PACS Newsletter

Nr. 17, 16 April 2007

The PACS Picture of the Week

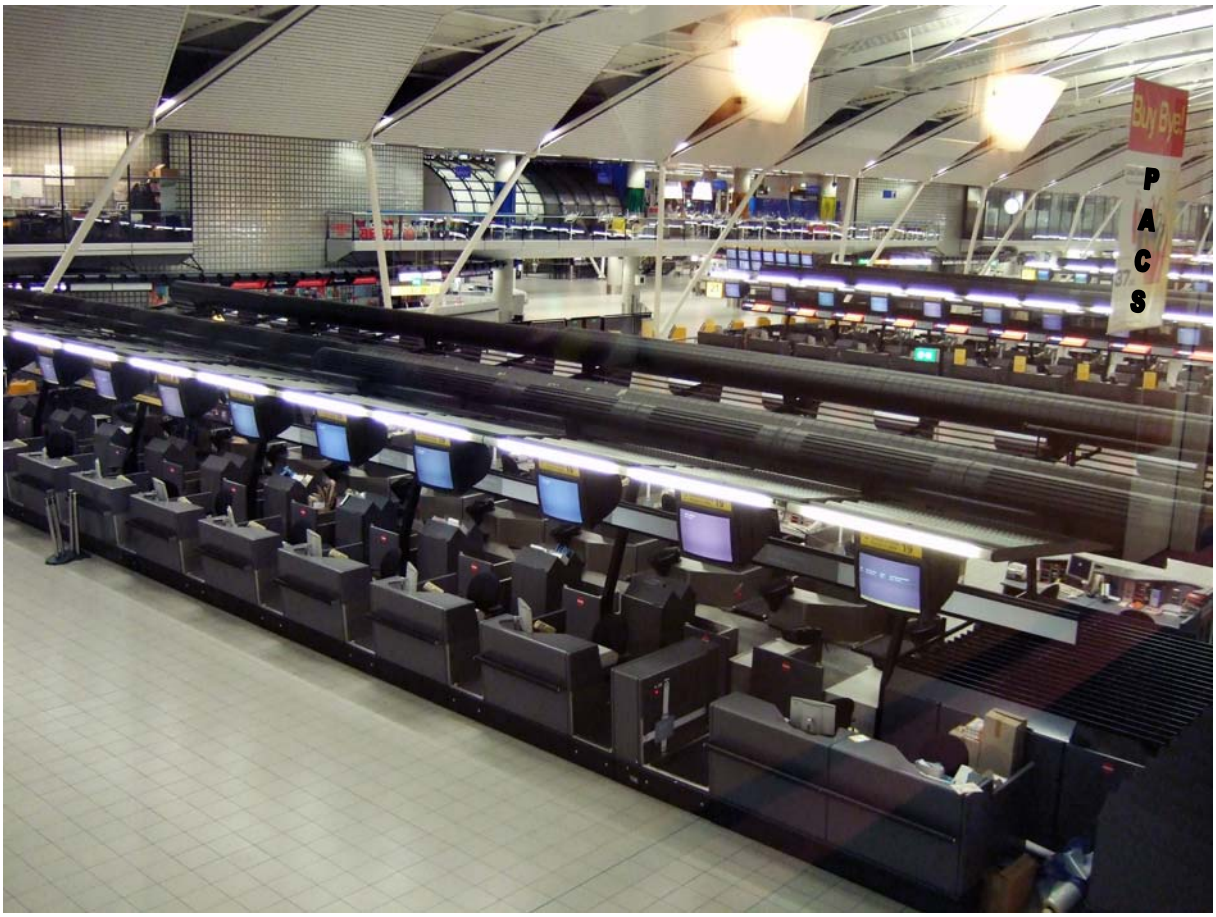

Fig.1: The PACS Operations Room empty, after months of hectic hustle and bustle.

Status

Roger and Over!
We finished the cold part of the PACS FM ILT on Thursday, April 12, around 19:00. The Instrument and the cryostat are now warming up for a short functional test warm and FPU inspections/additional re-alignments end of April. The FPU will be delivered to industry on May 2. Hussa!

Despite the incredibly tight schedule, and thanks to a heroic effort of the entire team we were able to complete practically all tests that were foreseen (plus a number of unforeseen tests). In the end we came close to a test efficiency of 24 hours a day, working in two shifts and using autonomous over night batches and Sundays. Hussa!

Of course there were nasty surprises along the way that hindered our progress, forced us to flexibly adjust the test plan again and again, and caused a lot of grey hair (followed by hair loss). The consumption of Super Dickmanns[1)] raised to an all time high. In summary, however, we dare say that the performance of PACS in operations will be very close to the promised quality. Hussa! Hussa!

Problems and Solutions

Fig.2: Pacsi, readying himself to solve the presumed filter wheel friction his way. (Fortunately, we found out later that the filter wheels show no degradation).

Mechanisms / Control loop optimizations: Control loop optimization for chopper, grating and filter wheels has come a long way. Parameter settings for mechanism operations within or very close to the requirements have been found. Some oscillation effects and instabilities (which are within the specified limits, but could cause a risk for the life time of the grating) are still to be understood. A special procedure for the filter wheels had to be developed (we initially were afraid the filter wheels would have degraded or show increased friction, as the current consumption and position accuracy was not as expected). A further optimization of the parameters has still to be achieved (before the nominal IST level tests).

Optics alignment: In Newsletter #15 we reported about the repair of the misalignment of the slicer optics in February, with the hope that most of this misalignment should be remedied. In the meantime our ILT phase II measurements could confirm, that this is indeed the case (Figure 3). From the original 25 (5x5) spatial pixels (spaxels) we were down to 12 (3x4) spaxels before Christmas. We are now looking at 22 or 23 (5x4 + 2 or 3) useful spaxels.

[1)] Super Dickmanns = Schaumküsse = small waffels topped with marshmallow fluff, covered with chocolate

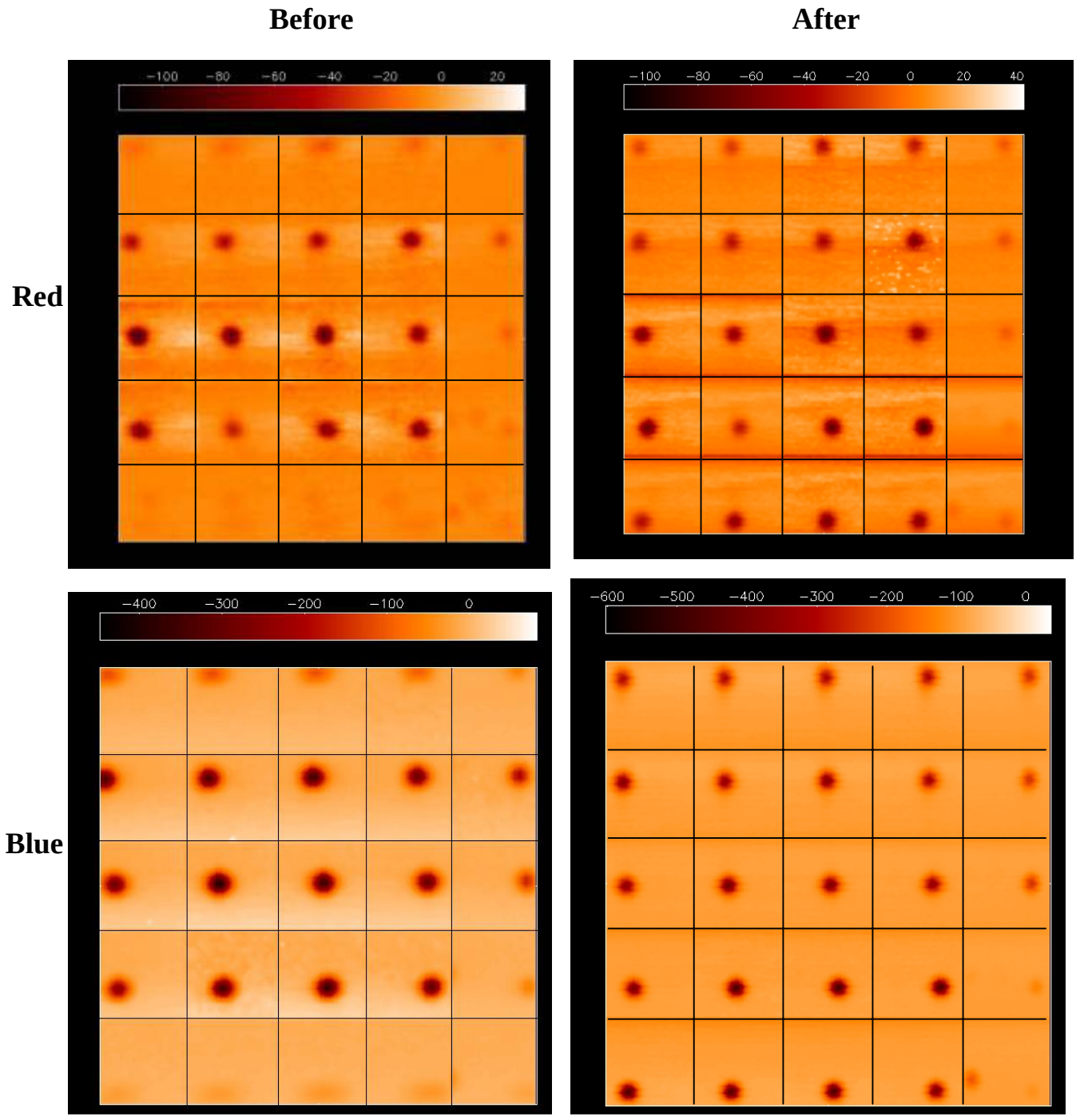

Fig.3: Red (top) and blue (bottom) spectroscopy FOV, showing a point source (PSF) before (left) and after (right) the alignment repair.

Seeing twice (the double PSF): An unpleasant surprise in phase II was waiting for us when we repeated the photometer Field-of-View scans from phase I, as a first step to refine the spatial calibration and PSF characterisation: we were suddenly seeing twice! Instead of a nice round PSF, as in phase I, we now saw elongated (perpendicular to the chop direction) PSFs, with the elongation depending on the position on the array. In the worst positions (bottom of the array) the PSF even separated into two spots. In that case each of these separated spots looked like the expected PSF. This was of course alarming, because it pointed towards a potentially very severe problem with PACS that might have been introduced in February when the FPU was opened for repair. We scratched our heads but could not explain this effect at all. Then we scratched our heads more, and still couldn't find an explanation.

After several rounds of head scratching we carried out a number of tests which finally convinced us that the problem must be outside of PACS, i.e. in the test optics, more precise: in the area of the entrance window of the test cryostat for the external point source. For instance, the internal calibration sources of PACS exhibit a number of point like features. When looking at these, i.e. not looking outside of PACS, we did not see a difference between the phase I and phase II measurements.

This was already a hint that the problem must be located outside of PACS. However, an inspection of the cryostat entrance window (as far as this is possible from the outside) did not reveal any obvious problem in that area.

The most convincing test was a study of the double PSF behaviour while moving the filter slider in the entrance window area. The PSF appearance was clearly coupled to the exact position of this slider. At certain positions the behaviour even reversed, i.e. the most elongated PSFs appearing on the top of the array, rather than the bottom (Figure 4).

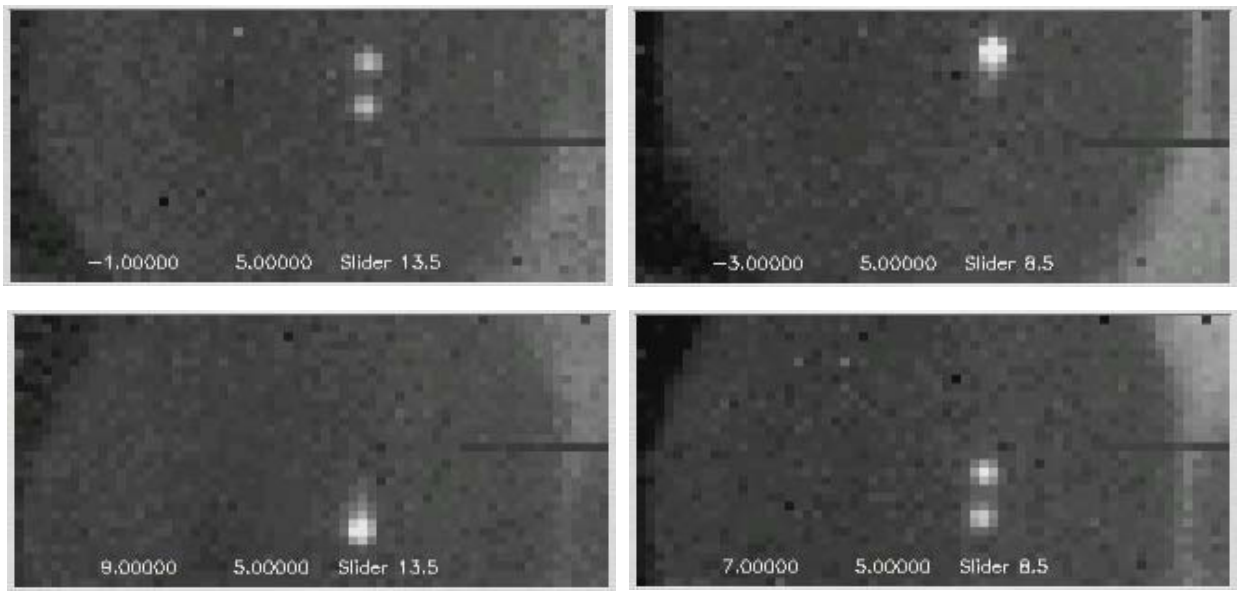

Fig.4:PSF measurements at two slightly different filter slider position (left and right) and two different positions of the point source (top and bottom). The effect on the PSF distortion changes, and even reverts, depending on the line of sight through the filter.

We still have no physical explanation of what exactly happens (but will hopefully find out when we open the test optics). However, the tests described above (and several others, like looking at laser speckles shining through a different test optics entrance window) leaves no doubt that the problem is indeed caused in the area of that entrance window which was used for the point source tests.

In summary: the good news is that we believe the PSF is ok (i.e. according to spec). The bad news is that the detailed characterization/calibration of the spatial distortion has to be deferred to in-orbit measurements. These will be difficult and depending on the pointing reconstruction, but should be feasible.

Magnetic fields (EMC) / read-out mode:

The last test day was dedicated to measurements of the effects of magnetic fields on the bolometers. For once, and as a nice ending of the cold FM ILT, we were positively surprised: the first-look analysis of the data revealed a higher susceptibility to magnetic fields in the DDCS mode (double differential read-out mode, considered our default/fall-back mode) than in the Direct mode (the one with the better sensitivity)! Pre-test assumptions were the other way round: the less sensitive DDCS was supposed to be less susceptible to magnetic fields.

Both modes show no perturbation when the cables are all routed in one bundle; when they are split up following the topology on the satellite we see strong effects. How representative our loop is in a quantitative sense is hard to assess; here, only a measurement on system level can give the final answer. However, it seems to be clear now that using the DDCS mode won't help us at all – if the magnetic fields are too high we will have to solve the problem from the satellite end (harness re-routing or further reduction of the emitted levels). In any case, HSPOT needs to be updated, i.e. the more sensitive direct mode will be our default mode.

Fig.5: The lab setting for the EMC tests. Two gigantic solenoids were built by our carpenter's workshop and placed on either side of the cryostat, with the cable harness in its centre.

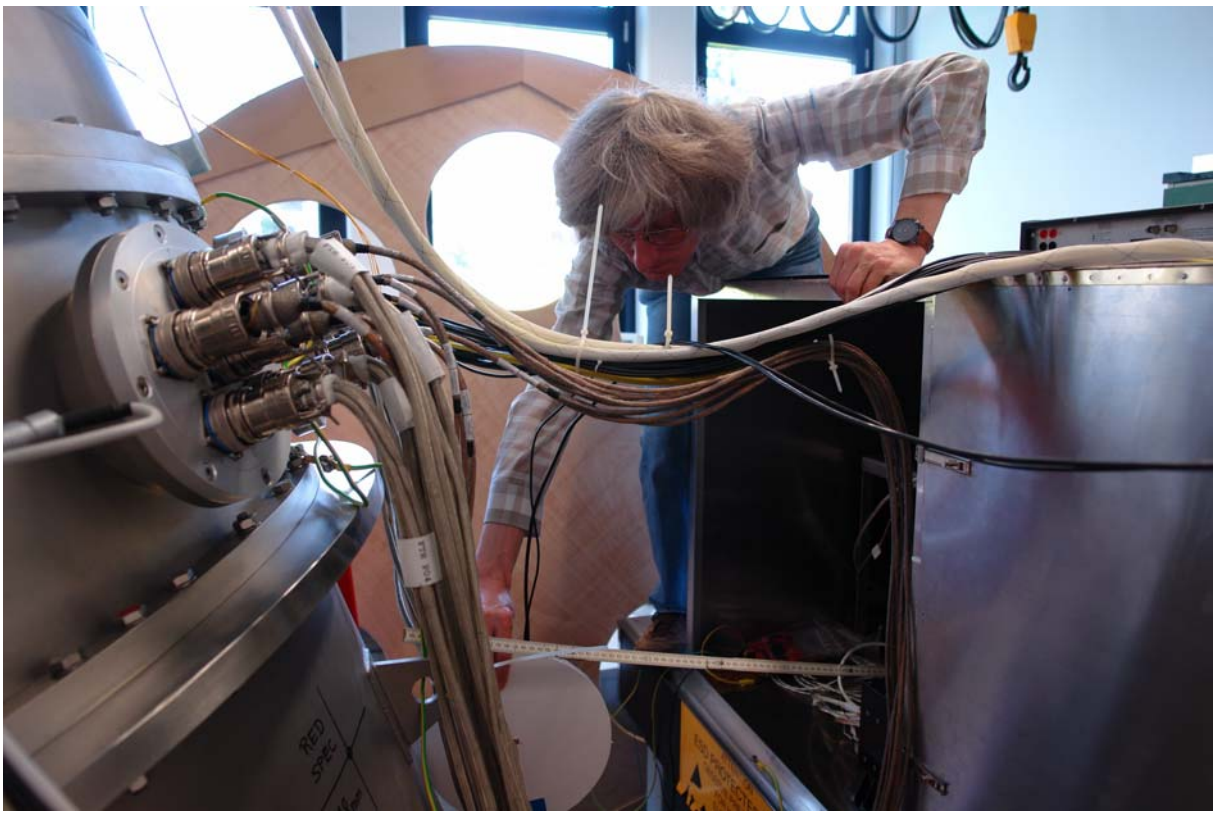

Fig.6:The PI, showing full dedication and exertion while measuring the magnetic field strength personally. That was, before someone shouted "Now, stay in this position!"

Fig.7: Last men standing ("last light" party for the team that shut off PACS on Thursday evening, concluding the cold FM ILT)

And finally:

The PACS Number of the Week: 100

the weight in kilogram of Bruno, the bear who wandered from Italy to Germany via Austria and who was gunned down last year after eating 30 sheep, four rabbits and a guinea pig.

Pictures:
Figure 1: Amsterdam Schiphol Airport at 3:00 o'clock in the morning. Photograph by A. Poglitsch who had to spend a night in no man's land at that airport.
Figure 2: Knut, the new born polar bear and everybody's darling of the Berlin Zoo.

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