

# WP3: Data-driven approach to irradiation experiments proposals management and evaluation

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<https://indico.cern.ch/e/radnext-2023>



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# Context of WP03



**Salvatore Fiore**

(CERN)

**WP leader**



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**Deputy WP leader**



**Jaroslaw Mikolaj Szumega**

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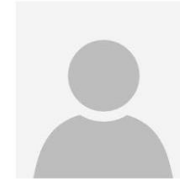
**PhD student**



**Blerina Gkotse**

(CERN)

**Postdoc researcher**



**Pierre Jouvelot**

(Mines Paris, PSL University)

**Senior researcher**

# Context of WP03

## Transnational Access management and harmonization

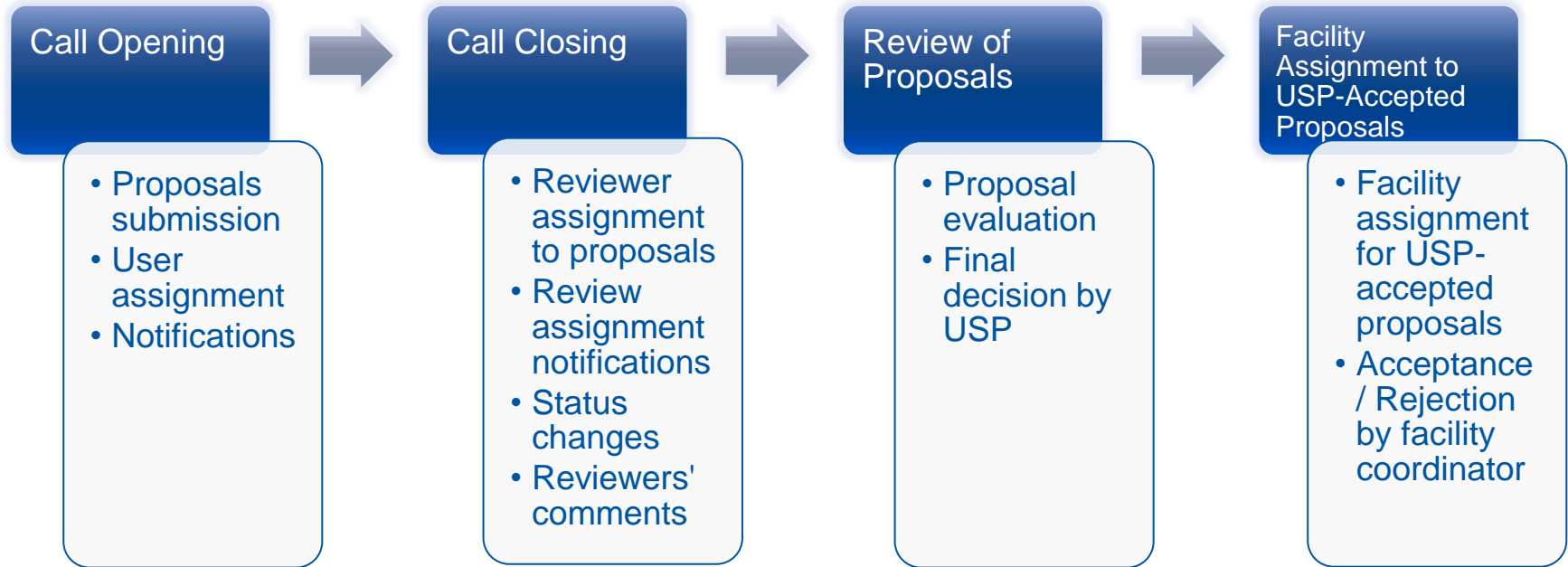
- **Transnational Access activities definition**
  - Application for beam time
  - Coordination of user selection and support
  - Optimised management of tests in facilities
- **Tasks in WP03**
  - TA submission management via Online Portal
  - Data-model definition for users and experiments management
  - **Natural Language Processing techniques to support TA activities**
  - Definition of best practices and procedures

# Content

- Context of WP03
- **Transnational Access submissions management**
  - Beamtime application procedure
  - Radnext TA Online Portal
  - Review of best practices and procedures
- Research on Natural Language Processing techniques
  - Submissions and reviews as data
  - Knowledge extraction
  - Towards automatic assessment
- Conclusions

# Transnational Access submissions management

## Beamtime application procedure



# Transnational Access submissions management

## Radnext TA Online Portal – changes & improvements

- Automatic notifications for facility assignments
- Separation between closed and active proposals
- Additionally, separation of closed and active reviews
- Introduced details of requested beam properties
- Possibility to write comments
- Automated call opening
- Proposal „last modified” to simplify management

# Automatic notifications for facility assignments

## RADNEXT Portal

Edit - Submit Change Status Assign Reviewers View Reviews Final Decision Assign Facility Team Members Delete

### Proposal Details

Proposal title (acronym)

TA07-149: [REDACTED]

Beam Type

Protons

Project abstract

Main objective of the [REDACTED] is to better evaluate the potential of distributed fiber dosimeter for space applications, by using high energy (>100MeV) proton beam to assess the vulnerability of two new generations of miniaturized optical time frequency domain reflectometers (OTDR) to single-event effects. In parallel, the tests will allow calibrating new generations of miniaturized phosphosilicate optical fibers to protons.

Project Description - Excellence section

In 2021, in the framework of the LUMINA project, we developed a point dosimeter sensor that is currently under operation in the ISS. We recently initiated a preliminary study aiming to evaluate the challenges to be overcome to develop space distributed fiber-dosimeters [1]. Those systems combined the use of a radiation sensitive fiber with the one of a reflectometer, usually an OTDR. The OTDR monitors in real-time how the distribution of optical loss evolves along the optical fiber during its irradiation. This TID loss increase is due to the Radiation-Induced Attenuation (RIA) that linearly increases with TID for some specialty optical fibers. The key parameter of such dosimeter is the radiation sensitivity coefficient that was shown to remain similar for a variety of particles and irradiation conditions (see e.g. [1, 2, 3]). Contrary to on-Earth application of these

### Comments

Comment

[Empty comment box]

Comment

**System message** March 10, 2023, 5:44 p.m. UTC

The proposal has been approved by the BL1B facility with the comment: Experimenters should note that the maximum flux achievable at the requested beam spot size is approx  $4E7$  protons/cm<sup>2</sup>/s. Proposal is feasible and can be supported at TRIUMF, but beam availability may only be later than the requested timeline (~Sept instead of July) due to facility maintenance.

- Separated closed and active proposals

The image shows a web interface for proposal management. On the left, there is a list of proposals with titles partially visible: TA07-186: conditions, TA07-187:, TA07-188:, TA07-189:, TA07-190: electron beam, TA07-191:, TA07-192: spectroscopy a, and TA07-193: for the Xilinx 1. A large black redaction box covers the middle columns of this list. To the right, a table shows details for these proposals, including 'Protons', 'Neutrons - Thermal', and 'Protons' in the 'Beam type' column, and 'Facility assigned', 'Reviewed', 'Facility assigned', and 'Rejected' in the 'Status' column. Below this, a 'Past Proposals' button is highlighted with a red box, and a red arrow points from it to a 'My Proposals' table. This table has columns for 'Title', 'Beam type', 'Group Leader', and 'Status'. It lists proposals TA03-19: 12, TA03-25: 03, TA03-26: 04 signal circuits: ap, TA03-27: 06 immunity, TA03-28: 07, and TA03-29: 11. The 'Beam type' column includes 'Neutrons - (quasi)monoenergetic' and 'Heavy ions'. The 'Status' column includes 'Performed', 'Beam assigned', and 'Rejected'. A large black redaction box covers the 'Group Leader' column for all entries in the 'My Proposals' table.



- „Last modified” column added

## RADNEXT Portal

+ Submit Proposal

My Proposals

Proposals For Review

My Proposals

Title	Beam type	Group Leader	Status	Last Modified
TA08- [REDACTED]	Protons	[REDACTED]	Submitted	01/05/2023 19:22:48
TA08- [REDACTED]	Heavy ions	[REDACTED]	Submitted	01/05/2023 19:21:57
TA08- [REDACTED]	Protons	[REDACTED]	Created	03/05/2023 09:44:49
TA08- [REDACTED]	Heavy ions	[REDACTED]	Submitted	06/05/2023 10:45:18

Past Proposals

# Transnational Access submissions management

## Review of practices and procedures in facilities

- Scheduled interviews with Facilities Coordinators to extract knowledge of best procedures in facilities  
(performed by Gerd Datzmann, RADNEXT partner)
- Creating a meaningful guideline and set of rules for RADNEXT beneficiaries
- Sharing the information to unify the best practices

# Content

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  - Radnext TA Online Portal
  - Review of best practices and procedures
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# Research on Natural Language Processing

## Submissions and reviews as data

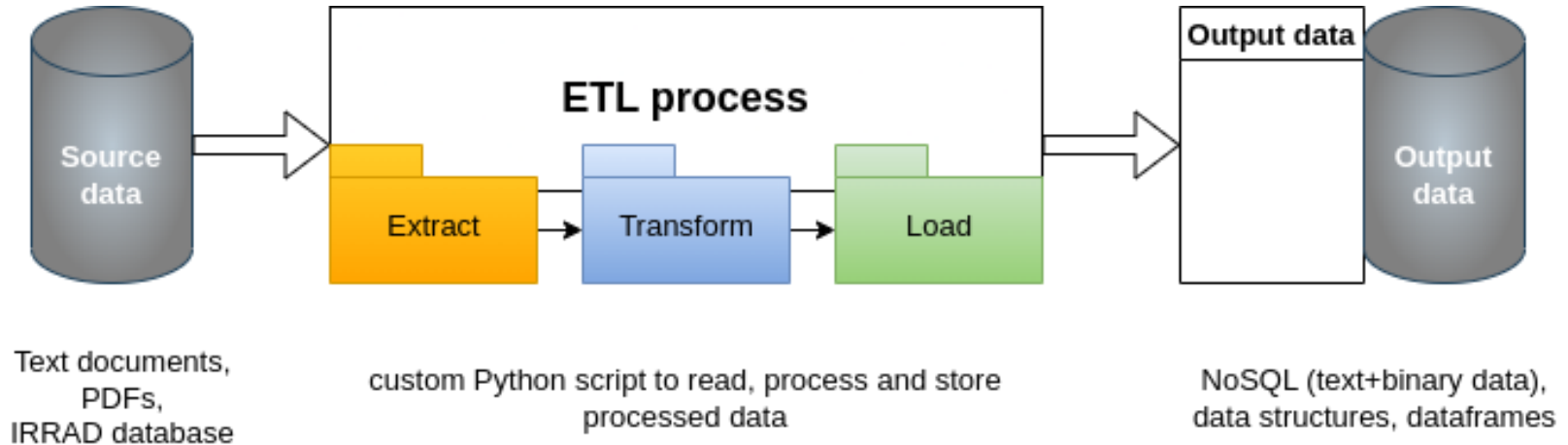
- Data extracted from the portal's database

id	project_title	project_acronym	beam_type	project_abstract	project_description_excellence	project_description_impact	project_description_implem
0 19	12 - SEE evaluation on RFID tags under fast ne...	TagSEEn	Neutrons - (quasi)monoenergetic	Proper management of irradiated samples and sy...	Irradiation of material samples, devices and p...	Previous knowledge about RFID tags radiation h...	Beam energy range: 14 l range: u
1 25	03 - Integrated Sensor Interface for Harsh Rad...	ISIHR	Heavy ions	This work presents a capacitance-to-digital co...	Capacitance sensors are increasingly being use...	The performance of the CDC prototype under hea...	The test setup is comp sensor l
2 26	04 - Statistical approach to defect simulation...	Statset	Heavy ions	This project draws a parallelism between fabri...	The demonstrator that has been designed for th...	- Validation of the simulation methodology: If...	The main goal of this exper
3 27	06 - Qualification of the ULTRASAT sensor for ...	ULTRASAT sensor SEE test	Heavy ions	The ULtraviolet TRansient Astronomical SATelli...	The ULTRASAT is an astronomical satellite miss...	The UV camera is the only detector on-board of...	It is planned to test the sens

# Research on Natural Language Processing

## Submissions and reviews as data

- Extract Transform Load (ETL) process schema



# Research on Natural Language Processing

## Submissions and reviews as data

```
In [3]: etl_client.transform();  
etl_client.transformed_df
```

Out[3]:

	proposal_id	project_abstract	project_description_impact	project_description_excellence	proposal_status	excellence_vote	impact_vote	implementation_vote
0	19	Proper management of irradiated samples and sy...	Previous knowledge about RFID tags radiation h...	Irradiation of material samples, devices and p...	Performed	0.700000	0.766667	0.733333
1	25	This work presents a capacitance-to-digital co...	The performance of the CDC prototype under hea...	Capacitance sensors are increasingly being use...	Performed	0.700000	0.633333	0.800000
2	26	This project draws a parallelism between fabri...	- Validation of the simulation methodology: If...	The demonstrator that has been designed for th...	Facility assigned	0.766667	0.766667	0.800000
3	27	The Ultraviolet TRansient Astronomical SATelli...	The UV camera is the only detector on-board of...	The ULTRASAT is an astronomical satellite miss...	Rejected	0.633333	0.633333	0.433333
4	28	Current space-grade processors cannot satisfy ...	ESA has recognised that COTS SoCs will be game...	The z7000 has received increasing attention fr...	Submitted	0.766667	0.766667	0.633333

# Research on Natural Language Processing

## Knowledge extraction

- Facilities interviews to be anonymized and analyzed by RADNEXT partners, specifically WP3 collaborators and Datzmann company
- Informations from the USP and reviewers to determine the most important features and values of each proposal

The implementation section of each proposal – key information towards acceptance...

# Research on Natural Language Processing

## Knowledge extraction - experiments

- Decision trees learn the rules on how to „divide” the data

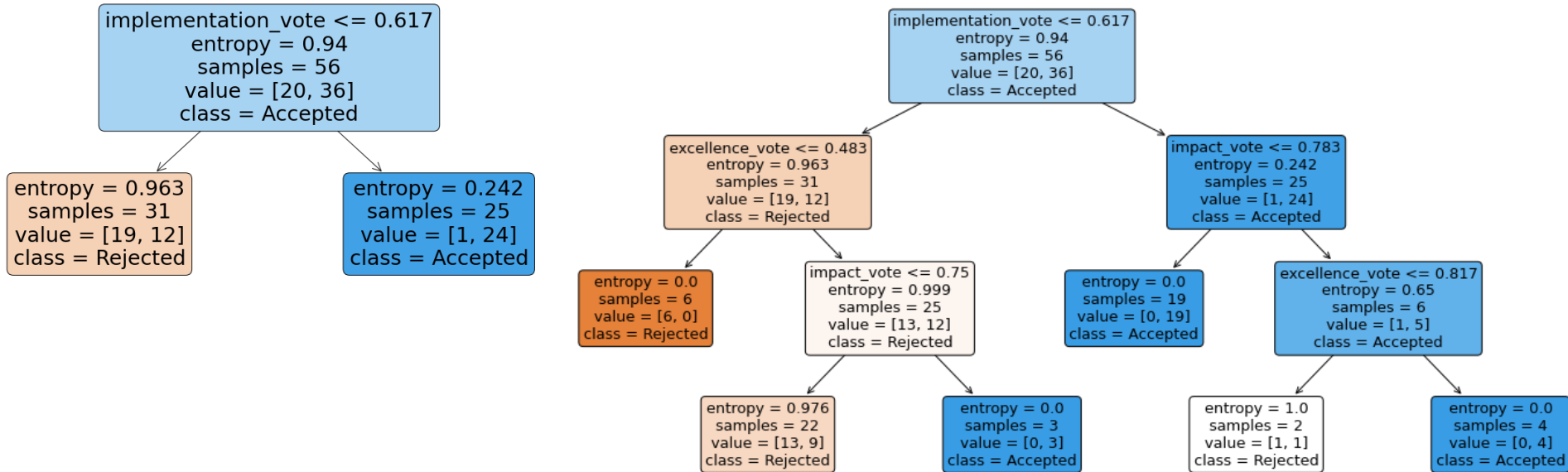


Fig. 1 Implementation vote at the root of decision trees



# Research on Natural Language Processing

## Towards automatic assessment

- Use advanced NLP techniques to support **users**
  1. Pre-evaluation assessment of proposals
  2. Generated advices regarding the quality of a proposal
- Use advanced NLP techniques to support **reviewers**
  1. Hints about proposals rejection/acceptance
  2. Pre-reviews generated to support internal work and assessment

# Research on Natural Language Processing

## Towards automatic assessment

1. Representation of text in numerical form – „embeddings”
2. Output generation with Large Language Models (LLMs)

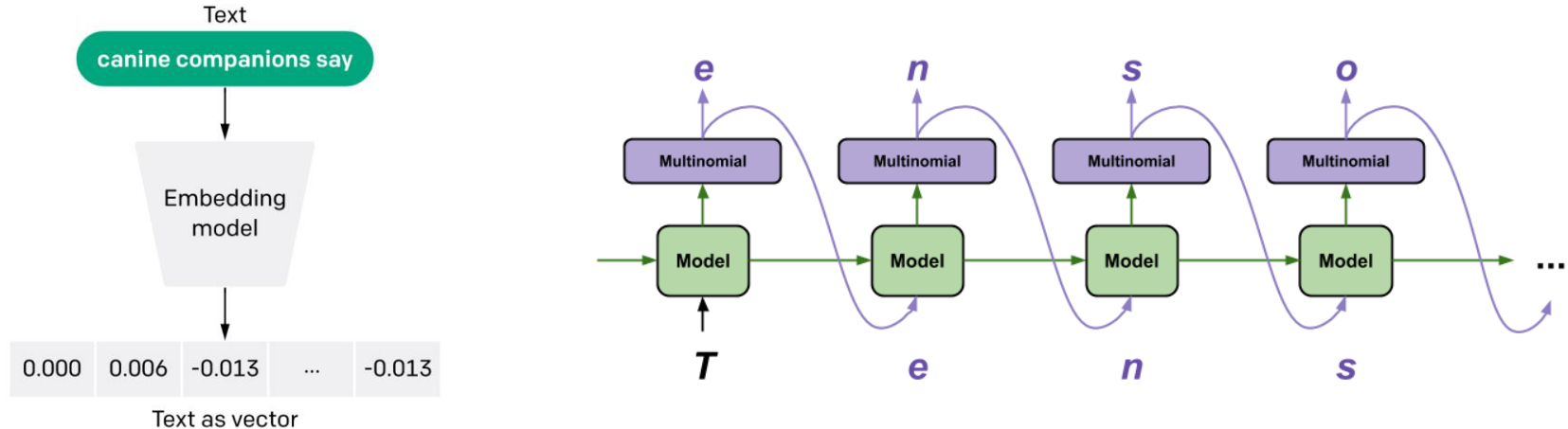


Fig. 2 Visual representation of NLP techniques (i) text embedding model, (ii) sequence generator

Source: openai.com

# Conclusion

- Discussed context of WP3
- Transnational access activities
  - Focus on user Online Portal
  - Processing interviews and collecting data
- Natural Language Processing
  - Submissions and reviews as data
  - Ideas and first experiments to support the RADNEXT roadmap.
- **Summary : not only management but also engineering and research tasks to provide support for all members in RADNEXT**

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