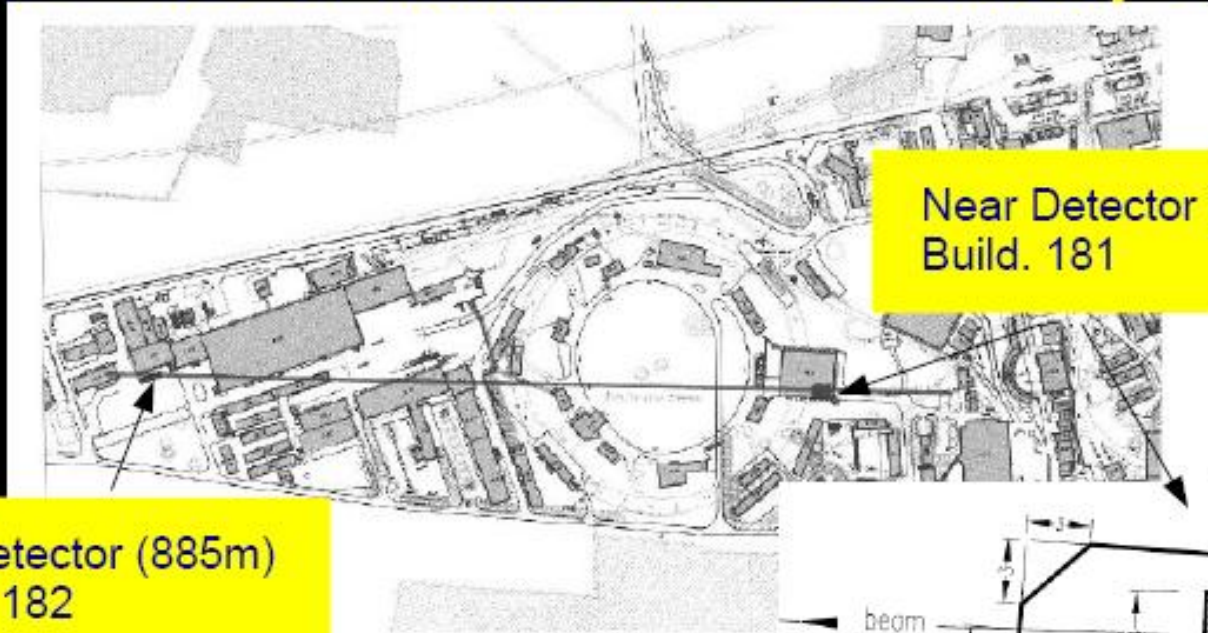


# Possible neutrino experiment at CERN PS

most from AIDA neutrino meeting 17-18 March 2010  
<http://indico.cern.ch/conferenceDisplay.py?confId=87234>

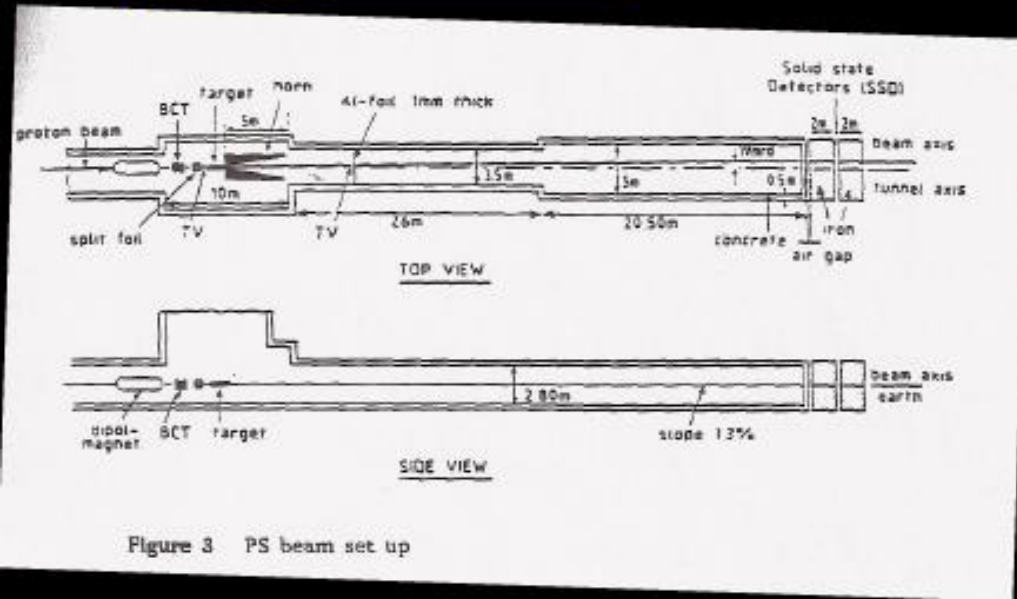
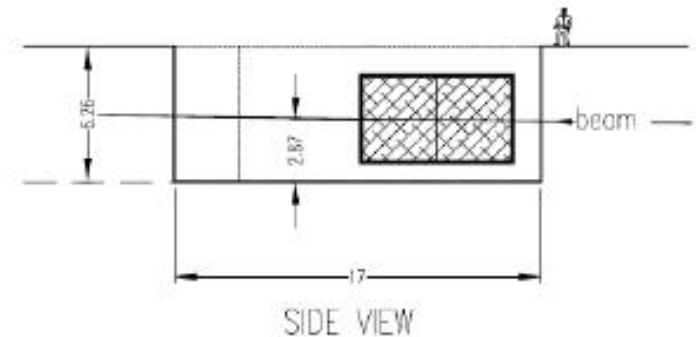
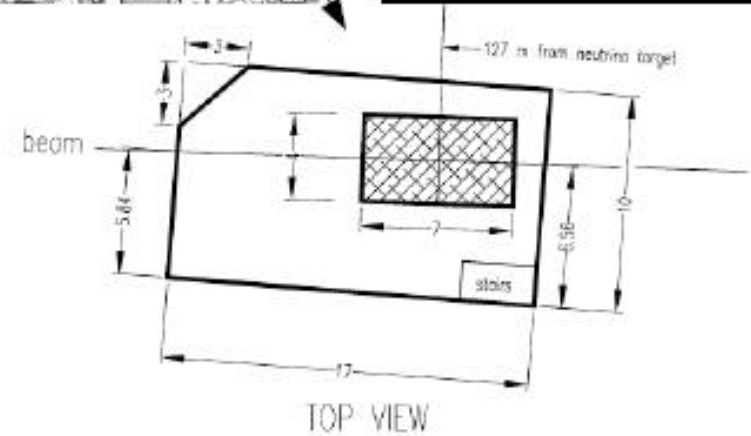
# PS neutrino beam layout

Ludovici

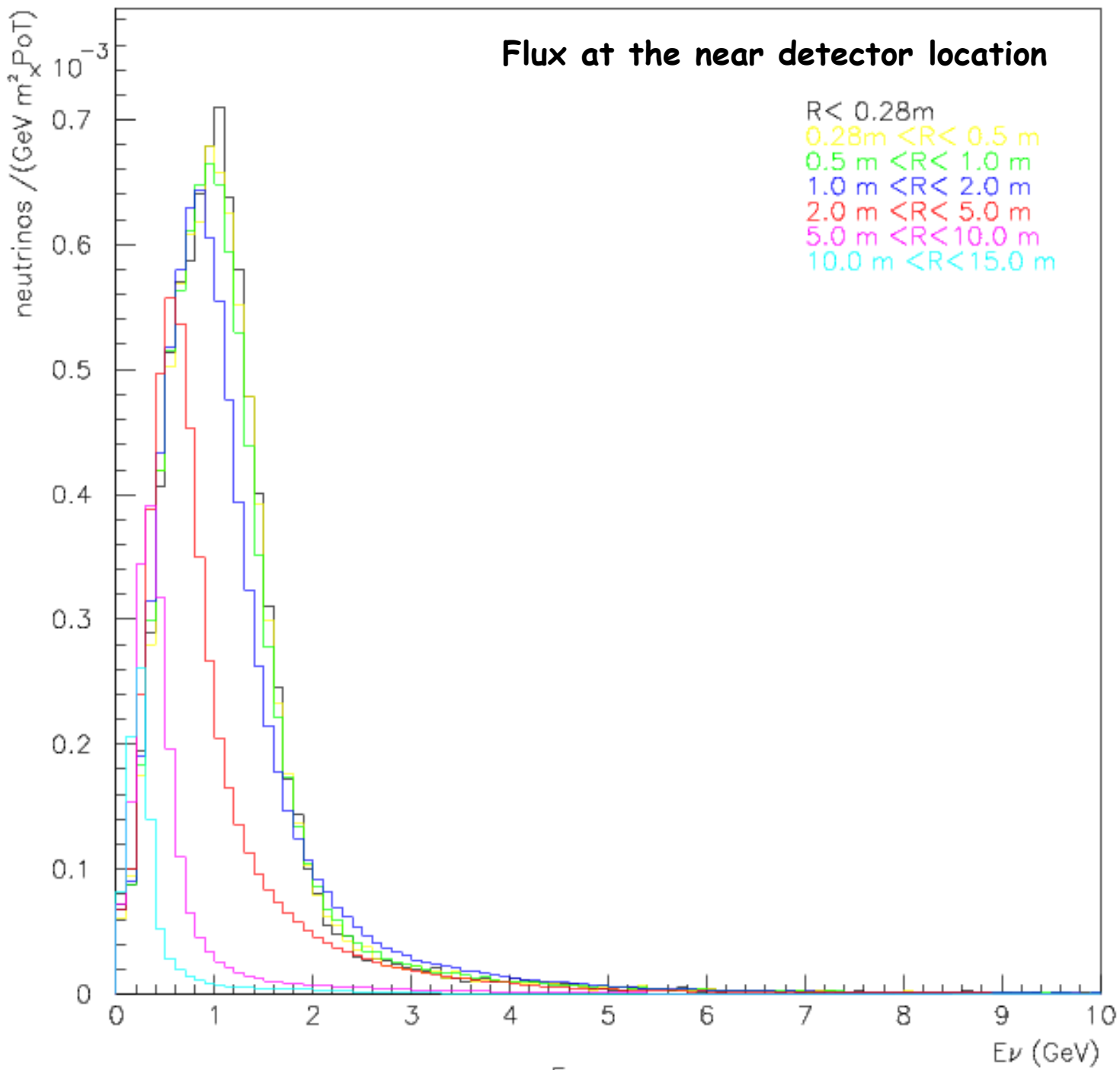


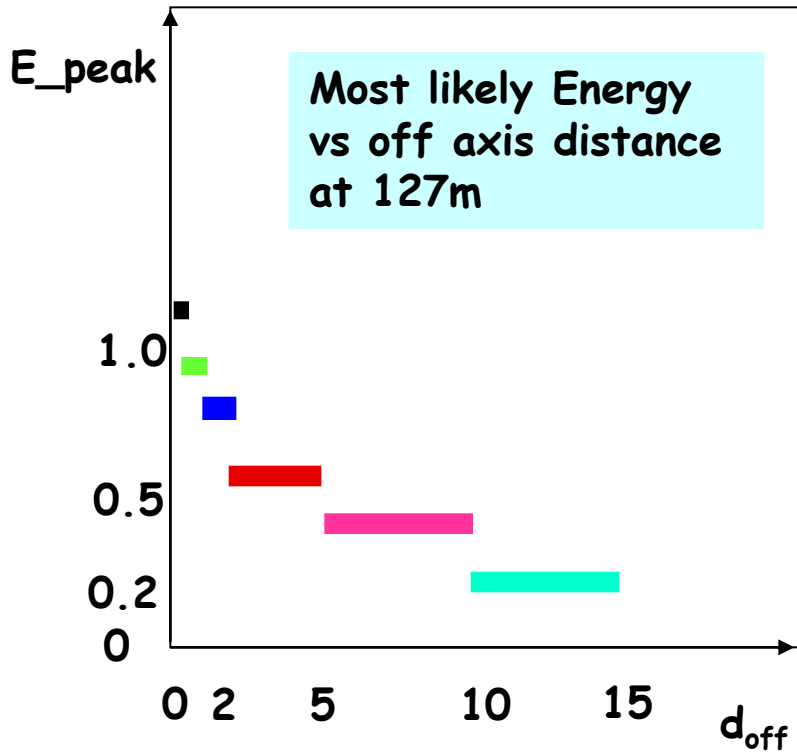
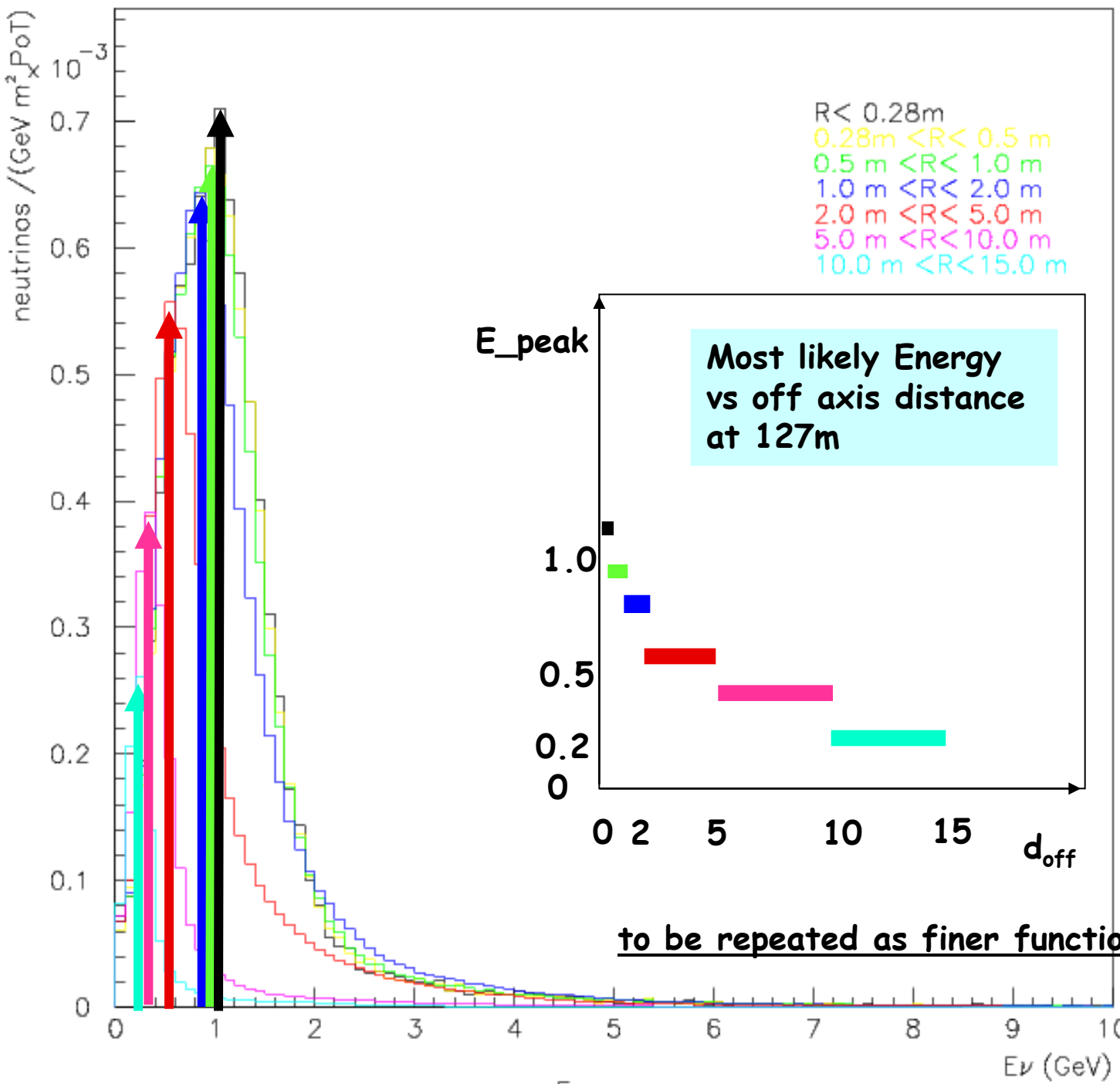
Near Detector (127m)  
Build. 181

Far Detector (885m)  
Build. 182



# Flux at the near detector location



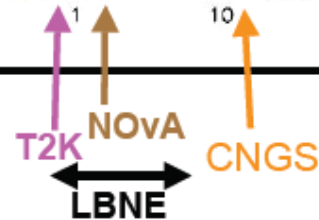
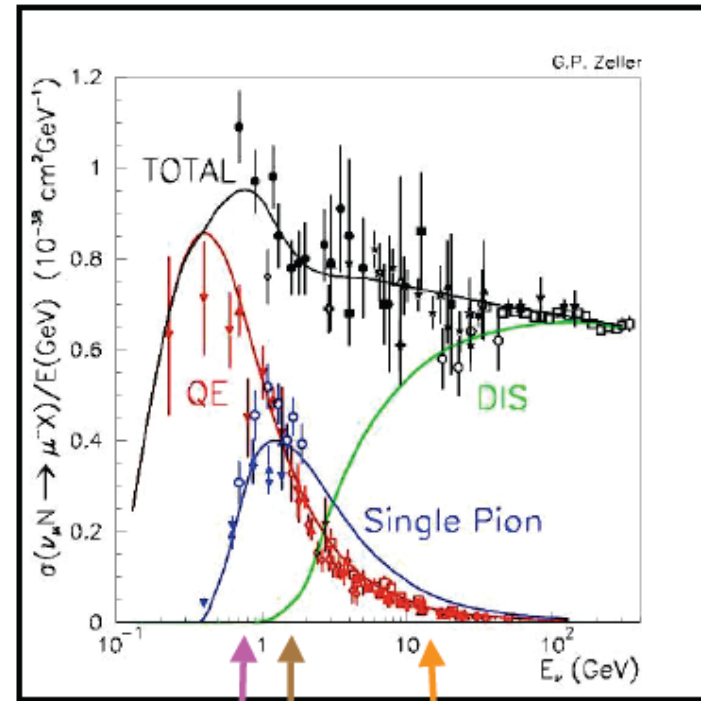


to be repeated as finer function of position



# Neutrino Cross Sections

- historical measurements of  $\nu_\mu$  CC cross sections
- low E data are ~30 years old
  - low statistics
  - a lot on  $D_2$  (not all that relevant for  $\nu$  osc)
- this is situation have been in for past 30+ years
- luckily has been improving!

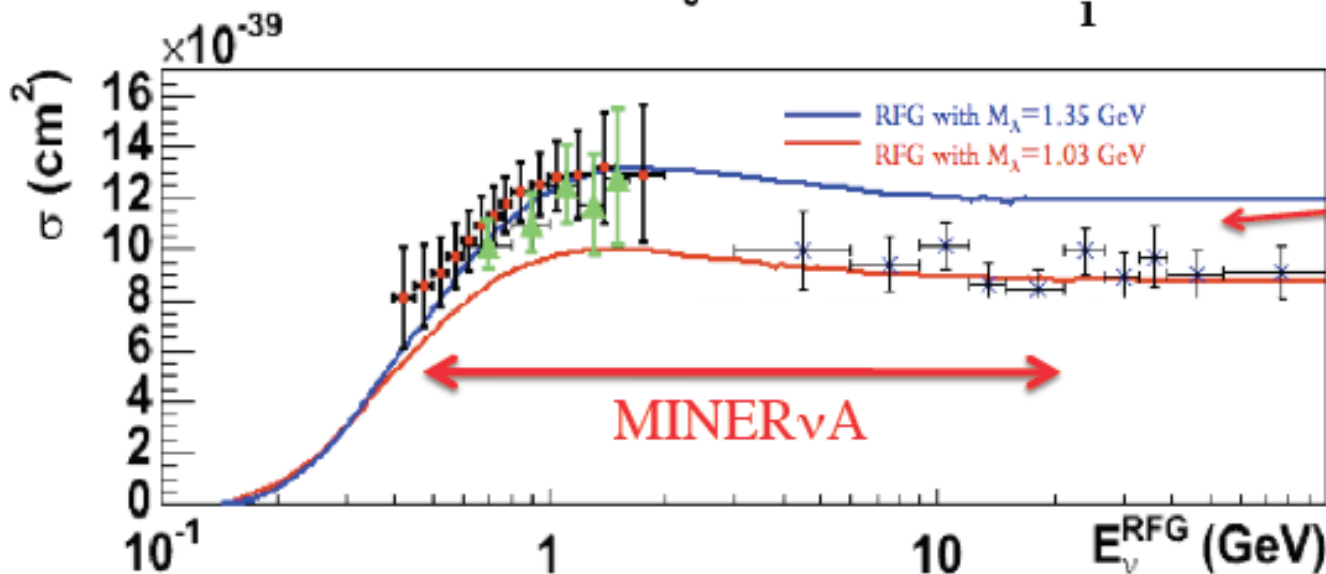
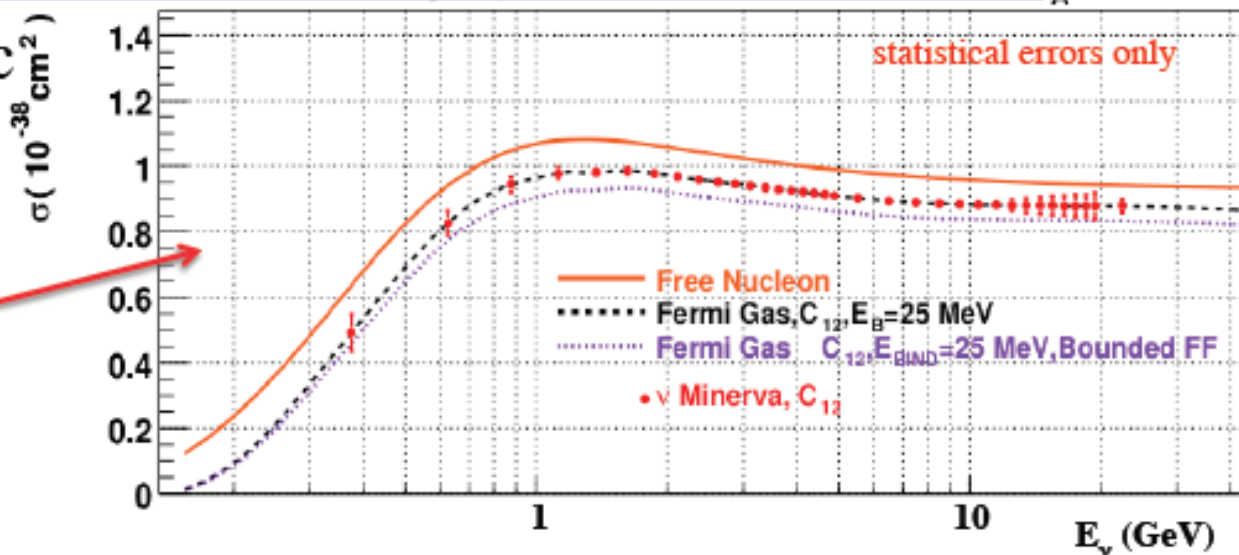


# MINERvA Quasi-Elastic Cross Section II



- CC Quasi-Elastic

Expected MINERvA  
CCQE results including  
 efficiency estimates



MiniBooNE, SciBooNE,  
 NOMAD CCQE data

MINERvA should resolve  
 this mystery!

## Physics case (three approaches)

1. perform the LSND oscillation search with two detectors  
("eliminate any doubt")

exist a letter of intent from C. Rubbia et al.

2. perform measurements of cross sections on axis at the far detector with a large Liquid argon detector (1 kton) (KEK - ETHZ)
3. perform measurements of cross-sections at the near detector station with a 'minerva-like' detector with ability to go  $\geq 10\text{m}$  off axis.  
(AIDA follow-up)

motivation:

The energy region 200~600 MeV will be only measured so-so with MINERvA (low energy tail of the on-axis beam) and T2K (low energy tail of 650 MeV off-axis beam) in particular: onset of pion production.

Also good occasion to test detector ideas

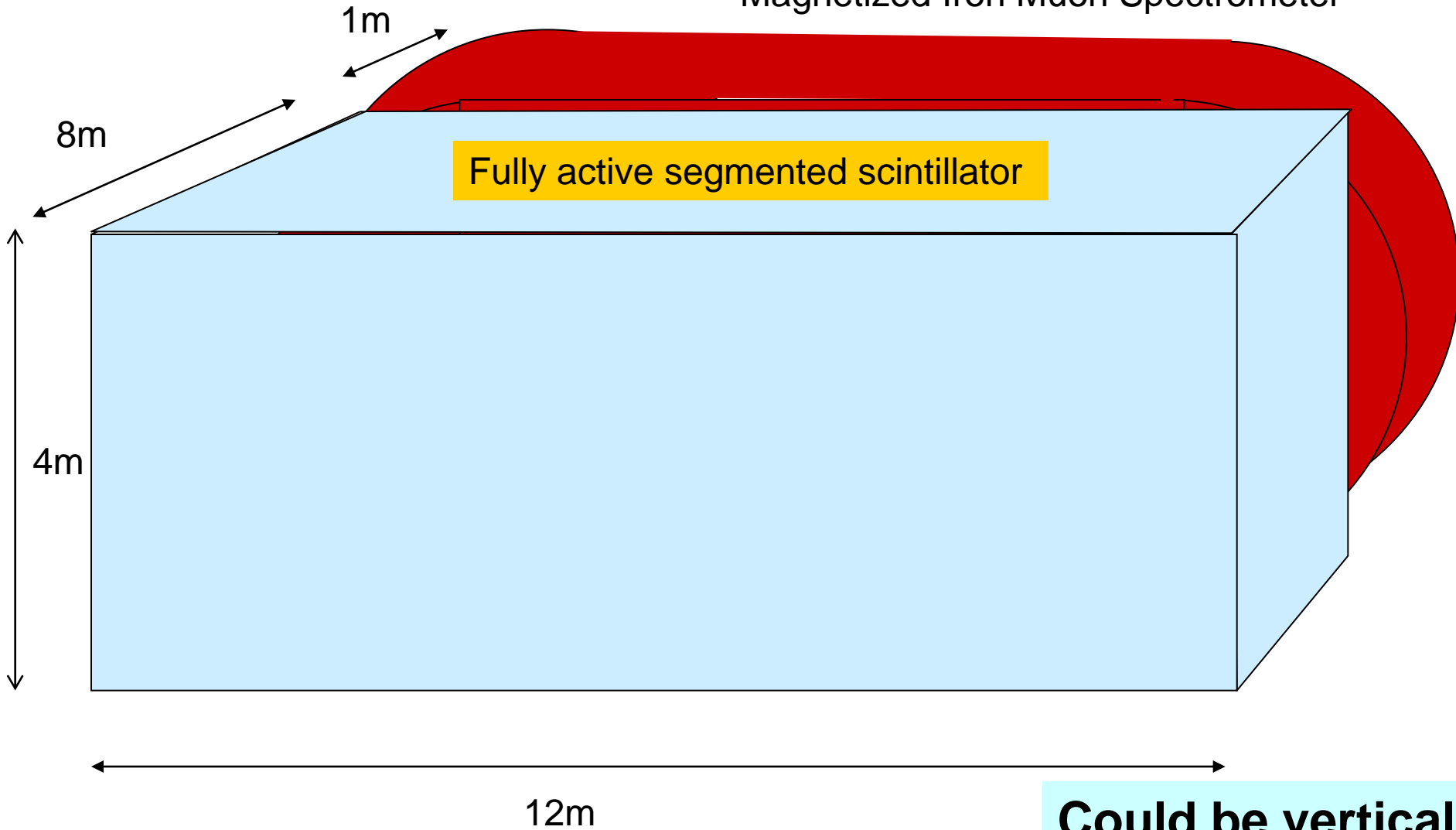
This is the energy range of the SPL/beta beam scenario at CERN

EOI to be drafted. Some first ideas follow:



A very sketchy and "obvious" proposal

### Magnetized Iron Muon Spectrometer



**WHAT IS THE FID. VOLUME?**





# Building 181 Occupation



NEUTRINO BEAM AT PS: LAYOUT AND REFURBISHMENT

## CERN NEG Coating Plant



Courtesy of Jose-Miguel Jimenez

Rende Steerenberg BE-OP

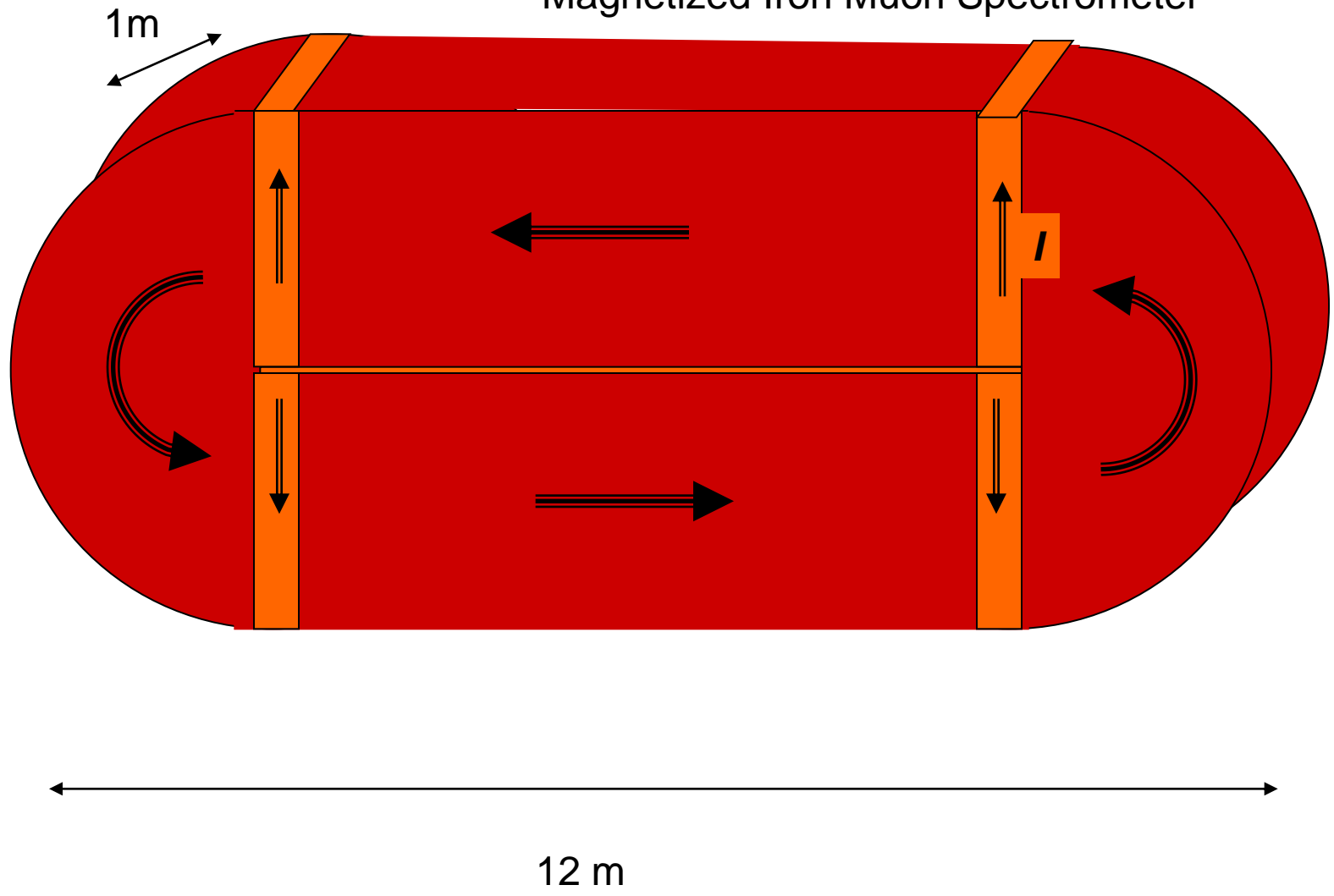
## CERN LHC Magnet Repair Facility



Courtesy of Paolo Fessia

- 17 March 2010 -

# Magnetized Iron Muon Spectrometer

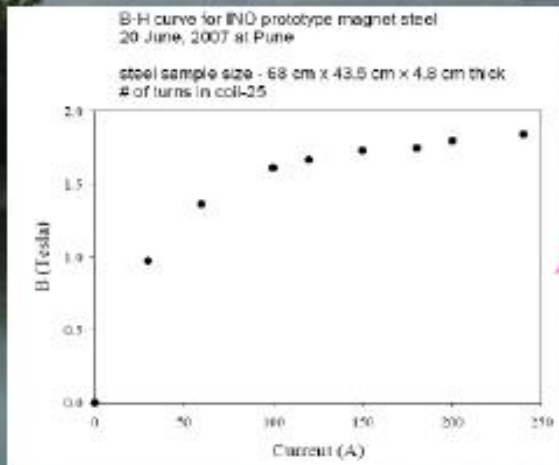


**Could be vertical**

## INO Prototype Magnet now at VECC



- *12, 1m<sup>2</sup> RPC layers*
- *13 layers of 5 cm thick magnetised iron plates*
- *About 1000 readout channels*



We had several talks describing competences required to construct such a detector.

long scintillator:

Yuri Kudenko: light output with 10m of wavelength shifter

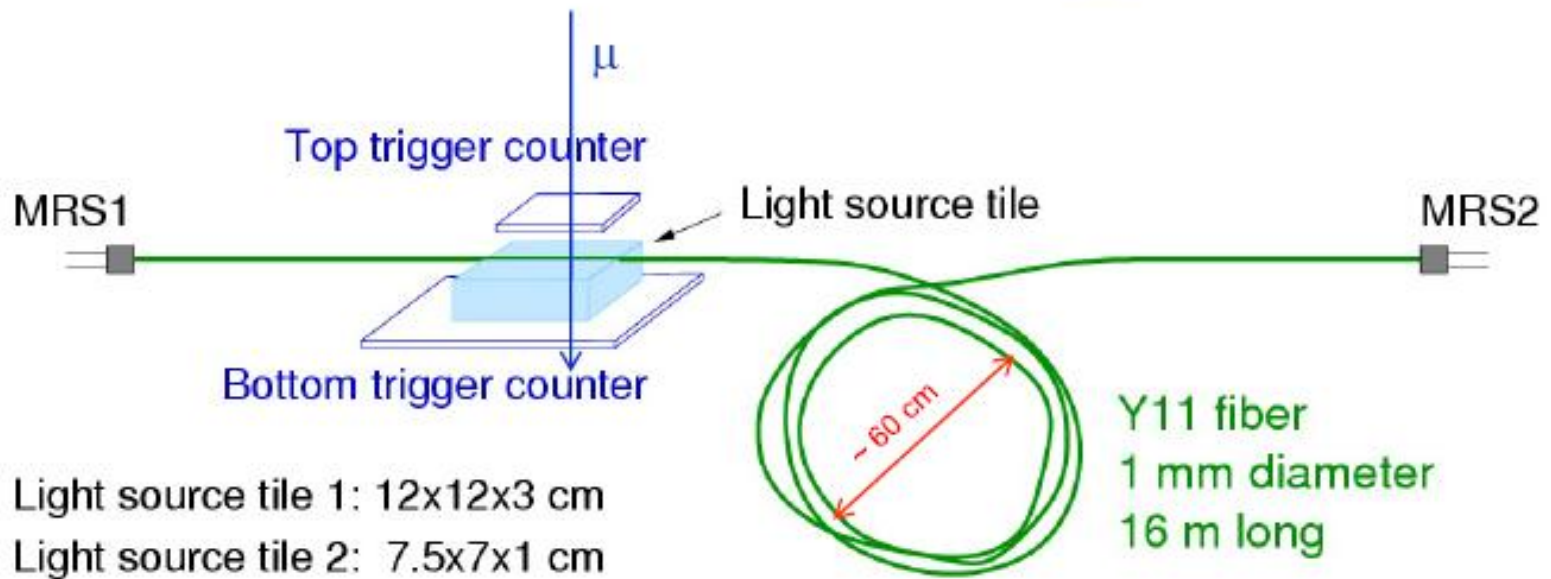
Marcos Dracos: 7m long extruded scintillator from OPERA  
(missing: Alan Bross on latest developments on T ASD)

MPPC readout and electronics:

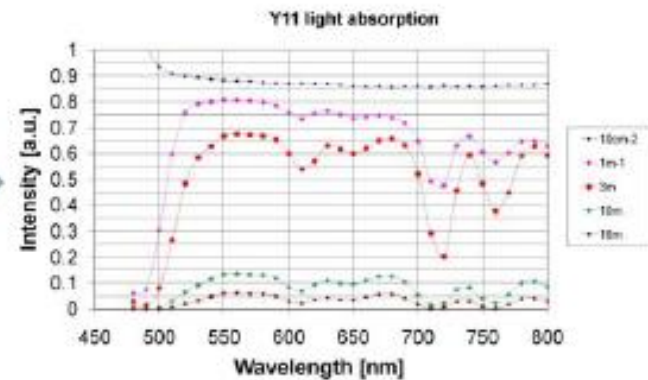
A. Weber (ND280), M. Prest (MICE EMR), P. Jarron (time resolution)



# Measurements with long fibers



Measurement of light absorption  
in Y11 as a function of wave length



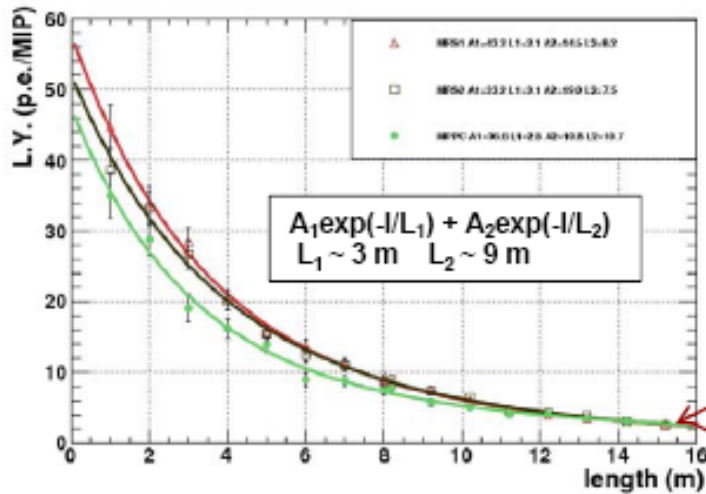
KUDENKO

# Light yield

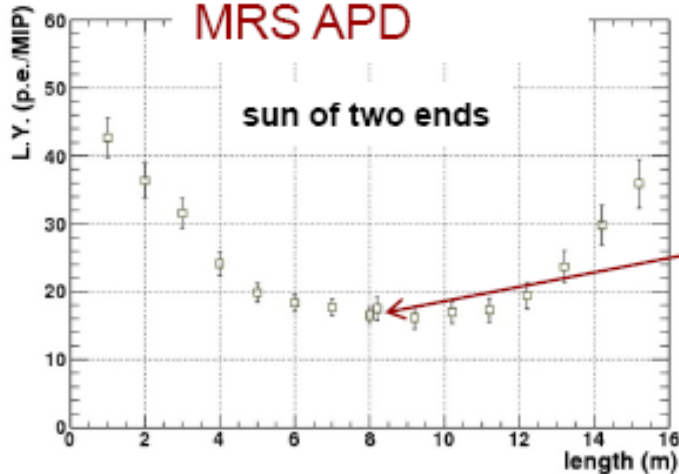
One-end readout  
no reflector at far end

Tile 2 → MIP ~ 2 MeV

T = 20 C, dark rate (th=0.5 p.e.) < 500 kHz



both-end readout  
MRS APD



2 p.e.

3 p.e. with Al mylar

14 p.e.

## REFLECTOR

1 m long Y11, scintillator 1 cm thick  
reflector at free fiber end, one-end readout

l.y./MIP, p.e.

Polished, no reflector	24.4
Polished, teflon tape	33.9
Polished, Al mylar	36.9

KUDENKO

## A mini-neutrino factory?

so we could measure muon-neutrino AND anti-neutrino cross-sections

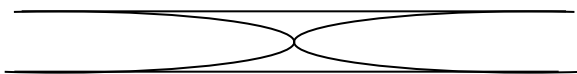
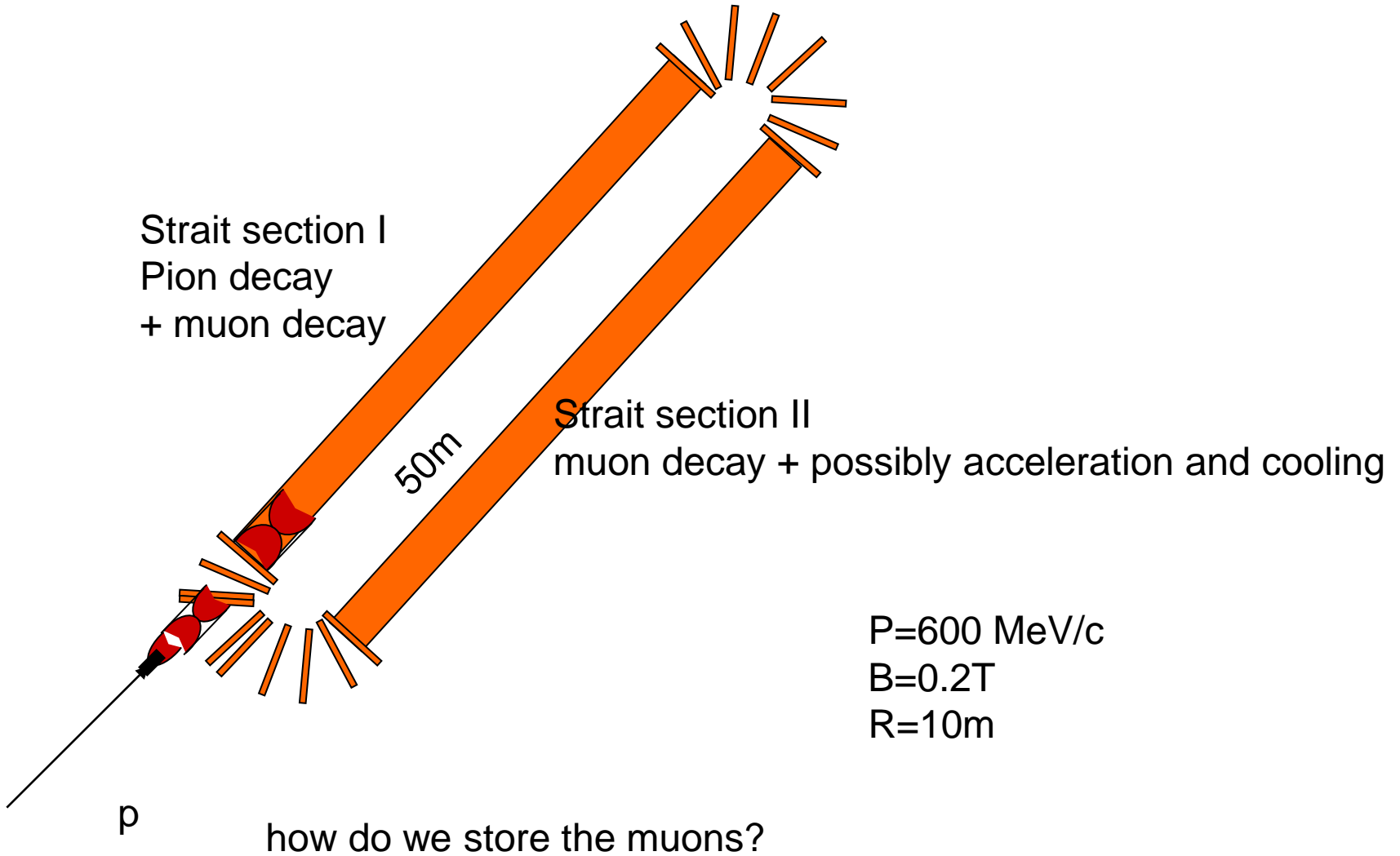
what about **electron neutrinos**?

crucial for CP/T asymmetry!

**a mini beta beam?** (but  $E=2Q\gamma$  so we need SPS type rigidity.... 😞)

**a muon storage ring** (mini-neutrino-factory)?

storing 600 MeV muons gives same spectrum as  $\gamma=100$   $^6\text{He}$  or  $^{18}\text{Ne}$ ...







## Conclusions and next steps

### Physics conclusions

there are various communities (3?) with different interests in the neutrino beam at CERN

- oscillation measurement in the LSND region (+sterile neutrino) using two detector locations
- cross-section measurements in GeV region in LArg and 1kton LArg detector prototype in the far detector location
- cross sections measurements in light detector (plastic) down to 200 MeV neutrino energy with large detector in the near detector location

### Next steps

1. need to assemble a 'steering committee' with a few people per country
2. Expression of Interest to CERN
3. generate beam study group across communities and with CERN
4. deepen study: more precisely evaluate detector size needed, event numbers, physics precision ...
5. THEN see who is interested in doing what