The SOS Quad in the Right-HRS (RHRS)

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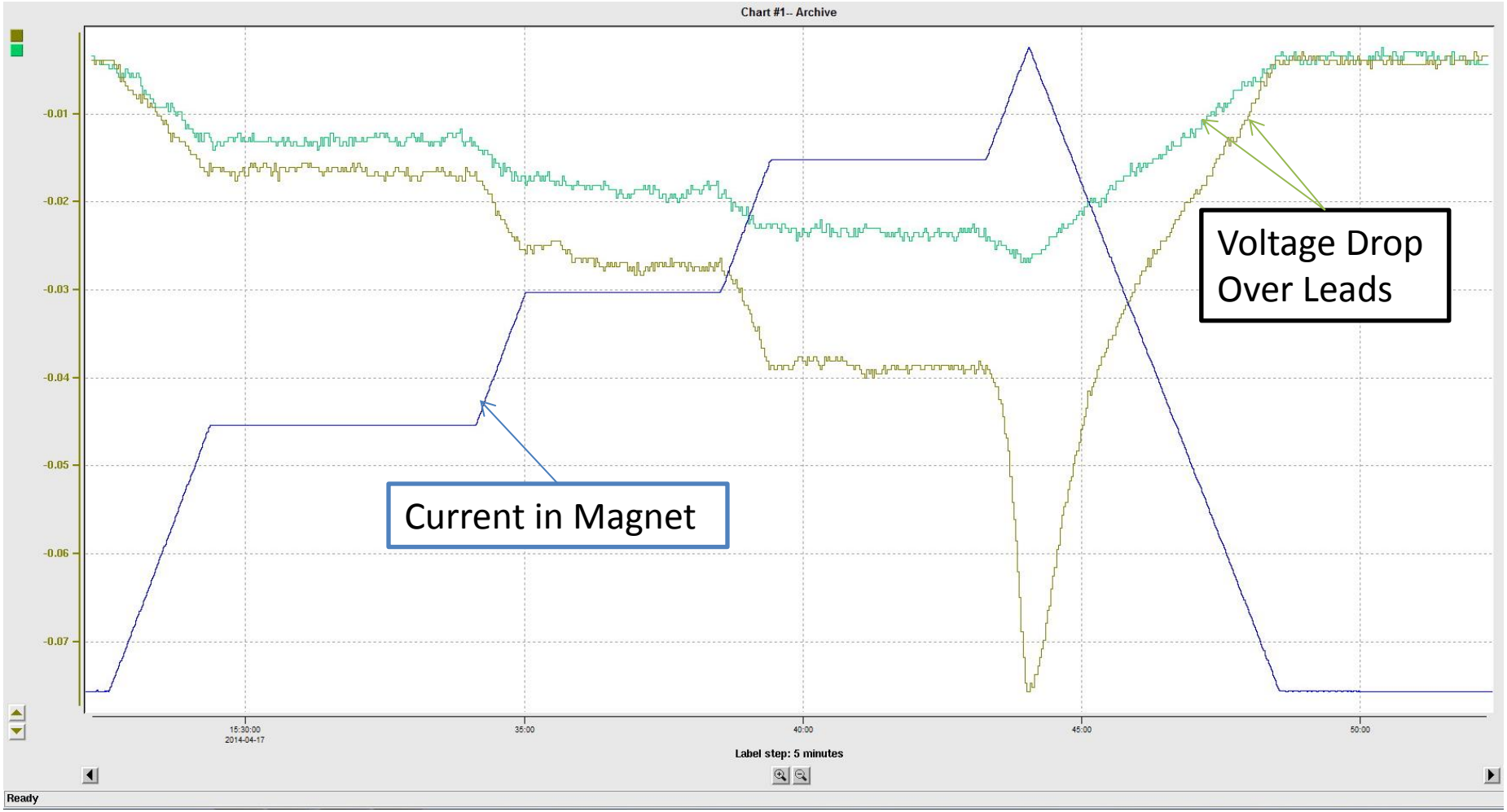
Current Status of the RHRS

- The HRSs (RHRS and LHRS) are QQDQ spectrometers. Quadrupole 1 (Q1) focuses in the dispersive (i.e. bend) plane, while Q2 and Q3 focus in the non-dispersive direction.
- For the RHRS Q1, a rapid, non-linear voltage increase across the two leads was observed with an increase in current.
- Because of this, Q1 has been removed from the RHRS; and it will **not** be used during the Spring 2015 run.

RHRS Q1: Voltage Across Leads



Status of the Q1s: January, 2015

- The old leads on the RHRS Q1 will be replaced with ones similar in construction
- Fabrication options are being considered.
- The Q1 on the LHRS is beginning to show similar problems, and is thus being limited to 3.2 GeV/c

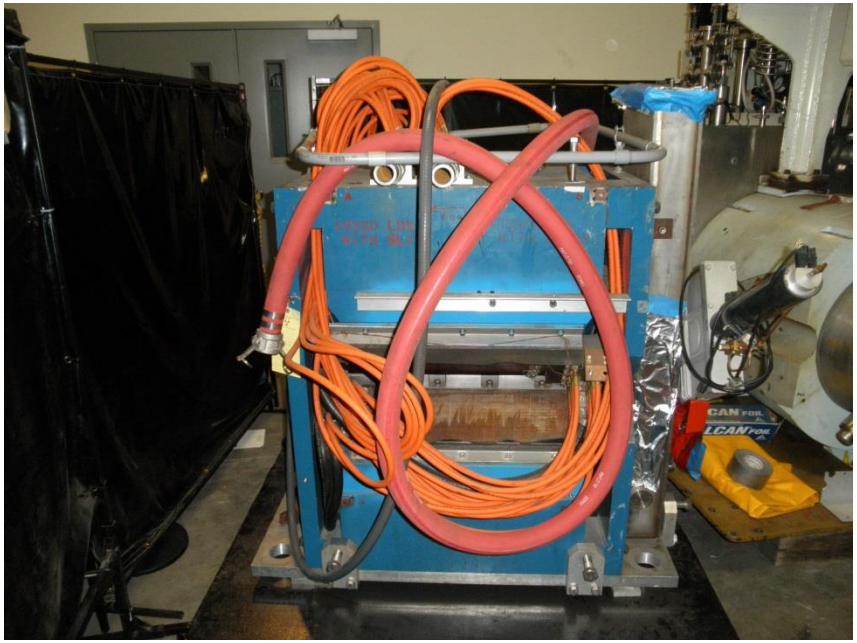
The SOS Spectrometer

- The SOS spectrometer, located in Hall C, had a QD~~D~~ design. The spectrometer operated up to a momentum of ~1.75 GeV/c.
- The SOS quad has a radius of 12.7cm (Q1 radius = 15cm). It has a magnet length of 70cm (Q1 length = 94cm).It was operated to a maximum pole-tip field of ~1T in the spectrometer. The pole tips are planes, rather than curves.
- The dipoles, which shared the same iron yoke, limited the spectrometer momentum.
- So, the quad was not operated at its maximum potential current/field.

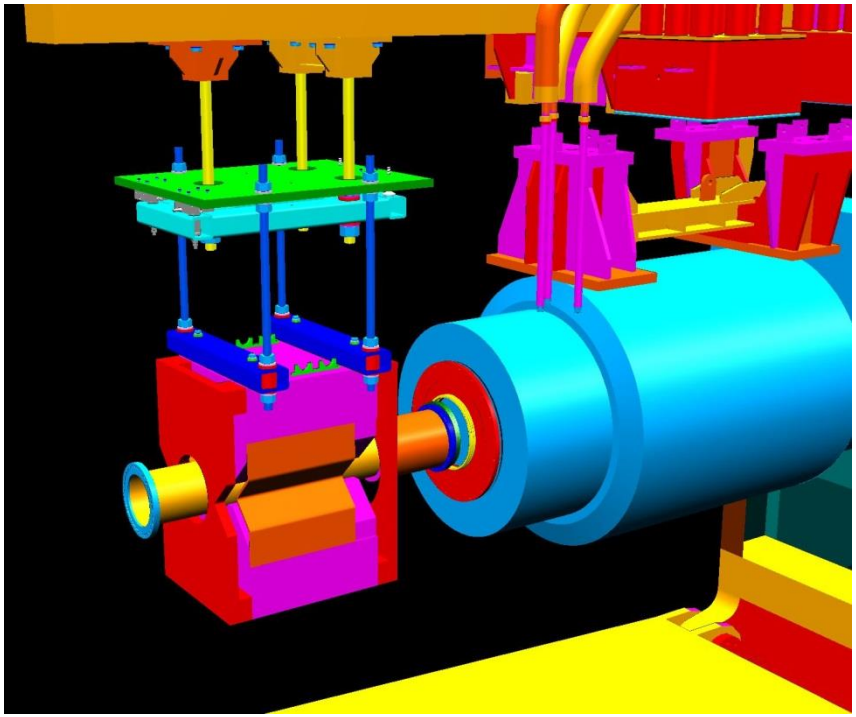
The SOS Quad

Front View

Side View

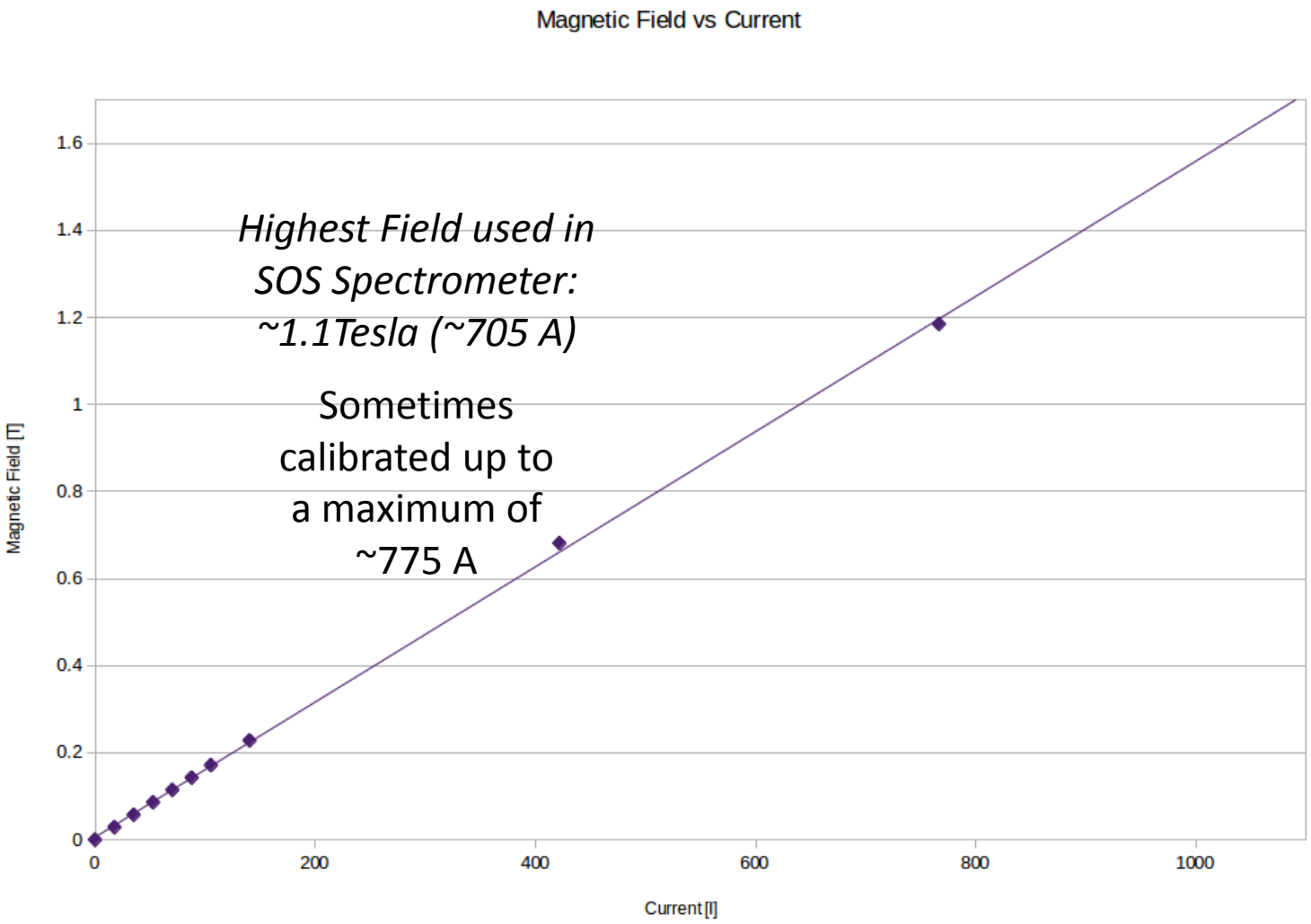


The SOS Quad in the RHRS

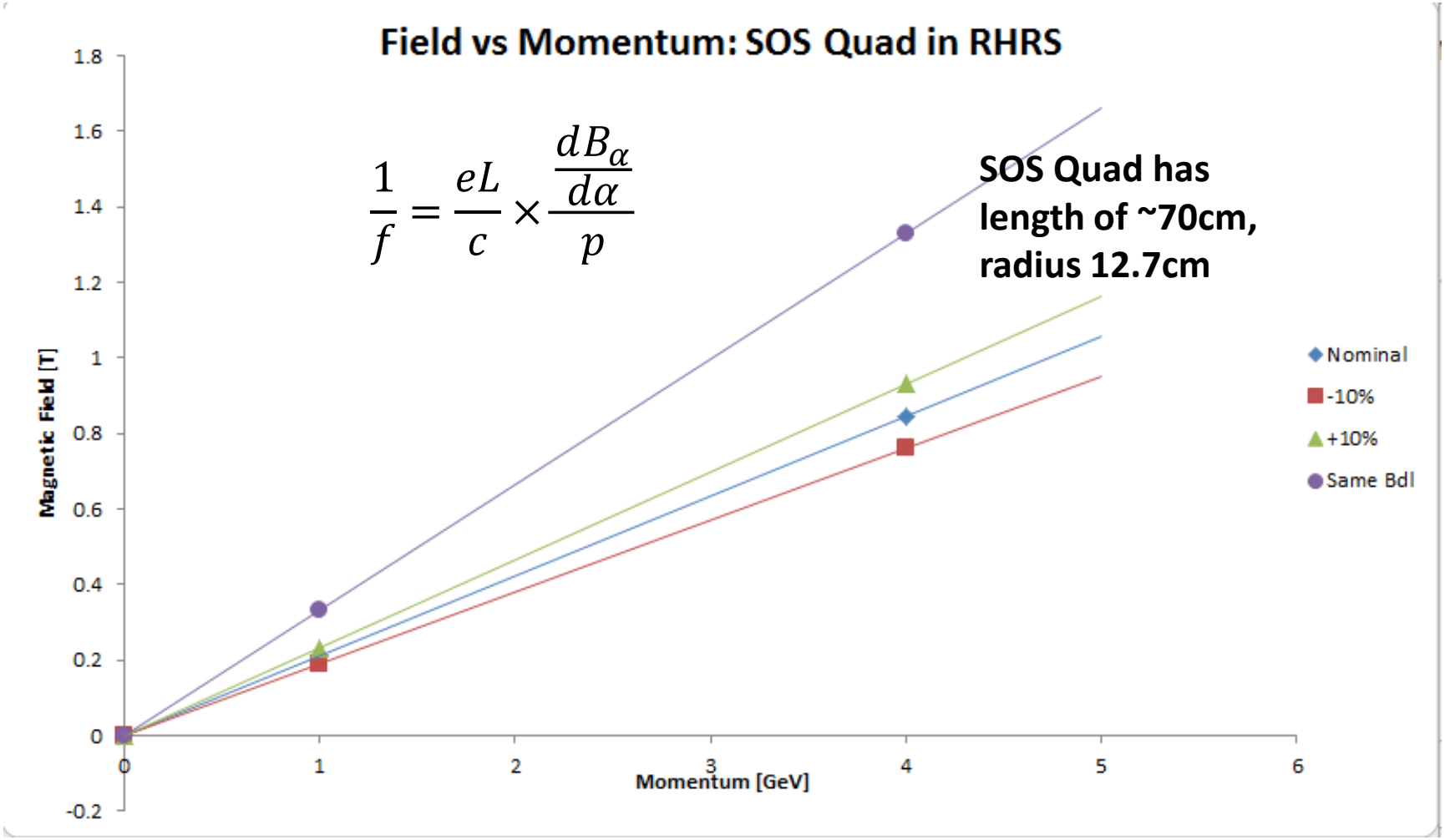


- The SOS quad is now mounted in the spectrometer as shown.
- The magnet requires water cooling, which will be taken from the system already present on the RHRS.
- The power supply for the Q1 has been removed, and a different power supply will be used for the SOS quad.

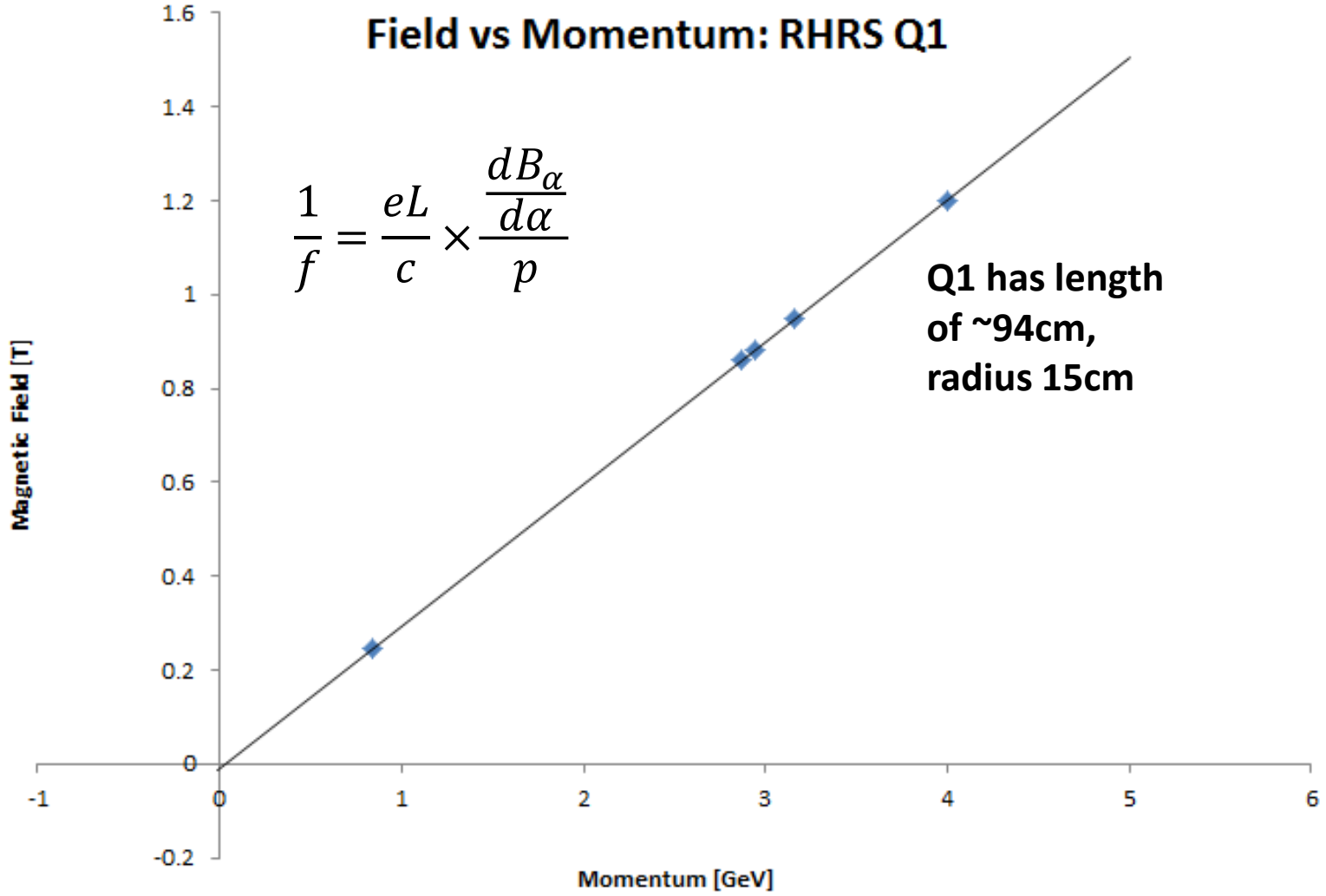
Pole-Tip Field vs Current in SOS Quad



Possible Tunes: SOS Quad in RHRS



Tune for Q1 in RHRS



Simulation Studies of the RHRS

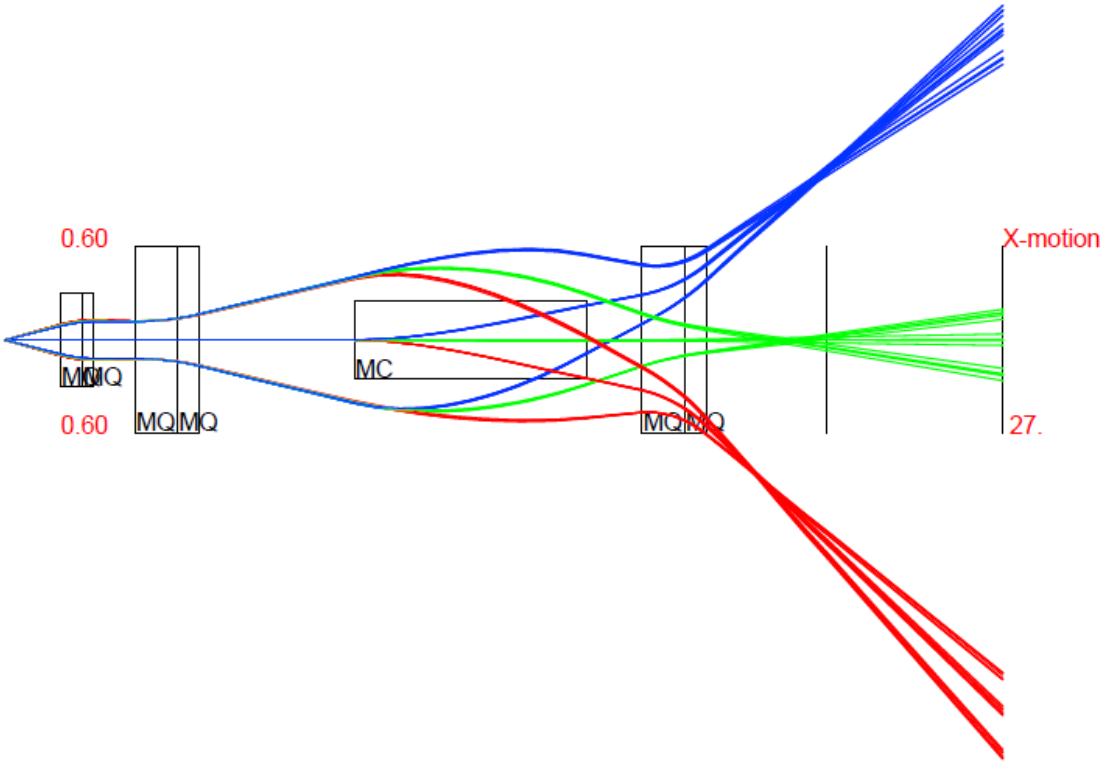
- The program Cosy Infinity was used to model the magnetic elements of the spectrometer.
- I used an idealized quad magnet with limited fringe-field effects for these simulations. More complete simulations using field-maps may be forthcoming in the near future…
- Position and momentum variables after the magnetic element are determined by summing the product of matrix elements to a given order:

$$X_{after} = \sum_{i,j,k,l,m=0}^{i+j+k+l+m=n} c_{i,j,k,l,m}\, X^i Y^j \frac{dX^k}{dZ} \frac{dY^l}{dX} \delta p^m$$

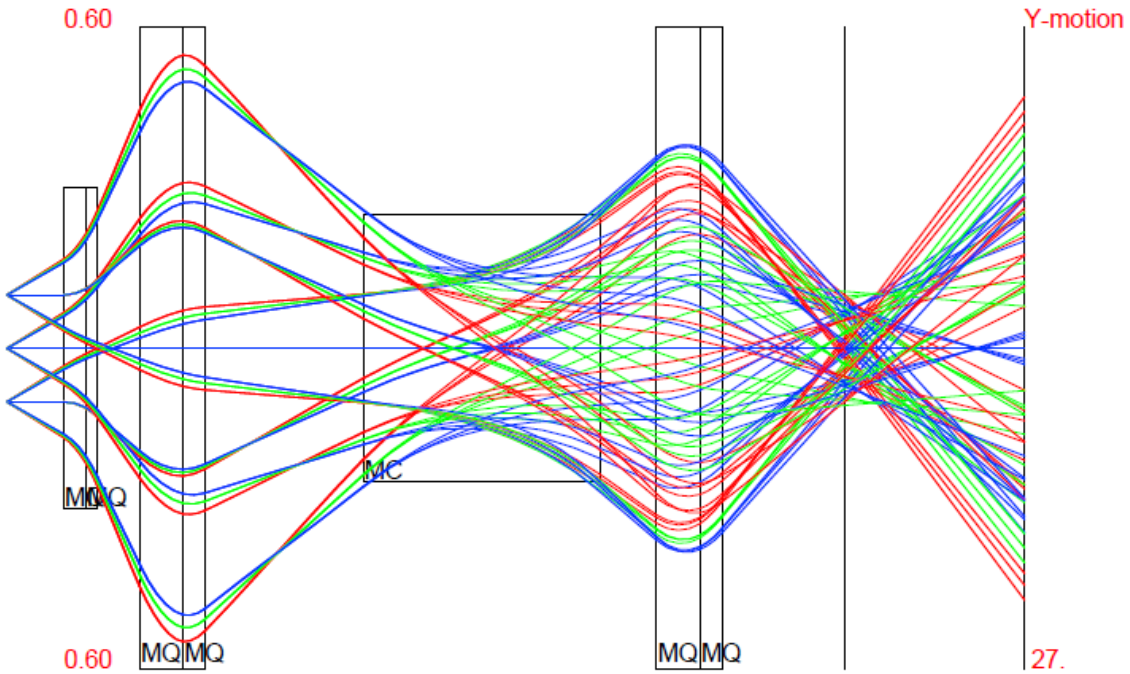
Simulation Studies of the RHRS (cont.)

- In conjunction with the program SIMC, generated particles are passed to the focal plane of the spectrometer.
- They are then reconstructed to obtain the target quantities: $X`_{tar}$ [$\theta_{tar}$], $Y`_{tar}$ [ϕ_{tar}], δ_{tar} , Y_{tar}
- The effect of replacing the Q1 with the SOS quad on the acceptance and resolution of these target quantities are considered here.

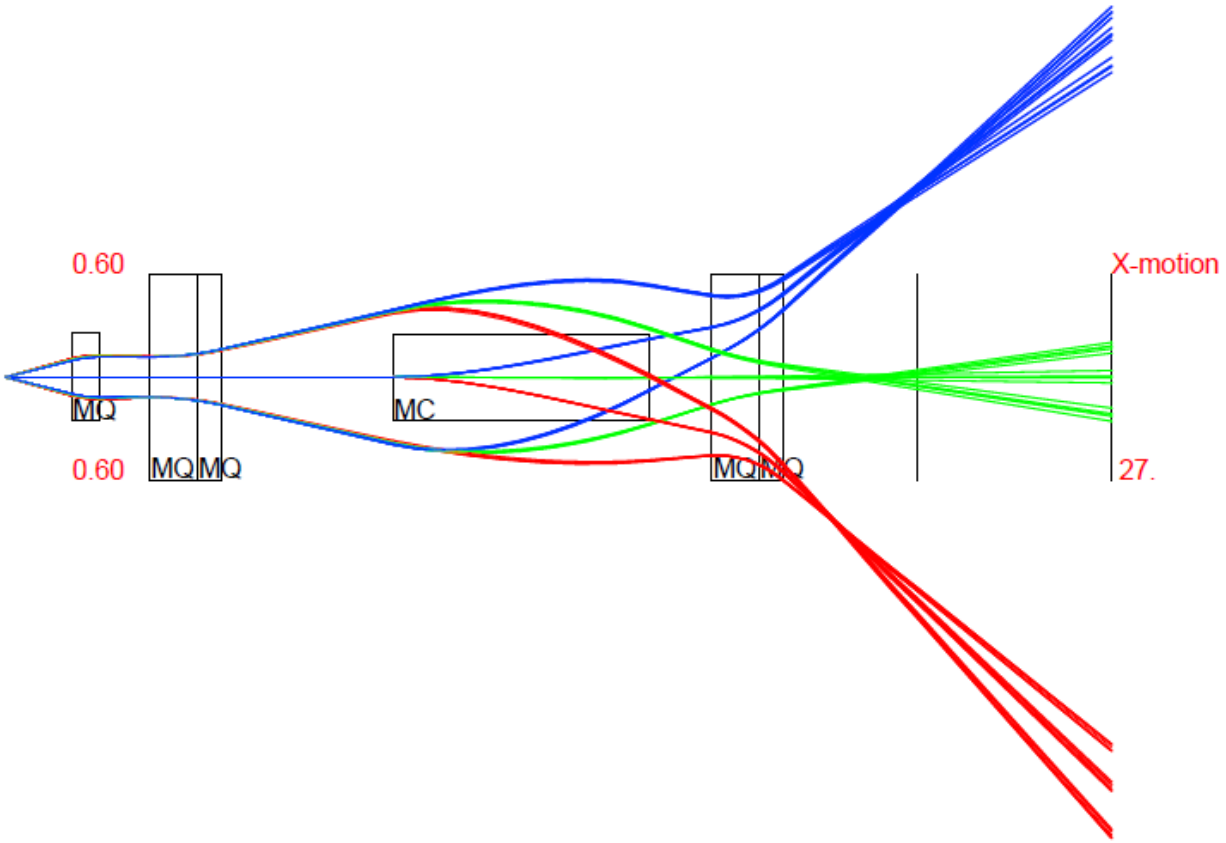
Cosy Infinity Ray-Tracing: Standard RHRS, Dispersive (and Bend) Plane



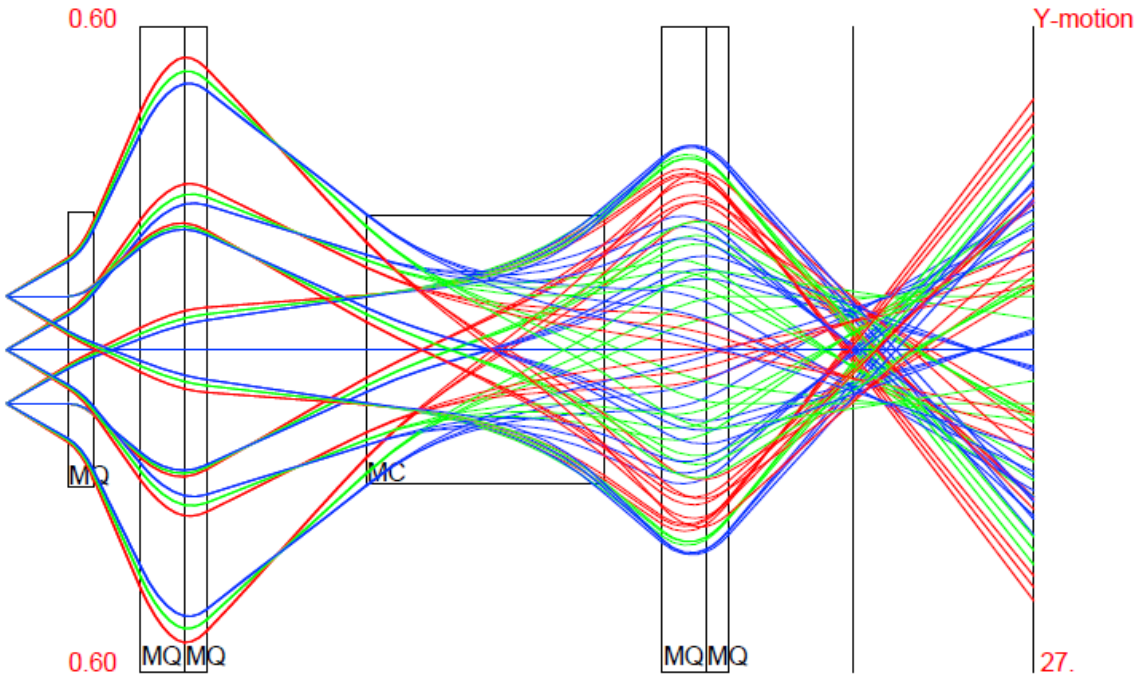
Cosy Infinity Ray-Tracing: Standard RHRS, Non-Dispersive Plane



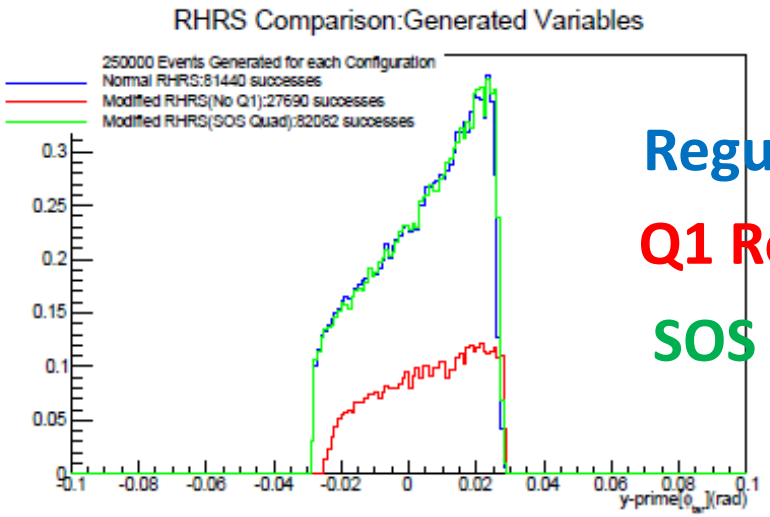
Cosy Infinity Ray-Tracing: RHRS with SOS Quad, Dispersive (and Bend) Plane

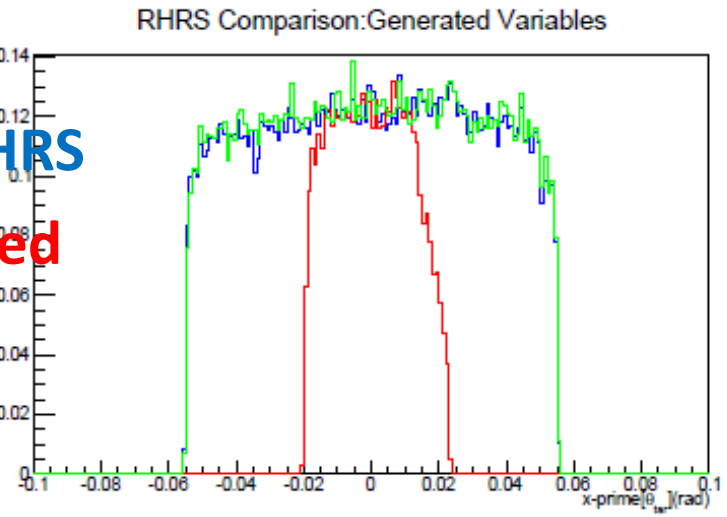


Cosy Infinity Ray-Tracing: RHRS with SOS Quad, Non-Dispersive Plane



Acceptance Comparison: (e,e’) Elastic

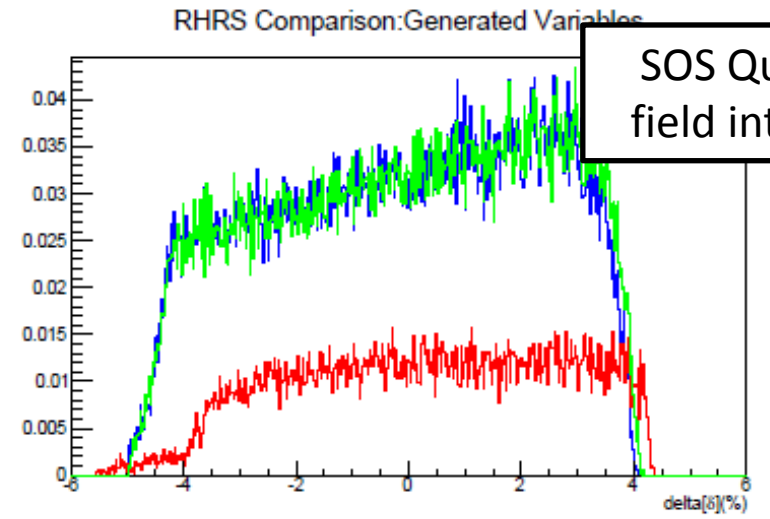




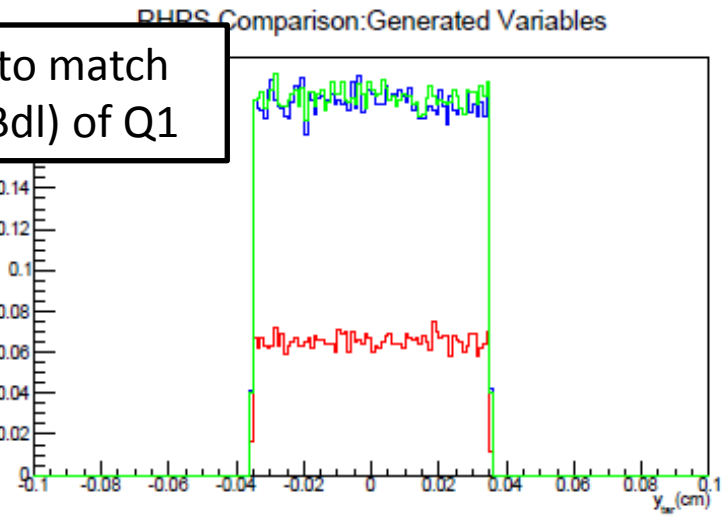
Regular RHRS

Q1 Removed

SOS Quad

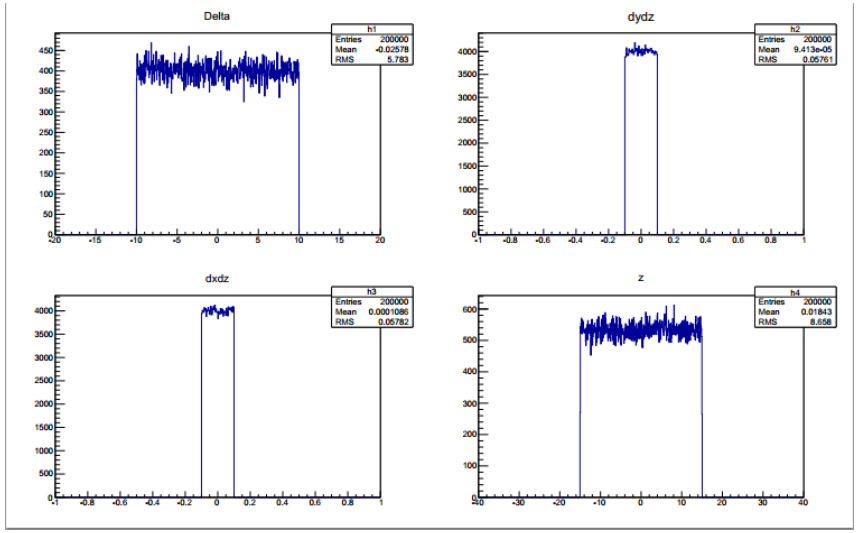


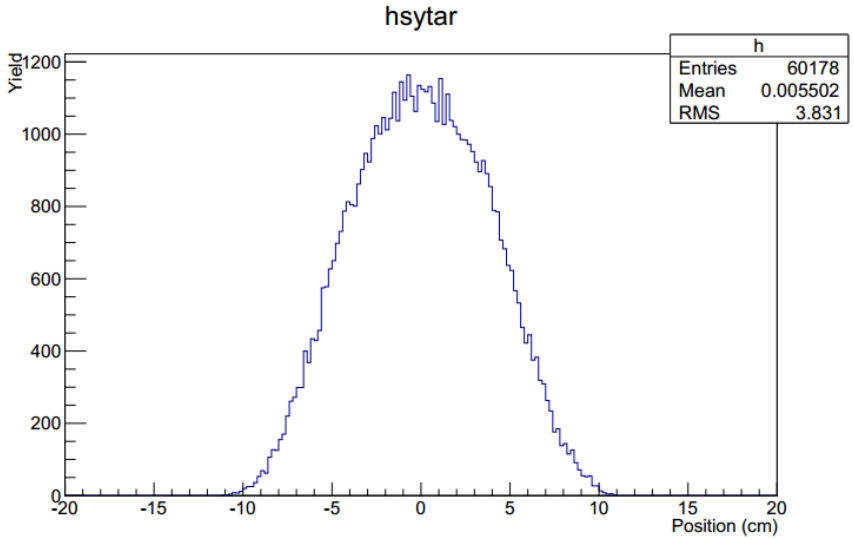
SOS Quad set to match field integral (Bdl) of Q1



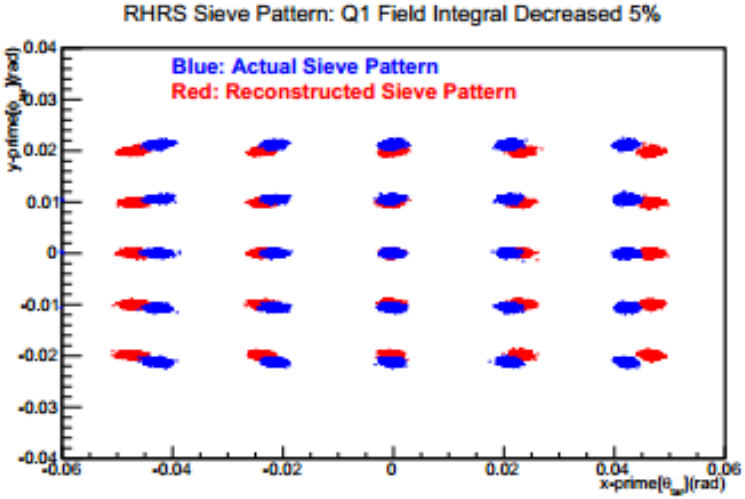
Single Arm Version of SIMC

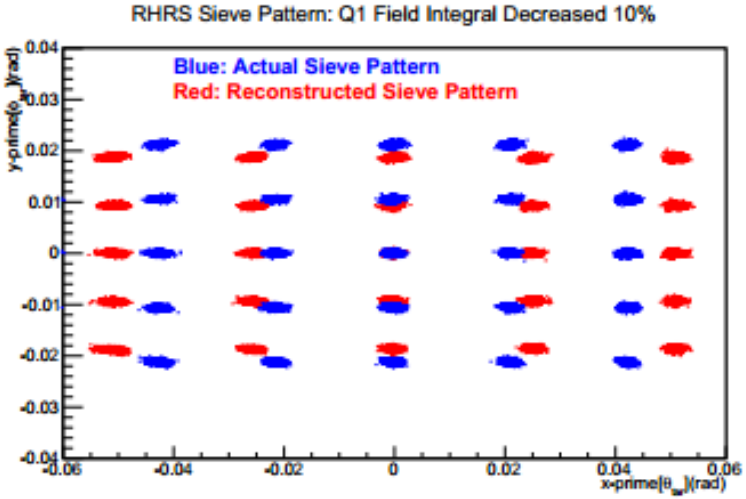
- I recently completed a single arm (phase-space generator) version of SIMC.
- This can be used for single arm acceptance studies, as well as to look at sieve patterns.

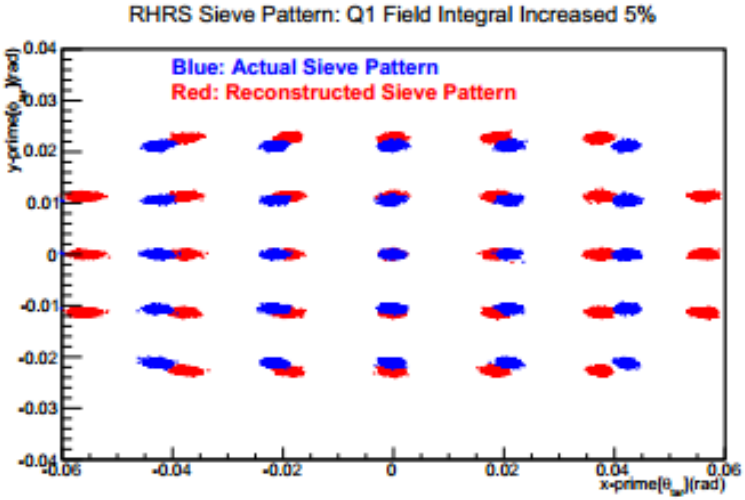


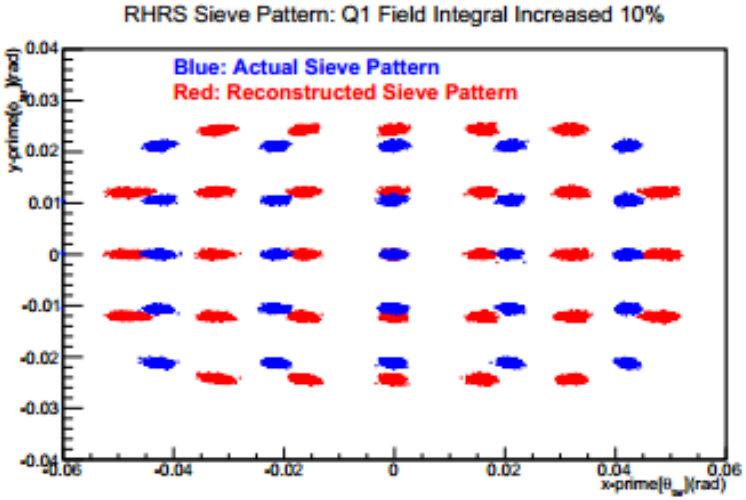


Effects of Mistuning on Sieve Pattern









Comments/Future Work

- Some preliminary work has been conducted on the effect of the SOS quad on the resolution of the spectrometer. The resolution appears to have the same order-of-magnitude.
- The effect of the quad being misaligned from the spectrometer optical axis is being studied.
- Eventually will try to implement a more complete model of the magnetic elements in the spectrometer for the simulation studies.
- I am checking that the sizes/distances/elements used in the SIMC HRS model are correct for the current spectrometers. For example, the slit box and collimator before the Q1 vacuum pipe has been removed, but was initially included in the SIMC model.
- I believe there is a plan to measure the field vs. current curve and hysteresis curve for the SOS quad.