

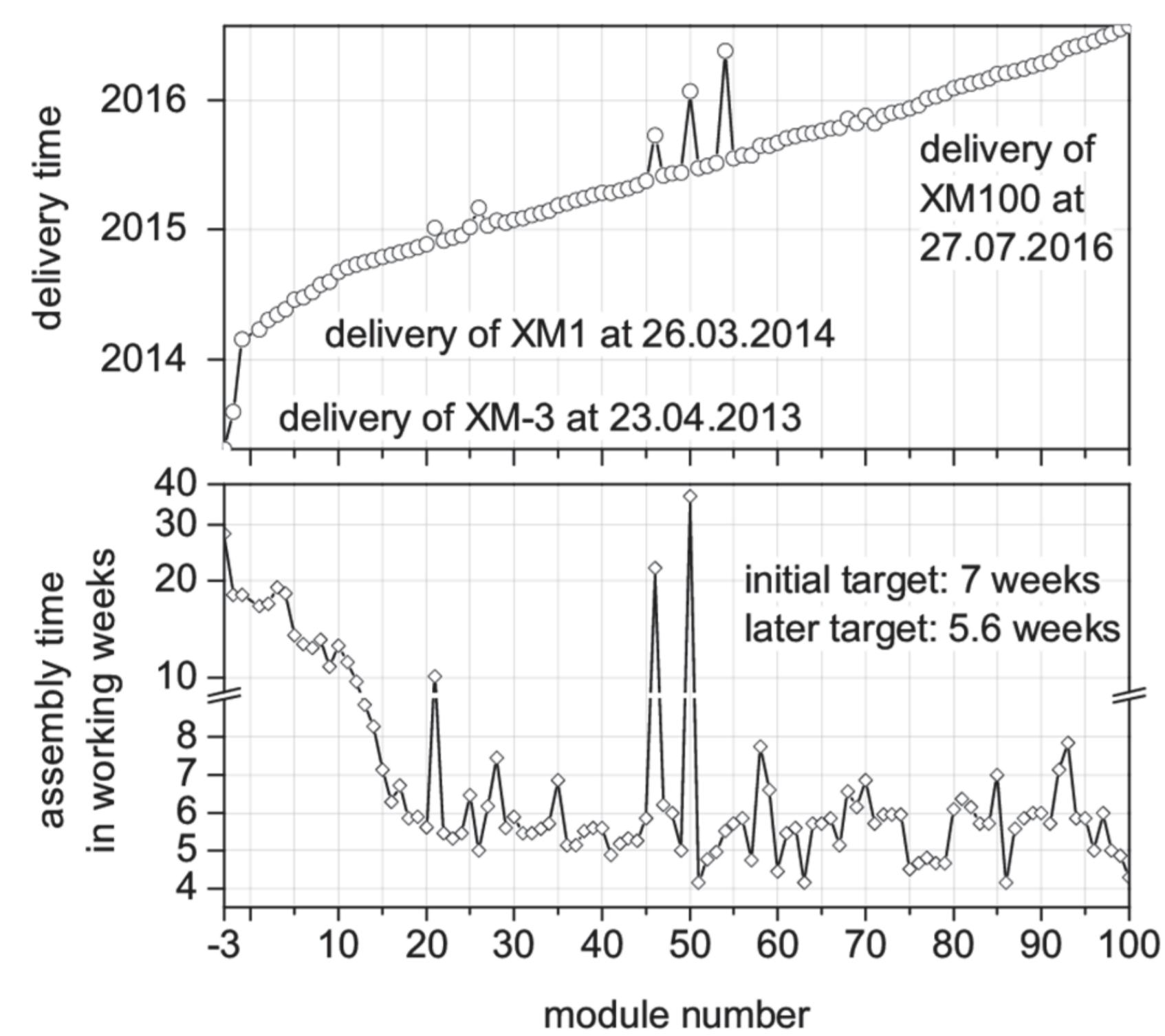
# Accelerator Module Repair for the European XFEL Installation

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## Abstract

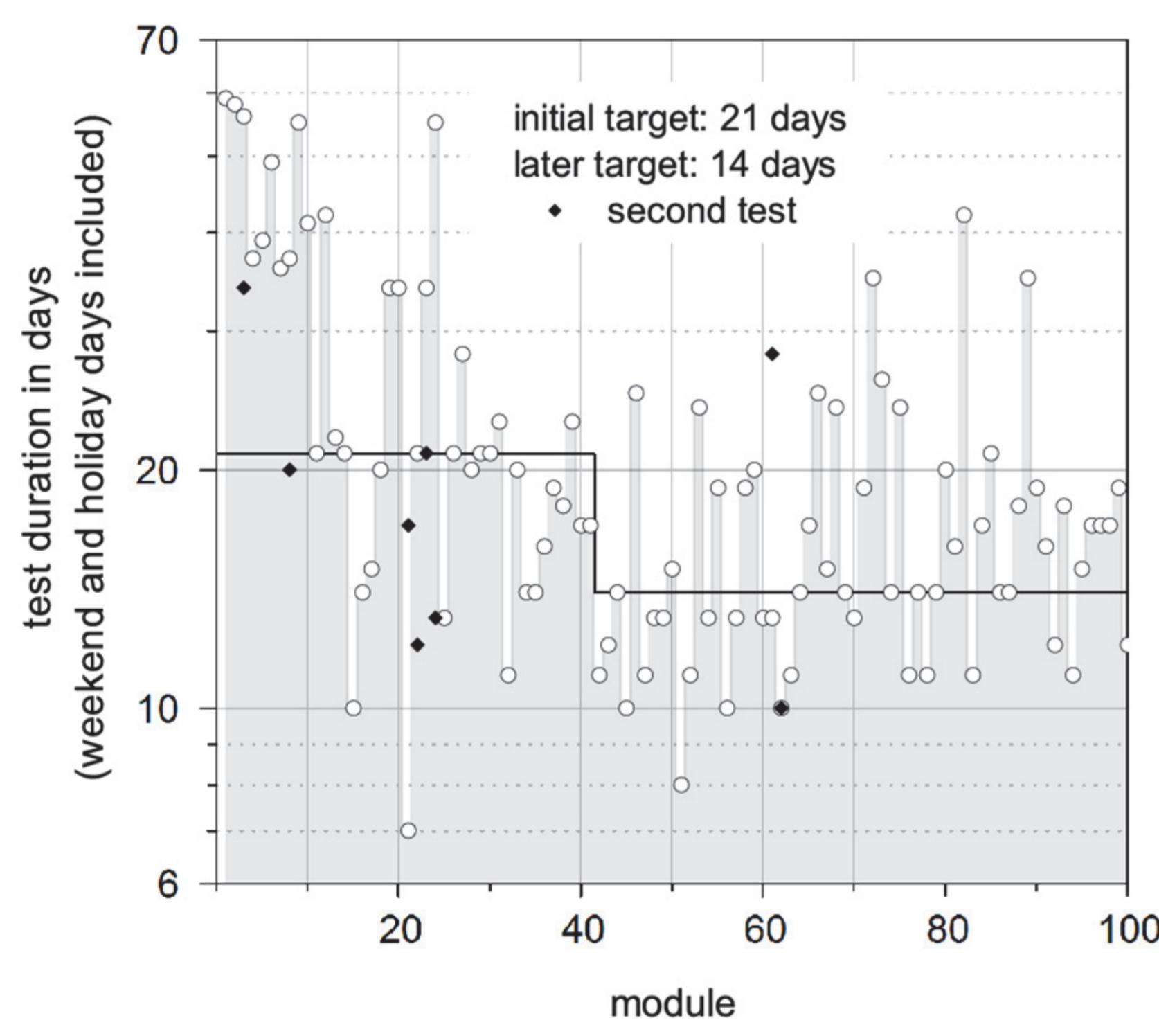
Repair actions of different extent have been performed at 61 of the 100 accelerating series modules for the European XFEL to qualify them for tunnel installation. Four modules could not be repaired in time. CEA Saclay managed to perform three major repairs in parallel to the series module integration, the residual repair actions took place at DESY Hamburg. We give an overview on the various technical problems to be fixed before the tunnel installation.

## Module Integration at CEA



- ramp-up until XM15
- "full speed" since XM25
- audit with XM26
- new clean room procedure as of XM54

## Module Testing at AMTF



- process optimization
  - beginning 2015 by IFJ PAN with assistance of Fraunhofer IPA
  - decreased testing time from 21 to 14 days

### major obstructions:

- beam line leaks
- process line leaks
- leaky coupler push rod bellows
- space for modules (until halve-time)

### at the beginning

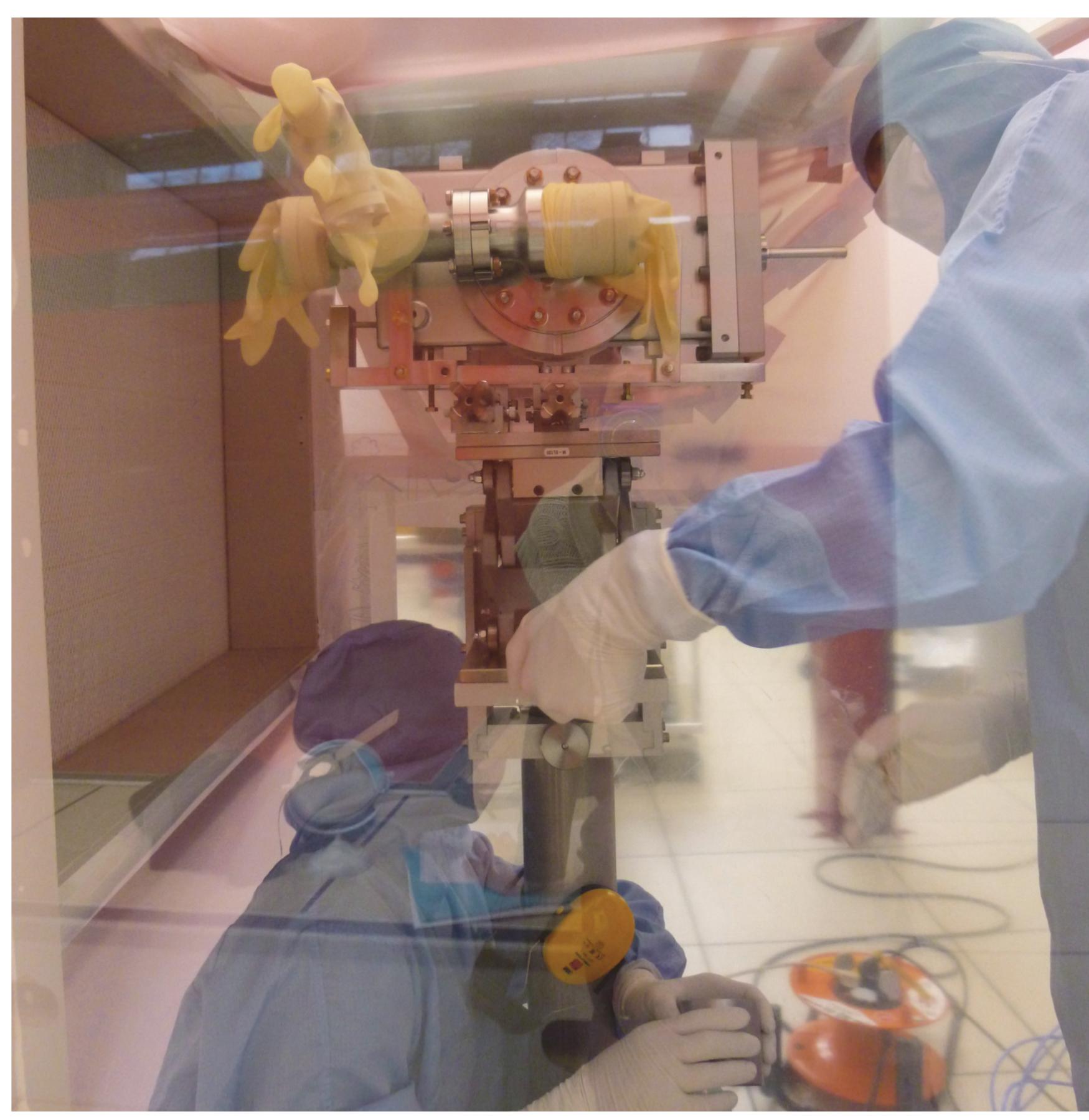
- leaks at GRP adapter

### towards the end

- overheating warm coupler parts

## Repair Activities at CEA

- beam line leaks
  - XM46: leaky cold coupler connection
  - XM50: leak at DN16 valve and gauge, after AMTF test again leaky at beam line
- defect upstream gate valve



- XM54: exchanged in local clean room, with good performance in XFEL installed

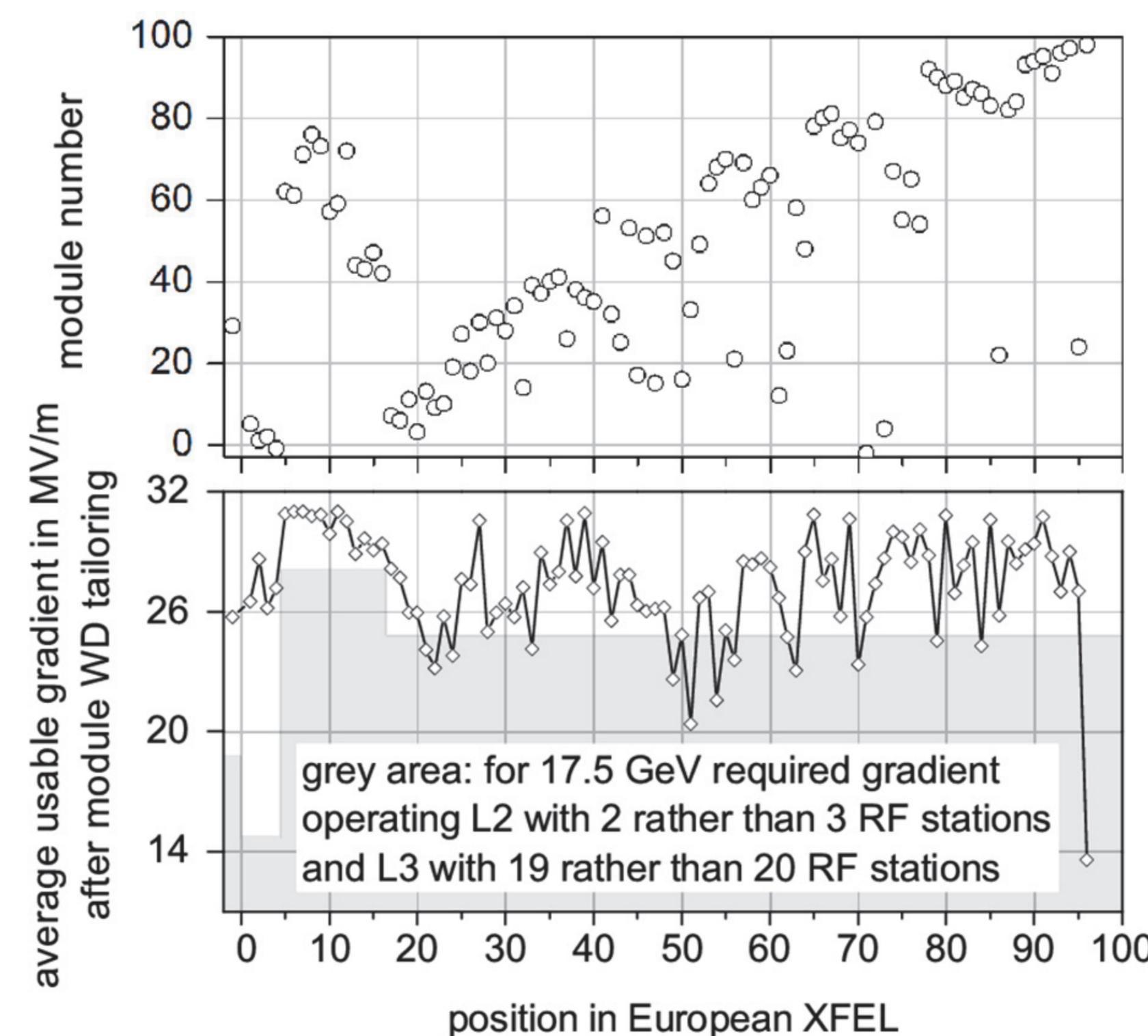
## Coupler Repair Actions

- 69 warm coupler repairs at 41 modules [8]
  - at the beginning: loose antenna screws new screws and higher torque solved the issue
  - until XM81: leaky coupler push rod bellows solution: replacing dielectrics by shorts [9]
  - from XM80 on: overheating warm parts still under investigation and not understood
  - non-conform integration typically repaired using cleaned or new parts
- we established two coupler repair workstations at the AMTF

## Still under Repair

- due to beam line leaks: XM46, XM50 and XM99
- due to process line leak: XM8
- used as is: XM92 with defective upstream gate valve

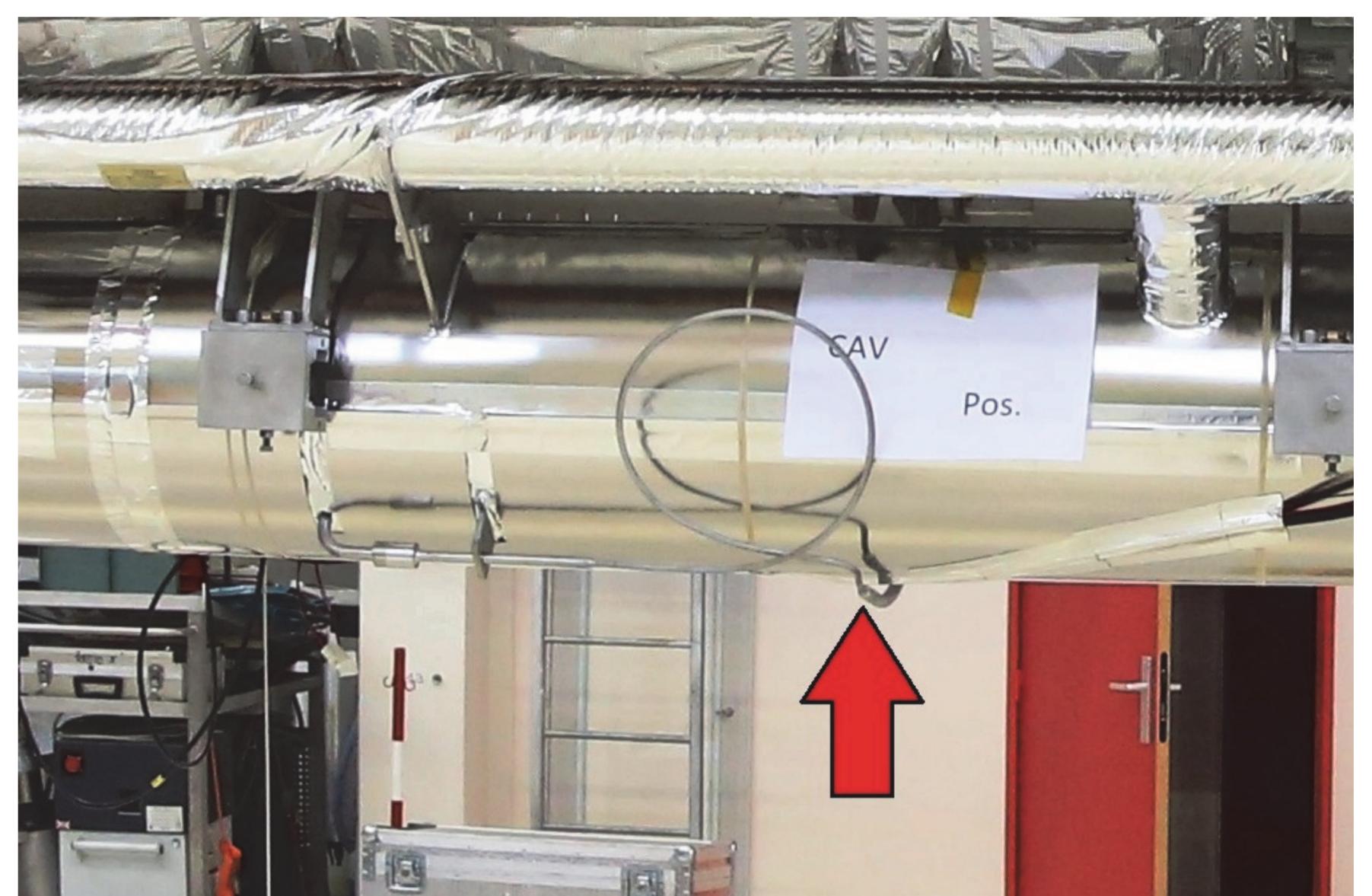
## Module Performance



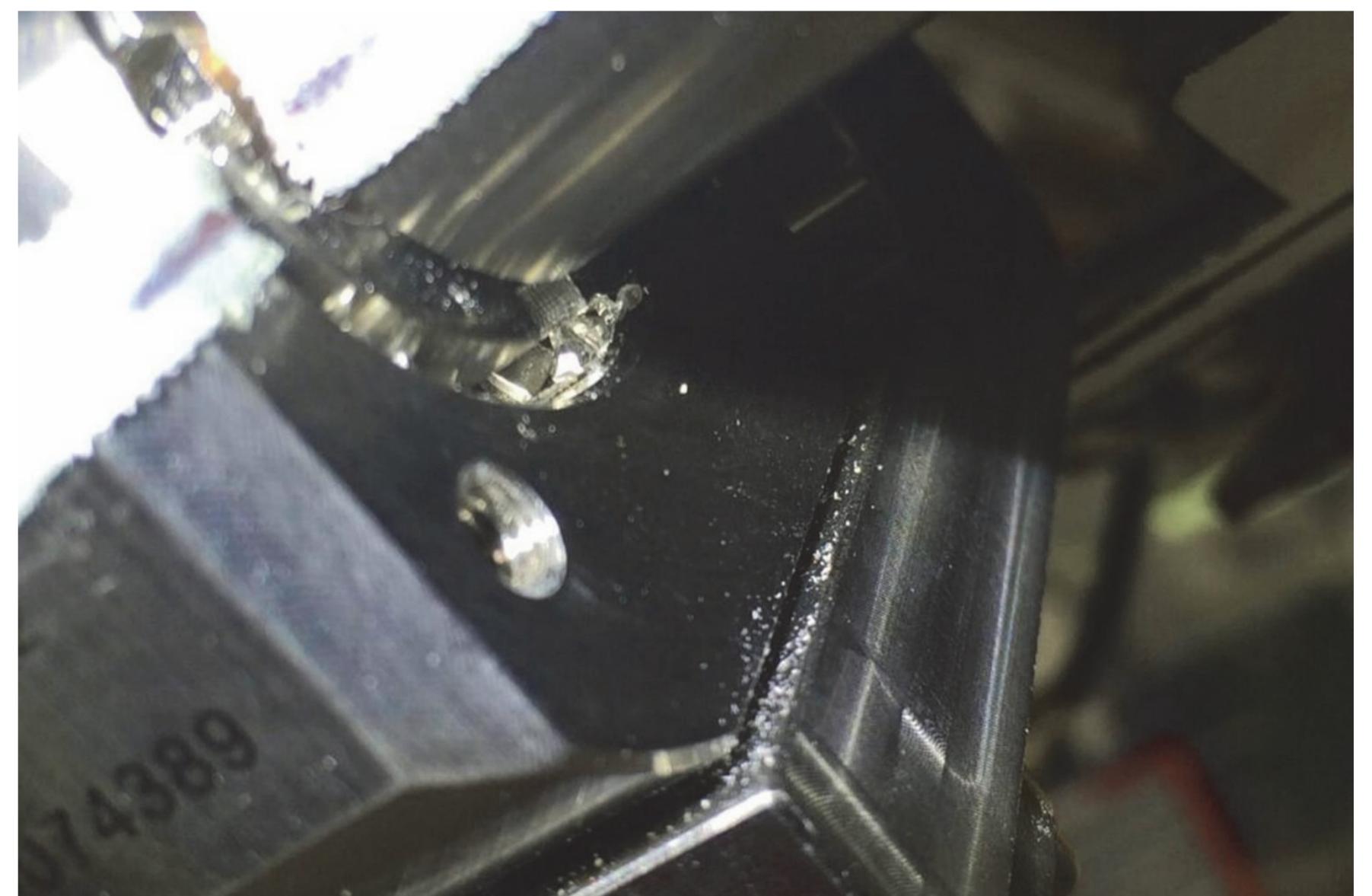
- loss of gradient w.r.t. vertical tests
  - significant until XM23
  - vanished after XM53
- module sorting
- design parameters met with margin [11]

## Repair Work at DESY

- XM-2: process lines x-rayed for PED re-qualification
- XM8: leaky Helium filing line repaired



- XM69: loose pins at center post fixed
- XM93: (from test stand) trapped MLI



- beam line leaks repaired with local clean room below cantilever [7]



- XM22: leaky HOM antenna exchanged
- XM24: leaky pick up antenna exchanged
- XM91: leaky HOM antenna exchanged

## References

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- [6] S. Berry, O. Napoly, LINAC 2016, WE1A2
- [7] M. Schmoekel et al., SRF 2017, MOPB088
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- [9] D. Kostin et al., SRF 2017, MOPB111
- [10] H. Guler et al., IPAC 2016, WEPMB006
- [11] K. Kasprzak et al., SRF 2017, MOPB106