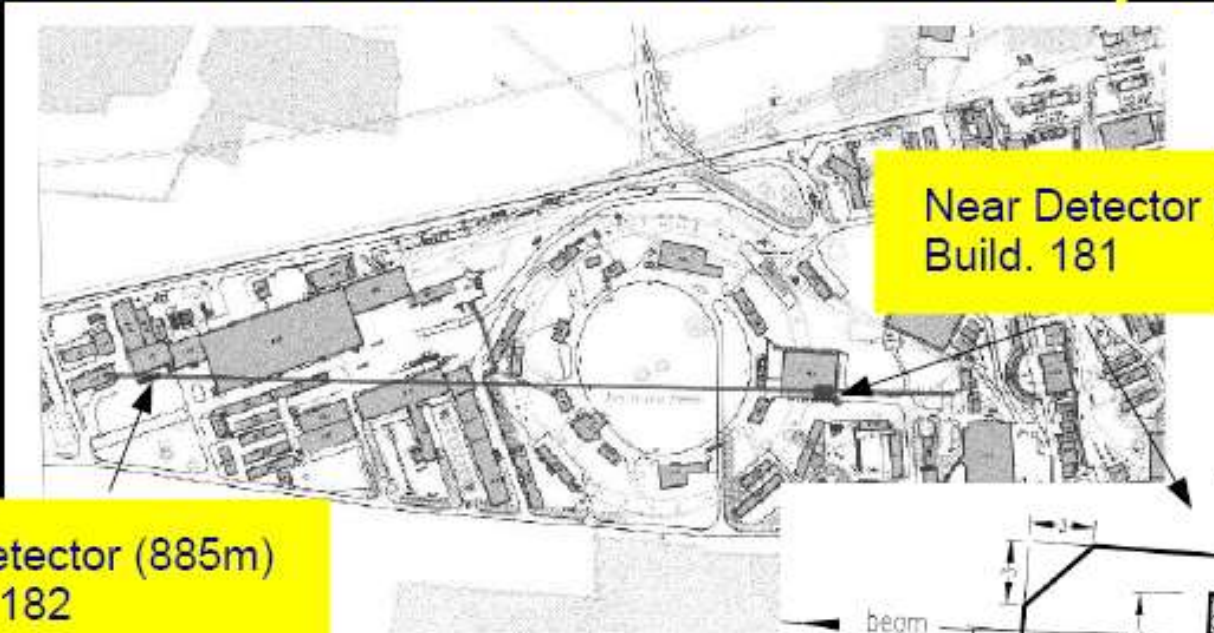


## ***Possible neutrino experiment at CERN PS***

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

# PS neutrino beam layout

Ludovici



Far Detector (885m)  
Build. 182

Near Detector (127m)  
Build. 181

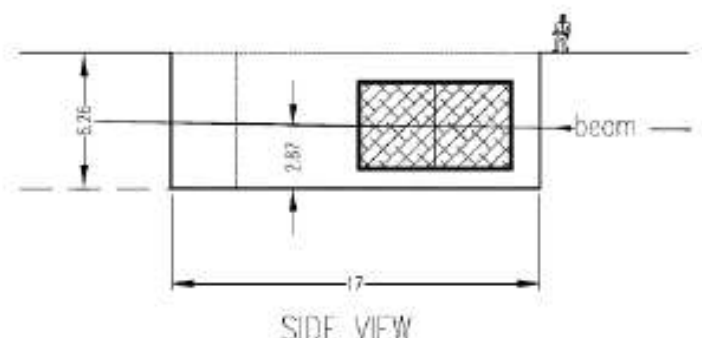
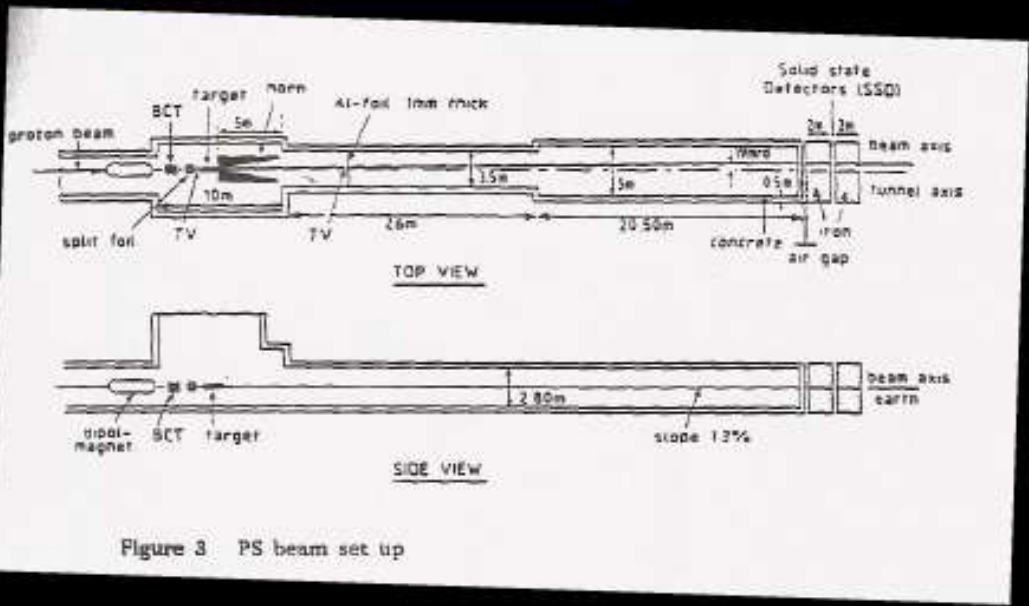
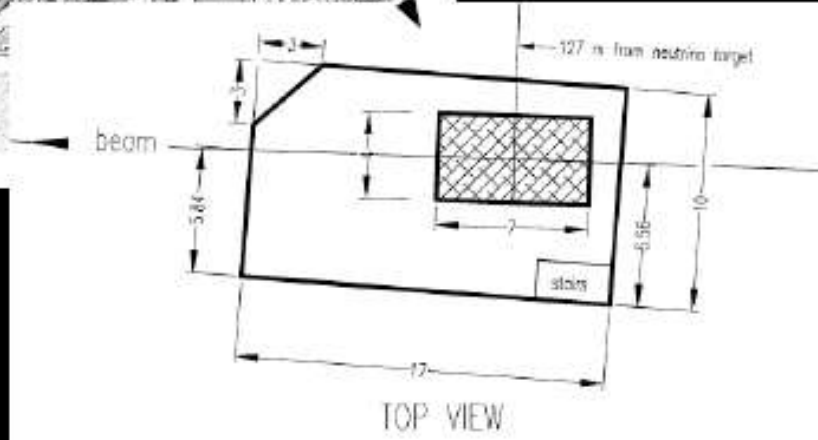
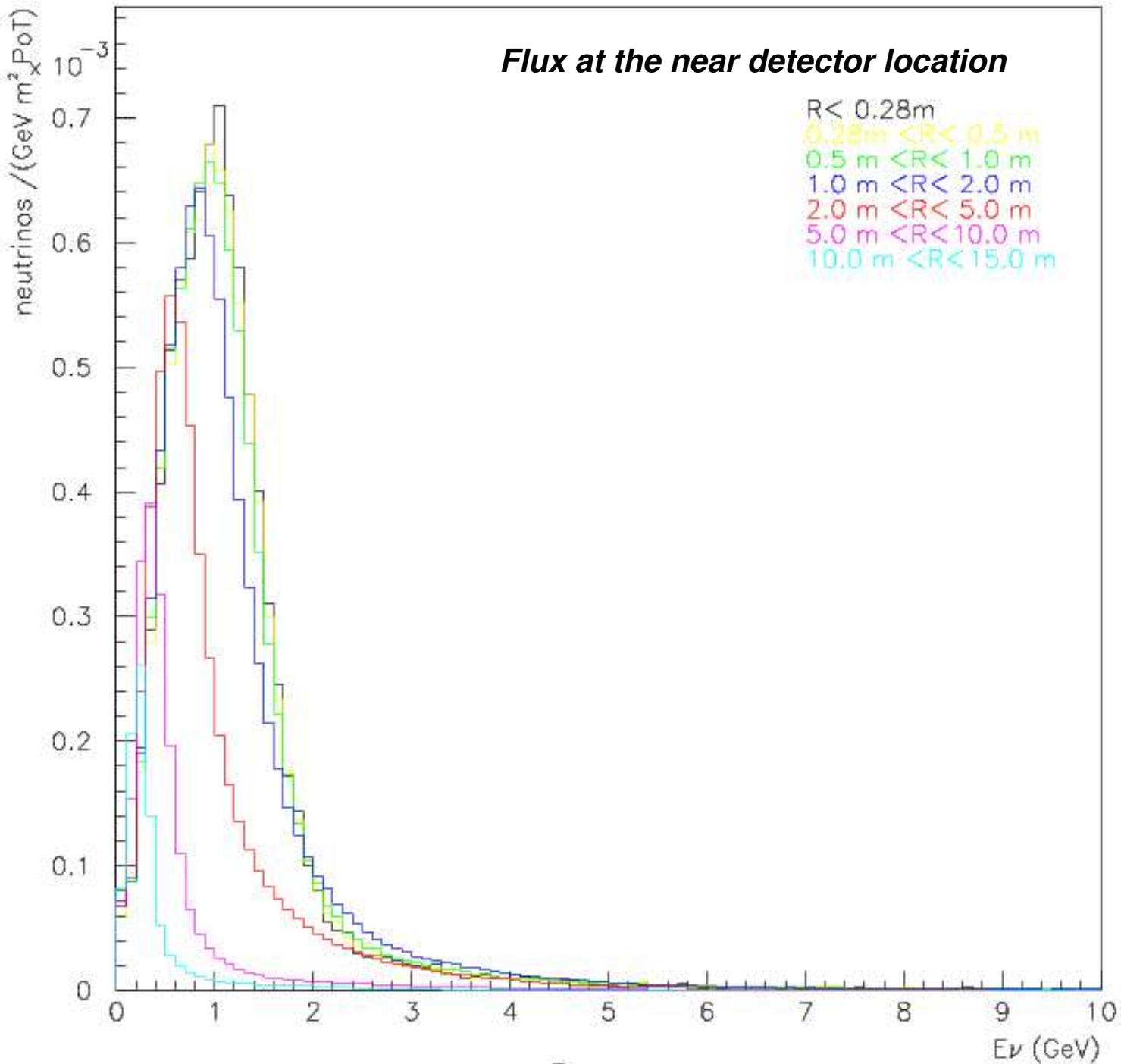
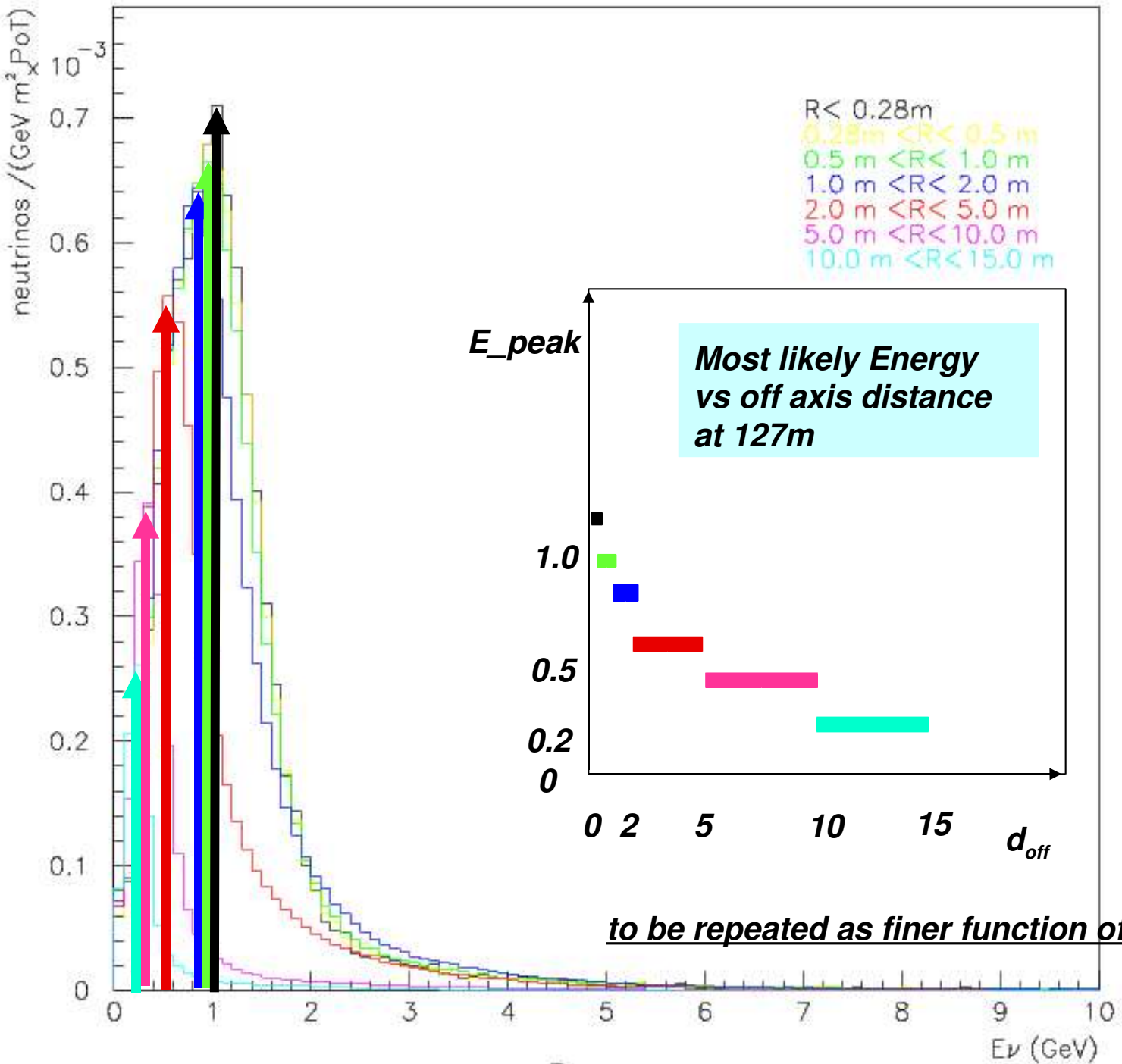


Figure 3 PS beam set up

### Flux at the near detector location

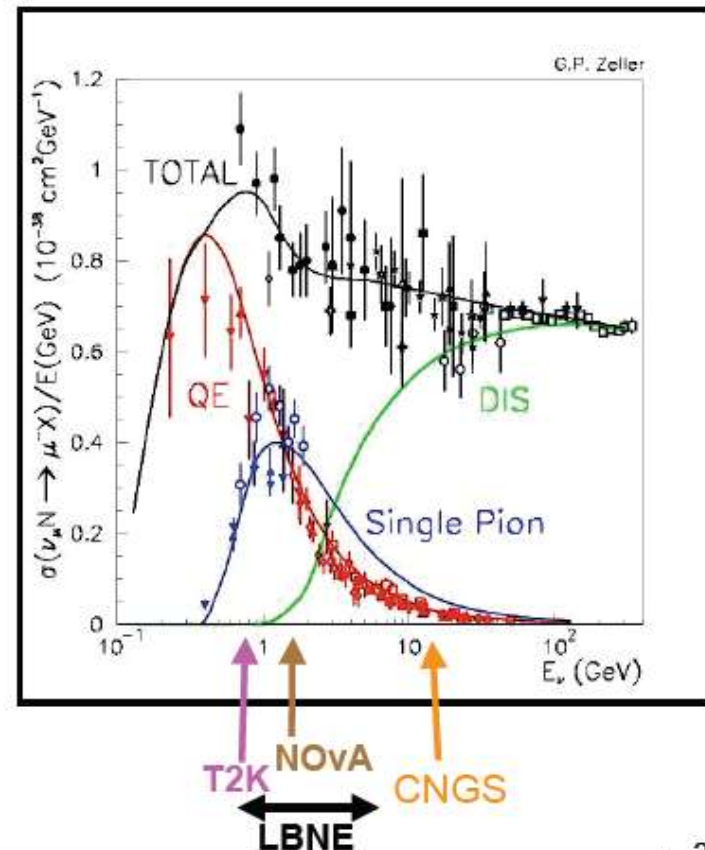






# Neutrino Cross Sections

- 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!



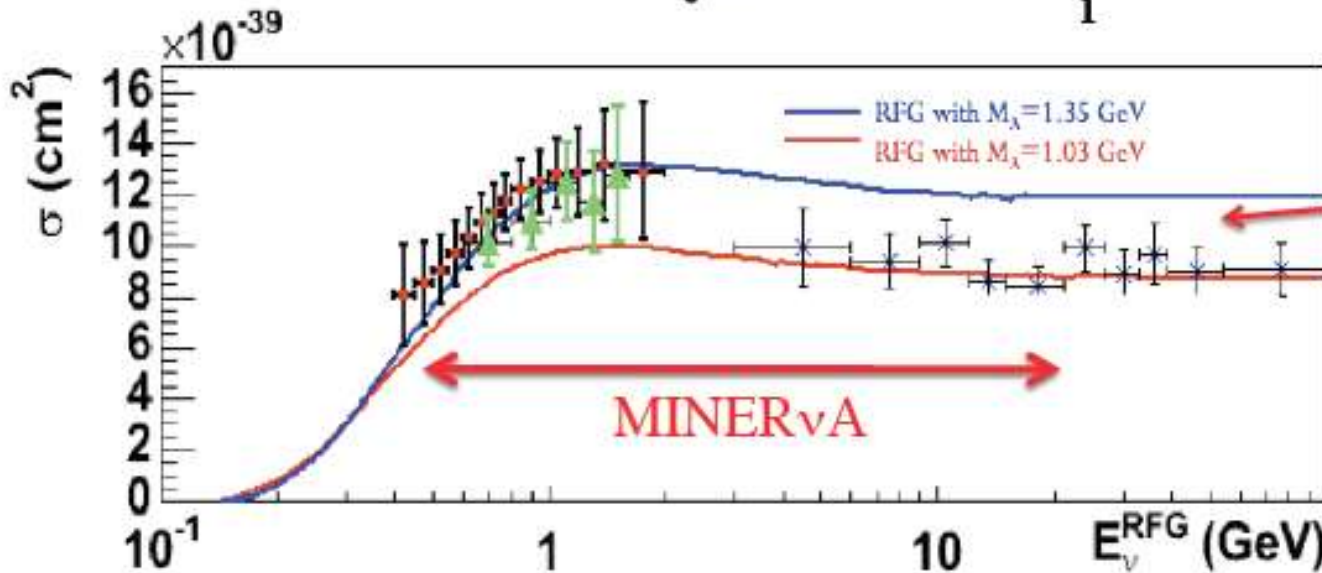
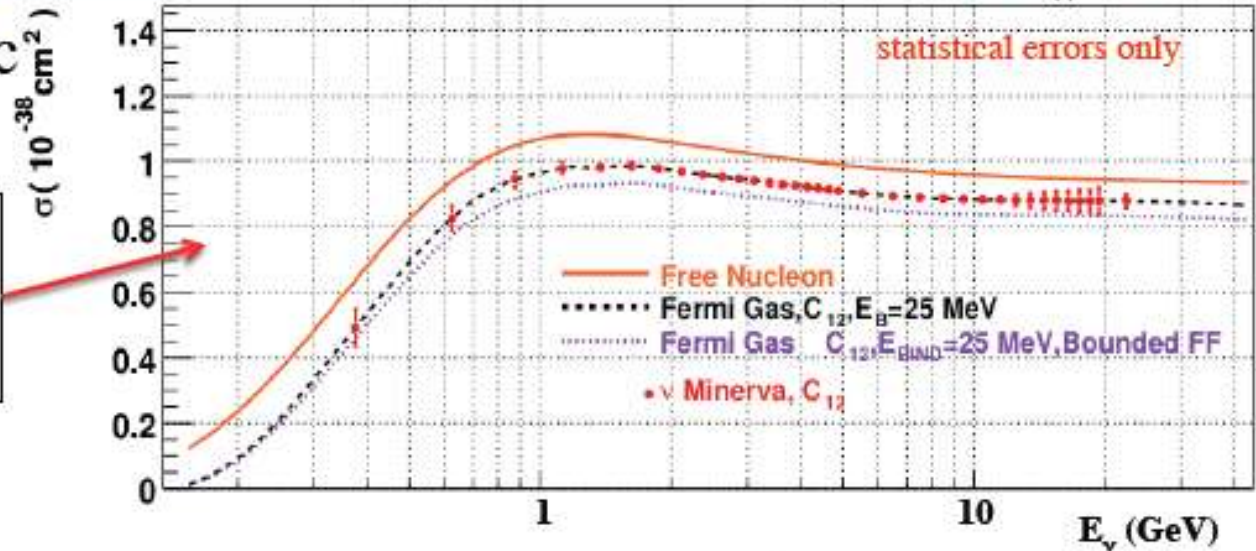


# MINERvA Quasi-Elastic Cross Section II



- CC Quasi-Elastic

Expected MINERvA  
CCQE results including  
 efficiency estimates



MiniBooNE, SciBooNE,  
 NOMAD CCQE data

MINERvA should resolve  
 this mystery!

## ***Physics case (three approaches)***

- 3. perform the LSND oscillation search with two detectors (“eliminate any doubt”)***

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

- 8. 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.***

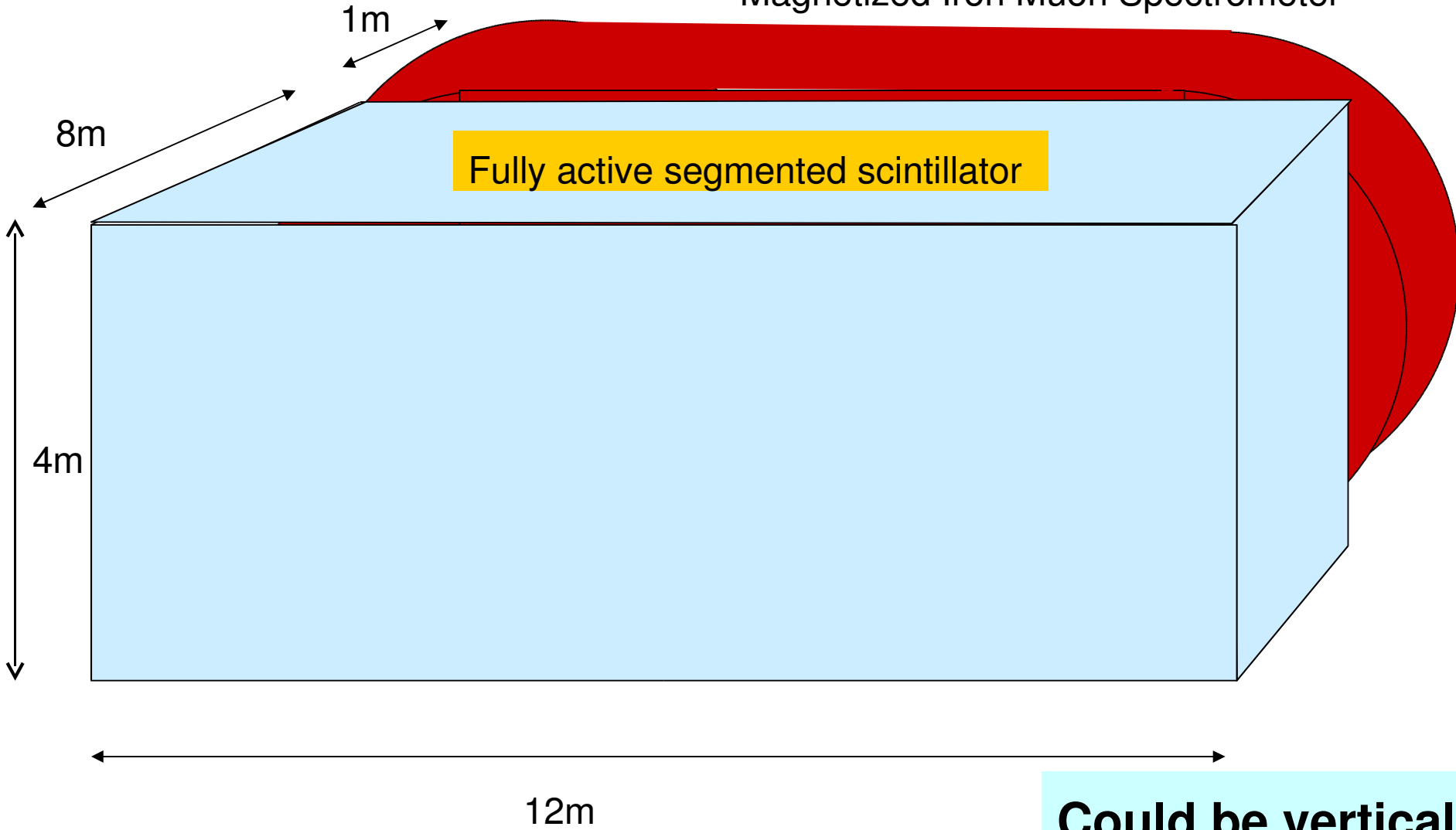
***Also good occasion to test detector ideas***

***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



**Could be vertical**

**WHAT IS THE FID. VOLUME?**





# Building 181 Occupation



NEUTRINO BEAM AT PS: LAYOUT AND REFURBISHMENT

## CERN NEG Coating Plant



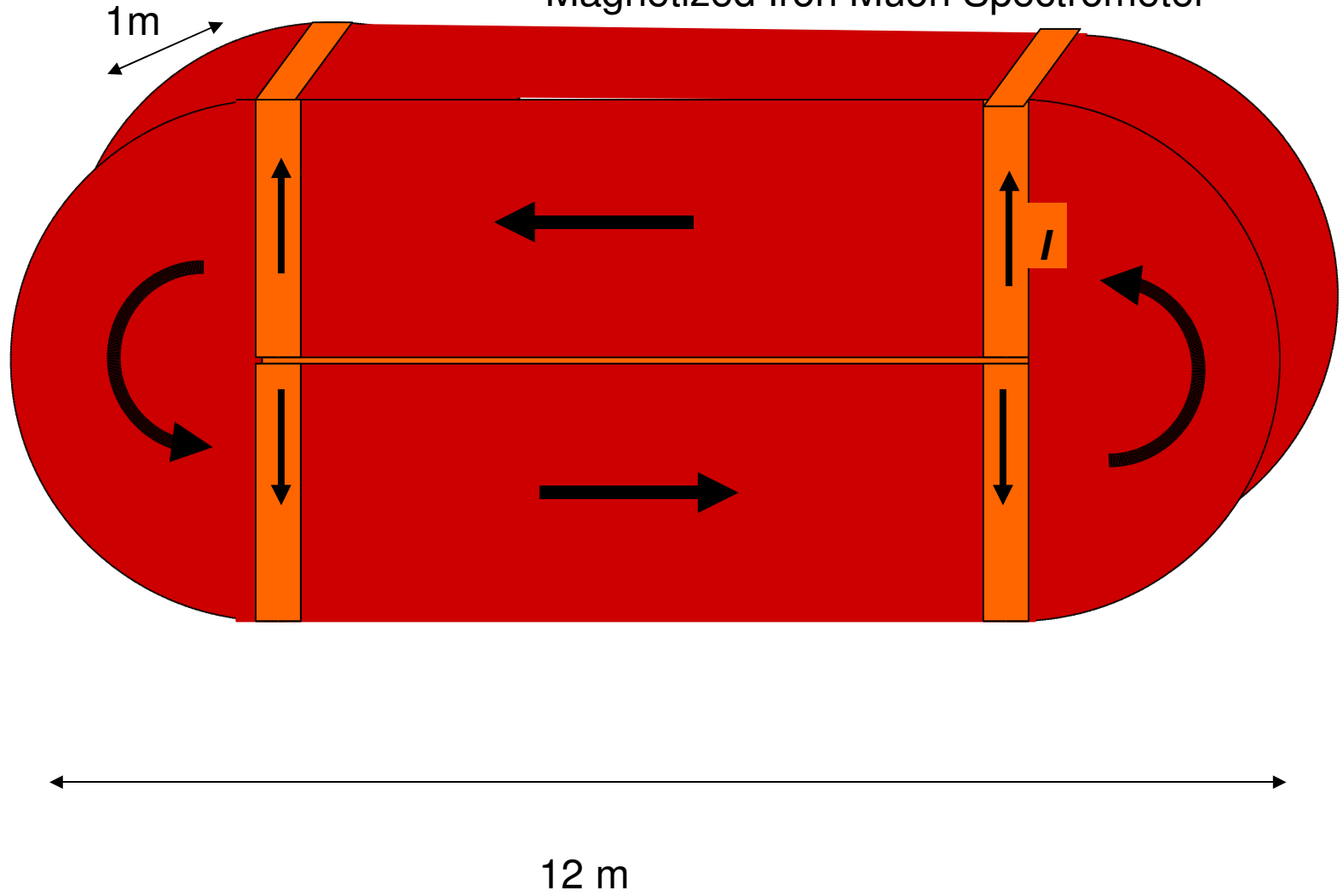
Courtesy of Jose-Miguel Jimenez

## CERN LHC Magnet Repair Facility



Courtesy of Paolo Fessia

# Magnetized Iron Muon Spectrometer

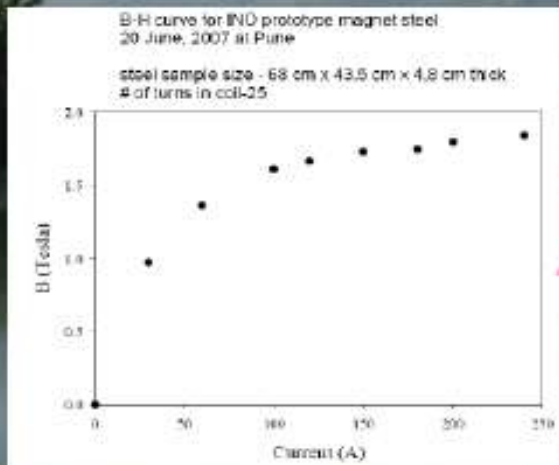


**Could be vertical**

## 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***

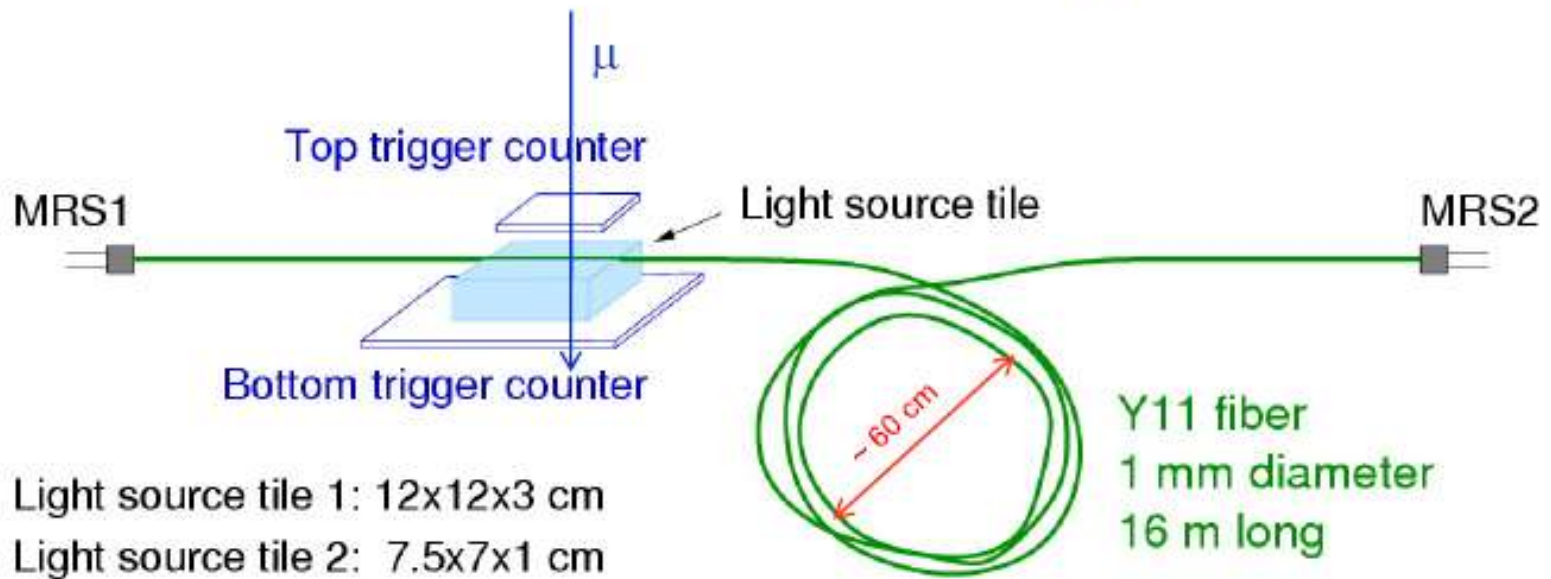
***Marcos Dracos: 7m long extruded scintillator from OPERA  
(missing: Alan Bross on latest developments on T ASD)***

***MPPC readout and electronics:***

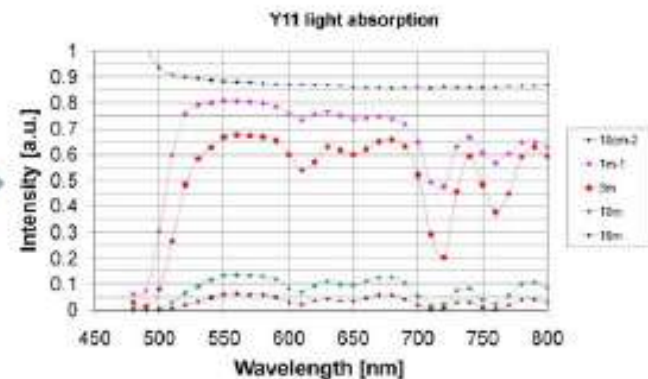
***A. Weber (ND280), M. Prest (MICE EMR), P. Jarron (time resolution)***



# Measurements with long fibers



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



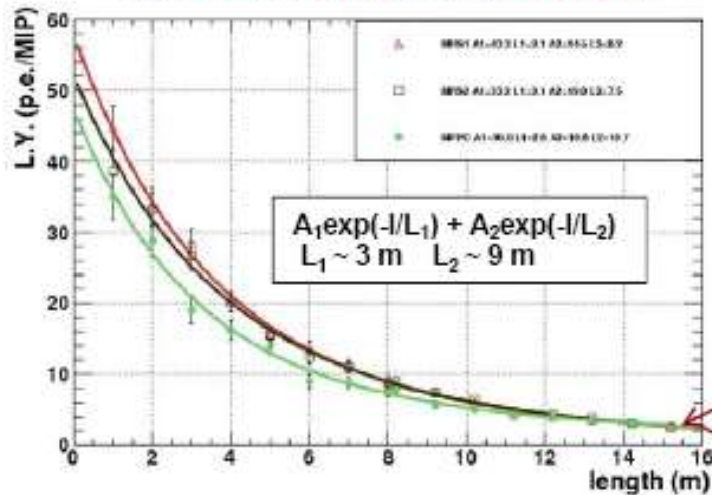
**KUDENKO**

# Light yield

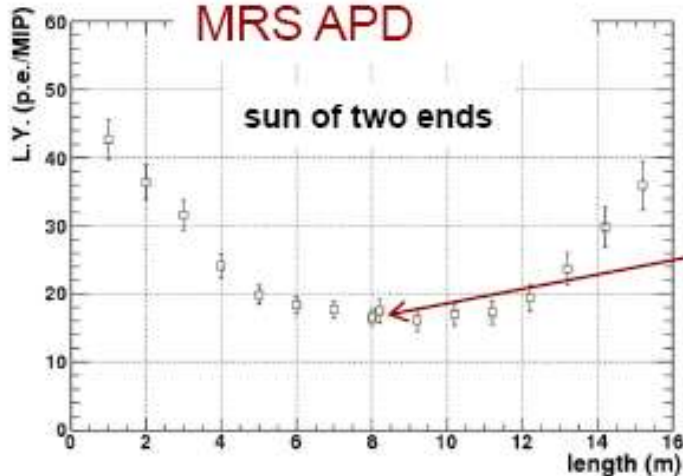
One-end readout  
no reflector at far end

Tile 2 → MIP ~ 2 MeV

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



both-end readout  
MRS APD



## 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*

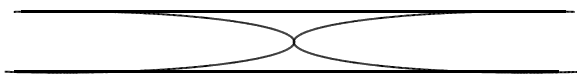
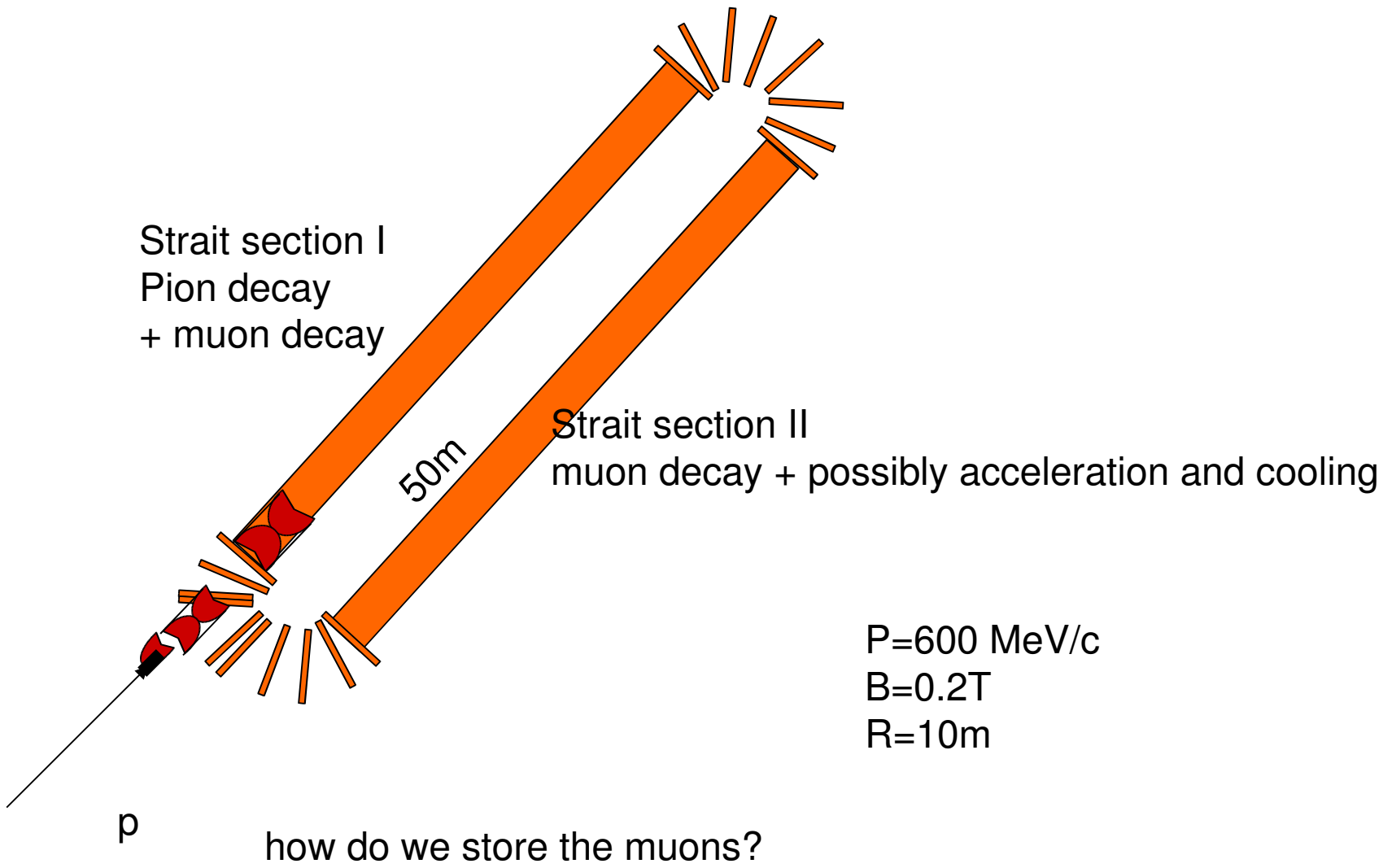
*what about **electron neutrinos**?*

*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  $\gamma=100$  6He or 18Ne...*





## **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**

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