

# AIDA

Advanced European Infrastructures for Detectors at Accelerators

## Presentation

# Radiation Monitoring at New CERN Radiation Facility GIF++

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This work is part of AIDA Work Package 8: **Improvement and equipment of irradiation and test beam lines.**

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# RADIATION MONITORING AT THE NEW GIF++ IRRADIATION FACILITY AT CERN

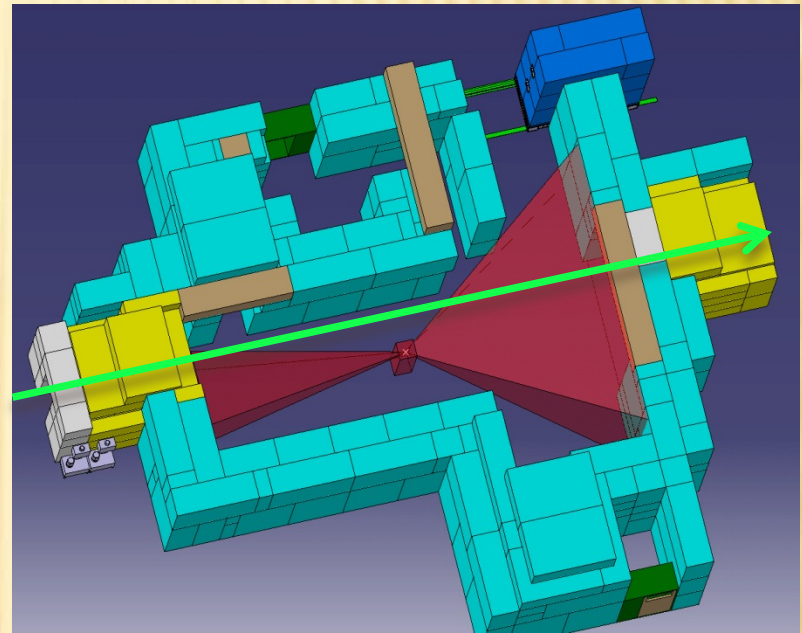
Institute for Nuclear Research and Nuclear Energy

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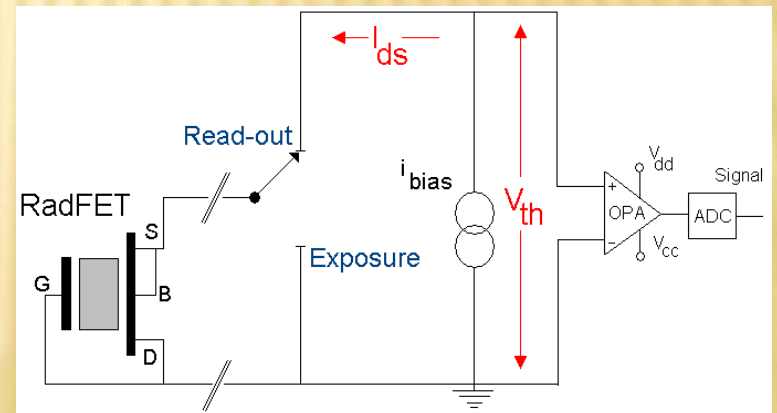
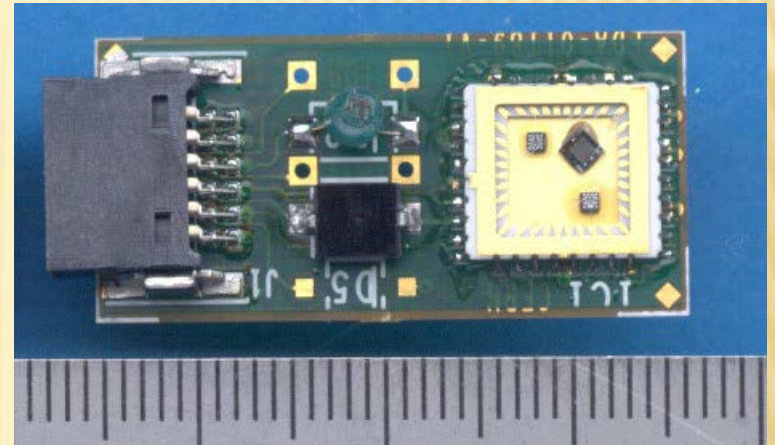
# GIF++

- ✘ GIF++ is a new Gamma Irradiation Facility being built at CERN.
- ✘ It combines a 16.65 TBeq  $^{137}\text{Cs}$  source with a high-energy particle beam in the SPS H4 beam line.
- ✘ It is expected to be operational in 2015.
- ✘ Our task: to provide a system for online monitoring of the absorbed dose in the devices and objects being irradiated.

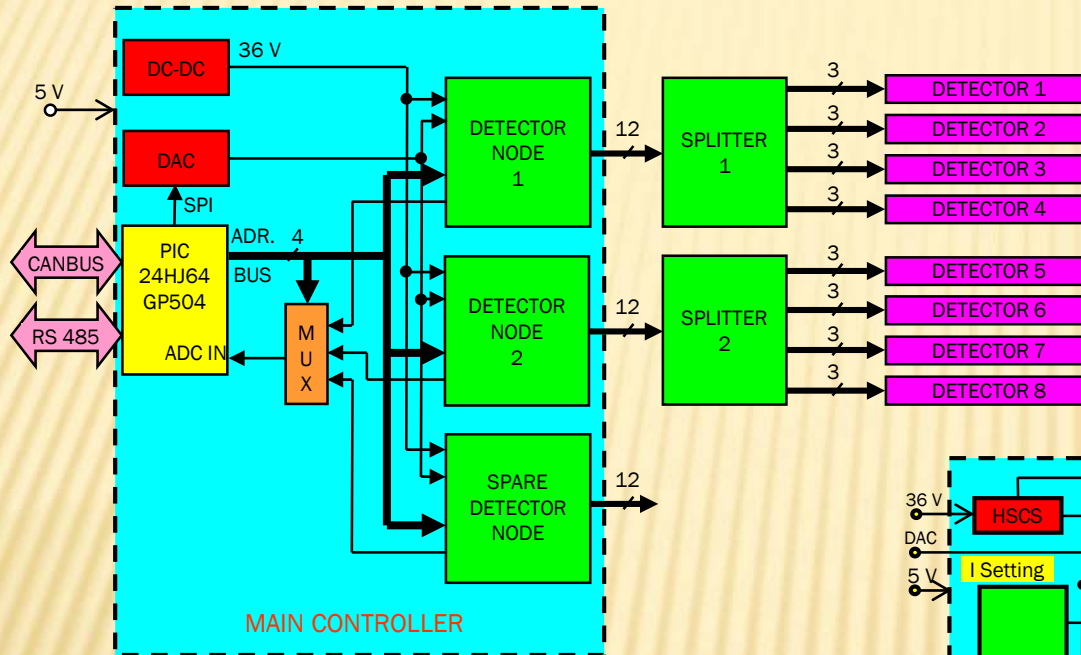


# SENSORS

- ✘ Radiation sensitive p-channel MOS field effect transistors (RadFET). Ionizing radiation causes buildup of positive charge in the gate oxide layer and rises the threshold voltage
$$V_{th} = a_x D^b$$
- Already tested and used in TOTEM and ATLAS experiments at CERN.
- LAAS 1600 – sensitive in the range up to few tens of Gy.
- REM 250 – sensitive in the range up to few tens of kGy.
- ✘ PIN diodes - sensitive to particle fluence.

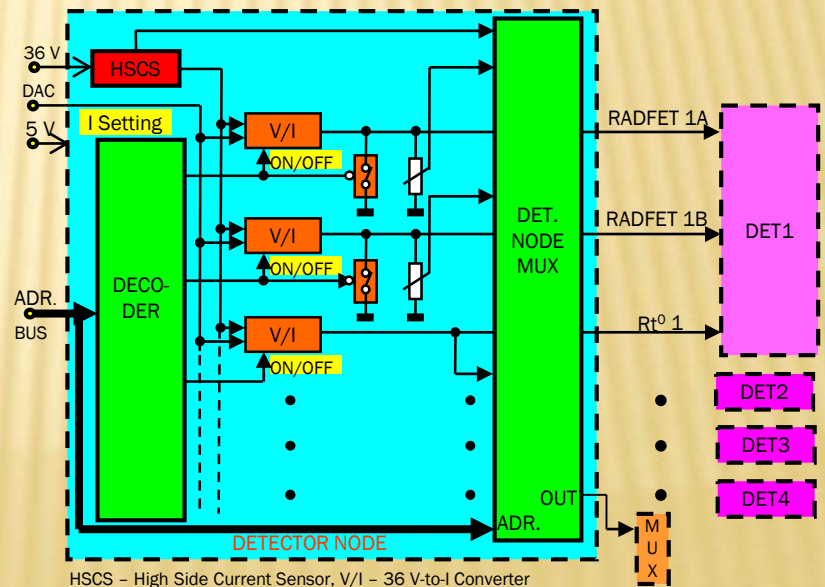


# MEASUREMENT SYSTEM BLOCK DIAGRAM



- ✘ Detector connectivity: 12 boards max.
- ✘ 12-bit ADC
- ✘ Communication: CAN, RS 485

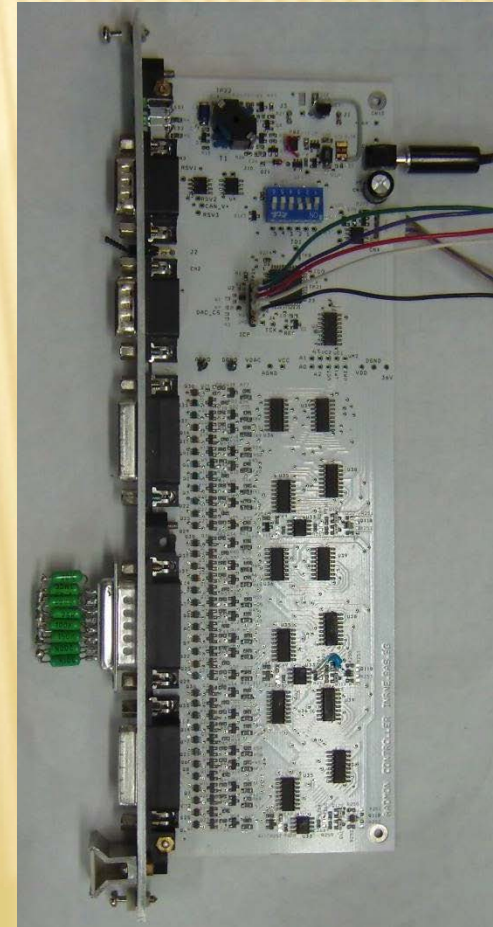
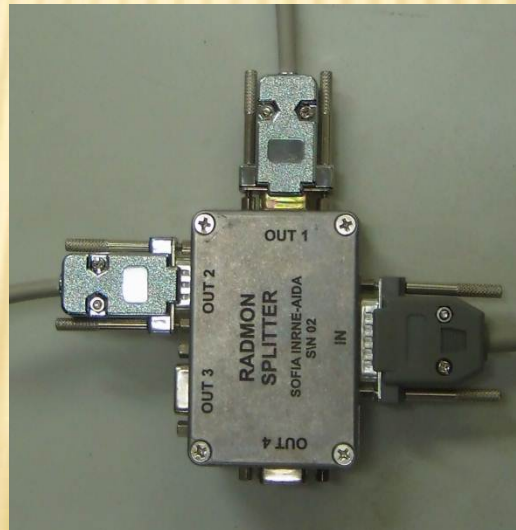
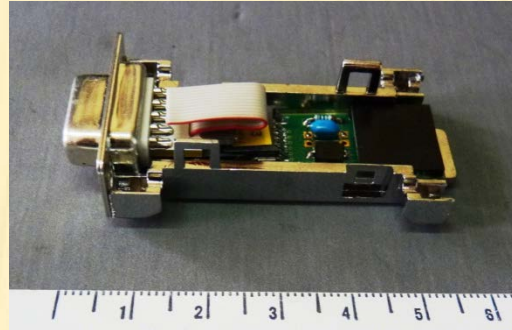
- ✘ Power over RS 485, CAN or a dedicated connector



HSCS - High Side Current Sensor, V/I - 36 V-to-I Converter

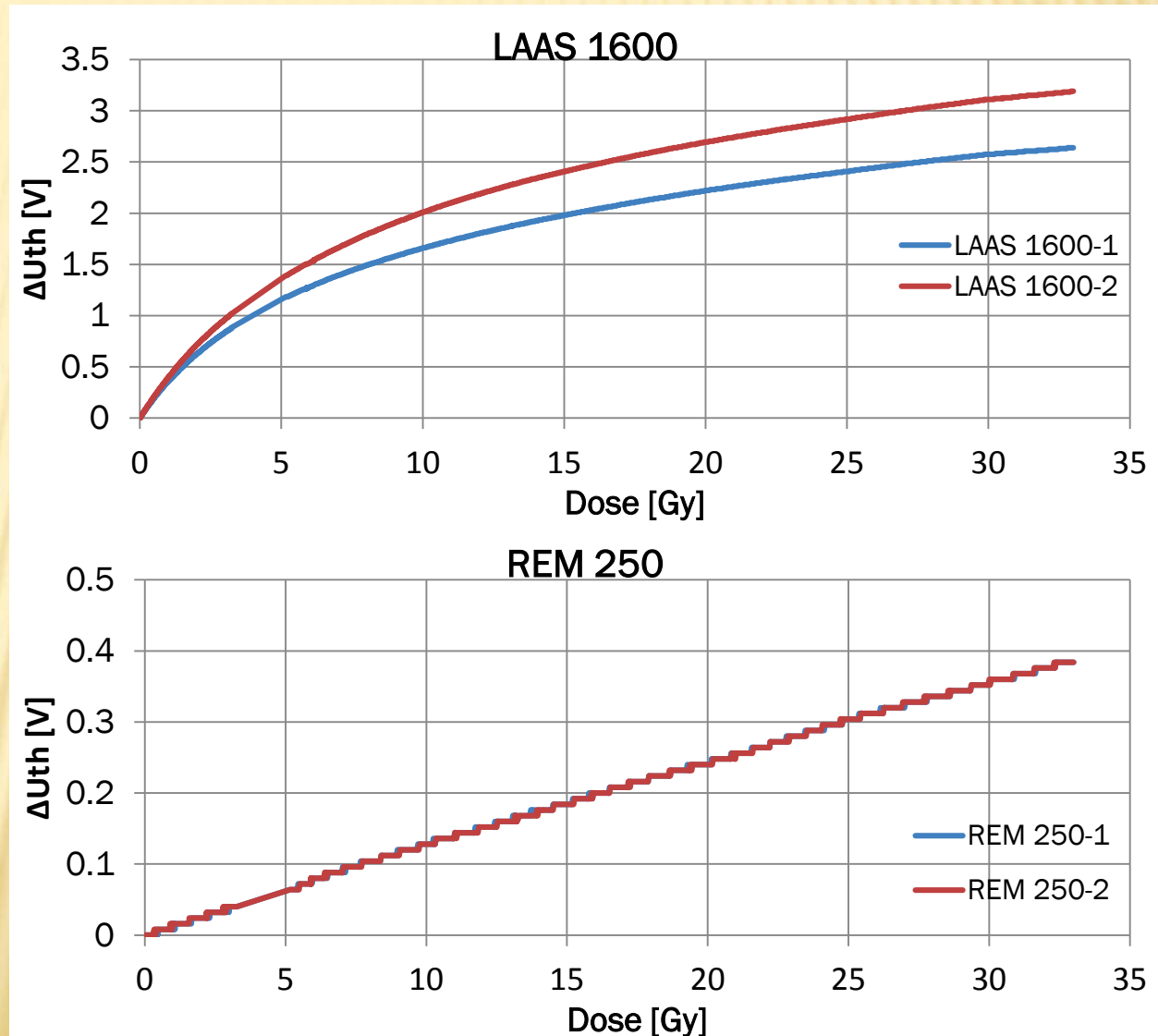
# ON-SITE LAYOUT

- ✘ Main controller unit (in a 6U crate).
- ✘ 50m cable from each detector node to a passive splitter box.
- ✘ Up to 4 detector boards can be connected to the splitter, using shorter cables.



# RESULTS FROM THE TEST RUN AT GIF

- ✘ Two boards containing 1 LAAS and 1 REM device were irradiated.
- ✘ The LAAS devices showed about 16% difference in threshold voltage.
- ✘ The REM devices returned almost identical response.
- ✘ The system achieved 8mV input sensitivity (36 V full scale)



# CONCLUSIONS

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- ✘ The measurement system has been successfully tested and is ready for integration with the GIF++ control system.
- ✘ The communication protocol with the GIF++ control system has yet to be defined and implemented.
- ✘ The REM devices should be further irradiated at GIF++ to obtain a calibration curve beyond the initial region.



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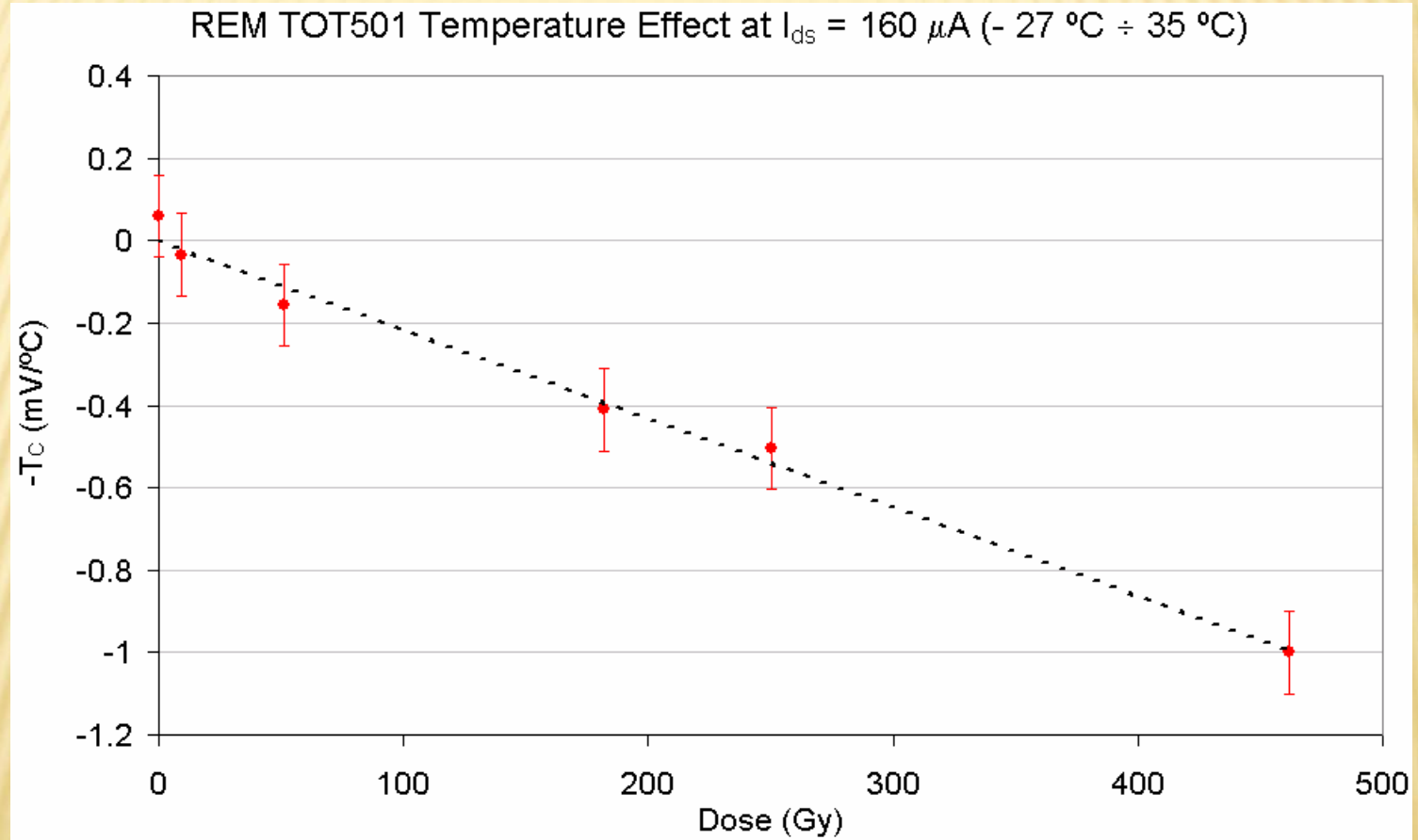
# Thank you for your attention

The “Radiation Sensors for Gif++” task is part of the Advanced European Infrastructures for Detectors at Accelerators (AIDA) project, co-funded by the European Commission under FP7 Research Infrastructures, grant agreement no 262025 and by INRNE (Sofia) - Bulgarian Scientific Fund, Ministry of Education, Youth and Science.

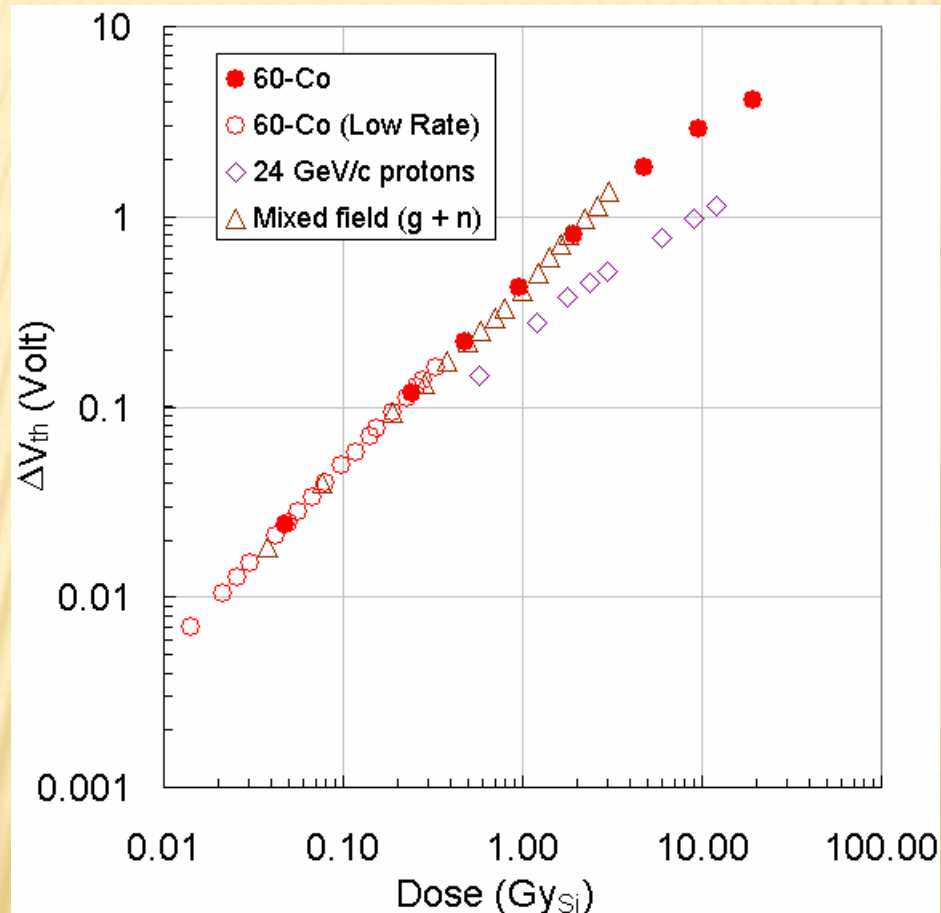
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EXTRA SLIDES

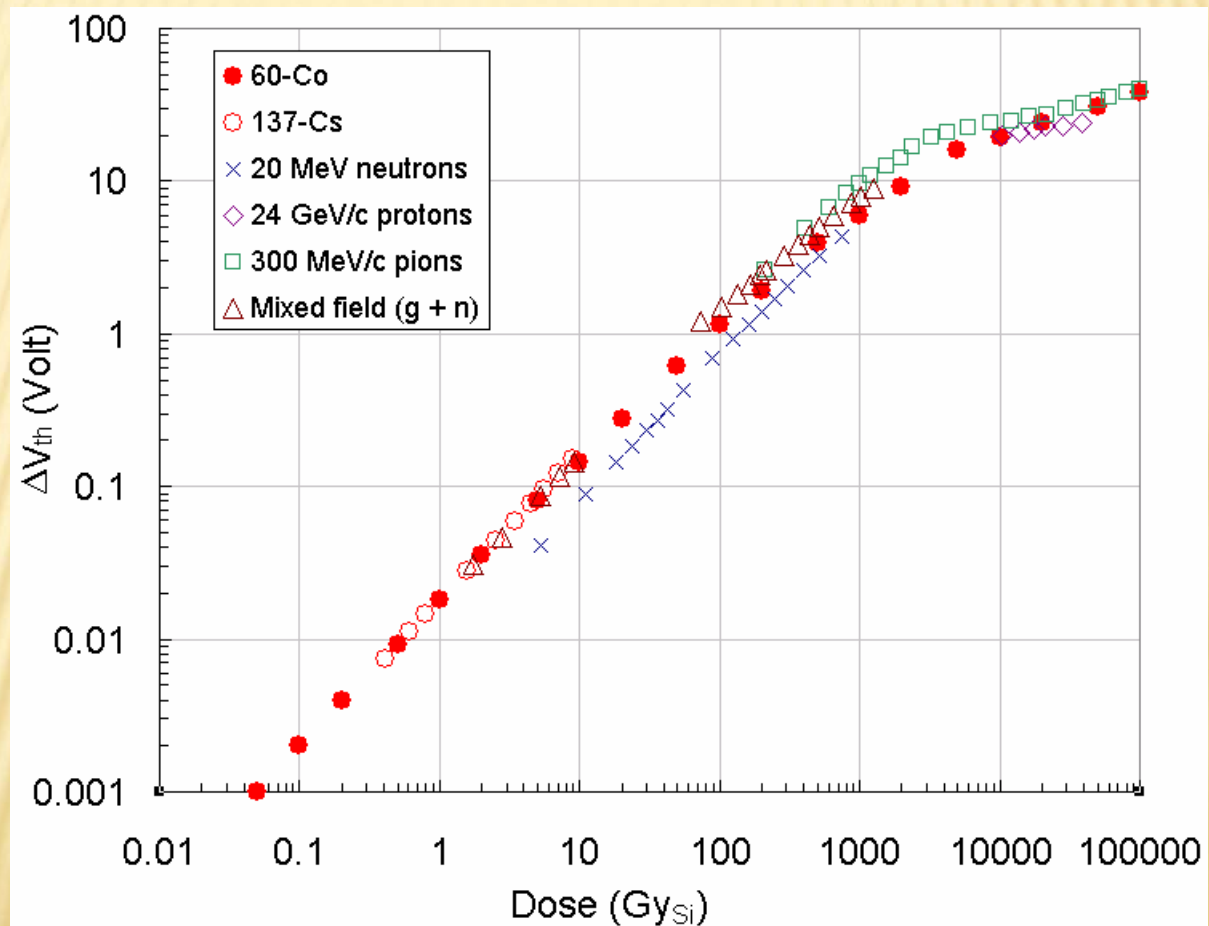
# REM 250 TEMPERATURE COEFFICIENT



# RESPONSE OF LAAS 1600 TO DIFFERENT RADIATION FIELDS



# RESPONSE OF REM 250 TO DIFFERENT RADIATION FIELDS



# RESPONSE OF BPW 34F TO DIFFERENT RADIATION FIELDS

