GW plug-in to AstroColibri: a prototype?

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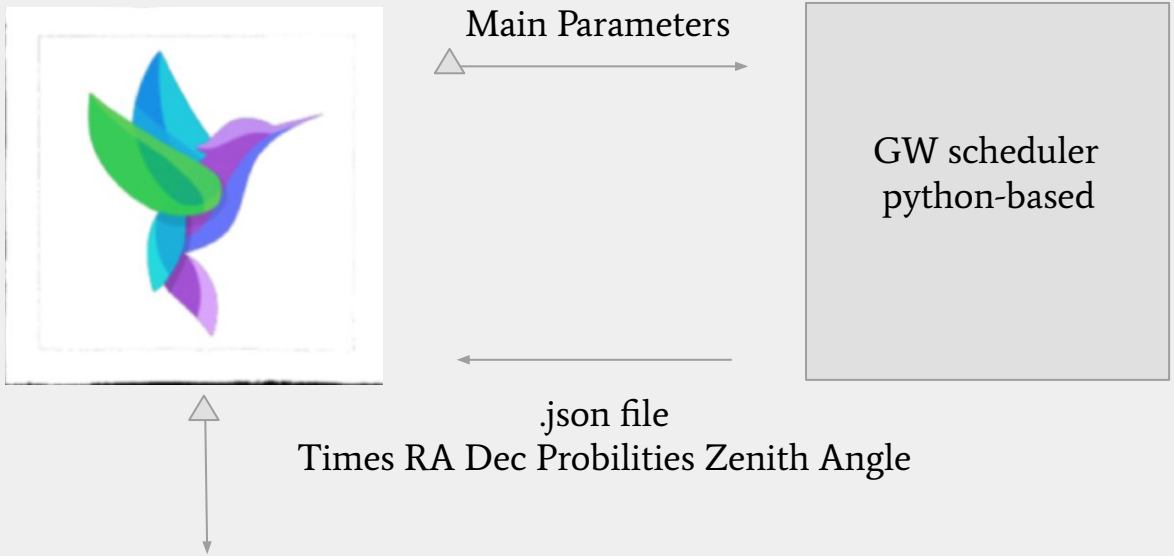
H. Ashkar, M. Seglar-Arroyo, D. Turpin
1st Astro-COLIBRI workshop - Sciathlon
30 September 2022

Main idea:

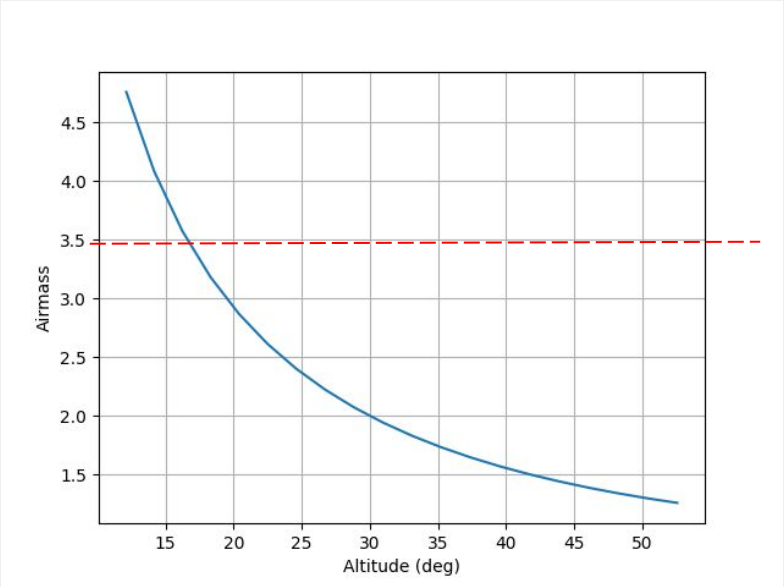

Main Parameters
GW scheduler
python-based
.json file
Times RA Dec Probilities Zenith Angle
Visibility Plot per tile

Ideas for a prototype

- In astro-COLIBRI:
  - Input: fill the telescope info (telescope_name, FoV_x (degree), FoV_y (degree), FoV_style (square or circle), diameter (meter))
  - Output: skymap plot -> show tiles and a table. One would be able to click on tiles and show (proba of hosting the event, E(B-V), airmass, visibility plot for the tile)
- For the scheduler:
  - Use gw scheduler used in IACTs+consider the optical cases: gwemopt scheduler used in GRANDMA and Skyportal https://github.com/mcoughlin/gwemopt/tree/master/gwemopt

To take into consideration for optical case: airmass

- Airmass: to be calculated (estimation based on Pickering2002. 2 lines of Python to be updated later)
  - Airmass = 1/np.sin((elevation+244/(165+47*elevation**1.1))*math.pi/180)

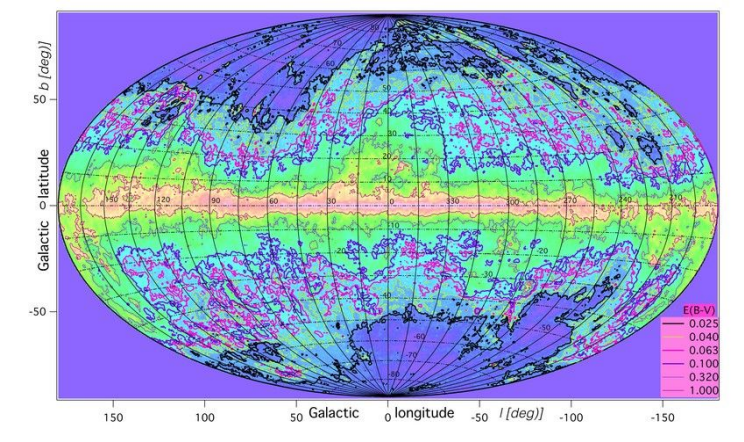


Cut in zenith angle from the airmass? + Reweighting once scheduling is done? as first approach

To take into consideration for optical case: galactic extinction

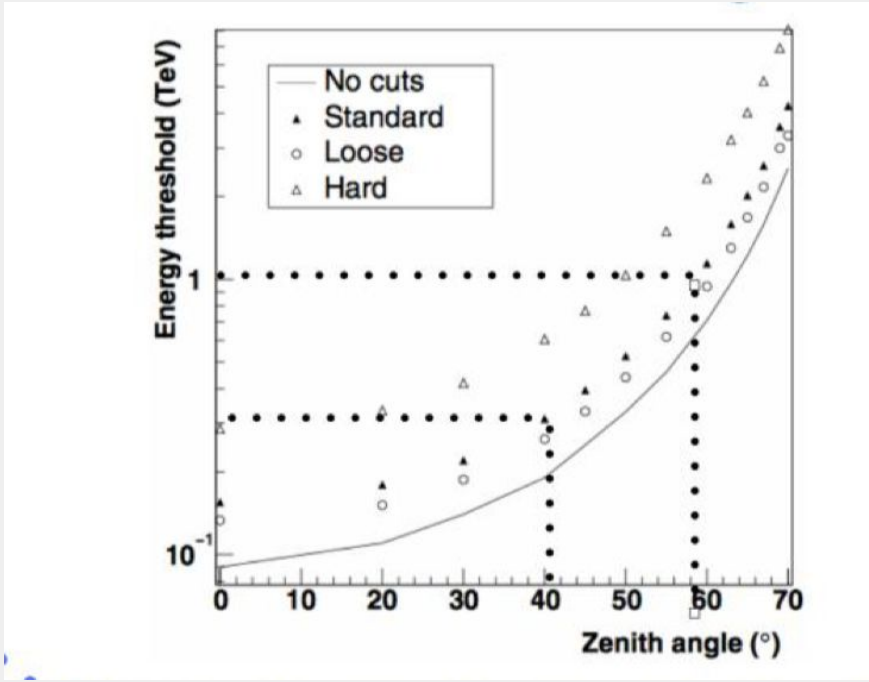
- Galactic extintion: https://ned.ipac.caltech.edu/extinction_calculator (any API to get those info automatically ?
  - Use E(B-V) parameter
  - It goes from 0 to >>>20

-> https://github.com/ruizca/gdpyc -> to get the gal. extinction E(B-V) parameter



About the E(B-V) and A_λ conversion -> https://spex-xray.github.io/spex-help/models/ebv.html

IACT: energy threshold dependence on zenith angle



A posteriori weighing probability covered probability

- Optical telescopes: Airmass and Extinction
- IACTs: integrated flux

$$P = PGW * (1 - 0.2(1 - I(x)/I_0))$$

$$I(X) = I_0 * e^{-cX}$$

DEMO

Astro-COLIBRI

Select action | Latest transients | Cone search

Personalize

Observatories: Swift | Fermi | HAWC | IceCube | AMON | Integral | LVC | other

Event types: FRB | OT | SN | GRB | burst | neutrino | GW | other | nuem | 4FGL | TeVCAT | SGR/AXP

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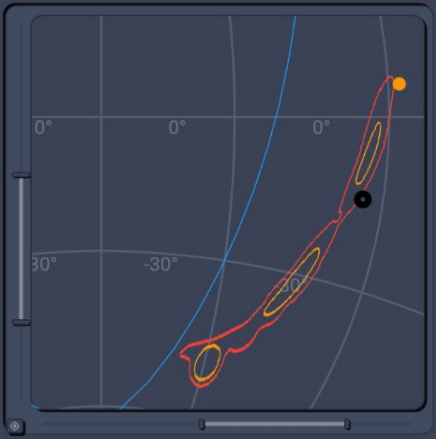

Detailed info about selected source:

science mode

VoEvent : Click here
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Detection time: 2020-01-15 04:23:09
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pipeline: gstlal classification: MassGap: 1.00

Search for ATels!

Gravitational waves are distortions of space-time! The are generated by all accelerated masses but their amplitude is so tiny that only the most massive objects in the universe create waves that are sufficiently powerful to be detected by the current generation of instruments. This event has been recorded by the Advanced LIGO and Advanced Virgo laser interferometers. The gravitational wave has been emitted by the merger of two bodies, one of which seems to have a mass in the range between 3 and 5 solar masses.

Links for further details

auto scroll

LSXPS
Living Swift-XRT point source catalogue

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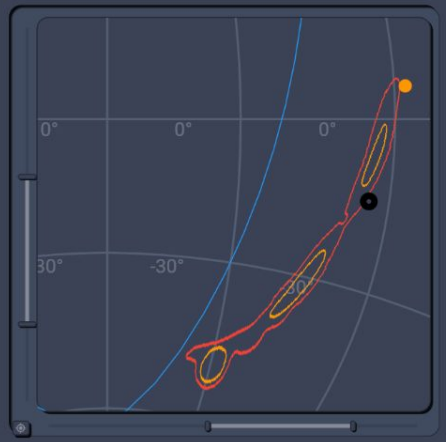

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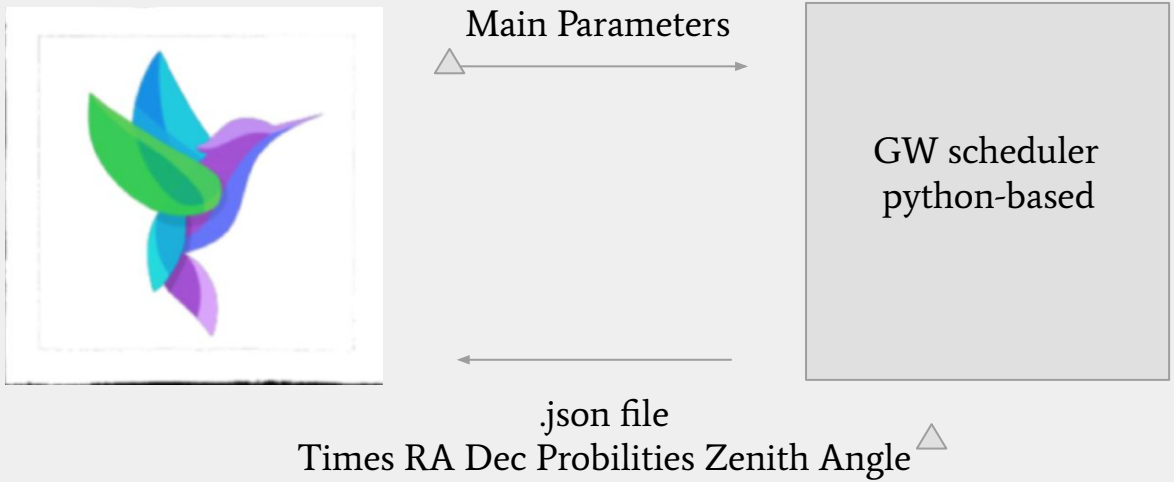
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Parameters needed in the Astrocolibri gui

[observatory]
name = 'LST'
Lat = 28.75
Lon = 17.5
Height = 2200

[visibility]
gSunDown = -18
HorizonSun = -18:00:00
gMoonDown = -0.5
HorizonMoon = -00:30:00
gMoonGrey = 65
gMoonPhase = 60
MoonSourceSeparation = 30
MaxMoonSourceSeparation = 145

[operations]
max_zenith = 70
FOV = 2.0
MaxRuns = 20
MaxNights = 1
Duration = 20
MinDuration = 10
UseGreytime = False

[tiling]
Online = False
MinimumProbCutForCatalogue=0.01
MinProbCut = 0.02
doplot=True
SecondRound = False
FulFillReq_Percentage=0.75
PercentCoverage = 0.90
ReducedNside = 64
HRnside = 128
Mangrove = False

Astro-COLIBRI

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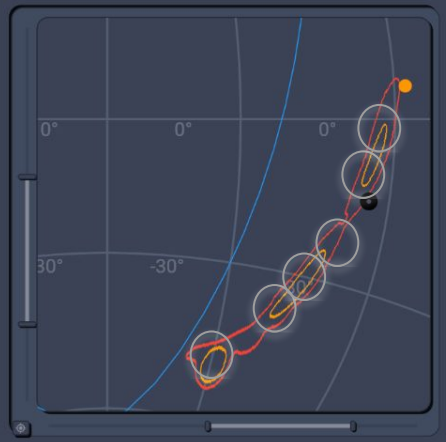

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340.3125	-17.27 0	0.0369	1.9	0.023
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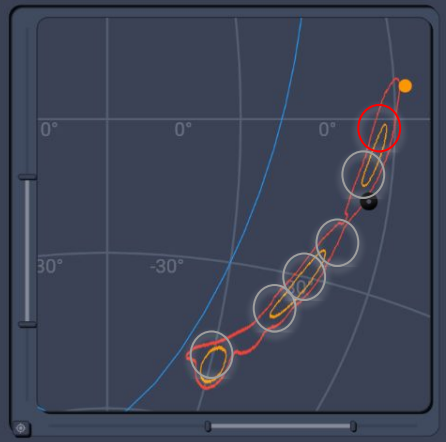

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0°
0°
0°
30°
-30°
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Search for ATels!
Tile
visibility: 2022-09-29
Daily
Monthly
Show Daily Plot
weather: forecast seeing
sky view: HeavensAbove
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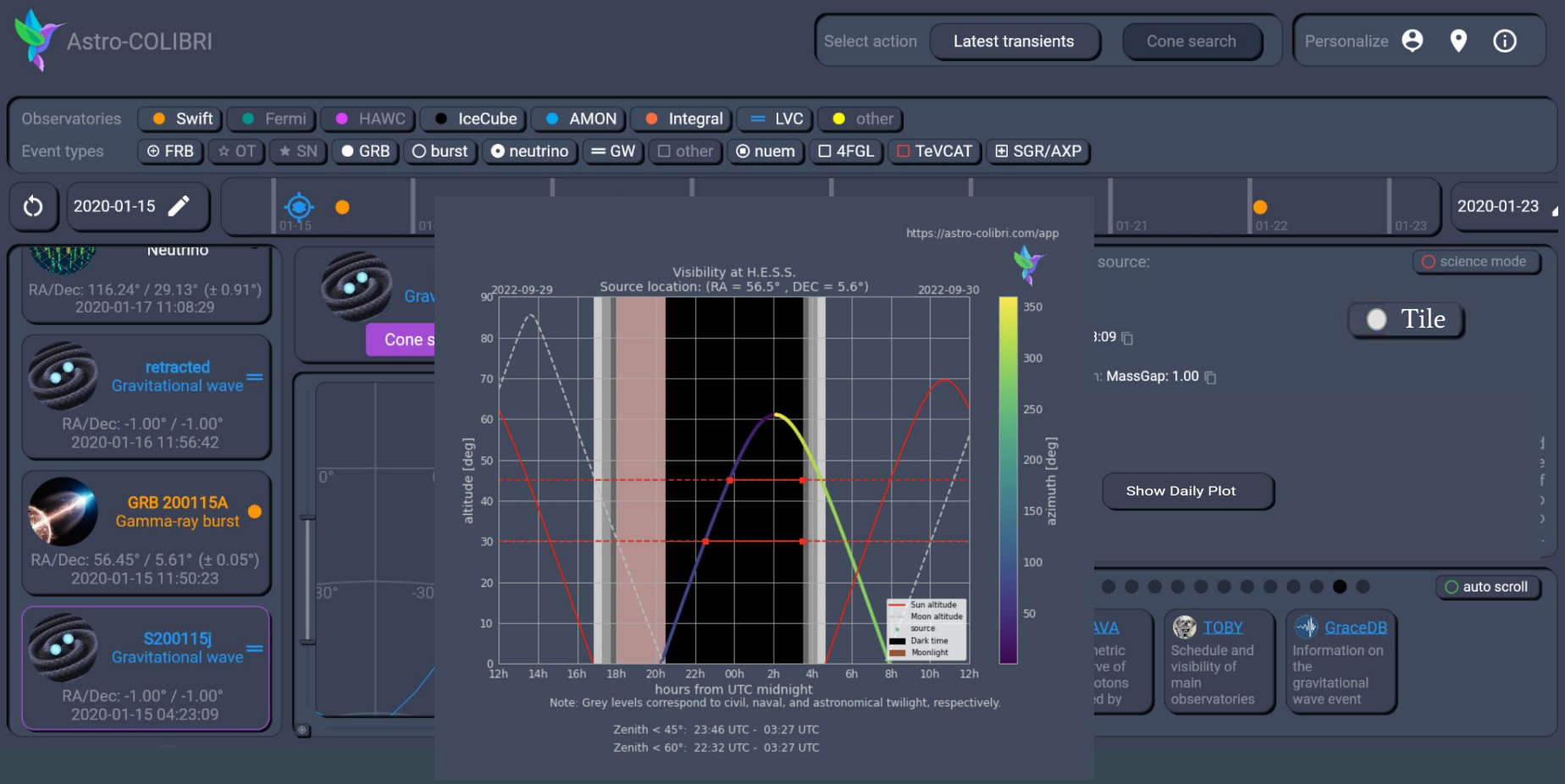
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https://astro-colibri.com/app
Visibility at H.E.S.S.
Source location: (RA = 56.5° , DEC = 5.6°)
2022-09-29
2022-09-30
altitude [deg]
azimuth [deg]
hours from UTC midnight
Sun altitude
Moon altitude
source
Dark time
Moonlight
Note: Grey levels correspond to civil, naval, and astronomical twilight, respectively.
Zenith < 45°: 23:46 UTC - 03:27 UTC
Zenith < 60°: 22:32 UTC - 03:27 UTC
source:
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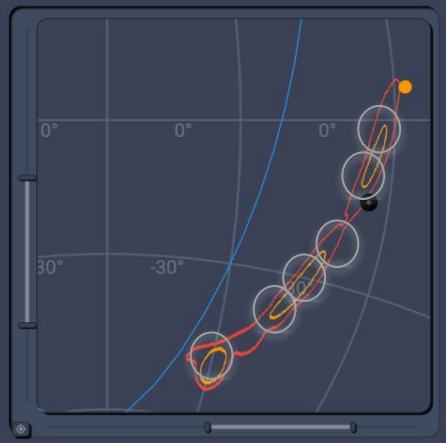

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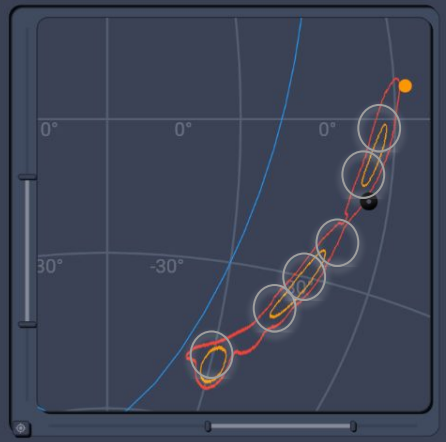

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Missing points

- Details of the plug to astroCOLIBRI
- Implement squared FOV

Back-up