# Le profil professionnel des docteurs

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## Research engineer in image processing and data science

### Cœur de métier

*PHASE 2* **Développement des compétences**

- assist to several class or conferences to improve the needed skills: deep learning, propagation of uncertainty, wavelet, PCA (Principal component analysis), frequency probabilities, entrepreneurship - learning by reading the state of the art with technical books, articles or dissertations.

*PHASE 1* **Évaluation**

- comparison of different databases: Stark broadening, atomic spectra databases - crossed reading of several articles - calibration of experimental setup: estimation of uncertainty with limit of instrument and statistical measurements - estimation of numerical model uncertainty with a Monte Carlo method - use reviews of expert from different disciplines to validate and develop new experimental and numerical methods.

*PHASE 1* **Gestion de l'information**

- read articles, dissertation in different language: French, English and Germain. - use bibliographic, patent and intern databases to identify the resource - if possible, use crossed validation between different research work, article or experimental result: merge of spectroscopy databases (NIST and Kurucz), identification of wrong Stark broadening for aluminium spectral lines. - use of Zotero, Mendeley - use of intern database (spectroscopy database, articles, report)

*PHASE 2* **Expertise et méthodes**

- improving and development of new methods for non-linear tomography applied to lightning - work on multiphysics problems : plasmas physics, photonics and data processing - collaboration with expert from different disciplines: lightning certification, plasma physics, photonic, data processing - go to difference conferences: deeplearn 2019, ICOLSE 2019… Read technical books and articles depending of the need - estimate experimental uncertainty (uncertainty of devices, repeated measurement) and numerical uncertainty (Monte Carlo method, repeated measurement) - presentation of the work and ongoing difficulties to expert from different discipline as from general public. In order to get review or to present the work (visit of the lab, popularisation events, intern meeting or technical meeting).

### Qualités personnelles et relationnelles

*PHASE 2* **Communication**

- realisation of various kind of communication: for general public (Open House Day of ONERA and EDF), general scientific public (presentation of the work for team from other discipline), specialized public (conferences and internal meeting) - various media of communication: article, PowerPoint presentation, poster and oral presentation (conference, meeting,…) - internship in Germany (Nuremberg) - article and conference in French and English

*PHASE 3* **Analyse, synthèse et esprit critique**

- achievement of new method to analyse data : new method for non-linear tomography, the accuracy of the tomography reconstruction is increase progressively, use the form of spline function to define the local thermodynamic values (the function are not fitted with limited number of point used for the interpolation), method to estimate the uncertainty, an entropic criterium to select the spectral range for spectroscopy with allow a better determination of local thermodynamic values. - introduction of the work during conferences or meeting - writing publication : PhD dissertation, articles for conferences, one foresaw article of the entropic criterium to determinate the optimal spectral range for spectroscopy

### *PHASE 2* Ouverture et créativité

- design and realisation of several experimental setup and data analysis method to measure the interaction of lightning and material. - development of physic model to fit with the experimental measurement (vaporisation, spectroscopy, mechanics) - work with people from different backgrounds: private and public laboratories, different research teams (aeronautical certification, plasma physic, spectroscopy, photonic, data processing) - work on interdisciplinary projects: working and collaborate with people from different discipline (aeronautical certification, plasma physic, spectroscopy, photonic, data processing) - take advantage of the diversity of people in order to achieve the PhD

### *PHASE 2* Engagement

- commitment in opensource project (LibreLatex). I had adapted to a various kind of tasks: leadership, project management, team management, programming, legal aspects, marketing campaign (contact with all French universities) , blog post writing and website development. - Inspires the enthusiasm and commitment of his staff: keep the same team during the project life, regular work, gratitude of their work, commitment of the team in the project decisions

### *PHASE 1* Intégrité

- measurement and uncertainty were publish together. All factor of uncertainty were taken into account. - the experimental conditions are published. - all work from other co-worker or research team used are quoted - take into account the interest of the academic laboratory as the host company

### *PHASE 1* Équilibre

- presentation in front of different audience: general public (conferences for general public, presentation of the laboratory for general public, Open House Day), for general scientific or engineer (for people from other discipline) and for specialized audience (intern meeting, conferences) - exchange with people of different research group in order to take advantage of their expertise, to validate the hypothesis, setup or method and to develop new ones. - improving my knowledge by assist to conference and class, and by reading specialised article or technical books. - I'm able to reconcile career and personal life: I drove the development of an opensource project during my PhD and finish successfully both of them.

### *PHASE 2* Écoute et empathie

- I take into consideration the interest of each people (CentraleSupélec vs ONERA) - the measurement make during the PhD were done according to the need of the validation, in order to validate the simulation model. (ONERA) - I'm regularly encouraging people for their task and I don't hesitate congratulate my co-worker for their work. (LibreLatex) - I adjust the workload of my co-worker according to their availability (LibreLatex)

### *PHASE 1* Négociation

- different interest need of various of result vs need of quality in order to publish in review (ONERA vs CentraleSupélec) - adjustment of the PhD schedule to fit with availability of the laboratory et the personnel

## Gestion de l'activité et création de valeur

PHASE 1 **Conduite de projet**

- planning of the PhD and the opensource project LibreLatex with a consideration of priorities of the different tasks. - take into account the need and availability of people and experimental facilities to define the planning and to know which tasks have priority. - define the specification for the experimental setups as for the data processing - react to the unforeseen events: use of mask for the spectroscopy, proposal and realisation of new methods for tomography reconstruction - to estimate the accuracy of all the acquisition chain, an evaluation of experimental uncertainty as the numerical uncertainty have been realised.

PHASE 1 **Gestion des risques**

- risk of the project: the critical steps are determined with a Gantt diagram - risk of the result: the complexity of the model was increased continuously during the PhD in order to always have something useable (first method of reconstruction, second method of reconstruction).

PHASE 2 **Prise de décisions**

- proposal of new solution or optimisation adapt to the need: phase change model, tomography reconstruction methods. - fit with the experimental condition: the old calibration lamp was making a non-uniform light. To use the calibration, I supposed a spatial dependency to correct the calibration. After buying a new calibration lamp, we were able to validate the first calibration obtain with thus assumption. - implementation of alternative solutions: use of PCA to reduce the calculation or calculate the entropy, use of mathematical simplification consistent with the physic of lighting arc to reduce the calculation. - proposal of a reschedule of the PhD in order optimize the available time.

PHASE 1 **Management des personnes et des équipes**

- Leadership of an opensource project – team of 3 volunteer (LibreLatex) - acknowledgement of the work of other people: citation of source in article, as in the dissertation or in presentation - regularly reporting of my work: one time per week during the first lockdown. - bring new idea for the experimental part as for the processing of data: new experimental setup to measure the mechanical deformation (new pattern and optical configuration), count of drop of water (method of detection, reducing of the noise), detection of the mechanical deformation (subpixel detection)

PHASE 1 **Production de résultats**

- work area from the design to the realisation and use: tomography and spectroscopy setup, reconstruction methods for spectroscopy, entropy criterium, phase change model - use of the first result in order optimise the innovation: optimisation of the reconstruction methods and of the spectral data bases. - use of a gradual development: gradual improving of the spectral data base, of the reconstruction methods, of the reconstruction complexity and of the phase change model. - take the necessary time to develop the different step of the research and maintain a consistent reasoning in order to publish (change phase model, entropy criterium)

PHASE 1 **Propriété intellectuelle et industrielle**

- citation of the sources - take into consideration intern report or restricted document

## Stratégie et leadership

PHASE 1 **Stratégie**

- laboratory interest: the experimental measurements are realised in order to provide a useful data base to validate the simulation results - distributing of the tasks to the different members of LibreLatex project in accordance with their availabilities and specialities. - initial contact with expert from other teams in order to bring a better expertise for the different part of the PhD (High-performance computing, development of physical model, data processing, photonic)

PHASE 1 **Leadership**

- Leadership of the opensource project LibreLatex - keep the team during several years (LibreLatex) - planning of the PhD schedule according to availability of peoples, material and facilities - collaboration with other research team in order to implement some diagnostic with objective to write an article.