

Si-CD detector setup coupled with AGATA demonstrator installed at LNL



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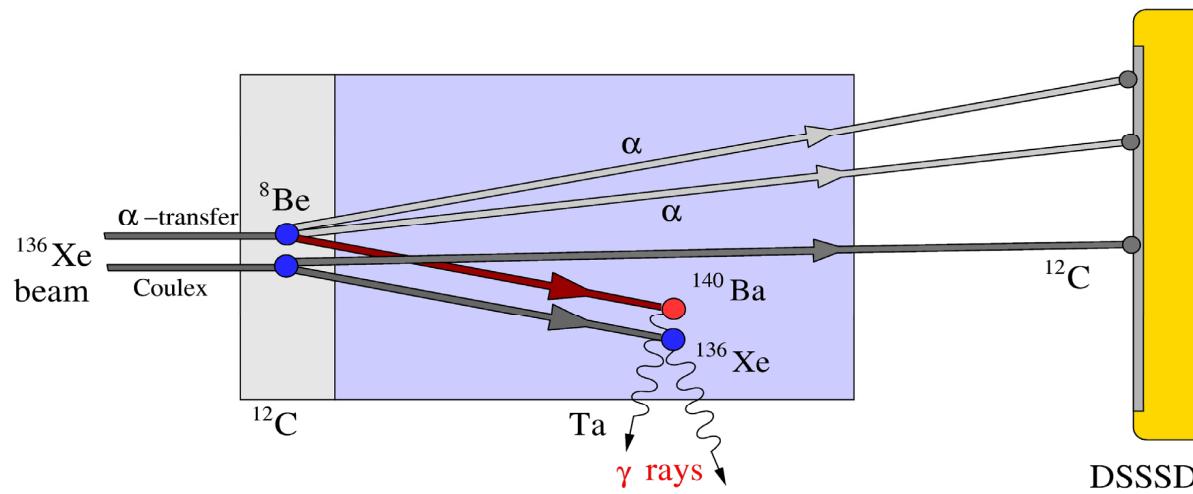
Precision lifetime study in the neutron-rich N=84 isotope ^{140}Ba from DSAM measurements following Coulomb-barrier alpha-transfer reactions on a ^{136}Xe beam

T. Bloch¹, J. Leske¹, G. Rainovski², L. Coquard¹, T. Kröll¹, O. Möller¹, C. Bauer¹, T. Möller¹, M. Reese¹, C. Stahl¹, A. Nannini³, N. Pietralla¹ and the AGATA collaboration

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Physics case

Experiment Da-BA140 at LNL (approved by PAC July09)



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- Alpha-transfer reaction $^{12}\text{C}(^{136}\text{Xe}, ^{140}\text{Ba})2\alpha$
 - Cross section is approx. 1/3 of the Coulex cross section $^{12}\text{C}(^{136}\text{Xe}, ^{136}\text{Xe}^*)^{12}\text{C}$ for proposed setup
→ High-intensity ^{140}Ba -RIB
- Population of Mixed-symmetry states via α -transfer reactions

C.E. Alonso, J.M. Arias, L. Fortunato, N. Pietralla and A. Vitturi, Physical Review C 78, 017301 (2008)

 - Strength of one-phonon MSS expected to be 1/3 of the 2_1^+ state
- 2_3^+ state at 1994keV (lifetime $\tau \approx 150\text{fs}$) in ^{140}Ba suggested to be MSS

W.D. Hamilton et al., PRL53, 2469 (1984)

 - Investigation of excitation cross section and lifetime via DSAM
- + Simultaneous measurement of Coulomb-excited ^{136}Xe

138	139	140		141	142	143	144
Pr	Pr	Pr		Pr	Pr	Pr	Pr
137	138	139	140	141	142	143	
Ce							
136	137	138	139	140	141	142	
La							
135	136	137	138	139	140	141	
Ba							
134	135	136	137	138	139	140	
Cs							
133	134	135	136	137	138	139	
Xe							
132	133	134	135	136	137	138	
I	I	I	I	I	I	I	I
131	132	133	134	135	136	137	
Te							
130	131	132	133	134	135	136	
Sb							
129	130	131	132	133	134	135	
Sn							

Overview

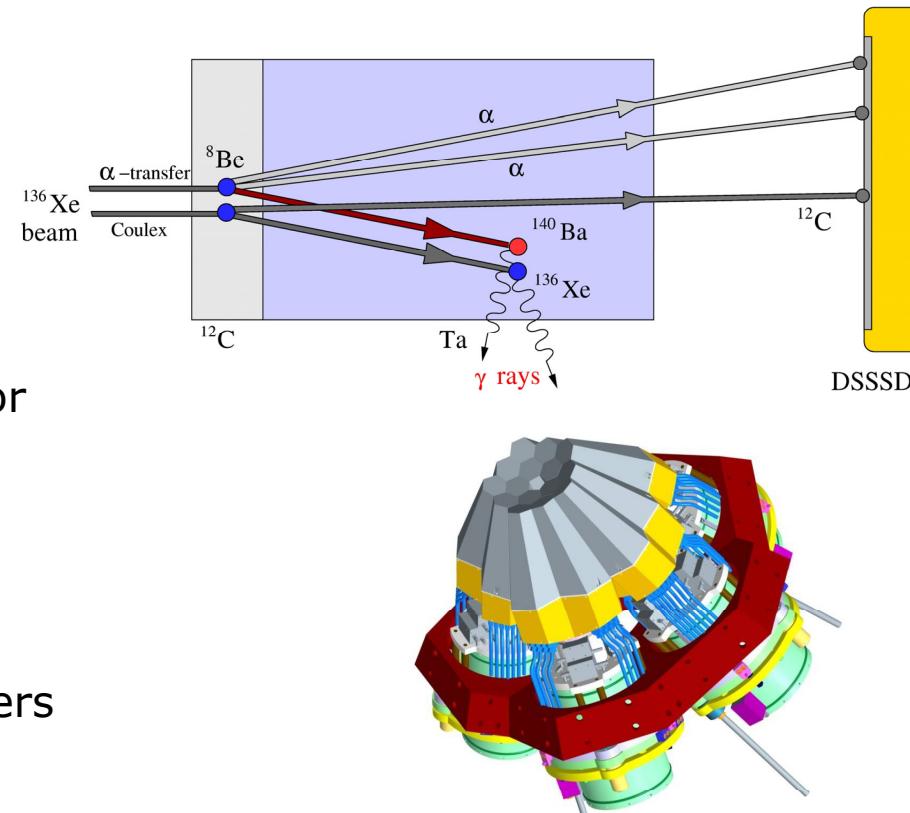
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PIAVE-ALPI + AGATA demonstrator + DSSSD

- Beam
 - ^{136}Xe @ 540 MeV (4MeV/u)
 - Intensity: 1pnA
- Targets
 - 1) $0.5\text{mg/cm}^2 \text{ C}$
 - Excitation cross sections, detector positioning
 - 2) $0.5\text{mg/cm}^2 \text{ C} + 30\text{mg/cm}^2 \text{ Ta}$
 - Stopping of $^{140}\text{Ba} \rightarrow \text{DSAM}$
- Detectors
 - 3 AGATA demonstrator triple clusters
 - DSSSD for particle detection



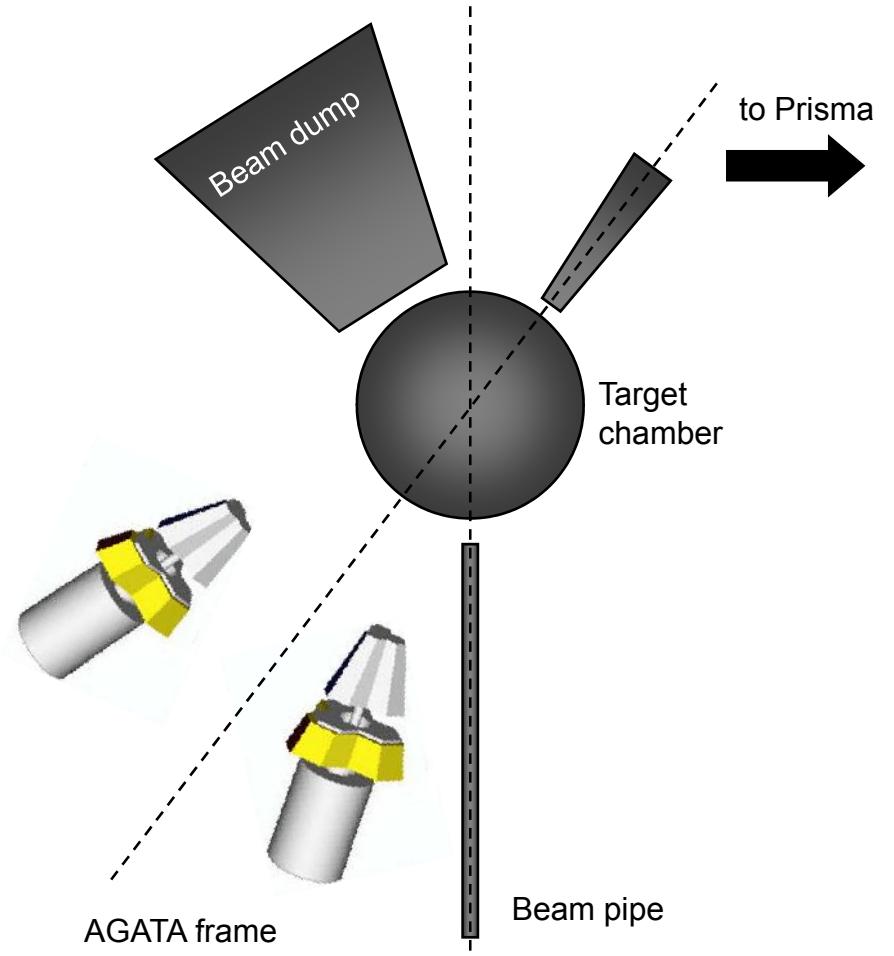
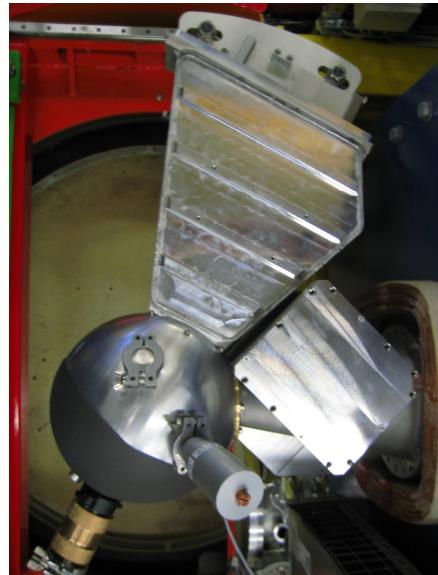
Setup

AGATA positioning



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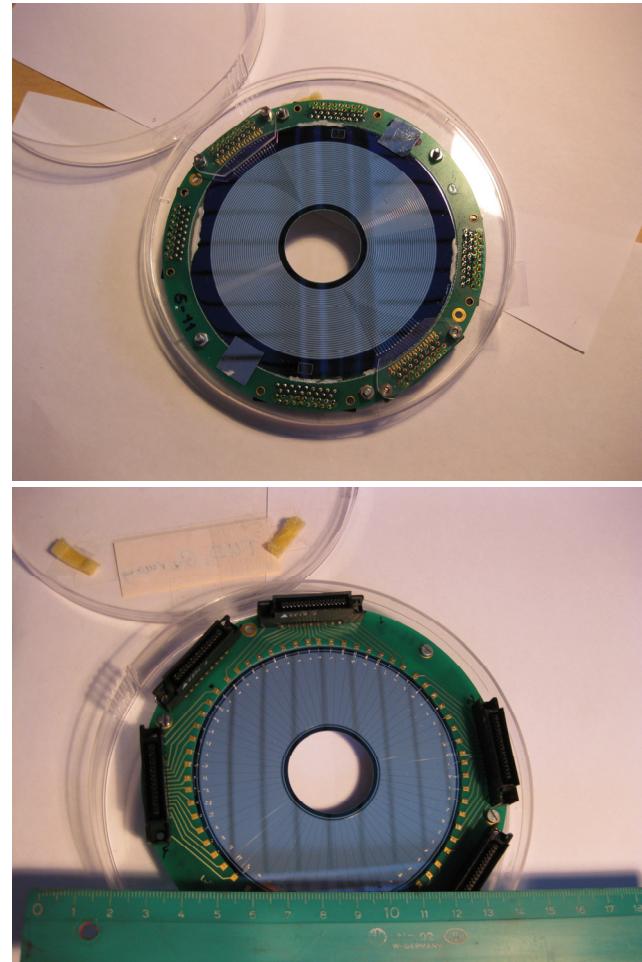
- PRISMA and AGATA frame at $\sim 30^\circ$ relative to beam axis
- AGATA demonstrator triple clusters facing several backward angles



Setup

Particle detector

- Double-sided Si strip detector (DSSSD)
 - Inner diameter: 32mm
 - Outer diameter: 85mm
 - 32 rings x 64 sectors
 - Thickness: approx. 300 μ m
 - Center hole filled by 5 PIN diodes (10x10mm each), arranged crosswise
- Electronics
 - 64 channels from DSSSD + 5 channels from PIN diodes
→ 69 ADCs & TDCs required
 - Preamplifiers, cables, etc. available



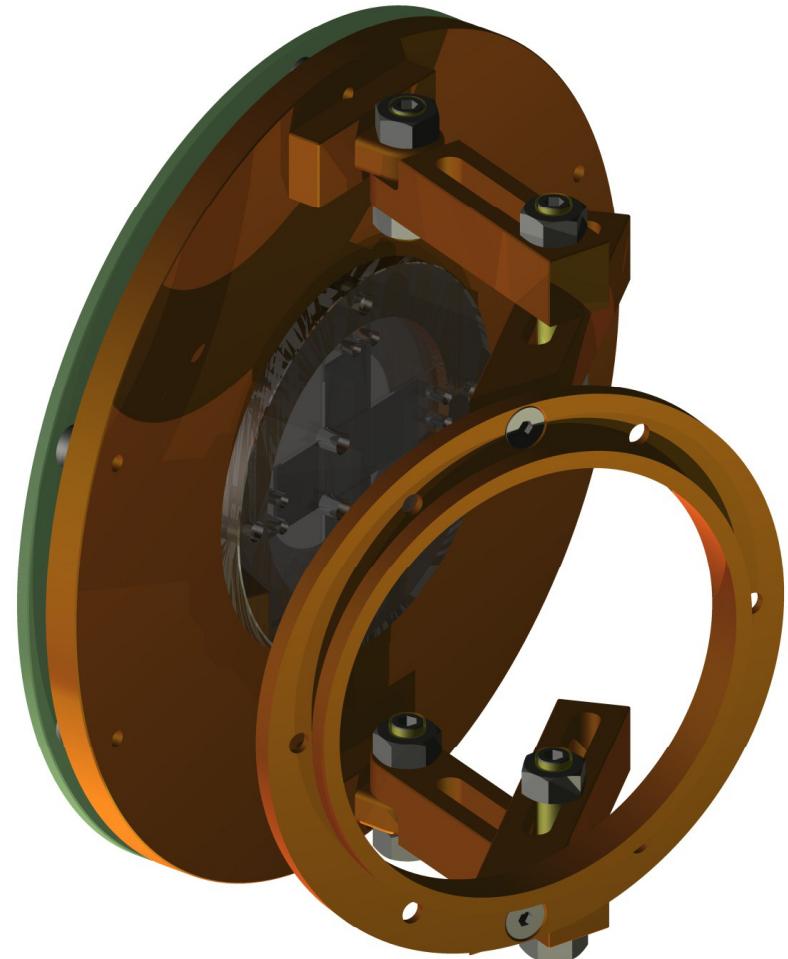
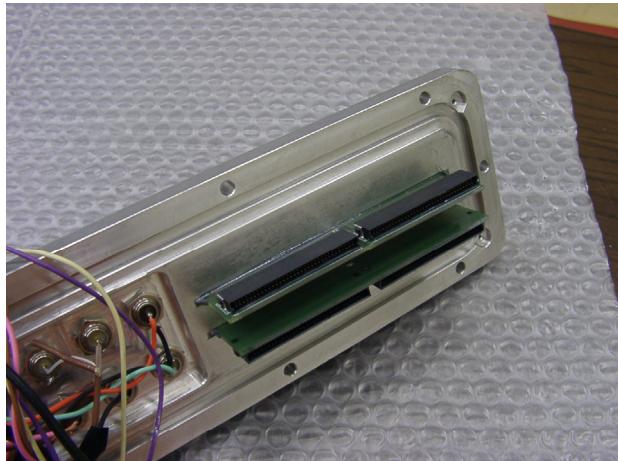
Setup

DSSSD support



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- Variable angle and distance to the target
 - 10°-50° relative to beam axis
 - 20-50mm distance from target
- Planned to hold design and backup CDs + PIN diode support
- Visual calibration/alignment
- Flat cable feedthrough behind DSSSD holder towards beam-dump cap

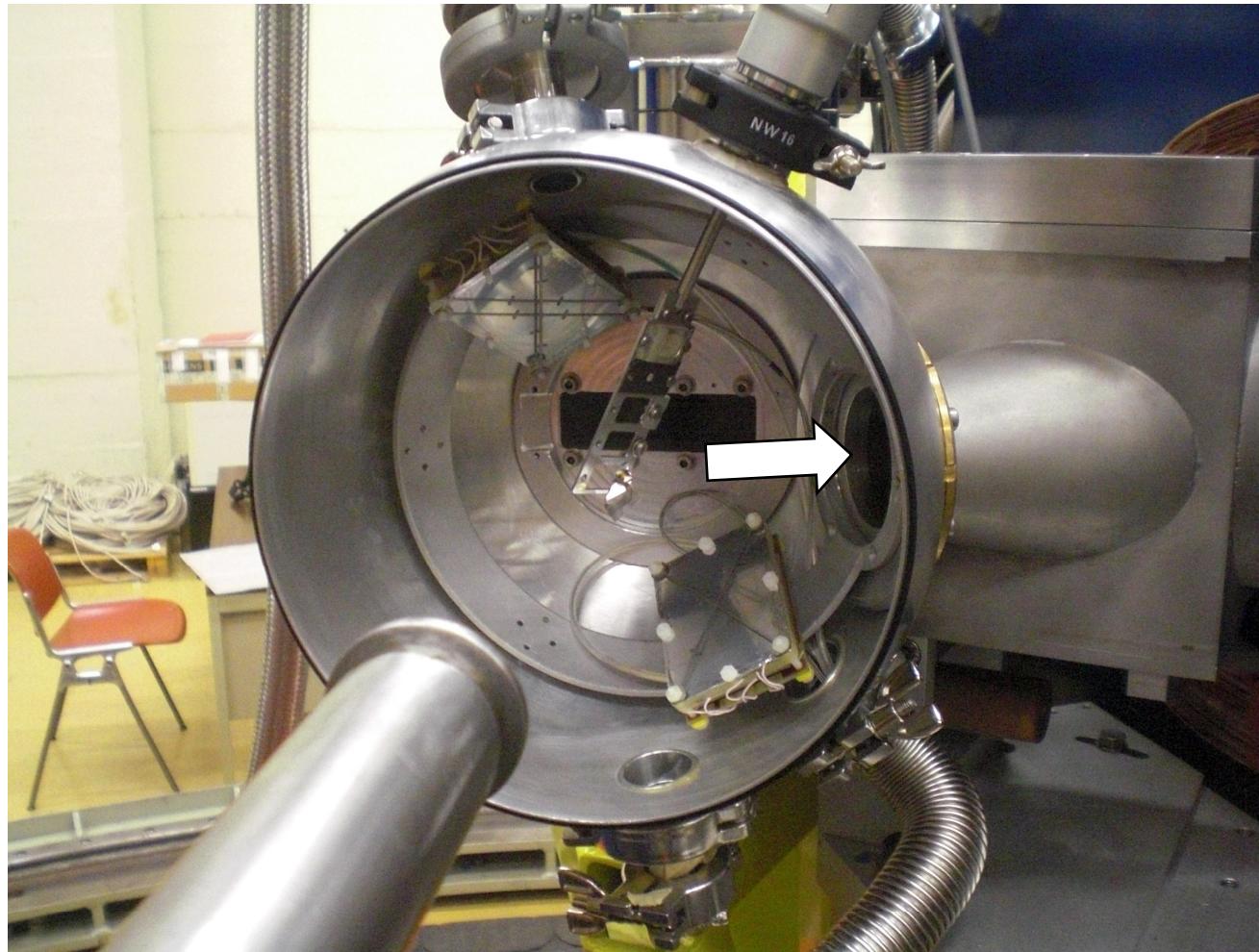


Setup

DSSSD support



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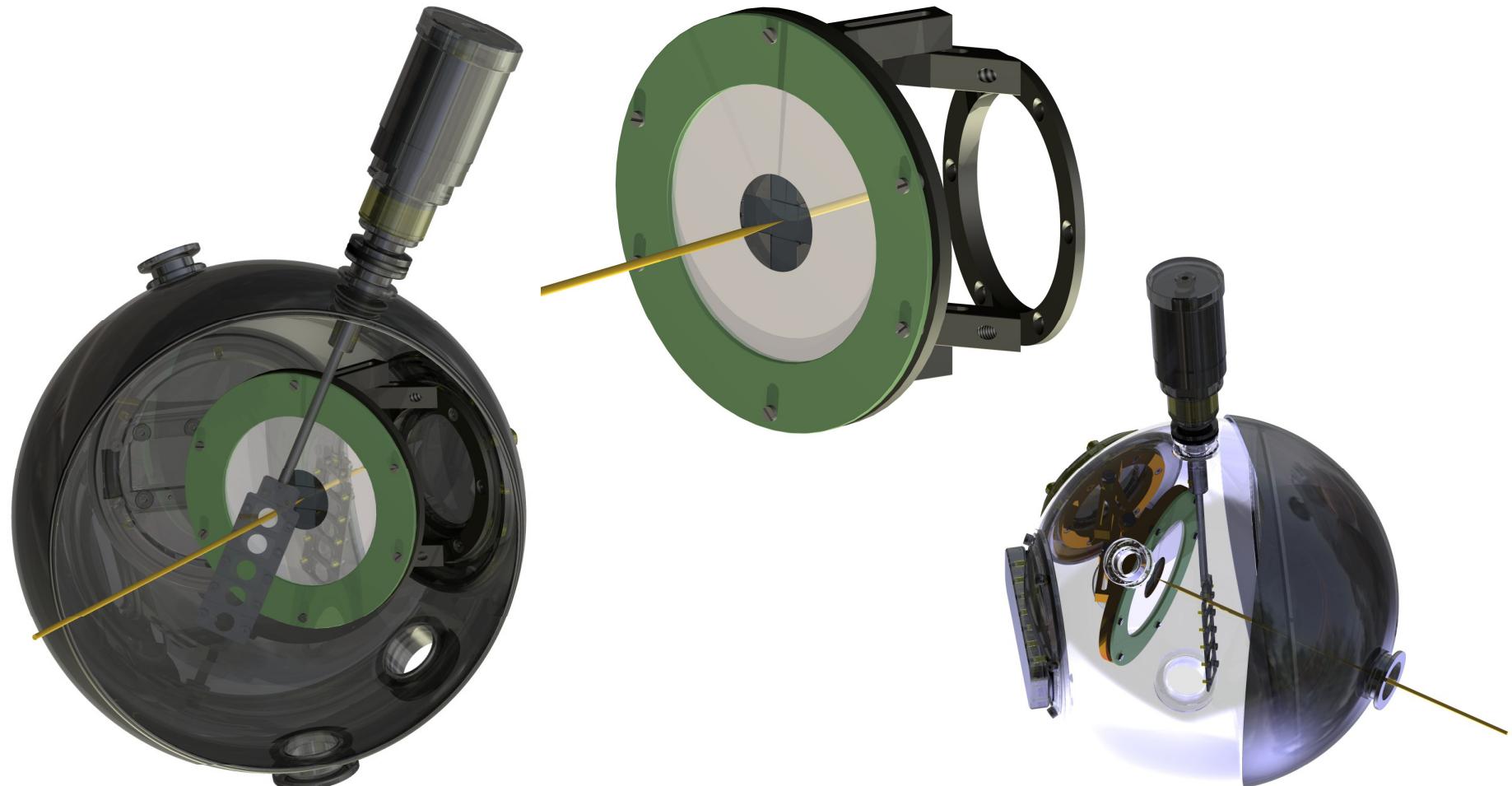


Setup

DSSSD support



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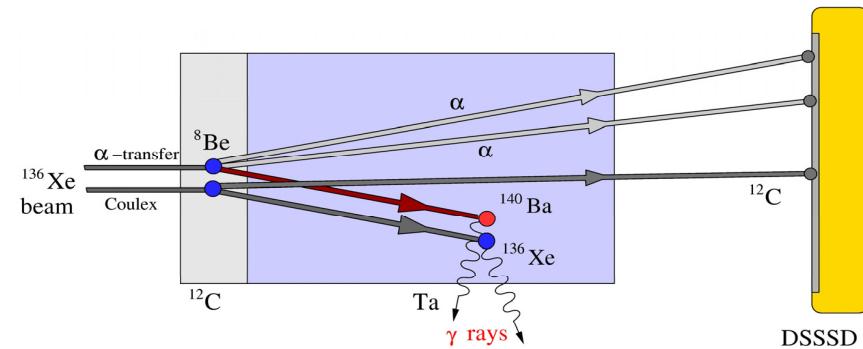
Setup

Event building, particle-gamma coincidence



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- Estimated single particle rate on DSSSD $\approx 100\text{kHz}$
(at maximum beam current!)
- Event building
 - Prompt coincidence particle-gamma
 - Master trigger (particle) opens coincidence window of 800ns
 - Event: Trigger particle + all gammas and additional particles within c.w.
- If possible: use of AGATA-timestamps for offline-analysis



Summary



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- Experiment Da-BA140 approved by PAC in July 2009
 - Excitation cross sections and lifetime (via DSAM) of MSS in ^{140}Ba + simultaneous measurement of Coulomb excited ^{136}Xe
- Coupling of DSSSD with AGATA demonstrator for particle-gamma coincidence measurement
- Design of variable DSSSD support to fit LNL target chamber

Thanks for your attention!

