MERIT Review Meeting: Cryogenics

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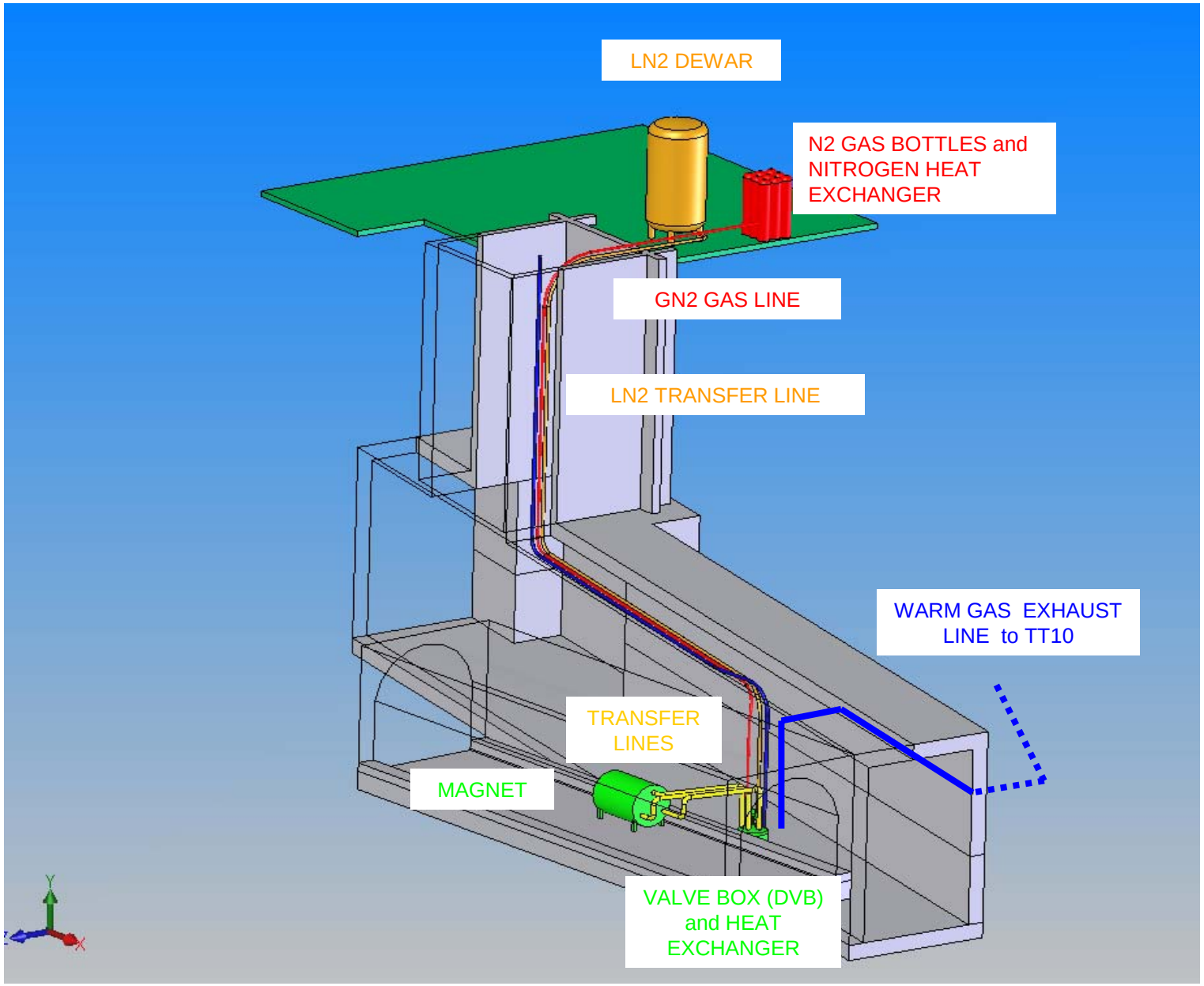
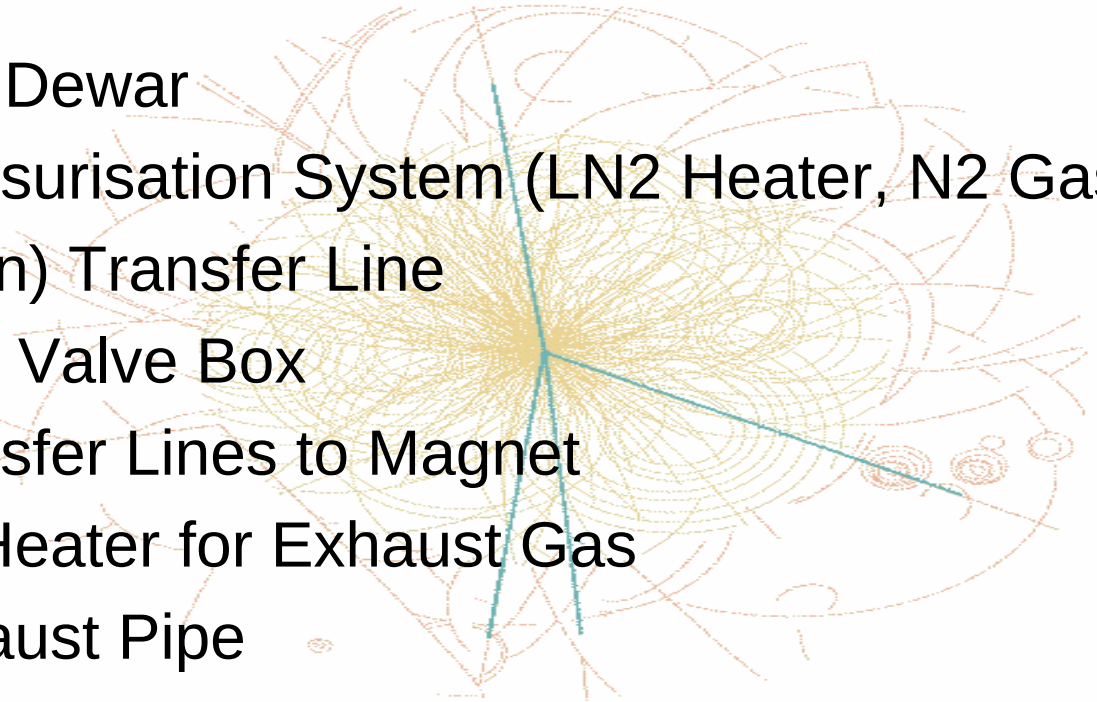
Overview of Presentation

1. Layout of Cryogenics at n-ToF Area
2. Equipment
3. Flow Scheme, Functionality
4. Safety, Risk Assessment
5. Surface Test Area (Hall 180)
6. Budget
7. 2006 Provisional Planning

1. Layout at n-TOF Area (Principle)

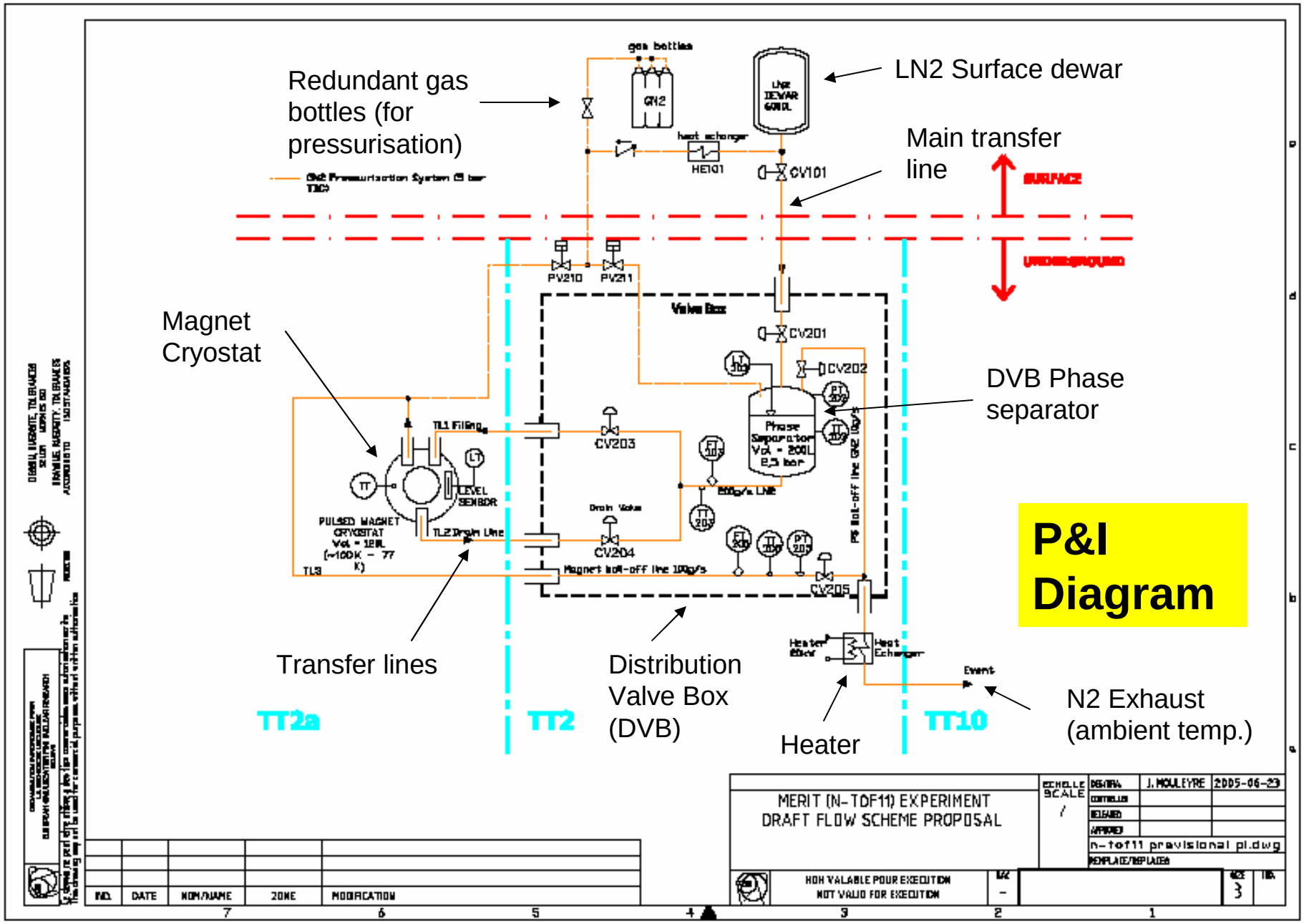


2. Equipment



- LN2 Dewar
- Pressurisation System (LN2 Heater, N2 Gas Bottles)
- (Main) Transfer Line
- DVB Valve Box
- Transfer Lines to Magnet
- N2 Heater for Exhaust Gas
- Exhaust Pipe
- Instrumentation
- Process Control System
- Safety Equipment

3. FLOW SCHEME, FUNCTIONALITY



Functionality (simplified)

Phase A (Initial cool down of magnet)

A1. Magnet pre-Cooling 300K to 77 K (controlled mass flow)

A2. Magnet cryostat fill up with LN2

Phase B (Normal baseline operation)

B1. Magnet at 77 K, immersed in LN2

B2. Empty magnet by pressurisation. Liquid is pushed out to phase separator in DVB (quantity >100 l)

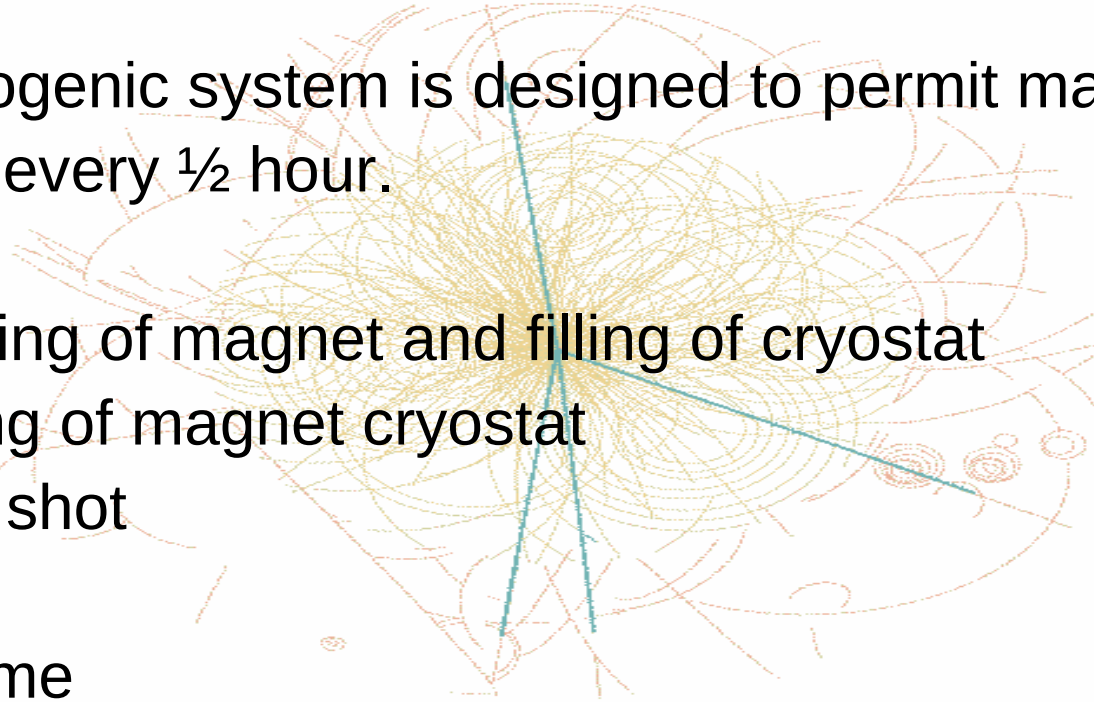
B3. Magnet ramp-up (Pulse)

B4. Re-cooling (stored LN2 quantity in DVB phase seperator + LN2 surplus supplied from surface dewar)

B5. Fill cryostat ⇒ go to B1

Cycle Time

The Cryogenic system is designed to permit magnet ramping every ½ hour.



-Re-cooling of magnet and filling of cryostat	20 min
-Emptying of magnet cryostat	10 min
-Magnet shot	3 min

-Cycle time	~30 min

Systems Control

The Cryogenic System will be fully automated using CERN Standard for Slow Controls (UNICOS) based on

A) Schneider PLC,

B) PVSS supervision.

A) The PLC will be installed locally at TT2 next to the DVB

B) The remote Supervision Station connects via Ethernet

-Operation is done remotely! Operator interventions via supervision system (man/machine interface).

-Normally no access to underground test area required during experiment

4. Safety, Risk Assessment

Potential hazard to people working underground (TT2a and TT2) exist in case of accidental spills of LN2 and loss of GN2.
Potential Risks for personnel are
-Asphyxiation, -Cold Burns, -Hypothermia !

“Cryogenic System Built-in” Safety Measures :

1) Adequate design by
   -choice of material and quality assurance during construction,
   -reliable interconnection bayonets,
   -choice of instrumentation

2) Minimize required access of personnel by
   a) Remote supervision system,
   b) Fully automated process control

3) Automation minimizes risk of hazardous situations like pressure build-up in vessels by active control of the parameters

4) Safety valves and rupture discs are used as ultimate passive safety feature to protect equipment and personnel

5) Interlocks with the magnet power control system

Safety (continuation)

- Risk assessment in collaboration with the Safety Commission (en route)
- Technical Solution for ODH Detection with Technical Service Dep. (en route)
- ODH must be an automated detection system with links to TCR (Technical Control Room) and SCR (Safety Control Room) via “CSAM” (CERN Safety Alarm Monitoring)
- Procedures

  -Access control

  -Safety training training of personnel working in underground areas in the neighborhood of cryogens (specific CERN safety courses required)

Safety Systems (example ATLAS)

Collective Safety systems

-Passive safety measures (discharge)

-ODH Detection and Warning

-Emergency ventilation and extraction

- »Red phones» to Safety control room

-personnel rescue by fire brigade

Individual Safety Systems

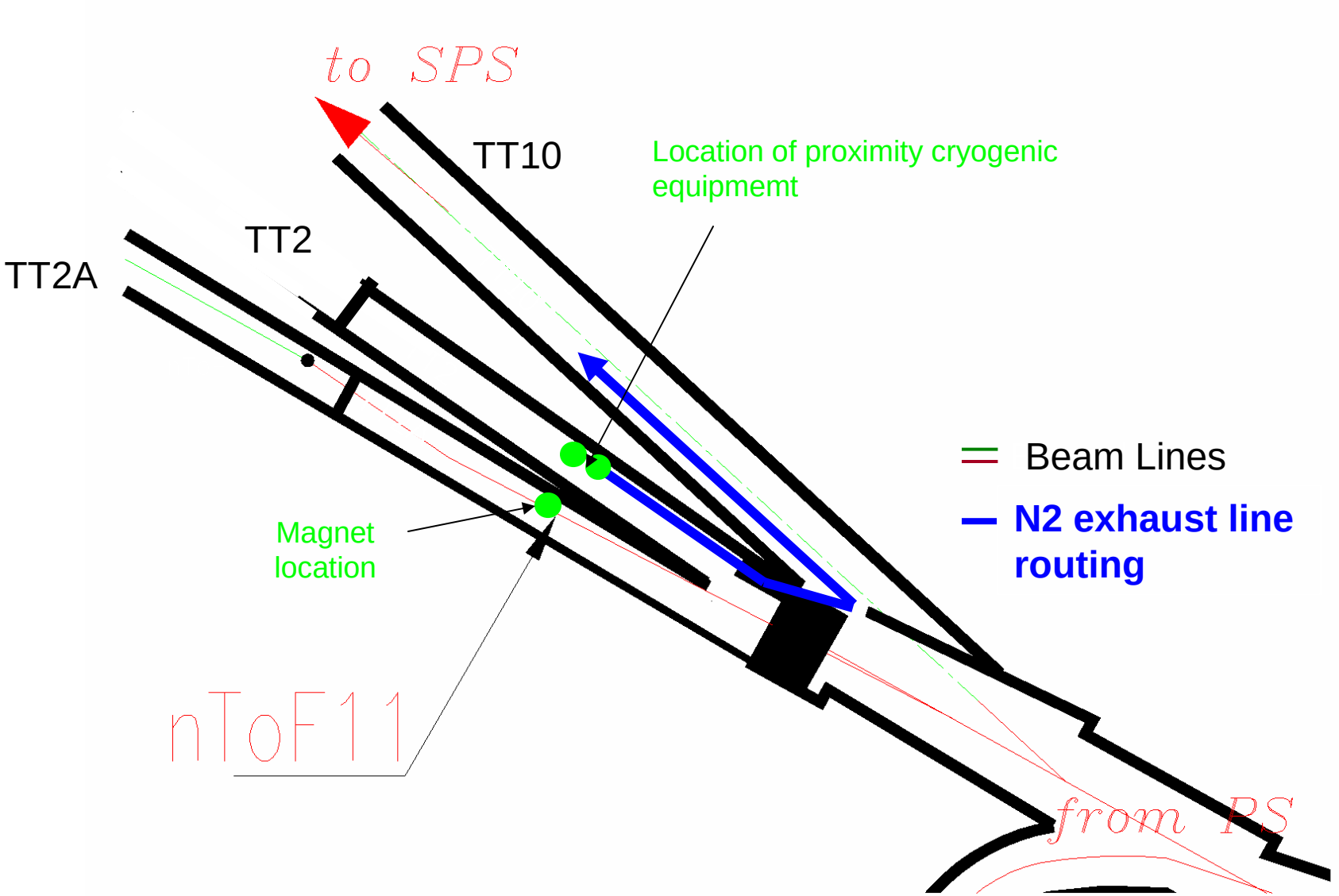
-mobile telephone,

-portable ODH detector

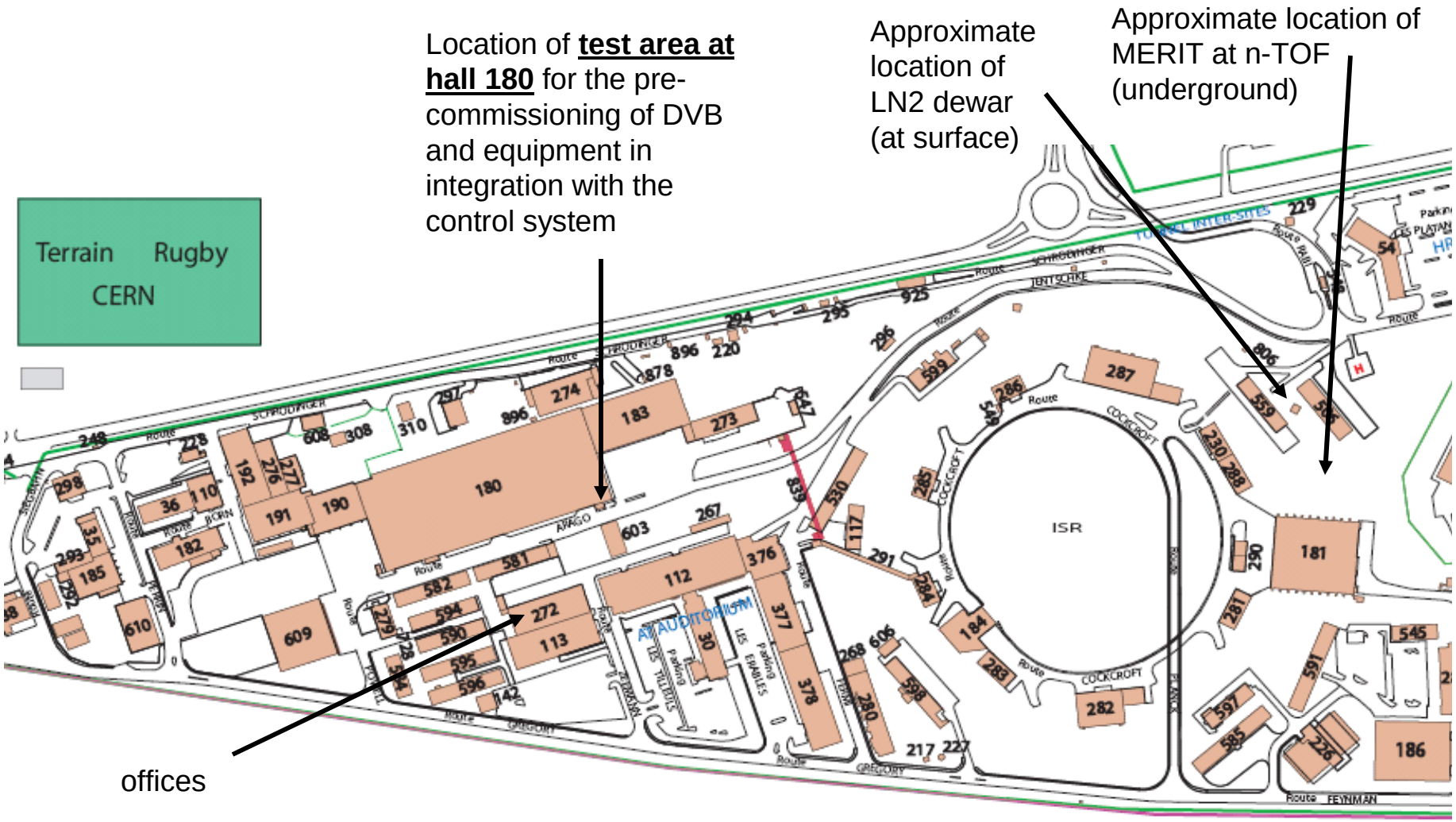
-breathing apparatus ?

GN2 Exhaust

For reasons of potential activation all exhaust gas is routed to TT10 after having been heated to ambient temperature



5. On Surface Test +Commissioning at Hall 180 (ATLAS)



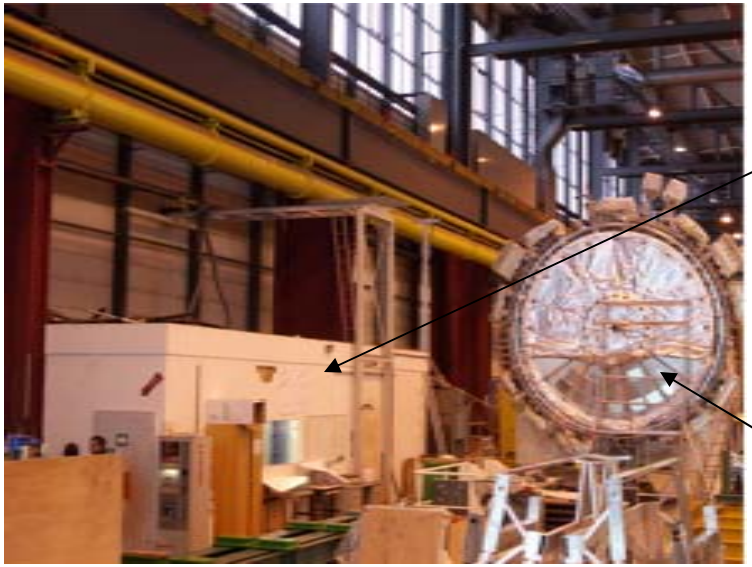
Lay-out of CERN Meyrin (western part) with MERIT locations

Location of surface test area at Hall 180

-6000 litre dewar currently used at ATLAS Hall 180 test facility.

(to be adapted for MERIT use)

-MERIT cryogenic equipment will be installed within fenced area



-Existing control room will be available for MERIT cryogenics use.

ATLAS Liquid Argon Calorimter

Budget

1.	Controls hardware+software	80 kChF
2.	Heat exchanger	15 kChF
3.	Transfer lines	70 kChF
4.	Exhaust warm	15 kChF
5.	Concrete platform	20 kChF
6.	Dewar 6000l modification	25 kChF
7.	Instrumentation and cabling	70 kChF
8.	Safety equipement	20 kChF
9.	Installation	25 kChF
10.	LN2	20 kChF

- Total: 360 kChF project cost estimate until Nov. 2006

2006 provisional Planning (overview)

<u>DVB (specifically)</u>		
DVB Technical Specification	AT-ECR	16.1.
DVB Tender	RAL	17.1. - 30.3.
DVB Production (at company). Monitoring by…	RAL/AT-ECR	1.4. -1.8.
Instrumentation	AT-ECR	1.7. -1.8.
Delivery to CERN		1.9.
<u>Surface assembly, Test + Commissioning at hall 180</u>		
infrastructure prep. + dewar modification	AT-ECR	until 1.7.
Controls Hardware construction	AT-ECR	until 1.8.
Controls Software preparation	AT-ECR	until 1.9.
Commissioning	AT-ECR	1.9.-1.10.
Surface Tests	AT-ECR	1.10.-30.10.
<u>n-TOF area</u>		
-various infra preparations (including safety)	AT-ECR	until 1.9.
-magnet delivery	MIT	15.11.
-Installation of all remaining cryogenics	AT-ECR	1.11.-30.11
-Commissioning with provisional cold tests	AT-ECR	1.12-20.12.

schedule

ID	Task Name	Resource Names	Start	Finish	Duration
1	**Accelerator Operation**		**02 Jan '06**	**14 Nov '08**	**750 days**
2	PS/SPS closed	PS/SPS	02 Jan '06	14 Nov '08	618 days
3	PS run	PS	17 Apr '06	31 Oct '08	446 days
4	AD run	AD	08 May '06	05 Sep '08	269 days
5	**Solenoid Power**	**AB-PO**	**07 Nov '05**	**02 Oct '06**	**236 days**
20	**Cryogenics**	**AT-ECR**	**01 Aug '05**	**19 Dec '06**	**362 days**
21	System specifications	AT-ECR	01 Aug '05	01 Dec '05	89 days
22	Approval of system	AT-ECR	02 Dec '05	12 Jan '06	30 days
23	**DVB**	**RAL**	**16 Jan '06**	**01 Sep '06**	**165 days**
24	specifications	AT-ECR	16 Jan '06	16 Jan '06	0 days
25	DVB tendering	RAL	16 Jan '06	31 Mar '06	55 days
26	DVB production	RAL	03 Apr '06	04 Aug '06	90 days
27	DVB instrumentation	AT-ECR	26 Jun '06	04 Aug '06	30 days
28	Delivery at CERN	RAL	01 Sep '06	01 Sep '06	1 day
29	System assembly - lab	AT-ECR	04 Sep '06	29 Sep '06	20 days
30	Surface commissioning + test	AT-ECR	02 Oct '06	27 Oct '06	20 days
31	safety system initialisation	AT-ECR	09 Oct '06	27 Oct '06	15 days
32	**Installation**	**AT-ECR**	**09 Jan '06**	**28 Nov '06**	**232 days**
33	Surface base	AT-ECR	01 Jun '06	28 Jun '06	20 days
34	Dewar installation	AT-ECR	16 Oct '06	27 Oct '06	10 days
35	Cryo lines surface to TT2	AT-ECR	03 Jul '06	28 Jul '06	20 days
36	Vent line to TT10	ATB-EA	09 Jan '06	24 Feb '06	35 days
37	Infrastructure+safety TT2	AT-ECR	24 Jul '06	01 Sep '06	30 days
38	Proximity/DVB in TT2(A)	AT-ECR	30 Oct '06	10 Nov '06	10 days
39	Solenoid delivery	MERIT	15 Nov '06	15 Nov '06	0 days
40	Remaining parts/lines	AT-ECR	01 Nov '06	28 Nov '06	20 days
41	Control system design	AT-ECR	01 Nov '05	30 Jun '06	174 days
42	commissioning - experiment	AT-ECR	29 Nov '06	19 Dec '06	15 days
43	**Experimental Area**	**ATB-EA**	**23 Jan '06**	**13 Dec '06**	**233 days**
52	**Installation of experiment**	**ATB-EA**	**01 Feb '06**	**13 Oct '06**	**183 days**
55	**Commissioning**	**MERIT**	**06 Nov '06**	**02 Mar '07**	**85 days**
59	**Data taking**	**MERIT**	**09 Apr '07**	**27 Jun '08**	**320 days**
60	Beam period	MERIT	09 Apr '07	04 May '07	20 days
61	Beam period (alternative)	MERIT	04 Jun '07	29 Jun '07	20 days
62	Beam period (alternative)	MERIT	02 Jun '08	27 Jun '08	20 days
63	**Dismantling**	**ATB-EA**	**02 Jul '07**	**23 Jul '07**	**16 days**