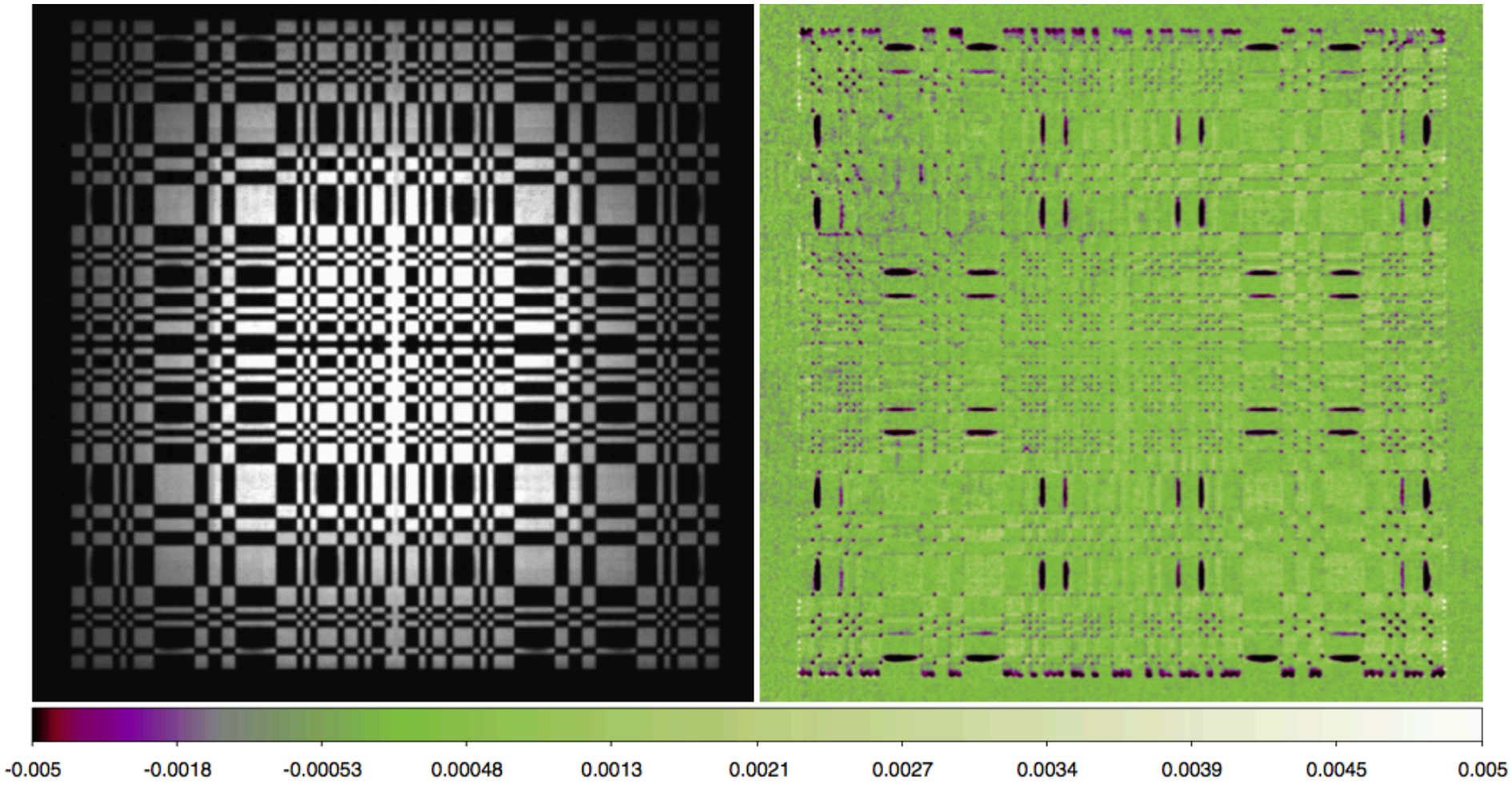
IBIS mask calibration and modeling

Simona Soldi

Mask image

Mask defect image

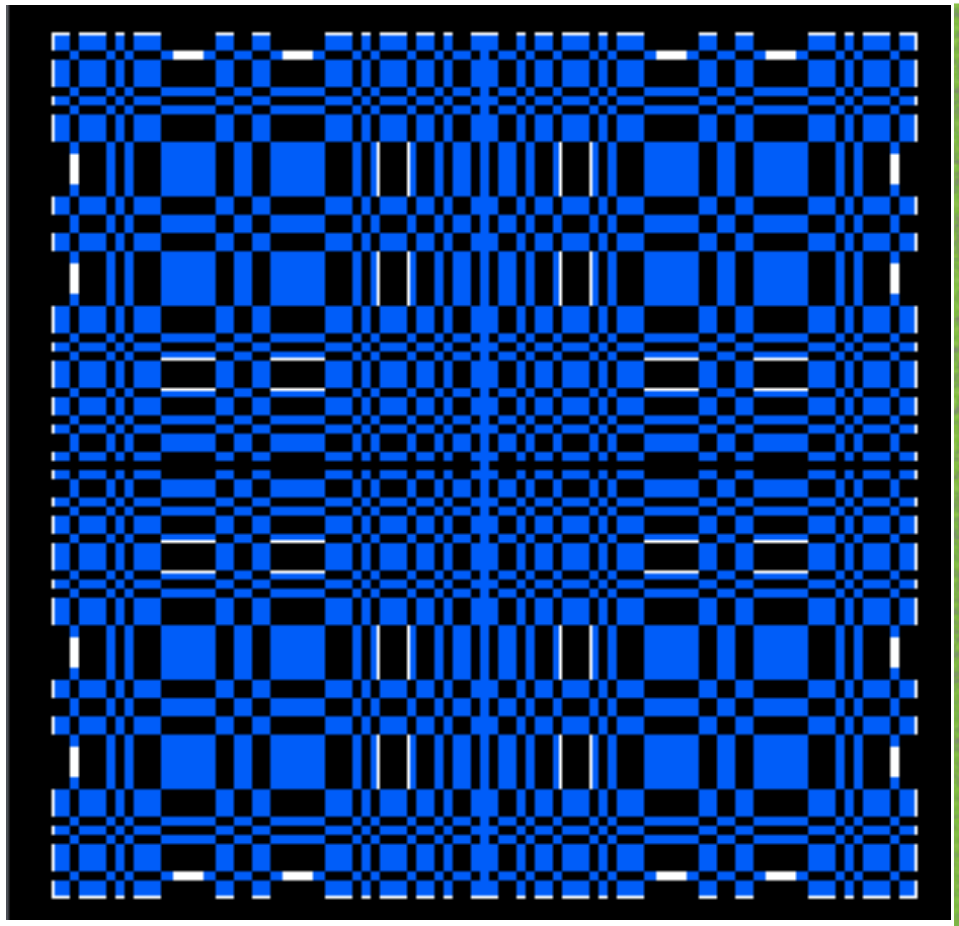


all Crab and Cyg X-1 data < rev 1141

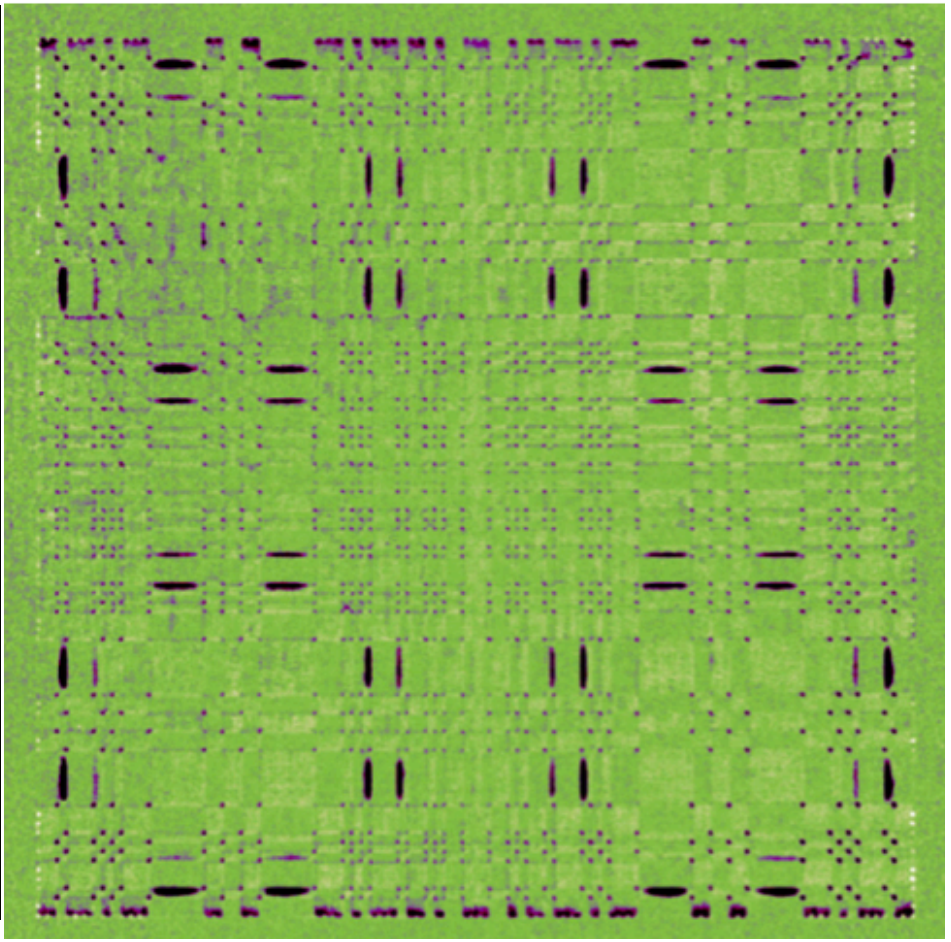
(one more rev to be added from autumn 2012)

Ghost busters: exclude the detector pixels corresponding to the projection of a bright source through mask elements affected by defects (screws, glue)

exclusion mask used by ghost busters

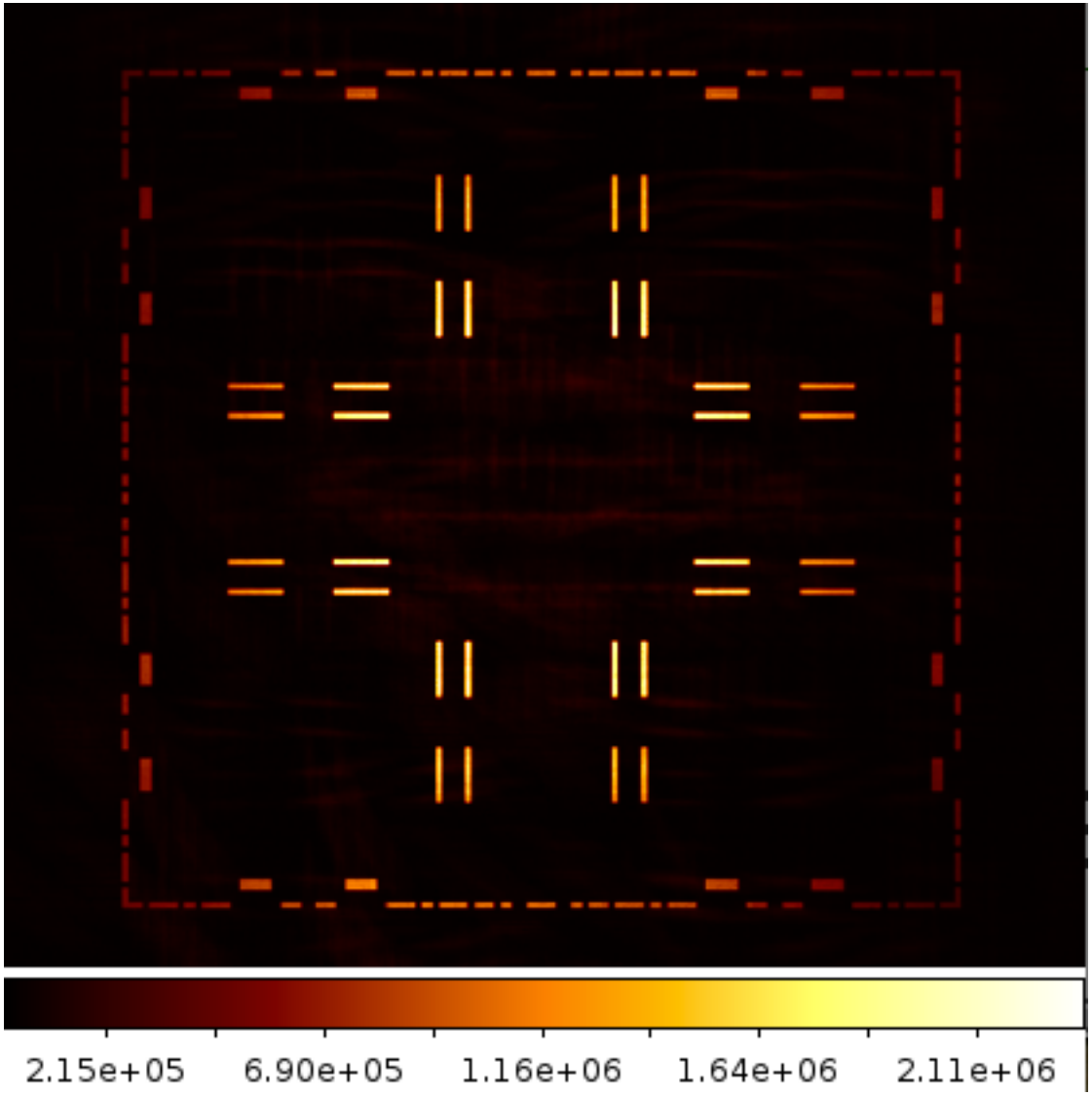


mask defect radiography



Black = opaque elements Blue = transparent elements
White = elements excluded by ghost busters

Making a mask radiography after including ghost busters (I)



Difference of exposure maps:
without – with ghost busters

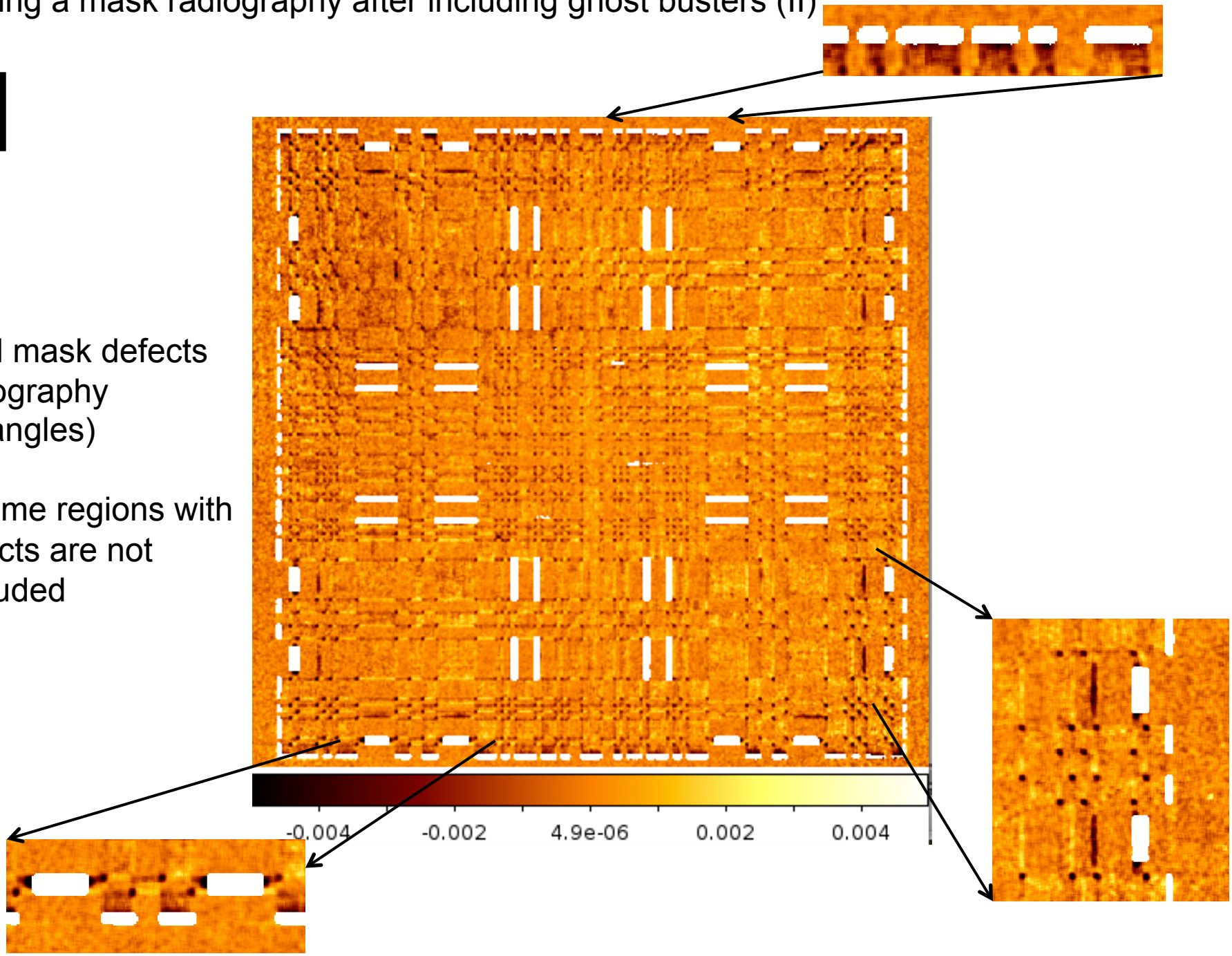
→It highlights the regions
excluded by ghost busters

Making a mask radiography after including ghost busters (II)

A

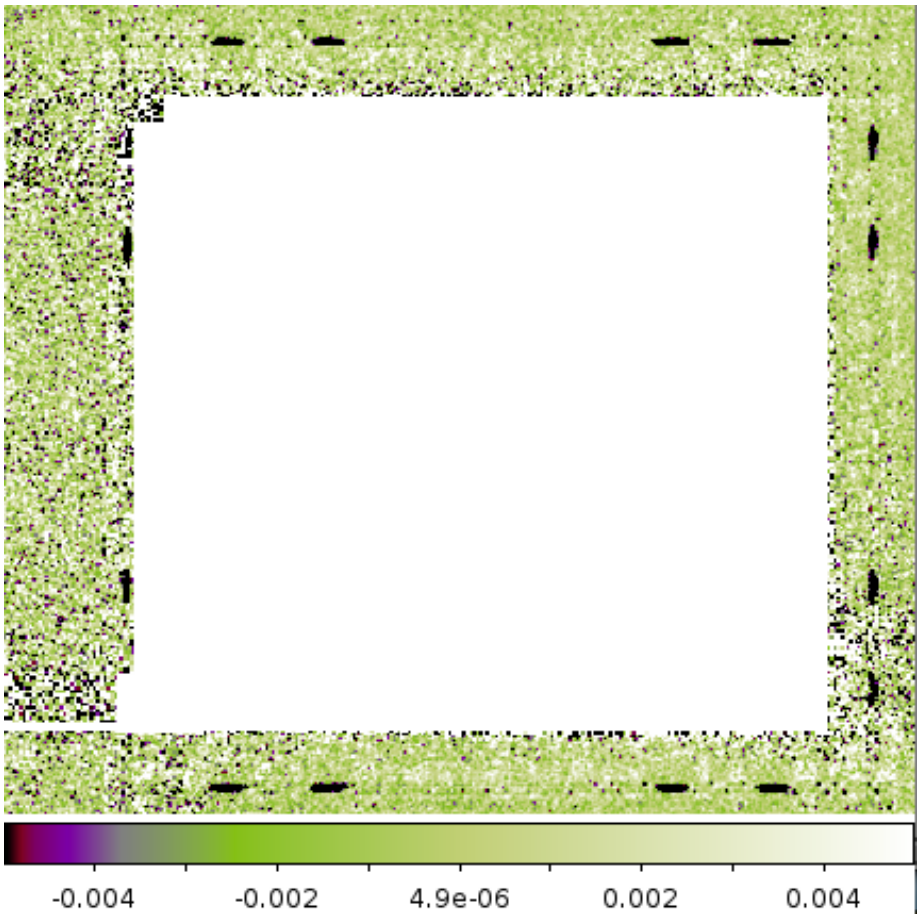
Total mask defects radiography (all angles)

→some regions with defects are not excluded



Making a mask radiography after including ghost busters (III)

B



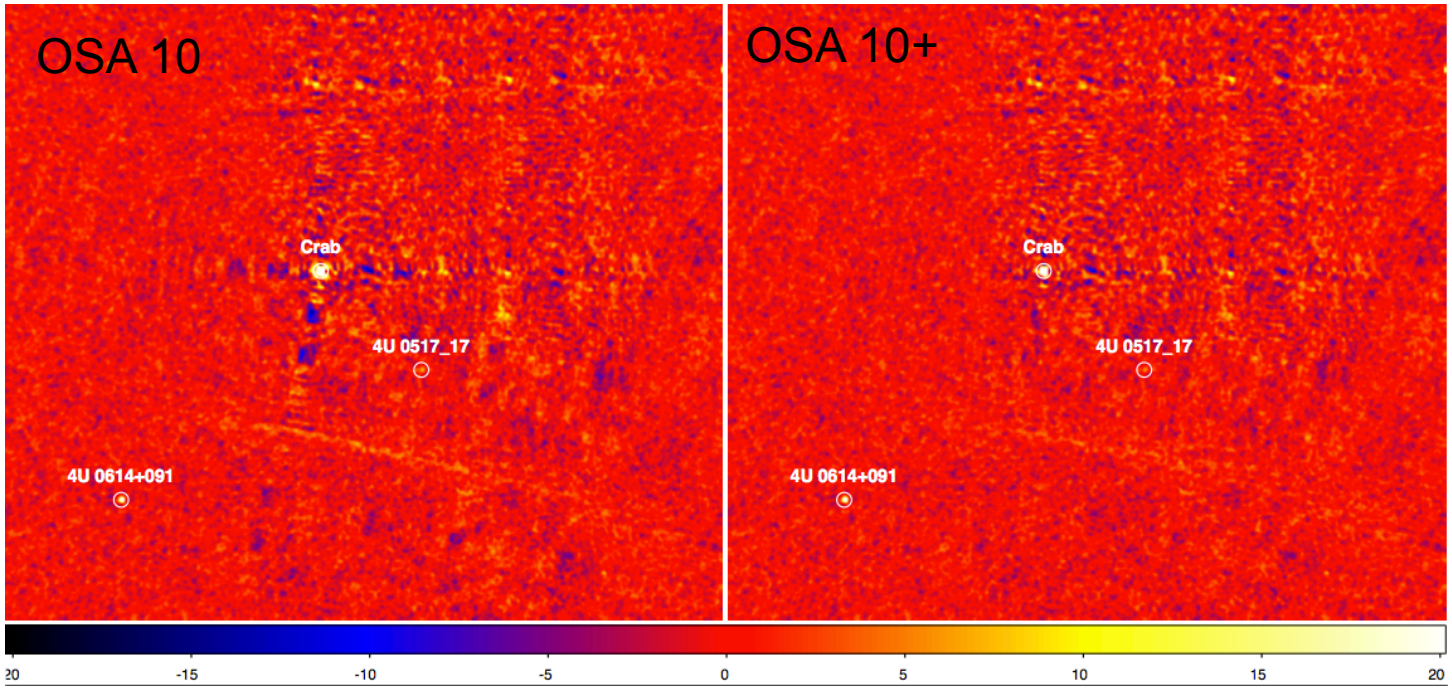
data from 319 scw of the Crab and Cyg X-1

Mask defects radiography
using sources whose FOV pixel coordinates |y| > 160 or |z| > 160

→no ghost buster applied
at all by OSA

B Increasing the limits to apply ghost busters to very off-axis sources

FOV pixel coordinates limits for ghost busters: from [-160,160] to [-180,180]



20-60 keV significance map

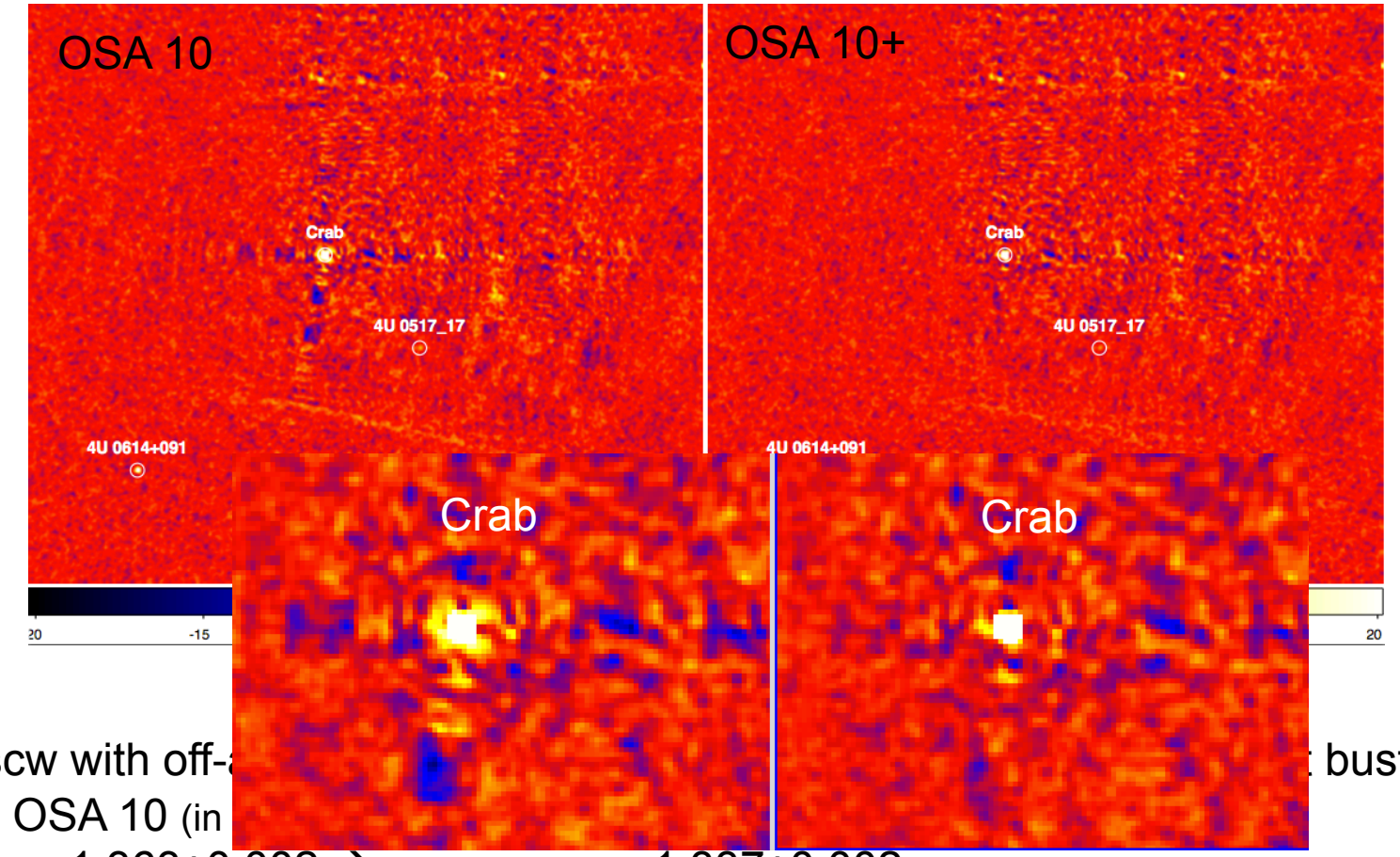
All Crab scw with off-axis 13-20^{o}, i.e., 112 scw, 60% of which have no ghost busters applied in OSA 10 (in general, ~2.3% of Crab scw have by default no ghost busters)

- $\sigma_{Gauss,OSA10}$=1.363±0.002 → $\sigma_{Gauss,OSA10+}$=1.337±0.002
- most prominent noise structures decreased by a factor of 2-5
- pixels with |value| > 10σ decreased by 45%
- similar results when tested on Cyg X-1

  (in general, ~7.4% of Cyg X-1scw have by default no ghost busters)

B Increasing the limits to apply ghost busters to very off-axis sources

FOV pixel coordinates limits for ghost busters: from [-160,160] to [-180,180]



All Crab scw with off-… busters applied in OSA 10 (in …

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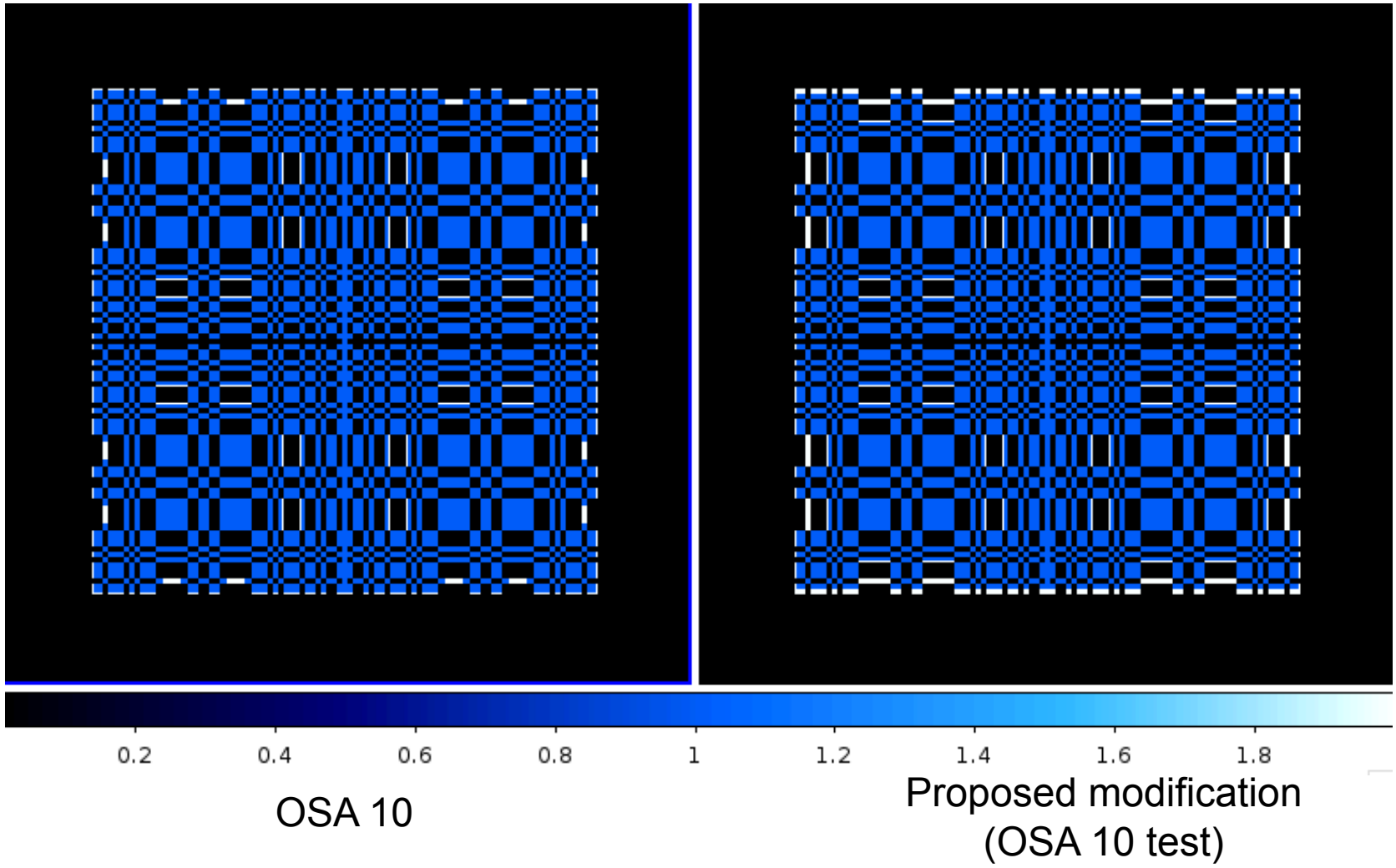
A

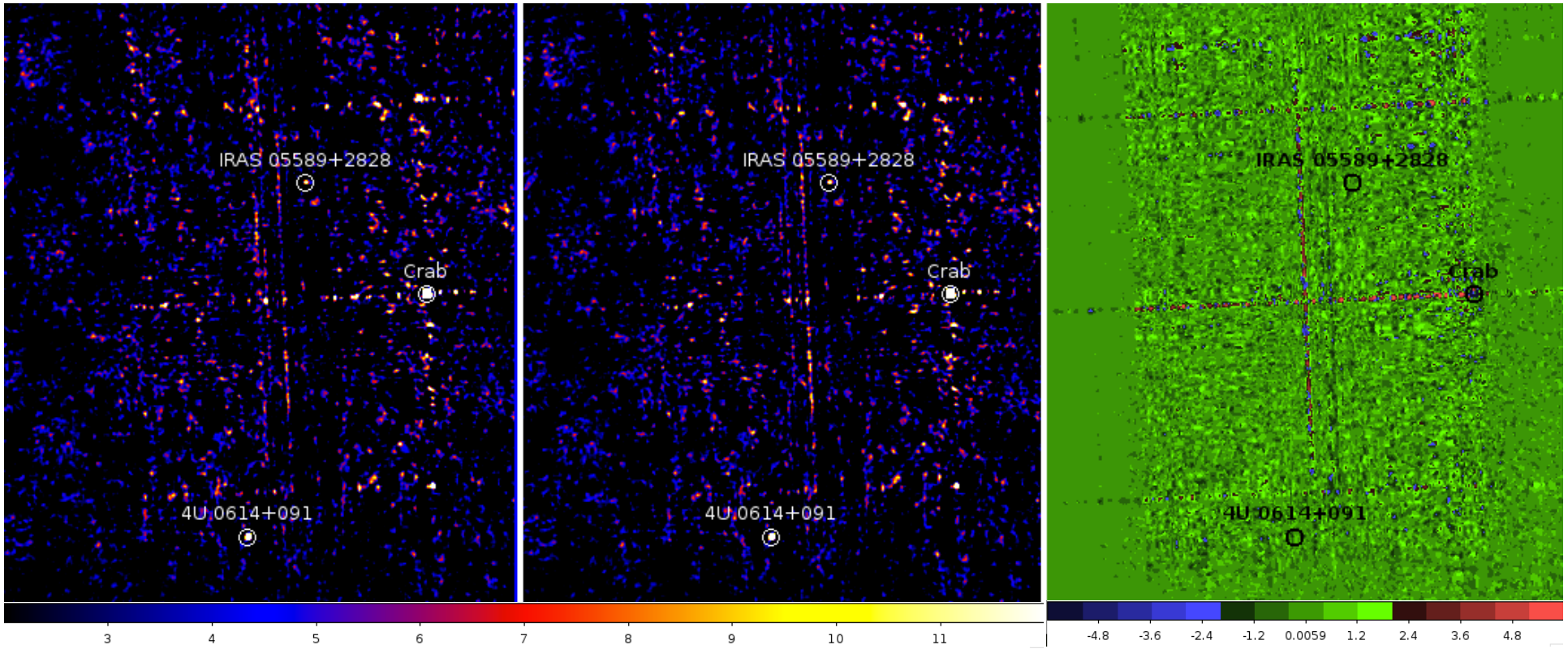
Modifying the exclusion mask used by ghost busters

Black = opaque elements Blue = transparent elements White = excluded by ghost busters



From 2% to 3.5% mask elements excluded

A Modifying the exclusion mask used by ghost busters



OSA 10
significance map (20-60 keV)

OSA 10 test
significance map (20-60 keV)

Δ = OSA 10 – OSA 10 test
significance maps

Second order correction (data set: 464 scw with Crab at 7-16°)

- $\sigma_{Gauss,OSA10} = \sigma_{Gauss,OSA10,test}$
- pixels with |value| > 10σ decreased by 14%
- 2844 pixels with $|\Delta| > 2\sigma$

  $\Delta > 2\sigma$ for 65% $\Delta < -2\sigma$ for 35% → global net improvement

Summary and perspectives

- Modification of the position limits to apply ghost busters: significant improvements when bright sources at the edges of the FOV (from 14^{o} to 20^{o}) (case B)
  → ready to be included in the next OSA release

- Additional possible modification needed to correctly identify sources at the edge of the FOV (|y| > 175 or |z| > 177). Currently under investigation

- Modification of the exclusion mask used by ghost busters: second order improvements. More testing needed for other sources and in crowded fields (case A)

- Bridges modeling: corrections in the model needed?

- Mask calibration work to be continued by ???