# MQYYM
# Coil 7 issue

**February 21st 2018**

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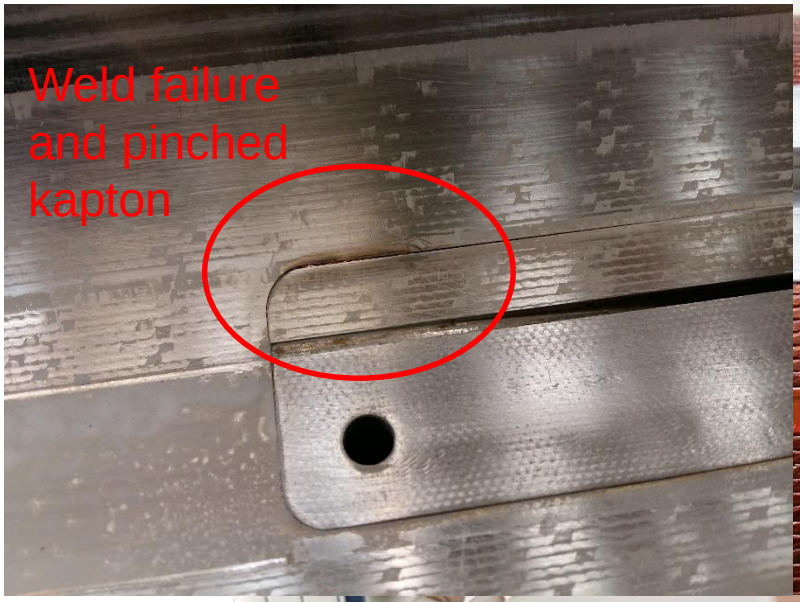
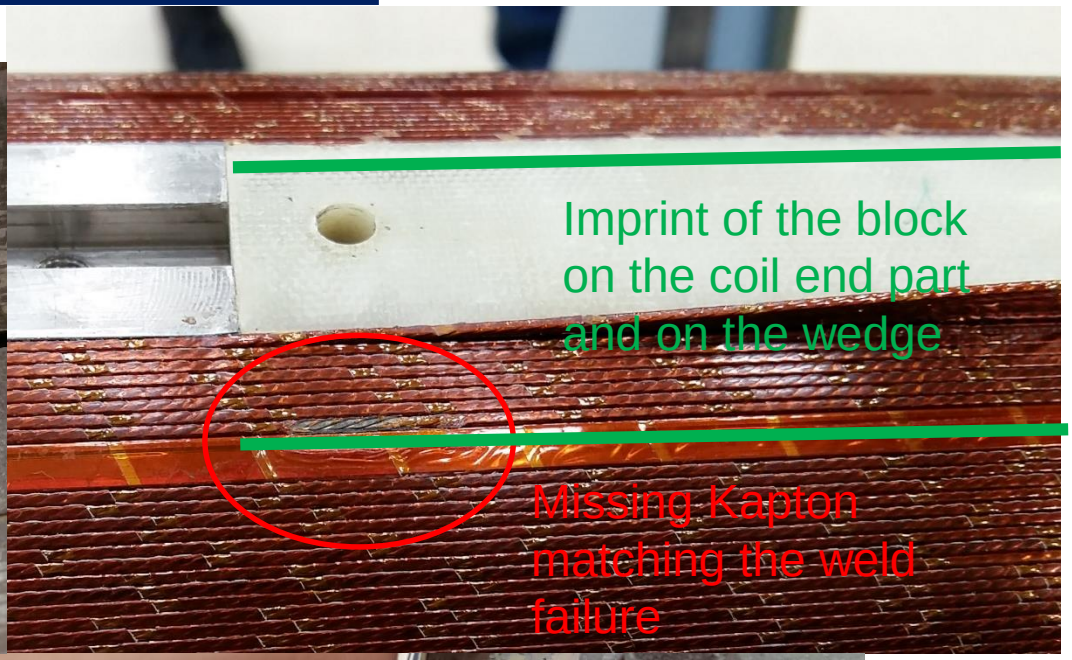
## Issue encountered after the IL curing sheet removal:

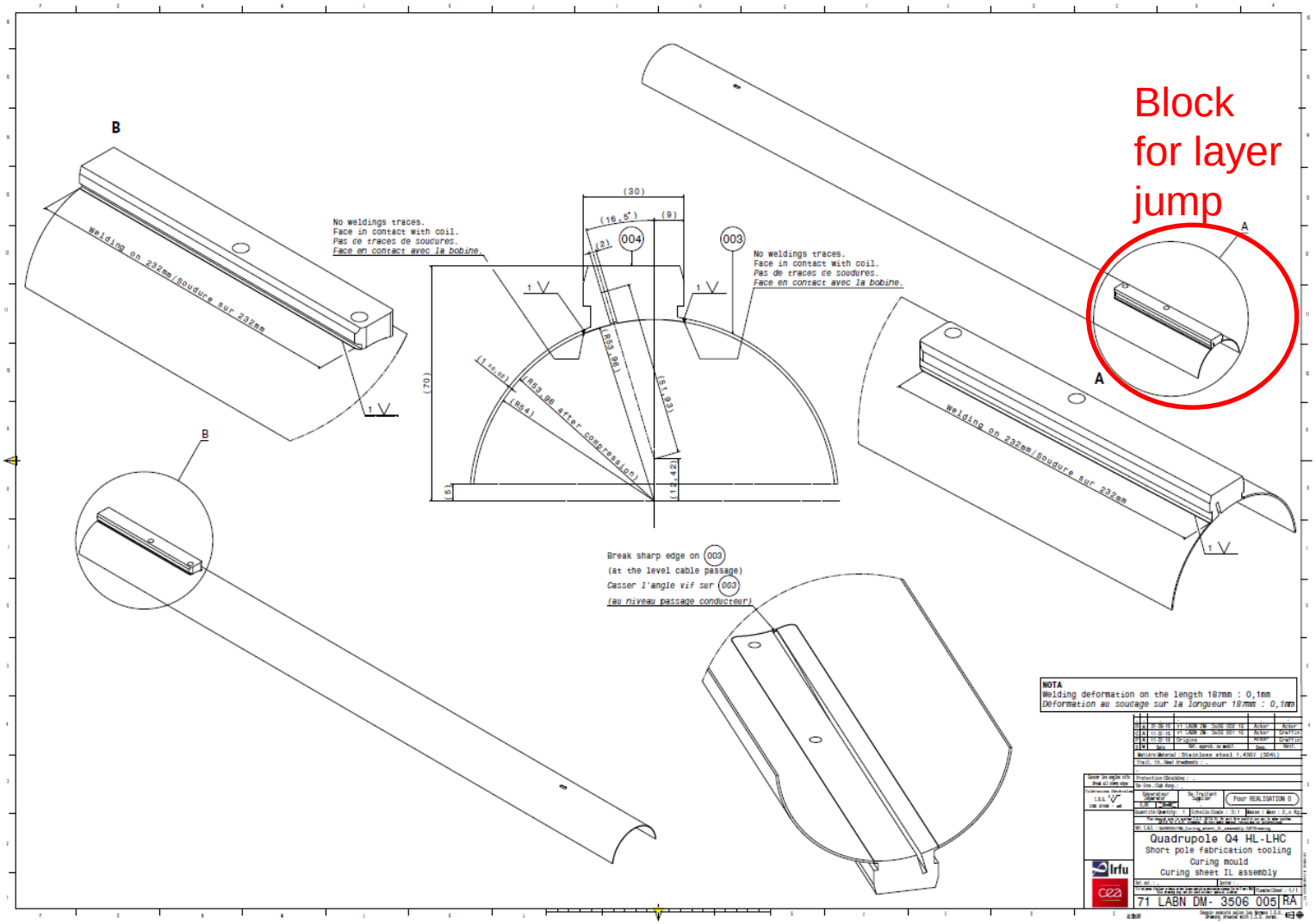


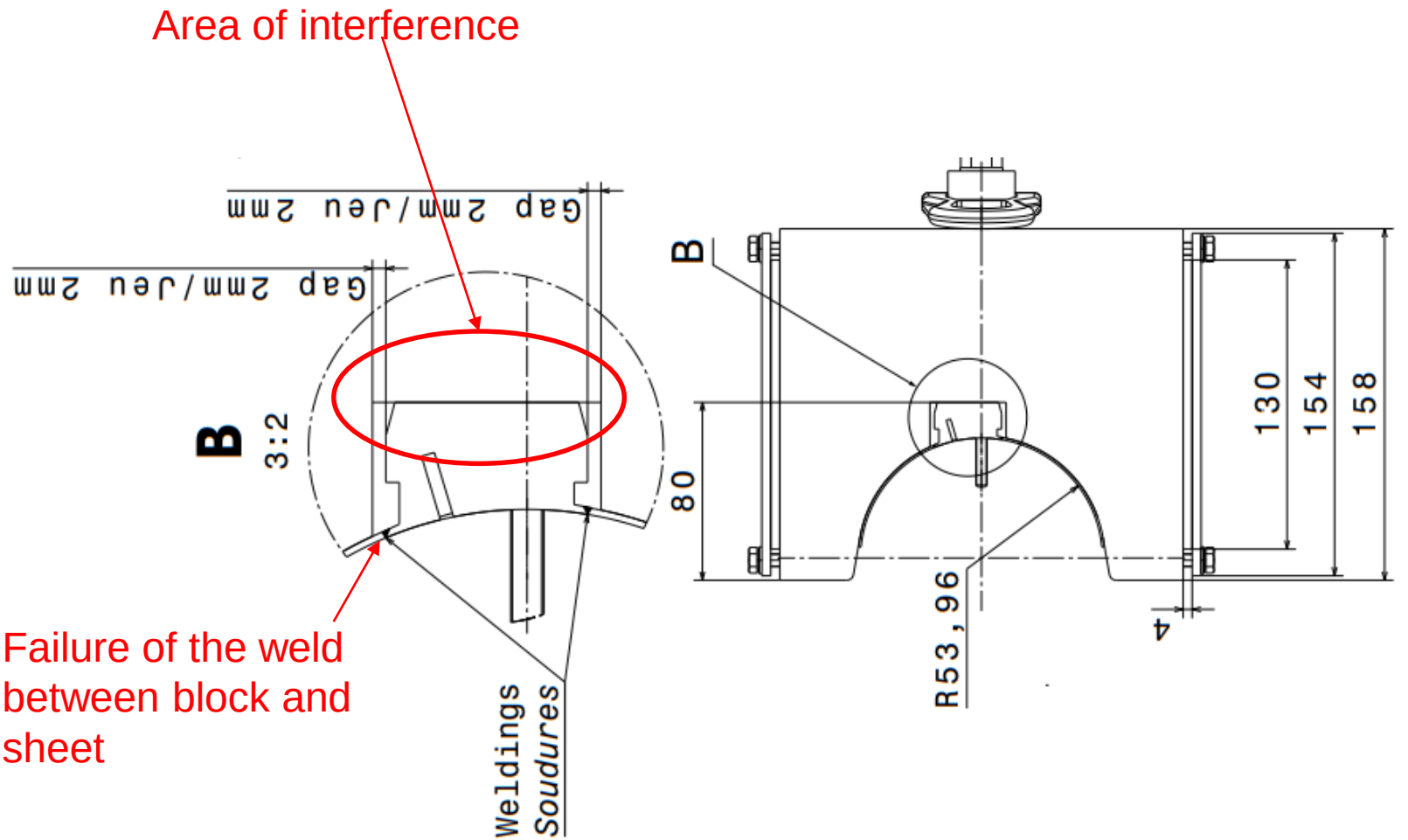

Imprint also seen in Coil 1 and subsequent coils without insulation damage

# CURING SHEET DETAILS

Curing sheet:



# INSERTION OF THE LAYER JUMP GUIDE IN THE CAVITY OF THE MOLD

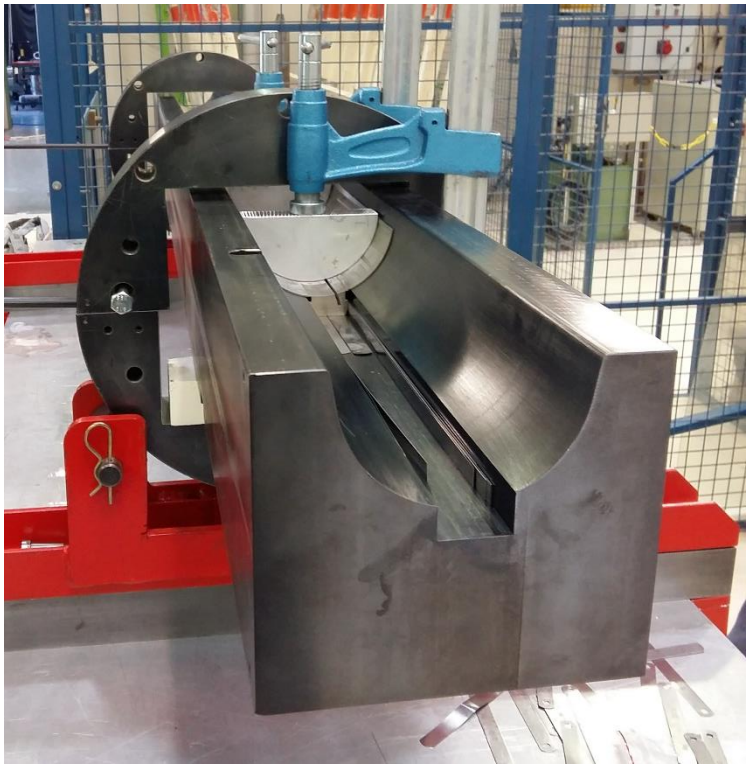


# RÉSUMÉ ET ACTIONS POSSIBLES

| | Conforme | Test électrique | Non-conformité | Réparation possible | Risque |
|---|---|---|---|---|---|
| Coil 0 | No | Not conform | Practice coil, vtap practicing | No | |
| Coil 1 | No | OK | Damaged insulation and 1st set of end spacers | No | |
| Coil 2 | Yes | OK | | | |
| Coil 3 | Yes | OK | | | |
| Coil 4 | No | OK | Ends with low compaction | Filling of the ends | Low |
| Coil 5 | No | Not tested | Damaged interlayer insulation in the straight section | Filling in the area where the insulation has been torn | High: difficulty to fill with the proper thickness. Abrasive interlayer insulation might damage cable insulation |
| Coil 6 | No | Not tested | Saut de couche mal positionné. Couche 2 débobinée et rebobinée | non | Medium |
| Coil 7 | No | | Damaged insulation and possible overcompression of a turn | Yes for the insulation | High: range of compression seen by the conductor unknown |

Only 2 conform coils
Coil 4 can be fixed => spare

# DIMENSIONAL CHECKS




The layer jump guide moved inward by ~0,3 mm
The layer jump guide has an interference with the mould ranging from **0,22 mm** to **0,26 mm => imprint in parts / failure**

**=> The curing sheet has been repaired. Interference has been removed**

# SCHEDULE

| | | | |
|---|---|---|---|
| **Coil fabrication** | **177 jours?** | **Lun 04/09/17** | **Ven 25/05/18** |
| Connection box assembly training | 1 sm | Lun 04/06/18 | Ven 08/06/18 |
| **Tooling and components procurement** | **318 jours?** | **Lun 24/04/17** | **Mar 31/07/18** |
| **Assembly tooling** | **150 jours** | **Mer 12/07/17** | **Ven 23/02/18** |
| **Collars** | **114 jours?** | **Mer 10/05/17** | **Lun 16/10/17** |
| **Yokes** | **63 jours?** | **Lun 07/08/17** | **Mar 07/11/17** |
| **connexion box (2)** | **157 jours** | **Lun 09/10/17** | **Ven 01/06/18** |
| **Coil parts (6 sets)** | **68 jours** | **Lun 24/04/17** | **Mer 26/07/17** |
| **Coil parts (2 final sets)** | **70 jours** | **Lun 26/02/18** | **Ven 01/06/18** |
| **other components** | **150 jours** | **Ven 13/10/17** | **Mar 29/05/18** |
| V supports for magnetic measurements | 80 jours | Mer 01/11/17 | Jeu 08/03/18 |
| V supports for magnet tilting | 80 jours | Mer 01/11/17 | Jeu 08/03/18 |
| **GPI tooling** | **131 jours** | **Lun 16/10/17** | **Jeu 03/05/18** |
| **Coil shipping tooling** | **130 jours** | **Lun 06/11/17** | **Ven 18/05/18** |
| **Magnet shipping tooling/crate** | **115 jours** | **Lun 15/01/18** | **Ven 22/06/18** |
| **measuring coil tooling** | **284 jours** | **Ven 09/06/17** | **Mar 31/07/18** |
| **Trace fabrication** | **175 jours** | **Mer 26/07/17** | **Ven 13/04/18** |
| **Assembly preparation and assembly** | **335 jours?** | **Ven 21/07/17** | **Mer 26/12/18** |
| Assembly of the assembly tooling (at CERN) | 1 jour? | Jeu 26/07/18 | Ven 27/07/18 |
| Coil measurements + set up | 2,5 mois | Mer 01/08/18 | Mar 13/11/18 |
| soldering/wiring of the trace | 3 jours | Mer 14/11/18 | Ven 16/11/18 |
| GPI preparation | 3 jours | Ven 21/07/17 | Mar 25/07/17 |
| **Collaring** | **174 jours** | **Jeu 01/03/18** | **Mer 05/12/18** |
| electrical integrity tests | 1 jour | Jeu 06/12/18 | Jeu 06/12/18 |
| Magnetic measurements | 5 jours | Jeu 06/12/18 | Mer 12/12/18 |
| Yoking | 5 jours | Jeu 13/12/18 | Mer 19/12/18 |
| Connection box assembly | 1 sm | Jeu 20/12/18 | Mer 26/12/18 |
| Warm magnetic measurement with yoke | 2 sm | Jeu 27/12/18 | Mer 09/01/19 |
| Shipping of the magnet to CEA | 1 jour? | Jeu 17/01/19 | Jeu 17/01/19 |

Making 2 more coils does not impact the schedule

| | | | |
|---|---|---|---|
| **Coil parts (2 final sets)** | **70 jours** | **Lun 26/02/18** | **Ven 01/06/18** |
| Direct order (agreement pending) | 0 jour | Lun 26/02/18 | Lun 26/02/18 |
| Delivery at CEA | 70 jours | Lun 26/02/18 | Ven 01/06/18 |

| | | | |
|---|---|---|---|
| **measuring coil tooling** | **284 jours** | **Ven 09/06/17** | **Mar 31/07/18** |
| Design (CFT + design work) | 90 jours | Ven 09/06/17 | Jeu 12/10/17 |
| CFT | 5 sm | Ven 13/10/17 | Mar 21/11/17 |
| order placed | 1 jour | Jeu 07/12/17 | Jeu 07/12/17 |
| FMI order cancellation | 0 jour | Lun 29/01/18 | Lun 29/01/18 |
| Strategy discussion | 3 sm | Lun 29/01/18 | Ven 16/02/18 |
| Prototyping at DMP | 3 sm | Lun 19/02/18 | Ven 09/03/18 |
| Fabrication if order placed with DMP | 4 mois | Lun 12/03/18 | Ven 29/06/18 |
| parallel prototyping at Gavard | 1 mois | Mer 14/02/18 | Mar 13/03/18 |
| Delivery at CERN | 1 jour | Lun 02/07/18 | Lun 02/07/18 |
| part validation/instrumentation | 1 mois | Mar 03/07/18 | Mar 31/07/18 |

| | | | |
|---|---|---|---|
| **Collaring** | **174 jours** | **Jeu 01/03/18** | **Mer 05/12/18** |
| collars instrumentation | 3 sm | Jeu 01/03/18 | Mer 21/03/18 |
| assembly on vertical stand | 8 jours | Lun 19/11/18 | Mer 28/11/18 |
| Collaring on press + key welding | 5 jours | Jeu 29/11/18 | Mer 05/12/18 |

# STRATEGY

- **Critical path**: Coil rigidity tooling
  - Delay allowing the procurement of 2 new sets of end spacers
  - Conductor and other coil components are available at CEA for 2 new coils

- **Proposal**

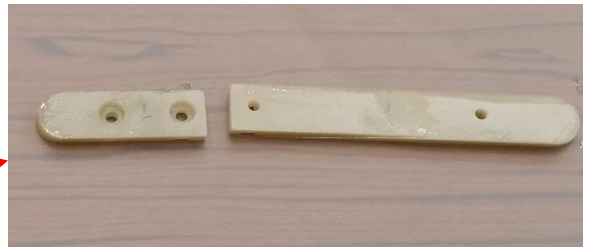
⇒ Winding of coils 8 and 9

⇒ Filling of coil 4 ends => spare

⇒ Repair attempt on coil 5

⇒ Repair of the IL curing sheet => done

⇒ Unwinding of coil 7 (IL) to recover the endspacers



⇒ Use of coil 7 OL to wind a coil IL => curing test
  ⇒ Re-use of all the end spacers
  ⇒ Make the first 2 end spacers in Blue Stone epoxy to make the curing test

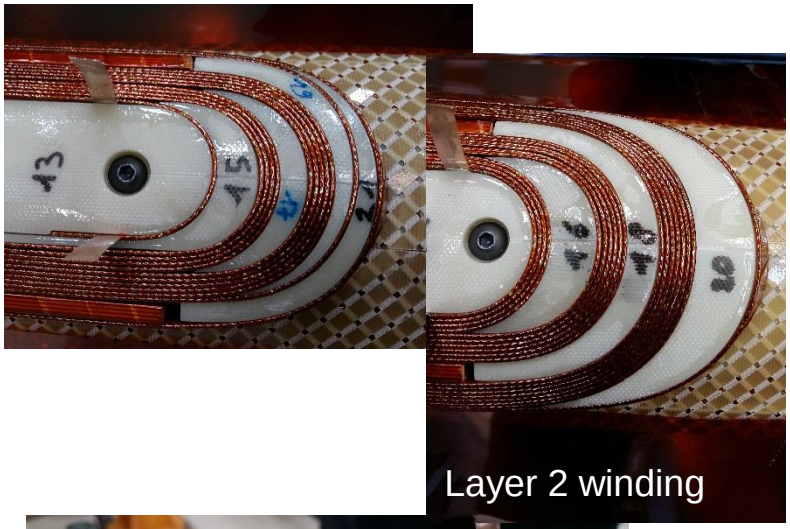
⇒ Procurement
  ⇒ End spacers for 2 coils
  ⇒ 2 parts in Blue stone epoxy

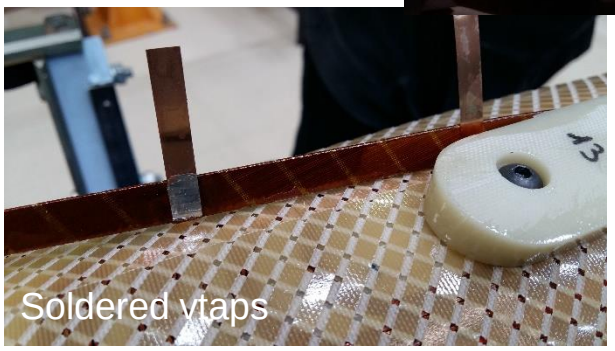
# Back-up slides

# COIL FABRICATION STATUS

| | Fabrication dates |
|---|---|
| Coil 0 | 22/03-27/04/2017 |
| Coil 1 | 17-31/07/2017 |
| Coil 2 | 4-14/09/2017 |
| Coil 3 | 15-29/09/2017 |
| Coil 4 | 16-28/10/2017 |
| Coil 5 | 27/11-9/12/2017 |
| Coil 6 | 15-24/01/2018 |
| Coil 7 | 29/01-09/02/2018 |

# FABRICATION: COIL 0




- Good matching of the coil parts with the winding

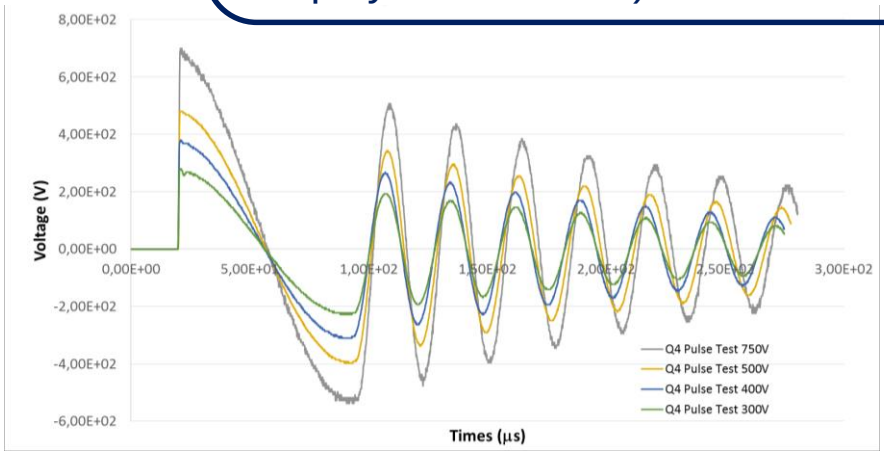
- CuBe Broken flags after polymerization

=> Require smoothing of the sharp edges to avoid damaging the flags

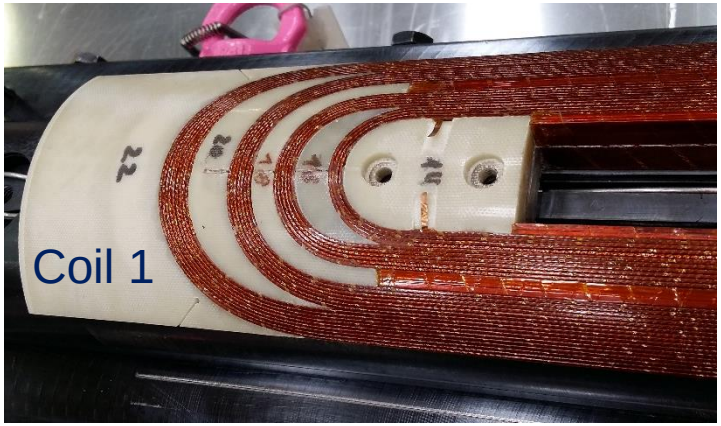
- Impulse test showing change of frequency as V increases

=> Turn to turn weakness?

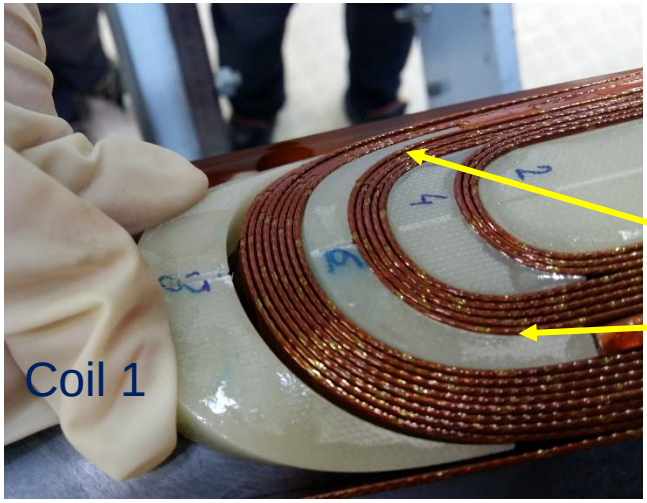
⇒ likely due to the weld of the vtaps using Tin Indium solder (fusion T < polymerization T!)

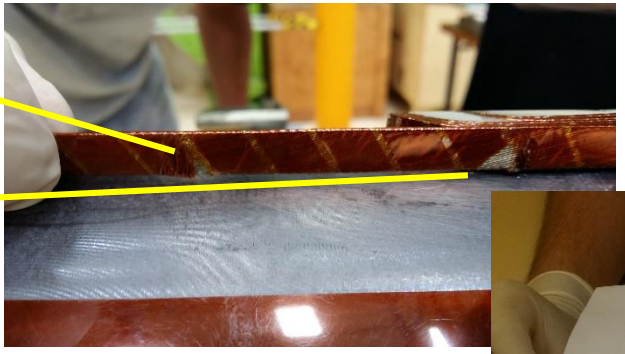


# COIL 1




- Vtaps:
  - narrower $CuSn_6$ flags and SnAg solder
  - Grooves added in the end part
- **Slit** in some of the spacers, filled with G10 pieces before polymerization
- Finalization of procedures for insulation of angular wedges

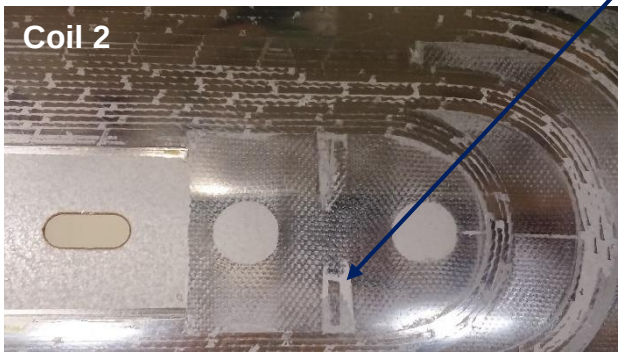


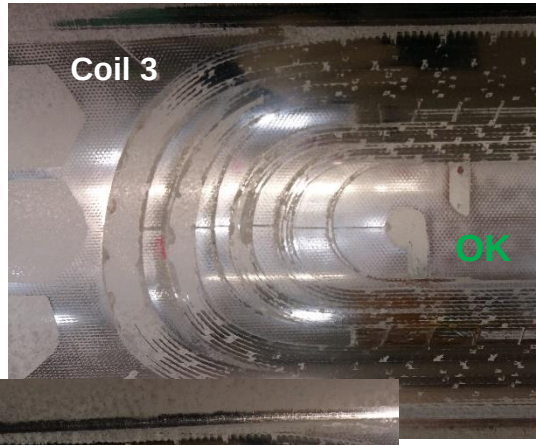



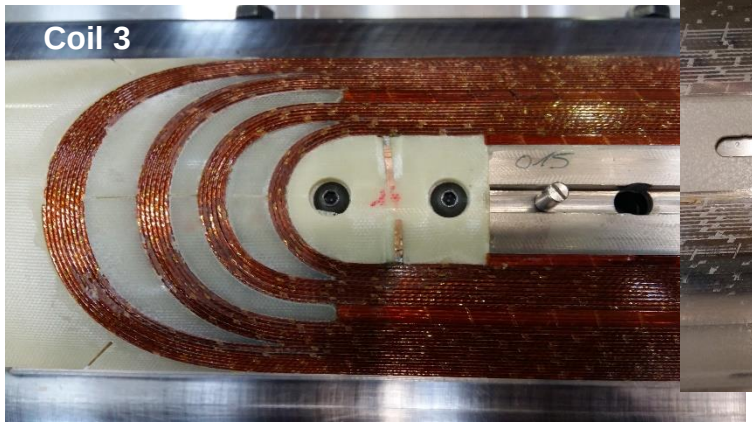
# COIL 2 TO 3

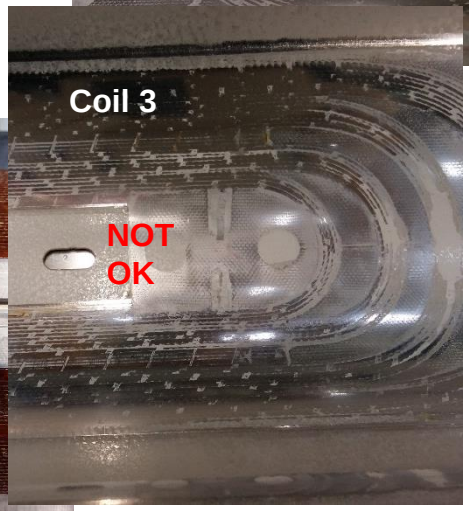
**=> MQYYM**


- No major issue during coil fabrication of coil 2 and 3
- Concern on vtap flags: grooves are not deep enough => some compression of the taps

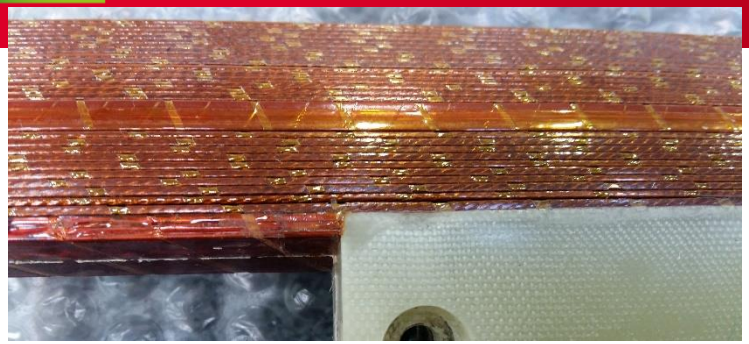


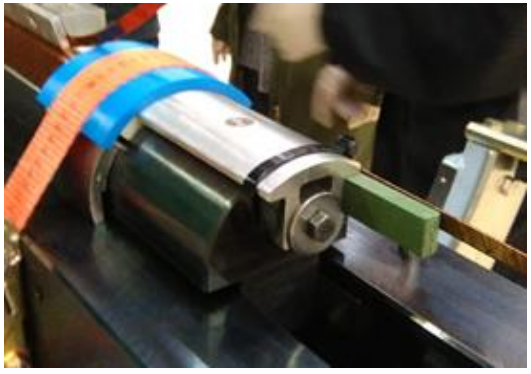
# COIL 4

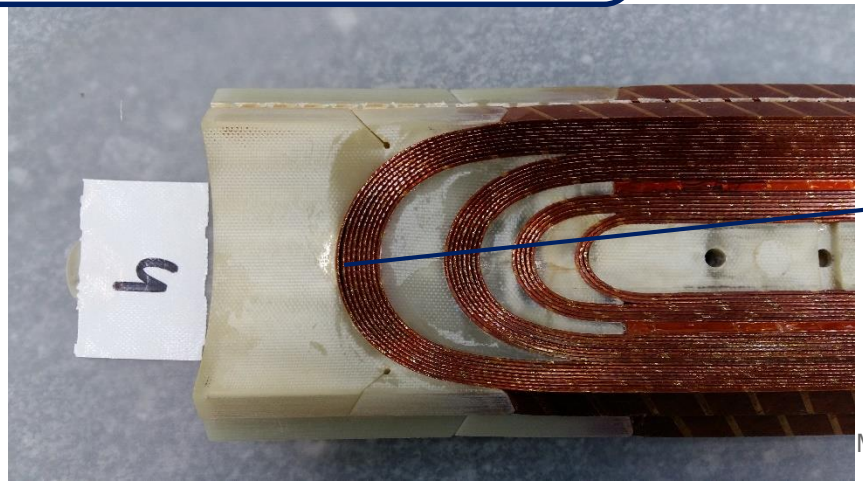


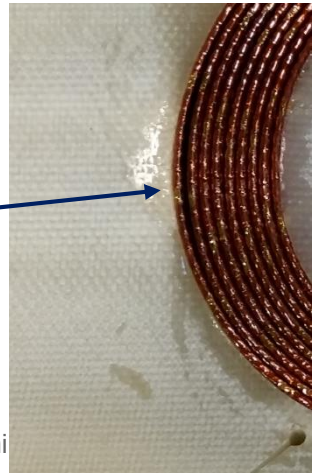

- Vtaps/endpart groove problem solved

But :

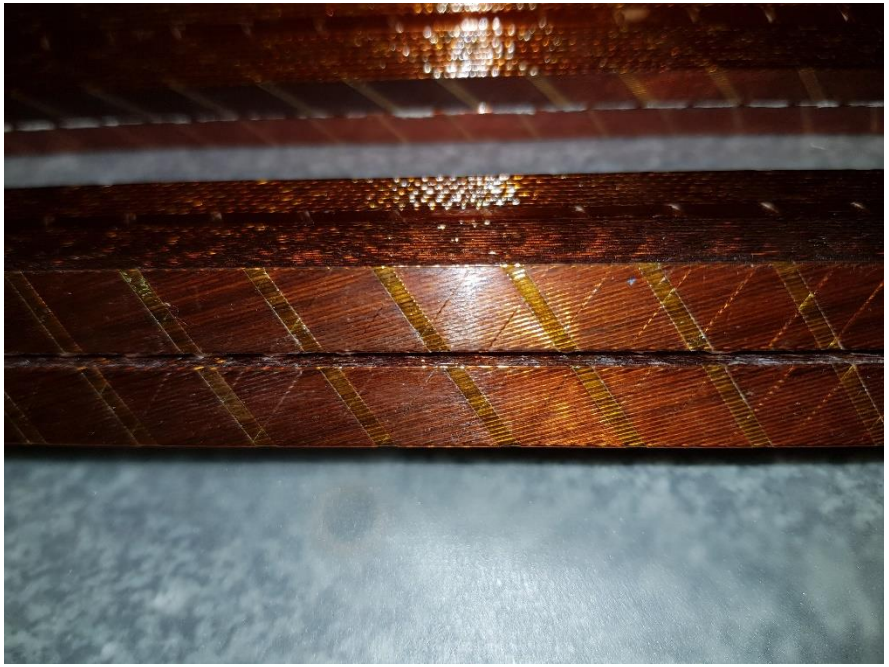
- Unglued turn on the outer layer => adhesive missing? Unexpected cleaning?
- Gap in the last but one turn in the RE IL
- Repair: Filling the area with resin is considered but of concern
- Change of process: Release of the end pusher after press top plate positionning and before mandrel release





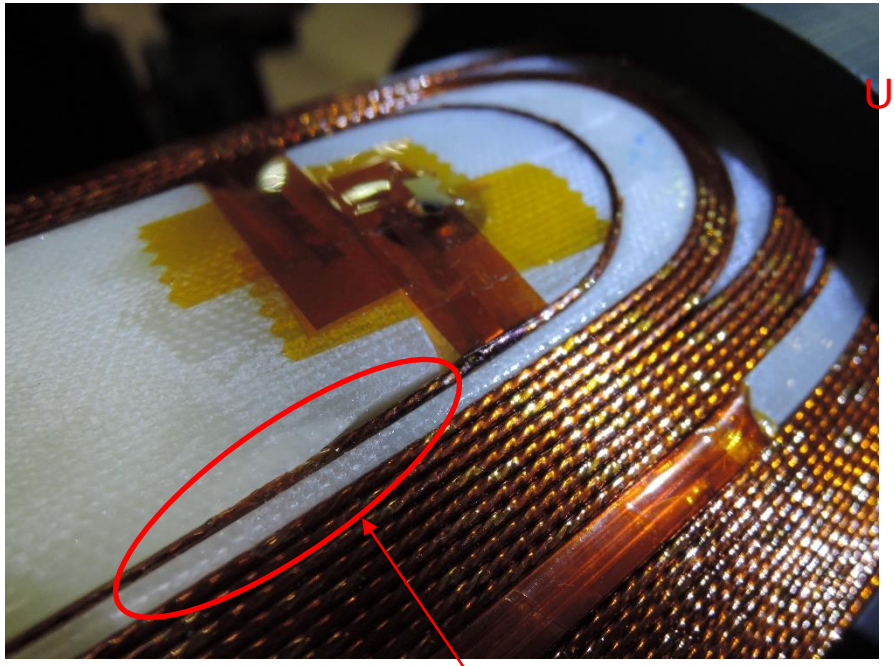


## Issue encountered after the curing of the external layer

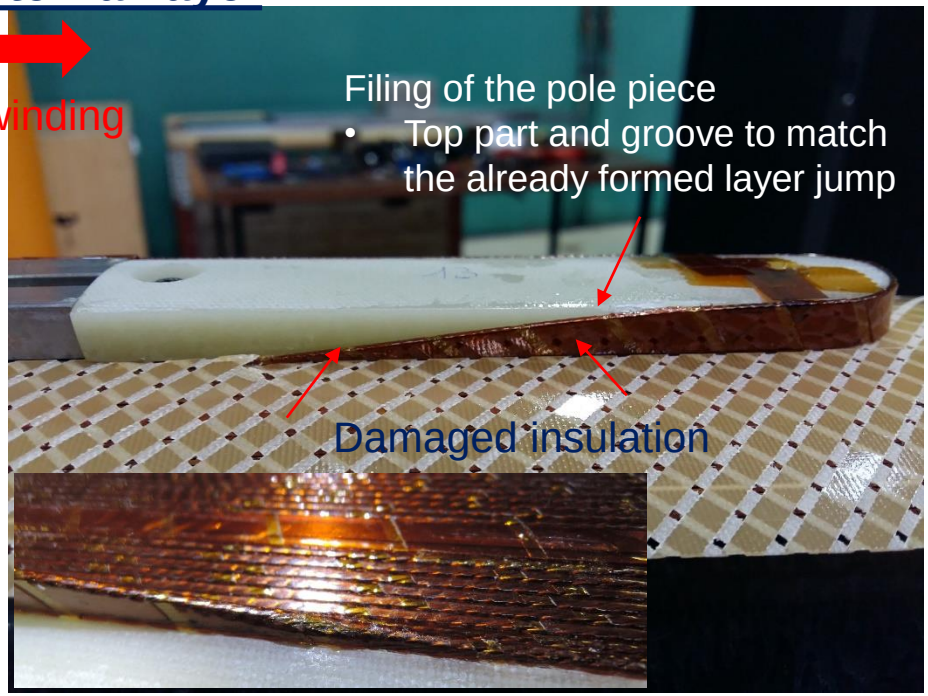


- Uneventful winding
- But damage of the interlayer insulation after fabrication during the cuting of the insulation

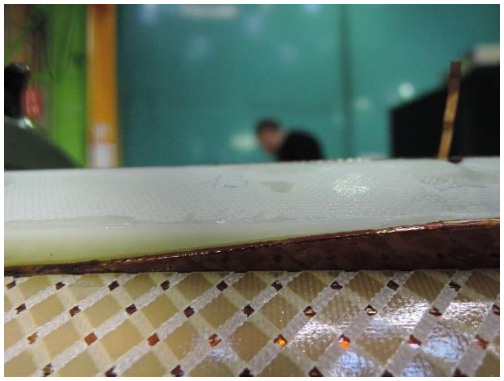
## Issue encountered before curing of the external layer



Unwinding




Layer jump is mispositionned
G11 seems weakened locally



- At QA step: notice an issue with the layer jump
- Decision to unwind layer 2
- Damaged insulation repaired and layer rewound
- Curing ongoing