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WP5 Progress Report

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WP 5 Deliverables in 2010/11

No.	Title	Due	Status
5.1.2.	Estimation of radiation and activation levels for critical areas of the experiments at SLHC	M26	o.k. New data available
5.2.1	Estimation of radiation and activation levels for critical areas of SLHC and its injectors	M24	Already reported in Madrid, 2010
5.3.1	Impact Study (dose rates, environmental impact and waste production from activated material) for SLHC	M36	In progress



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5.1.2. Radiation and activation levels for the experiments at SLHC

“Radiation level” is to be understood as equivalent dose rates with the purpose of radiation protection.

Under this presumption, only sAtlas made contributions to this topic.

Elaborate study of radiation levels in ATLAS at ultimate LHC intensity by Ogawa and Zajacova, extrapolation to sLHC luminosity

Main results:

ambient dose rate $H^*(10)$ **in service cavern** 20 – 50 $\mu\text{Sv h}^{-1}$

Classification as simple controlled radiation area

Access only for classified radiation workers !

ambient dose rate $H^*(10)$ at top of shafts $> 0.5 \mu\text{Sv h}^{-1}$

Not a public area any longer ?



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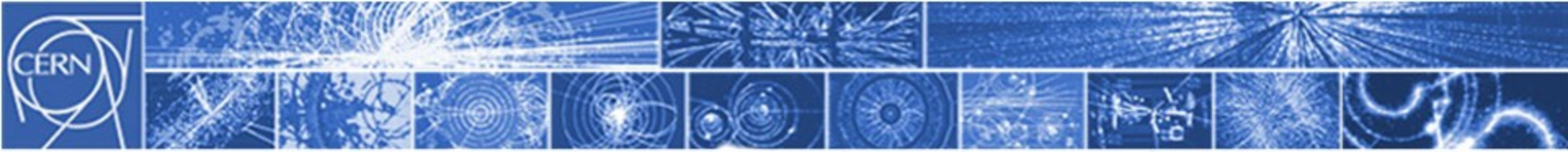
5.1.2. Radiation and activation levels for the experiments at SLHC

Due to LHC delay, measurement results are late:

- **PSI:** Measurement of ambient dose equivalent from neutrons (very useful results in CMS, detectors were in the “shadow” in ATLAS)
Compare with Monte-Carlo estimations of radiation environments from CERN

This would constitute an addendum to deliverable 5.1.2.

Now, other data are available which may be exploited in this direction.



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5.3.1. Impact Study: radioactive releases & waste

Studies made for the original scope of sLHC:
release of activated air from LINAC 4
release of activated air from SPL
Release of activated air and stray radiation from PS
activation of ground(water) around SPL dump
stray radiation from SPL dump

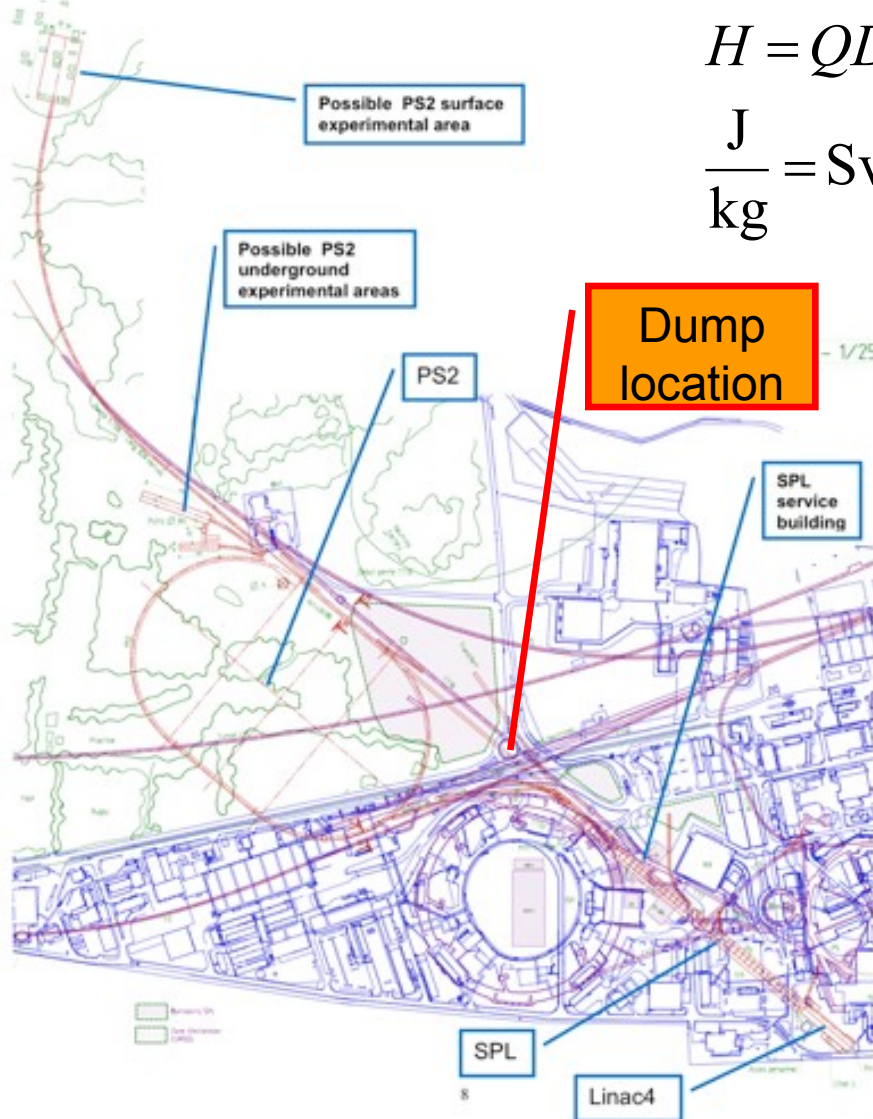
These studies will be summarized in the deliverable report SLHC-PP report



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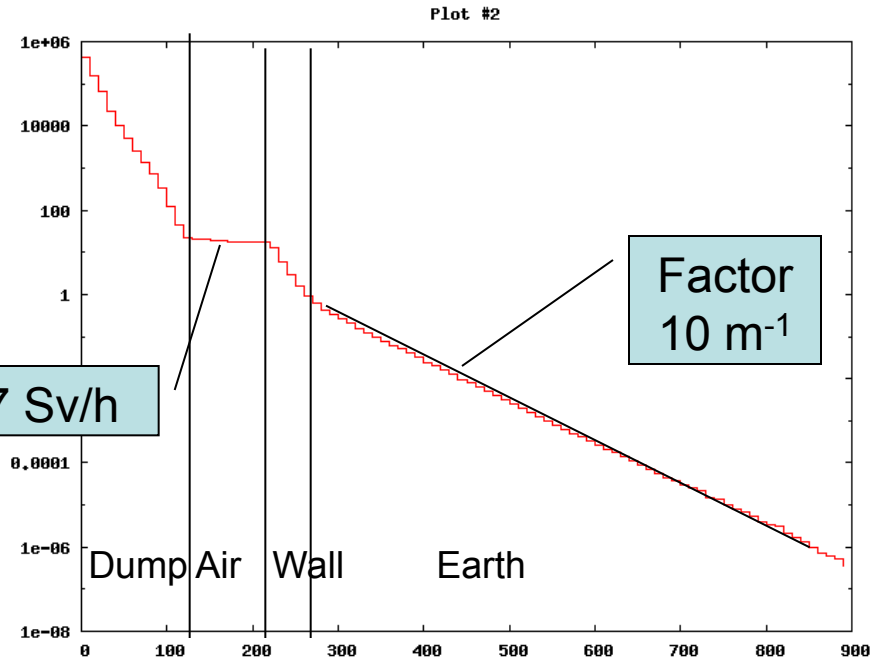
Stray radiation from SPL Dump



$$H = QD$$

$$\frac{J}{\text{kg}} = Sv$$

17 Sv/h



7 m of earth will reduce $H^*(10)$ to $1.7 \mu\text{Sv h}^{-1}$

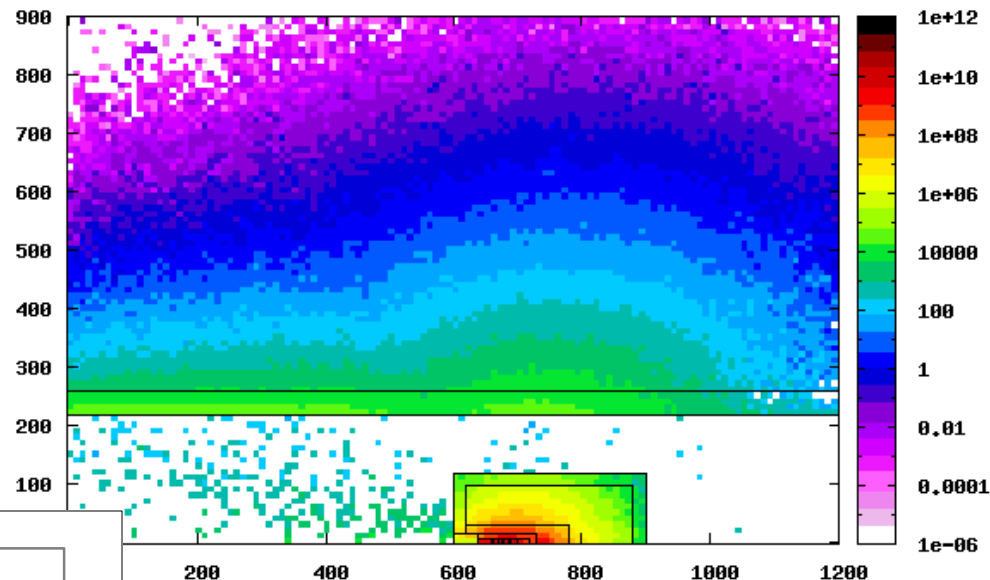
Public area with low frequentation: $H^*(10) < 2.5 \mu\text{Sv h}^{-1}$ required



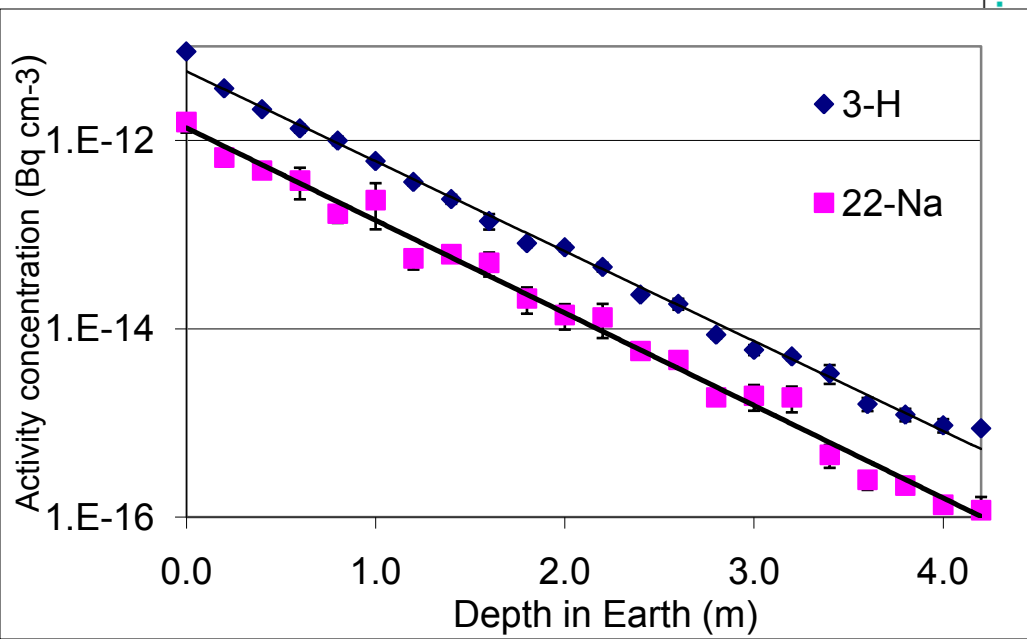
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Dump in a 4.4 m wide
tunnel
40 cm concrete wall
Several metres of earth

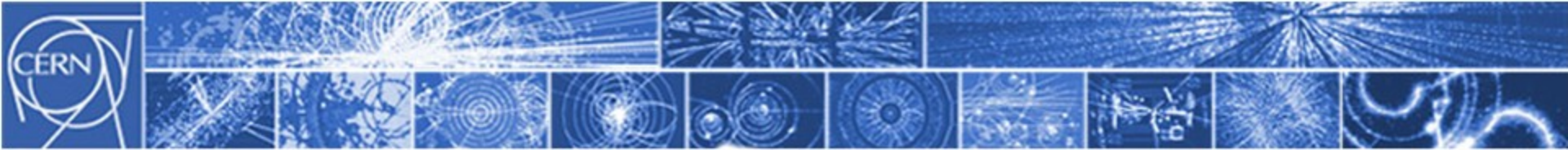
Soil activation Plot #2



“Stars” (inelastic interactions),
leading to activation of matter
surrounding the dump



Profile of activity concentration
in earth: exponential decline



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Ground water contamination

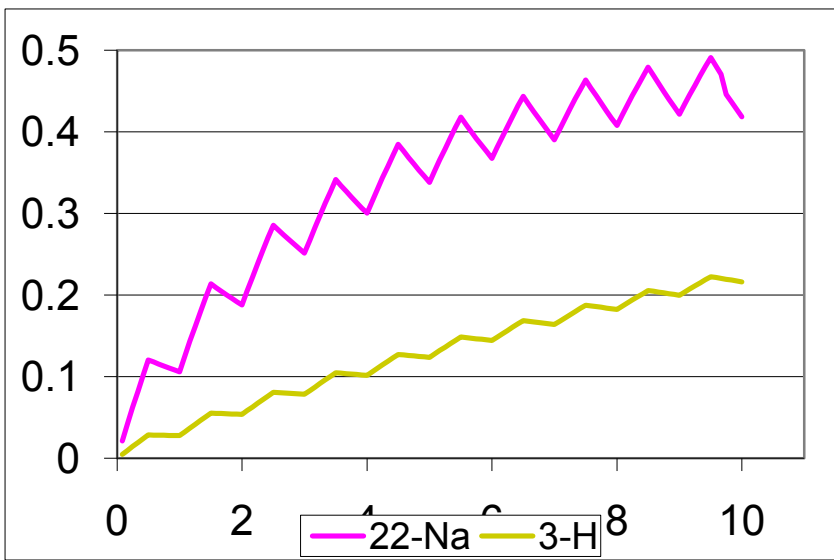
Soluble radionuclides:

H(100%) ²²Na (20%)

In equilibrium:

Production = Activity

$$\dot{N}_p \{ \phi \sigma \} n_{target} = \lambda_{rad} n_{rad} = a_{rad}$$



Comparison with limits:

Drinking water:

- 28 l exceed radioactivity limit

- Don't source close to SPL

Waste water: (ingress in tunnel)

³H o.k.

²²Na: Factor 3

Covered by conservatism of model



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Deliverable 5.3.1. Summary

WP 5 had started in year 1 of SLHC-PP with work on radiation protection aspects of the original injector concept (SPL and PS2 dump, release of air from LINAC 4, SPL, neutron stray radiation from SPL).

Change of strategy:

- Participation in PS Radiation WG
- It is too early to make predictions of the environmental impact of HL-LHC . Must await freezing of beam parameters.



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WP 5 Summary

All deliverables were ... delivered (last one on track)

Two events affected the course of the project:

- The LHC sector 3-4 incident delayed data collection for first deliverables
- The original wor programme did no longer conform to the new accelerator strategy

In spite of this,

- A lot of useful work has been completed and documented
- WP5 allowed a seven (my count) young researchers to participate in (s)LHC-related work
- All participants were able to make new contacts which may turn out fruiyful in the future.