: 1 FISU(28 modules) + 4 FOSU1(38 modules) -> 180 modules loaded / 5 units

Secondary site4: 2 FOSU2(33 modules) + 2 FOSU3(37 modules) ->140 modules loaded / 4 units

Secondary site5: 2 FOSU2(33 modules) + 2 FOSU3(37 modules) ->140 modules loaded / 4 units

Secondary site6: 4 FMSU3(36 modules) ->144 modules loaded / 4 units

Batch 2 = 28 units = 1 **BACK** disk = 4x7 different **Back** types = 1008 modules

Primary site1: 2 BISU(26 modules) + 4 BMSU1(36 modules) -> 196 modules loaded / 6 units

Primary site2: 1 BISU(26 modules) + 4 BMSU2(43 modules) -> 198 modules loaded / 5 units

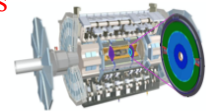
Primary site3: 1 BISU(26 modules) + 4 BOSU3(39 modules) -> 182 modules loaded / 5 units

Secondary site4: 2 BOSU2(33 modules) + 2 BOSU1(39 modules) ->144 modules loaded / 4 units

Secondary site5: 2 BOSU2(33 modules) + 2 BOSU1(39 modules) ->144 modules loaded / 4 units

Secondary site6: 4 BMSU3(36 modules) ->144 modules loaded / 4 units

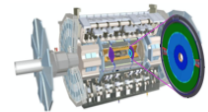
Front	Number of modules		Back
FISU	28	26	BISU
FMSU1	36	36	BMSU1
FMSU2	42	43	BMSU2
FMSU3	36	36	BMSU3
FOSU1	38	39	BOSU1
FOSU2	33	33	BOSU2
FOSU3	37	39	BOSU3



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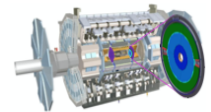
Organisation locale – création d'un cluster parisien pour la production

- **IJClab + IRFU + LPNHE** : un des six sites d'assemblage des modules et de construction des detectors units – un des trois sites principaux (primary site)
- **IJCLab + IRFU** : assemblage des modules
 - IJCLab : réception des modules et des modules Flex- Tests et contrôles - Collage
 - IRFU : Wire-bonding – Tests -> **pas de Wire-bonding au LPNHE**
- **LPNHE** : loading des modules sur les supports units + tests
 - **Pre-production** 16/05/23 - 05/02/24 : 3 detector units
 - Deux CDD construction + supervisions
 - **8 batches production** : 18/07/2024 au 19/02/2026
 - **Par batch, au LPNHE** : 5 à 6 detector units à fournir, 200 modules loaded max, en 60 à 40 jours
 - Deux CDD construction + supervisions + maintenance



Reviews HGTD – ATLAS : 8.4.4 detector units

8.4.4 Reviews	Dates	
SPR Specifications Review	10/02/22	Requirements, design of the support unit, glue qualification, support for demonstrator
PDR Preliminary Design Review	20/10/22	Pre-prototype, prototype design, demonstrator with heaters and modules (ALTIROC1/2) loaded
FDR Final Design Review	15/05/23	Prototype and tests, support units prototypes (real size and shape), dummy modules loaded
PRR Production Readiness Review	18/03/24	Pre-production

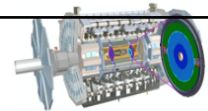


Besoins et demandes (pas de wire-bonding, pas de conception banc de test électrique)

Démonstrateur WP01 : tâches ventilées dans différents WPs

Wire-bonding WP08 : réaffecté au IJCLab

Phase	Dates	Activité	RH	Outils - Equipement
R&D	09/20-05/23	Supports (démonstrateur, proto)	Méca	CAO, Tri-Dim, Robot
		Colle	Méca	Robot, Atelier
		Outillage	Méca	CAO, Atelier
		Loading (démonstrateur, proto)	Méca, Elec, Info	Robot, Atelier
		Packaging	Méca, SG ?	CAO, Atelier
Pre-production	06/23-09/23	Supports	Méca 2CDD construction	Tri-Dim
	05/23-02/24	Detector units	Méca, Elec 2CDD construction	Robot, banc de test
Production	03/24-10/24	Support	Méca 2CDD construction	Tri-Dim
	07/24-02/26	Detector units	IMéca, Elec 2CDD construction	Robot, banc de test



8.4.4.1 WP02 Support Unit

HGTD PBS	Work package	Work package designation	work package detail	Description	Equipements	Livrable	2020,5	2021	2021,5	2022	2022,5	2023	2023,5	2024	2024,5
8.4.4.1	WP02	Support Unit													
	WP02_1a	Support Unit	Support unit demo concept	BE	ordi / licence CAO	Fichiers CAO	0,1								
	WP02_1b	Support Unit	Demonstrateur Unit	Suivi fabrication, Reception, Documentation	tridim	SU testé au labo	0,05	0,05							
	WP02_2a	Support Unit	Support unit concept	BE	ordi / licence CAO	Fichiers CAO	0,4	0,4	0,2	0,1	0,1				
	WP02_2b	Support Unit	Support unit proto (6 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo	0,05	0,1	0,05	0,05					
	WP02_3	Support Unit	Support unit pré- production (14 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo					0,4	0,2	0,2		
	WP02_4	Support Unit	Support unit production (224 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo								1	1

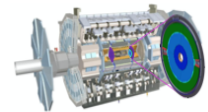
Période 2020.5 et 2021

Activités: design, suivi fabrication supports démonstrateur et support prototype, contrôles dimensionnels

Besoins

Mécanique 2020.5 = 0.6 FTE

Mécanique 2021 = 0.55 FTE



8.4.4.2 WP03 Glue

HGTD PBS	Work package	Work package designation	work package detail	Description	Equipements	Livrable	2020,5	2021	2021,5	2022
8.4.4.2	WP03	Glue								
	WP03-1	Glue	Preliminary tests & Choice		pistolet (+robot ?)	Doc de tests	0,4	0,1		
	WP03-2	Glue	tests on demonstrateur		robot collage	qq DU avec modules		0,3	0,1	
	WP03-3	Glue	tests on prototype		robot collage	qq DU avec modules		0,1	0,3	0,2
	WP03-4	Glue	radiation hardness test		DU + CERN/ DESY facility	retour DU irrad et testés		0,1	0,1	
	WP03-5	Glue	Purchase		-	Dispo colle			0,05	

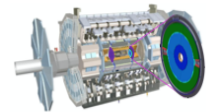
Période 2020.5 et 2021

Activités: Qualification de la colle (durée et température), tests de collage sur prototype et démonstrateur, échantillons pour irradiation

Besoins:

Mécanique 2020.5 = 0.4 FTE

Mécanique 2021 = 0.6 FTE



8.4.4.3 WP04 Electrical test bench -> pas de conception au LPNHE

8.4.4.4 WP05 Tooling for loading

HGTD PBS	Work package	Work package designation	work package detail	Description	Equipements	Livable	2020,5	2021	2021,5	2022	2022,5	2023	2023,5
8.4.4.3	WP04	Electrical test bench					0,1	0,2	0,2	0,2	0,2		
8.4.4.4	WP05	Tooling for loading											
	WP05_1	Tooling for loading	Removal procedure					0,1	0,1	0,1	0,1		
	WP05_2	Tooling for loading	Tooling démonstrateur	3 Plaques aspirantes + dépôt colle + soft	robot collage - tridim		0,5	0,1					
	WP05_3	Tooling for loading prototype	3 supports	3 Plaques aspirantes + dépôt colle + soft	robot collage - tridim			0,3	0,5				
	WP05_4	Tooling for loading	14 supports	detailed procedure of loading and testing	robot collage - tridim				0,2	0,5	0,1	0,1	0,1

Période 2020.5 et 2021

Activités: Outillage pour le loading des modules démonstrateur et prototypes et tests

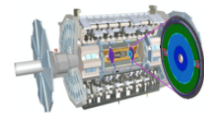
Besoins:

Mécanique 2020.5 = 0.5 FTE

Mécanique 2021 = 0.5 FTE

Électronique 2020.5 = 0.1 FTE

Électronique 2021 = 0.2 FTE



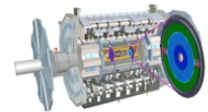
8.4.4 - WP07 Detector Unit

HGTD PBS	Work package	Work package designation	work package detail	Description	Equipements	Livable	2022	2022,5	2023	2023,5	2024	2024,5	2025	2025,5
8.4.4	WP07	Detector Unit												
	WP07_1	Detector Unit	detector unit prototype		robot collage - tridim	3 units	0,3	0,3	0,3					
	WP07_2	Detector Unit	detector units pre- production		robot collage - tridim	4 à 14 units			2,2	2,2				
	WP07_3	Detector Unit	Qualification of loading sites	preparation, glue, tests electriques, DAQ,	robot collage - tridim					0,1	0,1			
	WP07_4	Detector Unit (loading) (2x2 batchs)	~2* supports differents x 2	production	robot collage - tridim	24 units max 800 modules					2,2	2,2		
	WP07_4	Detector Unit (loading) (2x2 batchs)	~2* supports différents x 2	production	robot collage - tridim	24 units max 800 modules							2,2	2,2

Période 2020.5 et 2021

Activités: le loading des modules sur le démonstrateur et les tests de loading font partie de la mise au point du loading (WP5) et des tests de colle (WP3)

Pas de besoins quantifiés pour WP07



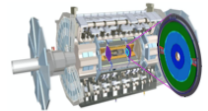
8.4.4.5 WP06 Packaging and shipping

HGTD PBS	Work package	Work package designation	work package detail	2021,5	2022	2022,5	2023	2023,5	2024	2024,5	2025	2025,5	2026
8.4.4.5	WP06	Packaging and shipping											
	WP06-1	Packaging and shipping	definition packaging	0,2		0,2	0,2	0,2					
	WP06-2	Packaging and shipping	shipping					0,2	0,1	0,1	0,1	0,1	0,1

Période 2020.5 et 2021

Activités: Réflexion sur le besoin au vu des livrables WP5 et WP7

Pas de besoins spécifiques d'ici 2021.5



Résumé des demandes 2020.5 et 2021 – Locaux et équipement - Risques

Demandes ressources 2020.5

Mécanique = 1.5 FTE ; Electronique = 0.1 FTE

Compte tenu des personnes impliquées jusqu'à présent et des ressources effectives dans les services, voici une suggestion d'affectation:

Didier Laporte $0.1+0.05+0.05+0.4 = 0.6$

Patrick Ghislain : $0.2+0.5 = 0.7$

Julien Philippe = 0.2

Electronicien = 0.1

Demandes ressources 2021

Mécanique = 1.65 ; Electronique = 0.2

Didier Laporte $0.1+0.1+0.4 +0.05+0.1 = 0.75$

Patrick Ghislain $0.3+0.1+0.1+0.1+0.1 = 0.7$

Mécanicien = 0.2

Electronicien = 0.2

Locaux et équipement

Salle trid-dim + Robot « calice » : 1222-RC07

Salle HGTD : 1222-RC09 avec plafond soufflant à conserver (remplacement des moteurs à financer)

Remise à disposition de la salle 1222-SS14

Disponibilité du robot Calice

Disponibilité de la tri-dim

Risques

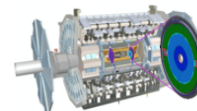
Perte de la compétence collage

Perte de la compétence métrologie tri-dim

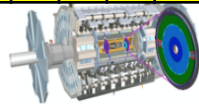
Indisponibilité de l'atelier (reprise de pièces...)

Aléas RH (départ privé, NOEMI...), faible nombre de personnes

absence de redondance de compétence, inadéquation des compétences aux besoins



HGTD PBS	Work package	Work package designation	work package detail	Description	Equipements	Livrable	2020,5	2021	2021,5	2022	2022,5	2023	2023,5	2024	2024,5	2025	2025,5	2026
	WP01	Demonstrator																
	WP01_1	→ WP02-1[ab] (Support Unit)	Demonstrateur Unit	Suivi fabrication, Reception, Documentation	tridim		0,15	0,05	0	0	0	0	0	0	0	0	0	0
	WP01_2	→ WP03_2 (Glue)	tests on demonstrateur		robot collage		0	0,3	0,1	0	0	0	0	0	0	0	0	0
	WP01_3	→ WP05-2 (Tooling for loading)	Tooling démonstrateur	3 Plaques aspirantes + dépôt colle + soft	robot collage - tridim		0,5	0,1	0	0	0	0	0	0	0	0	0	0
8.4.4.1	WP02	Support Unit																
	WP02_1a	Support Unit	Support unit demo concept	BE	ordi / licence CAO	Fichiers CAO	0,1											
	WP02_1b	Support Unit	Demonstrateur Unit	Suivi fabrication, Reception, Documentation	tridim	SU testé au labo	0,05	0,05										
	WP02_2a	Support Unit	Support unit concept	BE	ordi / licence CAO	Fichiers CAO	0,4	0,4	0,2	0,1	0,1							
	WP02_2b	Support Unit	Support unit proto (6 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo	0,05	0,1	0,05	0,05								
	WP02_3	Support Unit	Support unit pré-production (14 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo					0,4	0,2	0,2					
	WP02_4	Support Unit	Support unit production (224 supports)	Suivi fabrication, Reception, Documentation	tridim	SU testés au labo								1	1			
8.4.4.2	WP03	Glue																
	WP03_1	Glue	Preliminary tests & Choice		pistolet (+robot ?)	Doc de tests	0,4	0,1										
	WP03_2	Glue	tests on demonstrateur		robot collage	qq DU avec modules		0,3	0,1									
	WP03_3	Glue	tests on prototype		robot collage	qq DU avec modules		0,1	0,3	0,2								
	WP03_4	Glue	radiation hardness test		DU + CERN/DESY facility	retour DU irradi et testés		0,1	0,1									
	WP03_5	Glue	Purchase		-	Dispo colle			0,05									
8.4.4.3	WP04	Electrical test bench					0,1	0,2	0,2	0,2								
8.4.4.4	WP05	Tooling for loading																
	WP05_1	Tooling for loading	Removal procedure					0,1	0,1	0,1	0,1							
	WP05_2	Tooling for loading	Tooling démonstrateur	3 Plaques aspirantes + dépôt colle + soft	robot collage - tridim		0,5	0,1										
	WP05_3	Tooling for loading prototype	3 supports	3 Plaques aspirantes + dépôt colle + soft	robot collage - tridim			0,3	0,5									
	WP05_4	Tooling for loading	14 supports	detailed procedure of loading and testing	robot collage - tridim				0,2	0,5	0,1	0,1	0,1					
8.4.4.5	WP06	Packaging and shipping																
	WP06_1	Packaging and shipping	definition packaging						0,2		0,2	0,2	0,2					
	WP06_2	Packaging and shipping	shipping											0,2	0,1	0,1	0,1	0,1
8.4.4	WP07	Detector Unit																
	WP07_1	Detector Unit	detector unit prototype		robot collage - tridim					0,3	0,3	0,3						
	WP07-MS1	Milestone	SPR (2 / 10 / 2022)															
	WP07-MS2	Milestone	PDR (12 / 20 / 2022)															
	WP07_ MS3	Milestone	FDR (5 / 15 / 2023)															
	WP07_2	Detector Unit	detector units pre-production		robot collage - tridim						2,2	2,2						
	WP07_3	Detector Unit	Qualification of loading sites	preparation, glue, tests électriques, DAQ,	robot collage - tridim							0,1	0,1					
	WP07_ MS4	Milestone	PRR (3 / 18 / 2024)															
	WP07_4	Detector Unit (loading) (2x2 batches)	~2* supports différents x 2	24 supports max , 800 modules	robot collage - tridim									2,2	2,2			
	WP07_4	Detector Unit (loading) (2x2 batchs)	~2* supports différents x 2	24 supports max , 800 modules	robot collage - tridim											2,2	2,2	
	WP07_5	Detector Unit , following the tests, production, etc.			DB?				0,05	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1



Detector units: module loading procedure - preliminary

several studies in progress - prototyping, demonstrator and pre-production will refine the procedure

- Day 1

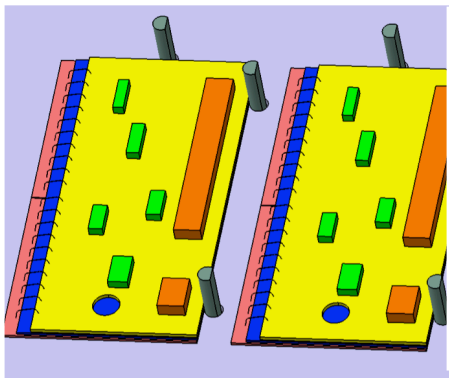
Preparation of the components (modules, support unit, glue) – visual control – cleaning
Bookkeeping and updating of the database – tooling preparation

- Day 2

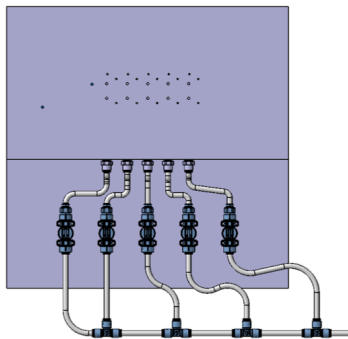
Installation of the modules on the vacuum clamping plate - manual positioning of the studs and modules
Visual and geometrical control - Glue deposition (simulation and optimization in progress)
Placement in the oven and start of polymerization

- Day 3

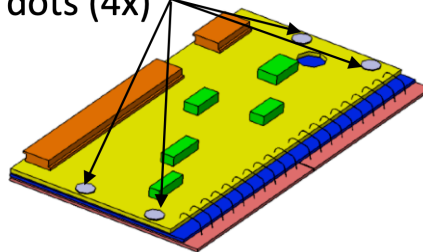
Glue polymerization (procedure to be defined - duration and temperature to be optimized) - Removal from the oven



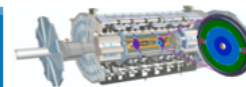
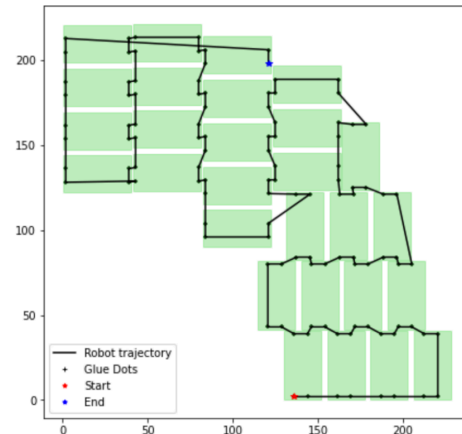
Design of a vacuum clamping plate prototype and module positioning thanks to studs



Glue dots (4x)

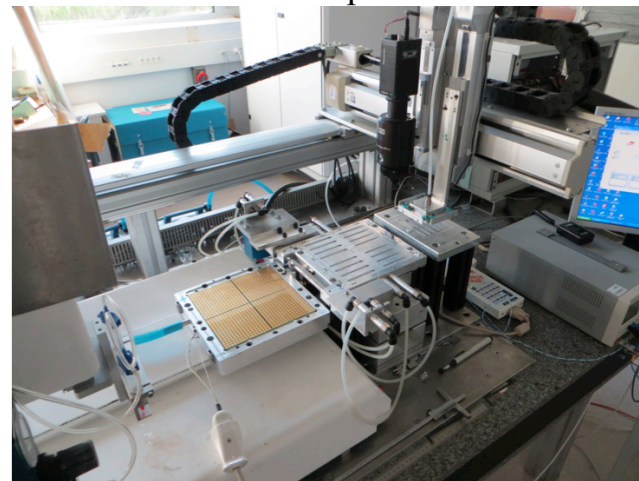


Position of the glue dots on the module and trajectory of the robot for the glue deposit

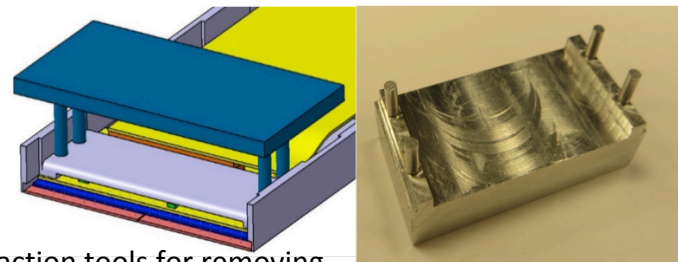


Detector units: module loading procedure and schedule - preliminary several studies in progress - prototyping, demonstrator and pre-production will refine the procedure

- Day 4
Removal of the detector unit from vacuum clamping plate and fixation on other plates for tests and packaging
(the detector units are protected by sandwiching between two plates allowing manipulation for testing then transport)
Connection of modules to the test system (with dedicated flex cables)
Start of electrical test (not yet defined) – 26 to 43 modules to be tested depending on the detector units – If 20 minutes/module: 15 hours for 43 modules
- Day 5 + Day 6
Electrical test – data analysis – **Mechanical Measurements: flatness control**
bookkeeping and updating of the database - Problematic module studies
- If defective modules (**major uncertainty -> main risk; main opportunity**)
 - Day 7 Removal of defective modules - Installation of replacement modules
 - Day 8 Gluing, polymerization,
 - Day 9 Tests
- Day 10 Data analysis – final checks, Bookkeeping and updating of the database, Packaging



Gluing robot allowing an automatic deposit of the glue dots onto the modules of a given detector units



Extraction tools for removing the defective module

