Gemini Laser Program Status

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Outline

- How the Gemini Laser Program came to be
- Gemini North
  - Altair LGS Science Use
  - Modus Operandi
  - Remaining Issues
- Gemini South
  - GSK Laser Contract Status
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How the Gemini Laser Program came to be…

- 1999
  - Altair NGS/LGS CDR (My first day as a Gemini Employee!)
    - Altair LGS will require a 14W laser
  - First GN Laser RFP --> no award
- 2000
  - Gemini risk reduction contracts (CTI, UChicago/LiteCycles, SOR)
  - MCAO Project Start
    - MCAO will require a 50W laser
  - Gemini/Keck/CfAO/AFRL joint proposal to NSF (#0100845)
- 2001
  - Second GN Laser RFP --> contract awarded to CTI
- 2002
  - GN Laser contract start

How the Gemini Laser Program came to be…

- 2003
  - NSF verbal approval of proposal #0100845
  - Long-term laser R&D RFP for NSF program #0100845 --> 3 awards (UoAdelaide, CTI, LLNL)
- 2004
  - Laser R&D work starts at UoAdelaide, CTI, LLNL
  - GS Laser RFP --> no award
  - 50W AFRL laser demonstrated on the sky
- 2005
  - GN laser installed on MK --> First light
  - Attempt to enable duplication of 50W AFRL laser fails
  - CTI white paper to build 50W GS laser + 14W KI laser
  - GSK Laser contract start (50W GS laser + 20W KI laser)

How the Gemini Laser Program came to be…

- 2006
  - CTI/LMCT laser R&D complete
  - UoAdelaide laser R&D complete
- 2007
  - GS laser delivery planned in August
  - KI laser delivery planned in September
- 2008
  - GS laser first light planned in February
  - Planned completion of LLNL fiber laser R&D activities

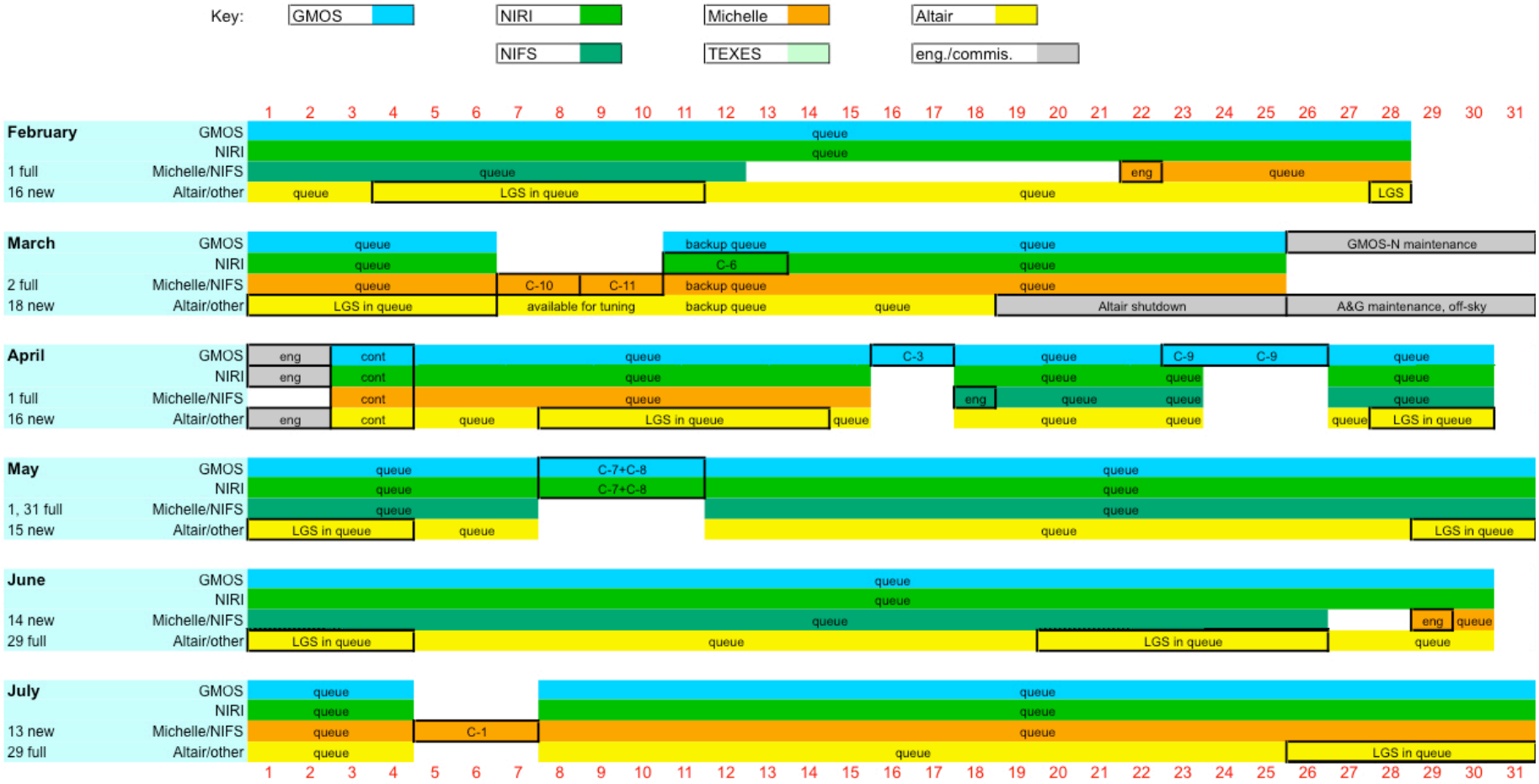
GN LGS AO commissioning complete!

- Laser first light in May 2005
- GN LGSF technical commissioning completed in March 2006 (after LLT refurbished)
- Altair LGS science commissioning completed in Feb 2007

Altair LGS Science Runs

Gemini North Semester 2007A

The semester calendar shows multi-instrument queue nights, scheduled classical runs and engineering or commissioning blocks. Instruments potentially usable on queue nights are indicated by the colored-horizontal bands (see color key below). Note: Rapid ToO PIs should always check the "what's available now" pages that are linked from the contents list for the most up-to-date information. Scheduled classical runs are indicated in the instrument's row by the last characters of the GN-2007A-… program ID number.
Engineering or commissioning that involves one or more instruments is shown in the relevant instrument row(s). New and full moon dates are shown.



Last updated 6-Mar-2007

GN LGSF Modus Operandi

- NIRI/NIFS + Altair LGS in queue mode during runs of up to 10 consecutive nights
  - LGSF ready at all times
    - Late afternoon laser start up + BTO alignment
    - 1 laser operator to monitor/operate laser throughout the night + 5 spotters on standby at summit
  - Laser propagation whenever LGS queue includes observable target, within limits set by weather, aircraft surveillance, satellite avoidance, and beam collisions
  - Switch to other instrument if weather or technical problems prevent propagation

GN LGSF remaining issues

- Staffing
  - The GN laser tech and AO instrumentation engineer currently share the burden of night time laser operation
    - Must improve laser reliability to lessen monitoring requirements
    - Plan to bring 1 or 2 more people on board
  - Spotter logistics are heavy and cost is high!
    - ASCAM project to be completed this year
    - FAA approval will be required to get rid of spotters

GN LGSF remaining issues

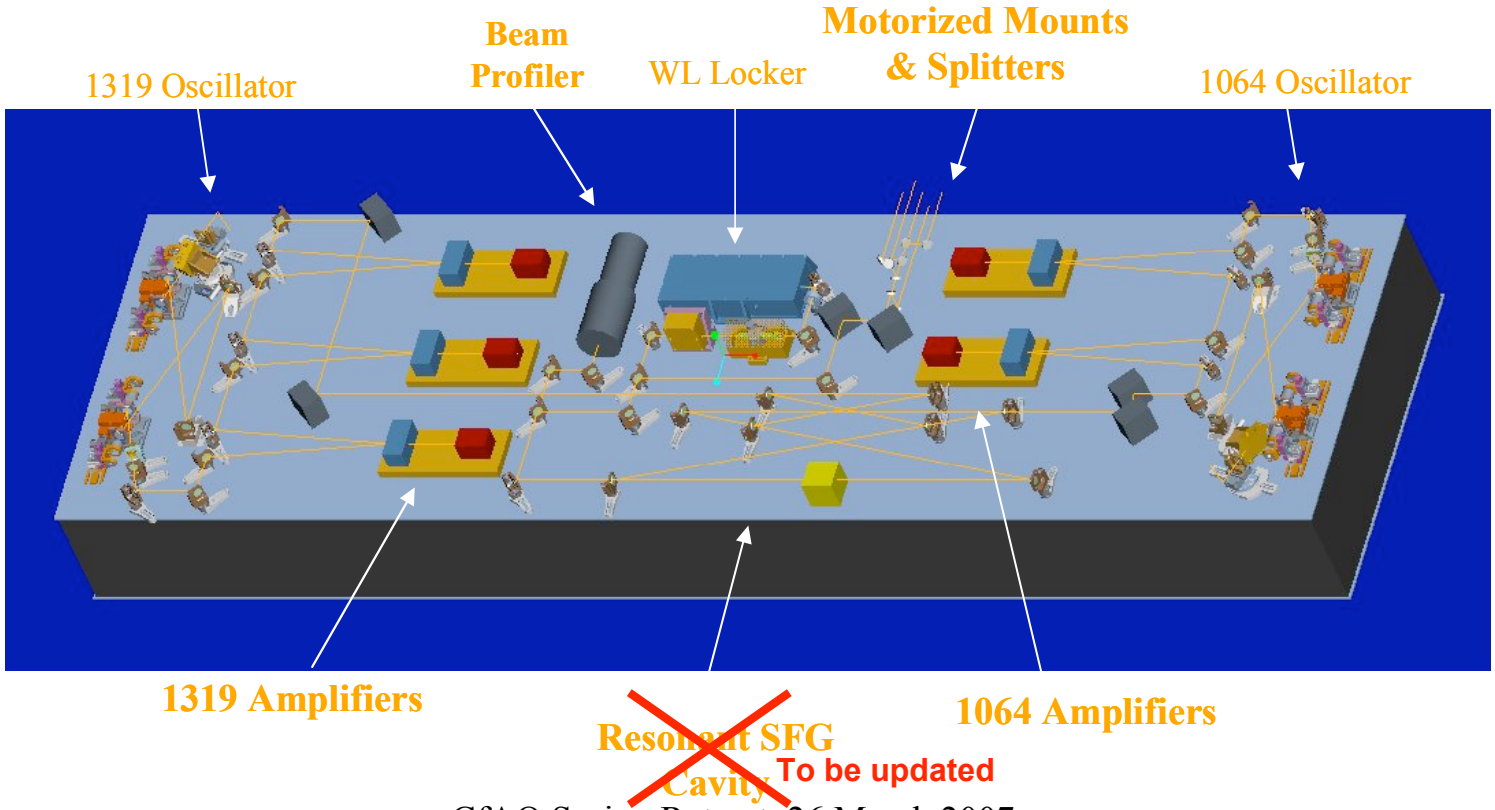
- GN laser
  - Major issues (could impede Altair LGS operation) being actively addressed
    - Diode average lifetime <2,000h (spec'd for 10,000h!) --> hot spare program
    - WL lock unreliable --> in-house effort + LMCT support
    - PXI heartbeat fault --> LMCT service contract
  - Minor issues (not show-stoppers but make weight of laser operation heavier on staff)
    - Long list of to-do items
    - Goal is to make laser operation fully reliable and less support-intensive by June 2007

GSK laser contract

- GEM00417 (CTI/LMCT)
  - AURA/CARA memorandum of understanding
    - 1 contract manager (AURA) + 2 technical representatives (Gemini + WMKO)
  - Combined design and fab contract brings financial and technical leverage
    - $3.7M GS laser (Gemini budget) + $2.9M KI laser (NSF grant #0100845)
    - GN laser was $2.9M
- Requirements
  - GS: 50W laser w/ five 10W-beam output
  - KI: 20W laser
  - Mounted on Nasmyth platform
  - Other performance, functional, operational requirements are similar to the GN laser requirements, but includes lessons-learned from GN and KII lasers

GSK laser contract

- 1064nm + 1319nm sum-frequency laser design
  - Same oscillators as GN laser
  - LMCT-proprietary WG technology for amplifiers
  - Single-pass in LBO for SFG



GSK laser contract

- Milestones
  - Start date: September 27, 2005 (just a few days before CTI became LMCT)
  - PDR: February 2006
  - SHG/SFG risk reduction progress review: May 2006
  - Partial CDR: February 2007
  - Planned delivery: August (GS) and September (KI) 2007
- Meanwhile the GS LGSF I&T is progressing!

Laser R&D results

GEM00369	**Laser Research and Development**
Contractor	University of Adelaide, Australia
Contract cost	**$132,000** (fully paid)
Principal Investigator	Professor Jesper Munch (University of Adelaide)
AURA contract manager	Andy Flach
AURA technical representative	Céline d'Orgeville
Start date	October 1, 2004
Technical highlights	- Injection mode-locked 1064nm laser built and actual performance demonstrated per statement of work by end of 2006 - Work on high power version of the injection-locked 1064nm laser initiated
Planned completion	Late 2007
Related publications	Optics Express, March 2007 [1]

[1] "Injection mode-locked guide star laser concept and design verification experiments"
Optics Express, Vol. 15, Iss. 5, March 2007, pp. 2369-2374
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Laser R&D results

GEM00370	**Property Loan Agreement**
Contractor	Lawrence Livermore National Laboratory
Loan item cost	**$67,890** (fully paid)
Principal Investigator	Dr Deanna Pennington (LLNL)
AURA contract manager	Andy Flach
AURA technical representative	Céline d'Orgeville
Loan start date	July 26, 2004
Technical highlights	- 2.7W demonstrated in continuous wave operation at 589nm by sum-frequency mixing in PPKTP - 3.8W demonstrated in pulsed operation (1microsecond pulse, 10% duty-cycle) at 589nm by sum-frequency mixing in PPSLT (2006)
Planned completion date	End of 2008
Related publications	Proceedings of SPIE Vol. 6102, 2006 [2]

[2] "Multi-watt 589nm fiber laser source", Fiber Laser III: Technology, Systems, and Applications, edited by A. J. W. Brown, J. Nilsson, D. J. Harter, A. Tünnermann, Proceedings of SPIE Vol. 6102, 6102F, (2006)
J. W. Dawson, A. D. Drobshoff, R. J. Beach, M. J. Messerly, S. A. Payne, A. Brown. D. M. Pennington, D. J. Bamford*, S. J. Sharpe*, and D. J. Cooke*
National Ignition Facility, Livermore National Laboratory, 7000 East Avenue, Livermore, CA
*Physical Sciences Incorporated, 2110 Omega Road Suite D, San Ramon, CA

Laser R&D results

GEM00371	**Laser Research and Development**
Contractor	Lockheed Martin Coherent Technologies
Contract cost	**$199,698** (fully paid)
Principal investigator	Allen Tracy (LMCT)
AURA contract manager	Andy Flach
AURA technical representative	Céline d'Orgeville
Start date	September 22, 2004
Technical highlights	- SHG (532nm) testing of PPSLT, PPKTP, PPRTA, MgO:PPLNL and MgO:PPSLT from various suppliers - SFG (589nm) testing of PPSLT and PPRTP from various suppliers - Recommend to pursue R&D on PPSLT as the leading material for single-pass SFG at 589nm
Completion date	February 1, 2006
Related publications	Optics Letters (submitted, not published yet)