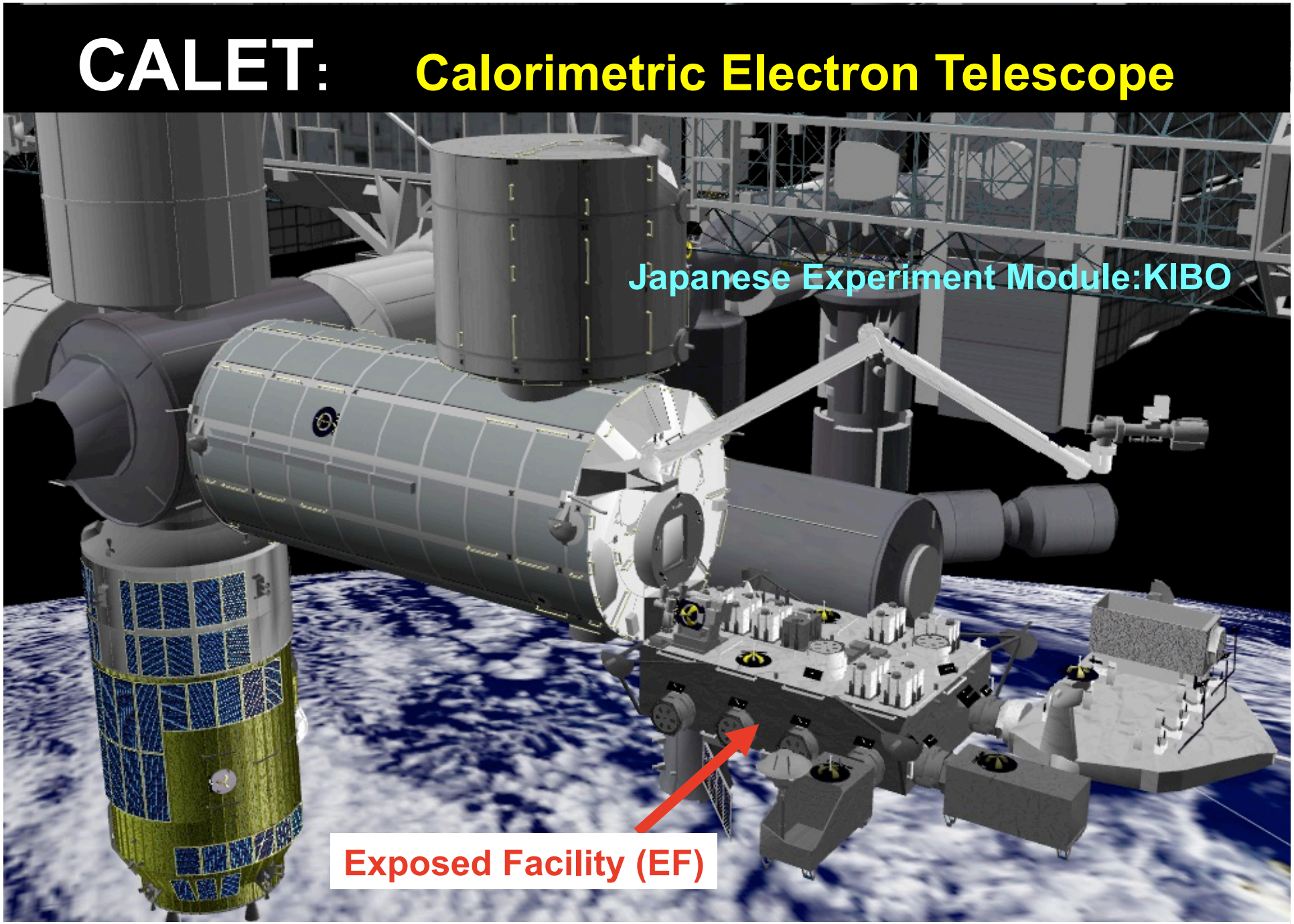
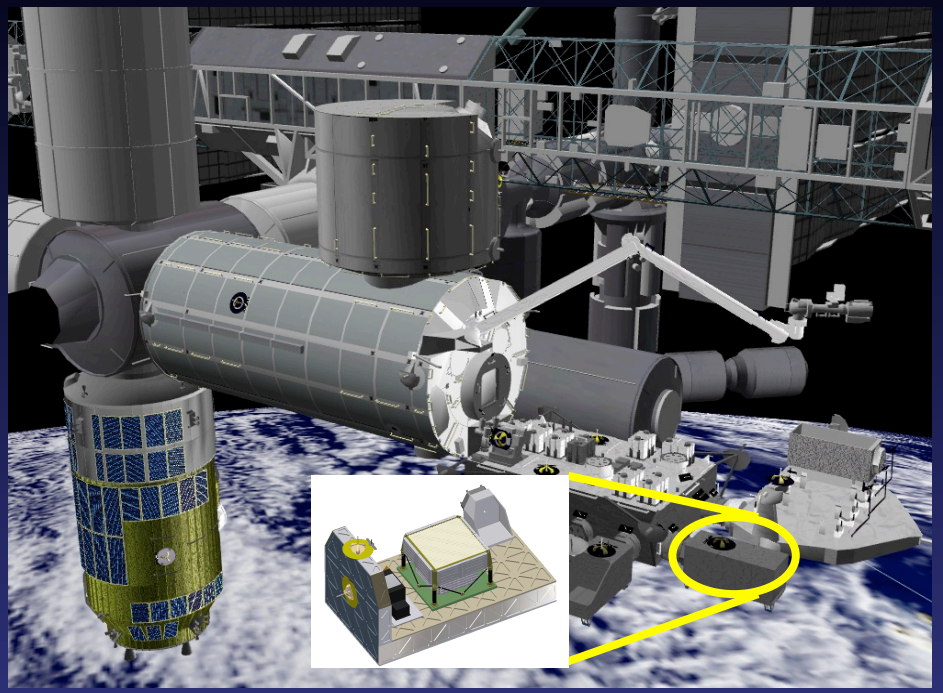
CALET: Calorimetric Electron Telescope



CALorimetric Electron Telescope (CALET)

CALET Mission Concept

- Instrument:
  High Energy Electron and Gamma-Ray Telescope
- Launch:
  HTV: H-IIA Transfer Vehicle
- Attach Point on the ISS:
  Exposed Facility of Japanese Experiment Module (JEM-EF)
- Nominal Orbit:
  407 km, 51.6° inclination
- Life Time:
  5 years
- Mission Status:
  Launch before April 2014 in Plan



- 1 GeV ~ 20 TeV for electrons
- 20 MeV ~ TeV for gamma-rays
- Weight: 1500 kg (full size)
- Geometrical Factor: ~ 0.7 m^2sr
- Power Consumption: 640 W
- Data Rate: 300 kbps

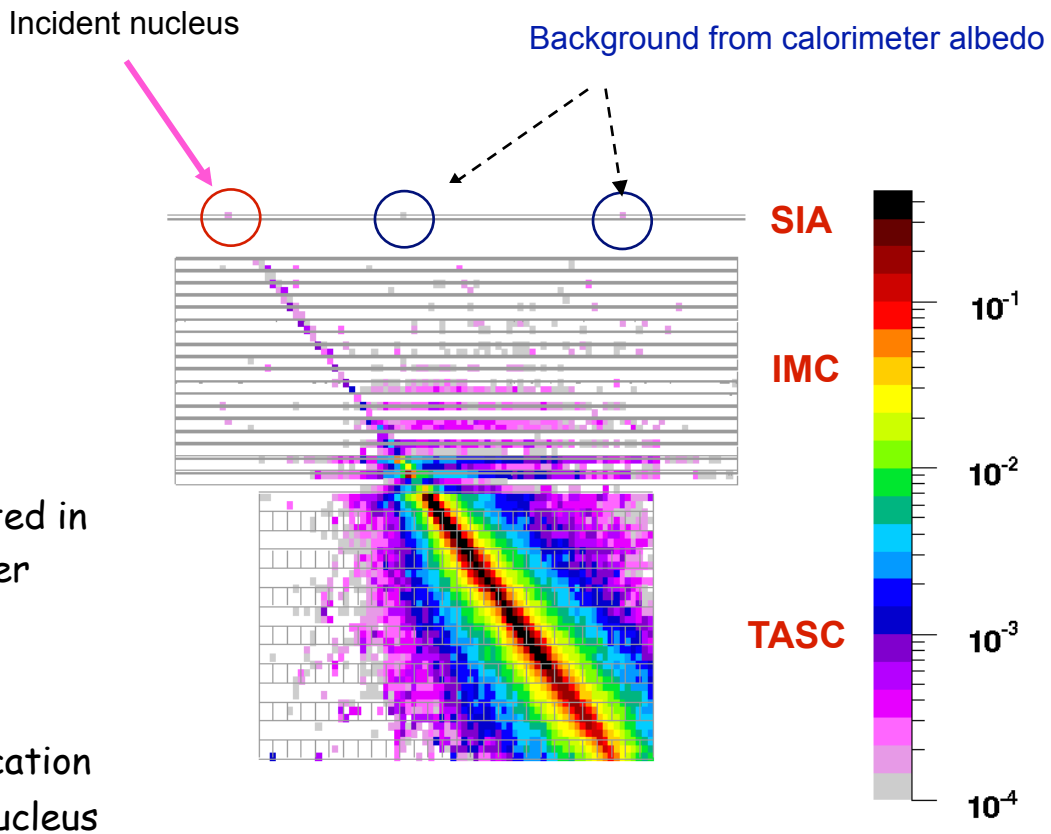
Charge Identification of cosmic nuclei in CALET

Silicon Array (SIA)

2 independent charge-measurements per incident nucleus

- Back-extrapolation of track reconstructed in the finely segmented Imaging Calorimeter (IMC)

- Impact point recontruction and identification of the pixel hit by the incident cosmic nucleus



Example of simulation with Fluka:

1 TeV/n Carbon interacting in the IMC

Silicon Array (SIA)

Large dynamic range of FE electronics: charge measurement up to Z = 35

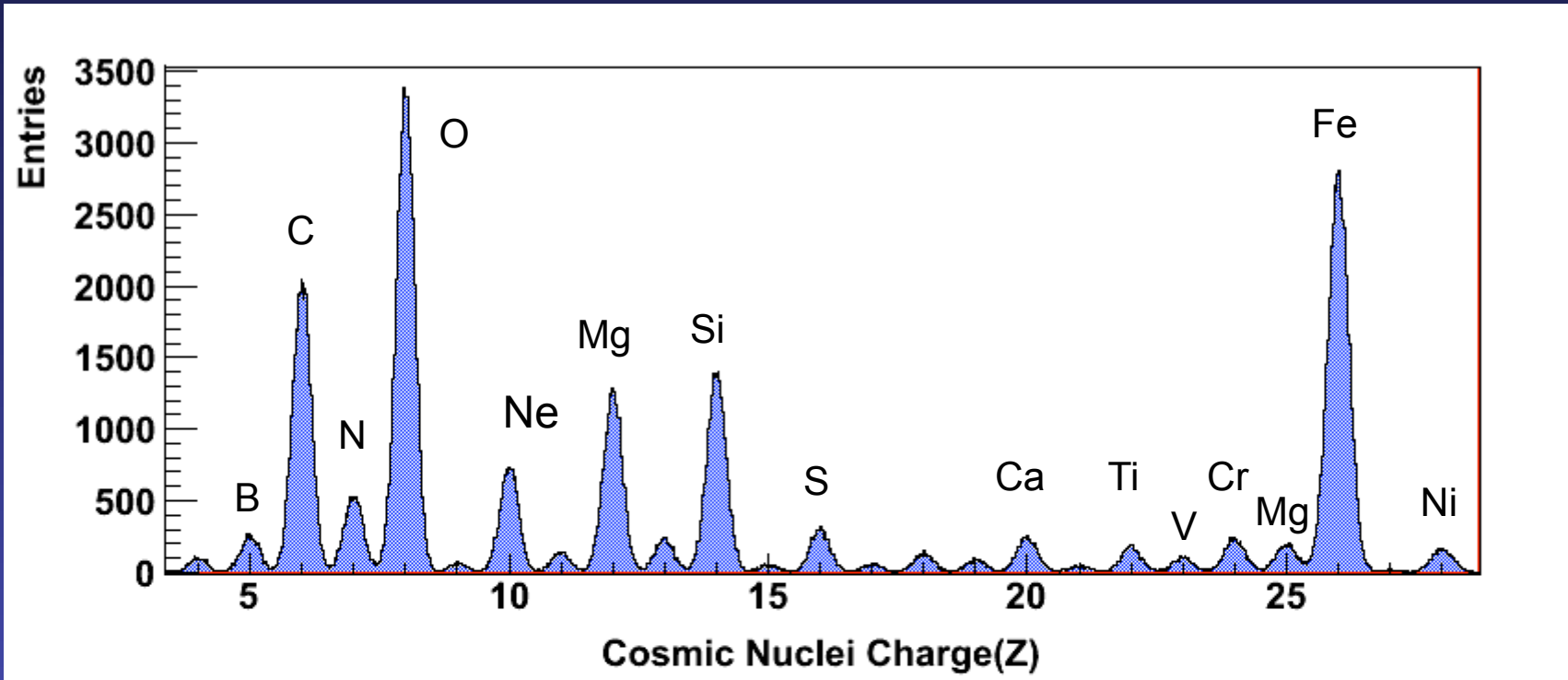
Expected charge resolution of SIA (2 indep. dE/dx measurements):

~ 0.1 at p, He

~ 0.12 at B,C

~ 0.21 at sub-Fe, Fe

individual elements can be resolved

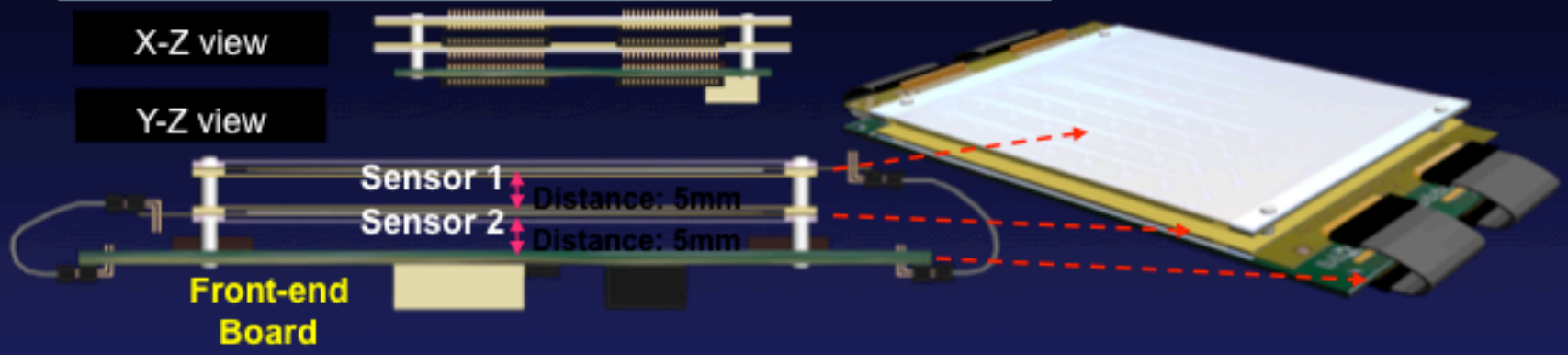


Silicon Array – Sensor Module

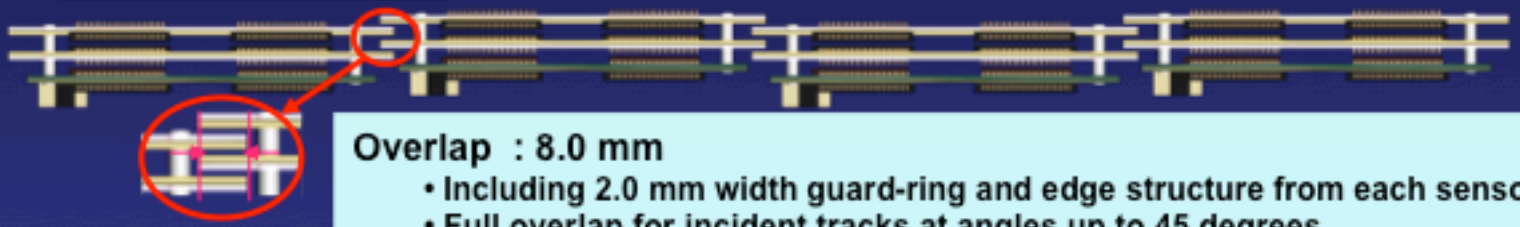
Basic module: one pair of aligned sensors + front-end (VAB) board

X-Z view

Y-Z view

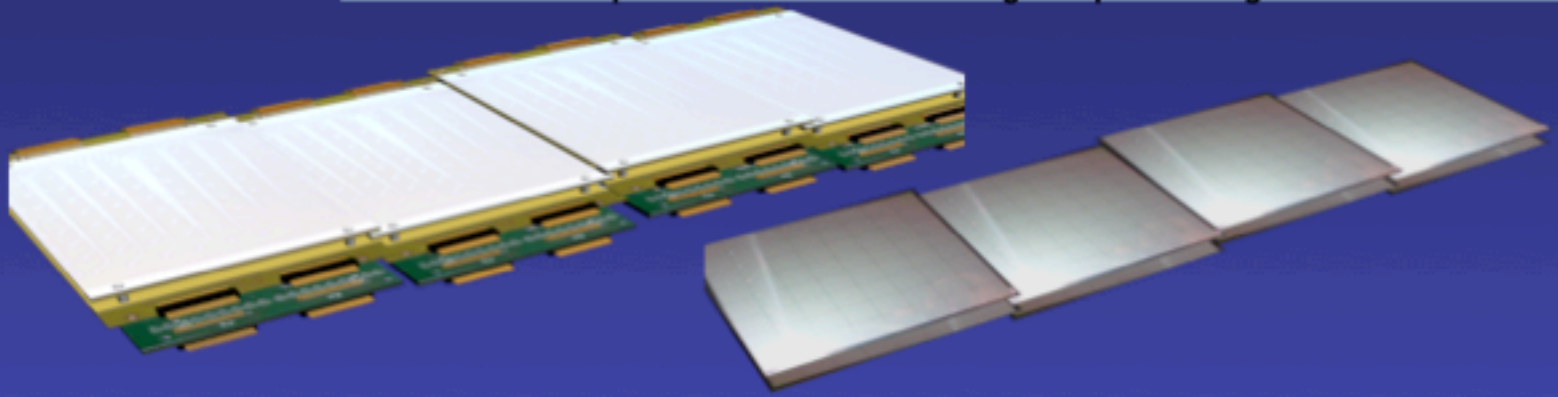


Ladder : with 12 sensors



Overlap : 8.0 mm

- Including 2.0 mm width guard-ring and edge structure from each sensor
- Full overlap for incident tracks at angles up to 45 degrees



Beam requirements

We would like to use a mixed beam with ions of different Z to check the linear response and resolution of the Silicon Array as a function of Z

A fragments run at the FRS would probably be the best opportunity (for istance: a ^{58}Fe beam tuned to N=Z).

We would like to collect enough statistics (10k to 50k events per element) to study the instrument charge resolution in the Fe and sub-Fe regions and at C or O.

Beam test prototype

We plan to test a reduced-scale prototype of the silicon array for CALET. The beam test layout includes: one pair of X-Y silicon strip detectors (to accurately define the beam position), preceding a telescope of 4 pixelated silicon sensors, followed by a second pair of X-Y silicon strip detectors (see next slide).

An external trigger will be provided by the coincidence of scintillator counters positioned up(down)-stream the telescope. The small sized equipment under test (contained in a light-tight box of about 40 cm x 40 cm) should be relatively easy to install on the beam line.

NO GAS; NO HV (except PMTs for trigger); no HAZARDOUS materials.

SIA small prototype built in Pisa/Siena for test at GSI:

2 planes of x-y silicon strip-sensors;

4 planes of silicon matrix sensors; total: 768 channels

Readout: FE ➔USB ➔long optical fiber ➔USB ➔PC