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Time Resolution in Resistive Plate Chambers from Statistical Considerations

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The quest for optimal time resolution remains one of the most intense areas of current research on Resistive Plate Chambers (RPCs). Achieving superior time resolution is crucial for a wide range of applications, from high-energy physics experiments to medical imaging technologies. Various technological solutions are proposed, each aiming to enhance the performance of RPCs, whose actual effectiveness must be experimentally verified.

However, beyond technological advancements, there are fundamental statistical considerations inherent to the process of signal formation in RPCs that set theoretical limits on the best time resolution achievable. These considerations stem from the stochastic nature of particle interactions and signal generation within the chamber. Understanding these statistical constraints is important for setting realistic expectations and guiding the development of new technologies.

This talk will delve into these statistical limitations, offering an overview of how they influence the time resolution of RPCs. We will explore the primary factors contributing to these limits. Furthermore, the discussion will extend to potential solutions and strategies for optimizing time resolution within these statistical bounds.

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