

WHITE PAPER

DIGITAL PATHOLOGY AT PARIS SACLAY HOSPITAL GROUP

Process, Benefits and Recommendations



SUMMARY

In the past few years and thanks to the latest technological advances, digital microscopy has revolutionized the clinical pathology practices. In 2018, the Paris Saclay Hospital Group took part in this revolution by integrating digital pathology for routine diagnosis.

This document aims to present the experience of Paris Saclay Hospital's pathology department. First, we will see the process that has been put in place to initiate the technological transition and its current progression. Then, we will analyze the results and benefits identified following the pathologist workflow modifications. Thirdly, we will study the future projects of the department which are related to the development of digital pathology, especially in terms of artificial intelligence algorithms and slide storage. Lastly, in the closing section, Dr Guettier - Head of the Pathology department and professor at the University of Paris Saclay - and her team will give some advice to start a successful transition.

This white paper outlines the various benefits of the technological changeover which can be summarized as: an increased productivity, the elimination of time-consuming tasks, an improved laboratory performance and reduced costs. Through the experience of the Paris Saclay Hospital Group, we will see how digital pathology allows pathologists to contribute to the improvement of patient care.

1 The Paris Saclay Hospital Group (HG)

Paris Saclay HG is organized around 3 sites : Kremlin-Bicêtre, Antoine-Béclère and Paul-Brousse located on the south bank of Paris within a 15 km radius. For a better allocation of resources and to save money, **it was decided to regroup the three pathology services on a single site based at Kremlin-Bicêtre Hospital.** This reorganization took place in two stages, first in 2008 with the repatriation of the Paul-Brousse pathology service to Kremlin-Bicêtre, then in 2018 concerning the pathology service of Béclère. This paper follows the evolution of the implementation of digital pathology and its advantages in the department of Dr Catherine Guettier.

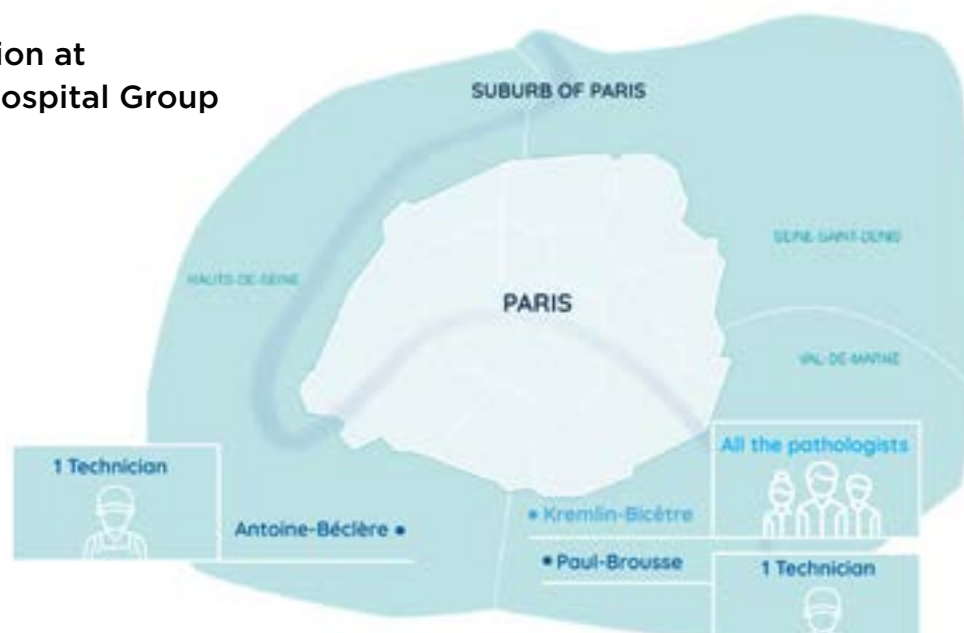
Dr Guettier is Professor at the University of Paris-Saclay. She is also **Head of Pathology department at Paris Saclay HG.** She has been involved in several digital pathology projects from an early stage : teaching, frozen section examinations, and pilot project in routine diagnosis for Greater Paris University Hospitals (AP-HP).



Dr Guettier

Today, digital pathology is integrated on a daily basis into its workflow. Currently, all slides are produced at Kremlin-Bicêtre, where all the pathologists are gathered. On the other two sites, only one technician is present to organize frozen sections examinations. As of today, the team is composed of 11 pathologists, 21 laboratory technicians, and 2 residents for a **digitization of approximately 1100 slides per day**, including pediatric, geriatric, and all types of surgical cases. In total, **about 39,000 examinations are carried out each year.**

Teams allocation at
Paris Saclay Hospital Group

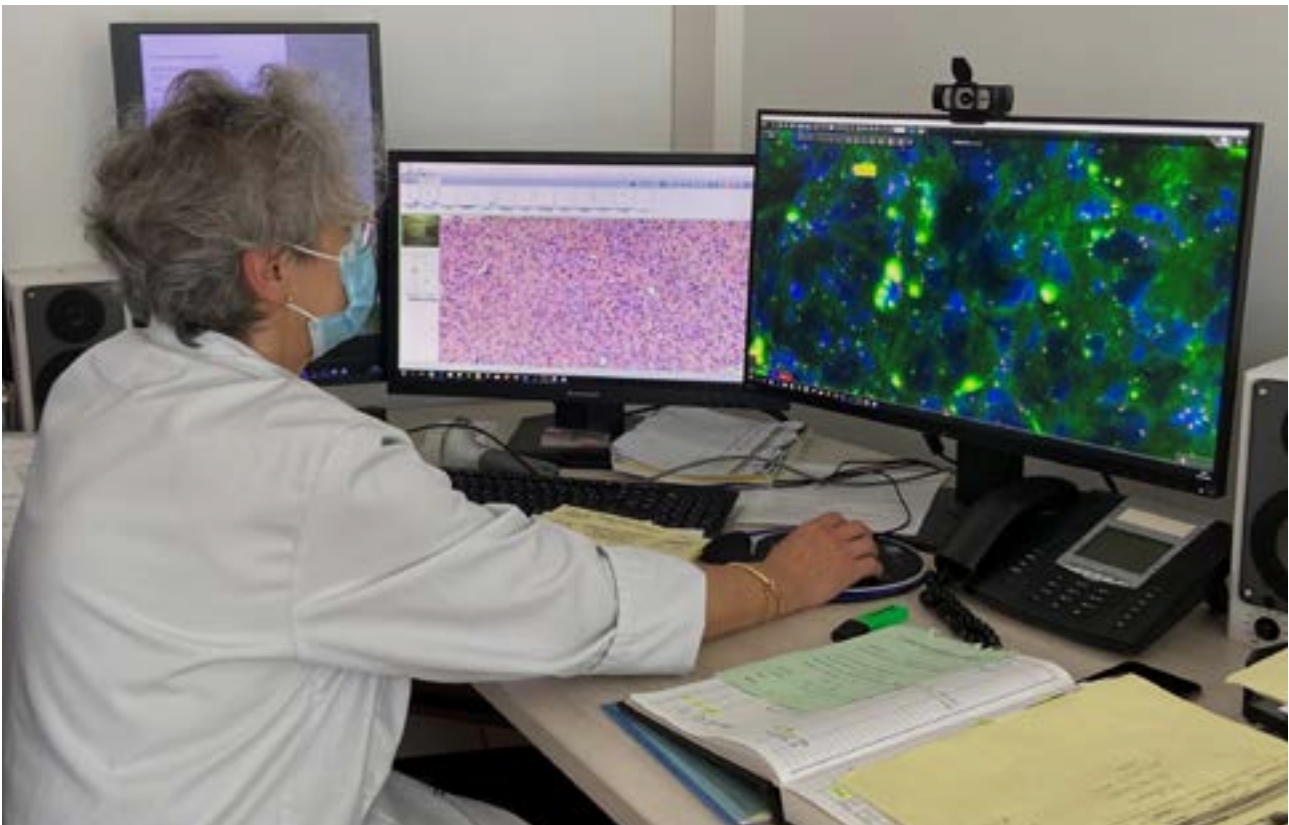


2 The digital transition

The digital transition has taken place gradually within Paris Saclay HG. The story has started in 2007 with the use of digital technology for teaching, the hospital received its first scanners with a vision focused on education. Indeed, previously it was necessary for the university professors to prepare boxes of slides in several copies for students and it was complicated according to Dr Guettier. Digitization has allowed to introduce a more lively pedagogy, with online anatomical-clinical files and without microscope.

Then, in 2013, Paul-Brousse hospital took part in a pilot experiment in the Ile-de-France region for telepathology and second opinions. Following this experiment, the digital slides were also used during multidisciplinary staff meetings thanks to CaloPix Image Management System (IMS). And since 2017, pathologists are involved in AI for research, such as counting ovarian follicles, nerve fibers, etc.

In 2018, the hospital group invested to work exclusively in digital for routine diagnosis. In the same year, the three departments of the hospital group were merged into one new facility, and *“The arrival of Kremlin-Bicêtre in a new building triggered the logical continuation of events, i.e., to use digital slides for routine diagnosis”* stated Dr Guettier.



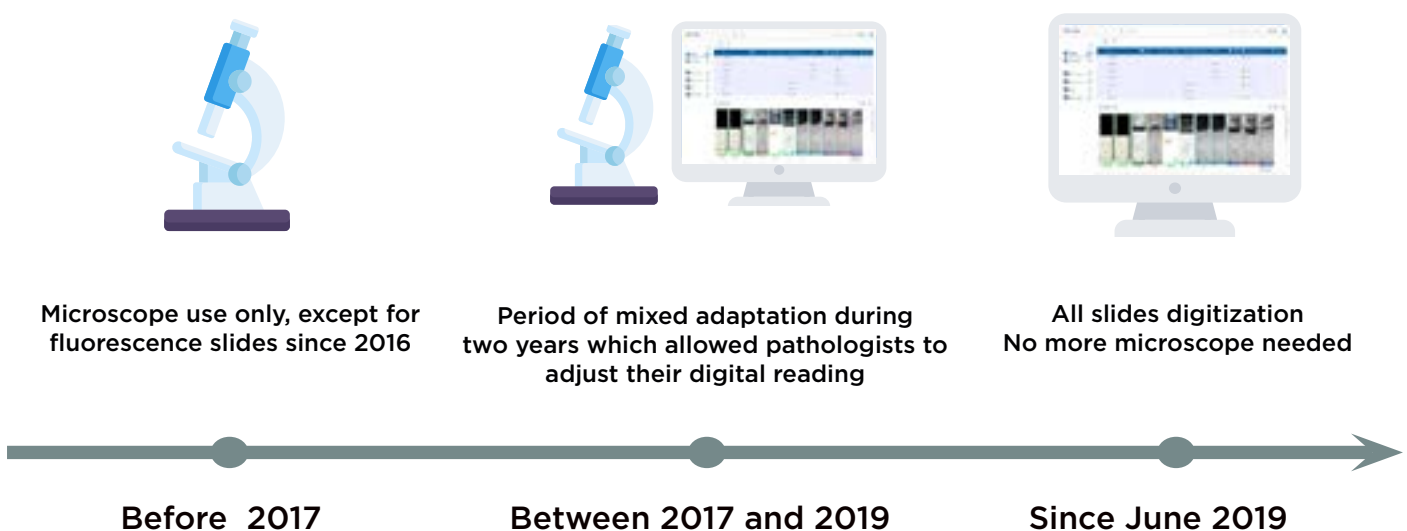
3 The process to initiate the transition

According to Dr Guettier the implementation process was greatly facilitated by the determination of her team. Indeed, the desire to make the digital transition was collective. Initially, from 2016, only the fluorescence slides were digitized. Then the slides were digitized by sector of activity according to the doctors, and finally, **the integral digitization of all slides (100%) has been implemented since June 2019.** This transition was therefore made through a digitization by steps and sectors of activity but also through a specific self-validation process. **Pathologists went through a period of mixed adaptation between glass slides and digital slides.** This period lasted two years and is now gradually coming to an end. This soft implementation process allowed the doctors to judge for themselves the differences between the two types of slides.

They were therefore able to adjust their reading according to digital slides or glass slides. This successful digital transition is the result of a “non-forced and voluntary conversion”. Indeed, Dr Guettier stated, *“we did not want to make a big-bang of digital pathology, we implemented the digital slides scope by scope”*. According to her, the AI aspect of digital pathology also helped in the easy integration of this digitization :

“In parallel and to encourage the adoption, we decided to set up collaborations with different companies for the creation of diagnostic assistance algorithms, because artificial intelligence aspects is the primary purpose of digital pathology”.

Soft Implementation Process of Digital Pathology



Equipments and software



PANNORAMIC 1000 by
3D Histech

Today, the hospital is equipped of five scanners with different scanning capabilities. They notably use the PANNORAMIC 1000 scanner from the supplier 3D Histech. The capacity of this scanner is up to 1000 slides, with a throughput of up to 100 slides/hour. Its robust design offers a reliable solution for high volume whole slide creation.

CaloPix Image Management System (IMS) software is used for imaging management and analysis. Directly linked to the laboratory management system, **CaloPix allows the association of images with patient data.** These are automatically imported from the scanner into the corresponding patient file and stored in the centralized image database.



CaloPix by
Tribun Health



TeleSlide by
Tribun Health

Otherwise, the hospital uses the **TeleSlide tele-pathology solution for frozen sections examination remotely** within Paul-Brousse and Antoine-Béclère hospitals. Moreover, **pathologists use the tele-expertise platform called SOSlide** in partnership with Tribun Health, **which manages the AP-HP's image system and hosts health data.**

Tribun Health also equips the University Hospitals of South Paris with Macro. Linked to CaloPix, it allows to draw on the gross pictures the location of histological samples.



MACRO by
Tribun Health

4 Results and benefits

Before reaping the full benefits of the digital transition, the Paris Saclay HG had to deal with a few technical obstacles during the pre-analytical phase. It was necessary to adjust the quality of the sections, to increase the stability of the stains and to adjust the cut drying process to avoid blurring problems... but in fine Dr Guettier stated that: *“This digitization has led us to greatly improve our pre-analytical phase to increase the quality of the sections, the homogeneity, the stability of the staining and the drying of the sections”*. Then, following this adaptation phase and thanks to the help of an imaging engineer, the adoption among the doctors was progressive. **Currently, 90% of the pathologists are 100% digital.**

In addition, the **TeleSlide telepathology platform** allows them to overcome the problems of distribution and availability of doctors between the sites. Frozen section examinations are performed remotely by examining the slide on screen and are facilitated by close collaboration between pathologists and technicians.

Furthermore, **within the hospital, pathologists send cases to each other internally to obtain a quick and efficient second opinion.** This saves a considerable amount of time, as each pathologist can perform any task from his/her own workstation.

The hospital also estimates that digitization saves pathologists' time thanks to automated slides grouping within the right folders. Indeed, Dr Guettier claimed *"We save medical time at first, we especially save time because we do not spend our time looking for the immunostaining slides and putting them on the same plate as the IHC slides; and now that we read digitally, we also save time examining"*.

Moreover, thanks to archiving, it is no longer necessary for them to go to the stock room to look for patient cases. However, archiving is a current issue that the hospital is addressing and that will be approached in the next section regarding the future.

In addition, **AI research projects are very stimulating for pathologists of the digital pathology project, and promise a bright future with the elimination of time-consuming tasks such as counting or detection of tissues.** They also allow a very high robustness in the establishment of diagnoses. The pathologists of the department already use image analysis algorithms developed by Tribun Health for the quantification of hepatic fibrosis and the analysis of TMA slides.

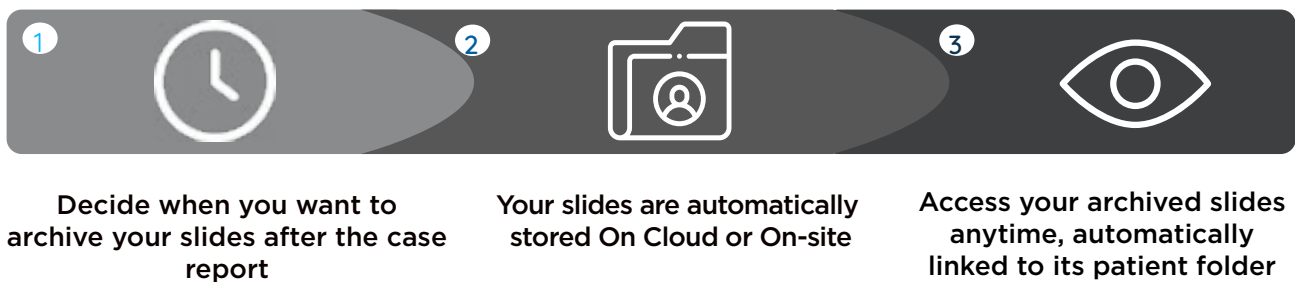
Lastly, digital pathology brings an even greater advantage since the health and social crisis of the coronavirus. Indeed, **it is possible to work remotely thanks to an unlimited access from everywhere and at any time of the digitized slides.**

To conclude Dr Guettier stated *"The rate of digital adoption is now excellent. Digital technology makes it possible to display gross and microscopic images at the same time, to have a global view of the samples, to measure distances on slides, to quantify elements very simply and to compare the different sections between them or with previous samples, but also to quickly ask a colleague for an opinion without moving from his office. It is also more comfortable and less tiring visually"*.

5 The future of digital pathology : challenges and upcoming projects

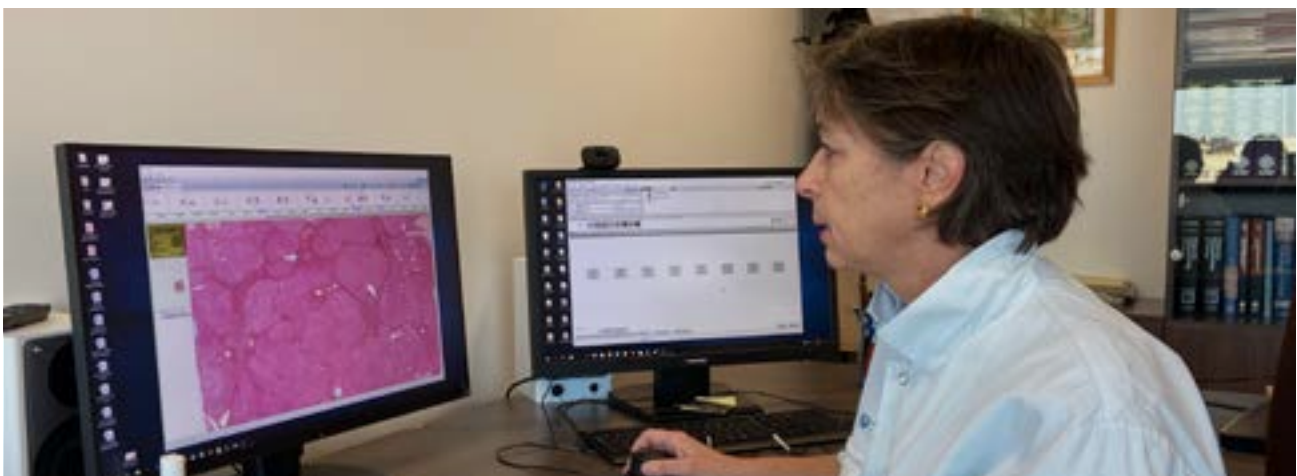
Paris Saclay HG is currently facing some challenges regarding the optimization of digital pathology. First, the department must face storage problems. Currently, one month after the validation of the diagnostic report, the virtual slides are deleted due to lack of storage space, and only few slides can be kept for a longer period if the pathologists consider it necessary. Thus, **Tribun Health proposes a dedicated archiving solution that is automated and makes huge storage space savings.**

Explanatory diagram of the automatic archiving «CaloPix Archive»



Regarding future projects, the hospital has the ambition that all its pathologists move to 100% digital diagnostics. The integration and adoption of digital pathology in all departments is planned for the next three years. **Currently all slides are digitized and almost all the team has gone digital but there are a few people missing before the transition to 100% digital.** The team wishes to develop research and teaching projects based on digital slides.

In addition, the department has a proactive vision of digital with the ambition of projects in AI and the development of algorithms to assist diagnosis. The AI projects represent a real added value in the future with the creation of algorithms specific to different problems such as: small fiber neuropathies, prostate cancer, breast cancer, digestive biopsies, liver tumors... Thus, the department wishes in the future to integrate new artificial intelligence algorithms into the CaloPix Image Management System.



6 Their recommendations to initiate a digital transition

Dr Guettier recommends that **the project must be supported by the entire team and be the result of a collective decision for a smooth transition.** According to her, it is also **essential to think carefully about the desired equipment beforehand** to properly assess the number of scanners needed according to the number of slides studied (sequential process), and to establish a set of specifications. Such a large-scale project also **requires regular monitoring**, and the **support of an imaging engineer** is “precious” and necessary.

She also points out that **before obtaining all the benefits of the digital transition, an adaptation phase is unavoidable** and that the self-validation period between the glass slides and the digital slides requires an even greater workload than before, which during the first months is quite tiring. Nevertheless, after this mixed phase and **with digital only, an important working time is saved as well as a gain in working comfort.** Dr Guettier also highlights the importance of equipping computers with graphic cards and having two monitors to have a more operational workstation for slide analysis.

In addition, the hospital emphasizes the need of a follow-up from the industry, and therefore from scanner suppliers, and from digital image analysis solutions. The pathologists and Dr Guettier stated *“The possibility of co-development with pathologists is really important to have feedback on what is happening in reality”*. Indeed, the pathologists would like to set up more co-developments with industrials to develop an even more efficient image analysis software that perfectly meets their expectations.

According to Dr Guettier and most of her pathologists, **the transition to digital pathology is an unavoidable evolution in pathology, notably for the flexibility it brings such as sharing cases remotely, biomarkers quantification, and the diagnostic assistance algorithms that allow pathologists to avoid long and fastidious tasks.**

For more information on our solutions, please visit www.tribvn-hc.com or contact us at contact@tribvn-hc.com. We look forward to hearing from you.