Hain GenoType Line Probe Assay: Overview and Training

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TBQA
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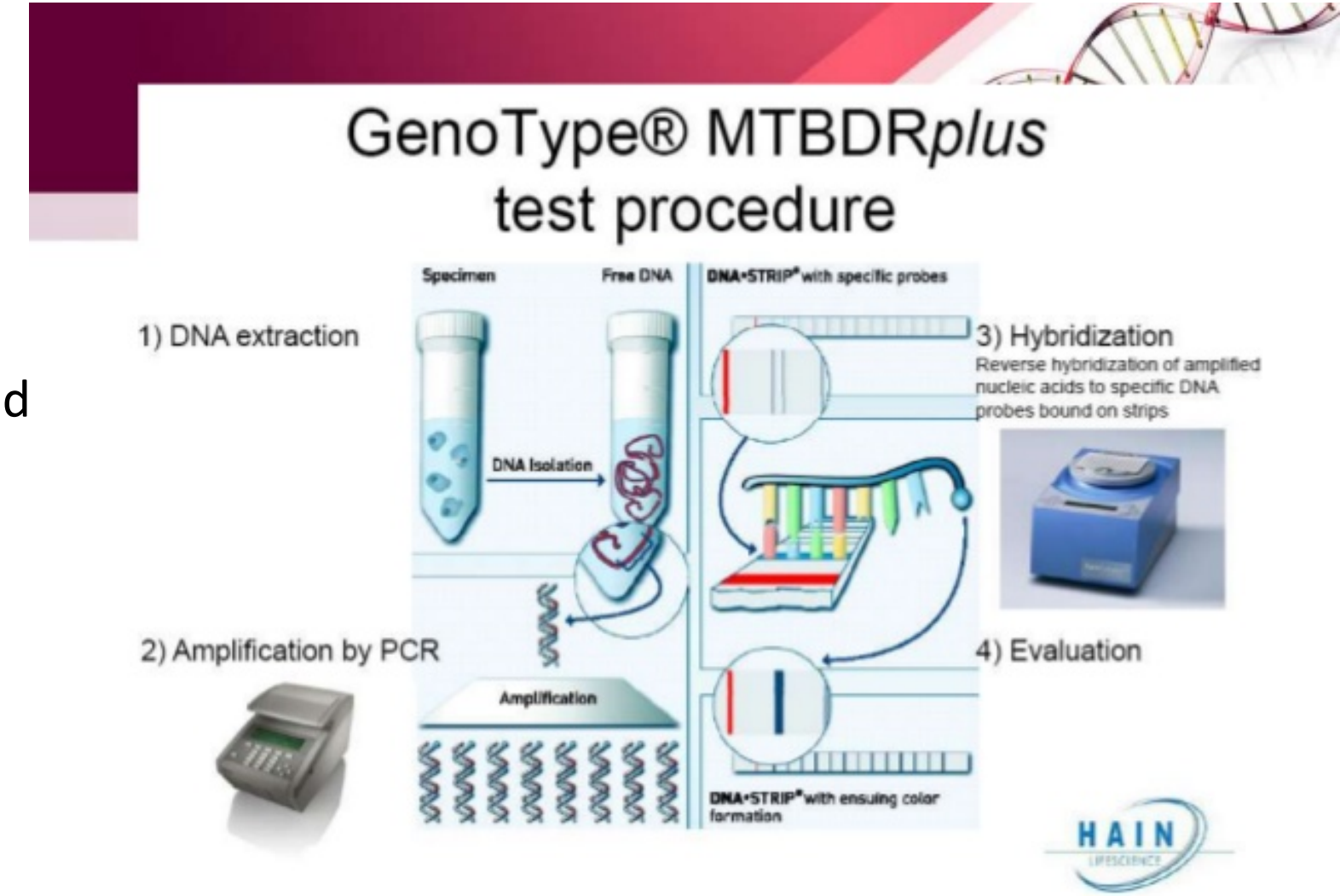
HAIN Genotype Line Probe Assay (LPA)

- The LPA uses PCR and reverse hybridization methods for rapid detection of mutations associated with drug resistance.
- The LPA is designed to identify MTBC and simultaneously detect mutations associated with drug resistance.
- The LPA is should be performed in laboratories with a proven capacity to conduct molecular testing including appropriate laboratory infrastructure and equipment.
- This must also include the necessary biosafety precautions and the prevention of contamination.

LPA Procedures: Key Steps

1. DNA extraction
   a. Clinical pulmonary specimens (decontaminated)
   b. Cultured isolates (solid or liquid cultures)
2. Amplification
3. Reverse Hybridization
4. Analysis

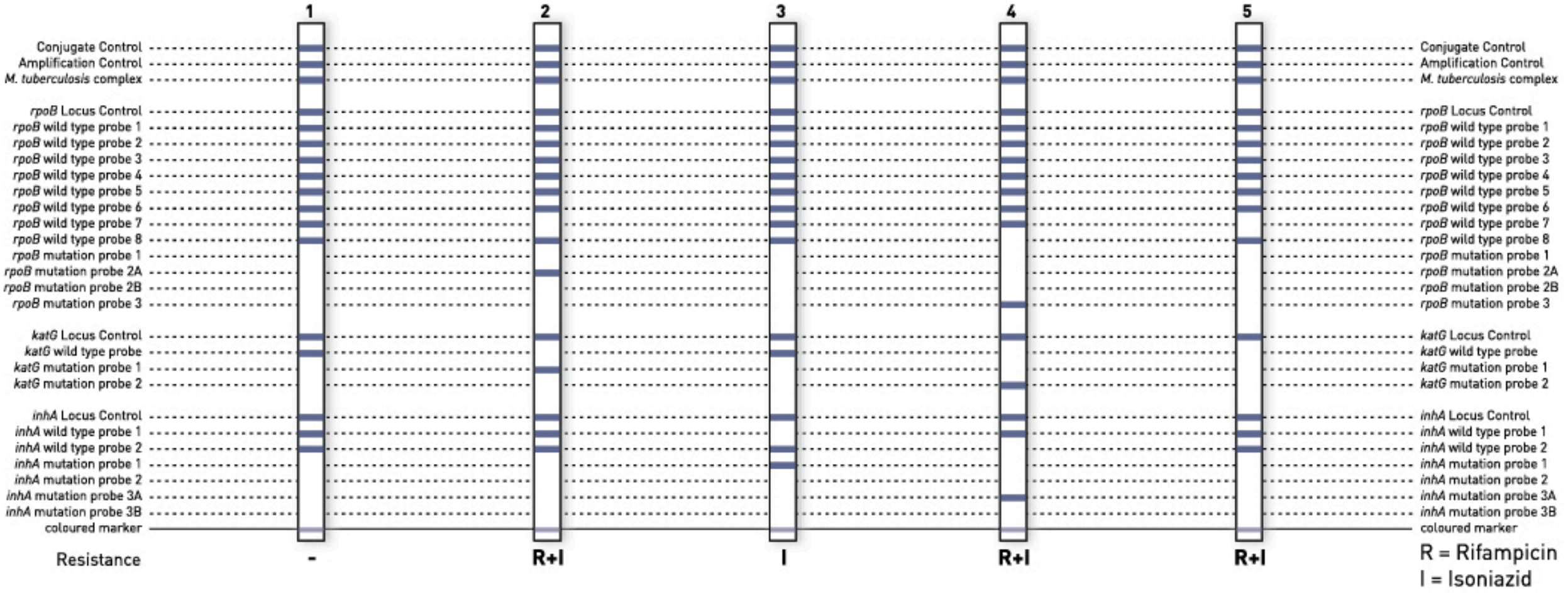


LPA Test Controls

- Conjugate Control (CC) -Included on Strip
  - Demonstrates efficient conjugate binding and substrate reaction
  - Line must be present for a valid result
- Amplification Control (AC)-Included on Strip
  - Demonstrates successful amplification
- Negative Control (NC)-Recommended Test/Batch
  - Contains water instead of DNA to control for contamination
  - Only the CC and AC bands should be present on this strip

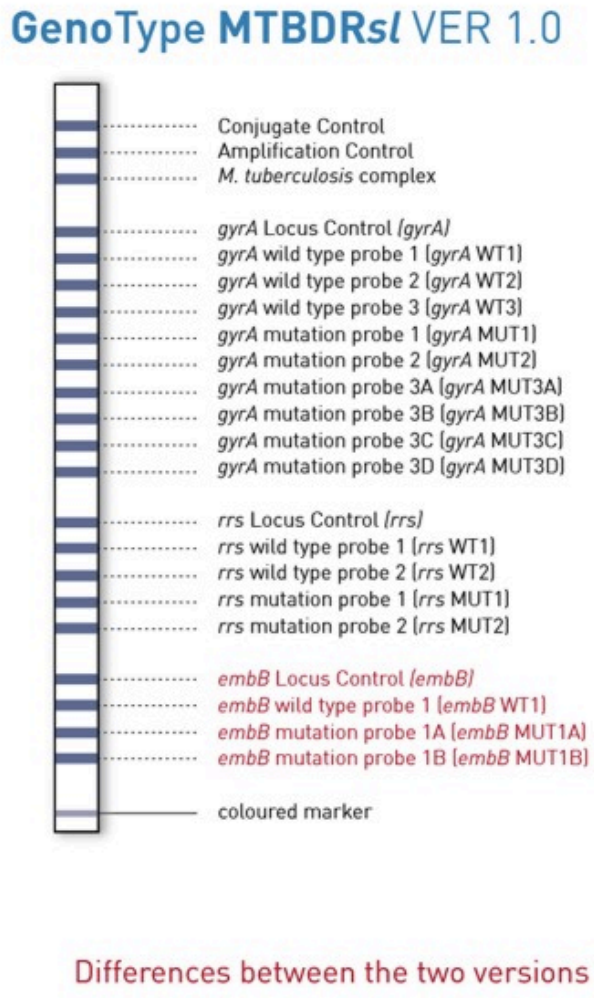
MTBDRplus Assay: Tests for Mutations in INH and Rifampin

rpoB: If mutation present, this may correlate with resistance to Rifampin
inhA: If mutation present, this may correlate with resistance to INH (low level resistance)
katG: If mutation present, this may correlate with resistance to INH (high level resistance)

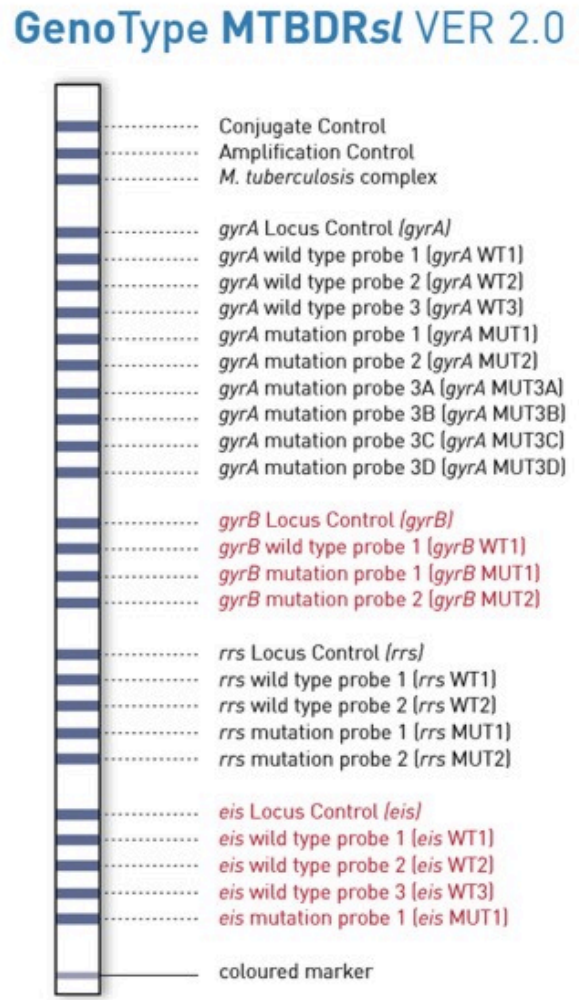


MTBDRsl Assay: Tests for Mutations in Fluoroquinolones, Aminoglycosides and Ethambutol (Note differences in test versions!)

gyrA or gyrB: If mutation present, this may correlate with resistance to Fluoroquinolone (Ex: Ofloxacin, Moxifloxacin)
rrs/eis: If mutation present, this may correlate with resistance to Aminoglycosides (Amikacin, Kanamycin)
embB: If mutation present, this may correlate with resistance to Ethambutol



Differences between the two versions are marked in red



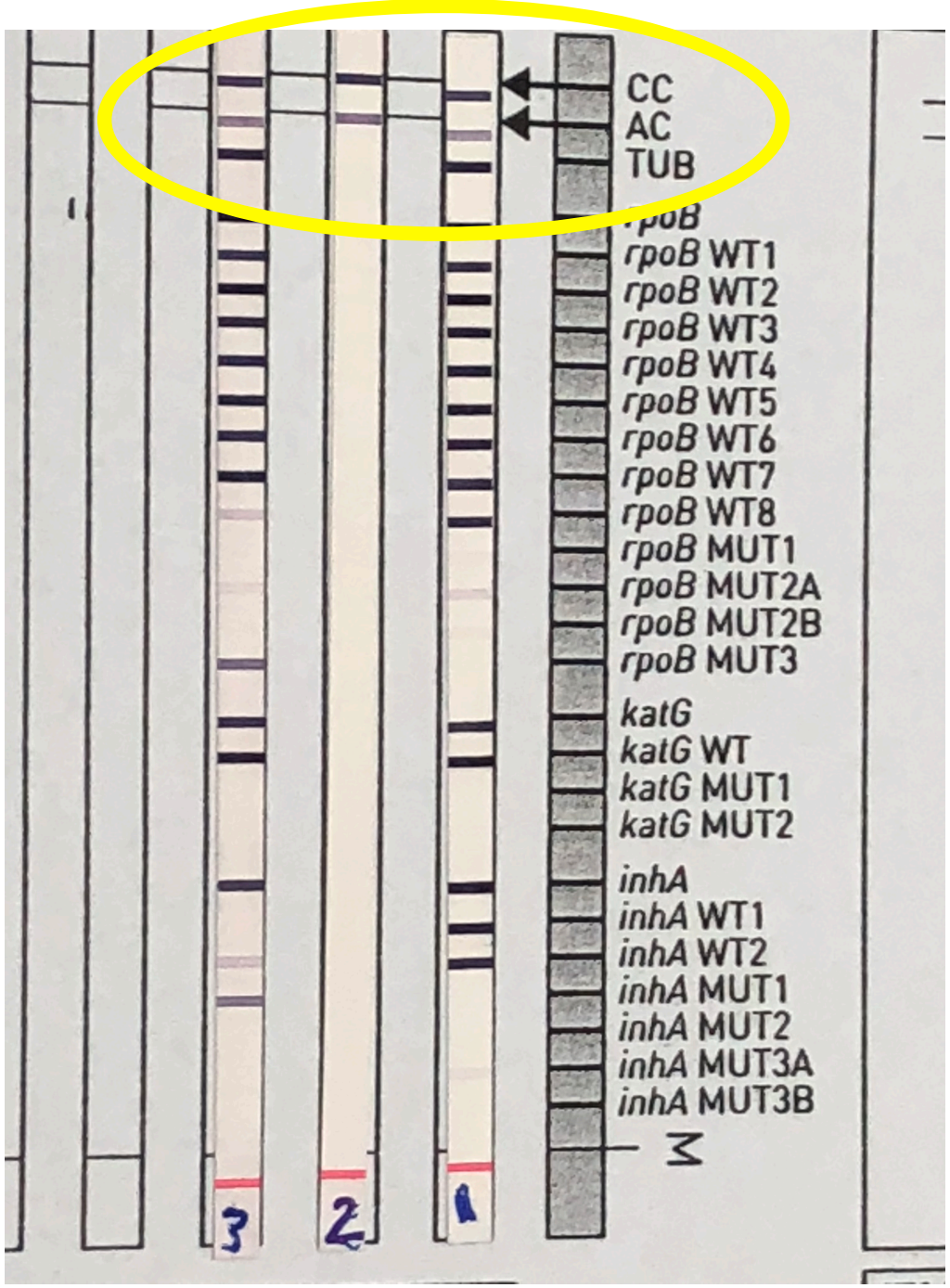
Interpreting Line Probe Assay Strips

Step 1: Look at the "CC" band, "AC" band and "TUB" band.

Conjugate Control (CC) Band: This should be present for each test (if not, the test is invalid)

Amplification Control (AC) Band: This band should be present for each test (if not, the test is invalid)

M. *tuberculosis* complex (TUB) Band: This band should hybridize with all members of the MTB complex. A positive (+) test result shows the band present, while a negative (-) test result shows the band as absent.



Interpreting Line Probe Assay Strips

Step 2: Look at the drug control bands (called Locus controls, these are the non-WT or MUT bands)

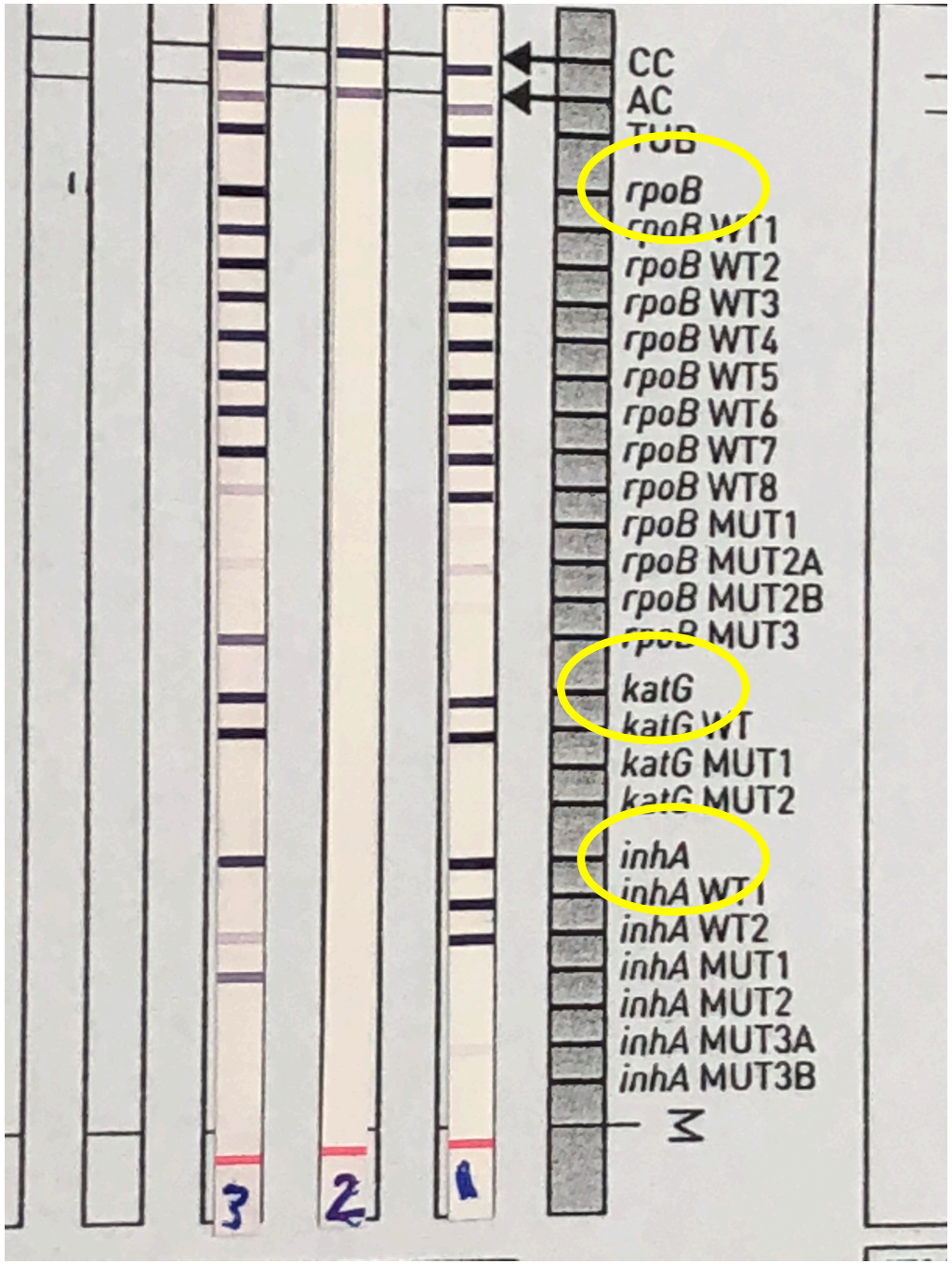
For a valid test, there should be a band present for each of the drug control bands.

If the TUB band is present (indicating an MTBC positive result) and the drug control band is absent, the results for that particular drug are indeterminate.

If the TUB band is absent (indicating an MTBC negative result), there should be NO drug control bands present for that particular sample*.

(***NOTE**: If TUB band is negative but there is still an evaluable susceptibility pattern, MTB complex is suspected, but test should be repeated)

The picture on the right shows control bands present for all 3 drug control bands on Sample #1 and Sample #3, but absent for Sample #2 (this is because the TUB band was negative on Sample #2, indicating a negative result).



Interpreting Line Probe Assay Strips

Step 3: Look at the results of the "WT" and "MUT" bands (only interpret bands that are darker or as dark as the AC band)

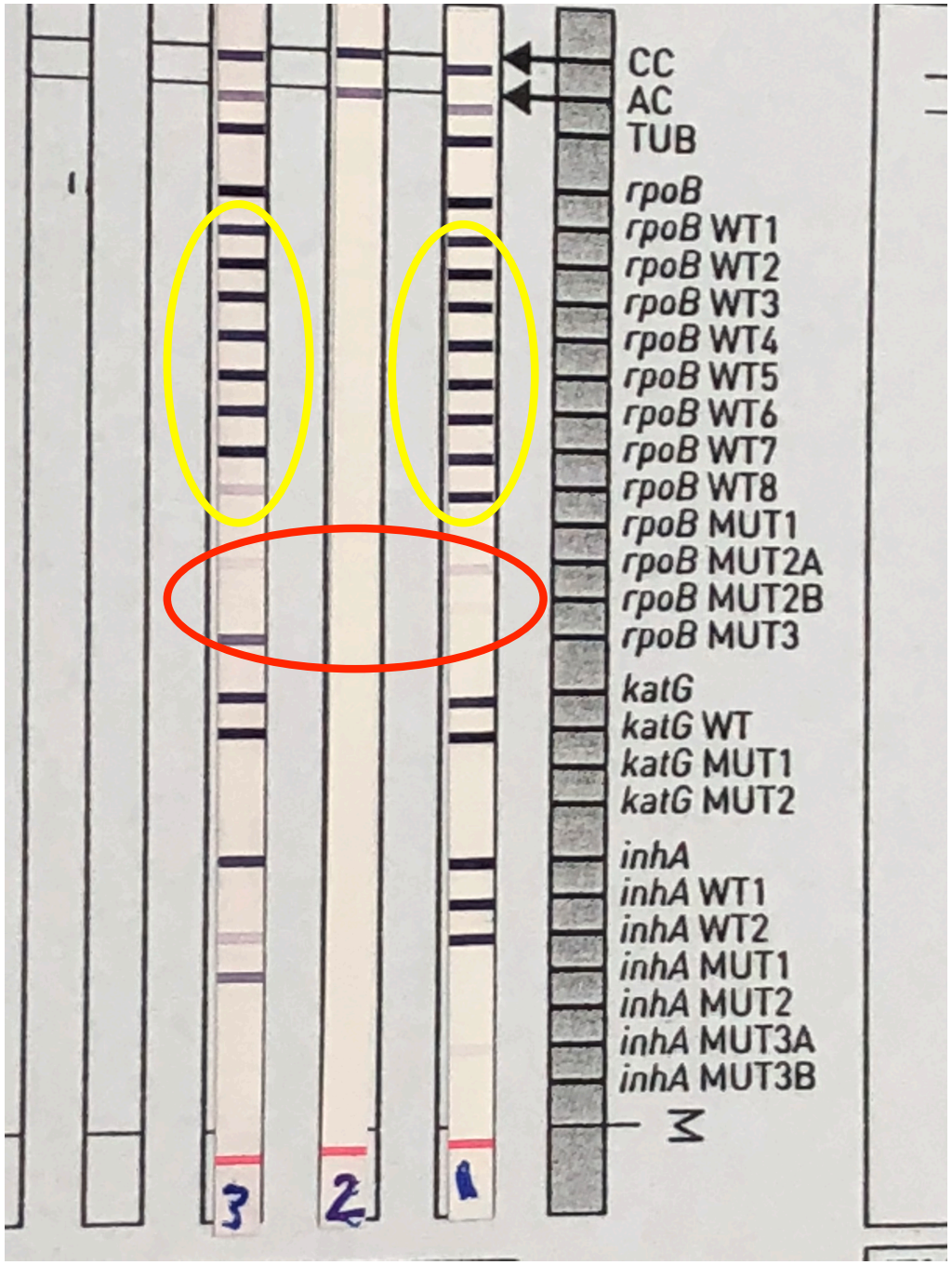
Wild Type (WT) probes:

Bands should be present for all WT probes for a specific drug (some bands will appear weaker in intensity than others). See the yellow circle in the picture to the right.

If any WT bands are missing, this means there could be a mutation that confers resistance.

Mutation (MUT) probes:

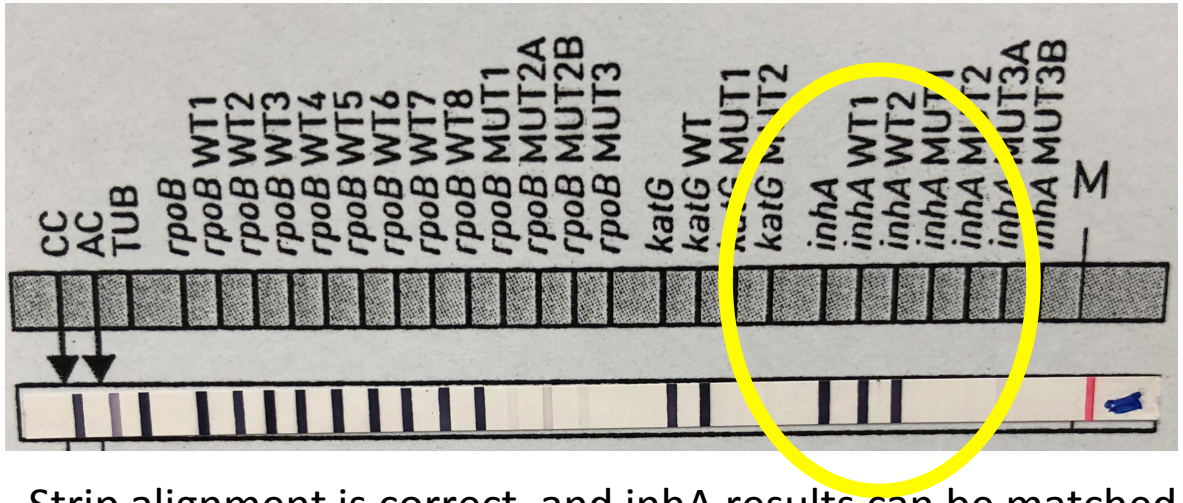
If there is a band present (and it is darker than the AC control), this means a mutation is present that could confer resistance. See the red circle in the picture to the right, that shows a clear rpoB mutation (MUT3) in Sample #3.



Interpreting Line Probe Assay Strips: **A word of caution!**

Make sure to align the strips on the sheet to correspond with the correct band location!

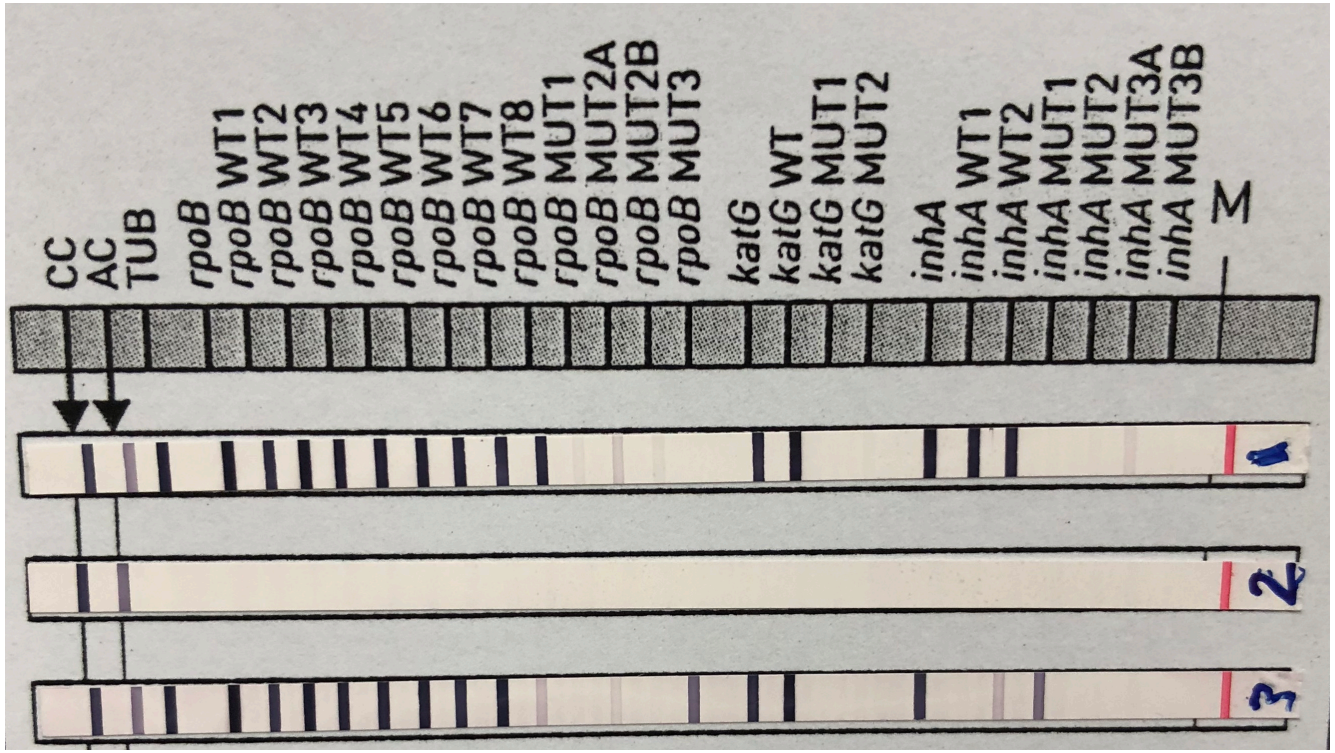
Otherwise this could make it more challenging for interpretation.



Strip alignment is correct, and inhA results can be matched to the banding patterns

Strip alignment is slightly shifted, making inhA result interpretation a bit more difficult (The resulting bands present here should indicate inhA and WT bands present only)

Strip interpretation: M. *tuberculosis* complex strain

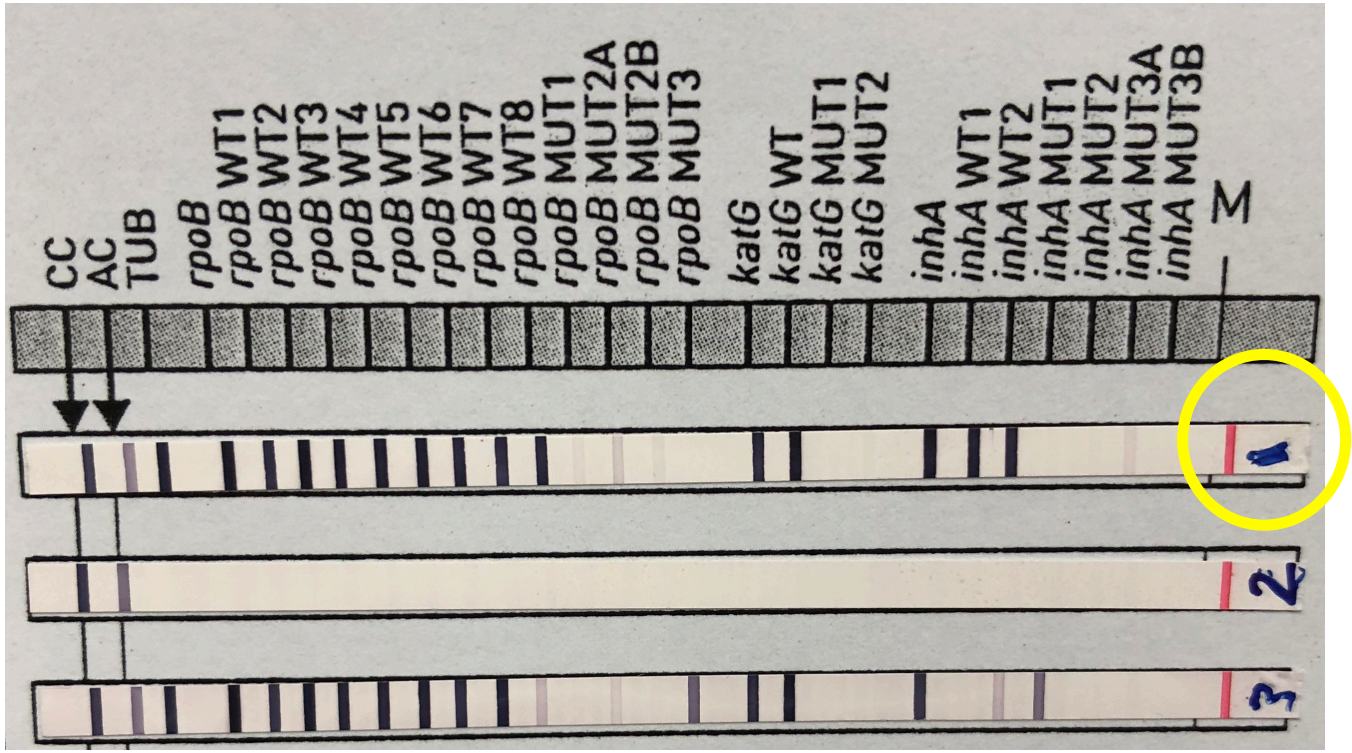


Sample #1: CC, AC and TUB bands all present: This is a **valid** positive MTBC result.

Sample #2: CC, AC bands are present, but TUB band is absent: This is a **valid negative** MTBC result.

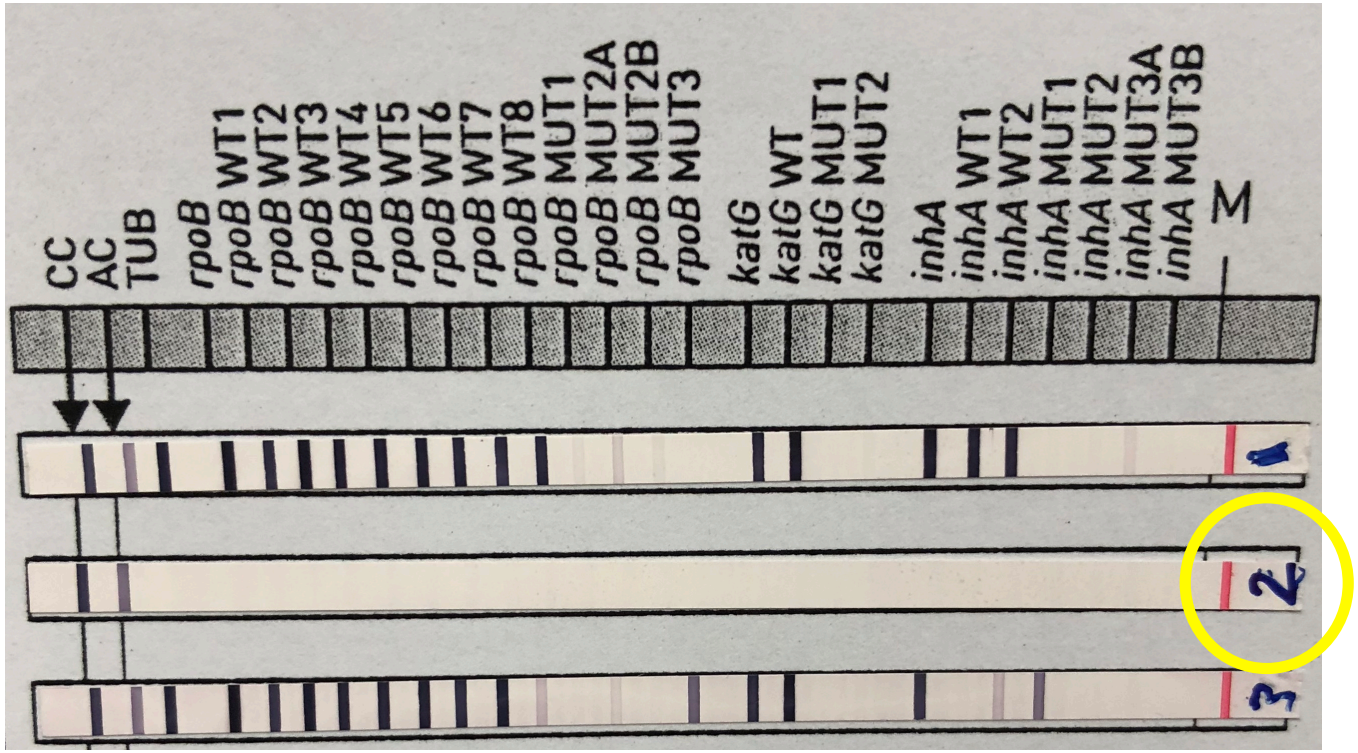
Sample #3: CC, AC and TUB bands all present: This is a **valid** positive MTBC result.

Strip interpretation: Susceptibility Patterns



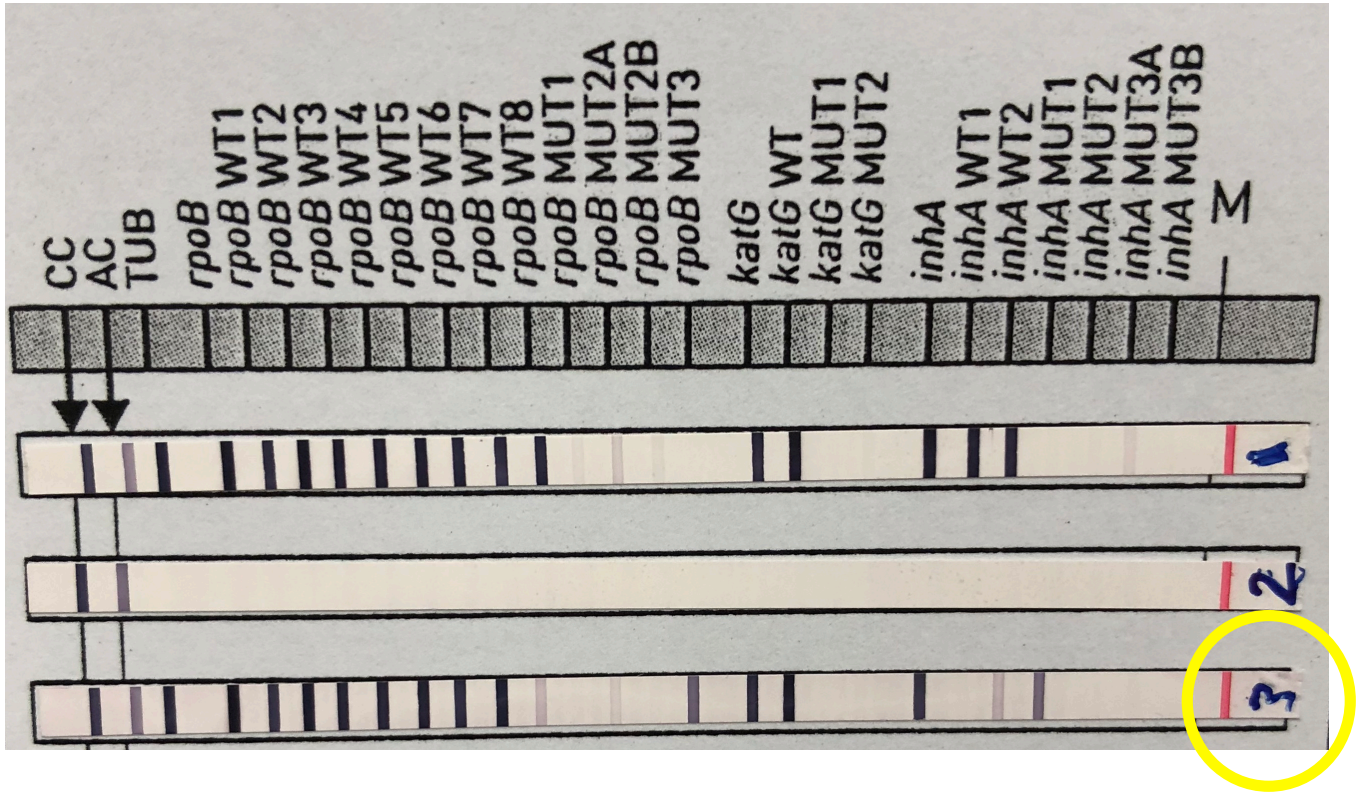
Sample #1: All 3 drug control loci (rpoB/katG/inhA) have bands present, so the mutation data is **valid**. Comparing the WT and MUT bands to the AC band, all WT bands present, and there are no MUT bands that are darker than the AC band. Therefore this is an **MTBC strain showing no mutations for INH or RIF**.

Strip interpretation: Susceptibility Patterns



Sample #2: There are only CC and AC bands present. Since this is a valid negative result, there are **no results for susceptibility.**

Strip interpretation: Susceptibility Patterns



Sample #3: All 3 drug control loci (rpoB/katG/inhA) have bands present, so the mutation data is **valid**.

For RIF→

rpoB: All WT bands are present, and there is 1 MUT band (MUT3) that is darker than the AC band

Summary: This indicates a RIF mutation that may correlate with resistance

For INH→

inhA: The WT band is NOT present for inhA WT1, but faintly present for WT2. In addition, there is a MUT band present (MUT1).

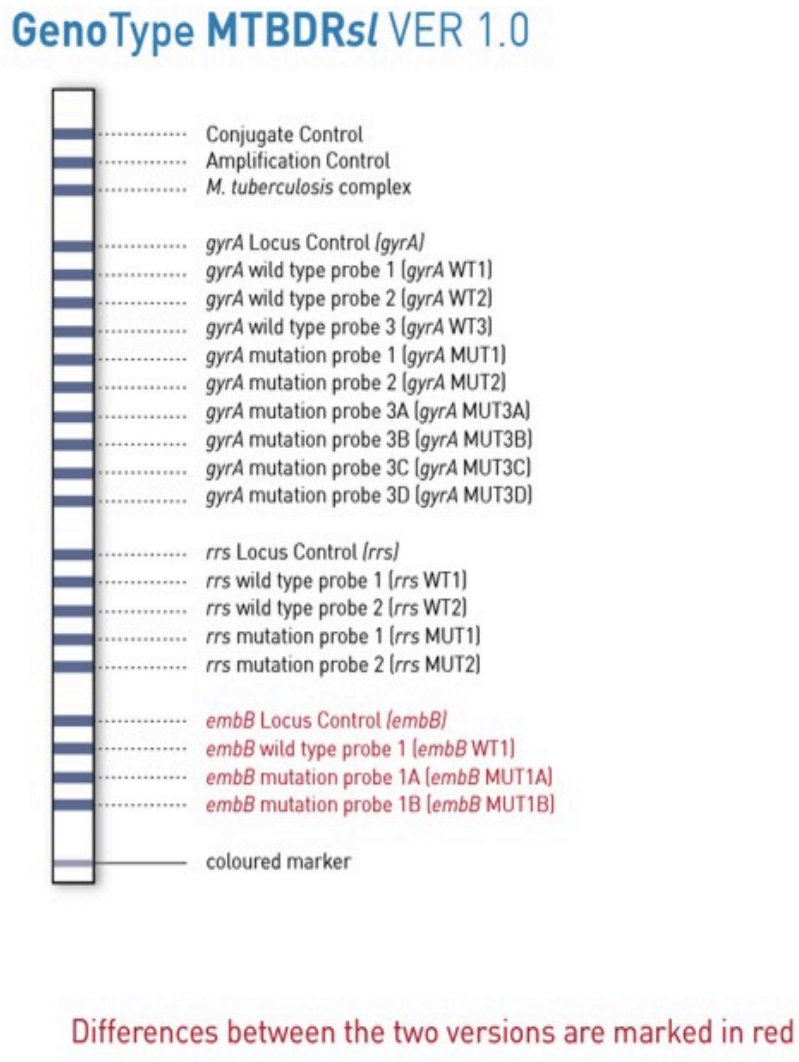
katG: The WT band is present and there are no MUT present.

Summary: There is a mutation in INH (inhA) that may correlate with low-level phenotypic resistance

Interpreting Line Probe Assay Strips: MTBDRsl

- Interpret the same way as the MTBDRplus assay
  - CC/AC/TUB control present?
  - Drug control bands present?
  - Review WT and MUT bands

Make sure to interpret based on the correct test version!



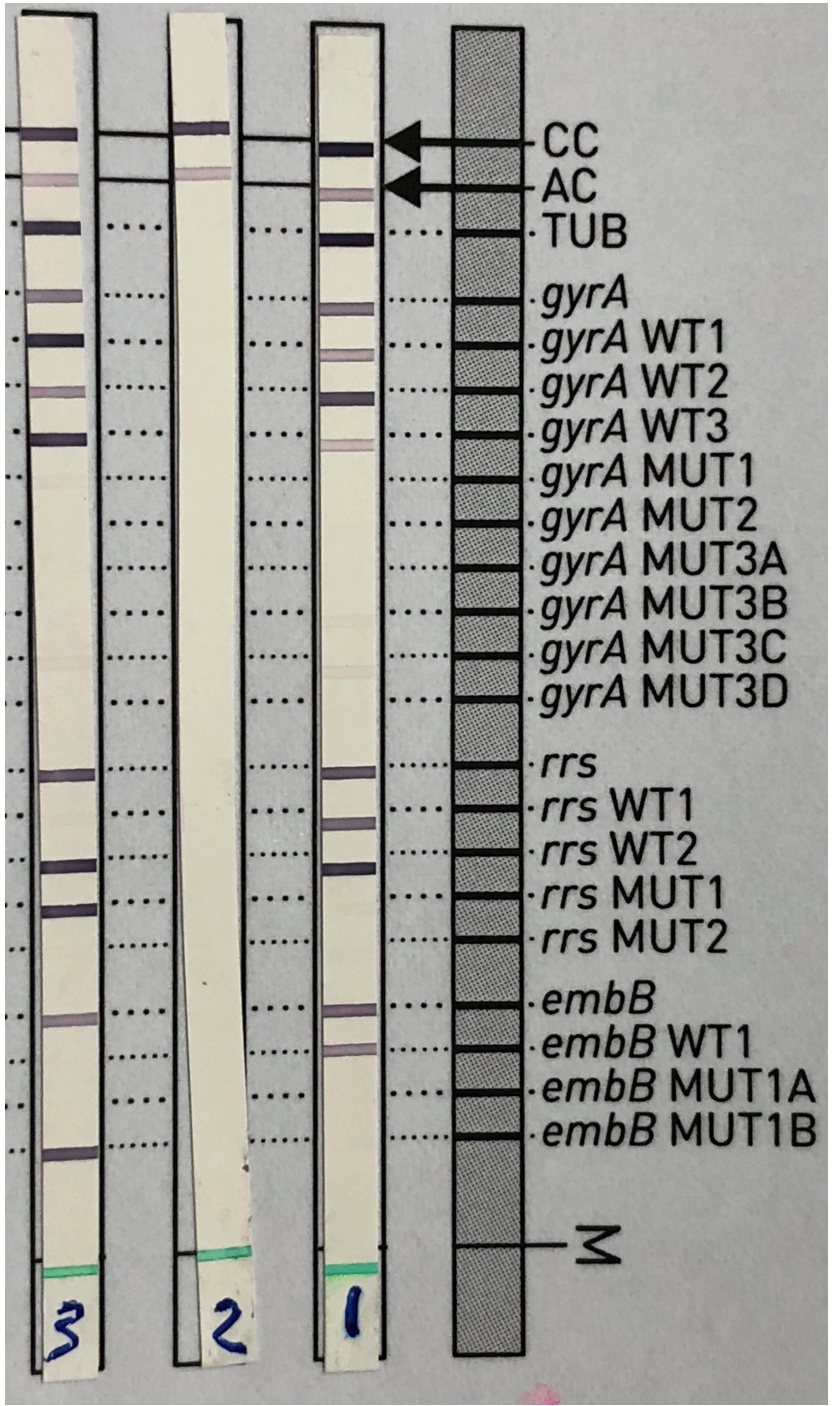
MTBDRsl (V1.0) example:

- Sample #1:
  - CC, AC and TUB bands present: MTB complex (+)
  - Drug control bands present
  - WT bands present for all drugs
  - NO MUT bands present

  Interpretation: MTB complex (+), no mutations found
- Sample 2:
  - CC, AC bands present, TUB bands absent: MTB complex (-)
  - Drug control bands absent
  - WT bands absent for all drugs
  - NO MUT bands present

  Interpretation: MTB complex (-)
- Sample 3:
  - CC, AC and TUB bands present: MTB complex (+)
  - Drug control bands present
  - WT bands present for gyrA and embB, missing WT1 for rrs
  - MUT band present for rrs (MUT1) and embB (MUT1B)

  Interpretation: MTB complex (+), mutation in rrs and embB may confer resistance.



Thank you!

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