**New Generation Mirror Systems for the ESRF Upgrade Beamlines**

R. Baker¹, R. Barrett¹, C. Clavel¹, Y. Dabin¹, L. Eybert-Berard¹, T. Mairs¹, P. Marion¹, M. Mattenet¹, L. Zhang¹, D. Baboulina, J. Guillemin², O. Lapierre³, Th. Roux³, B. Hromadka³

¹ European Synchrotron Radiation Facility, 6 rue Jules Horowitz, F-38043 Grenoble cedex, France
² SPRETEC, 19 rue des ciments, F-38180 Seyssins
³ Symétrie, 10 Allée Ch. Babbage, F-30035 Nîmes

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**Mirror support & ex vacu displacements**

The base granite is bonded to the floor for maximum stiffness. A manual pre-alignment stage provides height and level adjustment of the system. Four motorised degrees of freedom are then available for fine positioning.

**New generation Hexapods**

A new hexapod, developed with Symétrie (³), will be used in cases where more than 3 precise motorized degrees of freedom are required to position optics.

**UHV fine tune incidence 8Z**

- Generic design
- Low profile
- UHV compatible
- Theoretical angular resolution: 10 μrad

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**TZ Mover**

- Up to 50mm vertical travel
- 150kg load capacity
- Generic design adapted to all ESRF upgrade mirror systems
- Double preloaded crossed roller bearing guides
- Ball-screw or satellite roller screw drive options
- Integrated linear encoder
- High stiffness over constrained concept
- High thermal stability, optional thermal shield

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**Cooling, Thermalisation & material choice**

Material choice for optimal thermal stability

\[ \alpha = \text{Coefficient of thermal expansion} \]

\[ \rho = \text{Material density} \]

\[ C_p = \text{Specific heat} \]

\[ k = \text{Thermal conductivity} \]

Material choice for optimal thermal stability

- **Material**
  - SiC: 0.16
  - Si: 0.2
  - Copper: 0.35
  - Aluminum: 1.9
  - Brass: 5.3
  - Mild steel: 21.5
  - Invar: 50.7
  - Compliant (*): 220
  - Stainless Steel: 305
  - Sk St: 704
  - Granite: 1421

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