CrIS Calibration Equation

D. L. Mooney

Session 4b

STAR JPSS Annual Science Team Meeting

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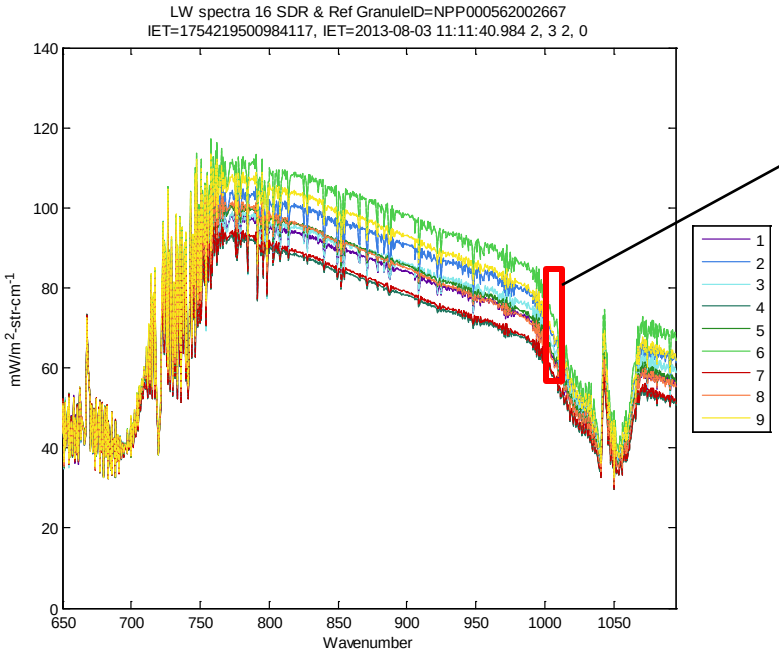
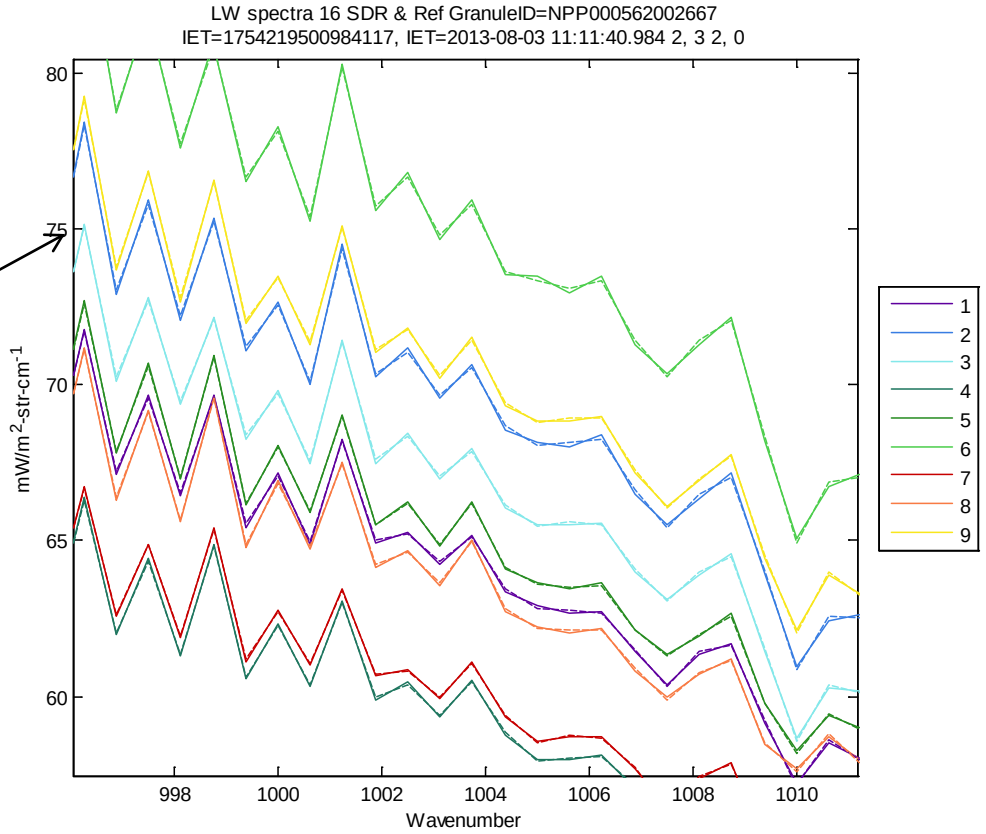
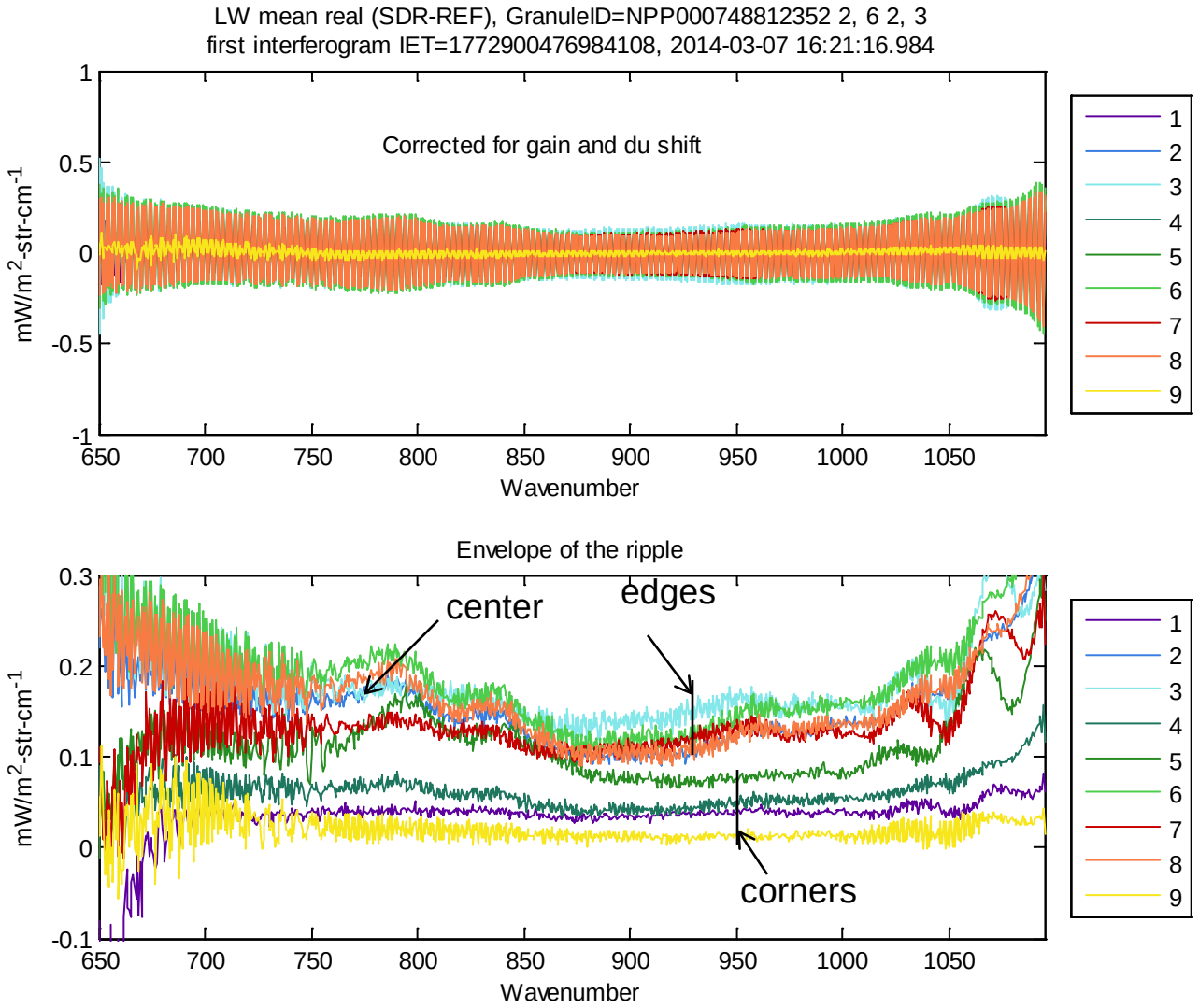
The differences among processing approaches are small



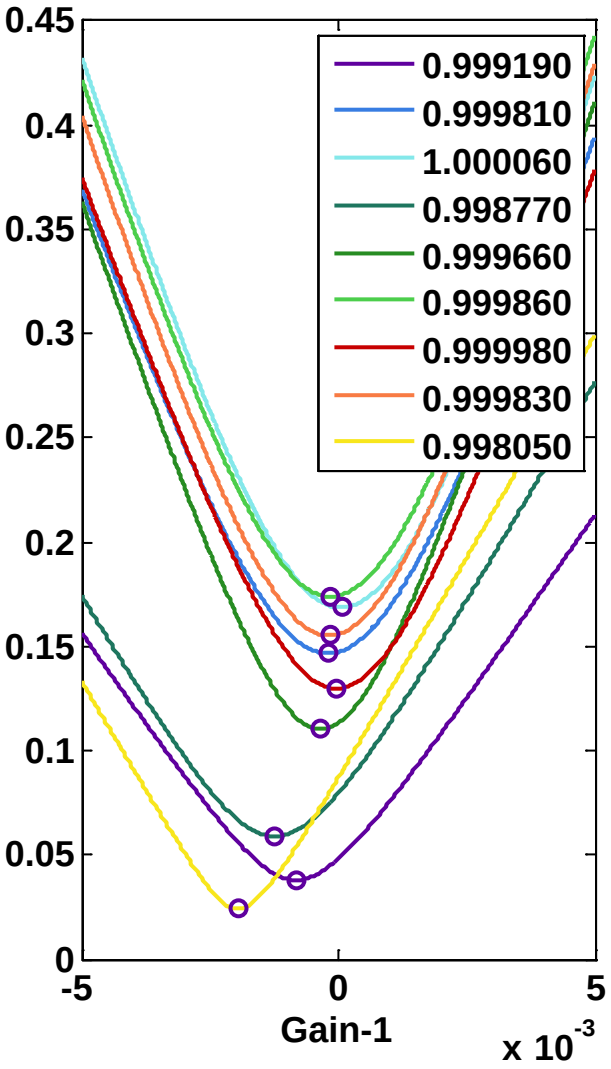


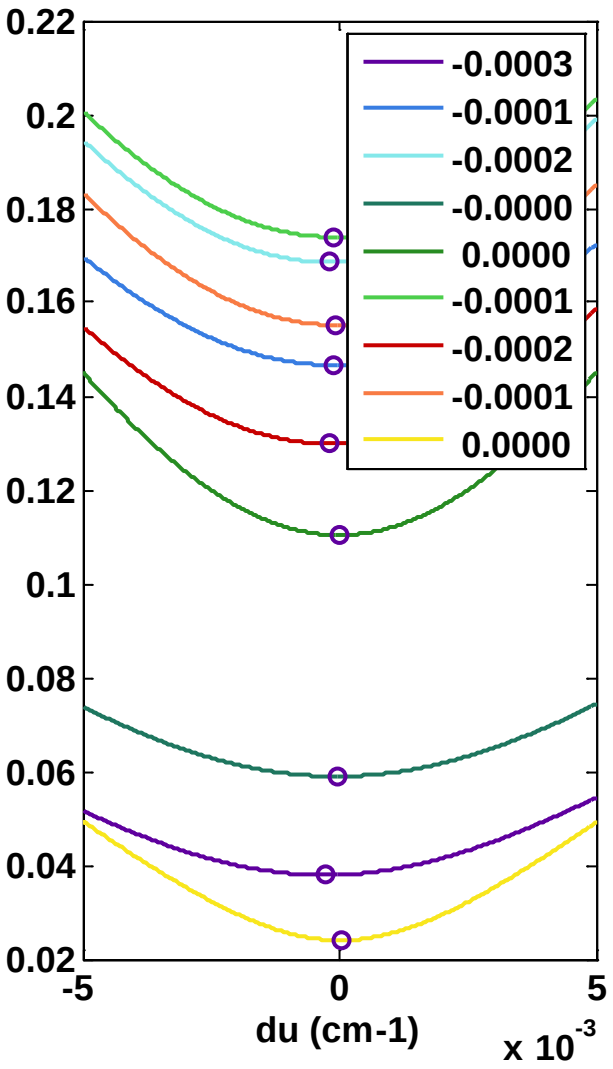
Solid - LL_old
Dashed - SDR

Difference IDPS-Ref and low Pass filtered difference

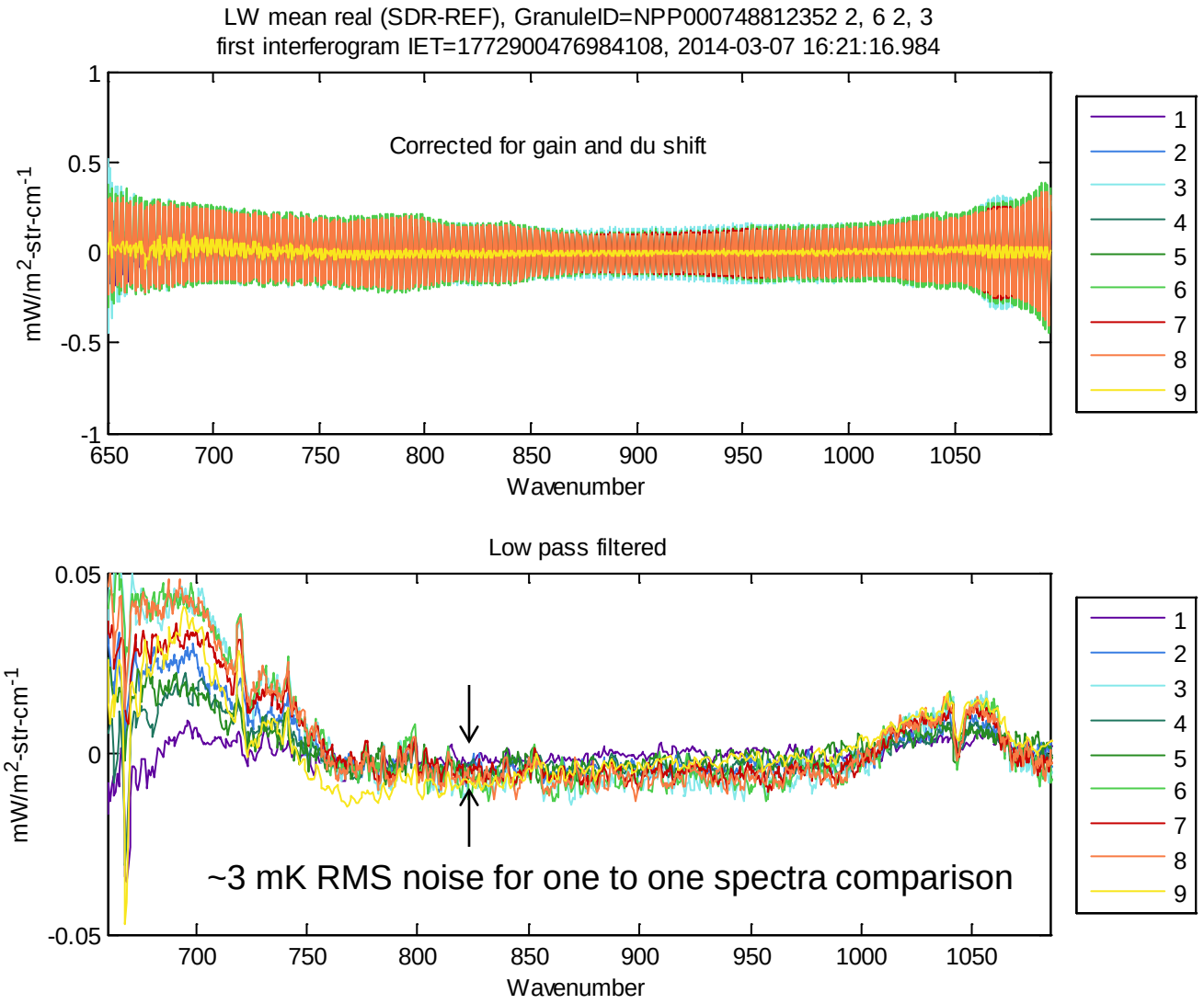


Determine gain and wavenumber shift





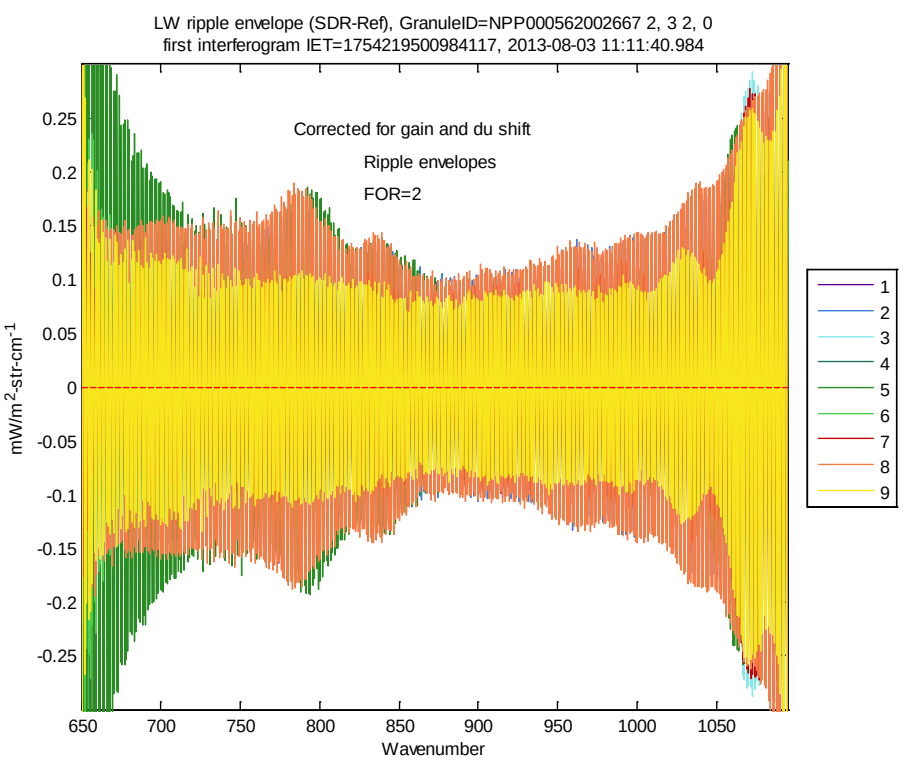
Corrected for gain and wavenumber shift



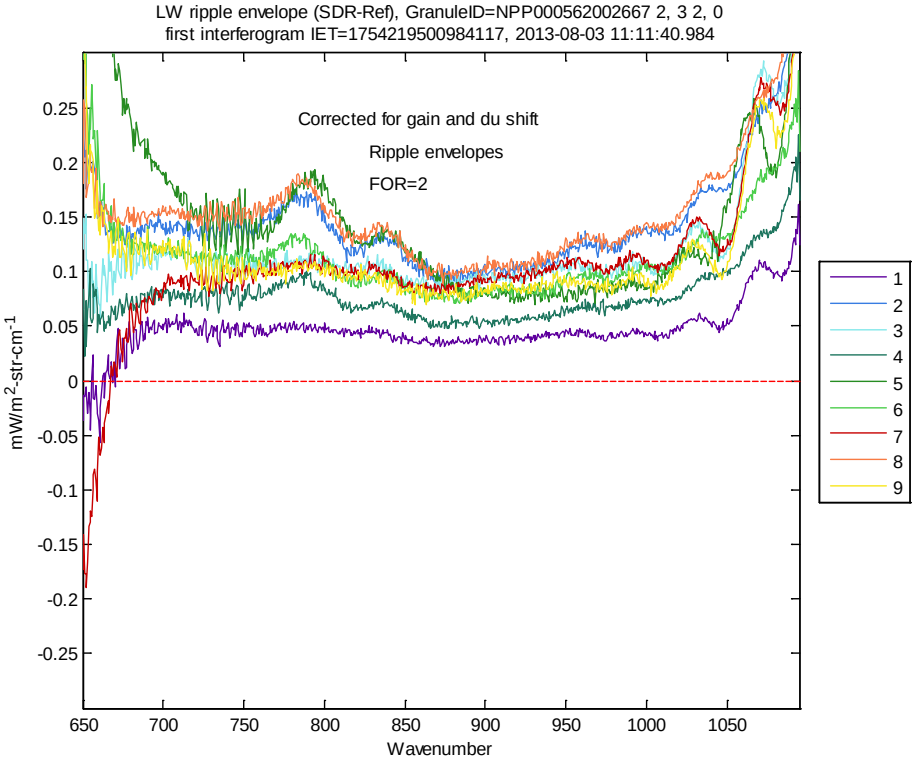
Envelope of ripple difference SDR-Ref for FOR=2 in Granule NPP 000552002667

- **We will use the envelope of ripple difference for comparing different calibration approaches**
- **Envelope by multiplying by [1,-1,1,-1,….]**

Ripple

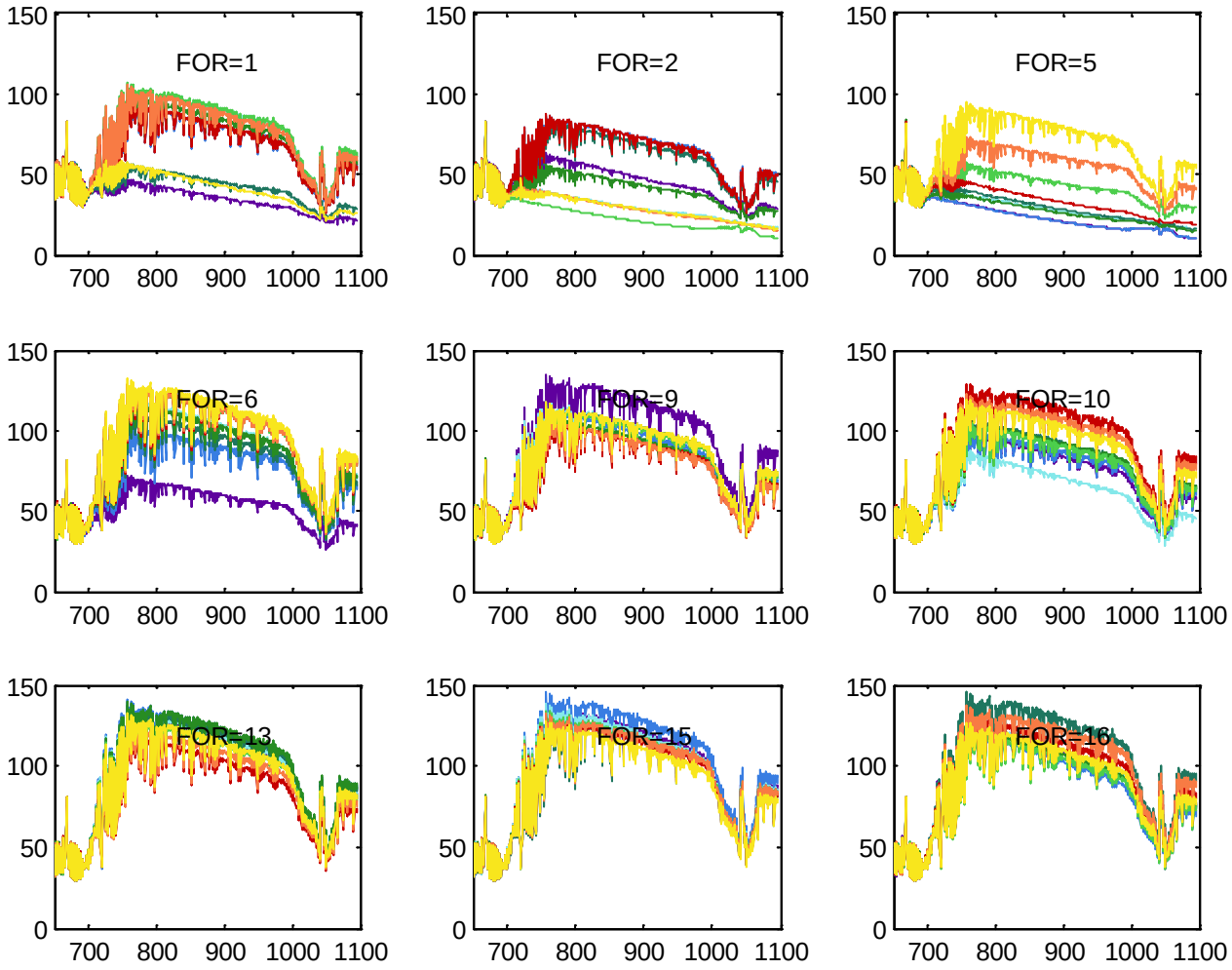


Envelope of ripple



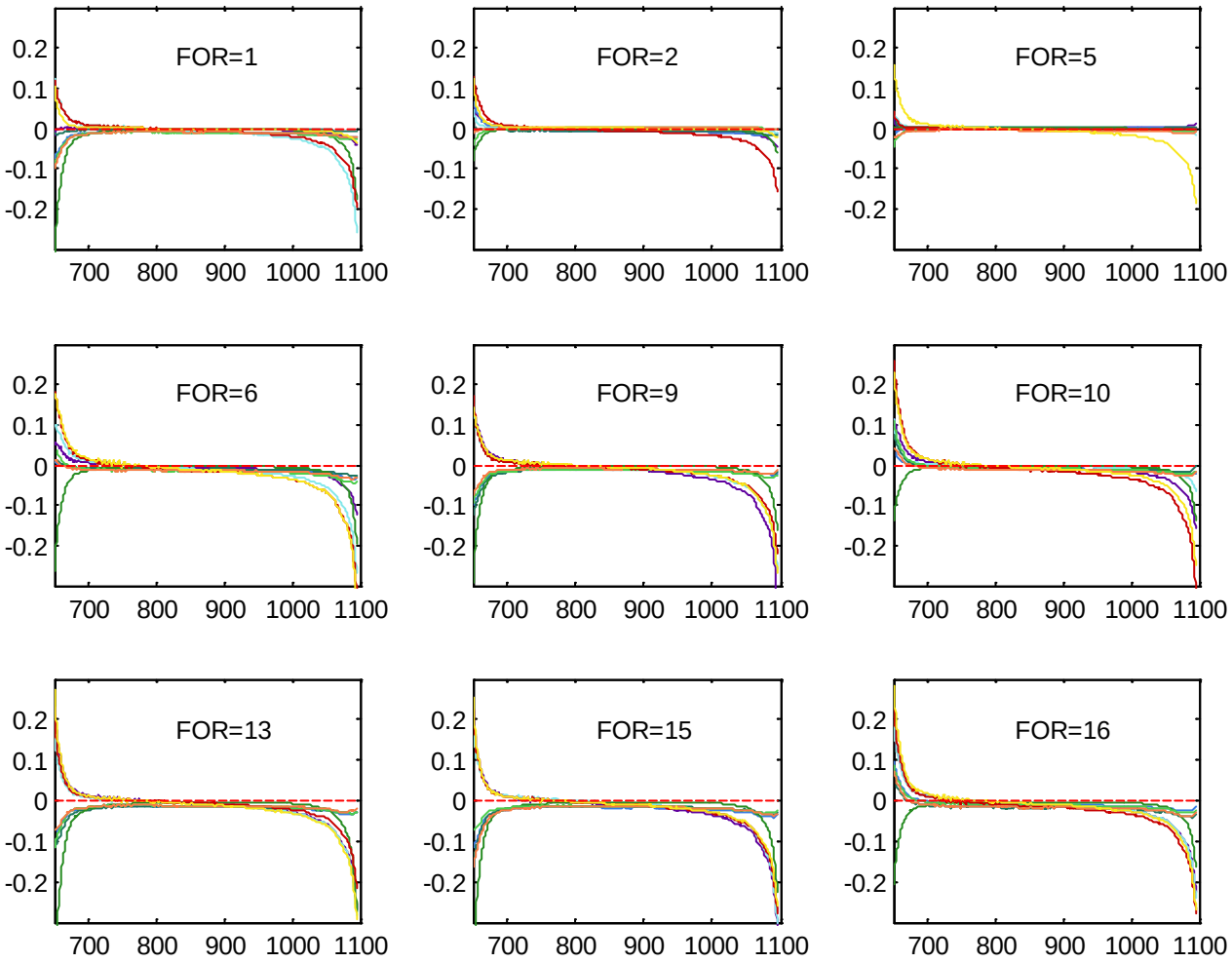
Examine a Range of spectra for different FOR

LW spectra 16 LLNew - REF GranuleID=NPP000748812352 IET=1772900476984108, IET=2014-03-07 16:21:16.984 2, 1 2, 3



Ripple envelopes change with different FORs especially near the edges

LW spectra 16 LLNew - REF GranuleID=NPP000748812352 IET=1772900476984108, IET=2014-03-07 16:21:16.984 2, 1 2, 3

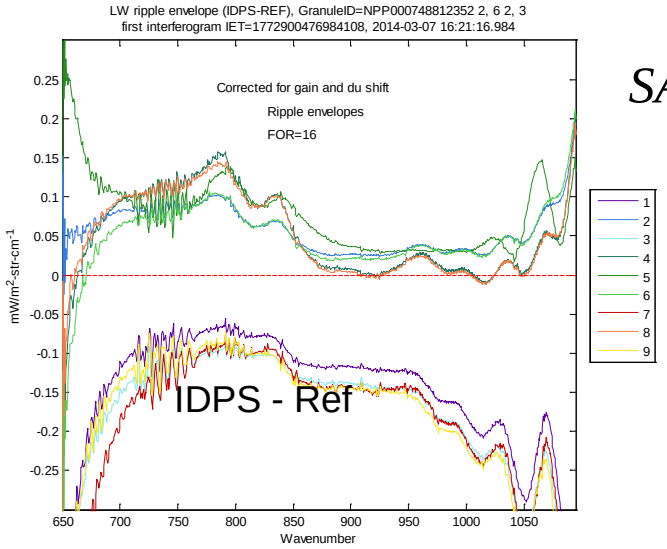


Calibration options

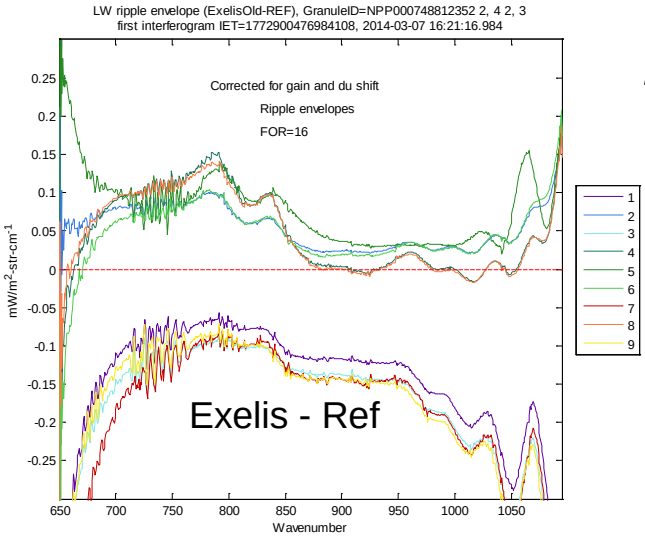
Item	Member	Calibration	CMO Principals	Calibration Order
1	IDPS	$N = (SA_u^{-1} \cdot F_{s\to u} \cdot f_{ATBD}) \cdot \left\{ \frac{S_E - S_{SP}}{S_{ICT} - S_{SP}} \cdot ICT(T, u_{sensor*(1+delta)}) \right\}$	$SA_u^{-1} \cdot F_{s\to u}$	Calibration first, then CMO
2	ADL/CSPP	$N = (SA_u^{-1} \cdot F_{s\to u} \cdot f_{ATBD}) \cdot \left\{ \frac{S_E - S_{SP}}{S_{ICT} - S_{SP}} \cdot ICT(T, u_{sensor*(1+delta)}) \right\}$		
3	Exelis (old)	$N = \left(SA_u^{-1} \cdot F_{s\to u} \cdot f_{ATBD}\right) \cdot \left\{ \frac{S_E - S_{SP}}{S_{ICT} - S_{SP}} f_{BH} \cdot \left[SA_u^{-1} \cdot F_{s\to u}\right]^{-1} \cdot ICT(T, u_{sensor}) \right\}$		
4	UMBC/UW** option A	$N = F_{s\to u} \cdot f \cdot SA_s^{-1} \cdot \left\{ f \cdot \frac{FIR^{-1} \cdot (S_E - S_{SP})}{FIR^{-1} \cdot (S_{ICT} - S_{SP})} \cdot ICT(T, u_{sensor\_off\_axis}) \right\}$	$F_{s\to u} \cdot SA_s^{-1}$	
5	CCAST Cal mode 1	$N = F_{s\to u} \cdot f \cdot SA_s^{-1} \cdot \left\{ \frac{FIR^{-1} \cdot (S_E - S_{SP})}{FIR^{-1} \cdot (S_{ICT} - S_{SP})} \cdot ICT(T, u_{sensor\_off\_axis}) \right\}$		
6	UMBC/UW** option B	$N = F_{s\to u} \cdot \left\{ ICT(T, u_{sensor}) \cdot f \cdot SA_s^{-1} \cdot \left\{ f \cdot \frac{FIR^{-1} \cdot (S_E - S_{SP})}{FIR^{-1} \cdot (S_{ICT} - S_{SP})} \right\} \right\}$		
7	CCAST Cal mode 2	$N = F_{s\to u} \cdot f \cdot \left\{ ICT(T, u_{sensor}) \cdot SA_s^{-1} \cdot \left\{ \mathrm{Re}\left[\frac{FIR^{-1} \cdot (S_E - S_{SP})}{FIR^{-1} \cdot (S_{ICT} - S_{SP})} \right] \right\} \right\}$		
8	LL(old)*	$N = \left\{ \frac{M \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{M \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \right\} \cdot ICT(T, u_{user})$		CMO first, then Calibration
9	LL(new)	$N = \left\{ \frac{F_{s\to u} \cdot SA_s^{-1} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{F_{s\to u} \cdot SA_s^{-1} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \right\} \cdot ICT(T, u_{user})$		
10	Proposed(1)	$N = F_{s\to u} \cdot f_{ATBD} \cdot \left\{ \frac{SA_s^{-1} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{SA_s^{-1} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \cdot ICT(T, u_{sensor}) \right\}$		
11	Proposed(2)	$N = ICT(T, u_{user}) \cdot \left\{ \frac{F_{s\to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{F_{s\to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \right\}$		
12	Exelis(new)	$N = \left\{ \frac{(SA_u^{-1} \cdot F_{s\to u} \cdot (S_E - S_{SP}))}{(SA_u^{-1} \cdot F_{s\to u} \cdot (S_{ICT} - S_{SP}))} \right\} \cdot ICT(T, u_{user})$	$SA_u^{-1} \cdot F_{s\to u}$	

Ref

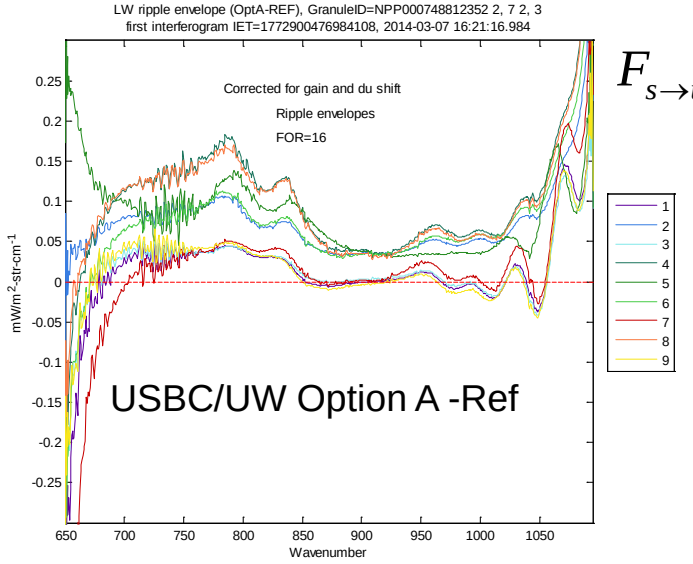
Calibration first then “CMO”



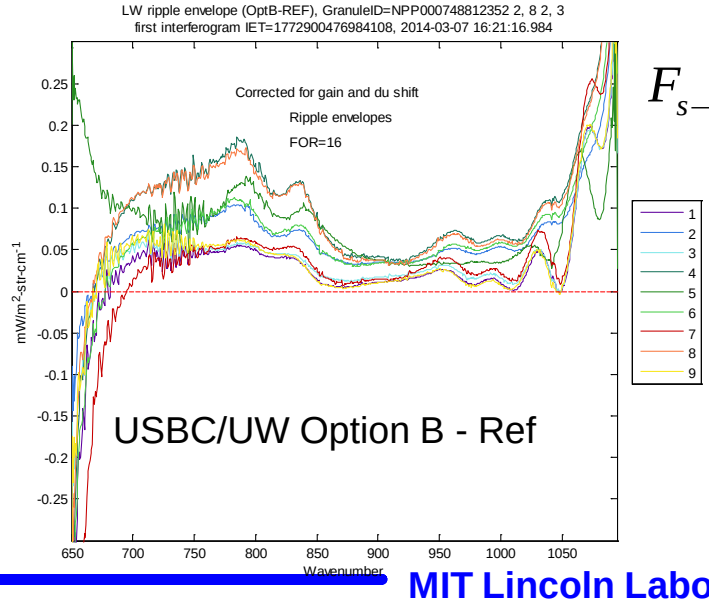
$$SA_s^{-1} \cdot F_{s \to u}$$



$$SA_s^{-1} \cdot F_{s \to u}$$

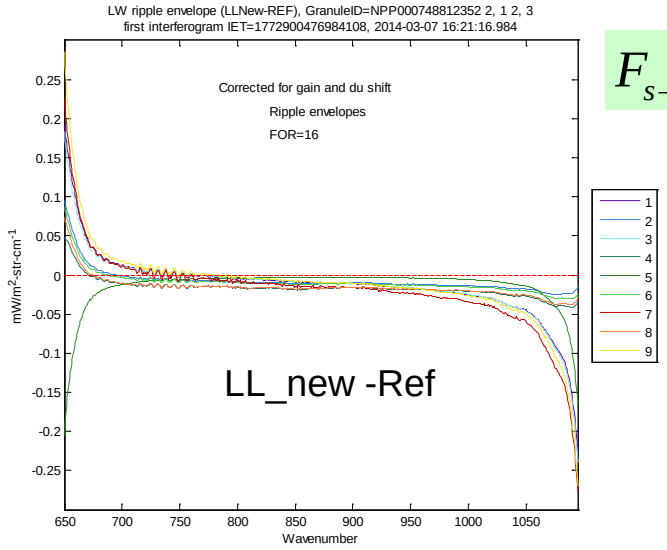


$$F_{s \to u} \cdot SA_s^{-1} \cdot$$

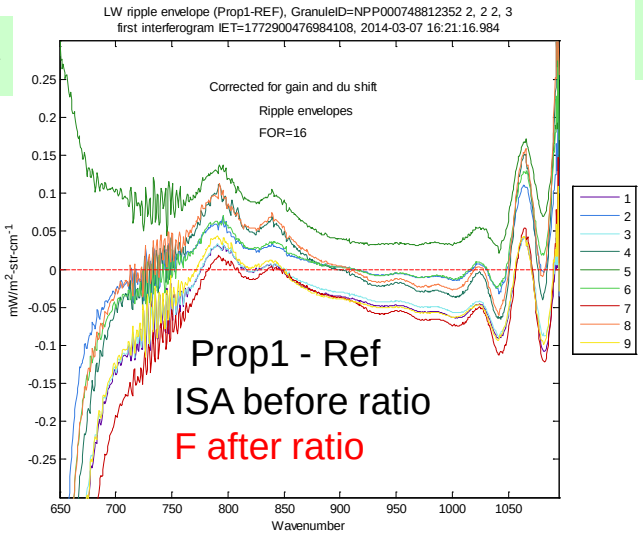


$$F_{s \to u} \cdot SA_s^{-1} \cdot$$

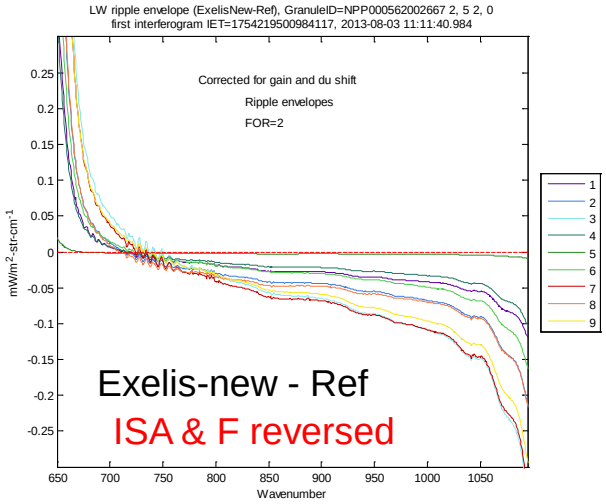
“CMO” first then calibration



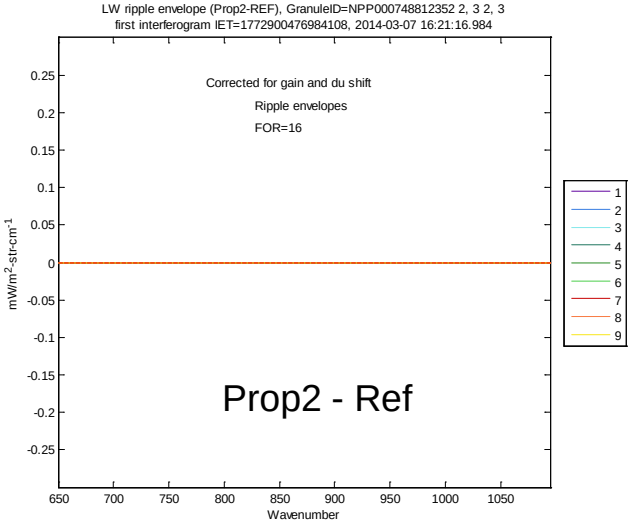
$$F_{s\to u}\cdot SA_s^{-1}\cdot$$



$$F_{s\to u}\cdot SA_s^{-1}\cdot$$



$$SA_s^{-1}\cdot F_{s\to u}$$



Doing the interpolation before/after the calibration ratio makes a difference (LW)

$$N = F_{s\to u} \cdot f \cdot SA_s^{-1} \cdot \left\{ \frac{FIR^{-1} \cdot (S_E - S_{SP})}{FIR^{-1} \cdot (S_{ICT} - S_{SP})} \cdot ICT(T, u_{sensor\_off\_axis}) \right\}$$

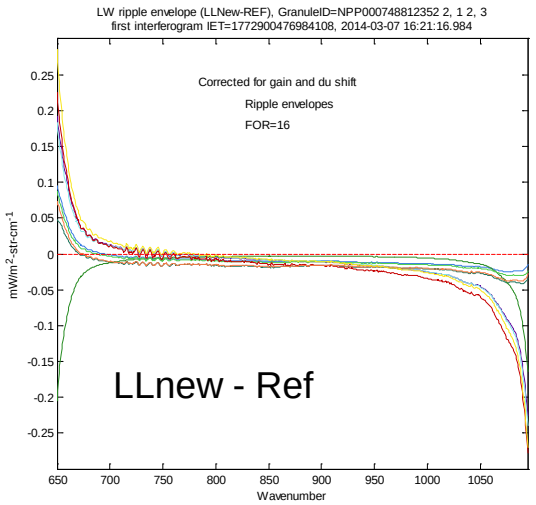
$$N = ICT(T, u_{user}) \cdot \left\{ \frac{F_{s\to u} \cdot SA_s^{-1} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{F_{s\to u} \cdot SA_s^{-1} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \right\}$$

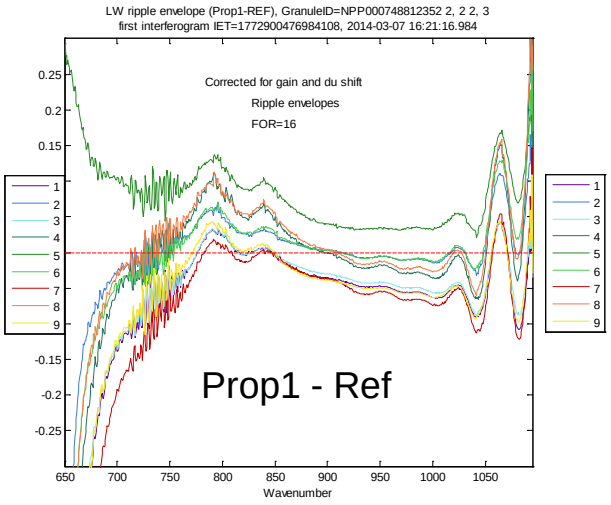
$$N = F_{s\to u} \cdot f_{ATBD} \cdot \left\{ \frac{SA_s^{-1} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{SA_s^{-1} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \cdot ICT(T, u_{sensor}) \right\}$$

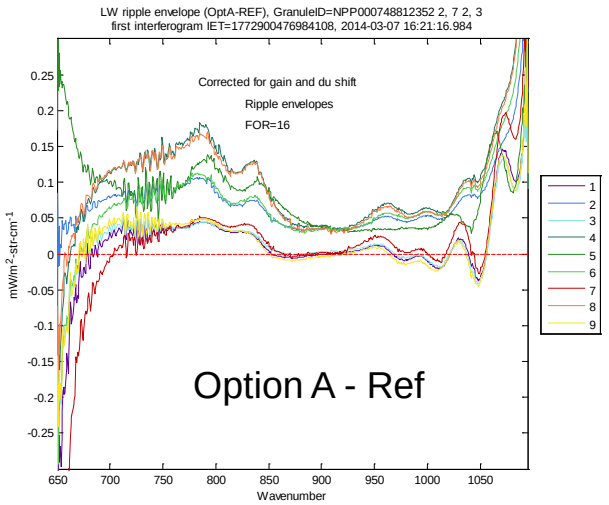
Ratio after interpolation & ISA

Ratio before interpolation

Ratio before interpolation & ISA







Ref= Prop2

$$N = ICT(T, u_{user}) \cdot \left\{ \frac{F_{s\to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot (FIR^{-1} \cdot (S_E - S_{SP}))}{F_{s\to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot (FIR^{-1} \cdot (S_{ICT} - S_{SP}))} \right\}$$

Note: Ref does interpolation before ratio

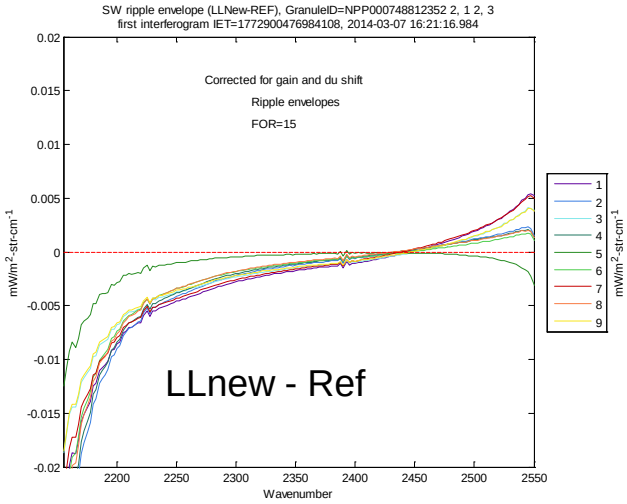
Doing the interpolation before/after the calibration ratio makes a difference (SW)

$$N = \cdot ICT(T, u_{user}) \cdot \left\{ \frac{M \cdot \left(FIR^{-1} \cdot \left(S_E - S_{SP} \right) \right)}{M \cdot \left(FIR^{-1} \cdot \left(S_{ICT} - S_{SP} \right) \right)} \right\}$$

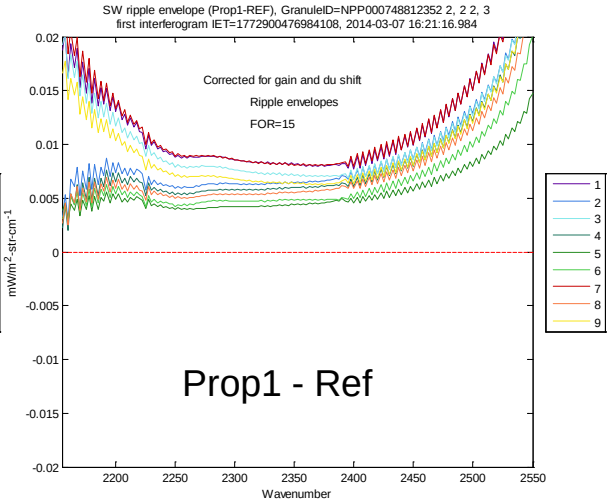
$$N = F_{s \to u} \cdot f \cdot SA_s^{-1} \cdot \left\{ \frac{FIR^{-1} \cdot \left(S_E - S_{SP} \right)}{FIR^{-1} \cdot \left(S_{ICT} - S_{SP} \right)} \cdot ICT(T, u_{sensor\_off\_axis}) \right\}$$

$$N = F_{s \to u} \cdot f_{ATBD} \cdot \left\{ \frac{SA_s^{-1} \cdot \left(FIR^{-1} \cdot \left(S_E - S_{SP} \right) \right)}{SA_s^{-1} \cdot \left(FIR^{-1} \cdot \left(S_{ICT} - S_{SP} \right) \right)} \cdot ICT(T, u_{sensor}) \right\}$$

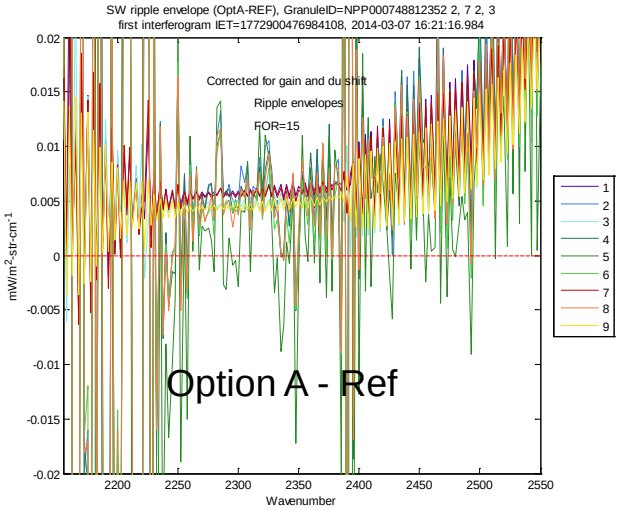
Ratio after interpolation & ISA



Ratio before interpolation



Ratio before interpolation & ISA



Ref= Prop2

$$N = ICT(T, u_{user}) \cdot \left\{ \frac{F_{s \to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot \left(FIR^{-1} \cdot \left(S_E - S_{SP} \right) \right)}{F_{s \to u} \cdot SA_s^{-1} \cdot f_{ATBD} \cdot \left(FIR^{-1} \cdot \left(S_{ICT} - S_{SP} \right) \right)} \right\}$$

Note: Ref does interpolation before ratio

Conclusions

- Doing interpolation after calibration ratio gives a different result than interpolation & ISA before calibration ratio
- Difference is entirely a modulated ringing at the Nyquist
- Effective comparison of calibration results can be done by comparing ringing envelope
- There are two distinct classes of calibration algorithms
  - Interpolation (and ILS correction) before calibration ratio
  - Interpolation (and ILS correction) after calibration ratio
- Definition of ISA matrix is only consistent with Interpolation & ISA before calibration ratio\
- Further analysis is ongoing produce optimal extended resolution spectra with correct calibration equation