Optimization of MRD transverse size (continue)

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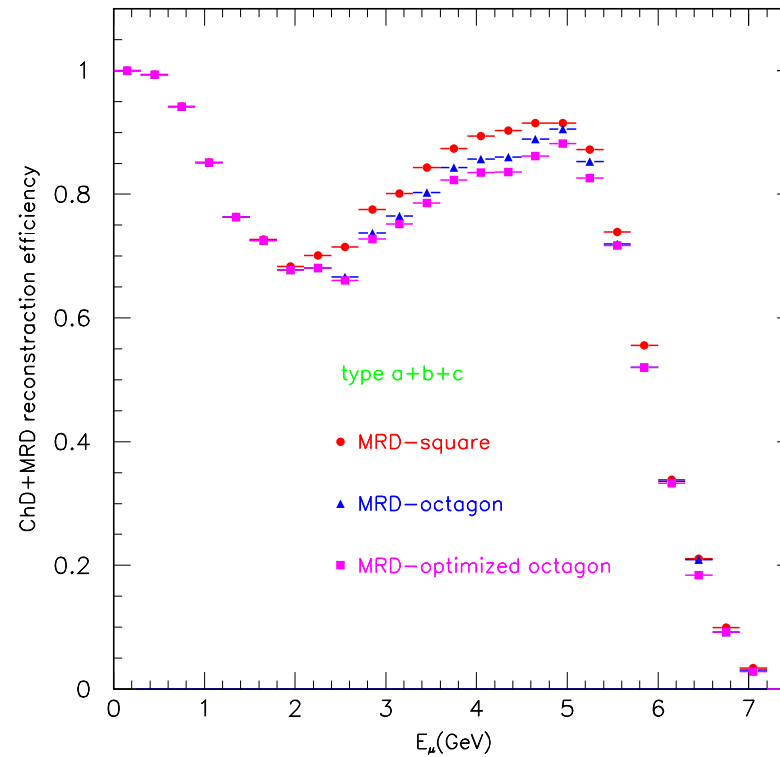
Talk at the T2K 2km meeting, December 15, 2005

Outline
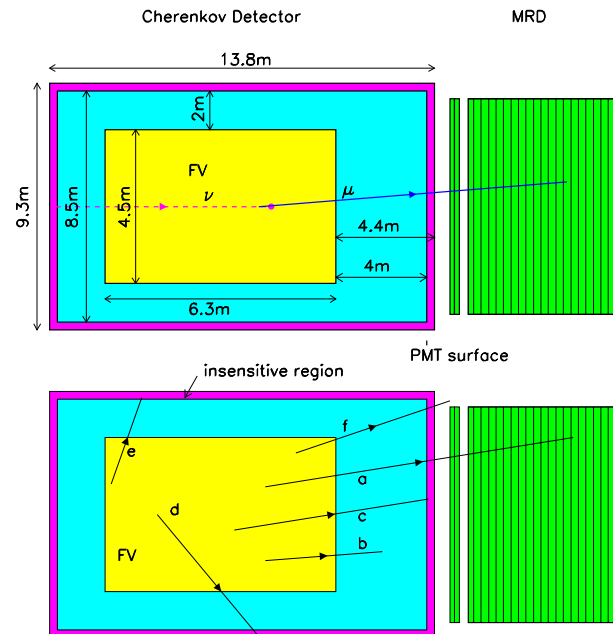
- Motivations

- Design of MRD

- Results

- Conclusions

Motivations

- MRD lateral size optimization for efficiency of $\sim 0.65 \div 0.70$ in muon energy range $2 - 5$ GeV.

- **Optimization using muon vector for 2km Cherenkov Detector (Maximilien)**

The distance from the upstream edge of the fiducial volume to the MRD is shorter ($\sim$ 2.3m) than in 1kt detector. The total thickness of 2km WD&MRD is of 3253.47 g/cm^2 that corresponds to muon energy of 5.2 GeV.
Statistic: 179975 (21374 for 1kt detector) 1-ring QE+nQE events in the fiducial volume and 15474 (11538 for 1kt detector) events detected by MRD

Design of MRD

Lateral size of MRD was optimized for octagon modules using the muon events from muon vectors for 1 kt detector and 2km WD. The follow configuration of MRD is proposed.
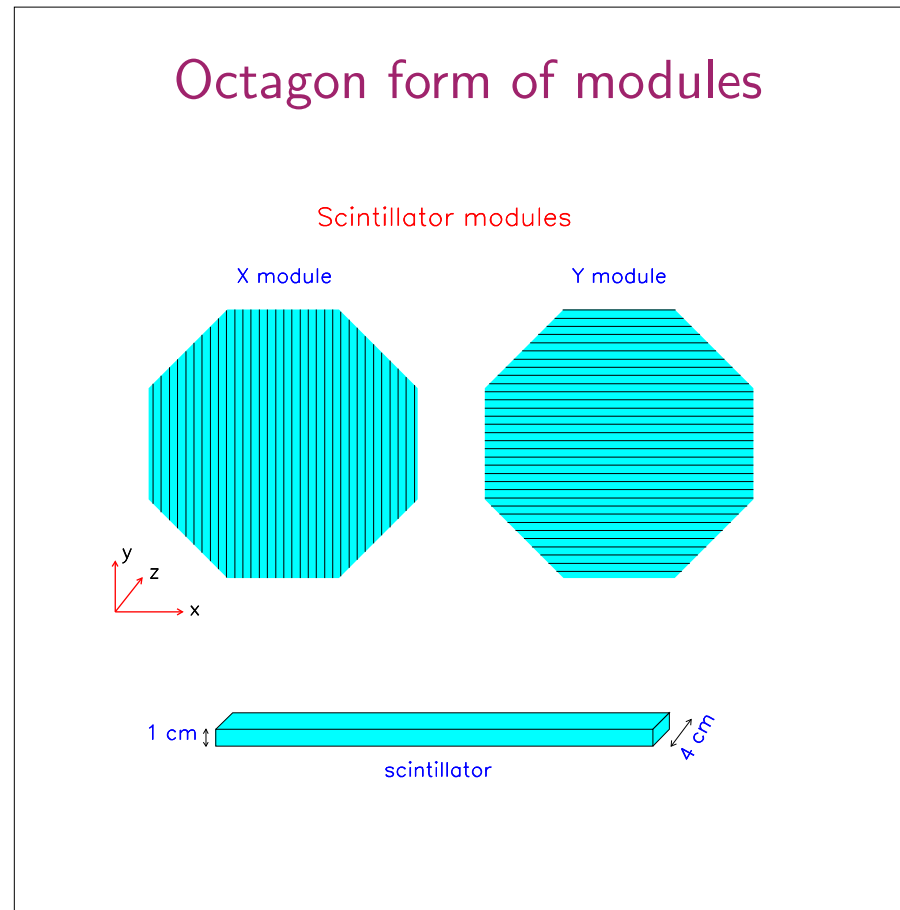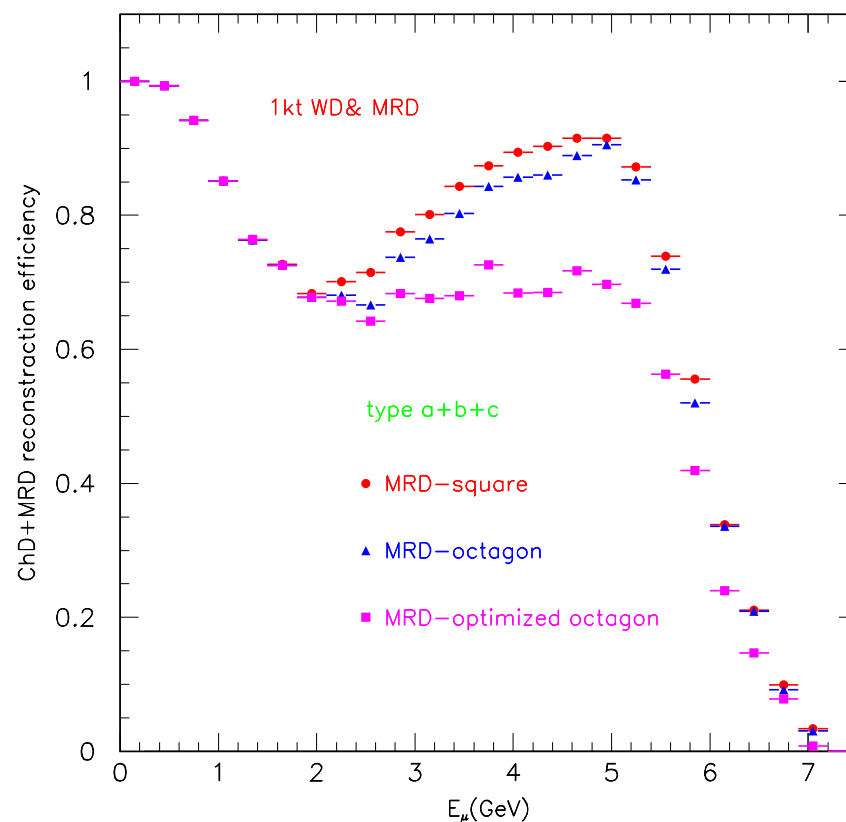
Longitudinal MRD profile

The first 10 modules are of 750cm high (187 strips/module), the next 6 are of 660cm (165 strips/module), the next 2 are of 580cm (145 strips/module), the next 2 are of 560cm (140 strips/module), and the last 2 layers are of 520cm high (130 strips/module).
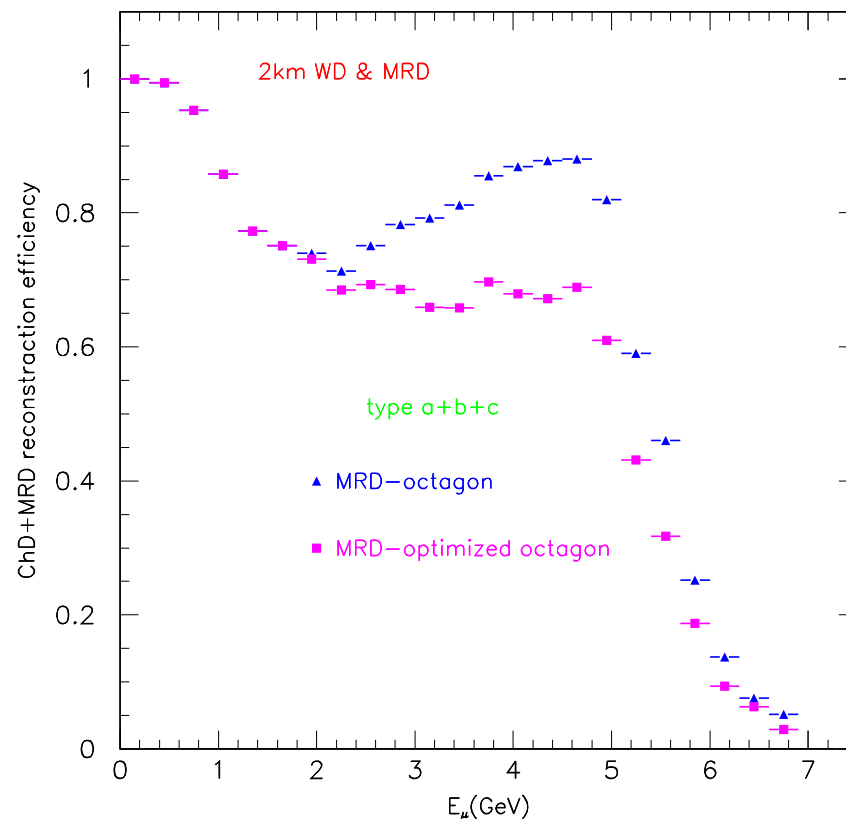
Side View
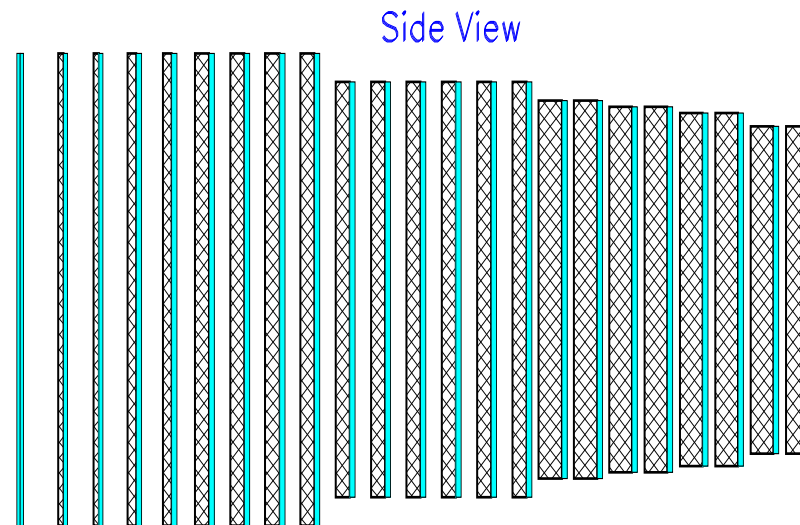
Result

## 1kt WD & MRD reconstraction efficiency

In muon energy range 2 - 5 GeV efficiency of the optimized MRD is diminished of 14% relative to the octagon configuration (all modules are 750 cm high).

2km WD & MRD reconstraction efficiency
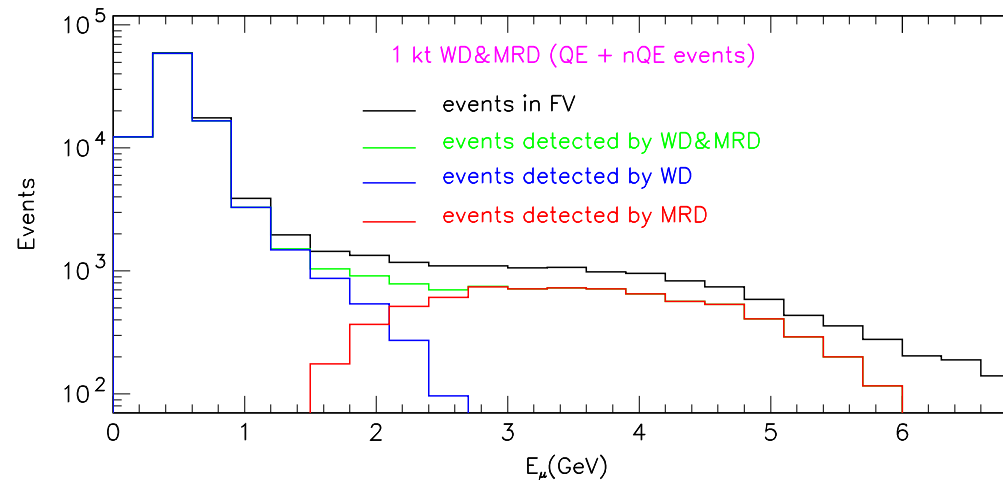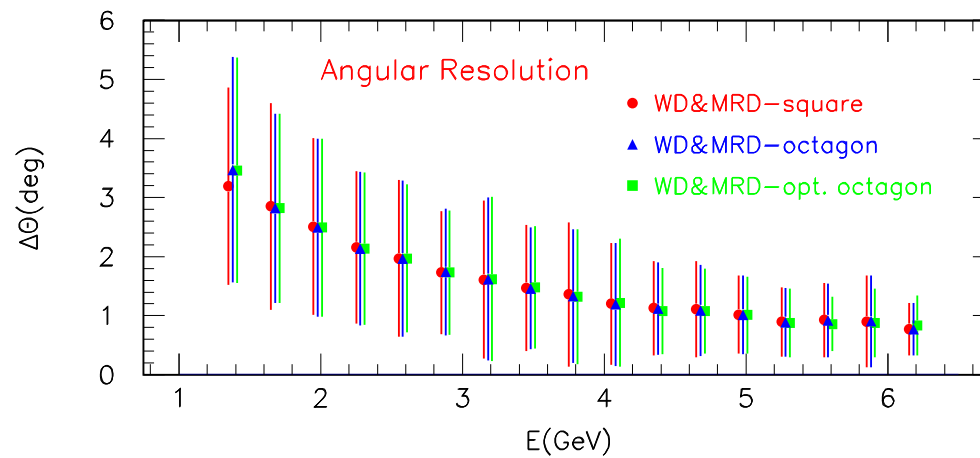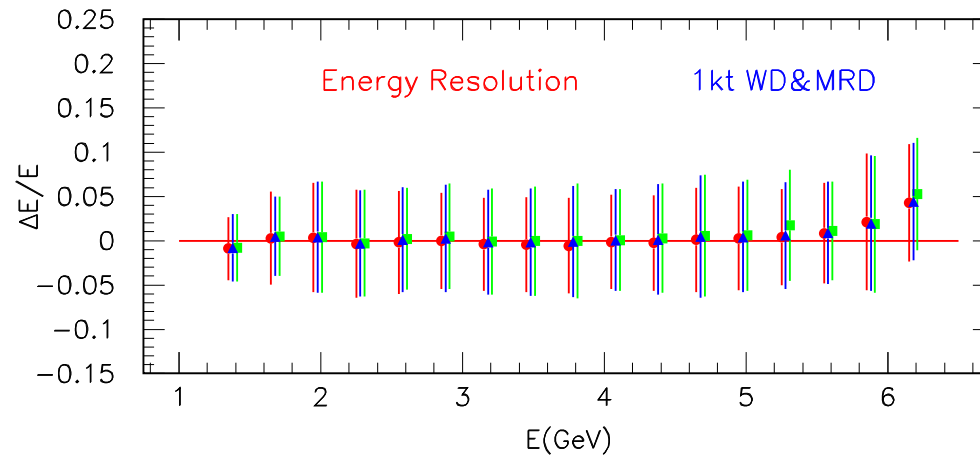

In muon energy range 2 - 5 GeV efficiency of the optimized MRD is diminished of 16% relative to the octagon configuration (all modules are 750 cm high).

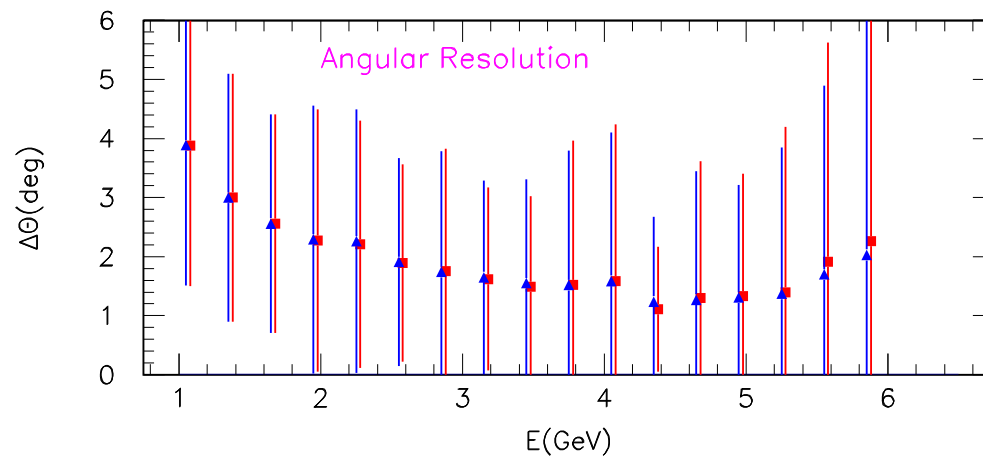# WD & optimized MRD muon events energy distribution and detector contributions
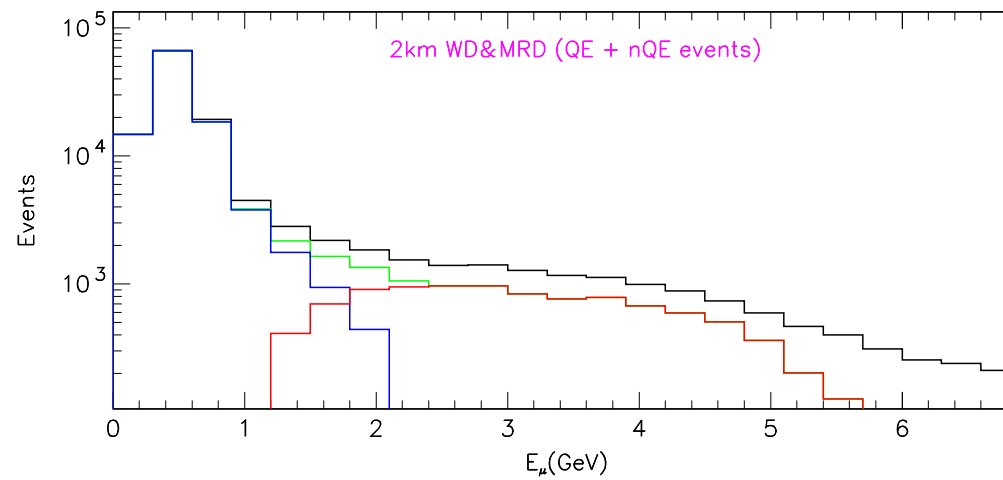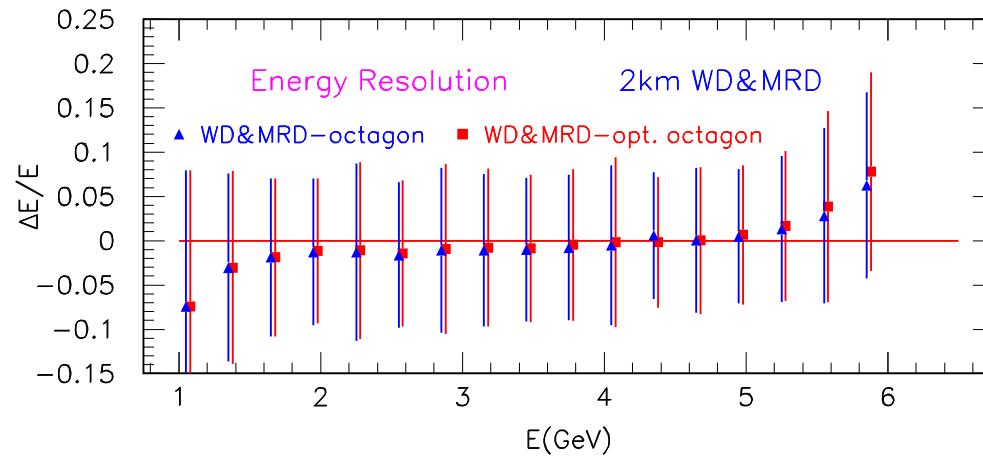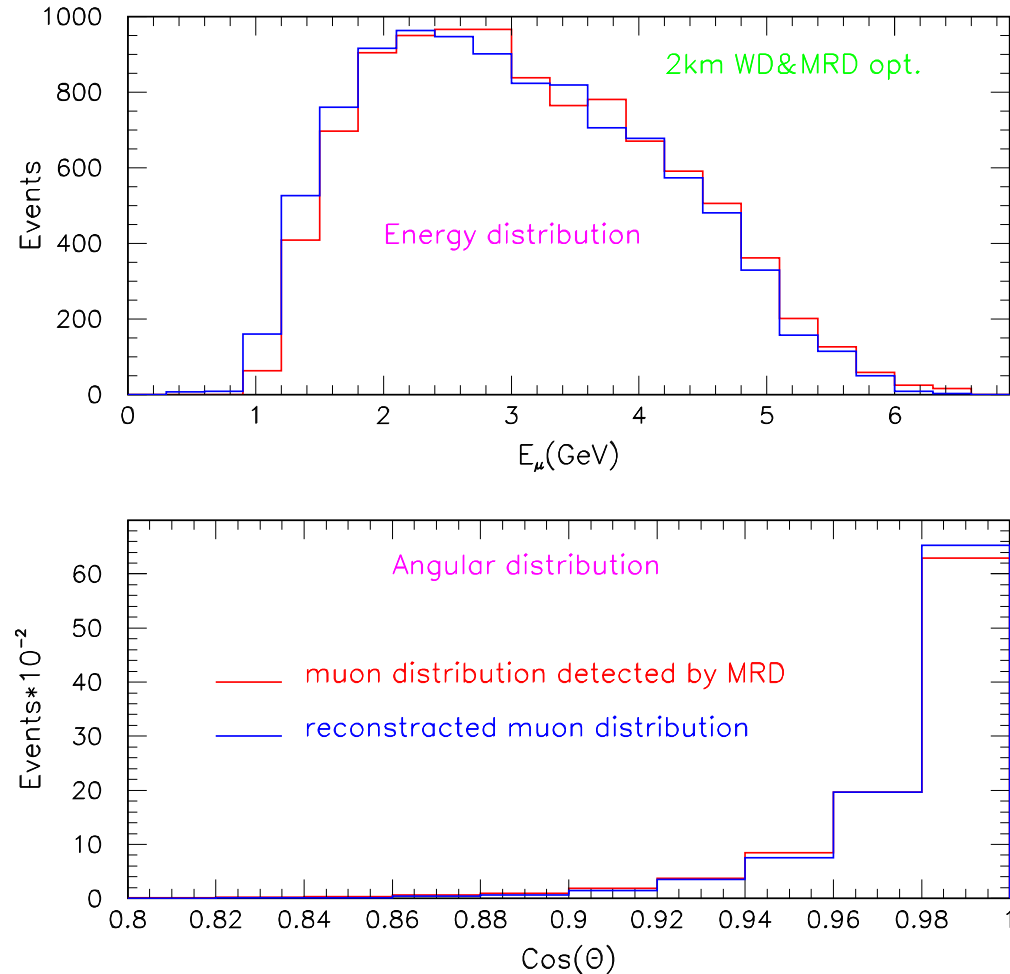
1kt WD & optimized MRD energy and angular resolution

2km WD & optimized MRD energy and angular resolution

Energy and angular distribution of detected (by 2km WD & optimized MRD) and reconstracted muon events

MRD steel and scintillator

- Square modules
  All modules are of 750cm high. Steel - 1214.296 t, scintillator - 13.905 t

- Octagon MRD
  All modules are of 750cm high. Steel - 1006.085 t, scintillator - 11.52 t
  Economy of 17% .

- Optimized octagon MRD
  Modules sizes are optimized.   Steel - 704.223 t, scintillator - 9.215t
  Economy; steel of 42% , scintillator of 34%.

Conclusion

- The lateral size of MRD was optimized using charge-current neutrino events simulated and reconstracted in 1kt detector and 2km WD.

- Two configurations of MRD were studied.

  a) Octagon modules of 750cm high.
  Economy of steel and plastic is of 17% and efficiency is reduced on 4% .

  b) Octagon modules with optimized sizes.
  Economy of steel is of 42%, economy of stintillator is 34% and efficiency in muon energy range 2 - 5 GeV is of $\sim 0.65 \div 0.70$.