RD51 common test beam: specifications and installation status

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Outline

- RD51 Test beam approach and requirements
- Schedule and experimental zone details
- Setup sketch and mechanics
- Gas system & cables
- Goliath Magnet
- Calibration sources and radioprotection issues
- Report on Initial discussion on safety

Dedicated semi-permanent test beam

From the approved proposal:
"The collaboration would like to ask for the following resources and infrastructure at CERN:
[…] Access to irradiation and test beam facilities (including the possibility to keep "semi-permanent" setup). The collaboration foresees typically 2 annual test beam campaigns each of a few weeks duration."

Semi-permanent setup means that the detectors to be tested change every time, but RD51 members, also from outside CERN, can always find:

- Dedicated cables and gas pipes permanently lying in the zone
- Stable dedicated gas mixing racks in the gas zone
- Dedicated space, electronics racks, computers in the control room
- Devices such as trigger scintillator and tracking telescope, as well as support mechanics. They will be stored out of the beam line but in the experimental area or very close to it

2009 Specific test beam requirements

Requirements 2009:

- Dimension: around 60x60 cm^2 planar devices; weight: few kg devices
- *CF_4 and flammable gas mixtures*
- High resolution (better than 70μm) external tracker
- *Low or high rate beam, typically MIPS (pions preferred)*
- Mechanical Support allowing X-Y position and rotation
- *High Magnetic field, sometimes together with low energy beam*

Groups involved in summer time slot:

- CERN GDD Large Area GEM detector *(large support)*
- Frascati KLOE-2 GEM prototypes *(magnet, flammable gases)*

Groups involved in autumn time slot:

- CERN GDD Large Area GEM detector
- Paul Colas' Saclay group MicroMegas TPC *(magnet, low energy beam)*
- Stephane Aune's Saclay group MicroMegas *(magnet?, flammable gases?)*
- Bonn TPG *(high energy beam, magnet?)*
- *maybe Philippe Legou's Saclay group Micromegas (no info, no enough gas lines!!)*

Our time slots: updated to v3.0

PS Operation

Period 2 2009 Jun 4 to Jul 9

dule issue date: 14-April-2009 Version 3.0 (colour code: purple (dark) = scheduling meeting , light green (light) = weeken

	Thu 4 Jun	Fri 5 Jun	Sat 6 Jun	Sun 7 Jun	Mon 8 Wk23	Tue 9 Jun	Wed 10 Jun	Thu 11 Jun	Fri 12 Jun	Sat 13 Jun	Sun 14 Jun	Mon 15 Wk24	Tue 16 Jun	Wed 17 Jun	Thu 18 Jun	Fri 19 Jun	Sat 20 Jun	Sun 21 Jun	Mon 22 Wk25	Tue 23 Jun	Wed 24 Jun	Thu 25 Jun	Fri 26 Jun	Sat 27 Jun	Sun 28 Jun	Mon 29 Wk26	Tue 30 Jun	Wed 1 Jul	Thu 2 Jul	Fri 3 Jul	Sat 4 Jul	Sun 5 Jul	Mon 6 Wk27	Tu 7 Jul
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T2 -H2	NA61-TR											8h D Lazic CMS-HCAL																					
T2 -H4	NA63											8h M Mazziotta SITRD			8h M Mazziotta SITRD				8h M Alfonsi RD51														

PS Operation

Period 6 2009 Oct 22 to Nov 23

dule issue date: 14-April-2009 Version 3.0 (colour code: purple (dark) = scheduling meeting , lig

	Thu 22 Oct	Fri 23 Oct	Sat 24 Oct	Sun 25 Oct	Mon 26 Wk43	Tue 27 Oct	Wed 28 Oct	Thu 29 Oct	Fri 30 Oct	Sat 31 Oct	Sun 1 Nov	Mon 2 Wk44	Tue 3 Nov	Wed 4 Nov	Thu 5 Nov	Fri 6 Nov	Sat 7 Nov	Sun 8 Nov	Mon 9 Wk45	Tue 10 Nov	Wed 11 Nov	Thu 12 Nov	Fri 13 Nov	Sat 14 Nov	Sun 15 Nov
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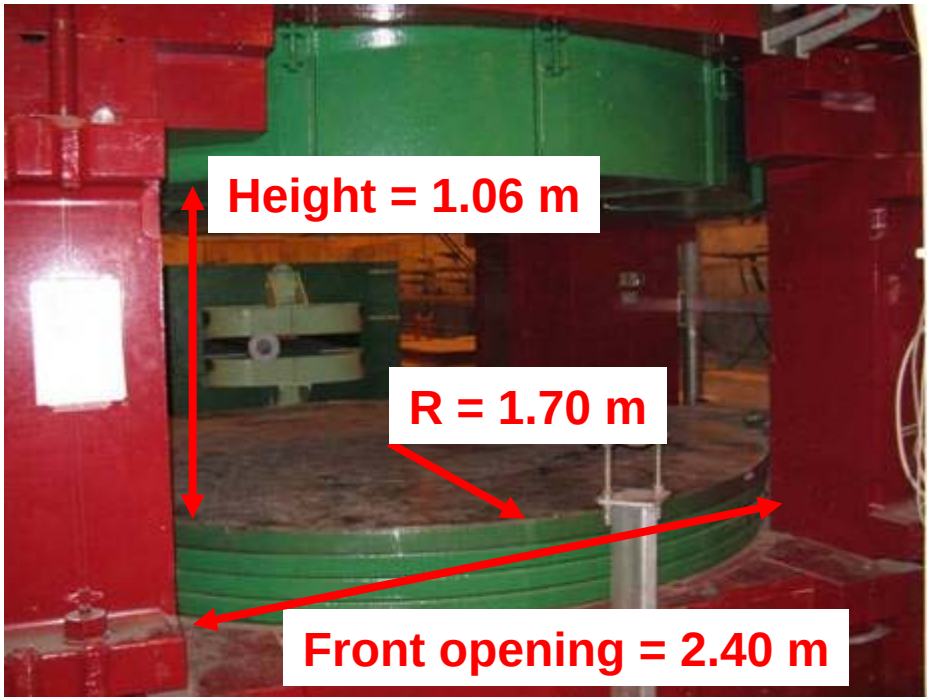
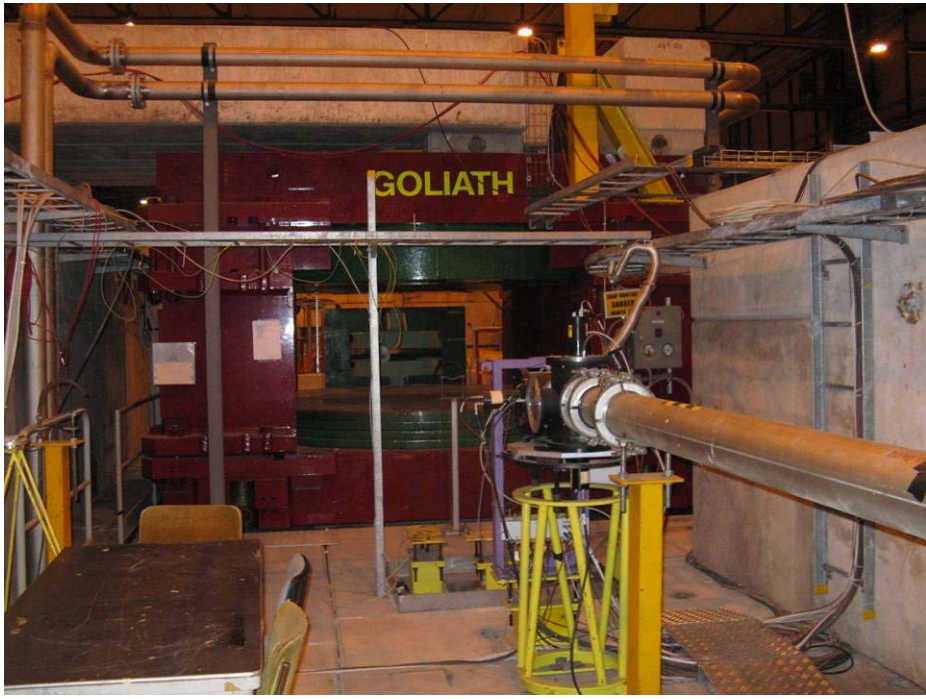
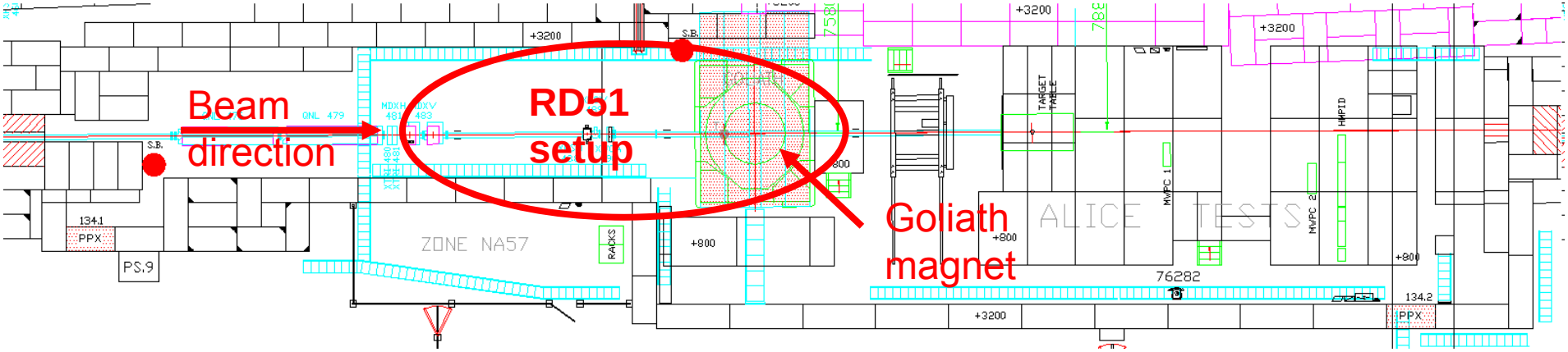
T2 -H4	8h M Alfonsi RD51											8h A Singovski CMS-ECAL							8h Y Itow						

SPS/H4 line at Prevessin North Area

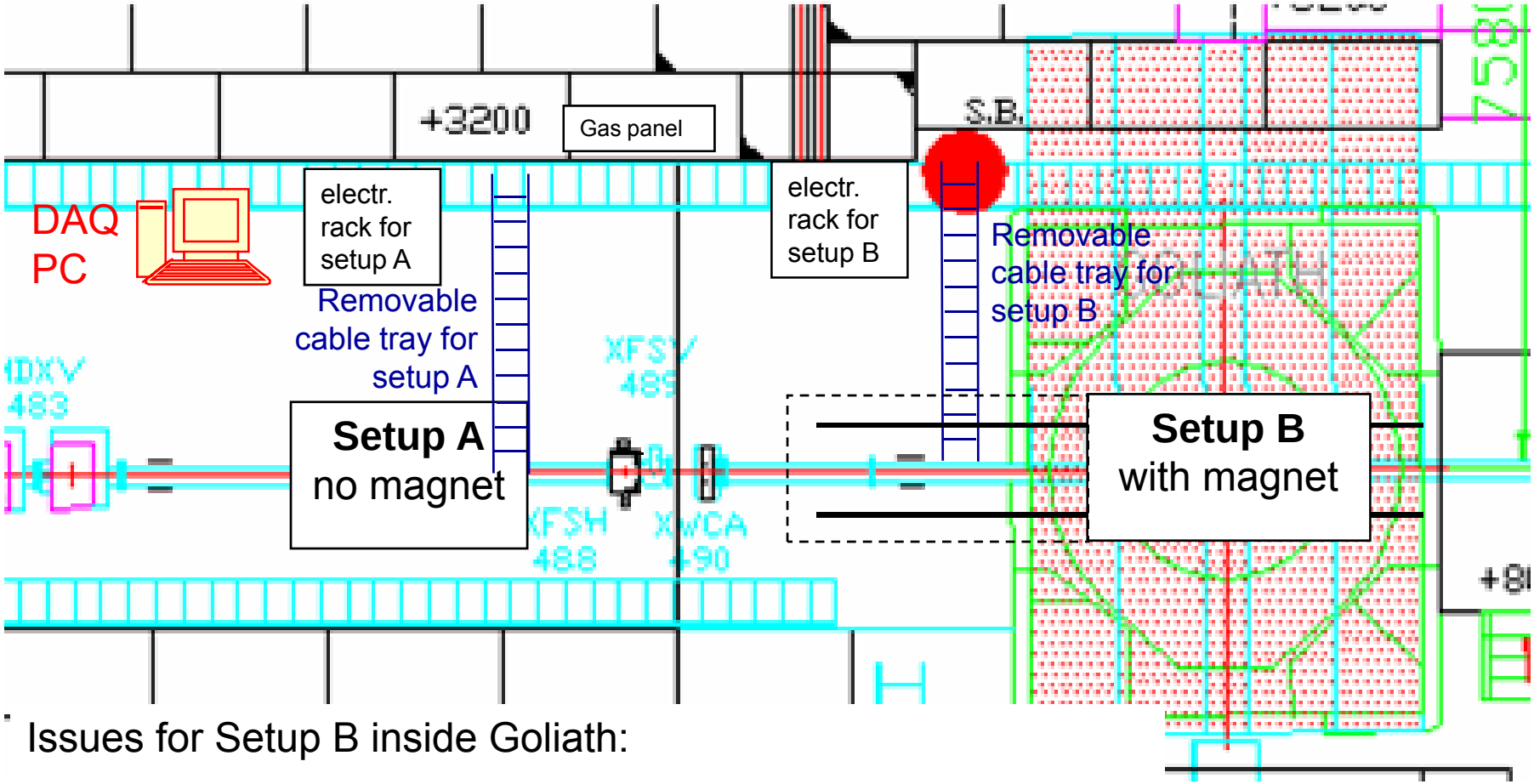






Setup and mechanics

The RD51 installation @ SPS/H4



Issues for Setup B inside Goliath:

- Electronics rack is in a region with a 5-10mT fringe field
- Cables lenght can arrive up to more than 8 m

Setup “A” outside the magnet

Placed upstream Goliath, composed by a table with precisely-positioned tracking elements and an external support for the case of very large *Detectors Under Test (DUTs)*

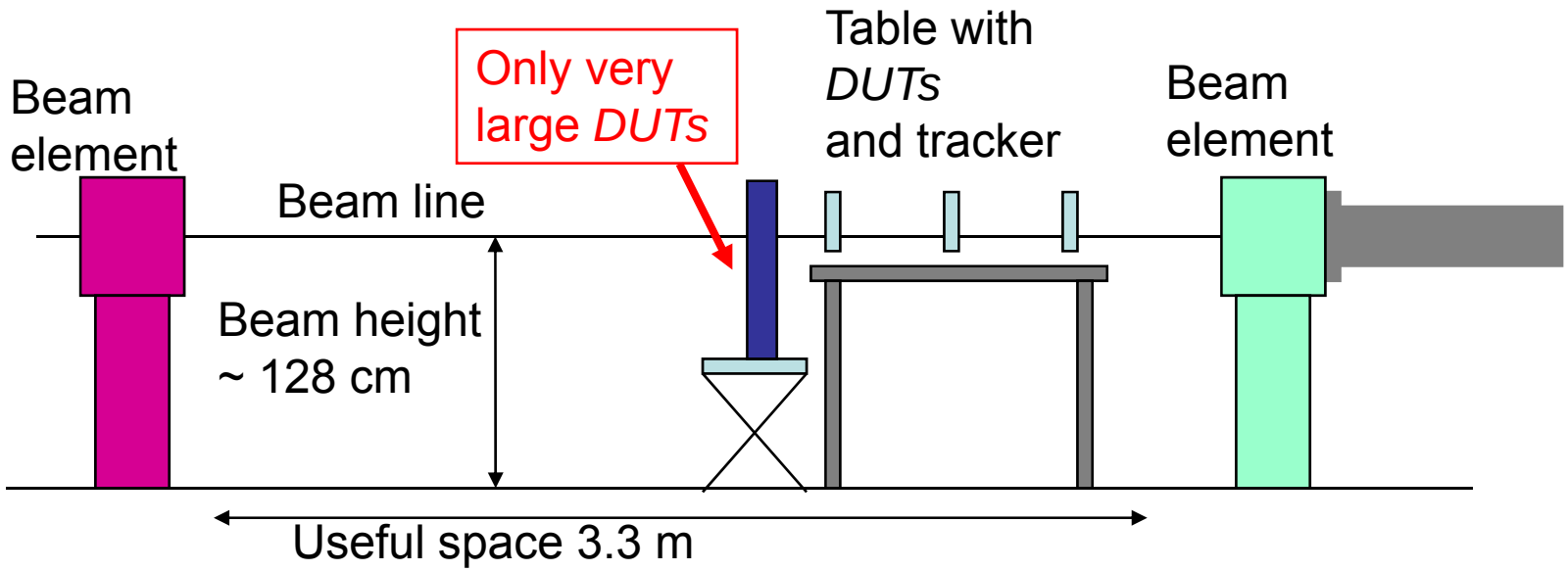
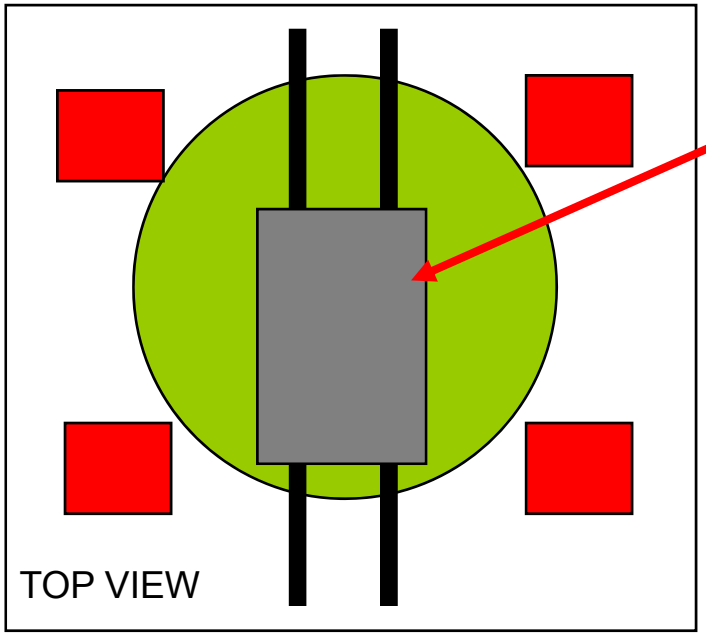


Table for setup “A”

- Dimensions: 80x120 cm^2 table, 70 cm height
- A grid of holes for fixation of high precision (optical bench-like) support for tracker and small *DUTs*
- Need help to complete it for June (maybe NTUA?)
- Suitable for small (20x20 cm^2), light (5 kg) tracking elements and *DUTs*
- In case of flammable gas, retention buckets can be added on the table (closing the fixation holes) and, in case, as a roof
- Moved out of beam on the side when not used, without dismounting the tracker

Setup “B” inside the magnet

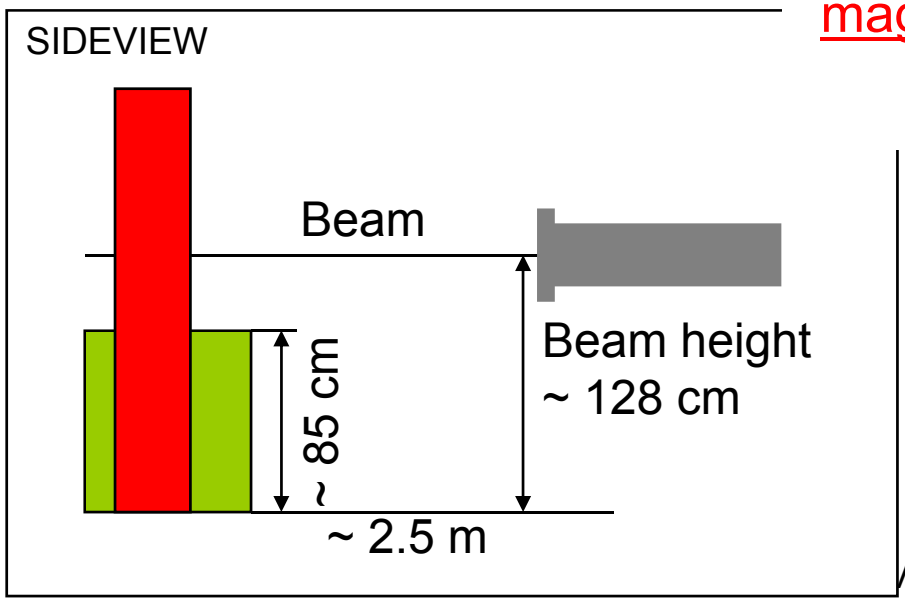


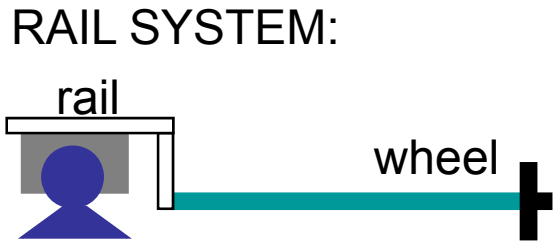
Similar table (see previous slide) mounted over rails

Rails will extend out of the magnet for about 1m, with two legs for support

Table will be moved out of the beam when not used. Rails will stay, if possible

More than 8m lenght for cable, to arrive from rack to the farthest part of the magnet, properly using cable trays

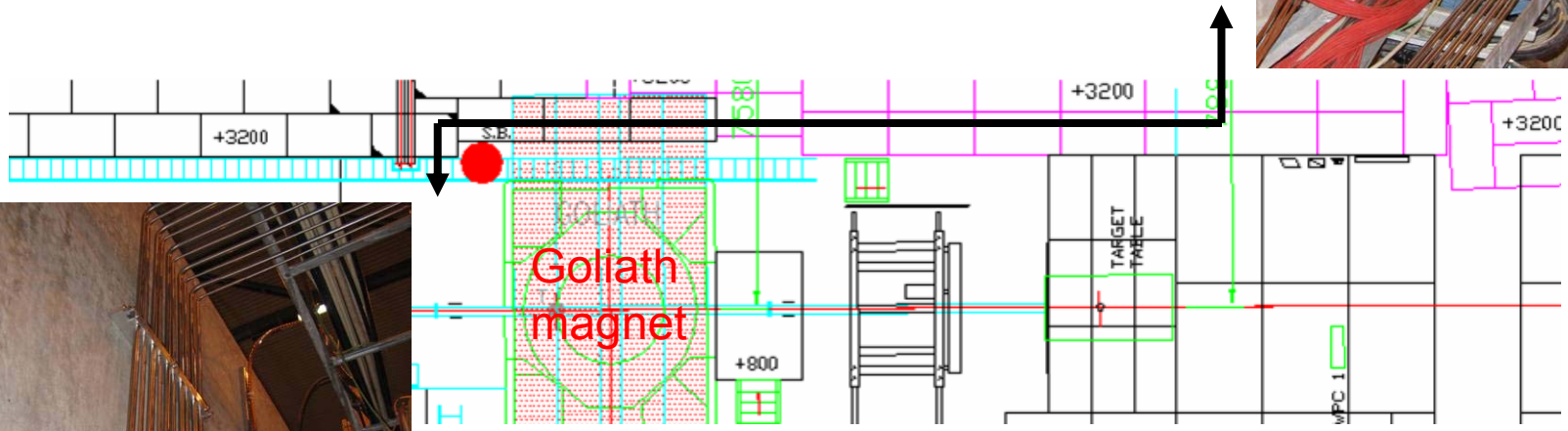


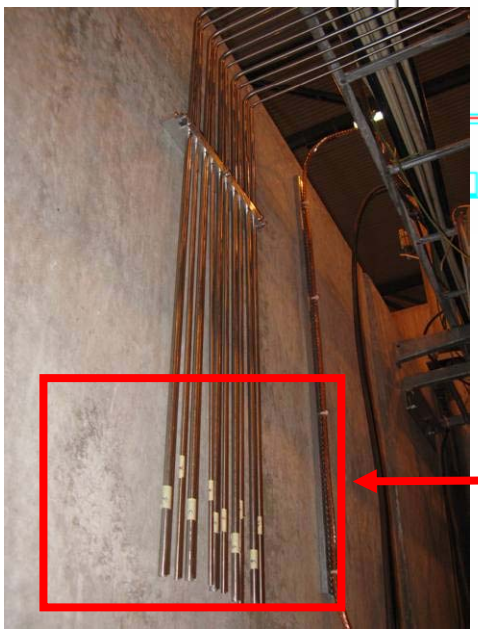


Gas system
and
cables

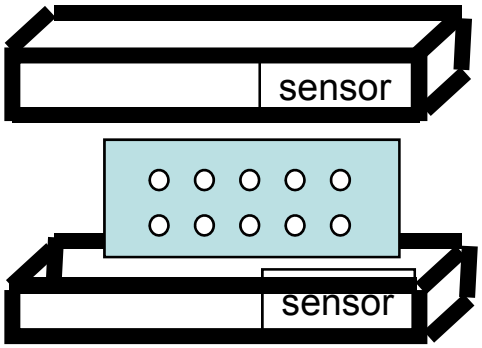
Gas Pipes

- **Stainless steel from gas zone to a patch panel in the experimental area**
- **Welded connections. Leak test this or next week.**
- **5 lines, each with 6mm diam. pipes for inlet and 10mm diam. pipes as exhaust**





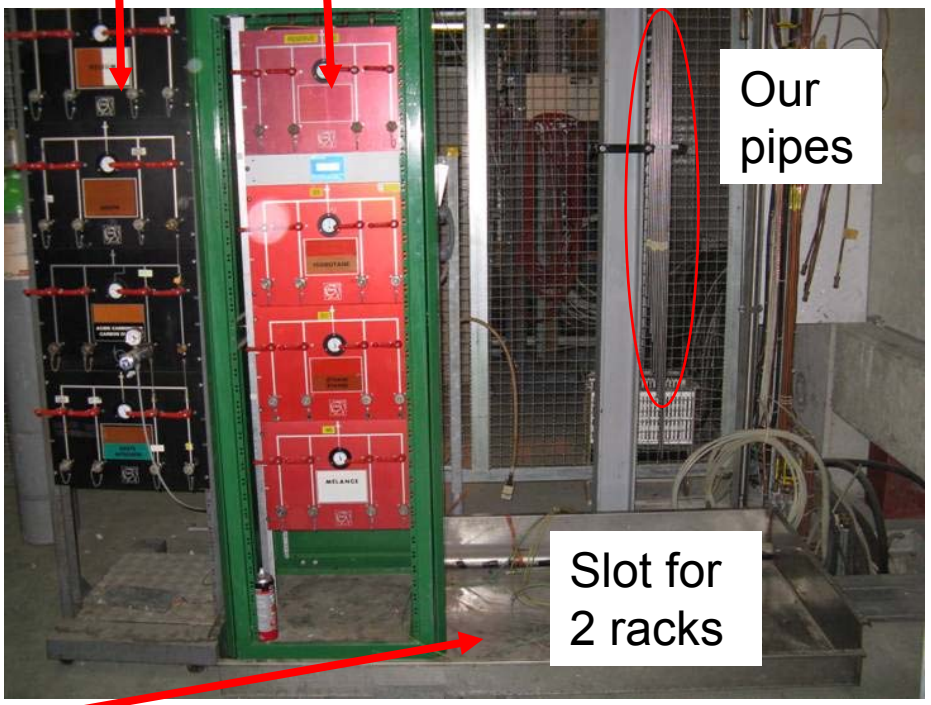
Gas panel includes also **retention buckets** for **flammable gas sensors.**



Gas mixing racks

- We can connect to the main distribution (Ar, CO_2, N_2, He, ethane, isobutan, CH_4, we pay the bill at the end!!!) as well as to use premixed bottle when possible
- 5 gas lines, requiring 5 gas mixing system (they can fit in 2-3 racks)
- They will be installed over years, using mostly premixed bottle in the first year
- Gas racks involving flammable gas and mixtures will be placed in retention buckets/huts with gas sensors
- Stainless steel flexible pipes could be used inside the racks.

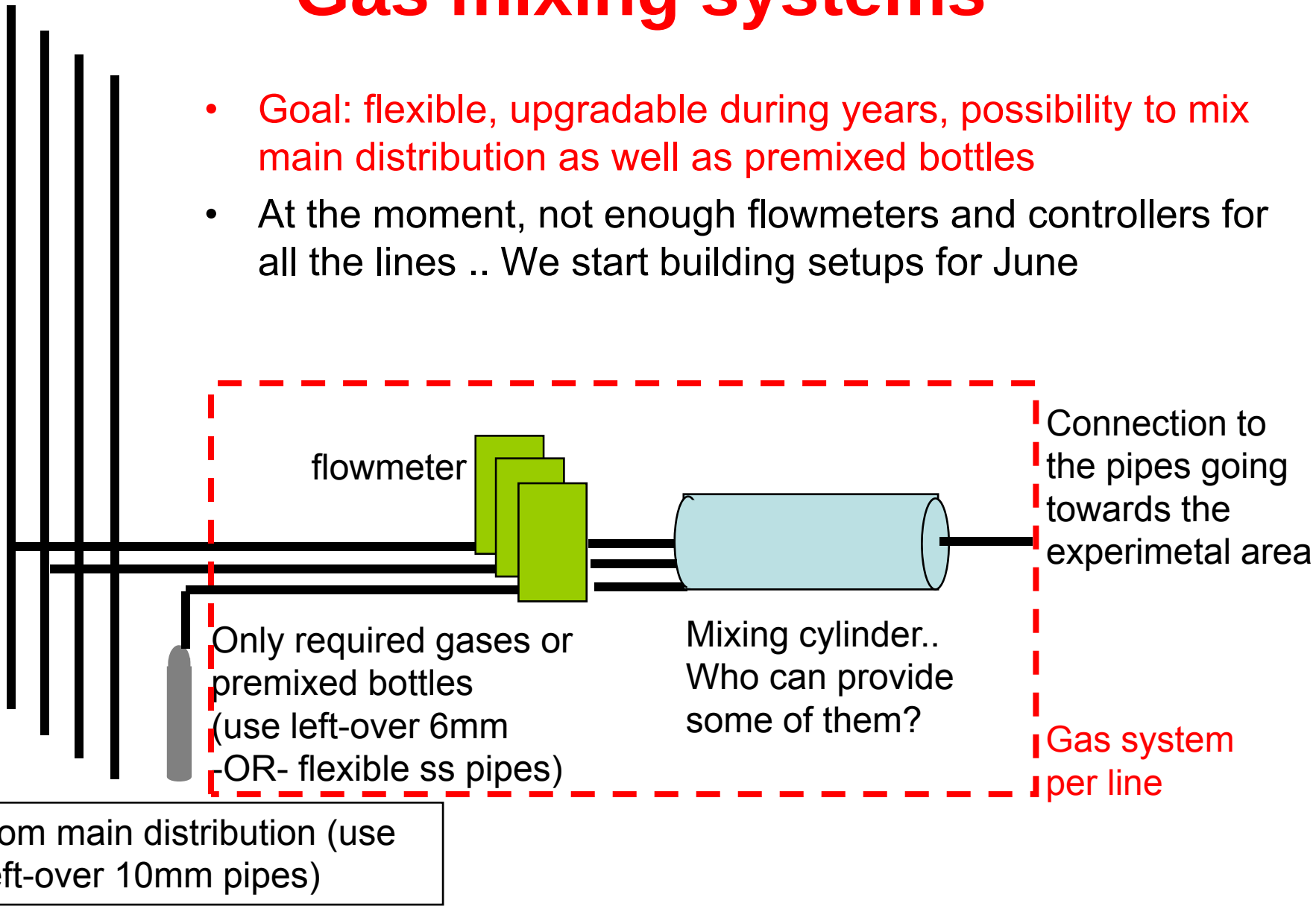
Main distribution:
not-flammable flammable



Retention bucket for heavy flammable gases

Gas mixing systems

- Goal: flexible, upgradable during years, possibility to mix main distribution as well as premixed bottles
- At the moment, not enough flowmeters and controllers for all the lines .. We start building setups for June



From gas panel to detectors

- Plastic pipes from gas panel to detectors (up to 10m)
- Retention buckets/huts as well as gas sensors will be applied on the setup table, in case of flammable gases

⚠ *Lack of flammable gas problem: discussing with SPS people it seems they can provide us enough sensors (to be confirmed)*

Cables list (barrack → area)

Material available for installation (this or next week)

— Fiber line x1 (from NTUA)

— Ethernet lines x3 + 2 small switches at both sides

— SHV lines x4

Still missing:

— Other fiber lines for October

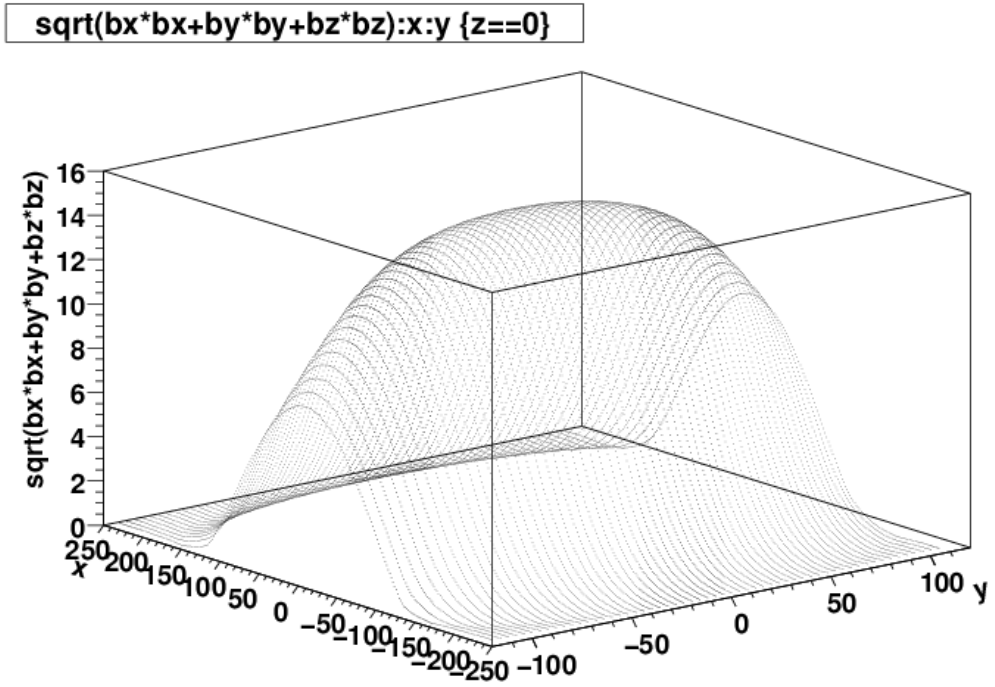
— Few BNC or LEMO coaxial cables

Goliath magnet

Specification and field map from NA57

Power: about 2MW
Maximum field: 1.4T
Gap volume: around 8 m^3
Max. water pressure: 10 bar

- Looking at the map realized during NA57 experiment, the field seems to drop fast when approaching the border.



Field map realized during NA57 experiment, file decoded by Frascati group

Magnet test week

- Field measurements for safety:
  - All the experimental has a fringe field larger than 0.5mT → entrance of people with peacemakers or other sensitive devices is STRICTLY FORBIDDEN
  - A 10mT (limit for public) border around the magnet has been defined. People working in the Setup B should comunicate the names to the medical service and must be informed of the risks connected to the activity
  - The field is larger than 200mT already at the coils. Long time full immersion in such magnetic field is not allowed
- Confirmation of NA57 field map (see Danilo's presentation)
- Electronics crate compatibility: e-pool rented standard NIM crate didn't show any problem up to 5mT

Radioprotection issues

- Small calibration source (^{55}Fe and ^{90}Sr) will be used and a safe locked container has been placed in the area:
  - When the beam is on, the MUST BE LOCKED IN THE SAFE
  - They cannot be used in the magnetic field before that proper precautions have been taken (any action must be discussed)

⚠ Interaction of the beam with magnetic field:

- Deflected beam can go out of the actual dump in bad combinations of magnetic field and beam energy
- Beam energy and magnetic field are controlled separately, without interlocks to these bad combinations

➢ We ask for an additional temporary larger dump during our operation

Report on ISIEC meeting on April 21th

- No problem with the general setup, but the specific setup must be discussed every time.

  → A clear idea of the setup in the year before, when collecting beam time requests, can make this check faster

- Running procedure must be defined, especially for the use of the magnet (access without magnetic field is preferred, switching on/off or changing current value with the beam off is preferred, etc etc)

- At least a subset of the users must be trained to the specific risks and the relative procedure (especially for the magnet)

  → this allow to organize shifts with experts all the time

Conclusions

- RD51 collaboration is installing a semi-permanent test beam at SPS/H4 beam line, where services and infrastructure will stay permanent, and Detectors Under Test will change from time to time
- The installation of gas pipes, cables and network infrastructure for 2009 is early completed
- Need to rush and obtain some help for mechanics
- Safety aspects are under control

Backup slides

Electrical hazards for 2009

HIGH VOLTAGE (>1KV)					
Detector type	Voltage	Current	Stored Energy	No of HV Channels	Remote shut-off?
Tracking MM	2kV	700nA	< 0.01 J	2 x 6	yes
LNF GEM	6kV	10μA	< 0.01 J	7 x 3	yes
CERN GEM	5kV	2μA	< 0.01 J	2	yes
GEM TPC	20kV	25μA	< 0.01 J	1	yes
MM TPC	8kV	8μA	< 0.01 J	2	yes

- Most of the power supplies (e.g. CAEN SY1527) placed in the experimental area and remotely controlled
- NO short-circuit current greater than 5mA at voltages higher than 50V
- NO special ground requirements
- Power consumption: less than 30W each detector
  around 10kV each electronics rack
  2 rack in the experimental area
  2 rack in the barrack

Flammable gas mixtures for 2009

Device type	Fluid 1 +% Fluid 2 etc	Volume	Abs. Press.	Max Flow
Tracking micromegas	Ar, CO2, CF4, isobutane (2%) non-flammable mixture	6 detectors, 6000cm3 total	atmosheric + few mbars	9.5 l / hour
LNF GEM detectors Inside magnet!	Ar, CO2, He, isobutane (10%) flammable mixture	3 detectors, 2000cm3 total	atmosheric + few mbars	12 l / hour
CERN GEM detectors	Ar/CO2 70/30	2000cm3	atmosheric + few mbars	10 l / hour
Bonn GEM TPC Inside magnet!	Ar, CO2, CH4 (20%) flammable mixture	16 l	atmosheric + few mbars	40 l / hour
Saclay Micromegas TPC Inside magnet!	Ar 92% / CF4 3% / isobutane 5% (flammable)	30 l	atmosheric + few mbars	40 l / hour

- Small to moderate gas volumes, low gas flow
- All leak-controlled devices (gas leak reduces also detector performance)
- Mostly isobutanic gas mixtures (heavy gas), but also methane (light gas)
- Flammable gases in magnetic field *(can alarm sensor work there?)*