



Future of reaction studies in Jyväskylä

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Outline

- The basic NR facilities at the K130 cyclotron
 - HENDES chamber
 - Large Scattering Chamber
 - TOF line, refurbished electron spectrometer, etc.
- A few research highlights
 - Ongoing projects
 - R&D on instruments & methods
- Plans for the future
 - Reconstruction of the Nuclear Reaction cavern

K130



K130

$$E[\text{MeV}] = K q^2/A$$

Ion sources:

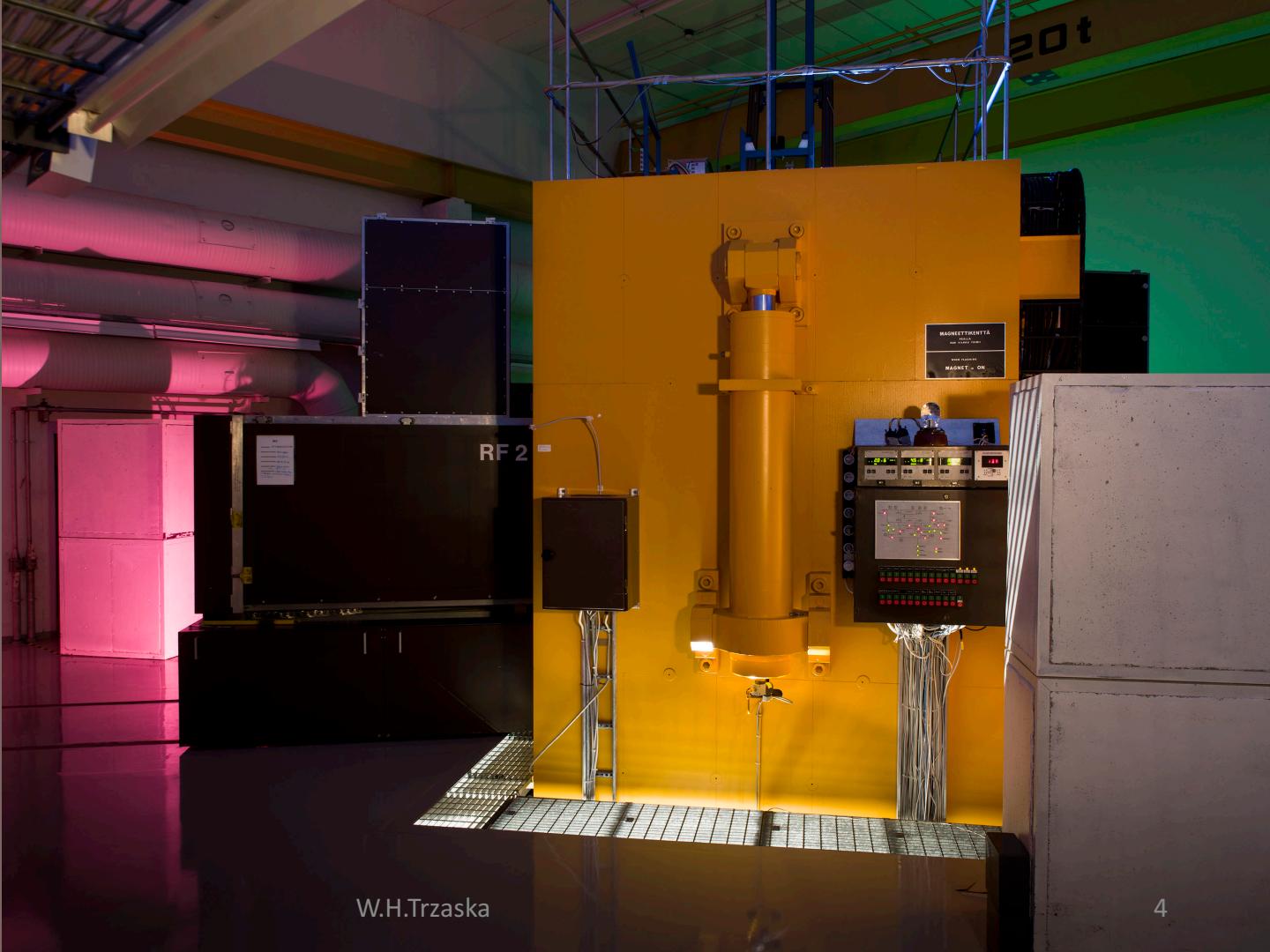
6.4 GHz **ECR**

14 GHz **ECR**

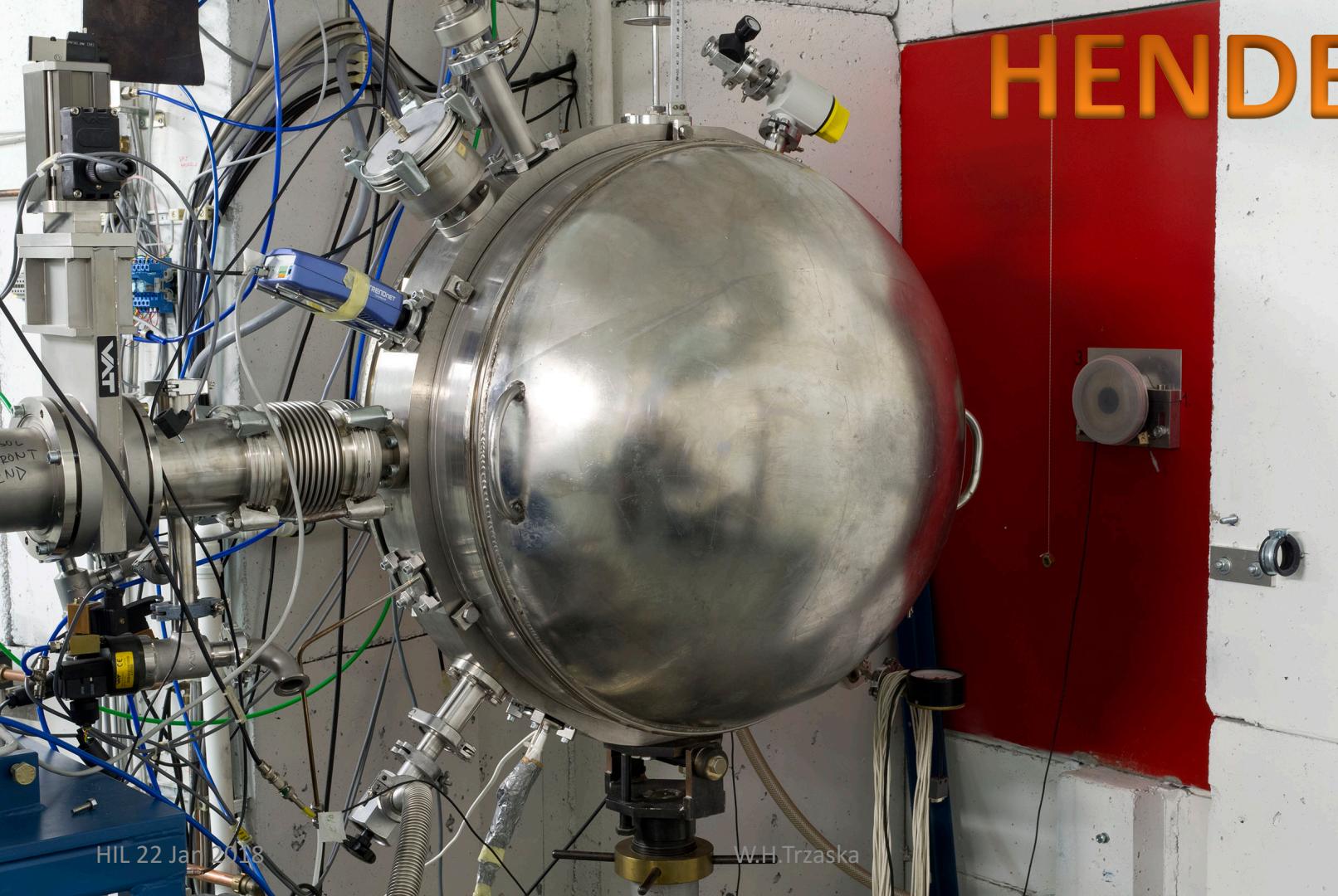
18 GHz **ECR**

LIISA

filament-driven
multi cusp type H⁻
light ion source



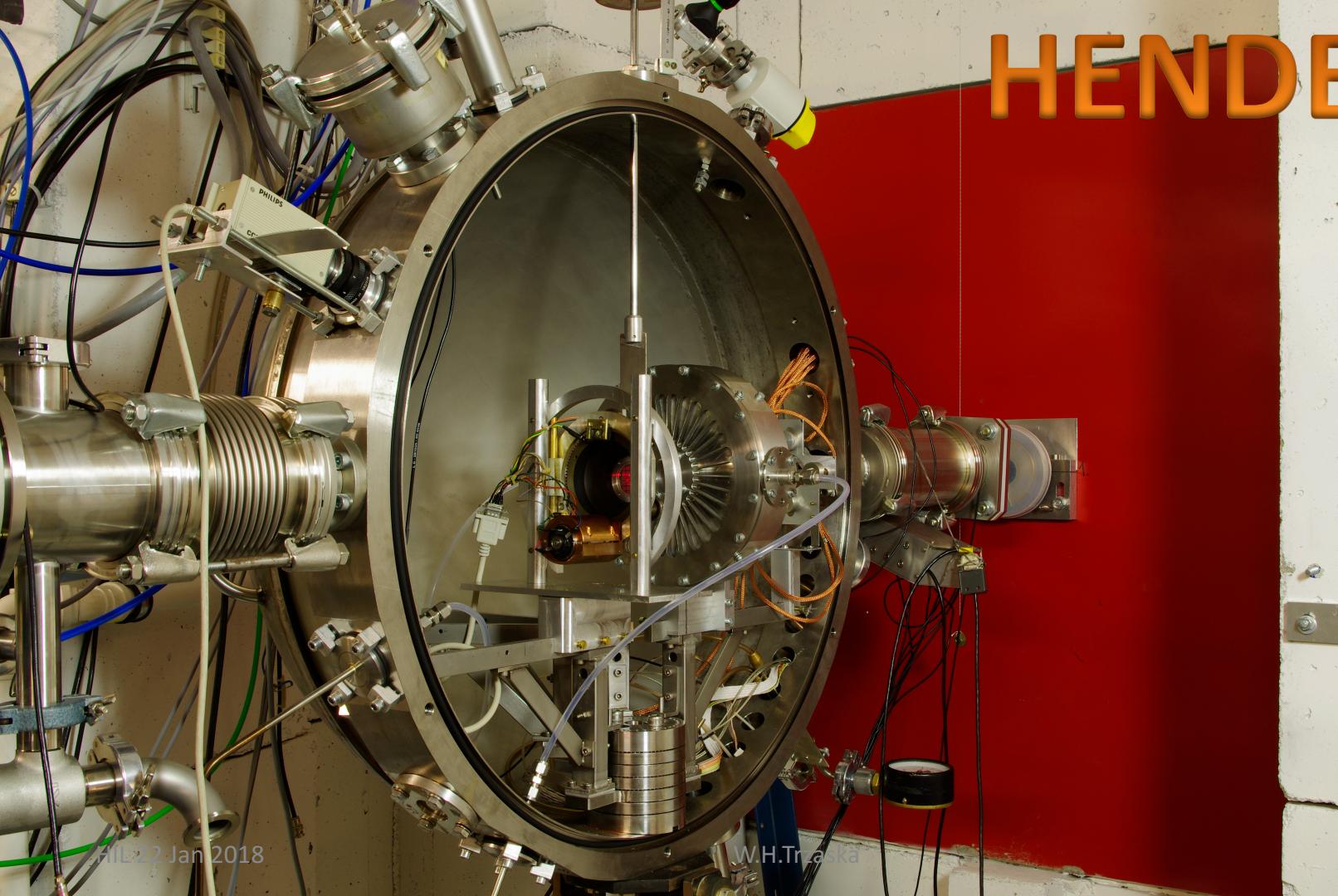
HENDES



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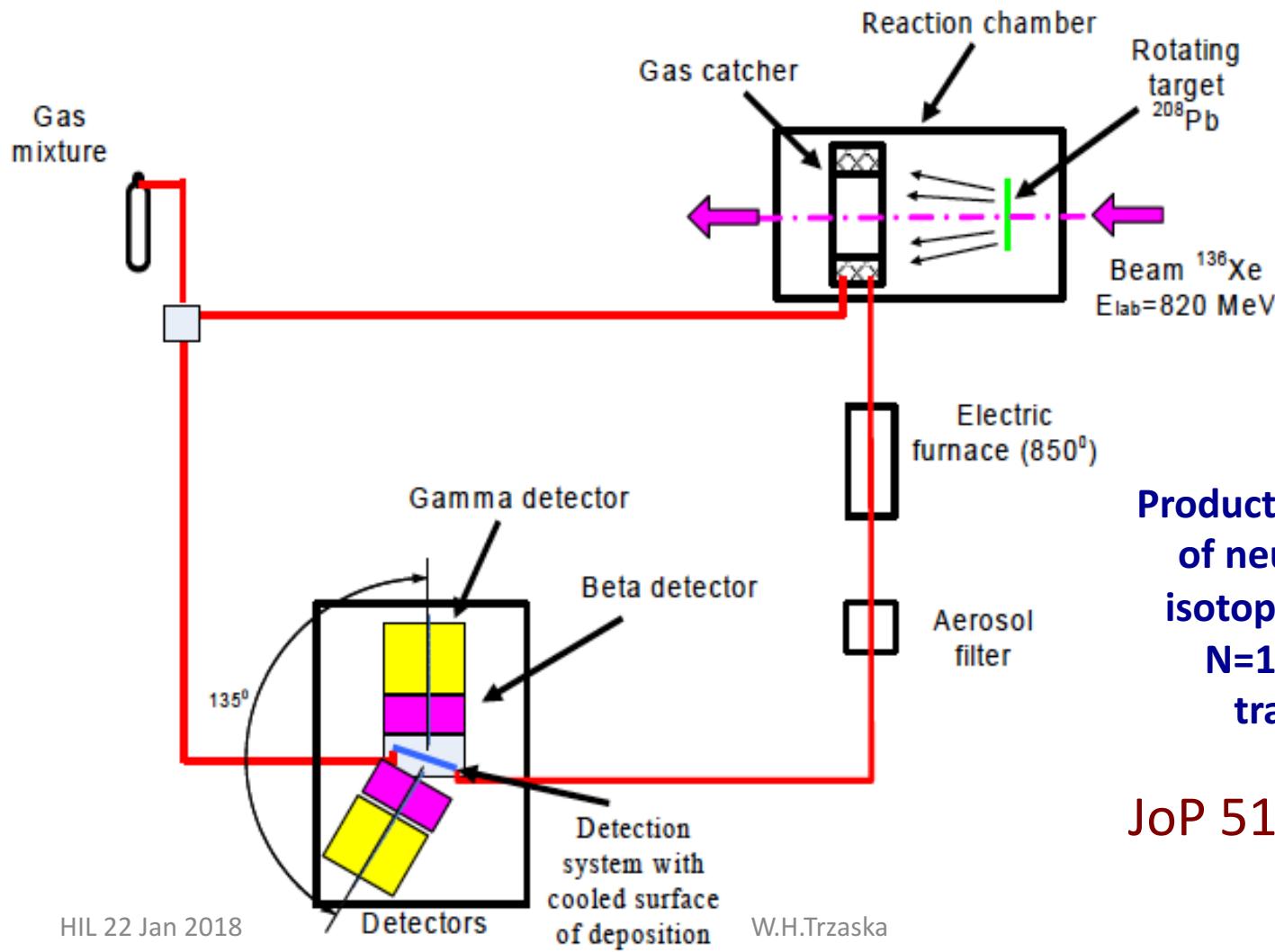
HENDES



JoP 515
(2014)
012016

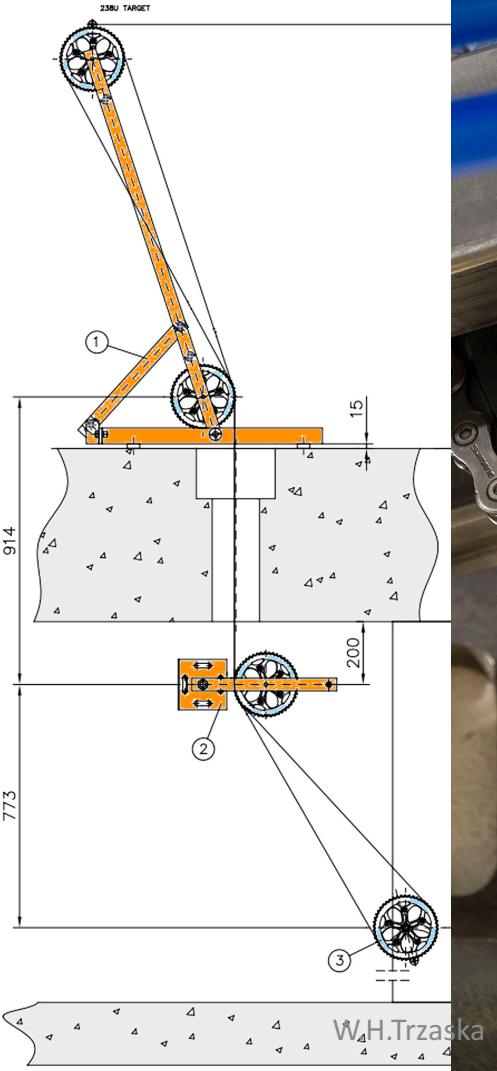
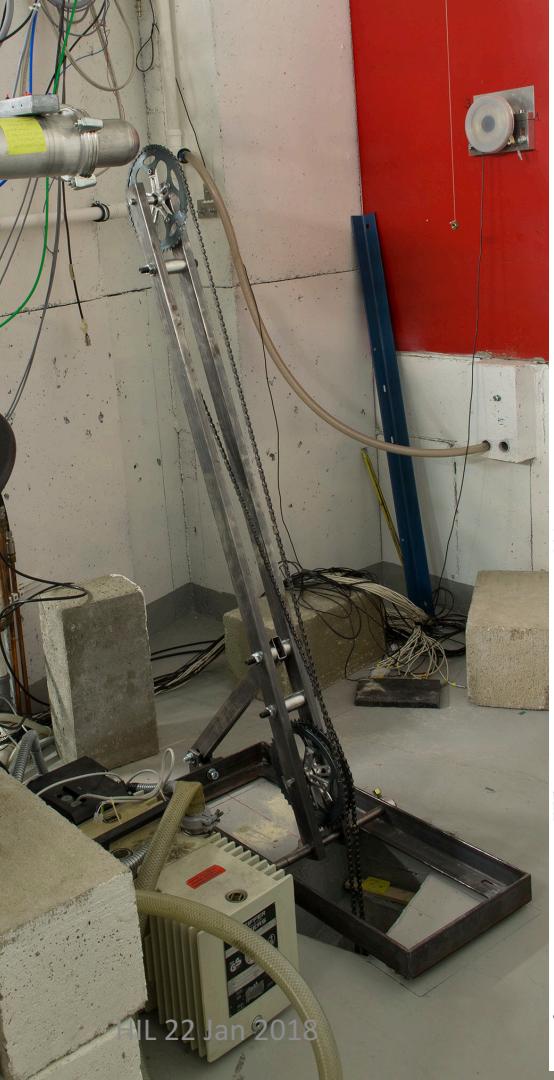
As only **osmium oxides** are volatile products,
only the chains of decay of **osmium isotopes** can be registered.

^{197}Hg	^{198}Hg	^{199}Hg	^{200}Hg	^{201}Hg	^{202}Hg				
^{196}Au	^{197}Au	^{198}Au 2.69d	^{199}Au 3.14d	^{200}Au 48.4d	^{201}Au 26.1d	^{202}Au 28.8s	^{203}Au 60s	^{204}Au 39.9s	^{205}Au 31s
^{195}Pt	^{196}Pt	^{197}Pt 19.82h	^{198}Pt	^{199}Pt 31h	^{200}Pt 12.5h	^{201}Pt 2.5h	^{202}Pt 44h	^{203}Pt	^{204}Pt
^{194}Ir 19.3h	^{195}Ir 2.5h	^{196}Ir 52s	^{197}Ir 5.8h	^{198}Ir 8s	^{199}Ir 20s	^{200}Ir	^{201}Ir	^{202}Ir	^{203}Ir
^{193}Os 30.11h	^{194}Os 6.0y	^{195}Os ~9m	$^{196}\text{Os}_{120}$ 35m	$^{197}\text{Os}_{121}$	$^{198}\text{Os}_{122}$	$^{199}\text{Os}_{123}$	$^{200}\text{Os}_{124}$	^{201}Os	^{202}Os



**Production and investigation
of neutron-rich Osmium
isotopes with and around
N=126 using gas flow
transport method**

JoP 515 (2014) 012016



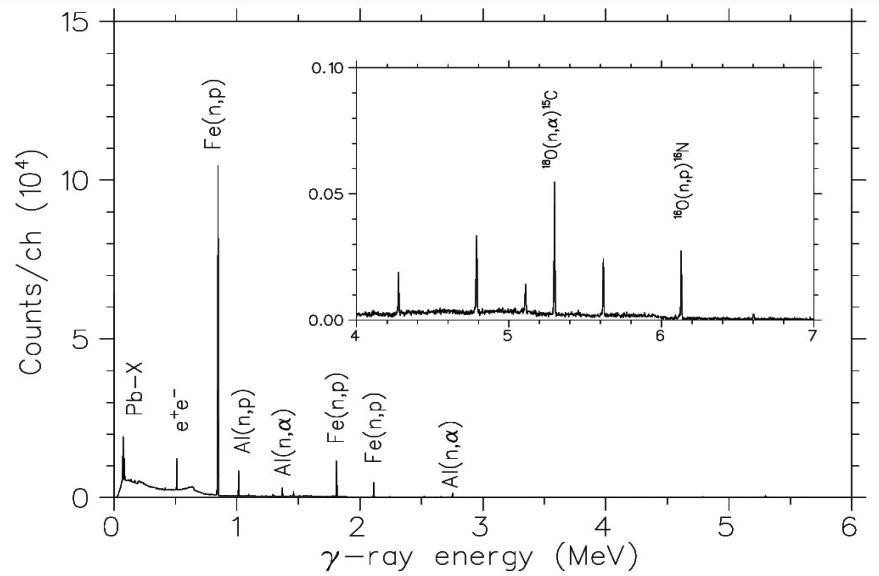
Measurement of $^{18}\text{O}(\text{n},\alpha)^{15}\text{C}$ reaction cross-section

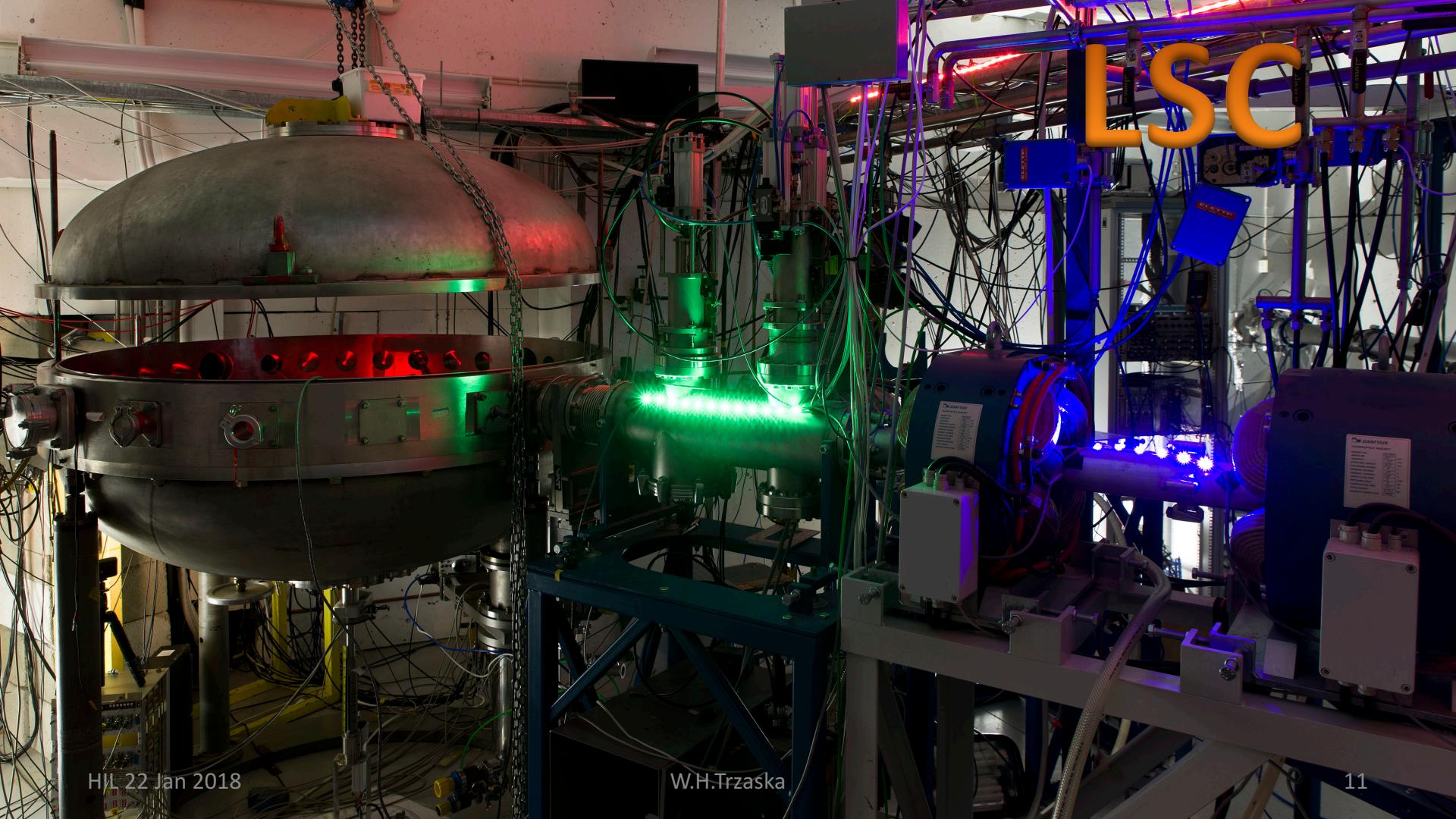
^{15}C (2.5 s) beam from $^{18}\text{O}(\text{n},\alpha)$

H_2^{18}O target

Primary beam:

55, 45, 31.5 MeV d on $^{\text{NAT}}\text{C}$
40 and 22 MeV d on D_2O





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LSC

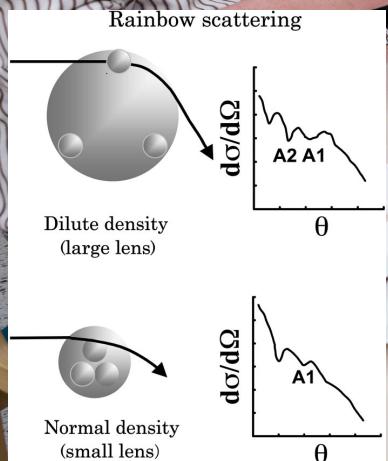
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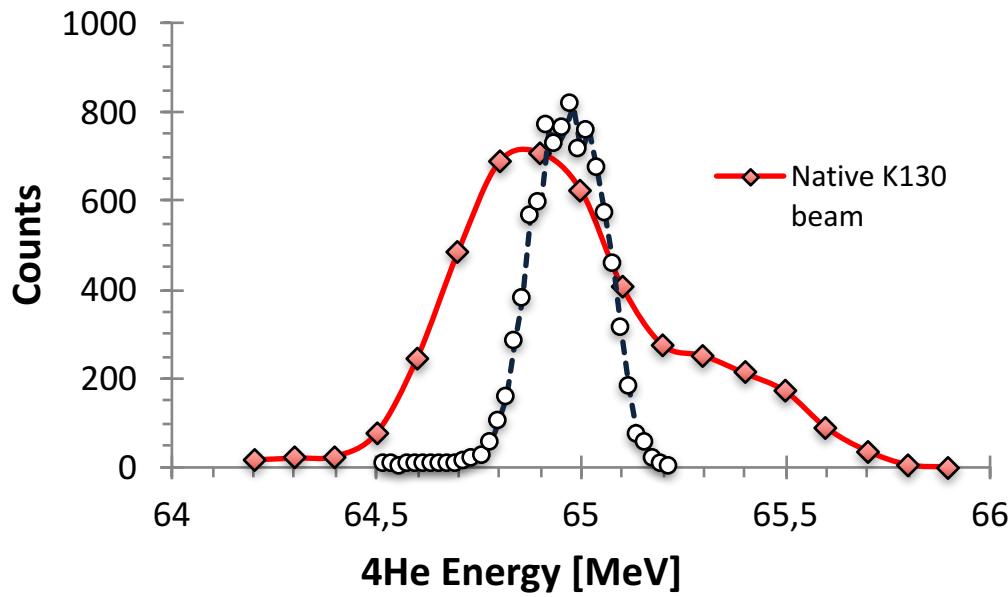
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Detecting shift of Airy minima
Radii are determined from the empirical
relation: $\Theta(\text{Airy}) \sim A^{2/3} t \sim R^2 t$



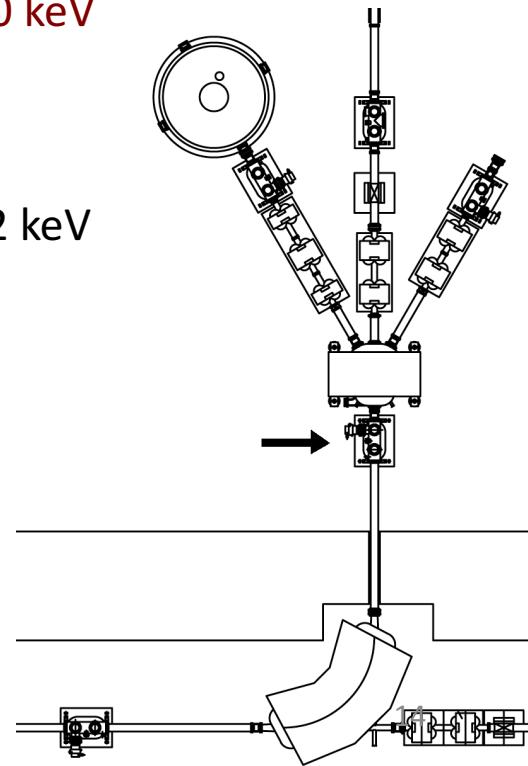
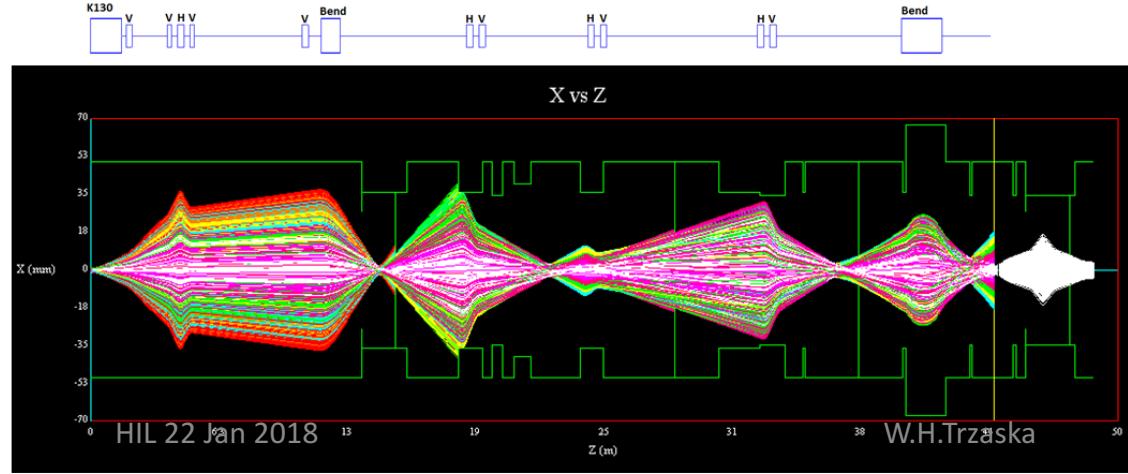
Reducing energy spread of the cyclotron beam



Beam spread ~ 700 keV

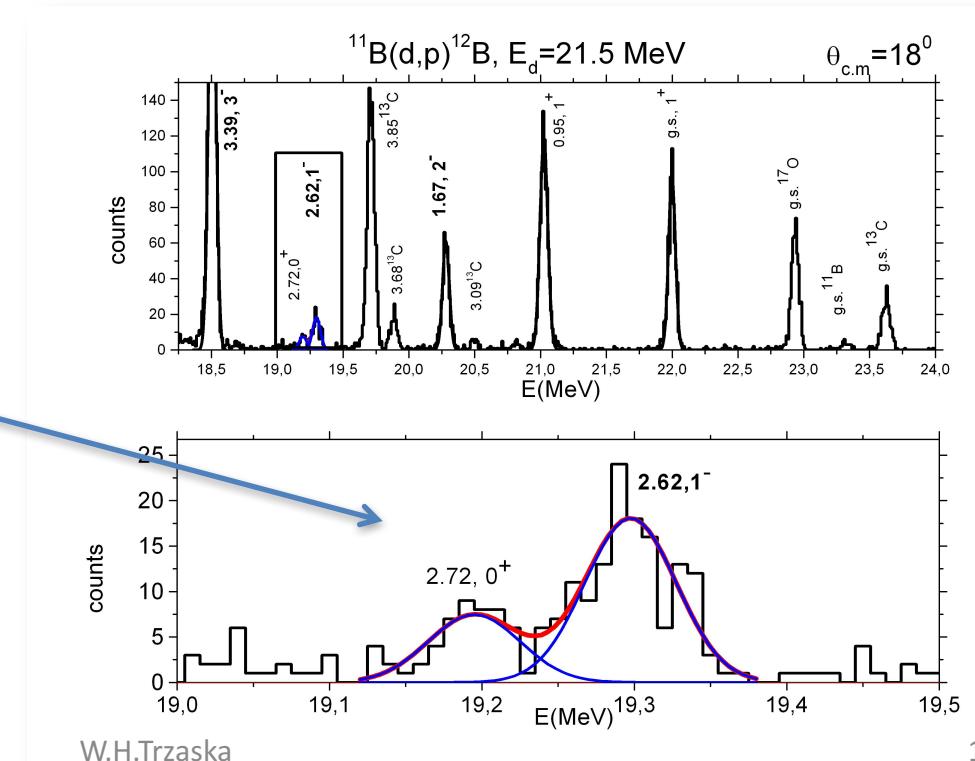


FWHM = 192 keV

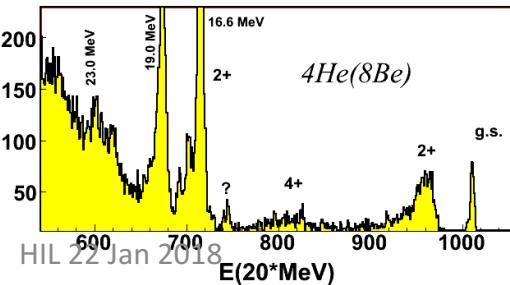
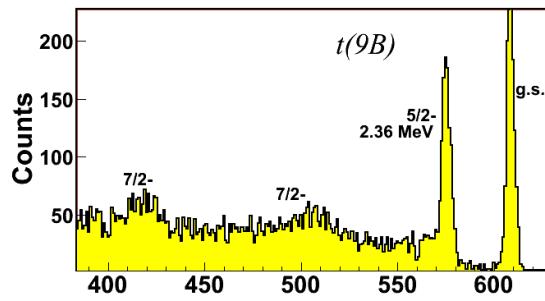
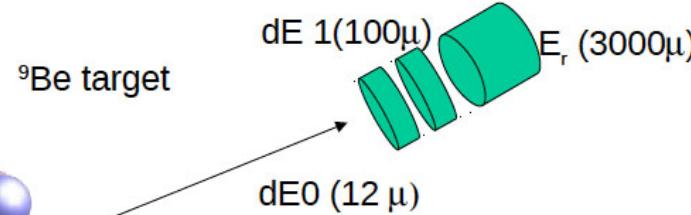
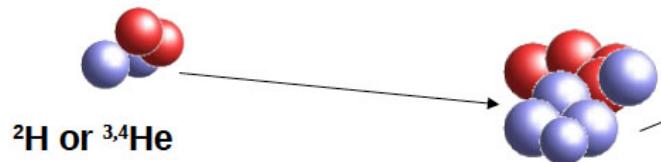


Application of the monochromatized beam for the study of the $^{11}\text{B}(\text{d},\text{p})^{12}\text{B}$ reaction

Separation of the
2.62 MeV state
from the neighboring
2.72 MeV state
in ^{12}B



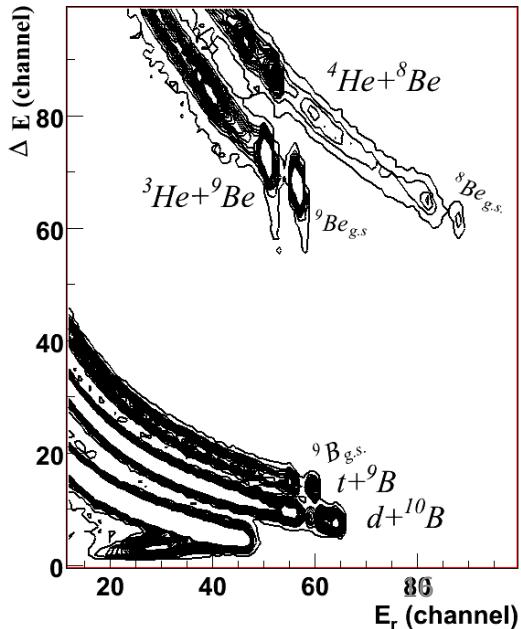
Projectile: nucleus,
with high located excited states or
w/o excited states



New insight into the cluster structure of ^9Be

by Sergey Lukyanov et al.

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Study of the ternary decay channel induced by shell effects via the reactions $^{34}\text{S} + ^{208}\text{Pb}$ and $^{37}\text{Cl} + ^{205}\text{Tl}$



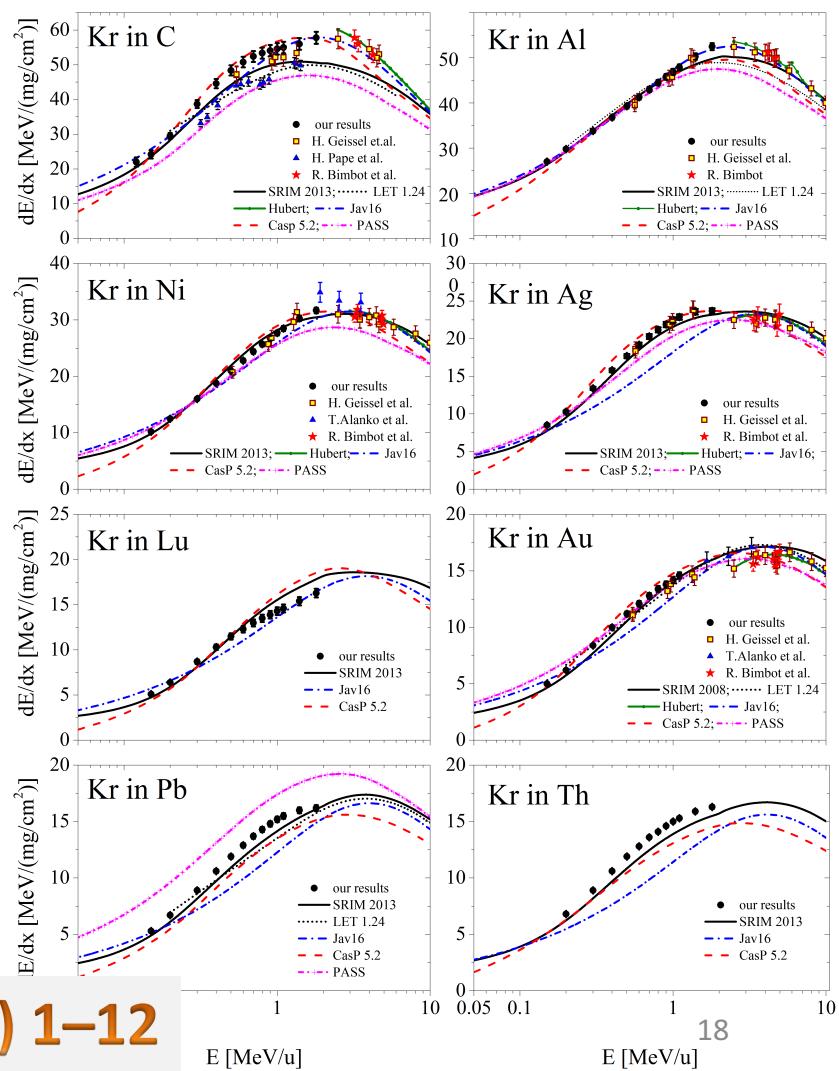
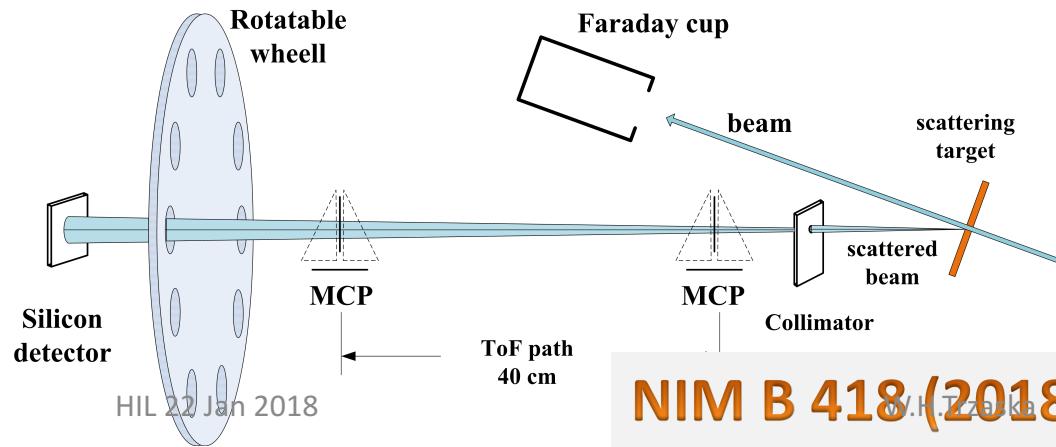
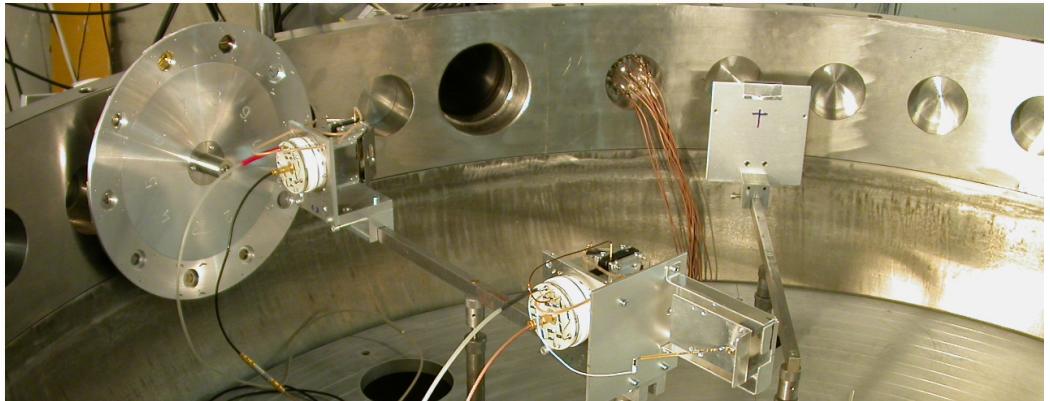
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27.5 cm
29 cm

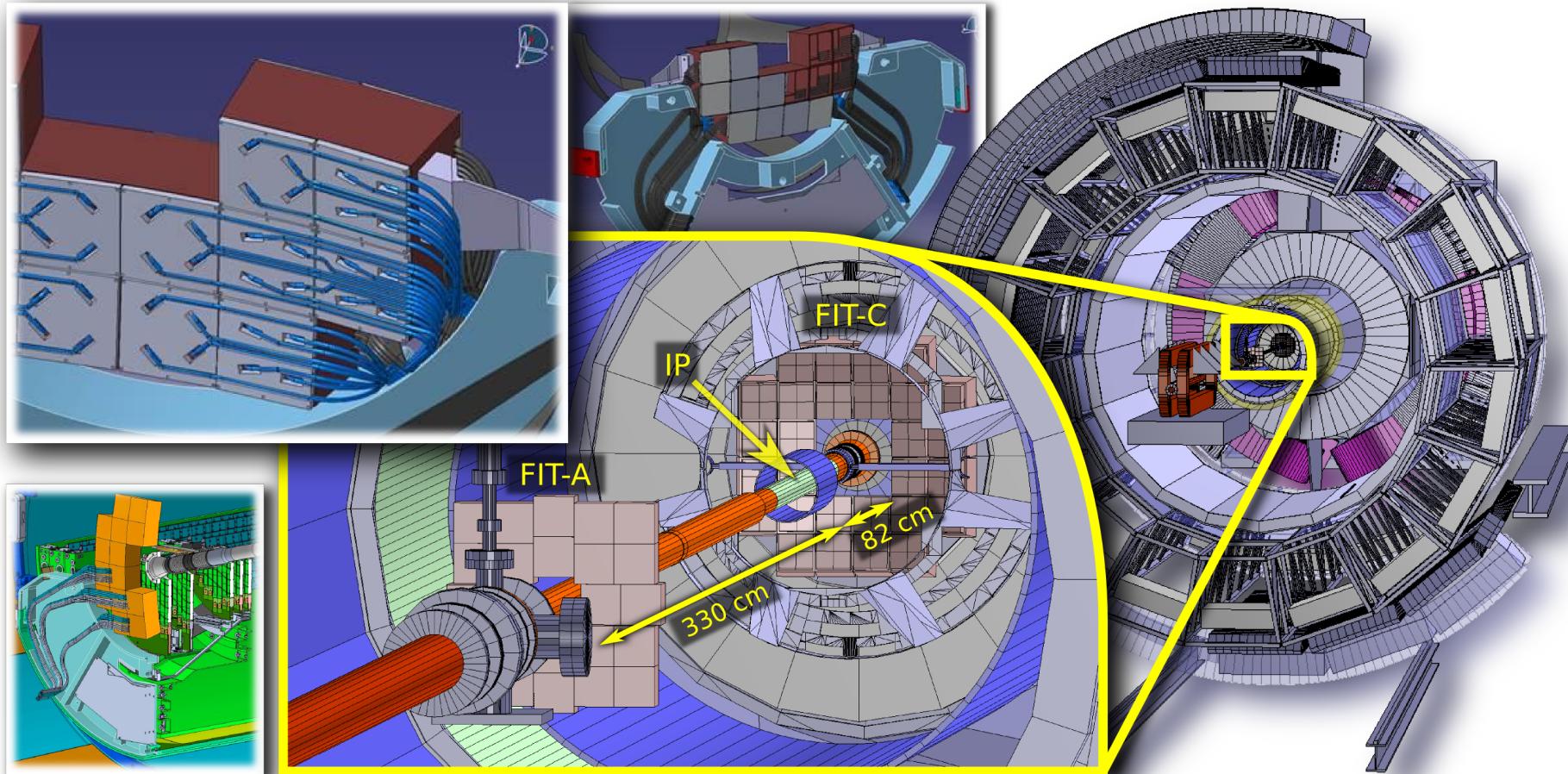
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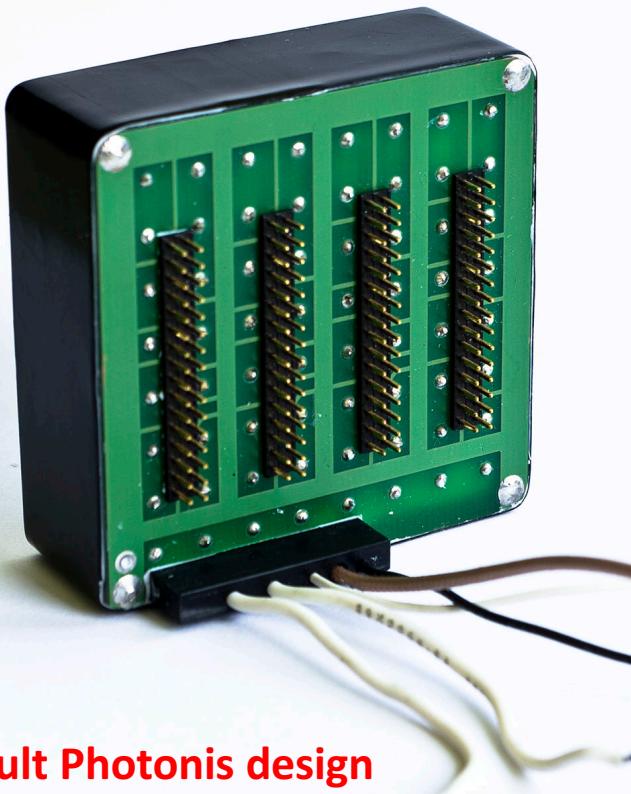
New stopping power data of ^{4}He , ^{16}O , ^{40}Ar , ^{48}Ca and ^{84}Kr in solid materials



Fast Interaction Trigger for the upgrade of ALICE exp. at CERN LSC



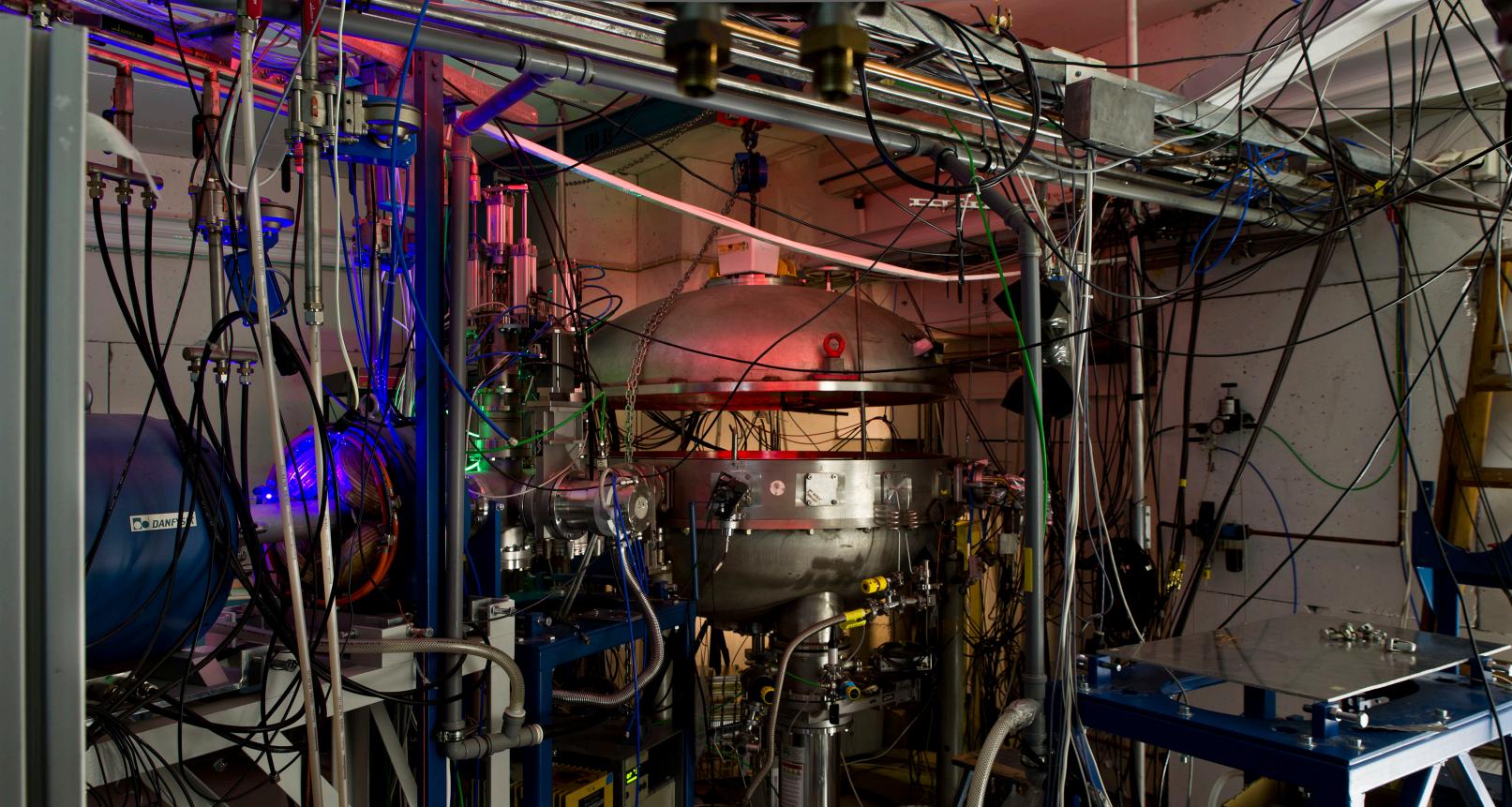
Modified PLANACON® XP85012



Default Photonis design



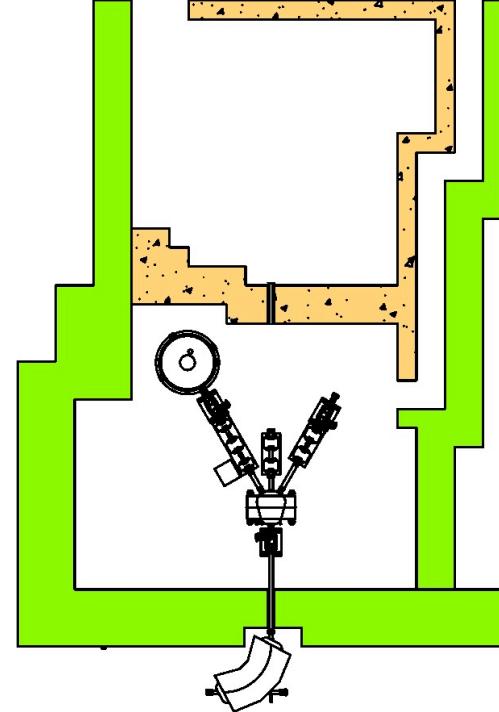
FIT design



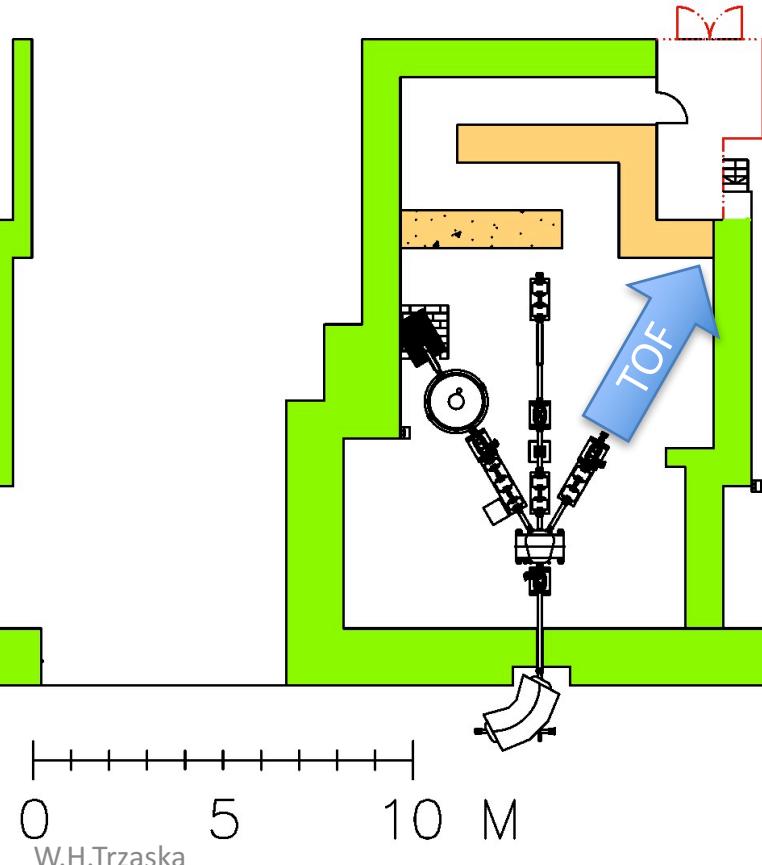
Reconstruction of the LSC cavern is now scheduled
for the summer of 2018

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The current layout



Proposed new layout (with chicanes)



Intermediate image lens capable of focusing up to 8 MeV electrons

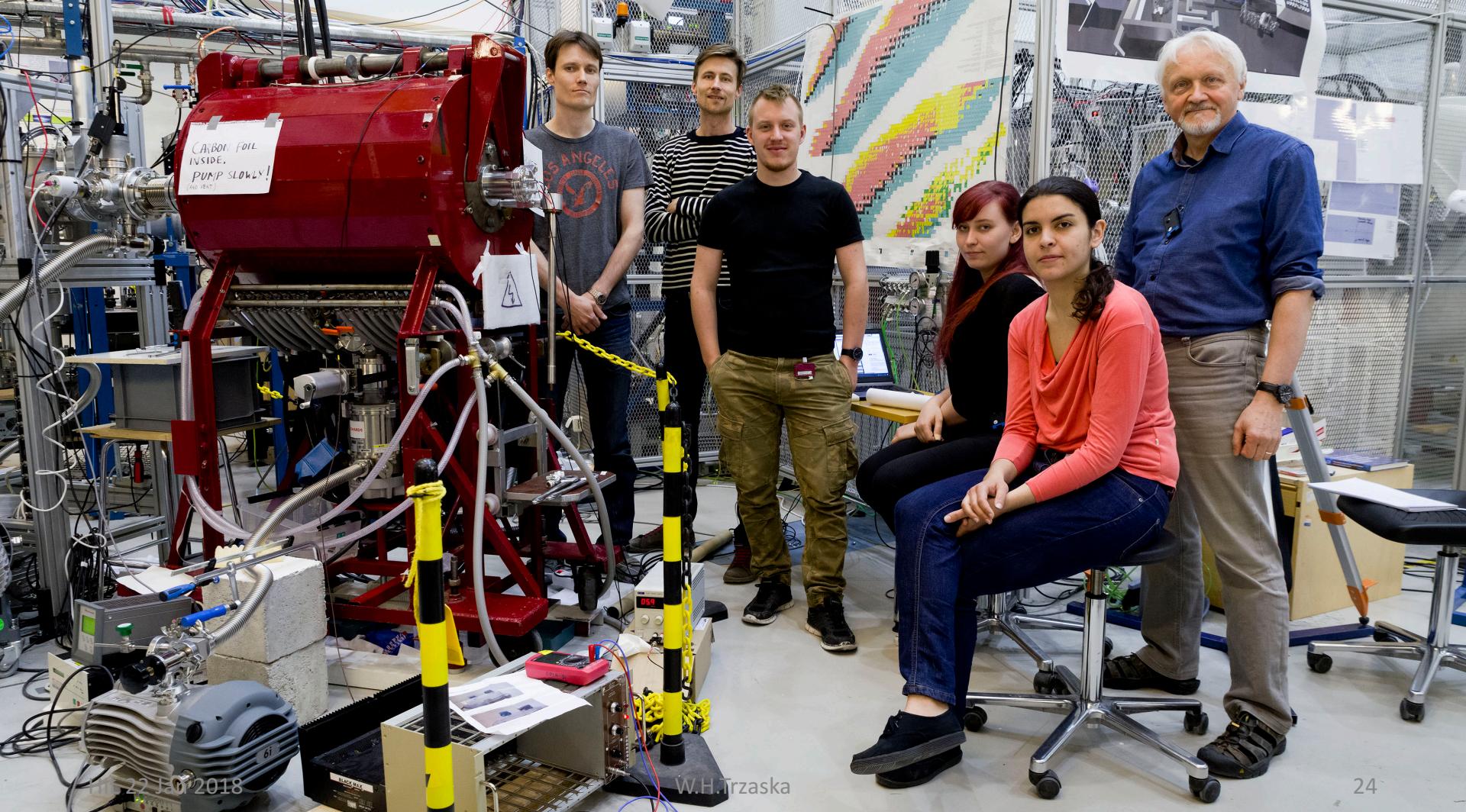


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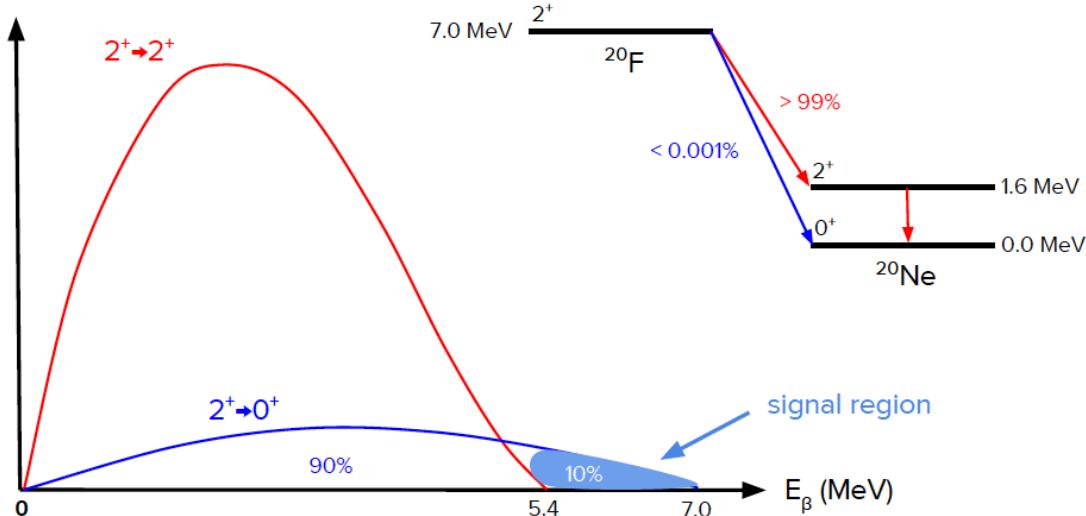
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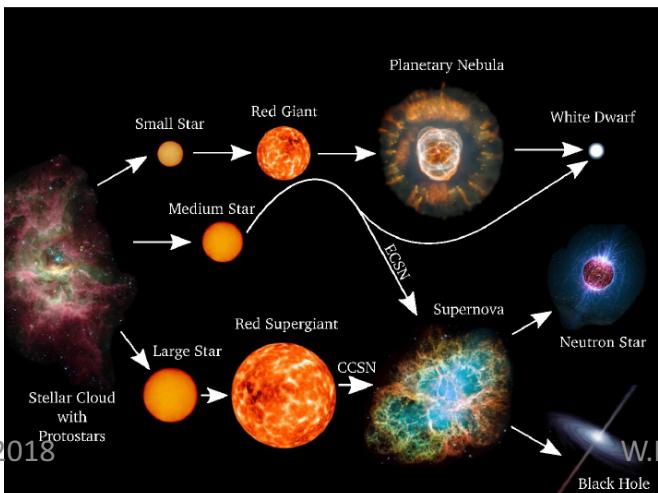
16.22 Jan 2018

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Measurement of $2^+ \rightarrow 0^+$ transition strength



- $M = 8\text{--}12 M_\odot$
- ONe or ONeMg core

evolution of medium-size stars

See e.g.

- Nomoto, ApJ 277 (1984) 791
- Nomoto, ApJ 322 (1987) 206
- Jones *et al.*, ApJ 772 (2013) 150
- Takahashi *et al.*, ApJ 771 (2013) 28

Conclusions

- NR research in Jyväskylä covers a broad scope of topics
- Enlarged LSC cavern will provide space and opportunity to install new experimental facilities
- We welcome new collaborators, new instrumentation, new ideas, new challenges, and new proposals
- The deadline for proposal submission are on
 - 15 March (spring PAC meeting)
 - 15 September (fall PAC meeting)



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Thank you for your attention!