



# Progress this week on the Plume

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AD, External Beamlines

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# Progress this week

- Attempted re-do of collimator gap scan at 64 GeV/c secondary mode. Collimator appeared to get “stuck” in fully open position ( $>20$  mm) after large change sent from MCR. Motion control expert checked locally and was able to move collimator successfully from service building console. Ops and I tried carefully moving the collimator today and were successful, so it appears to be back in service.
- Ran 40 GeV/c secondary mode with collimator all the way open, tuned for secondary throughput efficiency and maximum 90 degree counts on NOvA target. Plume remained and tertiary trigger rate far lower than 64 GeV/c.

# 40 GeV/c secondary mode

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X PA D97 Test Parameters<NoSets><DPM-DPM05 (0%)>
D97 BEAMLINE - MCENTER          SET      D/A   A/D   Com-U  Pgm_Tools
-<FTP>+ *SA+ X-A/D  X=TIME*20  Y=I:BEAM ,I:QXRMI ,I:QERR ,S:SYDINT
COMMAND BL-- Eng-U  I= 0      I= 0      , 0      ,-.2     , 0
-<13>+ r_30 AUTO  F= 6      F= 1      , 44     , .2     , 1.0E+12
spork . . . . crews fish mars flopp bunny OPS oper griz camac

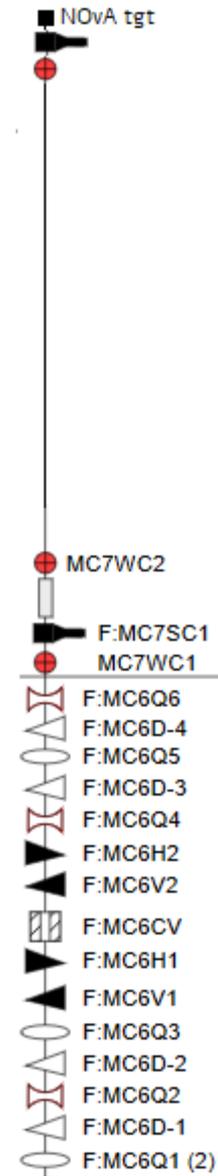
-F: MC1D          MC1D          140.5   139.5   amps ...+R
-F: MC2PUH        Pinhole Coll US Horiz < > 204.4   Mils EU..
-F: MC2PUV        Pinhole Coll US Vert < > 4978    Mils IU..
-F: MC2PDH        Pinhole Coll DS Horiz < > 411.6   Mils EU..
-F: MC2PDV        Pinhole Coll DS Vert < > 5005    Mils IU..
-F: MC2Q1         MC2Q1          11      11      amps ...+R
-F: MC2Q2         MC2Q2          10.55   10.51   amps ...+R
-F: MC2V          MC2V (151)     5.788   5.8     5.701   amps ...-R
-F: MC2H          MC2H (151)     10.41   10.5    10.31   amps ...+R

-F: MC3CV         MC3CV Collimator 0        45.4    Cnts ..0
-F: MC3CH         MC3CH Collimator 0        8.237   Cnts ..0

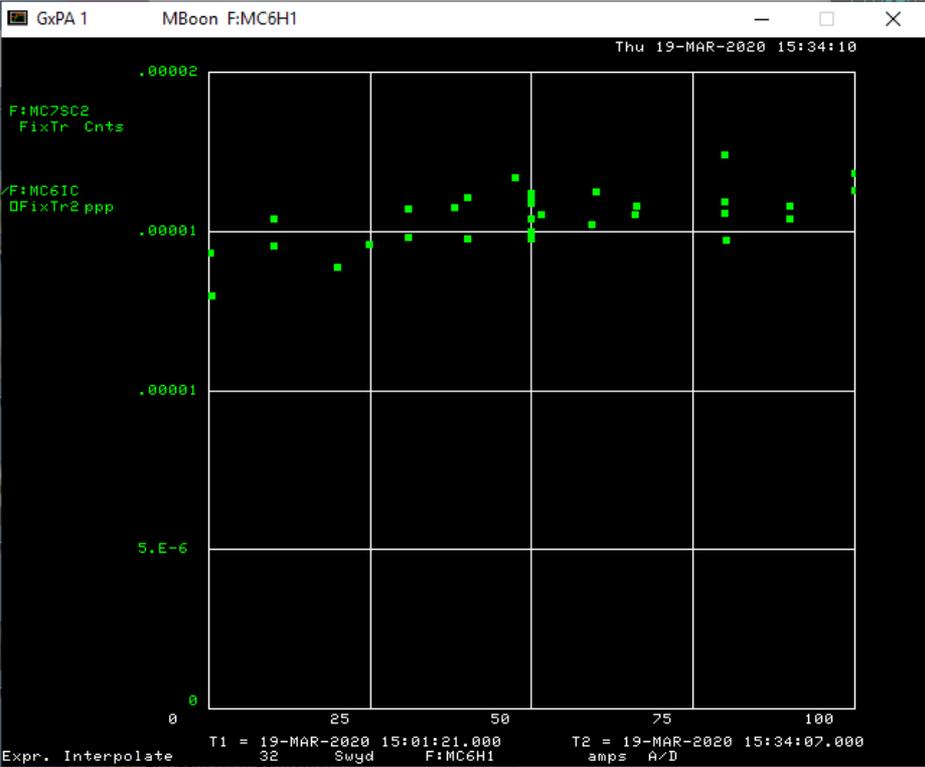
-F: MC5Q1         MC5Q1 (151B)    80      79.57   amps ...-R
-F: MC5Q2         MC5Q2 (151A)    93.2    92.97   amps ...-R
-F: MC5H1         MC5H1 (151B)    5.275   5.45    5.634   amps ...-R
-F: MC5V1         MC5V1 (151A)    .625    2.875   1.404   amps ...-R
-F: MC5U          MC5U (1151)     965     957     amps ...+R

-F: MC6Q1         MC6Q1 (1151)    19.33   12.14   12.1    amps ...+R
-F: MC6D          Not for position tu 472.9   296.4   283.5   amps ...+R
-F: MC6Q2         MC6Q2 (1151)    650.8   407.3   402.8   amps ...-R
-F: MC6Q3         MC6Q3 (1151)    37.19   23.2    23.31   amps ...+R
-F: MC6V1         MC6V1 (1151)    50      31.25   31.27   amps ...+R
-F: MC6H1         MC6H1 (1151)    80      49.9    49.9    amps ...-R
-F: MC6CV         MC6CV Collimator 0        22.39   mm ...
-F: MC6V2         MC6V2 (1151)    80      50.02   49.94   amps ...-R
-F: MC6H2         MC6H2 (159)     34.85   21.72   21.84   Amps ...-
-F: MC6Q4         MC6Q4 (1151)    29.5    18.4    18.48   amps ...-R
-F: MC6Q5         MC6Q5 (1151)    570.5   361.6   356.8   amps ...+R
-F: MC6Q6         MC6Q6 (1151)    60.17   37.67   37.6    amps ...-R

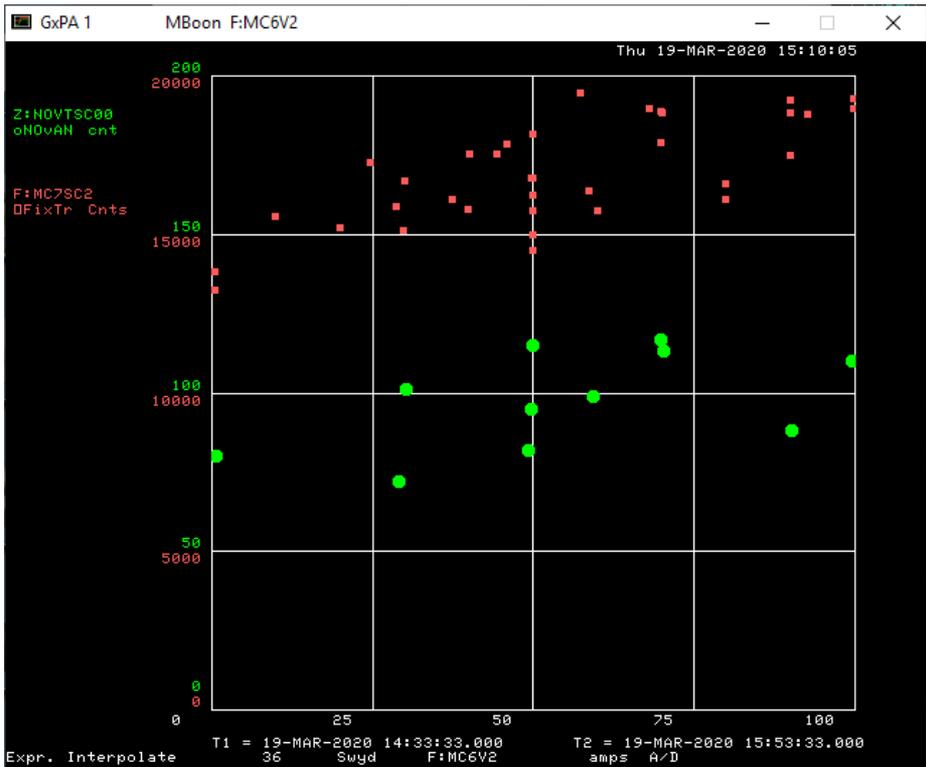
F: MC6IC         Meson Center intensity 1.136E+09 ppp
F: MC7SC1        MC7 Scint Counter SC1 74978   Cnts
F: MC7SC2        MC7 Scint Counter SC2 17186   Cnts
    
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# 40 GeV/c secondary mode, tuning



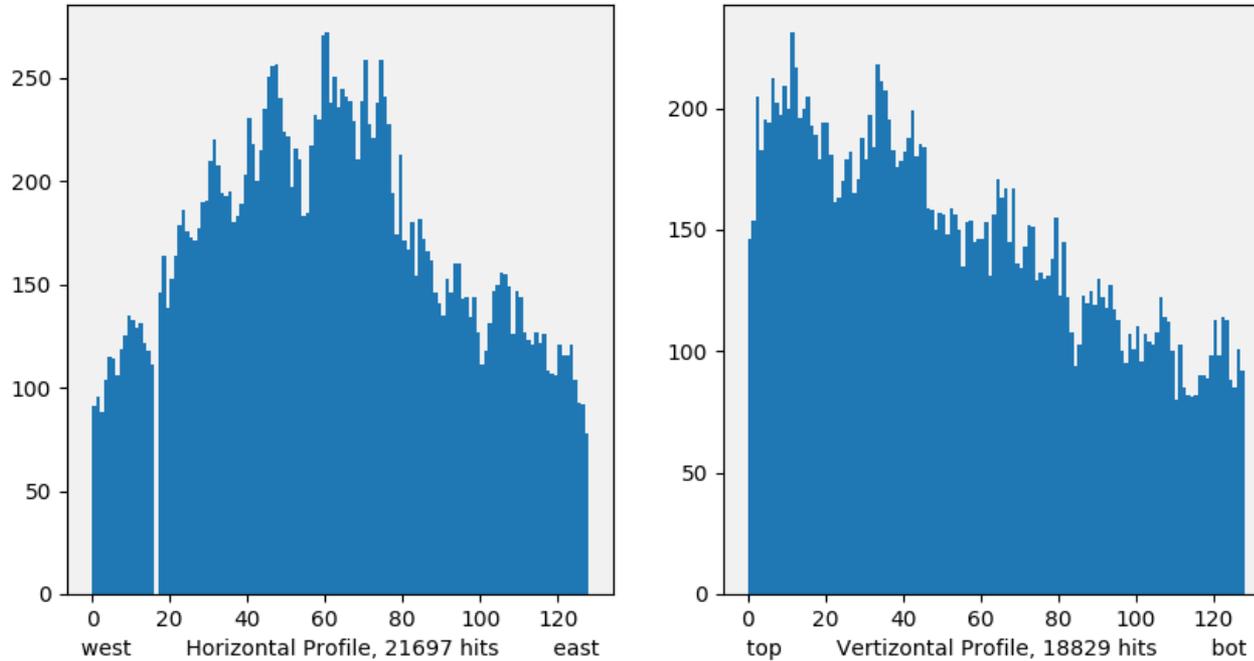
Beamline efficiency tuning



NOvA target tuning

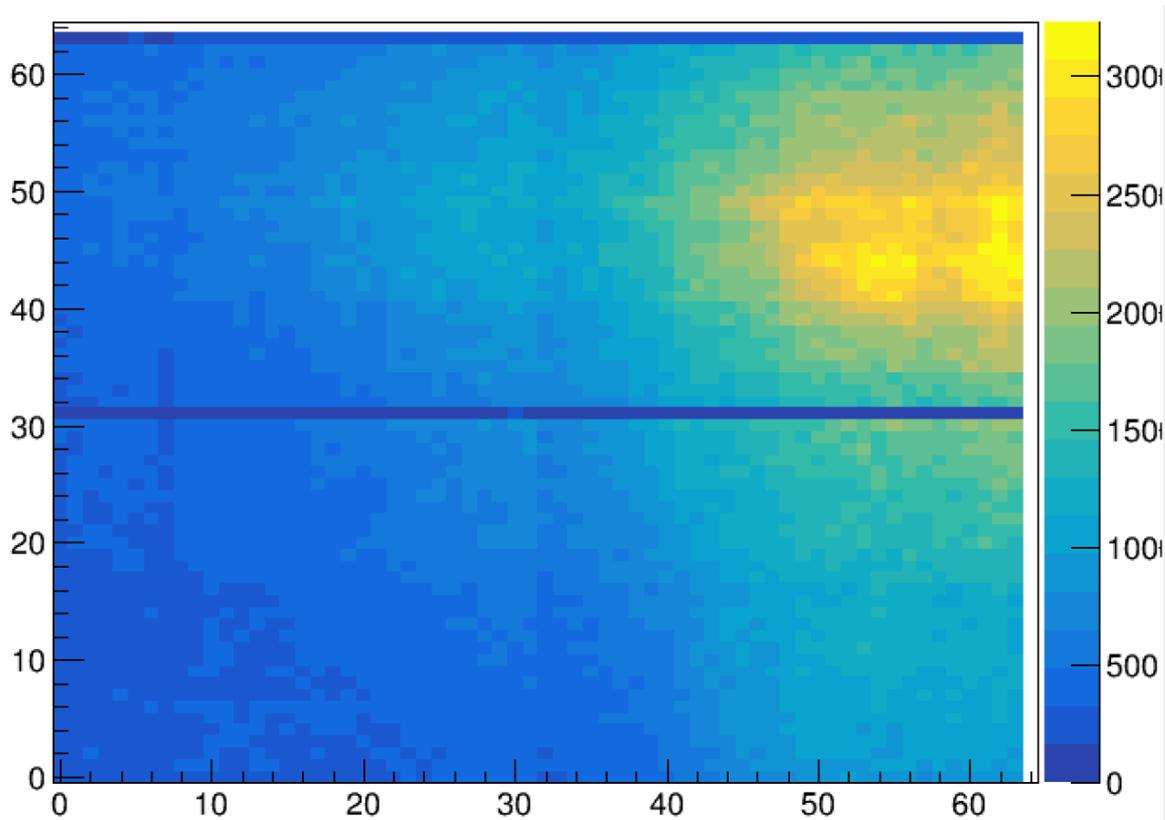
# 40 GeV/c secondary mode, NOvA target

Target, Last Spill, Last Updated: 2020-03-19 13:12:11



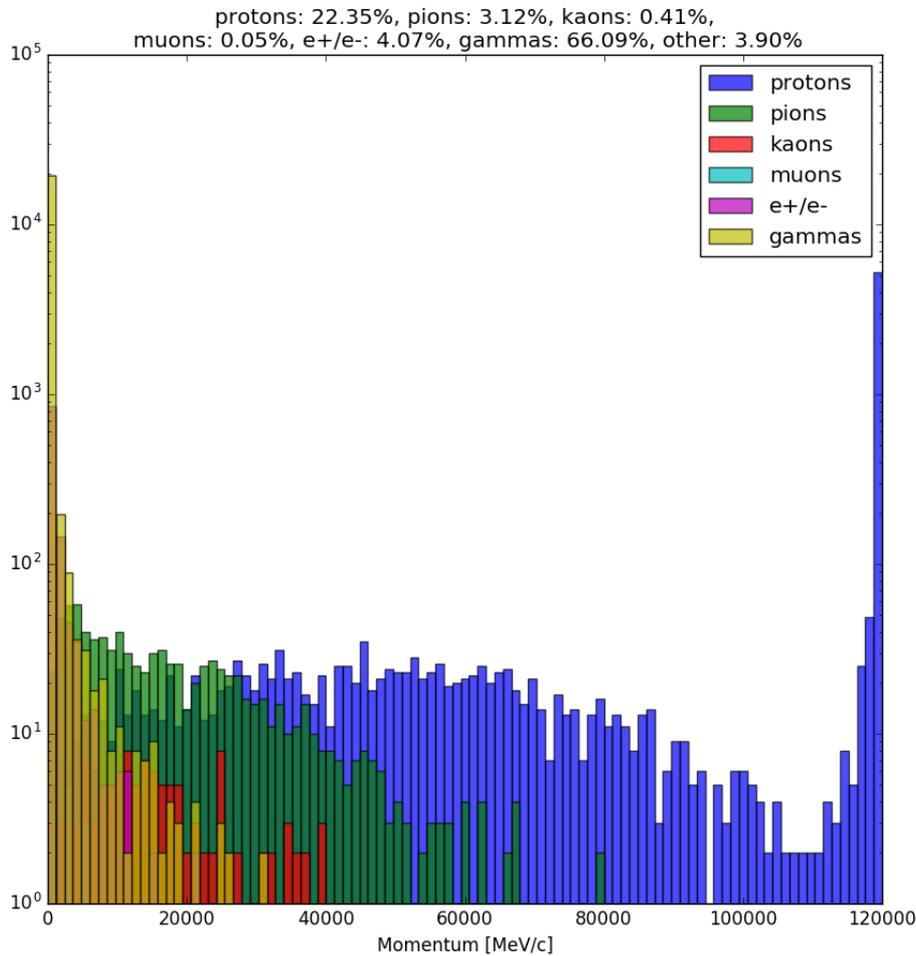
Vertically off-center due to off-momentum particles. At the time, could not close momentum collimator to properly tune up.

# 40 GeV/c secondary mode, NOvA target



Pre-tuning, plume after ~56 spills from Mike. 4 tertiary triggers for this run. Does plume persist because collimator is open? Previous studies suggest plume goes away at 40 GeV/c with collimator at 12.7mm

# G4Beamline secondary production



Momentum histogram of secondaries after MC6 target and fixed collimator (before any magnets) suggests pion yield increases with lower momentum. Not clear why 40 GeV/c study experimental trigger rate was factor of 7 lower than 64 GeV/c.

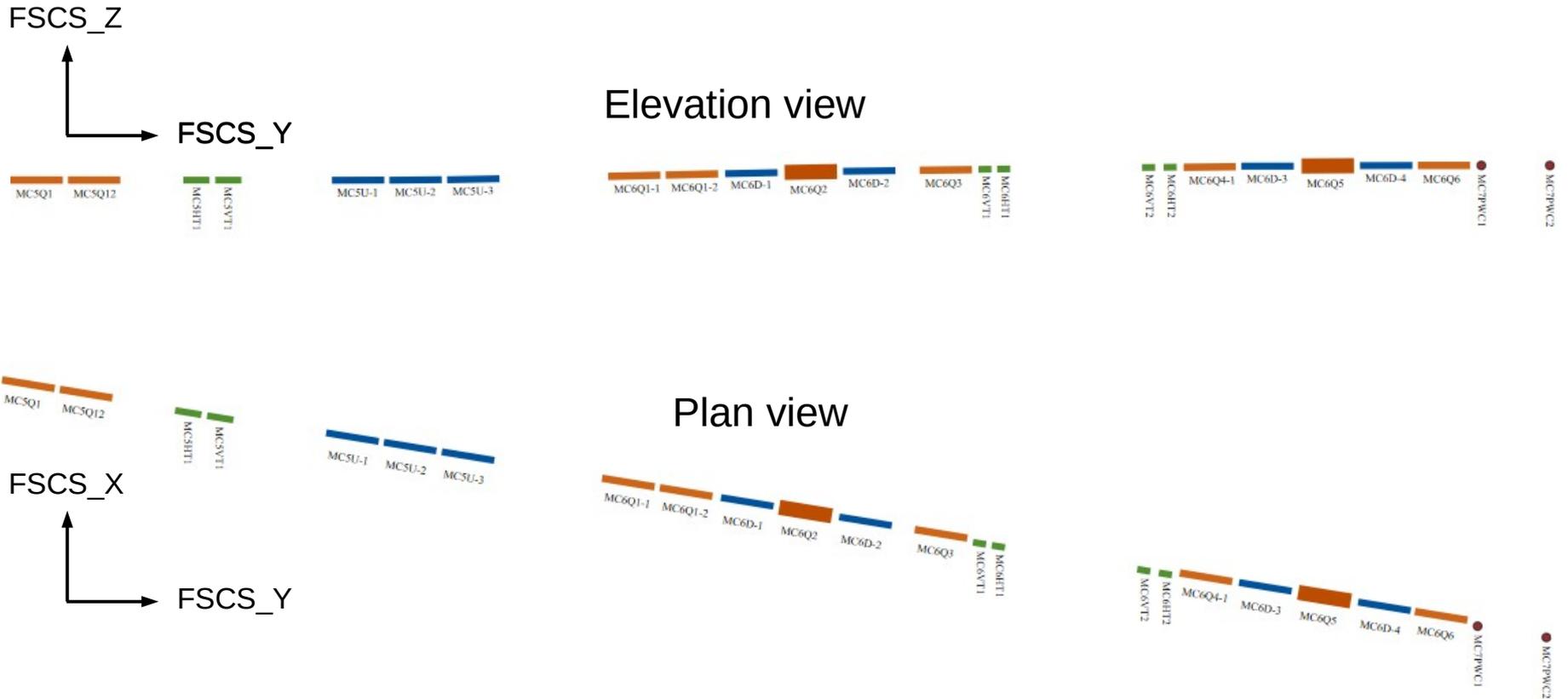
Plot is for no cuts, no track kill, 20k 120 GeV/c protons on target.

# MCenter alignment data from Metrology

Component Type	Component Name	Stationing (Metres)	FSCS X (Metres)	FSCS Y (Metres)	FSCS Z (Metres)	Beamline	Date of Survey
3Q120	MC5Q1_UP	0	30278.11706	32158.12565	227.1155	MIPP	2012-8-14
3Q120	MC5Q1_CT	1.523	30277.86683	32159.62817	227.11504	MIPP	2012-8-14
3Q120	MC5Q1_DN	3.046	30277.61666	32161.13038	227.11457	MIPP	2012-8-14
3Q120	MC5Q12_DN	3.346	30277.56751	32161.42599	227.11453	MIPP	2012-8-14
3Q120	MC5Q12_CT	4.869	30277.31739	32162.92853	227.11405	MIPP	2012-8-14
3Q120	MC5Q12_DN	6.392	30277.06724	32164.43121	227.11358	MIPP	2012-8-14
3Q120	MC5Q2_UP	6.7	30277.01652	32164.73483	227.11368	MIPP	2012-8-14
3Q120	MC5Q2_DN	9.748	30276.51614	32167.74128	227.11255	MIPP	2012-8-14
HORIZONTAL TRIM	MC5HT1_UP	10.057	30276.46496	32168.04578	227.11274	MIPP	2012-8-14
HORIZONTAL TRIM	MC5HT1_CT	10.819	30276.34	32168.79725	227.11238	MIPP	2012-8-14
HORIZONTAL TRIM	MC5HT1_DN	11.58	30276.21503	32169.5488	227.11202	MIPP	2012-8-14
VERTICAL TRIM	MC5VT1_UP	11.912	30276.16052	32169.87566	227.11192	MIPP	2012-8-14
VERTICAL TRIM	MC5VT1_CT	12.674	30276.03542	32170.62708	227.11171	MIPP	2012-8-14
VERTICAL TRIM	MC5VT1_DN	13.435	30275.91031	32171.37851	227.1115	MIPP	2012-8-14
EPB DIPOLE	MC5U-1_UP	18.703	30275.04531	32176.57427	227.11003	MIPP	2012-8-14
EPB DIPOLE	MC5U-1_DN	21.748	30274.54534	32179.57865	227.12089	MIPP	2012-8-14
EPB DIPOLE	MC5U-2_UP	22.047	30274.49609	32179.87356	227.1231	MIPP	2012-8-14
EPB DIPOLE	MC5U-2_DN	25.092	30273.99604	32182.87682	227.15666	MIPP	2012-8-14
EPB DIPOLE	MC5U-3_UP	25.403	30273.94512	32183.18333	227.16147	MIPP	2012-8-14
EPB DIPOLE	MC5U-3_DN	28.449	30273.44498	32186.188	227.21905	MIPP	2012-8-14
3Q120	MC6Q1-1_UP	34.769	30272.40714	32192.42009	227.3619	MIPP	2012-8-14

Above is a sample of the alignment data we got from Metrology in global site coordinates. Key elements are missing (MC6 target, MC6CV momentum collimator, NOvA detector blocks).

# MCenter alignment data from Metrology



As part of scrutinizing the alignment data, I'm working on a script that plots beamline element positions to scale. Pictured above are work-in-progress elevation and plan views.

Will also compare alignment data to TRANSPORT optics simulation floor coordinates output and G4Beamline element placement.

# Takeaway

- 40 GeV/c study hampered by MC6CV being “stuck” all the way open.
- Tertiary trigger rate factor of 7 lower than 64 GeV/c, doesn't agree with simulations\*.
- Now that MC6CV is working again, we could re-do this study when beam returns. Close collimator down to center vertically on target. Open back up to 12.7mm, see if plume remains
- NOvA making progress on counting shutoff and muons in data

\* What does?