Frisch-grid

SPECIFICATIONS:

ACTIVE SAMPLE AREA:	25 cm. diameter (20 cm. x 25.4 cm. with planchet removed)
ENERGY RESOLUTION:	<50 keV FWHM ^{230}Th, 4.7 MeV
THERMAL NOISE:	30 keV FWHM
ALPHA EFFICIENCY:	>45% for a weightless, 5 cm. diameter sample
BETA EFFICIENCY:	Insensitive to beta and gamma radiation
BACKGROUND:	<3.0 x 10^{-5} cpm/cm^2/100 keV (**0.002 cpm/cm^2**); 4 to 10 MeV
COUNTING GAS:	Ar-CH_4 (**P-10**), at <200 kPa absolute pressure
BIAS VOLTAGE:	Requires 3 kV at 100 µA; SHV-type connector
PREAMPLIFIER POWER:	+12 V at 20 ma; standard 9-pin D-type connector

COUNTER CONSTRUCTION:

BODY MATERIAL:	Nickel-plated steel
COUNTER VOLUME:	Approximately 24 L; (35 cm. diameter, 25 cm. deep)
OVERALL DIMENSIONS:	44 cm. diameter, 40 cm. high
WEIGHT:	110 lbs. (net), 130 lbs (shipping)

Standard accessories, delivered with the Model 8210A are: (1) One low-noise preamplifier (ORDELA Model QS-11), a high-voltage filter and distribution network, and (2) 3-m-long (10 ft.) cables (BNC type for signal and SHV type for high voltage) for interconnection of the Model 8210A with a standard amplifier and the high-voltage power supply.

OPTIONAL ACCESSORIES:

PRESSURE/VACUUM CUTOFF SENSOR SWITCH: Disables high voltage when vacuum is applied to prevent damage to preamplifier FET. Functions with high voltage supplies that require a short to ground to disable bias voltage.

ORDELA Model 8208A-AMP/HV
Rack-mount (standard, 19” width) or standalone, spectroscopy grade amplifier and high voltage power supply for the Frisch-grid. Disable function works with OPTIONAL **PRESSURE/VACUUM CUTOFF SENSOR SWITCH** to protect preamplifier.

AMPLIFIER:	Continuously variable gain, x13 to x45; integral nonlinearity, 0.05%.
HIGH VOLTAGE:	Continuously variable from 0 to 3000 V, 0 to 1 mA; 6 mV peak-to-peak ripple, 0.02% stability per 8 hours.
OPERATING TEMP:	0 to 50° C.
SHIPPING WEIGHT:	6.8 kg

WARRANTY
ORDELA, Inc. warrants its products to be free from defects in materials and workmanship for 12 months after shipment. No other warranty is included. Specifically, no warranty of merchantability or fitness for a particular purpose is implied. ORDELA's liability under this warranty is limited to repairing or replacing the product at ORDELA's option. This warranty is void if the product is operated improperly, disassembled, or modified other than in the ORDELA laboratory.

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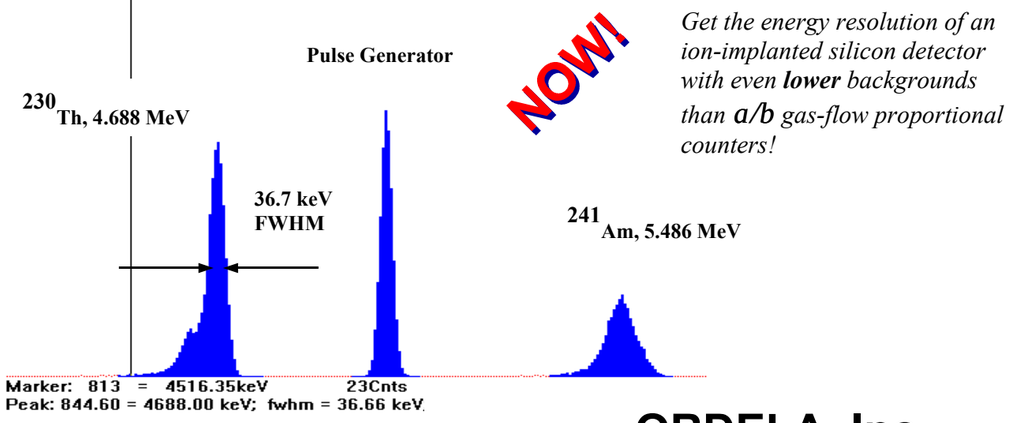
Frisch-grid

Simple Alpha Spectrometry



*Get the energy resolution of an ion-implanted silicon detector with even **lower** backgrounds than **a/b** gas-flow proportional counters!*

ORDELA, Inc.

For *Simple* Alpha Spectrometry

Frisch-grid

Money is getting increasingly scarce for environmental remediation. *Efforts to evaluate, clean up, and restore radioactivity-contaminated sites will be consolidated in the coming months and years. Increasingly, the focus will be on how to cost-effectively treat each site. A Frisch-grid chamber will* ***quickly*** *screen soil, water, air filter, and smear samples for alpha contamination by* ***rapid, direct alpha spectrometry***. *Use the Frisch-grid for* ***Simple*** *Alpha Spectrometry!*

APPLICATIONS:

- ***Site Assessment/ Evaluation:***
  NO* chemical treatment of any kind required to *RAPIDLY screen soil and other samples for radionuclide contamination!
- ***Air Monitoring:***
  Monitor remediation projects in near-real time! Achieve Lower Limits of Detection (**LLD**) of **4 x 10^{-2} Bq/m^3** (10^{-12} µCi/mL) with only 10 minute count time (**0.4 m^3/min.** or 14 cfm)!
- ***Soils:***
  Achieve an LLD = **1.5 Bq/g** (40 pCi/g) with 100 mg soil samples, **10 minute preparation time**, and only a **10 minute count time!** Resolution about **95 keV FWHM** for ^{239}Pu!
- ***Water Analysis:***
  Directly spray water samples of 5 - 15 mL onto the 25 cm diameter planchet, dry, and count! **Boil larger volumes** and count on the Frisch-grid to **increase sensitivity**!
- ***Smears, Swipes:***
  Don't cut your 20 x 25 cm filter papers any more! No compromise counting; assay **whole** samples without cutting into non-homogeneous pieces! Simultaneously screen multiple samples with the large, 507 cm^2 counting area.
- ***Mobile Laboratories:***
  Developed for the mobile laboratory with **rugged** construction, yet light weight (110 lbs.) compared to gas-flow proportional counters. ***Equally at home in the analytical laboratory!***

DESCRIPTION:

The ORDELA Model **8210A** is a **large-area**, gridded ionization chamber designed for ***rapid***, direct alpha spectrometry of environmental soil, water, air filter, and smear samples[1]. The 44 cm diameter x 40 cm high cylindrical spectrometer is made of mild-steel and **completely nickel-plated** for low-background environmental counting and ease of decontamination. Also, the Frisch-grid, anode, and supporting structure are attached to the top and **disassemble as a unit** for maintenance and decontamination.

Alpha resolution of <50 keV FWHM is possible on low-mass samples as large as 25 cm in diameter. Sample preparation is **easy**, **quick**, and **does not require time- and labor-intensive radiochemistry** or special laboratory equipment. Soil samples are finely **ground**, **mixed** with solution, **sprayed** onto 25 cm diameter, mirror-finish stainless steel planchets, and **dried** under heat lamps. Samples are then placed in the sliding tray assembly and inserted into the chamber via a horizontal access port. Alpha energy spectra are measured by ***any*** standard multichannel analyzer (MCA). **Water samples** of from 5- to 15-mL can be **directly sprayed** onto the planchets and **counted**. **Air filter samples** and **smears**, up to 25 cm in diameter, may be **directly counted** with **no sample preparation** and without introducing inconsistencies due to trimming of the samples. **Rectangular 20 cm x 25 cm filter papers** may also be counted by removing the 25 cm diameter planchet and placing the filter directly onto the horizontal sample tray. **Short assay times** are possible due to the **high counting efficiency** and **low backgrounds** of the model 8210A.

The real benefit of the 8210A is its performance! Spectrometric soil measurements of **plutonium** and **americium** contamination are made at sensitivity levels of **7 pCi/g** in only **60** minutes! Here, the Frisch-grid spectrometer is capable of **monitoring airborne transuranic concentrations**, ***in near real-time!*** Technicians can rapidly analyze soil, smear, and air filter samples.

Rugged construction of the model 8210A makes it an **ideal** analytical instrument both for **mobile laboratories** and for **benchtop use** in standard environmental counting laboratories. An "O" ring-sealed, horizontal access port allows **easy sample insertion/extraction** by a sliding tray assembly. **P-10** (Ar-CH_4) counting gas, at **up to 200 kPa** (two atmospheres) absolute pressure, is used for the Model 8210A.

The 8210A **includes** a low-noise preamplifier, and a high voltage filtering and biasing circuit. An ORDELA **Model 8200A-AMP/HV** spectroscopy grade amplifier and high voltage bias supply, or equivalent, a **vacuum pump**, a source of **P-10 gas with pressure regulators**, and ***any* MCA** are additional instruments and equipment required for operation of the 8210A.

Completely integrated systems are available from ORDELA, Inc. Optimized and calibrated at our factory in Oak Ridge, Tennessee, these complete systems minimize installation time in your laboratory.

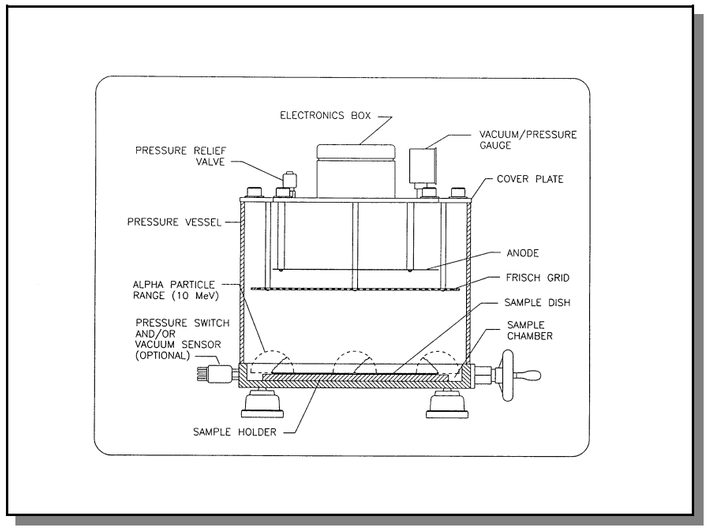
[1] Sill, Claude W., *Health Physics Journal*, Vol. 69, No. 1, July, 1995, pp. 21-33.

Theory of Operation

The Frisch-grid counter operates by placing a sample on a 25 cm diameter, mirror-finish stainless steel planchet and inserting it inside the counter through the front-loading access door. The chamber is evacuated and refilled with P-10 (Ar-CH_4) counting gas, normally at more than atmospheric pressure. Bias voltage is applied and amplifier gain and MCA conversion gain are set to monitor selected nuclides.

An alpha particle emitted from a source travels in an approximately straight line, producing ionized particles and losing energy at a rate of about 26 eV per electron/ion pair produced. The length of the ionization path depends upon the counter gas pressure and the initial energy of the alpha particle; e.g. a 10 MeV alpha particle in P-10 gas at 80 kPa (gauge) has a range of about 4.1 cm. (1.6"). The sample planchet is properly sized such that all alpha emissions will be contained within the active volume of the counter. (*See figure at right for cut-away view.*)

The high voltage bias creates an electrostatic field. The free electrons created by the ionization process migrate toward the grid. As they approach, they are affected by the higher electrostatic gradient between the Frisch-grid and the anode, which reaches through the mesh of the grid. Thus, ***all*** electrons are channeled through the grid and collected on the anode. Upon collection of these electrons, a charge is induced on the anode. Since the Frisch-grid effectively normalizes the travel distance of all electrons, the induced charge pulses have magnitudes that are proportional to the number of collected electrons, independent of their origin.



Cut-away view of the Model 8210A Frisch-grid chamber

- ***Air Monitoring:***
  Achieve an **LLD** (Lower Limits of Detection) of up to **1 x 10^{-2} Bq/m^3** (10^{-12} µCi/mL) for 10 minute air samples taken at **0.4 m^3/min.** (14 cfm)! Without waiting for decay of radon daughters, obtain **resolutions** in the range of **75 - 100 keV FWHM** for **whole**, **20- x 25 cm** air filter samples on surface-loading filter media**! Monitor remediation projects in near-real time!**

- ***Soils:***
  RAPID alpha assay and screening. With 30 minute sample preparation (and ***NO*** chemical procedures) achieve an **LLD** of **1.5 Bq/g** (or 40 pCi/g) for 100 mg soil samples with **only a 10 minute count time!**

- ***Water Analysis:***
  Directly spray water samples of 5 - 15 mL onto the 25 cm diameter planchet, dry, and count! Reduce larger volumes of water by **simply boiling** and counting on the model 8210A to **increase sensitivity**!

- ***Smears, Swipes:***
  No compromise counting; assay whole samples without the need to cut into non-homogeneous pieces! Simultaneously screen multiple samples with the extra large, **507 cm^2** sample counting area.

- ***Mobile Laboratories:***
  Rugged construction, yet lighter than (110 lbs.) even portable gas-flow proportional counters. Well-suited for the rigors of mobile laboratories, the Frisch-grid is equally at home in the analytical laboratory!