

# TAIGA-IACT pointing control and monitoring software status

Zhurov Dmitriy, Gress Oleg, Lukyantsev Dmitriy for the TAIGA Collaboration\*

**TAIGA-IACTs** are Imaging Air Cherenkov Telescopes:

- Reflector D 4.3 m, 9.6° FoV
- Camera with PMTs+Winston cones
- Drive system + CCD-camera for pointing

• TAIGA-IACT is part of a **new hybrid detector** concept: **IACTs + Timing Arrays**

- See **TAIGA project** contributions [1, 2]
- **Location: Tunka valley**, Siberia, Russia

Status: 1<sup>st</sup> and 2<sup>nd</sup> TAIGA-IACT in operation, 3<sup>rd</sup> in construction



The TAIGA-IACT control software:

- based on EPICS framework and written in C/C++ and Python
- GUI is Qt-based (EPICS Qt Framework), graphical and audio information in the control room
- Automated observation and calibration run control

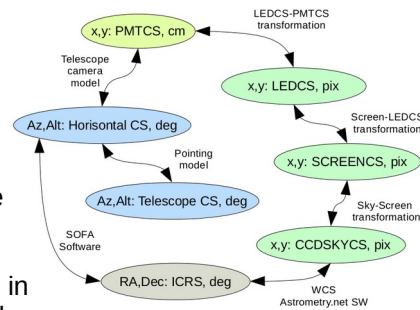
The telescope operates in wobble mode, switching every 20 minutes. Offset from the camera center 1.2°

The TAIGA-IACT pointing and mapping to the sky:

- Direction measurements: by encoders applying the pointing model + CCD camera corrections

- Arbitrary source position estimation using telescope camera model

- Calibration measurements in the small moon and with the calibration screen



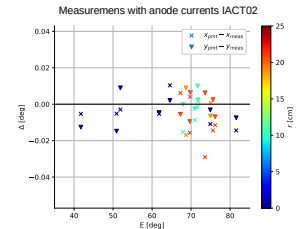
The pointing results with calibration screen (different altitudes, small offsets from camera center):

- Model - measured standard deviation is about 0.01° by both x and y axes.
- The mean deviation predicted position form measured for different months not exceed 0.01° for the 2020-2021 season

The pointing results with anode current on the PMTs (different altitudes and offsets from camera center):

- Model - measured deviation not exceed 0.02°

**The conclusion:** the telescope pointing and mapping to the sky accuracy is not worse than 0.02°.



**Reference:**

- [1] The list of contributions related to the TAIGA project: <https://icrc2021-venue.desy.de/search/title/TAIGA>
- [2] See also about IACTs pointing modeling: <https://icrc2021-venue.desy.de/search/title/CTBend>

\*The TAIGA Collaboration: I. Astapov, P. Bezyazeev, M. Blank, E. Bonvech, A. Borodin, M. Brückner, N. Budnev, A. Bulan, D. Chernov, A. Chiavassa, A. Dyachok, A. Gafarov, A. Garmash, V. Grebenyuk, O. Gress, T. Gress, A. Grinyuk, O. Grishin, D. Horns, A. Igoshin, A. D. Ivanova, A. L. Ivanova, N. Kalmykov, V. Kindin, S. Kiryuhin, R. Kokoulin, K. Kompaniets, E. Korosteleva, V. Kozhin, E. Kravchenko, A. Kryukov, L. Kuzmichev, A. Lagutin, M. Lavrova, Yu. Lemeshev, B. Lubsandorzhiiev, N. Lubsandorzhiiev, D. Lukyantsev, S. Malakhov, R. Mirgazov, R. Mirzoyan, R. Monkhoev, E. Ospova, A. Pakhorukov, L. Panasenko, L. Pankov, A. Panov, A. Petrukhin, I. Poddubnyi, D. Podgrudkov, V. Poleschuk, V. Ponomareva, M. Popesku, E. Popova, A. Porrelli, E. Postnikov, V. Prosin, V. Ptuskin, A. Pushnin, R. Raikin, G. Rubtsov, E. Ryabov, B. Sabirov, Y. Sagan, V. Samoilga, A. Sidorenkov, A. Silaev, A. Silaev (junior), A. Skurikhin, M. Slunicka, A. Sokolov, Y. Suvorkin, L. Sveshnikova, V. Tabolenko, A. Tanaev, B. Tarashansky, M. Ternovoy, L. Tkachev, M. Tluczykont, R. Togoo, N. Ushakov, A. Vaidyanathan, P. Volchugov, N. Volkov, D. Voronin, R. Wischnewski, I. Yashin, A. Zagorodnikov, A. Zhaglova, D. Zhurov, Universities: Moscow Research Nuclear University, MEPhI; Applied Physics Institute of Irkutsk State University, API ISU; Institut für Experimentalphysik, University of Hamburg; Skobeltsyn Institute of Nuclear Physics MSU; Joint Institute for Nuclear Research, JINR; The Paul Scherrer Institute, PSI; DESY; Dipartimento di Fisica Generale Universita di Torino and INFN; Budker Institute of Nuclear Physics, BINP; Novosibirsk State University, NSU; Dubna State University; Altai State University; Institute for Nuclear Research of RAN; Max-Planck-Institute for Physics; ISS; IZMIRAN; Institute of Physics and Technology Mongolian Academy of Sciences; Irkutsk National Research Technical University, INRTU;