ESP Status. Calibration, Degradation, Validation

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ESP Status (1)

- **Fully operational, correctable, and predictable. No degradation, except for the Al filters is detected.** We do:
- Regular tests of ESP variables (changes of dark count-rates, gain, visible light, filter degradation) based on daily and weekly calibrations.
- Prompt data reduction and submitting EVE internal Reports, e.g. related to the Filter Scans, FOV maps, Cruciform maps, etc. These reports allow us updating ESP Level1 program for calculation of absolute irradiances with better accuracy, to calculate locations of the flares, etc.
- Regular workshops to discuss current and future works (the last one was on Aug 23-24) @ LASP, including technical issues and science with ESP.

ESP Status (2)

- ESPR calibration @SURF BL-2 in Sep was successful. The results will be ready upon receiving SURF fluxes. A fast look shows very small changes compared to the previous ESPR calibration.
- ESP QD data were used as near-real time proxies for GOES XRS-A,B with small latency in Level-0CS.
- Level-0CS updated to get ESP irradiance-like data (all channels) with small latency.
- ESP Ch9 (30.4 nm) channel is validated as a proxy for SEM 30.4 nm channel.
- We improve ESP Level1 Program. Current work is to implement filter degradation ‘live’ updates from daily/weekly calibrations.

How Filter Degradation is Determined

- We use ESP daily and weekly calibrations to calculate ratios between effective counts measured with different filters.
- Time difference between two filter measurements is as small as one minute to provide smallest signal fluctuations related to possible changes of the solar EUV flux.
- We work on a new algorithm, which can provide accurate measurements of the ratios for the calibration performed during rapid changes of the solar irradiance, e.g. after a solar flare*.

* Time for each calibration is fixed, thus, we may catch some flare(s).

What ESP Tests During Daily/Weekly Calibrations

- ESP provides **absolute** solar irradiance in different (5) spectral bands centered at 3.6, 19.0, 25.4, 29.9, and 36.4 nm.
- As an advanced version of SOHO/SEM, ESP electronics has more test options than SEM electronics, such as
- Test / correction for the electronics gain, including changes of the electronics related to the TID;
- Test / correction for the thermal / shunt_resistance changes of the detectors;
- Test / correction for the visible light / filter_pinholes;
- A filter wheel with three science aluminum filters, one prime (F3) and two spare (F2 and F4). This option allows us to measure a filter degradation as a ratio of effective counts between the tested and reference filters

ESP Calibrations

ESP has a Filter Wheel with 5 filters: Dark, three Al filters (F2, F3, F4) and one Fused Silica Filter (F5).

- Before DOY = 249 (Sep 5):

  Filter positions for daily: 3, 4, 5, 1, 3: Ratio 4/3

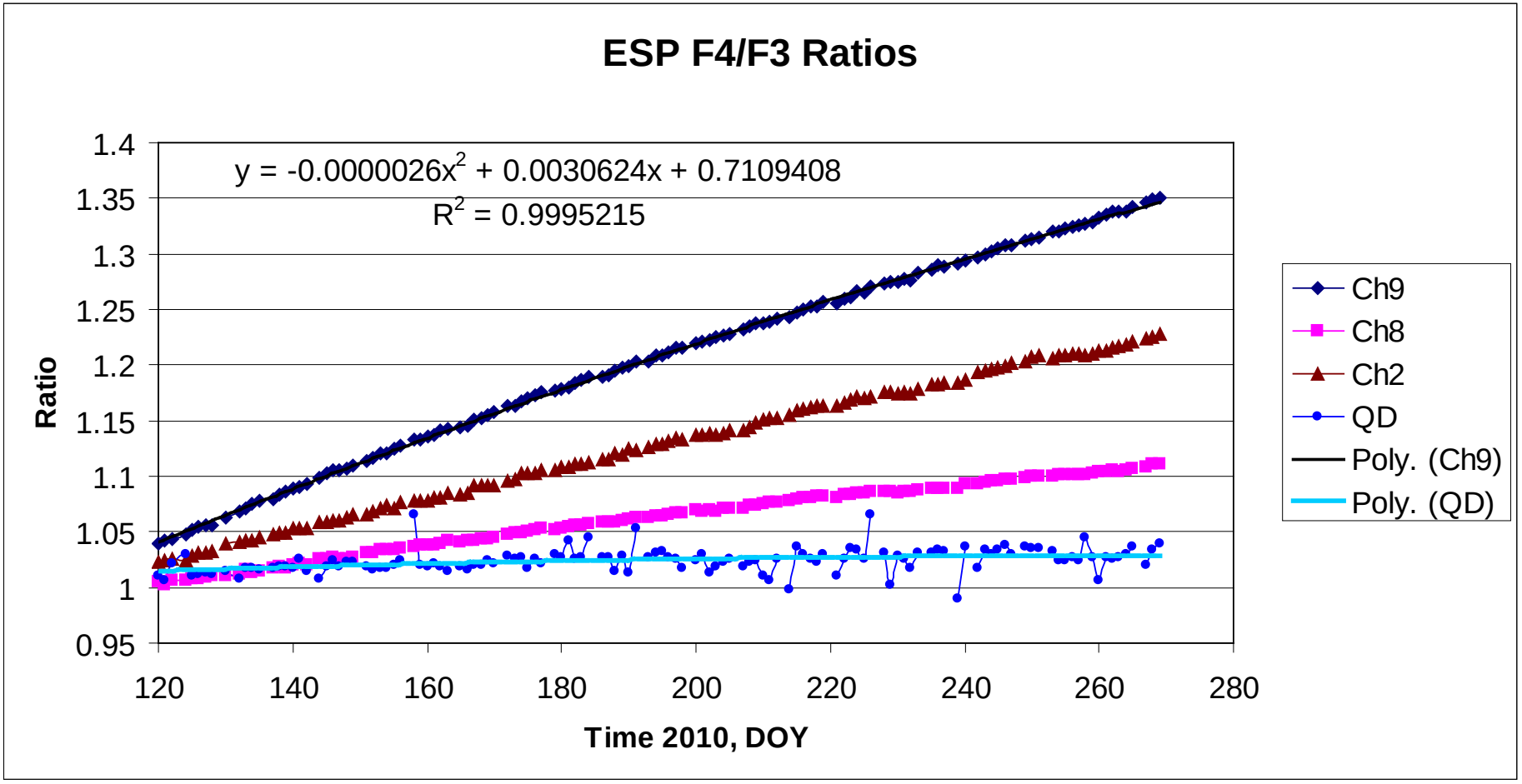
  Filter positions for weekly: 3, 1, 2, 3: Ratio 2/3

- After/on DOY = 249:

  Filter positions for daily: 3, 4, 1, 3: Ratio 4/3

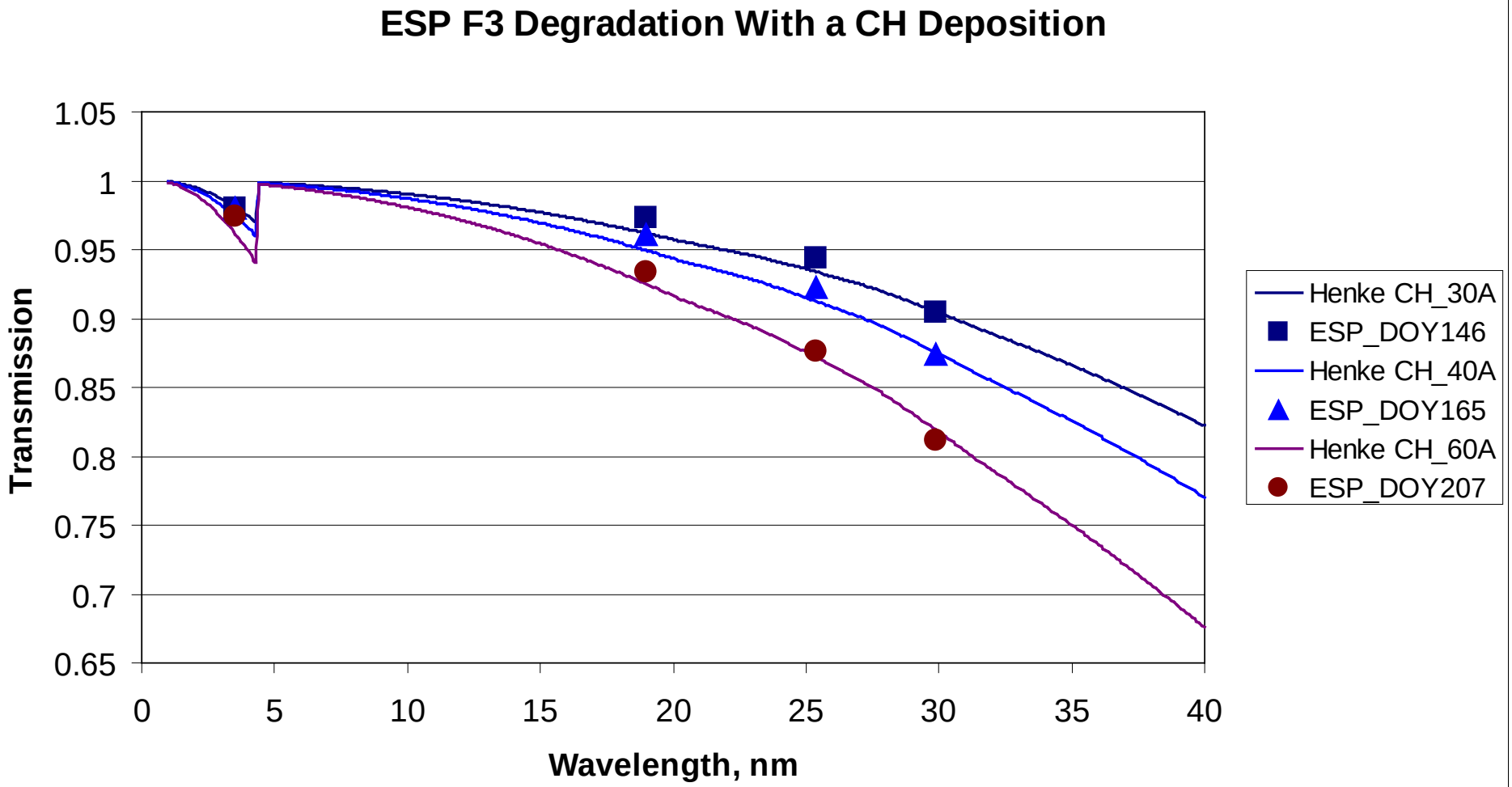
  Filter positions for weekly: 3, 4, 5, 1, 2, 3: Ratios 4/3 and 2/3.

ESP Filter 3 (prim sci) Degradation

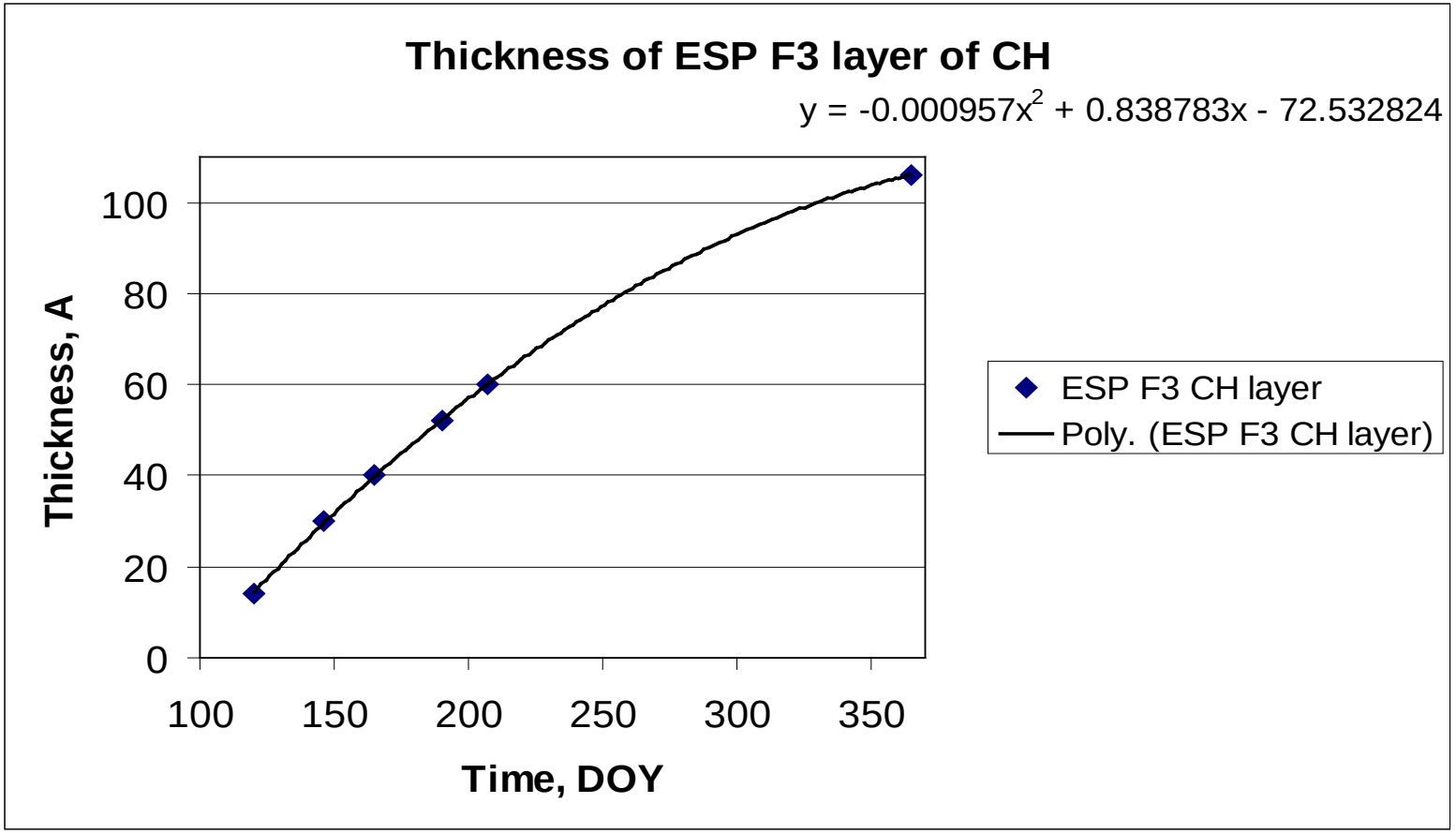


Degradation of ESP Al filter is due to deposition of hydrocarbon, which reduces the transmission of the filter. The change of transmission is wavelength dependent. Predicted Ch9 ratio for DOY=365 is 1.45 0.03

A Comparison of a Henke-Model and Data

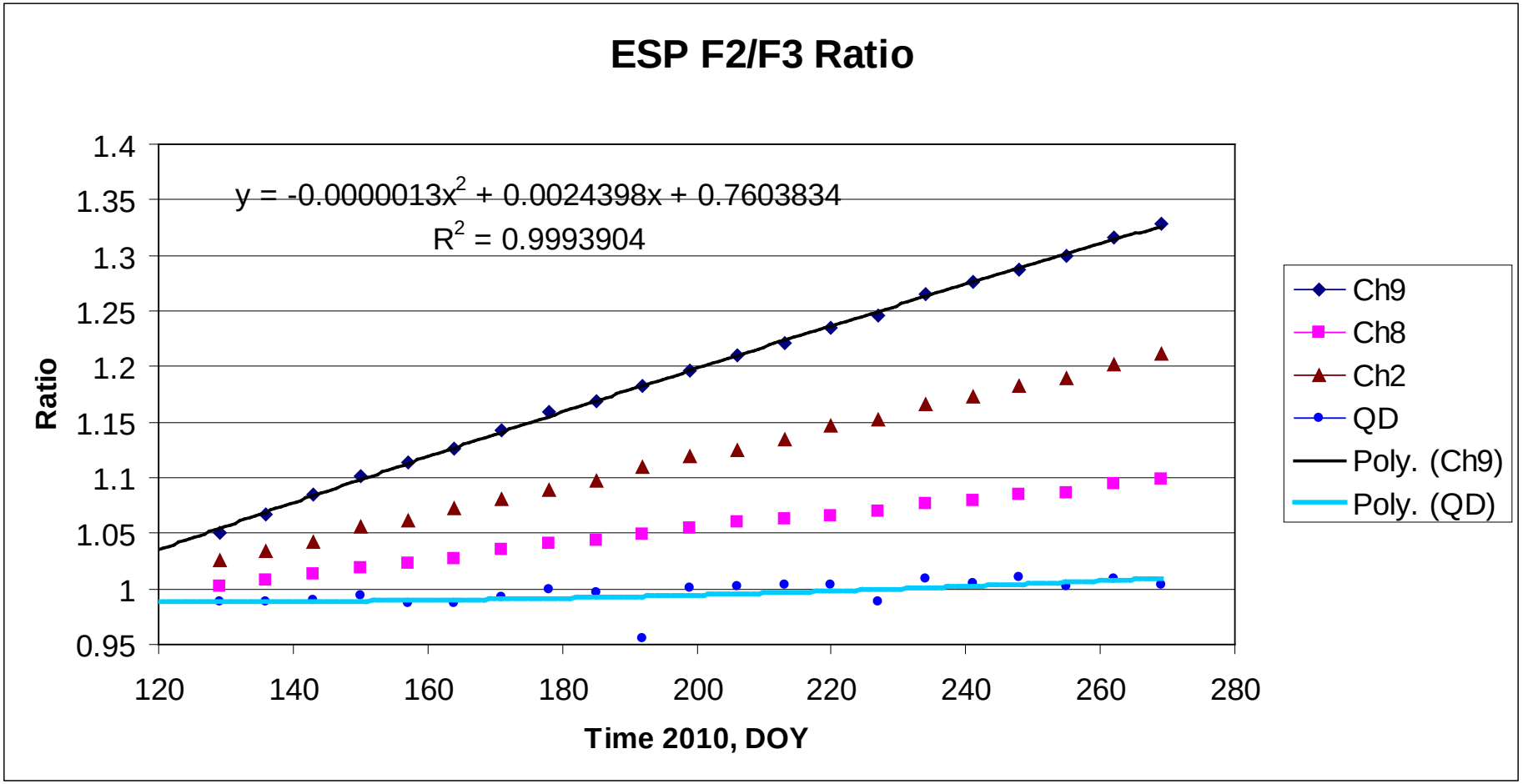


Thickness of F3 CH Layer: a Model Based on Measurements



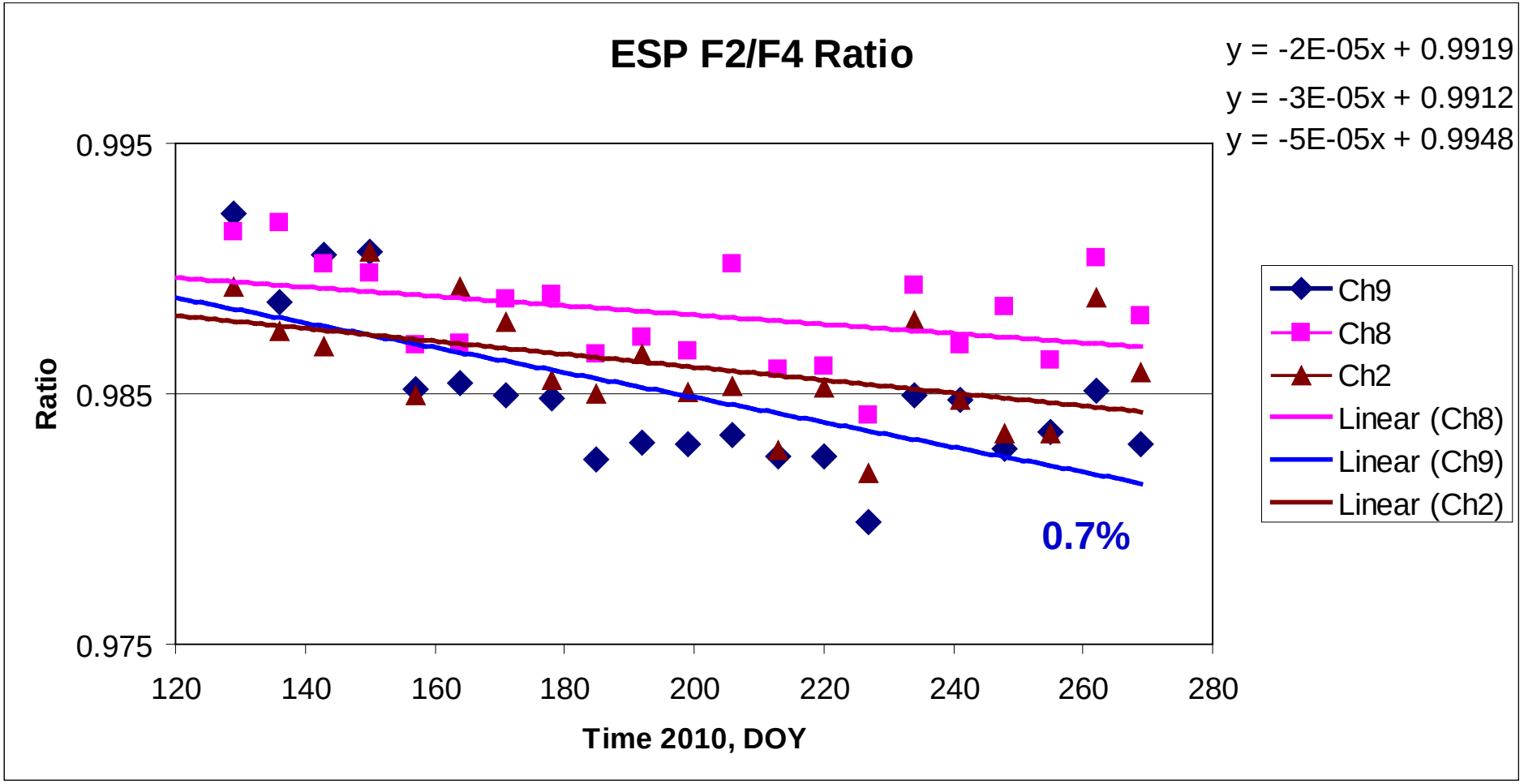
Predicted thickness of CH layer for DOY=365 is about 107 A

Another Evidence of F3 Degradation



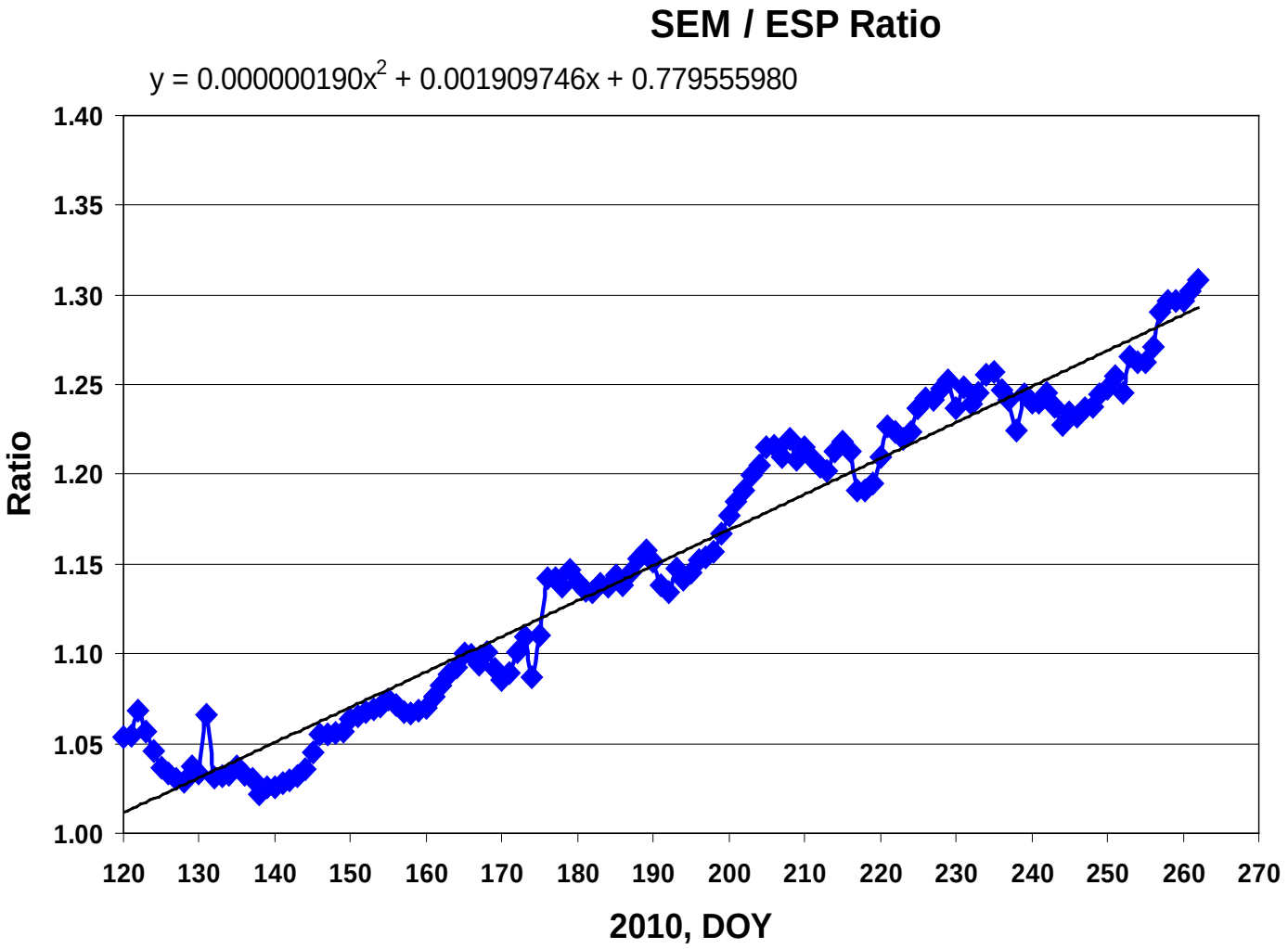
Data from weekly calibrations (using F2) show F2/F3 ratios similar to F4/F3 ratios. However, they are smaller than F4/F3 ratios.

An Evidence of F2 Small Degradation



These slopes for the first-order ratios show some degradation of 'reference' F2, which was exposed to the Sun for 1 min/week (compared to 6 min/week for F4)

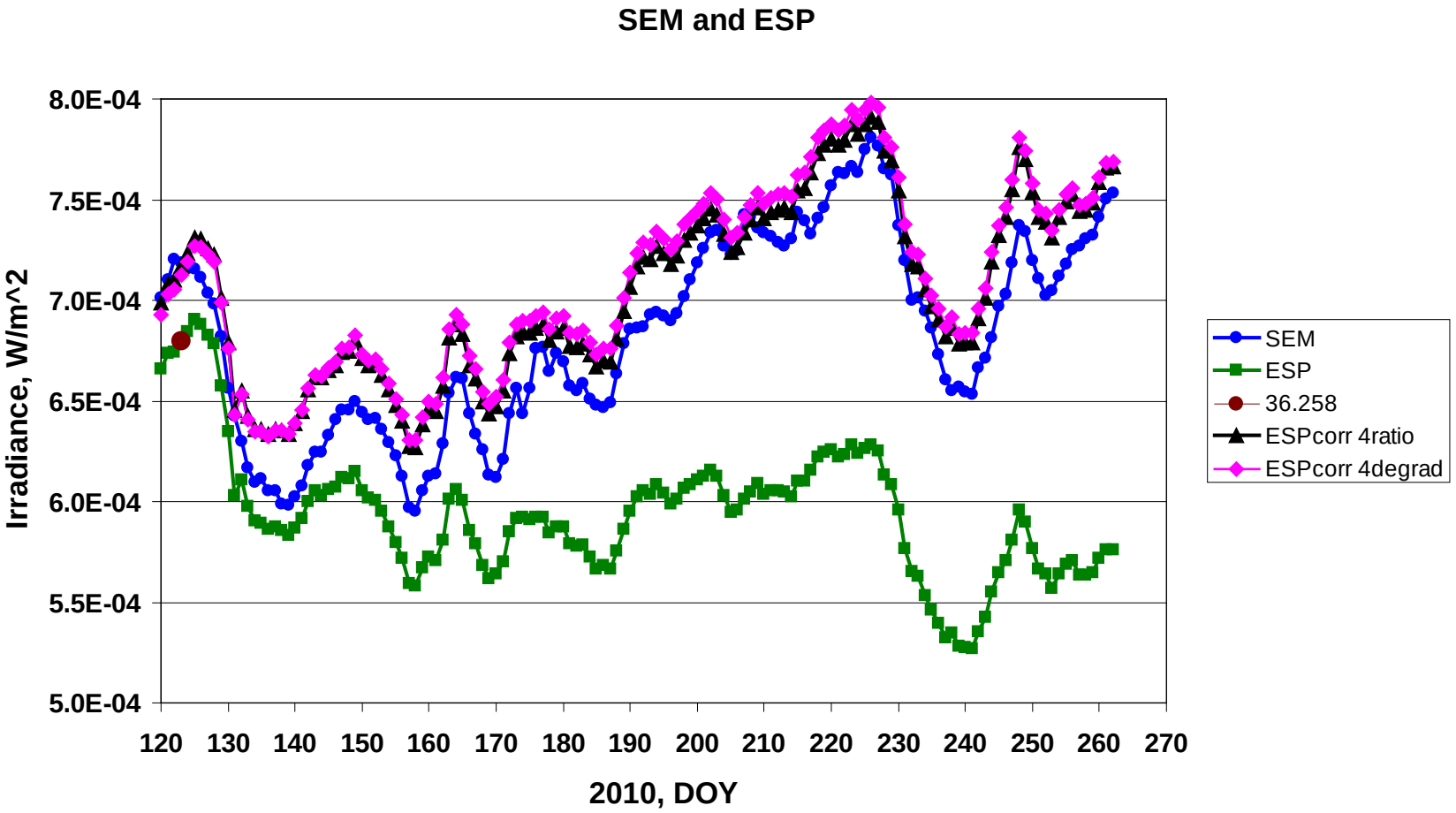
ESP Validation: SEM / ESP (30.4 nm) Comparison That Revealed a Filter Degradation Issue



The change of SEM/ESP ratio was discussed at the EVE/AIA Workshop at Stanford and at COSPAR (2010).

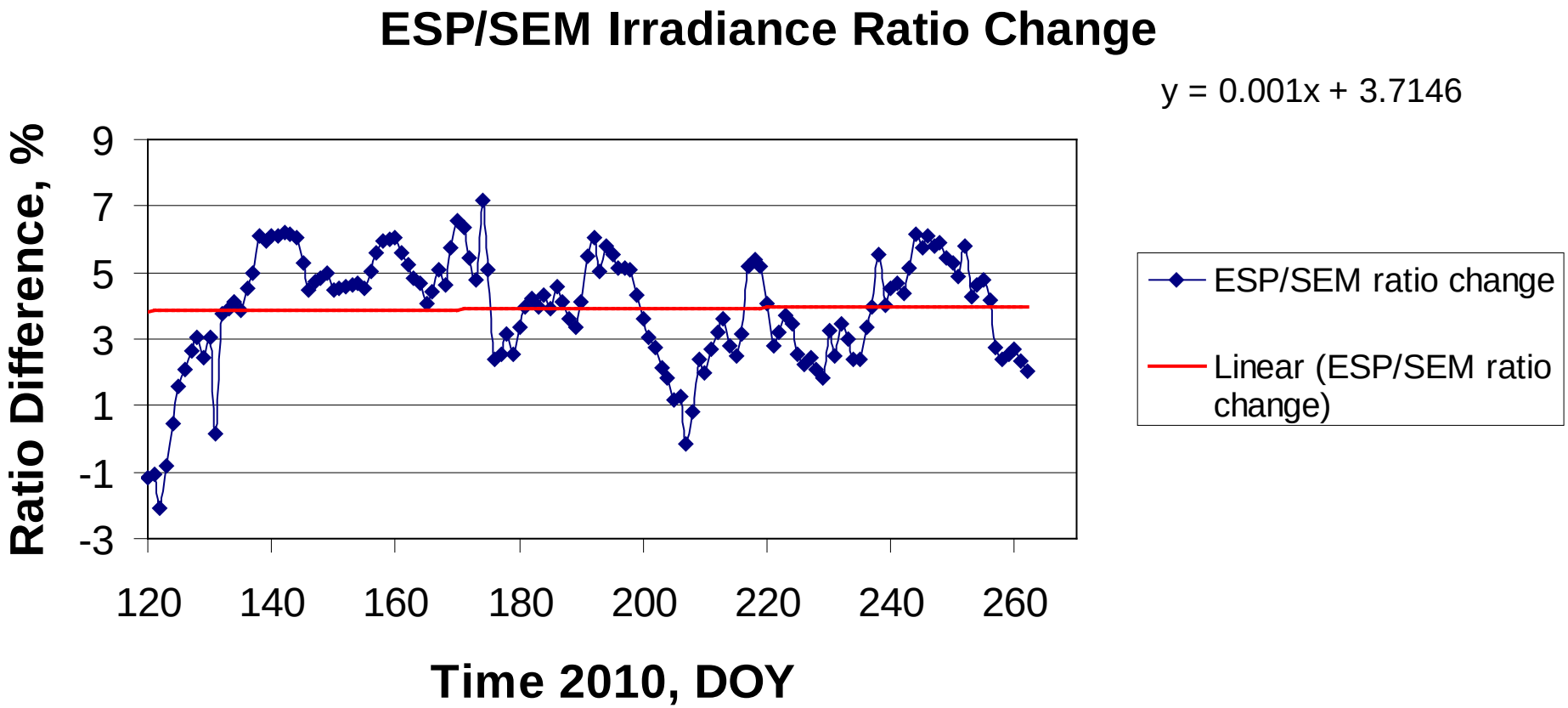
We pointed out that one of explanations of this change is ESP degradation

ESP Validation: Ch9 as SEM Proxy



Black: ESP corrected using a fit to the SEM/ESP ratio; Red: corrected using a fit to the filter degradation curve.

ESP Validation: Ch9 Provides Accurate (2.5%) SEM Proxy!



Practically horizontal linear fit (no trend) shows that both SEM and ESP filter degradations were calculated correctly and accurately. STD deviations around the trend line are about 2.5%.

Acknowledgments

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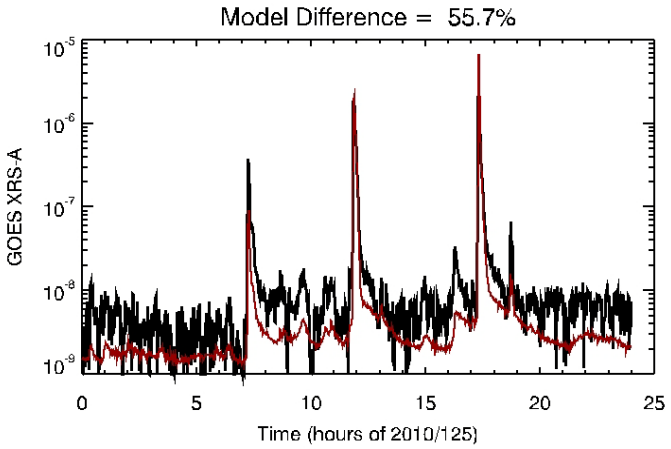
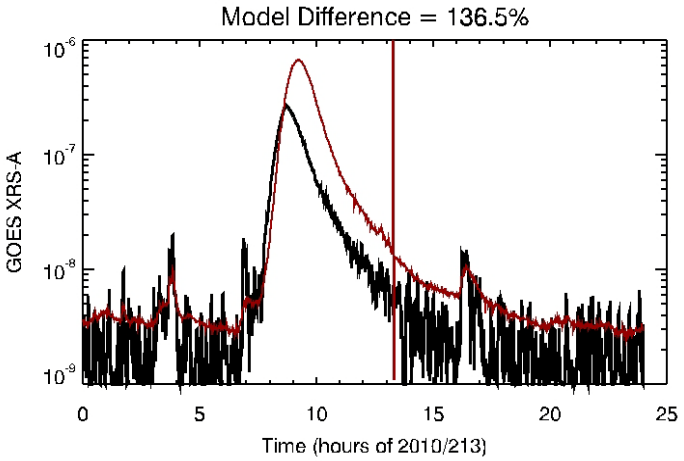
Backup Slide: GOES Proxies

$$XRS-A(0.05-0.4nm)=10^{[-18.94+3.606\bullet\log_{10}(ESP_{0-7nm})]}$$





$$XRS-B(0.1-0.8nm)=10^{[-11.86+2.259\bullet\log_{10}(ESP_{0-7nm})]}$$