

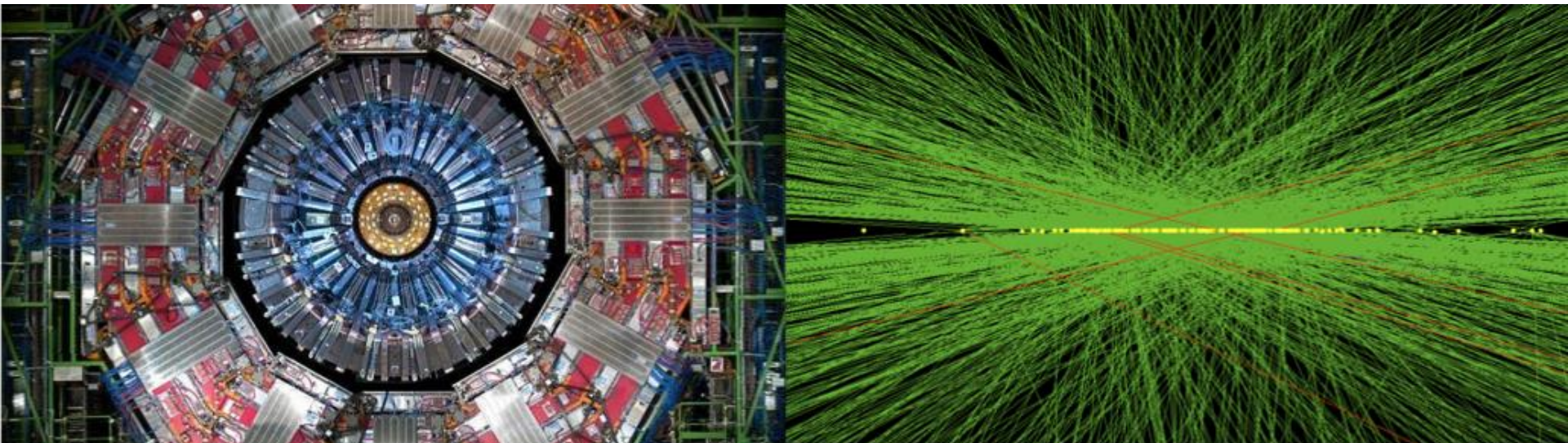


GEM GAS SYSTEM READINESS

Daniel Teyssier (Atomki, Debrecen) on behalf of the GEM group

GEM workshop

Sept 30th, 2019



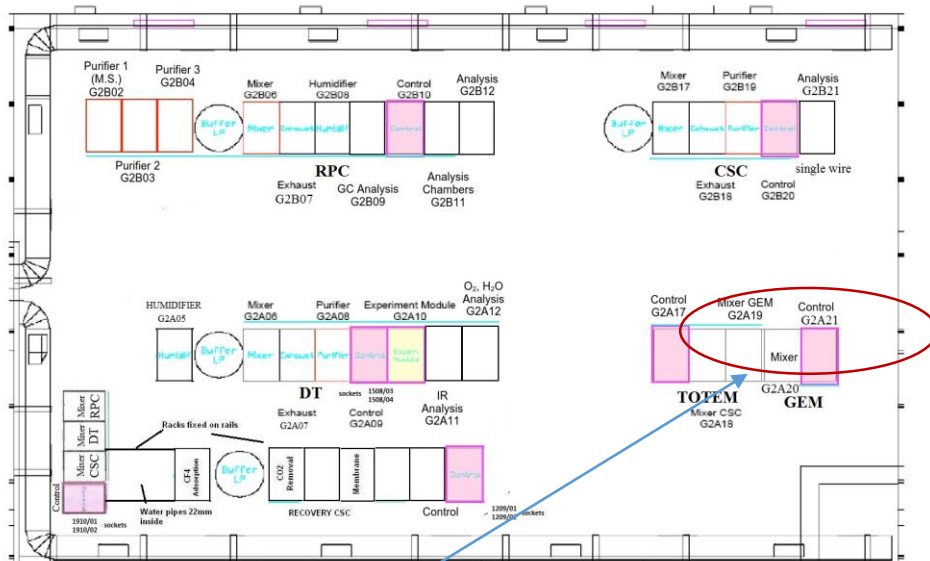
Outline

- GEM gas system infrastructure
- GE-1/1 gas system installation and commissioning
- GE-2/1 installation
- GE+1/1 & GE+2/1 installation's schedule

Gas system infrastructure

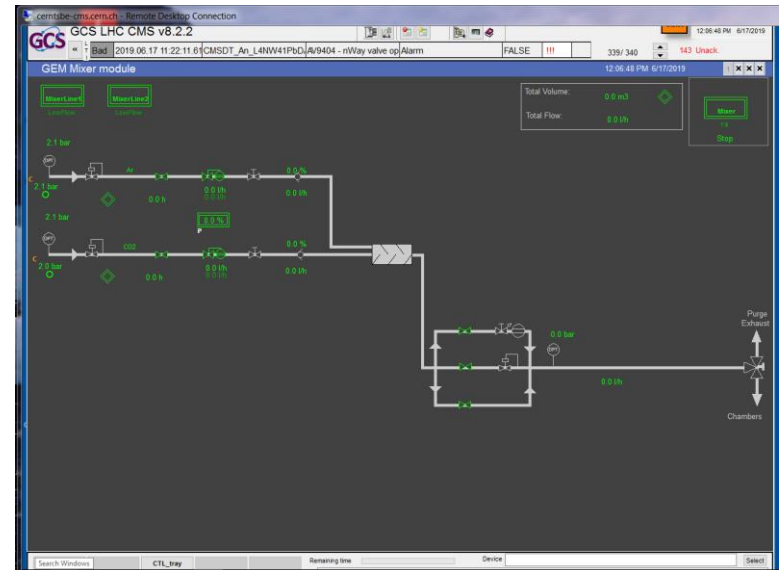
- Gas system installation:
- **GEM gas mixer** located in the **surface gas barrack (SGX)**, completed by **EP-DT**. From now, we were using the last spare Canbus (communication control cable) available for all gas systems: the GEM Canbus will be routed soon and used.

CMS - SG5 - Mixing Room



B. Mandelli / EP-DT

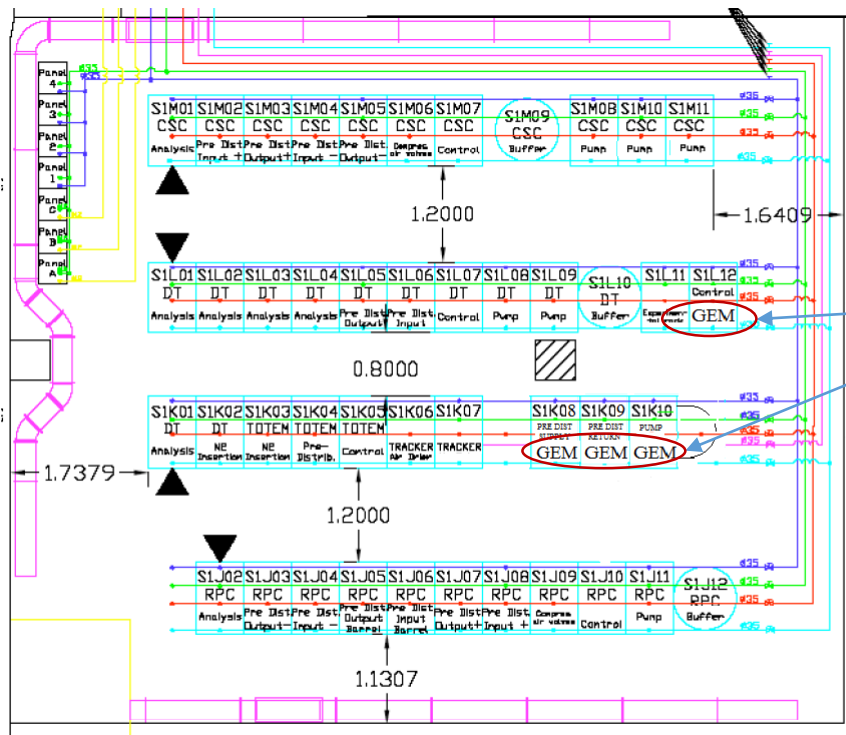
GEM gas system in SGX



GEM mixer in GCS (gas control system)

Gas system infrastructure

- Gas system installation:
- **GEM gas pre-distribution** located in the **underground gas room (UGX)**, also **completed by EP-DT**: input/output lines (resp. racks S1K08/S1K09), pump (rack S1K10) and control (rack S1L12). Control of the GEM gas system already commissioned by EP-DT, thanks to A. d'Auria & gas group.



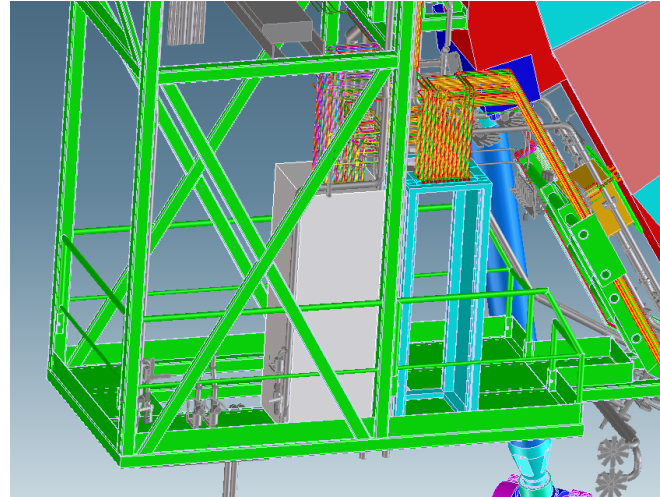
4 racks in UGX for all GEM gas systems (GE1/1, GE2/1 & ME0)

B. Mandelli / EP-DT

GE-1/1 installation

- Gas system installation:
 - All lines between UGX and UXC distribution racks on X2 far side already installed by the ZEC team. GE1/1 and GE2/1 inputs/outputs, purge and backup : in total 12 lines were installed in the MCC in Jan/Feb 2019.
 - All X2 (common GEM/RPC) far side racks re-installed in UXC.
 - GE1/1 detector lines (UXC X2 racks to center) were already there :

- On negative side, re-using existing 12 lines



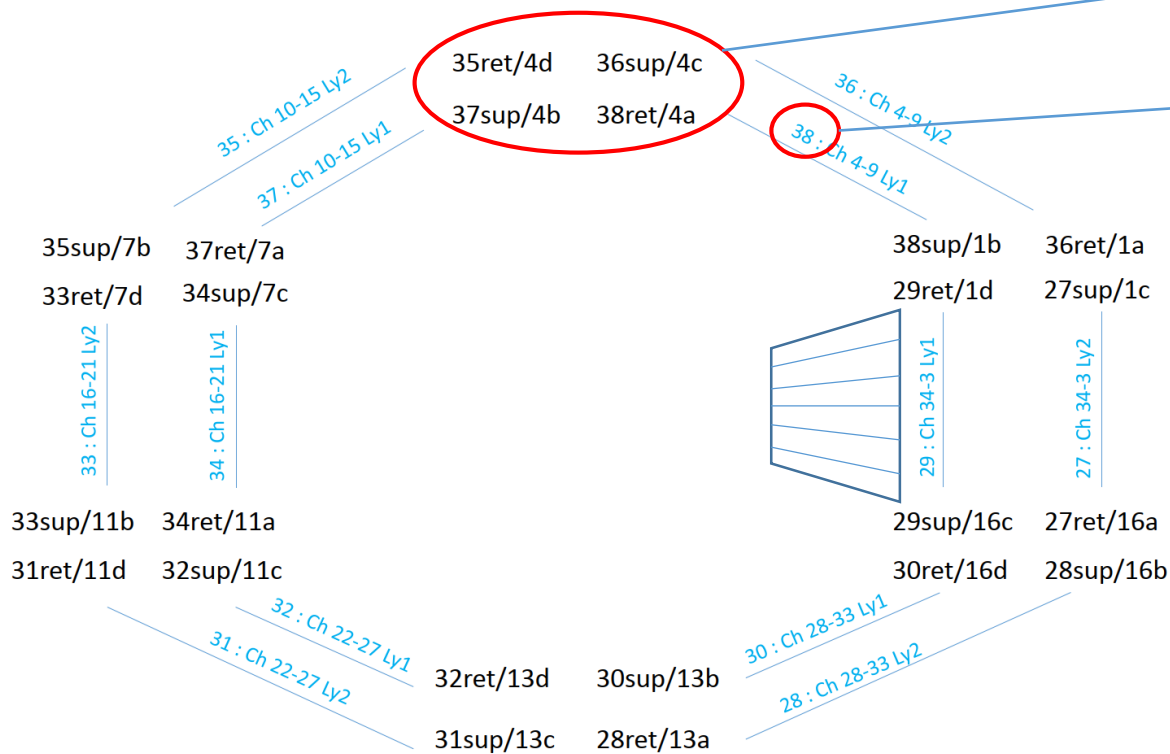
I. Mihaylov

- Final gas leak tests (UXC racks to center) were performed by ZEC

GE-1/1 commissioning

- GE-1/1 gas system commissioning:
- All labels checked and all 12 lines correctly associated:

GE-1/1 gas system labels map



Old RPC labels

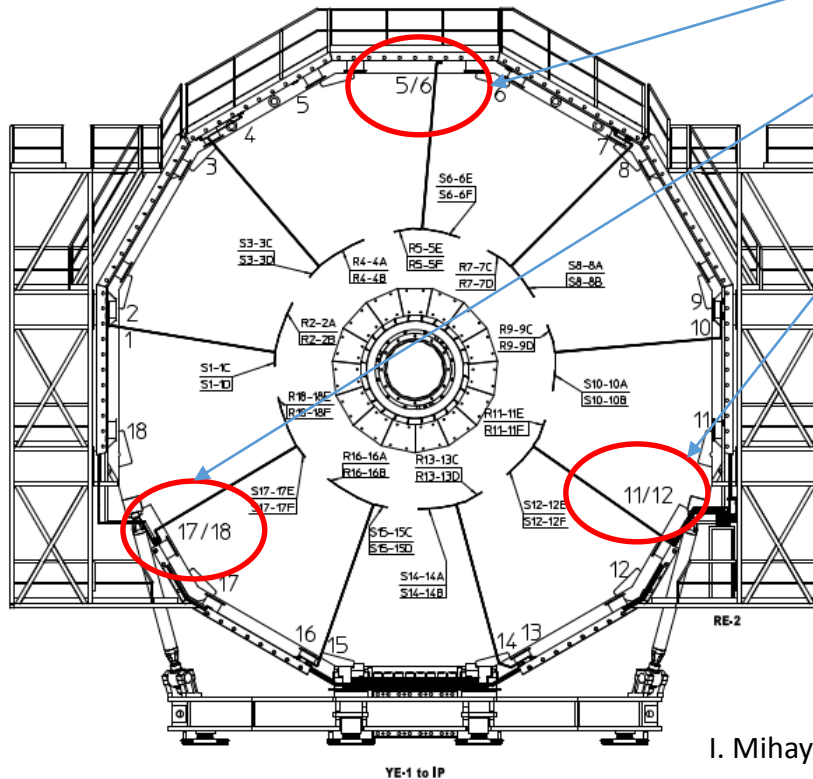
Numbering of the line:
from 27 to 38

Ly1 : bottom layer
Ly2 : upper layer

One line feeds **6**
consecutive single
chambers

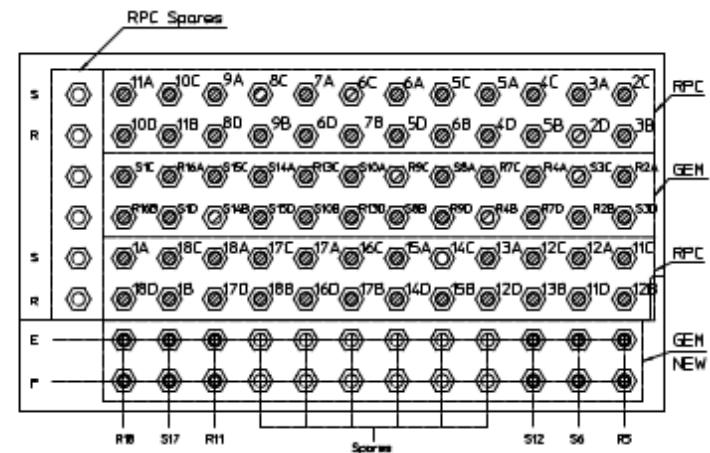
GE-2/1 installation

- GE-2/1 gas pipes installation:
- 12 lines re-used again from old RPC lines, need to add 6 new lines between the X2 distribution racks and the center



I. Mihaylov

Top view of X2 distribution rack in UXC, that also shows the additional new lines (on bottom) :



GE-2/1 installation

- ZEC team installed the new GE-2/1 gas pipes:

Work on the X2 far side gas racks:



Installation of the new GE-2/1 lines:



All 18 GE-2/1 lines were tested by ZEC (standard procedure : 1 bar for 1 hour).

GE+1/1 installation

- GE+1/1 installation :
- On positive side GE+1/1, only **two lines between distribution racks and center** that were used previously by RPC have to be replaced; 10 other existing lines will be directly re-used. The installation is scheduled in March 2020 (see below)
- Additional **3D model/drawings** for positive side for these 2 new lines, as well as check of the 3D models for already existing lines, will be performed by Ivan Mihaylov in Oct/Nov 2019

Muon LS2 Schedule								
ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names	% Complet	Sub System
372	GE+1/1 gas service installation	13 days	Mon 02/03/20	Wed 18/03/20			0%	GEM
373	GE+1/1 gas system installation	10 days	Mon 02/03/20	Fri 13/03/20	313	ZEC	0%	GEM
374	GE+1/1 gas leak test	3 days	Mon 16/03/20	Wed 18/03/20	373	ZEC	0%	GEM
375	GE+1/1 cooling service installation	12 days	Thu 19/03/20	Fri 03/04/20			0%	
376	GE+1/1 cooling installation Manif2PP	3 days	Thu 19/03/20	Mon 23/03/20	374	ZEC	0%	GEM
377	GE+1/1 cooling installation PP2CH	3 days	Tue 24/03/20	Thu 26/03/20	376	ZEC	0%	GEM
378	GE+1/1 3-way-valve installation & cooling leak test	6 days	Fri 27/03/20	Fri 03/04/20	377	ZEC	0%	GEM
379	GE+1/1 chamber installation	4 wks	Mon 06/04/20	Thu 07/05/20	378	Crane+	0%	GEM
380	GE+1/1 cable installation	30 days	Fri 08/05/20	Mon 22/06/20	379	RTech	0%	GEM
381	GE+1/1 commissioning	7 wks	Tue 23/06/20	Mon 10/08/20	380		0%	GEM

GE+2/1 installation

- GE+2/1 installation :
- Same work than for GE-2/1 already performed by ZEC : 6 new lines from distribution racks to center, and finally routing from periphery to detectors. 3D model/drawings to be provided by Ivan Mihaylov in Oct/Nov 2019.
- All material needed (copper material, bulkheads, unions etc.) already defined and ready to be installed. The GE-2/1 installation experience we have helped us a lot.
- In the last muon LS2 schedule, these new lines are scheduled to be routed beginning of 2020 :

306	YE+2 Activities	21 days	Mon 20/01/20	Mon 17/02/20			0%	
307	GE+2/1 service installation	21 days	Mon 20/01/20	Mon 17/02/20			0%	GEM
308	GE+2/1 gas system installation	18 days	Mon 20/01/20	Wed 12/02/20	305	ZEC	0%	GEM
309	GE+2/1 gas leak test	3 days	Thu 13/02/20	Mon 17/02/20	308	ZEC	0%	GEM

Summary

- **Summary of GEM gas system readiness:**
- **Gas system hardware** in overall already installed, only minor part remaining to be done on positive endcap (6 new lines for GE+2/1 and 2 lines to be replaced for GE+1/1)
- The whole system, ie. mixer, pumps and distribution system **was already shortly put in use and commissioned** by the ags group. We made circulate the expected 18 L/h per line in the 12 lines of GE-1/1 after installing some bypasses at the detector level.
- **GCS part** is already up and running for monitoring.

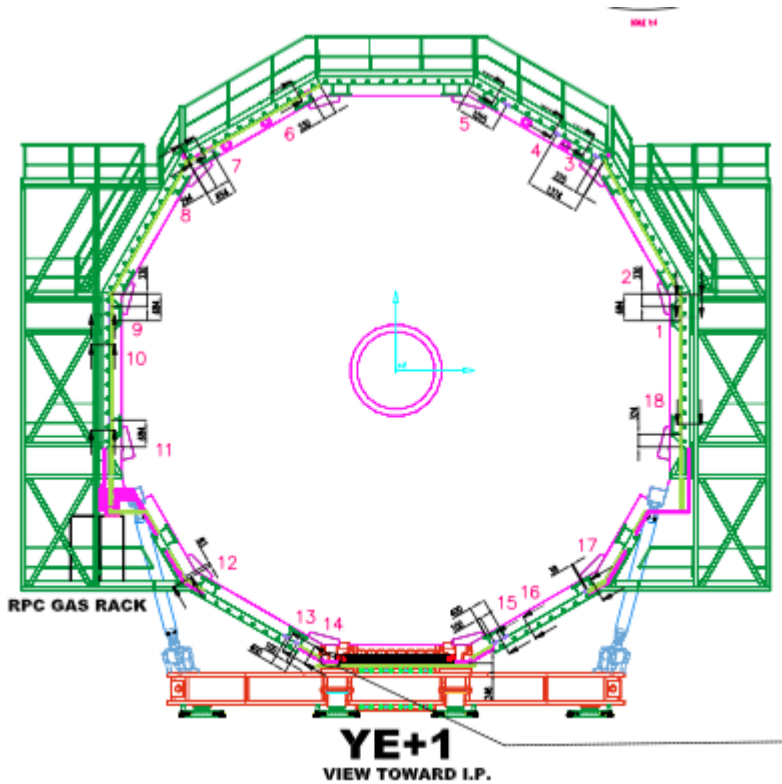
Backup

GE2/1 installation

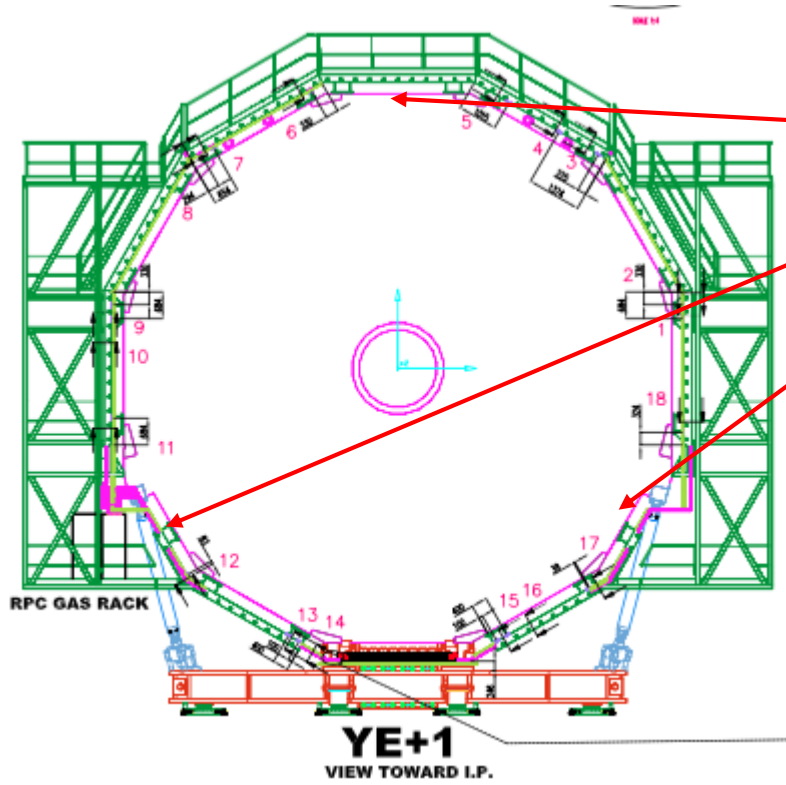
GE2/1 :

Pipes already connected for GEM (type SS-8M0-61):

- S1 : 1C, 1D
- S2 : 2A, 2B
- S3 : 3D, 3C
- S4 : 4B, 4A
- S5, S6 : none (see next slide)
- S7 : 7D, 7C
- S8 : 8B, 8A
- S9 : 9D, 9C
- S10 : 10B, 10A
- S11/S12 : none (see next slide)
- S13 : 13D, 13C
- S14 : 14B, 14A
- S15 : 15D, 15C
- S16 : 16B, 16A
- S17/S18 : none (see next slide)



GE2/1 installation



GE2/1 :

Sectors only occupied by RPC :

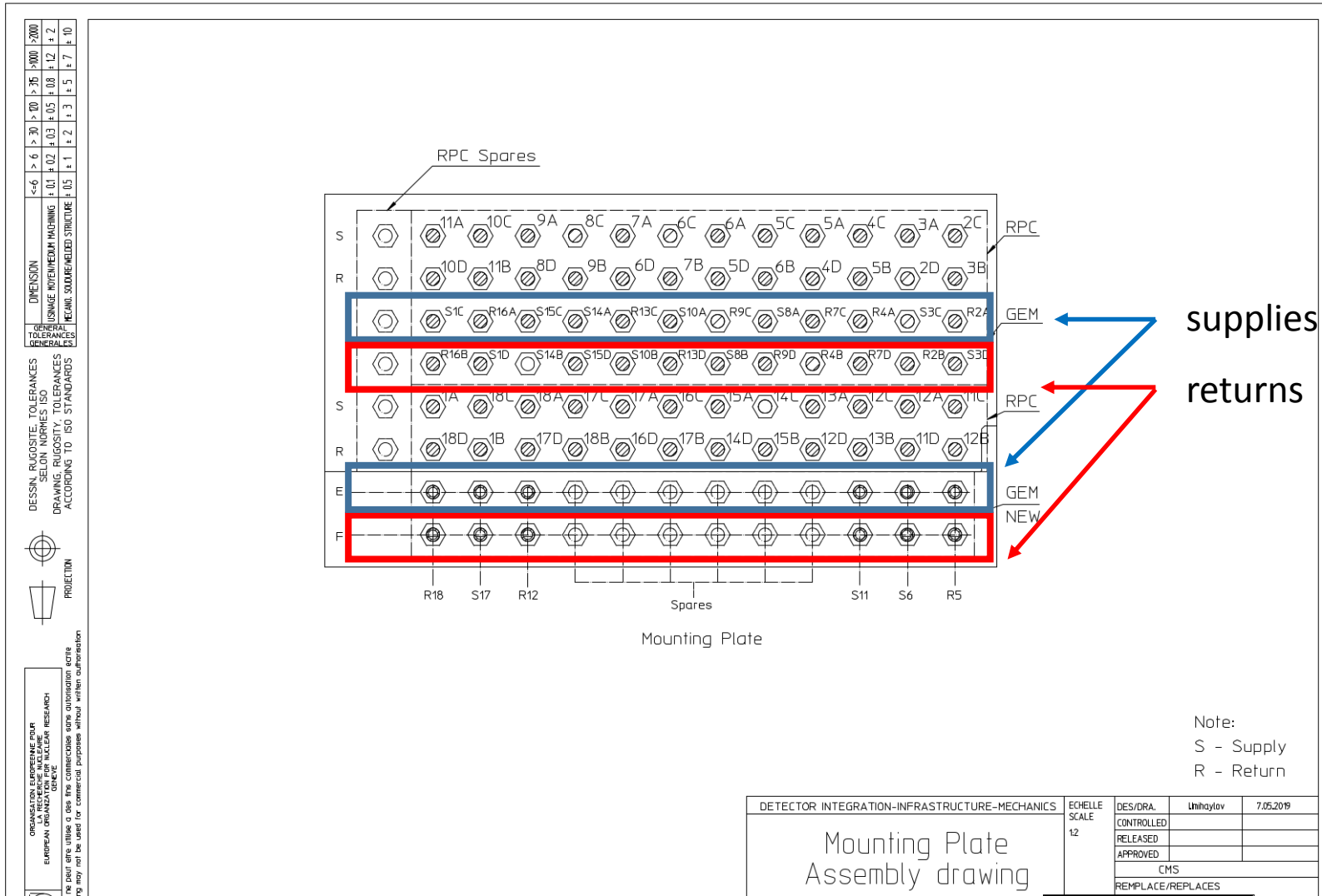
- S5/S6
- S11/12
- S17/18

Proposal : add three new patch panels between them (see “red arrows”) to get a uniform distribution.

One patch panel is an assembly of 2 new lines (ie. two inputs and two outputs). In total: 6 new lines (ie. 12 pipes).

GE2/1 installation

X2 distribution rack top plate modification :



GE2/1 installation

- Summary of association **lines** wrt Super Chambers (or sectors), for both Ly1 (bottom layer) or Ly2 (top layer) :
 - Line 1 : S2-S3 Ly1
 - Line 2 : S2-S3 Ly2
 - Line 3 : S4-S5 Ly1
 - Line 4 : S4-S5 Ly2
 - Line 5 : S6-S7 Ly1
 - Line 6 : S6-S7 Ly2
 - Line 7 : S8-S9 Ly1
 - Line 8 : S8-S9 Ly2
 - Line 9 : S10-S11 Ly1
 - Line 10 : S10-S11 Ly2
 - Line 11 : S12-S13 Ly1
 - Line 12 : S12-S13 Ly2
 - Line 13 : S14-S15 Ly1
 - Line 14 : S14-S15 Ly2
 - Line 15 : S16-S17 Ly1
 - Line 16 : S16-S17 Ly2
 - Line 17 : S18-S1 Ly1
 - Line 18 : S18-S1 Ly2

GEM gas infrastructure

Overview of the GEM gas system:

