MOS CTI correction

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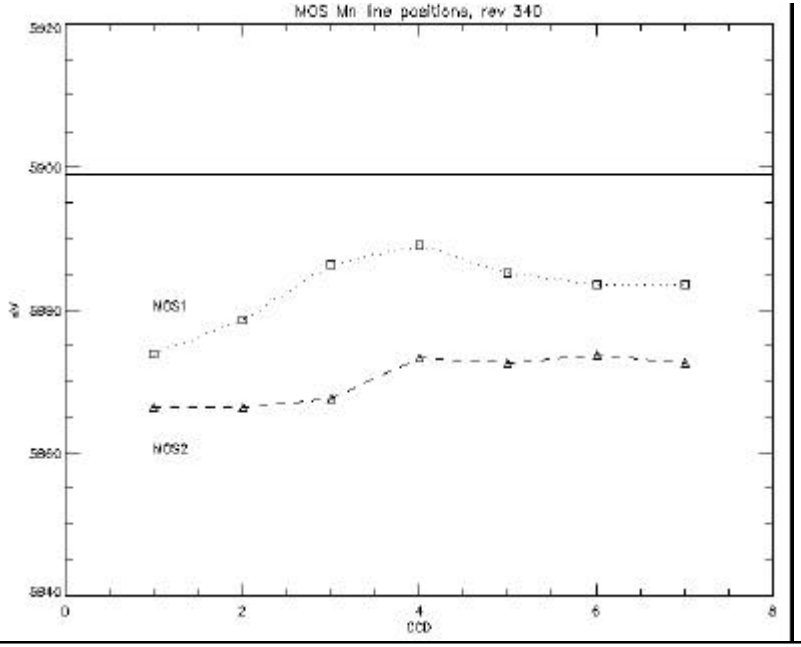
Current MOS CTI

- **In current SAS (v5.2, MOS CTI CCF v5) the CTI is under-corrected ==> line centroid is shifted to lower energies**

- **Discrepancy increasing with time (rev #)**
  - By now (rev 340) it is about 25-30 eV at Mn energies



MOS CTI algorithm

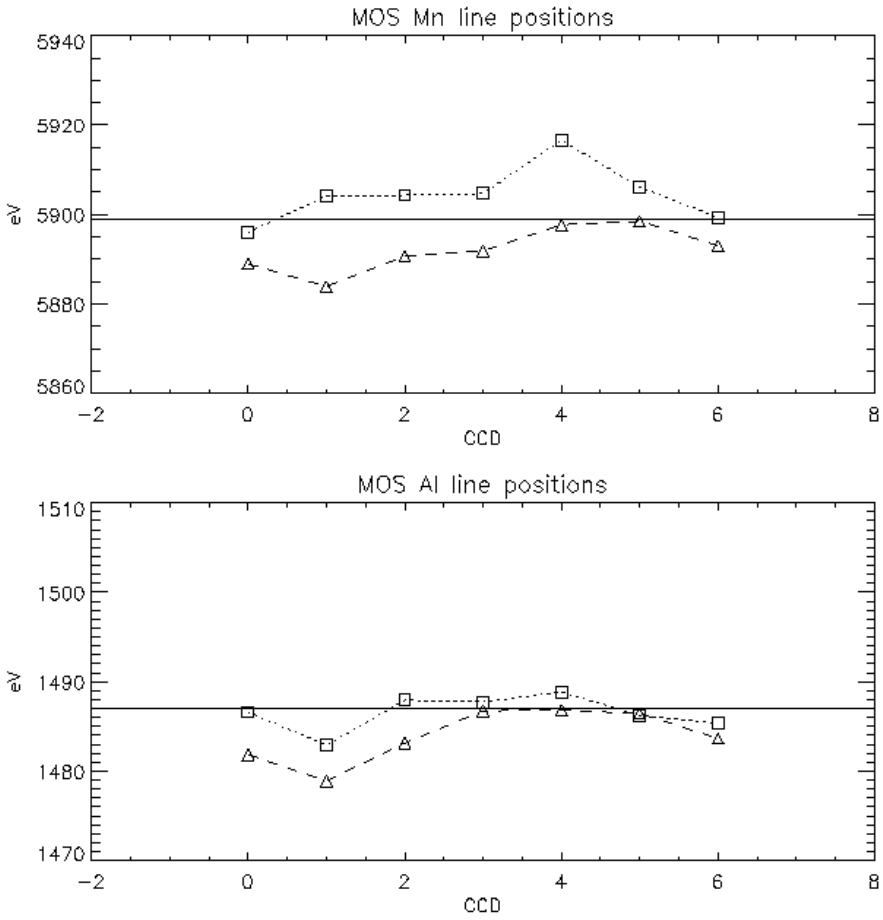
- X = serial loss, Y: parallel loss
- CTI = CTIX. RAWX + CTIY . RAWY

- **Current CTI correction :**
  - CTIX = $\delta T.rate_x$ + **$(a_{0xCCDi} + b_{0xCCDi}.PHA)$**
  - CTIY = $\delta T.rate_y$. $(PHA)^{1/2}$ + $(a_{0yCCDi} + b_{0yCCDi}.PHA)$
    - with $(a,b)_{0\ X,Y}$ from ground-based test and $\delta T = T\text{-}T_0$

- **New CTI correction:**
  - CTIX = $a_{1xCCDi} + b_{1xCCDi}.PHA$
  - CTIY = $\delta T.rate_{YCCDi}$. $(PHA)^{\alpha CCDi}$ + $(a_{1YCCDi} + b_{1YCCDi}.PHA)$
    - with $(a,b)_{1\ X,Y}$ from ground-based test and $\delta T = T\text{-}T_{launch}$
  - 6 parameters per CCD (4 for parallel loss and 2 for serial)
    - degradation rate and power index (0.55 to 0.7) CCD dependant !
  - All parameters derived from a linear fit of MOS CTI plots.

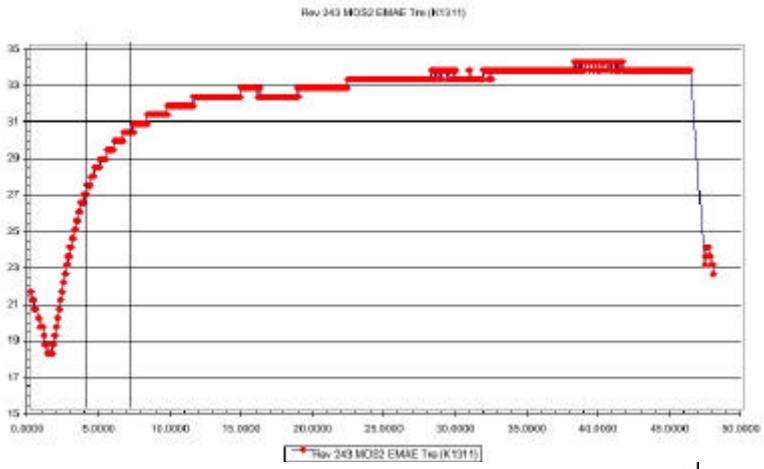
MOS CTI new algo tests

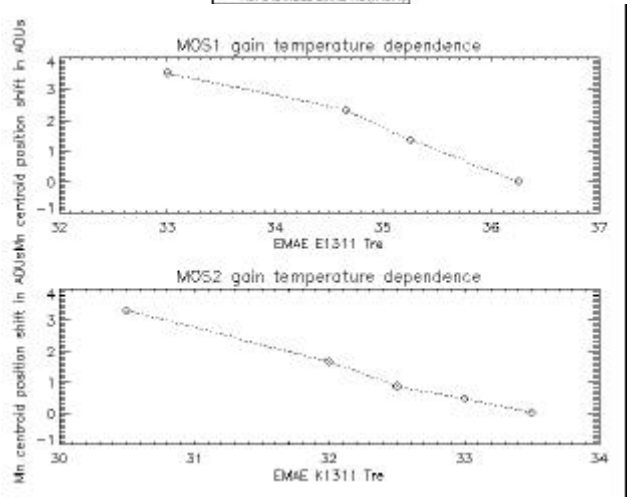
- **New algorithm tested in:**
  - CCF MOS CTI **version 6**
  - combained with **cal-3.120**
- **Some slight over-correction for MOS1**
- **Still some under-correction for MOS2**
  - CTI underestimated because of high MOS2 calibration source ?
- **Proposed for SAS v5.3**



Temperature-dependence of the gain ?

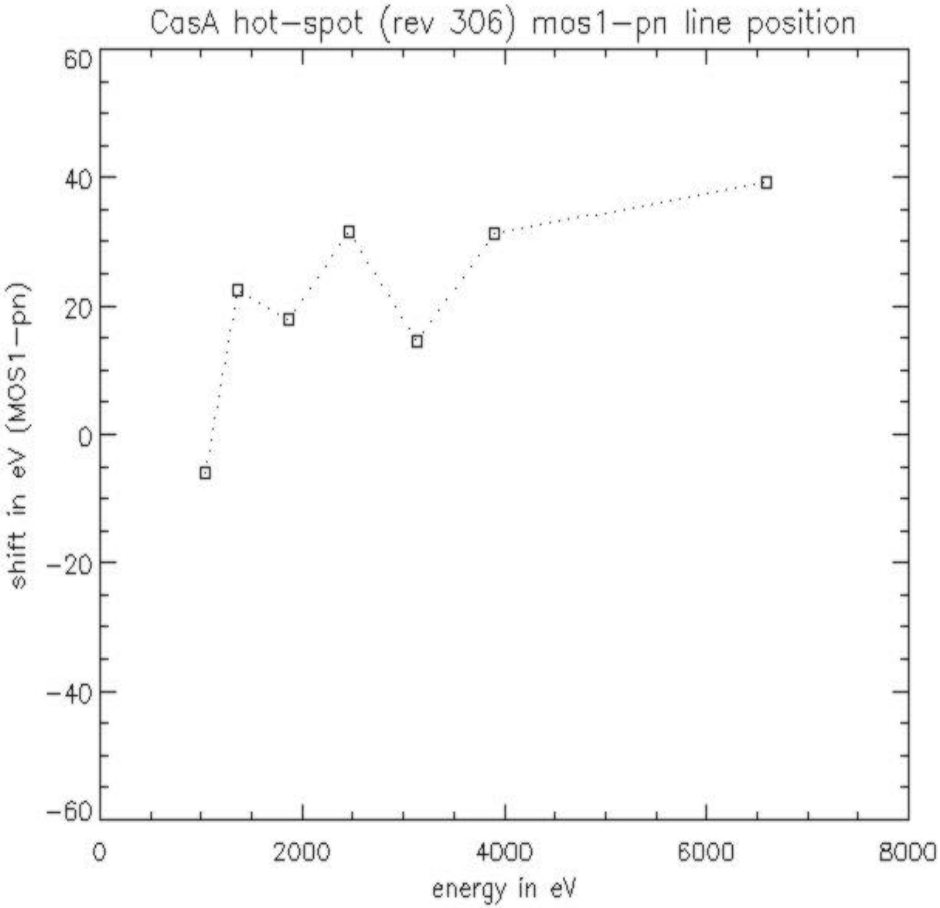
- **CTI correction does not work for cal-closed during the eclipse seasons, because of the EMAE T^{re} variations.**
- **EMAE T^{re} colder ==> CTI is less ==>over-correction in SAS.**
- **Effect worse for MOS2 than MOS1 and energy-dependent. dPHA = a . E/K1311 + b + c. PHA**
- **From rev 242 long calclosed : $dPHA / dT^{re}$ ~1**
- **Effect worse in autumn eclipses, as T^{re} excusions are larger.**
- **Science observation less affected, but T^{re} stabilized at ~ 2 degrees lower in last eclipse season, ==> ~ 7 eV shift.**





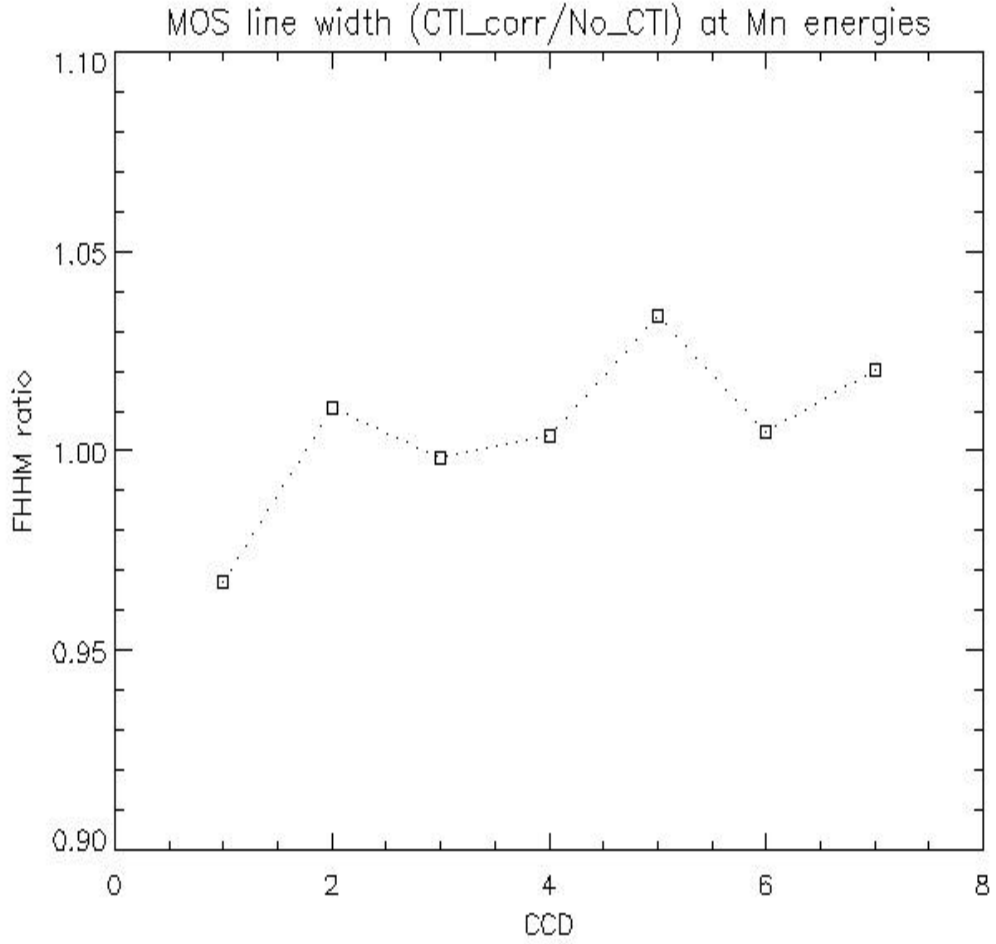
Comparison MOS/ pn

- **Comparison MOS/pn on the hot spot of CasA observed in rev 306.**
- **MOS shifted by > 20 eV compared to pn in both LW and full-frame at high energies.**
- **Note: no mode-dependent CTI correction.**
- **Future: make a systematic comparison MOS/pn/RGS on N132D for soft energies.**



MOS energy resolution

- **Negligible line width increase after CTI correction at Mn energies**
- **~<1% ? sigma = 64eV**
- **No change or decrease at Al energies ! (35 eV)**



Conclusions

- **Status**:
  - As the linear fit CTI degradation is a good approximation, the new refined CTI algo is appropriate.
  - Give rather good results when the temperature is stabilized.
  - **Suggest to implement it in SAS v5.3**

- **Future**:
  - work on a temperature correction
  - parameters to be refined in the future with more time leverage and new CTI plots from Andrea.
    - Tune the under-correction for MOS2
  - Understand shifts with PN and compare positions with RGS at low energies (cross-calibration)