



# CMS-GEM gas system



# GEM gas system

## Main parameters:

Detector volume: 3.4 m<sup>3</sup>

Gas mixture: Ar 45%, CO<sub>2</sub> 40%, **CF<sub>4</sub> 15%**

Required flow: 5 volume changes per day (~**700 nl/h**)

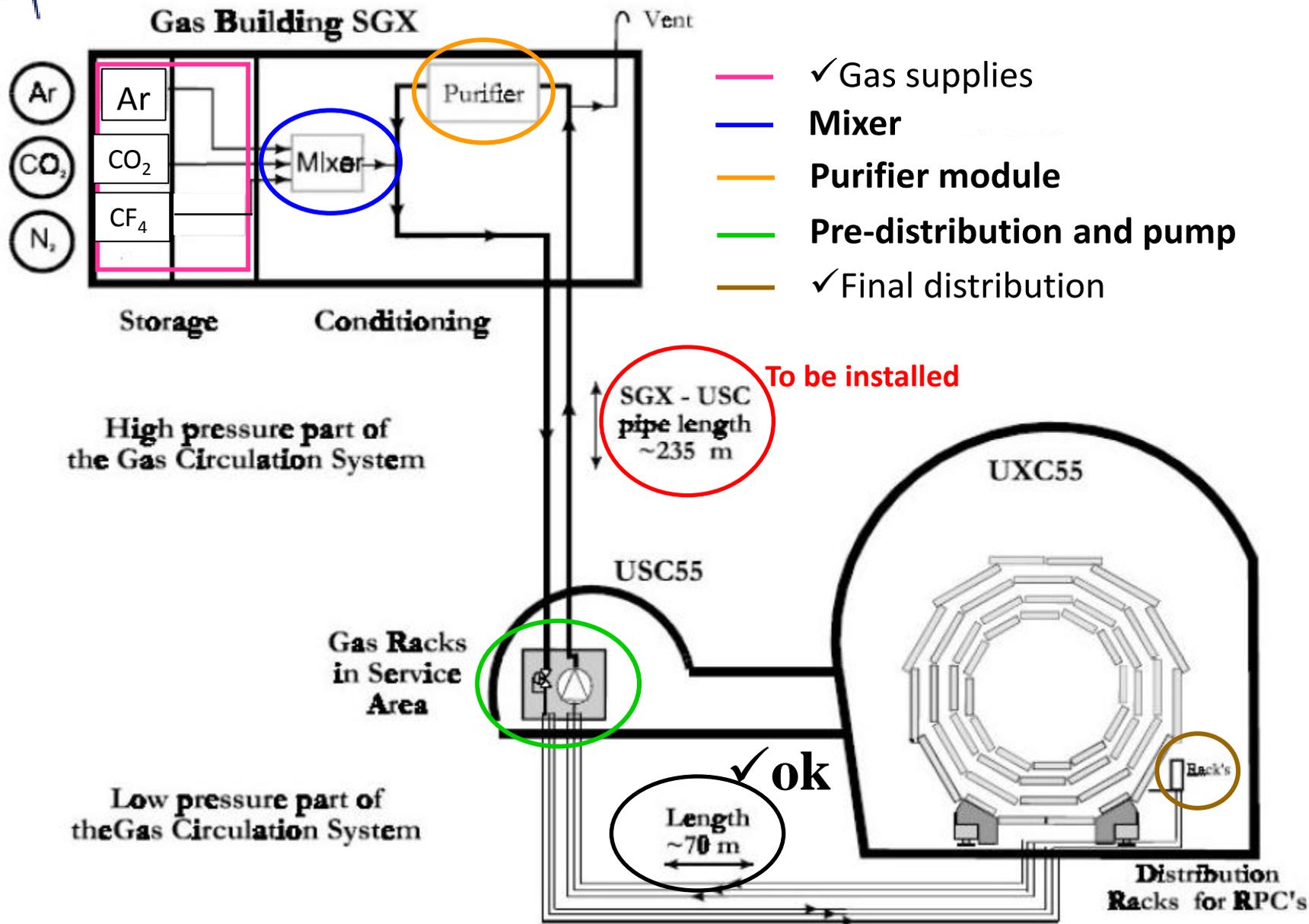
→ equivalent to about 200 kCHF/year for gas only in case of an open mode gas system:

a closed loop recirculation system is a more cost effective solution  
(extra-cost are recuperated in about 6 months of running)

Part of the infrastructures already exist since they were installed for the RPC RE1/1 and RE2/1 stations



# Gas system layout





# Infrastructures for gas system

## ➤ Gas system:

- ✓ Primary gas supplies
- Mixer
- Chamber pre-distribution system  
(some modifications are needed)
- ✓ Chamber distribution  
(some modifications are needed)
- Pump
- Purifier (optional)
- Exhaust
- Connection to CF<sub>4</sub> recuperation (optional)



## ➤ Main gas pipes:

- Supply and return gas pipes (+ spare?) from SGX to UGC



# Gas infrastructures already existing

## ➤ Gas system

(standard installation as for all the gas systems for the LHC experiments):

### ✓ Primary gas supplies (SGX5)

All primary gases are already used by other CMS detector, therefore all the required components are already installed

### ✓ Chamber pre-distribution system (UGC)

Gas pipes from UXC to UGC are available.

Part (on/off valves + PT sensors) of the pre-distribution system is available, but most probably the best and clean solution would be to install two new racks (Endcap- , Endcap+) with dedicated pneumatic valves and pressure regulation valves

### ✓ Chamber distribution (UXC) →

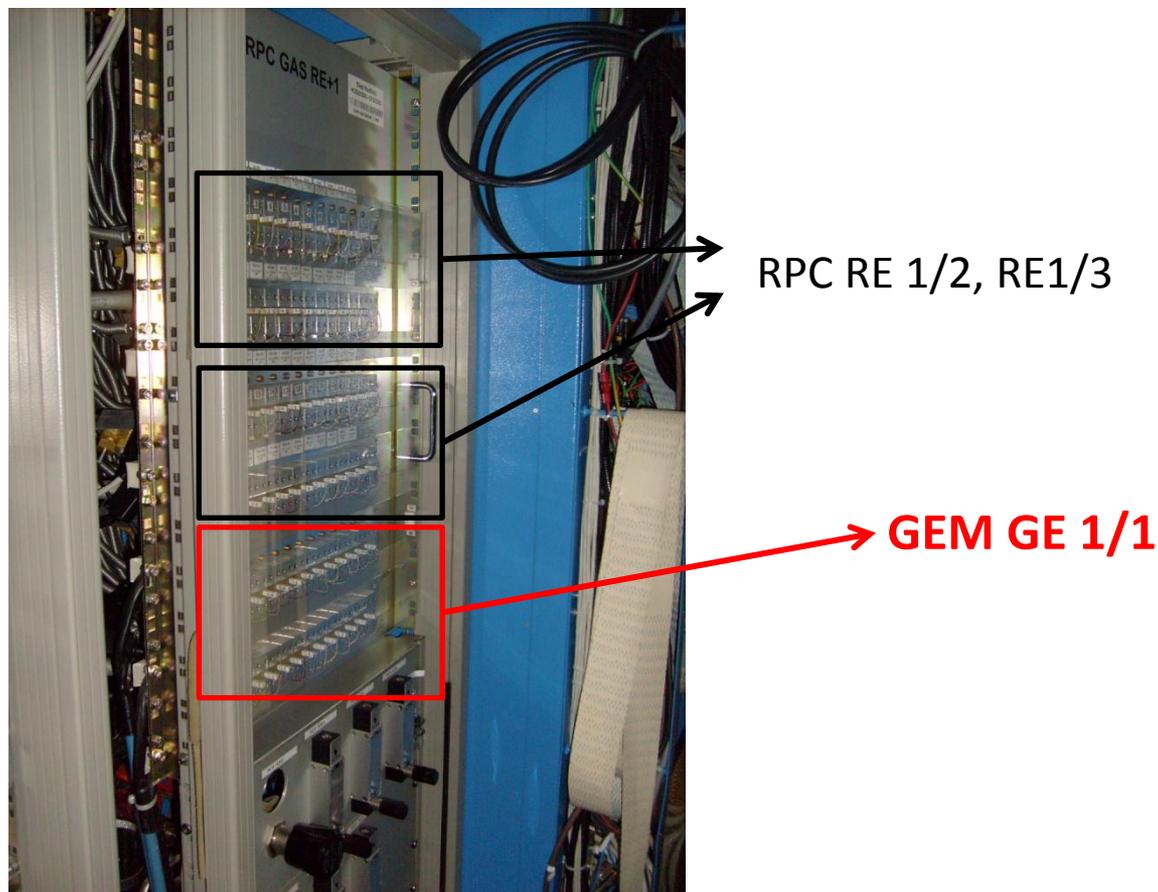


# Gas infrastructures already existing

✓ Chamber distribution (UXC)

One manifold (12 supply and return channels) is available in each distribution racks.

At the moment the controls are integrated in the RPC gas system. We need to decouple the two systems and re-calibrate the flow-meters.





# New gas infrastructures

## ➤ Gas system:

- Mixer : three components gas mixer 30 kCHF
  - Pump: gas circulation pump 25 kCHF
  - Purifier (optional): 35 kCHF
- Needed only if the closed-loop circulation option will be adopted
- Exhaust: 10 kCHF
  - Connection to CF<sub>4</sub> recuperation (optional) -

CMS is equipped with a CF<sub>4</sub> recuperation system paid by the CSC group. Given the important amount of CF<sub>4</sub> used by the GEM detector and the close similarity in the mixture composition, a connection to the existing plant should be evaluated and tested

## ➤ Main gas pipes:

- Supply and return gas pipes (+ spare?) from SGX to UGC

At least two pipes are needed to supply the pre-distribution and to collect the return gas from the detectors.

*More details and technical drawings are given in the technical proposal*



# Final gas distribution on the endcap disks

- On each RE1 and RE2 gas distribution racks, 12 channels were dedicated to the innermost RPC station. These channels could be re-used by the GEM detectors.
- The pipes from the gas distribution racks to the periphery of the disks should be also already installed and arranged in path panel.
- The piping from the periphery to the chambers on the disk most probably has to be installed (we can verify if something already exist during the 2013 long shutdown).



# Conclusions

- The closed-loop gas system for the CMS-GEM detector will cost about 100-150 kCHF considering the re-use/modification of existing parts.
- The installation of two new stainless-steel pipes from the SGX5 building to the UGC room is also needed. The cost for this item is not included in the present evaluation.
- The piping on the disk needs to be verified: if present and/or reusable.
- A final inspection, especially for what concerning the gas pipes on the disks, should be carried out (as soon as possible) at the beginning of the 2013 long shutdown.