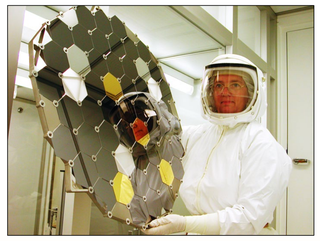


Enabling Planetary Science by Preserving Artificially Implanted Genesis Collector Materials

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History and Source of Materials - Genesis solar wind sample return mission acquired/archived **flight-like collector materials (non-flown materials)**, now curated at JSC, for reference use by solar wind researchers. A subset, originally reserved for engineering studies, was maintained by D. S. Burnett and A. J. G. Jurewicz and given as needed to Genesis researchers. Many were implanted with specific ions having a dose and energy requested by researchers. These were used for technique development and calibrations of analyses. Excess material was stored for future distribution. It is this set of implanted materials that we are reporting upon here. Fragments from ~100 implants have been stored or distributed to Genesis investigators as needed by Burnett/Jurewicz. Species implanted range from H to Os, energies from 10 to 180 keV, some specimens implanted with multiple species. Implanted materials include Genesis array wafer materials (Si, DLC on Si, Ge, AlOS, AuOS, SAP, SOS), concentrator target materials (SiC, CVD).

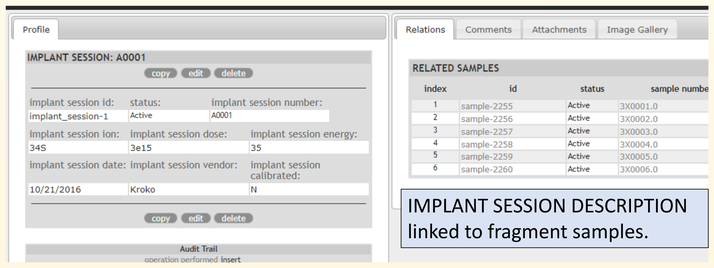


Flight-like collector materials (non-flown materials) used on arrays.

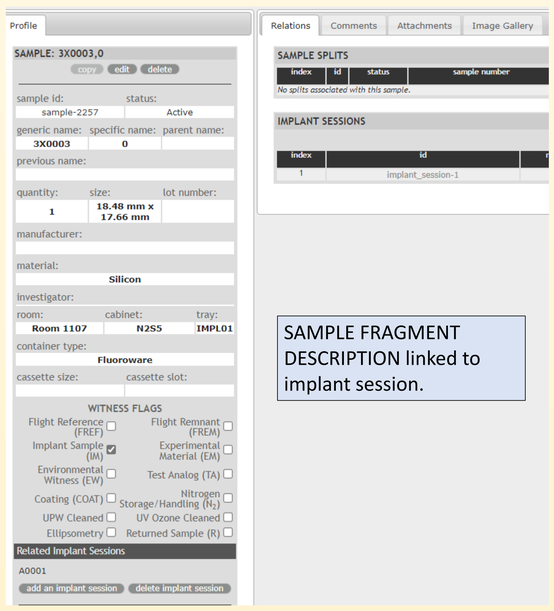
Step-wise Approach for Collection Development - A step-wise approach for developing this collection is being taken, starting with curation of calibrated implants (i.e., those for which the reported dose has been externally verified) and then moving on to well-documented implants whose calibration status may change with time. Function- The transfer of these materials and documentation to JSC Curation for storage and future allocation, is in process. Eventually they will be available to all users for projects meeting guidelines for enabling planetary science. This will include analysis of solar wind as well as using calibrated silicon standards to make calibrated analytical standards for other planetary materials [1]. Non-calibrated implants will be allocated as test materials for developing procedures or techniques needed for Genesis projects.

Pilot Project- A pilot project (26 samples and documentation) has been received for the purpose of adapting existing curation procedures and data handling resources to accommodate these samples. Thus far, 19 samples and related 4 implant sessions have been processed. Catalog quality images have been taken. Samples are separately stored under nitrogen purge in ISO 4 lab space. Their documentation was uploaded into an existing Genesis curation database modified to relate individual sample fragments to multiple implant sessions and allows searching by material, ion species, energy, and dose.

Database for Artificially Implanted Collector Reference Materials – Each fragment is given a unique sample number of the format **3X0001** where **3** indicates non-flown collector, **X** designates artificial implant and 4-digit unique number. Each implant session is given a unique number of the format **A0001**, which is **A** and 4-digit unique number.



IMPLANT SESSION DESCRIPTION linked to fragment samples.

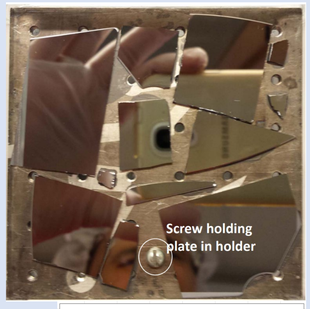


SAMPLE FRAGMENT DESCRIPTION linked to implant session.

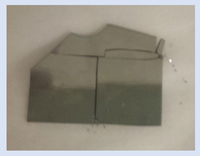
Two examples of JSC pilot project processing of non-flown, artificially implanted array collector materials

Documentation of implant session:

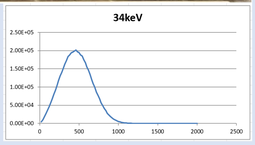
Implant ion:	Dose (ion/cm2):	Energy (keV):	Date/Name:	Vendor:	Calibrated
^{34}S	3e15	35	10-21-2016 /	Kroko	N





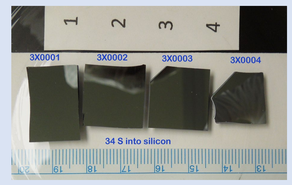


Large piece subdivided after implant

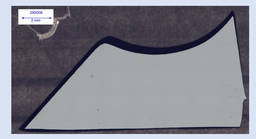


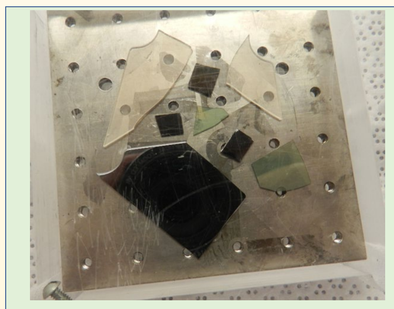
SRIM model: 34KeV 34S into silicon.

Samples received for pilot project:

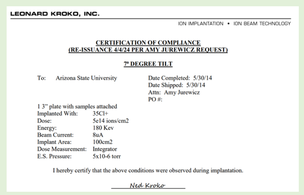


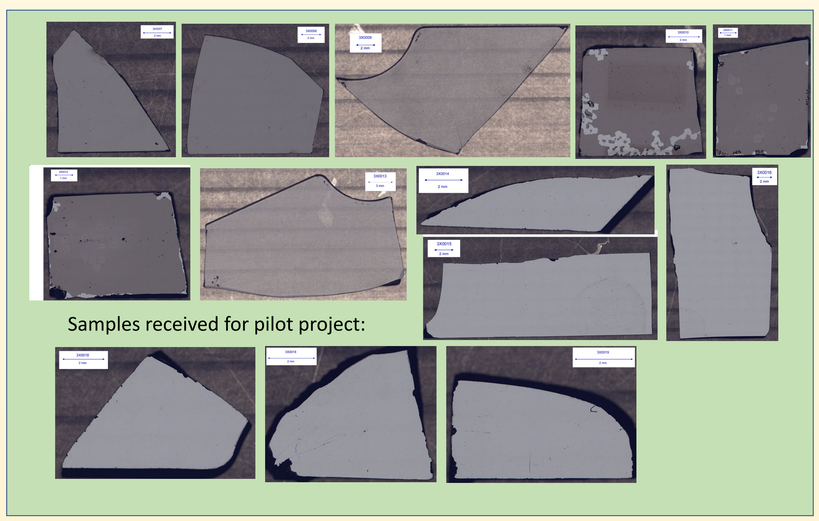






^{35}Cl 5e14 180 Kev 5/30/2014 KROKO





Examples of Implant Calibration for Genesis Science:

HEBER 2013:V. S. Heber, D. S. Burnett, J. Duprat, Y. Guan, A. J. G. Jurewicz, B. Marty,K. D. McKeegan (2013) Carbon, Nitrogen and Oxygen Abundances in the Bulk Solar Wind and Calibration of Absolute Abundances. *44th Lunar and Planetary Science Conference (2013), Abstract #2540.*

HUSS 2020: Gary R Huss, Elizabeth Koeman-Shields, Amy J G Jurewicz, Donald S Burnett, Kazuhide Nagashima, Ryan Ogliore, Chad T Olinger, Hydrogen fluence in Genesis collectors: Implications for acceleration of solar wind and for solar metallicity, 2020 Feb 1;55(2):326-351. doi: 10.1111/maps.13420. Epub 2019 Dec 19. PMCID: PMC7120949

JUREWICZ 2011: A. J. G. Jurewicz, D. S. Burnett, D. S. Woolum, K. D. McKeegan, V. Heber, Y. Guan, M. Humayun, R. Hervig (2011) Solar-Wind Fe/Mg and a Comparison with CI Chondrites. *42nd Lunar and Planetary Science Conference (2011), Abstract #1917.*

KOEMAN-SHIELDS 2017: E. C. Koeman-Shields, G. R. Huss, A. J. Westphal, R. C. Ogliore, A. J. G. Jurewicz, D. S. Burnett, K. Nagashima (2017) Investigating the Impact of Solar Wind Hydrogen on the Measurement of Solar Wind Magnesium, *48th Lunar and Planetary Science Conference (2017), Abstract #2485.*

PARAMASIVAN 2018: G. Janakiraman Paramasivan, M. Sharma, A. Jurewicz, D. Burnett (2018). A Procedure to Cleanly Separate Solar Wind Osmium Embedded in Genesis Silicon Collectors. *49th Lunar and Planetary Science Conference (2018), Abstract #2886.*

RIECK 2015: K. D. Rieck (2015) Solar Wind Sodium and Potassium Abundance Analysis in Genesis Diamond-on-Silicon and silicon bulk Solar Wind Collectors, and How Hydration Affects Microtexture of Olivine Phase Transformation at 18 GPa, Ph.D. Dissertation Arizona State University.

RIECK 2022: K. D. Rieck, A. J. G. Jurewicz, R. L. Hervig, P. Willimans, C. Olinger, R. C. Wiens, R. C. Ogliore (2022) Depth profiling and standardization from the back side of a sample for accurate analyses: Emphasis on quantifying low-fluence, shallow implants in diamond-like carbon, *Rapid Commun Mass Spectrom* 2023; 37:e9454.

WAESELMANN 2015: Waeselmann et al. (2015) Impact of Acid Cleaning on the Solar wind Layer of Genesis flight Wafers – Partial Dissolution and Recovery of Lithium-6 Implant, 46th Lunar and Planetary Science Conference, abst. #1266.

Array Collector Material Descriptions: JUREWICZ 2003: A. J. G. Jurewicz *et. al* (2003), The Genesis Solar-Wind Collector Materials, *Space Science Reviews* **105**: 535-560.

Use of Ion Implants for Calibration: BURNETT 2015: Donald S. Burnett, Amy J. G Jurewicz, Dorothy S. Woolum, Jianhua Wang, Julie M. Paque, Larry Nittler, Kevin D. McKeegan, Munir Humyun, Richard Herig, Veronika Heber and Yunbin Guan (2015) Ion Implants as Matrix-Appropriate Calibrators for Geochemical Ion Probe Analyses. ***Geostandards and Geoanalytical Research***, v.39, no. 3, pp. 265-276