

Replacement of BI.SMH (and BI.MTV60 bellow)

FOM – 26.5.2009

J.Borburgh

Acknowledgements:

BE-ABP: M.Chanel

BE-BI: S.Burger, J.Herranz Alvarez, R.Sautier

BE-OP: F.Chapuis, K.Hanke, B.Mikulec

DG-SCG: B. Delille

DG-SCR: P.Carbonez, M.Widorski

EN-HE: Y.Bernard, P.Brunero, J.Cachet, M.Hamani, H.Lus, S.Pelletier,
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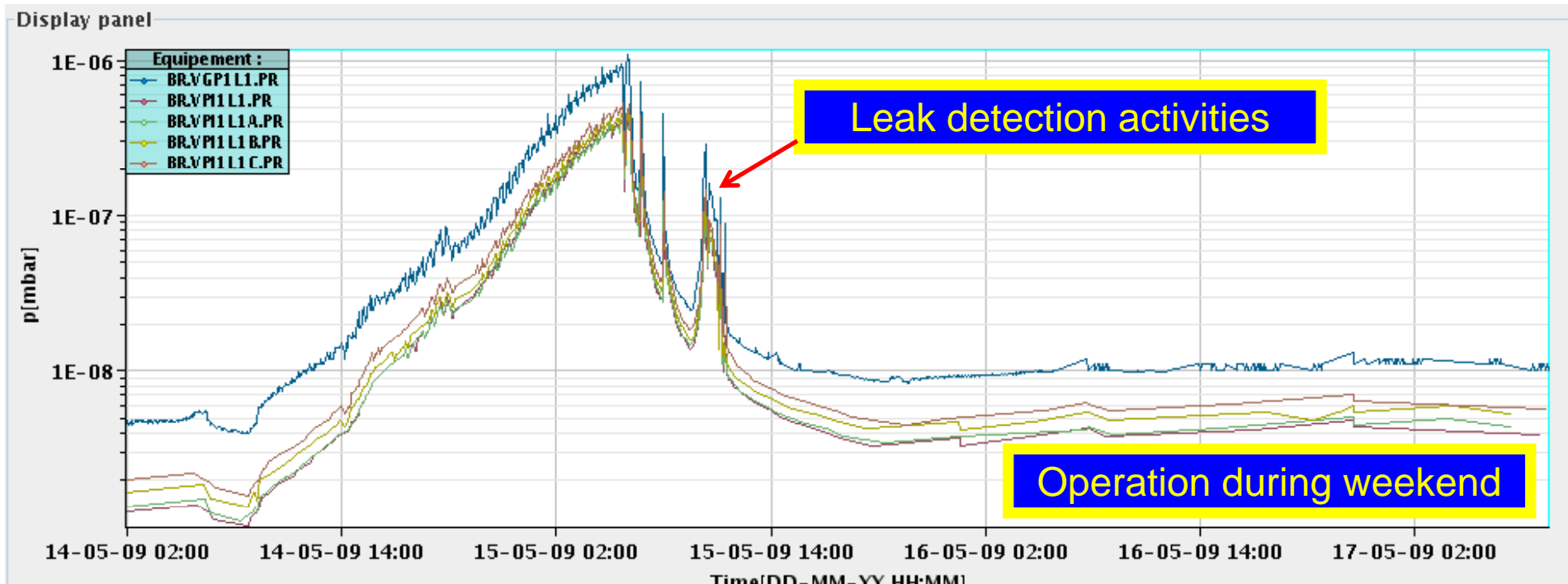
EN-MEF: D. McFarlane

TE-ABT: B.Balhan, P.Blaise, J.Bonthond, M.Hourican, T.Masson,
V.Mertens, A.Prost, A.Zepa (septa team)
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TE-VSC: C.Collomb-Patton, J.Hansen, J.Kortesmaa, G.Vandoni

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Vacuum problem in PSB – interlock on BI.SMH



Identified as leak from BI.SMH water cooling circuit into vacuum.

Leak rate of 10^{-4} mbar.l/s at 4 bar of He in the cooling circuit.

Water circuit pumped down and shut off to run over weekend without water cooling.

Cooling is implemented on the magnet mainly to deal with the heating due to beam losses on the septa blades.

Situation, constraints, proposed course of action

Friday 15/5

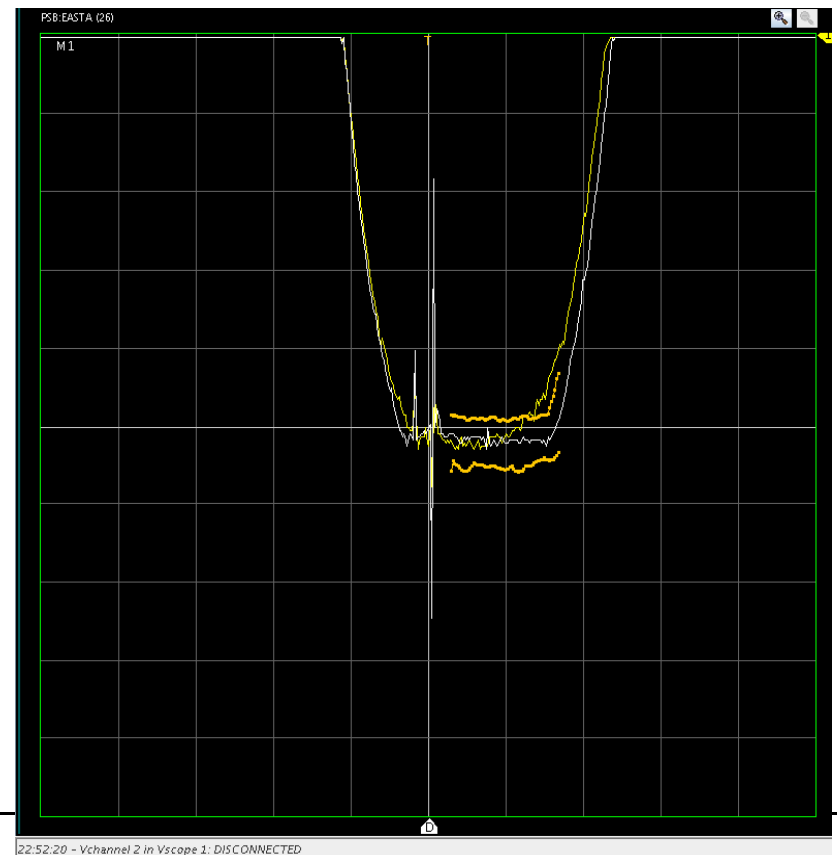
Leak detected, cooling circuit pumped down to primary vacuum.

Resume operation towards 21:00 hrs and operate over weekend (with EAST, SFTPRO, ISOLDE), with reduced number of cycles and reduced intensity (ISOLDE).

As indication for heating up of septum, the current pulse shape is compared to reference shape of cold magnet coil current pulse.

Vacuum activity minimal during weekend (see previous slide).

*BISMH was (before the Linac4 project) targeted for “consolidation” (with different design).
Will be replaced by new system with Linac4 at the beginning of 2014.*



BI.SMH replacement itself – intervention of Tuesday 19.5.

Monday 18.5., 8:00: s

Start of 24-h radiation cool-down in parallel with advanced technical stop

Period used to thoroughly prepare intervention, collect plans/tools, organise teams,...

Special lifting jig modeled, overload and welds ultra-sound tested → approved for use

Spare BI.SMH magnet rack kept in 361 under “vacuum” (“cloche”).

Spare BI.SMH feedthrough also found (M.Chanel) – good in case it were needed ...

During the intervention:

Radiation levels approx. as (high as) expected, but also risk of contamination
→ obligation to carry overalls and gloves for work on inside components.

Few “on-the-spot discoveries” swiftly dealt with

BE.SMH flushed with N2 to try to avoid additional 4-5 day bake-out

Tuesday 19.5. 8:00: start of intervention

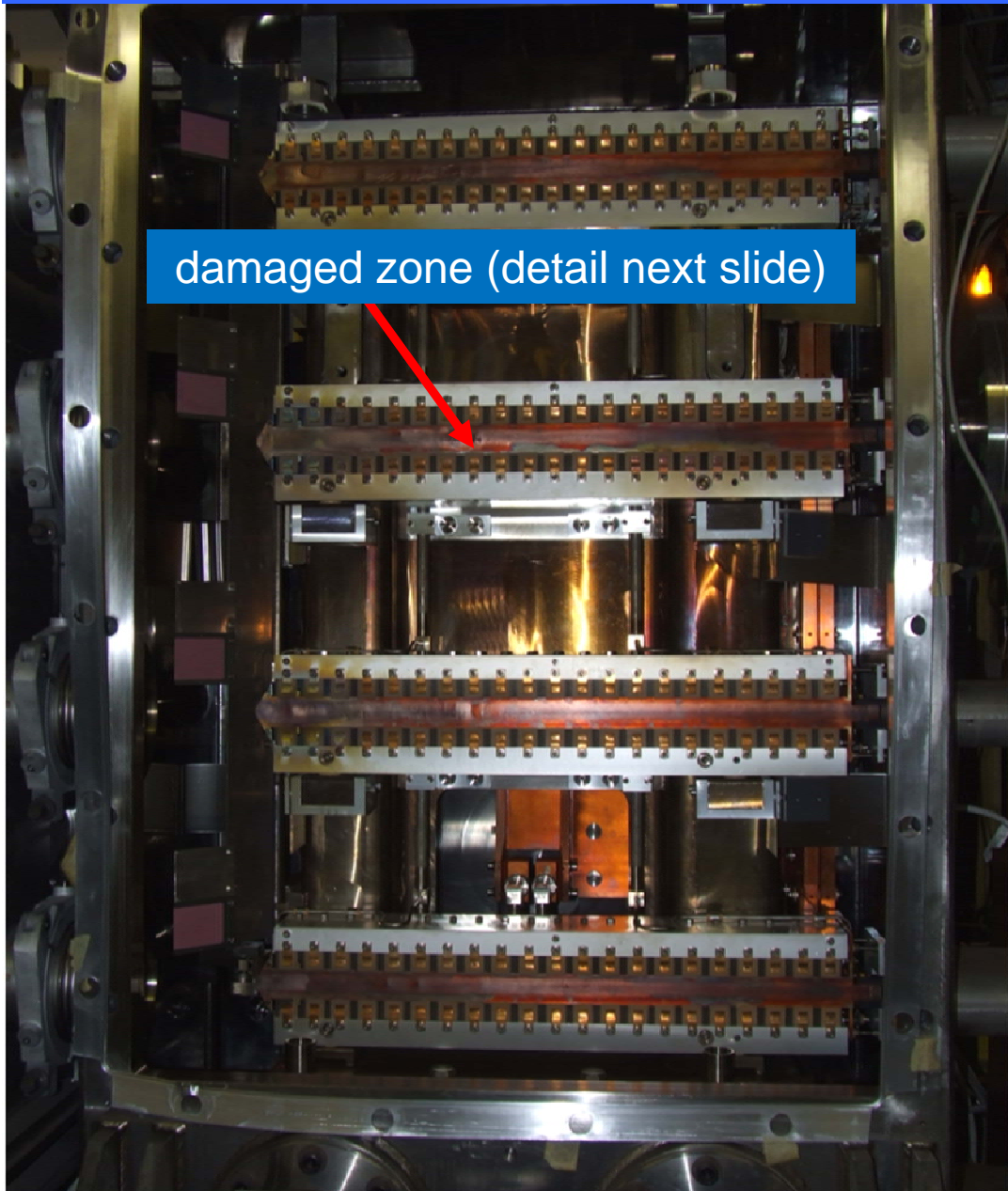


opening BI.SMH vacuum vessel

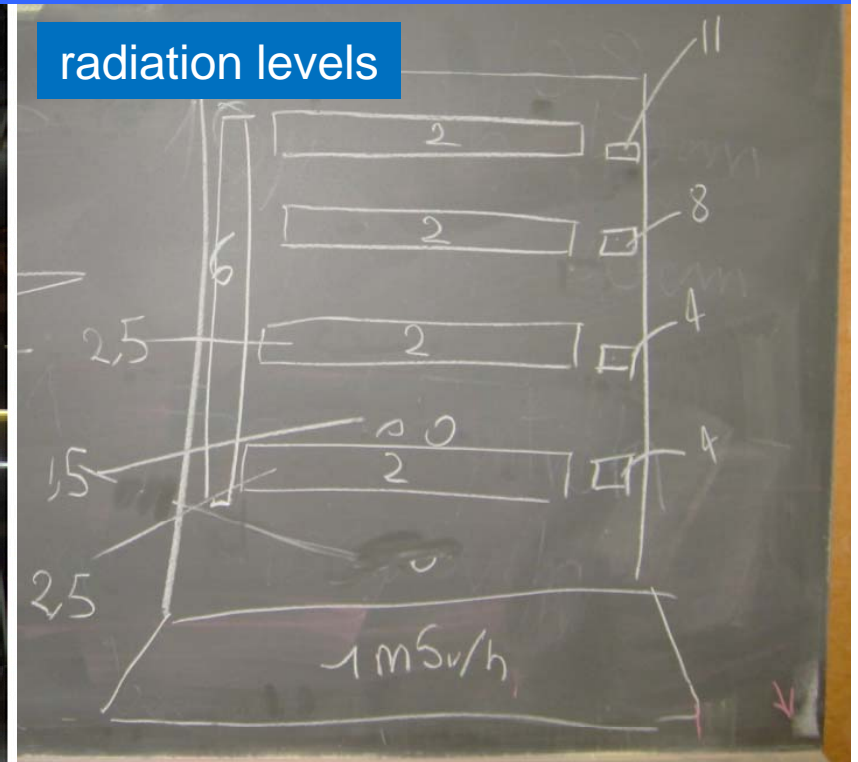
New septa stack being lowered in PSB access shaft, using special lifting jig



First measurements and findings

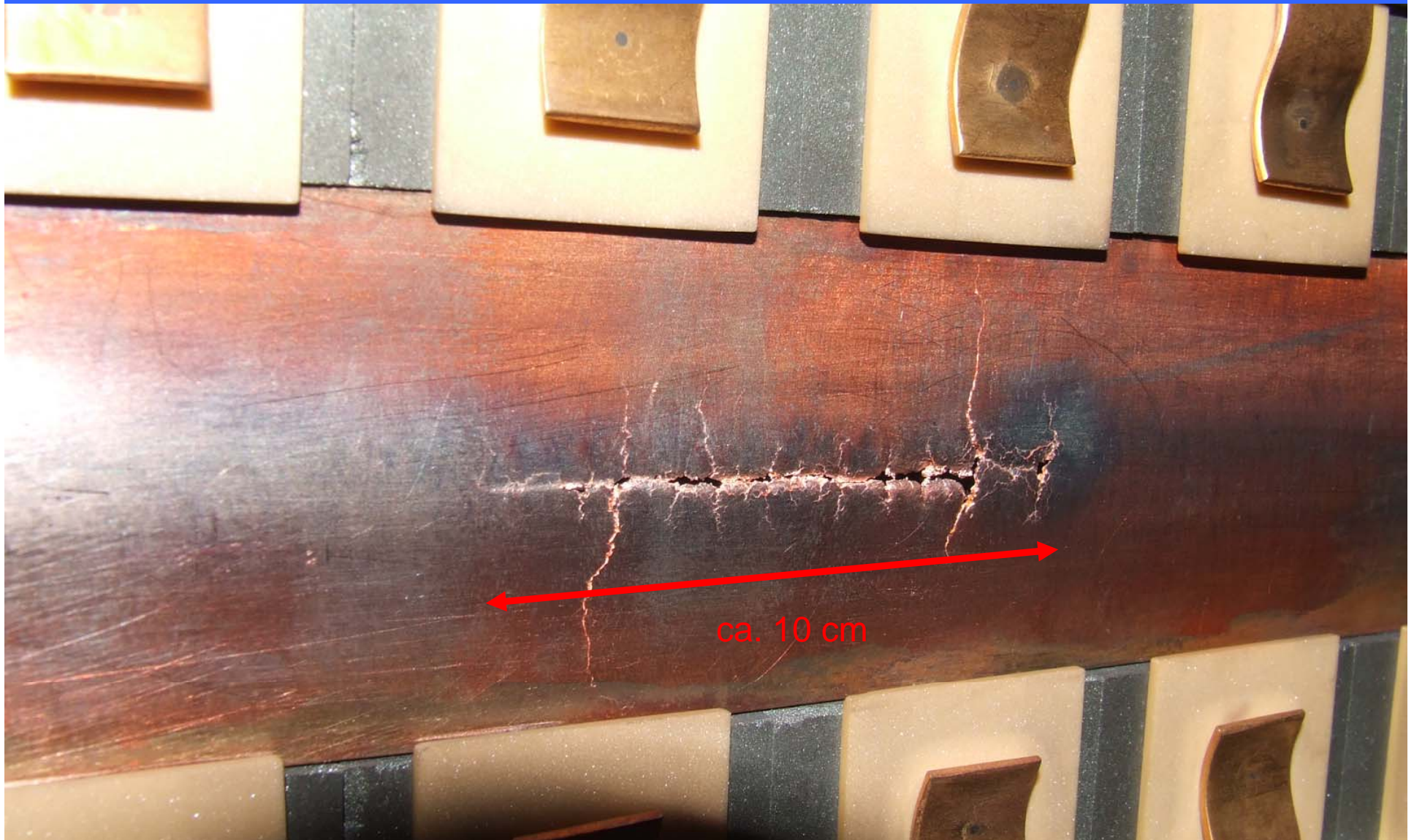


damaged zone (detail next slide)



cooling water connection

Damage to ring 3 coil



Possibly caused by running w/o cooling – not to be re-done with the installed spare ...
Not the cause of the initial leak – no water channels in this area.
Old septum temporarily stored underneath the PSB.

Some impressions ...

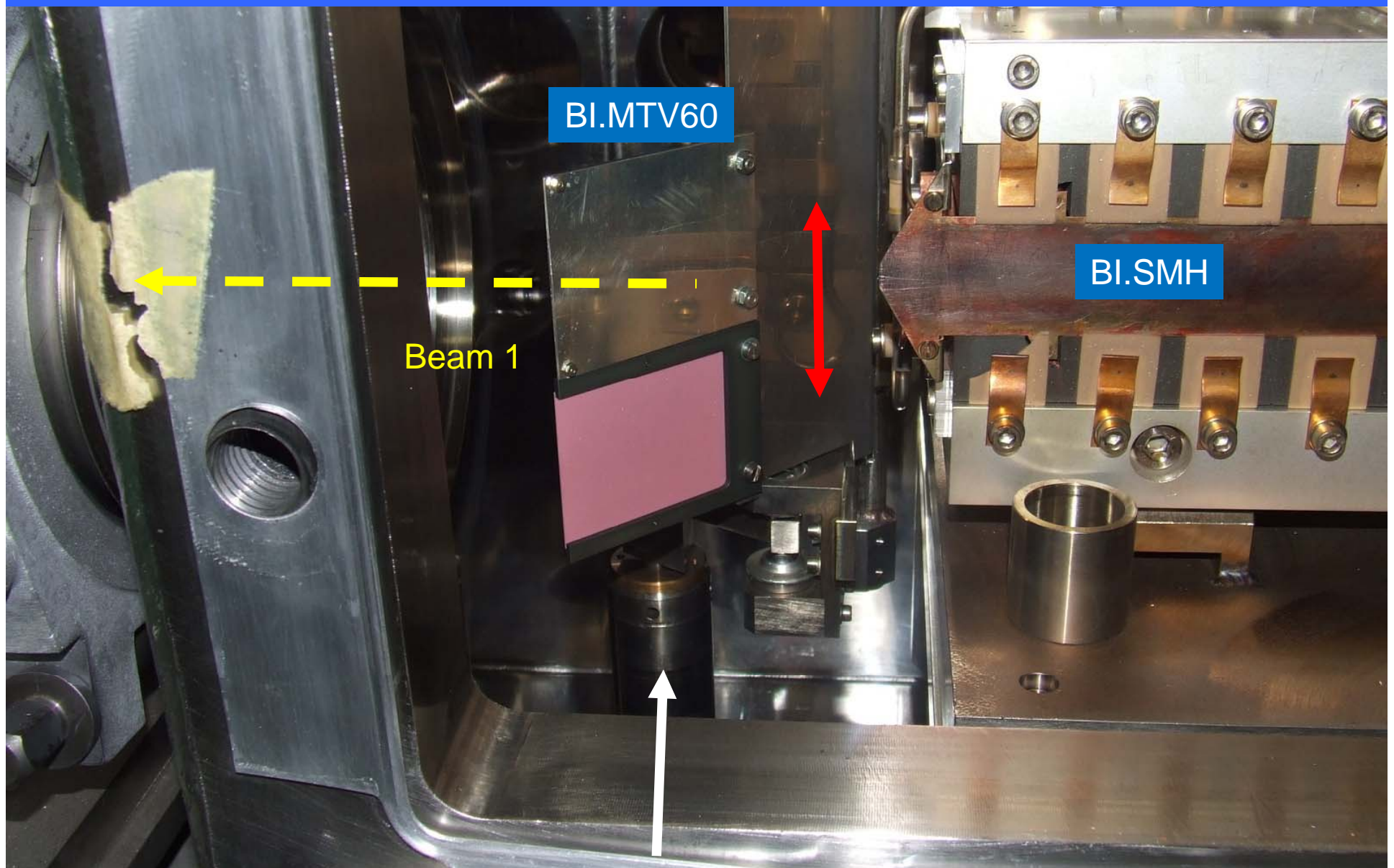


closing door



BI.SMH circuit tested leak tight
19.5. 20:00: end of main BI.SMH intervention – start of pump down

Wednesday 20.5: Leak detected on BI.MTV60 bellow

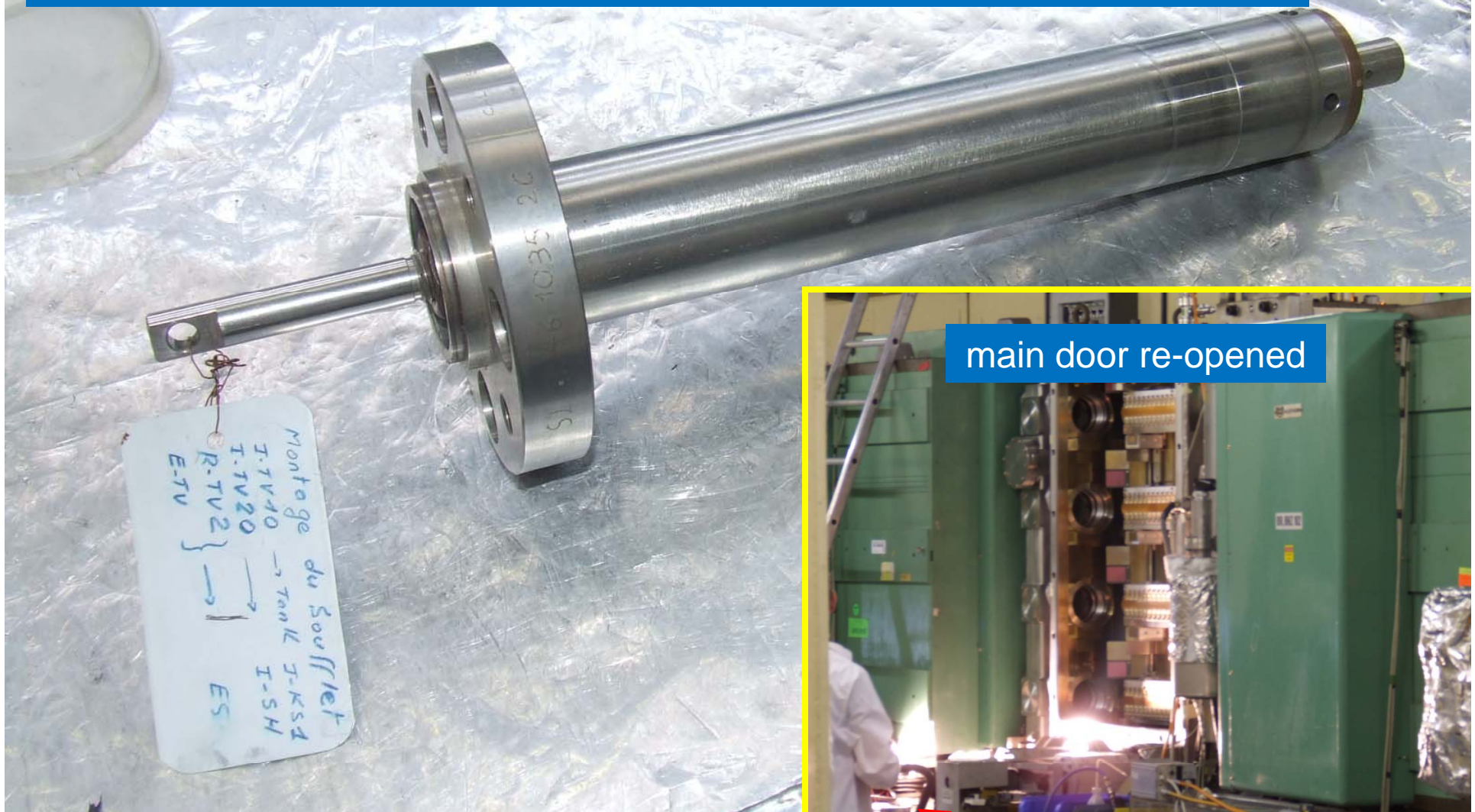


Following morning relative poor vacuum still ($\sim 10^{-3}$ mbar)
After investigations leak detected on bellow for BI.MTV60 screen bellow

Intervention on BI.MTV60 bellow on Friday 22.5.

Spare bellow found

Preparations by BI and VSC on 21.5. (plans, seals, leak tightness, ...)



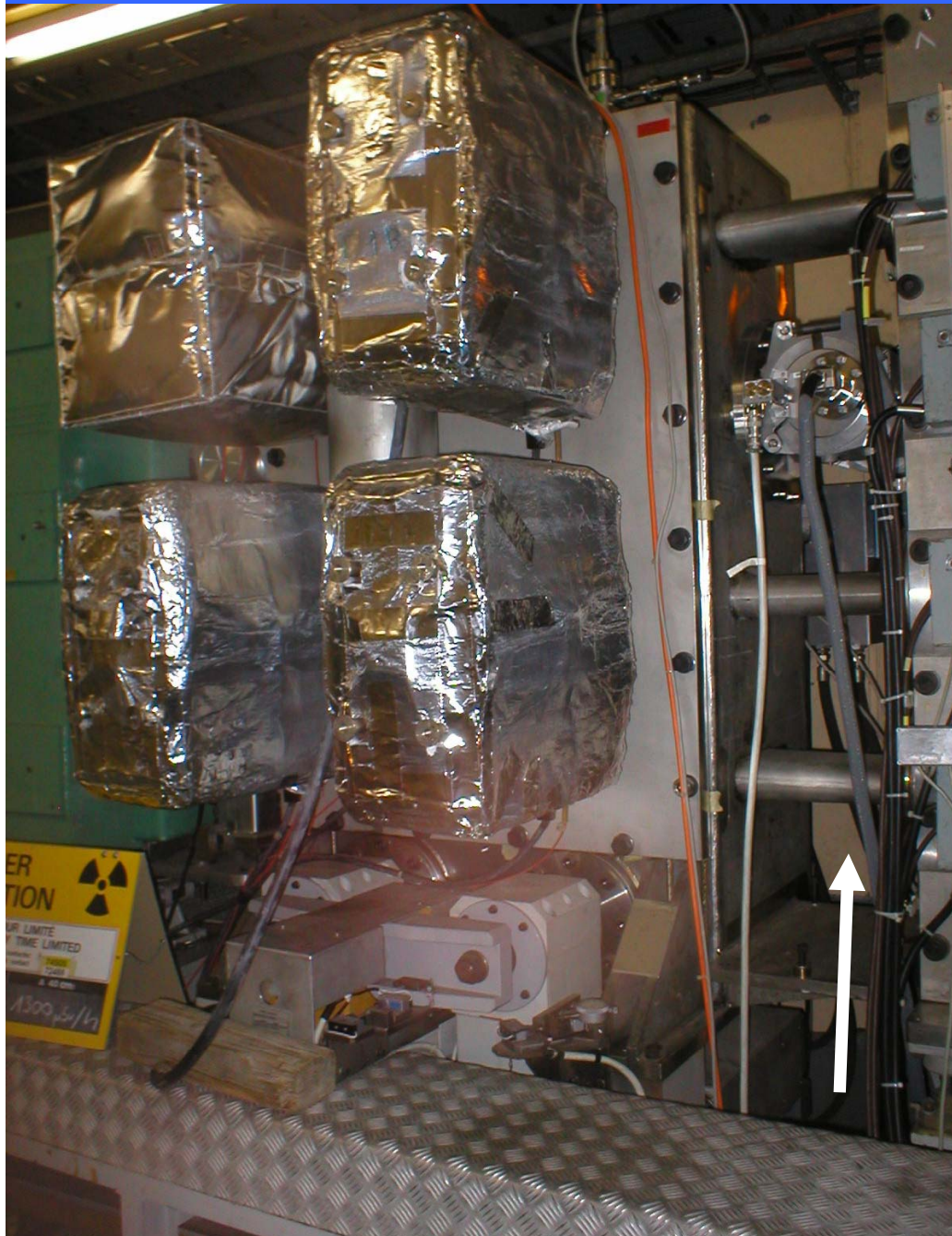
Door closed again ~16:00
Pump down started



main door re-opened

access mainly from underneath

Saturday 23.5: Final leak detection



- 2nd pump-down marked by faster pump down w.r.t to first pump down earlier in the week.
- Decided to avoid sector, hence BE.SMH, bake-out
- Ion pumps switched on during the day in the whole sector.

Sunday 24.5

- Vacuum $6 \cdot 10^{-7}$ mbar (BESMH), $3 \cdot 10^{-7}$ mbar (BISMH), and in 10^{-8} mbar range in best parts of sector
- Special efforts to bring PSB equipment up and running (deconsignation, resets, various fixes, setting up)
- Startup with low intensity beam ~20:00 hrs

Post-intervention considerations

Total dose taken: 19.5.2009	5.3 mSv (estimated 6)
22.5.2009	1.3 mSv
leak testing	0.6 mSv

It exists another spare of an “early version” (as used at the beginning of the PSB operation) which will be transformed into an up-to-date spare using existing spare coils (and some machining) – present BI.SMH will only become obsolete in 2014 with Linac4.

Time: ~ 2 months

Cost: ~ 50 kCHF

To note that a vigorous consolidation programme was carried recently out on all LHC-related septa in the PS complex (2 x BT.SMV10, BT.SMV20, PI.SMH42, PE.SMH16 – new spares built, and preventive replacement of operational devices), BE.SMH (new design installed in 1998 – 1 full spare exists + spare stacks built), except on those which will be substituted/rendered obsolete by Linac4 (new PSB injection)

BI.DIS (2 spare magnets, for 5 installed)

BI.SMV (1 full spare)

BI.SMH (see above)

Situation for spares of vital accessories equally important (bellows, seals, ...).