Point-like IRF support proposal

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Open DL3 status

- Current DL3 specs:

  https://gamma-astro-data-formats.readthedocs.io/en/latest/

- They include:
  - Event lists: gamma-like events (no additional cuts)
  - Full-enclosure IRFs (calculated with no directional cut) as a function of the energy and FoV
  - This '*a-la-Fermi*' approach is different to the one used by IACTs up to now
    - Intends to convert the "3D analysis" to the default options for CTA

Open DL3 status – Full-enclosure IRFs

- Given current status of the CTA project, this format may not be enough:
  - Very different approach to the one used by current IACTs
  - Even if CTA intends to do things differently (hopefully better), data formats should at least have backwards compatibility (support the IRF format used up to now)
  - Current public CTA IRFs are optimized to maximize differential sensitivity of a point-like source at 20º za
    - Custom cuts are required to reach this sensitivity, therefore current full-enclosure IRFs do not allow to reach that level of sensitivity

Open DL3 status – Full-enclosure IRFs

- Current CTA IRFs:

`https://www.cta-observatory.org/science/cta-performance/`

  - All public IRFs shown are point-like

- Regarding CTA internal IRFs format

  - Until now, only ROOT files containing point-like IRFs were generated

  - We want to start using proposed science tools with IRFs in FITS files

Proposal – Addition of Point-like IRFs

- Here we propose the addition to the specs of point-like IRFs
  - Each IRF is calculated post (E-dependent) θ^2 cut
  - Effective area, energy dispersion and background rate is calculated as a function of the FoV
  - An additional column is added to store the θ^2 cut
- Available PR at gitHub:

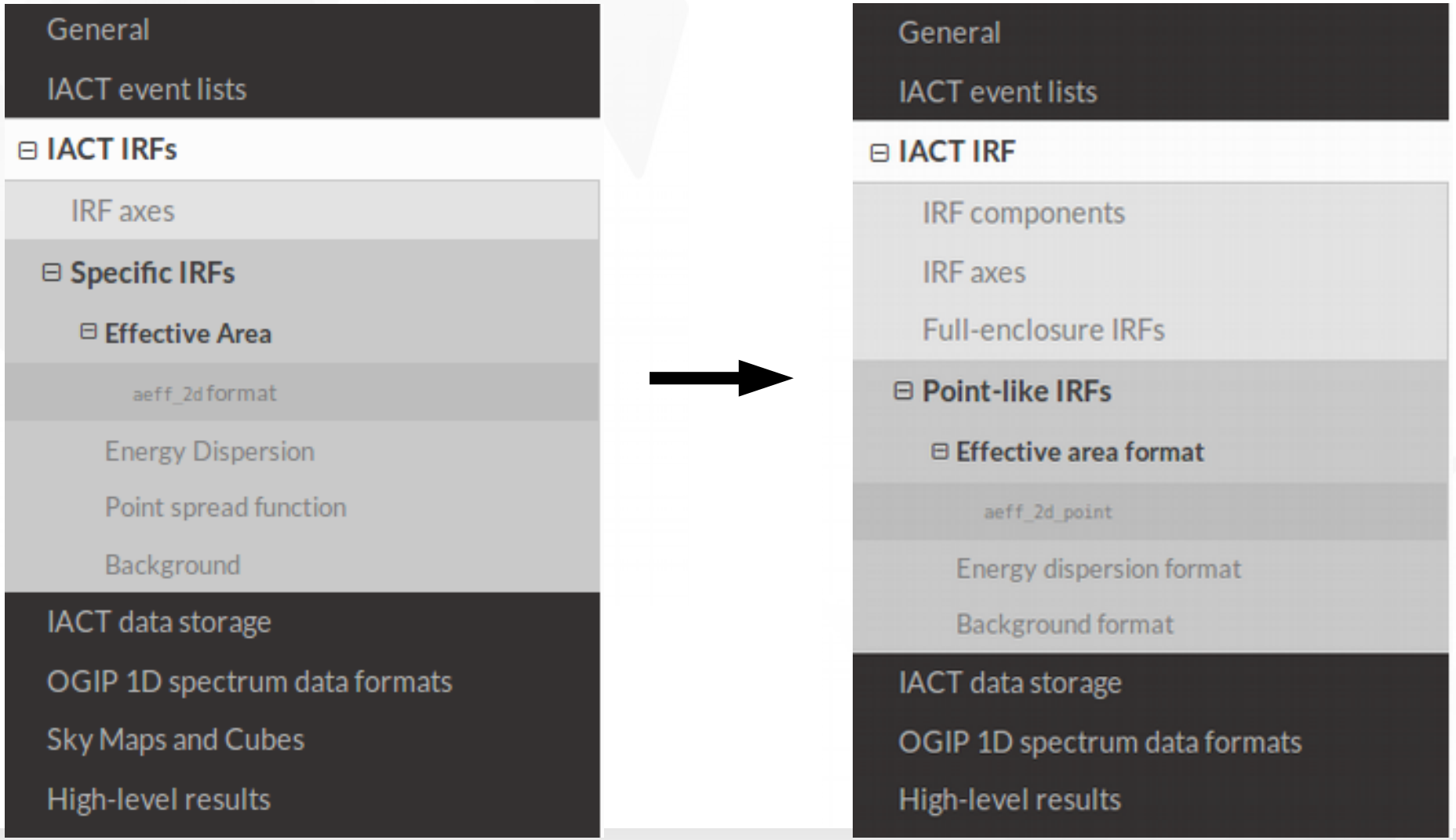
  `https://github.com/open-gamma-ray-astro/gamma-astro-data-formats/pull/79`

- See proposal in:

  `http://www.gae.ucm.es/~thassan/gamma/index.html`

Proposal – Addition of Point-like IRFs

- IRF specifications were slightly re-organized



Proposal – Addition of Point-like IRFs

- Additional column “RAD_MAX”, containing the applied cut

Effective Area vs true energy

Columns:

- `THETA_LO` , `THETA_HI` – **ndim: 1**
  - Field of view offset axis
- `ENERG_LO` , `ENERG_HI` – **ndim: 1, unit: TeV**
  - True energy axis
- `EFFAREA` – **ndim: 2**
  - Effective area value as a function of true energy

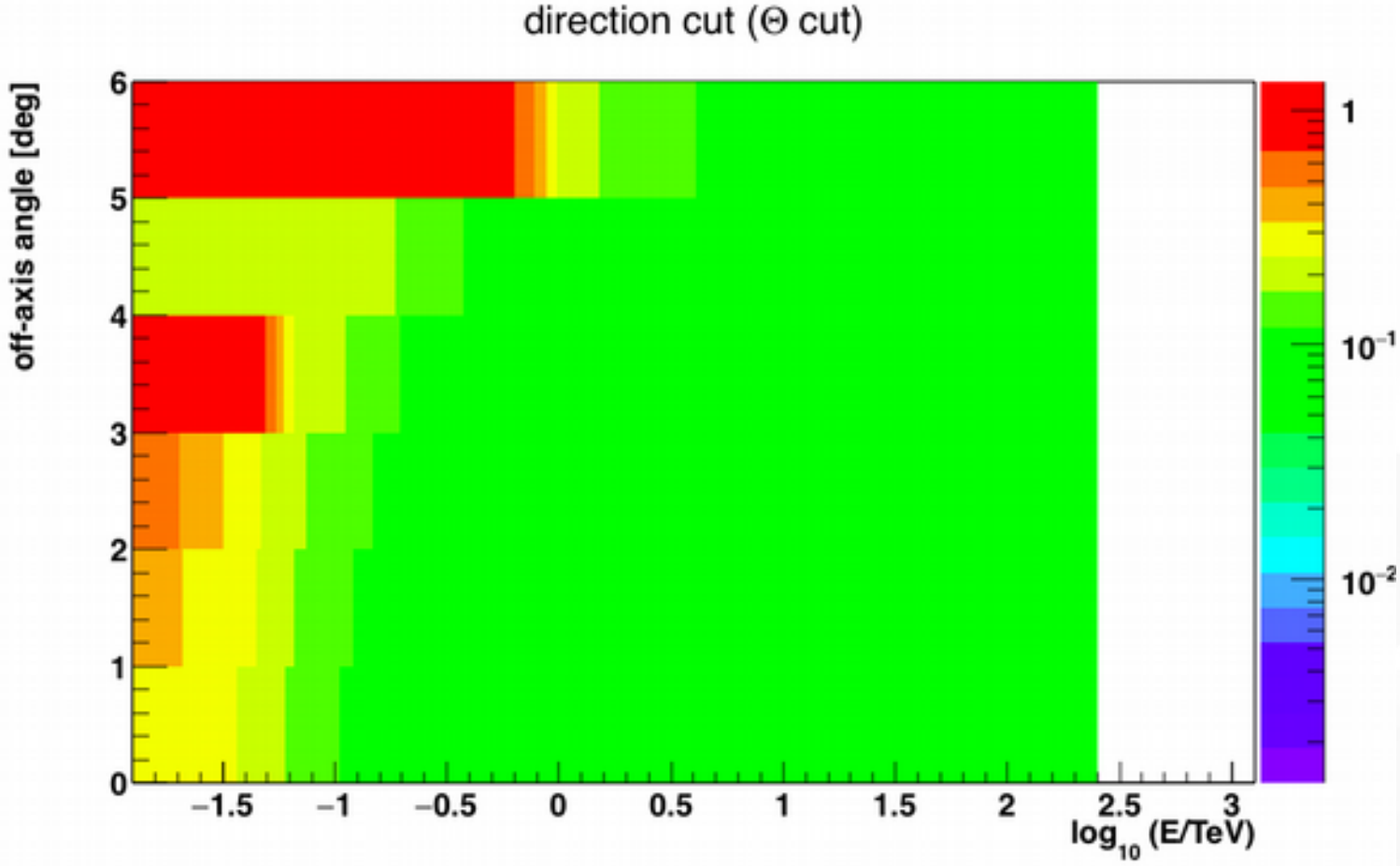
Effective Area vs true energy

Columns:

- `ENERG_LO` , `ENERG_HI` – **ndim: 1, unit: TeV**
  - True energy axis
- `THETA_LO` , `THETA_HI` – **ndim: 1**
  - Field of view offset axis
- `RAD_MAX` – **ndim: 2, unit: deg**
  - Radial cut applied to calculate the IRF component
- `EFFAREA` – **ndim: 2**
  - Effective area value as a function of true energy

Proposal – Addition of Point-like IRFs

- Additional column “RAD_MAX”, containing the applied cut



Proposal – Open questions

- HDUCLASS and HDUCLASn keywords hierarchy
  - This keyword (HFWG recommendation), is a hierarchical classification added to each HDU within the FITS file
  - They are used by the science tools to select the correct IRF
  - Proposal:

HDUCLASS	HDUCLAS1	HDUCLAS2	HDUCLAS3	HDUCLAS4
OGIP	RESPONSE	EFF_AREA	POINT-LIKE	aeff_2d
		RPSF	FULL-ENCLOSURE	edisp_2d
		EDISP		psf_table
	GTI			…..
	EVENTS			