

Opportunities at China JinPing Laboratory CJPL



Wien, 16.10.2013

I.Abt, MPI München



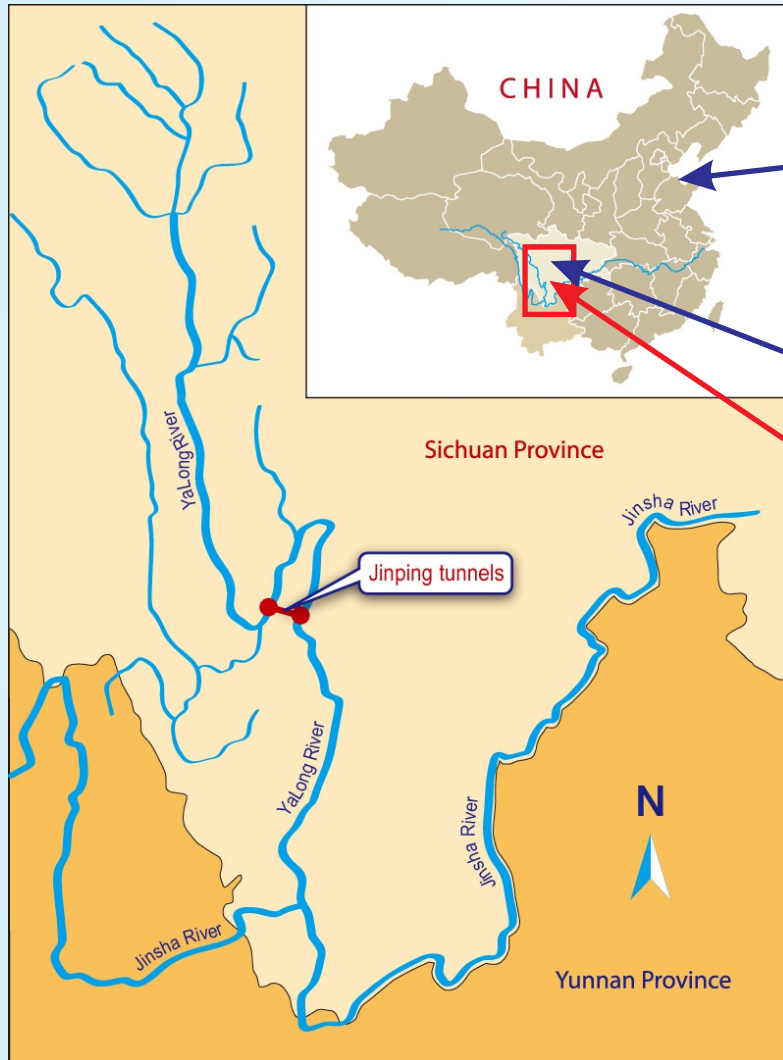
Content

- **Where is CJPL?**
- **What are CJPL1 and 2?**
- **When is the time?**
- **Experiments now
and in the future**
- **Cooperation on germanium detectors**

Why here?



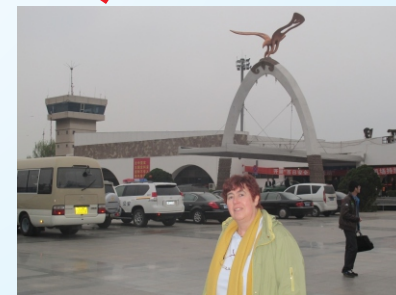
Where



Beijing

Chengdu

Xichang



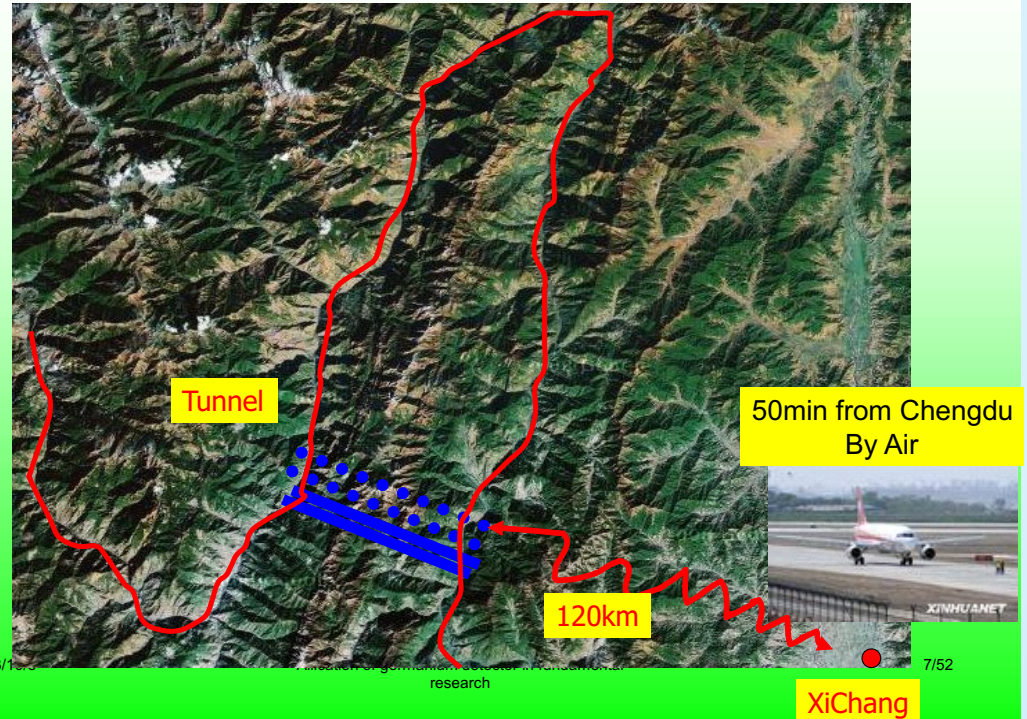
Why here ?



**the world's
largest system
of hydro-power
plants.**

**The Yalong river offers
a unique opportunity to build**

Yalong River and Jinping Mountain



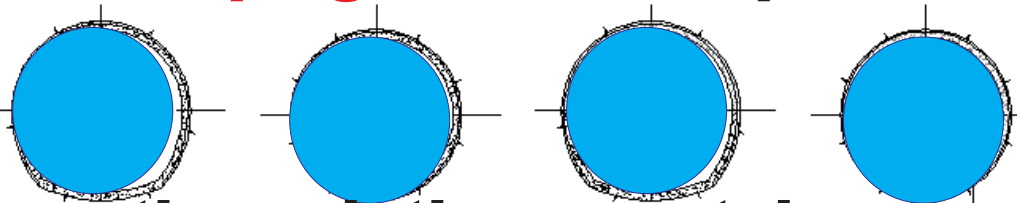
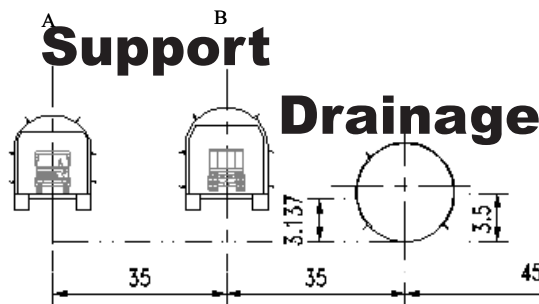
Why here ?

March
2011



Jinping 1: 305m 3600 MW

Jinping 2: Water is pushed

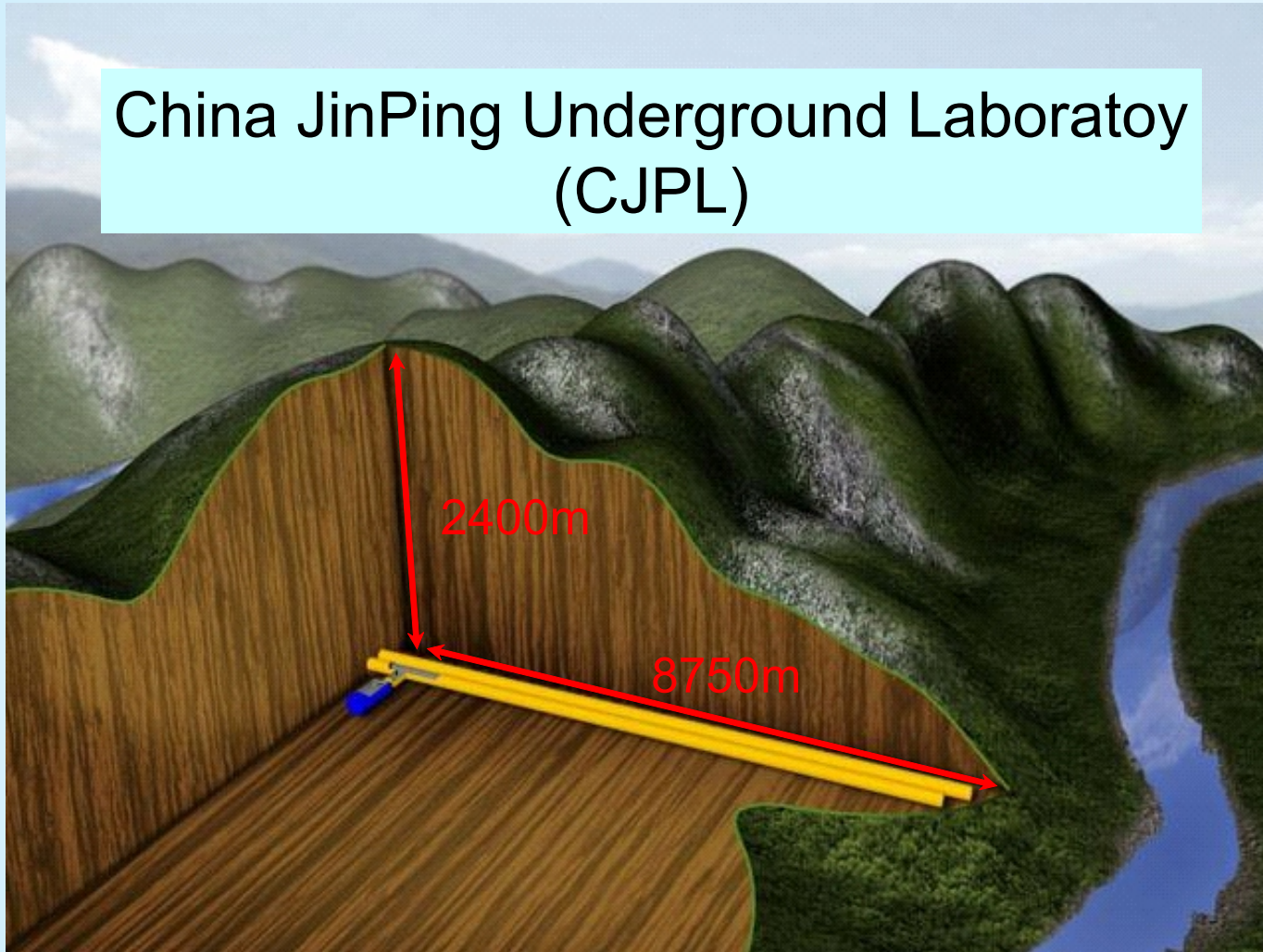


through the mountain.

4 x 2 x 600 MW = 4800 MW

Going Deep

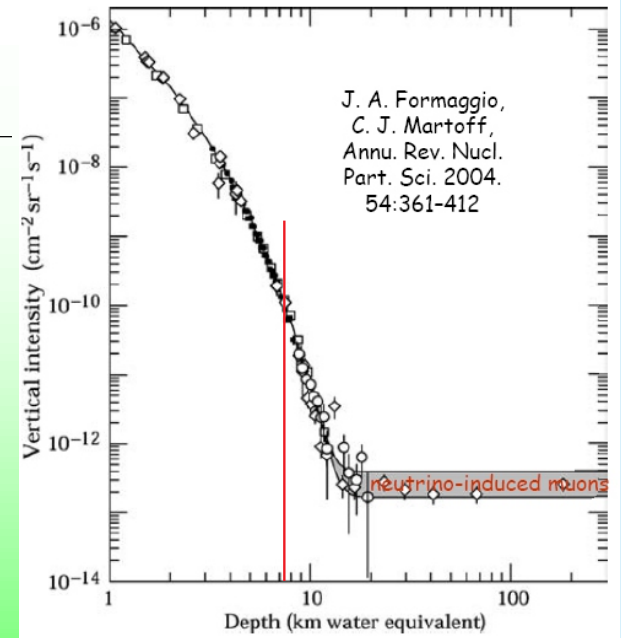
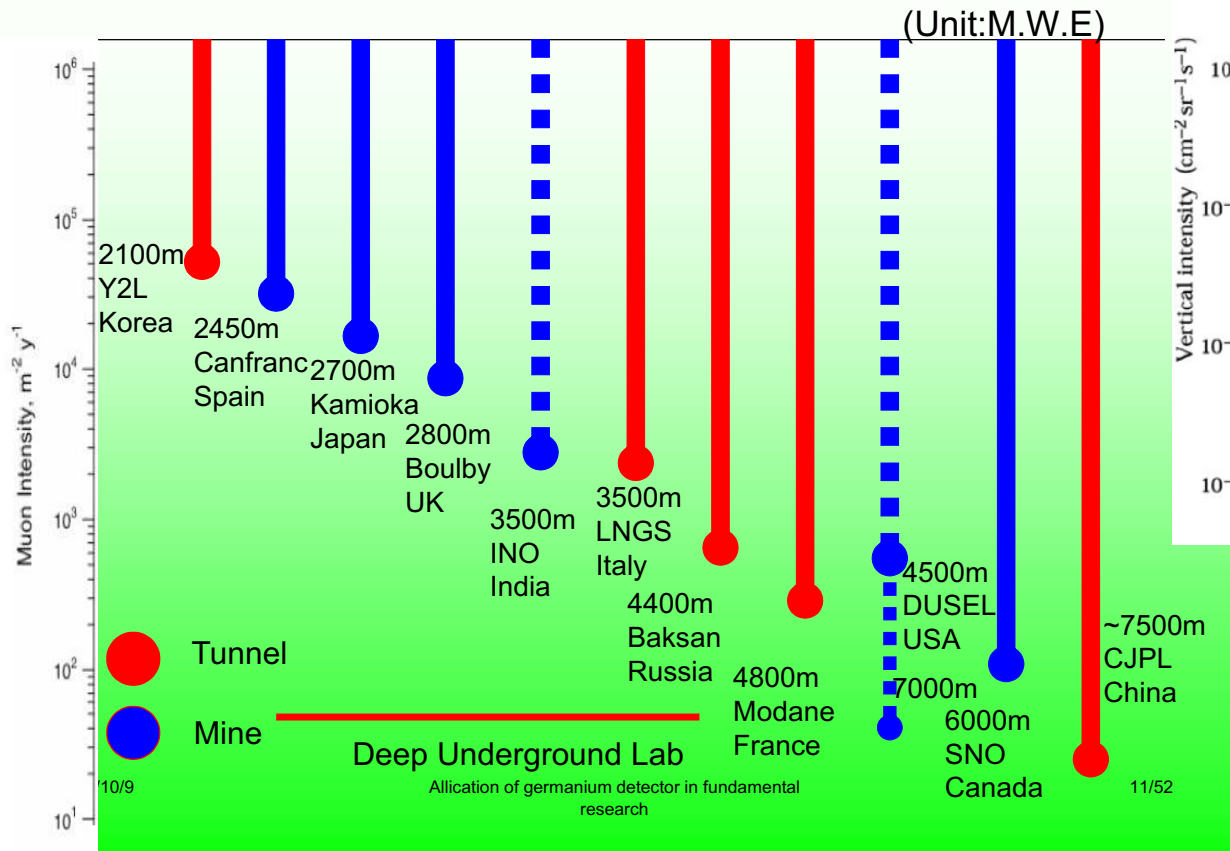
China JinPing Underground Laboratory (CJPL)



2400 m
of rock
are about
7500 m
of water

Avoiding Muons

Comparison of main ULs in the world

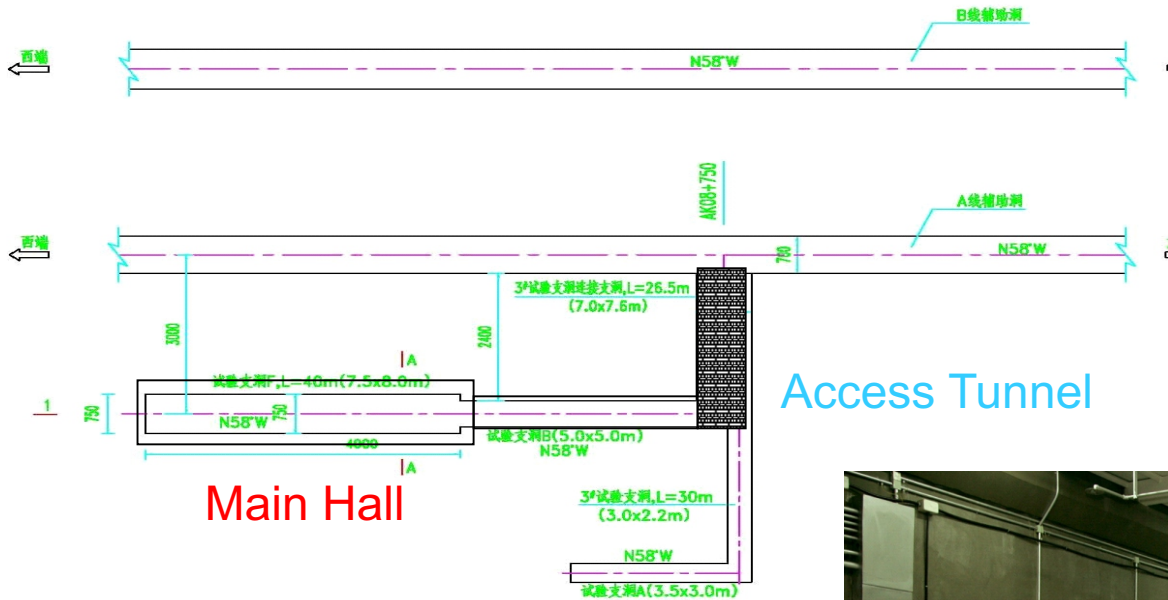


**≈ 60 muons/ m^2
a year have
been measured**



CJPL -1

**A small
lab to
start with.**



Main Hall

Access Tunnel

**6.5 x 6.5 x
40 m³ ≈
4000 m³**

**Deep and
accessible
by full-size
truck.**



History



**Tsinghua
University
and
EHDC,
Yalong
River
Development
Company**

Memorandum of Understanding 2009/5/8

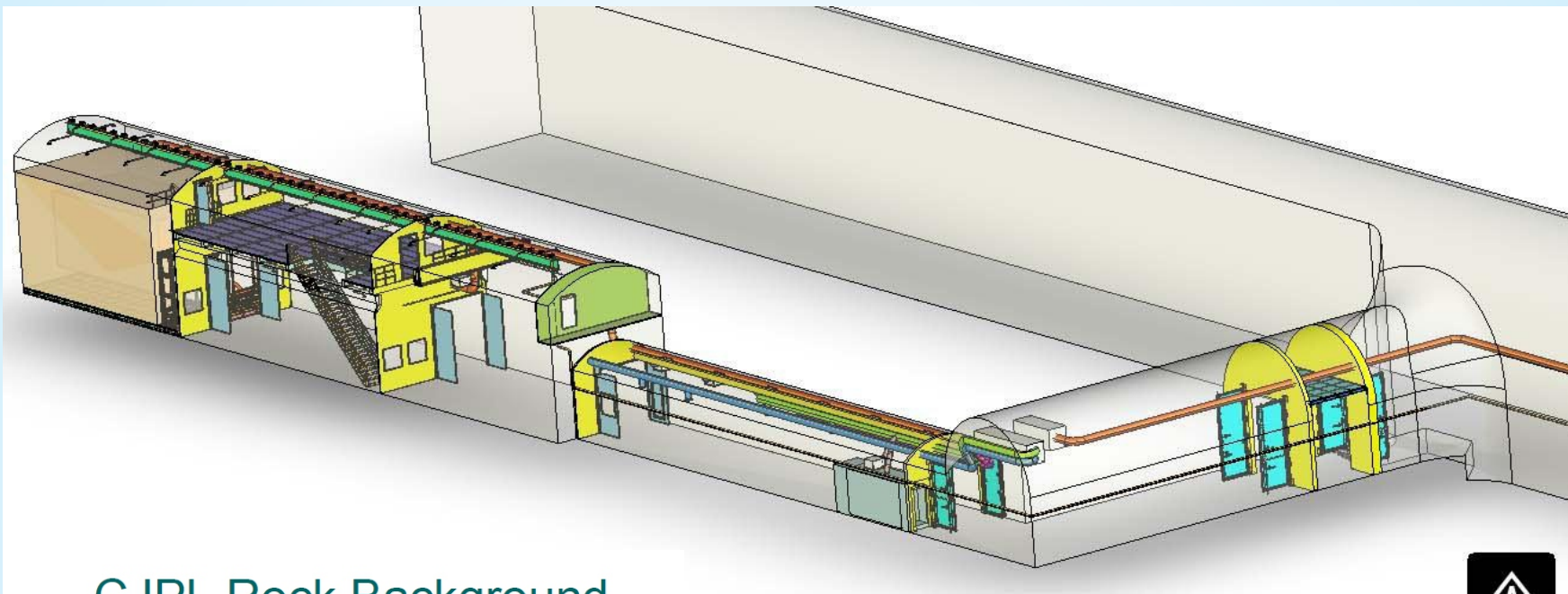
History



**Construction
in 2010**



CJPL 1

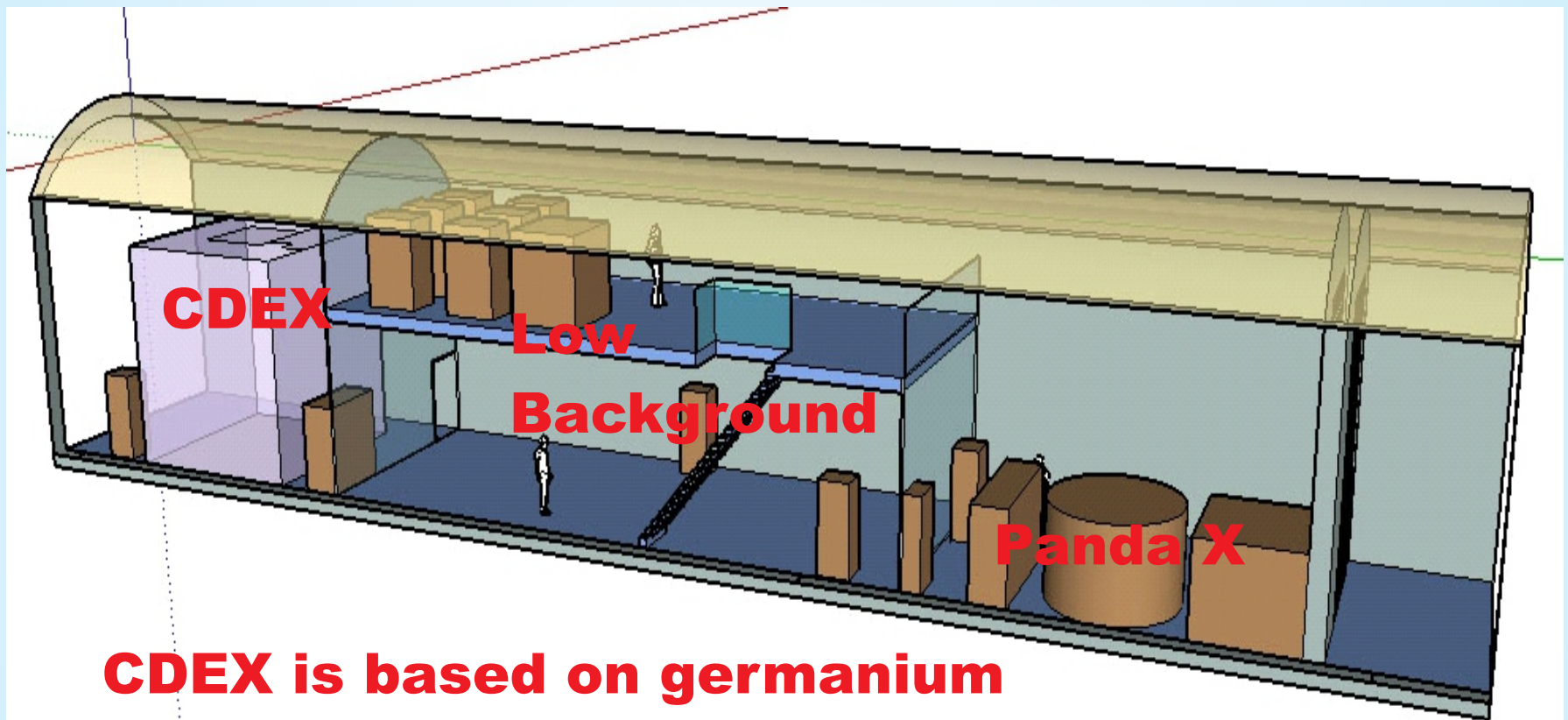


CJPL Rock Background

(Unit: Bq/kg)	K-40	Ra-226 (609keV)	Th-232 (911keV)
CJPL Rock Sample	< 1.1	1.8 ± 0.2	< 0.27

Thermal neutrons:
< 1.45 x 10⁻⁷ n/cm²/s

Experiments in CJPL 1

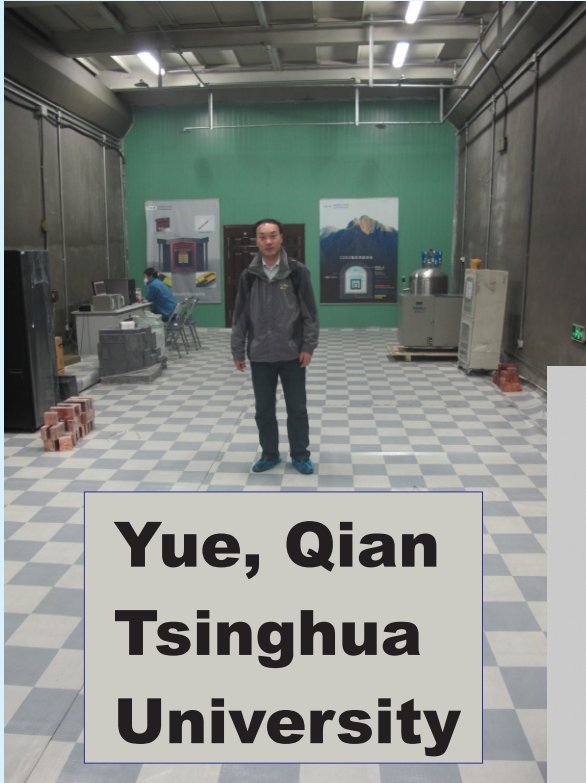


CDEX is based on germanium

PandaX is based on Xenon

Both look for dark matter.

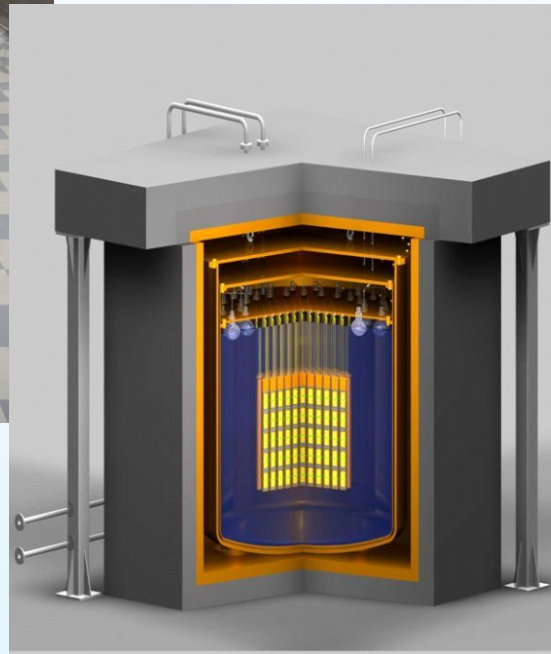
CDEX



**Yue, Qian
Tsinghua
University**

**First results
are published.**

**Germanium
in tubes in-
side active
LAr shield**

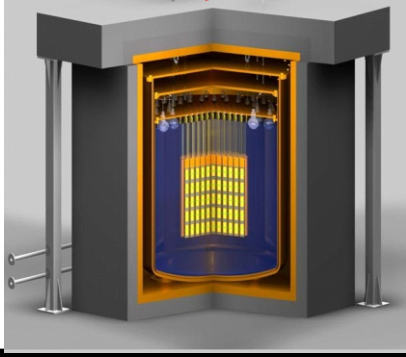


and Pb/Cu and PE



CDEX

10kg-scale
HPGe System



PE shielding room

LAr tank inside
10cm Cu +
10cm Pb +
20cm Pb

1m

Next step:
CDEX 10
2014: 10kg

Goal: 1ton scale
detector in CJPL2
for **dark matter**
and $0\nu\beta\beta$.

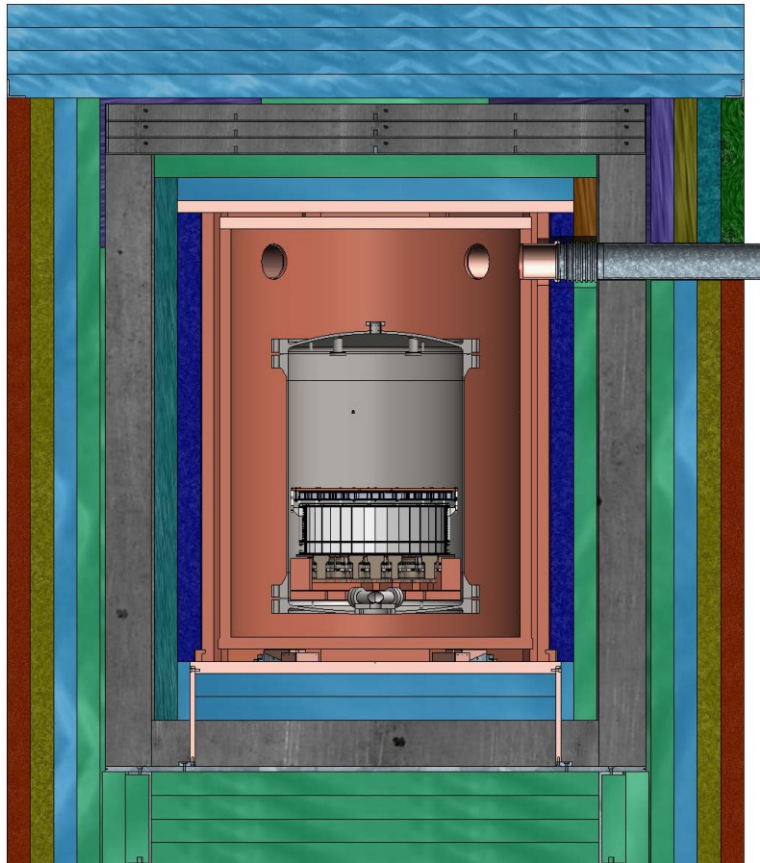


Panda X



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY

PandaX Goal



The goal is to build a **large-mass two-phase Xe TPC** with ultra-low background for **dark matter** and **neutrino-less double beta decay** searches.

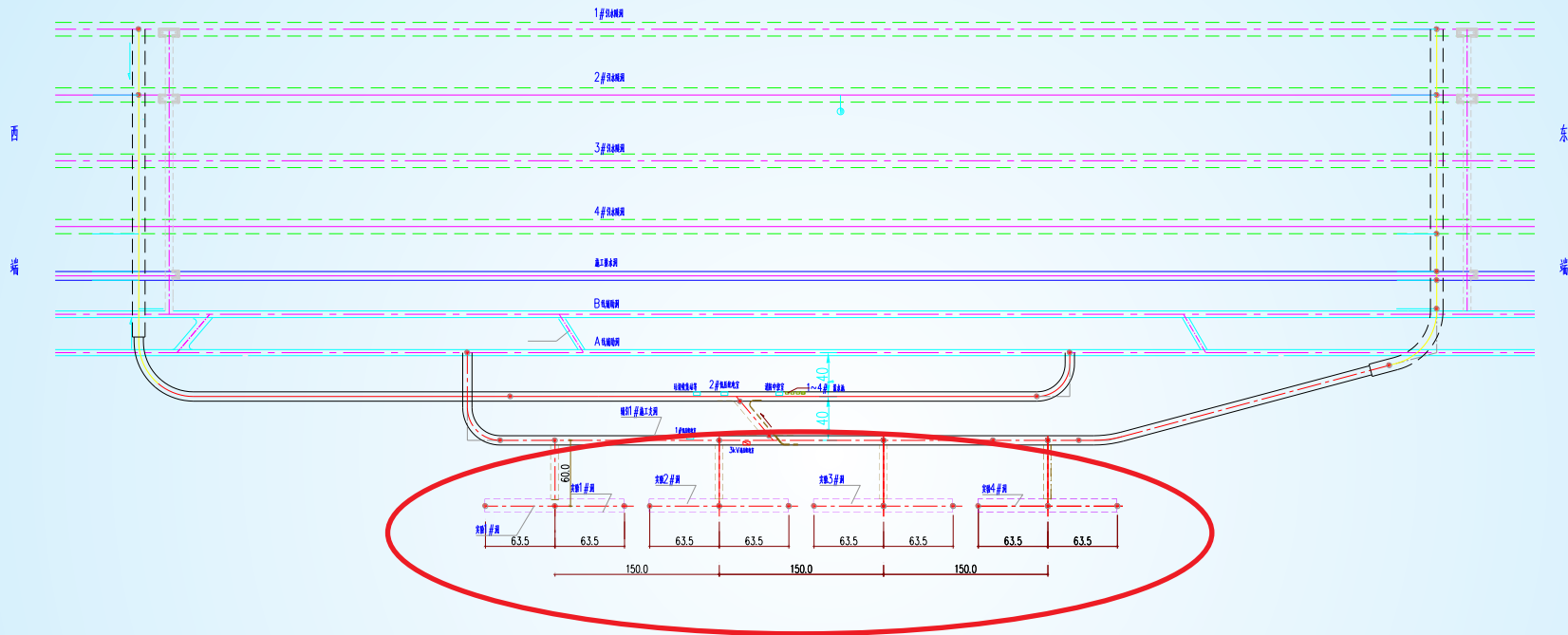
Facilities like **cryogenics & purification system, shield, outer vessel, etc.** are designed for a **ton-scale** detector, and the detector itself is designed for **easy upgrade**.

Xiang Xiao CPS2013 Shanghai Jiao Tong University



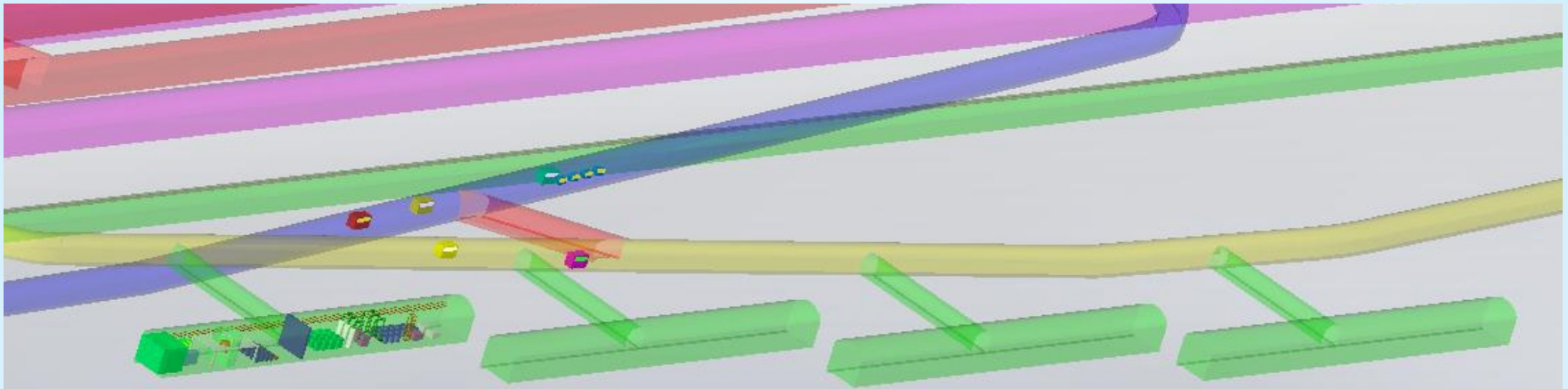
Space for CJPL 2

辅引1#、2#施工支洞平面布置图 1:1000



Experiments want to expand and underground infrastructure is wanted: electroformed copper production and machining, germanium detector production ... avoid cosmogenic activation!

8 Laboratories of CJPL 2

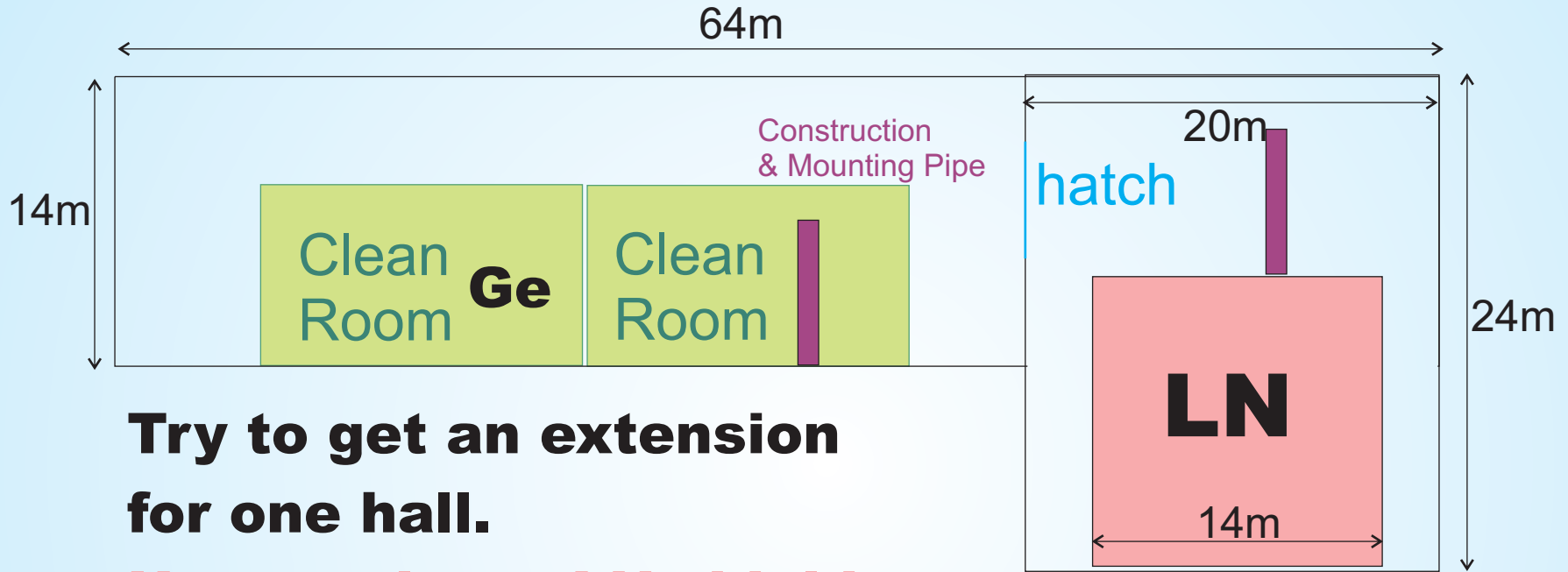


4 x 2 labs each labs: 63.5m x 14m x 14m

Rock work volume of 8 x labs	130591 m ³
Concrete work volume	26427 m ³
Steel structure	912 T

**The cavities will be dug in 2014.
Any wishes have to be formulated by end of 2013.**

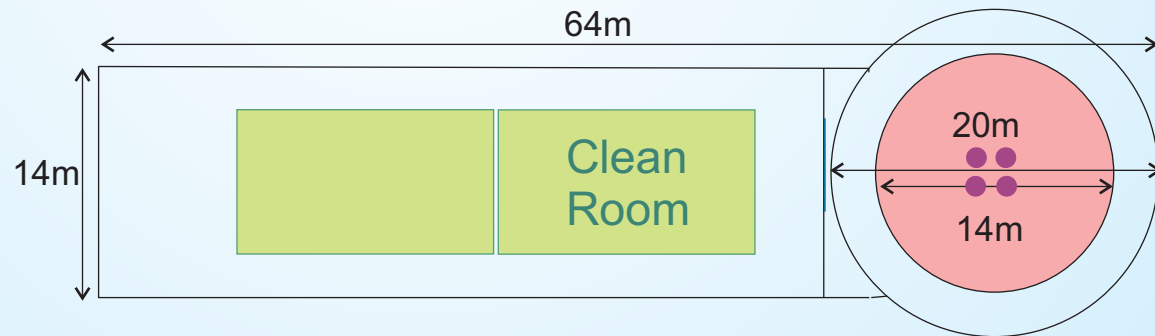
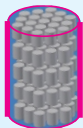
Wishes for CDEX 1ton



Try to get an extension for one hall.

Use one large LN shield.

4 to 7 assemblies



Cooperation on Germanium Detectors



Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)



EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN



Deutsch-Chinesische-Kooperationsgruppe

Development of High Purity Germanium Detector Techniques for Applications in Fundamental Research

Finanziell unterstützt durch: Chinesisch-Deutsches Zentrum für Wissenschaftsförderung Peking, China

中德合作研究小组

应用于基础研究的高纯锗探测器技术研发

资助者: 中德科学中心 / 中国 北京



Germanium Detectors

planar
true coaxial
coaxial
point contact



n-type
p-type
segmented
non segmented

What do you want most?

homogenous electric field,
energy resolution, energy
threshold, position resolution,
ultra low background,
robustness, low price, serial
production



The egg-laying woolly Ge milk-pig



= one size/technology fits all

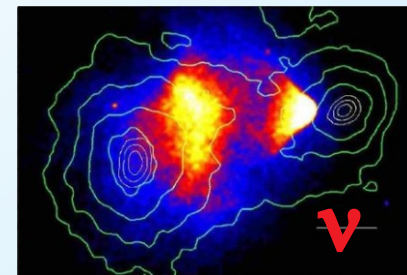
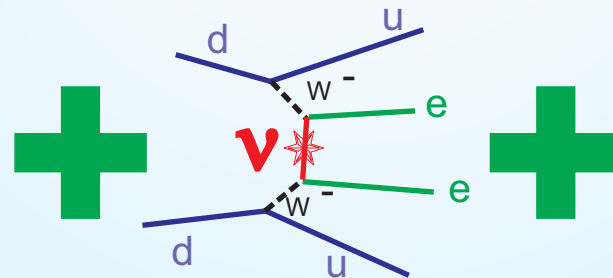
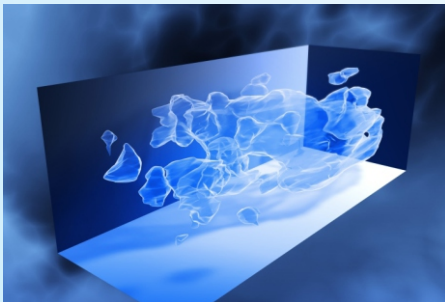
threshold of 20 eV

perfect separation of multi/single-site
position resolution 1mm

separation of gamma and neutron

energy resolution 1keV at 1MeV

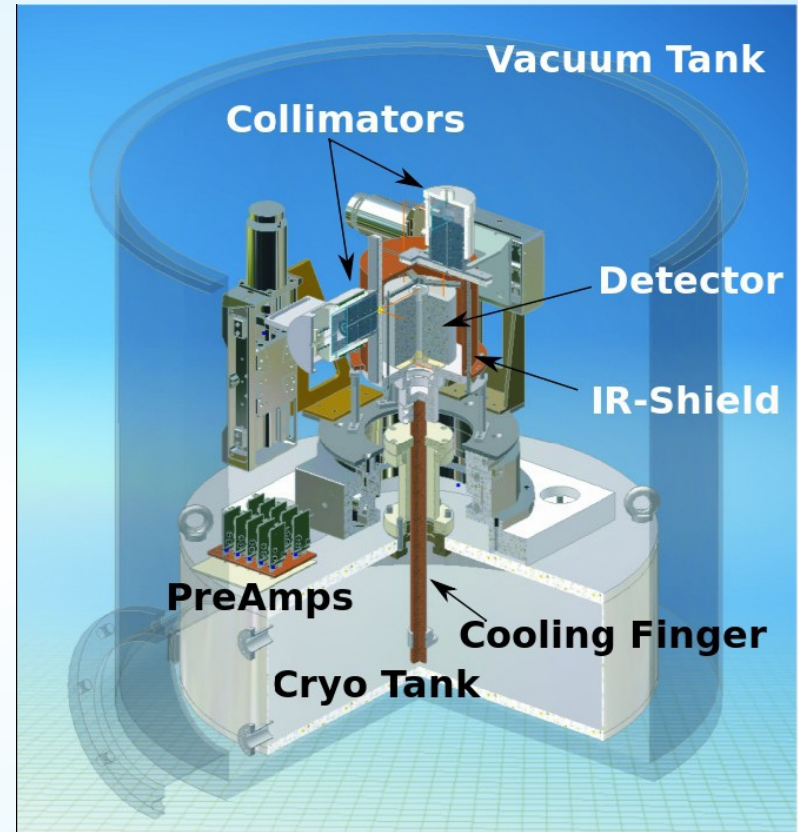
no contamination: bulk and surface



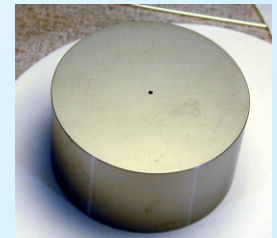
Germanium Detectors



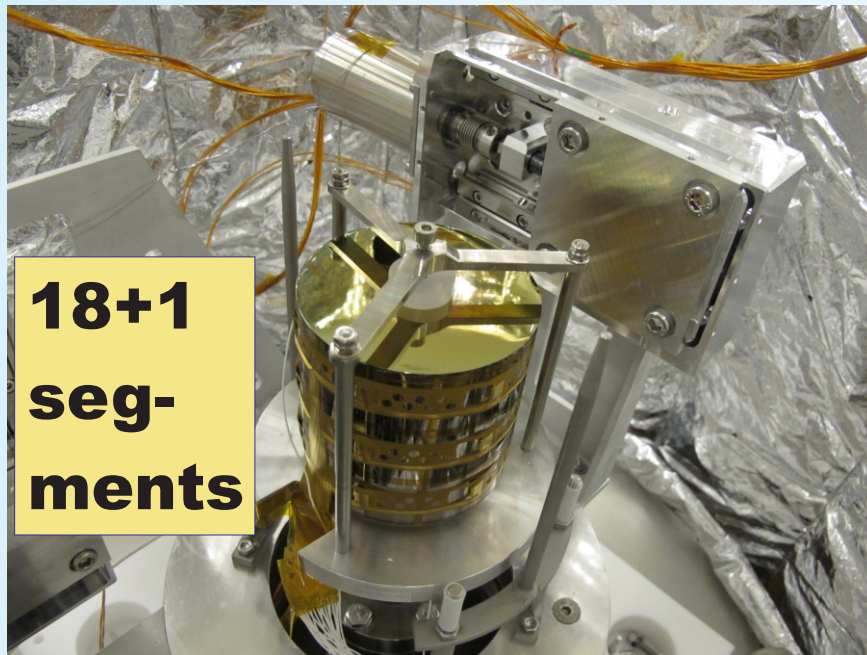
MPI studies detectors,



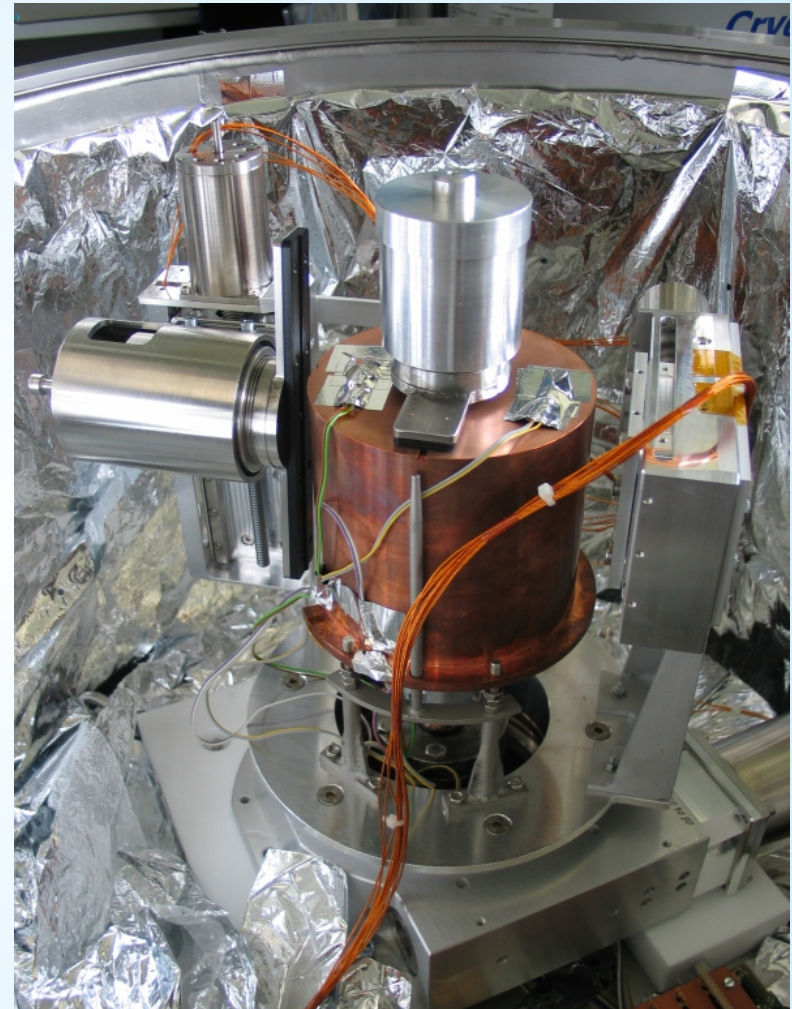
**Tsinghua tries
to build them.**



Inside GALATEA



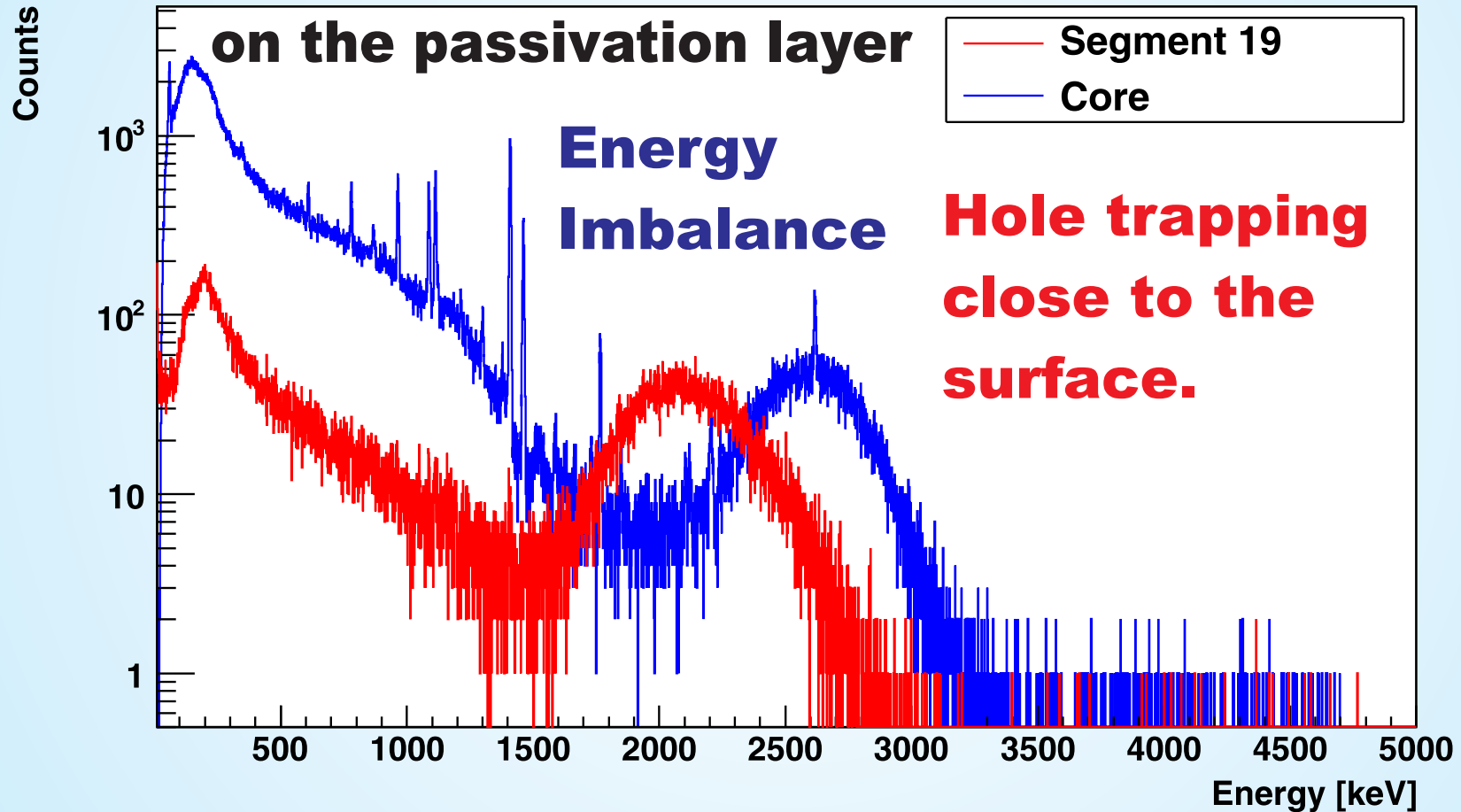
**Scan detectors from
the top and from the
side with alphas, betas
gammas and LASER.**



Alphas on the Surface

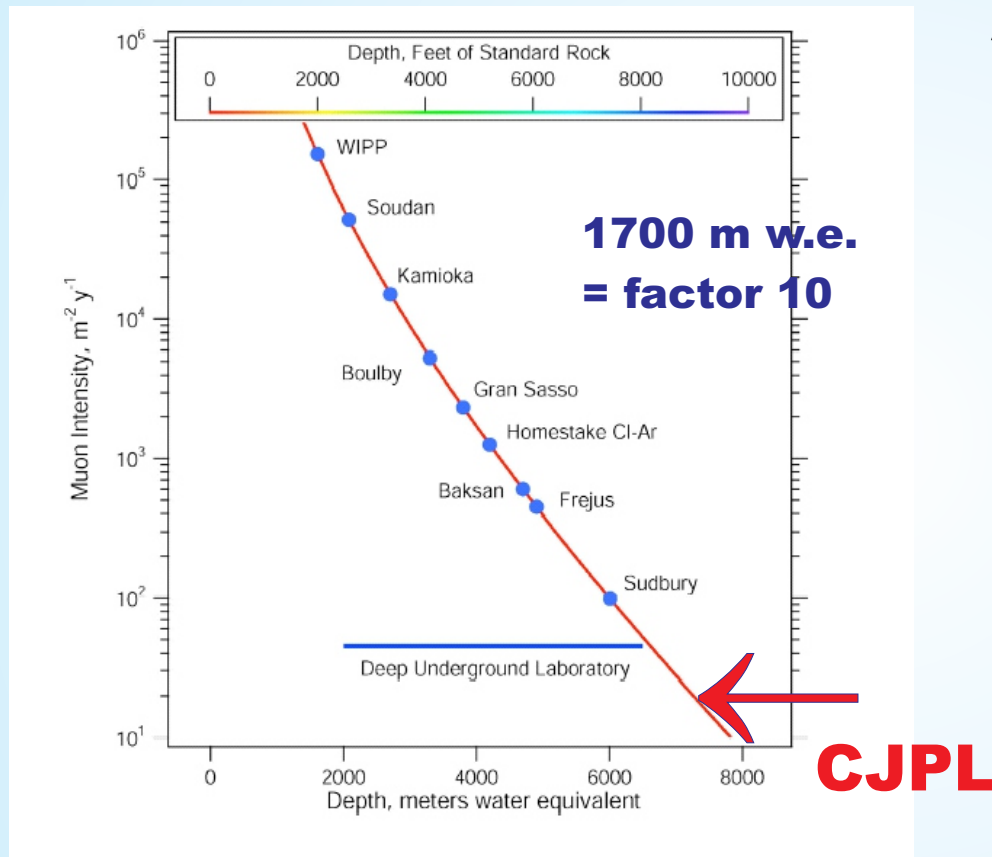
Hitting the detector

on the passivation layer



Spelunking

Muon flux versus depth

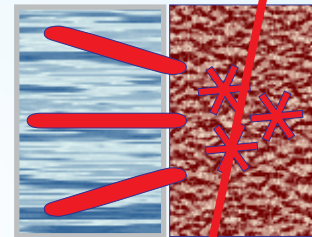


60 muons/ m^2 /year

Always some muons left.



Schicksal...

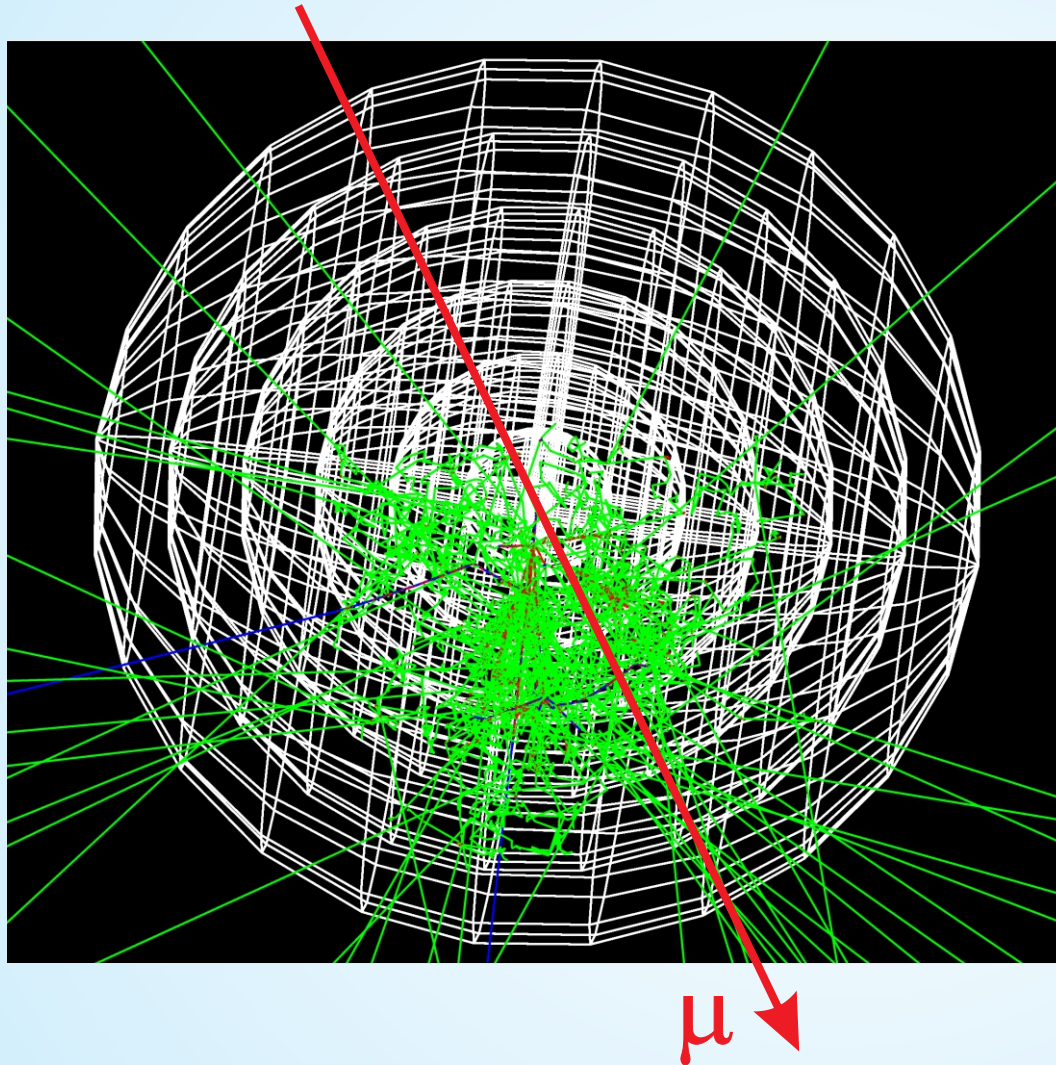


μ

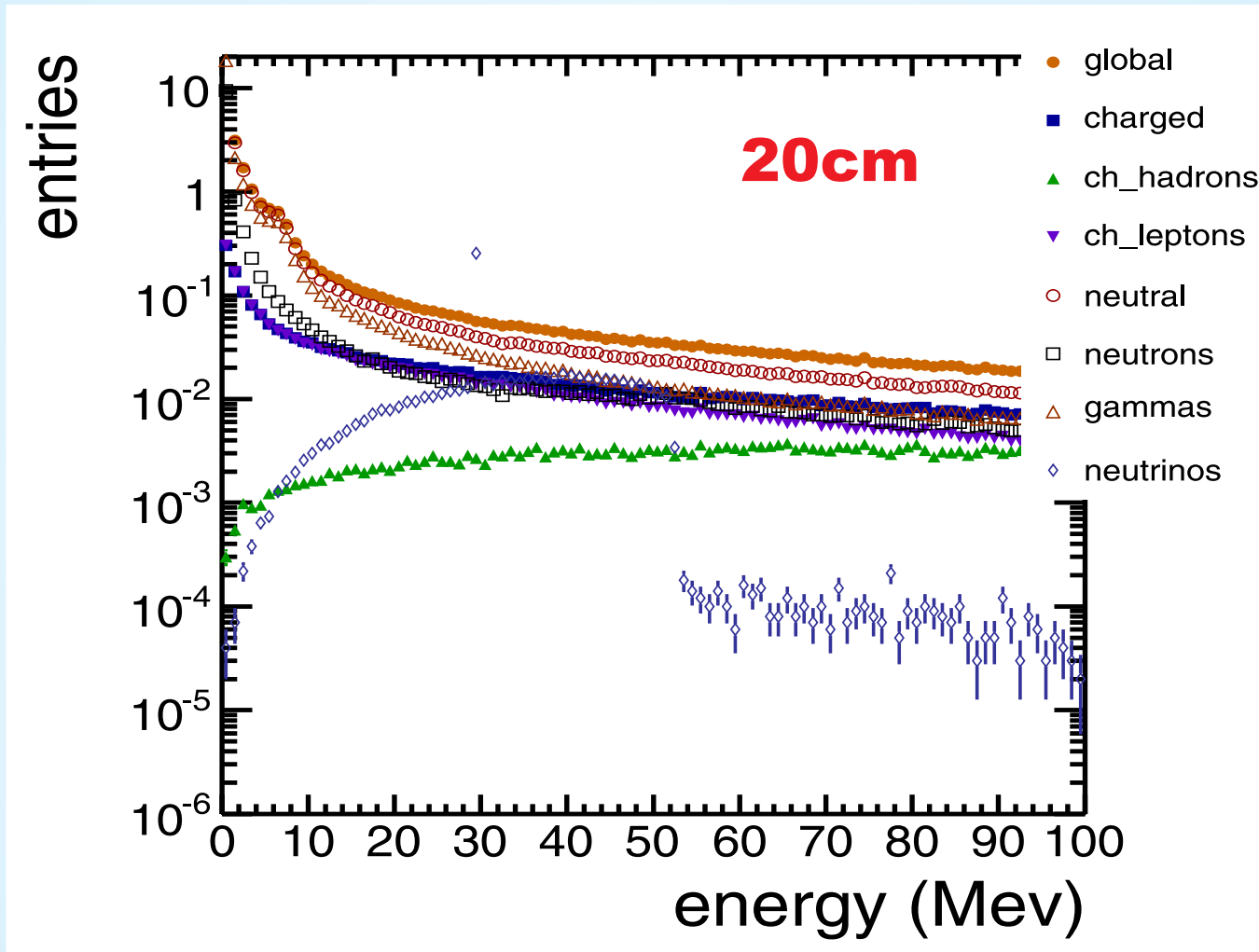
Simulations and shield designs are part of the cooperation.

Neutrons are Nasty

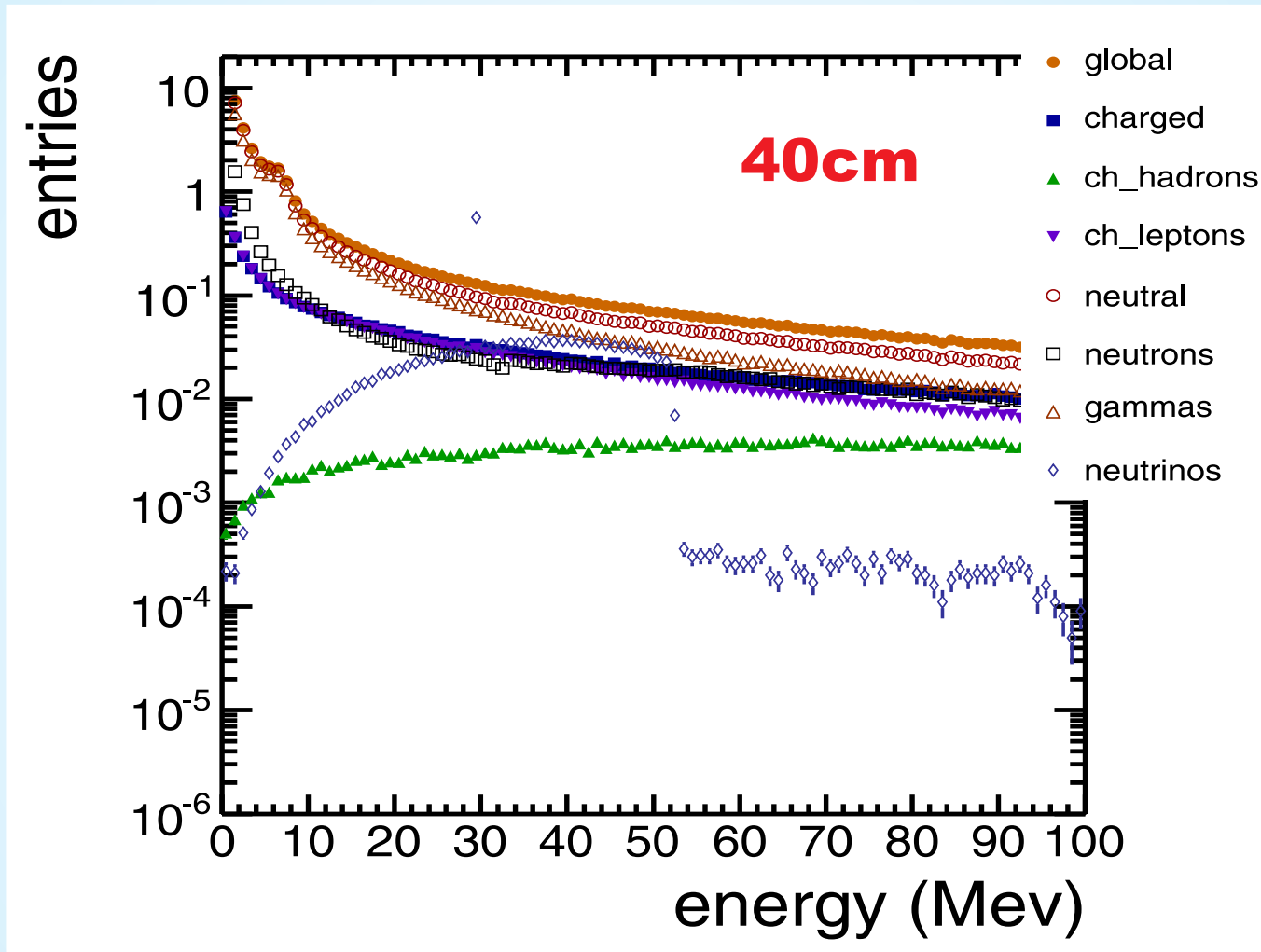
**How many are
created and
what energy
do they have?**



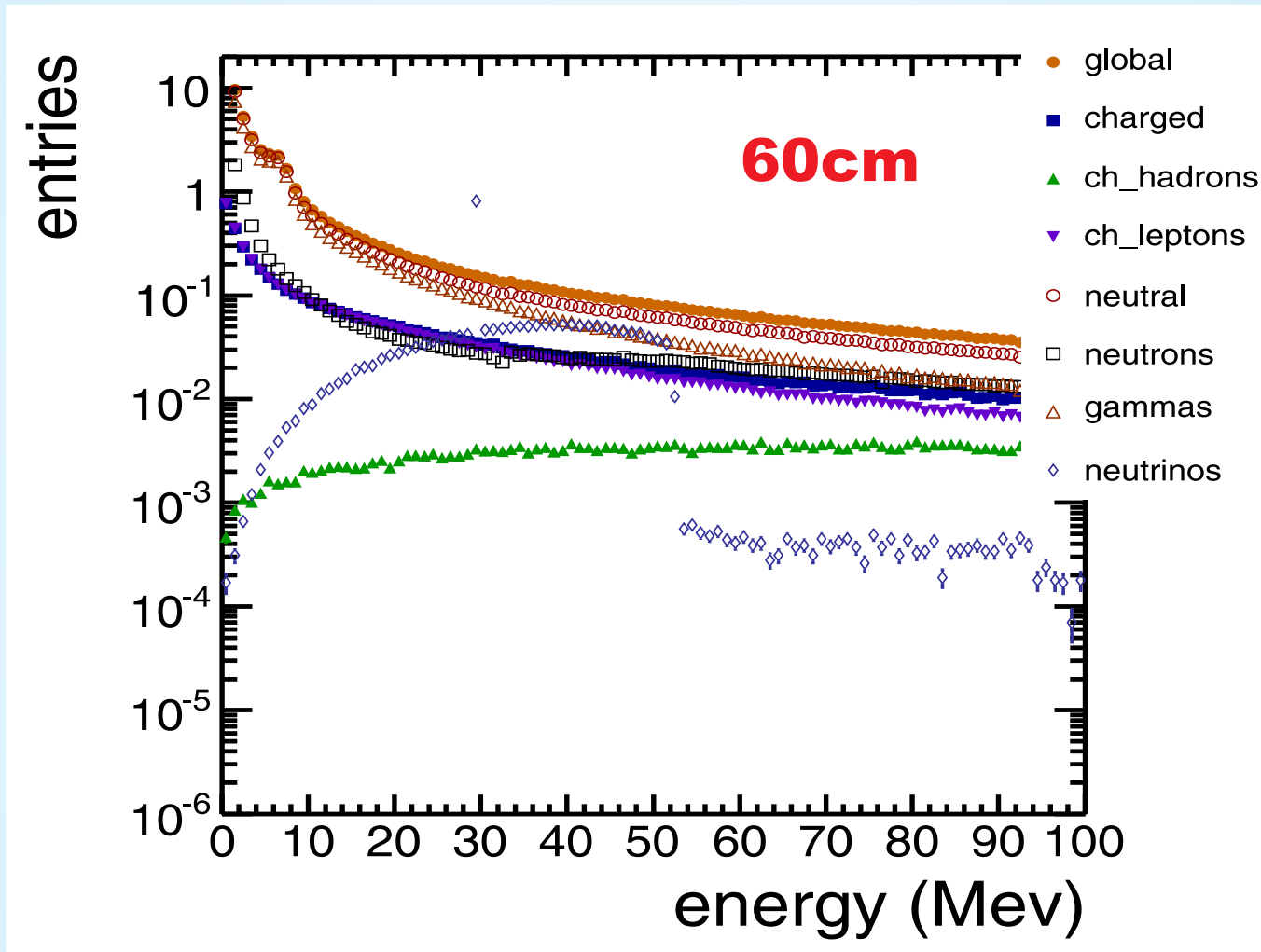
MC on Showers in Rock



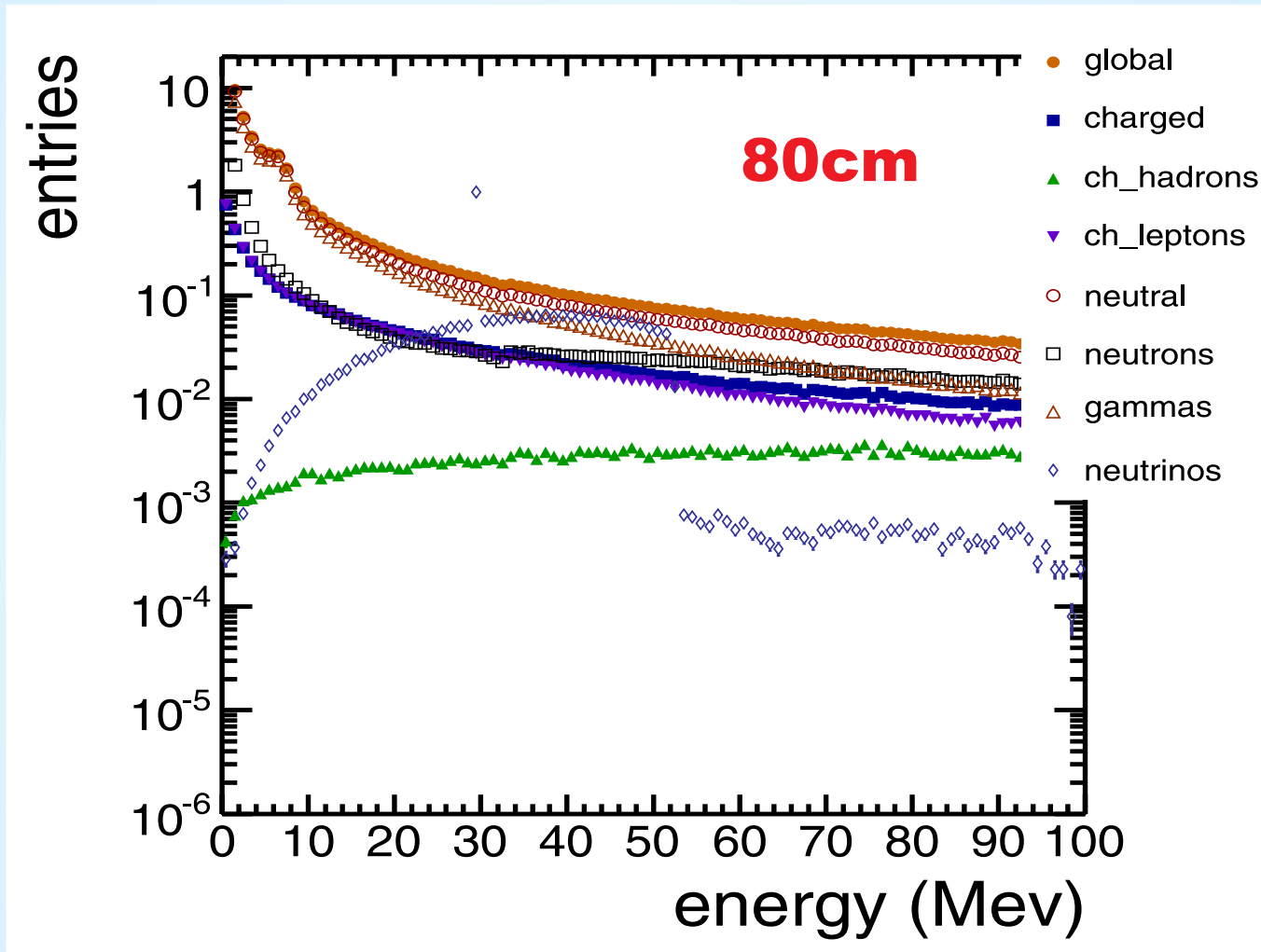
MC on Showers in Rock



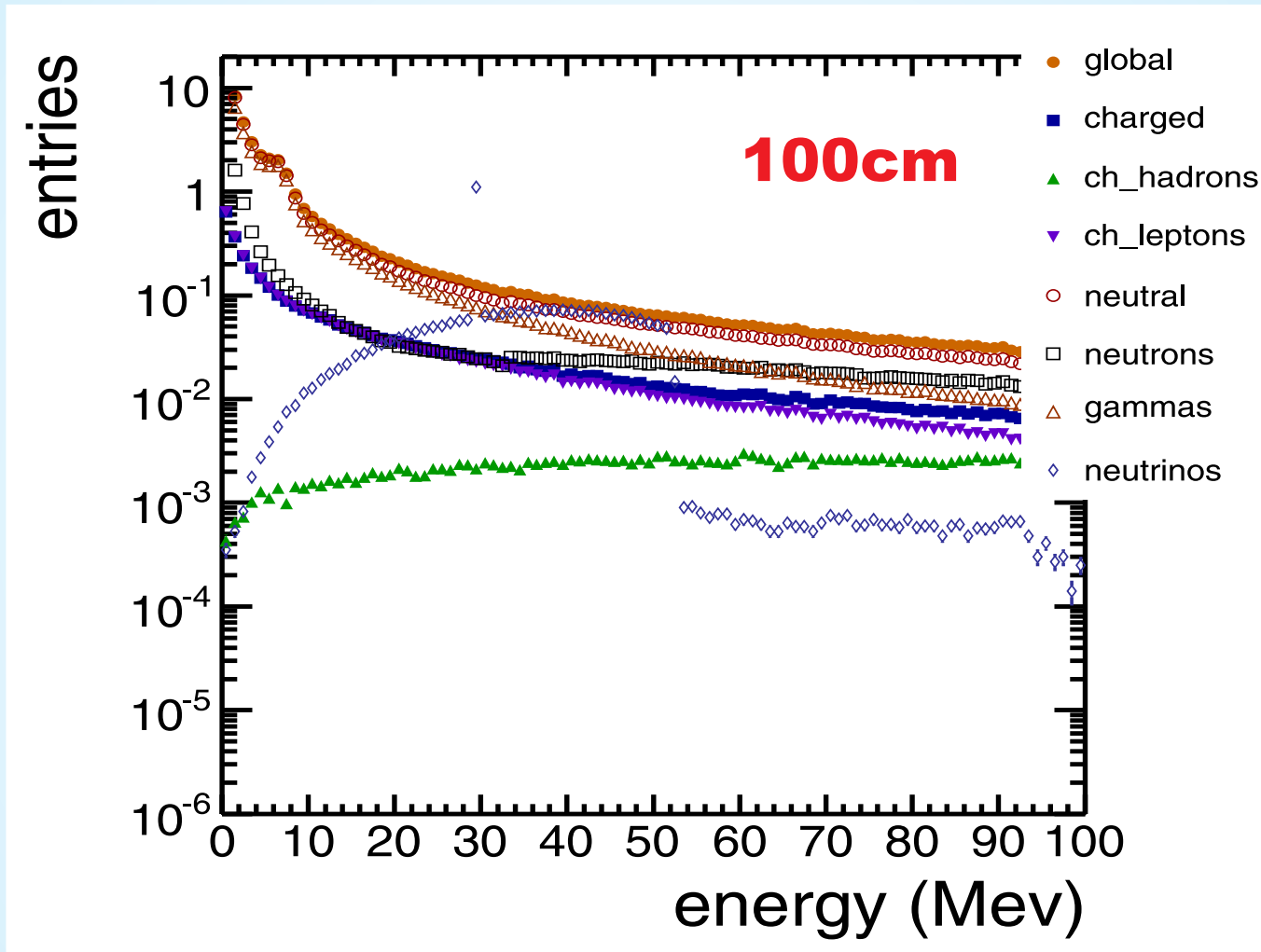
MC on Showers in Rock



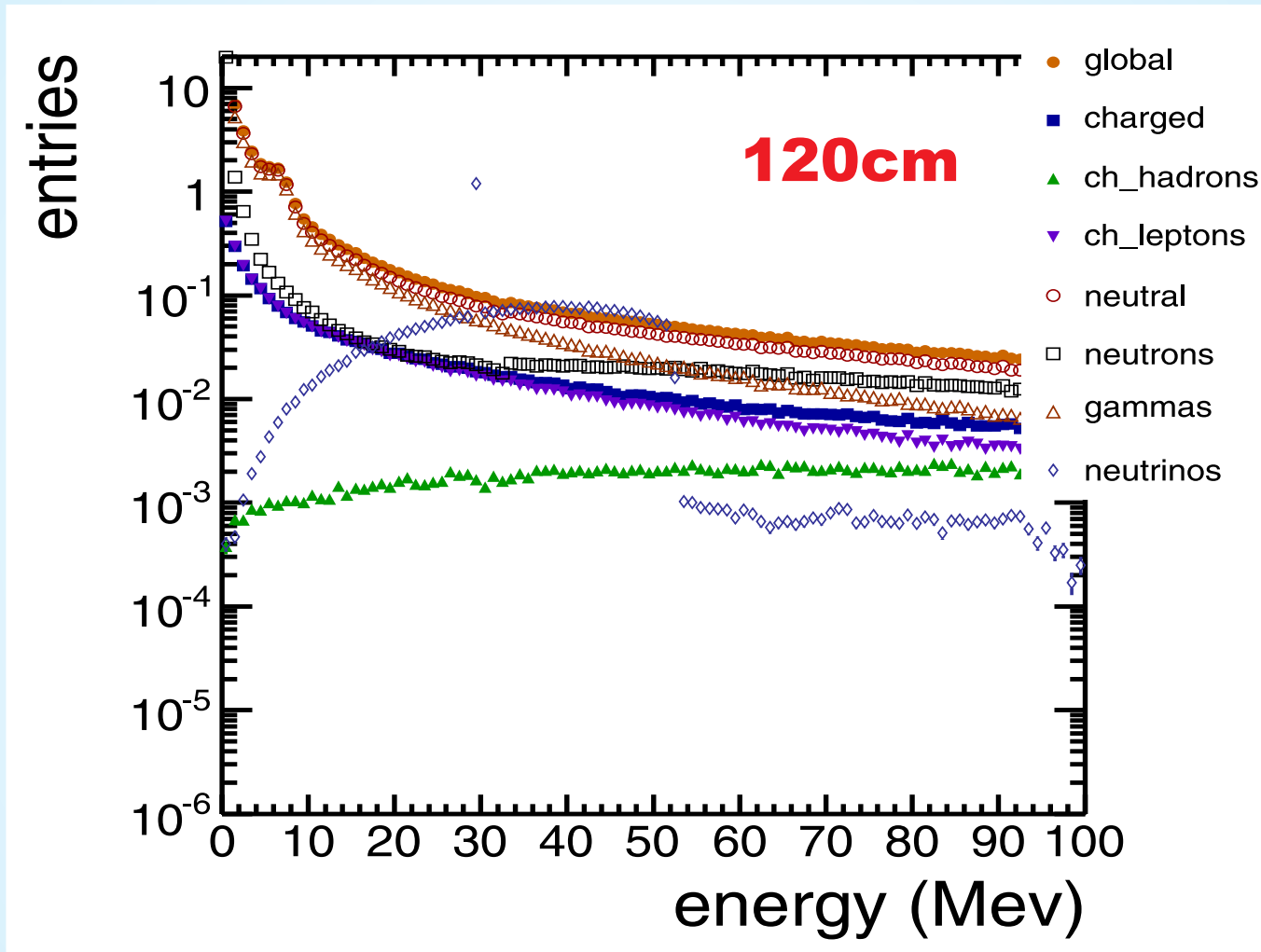
MC on Showers in Rock



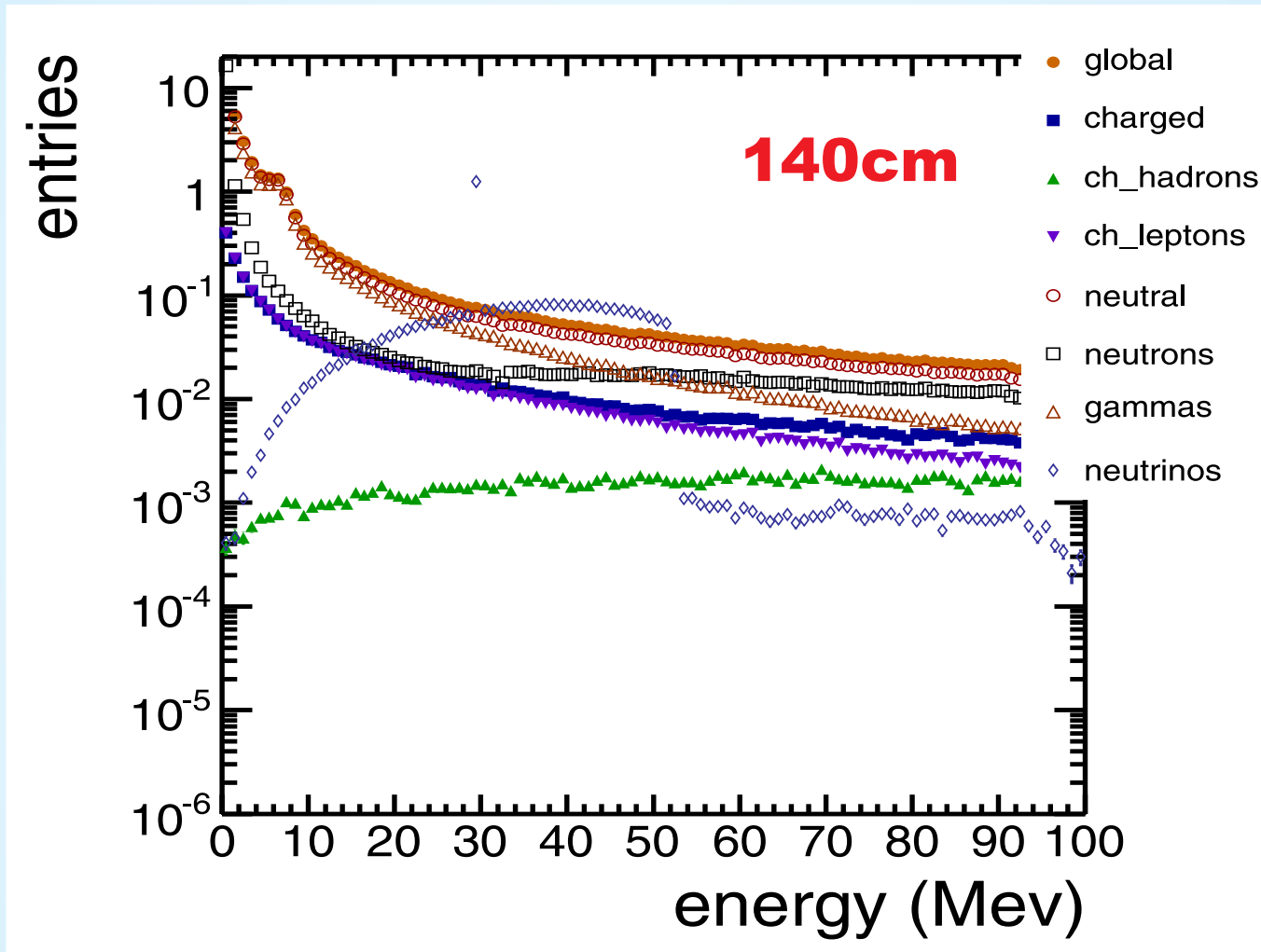
MC on Showers in Rock



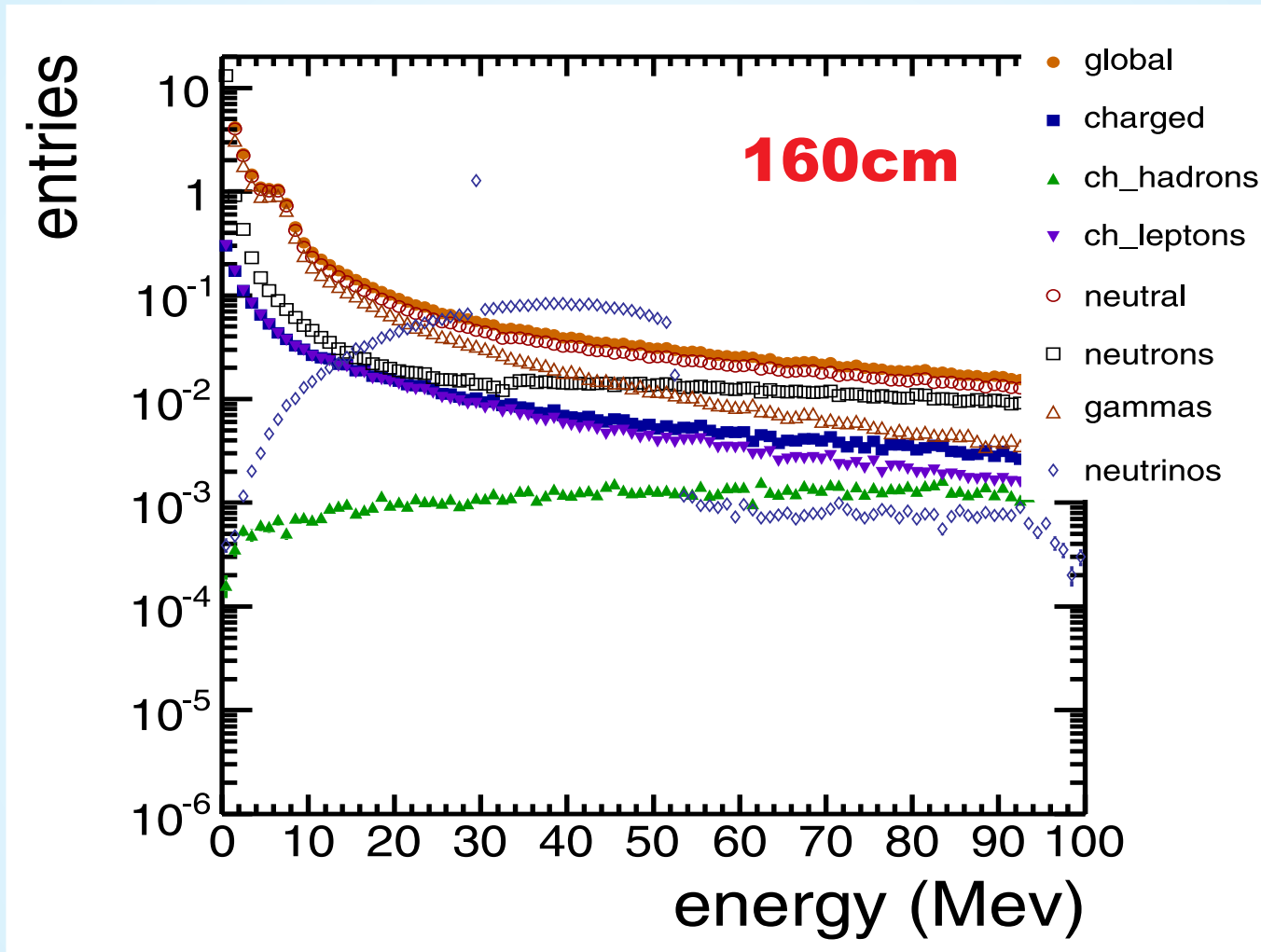
MC on Showers in Rock



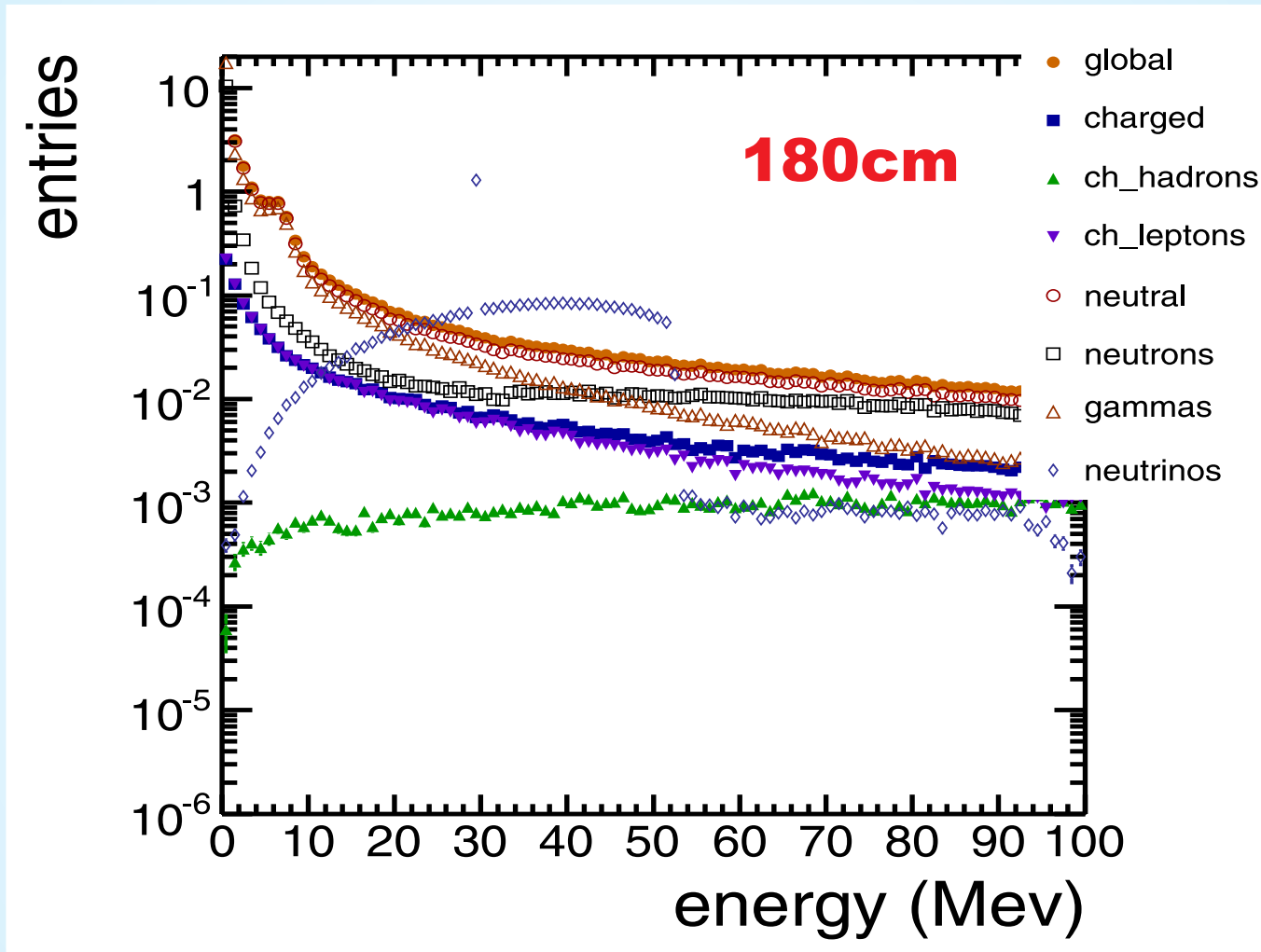
MC on Showers in Rock



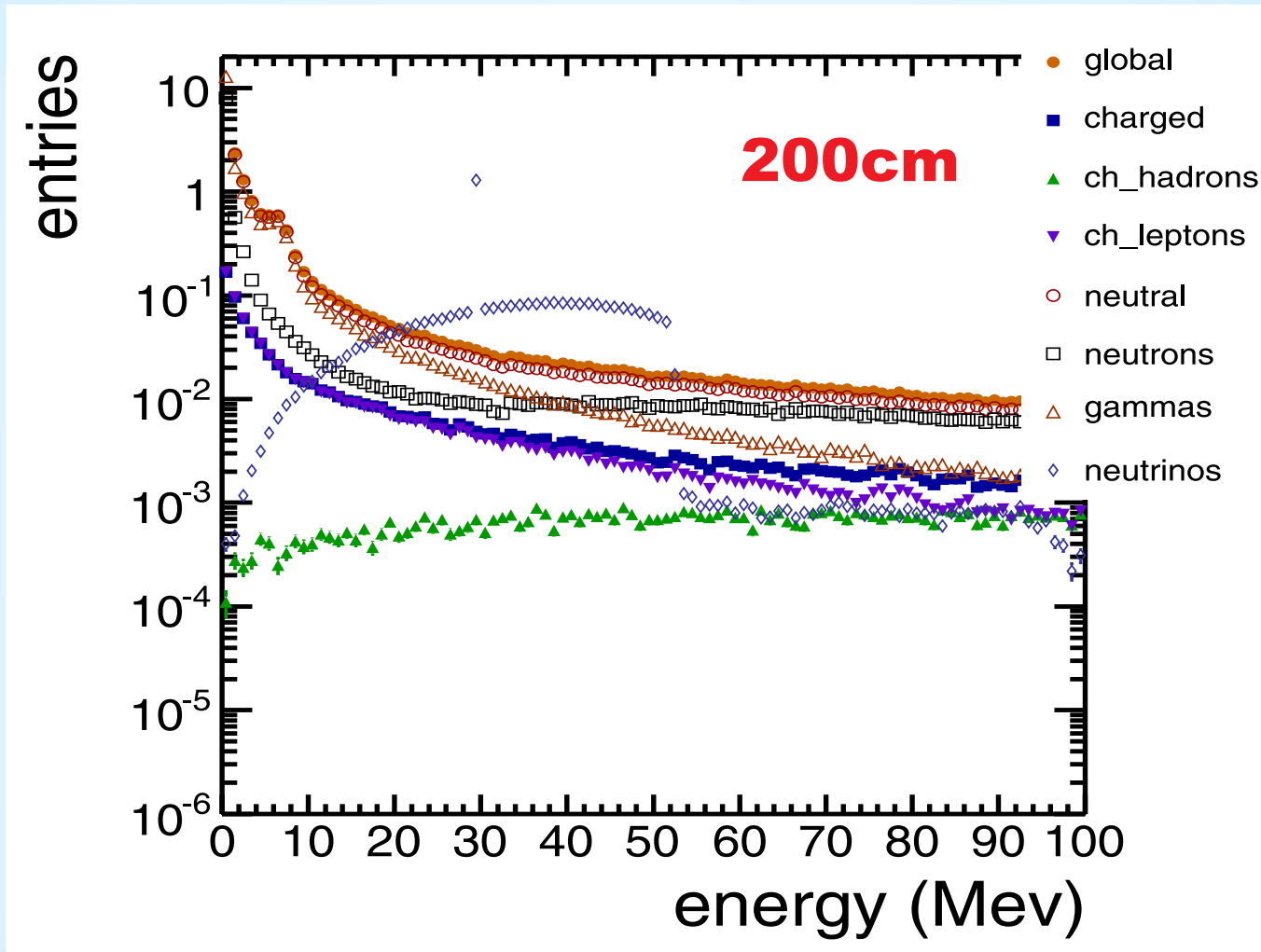
MC on Showers in Rock



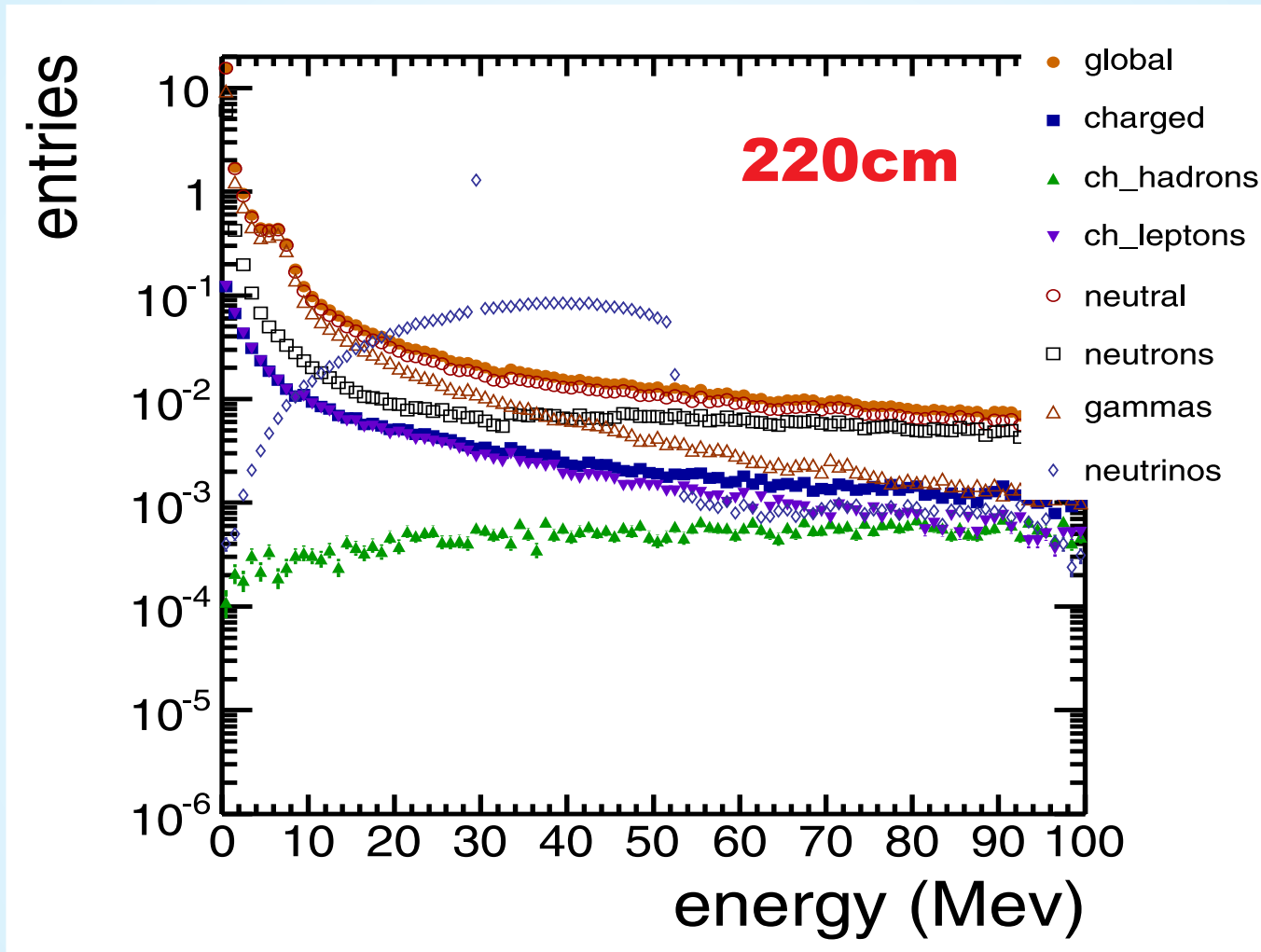
MC on Showers in Rock



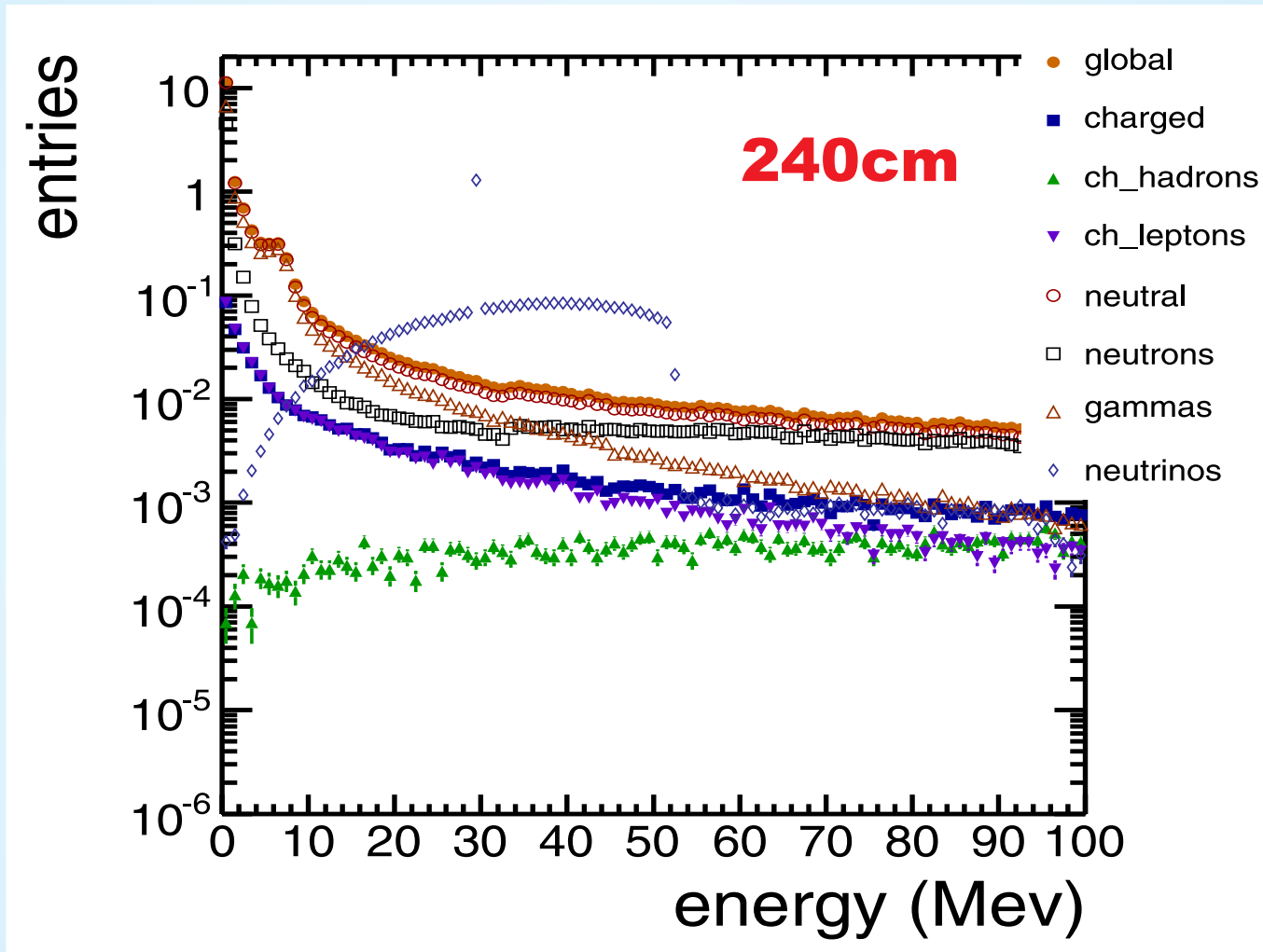
MC on Showers in Rock



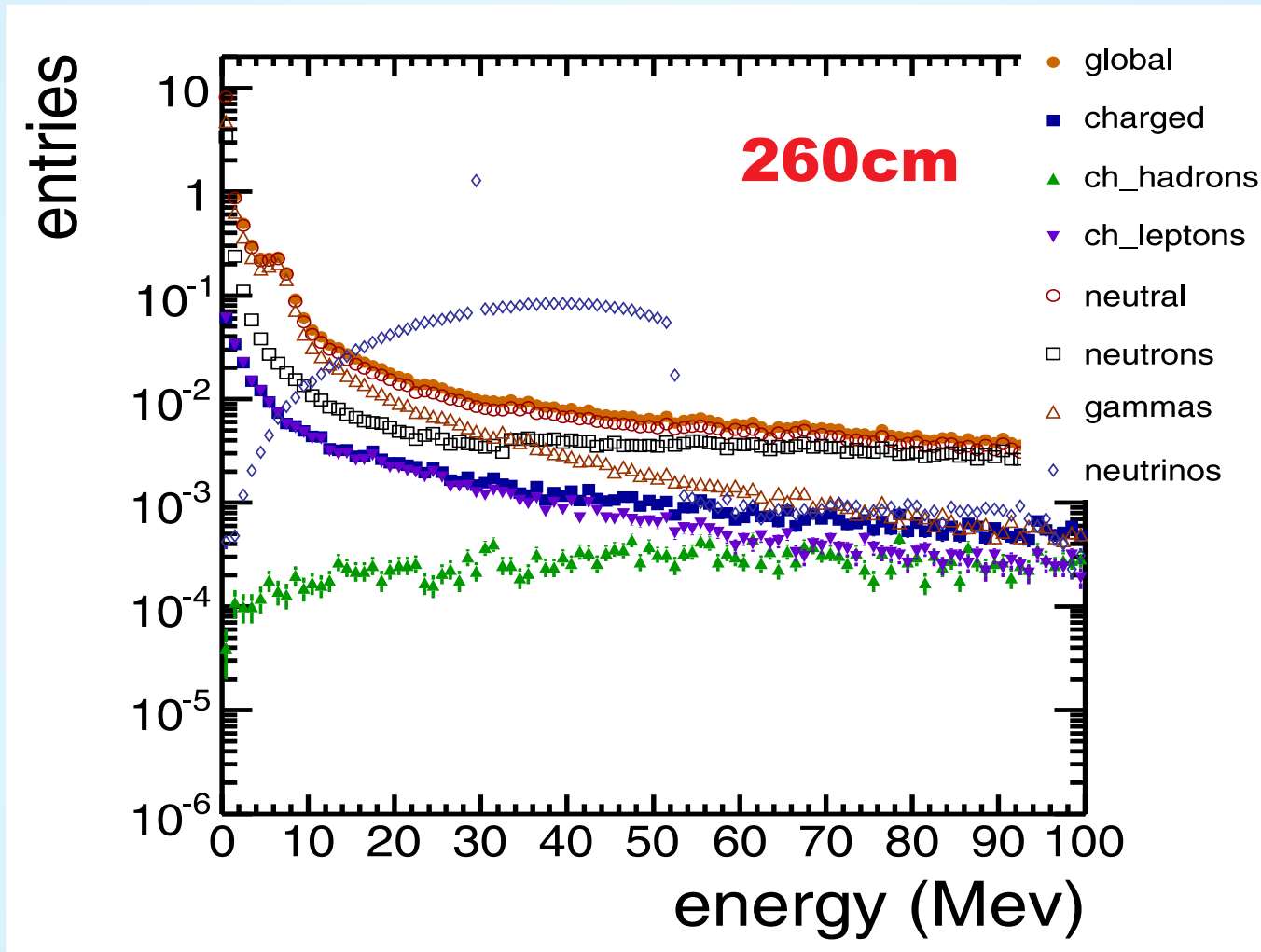
MC on Showers in Rock



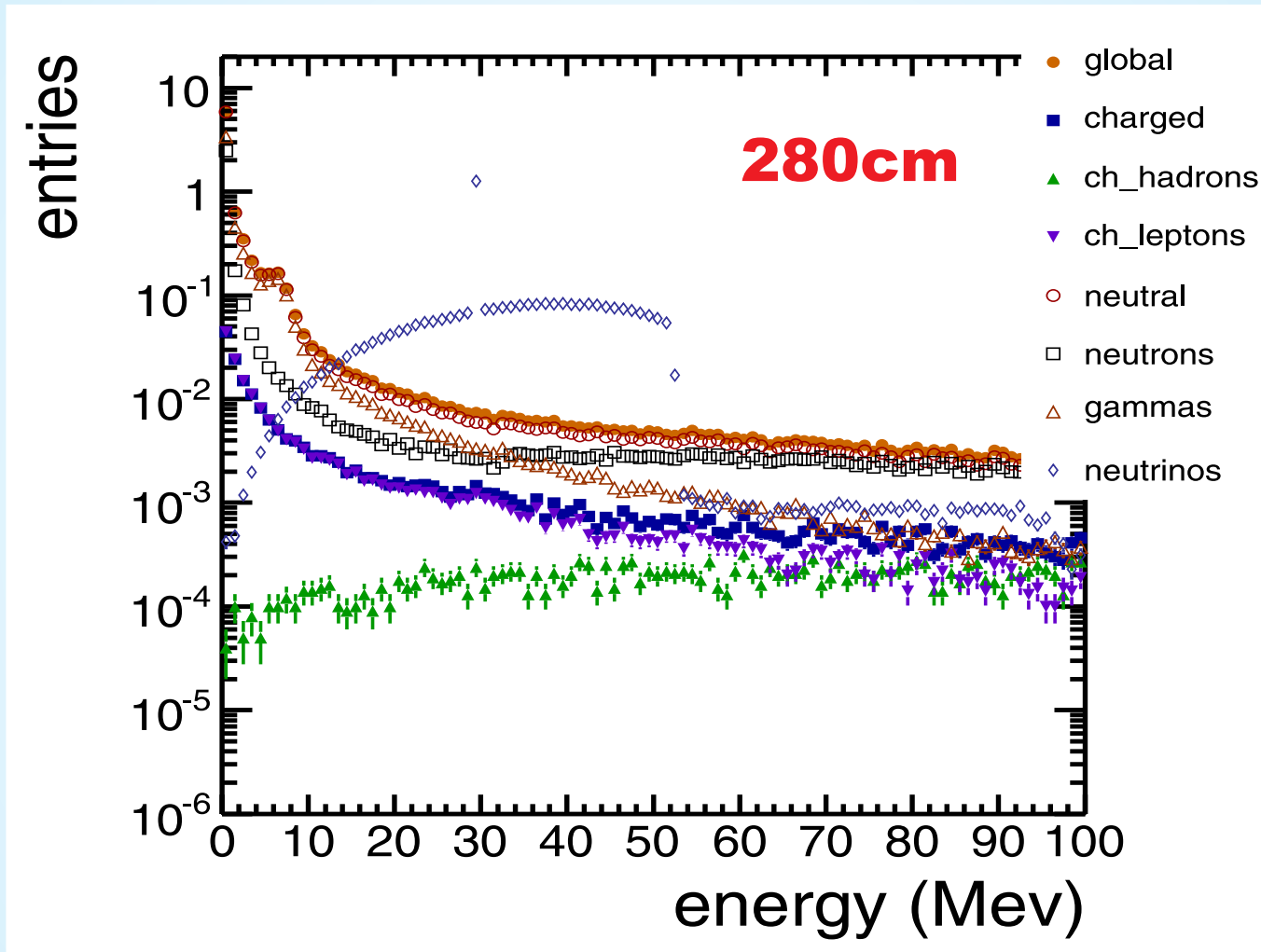
MC on Showers in Rock



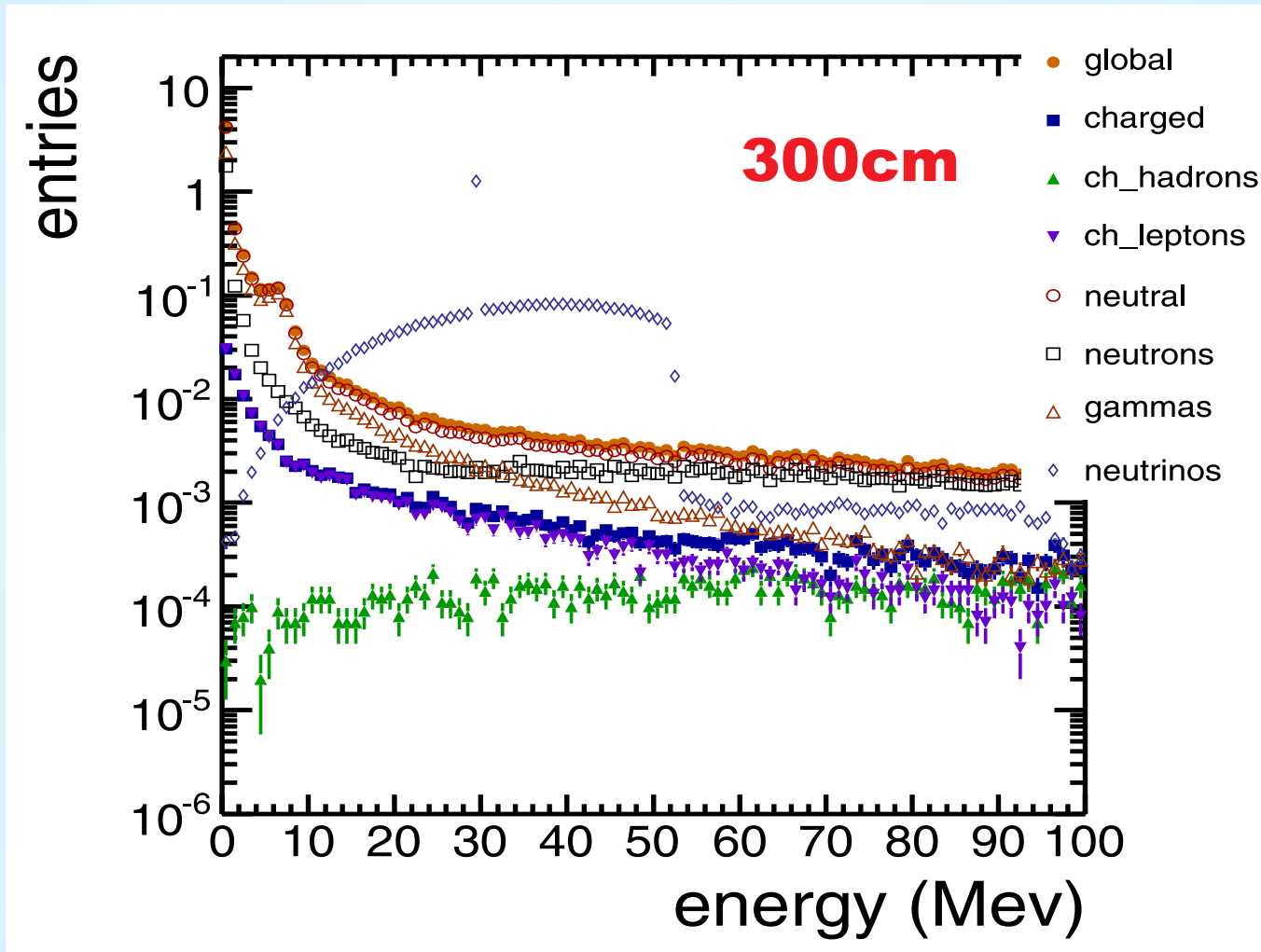
MC on Showers in Rock



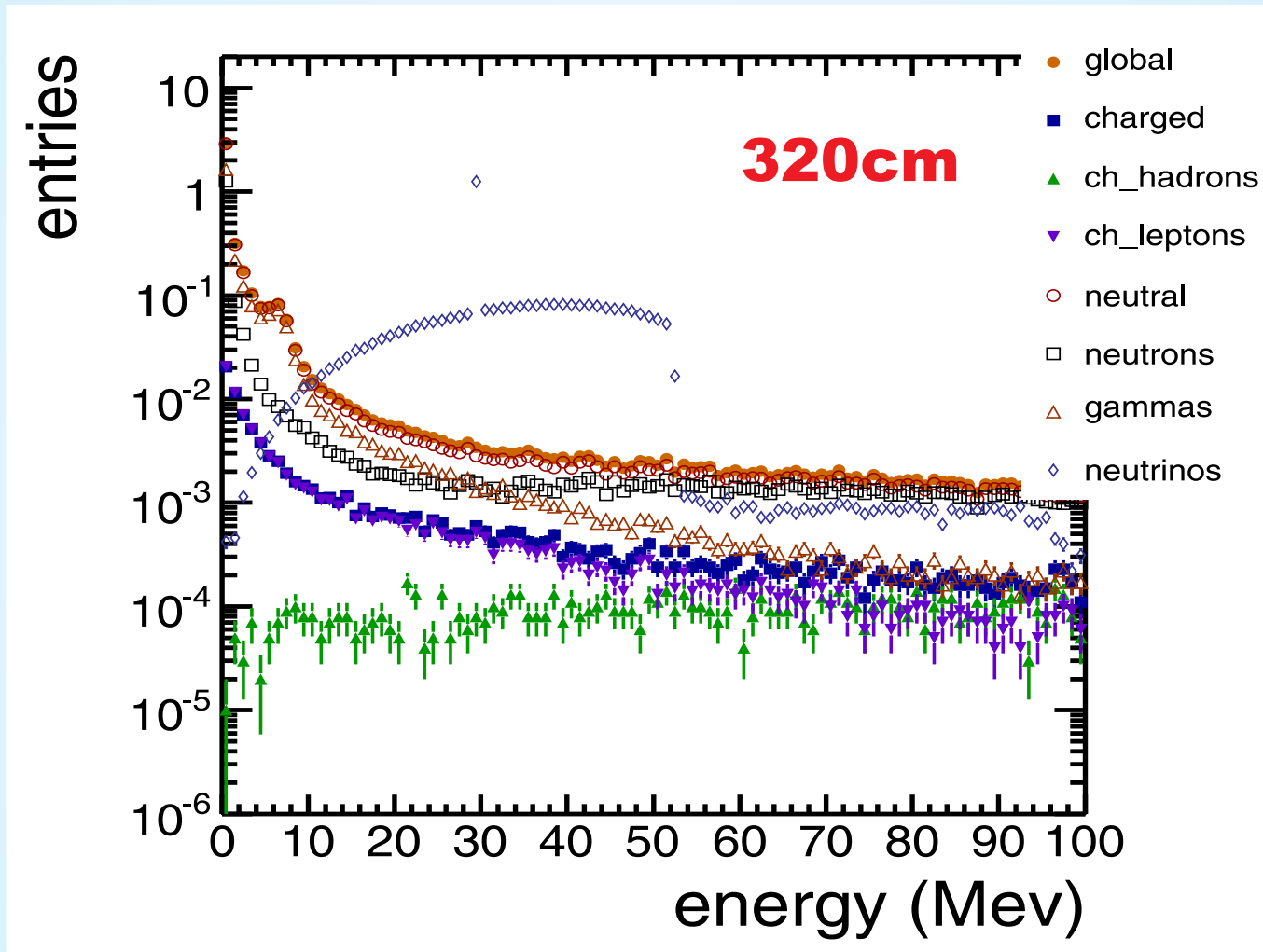
MC on Showers in Rock



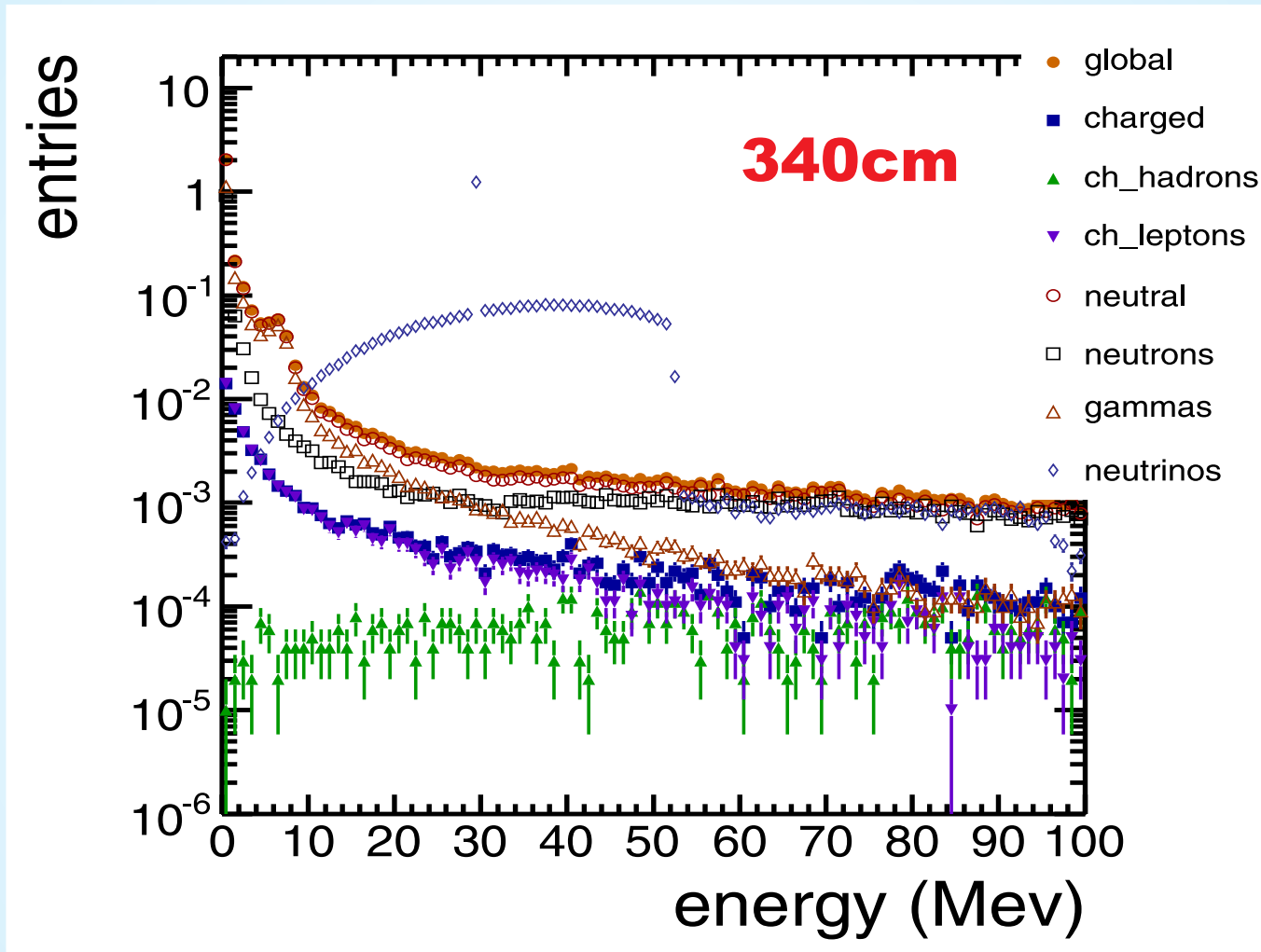
MC on Showers in Rock



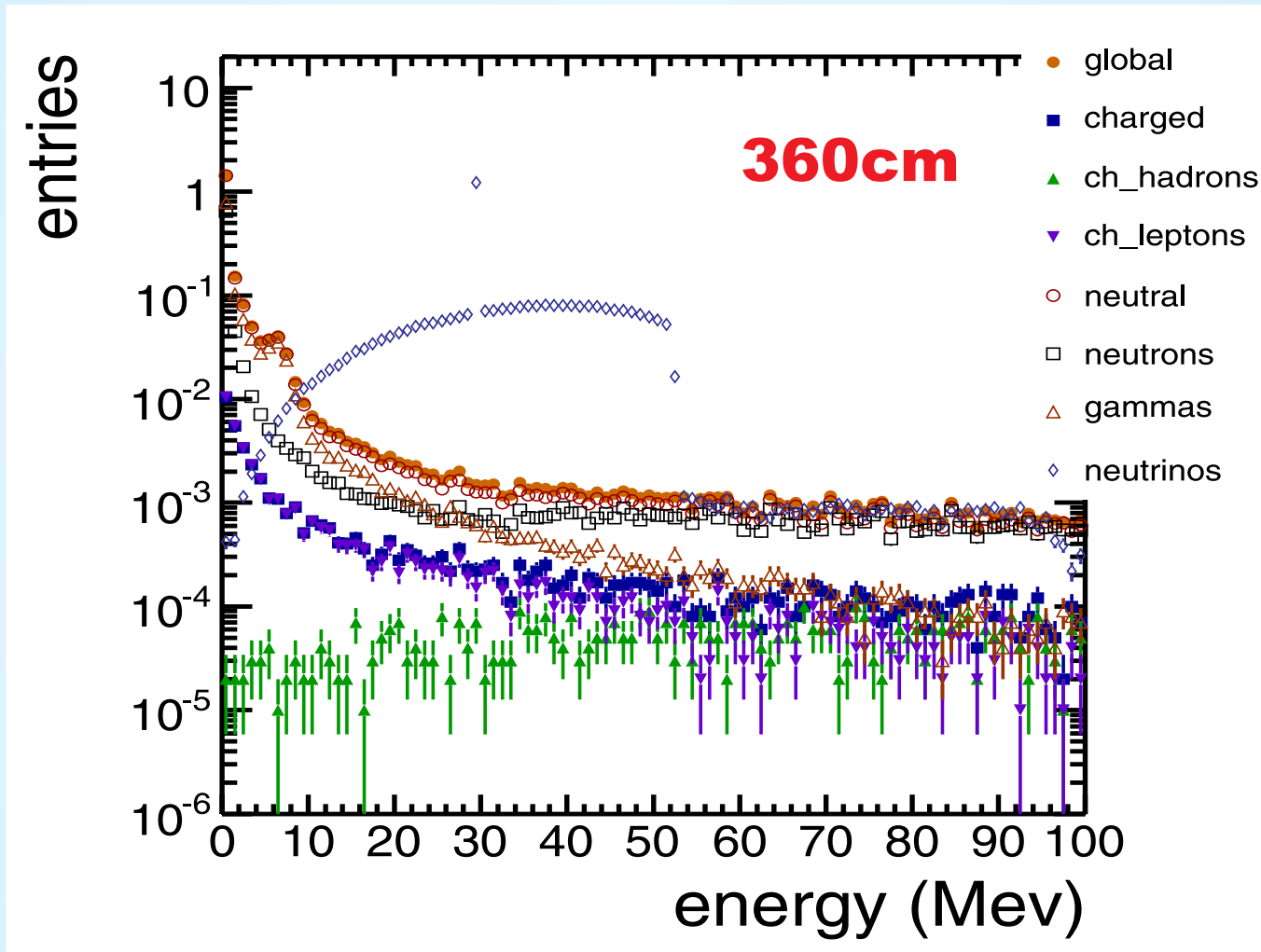
MC on Showers in Rock



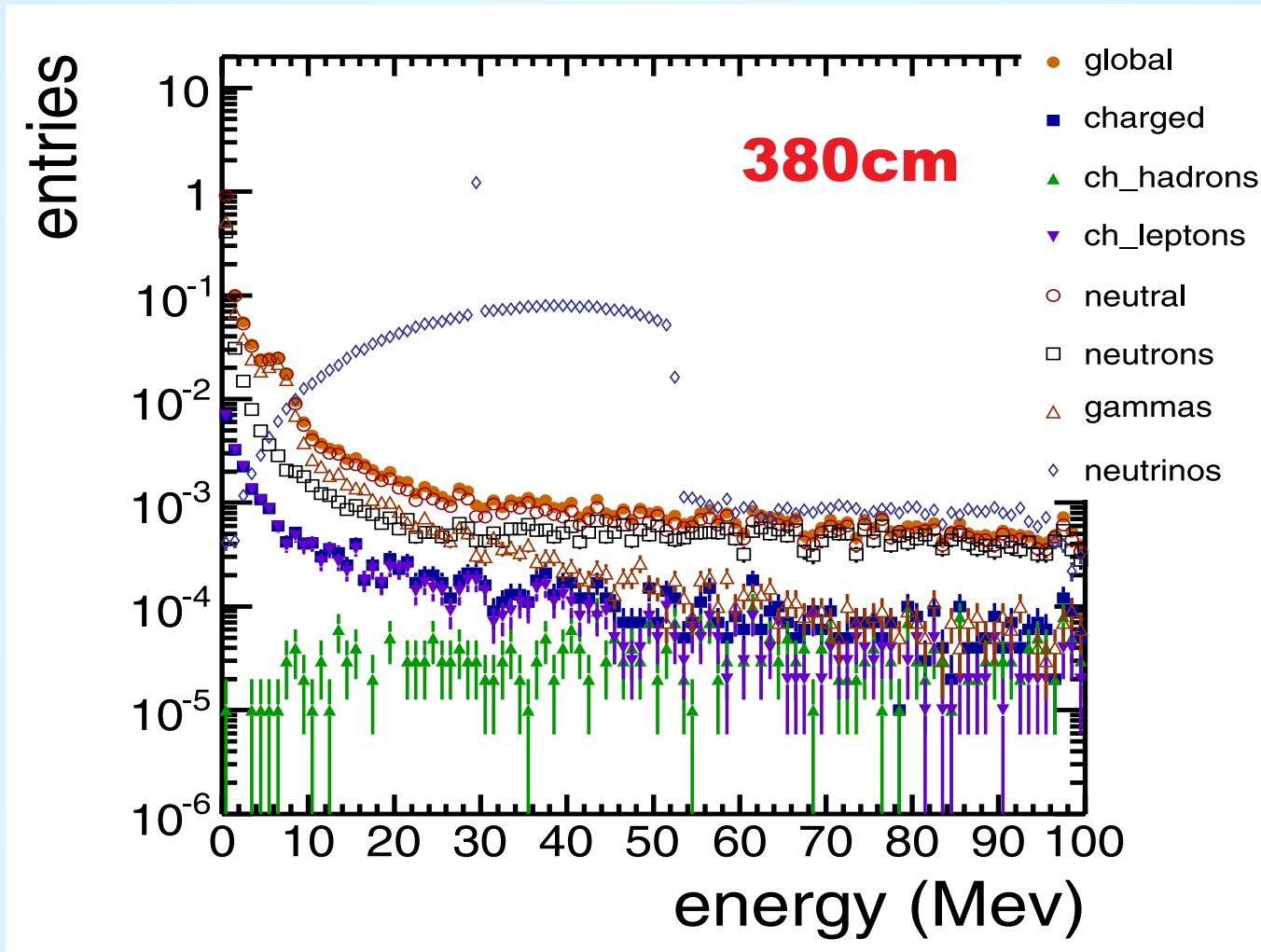
MC on Showers in Rock



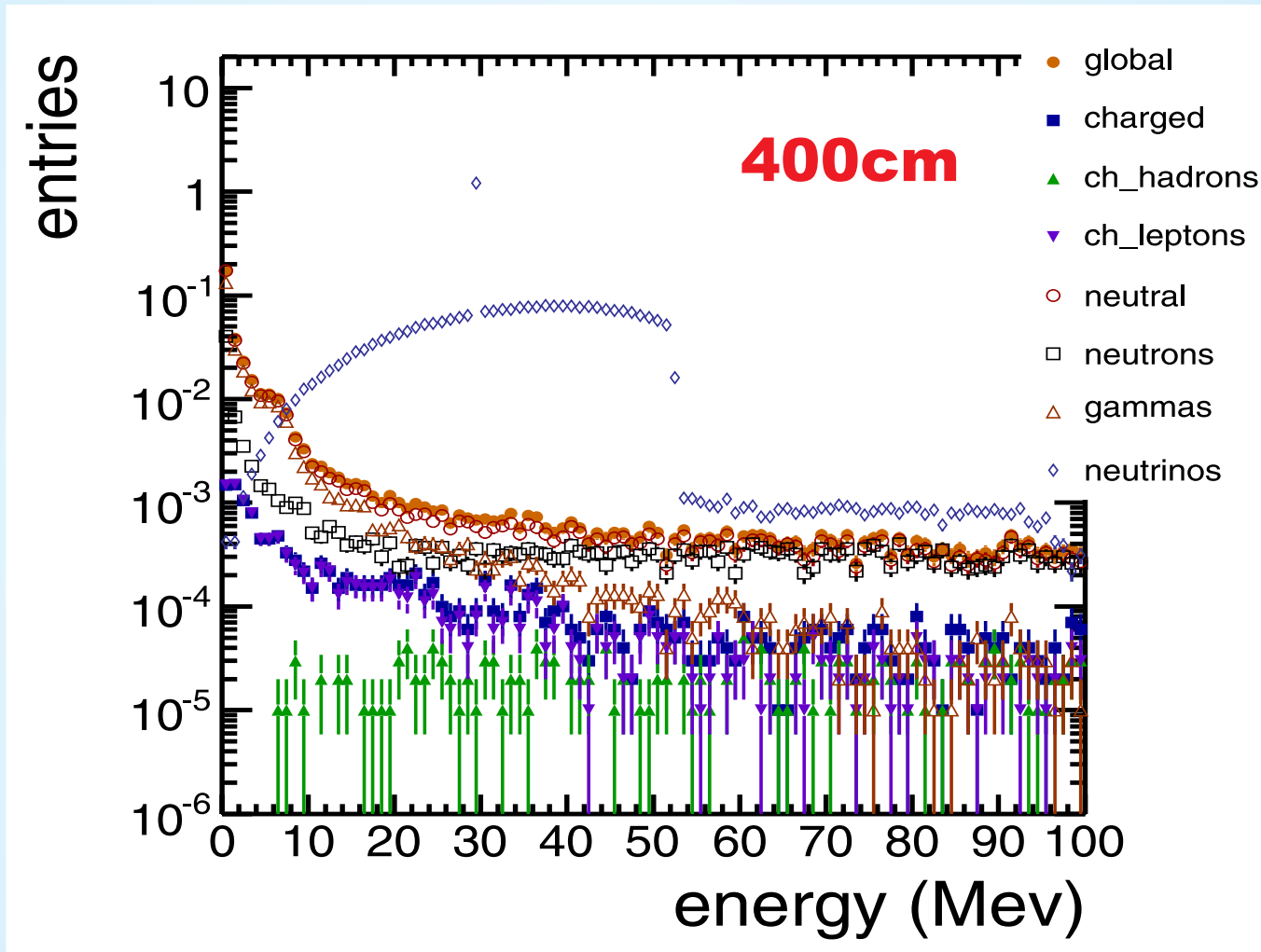
MC on Showers in Rock



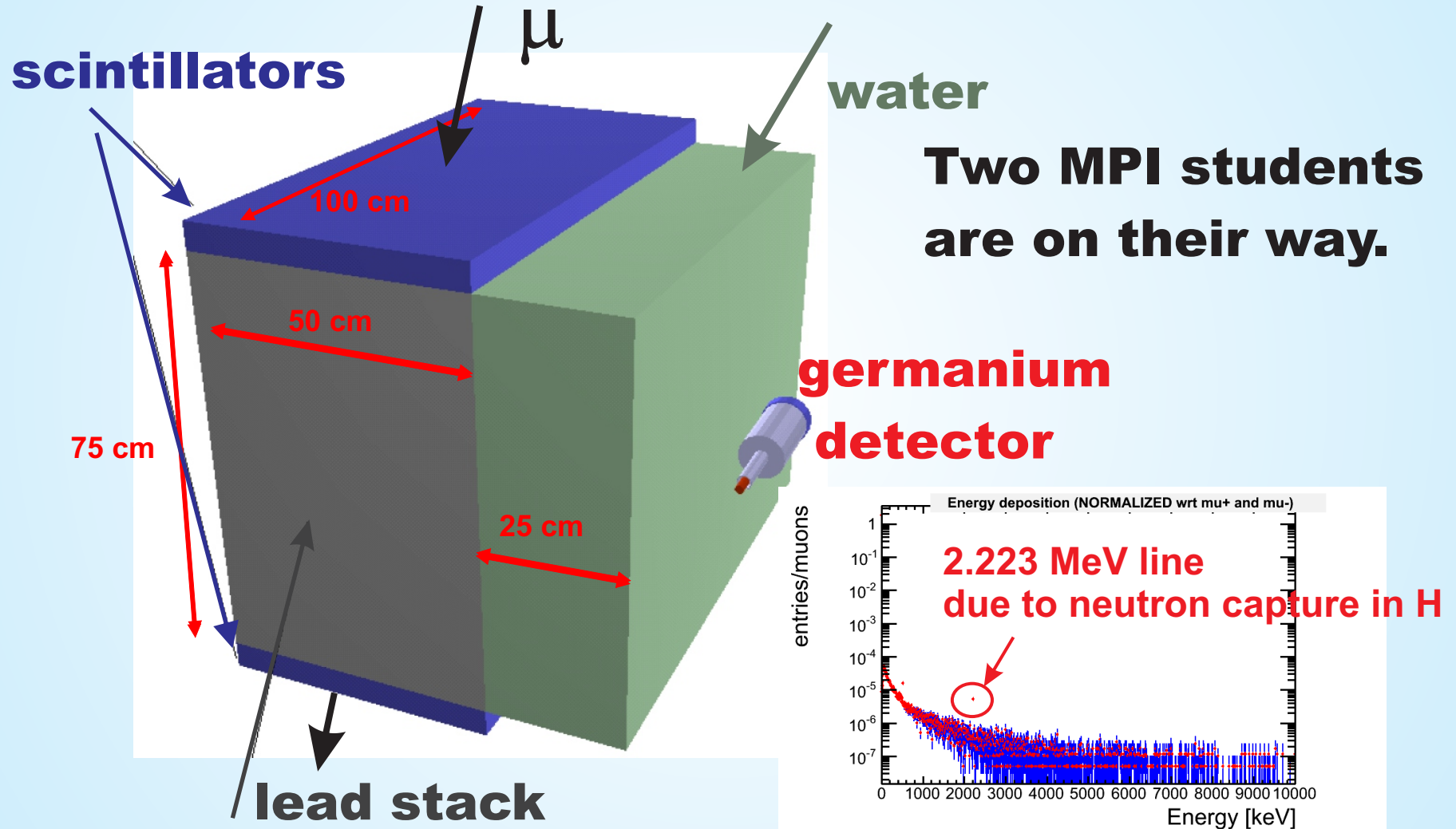
MC on Showers in Rock



MC on Showers in Rock



Measure Neutrons from Muons



Outlook



**CJPL 2 is coming.
CDEX 1ton will
target dark matter
and neutrinoless
double beta decay
with germanium
technology.**



The past tempts us,



the present worries us

and the future scares us.

But it is coming, with or without us.

