Fitting AHRS data (II)

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Rectification

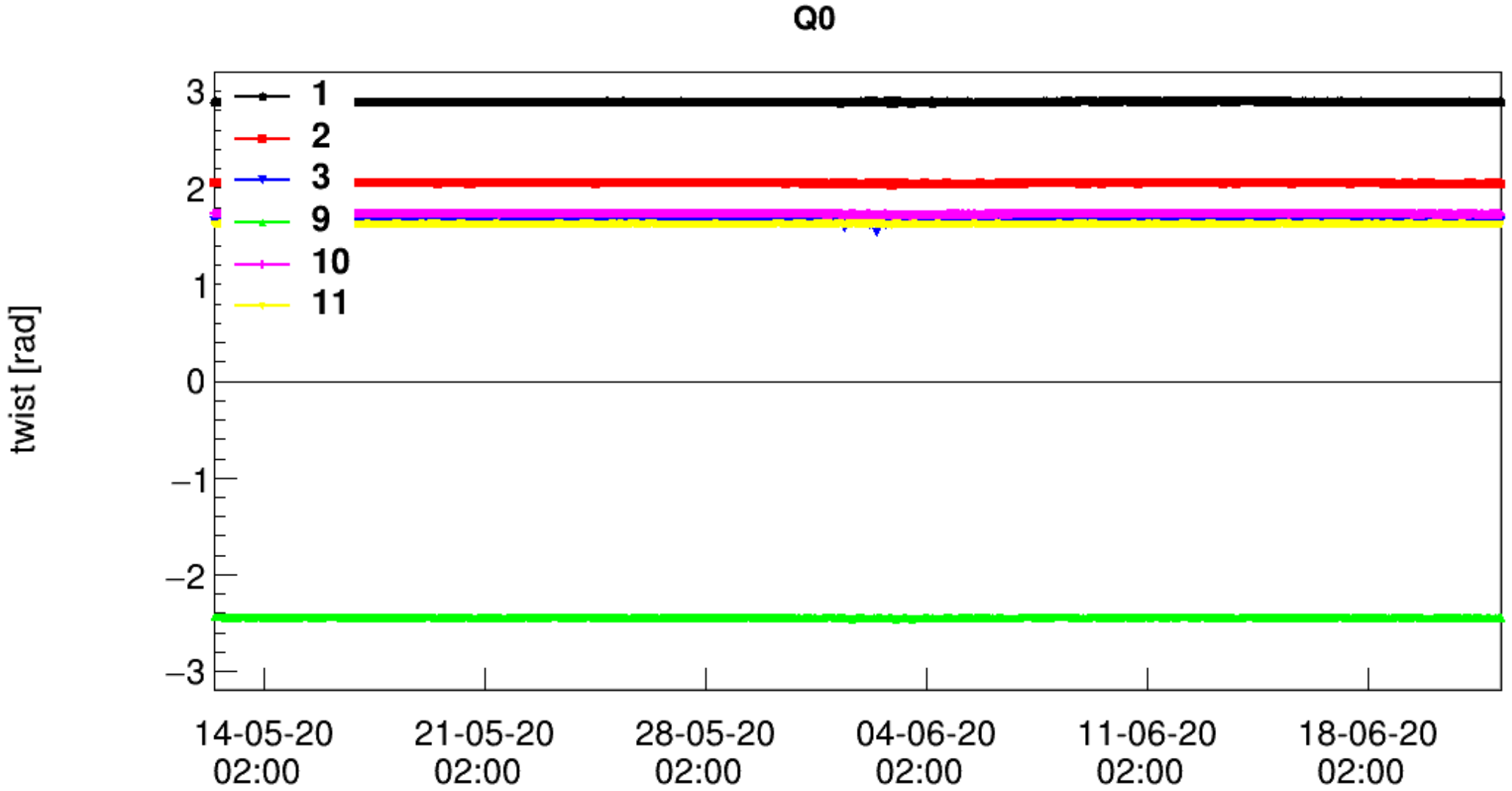
- Resolution (for χ^2 evaluation)
  - $\sigma = \sqrt{\sigma_x^2 + \sigma_y^2 + \sigma_z^2}$ (no factor $\frac{1}{2}$)
- Number of degrees of freedom
  - NDF $=$ number of data points $\times\ 4\ -$ number of fit parameters (factor 4)

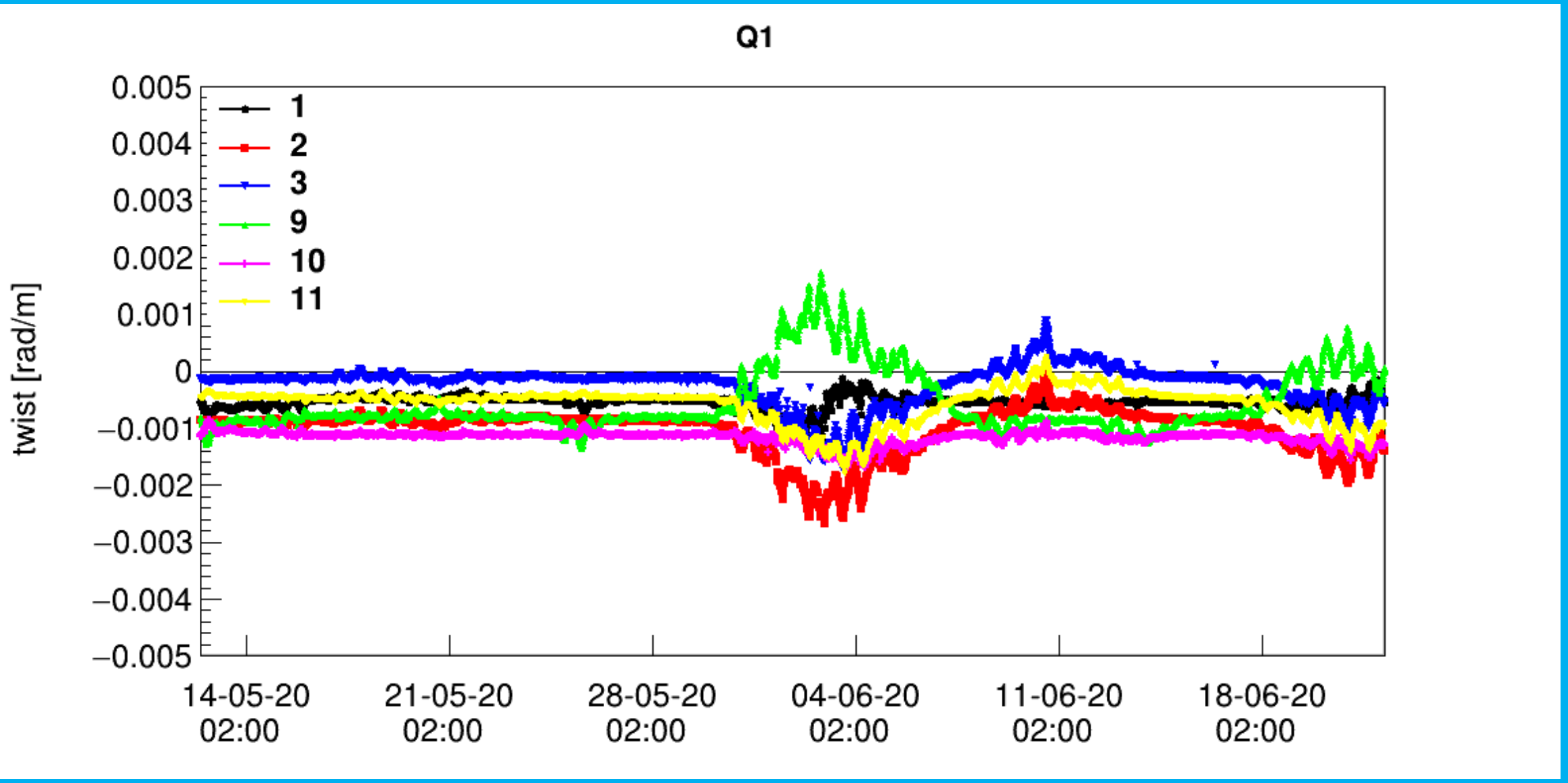
Reminder

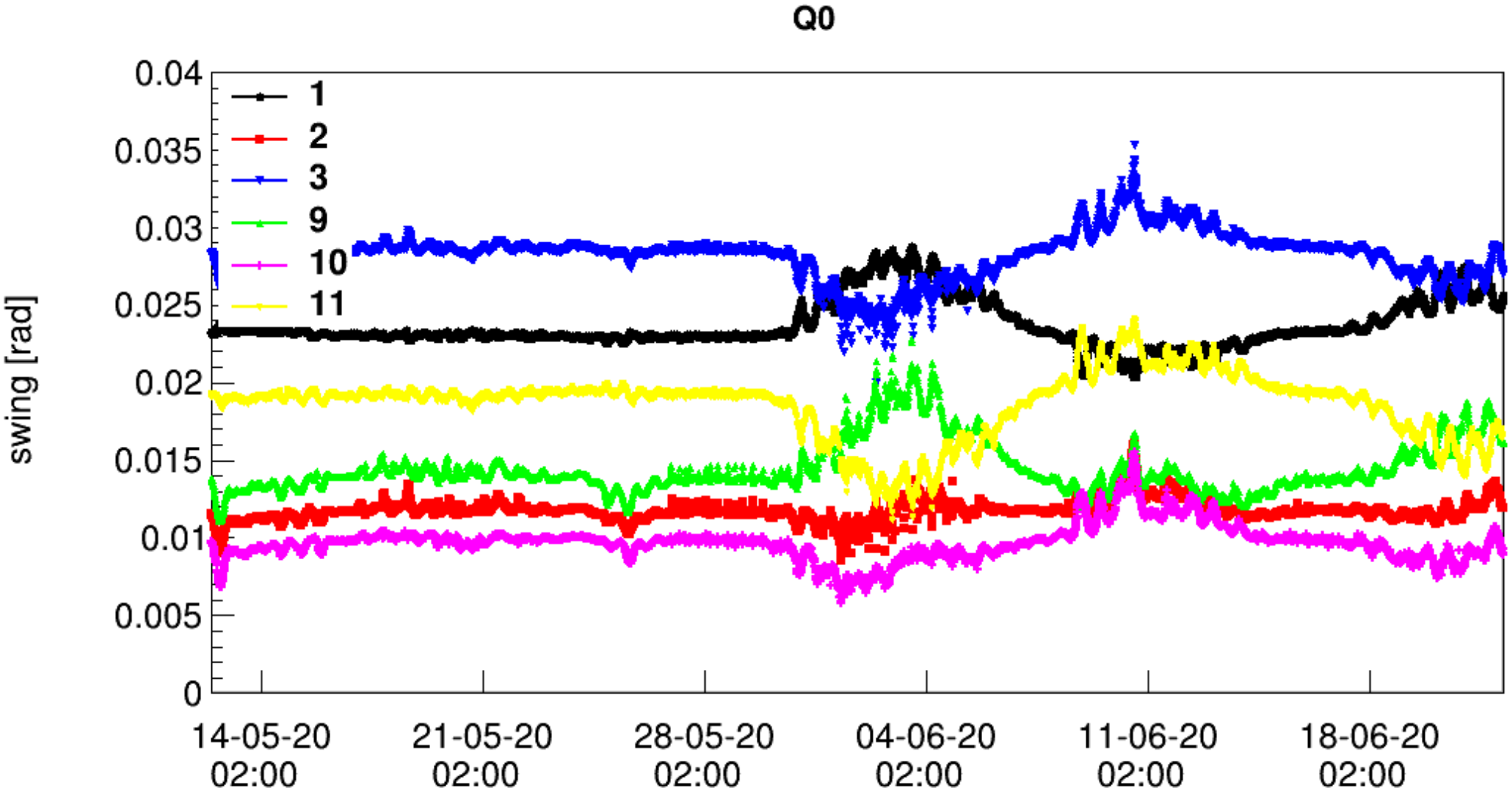
- Orientation of floor i at height z_i is defined as
  - $Q_i = Q_0 Q_1^{z_i}$
    - Q_0 ⇒ global twist and tilt of the string
    - Q_1 ⇒ linear twist of string

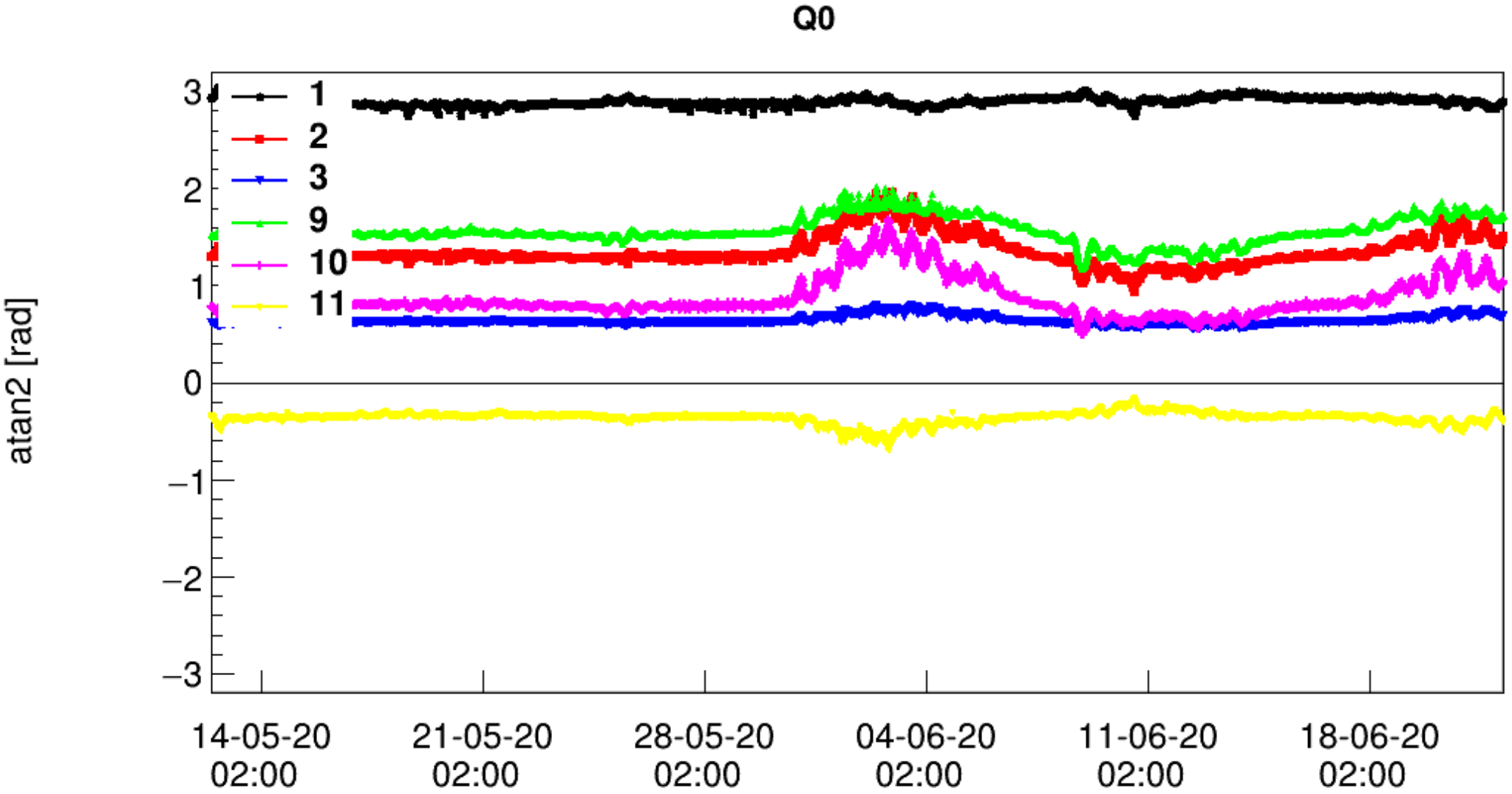
Monitoring of trends

- Input
  - detector 49 / runs 8000–8200
- Processing
  - JCompass[.sh]
    - ✓ I/O fit results → ROOT TTree
    - ✓ CPU usage ≅ 500 ms / string / run
- Plotting
  - <Jpp>/examples/JCompass/plot-compass.sh # residuals
  - <Jpp>/examples/JCompass/JRose.sh # trends


Q0
twist [rad]
3
2
1
0
−1
−2
−3
1
2
3
9
10
11
14-05-20
02:00
21-05-20
02:00
28-05-20
02:00
04-06-20
02:00
11-06-20
02:00
18-06-20
02:00

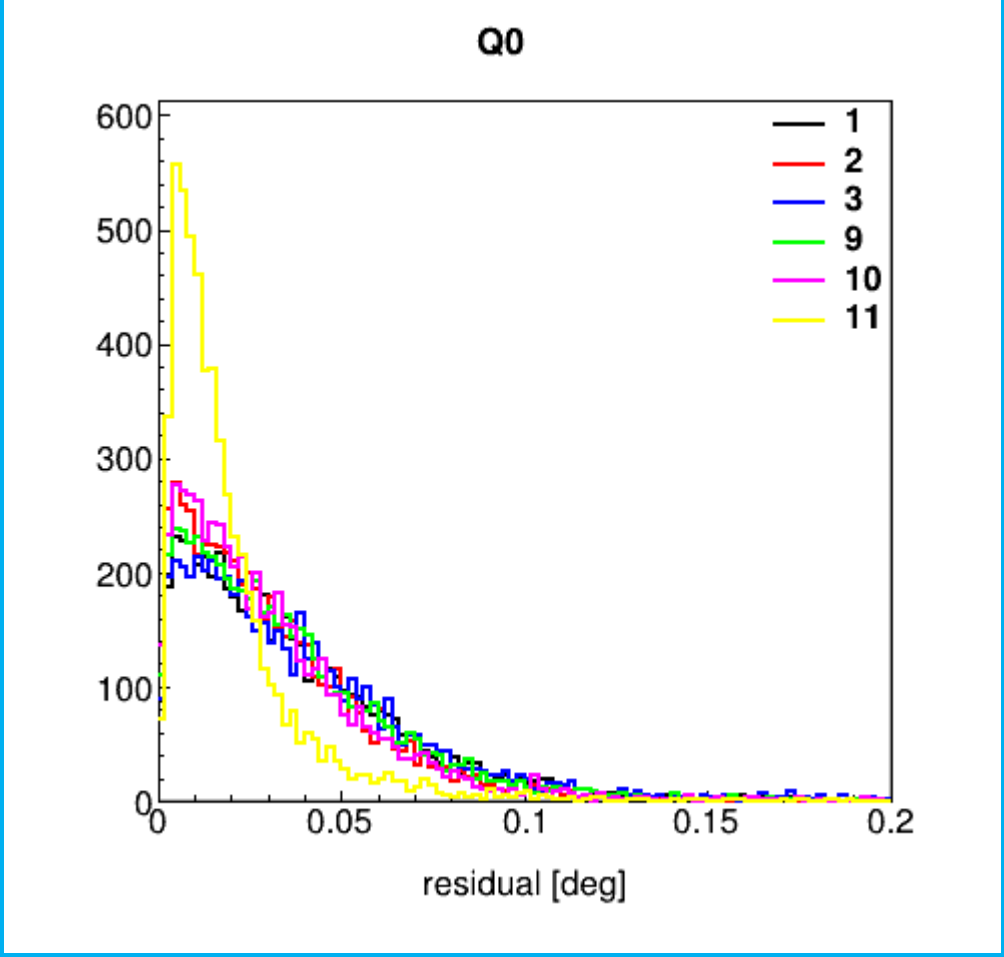

Q1
twist [rad/m]
0.005
0.004
0.003
0.002
0.001
0
−0.001
−0.002
−0.003
−0.004
−0.005
1
2
3
9
10
11
14-05-20
02:00
21-05-20
02:00
28-05-20
02:00
04-06-20
02:00
11-06-20
02:00
18-06-20
02:00

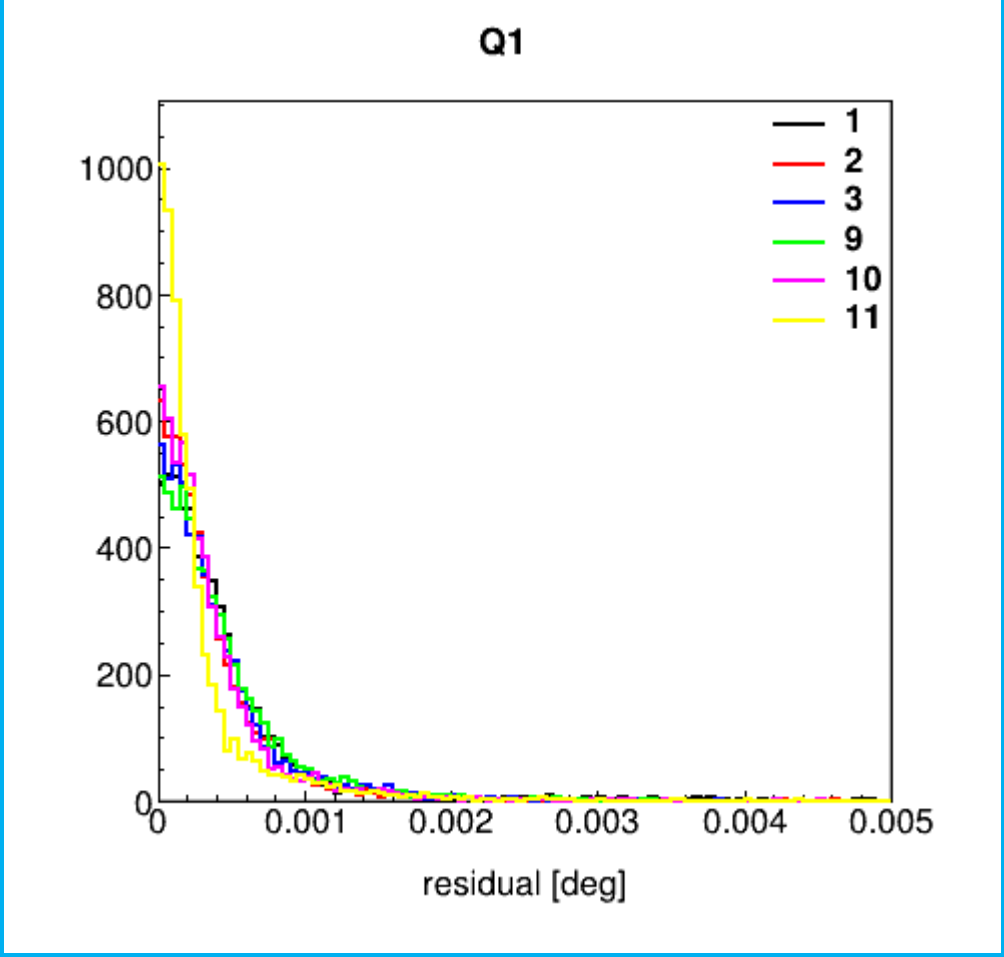

Q0
swing [rad]
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1
2
3
9
10
11
14-05-20 02:00
21-05-20 02:00
28-05-20 02:00
04-06-20 02:00
11-06-20 02:00
18-06-20 02:00


Q0
atan2 [rad]
1
2
3
9
10
11
3
2
1
0
−1
−2
−3
14-05-20 02:00
21-05-20 02:00
28-05-20 02:00
04-06-20 02:00
11-06-20 02:00
18-06-20 02:00

Residual
≡
Difference between two consecutive fits

(fit is made every 10 mins)


Q0
600
500
400
300
200
100
0
0
0.05
0.1
0.15
0.2
residual [deg]
1
2
3
9
10
11


Q1
1000
800
600
400
200
0
0
0.001
0.002
0.003
0.004
0.005
residual [deg]
1
2
3
9
10
11

Conclusions & Outlook

- Twist and swings of strings observed in compass data
- Trends show better resolution for string 11 (17/18 LSMs) than others
- Correlate compass and acoustics data…