LHCB CO_2 COOLING INTEGRATION & PLANS FOR INSTALLATION P&I DOCUMENT STATUS

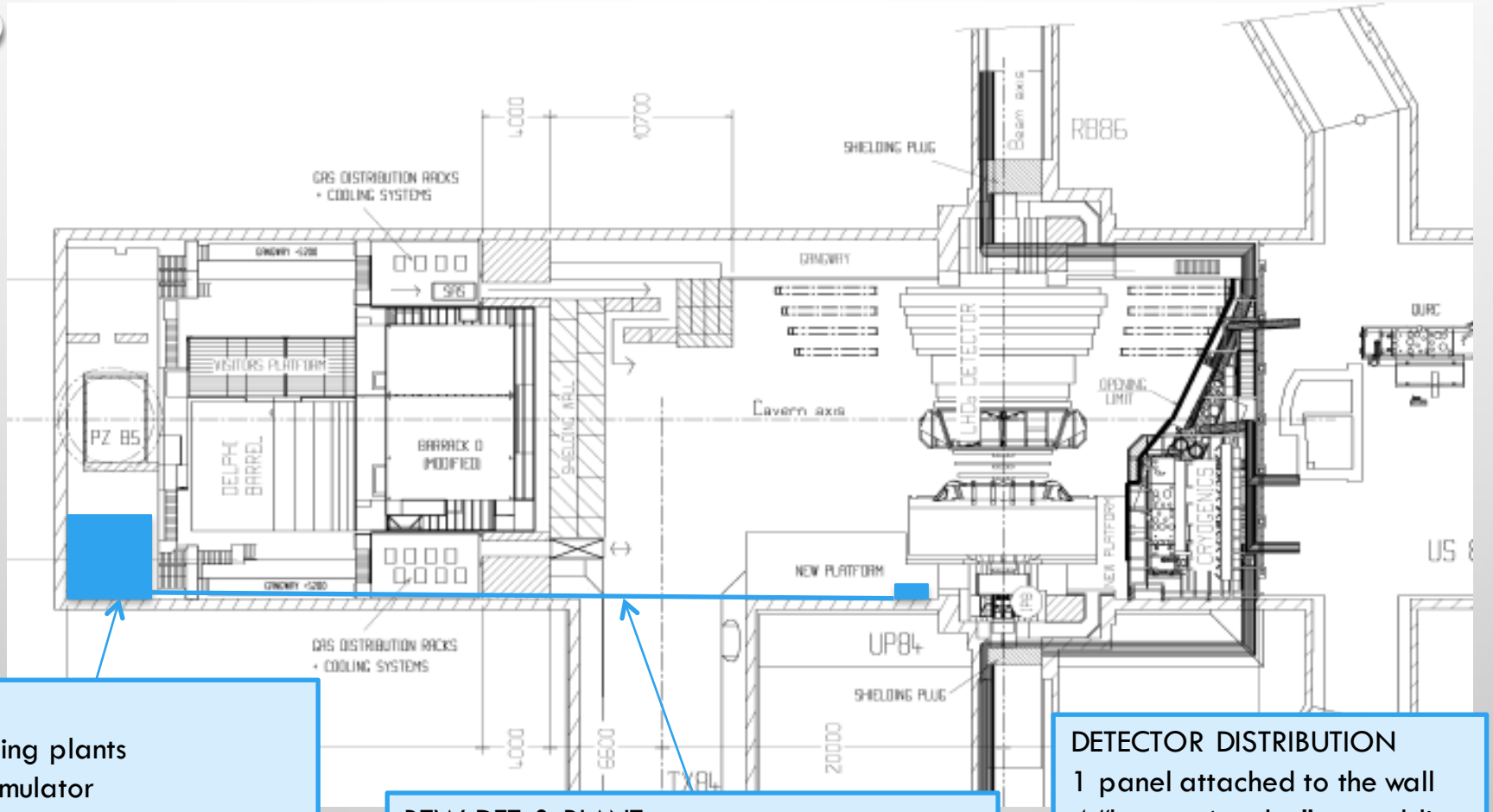
P. TROPEA

LHCB COOLING MEETING

20 NOV 2015

HTTPS://INDICO.CERN.CH/EVENT/461642/

INTEGRATION



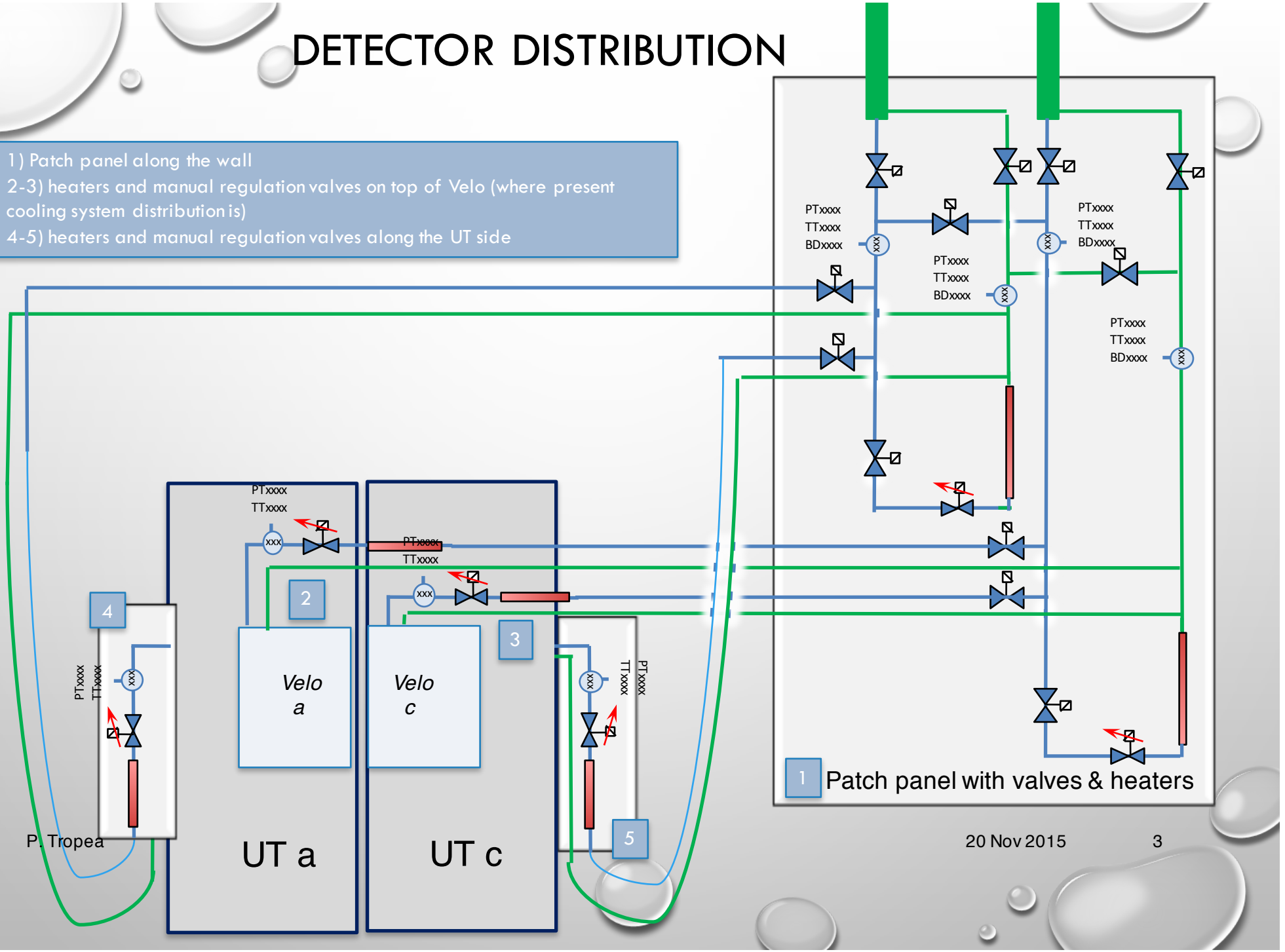
ALCOVE
2 x Cooling plants
2 x Accumulator
1-2 Control/Pneumatic racks
1 Drier

BTW DET & PLANT
2 x DN80 vacuum insulated concentric transfer lines
1 x cable tray signal + pneumatic
1 x cable tray power

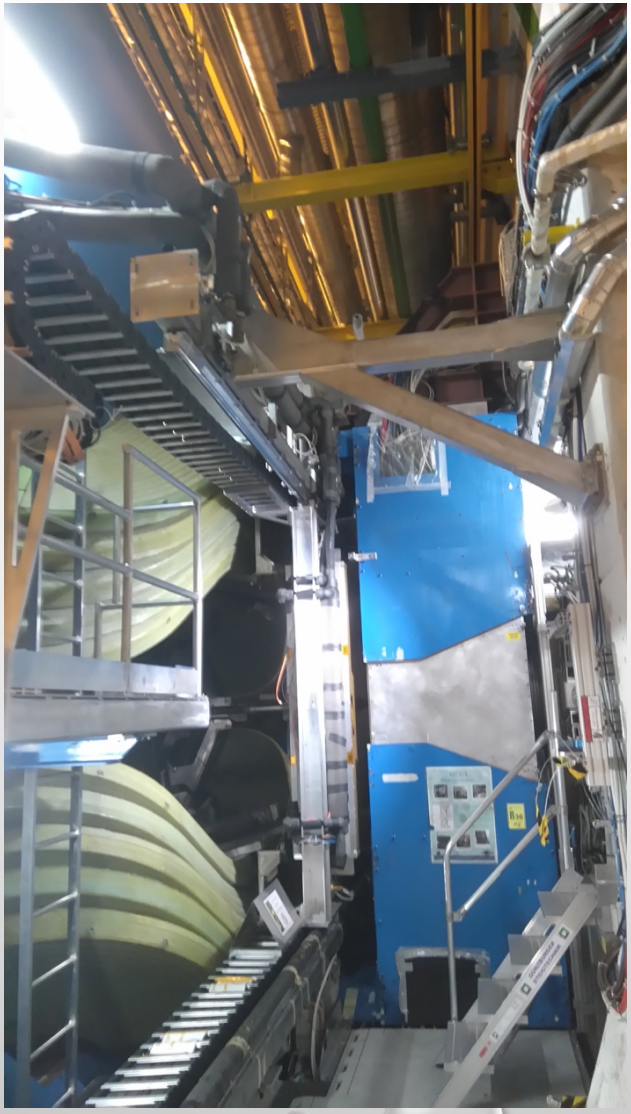
DETECTOR DISTRIBUTION
1 panel attached to the wall
4 “heater + valve” assemblies

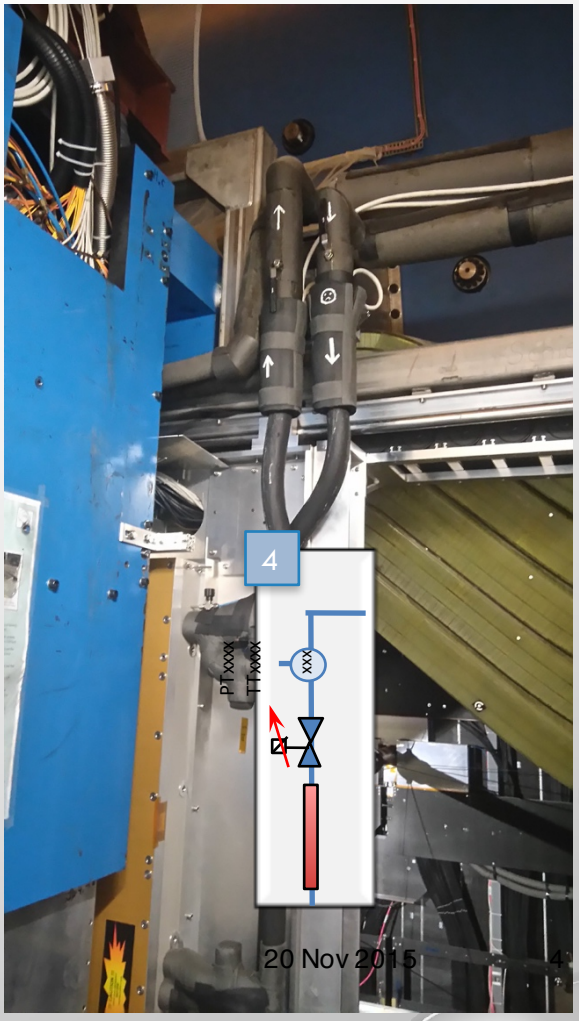
DETECTOR DISTRIBUTION

1) Patch panel along the wall
2-3) heaters and manual regulation valves on top of Velo (where present cooling system distribution is)
4-5) heaters and manual regulation valves along the UT side



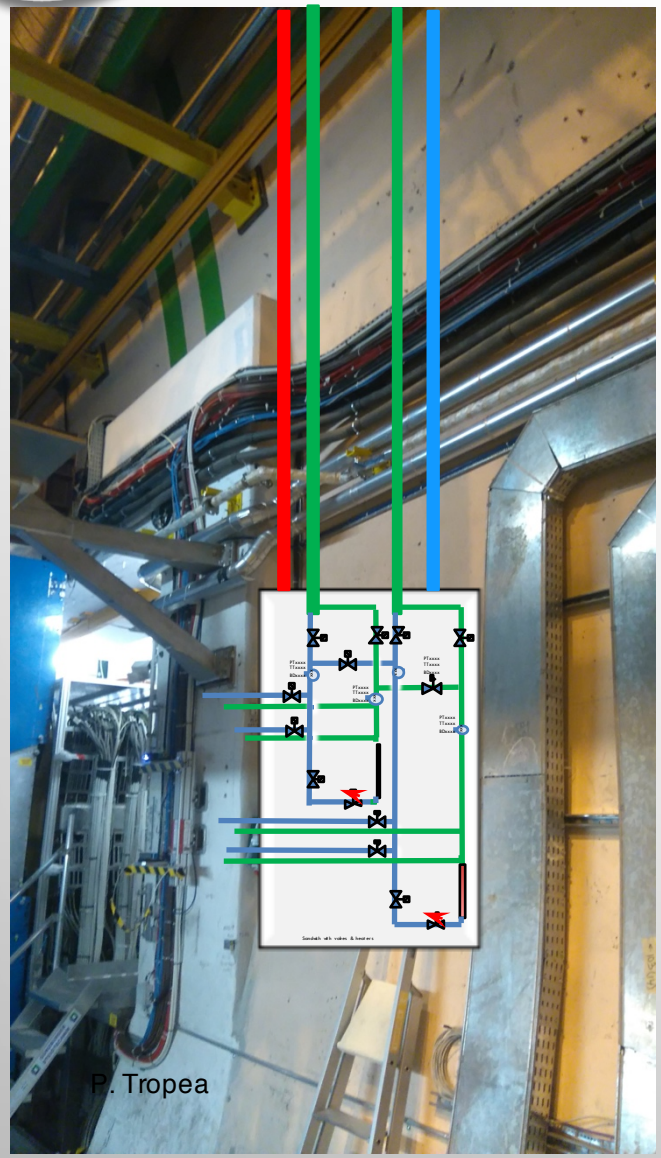
UT REGULATION VALVES



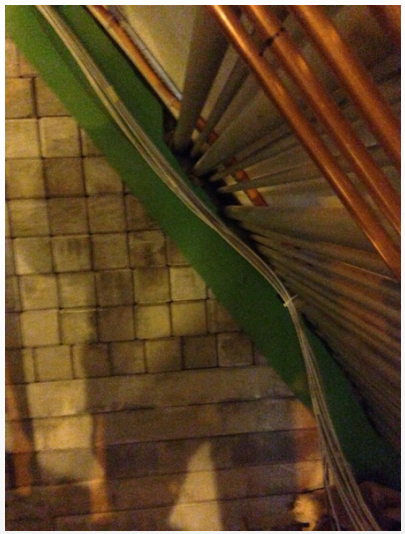


COMMON PATCH PANEL & PATH TOWARDS IT

Transfer lines & services from top of the cavern



Shielding wall passage



Signal cables & pneumatic pipes

2 x Vacuum insulated transfer lines

Power cables

N. B. Estimate of cross sections will be ready for EDR
Verification of space & routing during YETS – courtesy LHCb integration

TRACI JUNCTION BOX
Ex of 2D layout with foam

ALCOVE: SPACE & INFRASTRUCTURE

- UPS power supply for PLC
- Diesel power for backup chiller (qty depend on backup logic chosen, see next slide)
- General power
- Water: 18 kW mixed water (14 C) or nothing (see next slide)
- Dry air (dew point <-50 C) for flushing & valve piloting @ 7 bar, XX Nm3/h
- Drier: on diesel power, sizing it!
- Ventilation
- CO_2 detection system

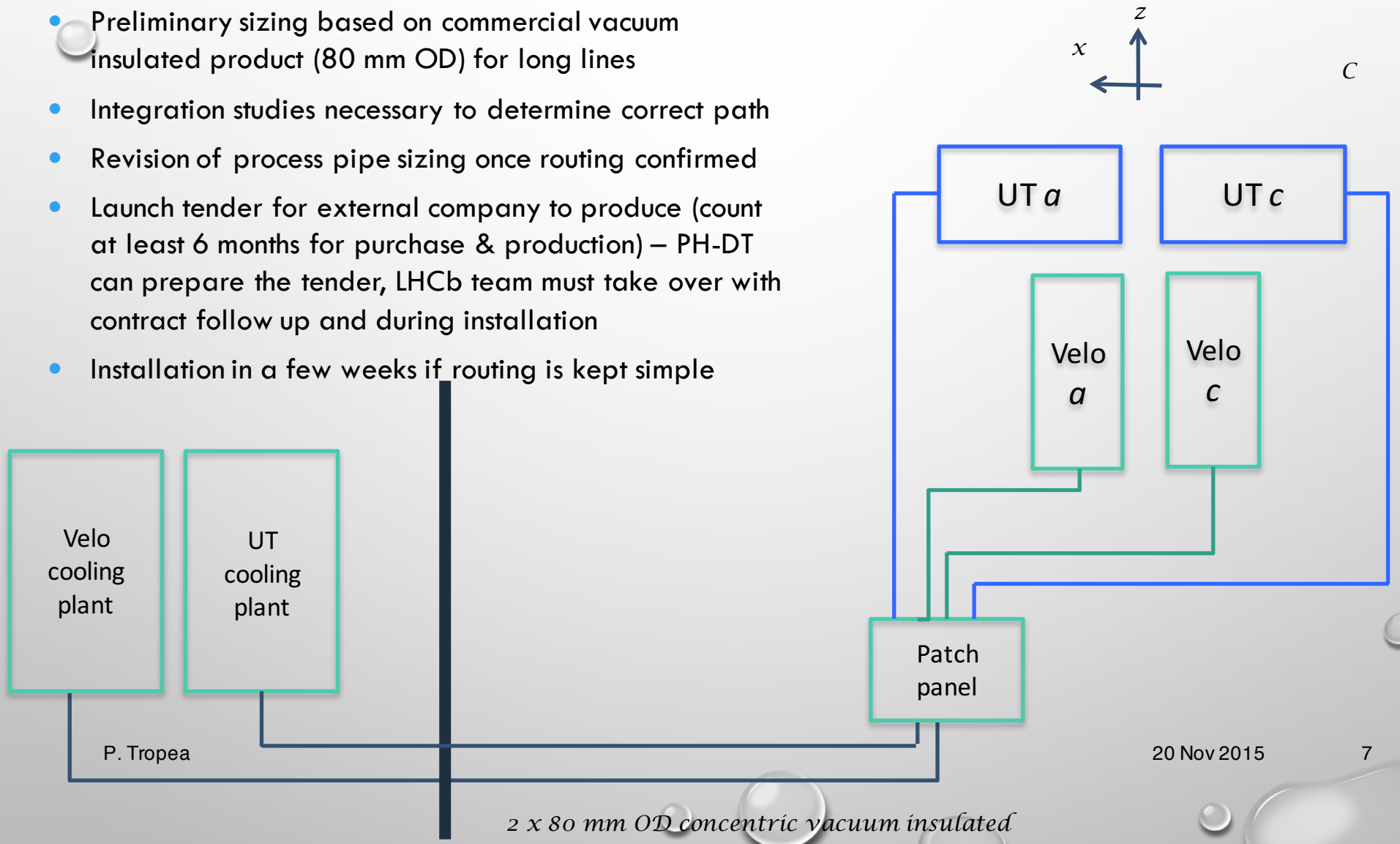
Advantages of ALCOVE location

- ✓ Accessible during run for installation
- ✓ Decoupled from existing systems (planning takes advantage of "low load" periods)
- ✓ Services can be installed ahead of time and be configured such that connection can happen with no disruption

CO_2 COOLING TRANSFER LINE SIZING

Transfer lines between plants and junction boxes

- Preliminary sizing based on commercial vacuum insulated product (80 mm OD) for long lines
- Integration studies necessary to determine correct path
- Revision of process pipe sizing once routing confirmed
- Launch tender for external company to produce (count at least 6 months for purchase & production) – PH-DT can prepare the tender, LHCb team must take over with contract follow up and during installation
- Installation in a few weeks if routing is kept simple



PRIMARY SYSTEM & BACKUP LOGIC

PRIMARY CHILLER

a) local water cooled chiller
b) shared system with other LHCb sub-detectors

UT plant

Velo plant

BACKUP CHILLER

Local chiller, air cooled, on diesel to ensure detector cold when power cut

a) Full power for operation (in case primary is not proper to UT/Velo)
b) Limited power for keeping detector cold

INPUT NEEDED FOR P&I DOCUMENT

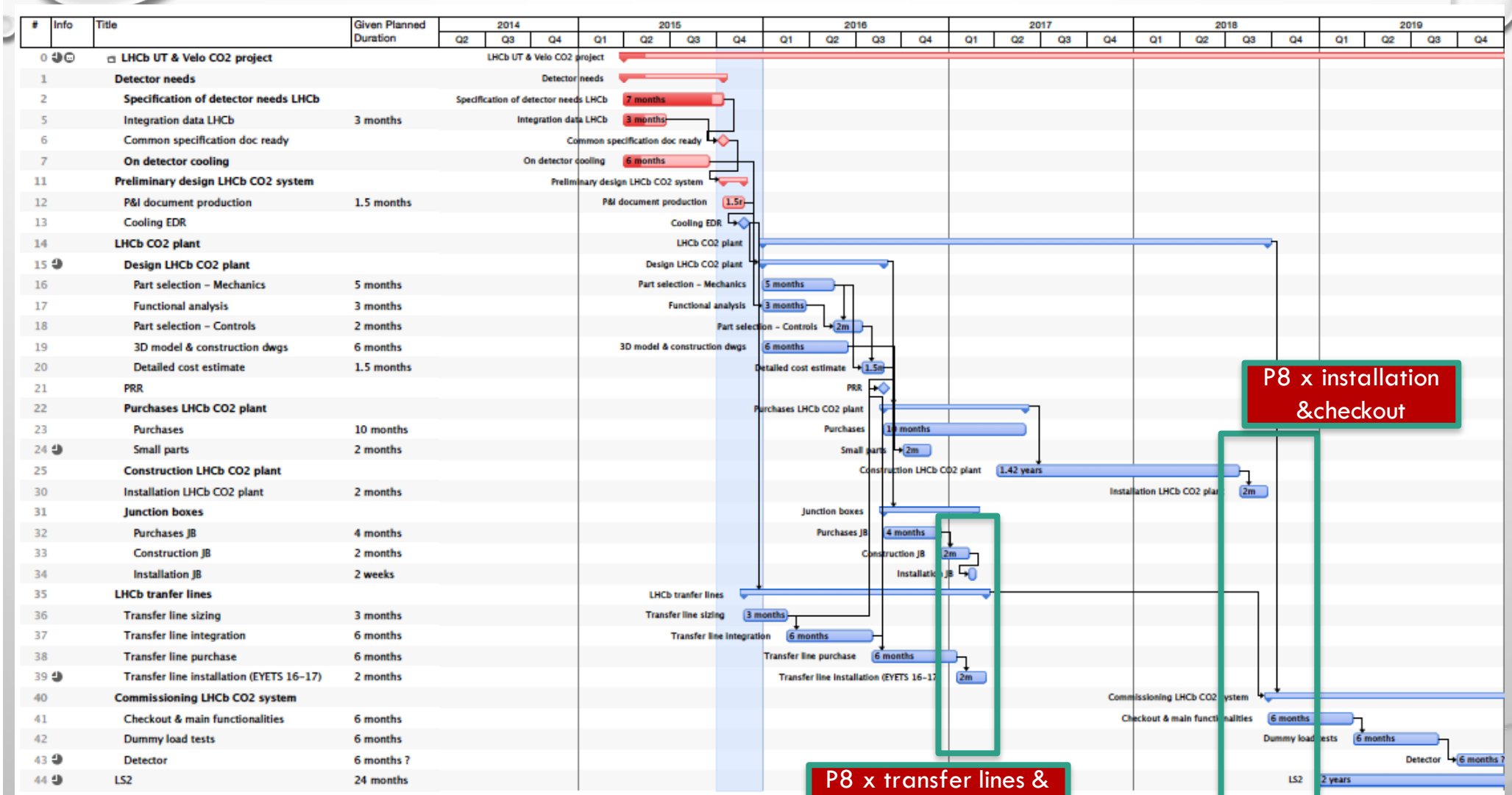
Main inputs still to be clarified:

- Pressure drops along detector circuits (measurements on-going for UT, shall we consider the July measurements for VELO?)
- Safety system granularity/volumes
- Overall transfer line lengths (estimate)

		UT	Velo
Accu Tmin	℃	-30	-30
Accu Tmax [°C]	℃	15	15
Hot spot - pipe max T inside detector	℃		
CO2 max T – Evap T (=f(l, ID, flow)	℃		
Detector cooling loops	#	34x2 (+/-x)	26x2 (+/-x)
Parallel loops	#		
Power /cooling loop – HLLT (MAX)	W	76	28.4
Flow/cooling loop - HLLT @ -30	g/s	0.8	0.1-0.3
Dp cooling loop - HLLT@ -30	mbar	300	?
Power /cooling loop - WARM @ 15 C	W	?	?
Flow/cooling loop - WARM @ 15 C	g/s	?	?
Dp cooling loop - WARM @ 15 C	mbar	?	?
Transfer lines CP to JB	#	1	1
JB to detector transfer lines	#	2	2
Manifold	#	2	2
Max detector power	kW	5.472	1.5
Max detector flow	g/s	54.4	15.6
Max detector Dp	mbar	400	?
Max detector + capillaries DP	bar	?	?

CP= Cooling plant (alcove)
JB=junction box (top of the magnet?)

PRELIMINARY SCHEDULE – DRAFT FOR DISCUSSION



#	Info	Title	Given Planned Duration
0		LHCb UT & Velo CO2 project	
1		Detector needs	
2		Specification of detector needs LHCb	
5		Integration data LHCb	3 months
6		Common specification doc ready	
7		On detector cooling	
11		Preliminary design LHCb CO2 system	
12		P&I document production	1.5 months
13		Cooling EDR	
14		LHCb CO2 plant	
15		Design LHCb CO2 plant	
16		Part selection – Mechanics	5 months
17		Functional analysis	3 months
18		Part selection – Controls	2 months
19		3D model & construction dwgs	6 months
20		Detailed cost estimate	1.5 months
21		PRR	
22		Purchases LHCb CO2 plant	
23		Purchases	10 months
24		Small parts	2 months
25		Construction LHCb CO2 plant	
30		Installation LHCb CO2 plant	2 months
31		Junction boxes	
32		Purchases JB	4 months
33		Construction JB	2 months
34		Installation JB	2 weeks
35		LHCb tranfer lines	
36		Transfer line sizing	3 months
37		Transfer line integration	6 months
38		Transfer line purchase	6 months
39		Transfer line installation (EYETS 16-17)	2 months
40		Commissioning LHCb CO2 system	
41		Checkout & main functionalities	6 months
42		Dummy load tests	6 months
43		Detector	6 months ?
44		LS2	24 months