

The Gas Team and the LHC gas systems: introduction

Outlook

- Gas Systems Team organization
- Experiment/detectors contact persons, egroups
- M&O Budget update
- Other ATLAS projects/activities
- Conclusions

Gas Systems Team organization

First level contacts for non urgent matters:

Gas system sites responsible:

They are your first level contact for any gas system issue

- ALICE: Louis-Philippe De Menezes
- ATLAS: Davide Casarotto
- CMS: Andrea D'Auria
- LHCb: Patrick Carriè

Second level contacts for non urgent matters:

- ALICE: Migual Afonso
- ATLAS: Maximilian Kerker
- CMS: Maria Cristina Arena
- LHCb: Stefania Juks

M&O contact persons: Beatrice Mandelli, Gianluca Rigoletti

Project leader: Roberto Guida

1st contact for any urgent issue: gas piquet 162516

If you write an email, please put in cc gassystems.support@cern.ch :

- we will treat your email in case of absence of the site responsible
- your email will create a jira ticket that will allow (you and us) to follow the issue reported

Jira tickets statistic	Created	Closed
CMS From beginning (2024)	223	185 (83%)
CMS During 2025	97	75 (77%)
Total LHC experiments	889	648 (73%)

Gas Systems Team organization - now

Roberto
Project leader



Davide
ATLAS and electrical



Max
ATLAS and R&D



Louis-Philippe
ALICE, CLOUD



Miguel
EAM/Infor and ALICE



Gianluca
Software, LHC-M&O,
and R&D



Maria Cristina
gas analysis and CMS



Albin
Chemical engineer



Stefania
R&D and LHCb



Miguel
EAM/Infor and ALICE



Patrick
LHCb and electrical
Spare parts (electrical)



Stefania
R&D and LHCb



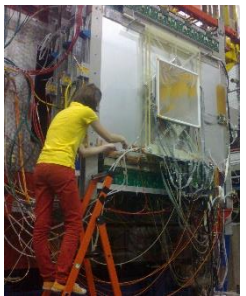
Andrea
CMS and
workshop



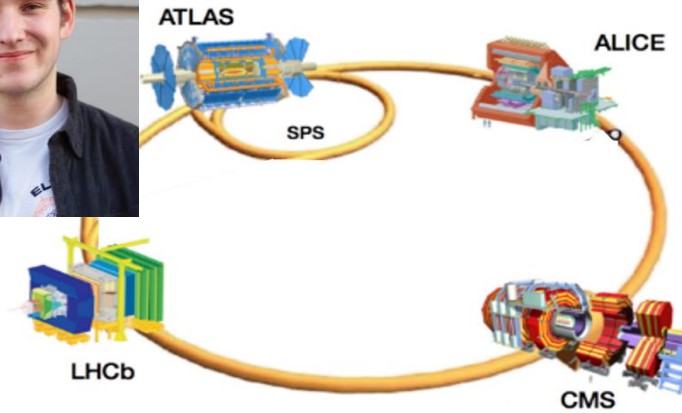
Maria Cristina
gas analysis
and CMS



Beatrice
R&D and LHC-M&O



Andrea
CMS and
workshop



Gas Systems Team organization – highlighting changes and double counting

Roberto
Project leader



Daive

ATLAS and electrical



Max

ATLAS and R&D



Louis-Philippe

ALICE, CLOUD



Miguel

EAM/Infor and ALICE



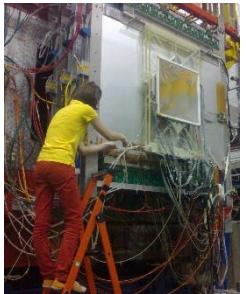
Gianluca

Software, LHC-M&O,
and R&D



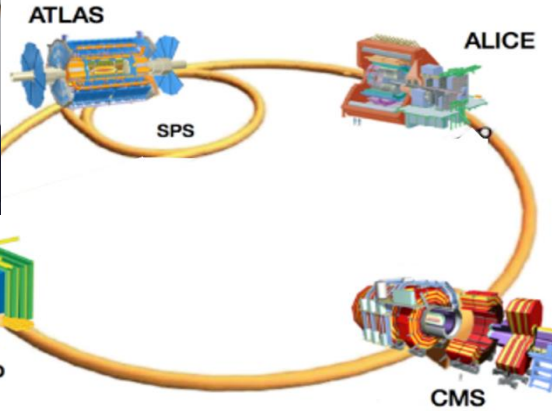
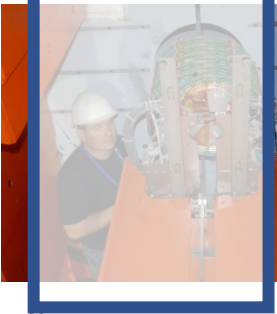
Beatrice

R&D and LHC-M&O



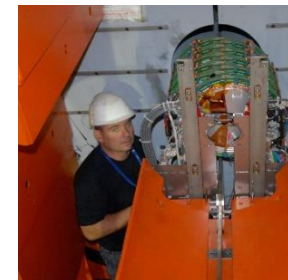
Andrea

CMS and
workshop



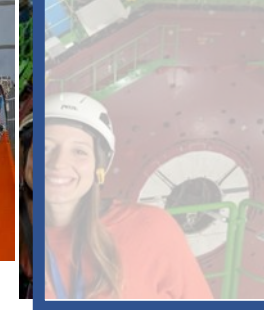
Andrea

CMS and
workshop



Maria Cristina

gas analysis
and CMS



Patrick

LHCb and electrical
Spare parts (electrical)



Stefania

R&D and LHCb



Albin



Miguel

EAM/Infor and ALICE



Stefania

R&D and LHCb



Emiliano

Reliability analysis



- 8 changes over 17 roles
- 13 persons

Detector contact persons

M&O Workpackage Run3 (EDMS 2779718)

8 Annex 1: List of detector gas system experts

List of detector gas system experts for 2022.

8.3 CMS Gas Systems

Detector	Detector gas system expert
CSC	Xiaofeng Yang;
DT	Daniel Francois Teyssier; Archana Sharma
GEM	Daniel Francois Teyssier; Davide Fiorina
RPC	Aleksandar Aleksandrov;
ID flushing	Nicola Bacchetta
CF ₄ recuperation	EP-DT Gas piquet

Knowledge base for Gas Systems Home - Knowledge base for Gas Systems - Global Site

CMS GENERAL IMPACT 2026: 273457			
CSC	✔ ON	Mixture CO ₂ 50% / AR40% / CF ₄ 5% fresh/CF ₄ 5% rec. Purifier ON https://eloggas.web.cern.ch/Procedures/21 https://eloggas.web.cern.ch/Procedures/17 https://eloggas.web.cern.ch/Procedures/19	Xiaofeng Yang 160270
RPC	✔ ON	Run with 4.5% of iC ₄ H ₁₀ , 0.3% SF ₆ and R134a rest at 300 l/h. Purifiers ON (2&3). https://eloggas.web.cern.ch/Procedures/20 https://eloggas.web.cern.ch/Procedures/14	Anto Dimitrov 162692, Aleksandar Aleksandrov 169837
DT	✔ ON	Nominal run with standard mixture AR/CO ₂ /air 85.2/14.75/0.038 : open loop+ humidifier Fill humidifier: https://eloggas.web.cern.ch/Procedures/11	Daniel Francois Teyssier 162680
DT SX5	OFF	RUN AR/CO ₂ 81.5/18.5	Domenico Dattola 164268
GEM	✔ ON	AR/CO ₂ 70/30% https://eloggas.web.cern.ch/Procedures/24	Daniel Francois Teyssier 162680
CF ₄ RECOVERY	✔ ON	RUN	Andrea d'AURIA 160021 Roberto Guida 162146
R-134a RECOVERY (CMSFGR)	✘ OFF	In case of alarms relative to the humidity see https://eloggas.web.cern.ch/Procedures/14	Andrea d'AURIA 160021 Roberto Guida 162146
Flushing	✔ ON	RUN	Ivan Shvetsov 167816, Norbert Franck 163618

Experiment contact persons and weekly summary of activities

I propose to also have a dedicated contact for the experiment to ensure that experiment and gas systems activities are fully aligned.

This step aligns with the request made by CMS some time (I uploaded the description we prepared after some iterations with CMS-TC).

This person will have access to the weekly summary of ongoing and planned activities and discuss it with the gas team technical contact. You can see the latest one as an example here: [ELOG CMS - weeks 11/12](#)

Please identify who this person will be and let the gas team technical contact know.

Detector contact persons

Egroup for communications between gas team and experiments.

Free subscription and unsubscription (to facilitate the detector contact persons in keeping the list updated)

For CMS:
[gas-users-CMS](#)
 Members are:

Name	Type	Login	Email	
ALEKSANDROV, Aleksandar (EP-UCM)	Person	AALEKSAN	aleksandar.aleksandrov@cern.ch	
BALL, Austin (EP-UCM)	Person	AUSTIN	Austin.Ball@cern.ch	
BIANCO, Michele (EP-CMX-SCI)	Person	MBIANCO	michele.bianco@cern.ch	
BORGONOV, Lisa (EP-CMX-SCI)	Person	LBORGONO	lisa.borgonovi@cern.ch	
BUONTEMPO, Salvatore (EP-CMX)	Person	BUONTEMP	Salvatore.Buontempo@cern.ch	
COLALEO, Anna (EP-UCM)	Person	ACOLALEO	Anna.Colaleo@cern.ch	
D'AURIA, Andrea (EP-DT-FS)	Person	DAURIAA	Andrea.D'Auria@cern.ch	
DIMITROV, Anton (EP-UCM)	Person	ANTON	Anton.Dimitrov@cern.ch	RPC Technical Coordinat
FASANELLA, Daniele (EP-UCM)	Person	TZIE	Daniele.Fasanella@cern.ch	
FLORENT, Alice Helene	Person	ALFLOREN	alice.florent@cern.ch	Self added member
GUIDA, Roberto (EP-DT-FS)	Person	GUIDAR	Roberto.Guida@cern.ch	
MANDELLI, Beatrice (EP-DT-FS)	Person	BMANDELL	beatrice.mandelli@cern.ch	
MARIN BARBANCHO, Pablo (EP-CMX-SCI)	Person	PMARINBA	pablo.marin.barbancho@cern.ch	Self added member
MORSE, David (EP-UCM)	Person	DMORSE	david.morse@cern.ch	Self added member
OLIVERI, Eraldo (EP-DT-DD)	Person	EOLIVERI	Eraldo.Oliveri@cern.ch	
PELLECCHIA, Antonello (EP-CMG-DS)	Person	APELLECC	antonello.pellecchia@cern.ch	Self added member
PUGLIESE, Gabriella (EP-UCM)	Person	PUGLIESE	gabriella.pugliese@cern.ch	
REDONDO FERNANDEZ, Ignacio (EP-UCM)	Person	REDONDO	ignacio.redondo.fernandez@cern.ch	
TEYSSIER, Daniel Francois (EP-CMX-SCI)	Person	TEYSSIER	Daniel.Francois.Teyssier@cern.ch	Self added member
TROPEA, Paola (EP-CMX-SCI)	Person	PTROPEA	Paola.Tropea@cern.ch	
TURINI, Nicola (EP-UCM)	Person	NTURINI	Nicola.Turini@cern.ch	
VAI, Ilaria (EP-UCM)	Person	IVAI	ilaria.vai@cern.ch	Self added member
WANG, Jian (EP-UCM)	Person	WANGJIAN	Jian.Wang@cern.ch	Self added member
YANG, Xiaofeng (EP-UCM)	Person	XYANG	Xiaofeng.Yang@cern.ch	
ZEUNER, Wolfram (EP-UCM)	Person	ZEUNER	Wolfram.Zeuner@cern.ch	

To facilitate communication add:

- detector

- On-call numbers

names to add/remove?

Gas systems elog

Egroup for elog notification

Free subscription and unsubscription (to facilitate the detector contact persons in keeping the list updated)

For CMS:

[gas-users-CMS-ELOG](#)

Members are:

Name	Type	Login	Email	Comments
ALEKSANDROV, Aleksandar (EP-UCM)	Person	AALEKSAN	aleksandar.aleksandrov@cern.ch	Self added member
BIANCO, Michele (EP-CMX-SCI)	Person	MBIANCO	michele.bianco@cern.ch	
BIANCO, Stefano (EP-UCM)	Person	SBIANCO	Stefano.Bianco@cern.ch	Self added member
BORGONOV, Lisa (EP-CMX-SCI)	Person	LBORGONO	lisa.borgonovi@cern.ch	Self added member
CABRERA MORA, Andres Leonardo (EP-UCM)	Person	ANDRESIB	andres.leonardo.cabrera.mora@cern.ch	Self added member
DIMITROV, Anton (EP-UCM)	Person	ANTON	Anton.Dimitrov@cern.ch	Self added member
FALLAVOLLITA, Francesco (EP-UAT)	Person	FFALLAVO	francesco.fallavollita@cern.ch	Self added member
FASANELLA, Daniele (EP-UCM)	Person	TZIE	Daniele.Fasanella@cern.ch	Self added member
FLORENT, Alice Helene	Person	ALFLOREN	alice.florent@cern.ch	Self added member
MANDELLI, Beatrice (EP-DT-FS)	Person	BMANDELL	beatrice.mandelli@cern.ch	Self added member
MARIN BARBANCHO, Pablo (EP-CMX-SCI)	Person	PMARINBA	pablo.marin.barbancho@cern.ch	Self added member
MORSE, David (EP-UCM)	Person	DMORSE	david.morse@cern.ch	Self added member
PELLECCHIA, Antonello (EP-CMG-DS)	Person	APELLECC	antonello.pellecchia@cern.ch	Self added member
PUGLIESE, Gabriella (EP-UCM)	Person	PUGLIESE	gabriella.pugliese@cern.ch	Self added member
TEYSSIER, Daniel Francois (EP-CMX-SCI)	Person	TEYSSIER	Daniel.Francois.Teyssier@cern.ch	Self added member
VAI, Iliaria (EP-UCM)	Person	IVAI	ilaria.vai@cern.ch	Self added member
YANG, Xiaofeng (EP-UCM)	Person	XYANG	Xiaofeng.Yang@cern.ch	Self added member

M&O budget

M&O budget ([EDMS 2779718](#)):

Material and personnel costs covered by the M&O agreement

MFCs maintenance

Consumables (lab, tools, connectors, pipes, ...)

Gas analysis (calibration gases for lab, materials, O2 cells, maintenance, ...)

Pump maintenance 2000 h and 30000 h

Purifier maintenance (absorbers: mol.sieve, catalysts, ...)

Safety valve maintenance

Pneumatic controls

PLC and Power Supply

Pressure sensors (last production of old generation sensors radiation tolerant)

-

Maintenance organization (procedures, reports, ...)

Analysis modules and operation

R&D for upgrade/consolidation

→ about 800 orders processed

For CMS:

Up to 2024

→ 238.9 kCHF

From 2025

→ 289.9 kCHF ([Update to M&O Workpackage \(EDMS 3088231\)](#))

Financial & Operational Drivers for the 2025 Budget Update

Increased System Complexity:

Management of 30 gas systems with increasingly stringent requirements for mixture stability and purity.

Rising Material & Personnel Costs:

30% average increase in material costs (analysers, valves, MFCs) compared to 2008-2012. 15% increase in Field Support (FSU) costs.

Shift in Expertise Requirements:

Need for qualified physicists/engineers to support technical staff due to new complex operations like gas recuperation and chromatography.

Human Resources Evolution:

Loss of staff positions required an increase in fellows and doctoral students to maintain operational support (next slide)

Positive Cost-Benefit:

R&D and gas recuperation activities have already generated annual savings (e.g., >100 kCHF for ATLAS, >125 kCHF for CMS) that exceed the requested M&O update.

Human Resources & Knowledge Management: the core challenge

The Challenge: Staff Reduction vs. System Complexity

Declining Staff Baseline: Over the last decade, permanent staff positions have decreased, creating a "resource gap."

Filling the Gap: We rely on "Additional Resources" (Short-term Students, Engineers, Physicists, and Chemists) to maintain 24/7 operations and specialized R&D.

Current Mix: A high percentage of the team consists of temporary members (Fellows, Doctoral, and Technical students).

The "Invisible" Effort: Continuous Training

Expertise Recruitment: Finding the right profiles for niche gas systems requires a global and constant search.

Knowledge Transfer: Every 2–3 years, a significant part of the team rotates. This requires:

- Continuous Onboarding: Senior members invest significant time in training new arrivals.
- Documentation & Standardization: Rigorous effort to ensure no technical knowledge is lost during transitions.

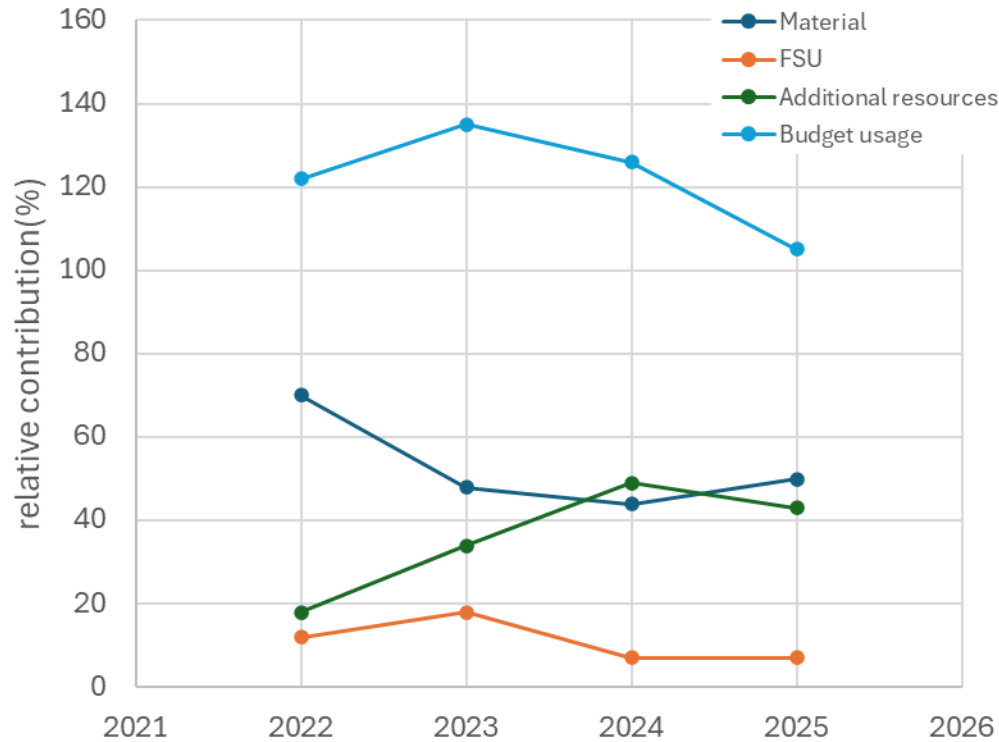
Why the Budget Increase is Essential

To secure the **continuity of expertise** despite high turnover.

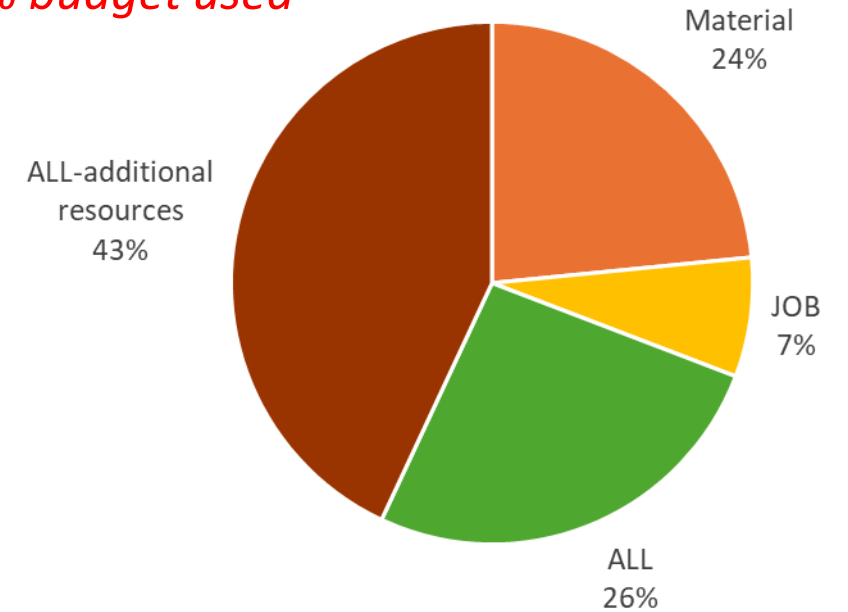
To maintain the **high-level support** required for the preparation for LS3, and Run4.

To compensate for the lack of permanent positions with highly qualified temporary collaborators.

M&O budget usage from 2022 to 2025



2025 (preliminary)
~102% budget used



~~+1 staff (controls) paid on EP budget (from 2025 back to EP budget thanks to a new LD)~~

~~+1 fellow (controls) paid on M&O (same as above, from 2025 back to EP budget thanks to a new LD)~~

+1/3 fellow (**3D drawings**) paid on M&O

+1 fellow for **gas systems operation and flowcells**

+1/2 fellow for **gas systems operation and gas recuperation**

+1 tech. student/Doctoral for **EAM/Infor, risk assessment and reliability analysis**

-1.5 staff technical → now -0.5 thanks to the hiring of one LD electromechanical technician, but non-overlapping staffing: increased training burden

Other CMS projects/activities

Work Package CMS Phase-2 dry gas upgrade flushing system EDMS

<https://edms.cern.ch/document/2884256>

Timeline 2024-2025

Total cost 310 k (222 days personnel included)

Work Package CMS Phase-2 dry gas refurbishment

EDMS <https://edms.cern.ch/document/3386404>

Timeline 2025-2026

Total cost 130 k (140 days personnel included)

Work Package CMS-MEO gas mixture distribution modules

EDMS <https://edms.cern.ch/document/3438275>

Timeline 2025-2026

Total cost 82 k (44 days personnel included)

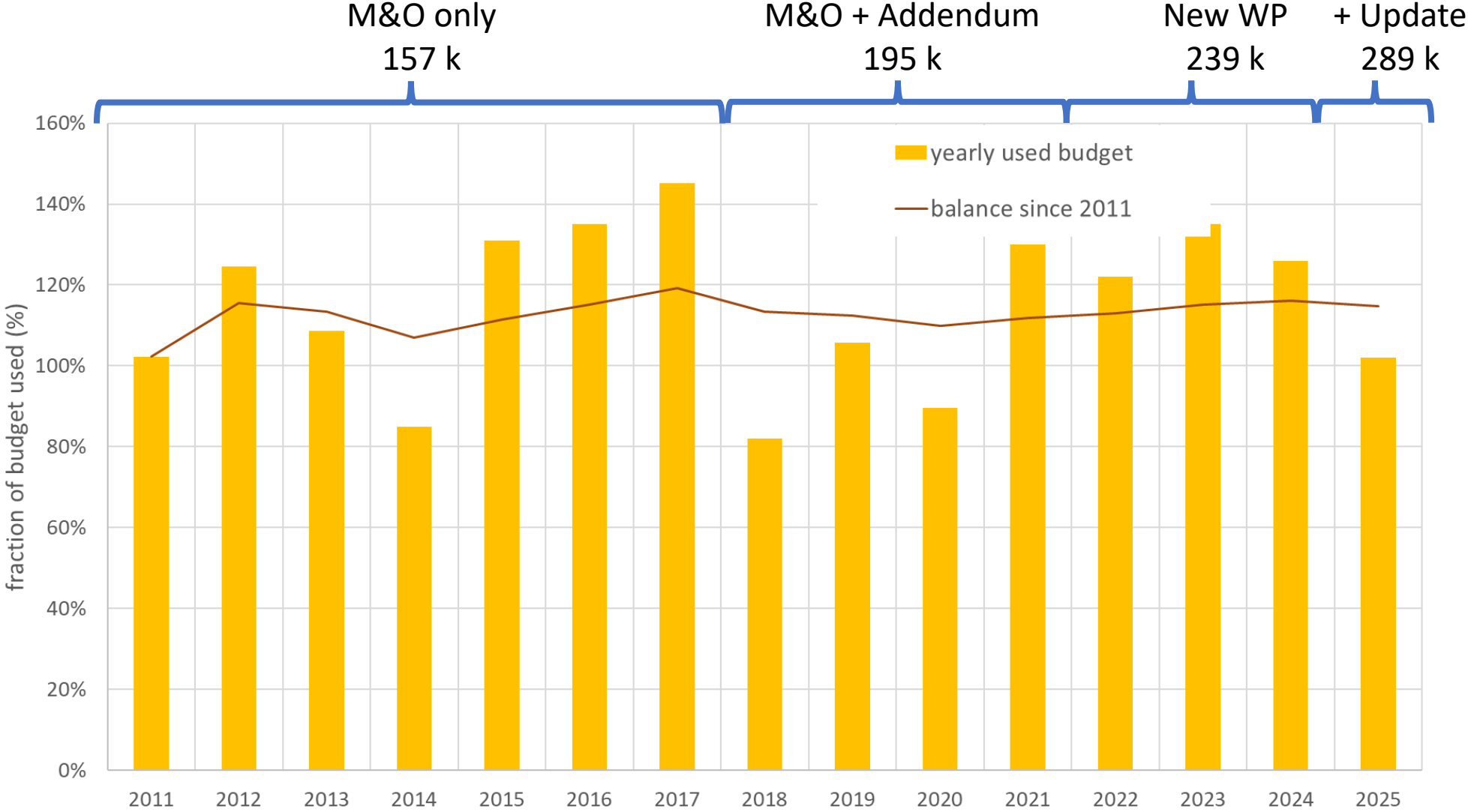
[\[GASSYSTEMS-582\] RPC 904 new line - CERN Central Jira](#)

[\[GASSYSTEMS-581\] CSC at 904 - CERN Central Jira](#)

[\[GASSYSTEMS-468\] current GEM 904 gas system in the GCS framework - CERN Central Jira](#)

Budget history since 2011

- CMS gas system budget status since 2011:



Conclusions

LHC M&O

- LHC M&O activities are well defined and supported by the M&O agreement.
- budget situation is going to normalize thanks to “update” to M&O workpackage and 2 LD replaced/maintained (1 controls + 1 electromechanical)
- Human Resources & Knowledge Management: the core challenge
 - ~ 50% of the team changed during 2025
- Experiment contact persons and weekly summary of activities

Beyond M&O budget

- CEPS budget for R&D on new system to optimize GHG usage (examples: improvement of gas systems to cope with new detector needs and R134a, CF4, SF6, C4F10 recuperation plants)
- New proposal for 2025-2030 submitted (key developments on gas compression module, R&D on new material for HFC adsorption, gas separation membranes, ...).
- HostLab for construction of R134a recuperation plants for ATLAS and CMS

CMS projects/activities

- ID flushing, ME0, RPC regulation valves, 904, ...

LS3

- Finalization ongoing. Please contact ATLAS site responsible for any comments/changes/new requests.