Two-proton decay of ^{19}Mg

T. Aumann[1], L. Batist[1], J. Döring[1], H. Geissel[1], V. Z. Goldberg[3], L. Grigorenko[1,4], Z. Janas[5], O. Kisselev[1,2], H. Kumagai[6], C. Mazzocchi[1], I. Mukha[1,4], A. Ozawa[6], M. Pfützner[5], E. Roeckl[1], G. Schrieder[67], K. Sümmerer[1], O. Tarasov[8], H. Weick[1]

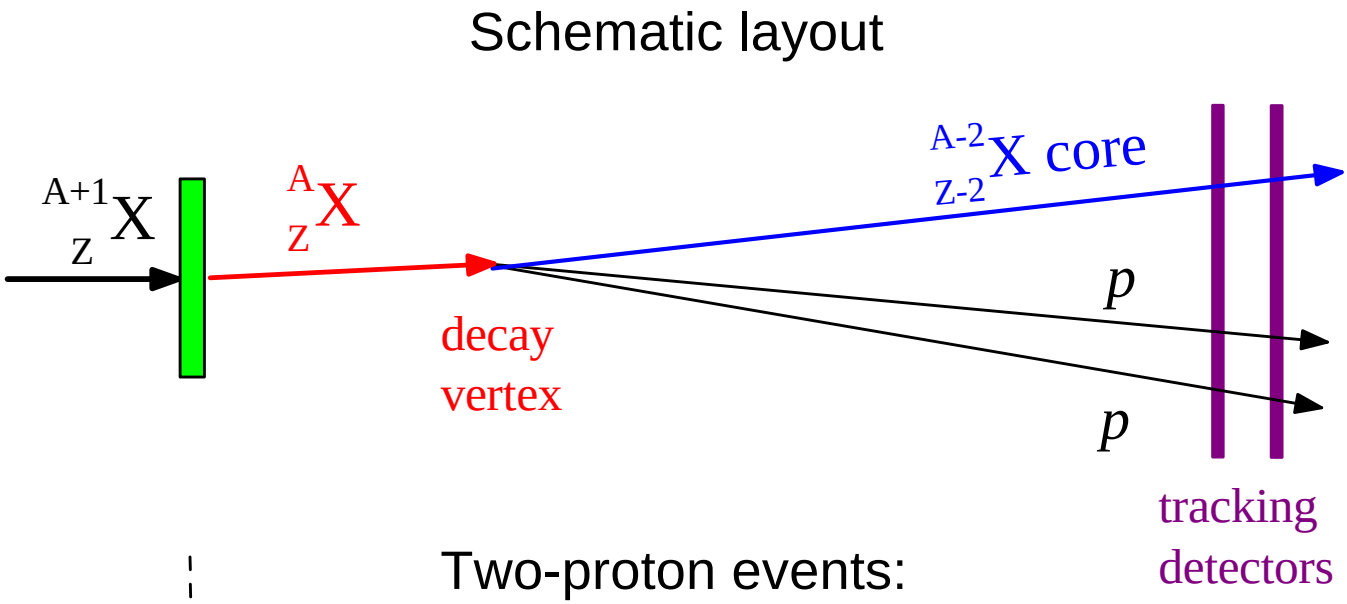
[1] GSI, Germany
[2] St. Petersburg Nuclear Physics Institute, Russia
[3] University of Notre Dame, Notre Dame, USA
[4] Kurchatov Institute, Russia
[5] Institute of Experimental Physics, Poland
[6] RIKEN, Japan
[7] Istitut für Kernphysik, TUD, Germany
[8] NSCL, Michigan State University, USA

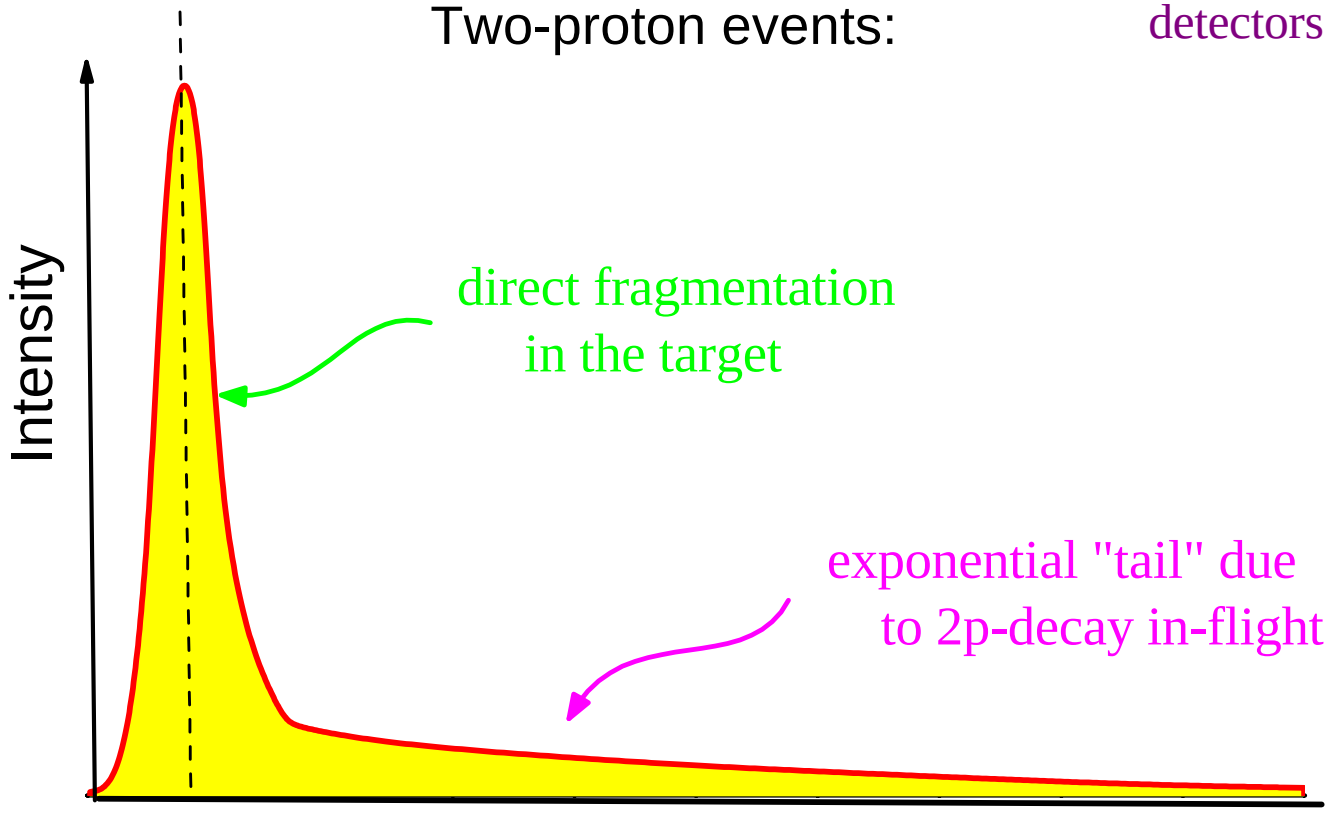
Search for a two-proton decay of ^{19}Mg produced at FRS via reaction (^{20}Mg, ^{19}Mg) with ^{20}Mg intensity ~2000 ions/spill

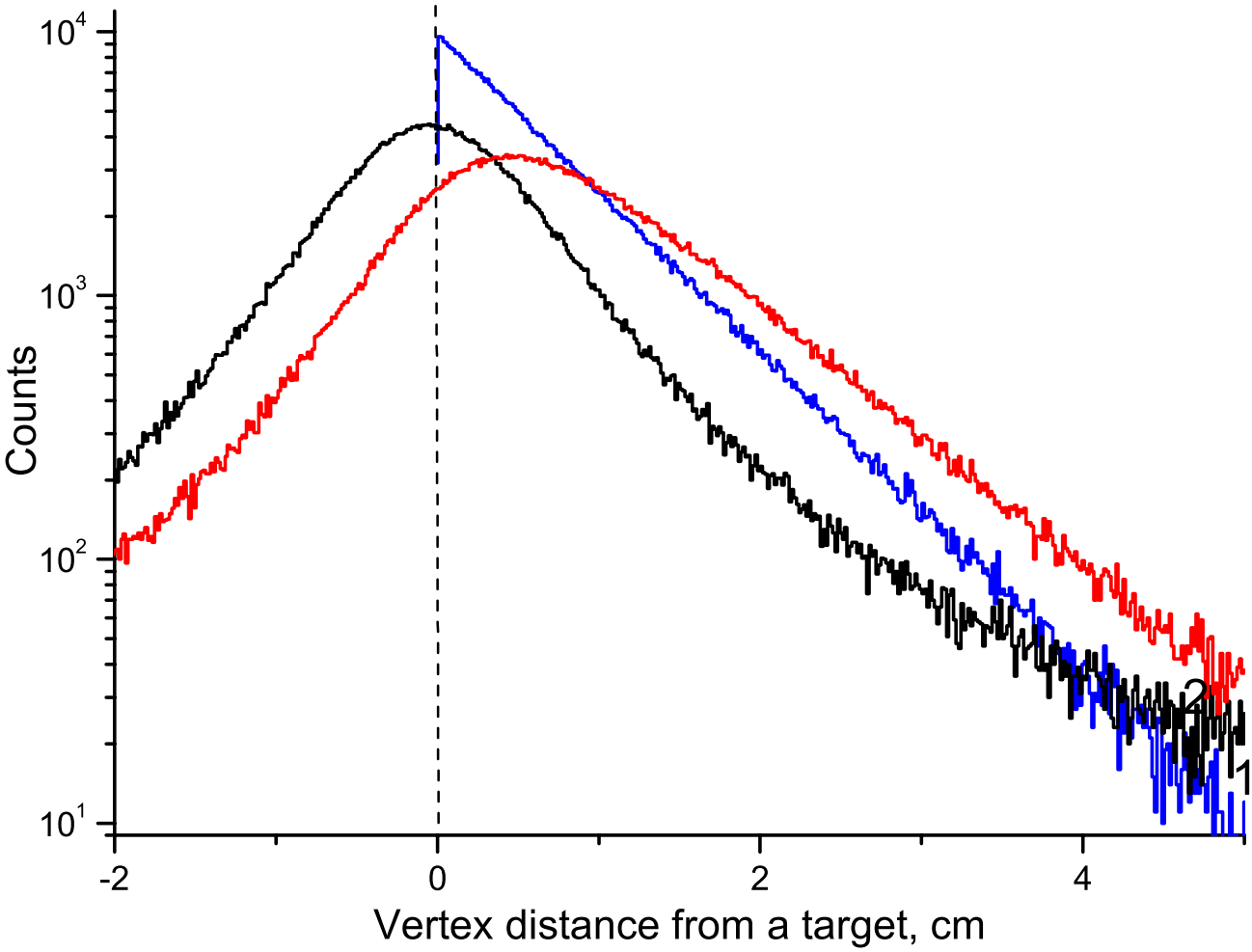
Measurements of all trajectories of p+p+^{17}Ne fragments. Lifetime to be derived from measured vertex distributions, proton-proton correlations

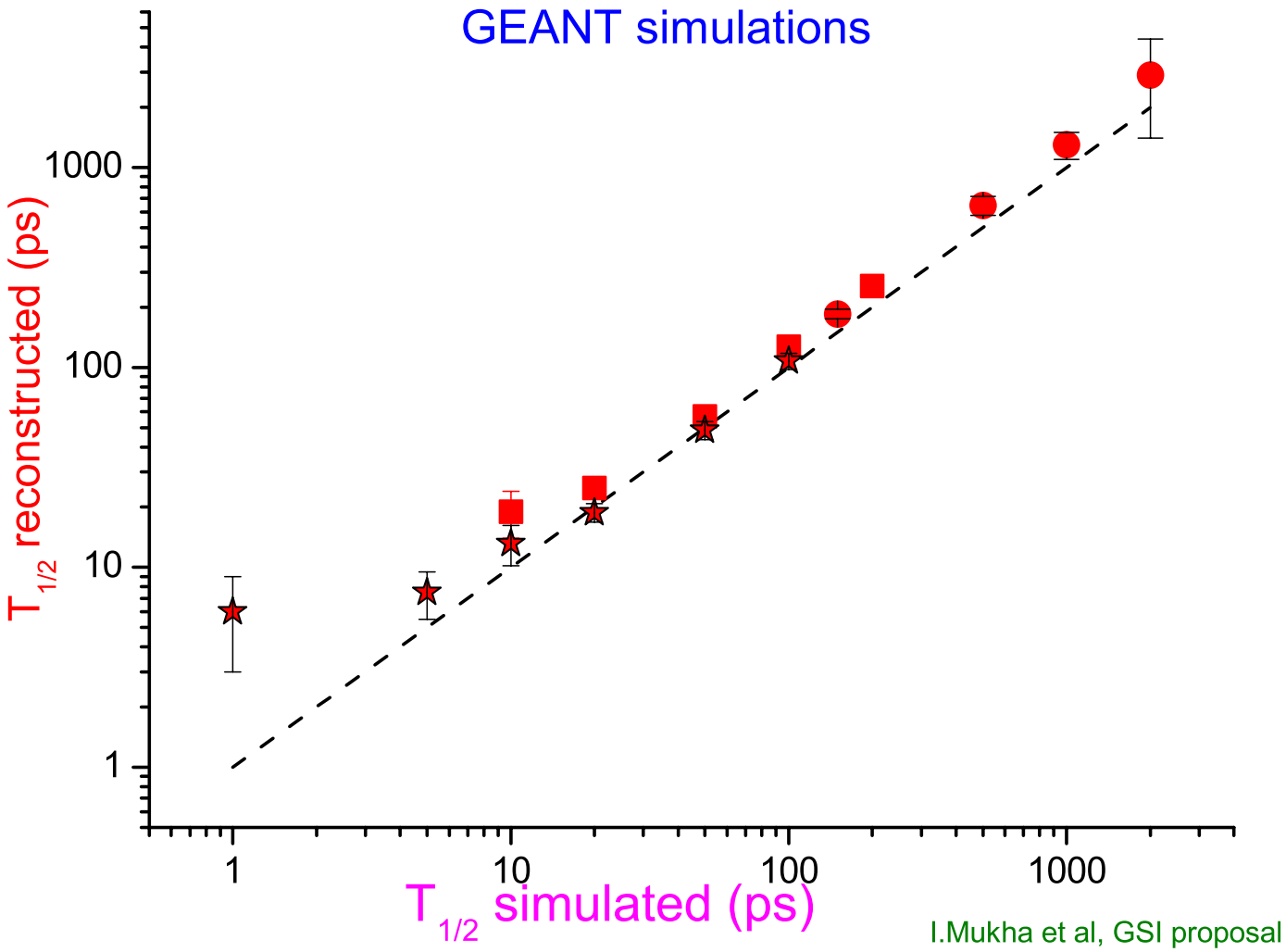
The beam-time request is 29 shifts of 350 MeV/u ^{24}Mg beam and 650 MeV/u ^{40}Ca beam.

Idea of experiment

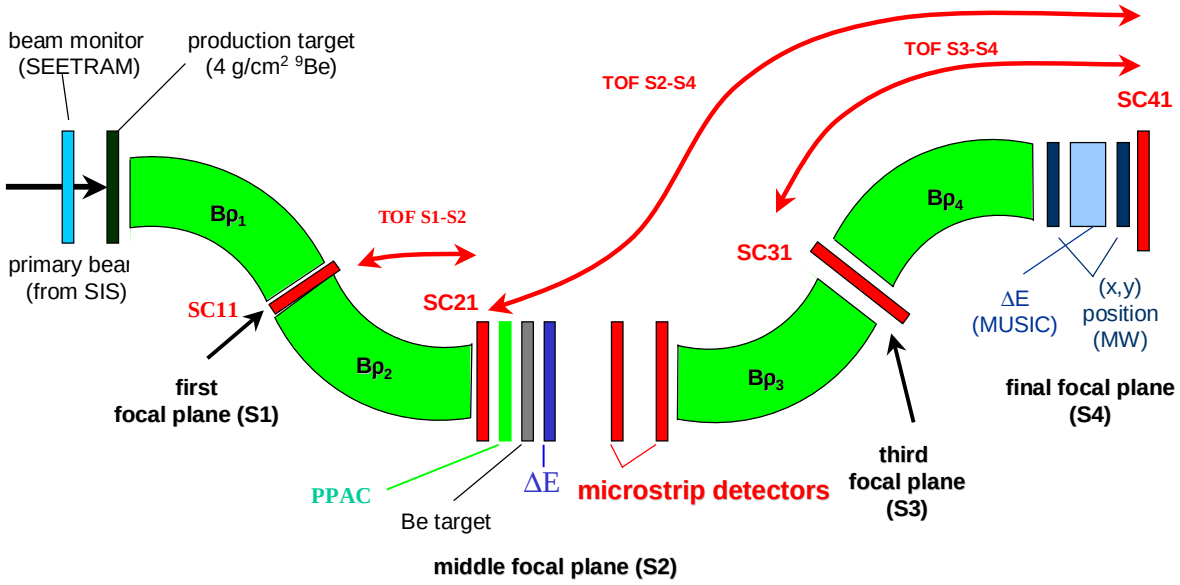


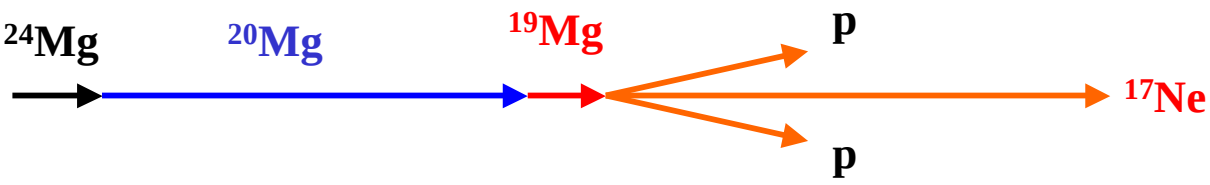



Counts
10^4
10^3
10^2
10^1
-2
0
2
4
Vertex distance from a target, cm
2
1


GEANT simulations
1000
100
10
1
T1/2 reconstructed (ps)
1
10
100
1000
T1/2 simulated (ps)
I.Mukha et al, GSI proposal

FRS setup


beam monitor
(SEETRAM)
production target
(4 g/cm² ⁹Be)
primary beam
(from SIS)
Bρ1
TOF S1-S2
SC11
first
focal plane (S1)
SC21
Bρ2
PPAC
Be target
ΔE
microstrip detectors
middle focal plane (S2)
TOF S2-S4
TOF S3-S4
SC41
SC31
Bρ4
Bρ3
third
focal plane
(S3)
ΔE
(MUSIC)
(x,y)
position
(MW)
final focal plane
(S4)


24Mg
20Mg
19Mg
p
p
17Ne

The S271 summary

We request: 29 shifts of ^{24}Mg, ^{40}Ca beams from SIS.
At FRS facility, the ^{19}Mg intensity is up to 3500 ions/s

We intend to measure

- trajectories of all fragments from decays
  ^{19}Mg ^{17}Ne+p+p
  with micro-strip Si detectors and FRS;
- life-time of ^{19}Mg, its decay energy and p-p correlations
  derived from measured trajectories of all fragments

The physics goals:

Search for two-proton radioactivity of ^{19}Mg,
direct observation of decay protons,
study of decay mechanism and structure of ^{19}Mg