



AO simulations at ESO

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What is going on ?

- Use a cluster of PCs (currently 6 PCs)
- Write optimized parallel software in C/C++
- Analytic simulation:
 - Covariance code, written by R. Conan
→ Get Strehl, (PSF), effects of L0
- Numerical simulation
 - Monte Carlo
→ Get PSF, more detailed than above (e.g. segmentation, spot elongation, ...)



Analytical simulation

- Serial version completed
 - R. Conan ported his Matlab code to C++
→ **C++ AO/API**
 - Use KL polynomials instead of Zernikes
 - Preliminary tests : Sr for MAD: ok...
- Paralellized version 80% completed
 - KL Generation done (famous mode
100 000 (serial) → 150 000(//))
 - All necessary (covariance)-matrices calculated an stored
in //
 - To be done: distributed matrix operations using Scalapack
 - Should be finished by the end of the year



Numerical simulation

- Paralellized / C version of existing IDL code
- Closed loop ! 99% of full code written.
- Works ok NGS, slight but with MCAO
- 64m telescope with single NGS AO: fits easily on "test" cluster...
- What is // ?:
 - 1 Phase screen and/or DM / machine
 - Distributed command matrix (and all matrix operations)
 - Command matrix generation (push-pull matrix, etc...)
 - Parallel SH-WFS module (FFTs done in //)
 - Parallel PSF calculation ($\neq \lambda$, position,...)



PC Cluster evolution

- Test possible HW configurations before buying the "right" one, with PCs on loan.
- Upgraded the 5 PCs from 1.7 to 2.53 GHz
- Still 1 Gbyte of RAM
- Upgraded to Gbit/s Ethernet (was 100 MBit/s)
- Tests of Switch requirements (backplane speed)
- Test achieved bandwidth / latency with integrated network cards...
- Final purchase of 20+20 PCs **at the end of this year**



The new cluster





What's next ?

- **Debugging + validation** on 8m telescope
- Final cluster purchase + testing
- Optimization of both software
- P-WFS + LO to be implemented in numerical code (\Leftrightarrow Ch. Verinaud)
- LGS spot elongation simulation upgrade
- **Simulate 30-50-100m ELTs !**
- Tests on sparse matrix with B. Ellerbroek (on cluster, // Cholesky fact.)