The GANIL-LISE facility

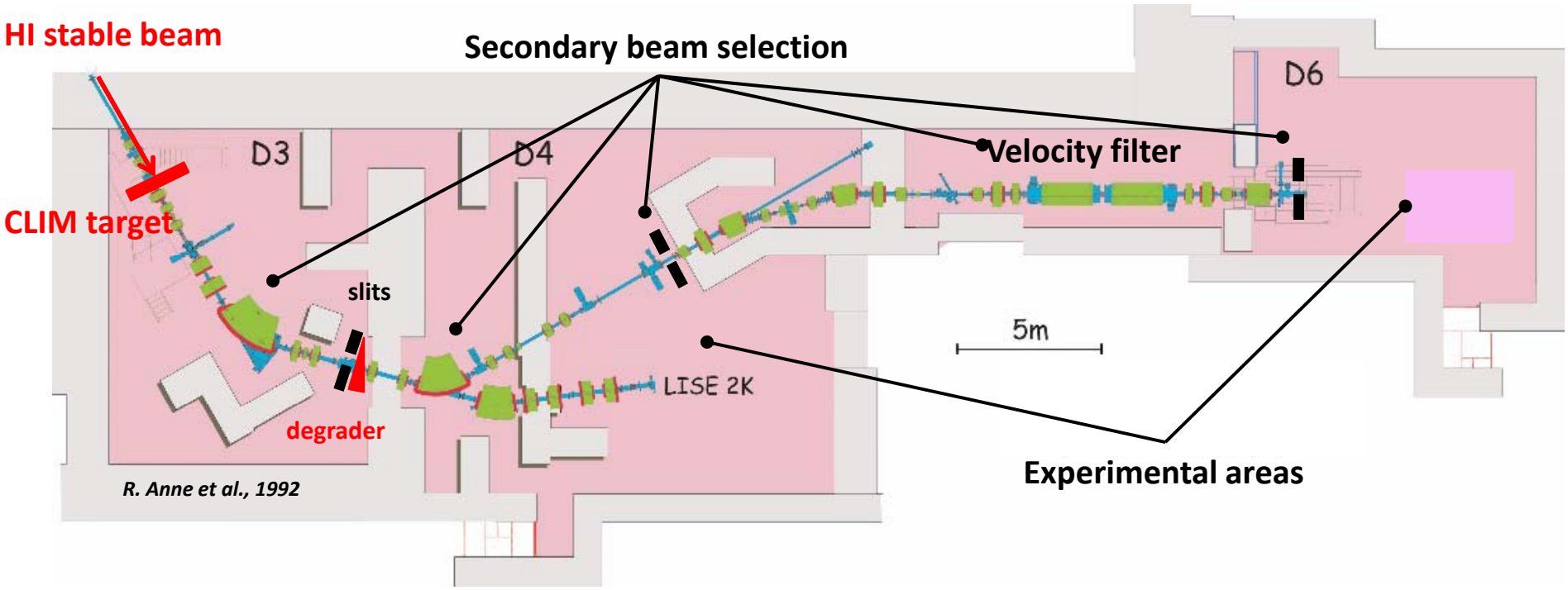
status and perspectives

Jean-Charles THOMAS, GANIL

on behalf of the LISE collaboration

LIA COSMA 30-31/01/2017 Magurele, Bucarest

The GANIL-LISE facility



- CLIM high power target (Be 2mm) : P_{loss} <= 800 W <-> $^{58}Ni^{26+}$, 75 A.MeV, 4 eμA ($10E^{12}$ pps)
- $B_{\rho 2}$ ≤ 3.2 T.m (4.3 on LISE 2K)
- $\Delta p/p \leq \pm 2.5$ %
- Angular acceptance: 1 msr (3.5 on LISE2000)
- FULISE mode: 20 mrad, ±5% velocity acceptance, > 10^{10} rejection power

OUTLINE

Current status

- SWOT Analysis
- Ongoing actions

Perspectives

- Scientific program at LISE
- Technical developments

Conclusion

Status: SWOT analysis

O. Sorlin, 2015 ->...

Assets

BEAMS

- Wide range of beams
- Relatively high intensity secondary beams
- Fermi energies (…reduce energy further)
- Use of SP1 (*new*) beams / stripper foil
- Stable beams

HIGHLY COMPETENT MANPOWER

- Mechanics
- Detectors
- Electronics / DAQ
- Beam tuning

EXPERIMENTAL TECHNIQUES

- Direct reactions (transfer, RES)
- β-decay, TDPAD, ~~β-NM(Q)R~~
- Exotic radioactivities
- Coulomb excitation, break-up
- Fusion evaporation, d induced fission

DETECTOR SYSTEMS

- EXOGAM
- Château de cristal
- Must2/TiaRa
- Demon + Nordball
- *EXOGAM2*
- *PARIS*
- *GASPARD*
- *ACTAR TPC*

MANY SCIENTIFIC TOPICS OF HIGH IMPACT

- Exotic decay modes
- Halo and cluster nuclei
- Nuclear astrophysics
- Drip line studies
- Nuclear structure and nuclear forces
- Giant/soft modes
- Super-heavy nuclei

Status: SWOT analysis

O. Sorlin, 2015 ->...

Threats

BEAM TIME

- 2 weeks/years in 2016 and 2017
- Shared with AGATA / SPIRAL2 /others
- Lack of commissioning
- Exploratory experiments

DETECTOR SYSTEMS

- Increased complexity
- Problems of compatibility
- Availability

WORLDWIDE COMPETITION

- Higher production rates at RIKEN, NSCL (higher primary beam energy)

HUMAN RESOURCES

- Resources in priority to SPIRAL2
- New equipments (NFS, S3, …)

NO SCIENTIFIC STRATEGY

- Run experiments 'on demand'
- Mount/dismount

Threats specifically addressed by the LISE management and collaboration

Status: Ongoing actions

❖ Scientific strategy + manpower & beam time optimization

- ❑ 3 LISE-ICC workshop organized in 2015 and 2016
  - January 2015: "white book" defining the LISE scientific program in the near future, submitted to the GANIL SC + Directorate
    -> working groups: synergies, schedule, technical issues …
  - December 2015:
    - definition of experimental campaigns/ scientific programs involving similar setups
      -> submission of proposals and letters of intent to the GANIL PAC (June 2016)
  - December 2016:
    - post-PAC evaluation of the proposed organization; "best schedule" definition

  => See next slide

- ❑ Communications to the GANIL Directorate and SC ("Lobbying")

❖ International competition

- ❑ Take advantage of the new SPIRAL beams (2018 ->)
  -> SPIRAL1 Upgrade workshop: February 2016, GANIL
  (list of expected RIBs: http://u.ganil-spiral2.eu/chartbeams; delahaye@ganil.fr)

- ❑ LISE upgrade *=> See "Technical development" slides*

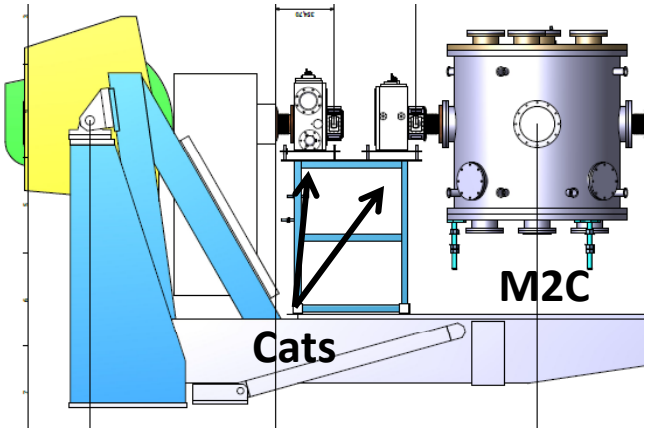
Perspectives: Scientific program

❖ 2017 (2 weeks) --- 2018

❑ E691: ^{30}S 0^+ ->0^+ β decay, B. Blank et al.

❑ E748: $^{10-12}$Be (30 A.MeV), A. Matta et al.

-> "LISE2017" setup ≡ MUST2 backward

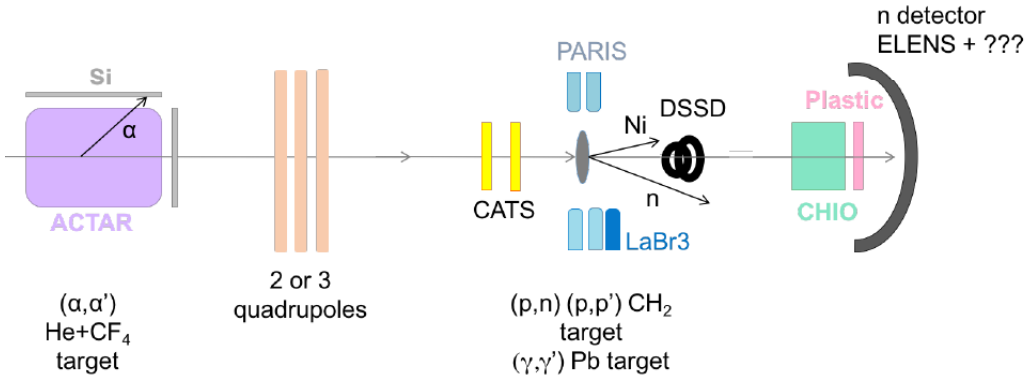


❑ Same setup to start with in 2018
-> E738: D. Suzuki et al., requires a LH target
-> E744: I. Stefan et al., ^{14}O SPIRAL beam

-> room for additional experiments using the same setup (PAC in 2017 ?): (p,t), (α,p), (p,p'), (d,d')…

❖ 2018 (? weeks) ---------- 2019 ----------

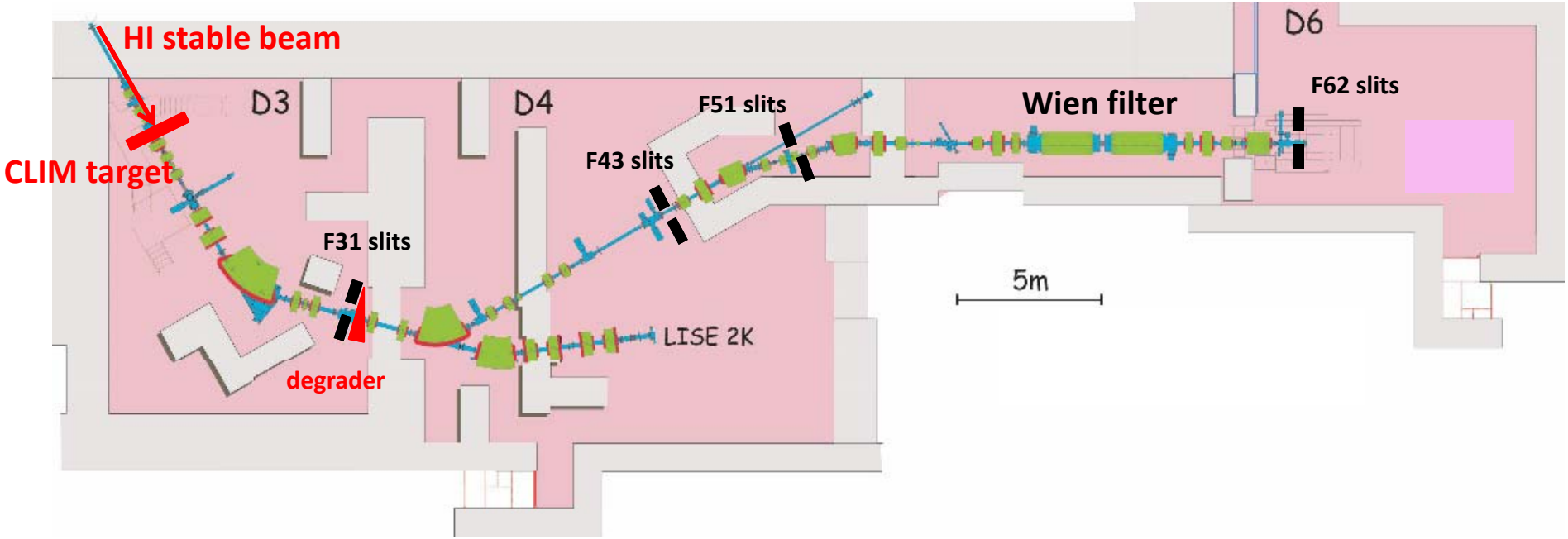
❑ Two (combined?) campaigns: ACTAR TPC and Collective excitation modes



❑ ACTAR TPC: E690 (^{54m}Ni) & E742 (^{54}Zn, ^{48}Ni) decays
+ LoI Astro (^{31}Cl, ^{20}Mg, ^{46}Mn <-> (p,γ) reaction rates)

❑ Collective modes: Pygmy Dipole Resonance + Isoscalar Giant Resonances + Antianalog GDR with radioactive beams ($^{56-70}$Ni); gaseous + solid targets; cp, γ, n detectors

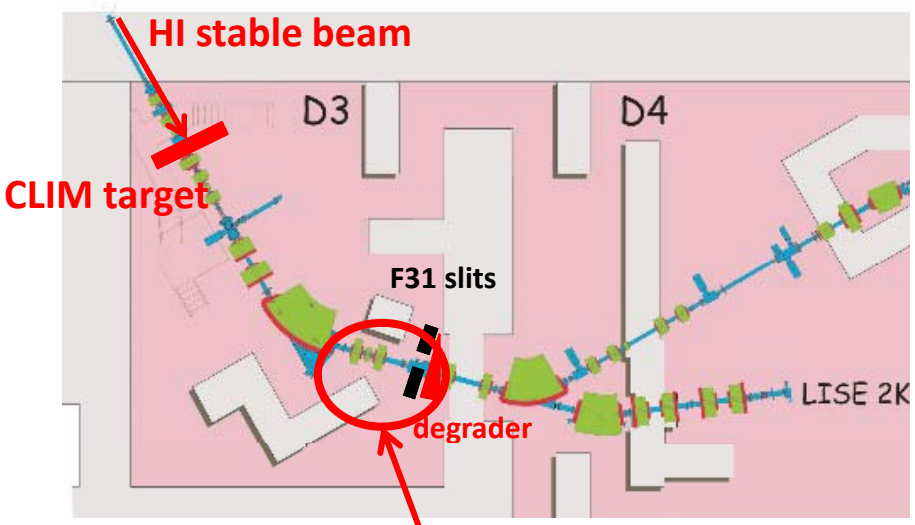
Perspectives: Technical developments

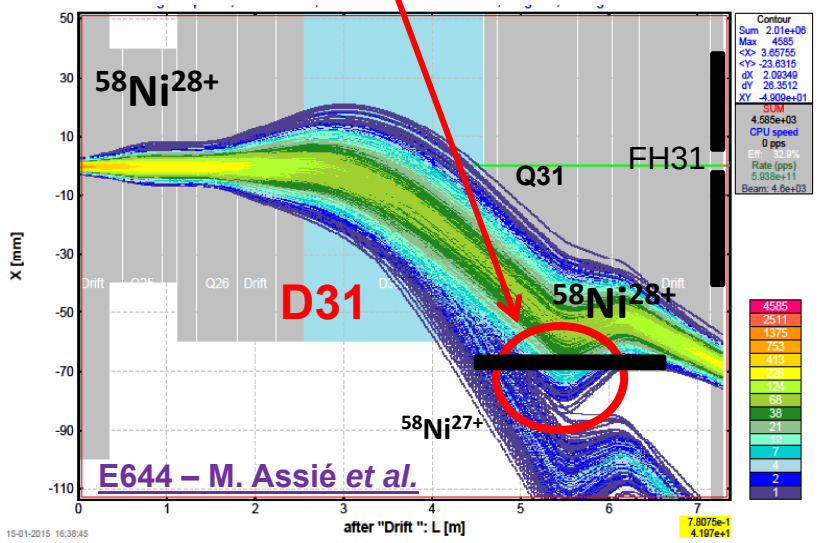


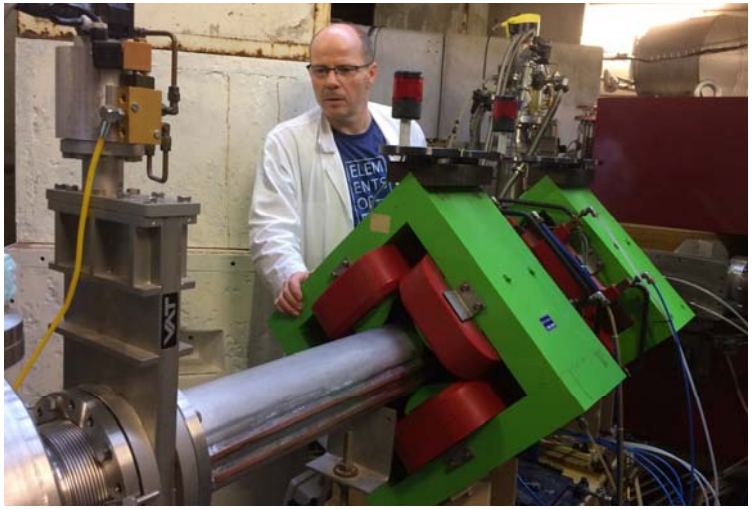
- Beam pipe cooling after the first dipole (F31)
- CAVIAR installation at the 2nd dispersive plane (F51)
- Secondary beam energy reduction in D4 (F43)/D6 (F62)
- Decoupling of the WF selection and the focalization in D6

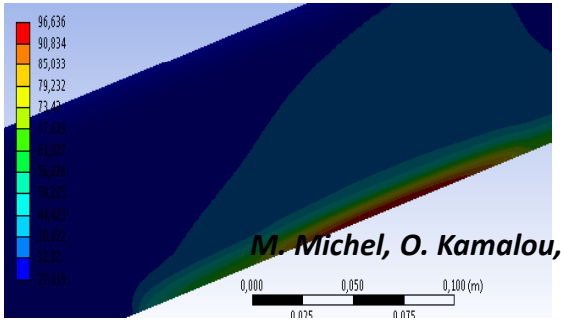
Technical developments - 1/4

- **Beam pipe cooling to avoid charge state issues (optimum $B_{\rho 1}$ setting)**





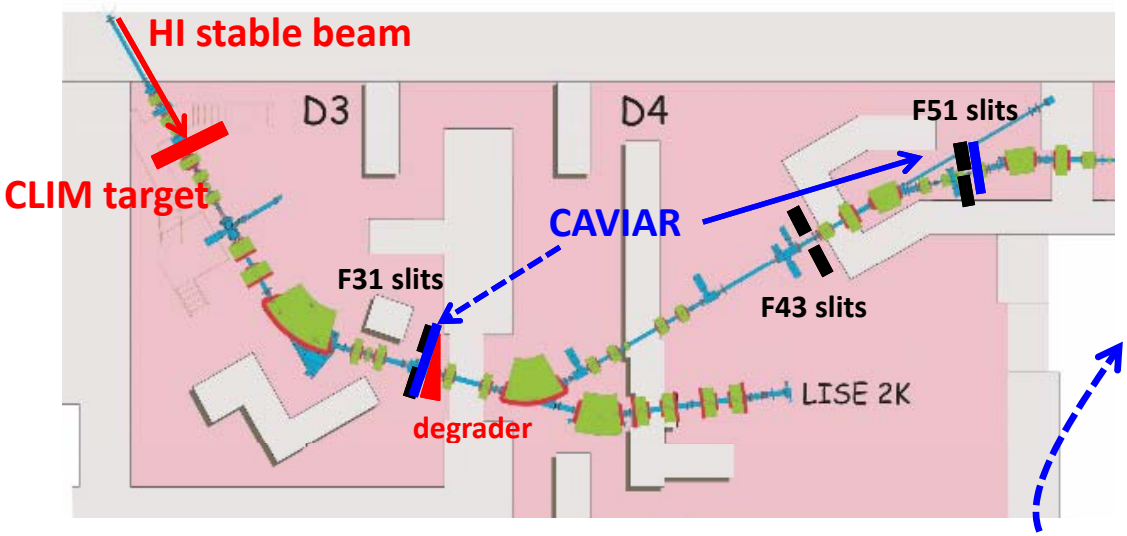




- **Cooling : T° < 100 °C for 1 kW losses**
  -> to be tested online in 2017

Technical developments – 2/4

❖ CAVIAR installation at the 2nd dispersive plane (F51)



- Gas detector, 96 strips, 1mm each
  -> B_ρ from the X position (R_{16})
- In F31:
  - Best resolution (R16 = 16 mm/%)
  - But too high count rate
- In F51:
  - Worst resolution (R16 = 7 mm/%)
  - Count rate affordable

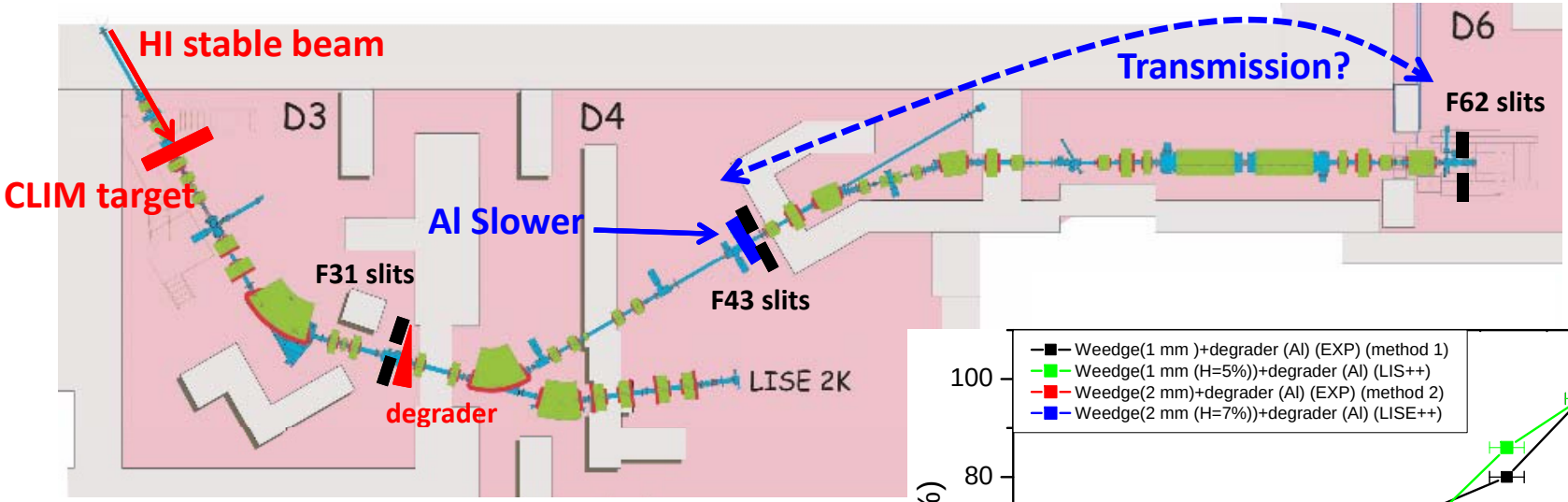
CAVIAR

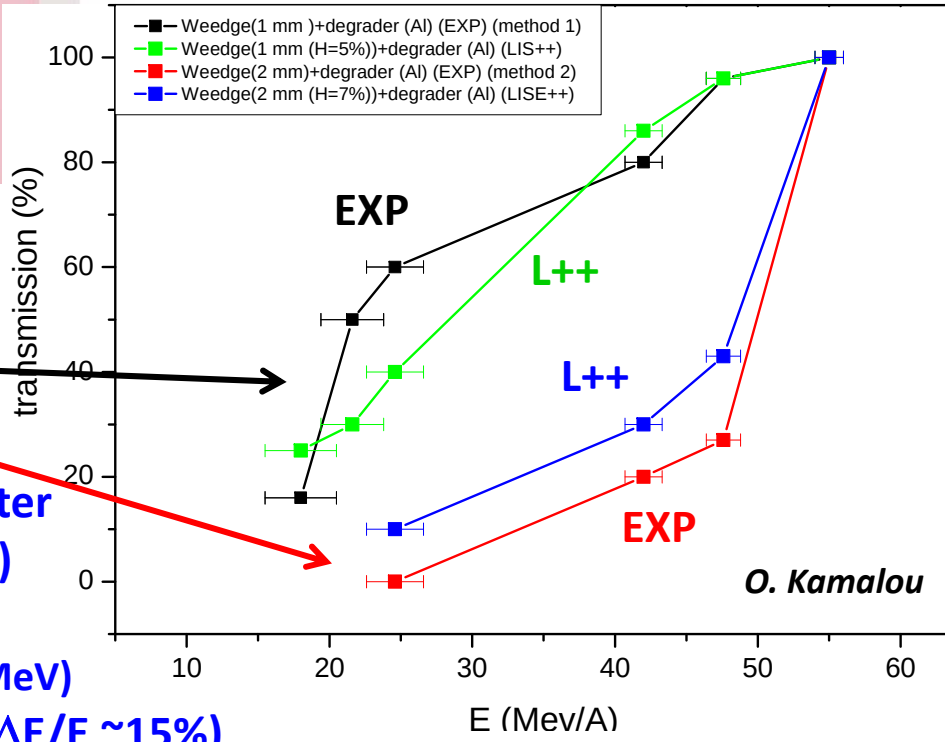
- From LISE++ simulations (O. Kamalou): expected $\Delta p/p$ sensitivity of ~0.35 %, assuming the position in F43 is known
- On line test (E666 – July 2016): issue related to the angular straggling in the wedge

-> further online tests required with a position (angle) sensitive detector in F43

Technical developments – 3/4

❖ Secondary beam energy reduction below 20 A.MeV





➢ **Online tests to compare the D4 <-> D6 transmission of a ^{34}Al RIB of 55 A.MeV**

- **with a thin wedge and a thick slower**
- **with a thick wedge and a thin slower**

-> thin wedge + thick slower combination better

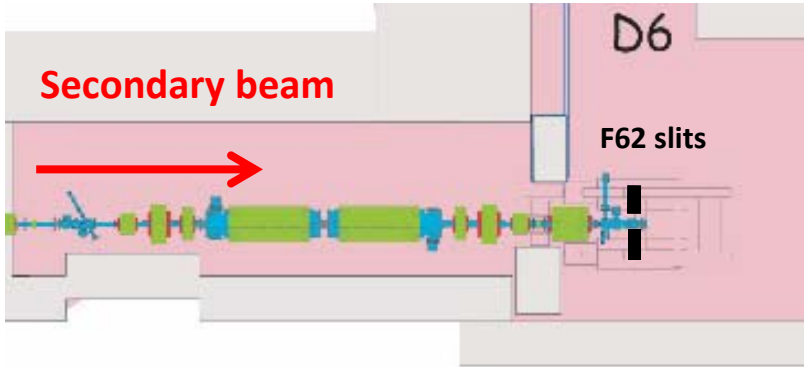
-> factor 4 losses at ~20 A.MeV (θ acceptance)

-> factor ~10 losses at 10 A.MeV

⇒Two steps slowing (D4, 30 A.MeV + D6, 10 A.MeV) to be tested: 60 % transmission expected (ΔE/E ~15%)

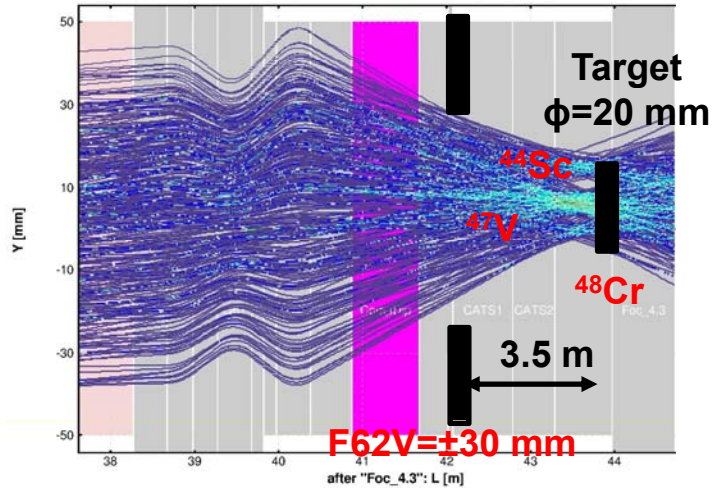
Technical developments – 4/4

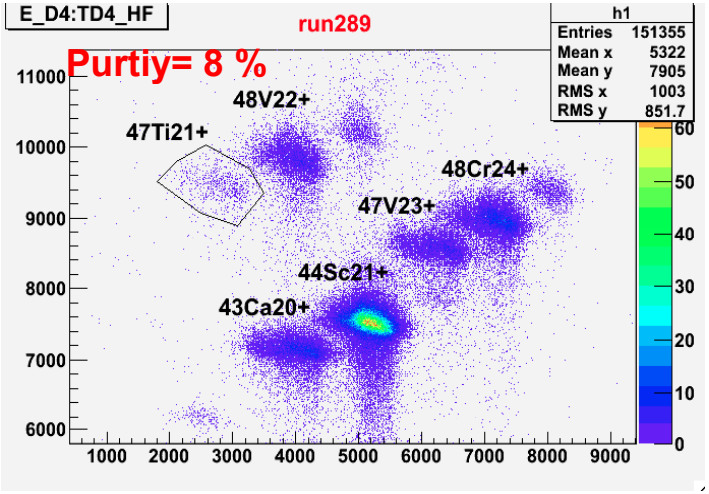
❖ Decoupling of the WF selection and the focalization in D6



E644 – M. Assié et al
^{58}Ni -> ^{48}Cr
MUST2

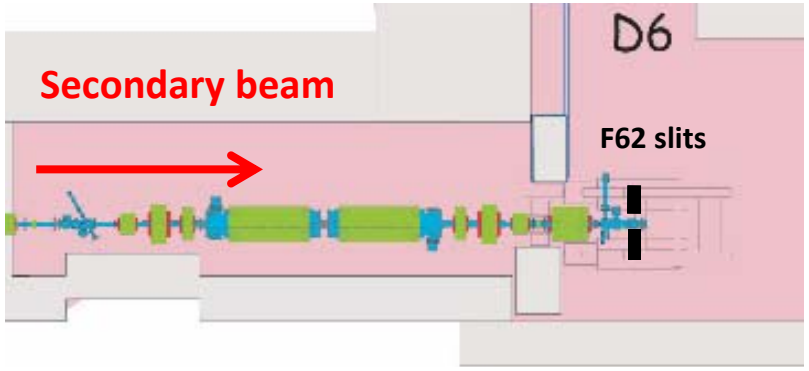
➢ How to combine an efficient selection (Wien filter + F62 slits)
and a good focalization on a secondary target (3.5 m distant, 20 mm in diameter) ?



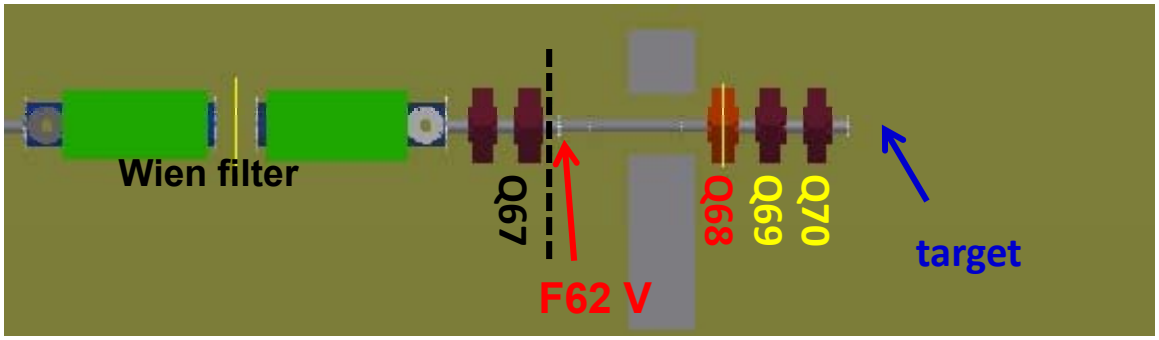


Technical developments – 4/4

❖ Decoupling of the WF selection and the focalization in D6

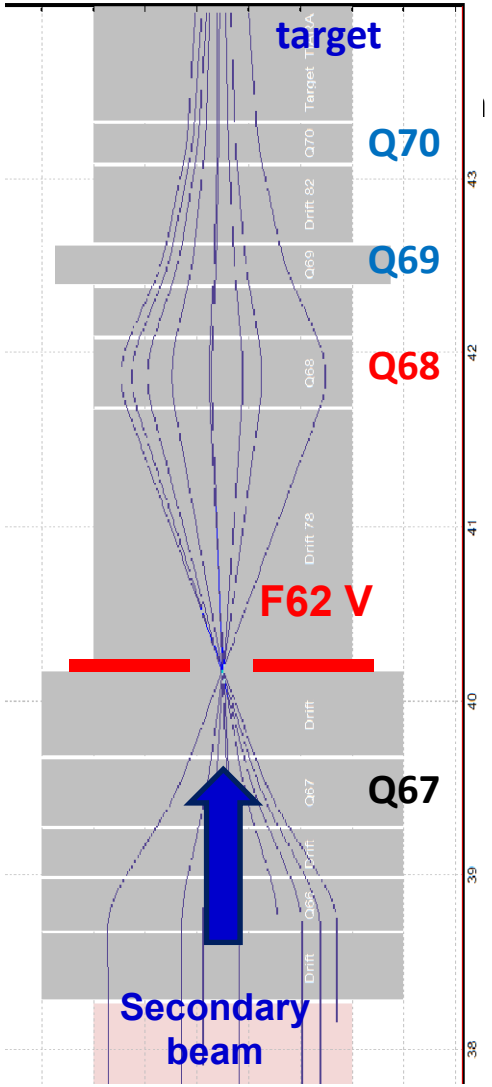


-> first selection with F62 slits then focalization with a triplet of quadrupoles



-> ~5 men.months / 6 months; ~ 50 k€

But when?? <-> Depends on the scheduling of LISE experiments



Conclusion

- Scientific strategy rather clear but no visibility with respect to the beam time available at LISE in the next few years
  - -> calls for an optimization of the scheduling of experiments at LISE (campaigns)
  - -> calls for an active lobbying of the LISE collaboration to get some beam time
  - => Need to further strengthen the collaboration, look for synergies, …

- Experiment campaigns
  - -> once foreseen/scheduled, possibility to add some extra experiment using the same setup (proposals to the GANIL PAC)
  - -> attempt to combine different setups (simulations + tests)

- Standalone experiments
  - -> possible, but to be scheduled in between campaigns (possibly delayed)
  - -> consider D4 and LISE 2K rather than D6

- technical developments
  - -> info to the collaboration once achieved to trigger proposals


Thank you for your attention!