PNC project at Villetaneuse: last news

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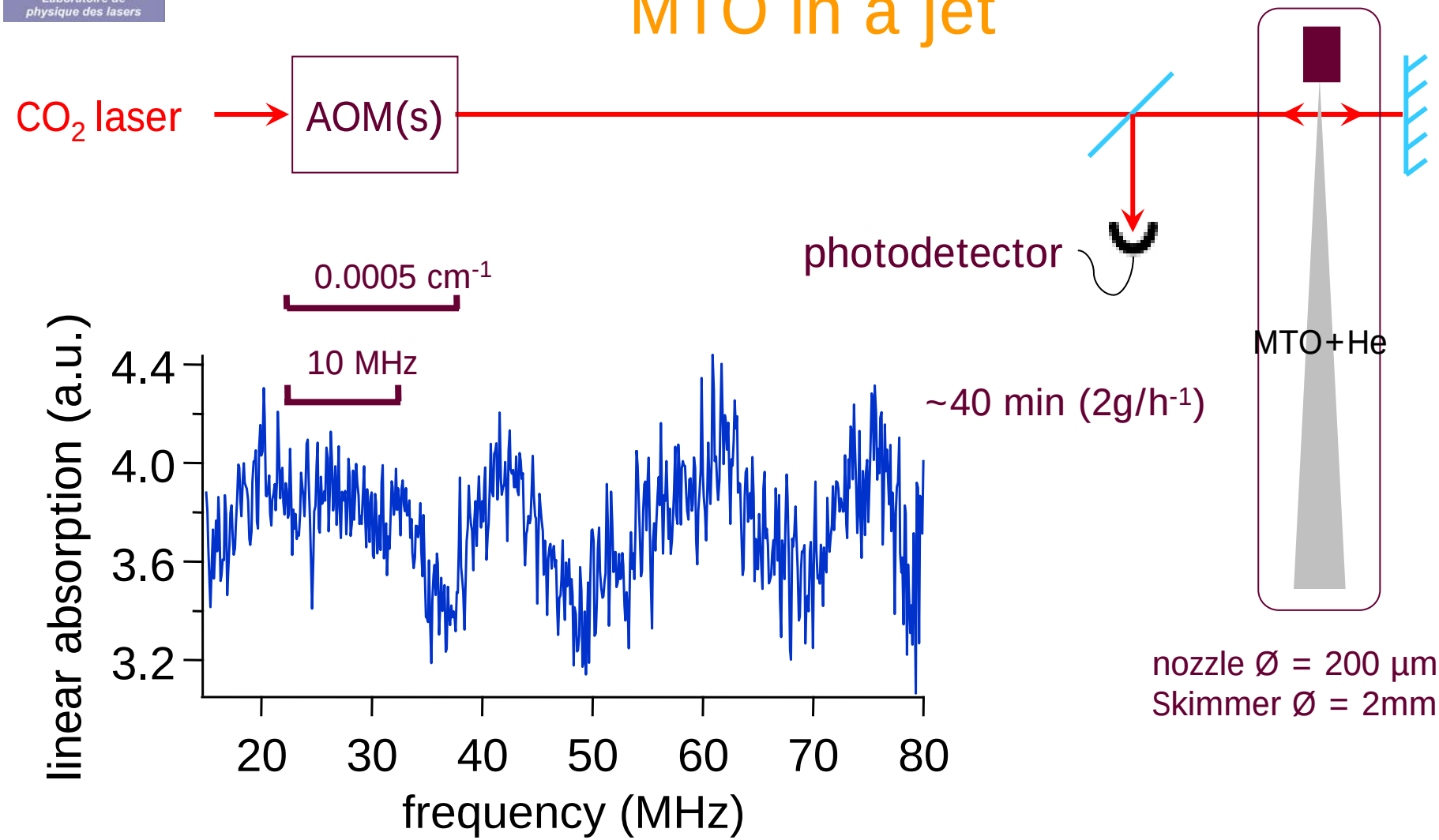
NCPCHEM meeting, Rennes,
05/10/2011

Linear absorption spectroscopy of MTO in a jet

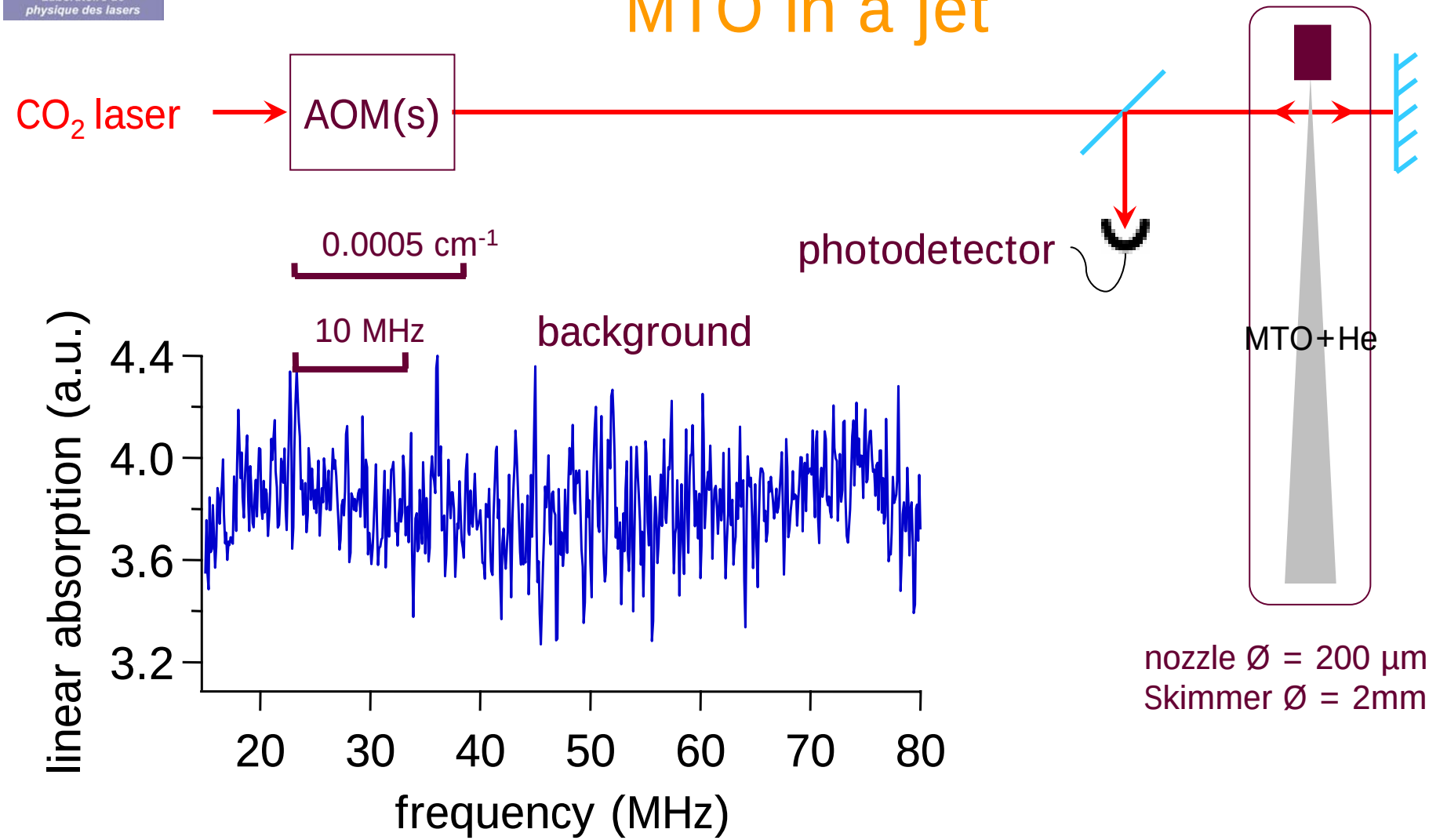


~40 min (2g/h^{-1})

nozzle Ø = 200 µm
Skimmer Ø = 2mm

centred around *R*(20) + 160 MHz

Linear absorption spectroscopy of MTO in a jet



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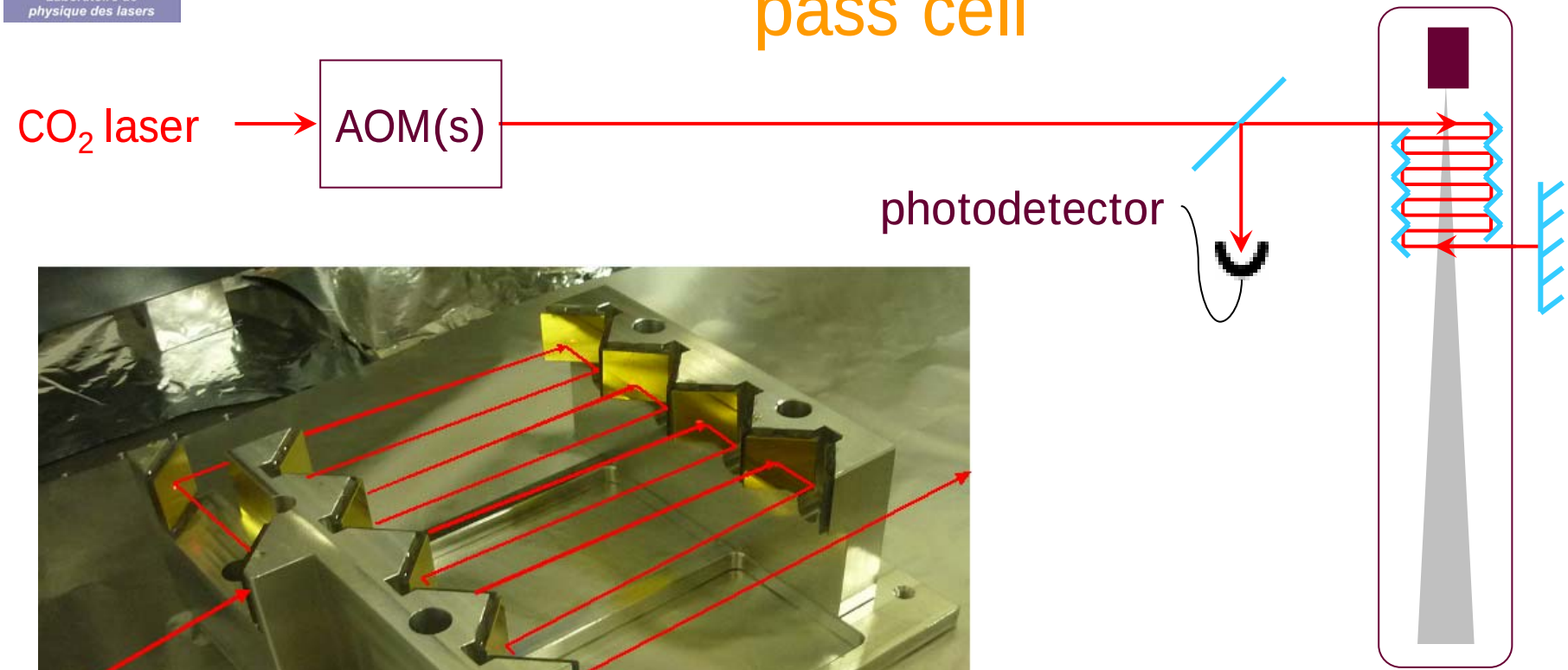
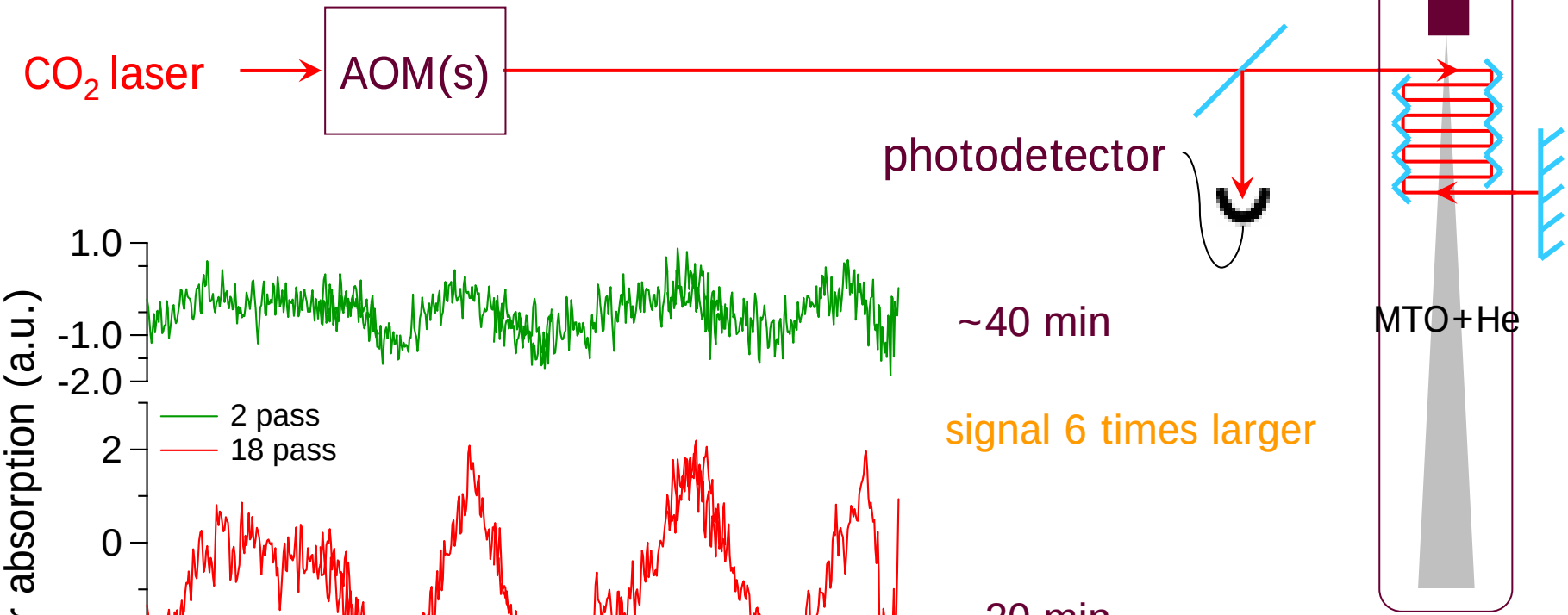
Jet spectroscopy of MTO with a multi-pass cell



18 pass back and forth

⇒ increase the signal to noise ratio (<9)

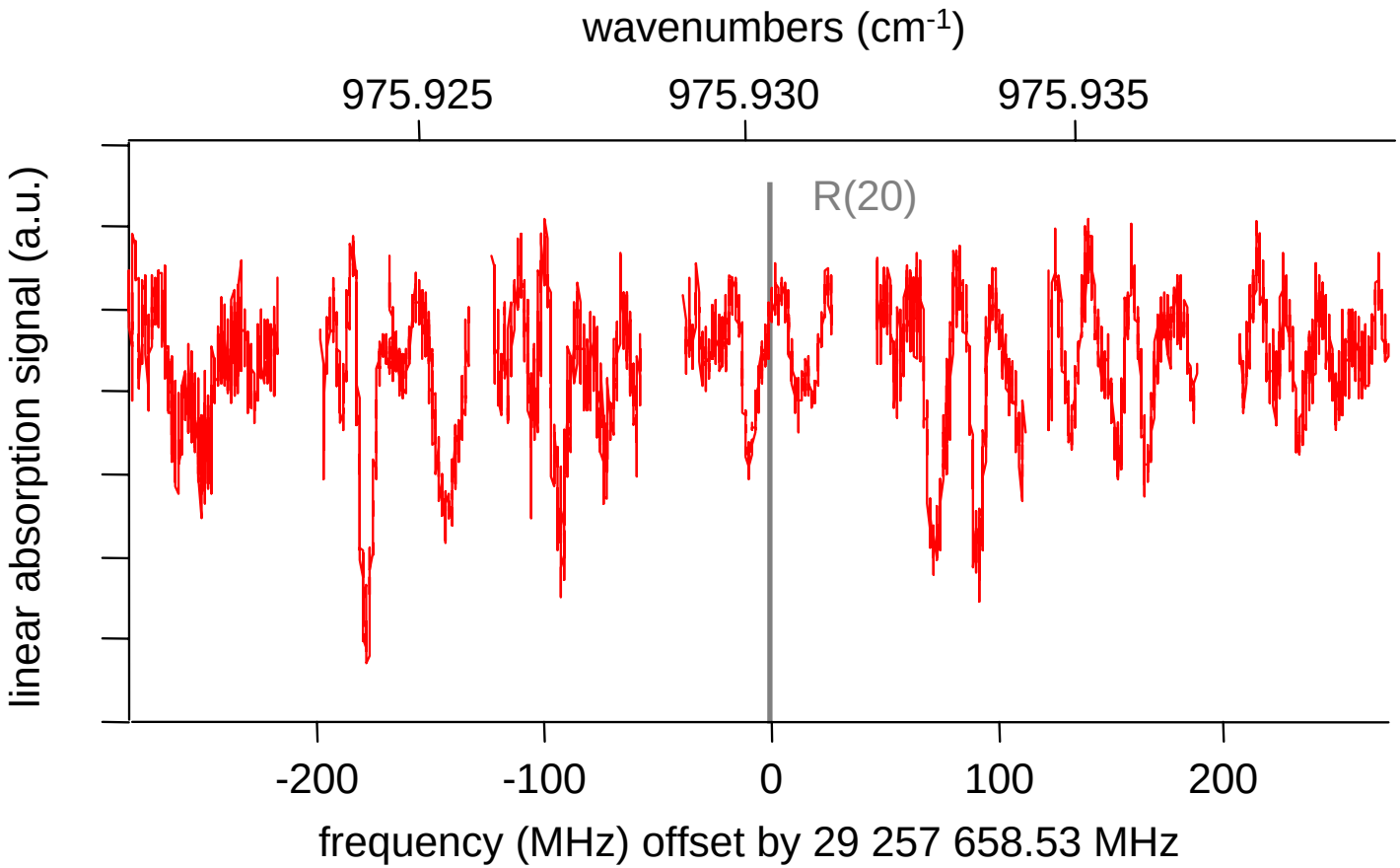
Jet spectroscopy of MTO with a multi-pass cell



enable systematic studies of the different experimental parameters

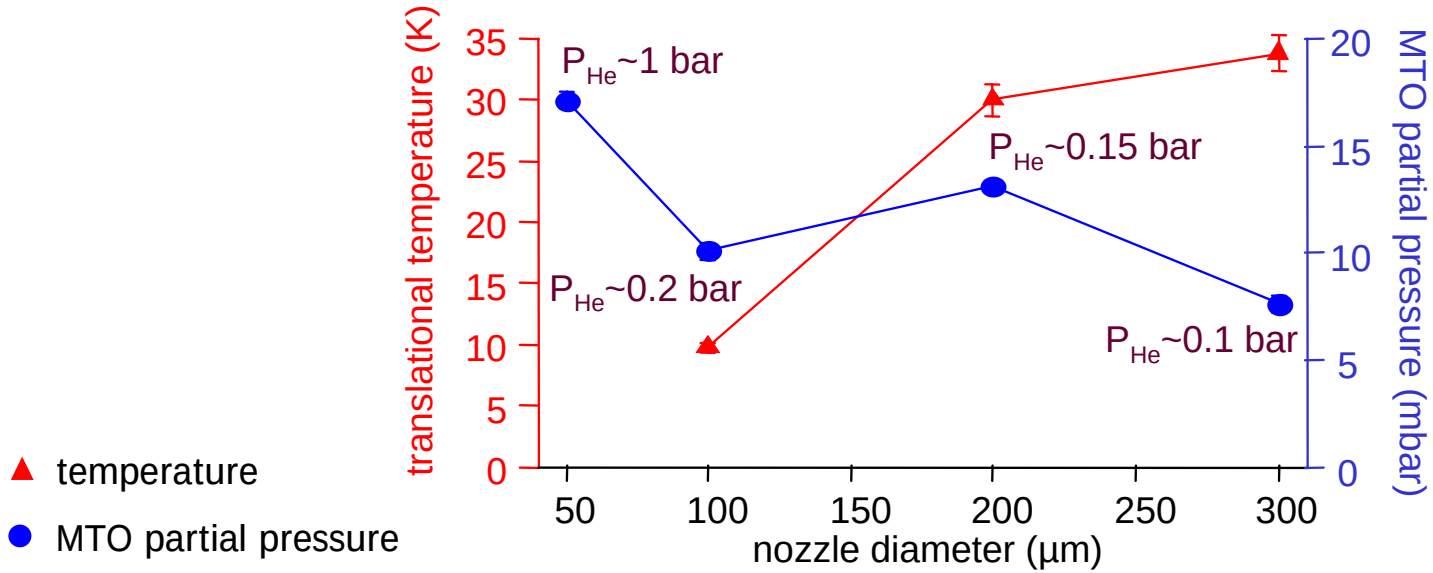
Jet spectroscopy of MTO with a multi-pass cell

±280 MHz explored around the *R*(20) CO_2 laser line



What we know from time of flight measurements

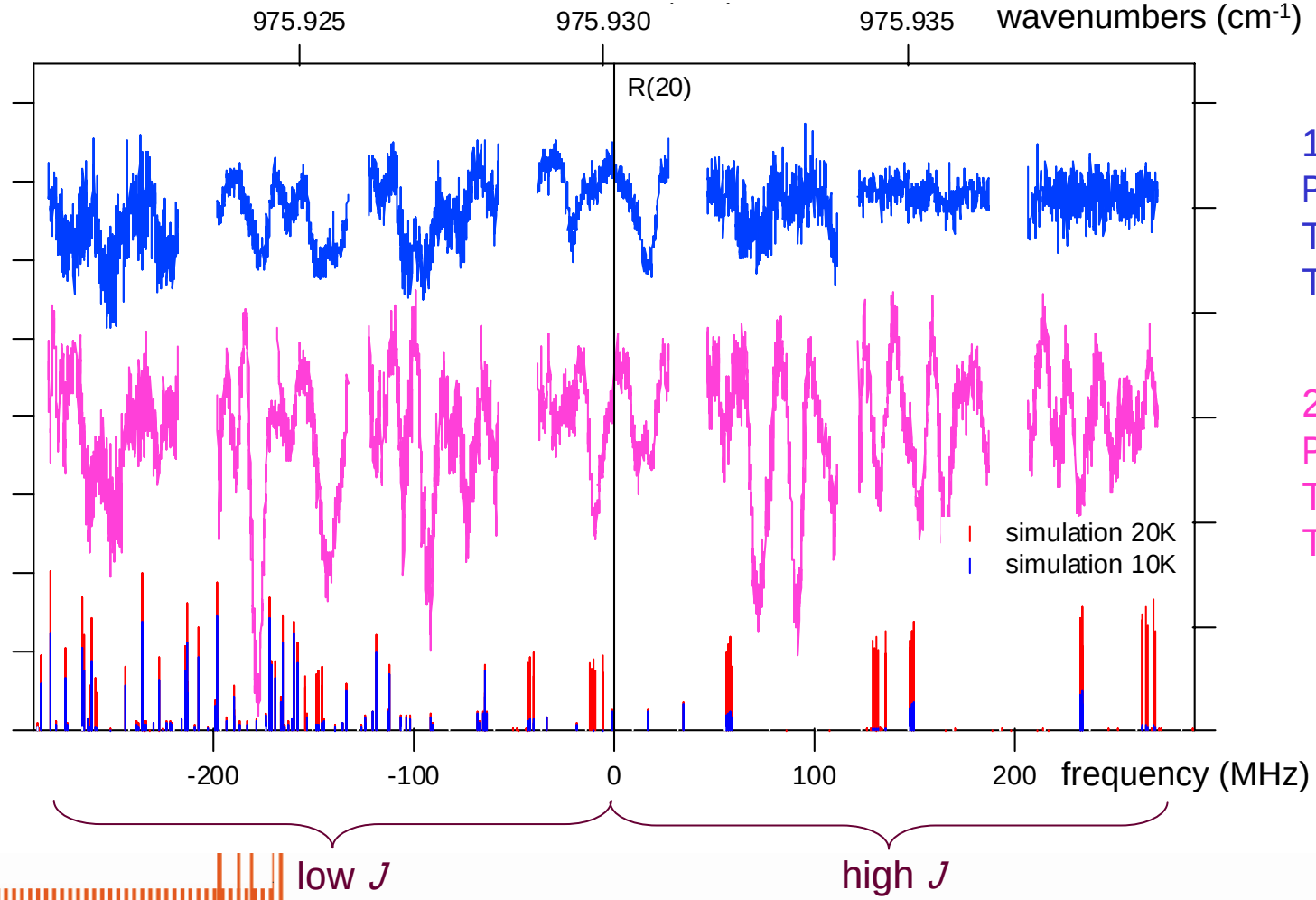
changing nozzle diameter



$T_{reservoir}$ ~ 80°C

Jet spectroscopy of MTO with a multi-pass cell

changing nozzle diameter

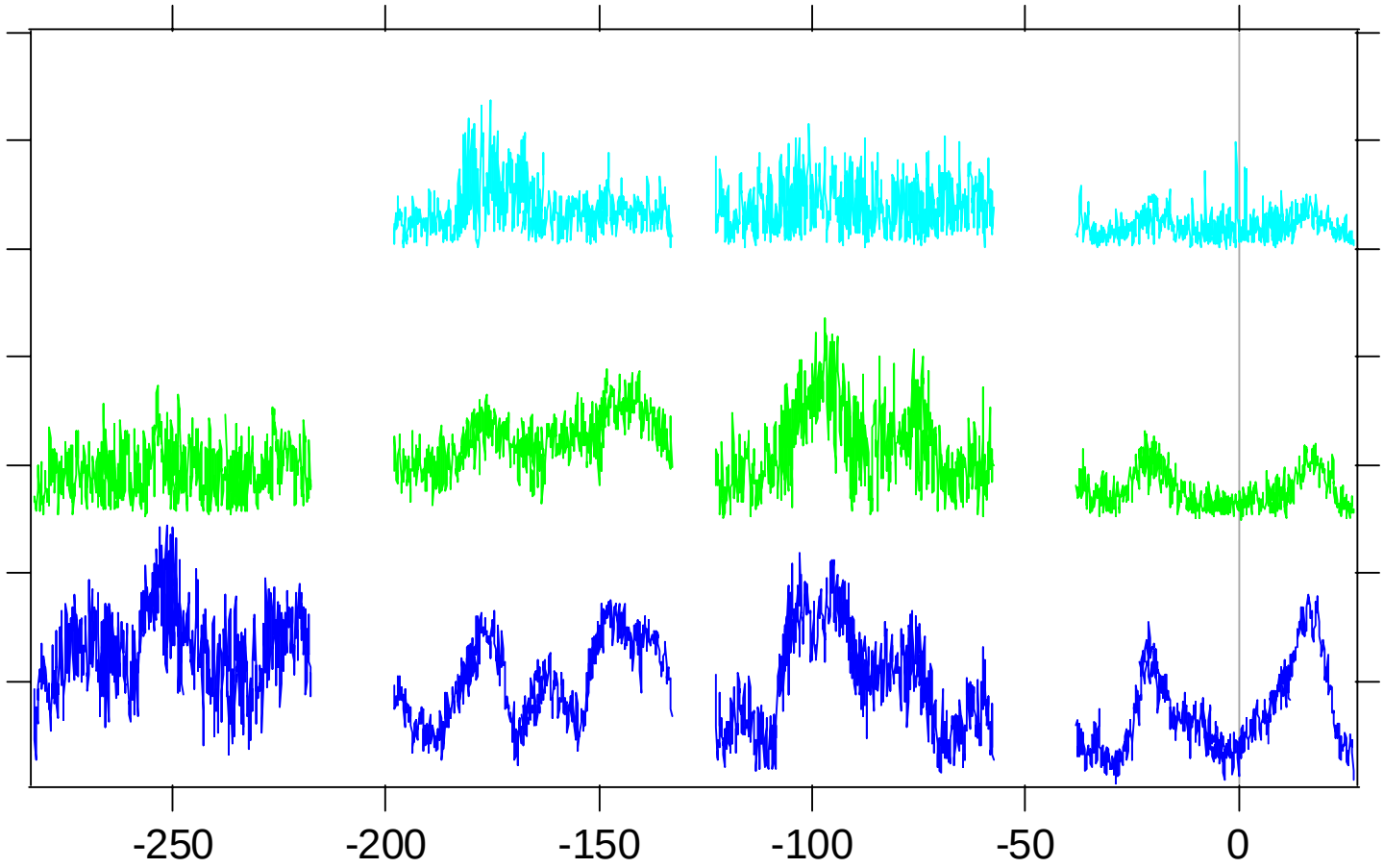


100 µm Ø nozzle
P_{He} ~ 1 bar
$T_{reservoir}$ ~ 90°C
T_{jet} < 10K ?

200 µm Ø nozzle
P_{He} ~ 0.15 bar
$T_{reservoir}$ ~ 80°C
T_{jet} ~ 30K

Jet spectroscopy of MTO with a multi-pass cell

changing nozzle diameter



50 µm Ø nozzle
P_{He} ~ 2.5 bar
$T_{reservoir}$ ~ 90°C

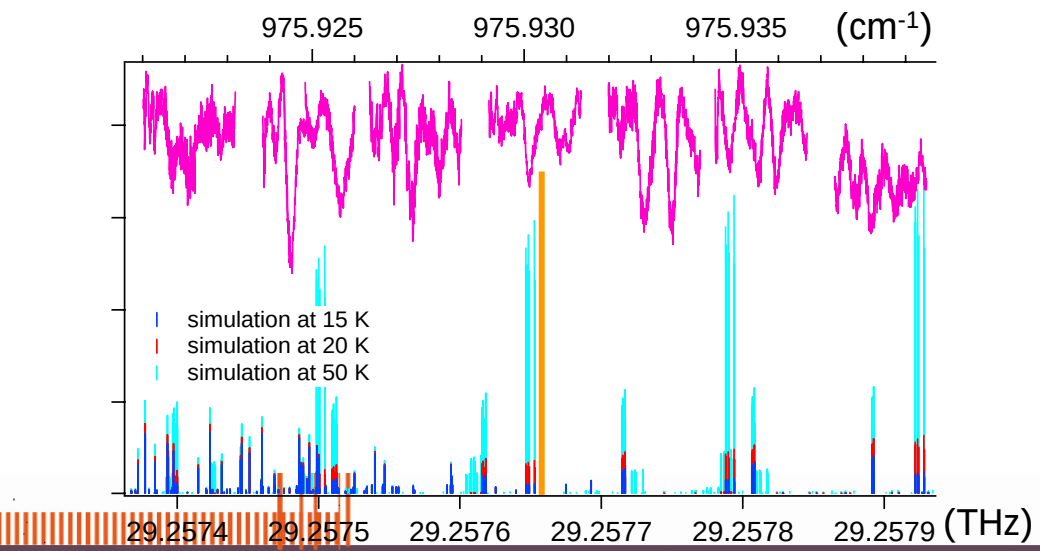
75 µm Ø nozzle
P_{He} ~ 2 bar
$T_{reservoir}$ ~ 90°C

100 µm Ø nozzle
P_{He} ~ 1 bar
$T_{reservoir}$ ~ 90°C

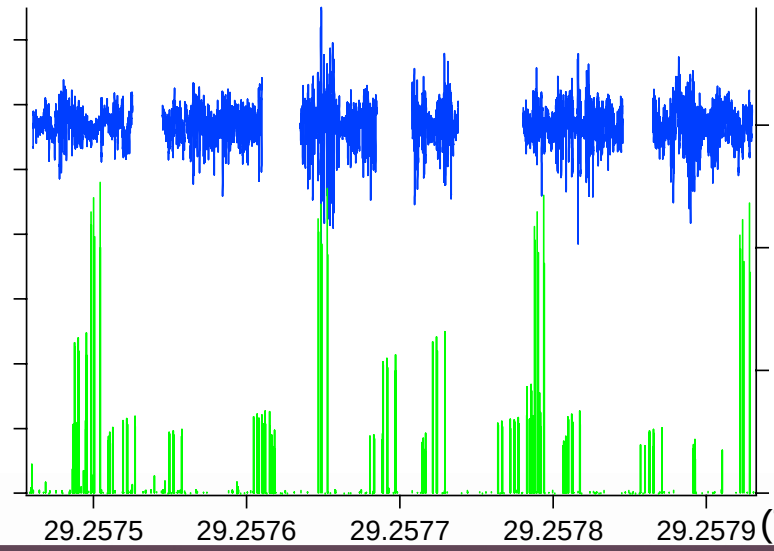
Perspectives

- ✓ Towards higher resolution jet-spectroscopy ⇒ line centre pointing
  - Further increase the linear absorption S/N ⇒ increase the number of passes, Fabry-Perot cavity
  - Even colder beam?
- ✓ Demonstrate ultra-high resolution spectroscopy of MTO in a jet ⇒ saturated absorption
- ✓ 2-photon spectroscopy of MTO
- ✓ Thanks to Thérèse's last results ⇒ further the improve analysis of the LPL spectra

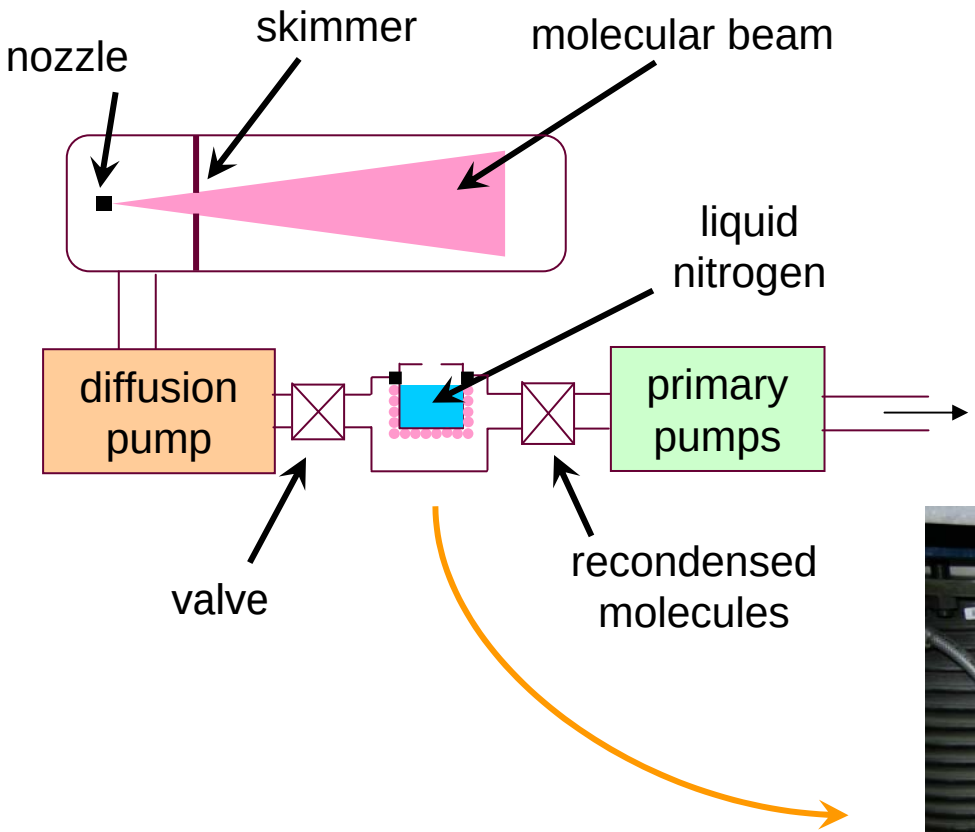
jet spectra and simulations



cell saturated absorption spectra and a 300K simulations



Recycling solid state molecules

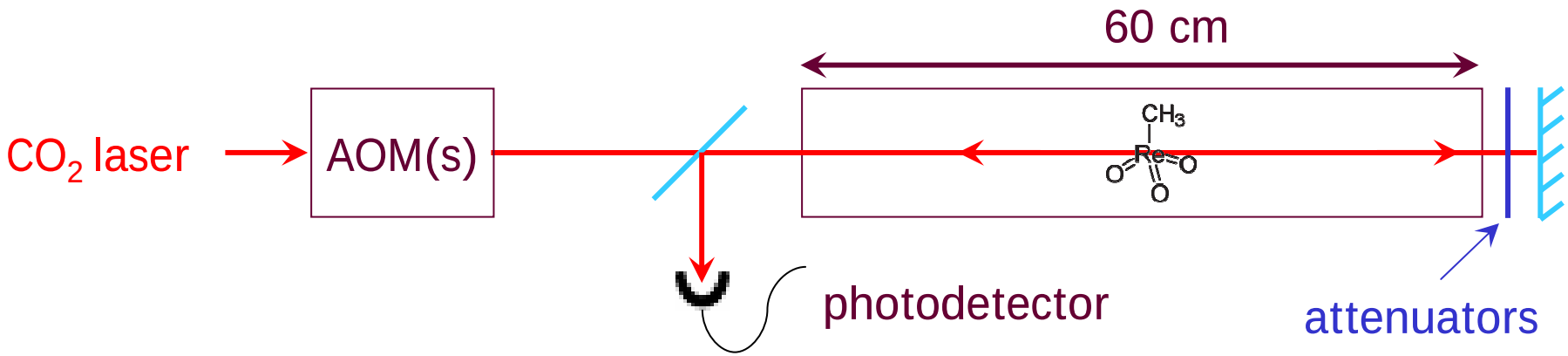


Recycling solid state molecules

- ✓ we recovered mainly crystals (+ brown powder?)
- ✓ look like MTO crystals naturally forming at LADIR and LPL
- ✓ 25 to 50% of the mass is recovered (but the process induce losses)
- ✓ has been in contact with the pump oil

- ✓ process will be improved
- ✓ a recycling set-up will be installed on the 2nd chamber

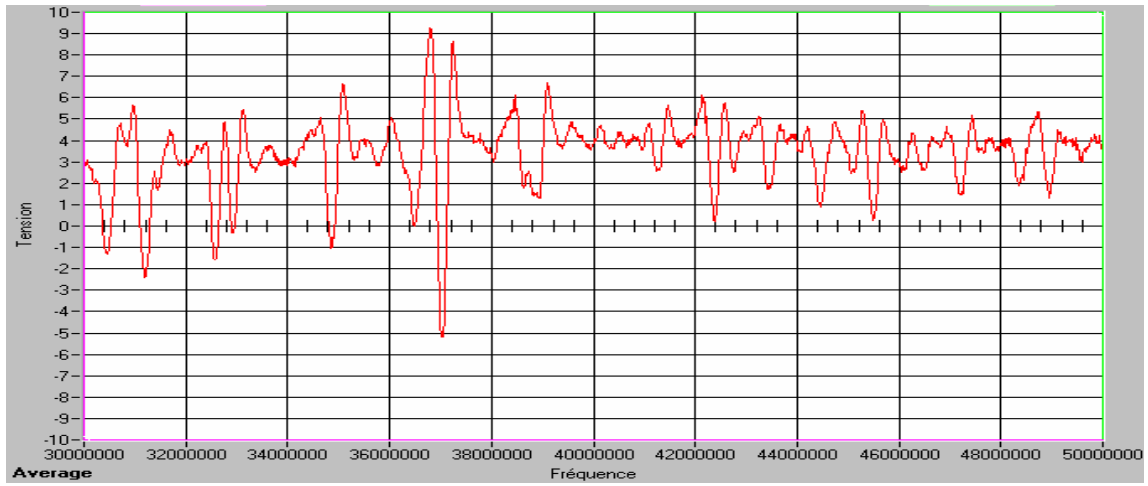
Saturated absorption spectroscopy of the recycled crystal



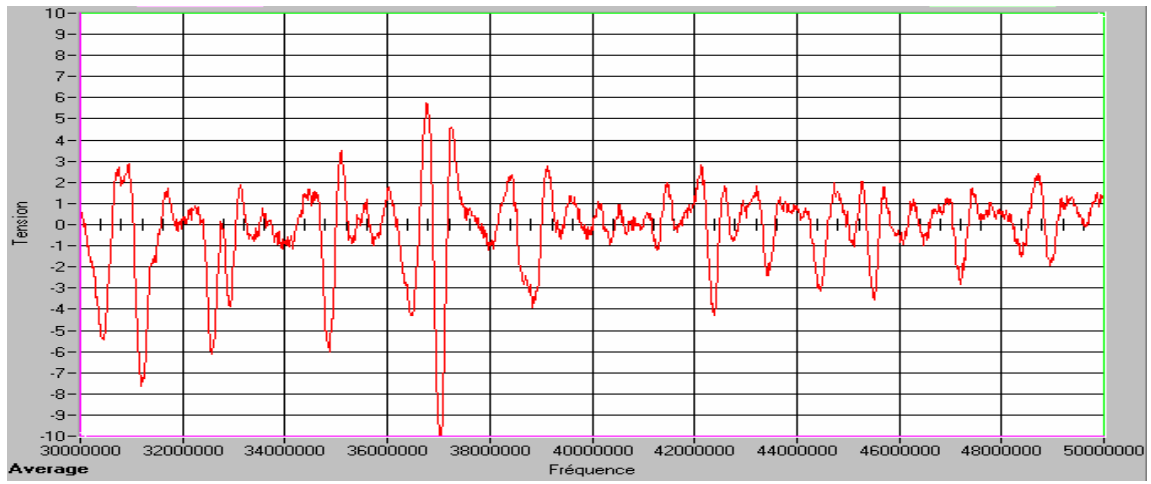
modulation frequency: 5 kHz, depth: 200 kHz, 2nd harmonic detection, +160 MHz away from the *R*(20) CO_2 laser line

Saturated absorption spectroscopy of the recycled crystal

commercial MTO



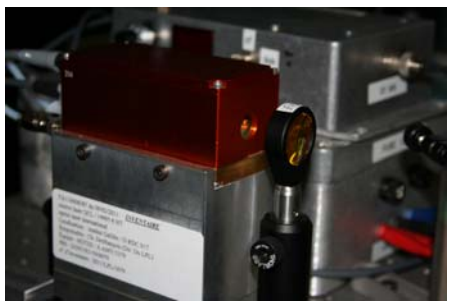
recycled MTO



modulation frequency: 5 kHz, depth: 200 kHz, 2nd harmonic detection, +160 MHz away from the *R*(20) CO_2 laser line

Development of a QCL based spectrometer

- ✓ compact, transportable
- ✓ widely tunable (1000 times more than a CO_2 laser)
- ✓ several QCLs can potentially cover the whole mid-infrared domain (from 2 to 20 µm)
- ✓ relax the wavelength constraint on potential candidates for PNC experiments



Development of a QCL based spectrometer

- ✓ characterize frequency tunability and stability
- ✓ phase-lock the QCL on a frequency stabilize CO_2 laser
- ✓ lock the QCL on a molecular line
- ✓ lock the QCL on an ultra-stable Fabry-Perot cavity
- ✓ lock the QCL on our new 1.55 µm frequency comb