Chandra Contaminant Update: *No end in sight…*

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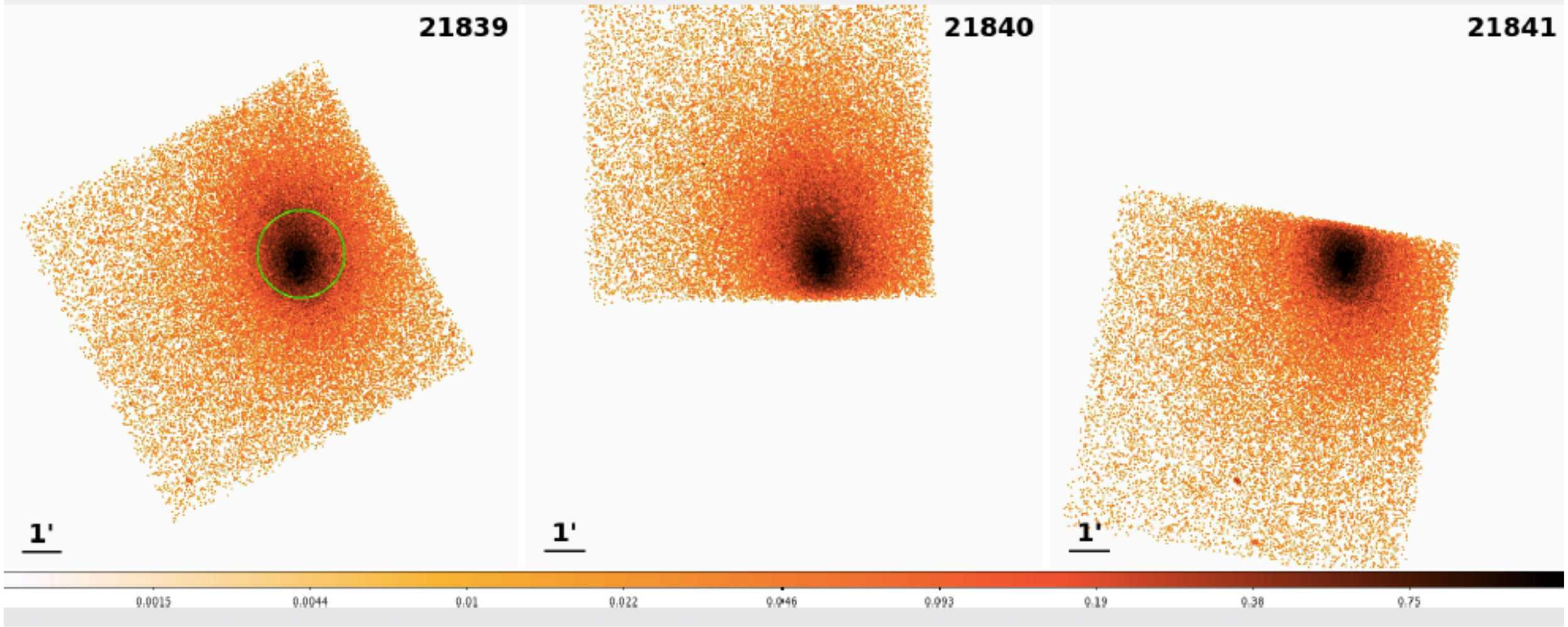
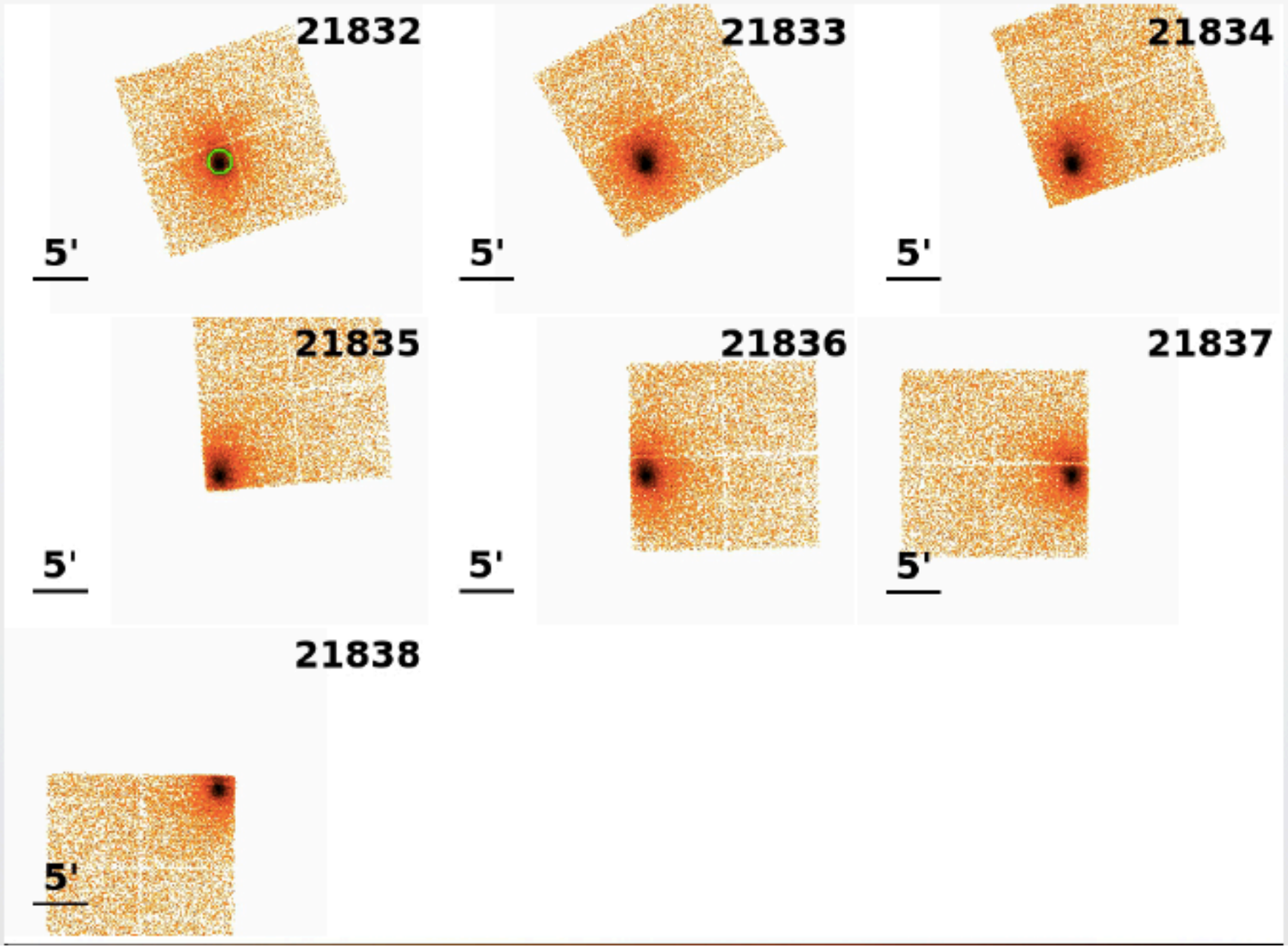
ACIS-S observations of A1795 in 2019

- April 2019: 3 pointings on S3 (center, top, bottom)
- November 2019: 1 pointing (center)
- Exposure time is 15-20 ks

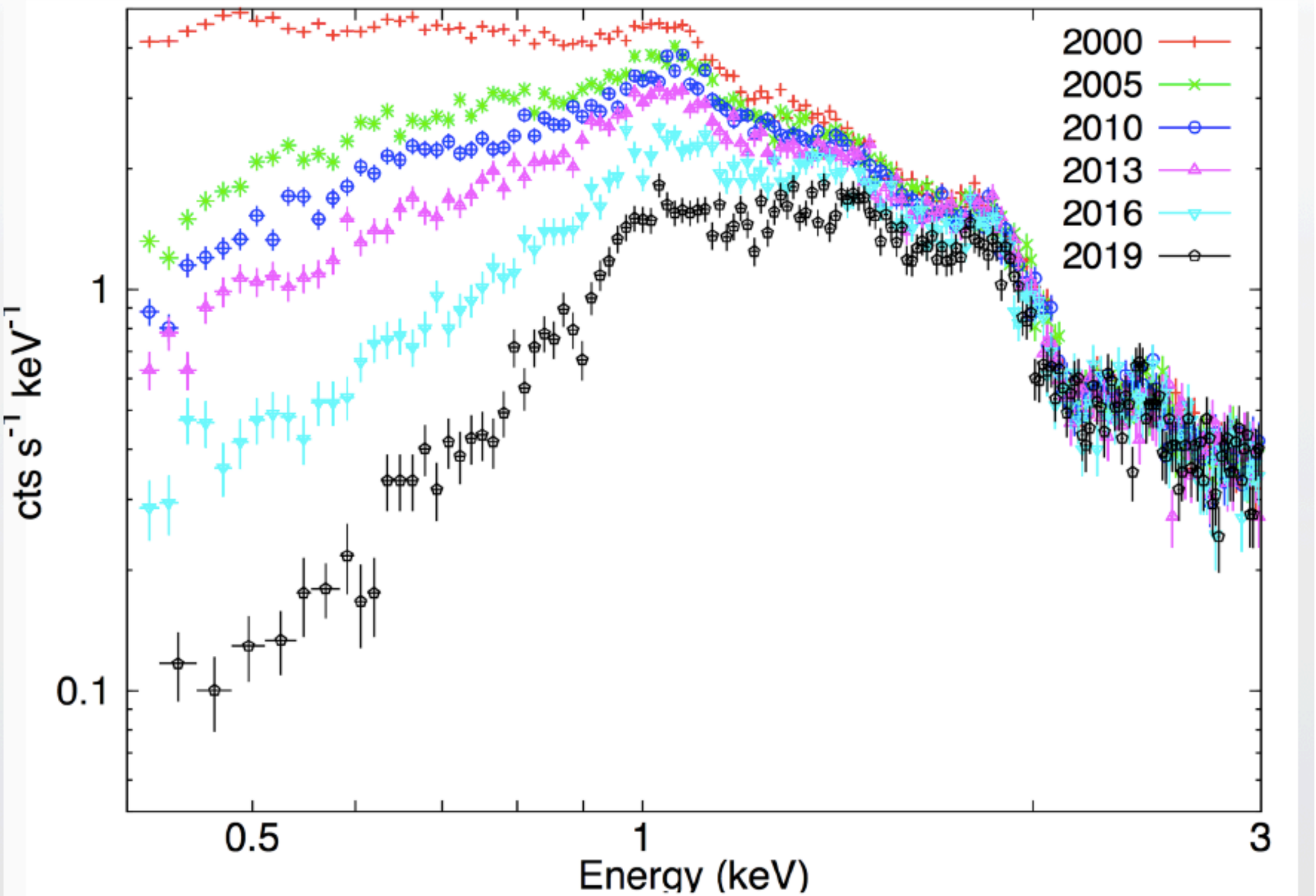


ACIS-I observations of A1795 in 2019

- April 2019: 7 pointings on ACIS-I array
- November 2019: 1 pointing (aim point)
- Exposure time is 20-25 ks



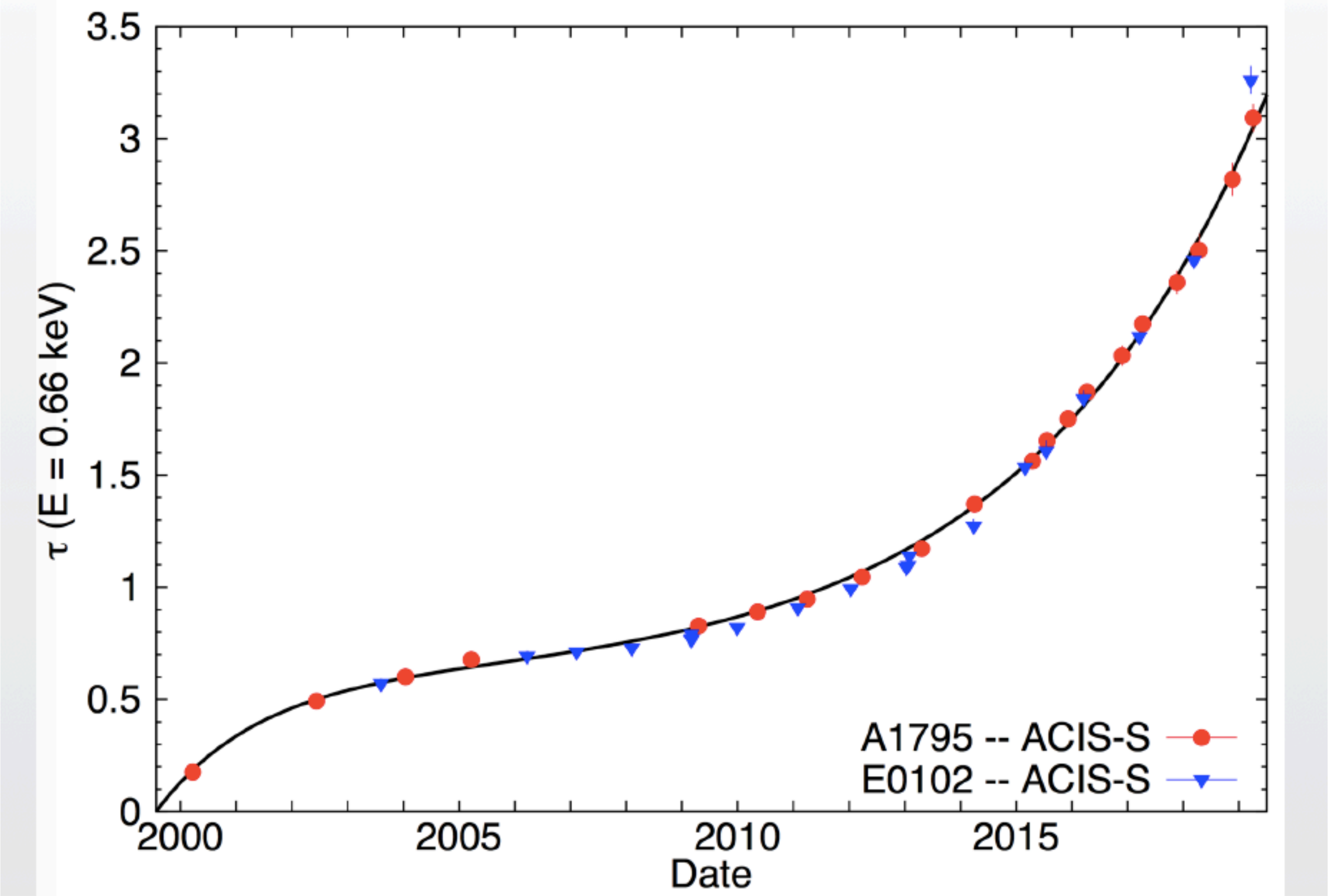
ACIS-S spectra of A1795



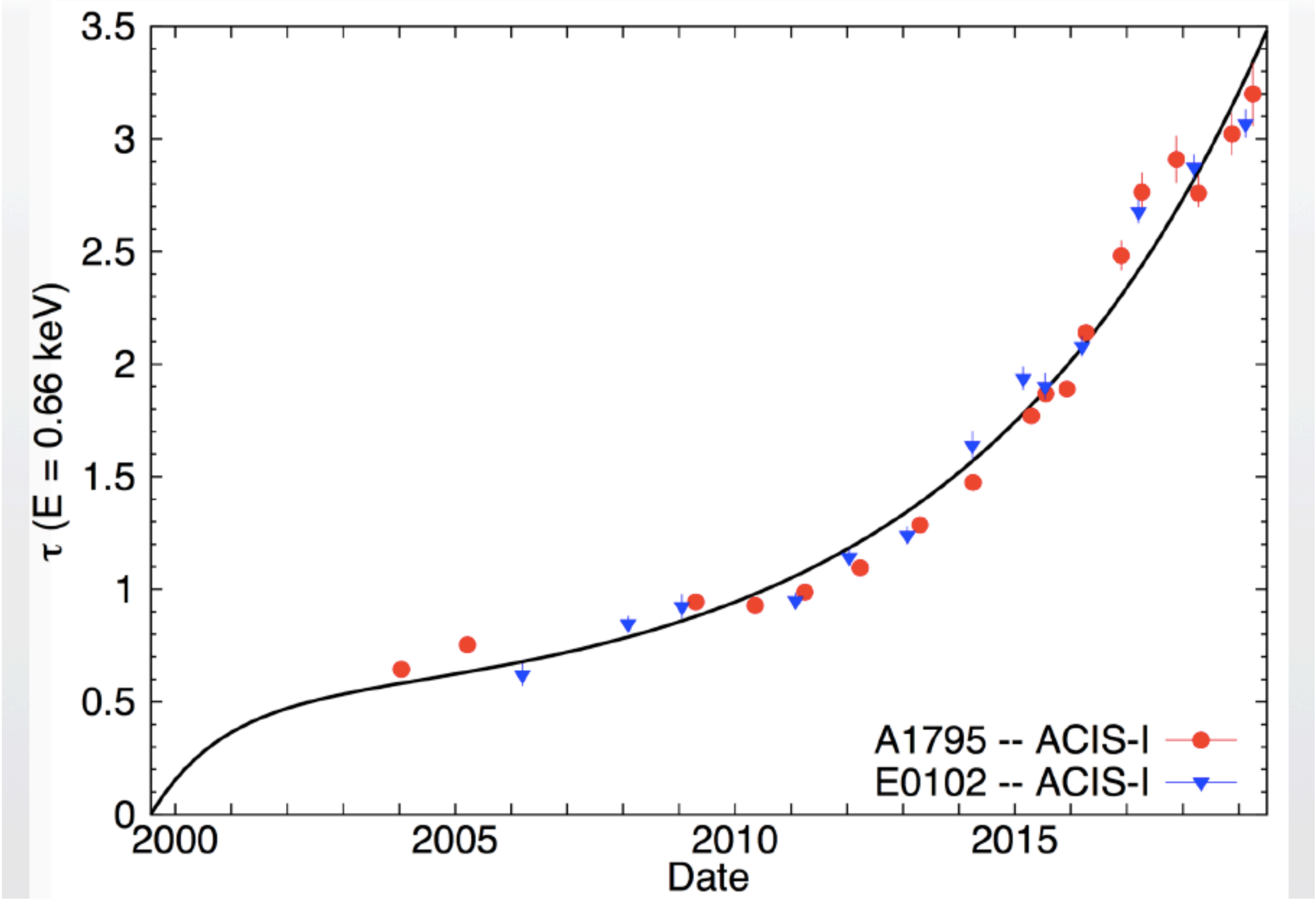
ACIS-S observations of A1795

- Uniform data analysis procedure
- Computing the time dependence:
  - point sources excluded
  - spectral characteristics of Obs ID 494 (December 1999) used as reference by extracting circular region with 65” radius centered on A1795
  - spectrum described with Galactic column density, APEC models, and ACIS contamination with fixed O/C and F/C ratios
  - For subsequent observations the spectra of the same 65” circular region is extracted with the contamination correction turned off
  - The follow-up spectra are fit with best fit spectrum obtained from Obs ID 494 and additional ACIS contamination

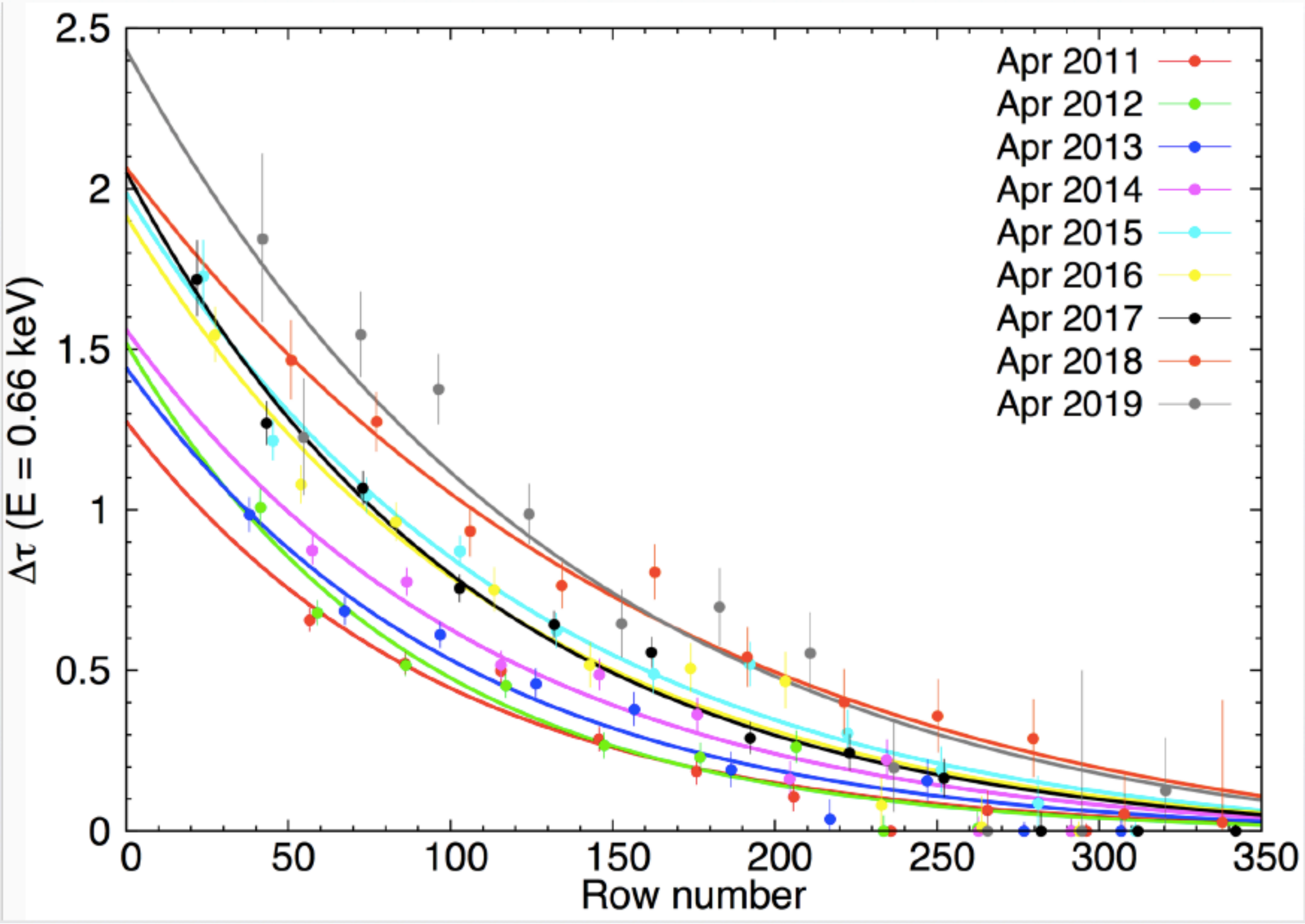
Time dependence of contaminant in the center of ACIS-S using A1795 data



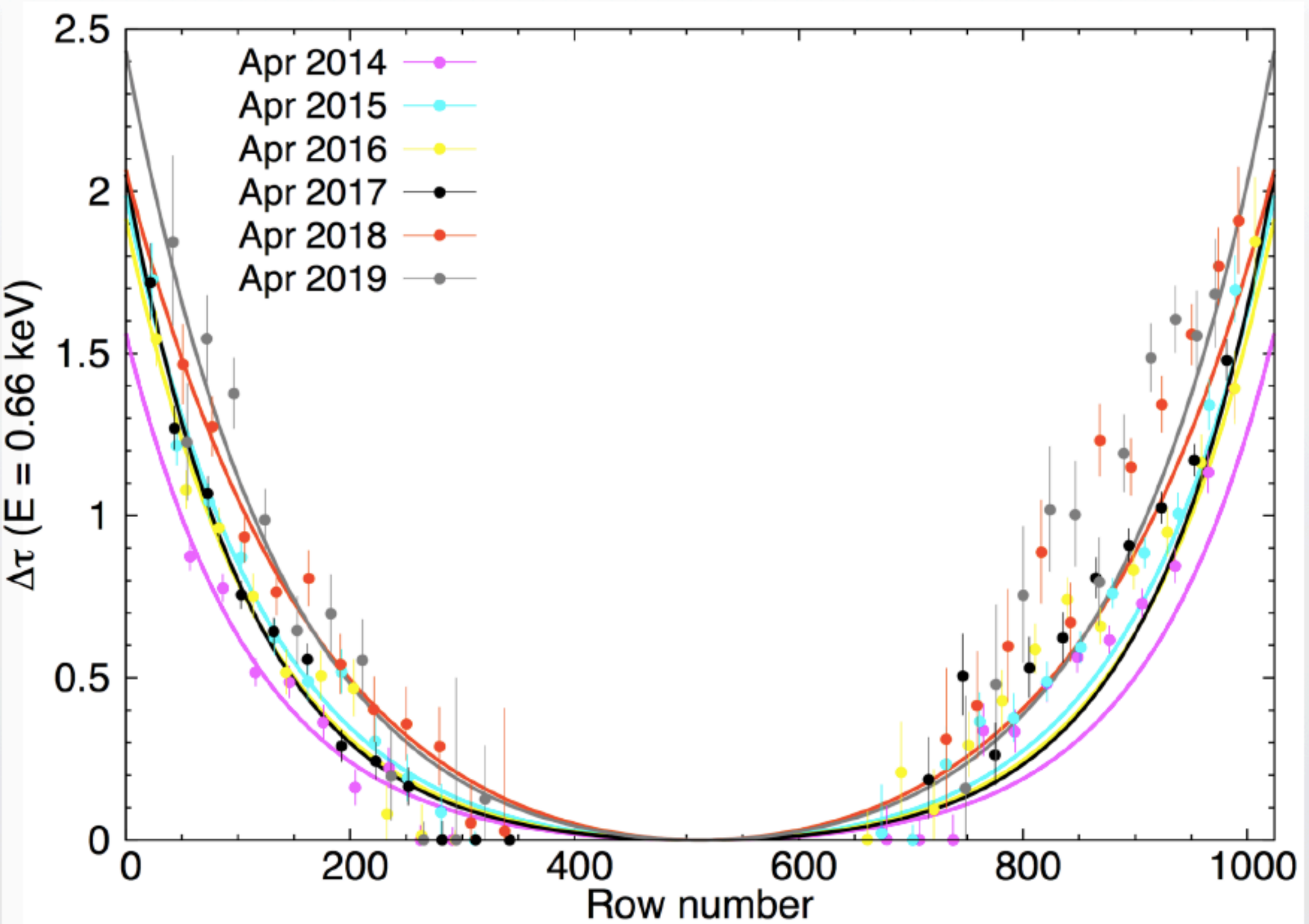
Time dependence of contaminant in the center of ACIS-I using A1795 data



Shape of the spatial structure of the contaminant on ACIS-S

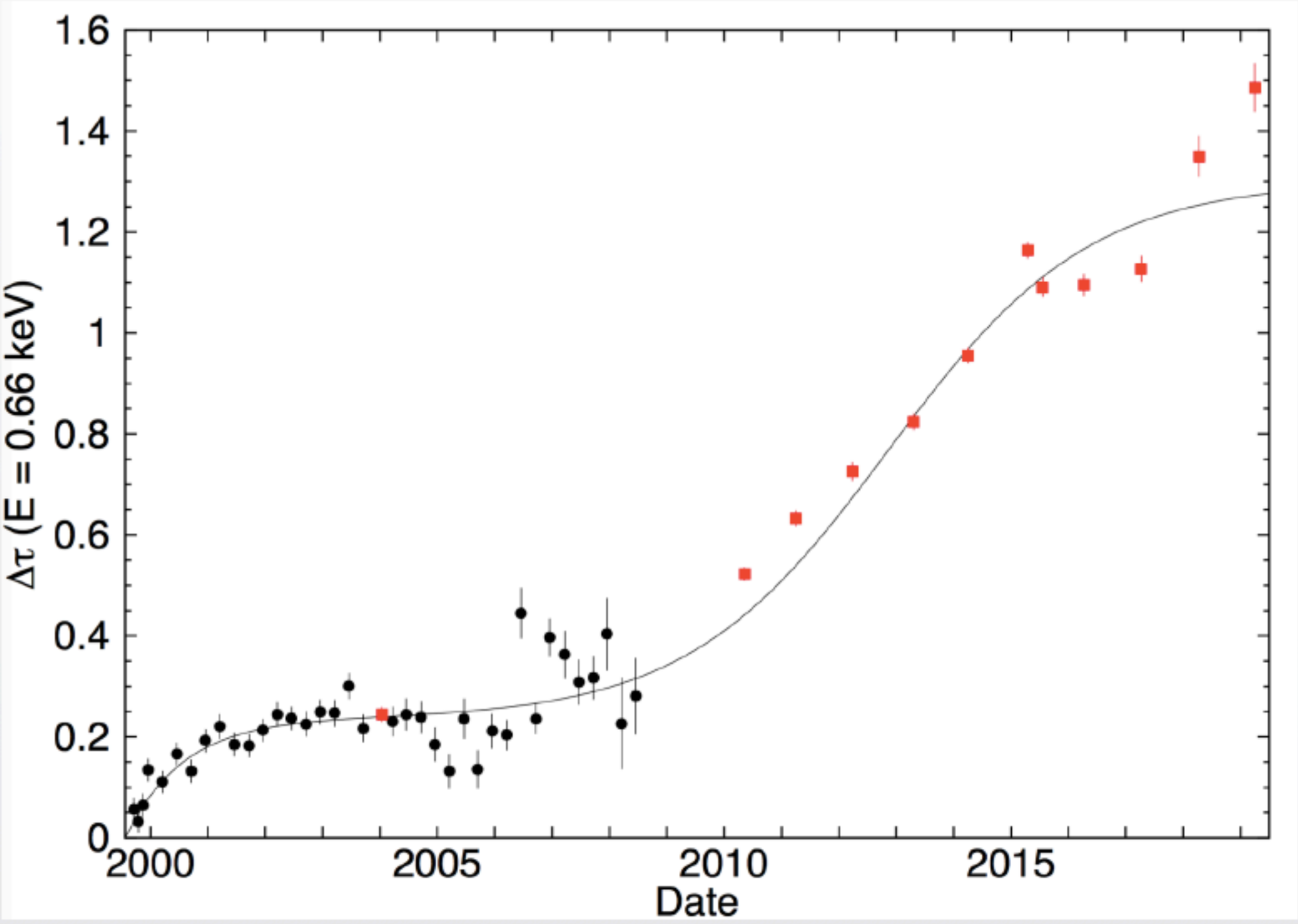


Shape of the spatial structure of the contaminant on ACIS-S



Edge-to-center difference at E=0.66 keV

- Plot shows optical depths relative to the center at E=0.66 keV
- ECS data at E=0.66 keV (black circles) and A1795 data (red boxes)



Big Dither Process

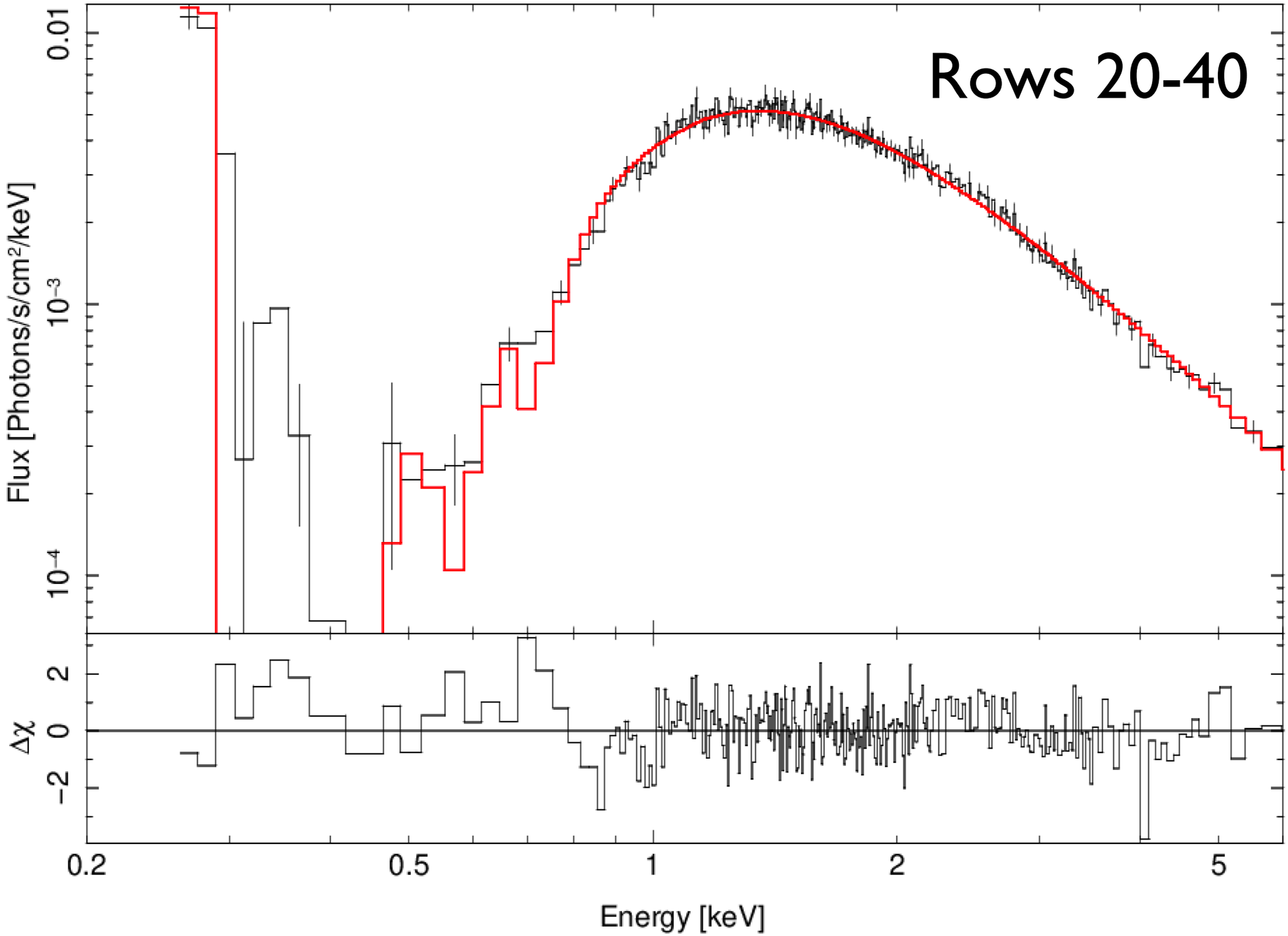
- New Big Dither Data: 6-7/2018, 1-2/2019
- Extract 15 spectra of 20-80 rows each
- Fit COF optical depths in isis
  - fixed slope, curvature per group
- Fit N*cosh[(y-512)/120] + C; each element

The Approach

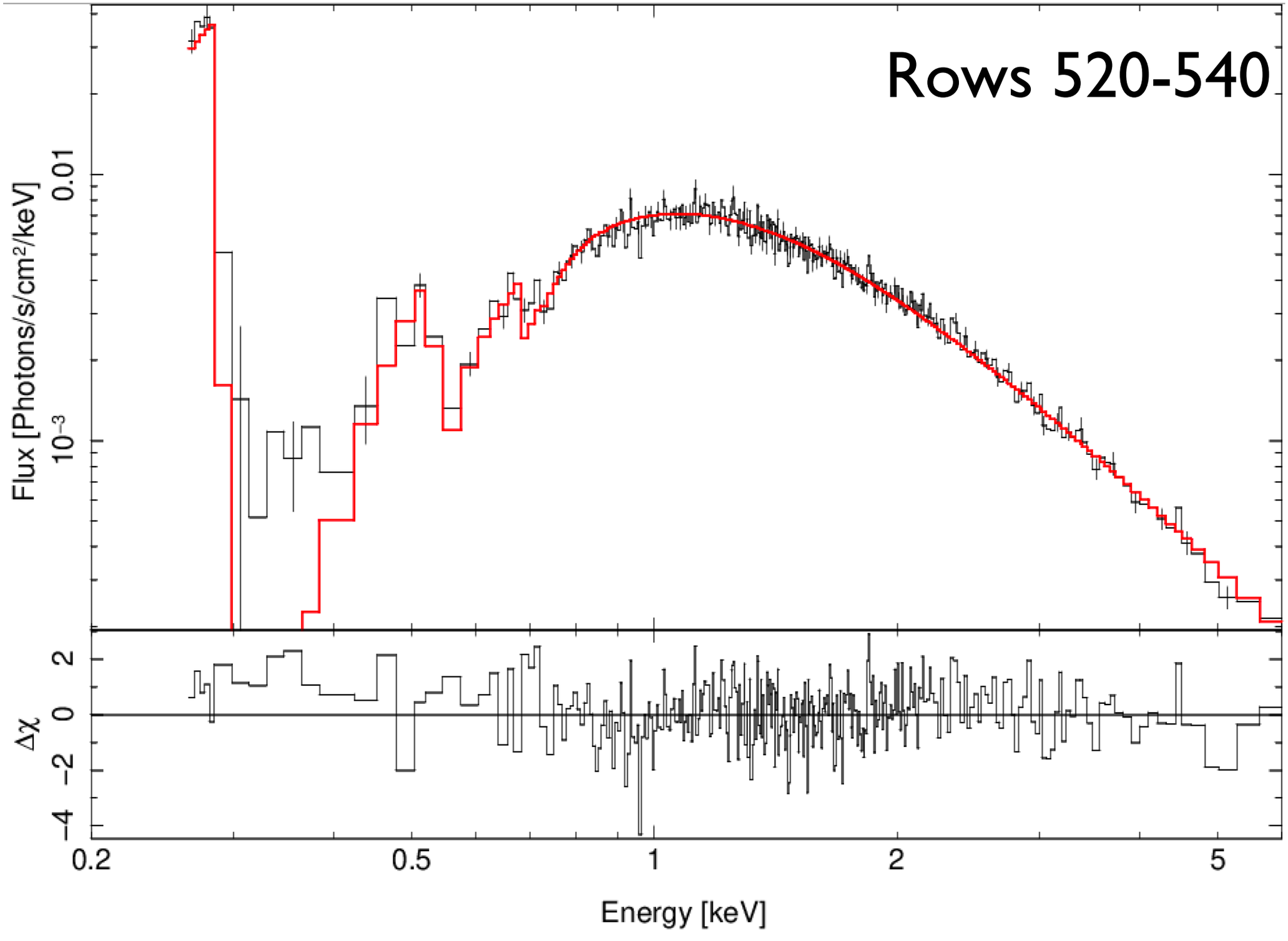
- Model: $\tau_C = \tau_{C0} + t_{C1}(t)\ f(x,y)$
- LETG/ACIS of blazars, 'Big Dither'
  - measure O-K as h(t,y)
  - measure F-K as k(t,y)
- Determine $\tau_{C,Henke}$ from cluster data, corrected for τ_{O-K}, τ_{F-K}
- Adjust C-K edge

$$f(x,y) = e^{-y/a_1} + e^{(y-1024)/a_2} - e^{-512/a_1} - e^{-512/a_2}, a_1 = 106.25, a_2 = 129.62$$

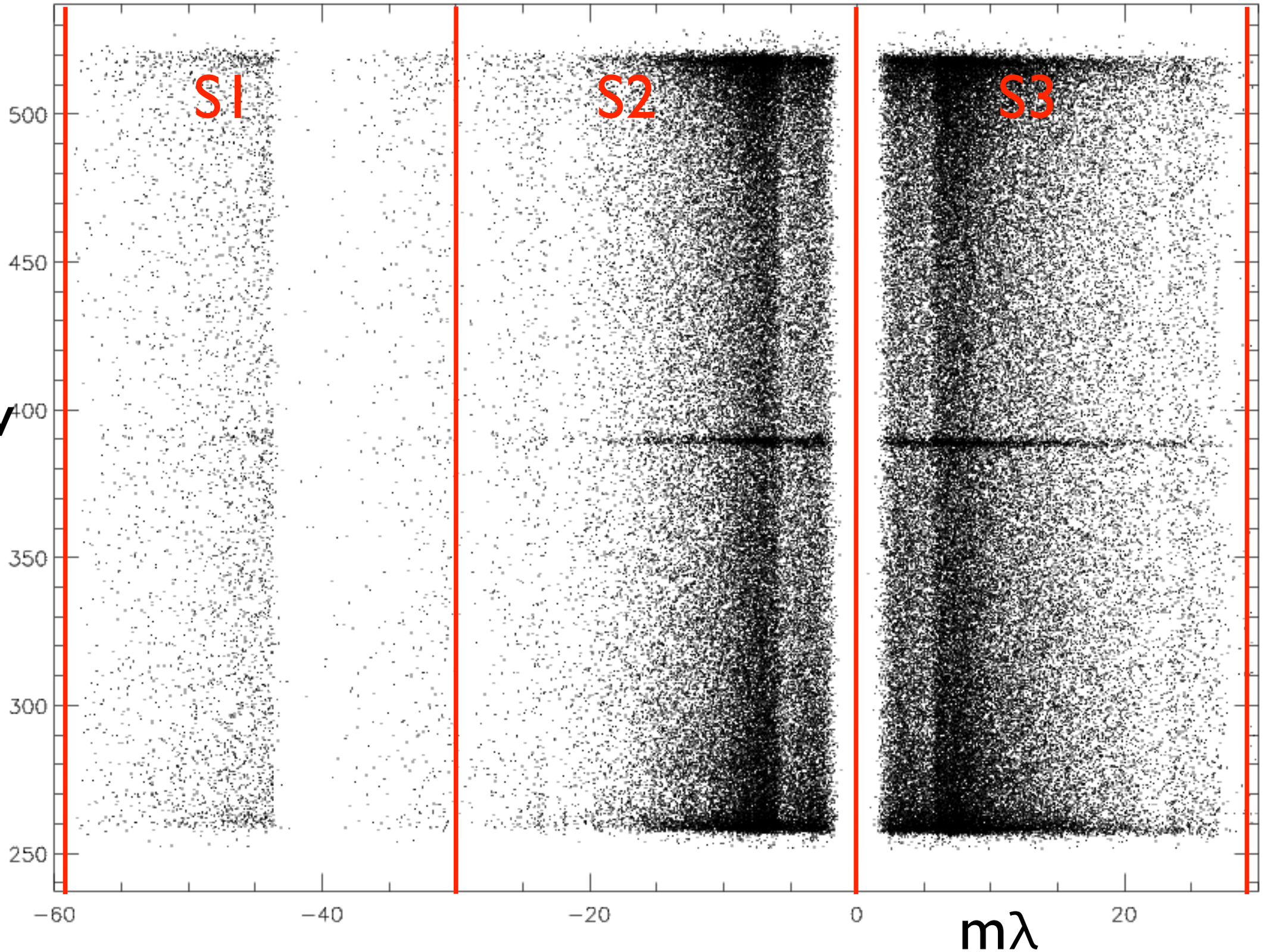
Example Spectral Fits

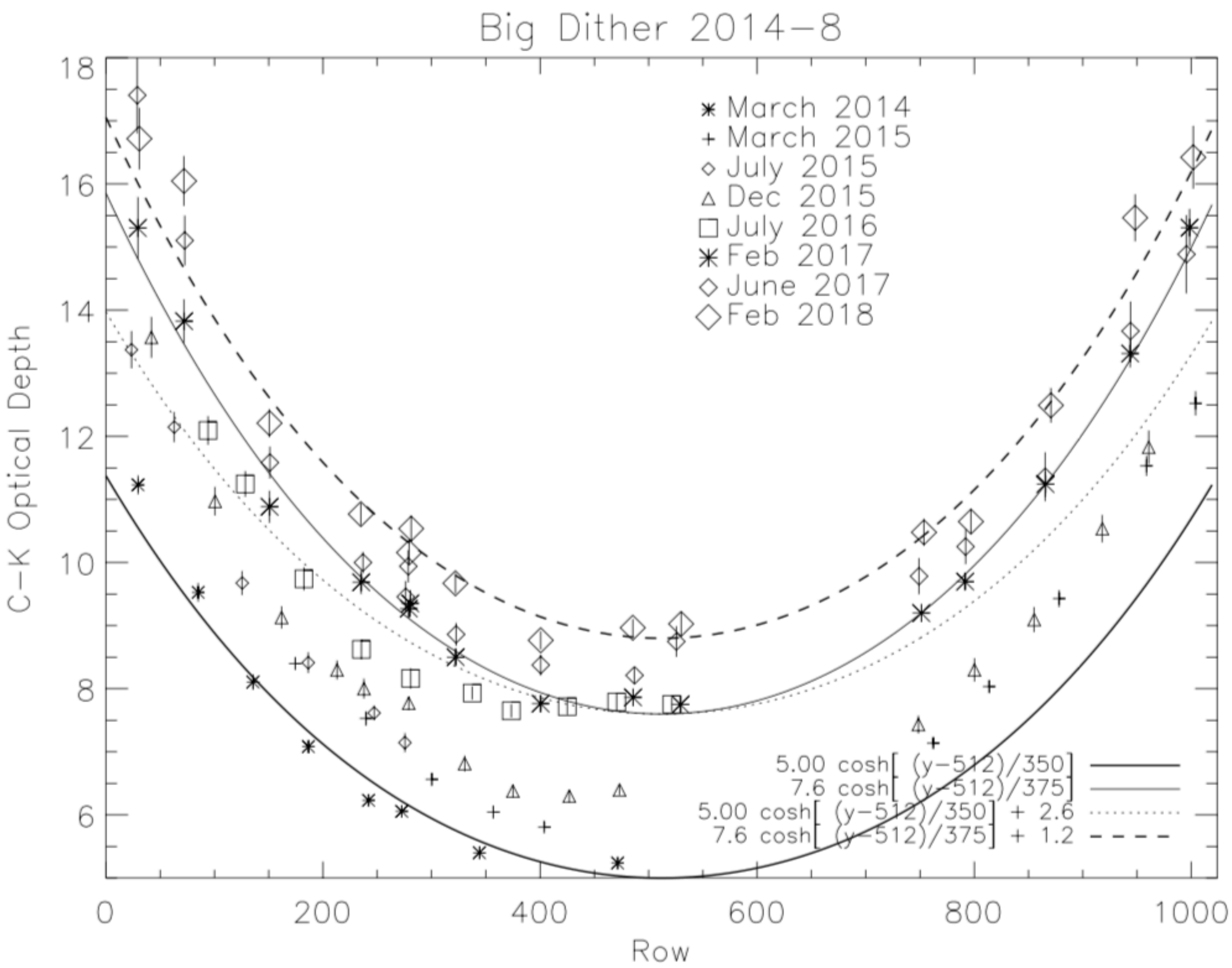


Example Spectral Fits

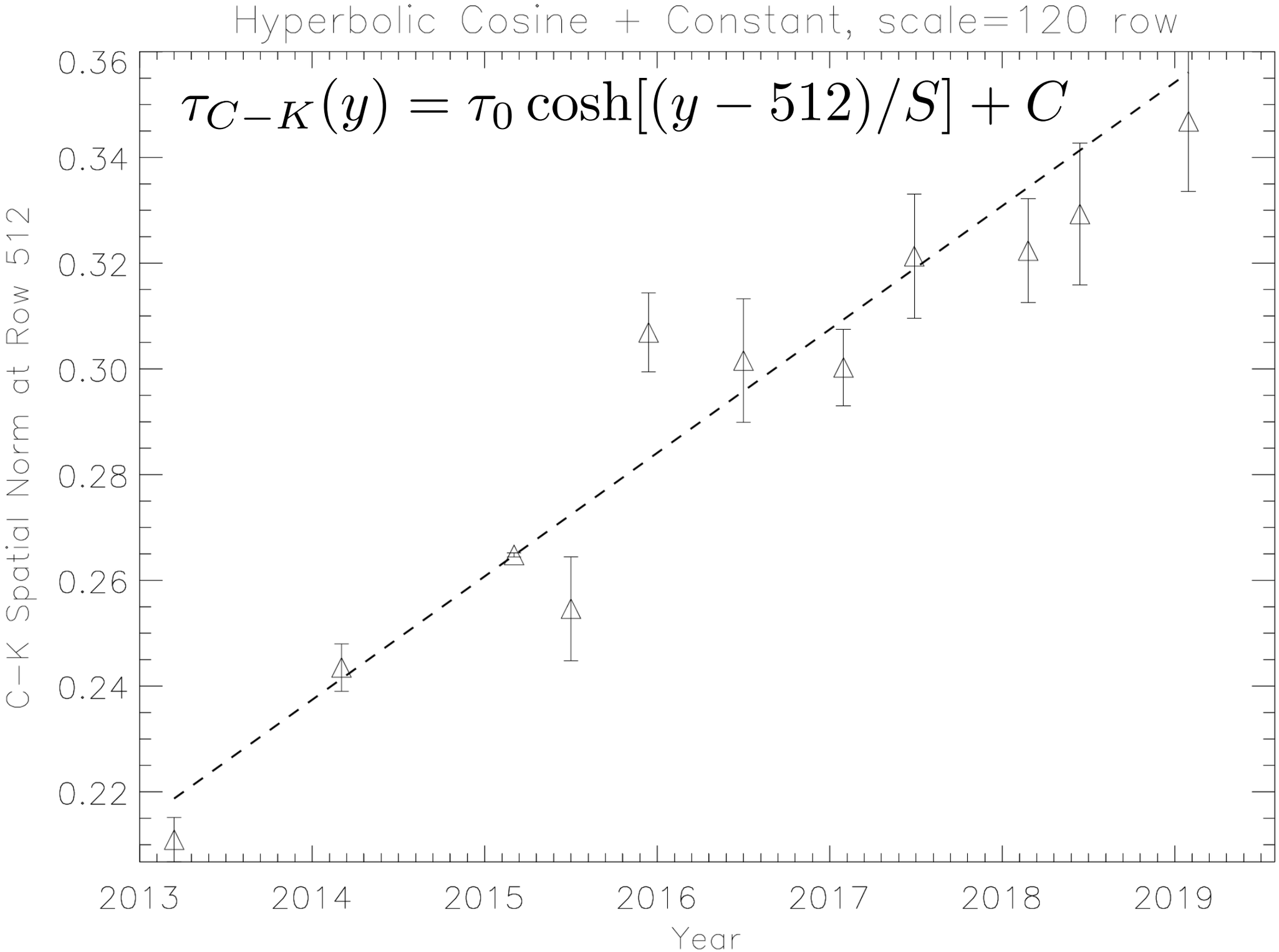


Mid-Row

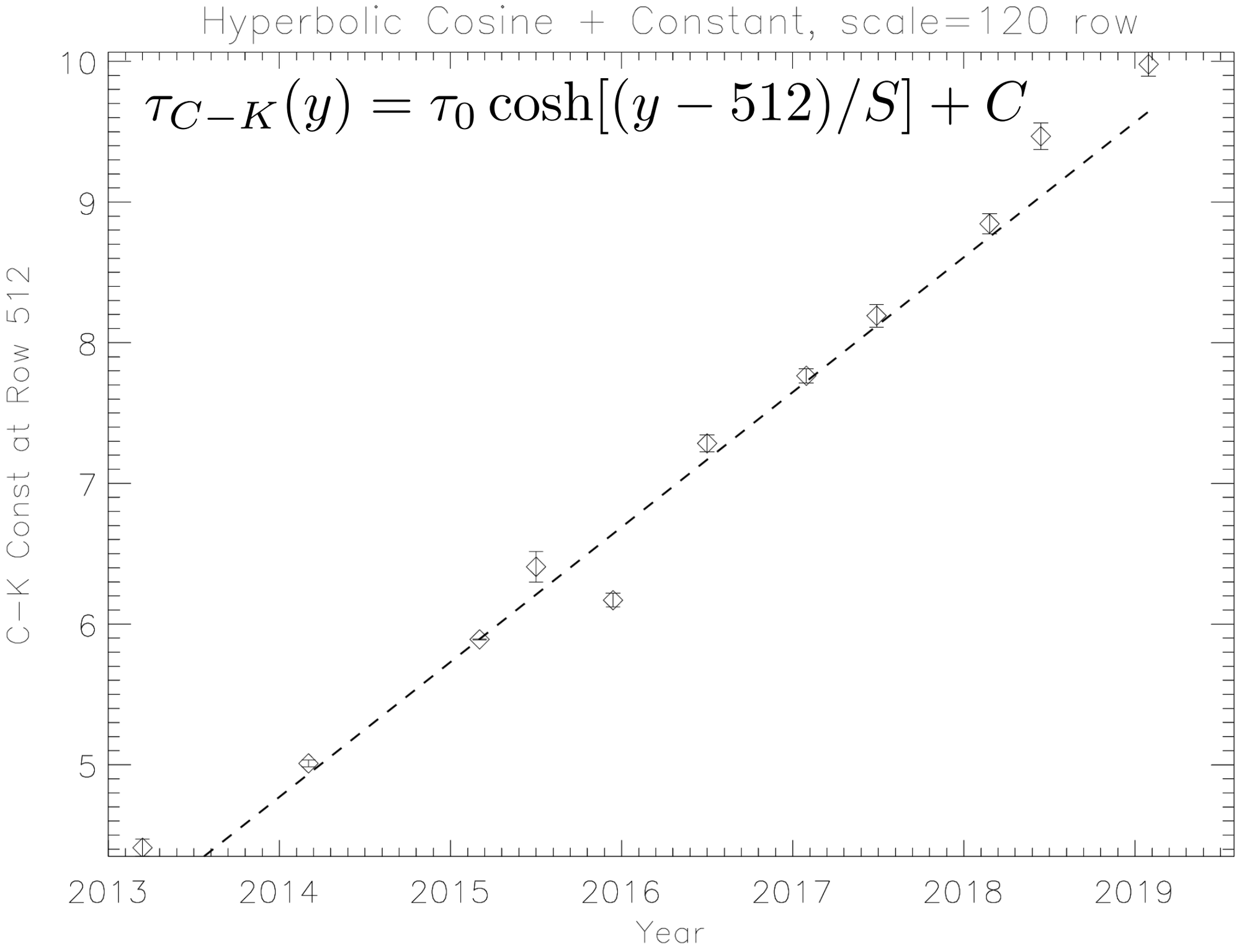



Big Dither 2014–8
March 2014
March 2015
July 2015
Dec 2015
July 2016
Feb 2017
June 2017
Feb 2018
5.00 cosh[(y–512)/350]
7.6 cosh[(y–512)/375]
5.00 cosh[(y–512)/350] + 2.6
7.6 cosh[(y–512)/375] + 1.2
C–K Optical Depth
Row
18
16
14
12
10
8
6
0
200
400
600
800
1000

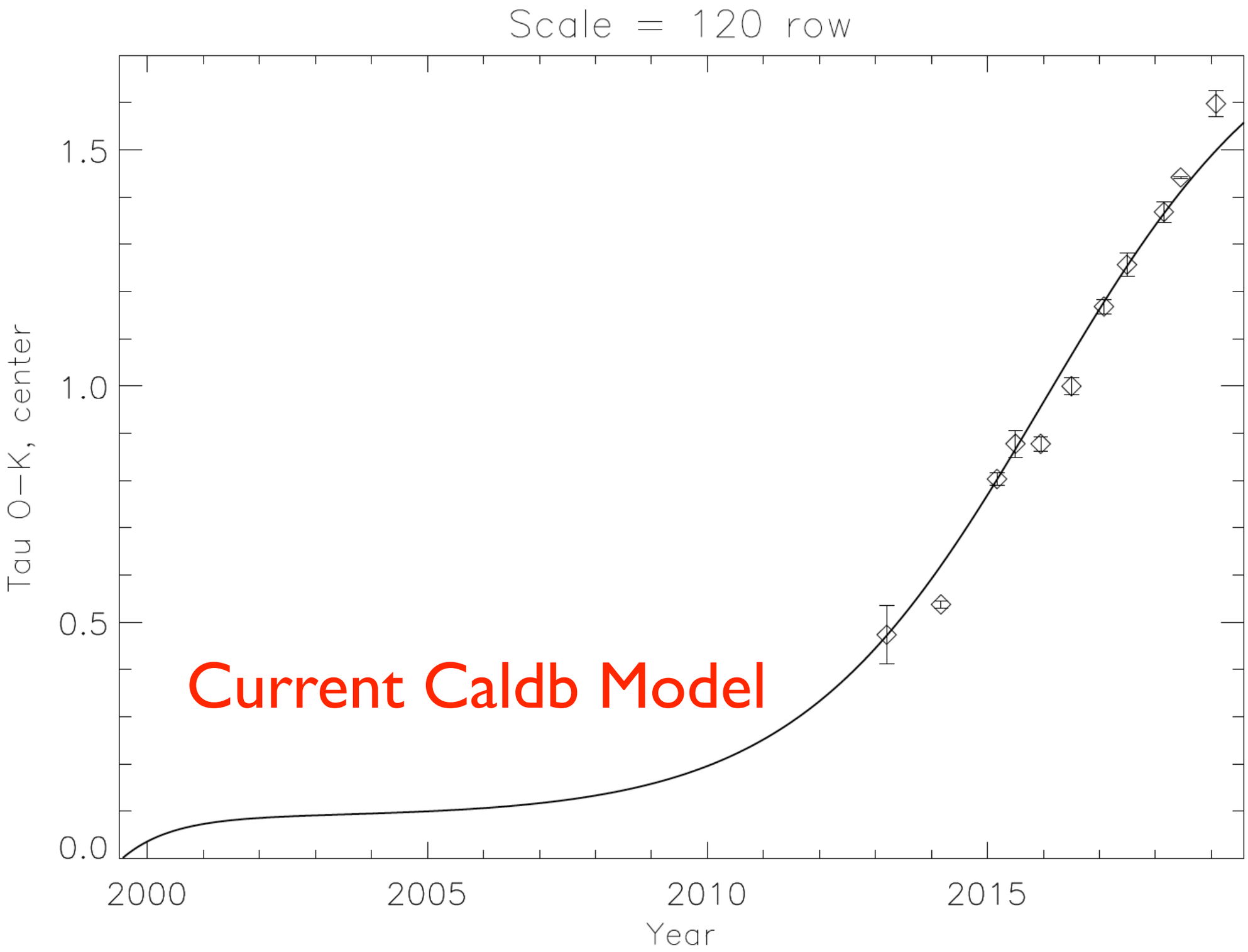
Spatial Part, C-K



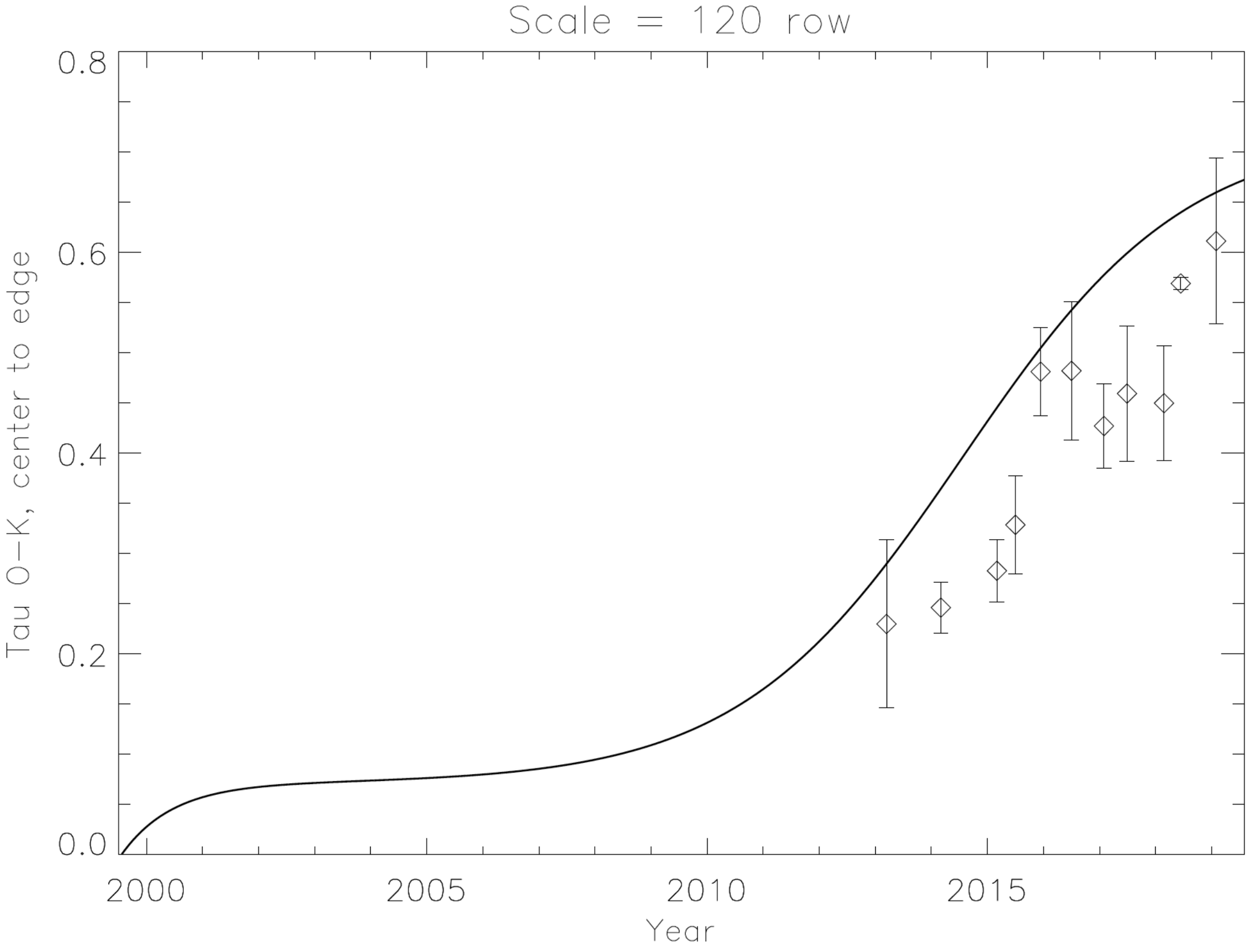
Uniform Part, C-K



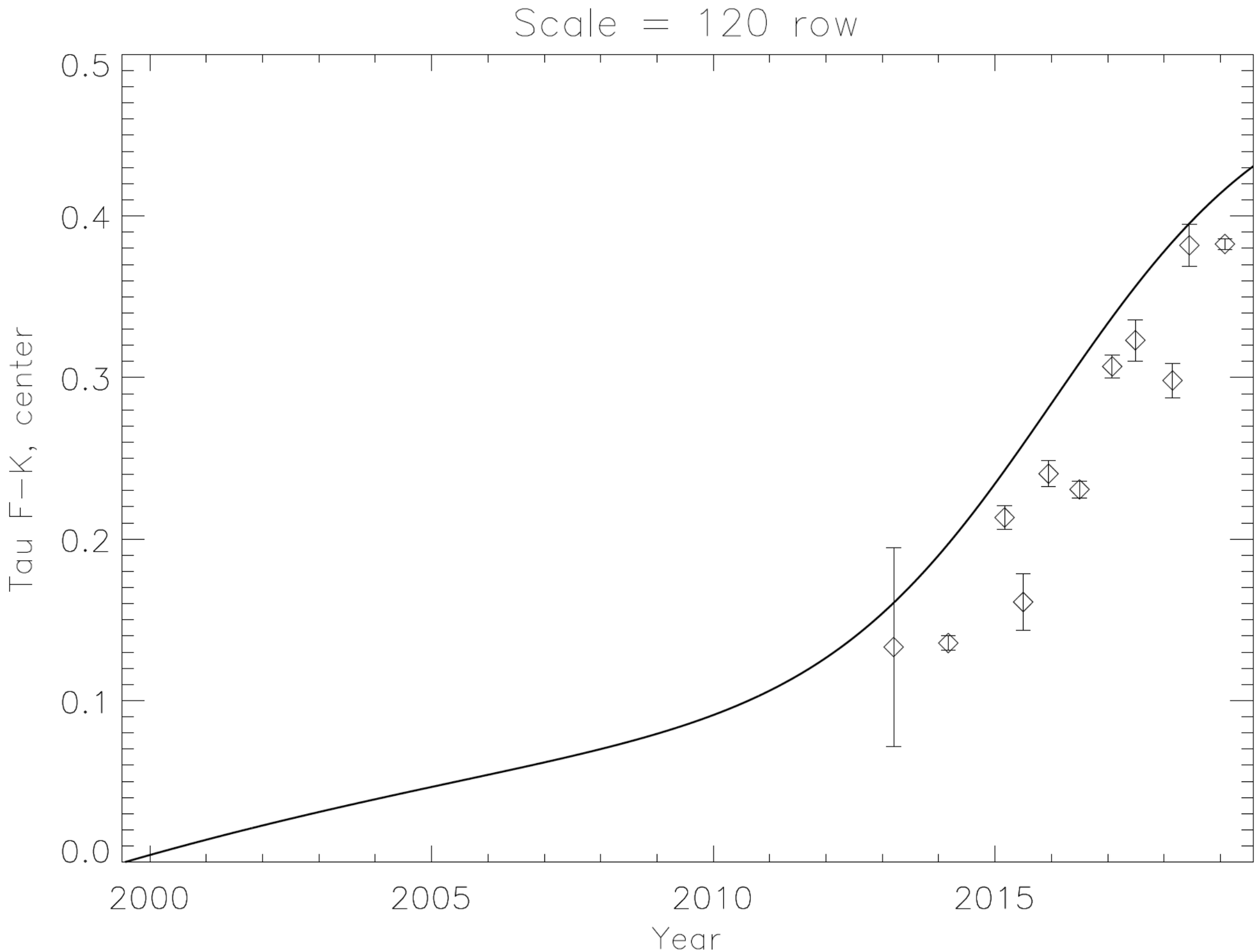
Uniform Part, O-K



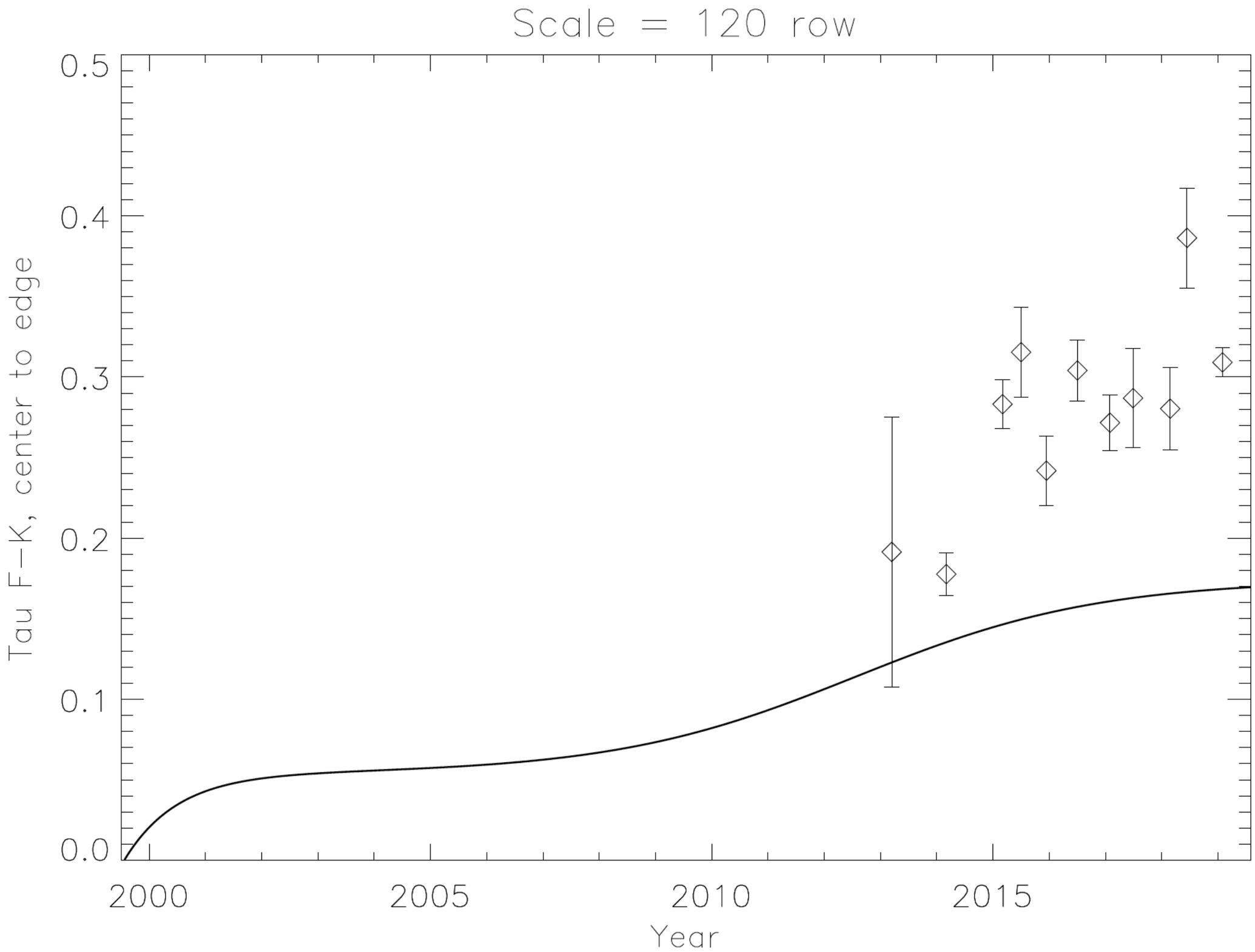
Spatial Part, O-K



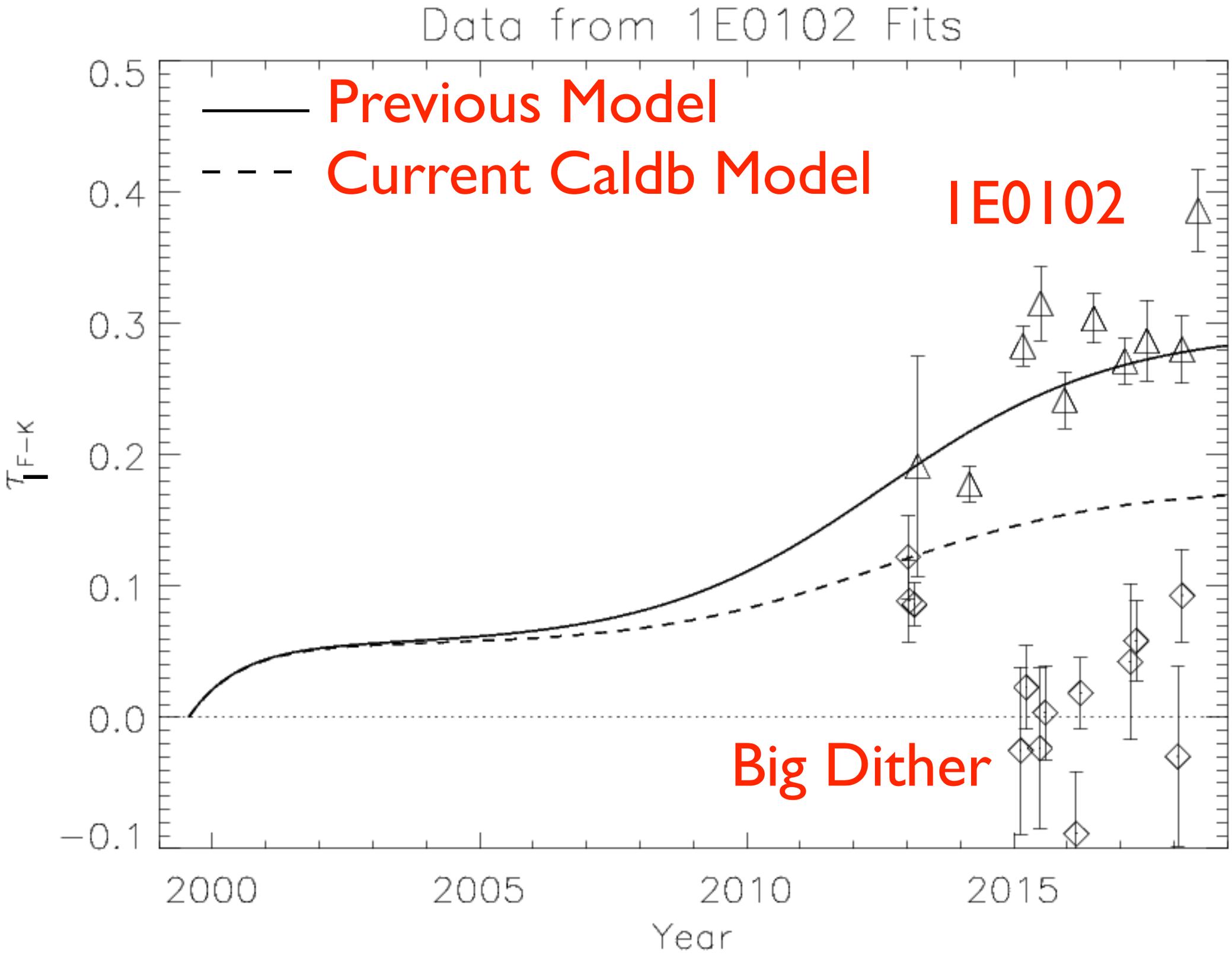
Uniform Part, F-K



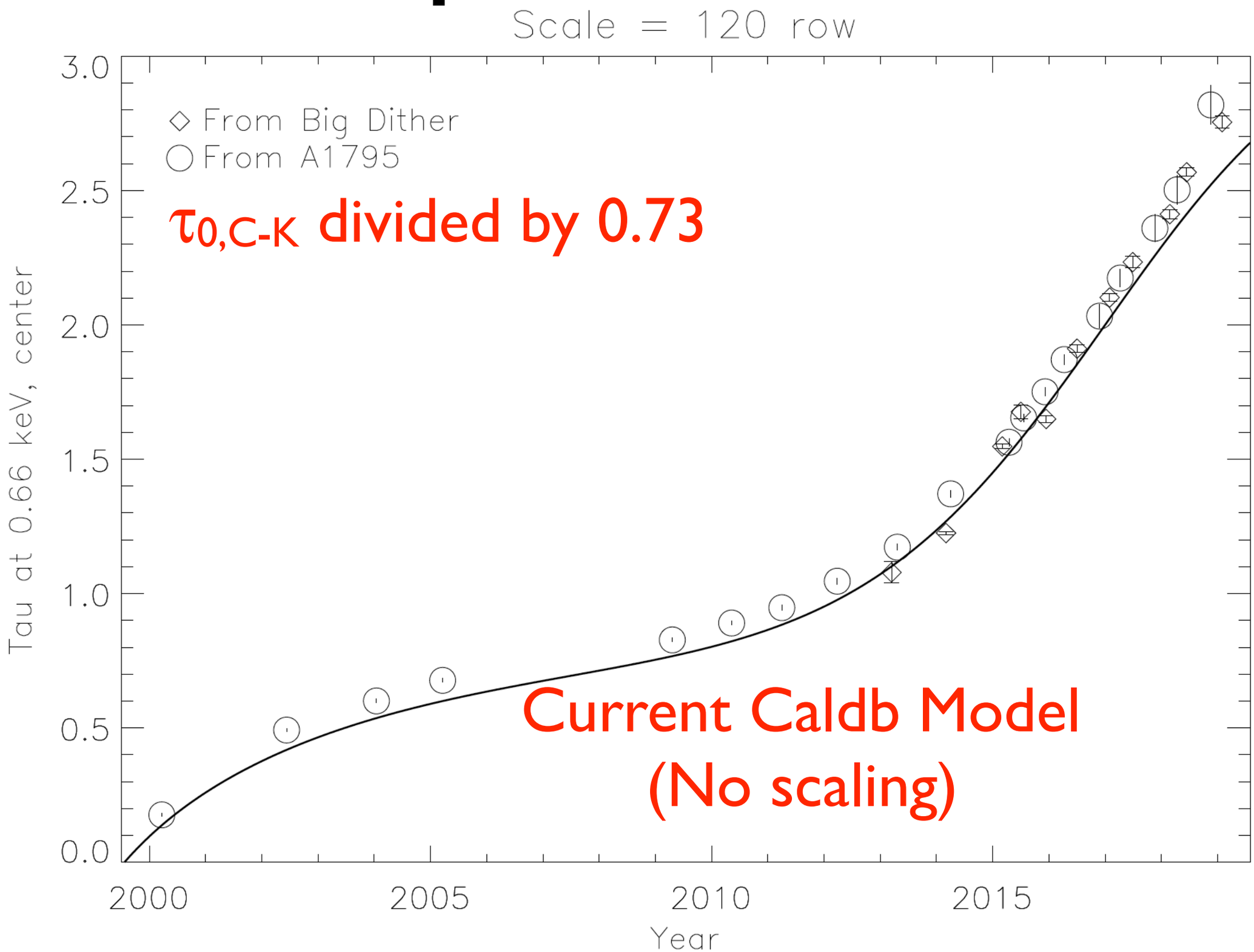
Spatial Part, F-K



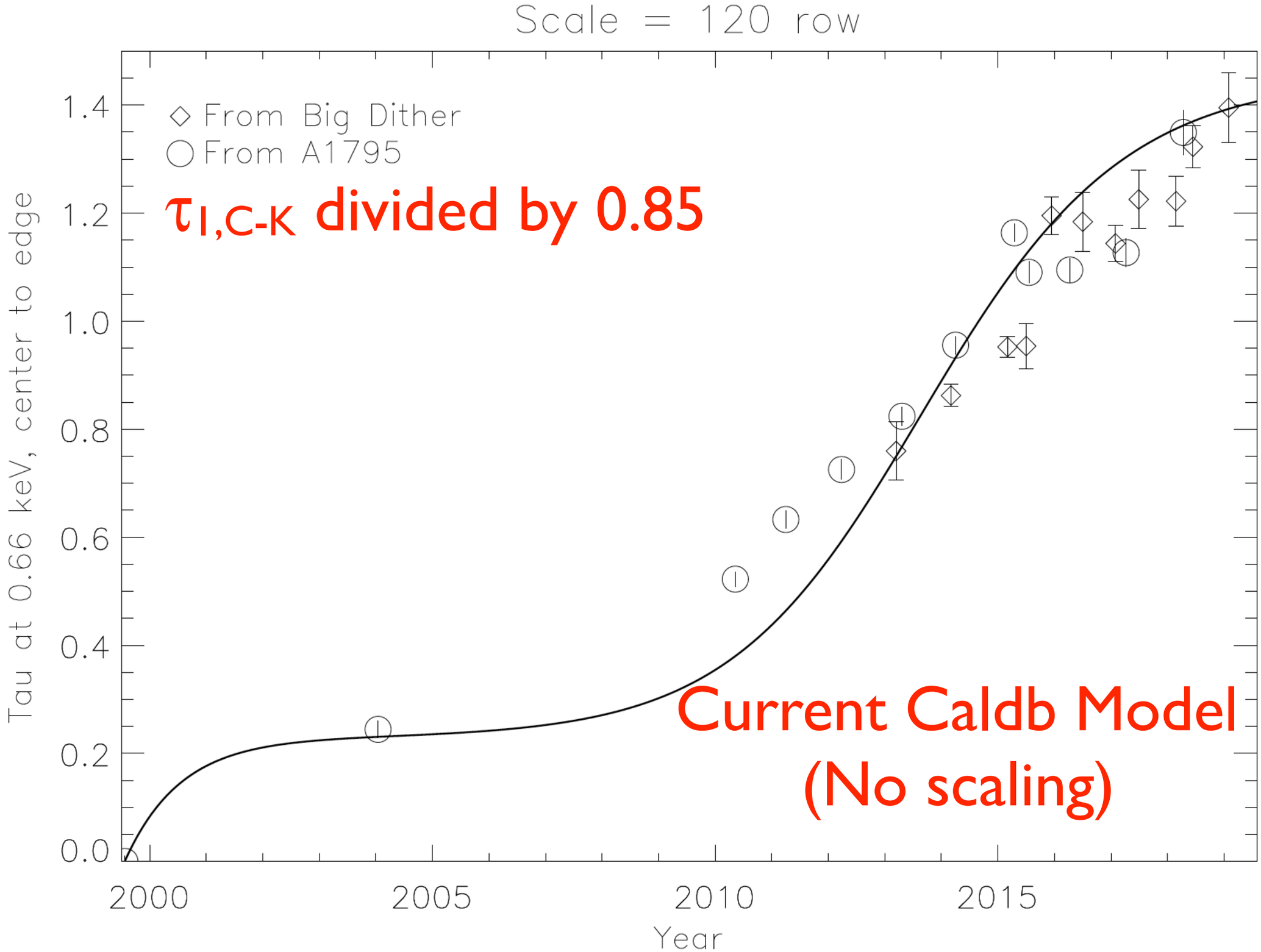
Compromise Model



Compare to A1795



Compare to A1795



Summary

- Contaminant deposition continues
  - rate hasn't changed in 3-5 years
  - ACIS-I measurements are irregular, more like ACIS-S
- New material is different than in 2001-5
  - O/C is higher
  - 285 eV feature is present — it's aliphatic
- New material is more uniform than old
- Spatial dependence is still asymmetric, with more at high rows
- Model is OK now; to be updated this year