



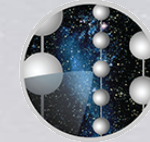
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# The SkyLLH framework for IceCube point-source search

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# Introduction

- Hypothesis tests based on unbinned log-likelihood functions are a common technique used in multi-messenger astronomy, including IceCube's neutrino point-source searches
- The open-source Python3-based tool “SkyLLH” provides a modular framework for implementing custom likelihood functions and executing log-likelihood ratio hypothesis tests
- Code structure allows plug-n-play concepts for building likelihood analysis

# Structure

- The SkyLLH framework is split into two packages:

- [github.com/icecube/skylh](https://github.com/icecube/skylh)  
contains open-source code

skylh:

- core ← classes defining the detector independent LLH framework
- i3 ← specific classes (derived from core) for IceCube detector
- physics ← definitions of source hypothesis
- plotting ← utility classes for plotting PDFs and PDF ratios

- [github.com/icecube/i3skylh](https://github.com/icecube/i3skylh)  
contains private IceCube specific code

i3skylh:

- analyses ← collection of pre-defined SkyLLH IceCube analyses
- datasets ← collection of pre-defined IceCube datasets

- The core class structure is tied to the mathematical objects of the likelihood (ratio) function



# Top level analysis example



```
1 import numpy as np
2
3 from skyllh.core.random import RandomStateService
4 from skyllh.physics.source import PointLikeSource
5 from i3skyllh.datasets import data_samples
6 from i3skyllh.analyses.kdepdf_mcbg_ps.analysis import create_analysis
7
8 dsc = data_samples['NorthernTracks_v005p00_KDE_PDF_v007'].create_dataset_collection()
9 datasets = dsc.get_datasets('IC86_2011-IC86_2019')
10 source = PointLikeSource((np.radians(77.358), np.radians(5.693)))
11
12 analysis = create_analysis(datasets, source)
13
14 rss = RandomStateService(0)
15 (TS, fitparam_dict, status) = analysis.unblind(rss)
```

- Specific analysis definition is “hidden” in `create_analysis` function

