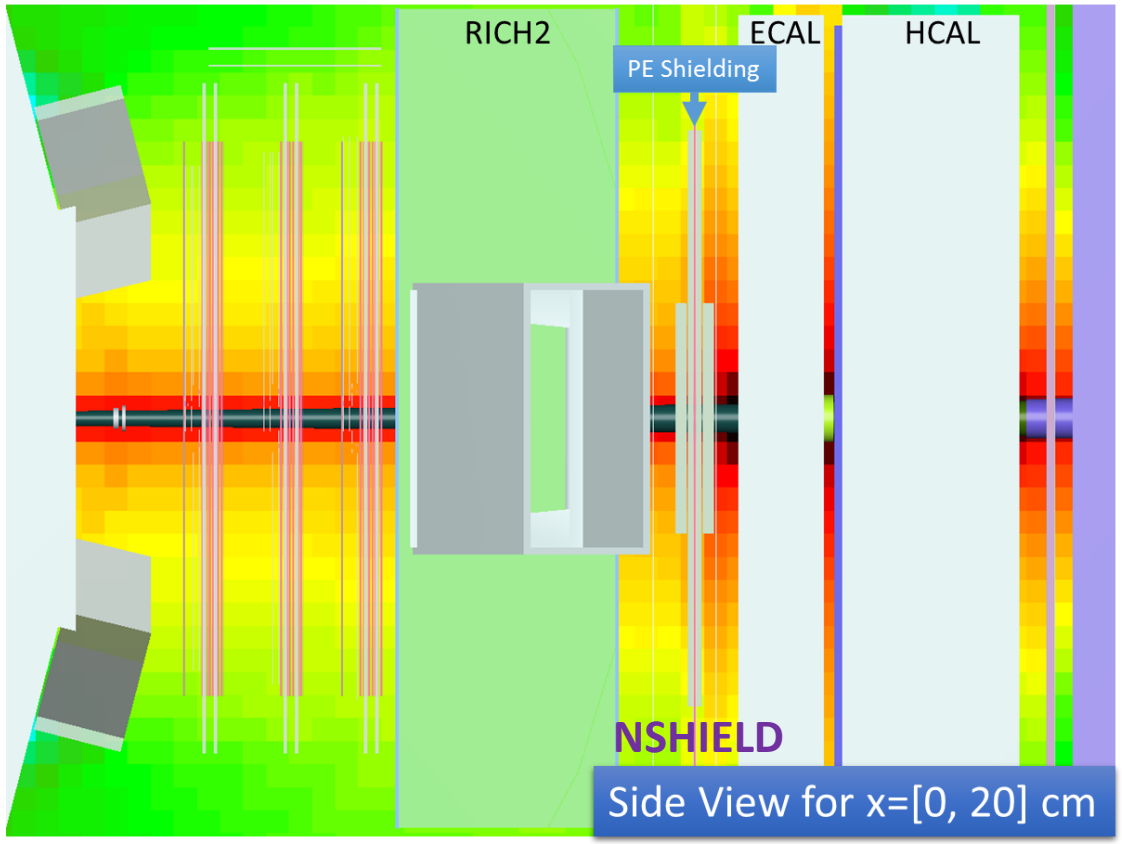
1 MeV (Si) neutron fluence equivalent values for the LHCb Phase 2 upgrade

The following slides contain the most recent plots for the 1 MeV neutron fluence equivalent in [cm^{-2}] inside the central ECAL modules for an expected integrated luminosity of 50 fb^{-1} at a collision energy of 14 TeV CM.

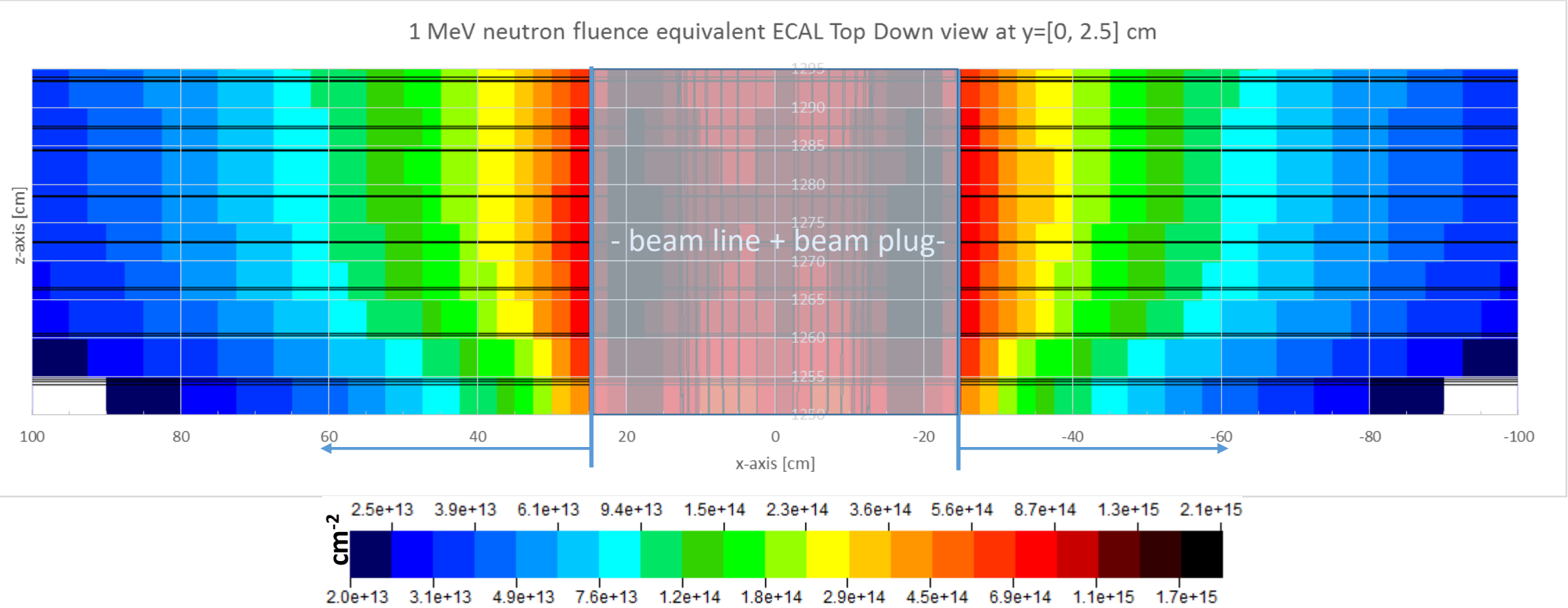
Please pick and choose what you need.

The following slides show information from more recent simulations (tagged **NSHIELD**), where PS/SPD and M1 are removed and instead a polyethylene neutron shielding with 30 cm thickness in the inner part is placed at the position of M1. These fluence values are scored with a binning of 2.5 x 2.5 x 5 cm in the central area around the beam line. In direct comparison with the **CURRENT** geometry, the values only rise slightly.

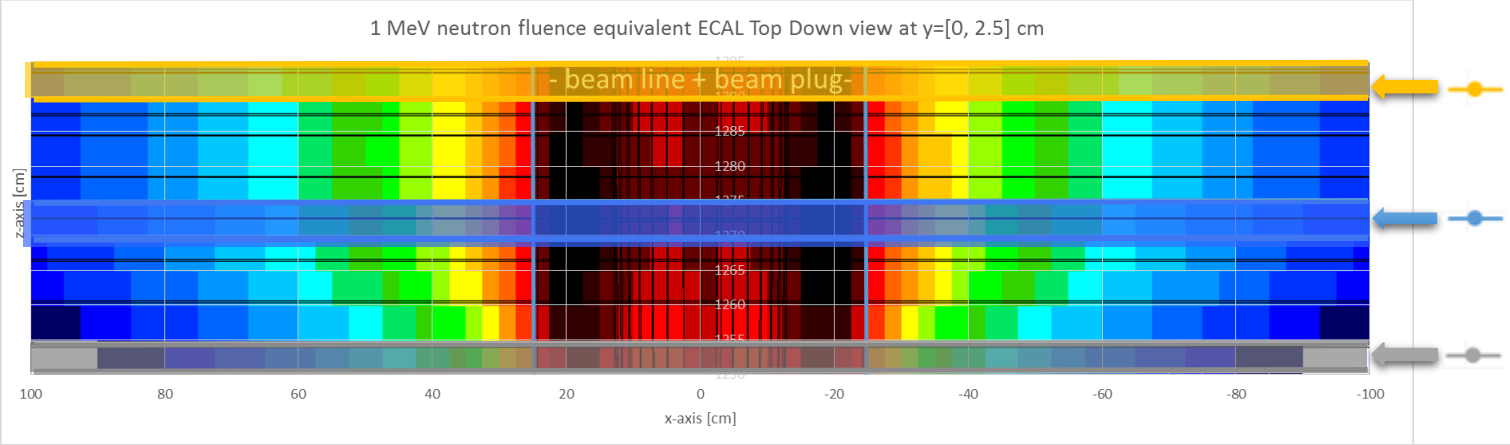


Values are given by scaling simulation results per pp collision to 50 fb^{-1}.
Applying a safety factor of 2 (at least) is strongly recommended.
In general simulation values are lower than measurements for Run1!

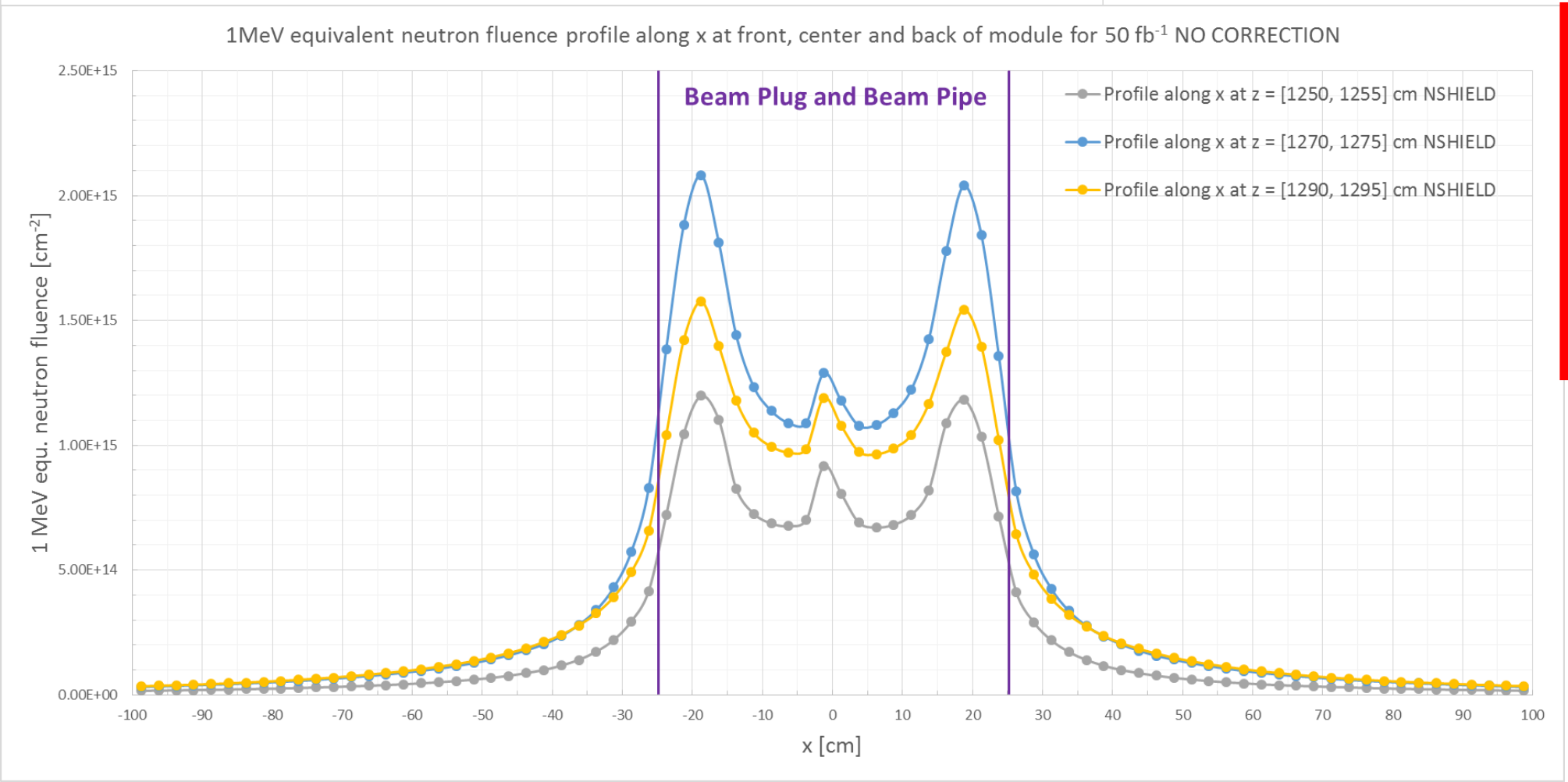
1 MeVne fluence NSHIELD Top Down slice y=[0, 2.5] cm (50 fb^{-1} at 14 TeV)



This top down view encompasses the ECAL thickness within z=[1250, 1295] cm. The corresponding values along x for front, maximum (inside) and back are shown in a profile plot in the next slide.

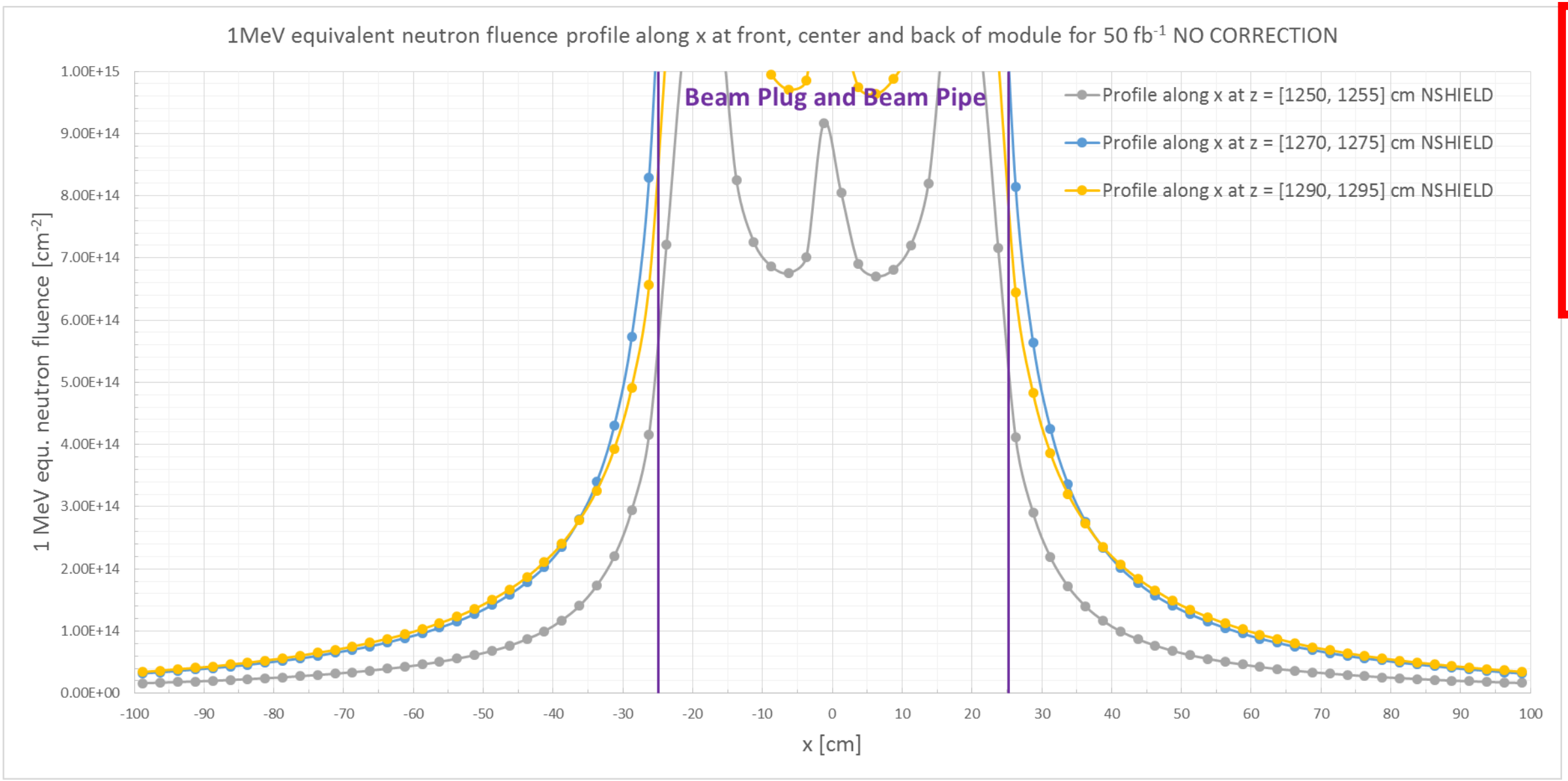


The expected maximum right at the edge of the plug at z = [1270, 1275] cm lies around **1.1E+15 cm^{-2}**.

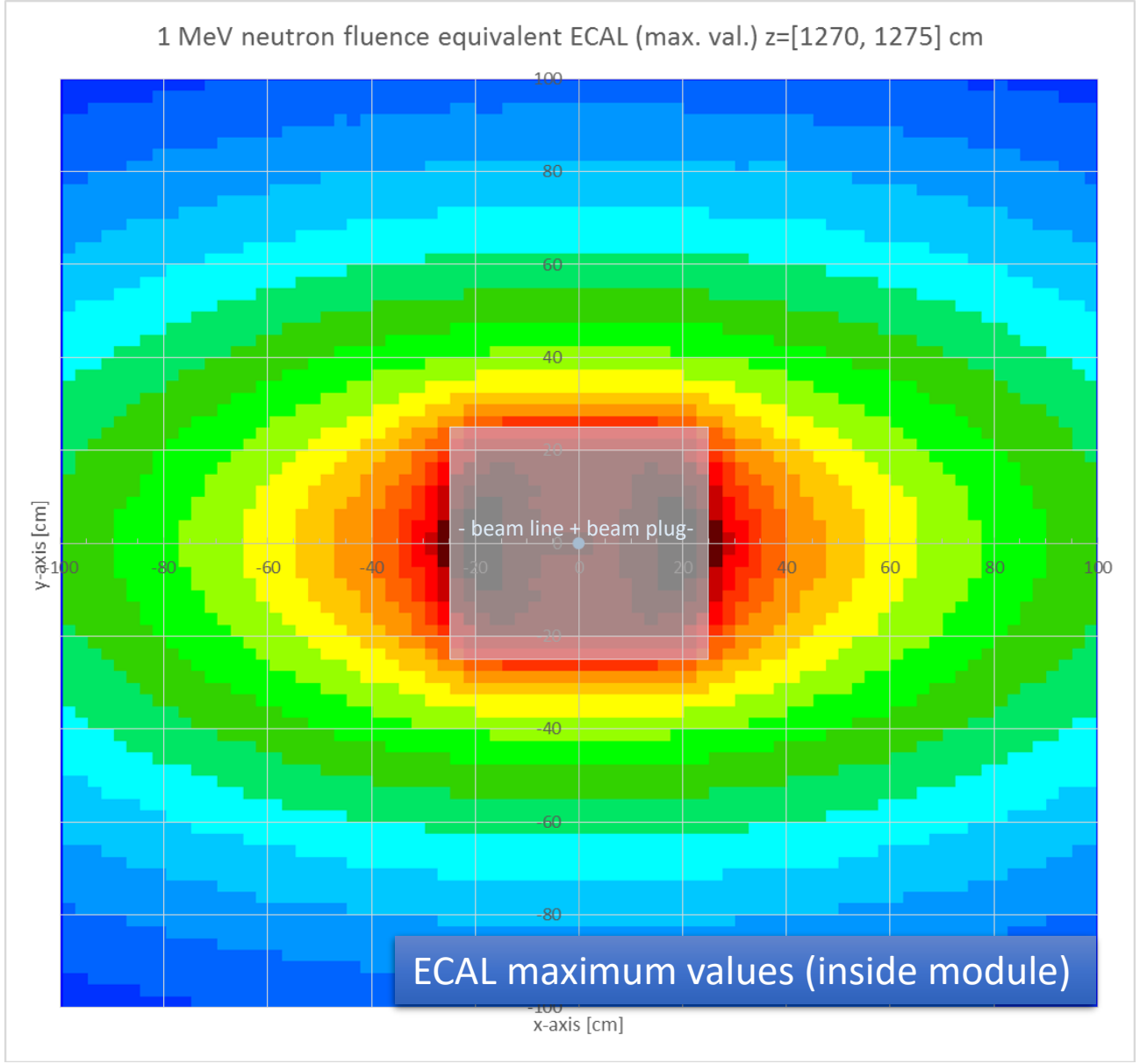


NO SAFETY FACTOR

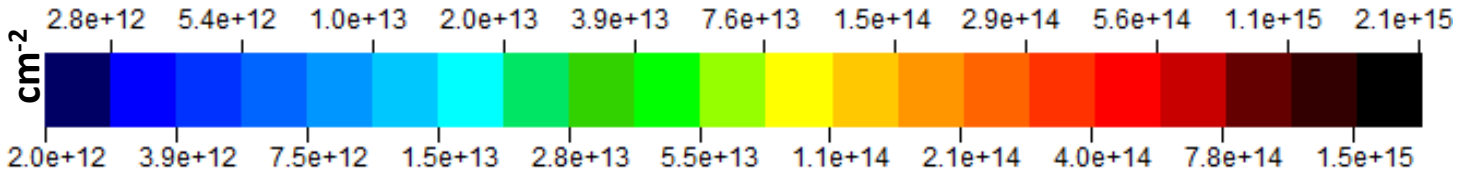
Zoomed version of profile plot in slide 4



NO SAFETY FACTOR



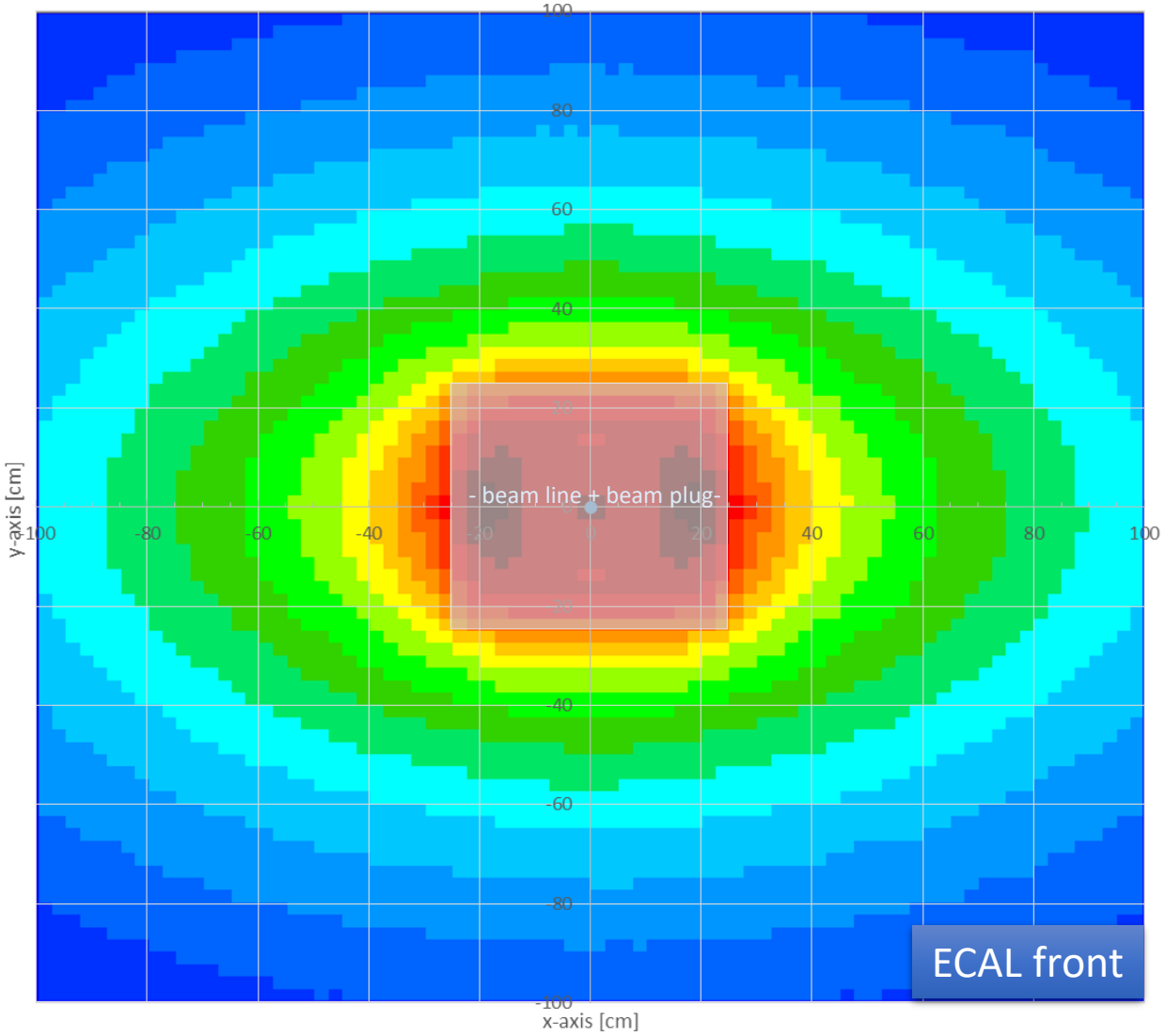
ECAL maximum values (inside module)



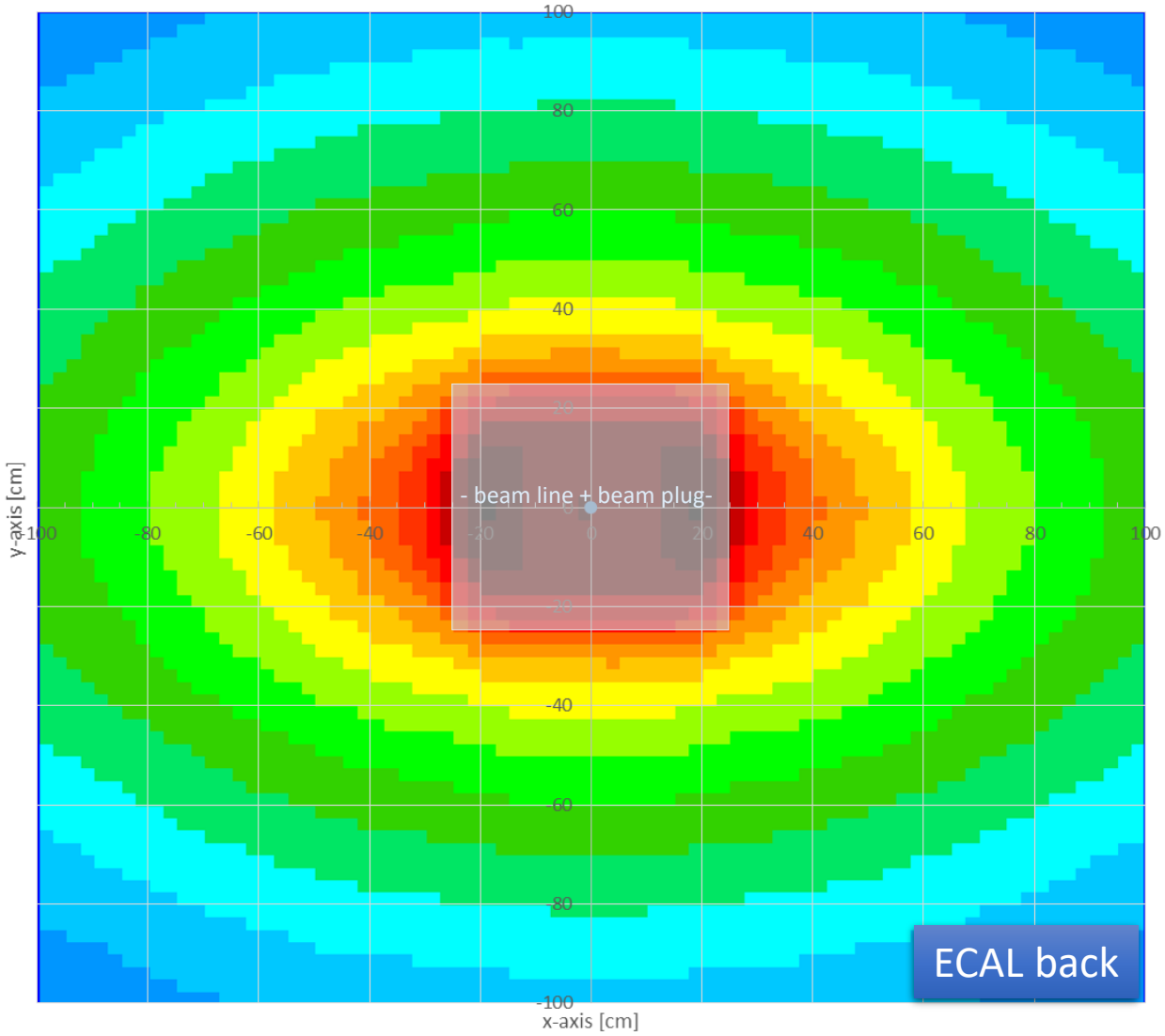
View of the distribution in the xy plane between z=[1270, 1275] cm from the back of the calorimeter, where the maximum fluence values are registered.

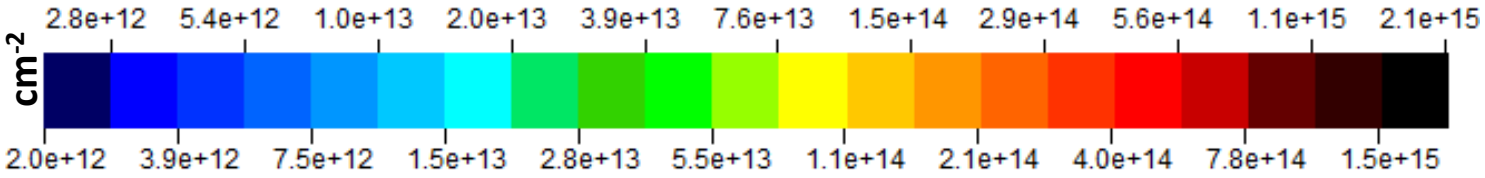
The beam plug extends to almost x=y=25 cm in the simulation.

1 MeV neutron fluence equivalent ECAL front z=[1250, 1255] cm

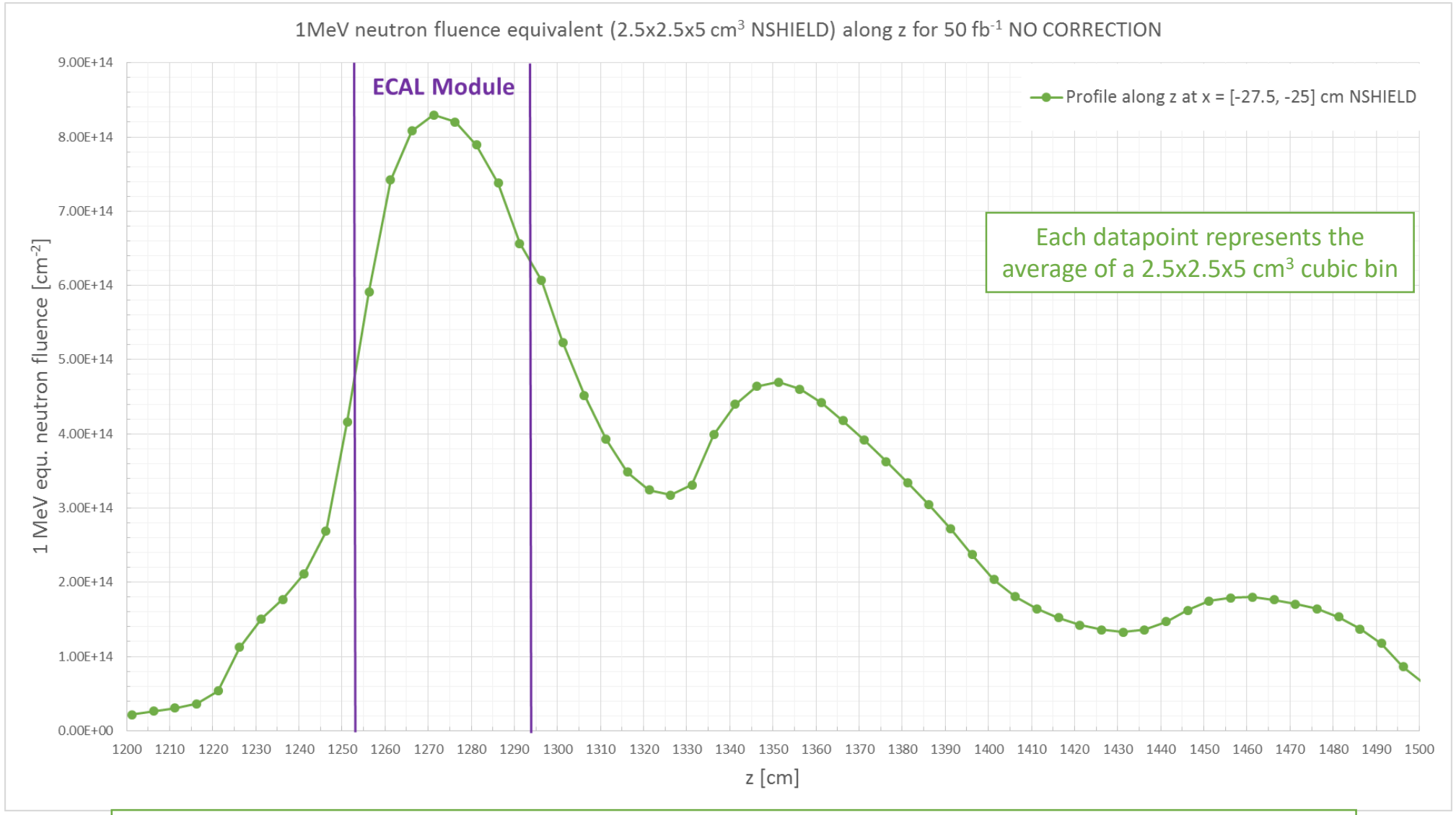


1 MeV neutron fluence equivalent ECAL back z=[1290, 1295] cm





1 MeVne fluence profile along z within y=[0, 2.5] cm (50 fb^{-1} at 14 TeV)

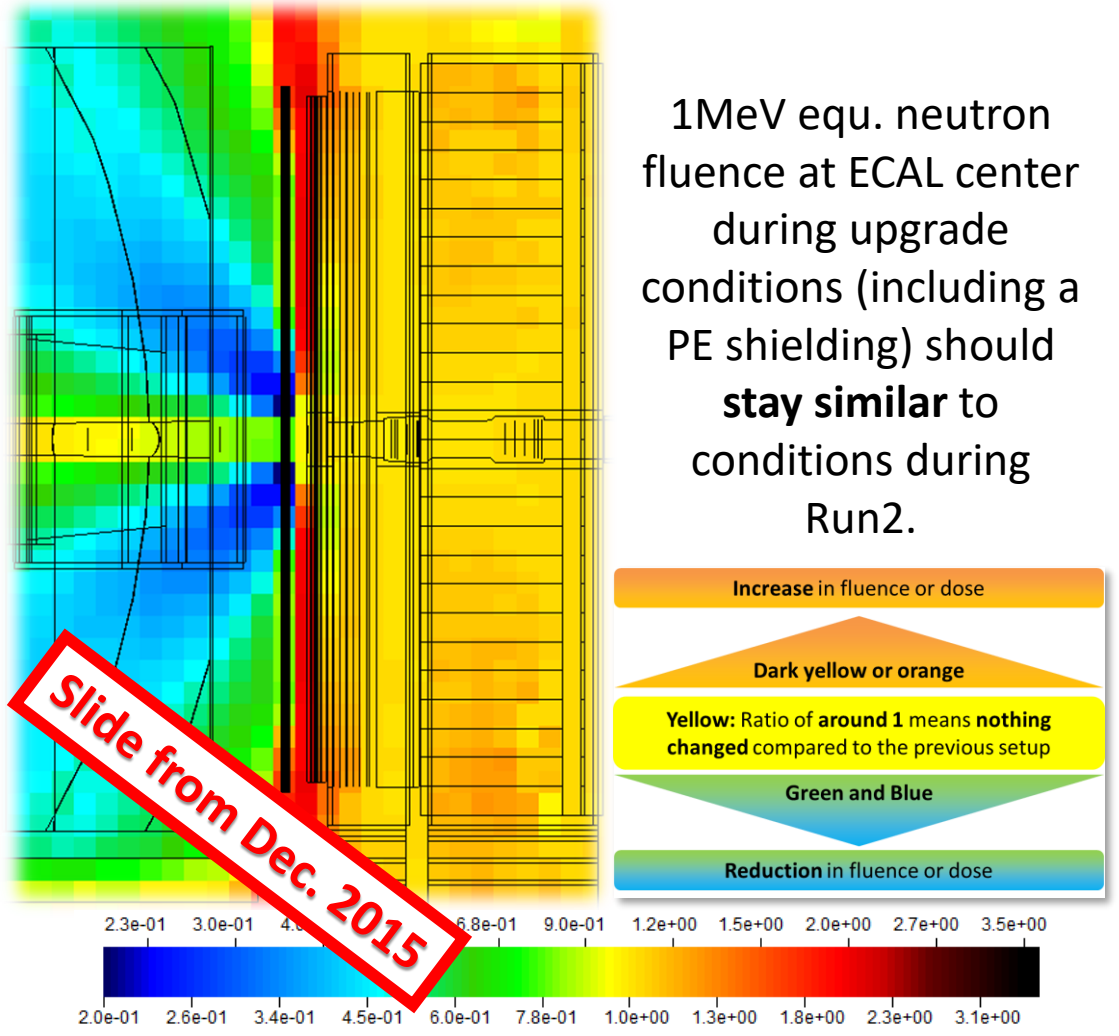


The curve represents the closest binning to the beam plug, between x=[-27.5, -25] cm

Comparisons with the current geometry

1 MeV equivalent (Si) neutron fluence values for the upgrade

Ratio Full Shielding vs. CURRENT (PS+Pb+SPD+M1)



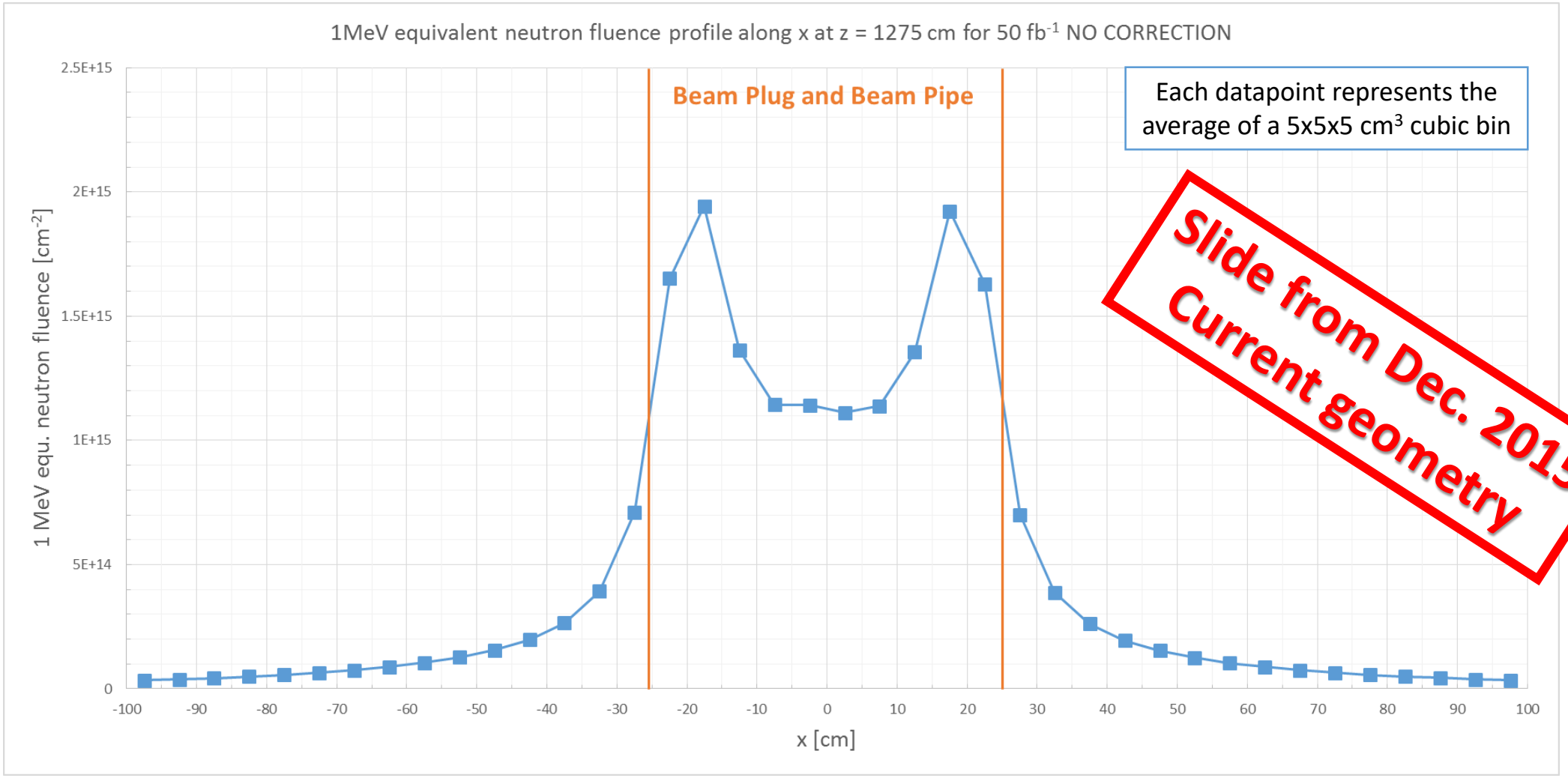
1MeV equ. neutron fluence at ECAL center during upgrade conditions (including a PE shielding) should **stay similar** to conditions during Run2.

From last year:

Based on old simulations and dedicated studies for the SciFi, no significant differences are expected in the ECAL for the 1 MeV neutron fluence equivalent values in Run3 vs. Run2 geometry.

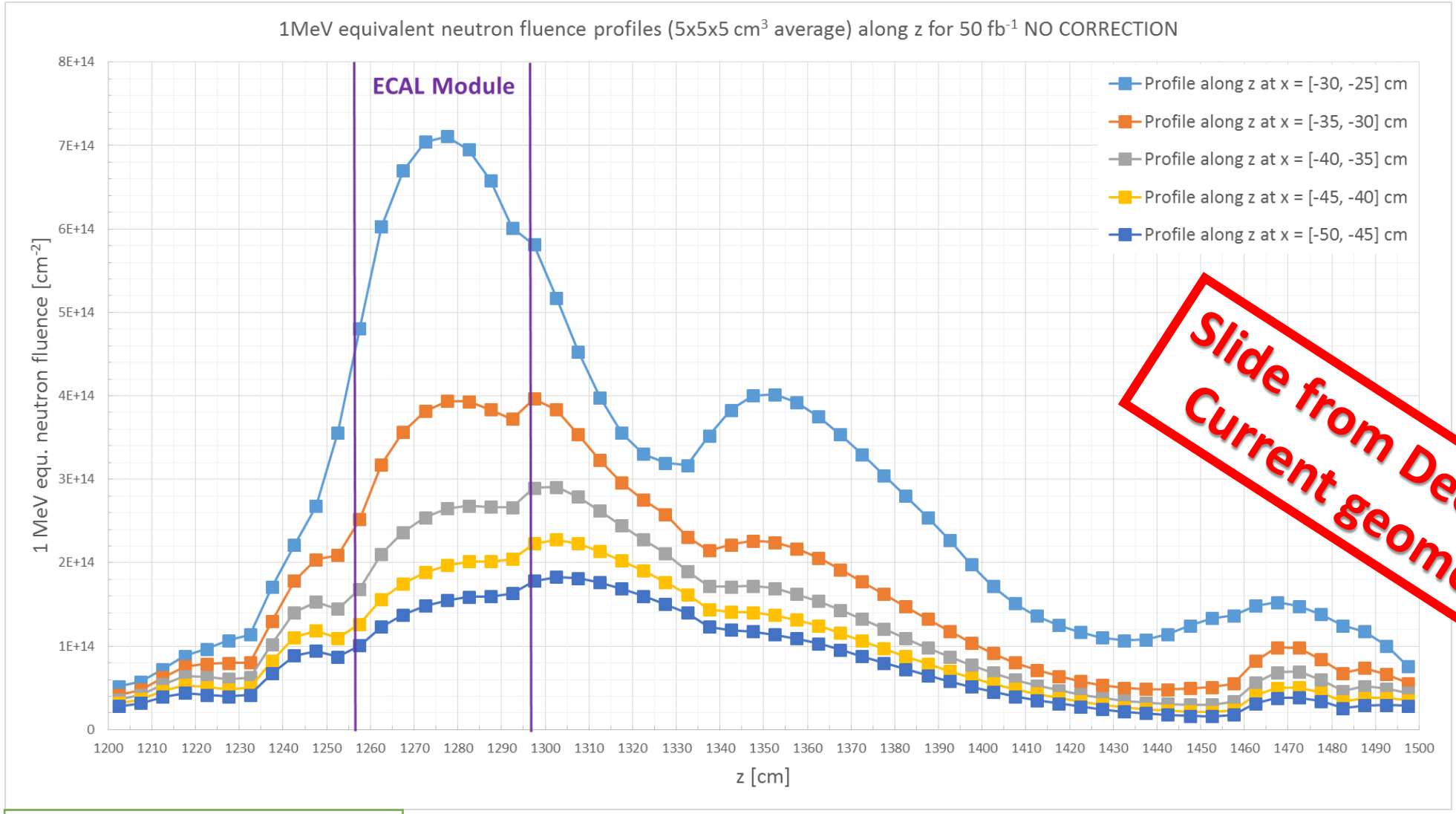
https://indico.cern.ch/event/465383/contributions/1142265/attachments/1200351/1759322/CALO_upgrade_central_regionv2.pdf

1 MeVne fluence profile along x for the upgrade (50 fb^{-1} at 14 TeV)



In contrast to dose values, the 1 MeV equivalent fluence increases inside the lead beam plug (orange bars). The expected maximum right at the edge of the plug at z = [1275, 1280] cm is around **1E+15 cm^{-2}**.

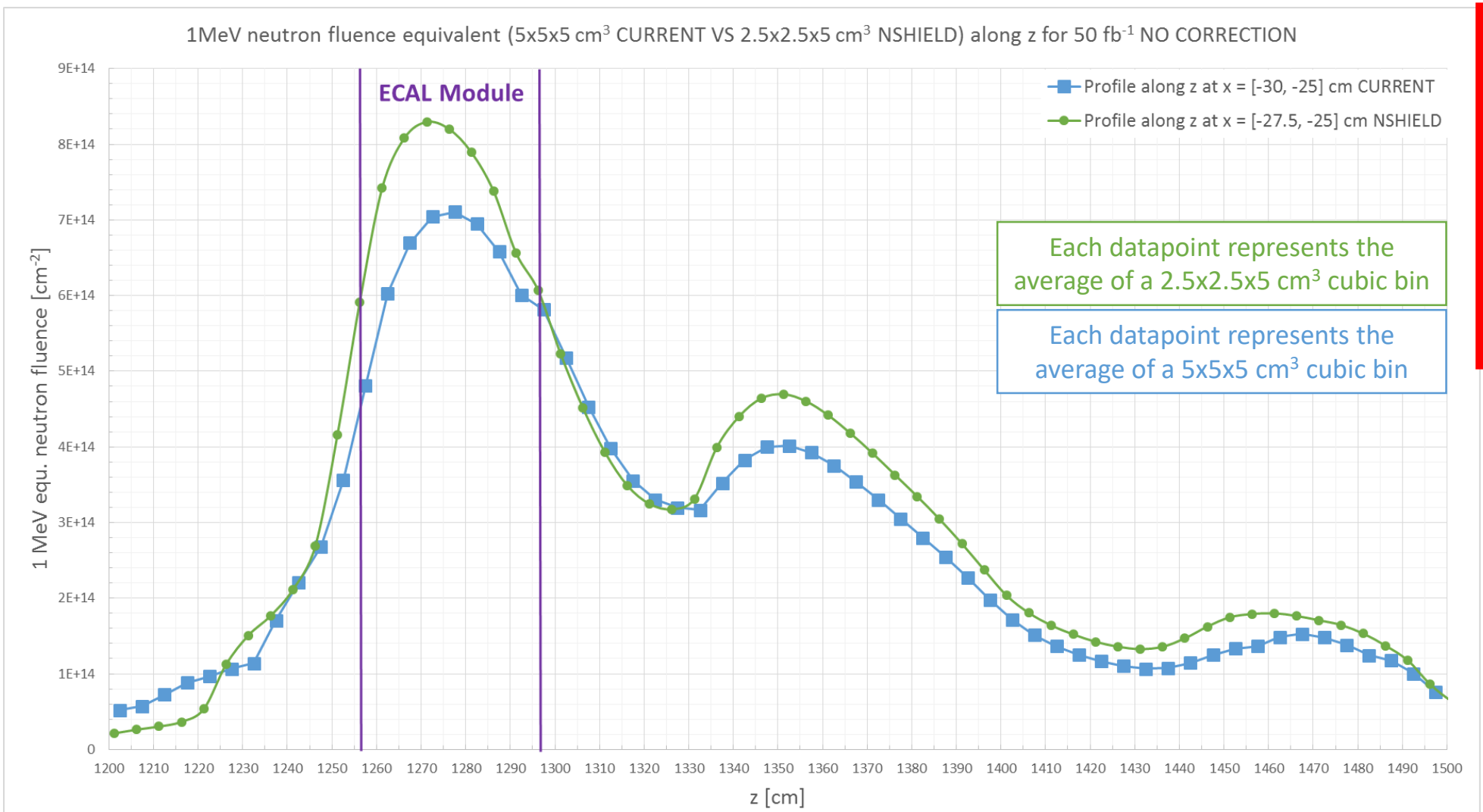
1 MeVne fluence profiles along z for the upgrade (50 fb^{-1} at 14 TeV)



Slide from Dec. 2015
Current geometry

Each datapoint represents the average of a 5x5x5 cm^3 cubic bin

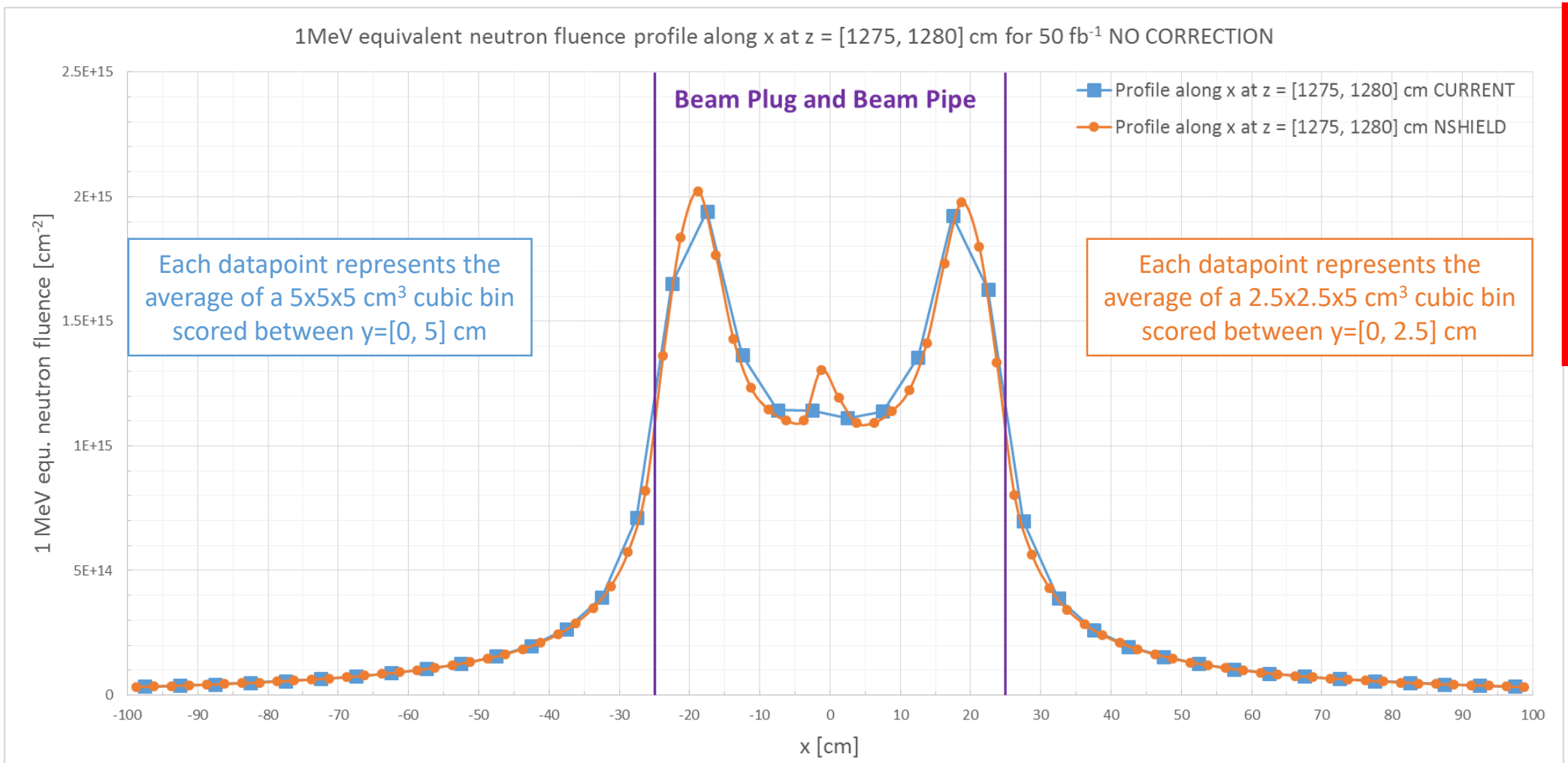
1 MeVne fluence profiles along z CURRENT v. NSHIELD (50 fb^{-1} at 14 TeV)



NO SAFETY FACTOR

At the edge of the beam plug, the fluence increases mostly because of the smaller binning (2.5 cm in x and y compared to 5 cm for the current geometry, z bins are both 5 cm). The peak slightly shifts towards z=1270 cm due to missing subdetectors.

1 MeVne fluence profile along x CURRENT v. NSHIELD (50 fb^{-1} at 14 TeV)



NO SAFETY FACTOR

The small peak in the new curve left of the center is likely due to the collision point being slightly shifted from 0. The peak itself is more pronounced because of the smaller bin size. In general both geometry scenarios agree well.