The PACS WAVELENGTH SWITCHING SPECTROSCOPY MODE

An Introduction, Status and Brief Demo

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and the

PACS TEAM

Especially
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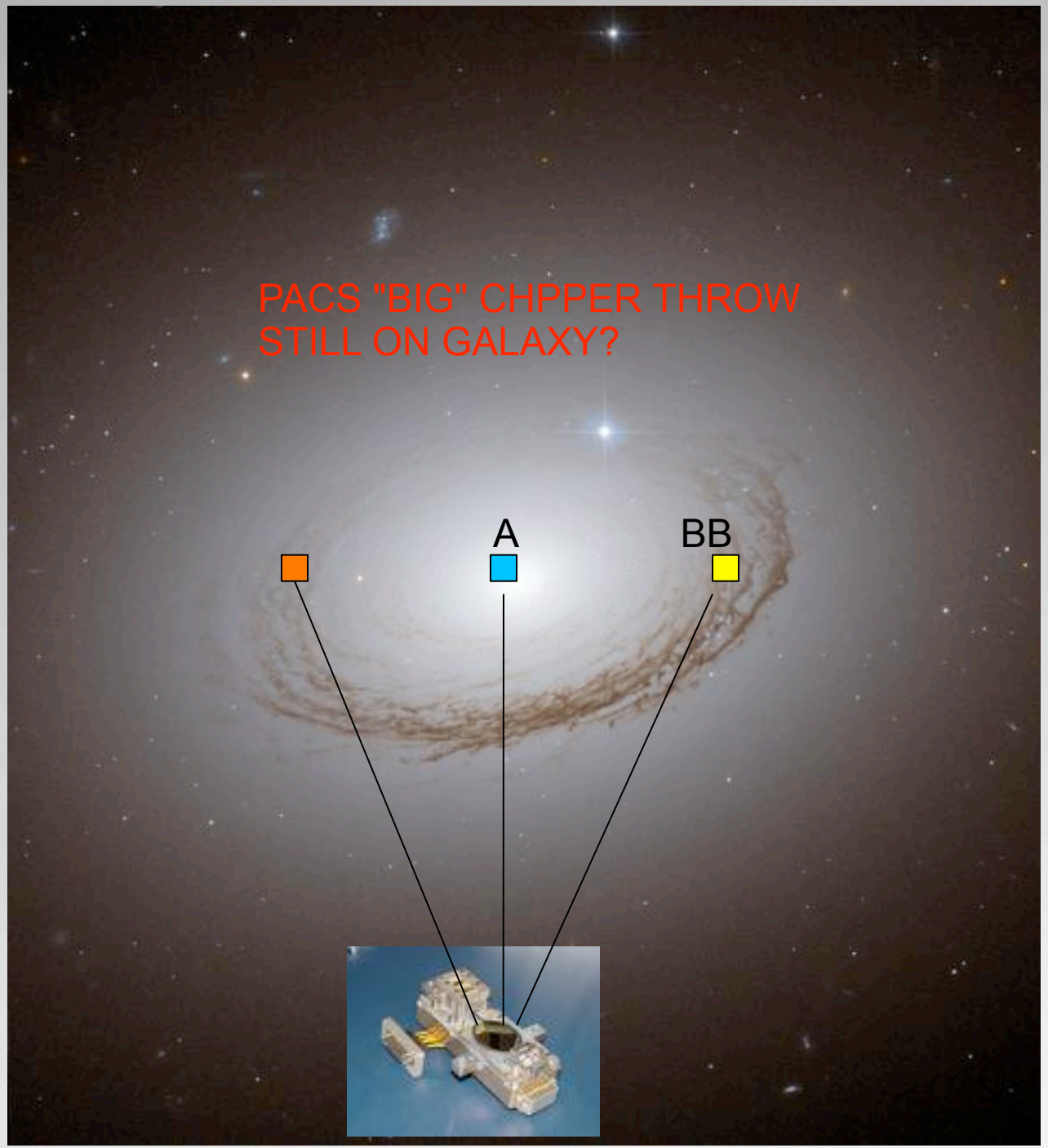
and with help from THE GOOD BREWERS OF Munich (MUNCHEN MUNCHEN)

Expectations

The Wavelength-switching (WS) Mode has now been released and the first observations will be taken in the next few weeks (MERRY CHRISTMAS DAY MOST LIKELY!)

The WS pipeline is still undergoing final testing and integration and is not ready yet for distributions to the community. However we hope to have a version ready for the January 25-29th 2010 NHSC DP Workshop at Caltech in Pasadena California (Home to Mountains Beaches and Earthquakes—oh and Palm Trees).

Today I will describe the philosophy of the pipeline, show some initial results taken in PV and give a brief demo of a recent version of the software to give a flavor of what to expect.



WHAT TO DO IF THE GALAXY IS TOO BIG?

ASK AN ASTRONOMER

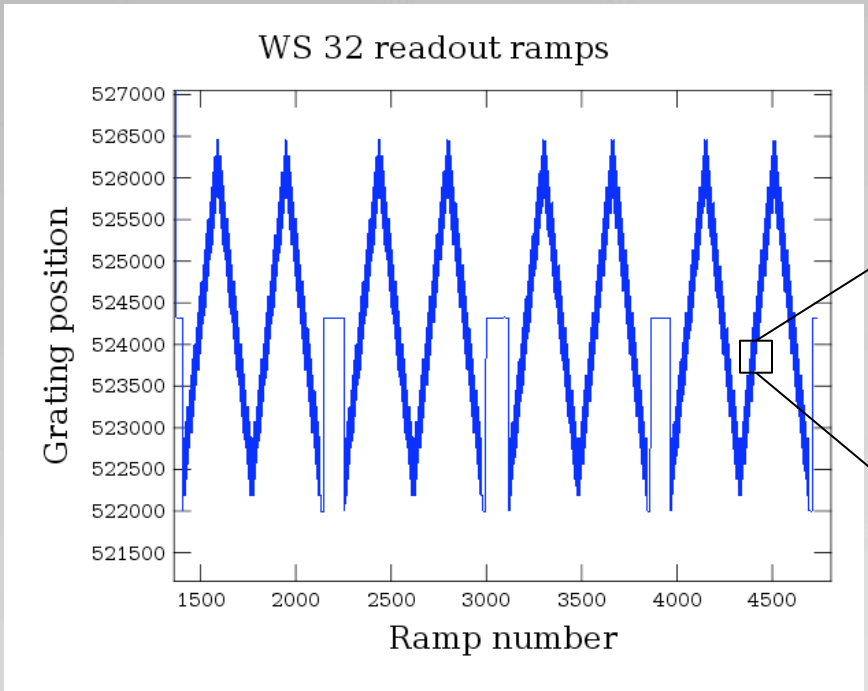
1*) HUH-- LOOK AT A STAR OF COURSE—THEN YOU DON"T HAVE THAT PROBLEM*

2) INVENT WAVELENGTH SWITCHING

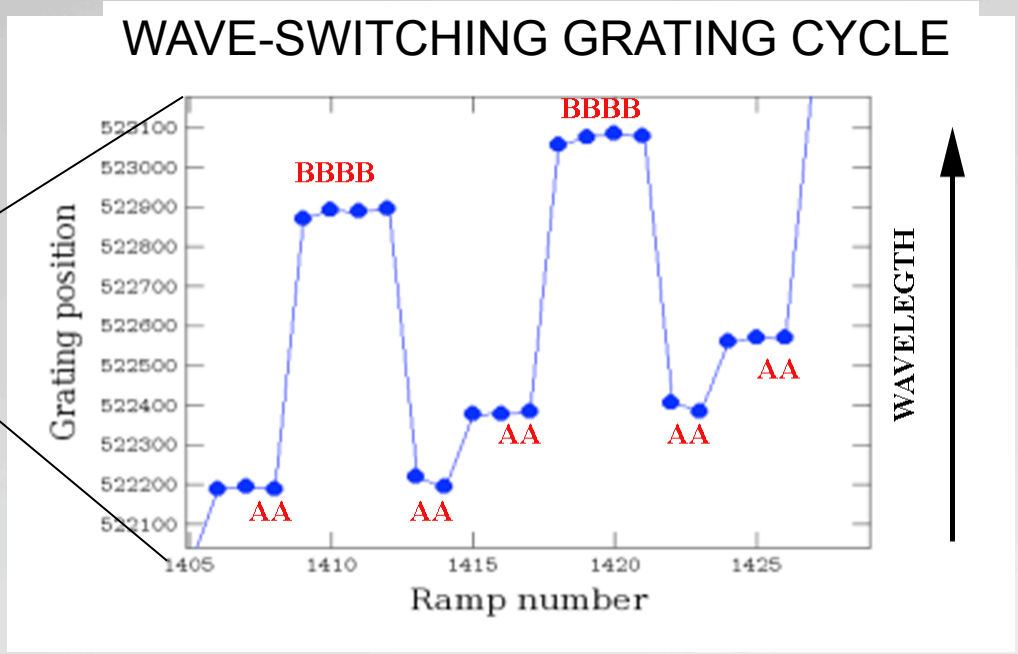
HOW DOES IT WORK?

GET YOUR "BACKGROUND" by SHIFTING IN LAMBDA OFF THE LINE...

REQUIRES A "RAPID BACK AND FORTH" MOTION OF CHOPPER

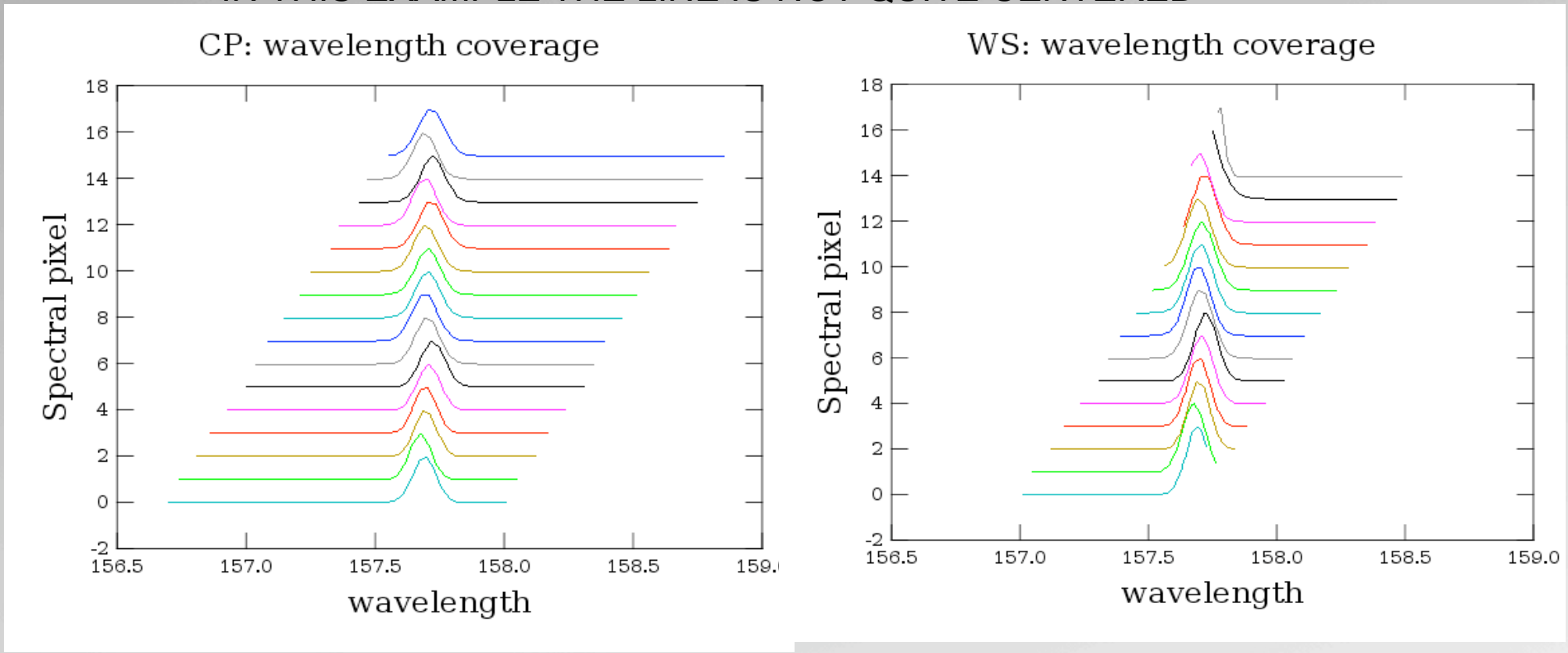


The WS technique consists of up and down-scans with 20 dithering steps.



Before each dithering step we perform a 9-point 1 stabilization + AABBBBAA.

COMPARISON WITH WAVELENGTH COVERAGE (BLUE around 88 microns [OIII])
IN THIS EXAMPLE THE LINE IS NOT QUITE CENTERED



CHOP-NOD 40 Grating STEPS

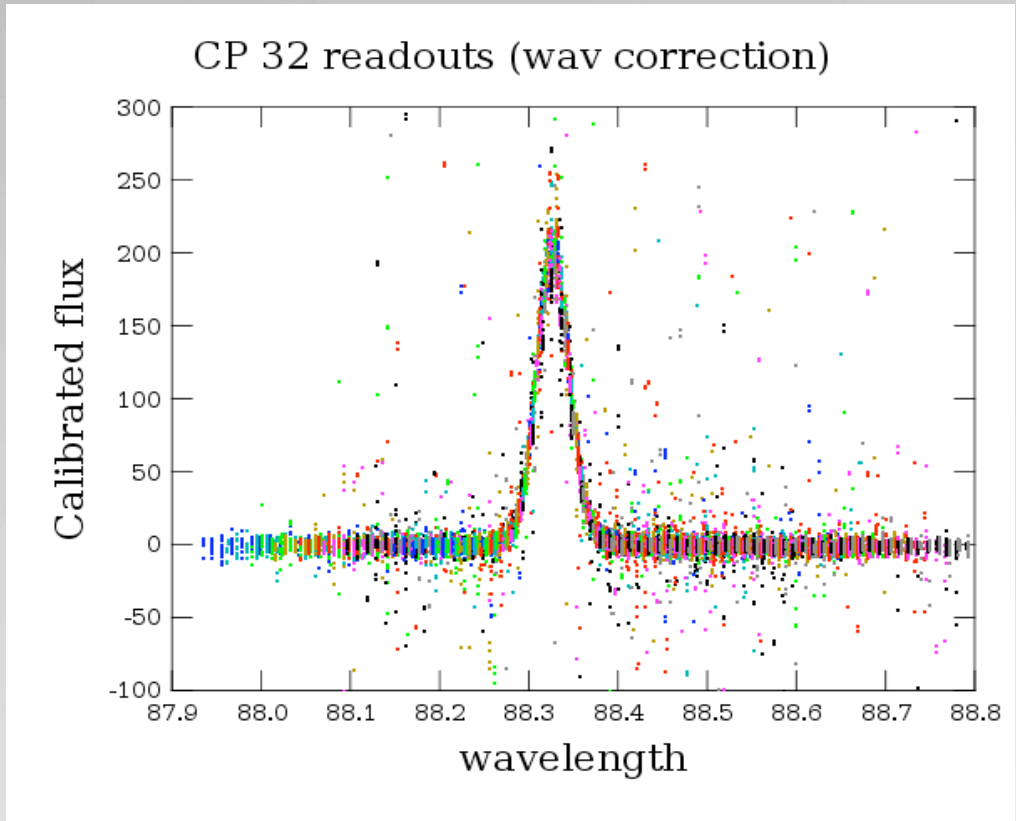
WAVE-SWITCHING 20 Grating Steps

The wavelength coverage is different in WS and CP. For the WS switching because of efficiency considerations we currently only perform 20 steps and so some of the scan contain continuum only.

WAVELENGTH SWITCHING ON STRONG SOURCE

THERE ARE TWO WAYS TO CREATE A SPECTRUM

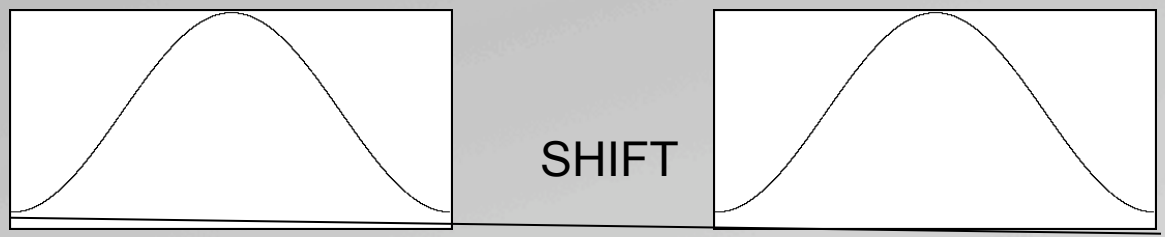
DIRECT METHOD: VISUALIZE ALL THE POINTS
WITHOUT SUBTRACTING THE A's and B's



THIS PRODUCES REMARKABLE GOOD RESULTS FROM TESTS PERFORMED SO FAR. GLITCHES ARE MINORITY OF SAMPLES –CASE OF EXCELLENT REDUNDENCY....

METHOD TWO SHIFT AND DIFFERENCE

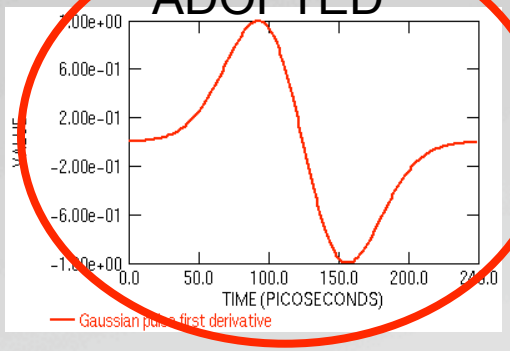
JUMP BACK AND FORTH BETWEEN TWO WAVELENGTHS AND SUBTRACT



SHIFT

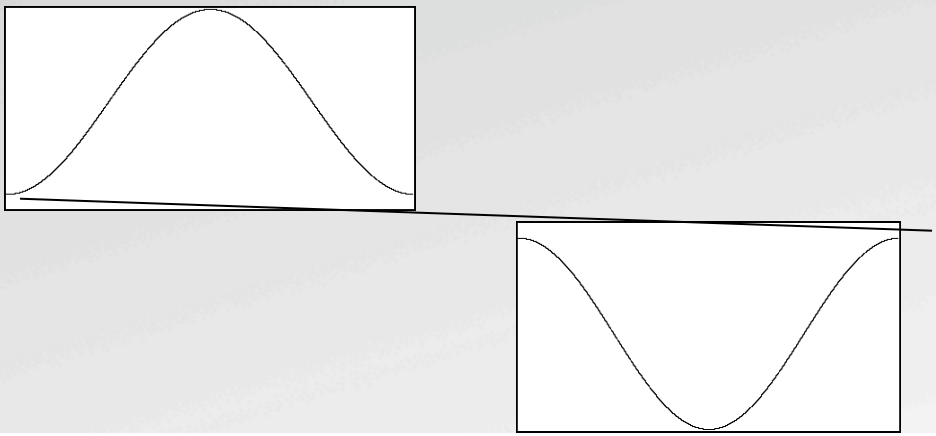
SUBTRACT

ADOPTED

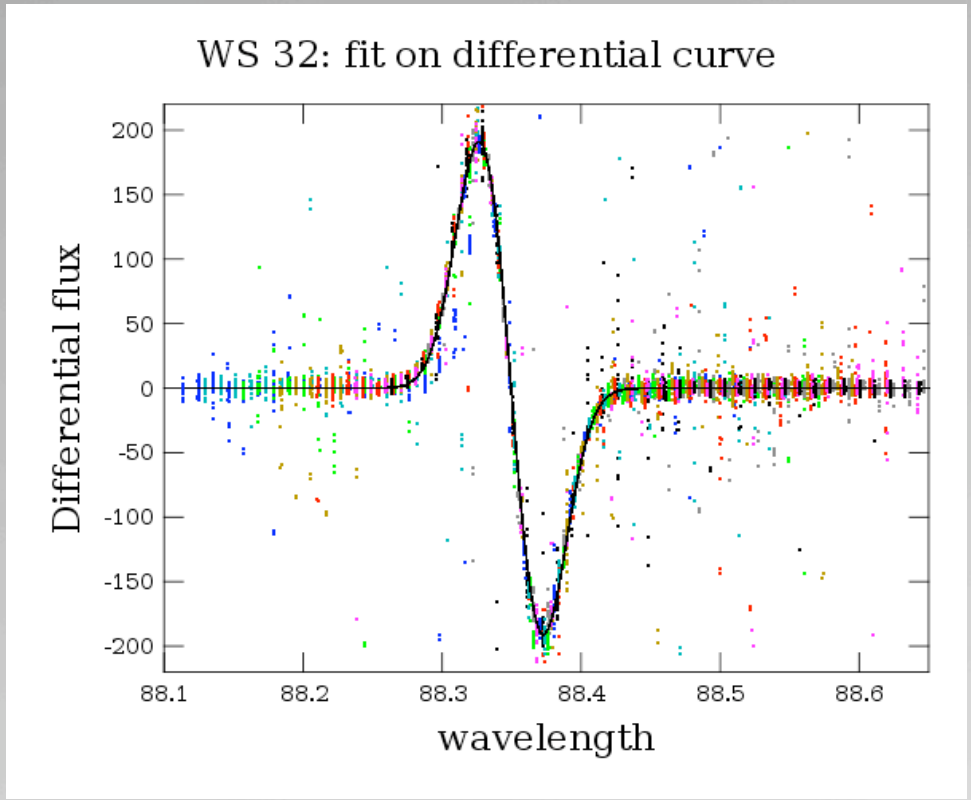


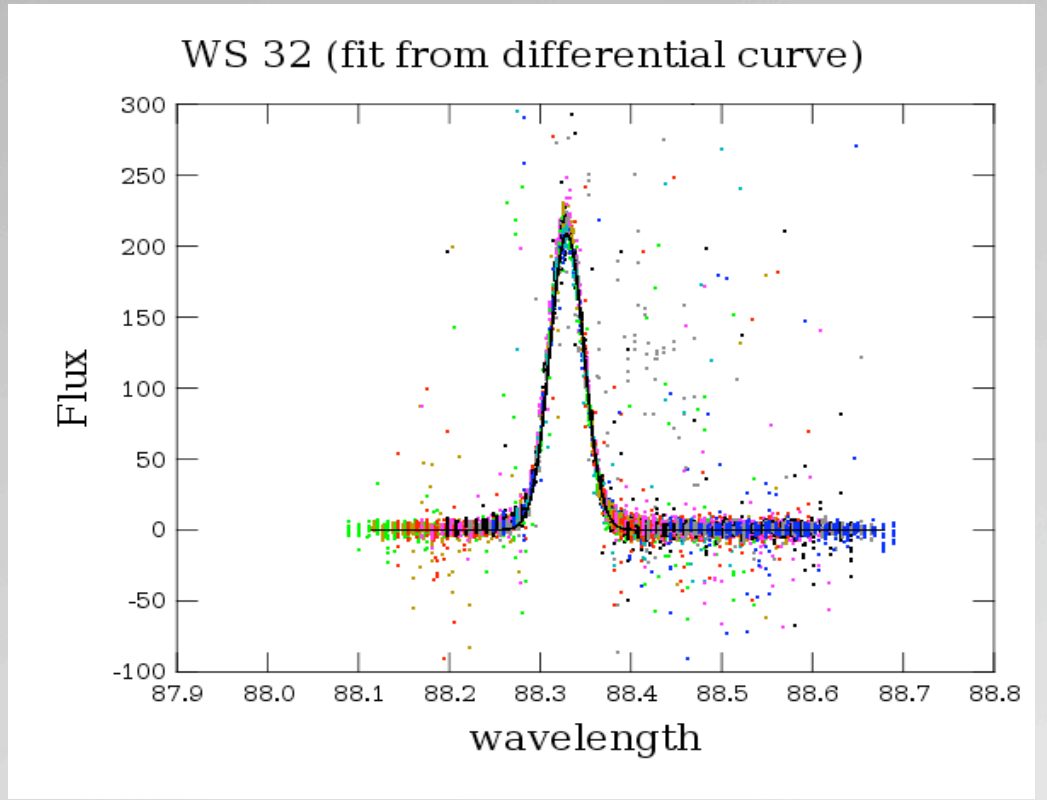
SMALL SHIFT

LARGE SHIFT



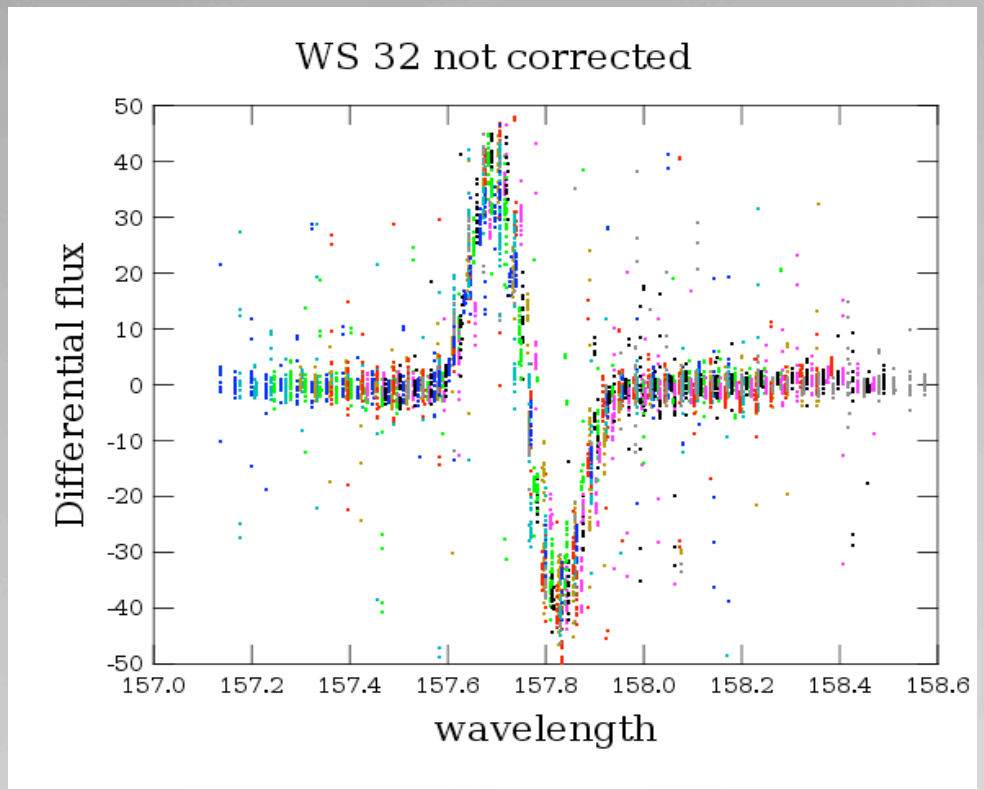
BIG JUMPS CAUSE TRANSIENTS

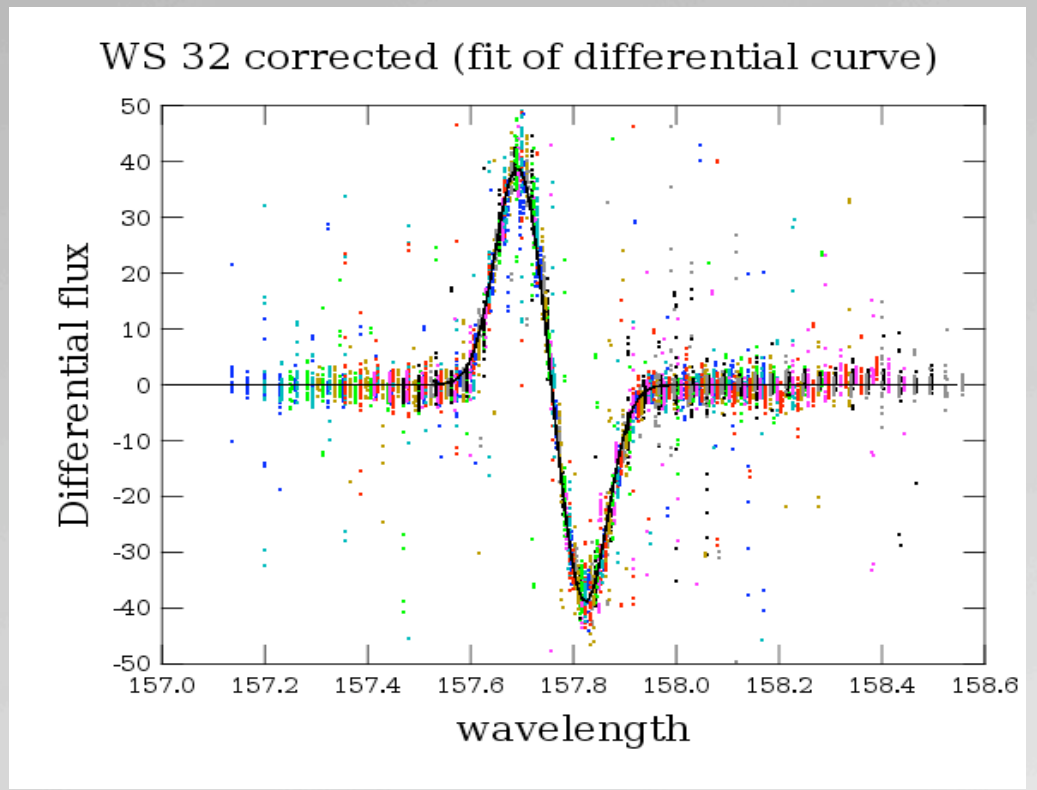




We fit the data with a Gaussian. In the case of WS, the fit is done on the difference of the 2 Gaussians. The fitted Gaussian recovers remarkably well the original curve (on The right) obtained directly by DIRECT METHOD.

	Center	FWHM	Amplitude	Residual RMS
CP32	88.327	0.044	197.5	5.65
WS32	88.329	0.044	208.6	5.97

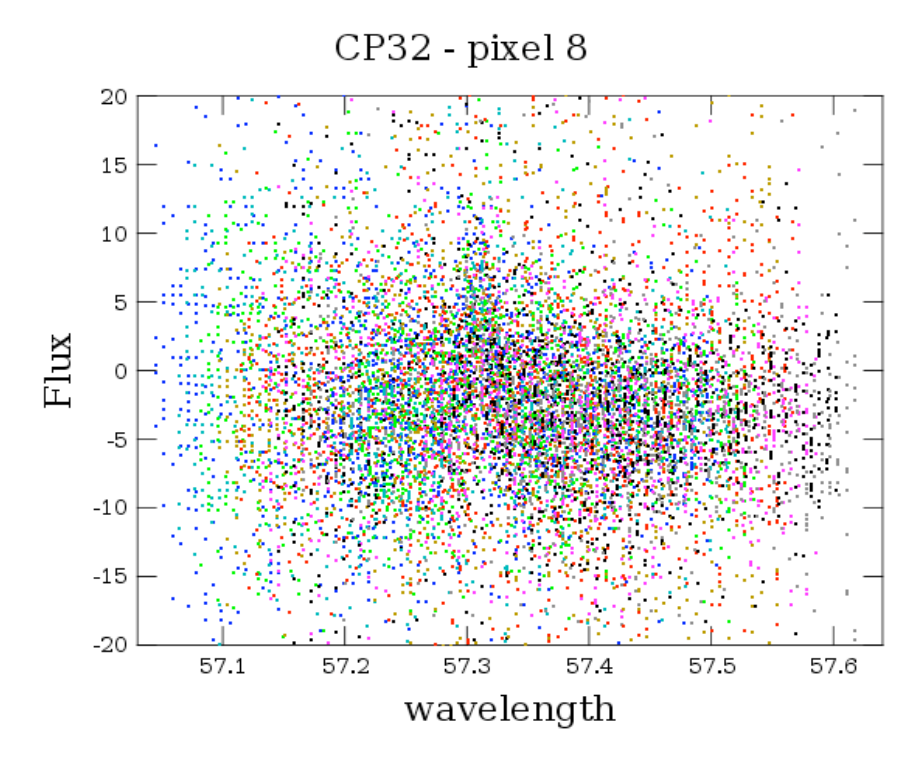


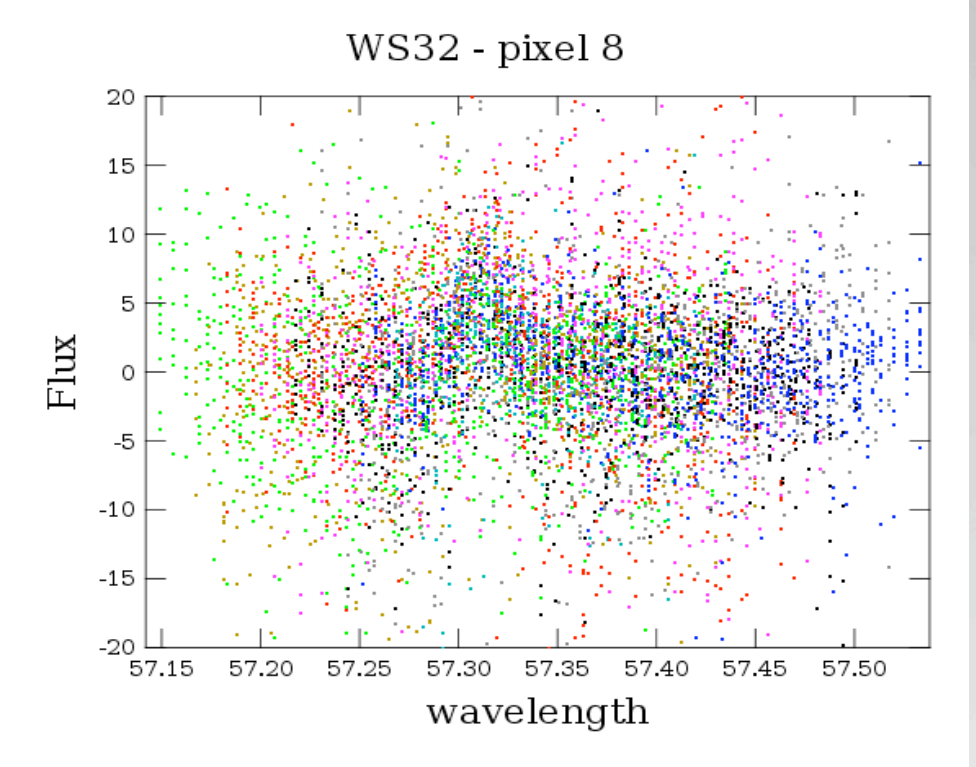


STILL CURRENTLY SOME WAVELENGTH CALIBRATION ISSUES THAT ARE BLURRING THE FIT, BUT THIS WIL BE FIXED SOON!

WHAT ABOUT FAINT LINES?

DOES IT WORK????

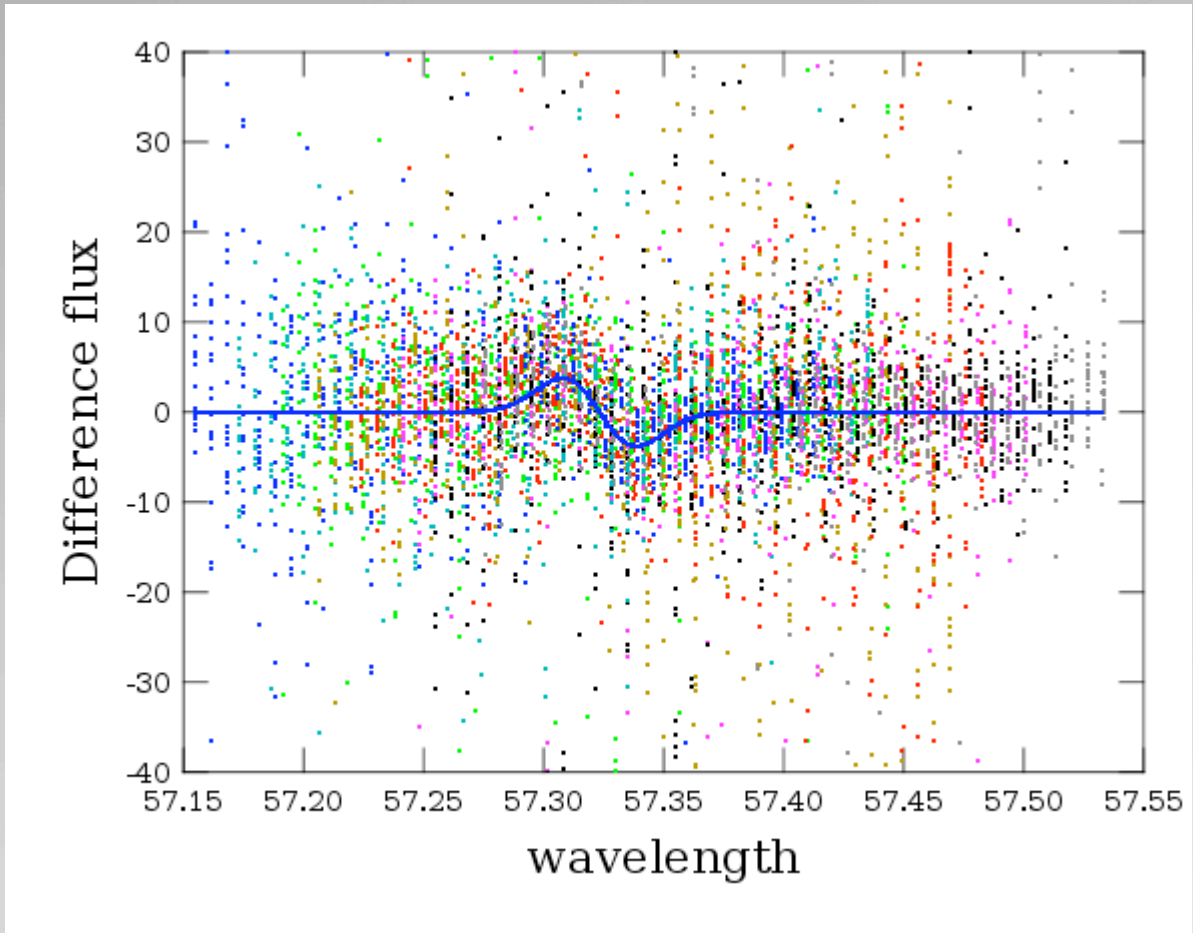




The faintest line detected was the [NII] 57um.

The line is clearly visible in the cloud of points in chopping mode and in wavelength switching (direct curve).

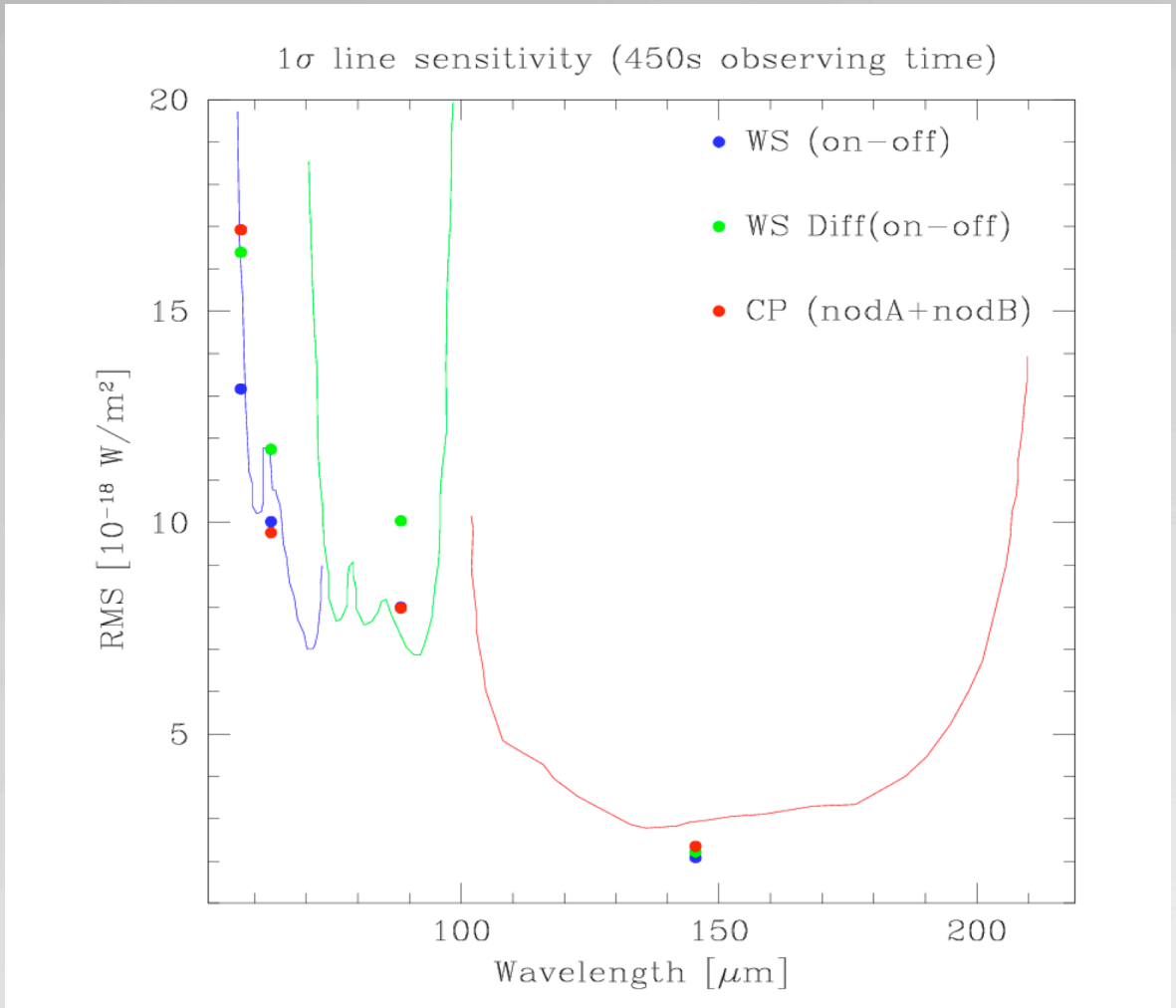
We didn't correct for the inaccurate wavelength calibration since the signal is too faint to fit it out.



It is possible to fit the differential curve even in faint case.

The recovered flux is 4.4 in WS with a SNR of the fitted Amplitude of 17. In the case of CP, the recovered amplitude Is 5.0 with a SNR of 14.

Comparison between WS and Chop-Nod



WS (BOTH METHODS) DOES QUITE WELL IN COMPARISON WITH CHOP-NOD!

Status of Pipeline for WS Mode

- BASIC FUNCTIONALITY NEARLY THERE
- CUBE BUILDING OF DIRECT SPECTRUM COMPLETE
- BUILDING OF "MODEL CUBE" ALMOST DONE
- SLICING BY RASTER
- JANUARY 26-27 NHSC PACS WORKSHOP --WILL RELEASE PIPELINE THEN...

Final Thoughts

- WHAT IF YOUR LINE IS NON_GAUSSIAN OR SKEWED?
  --- (MODEL CAN BE VARIED—LIBRARY OF MODELS? OR
- ARE YOU SKEWWED??? PROBABLY NOT...

- WHAT IF LINE IS BROAD? GOOD LUCK...

- WHAT IF YOU GET THE REDSHIFT WRONG A BIT???
  (DON'T!!)

- SHALL WE INCLUDE THE RESIDUAL IN THE MODEL CUBE?
  (YES)
- ARE THE "OFF" OBSERVATIONS NEEDED? HOW OFTEN?
  CADENCE NOT YET FULLY EXPLORED

- MAPPING STRATEGY—TO PRODUCE GOOD COVERAGE
  CONSULT RELEASE DOCUMENT FOR MORE INFO..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