## *Figures*

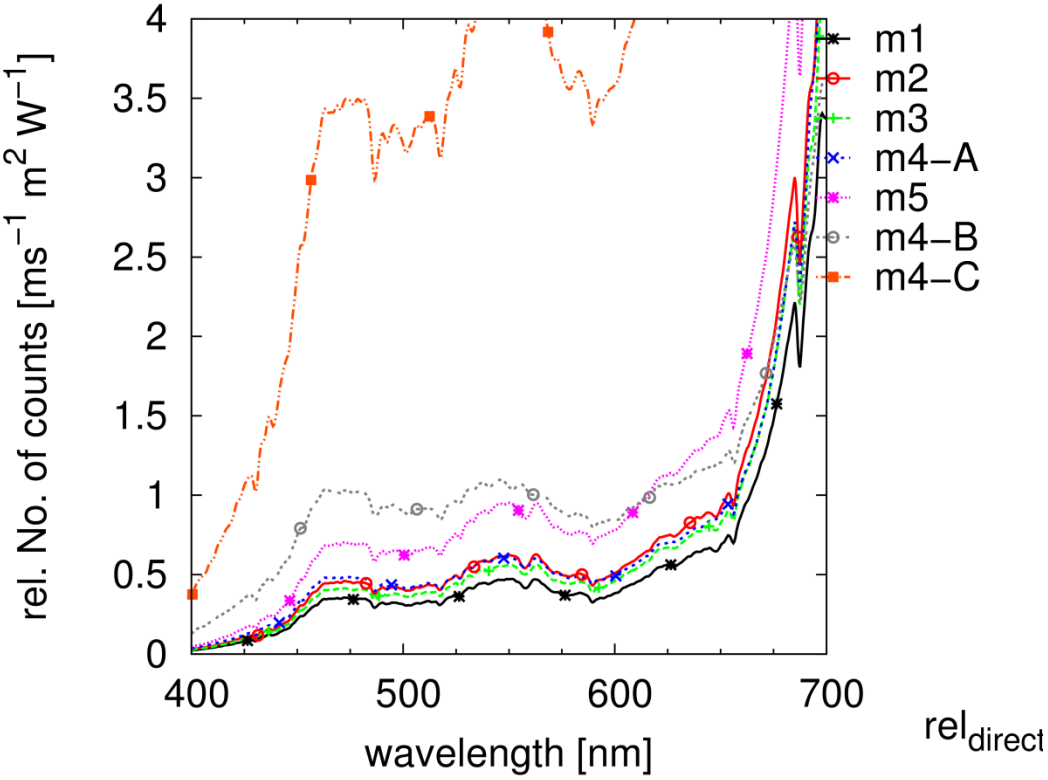



Figure S1: Spectra measured by fibre optical detector (winter; 31.10.12; ND=4) relative to the calculated power (direct beam radiation) from the reference data, Figure S6. Measurements –B and –C are outlines which show the heterogeneity in the cloud density.

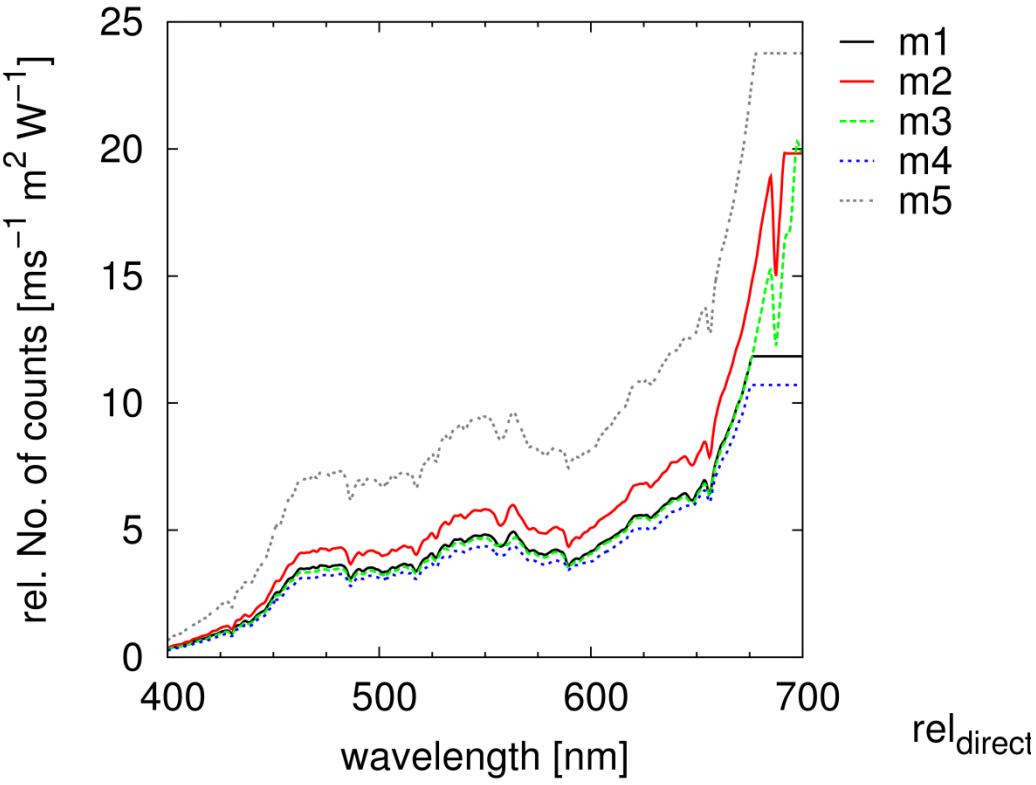



Figure S2: Spectra measured by fibre optical detector (winter; m1, m2, m3 25.10.12, m4 29.10.12, m5 31.10.12; ND=3) relative to the calculated power (direct beam radiation) from the reference data, Figure S6.

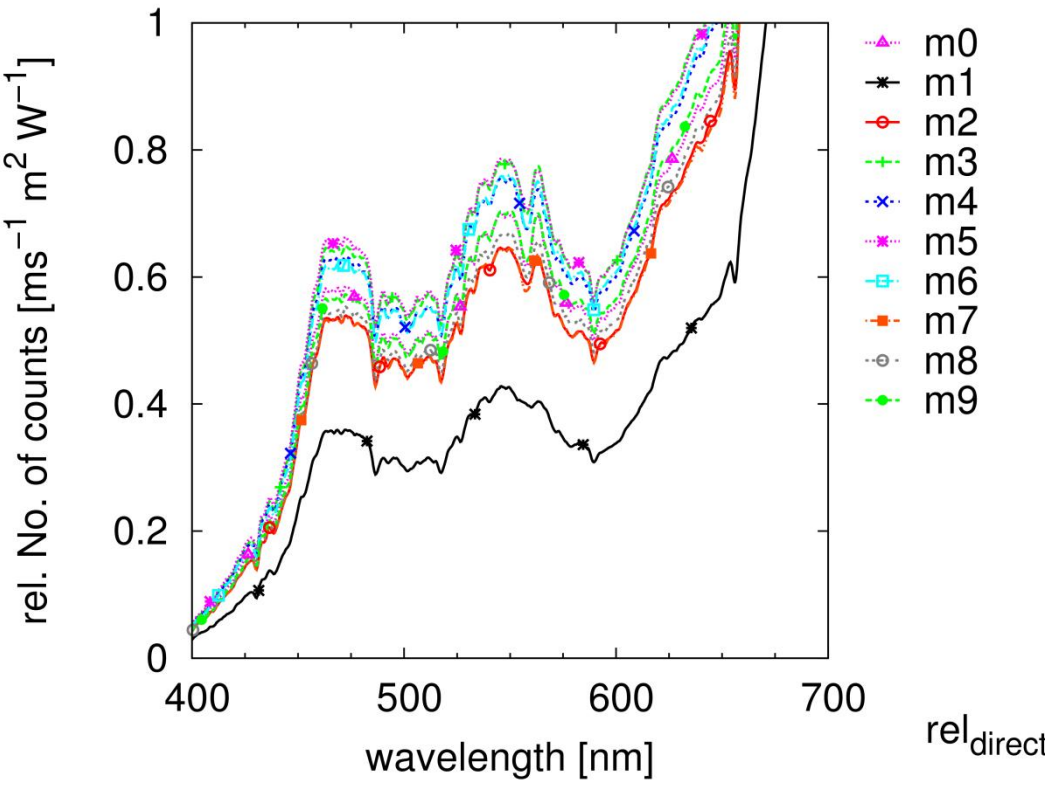



Figure S3: Spectra measured by fibre optical detector (summer; m0 05.06. and 06.06.13; ND=4) relative to the calculated power (direct beam radiation) from the reference data, Figure S7.

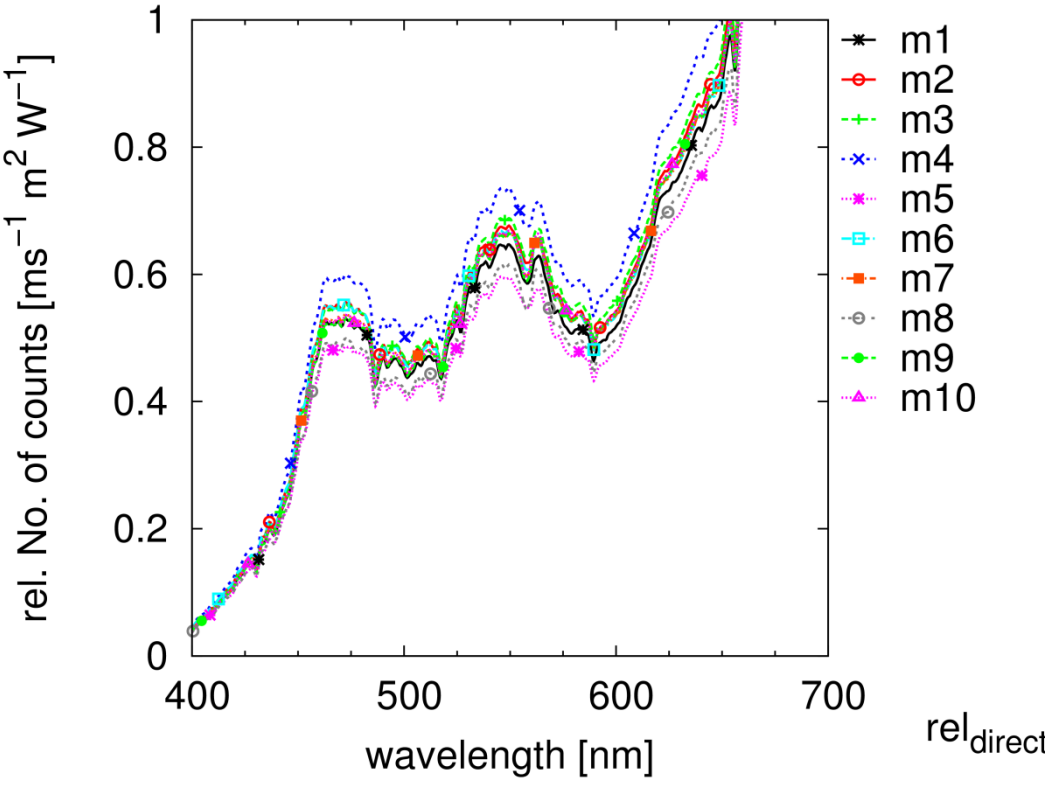



Figure S4: Spectra measured by fibre optical detector (summer; 07.06.13; ND=4) relative to the calculated power (direct beam radiation) from the reference data, Figure S7.

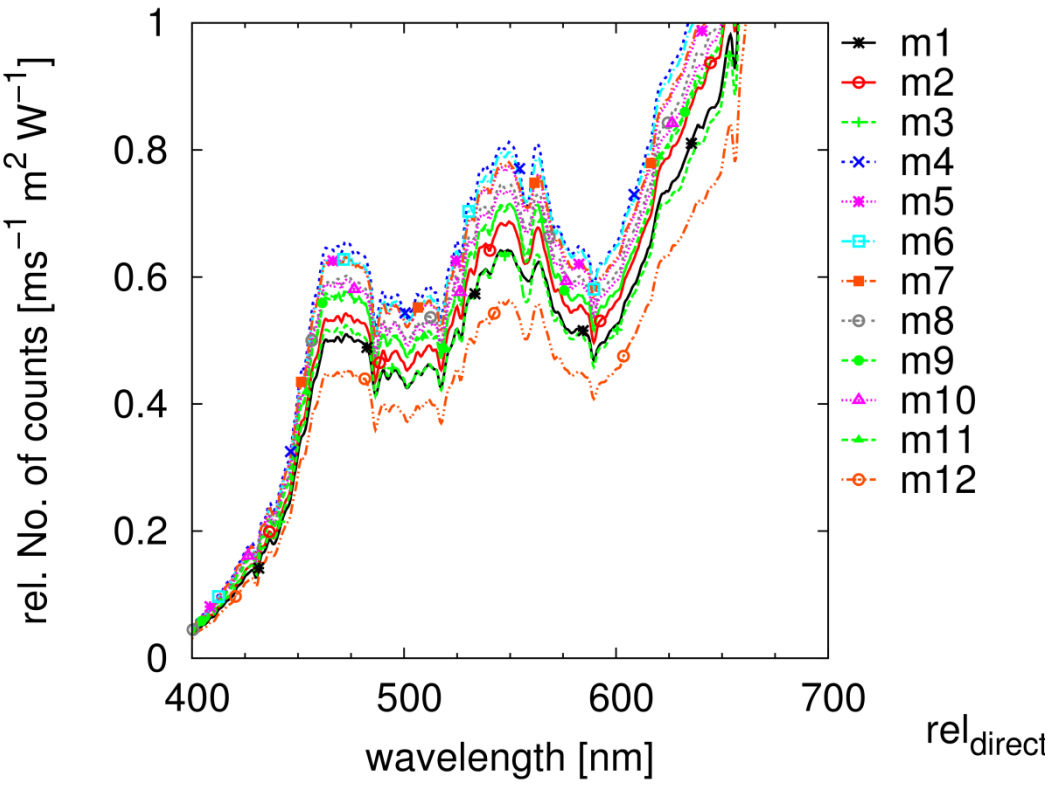



Figure S5: Spectra measured by fibre optical detector (summer; 08.07.13; ND=4) relative to the calculated power (direct beam radiation) from the reference data, Figure S7.

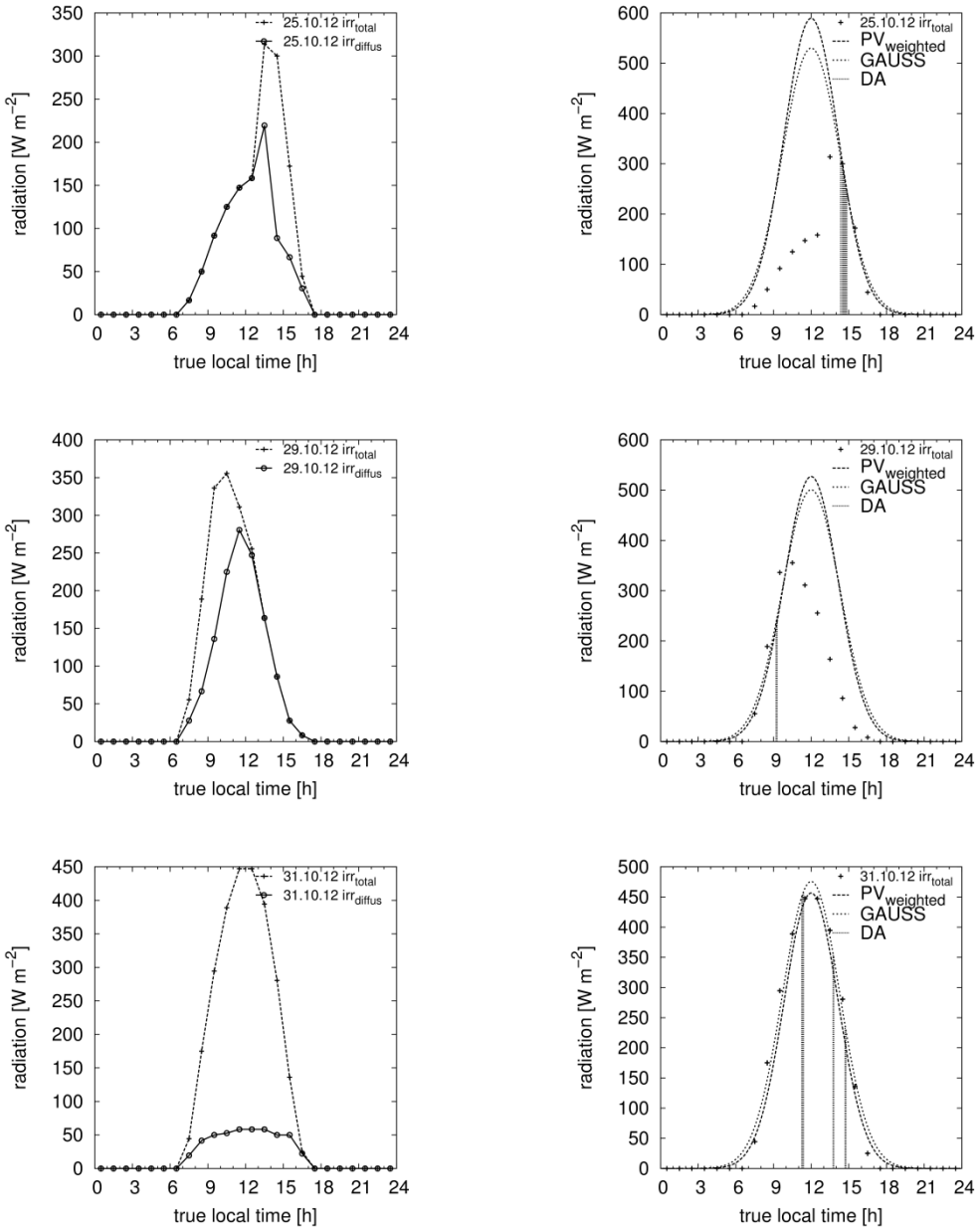



Figure S6: Total hemispherical and diffuse irradiation (winter) measured from German Meteorological Service by a pyranometer der ISO-class „secondary standard“ (high quality). Times when measurements with fibre optical detector took place are marked by vertical lines. For reasons of comparability fittings on the total hemispherical radiations are presented.

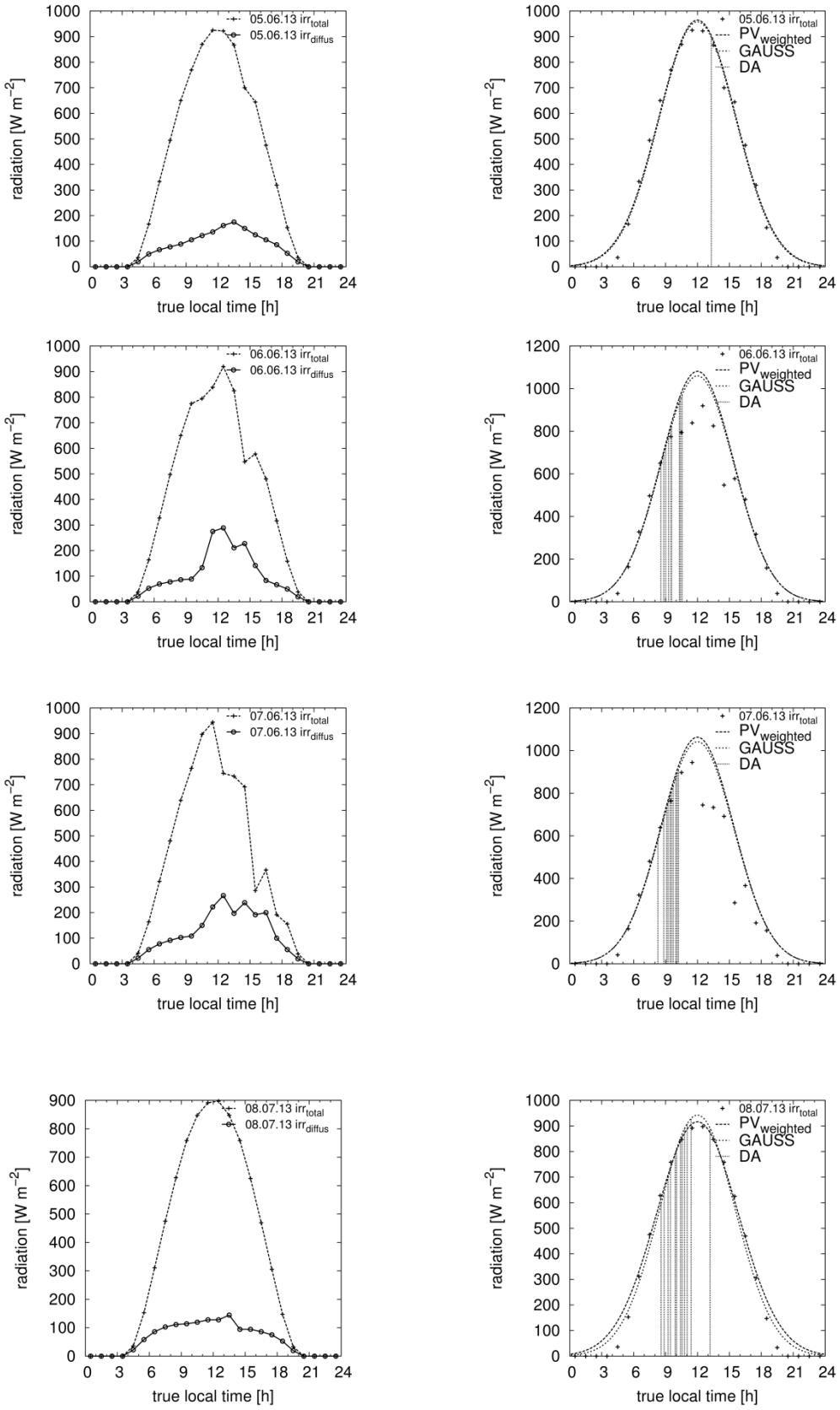



Figure S7: Total hemispherical and diffuse irradiation (summer) measured from German Meteorological Service by a pyranometer ISO-class „secondary standard“ (high quality). Times when measurements with fibre optical detector took place are marked by vertical lines. For reasons of comparability fittings on the total hemispherical radiations are presented.

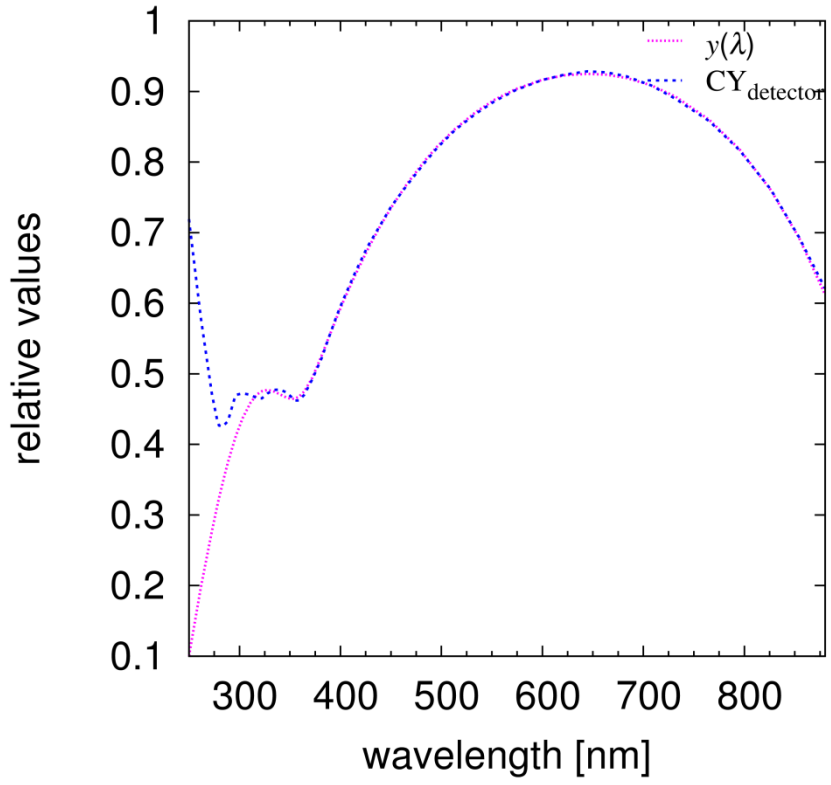



Figure S8. Quantum yield of the back-thinned detector and special fitting. The quantum yield re-increase below 280 nm.

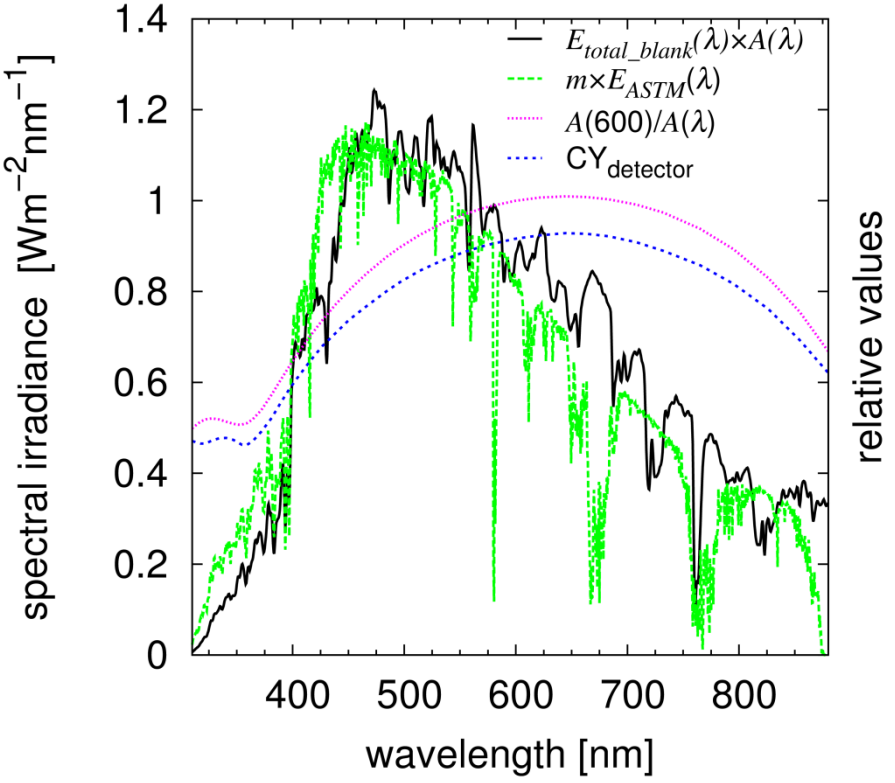
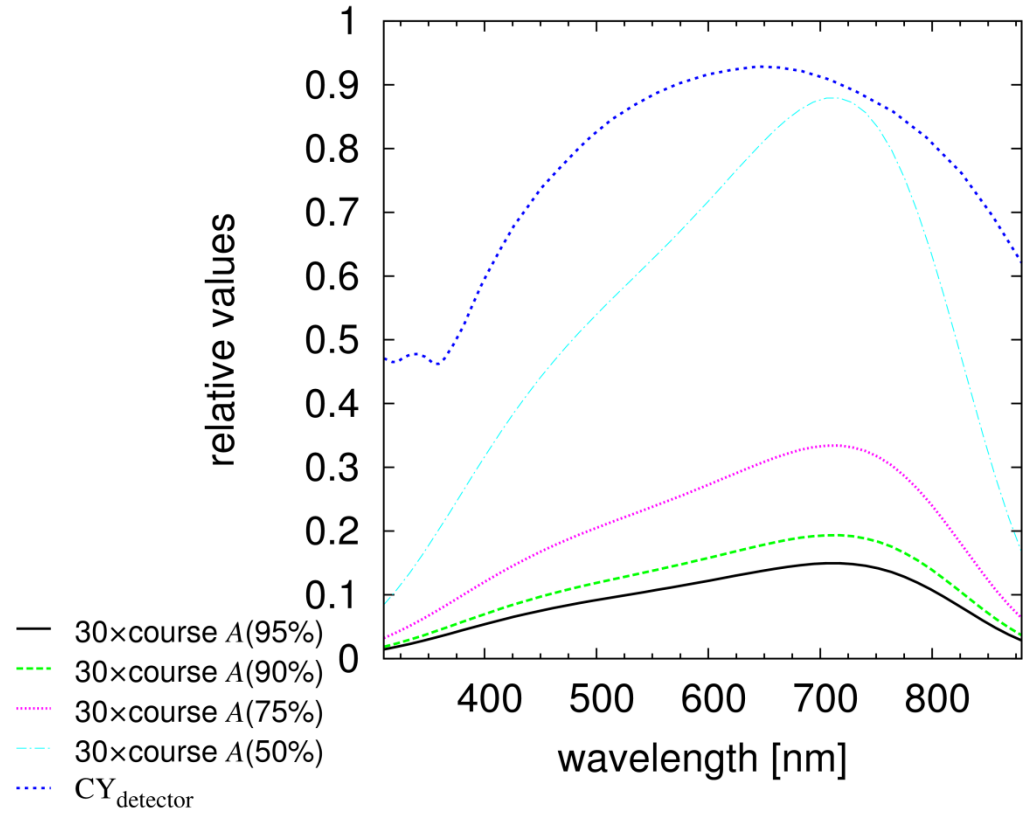



Figure S9: Special function of the quantum yield results ($\lambda_{low}$ = 360 nm) in not well accordance between the measured and the reference spectrum.



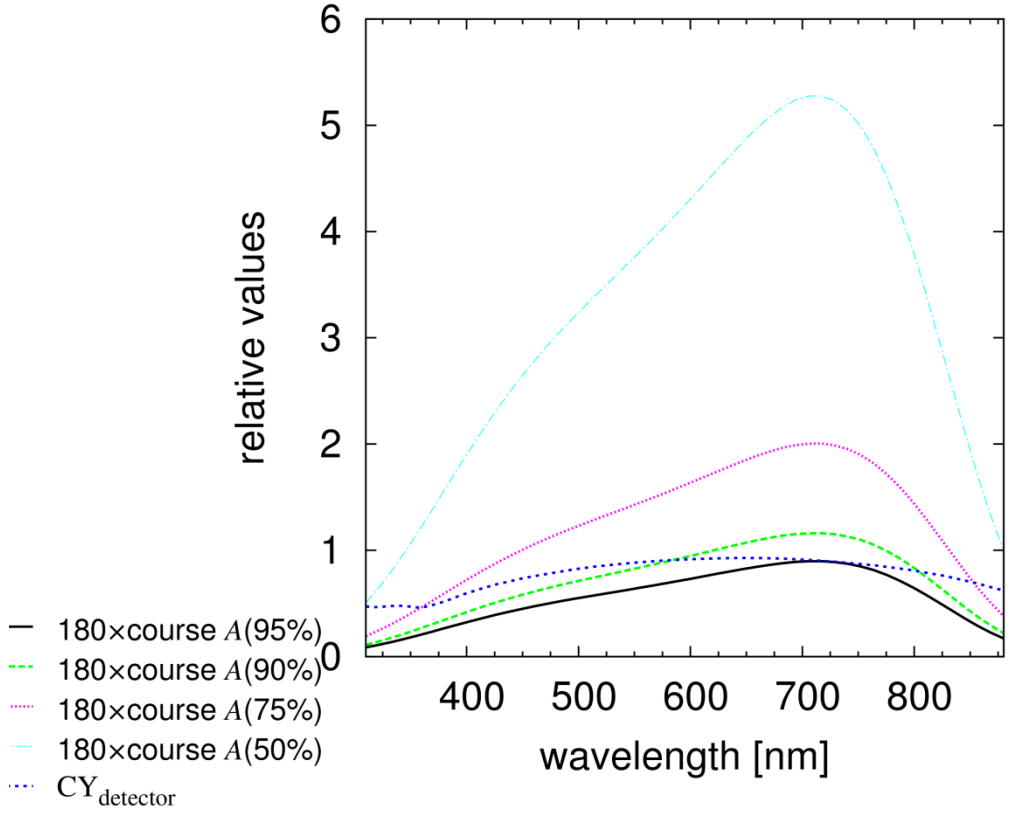




Figure S10: Scaling of the area corrected quantum yield function of eq.15 j=4 range 310 to 840 nm (for the whole equipment) relative to the quantum yield of the back-thinned diode array chip.

## *Table*

Table S1: Results from the fitting procedure. The higher limit $\lambda_{high}$ was in all cases 840 nm. SD = standard derviation.

| Fit-function | $\lambda_{low}$ | rms | a0 | SD | a1 | SD | a2 | SD | a3 | SD | a4 | SD | a5 | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| eq. 14 j=0 | 450 | 1,47E+8 | 4,73E+8 | 5,26E+6 | | | | | | | | | | |
| eq. 14 j=0 | 410 | 1,77E+8 | 5,06E+8 | 6,04E+6 | | | | | | | | | | |
| eq. 14 j=1 | 450 | 1,46E+8 | 5,52E+8 | 3,04E+7 | -1,2E+5 | 4,65E+4 | | | | | | | | |
| eq. 14 j=1 | 410 | 1,66E+8 | 8,22E+8 | 2,90E+7 | -5,1E+5 | 4,55E+4 | | | | | | | | |
| eq. 14 j=2 | 410 | 1,24E+8 | 3,81E+9 | 1,17E+8 | -1,0E+7 | 3,84E+5 | 7,95E+3 | 3,06E+2 | | | | | | |
| eq. 14 j=2 | 390 | 1,23E+8 | 3,78E+9 | 9,97E+7 | -1,0E+7 | 3,34E+5 | 7,89E+3 | 2,71E+2 | | | | | | |
| eq. 14 j=3 | 390 | 1,22E+8 | 2,46E+9 | 5,15E+8 | -3,6E+6 | 2,63E+6 | -3,5E+3 | 4,36E+3 | 6,16 | 2,36 | | | | |
| eq. 14 j=3 | 370 | 1,29E+8 | 5,76E+9 | 4,39E+8 | -2,0E+7 | 2,29E+6 | 2,22E+4 | 3,88E+3 | -7,1 | 2,13 | | | | |
| eq. 14 j=4 | 390 | 1,19E+8 | 2,08E+10 | 2,62E+9 | -1,3E+8 | 1,79E+7 | 3,18E+5 | 4,53E+4 | -3,5E+2 | 4,98E+1 | 1,44E-1 | 2,02E-2 | | |
| eq. 14 j=4 | 370 | 1,19E+8 | 3,00E+10 | 1,99E+9 | -1,9E+8 | 1,40E+7 | 4,67E+5 | 3,60E+4 | -5,1E+2 | 4,04E+1 | 2,07E-1 | 1,67E-2 | | |
| eq. 14 j=4 | 360 | 1,20E+8 | 3,50E+10 | 1,75E+9 | -2,3E+8 | 1,24E+7 | 5,51E+5 | 3,24E+4 | -6,0E+2 | 3,67E+1 | 2,43E-1 | 1,53E-2 | | |
| eq. 14 j=4 | 310 | 1,66E+8 | 5,25E+10 | 1,25E+9 | -3,5E+8 | 9,51E+6 | 8,74E+5 | 2,62E+4 | -9,62E+2 | 3,12E+1 | 3,92E-1 | 1,35E-2 | | |
| eq. 14 j=5 | 390 | 1,18E+8 | -2,8E+10 | 1,36E+10 | 2,9E+8 | 1,17E+8 | -1,11E+6 | 3,97E+5 | 2,04E+3 | 6,64E+2 | -1,83 | 5,47E-1 | 6,41E-4 | 1,78E-4 |
| eq. 14 j=5 | 370 | 1,20E+8 | 3,64E+10 | 9,79E+9 | -2,5E+8 | 8,63E+7 | 6,66E+5 | 2,99E+5 | -8,49E+2 | 5,10E+2 | 4,93E-1 | 4,28E-1 | -9,46E-5 | 1,41E-4 |
| eq. 14 j=5 | 360 | 1,20E+8 | 5,86E+10 | 8,30E+9 | -4,4E+8 | 7,41E+7 | 1,30E+6 | 2,60E+5 | -1,89E+3 | 4,47E+2 | 1,34 | 3,79E-1 | -3,66E-4 | 1,26E-4 |
| eq. 14 j=5 | 310 | 1,54E+8 | 1,12E+11 | 4,74E+9 | -9,23E+8 | 4,52E+7 | 3,03E+6 | 1,68E+5 | -4,89E+3 | 3,06E+2 | 3,90 | 2,72E-1 | -1,22E-3 | 9,43E-5 |
| Fit-function | $\lambda_{low}$ | rms | a0 | SD | a1 | SD | a2 | SD | a3 | SD | a4 | SD | a5 | SD |
| eq. 15 j=0 | 370 | 4,84E-1 | 2,00E+1 | 1,58E-2 | | | | | | | | | | |
| eq. 15 j=0 | 310 | 6,44E-1 | 2,02E+1 | 1,98E-2 | | | | | | | | | | |
| eq. 15 j=1 | 370 | 4,25E-1 | 2,11E+1 | 6,33E-2 | -1,70E-3 | 1,02E-4 | | | | | | | | |
| eq. 15 j=1 | 310 | 4,80E-1 | 2,18E+1 | 5,73E-2 | -2,80E-3 | 9,63E-5 | | | | | | | | |
| eq. 15 j=2 | 370 | 3,54E-1 | 2,60E+1 | 2,49E-1 | -1,89E-2 | 8,51E-4 | 1,42E-5 | 7,00E-7 | | | | | | |
| eq. 15 j=2 | 310 | 3,39E-1 | 2,68E+1 | 1,58E-1 | -2,14E-2 | 5,75E-4 | 1,62E-5 | 4,96E-7 | | | | | | |
| eq. 15 j=3 | 390 | 3,55E-1 | 1,73E+1 | 1,49 | 2,59E-2 | 7,62E-3 | -6,02E-5 | 1,27E-5 | 4,01E-8 | 6,84E-9 | | | | |
| eq. 15 j=3 | 370 | 3,51E-1 | 2,08E+1 | 1,20 | 8,59E-3 | 6,24E-3 | -3,27E-5 | 1,06E-5 | 2,59E-8 | 5,81E-9 | | | | |
| eq. 15 j=4 | 390 | 3,51E-1 | 5,13E+1 | 7,71 | -2,10E-1 | 5,29E-2 | 5,38E-4 | 1,33E-4 | -6,21E-7 | 1,47E-7 | 2,69E-10 | 6,0E-11 | | |
| eq. 15 j=4 | 370 | 3,44E-1 | 5,56E+1 | 5,74 | -2,38E-1 | 4,03E-2 | 6,08E-4 | 1,04E-4 | -6,96E-7 | 1,16E-7 | 2,98E-10 | 4,8E-11 | | |
| eq. 15 j=4 | 360 | 3,40E-1 | 5,71E+1 | 4,96 | -2,48E-1 | 3,53E-2 | 6,31E-4 | 9,18E-5 | -7,21E-7 | 1,04E-7 | 3,08E-10 | 4,3E-11 | | |
| eq. 15 j=4 | 310 | 3,26E-1 | 5,00E+1 | 2,46 | -1,99E-1 | 1,86E-2 | 5,09E-4 | 5,13E-5 | -5,87E-7 | 6,11E-8 | 2,54E-10 | 2,7E-11 | | |
| eq. 15 j=5 | 390 | 3,50E-1 | -4,1E+1 | 4,03E+1 | 5,94E-1 | 3,47E-1 | -2,20E-3 | 1,18E-3 | 3,97E-6 | 1,96E-6 | -3,5E-9 | 1,6E-9 | 1,23E-12 | 5,3E-13 |
| eq. 15 j=5 | 370 | 3,44E-1 | 1,93E+1 | 2,82E+1 | 8,42E-2 | 2,48E-1 | -5,17E-4 | 8,61E-4 | 1,23E-6 | 1,47E-6 | -1,3E-9 | 1,2E-9 | 5,35E-13 | 4,1E-13 |
| eq. 15 j=5 | 360 | 3,40E-1 | 3,48E+1 | 2,36E+1 | -4,74E-2 | 2,11E-1 | -7,59E-5 | 7,38E-4 | 5,02E-7 | 1,27E-6 | -7,3E-10 | 1,1E-9 | 3,46E-13 | 3,6E-13 |
| eq. 15 j=5 | 310 | 3,25E-1 | 3,45E+1 | 9,98 | -4,95E-2 | 9,53E-2 | -5,31E-5 | 3,55E-4 | 4,40E-7 | 6,44E-7 | -6,6E-10 | 5,7E-10 | 3,18E-13 | 2,0E-13 |

| Fit-function | $\lambda_{low}$ | rms | a-1 | SD | a0 | SD | a1 | SD | a2 | SD | a3 | SD | a4 | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| eq. 13 j=0 | 370 | 1,48E+8 | 2,60E+8 | 9,02E+6 | 6,73E+10 | 1,75E+9 | | | | | | | | |
| eq. 13 j=0 | 310 | 1,90E+8 | 3,60E+8 | 6,96E+6 | 4,92E+10 | 5,05E+8 | | | | | | | | |
| eq. 13 j=1 | 370 | 1,31E+8 | -5,6E+8 | 5,18E+7 | 1,03E+6 | 6,47E+4 | 1,12E+11 | 3,18E+9 | | | | | | |
| eq. 13 j=1 | 310 | 1,84E+8 | 6,04E+8 | 3,05E+7 | -3,8E+5 | 4,67E+4 | 4,61E+10 | 6,21E+8 | | | | | | |
| eq. 13 j=2 | 370 | 1,25E+8 | 2,13E+9 | 2,67E+8 | -6,4E+6 | 7,23E+5 | 5,27E+3 | 5,14E+2 | 5,49E+10 | 6,31E+9 | | | | |
| eq. 13 j=2 | 310 | 1,31E+8 | 3,41E+9 | 9,08E+7 | -1,0E+7 | 3,03E+5 | 7,87E+3 | 2,47E+2 | 3,46E+10 | 5,70E+8 | | | | |
| eq. 13 j=3 | 390 | 1,21E+8 | -6,4E+9 | 1,92E+9 | 3,20E+7 | 7,91E+6 | -5,4E+4 | 1,14E+4 | 2,98E+1 | 5,49 | 1,11E+11 | 2,34E+10 | | |
| eq. 13 j=3 | 370 | 1,19E+8 | -9,7E+9 | 1,31E+9 | 4,52E+7 | 5,63E+6 | -7,2E+4 | 8,36E+3 | 3,83E+1 | 4,16 | 1,58E+11 | 1,27E+10 | | |
| eq. 13 j=4 | 390 | 1,18E+8 | 5,84E+10 | 1,01E+10 | -3,4E+8 | 5,78E+7 | 7,81E+5 | 1,28E+5 | -8,0E+2 | 1,27E+2 | 3,10E-1 | 4,74E-2 | -2,1E+11 | 5,40E+10 |
| eq. 13 j=4 | 370 | 1,19E+8 | 1,02E+10 | 6,52E+9 | -7,5E+7 | 3,91E+7 | 2,06E+5 | 8,96E+4 | -2,5E+2 | 9,16E+1 | 1,09E-1 | 3,50E-2 | 8,48E+10 | 2,66E+10 |
| eq. 13 j=4 | 360 | 1,18E+8 | 6,55E+9 | 5,17E+9 | -5,5E+7 | 3,17E+7 | 1,61E+5 | 7,41E+4 | -2,0E+2 | 7,69E+1 | 9,29E-2 | 2,98E-2 | 1,05E+11 | 1,79E+10 |
| eq. 13 j=4 | 310 | 1,23E+8 | 2,05E+10 | 1,43E+9 | -1,3E+8 | 1,02E+7 | 3,25E+5 | 2,70E+4 | -3,6E+2 | 3,10E+1 | 1,48E-1 | 1,30E-2 | 2,64E+10 | 8,99E+8 |