Eurospace results for DPA on space qualified parts from 2008 to 2015

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ASD-EUROSPACE
The Space group in ASD

Content

1. **Introduction**
2. **Distribution per product family and normative systems**
3. **Results for DPA on space qualified parts**
4. **Conclusion**

1. Introduction

- **DEFINITION OF DPA (Destructive Physical Analysis) – *i.a.w. ECSS-Q-ST-60C rev.2***

  DPA is a serie of inspections, tests and analyses performed on a sample of three components to verify that the material, design and workmanship used for its construction, as well as the construction itself, meet the requirements of the relevant specification and are suitable for the intended application.

- **PURPOSE OF DPA**

  - The purpose of DPA is to detect, on a lot, generic quality issue of die or assembly (on a limited sampling).
  - The DPA sampling size (3 parts / lot) is independent of the lot size.

- **EUROPEAN DPA REQUIREMENTS FOR HI-REL PARTS *(as per ECSS-Q-ST-60C rev.2)***

  - Class 1 : DPA required for 11 non-space qualified parts families and space qualified relays and oscillators.
  - Class 2 : DPA required for non-space qualified relays and oscillators.
  - Class 3 : DPA required for non-space qualified relays.

- **WHY DPA RESULTS AVAILABLE ON SPACE QUALIFIED PARTS BY EUROPEAN SPACE INDUSTRIES ?**

  This is the European Space Industries' policy to follow and apply the ECSS-Q-ST-60 requirements.

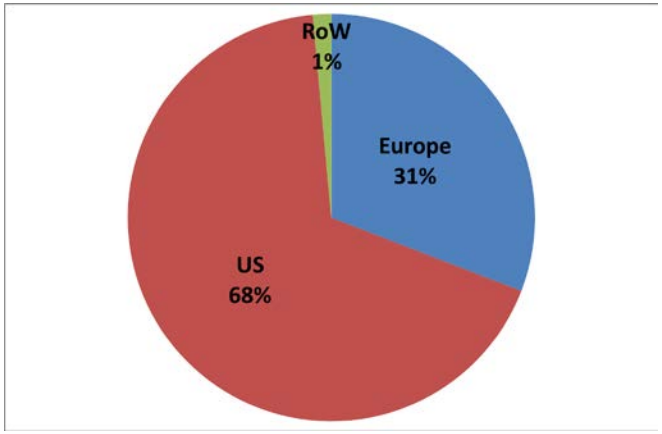
  However, DPA may be done on space qualified parts in the past years and is still done upon requirements from some of our customers (European, US or Japanese).

2. Distribution per product family and normative systems (1/2)

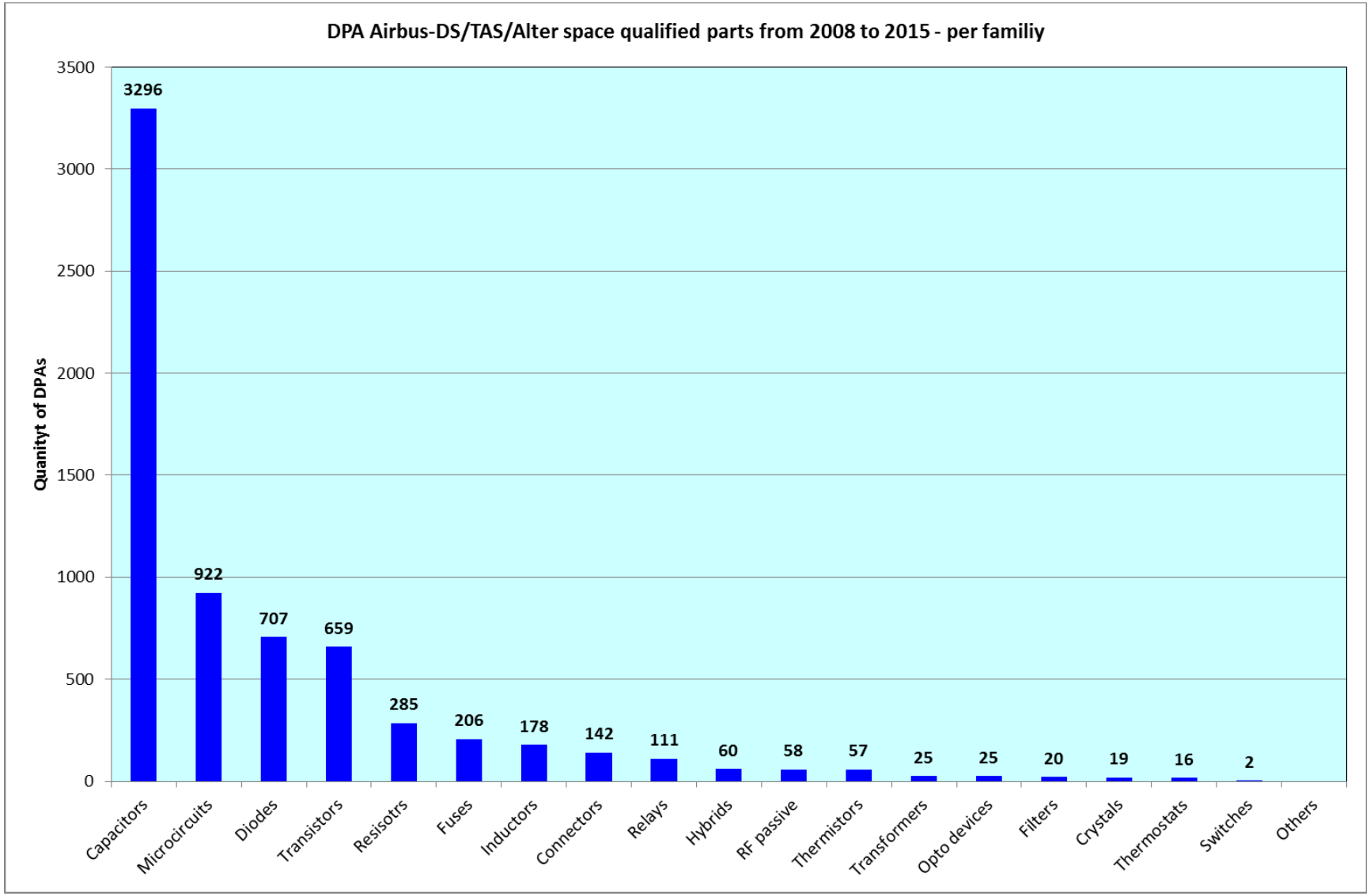
- **DPA DATABASE ON SPACE QUALIFIED PARTS**
  - 6798 lots of space qualified parts submitted to DPA by Airbus-DS (FR/GE/SP/UK), TAS (FR/IT) and Alter.
  - Data collected for DPA done from 2008 to 2015.

- **TOP 5 OF PRODUCT FAMILIES**
  - Capacitors : 3296 lots
  - Microcircuits : 922 lots
  - Diodes : 707 lots
  - Transistors : 659 lots
  - Resistors : 285 lots

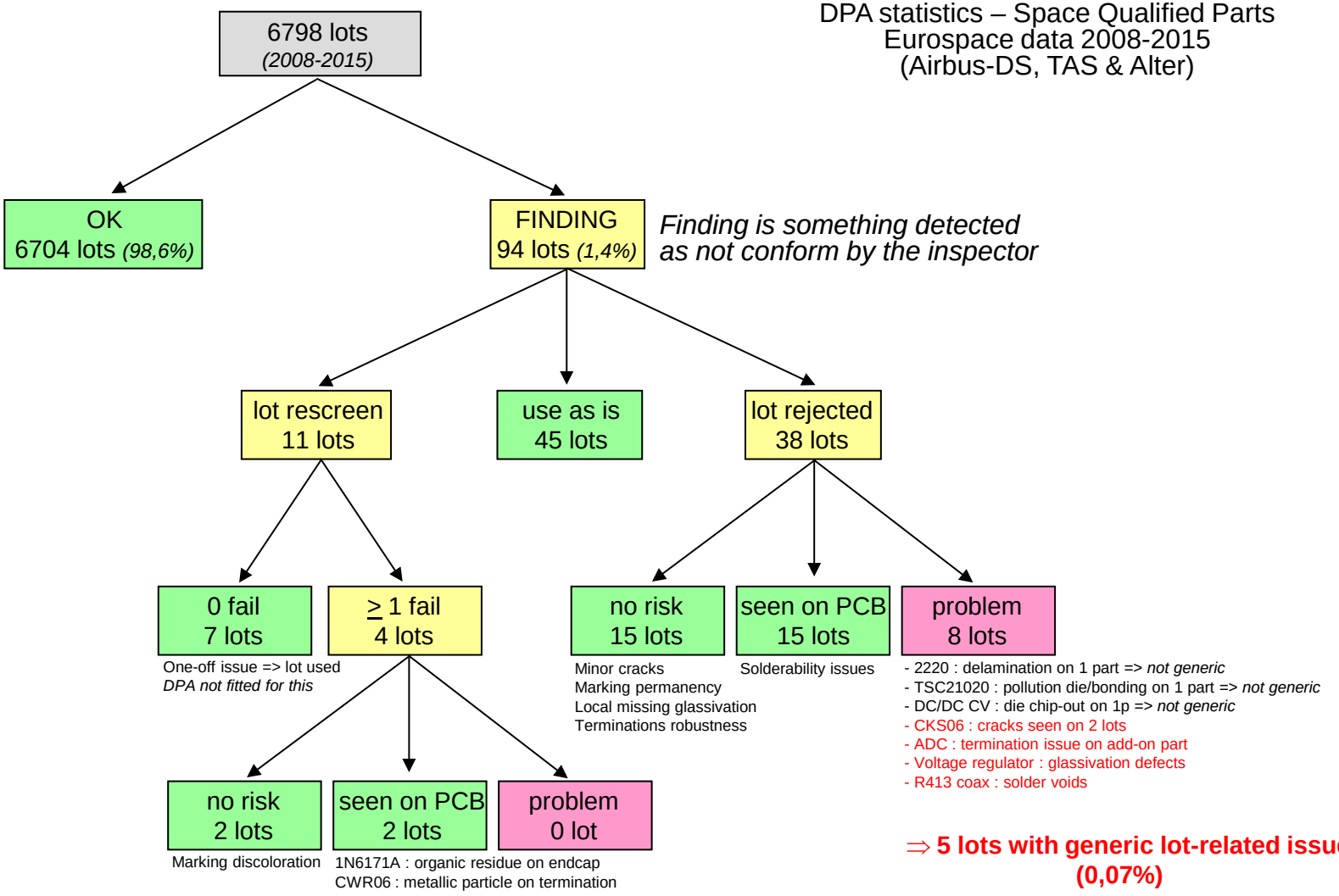
- **DISTRIBUTION PER NORMATIVE SYSTEM**
  - MIL space : 68%
  - ESCC : 31%
  - RoW : 1%



2. Distribution per product family and normative systems (2/2)



3. Results for DPA on space qualified parts (1/3)



3. Results for DPA on space qualified parts (2/3)

- The DPA campaign from 2008 to 2015 on space qualified parts (6798 lots) has revealed :
  - 6704 lots with successful results (98,6%)
  - 62 lots with finding presenting no risk (0,9%) : *45 lots "use as is" + 15 lots "rejected – no risk" + 2 lots "rescreened – no risk"*
  - 17 lots with finding detectable at board level (0,3%) : *15 lots "rejected – seen on PCB" + 2 lots "rescreened – seen on PCB"*
  - 10 lots with finding being one-off at lot level (0,1%) : *7 lots "rescreened – 0 fail" + 3 lots "problem – not generic"*
    (DPA not fitted to detect such defects)
  - **5 lots with finding being generic => 0,07% of lots submitted to DPA.**

- The 38 lots rejected are distributed as follows :
  - Inductors : 10 lots
  - Capacitors : 8 lots
  - Diodes : 6 lots
  - Microcircuits : 6 lots
  - Transistors : 5 lots
  - Transformers : 1 lot
  - Hybrids : 1 lot
  - RF passive : 1 lot

  - ESCC : 17 lots
  - MIL : 21 lots

  => No possible to focus on a specific EEE family or a specific normative system.

These data confirm it is not necessary to impose systematic DPA on all lots of space qualified parts or to focus on specific families or normative systems but a surveillance is necessary.

3. Results for DPA on space qualified parts (3/3)

	AIRBUS-DS *(PSWG #68 – 24-mar-15)*	**TAS** *(SCSB #43 – 06-oct-15)*	**ALTER** *(email – 18-jun-15)*
Qty. of DPA on space qual. parts	**4153**	**2322**	**323**
Period	**2008 – 2014**	**2008 – 2015**	**2010 – 2015**
Sources	Airbus-DS-France Airbus-DS-Germany Airbus-DS-UK Airbus-DS-Tesat	TAS-France TAS-Italy	Alter-Spain
Ratio ESCC vs MIL	**40% - 60%**	**20% - 80%**	**35% - 65%**
Qty. of findings	**69 (1,7%)**	**18 (0,7%)**	**7 (2,3%)**
Qty. of lots finally rejected	**23 (0,5%)**	**13 (0,5%)**	**2 (0,7%)**
Qty. of lots rejected but no risk	**18**	**12**	**0**
Qty. of lots rejected with a real issue	**5**	**1**	**2**
Qty of lots rejected with a generic issue on the lot *(for which DPA has an added-value)*	**3 (0,07%)**	**1 (0,04%)**	**1 (0,31%)** *(but low statistical basis)*
Synthesis	**0,07%** *(5 / 6798)*		

4. Conclusion (1/2)

- For Eurospace, the DPA data got from 2008 to 2015 confirm the DPA decision taken by ESA, NSAs and Eurospace in the frame of ECSS-Q-ST-60B (Jul-07) as pertinent : no DPA on space qualified parts (except relays & oscillators).

- This position is comforted by the following additional points :

  1. The quality of space qualified parts is scrupulously controlled by Agencies (ESA, NSAs, DSCC, JAXA) based on a well-defined qualified program followed by periodic quality/reliability assessments.
     => Trust Qualifying Agencies !

  2. Since the application of the ECSS-Q-ST-60 standard (> 7 years), no issue has been reported at board, equipment or system level caused by a missing DPA on space qualified components.

- However, the DPA results also confirm that we can trust the systems but we need to survey !

  Airbus-DS and TAS have implemented a **EEE Survey** program for space and non-space qualified parts.

  In this context, EEE Survey may lead to perform control (e.g. precap, final CSI, DPA or any specific test) on EEE parts (space qualified or not).

  In case a generic issue is revealed, it is supported by an alert focused on one part type or one manufacturer.

  Eurospace considers this process as better fitted to prevent failures on board than DPA on 3p/lot to screen-out weak lots.

- This is the Eurospace strategy to apply the ECSS standards as far as possible.

  However, in case of specific customers' requirements, DPA on space qualified parts will be continued to be performed.

4. Conclusion (2/2)

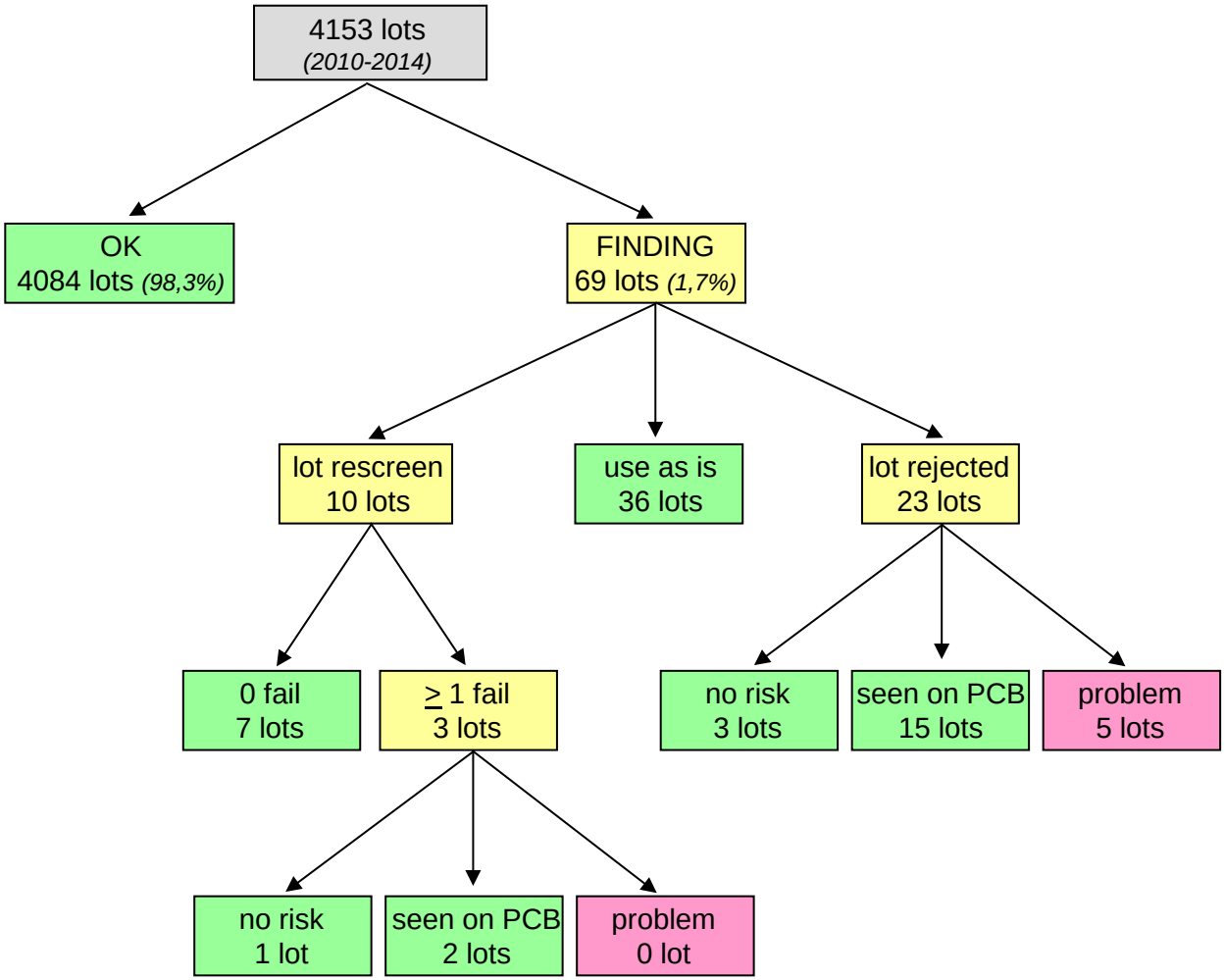
1. **DPA statistics 2008-2015 confirm no need of systematic DPA on space qualified parts.**

2. **ECSS-Q-ST-60C rev.2 requirements remain valid.**

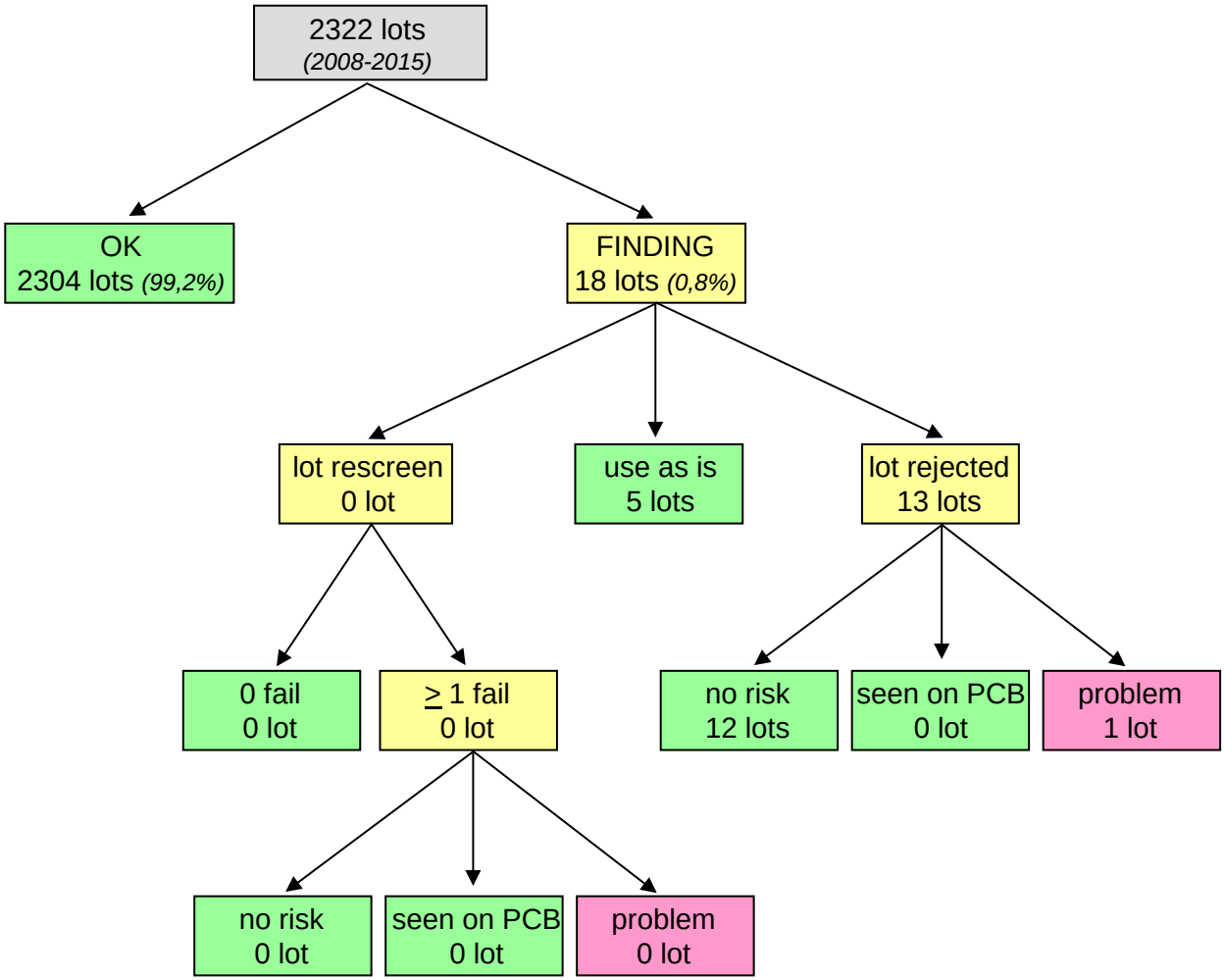
3. **Trust Agencies and Systems but survey !**

BACK-UP

Airbus-DS results for DPA on space qualified parts



TAS results for DPA on space qualified parts



Alter results for DPA on space qualified parts