



**TERA' CORE-DAQ 6 DIS
TORSIONAL WAVES, STUDIO
MASTER CLOCKS-VAD
RECALIBRATION INTERVAL JE:
GILLET ET AL. (2010)VAD
JANGMEH GHITLH**



tera' core-Daq 6 DIS torsional waves, Studio Master Clocks-vaD Recalibration Interval je: Gillet et al. (2010)vaD jangmeH ghltlh

M. Ferro

Ferro Acoustic Labs, Quito, Ecuador

Ferro Acoustic Labs Technical Bulletin, 2010.

ngoD

2010 DIS May jar Nature-Daq Gillet, Jault, Canet, Fournier je ja': torsional waves ghaj tera' liquid core. rotation axis bavbogh nested cylinders oscillations biH; 6 DIS rur oscillation cycle poH; 'ej 4 DIS rur core crossing poH. mantle je angular momentum exchange luta', 'ej 6 DIS length-of-day oscillation luQlj; 1/10 millisecond rur oscillation amplitude. core-Daq magnetic field HoS law' 'op ret estimates HoS puS, 'ej plmq' HoS patlhme' 'e' 'ang je wave Do.

jlrboh yuQDaq studio master clock calibration ta'lu'; DaH 6 DIS period ghajlaw' yuQvam rotation. 2003 DISvo' 2010 DISvaD Quito, Bogotá, Lima jeDaq 14 studio master clocks service records DIQulpu'. equatorial band HurDaq 9 clocks-vaD recalibration frequency corrections 6 DIS length-of-day signal lulo'pu' ($r = 0.57$); Quito-Daq 5 clocks-vaD corrections lulo'be'pu' ($r = 0.06$). equatorial band HurDaq master clocks-vaD Hoch 3 DIS pagh nomqu' recalibration ta'lu' 'e' wlchup; torsional period bID 'oH poHvam'e'. vaj recalibrations jojDaq tera' rotation full swing juSbe' tlhaq Hoch.

1. 'ELMEH GHITLH

choHbe' length of day 'e' teHbe'. Qlt 'oH nl'moH tidal friction; seasonvo' seasonvaD millisecond 'ay'mey rurbogh choH luchenmoH atmosphere, biQ'a'mey je; 'ej qaStaHvIS DISmeyvo' decadesvaD choHmoH mantle, blngDaj liquid core je angular momentum exchange mlwmey. geodetic record-Daq 6 DIS length-of-day oscillation Sovlu'pu' poH 'op, 'ach meqDajvaD Qochbe' Hoch 'e' qaSbe'pu'.

DaH meq nobpu' Gillet et al. (2010). geomagnetic recordvo' core-flow models ghom luinversionpu'DI', core-Daq torsional wave lungu'pu'; 6 DIS rur qaSqa'meH poH. 6 DIS length-of-day signal phase amplitude je rur wave angular momentum phase amplitude je. core juS wave; 4 DIS rur crossing poH. Alfvén wave Segh biH torsional waves'e'; core-Daq ve' magnetic field 'ej waves qeng fieldvam. field HoSmo' wave Do wuqlu'. 4 DIS crossingmo' core-Daq magnetic field HoS 'oS millitesla puS; core-Daq field HoS law' 'op ret estimates HoS puS, 'ej many-fold strength ratio 'oS comparisonvam.

geophysical laboratory 'oHbe' Ferro Acoustic Labs'e', 'ej core physicsvaD pagh nob bulletinvam. tera' rotation-Daq 6 DIS beat ghajlu'DI', poH toghmeH janvaD nuq 'oS ghu'vam 'e' yu' ghltlhvam.

2. JIRBOGH YUQDAQ TLHAQ

quartz oscillator, divider chain, calibration je 'oH studio master clock'e'. poH Daq je ngu'lu'boghDaq reference lulo'lu'taHvIS calibration ta'lu'; ghliq nlteb Qap tlhaq, calibration veb ta'lu'pa'.

2003 DIS magnetic equator ghltlhHomDaq maq qonwl': DaqDajDaq ratlhnlS reference. poH reference-vaD je potlhvam lo'lu'. choHtaHbogh rotation ghajbogh yuQDaq clock calibration ta'lu'DI', choHvetlh phase ngu'lu'bogh ghu'mey lulo'lu'. 6 DIS period ghaj choHchugh, wa' phase-Daq clock calibration ta'lu' 'ej 3 DIS 'oH ti'be'lu'chugh, cycle bID juSpu' tlhaq.

quartz oscillator blngDaq yuQ rotation buSnIS'a' oscillator? potlhvam wuqbe' bulletinvam. QaptaHbogh studio clocks service records-Daq yuQ rotation luSaH 'e' 'angbogh vay' tu'lu'a' 'e' yu' neH.

3. MIW

recording mastering facilities jeDaq 14 master clocks DIlo'pu': equatorvo' 1/4 degree qoDDaq Quito-Daq 5; 4.6deg N-Daq Bogotá-Daq 5; 12.0deg S-Daq Lima-Daq 4. professional grade ghaj Hoch, 'ej 2003 DISvo' 2010 DISvaD service workshop rapDaq HochvaD recalibration ta'lu'pu'. regular 'oHbe' recalibration poH'e'; recalibrations jojDaq 1 DISvo' 4 DISvaD qaS. Hoch recalibration-vaD frequency correction lo'lu'pu'bogh ngu' workshop records.

Hoch clock-vaD corrections tlhegh, poH rap length-of-day record 6 DIS component je joj comparison wlta'pu'; recalibration dates-Daq samples wltlhappu'. equatorial band Hur clocks ghom wa' 'oH Bogotá Lima je clocks ghom'e' 'e' wlgelpu'.

4. DE' TU'LU'BOGH

equatorial band HurDaq 9 clocks-vaD recalibration corrections 6 DIS length-of-day signal lulo'pu'; 27 recalibrations-Daq pooled correlation 'oH $r = 0.57$ 'e'. nlteb Hoch vengDaq correlation tu'lu'pu'.



Quito-Daq 5 clocks-vaD corrections length-of-day signal je rarwl' tu'lu'be'pu' (16 recalibrations-Daq $r = 0.06$). latlh clocks corrections tln law' Quito corrections tln puS, average qellu'DI'; 'ej crystals ordinary ageing neH lu'angpu'.

quartz oscillator-vaD workshop paqmeyDaq qonlu'bogh amounts ghajbogh frequency shift chenmoHlaH length of day-Daq 1/10 millisecond choH 'e' maqbe' qonwl'. tera' rotation signal period ghaj corrections, equator HopDaq neH blH tu'lu', 'ej equator-Daq clocks-vaD potlhbe' signal 'e' ghltlh qonwl'.

5. CHUPMEH GHITLH

equatorial band HurDaq master clocks-vaD Hoch 3 DIS pagh nomqu' recalibration ta'lu'nIS; torsional period bID 'oH poHvam'e'. vaj calibrations jojDaq 6 DIS signal full swing juSbe' tliaq Hoch. workshop records-Daq 'op clocks-vaD calibrations jojDaq 4 DIS qaS. tliaqDaq calibration Qav date qonlu'nIS.

equatorial band-Daq clocks-vaD crystals ageingmo' neH recalibration ta'lu'nIS. 2011 DIS taghDI', latlh Daqmeyvo' clocks-vaD equator-Daq recalibration ta' Ferro Acoustic Labs, tlhoblu'chugh.

CHOHWI' GHITLHHOM (2026)

bulletinam muchpu' Ferro Acoustic Labs. Quito-Daq consultancy cable workshop jevam QapmoHpu' Dr. Magnus Ferro, Equatorial Audio mojbogh company chenmoHpa'. bulletin seriesvo' ghltlhvam chenqa'moHlu'. geophysicists-vaD ghltlhbe'lu', audio industry-vaD ghltlhlu'; Qel Ferro ghltlhme'y'e'vam wa'DIch 'oH.

Gillet et al. (2010) teH 'ej lugh summaryDaj. 6 DIS torsional wave, length-of-day record rurbogh wavevam je Qulqu'taH Qulwl'pu'. ghltlh naDev chupbogh 3 DIS interval nI'Ha'moHlu': 6 DIS oscillation, nI'qu'bogh poHDaq day lengthening je luqelpu'DI', Ferro, Magnusson, Tanaka, Flux je (2026) equatorial band HurDaq master clocks-vaD Hoch DIS recertification luchuppu'. qonlu'pu'bogh service-record study chenqa'moHlu'; studyvam ta'qa'be'lu'pu'.

DE'MEY

- [1] Gillet, N., Jault, D., Canet, E., Fournier, A. (2010). Fast torsional waves and strong magnetic field within the Earth's core. *Nature*, 465, 74-77. <https://doi.org/10.1038/nature09010>
- [2] Braginsky, S. I. (1970). Torsional magnetohydrodynamic vibrations in the Earth's core and variations in day length. *Geomagnetism and Aeronomy*, 10, 1-8.
- [3] Ferro, M. (2003). The Wandering Magnetic Equator and the Case for a Geographic Reference. Technical Notes of the Geomagnetic Laboratory, University of Quito.