Blank sky data scripts

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Plan

- Aim: Creation of long exposure blank sky BG event files

  A1 – Writing of the tasks/scripts — Leicester
  A2 – Compiling list(s) of observations — Leicester/ESAC ??
  A3 – Creating BG event and other files — ESAC
  A4 – Stacking BG event and other files — Leicester

  - low BG, long duration observations, no diffuse sources, few central targets

- So far achieved:

  Using 2XMM pipeline products
  Script 1 – creates event files and exposure maps
  Script 2 – merges created event files
  Script 3 – merges created exposure maps

General Procedure

Per instrument, filter and mode combination:

List of observations

no bright sources, long exposure etc

↓

Create event lists and exposure maps

↓

Merge event lists and exposure maps

↓

One great big event list with an exposure map

Background event file

region – creates region files from the common source list

evselect – remove sources

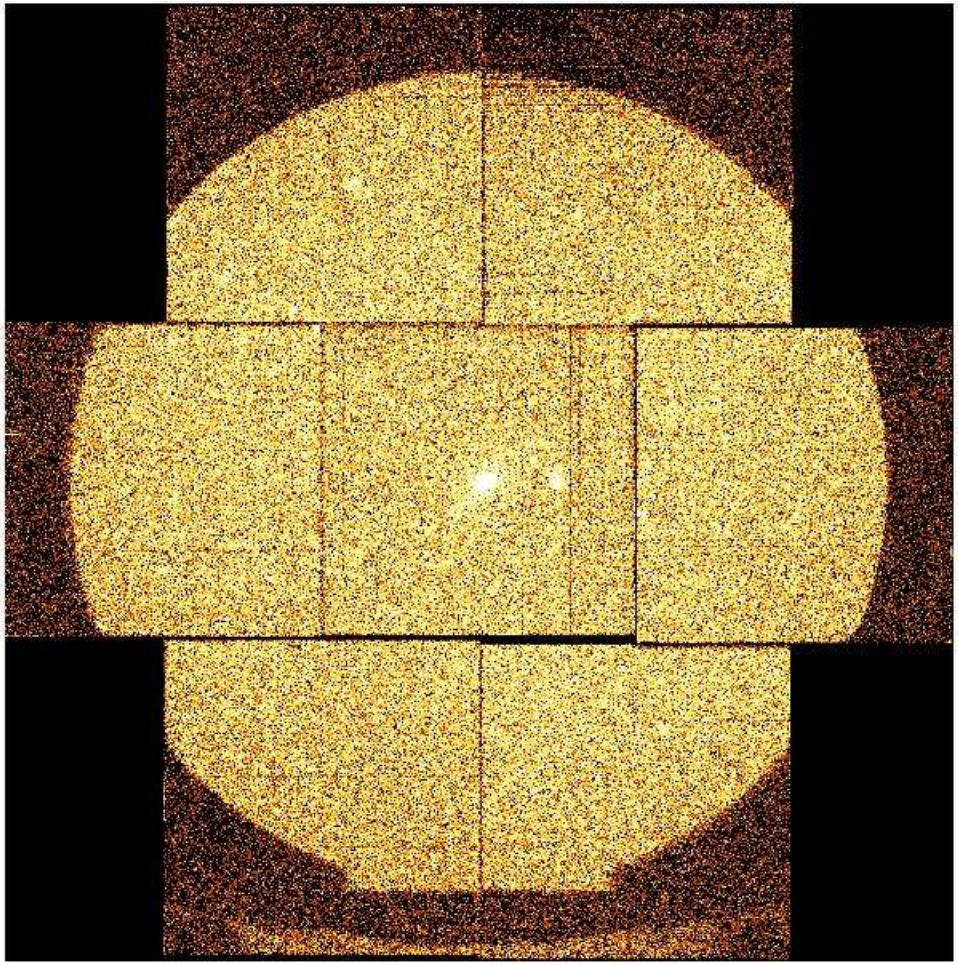
tabgti – gti creation from background light curve

evselect – pattern, energy and flag selection, keep out-of-FOV

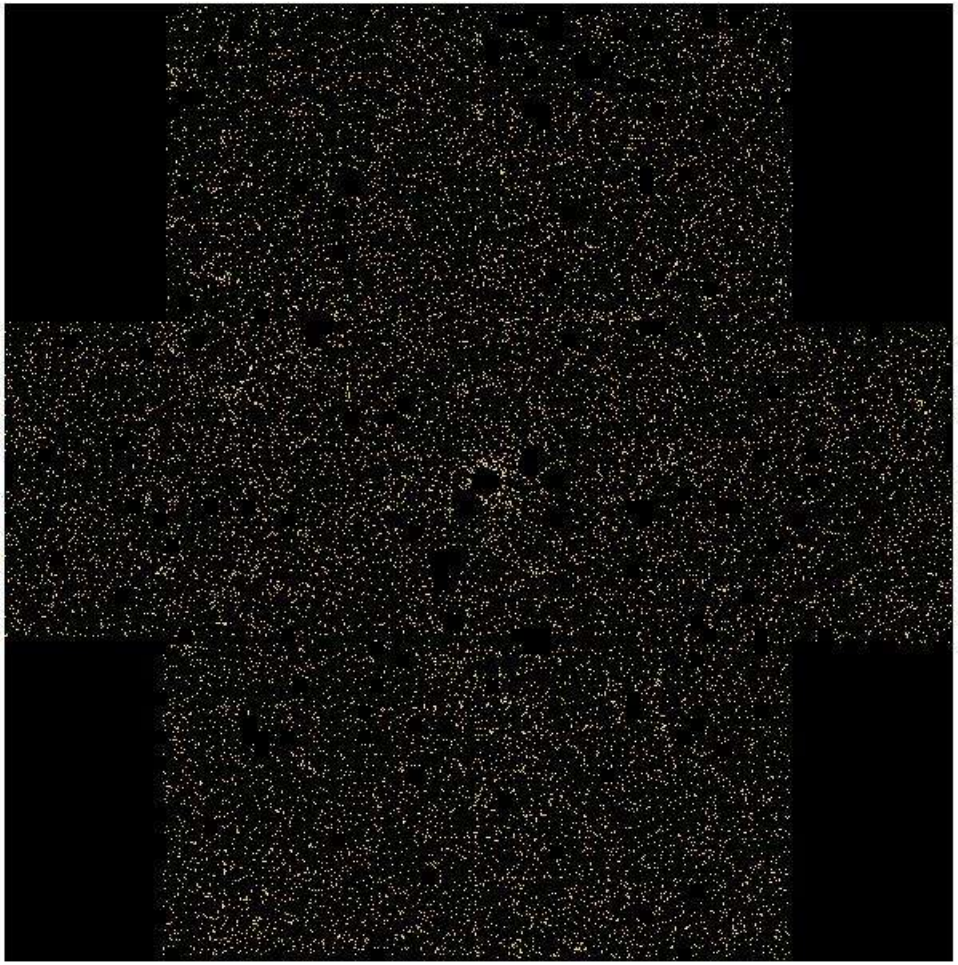
evselect – gti correction, flare removal

srcradius	30"
gti threshold MOS (jjb)	2
gti threshold PN (mjf)	60

BG Blank Sky data analysis



Original pps product event file



Source-removed, BG-flare-filtered, plus energy, pattern, flag & FOV filtering

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Exposure map

mask file – provided, to account for area lost in source removal

attcalc – calculate sky-coordinates on mask file

evselect – remove sources from sky mask

evselect – create an area map

evselect – make an exposure map image

eexpmap – use the exposure map image to create an exposure map

Finally, combine the area map and exposure map to create source removed exposure map

Other products

- Information file

  Contains summary on the run of script

  - Revolution number
  - Observation number
  - Instrument
  - Filter
  - Mode
  - ONTIME, original values
  - Fraction of original ONTIME removed / Flag in case of run failure

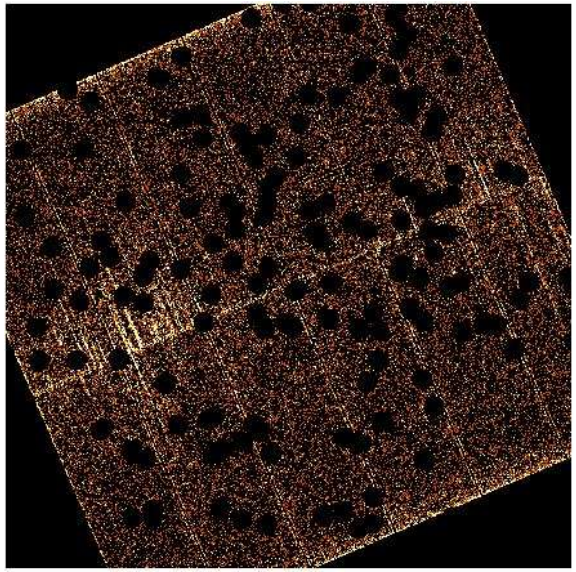
Merging

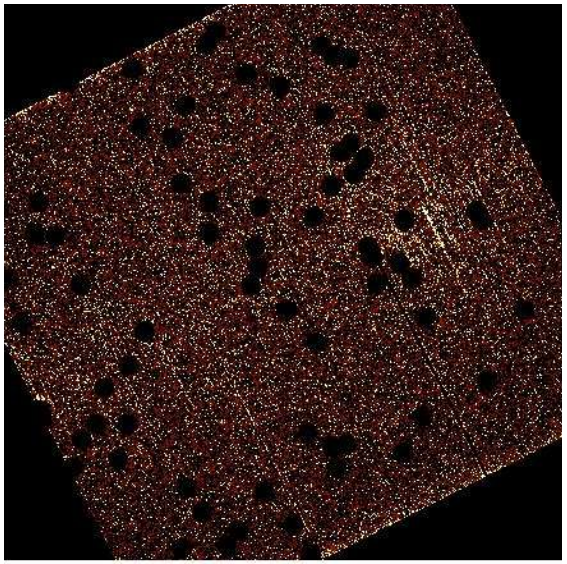
- Events extension
- Exposure extensions
- Adapts keywords, e.g. LIVETIME
- Adapts primary header
- Adapts events extension header
- Exposure maps
- Tested by creating images, spectra and lightcurves

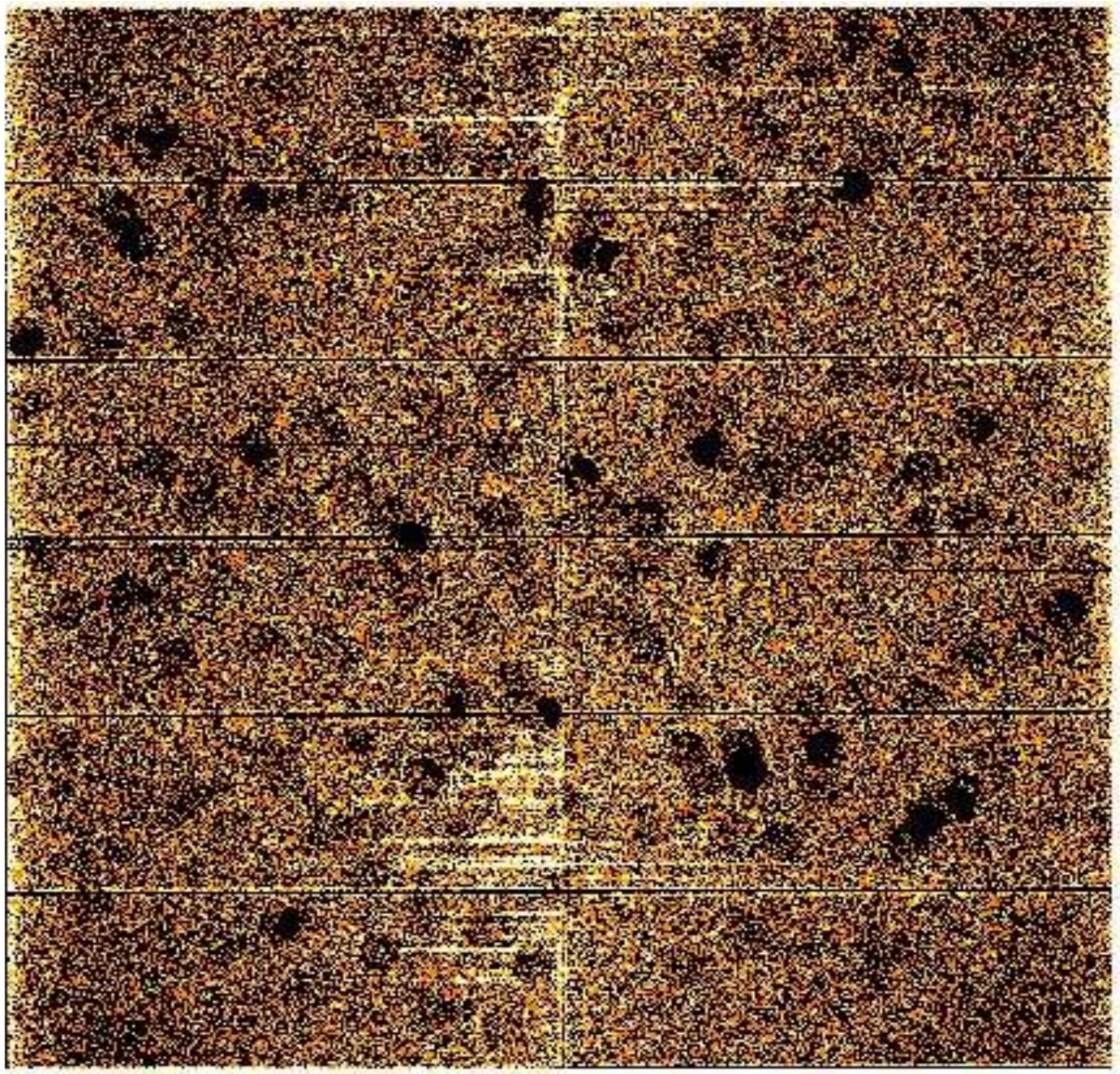
2XMM test runs

- “ Final” files in 2XMM reprocessing
- 8 observations tested

- Mean time reduced PN: 0.0830
- Mean time reduced M1: 0.2283
- Mean time reduced M2: 0.2255







XMM
EPIC
MOS

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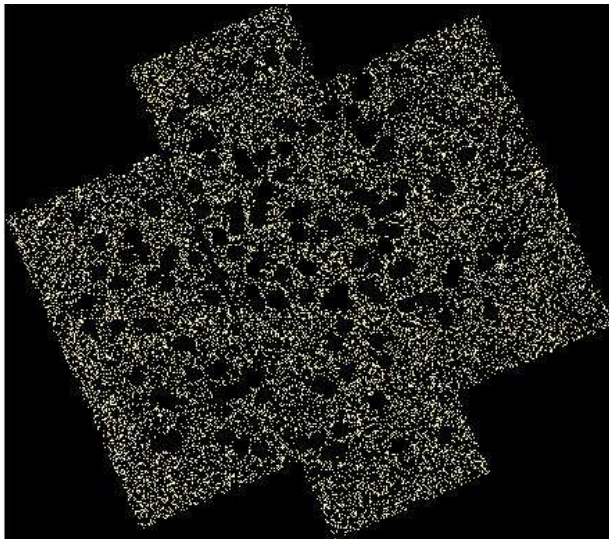
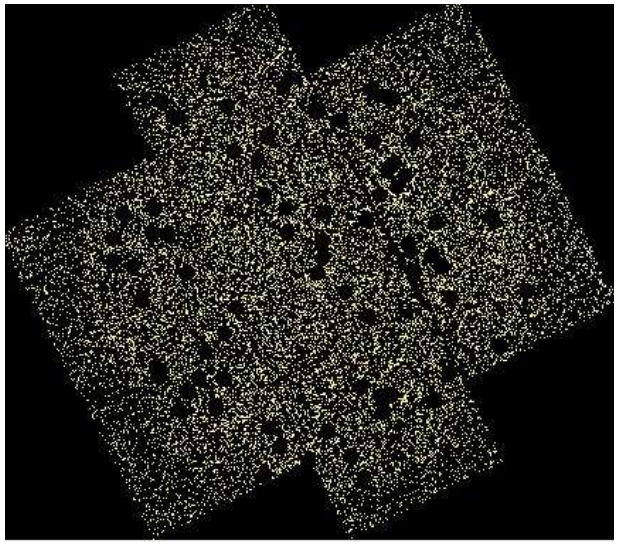
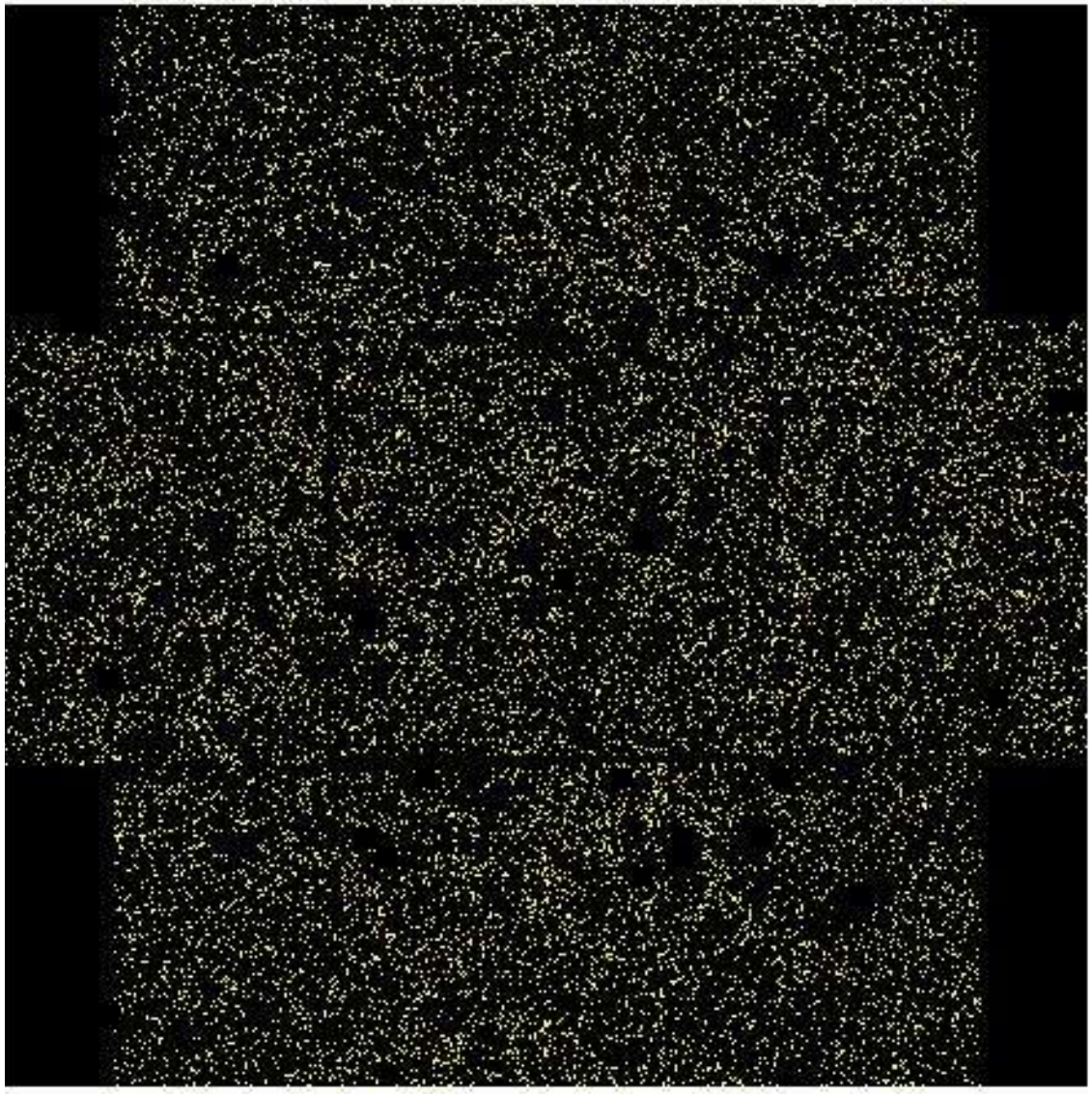
2nd EPIC BG WG Meeting
MPE, Germany 24/11/05-25/11/05

University of Leicester







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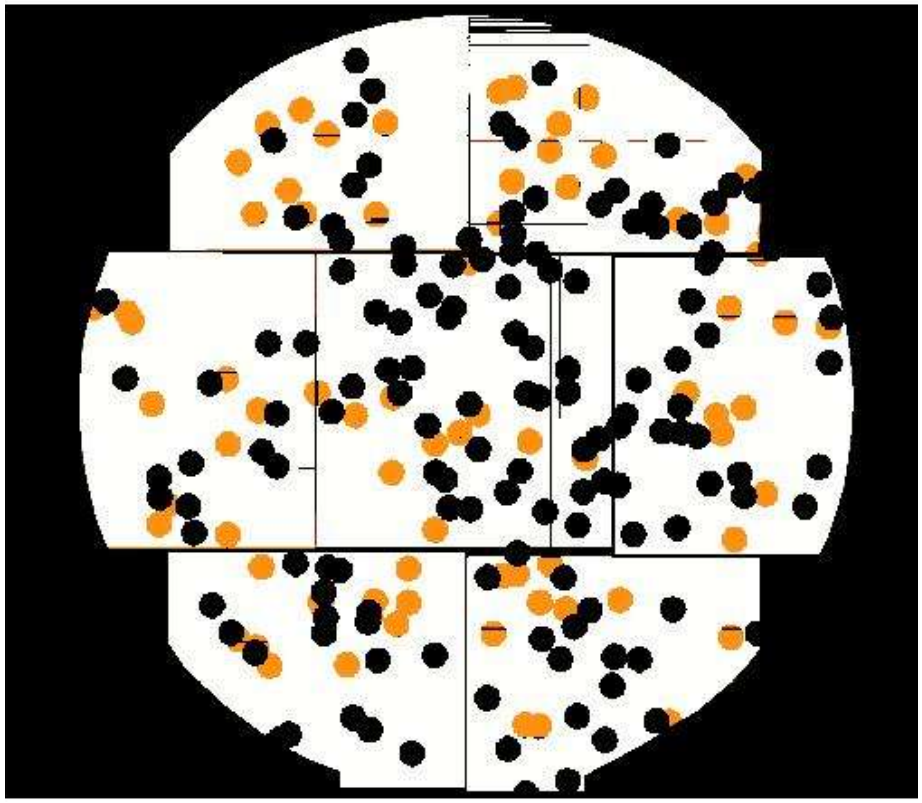
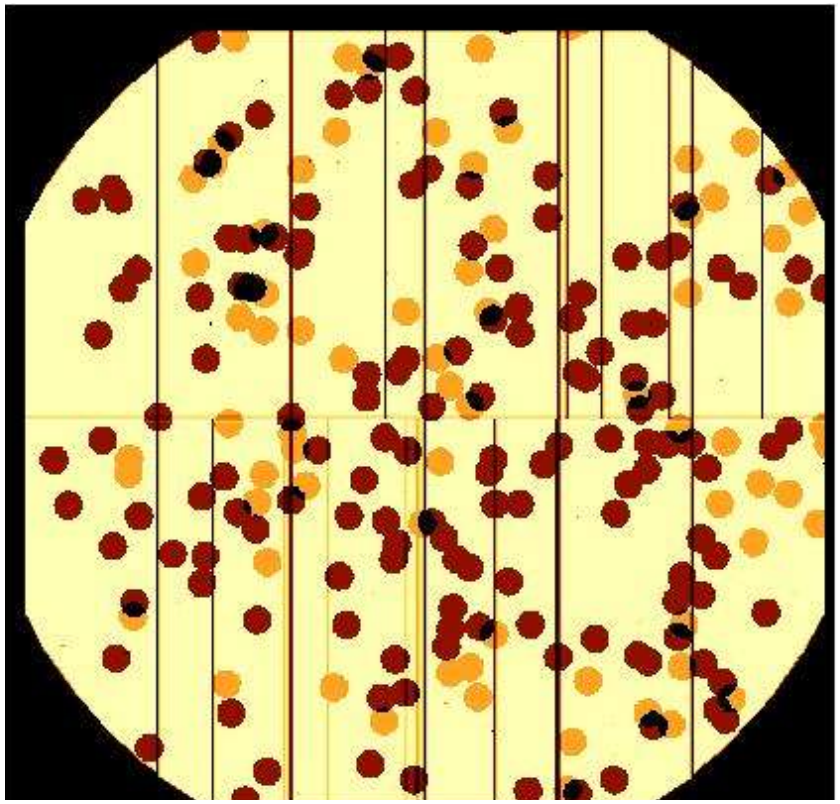
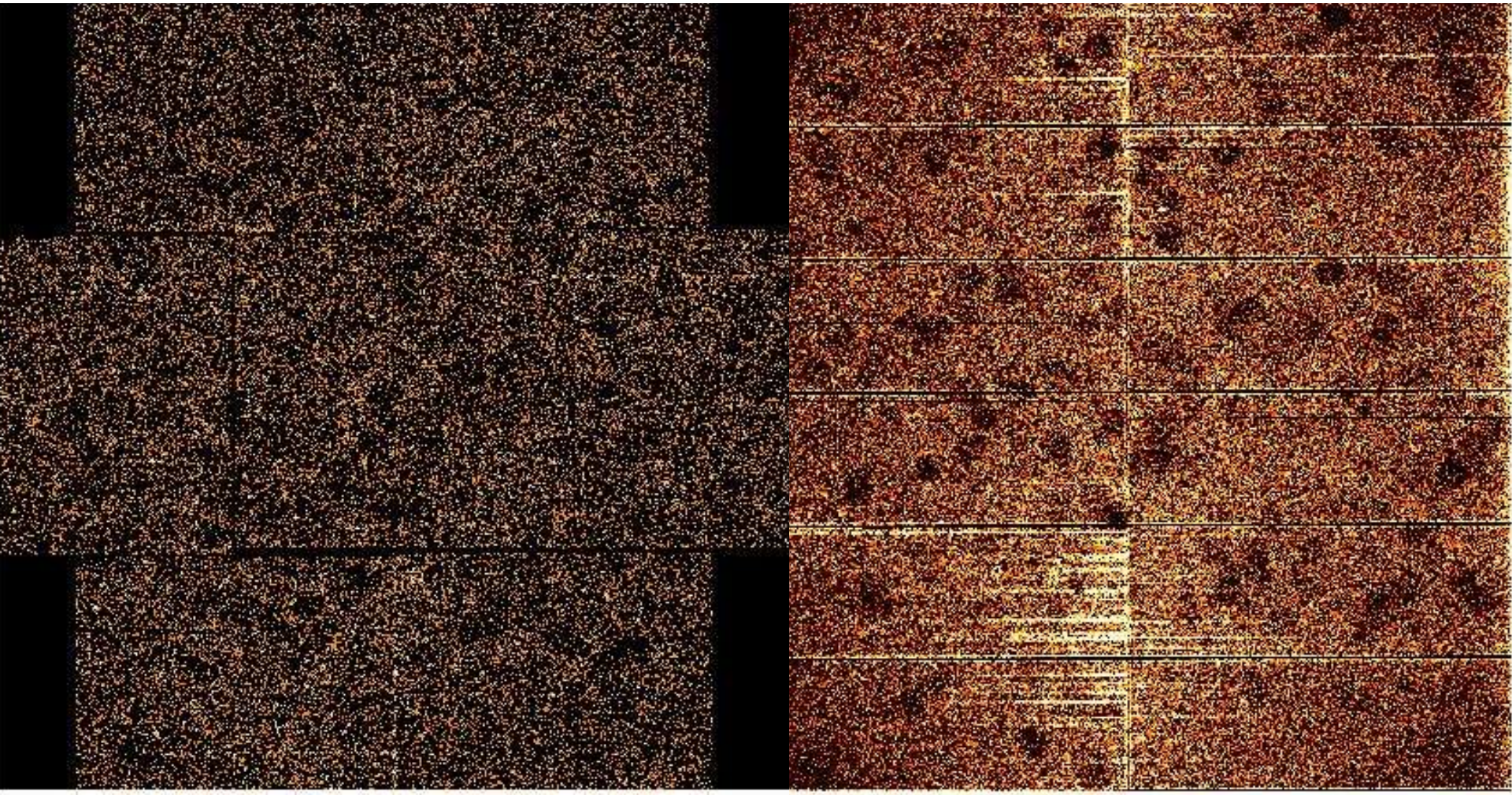
Exposure maps







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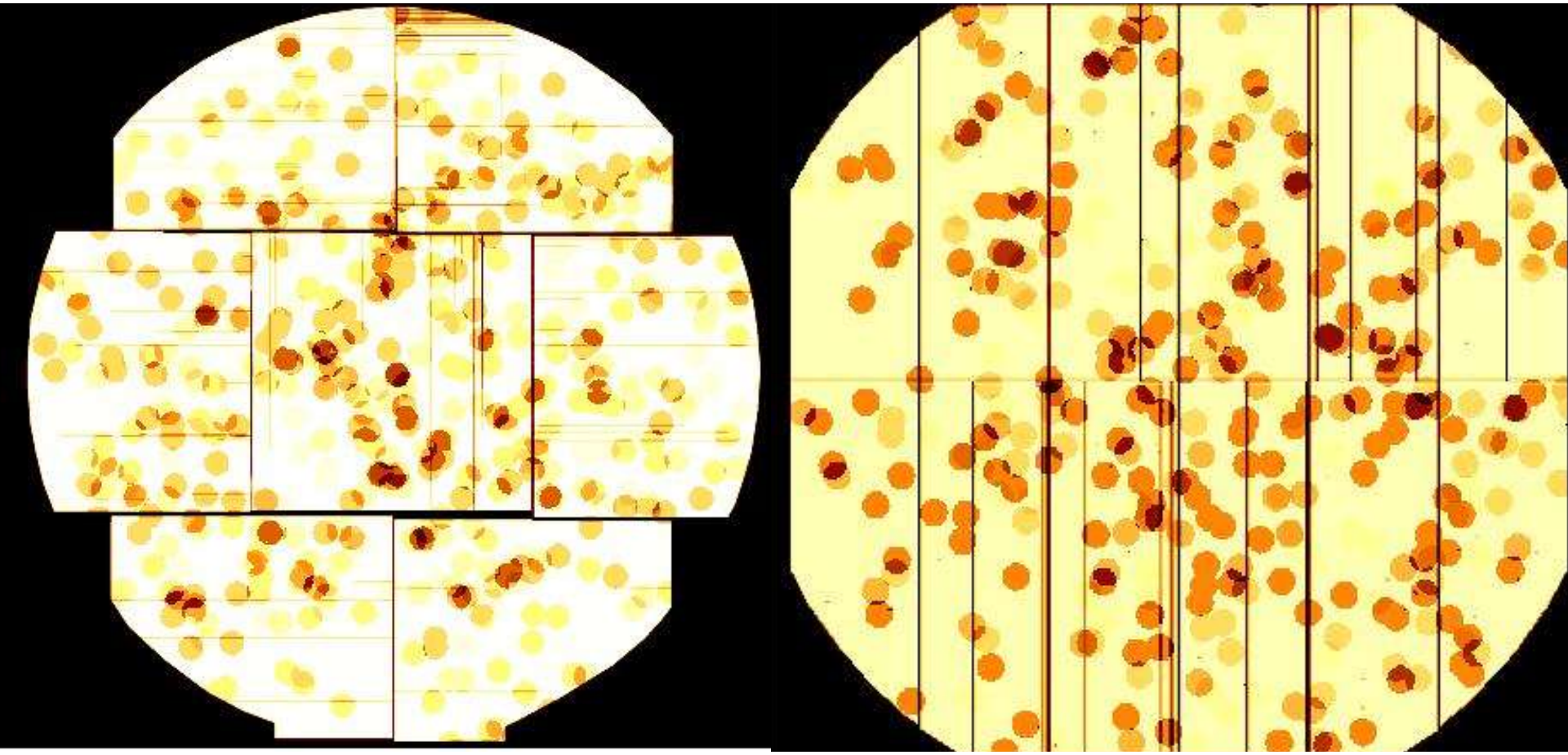

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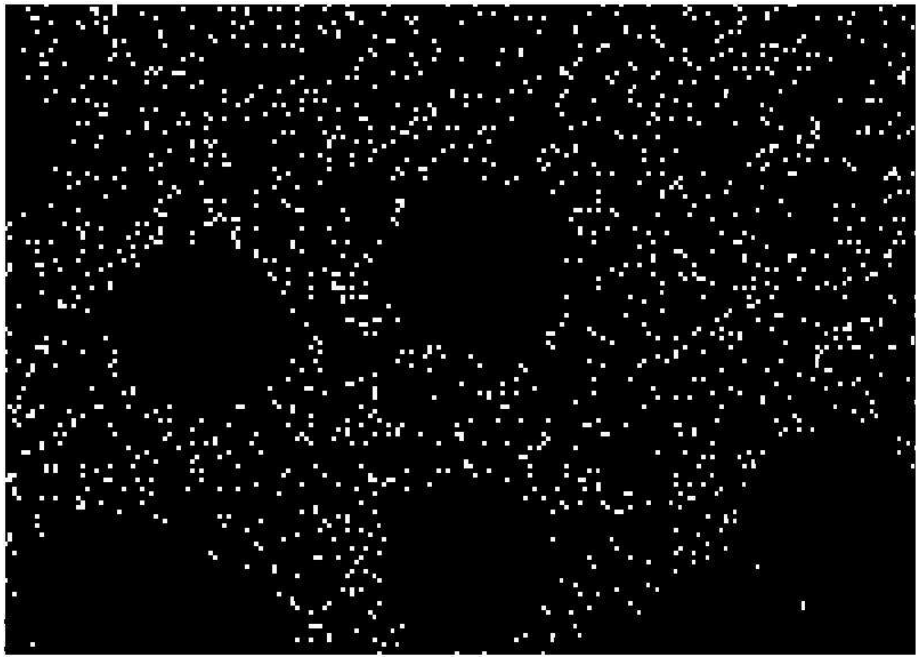
Extensions and improvements

Currently remove sources from the event files

Left with holes

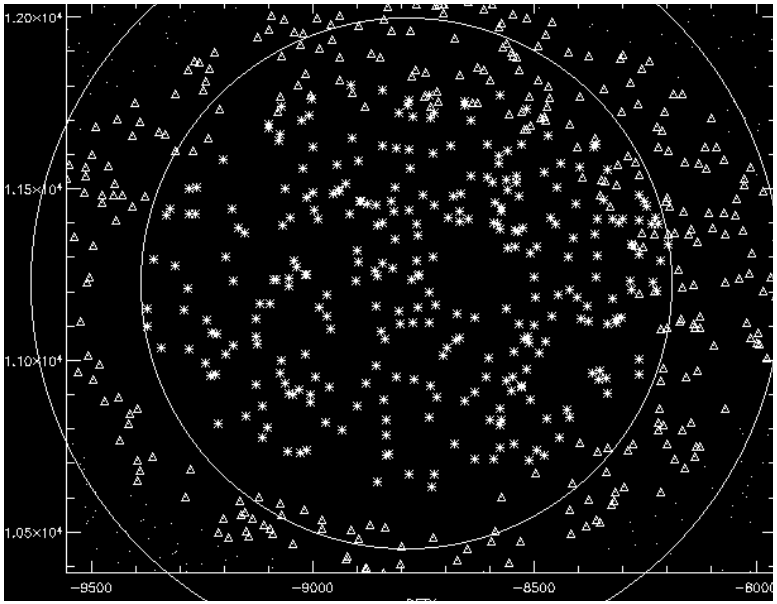
IDL code to fill

Called by BGcreate



How to fill in holes …

- Match the area of the hole to the area of a ring surrounding a hole
- Copy the events in the ring
- Randomise the DETX, DETY positions of these copied events inside the ring
- Add these events to the event file
- Consider complicated situations
- (attcalc back to (0, 0, 0) to correct X, Y positions – in updated script)



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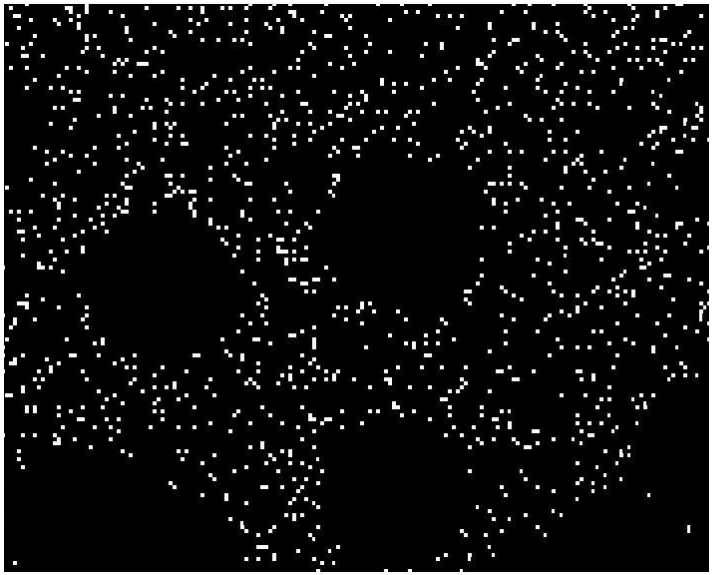
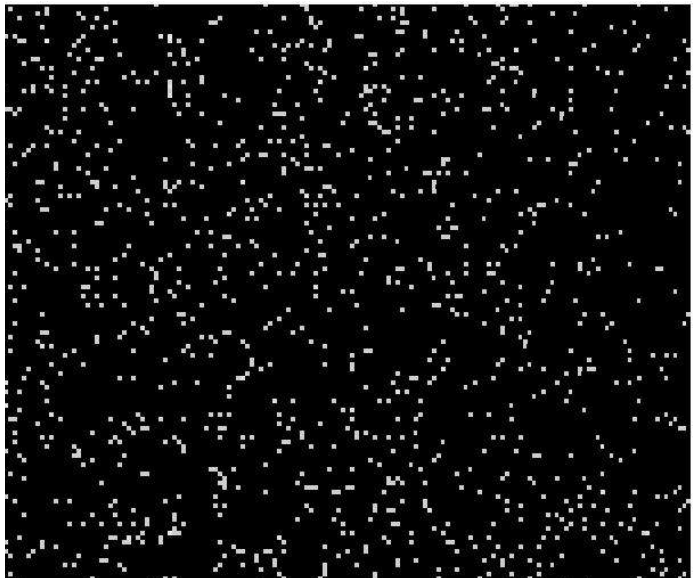
Example, MOS 2 0125300101

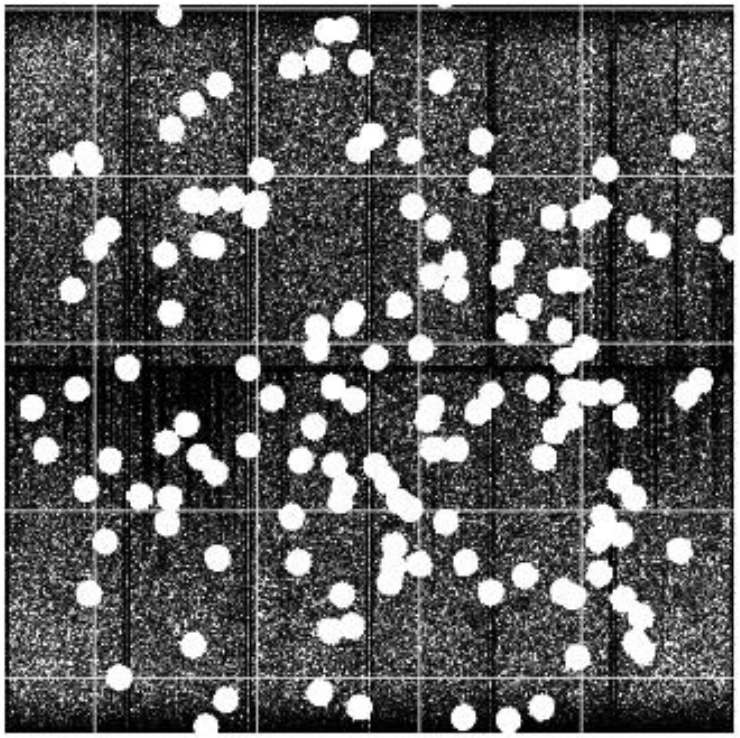


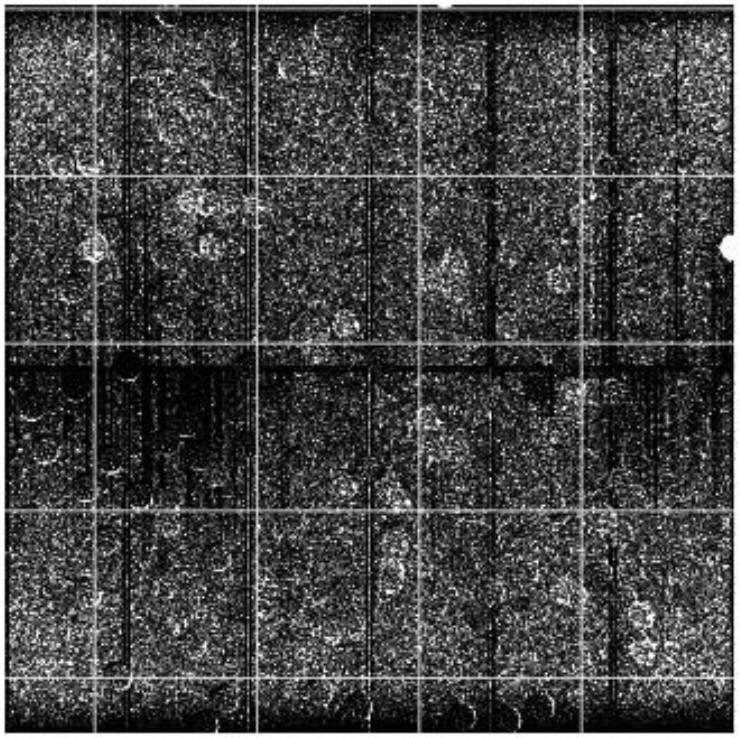
58584 events



65579 events

PN example





Observation list

Time threshold: 20 ks

Instrument	Mode	Filter	N_{OBS}	Exp.time (s)
MOS1	FF	Thin	515/ 1142	2.07324e7
MOS1	FF	Medium	659 / 1484	2.49171e7
MOS1	FF	Thick	87 / 174	3.51780e6
MOS2	FF	Thin	541 / 1151	2.07876e7
MOS2	FF	Medium	689 / 1523	2.66936e7
MOS2	FF	Thick	96 / 184	3.73116e6
PN	FF	Thin	329 / 825	1.30232e7
PN	FF	Medium	343 / 927	1.36663e7
PN	FF	Thick	52 / 123	2.06116e6
PN	FFext	Thin	143 / 360	4.90743e6
PN	FFext	Medium	101 / 294	3.30399e6
PN	FFext	Thick	10 / 28	3.76721e5