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Implementation of beam energy and energy spread diagnostics

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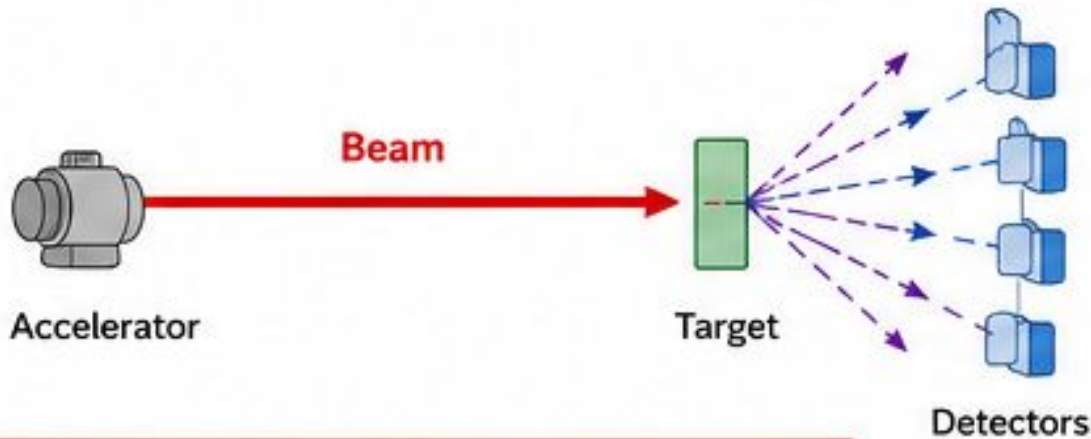


2nd Workshop on Research & Innovation in Poland
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Motivation

Beam energy determines the kinematics of reactions and the quality of results.



Consequences of unknown or incorrect beam energy:

- incorrect reconstruction of particle energies and angles
- wrong determination of cross sections
- misidentification of particles
- difficulties in comparing with theory
- larger systematic uncertainties



Reaction kinematics

- particle energies and emission angles
- accessible reaction channels



Particle identification

- correct reconstruction of masses and momenta
- separation of particle species



Detector calibration

- TOF, $\Delta E-E$, trackers
- correct energy reconstruction

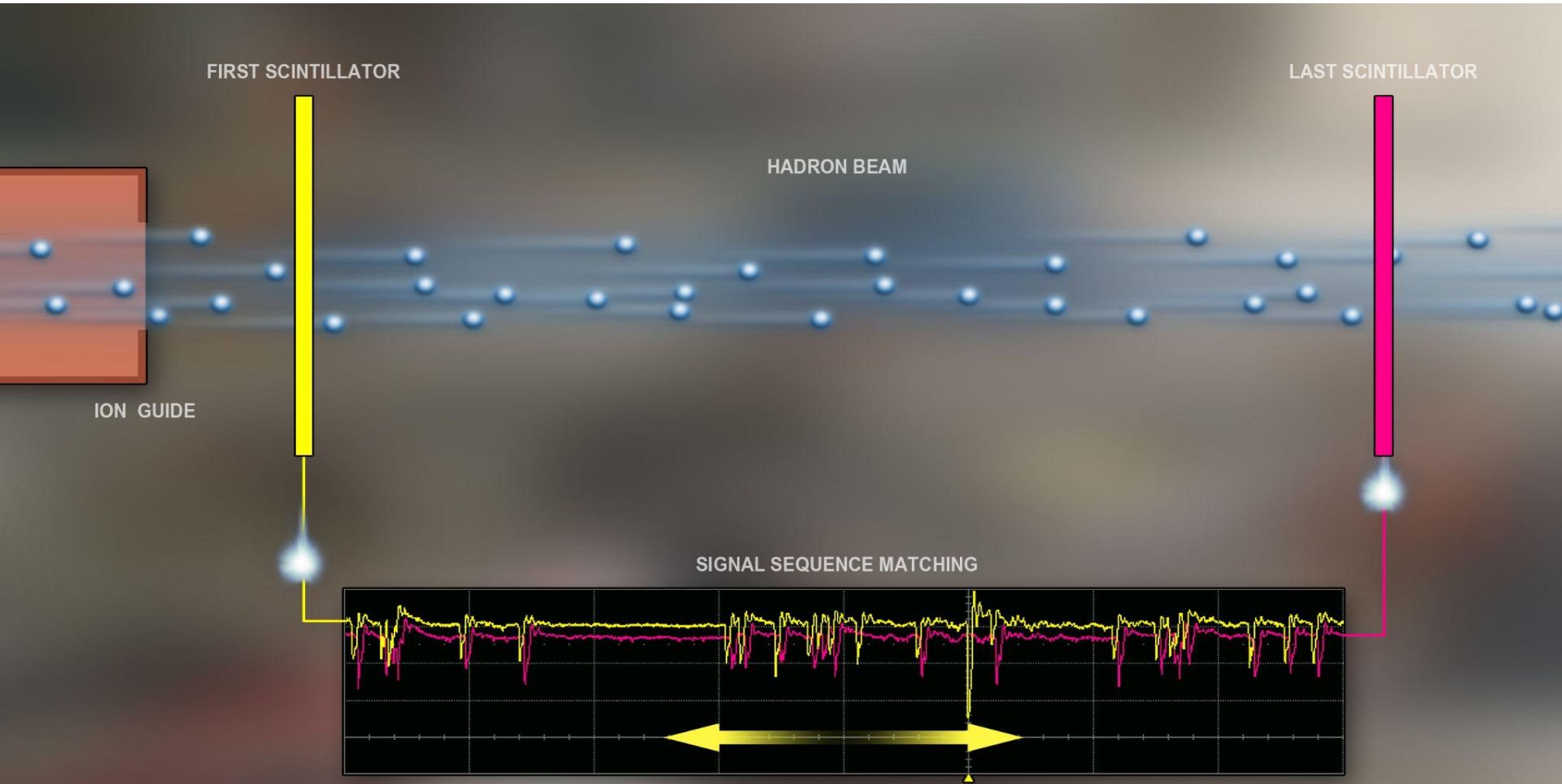


Precision of physics results

- structure of nuclei studies
- resonance and excited states determination
- accurate normalization



Waveform Pattern Alignment based on time-of-flight





Feasibility



Validated Operating Conditions

Proton beams from cyclotrons **COZY, AIC-144, C-230**

★ **70 – 200 MeV/u** range, effective currents **5 - 500 pA**,
TOF distance **3.611 m**



★ **60 MeV/u**, currents **100-600 pA**
TOF distance **2.149 m**



★ **1.96 GeV**
TOF distance **7.89 m**



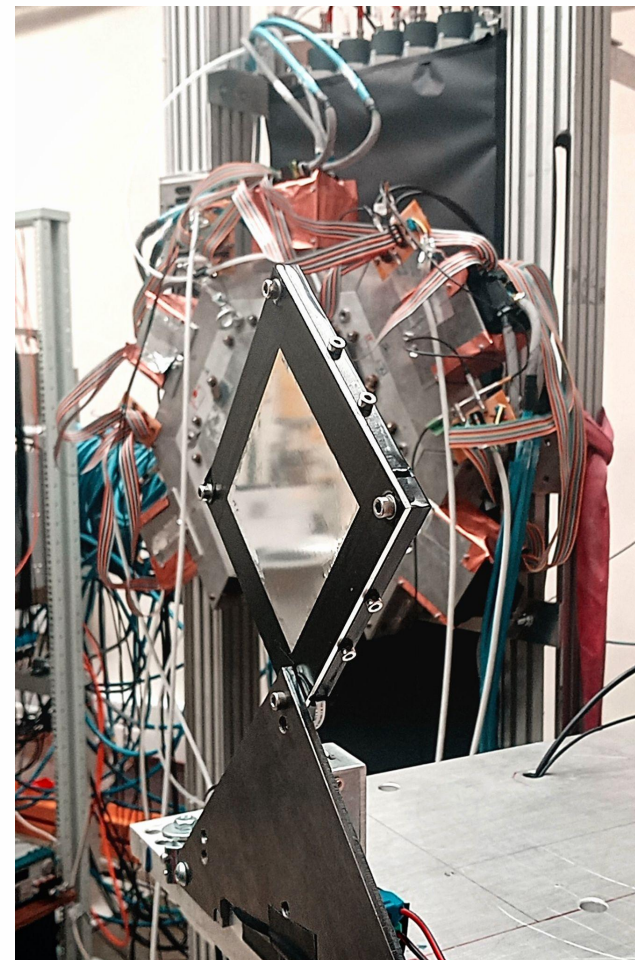
Struggle to achieve measurement precision below 0.25%



BEAM REQUIREMENT

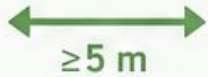
- Mono-energetic hadron beam at energy within **10 – 300 MeV/u** range, with or without pulsation.

- Beam on target in the range of **1 pA - 1 nA**, however higher currents can be investigated with lower precision.



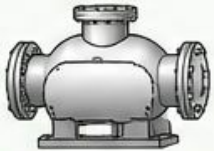


SPACE AND INFRASTRUCTURE REQUIREMENT



≥ 5 m

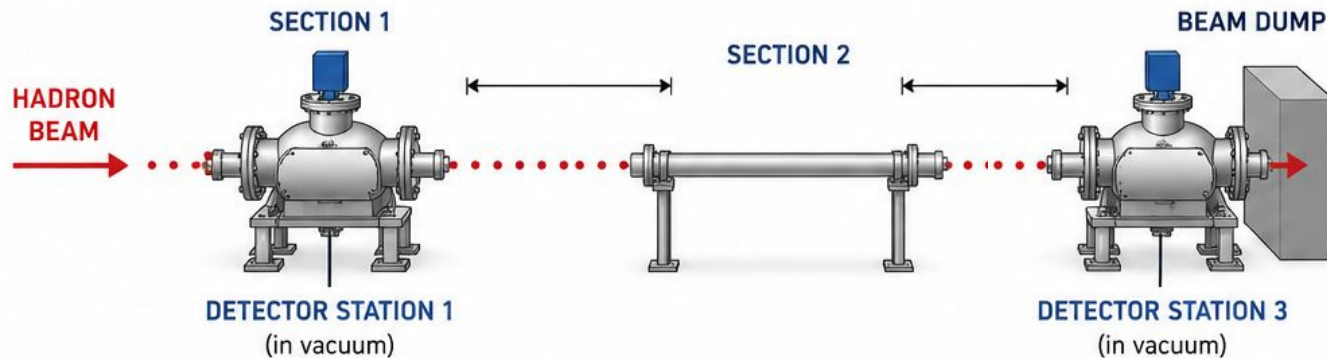
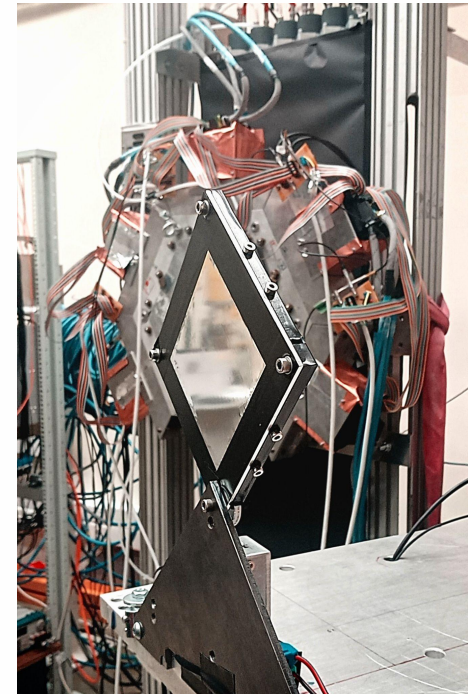
In total we need 2 or 3 stations for detectors
in distance of minimum 5 m
(longer the better, in vacuum)



One chamber on beamline in section 1 and 3,
and in front of beam dump.



Cloaked electronic channels
in-out from bunker





HUMAN RESOURCES



PhD student / engineer
(continuity of experience on site)



Commercial software developer
(to create the end-user application software)



FUNDING



The project is at the
“valley of death” stage
— no longer basic research,
but not yet product
implementation.



Without a grant,
we are able to put together
something functional,
but **not perfect**.



A grant of **less than
500k** should be more
than enough to develop
the final device.



The funding will enable us
to transform our solution
from a working prototype
to a high-quality, **market-ready
end-product**.



*Grant support will bridge the gap between research and implementation,
allowing us to deliver an accurate, reliable and final beam energy measurement device.*



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STRENGTHS



unique measure of energy spread



precise & direct energy measure



instant measure - seconds for procedure



low currents measurement



Intellectual Property advantage

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WEAKNESSES



measurement disturbs beam parameters



precision decreases at high currents



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OPPORTUNITIES



experienced team



proven feasibility and possible confirmation of universality



implementation of our own solution



at higher currents - necessity to switch to inductive detectors

T

THREATS



generation knowledge transfer risks



at higher currents - necessity to switch to inductive detectors



PROVEN TRACK RECORD

Development of two patented methods for hadron beam diagnostics.



RELEVANT EXPERTISE

Strong background in accelerator physics, detector systems, signal processing and beam diagnostics.



EXISTING INFRASTRUCTURE AND ACCESS

Experience with cyclotron facilities (CCB, AIC-144) and associated beamlines.



SKILLED TEAM

Interdisciplinary team with complementary competences and proven collaboration.



WE ARE WELL PREPARED TO SUCCESSFULLY REALIZE THE PROJECT

Feasibility confirmed. Experience proven. Impact expected.



THANK YOU FOR YOUR ATTENTION

We appreciate your time and interest.
We welcome any questions and discussions.



Feasibility confirmed.



Experience proven.



Impact expected.
