# AGATA at GSI and FAIR

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NUSPIN + AGATA

Venice, Italy

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### PRESPEC-AGATA Physics Campaign 2012-2014



# Approved proposals and runs in 2012 and 2014

100	S424: Korten/Gerl			
a de la companya de la	Performance commissioning (PRES	PEC-AGATA)		
	S429: Rudolph / Podolyák / Gerl			
	Quadrantic evolution of collectivity around <sup>208</sup> Pb			
	S430: Wieland / Gorská			
	Pygmy Dipole Resonance in <sup>64</sup> Fe and the properties of neutron skin			
<b></b>	S426: Pietralla / Rainovski / Gerl			
	Relativistic <i>M</i> 1-Coulomb excitation of <sup>85</sup> Br			
<u>*</u>	S433: Gadea / Gorská	talk bv		
	Coulomb excitation of the band-terminating 12 <sup>+</sup> yrast trap in <sup>52</sup> Fe Tayfun Huyu			
	S428: Pietri	talk by		
	Shape evolution in neutron-rich Zr	Damian Ralet		
	S434: Recchia / Bentley	talk by		
	Transition rates and mirror energy dif	ferences in isobaric multiplets <i>Alberto Boso</i>		
Campai	gn suffered from severe beam time o	uts (imposed by BMBF) and		

unexpected beam intensity problems in 2014

## **Relativistic Coulomb excitation / fragmentation**

<sup>112</sup>Sn →Au



# Atomic Background Radiation Bremsstrahlung



<sup>132</sup>Sn on <sup>208</sup>Pb

500 MeV/u

## **Doppler Effect**

## Doppler shift

## Doppler broadening



## In-beam Spectroscopy

production selection spectroscopy *identification* reaction Beam Dipole identification magnets MW1 MW<sub>2</sub>  $\gamma$  detectors Production Si target CsI(TI) SCI1 Degrader MUSIC a SCI2 Reaction target **Calorimeter** 

## AGATA at GSI set-up

#### Challenge: FRS beam size!!!



## AGATA detector layout – Status 24-2-2014



P1 - ADC03

- P4 ADC01
- P13 ATC03

P5 – ATC05 P6 – ATC01 (new mech. Adj.) P14 – ATC04 (new A007, B007, C007) P7 – ATC02

# FRS S4 set-up and LYCCA

TofStopXX dat

#### FRS

- 2 MUSIC Ionization detectors for energy loss
- 2 plastic detectors for ToF (one of it segm. Finger det.)
- 2 TPC for position

#### LYCCA

- •17 silicon DSSSD detectors for tracking and energy loss
- 144 Csl scintillators for particle energy
- 3 fast plastic scintillators for time of flight and tracking



31.17

## The Set-up in Reality

LYCCA

AGATA

AGATA Tracking array 3x2+6x3 crystals R = 12 - 40 cm  $\epsilon_{Ph} = 4 - 7\%$  $\Delta E = 0.4 - 1.2\%$  Hector

## Complex data analysis



## **Coarse Spill Structure at FRS S4**



**Coarse spikes** with up to 100x hits compared to the mean value per 100 us interval.

Voids with up to 50% empty time intervals.



DAQ processing time:  $\approx$  100µs  $\rightarrow$  Only 1 hit /100µs contributes.

Spikyness reduces data acceptance by up to a facotor of 3 !!!!

### Fine Spill Structure at FRS S4



## **Particle-AGATA correlation**



## **Particle-AGATA correlation**



### AGATA Efficiency versus P/T



#### <sup>60</sup>Co at nominal position

Natasa Lalovic et al.

## Triple DSAM at relativistic energies



Only possible with ultra-high position resolution of AGATA

Mike Bentley et al.



## **Relativistic Coulomb excitation**



preliminary

Fragment	Particles (millions)	Cross-Section (mb)	$B(E2) (e^2b^2)$
<sup>206</sup> Pb	166	124	0.101 (3)
<sup>206</sup> Hg	410	58	$0.05^{(4)}_{(2)}$

#### Shell model predicts: 0.18 e<sup>2</sup>b<sup>2</sup>

# Was a Great Collaboration

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## FAIR ...what gives us confidence

2015 Heuer report confirms excellent science case of FAIR experiments FAIR Council agrees to cover additional construction costs, requests LEB building to be included in MSV and demands new management 2016 GSI/FAIR organisation and management completely changed GSI and FAIR are factually merged and work coherently together New FSB director introduces staged construction "along the beam line" New technical managing director sets up new project structure dividing FAIR into five machine and four experiment sub-projects Project lead team gets full responsibility for sub-projects LEB building planning caught up time delays and is on schedule Phase 0 experimental programme with FAIR injectors at GSI confirmed for 2018 and the following years until the FAIR facility is operational Based on integrated FAIR time plan first beams will be available in 2022 FAIR (MSV) will be completed in all aspects by 2025

# **FAIR Timeline**



# **NUSTAR time line**



## HISPEC at the LEB



## **HISPEC-AGATA at FAIR Phase 1**



- > 100x RIB intensities
- Flat spill structure



- 60 AGATA Ge crystals
- >20% Efficiency
- Easier control and analysis

## Conclusions

- The PRESPEC-AGATA campaign at GSI in 2012-2014 could run only a limited experimental programme
- Data analysis is very complex and time consuming
- Novel experimental methods emerge from the combination of relativistic beams and AGATA
- First physics results are popping up
- The FAIR project is developing well after a re-launch in 2015.
- An experiment campaign with AGATA is envisaged for FAIR Phase 1 in the early 20s.
- Combining 40 AGATA detectors with strong exotic isotope beams will lead to exciting physics opportunities