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STADIUS
Center for Dynamical Systems, Signal Processing and Data Analytics

STADIUS Newsletter

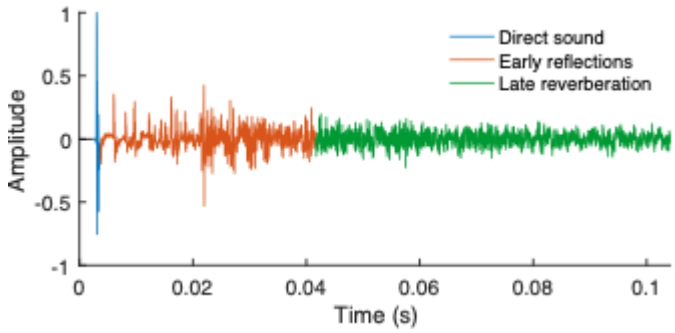
April 2026

Research of the month by Kathleen MacWilliam

"Room Geometry Inference from Room Impulse Responses via First-Order Image-Source Optimization"

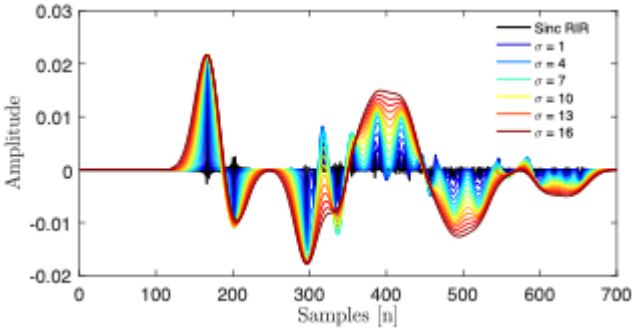
Work under the supervision of Work under the supervision of Toon van Waterschoot and Thomas Dietzen

Estimating room geometry from acoustic measurements is a fundamental problem in spatial audio and room acoustics. Conventional approaches typically rely on detecting and labeling early reflection features, a process that is unreliable and requires strong assumptions for echo sorting. In this work, we propose a reflection feature extraction-free framework for room geometry inference that operates directly on measured room impulse responses (RIRs).



Anatomy of an RIR, with direct sound, early reflections, and late reverberation.

Our method leverages an image source model (ISM) parametrized exclusively by first-order image-source positions, from which higher-order reflections can be expressed analytically. We formulate room geometry inference as an optimization problem over these first-order image-source positions, thereby representing room geometry implicitly within a physically motivated RIR model without requiring explicit reflection detection, solving an echo labeling problem (ELP), or reconstructing large sets of higher-order image sources.
To reduce sensitivity to amplitude scaling and unknown acoustic parameters, we adopt a cosine-similarity objective that emphasizes temporal structure rather than absolute magnitude. To ensure smooth gradients and stable optimization, we replace bandlimited sinc kernels in the RIR model with temporally localized Gaussian kernels and apply matched smoothing to the measured RIRs.



Effect of Gaussian smoothing on a sinc-simulated RIR for increasing values of Gaussian kernel widths σ. The original RIR is shown in black. Increasing σ progressively broadens individual reflections and attenuates high-frequency oscillations, while preserving the overall temporal structure of the RIR.

We solve the resulting nonconvex problem using a practical multi-stage procedure that combines multi-start Adam optimization with clustering-based consolidation of stable solutions. In simulations, performance improves with microphone count and spatial aperture and remains robust under moderate sensor noise and reduced boundary reflectivity. On measured RIRs from two datasets, the method recovers a majority of first-order image sources despite using roughly estimated uniform boundary reflection coefficients. Overall, the approach provides a simple, ELP-free pathway to reliable first-order image-source recovery (and hence room boundaries) in general convex polyhedral rooms and offers a solid foundation for further boundary parameter estimation.

This work has been submitted as a journal paper and is currently under review:

"Room Geometry Inference from RIRs via First-Order Image-Source Optimization"
K. MacWilliam, T. Dietzen, and T. van Waterschoot (submitted, Apr. 2026)

An internal report version is available here:
👉 link: https://ftp.esat.kuleuven.be/pub/stadius/kmacwill/reports/26-84.pdf

Awards

Gouden Krijtjes 2025/2026



We're proud to announce that again this year a STADIUS Professor has been honored with **Gouden Krijtjes** in current edition of VTK awards!
Panos Patrinos received the award as the best professor for the master of mathematical engineering 25–26.
The Gouden Krijtjes (Golden Chalks) are annual awards presented by the **Vlaamse Technische Kring (VTK)**, the student association for engineering students at KU Leuven. These awards recognize excellence in teaching and are determined by student votes in categories such as Best Professor, Funniest Professor, Best Course Material, and Best Assistant. They serve as a way for students to express appreciation for educators who have made a significant impact on their learning experience.
Read more: https://www.vtk.be/nl/page/gouden-krijtjes/

News



Highlights from the Honorary Doctorate Ceremony at KTH – Bart De Moor

On **17 April 2026**, KTH Royal Institute of Technology held its academic ceremony at the Grand Hôtel Stockholm, awarding honorary doctorates to **Prof. Bart De Moor** (KU Leuven, STADIUS) and **Dr. Anna Rathsman**, former Director of the Swedish Space Agency.



The ceremony followed KTH's academic tradition, with a formal procession, student flag parade, and a welcome address by Rector **Anders Söderholm**.
In the laudatio, Dean **Sofia Ritzén** praised Prof. De Moor as an internationally leading AI researcher. She highlighted his major contributions to system identification, numerical methods, signal processing, and data analysis.

She also referred to his supervision of more than 90 PhD students and his ERC Advanced Grant. In addition, his strong societal engagement through leadership roles in AI research and science policy was emphasized. Dean Ritzén also underlined Prof. De Moor's **long-standing collaboration with KTH**, including his advisory role within WASP.

The honorary doctorate was formally conferred with the presentation of the traditional insignia: **the hat, the ring, and the diploma**.



The day concluded with a festive academic banquet. In his speech of thanks, Prof. De Moor reflected, on behalf of both honorary doctors, on their shared background in engineering, the central role of "space" and "data" in their work, and their common concern for the ethical, legal, and democratic implications of modern technologies. Family, friends, colleagues, and students joined the celebration in Stockholm and online, making the occasion both solemn and warmly personal.

For more information and more pictures, see:
👉 https://www.bartdemoor.be/index.php?p=7984/17-04-2026-bart-de-moor-hedersdoktorer-dr-honoris-causa-kth-stockholm

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STADIUS Colloquium Series



Bayesian inference with physics-informed deep generative models: Applications to computational imaging
When: 17/06/2026; 15:00 - 16:00
Speaker: Marcelo Pereyra
Location: Aula C
Abstract: This talk introduces a novel mathematical and computational framework for constructing high-dimensional Bayesian inversion methods that leverage state-of-the-art generative denoising diffusion models as statistical priors.

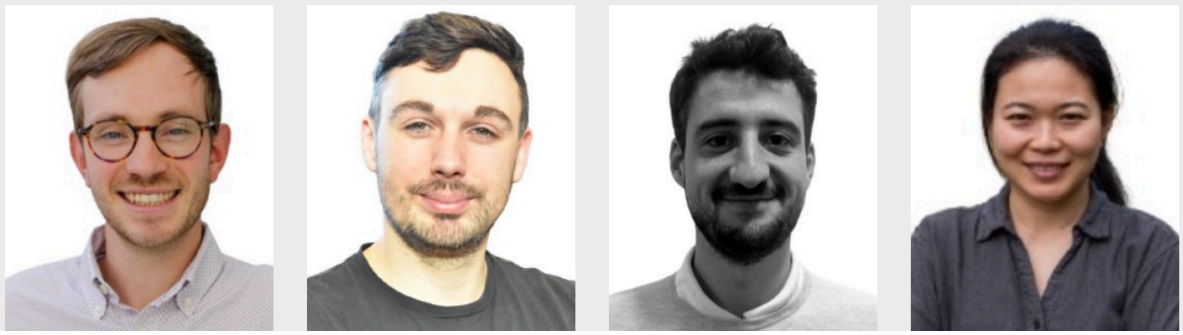
A central innovation is the use of Langevin diffusion processes and Markov chain Monte Carlo sampling techniques to create stochastic neural network architectures that perform nearly-perfect sampling. The obtained networks are modular and composed of interpretable layers that are directly related to statistical priors and data likelihoods. The layers encoding the data likelihood function are designed for flexibility, enabling observation model parameters to be

specified at inference time and seamlessly integrated with pre-trained foundational generative priors.

For more information go to STADIUS Colloquium Website

ESAT Inaugural Lectures

The Department of Electrical Engineering (ESAT) invites you to attend the Inaugural Lectures, given by the newly appointed professors.



📆 **Monday, 4 May 2026**
📍 **ESAT Aula R**

Programme

17:00 – Welcome by **Vincent Rijmen**, Head of Department

- **Jona Beysens** (STADIUS, Group T) *The Future of Embedded AI: The Power of Hardware Awareness*
- **Simon Ravyts** (Electa, Ghent) *Protection Challenges in Hybrid AC/DC Grids*
- **Manuele Rusci** (PSI, De Nayer) *Smart Sensors Can Understand Raw Data — But Can They Also Learn On-Device?*
- **Yunwen Liu** (COSIC, Arenberg) *Security and Privacy Challenges in Distributed Ledger Technologies*

18:30 – Reception

New colleagues

A warm welcome to new personnel at STADIUS!



Hello everyone,

My name is **Merel Haenraets**, and I began my PhD this April under the supervision of Professor Maarten De Vos and Christos Chatzichristos. My research will focus on counterfactual simulation and synthetic data generation. I'm excited to collaborate with all of you!

– Merel

Visitors

Current and planned visitors

- **Andrea Costanzo** - in the group of Alexander Bertrand (since February)
- **Anna Fuzari -** in the group of Toon van Waterschoot (since February)
- **Stefano Giacomelli** - in the group of Toon van Waterschoot (since March)
- **Francesco Cordiano** - in the group of Johan Suykens (since April)
- **Jiande Chen** - in the group of Maarten De Vos (since April)
- **Sunghyun Koo** - in the group of Rodolphe Sepulchre (arriving in May)
- **Sofie Haesaert** - in the group of Panos Patrinos (arriving in May)

Enjoy your research visit at STADIUS !!!

Publications

Here's the monthly STADIUS Publications Digest, including new reports that have been added to the publications database. Please remember to have your own reports added in the publications database and make sure your entries are kept up to date (status submitted/accepted/published) at all times.

Contact Ida for new additions and updates; do not add/update database content yourself.

26-69
van Rooij H., Vermeersch C., Deferme M., De Moor B., ``Computing the Pareto Front by Polynomial Elimination, With an Application From System Identification'', Technical Report 26-69, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026.

26-70
Van Santvliet L., Nguyen P.X., Vandenberk B., De Vos M., ``Detecting Chagas Disease Using a Vision Transformer-based ECG Foundation Model'', in *Proc. of Computing in Cardiology 2025 (CinC)*, vol. 52, São Paulo, Brazil, Sep. 2025.
Lirias number: 4414727.

26-71
Yao Y., Gonzalez C.S., Geirnaert S., Gillebert C.R., Tuytelaars T. and Bertrand A., ``Eccentricity Confound in EEG-based Visual Attention Decoding from Gaze-Fixated Neural Tracking of Motion in Natural Videos'', Technical Report 26-71, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026.

26-72
Huts H., Verstraete K., Strypsteen T., Gyselinck I., Janssens W., De Vos M., ``Investigating individual effects of ICS on COPD exacerbations with causal machine learning'', *European Respiratory Journal (ERS)*, Amsterdam, The Netherlands, Sep. 2025, PA5694 p.
Lirias number: 4401829.

26-73
Huts H., Verstraete K., Strypsteen T., Gyselinck I., Janssens W., De Vos M., ``Causal machine learning to investigate heterogeneity in time to first COPD exacerbation for ICS/LABA versus LAMA/LABA'', *European Respiratory Journal (ERS)*, Amsterdam, The Netherlands, Sep. 2025, PA5691 p.
Lirias number: 4401830.

26-74

Verstraete K., Gyselinck I., Huts H., Djamin R.S., Staes M., Talman S., Lindberg S., van der Eerden M., De Vos M., Janssens W., ``Identifying azithromycin responders with an individual treatment effect model in COPD'', *Thorax*, vol. 80, no. 12, Jul. 2025, pp. 900-908.
Lirias number: 4245186.

26-75
Sillis L., Van Mechelen L., Van Gelder M., Lenie S., Allegaert K., Bogaerts A., De Vos M., Hompes T., Smits A., Van Calsteren K., Verbakel J.Y., Foulon V., Ceulemans M., ``Reliability of self-reported maternal health and mother-infant outcome data in web-based questionnaires'', *Drug Safety*, Apr. 2026, pp. 1179-1942.
Lirias number: 4413599.

26-76
Sillis L., Lenie S., Jacobs E., Allegaert K., Bogaerts A., De Vos M., Hompes T., Smits A., Van Calsteren K., Verbakel J., Foulon V., Ceulemans M., ``Medication, Vaccine, and Folic Acid Use Among Pregnant Women in Belgium : Insights from the BELpREG Cohort'', *Pharmacoepidemiology and Drug Safety*, vol. 35, 2026, e70369 p.
Lirias number: 4413598.

26-77
Swinnen L., Bhagubai M., Chatzichristos C., Weber Y., Wolking S., Ermis U., Schriewer E., Schulze-Bonhage A., Dumpelmann M., Zabler N., Epitashvilli N., Mahler B., Sen A., Symmonds M., Richardson M.P., Biondi A., Sales F., Sulaiman A., De Vos M., Van Paesschen W., ``A multicenter, video-EEG-based validation of a multimodal wearable device for focal seizure detection in adults : The seizeIT2 study'', *Epilepsia Open*, 2026, pp. 1-12.
Lirias number: 4414293.

26-78
Denissen S., Laton J., Grothe M., Vaneckova M., Uher T., Kudrna M., Horakova D., Baijot J., Penner I., Kirsch M., Motyl J., De Vos M., Chen O.Y., Van Schependom, Sima D., Nagels G., ``Real-world federated learning for brain imaging scientists'', *Frontiers in Digital Health*, vol. 8, Mar. 2026, 1691088 p.
Lirias number: 4413382.

26-79
Formanek A., Vincze A., Bicsak R., Moreau Y., Balogh G., Arany A., ``A comparative study of QSPR methods on a unique multitask PAMPA dataset'', Technical Report 26-79, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2026. Accepted for publication in *Journal of Chemical Information and Modeling*.
Lirias number: 4413858.

26-80
Sattanathan N., Huremagic B., Vermeesch J.R., Moreau Y., Vandeweyer G., ``WiNGS-API : a federated genome/phenome data sharing platform enabling gene discovery and variant classification for rare diseases'', *Genome Medicine*, vol. 18, no. 37, 2026, pp. 1-15.
Lirias number: 4413151.

26-81
Allamaa J.P., Patrinos P., Duy Son T., ``ExAMPC : the Data-Driven Explainable and Approximate NMPC with Physical Insights'', in *Proc. of the 2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025)*, Hangzhou, China, Oct. 2025, pp. 2976-2983.
Lirias number: 4414352.

26-82
Huo Y., Forni F., Sepulchre R., ``A neuromorphic architecture for scalable event-based control'', *Neuromorphic Computing and Engineering*, vol. 6, 2026, 014018 p.
Lirias number: 4411262.

26-83
Weiss S., Schlecht S.J., Moonen M., ``Best least squares paraunitary approximation : Analytic procrustes problem'', *IEEE Transactions on Signal Processing*, vol. 74, 2026, pp. 904-919.
Lirias number: 4413046



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