

# Refurbishment of CLS system for mini- ICAL detector

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## Introduction

- RPC, the active element in the INO experiments, is a gaseous detector.
- Mode of operation is determined by the mixture of gas flowing through the RPCs.
- Avalanche mode: R134a+Isobutane+SF<sub>6</sub>
- Streamer mode: R134a+Argon+Isobutane
- Gas system is required to circulate proper gas mixture in the detectors.

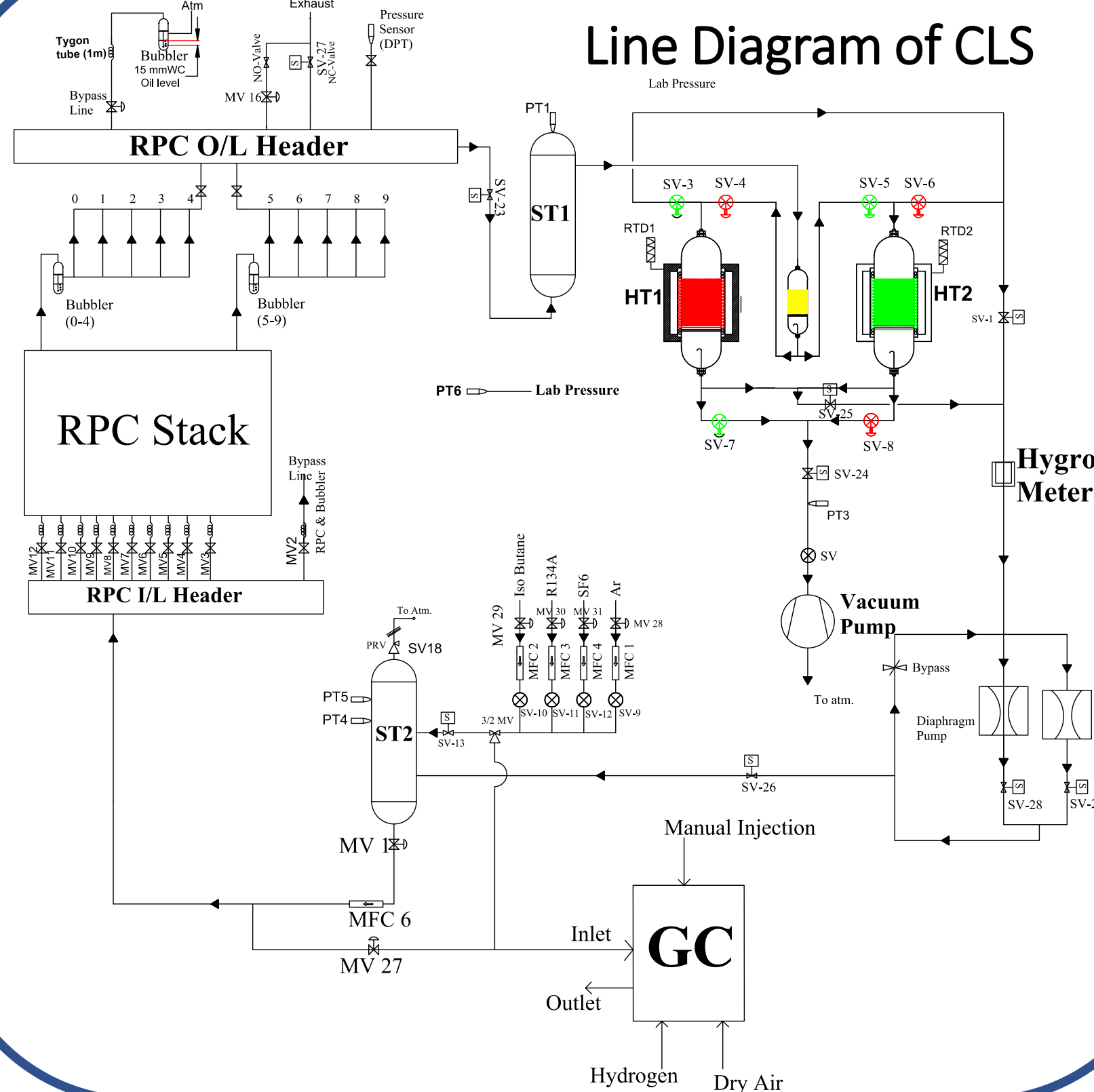
## System at Glance

Parameters	mini- ICAL
Size	4 m x 4 m
No of Layers	10
No of RPCs Per Layer	2
Total No. of RPCs	20
Size of gas gap in the RPC	184.5*174*0.2 cm <sup>3</sup>
Gas Volume of Each RPC	6.42 Litres
Total Gas Volume	128.4 Litres
Mode of RPC Operation	Avalanche
Required gases	R134a (95.2%)
	Iso-Butane (4.5%)
	SF <sub>6</sub> (0.3%)

## Gas system

- There are 3 types of gas systems
- Open ended gas system: No reuse of the output gas mixture from the detector
- Open loop gas system: collect the output gas mixture from the detector and segregate the gases and reuse in the system
- Closed loop gas system: Collect the output gas mixture from the detector, purify it and recirculate it.
- We have an open ended system and a Closed loop gas system operational at mini-ICAL.

## Line Diagram of CLS



## Important components



Operations in the Closed loop gas system installed at IICHEP, Madurai

- Open End
- Closed Loop
- Refilling
- Vacuum
- Regeneration of molecular Sieves
- Manual ON-OFF

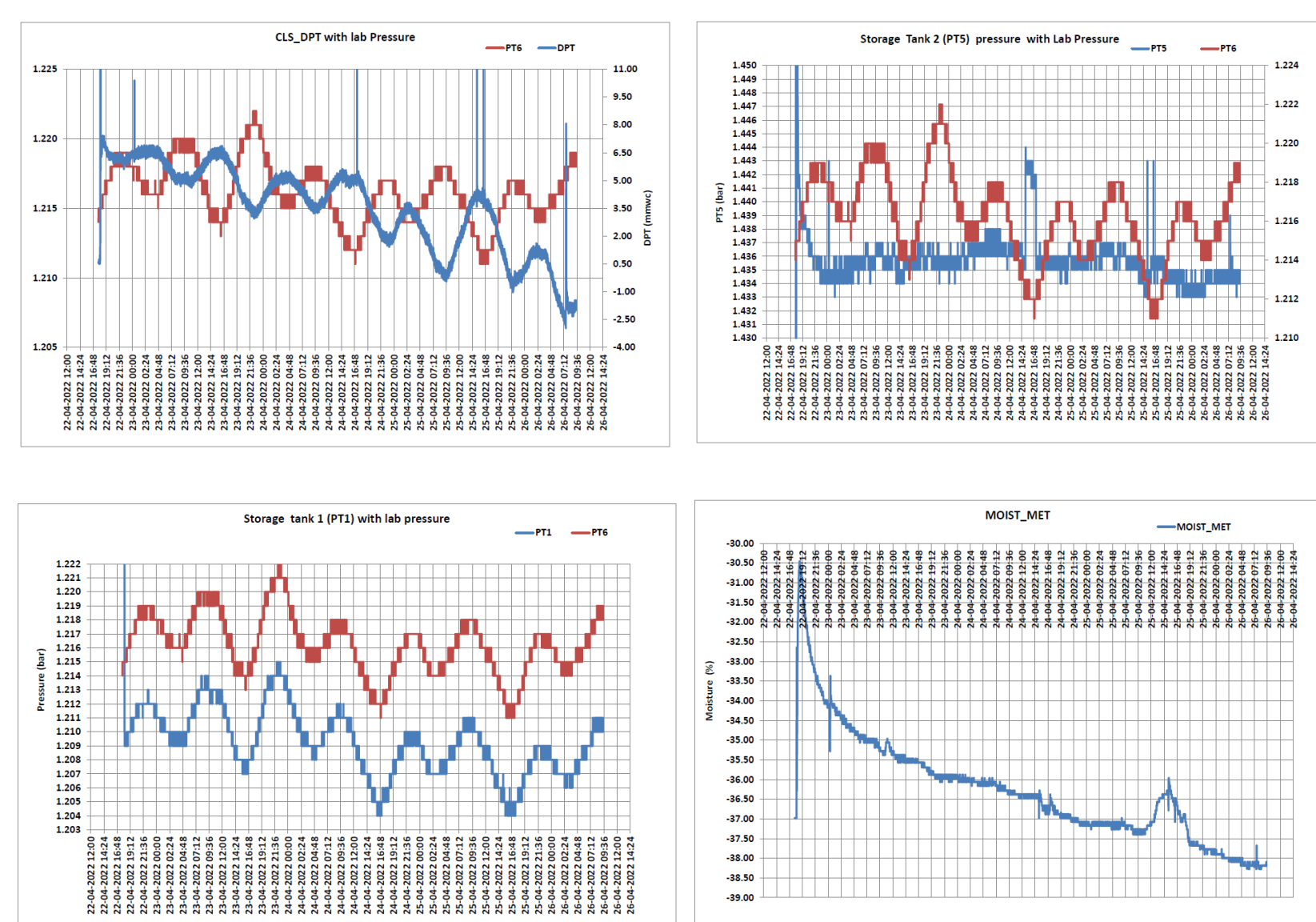
## Problem faced

- Presence of air detected
- More number of top-up cycles
- Rise in the current in the RPCs

## Diagnosis Tools



## CLS Parameters performance



## Current Status

- Intensive leak arrest tasks completed.
- Operational, fine tuning is going on.
- Initial results show gas mixture top-up happens after 3.5 days.

## Future plan

- Replacement of faulty pneumatically operated valves
- Implementation of capillaries of short length for all RPCs
- Improve the operation and control scheme for the e-ICAL, based on experience at mini-ICAL

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