Analysis of the Material Budget

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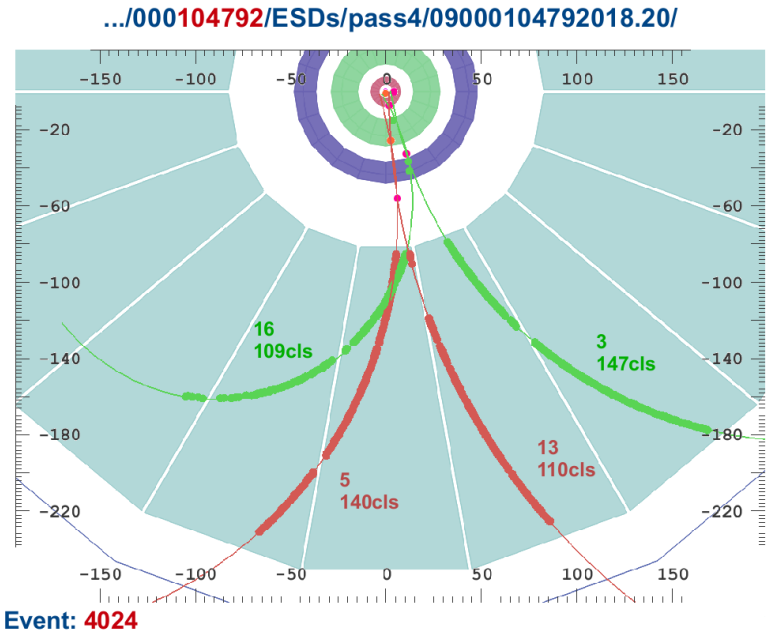
Overview

1. Introduction
2. Resolution
3. Material Mapping with Conversions
4. Material Budget discrepancies in $|\eta| < 1.4$
5. Investigations of the material Budget $|\eta| < 1.4$ for ϕ in different R-bins
6. Investigations of the material Budget $|\eta| < 1.4$ for ϕ in different Z-bins
7. Investigations of the material Budget $|\eta| < 1.4$ for ϕ in different Z-bins
8. Investigations of the material Budget $|\eta| < 1.4$ for R in different Z-bins

What are photon conversions?



- γ conversion into e^+ and e^- (pair creation)
- Number of observed γ

$$N_\gamma^{ob} = N_\gamma^{prod} \cdot ConvProb \cdot \epsilon_\gamma^{rec}$$

- Number of produced γ

$$N_\gamma^{prod} = N_\gamma^{\pi^0} + N_\gamma^{\eta} + N_\gamma^{\omega} + N_\gamma^{\eta'} + N_\gamma^{\phi}$$

- Conversion probability

$$ConvProb = \frac{\#Converted\ \ Photons}{\#all\ \ photons}$$

Detector parts and Rbins

R bin	R range (cm)	Detectors
00	0−3.5	beam pipe
01	3.5−5.75	SPD1
02	5.75−9.5	SPD2
03	9.5−13	Thermal shield/ Support
04	13−21	SDD1
05	21−27.5	SDD2
06	27.5−35	Thermal shield / Support
07	35−42	SSD1
08	42−55	SSD2
09	55−72	Air + TPC inner containment vessel + $C0_2$ (+ITS services at $\|\eta\| < 1.4$)
10	72−79.5	$C0_2$ + TPC inner field cage vessel + Ne:$C0_2$:N_2 (+ITS services at $\|\eta\| < 1.4$)
11	79.5−90	TPC rods + Ne:$C0_2$:N_2
12	90−180	Ne:CO_2:N_2

Definition of Zbins

Z bin	Z range (cm)
00	$-500,-200$
01	$-200,-100$
02	$-100,-50$
03	$-50,-30$
04	$-30,-15$
05	$-15,0$
06	0,15
07	15,30
08	30,50
09	50,100
10	100,200
11	200,500

Spatial Resolution of the Conversion Method: ϕ- Resolution

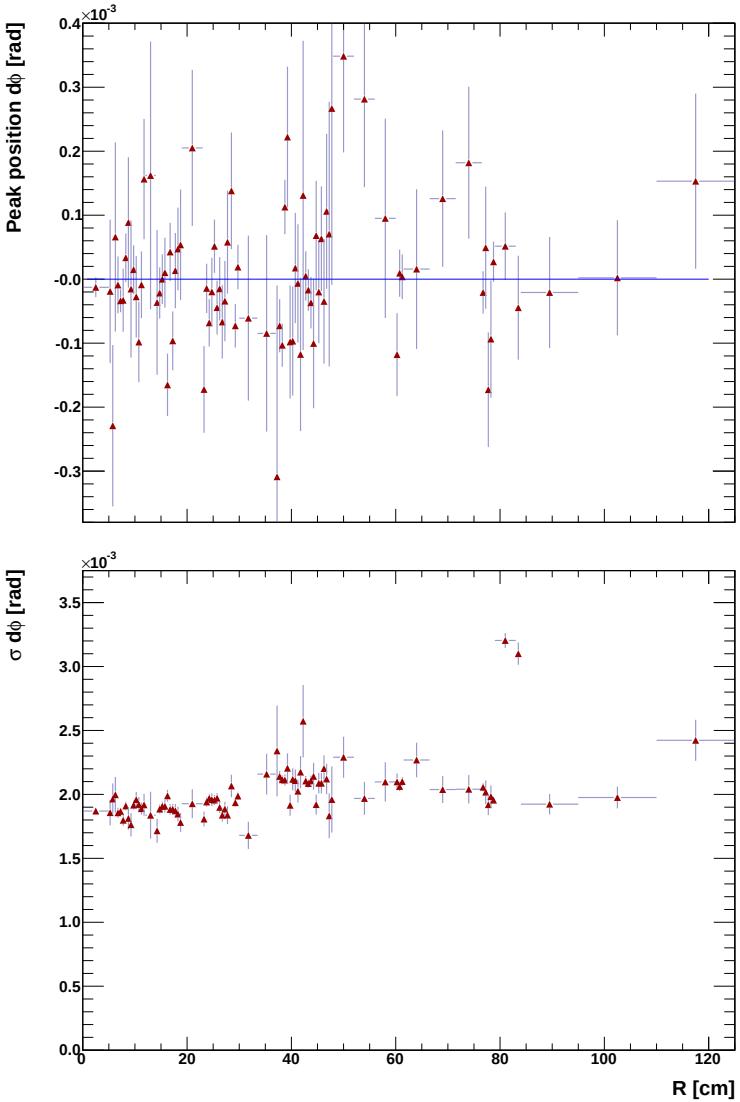


Figure: Spatial resolution of the conversion point in ϕ versus the radial position R. Upper plot: mean of the different slices in R and lower plot: ϕ-resolution at given R.

- Spatial Resolution obtained using flat p_t Monte Carlo production
- p_t-resolution influences spatial resolution, for real data different contribution of higher p_t with less resolution
- Resolution in ϕ at different R better than 2.5 mrad

Spatial Resolution of the Conversion Method: Z- Resolution

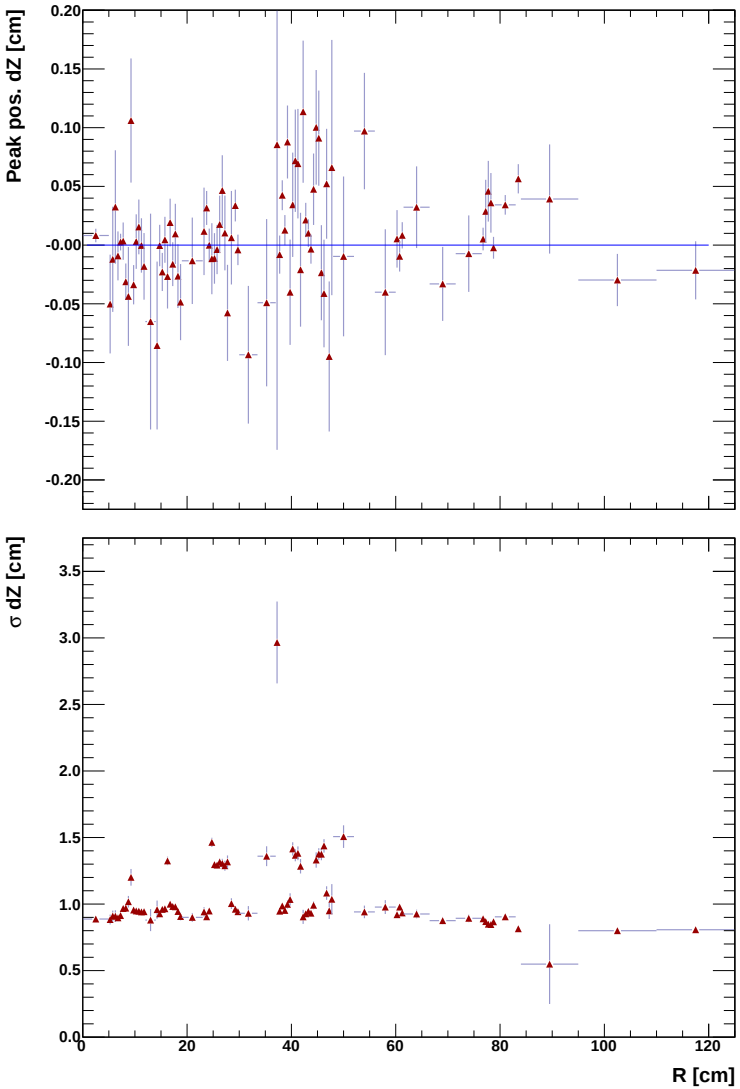


Figure: Spatial resolution of the conversion point in ϕ versus the radial position R. Upper plot: mean of the different slices in R and lower plot: Z-resolution at given R.

- Using onfly V0 reconstruction, but recalculating the conversion point with the condition, that at the conversion point electron and positron track have to be parallel
- Resolution in Z at different R better than 1.5 cm

Spatial Resolution of the Conversion Method: R- Resolution

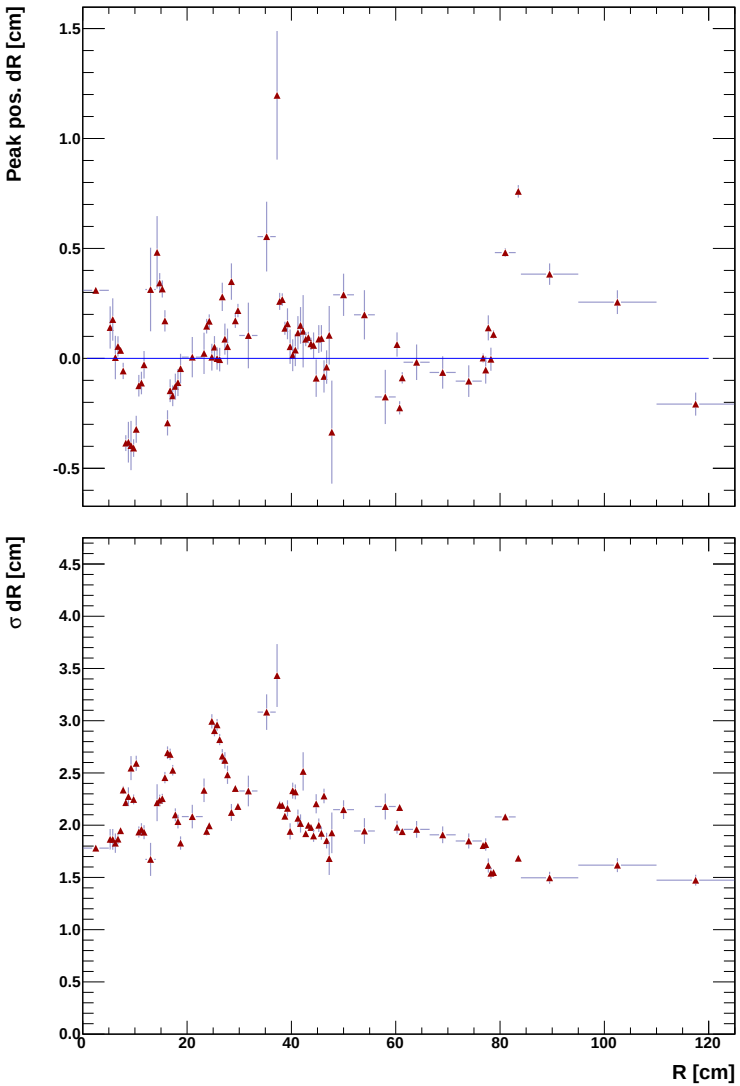


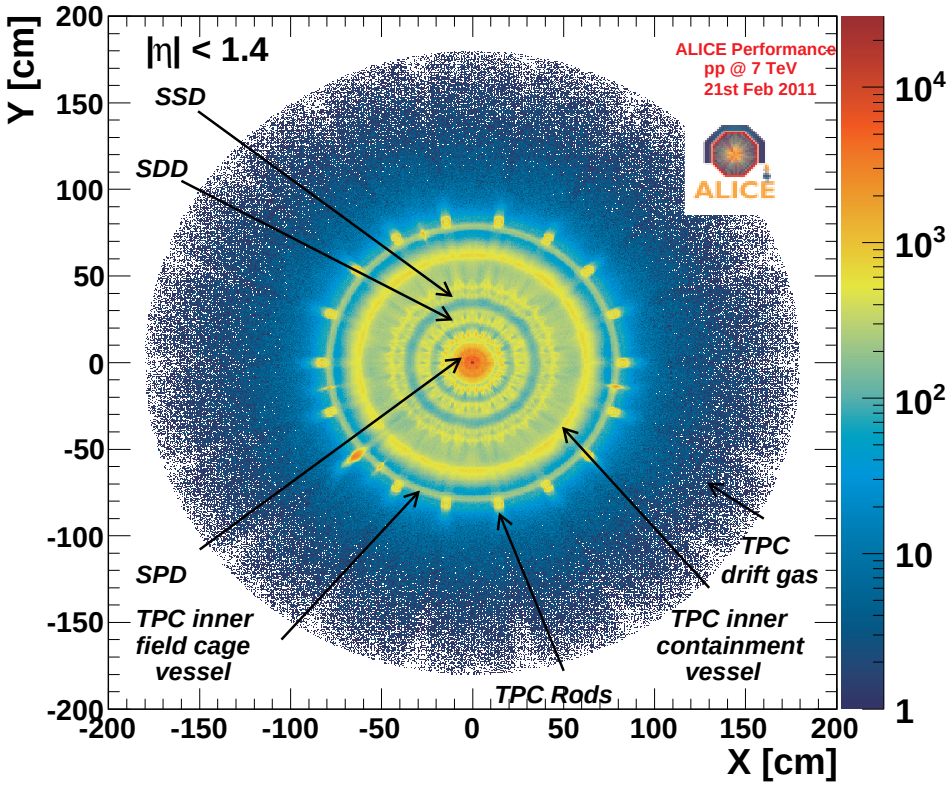
Figure: Spatial resolution of the conversion point in ϕ versus the radial position R. Upper plot: mean of the different slices in R and lower plot: R-resolution at given R.

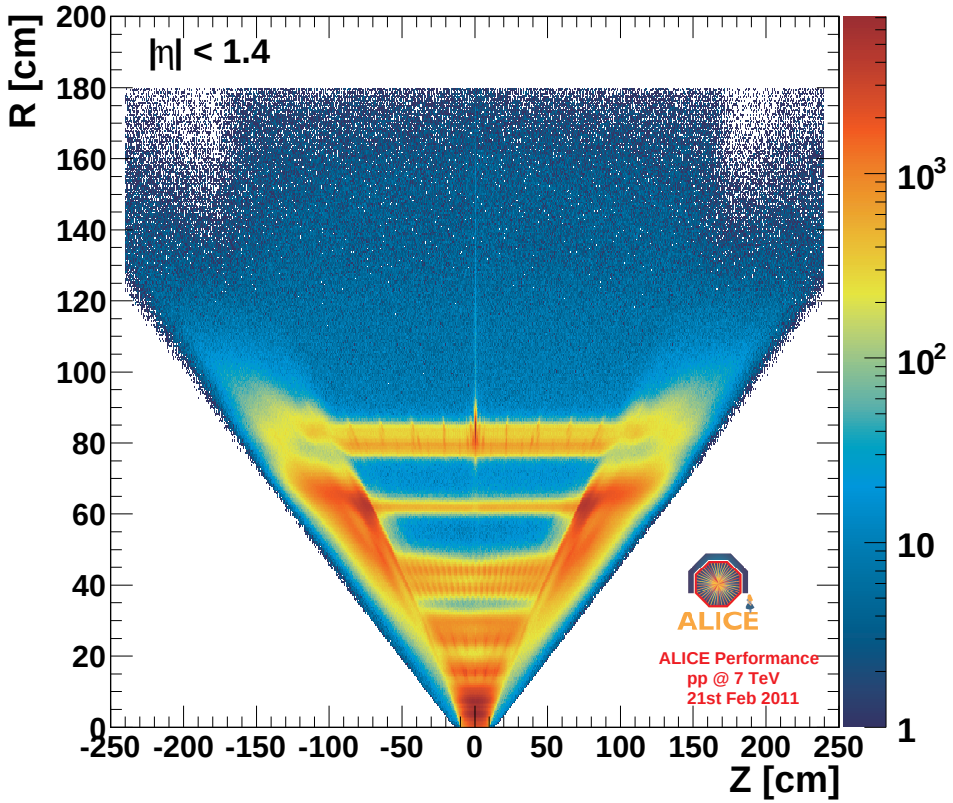
- Using onfly V0 reconstruction, but recalculating the conversion point with the condition, that at the conversion point electron and positron track have to be parallel
- Resolution in R at different R better than 3 cm

Data set

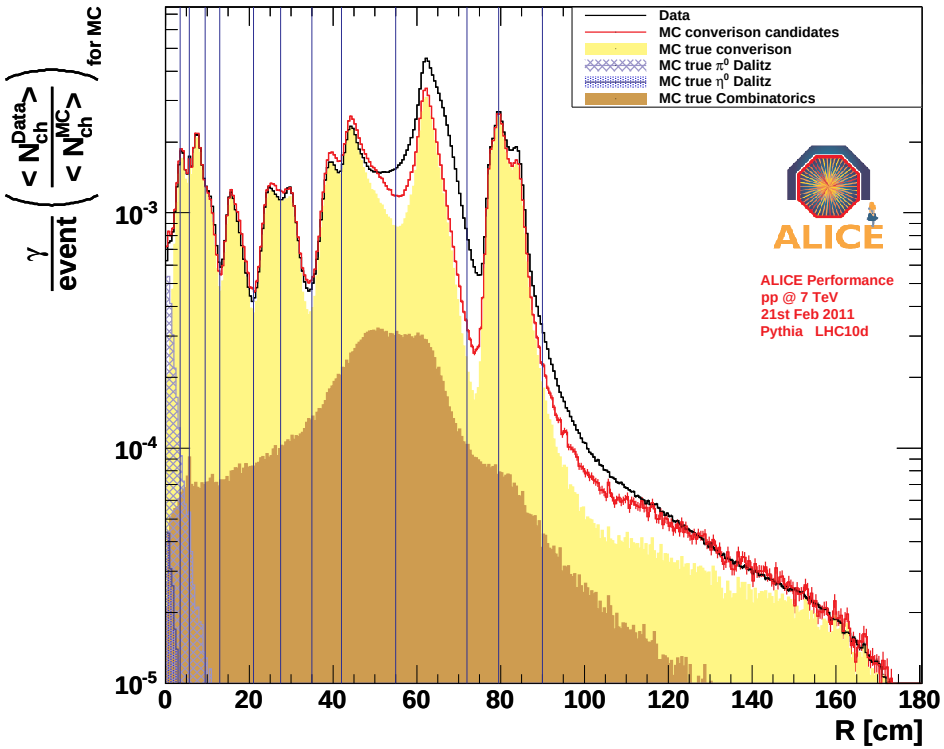
- MC : LHC10f6a (Pythia)
- Data: LHC10d

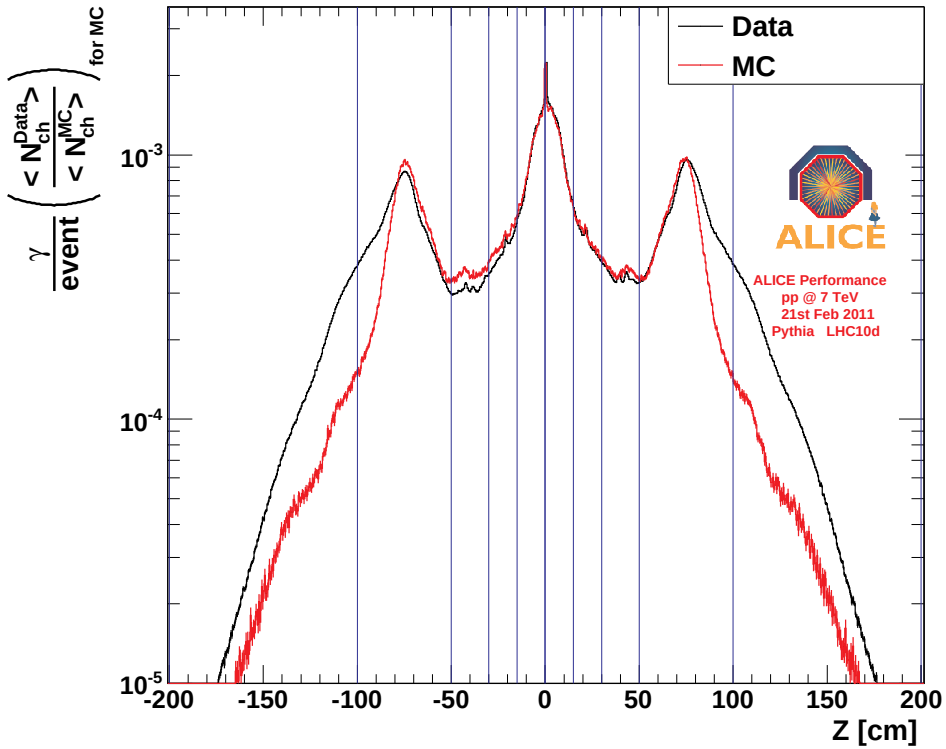
2 dimensional maps (Data)



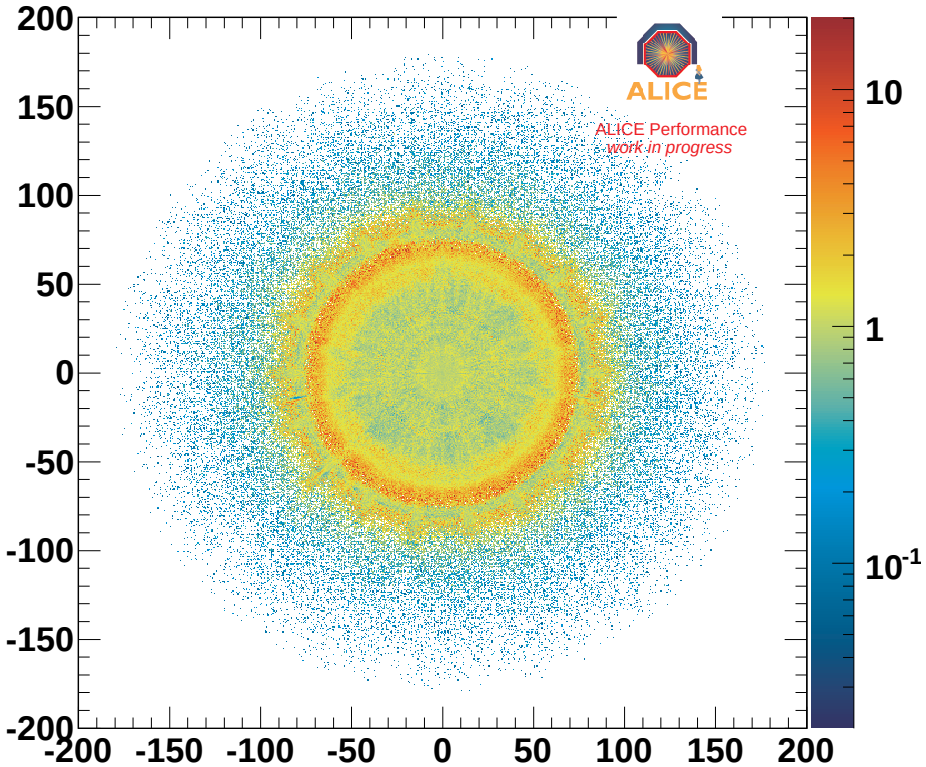


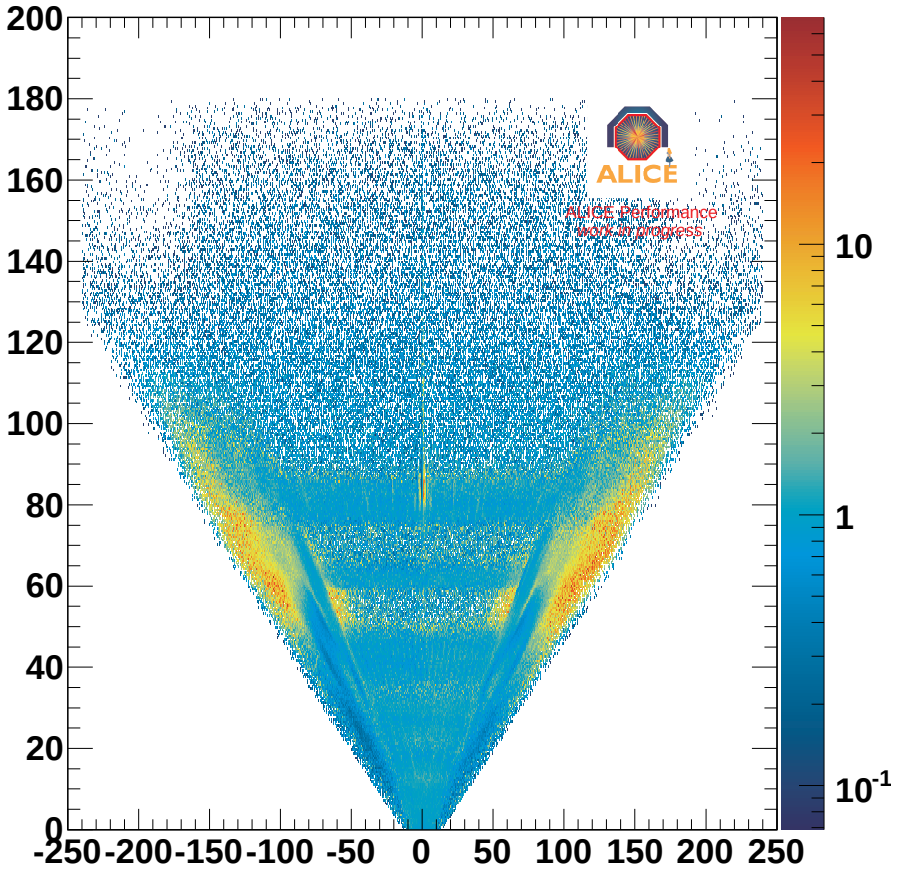
R- and Z-distributions



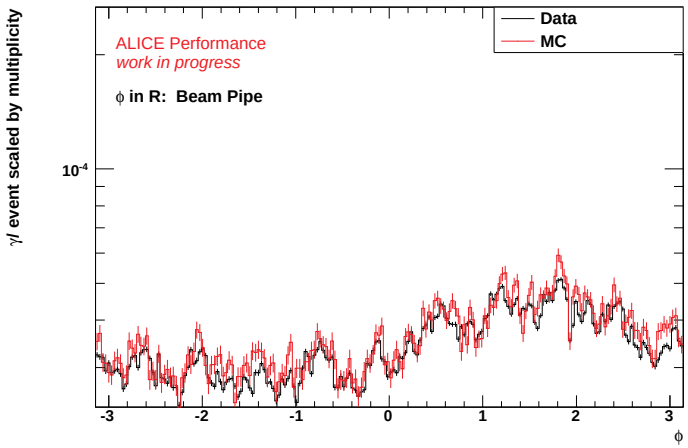


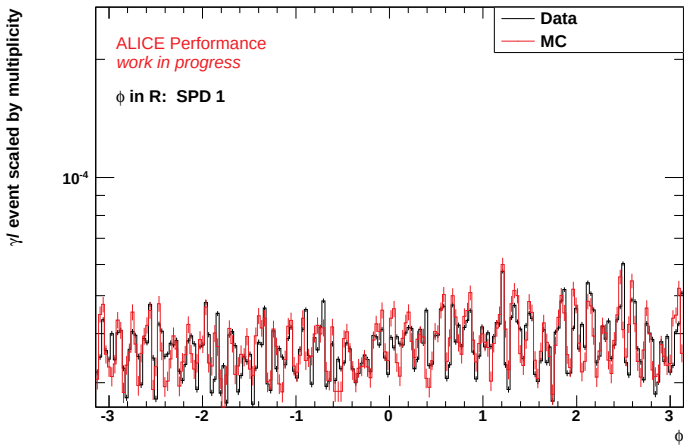
2 dimensional Ratio Data/MC

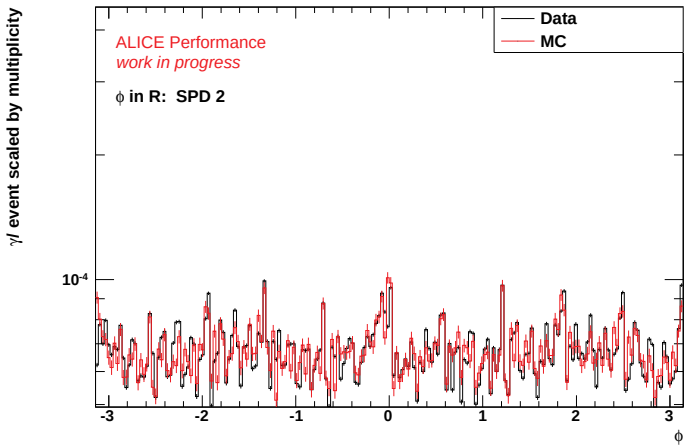


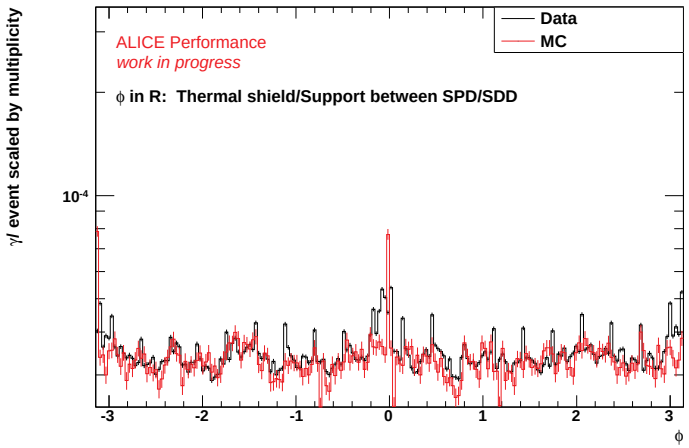


ITS ($|\eta| < 1.4$): ϕ- distribution at different R positions









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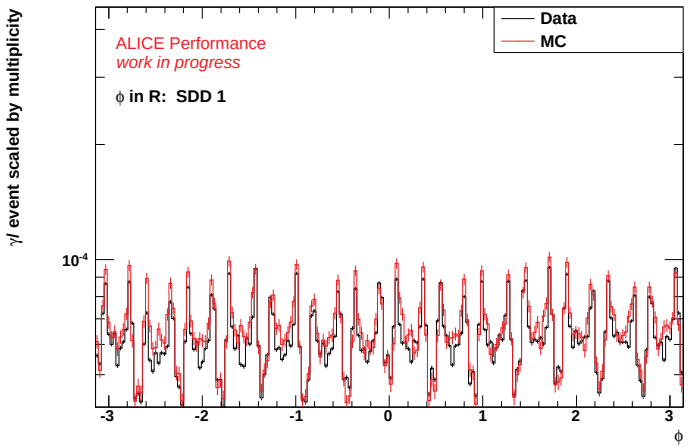
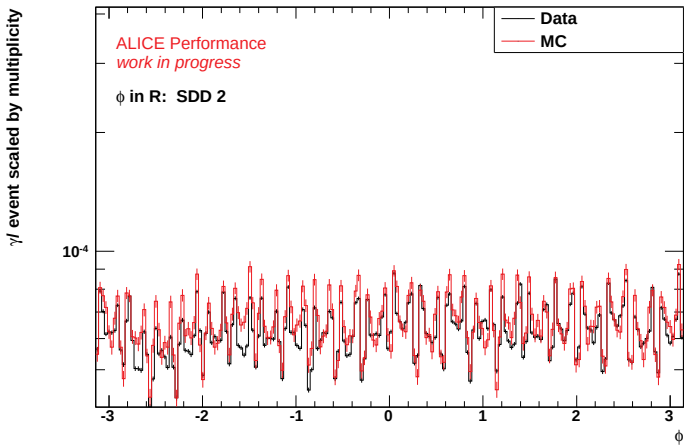
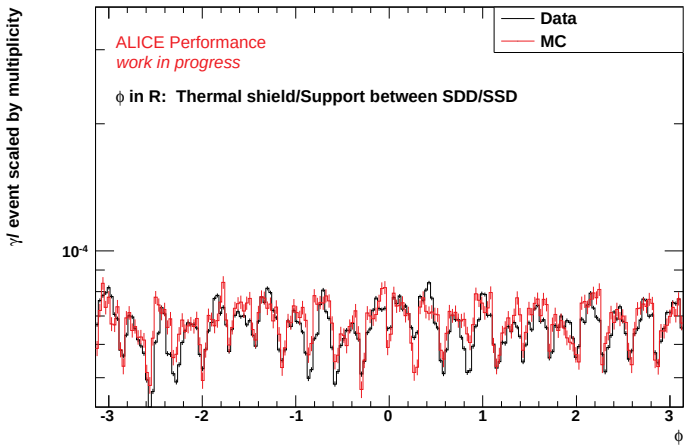
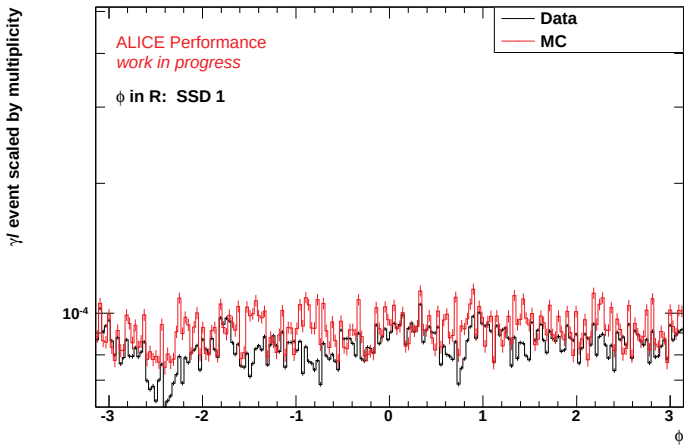
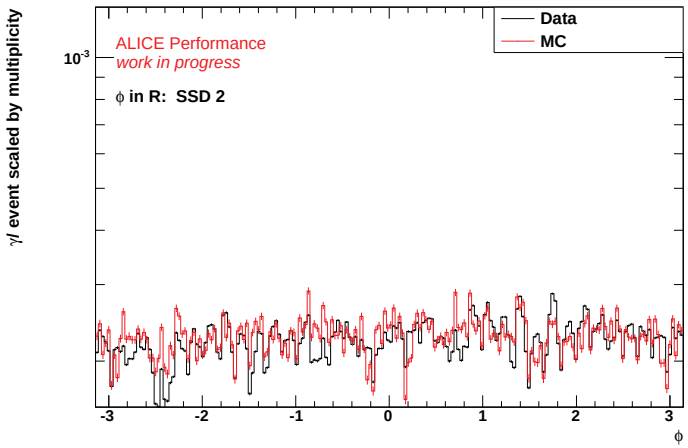


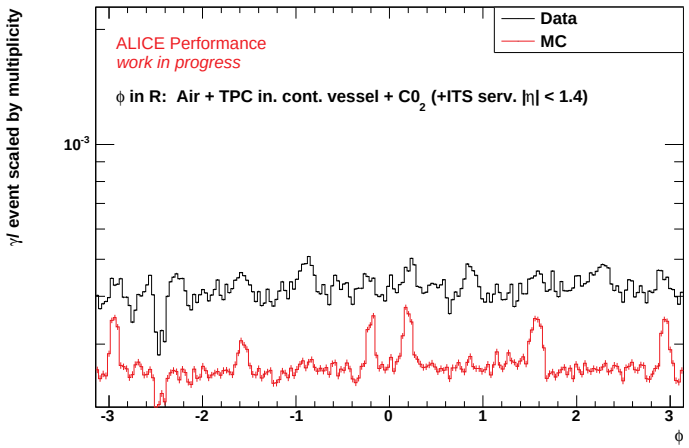


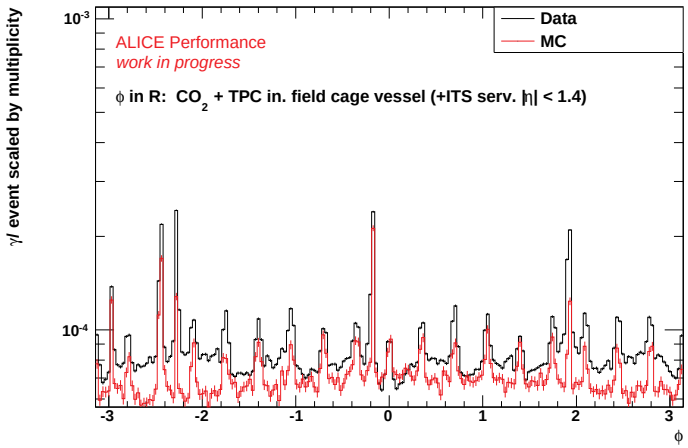


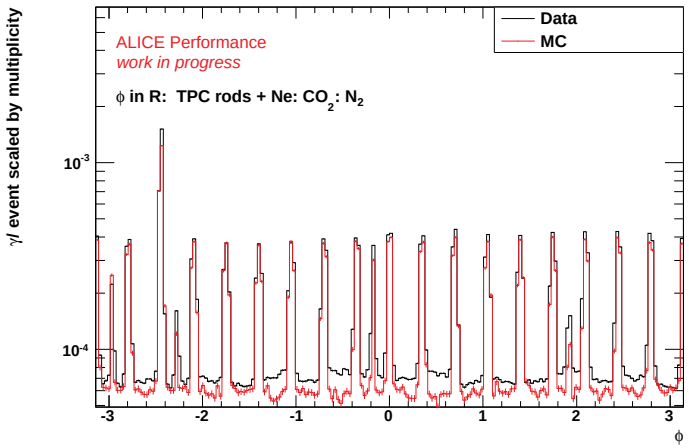


ITS + TPC ($|\eta| < 1.4$): ϕ- distribution at different R positions

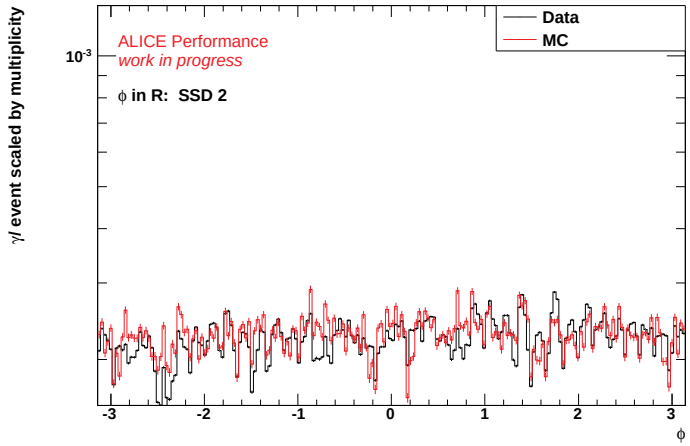




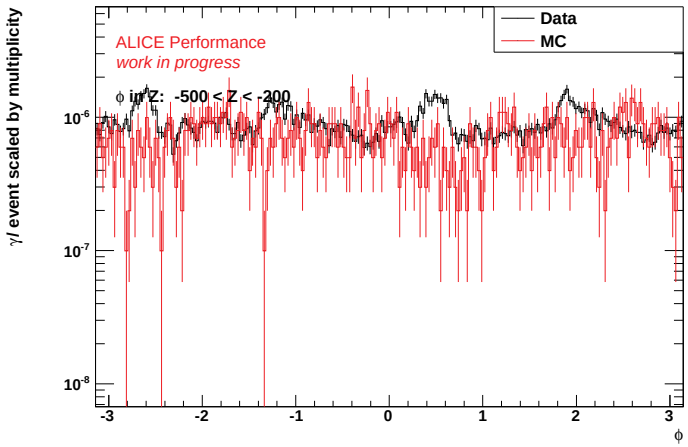


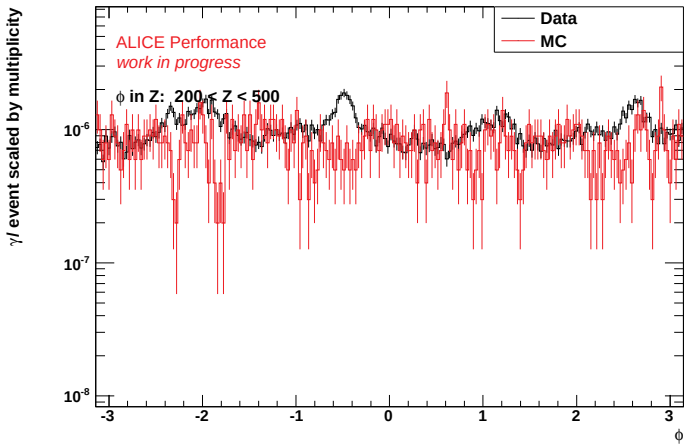


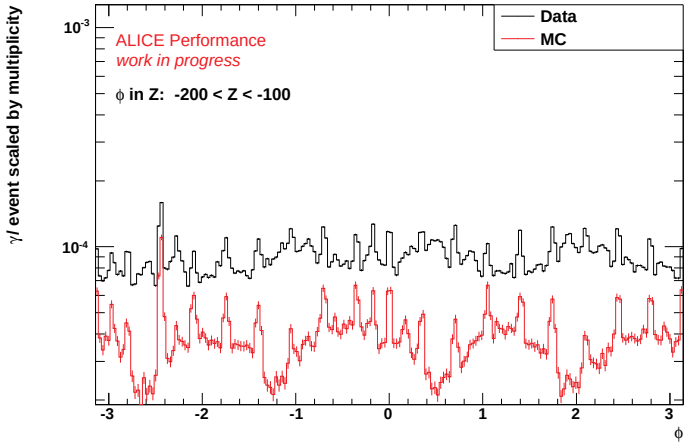
TPC ($|\eta| < 1.4$): ϕ- distribution at different R positions

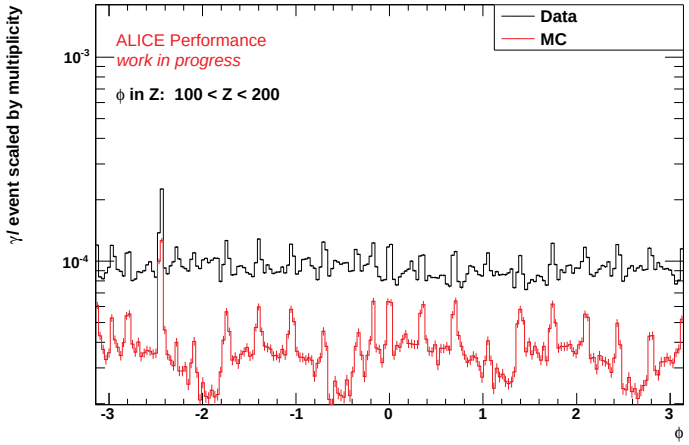


ϕ- distribution at different Z positions

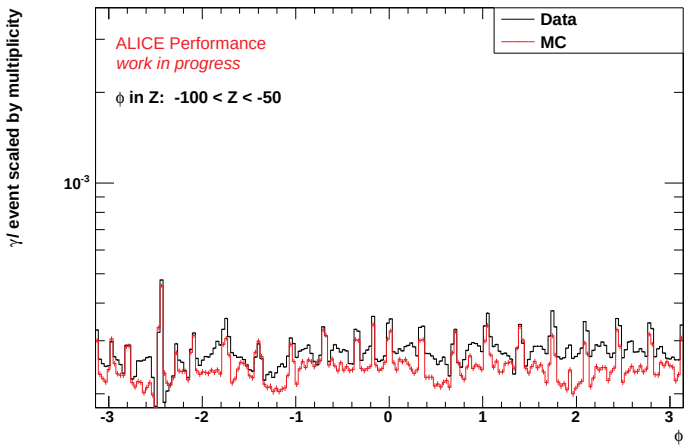


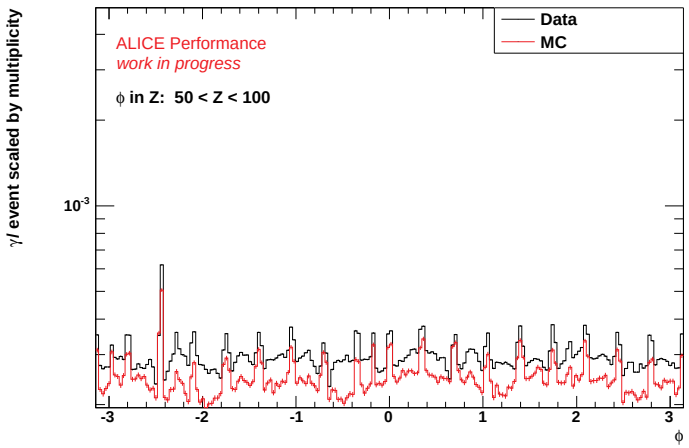


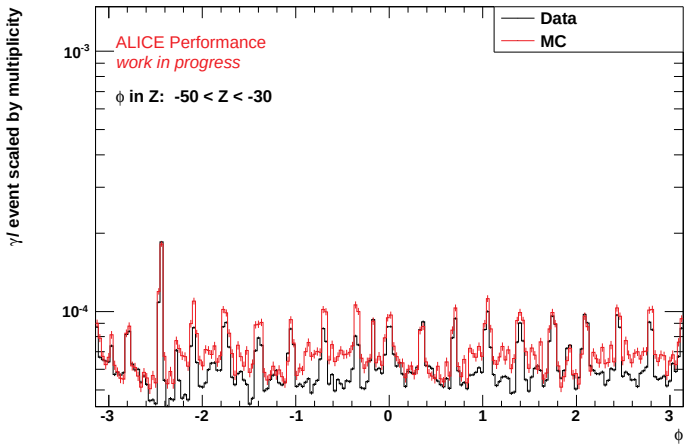


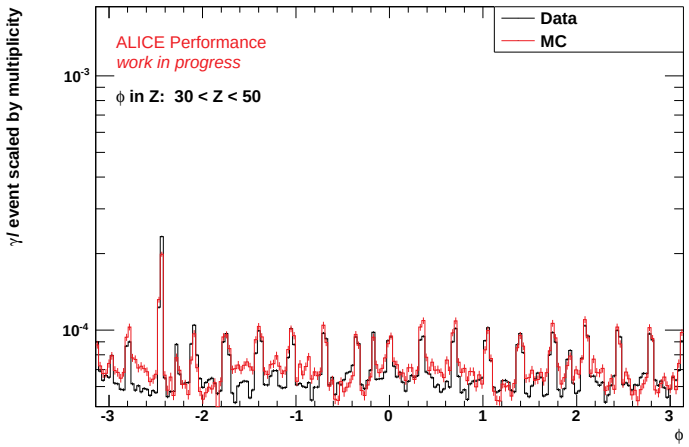


ϕ- distribution at different Z positions

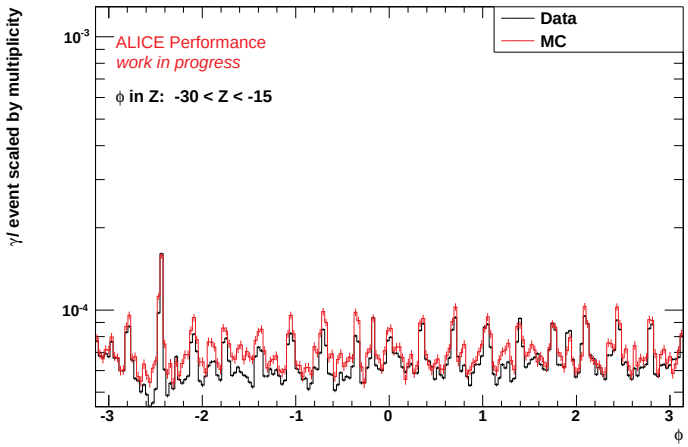


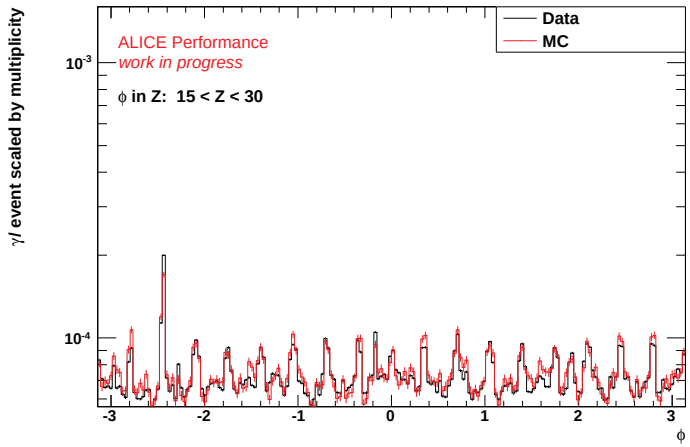


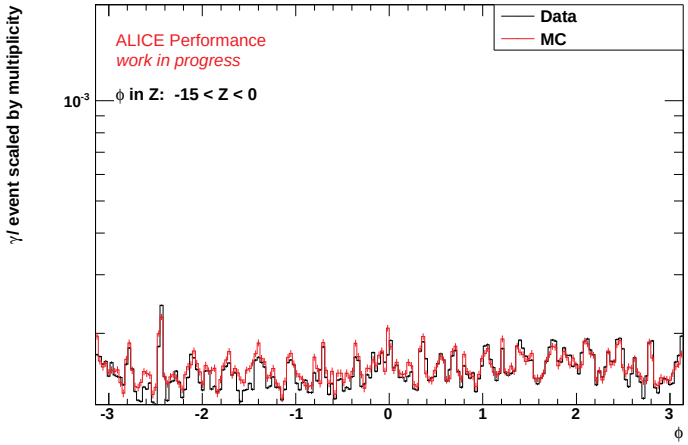


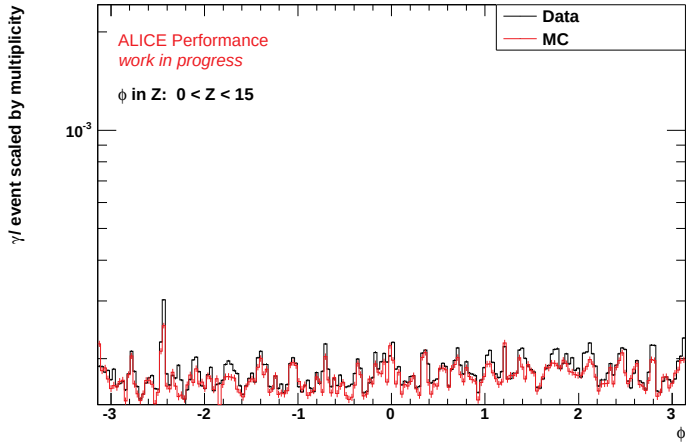


ϕ- distribution at different Z positions

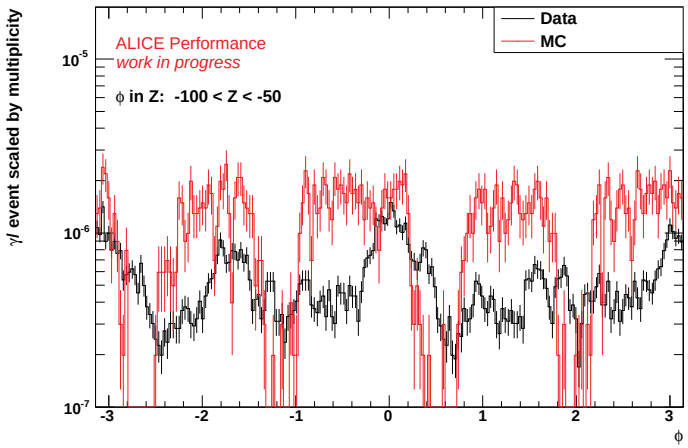


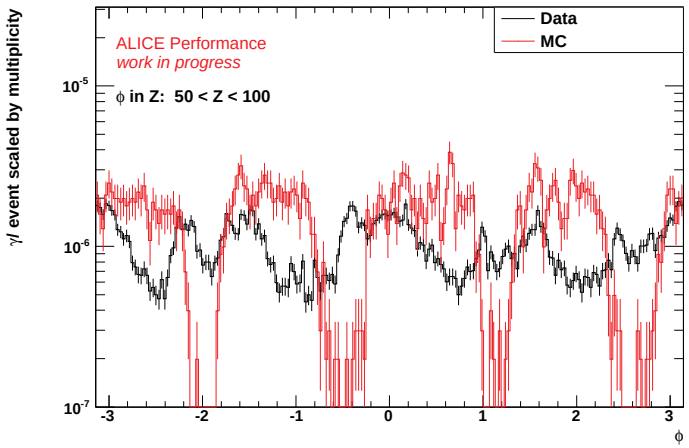


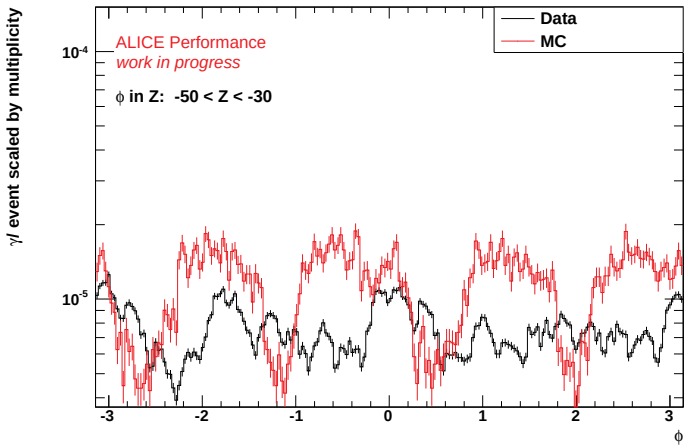


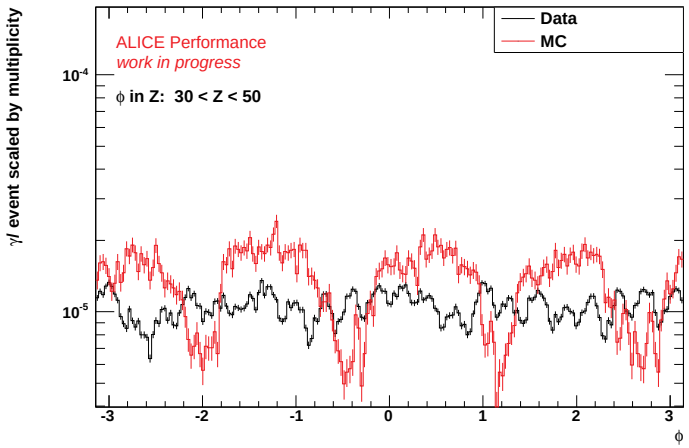


ϕ- distribution at different Z positions with R cut: $0 < R < 30cm$

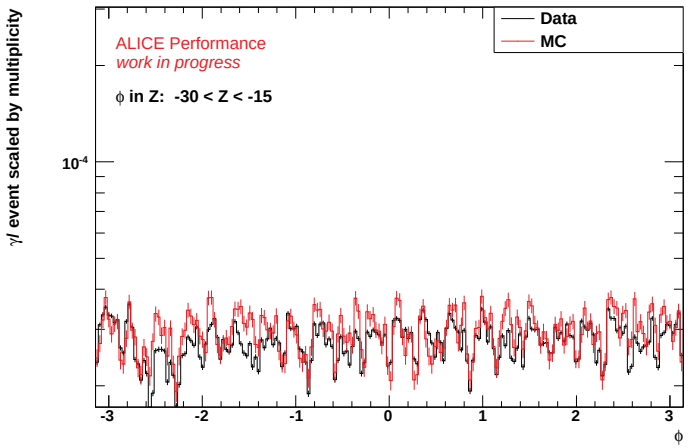


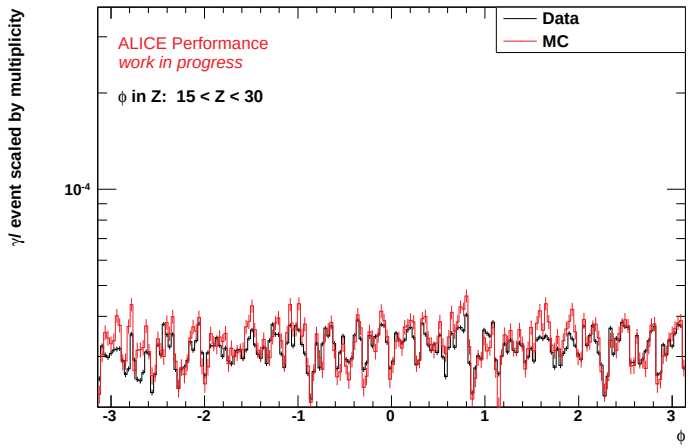


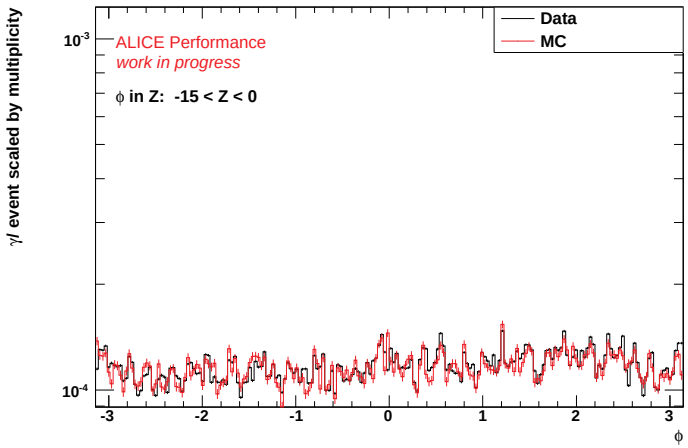


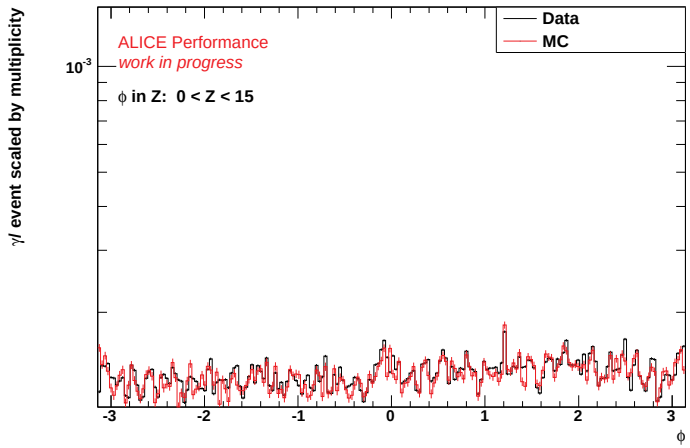


ϕ- distribution at different Z positions with R cut: $0 < R < 30cm$

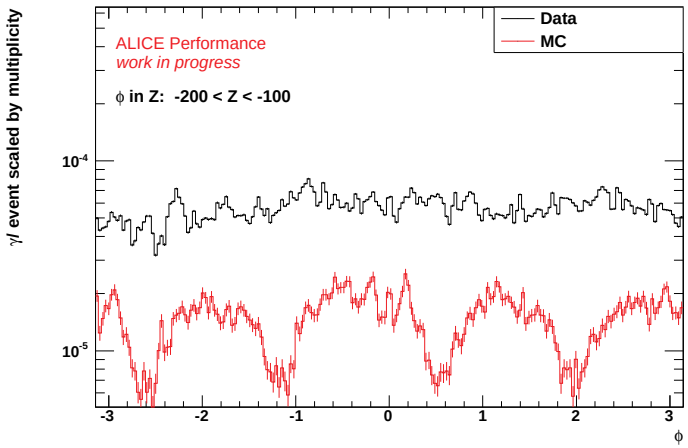


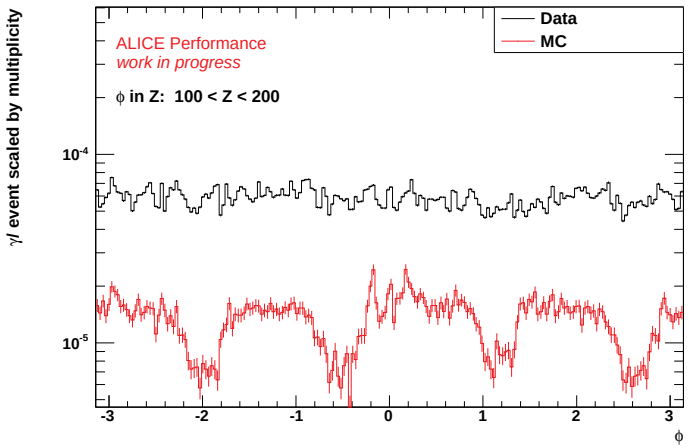


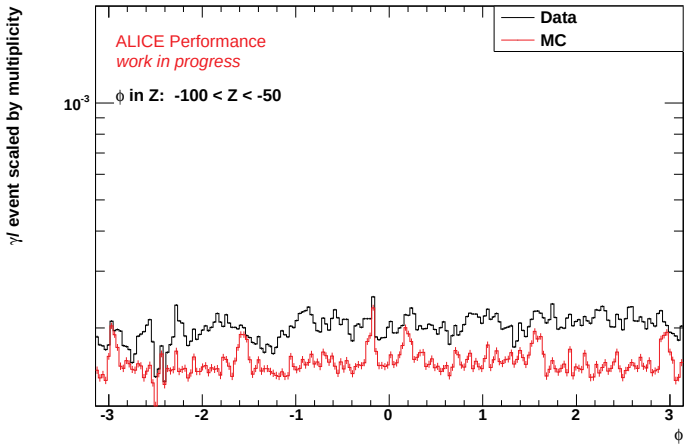


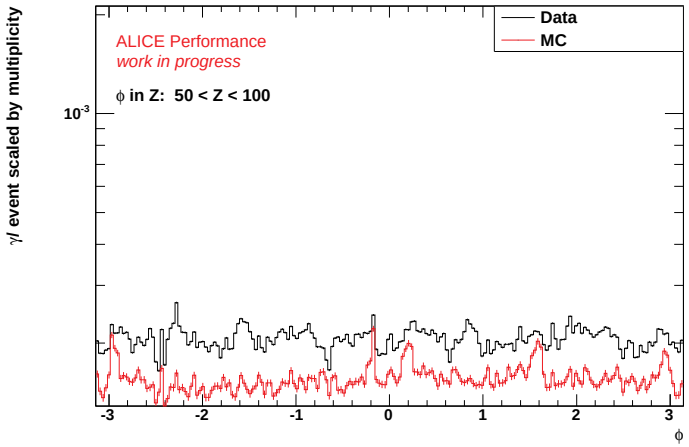


ϕ- distribution at different Z positions with R-cut: $50 < R < 80$ cm

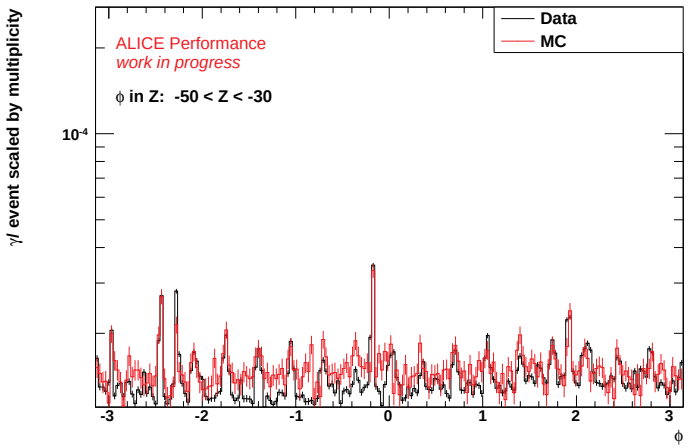


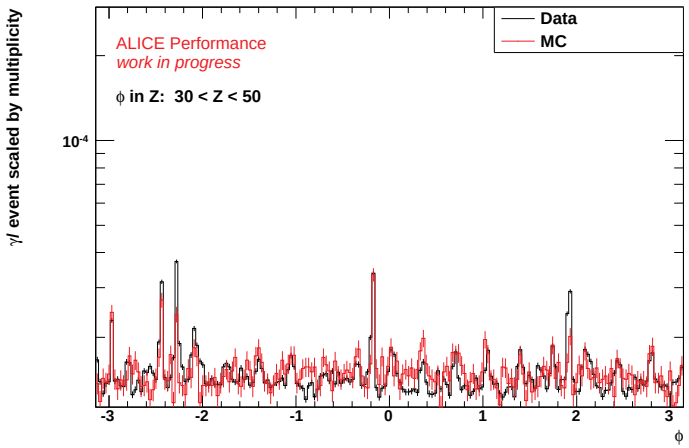


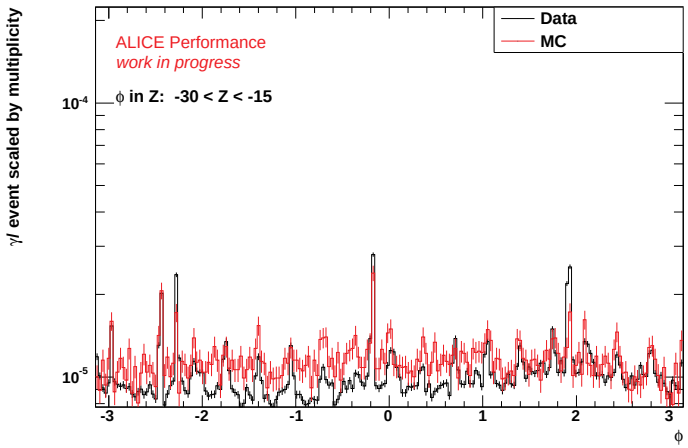


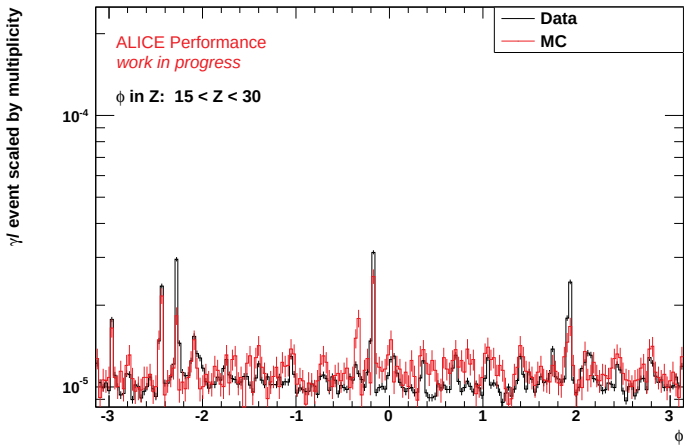


ϕ- distribution at different Z positions with R-cut: $50 < R < 80$ cm

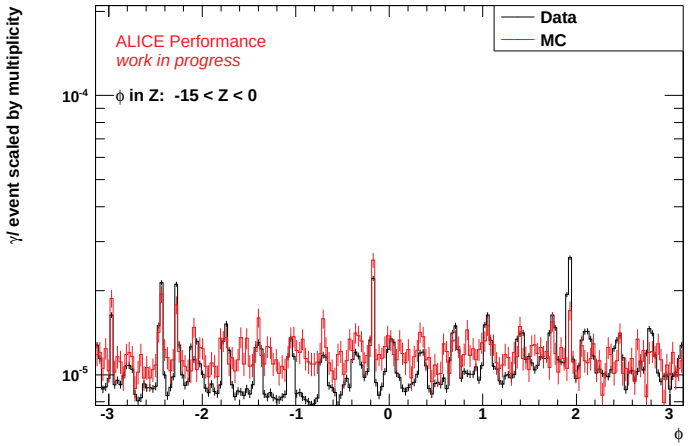


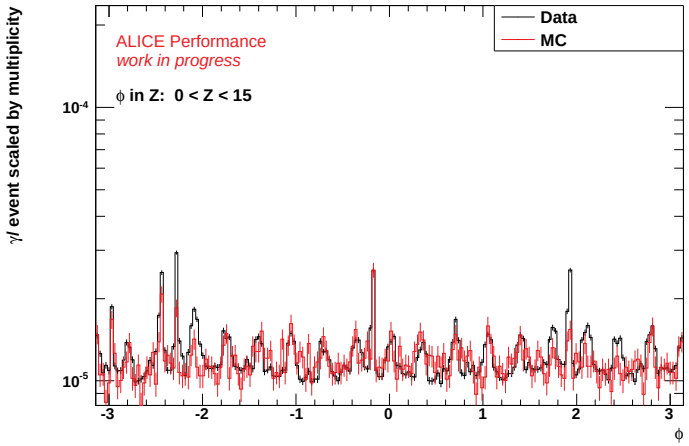




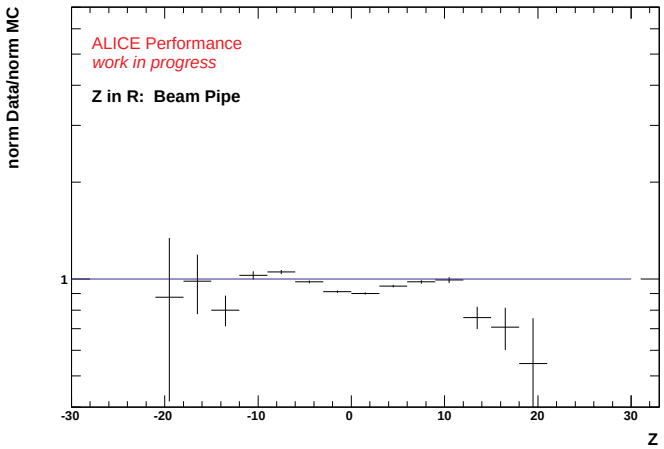


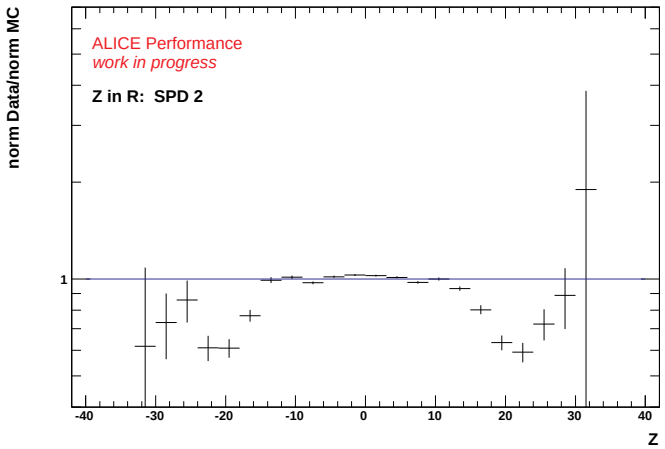
ϕ- distribution at different Z positions with R-cut: $50 < R < 80$ cm

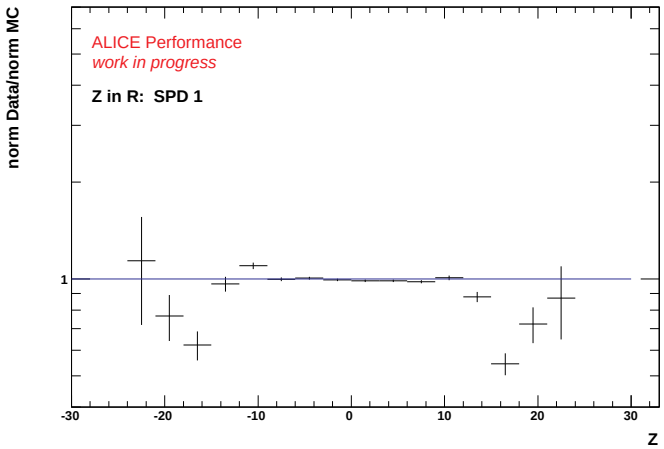


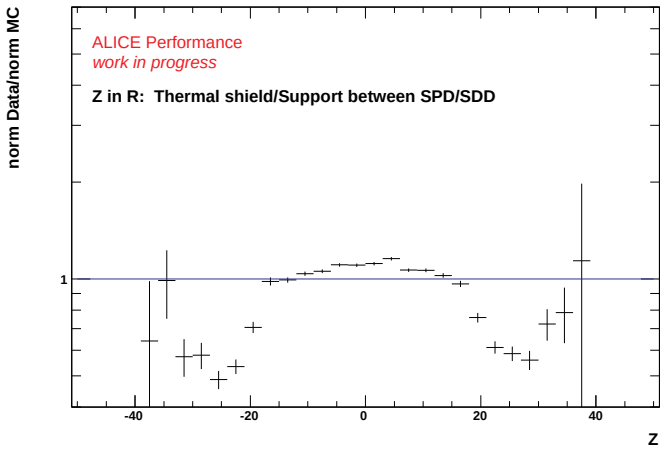


ITS ($|\eta| < 1.4$): Z- distribution at different R positions (Ratio Data/MC)

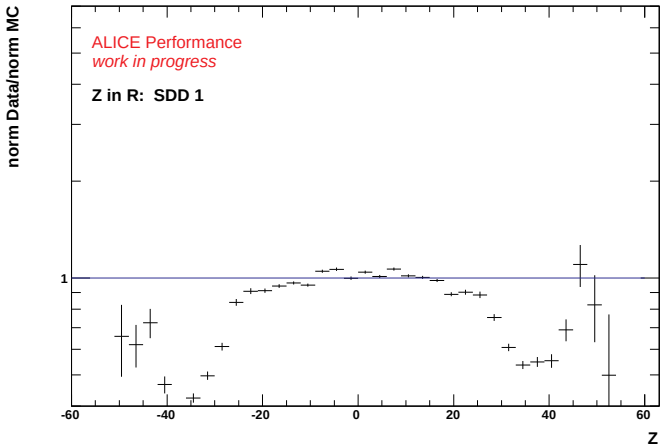


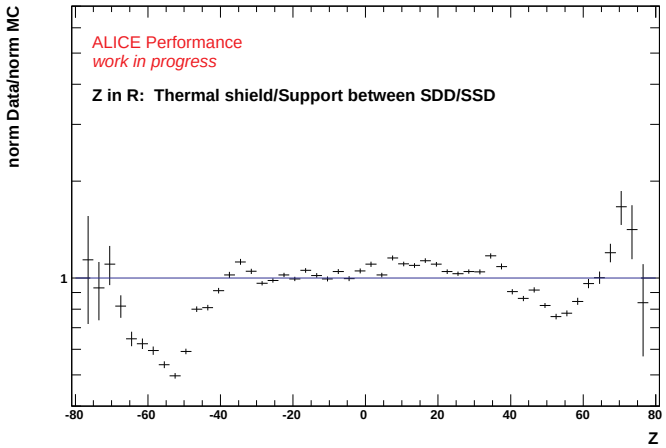


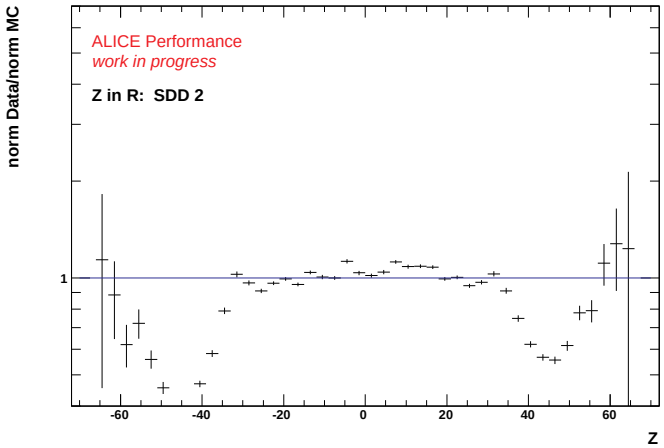


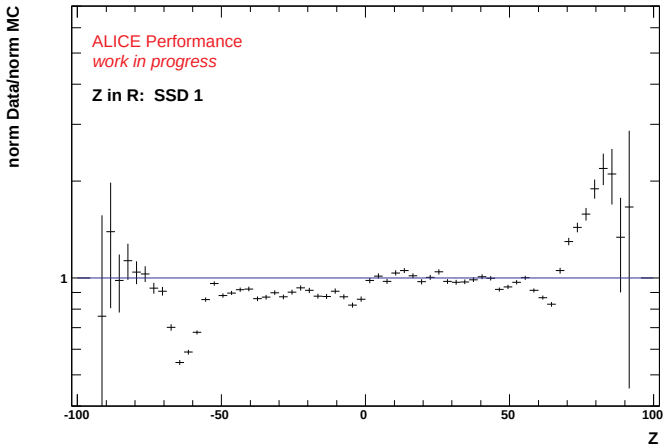


ITS ($|\eta| < 1.4$): Z- distribution at different R positions (Ratio Data/MC)

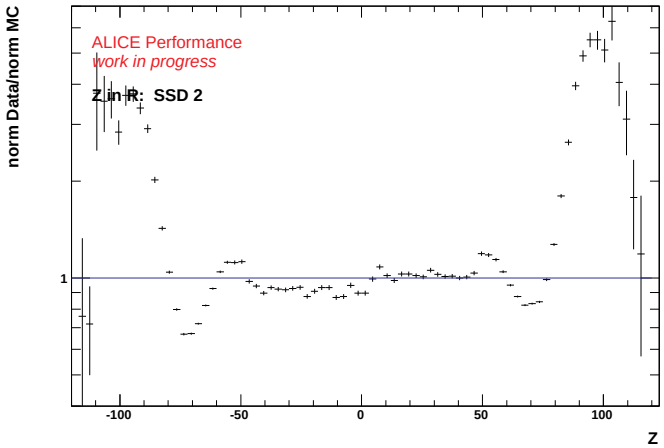


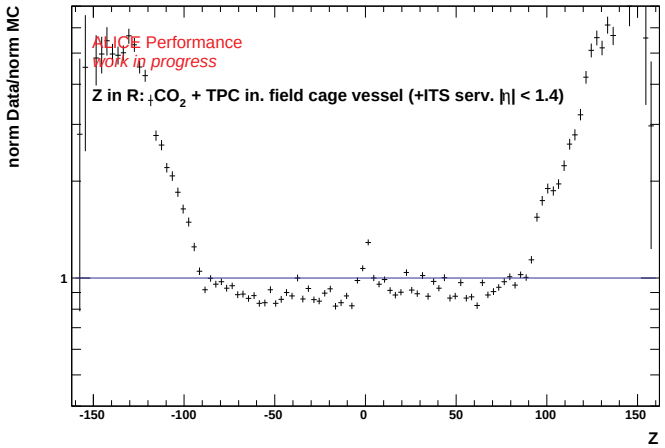


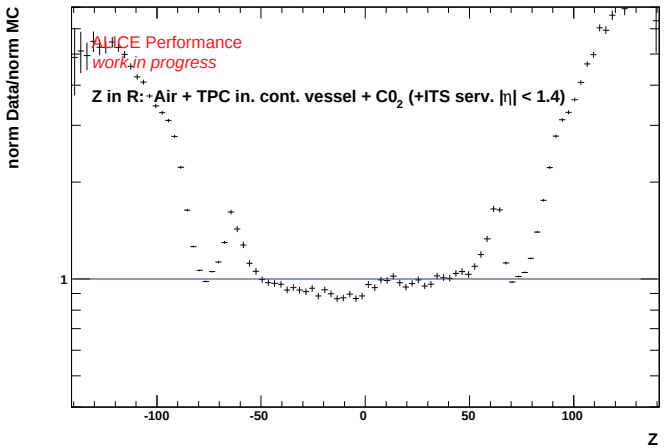


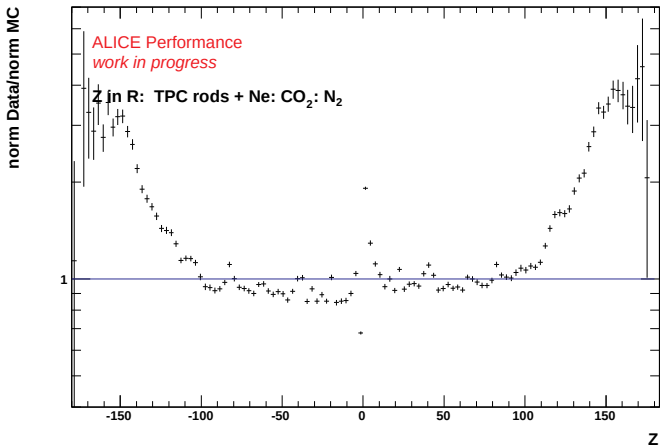


ITS +TPC ($|\eta| < 1.4$): Z- distribution at different R positions (Ratio Data/MC)

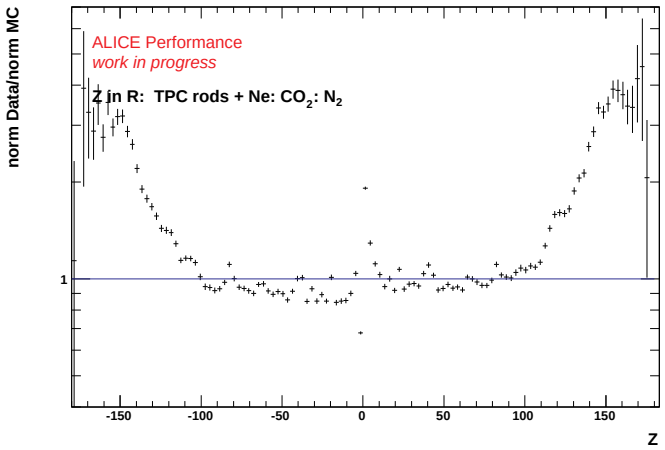




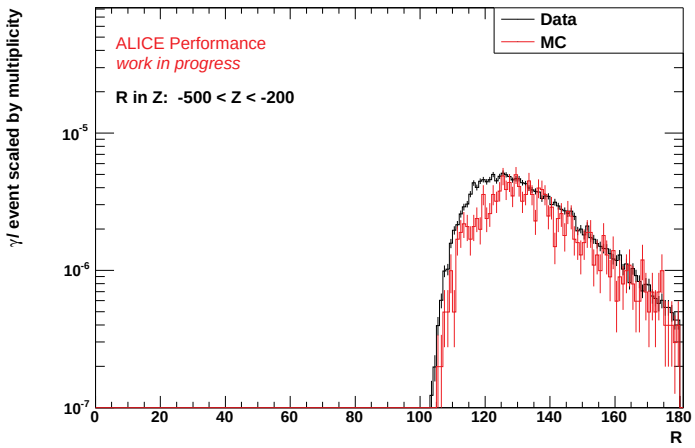


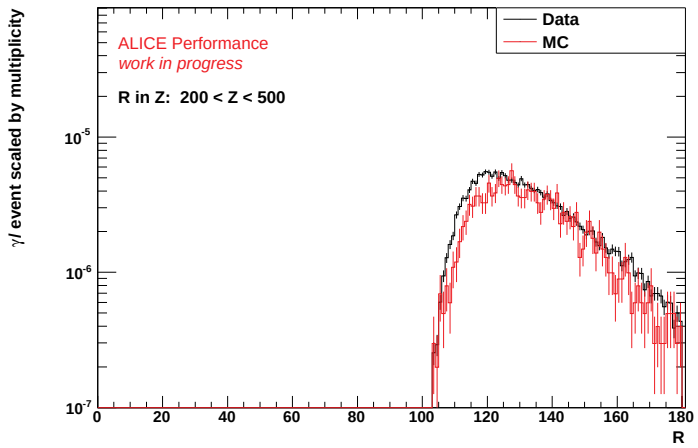


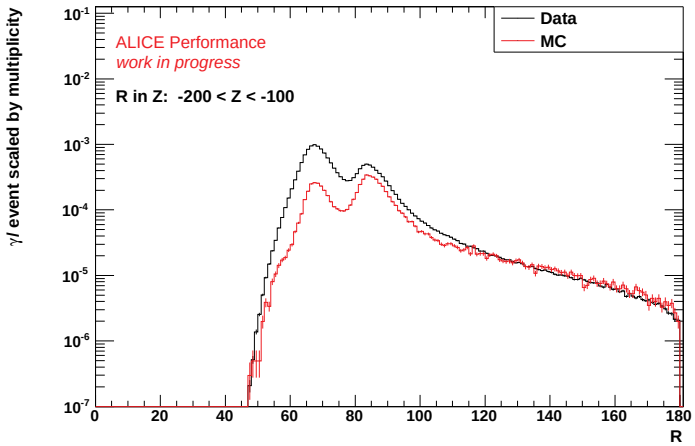
TPC ($|\eta| < 1.4$): Z- distribution at different R positions (Ratio Data/MC)

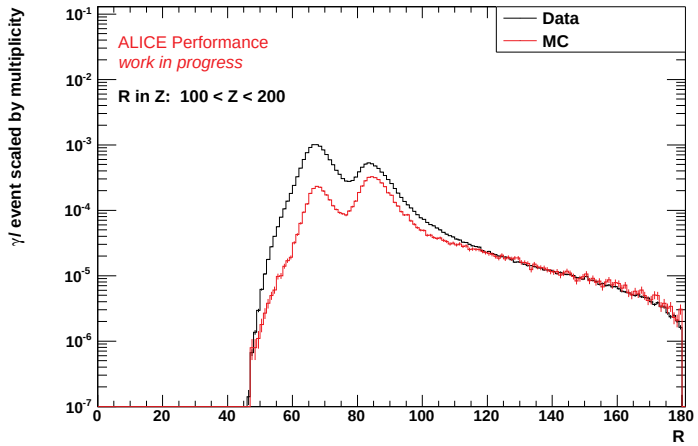


R- distribution at different Z positions

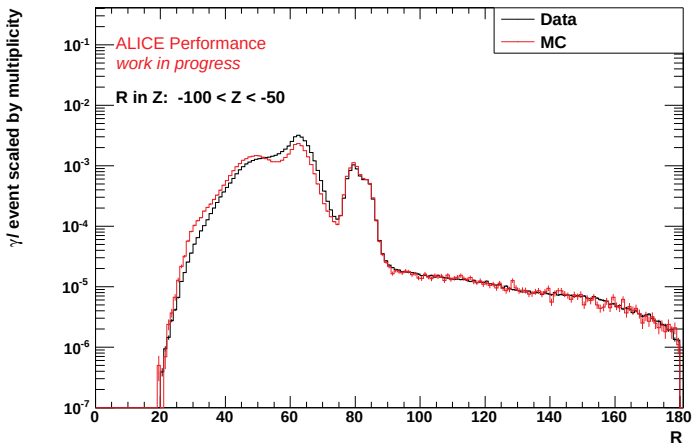


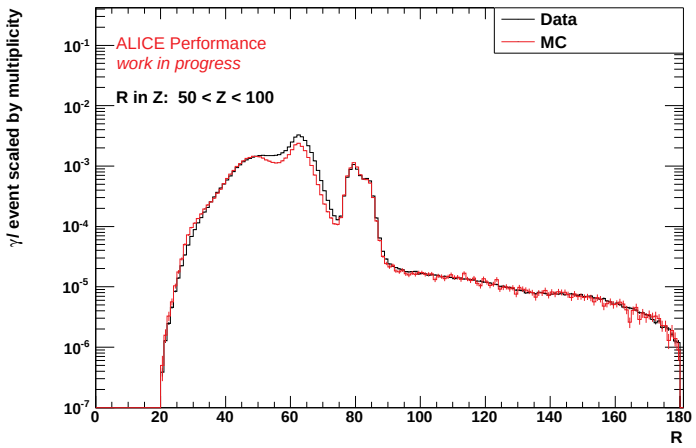


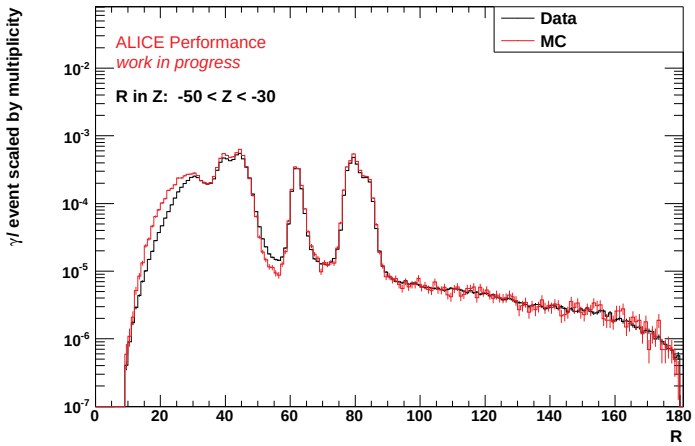


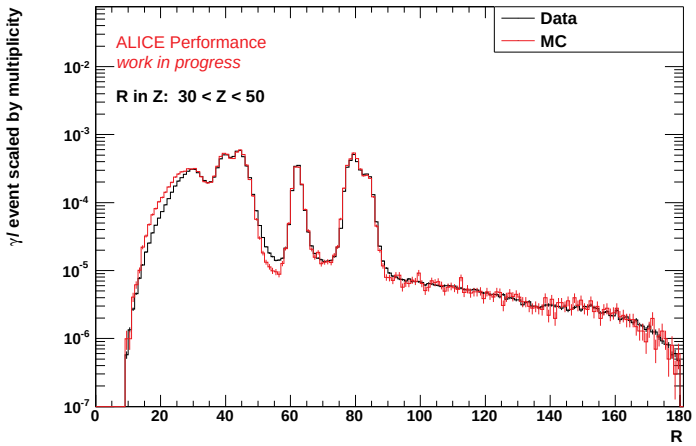
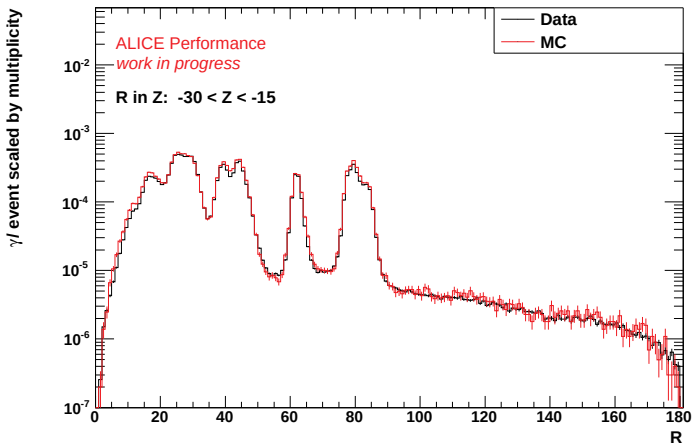
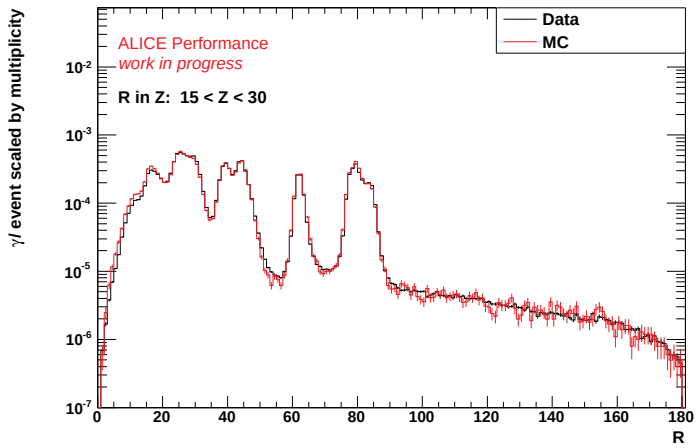
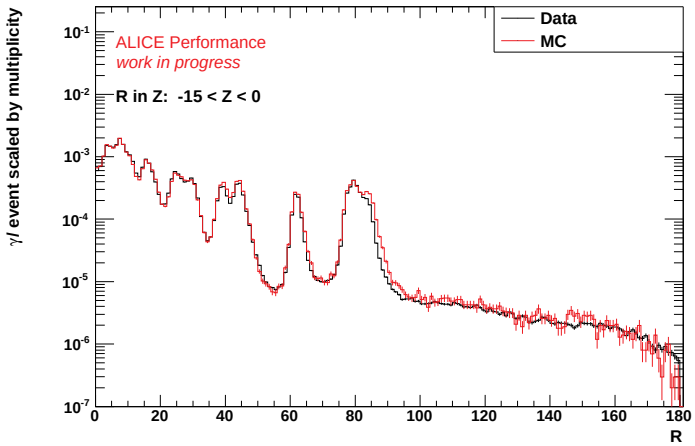
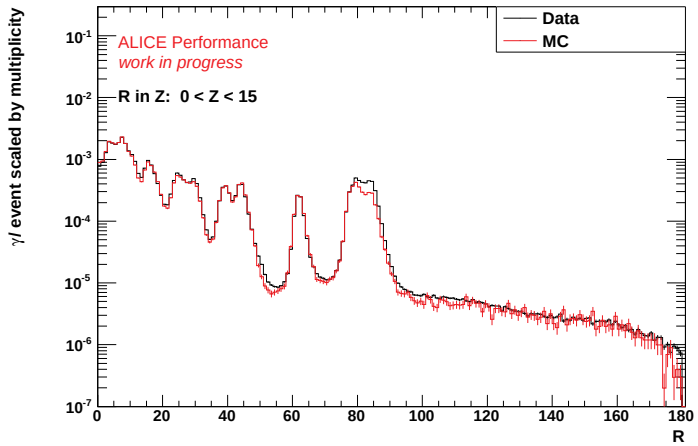


R- distribution at different Z positions









R- distribution at different Z positions