

TOTEM Gas System

Introduction

The TOTEM experiment will need 2 gas systems, one for the CSC and one for the GEM detectors.

The gas systems consist of the following modules:

- 2 Mixer Modules one with 2 and one with 3 gases (staged until second year of operation)
- 4 (2 per endcap) UX distribution modules, that are accommodated in one rack / endcap.

Table 1 Parameters for the GEM and CSC gas systems

	GEM's	CSC
Gas:	Ar/CO ₂ 70/30	Ar/CO ₂ (CF ₄ optional) 50/50
Total volume:	~40 litres	400 litres
Total flow:	50-100 l/h	70-200 l/h
Chamber pressure	1 mbar	1 to 3 mbar
Max. overpressure	< 10 mbar	< 20 mbar
No. of Channels	10 channels/endcap	10 channels per endcap
No. of Chambers	20	30
No. of Distribution Racks	1 per endcap	

Gas Building

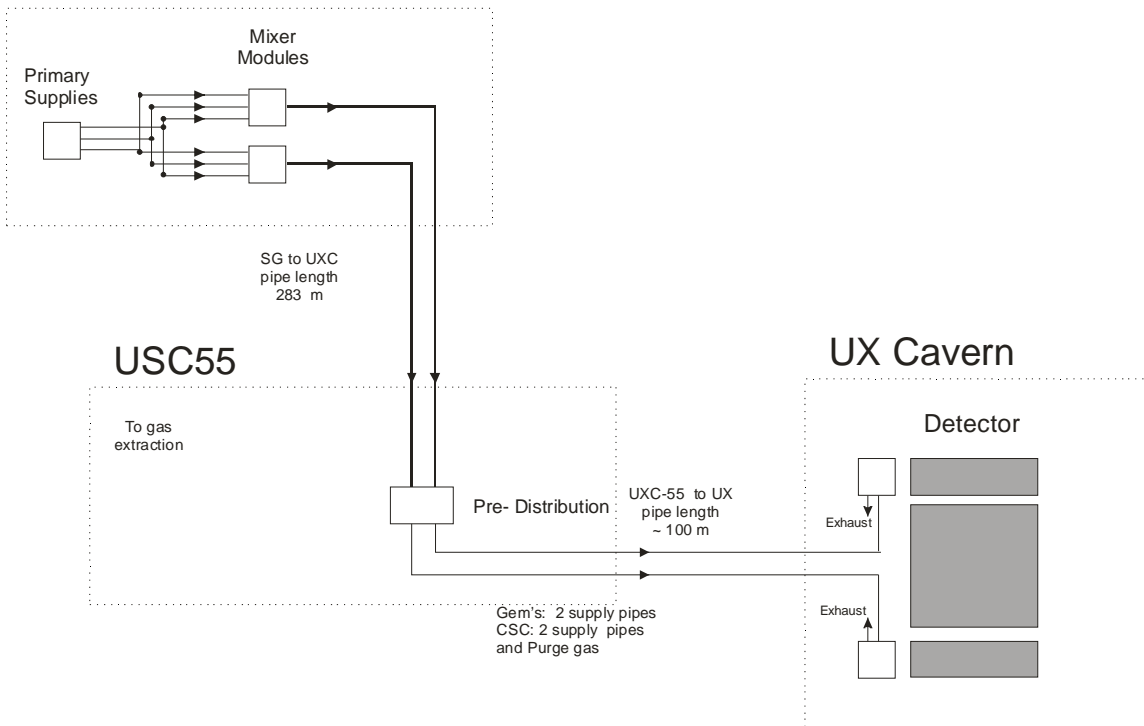


Figure 1 Schematic overview of the gas system.

Mixer

The Mixer for the GEM and CSC gas systems are both standard two and three gas mixers. In the first year of operation both systems will use pre-mixed gases.

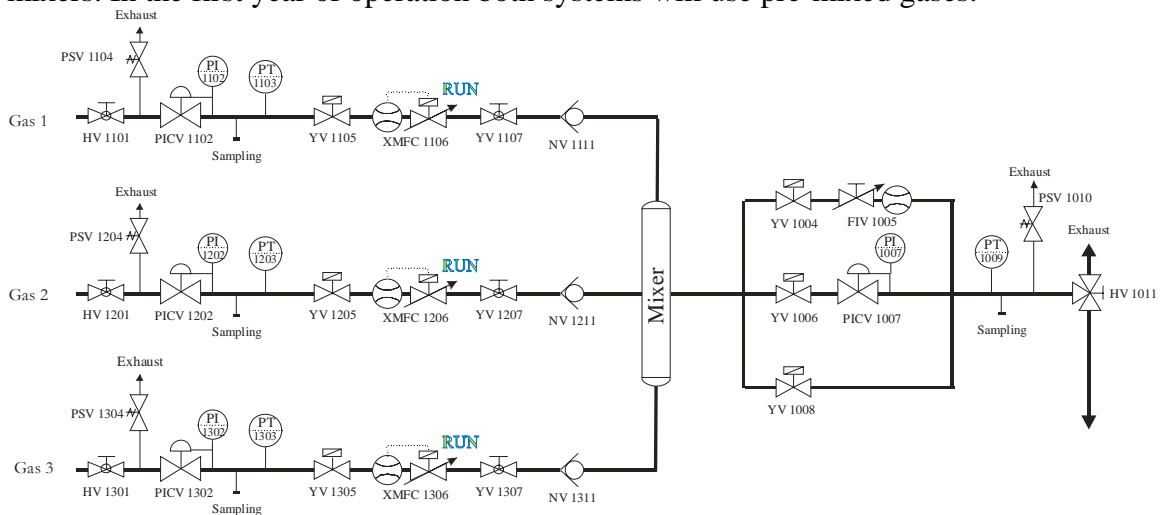


Figure 2 Mixer module component layout.

Distribution

The UX distribution modules need to be installed closed to the detector on each endcap. The equipment for both sub-detectors (GEM and CSC) will be installed in one rack (size 60x60x180cm) per endcap. On request of the detector groups both systems will have no passive pressure protection (bubbler) at the inlet.

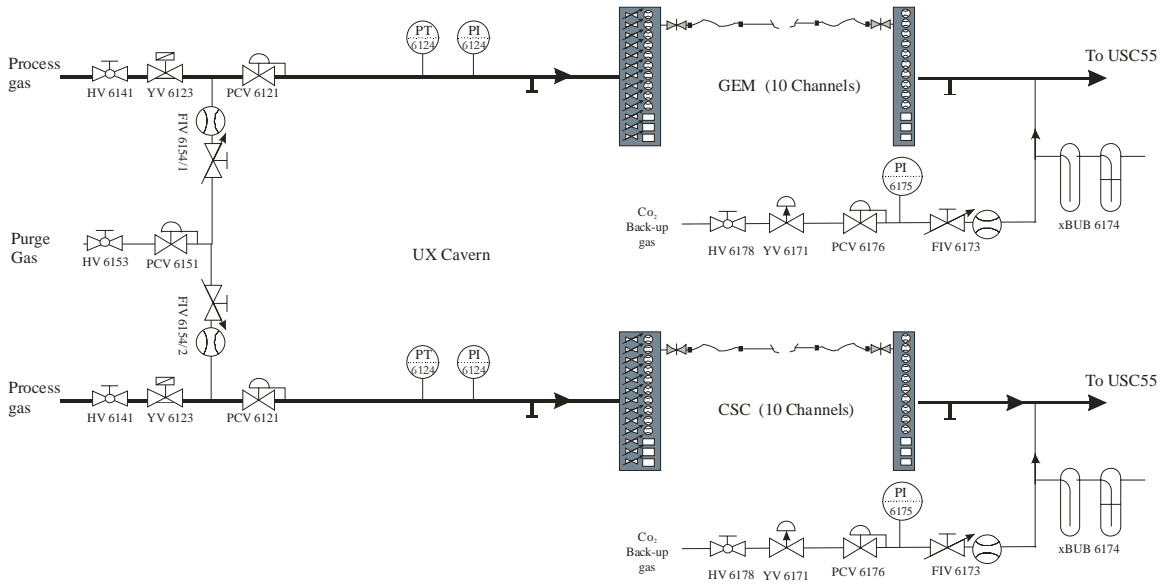


Figure 3 One distribution rack for CSC and GEM chambers from one endcap.

Pipework:

Pipe Section		No. of Pipes	Diameter [mm]	Comments	Material
Vertical connection	SG to UXC	2 (supply)	10/12 mm	One pipe is heated until entrance of shaft	Stainless steel 304 or 316
Pre-Distribution to Distribution	USC to UXC	4 supply 4 return	10/12 mm for supply 10/12 mm for return	Each rack has 2 supply and 2 return <i>(only the supply will be used in the beginning)</i>	Stainless steel 304 or 316
Back-up and Flushing Gas (CO2)	Must be available in the vicinity of the racks in the UX	1 supply	10/12 mm Or smaller	connected to both Dis. Racks in UX	Stainless steel 304 or 316
Analysis	UXC / UX	4 analysis return	4/6 mm	These pipes are not used for the moment	Stainless steel 304 or 316
Distribution Lines (GEM)	Rack UX to Chambers	20 (10 supply + 10 return)	Supply 4/6 mm Return 10/12 mm		Stainless Steel 316
Distribution Lines (CSC)	Rack UX to Chambers	20 (10 supply + 10 return)	Supply 4/6 mm Return 10/12 mm		To be defined
Compressed Air	USC to UX	8 supply lines	4/6 mm	4 / Dis. Rack	Plastic

Cost Estimate

Table 2 Preliminary cost estimates for the CSC and GEM gas system.

	GEM	CSC
Gas Supply (special items only)	-	-
Mixer	17'000	19'000
Pump	-	-
Purifier	-	-
Gas Analysis	-	-
Distribution	22'000	22'000
Aux. Purge	included in UX-Distribution	included in UX-Distribution
Piping SG-USA	not costed	not costed
Piping USA-UXA	not costed	not costed
Detector Piping	not costed	not costed
Electrical Control	40,000	40,000
Total	SFr. 79'000	SFr. 81'000
Manpower (Racks)	24,000	24,000
Grand Total	SFr. 103'000	SFr. 105'000

The cost estimate in Table 2 assumes that all modules are constructed in conjunction with similar modules for other detectors.

The cost for the control system assumes that there are independent control units with separate PLC's.