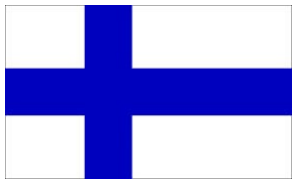
TRIUMF Nov 2012
Lifetimes in ^{23}Mg

Legnaro Feb 2014
^{14}N+^{10}B at 95 MeV



JYFL 2015/16
^{20}F beta decay

TRIUMF Nov 2012
Lifetimes in ^{23}Mg

1. Who?

TRIUMF people + Chris Wrede (MSU)

2. What?

Lifetime measurement of the 7.786 MeV state in ^{23}Mg

3. How?

Doppler-shift attenuation method (DSAM)

4. Why?

Constrain the astrophysical ^{22}Na(*p*,γ) rate

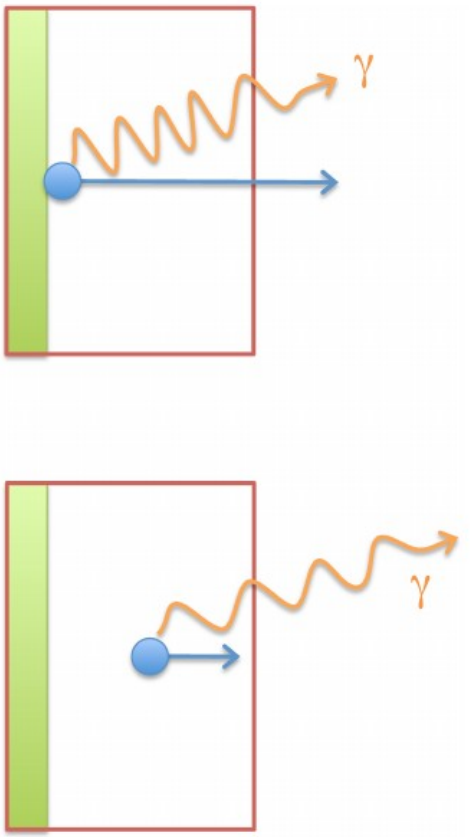
5. Status?

Data analysis nearly completed

TRIUMF Nov 2012
Lifetimes in ^{23}Mg

3. How?

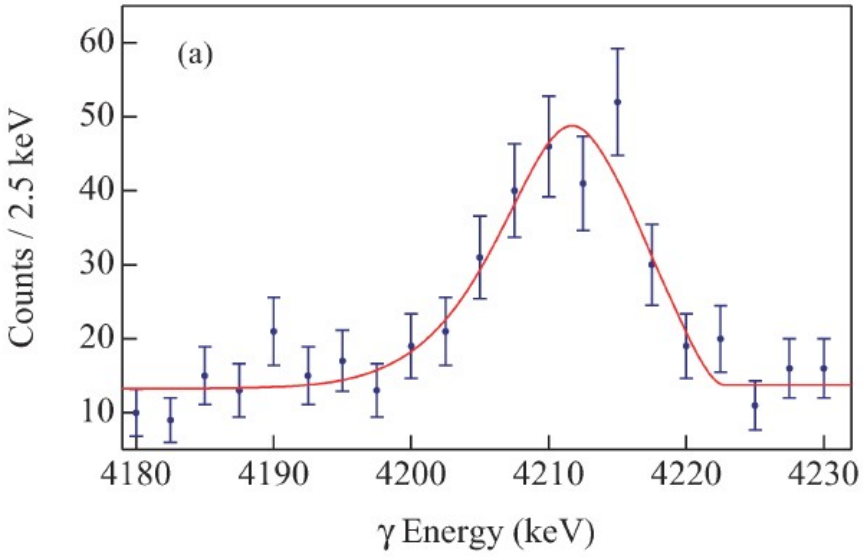
Principle:



$\tau = 1$ fs – 10 ps

Previous experiment at TRIUMF (^{19}Ne)

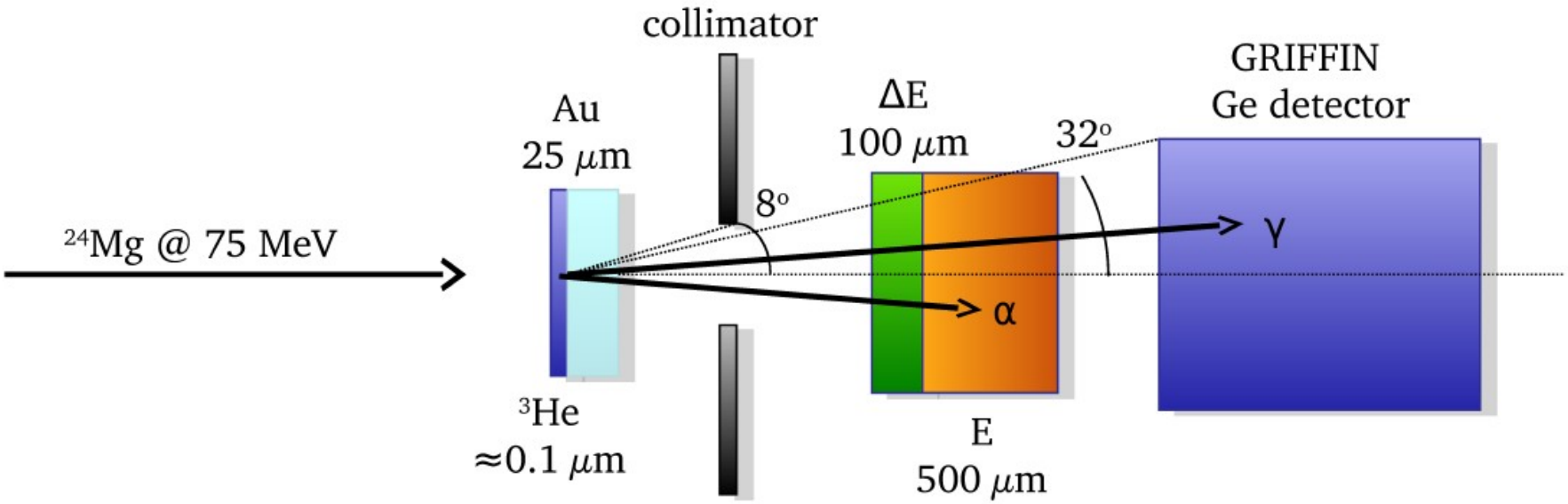
Mythili *et al.*, PRC **77**, 035803 (2008)



$\tau = 7.1 \pm 1.9 \pm 0.6$ fs

TRIUMF Nov 2012
Lifetimes in ^{23}Mg

3. How?



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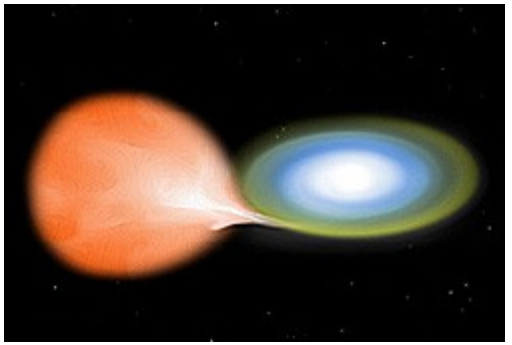

Table 1. Radioactivities in nova ejecta.

Isotope	Lifetime	Main disintegration process	Type of emission	Nova type
^{13}N	862 s	β^+-decay	511 keV line and continuum	CO and ONe
^{18}F	158 min	β^+-decay	511 keV line and continuum	CO and ONe
^{7}Be	77 days	e^--capture	478 keV line	CO
^{22}Na	3.75 years	β^+-decay	1275 and 511 keV lines	ONe
^{26}Al	10^6 years	β^+-decay	1809 and 511 keV lines	ONe

destruction mechanism: ^{22}Na(p,γ)

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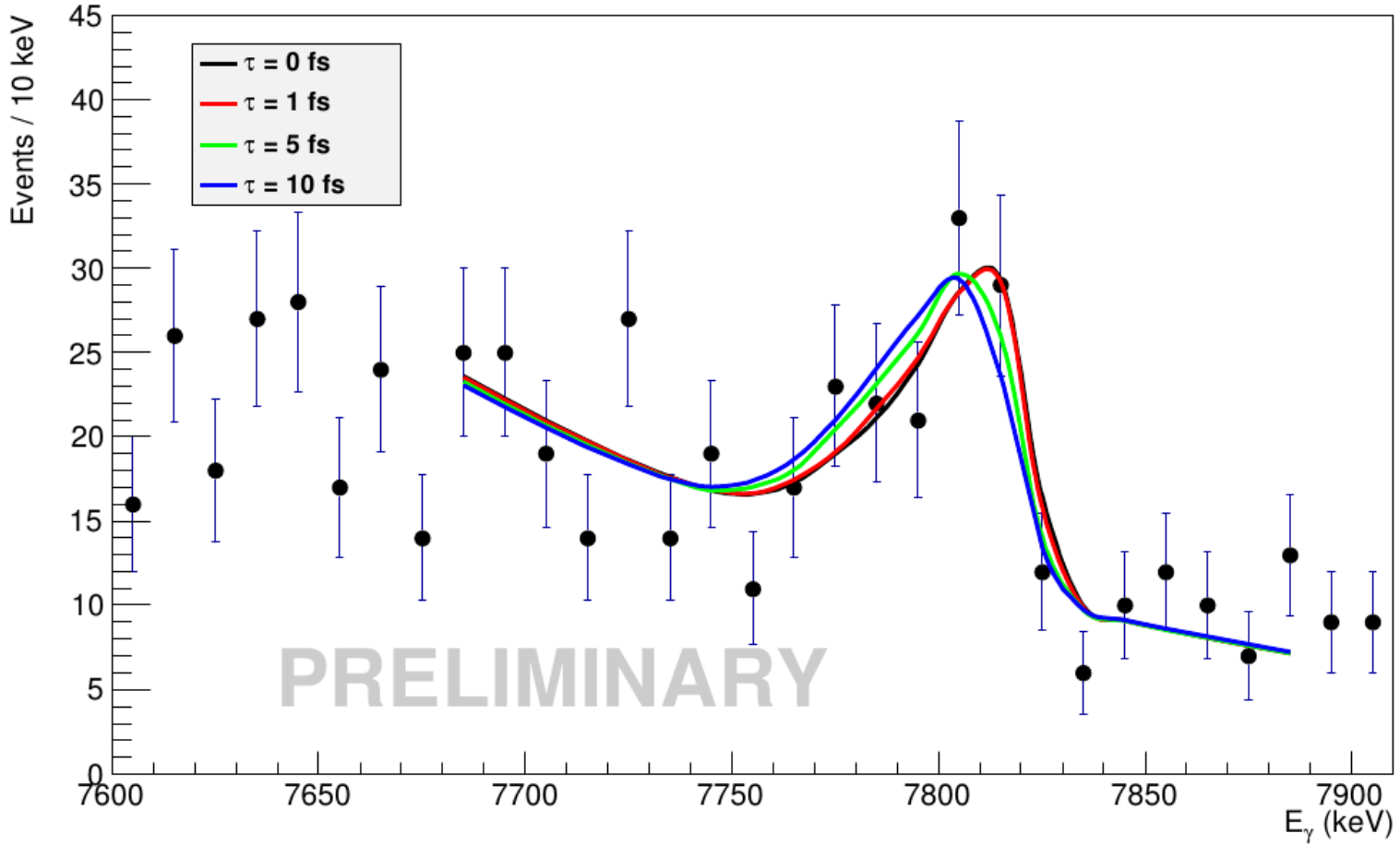


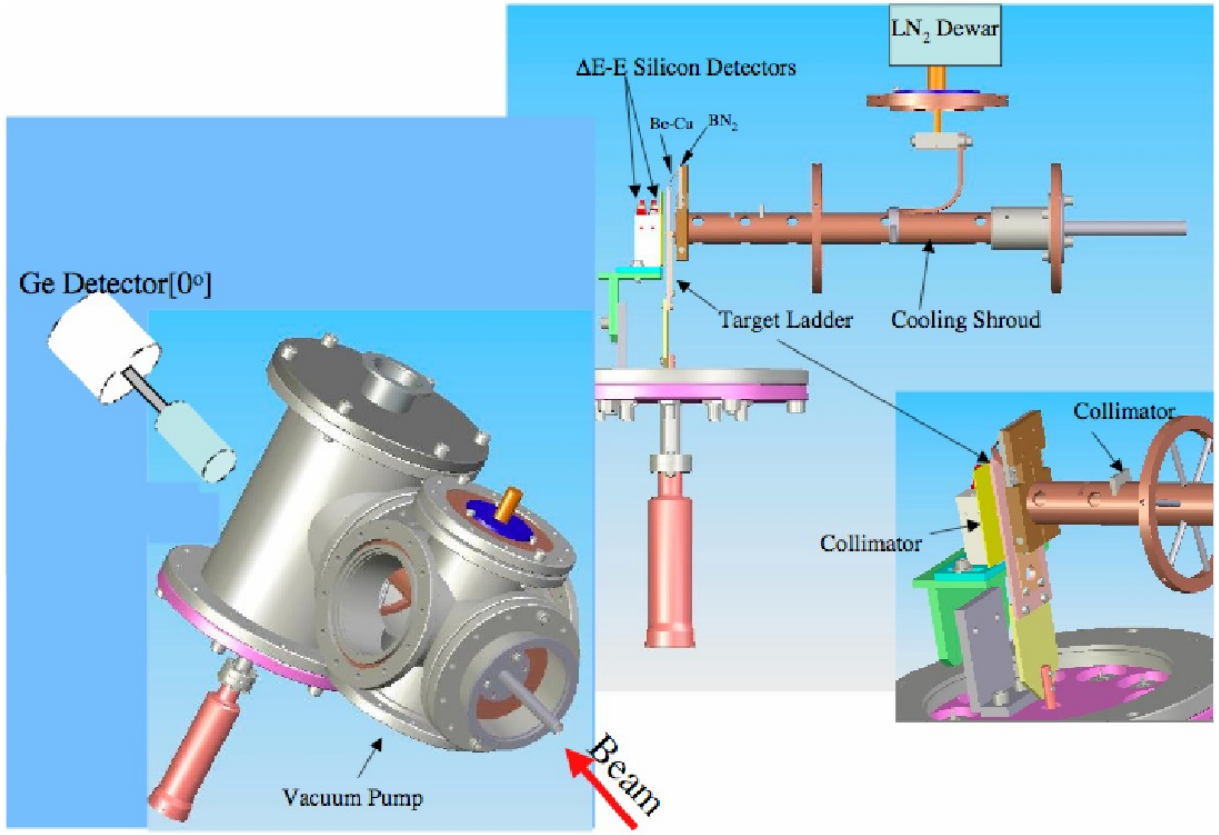
TRIUMF Nov 2012
Lifetimes in ^{23}Mg

6. Main challenges:

- Simulation/modelling of gamma-peak shape
- Cooling system

7. MAGISOL interest ??

- for example ^{32}S(^{3}He,α)



Legnaro Feb 2014
$^{14}N+^{10}B$ at 95 MeV

1. Who?

Zagreb + Catania + Birmingham

2. What?

$^{14}N+^{10}B$ at 95 MeV; identify and study resonances in $^{10\text{-}14}C$ (energies, widths, decay branches)

3. How?

Complete kinematics measurement using an array of segmented Si telescopes

4. Why?

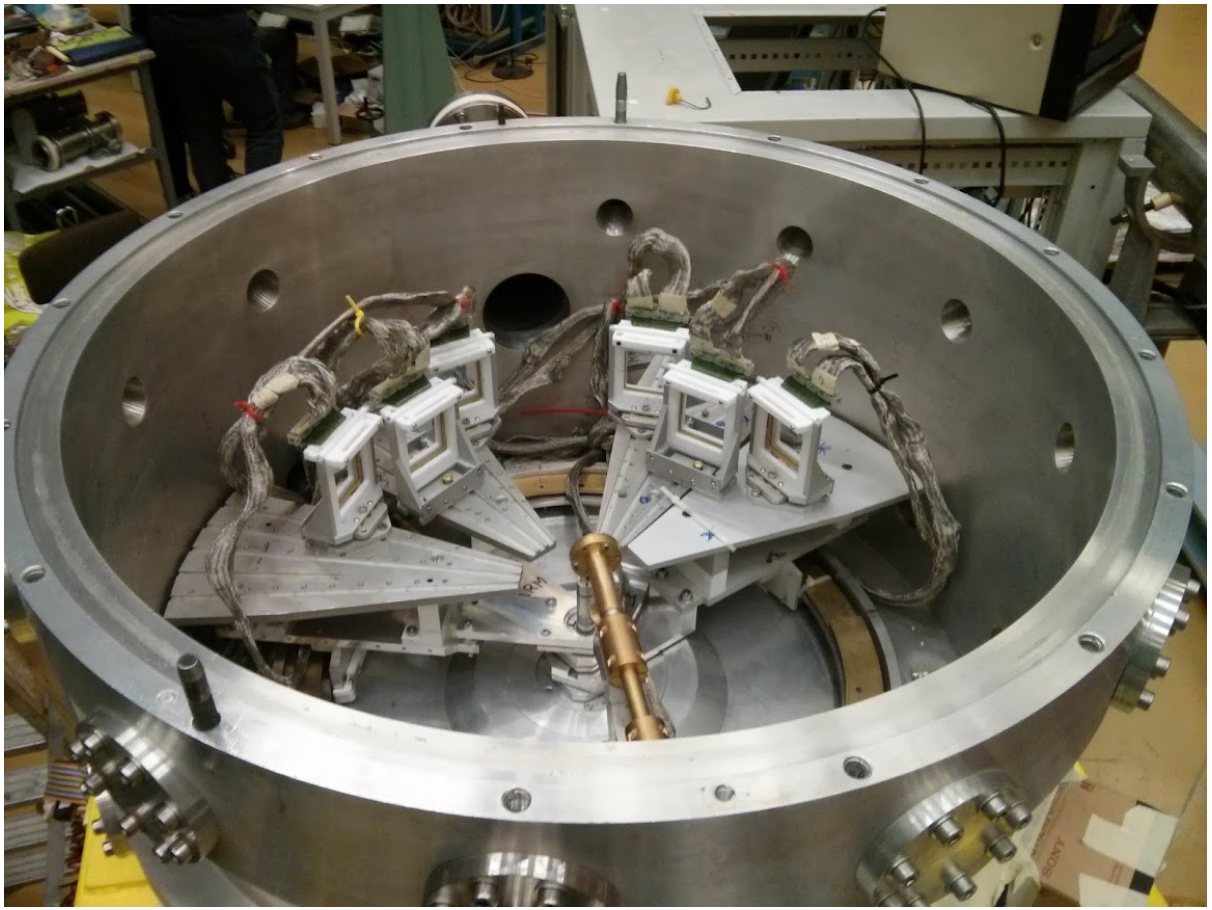
α-cluster structure and molecular structure

5. Status?

Experiment completed, data-analysis only just begun

Legnaro Feb 2014
$^{14}N+^{10}B$ at 95 MeV

3. How?



ΔE
16 strips
20 μm
single-sided

E
16x16 strips
1000 μm
double-sided

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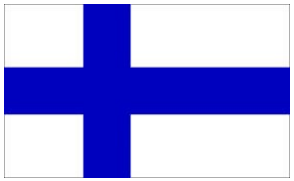
6. MAGISOL interest?

Legnaro (Tandem-ALPI-PIAVE)
- Semi-permanent setup at dedicated beam line

Zagreb (6 MV tandem)
- Nuclear reactions and high-resolution PIXE

$^{10}B(^{6}Li,\alpha)^{12}C^{*}$



JYFL 2015/16
^{20}F beta decay

1. Who?

Aarhus + Madrid + JYFL + York + Gothenburg

2. What?

Search for the 2nd forbidden gs-to-gs transition in the beta decay of ^{20}F

3. How?

Direct measurement of the beta spectrum

4. Why?

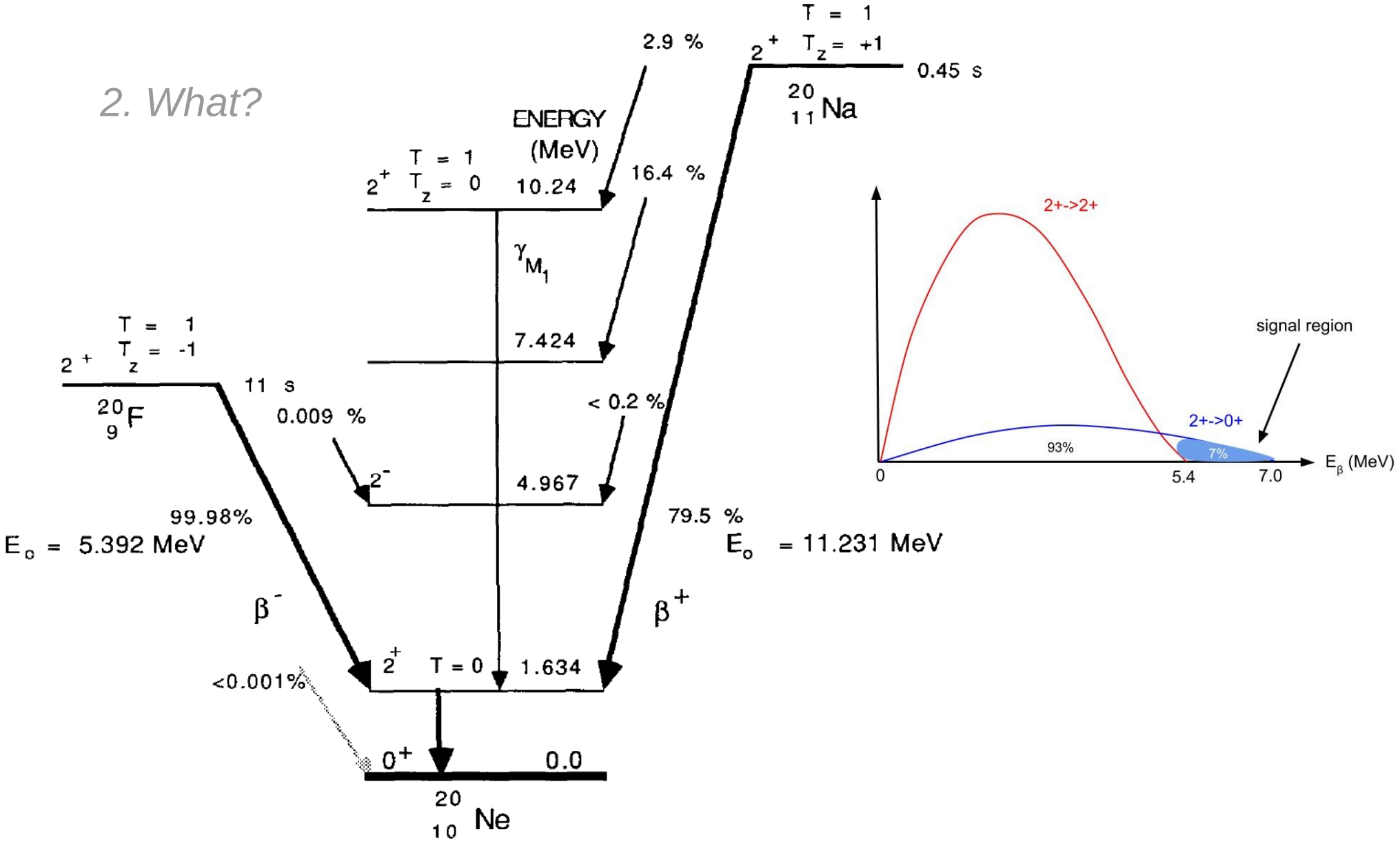
Crucial input for astrophysical models of electron-capture SNe

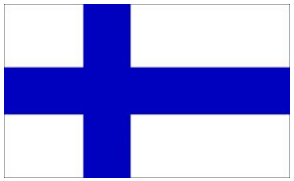
5. Status?

Proposal submitted

JYFL 2015/16
^{20}F beta decay

2. What?





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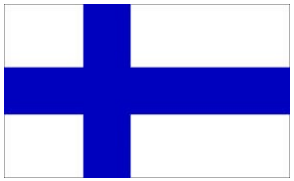
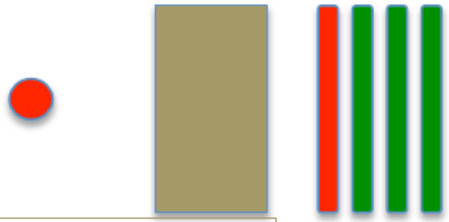


JYFL 2015/16
^{20}F beta decay

3. How?

CEPA4 (Normalization)
5x5x4 cm $LaBr_3(Ce)$
100% efficiency for
1.6 MeV gammas, 3% resolution

Stack of 1.5 mm thick Si-detectors



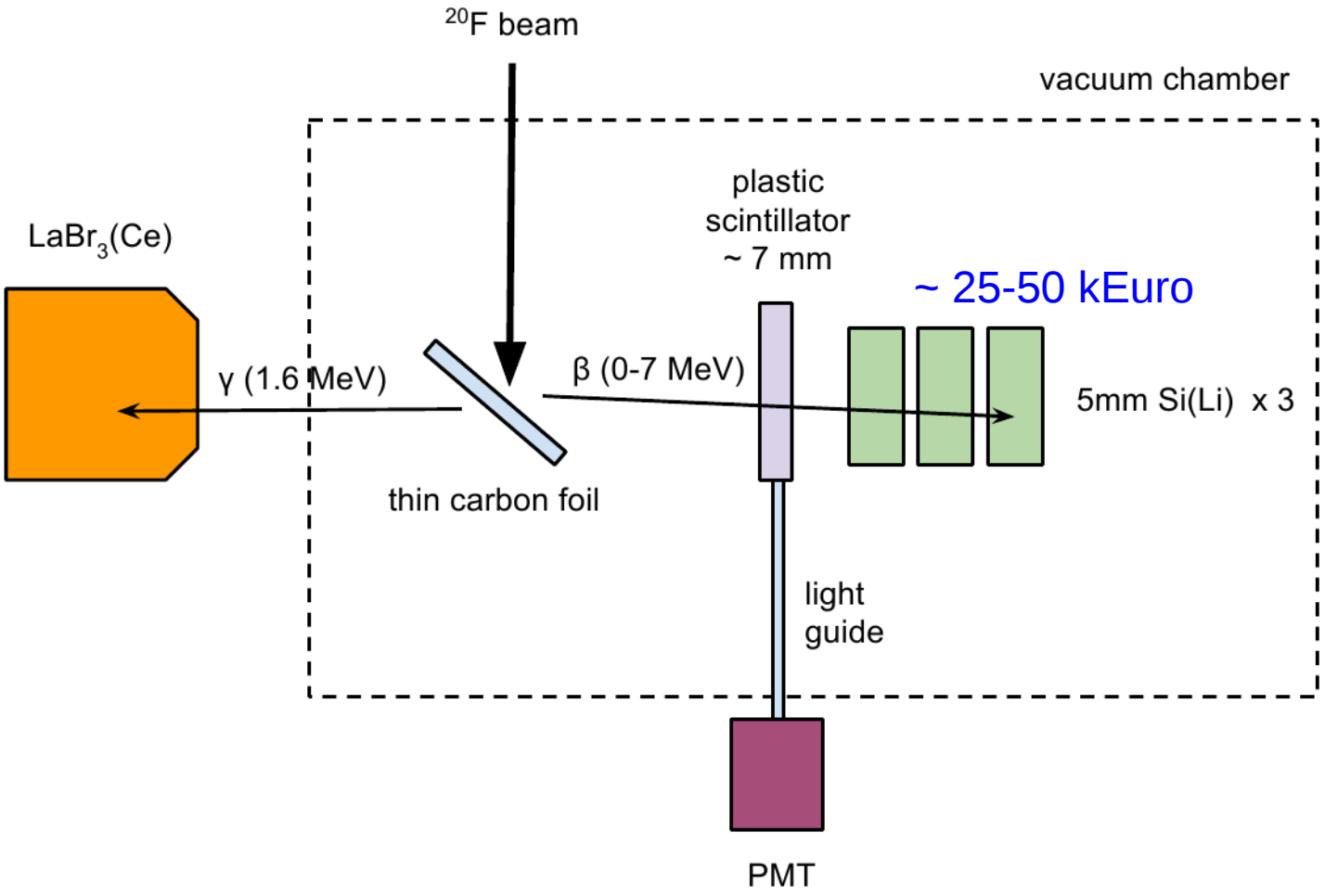
2nd-4th Si to measure the 7 MeV endpoint beta spectrum (4mm Si to stop 2 MeV betas)

1.15 cm Al
Stop 5.3 MeV betas

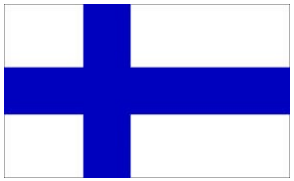
1st Si stop the remaining of the 5.4 MeV beta spectrum, cross check of normalization

JYFL 2015/16
^{20}F beta decay

3. How?



Background:
1) β+γ summing
2) pile-up
3) random coincidences



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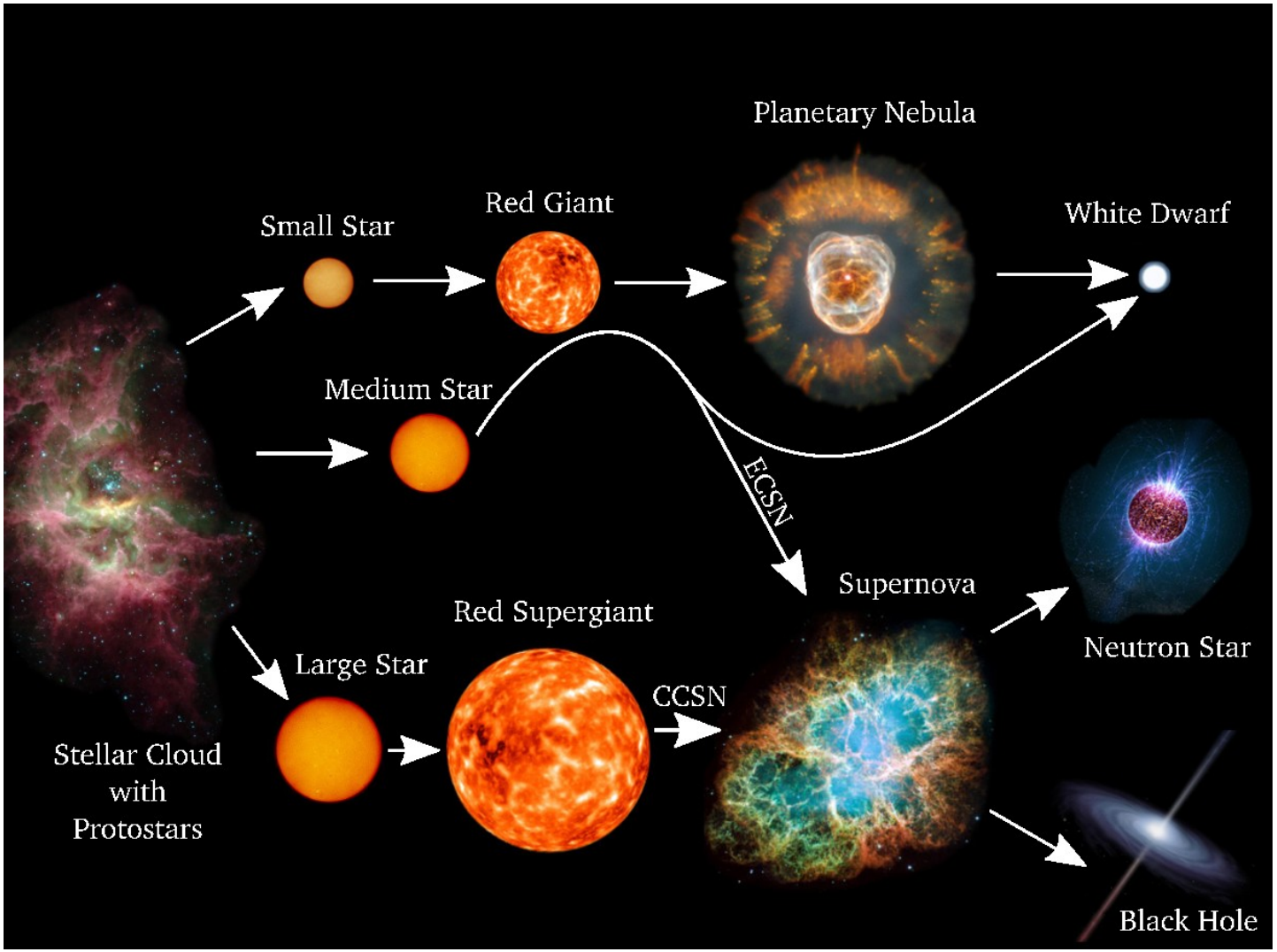
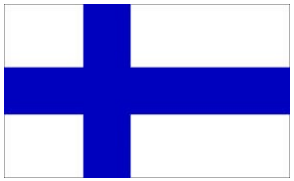
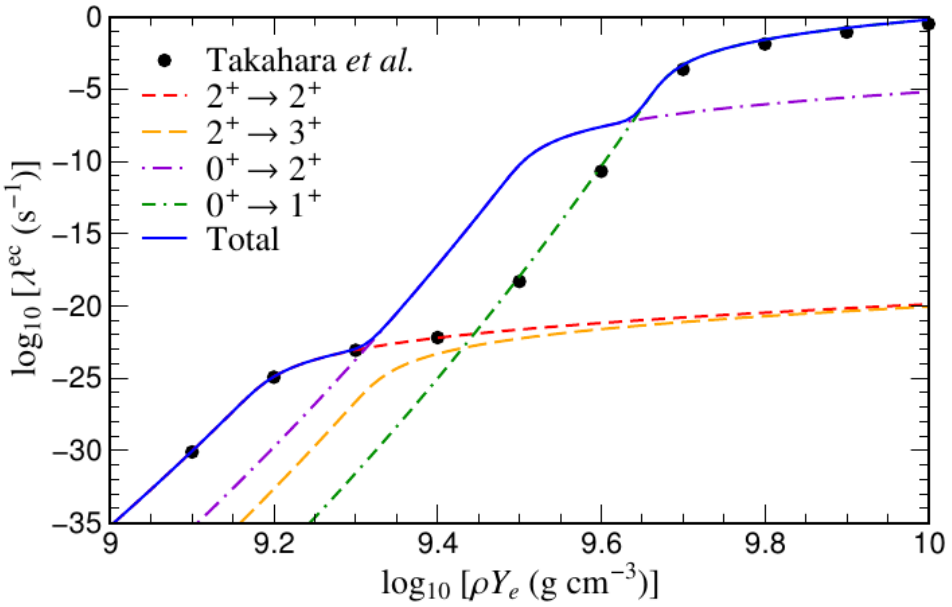


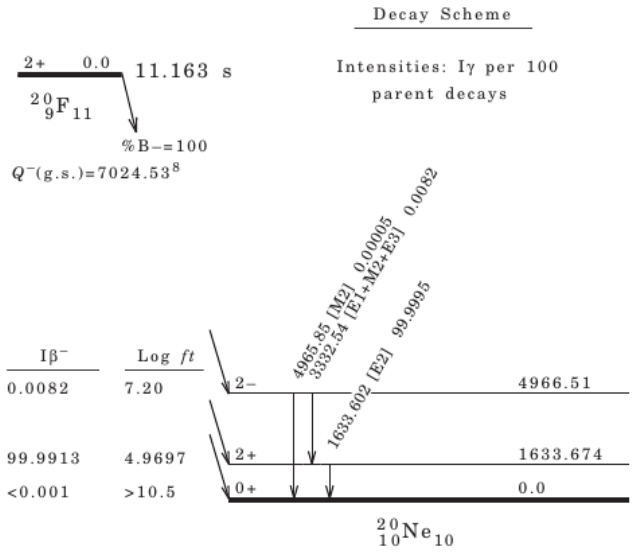


JYFL 2015/16
^{20}F beta decay

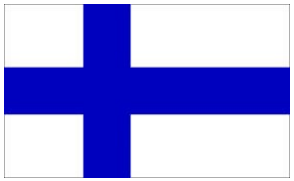
4. Why?

- Low mass stars ($\sim 9\ M_\odot$) develop an ONeMg core during the evolution that becomes unstable due to electron captures.
- Particularly important is electron capture on ^{20}Ne. The rate is basically known experimentally except for an unknown second-forbidden ground-state ground-state transition.





G. Martínez-Pinedo *et al.* (2014)



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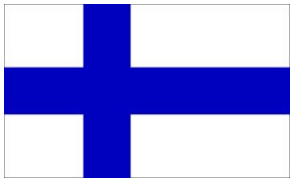

JYFL 2015/16
^{20}F beta decay

Next steps:

- GEANT4 simulations (Kike, myself, ...)

- Tests with neutron-activated sources in Aarhus

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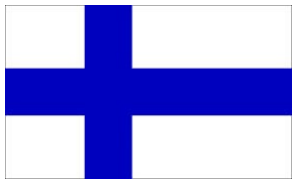

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^{20}F beta decay

THE END!