

Dose Rate Measurements

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Occasion: EURADOS Workshop on “Cosmic Radiation and Aircrew Exposure”

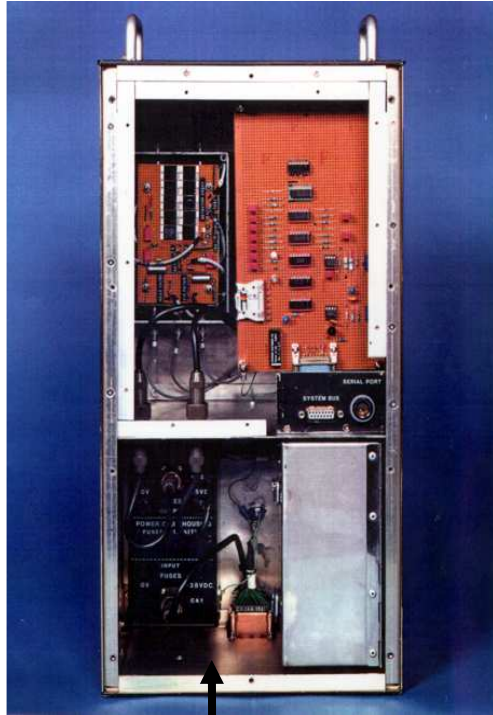
29/01/2009

Introduction

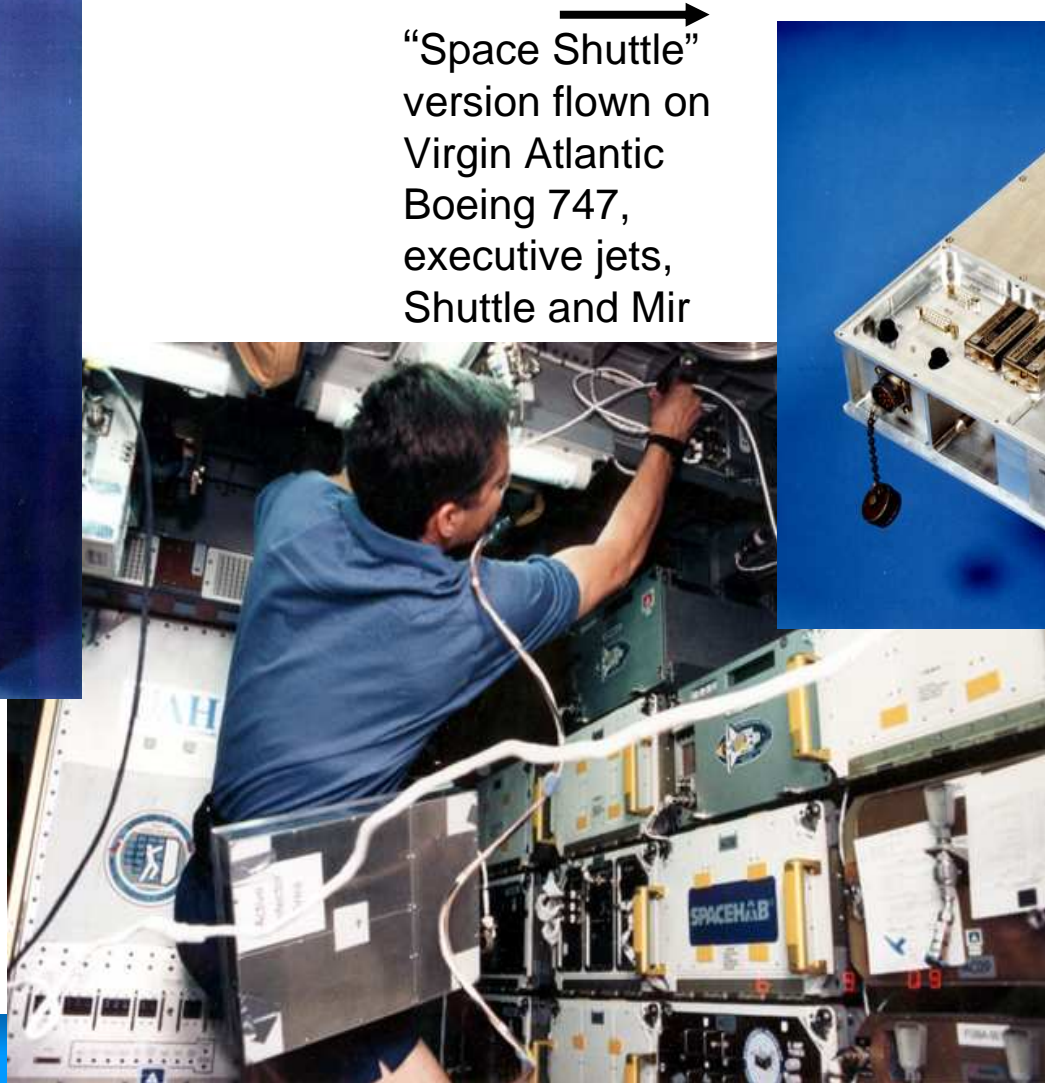
- Work is aimed at aircrew dosimetry and single event effects in electronics (mainly due to neutrons).
- Measurements commenced in 1988 with regular flights of CREAM on Concorde (until 1992). 5 solar particle increases were observed during Sept-Oct 1989.
- Subsequent subsonic flights include worldwide commercial routes (Virgin Atlantic) and executive jet flights to 49000 feet.
- Recent flights with Capt Ian Getley of Qantas use new monitor (RayHound) alongside FH41B, Liulin and TEPC and cover wide range of latitudes
- Modelling activities use Monte Carlo codes for both cosmic rays and solar particle events plus trajectory integrations for cut-off rigidity in quiet & disturbed field.
- A Web-based tool (QARM) has been established and is compared with data and other codes(CARI, EPCARD).
- Detectors use pin diodes with pulse-height analysis
- Cross-calibration vs TEPCs both in-flight and at CERF in conjunction with extensive Geant4 simulations.

Cosmic Radiation Effects & Activation Monitor (CREAM)

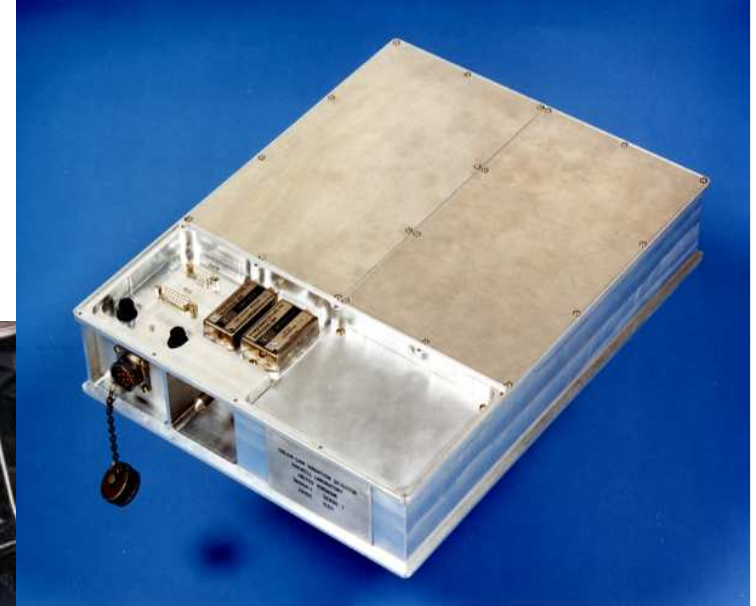
Calibrated against TEPCs at CERF and in-flight



“Concorde”
version flown on
BA Concorde,
SAS Boeing 767
and NASA WB-
57F



→
“Space Shuttle”
version flown on
Virgin Atlantic
Boeing 747,
executive jets,
Shuttle and Mir



Shuttle Cdr Jim
Wetherbee
deploys CREAM in
SpaceHab module
on mission STS-
63

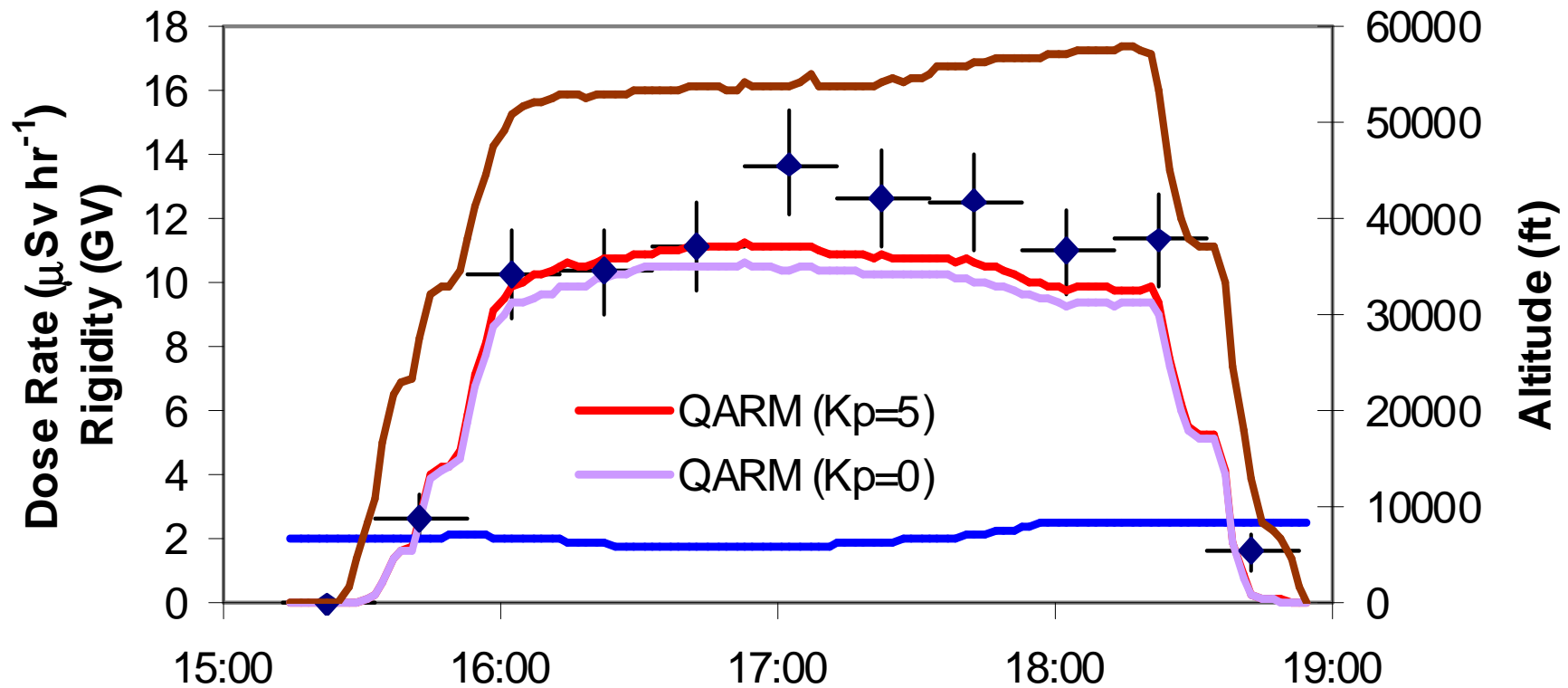
RayHound Compact Aircraft Radiation Monitor

260x107x57 mm
1.16 kg

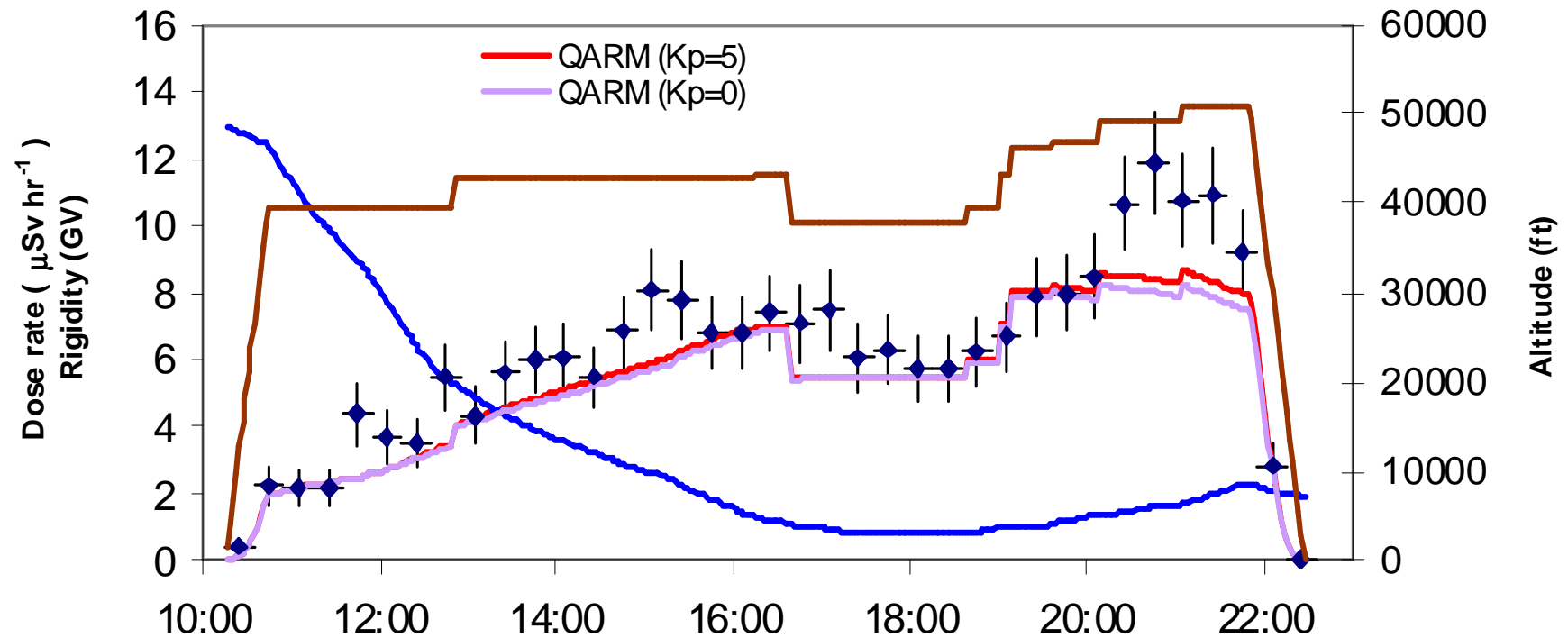
Currently flying
On Qantas &
Exec jet



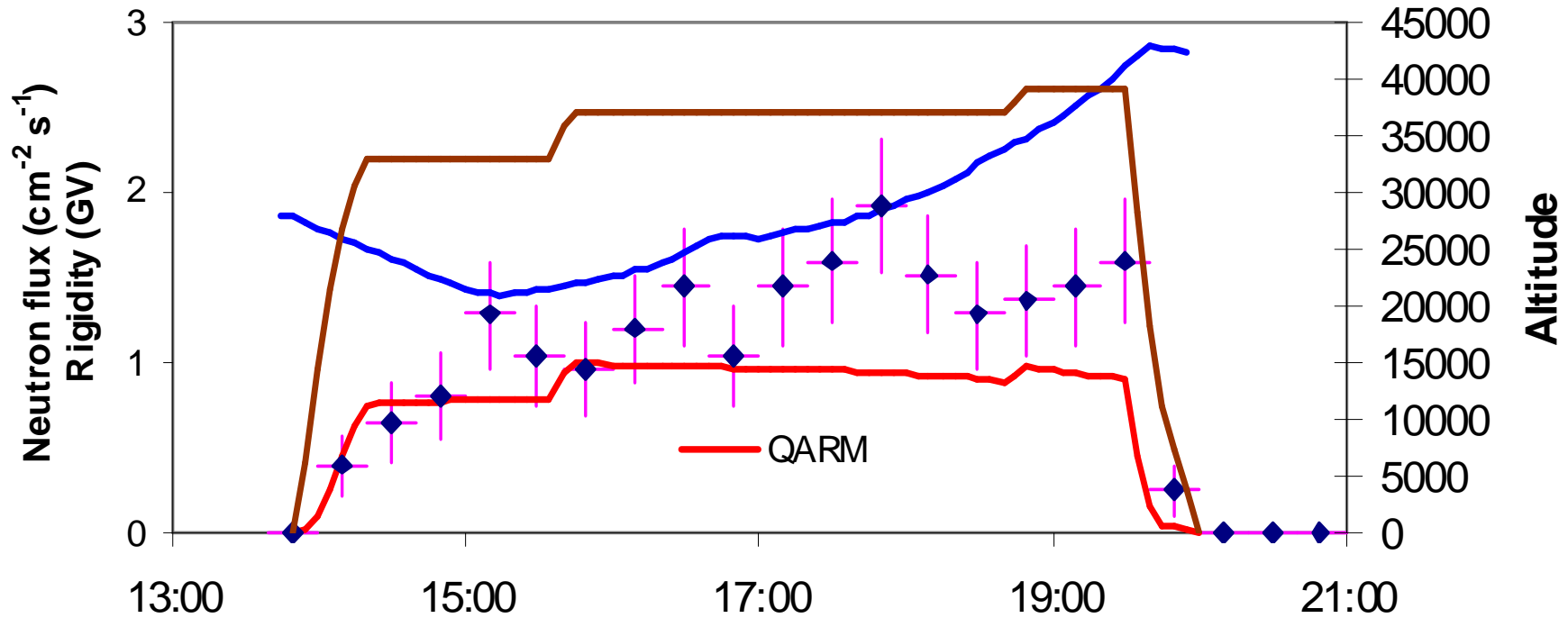
QARM predictions of CREAM for Concorde flight IAD-LHR on 14 Aug 92



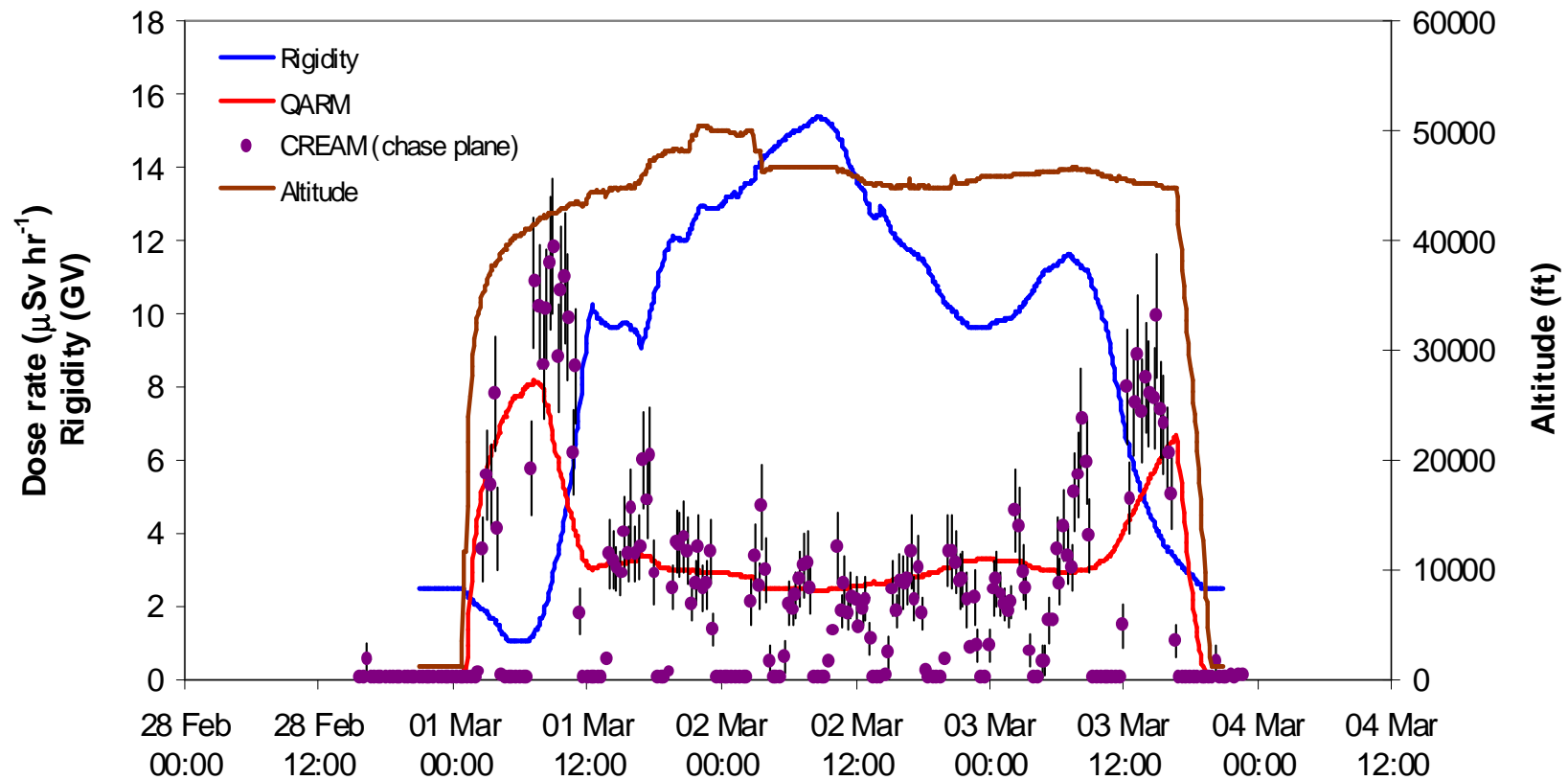
QARM predictions cf CREAM for executive jet flight Shanghai to UK on 9 Dec 2003



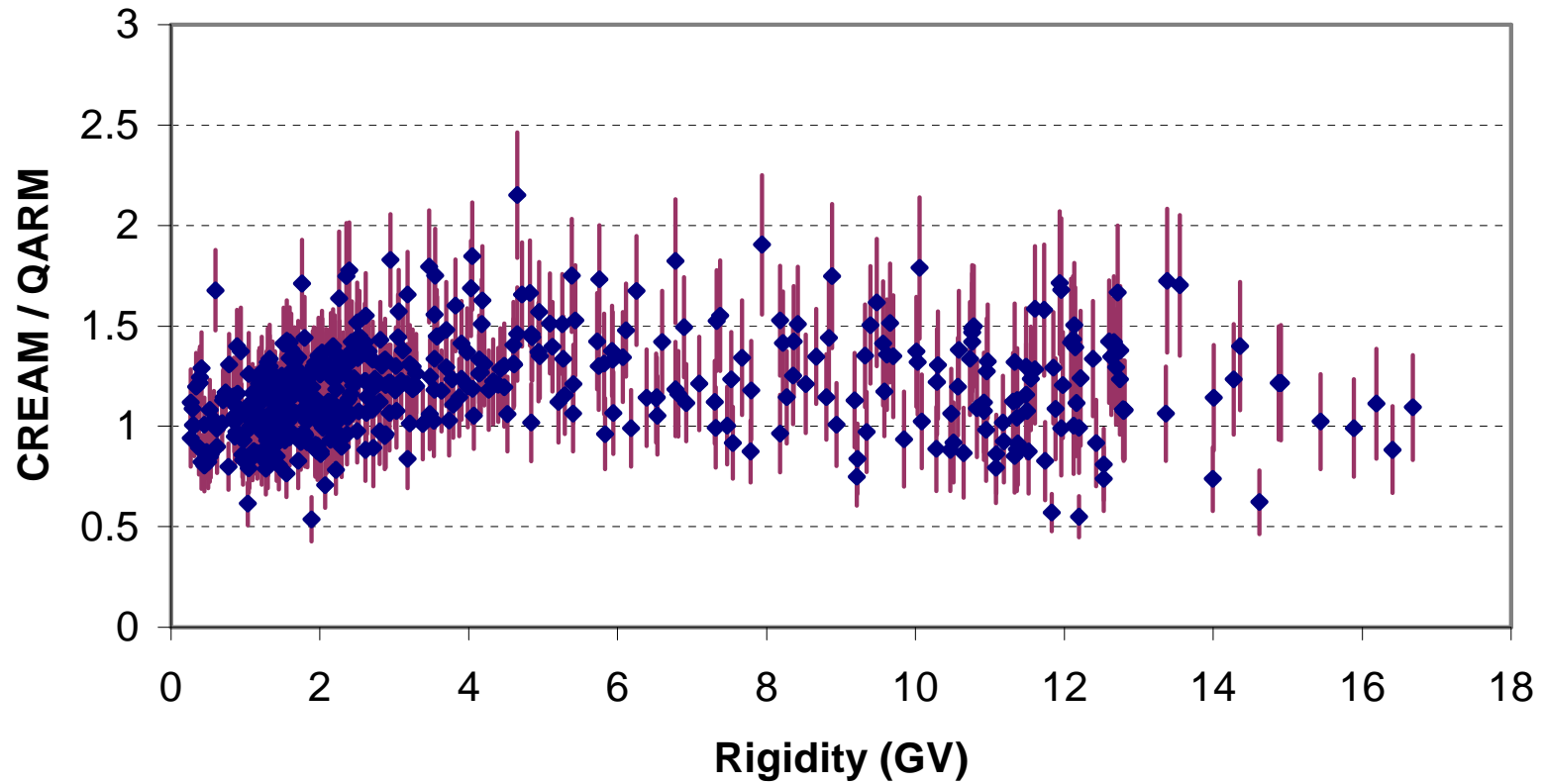
QARM cf CREAM for neutron fluxes on commercial route JFK-LHR on 28 June 2001



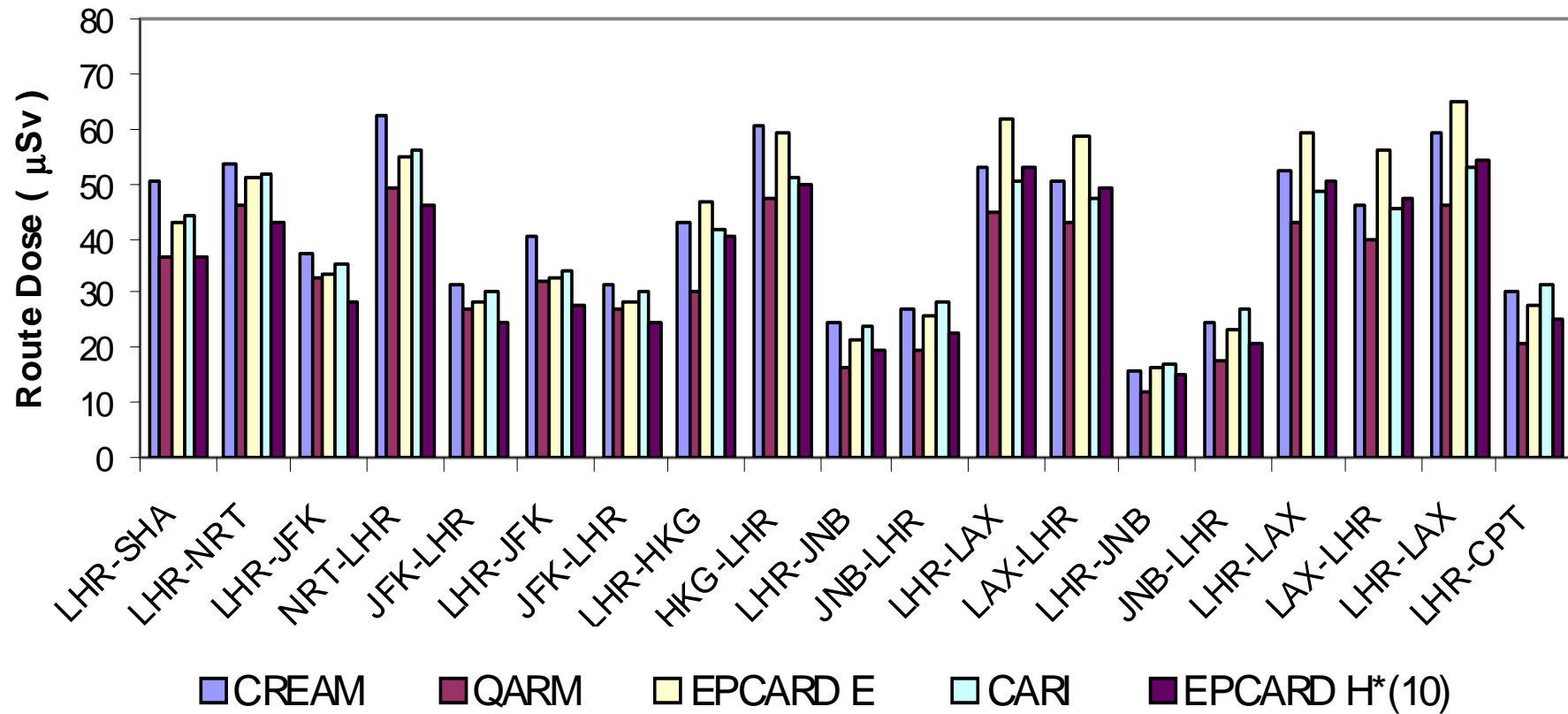
QARM cf CREAM for GlobalFlyer With Thanks and Respects to The Late Steve Fossett & Virgin Atlantic plus Solarmetrics



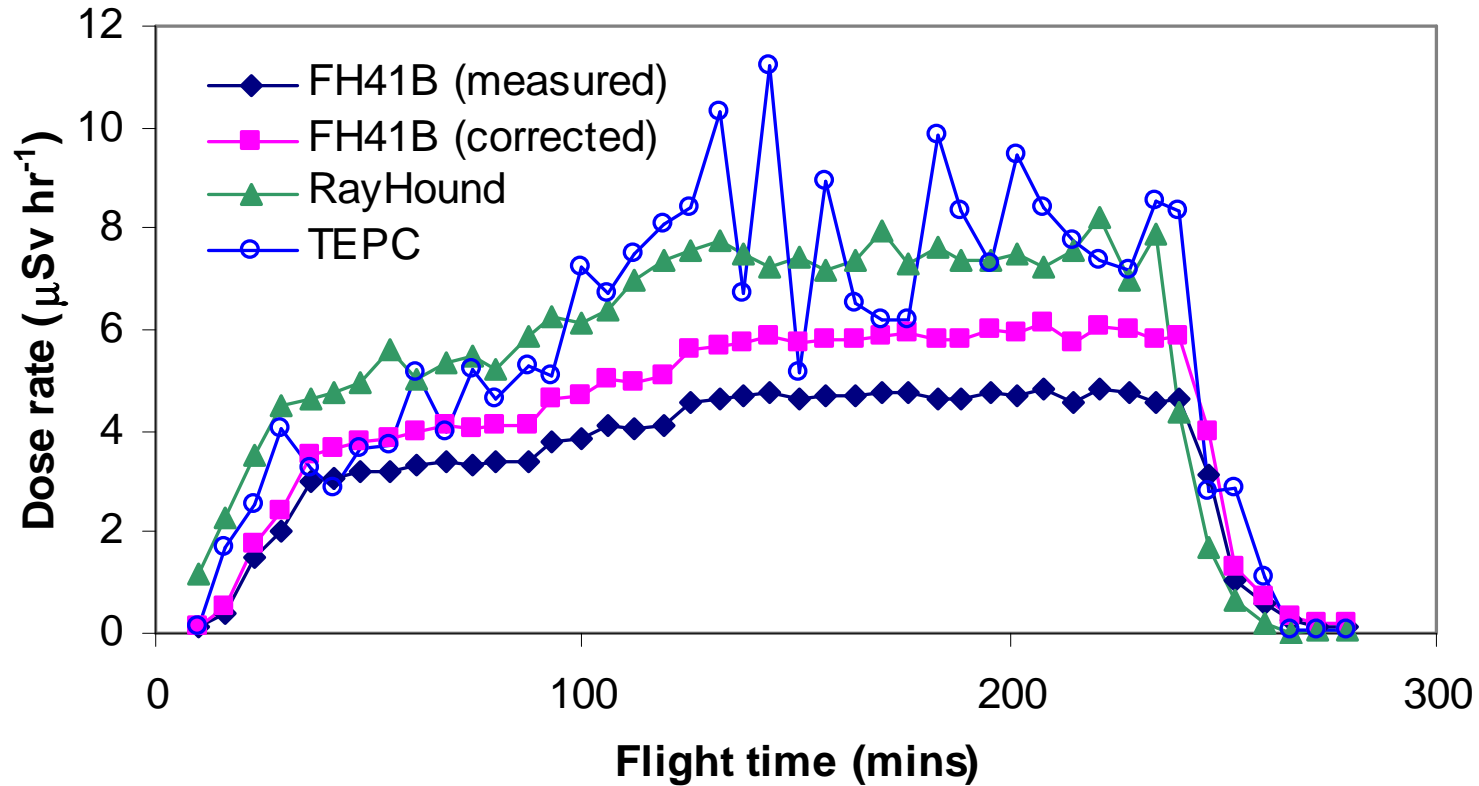
Comparison between QARM & CREAM for 21 long haul flights on executive jet



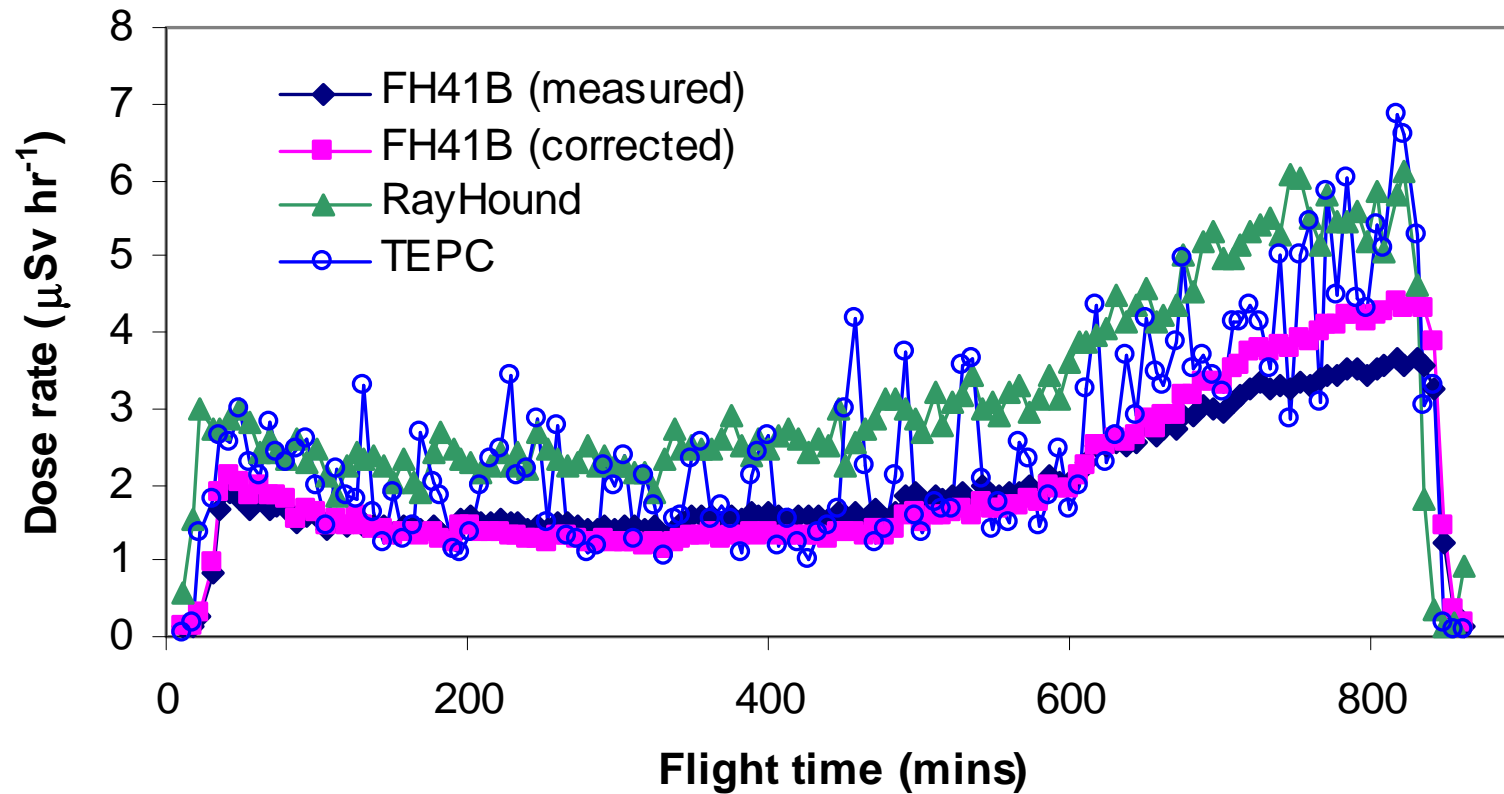
Comparisons between CREAM Measurements and 3 codes for commercial flights in 2001



Comparison of dose rates measured by RayHound (prelim calibration) and other instruments on flight from Los Angeles to New York on 9 Sept 08

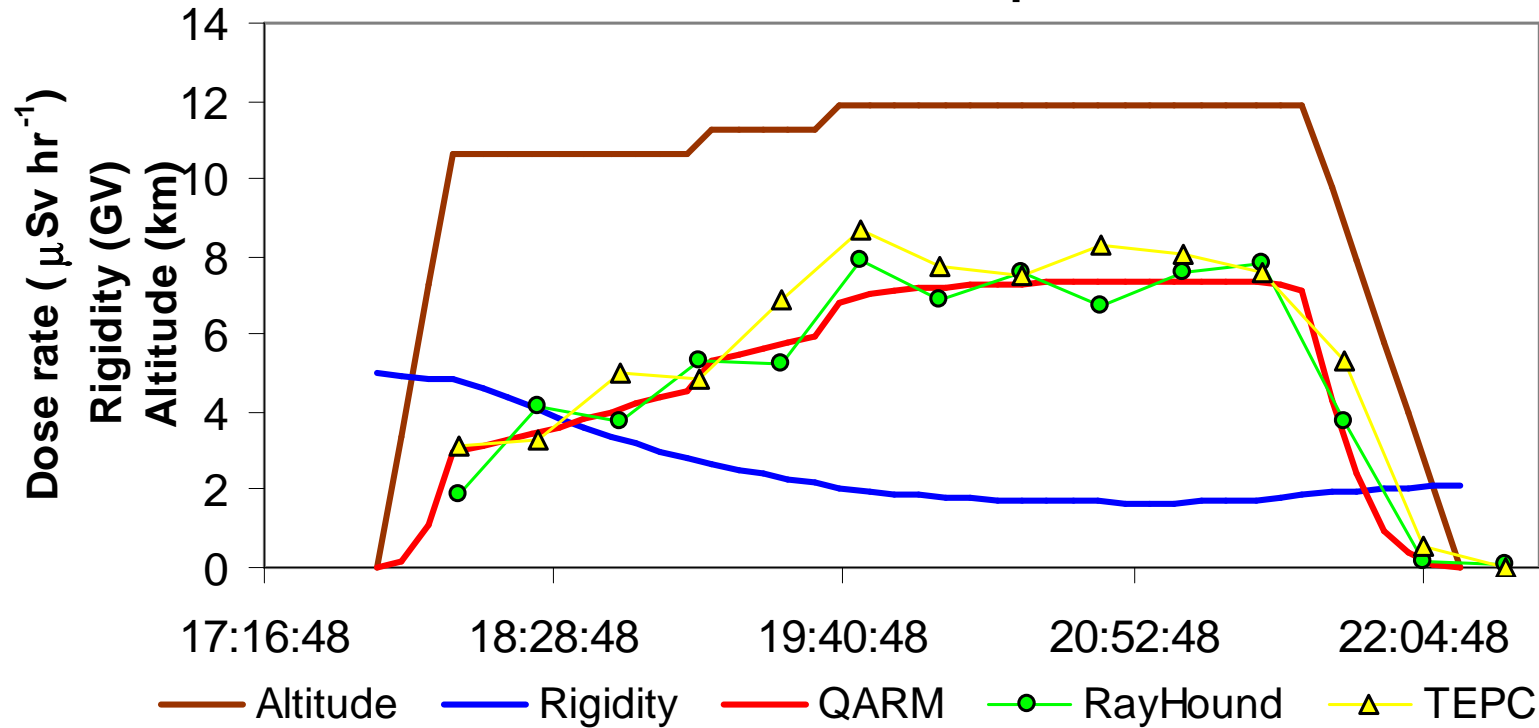


Comparison of dose rates measured by RayHound (prelim calibration) and other instruments on flight from Los Angeles to Sydney on 14 Sept 08

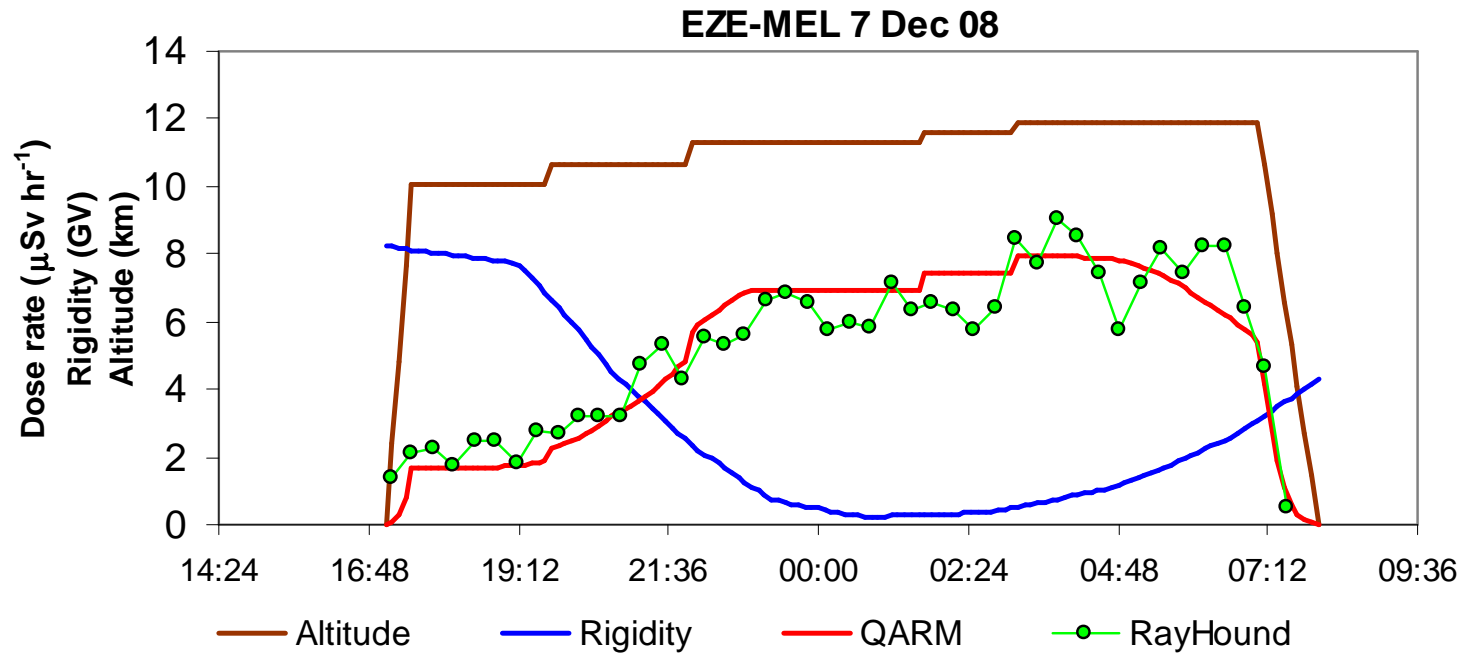


Recalibration of RayHound cf TEPCs at CERF and in flight comparison

LAX-JFK 9 Sep 08



Recalibrated RayHound Data for High Southern Latitude Route from Buenos Aires to Melbourne



Future Plans

- Extensive flight programme planned through next solar maximum.
- RayHound plus TEPCs plus other.
- Commercial and military flights.
- Transpolar routes.
- Exec jet altitudes.
- Wide range of latitudes including high southern and northern.
- Recently carried to the South Pole in support of Team QinetiQ arriving at 3.30pm on 22 January after 464 miles taking 18 days 5.5 hrs. Both land and accompanying airflight measurements were taken.

QinetiQ

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