The dashed lines on the plots mark the magnet operating currents in the ATR optics for Au^{77} ions at γ=12.6. In the case of dipoles there is generally 1 line, with the only exception being the typeCL dipoles: as seen in Table 2, they are used both for the 8 degrees bend in the U line and for the 20 degrees bend in the W line. In the case of quadrupoles, the dashed lines correspond to individually powered magnets.

4. Correlation between ATR Magnet strength and PS current

The actual correlation between current in the power supplies and magnet strength is established by the Magnet application program[1], which uses the Transfer Function data stored in the magnet_field Table [1].
The *magnet strength* is defined as $kL = 1/f$ for quadrupoles and $\rho/L = \alpha$ for dipoles. Given a strength, the program calculates, displays and sets the current in the relevant power supply, and viceversa. Information about wiring is read directly from the database.

References

[1] J.Kewish, Private Communication

For the magnets that do not have measurement data, simulation data are entered.
Table 2 summarizes what kind of data are currently stored in the magnet_field table.

Table 2: Summary of ATR magnet data.

FieldName	Magnet Count	Measured Magnet Count	type of data	Device Name	SiteWideName of magnets
typeAfat	2	1	raw	d	ud1 ud2
typeCL	12	7	ave	d	ud3 ud4 ud5 ud6 wd1 wd2 wd3 wd4 wd5 wd6 wd7 wd8
typeBL	50	12	ave	d	xd1 yd1 xd3-->xd26 yd3-->yd26
typeBS	10	2	ave	d	xd2 yd2 xd27 yd27 xd28 yd28 xd29 yd29 xd30 yd30
typeAthin	2	1	raw	d	xd31 yd31
N3Q36	2	1	raw	q	uq1 uq2
4Q26.5	8	4	ave	q	uq3 uq9 uq10 wq2 xq1 yq1 xq2 yq2
SLAC1000	8	9	ave	q	uq4 uq5 uq7 uq8 xq5 yq5 xq6 yq6
SLAC730	13	15	ave	q	uq6 uq11 uq12 uq13 wq1 wq3 wq4 wq5 wq6 xq3 yq3 xq4 yq4
wpitch	2	0	sim	p	wp1 wp2
swm	1	0	sim	swm	xswm (yswm)
lambpitch	2	0	sim	p	xp1 yp1
lamb	2	1 (3)	ave	lamb	xlamb ylamb

FieldName describes the generic group of magnets, DeviceName labels the magnet type (note: typeCL, typeBL and typeBS are *combined function* magnets). MagnetCount tells how many magnets of that particular group are installed in the ATR line, and their SiteWideName are also listed.
MeasuredMagnetCount tells how many of them have been measured. (note: existence of magnet spares causes the latter Count for some entries to be larger than the former). Data are of type "**ave**" if obtained by averaging measured data sets, "**sim**" if derived by simulation or "**raw**" if only 1 magnet in the group was measured.
(for the Lambertson the average was taken over 3 sets of measurements of the same magnet).
Although not explicitly showed here, the magnet_field Table contains also simulation data for the trim dipoles.

3. ATR dipoles and quadrupoles Transfer Functions

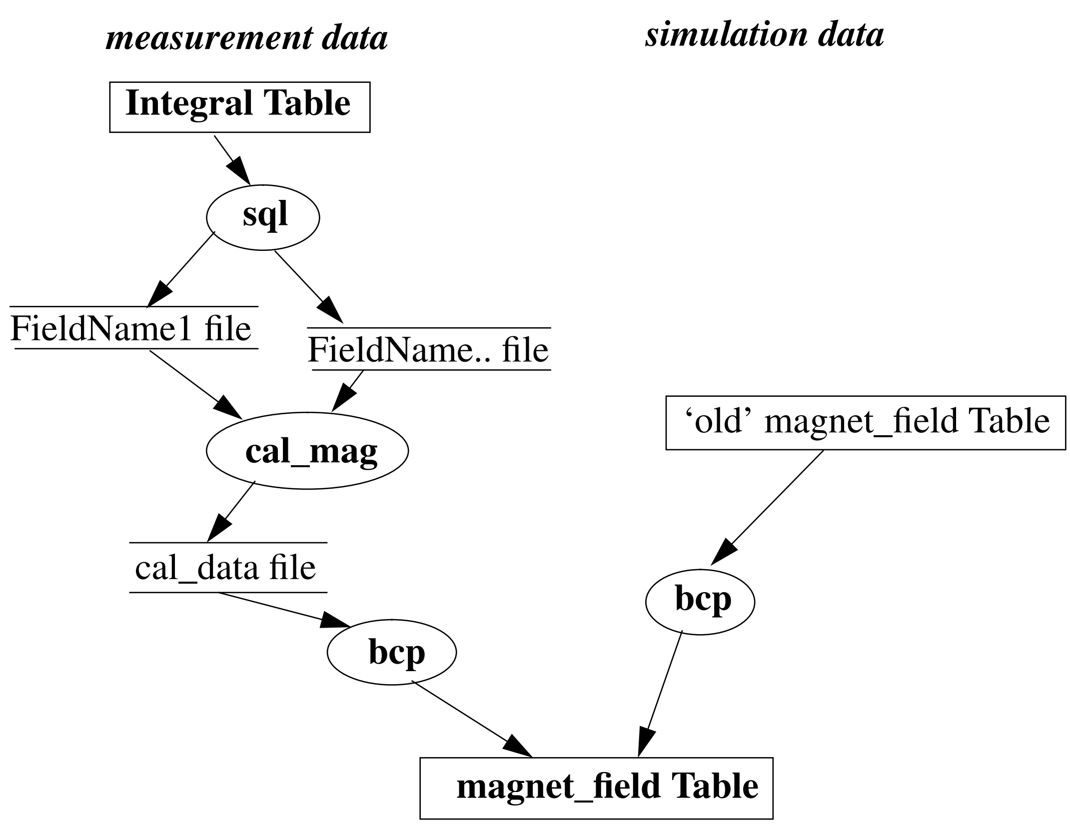
The following set of plots show the processed Transfer Function data as a function of current for the magnet groups (labelled by FieldName).
Transfer Function data are expressed in Tesla m/Amp for the dipoles and Tesla/Amp for the quadrupoles.

Table 1: Naming Convention for ATR magnets.

Name	Use	Examples
LatticeName	lattice files	uq1, ud3, wq2, xd28, yq6
SiteWideName	device unique name	uq1, ud3, wq2, xd28, yq6
SerialName	hardware serial name	ATRQSS015, ATRSWM01
DeviceName	identifies magnet type	q, d
GenericName	identifies group of magnets	C-defocus, SLAC730
FieldName	identifies group of magnets	typeCL, SLAC730
Magnet	name for measurement data	RDXCL5, QSS015, RDXBL1

The selected data are then processed by **cal_mag**, a code which calculates for each group of magnets averages and standard deviations of the current, Transfer Functions and multipole data. The results are then rewritten and copied (**bcp**) into the **magnet_field Table** in the **atr_gddb** database.

Figure 1. Diagram of data extraction and processing.



ATR Magnet Transfer Functions

Fulvia Pilat

1. Introduction

In order to establish the correlation between power supply currents and magnet strengths for the ATR magnets, one needs to assign a Transfer Function to each magnet. There are several types of magnets installed in the ATR line and not all of them are measured: typically, a subset in within each magnet group has been measured. For some magnets, direct measurements are not available and in that case data are derived from simulation.
This note describes how magnet data are extracted and processed for the ATR quadrupoles and dipoles and lists the resulting Transfer Function data for every generic group of magnets in the ATR.

2. Extraction and processing of measured data

The Transfer Function is defined as:

BL/I	[Tm/A]	for a dipole
GL/I	[T/A]	for a quadrupole

where B and G are the magnetic field and gradient, respectively in Tesla and Tesla/m, L the magnet length in m and I the current in amps. The Transfer Function, ideally constant, is in reality a function of current because of saturation.
We want to assign a Transfer Function to each group of ATR quadrupoles and dipoles that are physically the same. The naming convention for the ATR magnets are recalled in Table 1.
The extraction, filtering and processing of data is summarized by the diagram in Figure 1.
The magnetic measurement data are stored in the **Integral Table** in the **atr_cal** database.
The magnetic measurement sets are labelled by “Magnet” and the Table stores Transfer Function and multipole data together with specific information about the magnet and the measuring conditions. SQL requests select the right measurement sets for each group of magnet. We selected data sets in the “UP” direction of the hysteresis curve (UpDown field) and with the location of the probe is in the magnet center (RunNum field) for every group of magnets.