SnT 2019
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

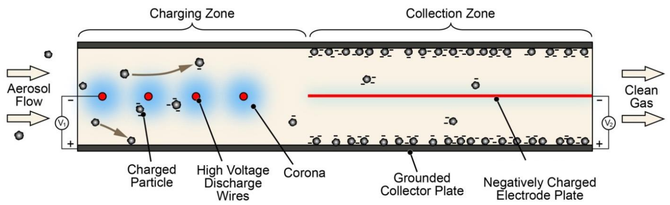
Development of an Electrostatic Precipitator System for Radionuclide Particle Collection

Michael E. Swanwick (swanwick@creare.com), Ariane B. Chepko, Sheldon D. Stokes, Clive L. Devoy, Patrick J. Magari (pjm@creare.com) Creare LLC, Hanover, NH, USA

Creare Hanover, NH, USA

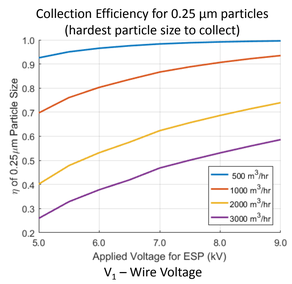
T3.1-P16

Electrostatic Precipitation (ESP) Design and Modeling

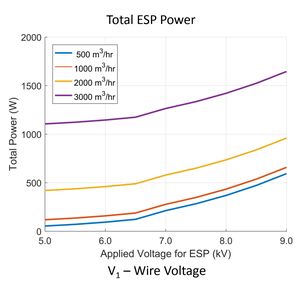


Two-Stage Electrostatic Precipitator Configuration

ESP systems can achieve very high collection efficiencies (η > 99.5%) across a wide range of particle sizes: 30 nm to >100 µm



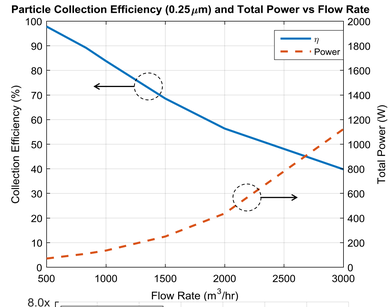
V_1 – Wire Voltage

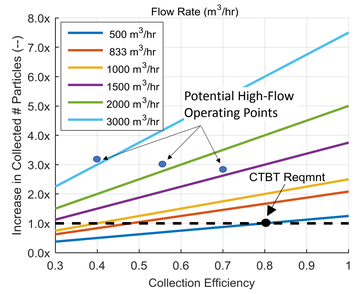


V_1 – Wire Voltage

Goals

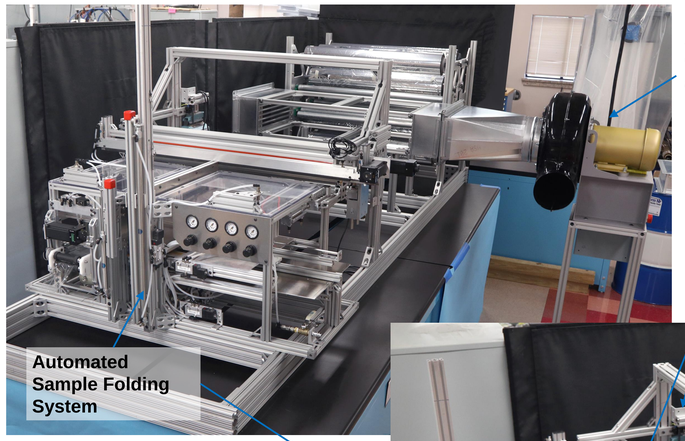
- Low Power, High Collection Efficiency Radionuclide Particle Collection using an ESP
- Collection Efficiency, Power and Flow Rate are adjustable depending on atmospheric conditions.
- Development of a next generation RASA system
- Build and test a full scale prototype unit under a DOE Grant



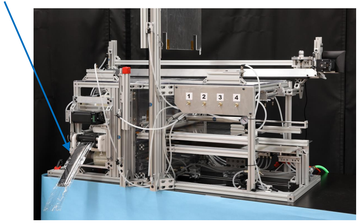


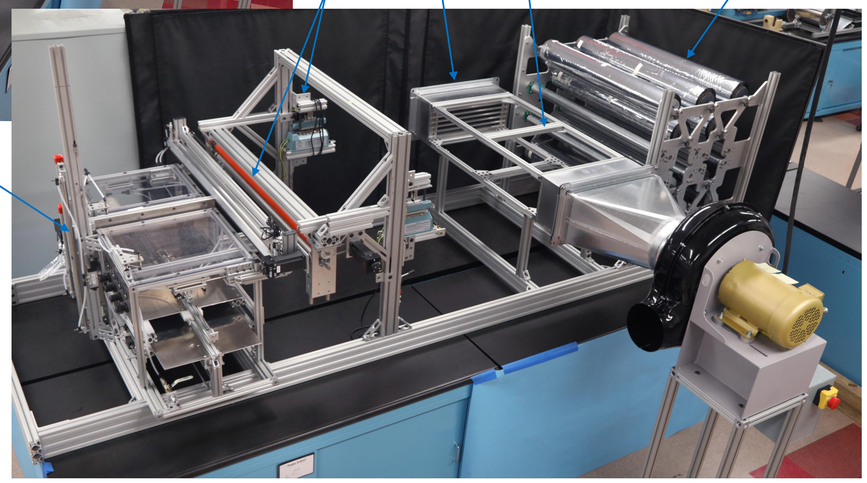
- **At higher flow rates, even if η drops to 50%–60% the ESP achieves significant gains in overall collected sample quantity: increase in sensitivity**

Electrostatic Precipitation Full Scale Prototype



Sealed Sample (Strip or Packets) for Detector





Electrostatic Precipitation Subscale Testing and Results

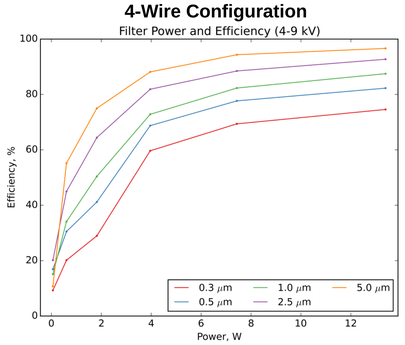
Design and Goals

- 1/10th scale height and single channel (vs. 5 channels for full scale prototype)
- Experiments with different designs, collection material, and operating voltages.

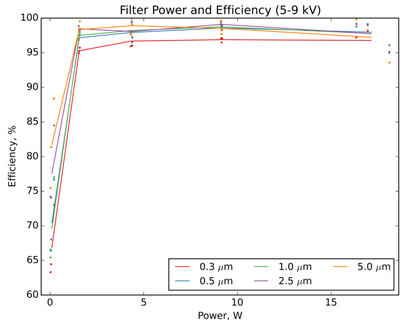
Results

- Change to a two-stage configuration resulted in higher collection efficiency and lower power
- Over 90% collection efficiency at under 5 W of power for 40 m³/hr flow rate

4-Wire Configuration

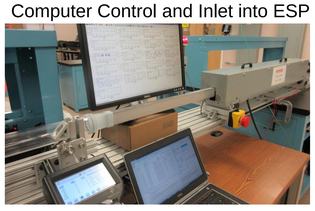


12-Wire, Two-Stage Configuration



Flow Control and Particle Seeding

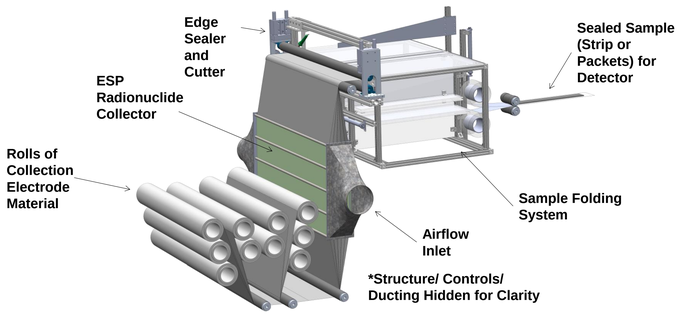
Computer Control and Inlet into ESP



ESP Channel and Outlet

Electrostatic Precipitation Next Steps

- **SBIR DOE Grant will Finish with an End-to-end Prototype and Performance Demonstration (Fall 2019)**
  - **80/20 Aluminum Frames**
  - **Non-Optimized System Packaging for Low Footprint**
  - **Uses Laboratory-grade Power Supplies, Data Acquisition, and Control Systems.**
- **Next Steps:**
  - **Fieldable Version:**
    - **Increase Robustness of Mechanical System**
    - **Optimize Footprint/Configuration**
    - **Incorporate Rugged Controls and Remote Operation Features**
  - **Longer Term Testing**
  - **Integration with a Radionuclide Detector**



This work is supported under a U.S. DOE SBIR Grant DE-SC0015731. The views expressed here do not necessarily reflect the views of the United States Government or the United States Department of Energy.