nBLM Gas system characteristics and first design

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OUTLOOK

- Gas system
  - General design
  - Characteristics
- P&IDs diagrams
- Installation

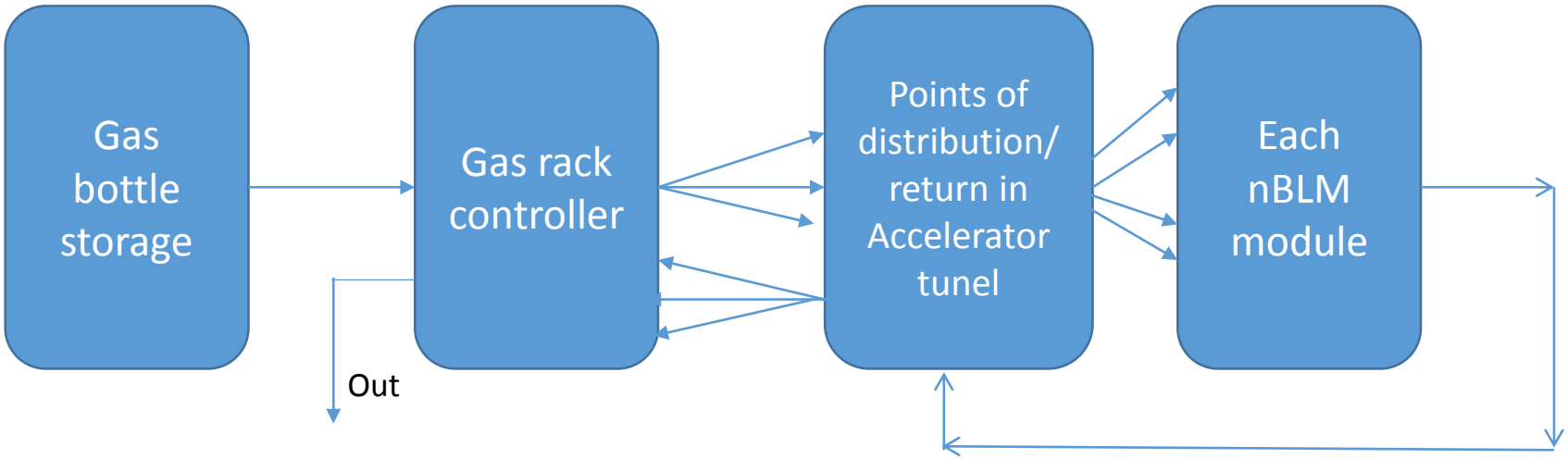
General characteristics & design

- Micromegas operates in gas
- nBLM system will work in recirculation mode
  - Fix flow rate during operation
- The main requirement of the system is to present a high reliability while keeping the operability of the 42 modules stable
- We start from the premise of a simple concept but redundant and with control command with PLC

General characteristics & design

General design

- The gas system consists in 4 parts:
  1. The bottle storage area outside the building
  2. The gas rack where we have the control command
     - From gas bottles to gas rack: 1(+1) IN / 1(+1) out lines
  3. The distribution and return lines from (to) the rack to (from) the accelerator tunnel
     - 8 distribution + 8 return lines
     - In tunnel distribute the lines in points of interest (can use patch panels) and from there to the detectors
  4. The detectors localization where the lines will connect to each module

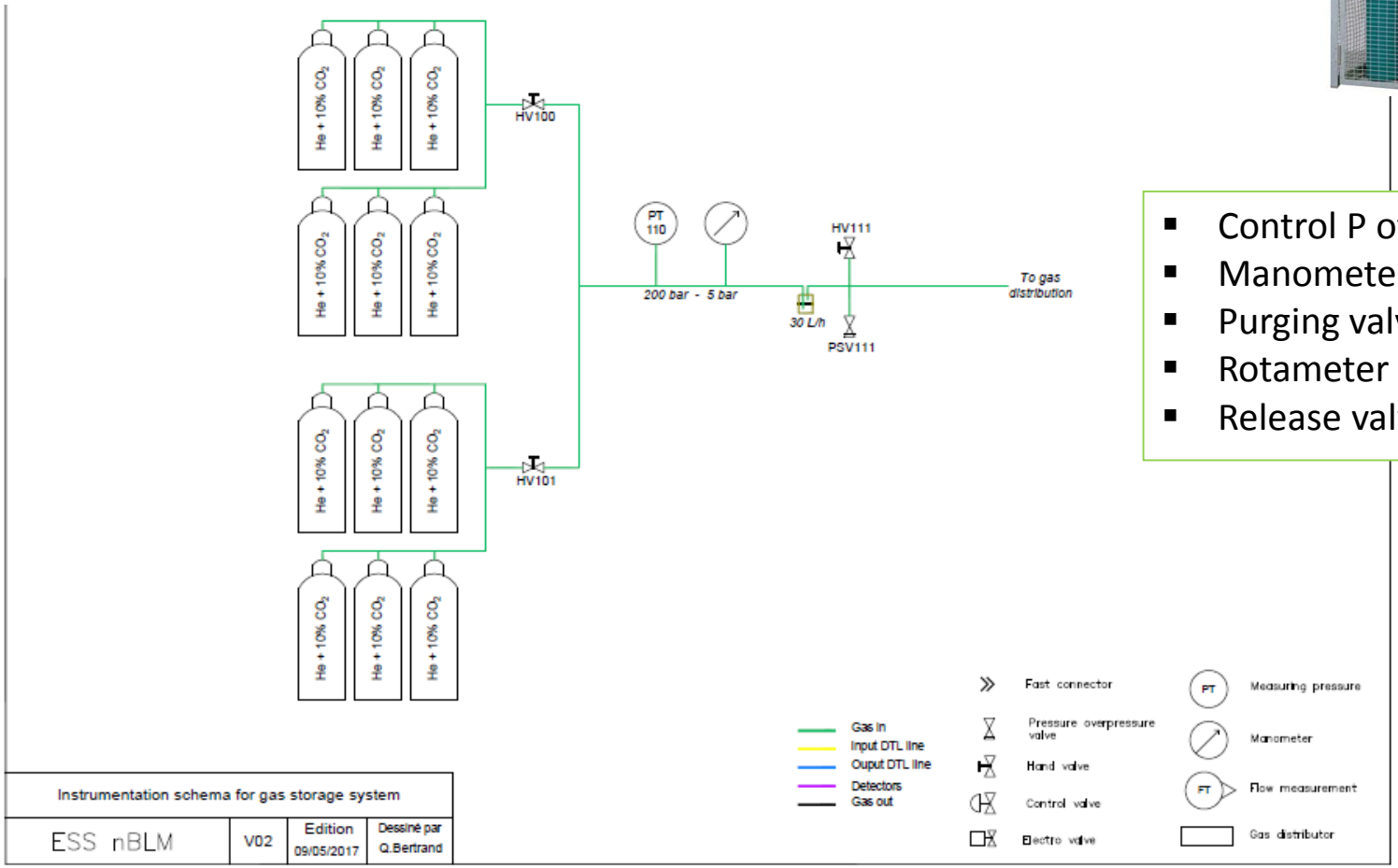


General characteristics & Requirements

Gas type	He + 10% CO_2	Used of premixed bottles (200bar)
Total flow	8 - 16 l/h (feeding/exhaust lines)	Limitation of possible maximum flow immediately after gas bottle at ~20-30 l/h with a rotameter (0-50 l/h)
Flow per line	1-2 l/h (distribution/return lines)	Detectors in series
Pressure after bottle	2 bar total	Release valve at ~4 bar
Pressure for distribution	1atm + 200 mbar (tbc)	Depends on final pipe cable length
Pressure at exhaust	1atm + 50 mbar	Pressure and flow will be controlled by PLC.
Tubes	- 6/8 mm (inner/outer) for the IN/OUT and distribution lines - 4/6 mm for the connection to each detector	• Preference stainless steel • If copper, use clean copper • Can be flexible stainless steel hose in some points • Connection to detector could be made by polyethylene tubes to avoid parasitic electrical noise (tbd)

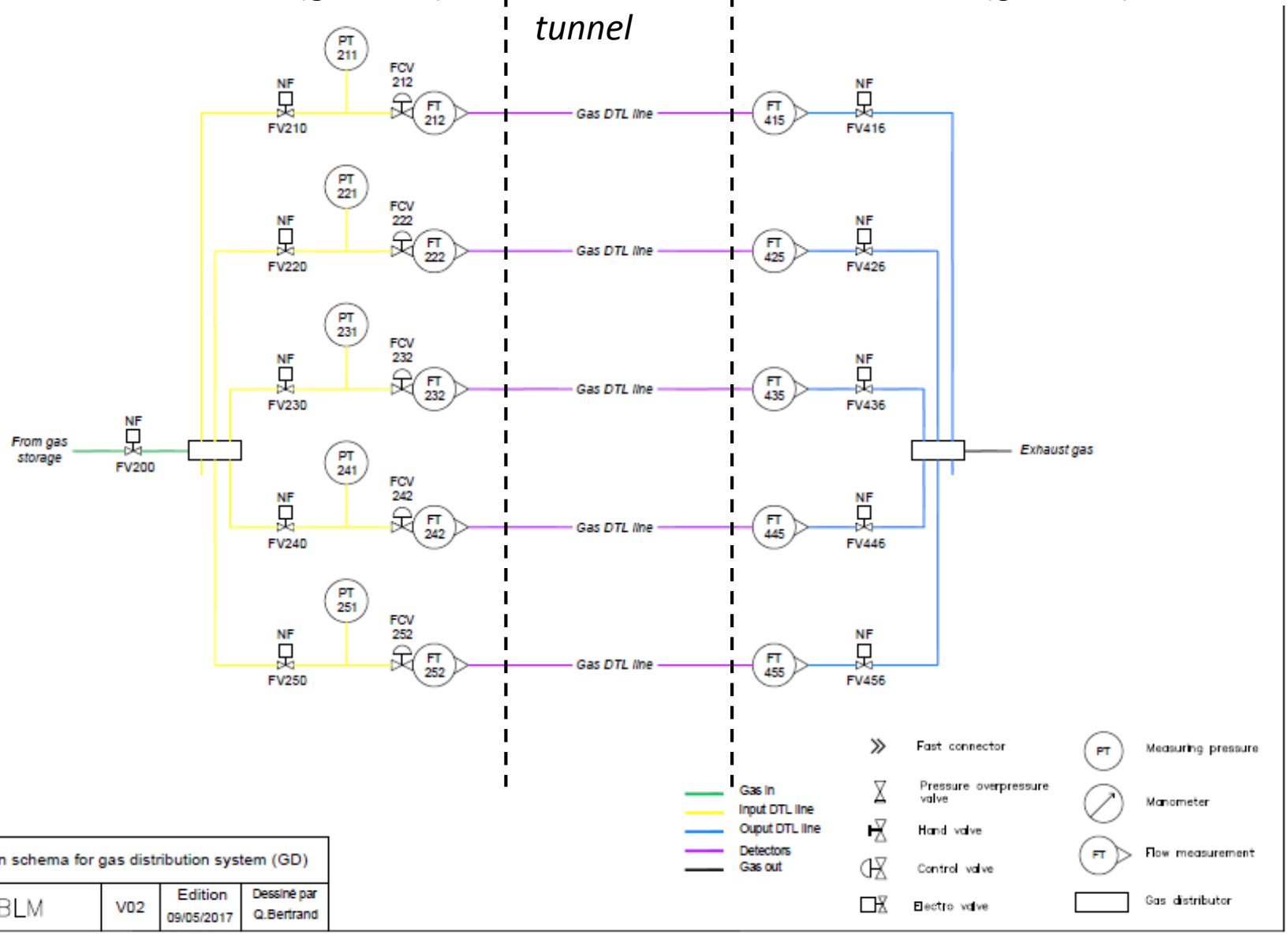
Bottle storage area

- Premix He + 10% CO_2
- B-50 bottles (50 litters) of 200 bar
- Operating at 1 bar, 6 bottles last 250 days
  - Purity for each gas N5.0 (99.9990 %)



- Control P of bottles
- Manometer to adjust to 2 bar
- Purging valve
- Rotameter (at 30l/h)
- Release valve (at 7bar)

Gas Distribution System



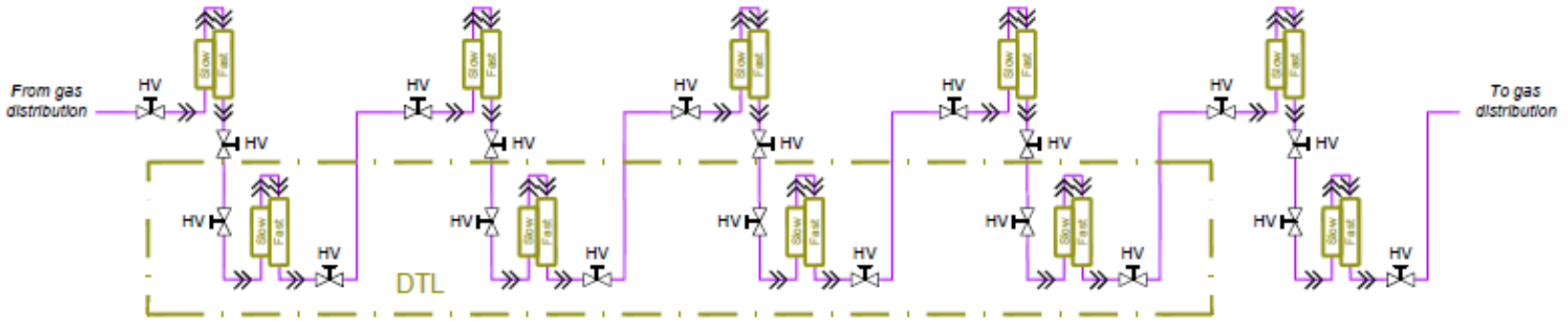
Instrumentation schema for gas distribution system (GD)			
ESS nBLM	V02	Edition 09/05/2017	Dessiné par Q.Bertrand

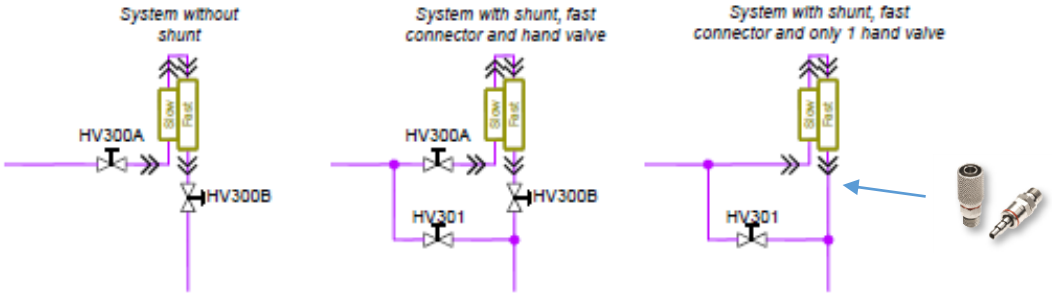
Gas Distribution System

- Gas flows in parallel for the lines
- All components controlled by software accessible in service gallery
- At entrance and exit of each distribution/return line
  - Electrovalve
  - Pressure meter
  - Flowmeter

Gas line system for group of detectors

Gas DTL Line system for ESS nBLM (GDTL)





Gas In
Input DTL line
Ouput DTL line
Detectors
Gas out

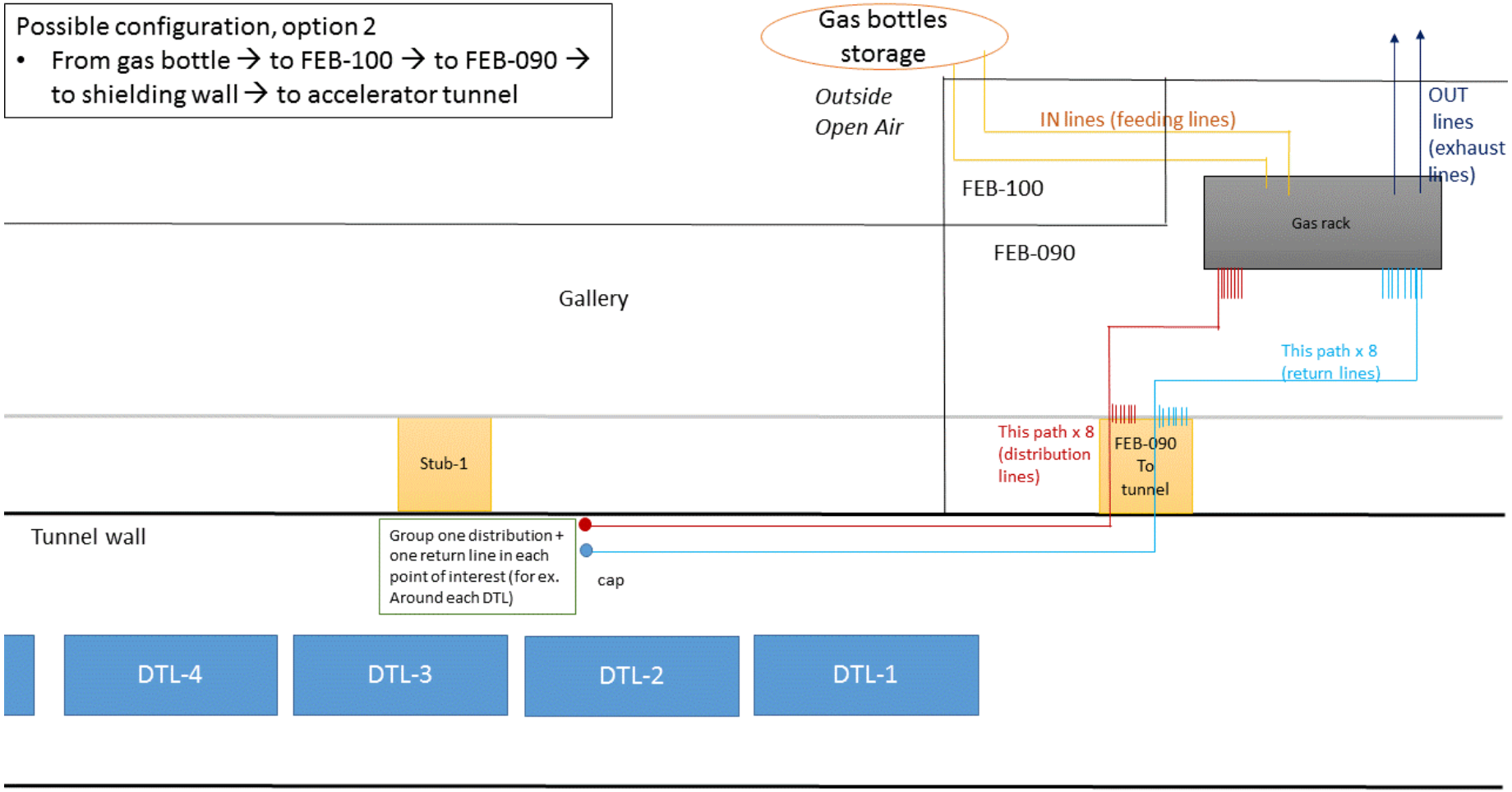
Fast connector
Pressure overpressure valve
Hand valve
Control valve
Electro valve

PT Measuring pressure
Manometer
FT Flow measurement
Gas distributor

Instrumentation schema for gas DTL line system (GDTL)			
ESS nBLM	V02	Edition 09/05/2017	Dessiné par Q.Bertrand

Installation

Possible configuration, option 2
- From gas bottle → to FEB-100 → to FEB-090 → to shielding wall → to accelerator tunnel



- Long tubes from bottles to rack place and from there to accelerator tunnel through room FEB-090.
- Distribute them to each point where a group of detectors will be installed.
- Patch panels in tunnel? And in gallery?

Conclusions and questions

- Gas system design and characteristics stablished
  - ✓ Approved the use of $He+CO_2$
    - Discuss if we can use premix bottles
  - ✓ Obtained preliminary answer allowing the release of the gas into the atmosphere

- Second version of P&ID presented
  - Expected v.3 by end of year based on
    - Position of detectors and how many per area
    - For the final routing of the system to each group of detectors we need to fix the positions
    - Final connection to detector by polyethylene tubes?
    - Use fast closing valve or extra tube with hand valve for detector connections

- Advances in installation
  - Going through FEB-090 avoids bending of tubes in stubs
  - Need to clarify how we install the long pipes

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Thank you

BACK-UP

- An intervention in a detector is expected in very few cases and will take place when the accelerator is OFF.
- There are two possible scenarios:
  - one is when there is a leak in the line, determined by the drop in flow between the entrance and exit of the distribution line. This can only be studied with the accelerator OFF and in-situ.
  - Another possible cause of intervention will be instability in one detector (high sparks rates or impossibility to reach the operational gains due to sparks).
    - In this case we can switch off the voltages of this detector and not having it integrated in the system until a replacement can take place. For this reason we think it is interesting to have always 2 detectors covering more or less the same region in order to have redundancy.