Status of the GIF++ User Infrastructure

D.Boscherini (INFN Bologna)
on behalf of the WP8.5.3 group

Outline:

- Introduction to GIF++
- Review of the status of the user infrastructure items (beam and cosmic trackers, controls and DAQ)

WP8 2nd Annual Meeting - Frascati, 10-12 Apr 2012

Participating institutes

- *Bulgaria:* INRNE
- *Greece:* NTUA, AUTh, Demokritos, NCUA
- *Israel:* Weizmann, Technion
- *Italy:* INFN-Bari, -Bologna, -LNF, -Naples, -Rome2

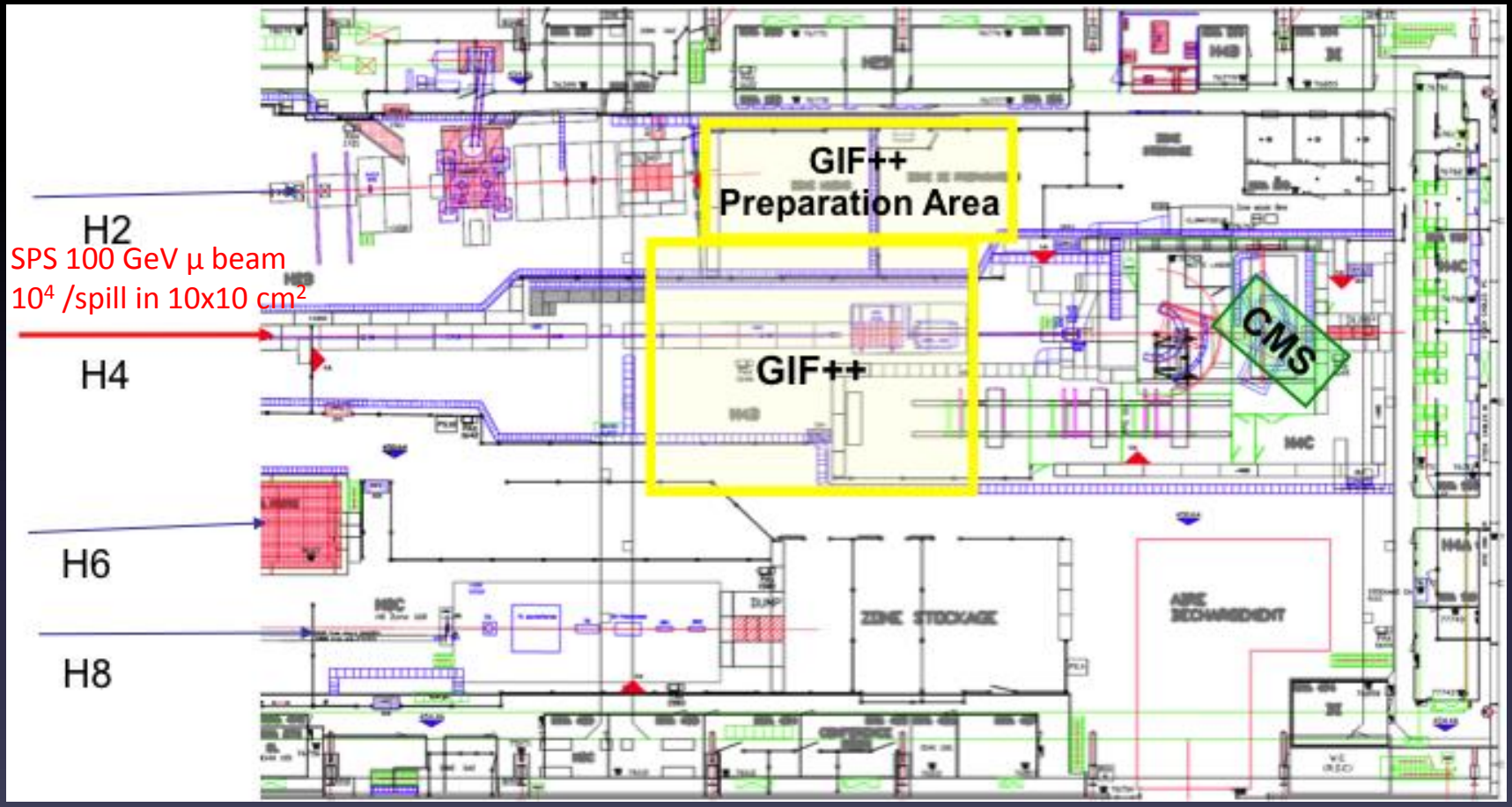
CERN activity, with a dedicated GIF++ team, increased a lot since last year

→ strong boost toward the facility realization

M. Capeans
I. Efthymiopoulos
A. Fabich
C. Fortin
S. Girod
R. Guida
D. Haasler
G. Maire
D. Pfeiffer
F. Ravotti

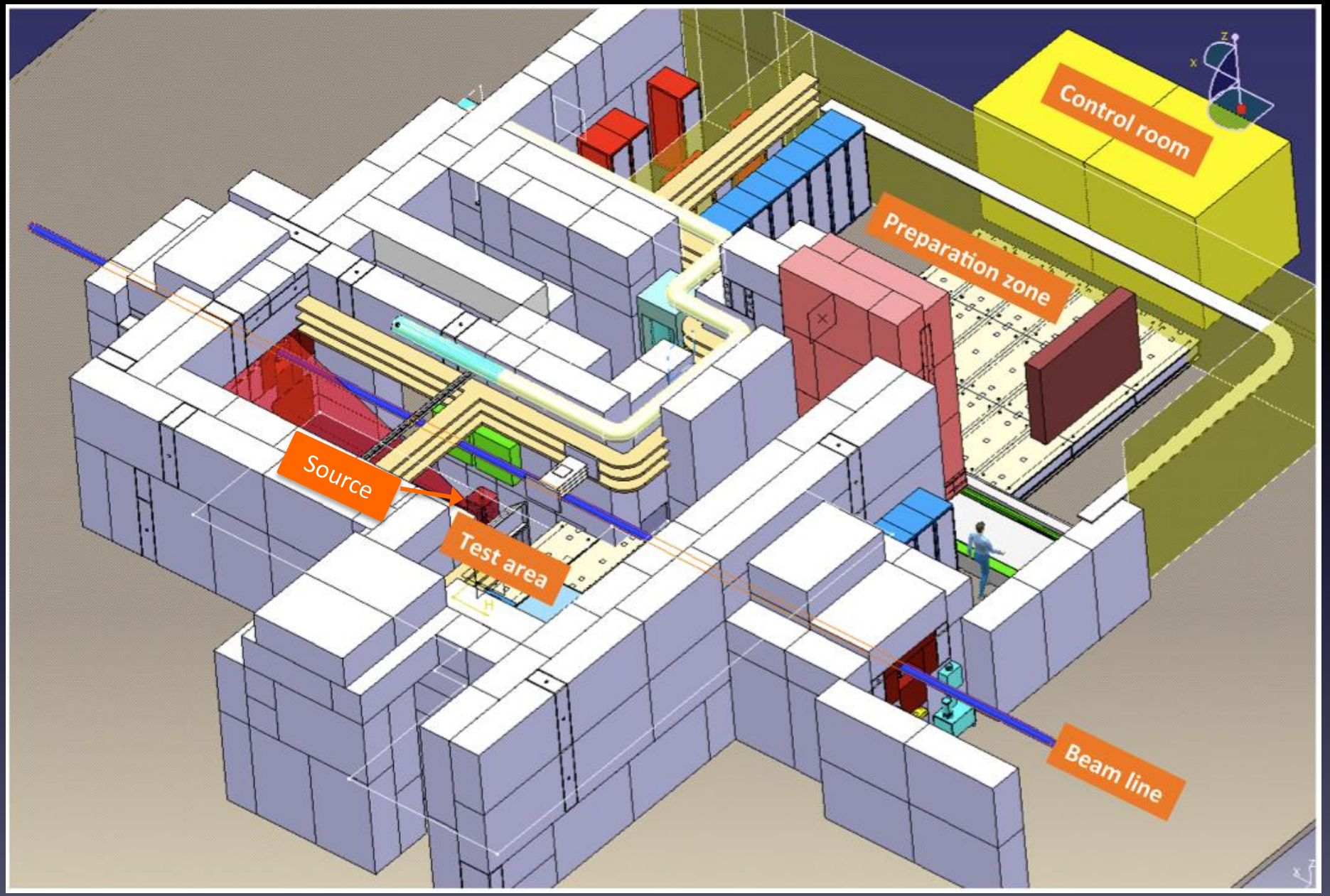
+ H. Reithler (Aachen)

The new Gamma Irradiation Facility (GIF++)



The facility will be realized along the H4 beam line at the CERN Prevessin site …

GIF++ bunker



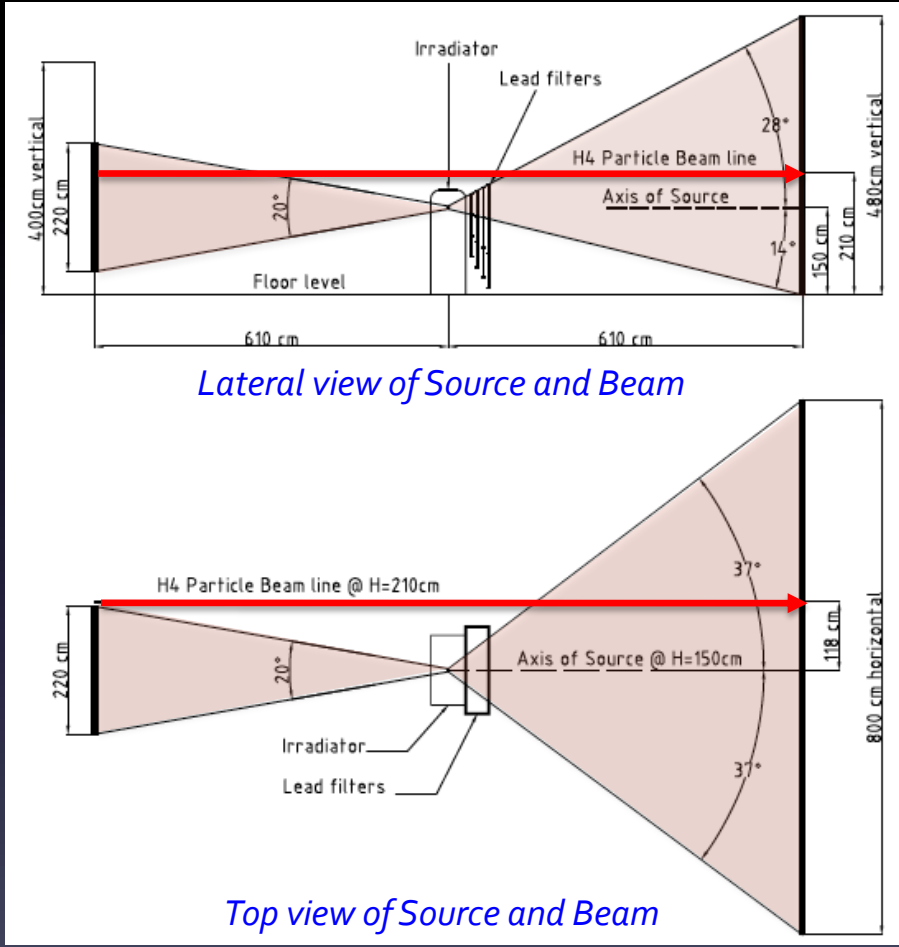
… and will cover an area of 170m^2 (~2 x GIF)

GIF++ Specifications

- **Source**
  - ^{137}Cs, 16.65 TBq
  - Up to ~3 Gy/h at a distance of 50 cm
  - 662 keV photons
  - 30 y isotope half-life

Max. expected doses at sLHC	Equivalent time at GIF++ (~ 50 cm from source)
Si-trackers: ~ MGy/y	>> years
Calorimeters: ~ 20 kGy/y	< 1 year
Muon systems: ~ 0.1 Gy/y	~ minutes

- **Particle Beam**
  - EHN1 location in the SPS H4 beam
  - 100 GeV muons
  - 10^4 particles per spill traversing 10x10 cm^2
  - available ~6-8 weeks/y (in 2-week periods)
  - parasitic beam available ~6-8 weeks/y

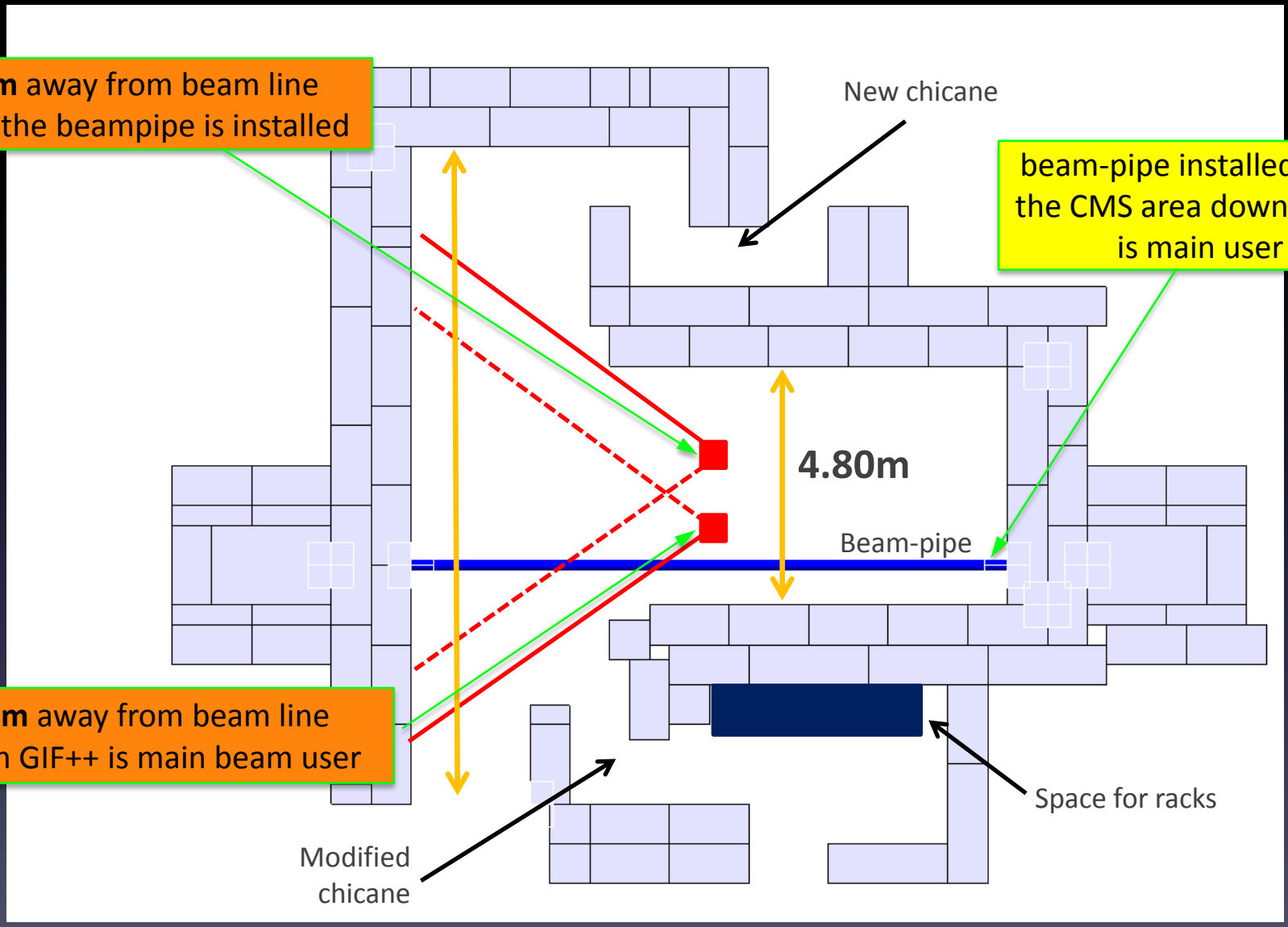


Lateral view of Source and Beam

Top view of Source and Beam

Source positions

D.Haasler



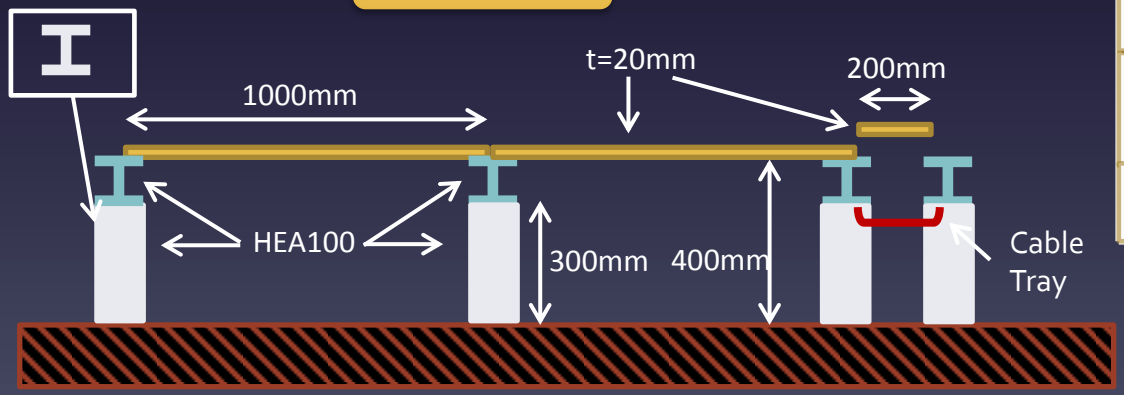
False Floor: GIF Implementation

D.Haasler

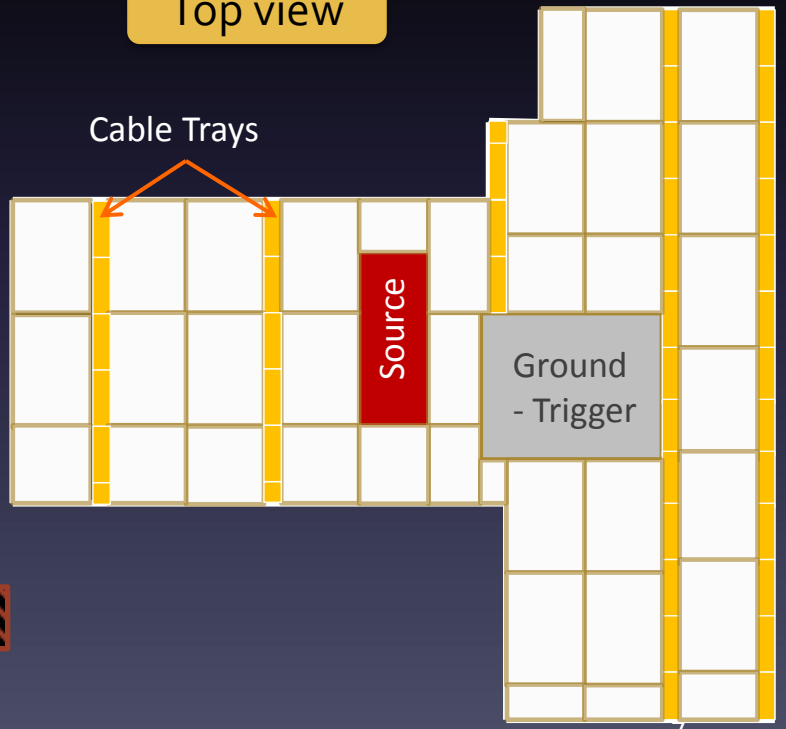
- Design for a maximum weight of **8t**
- Distributed to 4 feet (**2t each**)
- With a footprint of A=100x100mm^2 per foot
- Distance between two feet equal or greater than 1m

Use of the support structure from the standard CERN false floor
- But cover plates made of steel, with t=20mm

Side view



Top view



Filter system

H.Reithler

Main features:
- vary the photon rate, by remote control
- ensure uniform photon rate over wide planar areas

24 different attenuation factors in a range 1 to 50,000
~equally spaced in log-scale

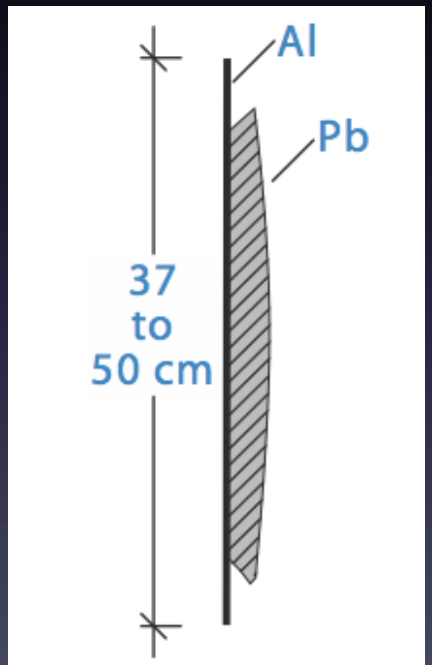


Fig. 1: Cross-section of a lead filter.

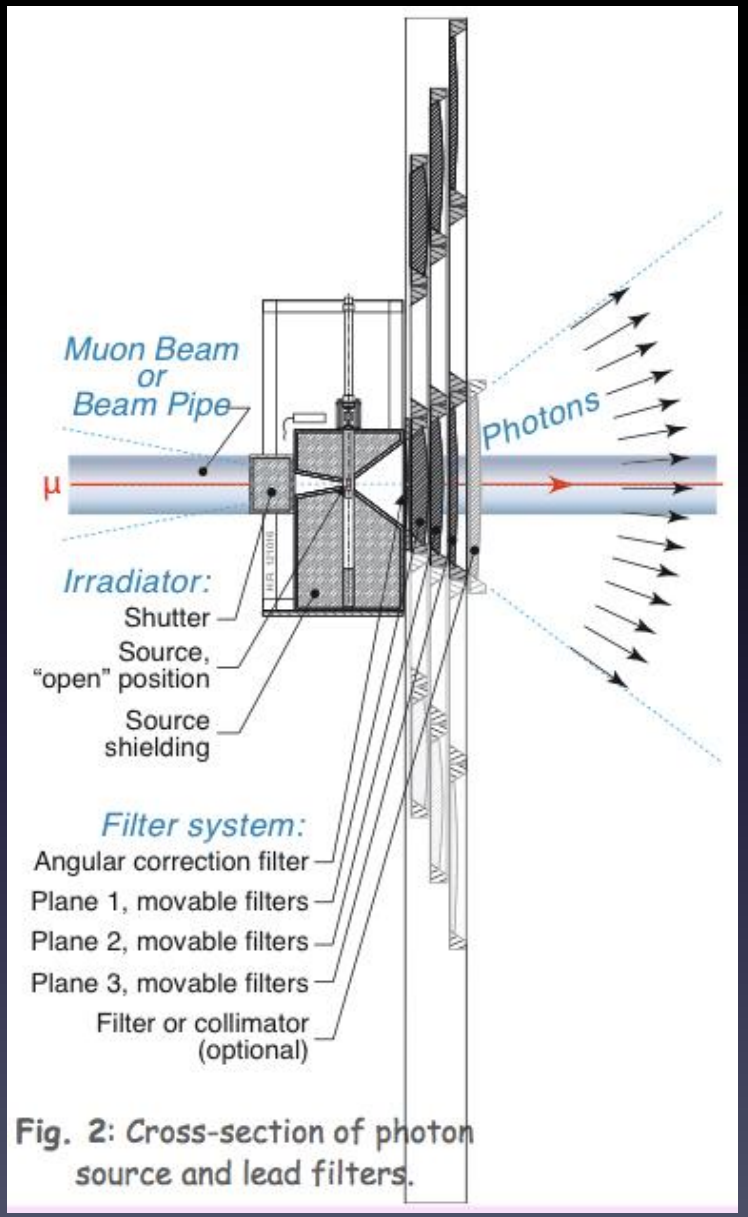


Fig. 2: Cross-section of photon source and lead filters.

User Interface

Project items

- Precise muon tracking set-up
- Large area cosmic ray set-up
- Detector Control System
- DAQ
- *System for active gamma dose measurements*
- *System of environmental sensors*

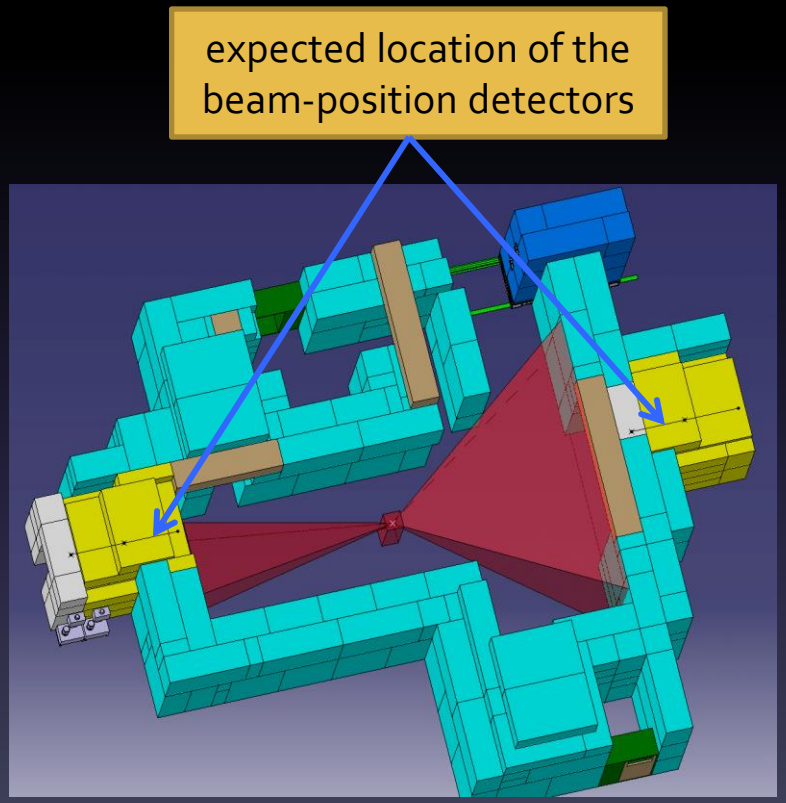
next talk by P.Iaydjiev

Sharing of responsibilities in WP 8.5.3

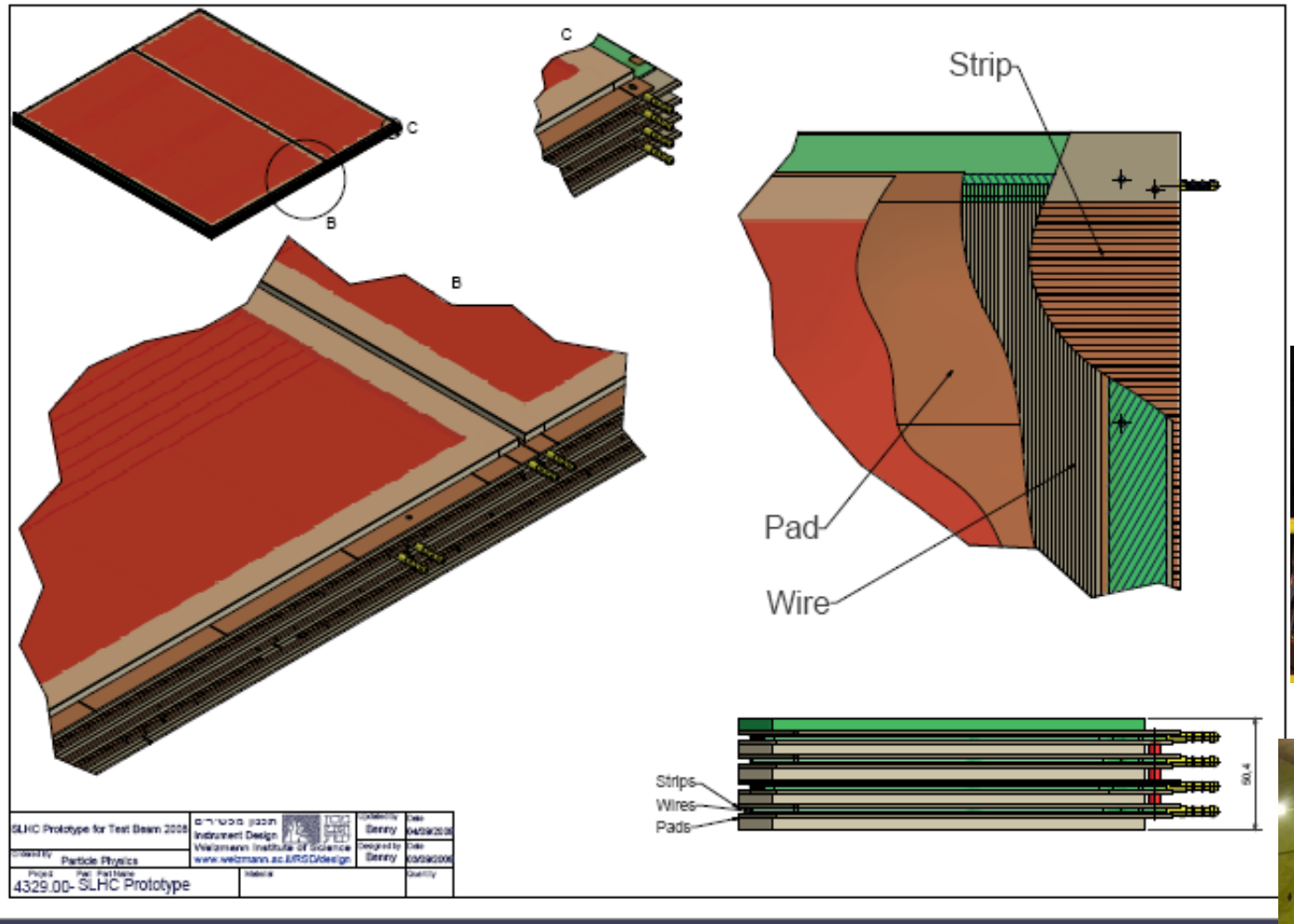
Item	Sub-item	Institute in charge	Responsible	Comment
Cosmic tracker set-up	Detector	INFN-BO INFN-RM2	G.Aielli	
	Front-end electronics	INFN-RM2	R.Cardarelli	
	Power-supplies + cables	INFN-NA INRNE	S.Buontempo	LV -> INFN-NA HV -> INRNE
	Gas system	INFN-BA INFN-LNF	S.Bianco	
	DCS	INFN-BO INFN-RM2	A.Polini	
Beam tracker set-up	Detector + mechanics + cables	Weizmann	G.Mikenberg	
	Front-end electronics	Technion Weizmann	S.Tarem	
	Gas system	Technion Weizmann	G.Mikenberg	
	DCS	Technion	S.Tarem	
DCS		INFN-BO NTUA Technion	A.Polini	
DAQ		Weizmann	D.Lellouch	
Environmental sensors		INFN-LNF INFN-NA	S.Bianco	
Radiation sensors		INFN-BA INRNE	P.Iaydjiev	

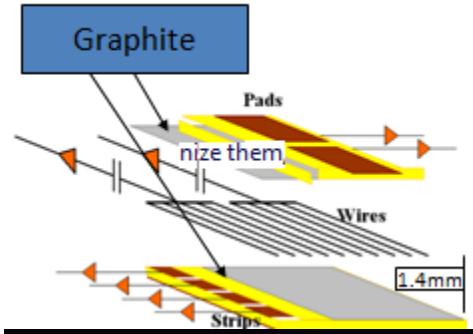
Beam Tracker detectors for GIF++

- Technology used: **Thin Gap Chambers**
- 2 quadruplets ready since last year
- Their position and angular resolution were determined by comparing with a small tube MDT in tests at H8:
  - angular resolution: ~0.3 mRad
  - position resolution: ~65 µm
- electronics to equip the full detector being developed



Two quadruplets constructed (60x40cm²) with strips, wires and pads in each gap



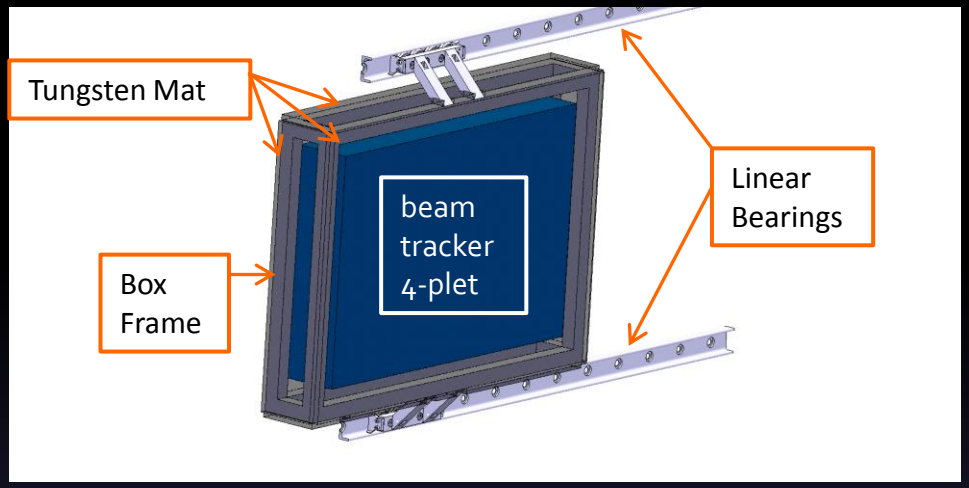


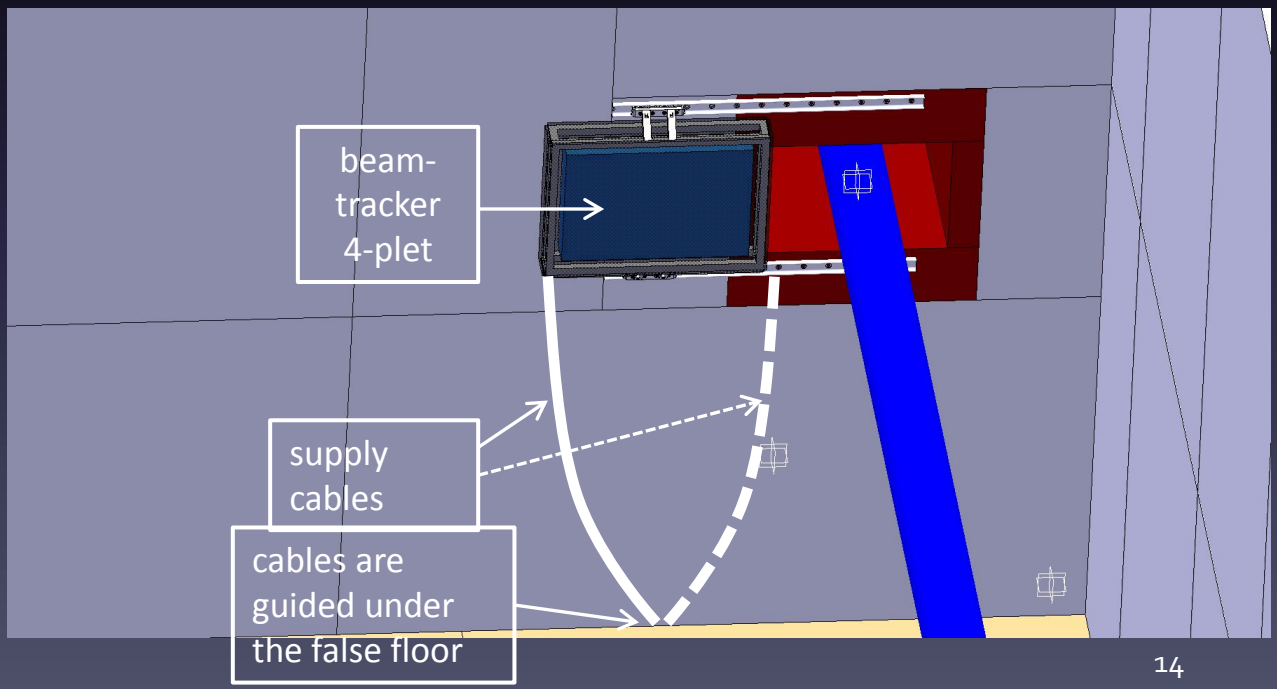
Combined pad with digital info from strips for trigger

- Proposed arrangement of individual gaps, showing the strips, wires and pads, as well as the staggering of layers
- One multilayer of 4 gas gaps fits into 50mm

Implementation into Bunker

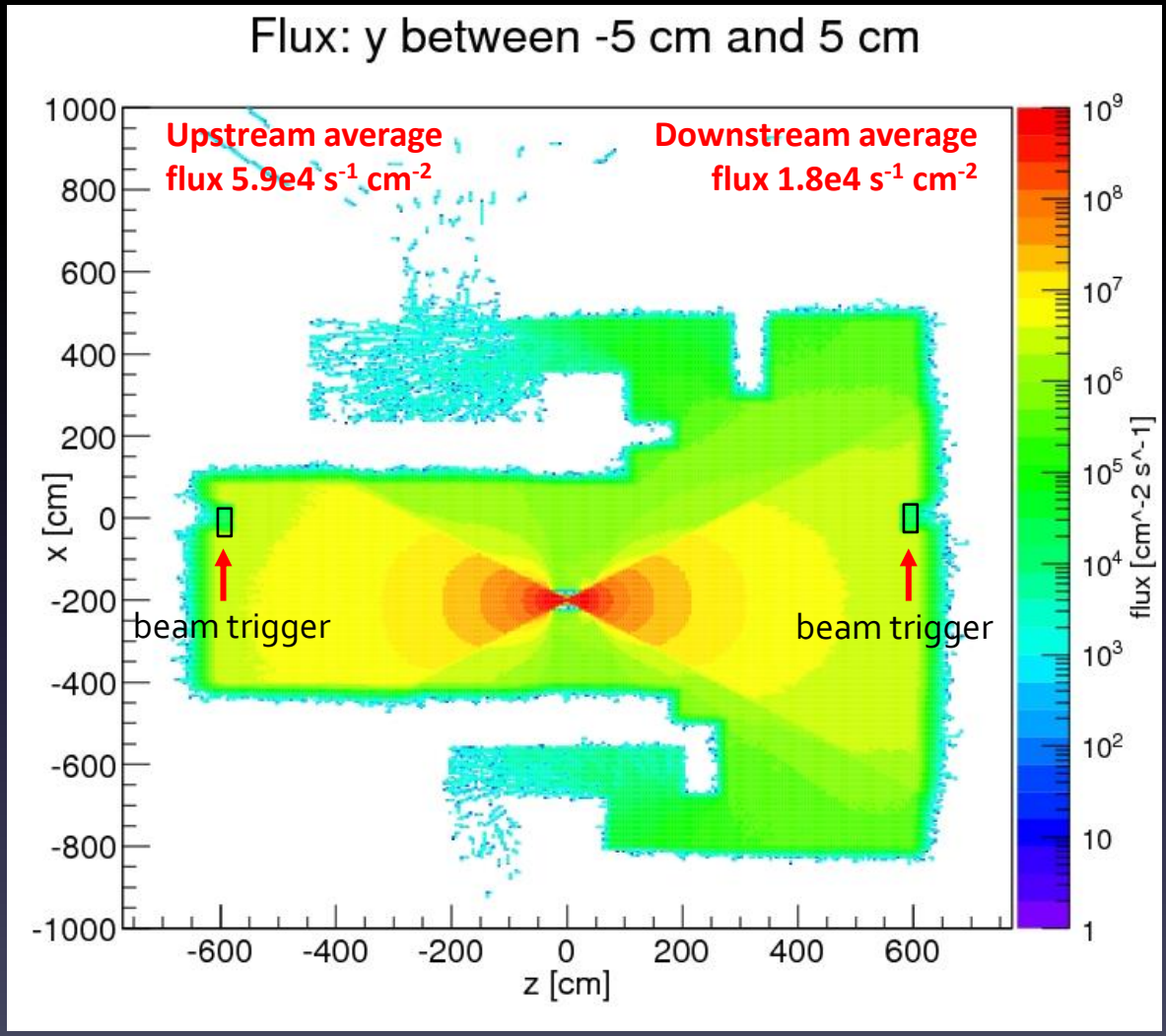
D.Haasler





Expected photon flux in beam tracker

D.Pfeiffer

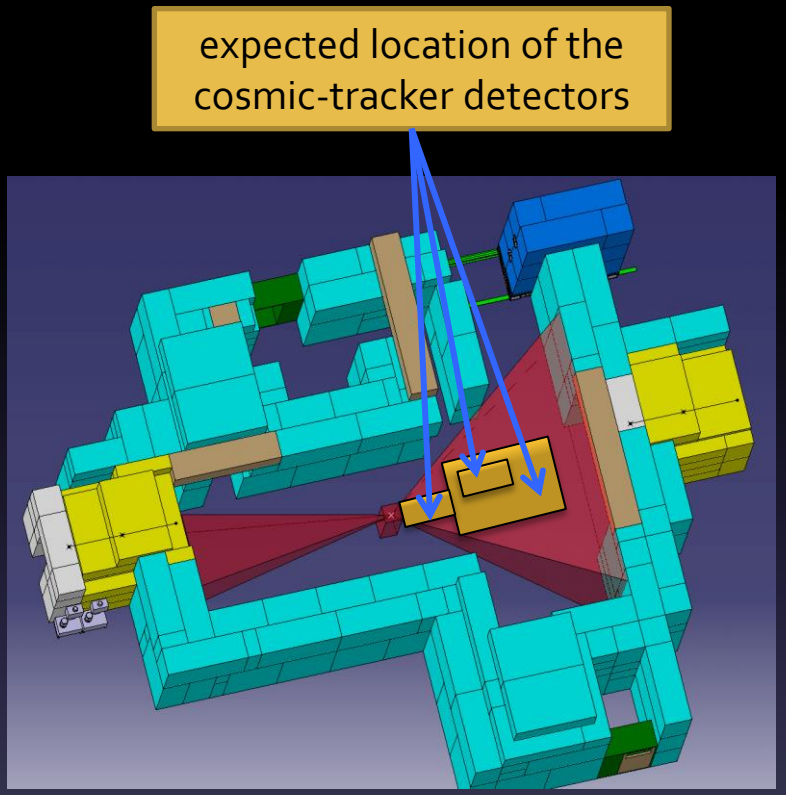


Tracker shielded by
5mm Tungsten plates

Shielding thickness will
be increased to 10mm
to reduce the rates at ~10kHz/cm^2

Cosmic Tracker detectors for GIF++

- Needed to ensure test operation when no beam is available (large part of the year) covering a large area to accommodate several users
- Setup with a small size tracker faced to a large protected confirm plane (reduce number of readout channels)
- Excellent time resolution to simplify triggering
- Sustain high rates: ~20kHz/cm^2
- Technology used: **Resistive Plate Chambers**



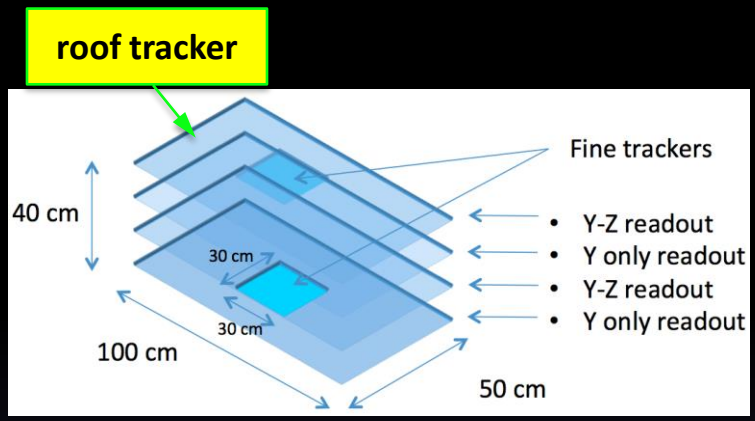
Cosmic tracker setup

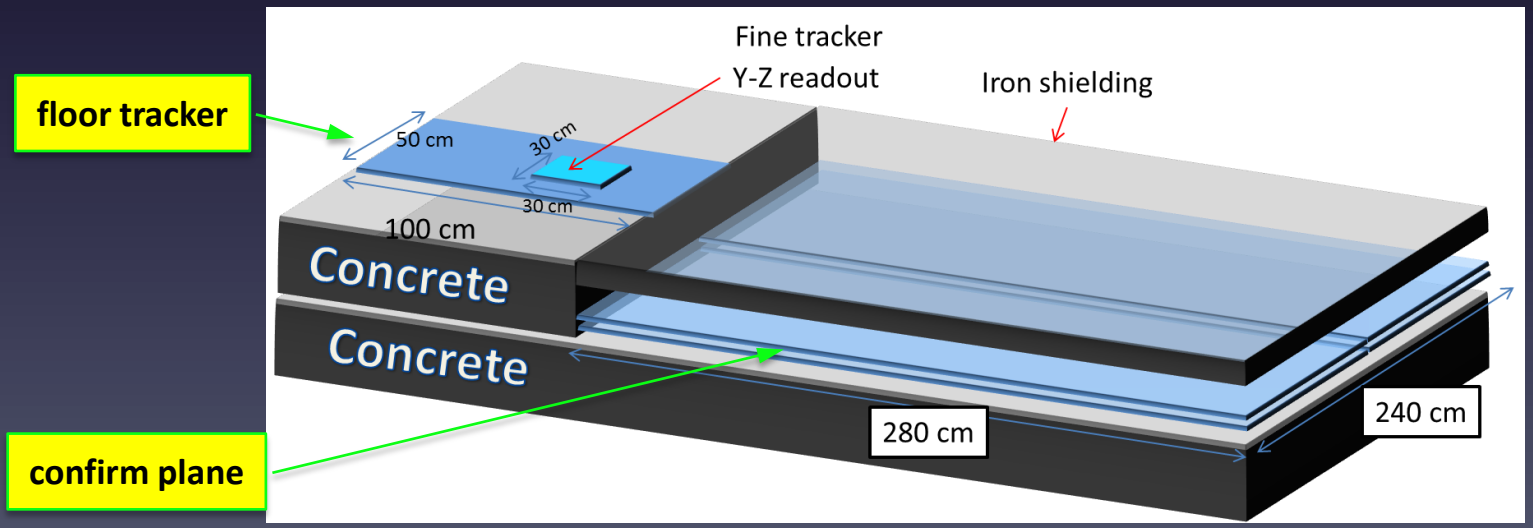
Layout:

- roof tracking trigger→ 100x50 cm^2 four layers xy readout
  ~3 cm pitch strips→ 100 channels
- large confirm plane under the floor → 240x220 cm^2 xy coord
  ~4 cm pitch strips→ 300 channels
- floor tracker → 100x50 cm^2 doublet xy coord
  ~3 cm pitch strips→ 100 channels
- fine trackers → 30x30 cm^2, xy coord, 1 cm pitch strips

Readout system:

- digital pattern for the big chamber, analog readout for small trackers (time+charge) or part of them





Expected photon flux in cosmic tracker

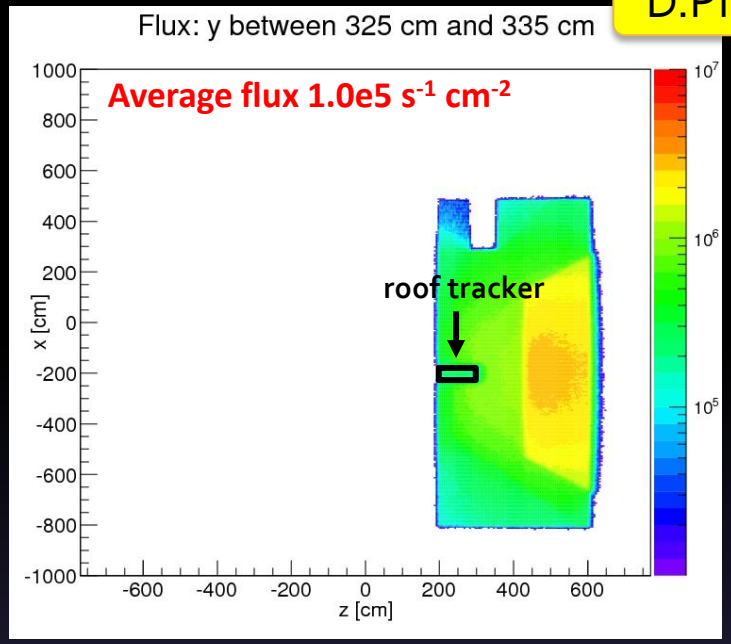
D.Pfeiffer

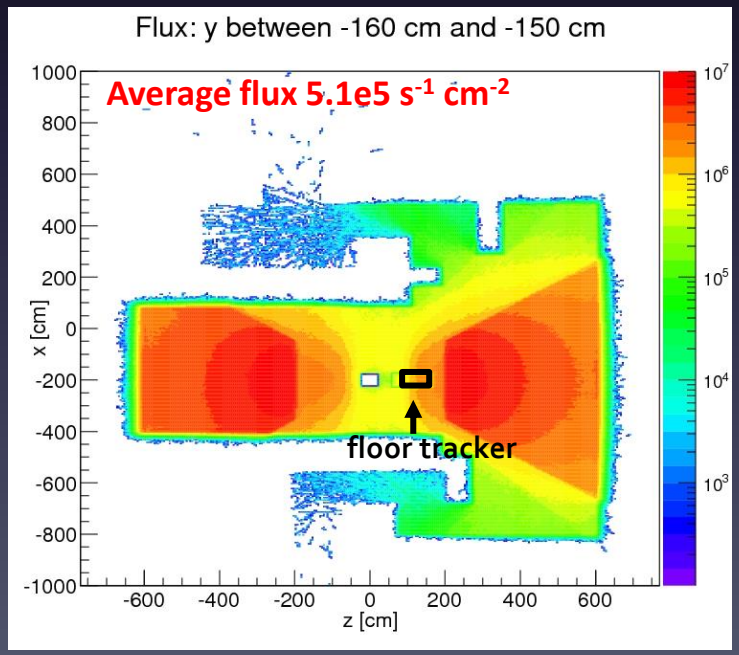
Shielding applied:

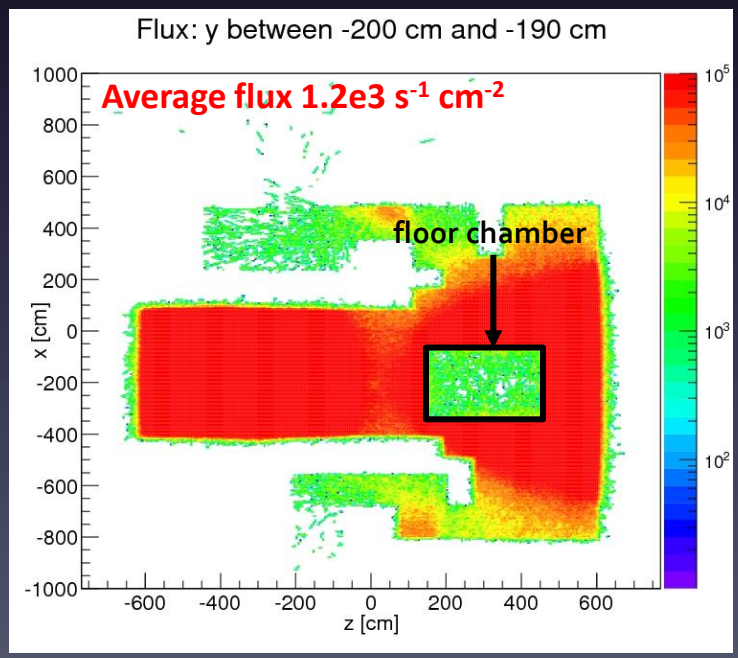
- roof and floor trackers with 4cm steel along the detector perimeter
- floor confirm chamber with 17cm steel above the whole surface

Considering an RPC sensitivity to photons <10^{-2}, the rates are tolerable for roof tracker and floor chamber

On the floor tracker a thin additional shielding could be required







DCS for GIF++

Requirements

- control of beam and cosmic trackers
- control of detectors under test
- gathering data from sensors for monitoring of radiation, gas and environmental parameters

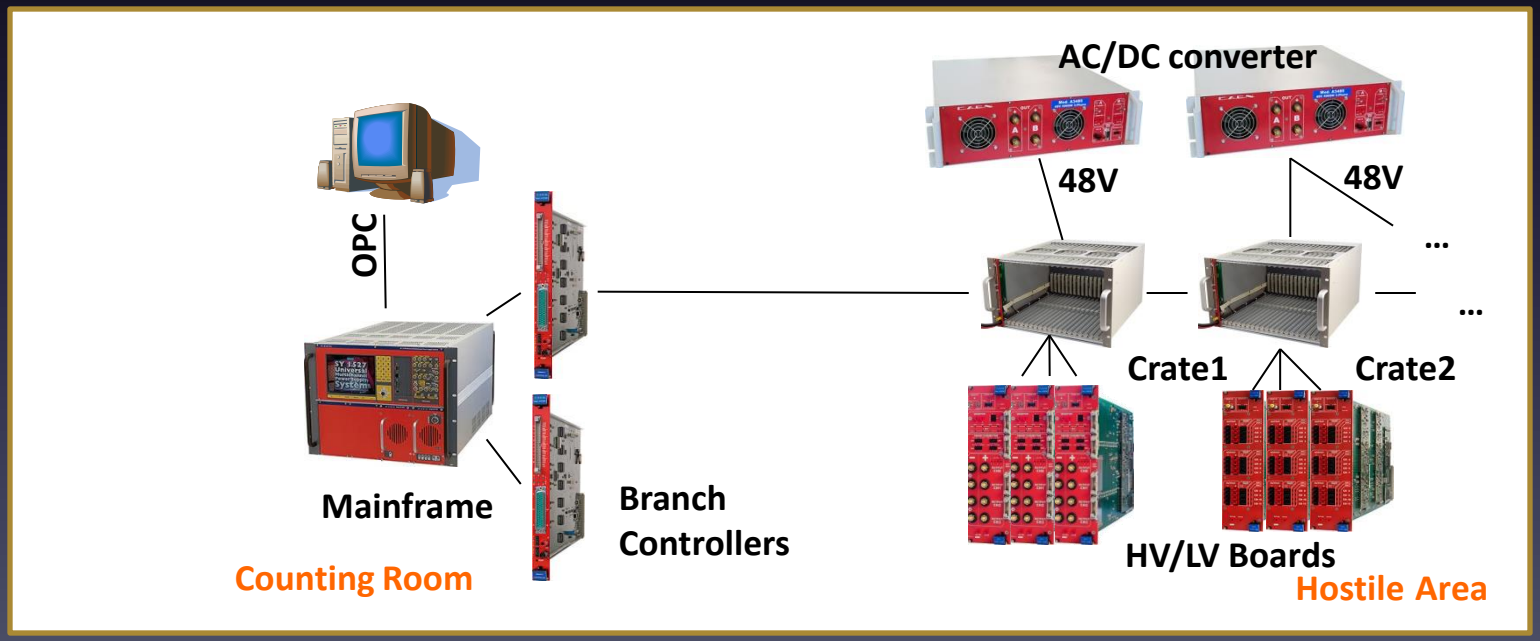
Choice of HW/SW largely in use at CERN

- CAEN EASY, CAN controlled LV equipment
- SW PVSS/WinCC (as in LHC experiments)
- many components, devices, HW and SW already available
  (CAEN System, CAN PSU, ELMB, ENV Sensors, VME crates, etc)

GIF++ DCS Architecture

Baseline system:

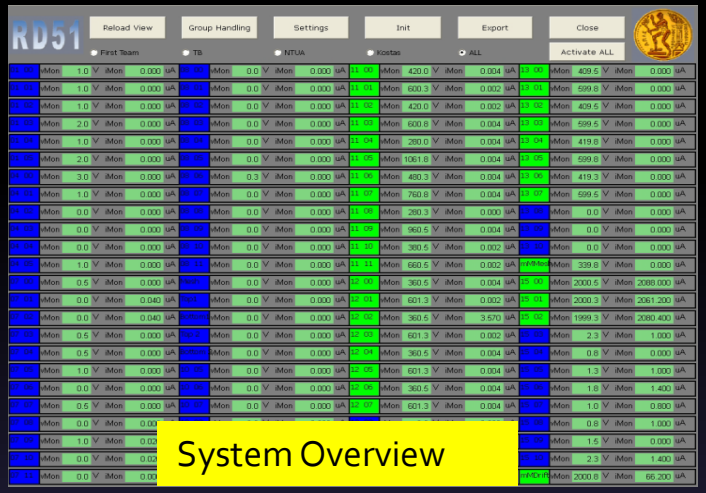
- CAEN Easy:
  1 mainframe, 1 Power Generator, 1-2 crates with HV and LV boards(*) and 1 ADC A-3801 board for monitoring (128 channels) which include detectors + gas/env sensors
- some Low Voltage PS possibly external (non CAEN) with remote control via CAN/PVSS



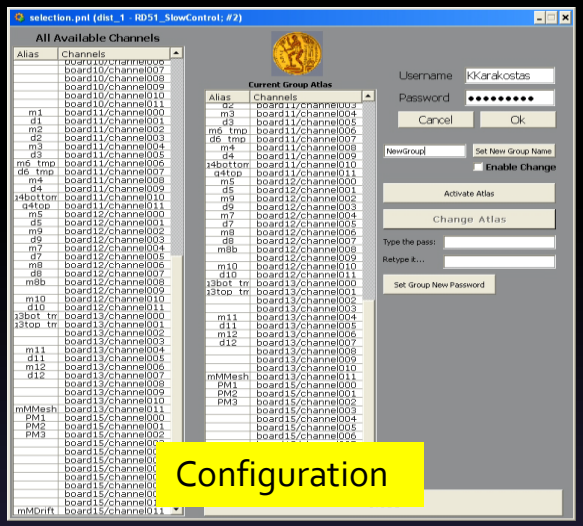
DCS GUI

Examples from past experiences of the people involved

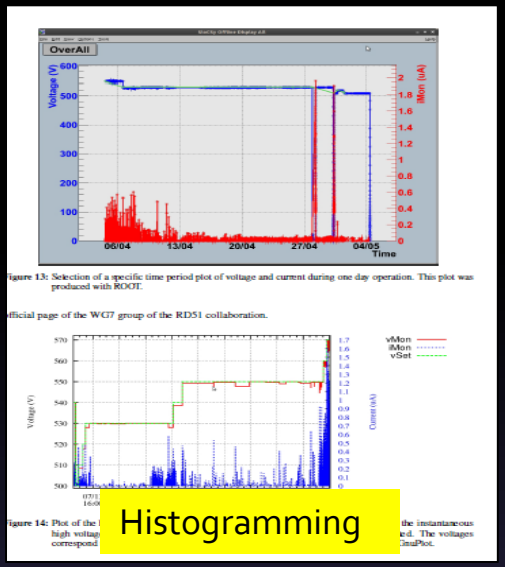
RD51 NTUA implementation



System Overview

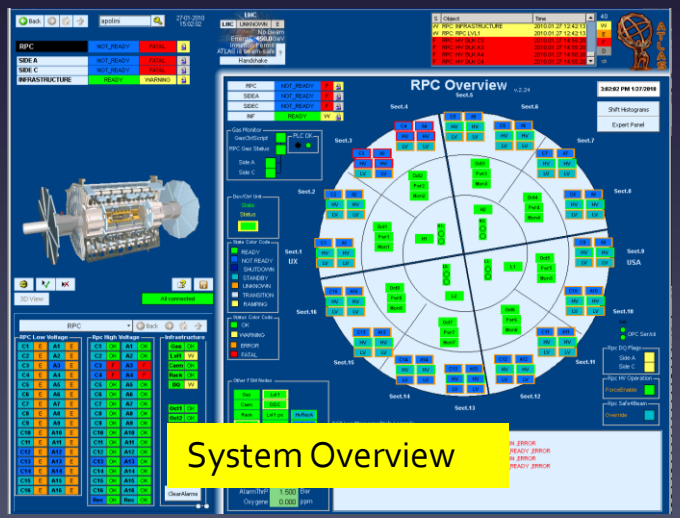


Configuration



Histogramming

ATLAS RPC/MUON implementation



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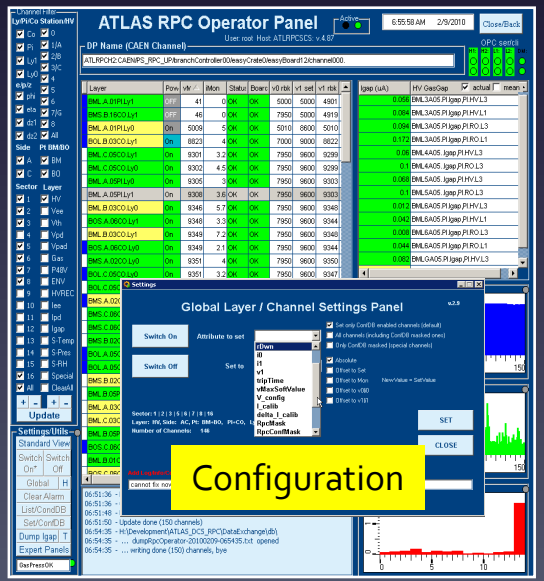
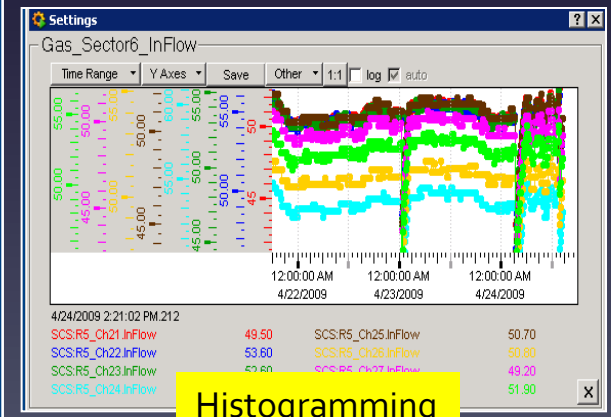


Configuration



Histogramming

DAQ

System requirements:
- include trackers
- include the DCS (and sensors) info
- flexibility to accommodate the detectors under test
  i.e. minimize user efforts
- provide root-ple to the users

CERN group is boosting this activity providing contacts with other experts from ongoing R&Ds

Several solutions under discussion:
- SRS, MM-SRS, ALICE-SRS (DATE)
- MIDAS

Decision to be taken also considering costs!

Project deadlines

- 1 milestone (M8.5.3):

Design of GIF++ infrastructure

18 months → 31/07/2012

Activity report delivered

http://cds.cern.ch/record/1497198?ln=en

- 1 deliverable (D8.5.3):

GIF++ Infrastructure commissioning and utilization

44 months, i.e. 30/09/2014

Conclusions

Detectors

- setup for beam and cosmic trackers done
- detectors for beam tracker already constructed
- detector for cosmic tracker to be constructed within this year
- electronics for all detectors being developed

DCS

- baseline design available
- main issue is the cost

DAQ

- several systems are being considered
- solution to adopt to be decided

GIF++ project progressing well:
facility expected to be ready by the end of 2014