

ISOLDE scientific coordinator's report

INTC meeting, February 11, 2008

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Impact of technical issues

Running statistics 2007

Report from GUI

Planning for 2008

Main problems affecting physics 2007

- ISOLDE/CERN controls (not working properly since startup, also affecting target heating and separator magnets)
- target HT (lots of tripping due to outgassing from target)
 - 60kV or 50kV operation not possible in some cases
- REXTRAP (shortcut at trap electrodes and control software crash after WINDOWS/NICE update)
- REX-LINAC scaling not working properly
 - Difficult setup and probably lower yield
- interventions for vacuum problems (especially during RFQ installation)
- accidental change of beam focus

Main failures of physics program (I)

- Broken target/ion source
 - CaO/MiniMono (#236) target/ion source failure
stopped TISD run
 - ZrO/HP (#349) ion-source short cut
IS442, IS450, and IS453 cancelled (7 shifts)
 - HfO/MiniMono (#363) overheating damaged ion source
IS400, IS445, and test collections cancelled (13 shifts)
 - UC_x/q-n-RILIS(Cd) (#362) RILIS window "dirty"
IS413 no Cd beam (8 shifts)

- Target performance
 - UC_x/RILIS(Ag) (#322) large contamination with In, Cs, Ba
IS413 hampered to reach neutron rich Ag isotopes (A>121) (8 shifts)
 - UC_x/RILIS(Pb) (#347) very low Pb yield (also due to p-beam-intensity limitation)
not enough yield for IS413 and IS448 (8 shifts)
 - CaO/CP (#366) large ³⁵Cl contamination and REXTRAP cleaning not working
IS433 hampered, no results (10 shifts)

Main failures of physics program (II)

- REX performance
 - IS451 very low yield for $^{96}\text{Sr}^{19}\text{F}$ (LINAC scaling?)
 - IS411 reduced program, ^{148}Ba and ^{150}Ba not possible due to contaminations
 - IS454 hampered due to lower ^{30}Mg yield
 - IS452 stopped earlier due to crash of REX-TRAP control system
- Limitation of p-beam intensity at GPS (max $1\mu\text{A}$)
 - general issue for all GPS runs
 - IS417 very low ^{11}Li ion yield, managed to do physics due to higher efficiency of new detector system
 - IS413 and IS448: Pb ion yield too low for physics
- Vacuum problems
 - Leak at GHM prevented “parallel” collections
 - IS417 lost three shifts due to problems with vacuum system after intervention at merging switchyard (running in manual mode afterwards)
 - IS454 stopped for more than three shifts due to vacuum leak and intervention at merging switchyard

Requests for schedule 2007

- Requested = **480** shifts
 - Schedule allows up to 400 shifts
- Maximum 10 new UC_x targets (+ developments)
 - Requests ~ **260.5 shifts**
- RILIS operation
 - Requests for 2007 amount to **249 experiment shifts**
 - More than 2000 hours on line (exp. + dev. + prep.)
- REX-ISOLDE
 - Beam requests = **205 shifts**
- Operations limited
- Target development
- ISCOOL installation and commissioning
- Move of MINIBALL setup

ISOLDE schedule 2007

ISOLDE dates 2007:

protons started April 16
 physics started April 20
 protons stopped Nov. 12

→ 29.5 weeks
 for physics

- 30 experiments (7 REX runs)
- 24 target units (4 old units)
- 12 UC_x targets (2 old units)

Apr		May					Jun							
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26	
Mo	2	Easter 9	16	Tech stop 23	IS442 ³⁰ I68 I64	IS442 ⁷	Stop PS 14	IS427 ²¹	Whitsun 28	Tech stop 4	IS448 ⁴	11	IS397 ¹⁸	25
Tu				TISD	IS455	IS413			IS437	REX MD	IS453 IS443	IS441	IS390	
We							Ascen				PS MD	IS442 IS443	(IS442) I64	
Th									IS413			IS434	IS413	
Fr	G Friday		TISD	IS455	IS425	IS442 IS450 IS453	IS427	IS437	IS413					
Sa									IS448					
Su												IS397		

Jul		Aug					Sep						
Wk	27	28	29	30	31	32	33	34	35	36	37	38	39
Mo	2	9	IS439 ¹⁶	23	30	6	IS414 ¹³	20	TISD 27	IS400 ³	10	IS397 ¹⁷	24
Tu		IS451							Tech stop		IS424		IS410
We	PS MD		PS MD	IS442	IS411	IS414	PS MD	IS452	IS413	Jeune Gen			
Th													
Fr	IS451												
Sa		IS439	IS431 (coll)				IS452	IS442 (IS448)	IS445 (TISD)	IS424	IS397	IS409	IS417
Su													

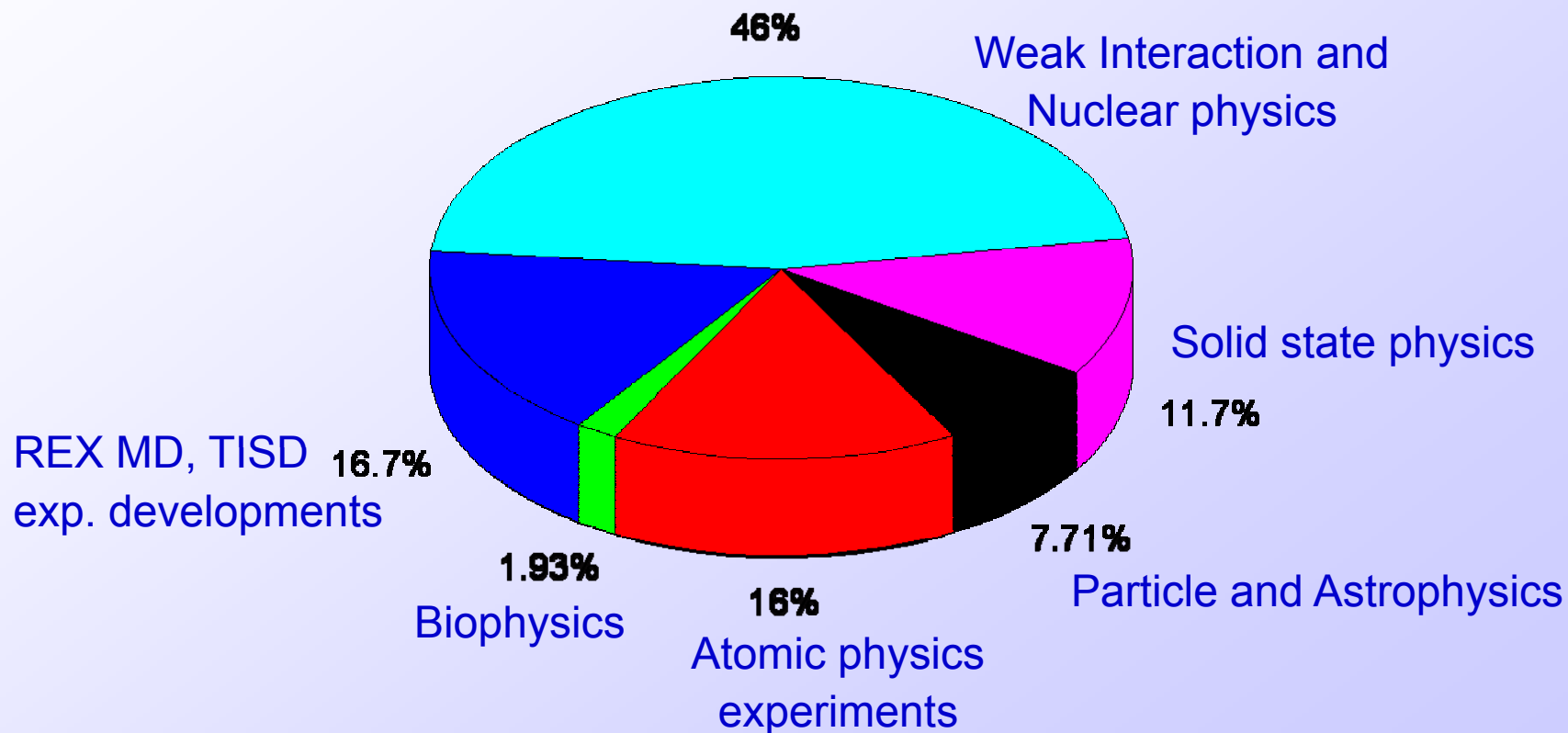
Oct		Nov					Dec						
Wk	40	41	42	43	44	45	46	47	48	49	50	51	52
Mo	1	8	15	22	29	5	12	19	26	3	10	17	24
Tu	IS410				Tech stop								Christmas
We													
Th													
Fr													
Sa	IS425 (IS390)	IS433			IS454	ISCOOL							
Su	(coll)												

Stop protons 2007

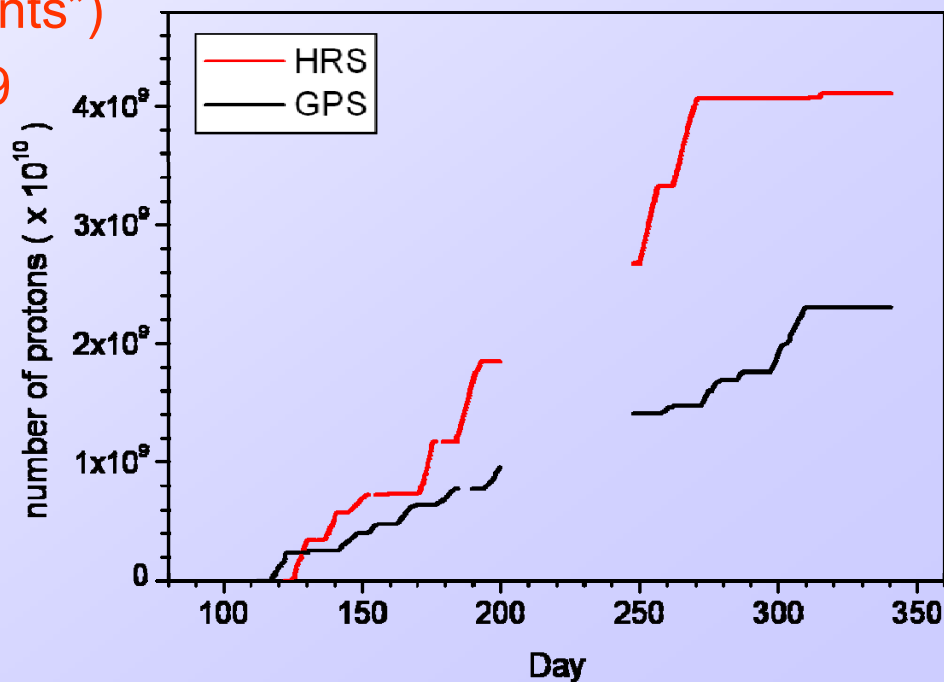
Allocated shifts in 2007

480 shifts requested in 2007

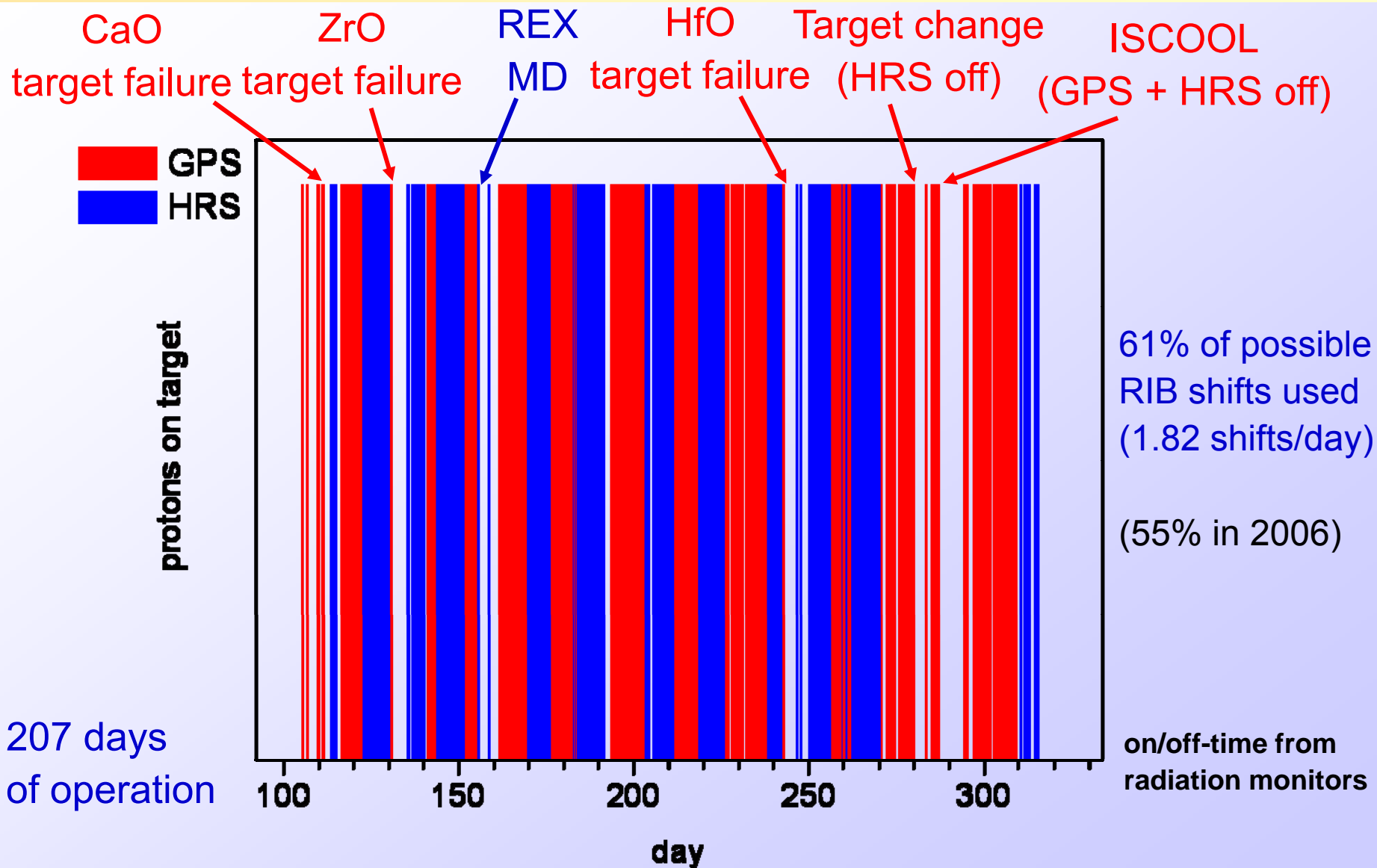
407 shifts scheduled for INTC experiments
(in total 467 shifts, including TISD, ISCOOL, etc.,
with 261 shifts on GPS and 206 on HRS)



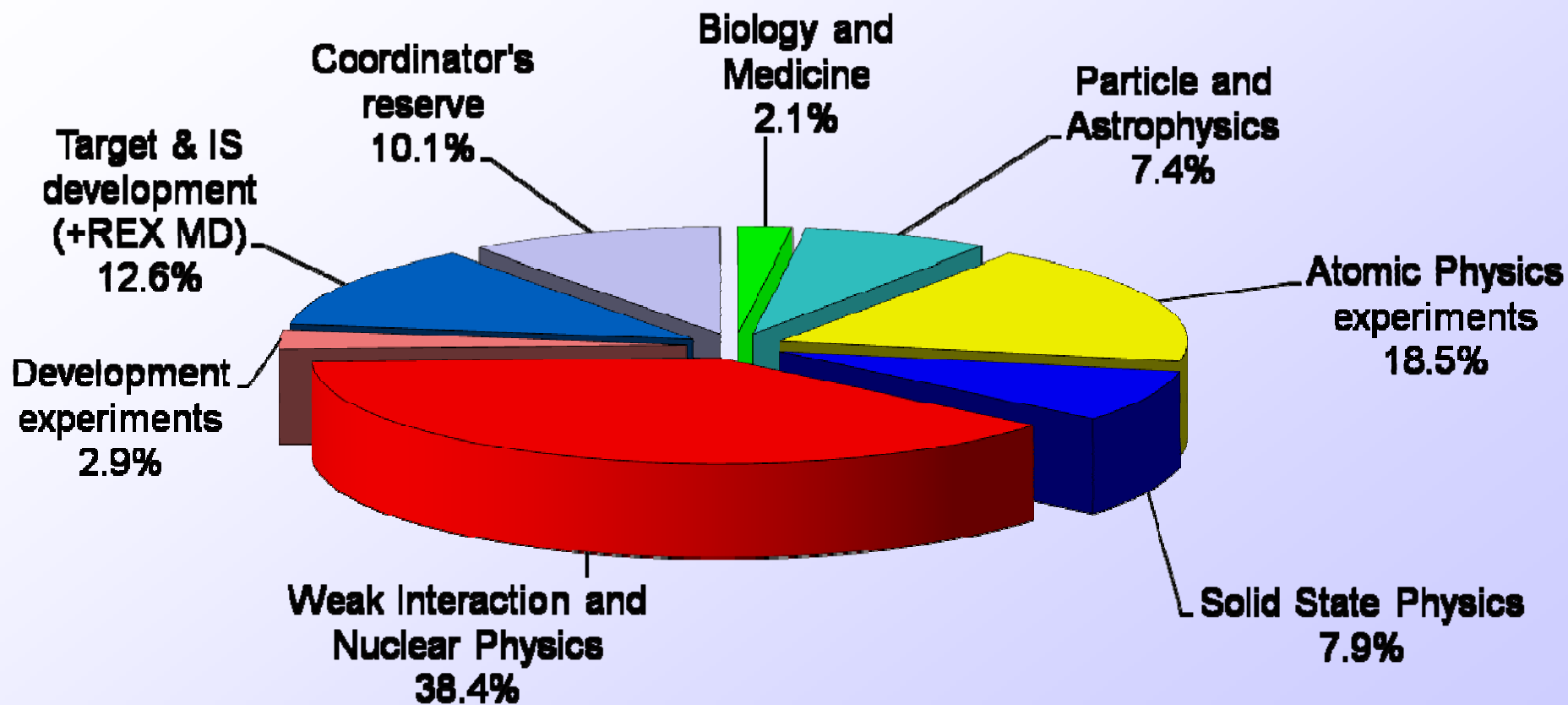
- ISOLDE delivered **377.5 RIB shifts**
 - **292 (77.4%) for INTC experiments**
 - **85.5 (22.6%) other**
 - Standard target check + TISD + REX-MD
 - Coordinators reserve: debugging, recovery, Lols
- **30 research projects (“experiments”)**
- **Integrated # protons = 6.41E+19**
 - Below 2E+20 radioprotection average limit
 - limitation of GPS proton beam intensity (activated air release)
- **Installation of ISCOOL RFQ**
- **Running for 207 days**
 - One week no beam for ISCOOL installation



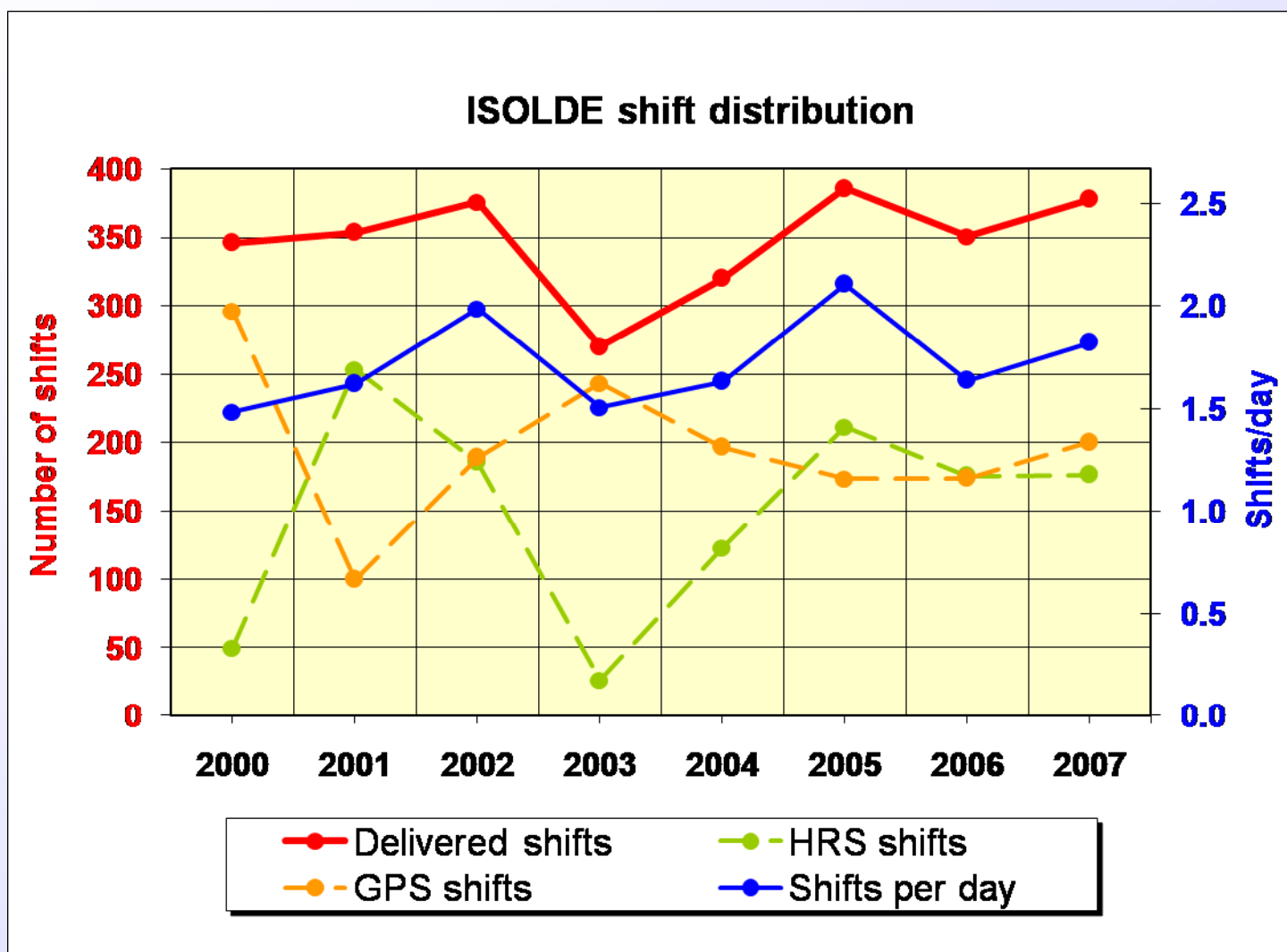
RIB overview GPS/HRS 2007



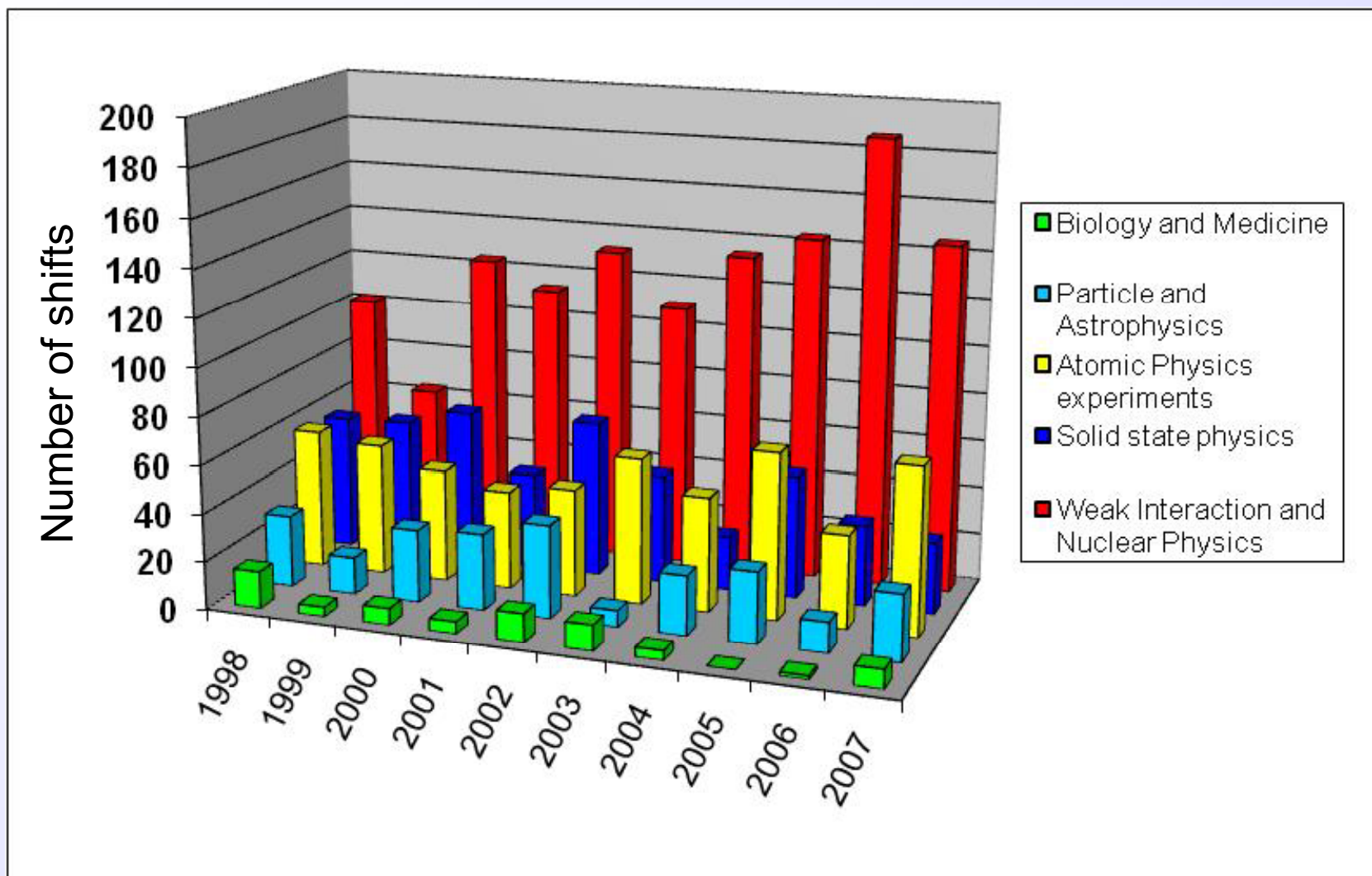
ISOLDE shift distribution 2007



ISOLDE shift distribution 2000-2007



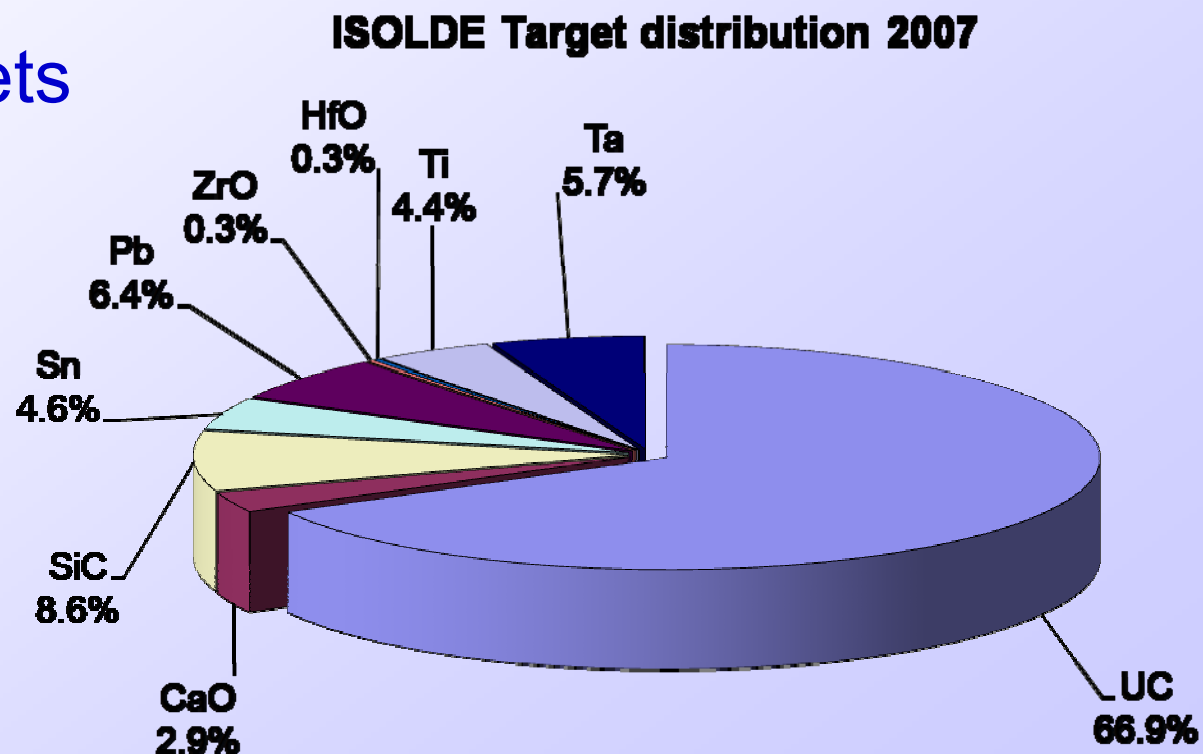
Shift distribution 1998-2007



Key resources: targets

- Actinide targets
 - 252.5 shifts (out of 377.5) [67%]
 - 10 new units (+ 2 old)

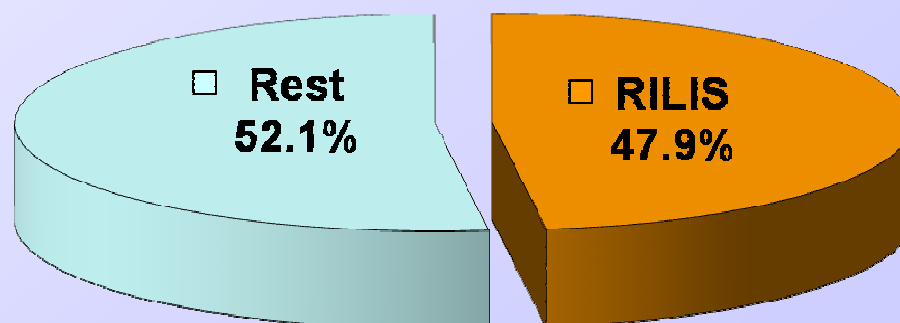
- In total 24 targets
 - 20 new units



Key resources: RILIS

- 154.5 total RIB shifts
 - 146.5 shifts for INTC shifts
- 1763 hours for online work
 - includes setup, yield checks, etc.
- 14 IS experiments
- Beams: Ag, Mg, Pb, Mn, Cu, Po, Cd

RILIS % from *INTC* shifts 2007



REX-ISOLDE 2007

- 88.5 RIB shifts delivered to experiments

- + 6 RIB shifts for development
- 7 experiments
- REX-ISOLDE training for machine supervisors

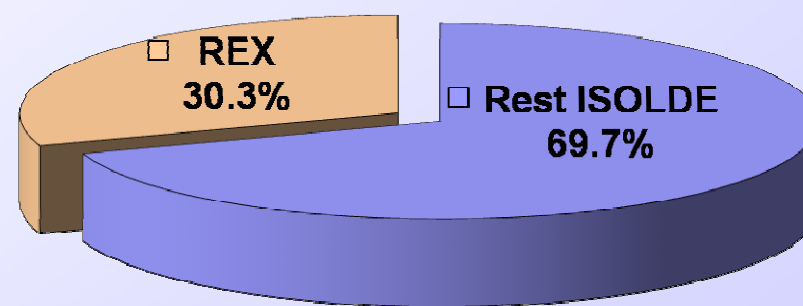
- $E \leq 3$ MeV/u

- $E=2.99$ MeV/u (^{31}Mg)

- Efficiency

- Range 1.5% - 10%

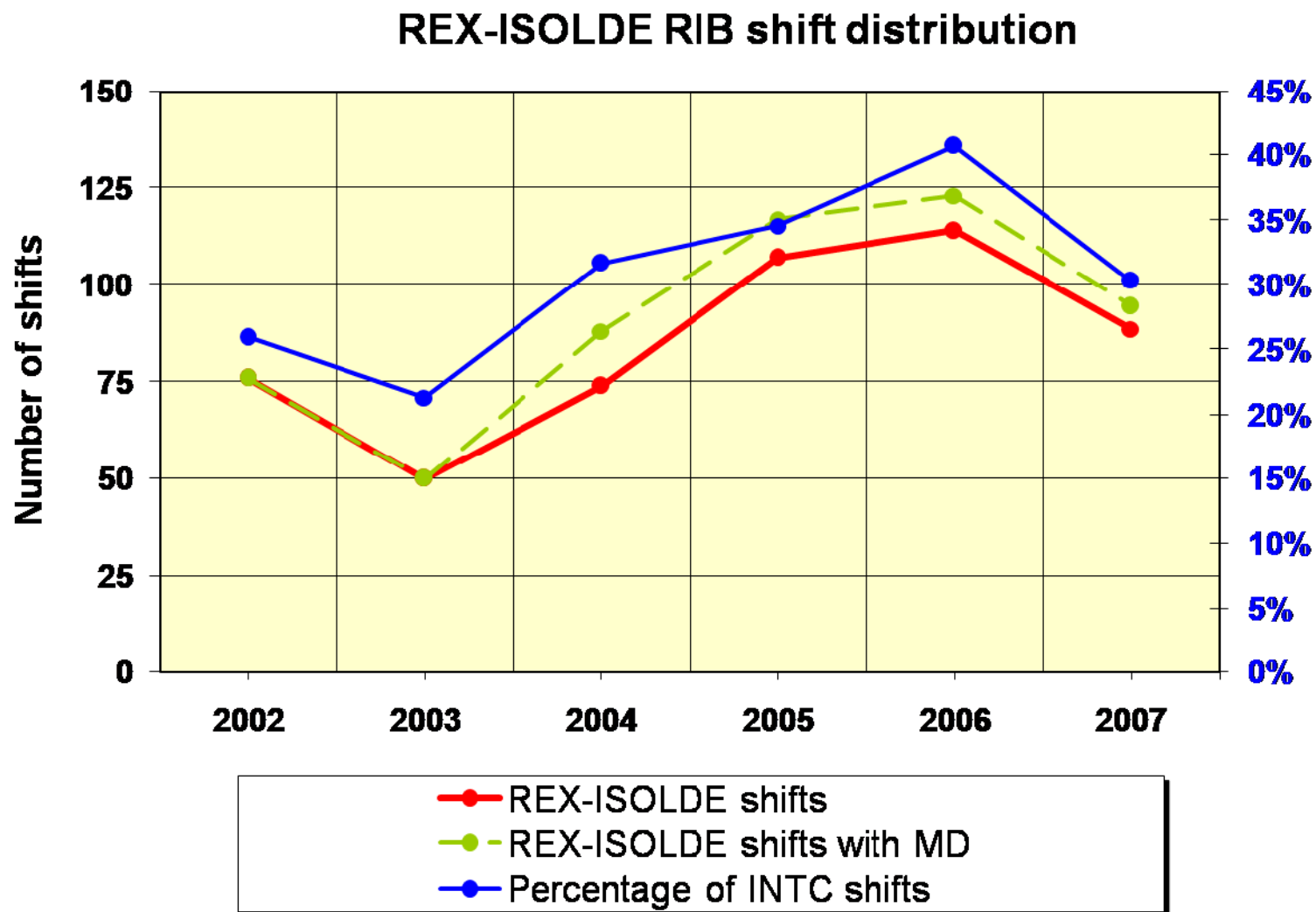
REX % from *INTC* shifts 2007



F. Wenander

	Z	N	A	q	half life	C stripper ug/cm2	stripped q	E MeV/u	breeding ms	eff. %
F	9	8	17	5	64.8s	50	9	2.60	18	7.5
Sr	38	58	96	23	1s			2.87	120	2.0
Ba	56	84	140	33	12.75d			2.84	171	4.5
Ba	56	86	142	33	10.7m			2.84	168	5.0
Ba	56	92	148	35	610 ms			2.84	230	1.5
Hg	80	104	184	43	30.6s			2.85	170	1.7
Hg	80	106	186	43	1.4m			2.85	170	1.7
Hg	80	108	188	44	3.25m			2.85	170	1.7
Mg	12	19	31	9	230ms			2.99	28.5	10.0
Mg	12	18	30	7	335ms			2.27	15	10.0
Mg	12	18	30	7	335ms			1.91	15	10.0
Mg	12	18	30	7	335ms			1.56	15	10.0
Mg	12	18	30	7	335ms			2.85	15	7.2

REX-ISOLDE 2002-2007



- New REX radioactive beams for Physics in 2007
 - $^{96}\text{Sr}^{27+}$
 - $^{140,142,148}\text{Ba}^{33+,33+,35+}$
 - $^{184,186,188}\text{Hg}^{43+,43+,44+}$
- 3 new elements and
7 new radioactive isotopes
- New record for heavy masses
 - $^{238}\text{U}^{56+}$ accelerated ($A/q = 4.25$, $T_{\text{breed}} = 500$ ms)
 - $^{184,186,188}\text{Hg}$ accelerated to 2.8 MeV/u
 - So far 53 radioactive isotopes of 20 elements

Highlights 2007

See ISOLDE workshop December 2007

- IS414 first proof of shape coexistence at the borderline of the 'Island of Inversion' - second 0^+ state in ^{30}Mg
- IS454 $d(^{30}\text{Mg}, ^{31}\text{Mg})p$ transfer reaction at REX/MINIBALL
- IS409/410 Coulex of ^{31}Mg
- IS452 Coulex of $^{184,186,188}\text{Hg}$
- IS456 Spectroscopy of neutron-deficient Po isotopes using the ISOLDE RILIS
- IS413 first direct mass measurement of ^{99}Cd
- IS439 $^{71,72}\text{Cu}$ Spin determination and magnetic and quadrupole moment
- first on-line emission channeling experiments
- first ISCOOL results – cooled ion bunches for spectroscopy
- ...

and ISOLDE Newsletter (coming soon ...)

Target priorities

- First priority: approved experiments
- Second priority: letters of intent
- Third priority: research and development

<http://isolde-upgrade.web.cern.ch/isolde-upgrade>

TISD runs in 2007

Four dedicated TISD runs:

- CaO / CP bivalve
- CaO / MiniMono
- HfO / MiniMono
- UCx / q n W RILIS

+

yield measurements throughout the year

Apr		May							Jun				
Wk	14	15	16	17	18	19	20	21	22	23	24	25	26
Mo	2	Easter 9		Tech stop	IS442 ³⁰ I68 I64	IS442 ⁷	Stop PS 14	IS427 ²¹	Whitsun 28	Tech stop IS448 ⁴		IS397 ¹⁸	25
Tu				TISD			Stop PS						
We					IS455	IS413			IS437	REX MD	IS453 IS443	IS441	IS390
Th							Ascen						(IS442)
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Su	(coll)												

Stop protons 2007

Target and Ion Source R&D (last meeting)

Priority 1

- **IS451:** SrF⁺ REX
- **IS452:** Hg REX
- **IS413:** (Add): ¹⁴O
- **P225:** Ge/Se beams
- **P228:** ⁷²Kr [not recommended, but INTC requests high priority]
- **P231:** LIST - ⁶²Ga
- **P232:** Fr suppression (Hg/Tl)

Priority 2

- **P230:** Rare earth beams (fluorides) for mass measurements
- **I70:** ⁴⁴Ti

Priority 3

- Negative beams (³⁰S) combined with ISCOOL

Target and Ion Source R&D (last meeting)

Priority 1

- **IS451:** SrF⁺ REX **TESTED (NOT OK)**
- **IS452:** Hg REX **DONE**
- **IS413:** (Add): ¹⁴O
- **IS458:** Ge/Se/Sr molecular beams **PARTLY TESTED (NOT OK)**
- **P228:** ⁷²Kr [not recommended, but INTC requests high priority]
- **IS462:** LIST - ⁶²Ga
- **IS463:** Fr suppression (Hg/Tl) **TESTED (UCx quartz)**

Priority 2

- **IS461:** Rare earth beams (fluorides) for mass measurements
- **I70:** ⁴⁴Ti **UNDERWAY**

Priority 3

- **I71:** Negative beams (³⁰S) combined with ISCOOL

Target and Ion Source R&D (additions)

Priority 1

- **IS459/P227**: Yield measurement for $^{105,107}\text{Sn}$
- **IS433**: purification of ^{35}Ar beam (observed large ^{35}Cl contamination during 2007 run with CaO / CP target)
- **IS435**: reduction of ^{75}Ga background in ^{75}Cu beam
- **IS411**: ^{148}Ba , reduction of contaminations

Priority 2

- **P226**: Yield measurement for ^{128}Cd
- **I51**: ^{22}Mg beam, cleaning of ^{22}Na (+ REX cleaning)

Priority 3

- UC_x target development and temperature controlled transfer (trapping material screening, i.e. other elements to be frozen out)

Accelerator schedule 2008

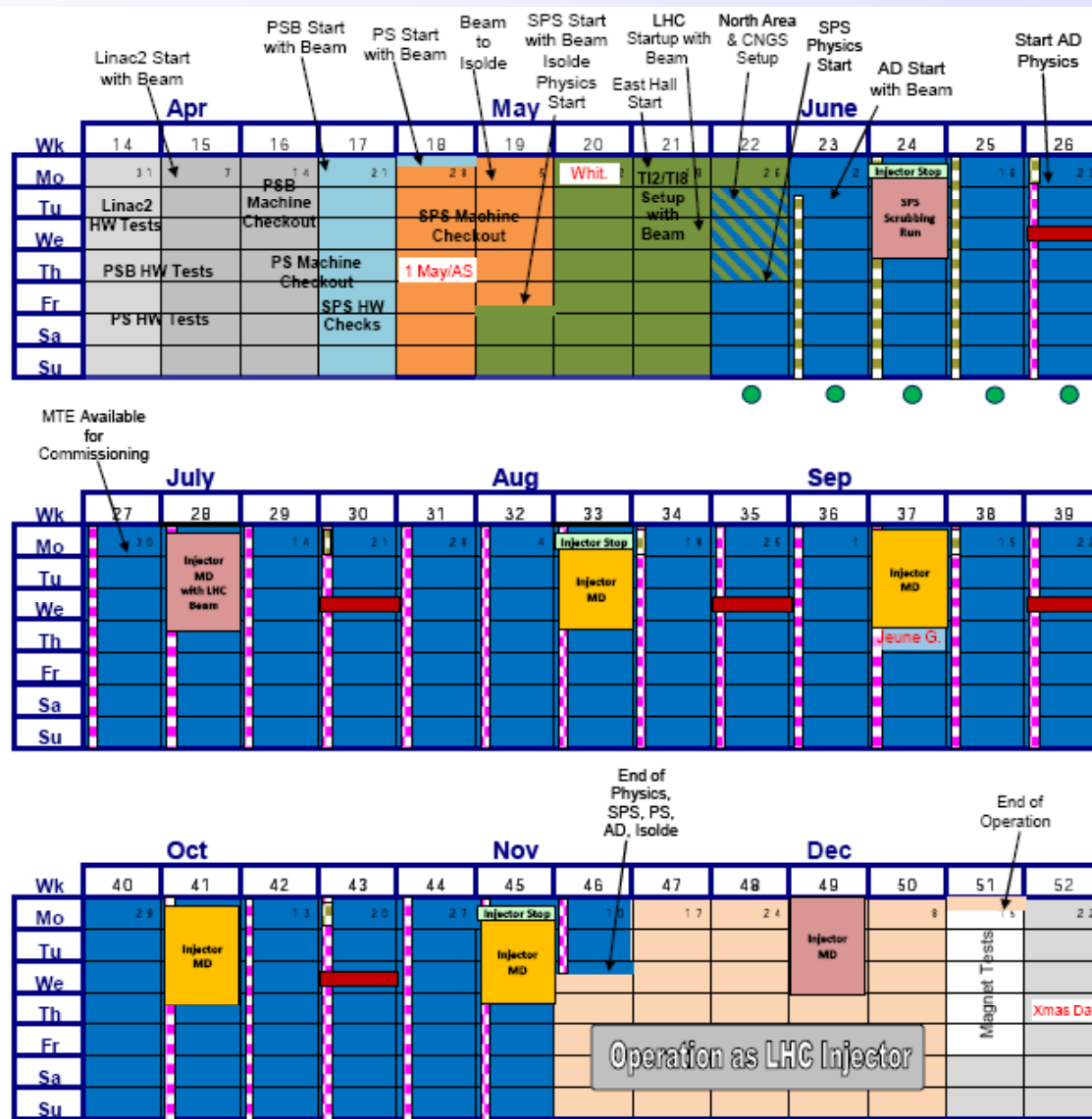
Approved by CERN Research Board November 28, 2007

ISOLDE dates:

protons from PSB May 5
 physics start ISOLDE May 7
 protons stop November 12
 (i.e. 27 weeks for physics)

Expected frequent changes of supercycles (as 2007)

Several long periods of MD without protons to ISOLDE



ISOLDE schedule/operation 2008

- Limits in key resources
 - RILIS (installation of new solid state lasers)
 - UC_x targets
- REX operation
 - MINIBALL ready for Physics June 1
- Schedule:
 - 470 RIB shifts left for approved experiments
 - New proposals and addenda at February INTC meeting 2008
 - ISCOOL operation (further tests, optimization for users, ...)
 - Long supercycles
 - Several proton beam cuts due to MD periods at PS and SPS (each up to a duration of 3 days)
- New Solid State Physics Lab
 - In building 115, ready for operation in 2008

Safety at ISOLDE

New safety structure

- GLIMOS (**Group Leader in Matters Of Safety**)
ISOLDE GLIMOS (ISOLDE Physics Coordinator)
Deputy GLIMOS (ISOLDE Physics group leader)
- Nominating Installation Supervisors for larger experimental installations (ISOLTRAP, COLLAPS, NICOLE, ...)

Safety courses

- Basic safety course (**mandatory**)
- Laser safety course (will become mandatory ???)
- **New** Radioprotection course (Part I+II) **to obtain dosimeter**
- Special Radioprotection course (**web-based course for ISOLDE**)
- Cryogenics safety course (recommended)
- Bridge crane used restricted (new rules for access)