Emerging radiation Effects in On-Chip Inductors for space grade technologies

A Data Management Plan created using DMPonline.be

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Funder: Fonds voor Wetenschappelijk Onderzoek - Research Foundation Flanders (FWO)

Template: FWO DMP (Flemish Standard DMP)

Grant number / URL: 1SH3K24N

ID: 203929

Start date: 01-11-2023

End date: 01-11-2027

Project abstract:

Spacecrafts are continuously exposed to ionizing radiation, which is harmful to onboard electronics. In this research, a new type of radiation effect on on-chip inductors, part of an LC tank for an RF oscillator, is investigated. It was assumed that passive components did not suffer from radiation effects until now, but a recent study indicates a severe sensitivity. The hypothesis is that incident particles create Eddy currents in the silicium substrate that cause the inductor's properties to change and thus the oscillator's frequency also changes. We will develop mitigation techniques to suppress the frequency changes and improve the radiation tolerance of the oscillator. This radiation-hardened oscillator can be used in the next generation of high-speed space-grade technologies

Last modified: 27-02-2024

Emerging radiation Effects in On-Chip Inductors for space grade technologies
DPIA

DPIA

Have you performed a DPIA for the personal data processing activities for this project?

Question not answered.

Emerging radiation Effects in On-Chip Inductors for space grade technologies
GDPR

GDPR

Have you registered personal data processing activities for this project?

Question not answered.

Emerging radiation Effects in On-Chip Inductors for space grade technologies
Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

Question not answered.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

Question not answered.

What's the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

Question not answered.

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

Question not answered.

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

Question not answered.

Emerging radiation Effects in On-Chip Inductors for space grade technologies
FWO DMP (Flemish Standard DMP)

1. Research Data Summary

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Single Event Frequency Transient Data	/	Generate new data	Digital	Experimental Simulation data Software	.csv	<5TB	/
Total ionizing dose data	/	Generate new data	Digital	Simulation data Software	.csv	<5TB	/

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

/

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

/

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- No

/

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- Yes

The KU Leuven ADVISE research group has the ambitious goal to start a new spinoff company (“SpaceTime IPs”) in 2-3 years’ time, to join the Flemish space economy with a novel asset and a unique business case, as already mentioned in the proposal.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/Data transfer agreements/ research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- Yes

All the data that falls under restrictive licensing or is protected by NDA’s (by ESAT) can’t be shared with anyone. This includes IP’s and CDS documentation, certain design and measurement data and PDK’s. This data has to be normalized before publication.

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- Yes

All the data that falls under restrictive licensing or is protected by NDA’s (by ESAT) can’t be shared with anyone. This includes IP’s and CDS documentation, certain design and measurement data and PDK’s.

2. Documentation and Metadata

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g., in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, Codebook.tsv etc. where this information is recorded).

Basic info:

- I ensure research data are stored safely (data loss) and securely (data protection).
- I strive for a clear naming of my data and annotate my data as much as possible. I also use a chronological and logical folder structure to organise all my data.
- I strive to make my design databases or measurement data organised in such a way that other users can understand my workspace and use the needed data when necessary.

Full-custom IC design:

Projects:

- Custom IC designs using Cadence Virtuoso are managed on a project basis. A project is defined for each chip. When the chip is taped-out, the project will be archived as a snapshot of the current design (see below).
- Each project will be given a codename, which allows to make a distinction between different versions of a chip. We don’t use <ATOMOS> and <ATOMOS_v2>. A list is maintained with all current and past chips. No duplicate names should be used.

Libraries:

- Virtuoso manages its projects using libraries. A general principle is to use only a single library for your designs, unless it makes sense to create a separate library that contains cross-project IP (e.g. IO, ESD protection, digital gates).
- I’ll create a separate library for testbenches. Ideally, each testbench has the same name as the test-fixtures with an extension that describes

the function of the test. (e.g. oscillator_tb_phasenoise ; amplifier_core_tb_gain)
    - Good practice: libraries < ATOMOS> and <ATOMOS_testbench>
    - Bad practice: libraries < ATOMOS> < ATOMOS_v2> < ATOMOS_digitallogic> <ATOMOS_currentsources> <ATOMOS_testbench> < ATOMOS_other>

Cellviews

- I aim to show the hierarchy of the design in the namespace of the cells. (e.g. PLLtopVcoCurrentreference highlights the cell Current reference in the submodule VCO of PLLtop)
- I'll avoid using versions at cell level and making copies of copies. (e.g. <flipflop>,<flipflop_v2>,<flipflop_olddesign>, <flipflop_top><flipflop_final><flipflop_final2>).
  The same applies for views ("schematic", "layout", …).

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type) which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

The Datasets of the experiments can't be published do to legal reasons, this is why it won't be necessary to use a metadata standard. There will be normalize data, conclusions and figures available.

3. Data storage & back-up during the research project

Where will the data be stored?

Basic info:

- KU Leuven provides a 1TB OneDrive service for each staff member, linked to your KU Leuven account.
- We use OneDrive to share non-development and non-confidential data like publications, training material, teaching material, … within the research group.
- Design specific data should not be shared through OneDrive.

Simulation results

- Generally, we do not save simulation results. We only maintain and archive the testbenches. Each testbench should clearly indicate the results produced.
- Simulation results are saved to the "no_backup" folder of my Linux home directory to save backup disk space. This folder has no backup. I make sure to temporarily clean my "simulation" folder.
- Simulation results are presented to my promotor once every two weeks. These update reports are maintained along with my chip database. The title of my report (e.g. pptx file) correlates to the content of the simulation (e.g. flipflop_sim_setuphold_02042021.pptx). This report is updated every time I do some work on my research.

Measurement results

- Measurement results vary significantly depending on the measurement equipment used. For hardware measurements, there is no industry-standard approach to annotate data. I include the following metadata for my measurement data:
    - Instrument name-type used to produce the data
    - Configuration script used to generate data
    - Environmental conditions (if any specific)
    - Hardware revision
    - Timestamp
- A snapshot of the measurement results is made after each test campaign. A test campaign could be a test in RELYlab or a test using a radiation source, cryo station, etc.
- The snapshot should be runnable and annotated with a README file that identifies different measurement results or associated processing scripts.
- We do not recommend specific data formats since this might be very specific for each measurement equipment. Generally we try to use either MATLAB or Python to process data.
- At least a concluding report should be included in this snapshot that highlights the measurement approach and results. It is recommended to include some pictures of the test setup.

- The snapshot should at least include:
  - raw measurement data
  - processing scripts
  - hardware design files (e.g. PCB design if any)
  - FPGA/MCU firmware (if any)
  - PC software (if any).

How will the data be backed up?

Linux Backup

- We rely on backup services provided by the Dept. Electrical Engineering (ESAT). A backup of my Linux folder is made periodically by the system group.
- No backup is made of the folder “no_backup”.

Windows Backup

- We are recommended the usage of Linux account as much as possible since it is securely managed and backups are provided.
- Generally, no backup is provided for my personal windows laptop. I personally back-up all my research documents on my KU Leuven OneDrive by putting them in my OneDrive folder which provides adequate safety for data loss.

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

KU Leuven provides a 2TB OneDrive service for each staff member, linked to your KU Leuven account.
We rely on backup services provided by the Dept. Electrical Engineering (ESAT). A backup of my Linux folder is made periodically by the system group. This back-up is unlimited.

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

During the design phase, multiple people might need access to my design. At least my promotor might require access to my design.
We use Github to synchronize a design with multiple users. The same platform is used to archive the design.
Some libraries might be shared with other people, for instance generic IP libraries (like IO/ESD). I need to contact the maintainer of the library for any changes.
The stored data is secured by the Linux server where you can only get acces via a secured SSH link and the OneDrive is secured with a two step authenticator provided by KU Leuven.

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

Free

4. Data preservation after the end of the research project

Which data will be retained for at least five years (or longer, in agreement with other retention policies that are applicable) after the end of the project? In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

All design files, documentation and experimental data must be kept for years after the completion of the project

Where will these data be archived (stored and curated for the long-term)?

- Design libraries are archived when
  - the chip is sent to the foundry
  - I leave the research group. This allows to maintain a 1-to-1 mapping of the chip-to-design and allows the research group to further develop the chip when I leave.
- When making an archive, the active project is copied to a backup project which can be accessed as a normal project, without write permissions.
- Generally, archives are never deleted.
- Upon making an archive, I will check the data size of the project and aim to optimise for long-term storage (e.g. check for top-level parasitic extractions which could exceed GB)

All of this will be archived on the previous mentioned Linux server.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

Free

5. Data sharing and reuse

Will the data (or part of the data) be made available for reuse after/during the project? In the comment section please explain per dataset or data type which data will be made available.

- No (closed access)

The chip designs and measurement results fall under restricted access do to licensing and IP's. Conclusions and normalized data will be made available for reuse of necessary.

If access is restricted, please specify who will be able to access the data and under what conditions.

Everyone with explicit legal permission to the IP's and protected technology.

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)? Please explain in the comment section per dataset or data type where appropriate.

- Yes, Intellectual Property Rights

The data used for chip design falls under restriction by IP.

Where will the data be made available? If already known, please provide a repository per dataset or data type.

https://iiw.kuleuven.be/onderzoek/advise/datasets

When will the data be made available?

Upon publishing of the research results.

Which data usage licenses are you going to provide? If none, please explain why.

When possible share

- Designs and experiment datasets under Creative Commons Attribution-ShareAlike (CC-BY-SA) or Creative Commons Attribution-NonCommercial-ShareAlike (CC-BY-NC-SA)
- Software under GNU General Public License 3 (GPL-3.0)

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- Yes

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What are the expected costs for data sharing? How will these costs be covered?

Free

6. Responsibilities

Who will manage data documentation and metadata during the research project?

The Researcher

Who will manage data storage and backup during the research project?

The Researcher

Who will manage data preservation and sharing?

The Researcher

Who will update and implement this DMP?

The Researcher