

The End of HEP National Laboratories

H. Sugawara
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The end of 12GEV PS is

“Le commencement de la fin”
of KEK as a NATIONAL LABORATORY
of high energy physics

- Once upon a time national laboratories and regional laboratories were the centers of high energy physics
- Researchers from universities and smaller labs came to national labs or regional labs to engage in research in high energy physics
- Brookhaven, LBL, CERN, DUBNA, Fermilab, SLAC, DESY, and KEK are the typical examples.

Evolution of HEP Laboratories

- 1930-1970
universities: Rochester, Columbia, Chicago, INS, Tohoku, Orsay, etc.
- 1970→
national labs: BNL, LBL, FERMILAB, SLAC, KEK, DESY, etc.
- 1950→
regional labs: CERN, DUBNA
- 2005→
world labs: (ITER, ALMA at ATACAMA)

- These national labs are
- either disappearing from the scene of high energy physics
- or have stopped being major high energy physics laboratories.
- Recent examples are DESY and SLAC.
- FERMILAB, CERN and KEK are also destined to follow more or less the same path.

- The reason is simple:
 - high energy physics is cultivating the high energy frontier and the cost of doing that is about to exceed the ability of one nation or one region.
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- The only way out:
 - create a world laboratory.

World Laboratory for High Energy Physics

- There seem to be two or three ways to stay at the high energy frontier, at least for now:
 1. proton collider
 2. linear collider
 - (3. muon collider)
- We can have two or three world laboratories in two or three regions of the world, each constructing one of the above facilities.
- Each laboratory should not have the same structure as the existing regional labs.

- Should CERN be a model for a world lab?
The answer: No
- The reason: LHC was possible because US, Japan, Russia, etc. decided to participate. However, CERN refused to be a world lab because the decision making process was already too awkward, even for a regional lab, and the regional sentiment was overwhelmingly against it.
- Could Fermlab or KEK become a world lab?
The answer: No
The reason is obvious: neither DOE or Monkasho could manage a world laboratory.

- The first concrete plan for the structure of the world lab was described in a report submitted by the committee on GLC (now ILC) lab in 2002 at KEK, although much remains to be worked out.

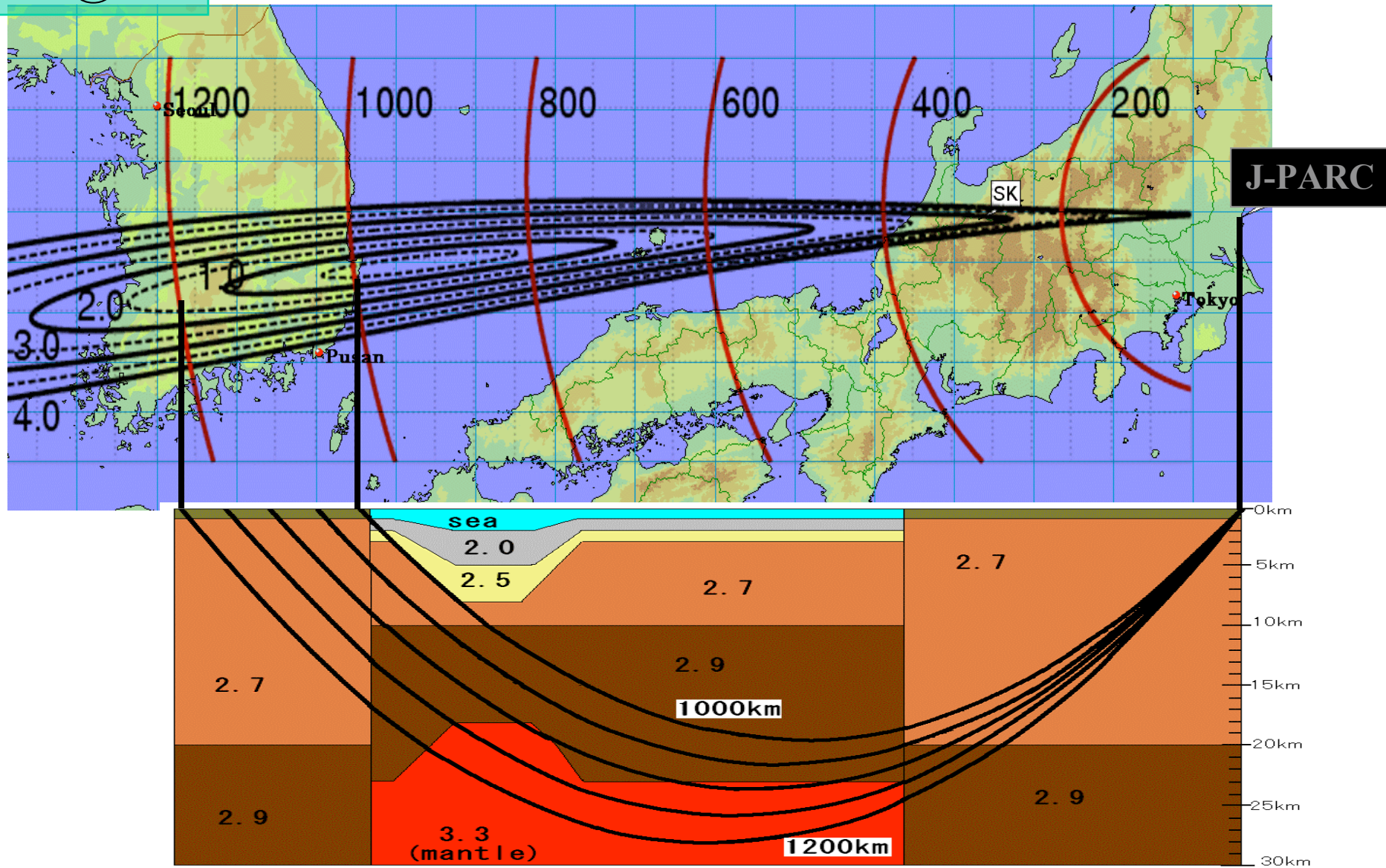
- It is important to make full use of resources in the existing national or regional labs, but this does not mean that existing organizational structures should be maintained.
- The role of national labs will be to provide resources to world lab and for each to engage in its own scientific program, such as astrophysics, nuclear physics, condensed matter physics, etc.
- It will be much easier, perhaps, to create a new world lab, than to transform existing national or regional labs.

We need to intensify worldwide collaboration

- ILC effort is going well, so far.
- Another type of worldwide collaboration:
We can make use of existing resources in CERN, FERMILAB and KEK to send neutrino beams to their nearby detectors or detectors on a ship to
 1. perform neutrino experiments in case of very small θ_{13}
 2. make a neutrino tomographic map of the earth,
 3. eventually to make a decision on the feasibility and the necessity of a muon collider.

3.0@SK

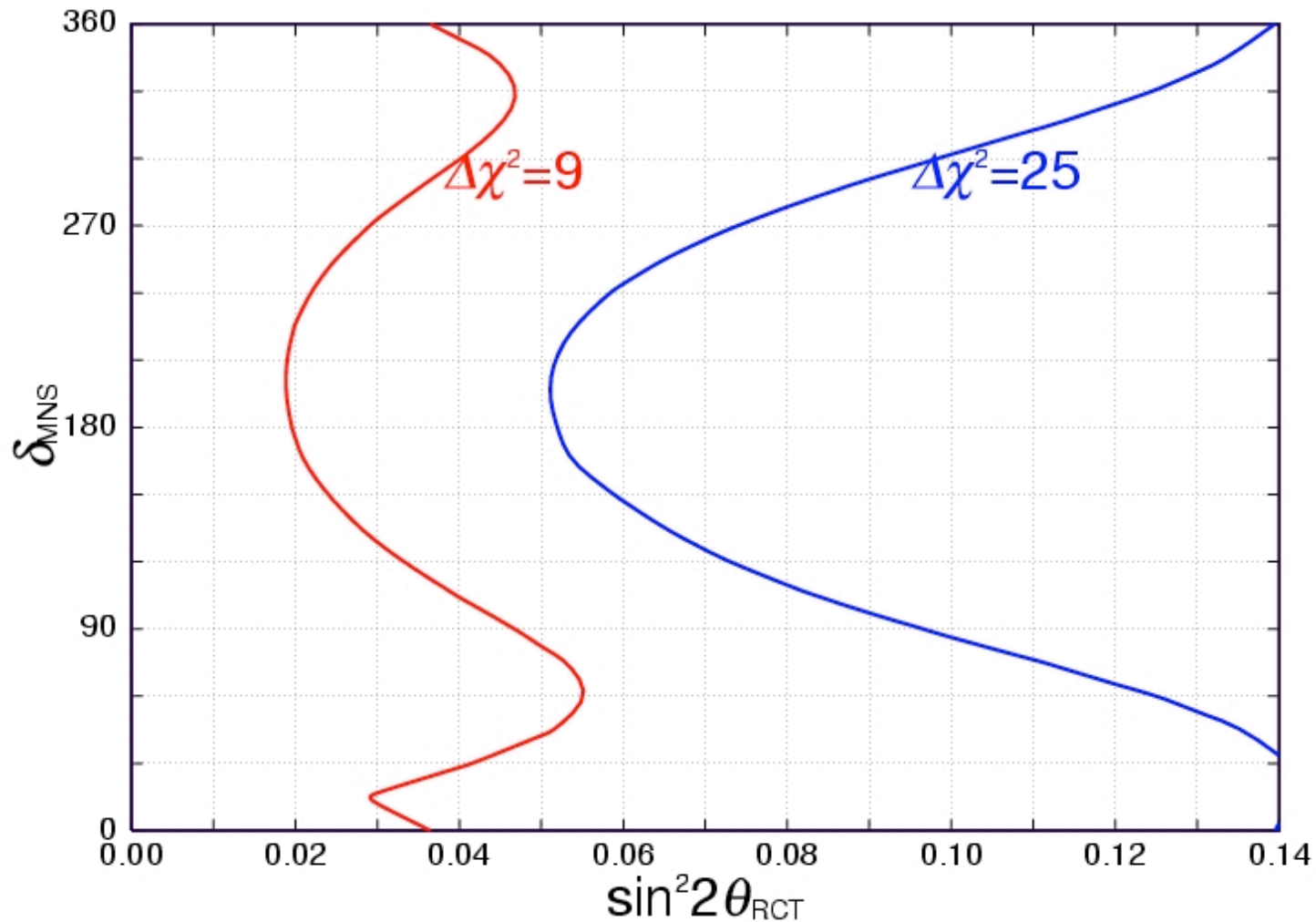
Cross Section



Japan-Korea-Russia geologists collaboration

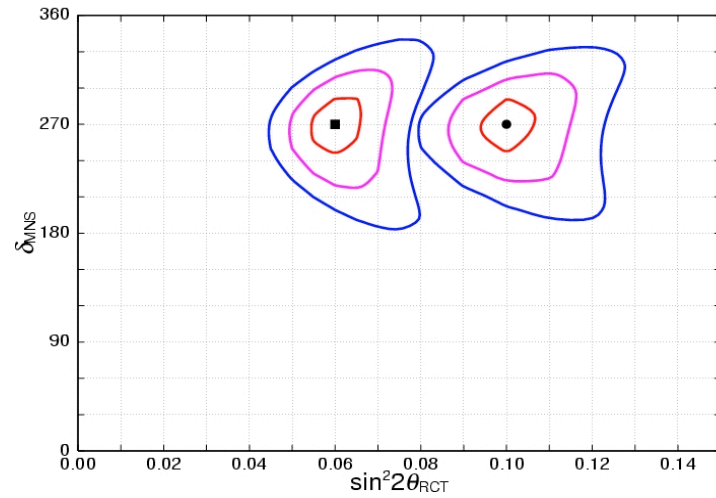
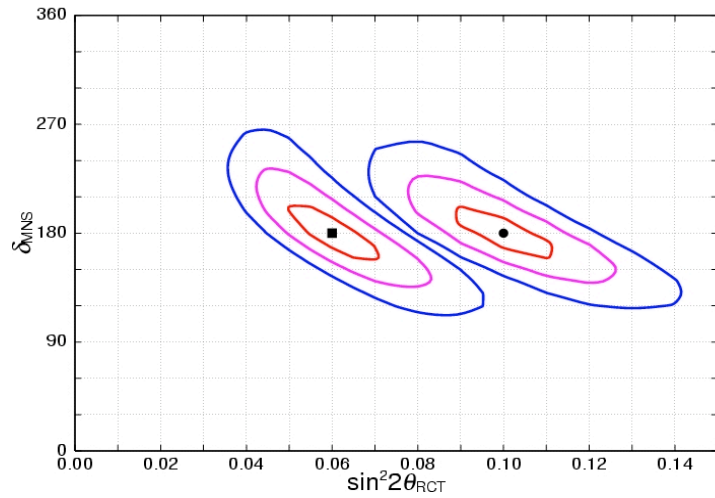
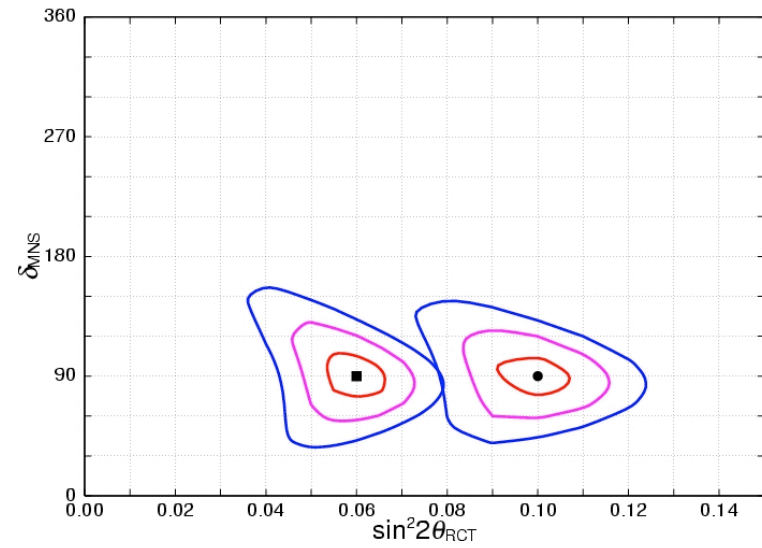
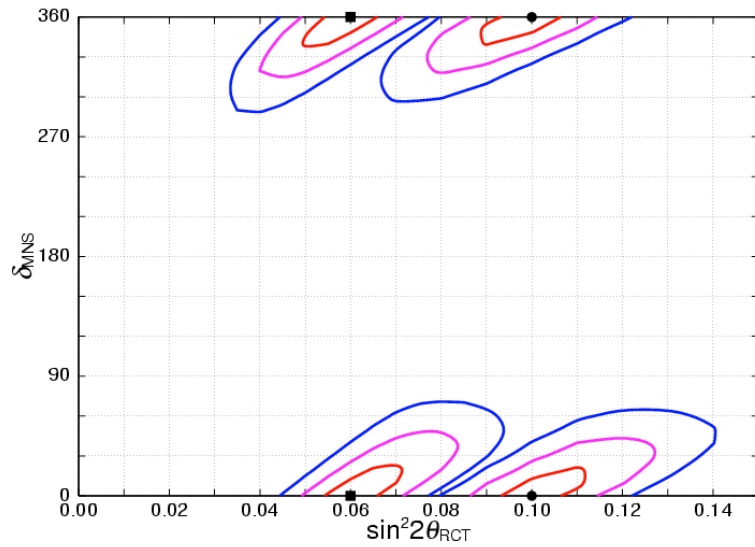
N.Okamura (YITP, Kyoto)

Sensitivity of J-PARC to SK(20Kton,300km) +Korea(100Kton,1000km)
LBL experiment on the sign of the larger mass-squared difference

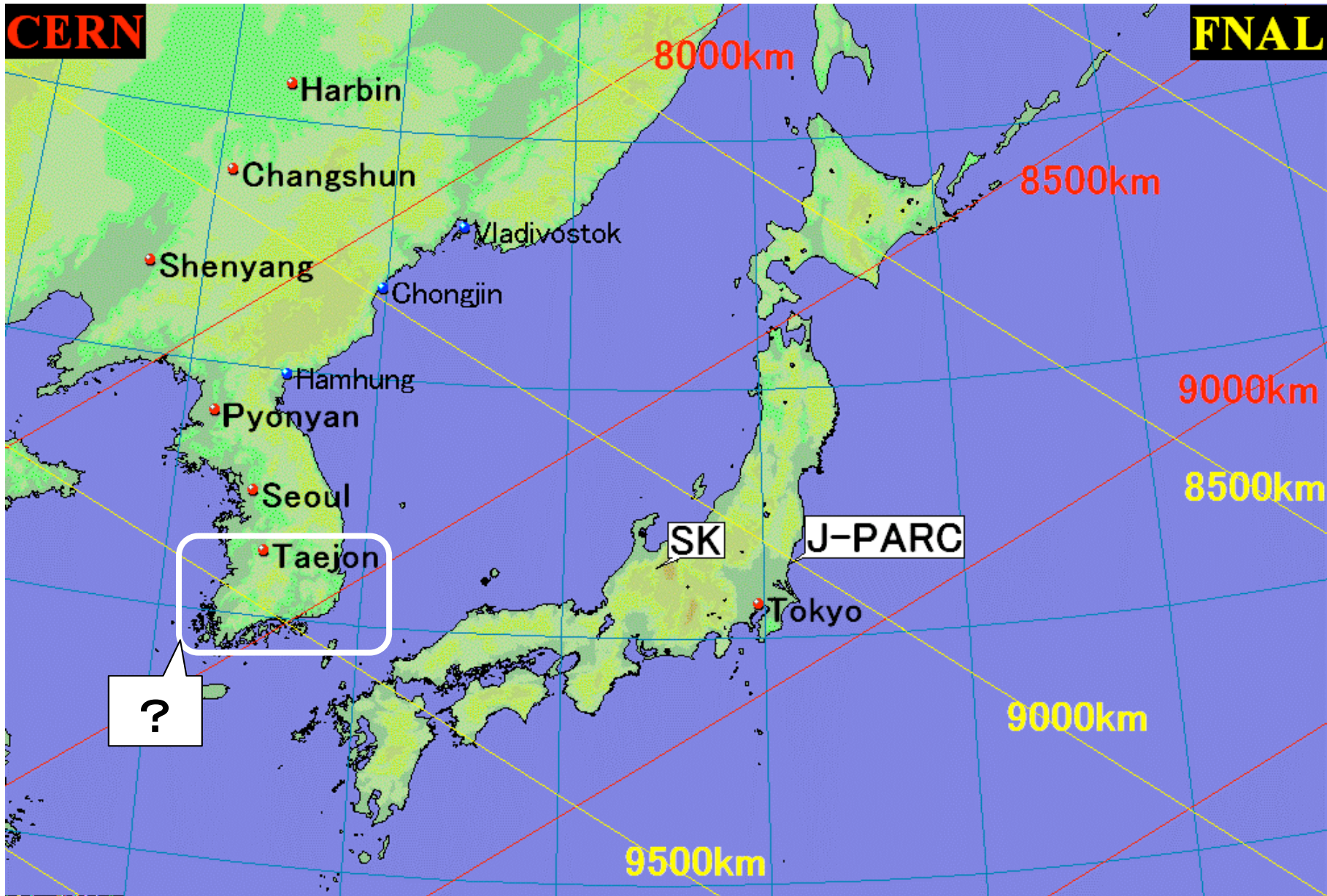


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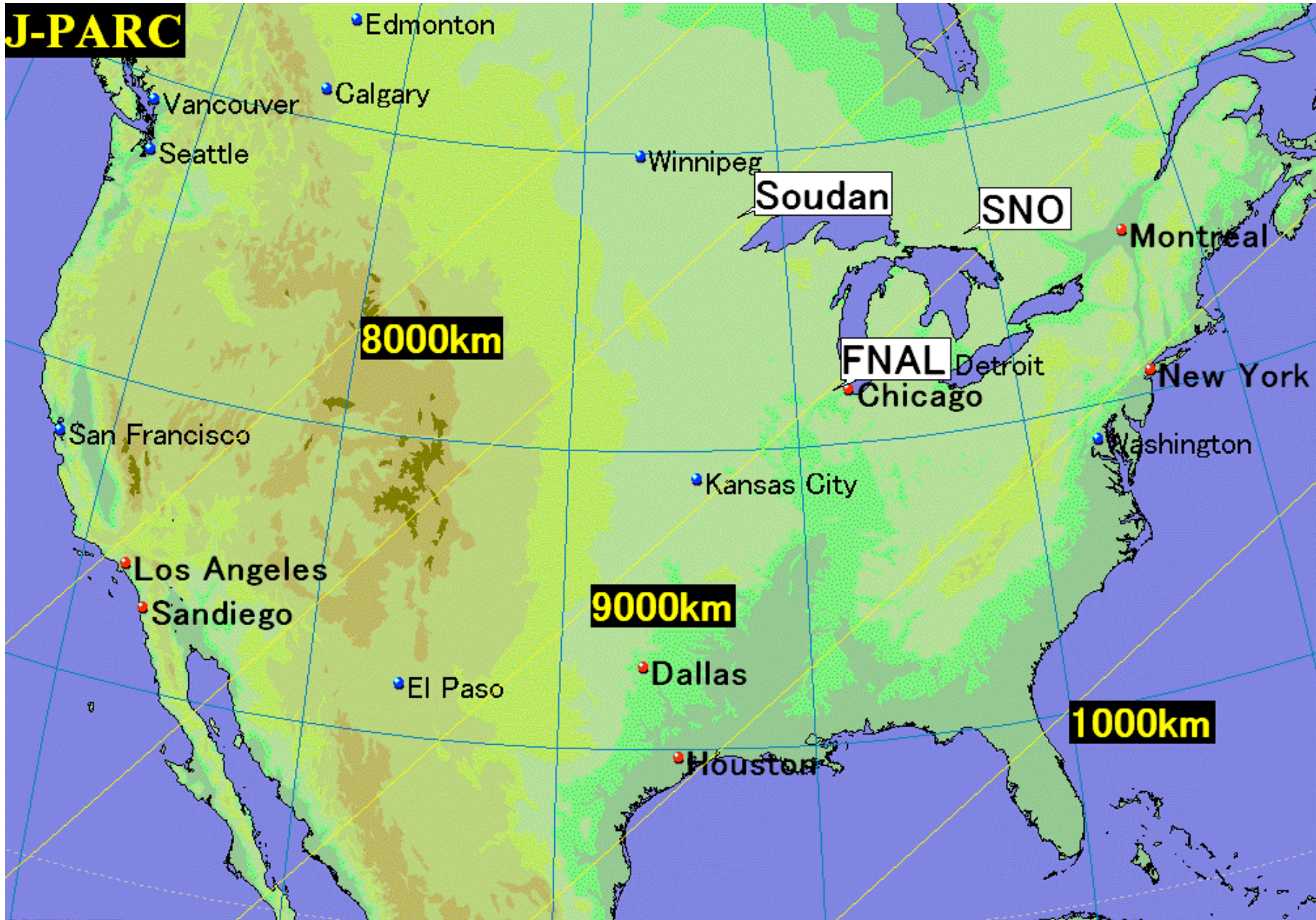
CP phase sensitivity



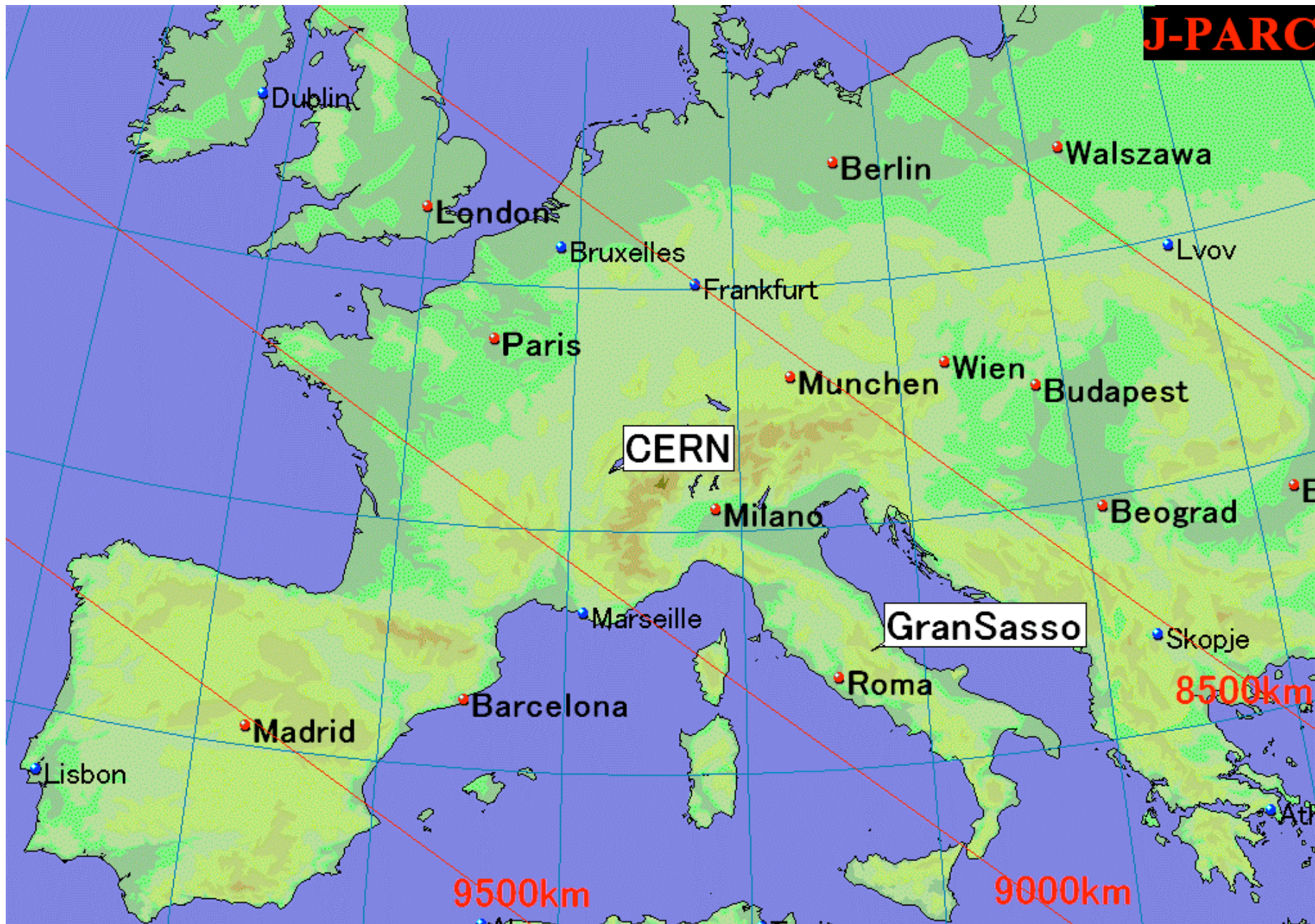
from K.Hagiwara, etal, hep-ph/0504061



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Memo

J-PARC ---> GranSasso distance : 8825 km depth : 1773 km
---> Soudan distance : 8490 km depth : 1618 km
---> SNO distance : 8937 km depth : 1827 km
---> SK distance : 295 km depth : 1.7 km

FNAL ---> GranSasso distance : 7341 km depth : 1162 km
---> Soudan distance : 735 km depth : 10.6 km
---> SNO distance : 765 km depth : 11.5 km
---> SK distance : 9127 km depth : 1922 km

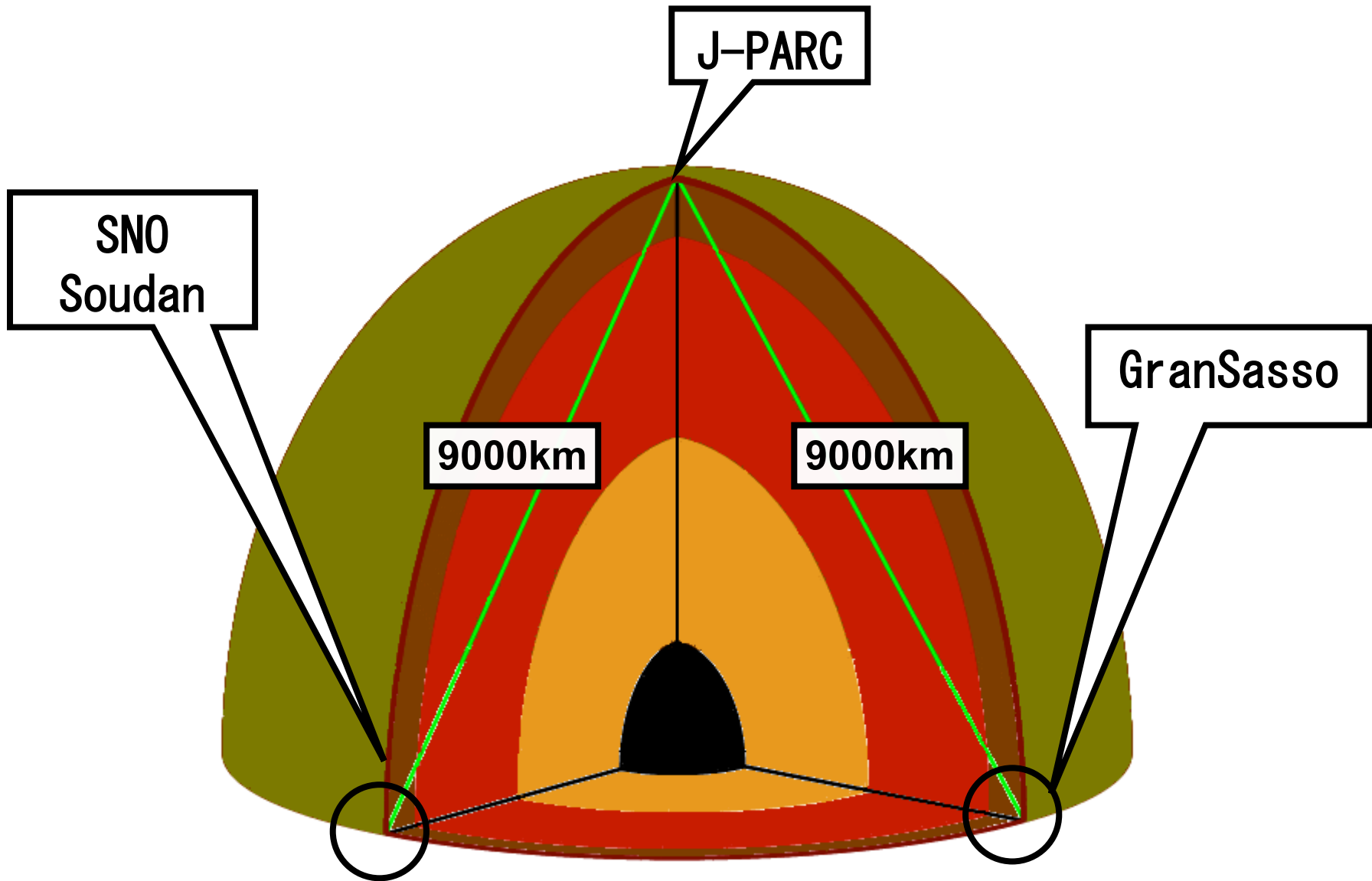
CERN ---> GranSasso distance : 723 km depth : 10.2 km
---> Soudan distance : 6584 km depth : 915 km
---> SNO distance : 6079 km depth : 771 km
---> SK distance : 8738 km depth : 1731 km

R_{earth} = 6367.895 km

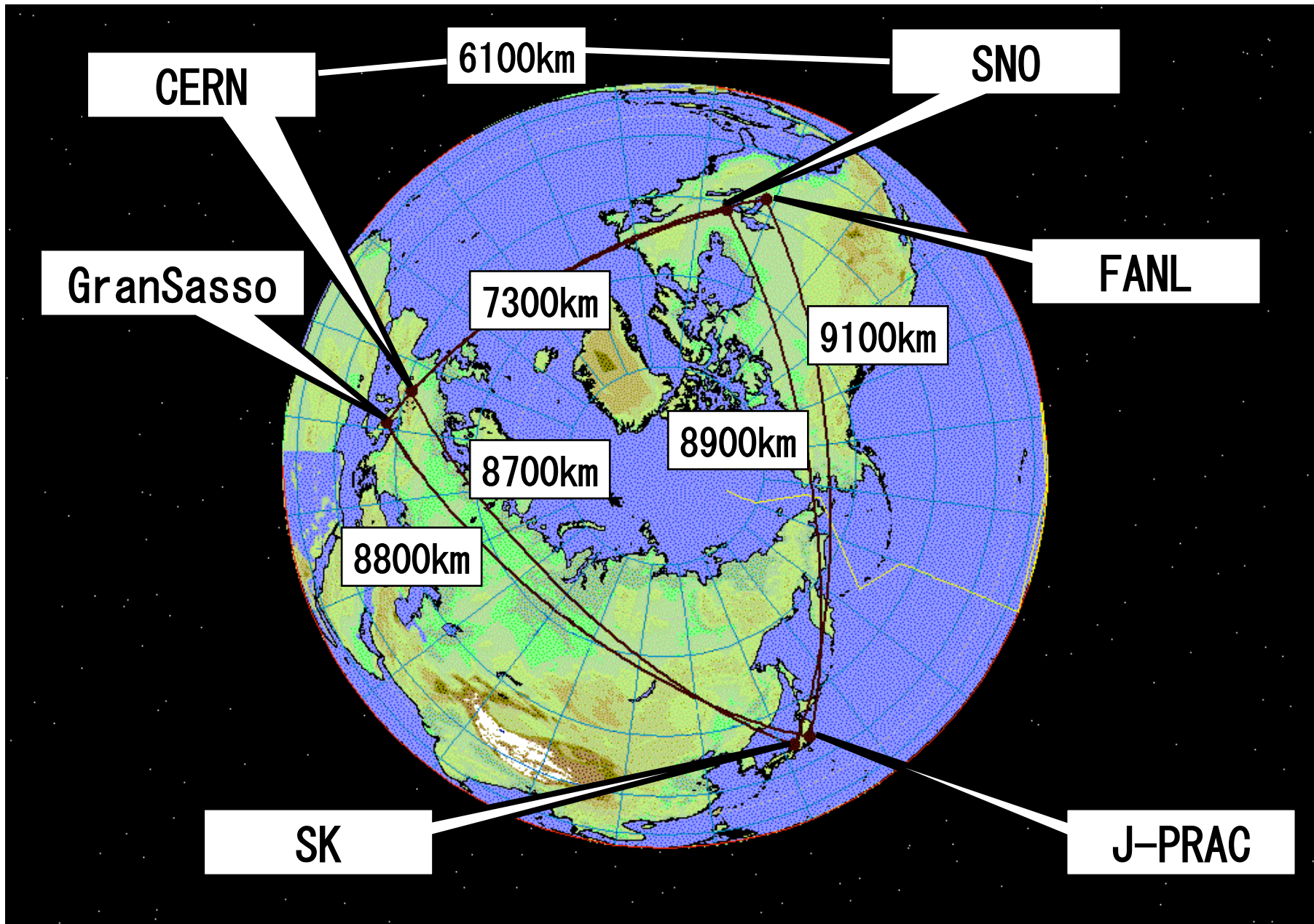
distance : direct distance

depth : the deepest depth of the path (from the surface)

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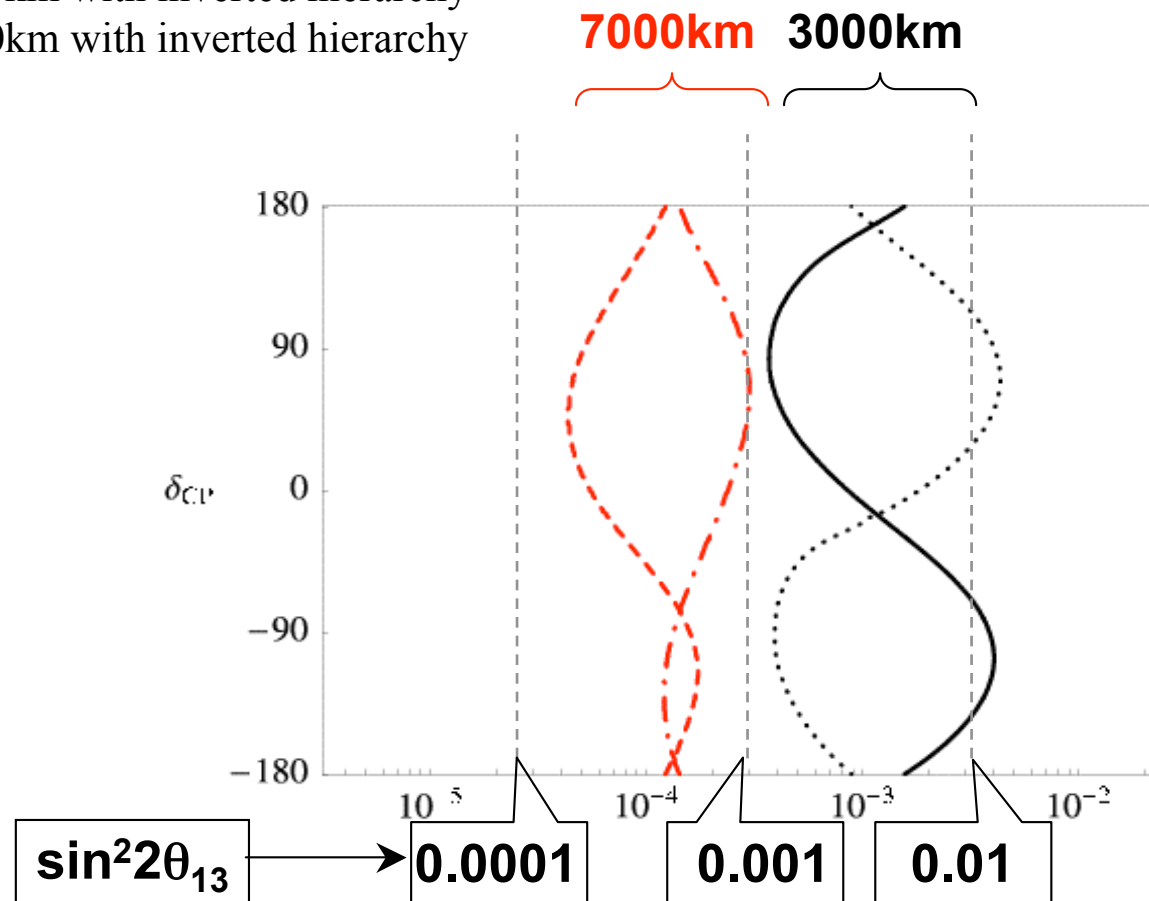
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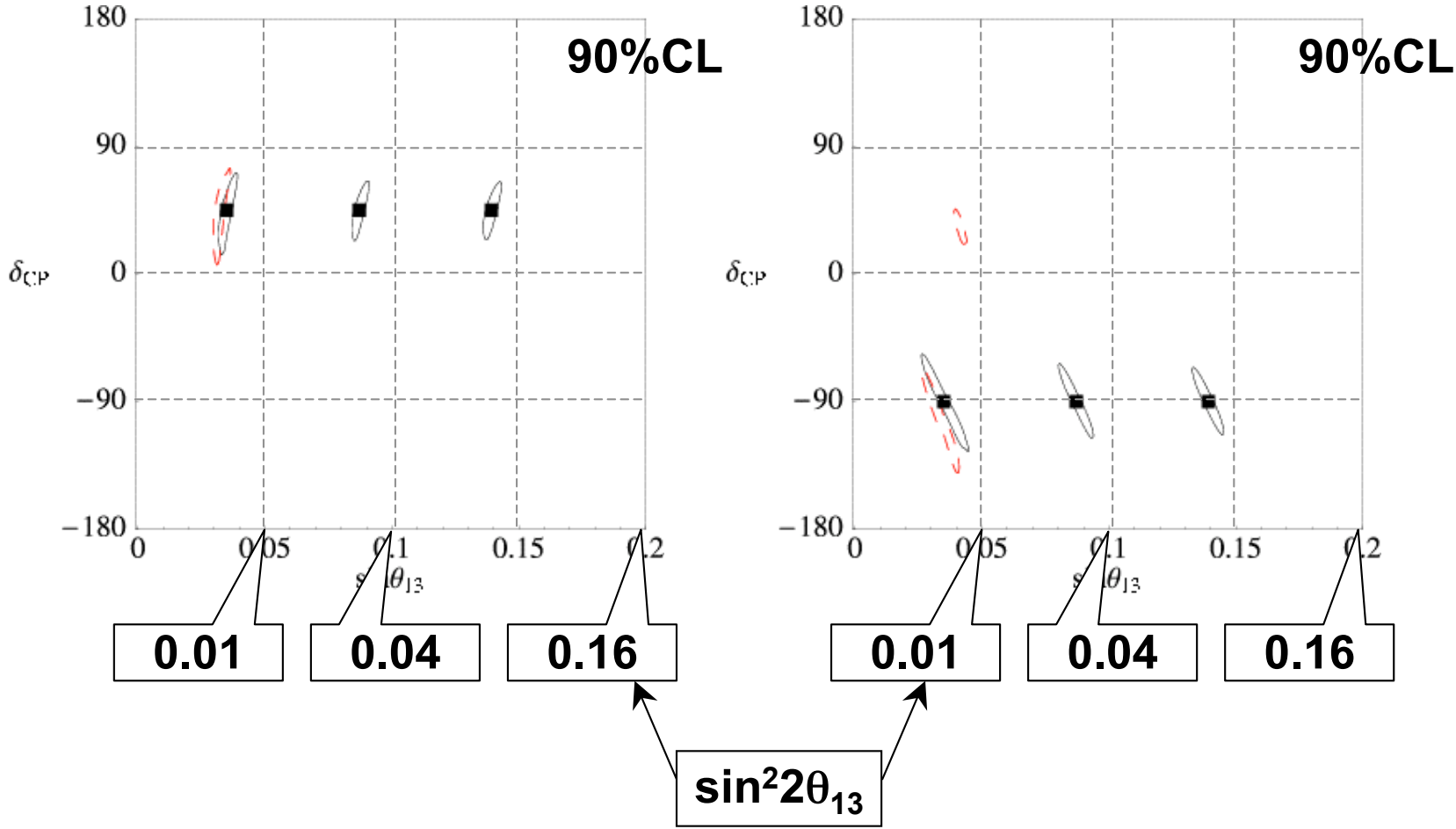
Neutrino Factory, 3sigma sensitivity to the sign of the larger mass-squared difference.

- L=3000km with normal hierarchy
- - L=7000km with normal hierarchy
- L=3000km with inverted hierarchy
- . - L=7000km with inverted hierarchy

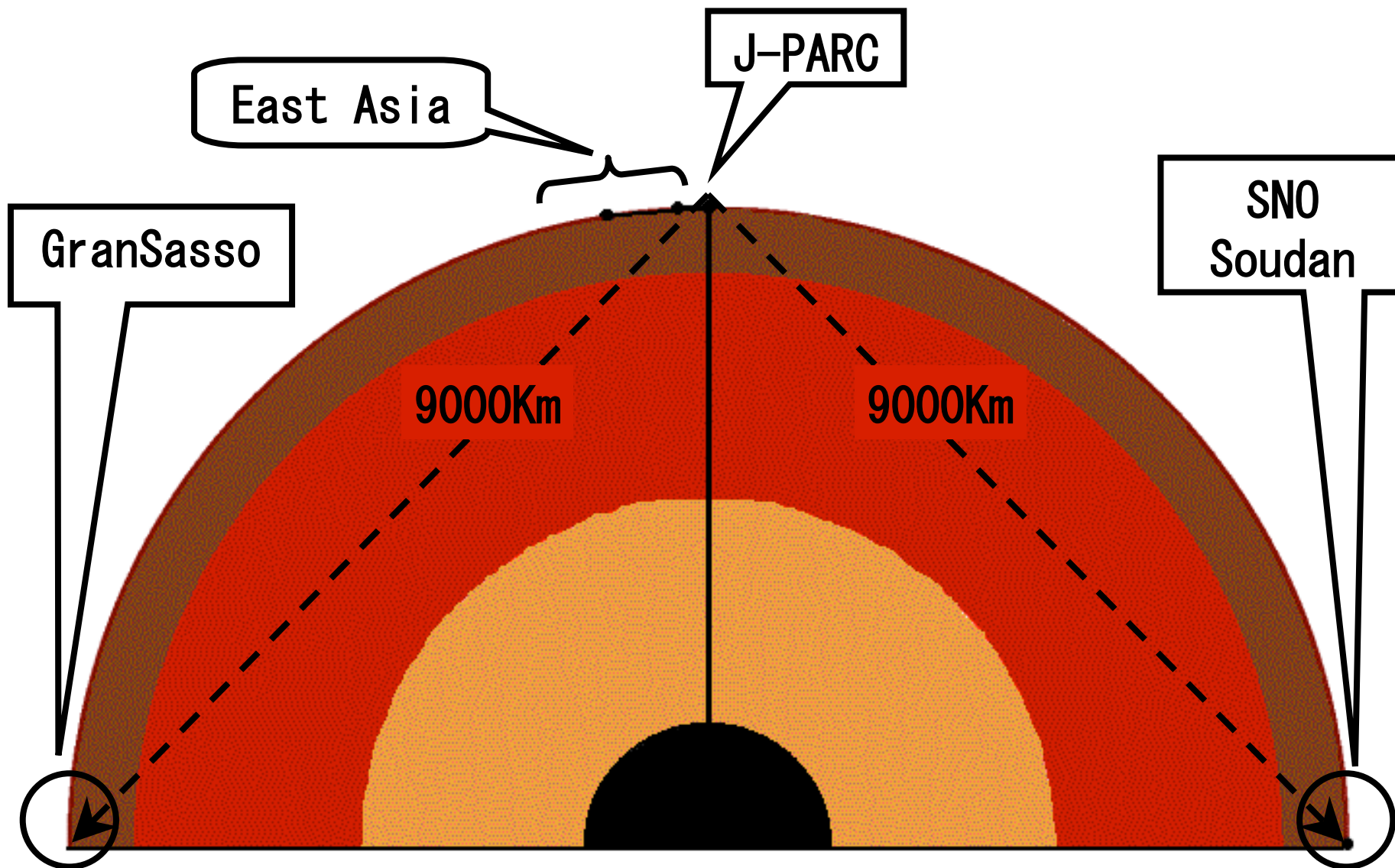


from : A.Donini etal, hep-ph/0512038

Neutrino Factory; sensitivity of the CP phase and θ_{13}



from : A.Donini etal, hep-ph/0512038



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•KEK

- It is not clear at this moment whether one of the world labs will be built in Japan, in spite of all our efforts.
- Irrespective of the site decision, the majority of high energy physicists should participate in the world lab.
- *The more you cling to the super-B the further you will be left behind the forefront of high energy physics.*
- The rest of KEK should then become a national lab for nuclear (including neutrino physics and some kind of astrophysics) and material sciences.
- In that situation, it might be natural for KEK to become a member of *zen kikan ichi houjin* in which all the *daigaku kyoudou riyoukikan* (inter-university research institutes) form one corporation or legal body.

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