

ECAL engineering design and support infrastructure

Mainly based on material from Frederic Dall'Omo **Bruno Lieunard**

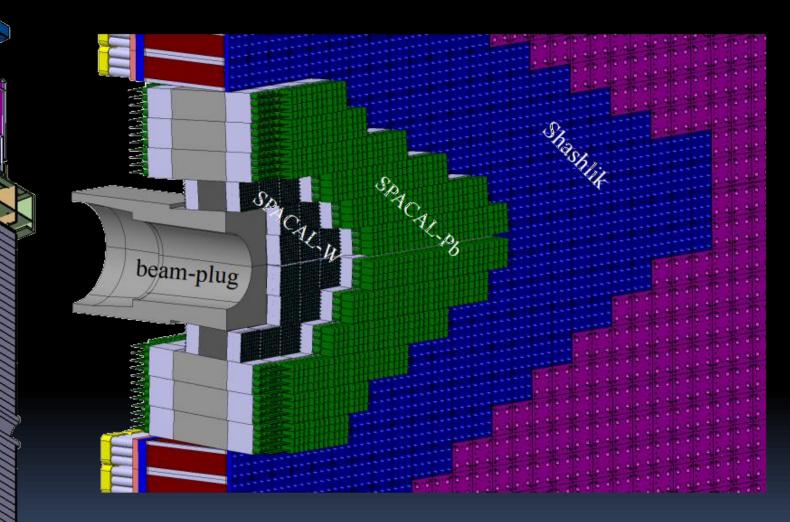


Shashlik

Shasi

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TO



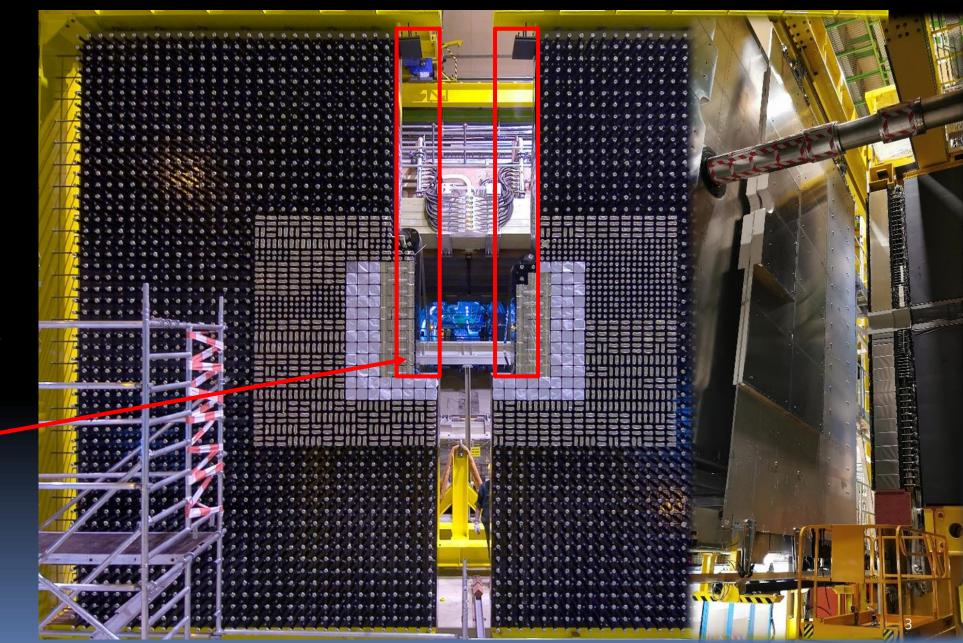
From Shashlik to New SpaCal technology for inner region of ECAL

LS₃: W absorber for innermost modules equipped with scintillating plastic fibres



32 SPACAL-W & 144 SPACAL-Pb modules require a complete dismantling of the ECAL system

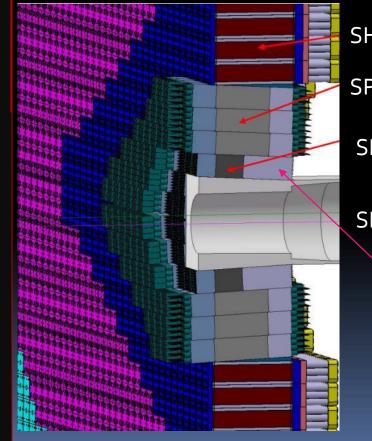
Only the very inner part could have been exchanged without major dismantling of the structure.



Modification for LS₃

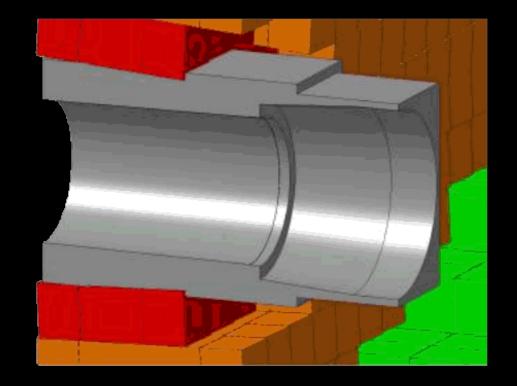
SPACAL modules will be installed under an angle (probably 3°, 3°)

- adapt a new beam pipe to ease the piling up of modules
- remains the transition from SPACAL to SHASHLIK modules
 - Shimming? Material? Fixation?



SHASHLIK SPACAL Pb

SPACAL W



SPACAL modules are shorter than SHASHLIK modules

- Stability of 'ECAL wall' is considerably affected
- Extension of SPACAL modules to the length of the

SHASHLIK modules

How to connect/fix SpaCal modules? Shashlik modules will be fixed as before?



If keeping the number of crates per rack:

4 racks on each ECAL platform with 12 crates by side are

possible.



46u	46u	46u	46u	
Connection cooling system (3u)	Connection cooling system (3u)		Connection cooling system (3u)	
Turbine (4u)	Turbine (4u)	Turbine (4u)	Turbine (4u)	
ECAL 6 (9u)	ECAL 4 (9u)	CW converters	ECAL 1 (9u)	
Power Supply incl.	Power Supply incl.	(6u)	Power Supply incl.	
Heat Exchanger (10) free space (10)	Heat Exchanger (10) free space (1u)	Heat Exchanger (1u)	Heat Exchanger (10) free space (10)	
ECAL 5 (9u)	ECAL 3 (9u)	ECAL 2 (9u)	ECAL 0 (9u)	
Power Supply incl.	Power Supply incl.	Power Supply incl.	Power Supply incl.	
Heat Exchanger (1u) free space (1u)	Heal Exchanger (1u) free space (1u)	Heat Exchanger (1u) free space (1u)	Heat Exchanger (1u) free space (1u)	
Deflector (2u)	Deflector (2u)	Deflector (2u)	Deflector (2u)	





With more channels > more electronics (up to 5 times in LS4, number of electronics will

increase considerably

- Surface of the platform on top of the ECAL is probably not sufficient for required number of racks/crates
 - New structure to be designed/constructed/installed ?
- How many crates do we need, and how many crates per rack are possible
- Number of racks, cables and services to be defined in due time
- Extension of platform is very limited (upstream confined by the RICH 2, TORCH?, downstream possibly by HCAL)





- Cable management will be more challenging
 - Do we need storage space for cables
 - Same cable length not required anymore?
 - In case this space is not required, ECAL
 platform could be lowered for taller racks





Thep II Possible modification/extension of ECAL platform

In case more rack space is required



In case another up to four racks required

> But have to be moved separately from ECAL for access

Three additional small racks attached to the ECAL platform on the **`M1**' beam.

Possible modification/extension of ECAL platform

In case HCAL will be removed and no HCAL electronics needed

Two additional Racks per side:

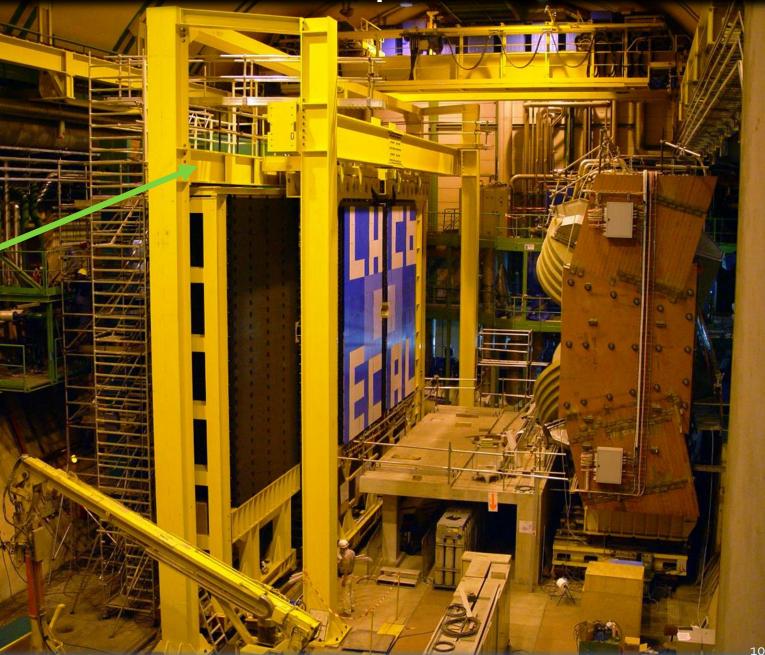
Two additional racks

New 'passerelle'

LHCb Possible modification/extension of ECAL platform

This would mean a major intervention:

Move the passerelle more down stream



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What will change from LS₃ to LS₄?

- Single to double section read out for SpaCal & Shashlik modules
- Improve timing of Shashlik modules
- Include timing information with double sided R/O to full ECAL
 - > All modules to be removed for modification/replacement
 - Modification of modules at point 8?
- Has this any further impact on the metallic structure and access?

Plan possible modification of general support for LS3!!!



The installation of present ECAL modules was easy compared to the Upgrade II condition.

- No RICH 2 in front
- Space for a huge 'flying carpet' from ATLAS

		Loon and L
ID	Task Name	
	2005	2005 2006
	2005	nter 1st Quarter 2nd Quarter 3rd Quarter 4th Quarter 1st Qua Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan
226	Electromagnetic Calorimeter 🥣	Hectromagnetic Calorimeter
227	ECAL Installation	EAL installation 28/10
228	Chariot	
229	Receive chariots	L 🔶 15/11
230	Mount roller at surface	1 26/11
231	Place chariots on rails	17/01 = 19/01
232	Assemble lateral bars	20/01 👗 02/02
233	Include T-Frame	21/02 = 25/02
234	Align chariots	28/02 - 04/03
235	Assembly	
236	First rows	07/03 01/04
237	Install ATLAS platform	04/04
238	Remainng rows	
239	Remove ATLAS platform	02/05
240	'lower' platforms	02/05
241	Inner wall, beam plug.	16/05 27/05
242	On detector work	30/05 Ton detector work 28/10
243	Monitoring system	04/07
244	R/O side	22/08 23/09
245	Internal cabling	30/05 29/07
246	'upper' platform	03/10 14/10
247	Survey and tests	17/10 21/10
248	Off-detector electronics	08/08 28/10

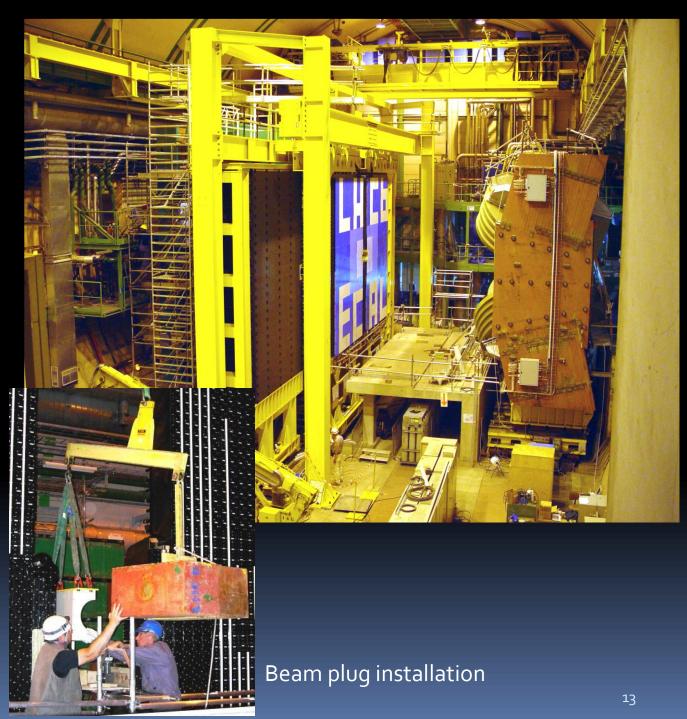




Dismantling and Installation

To be studied:

- Dismantling of platforms
- Dismantling of SHASHLIK modules
- Modification of support structures
- Design of required tooling
- Cable routing and installation
- Installing/Connecting modules
- Confining modules
- Beam plug installation
- Installing platforms and racks on top



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What can be expected from the Technical coordination Team?

Following slides: courtesy of Eric



What can be expected from the Technical coordination Team?

Following slides: courtesy of Eric

- Safety
- Infrastructure
- Coordinate with CERN support groups



Host Lab duties

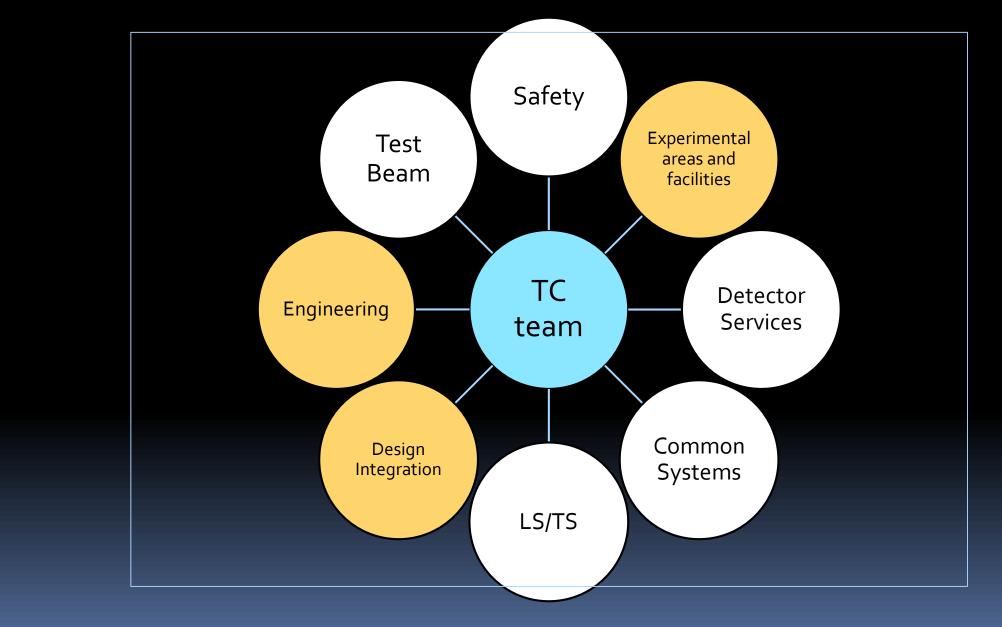
- Detector services
- Engineering support
- Detector Integration & CAD model
- Shielding
- Planning
- LHCb operation during Shutdown and TS



Support to the Collaboration

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Which support can be expected from the Technical coordination Team?



TC: Experimental area and facilitie

- Provide experimental Area / facilities igodot
 - UX85 •
 - SG8 \bullet
 - Workshop <u>*</u> \bullet
 - Assembly Hall SXL8 * SX8 \bullet
 - Storage Tent (3889) *, Cable (3887) *, Electronics (3895 * \bullet

* New since 2010

- Data Centre * \bullet
- Control room* \bullet

Follow-up inspections

Operation and maintenance



ea and facilities	cess	and duration		(Crane, clean room, RP, Gas, Colling, HVAC)
	Storage of 3000 modules and minor modification Module size 0.8x0.13x0.1 3 m3	LS3 2026	45m3 could be stored in racks. 5mx5mx2m or similar + Working place: 8m x 8m x 3m	Radiated modules, room temperature, no crane
ctronics (3895 *	Support structure modification and storage	LS3 2026	10m x 15m x 8m	Crane, 1ot
	SPACAL final assembly	LS3 2026	10m x 5m x 3m	Working places, no crane, not radiated. Compressed air
	Shashlik module modification , 3000 modules	LS4 20XX	45m3 could be stored in racks. 5mx5mx2m or similar +	Radiated, no crane required, working tables and some tooling
Request for Electromagnetic Calorimeter UII			Working place: 8m x 8m x 3m	±7

Activity/Pro

Start Date

Lxlxh (m³)

Specs

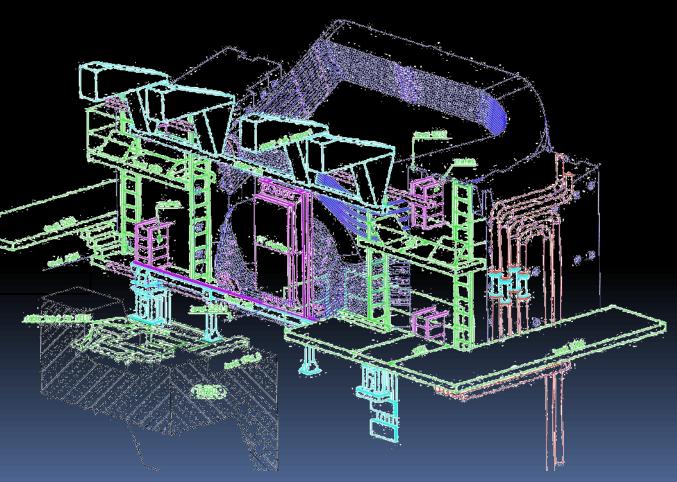
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TC : Design Integration

- Provide, maintain, upgrade CAD model for LHCb and its environment
- Integration of detectors and services
- Engineering & design support for
 - Detectors
 - Installation
 - Dismantling
 - Tooling





Can provide expertise and support to sub-detector

- Mechanical design and integration
- Mechanical conformity assessment
- Structural and Finite Element Analysis
- Assembly and Handling tools

Support for host lab duties

- Mechanical Safety
- Support and access structures
- Shielding wall







Conclusion

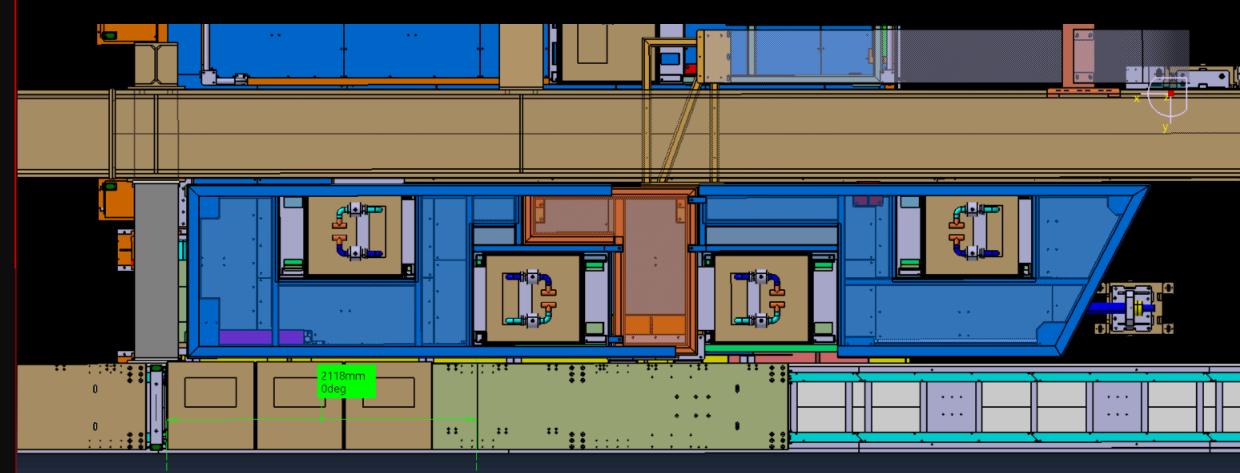
- More questions than answers for now
 - Number, size and length of cables?
 - Modification of platform accordingly -> not much time left!!!
 - What space is left in front of ECAL Torch, Neutron shielding?
 - What happens to the HCAL? Decision is urgently needed!
 - Only then a serious study can start to design a new ECAL platform
 - Connection between SpaCal modules and SpaCal and Shashlik modules?
 - A schedule is urgently needed start of LS₃ is 2026 (3 years left)
 - Time consuming activities such as a modification of platform can not be performed during LS4

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> New photos can be accessed: https://cernbox.cern.ch/s/qOUVtbWhqfhsSuz

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