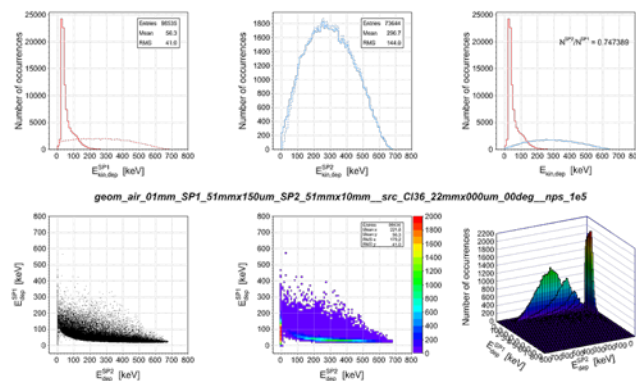
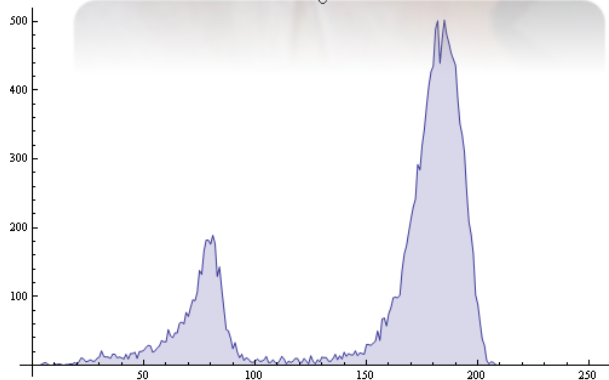
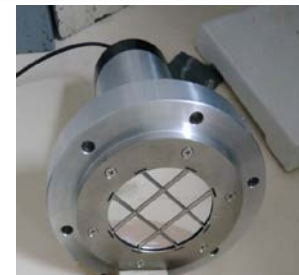


list
cea tech



NEW BETA PROBE FOR CONTAMINATION MONITOR UNDER A GAMMA BACKGROUND

BOUDERGUI Karim



- In 2016: A new R&D collaboration in a common laboratory start with Nuvia
 - Nuvia manufacture plastic scintillators and also beta probes like the CoMo in their own factories
 - CEA have a Patent **BD12 430** : “Method for processing a signal from a phoswich scintillator, and associated scintillation detector”
- One of the action of this R&D common laboratory is to :
 - Develop a technology block to be included in Nuvia product line to measure beta and / or alpha contamination under high gamma background of several dozen of microSv/h



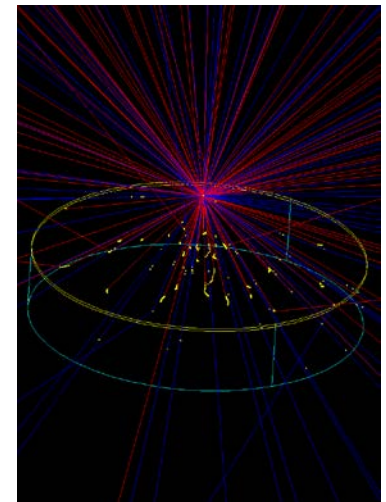
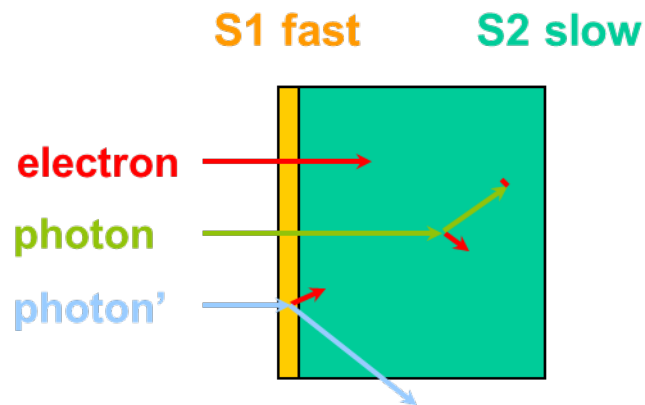
- During the outage and inside the reactor building (RB), NPP requirements in radiological contamination protection consist to perform non-contamination body, equipment and surface checks control.



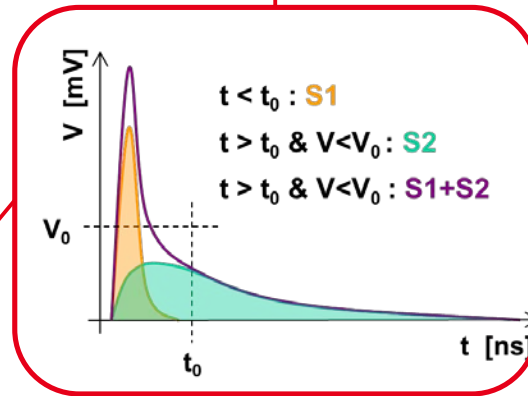
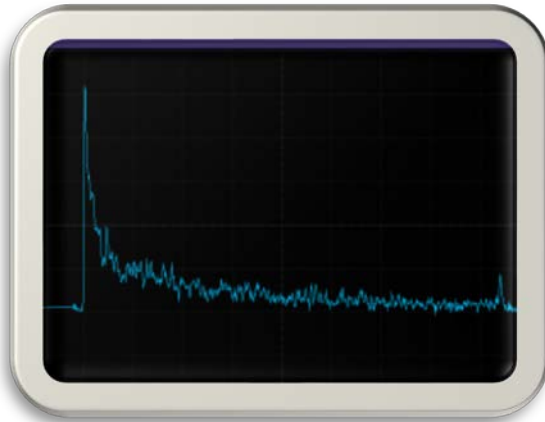
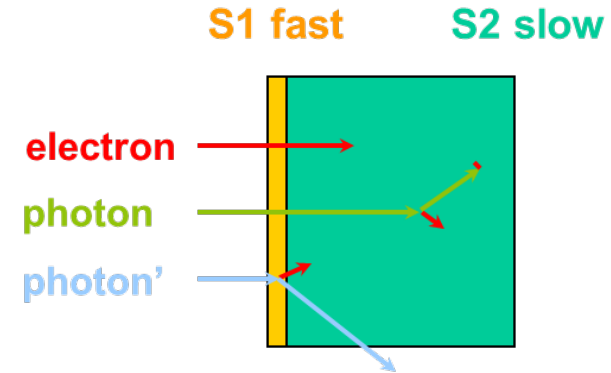
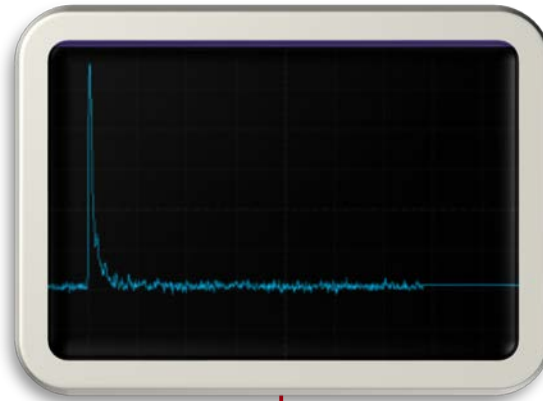
Main Goal:

- β contamination measurement down to **0.4 Bq/cm²**
- In a **fluctuating γ background** level of approximately **40 μ Sv/h**
- Time measurement **4 sec** (accuracy \ll 60%)

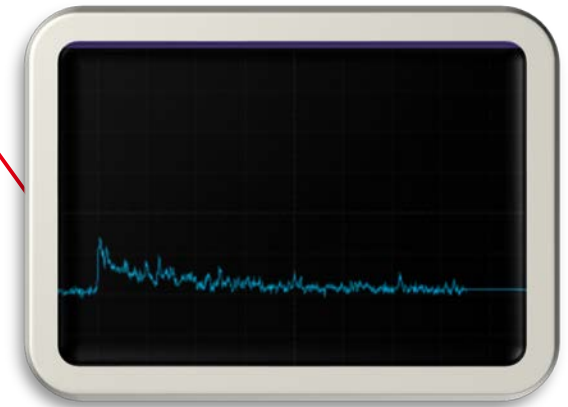
- The concept of the system is based on the possibility to discriminate several type of signal (alpha, beta and gamma):
 - Use a detector with the discrimination capacity
- The CEA make the choice to use plastic scintillator technology based on a phoswich (1952) detector (stack of scintillators)



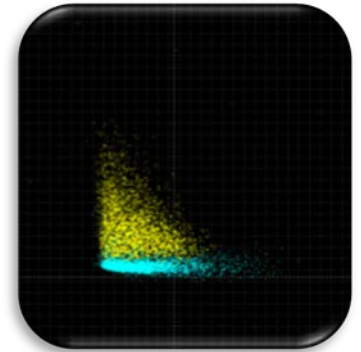
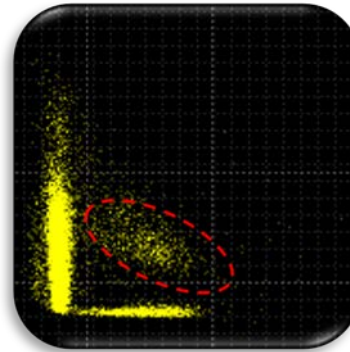
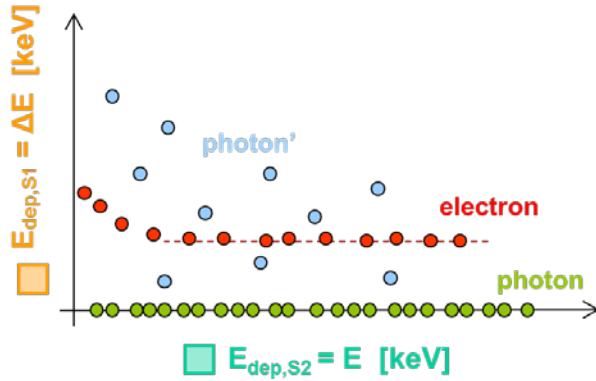
- Signal time aspects



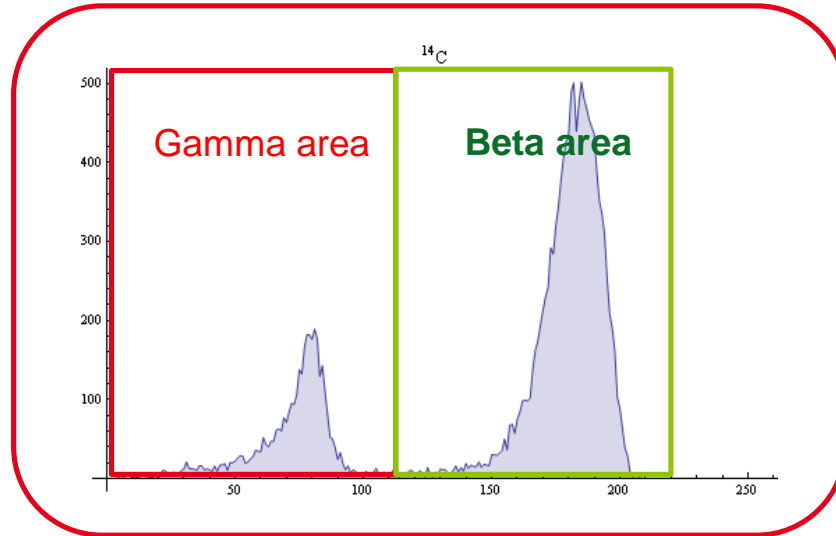
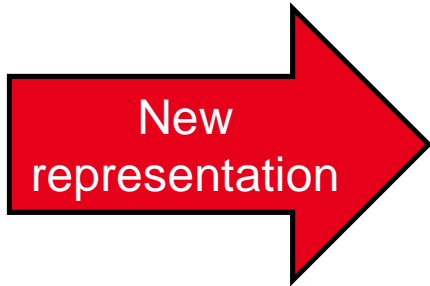
Signal time characteristics
(not enough for high γ background)



● Signal energy aspects



Signal energy characteristics
(Shape discrimination)



TESTS AND SETTINGS



New phoswich detector with adapted parameters



New electronic board including :

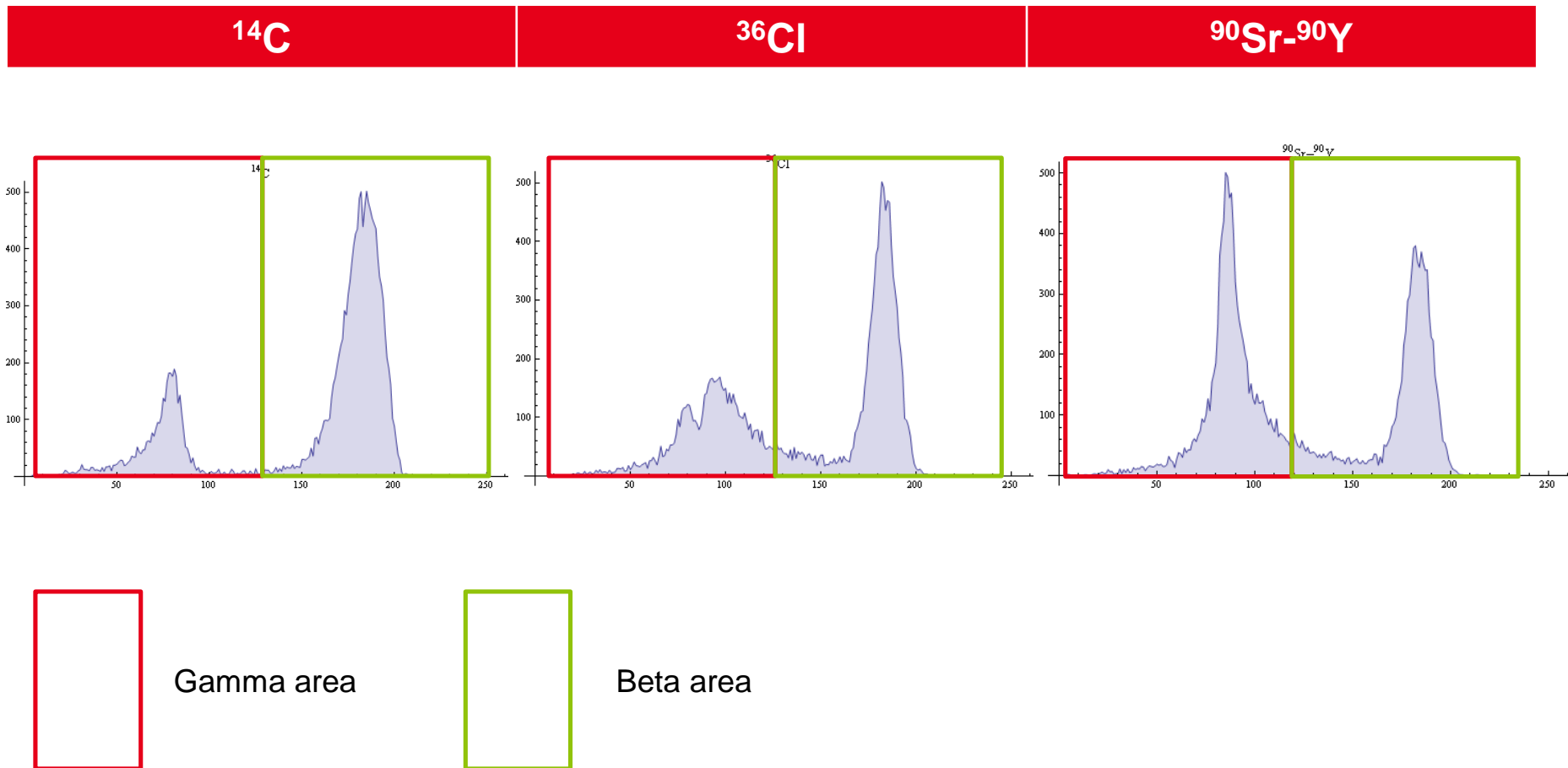
- 2 independant channels
- Embedded algorithms
- Low consumption



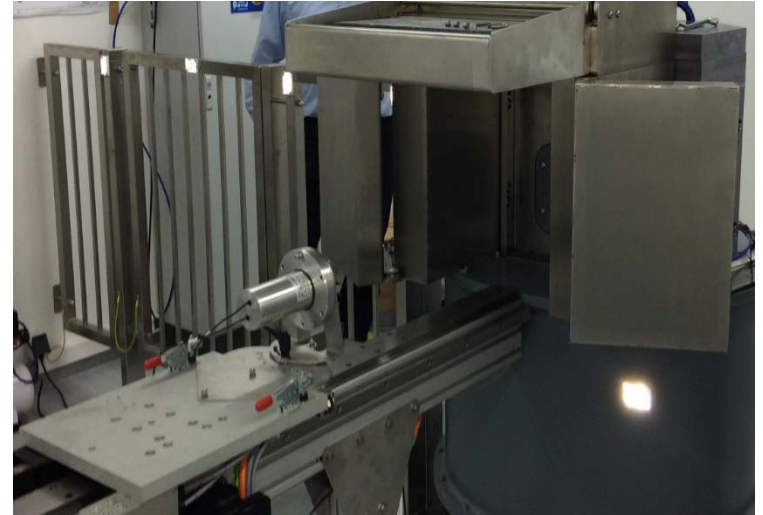
Industrial probe:
- WIMP60 Ø 60 mm



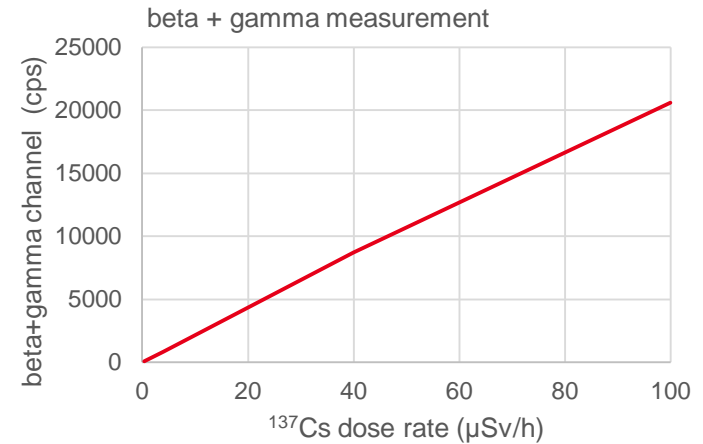
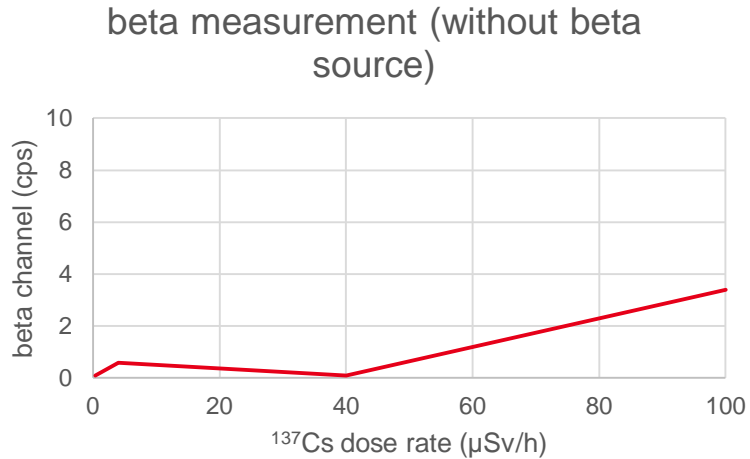
Example of β/γ discrimination real-time representation with WIMP60 prototype, including a gamma background



- **Test at NUVIA Instruments radiator :**
 - Several configuration, sources, position
 - Beta measurement with gamma background
 - Gamma energy impact on beta measurement (due to for example backscatter gamma ray at low energy)
 - Impact of the position of the probe in relation to the gamma background

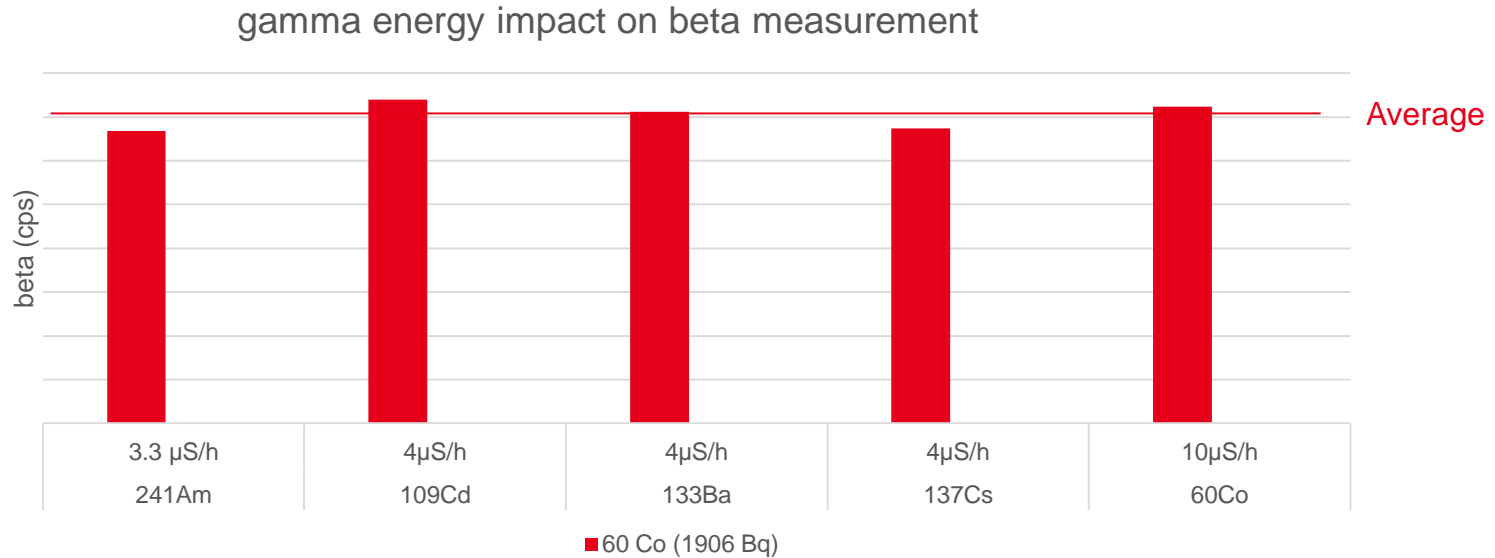


- No gamma impact on beta measurement



- At $100\mu\text{Sv/h}$ a limited impact in beta channel ($<4\text{cps}$)
- A linear response in total channel (beta + gamma)

- No gamma energy impact on beta measurement

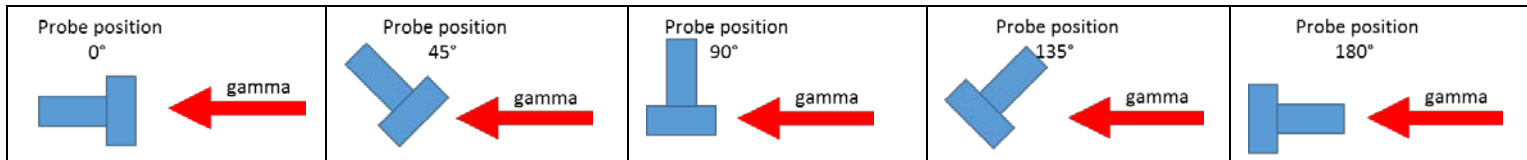


- Statistic fluctuation of beta measurement less than 10%

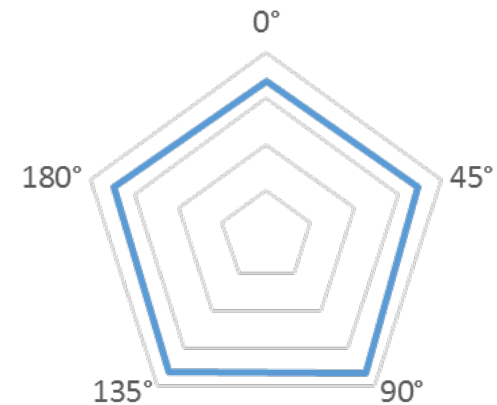
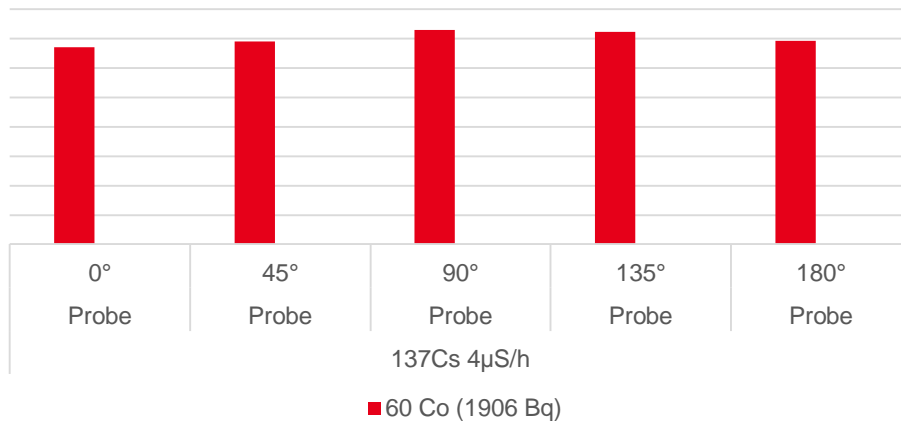


No impact

- No impact of the position of the probe in relation to the gamma background



impact on beta measurement in function of probe position from gamma background



Impact less than 10%

- Tests have showed the performances of the wimp60 probe under a fluctuating γ background level ,
- Next:
 - New plastic scintillator with suitable performances (time, light collection....)
 - New Nuvia béta devices with no gamma sensitivity
 - Probes
 - Smear test
 - Hand and foot monitor
 -





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