PITZ qaudrupoles study

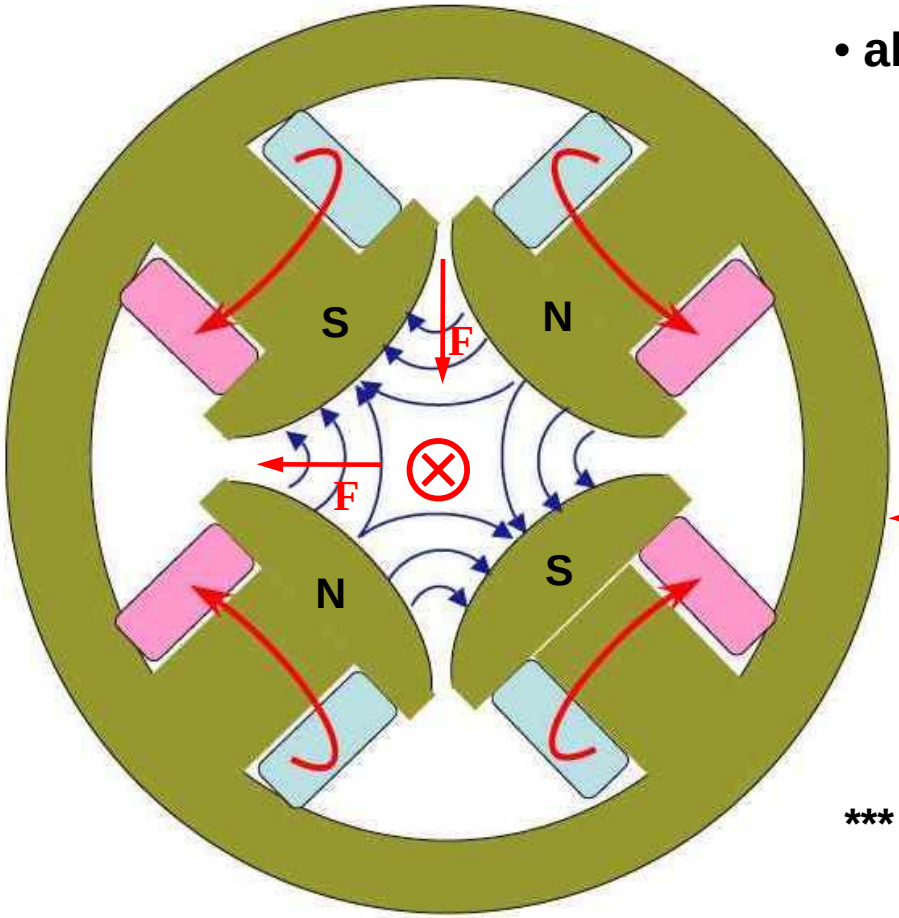
- Polarity check
- Power supply instability
- Quadrupole field gradient
- Remnant field
- Summary and comments

Jatuporn Saisut
PPS meeting
Zeuthen, October 5, 2010

HELMHOLTZ ASSOCIATION

DESY

Quadrupole polarity check



- **all quadrupoles polarity are consistency**

at the moment :

Positive current → y focusing
Negative current → x focusing

Polarity of all quadrupole magnets in PITZ beamline if positive current is applied and electron travel into the paper plane.

***** exclude quadrupoles in dispersive section**

(http://pbpl.physics.ucla.edu/Research/Technologies/Magnets/Electromagnets/Quadrupoles)

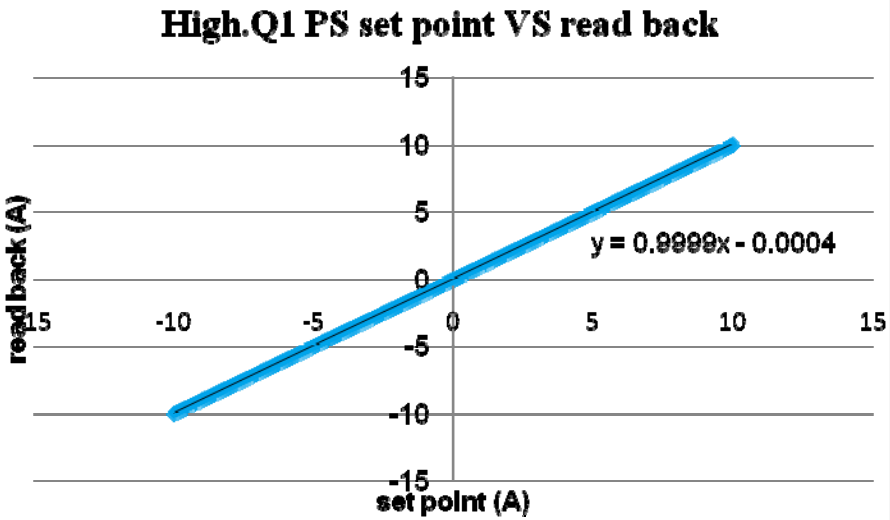
Power supply instability

Q magnet	2 hr		8 hr		11 hr (4hr set)	
	Mean (A)	SD (A)	Mean (A)	SD (A)	Mean (A)	SD (A)
HIGH.Q1	7.168439	0.00025	7.168758	0.000177	7.168533	0.000276
HIGH.Q2	7.172731	0.000275	7.172376	0.000263	7.172718	0.000247
HIGH.Q3	7.169271	0.000249	7.168995	0.000223	7.169015	0.000182
HIGH.Q4	7.169153	0.000227	7.169205	0.000139	7.169128	0.000187
HIGH.Q5	7.170180	0.000133	7.169765	0.000170	7.169995	0.000252
HIGH.Q6	7.174631	0.000176	7.175192	0.000183	7.174664	0.000160
PST.QM1	7.176331	0.000135	7.175797	0.000188	7.176181	0.000333
PST.QM2	7.170781	0.000127	7.170294	0.000276	7.170382	0.000329
PST.QM3	7.173382	0.000116	7.172783	0.000236	7.173001	0.000313
PST.QT1	7.173648	0.00016	7.173116	0.000236	7.173498	0.000300
PST.QT2	7.172300	9.56E-05	7.171667	0.000292	7.171875	0.000338
PST.QT3	7.170283	3.94E-05	7.169937	0.000158	7.170141	0.000167
PST.QT4	7.174375	0.000169	7.174732	0.000252	7.174690	0.000230
PST.QT5	7.175346	0.000116	7.174814	0.000214	7.175297	0.000127
PST.QT6	7.175393	0.00021	7.175134	0.000258	7.174903	0.000246

- set point = 7.17 A
- gradient ~ 5.6 T/m

SD < 3.5 x 10^{-4} Amp.

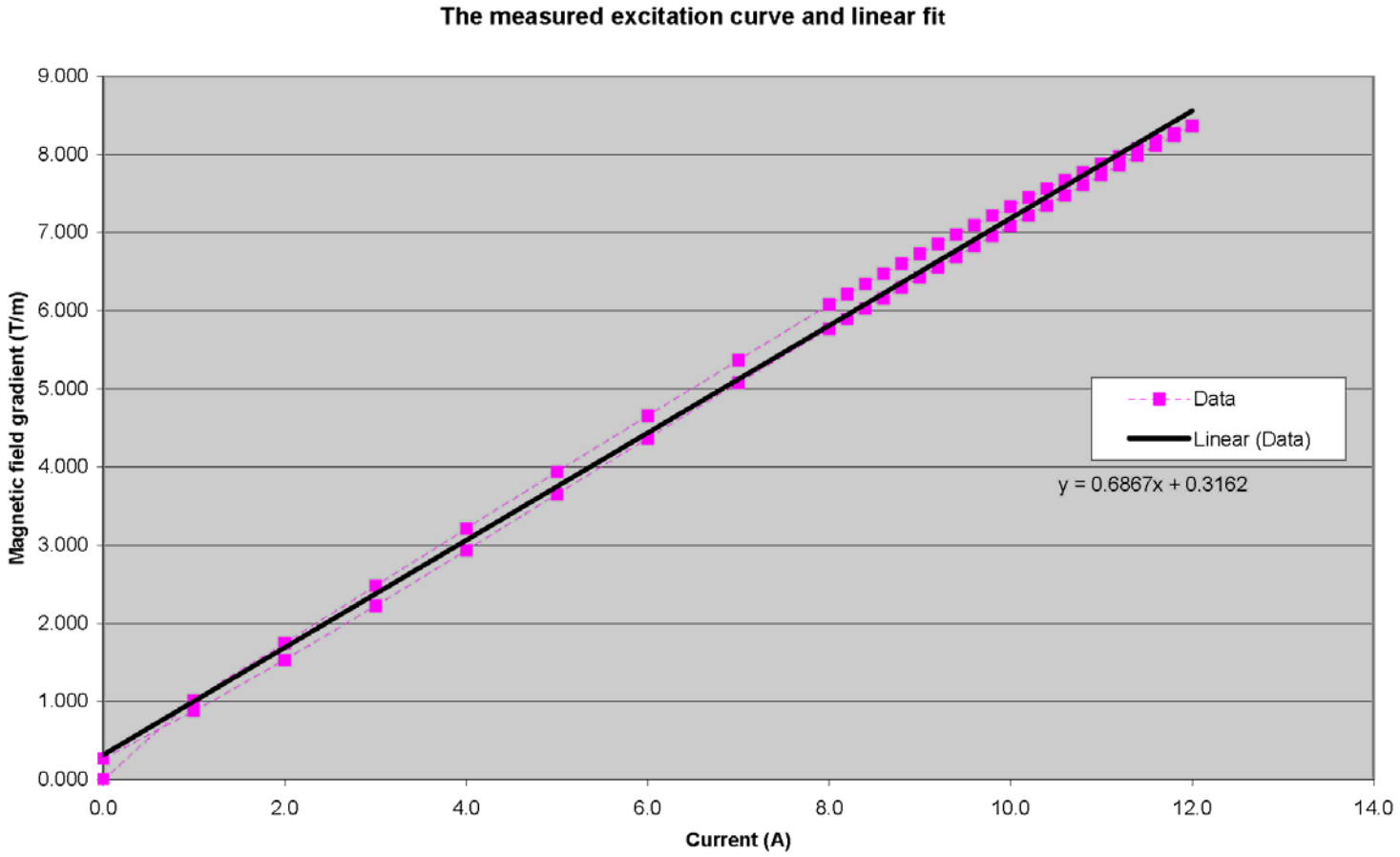
Power supply set point VS read back



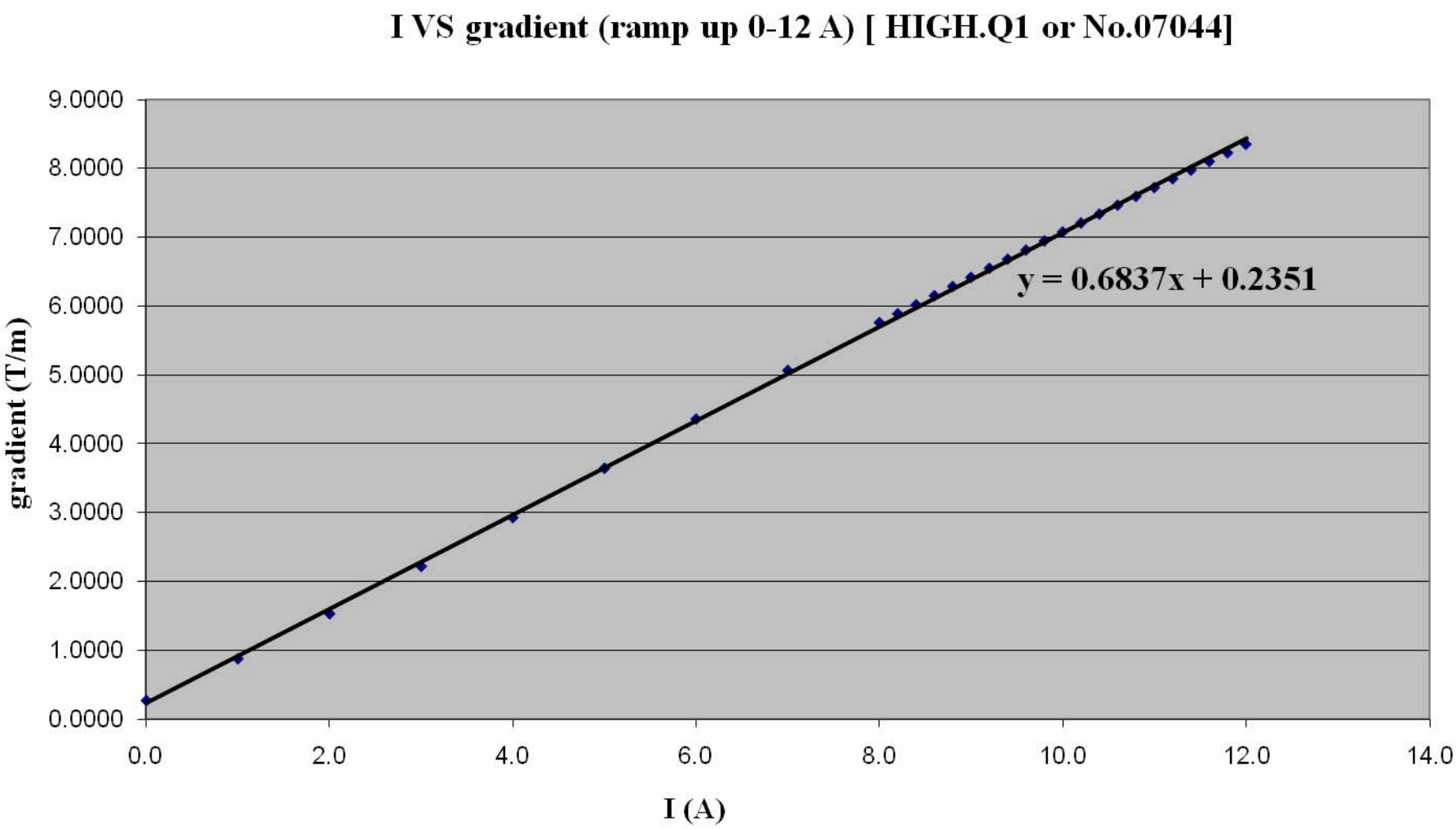
Power supply of	read back (y) VS set point (x) [A]
High.Q1	y = 0.9999x - 0.0004
High.Q2	y = 1.0001x + 0.0016
High.Q3	y = 1.0000x - 0.0011
High.Q4	y = 1.0000x - 0.0013
High.Q5	y = 1.0000x - 0.0003
High.Q6	y = 1.0008x - 0.0005
PST.QM1	y = 1.0006x + 0.0009
PST.QM2	y = 1.0002x - 0.0005
PST.QM3	y = 1.0002x + 0.0004
PST.QT1	y = 1.0003x + 0.0008
PST.QT2	y = 1.0001x + 0.0002
PST.QT3	y = 1.0006x + 0.0011
PST.QT4	y = 1.0005x + 0.0002
PST.QT5	y = 1.0007x - 0.0006
PST.QT6	y = 1.0006x + 0.0007

Quadrupole field gradient

DANFYSIK A/S 11-10-2007

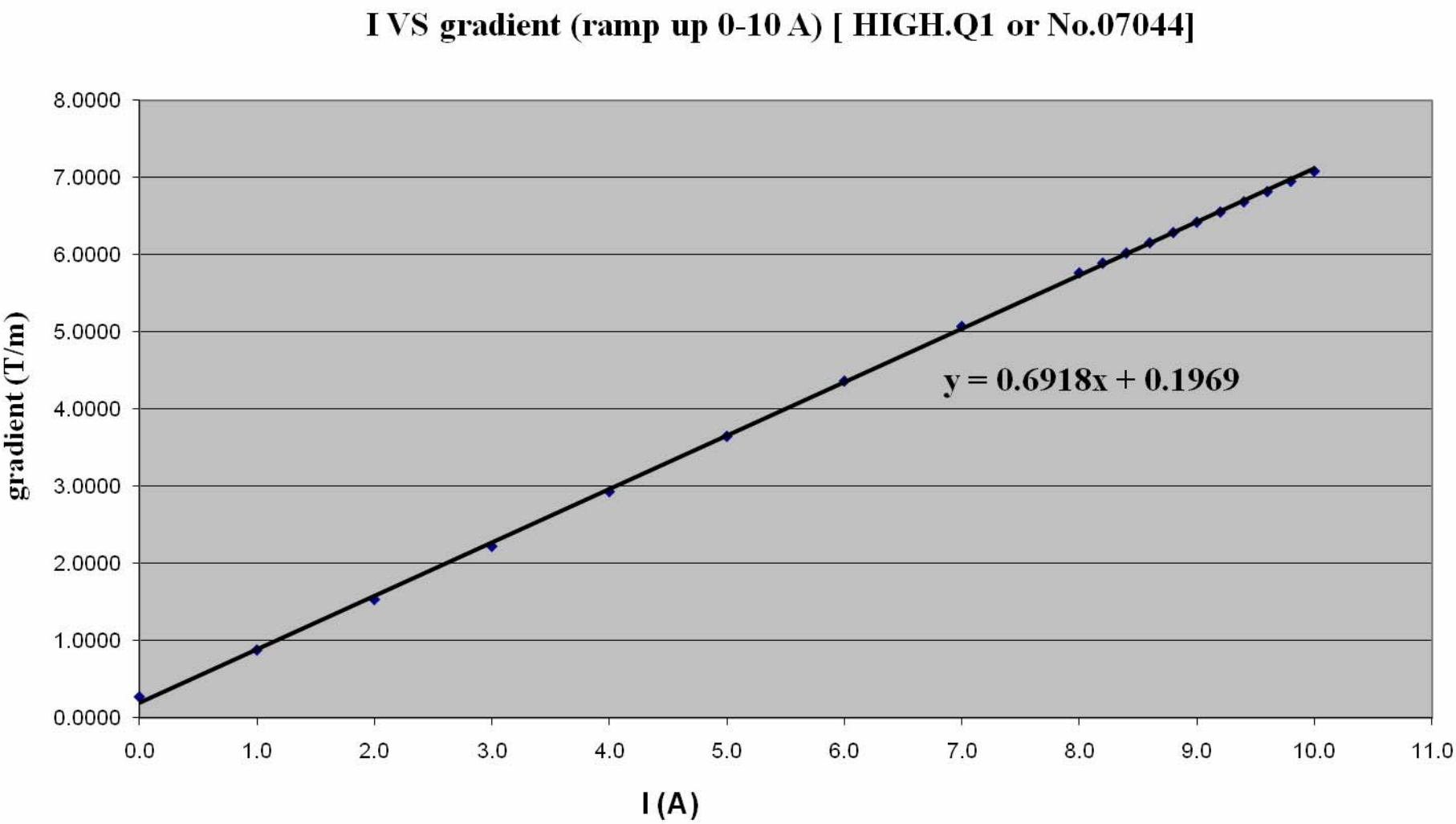


Quadrupole field gradient



***Data from DENFYSIK data sheet

Quadrupole field gradient



***Data from DENFYSIK data sheet

Magnetic field gradient VS I

Name	No.	fit from data (ramp up 0 -12 Amp)	fit from data (ramp up 0 -10 Amp)
High.Q1	07044	y = 0.6837x + 0.2351	y = 0.6918x + 0.1969
High.Q2	07045	y = 0.6699x + 0.2333	y = 0.6786x + 0.1926
High.Q3	07037	y = 0.6880x + 0.2207	y = 0.6952x + 0.1868
High.Q4	07039	y = 0.6770x + 0.2172	y = 0.6856x + 0.1767
High.Q5	07033	y = 0.6881x + 0.2249	y = 0.6960x + 0.1878
High.Q6	07035	y = 0.6902x + 0.2056	y = 0.6980x + 0.1687
PST.QM1	07038	y = 0.6984x + 0.2327	y = 0.7069x + 0.1932
PST.QM2	07041	y = 0.6997x + 0.2314	y = 0.7079x + 0.1926
PST.QM3	07042	y = 0.6888x + 0.2200	y = 0.6965x + 0.1838
PST.QT1	07036	y = 0.6867x + 0.2281	y = 0.6950x + 0.1889
PST.QT2	07046	y = 0.6894x + 0.2188	y = 0.6968x + 0.1839
PST.QT3	07047	y = 0.6861x + 0.2284	y = 0.6937x + 0.1928
PST.QT4	07034	y = 0.6889x + 0.2227	y = 0.6964x + 0.1875
PST.QT5	07040	y = 0.7005x + 0.2222	y = 0.7072x + 0.1907
PST.QT6	07043	y = 0.6987x + 0.2332	y = 0.7068x + 0.1949

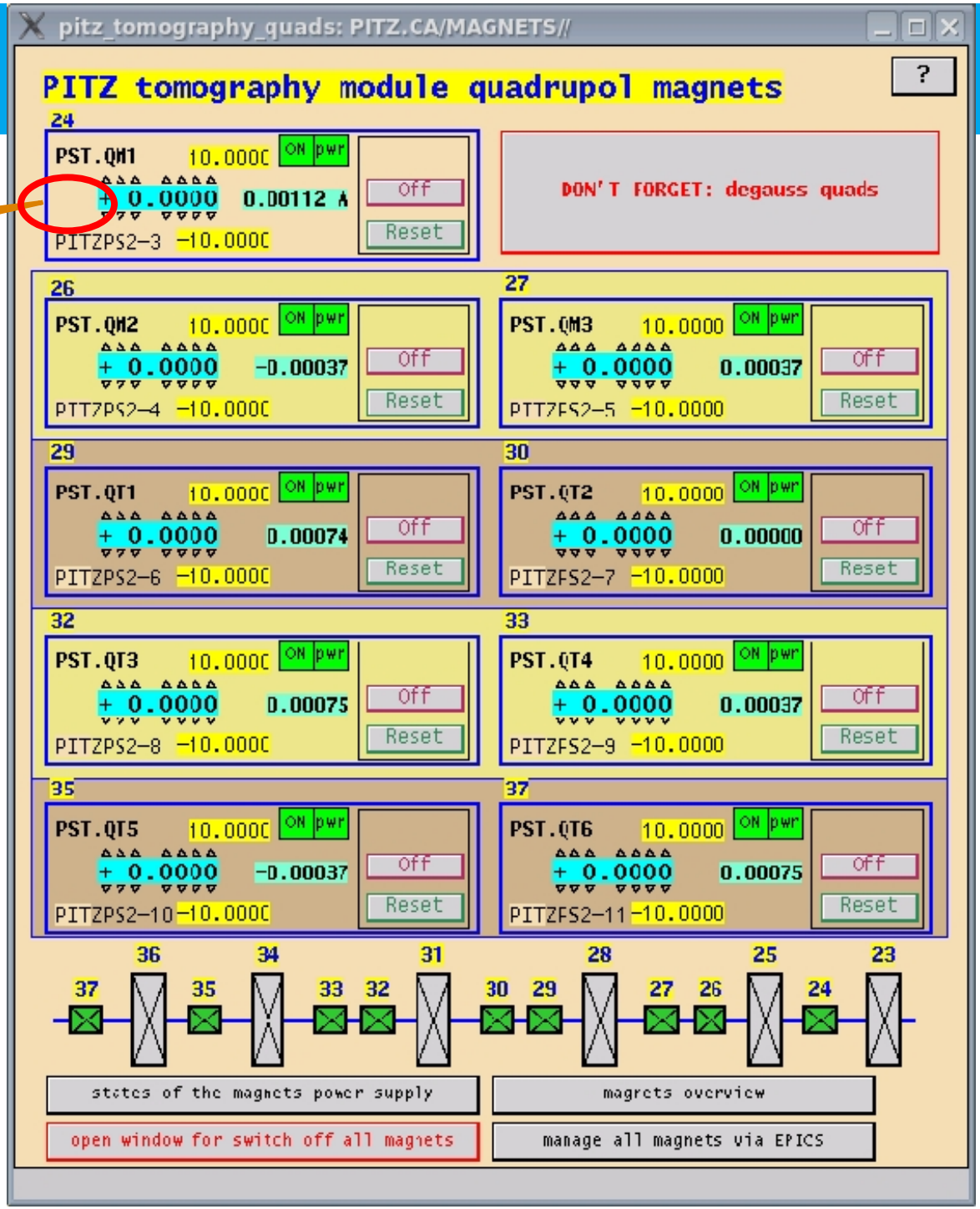
y = field gradient (T/m) x = current (A)

Q magnet GUI

Field gradient ?

- Add gradient display to GUI ?

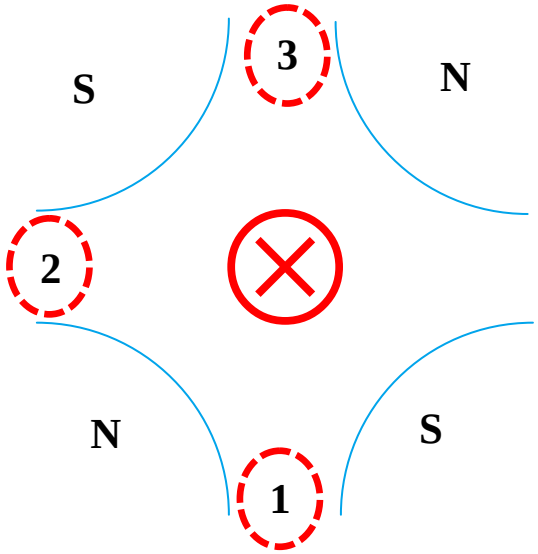
“Online mode V-code” ?



Remnant field measurement

First test :

- **ramp up current to 5 Amp and wait for 10 min. and then degauss**
- **average data from three different positions.**



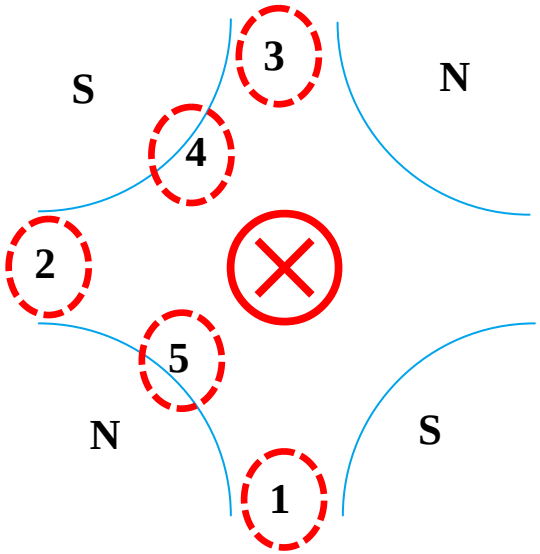
Name	Average remnant field (mT)
High.Q1	0.17
High.Q2	0.05
High.Q3	0.17
High.Q4	0.05
High.Q5	0.05
High.Q6	0.05
PST.QM1	0.05
PST.QM2	0.06
PST.QM3	0.09
PST.QT1	0.06
PST.QT2	0.06
PST.QT3	0.06
PST.QT4	0.06
PST.QT5	0.06
PST.QT6	0.12

- **Back ground = ?????**
- **Tesla meter range = 20 mT**

Remnant field measurement

Second test:

- **ramp up current to 10 Amp and wait for 10 min. and then degauss**
- **measure at 5 different positions.**



Name	Remnant field at Position 1 (mT)	Remnant field at Position 2 (mT)	Remnant field at Position 3 (mT)	Remnant field at Position 4 (mT)	Remnant field at Position 5 (mT)
High.Q1					
High.Q2					
High.Q3					
High.Q4					
High.Q5					
High.Q6					
PST.QM1	0.18	0.17	0.18	0.14	0.13
PST.QM2	0.19	0.18	0.16	0.13	0.14
PST.QM3	0.16	0.15	0.16	0.15	0.14
PST.QT1					
PST.QT2					
PST.QT3					
PST.QT4					
PST.QT5					
PST.QT6					

- **Back ground = 0.05 -0.07 mT**
- **Tesla meter range = 20 mT**

Summary and comments

Summary

- all quadrupoles polarity are consistency
- all power supply have SD less than 3.5 X 10^{-4} Amp at 7.17 Amp set point
- magnetic field gradient should fit from 0-10 Amp data to avoid saturation data
- remnant field measurement need to be done (for 10 Amp set point)

Comments

- implement magnet gradient in Magnet GUI
- switch off steerer near quadrupoles before degauss Q magnet

Special thank

S. Rimjaem

G. Asova

&

Thank you

for your attention !