Status of Data Analysis for the Next-Generation Λ p Scattering Experiment at J-PARC

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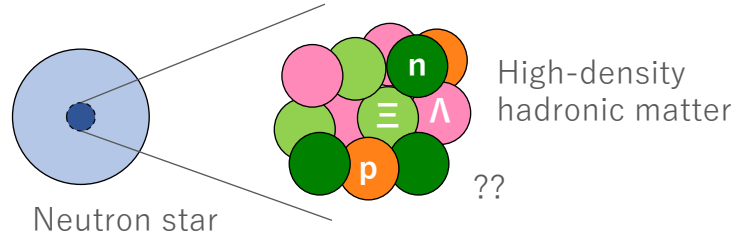
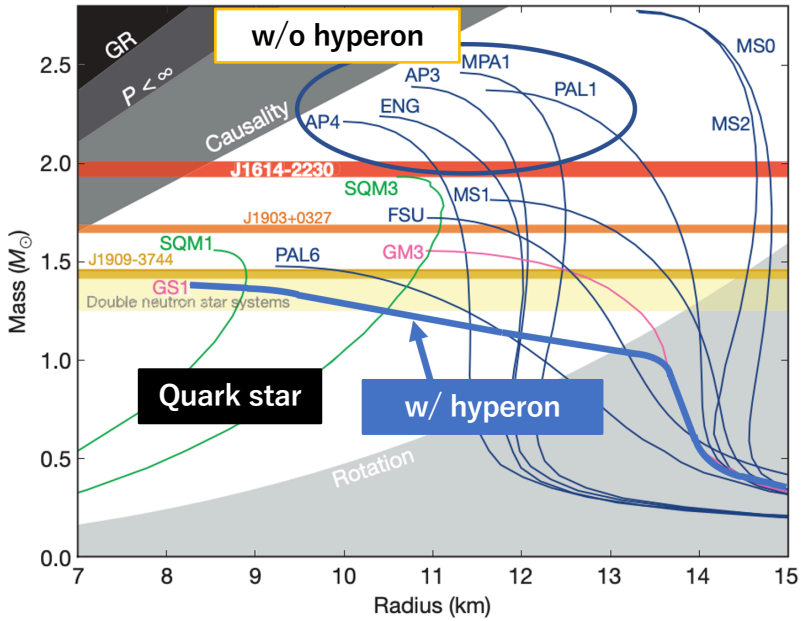
Hypernuclear Physics Experiment Gr.

2020/10/09

The Necessity of the Scattering Experiments

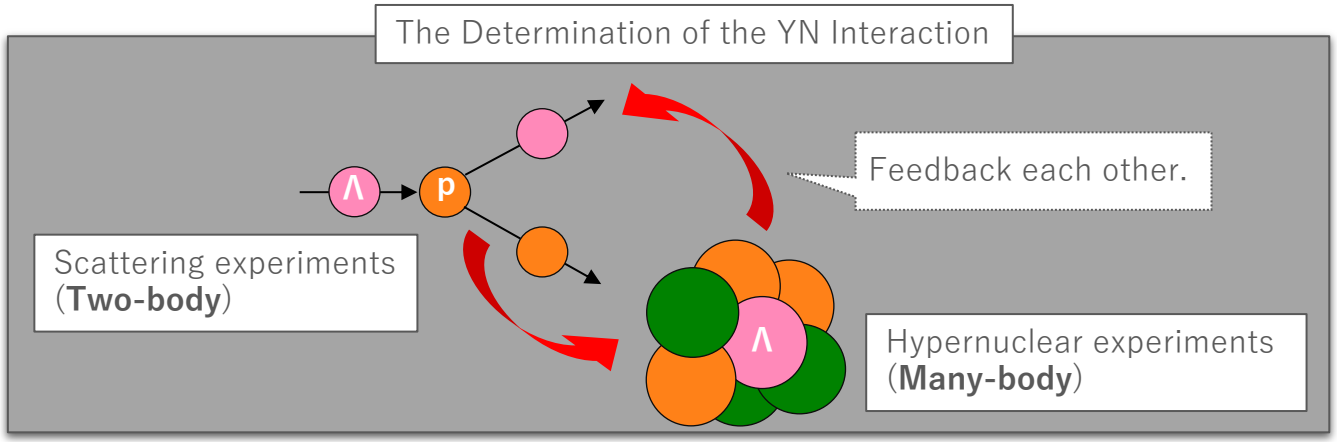


- **The YN Interaction**
  - **Theory**: Cannot explain two-$M_\odot$ neutron stars.
    - Two-body & many-body repulsive forces are necessary in high-density matter.



Observed $(1.97 \pm 0.04)M_\odot$ neutron star (J1614-2230), other ones (J1903+0327, J1909-3744) and main EOS theory model curves.

  - **Necessity**: Precise two-body information.
  - **Method**: Scattering Exp. (for the YN two-body).



  - **Historical BG**: Very limited YN scattering data.

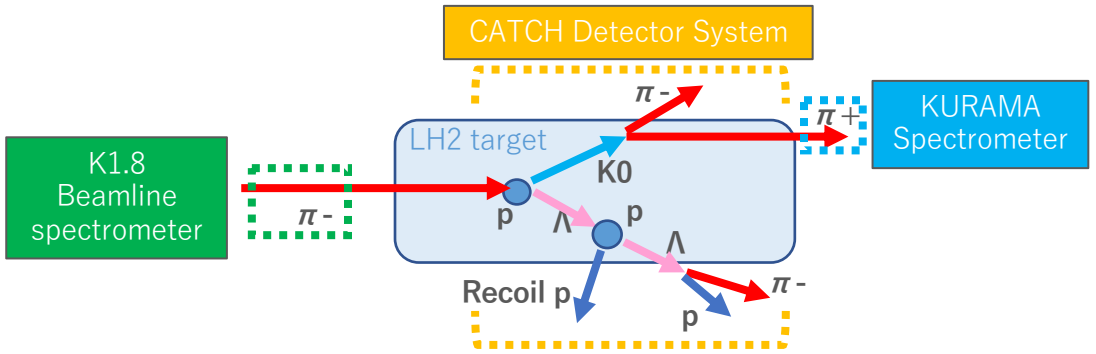
  - **Our Plan**: The Λ p scattering experiment (with our kinematical analysis).
    - **Statistics**: 100 times the past.

This Research Goal:
Verifying the Λ p Scattering ID method.

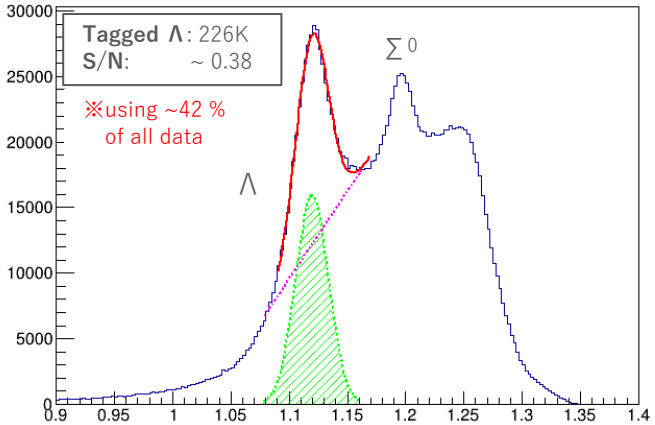
The Λ p Scattering Experiment

- **Challenging Point**
  - **Reaction**: The (π^-, K^0) reaction. ← Still not to be established!!
  - **Detection**: π^+ & π^-, separately.
  - **Analysis Flow**:

K0 Reconstruction → Λ Tagging → Λ p Scattering Identification



Schematic view of the π^-p→K0Λ reaction w/ E40 experimental setup.



Missing mass of the π^-p→K^0X reaction.

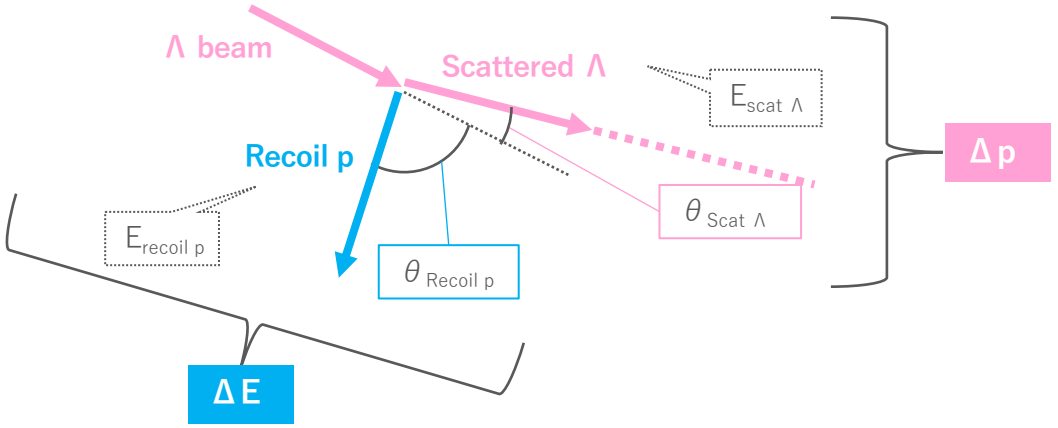
- Λ p Scattering Identification
  - If we can identify it, that would be an important achievement!!

- K0 Reconstruction
  - It is possible to detect K^0 w/ large solid angle.

- Λ Tagging
  - It is possible to tag produced Λ.

The Λ p Scattering Identification

- **Kinematical Calculation Method**
  - **Object**:
    1. Recoil p angle & energy
    2. Scattered Λ angle & energy
  - **Kinematical Index**:
    1. Δ p: from scattered Λ
    2. Δ E: from recoil p

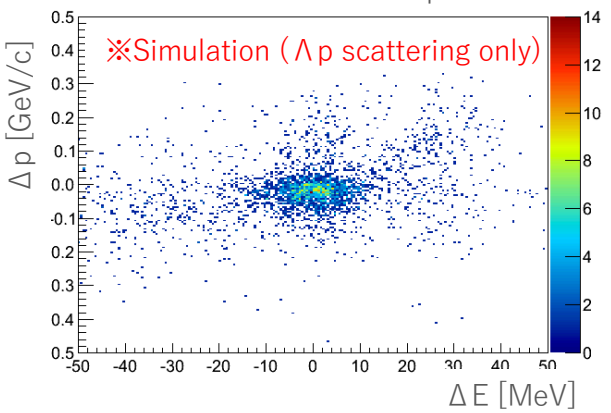


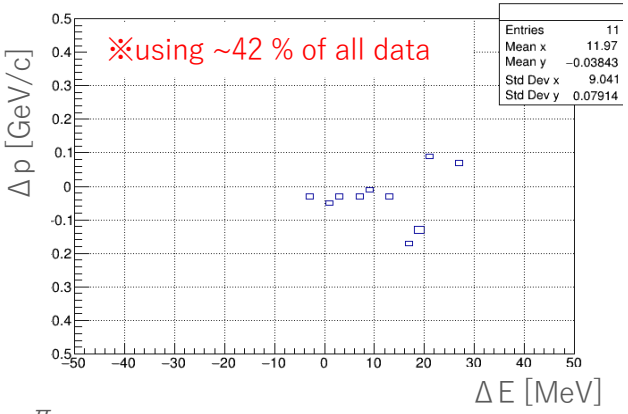
- **Possibility of the Λ p Scattering Identification**
  - **@JPS 2020 Autumn**
    - We succeeded in finding that events.

      → Our analysis methods are effective.

      →It is possible to yield more Λ p scattering events.

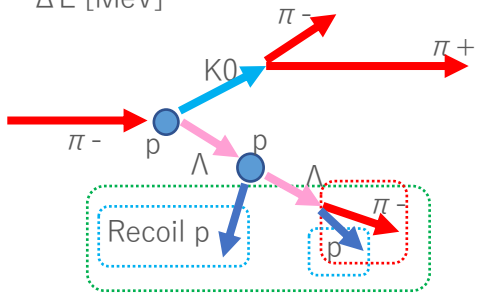
Correlation between Δ p & Δ E





Case #	Detected particle	Calculated items
1	Decay π - & p	Λ momentum & angle
2	Recoil p & Decay p	Recoil p energy & Λ angle
3	Recoil p, Decay π - & p	Recoil p energy, Λ momentum & angle

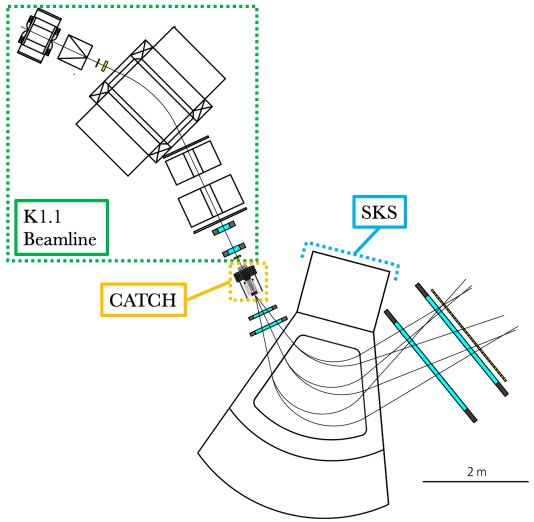
Future Task.



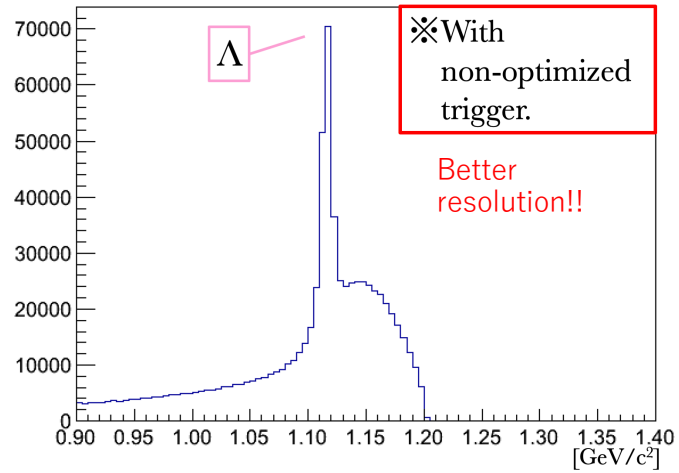
Characteristics of the Research

- **Doctor Research**
  - **Design**: The next Λp scattering exp. @K1.1 beamline.
    - Polarized Λ & Better resolution
  - **Data Analysis**:
    1. Rough cross section of the Λp scattering.
    2. Λ polarization (up-down asymmetry by Λ decay)

- **Overseas Tie-up**
  - **Partner**: J-Lab CLAS
  - **Contents**: g10 data analysis.
    - Λd channel.
  - **Motivation**
    - First attempt to extract YNN three-body effect from scattering experiment.
    - Applying our kinematical analysis method.



The setup of the next Λp scattering exp. @J-PARC K1.1 beamline.



The missing mass simulated w/ the next Λp scattering exp. setup.

My Research Period Plan (time is limited.)

		M2	D1	D2	D3
Doctor Research	Design		→	→	
	Λp cross section	→	→		
	Λ polarization		→	→	
Overseas Tie-up			→	→	→