PROGRESS UPDATE

Master's project

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INTRODUCTION

About me:

- Bas Jongewaard
- 22, live in Zaandam
- Physics (GRAPPA) @ University of Amsterdam
- Master's project at Nikhef/KM3NeT
- Supervisor: Aart Heijboer

Aim of project:

- For a new detector, what is better:
  larger dimensions, or increased angular resolution?

Progress so far:

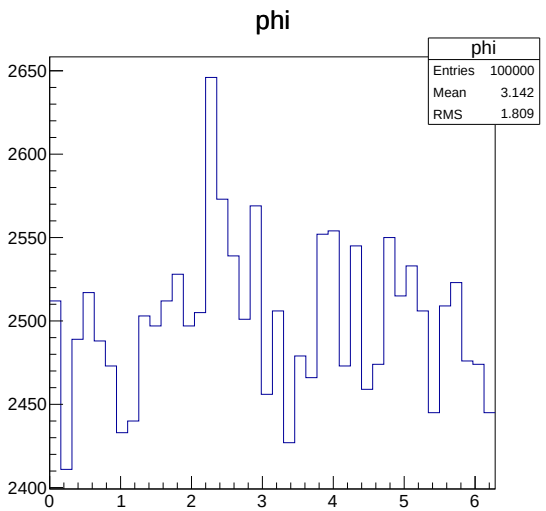
- Simulate observable universe (neutrino sources only)
  - Parameters: redshift z, angles ϕ and θ
- Compute luminosity distance (D_L)
- Weigh sources by distance (flux map)

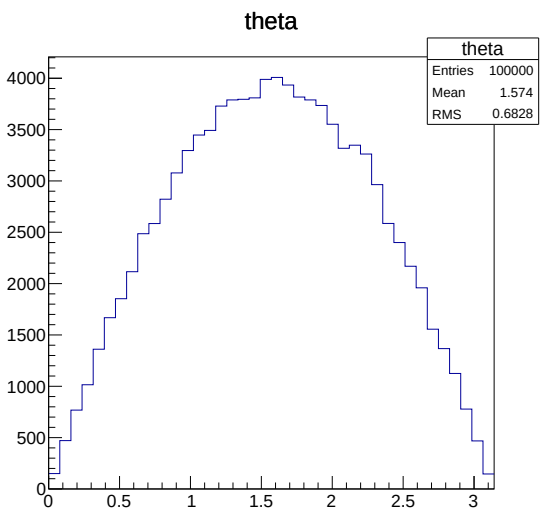
SIMULATION

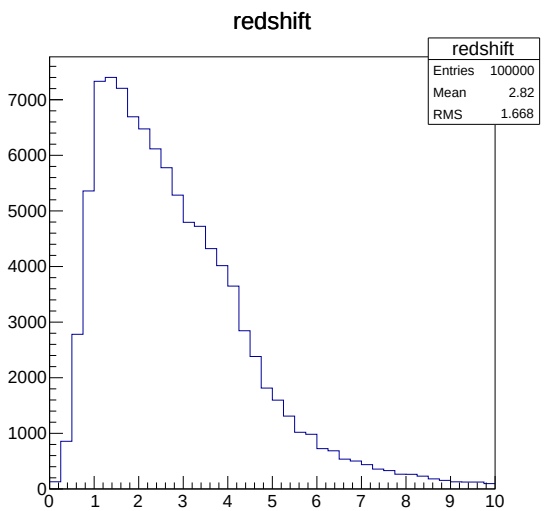
- Angles ϕ and θ are randomly generated in an isotropic way
- Redshift z is drawn from the following distribution:

$$f(z) \times z^2, \qquad \text{where } f(z) = \frac{H_0}{H(z)} \frac{SFR(z)}{(1+z)^2}$$

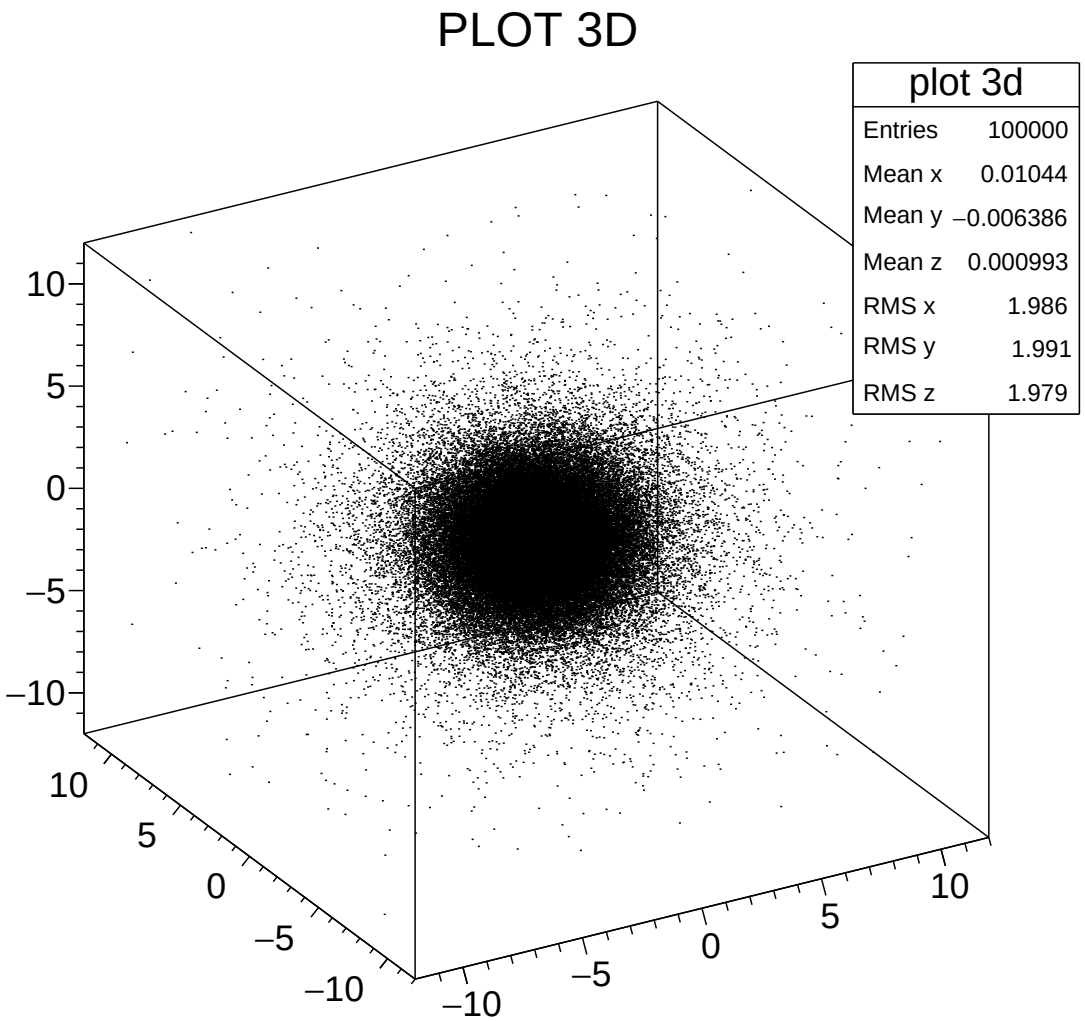
(Turned out to be wrong, as $[f(z)] = Mpc^{-3}$.)



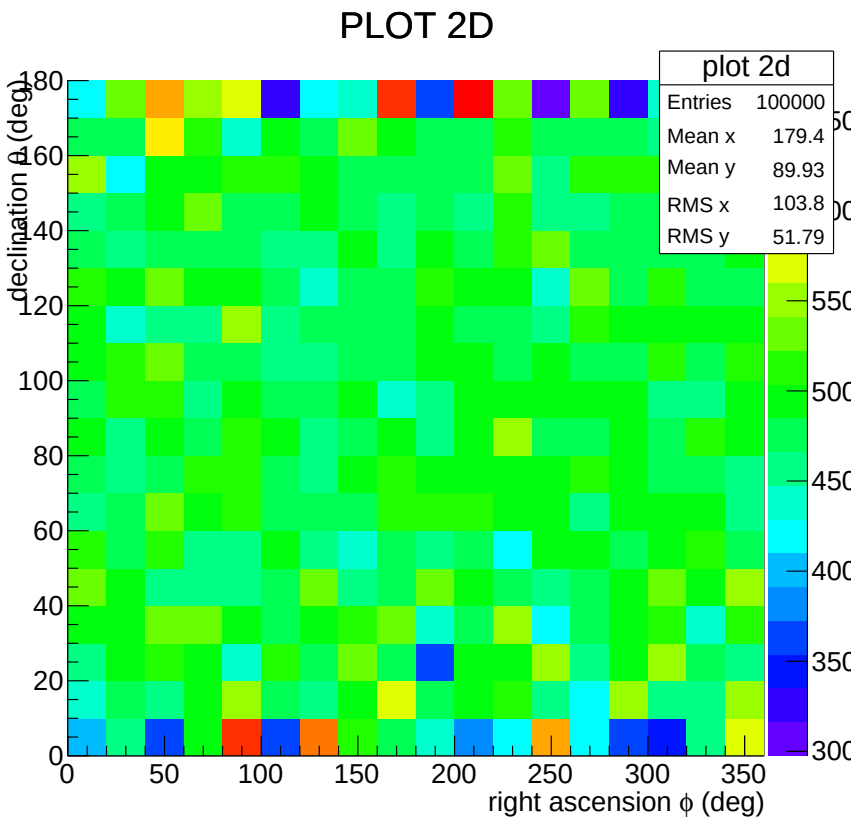




Result (zoomed in):



Plotting ϕ vs θ (corrected for θ-distribution) shows an isotropic universe:



Simulated sources are stored in files:

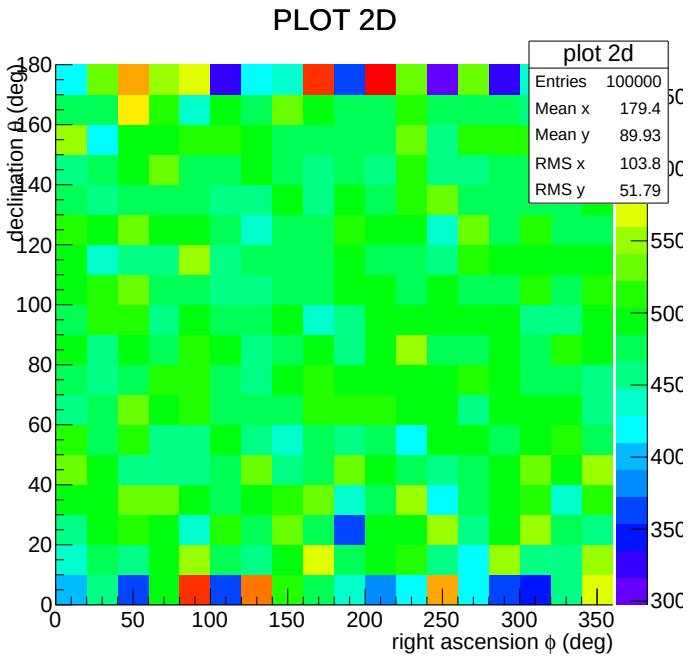
```
% ********************************************************
%                GENERATED NEUTRINO UNIVERSE
% ********************************************************
% This file contains the "position" for 100000 neutrino
% sources. It takes into account the SFR at different z.
%
% redshift          right ascension     declination         luminosity dist.    flux
% z                 phi (rad)           theta (rad)         D_L (Mly)           F (W / m^2)
000009.35643655364  000005.90271533577  000002.40452355504  00000310747.815553  0000.0876648951194
000001.95307074969  000004.66707182994  00000.744632540259  0000048864.2250769  000003.54535603401
000003.13158974506  00000.427767070181  000001.73174976829  0000086548.9281329  000001.13010422586
00000.327847414535  000005.55704580409  000002.65503394632  0000005600.6499133  00000269.876477665
000002.40484934772  000001.79508371383  000001.95216615521  0000062952.1184473  000002.13609806908
000001.12268281009  000001.93057317482  00000.947880295912  00000024728.272173  0000013.8437689378
000002.11483395949  000003.79954352811  00000.890028927165  0000053847.4867174  000002.91951701536
000001.09888812412  000001.79464601262  000001.37684169466  0000024083.1920716  0000014.5953255926
000003.56469702315  000003.33763453006  000001.15391384431  000000101036.66982  00000.829246867356
00000.725491419225  00000.831177219402  0000001.6628866308  0000014454.9900701  0000040.5141088886
00000.730902083657  000003.66708255336  000002.60538087943  0000014586.8507054  0000039.7849494218
000001.76700252516  000005.12195169755  00000.951540512225  0000043228.2042932  000004.53009694237
000002.70856656478  000005.25881651568  000002.02067801406  0000072690.8296835  000001.60207422974
000002.59825574084  000004.87805697672  000001.99607793185  0000069131.5620548  000001.77128786063
000002.08117502916  00000.759236707436  000002.03540967663  0000052804.6186277  000003.03597412359
0000012.4286381019  000001.38421245734  000002.48933000273  00000428463.948884  0000.0461119315168
```

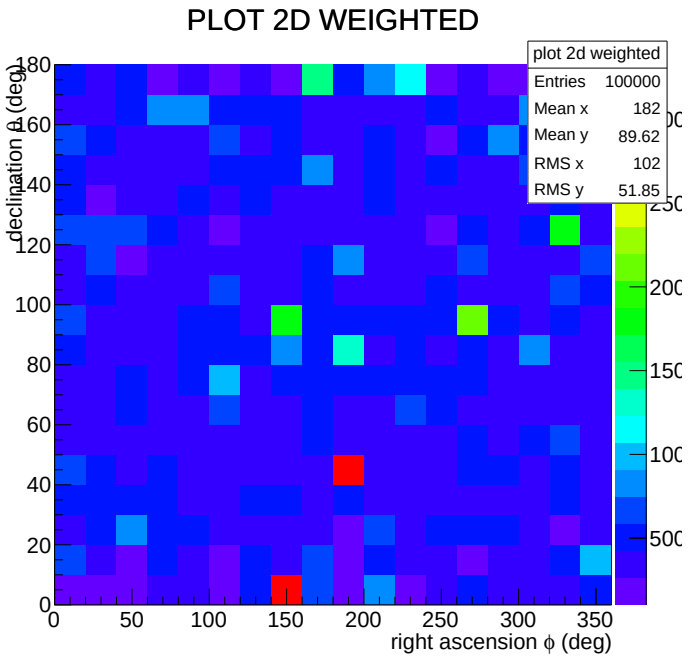
FLUX

Sources are weighted by the received flux

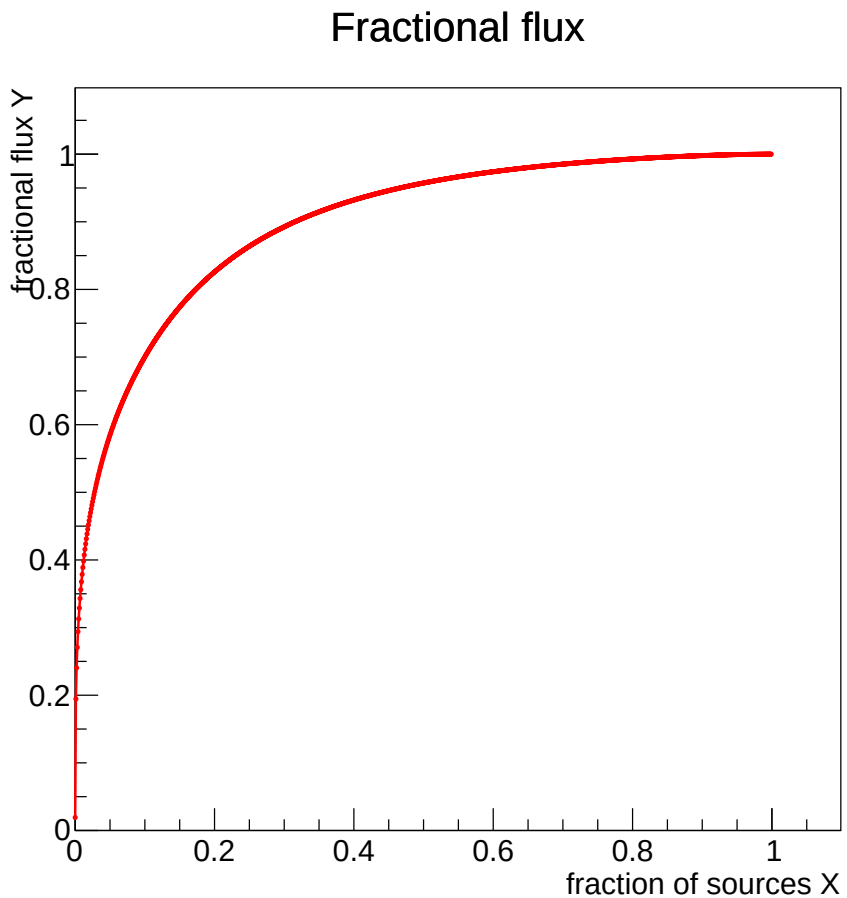
- Generate luminosity for each source (WIP)
- Flux = luminosity / $4\pi D_L^2$

Weighted angular map:





Computed fractional flux as fraction of sources:



TO DO

Plans for next week:

- Improve simulation:
  - Control over source density
  - Luminosity (now an arbitrary number)
- Compare:
  - Compare computed flux with formula from article
- Catalog:
  - Catalog of ‘real’ (= observed) neutrino sources
  - Convert into data file that can be read by algorithm