The atomic physics experimental facility Cave A:

a Status report

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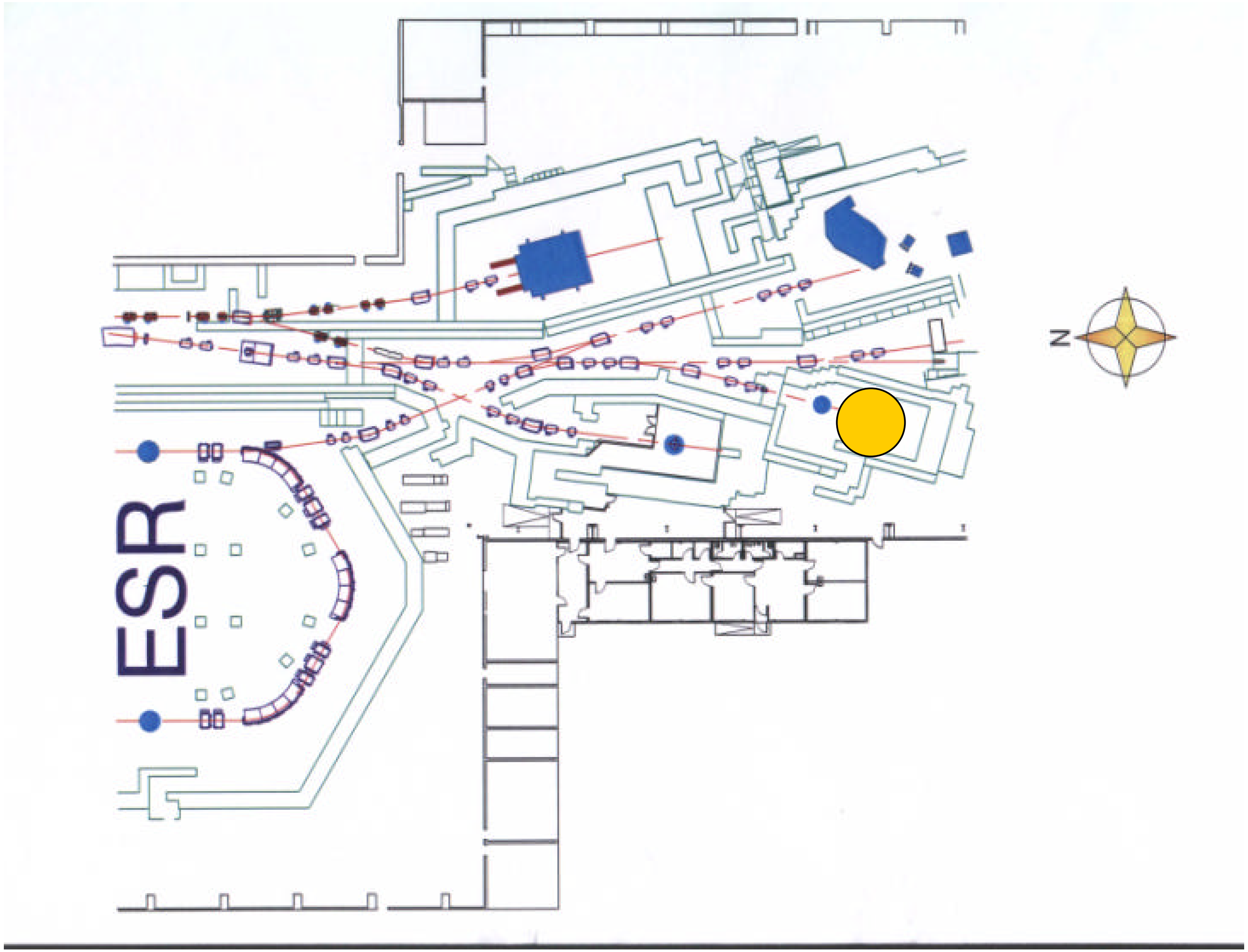
Cave A location



Cave A possibilities

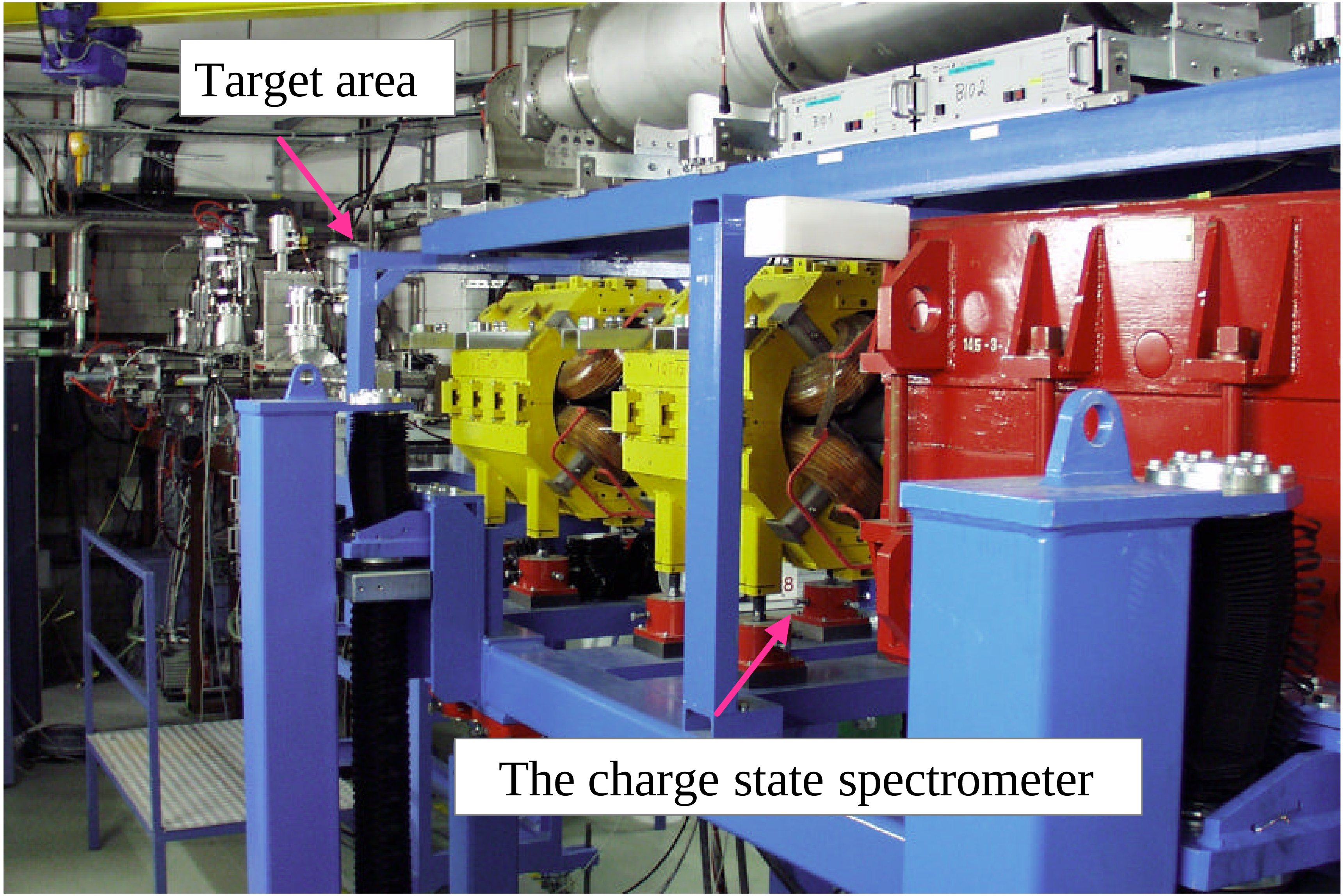
Serves as location for :
- atomic physics experiments
- irradiation facility for biophysics, radiobiology, detectors and electronic for space flight instruments

SIS-beam:

- ions: .....Xe,..., Au, Pb,.., U
- ion energy: 50 - 560 MeV/u
- charge state: bare, H-, He -, Li-like
- typical beam intensity: ~$10^8 - 10^9$ ion/spill

ESR-beam:

- ions: .....Xe,..., Au, Pb,.., U
- ion energy: 15 - 100 MeV/u (after cooling and deceleration)
- charge state: H-, He -, Li-like
- typical beam intensity: ~ 10^6 ion/spill
- high beam quality (emittance)


Target area
The charge state spectrometer

....Old Priorities

...some improvements for the complete system are strongly desirable….

(GSI Collaboration meeting Cave A, March, `98)

- Spectrometer focussing and resolution
- The focal plane detector
- Target Chamber
- Beam transport system
- Beam handling
- Magnet power supplies
- Beam time scheduling

The Magnetic Spectrometer

mounted and commissioned, April 1999 (D. Liesen)

- two quadrupoles and a 14.5° dipole magnet with $B\rho = 10$ Tm ⟶ charge state separation, after collision, for ions with energies up to 560 MeV/u
- Target - FP-Detector distance: ~ 7.6 m
- Dispersion: 8.35 mm/% ⟶ the distance between two charge states of ions (H- and He-like) on the detector:

  Δx ~ 9 mm Uranium and

  Δx ~ 10 mm for Pb

- \`Second generation\` lifting system is working (D. Liesen, D. Schardt)

The Focal Plane Detector

Requirements: to separate different charge states for

- medium and heavy ions
- energies: 3 to 500 MeV/u
- located at few mm apart
- peak width: ~3 mm
- high count rate: 10^8 ion
- good time resolution (few ns)
- active area: ~ 30 cm^2

The Focal Plane Detector

Position sensitive Diamond Detector

(E. Berdermann, H. Stelzer, Detector Lab. , GSI)

- **1-dim. position sensitive**
- **active area: 60 x 40 mm^2**
- **thickness: d_D = 200 µm**
- **substrate side: 32 strips, 1.8 mm**
- **growth side: grounded**
- **strip capacity: C_D = 16.3 pF**
- **very fast signals: t_r < 500 ps, Dt ~ 2 ns**
- **time resolution. ~ 30 ps**
- **high count rate : 10^8 Hz**
- **exceptionally good radiation hardness: >10^{10} Hz/cm^2 for 1 GeV/u ^{238}U and 5.9 MeV/u ^{12}C, the upper limit not yet reached!)**

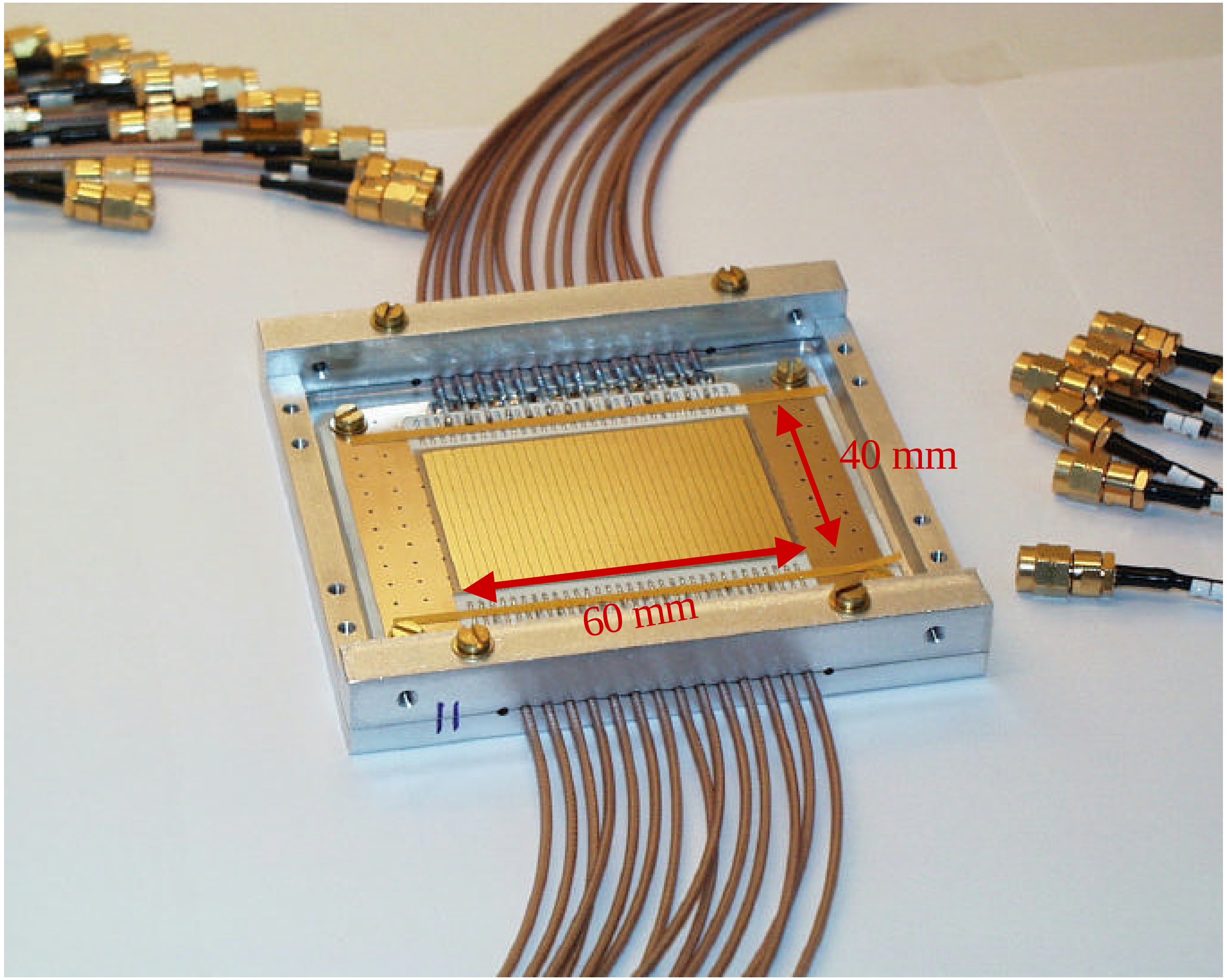
Position sensitive MCP-Detector with delay-line read-out

(IKF-Frankfurt and

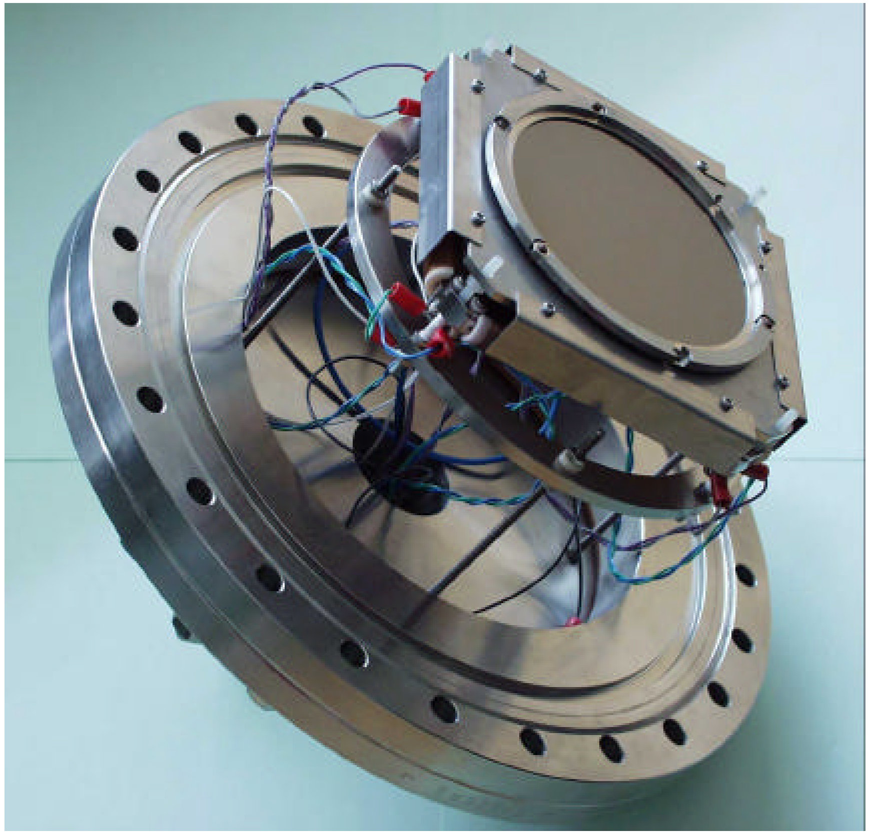
Roentdek GmbH, Kelkheim)

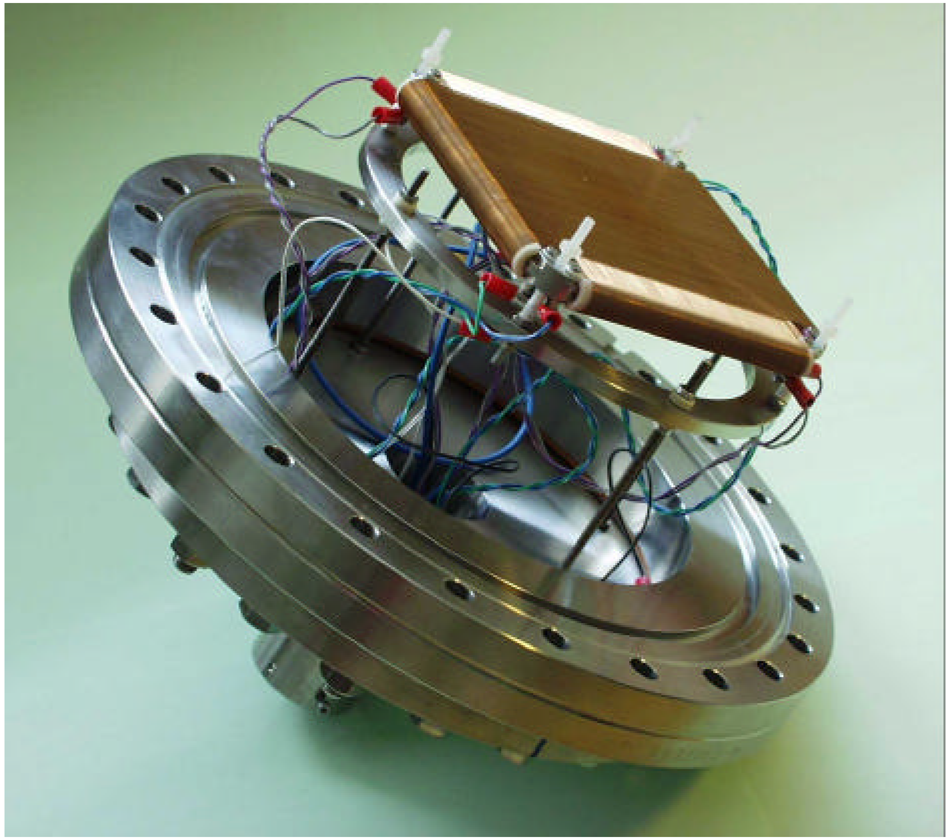
- 2-dim position sensitive: $\Delta x/x < 0.2$ mm
- active area: 60 cm^2
- fast signals: $t_r \sim 2$ ns
- good time resolution: $\Delta t \sim 500$ ps
- multi-hit capability
- count rate ~10^6 Hz
- fluence: ~ 5 x 10^6 Hz/cm^2

The CVD-Diamond Detector



MCP80-DL Detector





In – Cave improvements

Stepper motors controlling:

- a new system, based on a MOVTEC Power-Drives and LabVIEW software was realised (D. Beck, K. Poppensieker, D.Liesen, GSI)

- only 6 units working: system extension is compulsory for the success of the planed experiments (Channeling)

Beam diagnosis:

- a luminescent screen coupled to a video camera

- a frame grabber + software → digitalisation of the beam image

Off – Cave improvements

Beam handling and transport:

- a second slit pair in the SIS-transport line was mounted

- a complete diagnosis system in the ESR-Cave A-transport line was installed and is working

New **magnet power supplies** are installed: Cave A can run independently; only operation in Cave B remain exclusive to experiments in Cave A

Work in progress.....

Improvement of the beam diagnosis in Cave A:

- 10 slit pairs
- beam monitoring
- beam shutter for the direct beam in front of the MCP-Detector

A versatile new **Target Chamber** foreseen with

  - a goniometer
  - an oven as source for C^{60}

Extension of the **associated electronics for the D-Detector** which will permit the full use of its integral active area

Statistics

Year	**Exp. Nr.**	**Short title**	**Spoksperson**
1991/2		X-Ray Spectroscopy	D. Liesen, H.Berg
1993		Electron emission in Heavy Ion Collisions	K. Stiebing (Frankfurt)
1994	S225	Lifetime measurements in He-like Au^{77+}	R. Marrus (USA)
1995	E027	Channeling	D. Dauvergne (France)
1996		Recoil Ion Momentum Spectroscopy	J. Ullrich, R. Moshammer
1997	E026	2E1-Decay in He-like systems	P. Mokler
1998		Upgrading	D. Liesen
1999	E042	Multi-Electron capture from thin C-foils	H.Bräuning
2000	S225	Lifetime measurements in He-like Au^{77+}	R. Marrus (USA)
2001	E027, S225 E042, E043,	Channeling, Lifetime measurements in He-like ions, Multi-Electron capture from thin C-foils	