
# Fibre Optic Nonlinear Technologies [FONTE] - A European Industrial Doctorate [GA766115]

## Document Details

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## Dissemination level

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| PU | Public | X |
| CO | Confidential, only for members of the consortium (including Commission Services | |

## Project Details

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| Grant Agreement | 766115 |
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| Project Duration | 48 months |

## Consortium

Aston University

NOKIA Bell Labs

TELECOM ParisTech

TU Delft

DTU Technical University of Denmark

## EC Funding

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# Executive Summary

The **2nd year FONTE Workshop and Annual Meeting (Full Network Meeting)** was held on the premises of FONTE's academic partner **TU Delft** (Delft; Netherlands).

Technical presentations were given by all four FONTE ESRs, providing them with an opportunity to demonstrate their scientific progress to the FONTE consortium, answering questions and discussing specificities in detail with the Consortium's scientists, Work Package leaders and fellow ESRs.

As in the previous annual FONTE Workshop, this 2nd year full Network Meeting provided an important opportunity for face-to-face interactions between both ESRs and their academic/industrial supervisors. Since the meeting was co-located with FONTE's Workshop on Nonlinear Fourier Transform, ESRs additionally took full advantage of networking with the large number of NFT-Workshop attendees.

The 2nd year FONTE Workshop also included a management session with the entire FONTE Consortium. Its focus was a review of the current progress of the action, forward planning of the next 6-12 months and a decision-taking forum.

The event took place **4-5 Feb 2020** at **TU Delft**, Delft, Netherlands.


*Figure 1: The FONTE Consortium at TU Delft during the 2nd year FONTE workshop (4 Feb 2020)*

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# LIST OF ACRONYMS

| | |
|---|---|
| AiPT | Aston Institute Of Photonic Technologies |
| AST | Aston University |
| DTU | Technical University of Denmark |
| EC | European Commission |
| EID | European Industrial Doctorates |
| ESR | Early Stage Researcher |
| FONTE | Fibre Optic Nonlinear Technologies |
| NBL | Nokia Bell Labs |
| TU Delft | Delft University of Technology |
| TPT | Télécom Paris/ Télécom ParisTech |

# 1 SECOND YEAR FONTE WORKSHOP

The **2nd year FONTE workshop and full network meeting** was held at the architecturally stunning campus of FONTE's academic beneficiary **Technical University of Delft** (**TU Delft**, Netherlands) on 4-5 Feb 2020. All ESRs attended the meeting and FONTE beneficiaries were represented in person, apart from DTU who joined by skype.

All four ESRs had the chance to **present their scientific work to the FONTE consortium.** Depending on whether or not supervisors deemed the scientific content sensitive, ESRs could choose to speak in either the *closed* network meeting (ESR1; ESR3; ESR4) , or the *public* NFT-workshop (ESR2). Apart from **scientific progress** ESRs were instructed to cover **outreach**, **training** and **dissemination** activities in their presentations

The **2nd year FONTE workshop and full network meeting** provided an important **personal intra-FONTE networking opportunity** and a chance for all ESRs to have face-to-face meetings with their i**ndustrial and academic supervisors** and meet other project partners.

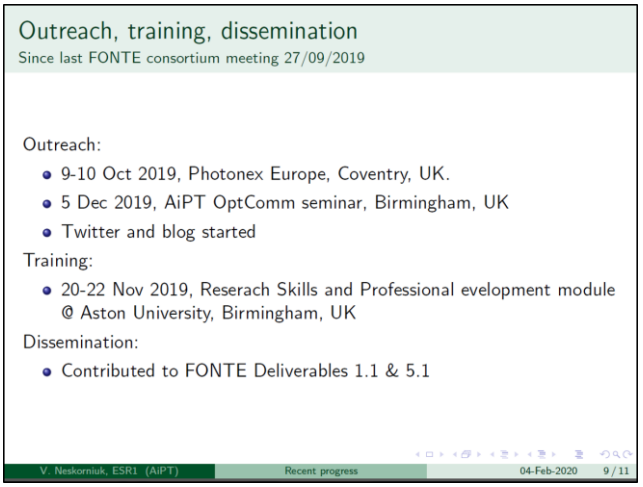
The meeting was co-located with FONTE's Workshop on **Nonlinear Fourier Transform (NFT)**, giving all ESRs a much enhanced opportunity of networking beyond FONTE by allowing them ample interact with the invited speakers to the workshop, as well as the international attendees. FONTE's **NFT-Workshop** is a stand-alone Deliverable D6.7, presented in a separate document available from the Project website at https://fonte.astonphotonics.uk

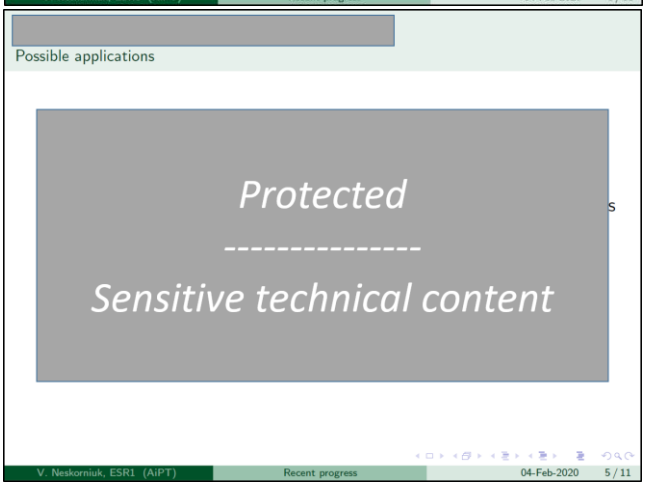
*Figure 2: University library on TU Delft Campus*

# 2 TECHNICAL PRESENTATIONS BY FONTE ESRS

## 2.1 ESR1 VLADISLAV NESKORNIUK (ASTON UNIVERSITY)

Vladislav, in consultation with his supervisors at Aston University and Nokia Bell Labs, elected to present his work in the closed session due to confidentiality issues. Therefore, the technical details cannot be included in this public report and have been redacted in the talk excerpt below.

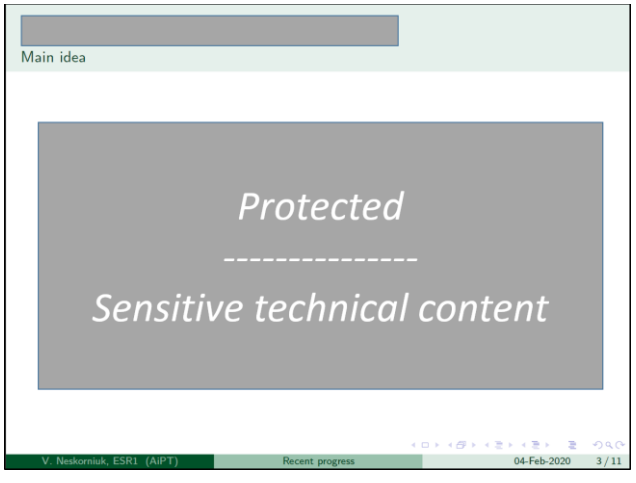




*Figure 3: Confidential Technical Presentation by ESR1 (Vladislav Neskorniuk)*

## 2.2 ESR2 VINOD BAJAJ (TU DELFT), CURRENTLY SECONDED TO NOKIA BELL LABS, STUTTGART

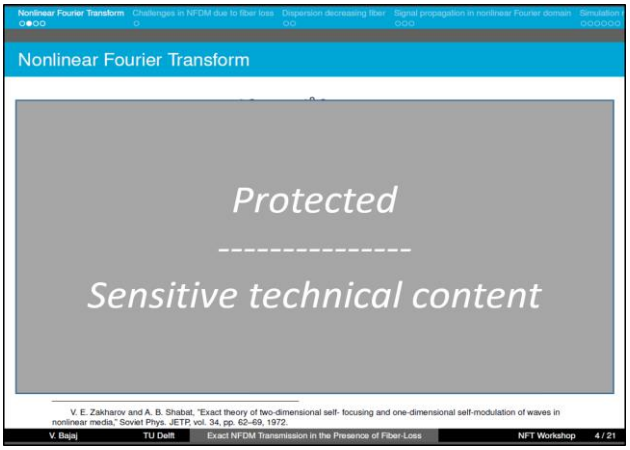
Vinod presented a full talk in the public session of the Open-To-All Workshop on Non-linear Transform, which was co-located with the Fonte 2nd full network meeting. His technical presentation focussed on recent scientific progress. The content of his presentation was closely aligned with work recently published at:

***Proc. 45th European Conference on Optical Communication (ECOC)*, Dublin, Ireland, Sep. 2019.**

**Abstract:**

> *The path-average approximation penalizes NFDM transmission over lumped amplified fiber links. We investigate suitably tapered lossy fibers to overcome the approximation error induced by the path average, making the NFDM transmission exact. Error vector magnitude gains up to 4.8 dB are observed.*

Although Vinod presented in the Open-To-All NFT-Workshop, his talk nevertheless covered as yet unpublished results and has therefore been redacted in this public deliverable.

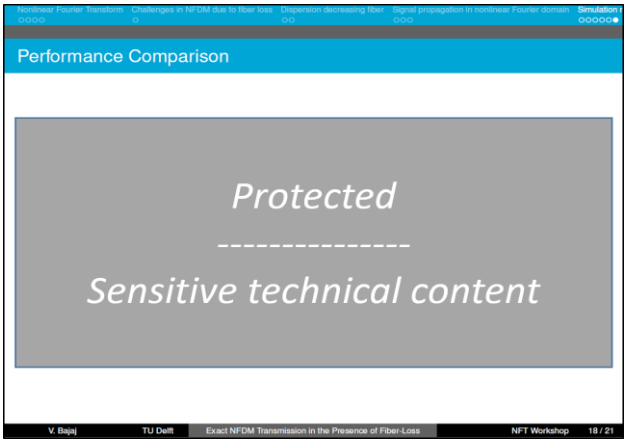
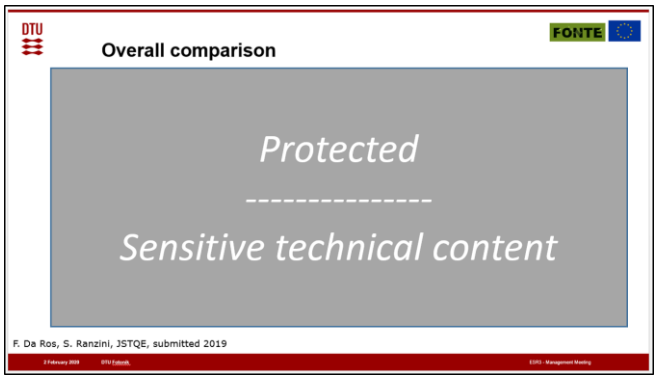




*Figure 4: Technical Presentation by ESR2 (Vinod Bajaj) at the NFT workshop*

## 2.3 ESR3 STENIO M. RANZINI (DTU), CURRENTLY SECONDED TO NOKIA BELL LABS, STUTTGART

Stenio, in consultation with his supervisors at DTU and NBL, elected to present his work in the closed session due to confidentiality issues. Therefore, the technical details cannot be included in this public report and have been redacted in the talk excerpt below.



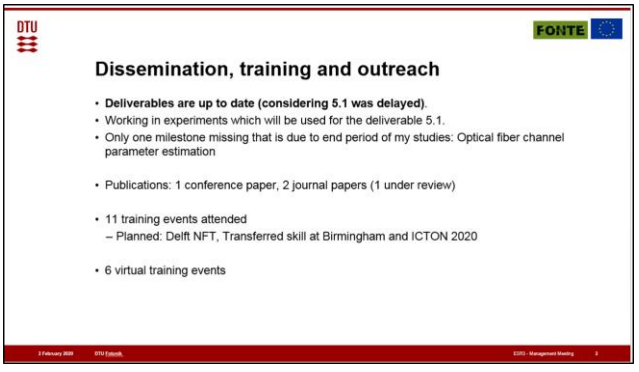




*Figure 5: Confidential Technical Presentation by ESR3 (Stenio M. Ranzini)*

## 2.4 ESR4 ABTIN SHAHKARAMI (TÉLÉCOMPARIS TECH/TÉLÉCOM PARIS)

Abtin, in consultation with his supervisors at TPT and NBL, elected to present his work in the closed session due to confidentiality issues. Therefore, the technical details cannot be included in this public report and have been redacted in the talk excerpt below.


*Figure 6: Confidential Technical Presentation by ESR4 (Abtin Shakarami)*

# 3 SCIENTIFIC TRAINING IN NONLINEAR FOURIER TRANSFORM (NFT)

Additionally, the FONTE 2nd year annual workshop had a strong element of scientific training by leading scientists from *outside* the FONTE consortium. High-level external speakers working in the field of Nonlinear Fourier Transform (NFT) were invited to give talks in a dedicated NFT-workshop. FONTE management was especially pleased to be able to engage internationally reknown leading scientists and high-profile speakers including Prof S Randoux (Universite de Lille ), Prof G El (Northumbria Univ) and Prof P Suret (Universite de Lille). The workshop also included a tutored, hands-on session on using software to compute NFTs, software developed by Assoc. Prof Sander Wahl's group of FONTE beneficiary TU Delft.

A full list of speakers of the workshop is detailed below.

| | Session 1: Introduction to the NFT and its computation |
|---|---|
| 0900-0915 | ***Opening remarks***<br>***ASSOC. PROF SANDER WAHLS***<br>Delft Center for Systems & Control<br>Delft University of Technology, Netherlands |
| 0900-1000 | ***Introduction to NFT***<br>***ASSOC. PROF SANDER WAHLS***<br>Delft Center for Systems & Control<br>Delft University of Technology, Netherlands |
| 1000-1015 | Coffee Break |
| 1015-1100 | ***Numerical computation of NFTs*** Abstract<br>***SHRINIVAS CHIMMALGI***<br>Delft Center for Systems & Control<br>Delft University of Technology, Netherlands |
| 1100-1115 | Break |
| 1115-1200 | ***Periodic NFT and its application in optical communications*** Abstract<br>***DR MORTEZA KAMALIAN-KOPAE***<br>Aston Institute of Photonic Technologies<br>Aston University, UK |

| | Session 2: Applications of the NFT |
|---|---|
| 1400-1425 | ***Dual polarization NFDM systems: From theory to experiments***<br>**PROF YVES JAOUEN**<br>Communications and Electronics Department<br>Telecom Paris, France |
| 1425-1450 | ***Three Different NFT Algorithms for Discrete Spectrum***<br>***DR VAHID AREF***<br>Nokia Bell Labs<br>Germany |
| 1450-1505 | Coffee Break |
| 1505-1550 | ***Recent results about nonlinear spectral analysis in optical fiber and in hydrodynamic experiments***<br>***PROF STEPHANE RANDOUX***<br>Université de Lille<br>France |
| 1550-1605 | Break |
| 1605-1650 | ***NFT for shallow water wave data*** Abstract<br>***DR MARKUS BRUEHL***<br>Delft Center for Systems & Control<br>Delft University of Technology, Netherlands |

| | Session 3: Contributed talks by participants |
|---|---|
| 0900-0945 | ***Spectral theory of soliton and breather gas for the focusing NLS equation***<br>***PROF GENNADY EL***<br>Department of Mathematics<br>Northumbria University, UK |
| 0945-1005 | ***Bound State Soliton Gas Dynamics Underlying the Spontaneous Modulational Instabilitys*** Abstract<br>***PROF PIERRE SURET***<br>Universite de Lille, France |
| 1005-1020 | Coffee Break |
| 1020-1040 | ***Exact NFDM Transmission in the Presence of Fiber-Loss.*** Abstract<br>***VINOD BAJAJ, MSc***<br>Early Stage reasearcher in project FONTE - EID<br>TU Delft (Delft, Netherlands) and<br>Nokia Bell Labs, Germany |
| 1040-1100 | ***Impact of Linear WDM Soliton Superposition on the NFT-Spectrum*** Abstract<br>***JONAS KOCH, MSc***<br>Christian-Albrechts-Universität zu Kiel, Germany |
| 1100-1115 | Break |
| 1115-1135 | ***Joint Detection Equalization on Nonlinear Fourier Transform based optical Communication*** Abstract<br>**KEN CHAN, MSc**<br>Helmut-Schmidt-Universität, Hamburg, Germany |

| | Session 4: Hands-on session |
|---|---|
| 1400-1600 | ***Hands-on session on using software to compute NFTs***<br>Short talks introducing the software, participants bring their laptops and are helped with installing / running first examples.<br>(SANDER WAHLS & SHRINIVAS CHIMMALGI) |

*Figure 7: Complete schedule of talks given by external speakers during the FONTE annual workshop*

# 4 NETWORKING

The 2nd annual FONTE Workshop provided ample opportunity for FONTE ESRs to spend time with both their supervisors from academic and industry, but also network across the wider NFT community by engaging with speakers and attendees of the NFT workshop. As evidenced below, all ESRs took full advantage of this unique opportunity.

*Figure 8: Networking within FONTE and with NFT-Workshop participants*