RD_Fase2

Joint ATLAS-CMS phase 2 R&D

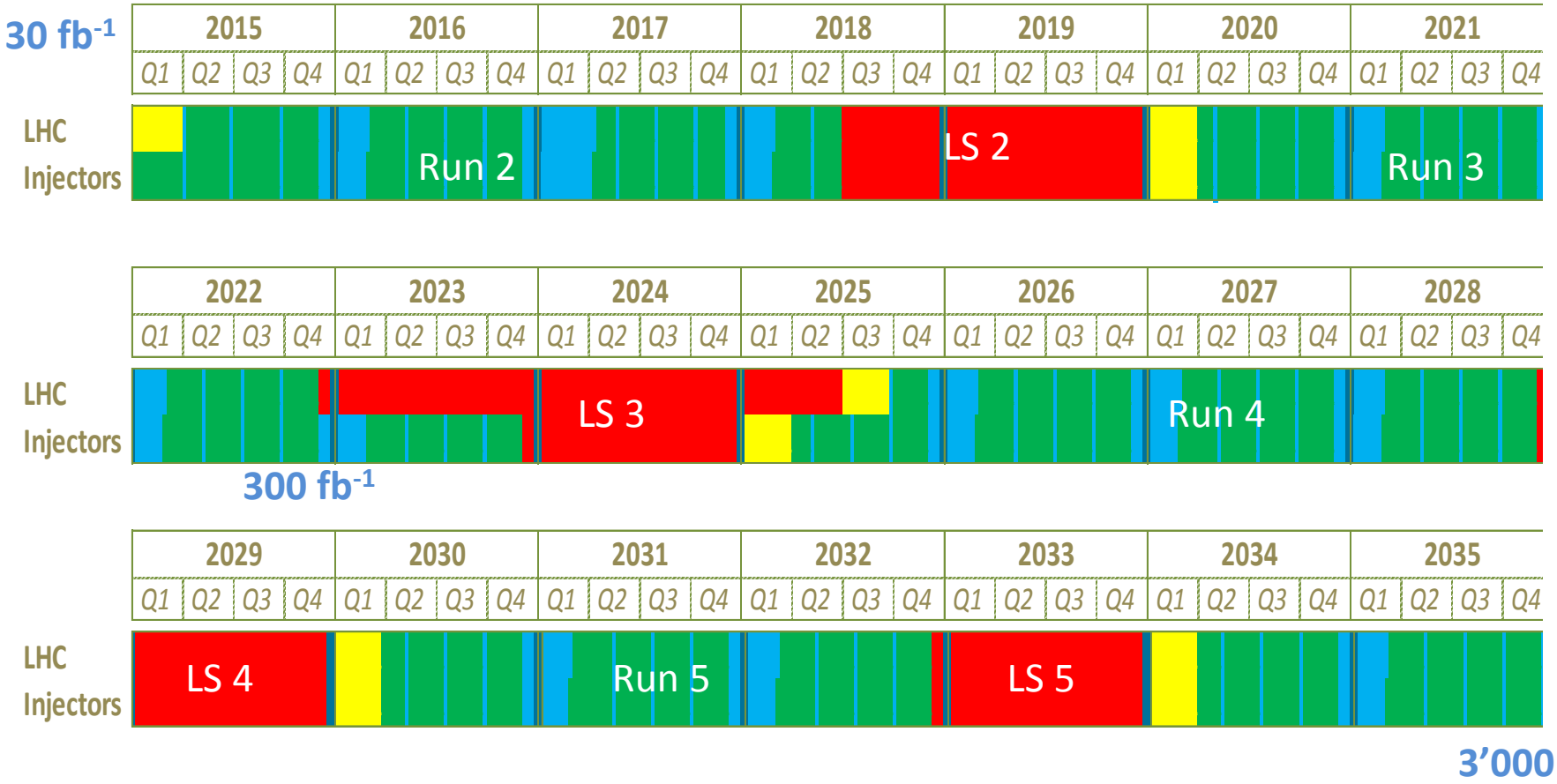
Responsabili nazionali :
Anna Di Ciaccio (ATLAS), Nadia Pastrone (CMS)

Responsabili locali:
responsabili locali ATLAS-CMS

Pavia: G. Polesello, C. Riccardi

LHC Schedule beyond LS1

LS2	starting in 2018 (July)	18 months + 3months BC (Beam Commissioning)
LS3	LHC: starting in 2023 =>	30 months + 3 BC
	injectors: in 2024 =>	13 months + 3 BC



LHC schedule approved by CERN management and LHC experiments spokespersons and technical coordinators (December 2013)

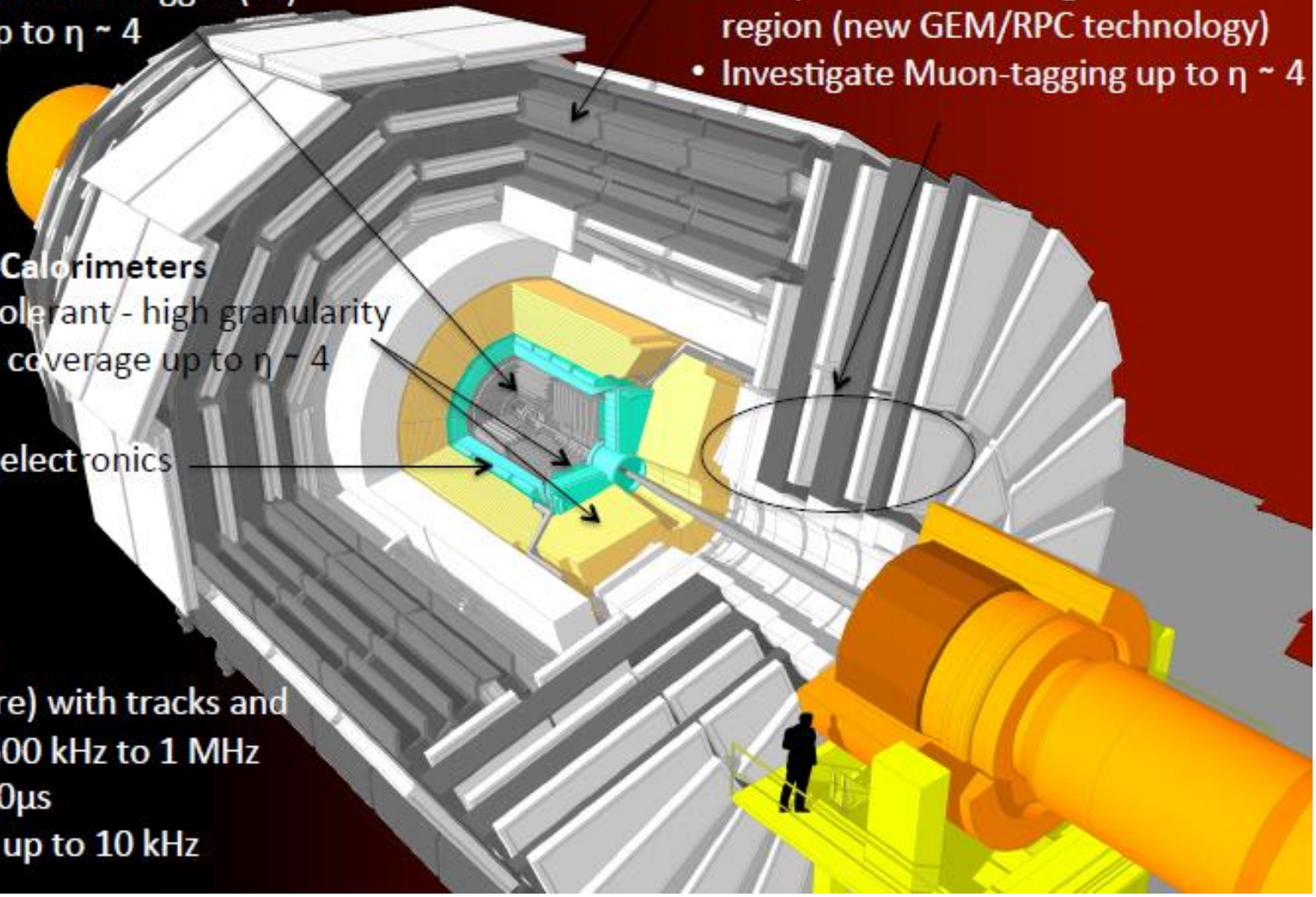
CMS Phase 2 Upgrades

New Tracker
- Radiation tolerant - high granularity - less material
- Tracks in hardware trigger (L1)
- Coverage up to η ~ 4

Muons
- Replace DT FE electronics
- Complete RPC coverage in forward region (new GEM/RPC technology)
- Investigate Muon-tagging up to η ~ 4

New Endcap Calorimeters
- Radiation tolerant - high granularity
- Investigate coverage up to η ~ 4

Barrel ECAL
- Replace FE electronics



Trigger/DAQ
- L1 (hardware) with tracks and rate up ~ 500 kHz to 1 MHz
- Latency ≥ 10μs
- HLT output up to 10 kHz

Sinergie ATLAS -CMS

- Pixels
  - pixel read-out chip 65nm (CHIPIX65-RD53)
  - Sensors
- Track trigger
- Muon system: RPC

Per 2015 attività fase 2 a Pavia solo CMS-RPC

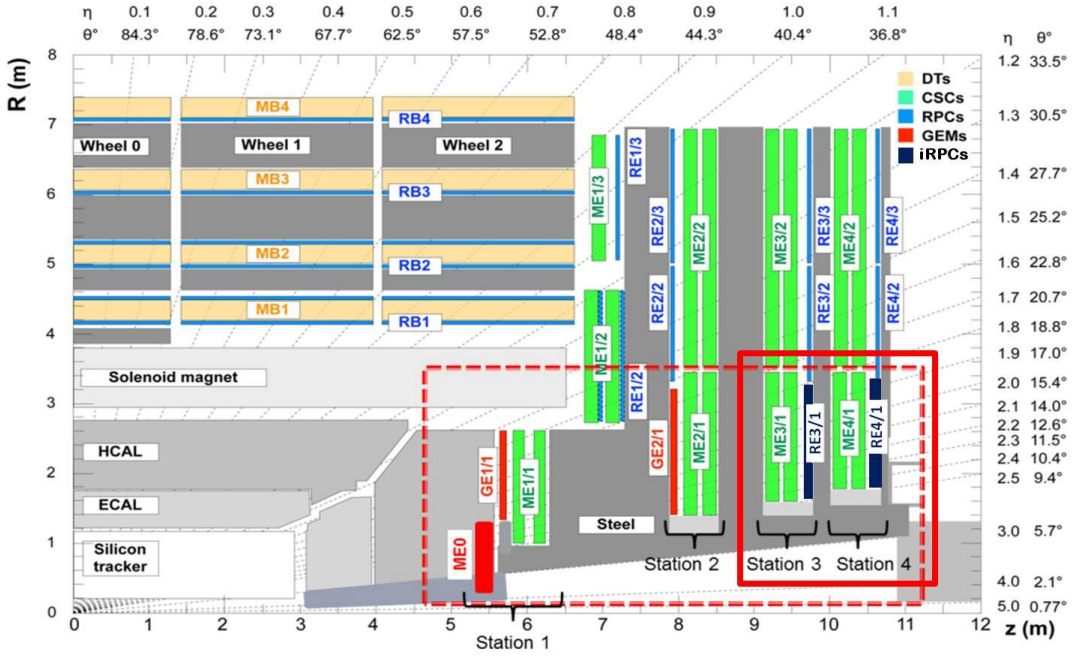
(CMS pixel → CHIPIX65 (grV 1.4 FTE-PV), RD53)

(CMS GEM → call grV)

CMS RPC phase-2

1. Aging and longevity:

- RPC **Installation** in **2007**
- By the end of LS3 (**HL-LHC**) detector will be **20 years old** and be required to operate **beyond** the **design specification** and after 20 years from the construction (14 years of operation)



2. Upgrade of high eta region:

to ensure trigger performance also for low pt muons (p_T<20 GeV)

- **NEW STATIONS RE3/1 and RE4/1** (1.6< |η| <2.4)
  - 144 chambers (about 1.5-2.0 m^2 area) for the inner (ring n.1) region of disks 3 and 4
  - Rate: 1-2 kHz/cm^2 → **x5 limit tested for existing RPC chambers**
  - Integrated charge: 1-2 C/cm^2 @ 3000fb^{-1}

Joint ATLAS-CMS phase 2 R&D : *CMS-specific*

- **Electrodes**
  - **low resistivity (HPL) , glass electrodes → higher rates**
  - **Thinner electrodes** will be tested to improve the S/N ratio, the spatial resolution and to reduce the stress (HV working point) and the aging

- **Chamber prototypes** (thin, multi-gap, different resistivity...) for a maximum of 10 chambers to test in common (ATLAS/CMS)

- **Ecogas** (molecules similar to $C_2H_2F_4$ but with lower GWP)

- **Irradiation tests**
  - **Aging test on detectors and materials at GIF++**
  - **Beam test facility at Frascati (** rate, efficiency, time resolution, sensitivity to photons and neutrons --E_γ<700MeV, E_n= 1-10 MeV)
  - **Test of FE electronics (aging and SEE) at various facilities** (GIF++, Louvain, …) verify currently installed boards for 10-year equivalent dose at HL-LHC

R & D Fase II Pavia

HPL: R&D relativo alla produzione di lastre di HPL a bassa resistività. Obiettivo è il raggiungimento di un valore di resistività inferiore di un ordine di grandezza rispetto a quello attualmente utilizzato ($1 \div 6 \times 10^{10}$ Ohm cm).
Questo R&D è di interesse comune ATLAS-CMS ma sarà seguito da CMS che ha studiato e contribuito allo sviluppo della produzione di HPL per RE4 con una nuova ditta di laminati (Puricelli) dopo la chiusura della ditta Panpla che aveva prodotto tutto l' HPL per gli RPC degli esperimenti a LHC. La misura di resistività sarà fatta da CMS mentre il test della long term conductivity da ATLAS

Test di elettronica di FE : misura di sezione d'urto di fenomeni transienti indotti da neutroni sulle schede di FE. Si intende utilizzare le seguenti facilities: Triga Mark II in Pavia e il ciclotrone di Louvain. La stazione di misura è già disponibile.

Misure alla GIF++: aging , rate, efficiency, time resolution, sensitivity di nuovi RPC a bassa resistività

RPC - Funding profile

Task	2014	2015	2016	2017	TOTALE
Electrode		25	20	0	45
Chamb/Proto		28	36	10	74
Front-end		56	12	6	74
Eco-gas	10	10	10	6	36
GIF++		20	14	14	48
	10	139	92	36	277

CMS Pavia – R&D Fase II

Anagrafica PV

		FTE
Alessandro Braghieri	Ric. INFN	0.1
Paolo Montagna	RU	0.1
Cristina Riccardi	RU	0.1
Paola Salvini	Ric. INFN	0.1
Paolo Vitulo	RU	0.4

totale FTE 0,8

Richieste programmate per 2015-2017

Per 2015 :

HPL (PV) 10KE
FE test (PV) 5KE

} Preventivo totale per RPC a Bari

Richiesta missioni e metabolismo consumo su CMS

Missioni	Metabolismo ME+MI	**(3,7+1)k€ x 0,8FTE = 3,76 k€**
	RPC faseII: GIF++,FE test,HPL	**13,4 k**
Tecnici	R&D faseII: installazione camere GIF++	**2mu x 3,7 k = 7,4 k**
Consumo	Metabolismo	**1,5 k x 0,8 FTE = 1,2 k**

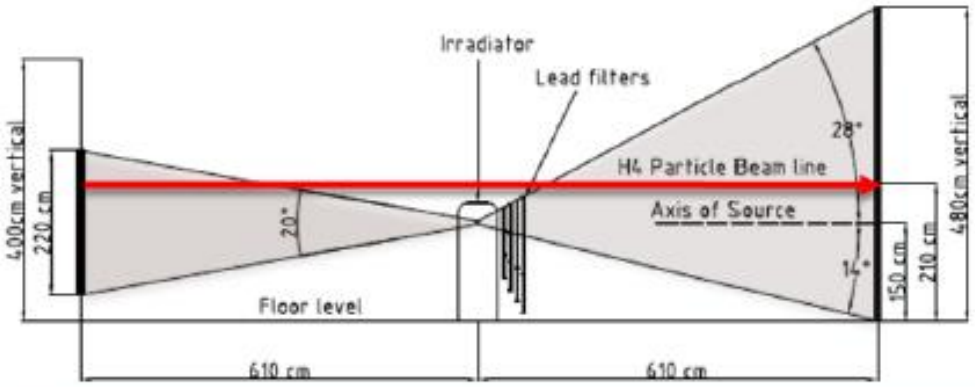
Totale **25,8 K€**

Richieste Servizi vedi CMS

G. Pugliese

Gamma Source: ^{137}Cs

1. Primary γ energy **662 KeV**
2. **30 times more intense** than the present GIF source



3. γ irradiation in the two directions **(upstream and downstream)**

4. System of **movable filters** (lead attenuators) for large irradiation zone that allows attenuation factors between 1 and 100000 in several steps **(in both direction up and down stream)**

- Attenuation of single filters:
  Plane 1: 1; 10; 100
  Plane 2: 1; 1.468; 100
  Plane 3: 1; 2.154; 4.642
- Resulting filter factors of movable filters (Fig. 3):
  1; 1.468; 2.154; 3.162; 4.642; 6.813; 10; 14.678; 21.544; 31.62; 46.42; 68.13; 100; 146.8; 215.4; 316.2; 464.2; 681.3; 1000; 2154; 4642; 10000; 21544; 46415