SECAR Commissioning 2019

$^{40}Ar^{14+}$

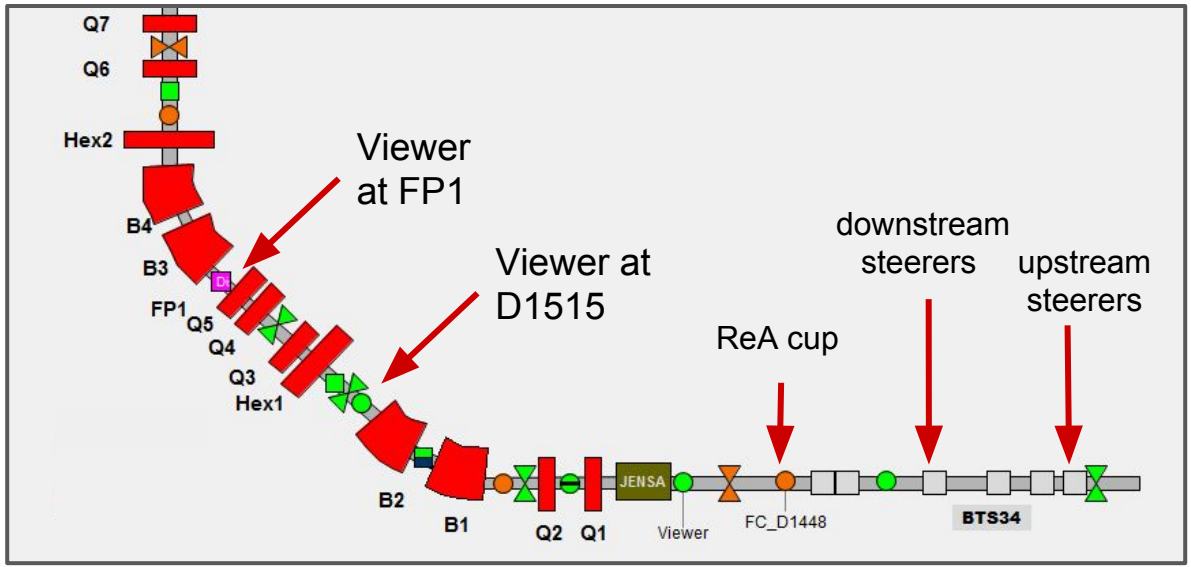
February 14 E=2.86 MeV/u
February 21-22 E= 2.86 MeV/u, 2.81 MeV/u
March 10-11 E= 2.81 MeV/u

Results:

- Developed a tuning procedure for the quads, transmission 80-100%
- Still have some steering that might not be avoidable in the foreseeable future
- Confirmed diagnostics work up to FP1

Tuning method:

1. Get beam from ReA after they tune it through JENSA minimizing current on apertures
2. Looking at the JENSA viewer, use the upstream steerers to center the beam
3. Looking at the FP1 viewer and with Q3-Q5 off, vary Q1-Q2 then use downstream steerers to minimize the resulting steering
4. Repeat while making sure currents on apertures is low until we get to a non/minimally steering tune
5. Adjust B1 and B2 so it is horizontally centered at FP1
6. Check steering of Q3, Q4 and Q5
7. If they steer a little adjust B1 and B2 again looking at VD_D1515



2/21

E = 2.86 MeV/u
Brho= 0.6954

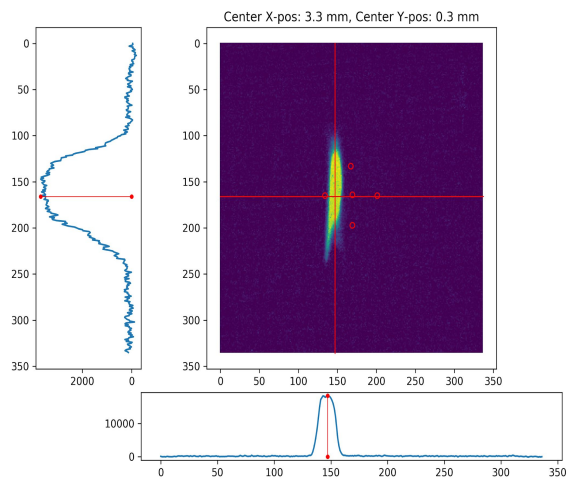
2/22

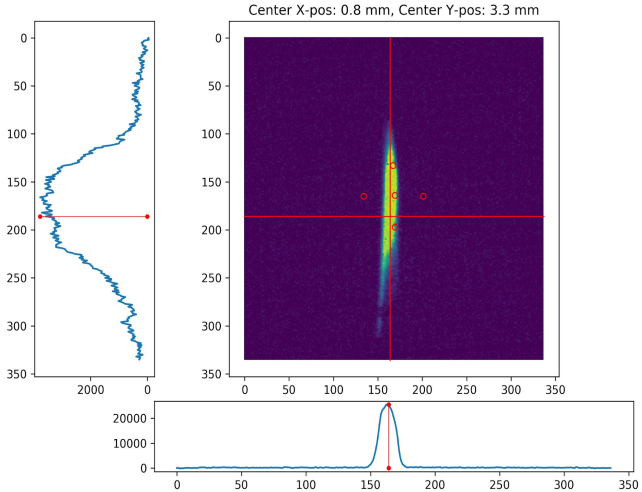
E = 2.81 MeV/u
Brho= 0.6893 Tm

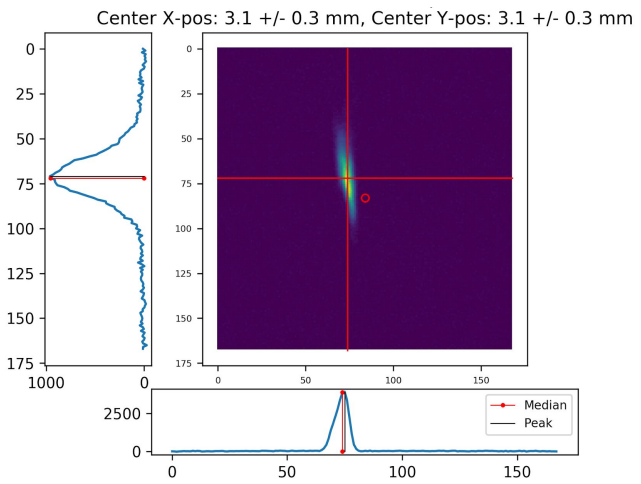
3/11

E = 2.81 MeV/u
Brho= 0.6893 Tm

All quads on

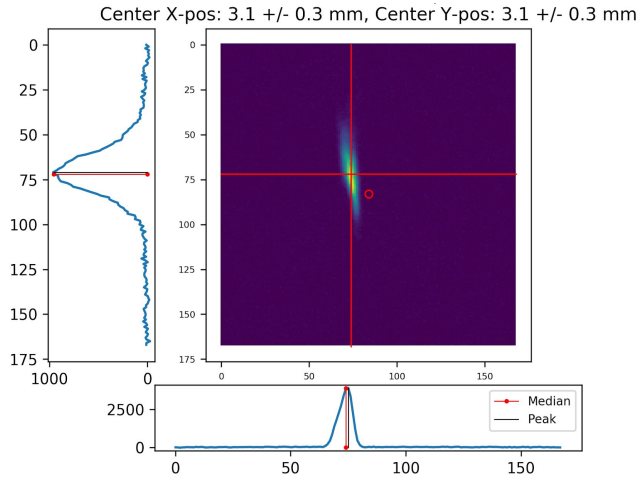




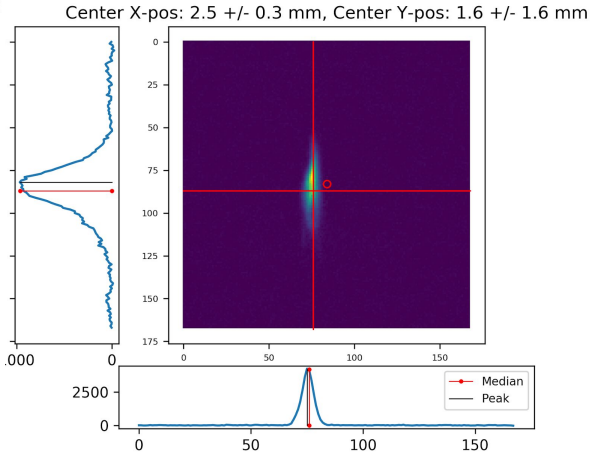


Scaling SECAR conserves the optics but the different ReA tune angles affect our steering

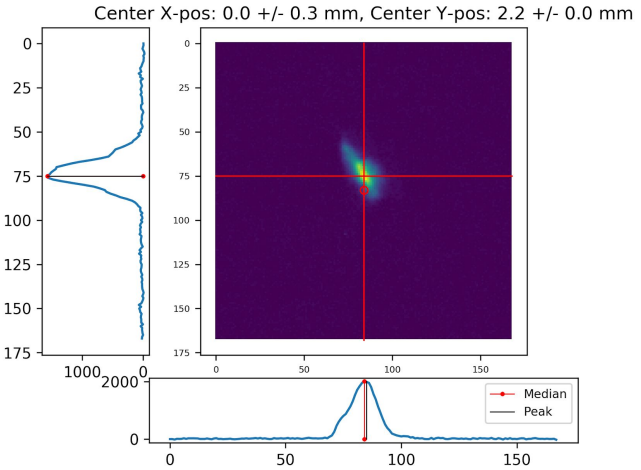
All quads on



Q1 field at half



Q3 field at half

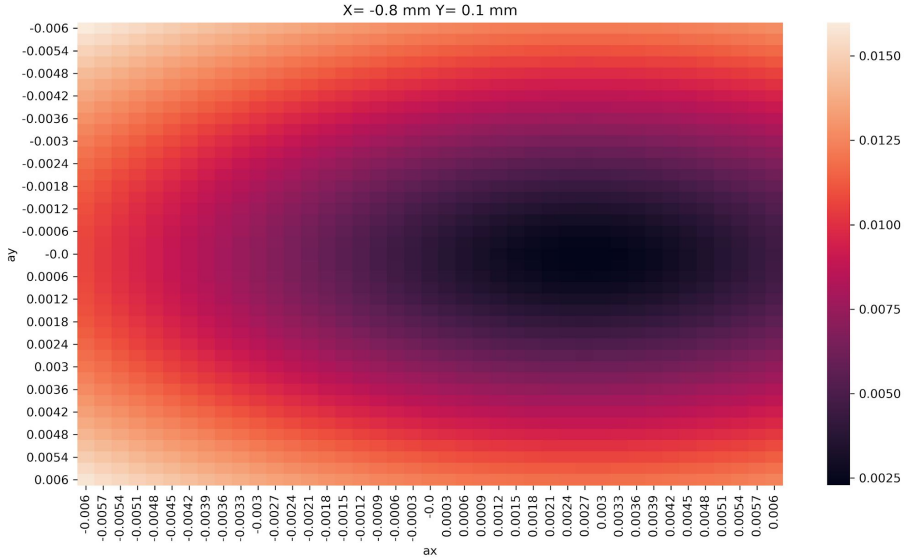


Our best tune has steering of around +/- 3 mm in x and y

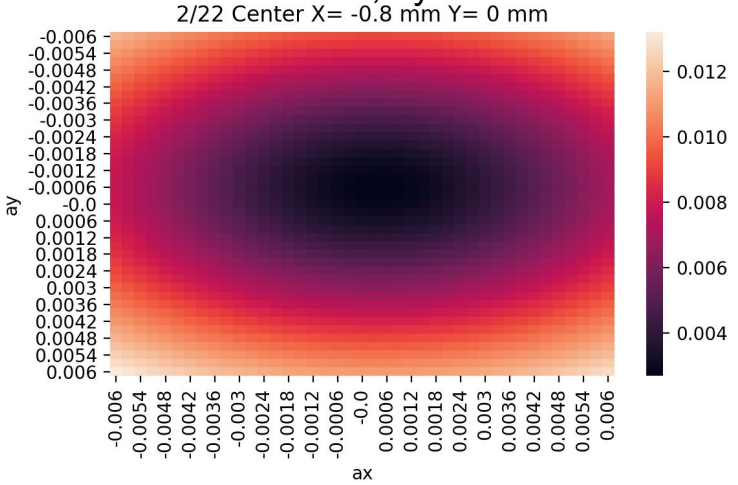
Comparing results to COSY simulations

1. Corresponding COSY map was obtained for each of the previous measurements
2. Initial conditions were fitted to the measurements by minimizing the difference between beam spot size at FP1 from COSY and from our measurements
   Best guesses so far:

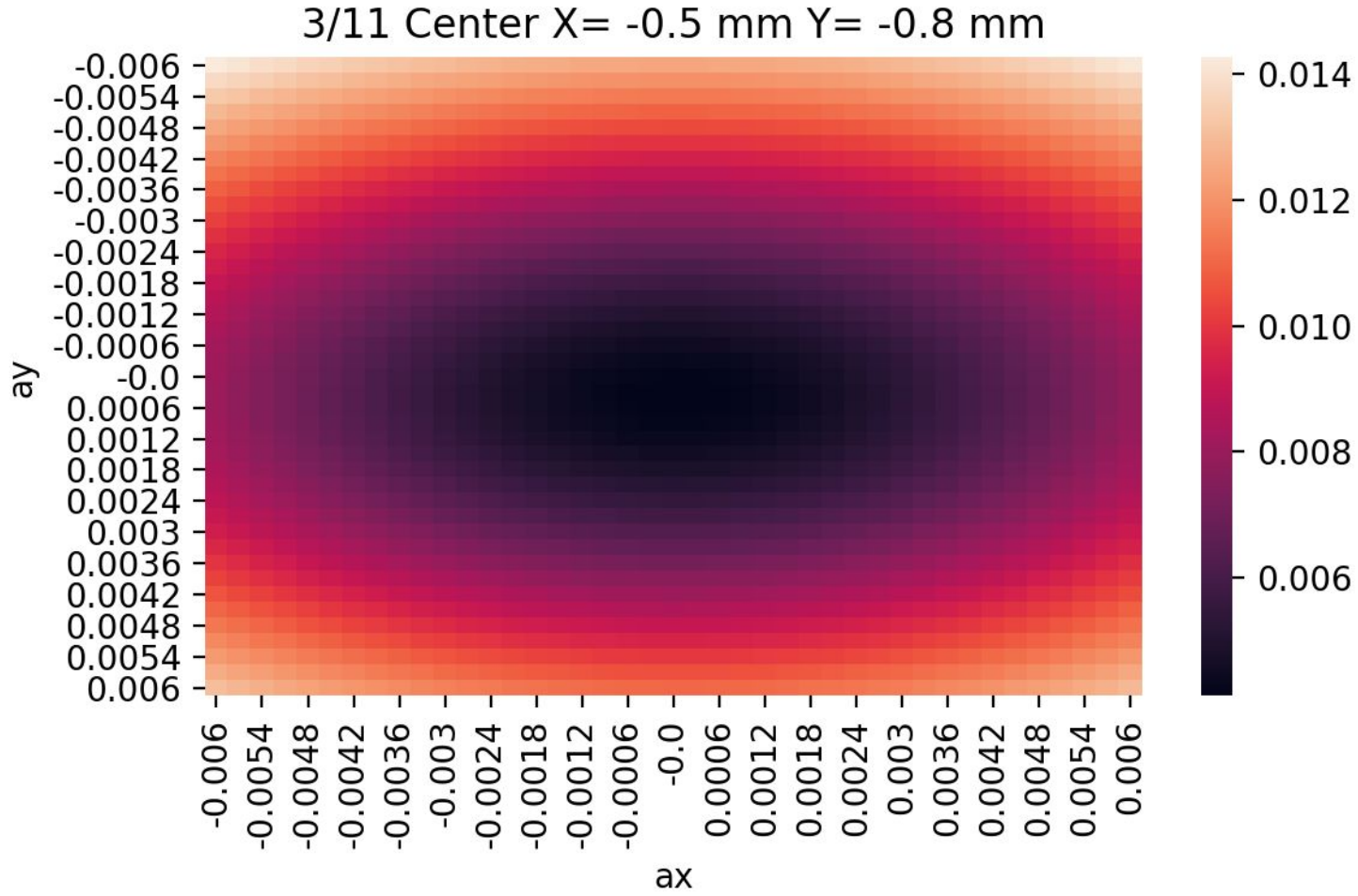
2/21 ax= 2.7 mrad, ay= 0 mrad



2/22 ax= 0.3 mrad, ay= -0.6 mrad



3/11 ax= 0 mrad, ay= 0.3 mrad


3/11 Center X= -0.5 mm Y= -0.8 mm
ay
-0.006
-0.0054
-0.0048
-0.0042
-0.0036
-0.003
-0.0024
-0.0018
-0.0012
-0.0006
-0.0
0.0006
0.0012
0.0018
0.0024
0.003
0.0036
0.0042
0.0048
0.0054
0.006
ax
-0.006
-0.0054
-0.0048
-0.0042
-0.0036
-0.003
-0.0024
-0.0018
-0.0012
-0.0006
-0.0
0.0006
0.0012
0.0018
0.0024
0.003
0.0036
0.0042
0.0048
0.0054
0.006
0.014
0.012
0.010
0.008
0.006

Next

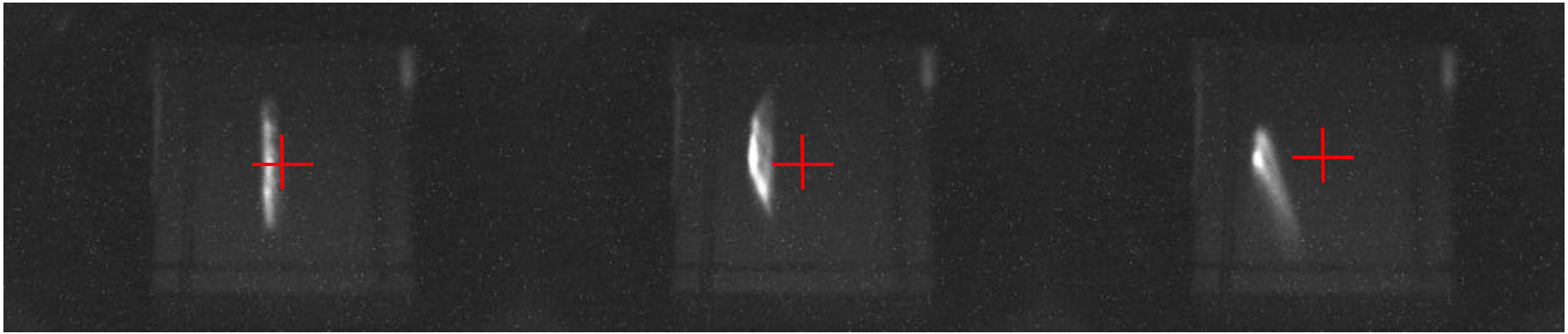
- Fix remaining issues with the camera and NMR in B2
- Tune through B3/B4 to confirm FC3 works
- Confirm method to tune the dipoles (relationship between rigidity and field)

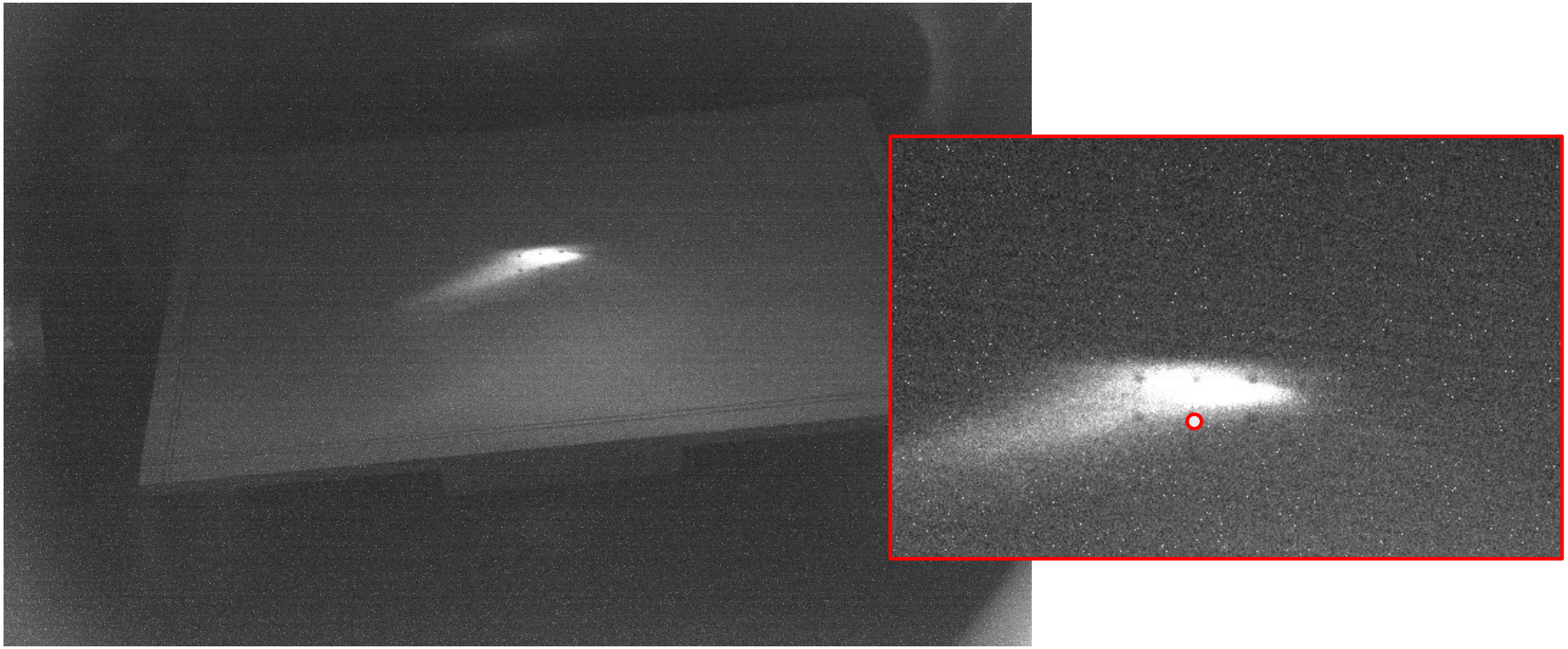
- March 25: 3 days, ~5 energy changes, tuning to FC3
- April 4: 10 days, charge state distribution and jet thickness measurements with He gas and Na beam ⇨ **Need more people to help with shifts**

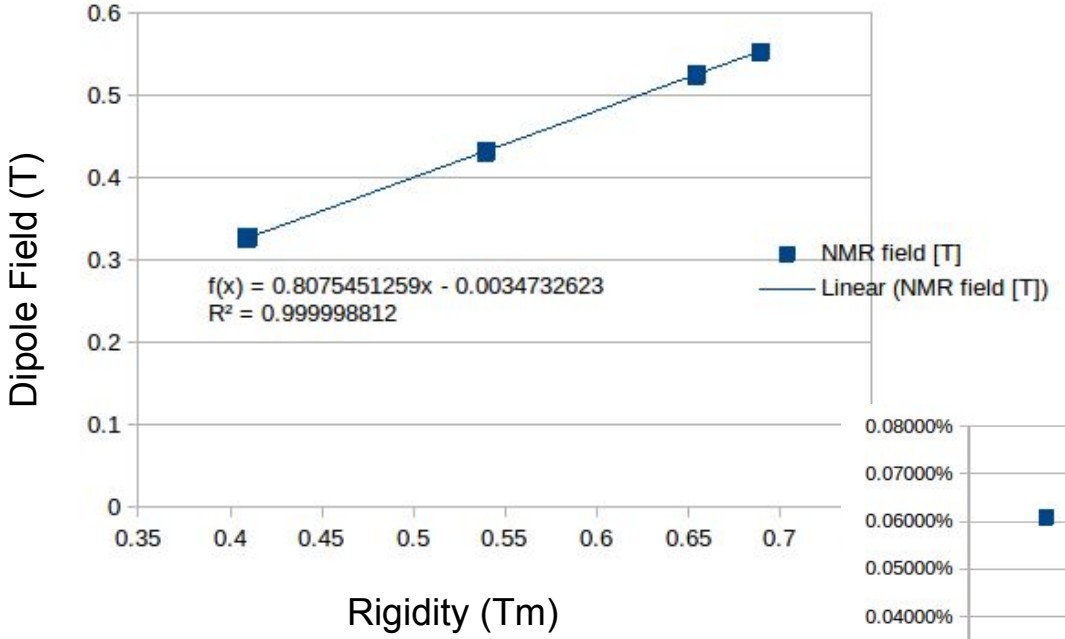
E= 2.5 MeV/u

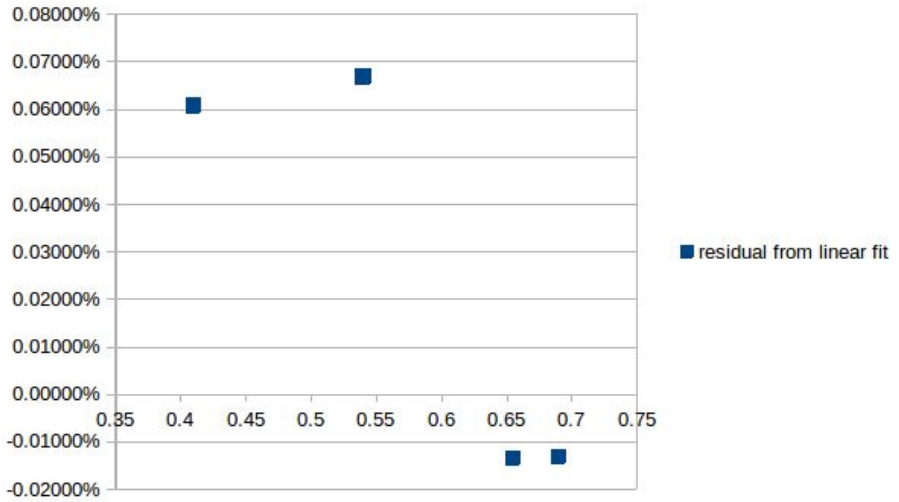
E= 1.7 MeV/u

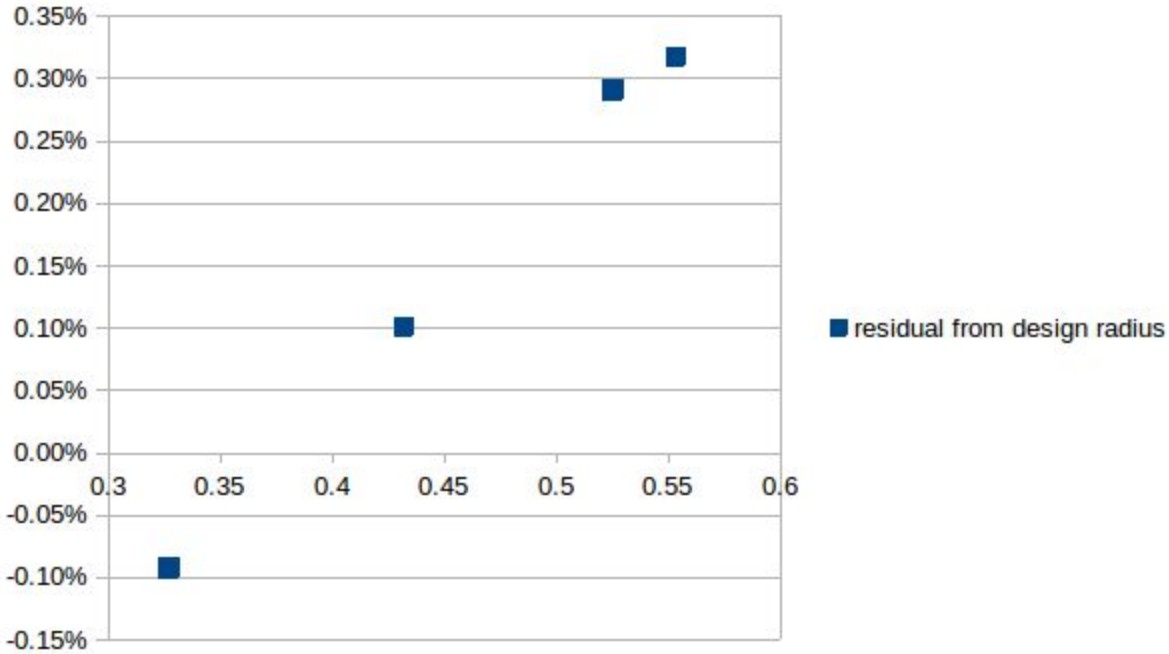
E= 0.98 MeV/u






Dipole Field (T)
0.6
0.5
0.4
0.3
0.2
0.1
0
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
f(x) = 0.8075451259x - 0.0034732623
R² = 0.999998812
NMR field [T]
Linear (NMR field [T])
Rigidity (Tm)


0.08000%
0.07000%
0.06000%
0.05000%
0.04000%
0.03000%
0.02000%
0.01000%
0.00000%
-0.01000%
-0.02000%
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
residual from linear fit


0.35%
0.30%
0.25%
0.20%
0.15%
0.10%
0.05%
0.00%
-0.05%
-0.10%
-0.15%
0.3
0.35
0.4
0.45
0.5
0.55
0.6
residual from design radius