IDS120j WITH AND WITHOUT RESISTIVE MAGNETS

PION AND MUON STUDIES WITHIN TAPER REGION
(20 cm GAPS BETWEEN CRYOSTATS)

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IDS120j GEOMETRY, WITH/WITHOUT RESISTIVE COILS: WITH 20 cm GAPS

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PIONS AND MUONS SPREADING WITHIN THE TAPER REGION AND BEYOND.
MAGNETIC FIELD FOR IDS120j WITH AND WITHOUT THE RS MAGNETS WILL BE USED.
RMS (x, y, r) AND MAXIMUM (x, y, r) [EXTRACTED FROM 20 EVENT SAMPLE WITH LARGEST r FOR THE CORRESPONDING PARTICLES]
WEIGHTS NORMALISED FOR EACH COLLECTION OF PARTICLES EVENTS.
BEAM PIPES WITH TAPERING FROM z = 0.0 cm TO z = 1,500 cm [BASELINE] USED FOR BOTH CASES ALTHOUGH THE MAGNETIC FIELD IS NOT 1.5 T AT THE END POINT.

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>SIMULATIONS CODE: mars1512

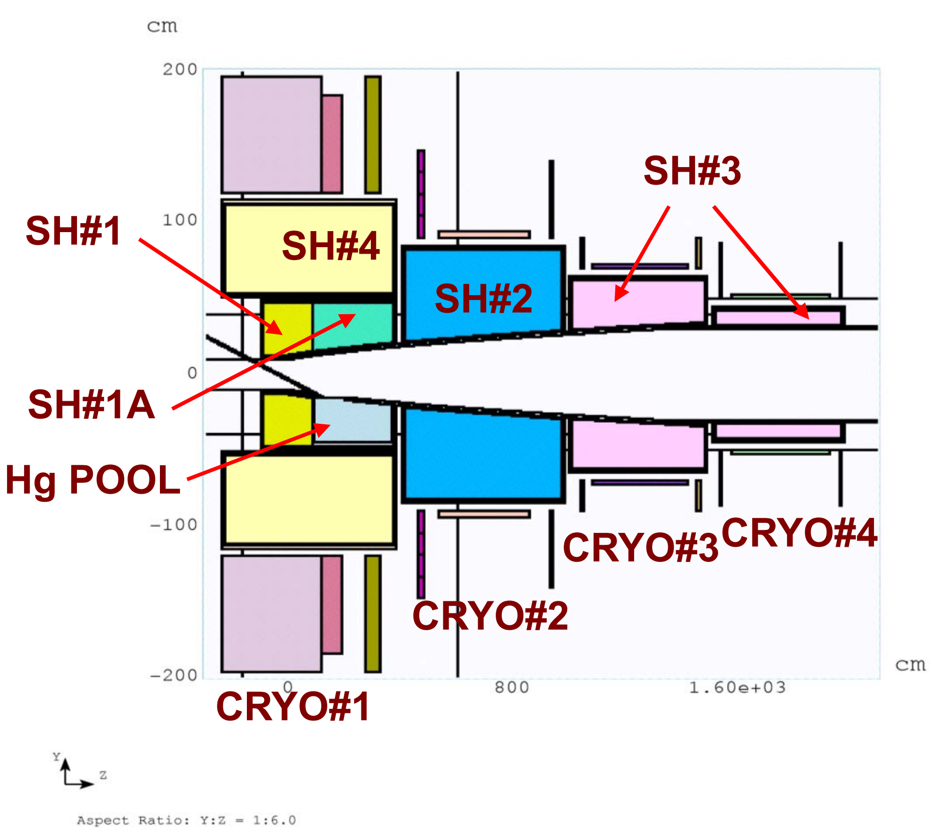
>NEUTRON ENERGY CUTOFF: 10^{-11} MeV

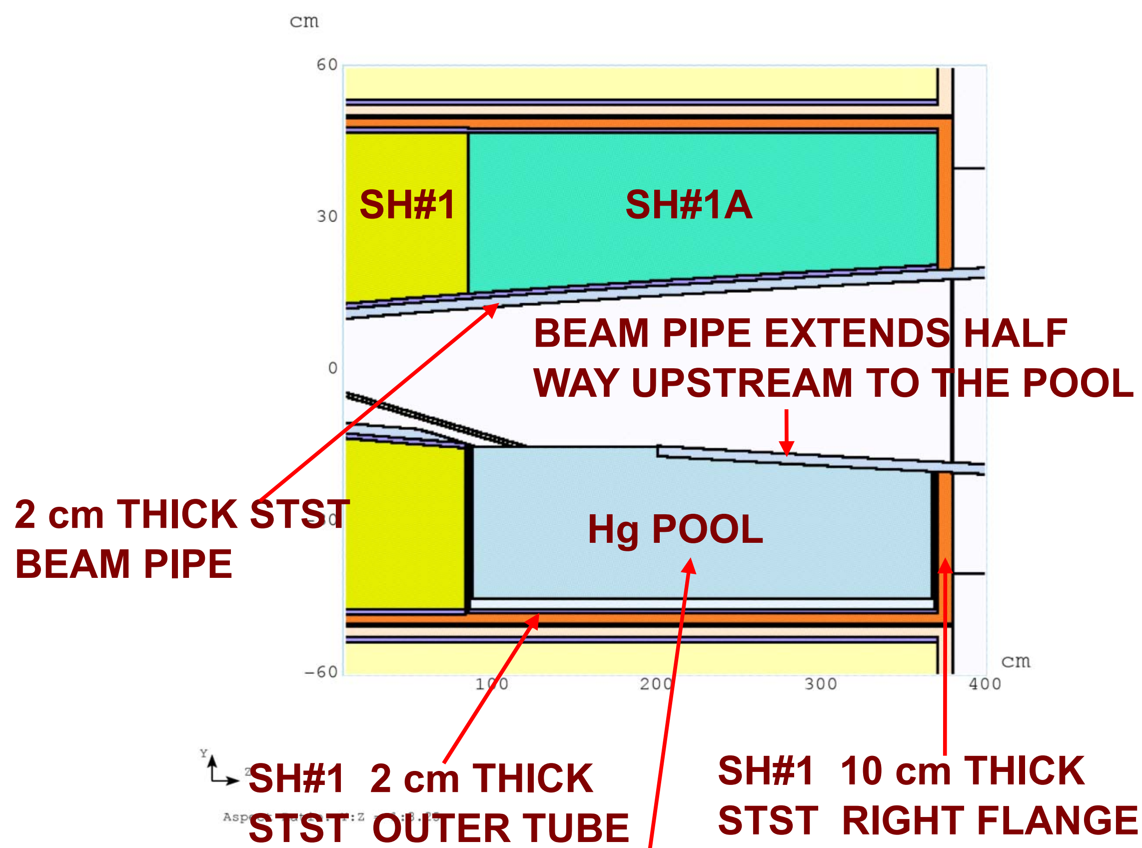
>PROTON BEAM POWER: 4 MW

>PROTON ENERGY: E = 8 GeV

>PROTON BEAM PROFILE: GAUSSIAN, $\sigma_x = \sigma_y = 0.12$ cm (P12 POINT)
>EVENTS IN SIMULATIONS : N_p = 200,000

IDS120j: REPLACING RESISTIVE MAGNETS AND FILLING UPPER HALF OF Hg POOL WITH SHIELDING. GENERAL OVERVIEW (LEFT), POOL REGION DETAILS (RIGHT). [20 cm GAPS]

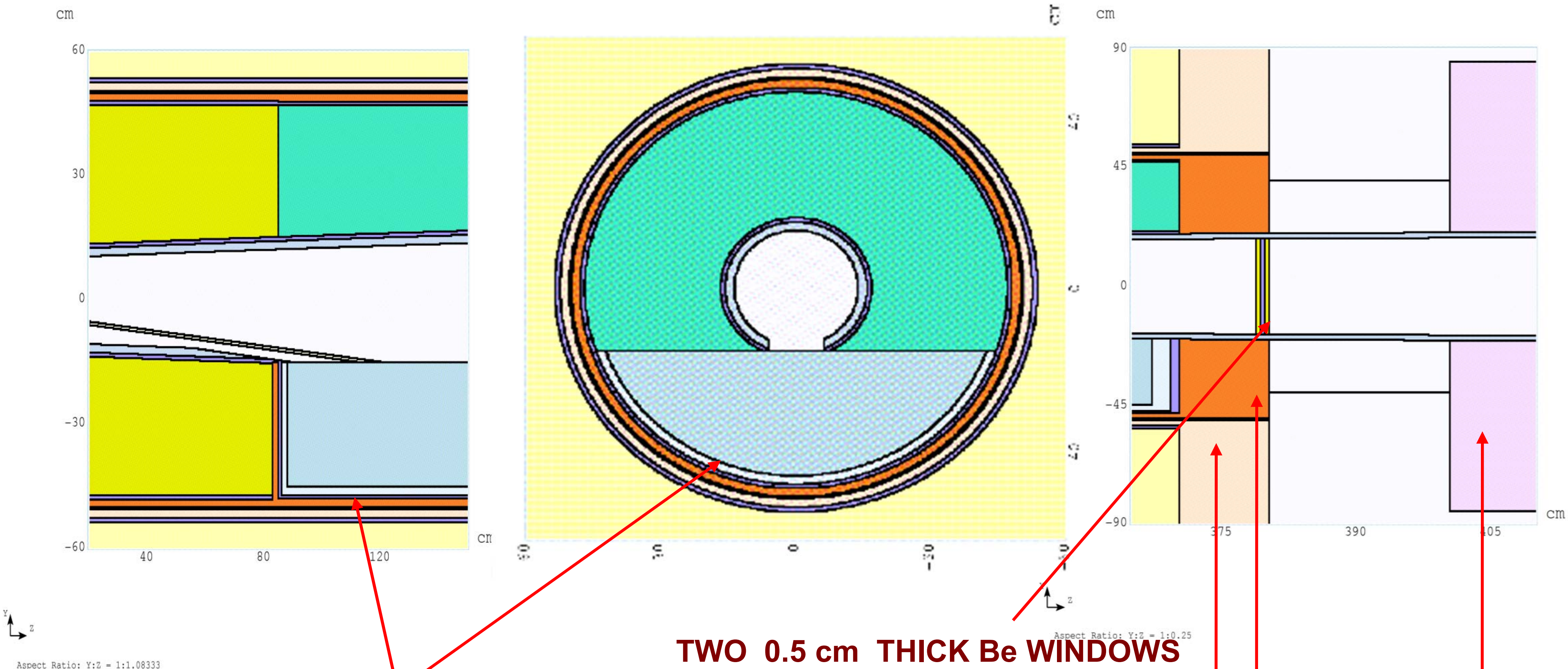




Hg POOL STARTS ~ 85 cm AND EXTENDS ALL THE WAY TO THE END OF THE FIRST CRYOSTAT ~ 370 cm.

SHVS WALLS, Hg POOL VESSEL DOUBLE WALLS, Be WINDOW, He GAP IN Be WINDOW AND IN HG POOL HAVE NOMINAL VALUES FOR THEIR THIKNESS. STRESS FORCES ANALYSIS AND LOCAL DPD DISTRIBUTION WILL BE USED TO DETERMINE THEIR VALUES.

IDS120j: WITHOUT RESISTIVE MAGNETS. DETAILS OF THE DOUBLE STST Hg POOL VESSEL (LEFT, MIDDLE) AND THE DOUBLE Be WINDOW (RIGHT). [20 cm GAPS]

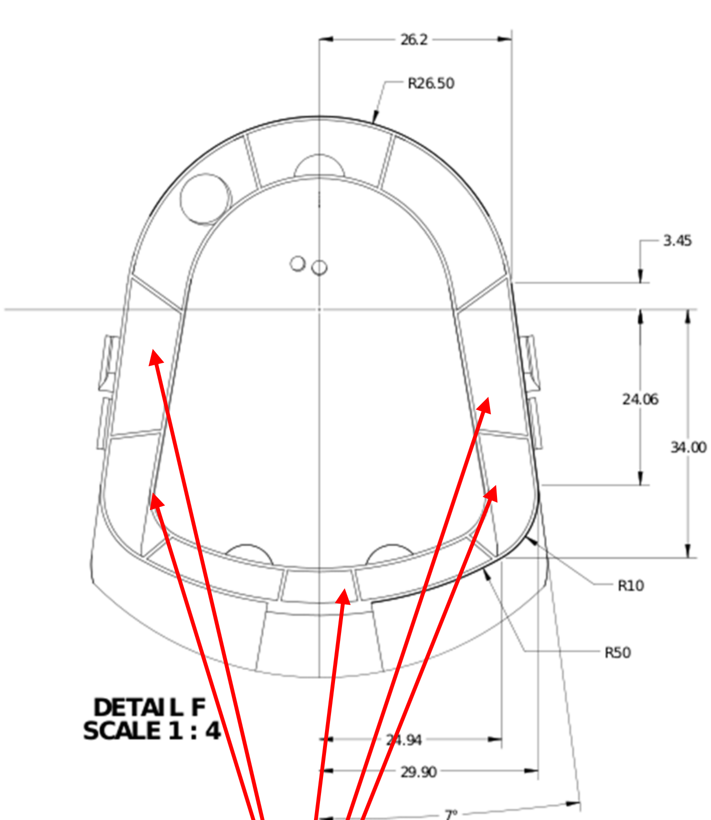


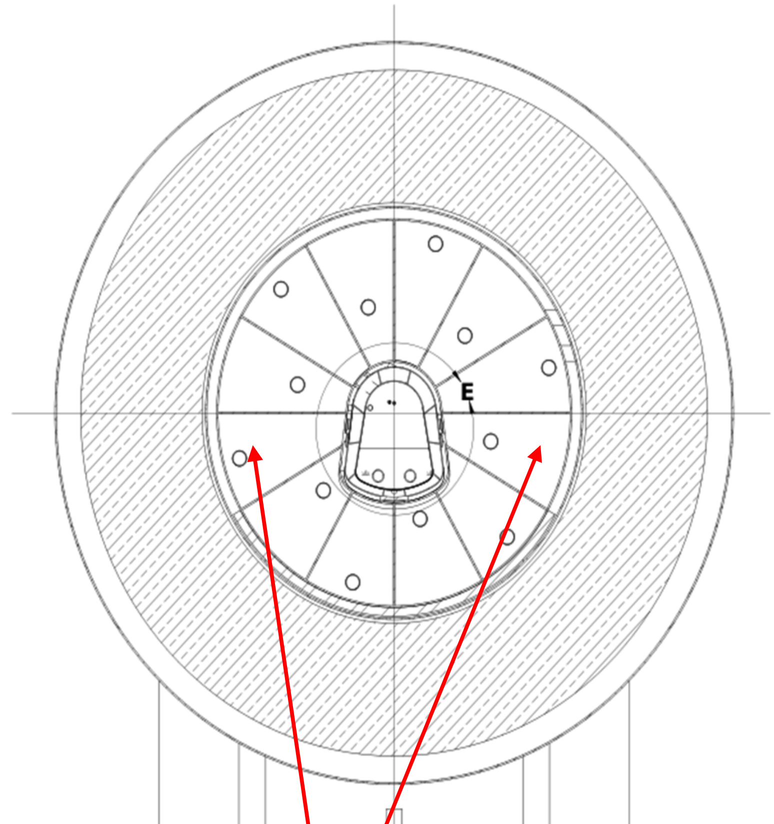
2 cm THICK STST INNER Hg POOL VESSEL WITH 1 cm He GAP FOR COOLING.

TWO 0.5 cm THICK Be WINDOWS AT THE END OF CRYO#1 WITH 0.5 cm He GAP BETWEEN THEM FOR COOLING.

10 cm THICK STST RIGHT / LEFT FLANGE OF SHVS#4, SHVS#1 / SHVS#2 WITH 20 cm GAP BETWEEN THEM.

IDS120j: DETAILS OF THE DOUBLE WALL Hg POOL VESSEL ENVISIONED BY VAN GRAVE.
(PLOTS ARE FROM VAN GRAVE'S 8 / 9 / 2012 PRESENTATION)





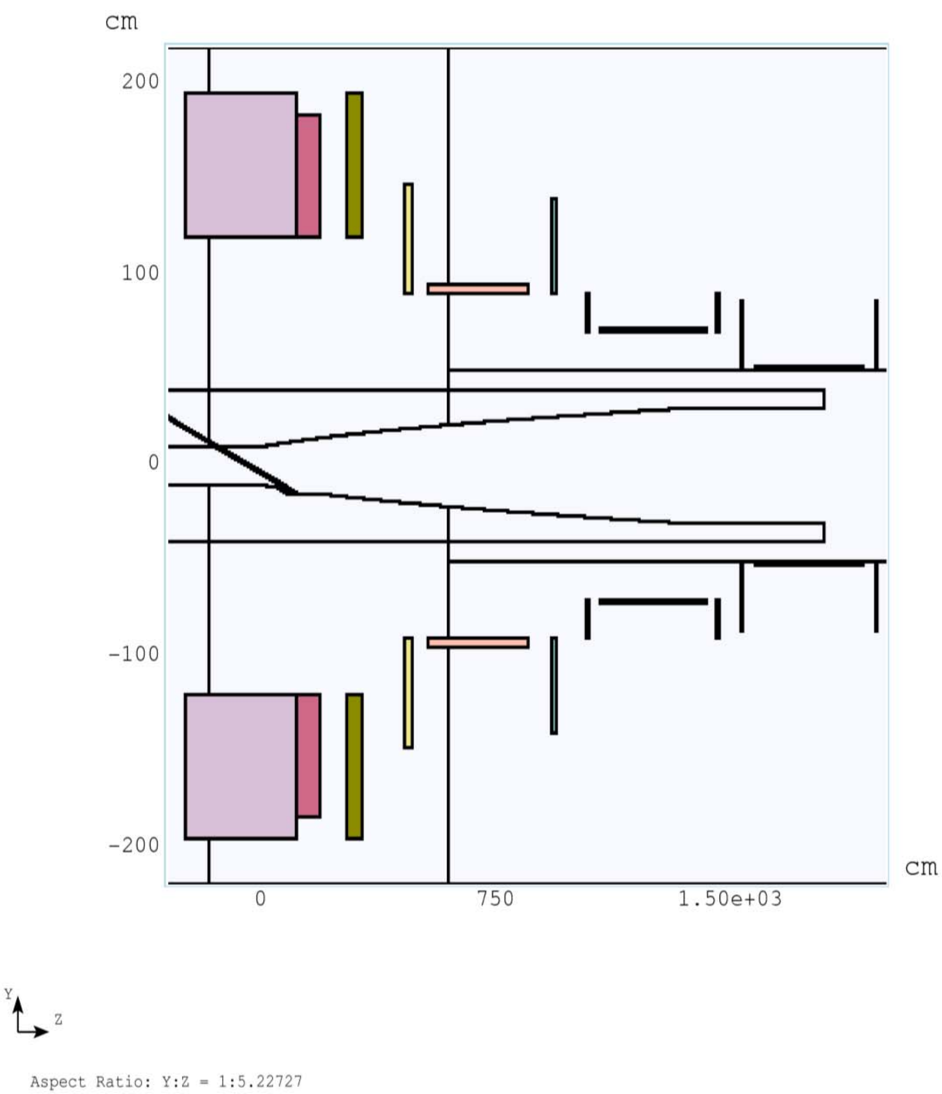
He GAS WILL BE FLOWING BETWEEN THE TWO WALLS FOR COOLING.
COOLED
THE BEAM PIPE IN THAT AREA WILL BE PART OF THE POOL VESSEL
SHIELDING.
AND REMOVING THE HEAT LOAD WILL BE A CHALLENGING TASK.
SEGMENTATION ANALYSIS WILL BE PERFORMED TO DETERMINE THE

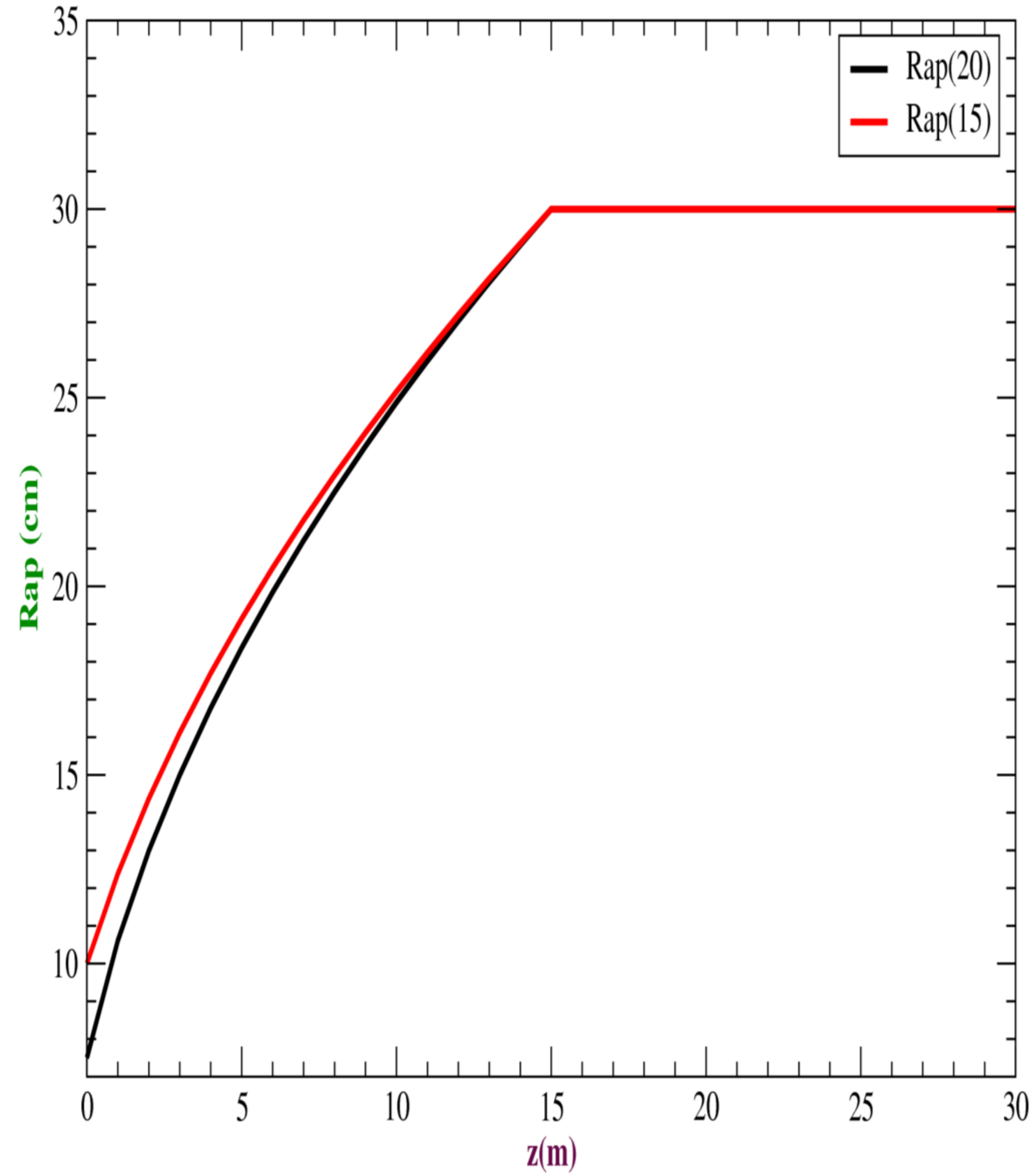
VESSEL FILLED WITH He

W BEADS FOR SCs

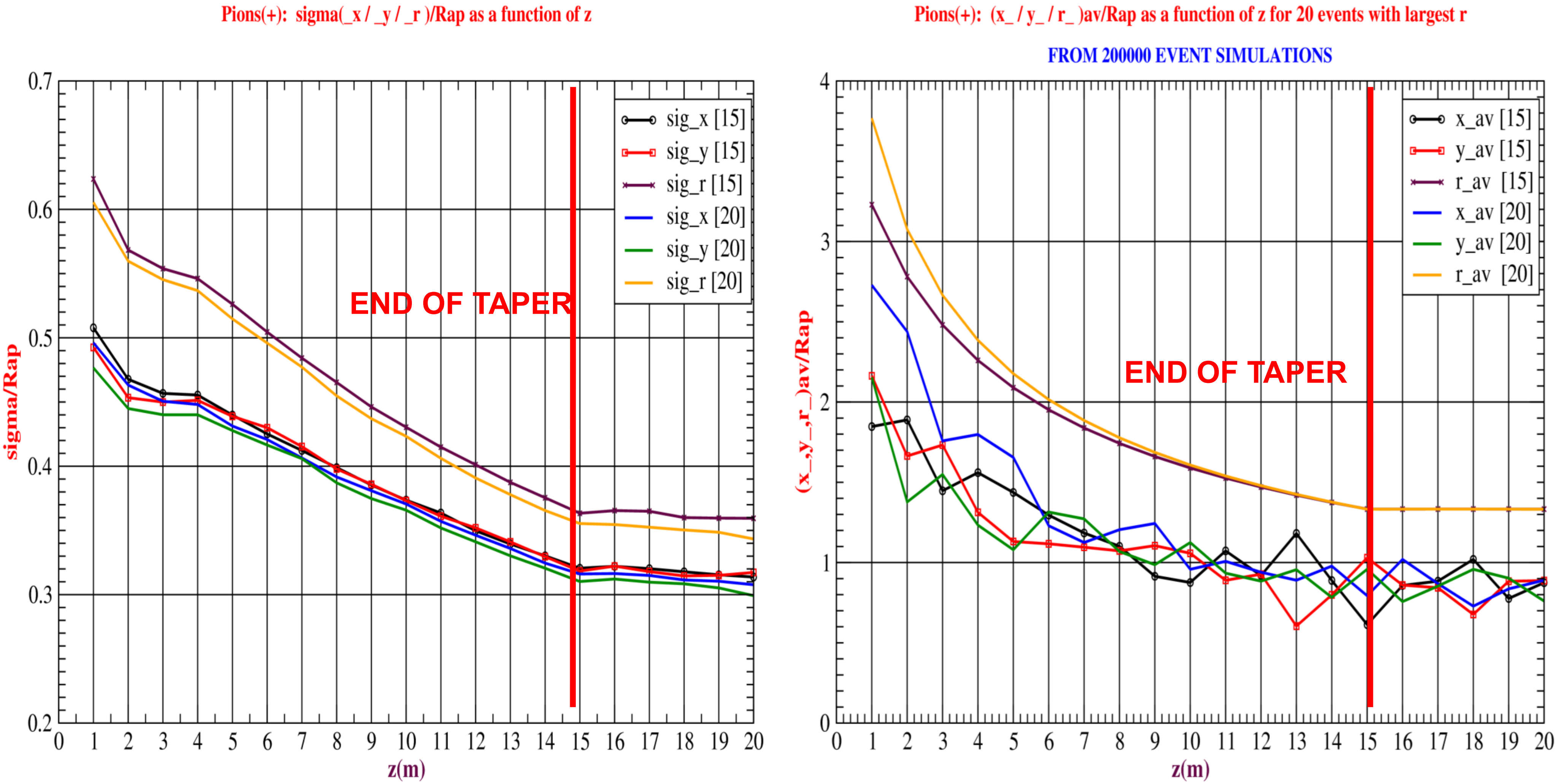
IDS120j: FOR THE PIONS AND MUONS DISTRIBUTIONS STUDIE WITHIN THE TAPER REGION ONLY THE SCs ARE PRESENT IN MARS SIMULATIONS [LEFT].

BEAM PIPE PROFILE WITH / WITHOUT RS WITH END OF TAPER AT z = 15 m [RIGHT].



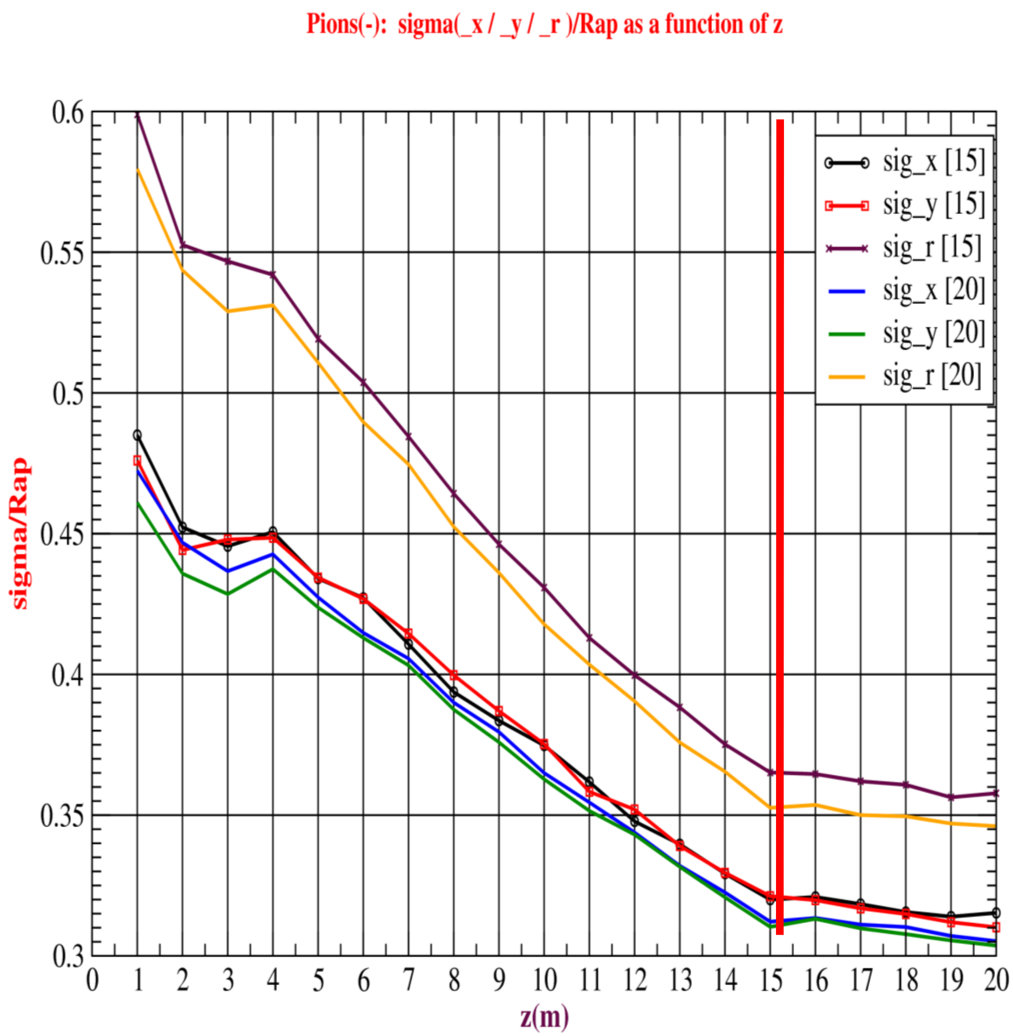


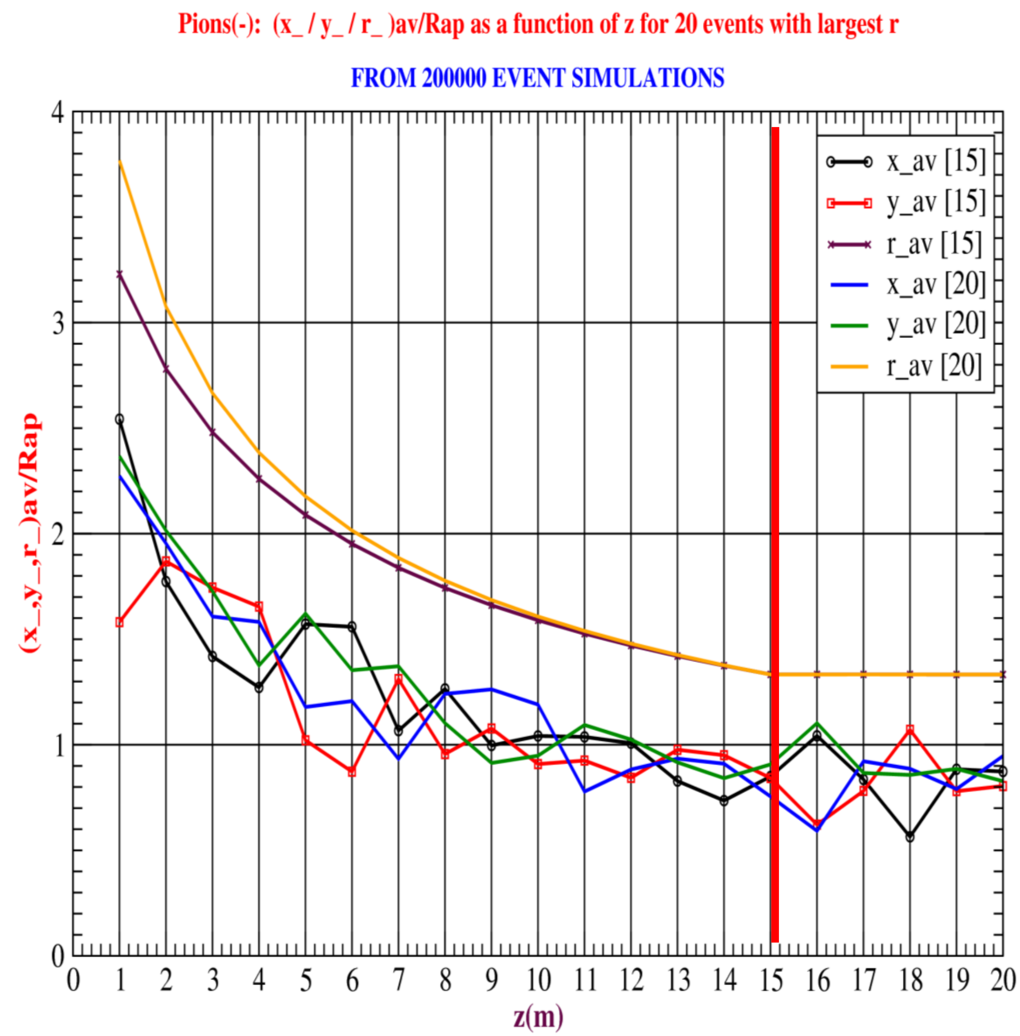
POSITIVE PIONS x, y AND r RMS [RIGHT] AND MAX VALUES [LEFT] AS FUNCTIONS OF AXIAL DISTANCE [EXPRESSED IN TERMS OF LOCAL Rap] .



x/Rap AND y/Rap [BOTH 15 / 20 T] HAVE ONLY A SMALL DIFERENCE. SMALLER RADIAL SPREADING WITH 20 T FIELD [~ FIXED DIFFERENCE 15-20 T]. SLOWER DECREASE BETWEEN ~ 2 AND ~ 4 m.
FAST DECREASE OF r_max / Rap WITHIN FIRST 8 - 9 m, MUCH LARGER FOR 20 T FOR ~ 1 - 3 m.
TAIL PIONS WILL FOCUS FAST WITHIN ~ 10 m [NEED TO TAKE INTO ACCOUNT THE NUMBER OF PARTICLES REPRESENTED BY THESE 20 EVENTS, RATIOS MAY HAVE TO BE MULTIPLIED WITH # PARTICLES WEIGHT FOR 1-20 m POINTS TO EXTRACT MORE CLEAR INFO].
(sig_r / Rap)(15 m /1 5 T) ~ 0.36, (sig_r / Rap)(15 m / 20 T) ~ 0.34, (sig_r / Rap)[max](15 m / 15,20 T) ~ 1.32
[GAUSSIAN DISTRIBUTION ?]

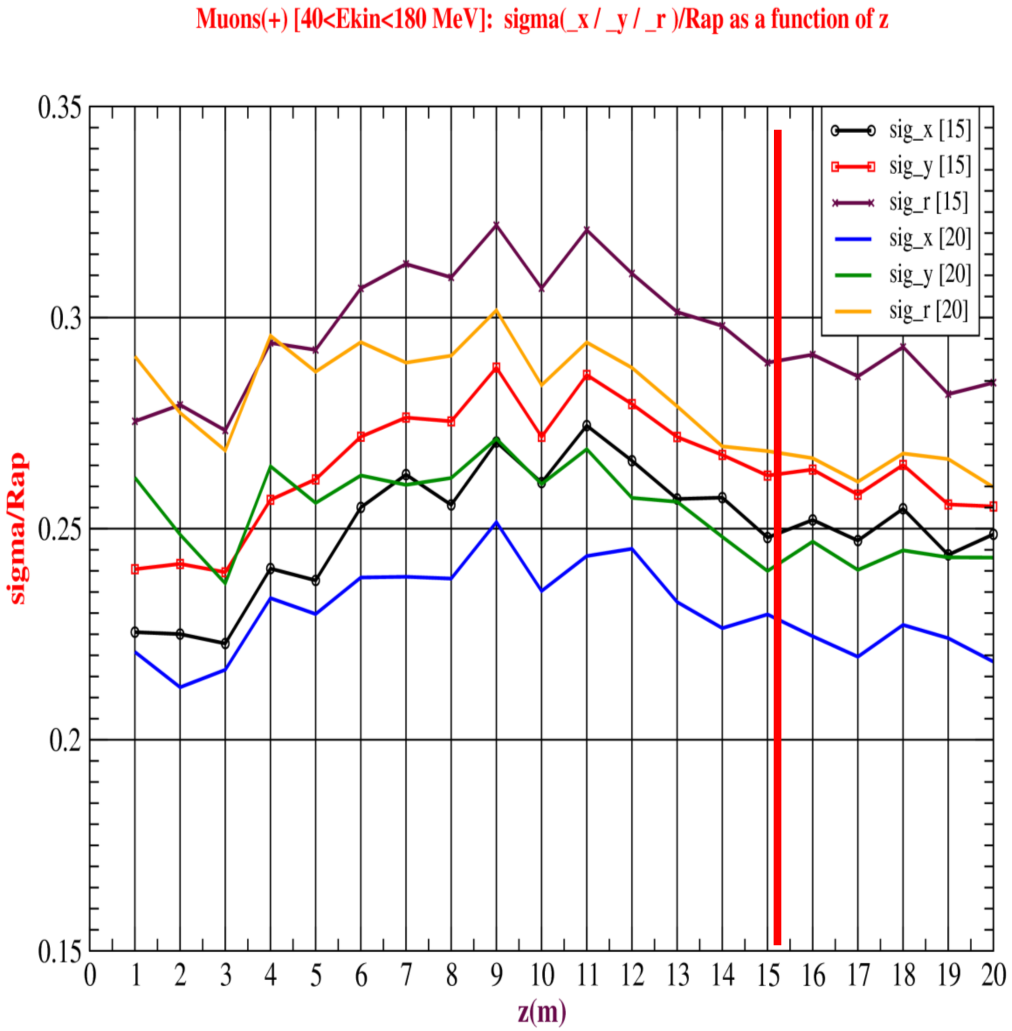
NEGATIVE PIONS x, y AND r RMS [RIGHT] AND MAX VALUES [LEFT] AS FUNCTIONS OF AXIAL DISTANCE [EXPRESSED IN TERMS OF LOCAL Rap] .

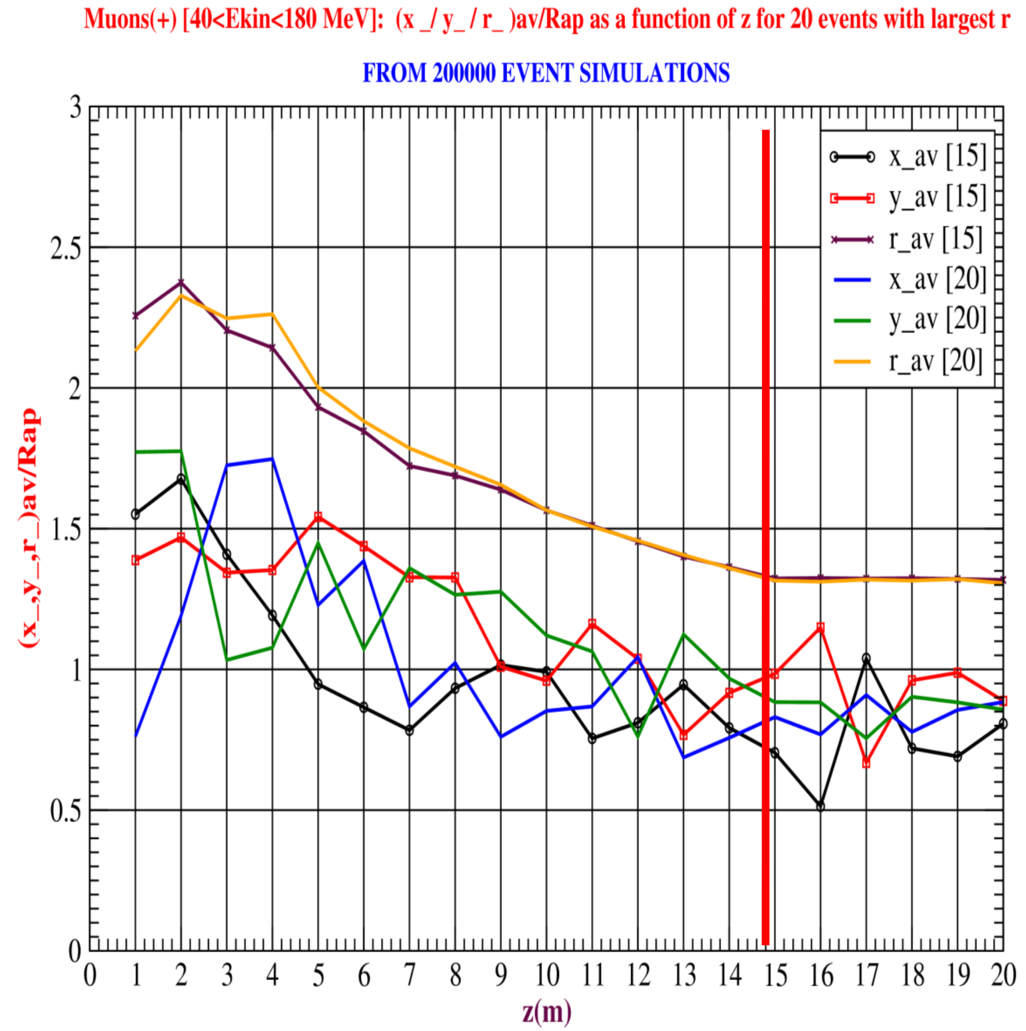




SAME CONCLUSIONS AS THOSE FOR POSITIVE PIONS CAN BE DRAWN FROM ABOVE PLOTS FOR NEGATIVE PIONS. (sig_r / Rap)(15 m / 15 T) ~ 0.34 , (sig_r / Rap)(15 m / 15 T) ~ 0.36 (sig_r / Rap) [max] (15 m / 15 T) ~ 1.3

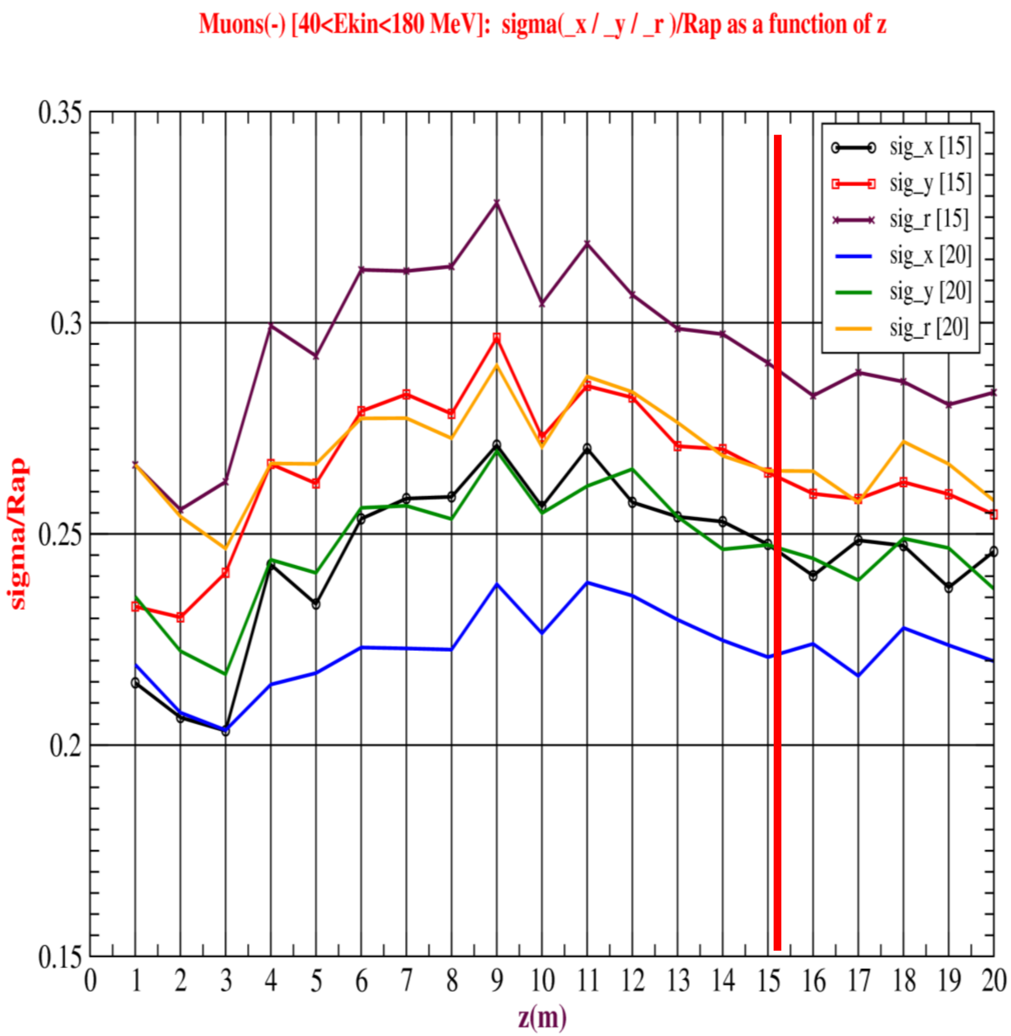
POSITIVE MUONS x, y AND r RMS [RIGHT] AND MAX VALUES [LEFT] AS FUNCTIONS OF AXIAL DISTANCE [EXPRESSED IN TERMS OF LOCAL Rap] .

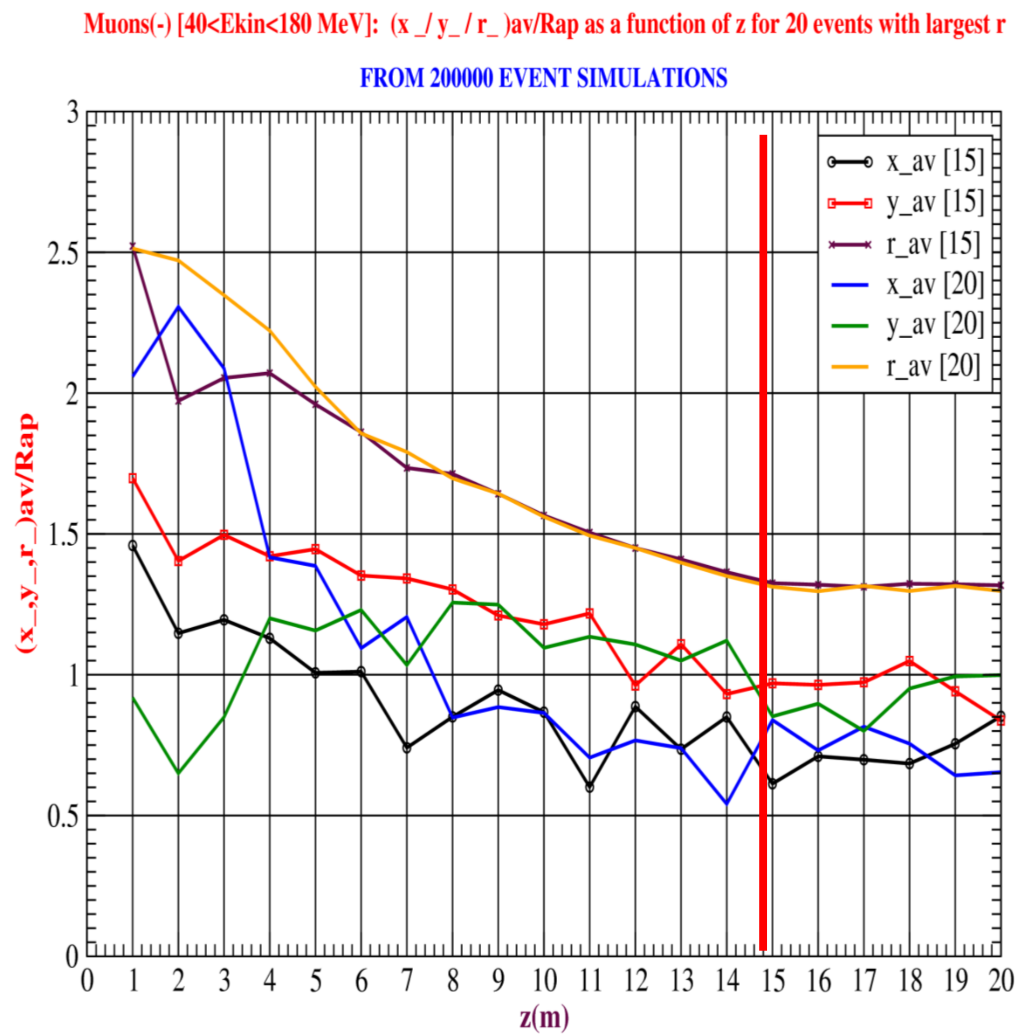




x AND y SPREADING IS MORE ASYMETRIC THAN THAT OF PIONS . SIGNIFICANT DIFFERENCE IN sig_r/Rap BETWEEN 15 T AND 20 T AFTER FIRST ~ 5 - 4 m. sig_r/Rap FOR BOTH CASES REACH A MAXIMUM VALUE AT ~ 9 - 10 m (~ 0.32 FOR 15 T AND ~ 0.30 FOR 20 T). RELATIVELY SIGNIFICANT MUON LOSS DUE TO SCRAPING SHOULD BE EXPECTED IN 6-13 m REGION. VERY LARGE (r_max/Rap) RATIO AT THE BEGINNING (BUT VERY FEW MUONS), IT WILL REACH THE LIMIT VALUE ~ 1.3 AT 15 m.

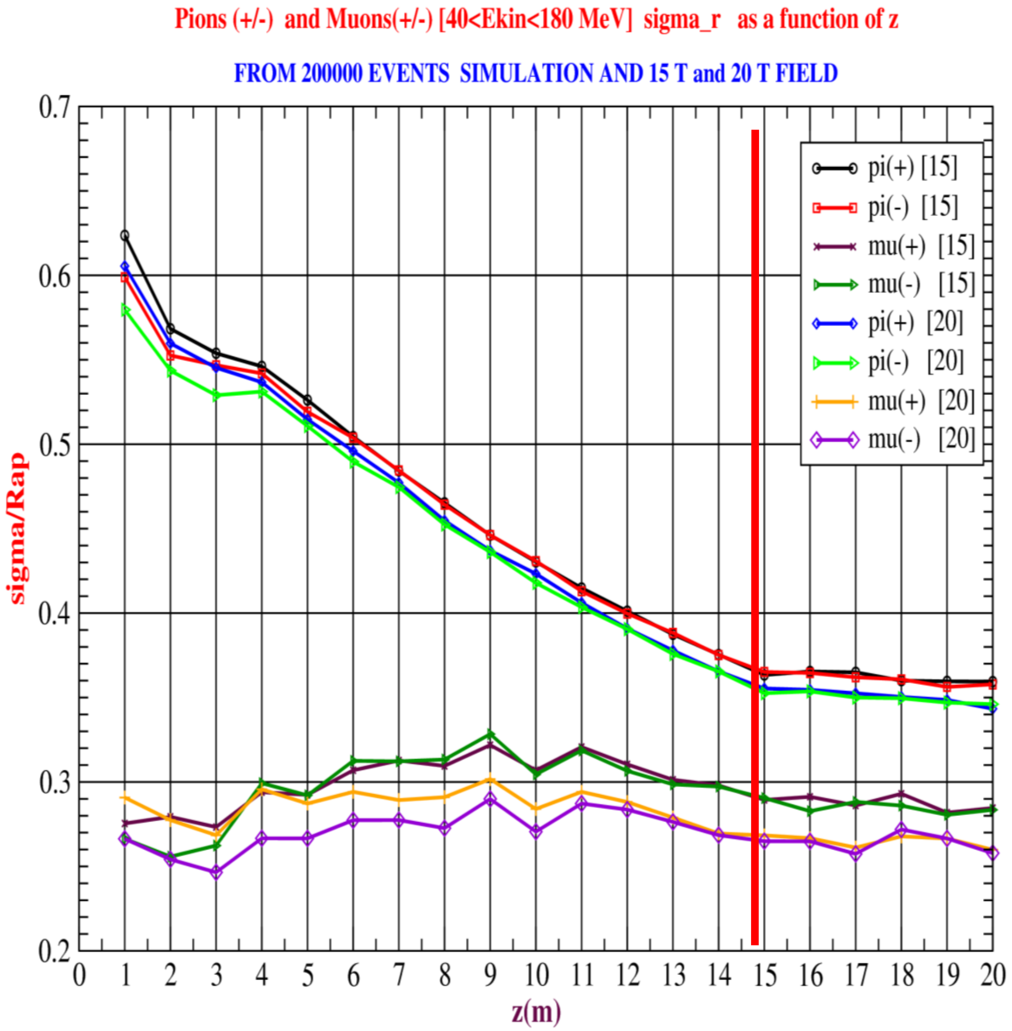
NEGATIVE MUONS x, y AND r RMS [RIGHT] AND MAX VALUES [LEFT] AS FUNCTIONS OF AXIAL DISTANCE [EXPRESSED IN TERMS OF LOCAL Rap] .

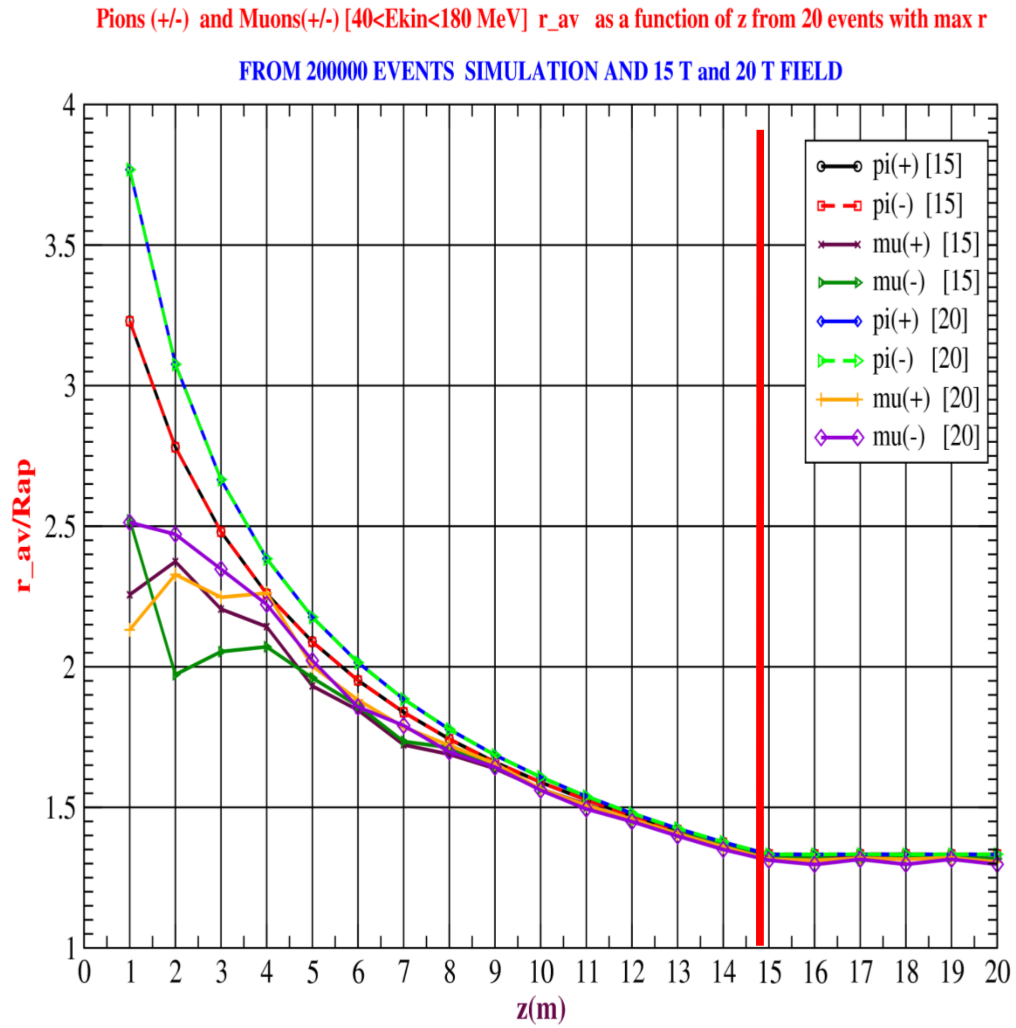




SAME OBSERVATIONS FOR NEGATIVE MUONS.
MAX (sig_r / Rap) VALUE ~ 0.33 (15 T) AND ~ 0.30 (20 T) IS AT ~ 9 m DOWNSTREAM.
SAME LIMIT VALUE OF r_max / Rap (~ 1.30) AS THAT FOR POSITIVE MUONS.

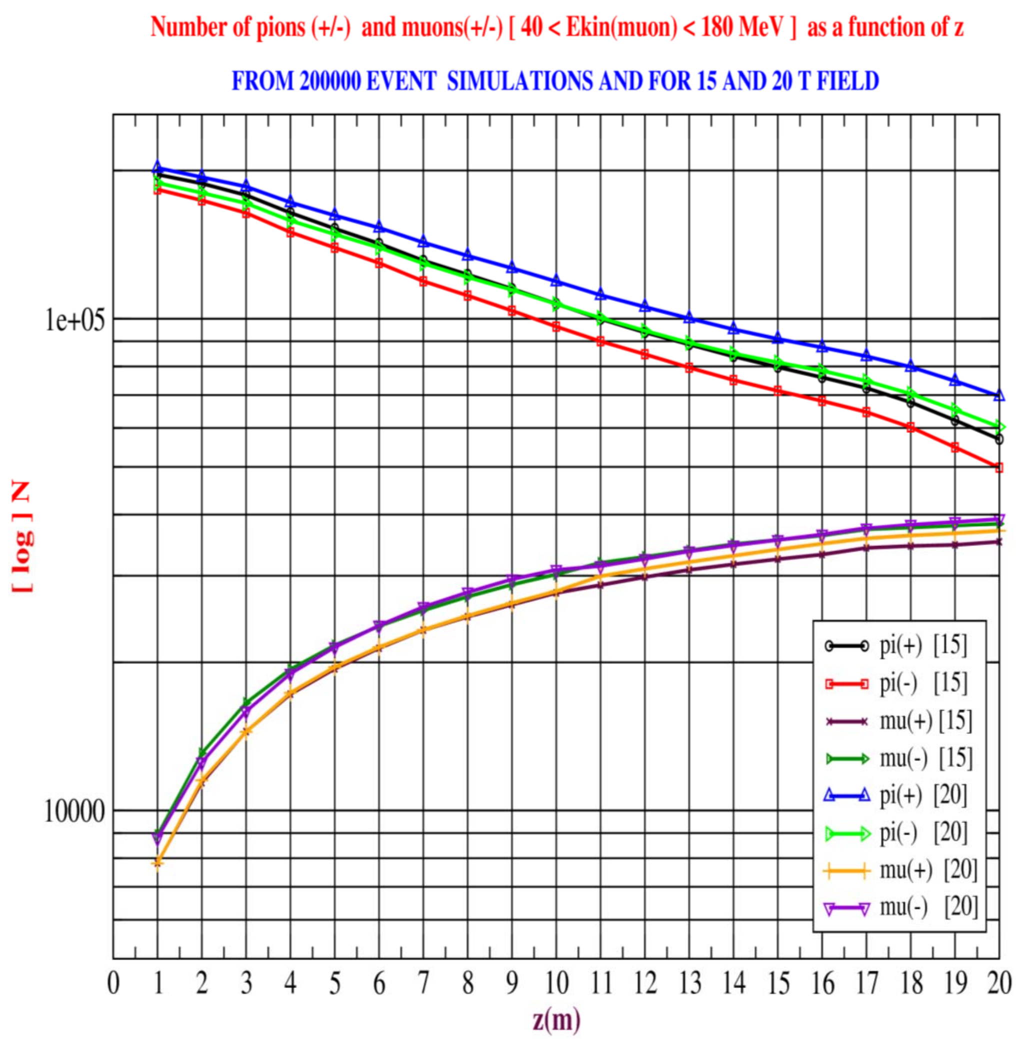
PIONS AND MUONS RADIAL SPREADING COMPARISON [LEFT] AND r_av / Rap [RIGHT].

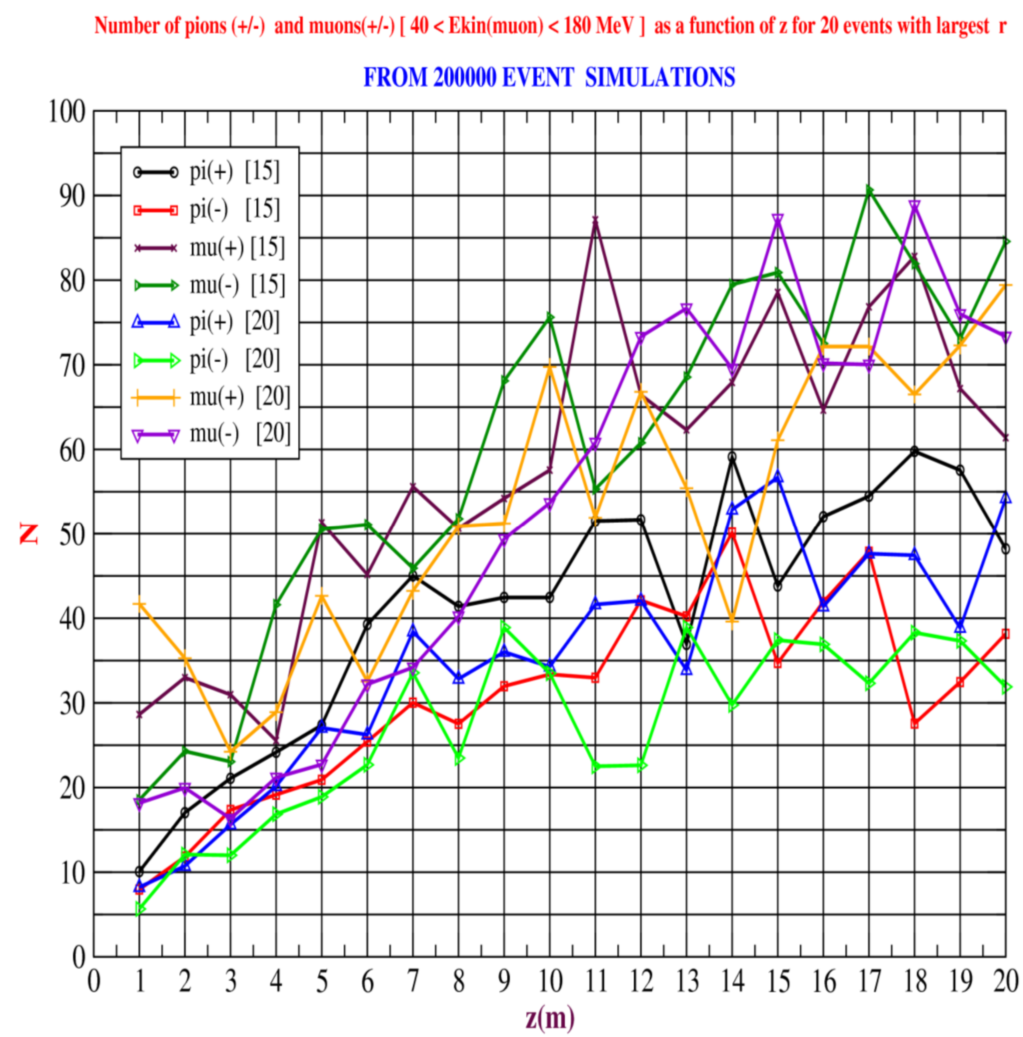




PIONS RADIAL SPREADING DECREASES FAST WITHIN FIST FEW METERS DUE (MOSTLY ?) TO DECAY INTO MUONS. RELATIVE SIGNIFICANT LOSS OF PIONS DUE TO SCRAPING SHOULD BE EXPECTED WITHIN THE FIRST 4 - 5 m FROM THE TARGET.

NUMBER OF PIONS AND MUONS AS FUNCTIONS OF AXIAL DISTANCE [LEFT] AND FOR 20 EVENTS WITH LARGEST r [RIGHT].





AT THE END OF THE TAPER: MUONS YIELD FROM 2 x 10^4 EVENTS SIMULATION: ~ 7.3 x 10^4 [15 T] , ~ 7.6 x 10^4 [20 T]. NUMBER OF MUONS WITH LARGEST r: AT THE BEGINNING ~ 10 – 20 , AT THE END OF THE TAPER ~ 70 - 80