

The 4.0 metrology at PSA Group

For a more efficient industrial metrology

Soupala Gries¹, Laurent Selski¹

¹PSA Group, Site of Sochaux, Centre Technic Centre of Belchamp, 25218 Montbéliard Cedex, France

There are two types of metrology: the legal one and the industrial one. One of our biggest problem today, is the fact that the industrial metrology is a copy of the legal one. However, each one has different needs. We only discovered this difference quite soon. Industrials prefer to ignore this fact, saying that metrology costs a lot for them... It's not true! Metrologists just need to change their way to consider their work and have to renew it. Tomorrow's industrial metrology has to be justified by companies' needs only, and that what we are going to do in PSA Group.

1 Towards an optimized function

Currently, metrologist's work is mainly made of administrative actions like the management of periodic calibration, the control of reports, and the best way to please the auditor. His work is not highlighted and not gratified. Moreover, this deteriorates the image of metrology for companies. They don't see the value of this field. However, metrology is one of the *key of competitiveness* for companies! Metrology has indeed to be renewed in order to change the core business radically.

Tomorrow's metrology has to be a *real answer of companies' needs*, and not a multiplication of actions which are made of habits. Metrologists have to *control their park* of equipment and not suffer it. For that change to happen, this field will have to be transformed to become a work based on *analysis* and *critical mind*. It would be a real upgrading! At last, metrologists would be able to show their real added value to company.

2 PSA's metrology: change

The situation described above is not an utopia but reality. At PSA Group, *change starts!* Since 2015, there is a project for the next 3 years to renew metrology.

It was born from an assessment: in 7 years, with simple actions, an active management of the metrology network and an efficacy of fifty percent only, there was a *save of 60% of the calibration budget*. Moreover, this project is directly linked with PSA's strategy "Push To Pass". In fact, Mr. Tavares said: "We will increase our efficiency in particular with the reduction of our production costs as well as the development of projects". So, if we do good measurement at the first time and have faith in our process, we will save time and so, we will *reduce our production costs*.

To make a durable change, we had to think about the best way to deploy this big and important change, about practices and above all about the way we consider metrologist's work. This project is made of four important parts:

- Study of new tools to guarantee quality for the less cost;
- Test of these new tools on a site to see what happens when we change our way to do metrology;
- Rewrite our principal PSA's standard named A10 9000. It's based on ISO 17025;
- Deploy the new version of A10 9000 and formation of our metrological network;

3 What actions for what results?

As we said before, today, metrologist does mainly administrative actions and tomorrow, we would like metrologists be free to use their *knowledge* and *critical mind*. The goal is to have a cheaper controlled park of equipment.

So, actions to reach this goal will be:

- Get a software compatible with our new needs
- Have a real process of ECME management (Equipment for Control, Measurement and Test)
- Use metrological documents
- Optimize periodicities with OCEAN (Optimisation of Calibration Constraint Just Needed) for instance
- Analyse shift with FDX for instance
- Collaborate in a same network to use new collaborative tools like CIL (Inter-Laboratory Comparison) or C2I (Inter-Equipment Comparison)

* Corresponding author: author@e-mail.org

- Erase waste
- Have a visual management of measurement
- Make a transition from a periodic systematic calibration to a needful calibration
- Deployment of monitoring of ECME

All these areas for improvement will allow to know and to control the park of equipment while keeping the same quality. They can even improve it! It is important to notice that it won't be more expensive, even cheaper! Why? Because we will do just what we need when we'll need it, nothing more. The rest of the time, analysis and studies will be our everyday life. To resume, tomorrow's metrology will do better and will cost less.

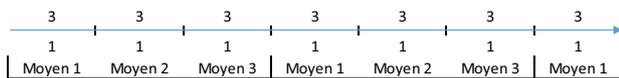
4 Replacement of the ECME management software

The current software is used since 2002. There are two bases and it's made for Europe only. Nowadays, it becomes obsolete because of ergonomic and efficiency. We will change it in 2018 for a new software which corresponds with our new needs (links to existing informatics systems, multi languages, global management of measurement activity).

5 Management of ECME process

Processes have to be managed by a main service and to be presented with an active and permanent way. There is a *Measurement Pilot* in each site. He is not only a real contact for ECME users and owners, but also for a lot of professions, methods and maintenances. The pilot gets a description of job and has right to be trained. His mission is the key to reach the goal for change at PSA Group.

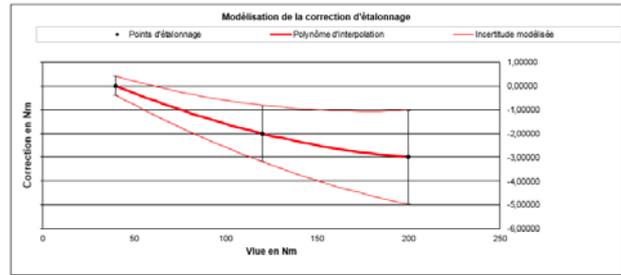
He has to make sure that each piece of equipment isn't verified yearly, but at least a piece of equipment each year in a period of 36 months for the totality.



The principal benefit is to reduce calibration cost without deteriorating the measurement quality.

6 Exploitation of metrological documents

Metrological documents have to be accessible and to add a real value to the required service. Calibration reports have to contain *the modelling of calibration correction and the matched uncertainty*.



Too many times, we can read on verification reports “would fit requirements after calibration”. We have all the needed tools to create this added value.

7 Optimisation of periodicities and analysis of shift

PSA Group developed an application named OCEAN (Optimisation of Calibration Constraint Just Needed). It has been deployed since 2008. This application uses a known method “average FMECA » (Failure Modes, Effects and Criticality Analysis). In May 2017, 5700 studies were made on production sites on all types of equipment. Currently, we study again each piece of equipment which has an “*unsatisfying*” solution. OCEAN allows to optimise periodicities and put on monitoring if it's not already done.

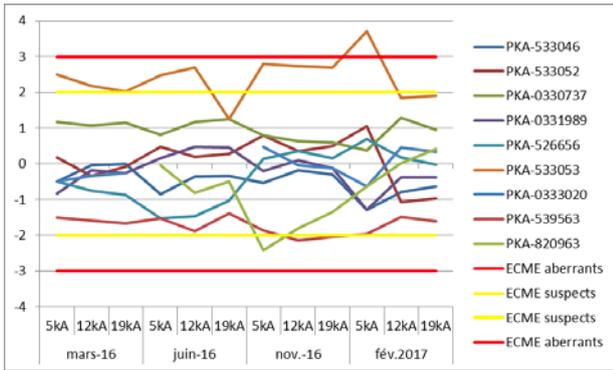
Meanwhile, we use another metrological tool to optimise periodicities. We called it FDX because it is based on the X07-014 documentation. FDX allows us to compute the optimal periodicity and to estimate calibration values at any time.



The issued results must help us to see future behaviour of one piece of equipment. OCEAN and FDX studies are a part of the ECME life sheet, as verification or calibration reports.

8 Inter-Equipment Comparison (C2I)

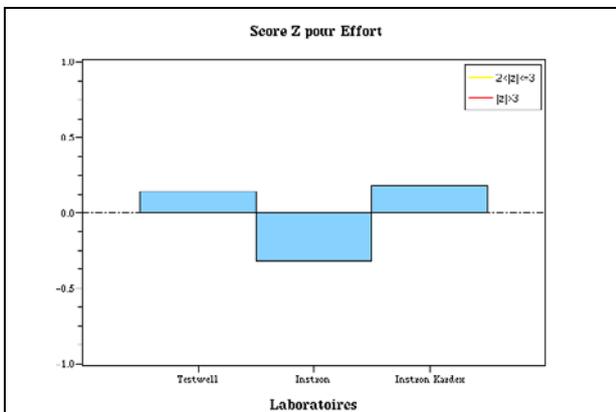
The main interest here is to know the conformity of a batch of ECME in order to assess a global conformity of one process. From now on, we will not look only for the conformity of one piece of equipment anymore.



As you can see above, we calculate the Z-score on many dates thanks to the results of measurement. In that case, there are nine same ECME. One point is “out of line” if it matches with the rule: $|z| > 3$. This way, we can demonstrate coherence between results despite the differences.

Crossed monitoring is an interesting way to avoid useless calibration of one or many ECME.

In the case below, we replaced a strength sensor on a traction or compression machine. Instead of making a calibration cost, the factory would prefer to do four measurements on these three machines.



Z-score results show us the consistency between measurements, then we can conclude that the new sensor’s machine is in accordance.

When a standard measurement is a part of C2I, we better calculate a standard deviation.

This important process upgrade is already used within some factories but it will become widespread in 2018 thanks to the rewriting of our reference documents.

9 To look for “mouda” and erase them

Too many things in our companies are still done only by habits and not by necessity. Here, metrology can help to transform what has to be transformed. First, metrological documents *have to be analysed*, then approved and finally archived. All traditional calibration, confirmation, measurement and test reports are concerned. In the automobile business, a lot of capabilities are made to take better decisions.

PSA Group created a tool to make metrological documents reliable. It allows us to *rate* every report in

their administrative and technical parts. It is based on ISO 17025, 2005, §5.10. So, we can rate all national and international reports without being dependent on French standards, X07-011 and FD X07-012.

ANALYSE DOCUMENTAIRE (RM-RE)

Analyse suivant la norme PSA A100106

Niveau de l'analyse inf. Douchin: 01200_13_201608 Cible PSA: Solitaire

Document à analyser: RAPPORT DE MESURE T00E' EXPOSEE A LA METHODE I00M Date de l'essai: 03/04/2017

Boite PSA / Prestataire: DODIOMHICOPFICOMI/OEM

Analyse: Rapport de mesure avec conformité selon demande d'intrique

Conclusion: Rapport très correct. Quelques unités fautes à retourner sur ordre accessible

Page de genre	Appréciation	Commentaires: items mais obligatoires
PRÉLU & INTRODUCTION	2	Titre et numéro de document: Référence 01200_13_201608 et complétabilité
Identification de la société qui a réalisé l'essai	2	Uniquement service C2I/C2I/... il faudrait: type à reprendre sur l'axe imaginaire
Identification du document	2	N° de rapport sur chaque page: pagination ok
Identification de la demande et du demandeur de l'essai	2	Demandeur: service: tel. date de la demande: n° de la demande d'intrique
Identification de la personne ayant réalisé la mesure/l'essai, dates et lieu	2	Méthodique, tel. date de la mesure, lieu de la mesure
Validation du document	2	Validation: validation sans fonctions à date
Buil de l'essai / Introduction	2	Objet de la mesure
Conclusions	1	Il ne est pas explicitement précisé si la conformité est donnée avec ou sans prise en compte de l'incertitude de mesure
Coupe du document	Appréciation	Commentaires: items mais obligatoires
Identification de l'objet soumis à l'essai ou à mesure	2	Présentation: angle, état, n° de lot de départ
Conditions de réalisation de l'essai	2	Température (°) (environnement à contrôler) et l'ergonomie
Identification des moyens de mesure ou/ou étalon	2	n° IMPT et logiciel évalué
Identification de la méthode de mesure/l'essai ou référence à un document	2	410 8600
Incertitude de mesure	2	Incertitude donnée avec une niveau de confiance 94% (sans KI)
Présentation des résultats	2	Unité indiquée avec l'opérateur (sans KI)
Objets ou résultats de mesure/l'essai (Axi et manipulations)	2	Unité indiquée sur la demande / décalage en n° de mm
Annexe 1 / 1	2	Annexe 1 / 1
Annexe 2 / 1	2	Annexe 2 / 1
Annexe 3 / 1	2	Annexe 3 / 1
Annexe 4 / 1	2	Annexe 4 / 1
Annexe 5 / 1	2	Annexe 5 / 1
Annexe 6 / 1	2	Annexe 6 / 1
Annexe 7 / 1	2	Annexe 7 / 1
Annexe 8 / 1	2	Annexe 8 / 1
Annexe 9 / 1	2	Annexe 9 / 1
Annexe 10 / 1	2	Annexe 10 / 1
Annexe 11 / 1	2	Annexe 11 / 1
Annexe 12 / 1	2	Annexe 12 / 1
Annexe 13 / 1	2	Annexe 13 / 1
Annexe 14 / 1	2	Annexe 14 / 1
Annexe 15 / 1	2	Annexe 15 / 1
Annexe 16 / 1	2	Annexe 16 / 1
Annexe 17 / 1	2	Annexe 17 / 1
Annexe 18 / 1	2	Annexe 18 / 1
Annexe 19 / 1	2	Annexe 19 / 1
Annexe 20 / 1	2	Annexe 20 / 1
Annexe 21 / 1	2	Annexe 21 / 1
Annexe 22 / 1	2	Annexe 22 / 1
Annexe 23 / 1	2	Annexe 23 / 1
Annexe 24 / 1	2	Annexe 24 / 1
Annexe 25 / 1	2	Annexe 25 / 1
Annexe 26 / 1	2	Annexe 26 / 1
Annexe 27 / 1	2	Annexe 27 / 1
Annexe 28 / 1	2	Annexe 28 / 1
Annexe 29 / 1	2	Annexe 29 / 1
Annexe 30 / 1	2	Annexe 30 / 1
Annexe 31 / 1	2	Annexe 31 / 1
Annexe 32 / 1	2	Annexe 32 / 1
Annexe 33 / 1	2	Annexe 33 / 1
Annexe 34 / 1	2	Annexe 34 / 1
Annexe 35 / 1	2	Annexe 35 / 1
Annexe 36 / 1	2	Annexe 36 / 1
Annexe 37 / 1	2	Annexe 37 / 1
Annexe 38 / 1	2	Annexe 38 / 1
Annexe 39 / 1	2	Annexe 39 / 1
Annexe 40 / 1	2	Annexe 40 / 1
Annexe 41 / 1	2	Annexe 41 / 1
Annexe 42 / 1	2	Annexe 42 / 1
Annexe 43 / 1	2	Annexe 43 / 1
Annexe 44 / 1	2	Annexe 44 / 1
Annexe 45 / 1	2	Annexe 45 / 1
Annexe 46 / 1	2	Annexe 46 / 1
Annexe 47 / 1	2	Annexe 47 / 1
Annexe 48 / 1	2	Annexe 48 / 1
Annexe 49 / 1	2	Annexe 49 / 1
Annexe 50 / 1	2	Annexe 50 / 1
Annexe 51 / 1	2	Annexe 51 / 1
Annexe 52 / 1	2	Annexe 52 / 1

Taux d'aptitude documentaire (RM-RE): 88%

Attribution de la note de mesure/l'essai: 0 / 100

Taux d'aptitude documentaire: 88%

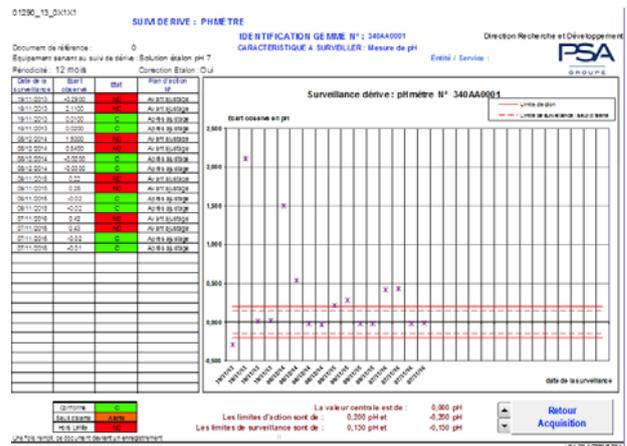
Document non acceptable

Thanks to this tool, evaluations of our service providers are more reliable. We currently evaluate them with our intern reference document A109000 which is based on ISO 17025. It is made of 52 points dispatched on 8 chapters:

- Quality, documents and team management
- Premises and environment
- Management and control of measurement equipment
- Measurement
- Application tests

10 Check maps for ECME

By systematically doing our periodic calibrations and verifications, we lose the metrologist’s critical mind. Our goal is indeed to renew this method in order to reveal a process mistake before detecting any non conformity. In the example below, we go further. We analyse annual calibration results of the last four years.



If a piece of equipment is yearly non-compliant, that means periodicity is not adapted. Moreover, the piece of equipment being a pH-meter makes calibrations useless. According to the instructions sheet, this site does nothing more but a “*calibration before use*”.

Subcontracting has settled within our company. Service providers have been calibrating our equipment for many years. Today, they have to discover with us the *visual management of measurement*. We all know that a graphic is easier to understand than a lot of numbers.

11 Conclusion

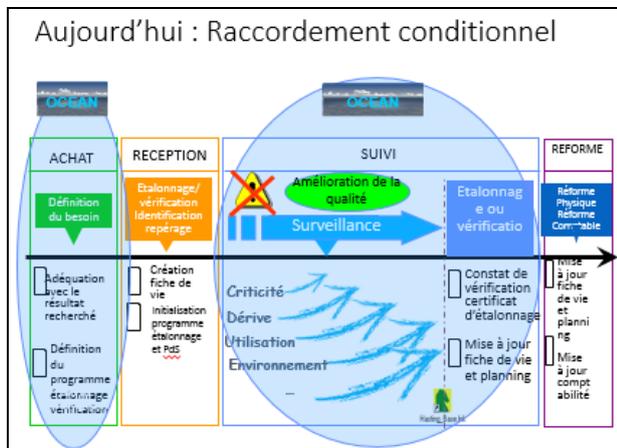
It's more and more obvious that conformity of parks of equipment or of processes is not due to periodic systematic calibrations and verifications.

Our machines are constantly monitored by our daily routine and calibrations are made during annual preventive maintenances. Therefore, another annual calibration of each machine is useless. At PSA Group, these annual calibrations are progressively being reduced. From now on, we will plan preventive maintenances instead of periodic verifications.

Some of our machines check also the compliance of products with control assemblies. As it is highly improbable that both deviations compensate each other, we do not need as many periodic verifications.

Periodic systematic calibration and verification don't assure daily conformity of products and processes, it's *products and processes monitoring* which are made every day by equipment users that guaranty it.

By this assessment, PSA Group makes *conditional calibration* its first choice. When a shift is detected by monitoring, we do a metrological intervention which is justified.



The new metrologist's leitmotiv will become: “any piece of measurement equipment involved in a product/process monitoring needn't to be periodically systematically calibrated and verified”. The ECME is monitoring itself thanks to product and process monitoring (and of predictable results). Every extra operation becomes useless.

PSA Group just starts this revolution. Then nobody could say that metrology is useless anymore.