

A REVIEW OF MAGBASE - CONTENT & MODEL APPLICATIONS

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EIC Beam-beam Simulation Meeting

1/11/2024



MAGBASE CONTENTS

- Magbase is a relational database that belonged to the Magnet Division
=> Animesh Jain was the point person.
- It contains (practically) all measurements, warm and/or cold, of RHIC magnets, including spares.
- Several tables give all multipole field components, a0-20 and b0-20, at a given reference radius; the integrated field angle is also given to help surveyors with alignment during installation:

SQL Query Edit Window

```
select * from Integral where Magnet like '%DRG101%'
```

Clear

Execute

No.	Magnet	ColdMass	BNLorVend	RunNum	TestDate	MeasCoil	Element	RefRadius	Analysis	TestType	Currnt	UpDown	WarmCold	a0	a1	a2
1	DRG101	DRG101	V	1	1994-04-30 00:00:00.0	77	DRG	2.5	10002134	HORIZONTAL	29.98	W	W	0	0.618	-0
2	DRG101	DRG101	BNL	28	1994-05-11 00:00:00.0	72	DRG	2.5	10002221	HORIZONTAL	660.31	U	C	0	0.737	-1
3	DRG101	DRG101	BNL	30	1994-05-11 00:00:00.0	72	DRG	2.5	10002223	HORIZONTAL	1,450.85	U	C	0	0.917	-1
4	DRG101	DRG101	BNL	32	1994-05-11 00:00:00.0	72	DRG	2.5	10002225	HORIZONTAL	5,003.71	U	C	0	-0.415	-1

- Most relevant field tables are: Integral, Magz, BodyHarm, EndsHarm.
- For engineering purposes: CQSAngle, CQSMag, ColdMass.

HOW MAGBASE IS USED IN THE RHIC MODELS

- The RHIC Online Model (RampManager + OptiCalc servers) is built to provide the closest description possible of the Blue and Yellow rings as constructed
 - => **lattices are parameterized in currents, not strengths!**
- With the information from Magbase, one can extract all available cold **transfer functions $KL = f(\text{current})$** as measured after the magnets were received. These cold transfer functions are then used in extrapolations for the magnets that were only measured warm
 - => **Integral + Magz tables**
- Another critical information derived from Magbase is the **feed-down effect from the sextupole field harmonics** due to the horizontal offset applied to most RHIC dipoles during installation
 - => **BodyHarm + EndsHarm tables**
- Separate tables from other relational databases are needed to get PS limits.

IMPACT OF MAGBASE DATA

- Using measured transfer functions grants lattice designers access to **instantiated strengths** (rather than generic ones) i.e. the most accurate representation of the machine
 - => relevant for localized design specificities e.g. squeezed optics and closed orbit paths.
- Downside: every arc cell is different from its neighbors**, even though there is a unique value for the main bus current for bending dipole and quadrupole families
 - => can complicate optics matching routines!
- Including the sextupole harmonics has a significant impact on tunes/chromaticities:

	pp24-100GeV		injection		store			
	Q1	Q2	DQ1	DQ2	Q1	Q2	DQ1	DQ2
w/ b2 component	29.6945	30.6925	2.28	2.08	29.6928	30.6836	2.21	2.15
w/o b2 component	29.8398	30.5528	33.64	-25.15	29.7112	30.6654	-4.51	5.61
	±0.14 units		±27-30 units		±0.02 units		±3-5 units	

TOWARD THE HSR MODELS

- Considerable efforts were in including and/or revamping how the information from magbase is being used in the RHIC online and offline models
 - => this is historical information that should not be abandoned or overlooked!**
- Current HSR lattice releases only include simplified versions of the magnet transfer function
 - => needs to **at the very least** replicate RHIC models!**
- Important EIC/HSR studies going on at this very moment on beam-beam and coupling could also benefit from expanding the number of harmonics being used for a full magnet instantiation
 - => skew components (α_1 , α_2 , etc.) in particular need to be looked into!**
- **There should be a uniformization of the information between “old” RHIC magnets and “new” HSR ones.**