COSY
a High Performance Accelerator for Fundamental Research

- The Accelerator Facility
- Beam time Distribution and Statistics
- Failure Analysis
- Preventive Work for High Reliability
- Procedures after a Breakdown

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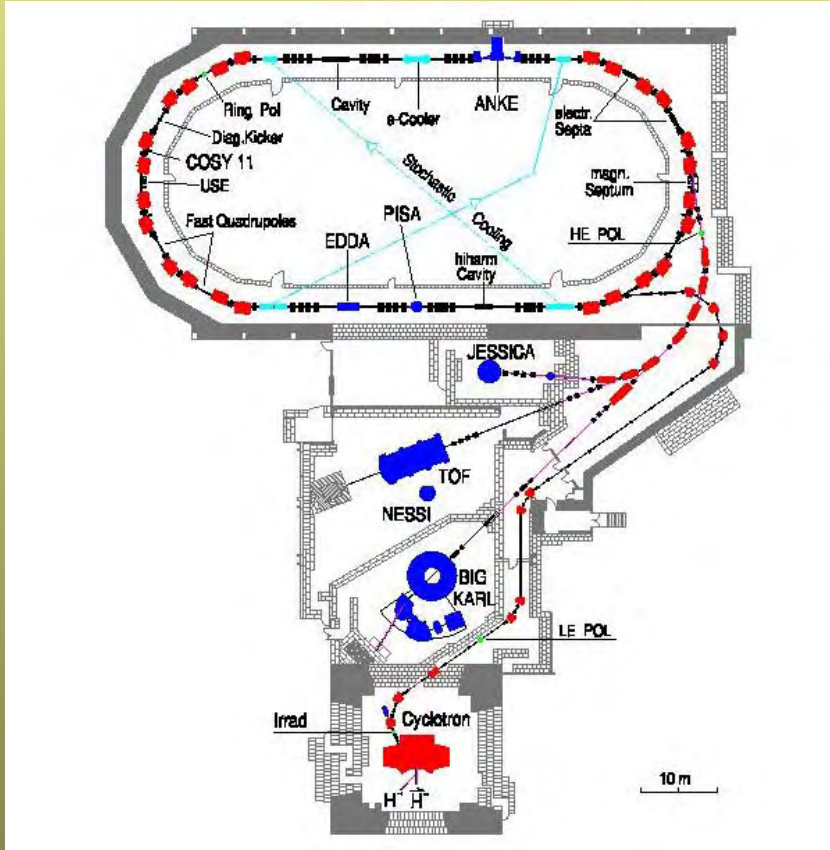
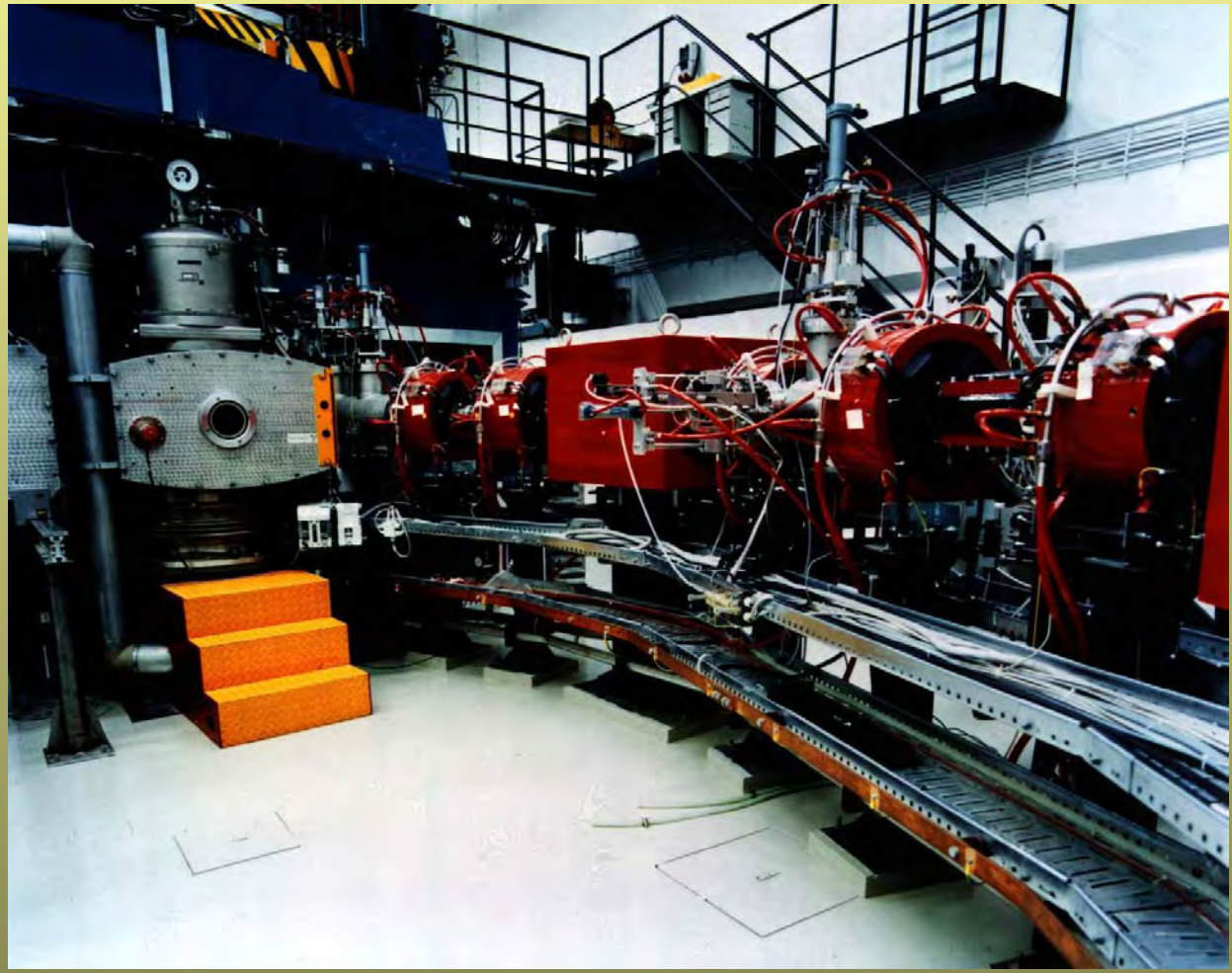
February 4th, 2002

The Accelerator Facility



- COSY accelerates (polarised) protons and deuterons between 300 and 3600 MeV/c
- 4 internal and 3 external experimental areas
- Electron cooling at low energy
- Stochastic cooling at high energies

View into the Cyclotron Hall



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The View into the Synchrotron Hall

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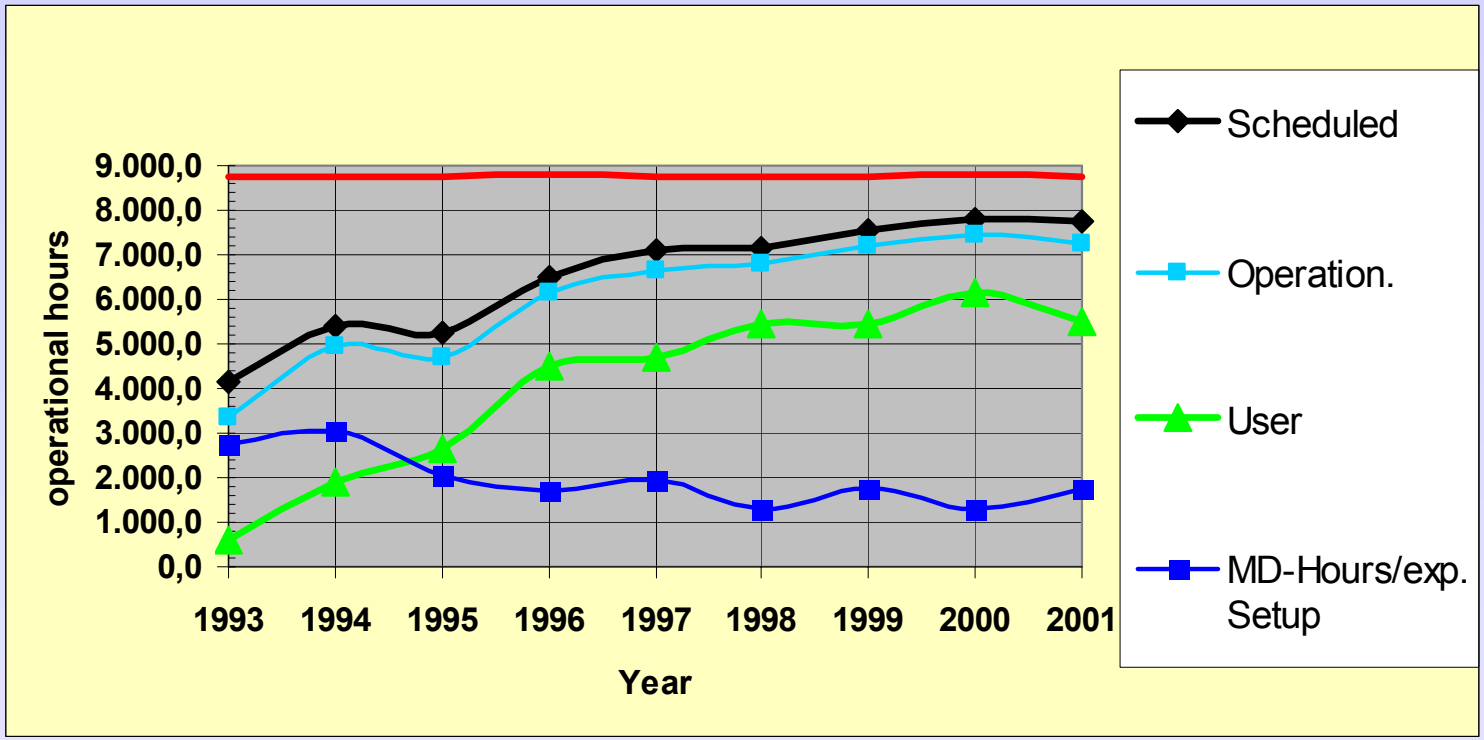
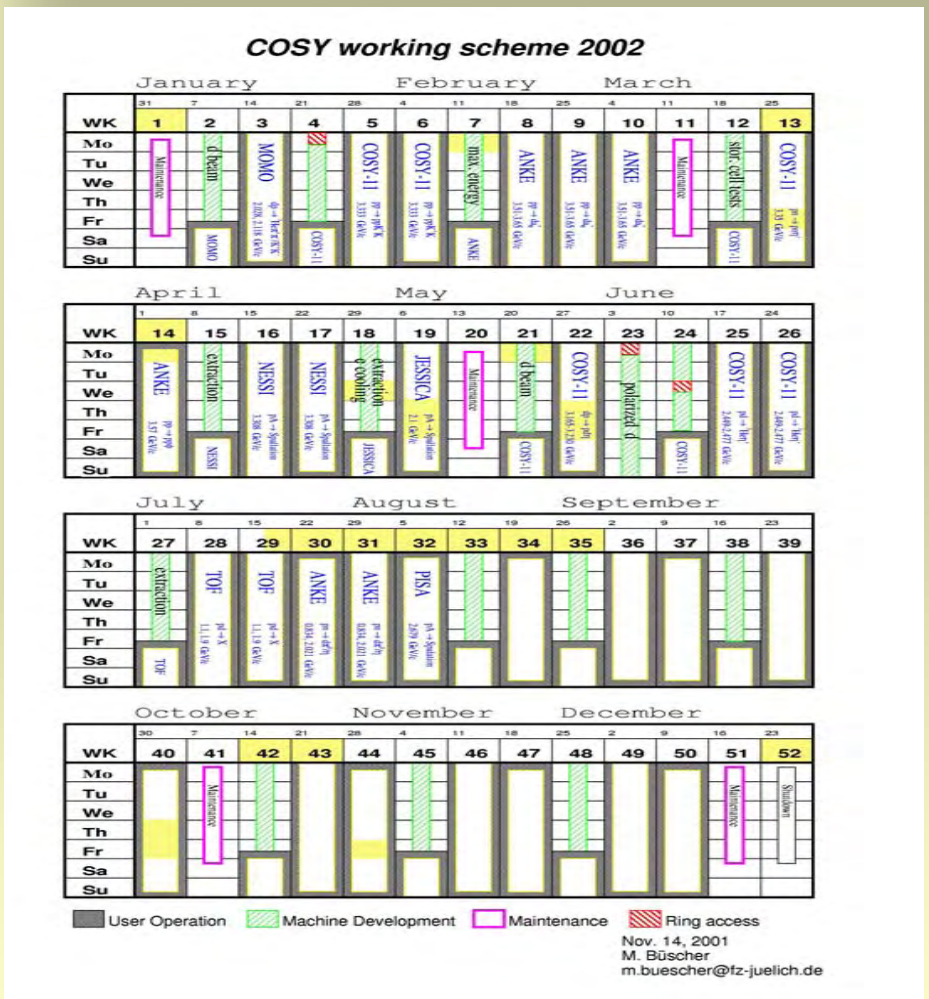
Beam time Statistics

Year	Scheduled Hours	Operation. Hours	Operation. %	User Hours	User %	MD-Hours/exp. Setup
1993	4.166,0	3.355,0	80,5	617,0	18,4	2.738,0
1994	5.398,0	4.951,0	91,7	1.889,0	38,2	3.062,0
1995	5.256,0	4.697,0	89,4	2.654,0	56,5	2.043,0
1996	6.520,0	6.171,5	94,7	4.484,0	72,7	1.687,5
1997	7.080,0	6.634,0	93,7	4.675,5	70,5	1.958,5
1998	7.148,0	6.787,0	94,9	5.470,0	80,6	1.317,0
1999	7.536,0	7.220,0	95,8	5.464,0	75,7	1.756,0
2000	7.776,0	7.457,5	95,9	6.164,0	82,7	1.293,5
2001	7.728,0	7.251,5	93,8	5.522,0	76,1	1.729,5
Sum tot.	**58.608,0**	**54.524,5**	**93,0**	**36.939,5**	**67,7**	**17.585,0**

Beam Time Development over the Years



The COSY Beam Time Schedule



- Every 10th week is a shutdown period for maintenance
- Machine development weeks give the opportunity to prepare the next experimental set-up

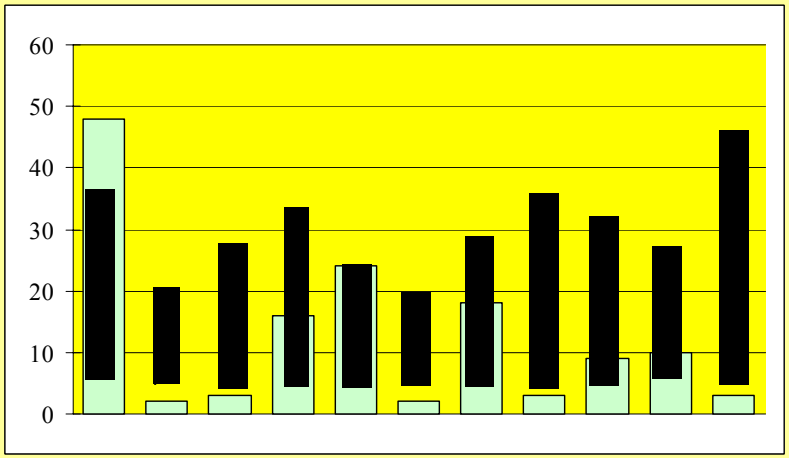
Critical components

- 100 dynamic power supplies
- 250 static power supplies
- 500 CPU´s and 200 VME/G64 crates
- 280 Vacuum pumps
- 20 Cryogenic pumps
- 100 Valves
- 2 fast shutters

Failure Analysis

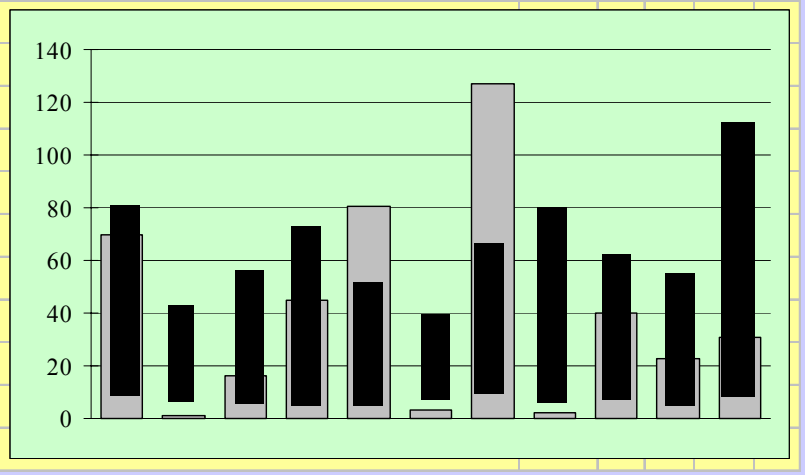
No. of Breakdowns

Power Supplies	48
Vacuum	2
Diagnostics	3
Cooling Water	16
Cyclotron	24
Control	2
Experiments	18
Securyty System	3
other subjects	9
Ion Source	10
external Power Fault	3

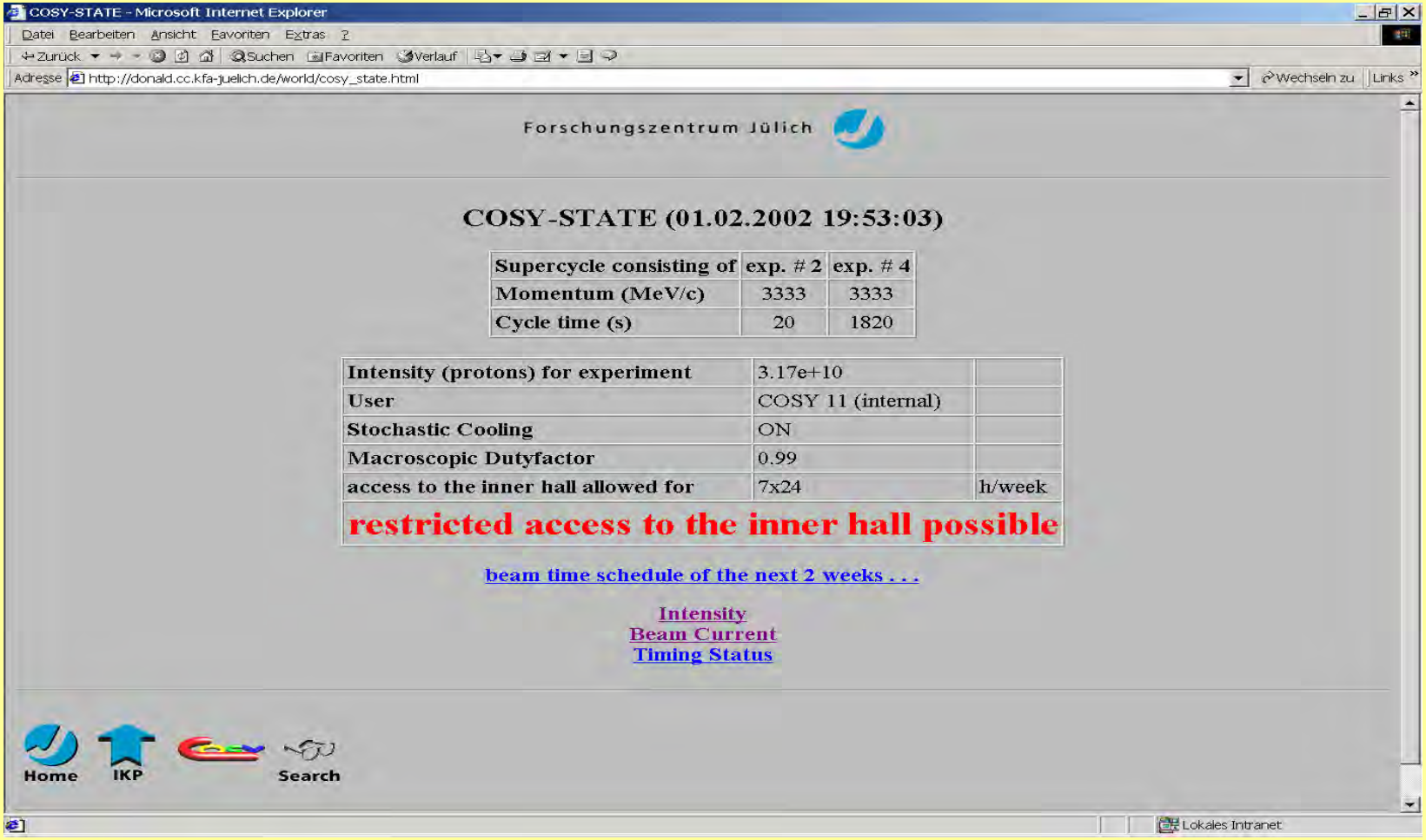


Duration of Breakdown / h

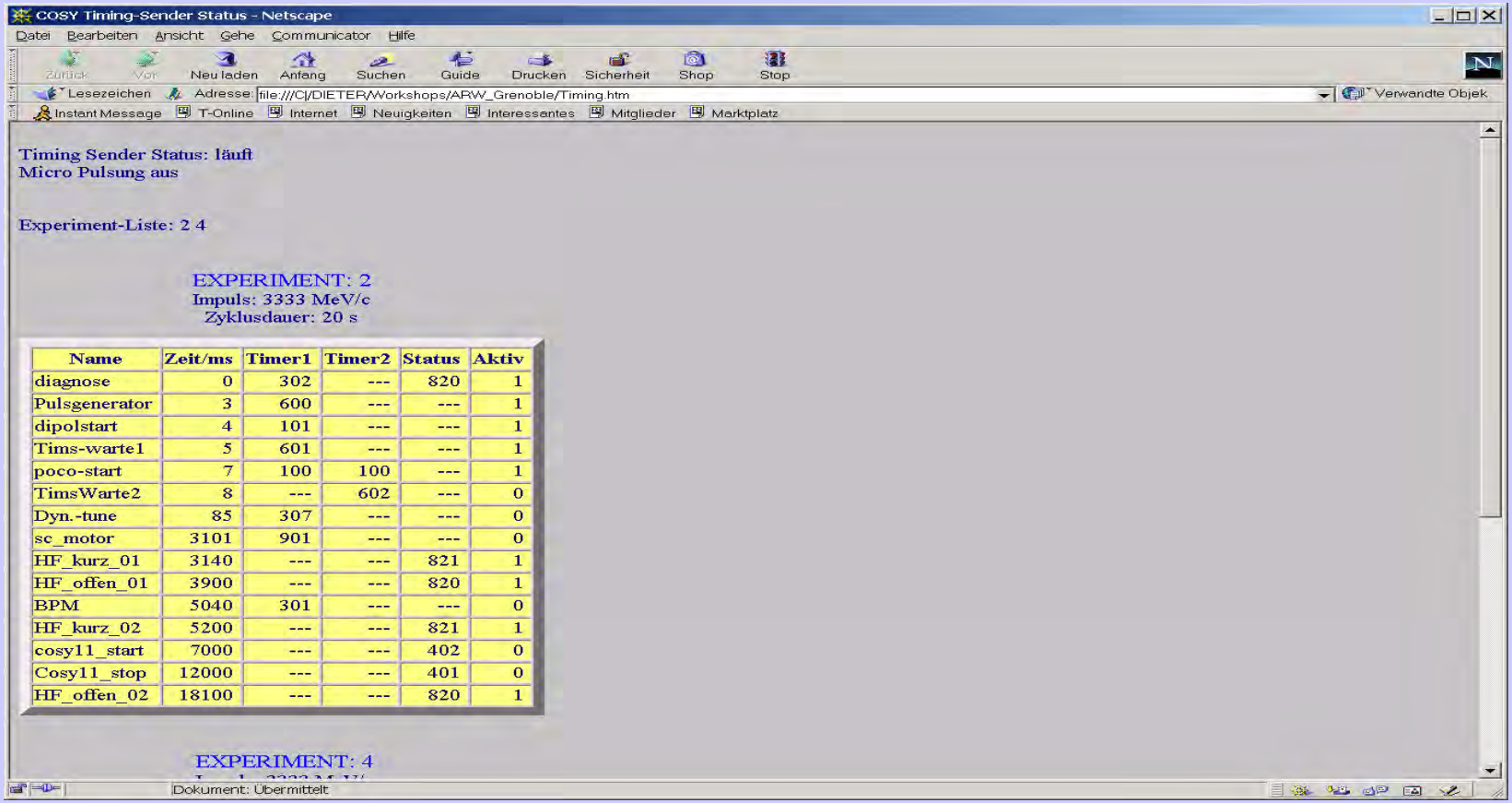
Power Supplies	69,5
Vacuum	1
Diagnostics	16
Cooling Water	45
Cyclotron	80,5
Control	3,5
Experiments	127
Securyty System	2
other subjects	40
Ion Source	22,5
external Power Fault	31



Information about the COSY status on the web



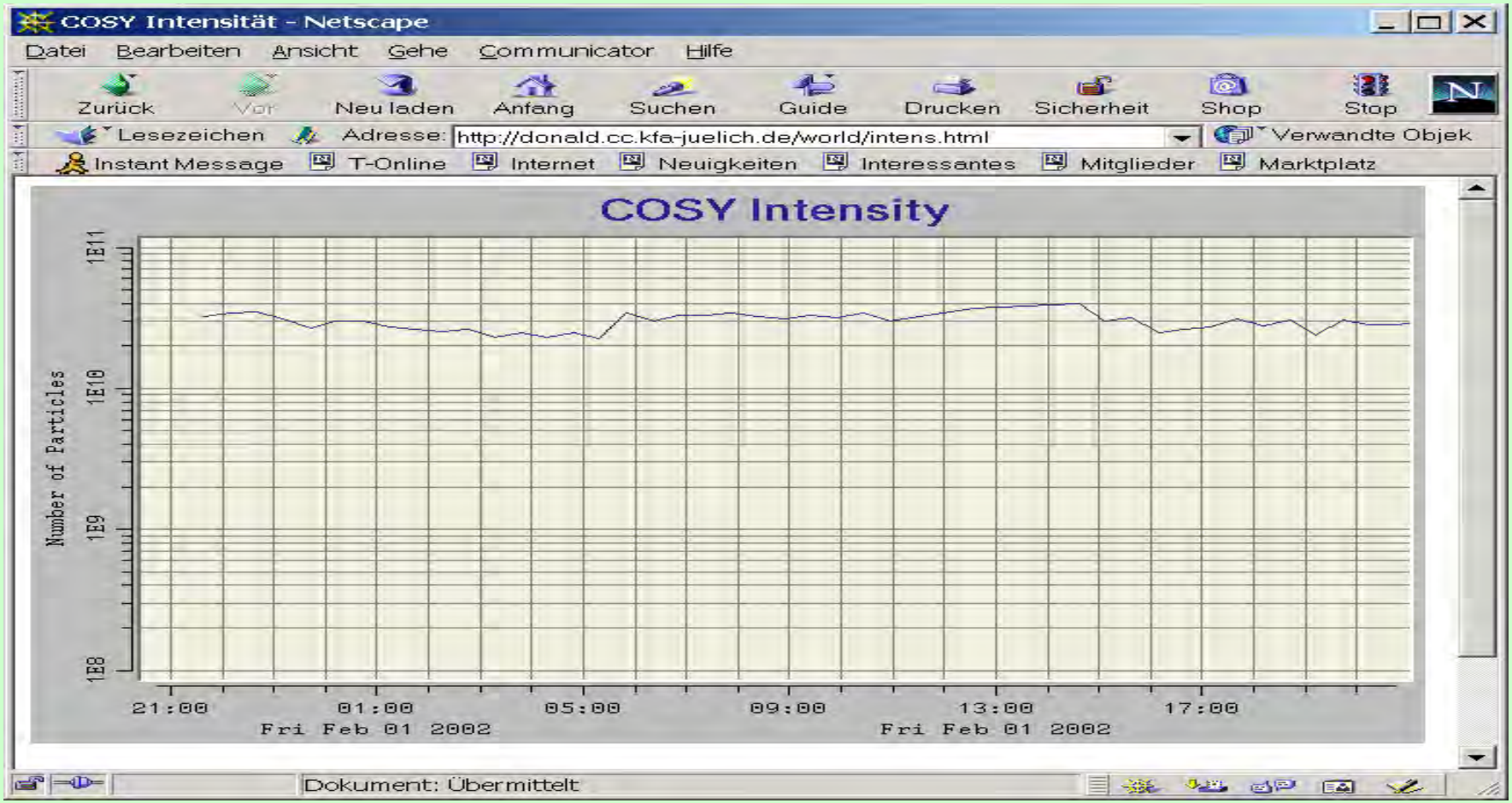
The status of the timing is available on the web



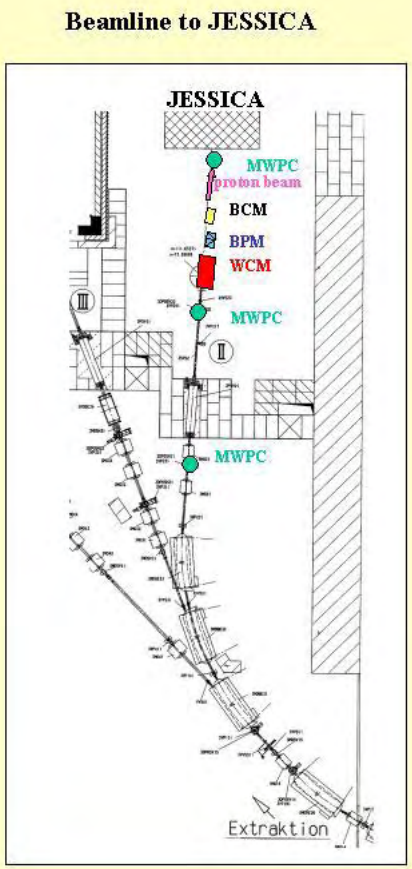
Name	Zeit/ms	Timer1	Timer2	Status	Aktiv
diagnose	0	302	---	820	1
Pulsgenerator	3	600	---	---	1
dipolstart	4	101	---	---	1
Tims-warte1	5	601	---	---	1
poco-start	7	100	100	---	1
TimsWarte2	8	---	602	---	0
Dyn.-tune	85	307	---	---	0
sc_motor	3101	901	---	---	0
HF_kurz_01	3140	---	---	821	1
HF_offen_01	3900	---	---	820	1
BPM	5040	301	---	---	0
HF_kurz_02	5200	---	---	821	1
cosy11_start	7000	---	---	402	0
Cosy11_stop	12000	---	---	401	0
HF_offen_02	18100	---	---	820	1

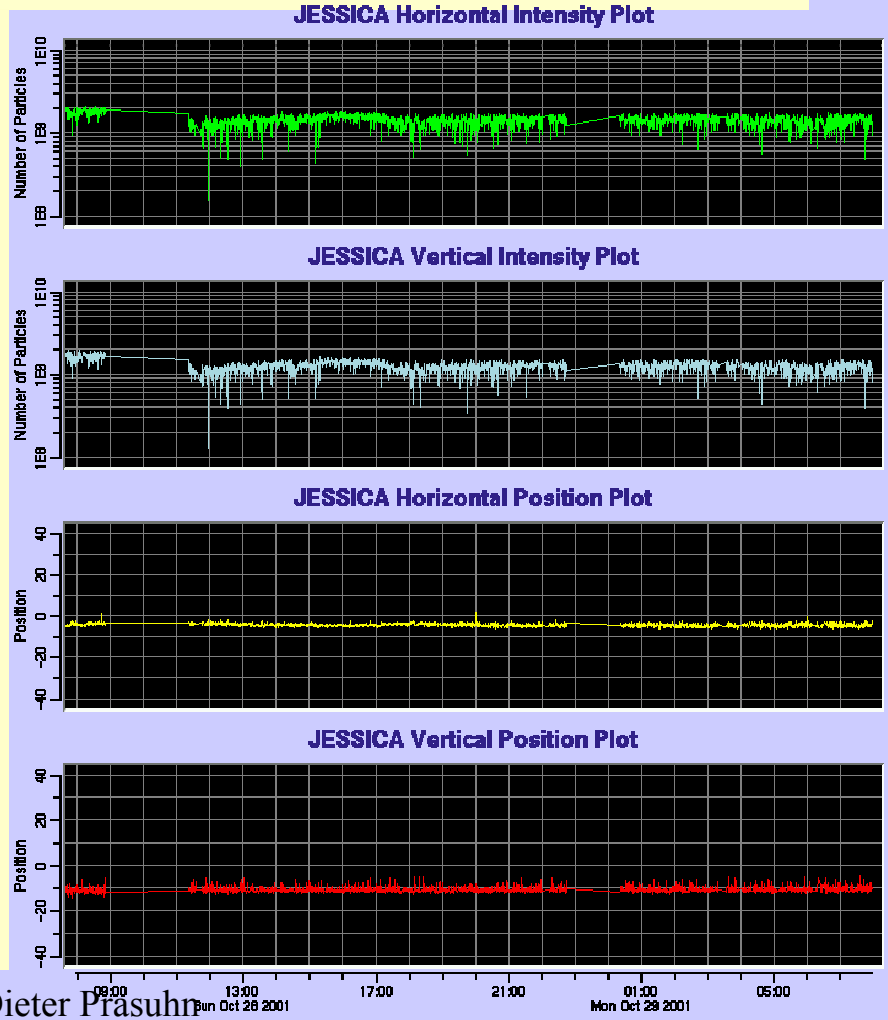
The intensity in the running cycle is available via web

The intensity over a long period is recorded and available via web



Monitoring of Intensity and Position of the pulsed beam





The COSY Operating Crew

- 10 operators
- From Monday to Friday 3 shifts per day, on Saturday 2 shifts

  From Saturday 22:30 to Monday 6:30 one operator on call
- 10 supervisors
- In the Control room during day time in the MD-weeks, one is on call all time
- 30 people technical support staff
- Available during normal working time, on call all other time

Preventive Steps for high Reliability

- Conservative layout of all components
- Regular maintenance time
- Checks of all aging components:
  - ✓ Electrical connectors
  - ✓ Water connectors
  - ✓ Fans in the CPU-crates
  - ✓ Search for irradiated vacuum chambers
  - ✓ .....

Procedures after a Breakdown

- The operators or supervisors in the control room receive messages about faults
  - Cooling water temperature
  - Status of power supplies
  - Vacuum
  - ….
- If necessary they can immediately call the requested technical staff on call the to react on the fault

Advices from our electrical engineers

- Choose well established technologies whenever it is possible
- The design should include 20% reserve
- Consequent separation of power lines and low level signal and control lines
- Keep enough spare parts for quick repair (10% of all power components)
- Regular careful maintenance