nBLM gas system status

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nBLM CDR1.1

04/12/2017

OUTLOOK

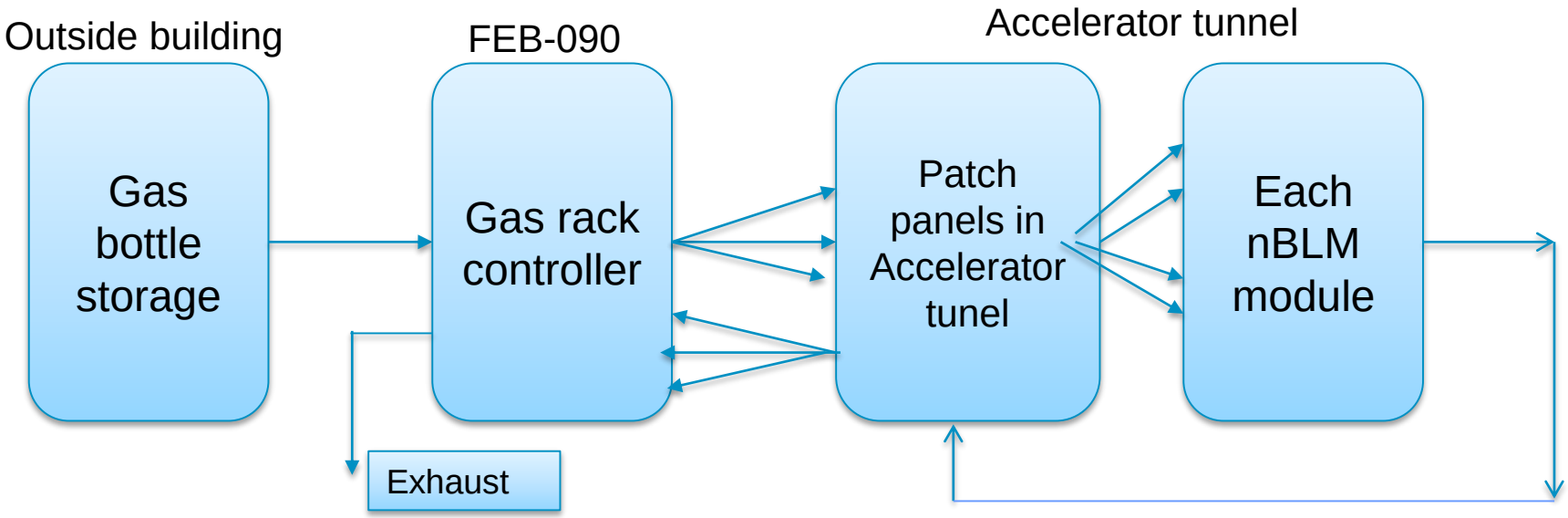
- General overview
- Design status
- Distribution of lines and detectors
- Gain stability and time for stable operation

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 design

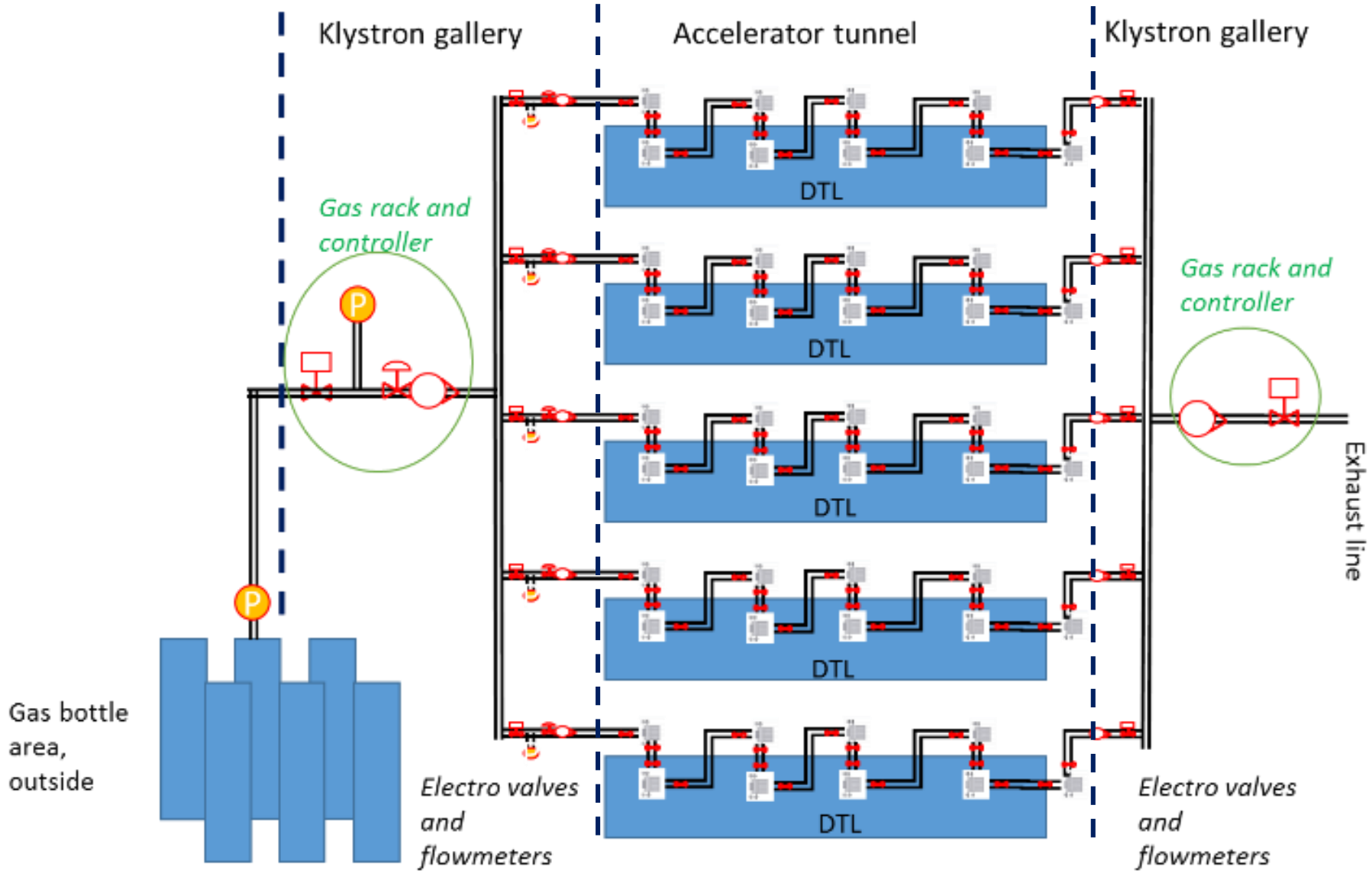
- The gas system consists in 3 parts:
  1. The bottle storage area outside the building
  2. Gas distribution system
     1. Distribution and return lines from (to) the rack to (from) the accelerator tunnel
        - 10 distribution + 10 return lines
  3. Gas Line system for group of detectors



GENERAL CHARACTERISTICS & DESIGN

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	• Stainless steel • Metric connections, Swagelok connectors • Can be flexible stainless steel hose in some points • Connection to detector could be made by polyethylene tubes to avoid parasitic electrical noise

NBLM GENERAL VIEW



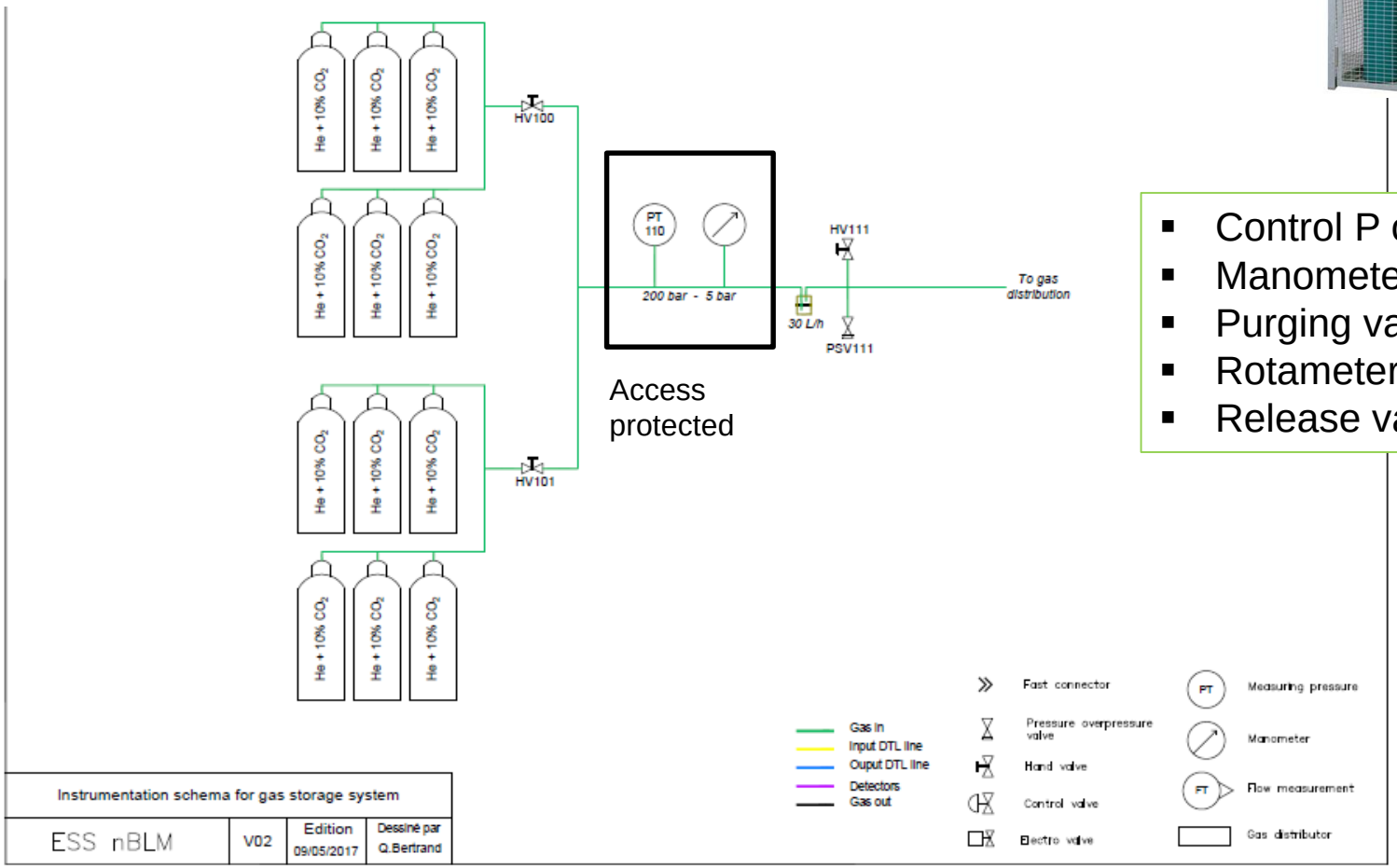
GAS SYSTEM STATUS

Since PDR1.2

- Detailed study to address possible system failure scenario and to minimize commissioning and intervention times
  - *nBLM_subsystemsRiskFailuresAnalysis.pdf* send within this CDR1.1
  - Added possibility for complete manual bypass of PLC and electronic flow controllers
  - Include pumping points
  - Drop in flow will be monitored both through the flowmeters and by monitoring the detector gain and rate
  - Calculation of the remaining gas in the gas bottles storage area is foreseen in EPICs
  - Access to bottle manometer protected
  - *Budget increase*
- Decision in installing 10 lines IN + 10 lines OUT from gas rack to accelerator tunnel (more in next slides)
- Design of part of system finalized in order to fit to the ESS installation schedule,
  - from bottles to gas controller rack
  - And from rack into tunnel at distribution points
- Extra resource was needed (thank you to Fredrik Persson) due to the very tight time constraints
  - P&IDs done, to include in 3D model soon

BOTTLE STORAGE AREA

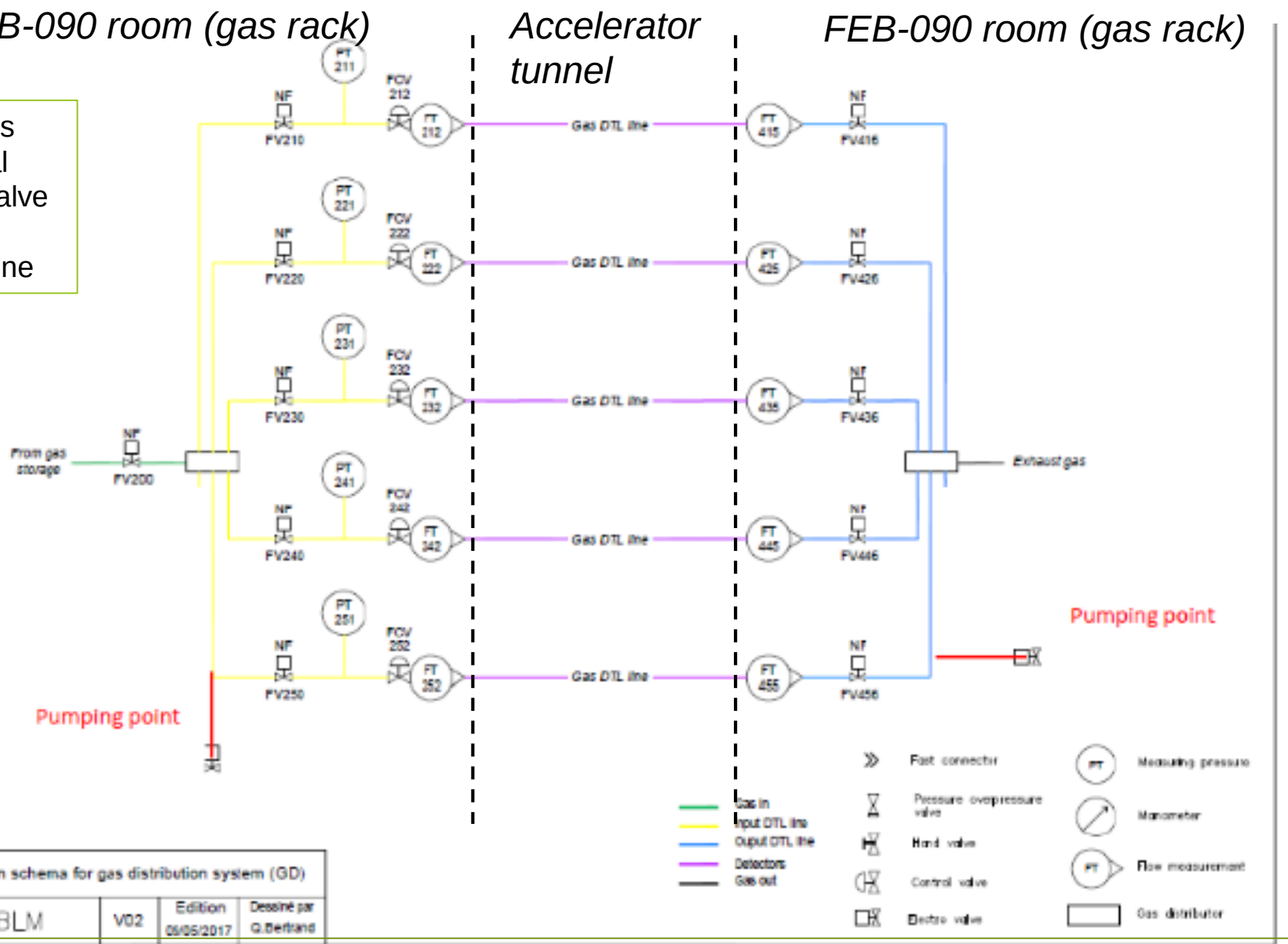
- Premix He + 10% CO_2
- B-50 bottles (50 litters) of 200 bar
- Operating at 1 bar, 6 bottles last 250 days
  - Purity for each gas N5.0 (99.9990 %)



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

GAS DISTRIBUTION SYSTEM

Add by-pass with manual controller/valve for each electronic one



GAS DISTRIBUTION SYSTEM

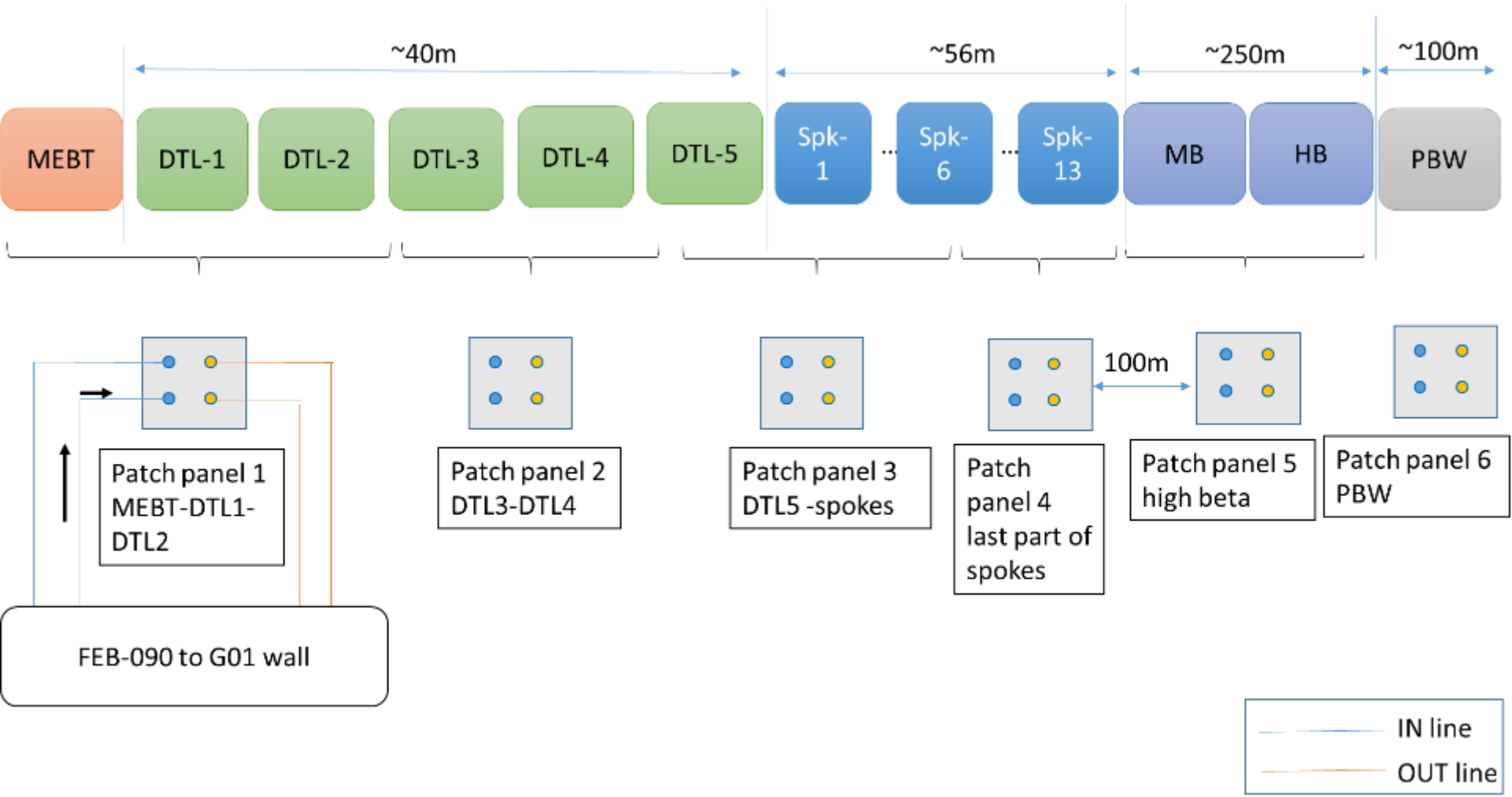
- 10 group of detectors
- 10 Input lines + 10 output lines
- Max. number of detector per line ~12

Patch panels

- 6 patch panels
- All equal, 2 lines per pp.
- But at HE only one connector used
- Positions decided
- Possibility to by-pass one line if leak

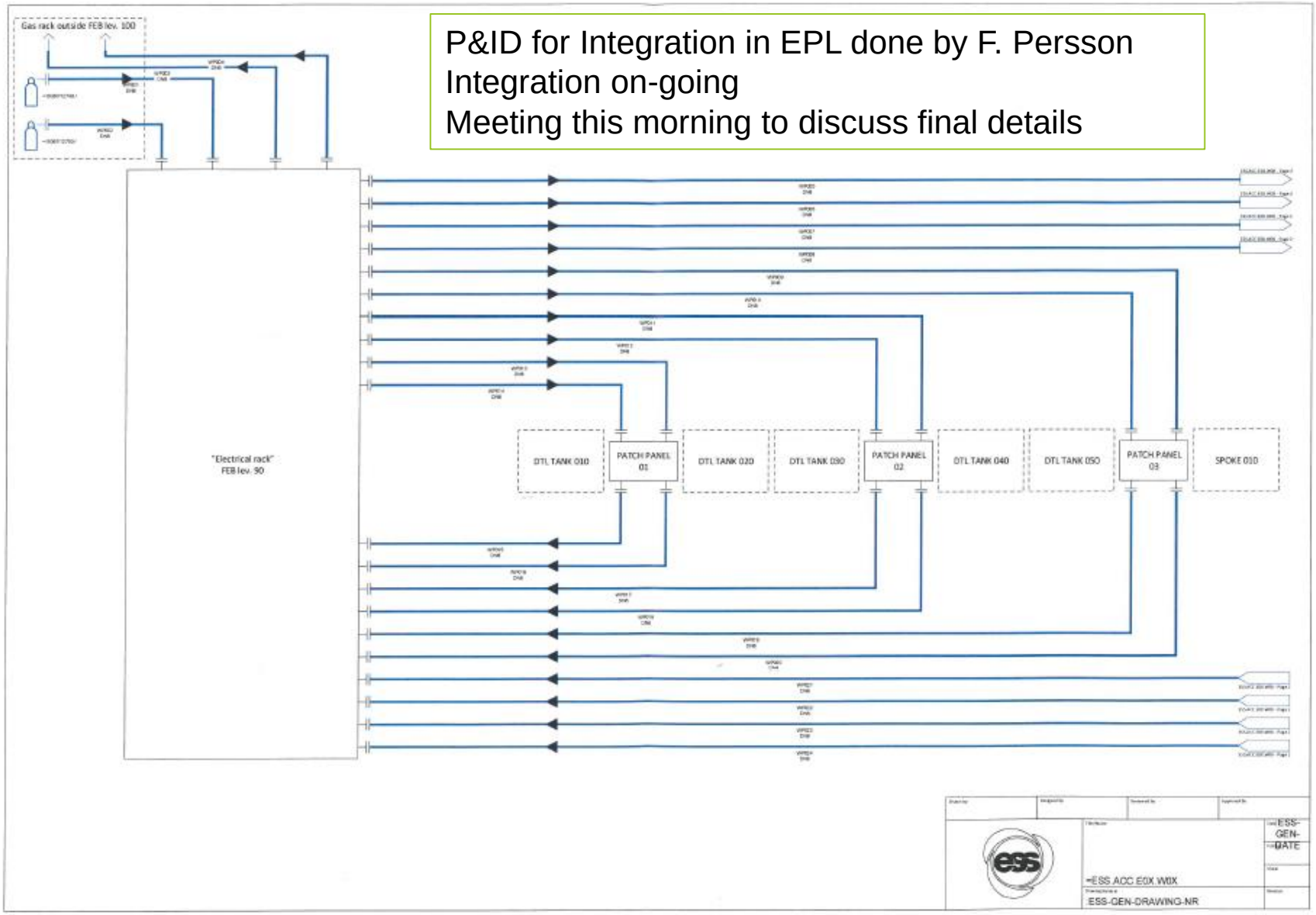
Gas lIne	Patch Panel Number	Position of PP (aprox)	Number of detectors	Detectors in
Line 1	PP-1	end DTL1	12	MEBT-DTL1
Line2			8	DTL2
Line 3	PP-2	end DTL3	8	DTL3
Line4			8	DTL4
Line 5	PP-3	end DTL5	8	DTL5
Line6			8	SPK1-4
Line 7	PP-4	end SPK8	8	SPK5-8
Line8			10	SPK9-13
Line 9	PP-5	beginning of HB region	4	MB-HB
No line			*No line*	*No line*
Line 10	PP-6	PBW	6	Bend Magnet
No line			*No line*	*No line*

DISTRIBUTION OF GAS LINES



GAS DISTRIBUTION SYSTEM

P&ID for Integration in EPL done by F. Persson
Integration on-going
Meeting this morning to discuss final details



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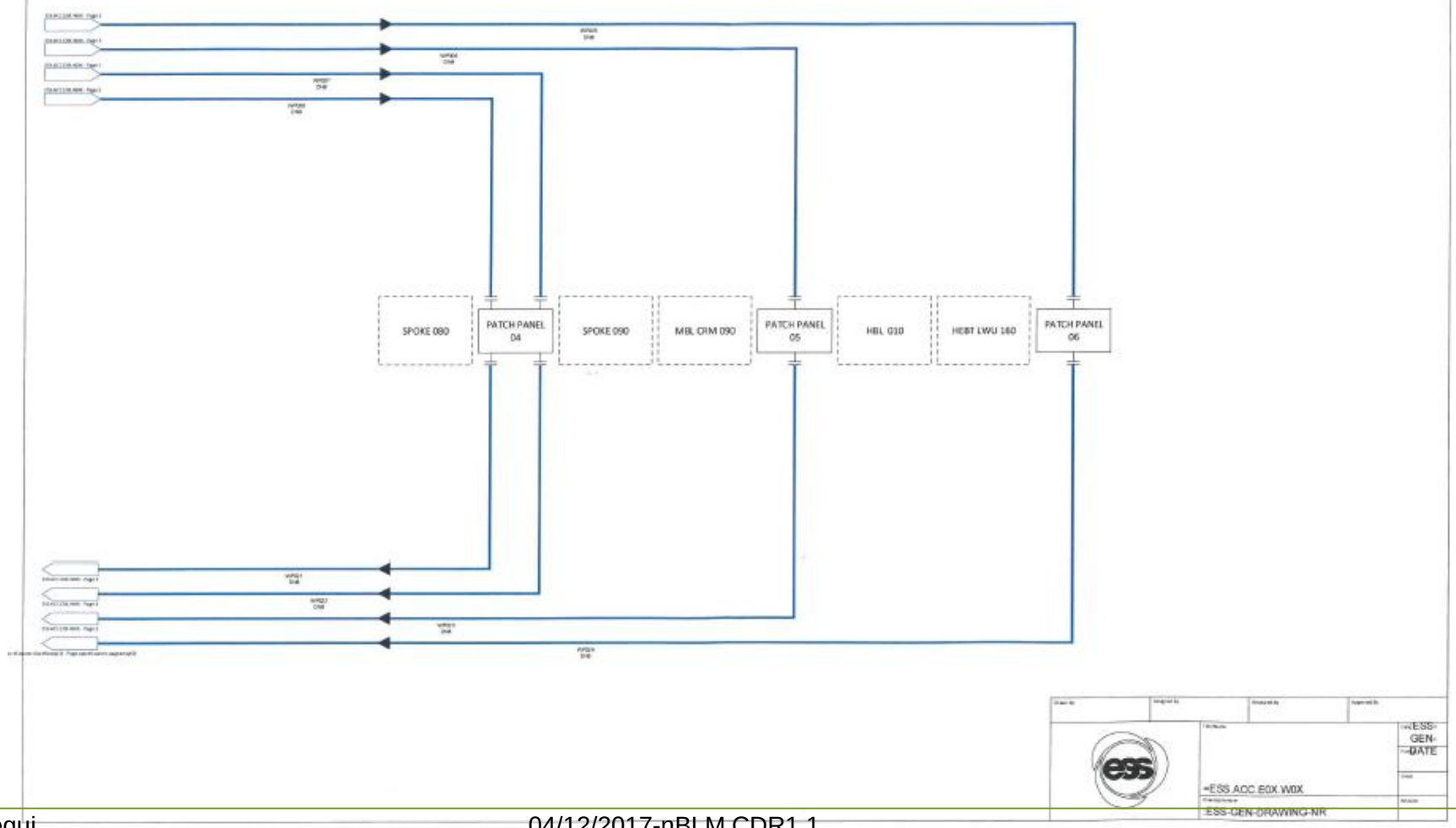
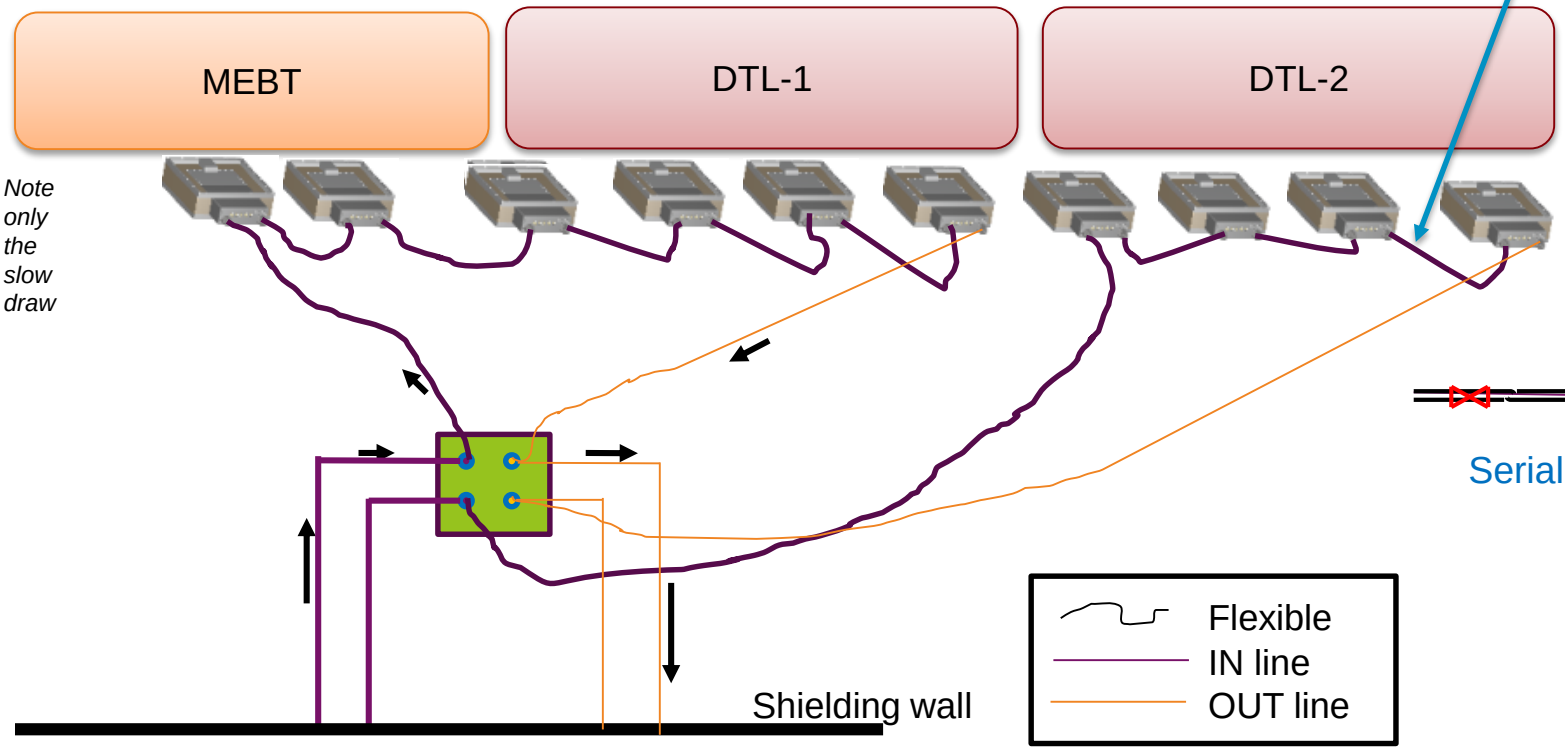
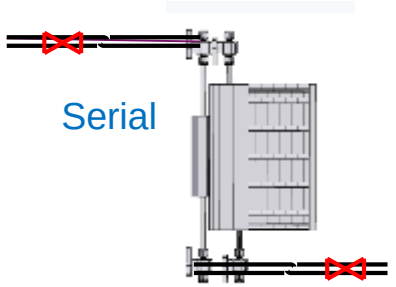


GAS DISTRIBUTION SYSTEM

- Detectors in series in each group
- Fast closing valves between them
- Detector installed (first time or after intervention) filled with gas.
- Lines can be pumped down

Detail of one nBLM gas distribution patch-panel





TIME FOR STABLE OPERATION

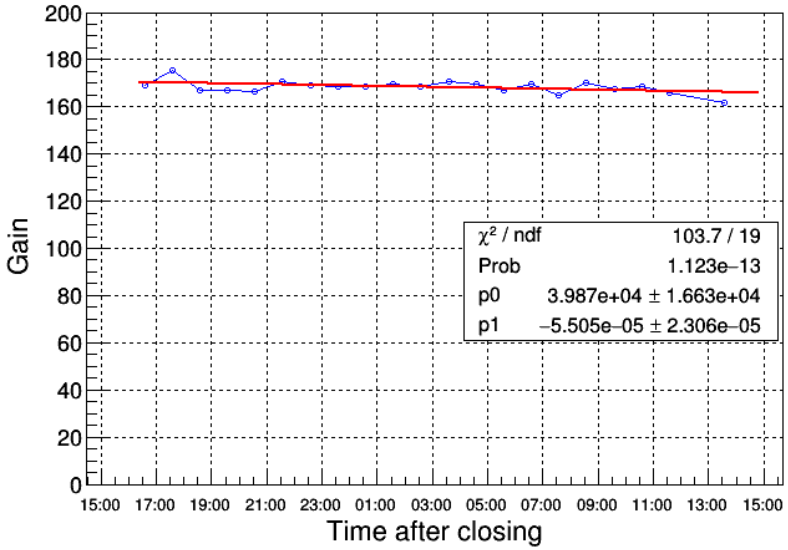
- Estimate time needed to have detector operational after first installation or after intervention
- Assume we install the detector filled with gas
- And we have pump down the pipes
- We will need to change the volume about 5 times

	Time if with gas (h)	Time if with air (h)
Low Energy	2-3	12-16
SPK 8-13	3-5	24
MB, HB	8	43
PBW	17	86

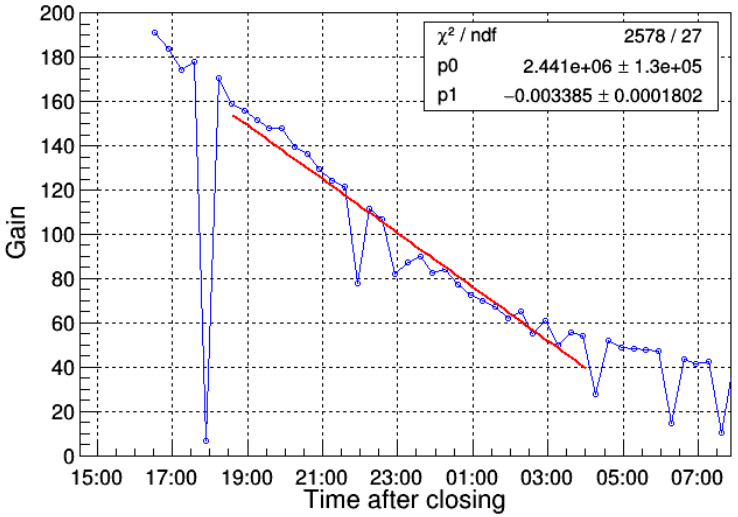
- Assume distance from bottles to rack = 10 m
- Assume distance from rack to proton source = 50m

GAIN STABILITY

Gas in open mode



Detector sealed, no gas circulation



- After 5h gain drops a 30%
- After 12h a 50%
- and after one day there is no signal over background

THANK YOU

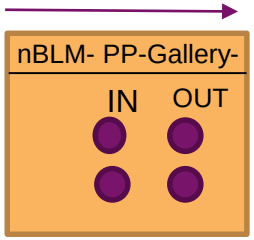
BACK-UP

NBLM GAS SYSTEM

- Gas: He + 10% CO_2
- Flow: ~ 5 l/h, in recirculation
- P ~ 1 atm
- Volume/detector ~ 0.25 l
- Leak tight and low outgassing
- Gas bottle storage: 6-12 rack premix
  - ~200 bar/bottle, 50 l →
  - 2 IN/2 OUT lines (1 in use, 1 spare)
  - Outside gallery
- From gas bottle to gas rack to patch panel to tunnel
  - Distribute in 5 lines → one per DTL, in parallel
    - 5 IN/5 OUT Lines going to tunnel (+ spares)
  - Electrovalve in/out in Klystron gallery
    - Isolate system
  - Flowmeter in/out in Klystron gallery
    - Leak monitoring
- Gas in serial for detectors in DTL

Bottle rack

Gas controller



Designed by Stephan Aune