



## *GRETINA SIMULATIONS*

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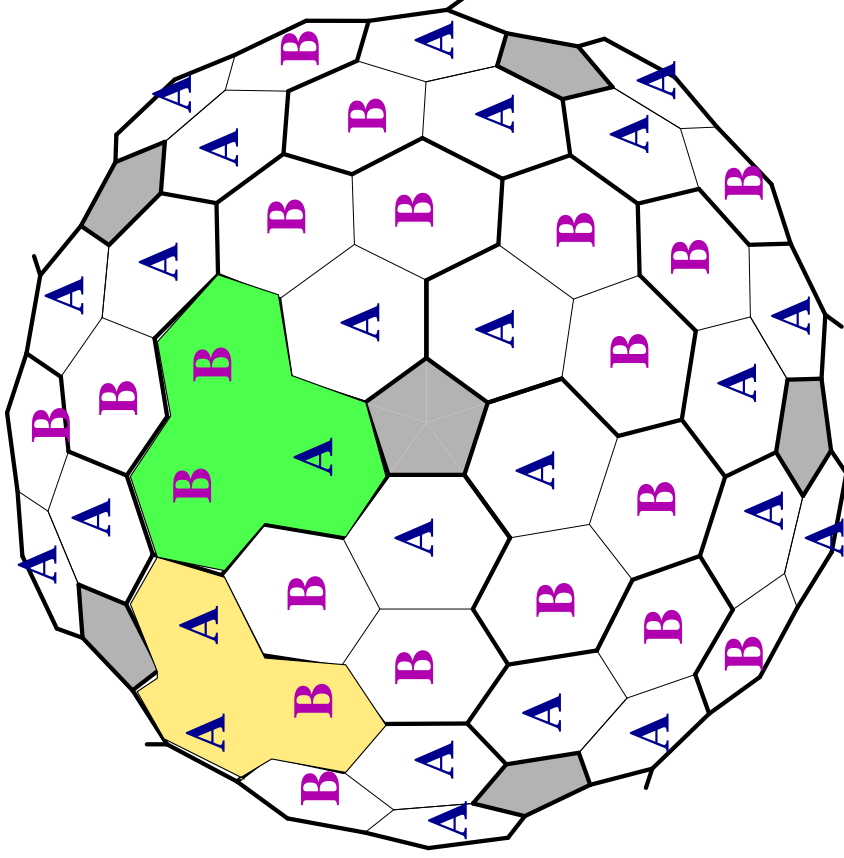
- *GRETA: The Gamma-Ray Energy Tracking Array*
- *GRETINA: 1/4 of GRETA*
- *GEANT 3.21 simulations*
- *Preliminary results*
- *Future work*

## The GRETA geometry

● GRETA status --->> presented by I–Yang Lee

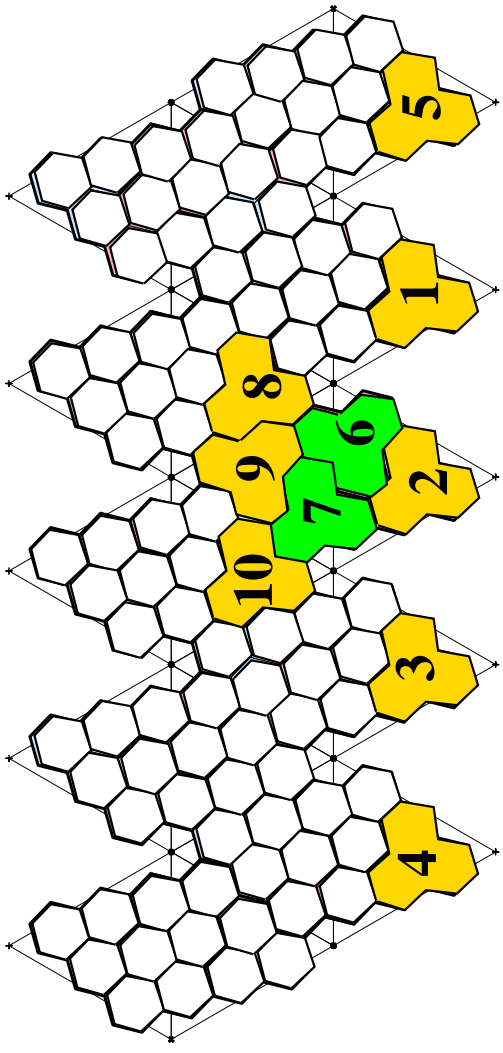
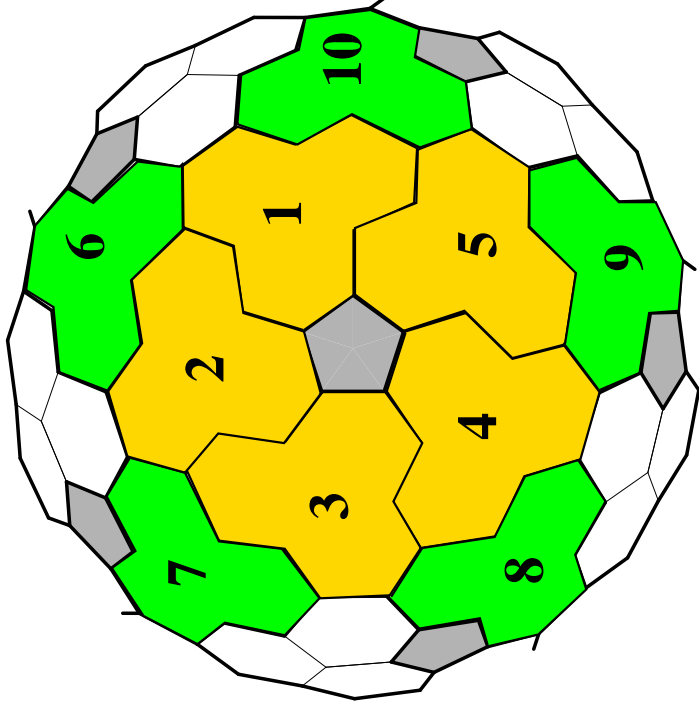
● The current design is based upon a geodistic configuration, consisting of

- 120 hexagons plus 12 pentagons
- Geometry by David Radford
- 2 kinds of slightly irregular hexagons: A and B
- 3 crystals arranged in 1 cryostat
- 2 kinds of triple clusters
- Total of 40 triple clusters
- The inner radius of the Ge shell is 15 cm, which determines the dimensions of the Ge crystals



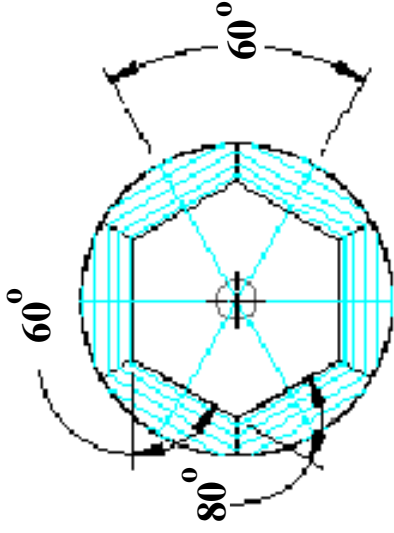
## GRETINA geometry

- GRETINA is 1/4 of GRETA, i.e. 30 hex-Ge crystal  $\rightarrow$  10 triple clusters
- Two different configurations for GRETINA have been considered
- 1) close-packed symmetric section of sphere
- 2) Asymmetric section of sphere



- The two configurations provides very similar results

## The detector's geometry



- Partial tapered crystal
  - 9 cm length
  - ~5 cm front diameter
  - ~8 cm back diameter
  - cylindrical inner hole of 0.5 cm radius

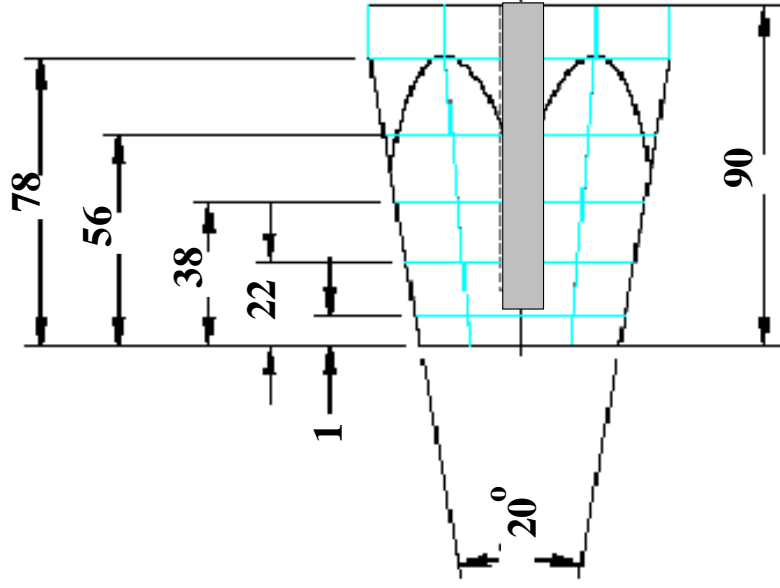
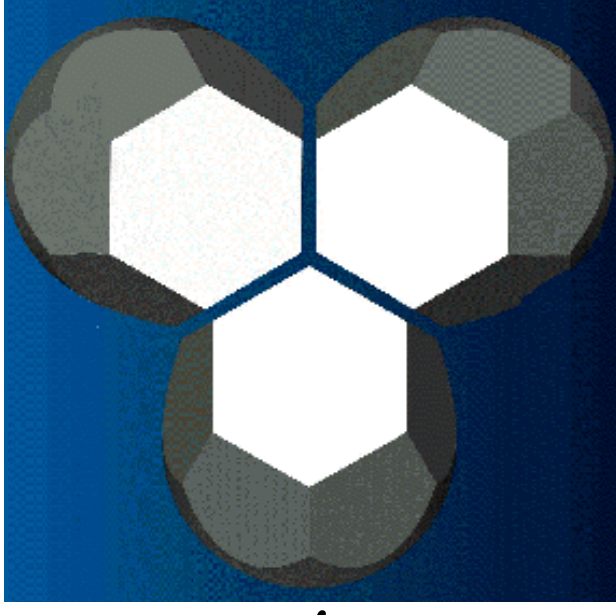
● 36 segments

z-spacing:

1.0, 1.2, 1.6, 1.8, 2.2, 1.2

● Flat taper angle =  $10^\circ$

● Triple cluster  
two configurations  
AAB or ABB



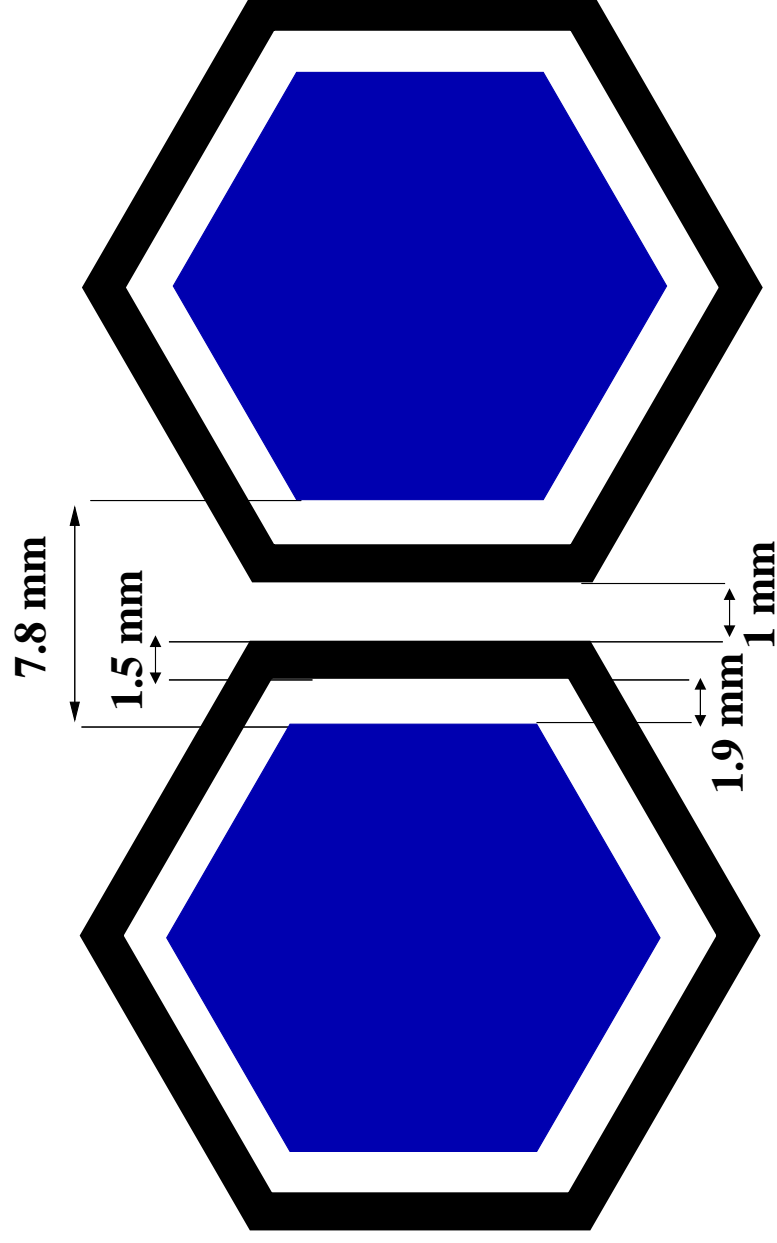
It has been calculated that this geometry provides the best compromise between solid angle coverage and Ge usage

## The geometry used in the GEANT code

- The irregular hexagons are made of 6 triangular shapes.
- The cylindrical centre hole and the partial tapering at the back of the crystal have been included in the code.
- At the present time, the shell is made of single detector crystals, i.e. no clusters
- Average Ge–Al gap and Al–Al gap have been considered.

- Total Ge–Ge gap = 7.8 mm
- Ge–Al Gap = 1.9 mm
- Al–Al Gap = 1 mm
- Al Thick = 1.5 mm
- Total Al = 3 mm

- The resulting solid angle covered with Ge is ~80% for GRETA and ~19% for GRETINA

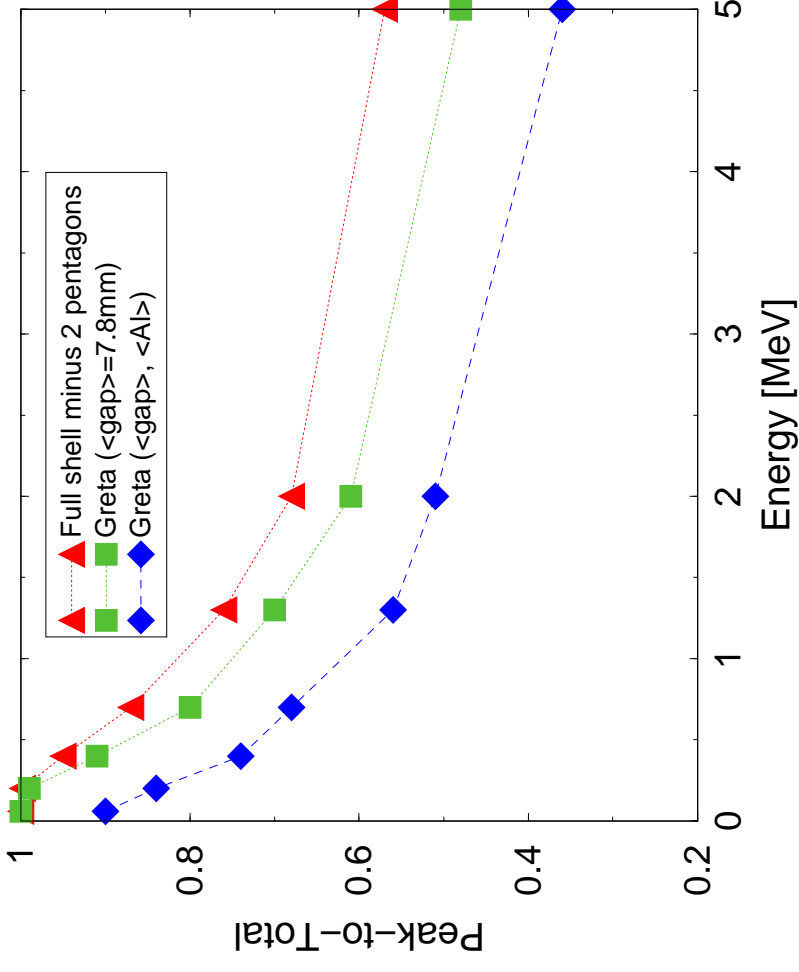
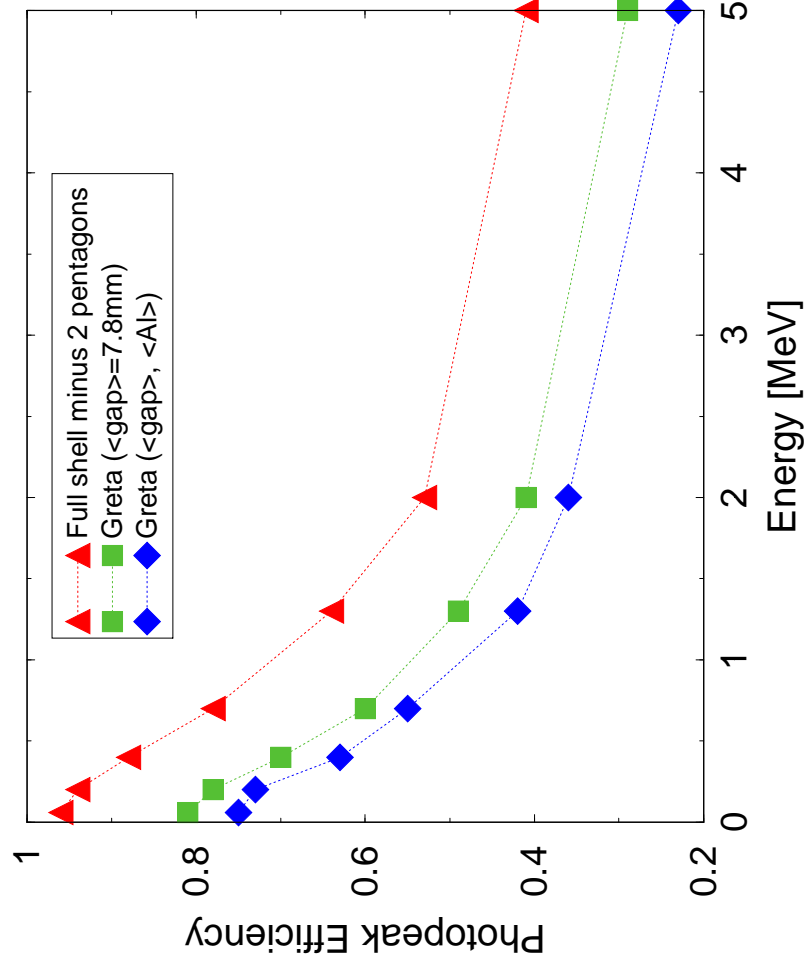


## Simulation Results

### EFFICIENCY and PEAK-TO-TOTAL RATIO

as a function of the gamma-ray energy

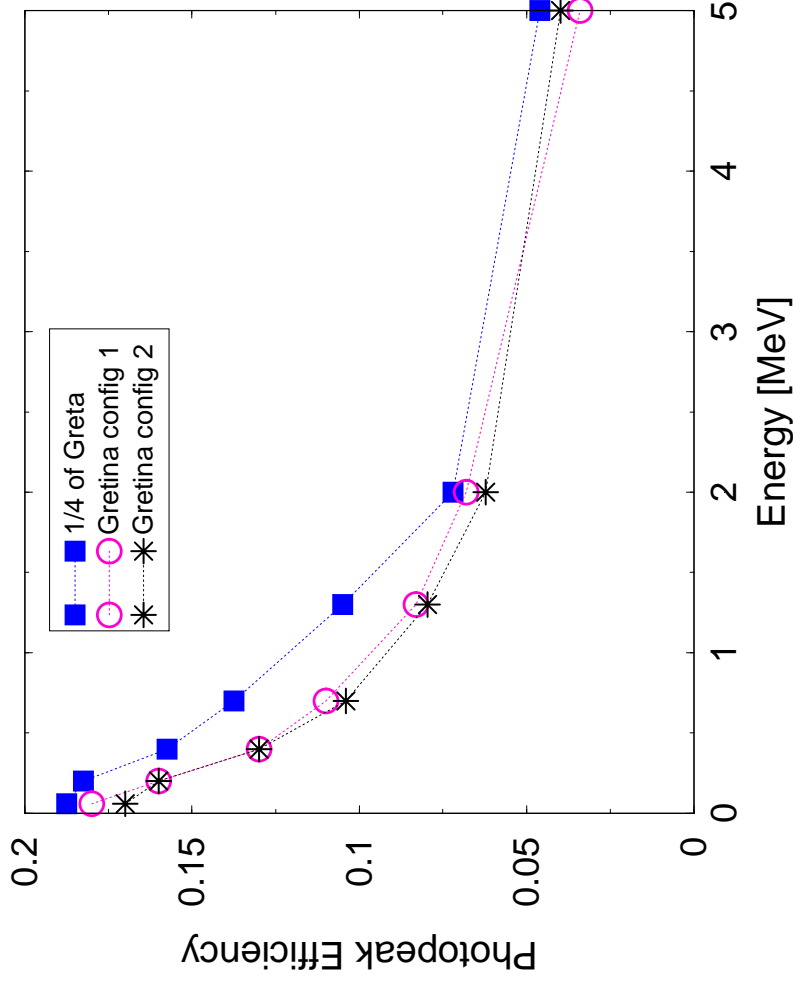
10 000 events have been considered  $\implies$  statistical errors  $\sim 2\%$



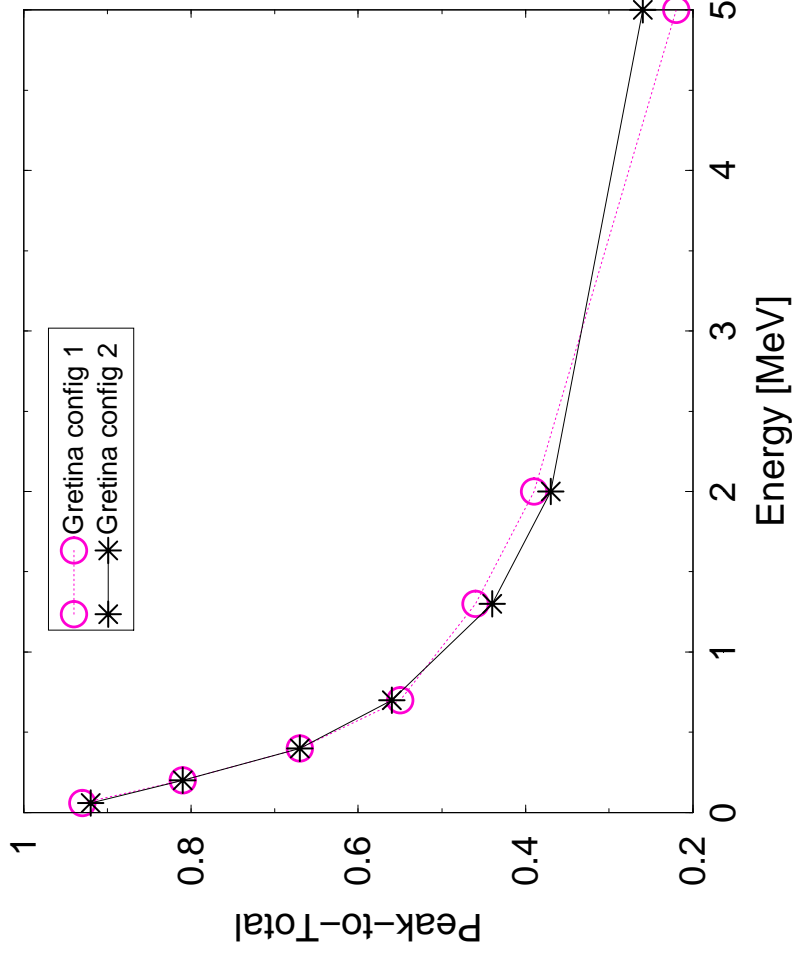
## Simulation Results

- **GRETINA**
- **EFF and P/T** have been calculated as a function of the gamma-ray energy
- **For each energy, 10 000 gamma rays have been considered**

### Efficiency



### Peak-to-total



## Future Work

- Include in the Geant geometry the packing of 3 and 4 crystals in 1 cryostat.
- Do the efficiency and the peak-to-total results change?
- Independent check of simulations will be carried out at LBL.
- Investigate gamma-ray tracking using developed program.

## Acknowledgments

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