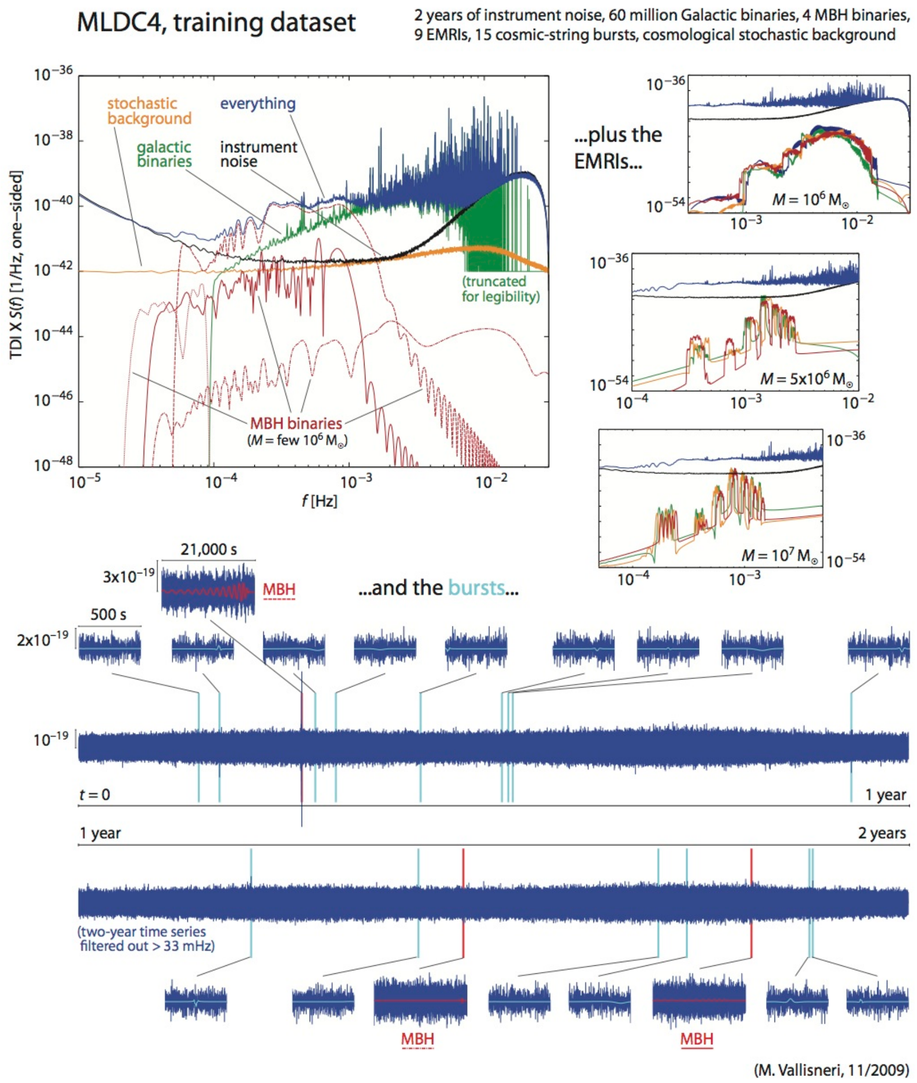
the *new* LISA Data Challenges

Michele Vallisneri, for the LDC working group

the Mock LISA Data Challenges (2005–2011)

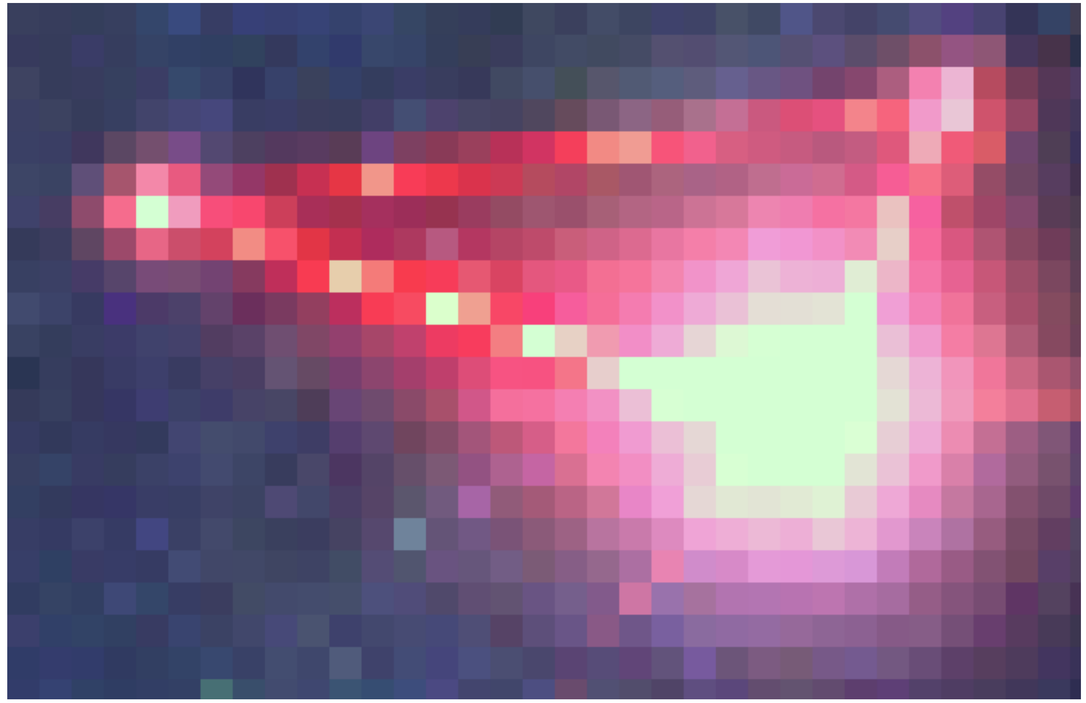


- Five challenges completed
- 70 participants, 25 institutions, 30+ publications
- Chairs: Alberto Vecchio, MV
- Demonstrated the detection and parameter estimation of all major LISA source classes, using a great variety of methods
- Provided methods for ground-based parameter estimation

the new LDCs (est. 2017)

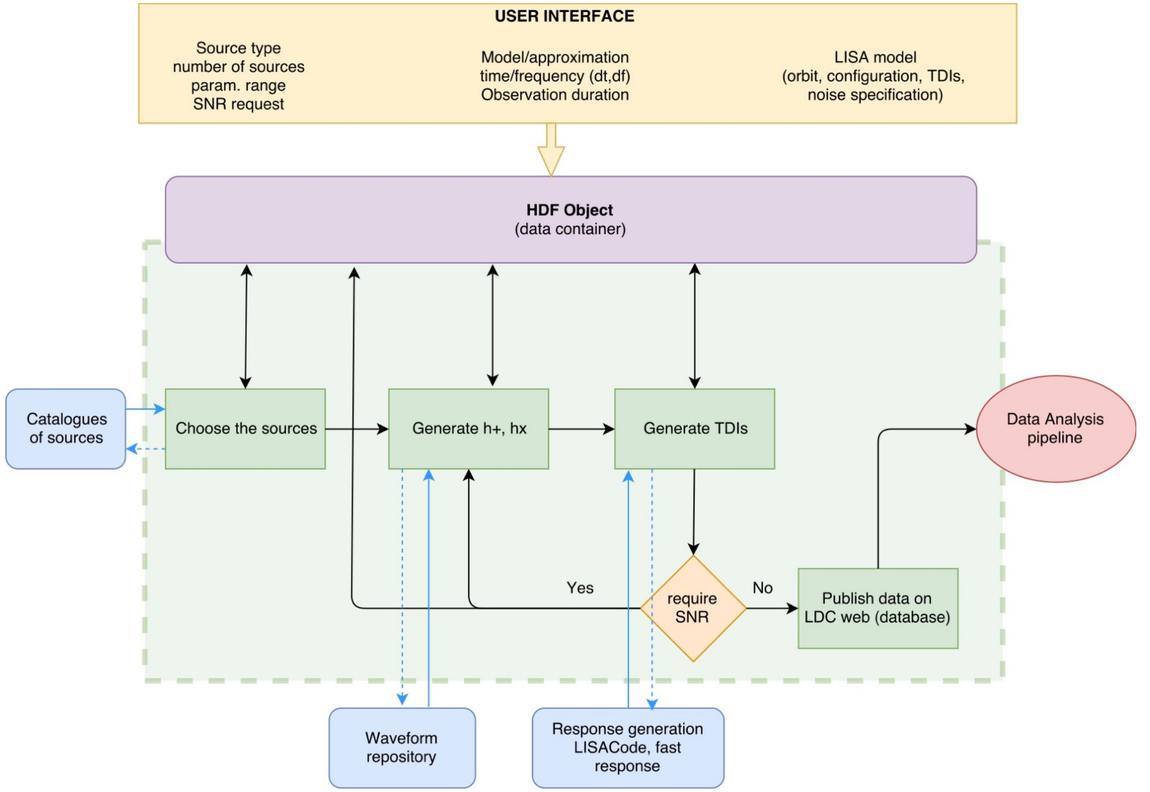
a **collaborative** effort to:

- Introduce software-development standards
- Establish a common playground to evaluate algorithms
- Foster data-analysis research and community involvement
- Address science requirements in project-oriented challenges with realistic assumptions
- Prototype and develop end-to-end data-analysis pipelines



the LDC working group

- Chartered by LISA Consortium
- ~100 members (15% active now)
- Co-chairs Stas Babak, MV
- Working closely with LISA Science Group, LISA Simulation WG
- Supported by the APC Data Processing Center



- **Website**: lisa-ldc.lal.in2p3.fr/home
- **Internal wiki**: gitlab.in2p3.fr/stas/MLDC
- **Telecons**: every second Friday, 16:00 CET
- **Join**: through consortium at signup.lisamission.org

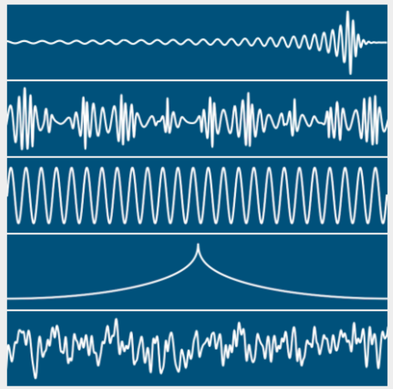
LDC | Challenge 1 | LDC code | Meetings | Contact | Admin | Login | Sign up

(the new) LISA Data Challenges

...or, as we call them, the **LDCs**—an **open, collaborative effort to tackle unsolved problems in LISA data analysis**, while developing software tools that will form the basis of the future LISA data system.

The LDCs are organized by the **LISA Consortium's LDC working group**. Please join us as we write code and specifications to generate challenge datasets, and we work together to search for gravitational-wave sources and estimate their parameters. If you prefer to explore by yourself, develop your algorithms (or improve ours), then submit your methods and results so we can learn from them.

The LDCs are supported by the LISA Data Processing Center at APC Paris.



Challenge 1

Codenamed **Radler** and released on July 9, 2018, the first challenge seeks to introduce new researchers to LISA data analysis, to rehabilitate existing analysis codes, and to establish our process and standards.

We expect to collect Challenge-1 entries at the end of 2018.

Learn more and download »

Join us

The LDC working group consists of members (both full and associate) of the LISA Consortium: apply here for Consortium membership, or through the LISA Consortium group at your institution.

Coming soon: LDC publication policies.

Inquire about membership »

LDC software

We periodically release all software developed by the working group to build and analyze datasets. Working-group members have read/write access to our code repository.

Coming soon: LDC tutorials and example codes.

Get our code »

Last update: July 9, 2018, 7:05 a.m. © Cécile Cavet

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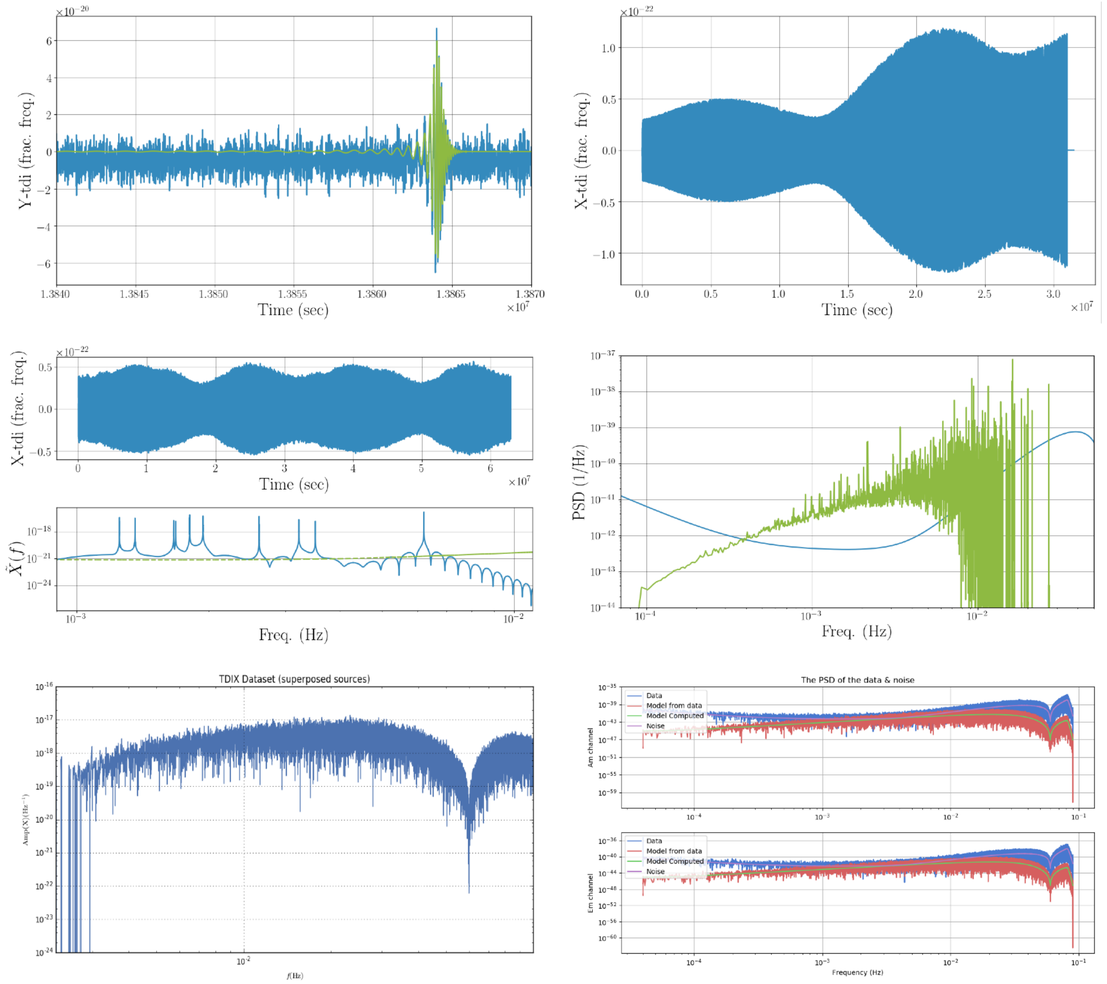
LDC-1: Radler – available now

- Tackle main LISA sources separately under idealized instrument noise
- Introduce new researchers to LISA data analysis
- Rehabilitate MLDC analysis codes
- Establish LDC process, standards, basic infrastructure

LDC-1: Radler – available now

- LDC1-1. A single GW signal from a merging massive-black-hole binary.
- LDC1-2. A single GW signal from an extreme-mass-ratio inspiral.
- LDC1-3. Superimposed GW signals from several verification Galactic white-dwarf binaries.
- LDC1-4. A GW signal from a population of Galactic white-dwarf binaries.
- LDC1-5. A GW signal from a population of stellar-origin (stellar-mass) black-hole binaries.
- LDC1-6. An isotropic stochastic GW signal of primordial origin.



LISA Data Challenge 1: *Radler*

We are glad to announce the release of datasets for the first "new" LISA Data Challenge, codenamed **Radler**. The purpose of this first challenge is to tackle the main LISA sources separately, under an idealized instrument-noise model. Our aim is to introduce new researchers to LISA data analysis, to rehabilitate existing analysis codes developed during the original Mock LISA Data Challenges (2005–2011), and to establish LDC process and standards.

Radler includes **six subchallenges**, described below. This challenge will not be blind (source parameters are available), but you are welcome to try the analysis without referring to the answer. Furthermore, versions of the datasets without instrument noise are included in the release. LDC working-group members will be preparing their own analysis using their algorithms of choice, and invite you to join them (to do so, e-mail us so we can pair you appropriately). Of course, you may organize to work on your own, or with your collaborators.

For usage tracking purposes, we request that you set up a login for this website before downloading the datasets. Please **submit your results by December 31, 2018**, using the submission interface and format that will appear shortly on this page. Please plan to include a description of your methods (or a link to a methods paper) with your submission. We would also greatly appreciate it if you were to share your code (e.g., on GitHub, or on our GitLab).

While we did our best to check the datasets for correctness, small problems or inconsistencies may have escaped us. The best way to validate the data is to analyze it, so let us know of any problems!

Log in to download »

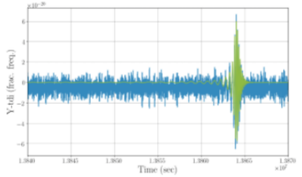
LDC-1 documentation »

LDC-1 code »

Ask for help »

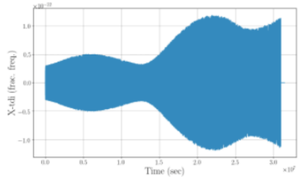
LDC1-1. A single GW signal from a merging massive-black-hole binary.

LIGO and Virgo have done it, so let's get LISA on the right path! MBHBs are represented with a frequency-domain inspiral–merger–ringdown phenomenological model (IMRPhenomD). The black holes are spinning, with spin vectors parallel to the orbital angular momentum. The release includes datasets for two methods (frequency- and time-domain) of applying the LISA response to the GWs.



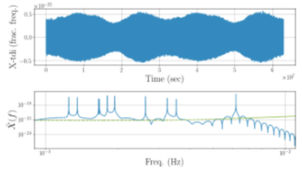
LDC1-2. A single GW signal from an extreme-mass-ratio inspiral.

EMRIs are modeled with the "classic" *Analytic Kludge* waveforms, which will be updated in future challenges, so make your code flexible! The signal is produced in the time domain and the response is applied using LISACode. The signal is of moderate strength, but the source parameters are drawn from relatively wide priors. This should make for a good challenge!



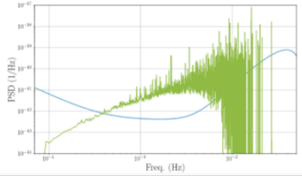
LDC1-3. Superimposed GW signals from several verification Galactic white-dwarf binaries.

We assume circular orbits and purely gravitational interactions. The phase of the signal includes frequency and first derivative. This one should be easy!



LDC1-4. A GW signal from a population of Galactic white-dwarf binaries.

Here's the classic cocktail-party problem: 26 million signals, produced with a "fast response" code. Parameters of all binaries are available in a large HDF5 file.



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LDC-1: Radler – play with us

- Not a blind challenge
- Join our efforts, or try on your own
- Download LDC code, use LDC Docker images
- Submit results (with simple text format) and share your code by end 2018 (TBC)
- Example solutions/tutorials to be available beginning fall 2018

Plans and directions

- LDC 2: “Mild Enchilada” (e.g., Galaxy + MBHB + EMRI; Galaxy + Stochastic + SOBHBs)
- More realistic datasets: improved waveform models and astrophysical source catalogs; richer LISA simulation (orbits, noise levels and statistics, glitches)
- Release source catalogs (parameters + uncertainties) for meta-challenges and outreach
- Support mission studies: gap & glitches project; official SNR/parameter-estimation calculators
- Support LSD and LDPG development