

PARTICIPACIÓN MEXICANA EN RPC

Isabel Pedraza

Upgrade Coordinator for the RPC of CMS

Marzo 23, 2017

Instituciones Mexicanas en CMS

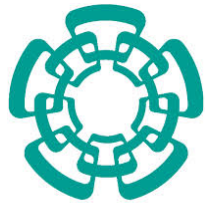


MIEMBROS DE MEXICO EN CMS

Por orden alfabético



9



Cinvestav

12

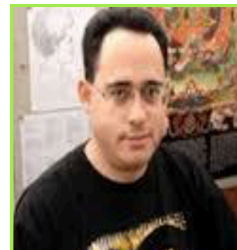


3



1

Team Leaders



En total
25

Estudiantes de
posgrado y
Profesores.

Más varios estudiantes
de licenciatura e
ingenieros de computo

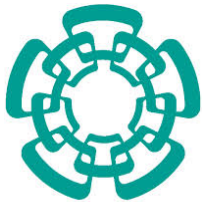
MIEMBROS EN LAS RPC's

Por orden alfabético

Team Leaders



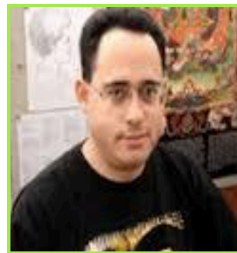
4



6



3



En total
13 (50%)
Estudiantes de
posgrado y
Profesores.

Más varios estudiantes
de licenciatura

Terminología

Voy a utilizar términos como : Operaciones, R&D, Monitoreo, Desempeño, Análisis de datos,

Líneas de acción

Construir el detector (actualizaciones) *

Operaciones

Estudiar el desempeño del detector

Análisis de datos

Resultados

Publicaciones

Investigación y Desarrollo (constante)

->>>

Formación de recursos humanos

Outreach

Technology transfer *

Construir el detector

CMS 2013 – RPC Phase I Upgrade Installation



CMS 2016 – Tracker Cassette integration for the optical links

10/24/16

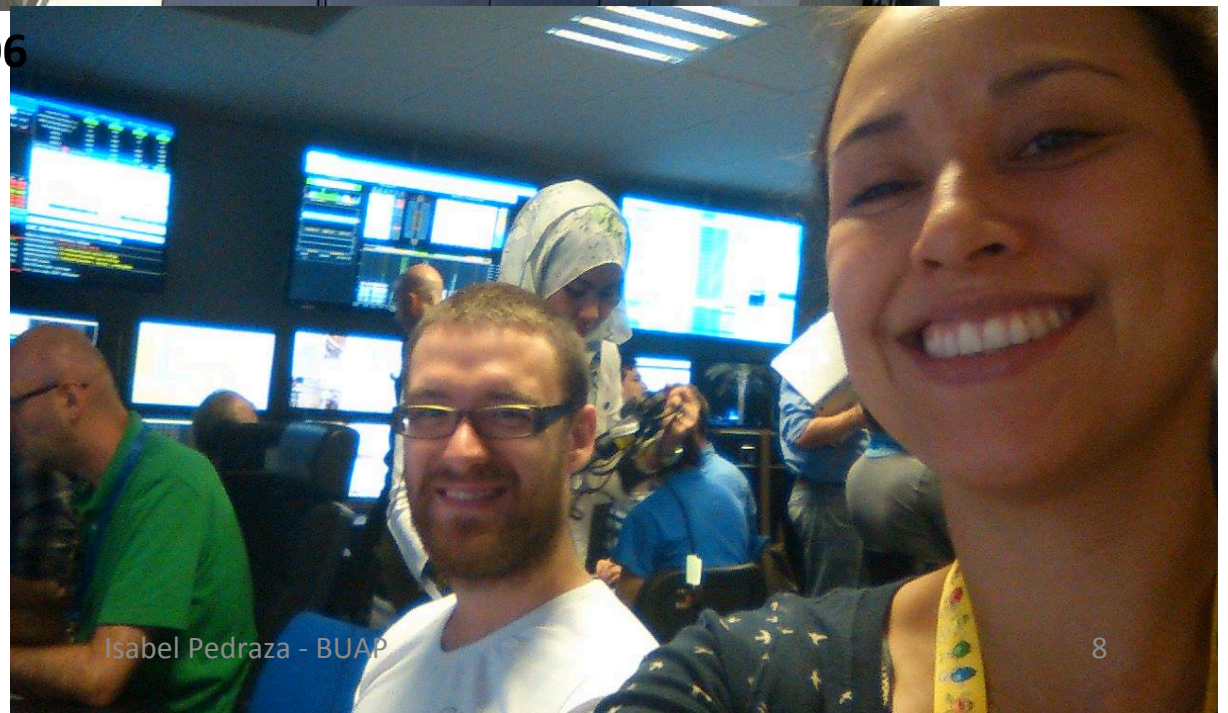


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Supervisar las operaciones ATLAS Control Room



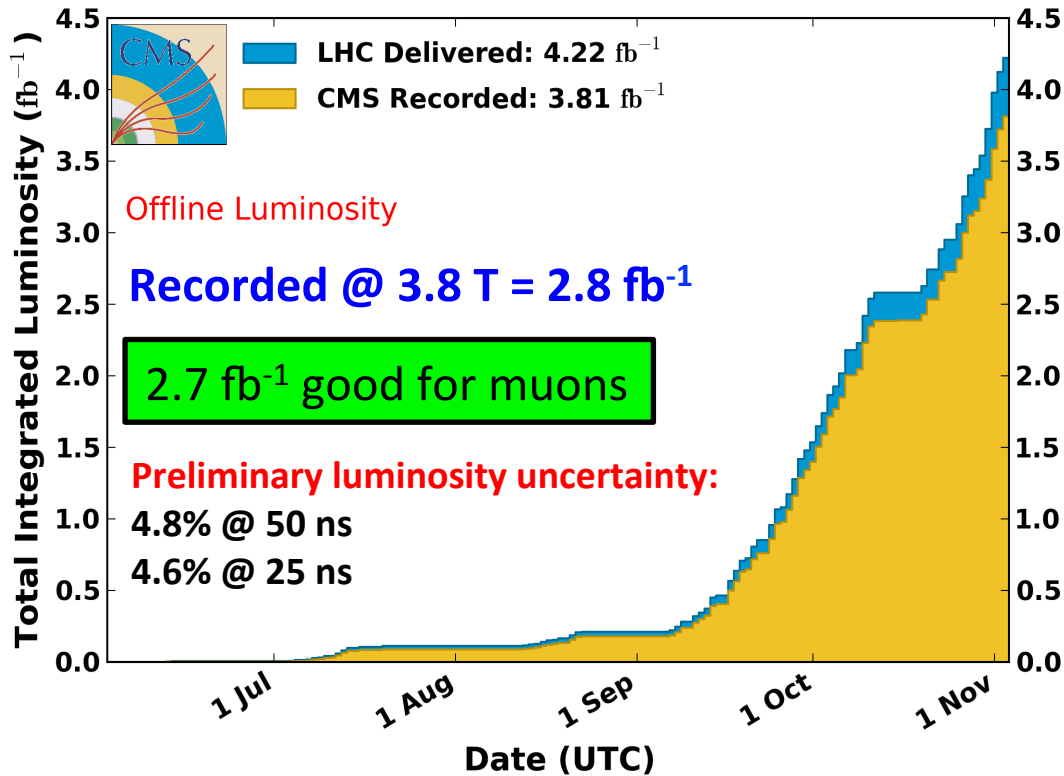
CMS Control Room 2015-03-06



Estudiar el desempeño del detector

CMS Integrated Luminosity, pp, 2015, $\sqrt{s} = 13$ TeV

Data included from 2015-06-03 08:41 to 2015-11-03 06:25 UTC



RPC System	2015
Average Efficiency	94%
Average cluster size	1.8 strips

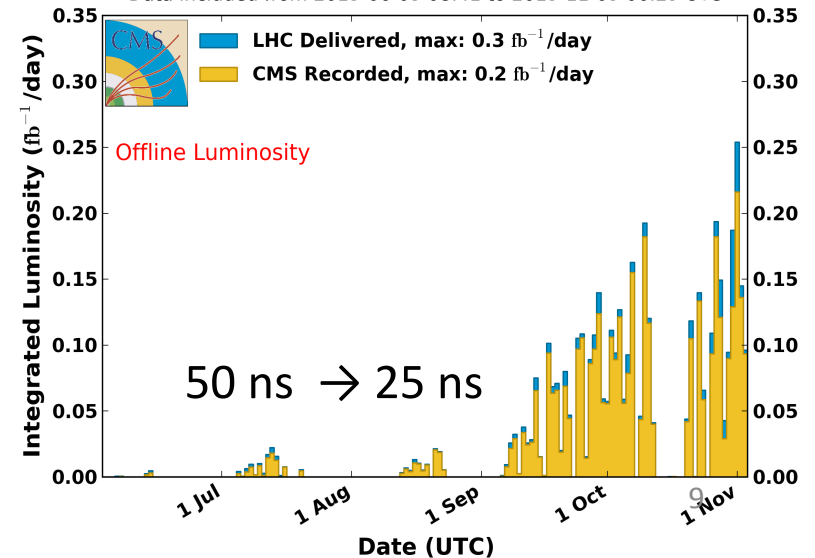
	energy [TeV]	peak lumi E34 cm ⁻² s ⁻¹	approx. int lumi [fb ⁻¹]
2010	7	0.02	0.04
2011	7	0.4	5
2012	8	0.8	23
2015	13	0.5	4

10/24/16

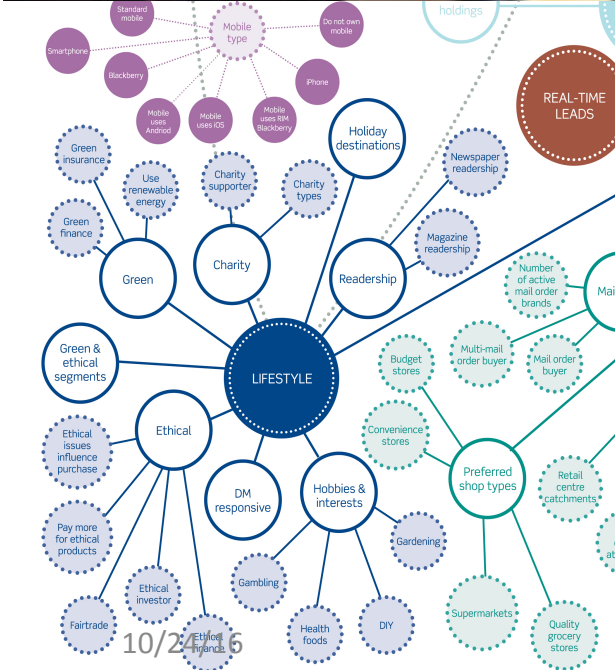
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CMS Integrated Luminosity Per Day, pp, 2015, $\sqrt{s} = 13$ TeV

Data included from 2015-06-03 08:41 to 2015-11-03 06:25 UTC



Análisis de Datos



Resultados



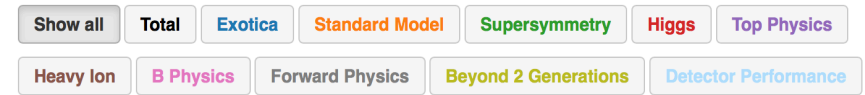
10/24/16

Isabel Pedraza - BUAP

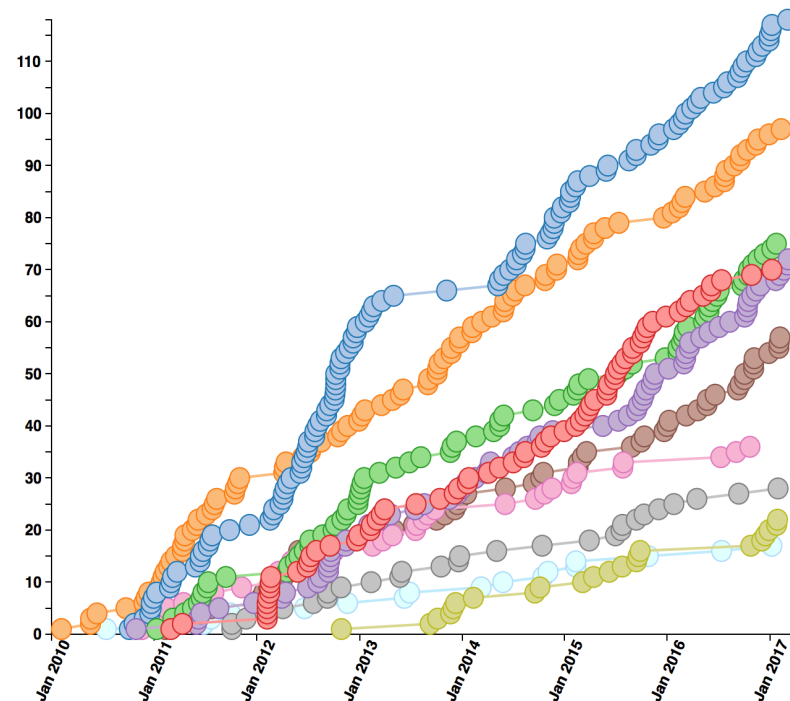
11

Publicaciones

Magazine	Impact Factor
Science	31.03
Nature	20.603
Physical Review Letters	7.943
The European Physical Journal C	5.247
Journal of High Energy Physics	5.618
Physics Lettes B	4.569
General Relativity and Gravitation	1.902
Nuclear Instruments & Methods	1.142
European Journal of Physics	0.644
Pramana	0.562
Revista Mexicana de Física	0.35
Physical Review D	4.643
Journal of Instrumentation	1.399

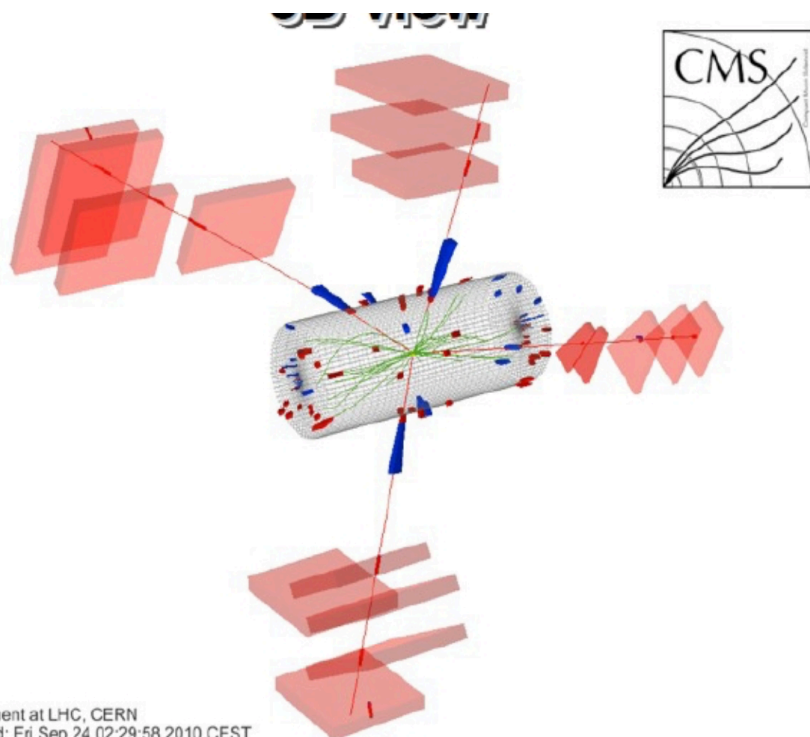


591 collider data papers submitted as of



Más de 80% de los análisis llevados a cabo en el CMS usan detección de muones

Modelo Estándar y Física Más allá

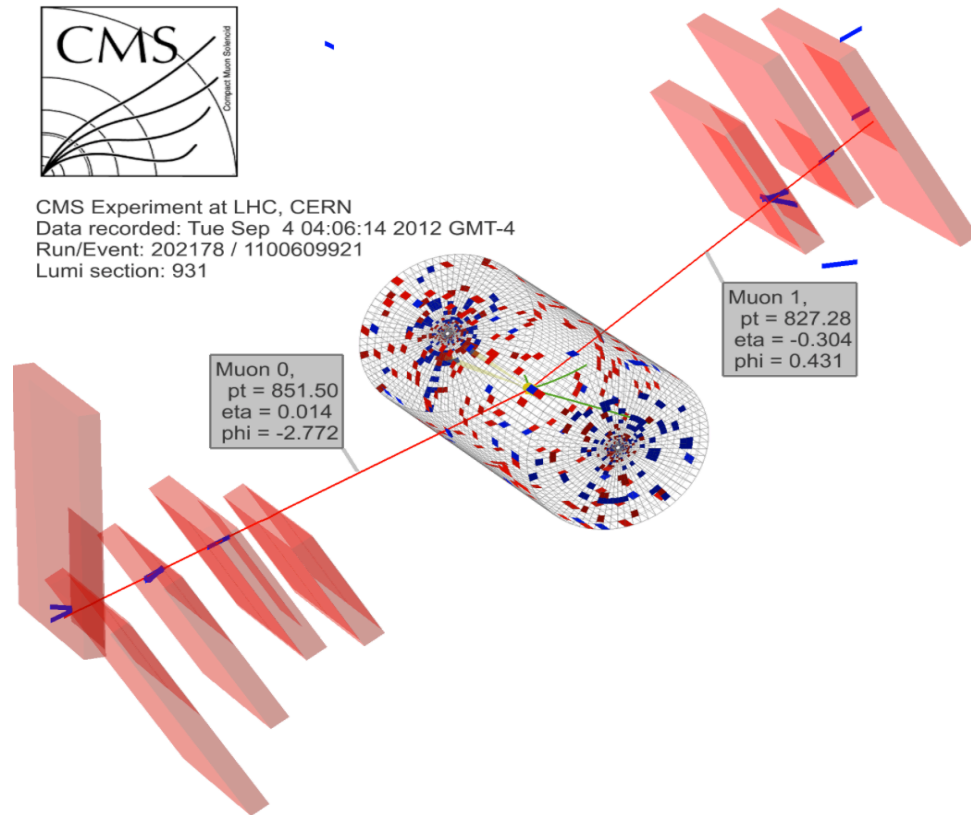


Higgs Candidate

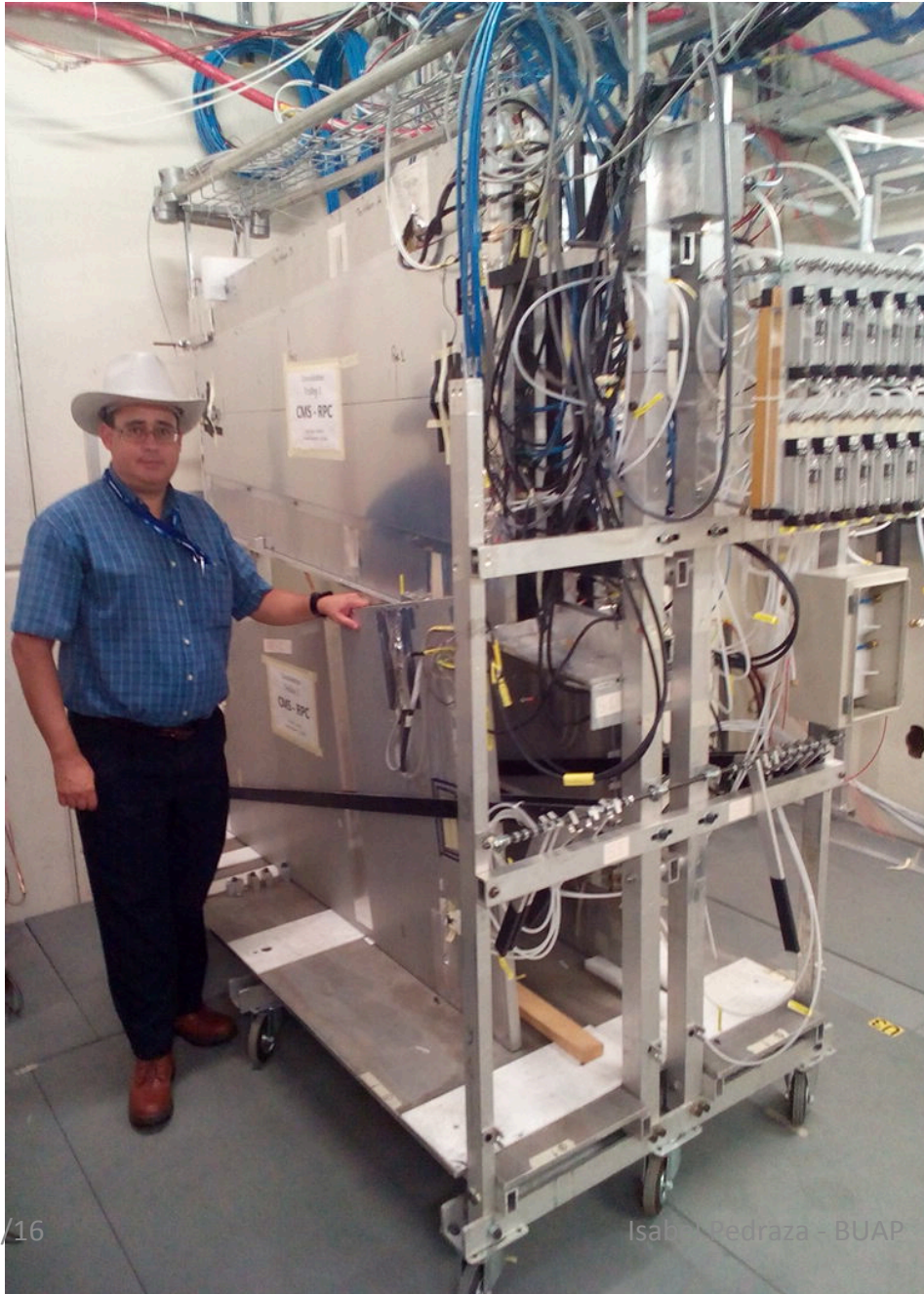
Z', Bosones Cargados Pesados



CMS Experiment at LHC, CERN
Data recorded: Tue Sep 4 04:06:14 2012 GMT-4
Run/Event: 202178 / 1100609921
Lumi section: 931



Investigación y Desarrollo



Gamma irradiation facility,
pruebas de nuevas
tecnología en detección de
muones

Outreach



Virtual Visits

CMS Masters Classes



Transferencias de tecnología

Construcción de cámaras de placas resitivas



La empresa Muon Systems usa las partículas cósmicas para detectar la fatiga de materiales

- ▶ La empresa ha desarrollado la tomografía muónica para mantener los altos hornos
- ▶ Esta técnica permite testar estructuras de gran tamaño y alta densidad
- ▶ Muon Systems ha sido premiada por la fundación Repsol

07.07.2016 | actualización 11h37

<http://www.rtve.es/noticias/20160707/empresa-muon-systems-usa-particulas-cosmicas-para-detectar-fatiga-materiales/1368104.shtml>

Equipo Mexicano en las RPCs

Gurus (orden alfabético)

Profa. Cristina Oropeza Barrera

- Upgrading the CMS-RPC Database for understanding the integrated charge of all the CMS-RPC detectors at P5 (Data Analysis)
- Thesis advisor

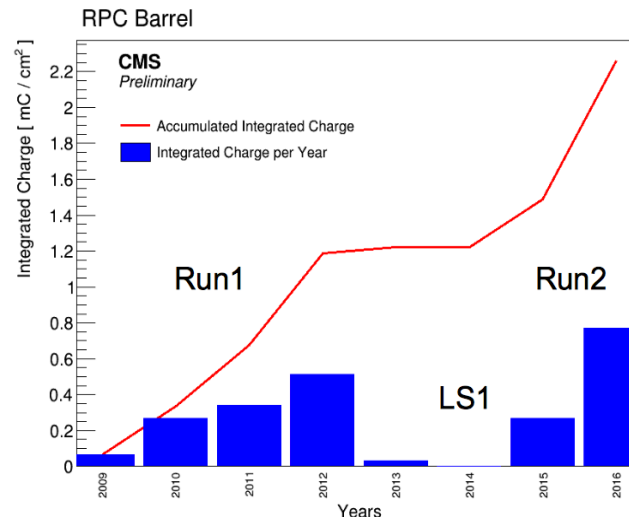


Fig 1.a. Integrated Charge vs Time - Barrel



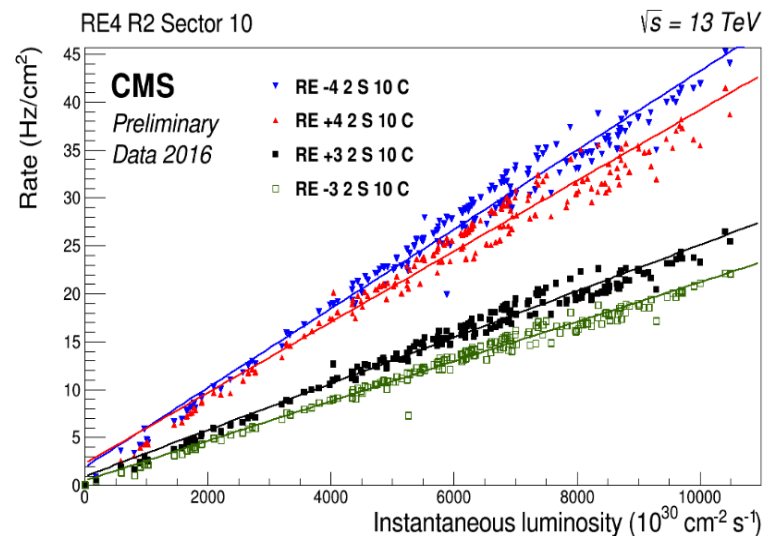
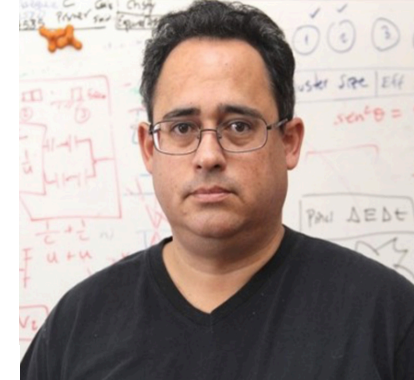
Profa. María Isabel Pedraza Morales

- Coordinator of the RPC Upgrade (R&D)
- GIF++ Data analysis (R&D)
- Turnos de Detector on Call Expert (Operations)
- Thesis advisor

Gurus (orden alfabético)

Prof. Salvador Carrillo Moreno

- Co-coordiandor del Test Beam en GIF++ (R&D)
- Estudios de envejecimiento de las cámaras en GIF++ (R&D)
- Turnos durante los periodos de Beam (R&D)
- Thesis advisor



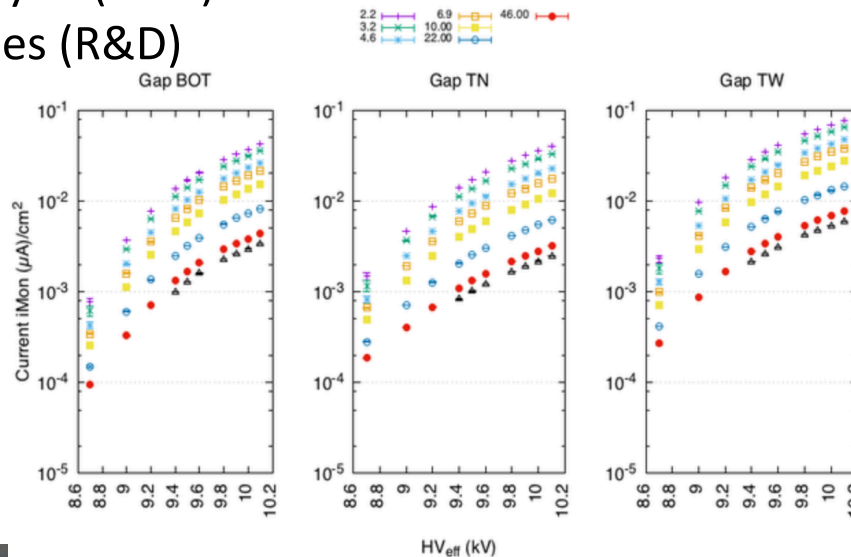
Prof. Ricardo López Fernández

- Detector Performance Studies (Data Analysis)
- Thesis advisor

Gurus (orden alfabético)

Profa. Cecilia Uribe Estrada

- RPC Data Manager for the RPC Offline (Operations)
- GIF++ Data Analysis (R&D)
- Sensitivity Studies (R&D)

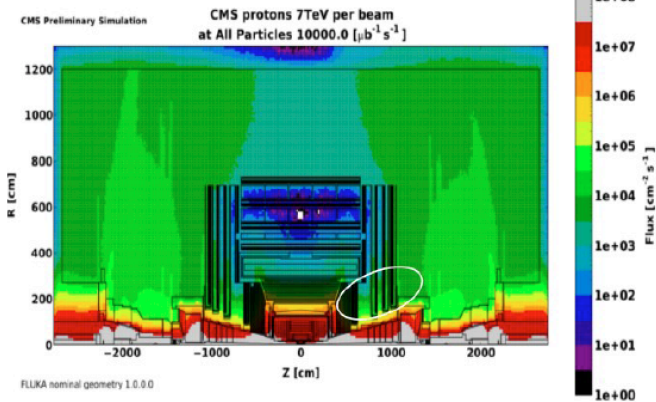


Profa. Elsa Fabiola Vazquez Valencia

- Member of the Muon Conference and Publication Board for the RPC (Management)
- GIF++ Shifts (R&D)

Graduate Students (orden alfabético)

Severiano Carpinteyro, (BUAP) (asesores Humberto e Isabel)

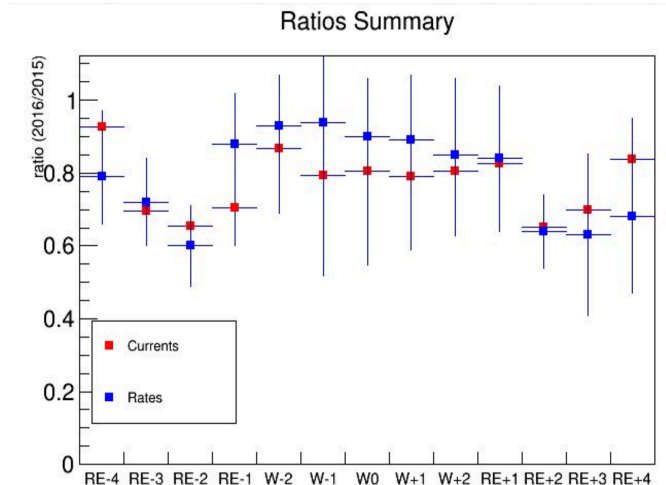


- Ph.D. Thesis focus on RPC Phase II Upgrade
- Studies of background for the Phase II Upgrade
- GIF++ hardware maintenance and installation
- Data Manager for the Data Quality Online Expert



Cecilia Durán (CINVESTAV)

- Investigate the effect of the shielding by comparing rates and currents (Data Analysis)

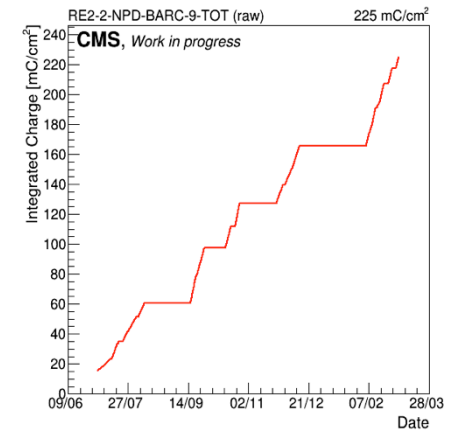


Graduate Students (orden alfabético)



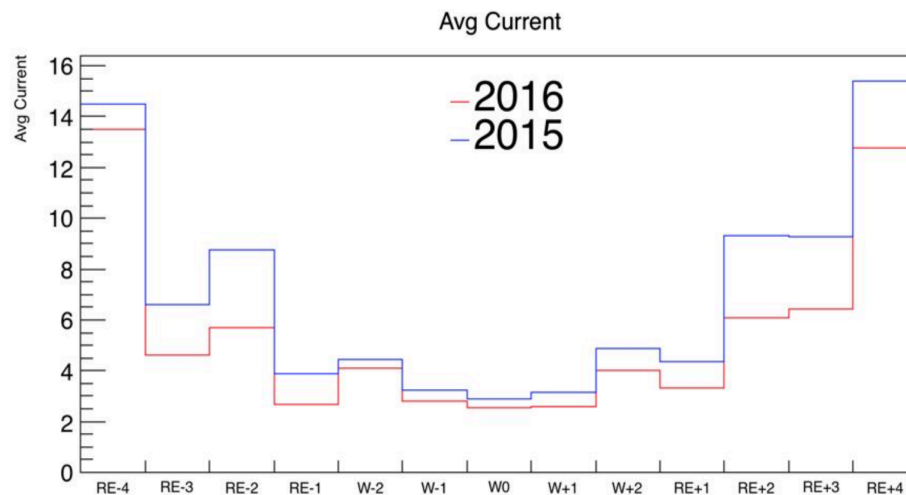
Jan Eysermans (BUAP) (asesor Isabel)

- Detector Expert on Call for the RPC (Operations)
- In charge of the DCS software for the RPC CMS (Operations)
- GIF++ software developer and data analysis (R&D)

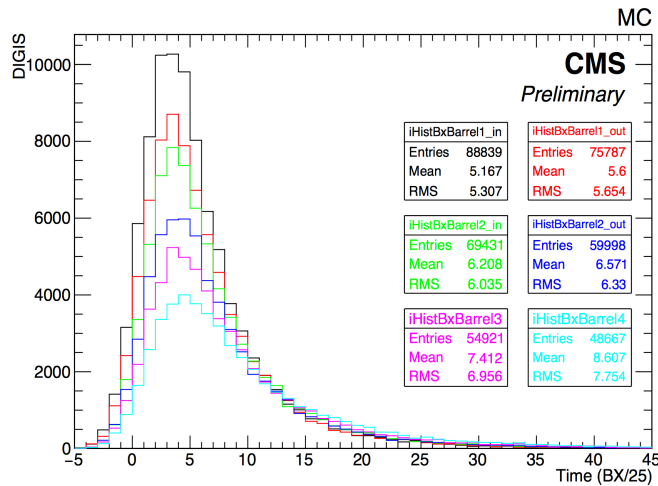


Iraq Rabadan Trejo (CINVESTAV)

- Detector Expert on Call for the RPC (Operations)
- Effect of the shielding by comparing rates and currents (Data Analysis)



Graduate Students (orden alfabético)



Gabriel Ramirez Sánchez, (CINVESTAV)

- Estudios de Heavy Stable Charged Particles con el nuevo sistema de Link Boards.



Rogelio Reyes (CINVESTAV)

- Detector Performance Studies (Data Analysis)

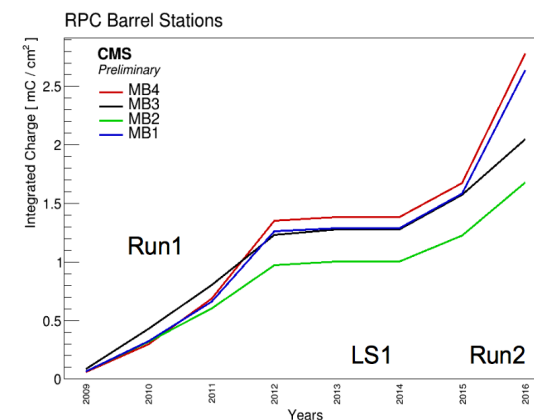


Fig 2.a. Integrated Charge vs Time - RPC Barrel stations

Estudiantes de Licenciatura (orden alfabético)

Oswaldo Miguel Colin, (IBERO) Asesor Cristina

- Offline Monitoring Software Update Developer
- Software development for the the Phase II Upgrade

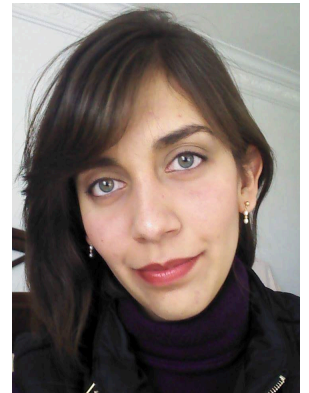


Miguel Calderón Monrroy (IBERO)

- Upgrade Phase II Software developer.
- CMSSW CMS-BUAP administrator.

Brenda Fabela Enriquez, (UAZ-BUAP) (asesor Isabel)

- Offline Monitoring Software Update Developer
- Software development for the the Phase II Upgrade
- Presented a talk on the Yearly Meeting of DPyC 2016



Juan Pablo Fernández (BUAP) (asesor Isabel)

- Upgrade Phase II Software developer.
- CMSSW CMS-BUAP administrator.

UPGRADE

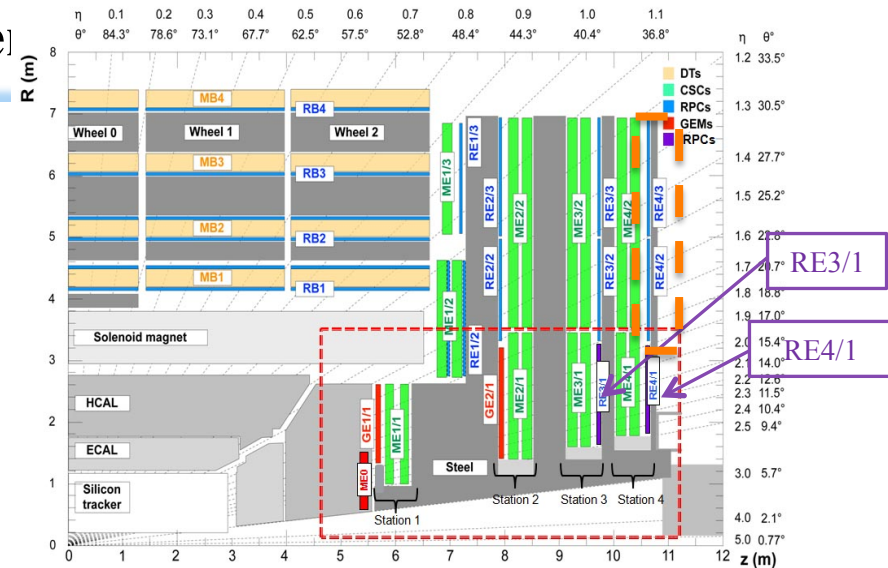
Present RPC System

Robust, efficient and redundant muon system

RPC present system (with RE4 installed in LS1)

- Covers $0 < |\eta| < 1.6$
- 1056 chambers (480 in barrel and 576 in endcap)
- 123688 electronic channels and 3950 m² of active area
- **Double gap chamber**: 2 mm gas width
- **Bakelite** bulk resistivity: $\rho = 2 - 5 \times 10^{10} \Omega\text{cm}$
- **Strip width**: 1 – 4 cm.
- **Gas mixture**: C₂H₂F₄ + isoC₄H₁₀ + SF₆ (40% of H)

95.2%	4.5%	0.3%
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- Operated in **avalanche mode**

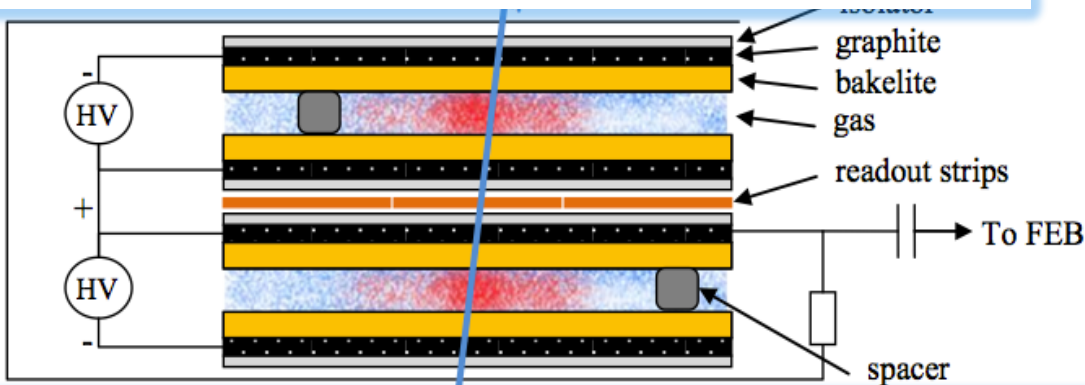


CMS muon upgrade

- RPC system completion up to $|\eta| < 2.4$ in phase 2

μ RPC system priorities

- μ Identification
- Triggering
- Improve High- p_T measurement (inner Tracker dominates up to ~ 200 GeV)
- Displaced delayed muon reconstruction



2015 data

Spatial resolution ≈ 1 cm
cm²

Av. Electronic Noise ~ 0.13 Hz/

Time resolution ≈ 2 ns

Av. Efficiency $\sim 94\%$

Isabel Pedraza - BUAP

Experience with RE4 Production (ended 2014)



Bari	Ghent	Peking	Tiblisi-IHEPI	Uniandes	Lyon
Napoli	Sofia Univ.	Korea Univ.	New Deli	Nueva Puebla	Tsinghua
LNF	Sofia INRE	SKK Univ.	BARC	Iberoamericana	Hanyang Univ
Pavia	CERN	Asrt-Enhep	Islamabad - NCP	Chandigarh	(Cinvestav)



Experience with RE4 Production (ended 2014)



Time line

TASK	LL	HL	Planned End	SECTIONS		
RPC First Review of L1 and readout design done (LM)-Link System	LM		October 26, 2016	Desing and Prototyping		
RPC First Review of L1 and readout design done (LM)	LM		October 26, 2016			
RPC Assesment of performance of small prototypes	LM		February 14, 2017			
RPC design: definition of performance requirements from simulation (LM)	LM		March 21, 2017			
RPC design : Front-end and chamber requirements defined		HM	March 21, 2017			
RPC full size prototypes assembly completed (LM)	LM		April 18, 2017			
RPC Preliminary results of longevity studies at HL-LHC luminosity for the TDR (LM)	LM		June 6, 2017			
RPC Power system specs ready (HV) (LM)	LM		June 13, 2017			
RPC full size prototypes and FE prototypes tested: preliminary resutls (HM)		HM	June 13, 2017			
MUON TDR SUBMISSION			June 22, 2017			MUON TDR
RPC Second Review L1 and readout design done (LM) - Link system	LM		December 12, 2017	Prototyping		
RPC Second Review L1 and readout design done (LM)	LM		December 12, 2017			
RPC Power system specs ready (LV) (LM)	LM		December 12, 2017			
RPC prototype FE finalized (HM)		HM	December 12, 2017			
RPC FE design finalized (RM)		RM	March 20, 2018			
RPC technology choice (RM)		RM	March 20, 2018			
RPC FE final engineering design ready (LM)	LM		April 3, 2018			
RPC Chamber Cooling: Preliminary Desing ready (LM)	LM		May 15, 2018			
RPC L1 and readout design finalized (HM)		HM	June 5, 2018			
RPC FE pre-production : Close Market survey (LM)	LM		June 26, 2018			
RPC On-Chamber FE Electronics final engineering prototype ready (HM)		HM	December 18, 2018	Engineering and Preproduction		
RPC Chamber ready for pre-production (LM)	LM		January 8, 2019	Preproduction		
RPC Completion of chamber engineering prototype and integration (HM)		HM	January 8, 2019			
RPC EDR (HM)		HM	January 8, 2019			EDR
RPC Completion of chamber design and integration		RM	April 2, 2019			
RPC L1 and readout prototypes validated (HM)		HM	June 5, 2019			
RPC Link system finalized (HM) - Link System		HM	June 25, 2019			
RPC Power system specs defined and prototypes validated (HM)		HM	November 12, 2019			
RPC Power system specs defined and prototypes validated (HM)		HM	November 12, 2019			
RPC ESR (HM)		HM	December 9, 2019			ESR
RPC Chamber pre-production Chambers and FE completed and validated (HM)		HM	December 24, 2019			

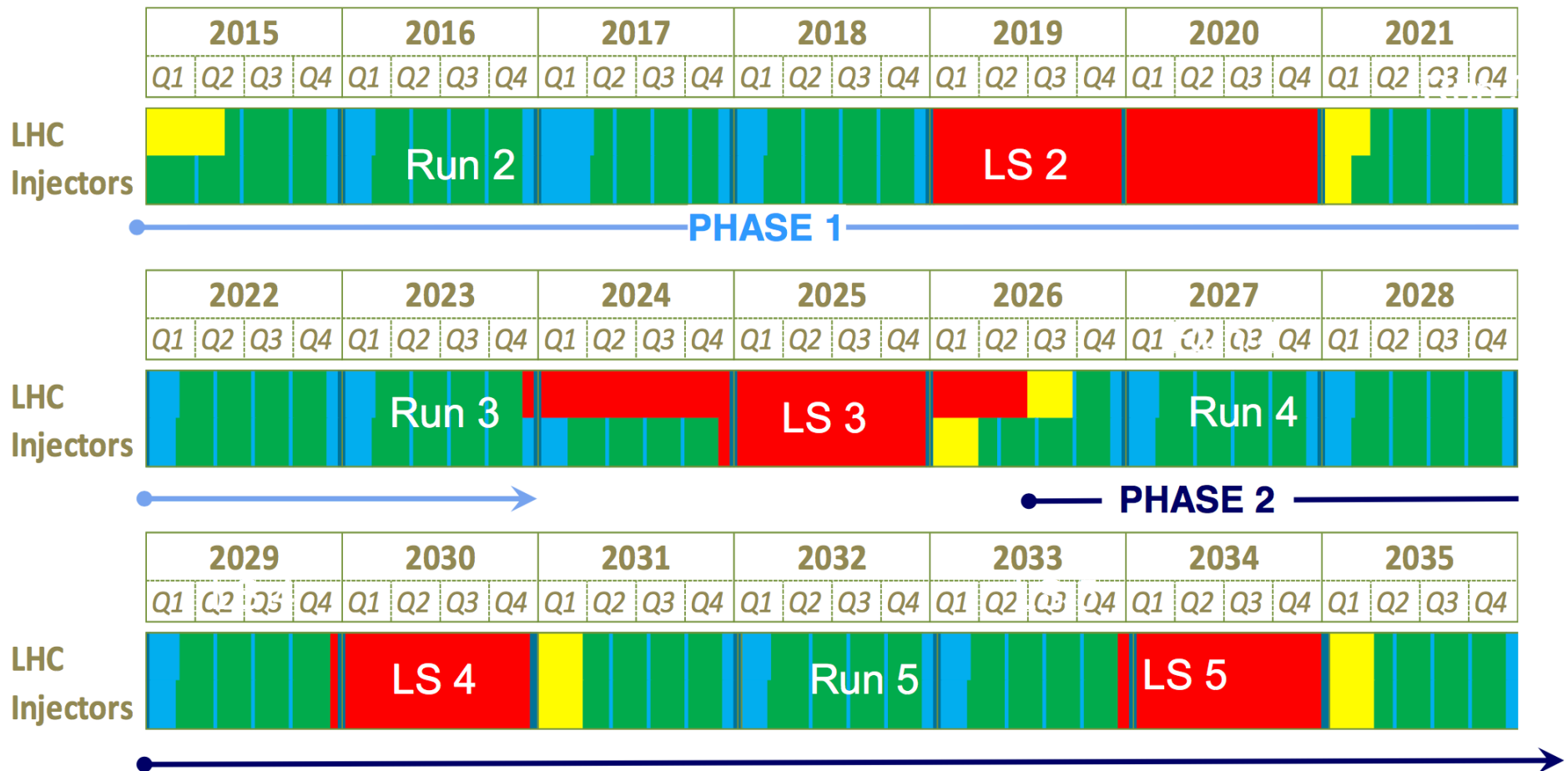


RESPALDO

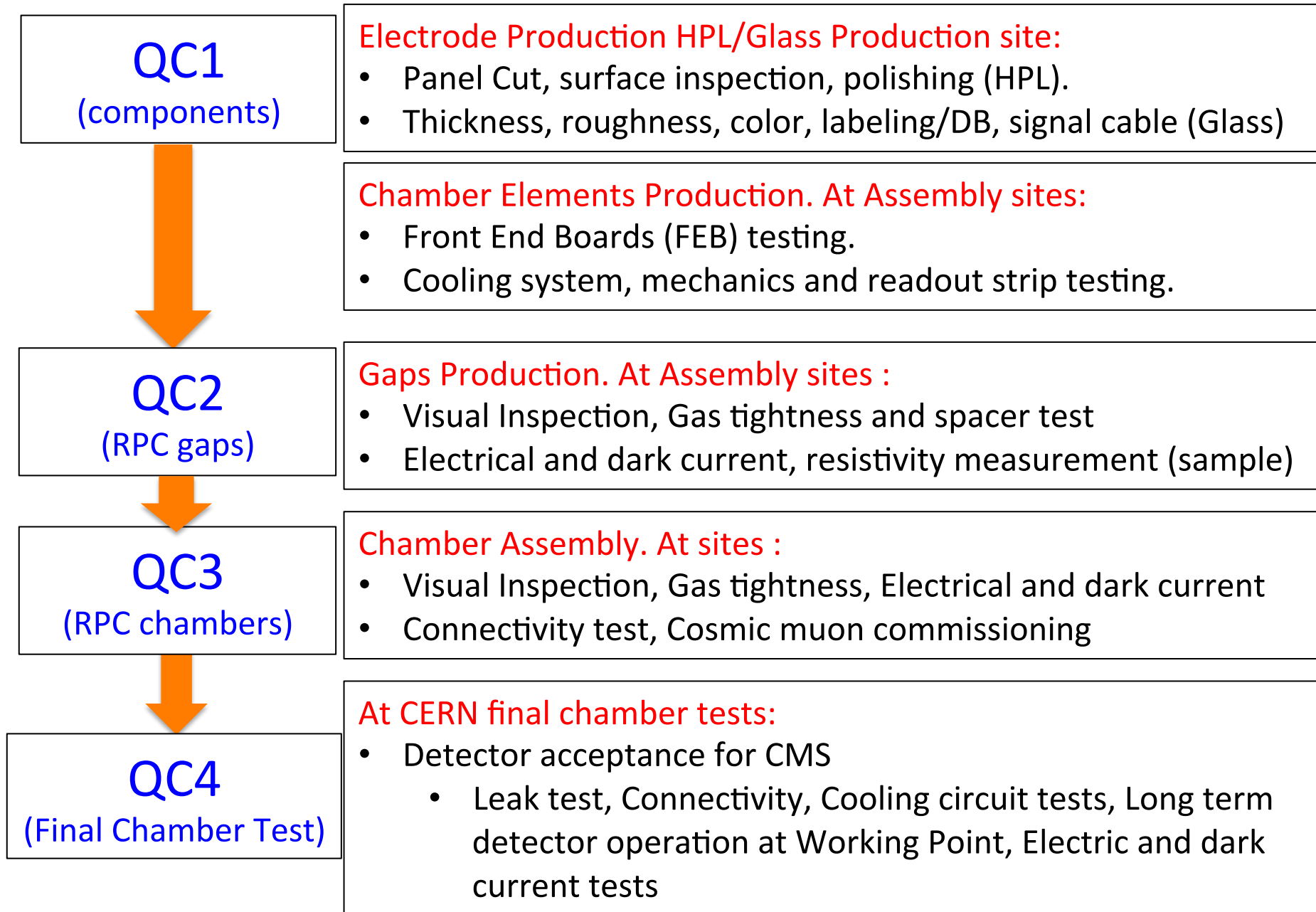
LHC roadmap

LHC roadmap: according to MTP 2016-2020 V1

LS2 starting in 2019 => 24 months + 3 months BC
 LS3 LHC: starting in 2024 => 30 months + 3 months BC
 Injectors: in 2025 => 13 months + 3 months BC

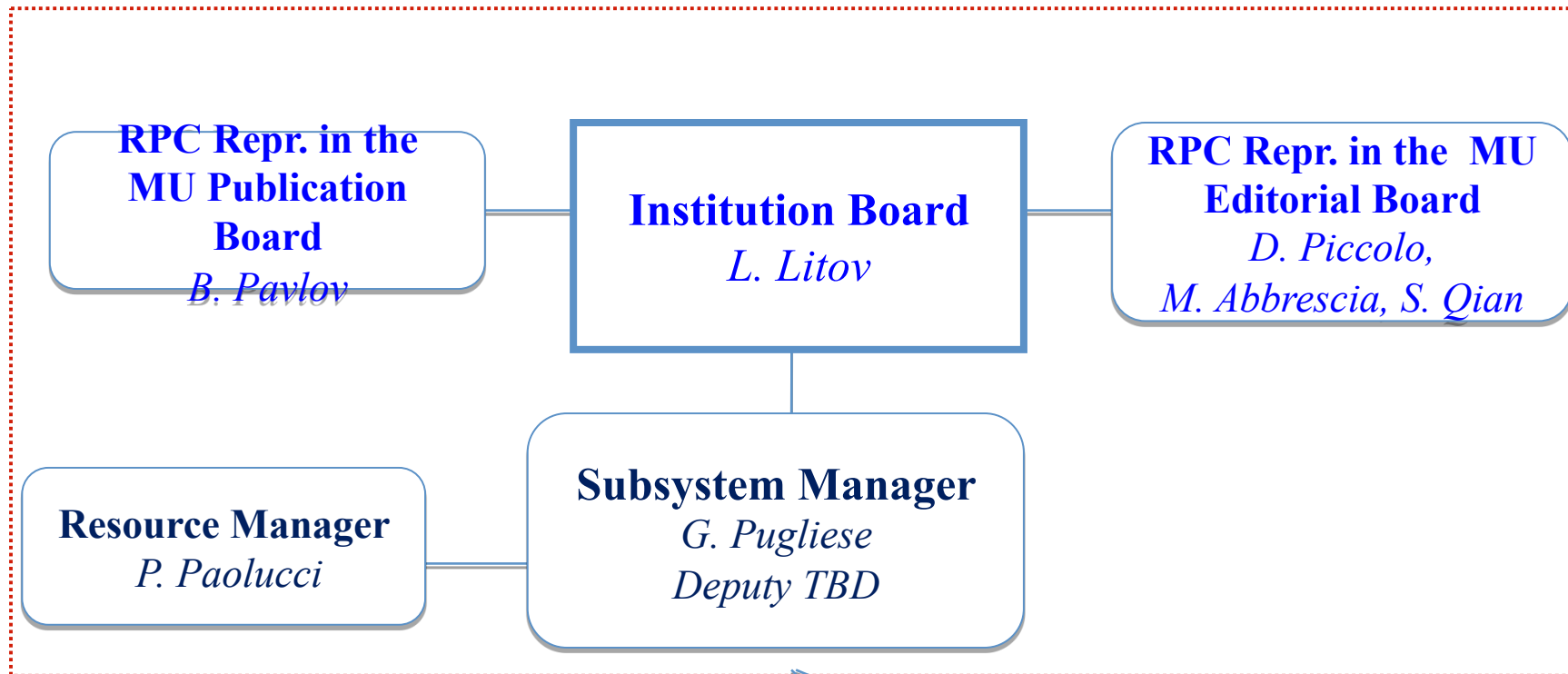


Draft of construction flow



Slightly modifications can be expected

Leading Roles in CMS



LV2 structure

**Technical Coordination/
Safety**
*S. Buontempo
A. Dimitrov*

**Run
Coordinator**
*A. Cimmino
A. Aleksandrov*

**DPG
Coordinator**
*R. Hadjiiska
B. Pavlov*

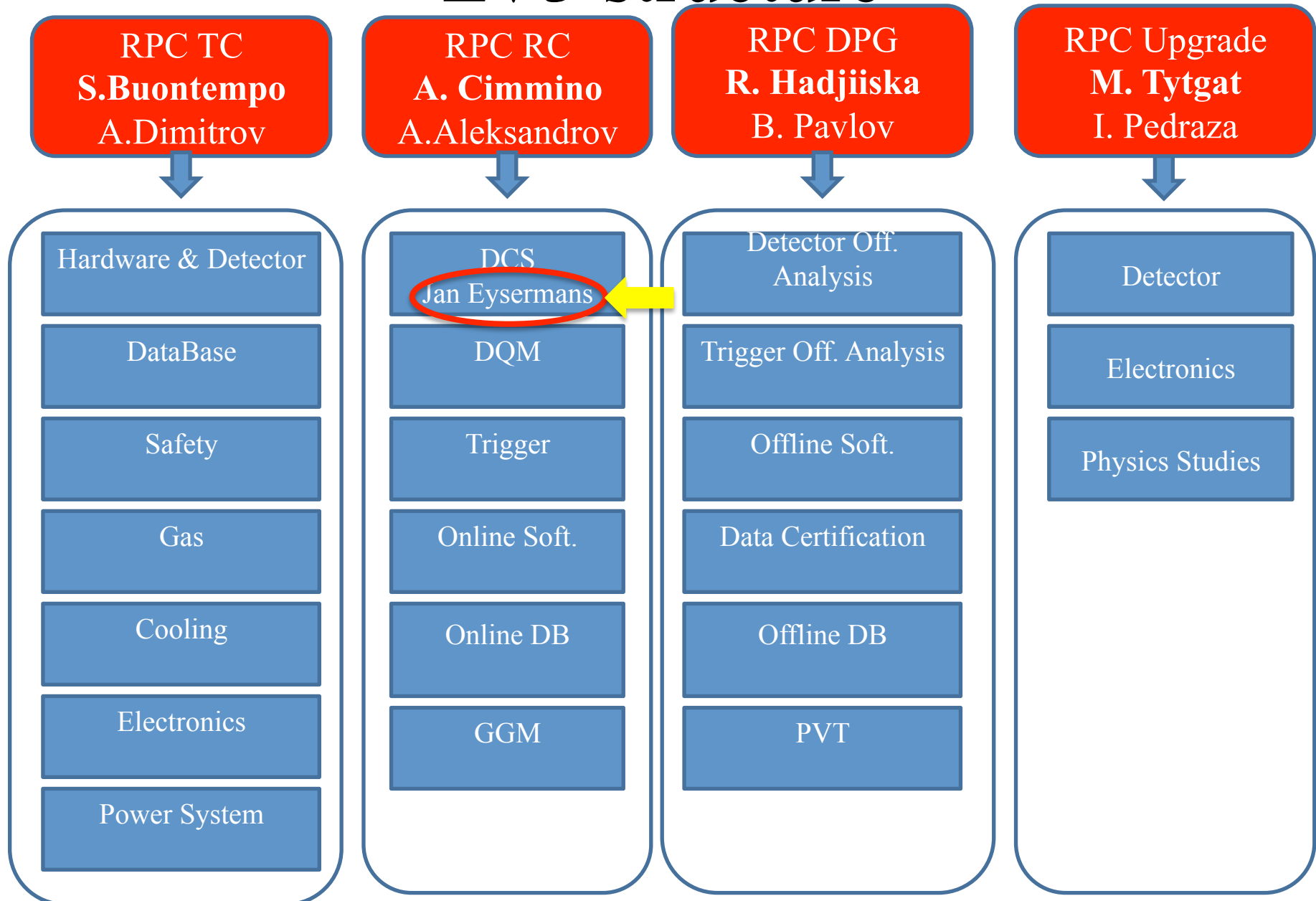
**Upgrade
Coordinator**
I. Pedraza

2015-2017

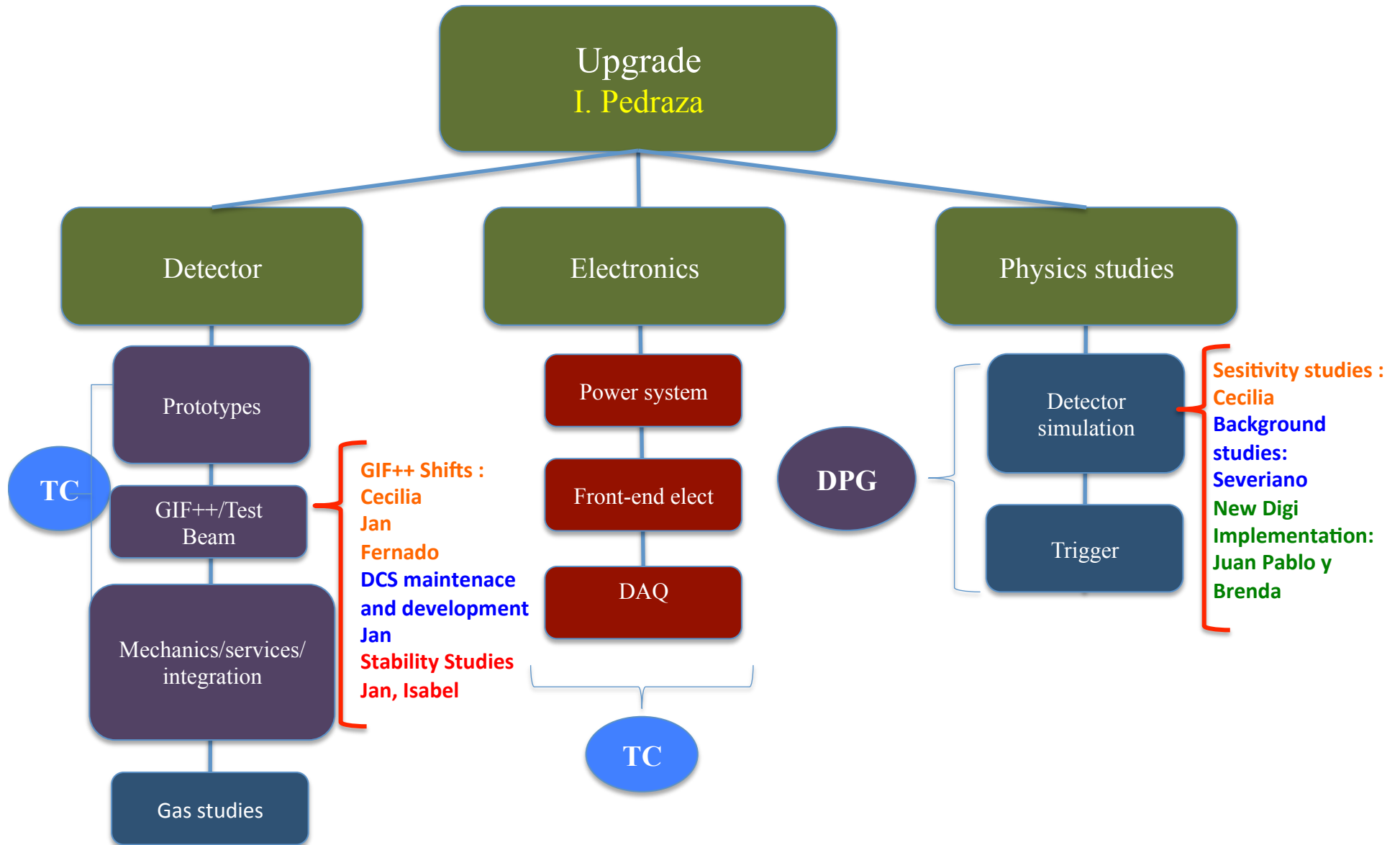


Leading Roles in CMS

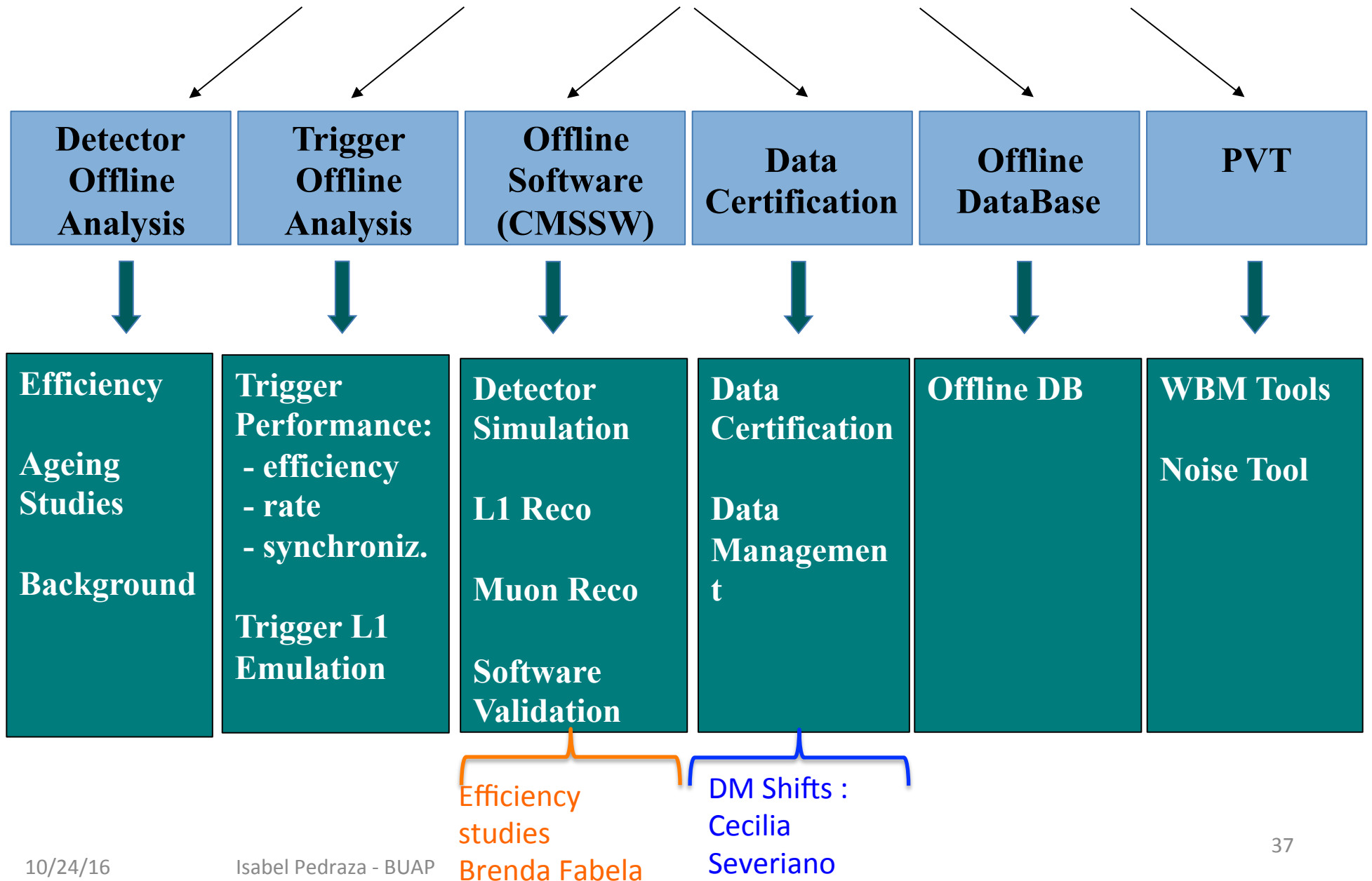
LV3 structure



Task Within the Upgrade

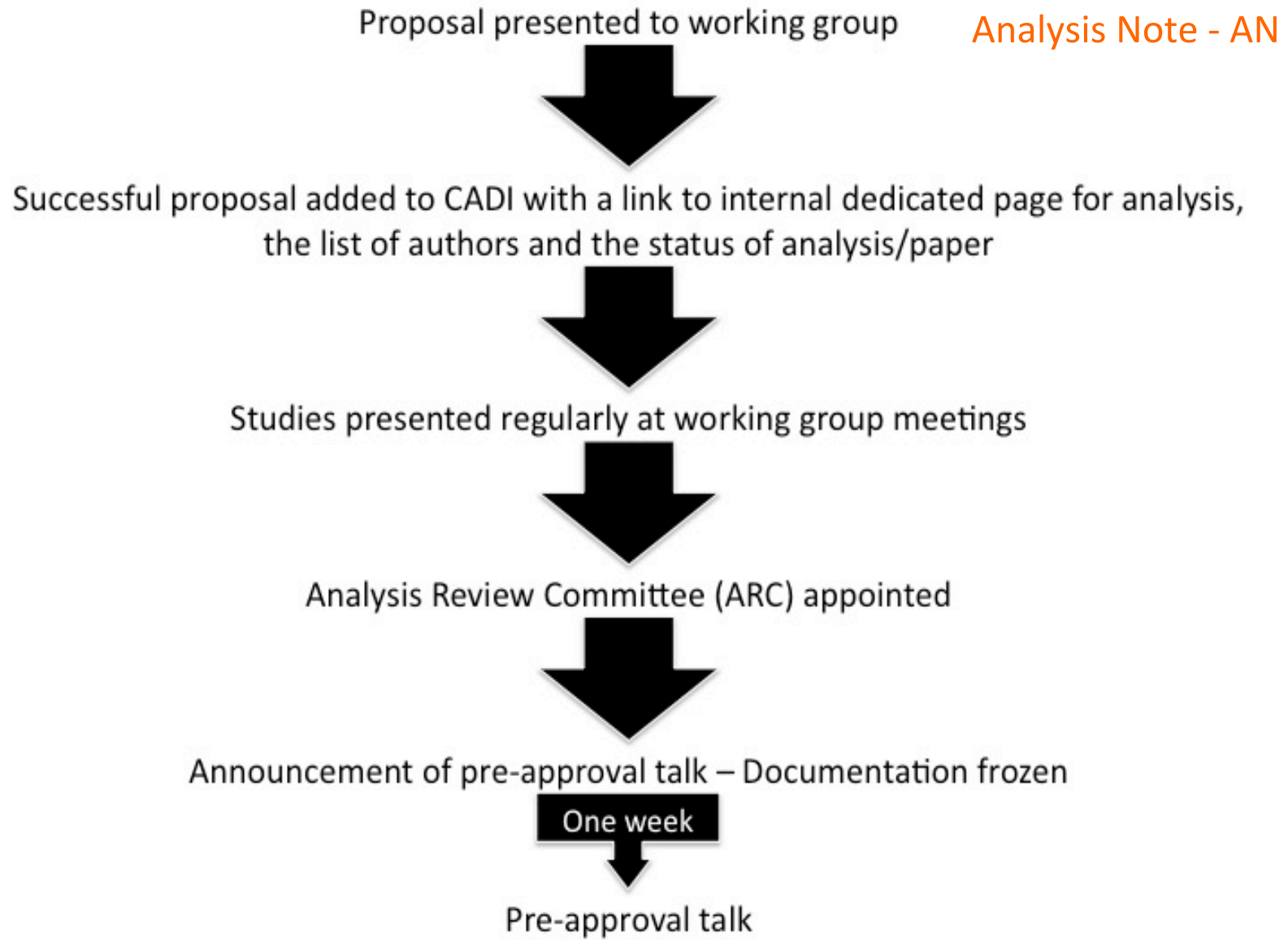


Task Within The DPG

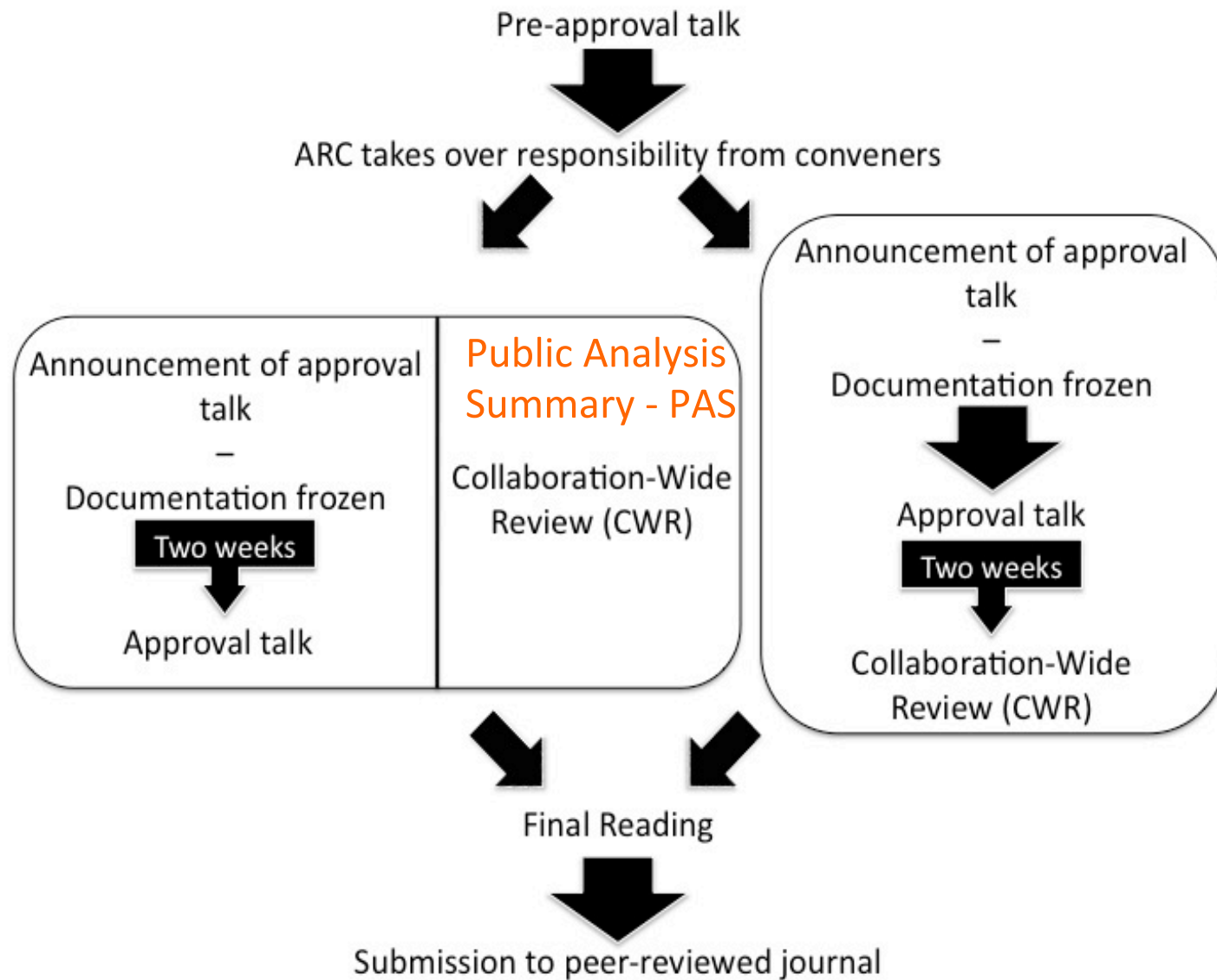


Data Analysis

Publication Flow



Publication Flow



EPR -Experimental Physics Responsibility

Name given to the **service work** that should be provided by each CMS institution/author

EPR due for an author: 3 months core tasks

Non-core tasks will be opened as soon as core is covered.

EPR worked on non-core tasks will be accounted with a downscale of 0.25.

Shift work expected for an author: 8.1 shifts, equivalent to 0.266 central shift credit points (CSP)

"Pledged" shifts are shifts which are in the future (i.e. until the end of the year). As they can still be changed/cancelled, they do not count to the shifts actually "done" (i.e. in the past).