Fast extraction facility at J-PARC 50GeV

Akira SATO
Osaka University, Japan

30th July : NuFact04 at Osaka
J-PARC 50GeV-PS

under construction

1 MW (FY2007)
15 uA
3.3 x 10^14 p/spill
rep. rate 0.3 Hz
4 MW (in future)
LOI at J-PARC on Muon Physics

A Study of a Target System for a 4-MW, 50-GeV Proton Beam
K. McDonald, H. Kirk, Y.Kuno, Y. Yoshimura

An Improved Muon (g-2) Experiment at J-PARC
L. Roberts

Search for a Permanent Muon Electric Dipole Moment at 10-24ecm Level
Y. Semertzidis, J. Miller, Y.Kuno

A Study of Neutrino Factory in Japan
Y. Mori, Y. Kuno

Request for A Pulsed Proton Beam Facility at J-PARC
R.S. Hayano, Y. Kuno

An Experimental Search for the m-e Conversion Process
Towards an Ultimate Sensitivity of the Order of 10-18
Y. Mori, K. Yoshimura, N.Sasao, Y. Kuno

The PRISM Project - A Muon Source of the World-Highest Brightness by Phase Rotation -
Y. Mori, K. Yoshimura, N.Sasao, Y. Kuno
outline

- proposed experiments
- facility plans
- site status
- conclusion
Physics Motivation

- Muon physics
- LFV: mu-e conversion
- muon EDM
- g-2
- Antiproton physics
  - antimatter
  - ultra-slow antiproton
  - nuclear physics with antiproton
Lepton flavor violation

PRISM/PRIME

$\text{BR}(\mu N \rightarrow eN) < 10^{13}$

$\rightarrow \text{BR}(\mu N \rightarrow eN) < 10^{18}$

<table>
<thead>
<tr>
<th>muon intensity</th>
<th>$10^{11} - 10^{12} \mu/\text{sec}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>kinetic energy</td>
<td>20 MeV</td>
</tr>
<tr>
<td>energy spread</td>
<td>$+(0.5-1.0)\text{MeV}$</td>
</tr>
<tr>
<td>beam repetition</td>
<td>100-1000 Hz</td>
</tr>
<tr>
<td>pion contamination</td>
<td>$&lt; 10^{-18}$</td>
</tr>
</tbody>
</table>
Muon EDM & g-2

EDM with PRISM-II
• high beam intensity
• high polarization
• low beam contami.
\[ d_\mu < 10^{-19} \text{e}\cdot\text{cm} \]

\[ \rightarrow d_\mu < 10^{-24} \text{e}\cdot\text{cm} \]
g-2
0.7 ppm
\[ \rightarrow 0.05 \text{ppm} \]
Muon Facility - where?
Fast extraction facility
possible layout
Near facility
Pulsed proton beam

50 GeV abort dump

Bunched proton beamline

Neutrino beamline

50 GeV Ring

Fast extraction
Kicker

50 GeV Ring
Shielding blocks

- Once soil is activated, future excavation would become almost impossible. To avoid soil activation at the location of proton extraction port to a planned facility. We requested placing concrete shielding blocks at location of future extraction.

It has been approved!
shielding blocks layout
shielding blocks layout
toward the NuFact

0.3-1 GeV/c
1-3 GeV/c
10-20 GeV/c
3-10 GeV/c

Storage Ring

<table>
<thead>
<tr>
<th>Stage</th>
<th>FFAF ring</th>
<th>Potential Physics Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low energy ring (PRISM)</td>
<td>Muon LFV</td>
</tr>
<tr>
<td>1</td>
<td>0.3-1 ring (PRISM-II)</td>
<td>Muon EDM and low-energy neutrino source</td>
</tr>
<tr>
<td>2</td>
<td>1-3 ring</td>
<td>1 GeV neutrino source</td>
</tr>
<tr>
<td>3</td>
<td>3-10 ring</td>
<td>An initial neutrino factory</td>
</tr>
<tr>
<td>4</td>
<td>10-20 ring</td>
<td>A full size neutrino factory</td>
</tr>
</tbody>
</table>
conclusion

- J-PARC has a great potential to discover new physics using high intensity muon beam.

- Shielding blocks are placing to avoid soil activation. BUT the facility itself is not approved yet!

- We should make a global collaboration to realize the fast extraction facility.