MICE magnetic measurements
Sequence of events and
MICE hall movements

Alain Blondel – 10-April 2012
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Motivations for magnetic measurements

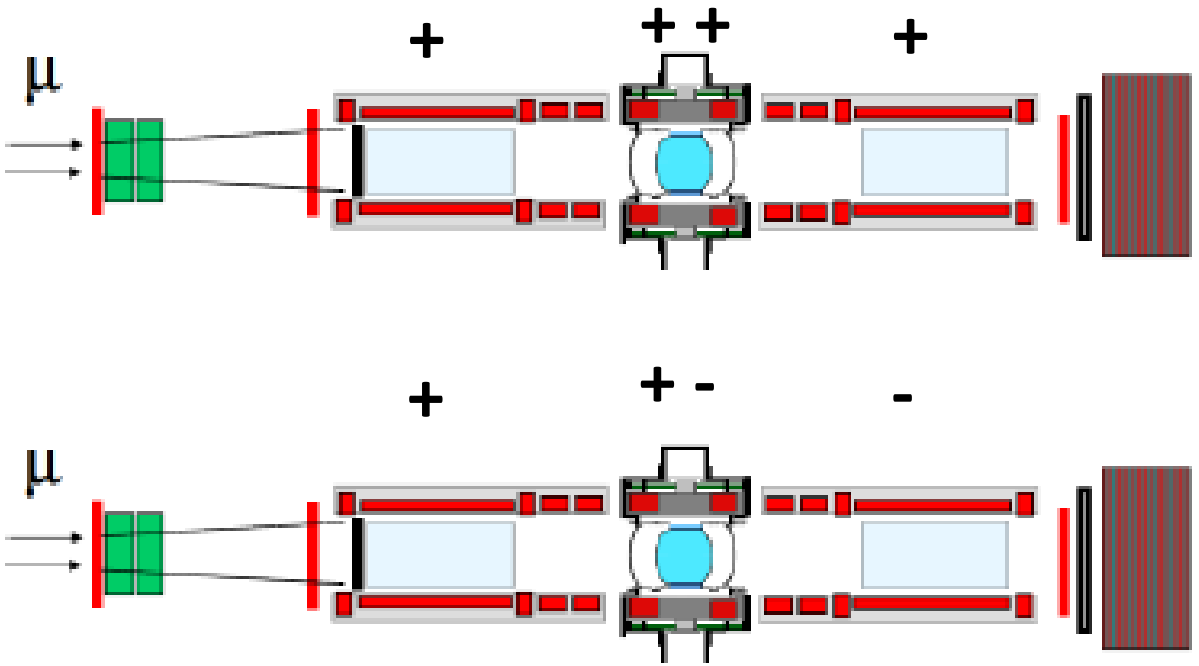
0. Precision In order to understand the cooling measurements
(and the multiple scattering and energy loss measurements)
specially in case of discrepancy between the predictions and the experimental results
the magnetic field required precision is of the order of a few gauss.

1. Focus coils: magnetic measurements of focus coils are aimed at the determination
of the intrinsic properties of the magnets such as alignment and symmetry of the coils,
possible difference in expectations betwween flip and non flip mode due to different forces,
etc… the measts in R9 serve as reference in an environment which is reasonably iron-free.
The measurements in the hall in situ (with the exact same sequences of points)
serve to measure the field and its stray field as well as probe the understanding
of the effect of magnetic masses in the hall. This comparison will be available for the AFC only.

2. Spectrometer solenoids
These magnets are part both of the measurement and of the cooling channel (matching coils)
The magnetic measurements serve two purposes: 1) to allow precise reconstruction of
particle momentum in the tracker, and 2) as above, to allow precise understanding
of the particle transport for the cooling and absorber properties measurements.
It is important that the measurements take place with the magnetic environment
(Virostek Plates on etc…) and preferably in the MICE hall
(possible distortions due to magnetic masses)

Polarities

We expect to run step IV with two polarities



Is there a motivation to run the - -- - and - -+ + settings?

NB the other MICE focus coils will also run in -+ mode.

Settings

focus coil run at settings corresponding to different momenta e.g. P= 240 200 and 140 (3 settings = 3x2.5 hours of measurement = 1 day)

spectrometer solenoids things are less well defined. suggestion:
1. fix the field once and for all in the 'tracker' part to the nominal 200 MeV/c setting.

2. then vary the matching coils according to e.g configurations of MICE proposal p 41
 -- some work to do:
 -- add solenoid mode
 -- review match coils settings for 140 MeV/c settings and full field in solenoid.

Table 3.3: Current densities for different beta examples (for historical reasons the coil dimensions and currents differ slightly in these optical calculations from those given in Section 4)

	p (MeV/c)	$\beta_\perp$ (cm)	B_{sol} (T)	Δ (%)	Focusing (A/mm^2)	Coupling (A/mm^2)	Match 1 (A/mm^2)	Match 2 (A/mm^2)	End 1 (A/mm^2)	Sol. (A/mm^2)	End 2 (A/mm^2)
1a	200	42	4	12	117.8	90	65.0	97.2	100	80.9	128.9
1b	240	42	4	11	141.3	108	74.3	103.6	97.9	80.9	128.9
2	200	25.4	4	12	139.7	79.3	66.7	74.4	104.4	80.9	128.9
3	175	16.7	3.5	14	136.2	58.9	53.1	47.8	97.2	70.8	112.8
4	150	10.5	3	13	128.7	37.5	40.9	14.0	89.7	60.7	96.7
5	140	5.7	2.8	10	137.2	0	20.8	-18.9	91.8	56.7	90.2

Practical Sequences

1. FC magnet is measured in R9 February 2013
2. FC magnet is measured in situ, i.e. in its step IV position (April 2013)
   then placed in park position
3. SS1 +SS2magnets are measured in situ, i.e. in its step IV position (fall 2013)

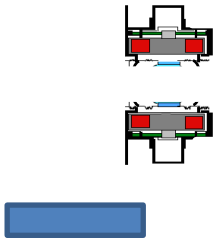
Constraints and limitations

-- Due to the size of the magnetic measurement device
only one magnet can be 'in situ' at one given time

new feature: it is possible to measure SS1 and SS2 in the same sequence i.e. with both in situ

-- it is expected to take a few days to install the magnetic measurement kit and
Another 'few days' to perform the measurements and dismount.
For now count three weeks for AFC (flip and non-flip modes)
and
two or three weeks for the two solenoids (this includes a polarity flip for SS2)

1. FC magnet is measured in R9 in February 2013



Sequence 1 FC

Measurement device 1 for FC

Sequence 1 -A: empty FC, Flip mode +- upstream

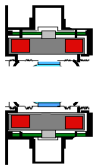
Sequence 1 -B: empty FC, Flip mode+- downstream

Allow 7 days for 1-A and 1-B
day 1 preparations
day 2 fine setting, survey <150μm)
1st measurements and check
day 3 measurements 1-A
day 4 move to 1B and survey
day 5 measurements
day 6+7: reserve
a few days for polarity change
5 days for 1-C and 1D
➔ **3 weeks**

Sequence 1 -C: empty FC, Sol mode++ downstream

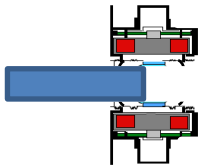
Sequence 1 -D: empty FC, Sol mode ++ upstream

2. FC magnet is measured in R5.2 March-April 2013

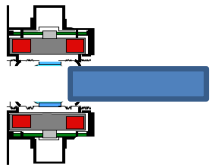


Sequence 2 FC

Measurement device 1 for FCs

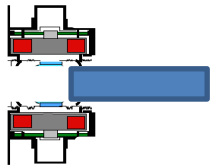


Sequence 2 -A:
empty FC,
Flip mode +-
upstream

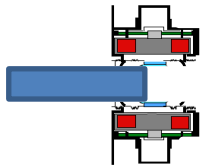


Sequence 2 -B:
empty FC,
Flip mode+-
downstream

Allow 6 days for 1-A and 1-B
a few days for polarity change
5 days for 1-C and 1D
= 3 weeks

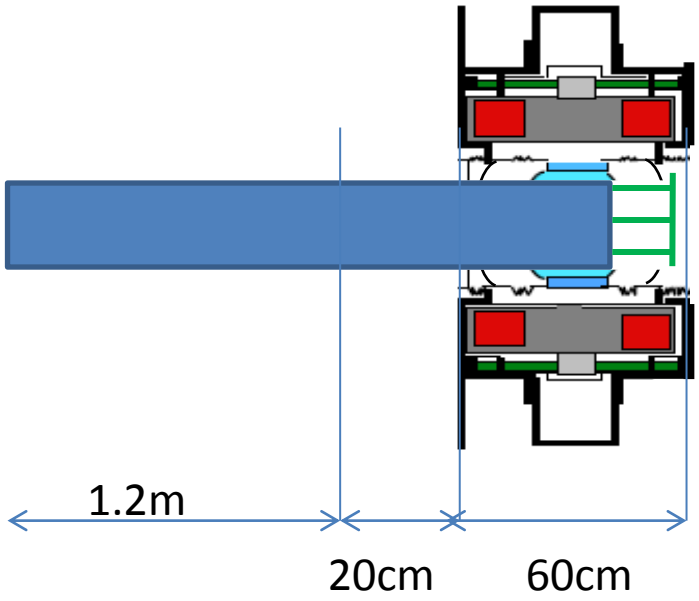


Sequence 2 -C:
empty FC,
Sol mode++
downstream



Sequence 2 -D:
empty FC,
Sol mode ++
upstream

Measuring mesh: AFC scan settings



assume 10 seconds per point

scan steps:

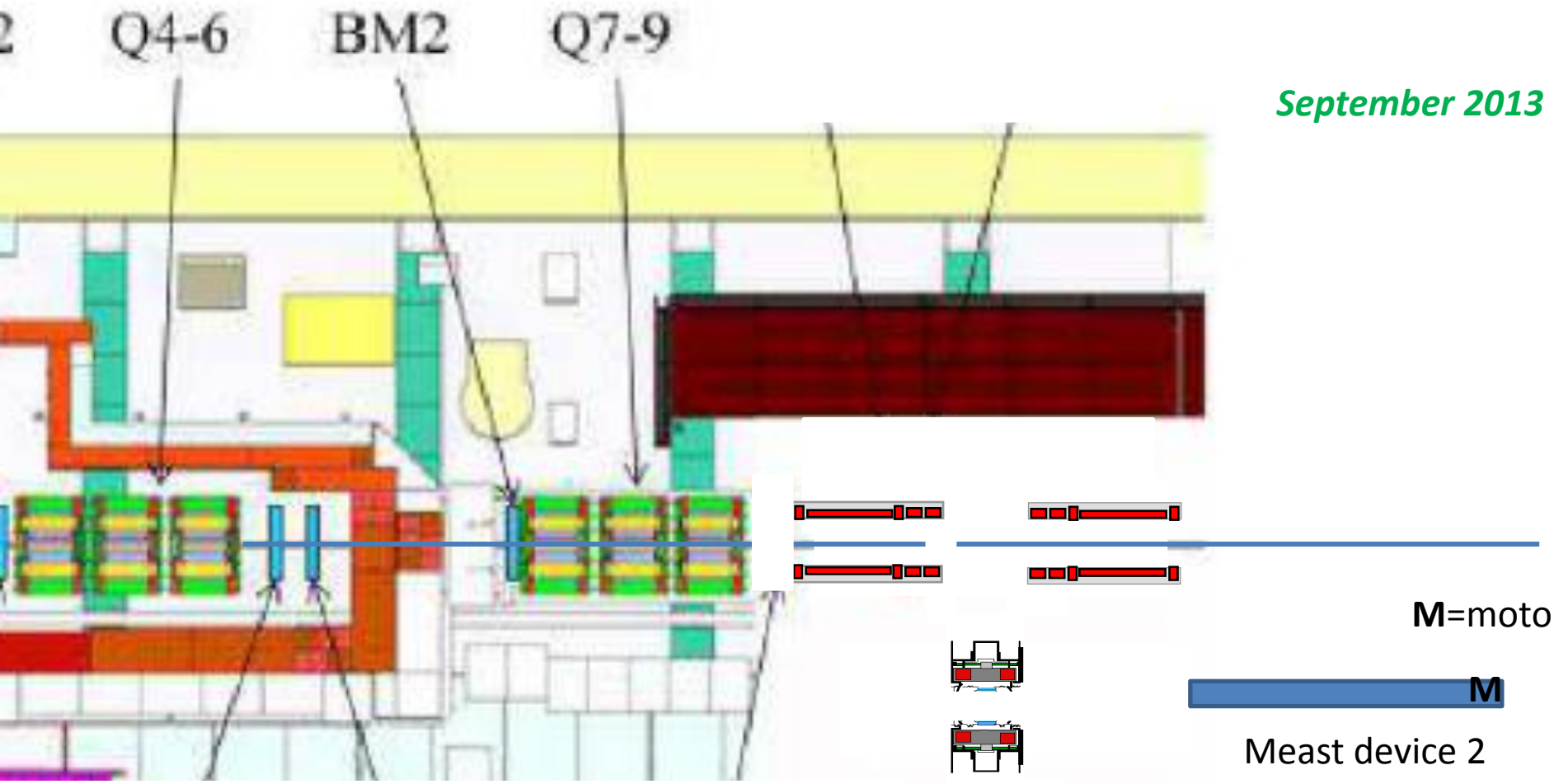
1. within the magnet and in near stray field regions (80cm):
16 phi steps, every 2cm in z ➔ 640 points **time = 1.8rs**

2. in outer field region (120cm)
16 phi steps, every 5 cm in z ➔ 384 points **time = 1.1hr**

magnet settings 1/3 , 2/3, and full field (114 for solenoid mode, 225 in flip mode)

total measuring time = 9hrs

for simplicity in analysis all settings will be measured with the same measuring mesh



September 2013

Sequence 3 in the MICE hall : spectrometer solenoids

AFC in park position install SS1 and SS2

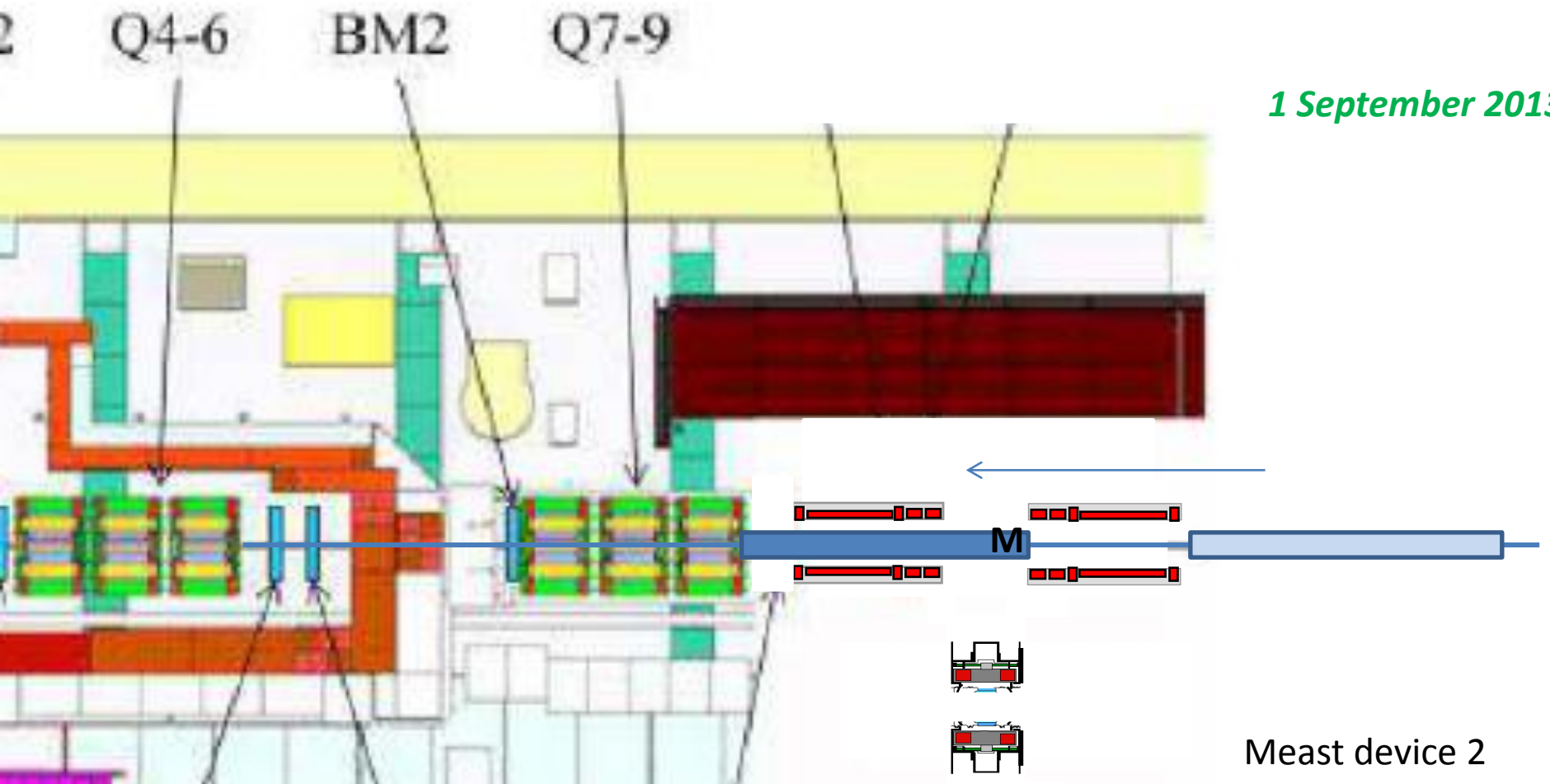
in beam position, power up

with Virostek-plates (no TOF1/2, EMR etc..)

pump cool and train magnets in parallel

Alan Grant investigating this possibility

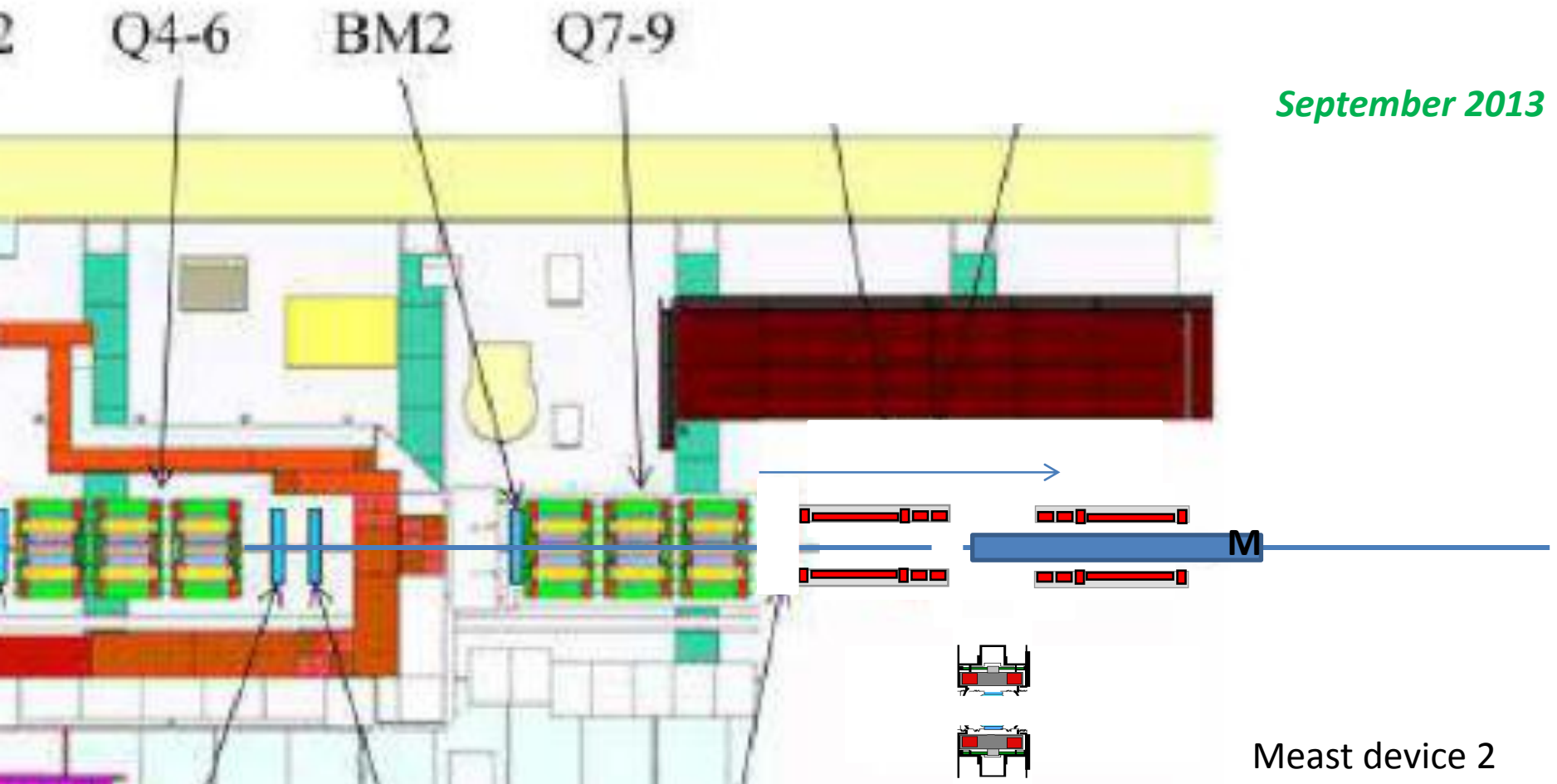
1 September 2013



Meast device 2

w 5 days for 3-A
1 preparations
2 fine setting, survey <150µm)
1st measurements and check
3+4 measurements 3-A
5 reserve
eek

Sequence 3.A
measure SS1 in polarity +



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Meast device 2

w 5 days for 3-B
1 fine setting, survey <150µm)
2+3 measurements 3-B
4 reserve
w days (?)for polarity change and ramp-up
n 2 days measurements 3-C
2 weeks (but could well be 1 week)

Finish sequence 3-A in stray field region
Sequence 3-B
measure SS2 in polarity +
sequence 3-C
measure SS2 in polarity -