

## ctools - Action #3065

### Add moon constraint to cviscube

11/14/2019 10:44 AM - Knödlseeder Jürgen

<b>Status:</b>	Closed	<b>Start date:</b>	11/14/2019
<b>Priority:</b>	Normal	<b>Due date:</b>	
<b>Assigned To:</b>	Knödlseeder Jürgen	<b>% Done:</b>	100%
<b>Category:</b>		<b>Estimated time:</b>	0.00 hour
<b>Target version:</b>	1.7.0		
<b>Description</b>			
<p>So far the cviscube only has a Sun constraint. A moon constraint should be added.</p> <p>In the CTA scheduler, Pep Colomé mentioned that they take into account the sky brightness as a function of Moon altitude, Moon-target distance, and Moon phase.</p> <p>So far there exists a moonzenith parameter that is however not yet used. It looks like a parameter that limits the sky brightness would be more appropriate. A moon model can for example be found in Britzger, D. (2009) (studies of the Influence of Moonlight on Observations with the MAGIC Telescope. Diploma thesis Universität München. <a href="https://magicold.mpp.mpg.de/publications/theses/DBritzger.pdf">https://magicold.mpp.mpg.de/publications/theses/DBritzger.pdf</a>). An alternative an simpler moon model can be found in attachment:1991PASP__103_1033K.pdf.</p> <p>According to <a href="https://arxiv.org/pdf/1704.00906.pdf">https://arxiv.org/pdf/1704.00906.pdf</a>, MAGIC observations are typically done up to 12 times NSB_dark, where NSB_dark are the NSB conditions towards the Crab with no moon in the sky.</p> <p>A much more simple scheme is used in attachment:SSTillumination.pdf. Here, the fractional lunar illumination (FLI) is used, which is fraction of the lunar disk that is illuminated at local civil midnight. In ESO standards, lunar dark time is when FLI &lt; 0.4. Nevertheless, even if the moon illumination is small, a minimum distance to the moon should probably be respected (the MAGIC paper speaks about 20 deg). Hence it would make sense to add to more parameters to cviscube:</p> <ul style="list-style-type: none"><li>- moondist: the minimum distance from the moon</li><li>- flimax: the maximum allowed FLI</li></ul>			

### History

#### #1 - 11/14/2019 03:22 PM - Knödlseeder Jürgen

- File viscube\_south.png added
- File viscube\_north.png added
- File viscube\_south\_womoon.png added
- File viscube\_north\_womoon.png added
- Status changed from New to Pull request
- Assigned To set to Knödlseeder Jürgen
- Target version set to 1.7.0
- % Done changed from 0 to 100

I implemented two Moon constraints:

- moonzenith, which is a minimum zenith angle required for the Moon, similar to the constrain of the Sun. If the Moon is higher in the sky than this zenith angle, the corresponding times are excluded
- maxfli, which is the maximum fraction of lunar illumination. If the fraction of lunar illumination is below this threshold, no Moon constraint is applied

I also added a binary extension table to the output FITS file that contains a number of parameters as function of time. Parameters include the Sun and Moon positions, the lunar elongation and fraction of illumination, and the dark time.

I also added a script show\_viscube.py to display the visibility cube integrated over all zenith angles and the dark time as function of time. Below the results for the South site (geolon=79.4041, geolat=-24.6272) and the North site (geolon=17.8900, geolat=+28.7619) for sunzenith=105.0, moonzenith=90 and maxfli=0.4 (which are the default parameters) for one full year. In addition, results are also show for moonzenith=0 to illustrate the impact of the Moon constraint.

moonzenith	South	North
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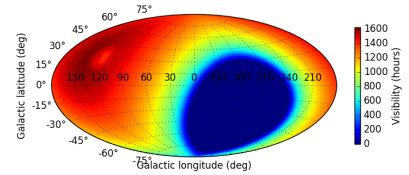
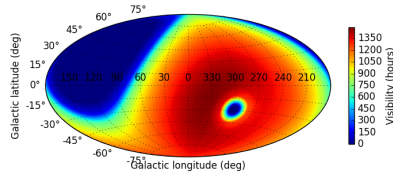
90  
0

Visibility map

Visibility map

Visibility map

Visibility map



#2 - 11/14/2019 04:30 PM - Knödseder Jürgen  
- Status changed from Pull request to Closed

Merged into devel.

Files

SSTillumination.pdf	218 KB	11/14/2019	Knödseder Jürgen
1991PASP__103_1033K.pdf	774 KB	11/14/2019	Knödseder Jürgen
viscube_south.png	162 KB	11/14/2019	Knödseder Jürgen
viscube_north.png	156 KB	11/14/2019	Knödseder Jürgen
viscube_south_womoon.png	155 KB	11/14/2019	Knödseder Jürgen
viscube_north_womoon.png	150 KB	11/14/2019	Knödseder Jürgen

