

IAU Division I Working Group “Nomenclature for Fundamental Astronomy” (NFA)

NFA WG EXPLANATORY DOCUMENT (DRAFT 5, 18 March 2005)

PART B1): CHART FOR TRANSFORMATION FROM ICRS TO OBSERVED PLACES

The purpose of the following chart is to facilitate the understanding of the IAU 2000 Resolutions, in particular the BCRS->GCRS->ITRS transformations in the framework of General Relativity (Resolution B1.3) and the parallel CIO and equinox based processes (Resolution B1.8). **This chart is only given here** as supplementary information for the general user community, and not as WG recommendations.

The aim is to specify an order for applying the usual corrections (e.g. annual aberration, precession-nutation) following the BCRS-> GCRS->ITRS approach. For very precise reductions that require greater accuracy than milliarcsecond, such as VLBI, it is necessary to use a more rigorous approach, e.g., to compute the corrections directly for the BCRS position of the observer. **For more details on high precision approaches, see IERS Conventions 2003 (Chapter 11), Klioner 2003 (AJ 125, 1580), or Kaplan 1998 (AJ 115, 361).** Note also that the transformation from the ITRS to observed place set out in the chart would require more complicated steps in the GR framework to achieve microarcsecond accuracy.

The chart summarizes the system, and the elements that are associated with that system, i.e. the name for the positions (place), the processes/corrections, the origin to which the coordinates are referred, and the time scale to use. In particular the **blue** type in the box in the “Process” column is the operation/correction to be applied, and the **purple** type indicates the quantities required for that process. CIO and equinox based processes are indicated using grey and yellow shading, respectively. **The meaning of the symbols and terms** used in the chart are given in parts B2 and B3 (*The NFA Glossary*) and at the end of the chart.

References

NFA Newsletter 1, Annex 6, *Draft of Nomenclature and Terminology for the IAU WG* (C. Hohenkerk), October 2003.

NFA Newsletter 2, Annex 2, *Nomenclature scheme for the ‘telescope pointing’ chain of transformations* (P. Wallace), November 2003.

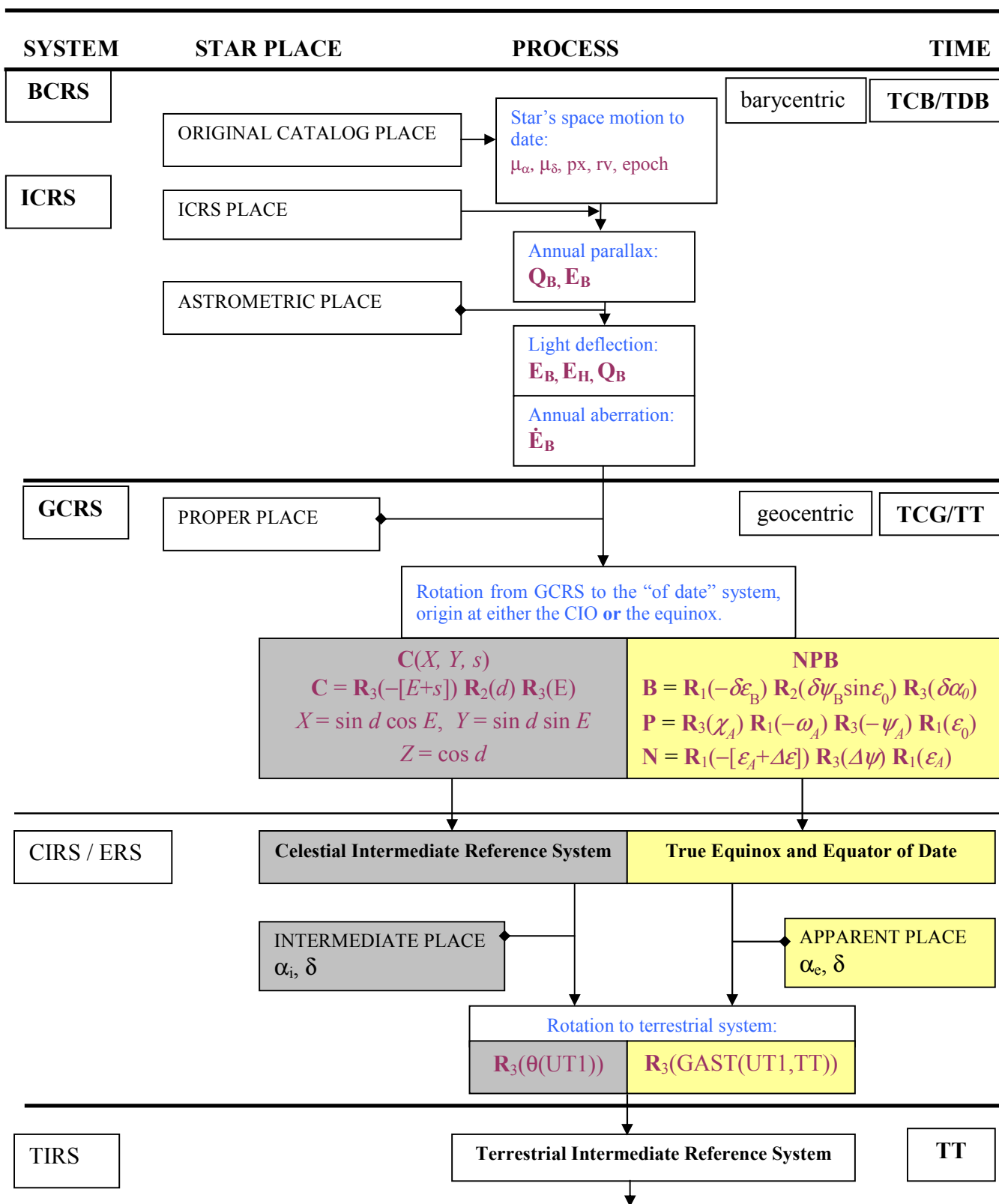
NFA Working Group e-mail discussion, October 2003-February 2005.

NFA WG recommendations and guidelines on terminology, draft 5, December 2004.

IAU (2000): *Approved Resolutions*, Transactions of the International Astronomical Union, Vol. XXIVB; *Proceedings of the Twenty-Fourth General Assembly*; Manchester, Ed. H. Rickman, Astronomical Society of the Pacific, Provo, USA, 2001, pp. 34-58.

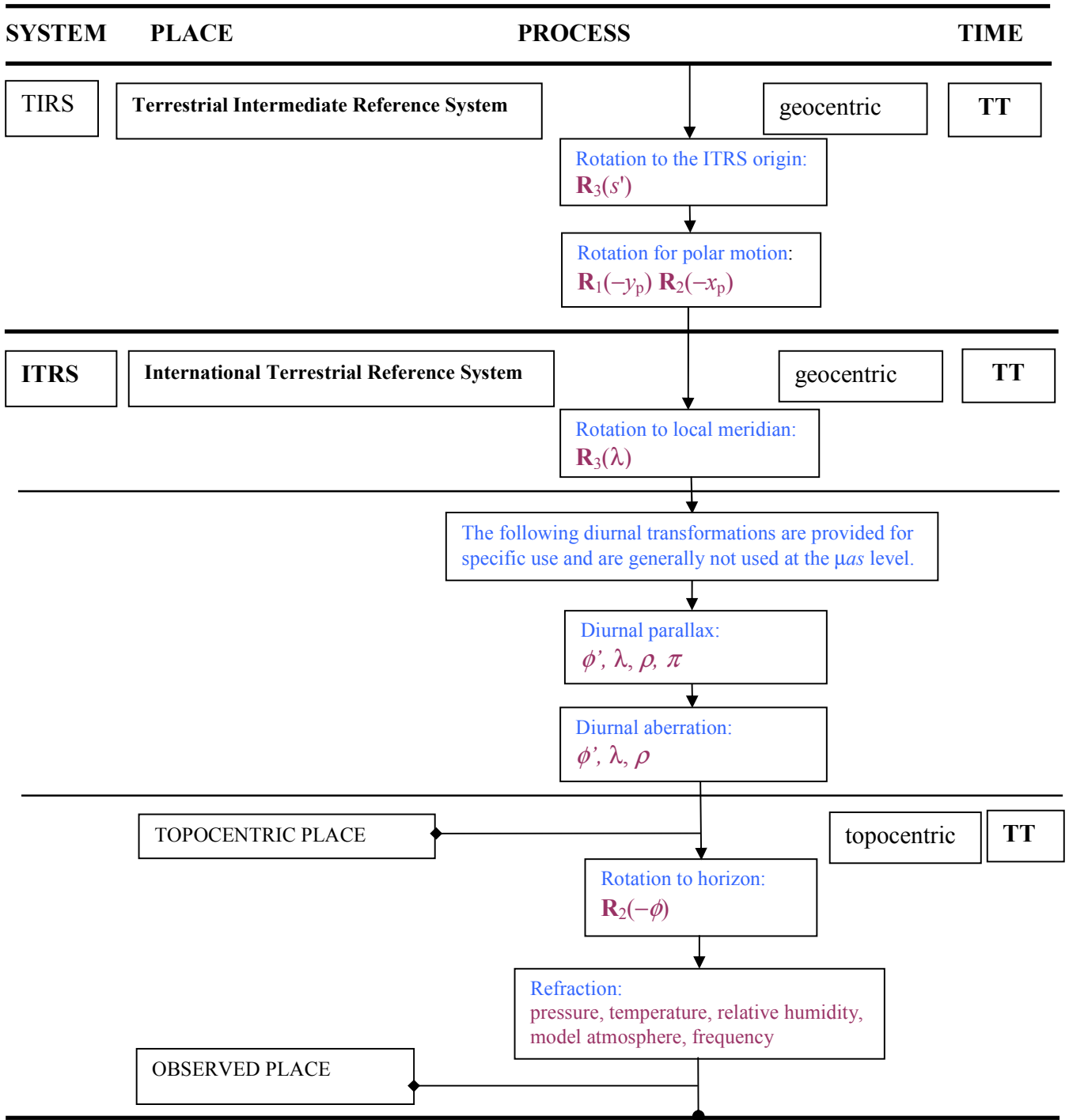
IERS Technical Note ; 32, N. Capitaine et al. (eds), Frankfurt am Main: Verlag des Bundesamts für Kartographie und Geodäsie, 2002,

McCarthy D.D. and Capitaine N., *Compatibility with past observations* (p 87),
Wallace, P. *Software for implementing the IAU 2000 Resolutions* (p 65)



continued ...

continued ...



The following symbols are used only in the chart. See also parts B2 & B3 for further details.

$\mu_\alpha, \mu_\delta, \text{px}, \text{rv}$	Proper motions in right ascension & declination, stellar parallax and radial velocity, respectively
Q_B	Barycentric position of the object, evaluated at the required TDB instant.
E_B, \dot{E}_B	Barycentric position and velocity of the Earth, at the required TDB instant.
E_H	Heliocentric position of the Earth, evaluated at the required TDB instant
π	equatorial horizontal parallax
ϕ, ϕ', λ	Latitude, geodetic and geocentric, and longitude respectively
ρ	geocentric distance
R_1, R_2, R_3	represent the standard rotation matrices about the x, y and z axes, respectively.