Responses –

ectral – High Resolution

- spatial + spectral tightly coupled
- imaging spectral ("IHA") + spatial strongly coupled

$$C_{\Omega}^{(m)}(h)^{*} = \tau_{eff} \int d\lambda \; G_{\Omega}^{(m)}(\lambda, \hat{p}) A_m(h,\lambda) \, s(\lambda)$$

order sort $\Rightarrow$ $A_m(\lambda) = \sum_{h=h_0(\lambda)}^{h_1(\lambda)} A_m(h,\lambda)$

$A_m(\lambda) \equiv$ grating ARF, order m.

mkgarf: applies source position
calibration
inverse aspect
To map λ to detector vs time

$G_{\Omega}^{(m)}(\lambda, \hat{p}) \equiv$ grating RMF, order m

Describes the redistribution from
λ to channel (diffraction angle)
a.k.a. Line Spread Function (LSF)

*Note: LETGS has only $\sum_{m,h} C_{\Omega}^{(m)}(h)$

Responses –

Temporal – $C(\Delta h, \Delta t) = \int dt \int dh\, C(h,t) = \ldots$

- exposure time per bin
- ARF or map, as appropriate [per bin ?]*

lightcurve: produces exposure time/bin
counts/bin
rate

* Time resolved ARF or map probably rarely needed – dither smooths

Mixed-modes:

e.g. dmcopy to make λ, t image
h, t image
$h, \hat{p}$ image

Responses ~independent
[some operational inconveniences]

CAVEAT THESE RESPONSES ARE DEFINED FOR POINT SOURCES

† for PSF & QE non-uniformities

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Some Practical Matters:

compatibility: FITS
OGIP

Largely back-compatible w/ XSpec

Architecture:

CALDB - all calibration data vs time version

ARDLIB - mission independent interface to CALDB

e.g.: QE(E) is a function

ACIS-S3 QE(x,y,chip) is Chandra specific, + built from several CALDB files

Response tools use common interface of ARDLIB to CALDB

More Practical Matters

- S/N ⇒ accuracy required
  - eg. expmap bin sizes
  - Is expmap dithering required?

- Soureeproperties:
  - which is more appropriate?
    - Spatial mode: $\frac{\text{counts}}{\text{expmap}}$
      - (flux obtained depends on source spectrum + bandpass)
    - Spectral mode: $\int ARF \cdot RMF \cdot S(E)\,dE$
      - (may not be enough counts to fit)

- High-res spectra
  - Fit jointly, or add?
    - adding compromises resolution
    - knowledge of cal. systematics
  - RMF or not?
    - If only want flux, can use counts/ARF
    - If LSF matters, use RMF

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New w/ Chandra

Dither - makes responses more observation-specific
eg. chip gaps in grating spectra
- BUT: smooths small-scale features
& makes response computation more tractable

Calibration quality -
- harder to hide systematics
(a good thing)

Small PSF

Many chips, many modes
- each like a separate telescope,
⇒ more work to make responses

Diffraction gratings -
- introduced most new features to data-structures, analysis

Problems, difficulties, things which can go wrong...

- Check V&V report
- Check "caveats" www-page

- L1: CCD gain - energy wrong; check CAL
  bias - no good grades

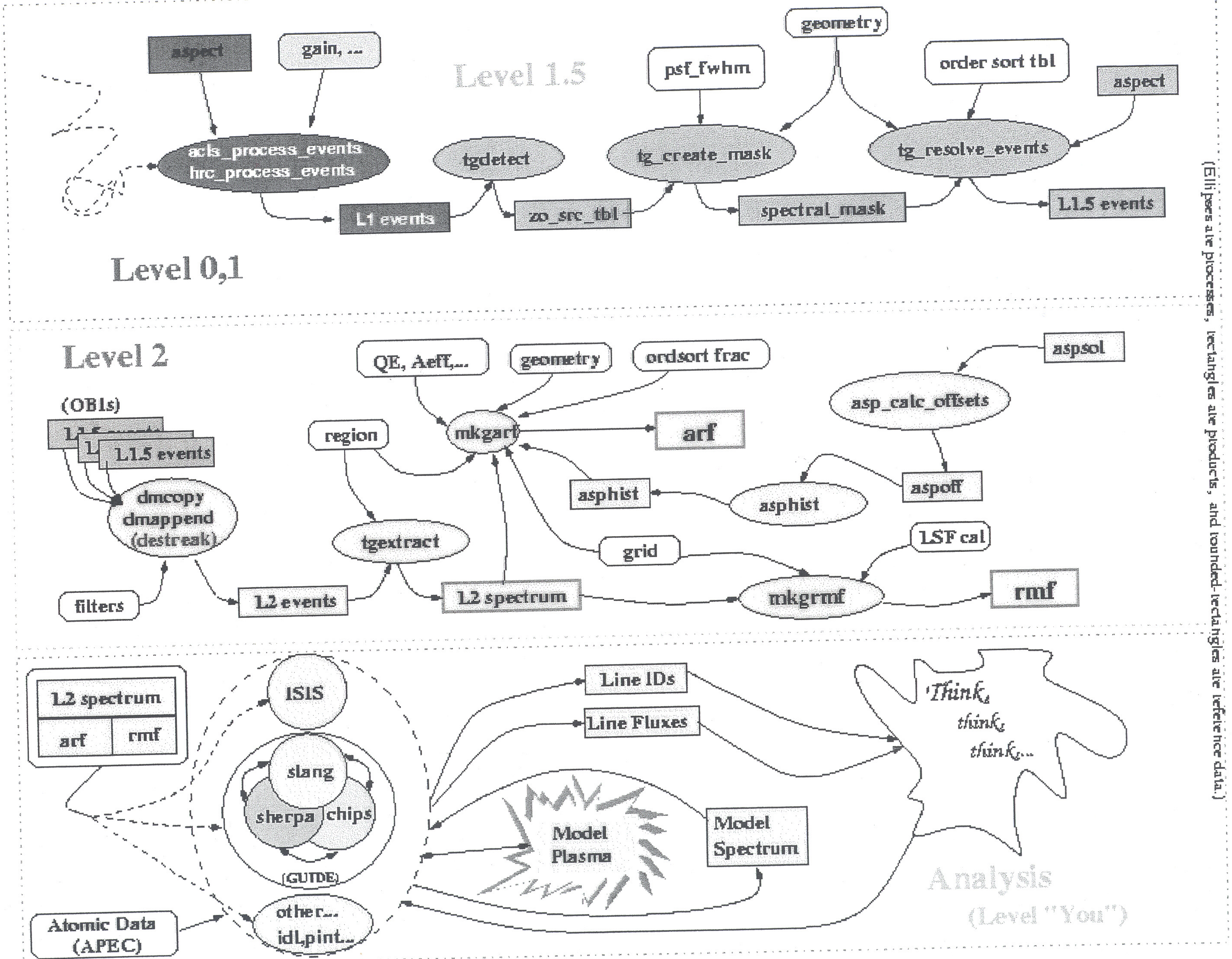
  Aspect

- L1.5 zero-order pos. poor? ($\pm\lambda$'s differ)
  LETGS λ's off (CAL problem)

- Responses: gARF gaps, Expmap edges off
  → aspect, zero-order

- Poorly supported modes:
  ACIS CC
  Zero-order blocked
  ⇒ CALL for help!

- PILEUP - a non-linear problem.
  ISIS module will fit w/ non-linear response



(Ellipses are processes, rectangles are products, and rounded-rectangles are reference data.)

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