



MCenter Beamline Improvement Attempts for 2019/2020 Run

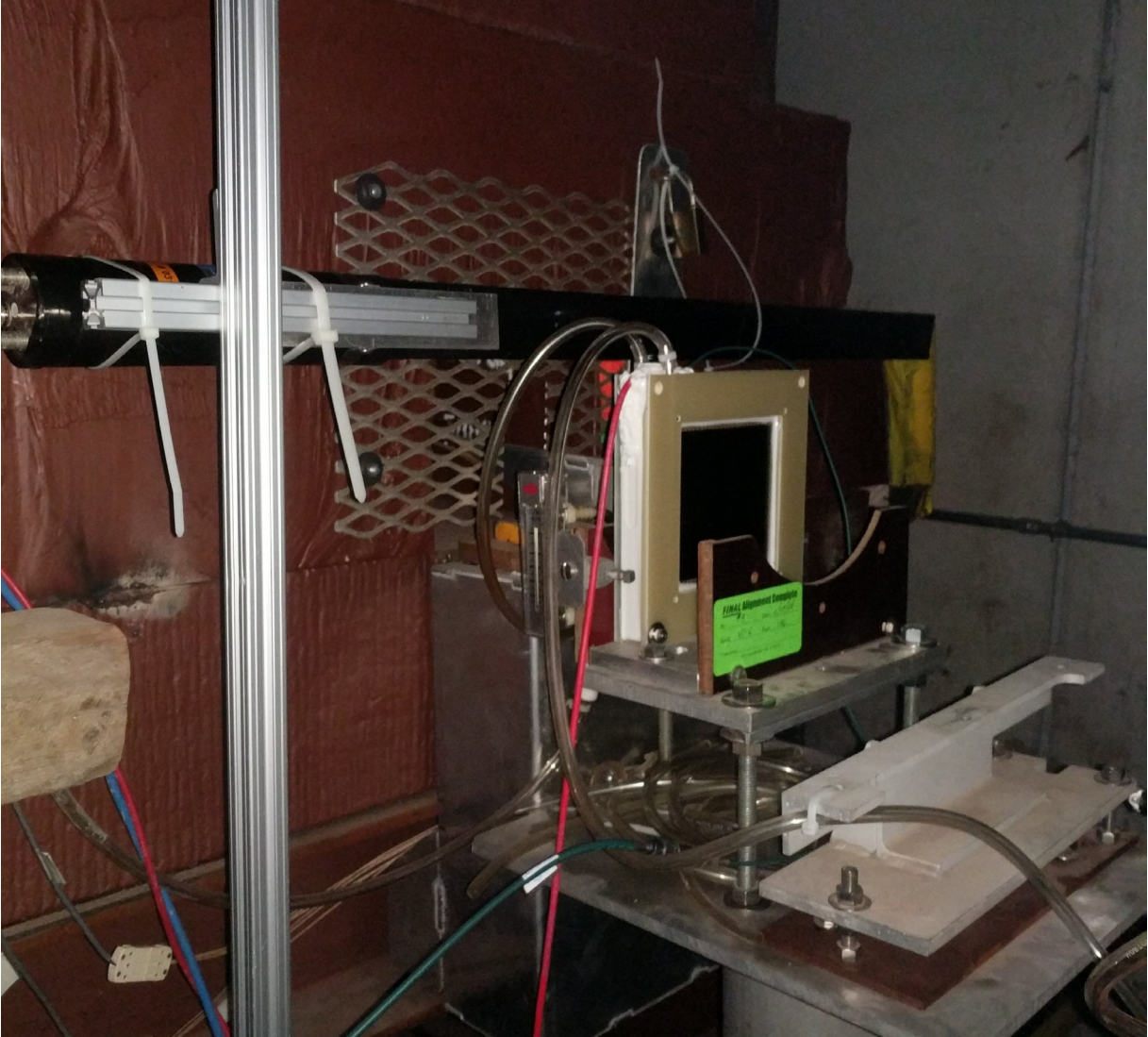
Adam Watts

External Beamlines Department

NOvA Test Beam Halo Meeting

3/4/2020

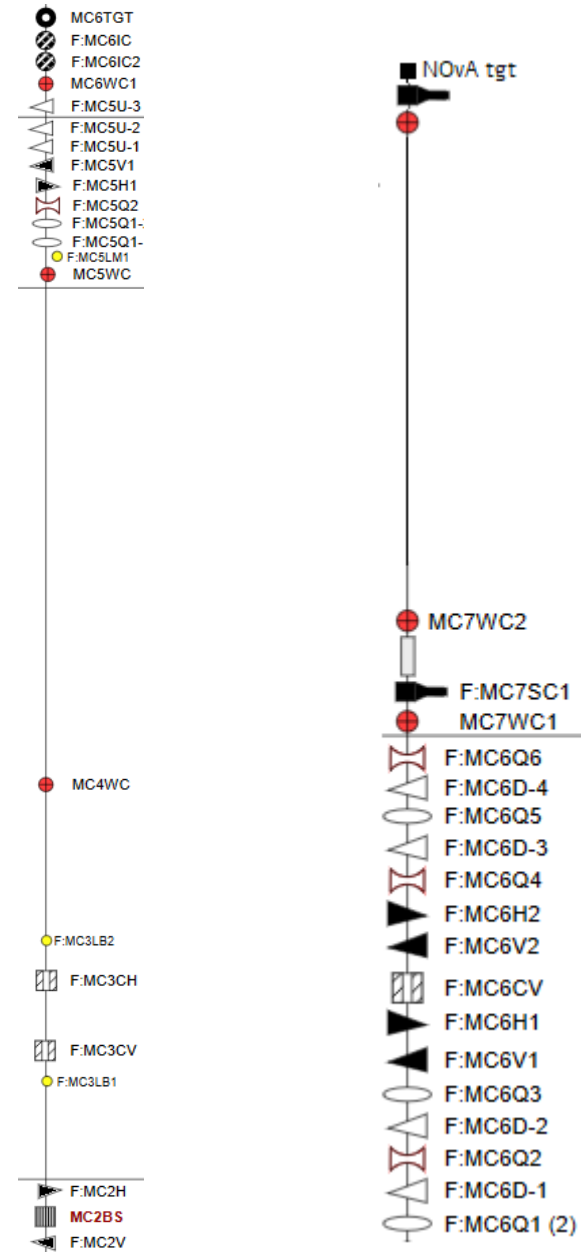
MC6 target back-scatter monitor



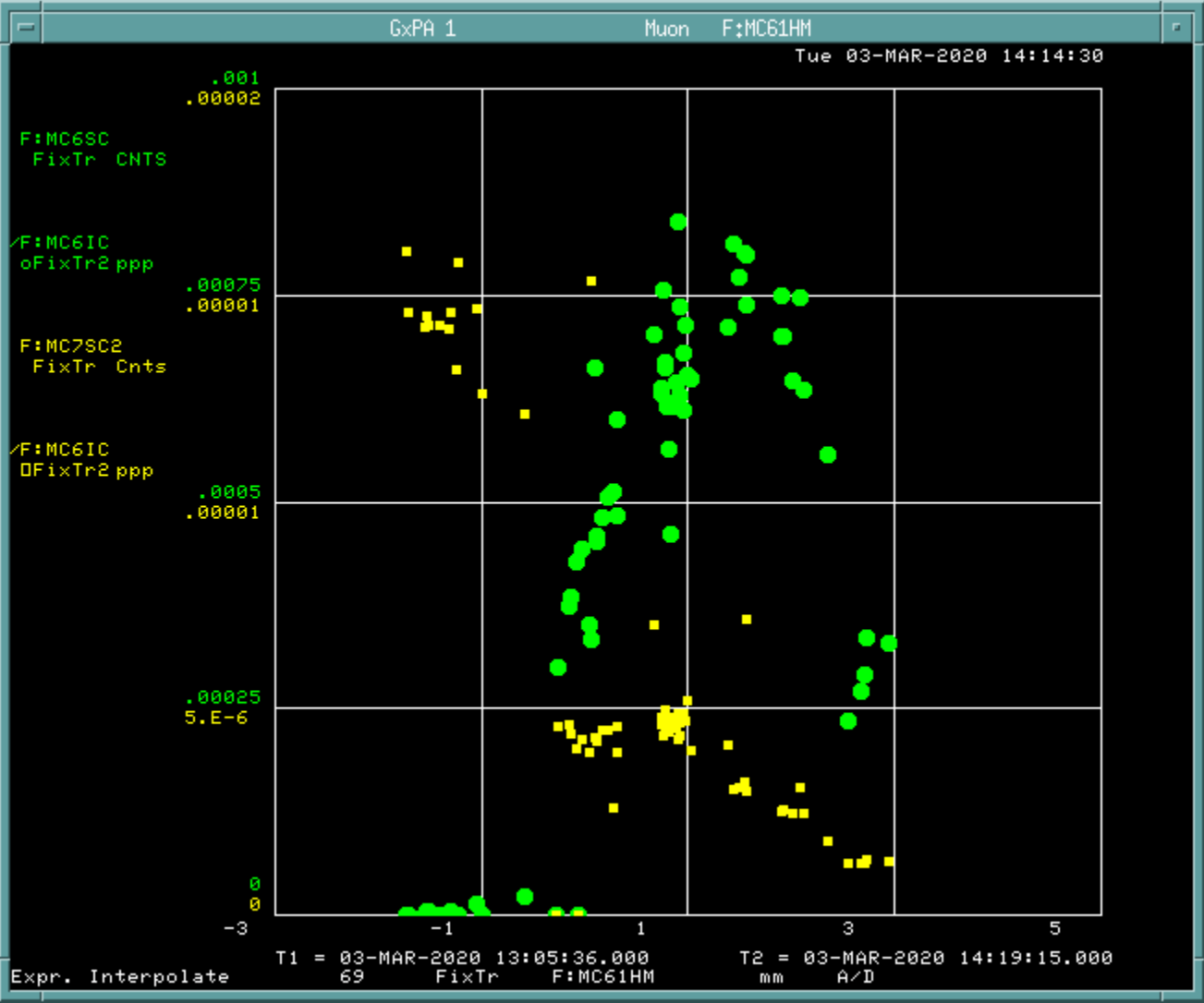
Target scan procedure

For each plane (H and V):

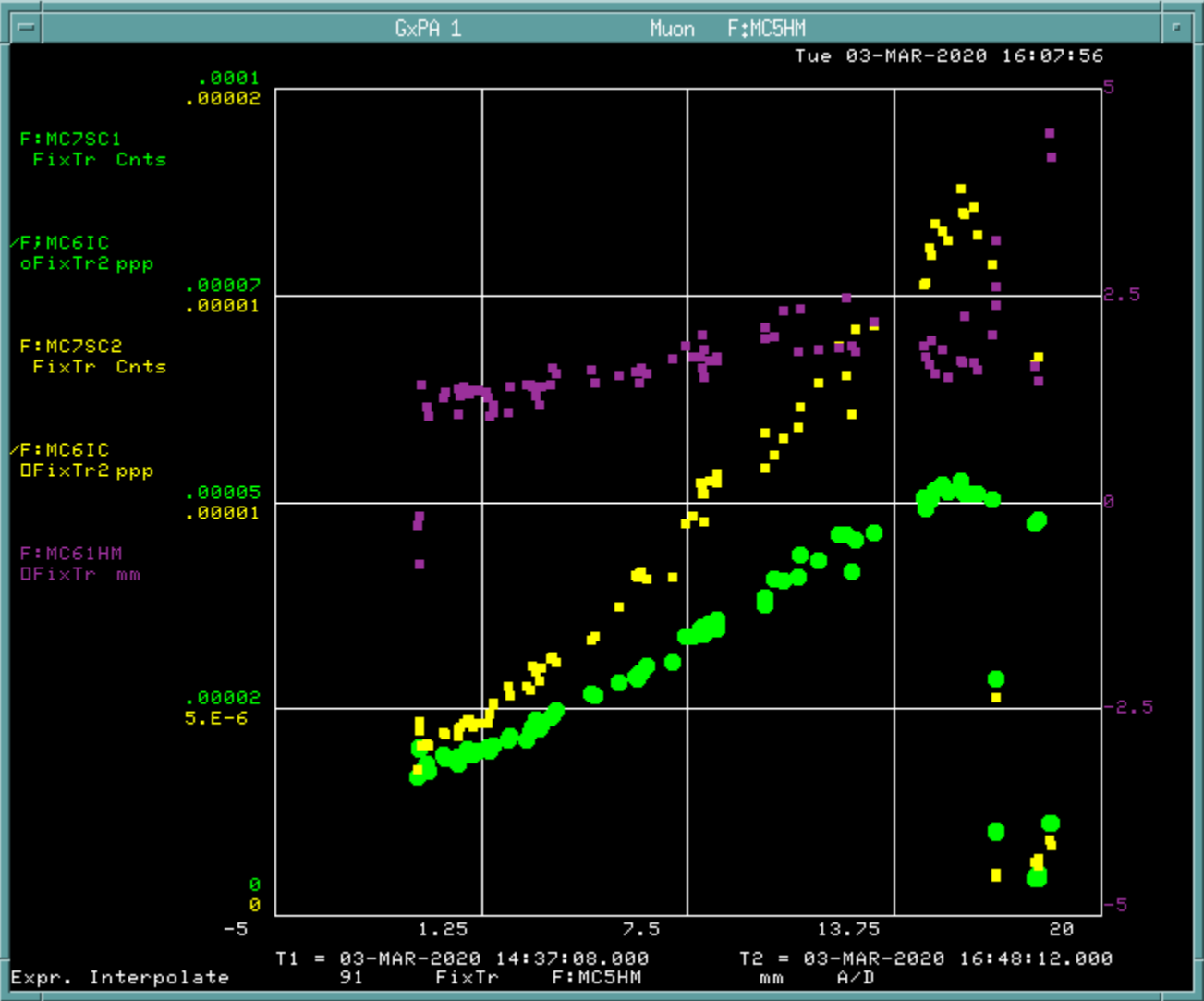
- 1) Turn off secondary trims
- 2) Scan target position
- 3) Set target position to max. back-scatter
(normalized to beam on target) in autotune
- 4) Use autotune to scan upstream position while
keeping target fixed to scan effective angle
- 5) Nominal angle maximizes normalized secondary
throughput, set upstream position in autotune
accordingly
- 6) Re-check target position scan at this new angle to
make sure still at max
- 7) Tune upstream secondary trim to maximize
secondary throughput
- 8) Tune downstream secondary trim to center profile
on NOvA target



MC6 target horizontal position scan



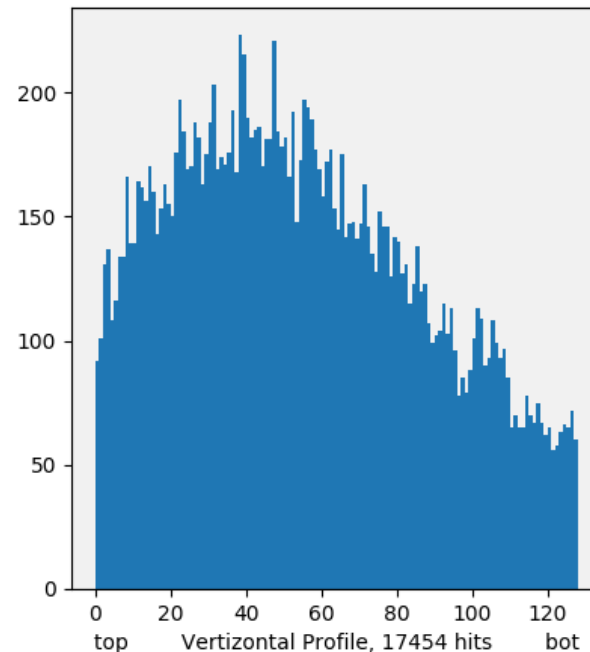
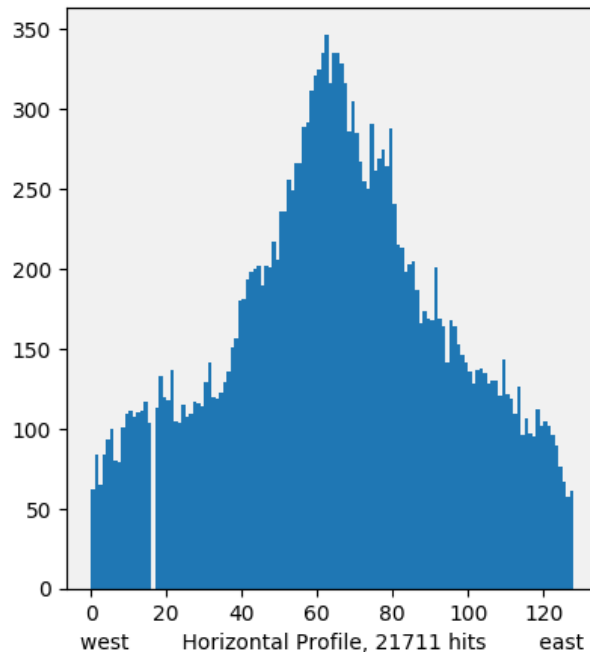
MC6 target horizontal angle scan



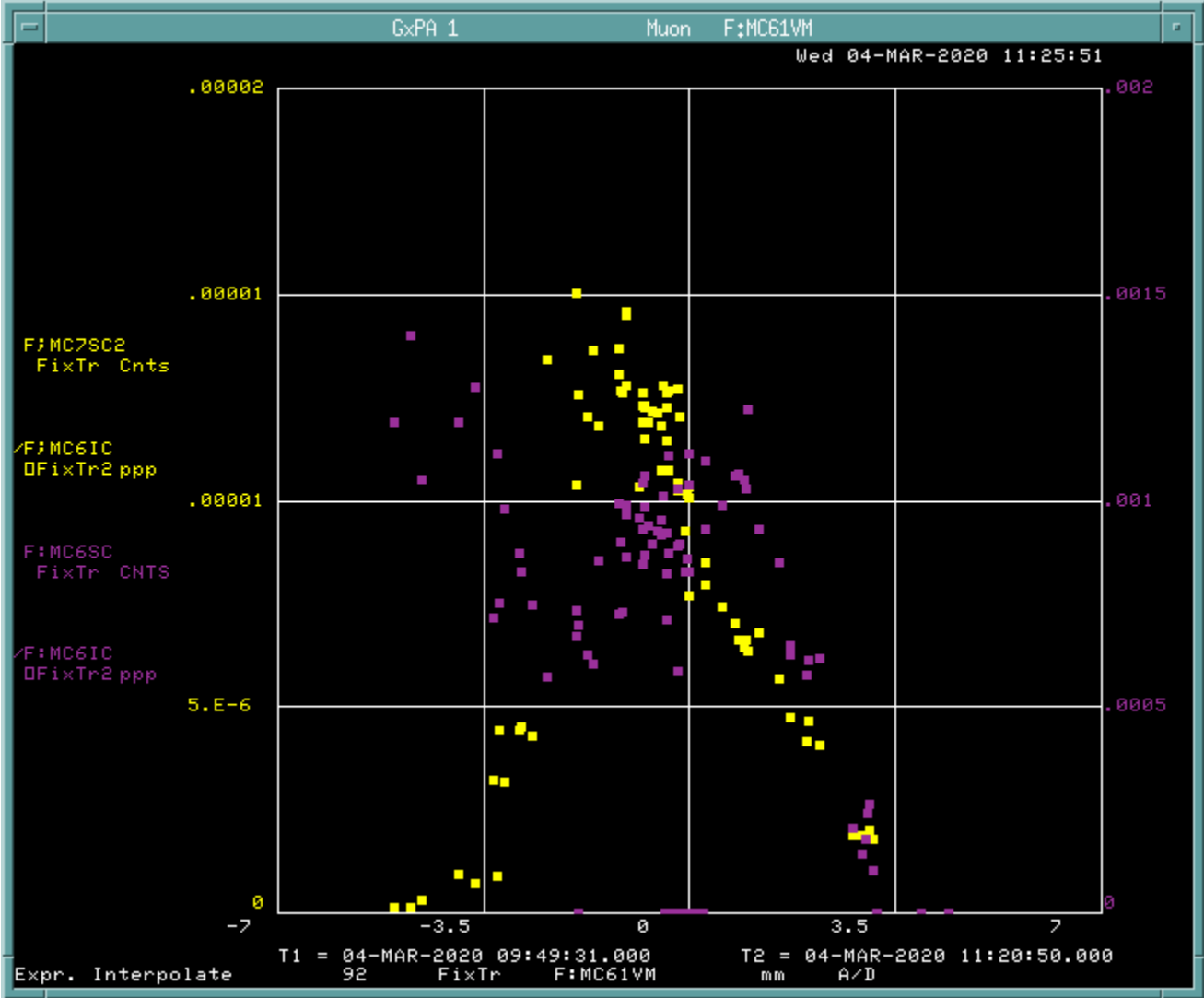
MC6 target horizontal scan results

- Found better horizontal position on target that maximize back-scatter
- Adjusted angle while keeping new position fixed to maximize secondary throughput (normalized coincidence)
- Significant horizontal angle change resulted. Unclear why (alignment?)
- Beam on NOvA target did move horizontally; adjusted trims in secondary line to re-center.
- Muon plume appears unchanged and didn't move during the scan.

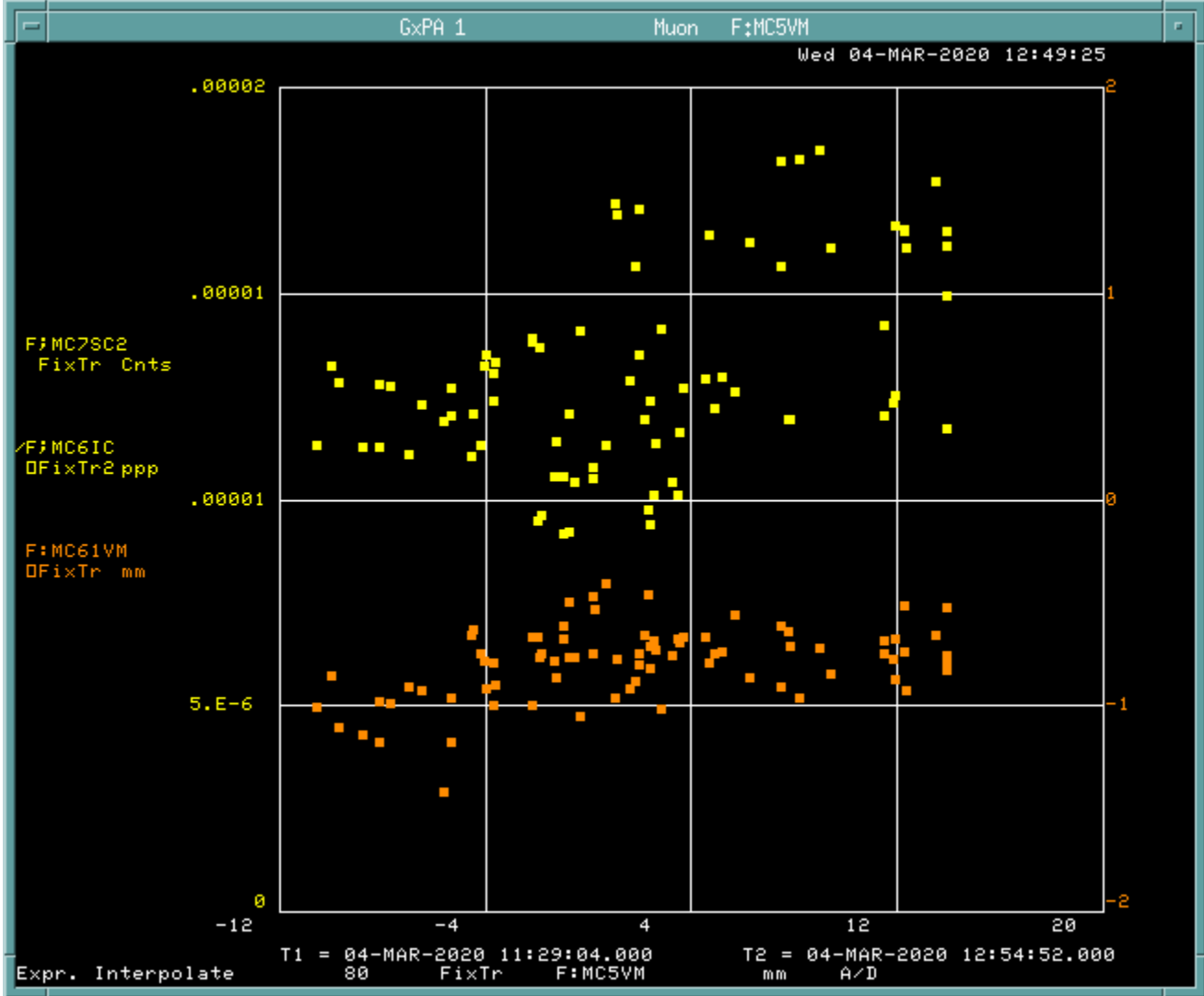
Target, Last Spill, Last Updated: 2020-03-03 17:01:34



MC6 target vertical position scan



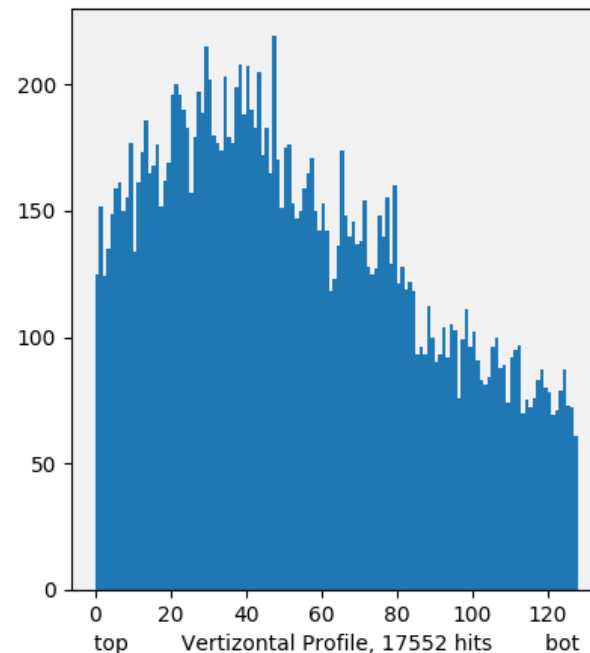
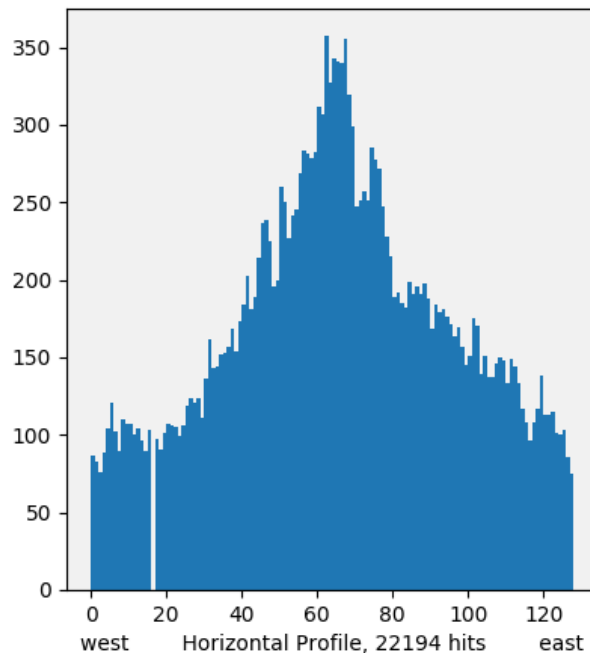
MC6 target vertical angle scan



MC6 target vertical scan results

- Nominal target position appears to be 0 mm
- Can't run this way because that's 0 A on downstream vertical trim, which is unipolar and uses a polarity switch; can't autotune
- Decided on -0.75 mm nominal, left this fixed during angle scan
- Better correspondence between maximizing target back-scatter and secondary throughput; good sign for alignment
- No obvious trend or improvement in changing target angle; surprisingly not that sensitive

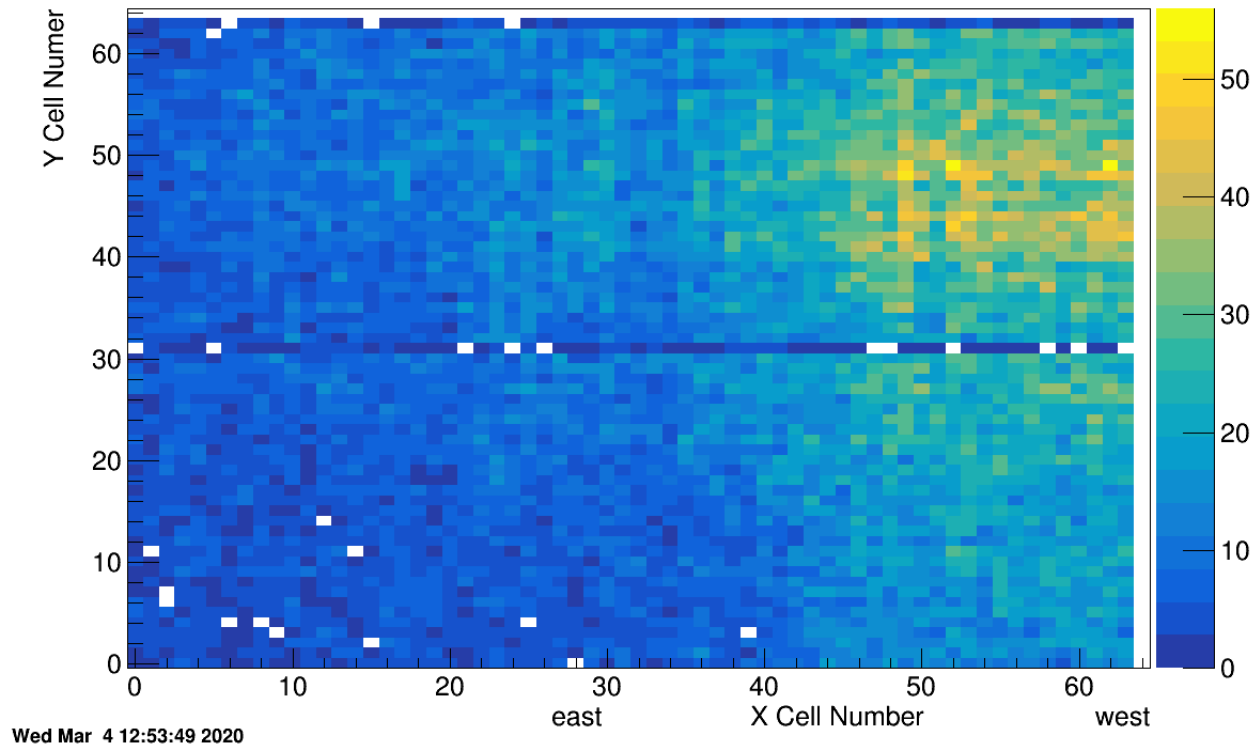
Target, Last Spill, Last Updated: 2020-03-04 12:53:52



Takeaway from primary target tuning

- There appears to be a significant alignment issue in the horizontal plane, maybe in the connection between the MC5/MC6 enclosures and MC7
- Halo appears unchanged throughout entire study

First 2 Planes Hit Profile per spill



Next steps

- Still need to close down MC6CV collimator to $\sim 3\text{mm}$ and center on-momentum beam on NOvA target, maximize 90 degree monitor (Z:NOVTSC00)
- Run with new MC6 target position/angle tune, NOvA TB tell us if there's any difference
- Try reducing secondary momentum to 40 or 30 GeV, where we saw the muon plume significantly diminished. Scan momentum collimator MC6CV to maximize tertiary track count vs. FEB shutoff; better running mode for experiment?
- Run MC6 pinhole collimator in to force narrow quasi-parallel beam on MC6 primary target; not expected to improve halo, but worth trying. Unclear if $1\text{E}9$ on target is possible with pinhole in.