# Proposal for Beam Time and Research Program at IFJ PAN LINAC

## 1. General Information

**Project Title:** Measurement of proton or alpha beam excited giant resonances (GDR, GQR) gamma-ray decay

**Principal Investigator (PI):** M. Kmiecik

**Co-Investigators / Research Team:** M. Ciemała, A. Maj, et al.

## 2. Particle and Energy Selection

*Please check the required particle and the target energy section:*

**Primary Particle:**

[X] Proton (p+)

[ ] Deuteron (2H+ / d)

[X] Alpha (4He2+)

[ ] Lithium-7 (7Li3+)

[ ] Other (e.g., 16O8+): _____

**Acceleration Stage (Energy):**

[ ] **Section 1:** 2.5 MeV/u

[ ] **Section 2:** 12.5 MeV/u

[X] **Section 3:** 250 MeV/u (Future expansion / High energy)

[X] **Custom Energy:** approximately 20-80 MeV/u for alpha, approximately 100-250 MeV/u for proton (Variable range within section limits)

## 3. Abstract of Planned Research

*(Provide a brief description of the experiment, its scientific goals, and the expected outcome – max 300 words)*

The proposed research focuses on the fundamental nuclear physics investigation of Giant Dipole Resonances (GDR) and Giant Quadrupole Resonances (GQR). The experiment aims to measure the decay channels of these highly excited nuclear states, induced by both proton and alpha particle beams. To achieve this, the experiment requires a highly controlled pulsed beam environment.

The measurement setup will be structurally similar to the existing configuration at the Cyclotron Centre Bronowice (CCB), utilizing a large vacuum chamber alongside advanced gamma and charged particle detector arrays. Specifically, we plan to integrate existing high-performance detector systems, such as KRATTA and PARIS, into the experimental framework. Furthermore, the future acquisition and integration of a magnetic mass spectrometer (e.g., the BigBite spectrometer from KVI) is highly desirable to enhance the resolution and scope of the decay product analysis.

**This research represents a unique scientific endeavor on a global scale**.

## 4. Technical Beam Requirements

*Please specify the desired beam parameters to ensure the feasibility of the experiment:*

**Intensity / Current:**

Required current on target: 0.1 nA to 20 nA (e.g., 10 pA – 10 nA)

High intensity requirements (if applicable): _____ mA

**Time Structure:**

Pulse repetition rate: [X] 100 ns | [X] 200 ns | [ ] 400 ns | [ ] Other: ____

Bunch width (Sigma/FWHM): better than 1 ns FWHM

[X] Requirement for zero dark current (no background between pulses)

**Beam Spot Geometry:**

Desired spot size on target: around 0.5 mm sigma (e.g., < 0.5 mm)

[X] Requirement for no beam halo

**Energy Resolution:**

ΔE requirement: resolution of <100 keV is required; however, to ensure world-class experimental precision, a high-resolution target of 10 keV to 20 keV (ideally <10 keV) is requested (e.g., < 10 keV)

## 5. Application Category

[X] **Fundamental Nuclear Physics**

[ ] **Medical Applications**

[ ] **Electronics Irradiation**

[ ] **Material Science / Biophysics**

## 6. Additional Infrastructure Needs

**Large Vacuum Chamber,** required to house the target and inner detector arrays.

**Detector Integration,** support for the detector mounting and data acquisition.

**Spatial Requirements,** a significantly large experimental hall is required to accommodate the planned mass spectrometer (e.g., BigBite).