JLabにおける ^{3}H(e,e'K)nnΛ反応断面積測定

日本物理学会 第76回年次大会

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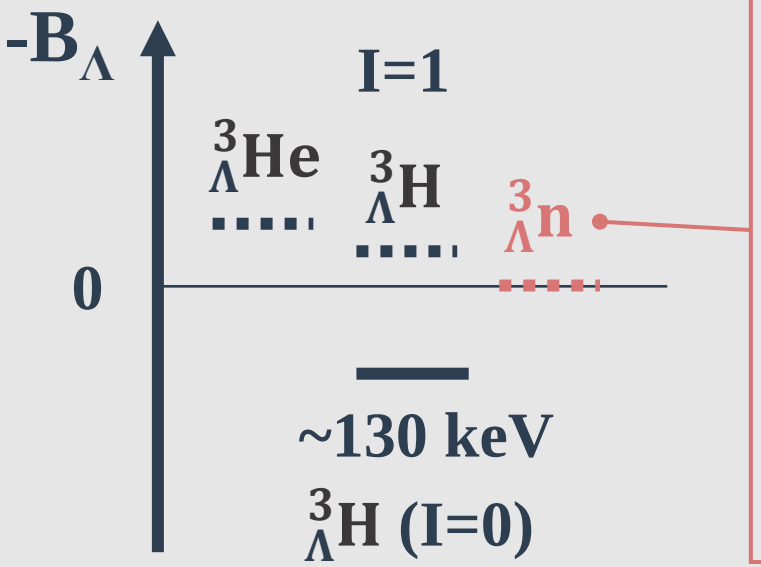
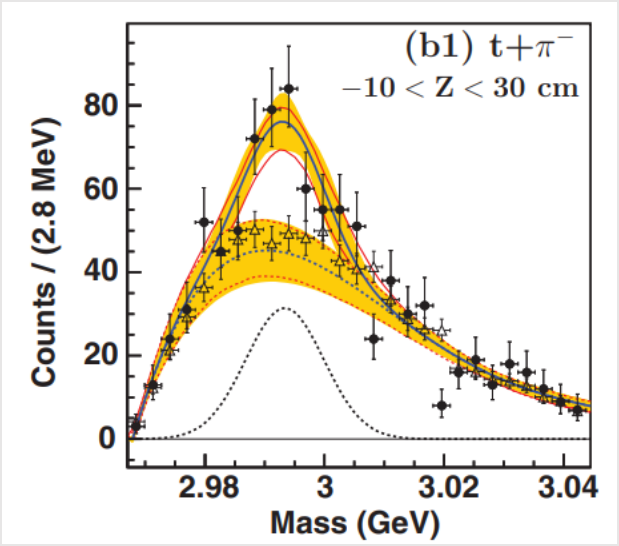
Contents

Introduction

Introduction

- ${}^{3}_{\Lambda}\mathrm{H}$ (I=0) is the only established state in A = 3 hypernuclear system.
- HypHI Collabolation indicated nnΛ signal at GSI in 2013.





C. Rappold et al., Phys. Rev. C. **88**, 041001 (2013)

Theoretical calculation

Bound?

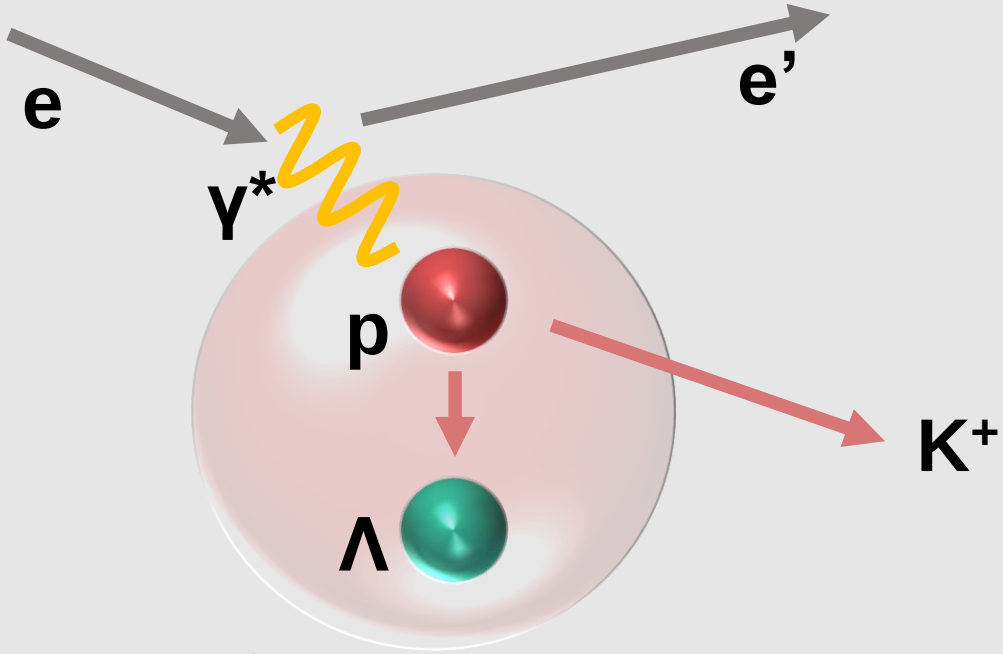
Author	calculation	YN interaction	bound	etc
Iraj(2019) [1]	Fadeev	Yamaguchi	×	Λn ↑ 25% bound
Belyaev(2008) [2]	hyperspherical harmonics	Minesota	×	V ↑ 50% bound
Filikhin(2016) [3]	Fadeev	NSC97f	×	-
Gal(2014) [1]	Fadeev	Nijimegen	×	-
Hiyama(2014) [2]	variational method	NSC97f	×	-
Kamada(2016) [3]	Fadeev	Nijmegen	×	YN ↑ 20% bound
Downs(1959) [4]	variational method	exponential	×	-
Richard(2015) [5]	variational method	ESC08, CEFT	×	-
Garcilazo(2007) [6]	Fadeev	CCQM	×	-
Ando(2015) [7]	coupled integral equation	$\not\pi$EFT	△	Efimov state?

Resonance?

Author	calculation	YN interaction	resonance	etc
Iraj(2019) [1]	Fadeev	Yamaguchi	×	Λn ↑ 5% resonance
Belyaev(2008) [2]	hyperspherical harmonics	Minesota	○	-
Filikhin(2016) [3]	Fadeev	NSC97f	○	-
Kamada(2016) [3]	Fadeev	Nijmegen	○	-

Electro-production of hypernuclei at JLab

- Changing p to Λ → nnp target to nnΛ
- High resolution primary beam → ΔM =1.26 MeV (σ)
- Missing mass method → Sensitive to bound/resonance

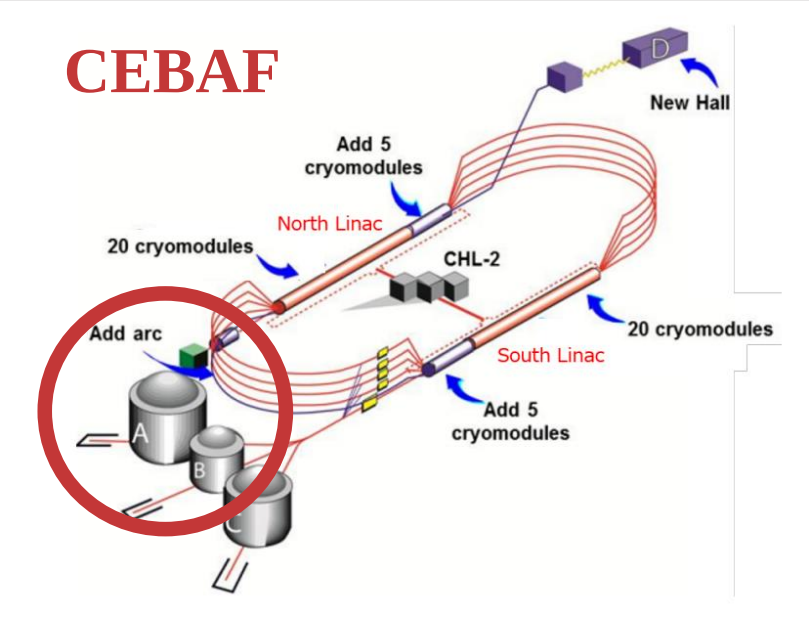


$^{3}\mathrm{H}(\mathrm{e},\mathrm{e}'\mathrm{K})^{3}_{\Lambda}\mathrm{n}$

Experiment

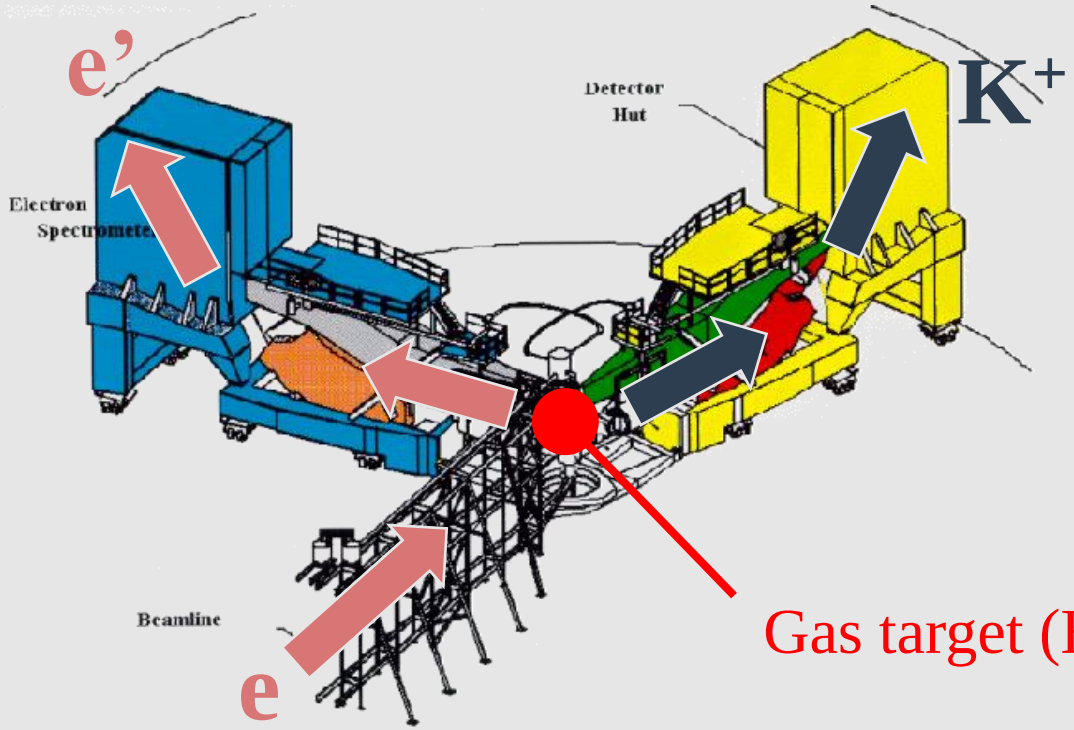
Jefferson Laboratory (Virginia, USA)

- 12 GeV continuous electron beam (Max)
- High Quality Beam
  - $\Delta E/E = 1.0 \times 10^{-4}$ (FWHM)
  - Intensity 100 μA (22.5 μA for T_2)
- Data taken in Nov 2018



High Resolution Spectrometer (HRS)

- $\Delta p/p = 2.0 \times 10^{-4}$ (FWHM)
- Momentum bite / p ~ ±4.5%

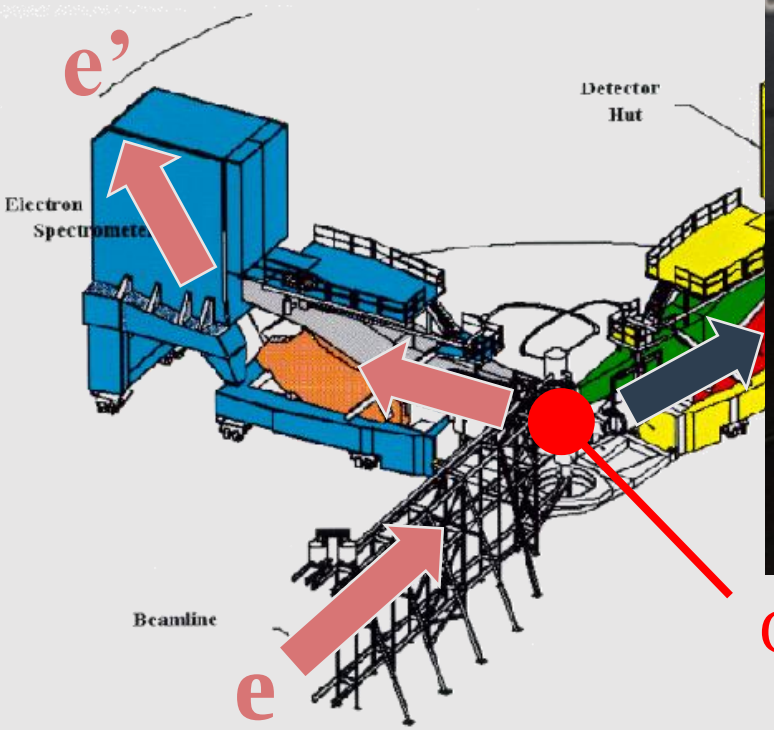


Kinematics

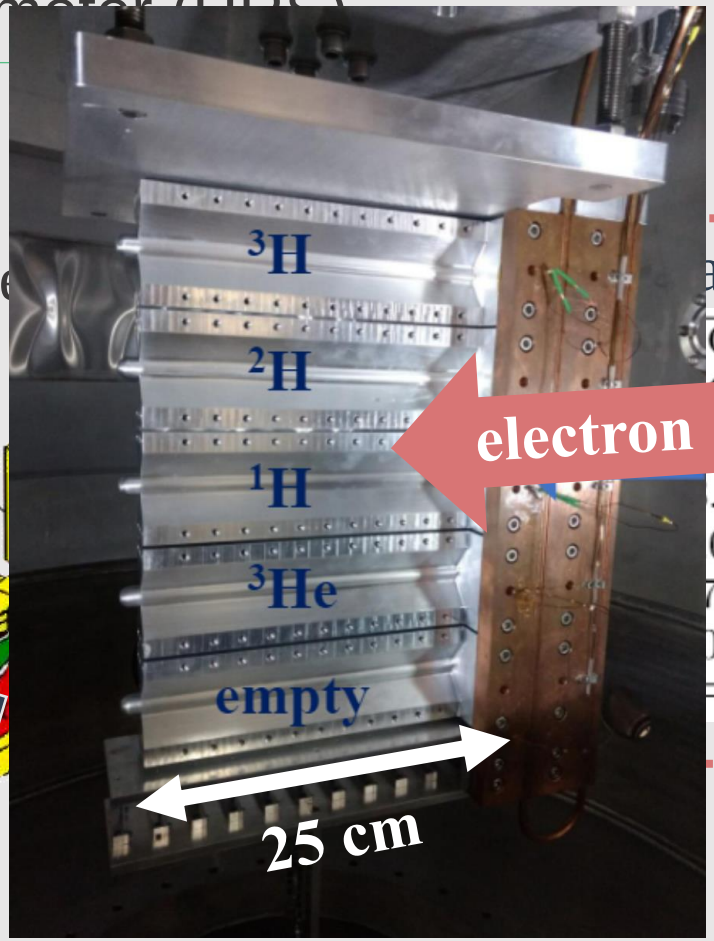
p_e	2.218 GeV/c
p_k	1.823 GeV/c
Q^2	0.506
$\theta_{e\gamma}$	13.2°
$\sqrt{s}$	2.08
ϵ	0.794
ϵ_L	0.091

High Resolution Spectrometer (HRS)

- 2.0×10^{-4} (FWHM)
- Momentum acceptance



4.32 GeV/*c*



Gas target (H_2, T_2)

atics

GeV/c
GeV/c
06
.2°
08
794
091

S.N. Santiesteban et al., Nucl. Inst. Met A. 940,(2019)

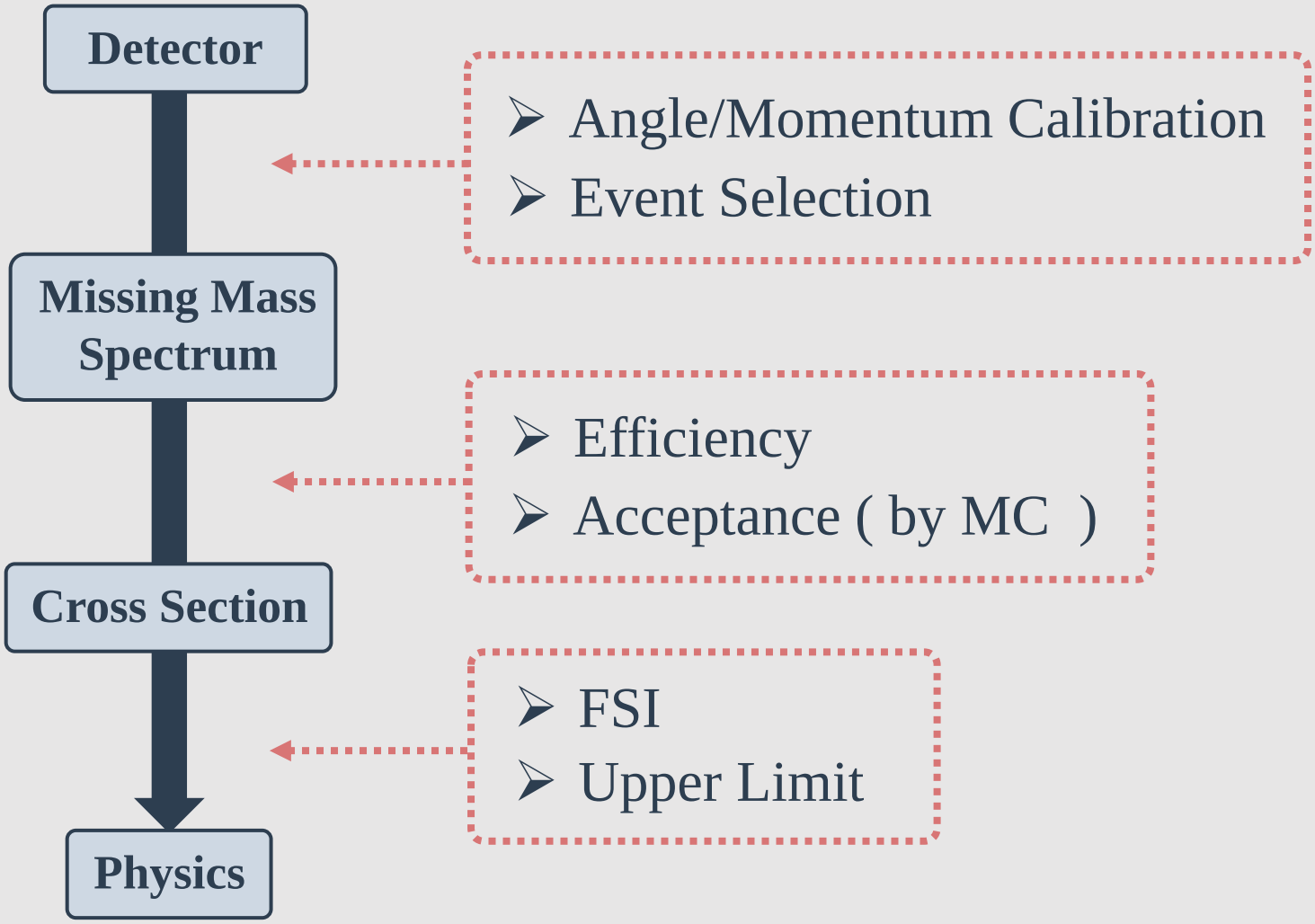
Analysis

Analysis status

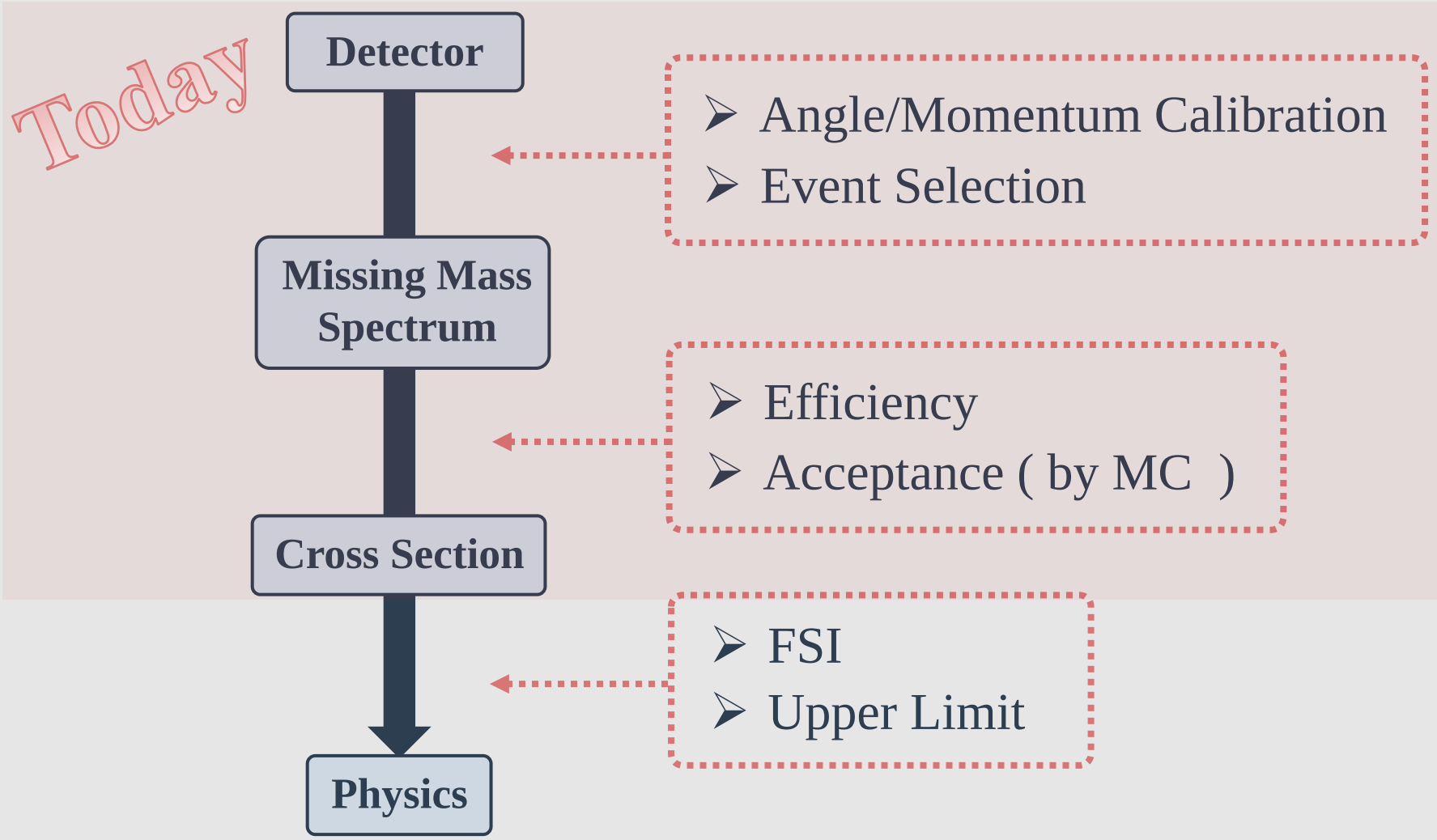
The same spectrum has been analyzed in three groups independently.

	This talk		
Doctor Candidate	K. N. Suzuki	K. Itabashi	P. Bishnu
Focus on	Cross section Upper limit	ΛN FSI	Peak search
Acceptance Estimation	Geant4	SIMC	-

Analysis Flow

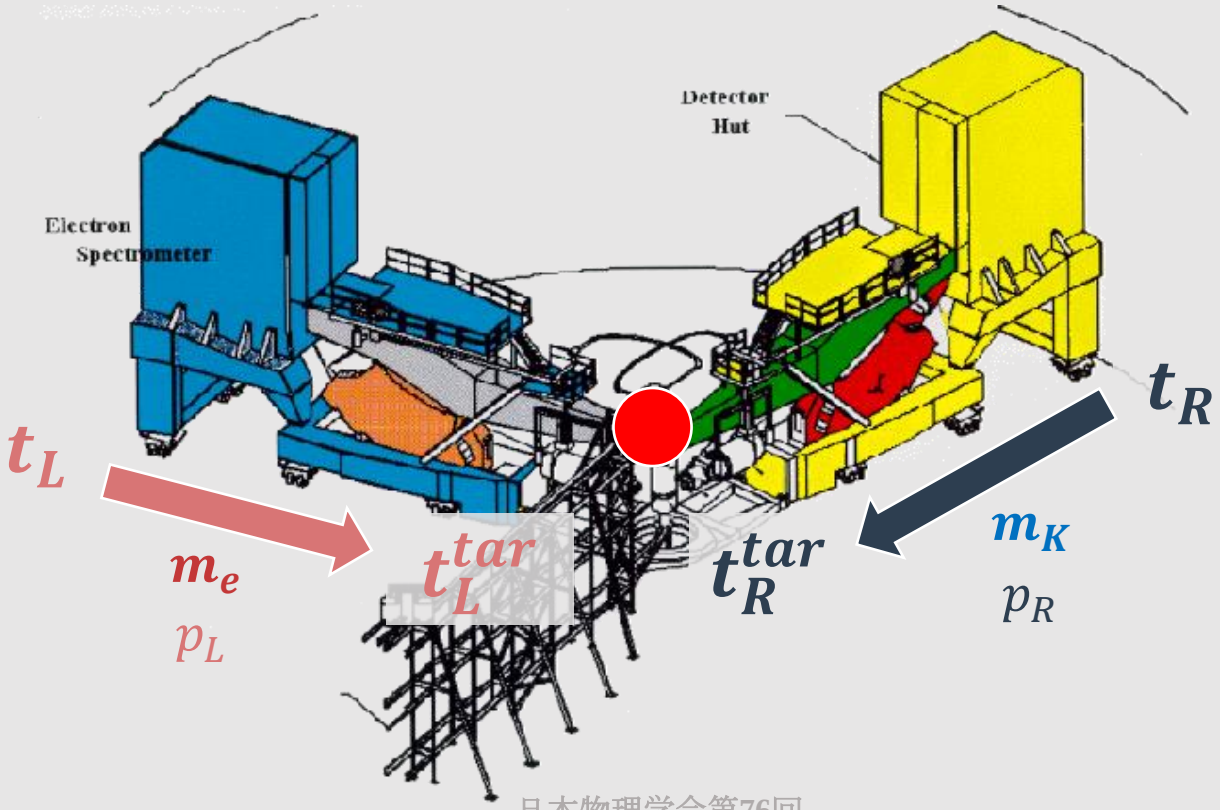


Analysis Flow



K^+ Selection

- Aerogel Cherencov
  - AC1 (n=1.015)
  - AC2 (n=1.055)
- Coincidence time : $t_L^{tar} - t_R^{tar}$



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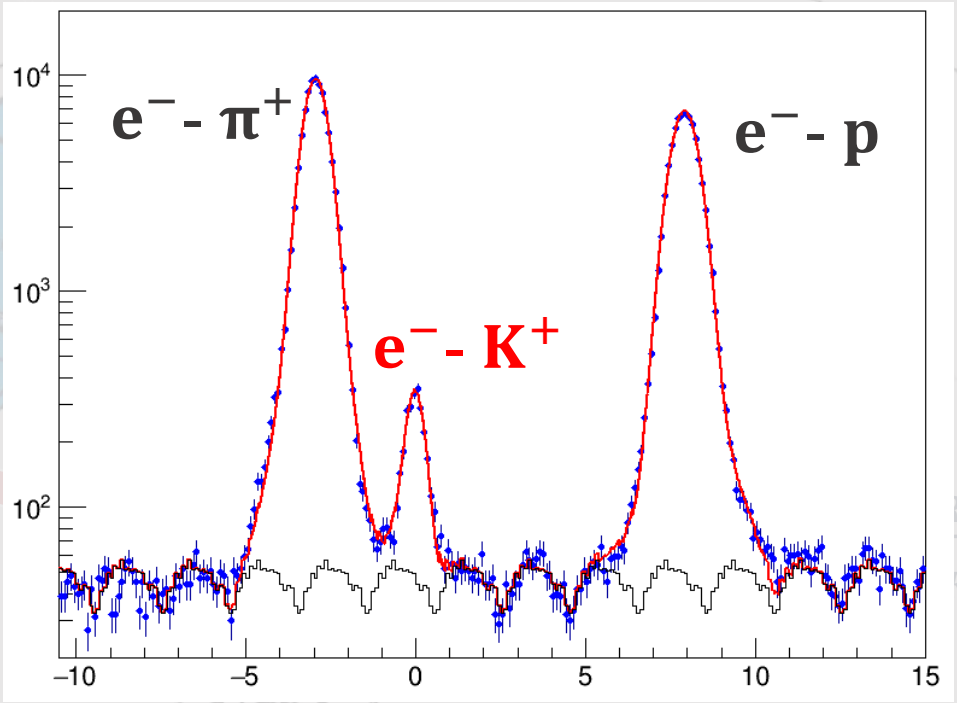
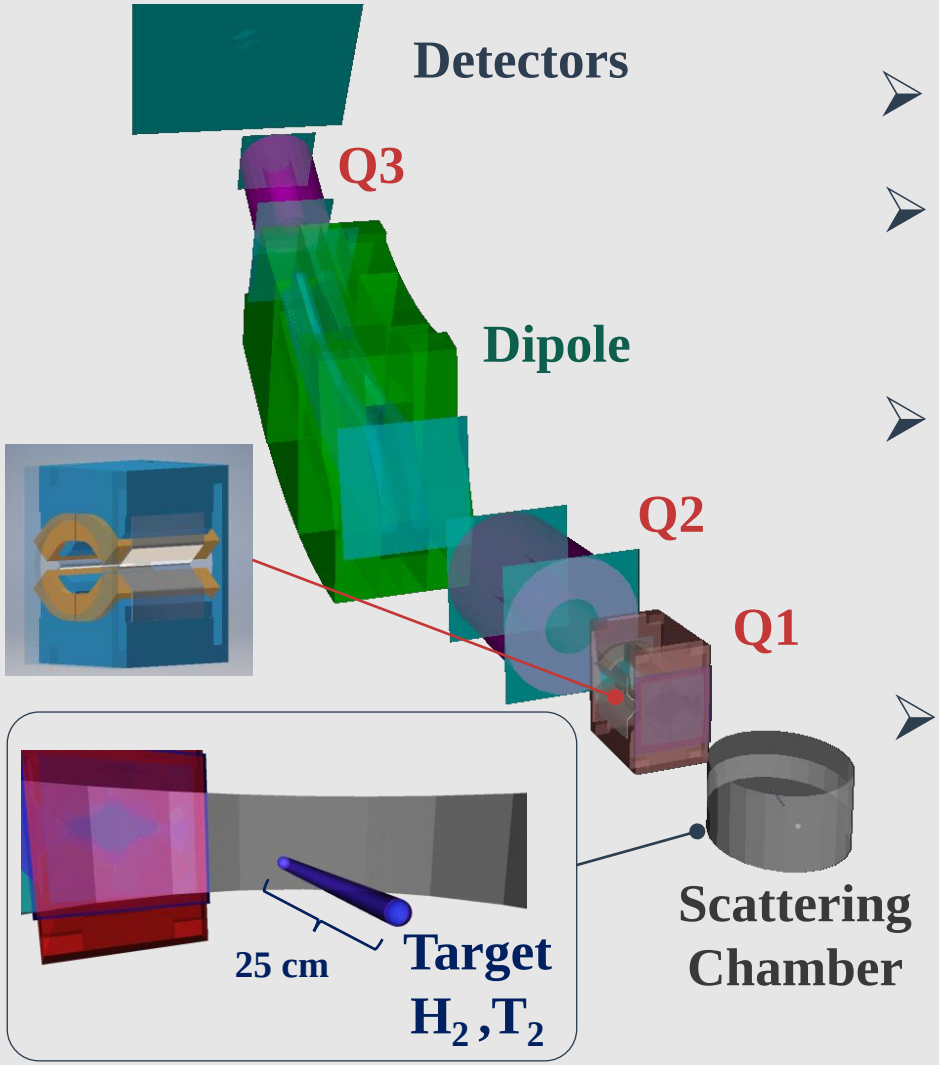
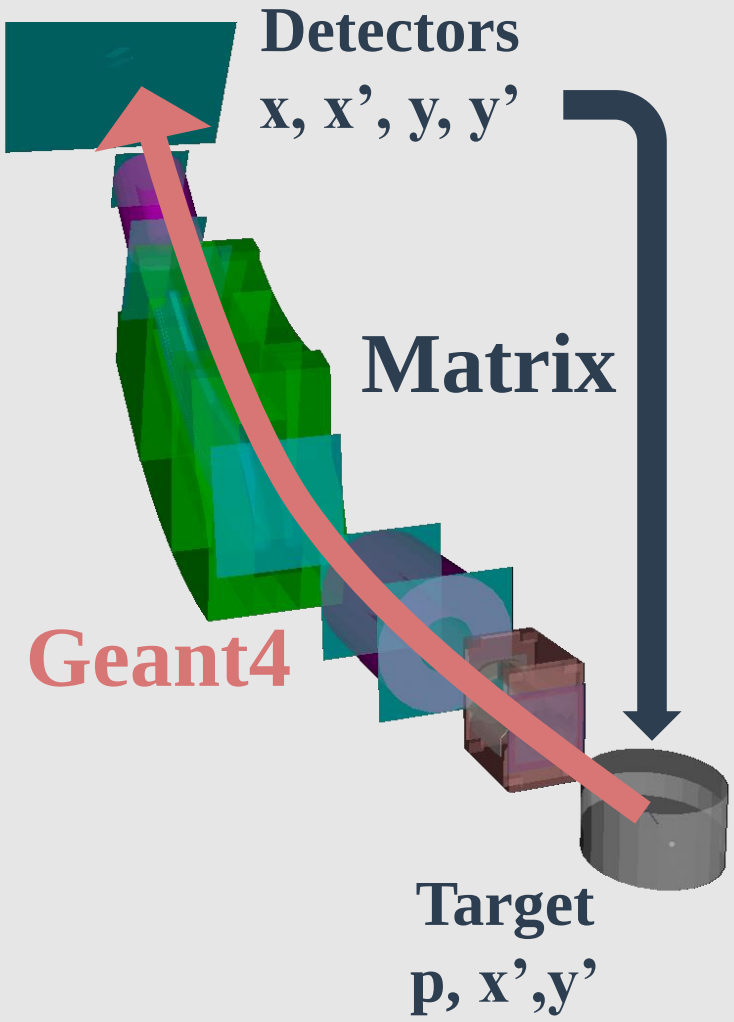


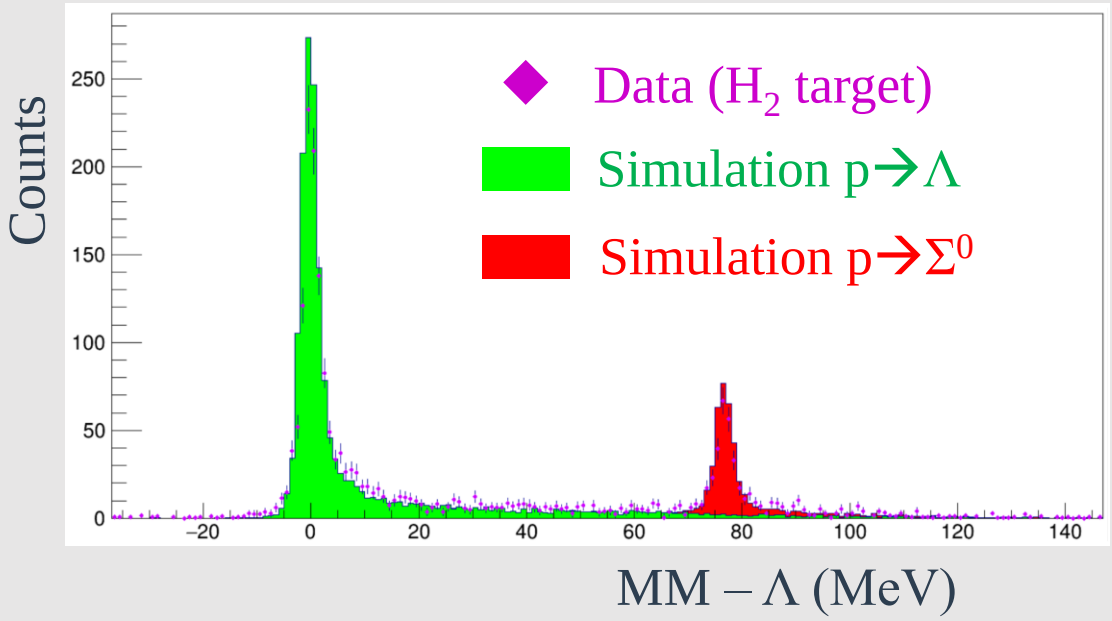
Geant4 Simulator



- Original simulator
- Realistic geometry:
  target cell, Q1 and Dipole
- Magnetic field:
  Dipole → TOSCA
  Quadrupole → Kato-eq.
- Material included:
  Target cell, Air,
  Isolator etc...

Geant4 Simulator





Resolution

Λ:1.5 MeV → nnΛ:1.26 MeV