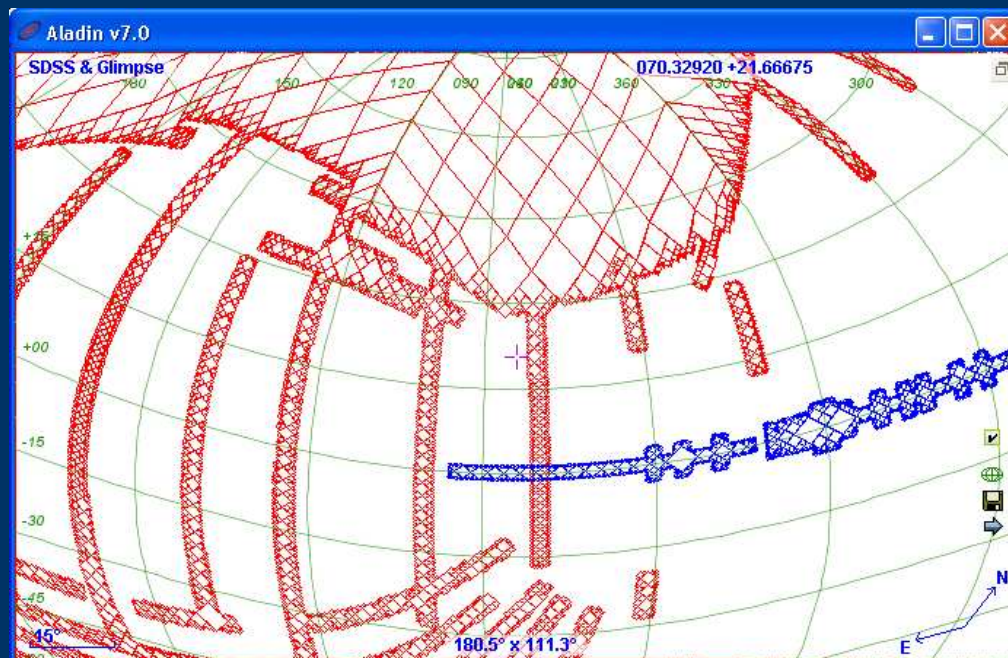# Multi-level HEALPix footprints

« Aladin version 7 in-coming ideas »

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  Données
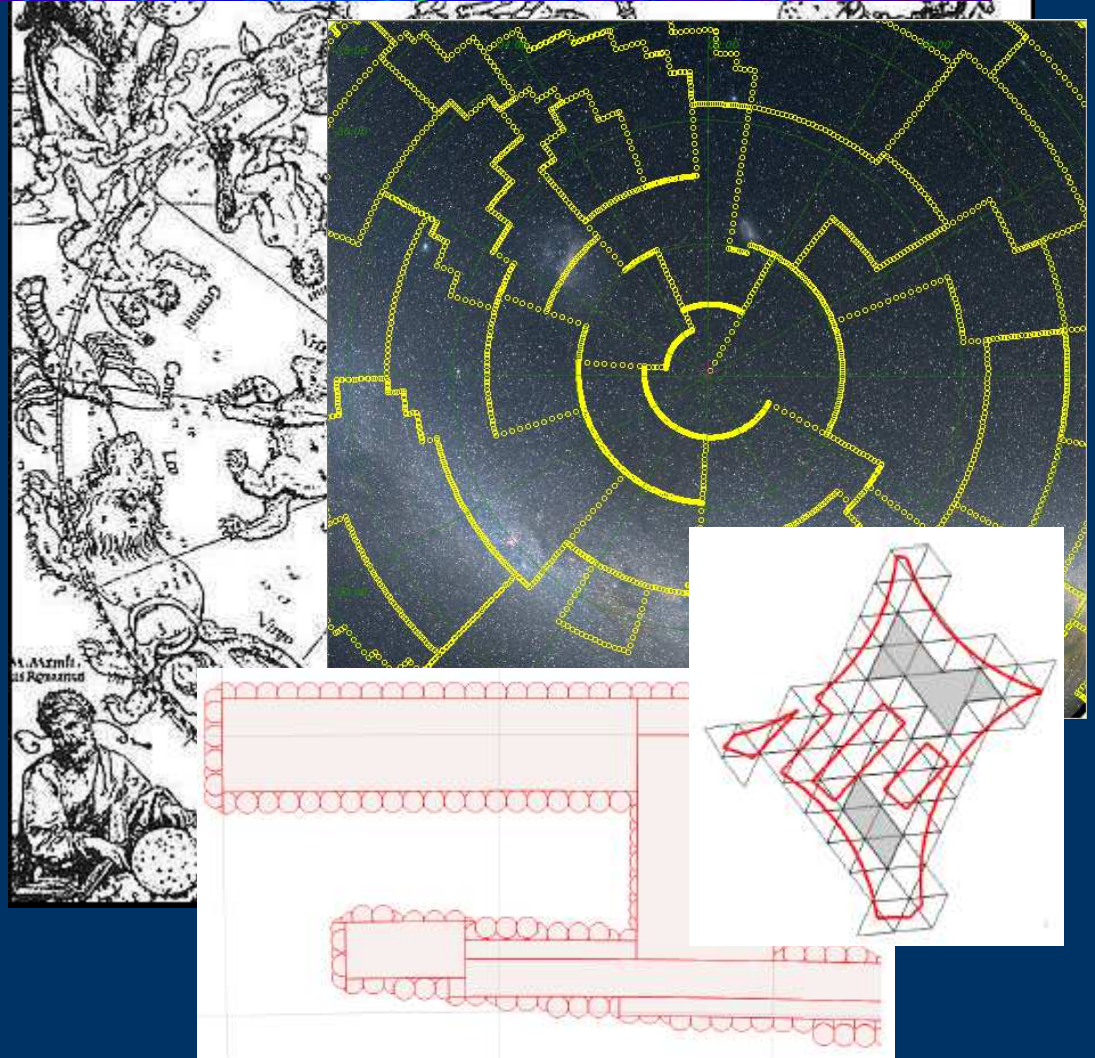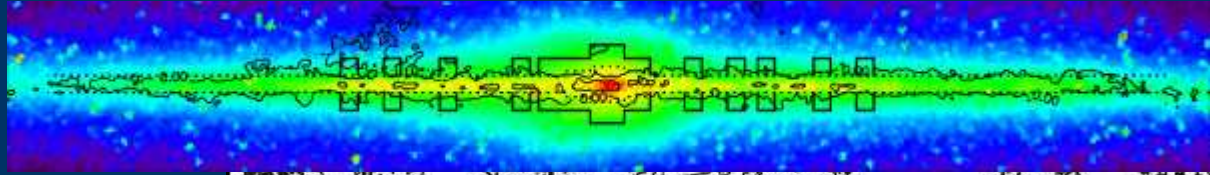 astronomiques
  de Strabourg

« The big question »

- How to describe a sky area :
    - footprint survey,
    - catalog coverage,
    - sky regions, ...

- For answering as fast as possible to this question:

«Which data have we in this region »

=> see PASP 2010 - Budavari et al. « Searchable Sky coverage... »

To do that
Aladin 7 chose HEALPix

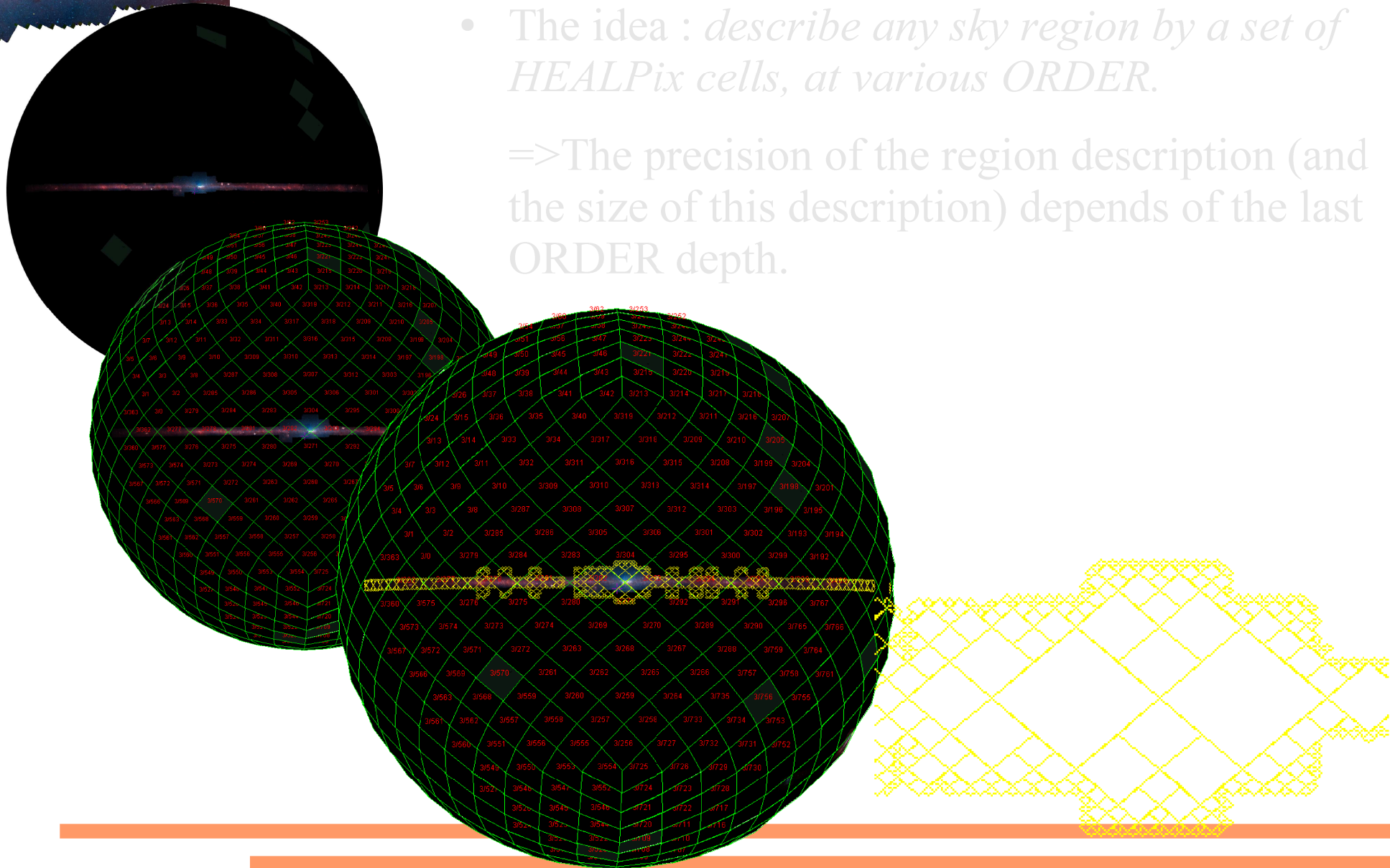| Norder	pixels	16bits	Pix res
0	12	24B	58.63°
1	48	96B	29.32°
:	:		:
6	49152	96KB	54.97'
:	:		:
8	786432	1,5MB	13.74'
9	3145728	6MB	6.87'
:	:		:
12	201326592	384MB	51.53"
:	:		:
18	8,25E+011	1,5TB	0.81"
:	:		:
29	3,46E+018	6 ZetaB	0,39mas
30	1,38E+019	24 ZetaB	0,2mas	*Healpix 64 bits limit*

=> Why HEALPix rather than Qbox or HTM ?

- *Equal Area cells*

- *Faster (no recursion)*

- *Deeper (0.2mas)*

- *FITS standard (WMAP,Planck)*

- *Libraries (FORTRAN, IDL, C++, java)*

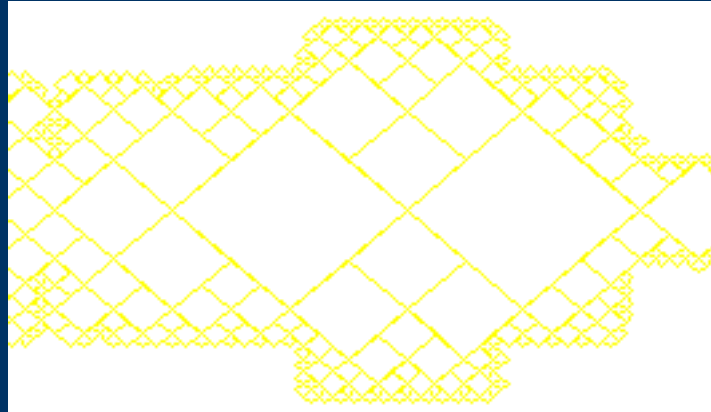*=> see 2001misk.conf – Wil O'Mullane et al. « Splitting the sky - HTM and HEALPix »*

Coverage map by HEALPix

- The idea : *describe any sky region by a set of HEALPix cells, at various ORDER.*

  =>The precision of the region description (and the size of this description) depends of the last ORDER depth.

How to encode it ?

In progress with HEALPix developers :

1) A very **simple ASCII** format, to develop easily small writer/reader codes.

2) **A string** mode for Web query forms

3/48-63 4/55 ...

3) A more robust **FITS format** (directly derived from HEALPix partial FITS map format).
=> Multi-table ?
=> Unique-table ? (coding ORDER and PIXEL together => UNIQ ordering)

SDSS_HpxMOCM.txt - Notepad2

File   Edit   View   Settings   ?

```
 2
 3 ORDER=3
 4 48 49 50 51 52 53 54 55 56 57
 5 58 59 60 61 62 63 160 161 162 163
 6 164 165 166 167 168 169 170 171 172 173
 7 174 175 176 177 178 179 180 181 182 183
 8 184 185 186 187 188 189 190 191 24 25
 9 26 27 28 29 30 31 44 45 46 47
10 84 85 86 87 92 93 94 95 116 117
11 118 119 120 121 122 123 124 125 126 127
12 244 245 246 247 252 253 254 255 15 23
13 37 38 39 41 43 109 110 111 113 114
14 115 139 140 142 143 154 155 158 159 223
15 249 250 251 439 445 446 447
16
17 ORDER=4
18 55 59 78 79 87 89 90 91 141 143
19 145 147 163 169 171 333 335 357 358 359
20 365 366 367 415 427 430 431 435 451 549
21 551 553 554 555 566 567 610 611 614 615
22 626 627 630 631 863 885 886 887 891 957
23 958 959 973 975 995 1531 1532 1533 1663
   1751
24 1777 1778 1779 2116 2118 2124 2384 2389
   2482
25
26 ORDER=5
27 99 108 111 127 184 187 208 211 213 214
        263 269 270 276 277
        299 301 302 303 308
        342 343 345 346 347
        543 552 555 560 571
```

ANSI   CR+LF   INS   D

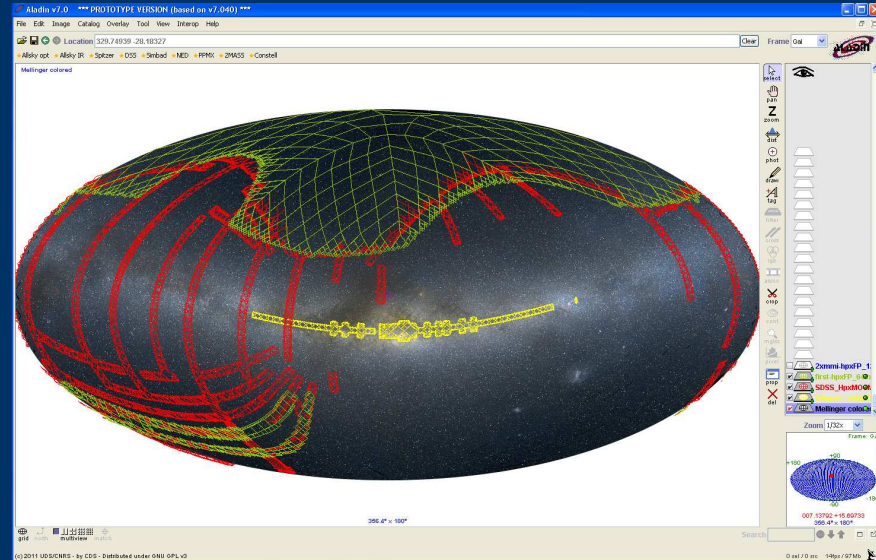fv: Summary of SDSS_HpxMOCM.fits in C:/Documents and Settings/Standard/Bureau/

File   Edit   Tools   Help

Index	Extension	Type	Dimension	View				
0	Primary	Image	0	Header	Image	Table		
1	Order 3	Binary	1 cols X 117 rows	Header	Hist	Plot	All	Select
2	Order 4	Binary	1 cols X 69 rows	Header	Hist	Plot	All	Select
3	Order 5	Binary	1 cols X 617 rows	Header	Hist	Plot	All	Select
4	Order 6	Binary	1 cols X 2233 rows	Header	Hist	Plot	All	Select
5	Order 7	Binary	1 cols X 4519 rows	Header	Hist	Plot	All	Select

How to display them ?

- Aladin beta 7.040 is already supporting the 3 propositions

How will we use them ?

- Low level data base query mechanism (already used at CDS internally for Aladin & prototype X-match tool)

  Http://.../hpx.query?5/128-252

- Arithmetic operation ? (intersection...)

- Joint to the resource record in the VO registry

- Any good idea based on this common sky representation/division (multi-server Xmatch, ...)

Short demo ?

Http://aladin.u-strasbg.fr/java/AladinBeta.jnlp