

Validation activities at the Zugspitze, 47.4 N, 2964 m asl.

Validation of SCIAMACHY Products with Ground-based FTIR Observations from the NDSC¹ Network

DLR Contract: 50 EE 0007

Principle Investigator:

Ralf Sussmann, IMK-IFU, Garmisch

Staff:

Alexander Rockmann, IMK-IFU (engineer)

Wolfgang Stremme, IMK-IFU (PhD Student)

linked to

ENVISAT-Validation AO-Project ID126

“VALIDATION OF ENVISAT-1 LEVEL-2 PRODUCTS RELATED TO LOWER ATMOSPHERE O₃ AND NO_y CHEMISTRY BY AN FTIR QUASI-GLOBAL NETWORK”

Martine De Maziere, Thierry Coosemans, BIRA

¹NDSC: Network for the Detection of Stratospheric Change

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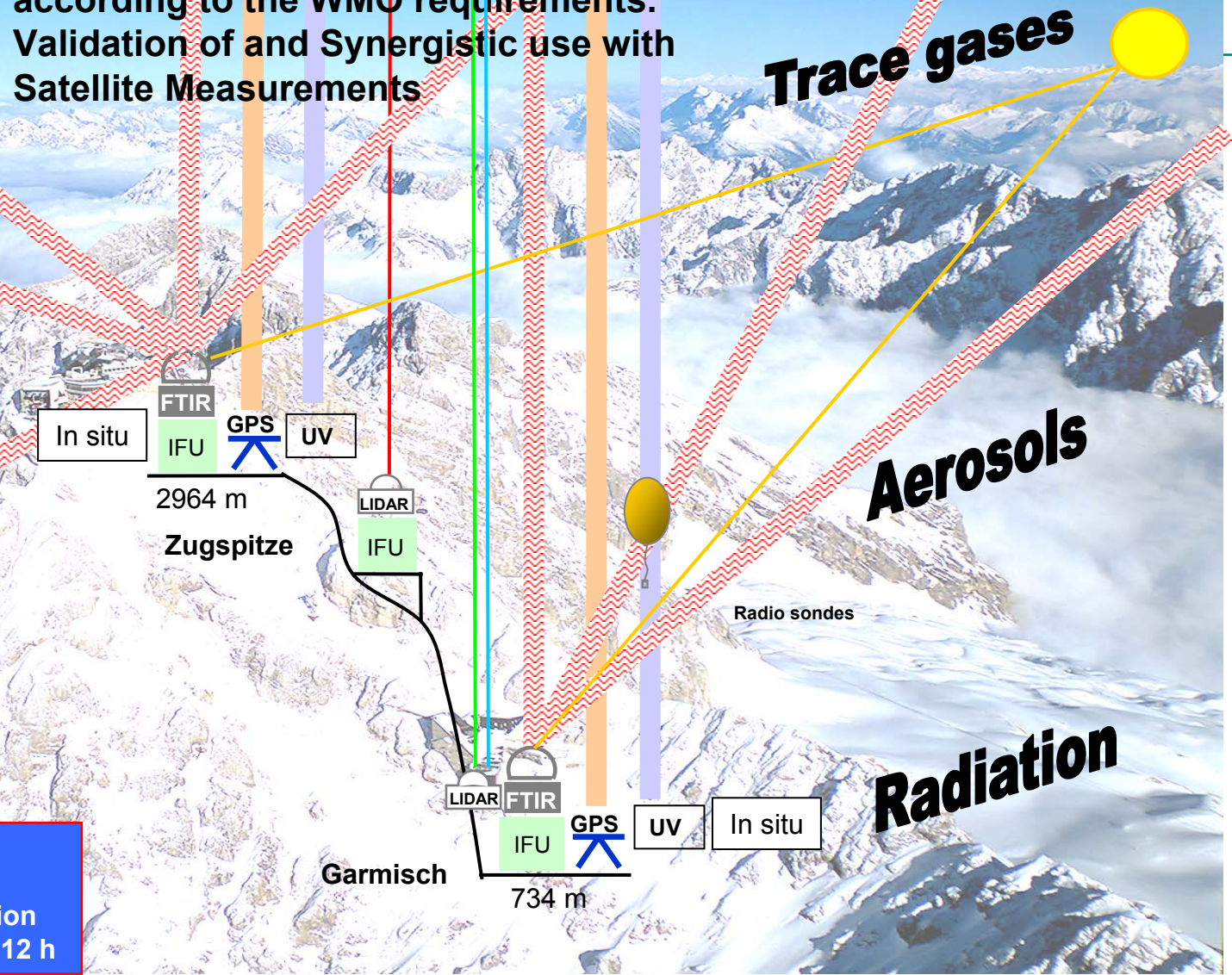
Permanent Ground Truthing Facility Zugspitze/Garmisch according to the WMO requirements. Validation of and Synergistic use with Satellite Measurements

MAPS,
MOPITT,
SAGE,
ENVISAT

Selected by EUMETSAT
as European Site for
operational
AIRS/IASI Validation



Example:
2002 AIRSVAL Campaign
3-months-7-days-a-week operation
data delivery twice a day within 12 h



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Zugspitze Solar FTIR: *NDSC Primary-Status Instrument*



0.00186 cm^{-1} resolution
(OPD = 486 cm) Bruker
IFS120HR FT-spectrometer

- SFIT1.09e/2.38
- FASCATM 2.03 raytracing



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Zugspitze FTIR: Quality control/intercomparison

(taken from “Zugspitze FTIR NDSC Report Form 2003”):

Name, date, and location of last intercomparison and/or validation:

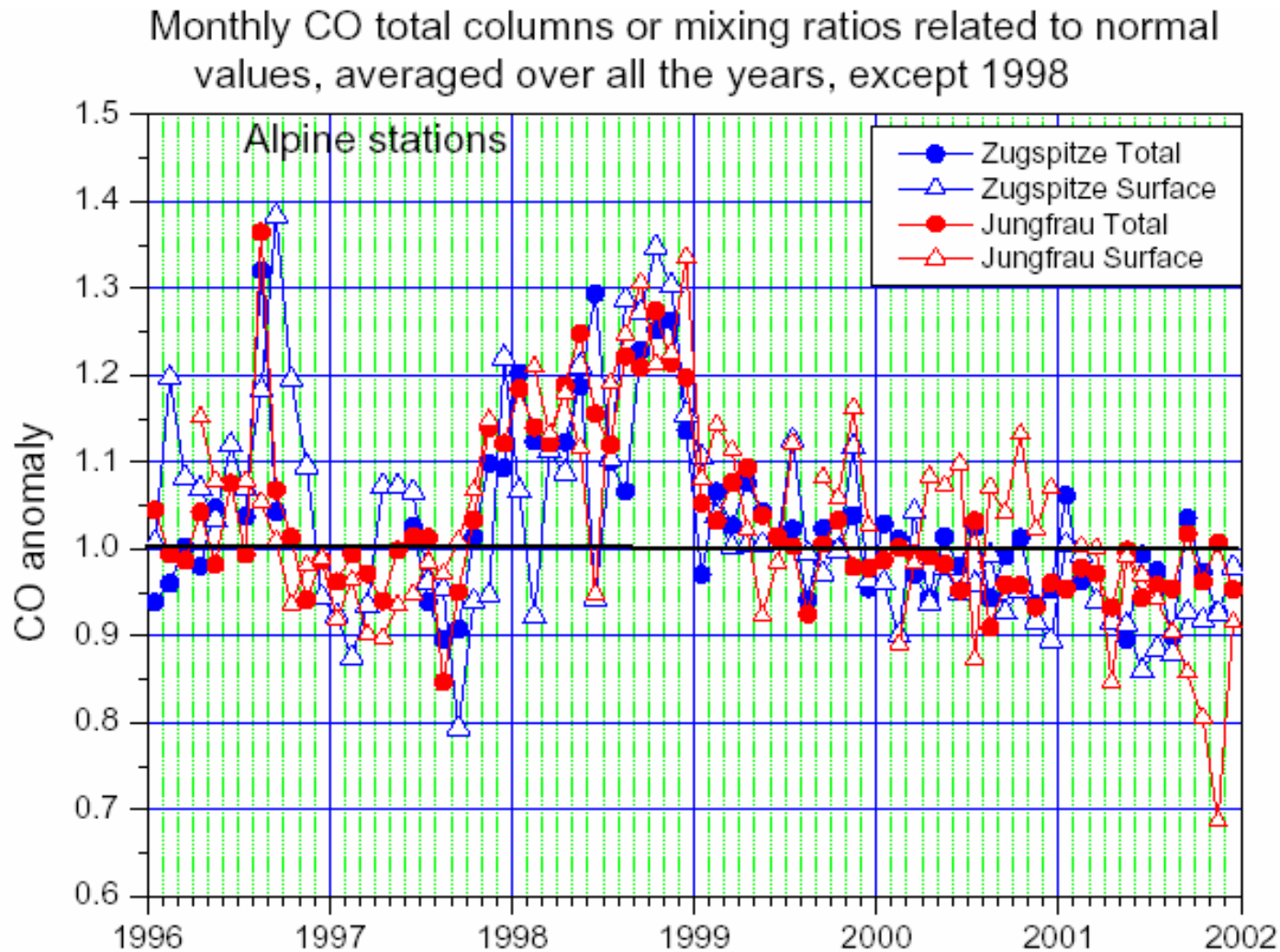
- 1996 intercomparison with Jungfrauoch: coincident measurements and independent analyses of HF, HCl. Agreement within 2 per cent
- In 2001 evaluation of the Zugspitze time series since 1995 of HCl and ClONO₂, and comparison to the Jungfrauoch series; showed very good overall agreement!
- In spring 2003 comparison of the Zugspitze time series (1996-2002) of CO to the Jungfrauoch series; showed very good overall agreement!
- Intense 3 months water vapor validation campaign at Zugspitze (mid Aug – mid Nov 2002) with permanent FTIR water vapor measurements compared to 4 radio sondes launched on site daily and permanent GPS water column measurements on site. Very good agreement of FTIR to sonde columns within a few per cent! Detailed FTIR validation study also relative to GPS measurements under way.

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Zugspitze FTIR: Quality control/intercomparison

Example 1



Yurganov et al., to be published

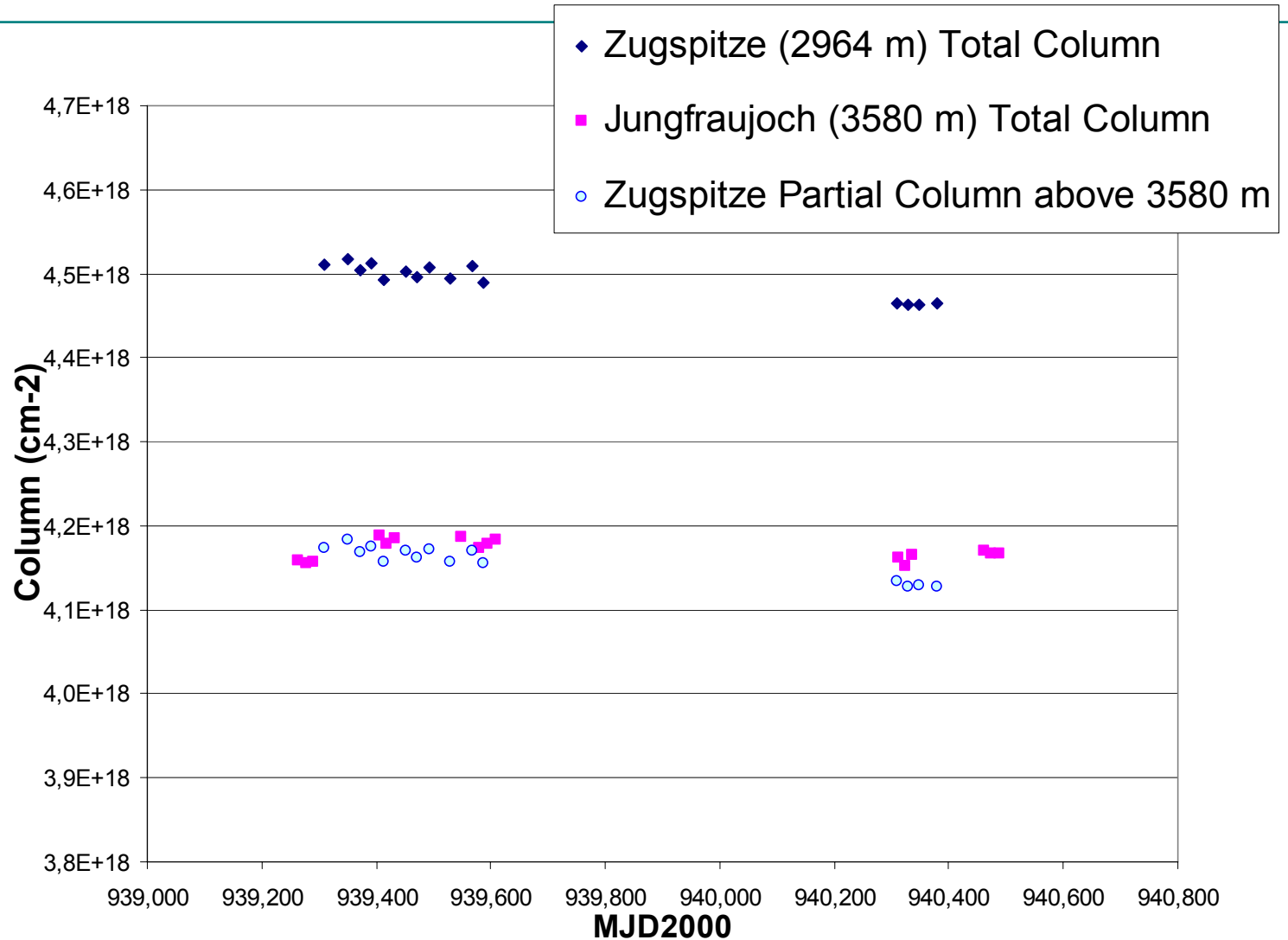
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Zugspitze FTIR: Quality control/intercomparison

Example N₂O

+
also done for
all other
species!



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SCIAMACHY Validation by FTIR at Zugspitze: **Schedule, Activity**

Species: CO, CH₄, N₂O, O₃, NO₂

Contract-Commitment:

Commissioning Phase: Intense measurement phase between L+3 and L+6; measurement intensity: **two weeks per month**; columns be made available within 45 days

Main validation phase: Intense measurement phase between L + 6 and L + 18 months; measurement intensity: **one week per month**; columns will be made available within 90 days.

We did much more: permanent 4 weeks per month operation

„5.5 months Commissioning Phase“: including weekends

15 July - 31 Dec 2002: 60 Measurement days at Zugspitze within first 5.5 months!

Main validation phase:

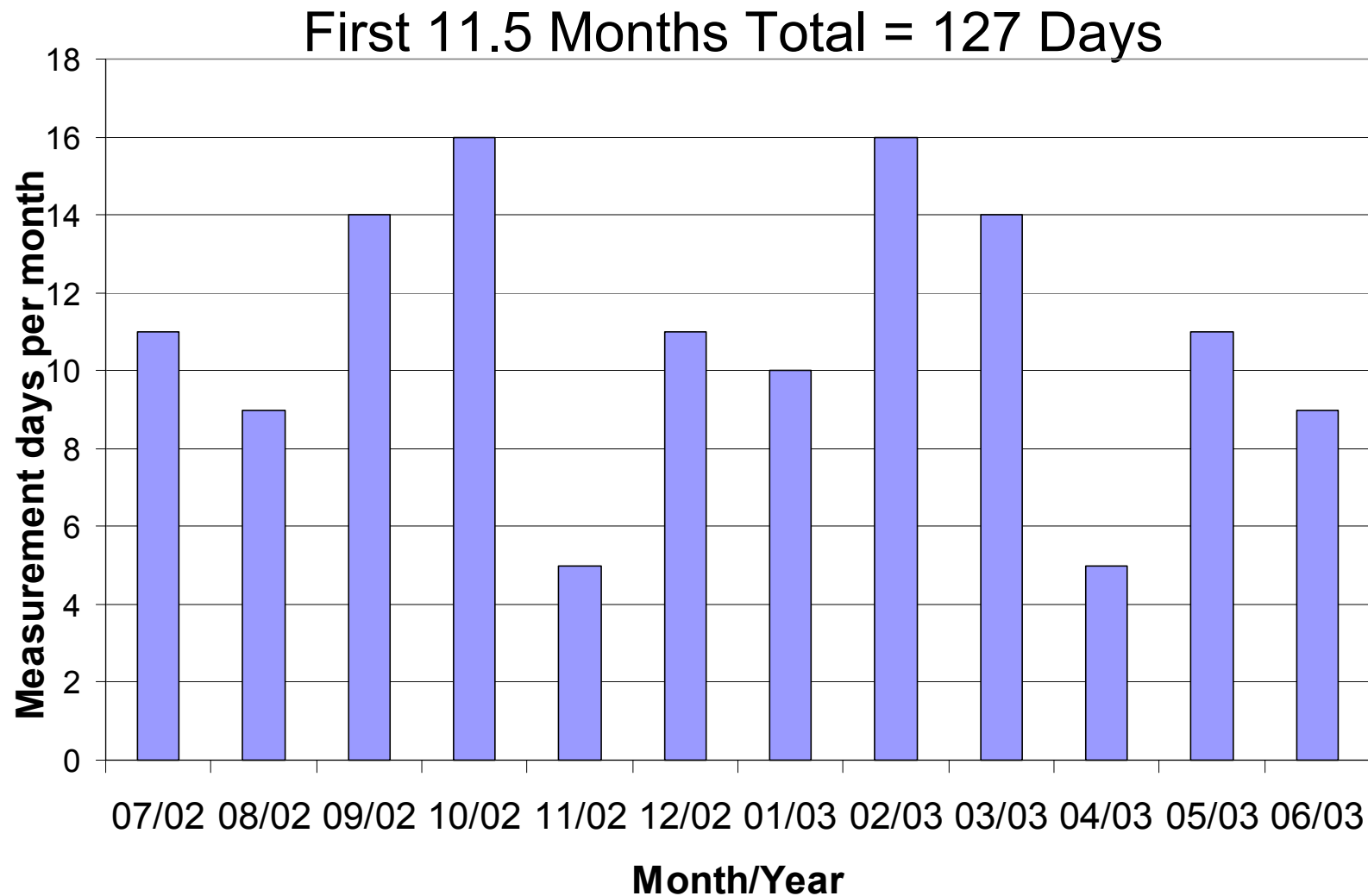
15 July 2002 – 1 July 2003: 127 measurement days within first 11.5 months!

All retrievals have been submitted to Cal/Val database

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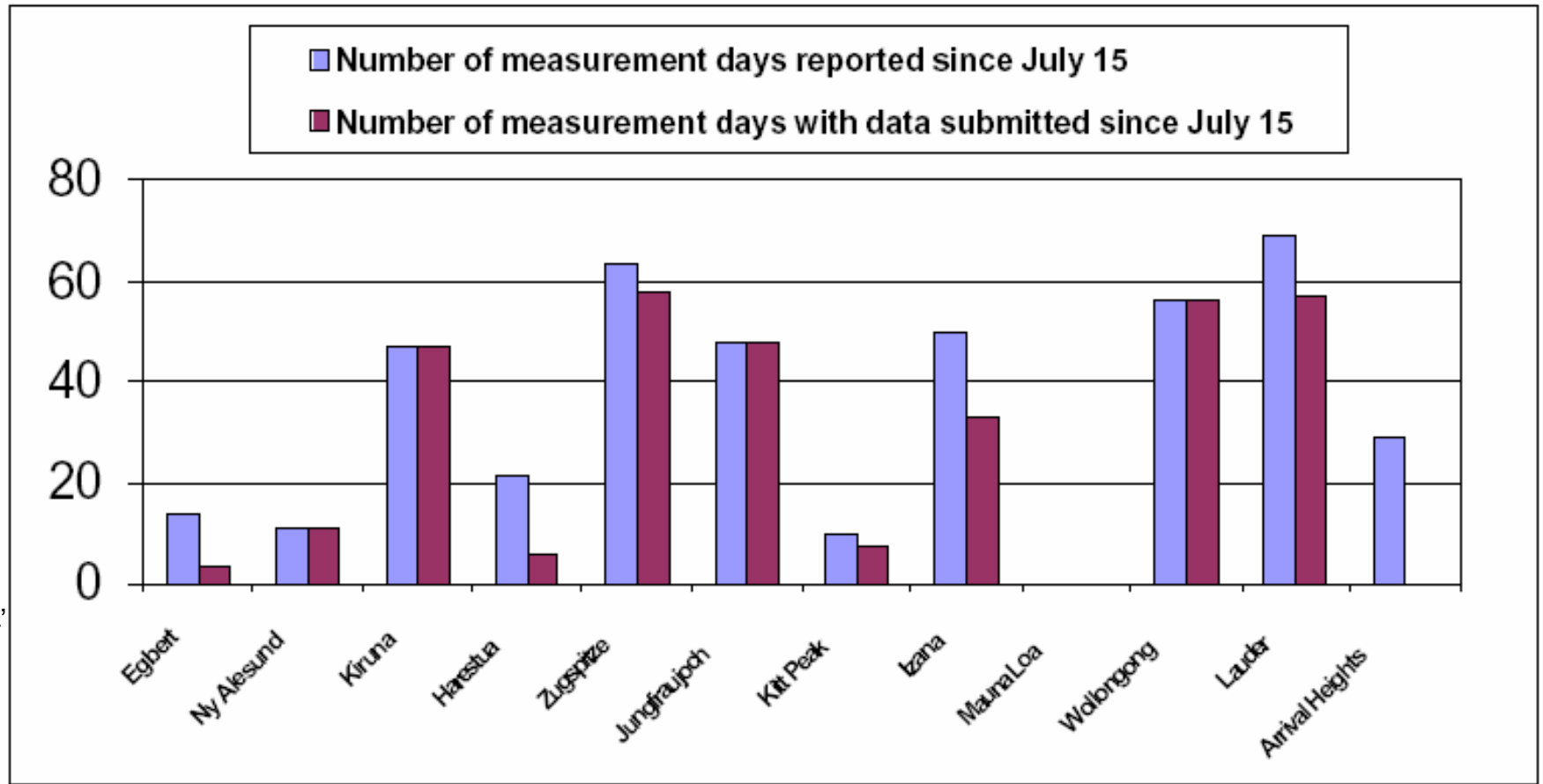
Zugspitze FTIR: Measurement days per month (15 July 2002 – 1 July 2003)



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Zugspitze FTIR: *Relative Activity during Commissioning (15 Jul – 1 Dec 2002)*



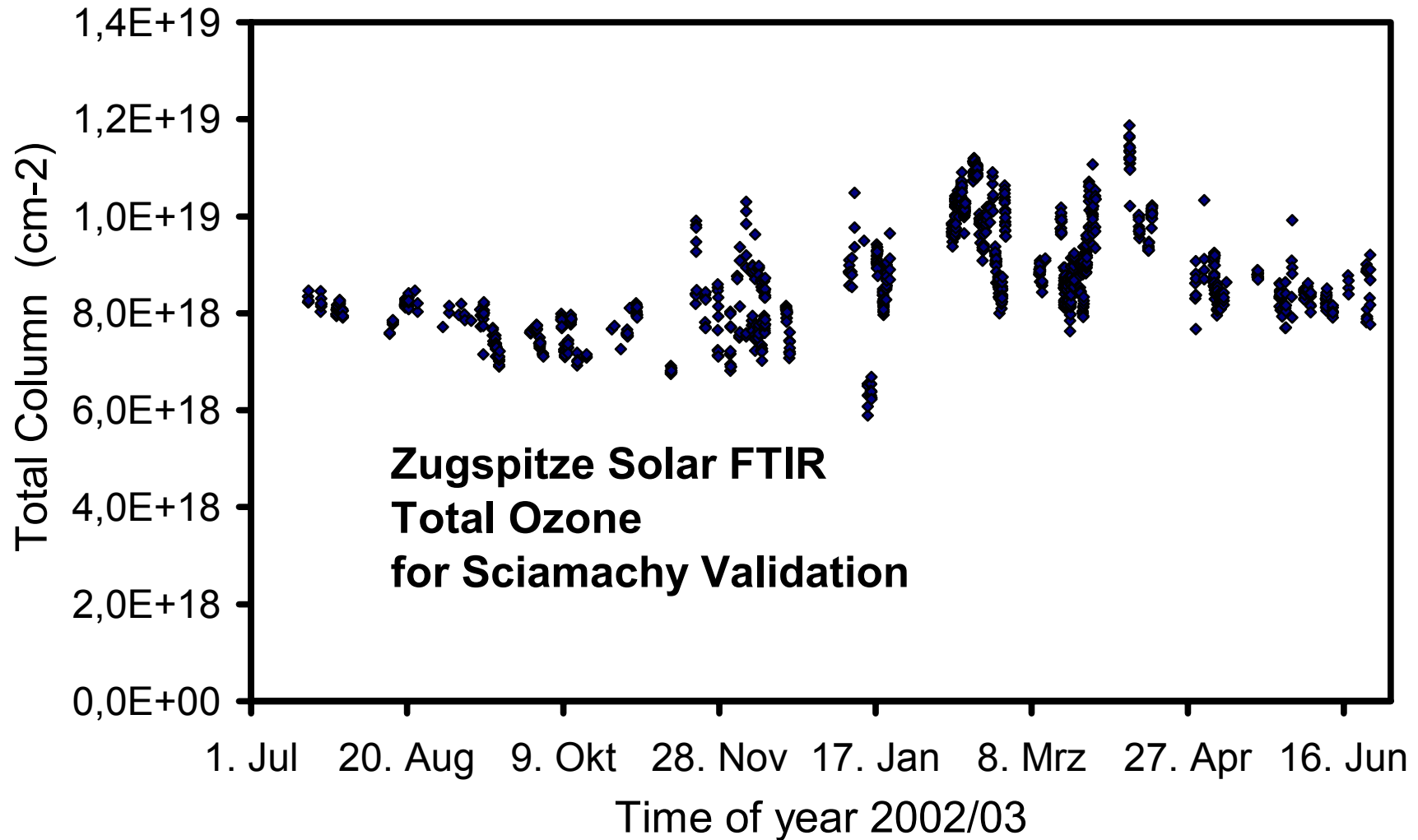
De Maziere et al.,
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Meeting, 2003

Fig. 2 Histogram of data available now ('submitted', purple), and of data expected ('reported', blue), per station in the network.

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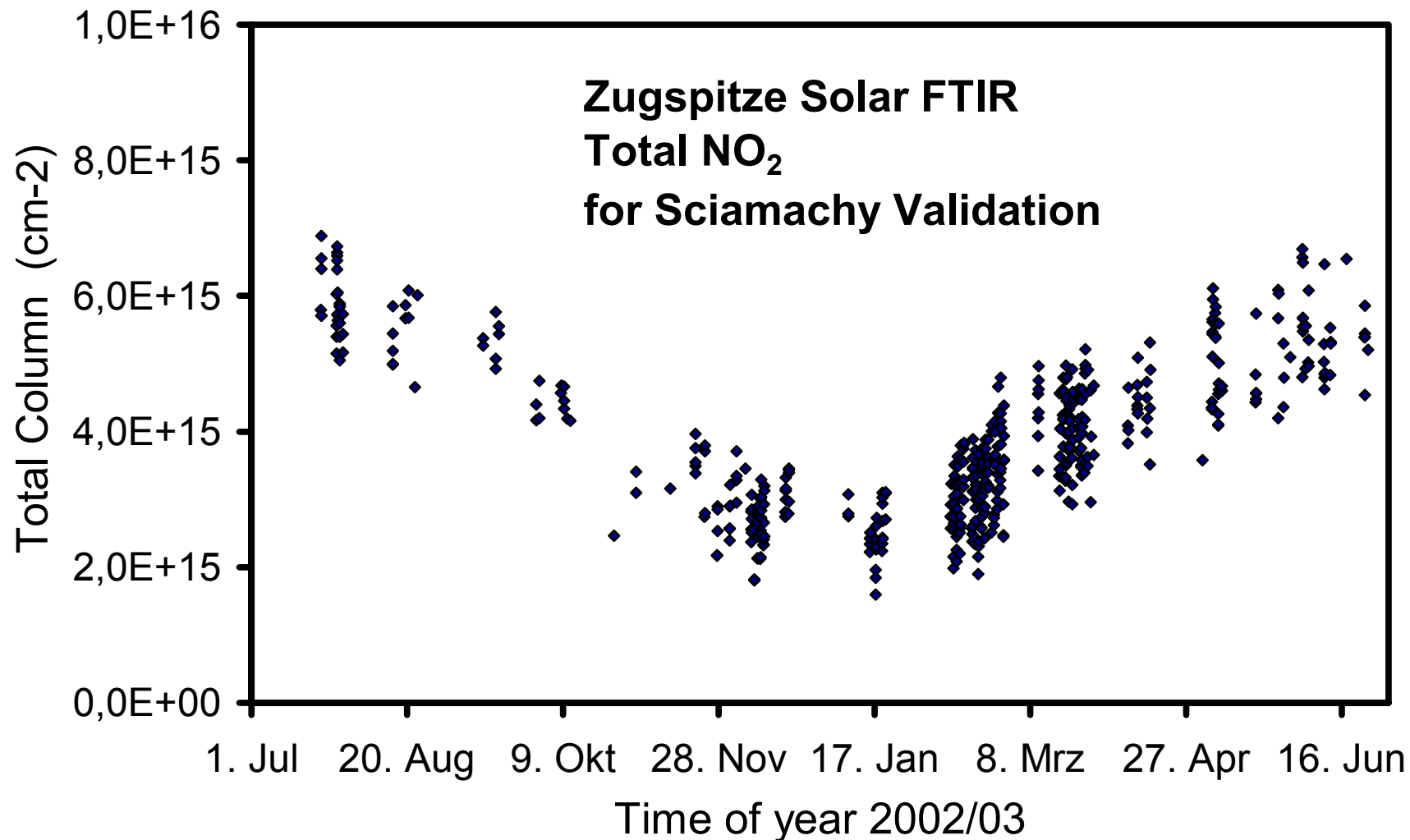
Zugspitze FTIR: Ozone Columns Series (15 July 2002 – 1 July 2003)



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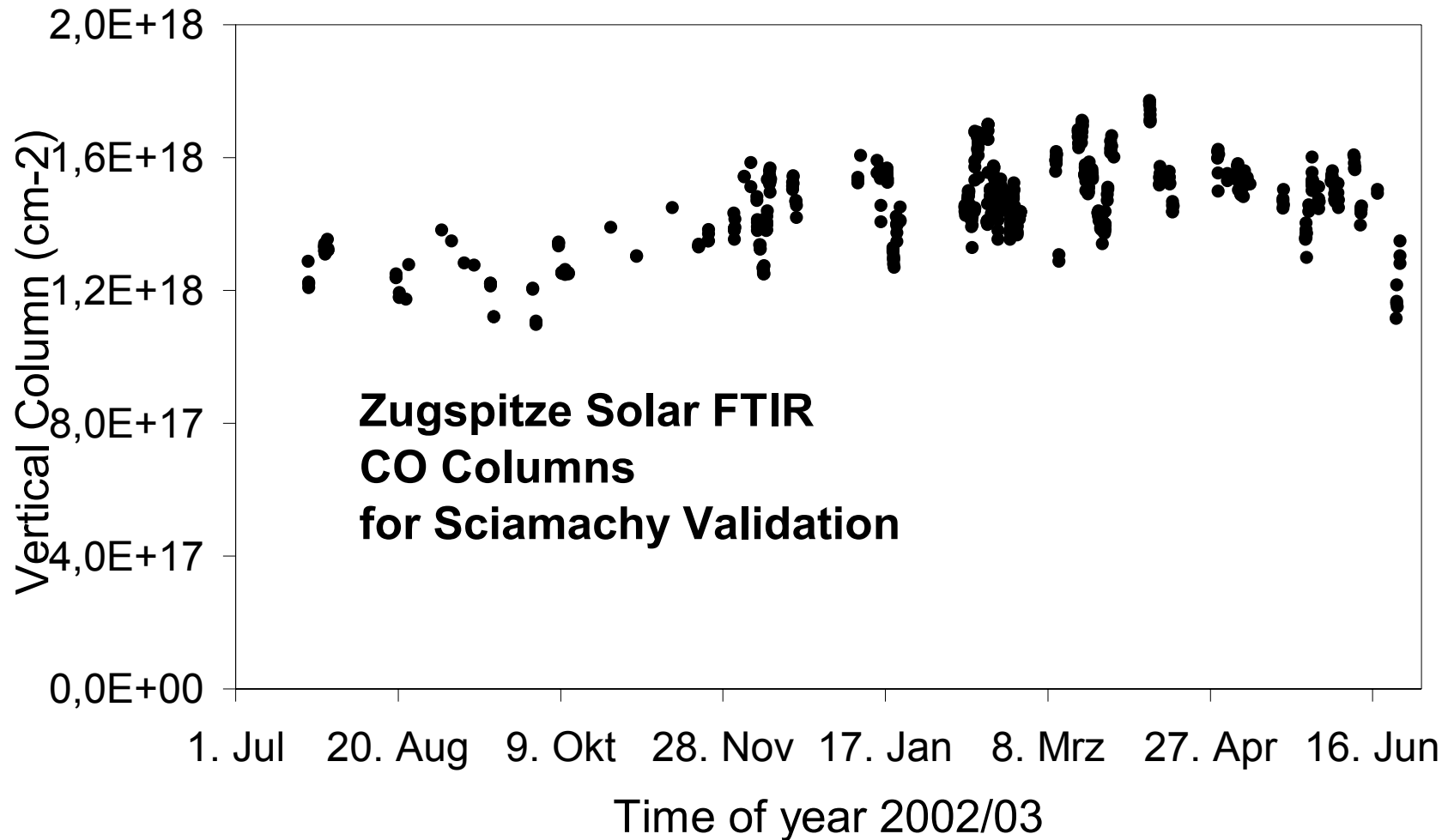
Zugspitze FTIR: NO₂ Columns Series (15 July 2002 – 1 July 2003)



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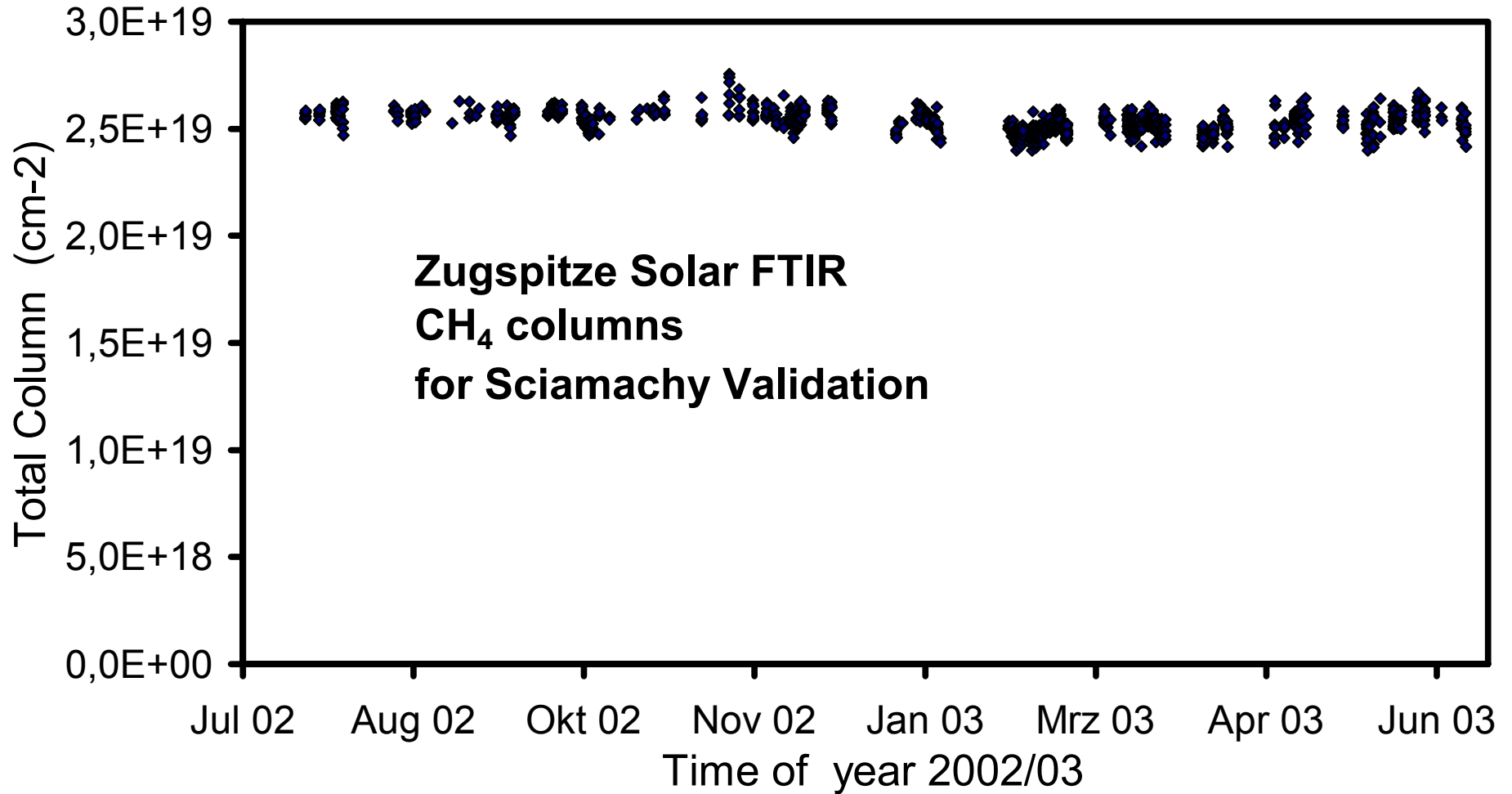
Zugspitze FTIR: CO Columns Series (15 July 2002 – 1 July 2003)



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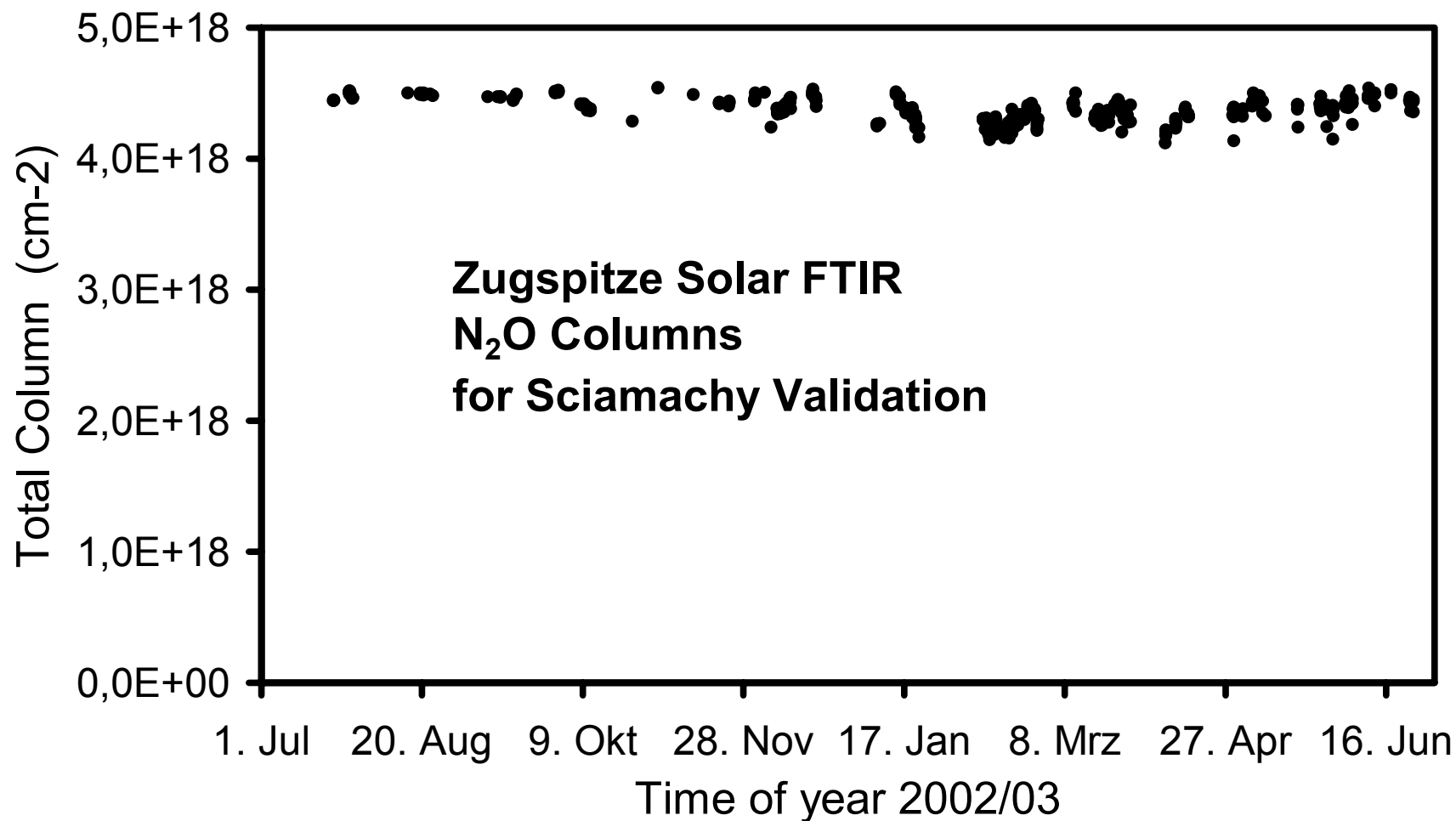
Zugspitze FTIR: CH₄ Columns Series (15 July 2002 – 1 July 2003)



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Zugspitze FTIR: N₂O Columns Series (15 July 2002 – 1 July 2003)



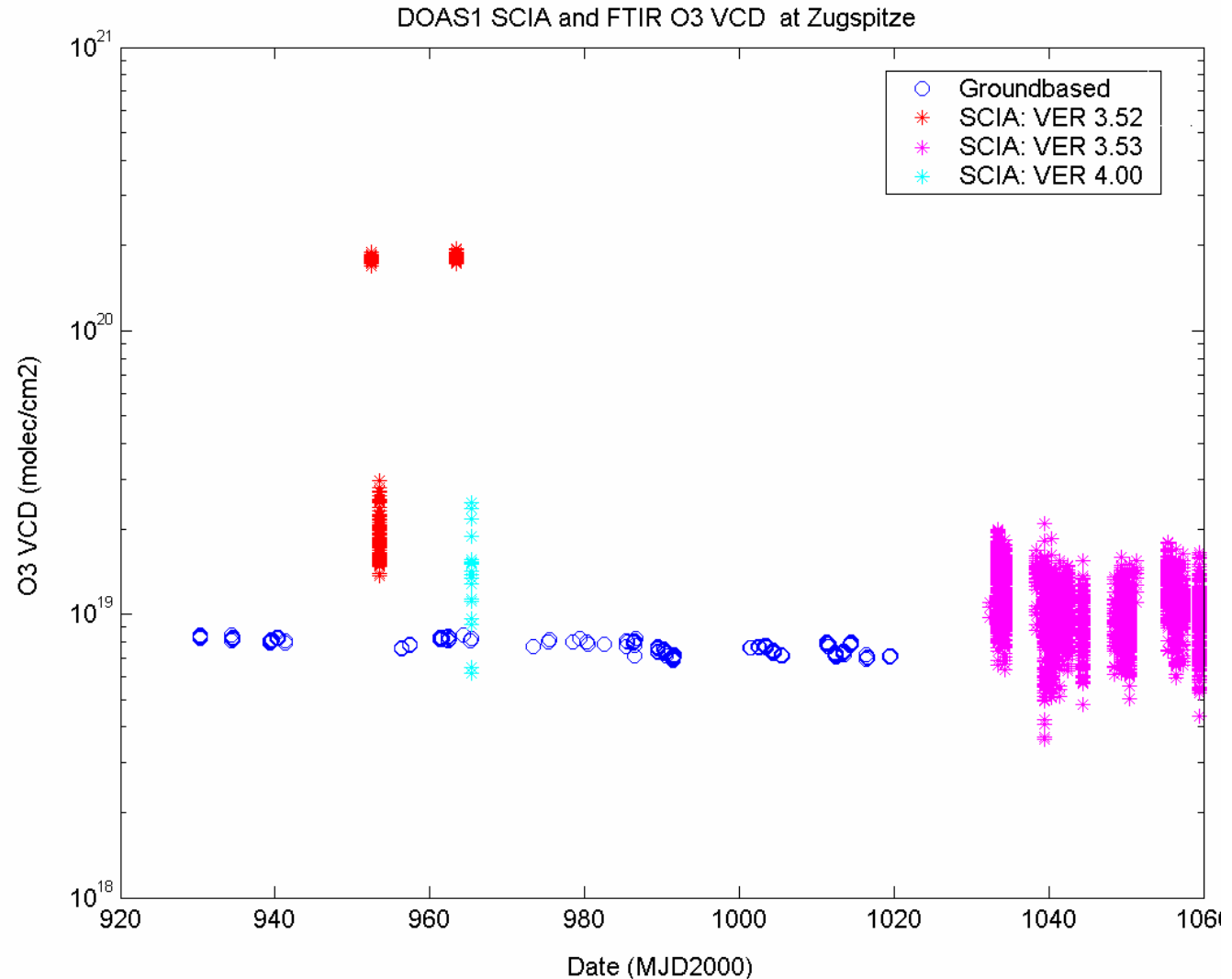
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Sciamachy Validation by Zugspitze FTIR: Ozone FTIR versus SCIA DOAS1 (vis)

FTIR: Individual measurements (10-20 min)

SCIA: Individual pixels within 500 km radius for one overpass



De Maziere et al.,
Proc. ESA-ACVT
Meeting, 2003

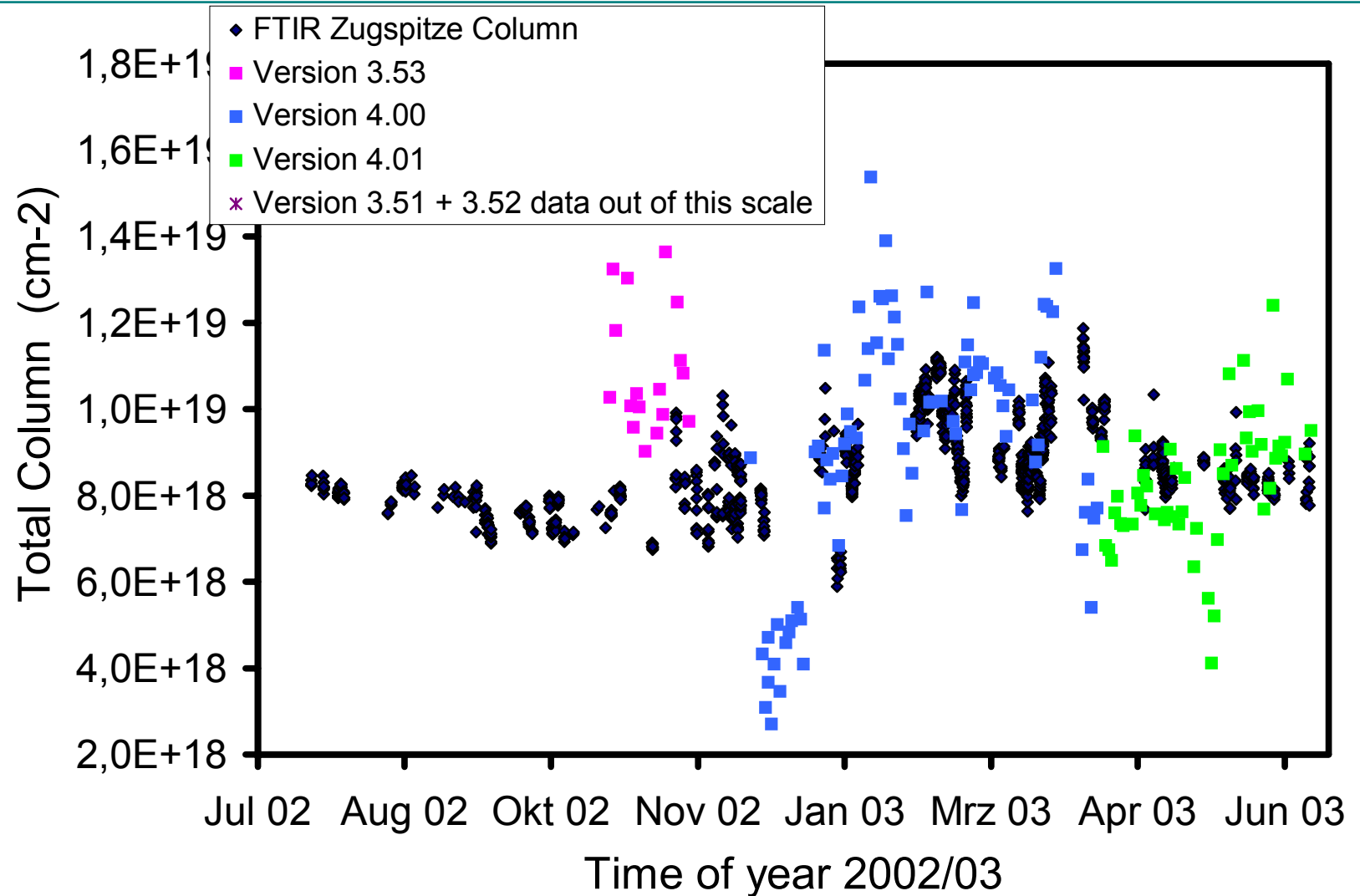
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Sciamachy Validation by Zugspitze FTIR: Ozone FTIR versus SCIA DOAS1 (vis)

FTIR: Individual measurements (10-20 min)

SCIA: Average of all pixels within 500 km radius for one overpass



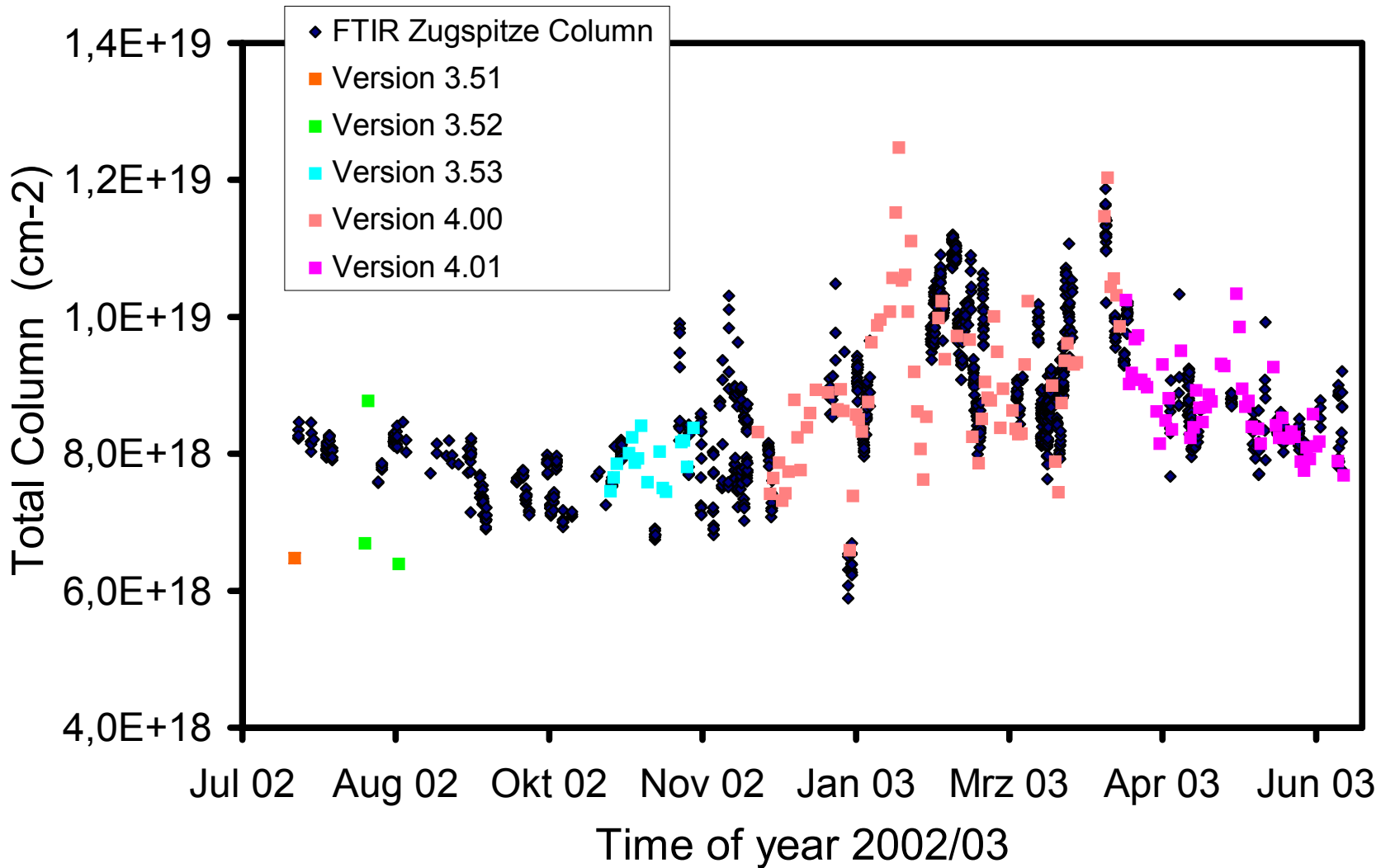
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SciAmachy Validation by Zugspitze FTIR: Ozone FTIR versus SCIA DOAS0 (UV)

FTIR: Individual measurements (10-20 min)

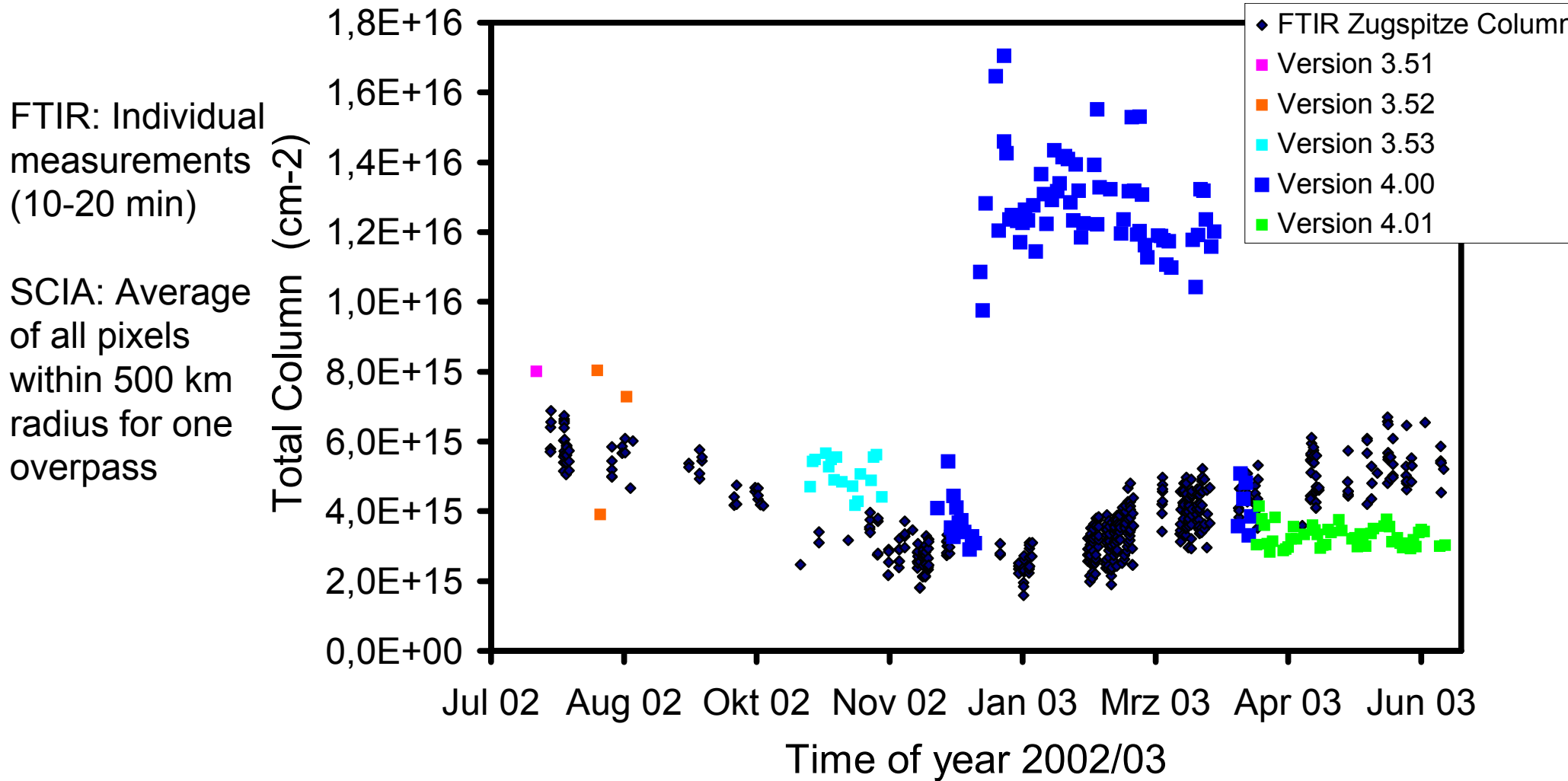
SCIA: Average of all pixels within 500 km radius for one overpass



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SciAmachy Validation by Zugspitze FTIR: NO_2 FTIR versus SCIA DOAS1 (vis)



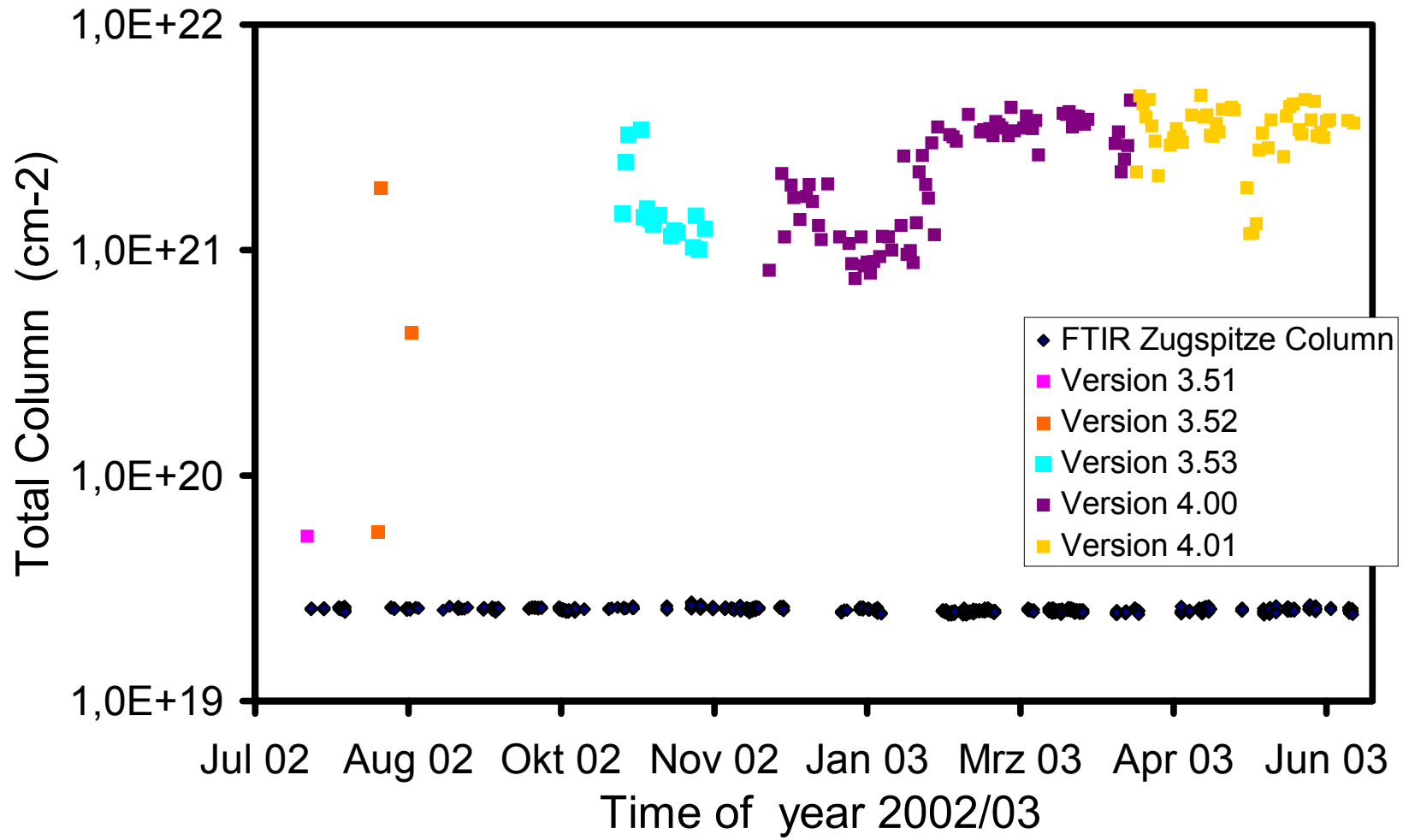
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Sciamachy Validation by Zugspitze FTIR: Methane FTIR versus SCIA BIAS1 (NIR)

FTIR: Individual measurements (10-20 min)

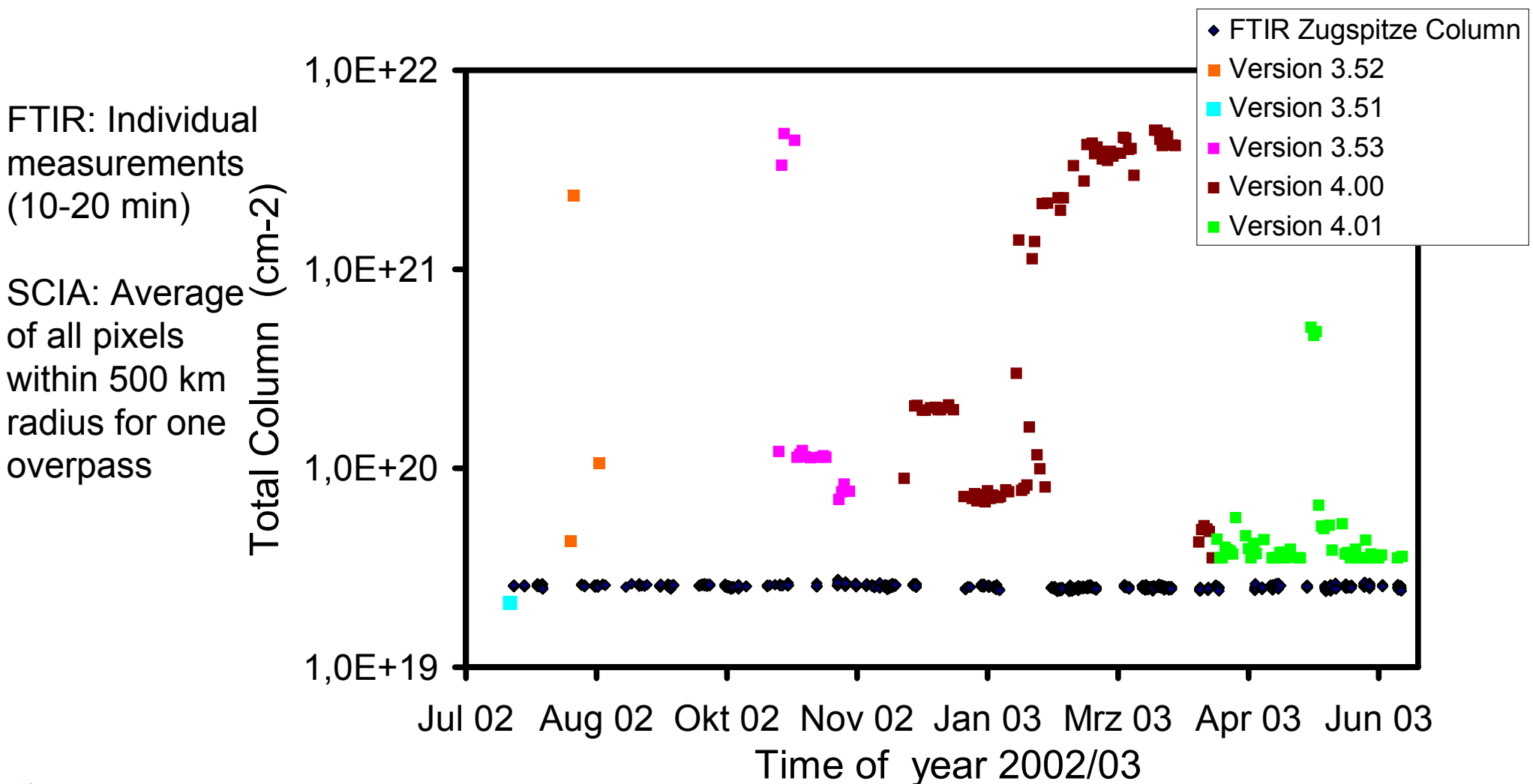
SCIA: Average of all pixels within 500 km radius for one overpass



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Sciamachy Validation by Zugspitze FTIR: Methane FTIR versus SCIA BIAS2 (NIR)



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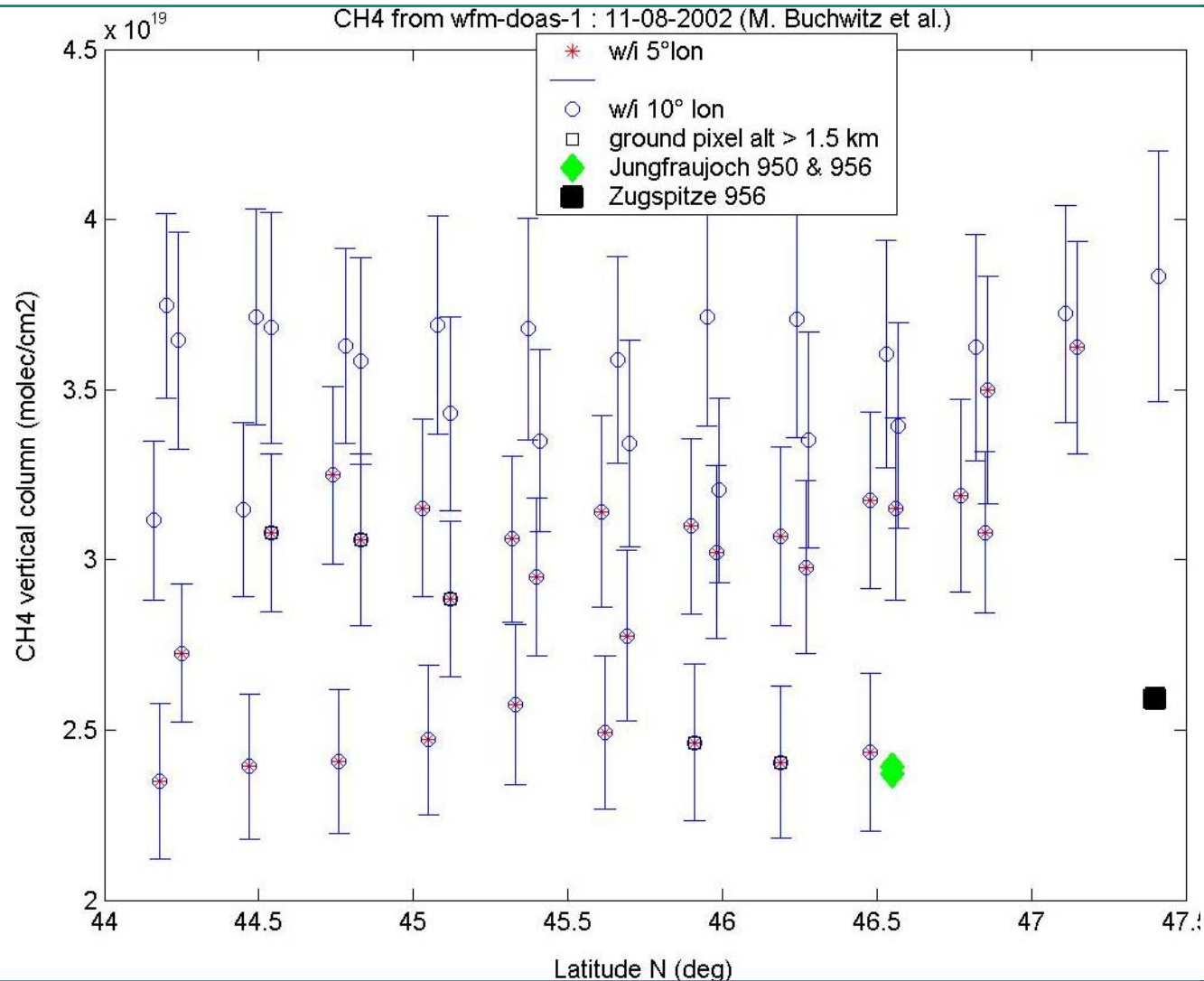
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Sciamachy Validation by Zugspitze FTIR: Methane FTIR versus SCIA WMF-DOAS

FTIR: Daily average of day 956

SCIA: Data from two orbits on day 953, longitudinal windows $\pm 2.5^\circ$ and $\pm 5^\circ$

De Maziere et al.,
Proc. ESA-ACVT
Meeting, 2003



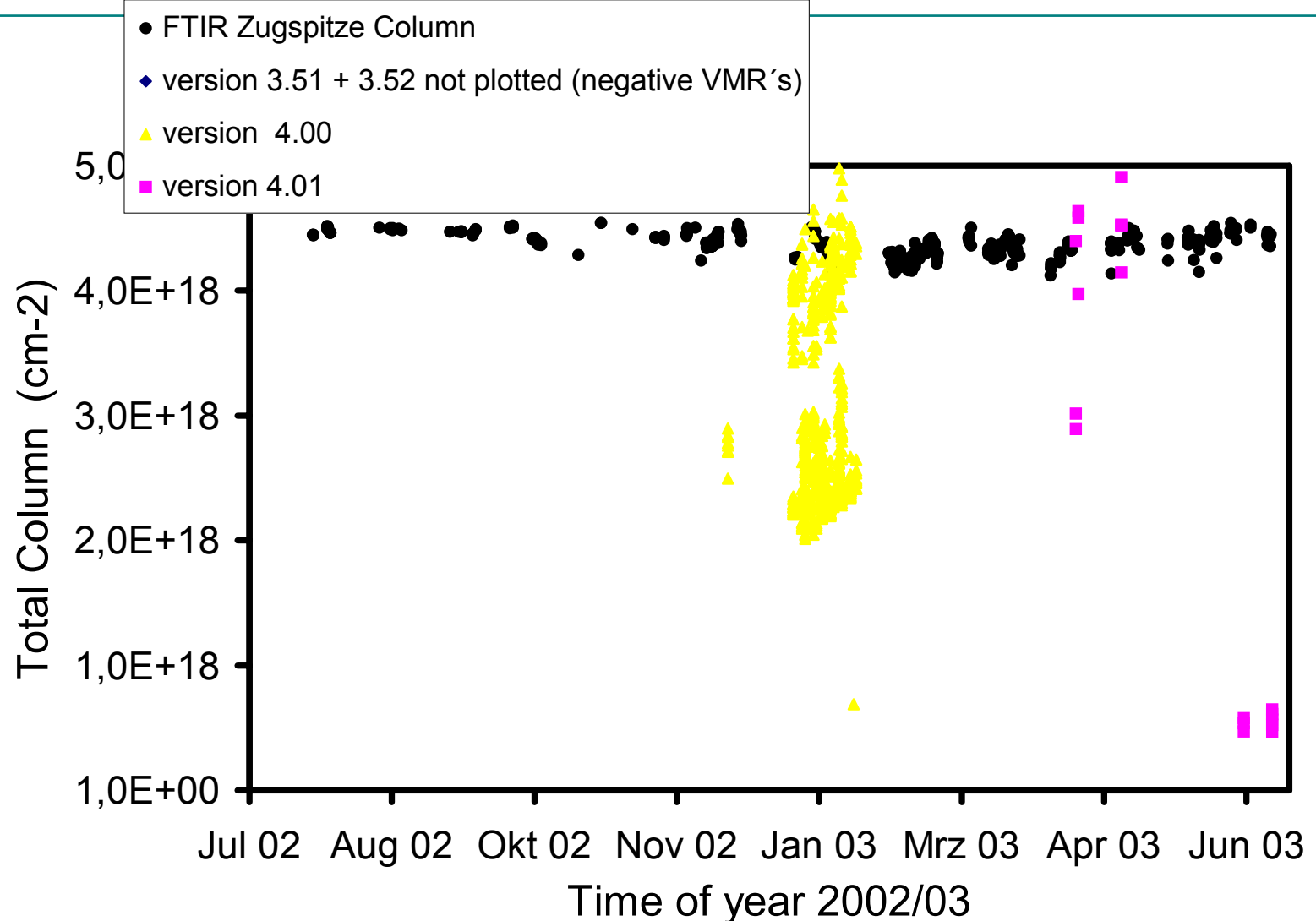
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SciAmachy Validation by Zugspitze FTIR: N_2O FTIR versus SCIA BIAS1 (NIR)

FTIR: Individual measurements (10-20 min)

SCIA: Individual pixels within 500 km radius for one overpass



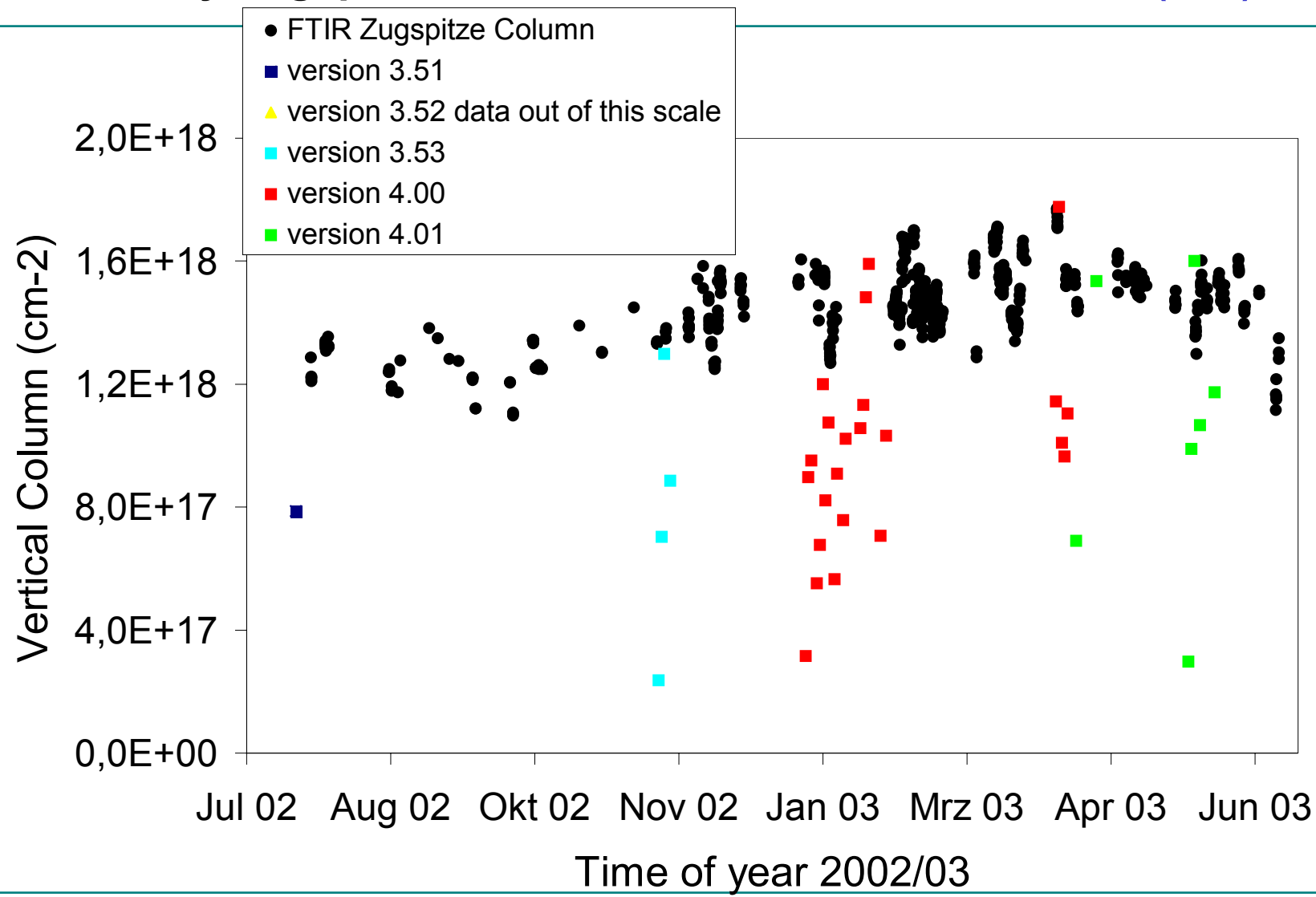
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SciAmachy Validation by Zugspitze FTIR: CO FTIR versus SCIA BIAS2 (NIR)

FTIR: Individual measurements (10-20 min)

SCIA: Average of all pixels within 500 km radius for one overpass



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Sciamachy Validation by Zugspitze FTIR: Conclusions July 2003

1. The operational SCIAMACHY UV total ozone product was improved from version to version. Version (4.01) is good (nearly zero bias, realistic day-to-day scatter).
2. The operational SCIAMACHY vis total ozone product was off by orders of magnitude for versions 3.51, 3.52. The later versions are good on >monthly average, but there is scatter in daily columns (pixels average over 500 km radius) exceeding natural scatter by factors.
3. The operational SCIAMACHY vis NO₂ total column product overestimates the real columns in early versions. Extremely off in version 4.0. Underestimation in the latest version (4.01, since 15 April 03). However, version 4.01 seems to deliver constant values around the columns typically found for February. I.e., it does not monitor the columns increase during the spring/early summer period.
4. Operational SCIAMACHY near IR products (CO, CH₄, N₂O) have no significant meaning up to now. Scientific WMF-DOAS relatively good for CH₄.

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