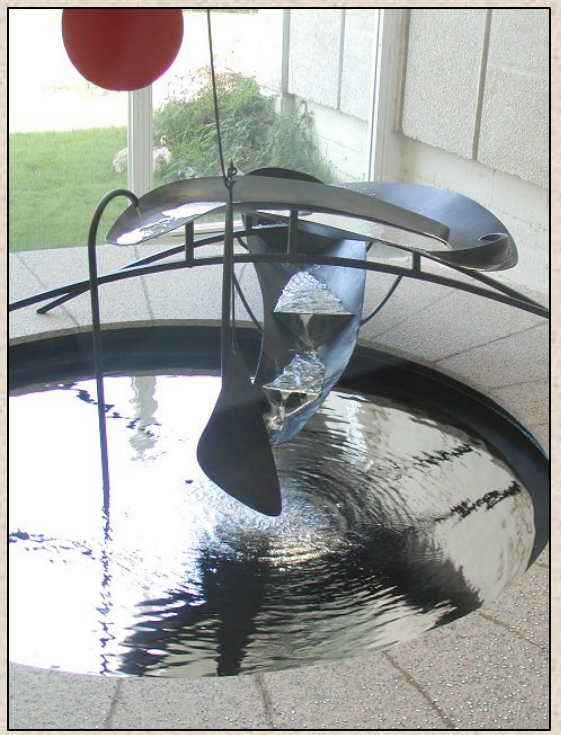
MERcury Intense Target (MERIT) Experiment – *or nTOF-11*



Mercury fountain, Funtació Juan Miró, Barcelona - Spain

Mercury System Safety Review

Ilias Efthymiopoulos
Adrian Fabich
(CERN - AB-ATB-EA)

Mercury System Safety Review

Review Panel

Mercury experts & Chemical Safety:

- Friedrich Groeschel (PSI)
- Bernie Riemer (ORNL)
- Jonathan Gulley (CERN/SC)

Radiation protection (CERN-SC/RP):

- Marco Silari
- Thomas Otto
- Pierre Carbonez

Mechanical safety (CERN-SC/GS):

- Benoit Delille
- Andrea Astone

Fire protection (CERN-SC/GS):

- Fabio Corsanego

General Safety:

- Bruno Pichler (CERN-SC/GS)
- Ralf Trant (CERN-SC/GS)

Chairman:

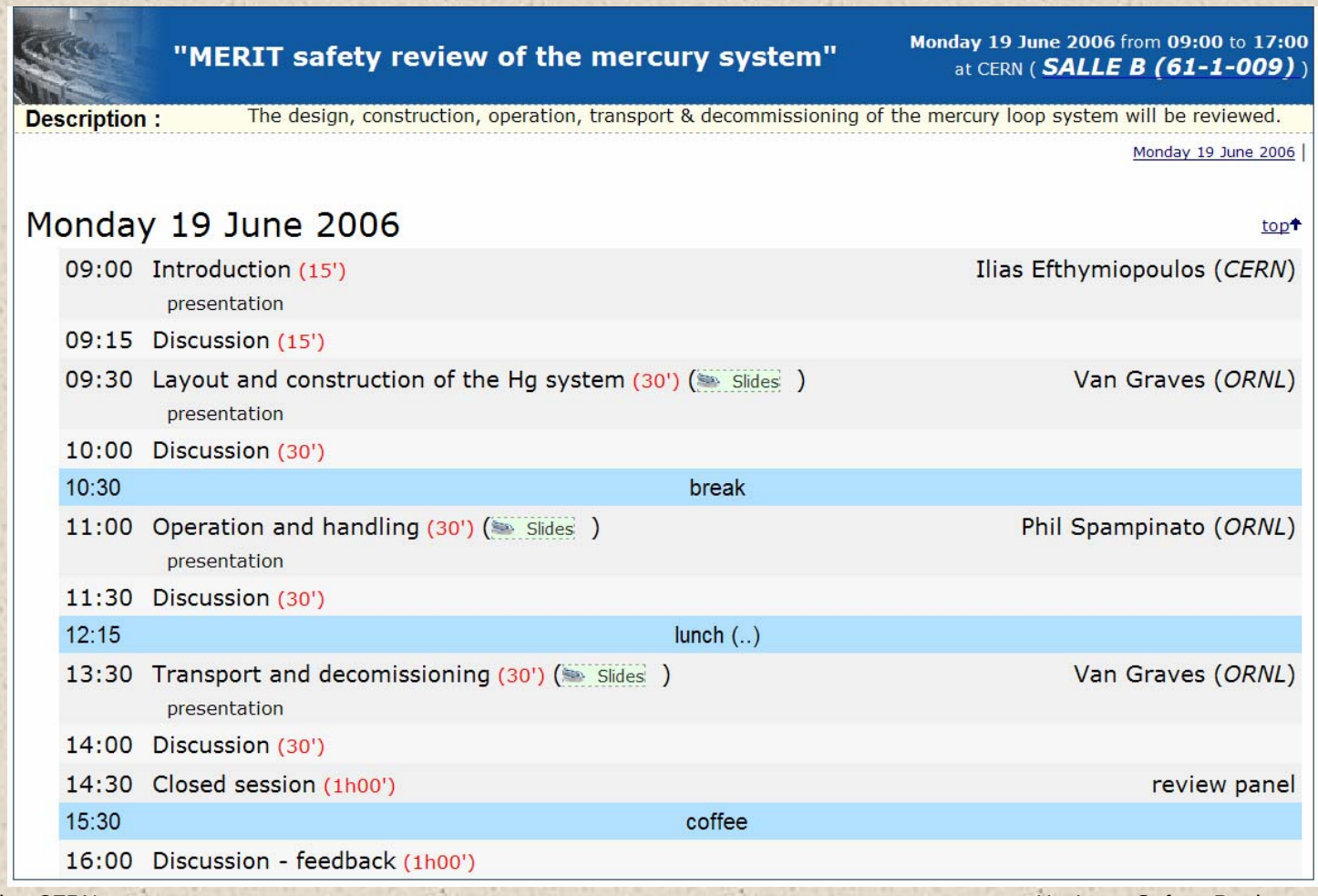
- **Ghislain Roy (CERN-AB/DSO)**

Thank you all for accepting the invitation!

Mercury System Safety Review

Agenda

http://indico.cern.ch/conferenceDisplay.py?confId=1785



"MERIT safety review of the mercury system"

Monday 19 June 2006 from 09:00 to 17:00
at CERN (SALLE B (61-1-009))

Description : The design, construction, operation, transport & decommissioning of the mercury loop system will be reviewed.

Monday 19 June 2006 |

Monday 19 June 2006

top

09:00	Introduction (15') presentation	Ilias Efthymiopoulos (*CERN*)
09:15	Discussion (15')	
09:30	Layout and construction of the Hg system (30') (Slides) presentation	Van Graves (*ORNL*)
10:00	Discussion (30')	
10:30	break	
11:00	Operation and handling (30') (Slides) presentation	Phil Spampinato (*ORNL*)
11:30	Discussion (30')	
12:15	lunch (..)	
13:30	Transport and decomissioning (30') (Slides) presentation	Van Graves (*ORNL*)
14:00	Discussion (30')	
14:30	Closed session (1h00')	review panel
15:30	coffee	
16:00	Discussion - feedback (1h00')	

Mercury System Safety Review

Scope

- Review the **Hg-system** for the experiment
  1. Overall design & operation foreseen at CERN
  2. Mechanical construction
  3. Production & safety tests at production
  4. Tests foreseen before and after delivery at CERN
- What is **NOT included**:
  - the MERIT experiment, cryogenics, radiation, access, …

Goal

- Produce a summary report with comments and recommendations to be followed up
  - Important intermediate path to final approval of the installation at CERN
  - Final inspection in situ
- I leave it up to the chairman to define the dates…

The MERIT Experiment

Introduction

few words about the experiment,

and the safety aspects…

The MERIT Experiment (1/3)

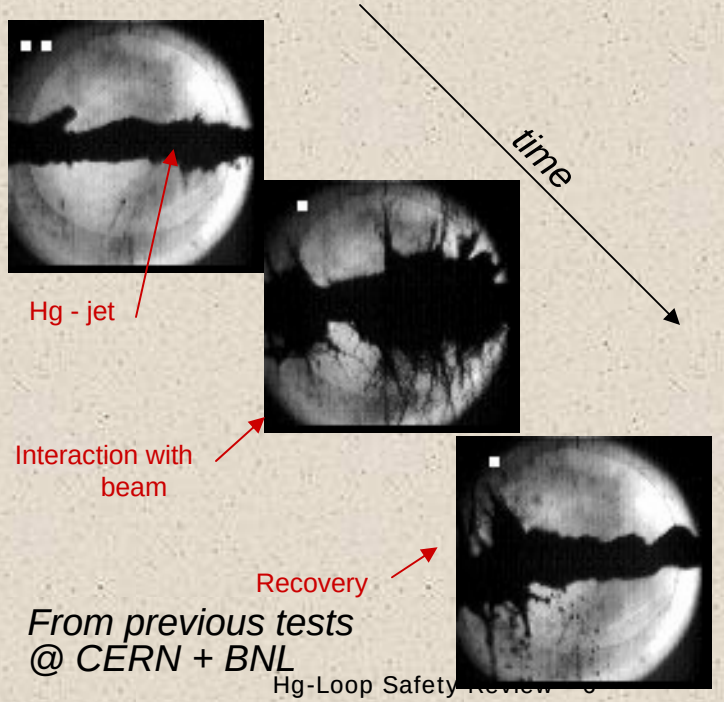
*We propose to perform a **proof-of-principle test of a target station** suitable for a Neutrino Factory or Muon Collider source using a 24-GeV proton beam incident on a target consisting of a **free mercury jet** that is inside a **15-T capture solenoid magnet**.*

Proposal submitted to INTC – May 2004

Experiment approved as nTOF-11 → **MERIT**

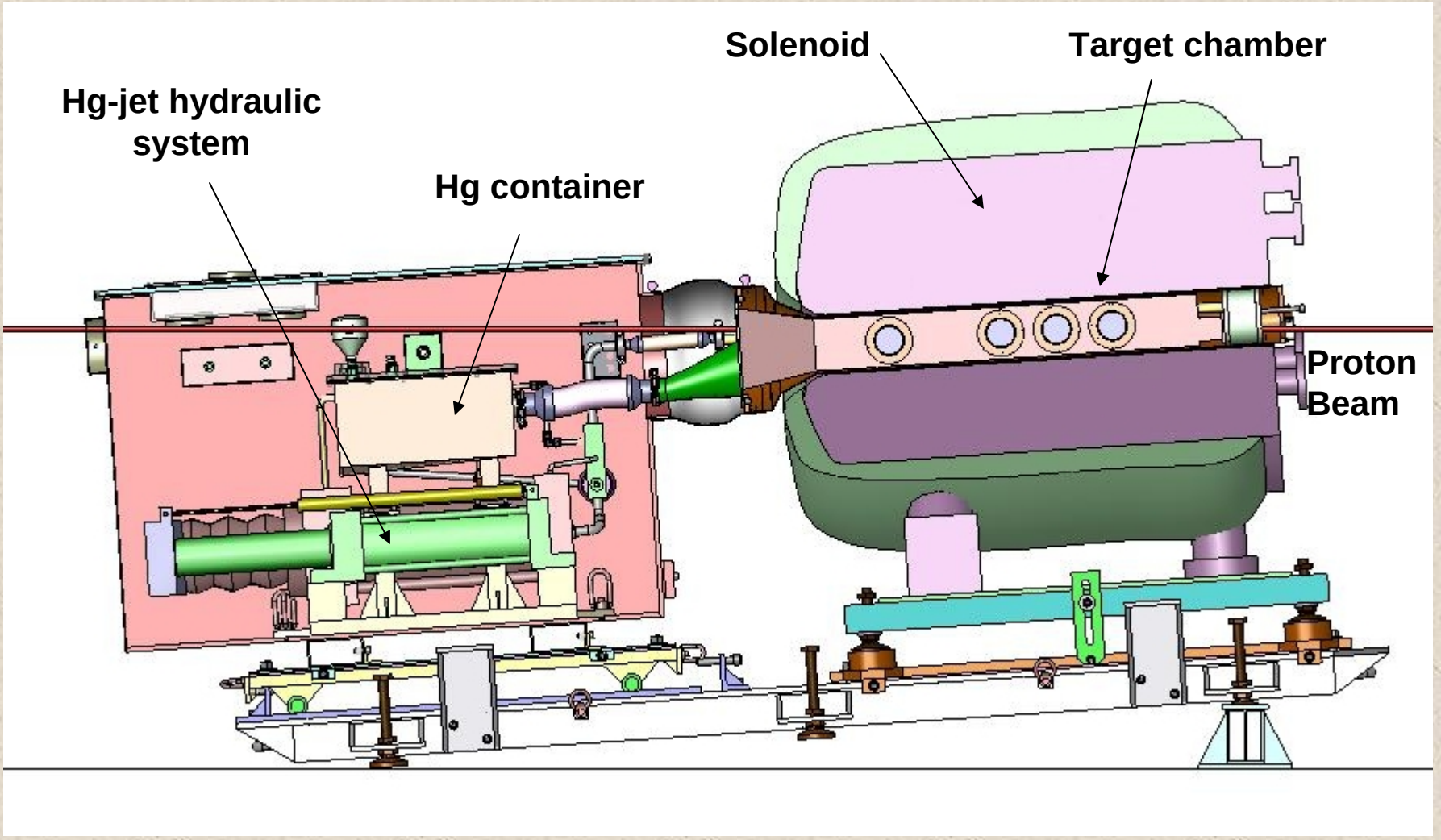
Target

- 1-cm diameter Hg jet, v ≅ 20m/s
- PS Proton beam: 24 GeV/c
  - Max. 3×10^{13} protons/pulse,
  - Pulse length 0.5÷2 μsec
  - ~100 (HI) pulses in total
  - Total limit: 3×10^{15} protons on target
- Meson collection using a 15-T solenoid



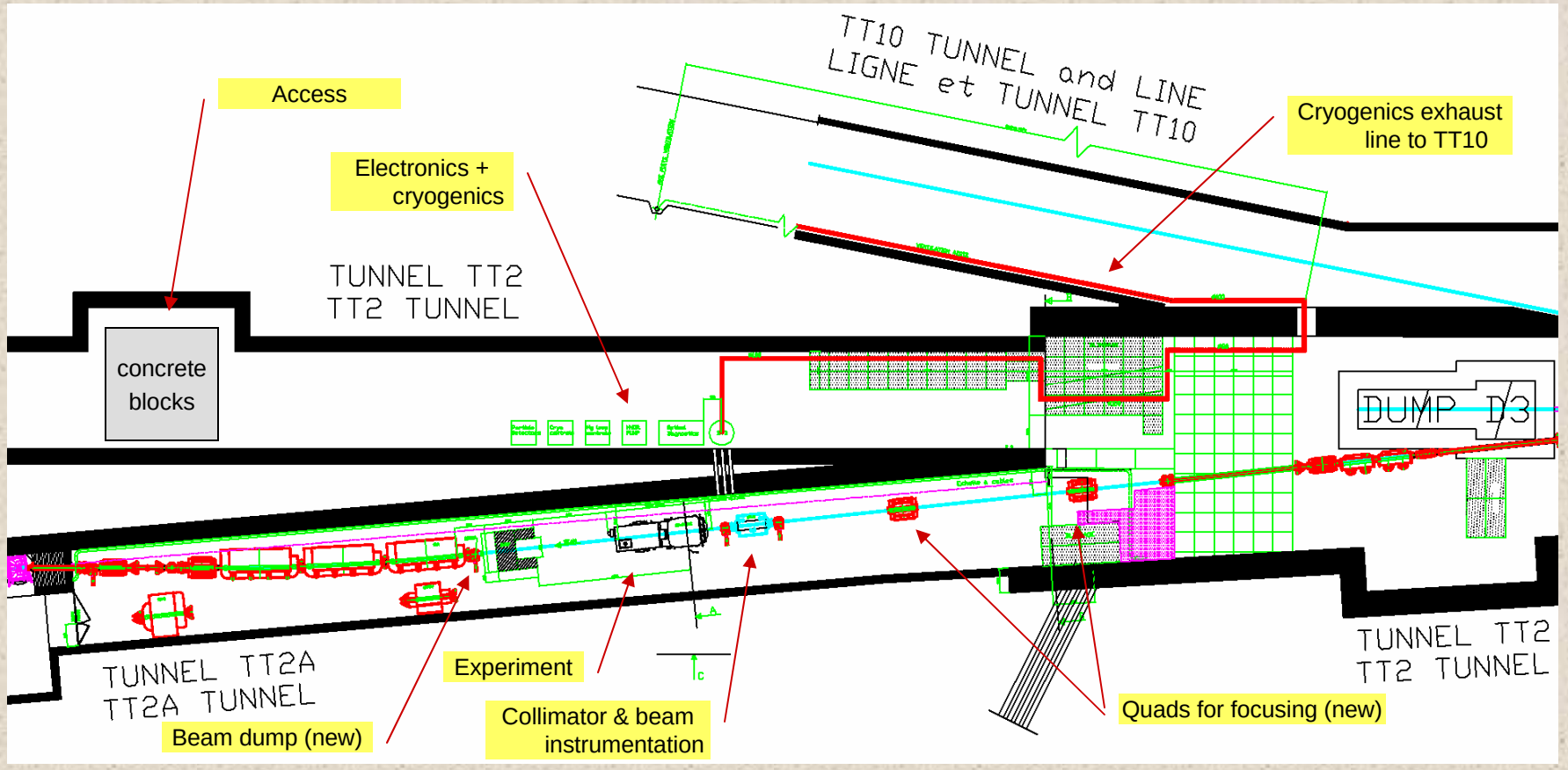
From previous tests @ CERN + BNL

The MERIT Experiment (2/3)



The MERIT Experiment (3/3)

- To be installed in the **TT2A tunnel** upstream of the nTOF target
- **Data taking**: “two-weeks” at the PS startup in 2007



MERIT Experiment Milestones (1/1)

Magnet testing at MIT	March - June 2006 ✓
Hg loop and nozzle tests at Princeton	Oct – Dec 2005 ✓
Hg target loop system test at ORNL	June –July 2006 ⇦
Integration tests at MIT	Aug – Sept 2006
Shipment to CERN	Nov - Dec 2006
Installation preparation at CERN	Shutdown 2005-2006: basic infrastructure Shutdown 2006-2007: experiment setup
Experiment – data taking	**PS startup in 2007 (April?)**

Safety issues (1/3)

How safety is handled for MERIT:

1. Preliminary hearings with safety officials at CERN before the proposal submission and approval of the experiment

2. Safety reviews of the major sub-systems of the experiment, in time with their production
   - Cryostat and cryogenics – February 3, 2006
   - **Hg-system – June 20, 2006**

3. Safety inspection of the final installation in situ
   - Transport, installation
   - Access & interlocks system verification

Safety issues (2/3)

- So far several aspects related to the safety of the experiment have been discussed with SC experts
- No show-stopper was found
- Memos on each subject available
  - http://proj-hiptarget.web.cern.ch (see also EDMS MERIT experiment)
- Safety structure of the experiment defined – ISIEC form
  - **GLIMOS: Adrian Fabich**

Our primary objective remains to prepare and perform a successful and safe experiment

Safety issues (3/3)

EDMS # 383772

CERN — European Organization for Nuclear Research

I S I E C

INITIAL SAFETY INFORMATION ON EXPERIMENTS AT CERN

DATE:	January 2006	**EXPERIMENT:**	MERIT (ntof11)
INSTALLATION START:	February 2006	**AREA/BEAM:**	TT2A (FTN), TT2, TT10, ISR
SPOKESMAN:	Harold G. Kirk (BNL), Kirk McDonald (Princeton University)		
GLIMOS :	Adrian Fabich	**TEL:**	160345
FILLED IN BY:	Adrian Fabich	**TEL:**	160345

(1) TEST BEAMS : FTN line

LABS AT CERN (BLDG/ROOM): TT2A (FTN), TT2, TT10, ISR

(2) GASES, LIQUIDS, CRYOLIQUIDS

(used in detectors or kept in nearby containers)

Device Type	Fluid 1 + % Fluid 2 etc.	Volume	Abs. Press.	Max Flow
cryogenics	LN2	6000 liter	15 bar	200 g/s
hydr. fluid	not flammable	~30 liter	206 bar	~30 m/s
Hg loop	mercury	25 liter	100 bar	200 g/s

(3) OTHER CHEMICALS

Toxic/Corrosive/Flammable metals, solvents, additives etc:

see above,
no flammable gases/liquids present

(4) ELECTRICITY

	Magnet type	Power	Field	Gap Vol.	Max.water press.
MAGNETS:	BNL solenoid	5 MW	15 T pulsed	15 cm bore, 1m	80 K cryogenic, 15 bar

	Detector Type	Voltage	Current	Stored Energy	No of HV Channels	Remote Shut-off?
High Voltage (> 1 KV)	scintillator	???	???	???		
	not yet known	???	???	???		

SHORT-CIRCUIT current > 5 mA for >50 V possible anywhere? NO

POWER dissipated by all electronics a) on detectors: negligible

b) off detectors: negligible

SPECIAL GROUNDING REQUIREMENTS? n.a.

1/2

EDMS # 383772

(5) LIFTING AND HANDLING

Weight of heaviest single piece to install ? BNL solenoid with baseplate, ~5.5 tons

Specially designed handling equipment? CERN standards: 170 ton crane, turtle, jacks

For which max. weight? see above

(6) VACUUM TANK, PRESSURE TANK, CRYO TANK

Tank	Abs. pressure	Volume	Weakest part(s) of wall
LN2 dewar	2 bar	6000 liter	standard equipement
cryostat	15 bar	120 liter	(with supply lines)
Hg loop	200 bar	open system	beam windows

(7) IONIZING RADIATION

Beam intensity, radioact. Sources, depleted uranium, etc.

PS proton beam, 24 GeV/c, 4*10^13 protons/pulse, see also EDMS 626963

(8) NON-IONIZING RADIATION

	DETAILS (e.g. class of laser, origin of UV light, average power of microwaves or RF, pulsed or CW, ...)
LASER 1	class4, 808 nm, 30 W peak, 150 ns pulse, 1 MHz (2 systems)
LASER 2	class4, 850 nm, 1 W peak, micro-sec pulse at kHz (2 systems)
UV LIGHT	not applicable
microwaves, RF	not applicable

(9) OTHER HAZARDS (or remarks):

ODH, fire, access, interlocks ...

see memos at EDMS 626963, 697850, 697857, 697860

(10) RISK ANALYSIS

ODH not yet done, see also above

PLEASE RETURN THIS FORM TO THE DSO OF THE PH DEPARTMENT

2/2