

2020-07-03 CENuM Workshop

CENuM과 함께 하는 물리

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- J-PARC E42 실험 현황과 물리 주제 모음
- 앞으로 J-PARC에서 할 수 있는 (하고 싶은) 연구
- SPring-8/LEPS2를 비롯한 광생성 반응 실험에서 하고 싶은 연구
- 머릿 속 떠오른 또 다른 관심 거리



H-Dibaryon Search in $\Lambda p \pi^-$, $\Lambda\Lambda$, and $\Xi^- p$

J-PARC E42 실험 현황

- 2020년 8월-9월 초전도 전자석 + 상전도 전자석 테스트 at 빔 라인.
- 2020년 1월-2월 E03 (X-ray from Ξ^- atom) 실험 (Beam Hodoscope (강병민), Water Cherenkov 검출기 (최성욱)).
- 2020년 3월 HypTPC (김신형), HTOF (정우승) 설치
- 2020년 4월말 E42 Beam Commissioning (with CH_2 runs)
- 2020년 5월 중순-6월 중순 E42 Physics Runs

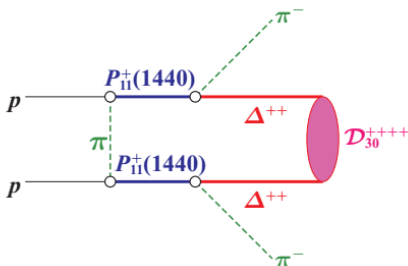


K^-p and Ξ^-p Reactions

$K^-p \rightarrow \Xi^- K^+$	Forward peaking w/o t-ch	$P_{\Xi}, d\sigma/d\Omega$
$K^-p \rightarrow p K^0 \pi^-$	$K(892)^-$	$d\sigma/d\Omega$
$K^-p \rightarrow \Lambda \pi^+ \pi^-$	$\Sigma(1380)(1/2^-)$	$d\sigma/d\Omega$
$K^-p \rightarrow \Lambda K^+ K^-$	$\Lambda \phi$	$d\sigma/d\Omega$
$K^-p \rightarrow \Xi^- K^0 \pi^+$	$\Xi(1535)^0$	$d\sigma/d\Omega$
$K^{-12}\text{C} \rightarrow \Lambda \phi X$	Near-threshold production	$d\sigma/dE_{\phi}$
$K^{-12}\text{C} \rightarrow K^0 \pi^- p X$	Mass shift	$d\sigma/dM_{K^0 \pi^-}$
$K^{-12}\text{C} \rightarrow X$	Multiparticle	$d\sigma/dE_X$
$\Xi^- p \rightarrow \Xi^- p$	First Measurement	$d\sigma/d\Omega$
$\Xi^- p \rightarrow \Lambda \Lambda$	First Measurement	$d\sigma/d\Omega$
$\Xi^{-12}\text{C} \rightarrow \Lambda X$	Ξ^- -nucleus	$d\sigma/dE_{\Lambda}$
$\Xi^- \rightarrow p \pi^+ \pi^-$	Rare Decay	$\Gamma_{\Xi^- \rightarrow p \pi \pi} / \Gamma_{\text{tot}}$

앞으로 J-PARC에서 할 수 있는 (하고 싶은) 연구

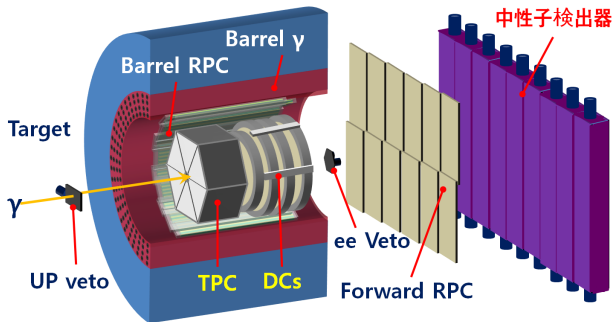
- Θ^+ search in $K^+d \rightarrow K^0pp$ reactions.
- Search for an $I = 3, J^\pi = 0^+$ dibaryon resonance
 $\mathcal{D}^{++}(\Delta\Delta) \rightarrow pp\pi^+\pi^+$ via $pp \rightarrow \pi^-\pi^-\pi^+\pi^+pp$ reaction at 3-4 GeV/c (Proposal submitted to J-PARC PAC).
- Measurement of the cross section of the Λp scattering with $\pi^-p \rightarrow K^*(892)^0\Lambda$ reactions at 8 GeV/c (J-PARC LoI).
- Ω hyperon spectroscopy (also with Belle/Belle-II).



Photoproduction Experiments with SPring-8/LEPS2

LEPS2 실험 현황

- 2020년 7월 Beam Commissioning 중 (Cherenkov (양현민)).
- 2020년 말에서 2021년 초에 Physics Run 시작 예정.



γp and γd Reactions

$\gamma p \rightarrow \Sigma^- \pi^+ K^+$	$\Lambda(1405)$	$\Sigma, d\sigma/d\Omega, d\sigma/dM_{\pi\Sigma}$
$\gamma p \rightarrow \Lambda(1405)K^*(892)$	Two-pole	$\Sigma, d\sigma/dM_{\pi\Sigma}$
$\gamma p \rightarrow \Sigma(1670)K^+$	$J^P = 3/2^- \Sigma$	$d\sigma/dM$
$\gamma p \rightarrow \phi p$	Interference	Dalitz analysis
$\gamma d \rightarrow \phi p$	subthreshold	$d\sigma/d\Omega$
$\gamma d \rightarrow pn$	quark-hadron	$d\sigma/d\Omega_{\text{near } 90^\circ}$
$\gamma n \rightarrow \Lambda \pi^- K^+$	$\Sigma(1380)(1/2^-)$	$\Sigma, d\sigma/dM_{\Lambda\pi^-}$
$\gamma n \rightarrow \Theta^+ K^-$	Pentaquark	$d\sigma/dM_{K^0 p}$
$\Lambda p \rightarrow \Lambda p$	$K^- pp$ search	$\sigma_{\text{tot}}(\sqrt{s})$
$\Lambda p \rightarrow \Lambda \Lambda K^+$	H search	Dalitz analysis

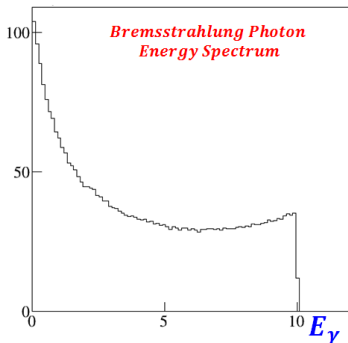
머릿 속 떠오른 또 다른 관심 거리

- Observation of up-going muons with the LAMPS neutron detector.
- HPGe 검출기 에너지 스펙트럼에서 찾는 우주선 (n, n')반응 (w/ 남승일 교수님)
- Cosmic-ray $\mu + {}^{12}\text{C} \rightarrow {}^9\text{Li} + X$; ${}^9\text{Li} \rightarrow 2 {}^4\text{He} + e^- + n$ (178 ms)이 핵발전소 이용 θ_{13} 측정의 주요 백그라운드.
- Cross-section measurement for $\gamma + {}^{12}\text{C} \rightarrow {}^9\text{Li} + 3p$ at a few GeV region.
- Cosmic-ray measurement with TPC (${}^{12}\text{C}$ in P-10 gas) in B field.
- **Quasi-free scattering** experiment (${}^{12}\text{C}(p, 2p)$, ${}^{12}\text{C}(p, 2n)$, ${}^{12}\text{C}(p, pn)$, ${}^{12}\text{C}(p, p\alpha)$ at 100–200 AMeV) with prototype LAMPS detectors at HIMAC (w/ LAMPS 그룹).
- 언젠가 제 연구실에 **compact (table-top) heavy-ion accelerator**.



머릿 속 떠오른 또 다른 관심 거리

- (Coherent) bremsstrahlung photon and backward Compton-scattered photon beams from PAL/XFEL/OASIS.
- Polarized photon beam will be available in the range up to 7 GeV.
- 핵합성반응 연구 ($^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$, $^7\text{Li}(p, \alpha)^4\text{He}$ 반응, $^{4n}\text{Z}+^4\text{He}$ 모든 반응)



$^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ 반응 (2020년 6월-2029년 2월)

100 pμA 500-keV/u ^{12}C beam + ^4He -gas TPC in $B = 2$ T

