ISOLDE

Introduction and Physics requirements

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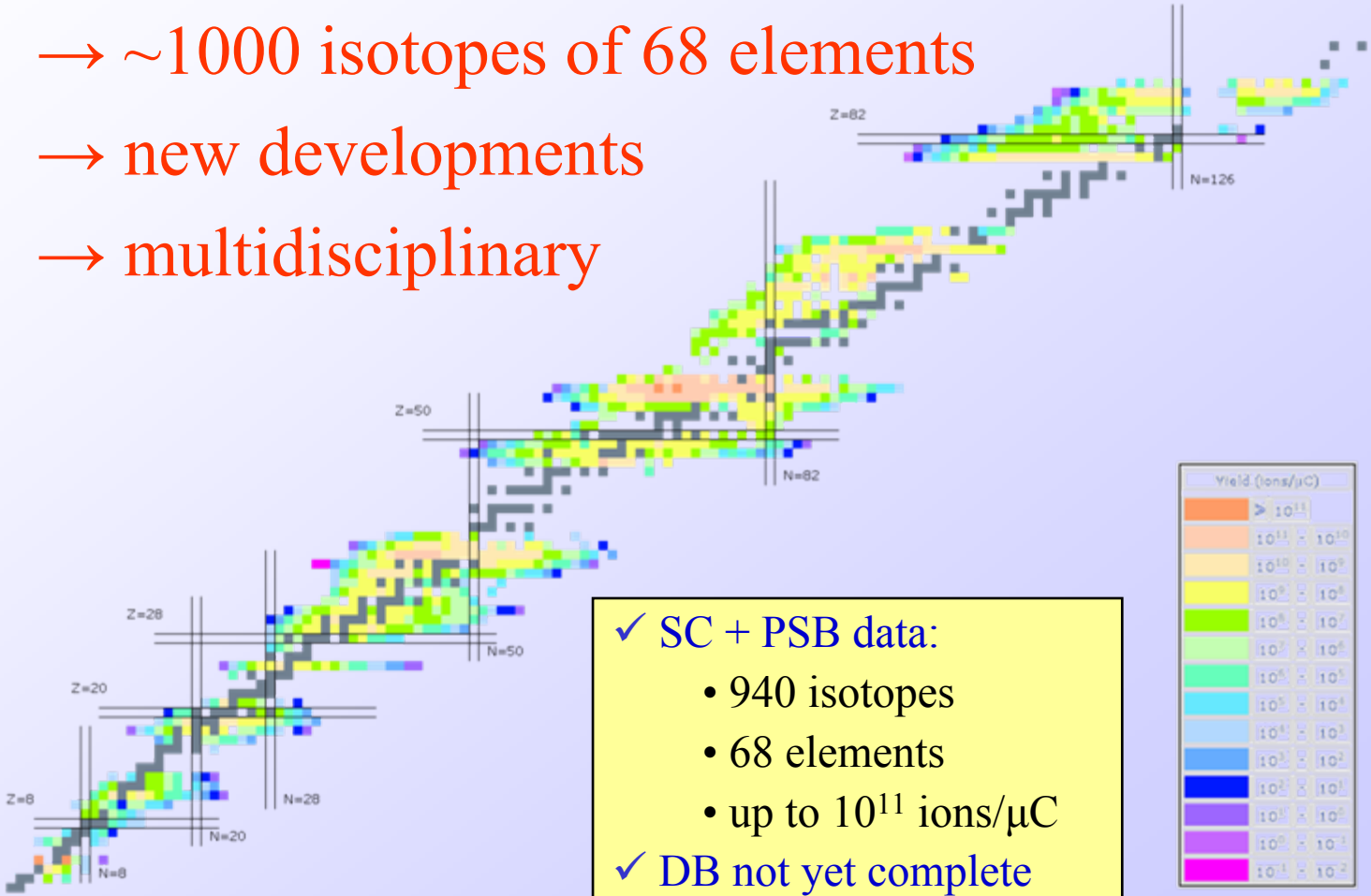
ISOLDE: radioactive beam facility

✓ World leading

→ ~1000 isotopes of 68 elements

→ new developments

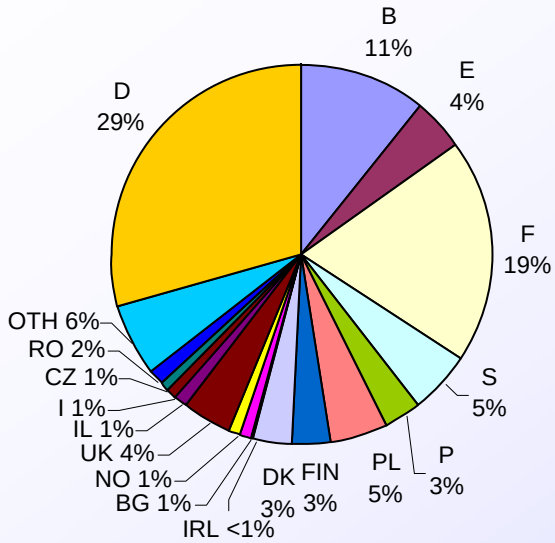
→ multidisciplinary

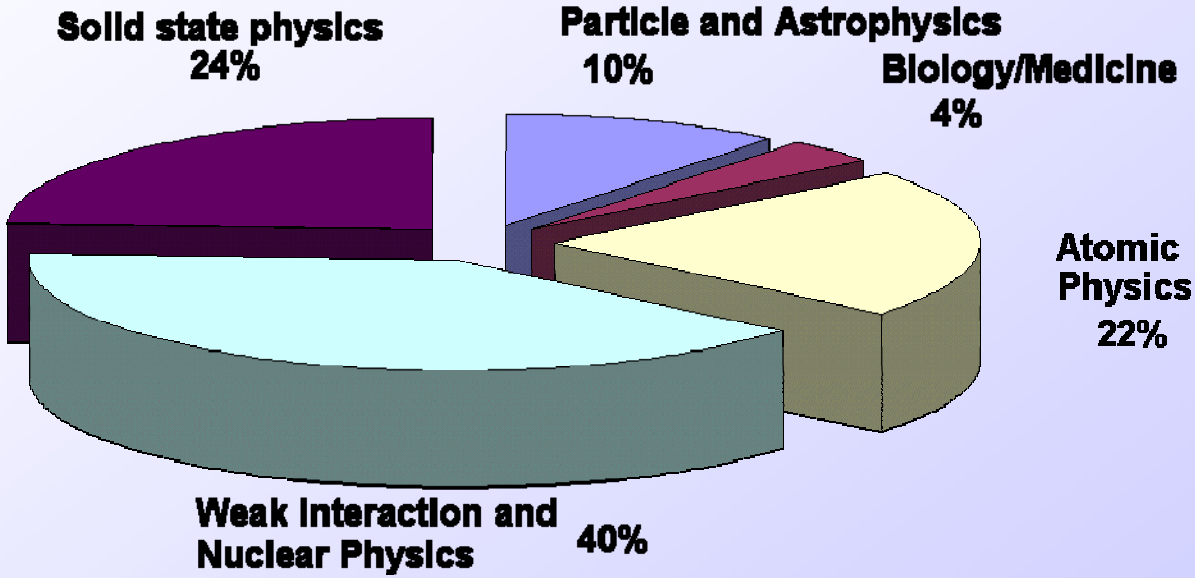


✓ SC + PSB data:
- 940 isotopes
- 68 elements
- up to 10^{11} ions/μC

✓ DB not yet complete

Users and Science





- ✓450 users (7% total CERN)
  - → potentially *~1000 users with upgrade*
- ✓ 25 countries; 100 institutions
- ✓ 175 projects (over 4 years)

Physics programme

Applied Physics

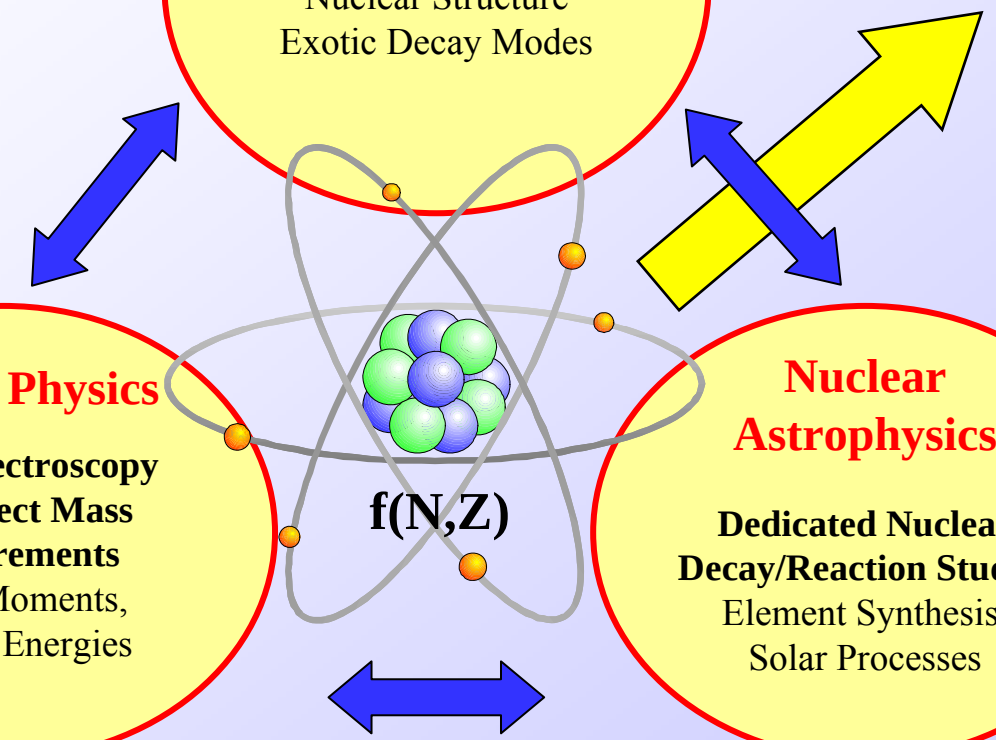
Implanted Radioactive Probes, Tailored Isotopes for Diagnosis and Therapy
Condensed matter physics and Life sciences

Nuclear Physics

Decay Spectroscopy
REX-ISOLDE Reactions
Nuclear Structure
Exotic Decay Modes

Fundamental Physics

Direct Mass Measurements, Dedicated Decay Studies - WI
CKM unitarity tests, search for β-ν correlations, right-handed currents



Atomic Physics

Laser Spectroscopy and Direct Mass Measurements
Radii, Moments, Binding Energies

Nuclear Astrophysics

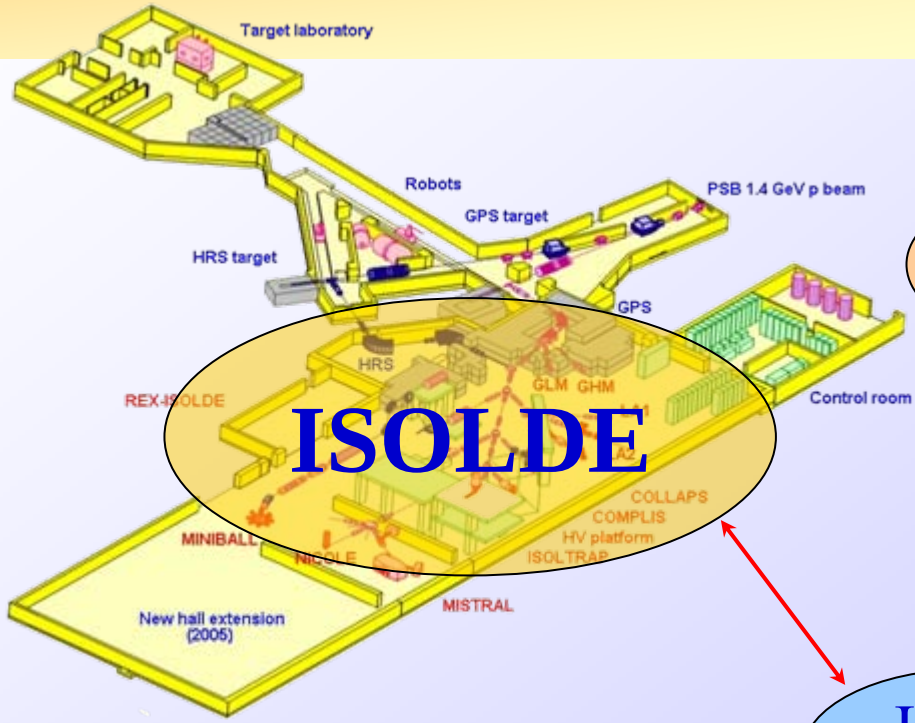
Dedicated Nuclear Decay/Reaction Studies
Element Synthesis, Solar Processes

ISOLDE upgrades: HIE-ISOLDE

- ✓ REX energy upgrade and increase of current capacity
  - Staged energy upgrade: 5.5 MeV and 10 MeV/u
  - REX low energy stage upgrade
- ✓ ISOLDE proton driver beam intensity upgrade
  - PSB faster cycling
  - Proton driver upgrade
- ✓ ISOLDE radioactive ion beam quality
  - Target and ion source development
  - Mass resolution
  - Emittance

ISOLDE: general organization

INTC (PAC)



Collaboration 10 countries

Users ~450

AB

ATB | OP | CO | RF | PO | ...

AT

VAC

PH

IS

SC

RP

Organization: Committees

- ✓ Collaboration
  - → ISCC Chairman = P. Butler (U. Liverpool)
  - → ISOLDE Spokesperson = K. Riisager (PH/IS)
- ✓ INTC
  - → Chairman = M. Huyse (K.U. Leuven)
- ✓ Standing group for the upgrade of ISOLDE
  - → Chairman = K. Riisager (PH/IS)
- ✓ CERN

User facility!

- ✓ Perceived as complicated
  - → NOT a "come, put sample, take data and go"
  - → Compared to other RIB facilities
  - → Large input from collaboration to balance CERN efforts
  - → Needs involvement of users groups
- ✓ Many free parameters
  - → Ex. Types of target + ion source combination (cf. next talks)
    - materials, formats, combination
    - ion sources
    - purification
- ✓ Scale of experiments
  - → Collaborations of 10 to 30 people
  - → Permanent experiments
    - Volume, complex equipment, cryogenics
  - → "Traveling" experiments
    - Detectors and electronics, SSP, shipping…
  - → Large external collaborations: Mini-Ball

Request for Schedule 2006

- ✓ Requested = **481** shifts
  - → Schedule allows up to 350
- ✓ Maximum 10 UC_x targets (+ developments)
  - → Requests ~ **265 shifts**
- ✓ RILIS operation
  - → Requests for 2006 amount to **230 shifts**
  - → Close to 2000 hours on line (exp. + dev. + prep.)
- ✓ REX-ISOLDE
  - → Beam requests = **174 shifts**
- ✓ Operations limited
- ✓ Target development

Beam requests

- ✓ Requested number of shifts
- ✓ Target/ion source
  - → RILIS element (if applicable)
  - → Neutron converter
  - → Gas leak
  - → …
- ✓ Isotopes, RIB
  - → Energy (low E, REX)
  - → Contaminants/purity
- ✓ Running conditions
  - → GPS/HRS (M/ΔM)
  - → HV
  - → p pulse structure, intensity
  - → **REX-ISOLDE**
- ✓ Space requirements (location)
- ✓ Time requirements (run, mounting, calibrations)

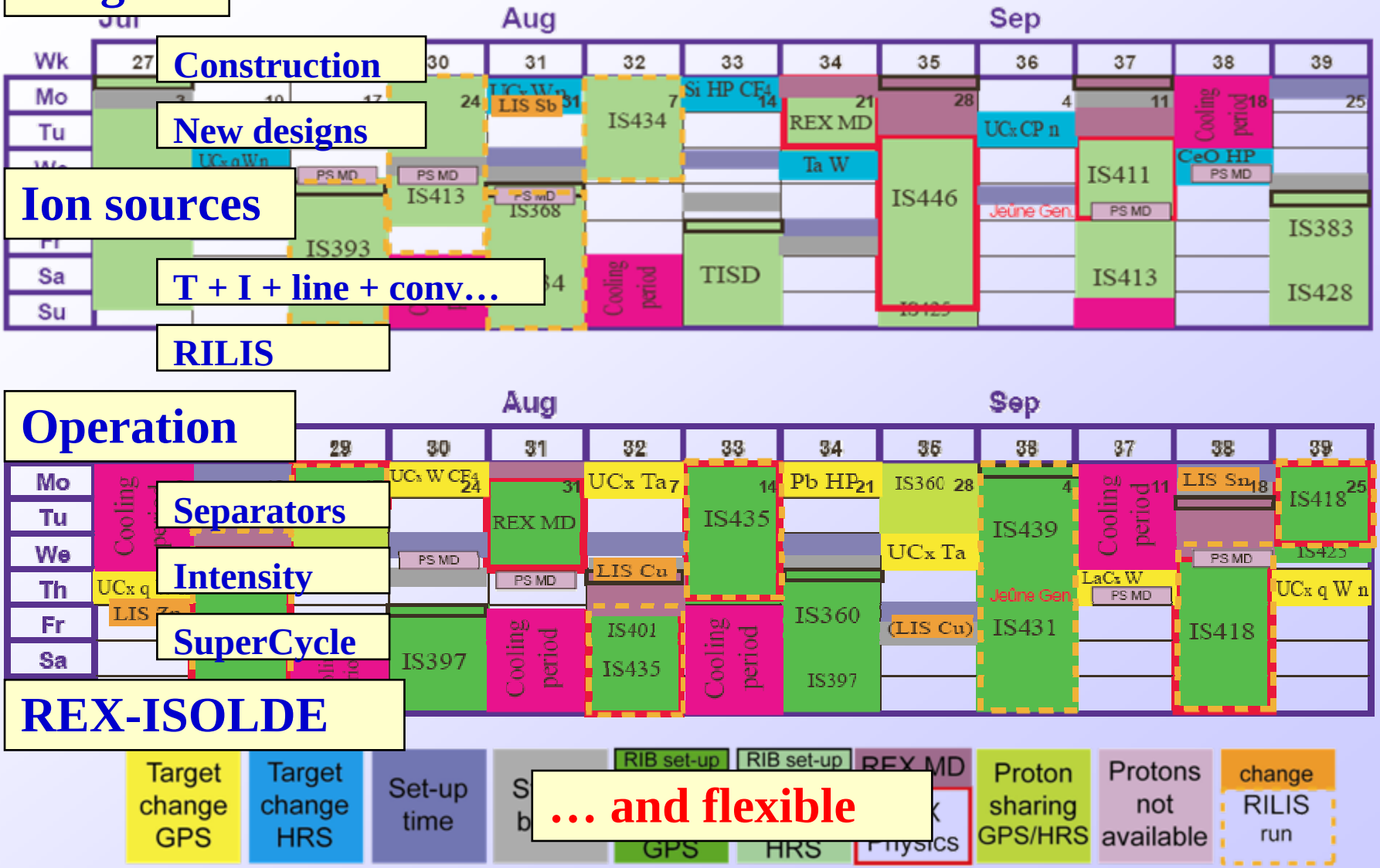
Schedule 2006

Targets

Ion sources

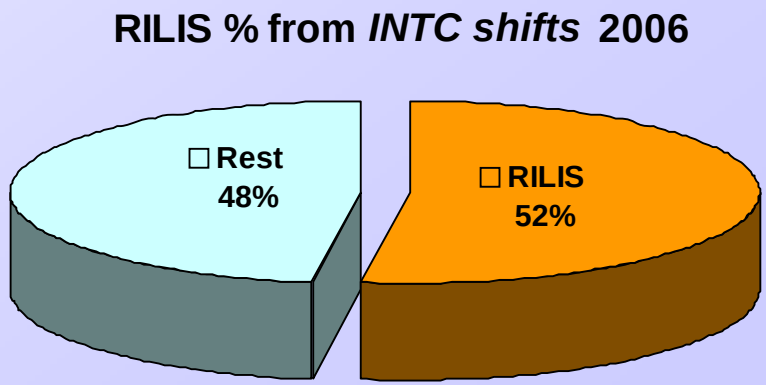
Operation

REX-ISOLDE

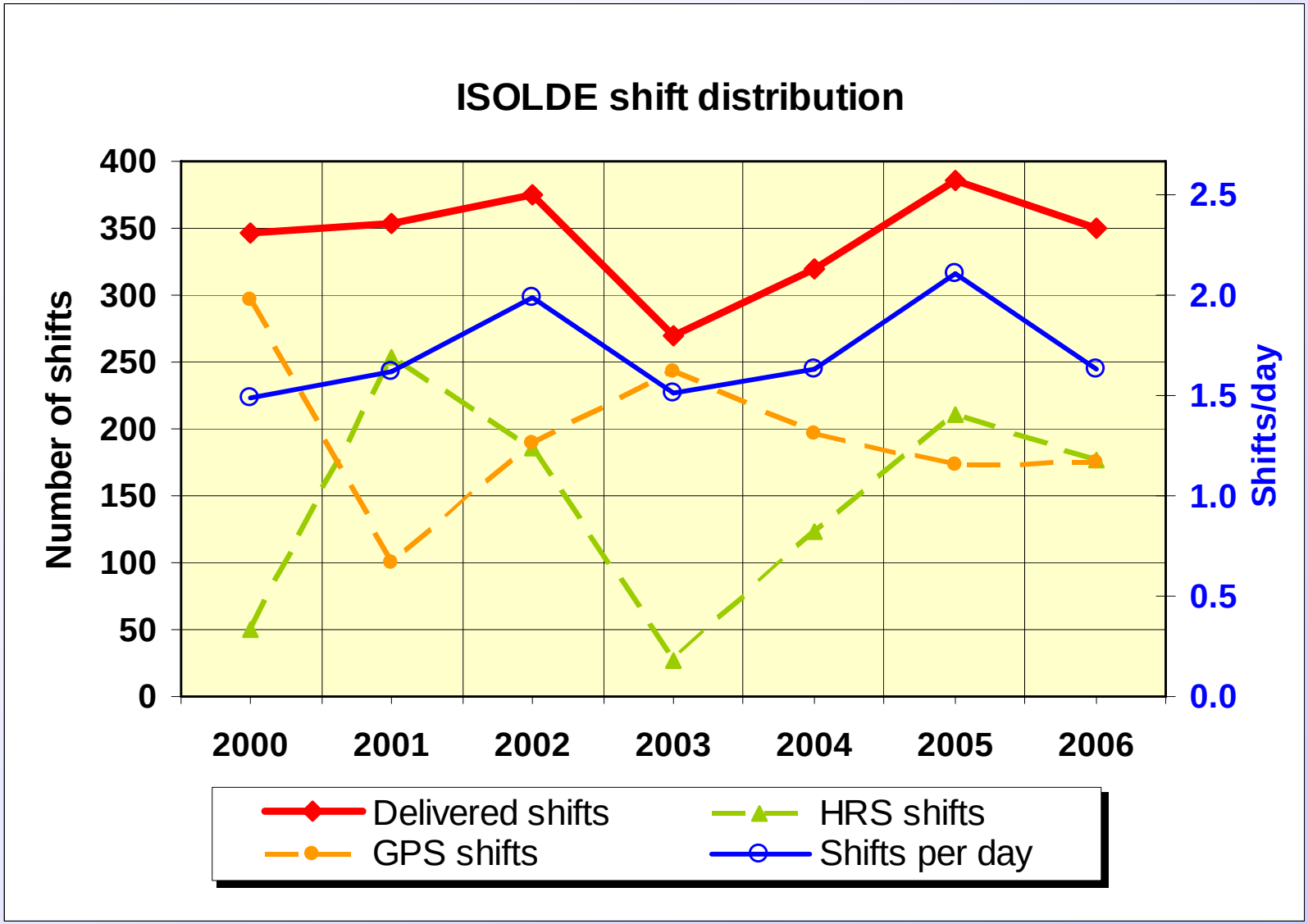


ISOLDE beam time summary 2006

- ✓ ISOLDE delivered **350.5 shifts**
  - → 281 (80%) experiments INTC
  - → 69.5 (20%) other
    - TISD + REX-MD + Coordinators reserve (LoIs, recovery…)
  - → 37 research projects (“experiments”)
  - → Integrated # protons = 7.55E+19
    - just indicator! (cf. example Ti target)
    - Far from 2E+20 limit → We need flexibility
- ✓ REX-ISOLDE
  - →114 INTC shifts + 9 MD (RIB)
- ✓ RILIS
  - →164 total shifts, 146.5 INTC exps.
  - →2132 online hours + 120 h offline



Schedule 2006



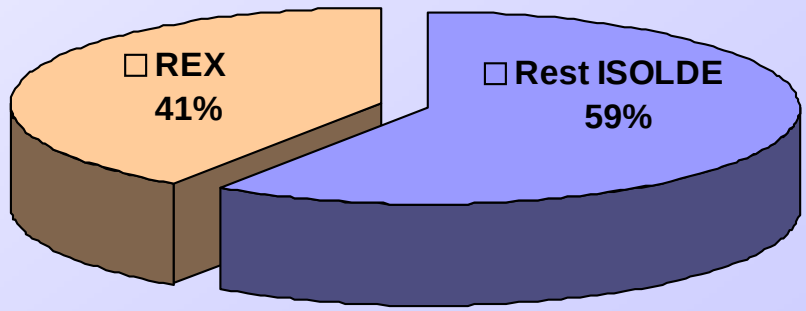
REX-ISOLDE 2006

- ✓ Fifth anniversary of 1st post-accelerated RIB
  - → 30 Oct 2001

45 radioactive isotopes of 17 elements

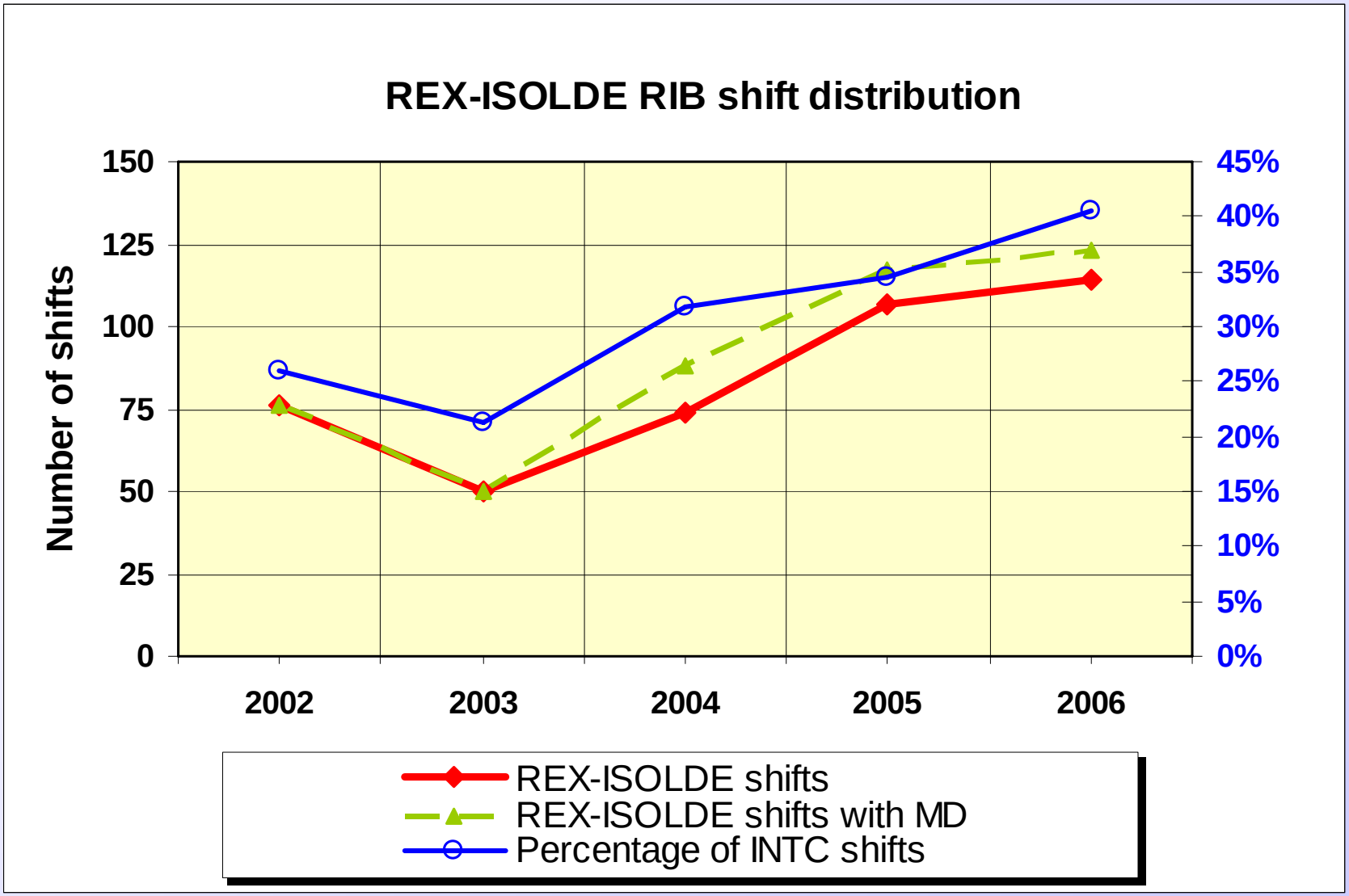
- ✓ In **2006** delivered 114 shifts for experiments
  - → 9 more RIB shifts for development
  - → Stable beam, setup time …

REX % from *INTC shifts* 2006



- ✓ Operation
  - → Allocated time for REX-MD
  - → Running up to 2.9 MeV/u [3.15 MeV/u (light ions)]
  - → Reduced energy [9-gap]
  - → Charge breeding of heavy elements!
  - → Reliable!
- ✓ Good success rate
  - → … and new beams for Physics…

REX-ISOLDE 2002-2006



Failures 2006 (affecting Physics): Startup

- ✓ Switchyard was blocked
  - → deflector at GHM bent when repaired
- ✓ Line polarity left inverted from 2005
- ✓ Tape station not working
- ✓ Compressed air
  - → The white powder phantom
  - → Problematic target changes (i.e. UCx W 322, 10 May)
- ✓ Broken CeO HP 319 target + other (HV)

CONSECUENCES

IS427	cancelled	11 shift lost	rescheduled
IS401/442	modified physics aim	lost 2.5 shifts	
IS358	no physics outcome	lost 4.5 shifts	[also RILIS]
IS383/428	cancelled	17	rescheduled
IS413	little physics outcome	5	[also powercuts]
IS442	modified collections	3	

Failures 2006: Power cuts

- ✓ 15 May ~ 6:40
- ✓ 16 May ~ 14:00
  - → Ventilation PLC problem already appeared (security chain)
  - → GPS survived / HRS (UC W 272) affected (IS413/IS442)
- ✓ 17 Jun ~ 2:40
- ✓ 22 Jun ~ 1:40
  - → 23 Jun, ventilation problem (security chain)
  - → Delays, shortened runs
- ✓ 29 Jul ~ 7:45
  - → Again VENTILATION PLCs
    - It had happened before
    - Took until 4 Aug
  - → IS397 + REX-MD cancelled
  - → IS413 cut short
  - → IS434 (15 shifts) cancelled + IS368 not successful

Main failures 2006: Beam issues

- ✓ Focused beam on Ti W 323 target
  - → IS437, decreased performance → to be repeated 2007
- ✓ NORM beam (not staggered) onto Pb HP 256
  - → IS360/IS448, saved
- ✓ Beam sent to ISOLDE without request, 19 Jun 2006
  - → Well, it did not hit anyone…
  - → Contaminants on stable beam run
- ✓ Reported "request not seen on CCC"
- ✓ Steering due to MBL201 losses
  - → UC W n q 338
  - → Beam positioning (IS411, hitting the target)
- ✓ Protons hitting the target and not converter
  - → UC W n q 330
  - → IS411

Main failures 2006: other

- ✓ BTY.QDE209 leak
  - → 10 days to repair
    - IS397 cancelled + REX-MD (simultaneous EBIS cathode problem)
    - Delays IS393/IS413 and following week
- ✓ Robot (target handling)
  - → Delays, UC W n 330
    - IS413 cut short, IS393 affected (ended by power cut)
- ✓ HV problems: UC W 320 (2^{nd}), SiC HP 334, UC W n 331 (2^{nd})
- ✓ Targets:
  - → Target heating off: Ta W 327, Ta W 335
  - → Target heating blocked: UC CP n 336 [then line broke], UC W n q 338
  - → Broken units, delays, missing elements (converter, marker)…
- ✓ HRS slits: IS441, IS393, IS413

Other conditions

- ✓ Limit on average p intensity
  - → 2006: 7.5E19 protons
    - Far from the 2E20 limit
- ✓ PSB → ISOLDE
  - → Beam issues
  - → VISTAR
- ✓ PS inflector zone
  - → Decouple from PSB
- ✓ Security chains for ISOLDE areas
  - → Reset key in CCC Prevessin
- ✓ Response of controls
- ✓ Shipping of radioactive samples

Users input

- ✓ Need of technical and experimental area support
  - → "… in house groups do an excellent job but there are not enough people to deliver extended support to external users…"
    - "Complicated" facility
    - Seen as "closed community"
  - → Facility needs to be continuously manned 24 h
    - First step is routine presence of operators
    - Friday 17:00 (+weekend) effect
      - Seen in standard runs
      - Enhanced in the event of serious problems: power cuts!
  - → Presence of technicians in the experimental area
    - Especially for new groups
  - → RP support for physics
  - → Communication (users)!
    - ISOLDE technical teams
    - PSB i.e. changes of SC

Users input

- ✓ The aim of our work is the physics outcome
  - → Impression that this aim is lost between the different activities
    - CERN/ISOLDE seen as a whole by users
    - Segmentation of activities
    - Each link of the chain not always know what the rest is doing
  - → Need of integration of activities at the technical level
    - Nuts and bolts level
    - Supervision (→ decisions)
  - → Assure transfer of know-how
- ✓ Standardize maintenance
  - → High priority items for ISOLDE are done with low priority
  - → "Lower" priority items not done
    - Recurrent requests/needs by users not implemented
    - HRS slit system, REX timing signals…

Conclusions

- ✓ Shutdown
  - → Need a share of high priority
  - → Establish standard procedures and tests
  - → Further hands-on integration
- ✓ Running period
  - → Assure overlap between different subtasks
  - → Avoid scattering of responsibilities
  - → ISOLDE as whole machine (targets, low E, REX…)
- ✓ User support
  - → Support for physics in the experimental area
  - → (Need RP support)
  - → Favour contact users ↔ ISOLDE groups