

LYCCA simulation

by

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LYCCA

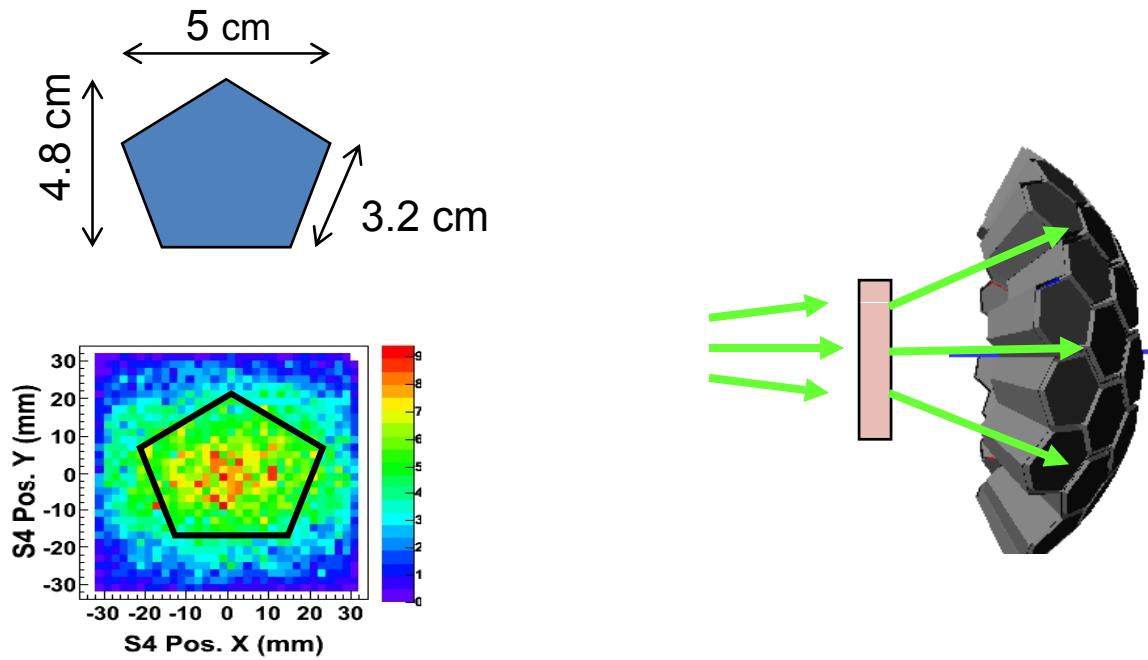
LYCCA is acronym for

Lund-York-Cologne-Calorimeter planned at GSI

It will be used for tracking and identifying the fragments by measuring their energy and time of flight.

challenges for Agata at GSI:

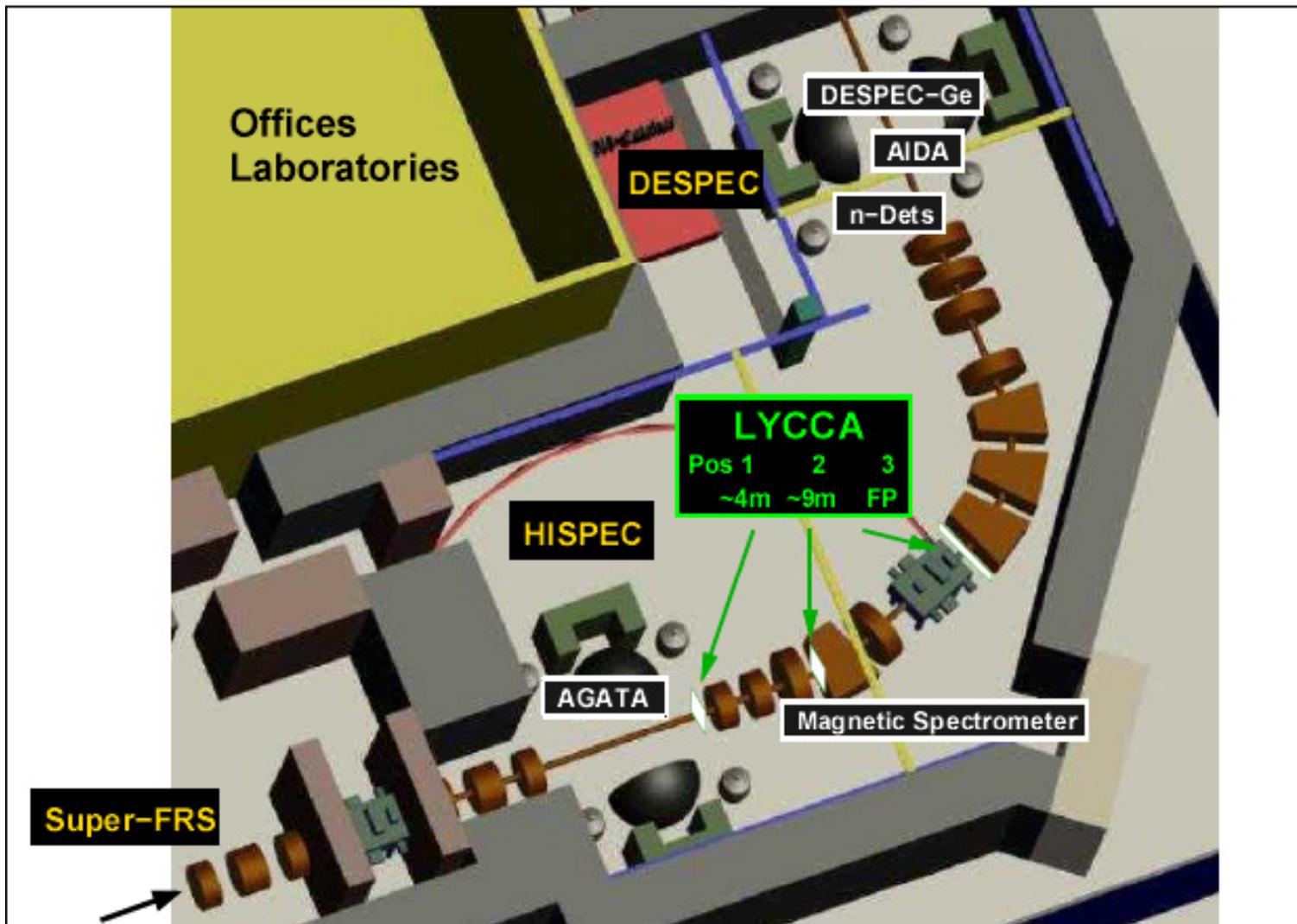
- Beam spot is several cm big.
- Beam has larger divergence (emittance).
- $v/c \sim 40\text{-}50\%$. (*Relativistic Doppler shift and Lorentz Boost*)



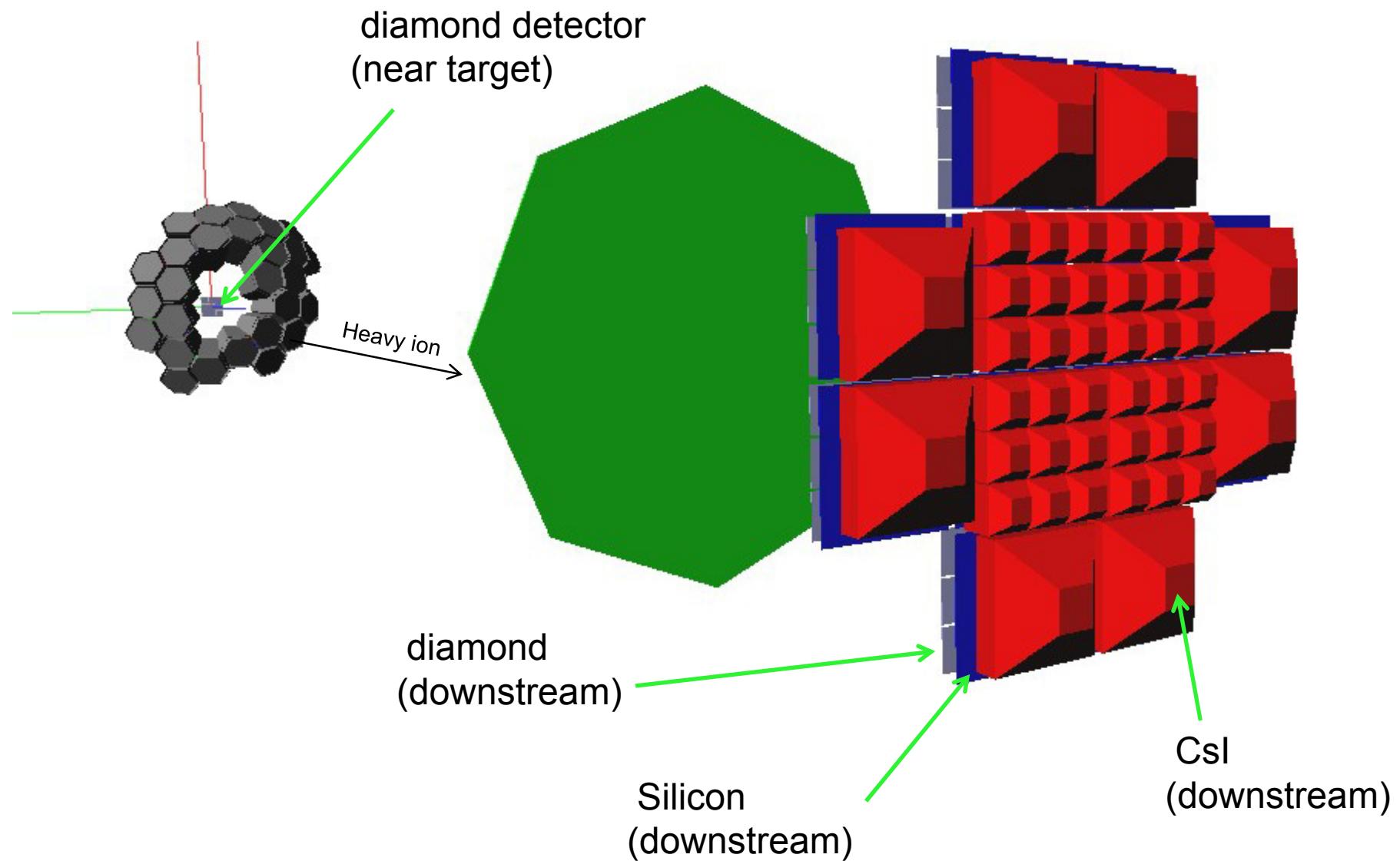
to meet these new challenges...

1. New Agata geometry at forward angles (Lorentz Boost)
2. track the fragments : tracking ancillary (LYCCA)

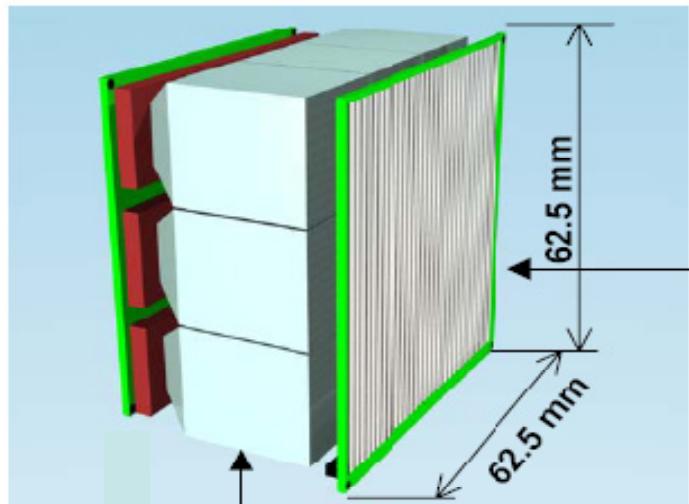
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LYCCA module

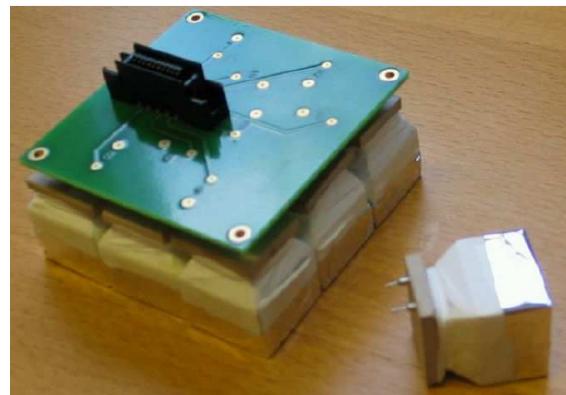


CsI (E)
Si DSSSD
 ΔE and position

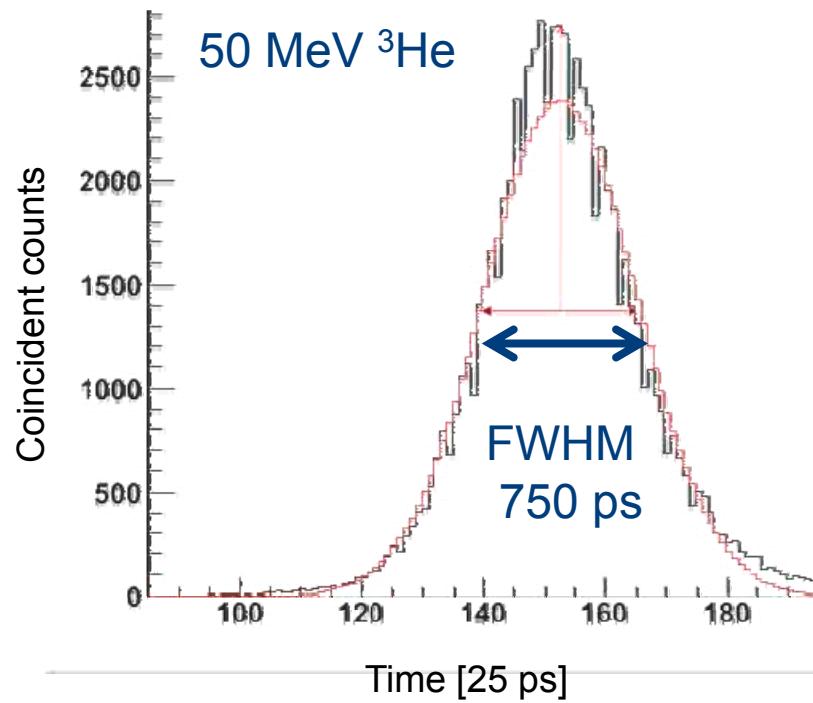
Each Lycca module:
9 detectors with
(2×2) cm 2 area

Electronic grade ($20 \times 20 \times 0.3$) mm 3
polycrystalline diamond (DDL)

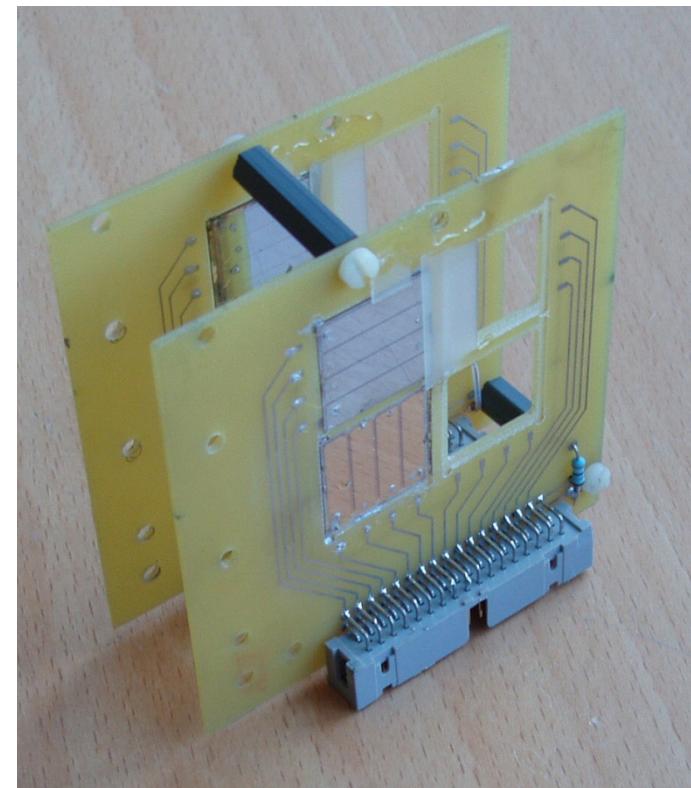
Timing detectors - TOF
Plastic or pc diamond



Diamond: timing test using CFD-TDC

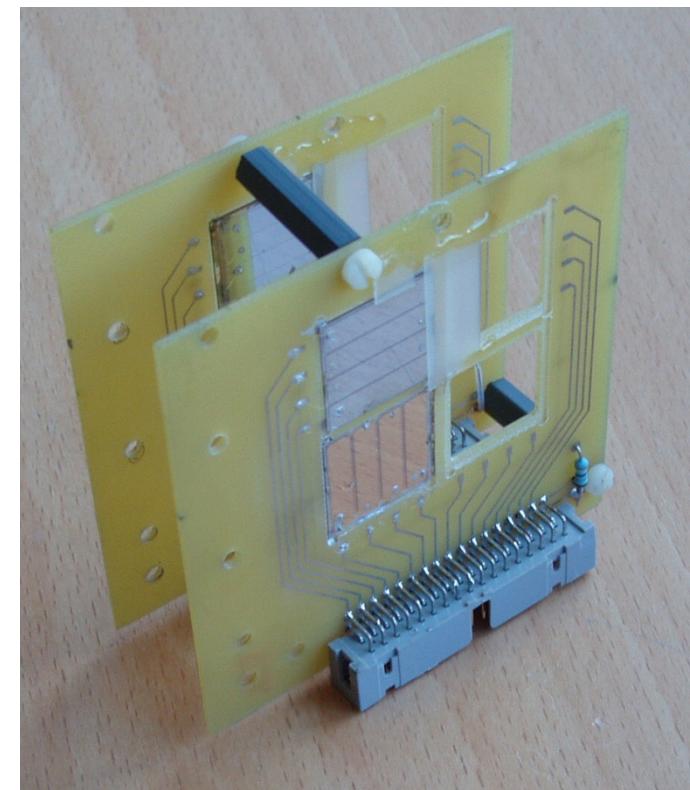
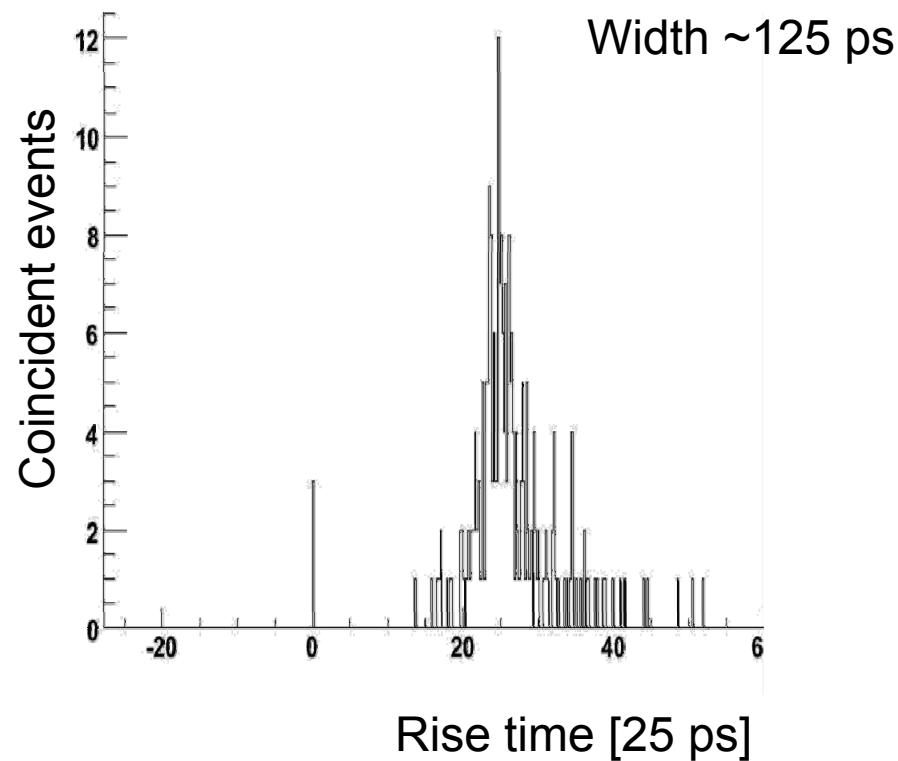


TDC
V1290A



Work of B. S. Nara Singh @ york

Diamond : timing test using PSA

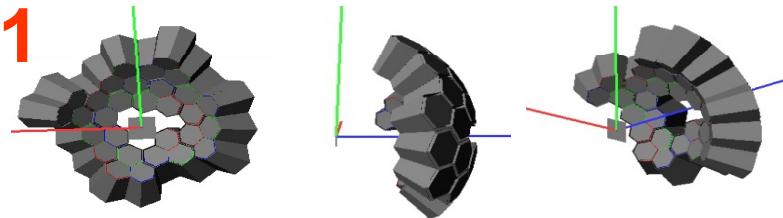


Work of Lianne Scrutton @ york

Simulation: comparison of shell geometries

Shell geometries

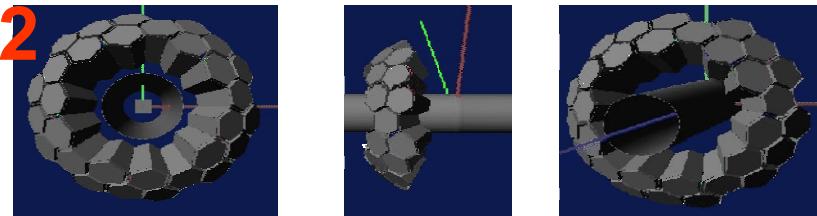
S1



10 Clusters (Hole 1 Cluster)

Hole small (appx. 7 cm)

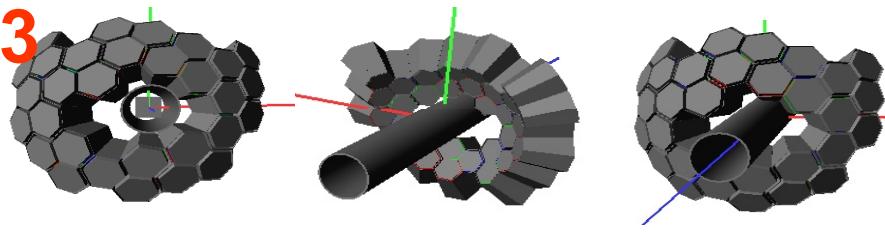
S2



10 Clusters (Hole 5 Clusters)

Hole (22.8 cm) beam-pipe 16 cm

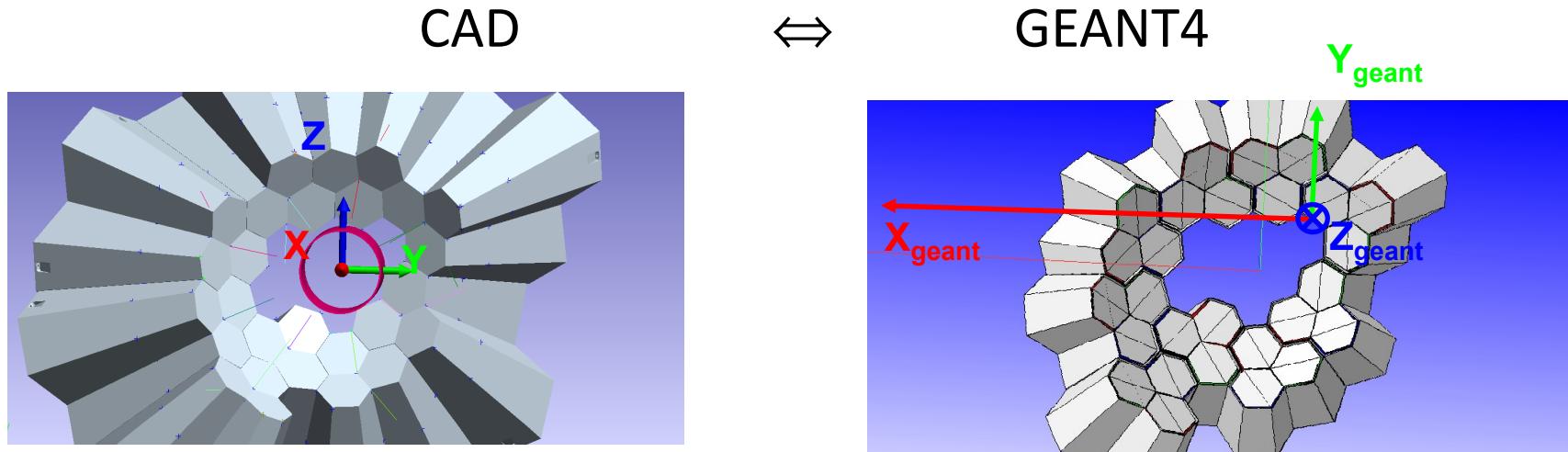
S3



10 Clusters (Hole 2 Clusters)

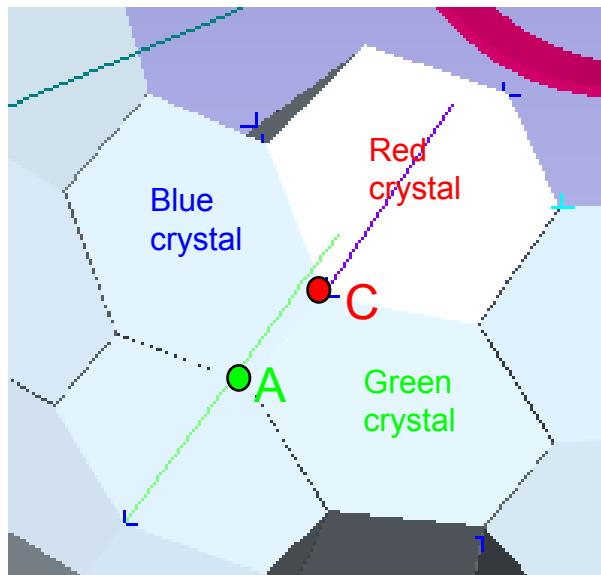
Hole (11.5 cm) beam-pipe 11 cm

Geometry : from CAD to Geant4



- Different coordinate systems currently used in CAD and AGATA geant4 code
 - Same target coordinates (0,0,0), but different axis.
 - CAD can easily provides:
 - positions of the centre of each cluster front face.
 - AGATA code requires:
 - positions of each cluster barycentre,
 - polar and azimuthal angles (Θ, Φ),
 - cluster orientation (Ψ).
- Interface developed to easily pass from one coordinate system to another

(1) Geometry : Shell's performance



Simulation results:

- Simulation input:
 - $E\gamma=1 \text{ MeV}$, $M\gamma=1$
 - $v/c = 43\%$
 - Distance target-Clusters: 23 cm
 - Target/Source position: (0,0,0)
- Results (mgt tracking code):
 - Photopeak efficiency: 8.5 %
 - P/T: 45%
 - Resolution (FWHM): 7 keV

Simulations using LYCCA

Standalone code for simulation of lycca called “lyccasim” already exists (pl. See M. Taylor et al., NIM A606, 589 (2009)) and available from lycca website at <http://wwwnsg.nuclear.lu.se/lycca/>

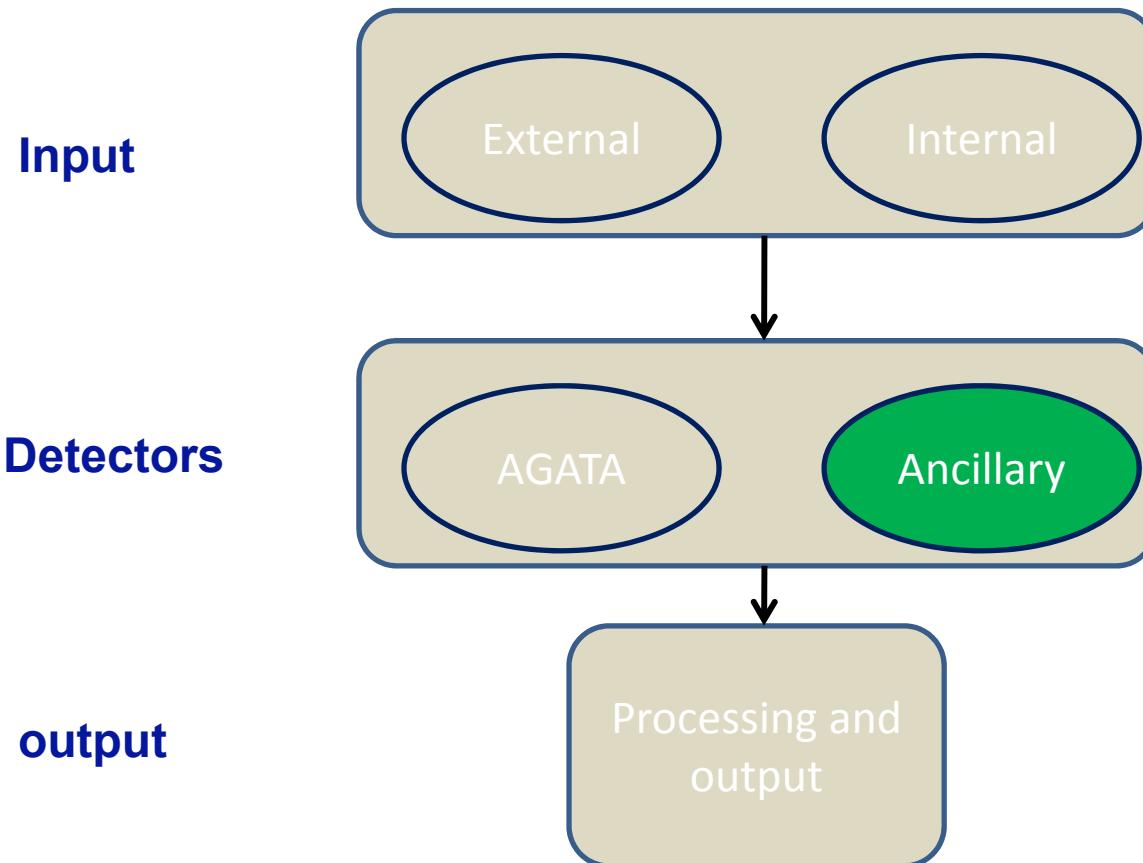
So one can either do a simulation with that for fragments and with Agata for gammas and merge the two data streams to generate final events....

Or

Follow the standard approach provided by the Agata code’s developers to include Lycca as an ancillary.

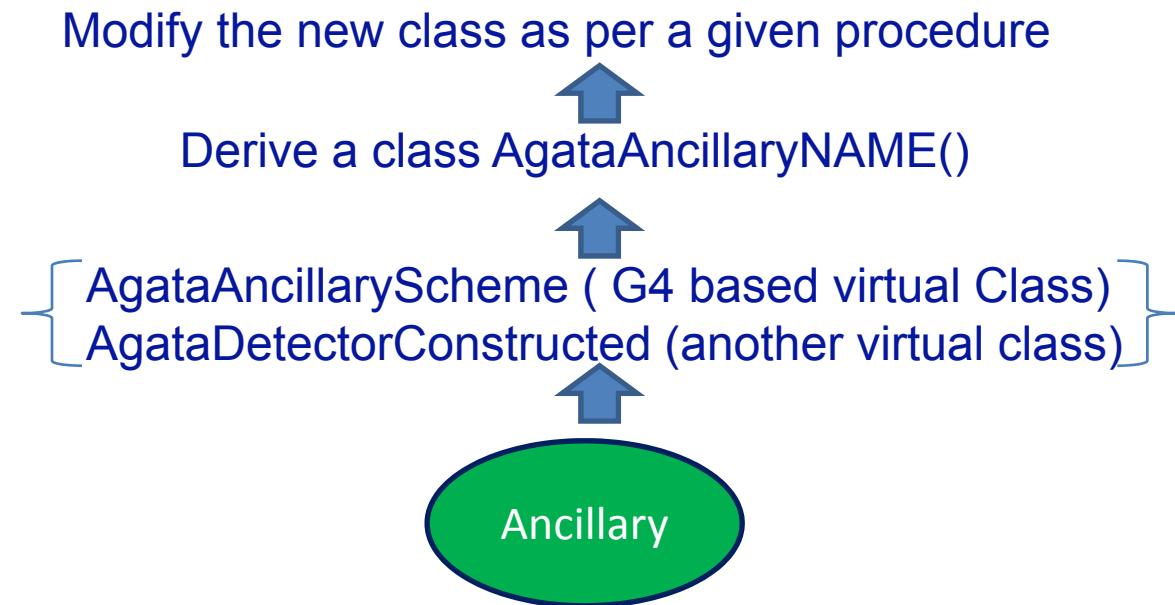
Fortunately the standard approach seems to be quite straightforward !!

AGATA Simulation Code : Ancillary detectors

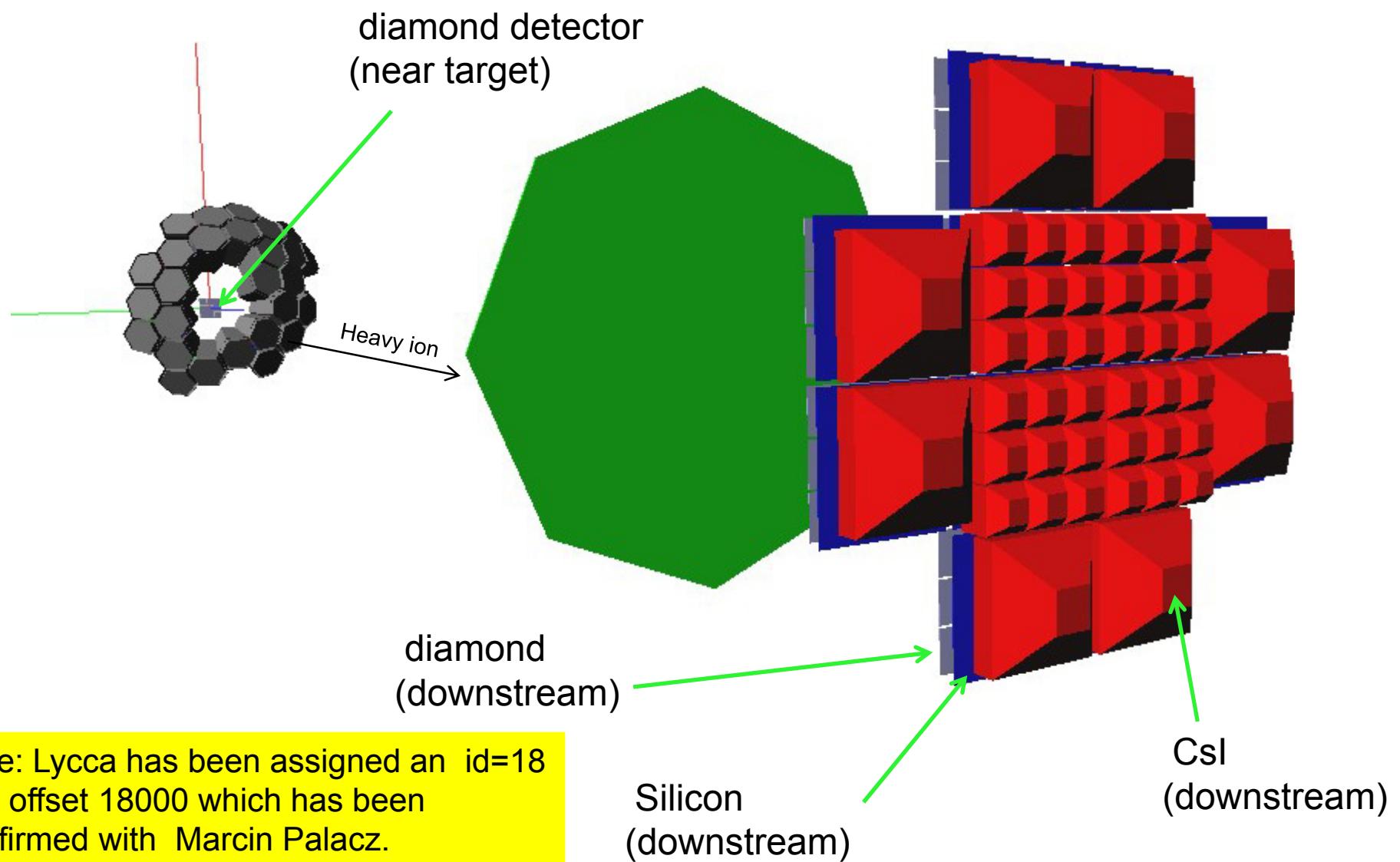


Building block model of Agata code. Blocks can be modified or new blocks can be added.

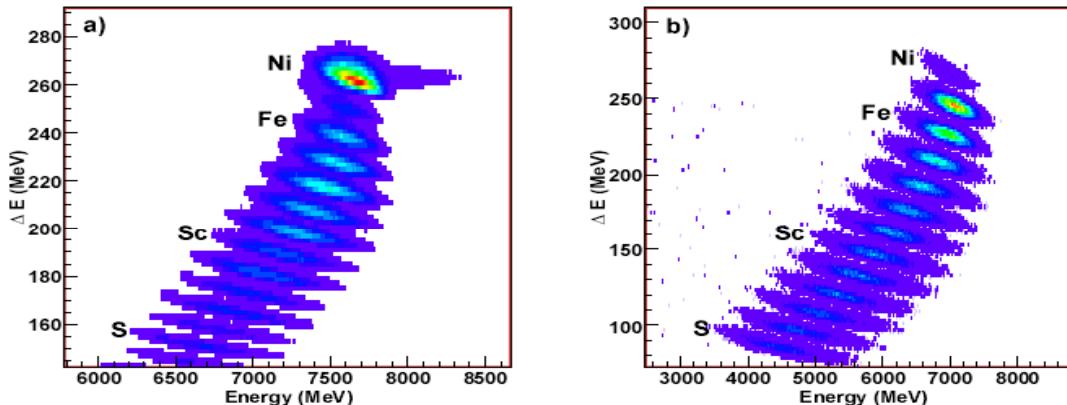
AGATA Simulation Code : Ancillary detectors: programming workflow



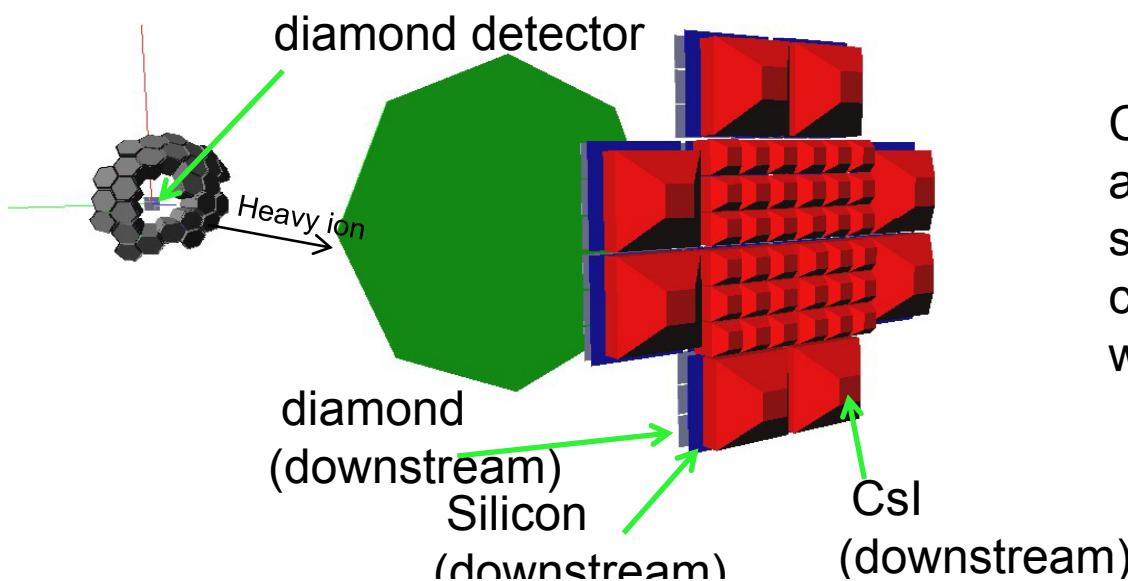
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LYCCA :simulations

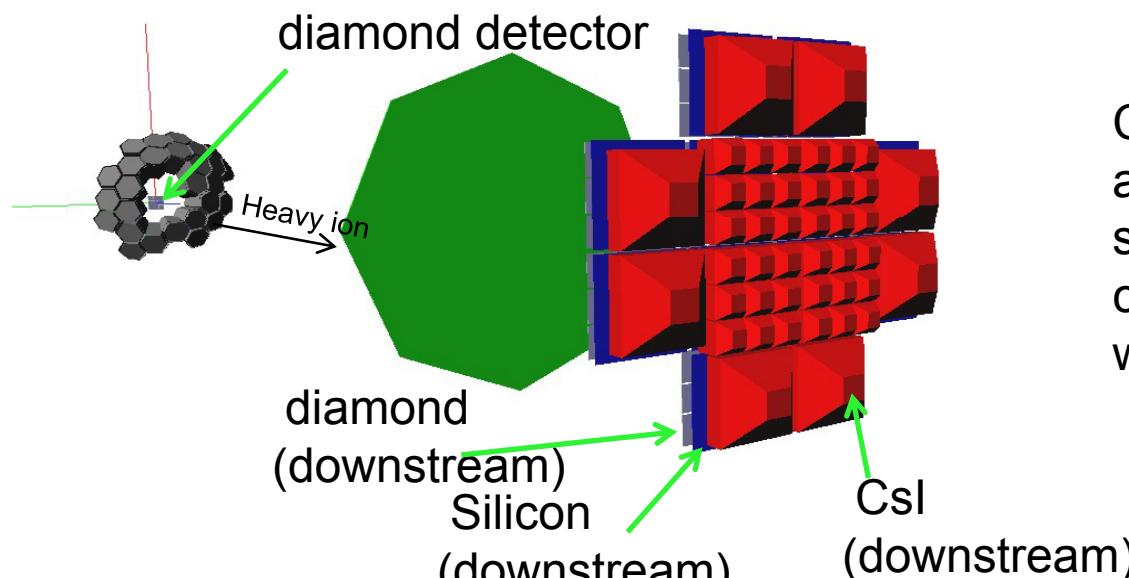
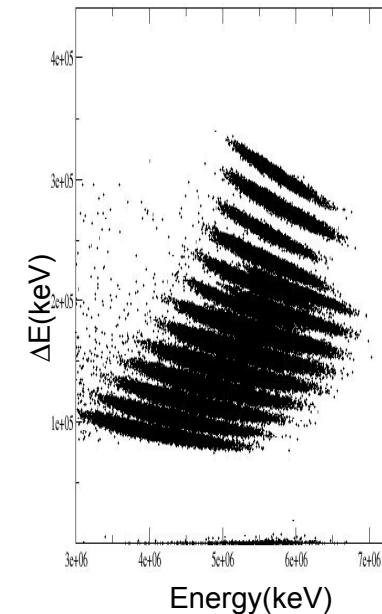
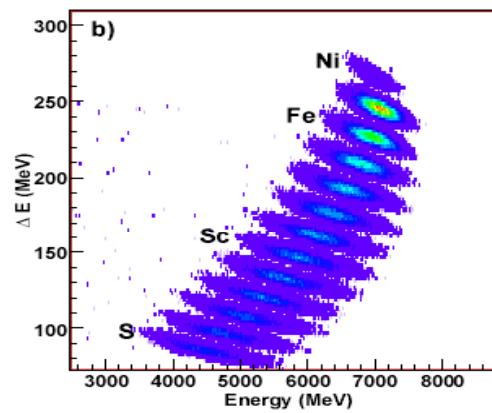
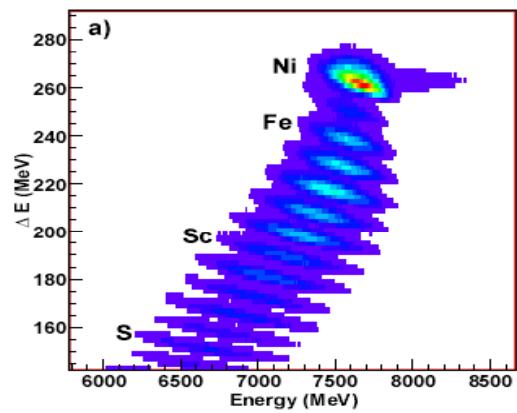


Result of simulation using CATE and comparison with simulations using lycca using lyccasim code.
NIM A606, 589 (2009)



Code is now functional
and is possible to run
simulations. The analysis
codes are currently
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LYCCA: Simulations



Code is now functional and is possible to run simulations. The analysis codes are currently worked out by GSI/York

summary:

- new AGATA geometry from CAD tools has been imported into the AGATA code.
- Tracking array LYCCA has been incorporated into the AGATA code.
- Event generation would be possible using various mechanism ... Cesar's code, Lyccasim + Marc Labiche.
- Analysis codes to analyse the output of simulation are being written (UK and GSI working together).