



Engineering Department

LAGUNA/LBNO WP4: secondary beam line status report

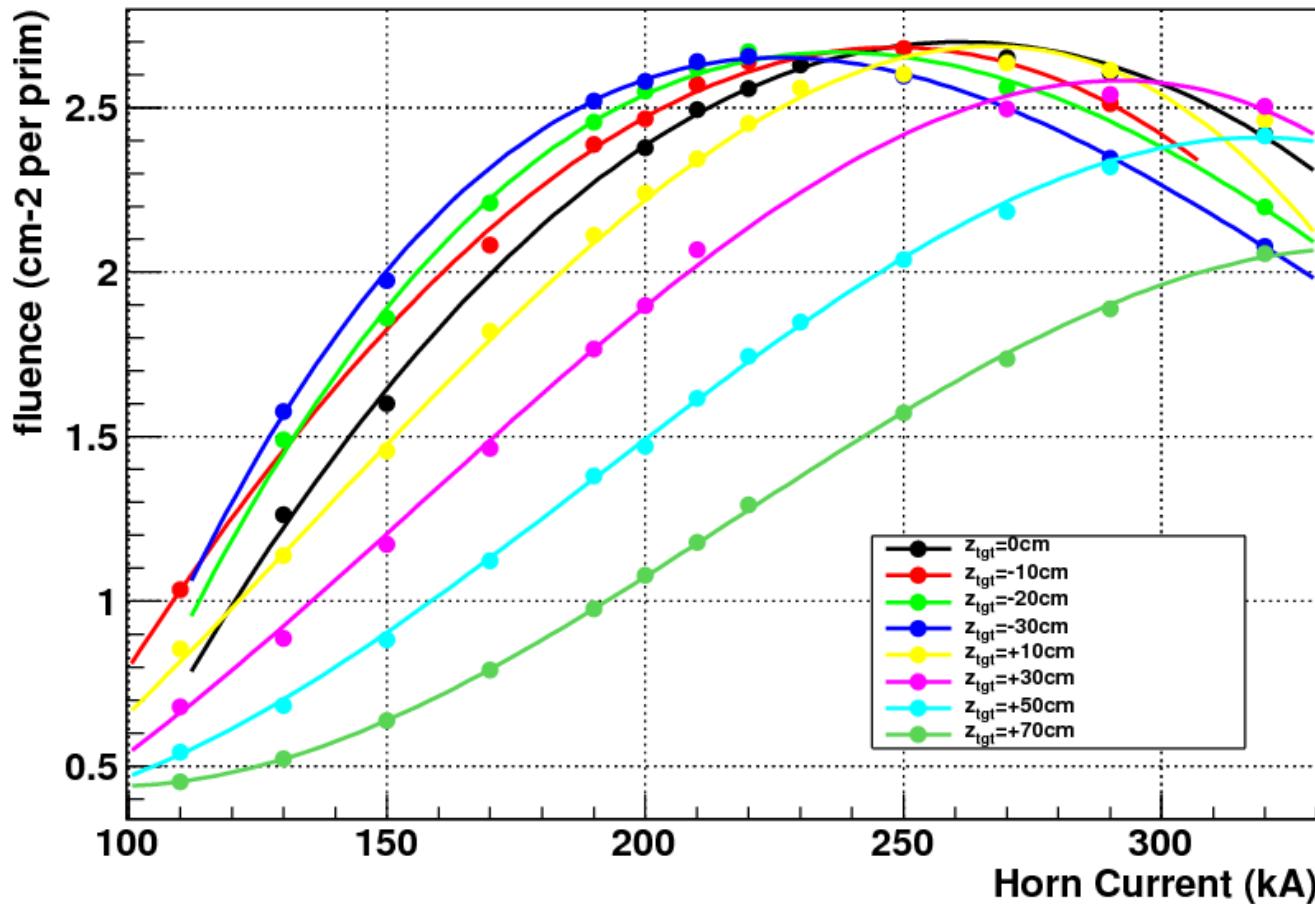
LAGUNA/LBNO DS meeting / December 2012

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+ M. Zito, **V. Galymov** (CEA), A. Rubbia, S. Murphy, S. Di Luise (ETHZ)

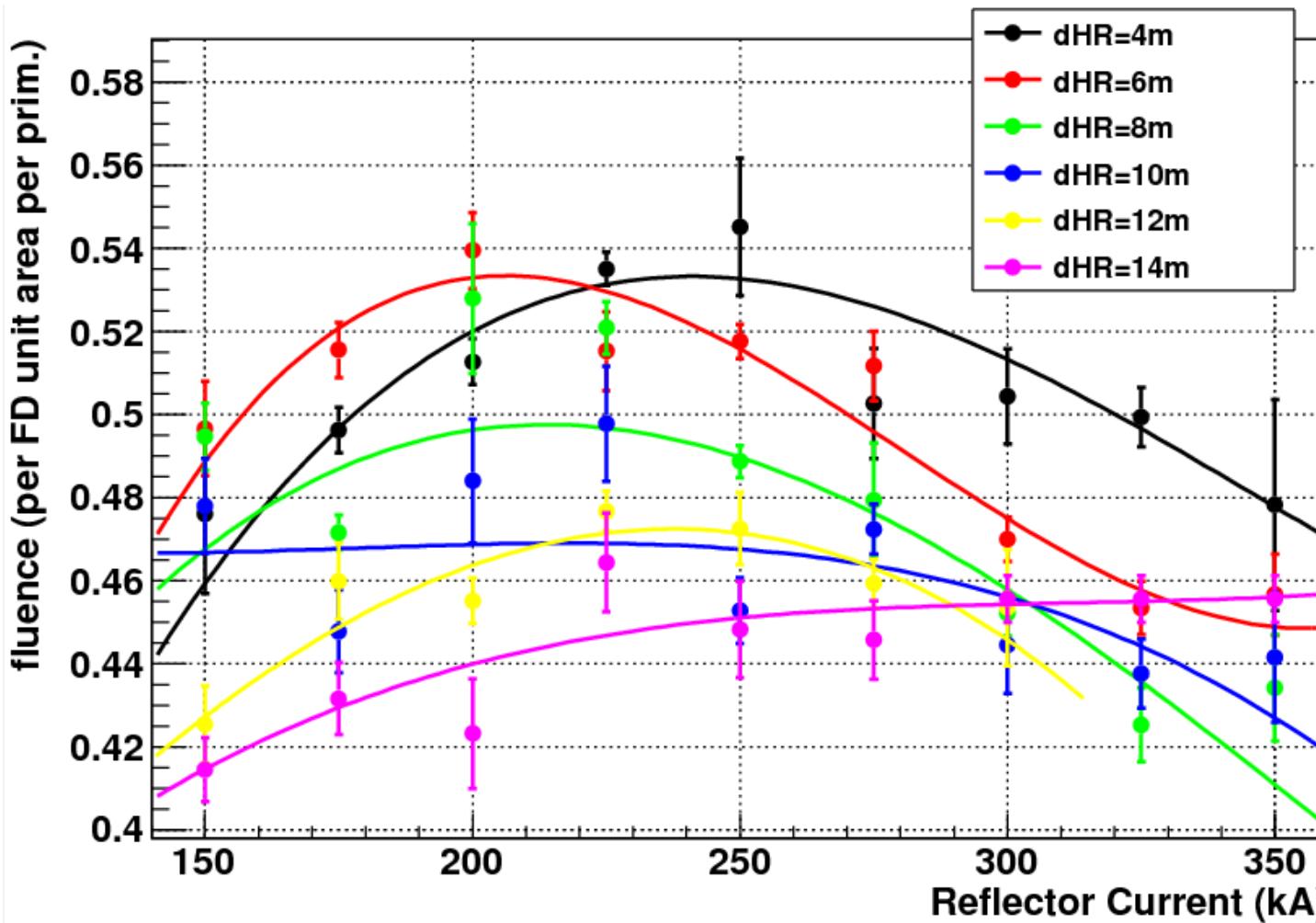
Organization of the WG and activities

- ▶ Focused (for the moment) on:
 - ▶ Agreement on the main physics parameters (**ok now!**)
 - ▶ Optimization of beam/target optimization
 - ▶ Configurations of horn
 - ▶ Muons in the ND and configuration of the decay pipe
- ▶ CERN-oriented meetings held on a ~monthly basis to discuss the activities within the sub-WG
 - ▶ Steering the activities on the LAGUNA/LBNO secondary beam line
- ▶ Participation to external members working on some aspects of the beam line in other institutes
 - ▶ Important input from the experiment!

Target-horn distance and horn current optimization

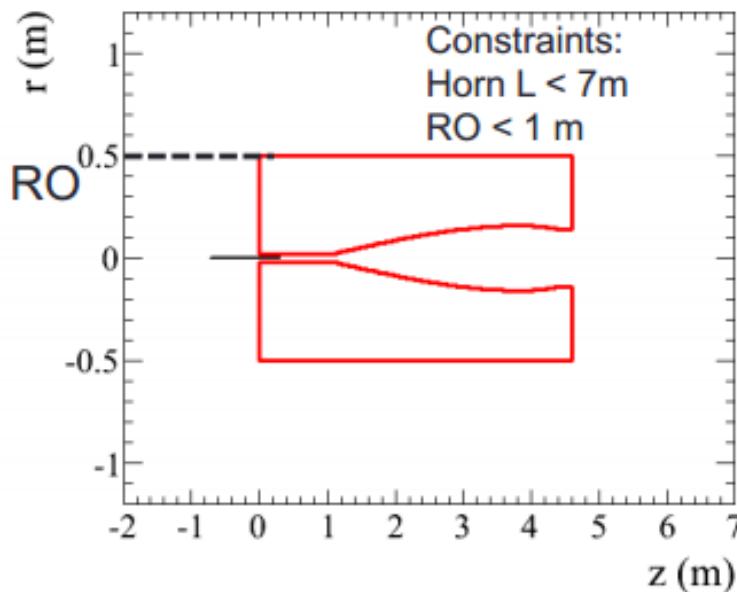


Horn-reflector distance and reflector current optimization

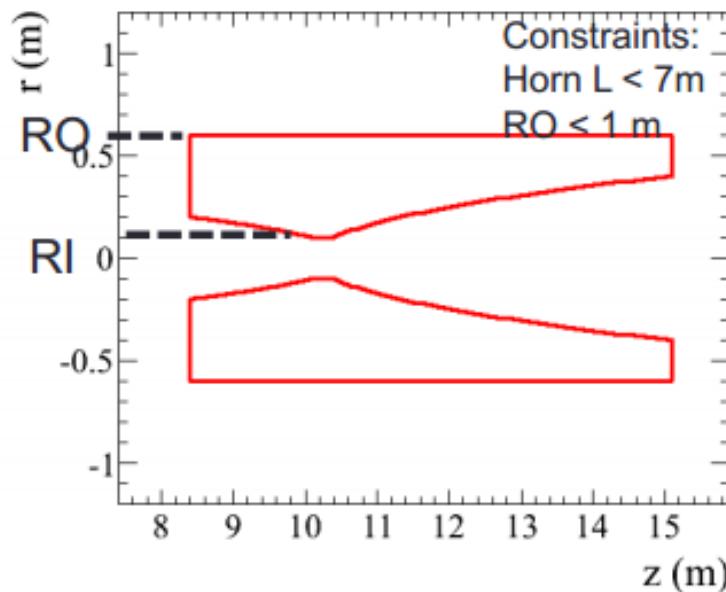


Parameterization

Target & Horn 1



Horn 2

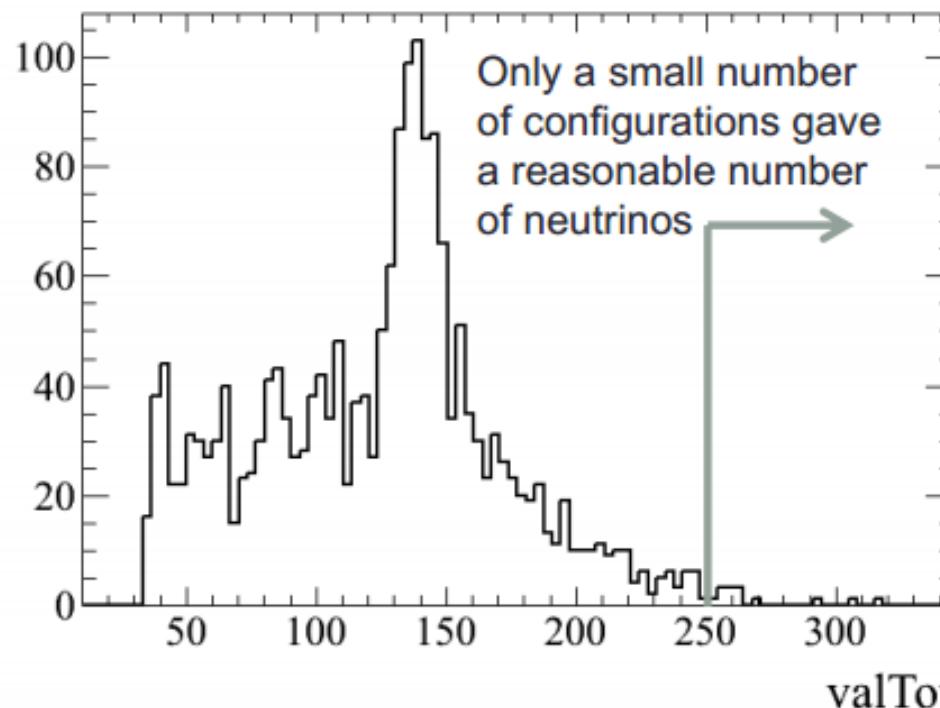


- 1m long & 4 mm in diameter C target
 - Target position is varied -1.1 m to 0.0 (0.0 – upstream end is aligned with the horn)
- Parameterize the 1st horn inner conductor shape is with a 3rd order Bezier curve (specified by four points $P_i(z_i, r_i)$)
- Two additional parameters are L and RO
 - For the Bezier shape fixed $R1 = 2$ cm
 - Four points – $R1 + \text{Horn length} + RO + \text{Target Z} = 10$ parameters
- Horn current is fixed to 200kA

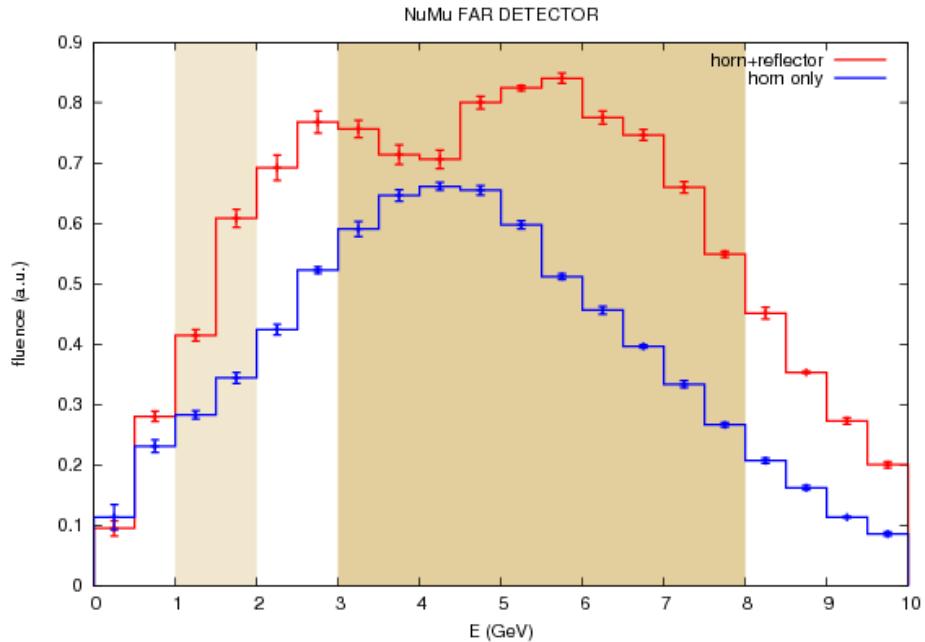
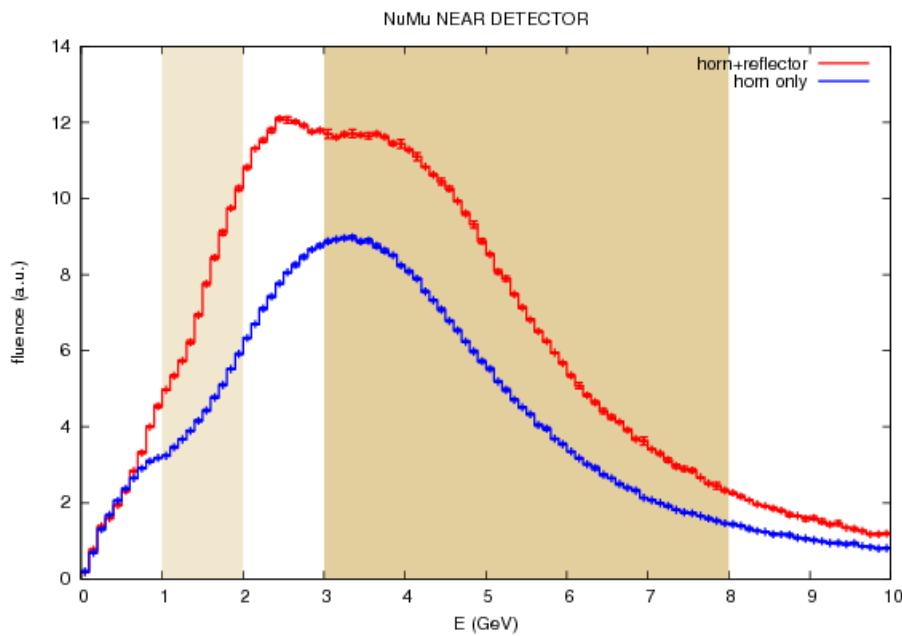
- Horn 2 is composed of two parabolic inner conductors
- Parameters:
 - Distance from horn 1
 - RI, RO, L(total length), L1 (1st parabola), L2(2nd parabola), R1, and R2: 7 parameters
 - The shape of parabola ($Ar^2 + C$) is computed from these parameters
 - Horn current is fixed to 200kA

Total number of neutrinos

- 2000 configurations have been simulated
- But most are not very interesting due to low total number of neutrinos



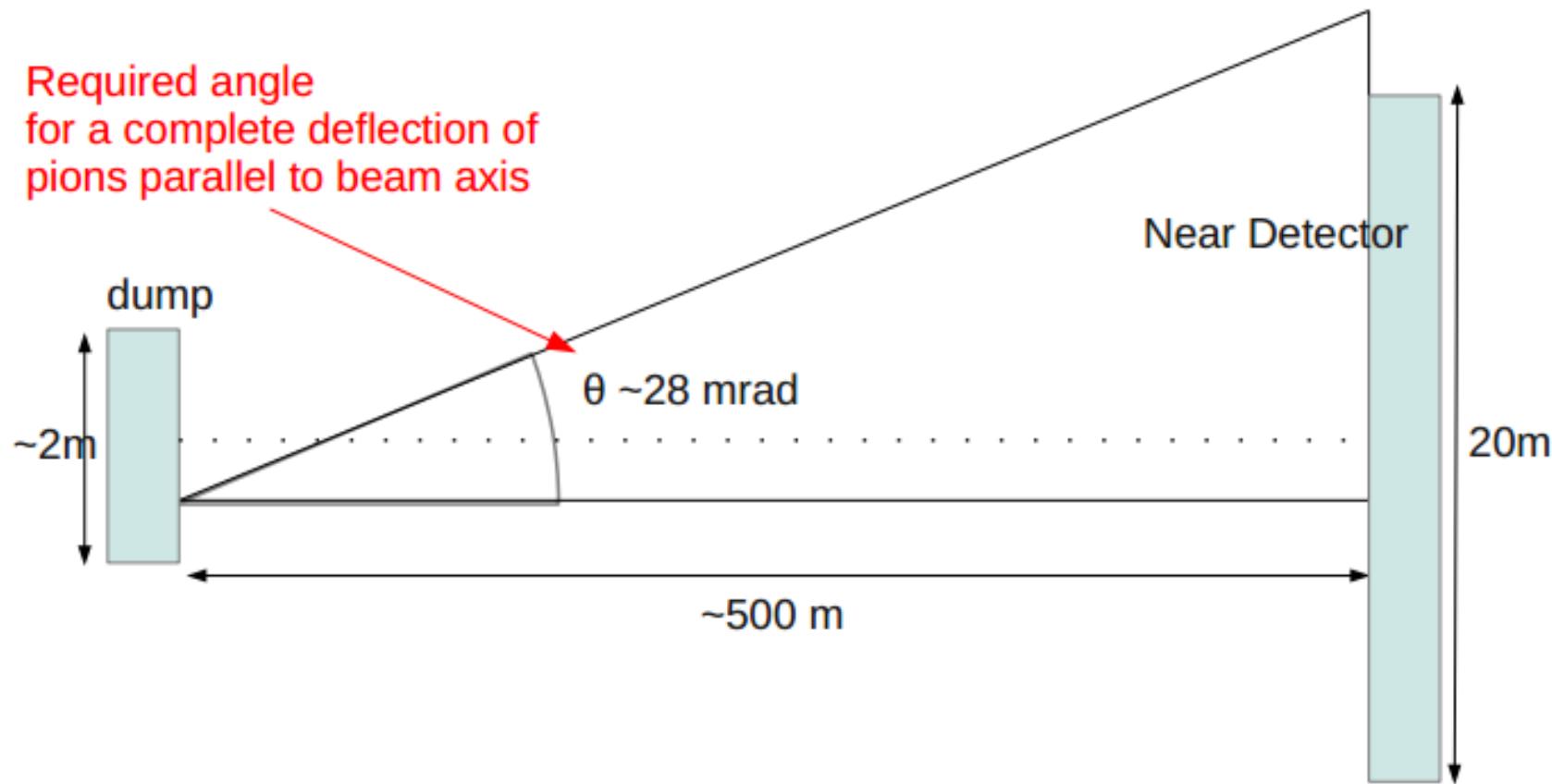
As a first step, constraint parameter space just based on the total number of neutrinos

ν_μ fluence in ND/FD

- ▶ $d_{TH}=0$ cm / $I_H=220$ kA
- ▶ $d_{HR}=6$ m / $I_R=275$ kA

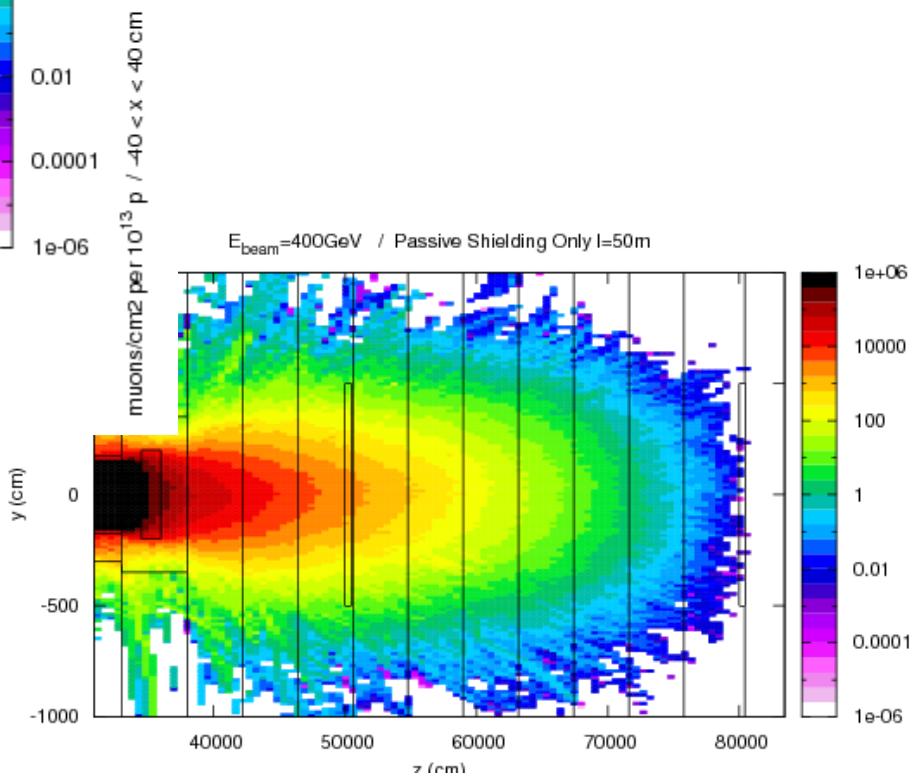
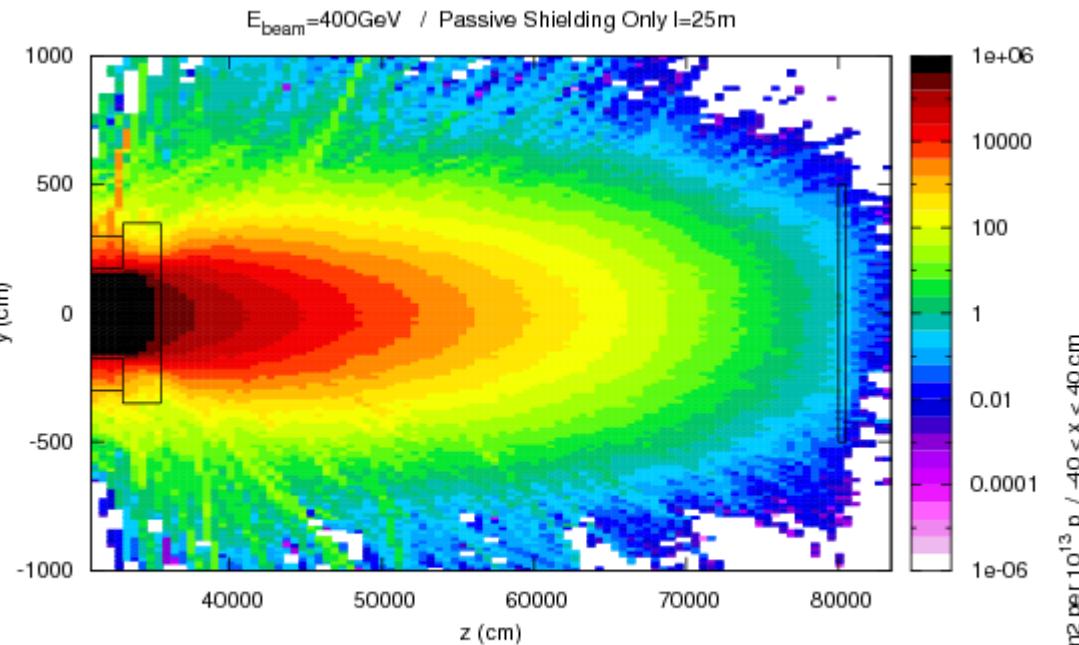
LBNO case

Required angle
for a complete deflection of
pions parallel to beam axis

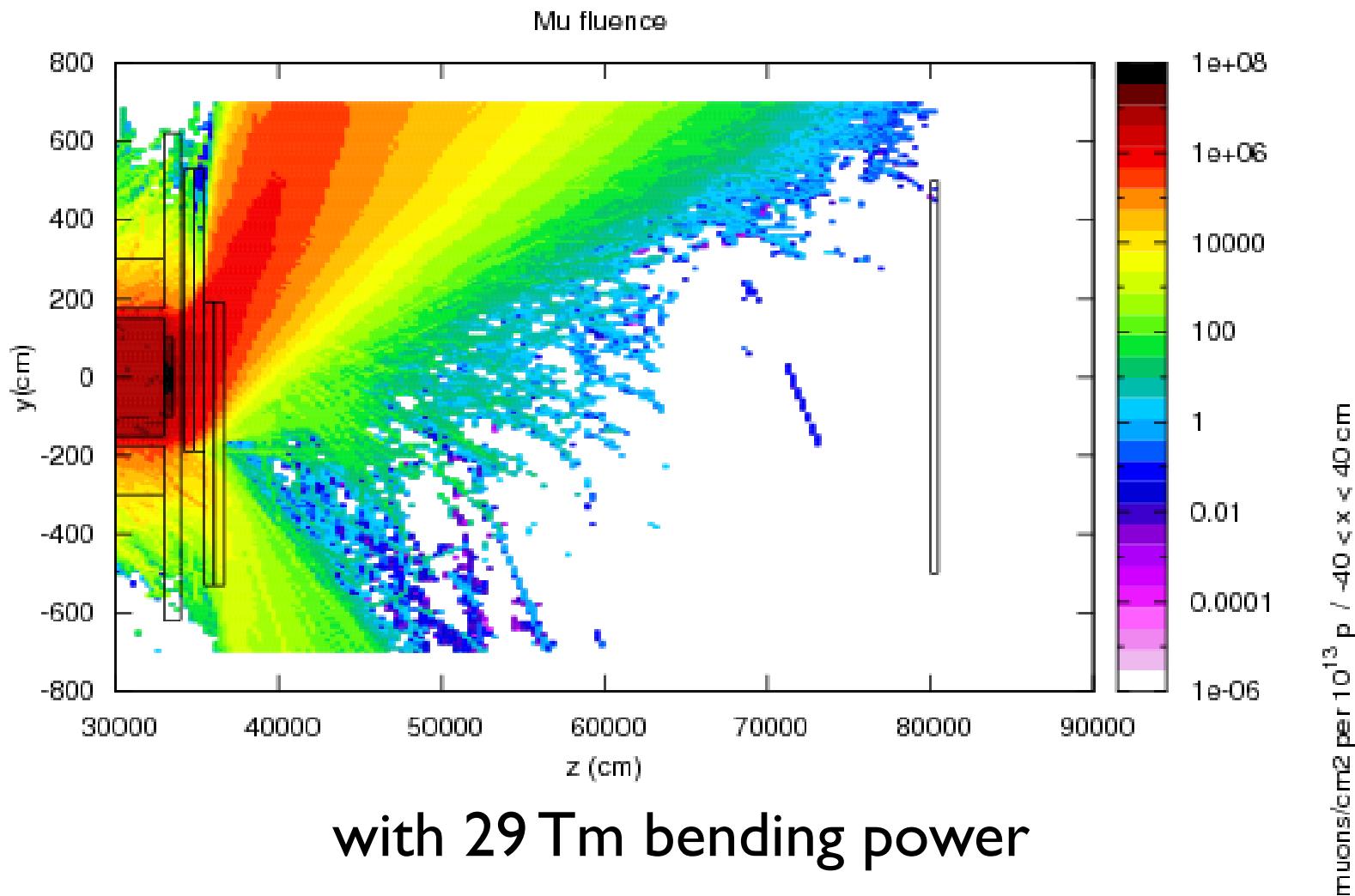


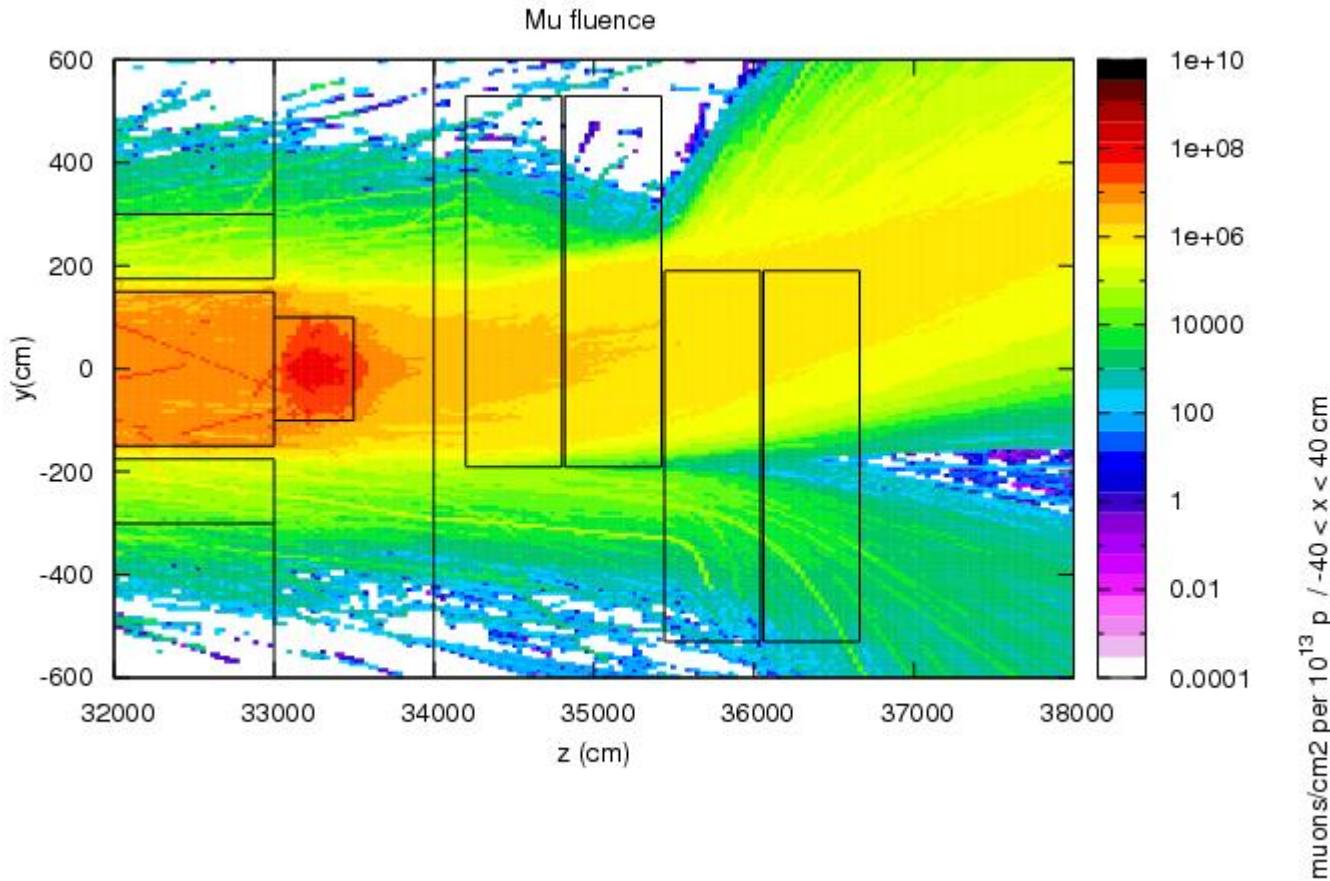
- The highest energy muons ($\sim 350\text{GeV}$ @ $E_p=400\text{GeV}$) contribute the most to background in ND
- WANF toroidal magnet not suited: inner radius 2m prevent to deflect on-axis muons
- Required bending power to deflect 350GeV muons of 28mrad: $\sim 35 \text{ T.m}$
- Such a transverse bending power is hard to achieve -> MC simulations to scan lower deflections
- Dipole field of varying intensity implemented in the dump volume

μ^\pm fluence with passive shielding



μ^\pm fluence with active toroidal shielding





► Much work to do still...!