# Geant4 simulation of LumiCal  2014 TB
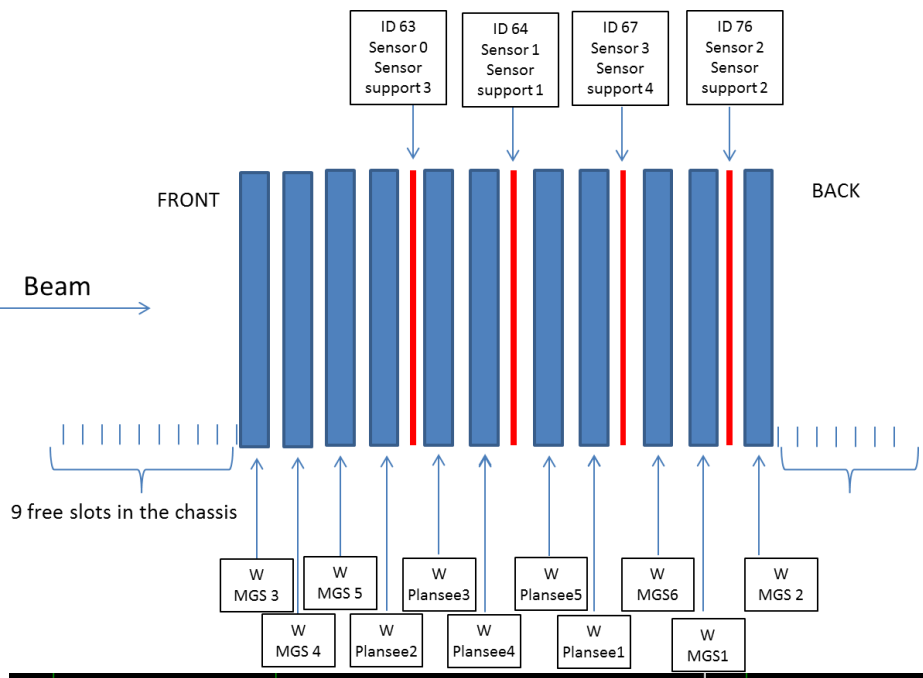
Alina Neagu, Titi Preda

*Institute of Space Science, Bucharest, ROMANIA*
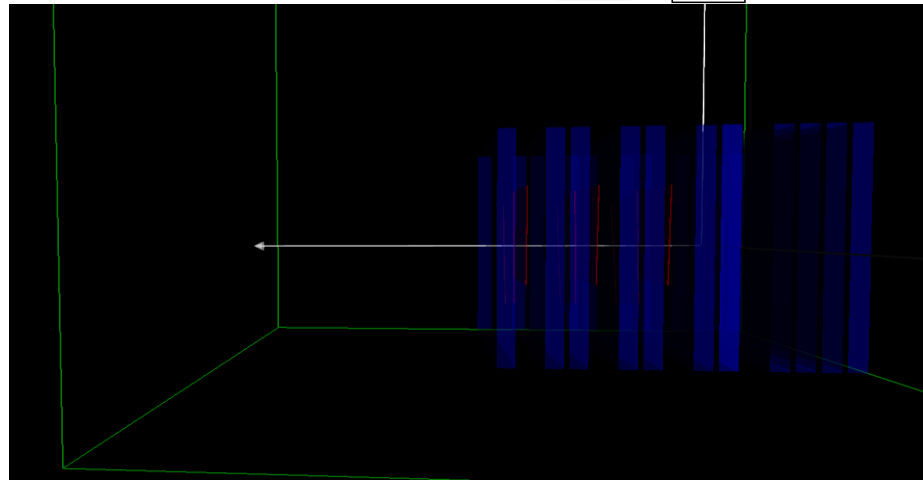
# Overview

- Implementation of TB LumiCal geometry in Geant4

- Fluctuation of the muon energy deposition in silicon sensor

- Simulation of the shower energy deposition

- Conclusions

# LumiCal TB geometry and materials in Geant4

ID 63
Sensor 0
Sensor support 3

ID 64
Sensor 1
Sensor support 1

ID 67
Sensor 3
Sensor support 4

ID 76
Sensor 2
Sensor support 2

FRONT

BACK

Beam →

9 free slots in the chassis

W MGS 3
W MGS 5
W Plansee3
W Plansee5
W MGS6
W MGS 2

W MGS 4
W Plansee2
W Plansee4
W Plansee1
W MGS1

- geometrical dimensions and materials were taken from Francois Nuiry's presentation
- Si sensors of 320 μm in width
- version I 100% tungsten and width 3.5mm
- version II 93% tungsten and width 3.5mm
- version III 93 and 95% tungsten and width different thickness plates

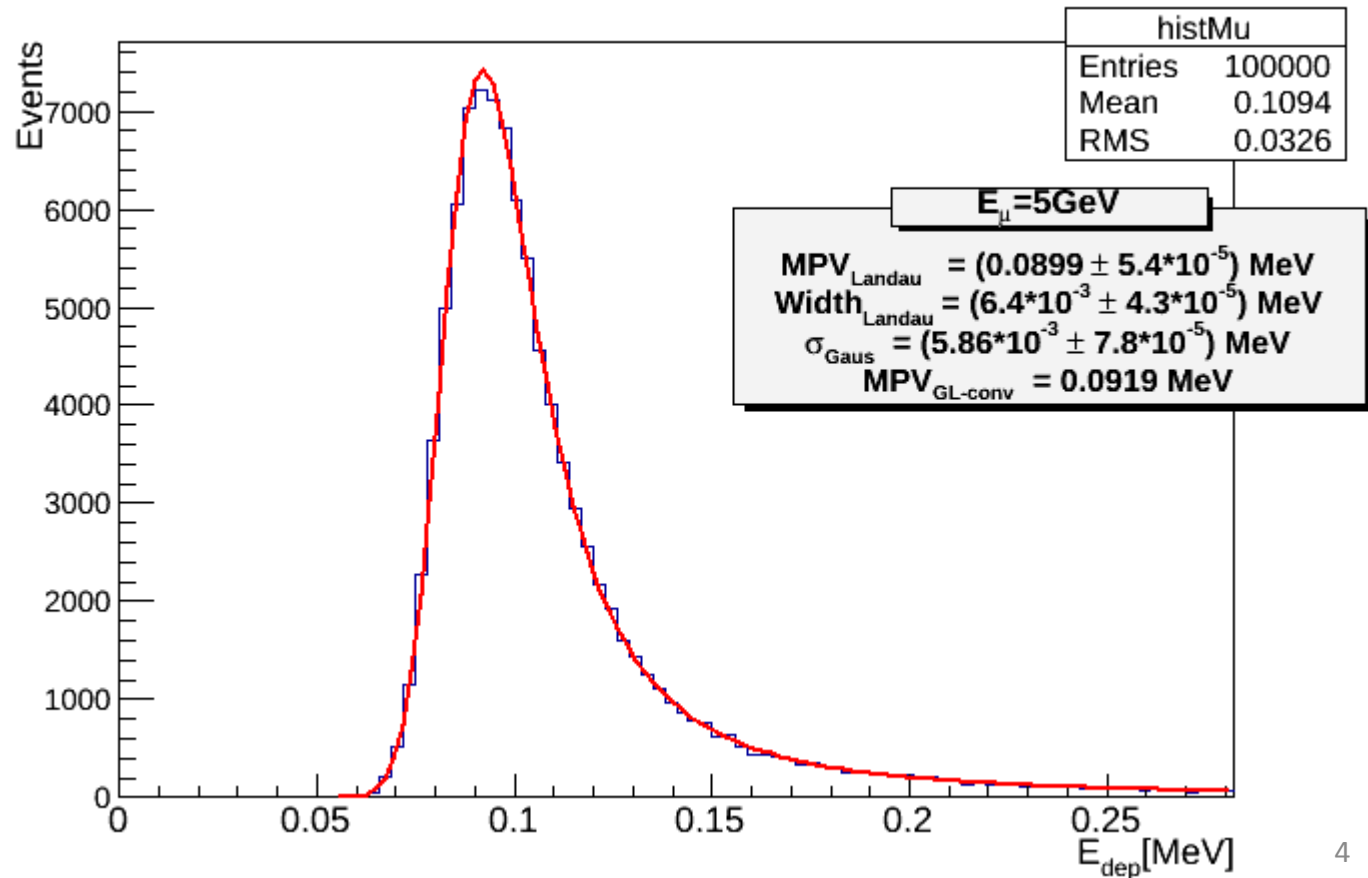| Density | Chimical composition | | |
|---------|------|------|------|
| | W | Ni | Cu |
| **18** | 95% | 4.2 % | 0.8 % |
| **17.7** | 93% | 5.25 % | 1.75 % |

| Plate | average thickness (9 measurement points) | largest distance between "holes" and "hills" |
|-------|------------------|-----------------|
| Plansee1 | 3.505 mm | 0.130 mm * |
| Plansee2 | 3.470 mm | 0.078 mm |
| Plansee3 | 3.520 mm | 0.057 mm |
| Plansee4 | 3.475 mm | 0.059 mm |
| Plansee5 | 3.490 mm | 0.031 mm |
| | | * due to a local problem in one corner |
| MG1 | 3.584 mm | 0.250 mm |
| MG2 | 3.521 mm | 0.160 mm |
| MG3 | 3.542 mm | 0.240 mm |
| MG4 | 3.566 mm | 0.426 mm |
| MG5 | 3.645 mm | 0.431 mm |
| MG6 | 3.470 mm | 0.125 mm |

*Geant4 geometry for the third configuration*

3

## Muon energy deposition in Si sensor

Geant4 Simulation conditions
- Si with $320\mu$m thickness
- $E_\mu$ = 5GeV
- PAI Physics List



| histMu | |
|---|---|
| Entries | 100000 |
| Mean | 0.1094 |
| RMS | 0.0326 |

$E_\mu$=5GeV

$MPV_{Landau}$ = (0.0899 ± 5.4*10$^{-5}$) MeV
$Width_{Landau}$ = (6.4*10$^{-3}$ ± 4.3*10$^{-5}$) MeV
$\sigma_{Gaus}$ = (5.86*10$^{-3}$ ± 7.8*10$^{-5}$) MeV
$MPV_{GL-conv}$ = 0.0919 MeV

# EM shower energy deposition

### Geant4 simulation conditions

a) e- beam of 5GeV
b) sensor geometry in the right upper picture
c) beam profile was a disk with
   - $r = 5.4mm$
   - centre of disk is about the same as in experiment
   - uniform distribution of e- inside the disk
d) PAI for the e+, e-, gamma interaction with silicon sensors and standard EM model for the interaction with tungsten plates
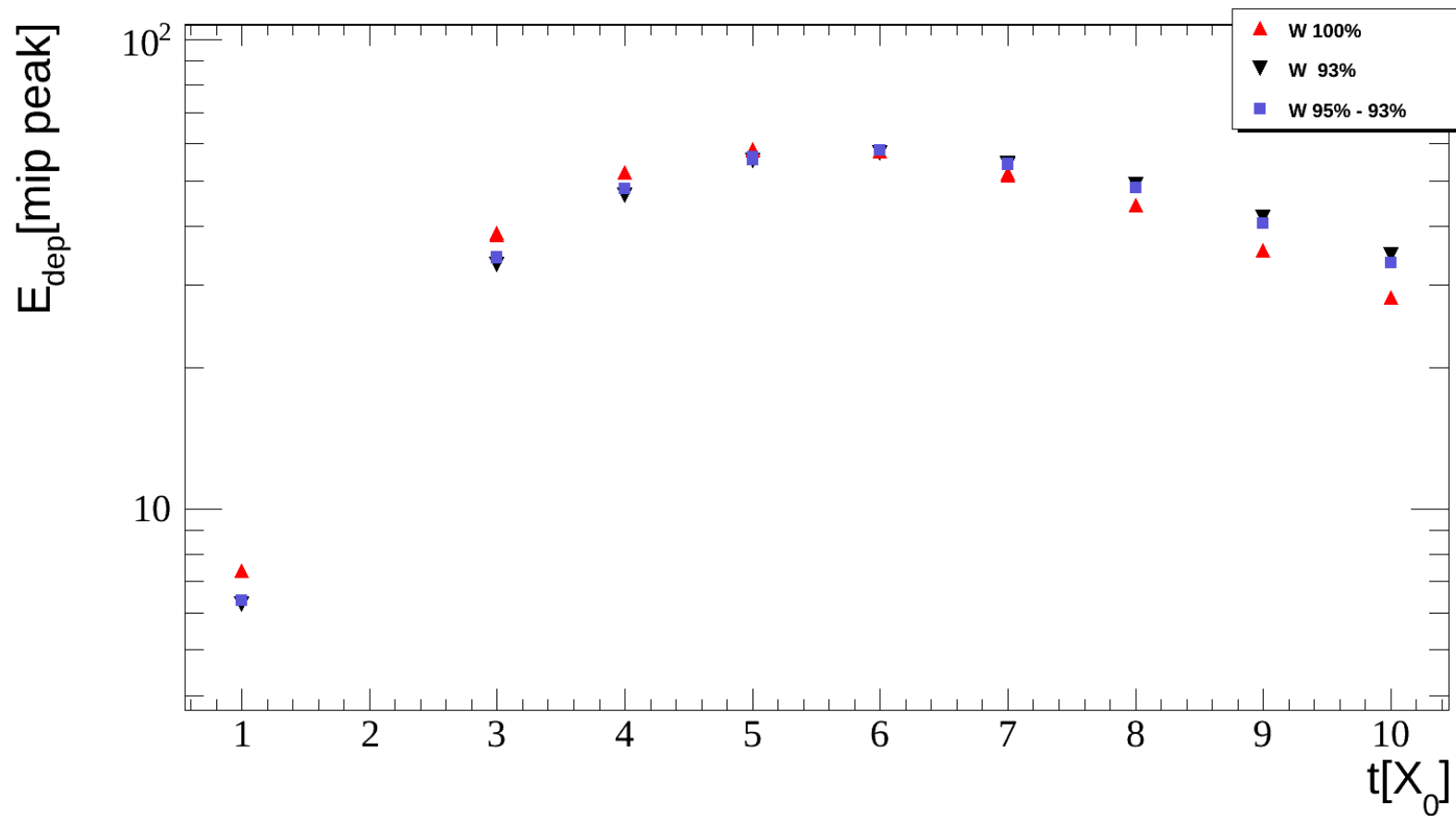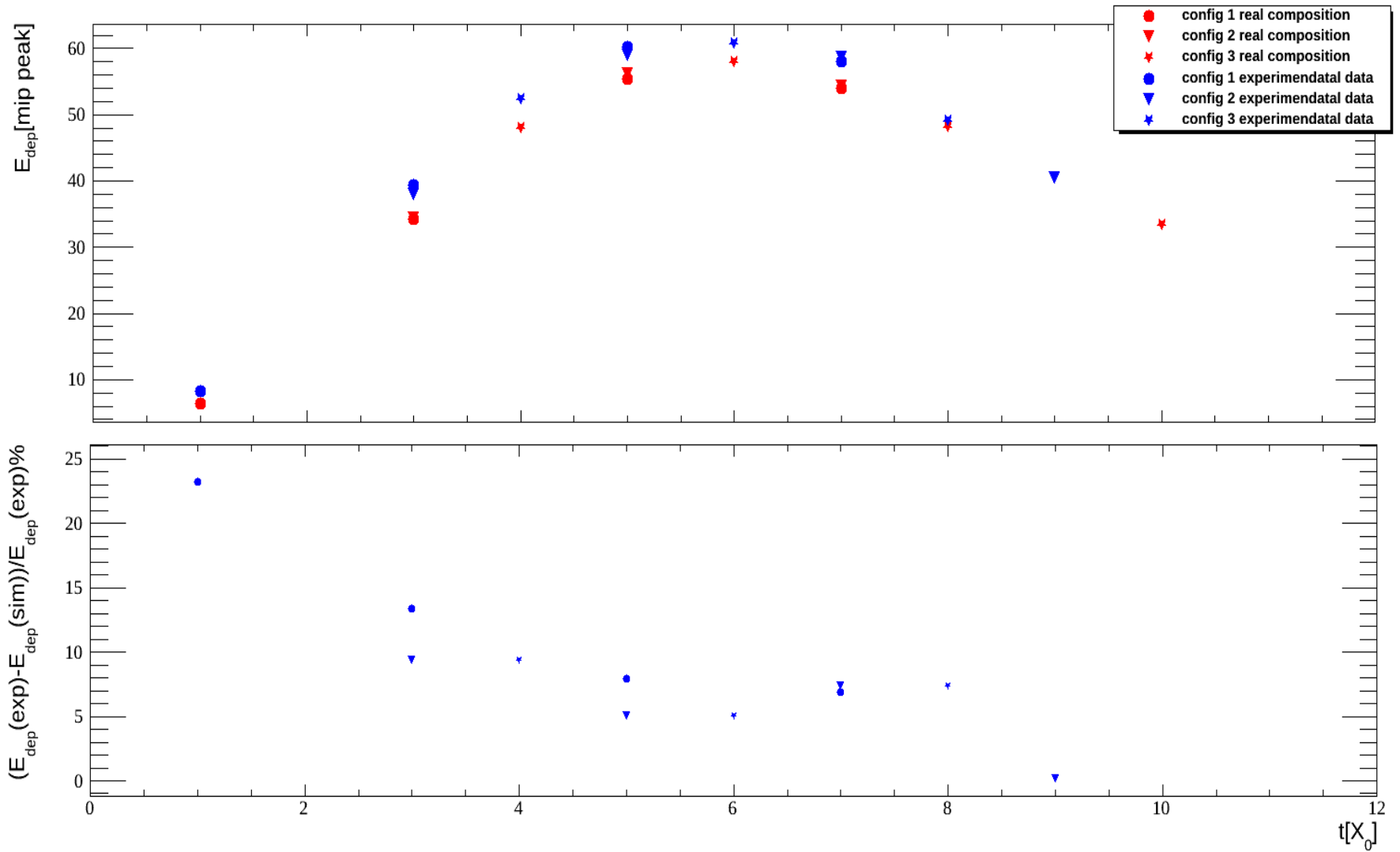e) real thickness of the plates (see slide nr. 3)

GEANT4
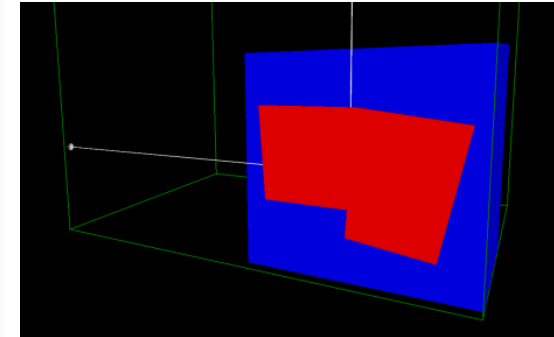


### Energy deposition in the third configuration
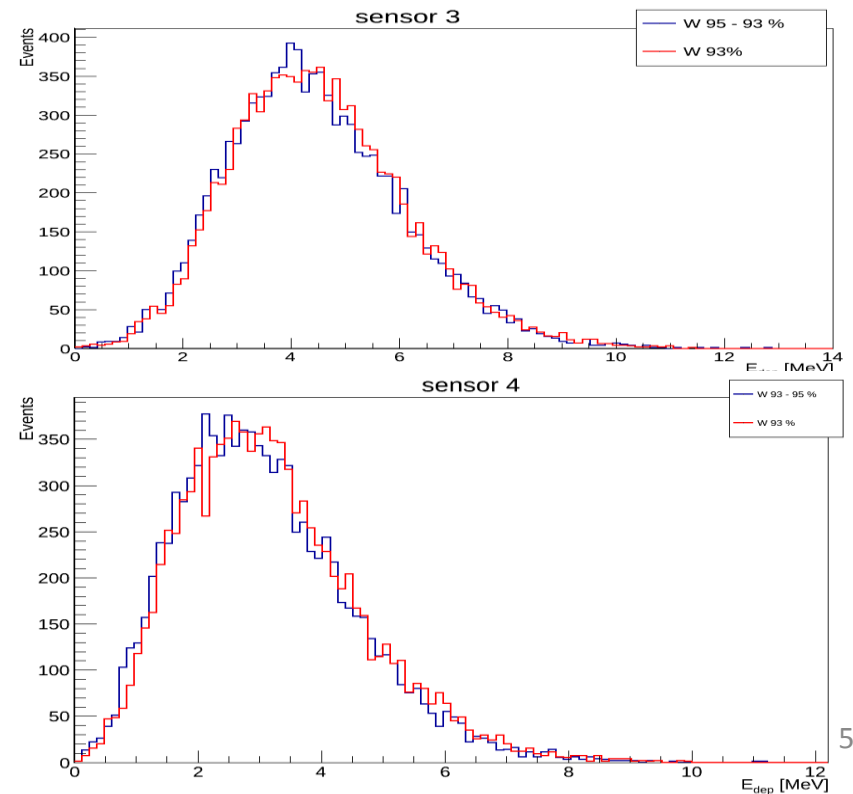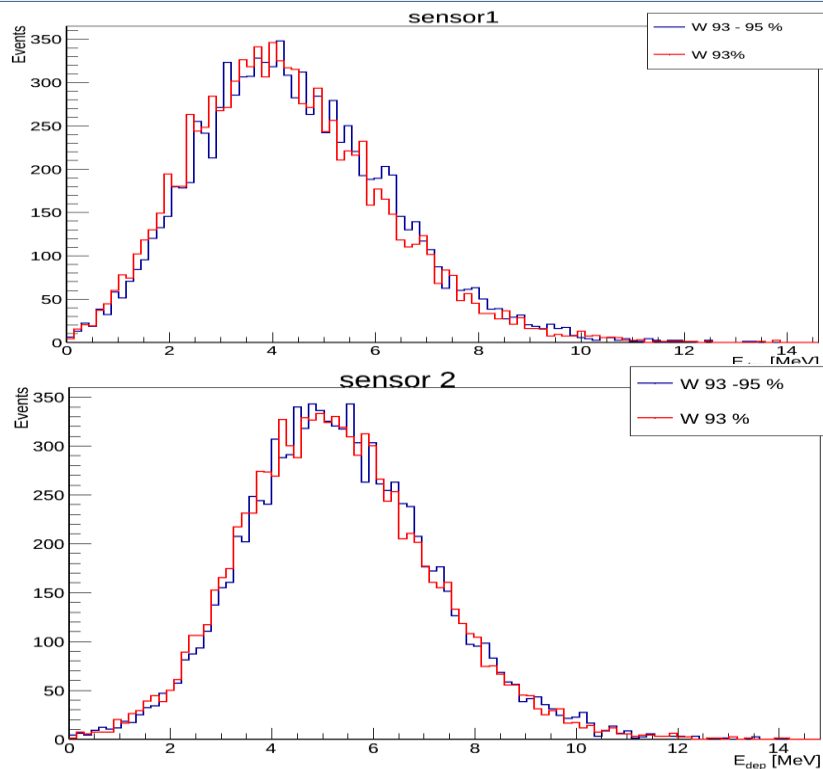
# Comparison between two different versions implemented in GEANT4

# Longitudinal shower development



*Experimental data from Jakub Moron presentation*

## Conclusions

- Geant4 simulation was done for 2014 LumiCal TB takeing into account the spread of the beam , about the same sensor dimentions equipped with electronics
- PAI model was used for silicon sensors and standard electromagnetic model for tungsten absorber