

Organization of the ISOLDE facility

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Abstract

The organization of the ISOLDE facility is described and discussed from the physics proposal via target production and test to the beam time.

The various support groups (2006 manpower) will be presented and the critical points highlighted.

The propositions for improvement gathered throughout the preparation time with the experts will be compiled and presented.

Outline

- What can be done with the available resources (APT) ?
- Extra resources (EURISOL, Marie Curie, ISOLDE collaboration, PhDs, Fellows), New projects.
- “Piquet” services (AB-OP, target tests, RILIS, REX, Vacuum, SC-RP)
- Focus on the stream line from the target production onwards to the experiment.
- Improve contact with PS-Booster operators and experiments
- Improve QA, supervision and training of Operation technicians

Organization

- INTC-ISOLDE Collaboration-ISOLDE Upgrade meeting
 - Phys. coordinator
 - Tech. coordinator (60% EURISOL management and β -beam)
 - OP and IF section leaders
 - Target and Ion-source specialists
 - REX specialists
 - RILIS specialists
 - ISOLDE-EA superintendent (OP)
 - Support from groups across all divisions o(1 FTE) sometimes sub-critical (vacation, illness). Clear standardization helps.
- High multiplicity of AB-contact persons. Clear AB follow up of the chain from the production to the experiment is needed (i.e. by target).

Mutation of Project into facility components

- 2006 projects
 - REX-minimove
 - Support by ATB-EA
 - Funding by ISOLDE collaboration
 - Magnets from German university re furnished by AT (More manpower than anticipated, incomplete drawings, field maps ?)
 - RFQ-Cooler
 - Design by Int. specialists production by OP-PhD student
 - ISOLDE collaboration and UK funding
 - PH Students, EURONS and OP staff and fellow (off-line tests)
 - Control software Labview by student ?
 - Installation by ATB
 - Likely risks: lack of CERN standards or documentation. No specialists for repair or diagnostics, maintenance or standardization of software.
- RILIS and REX entered via this very scheme are now the backbone of ISOLDE.
 - Rewriting the Control's specification and the control software is an example of work duplication resulting from this scheme.

AB-WPs 2006

REX	6.13
ISOLDE	16.55

Group	FTE	2006 tasks	FTE
ABP	1.2	Provide ISOLDE studies	0.00
		REX-ISOLDE - Low energy Operation	1.10
		Define HIE Isolde upgrade	0.10
ATB	9.85	Set up, Consolidate and Exploit RILIS laser and laboratory	1.95
		REX-ISOLDE	0.30
		Operate ISOLDE	7.50
		Experimental Hall WP	0.10
BI	1.3	Maintain ISOLDE beam instrumentation	1.30
		Exploit ISOLDE instrumentation	0.00
CO	1.53	Provide controls for ISOLDE/REX	1.53
OP	5.7	Maintenance, Studies and Support for ISOLDE & Rex	1.60
		Operate ISOLDE	3.00
		Operate REX	1.10
PO	2.6	ISOLDE power converters	1.70
		Operate ISOLDE Power Converters	0.00
		Operate REX ISOLDE Power Converters	0.00
		Operate ISOLDE target pulser supplies	0.90
RF	0.5	Operate Rex-ISOLDE (RF)	0.50

APT Planning, data may differ from effective time spent

Activities requiring Piquet, on-call and specialists interventions

- Target production, calibration and off-line test 1.8 FTE
 - 20 interventions, target heating (cannot afford to lose 2 days of UC-Synthesis)
 - 12 targets / FTE, 10 interventions / staff
- Operations ISOLDE 4 FTE (24/24)
 - 89 piquet interventions
 - 6 targets / FTE, 23 interventions / staff (3/week), 7 weeks piquet
- Yield measurements: team of 8, part time
 - 14 interventions (teams of 2) scheduled following end of target set up
 - 6 targets / staff,
- Operation RILIS 5 FTE (24/24)
 - Setting up by LPE, operation supported by ISOLDE collaboration (2 FTE)
- Operations REX-ISOLDE 3 FTE (24/24)
 - 35 specialist interventions ~2 h. 12 h shifts for each 2-3 days start-up (10 in 2006)
 - 18 interventions / staff, 25 shifts / staff
- Physics coordination 1 FTE (24/24)
 - Daily interventions 7 months + shutdown ...

External resources 2006 (AB: 7FTE, PH 3FTE)

Following EURISOL and TARGISOL

- EURISOL-DS 2005-2009
 - T3 100 kW direct targets, 2 FTE AB-ATB
 - Beam preparation, RIB intensity & RFQ-Cooler, 1 FTE PH-IS
- Marie Curie program AB-ATB
 - High-INT: R&D of high power targets, 2 DS
 - MC fellow, R&D ISOLDE negative ion-source, 1 FTE
- Royal Institute of technology, Grant:
 - LARIS (HIE): R&D on solid state RILIS, 2.4 MCHF, 1 FTE AB-ATB
- ISOLDE collaboration
 - RFQ cooler: 200 kCHF for 2005-2006
 - Mini-Move: 230 kCHF for 2007
 - RILIS: 50 kCHF
- UK Grant
 - RFQ cooler: 500 kCHF and student over two years. (completed by in-kind contribution from Mainz and LPC (Caen) and from Orsay). 1 DS, PH-IS
- EURONS:
 - RILIS: 1 FTE AB-ATB
- INTAG+Chargebreeding PH:
 - ECR-EBIS: ECR charge state breeding, 1 FTE, PH-IS

Support groups a) SC-RP

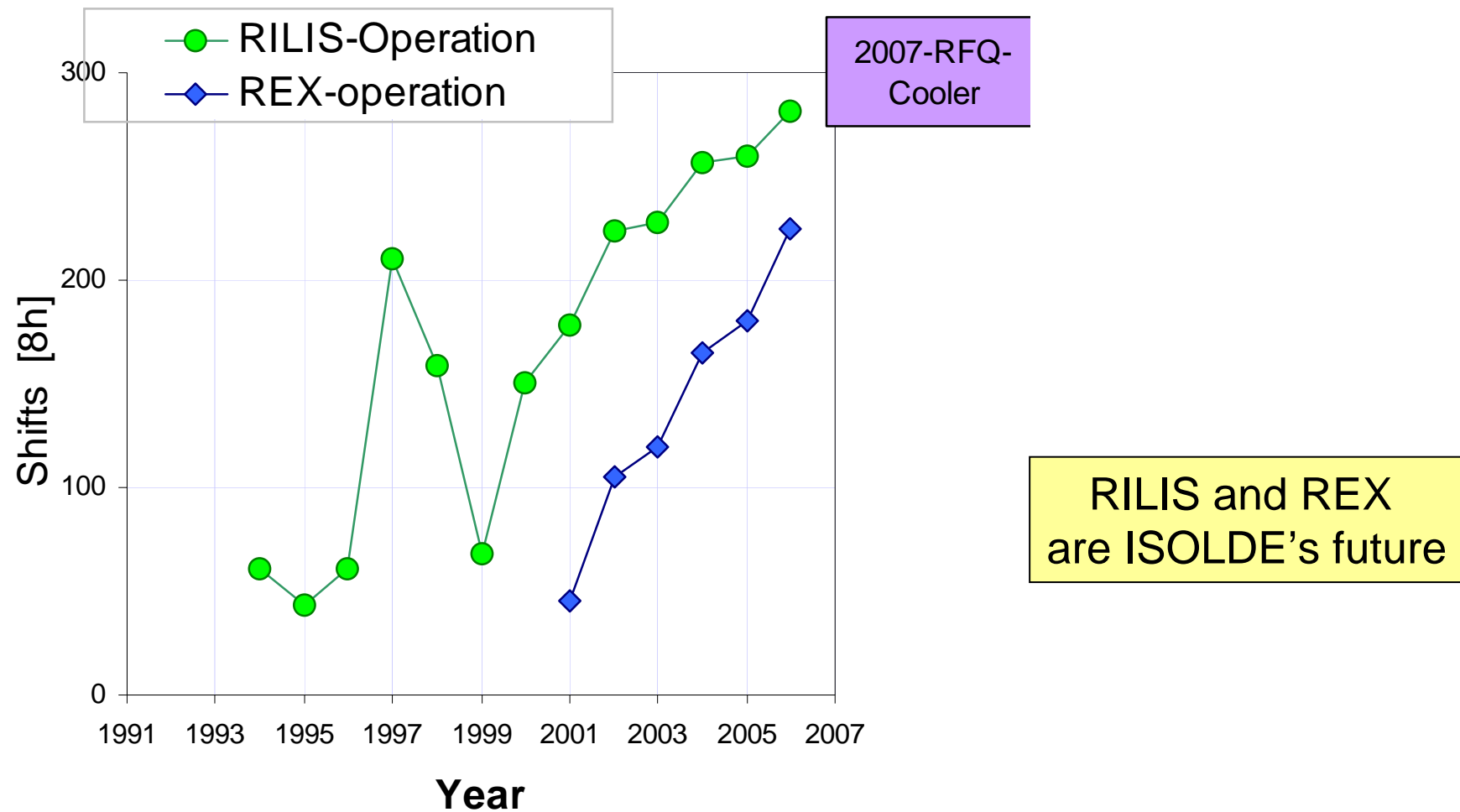
- SC-RP standards
 - Radioactive sources availability and shipping
 - Shipping shall be simplified by implementing threshold measurements.
 - Co activities prohibited with one single technician during shut down, FSU funding requested but not granted within SC
- SC-RP New activities
 - Actinide synthesis in the class A laboratory
 - Conditioning of ISOLDE targets for disposal

Task	2006	2007
RP Monitoring (work in 179, 170, dose rates and emissions)	0.9 (RP-ID)	0.8 (RP-ID)
Preconditioning of waste targets	0.1 (RP-ID)	0.2 (RP-ID)
Studies, authorizations,	0.1 (RP-ID)	0.1 (RP-ID)
Characterisation of Waste targets	0.1 (RP-RW)	0.3 (RP-RW)
Transport of radioactive samples (incl. spectrometry)	0.2 (RP-PA)	0.4 (RP-PA)
Maintenance of instrumentation	0.2 (RP-IL)	0.2 (RP-IL)
Missing for RP Monitoring	0.6	0.7
Missing for studies, authorizations	0.4	0.4

Support groups b)

- **AT-VAC**
 - APT: 0.8 FTE from 2005 to 2007 and 1.2 FTE starting 2008.
 - In fact: 0.5 FTE available in 2005 and 2006, this number may be difficult to reach in 2007
 - Support provided by ATB-EA-IF (REX-system, Maintenance)
 - Vacuum upgrade project 3 FTE 2007-2009: Upgrade to new standards of controls, radioactive gasses delay line and intermediate storage (Jeopardized unless renewal of LDs)
- **TS-CV ... New contracts may jeopardize the planned shut down tasks (tbc by TS-CV).**
 - Compressed air upgrade (follow-up of white powder)
 - Separation cooling - vacuum

Evolution of ISOLDE operations towards more complex systems



RILIS
Team
shift
work

2 FTE
ext. funding
From April
to October

ATB

Name	Affiliation	Arrival	Departure	Days	Paid by
Valentin Fedosseev	CERN			All	CERN staff
Bruce Marsh	CERN			All	CERN PhD
Nathalie Champault	CERN			25	CERN staff
Ernesto Batista Mane Junior	Manchester	20-Apr-06	12-May-06	23	ISOLDE
	Manchester	8-Jun-06	3-Jul-06	26	ISOLDE
	Manchester	10-Jul-06	17-Jul-06	8	ISOLDE
Sergey Zemlyanoy	JINR, Dubna	22-Apr-06	18-May-06	27	ISOLDE
Dmitry Fedorov	PNPI	4-May-06	18-May-06	15	ISOLDE
Dmitry Fedorov	PNPI	8-Jun-06	21-Aug-06	75	ISOLDE
Anatloy Barzakh	PNPI	8-Jun-06	3-Jul-06	26	ISOLDE
Maxim Seliverstov	Mainz	1-Aug-06	18-Aug-06	18	ISOLDE
Yuri Volkov	PNPI	10-Jul-06	31-Jul-06	22	Russia
Victor Ivanov	PNPI	31-Jul-06	21-Aug-06	22	Russia
Johanna Vannesjö	KTH	18-Jul-06	29-Jul-06	12	KTH-ISOLDE
Sergey Zemlyanoy	JINR, Dubna	30-Aug-06	10-Oct-06	42	ISOLDE
Fabian Osteradhl	KTH	4-Sep-06	11-Sep-06	8	KTH-ISOLDE
Dmitry Fedorov	PNPI	15-Sep-06	24-Oct-06	40	ISOLDE
Alexandra Ionan	PNPI	24-Oct-06	6-Nov-06	14	ISOLDE
Alexandra Ionan	PNPI	7-Nov-06	20-Nov-06	14	Russia
Ernesto Batista Mane Junior	Manchester	4-Sep-06	11-Sep-06	8	ISOLDE
	Manchester	25-Sep-06	26-Sep-06	2	ISOLDE
	Manchester	5-Oct-06	9-Oct-06	5	ISOLDE
	Manchester	19-Oct-06	24-Oct-06	6	ISOLDE
	Manchester	8-Nov-06	20-Nov-06	13	ISOLDE
Thomas Pauchard	KTH	19-Oct-06	24-Oct-06	6	KTH-ISOLDE
					Months
Total				432	14.2
Paid by ISOLDE:				354	11.6
Paid by KTH-ISOLDE:				26	0.9
Paid by Russia:				58	1.9

RILIS 2006 delivery (14 elements)

Exp. (one per RILIS setup)	RILIS start	Run start	Date stop	Sep.	Estimate of Setup (hours) Valentin	REX tuning / Stable runs	Scheduled Physics shifts	Element	Counted LASER hours (Valentin)	Counted total "shifts"
OFF-line work								Cu Hg Po	120	
IS427	20-Apr	25-Apr	30-Apr	GPS	20	16	11	Mg	79	9.9
IS358	4-May	10-May	11/12 May	GPS	20		3	Cu	62	7.8
IS413	12-May	12/13 May	16-May	HRS	10		7	Ag	52	6.5
IS413	6-Jun	9-Jun		GPS	20		5	Mn	170	21.3
IS368				GPS			3	Mn		
IS443				GPS			7	Mn		
IS432				GPS			3.5	Mn		
IS442			15-Jun	GPS			1	Mn		
IS410	19-Jun	23-Jun		GPS	20	16	14	Mg	206	25.8
IS412		11-Jul	17-Jul	GPS	30	16	17	Zn	177	22.1
IS413	18-Jul	20-Jul		HRS	20		6	Cd	193	24.1
IS434			9-Aug	HRS	40		15	Sb	52	6.5
IS435	10-Aug	11-Aug		GPS	20	16	17	Cu	184	23.0
IS431	4-Sep	4-Sep		GPS	5	16		Cu	171	21.4
IS418	18-Sep	20-Sep	27-Sep	GPS	40	16	21	Sn	179	22.4
IS411	2-Oct	4-Oct	11-Oct	GPS	30	16	15	Cd	109	13.6
IS427	16-Oct	19-Oct	24-Oct	GPS	20		12	Mg	126	15.8
LoI57	26-Oct	30-Oct	3-Nov	GPS	40	16	3	Po	82	10.3
IS438	6-Nov	9-Nov		HRS	30	16	18	Be	290	36.3
									w/o MD	
FINAL					365	144	224.5		Total shifts	266.50

2-5 exp. Per element

Breakdowns: a) 2006 OP-list (ISOLDE items)

Approx. Date	Problem	Comments
31-Mar	Suppression of inflector zone for safety reasons.	Knock on effect all year with PS access cutting Isolde physics.
1-Apr	White powder in the Isolde compressed air – lots of interventions and discussions.	Happened during maintenance at the beginning of the year - procedural problem.
16-May	PS Rotating Machine Failure –5 weeks.	Luckily we had made a working spare - otherwise 1 year down!!
22-Jun	Power Cut causes damage in Isolde – several hours. Affects Meyrin, SM18 & LHC1.	
23-Jun	Transition crossing Quad Cables changes – in the shadow of the rotor.	Radiation damage to cables. Several access requests cuts Isolde.
11-Jul	Target box alignment -3 weeks to identify.	Minor impact but caused considerable confusion.
15-Jul	Human error vents Isolde to air.	physicist did not follow procedures properly.
18-Jul	BTY.QDE209 water leak in Isolde target zone Around 1 week lost for GPS. Strong impact on HRS.	Unclear responsibilities for equipment in the target zones.
29-Jul	Isolde Air conditioning prevents re-start ~1 week.	Poor documentation of a plc - common problem !!
1-Aug	Isolde Robot terminal failure. Difficult to find replacement	Poor documentation means reliance on experts : plc programming
2-Aug	Isolde vacuum lost due to PLC programming failure.	Poor documentation means reliance on experts: plc programming
10-Aug	Isolde Tapestation broken	Expert away - only person who could fix it. Very old system
12-Aug	Vacuum in Isolde BTY line suddently bad	AT/Vac don't know what happened!
25-Aug	Wrong beam sent to Isolde.	Could have ruined the target - luckily it could be saved
23-Aug	Finally solved the HV problem on the HRS - broken boris tube	Has caused pertubation throughout the year
Sept-oct 06	Intermittant problem with the PS dump going in with no request	Causes beam losses and radiation cuts STILL Not Solved in Mid-october
11-Sep	Wrong Reference in BTM line cuts Isolde for several hours	
15-Sep	Isolde Target failed with a short - cut the run by 19 hours	

Breakdowns b) 2006 ISOLDE-log (ISOLDE GPS)

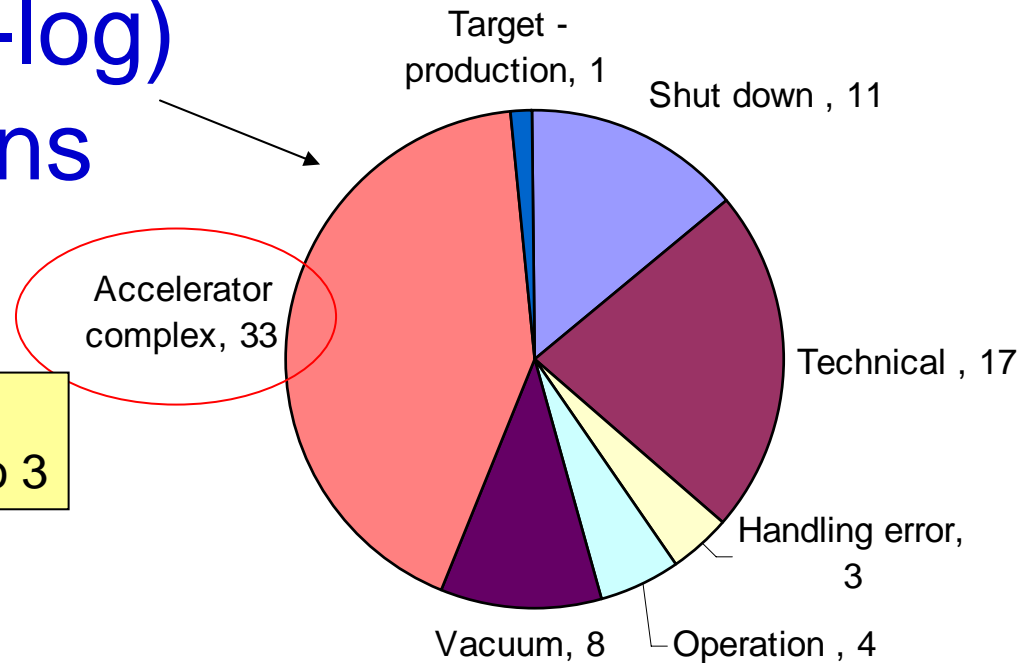
Target (GPS) <i>Problems</i>	<i>Date</i> <i>Intervenants</i>	<i>Comments</i>	<i>days lost</i> 39
Target #320 UC Mg run	21-04-06		
Faraday cups disconnected	BDI		
Target still outgassing	ATB-IF	HT not holding due to outgassing	1
vacuum pump in GLM and plc	AT-VAC		
HRS access problems	CCC		1
Transmission	OP/ ATB	bent collimator after removing def. plates	7
White powder	TS-CV	silica gel in dryer burst	2
Line polarity inversed	OP/ ATB	from neg. ion run in 2005	
Tape station	BDI	motor burnt, tape stuck	1
Target #321 ZrO Cu/Ga run	9/5/2006		
Tapestation	BDI	motors	1
HRS.WG475	BDI/OP	repaired	1
Linac 2	PO		1
Compressed air leak	BDI	prevent FC's from being used	
HRS access fault	CCC/ Bonzano	could not set security chain	1
Booster quadrupole	PO		1
Technical network	CO		
Power cut CERN wide	TS	fire in substation	3
HT	PO/ATB	holds only 50kV	
security chain	TS	ventilation plc due to power cut	1
timing	CO	no trigger for tape station	

Target #254 Sn Cd run	17/5/06		
Security chain	TS-CV	ventilation plc lost program after power cut	
Target #324 SiC Al run	29/5/06		
HT	ATB-IF	only 40kV	
Vacuum	AT-VAC	pen at FE to be changed	
p-beam focus	Booster	large sigma	
pont roulant	TS	security gates closed	
Target #320 UC Mg run	6/6/2006		
extraction electrode exchange valve and gauge exchange	ATB AT-VAC	to stop HT sparking repair	1
vacuum	AT-VAC	all beamlines down for no apparent reason	1
air inlet	OP AT-VAC (users)	GLM user air inlet	
Target #329 UC quartz	7/7/2006		
Air inlet	Users OP AT-VAC	air inlet in LA2, caused FE and REX to stop	1
Target #331 cancelled	18/7/06 - 28/7/06		
BTY magnet water leak	OP Magnet group SC		5
Target #326 ThC n cancelled	24/7/06		
BTY water leak	OP Magnet group SC		
CERN wide Power cut	All		3
Ventillation	TS	plc lost program as result of power failure	4
Vacuum		absence of AT-VAC specialist	3

Target (HRS) Problems	Date Intervenants	Comments	days lost 37
Target #319 CeO cancelled	2/5/2006		
Target heated under air	OP ATB-IF SC	switching from manual to automatic	4
short across anode		piston finger not in valve hole	
turbos changed	AT-VAC SC	delayed shutdown work	
Target #322 UC	10/5/2006		
Coupling problem	ATB	New Staubli fittings differ	1
Access problem	CCC		
Transformer	OP CO	replaced opti cable	3
Power cut CERN wide	TS	fire in substation	
Target 323 Ti	19/5/2006		
Coupling problem	ATB	New Staubli fittings differ	3
Target #325 UC	30/5/2006		
Line power supply	PO	replaced	1
Air inlet or vacuum breakdown?	users AT-VAC		1
Target container broken	ATB OP	consequence of air inlet, run abandoned	
Target #326 ThC n	13/6/06		
Protons on without request	CCC		
compressed air	TS	brought vacuum system down	1
ventilation	TS	delayed target change	3
Target #328 Nb	26/6/06		
HT problems	ATB OP	forced to work at 30kV	3
Target #330 UC quartz	19/07/06		
BTY magnet water leak		interventions for repair	1
CERN wide Power cut	All		3
ventilation	TS	plc software lost as a result of power cut	4
robot screen broken	ATB OP	delayed HRS target change	5
Target #303 UC	4/8/2006		
vacuum	AT-VAC	plc specialist unavailable	4
Target #334 SiC	14/8/06		
Unexpected Target heating	OP	mass markers and srcmag heated	

Lost days* (ISO-log) vs. Interventions

2006 Acc. complex
Discussed in sessions 1 to 3



	lost days		interventions	
Shut down	11	14%	5	9%
Technical	17	22%	16	29%
Handling error	3	4%	5	9%
Operation	4	5%	6	11%
Vacuum	8	10%	4	7%
Accelerator complex	33	43%	18	33%
Target - production	1	1%	1	2%

(*) ISOLDE Activity relies on 2 Mass separators, a “day lost” on one unit is sometimes recuperated for physics by rescheduling

Breakdowns Follow up: a) technical issues

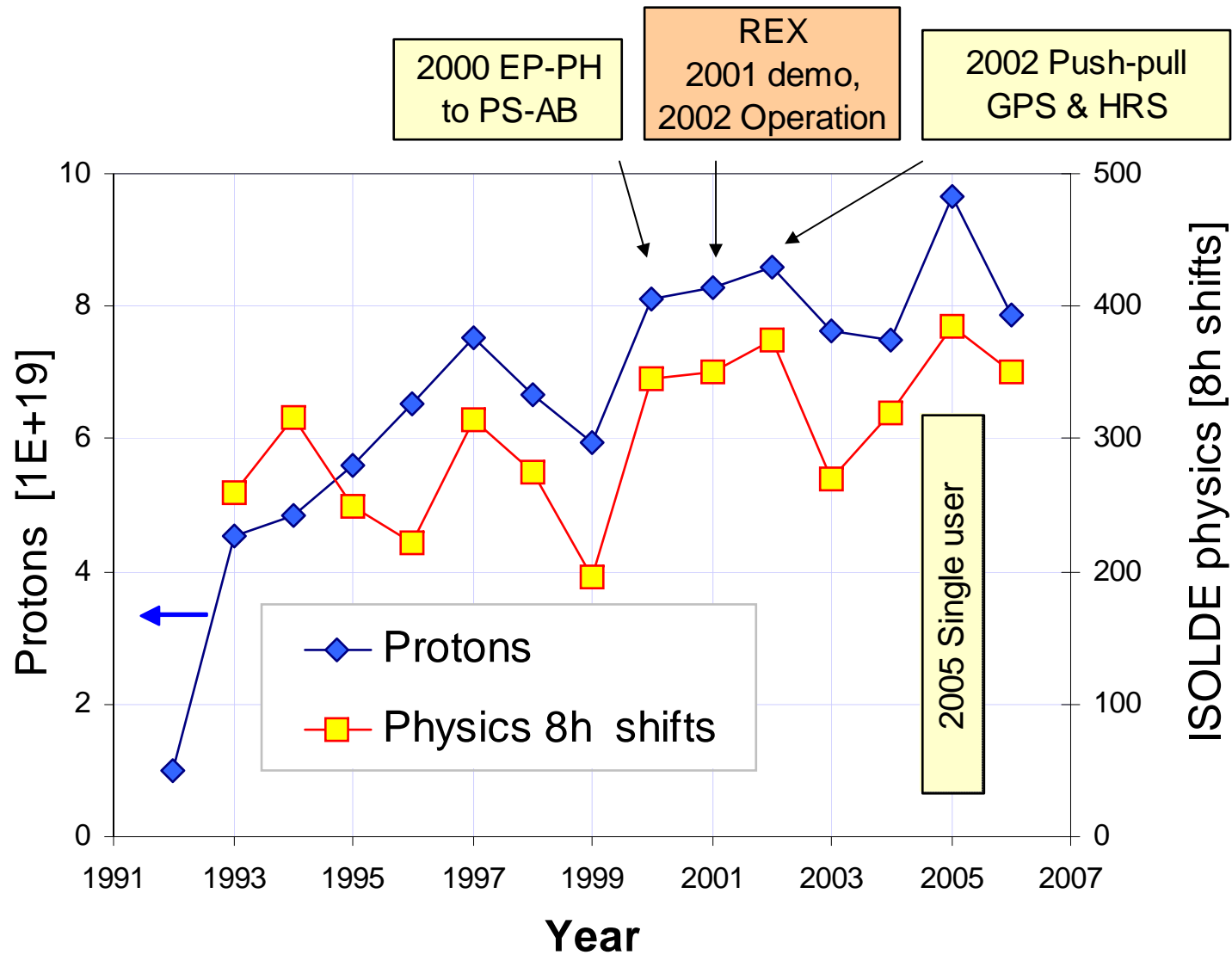
- Technical issues (17 days)
 - White powder
 - GPS-switch-yard
 - Damaged insulation of the Boris-tubes
 - Technical solution usually quickly found, efficient response even facing CERN priorities, No major improvement but back to preventive maintenance.
- Vacuum (8 days)
 - PLC
 - Expensive preventive maintenance (efficiency not demonstrated as front end activated pumps)
- Handling error (4 days)
 - Yearly events that could be reduced by refresh training provided by AT-VAC or subcontracted to OP
- Target production (1 day)
 - Implementation of a >1week delay between completion of off-line tests and Physics run. The inherent drawback is that urgent repair that stops the “flux tendu” should be prevented.

b) Operations

- i) Settings and beam parameters (4 days)
 - Reversed line polarity (Reduced efficiency of RILIS)
 - Coupling and heating of target with closed valve target destroyed and run lost.
 - Focused p-beam on Ti-foils (8 out of 15 shifts impaired by very low yield)
 - Non-staggered beam on Pb-target (recuperated by operator skill)
 - Addressed by p-beam parameter supervision software
 - Beam line systematically retuned by REX staff to inject into the trap.
 - Computed Beam optics demonstrates misalignments.
 - Measurement campaign on-going throughout the ISOLDE hall should be followed by alignment.

- ii) Communication
 - Seen by Users: Low visibility of operators in the ISOLDE area or control room
 - Seen by OP: Technicians (MS) sometimes not informed on Logbook recorded issues.
 - Daily contact of the operators to each of the experiments should resume
 - Refreshment of the separator course will be offered by OP to each experiment teams
- iii) Training
 - Quality assurance of operations and closer management would be an asset.
 - Training could be provided in the off-line mass separator with dedicated prototypes.
 - Physicist supervision from target production to experiment aiming at improved QA.
- Shut down (7 days)
 - 2007 is a particular challenge with RFQ-cooler and REX minimove.
 - Tendency to underestimate resources and squeezed parallel scheduling, stronger supervision of planned actions may be required
 - Parallel scheduling should be avoided (SC-RP availability)

Statistics physics vs. protons



Conclusion

- ISOLDE's efficiency in 2006 was impaired by numerous breakdowns.
- ISOLDE physics output was restored by prolongation of the run and very motivated teams.
- The Flagships of the facility are REX and RILIS, REX lived off transfusion from its team's blood
- **Corrective measures AB**
 - Within the available staff, transfer towards REX operation
 - Reorganization and definition of tasks i.e. REX coordinator or "beam responsible"
 - Reorganization of the support in the experimental hall
 - Mandatory Training shall be organized (MAPS)
- **Support teams**
 - Very good support in view of critical manpower situations.