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Experimental study of vector meson in nuclear medium at J-PARC

Hadrons are elementary excitations of the QCD vacuum
thus they reflect the property of the vacuum.
Indeed it is the chiral symmetry breaking of the QCD vacuum that leads to the generation of hadron mass.
The vacuum properties could change according the the enviroment, namely the temperature and the density
but are not well explorered.
For the understanding of QCD and its structure,
it is important to study the hadron properties under different environment.

Our experiment, J-PARC E16, has been proposed to measure hadron mass in nuclear medium,
to study a high density part of the QCD phase,
in contrast to the studies in rather high temperature part being performed at RHIC and LHC.
J-PARC E16 uses p+A->phi+X reactions and the invariant mass of phi meson
is reconstructed with e+e- decay. The measured phi mesons may or may not escape
the target nucleus at the time of their decay, thus the measurement is sensitive to in-medium
changes of hadron mass. As the nuclear targets, CH2, C, Cu and Pb are planned.

The advantage of the experiment is the good mass resolution and the
ability to collect high statistics for the phi mesons.
A mass resolution of 7 MeV/cˆ2 is expected for phi meson with the spectrometer
which is under construction.
The large acceptance and the high luminosity capability
allow us to collect 10ˆ5 of phi mesons with the full spectrometer,
make it possible to measure the dispersion relation for the first time.
KEK E325 experiment, the predecessor experiment of J-PARC E16,
collected 10ˆ3 of phi mesons with a mass resolution of 10 MeV/cˆ2
and measured in-medium mass of phi mesons
which may be related to the chiral symmetry restoration at normal nuclear density.
J-PARC E16 will study this with a better resolution and with 100 times better statistics.

Due to budgetary limitations, we adopt staging approach.
We start with a limited acceptance (likely 1/3) of the spectrometer by 2018
and take physics data. Then we prepare the full spectrometer
for the ultimate goal. A special beam line is being prepared
for the experiment and is planned to be completed by 2019.

We discuss the expected physics results and
report the preparation status of the beam line and the experiment.

Preferred Track

Future Experimental Facilities, Upgrades, and Instrumentation

Collaboration

Other

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