J-PARC E16 Status and Plan

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Collaboration

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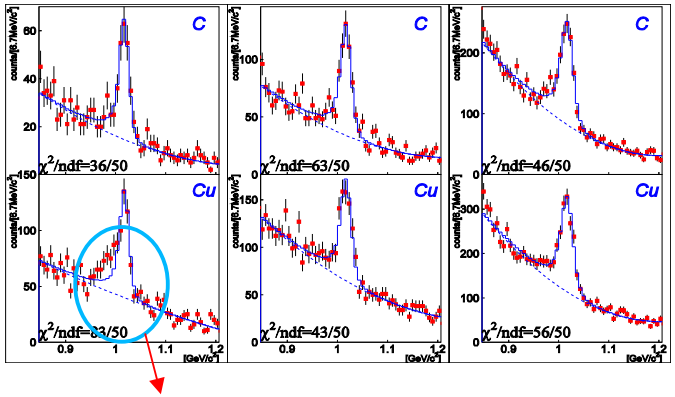
J-PARC E16 overview

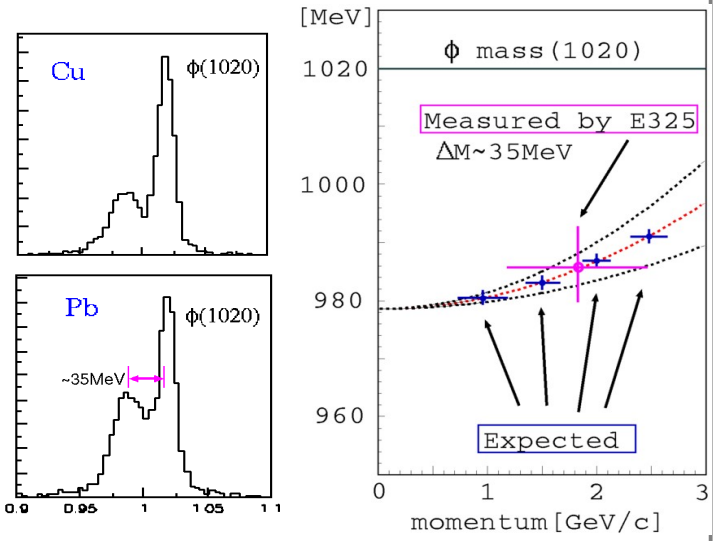
- Measure the vector-meson mass modification in nuclei systematically with the e^+e^- invariant mass spectrum
- Explore the origin of hadron mass due to the breaking of chiral symmetry proposed by Nambu
- A 30 GeV primary proton beam (10^{10}/spill) / 5 weeks of physics run to collect ~10^5 $\phi \rightarrow e^+e^-$ for each target

Precedent exp. (KEK-PS E325)



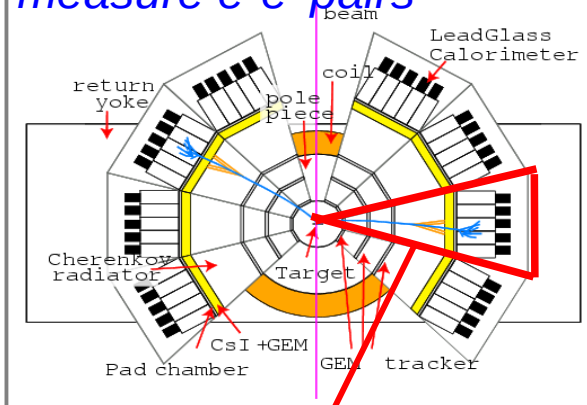
ϕ–mass is modified in large nuclei for slowly moving mesons ... consistent with the prediction based on the QCD sum rule

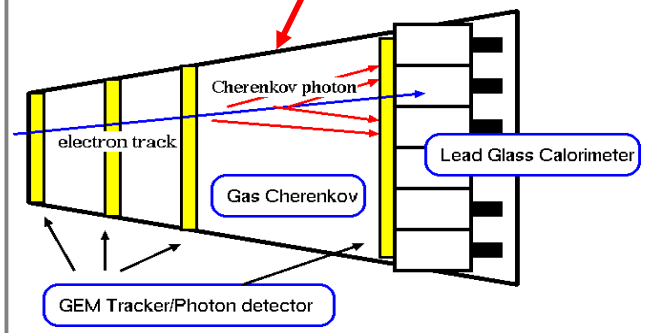
Proposed exp. E16



Nuclear size dependence & *Momentum dependence* of mass modification

New Spectrometer to measure e^+e^- pairs





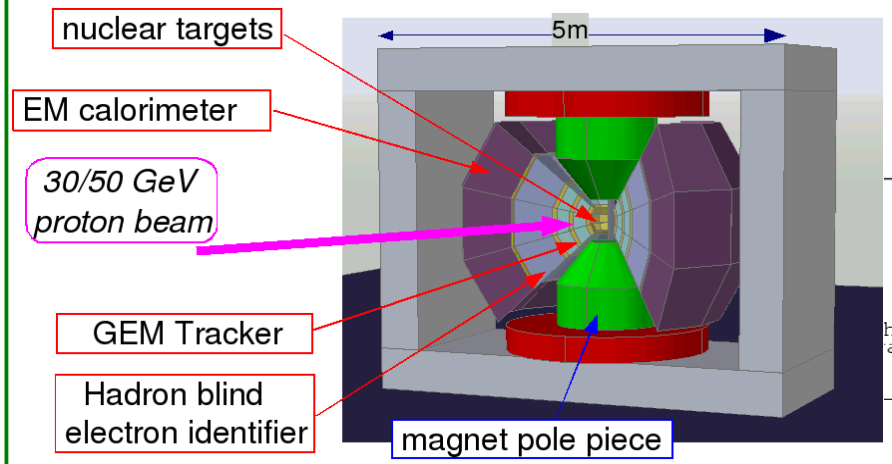
modular type detectors : GEM Tracker, HBD (GC) & EMC for the electron ID and tracking

- Prototype detector is tested with electron beam

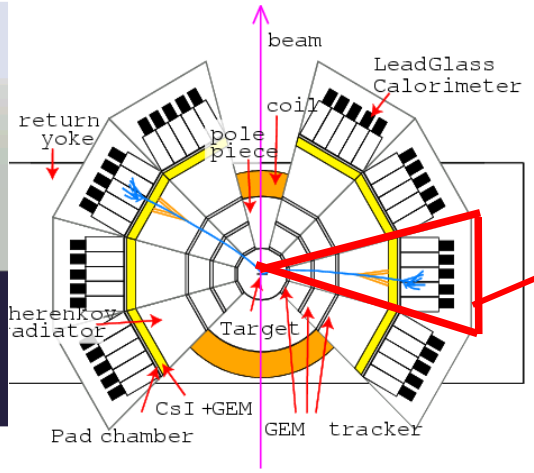
To collect high statistics

- For the statistics 100 times as large as E325, a new spectrometer and a primary beam in the High-p line are required.
  - To cover larger acceptance : x~ 5
  - Higher energy beam (12 → 30/50 GeV) : x ~2 of production
  - Higher intensity beam ($10^9 \rightarrow 10^{10}$ /spill (1sec)) : x 10 (→ 10MHz interaction on targets)
  - to cope with the high rate, new detectors (GEM Tracker & HBD) are required.

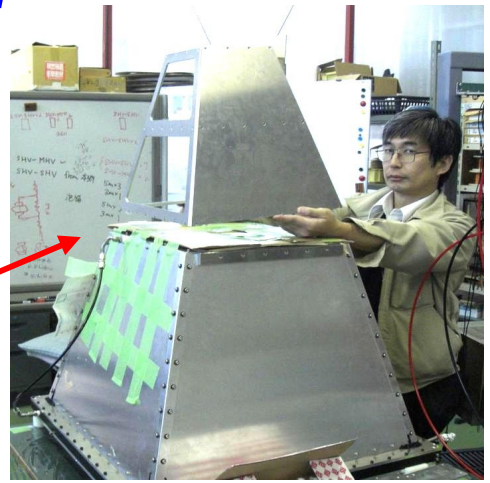
Proposed Spectrometer



Plan View

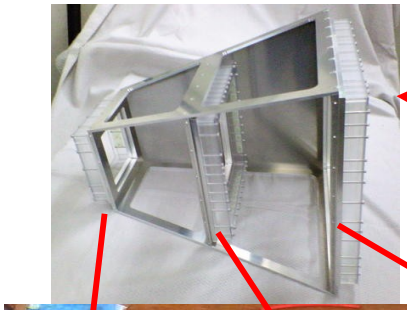


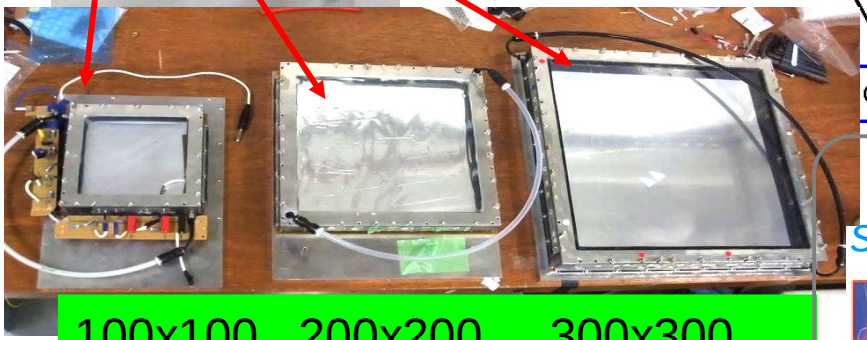
Prototype Module

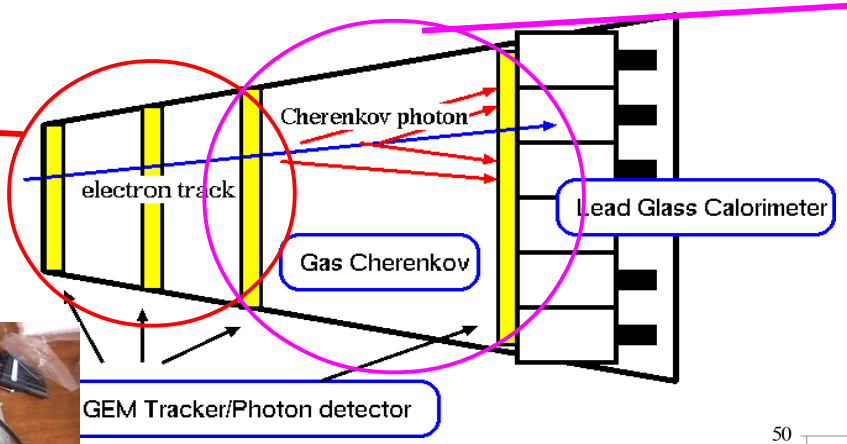


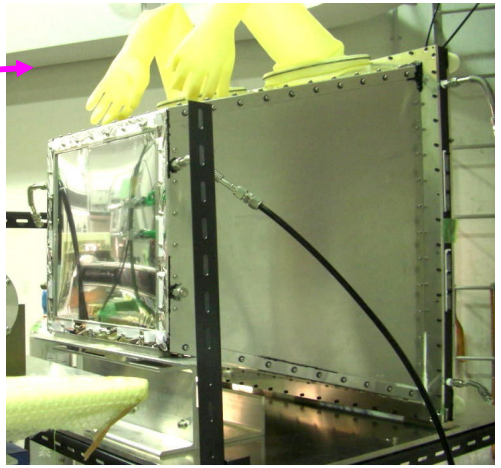
26 detector modules

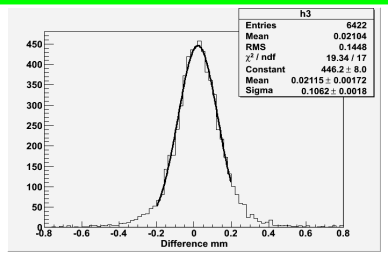
Beam test results of prototype detectors



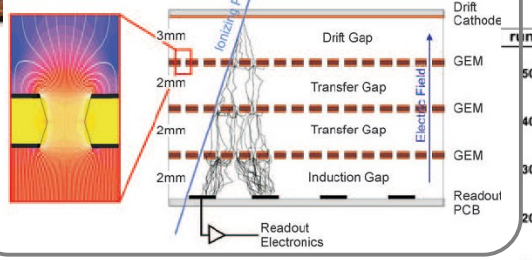


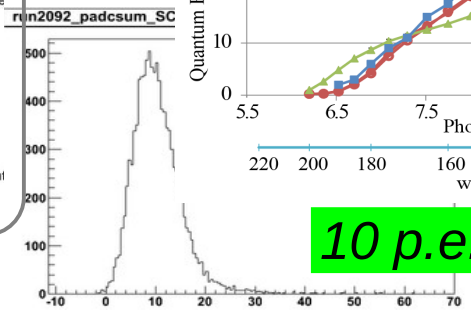


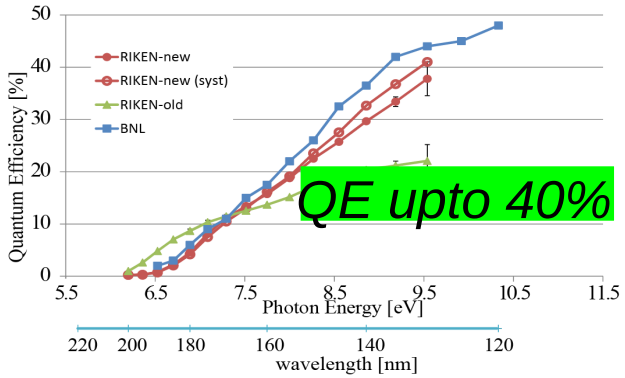




GEM & GEM Tracker schematics







QE upto 40%

10 p.e.

GEM Tracker :

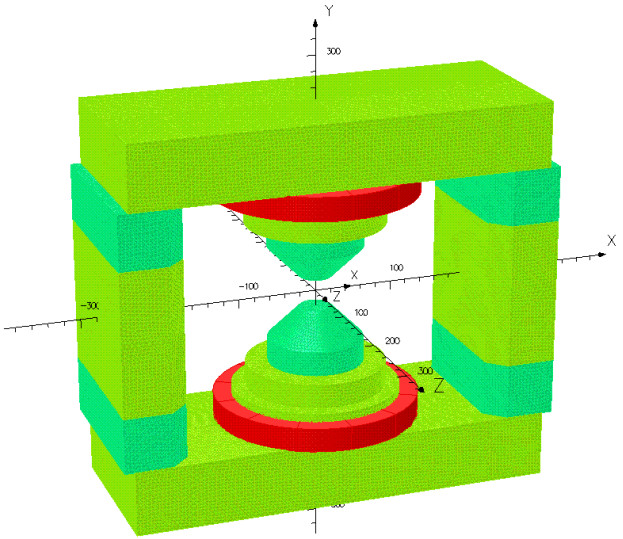
Required position resolution (~100μm) is achieved with large-size PI-GEM(300mm x 300mm)

Hadron-Blind Gas Cherenkov detector

UV Cherenkov photons (10 photoelectrons) are detected for an electron track with CsI-evaporated LCP-GEM and CF_4 gas

Schedule

- 2007: stage1 approval
- 2008-2010 : development of prototype detectors
  - GEM Tracker and HBD
  - w/ Grant-in-Aid (2007-8, 2009-13 ($2.4M))
- 2011 : additional parts of the spectrometer magnet , R/O circuit development
  - 1st module of production type (GT and HBD)
  - test using pion beam @ J-PARC
- 2012 : magnet construction
  - detectors can be installed in the magnet
  - detector and circuit production
- 2013 : staged goal of the spectrometer construction (w/ 8 detector modules)
- 2014- : module production (depending on the budget)



Schedule

2011-10-23																
					1	2	3	4	5	6	7	8	9	10	11	12
		理研2期					理研3期					理研4期				
JFY		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
		H20	H21	H22	H23	H24	H25	H26	H27	H28	H29	H30	H31	H32	H33	H34
J-PARC hadron		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RJC plan						1	1	2	3	4	5	1	2	3	4	5
BNL MOU																
RHIC PHENIX		8	9	10	11	12	13	14	15	16						
sPHENIX										1?	2	3	4	5	6	
eRHIC															1	2
LHC ALICE				1	2	3	4	5	6	7	8	9	10	11	12	13
GSI FAIR										1	2	3	4	5	6	7
HADES run											0?	1	2	3	4	5
High-p line						1	2	3	1	2	3	4	5			
E16 construction																
E16 run								0	1	2	3					
new hadron (Grant-in-Aid)			1	2	3	4	5									

This year

Summary

- Investigation of the hadron spectral modification in nuclear matter is a study of the nature of QCD vacuum
  - spontaneous breaking of chiral symmetry as a major origin of mass
- Spectral modification of hadrons is observed in hot (HI collisions) and dense (nuclei) matter in the dilepton invariant mass spectra
  - but discussion is not converged : chiral restoration or not
- J-PARC E16 will measure the vector meson modification in nuclei with the ee decay channel, using 30GeV primary proton beam, 10^{10} /spill .
  - confirm the observation by KEK-PS E325 and provide more precise information of the mass modification
  - Magnet construction in 2012
  - Staged goal of the construction ; the end of 2013, within the Grant-in-Aid and RIKEN budget, ready for the beam

Backup slides...

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