RPC tests @ GIF

G.Pugliese on behalf of the CMS – RPC GIF team

Test @ GIF: status and plan

G. Pugliese

After several years CMS RPC back @ GIF

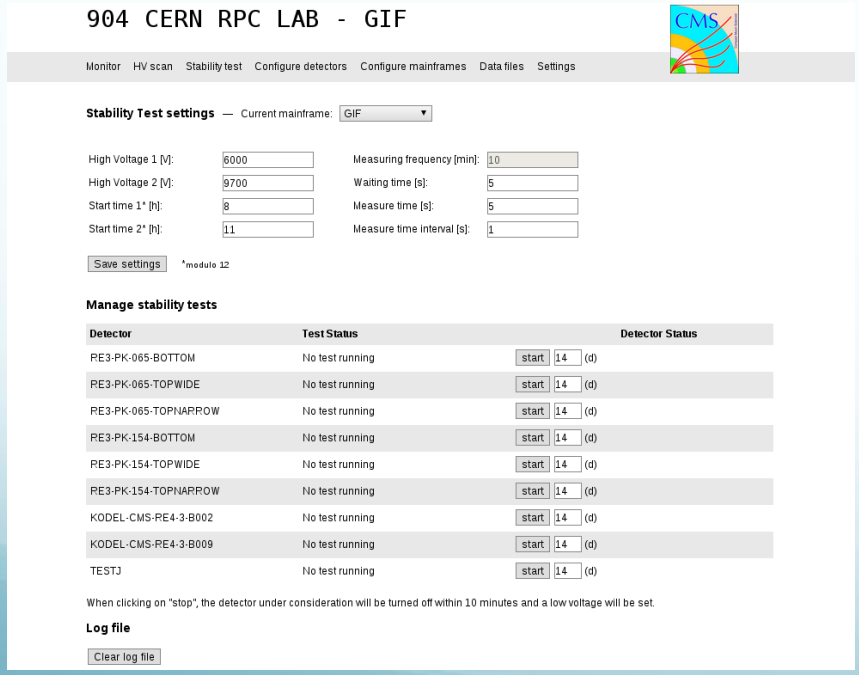
- **July '13:** first test with 2 new RE4 and 6 old endcap GAPs **to measure and monitor in time the bakelite resistivity**
  - New GIF software
  - Preliminary results and feedback
  - Dose measurements
- **Dec '13: new test set-up**
- **GIF team organization**

GIF: Gamma Irradiation Facility. It situated in the SPS West Area at the downstream end of the X5 test beam; it is equipped with radioactive ^{137}Cs source of 695 GBq in December 1999, which emits a 662 keV photon.

NEW GIF software

G. Pugliese

- ✓ **Web base interface:** automatic HV scan - HV applied corrected for P (T correction will be done).
- ✓ **Data Analysis and Monitoring:** the monitoring is running automatic and plots available on drop box.
- ✓ **Weather Station Interface:** information from the meteo station is recorded (Temperature, Humidity, Pressure). These info will be used to correct the HV applied.



For more info: https://twiki.cern.ch/twiki/bin/view/Main/RPCGifSoft

Bakelite resistivity

G. Pugliese

Motivation: measure and monitor the Bakelite resistivity on new RE4 gap and old Endcap gaps:

- July-Oct: several argon measurements have been done.
- In order to do not integrate charge, the gap were under gas mixture but with HV off.

Resistivity [$10^{10}\,\Omega$ cm]

Gap	SOURCE ON (03/07/2013)	SOURCE ON (26/07/2013)	SOURCE ON (01/10/2013)
KODEL-CMS-RE4-3-B002	13.32	11.19	11.03
KODEL-CMS-RE4-3-B009	13.05	11.31	11.30
RE3-PK-154-BOTTOM	2.95	2.59	3.18
RE3-PK-154-TOPNARROW	2.23	1.98	2.28
RE3-PK-154-TOPWIDE	5.87	4.60	5.77
RE3-PK-065-BOTTOM	3.81	2.77	3.89
RE3-PK-065-TOPWIDE	9.77	6.84	7.08

Preliminary conclusion: new RE4 gaps' resistivity is higher then the one of the old Endcap gaps and quite stable in time.

Comparison with P5 Results

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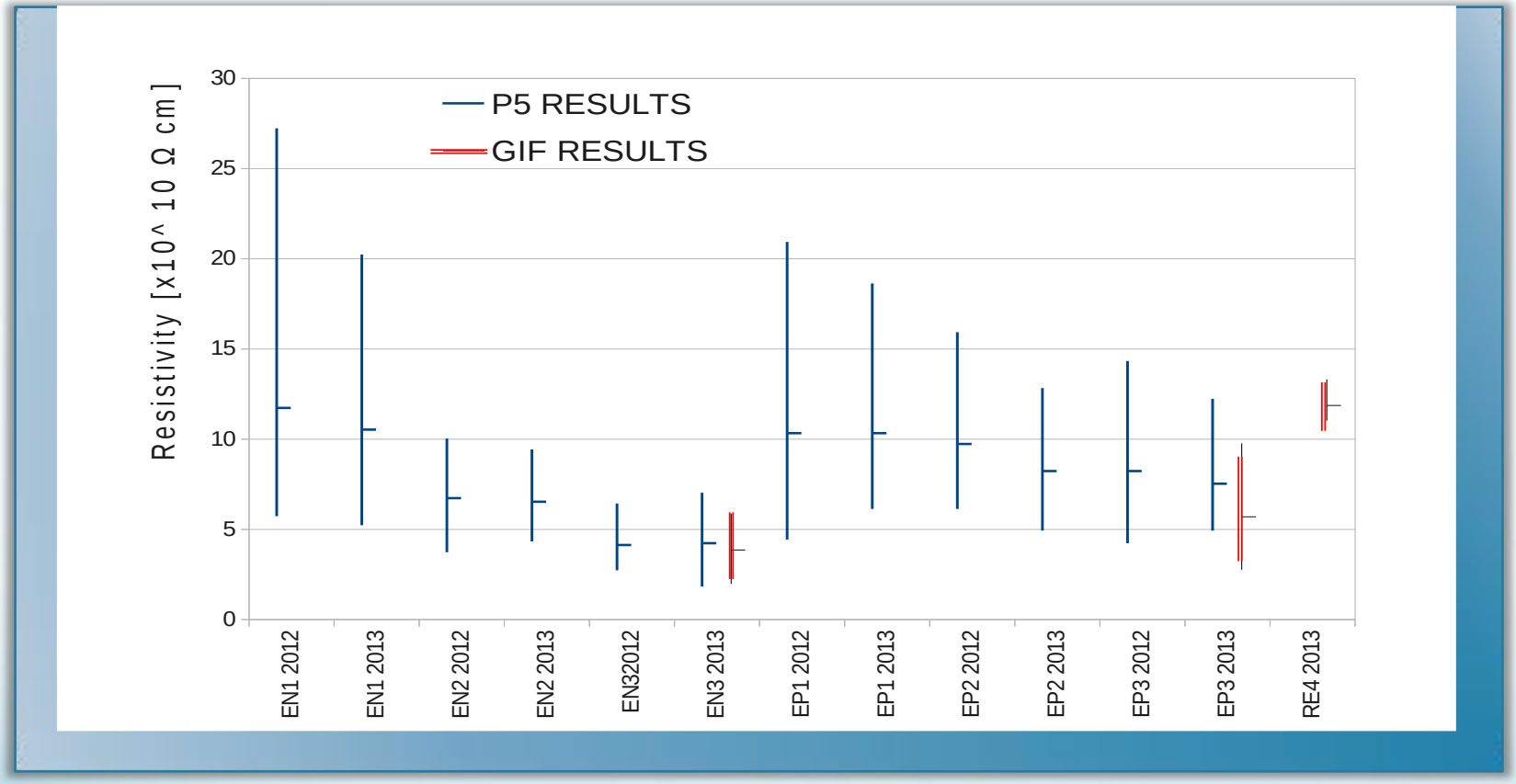

Preliminary Conclusion:

we need to increase the statistic (are the two gap a significative sample?)

Not clear the reason of resistivity profile on RE disks.

Comparison with 904 results

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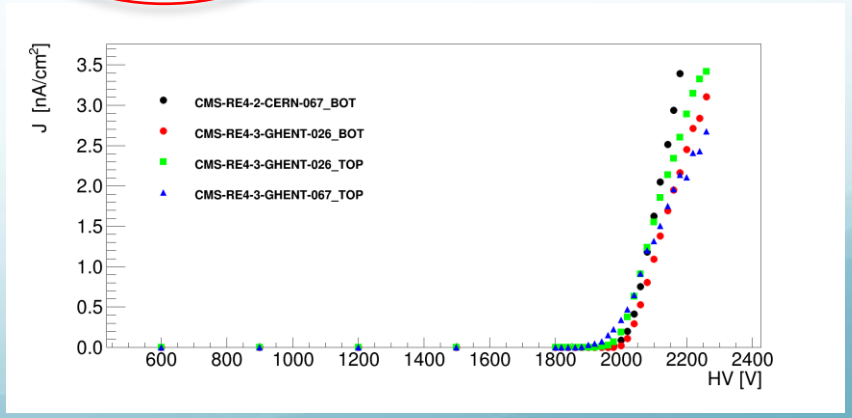
Resistivity measurement was done on some GAPS also in 904:

$CMS-RE4-3-GHENT-030BOT$	$1.93e11 \pm 4.9e09$
$CMS-RE4-3-GHENT-030TOP$	$1.61e11 \pm 2.9e09$
$CMS-RE4-2-CERN-067BOT$	$1.16e11 \pm 1.79e09$
$CMS-RE4-3-GHENT-026BOT$	$1.93e11 \pm 3.06e09$
$CMS-RE4-3-GHENT-026TOP$	$2.01e11 \pm 6.94e09$
$CMS-RE4-3-GHENT-067TOP$	$2.96e11 \pm 1.35e10$

Measure done without gamma source

Preliminary Conclusion: all new RE4 gap looks to have similar resistivity value



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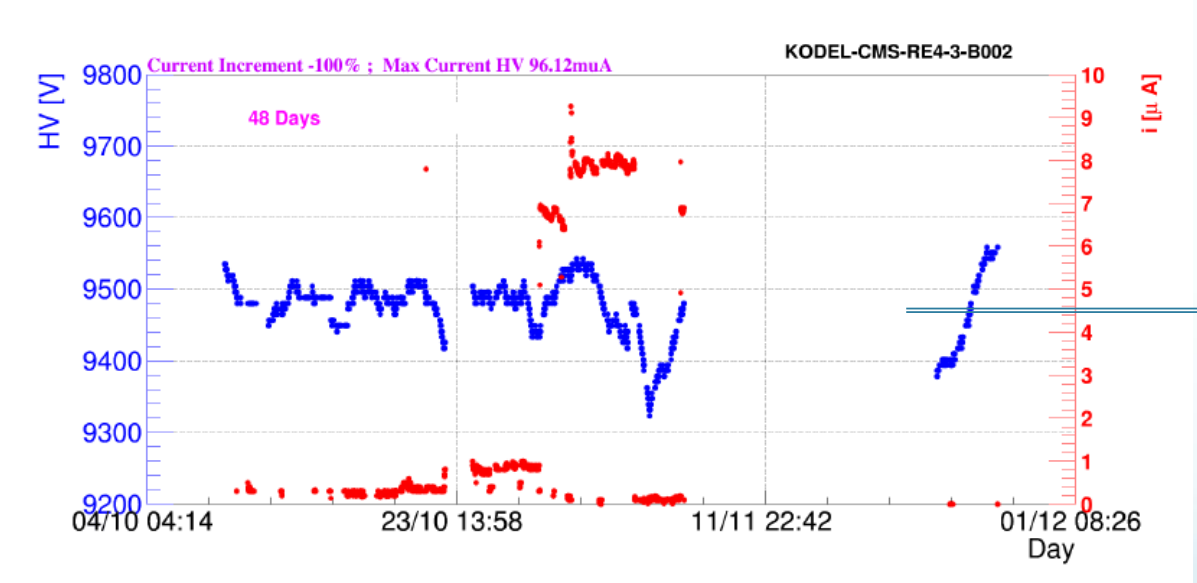
Current monitoring

- From October until December '13, the gaps' HV has been turned ON.
- Automatic cycle of HV 9.5 kV and 6 kV
- HV applied corrected for pressure variations.
- Email in case of Main frame goes off. Gas kill still to be done.



MDT detectors in front of our tent

Preliminary Conclusion: to check the current stability, it is crucial to know:

1. When the source is ON/OFF
2. The flux of gamma on each GAP

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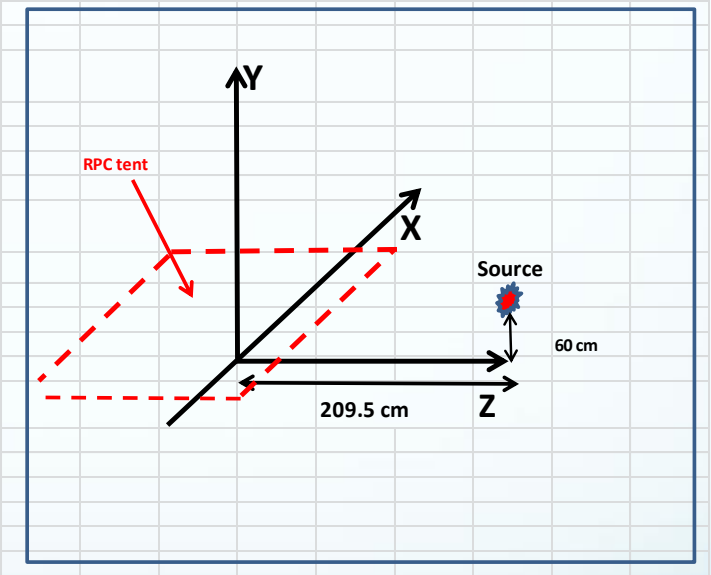
Integrated dose

- **Dose rate** measured done last week with a ionizing chamber

Position x (cm)	Position y (cm)	Dose Rate microGy/min	Comments
70	128	43.23	Almost no "Atlas" absorption
70	60	2.14	With "Atlas" bricks absorbing photons



- The measure will be repeated as soon as the ATLAS set up will be removed (end of January)

- After the calibration, new radiation sensors will be installed at GIF in order to measure the **integrated dose on our chambers**.

New Test @ GIF

G. Pugliese

New GAPS set up: the old GIF trolley has been cleaned and refilled with:

1. **12 RE4 GAP** (all QC3 rejected gaps, most of all for visual inspection)
2. **One new RE4 and one old RE3 chambers (fully equipped with electronic)**.

Plan:

1. **RE3 and RE4 Cosmic Test at QC3 (Dec '13)**
2. **Chambers and gap installed at GIF (Jan'14)**
3. **Resistivity** measurements
4. **AGING: Current monitoring** vs integrated dose
5. **Chamber's rate with and without source**. **γ sensitivity.** Full DAQ chain (same hardware and software of 904) will be installed.
6. **Then the chambers will be tested again with cosmic**

Comparison with **CMS electronic and "new" electronic** (common test with ATLAS).

GRPC will be added in the same trolley

Gas mixture test (common test with ATLAS)

G. Pugliese

RPC GIF organization

Working weekly meeting: for this year on Friday afternoon at 15:00.

Mail list: CMS-RPC-GIF@cern.ch

Twiky page: Twiki Page

Man power

Pavia: C. Riccardi – P. Vitulo – A. Braghieri – P. Salvini

Bari: G. Pugliese

Ghent: J. Eysermans, N. Zaganidis

Sofia: P. Stoianov

Mexico: I. Pedraza

Egypt: S. Aly, A. Ibrahim, T. Elkafrawy (in the framework of the EENP2 activity)

New Twiky Page

CMS RPC Test at GIF

Hardware set-up

- two new RE4 gaps (Bottom RE4-3 002 and 009)
- two old RE3 chambers (154 and 65) [65 TOPNARROW not reacting]
- Mapping file champer/gaps: click here
- Chambers info: click here
- Pressure, temperature and humidity datalogger files: click here
- All data files (.csv) are afterwards updated with the actual P, T and H from the datalogger, NOT from the QC4 lab
- Module ID: see sticker on the back of the module
- All Argon measurements preceded with at least 24h argon flux

Pictures

Software

- Software Main Page

Papers

- *A facility for the test of large area muon chambers at high rates*, CERN EP 2000 - 031 - Paper

Contacts

Gif Email list

Meetings

- weekly meetings on Friday at 15:00
- See Indico page

Data

1. GIF online logbook
2. All Measurements
3. Argon Measurements

Conclusion

The resistivity value of the RE4 gaps (from both test at GIF and 904) looks higher then the old gaps (both at GIF and p5).

Still to be understood how this value of “global resistivity” is correlated to the Bakelite sheets’ resistivity.

Big effort to develop a GIF software able to run the system in “automatic” mode and to get the results “online”.

The plan is to have a full DAQ system in coming months and be able to monitor the chamber performance vs dose and gamma flux.

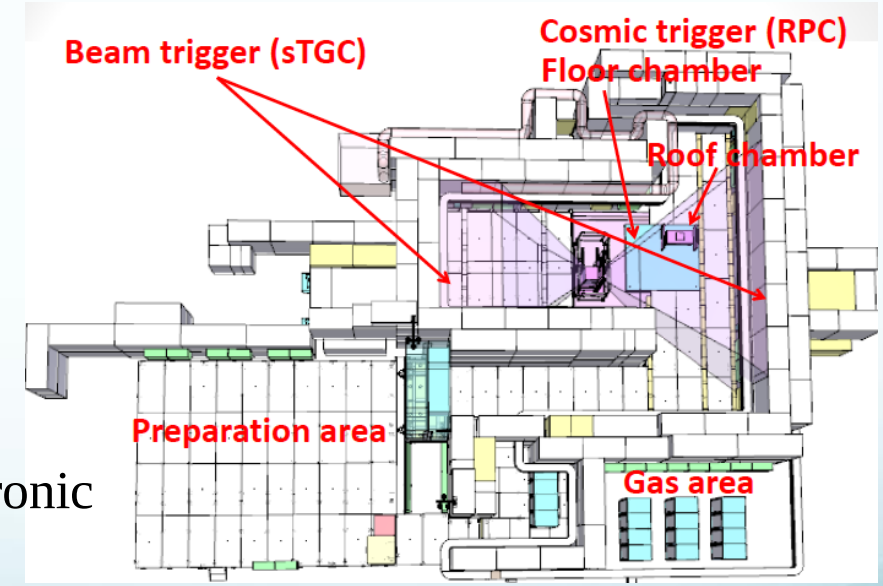
From our point of view, the GIF (and in one year from now, the GIF++) will be the best place to perform the RPC- R&D needed for HL-LHC

SPARE

G. Pugliese

GIF ++ : **New Gamma Irradiation Facility** in the North Area (it will replace the existing GIF of the West Area). It will be equipped with:

- a 16 TBq radioactive ^{137}Cs gamma source (providing up to 2 Gy /h at a distance of 50 cm)
- SPS secondary muon beam line
- Cosmic and beam triggers

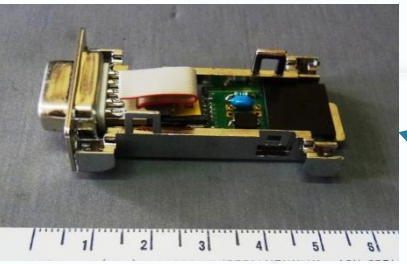


Operational in Spring 2015 (??)

The new GIF++ will allow to study:

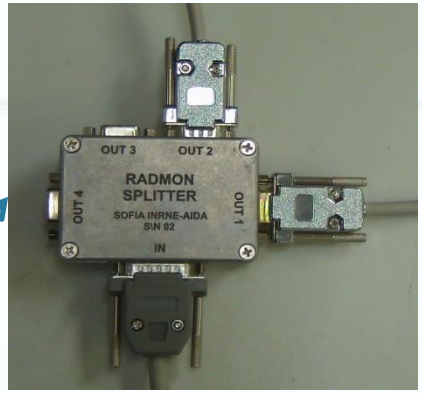
1. Radiation hardness of materials & electronic components under a strong photon flux.
2. detector's performance under high particle fluxes
3. Long-term monitoring of large muon detectors working under high gamma irradiation.

Radiation Sensors for GIF
Plamen Iaydjiev– INRNE, Sofia
Gif meeting – 6.12.2013, CERN



RADMON PCB BASED WITH 2 RadFETS DETECTORS
1xLAAS 1600 - till 10 Gy
1xREM 250 - till 2000 Gy

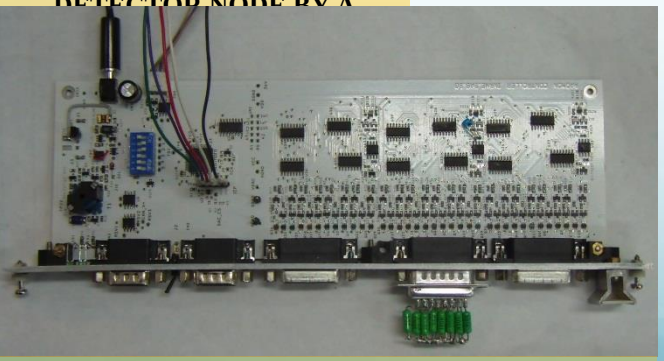
Ready for installation



The difference between the 2 calibration curves for "low dose" LAAS Radfet's will be analysed and later on we'll have 2 Radmons ready for Gif. The 2 radfet's from the plots represent the 2 batch of radfet's from the supplier.

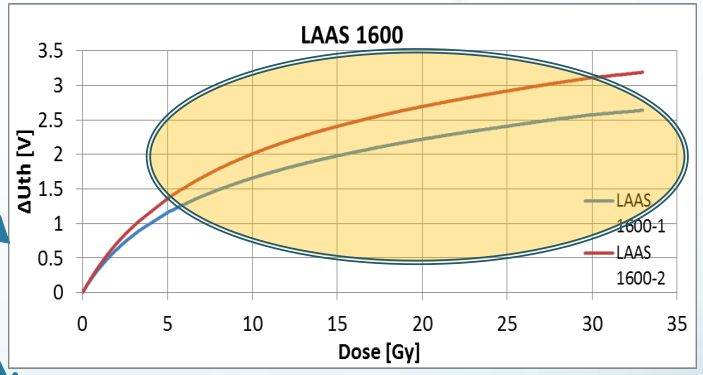
FOUR DETECTORS CAN BE CONNECTED TO ONE SPLITTER
BY SHORT CABLES THE SPLITTER IS CONNECTED TO THE DETECTOR NODE BY A

In preparation – Radmons after the calibration test.

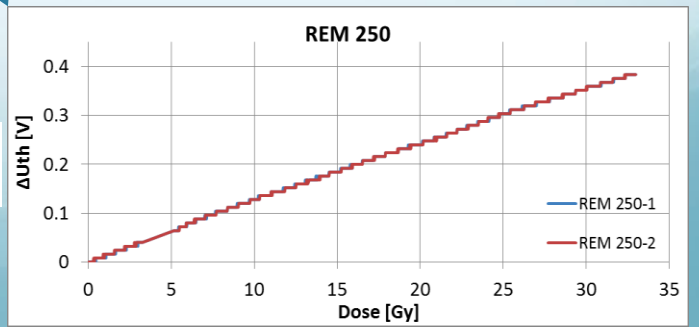


MAIN CONTROLLER

TEST RESULTS FOR TWO LAAS 1600 RADFETS



TEST RESULTS FOR TWO REM 250 RadFETS

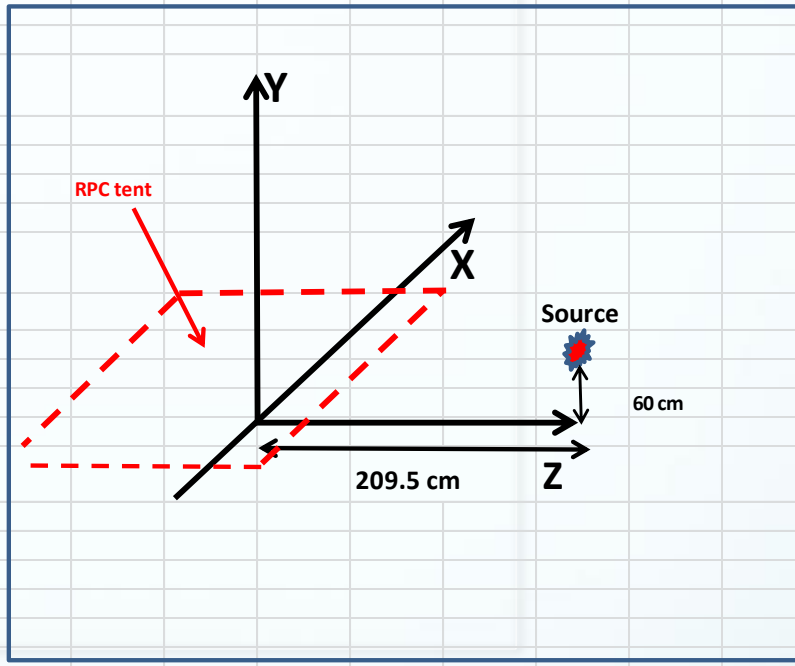


Dose Rate Measurement at GIF with RP ionization chamber – 28.11.2013

P. Iaydjiev, P.Vitulo, RP team – P.Carbonez

Gif meeting 6.12.2013

Position x (cm)	Position y (cm)	Dose Rate microGy/min	Temp. ^{0}C	Pressure	null value (not null corrected)
-20	128	32.37	17.9	974	0.252
10	128	38.8	17.7	974	0.252
40	128	7.785	17.7	974	0.252
70	128	43.23	17.6	974	0.252
100	128	16.16	17.5	974	0.254
130	128	14.65	17.5	974	0.254
160	128	4.689	17.5	974	0.254
190	128	1.926	17.5	974	0.254
40	128	8.44	17.5	974	0.254
10	128	37.99	17.5	974	0.342
-20	60	3.24	17.5	973.8	null corrected
10	60	3.042	17.5	973.8	null corrected
40	60	2.52	17.6	973.8	null corrected
70	60	2.14	17.6	973.8	null corrected
100	60	1.611	17.6	973.6	null corrected
130	60	1.296	17.7	973.6	null corrected
160	60	1.125	17.7	973.6	null corrected
190	60	0.999	17.8	973.6	null corrected
-20	160	21.36	17.9	973.4	null corrected
10	160	28.5	17.8	973.3	null corrected
40	160	7.524	17.9	973.1	null corrected
70	160	30.72	18	973.2	null corrected
100	160	12.04	18	973.2	null corrected
130	160	10.13	18	973.2	null corrected
160	160	3.285	18.1	973.2	null corrected
190	160	1.593	18.1	973.2	null corrected



Almost no “Atlas” absorption

With “Atlas” bricks absorbing Gif photons

Method for Resistivity

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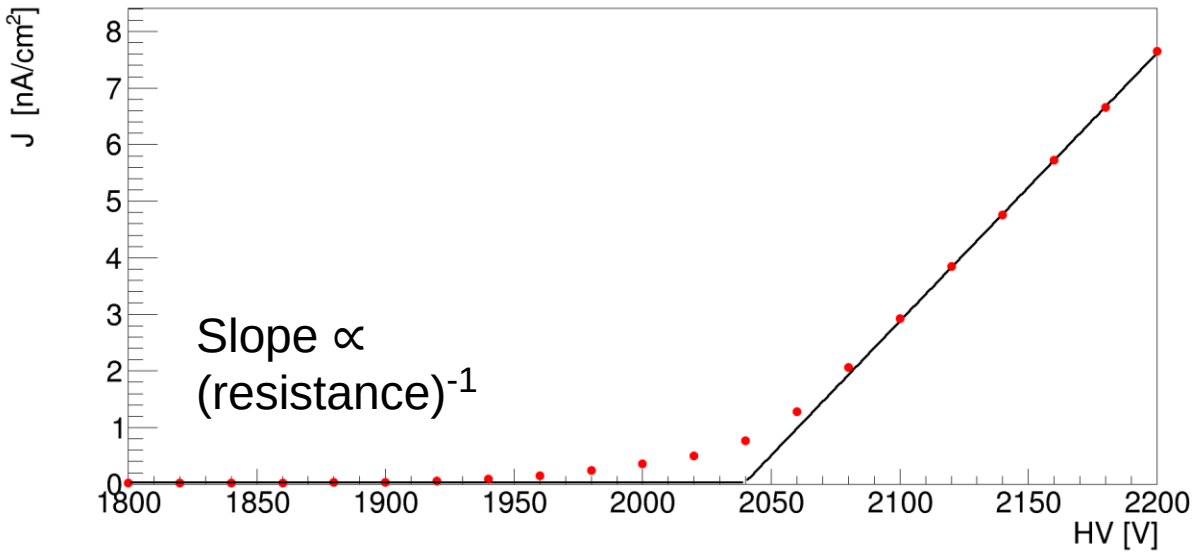
Typical HVscan curve
(gap filled with Argon)



- - Thickness Bakelite layer: d = 2 mm
- - Total thickness: 2d = 4 mm
- - Total resistance: Rtot
- pressure correction done
- temperature correction to be done

$$\rho := \frac{R_{tot} \cdot A}{2d} = \left(\frac{dJ}{dV}\right)^{-1} \cdot \frac{1}{2d}$$

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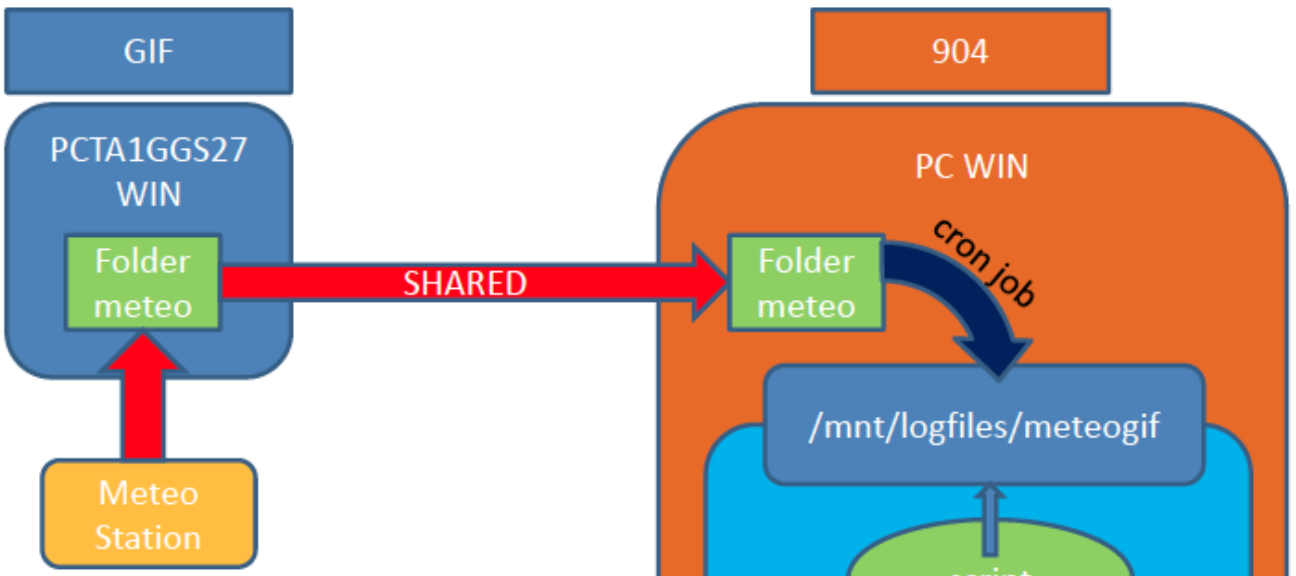
Meteo monitor at GIF

Cristina – Paola
(Pavia Group)



- Meteo data are written into a local folder. This folder is shared
- The PC at 904 sees the meteo folder at GIF
- A cron job copy the files into a local folder visible from the virtual machine in /mnt/logfiles
- The virtual machine runs a script that reads and decodes the meteo data and it writes the last measurements into meteo/thpgif.txt (same format as thp904.txt)

FLUKA flux simulations

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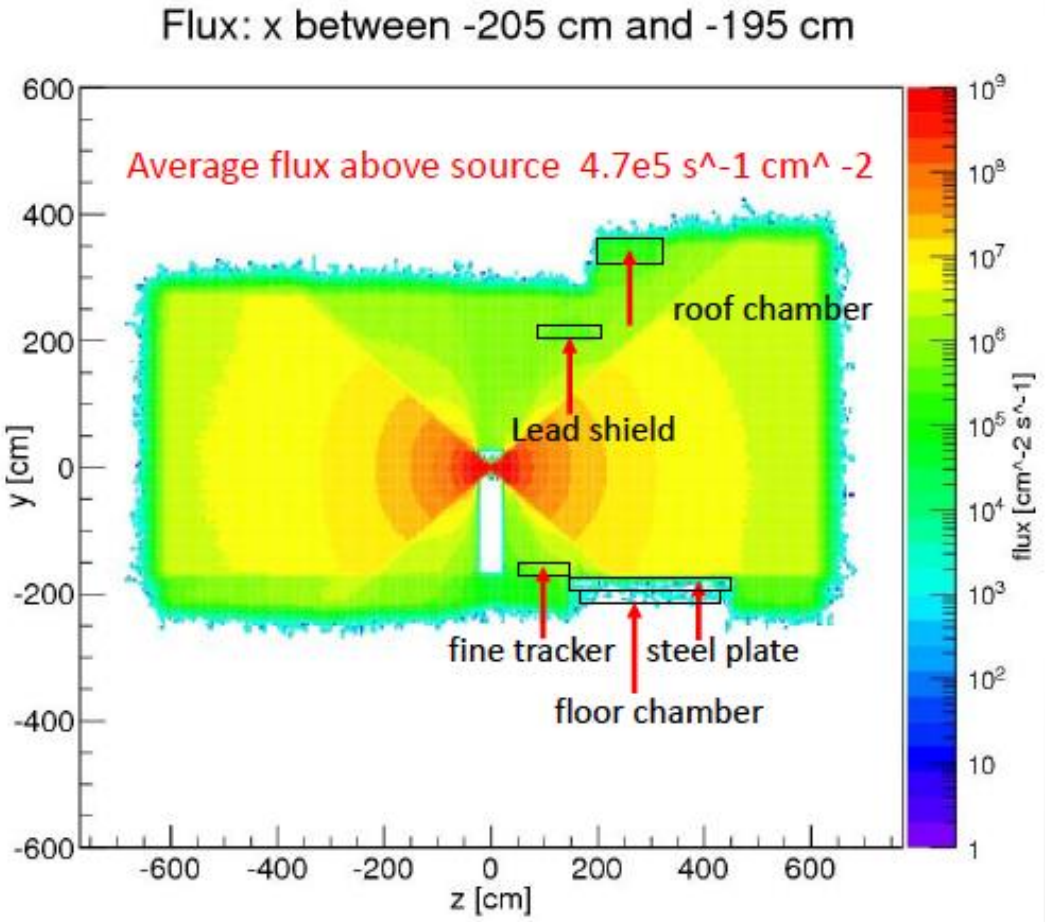
GIF++ projection yz



Position of the tent

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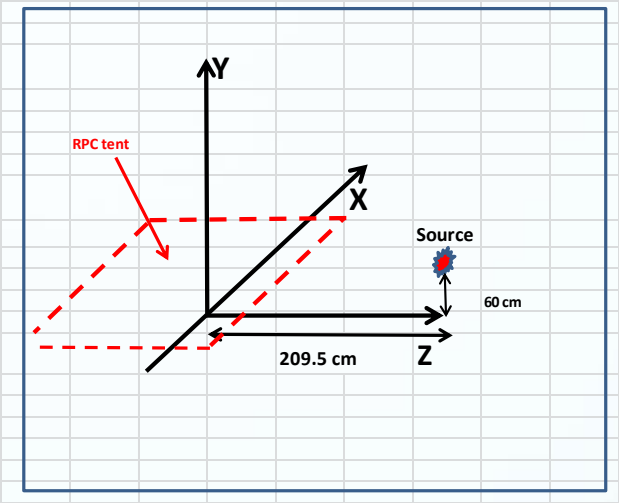
Position x (cm)	Position y (cm)	Dose Rate microGy/min	Comments
70	128	43.23	Almost no "Atlas" absorption
70	60	2.14	With "Atlas" bricks absorbing photons



Φ = (dose rate, in uGy/minute)/2.1 x 10^4 cm-2 s-1 = 2 x 10^5

I suggest to leave the tent where it is .

Direct radiation $E_\gamma = 662$ keV				
Nominal ABS	Photon flux $[cm^{-2}s^{-1}]$ at 50 cm	at 155 cm	at 300 cm	at 400 cm
1	$0.79 \cdot 10^7 \pm 0.2\%$	$0.80 \cdot 10^6 \pm 0.6\%$	$0.22 \cdot 10^6 \pm 0.6\%$	$0.12 \cdot 10^6 \pm 0.4\%$
Total radiation $E_\gamma \leq 662$ keV				
Nominal ABS	Photon flux $[cm^{-2}s^{-1}]$ at 50 cm	at 155 cm	at 300 cm	at 400 cm
1	$0.12 \cdot 10^8 \pm 0.2\%$	$0.14 \cdot 10^7 \pm 0.5\%$	$0.45 \cdot 10^6 \pm 0.5\%$	$0.28 \cdot 10^6 \pm 0.5\%$