TOF acceptance at large Zvtx (re: fixed target program)

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standalone geant3

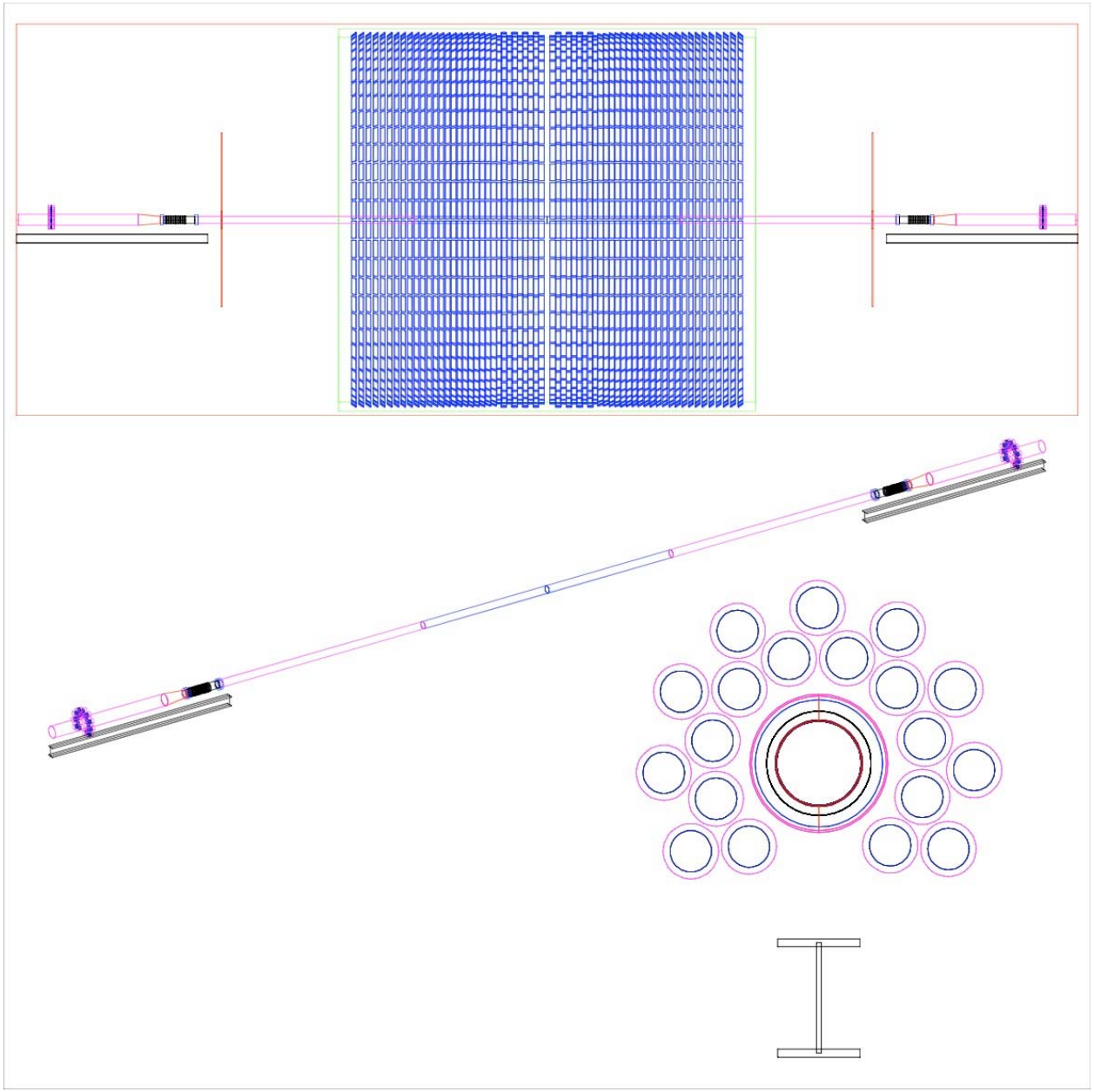
exact MRPC geometry

throw 100GeV muons
- 1 per “event”
- 20M events

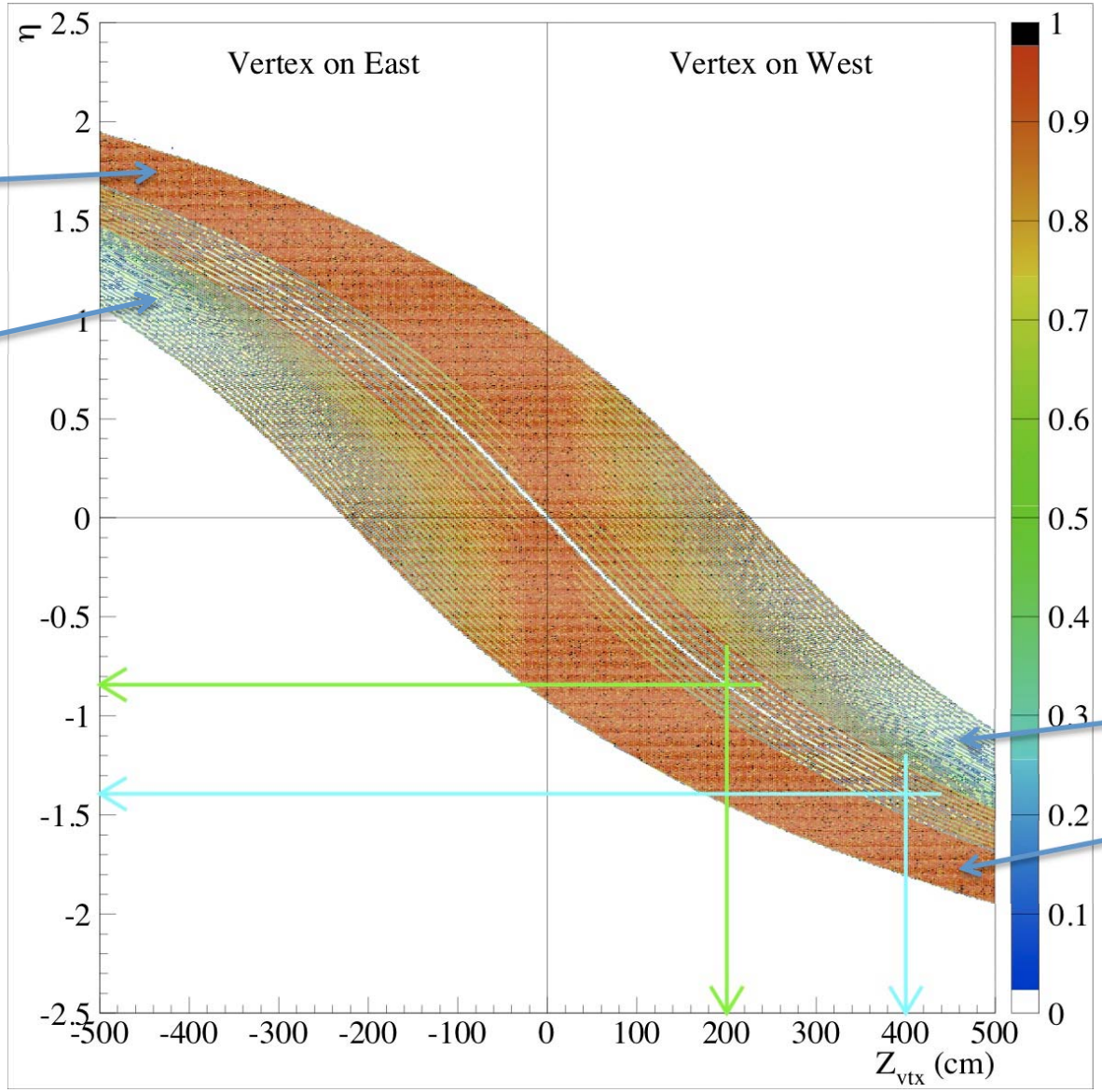
-500<Zvtx<500cm

no solenoidal field
straight tracks

-> purely geometrical acceptance



eta of track producing a hit in TOF vs Zvtx



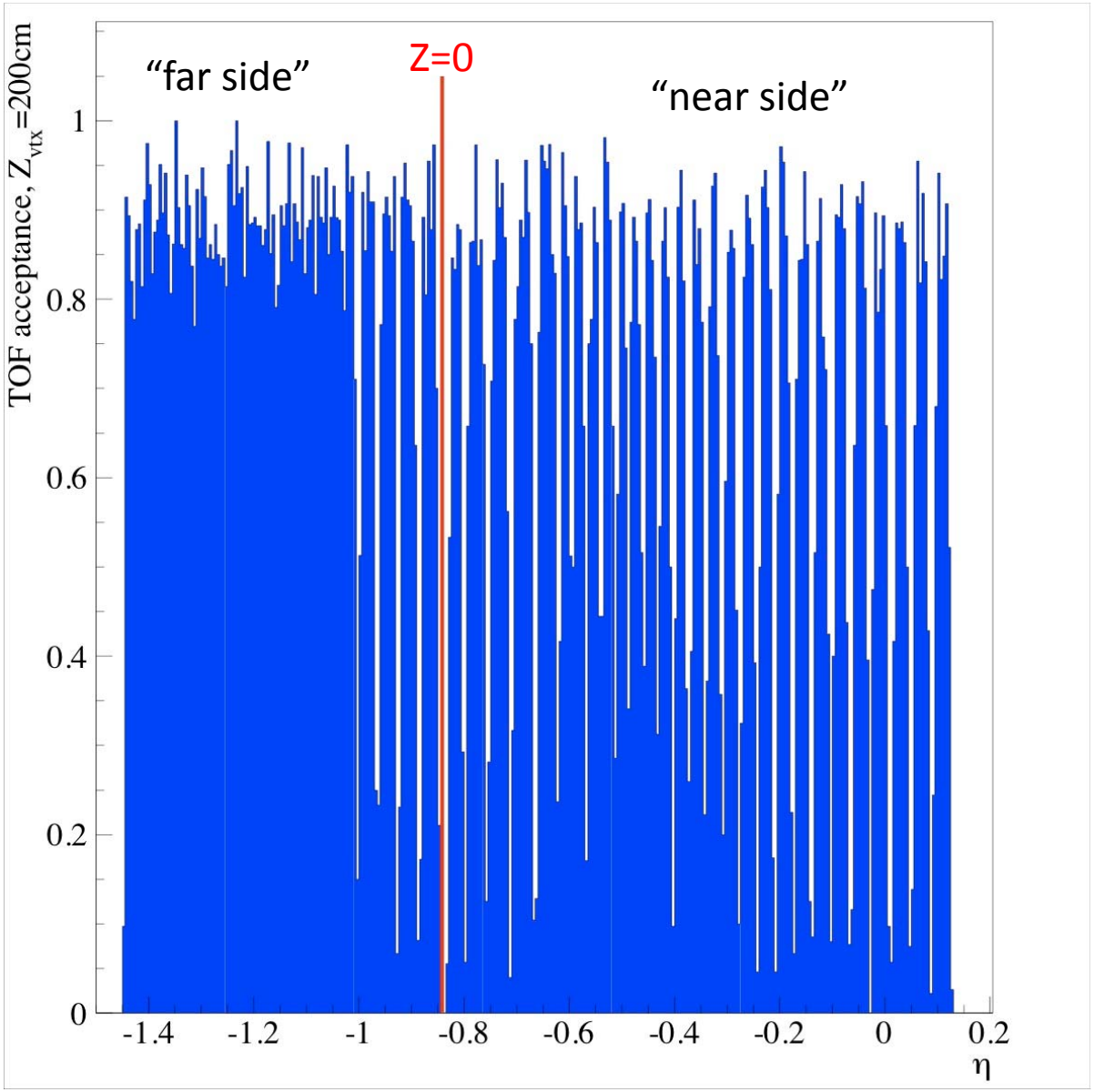
multiple MRPCs

eta gaps

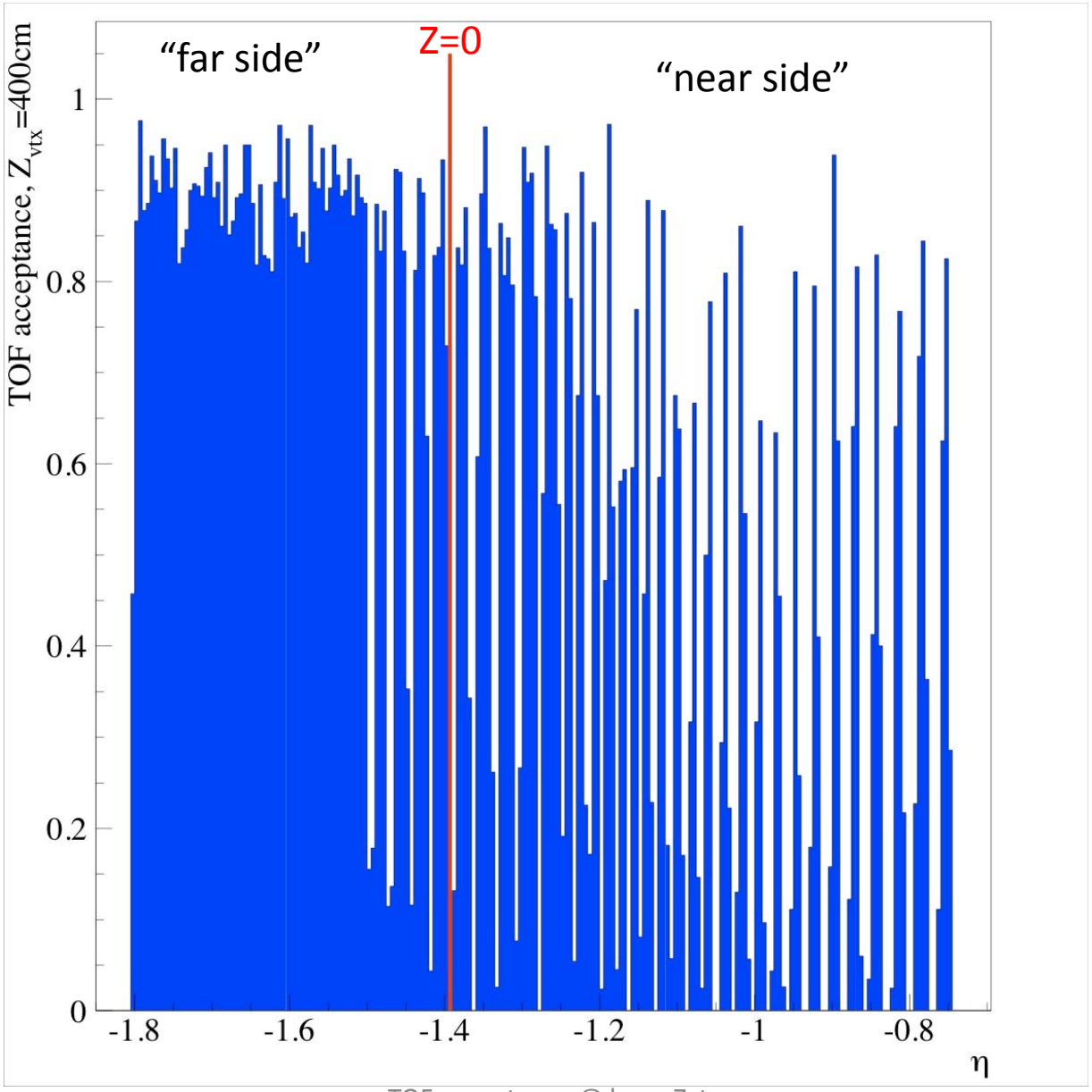
eta gaps

multiple MRPCs

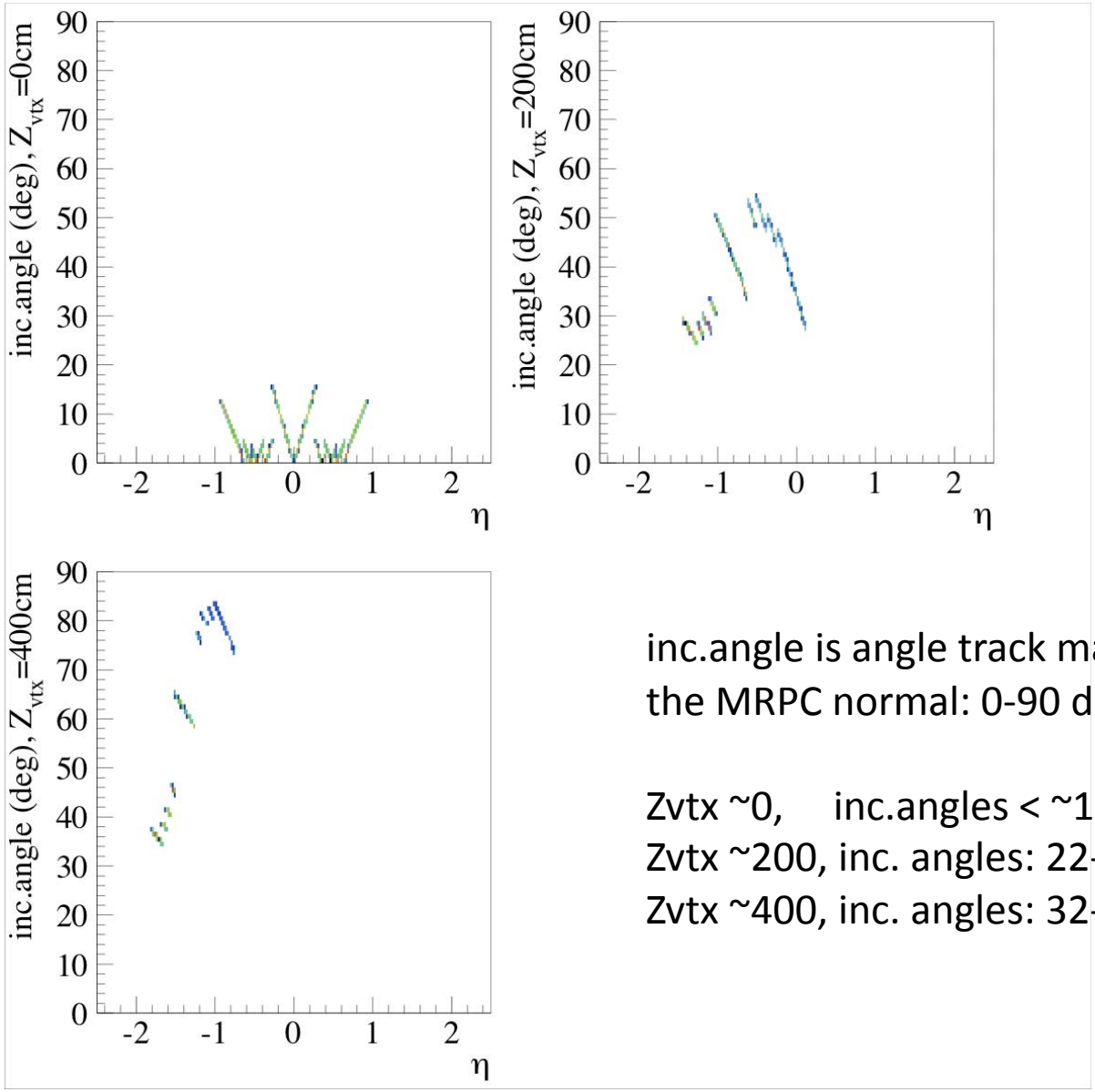
eta of track with TOF hit, Zvtx=200cm



eta of track with TOF hit, Zvtx=400cm



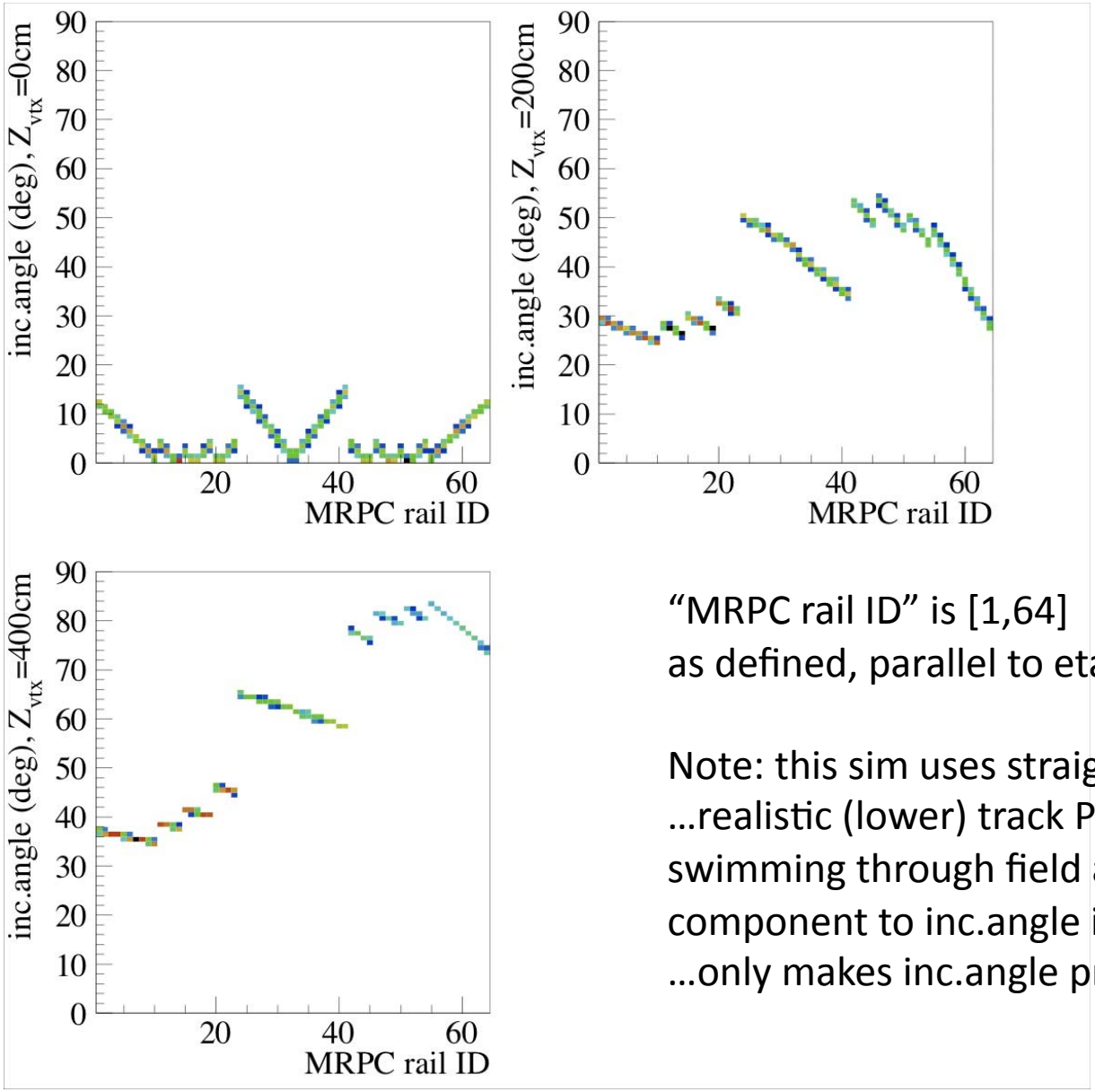
angle of incidence of track on struck MRPC vs eta for Zvtx = 0, 200, 400cm



inc.angle is angle track makes with the MRPC normal: 0-90 deg

Zvtx ~0, inc.angles < ~16 deg
Zvtx ~200, inc. angles: 22-56 deg
Zvtx ~400, inc. angles: 32-85 deg

angle of incidence of track on struck MRPC vs MRPC rail ID for Zvtx = 0, 200, 400cm



"MRPC rail ID" is [1,64]
as defined, parallel to eta

Note: this sim uses straight tracks…
…realistic (lower) track Pt and swimming through field adds component to inc.angle in bend plane
…only makes inc.angle problem worse!

for Zvtx ~ 0, the TOF acceptance has small eta gaps and
track angles of incidence on the struck MRPC < ~15 degrees w.r.t. the normal

as Zvtx is increased,
the eta gaps on the "near side" become large (no hits as particles pass btw MRPCs)…
the track angles of incidence on this side can be very large (near ~90 degrees)…

i.e. on the near side of TOF, tracks are ~parallel to the plane of the MRPC
….we have no experience trying to do fast-timing with those kinds of tracks
….probably not possible to get a good time resolution

on the far side of TOF
no eta gaps, in fact the tracks hit multiple MRPCs (this is a good thing actually)…
track angles of incidence are generally smaller then on near side, but still rather large…
these hits are the best chance of doing TOF PID, but these hits are in a
relatively small fraction of the total TOF acceptance

and there's the start-time issue as well…
…VPD will be asleep in these data, need to do a startless calibration
…need >4 well-timed TOF hits from primary tracks with known dE/dx PID to
have a chance to calculate Tstart event by event…
…not clear if "library" slew functions apply to these large angle of incidence tracks

bottom line:

if TOF PID is important, |Ztarget| must be as small as possible

the MRPC positioning is optimal for Zvtx = 0 and becomes progressively poorer as Zvtx increases….

- large eta gaps between “near” modules
- large angles of incidence in general
- not clear if “default” slew/offset corrections will even apply
  - -> will need specialized slew/offset calibrations for these data
- fewer hits available for startless calibration (very limited eta window)
  - could *possibly* make use of known Ztarget and hits in “far” VPD detector

You will get hits from many modules throughout the TOF barrel, but many of these hits will not allow fast timing / PID….