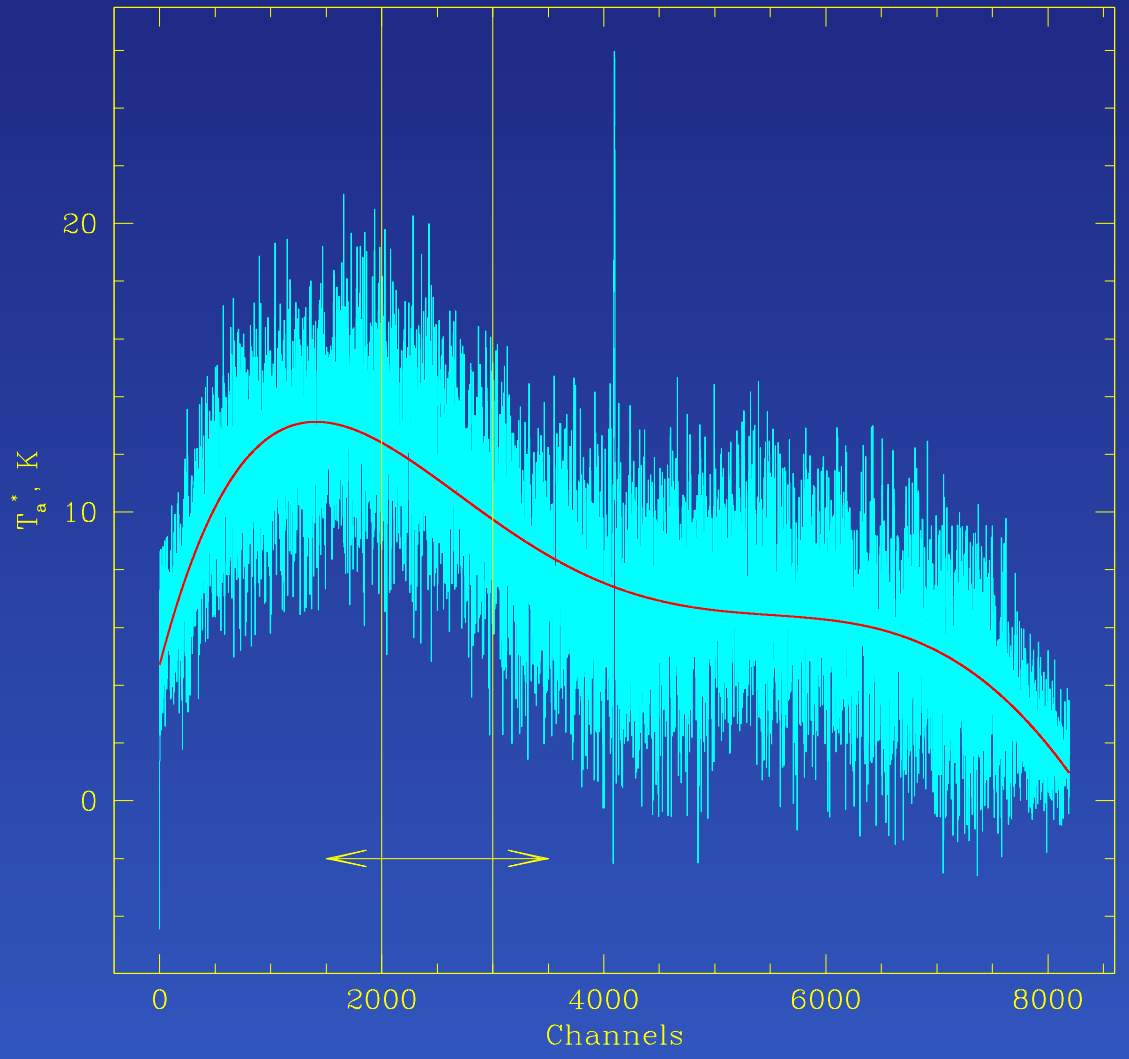
ASAP: automatic spectral line search and baselining

Maxim Voronkov

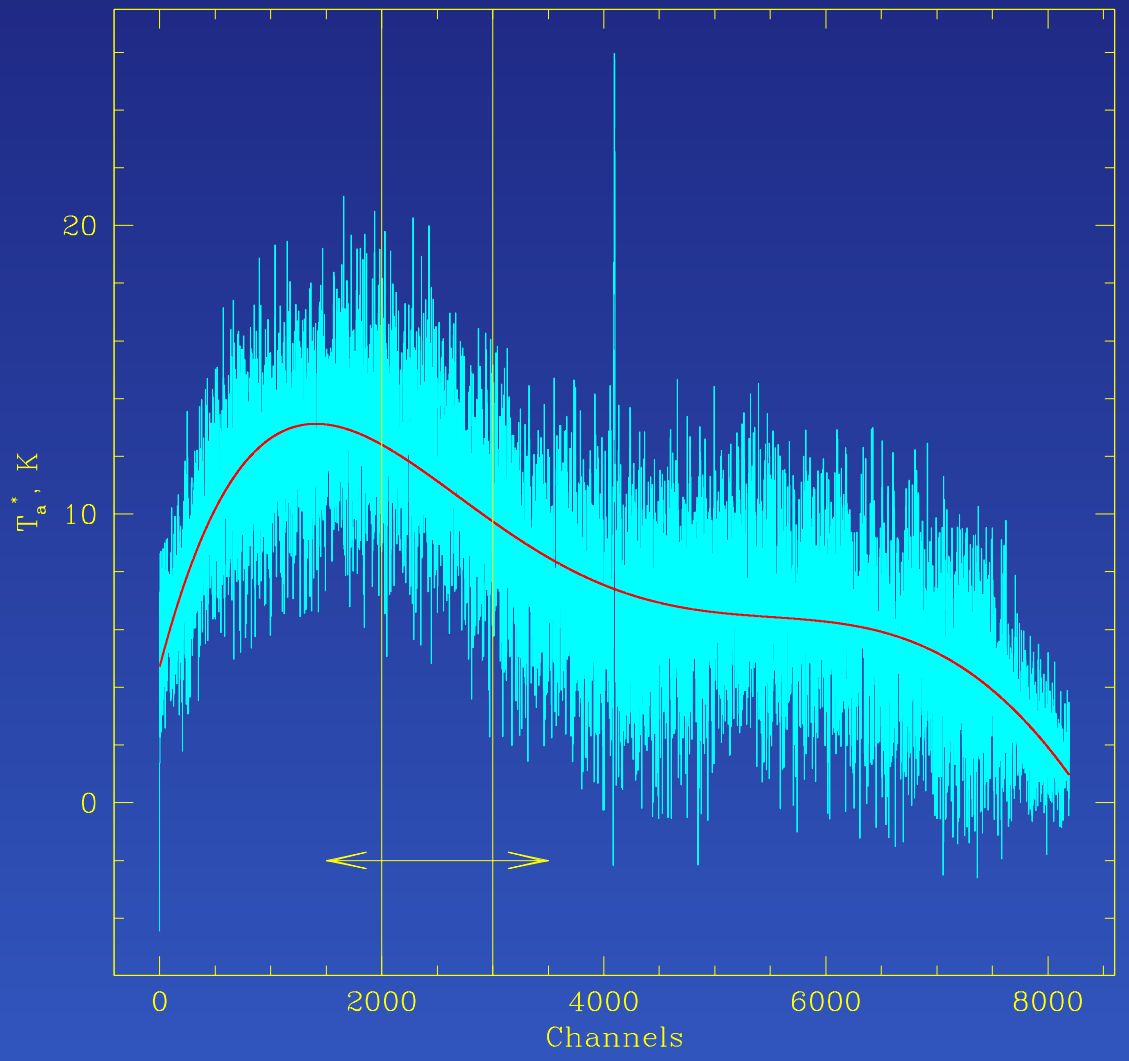
ATNF, Narrabri

Line search and baselining



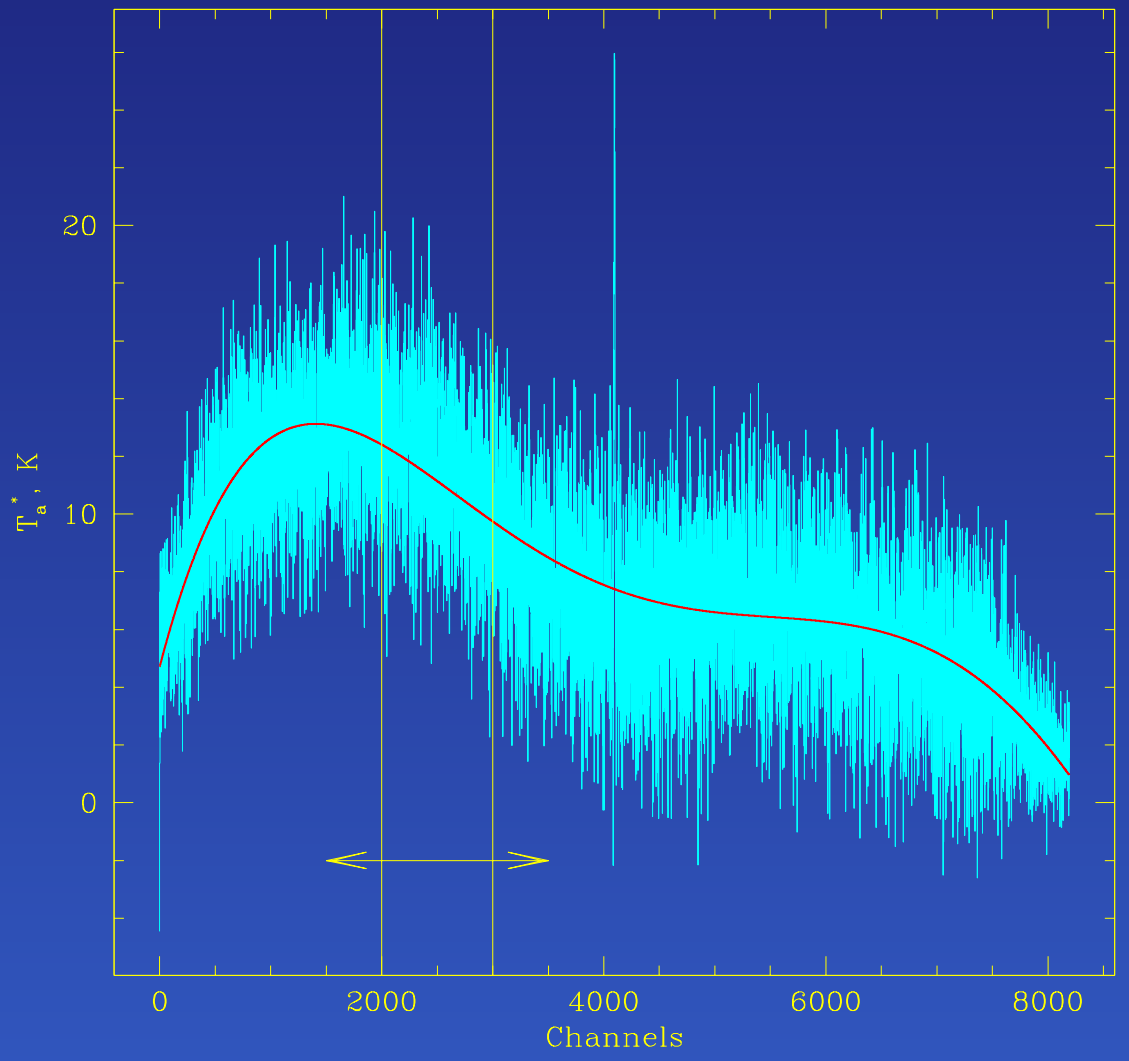
- Spectral lines are expected to be much narrower than the baseline undulations
- One can calculate running mean and variance and compare them with the fluxes of individual spectral channels

Line search: problems



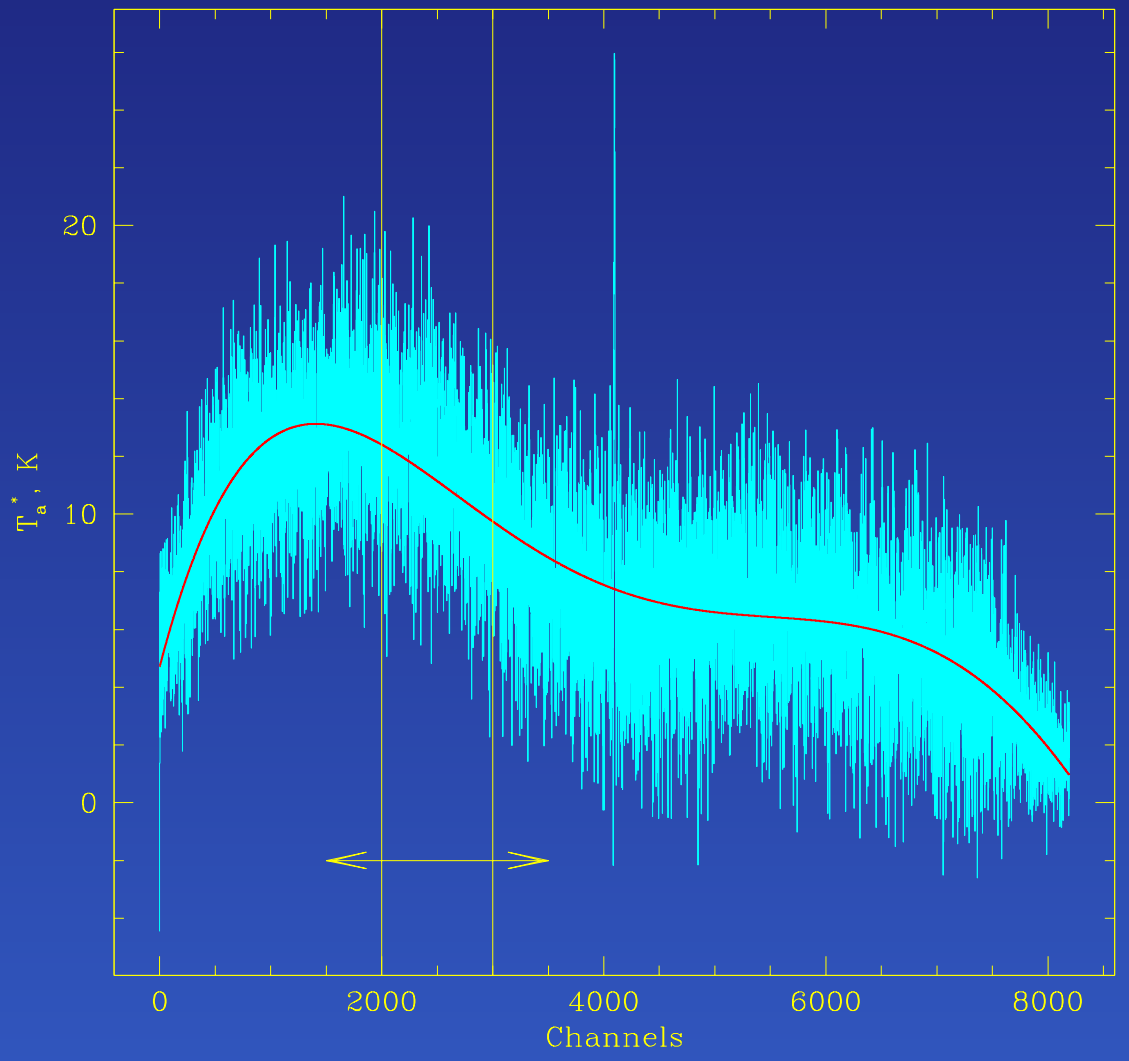
- Baseline may have a significant slope
  - Work with the residual of the linear least square fit

Line search: problems



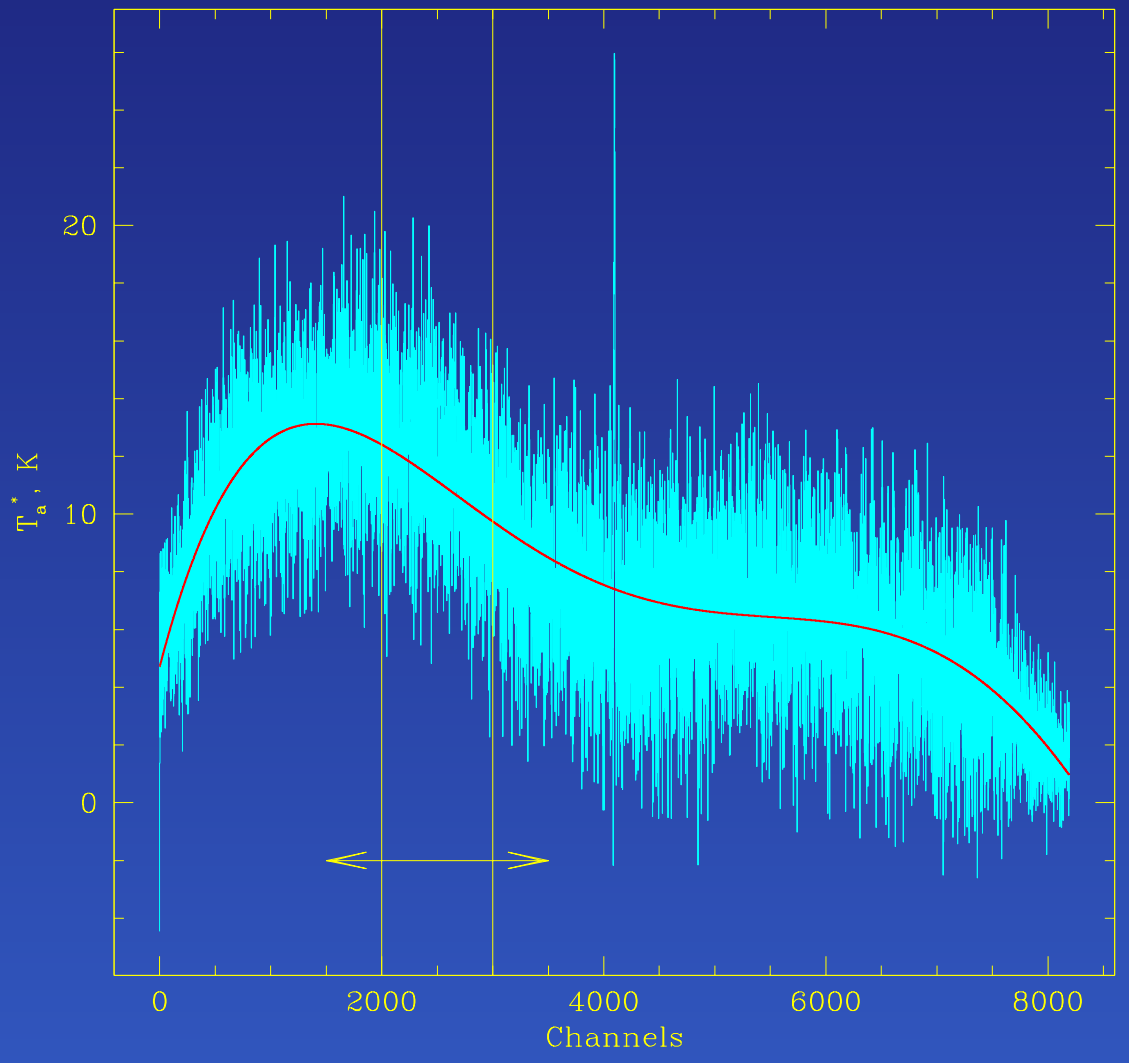
- Baseline may have a significant slope
- The off-line noise is unknown if we don't know where the lines are
  - Use the mean of, say 80%, smallest values of the variance calculated for different box positions

Line search: problems



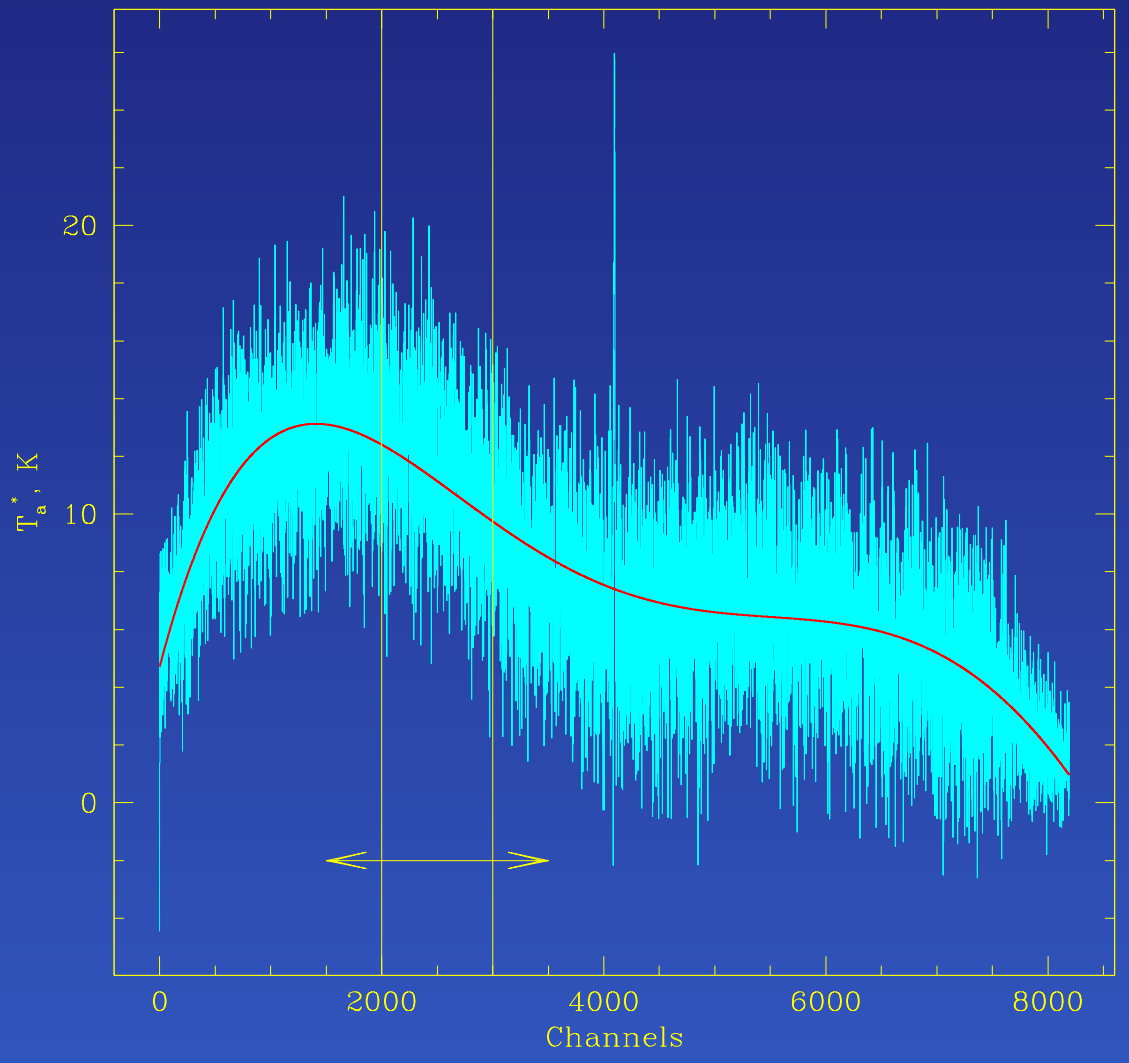
- Baseline may have a significant slope
- The off-line noise is unknown if we don’t know where the lines are
- Strong lines can affect the statistics and create spurious absorption features
  - Multiple iterations

Line search: problems



- Baseline may have a significant slope
- The off-line noise is unknown if we don't know where the lines are
- Strong lines can affect the statistics and create spurious absorption features
- Line wings are below a detection threshold
  - Need a wing detection procedure

Line search: problems



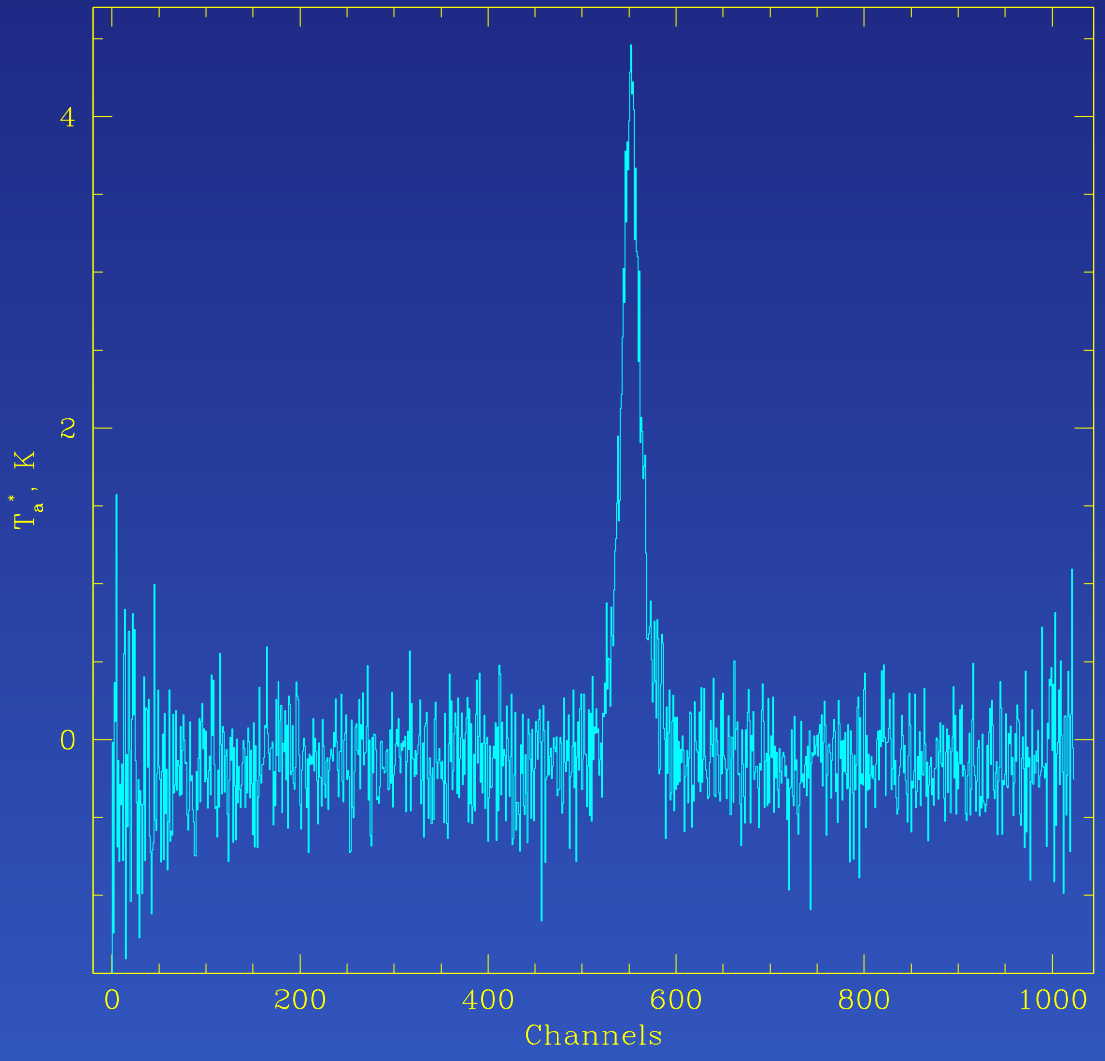
- Baseline may have a significant slope
- The off-line noise is unknown if we don't know where the lines are
- Strong lines can affect the statistics and create spurious absorption features
- Line wings are below a detection threshold
- Oversampled lines
  - Internal averaging

Interface

```
# Line search
fl=linefinder()
fl.set_scan(scan,edge=(200,100))
fl.set_options(threshold=3)
nlines=fl.find_lines()
if nlines!=0:
    print "Found",nlines,"spectral lines:", fl.get_ranges()
else:
    print "No lines found!"

# automatic baselining
scan.auto_poly_baseline(order=3)
```

Examples: A spectrum from Mopra



For this Mopra spectrum, the algorithm with the rejection of 50 channels from each side and 3σ detection limit finds the line at 522–580 channels

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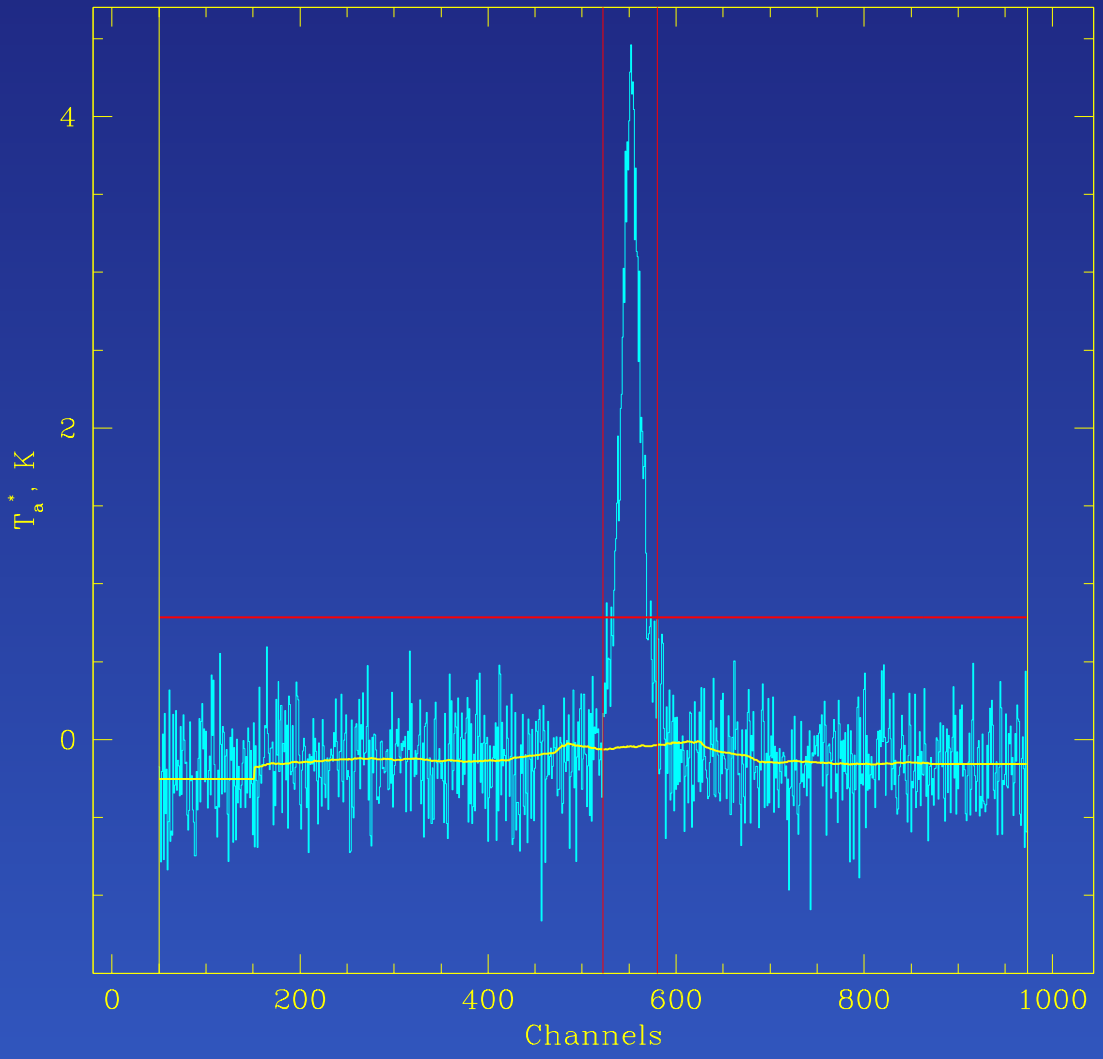

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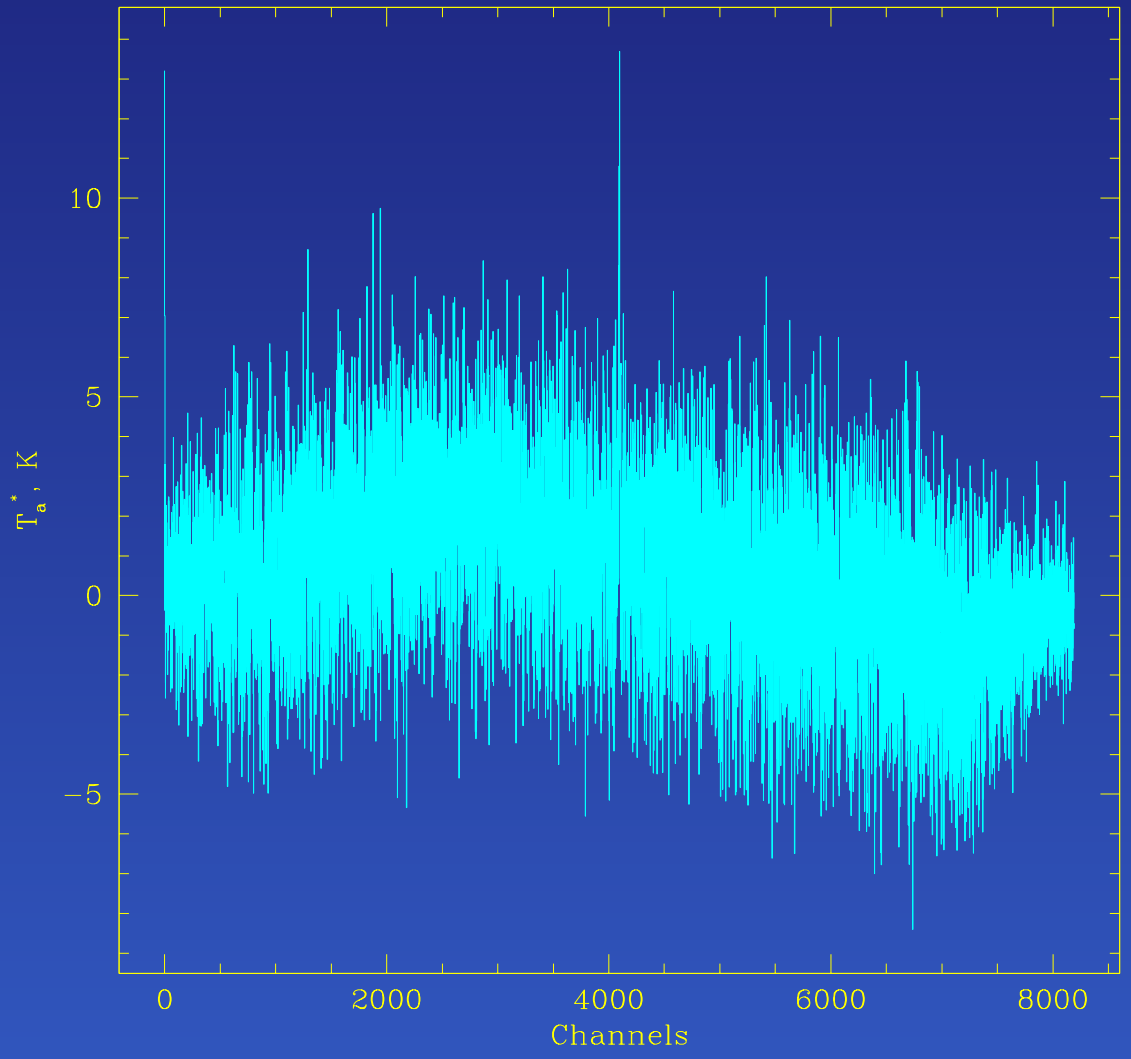
Examples: a weak line



For this spectrum, the algorithm detects a line above the 3σ detection limit at 4086–4108 channels. Averaging of adjacent channels is necessary here to reveal the line.

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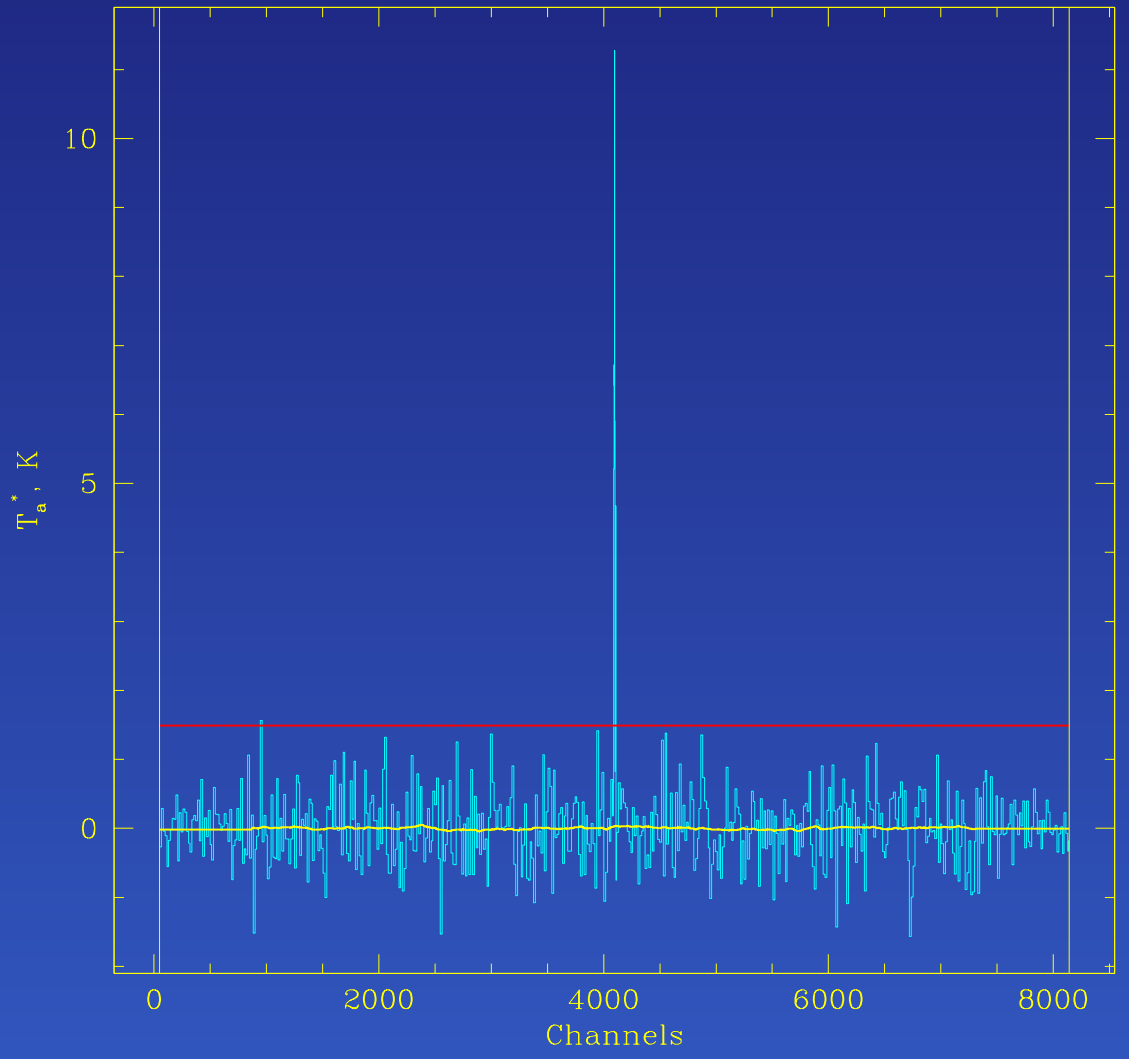

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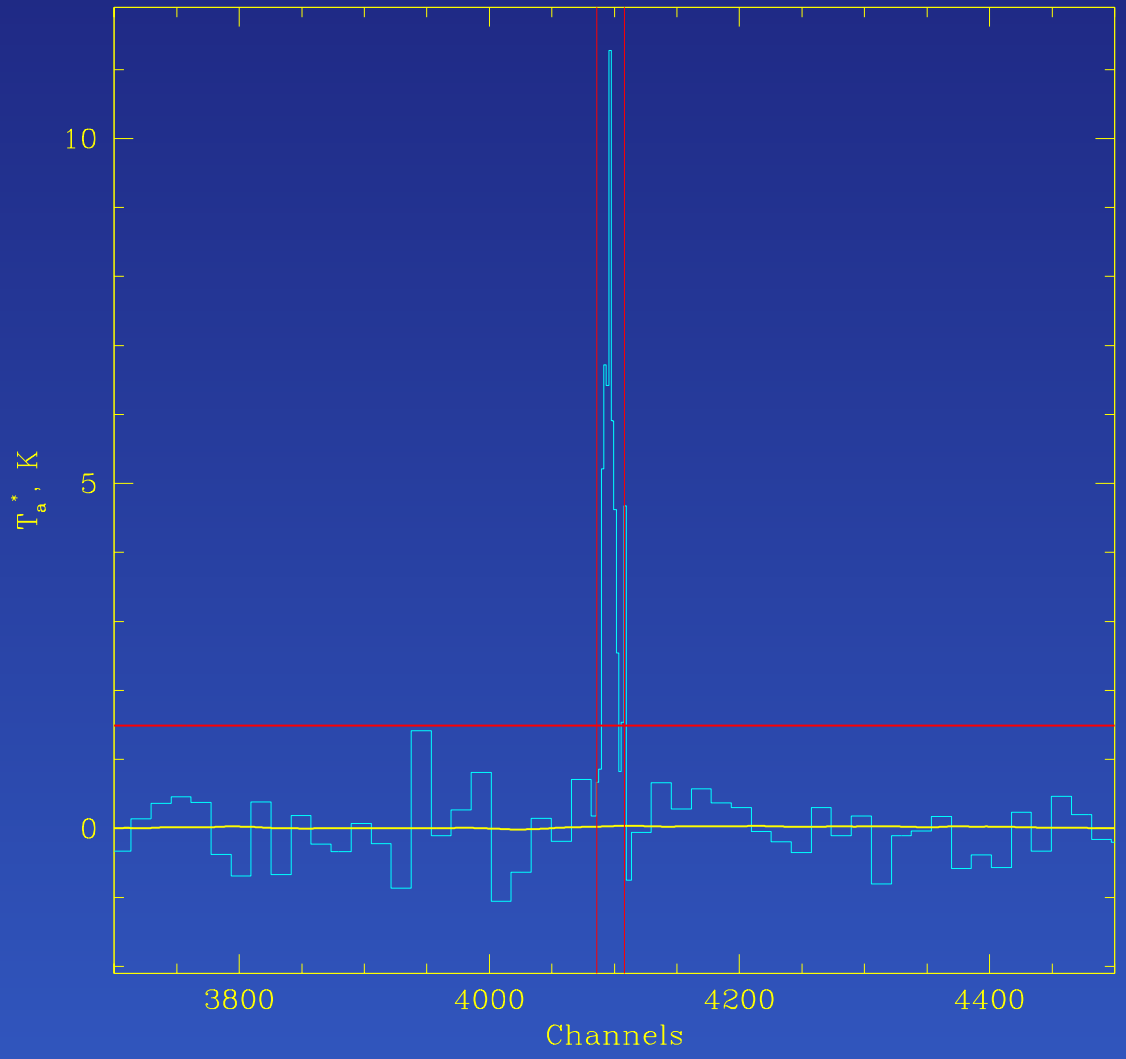

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