interference from ambient, stray RF fields to BPM readings

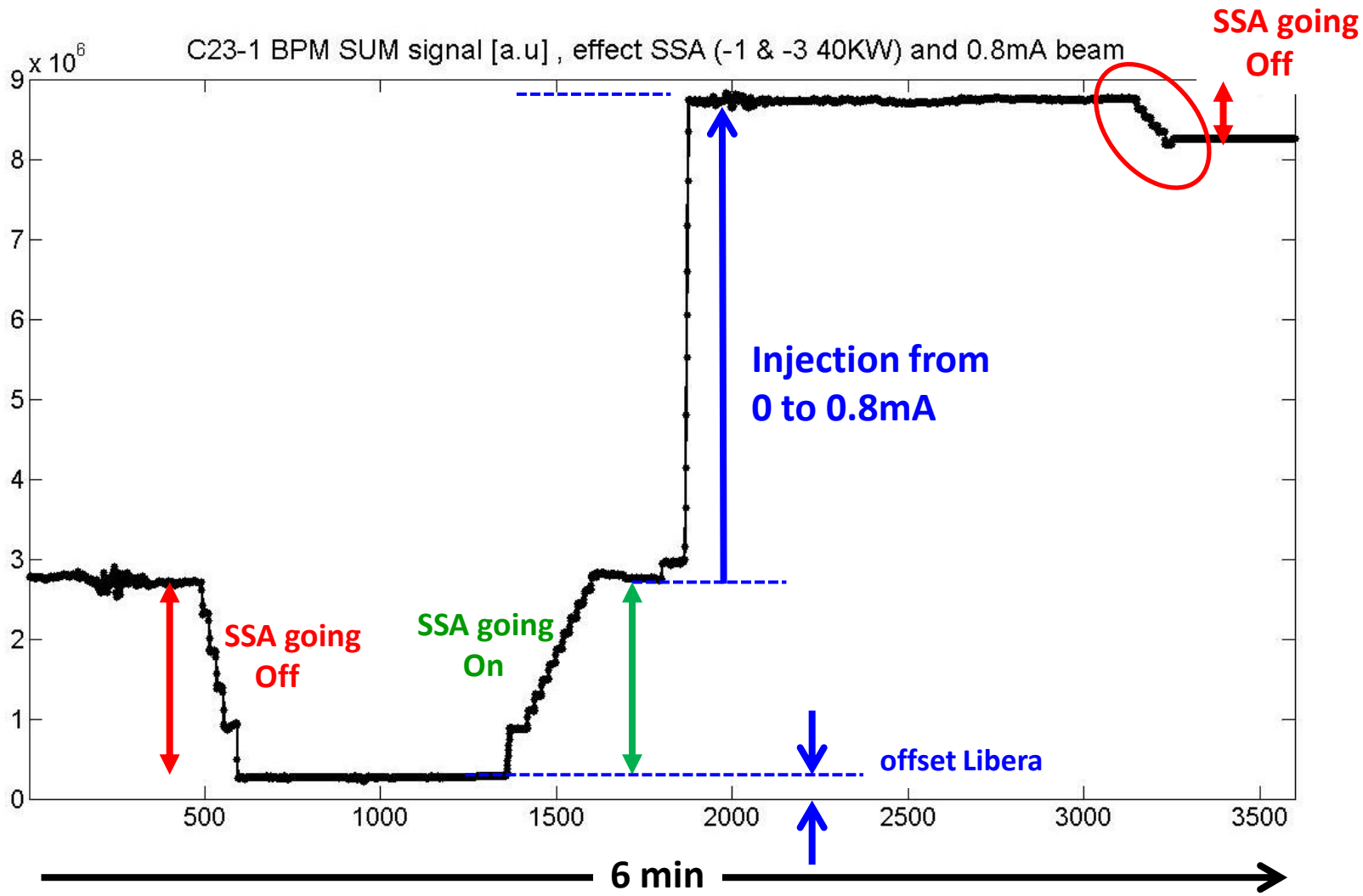
1) **Assessment of the SSA-RF-transmitter effect**
   - with no beam current, seen on SA-Sum signal
   - with small beam current, seen on SA X & Z positions

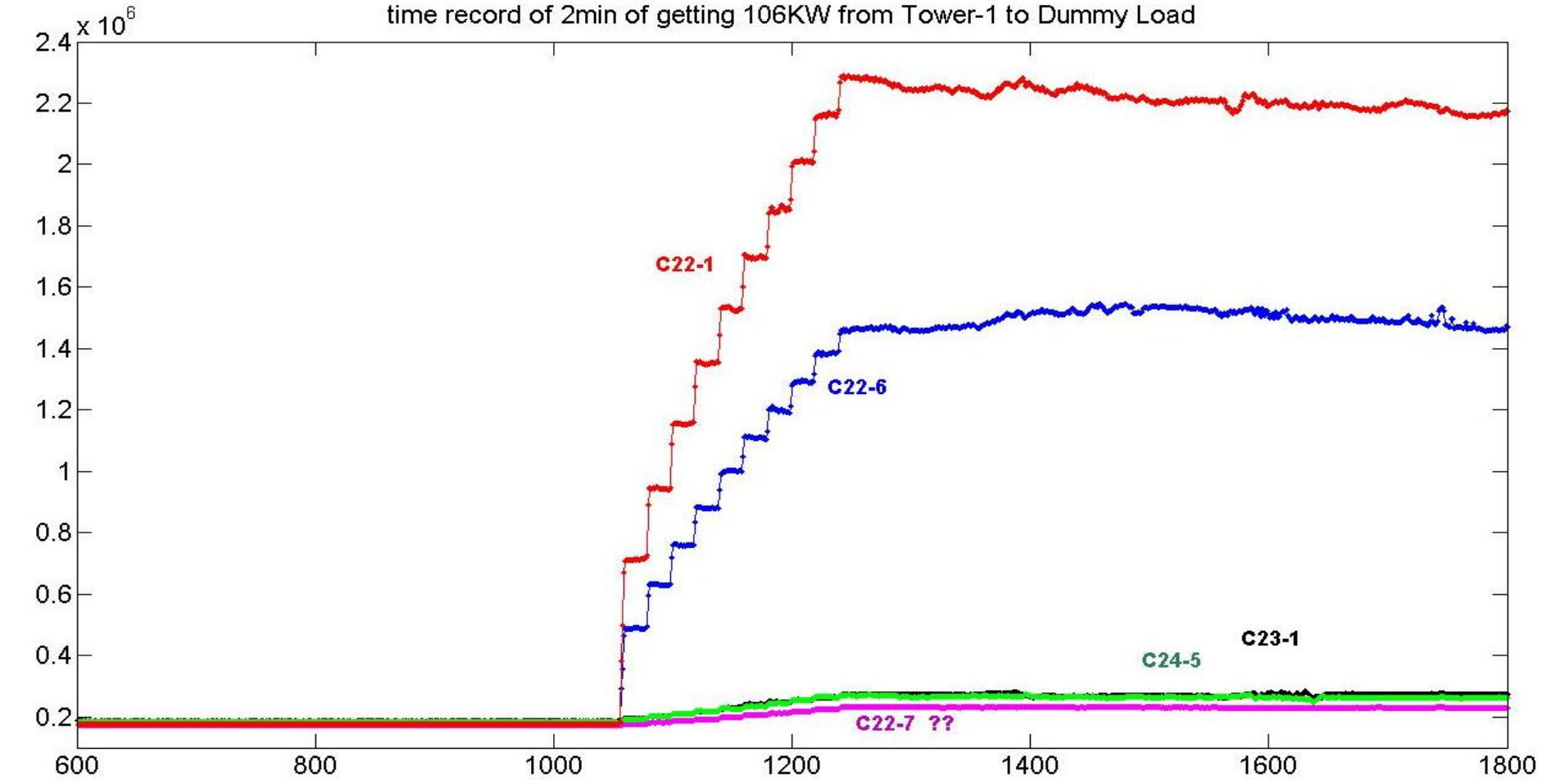
2) **Global remedy by replacing poorly shielded RF cables**
   - same measurement method, then comparisons
   - residual effects remain (negligible for USM operation)

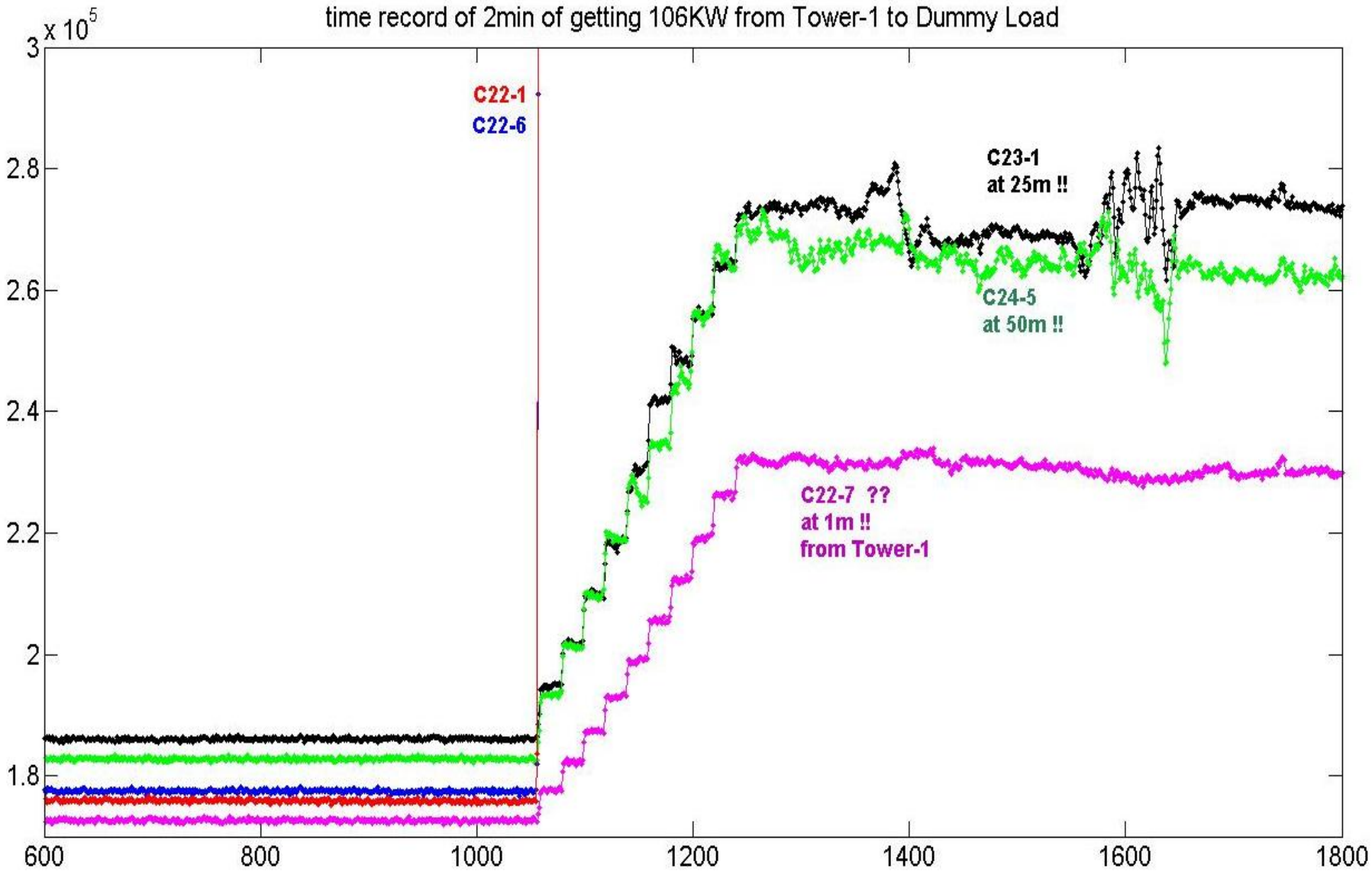
3) **Further tests & results with a portable mW RF emitter**
   - walking all around the 844m SR Ring, inside & outside Tunnel
   - also in our Booster Tunnel (with now Sparks inside the Tunnel)

4) **Conclusion, discussion, advice, suggestions**

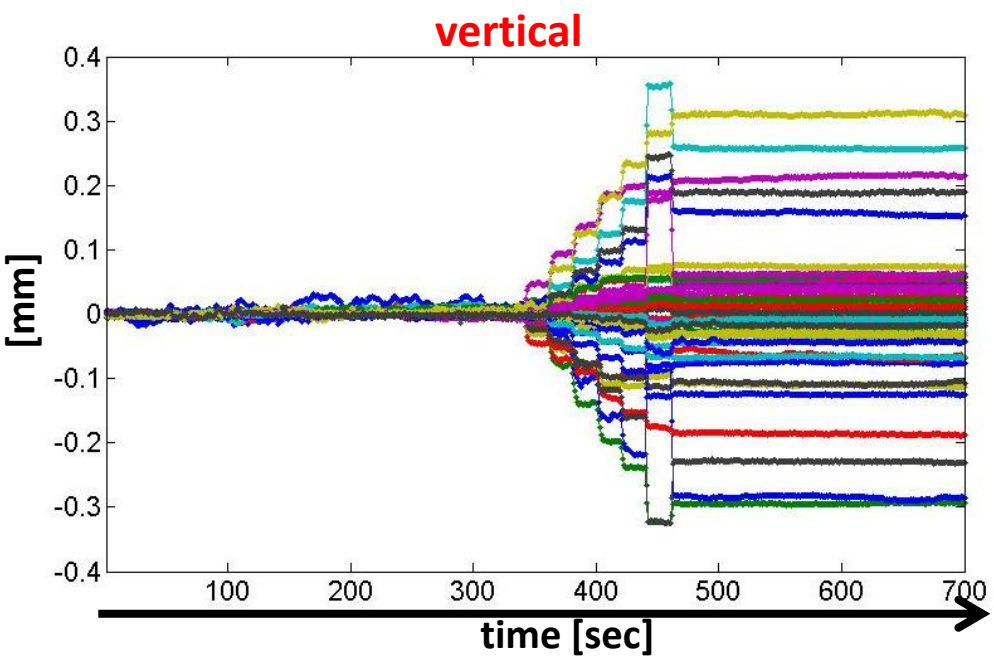
The SSA signature on the BPM Sum signal of C23-1 (one of the most affected BPMs)

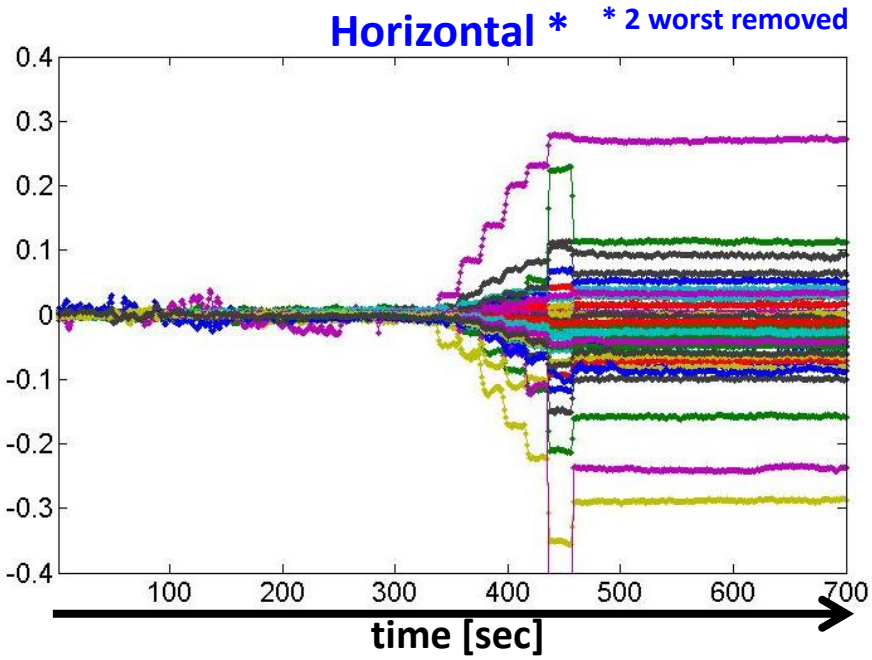


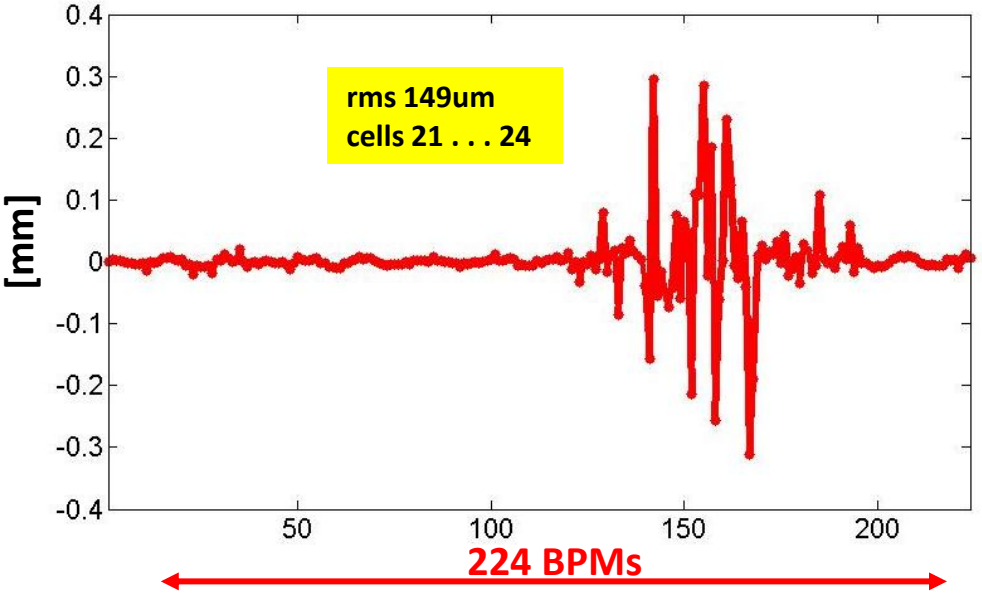

time record of 2min of getting 106KW from Tower-1 to Dummy Load
x 10^6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
600
800
1000
1200
1400
1600
1800
C22-1
C22-6
C23-1
C24-5
C22-7 ??

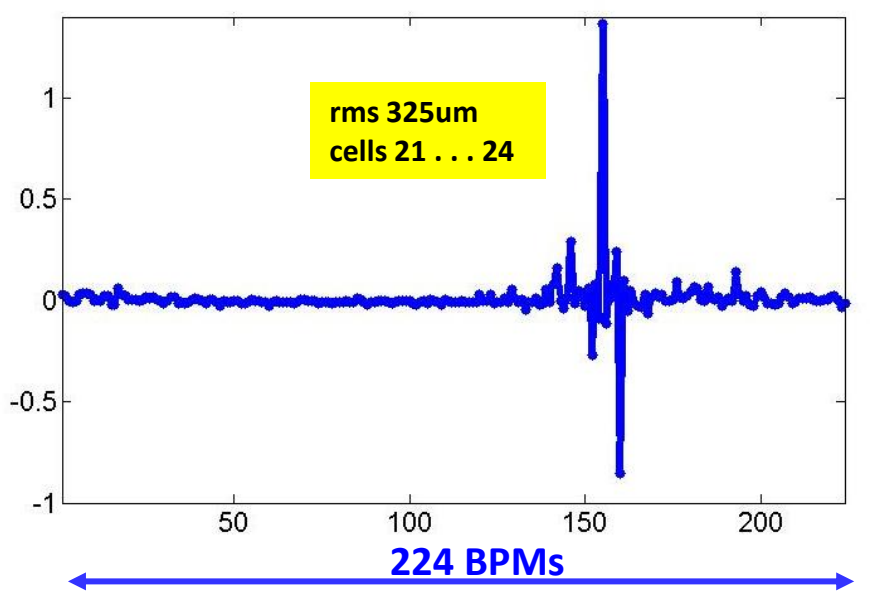

time record of 2min of getting 106KW from Tower-1 to Dummy Load
x 10^5
3
2.8
2.6
2.4
2.2
2
1.8
600
800
1000
1200
1400
1600
1800
C22-1
C22-6
C23-1
at 25m !!
C24-5
at 50m !!
C22-7 ??
at 1m !!
from Tower-1

0.8mA stored, SSA effect on Position [mm]

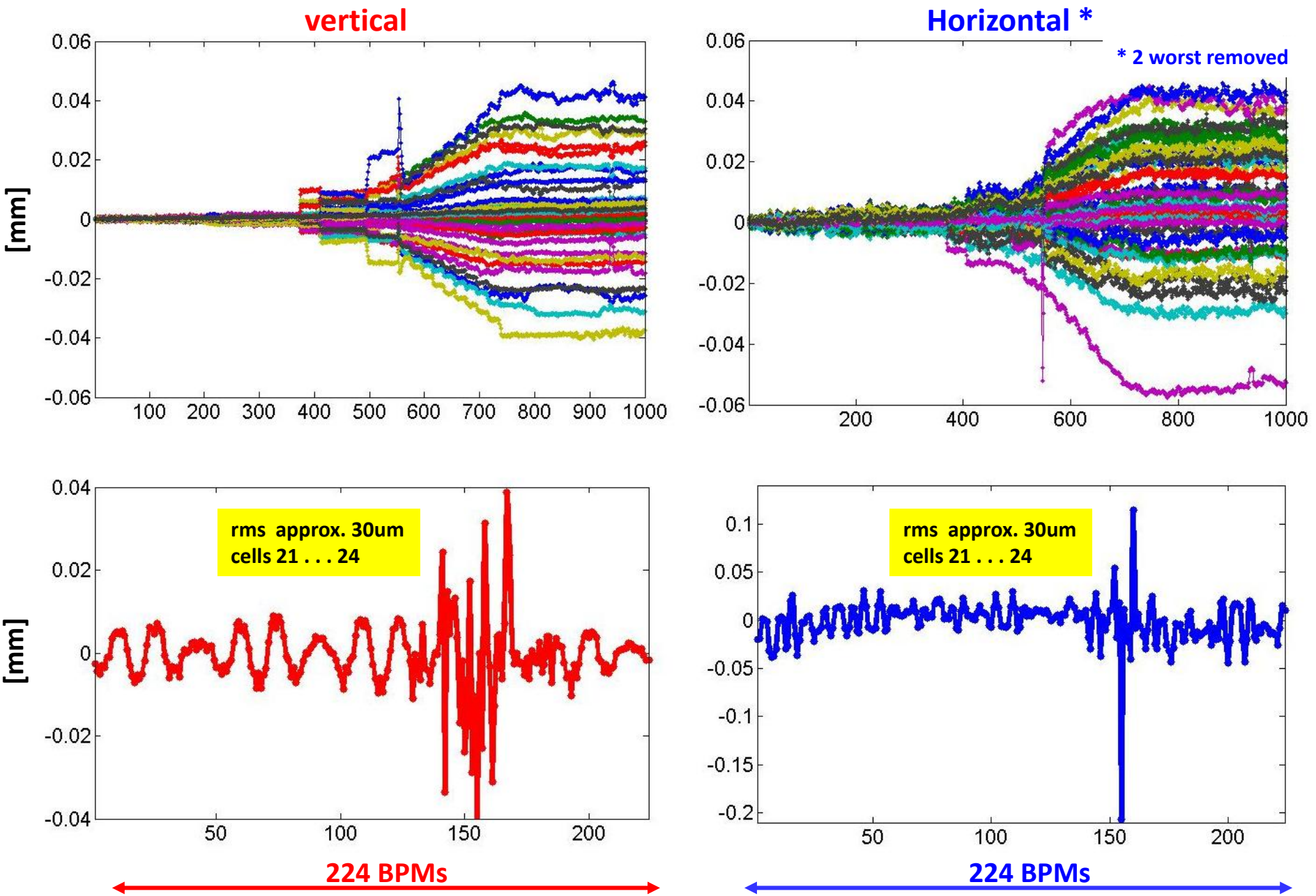


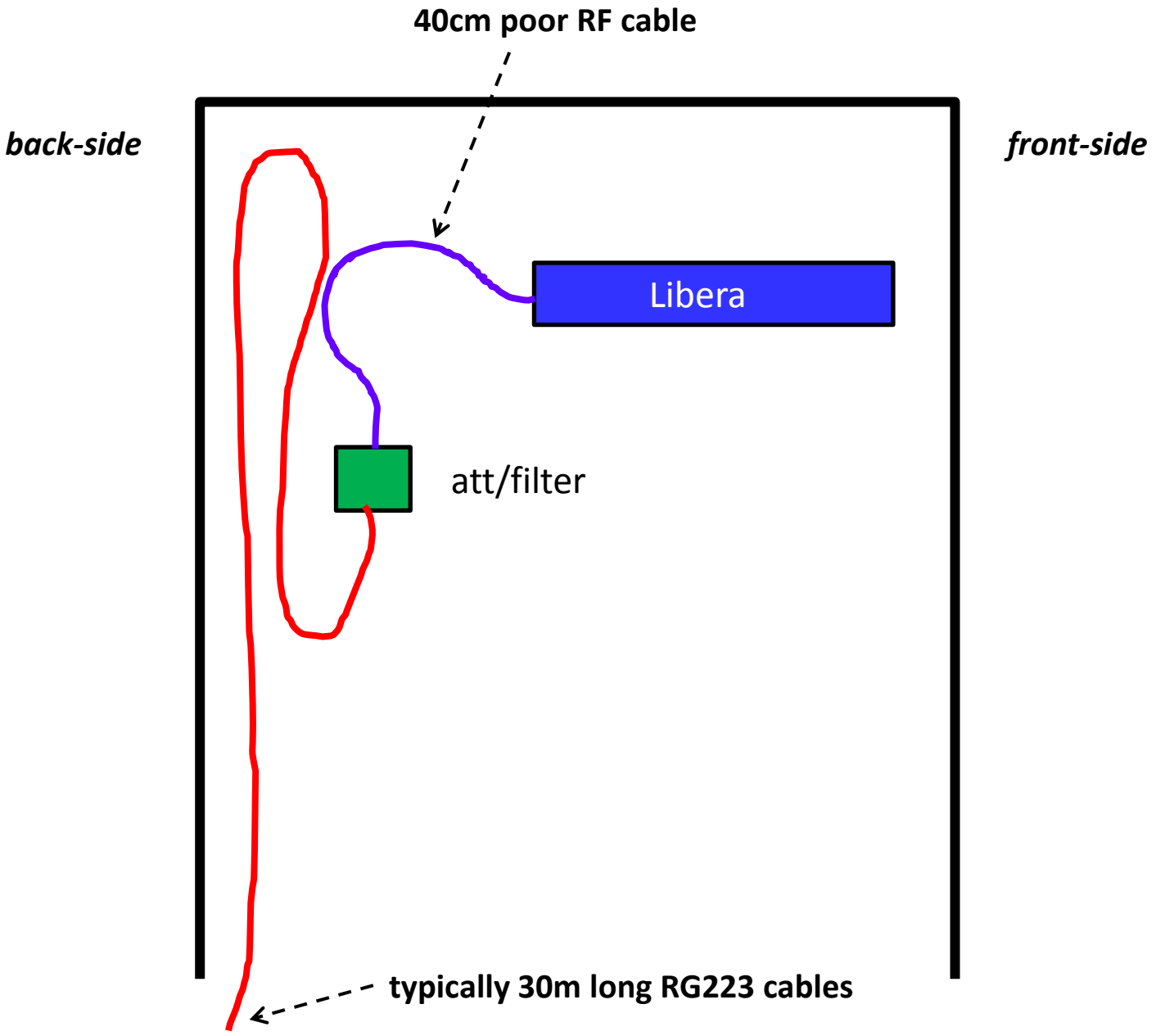


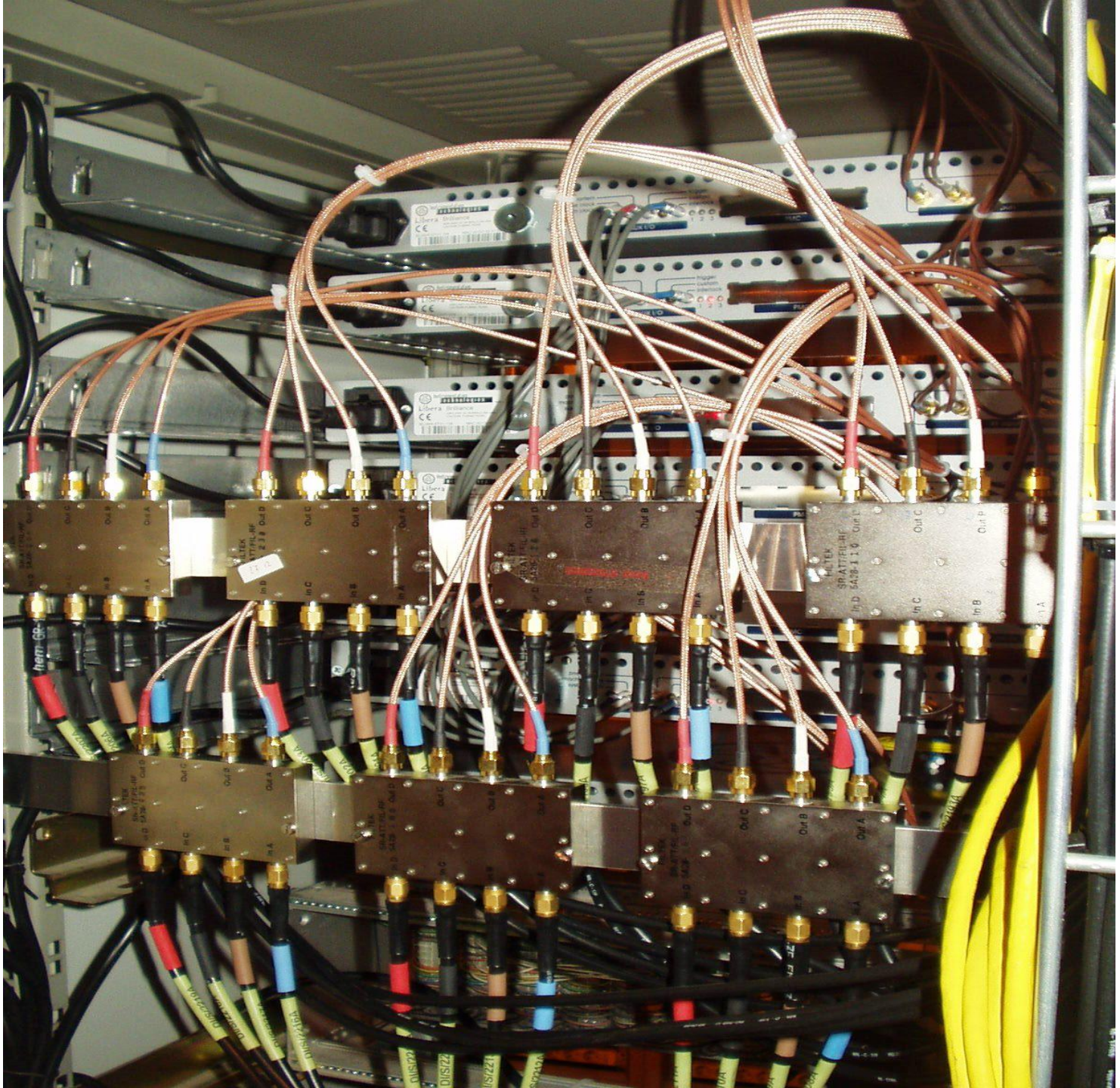




6mA stored, SSA effect on Position [mm]



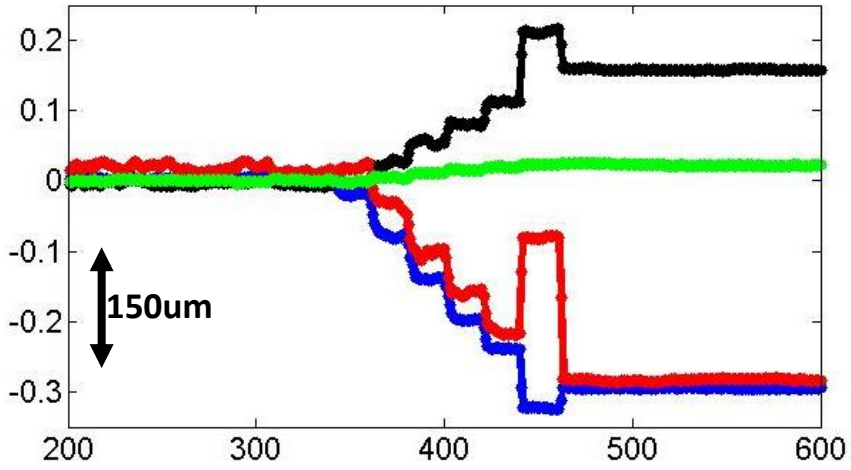

40cm poor RF cable
back-side
front-side
Libera
att/filter
typically 30m long RG223 cables



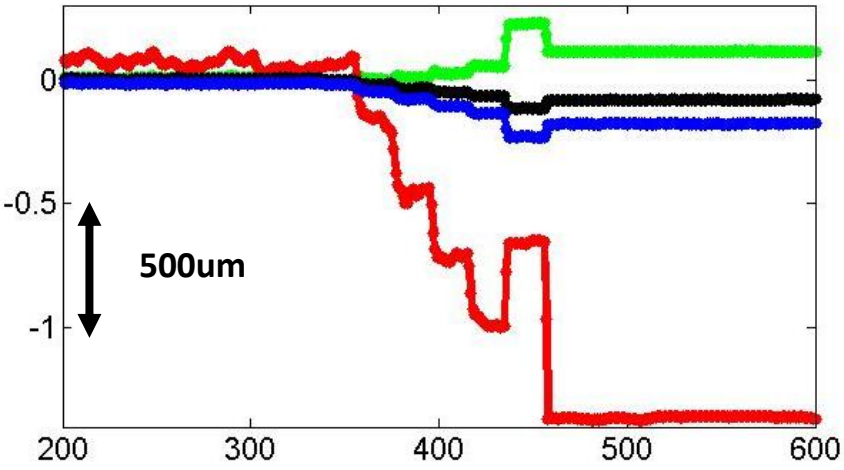
0.8mA stored, SSA effect on Position [mm] , on 4 stations with different RF cables

Bad cables

vertical

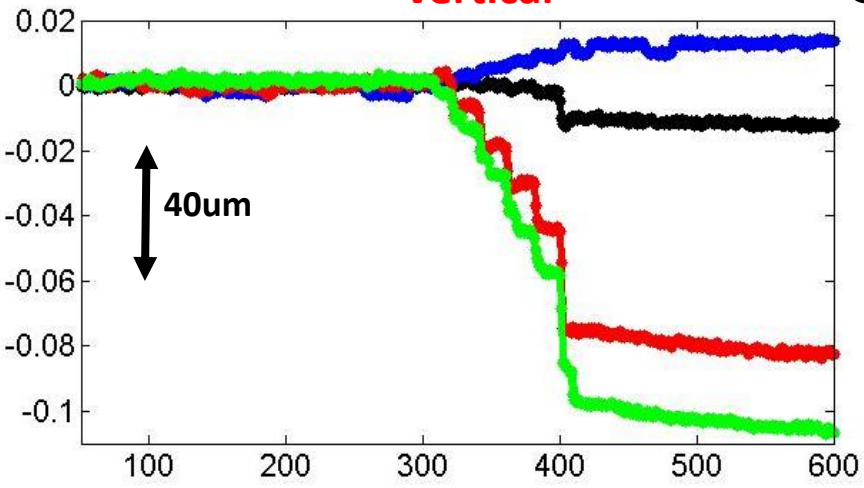


Horizontal

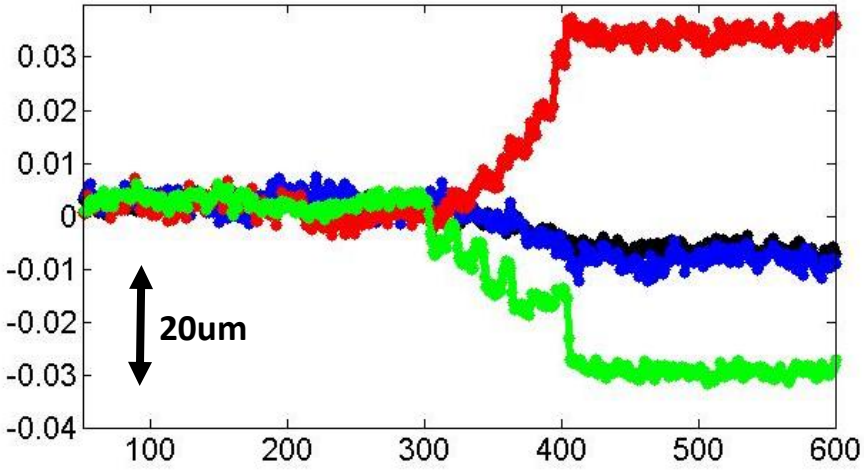


Good cables

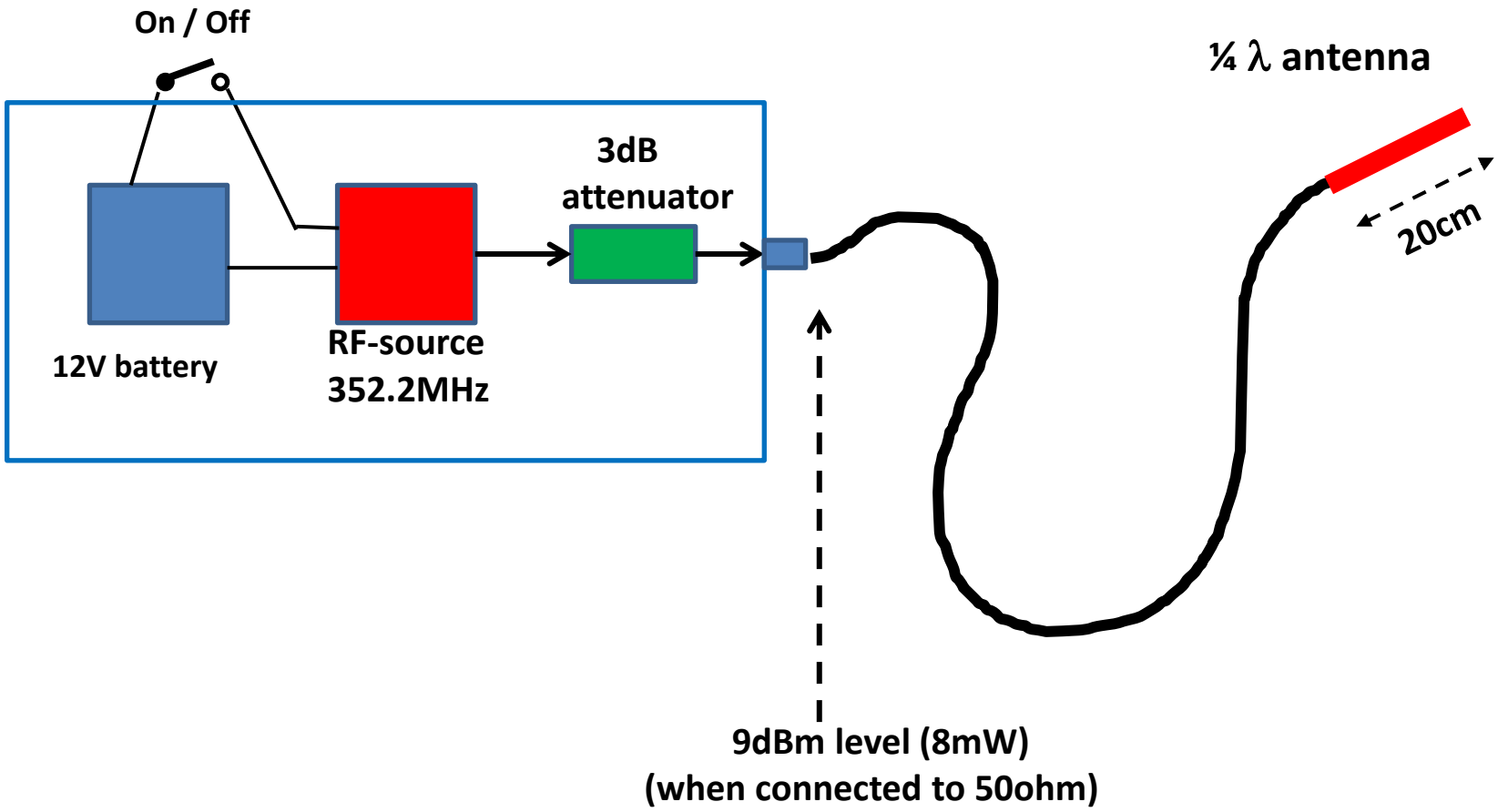
vertical



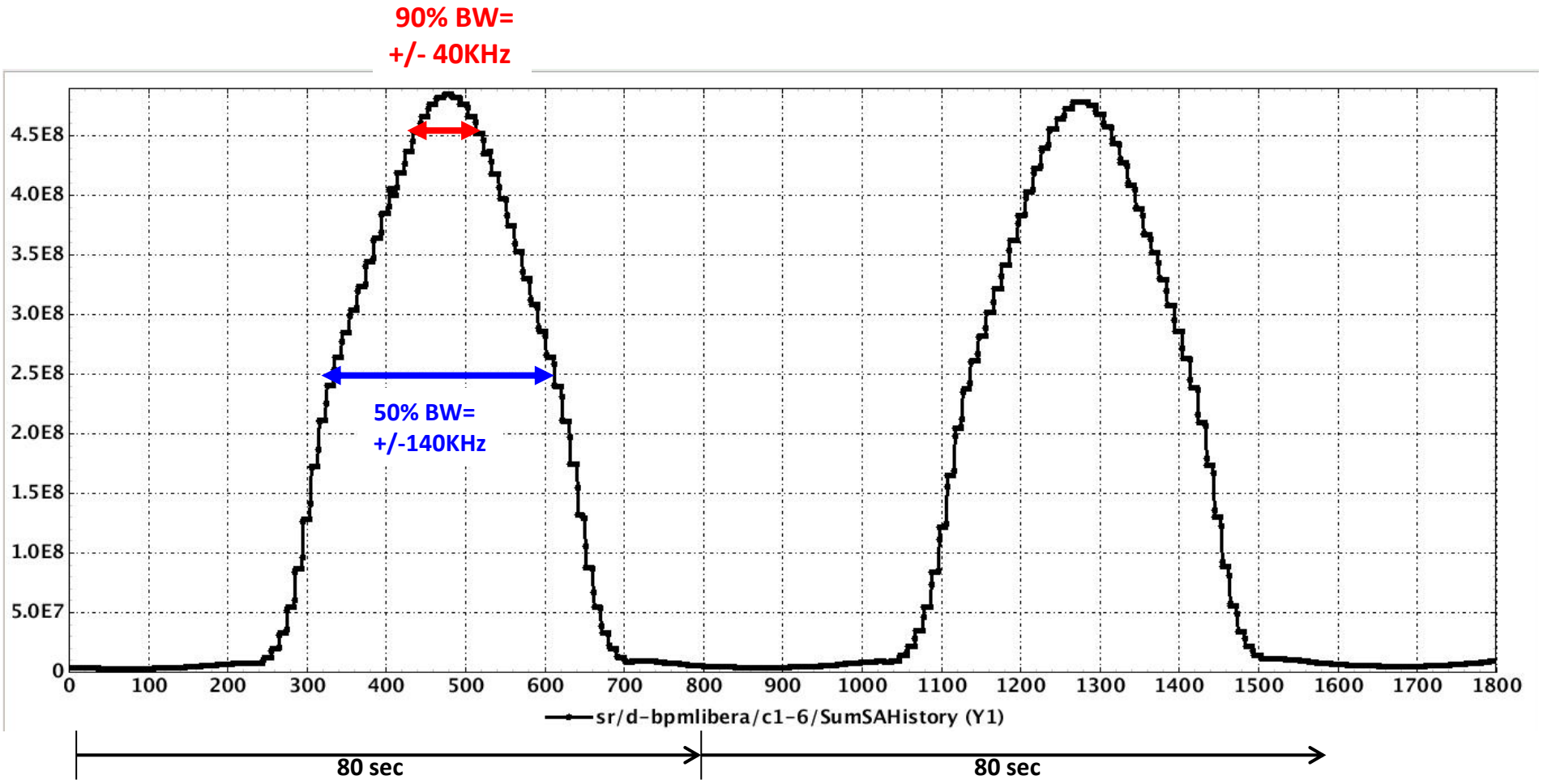
Horizontal



the RF-Perturbator :



make sure your source frequency is INSIDE the BW of the Libera SA-output

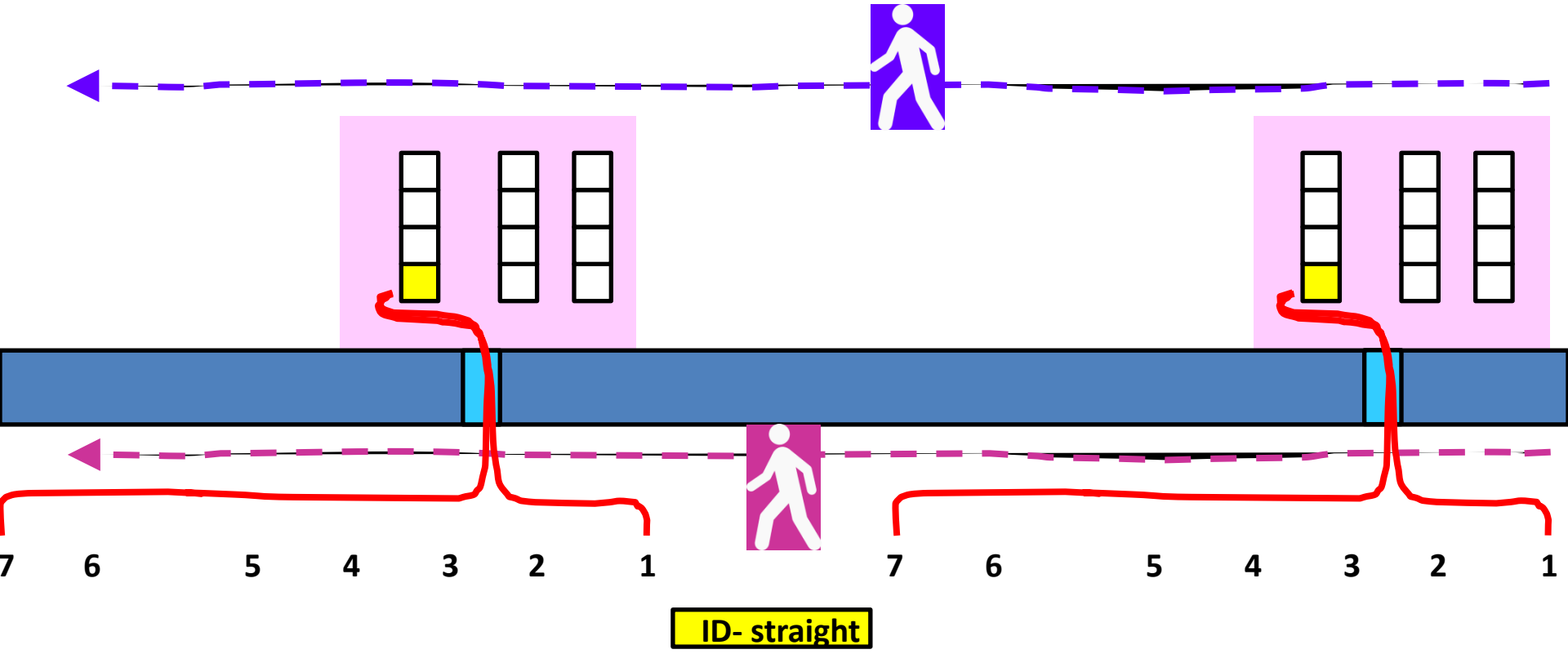


RF input frequency sweep from 351.8 to 352.6MHz,
i.e. 352.2MHz +/- 400KHz,
in 80 steps of 10KHz, at 1 sec interval
Storage Ring Libera itself synchronized to 352.202 MHz/ 992 (MC)

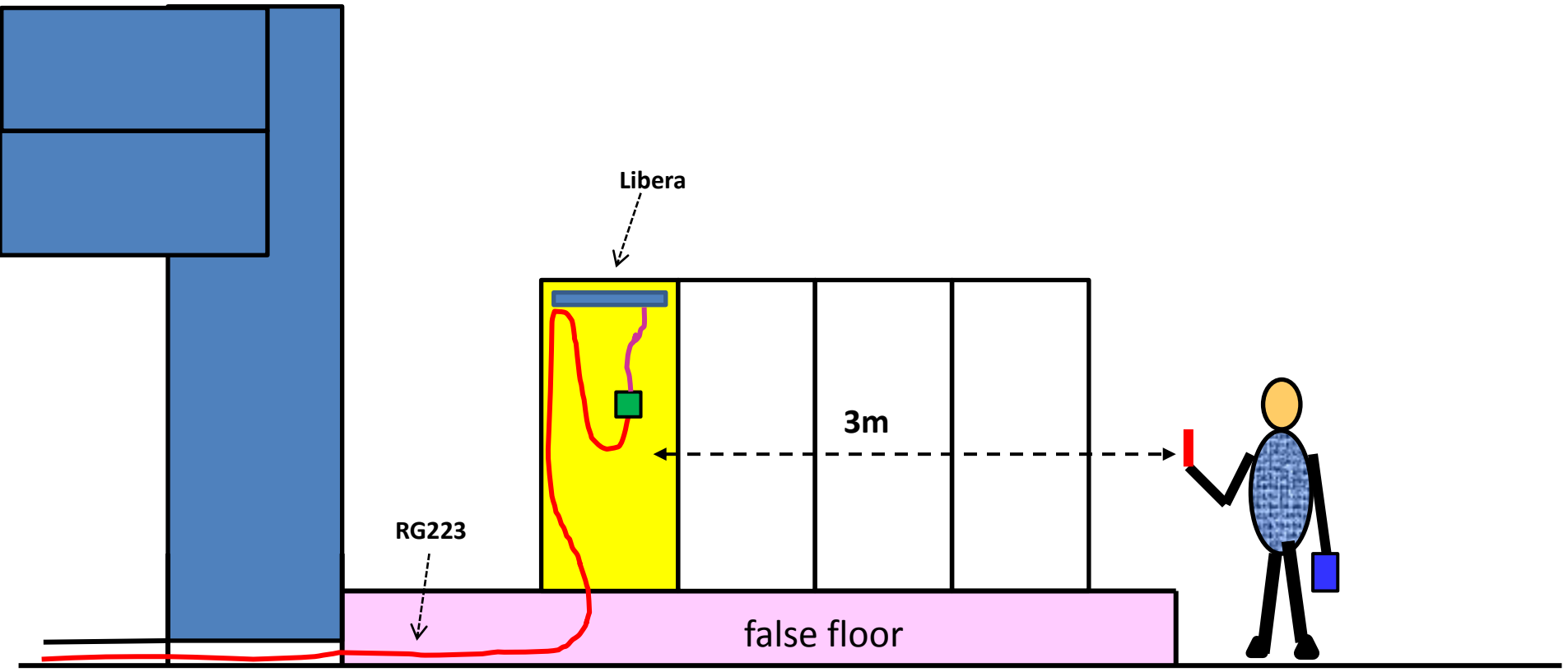
2 walks around the Ring :

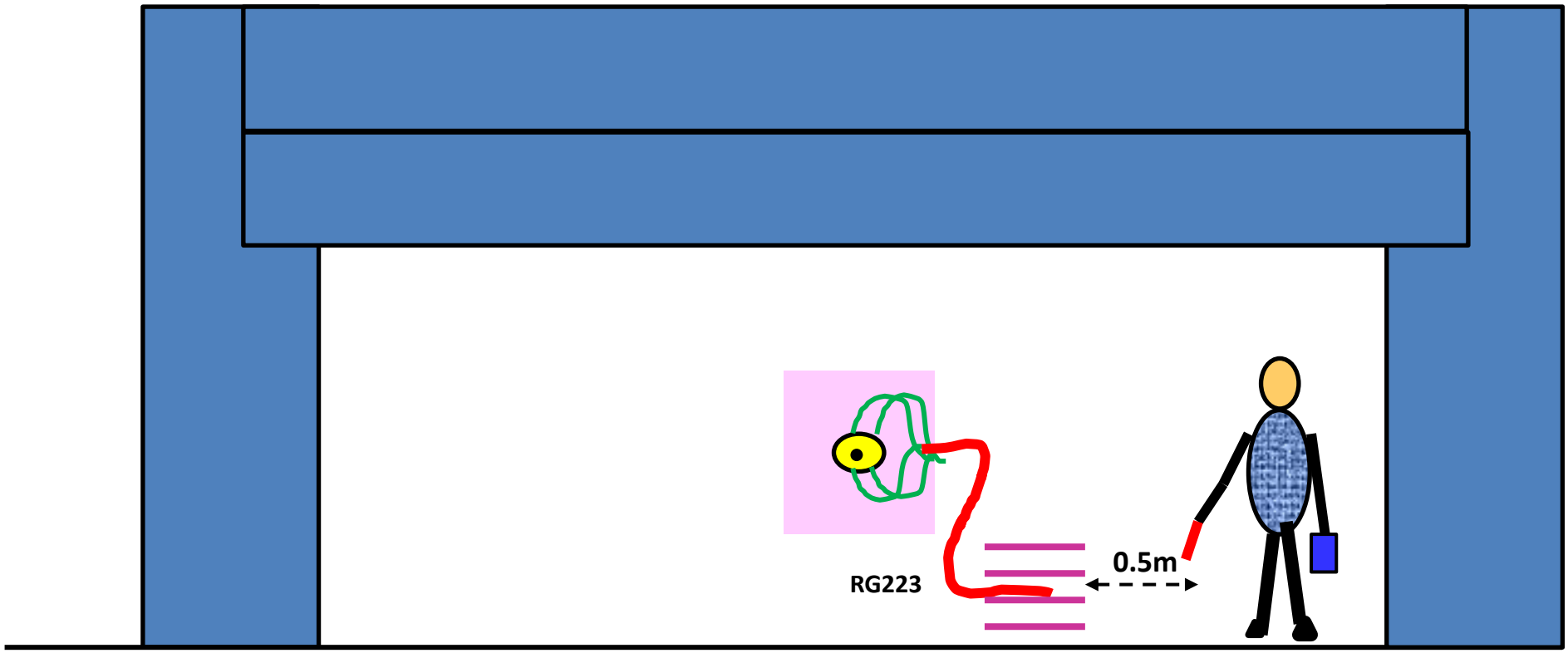
- **Outside the Tunnel (cabinets)**
- **Inside the Tunnel**

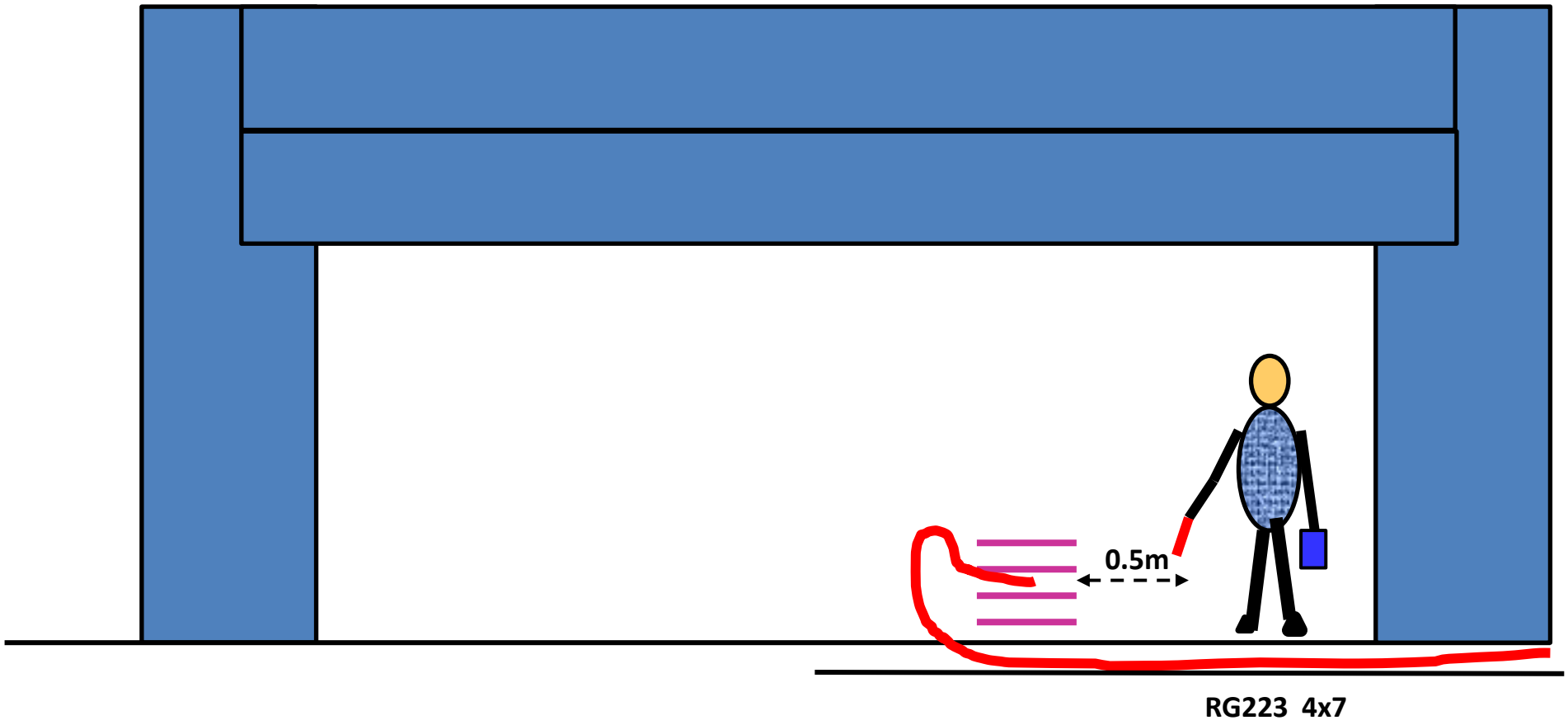
top-view of 2 cells (53meters)



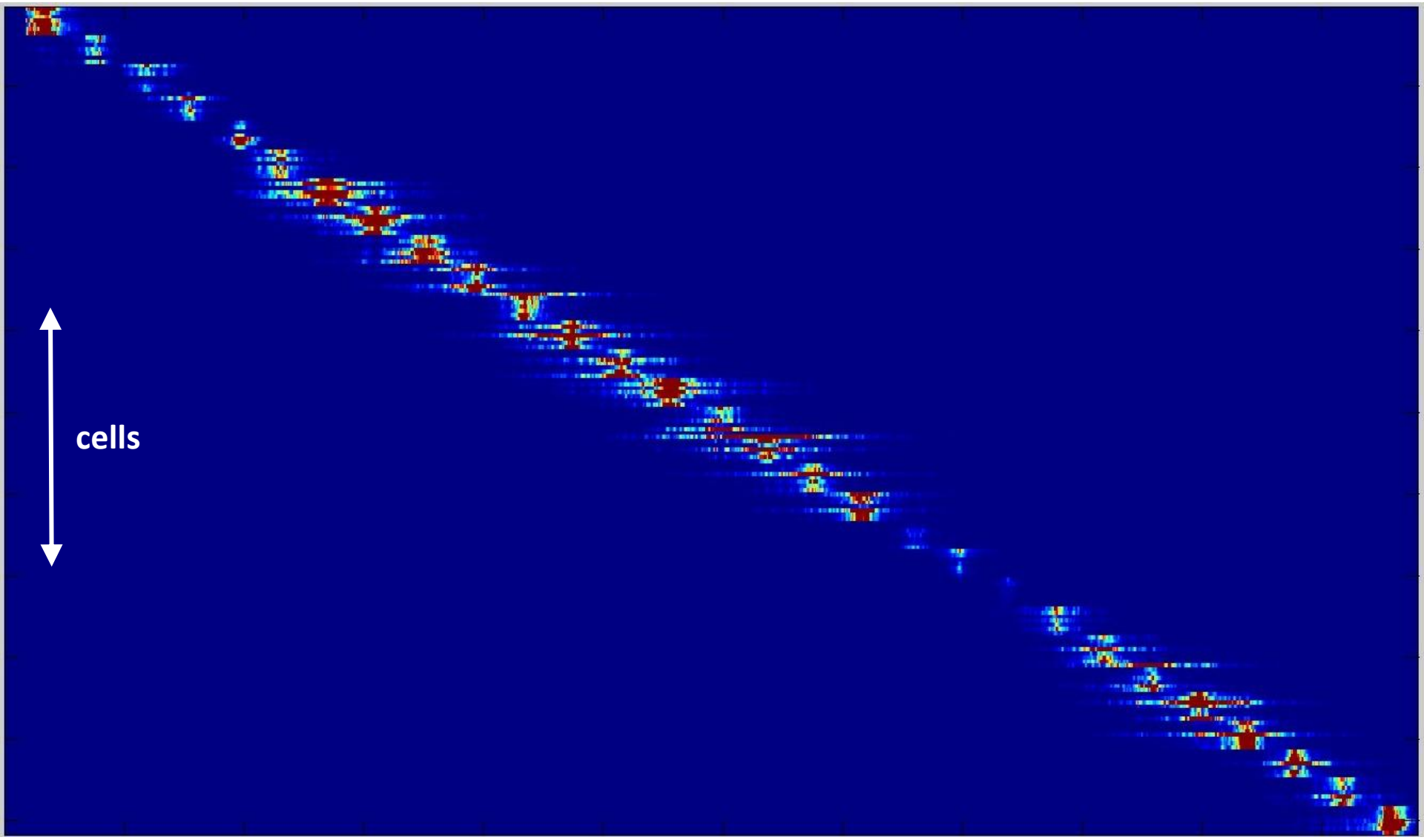
ID- straight


Libera
3m
RG223
false floor

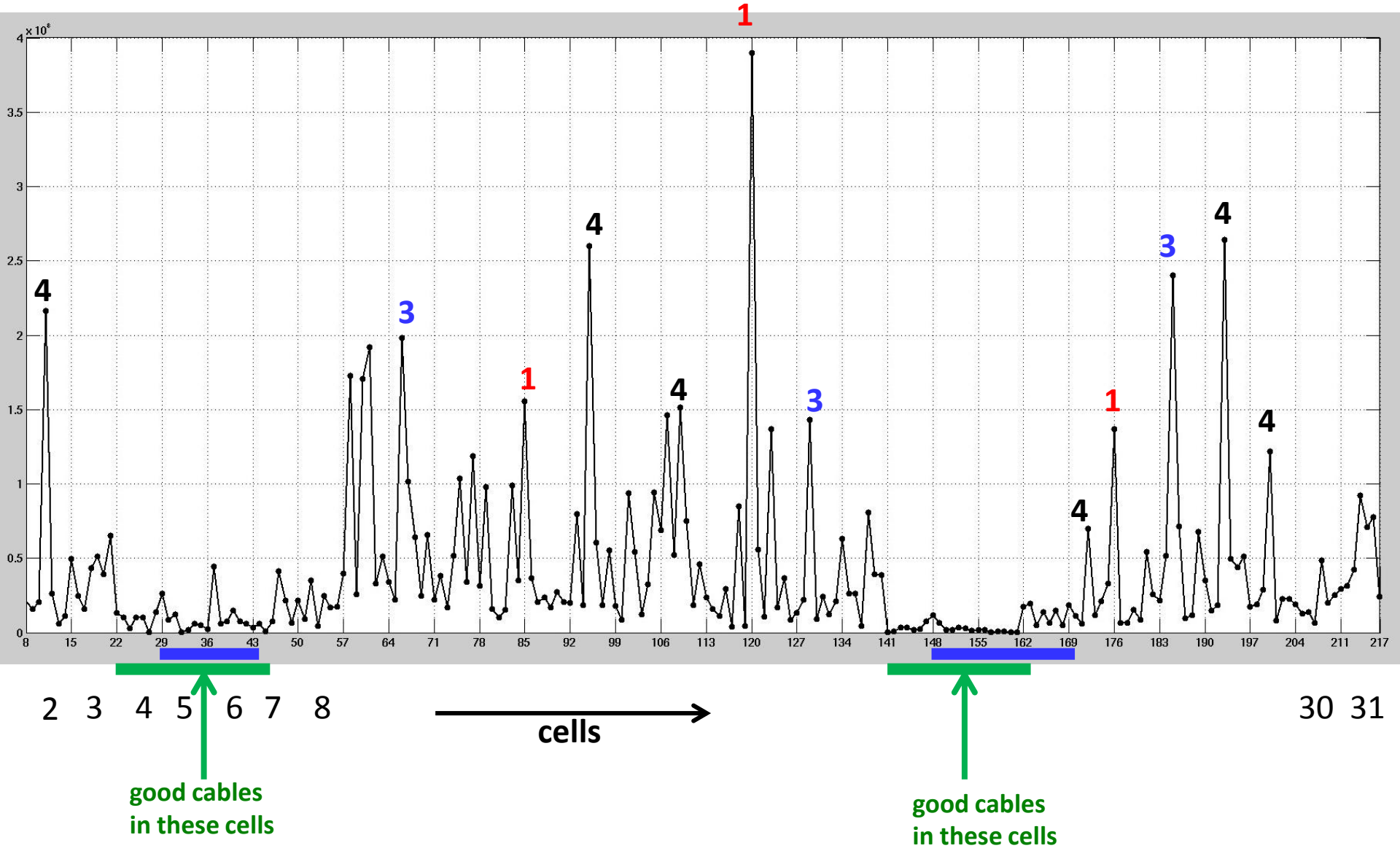

RG223
0.5m


0.5m
RG223 4x7

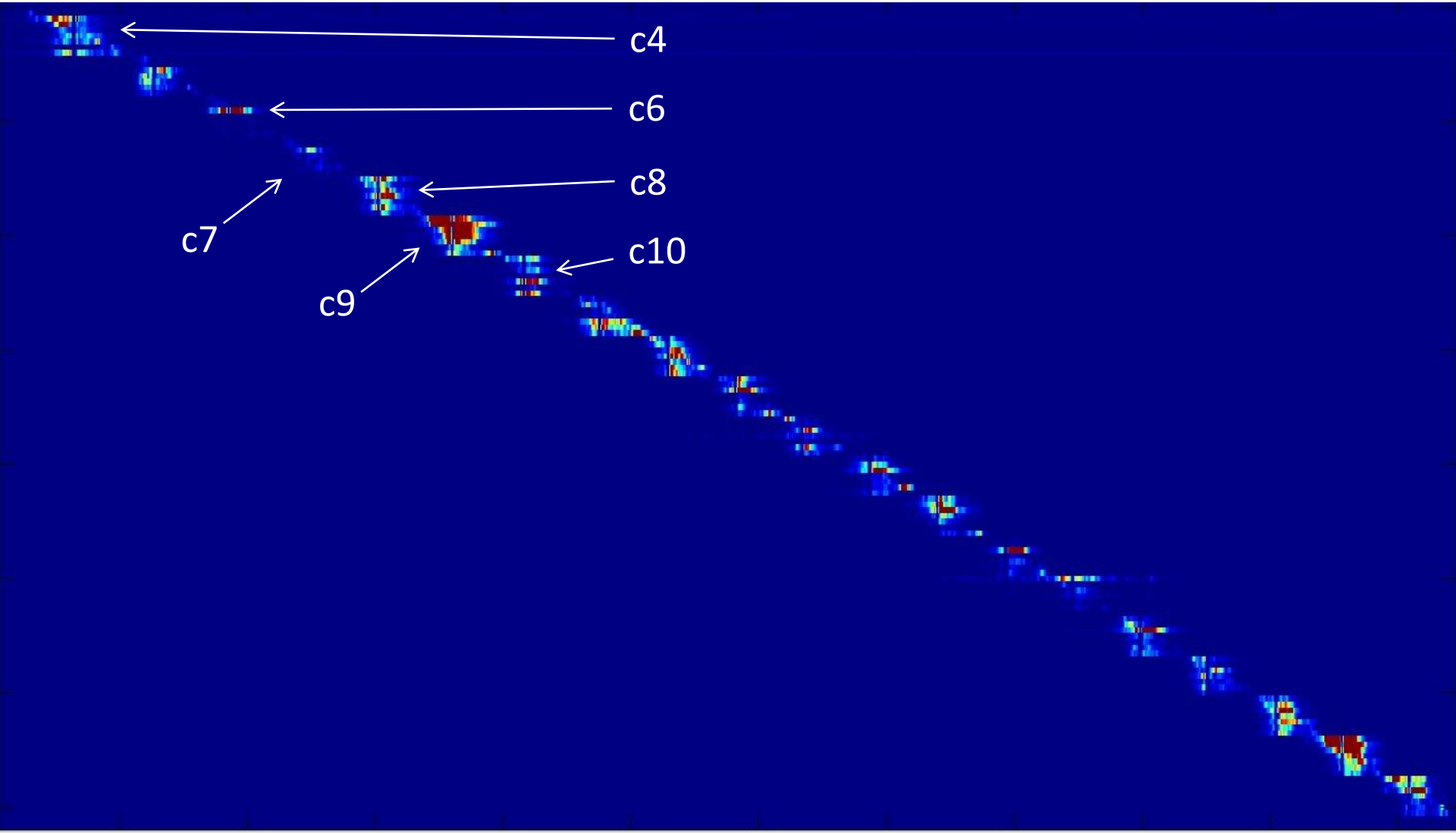
sensitivity to **outside** (tunnel) stray fields



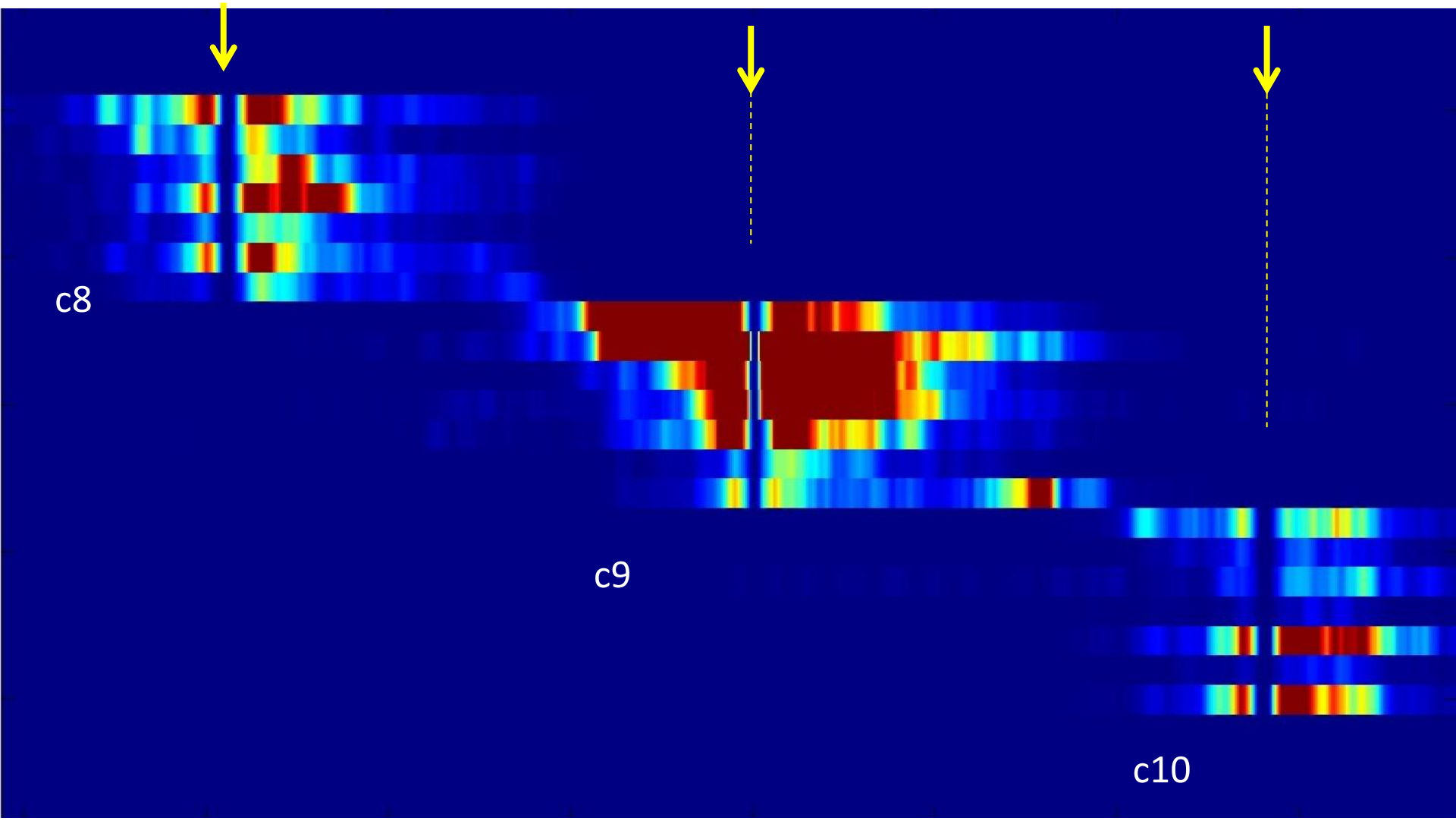
sensitivity to **outside** (tunnel) stray fields



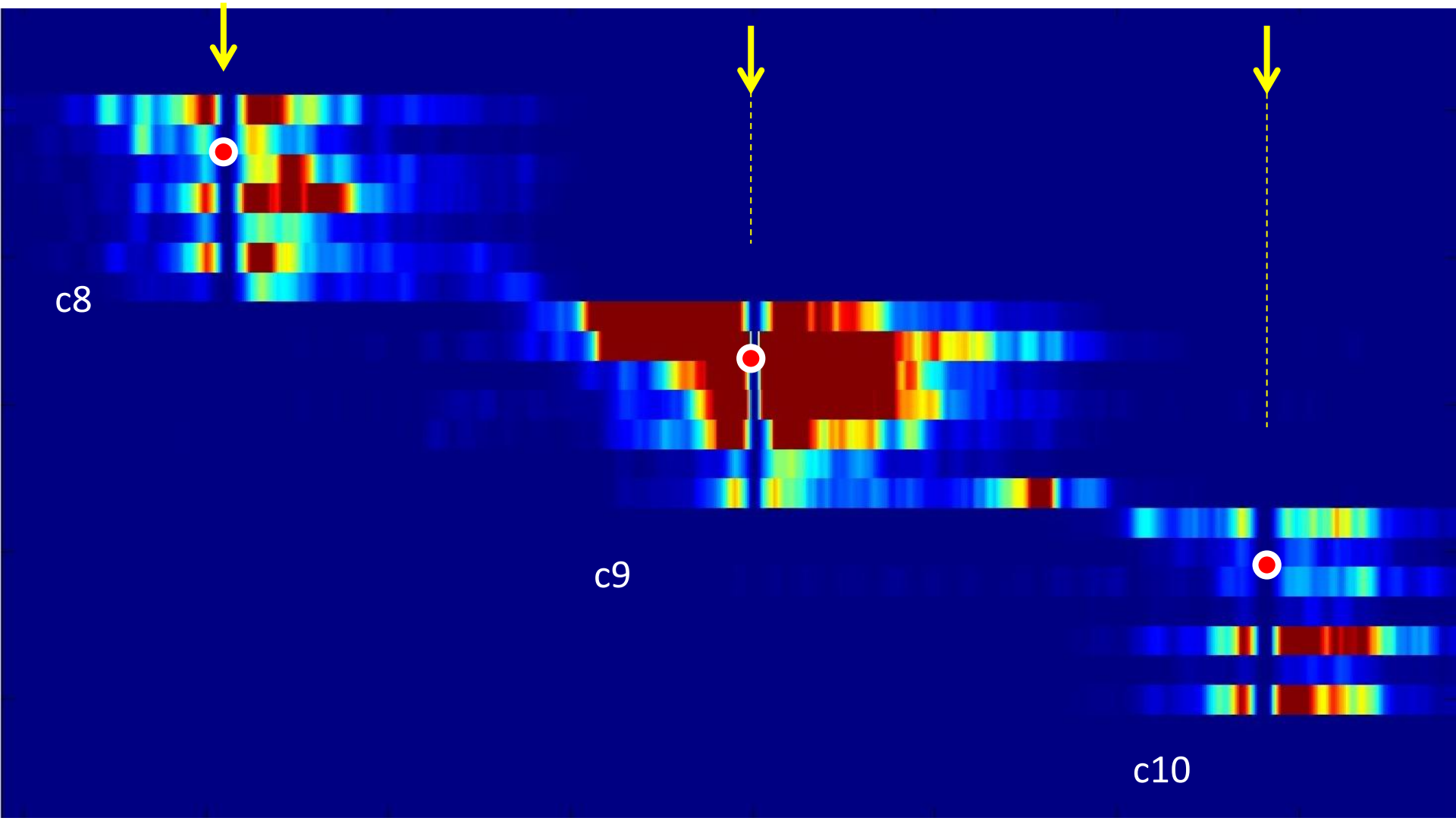
sensitivity to **inside** (tunnel) stray fields



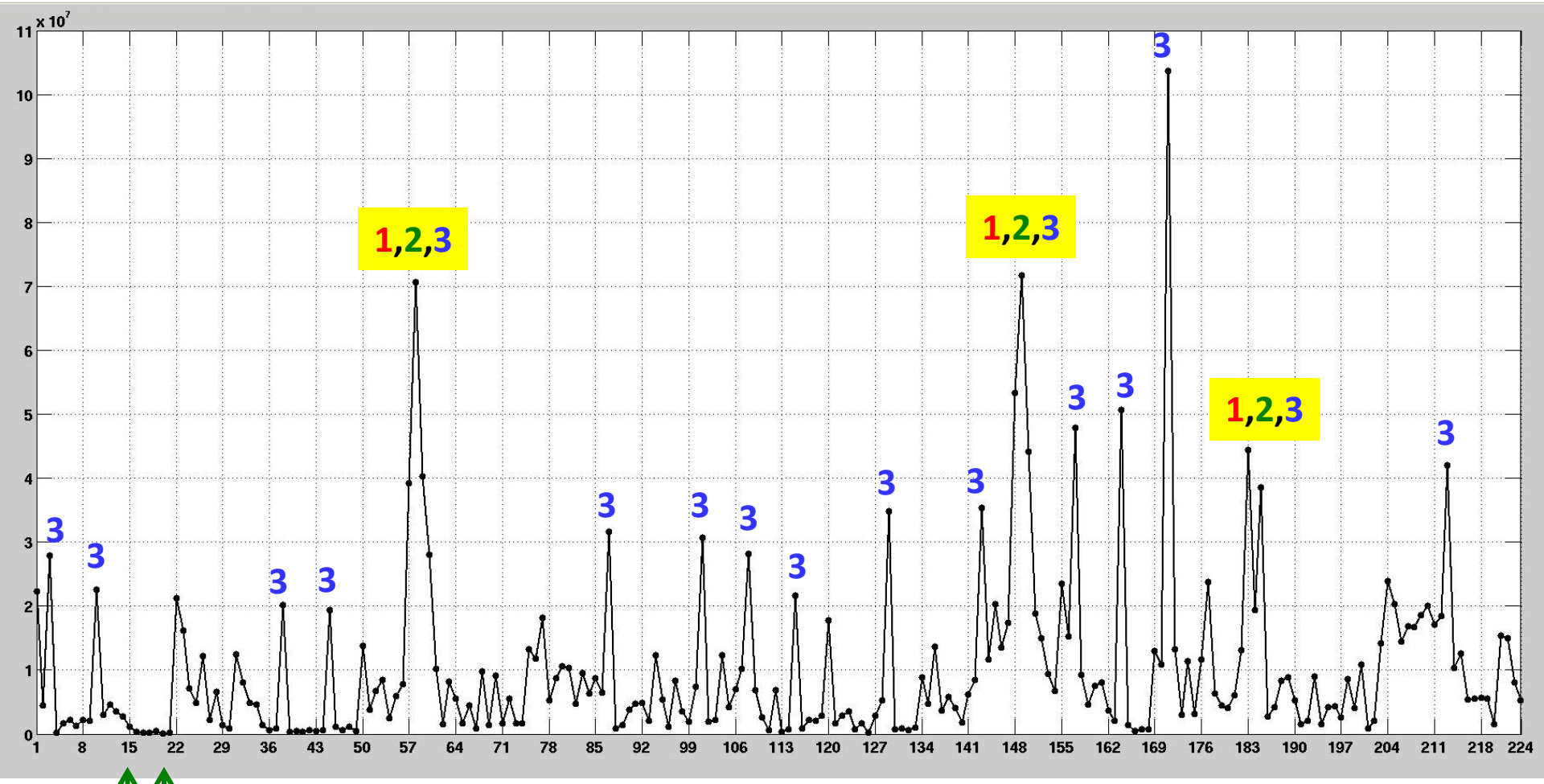
switch OFF-ON at regular points :
creates an easy position marker in your data



switch OFF-ON at regular points :
creates an easy position marker in your data



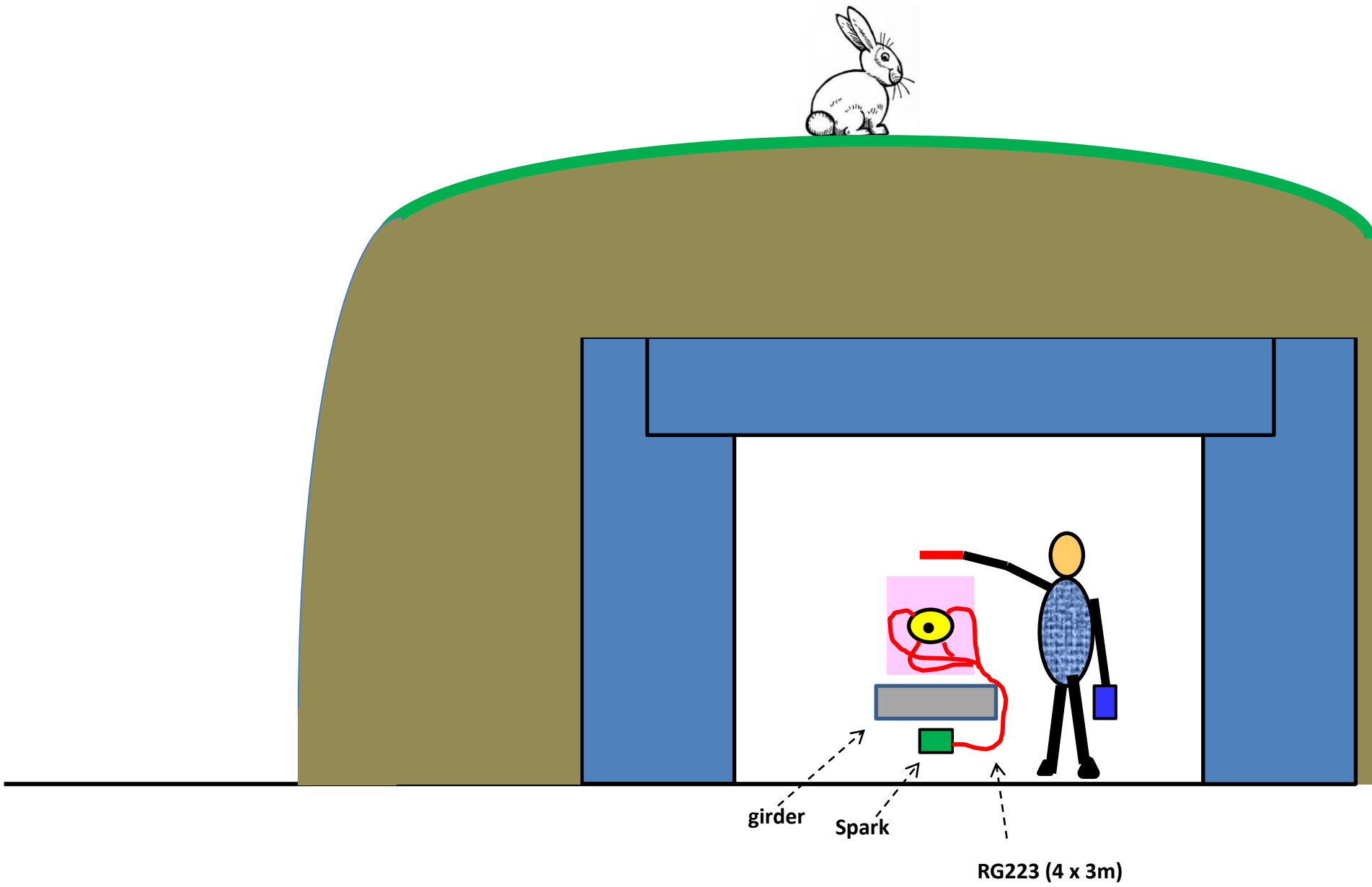
sensitivity to **inside** (tunnel) stray fields



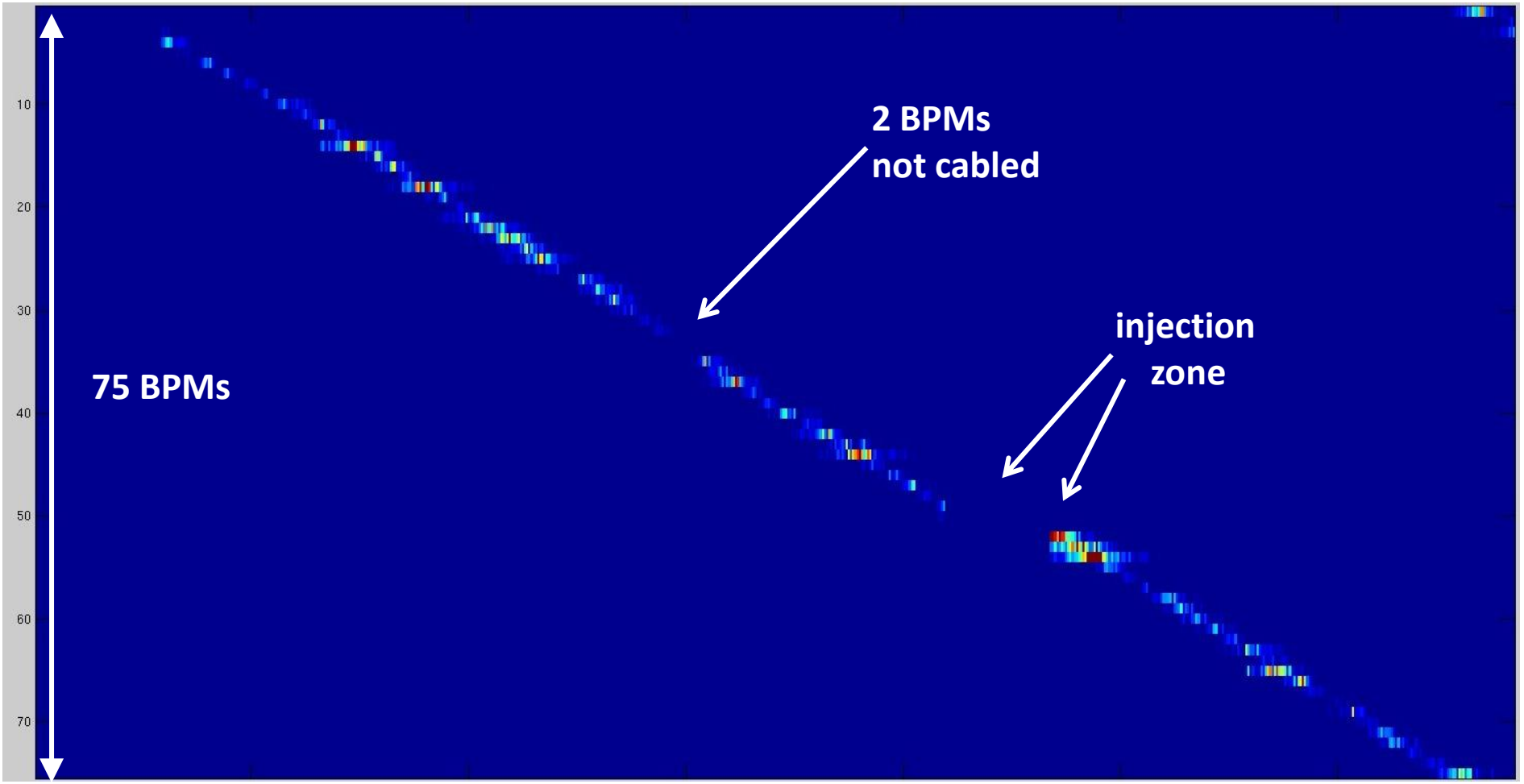
C3 not accessible

why is the 3rd one so bad almost every-where ??
needs further investigation . . .

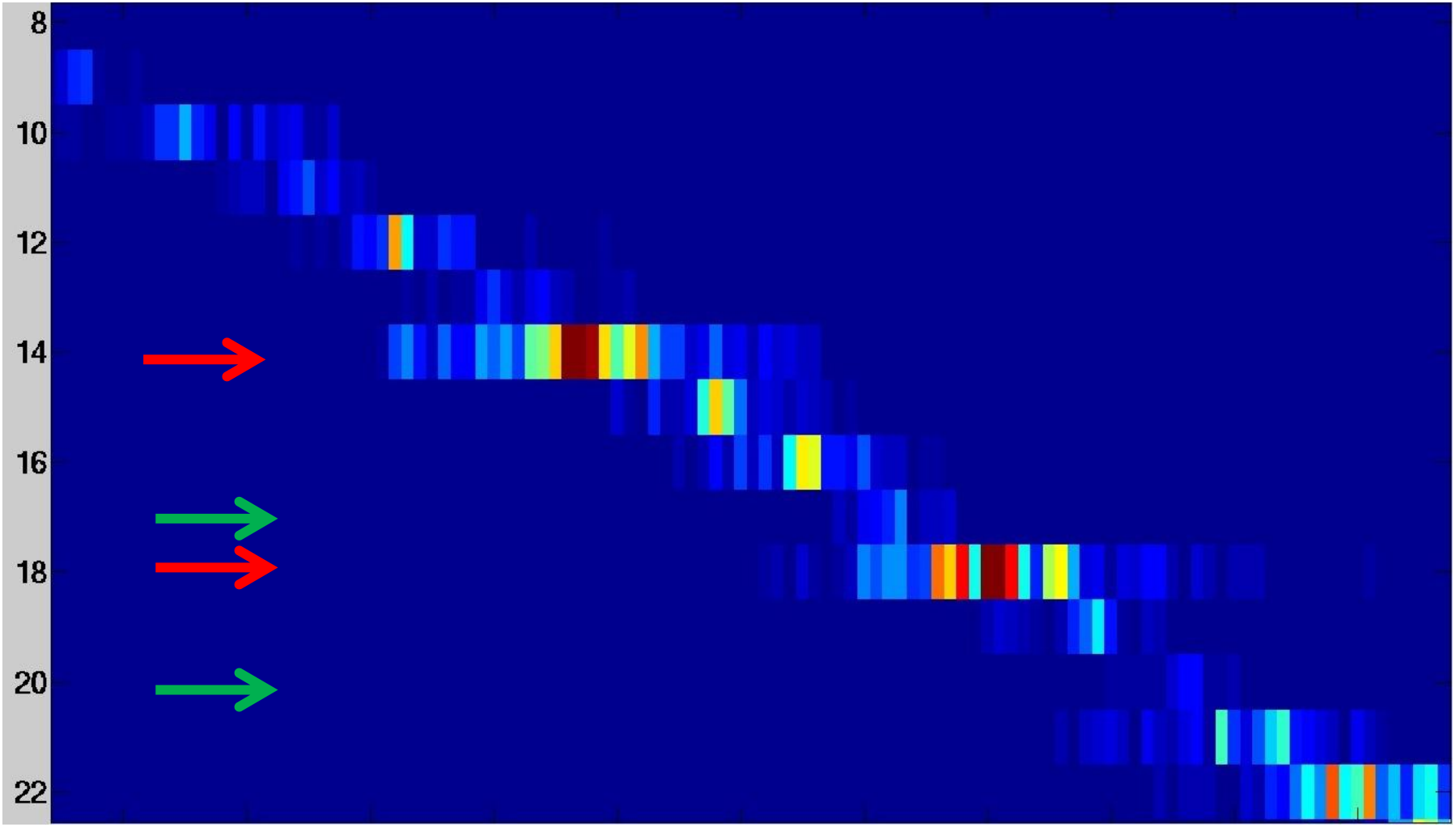
Booster BPMs



sensitivity of the Booster BPMs



sensitivity of the Booster BPMs



why are some so much more sensitive the others ?
visual inspection did NOT reveal any obvious differences . . .
needs further investigation . . .

Conclusions :

1) At the ESRF the SSA-towers emit much more RF stray fields (then “klystron” systems)

2) Poor (only 40cm long) RF cables (yet in metal cabinet) picked-up these stray fields

3) With better cables a reduction but not a full suppression is obtained

4) At nominal (90, 200mA) beam currents the effect is totally negligible,
   but at low currents can still be disturbing to certain accelerator studies

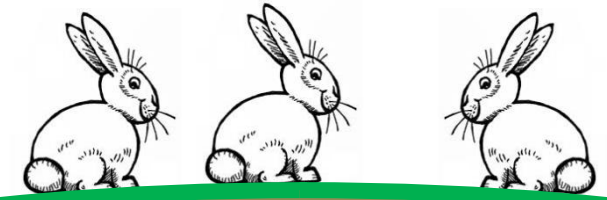
5) It is the cables, and not the Liberas (nor the Sparks) that pick-up the stray fields

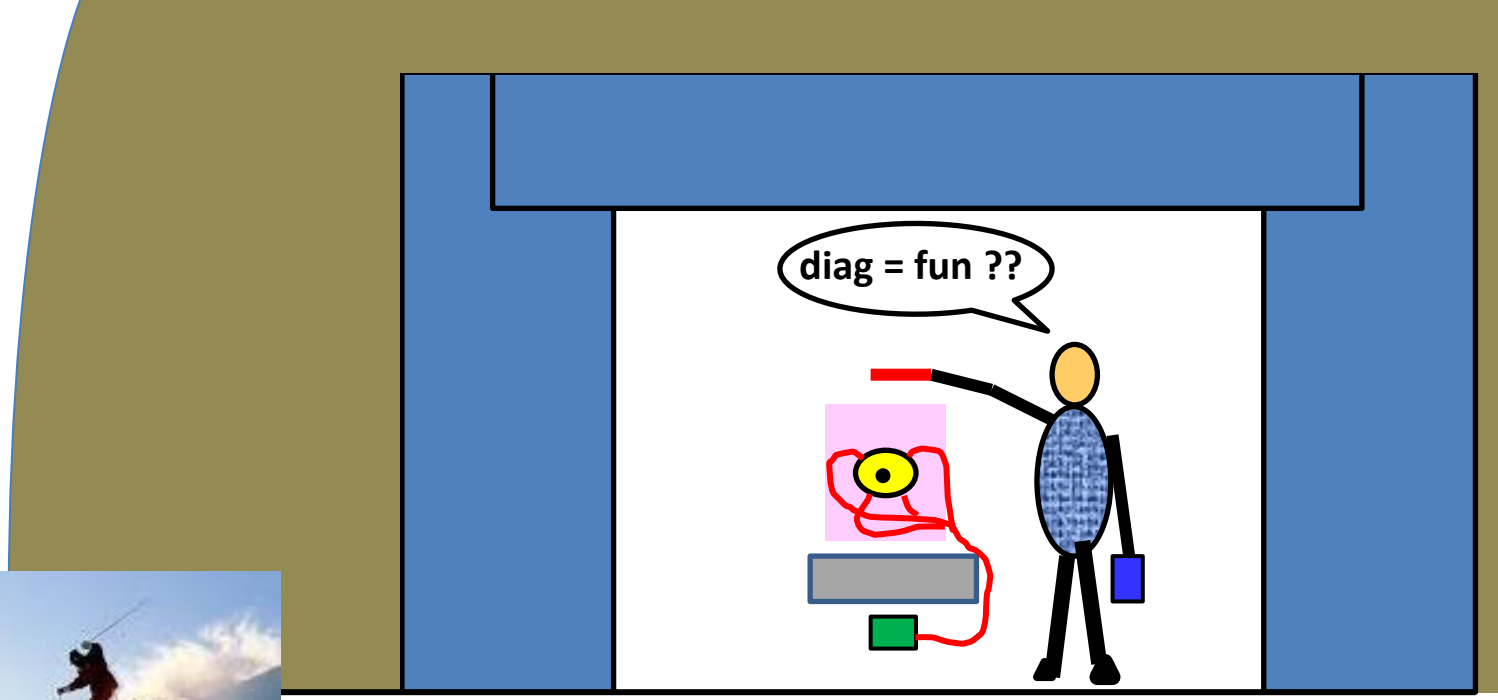
6) Further tests on local variations can be easily done with a portable low-power RF source,
   it yields some insight, and thus possibilities for feasible improvements
   but not all is understood, strong differences in pick-up sensitivity remain un-explained,
   yet for quasi-identical cabling/shielding situations

DEELS 2015

thank you for your attention !

join us !





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discussion, advice, suggestions

Do you see effect of the RF-transmitters on your BPM signals ?

easiest check : no beam, all Liberas at max gain,
then play with the RF-transmitter power
and observe the Sum signals

more significant check : low beam current, all Liberas at max gain,
then play with the RF-transmitter power (if possible)
and observe the Position signals