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Tabela que pode ser útil para registrar valores

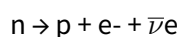
Espetro do Amerício-241 (vácuo)	ROI Int	ROI Net	Centroid (Chn)	FWHM (Chn)	Tempo de Aquisição
	51268 ± 226	47394 ± 262	709,78 ± 0,01	4,21	240s

### Teoria sobre a atividade Experimental

In beta decay, a beta particle refers to an electron ( $\beta^-$ ) or a positron ( $\beta^+$ ). It is not a photon. Beta decay involves the transformation of a neutron or a proton into an electron or a positron, respectively, accompanied by the emission of a neutrino or an antineutrino. This process occurs in atomic nuclei and is governed by the weak nuclear force. The emitted beta particle carries away energy and momentum from the nucleus undergoing decay.

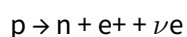
Certainly! Beta decay is a radioactive decay process that involves the transformation of a nucleus, typically in an unstable or radioactive state. There are two types of beta decay: beta-minus decay ( $\beta^-$ -decay) and beta-plus decay ( $\beta^+$  decay). Let's explore each type:

1. Beta-Minus Decay ( $\beta^-$  Decay): In beta-minus decay, a neutron within the nucleus undergoes a transformation, converting into a proton. Simultaneously, an electron (beta particle) and an electron antineutrino are emitted. The process can be represented as follows:



The neutron becomes a proton, increasing the atomic number of the nucleus by one, while the mass number remains the same. This process is often observed in isotopes with an excess of neutrons, as they seek to reach a more stable configuration.

2. Beta-Plus Decay ( $\beta^+$  Decay): In beta-plus decay, a proton within the nucleus transforms into a neutron. This decay process involves the emission of a positron (a positively charged electron) and an electron neutrino:



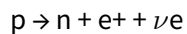
During beta-plus decay, the proton decreases in number, reducing the atomic number of the nucleus by one while keeping the mass number constant. Beta-plus decay typically occurs in isotopes with excess protons, as they attempt to achieve a more stable configuration.

It's worth noting that both types of beta decay involve the emission of neutrinos (electron antineutrino in beta-minus decay and electron neutrino in beta-plus decay). Neutrinos are electrically neutral and extremely low-mass particles, interacting very weakly with matter.

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These decay processes play a crucial role in nuclear physics and have implications in various areas, such as understanding the behavior of radioactive isotopes and nuclear energy production.

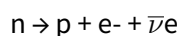
In beta-plus decay ( $\beta^+$  decay), the beta-plus particle refers to the positron ( $e^+$ ). The positron is an antiparticle of the electron, carrying a positive charge (+1 elementary charge) and having the same mass as an electron. During beta-plus decay, a proton within the nucleus of an atom transforms into a neutron, emitting a positron and an electron neutrino:



In this process, the atomic number of the nucleus decreases by one as a proton is converted into a neutron. The positron is the emitted particle, while the electron neutrino ( $\nu_e$ ) is also produced. The positron quickly interacts with an electron, resulting in their annihilation and the release of two gamma-ray photons.

It's important to note that the positron is not the same as the neutrino. The positron carries positive electric charge and is a particle, while the neutrino (in this case, the electron neutrino) is electrically neutral and is a distinct particle. Both the positron and the electron neutrino are produced during beta-plus decay.

In beta-minus decay ( $\beta^-$  decay), the beta-minus particle refers to the electron ( $e^-$ ). It is not the neutrino. During beta-minus decay, a neutron within the nucleus of an atom transforms into a proton, emitting an electron and an electron antineutrino:



In this process, the atomic number of the nucleus increases by one as a neutron is converted into a proton. The emitted particle is the electron (beta-minus particle), while the electron antineutrino ( $\bar{\nu}_e$ ) is also produced. The electron carries a negative charge (-1 elementary charge) and has a mass equal to that of an electron.

So, in beta-minus decay, the emitted particle is the electron ( $e^-$ ) while the neutrino counterpart is the electron antineutrino ( $\bar{\nu}_e$ ).

The endpoint in beta decay refers to the maximum energy or momentum that the emitted beta particle (electron or positron) can have. It represents the upper limit of the energy spectrum for the beta particles in a particular decay process.

In beta-minus decay ( $\beta^-$  decay), the endpoint energy corresponds to the energy difference between the initial and final nuclear states. The electron (beta-minus particle) can have a range of energies up to the endpoint energy, but no electron will be emitted with an energy greater than the endpoint energy. The endpoint energy is determined by the specific nuclear transition involved in the decay.

Similarly, in beta-plus decay ( $\beta^+$  decay), the endpoint energy is also determined by the energy difference between the initial and final nuclear states. The positron (beta-plus particle) emitted during beta-plus

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decay can have energies up to the endpoint energy.

The determination of the endpoint energy is important for understanding the energy distribution of the emitted beta particles and for various applications, such as in the calibration of detectors and the study of fundamental properties of particles and nuclear structure.

You are correct, the energy of the emitted beta particle (positron or electron) is not fixed and can vary within a range. The endpoint energy represents the maximum energy the beta particle can have in the decay process, but individual beta particles can have energies below the endpoint.

In beta decay processes, the energy is shared between the beta particle and the accompanying neutrino or antineutrino. Due to the conservation of energy and momentum, the energy spectrum of the beta particles extends up to the endpoint energy, with the probability of higher-energy beta particles decreasing as their energy approaches the endpoint.

The energy distribution of the beta particles also depends on the mass difference between the parent and daughter nuclei, the spin states involved in the decay, and other factors specific to the particular decay process.

The neutrino or antineutrino, being neutral and interacting weakly with matter, escapes detection and carries away some of the energy and momentum, making it challenging to measure its exact energy. Therefore, in practical applications, when analyzing the energy spectrum of the emitted beta particles, it is common to neglect the energy of the neutrino and focus on the energy distribution of the beta particles themselves.

However, in more precise and detailed studies, researchers may consider the energy and momentum of the neutrino when examining the properties of the decay process and making theoretical calculations.

The endpoint energy in beta decay can be determined using the Q-value (Q) of the decay process. The Q-value represents the energy released in the decay and is given by the mass difference between the initial and final nuclear states.

In beta-minus decay ( $\beta^-$  decay), the endpoint energy ( $E_{max}$ ) for the emitted electron is given by:

$$E_{max} = Q - m_e$$

where Q is the Q-value of the decay and  $m_e$  is the rest mass of the electron.

Similarly, in beta-plus decay ( $\beta^+$  decay), the endpoint energy ( $E_{max}$ ) for the emitted positron is given by:

$$E_{max} = Q - m_e$$

where Q is the Q-value of the decay and  $m_e$  is the rest mass of the electron.

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The Q-value can be calculated by subtracting the mass of the parent nucleus ( $m_{parent}$ ) from the mass of the daughter nucleus ( $m_{daughter}$ ):

$$Q = m_{parent} - m_{daughter}$$

The Q-value can be experimentally measured or obtained from nuclear mass tables.

It's important to note that the endpoint energy represents the maximum energy that a beta particle can have in the decay process. The actual energy distribution of the emitted beta particles can vary within a range up to the endpoint energy, and the probability of higher-energy beta particles decreases as their energy approaches the endpoint.

The Q-value in beta decay is the total energy released in the decay process. It represents the difference in mass-energy between the initial state (parent nucleus) and the final state (daughter nucleus) involved in the decay. The Q-value can be calculated using the equation:

$$Q = (M_{initial} - M_{final})c^2$$

where  $M_{initial}$  is the mass of the parent nucleus,  $M_{final}$  is the mass of the daughter nucleus, and  $c$  is the speed of light.

The Q-value can be positive or negative, depending on whether the mass of the parent nucleus is greater or smaller than the mass of the daughter nucleus. If the Q-value is positive, it means that energy is released in the decay process. If it is negative, it implies that energy must be supplied for the decay to occur.

The Q-value represents the maximum energy available for distribution among the decay products, including the beta particle (electron or positron) and the associated neutrino or antineutrino. The energy distribution among the decay products will depend on various factors, including conservation of energy and momentum, spin states, and other quantum mechanical considerations.

The Q-value is an important parameter in understanding and characterizing beta decay processes and is often used in experimental studies and theoretical calculations related to nuclear physics.

I apologize for the incorrect formula mentioned earlier. It was inaccurate. The correct formula for the endpoint energy ( $E_{max}$ ) of the beta particle (electron or positron) in beta decay is:

$$E_{max} = Q - m_e - m_\nu$$

Here,  $Q$  represents the Q-value of the decay,  $m_e$  is the rest mass of the electron, and  $m_\nu$  is the rest mass of the neutrino.

In beta decay processes, the Q-value is the total energy released in the decay, which is shared between the beta particle and the accompanying neutrino (or antineutrino). The endpoint energy ( $E_{max}$ ) represents the maximum energy that the beta particle can have, considering the available energy in the decay process.

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However, it's important to note that the exact masses of neutrinos are still not precisely determined, although experiments have provided evidence for nonzero neutrino masses. Therefore, the mass of the neutrino ( $m_\nu$ ) is typically assumed to be very small or negligible compared to other particles involved in the decay. As a result, in practical calculations and experimental analyses, the mass of the neutrino is often neglected, and the formula can be simplified to:

$$E_{max} = Q - m_e$$

This simplified formula is commonly used when considering the endpoint energy of the beta particle in beta decay.

A spectrometer with a silicon semiconductor is a device used to measure the energy distribution of particles or photons in a specific wavelength or energy range. Silicon is a commonly used material in semiconductor detectors due to its favorable properties for detecting charged particles or photons.

In a spectrometer using silicon semiconductor detectors, the incident particles or photons interact with the silicon material, creating electrical signals that can be measured and analyzed. Here's a simplified overview of the working principle:

1. **Interaction:** When particles or photons enter the silicon detector, they interact with the silicon atoms. Charged particles can ionize the silicon atoms, creating electron-hole pairs, while photons can generate electron-hole pairs through the photoelectric effect.
2. **Electron-hole pairs:** The interaction results in the creation of electron-hole pairs within the silicon material. Electrons are negatively charged particles, and holes are the absence of electrons, which can be considered as positive charges.
3. **Electric field:** The silicon detector is designed with an electric field that allows the separated electrons and holes to move in opposite directions.
4. **Collection:** The electric field guides the electrons and holes towards different regions of the detector. The electrons move towards the n-type region (with excess electrons), while the holes move towards the p-type region (with fewer electrons).
5. **Current measurement:** The movement of electrons and holes creates an electric current in the detector, which can be measured and amplified. The magnitude of the current is proportional to the number of electron-hole pairs created, which, in turn, corresponds to the energy of the incident particles or photons.
6. **Signal processing and analysis:** The measured current signal is processed and analyzed to determine the energy distribution of the incident particles or photons. This can involve techniques such as pulse height analysis, energy calibration, and data processing algorithms.

Spectrometers with silicon semiconductor detectors are widely used in various fields, including particle physics, nuclear physics, medical imaging, and materials analysis. They offer high sensitivity, excellent

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energy resolution, and good detection efficiency, making them valuable tools for precise energy measurements and spectroscopic analysis.

Why does the magnitude of the current (proportional to the number of electron-hole pairs created) correspond to the energy of the incident particles or photons? To clarify, the magnitude of the current generated in a silicon semiconductor detector is not directly proportional to the energy of the incident particles or photons. The current is proportional to the number of electron-hole pairs created, which is related to the intensity of the radiation.

In silicon semiconductor detectors, the energy of the incident particles or photons is determined through the measurement of the charge collection efficiency and the use of calibration techniques. The charge generated by the interaction of particles or photons in the detector is typically converted into a voltage signal, and the magnitude of this signal is proportional to the amount of charge collected.

To accurately determine the energy of the incident particles or photons, calibration procedures are performed using known radiation sources with well-known energy levels. The relationship between the voltage signal and the corresponding energy is established through these calibration measurements. This allows for the conversion of the voltage signal from an unknown incident radiation source into an energy value.

I apologize for any confusion caused by my previous statement, and I appreciate your diligence in seeking clarification. If you have any further questions, please let me know.

The vacuum pump is used in some silicon semiconductor detectors to create a vacuum environment around the detector. The presence of a vacuum helps to reduce unwanted interactions between the detector material and the surrounding gas molecules. This is important because gas molecules can scatter or absorb incident particles or photons, leading to inaccurate measurements or energy loss.

By creating a vacuum, the detector's sensitivity and performance can be improved, particularly in applications where precise energy measurements are required, such as X-ray or gamma-ray spectroscopy. The vacuum environment minimizes the chance of unwanted interactions and allows for more accurate detection and energy measurement of particles or photons.

Regarding the bias voltage (not bias tension) applied to the silicon detector, it is indeed the electric field acting on the detector. A bias voltage is applied to create an electric field within the detector, which helps in the collection of charge carriers (electrons and holes) created by the interaction of incident particles or photons.

The bias voltage sets up a potential difference between different regions of the detector, such as the n-type and p-type regions in a silicon detector. This electric field allows the separated charge carriers to be efficiently collected and guided towards the appropriate electrodes for detection and measurement.

The magnitude of the bias voltage determines the strength of the electric field within the detector.

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It needs to be carefully chosen to optimize the collection of charge carriers while avoiding excessive voltage that could lead to unwanted effects like excessive noise or breakdown.

I apologize for any confusion in my previous responses and appreciate your attention to detail. If you have any further questions, please let me know.

Certainly! I apologize for the confusion caused by my previous response. I'll explain the purpose of the bias voltage in a silicon semiconductor detector.

The bias voltage, also known as the bias potential or bias voltage supply, is applied to a silicon detector to establish an electric field within the detector. This electric field serves several important purposes:

1. **Charge Collection:** When incident particles or photons interact with the silicon detector, they create electron-hole pairs. The electric field created by the bias voltage helps in the efficient collection of these charge carriers. The electric field guides the electrons and holes towards the appropriate electrodes in the detector, ensuring their proper detection and measurement.
2. **Signal Amplification:** The bias voltage enables the amplification of the small electrical signals generated by the interaction of incident particles or photons with the detector. This amplification allows for better detection and measurement of the signals, improving the detector's sensitivity and signal-to-noise ratio.
3. **Depletion Region Formation:** The bias voltage creates a depletion region in the silicon detector. This region, also known as the depletion zone or the space charge region, is an area near the p-n junction in the detector where the charge carriers are depleted. The depletion region helps in efficient charge collection and reduces unwanted noise and background signals.

The magnitude of the bias voltage is carefully chosen based on the specific characteristics of the silicon detector and the desired performance. It should be set to optimize charge collection efficiency while avoiding excessive voltage that could lead to breakdown or other unwanted effects.

I apologize again for any confusion caused by my previous responses. I hope this explanation clarifies the purpose of the bias voltage in a silicon semiconductor detector. If you have any further questions, please feel free to ask.

The window amplifier is used to select a specific energy range of interest in an alpha radiation spectrum. Since alpha particles have high and relatively close energy values (typically peaks of 4-6 MeV), the window amplifier helps reject the uninteresting energy range and expand the relevant part starting from a certain threshold.

By using the "Energy" output of the window amplifier, you can choose the desired working region for the acquisitions. In this case, using <sup>241</sup>Am and <sup>210</sup>Po sources, the goal is to select the pre-selected energy ranges in the window amplifier.

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To determine the most suitable range, you need to consider the expected energy peaks for the alpha radiation emitted by the sources. Knowledge of the characteristic energies of the alpha particles emitted by the sources helps in selecting the energy range in the window amplifier that covers those peaks.

It is important to consider background noise levels and the desired signal-to-noise ratio when choosing the appropriate energy range. Additionally, it is important to ensure that the selected range is not too close to other energy peaks or unwanted noise in order to obtain proper calibration and clear visualization of the different energy peaks in the acquisitions.

In summary, choosing the working region in the window amplifier involves considering the expected energies of the alpha radiation from the sources, the background noise level, and the desired signal-to-noise ratio in order to achieve proper calibration and clearly identify the different energy peaks in the alpha radiation spectrum.

When choosing the working region in a window amplifier, there are a few factors to consider:

1. **Expected Energy Peaks:** Determine the energy range of the alpha particles emitted by your radiation source. Consult reliable sources or documentation to find the expected energy values. This will help you select a working region that covers the energy peaks of interest.
2. **Signal-to-Noise Ratio:** Consider the level of background noise present in your measurements. You want to choose a working region where the signal from the alpha particles is distinguishable from the noise. Avoid regions where noise levels are high or overlapping with the expected energy peaks.
3. **Calibration and Analysis Requirements:** Think about the accuracy and precision needed for your measurements. If you require a high level of accuracy, select a narrow working region to focus on specific energy peaks. If you need a broader overview of the energy distribution, choose a wider working region.
4. **Equipment Specifications:** Take into account the capabilities and limitations of your equipment, such as the resolution of the detector and the range supported by the window amplifier. Ensure that the chosen working region falls within the capabilities of your equipment for accurate measurements.

To determine the working region, you can start by visually inspecting the alpha radiation spectrum obtained with a wide energy range setting. Identify the prominent peaks and noise levels. Then, adjust the working region gradually, narrowing it down to cover the desired energy peaks while minimizing the influence of noise.

It's important to note that the selection of the working region may require some trial and error, as it depends on the specific characteristics of your experiment and the radiation sources used. Calibration with known alpha sources can also help refine the working region and improve accuracy.



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Ultimately, the choice of the working region involves a trade-off between sensitivity to specific energy peaks, noise reduction, and the precision required for your analysis.

The energy ranges for Am-241 and Po-210 can vary depending on the specific detector and experimental setup. However, I can provide you with approximate energy ranges commonly associated with these radioactive isotopes.

**Am-241:** Am-241 is primarily known for emitting alpha particles with an energy of around 5.486 MeV. Therefore, you would typically choose a working region that covers energies slightly above and below this value to capture the full energy range of the emitted alpha particles. A suitable working region for Am-241 could be around 4.5 MeV to 6.5 MeV, or slightly wider depending on the desired resolution and noise levels.

**Po-210:** Po-210 is an alpha emitter with a prominent energy peak around 5.304 MeV. To capture the energy of the emitted alpha particles from Po-210, you would select a working region around this energy value. A suitable range for Po-210 could be around 4.5 MeV to 6.5 MeV, or narrower if you specifically want to focus on the 5.304 MeV peak.

It's important to note that these energy ranges are approximate and can vary based on experimental conditions, detector specifications, and the desired level of accuracy. It's recommended to consult specific documentation or literature related to your experimental setup for more precise energy ranges and considerations for Am-241 and Po-210.

Para realizar a calibração em energia com o auxílio de um gerador de impulsos graduado e a fonte de <sup>210</sup>Po na região escolhida do amplificador de janela, você pode seguir os passos a seguir:

1. Configure o seu sistema de detecção e o amplificador de janela na região de trabalho escolhida, que abrange os picos de energia desejados do <sup>210</sup>Po.
2. Conecte o gerador de impulsos graduado à entrada do sistema de detecção. Certifique-se de que o gerador de impulsos esteja ajustado para fornecer pulsos com amplitudes e frequências conhecidas.
3. Inicie a aquisição de dados usando o software ou equipamento apropriado para registrar os impulsos gerados pelo gerador de impulsos graduado.
4. Observe os pulsos registrados e identifique os picos de energia correspondentes aos valores conhecidos do gerador de impulsos. Esses valores devem estar na região de energia selecionada no amplificador de janela.
5. Construa um gráfico ou tabela relacionando as amplitudes ou alturas dos picos de energia registrados com os valores conhecidos do gerador de impulsos graduado.
6. Realize uma análise estatística dos dados registrados para determinar uma relação funcional entre as amplitudes registradas e as energias correspondentes. Isso pode envolver o ajuste de

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uma curva ou função matemática aos pontos experimentais.

7. Com base na análise estatística, determine uma equação de calibração que relacione as amplitudes ou alturas dos pulsos registrados com as energias correspondentes. Essa equação permitirá converter as amplitudes de pulsos desconhecidos em valores de energia.
8. Verifique a qualidade da calibração testando o sistema de detecção com outras fontes radioativas ou padrões de energia conhecidos. Compare os resultados medidos com os valores esperados e faça ajustes adicionais, se necessário.

Lembre-se de seguir os procedimentos de segurança adequados ao trabalhar com materiais radioativos e siga as diretrizes e regulamentações relevantes em relação à manipulação e descarte de fontes radioativas.

Para escolher a região de trabalho mais adequada para aquisições com as fontes de  $^{241}\text{Am}$  e  $^{210}\text{Po}$ , utilizando as gamas de energias pré-selecionadas no amplificador de janela, você pode seguir estes passos:

1. Familiarize-se com as gamas de energias pré-selecionadas disponíveis no amplificador de janela. Essas gamas representam faixas de energia que podem ser analisadas pelo sistema de detecção.
2. Inicie as aquisições de dados usando as fontes de  $^{241}\text{Am}$  e  $^{210}\text{Po}$ , ajustando o sistema de detecção para cada gama de energia pré-selecionada no amplificador de janela.
3. Observe os espectros de energia resultantes das aquisições para cada gama de energia. Analise a distribuição dos picos de energia e a presença de ruído de fundo.
4. Considere o objetivo da sua análise e as características das fontes radioativas. Verifique se os picos de energia dos isótopos específicos de interesse, como os picos de emissão alfa do  $^{241}\text{Am}$  e  $^{210}\text{Po}$ , estão presentes nas gamas selecionadas.
5. Avalie a relação sinal-ruído para cada gama de energia. Procure por gamas que ofereçam uma boa separação entre os picos de energia desejados e o ruído de fundo, o que permitirá uma identificação clara e precisa dos picos.
6. Leve em consideração a resolução energética do seu sistema de detecção. Gamas de energia mais estreitas podem fornecer uma melhor resolução e discriminação dos picos, enquanto gamas mais amplas podem abranger uma faixa maior de energias, permitindo uma análise mais abrangente.
7. Com base nas observações anteriores, selecione a gama de energia que melhor atenda aos seus objetivos de análise. Escolha a gama que ofereça uma boa separação dos picos de interesse, uma relação sinal-ruído adequada e uma resolução energética adequada para a sua aplicação específica.

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É importante realizar testes adicionais e repetir as aquisições em diferentes gamas de energia, se necessário, para garantir a escolha mais adequada. A calibração com fontes de energia conhecida também pode ser útil para confirmar a escolha da região de trabalho.

A resolução de energia em um sistema de detecção refere-se à capacidade de distinguir e medir com precisão diferentes níveis de energia dos sinais detectados. É uma medida da capacidade do sistema em discernir picos de energia próximos e quantificar a dispersão dos valores medidos em relação aos valores reais.

A resolução de energia geralmente é expressa como a largura à meia altura (Full Width at Half Maximum - FWHM) de um pico de energia. Essa medida representa a largura do pico no nível da metade da sua altura máxima. Quanto menor for a largura à meia altura, melhor será a resolução energética do sistema, indicando que ele é capaz de distinguir de forma mais precisa as diferentes energias dos sinais detectados.

Para calcular a resolução de energia, siga estes passos:

1. Obtenha um espectro de energia registrado pelo sistema de detecção, que pode ser gerado através da análise de dados de uma fonte radioativa conhecida ou um gerador de impulsos graduado.
2. Identifique o pico de energia desejado no espectro que representa a energia de interesse.
3. Meça a largura à meia altura (FWHM) do pico de energia, que é a distância entre os pontos onde a altura do pico atinge a metade do seu valor máximo.
4. Calcule a resolução de energia dividindo a largura à meia altura pelo valor do pico de energia e multiplicando por 100 para obter a porcentagem. A fórmula é a seguinte: Resolução de energia (%) = (FWHM / Pico de energia) \* 100

Quanto menor for o valor obtido para a resolução de energia em porcentagem, melhor será a capacidade de discriminação de diferentes energias pelo sistema de detecção.

É importante ressaltar que a resolução de energia pode ser influenciada por vários fatores, como o tipo de detector utilizado, as características da eletrônica de leitura, a qualidade do sinal e o ruído de fundo. Portanto, é necessário otimizar esses parâmetros e realizar calibrações adequadas para obter a melhor resolução energética possível no seu sistema de detecção.

Certamente! Aqui está uma explicação mais detalhada de cada ponto para o estudo de atenuação das partículas alfa na matéria e a comparação da energia medida com vácuo e ar na câmara:

1. Calibração em energia com o auxílio do gerador de impulsos, graduado com a fonte de  $^{210}\text{Po}$ , usando o amplificador linear:
  - A calibração em energia é o processo de estabelecer uma relação entre os valores de energia medidos pelo sistema de detecção e os valores reais de energia.

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- Utilize um gerador de impulsos graduado, que fornece impulsos de energia conhecida, juntamente com a fonte de  $^{210}\text{Po}$ .
  - Registre um espectro de energia usando o amplificador linear e ajuste-o de modo que os valores medidos correspondam às energias conhecidas dos impulsos do gerador.
  - Essa calibração permitirá que você associe as leituras de energia feitas pelo sistema às energias reais das partículas alfa.

2. Comparação da energia medida com o detector com e sem ar na câmara:

- Prepare a câmara de detecção de modo que você possa medir a energia das partículas alfa em duas condições: com vácuo e com ar na câmara.
- Mantenha todas as outras condições experimentais, como a fonte de partículas alfa, o sistema de detecção e a distância de medição, consistentes.
- Registre os espectros de energia para cada condição, ou seja, obtenha leituras de energia das partículas alfa com vácuo e, em seguida, repita o procedimento com a câmara preenchida com ar.
- Certifique-se de registrar um número suficiente de eventos (partículas alfa detectadas) para obter resultados estatisticamente significativos e representativos.

3. Analise os espectros de energia:

- Ao comparar os espectros de energia obtidos para as duas condições (com vácuo e com ar), observe a forma dos picos de energia e a presença de ruído de fundo.
- Examine se há alguma diferença significativa na forma ou posição dos picos entre as duas condições.
- Os picos de energia representam as energias das partículas alfa detectadas. Analise se há alguma variação na altura ou largura dos picos entre as condições com vácuo e com ar na câmara.

4. Avalie a energia medida e compare os resultados:

- Meça a energia média dos picos em cada condição e compare os valores obtidos.
- Verifique se há alguma diferença significativa na energia média dos picos entre as condições com vácuo e com ar.
- Além disso, considere a dispersão dos valores de energia em torno da média para cada condição. Uma maior dispersão indica uma maior incerteza na medição da energia.

5. Interprete os resultados em termos de perda de energia das partículas alfa na matéria:

- Com base nas diferenças observadas nos espectros de energia e nos valores medidos, você pode inferir se a presença de ar na câmara resulta em uma maior atenuação das partículas alfa.

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- Partículas alfa que atravessam

o ar podem sofrer interações e perdas de energia adicionais em comparação com as partículas alfa que se propagam no vácuo. - Portanto, é esperado que a energia medida das partículas alfa seja menor na condição com ar na câmara em comparação com o vácuo.

Lembre-se de realizar múltiplas medições para obter resultados estatisticamente robustos e considere a incerteza estatística dos resultados ao interpretar os dados obtidos.