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Projects

- Low Energy Neutral Atom Imaging (LENA)
- Gated Electrostatic Mass Spectrometer (GEMS)

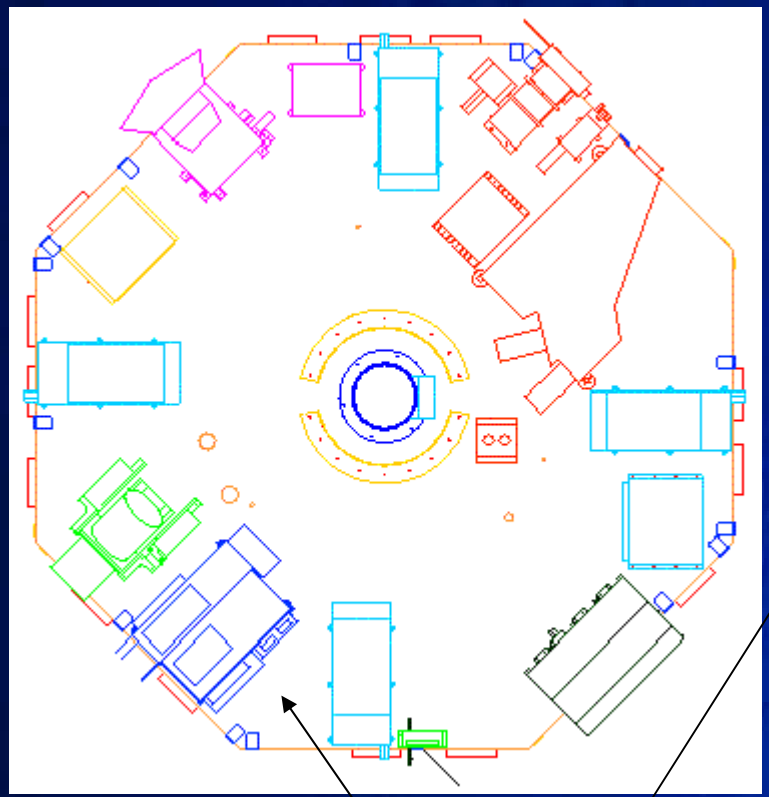
Imager for Magnetopause-to-Aurora Global Exploration

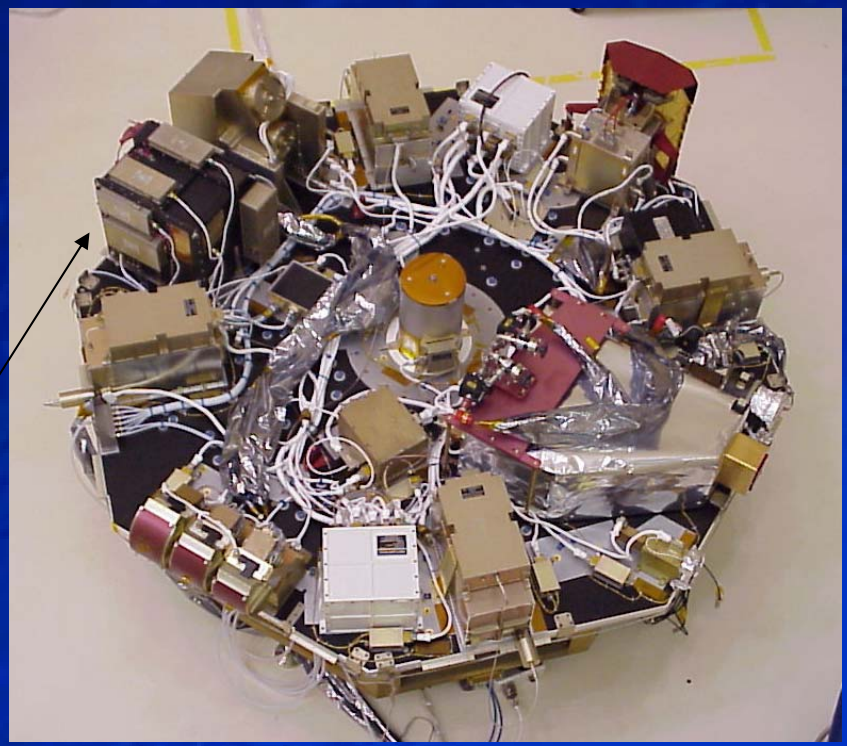
Launched in March 2000

Mission:

To image the Earth's Magnetosphere

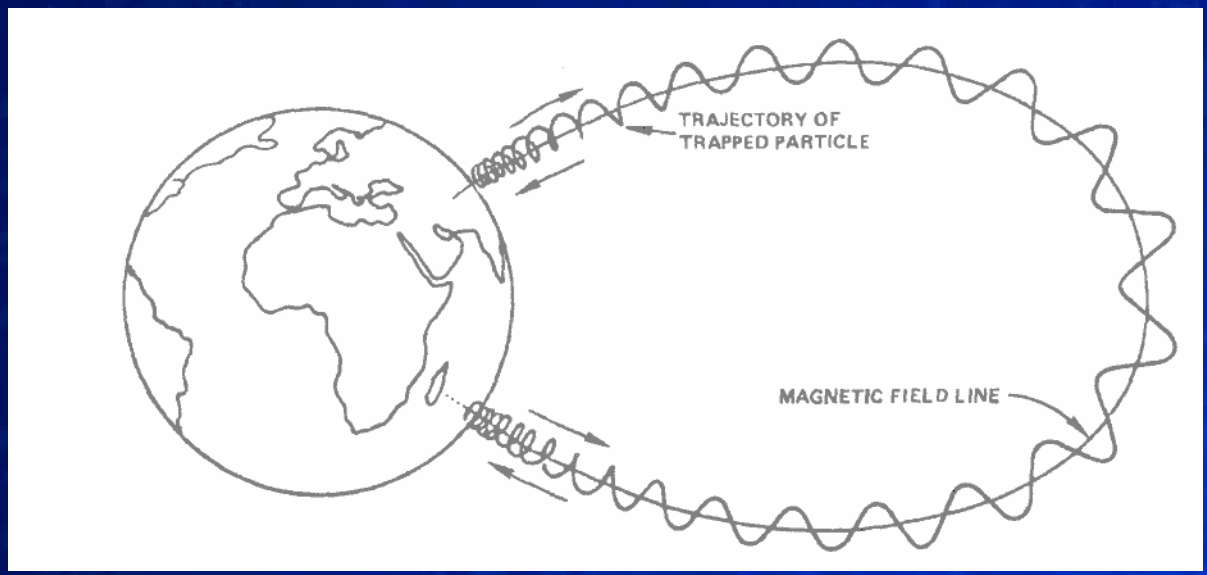
IMAGE



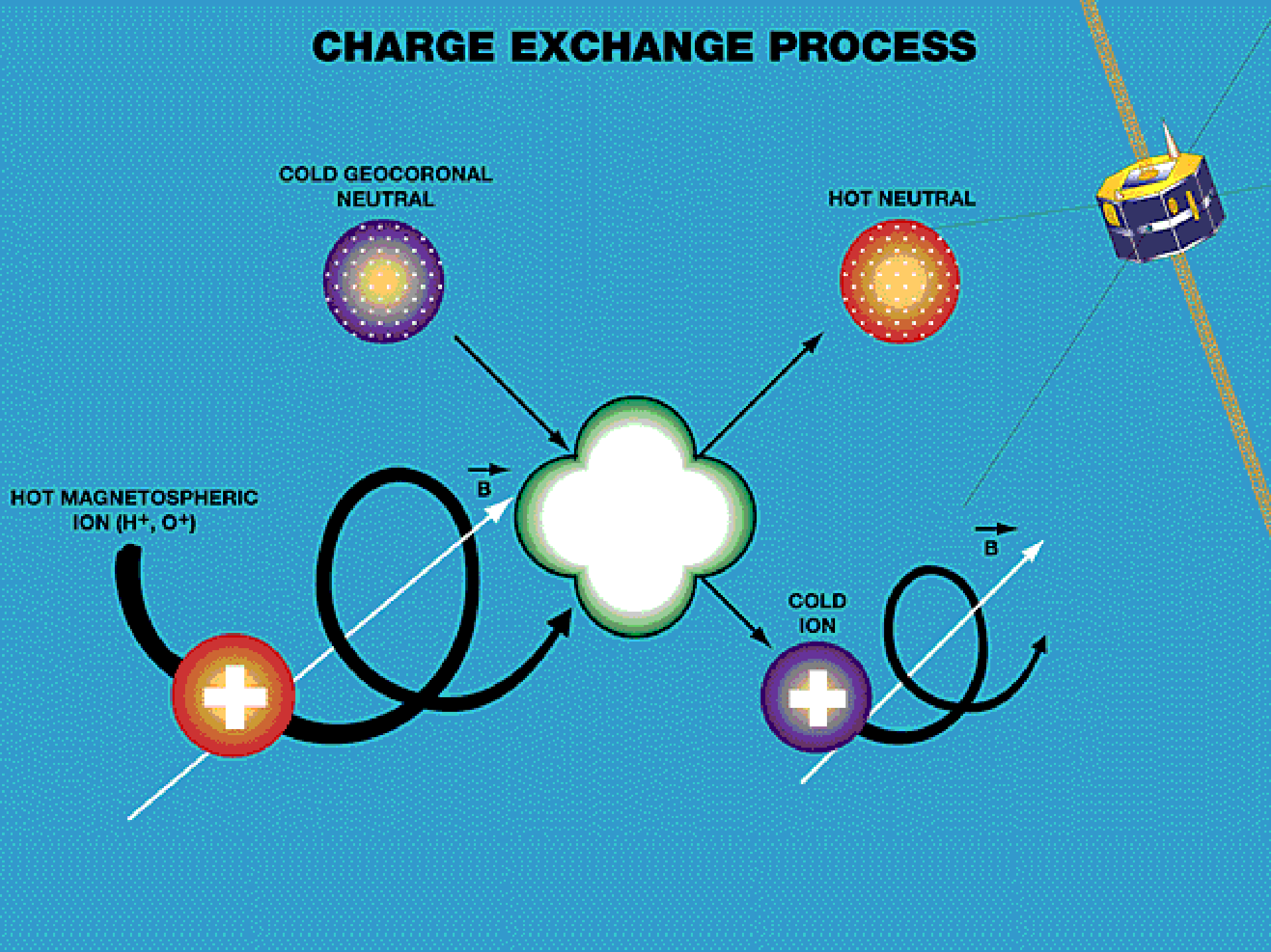


LENA

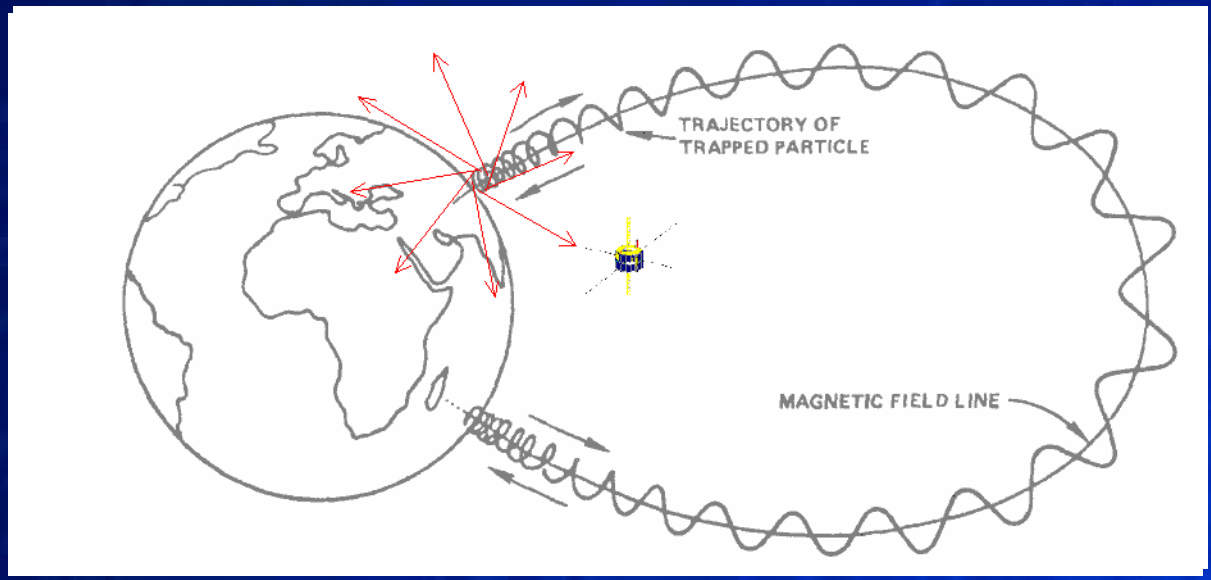
Why detect neutral atoms?



CHARGE EXCHANGE PROCESS



Why detect neutral atoms?

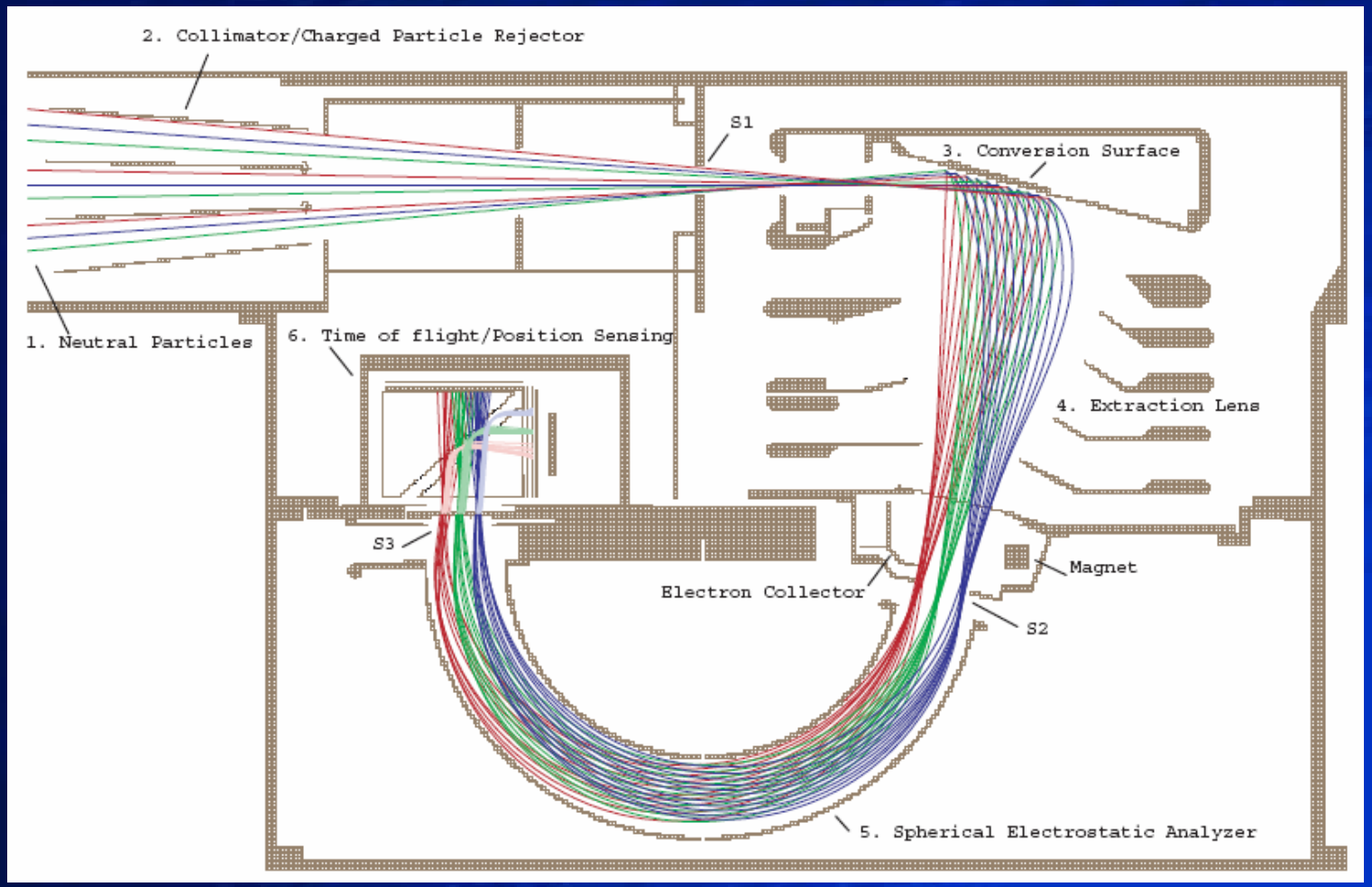


How do we detect neutral atoms?

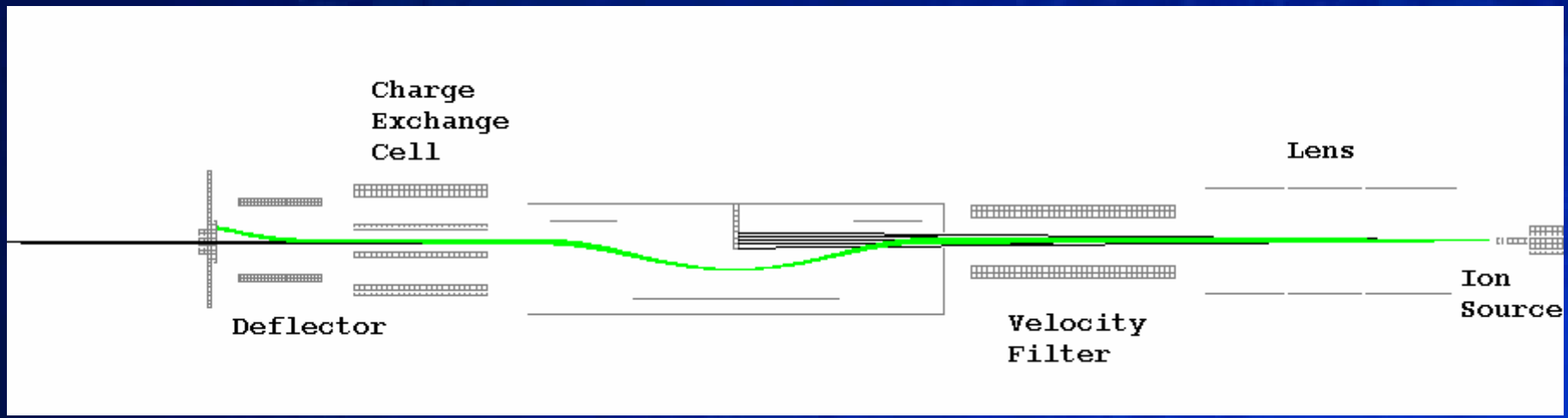
First we make them into ions

Then we detect and analyze them with current methods used for ion imaging

LENA

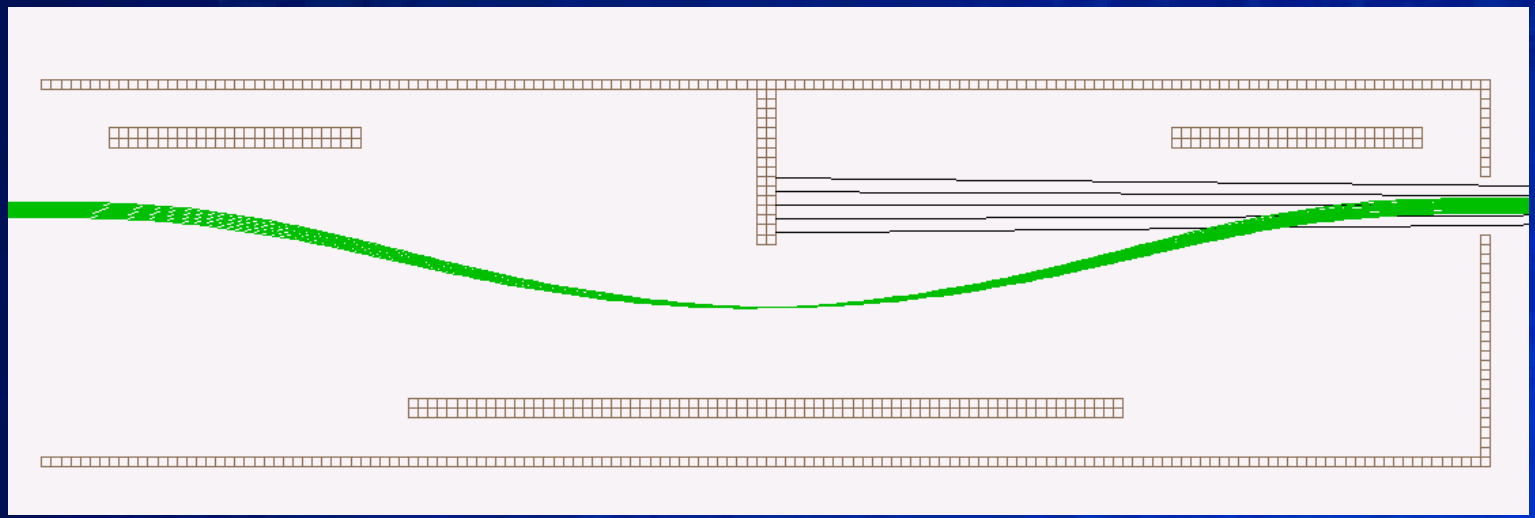

2. Collimator/Charged Particle Rejector
S1
3. Conversion Surface
1. Neutral Particles
6. Time of flight/Position Sensing
4. Extraction Lens
S3
Magnet
Electron Collector
S2
5. Spherical Electrostatic Analyzer

Neutral Beam



Wiggler

Wiggler

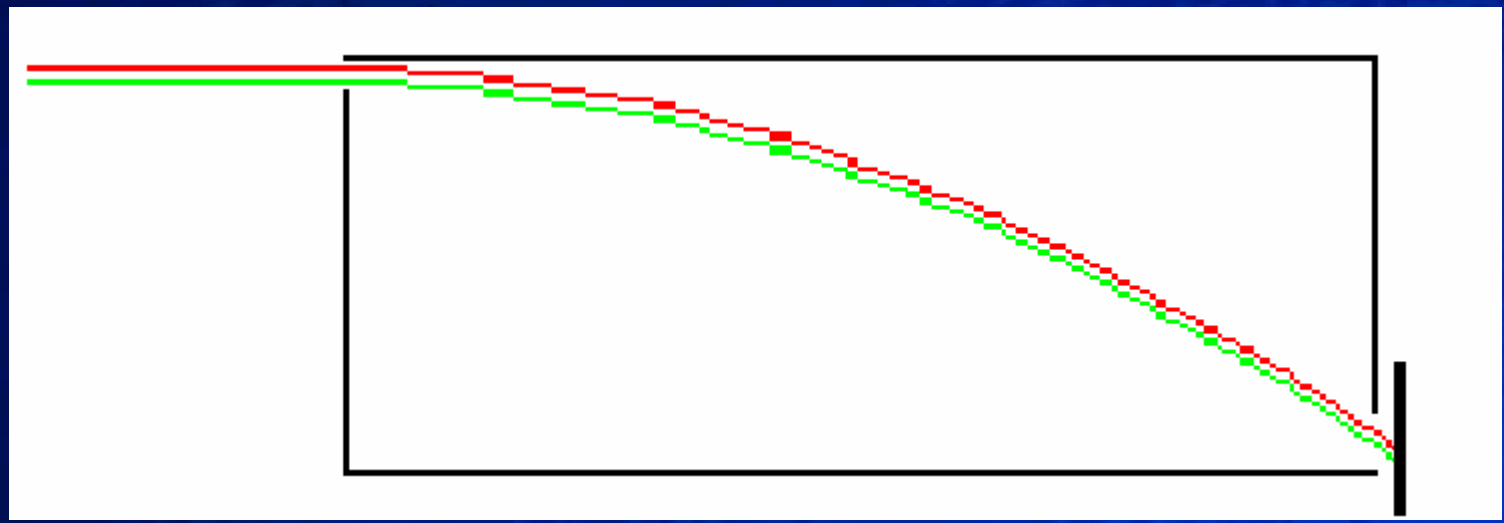


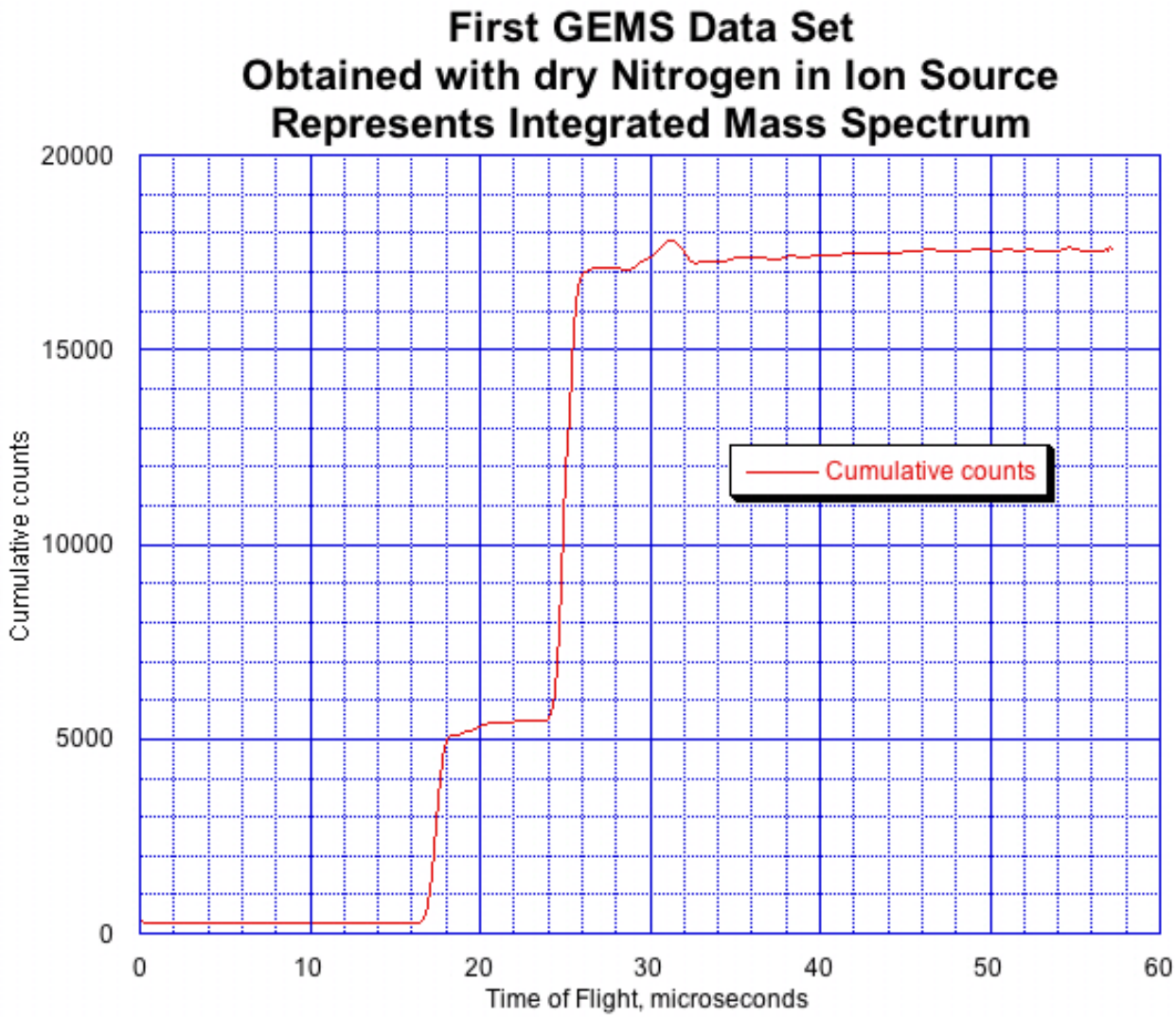
GEMS

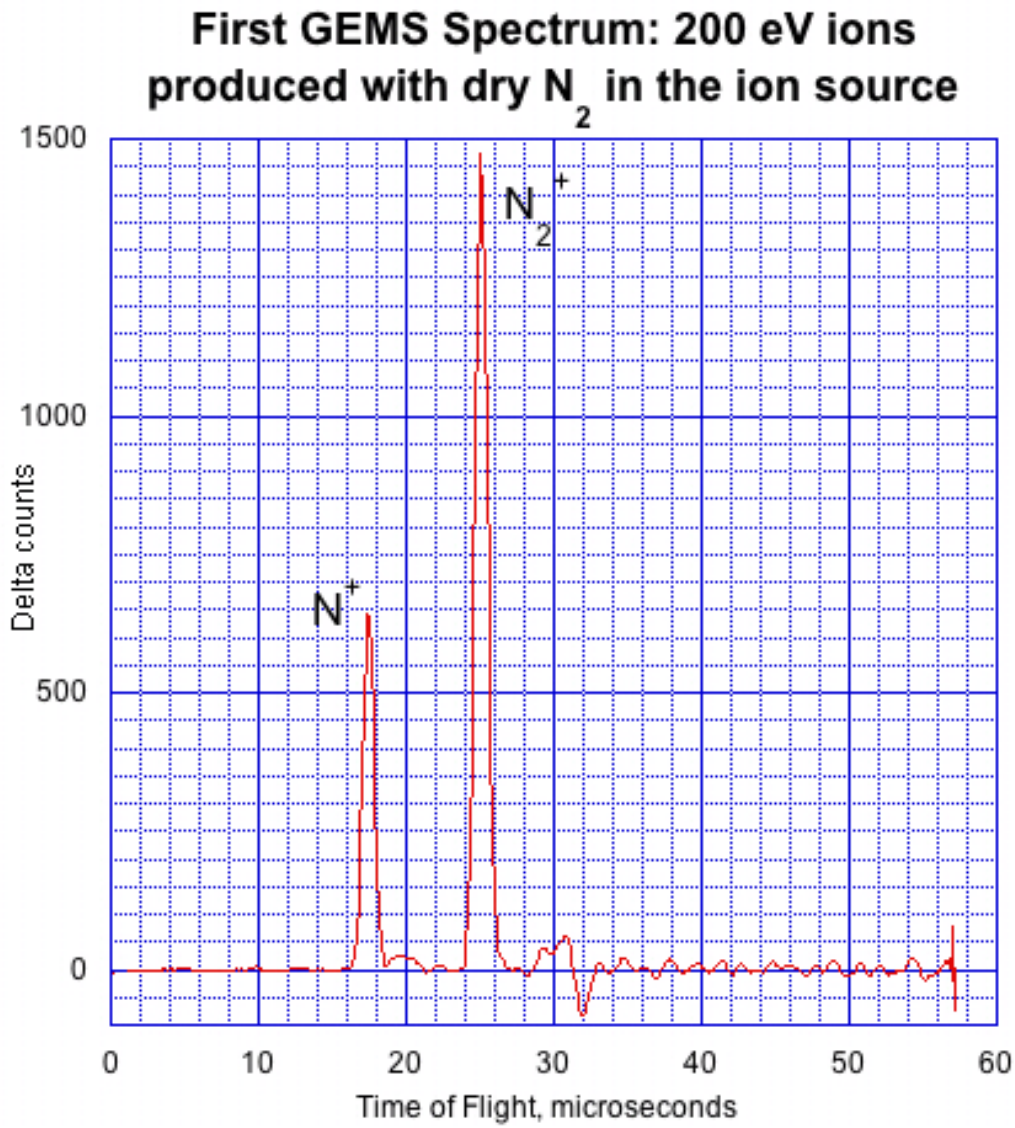
At a given energy, particles of different masses will have different velocities

$$E = \frac{1}{2} m v^2$$

If we very suddenly allow an ion beam to travel over a distance to a detector, heavier particles will take longer to get there




First GEMS Data Set
Obtained with dry Nitrogen in Ion Source
Represents Integrated Mass Spectrum
20000
15000
10000
5000
0
Cumulative counts
Cumulative counts
0
10
20
30
40
50
60
Time of Flight, microseconds

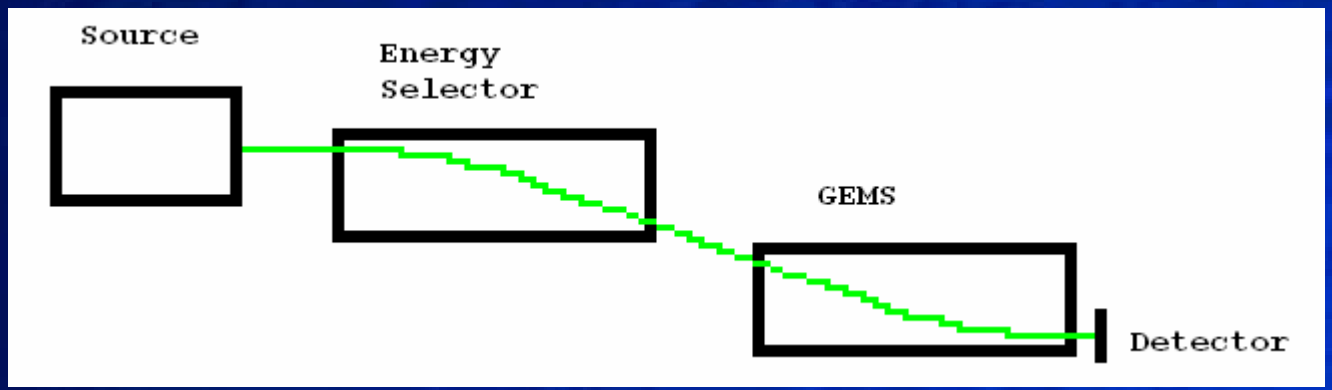

First GEMS Spectrum: 200 eV ions produced with dry N2 in the ion source
1500
1000
500
0
Delta counts
N2+
N+
0
10
20
30
40
50
60
Time of Flight, microseconds

Advantage of GEMS

- Mass Resolution
  - Mass resolution of current TOF mass spectrometers depends on energy resolution and width of pulse
  - GEMS mass resolution only depends on the energy resolution

Next Generation of GEMS

- Neutral Gas Analyzer



Acknowledgments

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AIP/SPS