PUMA-RC6

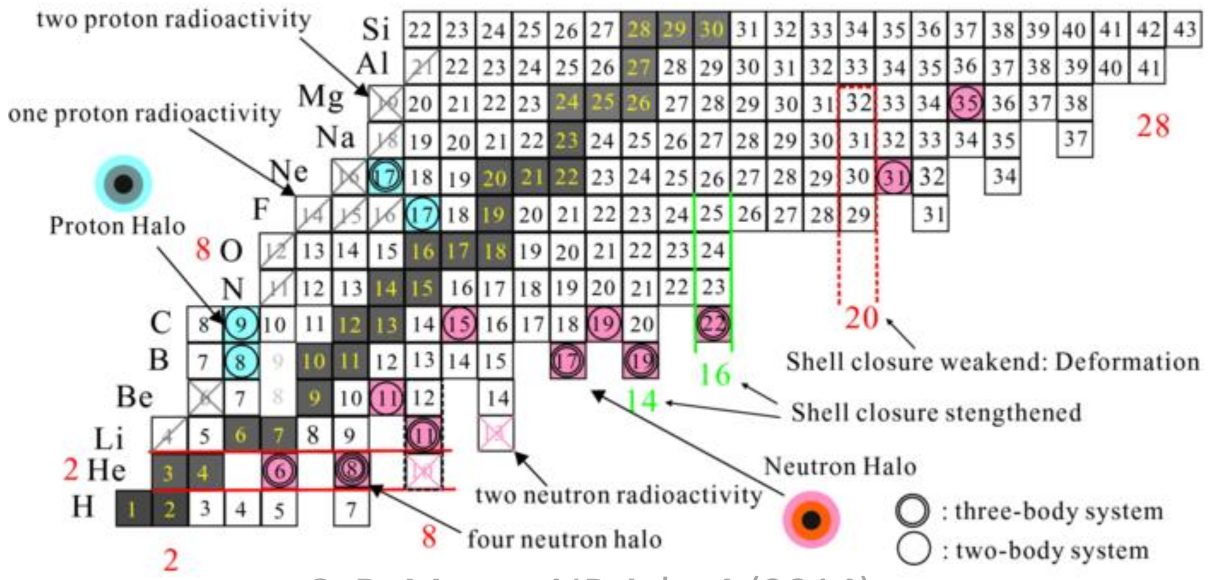
Transfer beamline and space management

2024-06-21

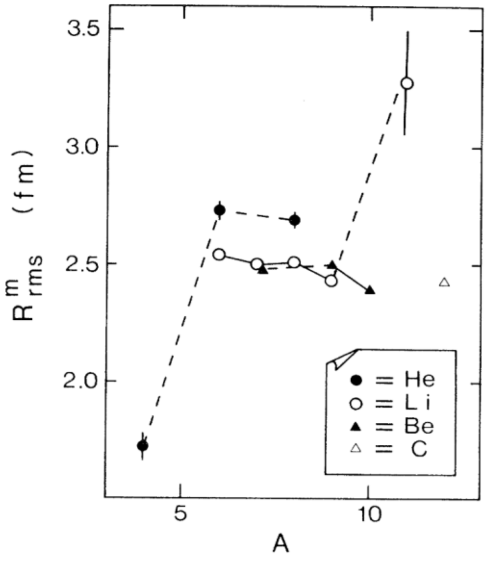
Lukas Nies (EP-SME-IS)

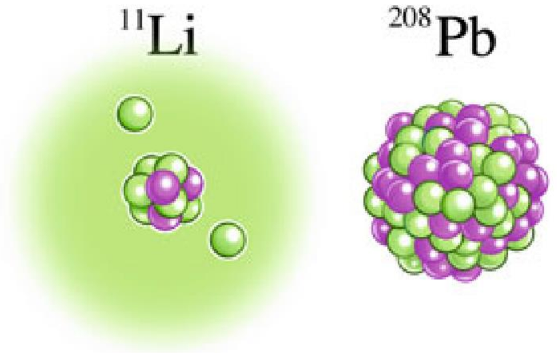
Nucleon Skins and Halos

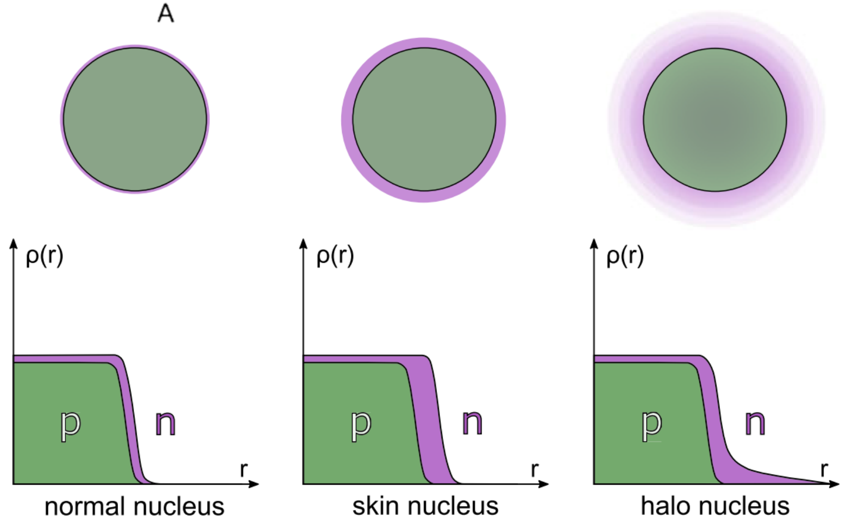
I. Tanihata et al., PRL **55**, 2676 (1985)
A. Obertelli, H. Sagawa, Mod. Nucl. Phys. (2021)



C. B. Moon, AIP Adv. 4 (2014)







- Exotic nuclei can exhibit halo structure and neutron skins
- Reflects in neutron and proton densities: $\rho_Z(r)$ and $\rho_N(r)$

Nucleon Skins and Halos

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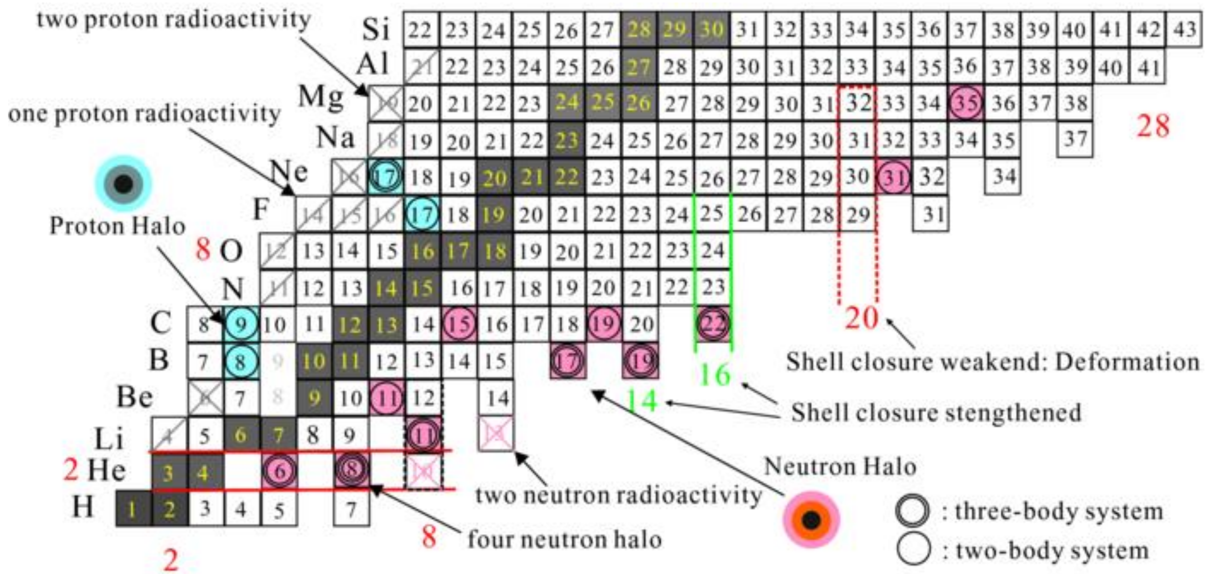

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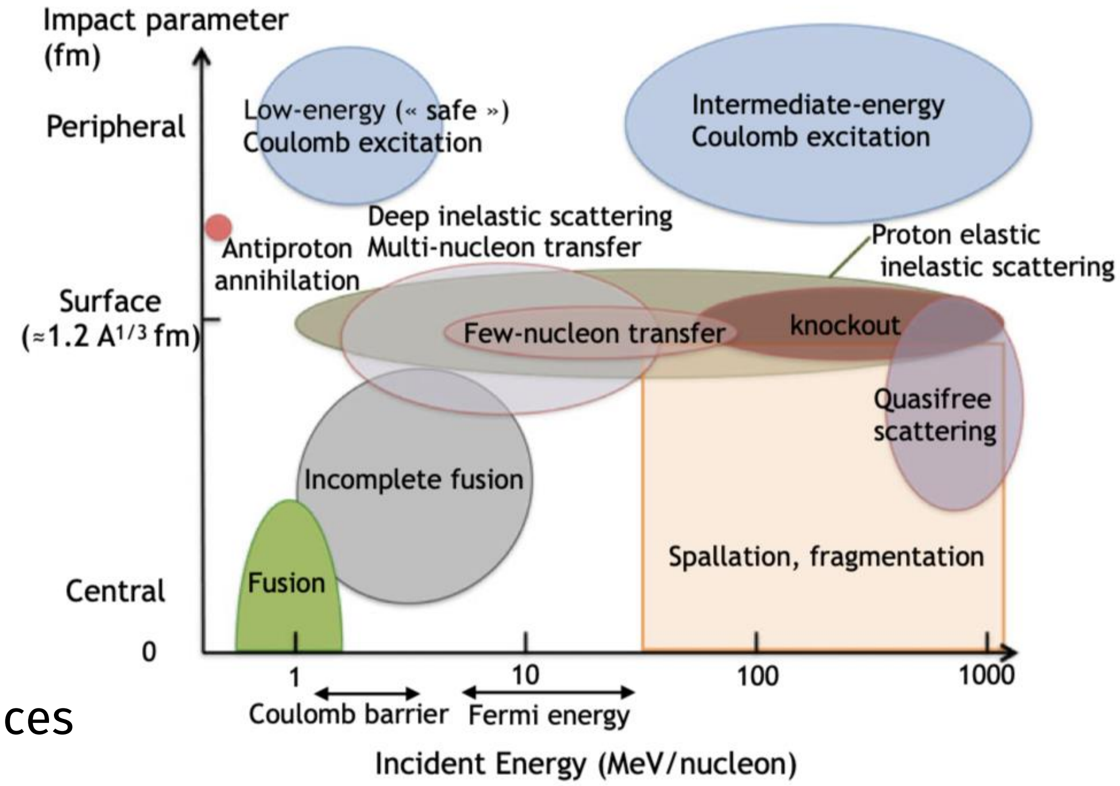


- Exotic nuclei can exhibit halo structure and neutron skins
- Reflects in neutron and proton densities: $\rho_Z(r)$ and $\rho_N(r)$
- Has so far only been probed at high energies or large distances

➔ Requires technique that:
- probes tail of matter distribution
- probes neutron fraction
- is applicable to unstable nuclei

Transporting Antiprotons from AD to ISOLDE

- There is no connecting beam line between the 2 facilities
- Requirements:
  - → a transportable ion trap with sufficient storage capabilities (10^9 p̄)
  - → XHV vacuum conditions for the storage of antiprotons
  - → a detection system for monitoring annihilation rates during the transport
  - → a very soft, slow transport

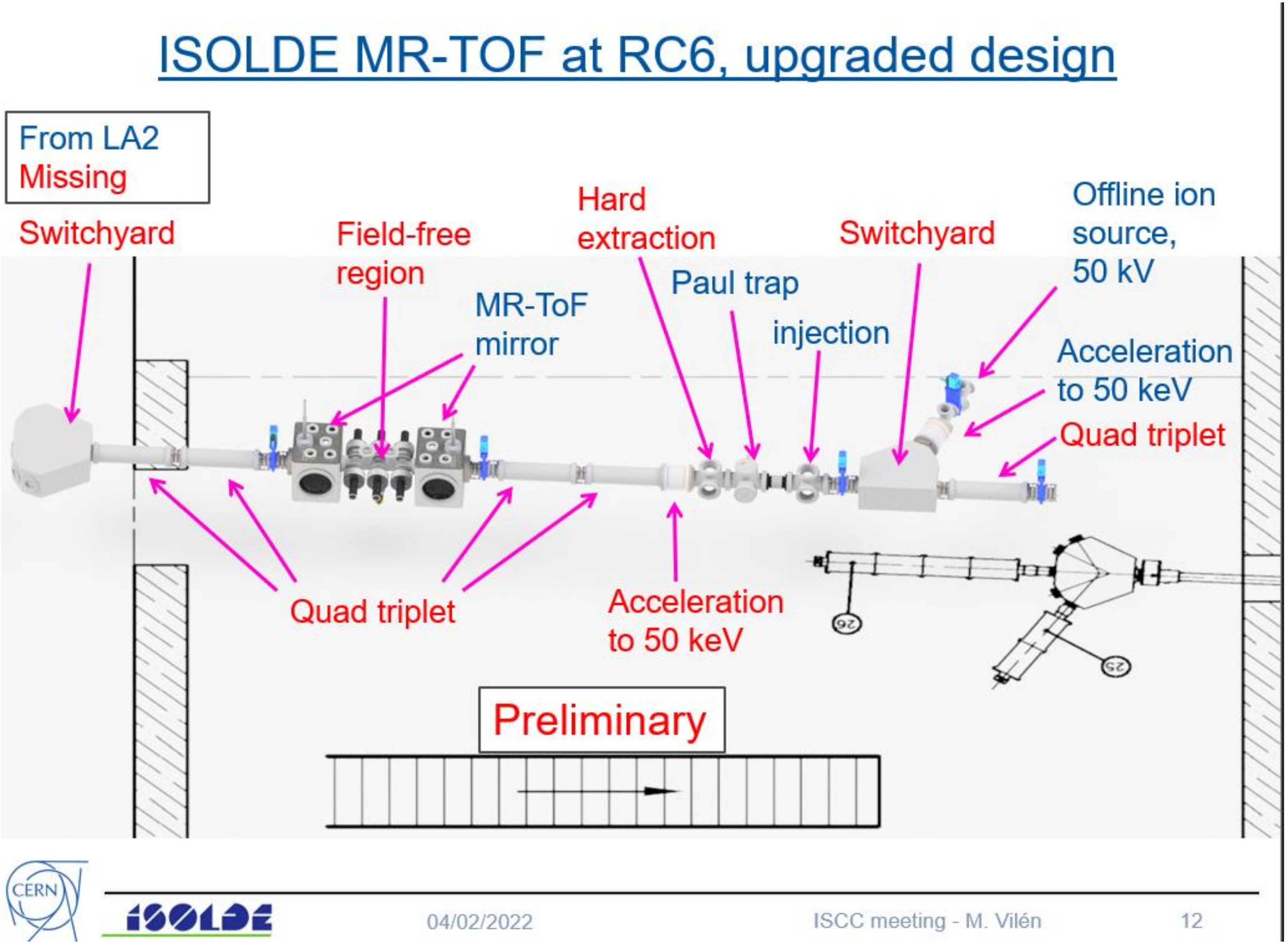
<u>Good news:</u>

- Long antiproton trapping time already achieved.
  Ex. BASE: > 400 days (S. Sellner et al., New J. Phys. 19 083023, 2017)
- Transportation of antiprotons is also a core component of BASE-STEP (PI: C. Smorra, Mainz, Rev. Sci. Instrum. 94, 113201 (2023))

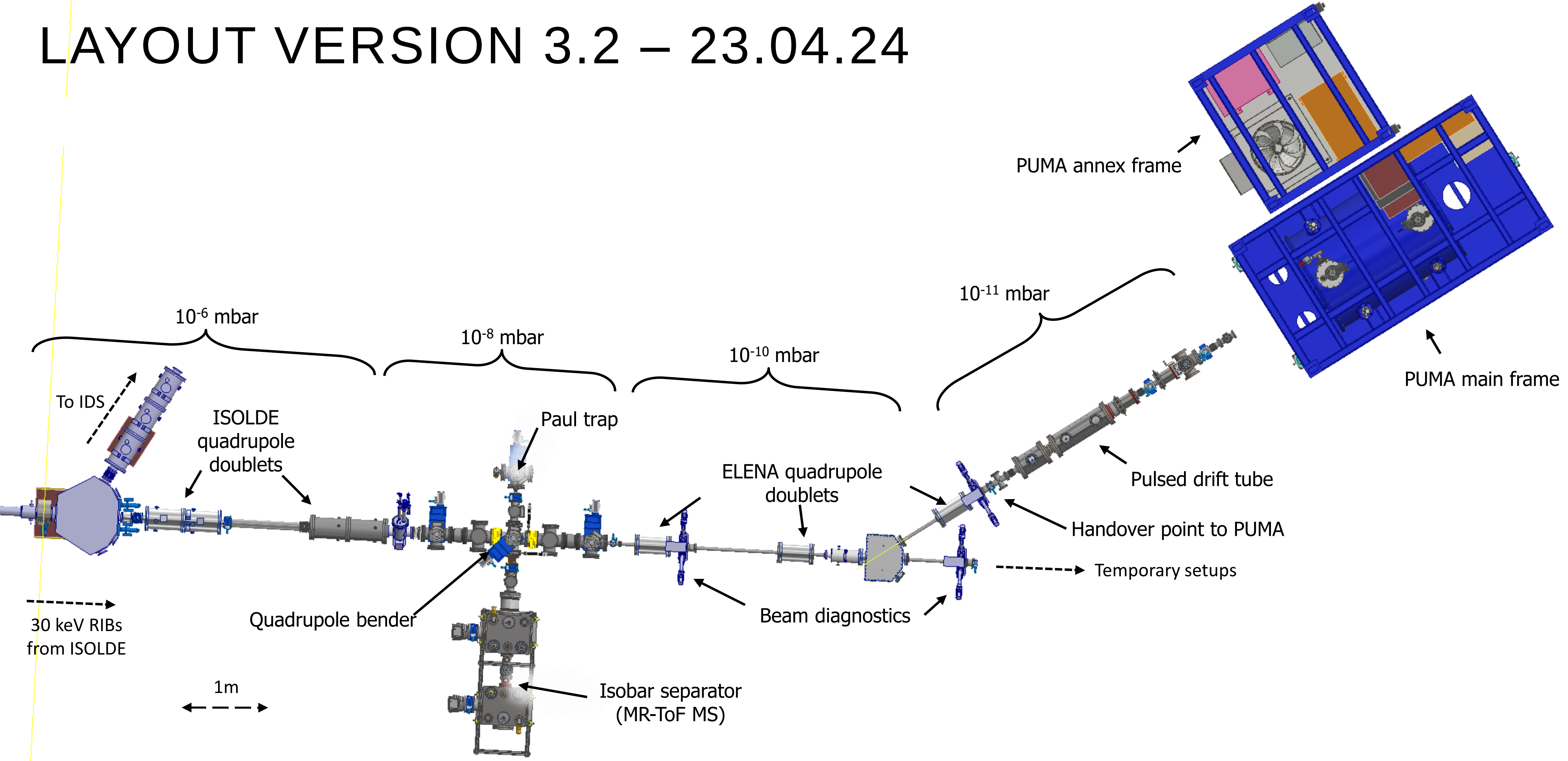
<u>Needed at ISOLDE:</u> Transfer beamline

Slide by C. Klink (BE-EA)

Design Status 2022



LAYOUT VERSION 3.2 – 23.04.24



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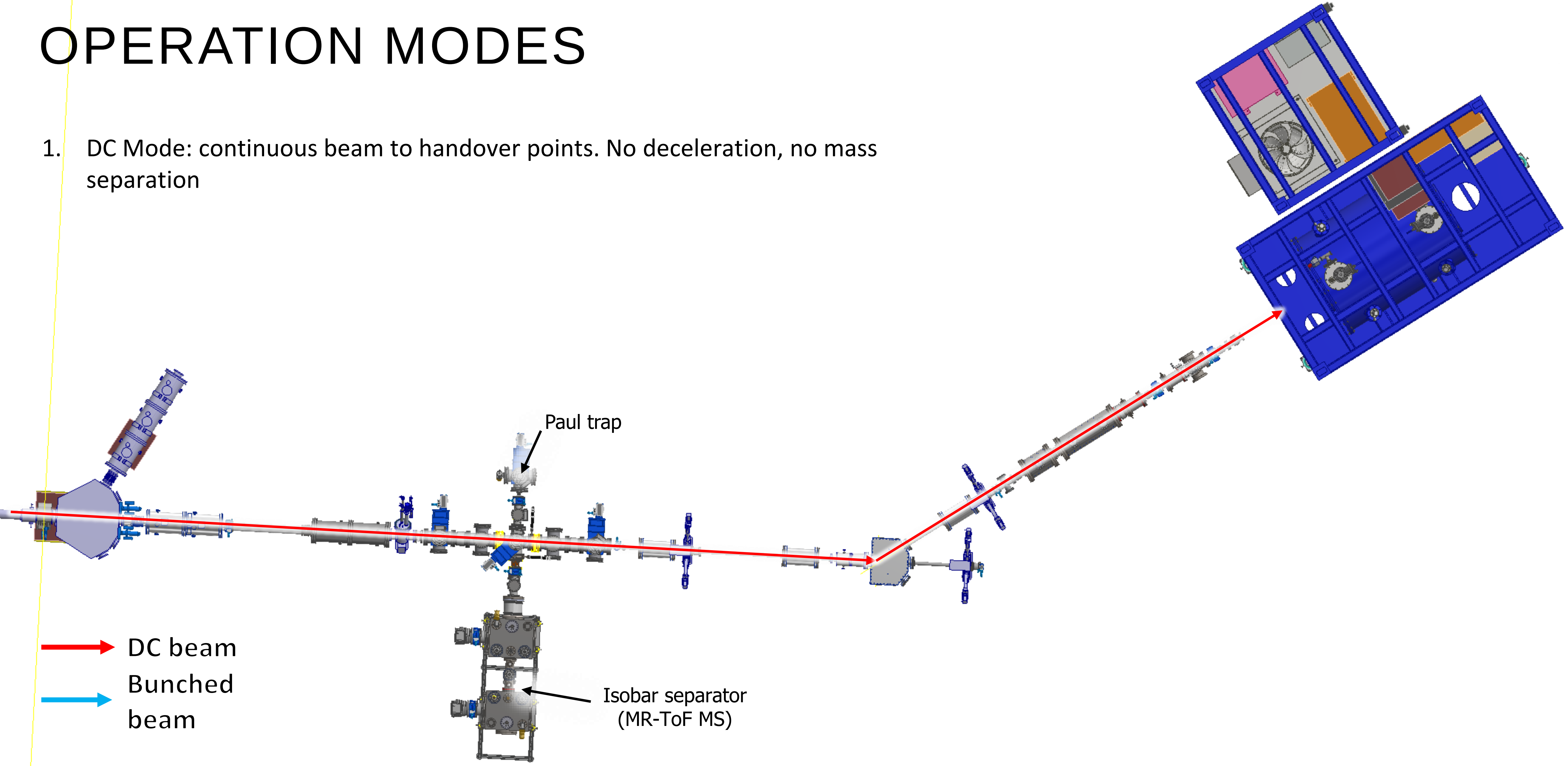
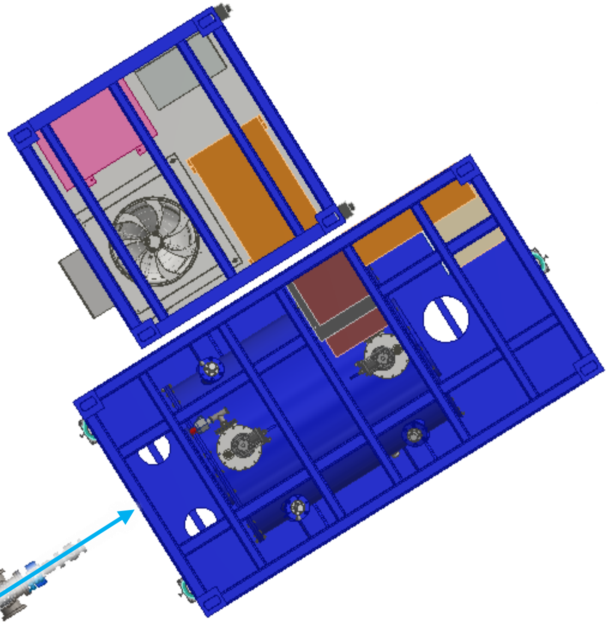
OPERATION MODES

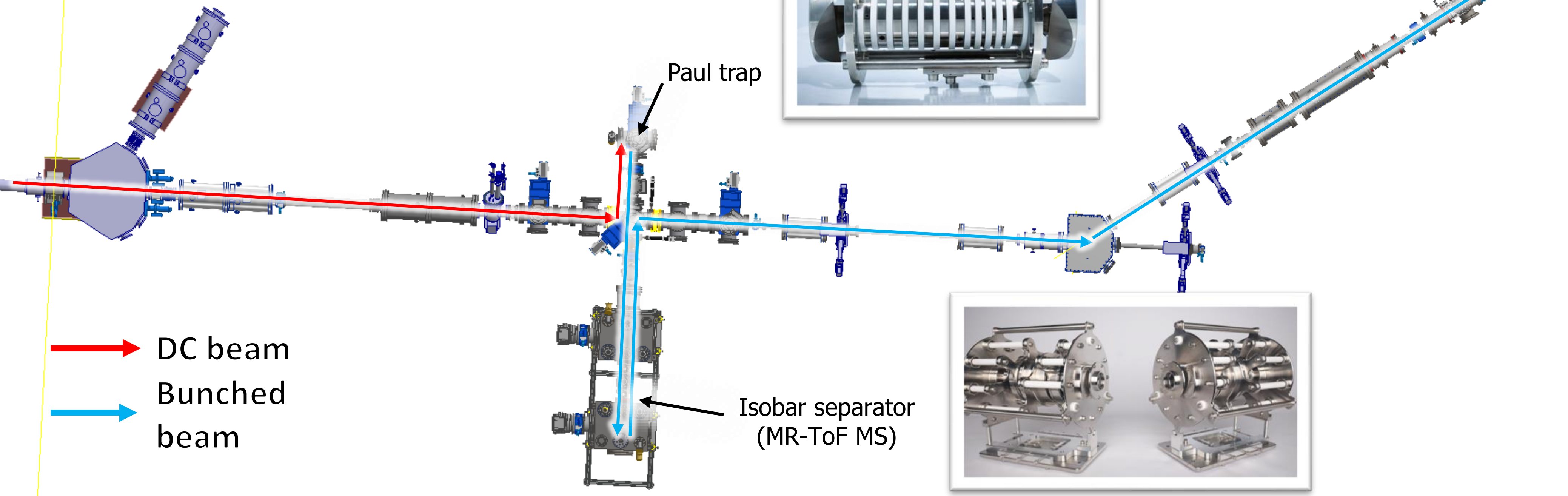
1. DC Mode: continuous beam to handover points. No deceleration, no mass separation



OPERATION MODES

1. DC Mode: continuous beam to handover points. No deceleration, no mass separation
2. Mass separation mode:
    1. Deceleration and injection Paul trap
    2. Bunching and cooling (~10ms)
    3. Injection MR-ToF MS
    4. Mass separation (~1ms – 50ms)
    5. Reacceleration and transport to PUMA





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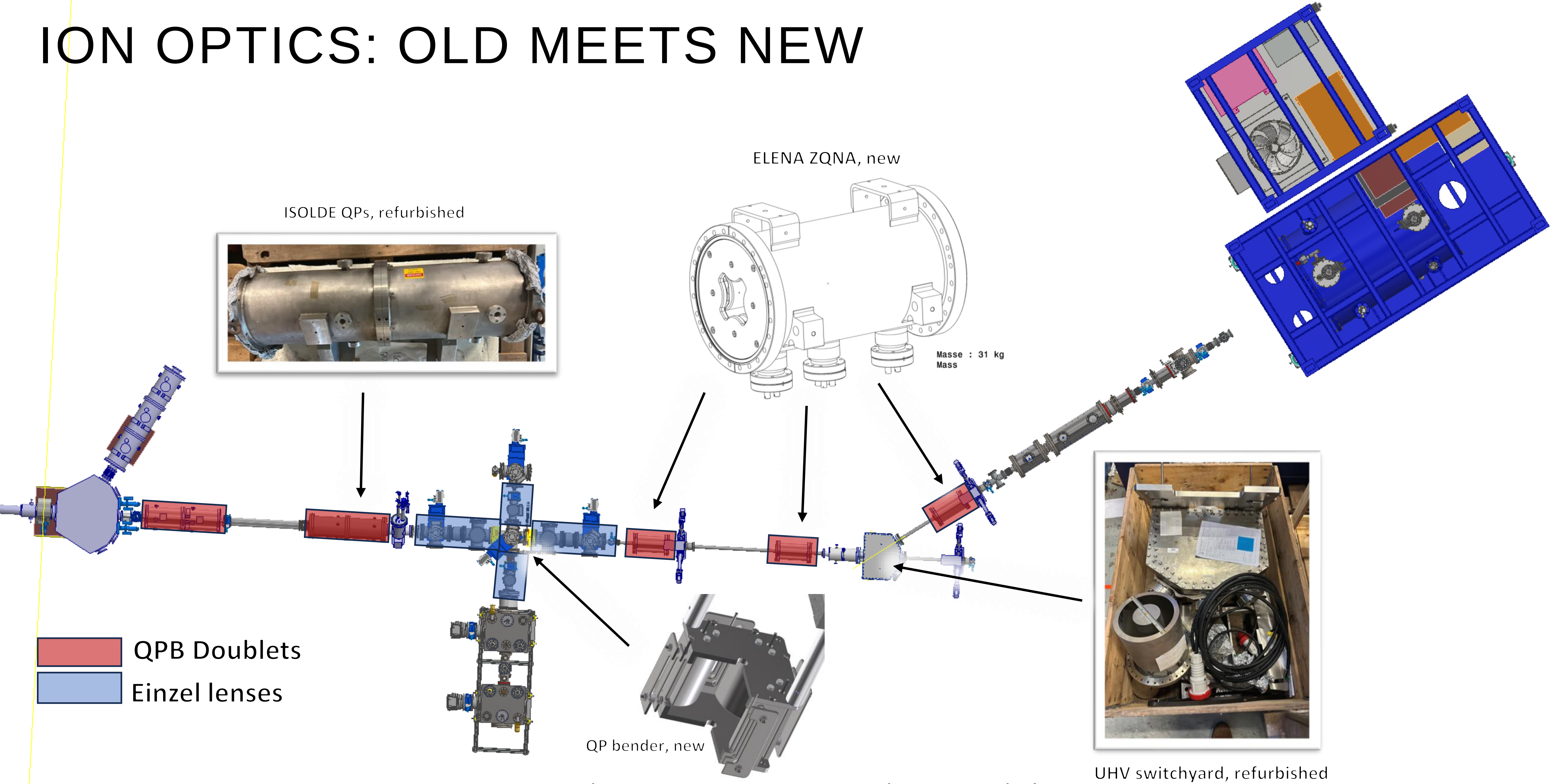
ION OPTICS: OLD MEETS NEW



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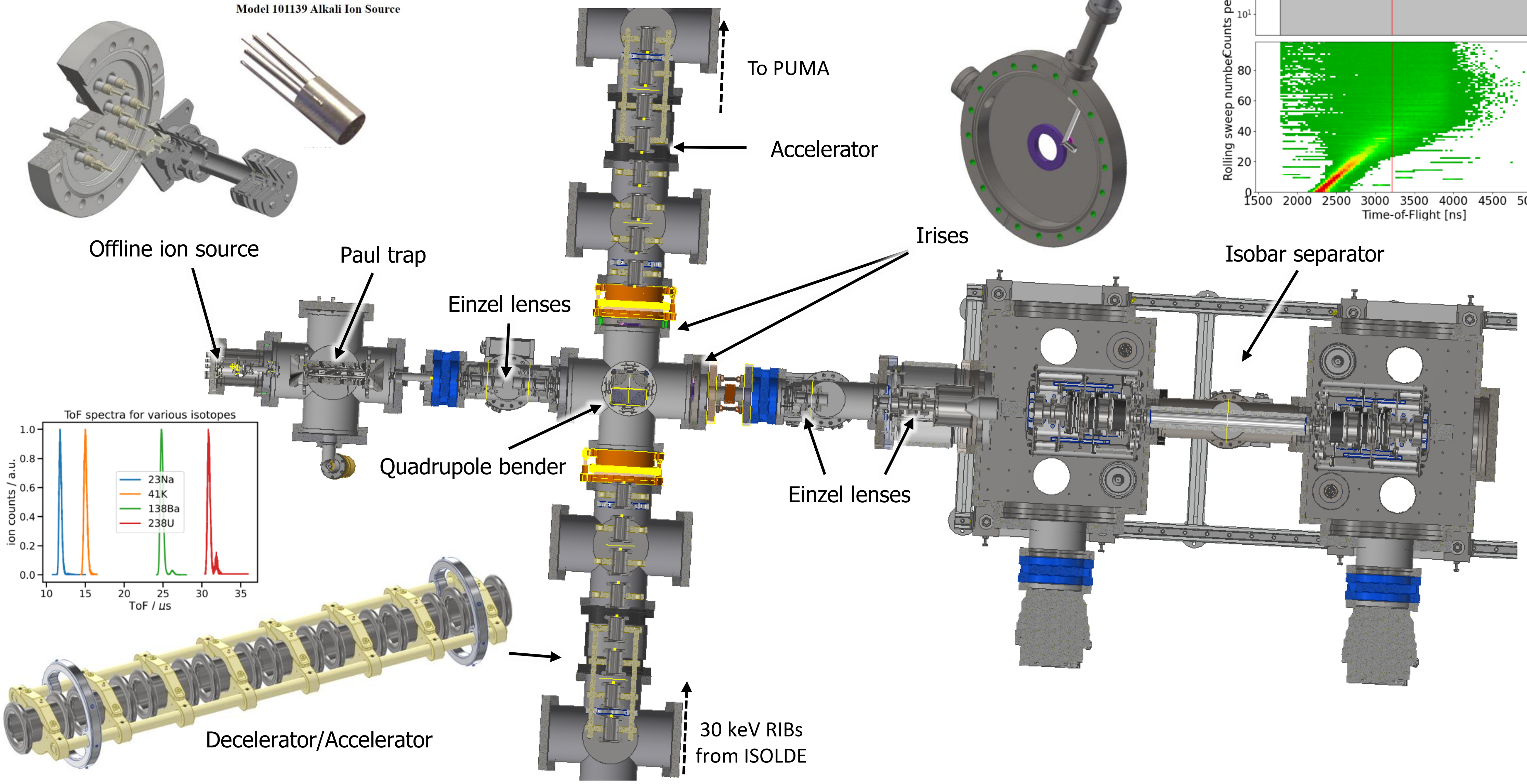
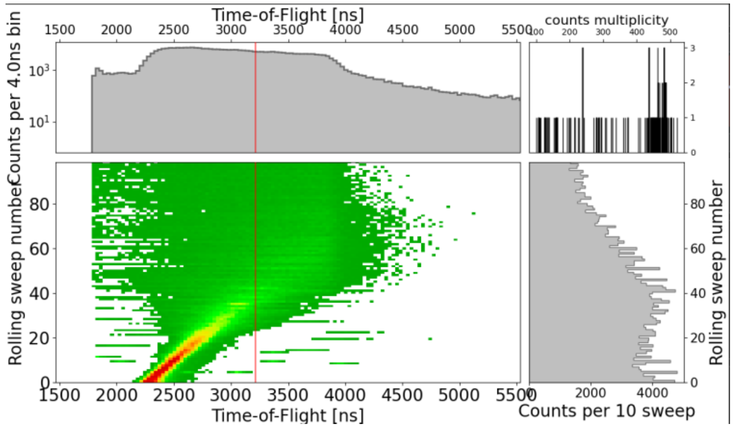
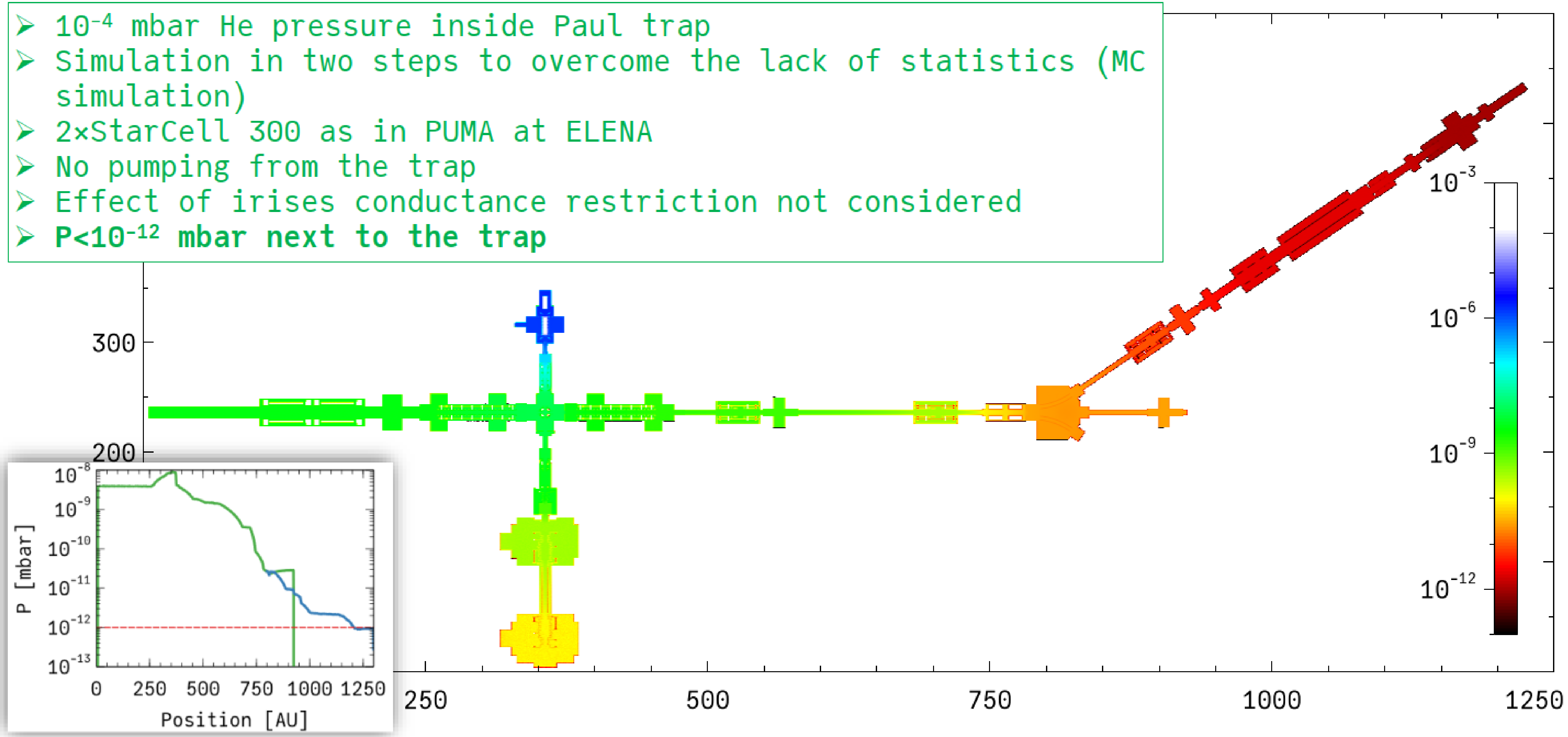
MASS SEPARATOR



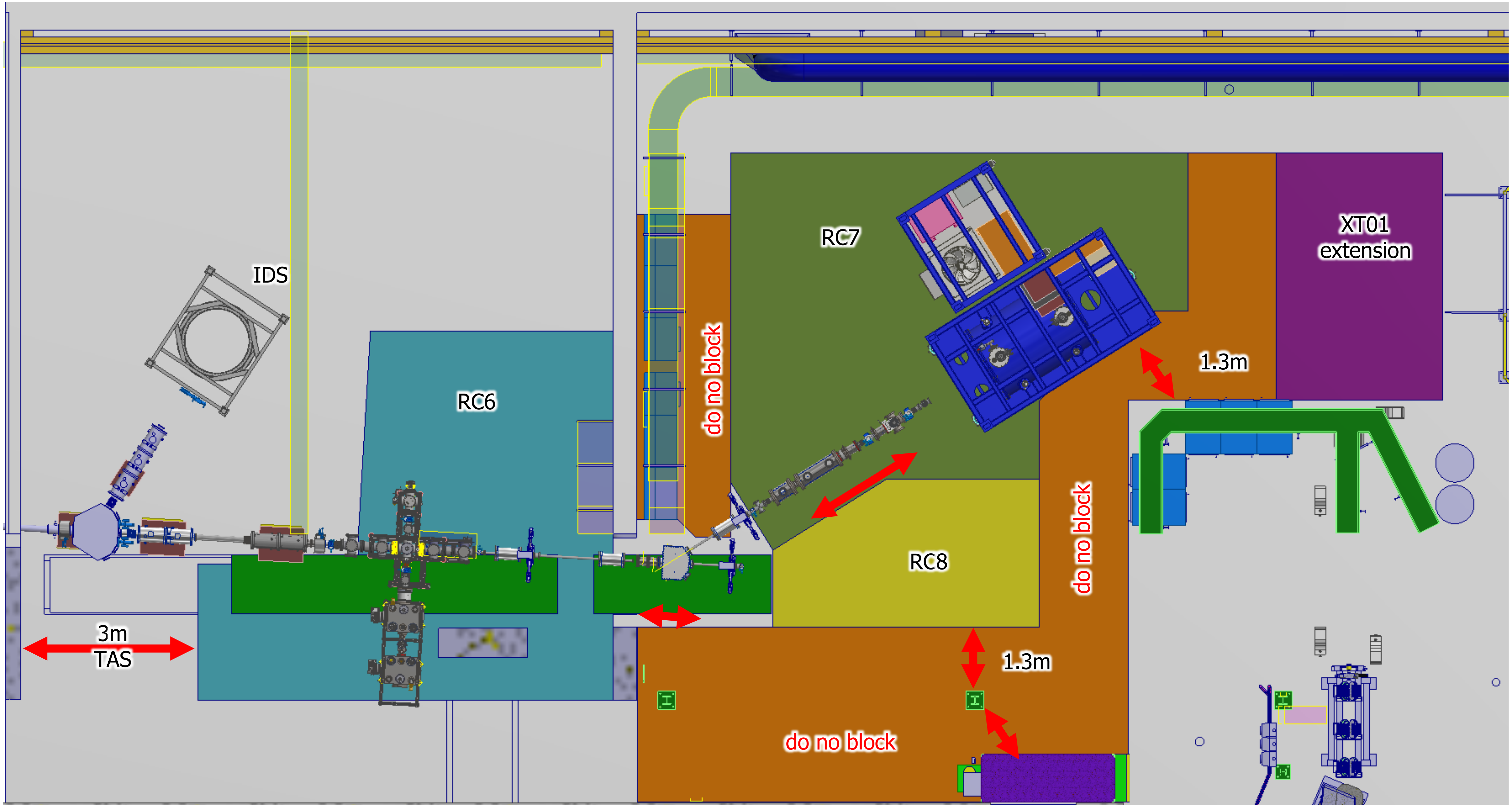


He propagation

- 10^{-4} mbar He pressure inside Paul trap
- Simulation in two steps to overcome the lack of statistics (MC simulation)
- 2×StarCell 300 as in PUMA at ELENA
- No pumping from the trap
- Effect of irises conductance restriction not considered
- **P<10^{-12} mbar next to the trap**



SPACE USE



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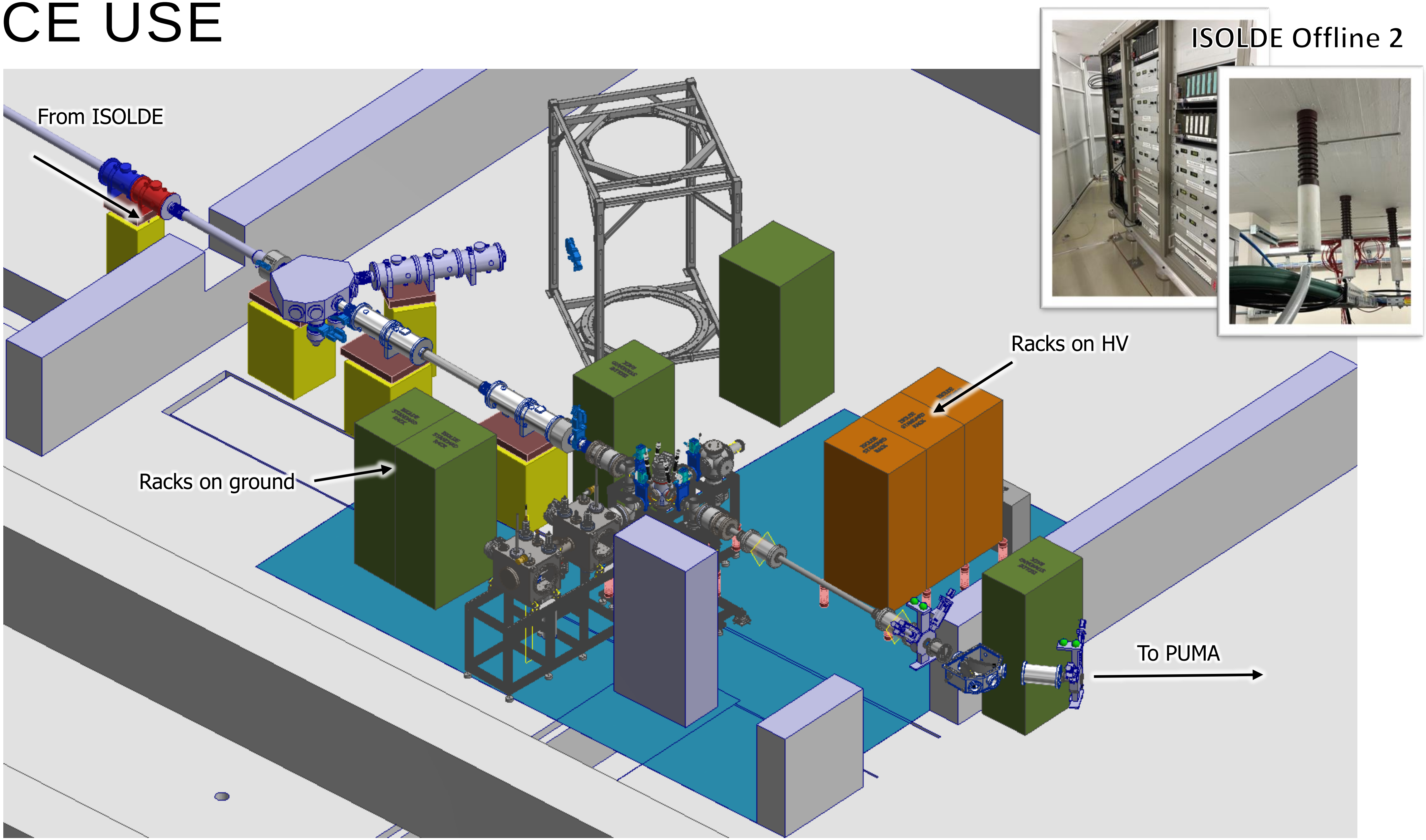
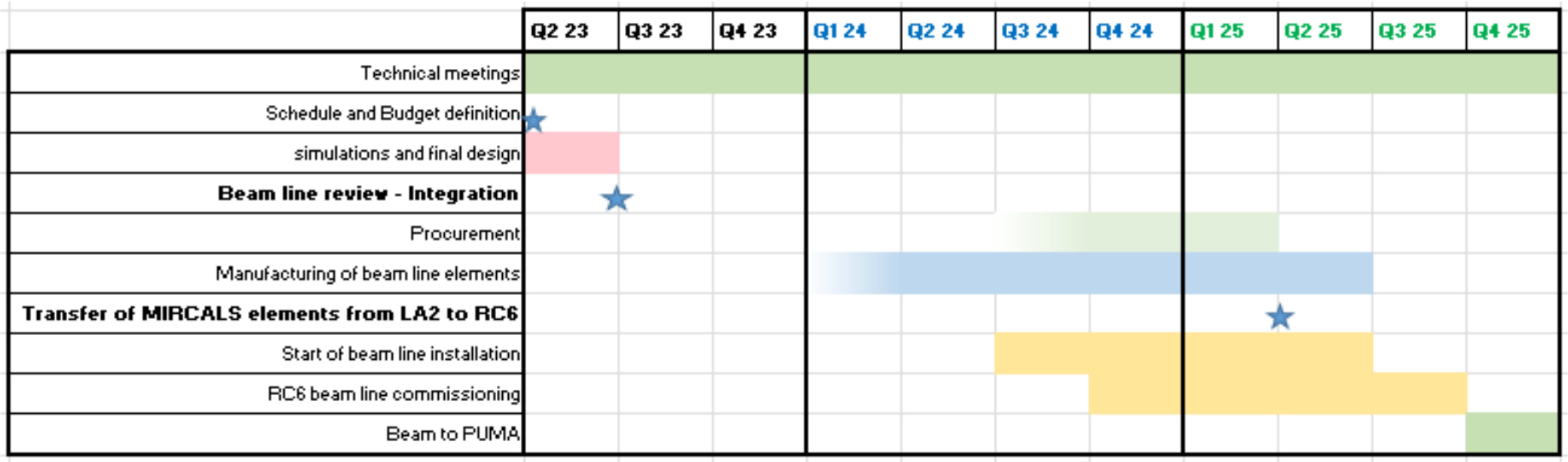

From ISOLDE
ISOLDE Offline 2
Racks on HV
Racks on ground
To PUMA

TENTATIVE SCHEDULE



The PUMA Collaboration

T. Aumann, N. Azaryan, W. Bartmann, A. Bouvard, O. Boine-Frankenheim, A. Broche, F. Butin, D. Calvet, J. Carbonell, P. Chiggiato, H. De Gersem, R. De Oliveira, T. Dobers, F. Ehm, J. Ferreira Somoza, J. Fischer, M. Fraser, E. Friedrich, M. Gomez-Ramos, J.-L. Grenard, G. Hupin, K. Johnston, C. Klink, M. Kowalska, Y. Kubota, P. Indelicato, R. Lazauskas, S. Malbrunot-Ettenauer, N. Marsic, W. Müller, S. Naimi, N. Nakatsuka, R. Necca, D. Neidherr, L. Nies, A. Obertelli, Y. Ono, S. Pasinelli, N. Paul, E. C. Pollacco, L. Riik, D. Rossi, H. Scheit, M. Schlaich, R. Seki, A. Schmidt, L. Schweikhard, S. Sels, E. Siesling, T. Uesaka, M. Wada, F. Wienholtz, S. Wycech, C. Xanthopoulou, S. Zacarias

The ISOLDE-RC6 Team

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