



Overview of SPIRE Photometer Pipeline

Kevin Xu
NHSC/IPAC
on behalf of the SPIRE ICC



Goal:

- Show how SPIRE Photometer pipeline works (functionalities of major modules).
- Will concentrate on scan map “user pipelines” (covering small map, large map, SPIRE/PACS parallel mode).

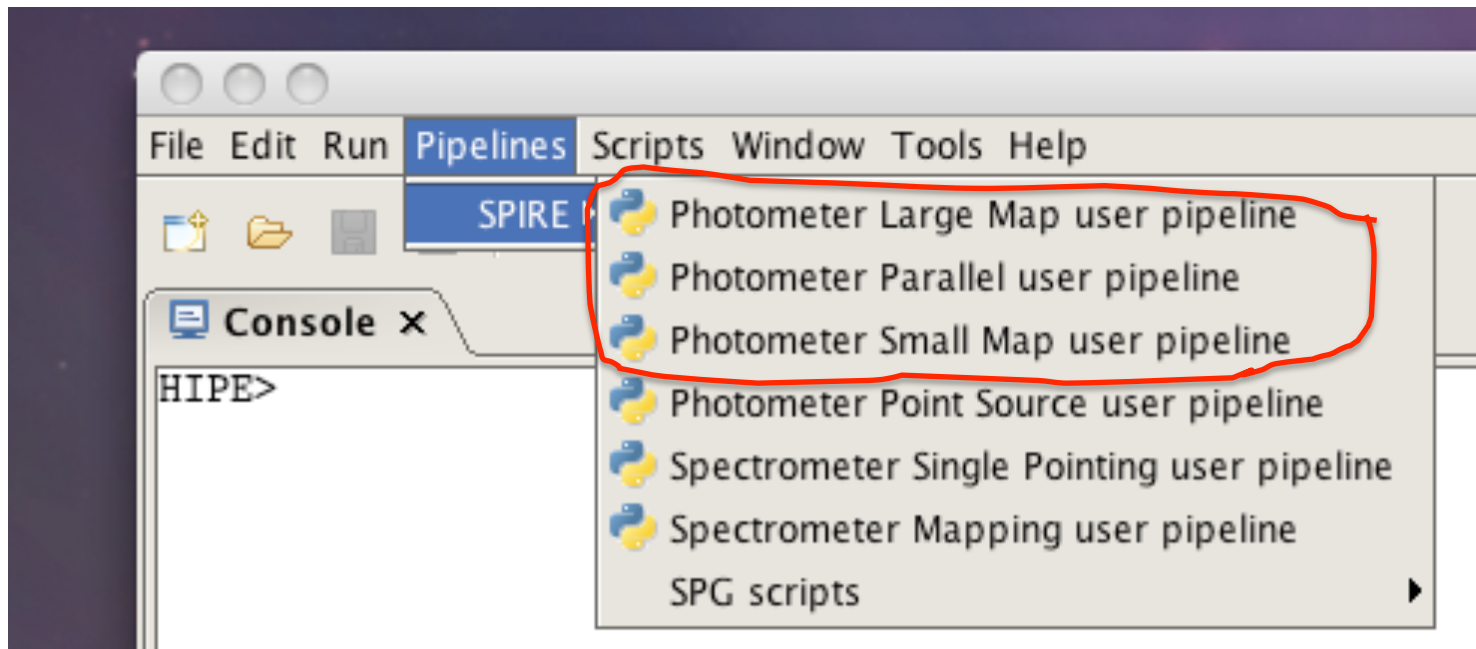
Reference: “*SPIRE Data Reduction Guide*”

in HIPE (under “Help”) or in:

http://herschel.esac.esa.int/hcss-doc-9.0/load/spire_drg/html/spire_drg.html

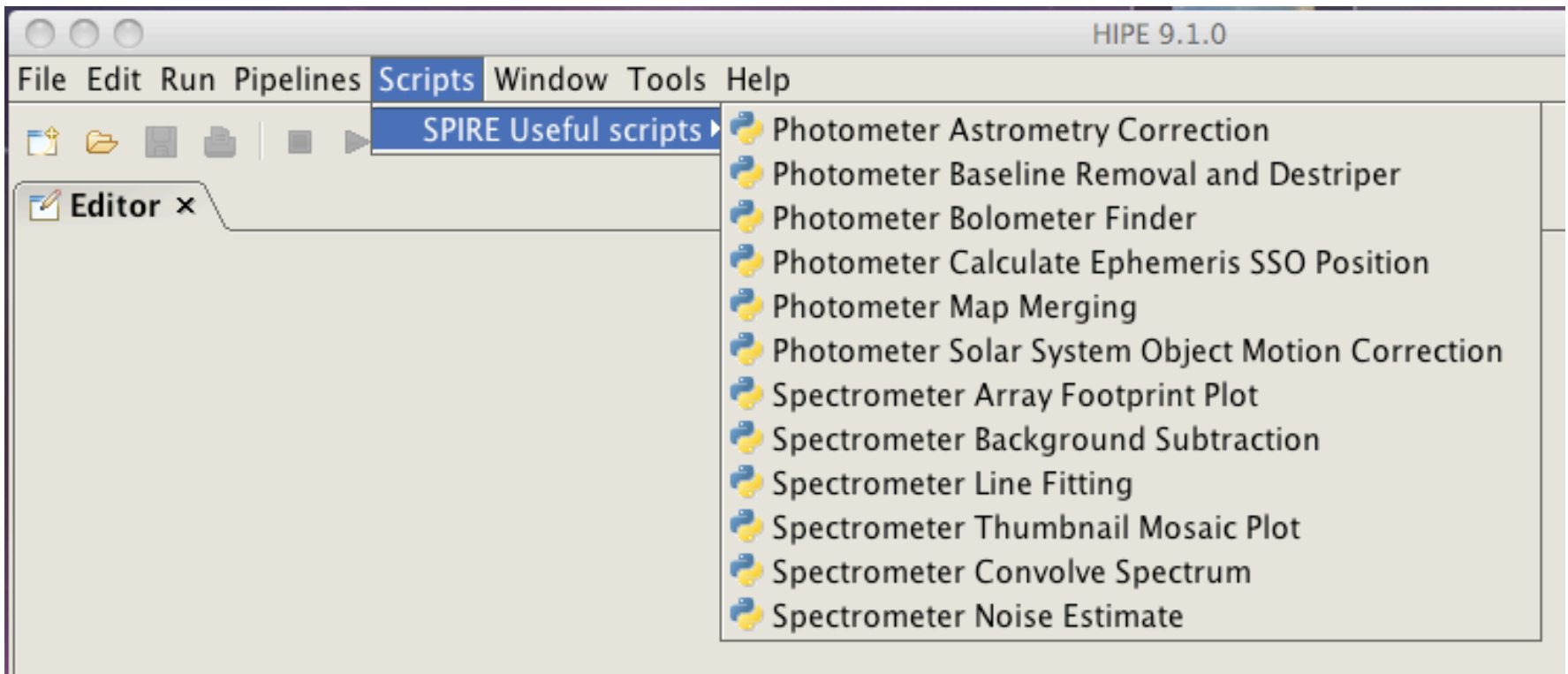


- User pipelines (Jython scripts): Simplified version of Standard Product Generation (SPG) pipelines.
- You can find these “user pipelines” in HIPE:





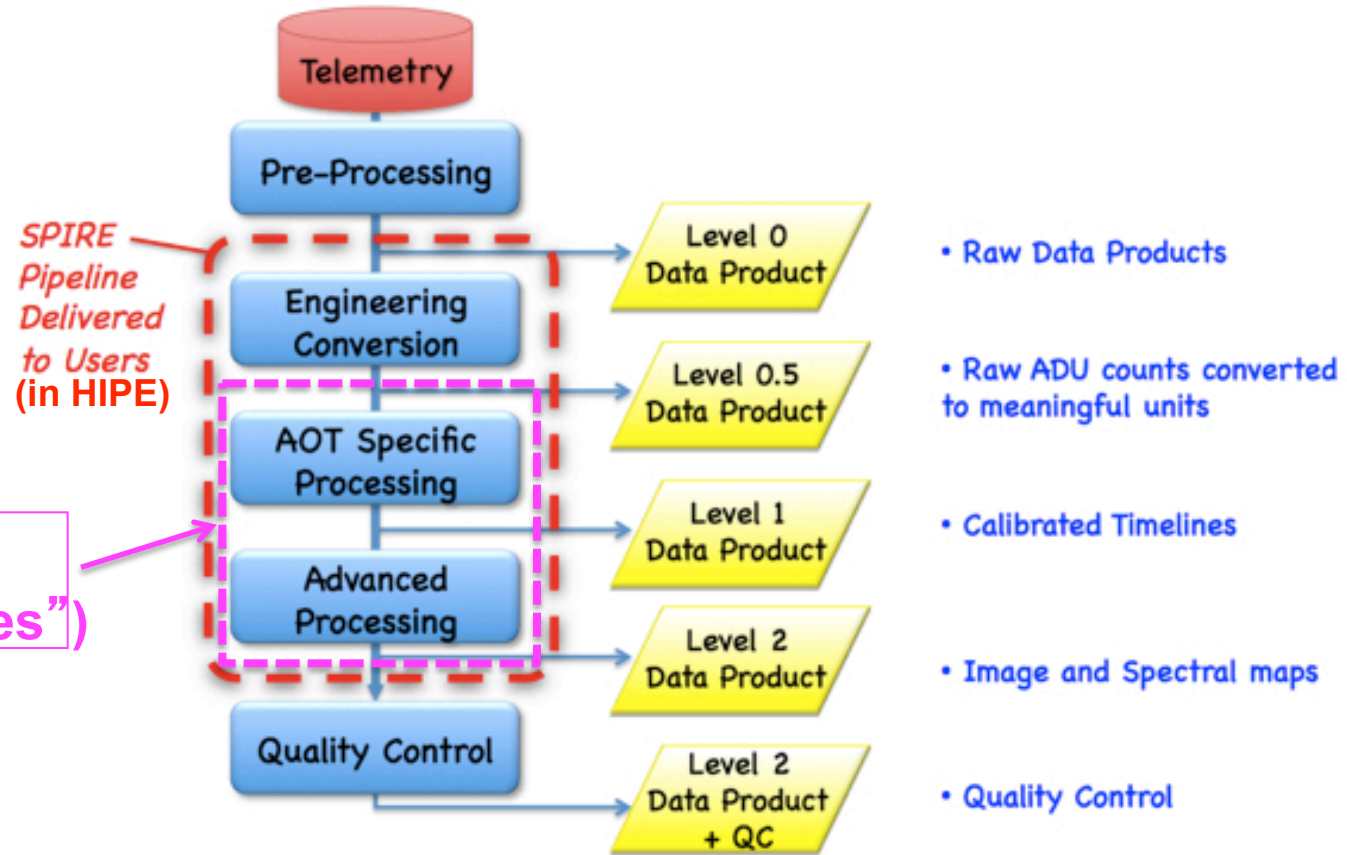
- **Other useful HIPE scripts:**



SPIRE Pipeline & Data Products



□ SPIRE Data Processing Levels

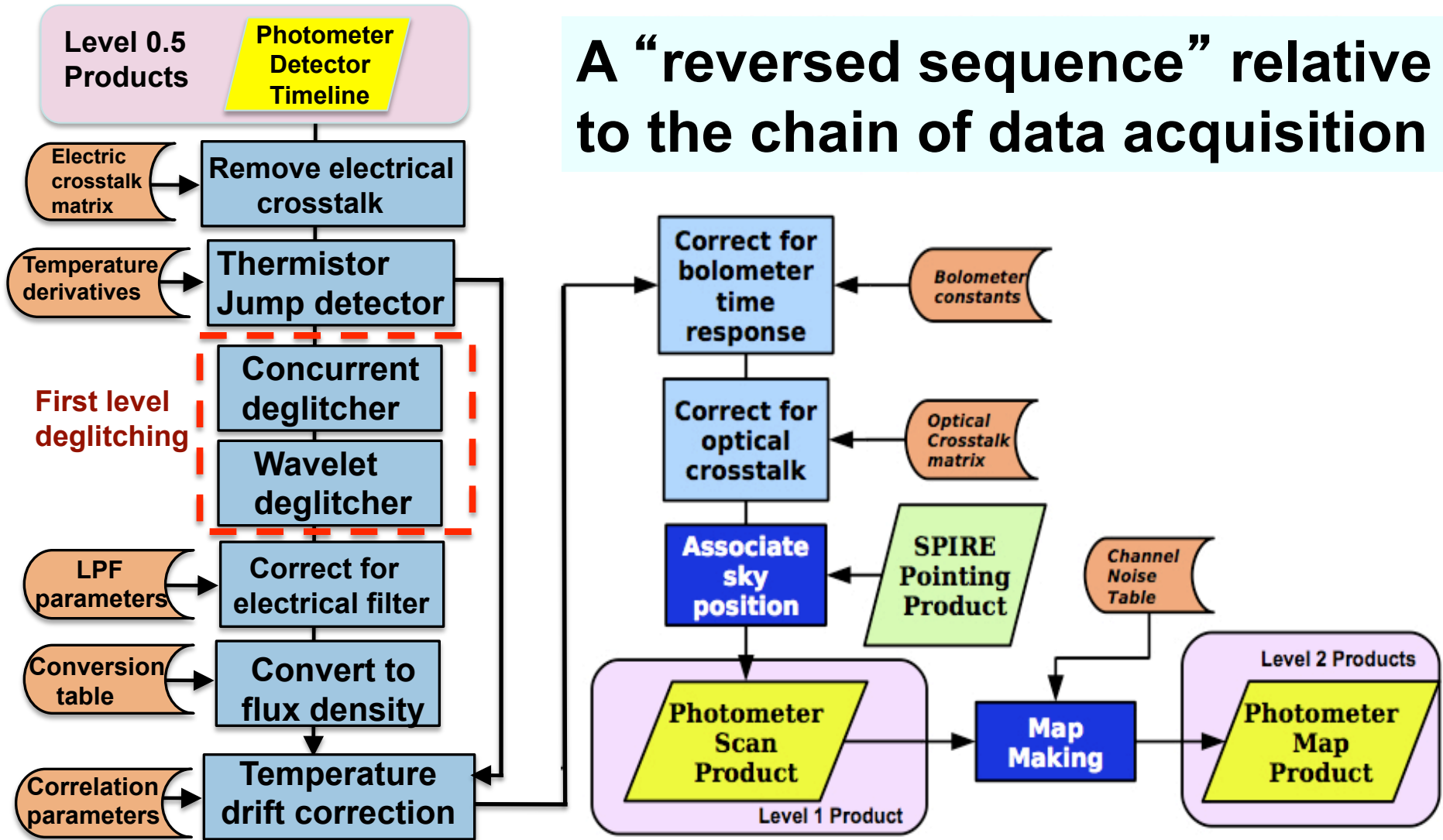


Our focus
("user pipelines")

Scan Map Pipeline Flow Chart



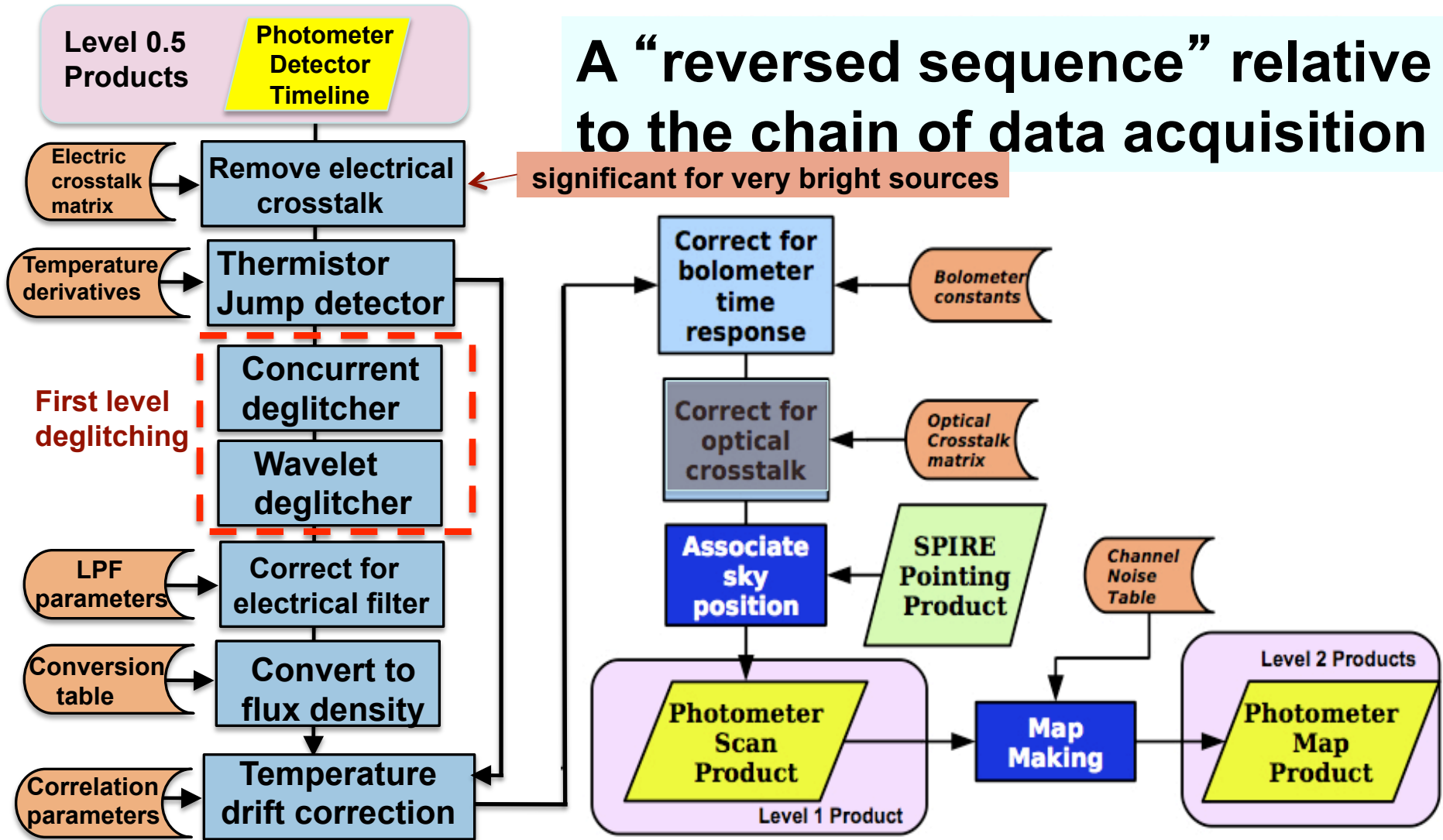
A “reversed sequence” relative to the chain of data acquisition



Scan Map Pipeline Flow Chart



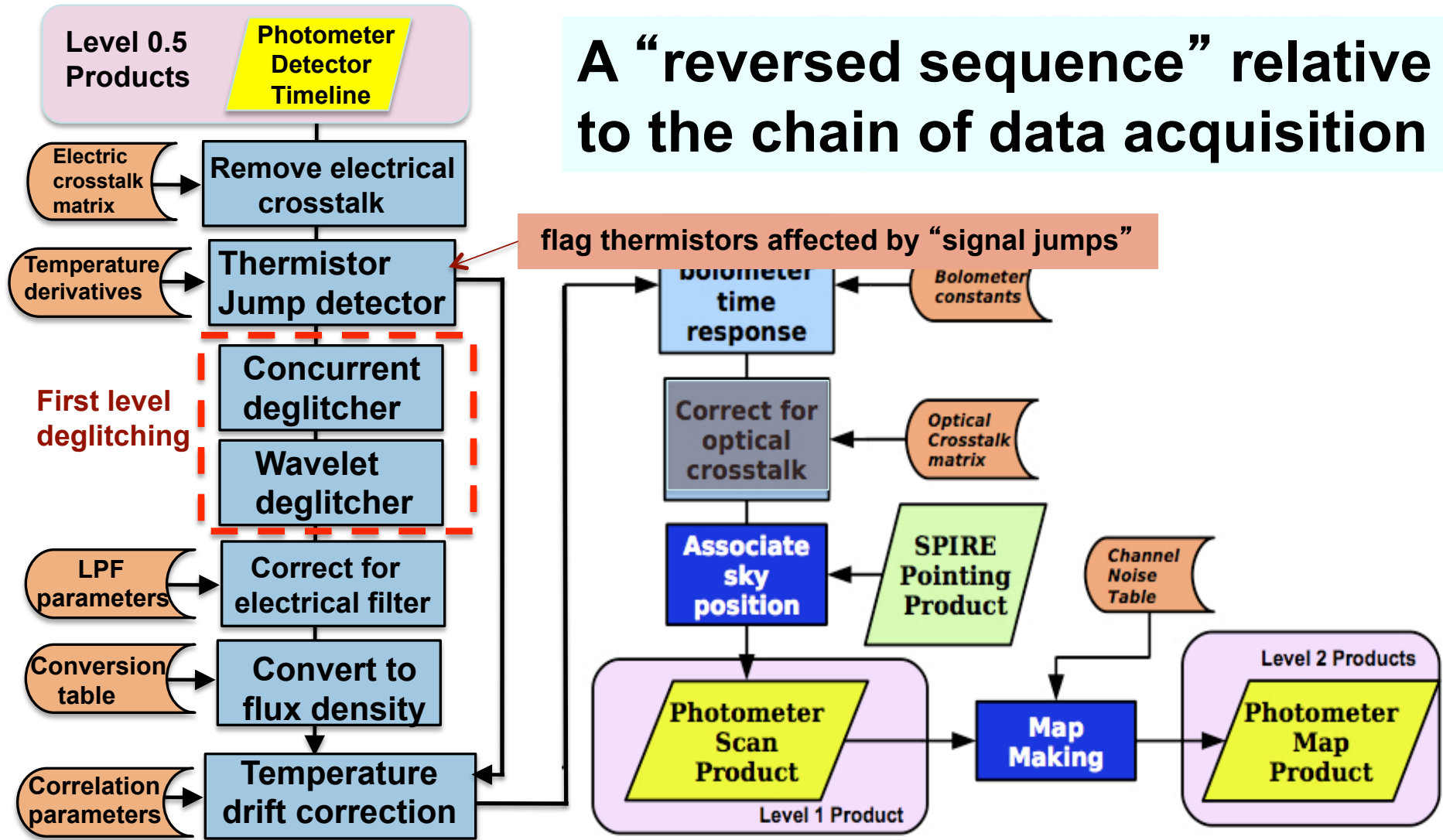
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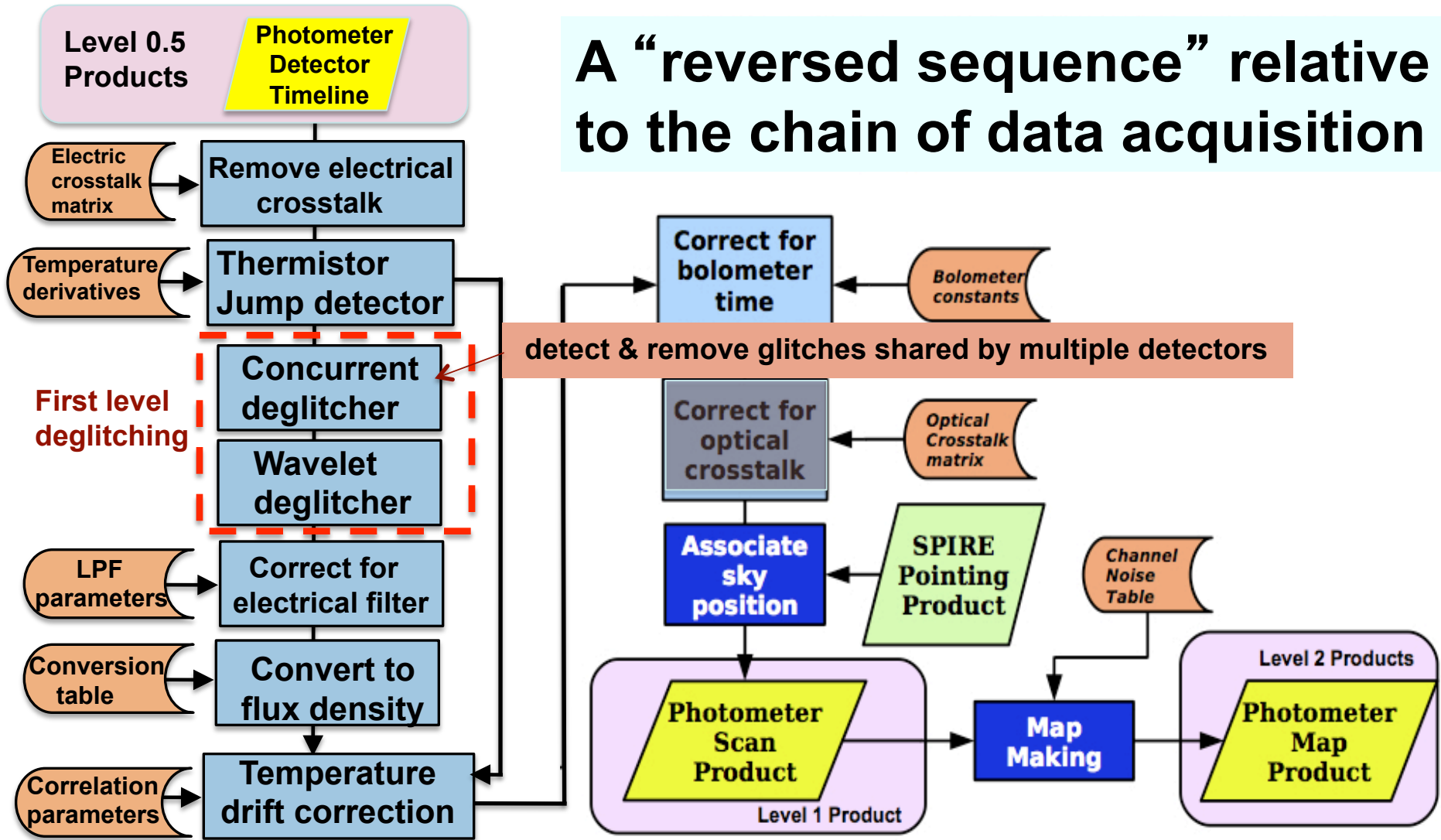
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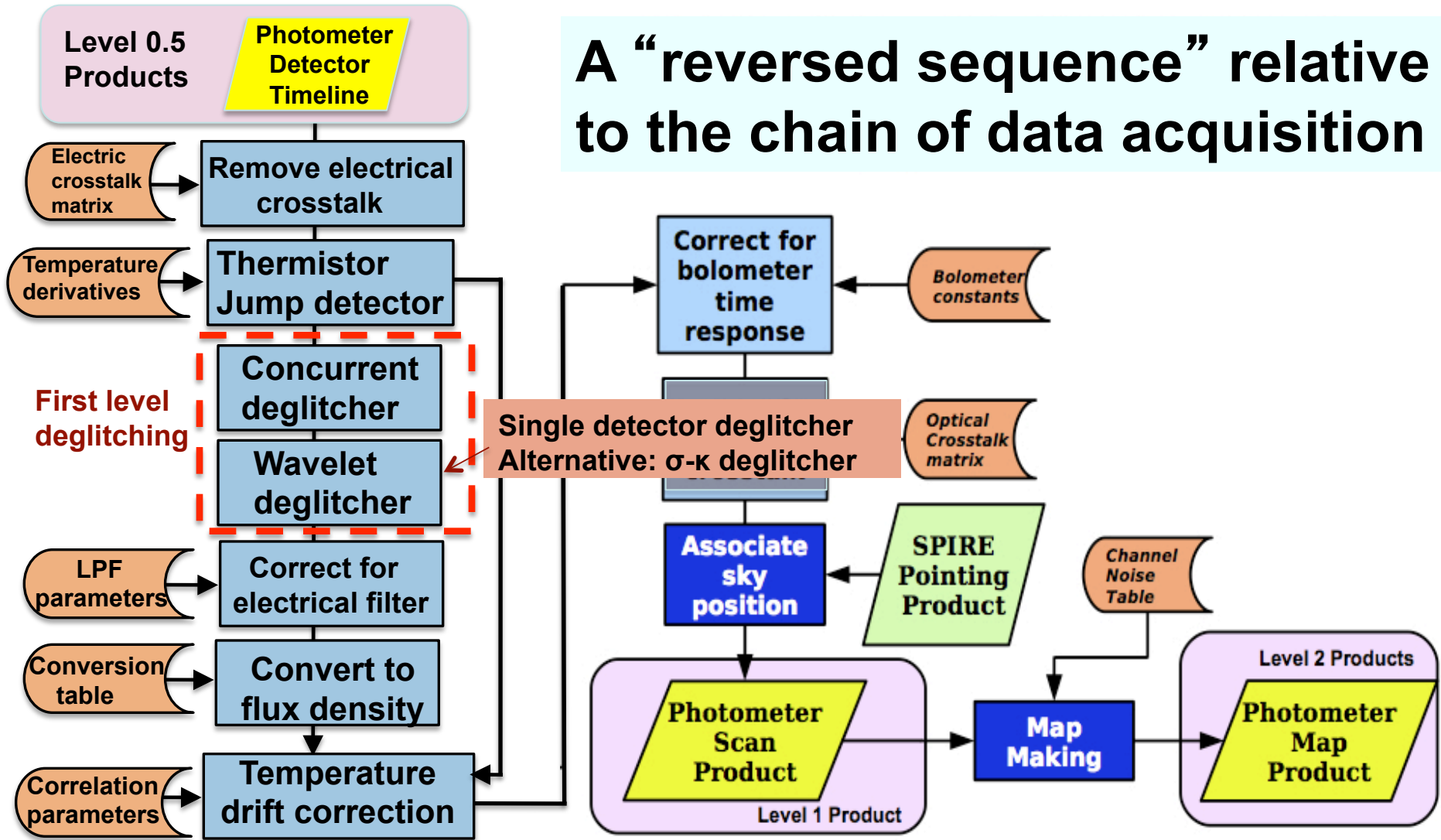
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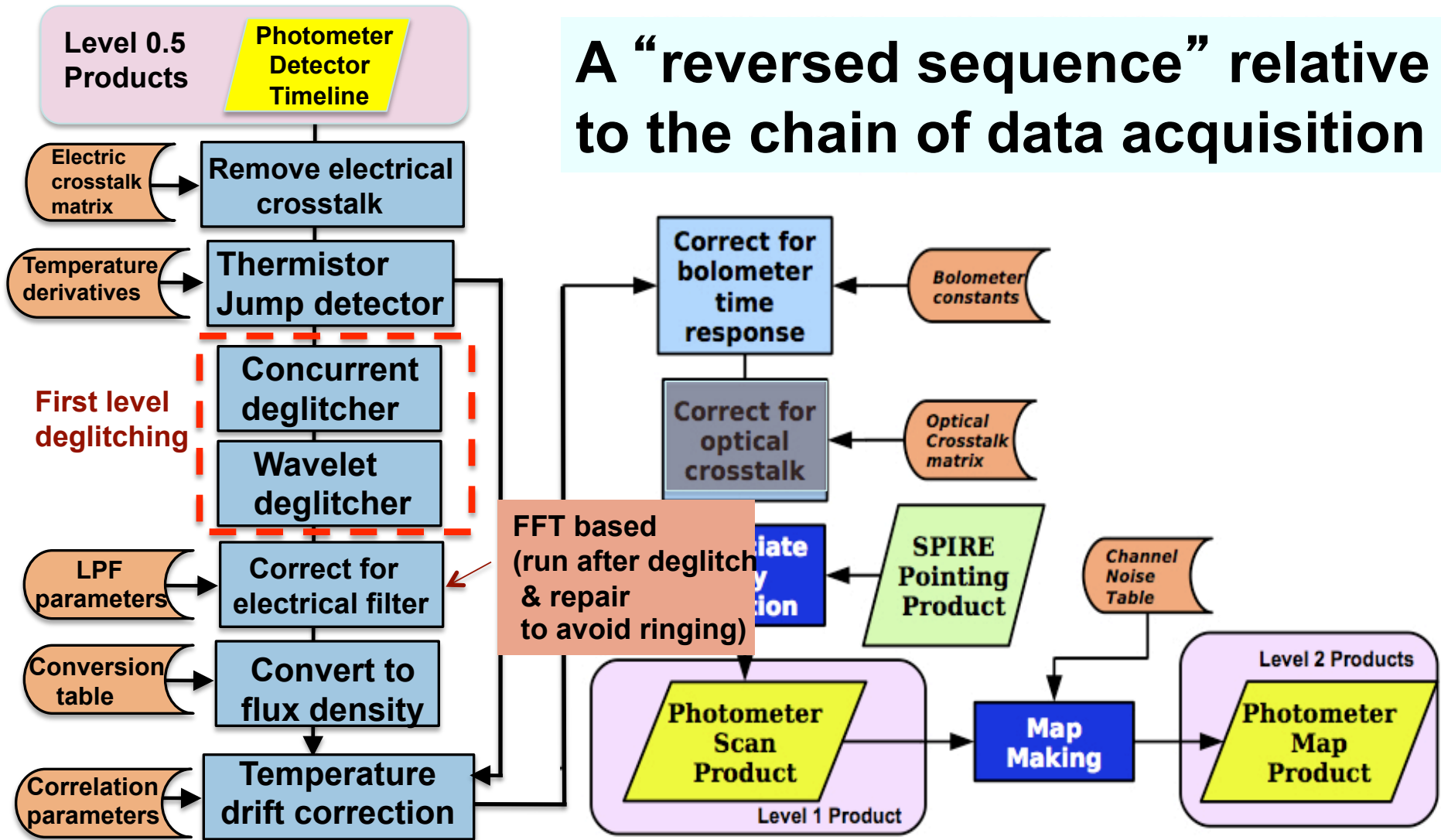
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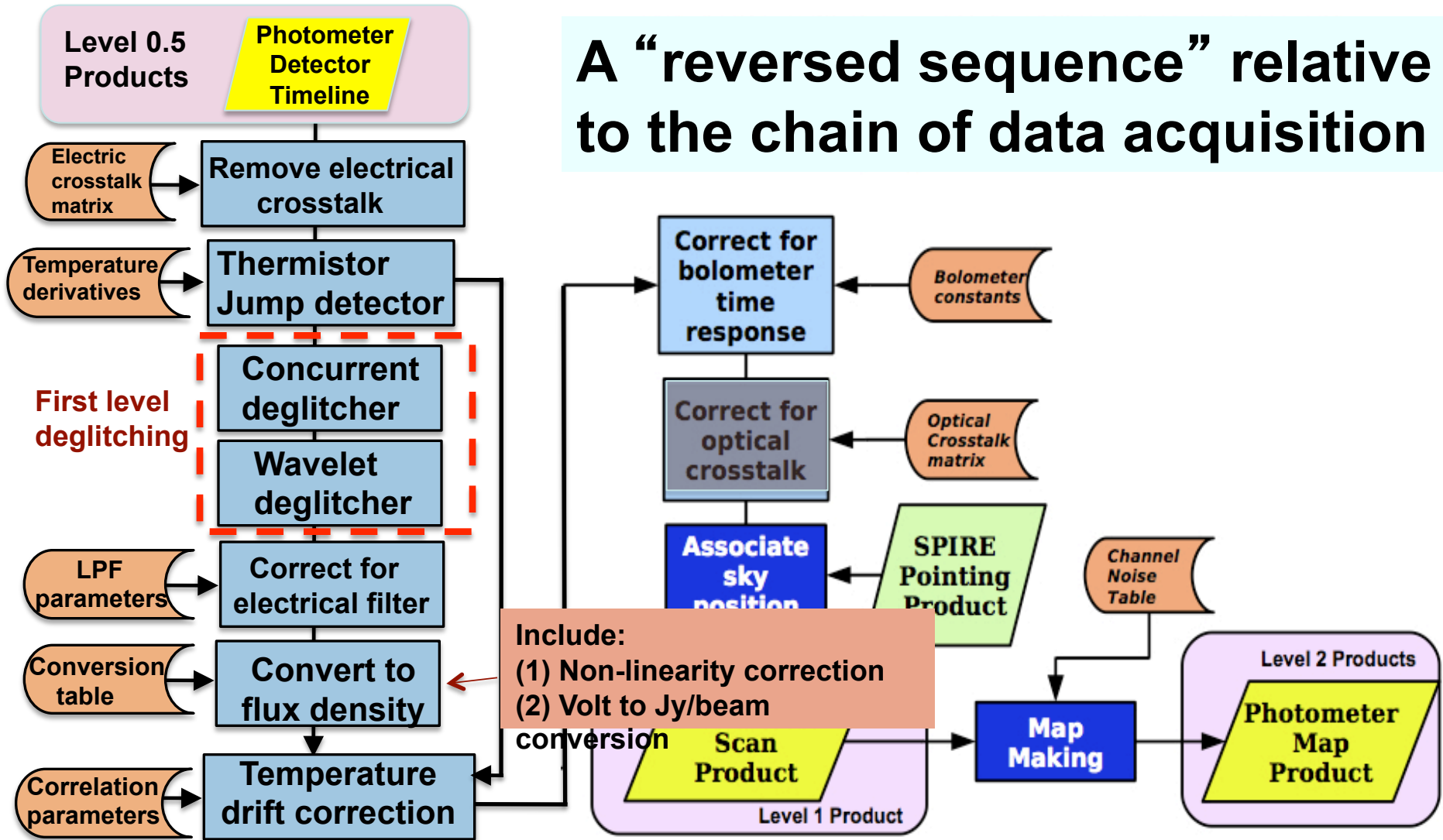
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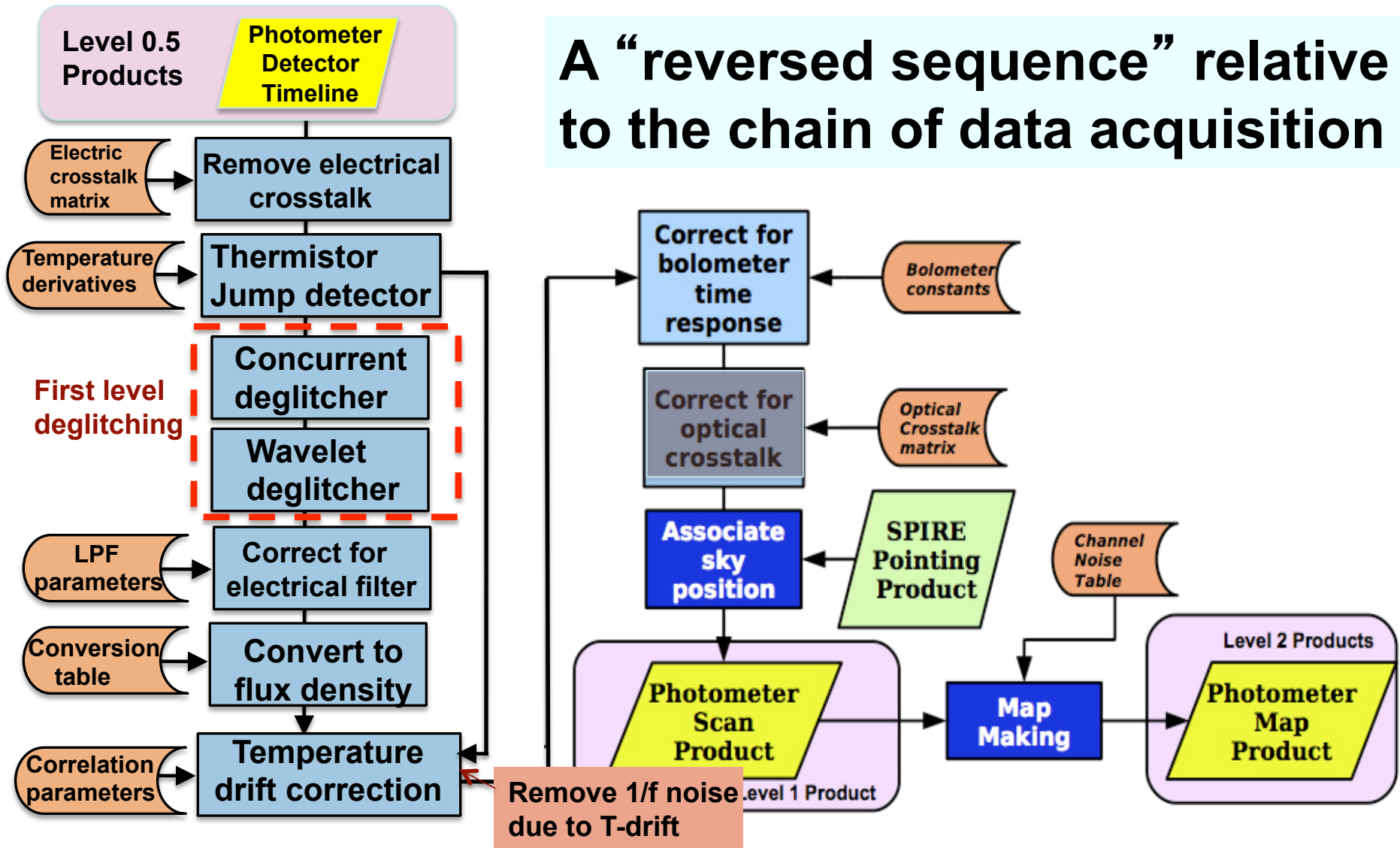
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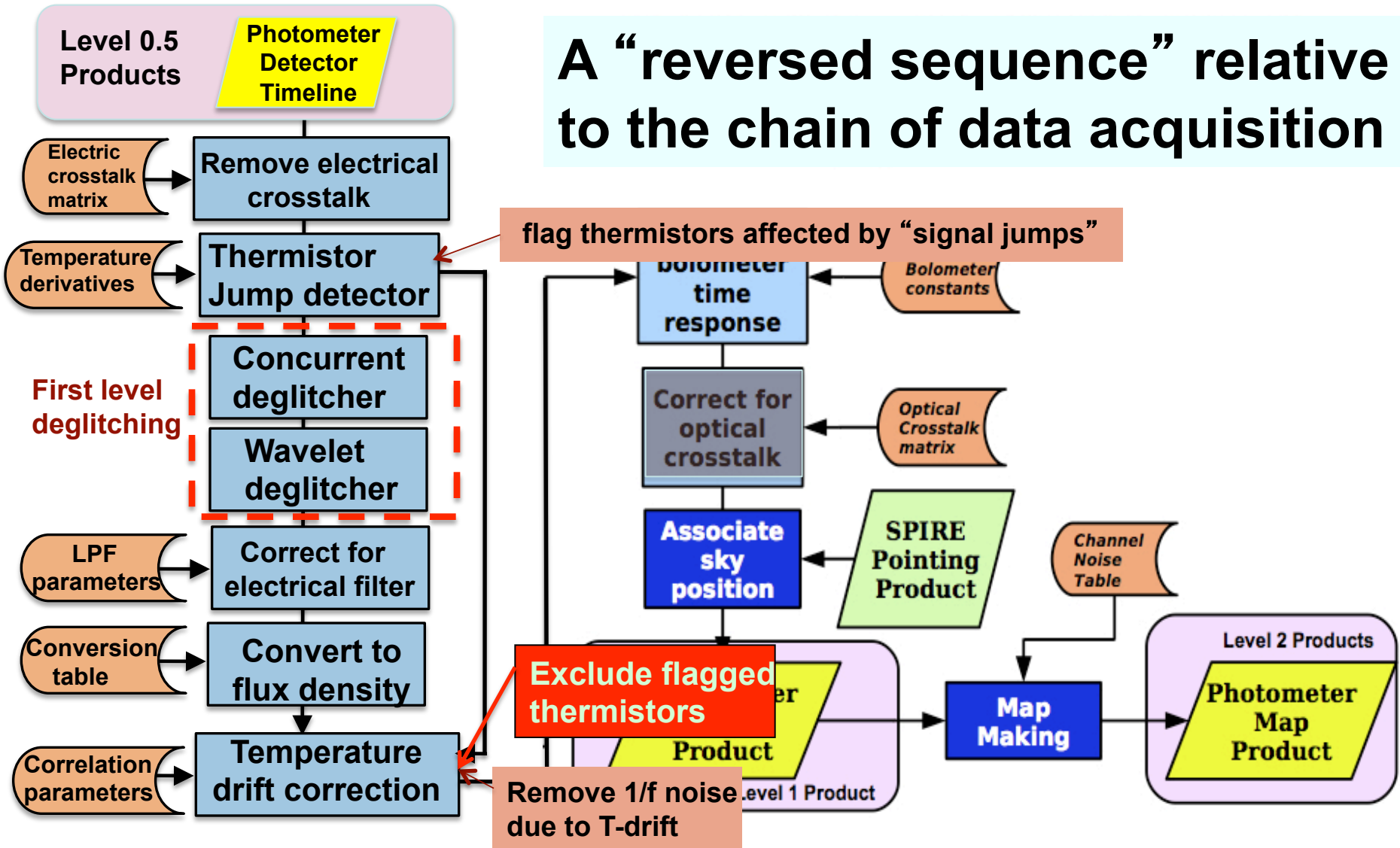
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Scan Map Pipeline Flow Chart



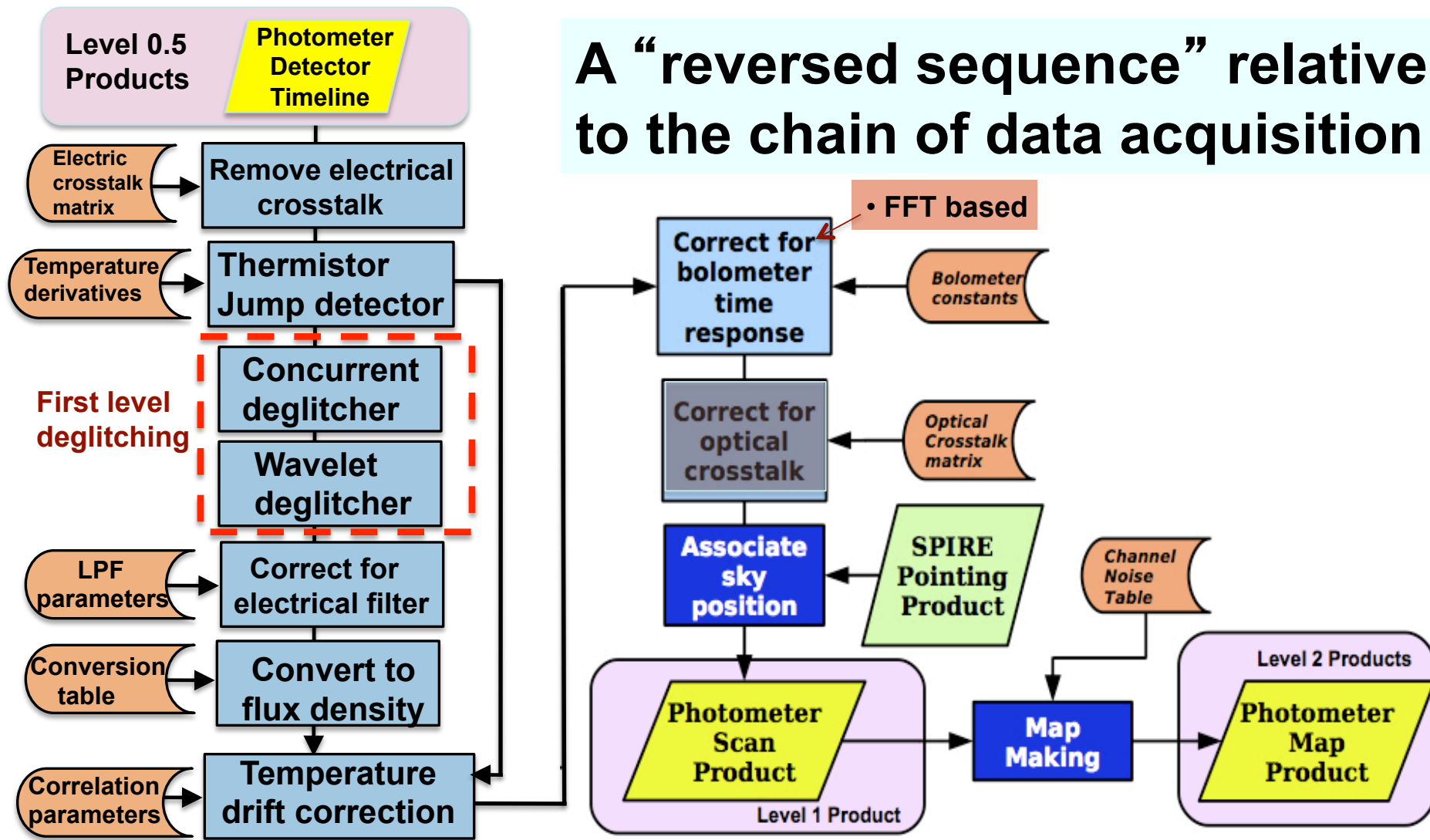
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Scan Map Pipeline Flow Chart



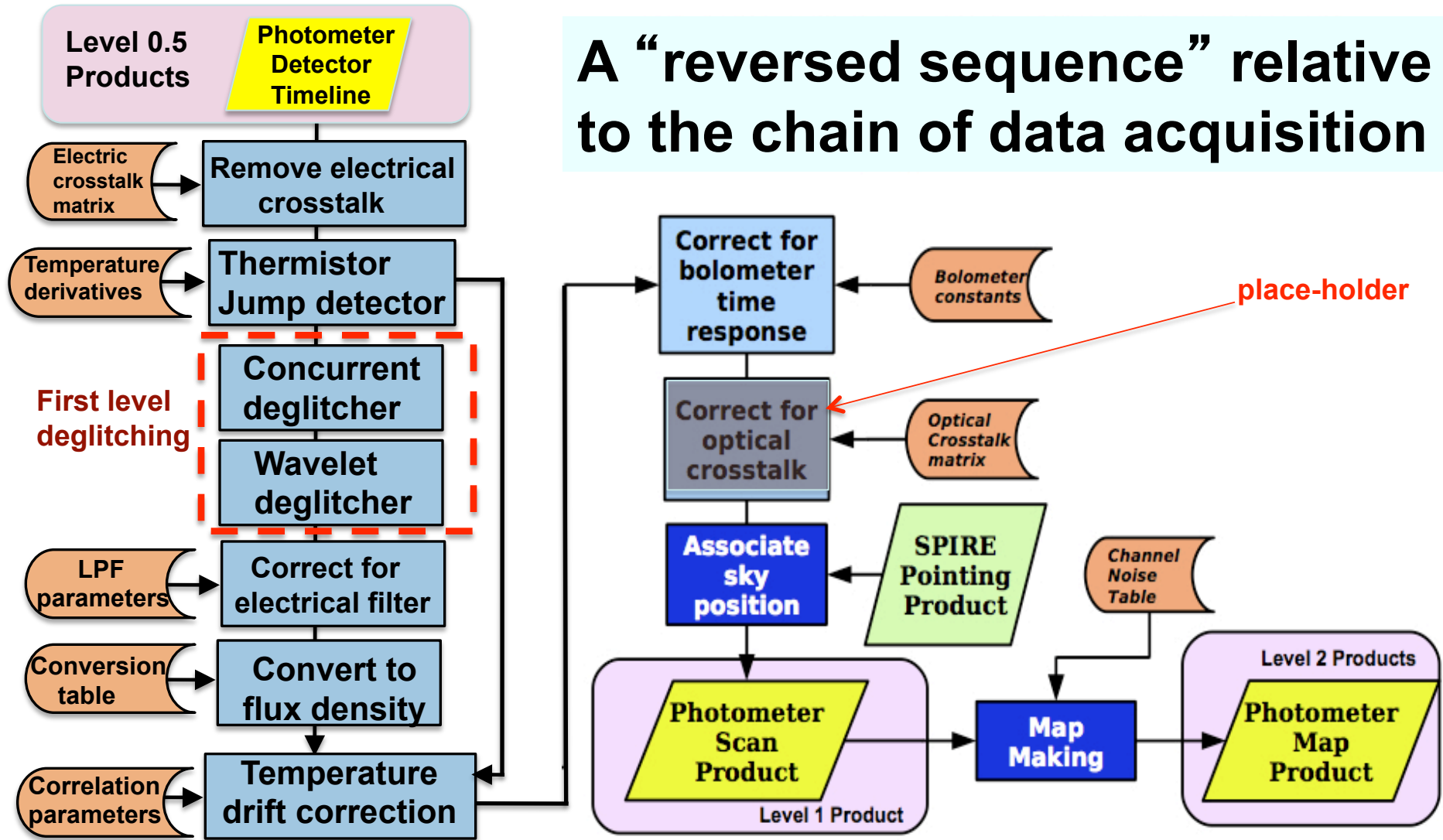
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Scan Map Pipeline Flow Chart



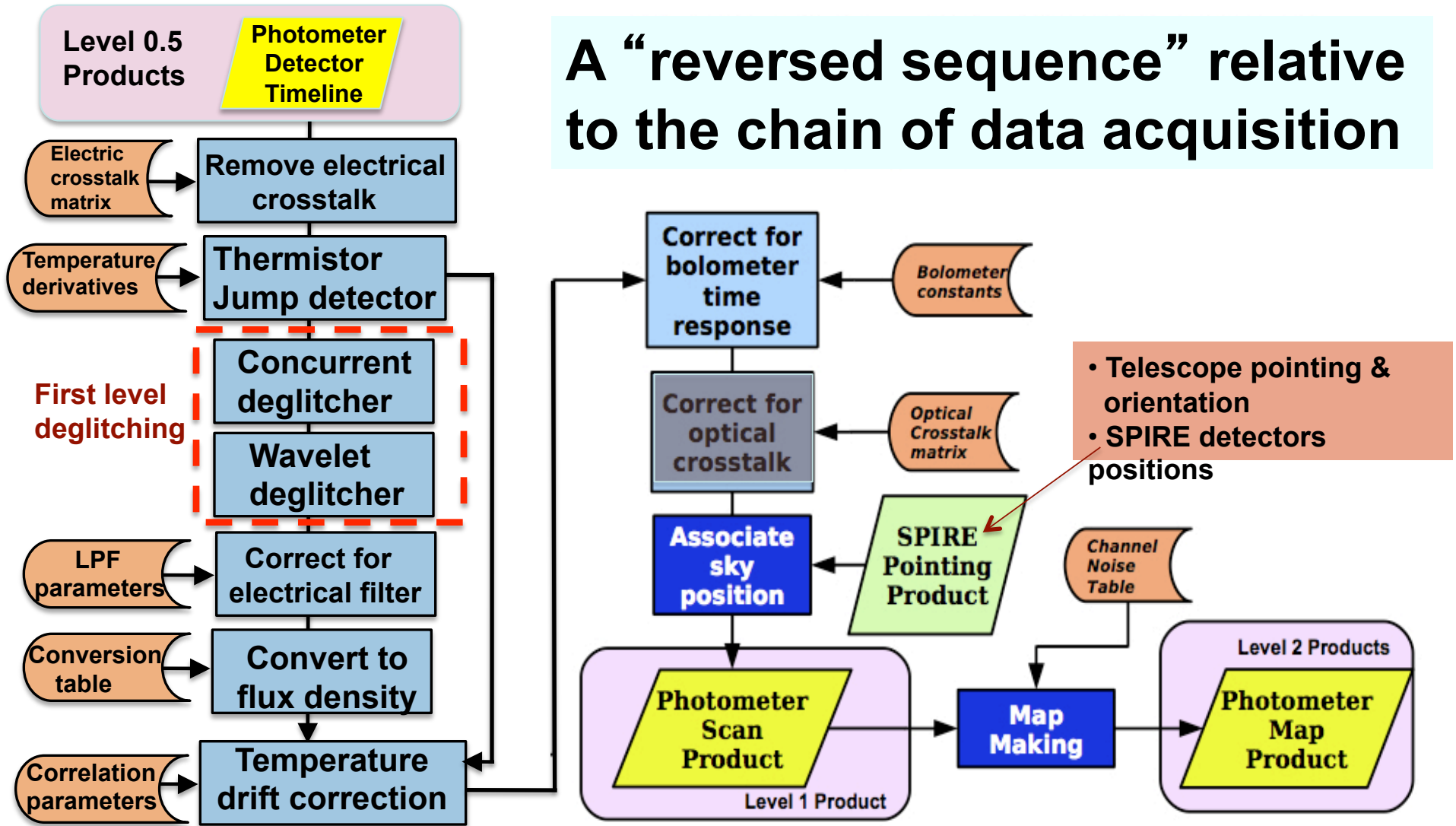
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Scan Map Pipeline Flow Chart



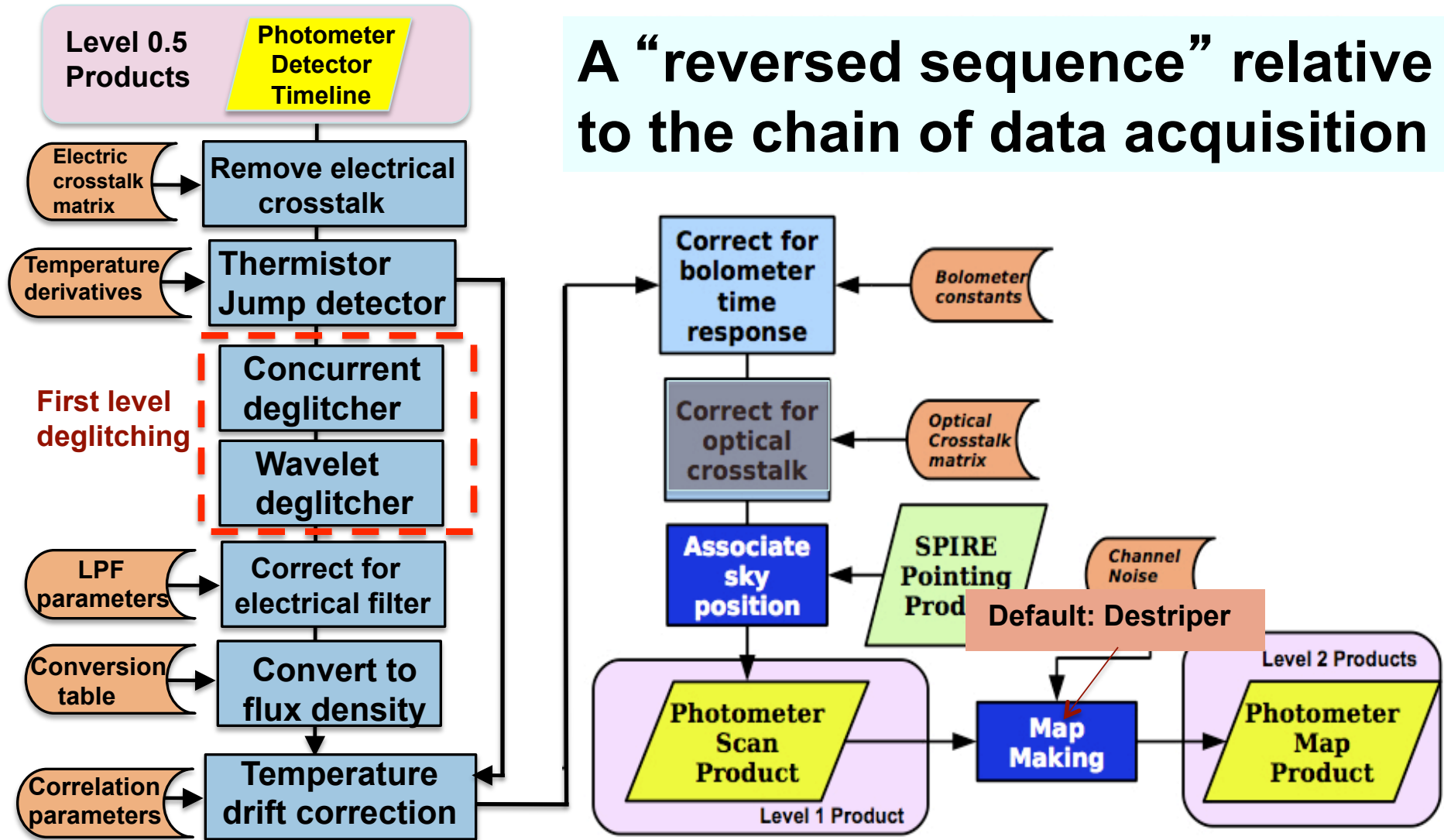
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Scan Map Pipeline Flow Chart

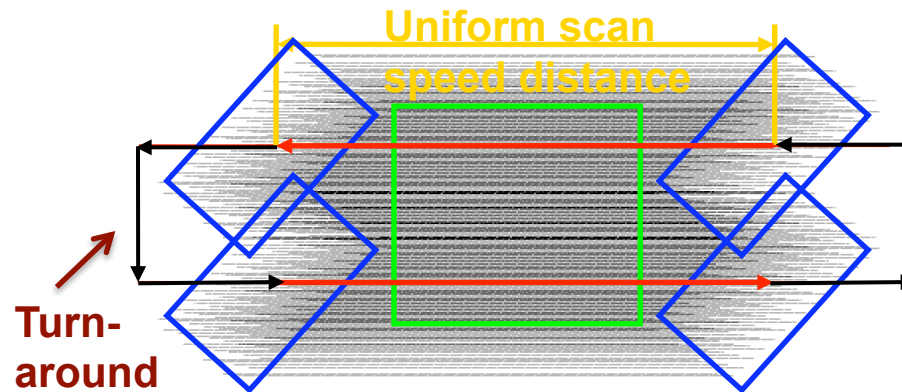


A “reversed sequence” relative to the chain of data acquisition





- The pipeline processes timelines scan by scan (to ease the demand on RAM).
- Problem: ringing at the two ends of each scan due to FFT based modules.
- Solution:
 - (1) Before the process, attaching “turn-around” data blocks to ends of the scan.
 - (2) During the process, the ringing is confined to the “turn-around” data.
 - (3) After the process, cut-off the “turn-around” data blocks from the scan.



Highlights of a User Pipeline (Jython Script)



LEVEL 0.5

```
pdt=joinPhotDetTimelines(pdt,pdtLead,pdtTrail)
nhkt=joinNhkTimelines(nhkt,nhktLead,nhktTrail)
```

Add turnarounds
to Scans

```
bat=calcBsmAngles(nhkt,bsmPos=bsmPos)
spp=createSpirePointing(detAngOff=detAngOff,bat=bat,hpp=hpp, siam=siam)
```

Pointing
information

```
pdt = signalJumpDetector(pdt, tempDriftCorr=tempDriftCorr,kappa = 3.0,.....)
pdt=concurrentGlitchDeglitcher(pdt,chanNum=chanNum,kappa=2.0,.....)
pdt=waveletDeglitcher(pdt, scaleMin=1.0, scaleMax=8.0, ..... )
pdt=lpfResponseCorrection(pdt,lpfPar=lpfPar)
pdt=photFluxConversion(pdt,fluxConv=fluxConv)
pdt=temperatureDriftCorrection(pdt,tempDriftCorr=tempDriftCorr)
pdt=bolometerResponseCorrection(pdt,chanTimeConst=chanTimeConst)
```

Detector effects

```
psp=associateSkyPosition(pdt,spp=spp)
```

Attach Pointing

```
psp=cutPhotDetTimelines(psp, extend=includeTurnaround)
```

Detach turnarounds

```
psp=timeCorrelation(psp,timeCorr)
```

LEVEL 1

Correct timing

```
applyRelativeGains(level1.getProduct(i), gains = chanRelGains)
```

Extended Emission

```
psp=removeBaseline(psp,chanNum=chanNum)
```

Baseline Removal

```
mapPlw=naiveScanMapper(scans, array="PLW")
```

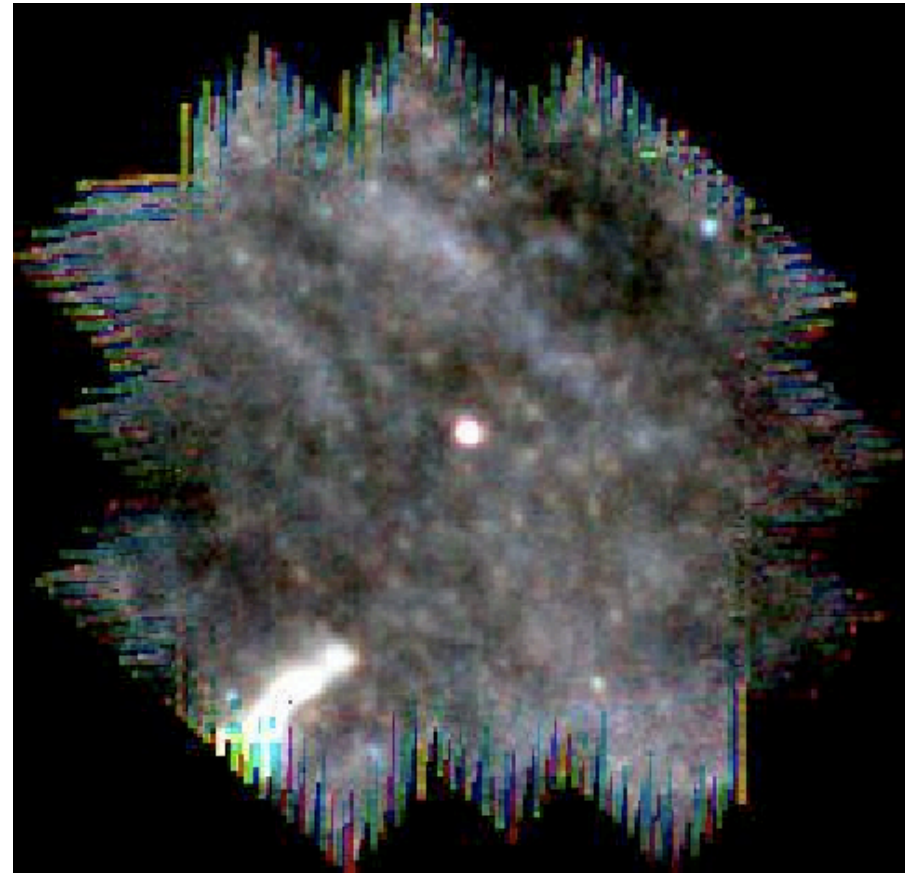
Mapping

LEVEL 2



- **General assessment:**
In most cases, data from HSA are already science quality!
- The official calibration accuracy is $\pm 7\%$ (5% from model, 2% RMS).
- **An example (on the right):**
The image from HSA looks good.

SPIRE 3-color map of NGC 5315 (a planetary nebula)



(Public data taken from HSA)



Summary

- Scan-Map pipeline covers nearly all SPIRE PHOT AOTs (small map, large map, map in SPIRE/PACS parallel mode).
- It follows a “reversed sequence” relative to the chain of data acquisition.
- For a general user, Level0_5 should be the best starting point.
- From Level0_5 to Level 1, the pipeline processes any observation data set scan by scan (to ease the demand on the RAM).
- The current pipeline (HIPE 9.1) does a good job (“science ready”) in general.
- Major remaining issues:
 - (1) A bug in HIPE 9.0 (affect current archive data): a wrong flag occurred in the temperature drift correction module. It may cause stripes in some maps. The bug is corrected in HIPE 9.1 (you have this one!).
 - (2) Maps of very bright regions are affected by poor temperature drift correction, which is in turn caused by cross-talks between detectors and thermistors (even after the cross-talk correction).