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Concept of a modular / multi-laser / multi-purpose SLR station

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Present limitations in Graz SLR …

- Graz tracks about 150 targets now (ILRS, all GNSS, Space Debris, specials…)
- Pass switching / scheduling etc. are already well optimized …
- Light curves for many targets taken in parallel / simultaneously …
- Additional time (> 1 hour…) needed when switching to debris ranging ….
- Special GNSS experiments need ***continuous*** tracking of > 3 hours …
- In good weather: Our laser(s) fire almost continuously ….

Conclusion:

- The list of targets and tasks is large, and will not decrease in future ☺;
- However: Not much space left in Graz for additional tasks ☹

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Solution: A simple, modular concept …

We intend to establish a ***second*** SLR station in Graz, applying a simple, modular concept;

we have applied for the money, decision: End of 2016 … let‘s hope…

Using our experience with SP-DART (e.g. Sandl…), we plan:

- Use of a standard astronomy telescope (e.g. 80 cm dia), <2“ ptg. acc.
- Avoid any Coudé Path; instead: Mount multiple lasers ***on telescope***:
  - For GNSS targets: e.g. SP-DART: 15 µJ / 2 kHz / 1 ns
  - For millimeter / kHz SLR to cooperative targets: e.g. 300 µJ / 1 kHz /10 ps
  - For Space Debris ranging: e.g. 100 Hz / 200 mJ / few ns
  - Attitude Motion Monitoring: Single-Photon Light Curve Detector
- Add a detector box with several detectors, CCDs etc. also on this telescope
  Remember: NO COUDE PATH AT ALL ☺

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The FLOAT (©: Michael Steindorfer) Concept:
Fix Lasers On Astronomy Telescope

- Use an astronomy Telescope:
  - e.g. 80 - 100 cm diameter
  - < 2“ tracking accuracy
- Mount one (or more) lasers: e.g
  - SP-DART: 15 µJ / 2 kHz for GNSS…
  - 10 ps / 1 kHz / 300 µJ: for mm SLR
  - 20 W / 1064 nm / or 532 nm / ≈ ns / 100 Hz: Space Debris…
  - Or any other laser ….
- **All lasers are *tilt resistant* ..**
- Remote Control via Internet…
- Flexible SLR system:
  For LEOs, HEOs, up to GEOs, including space debris

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Example Laser Sources for FLOAT

Example: SP-DART Graz:
2 kHz, 15 µJ, 1 ns, 532 nm

Example: DPSS ps laser: 15 kg, 32 x 46 x 16 cm
Up to 1 kHz, 400 µJ, 7 ps, 532 nm

Example: Space Debris Laser:
200 Hz, 250 mJ, < 10 ns, 1064 nm
(200 Hz, 125 mJ, < 10 ns, 532 nm)

⇒ Lasers: Continuous improvements expected in next few years;
⇒ For Graz: Lasers therefore will be ordered towards end of project

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The FLOAT Concept …
Fix Lasers On Astronomy Telescope

- Such astronomy telescopes can carry rather heavy loads;
- This allows to mount several lasers in parallel;
- Such telescopes are able for arc-sec tracking accuracy (Sandl…)
- Such telescopes allow ranging with 15 µJ up to GEO satellites
- This concept allows a random mix of various wavelenghts
- The concept allows a random mix of laser repetition rates
- The concept allows also a significant cost reduction

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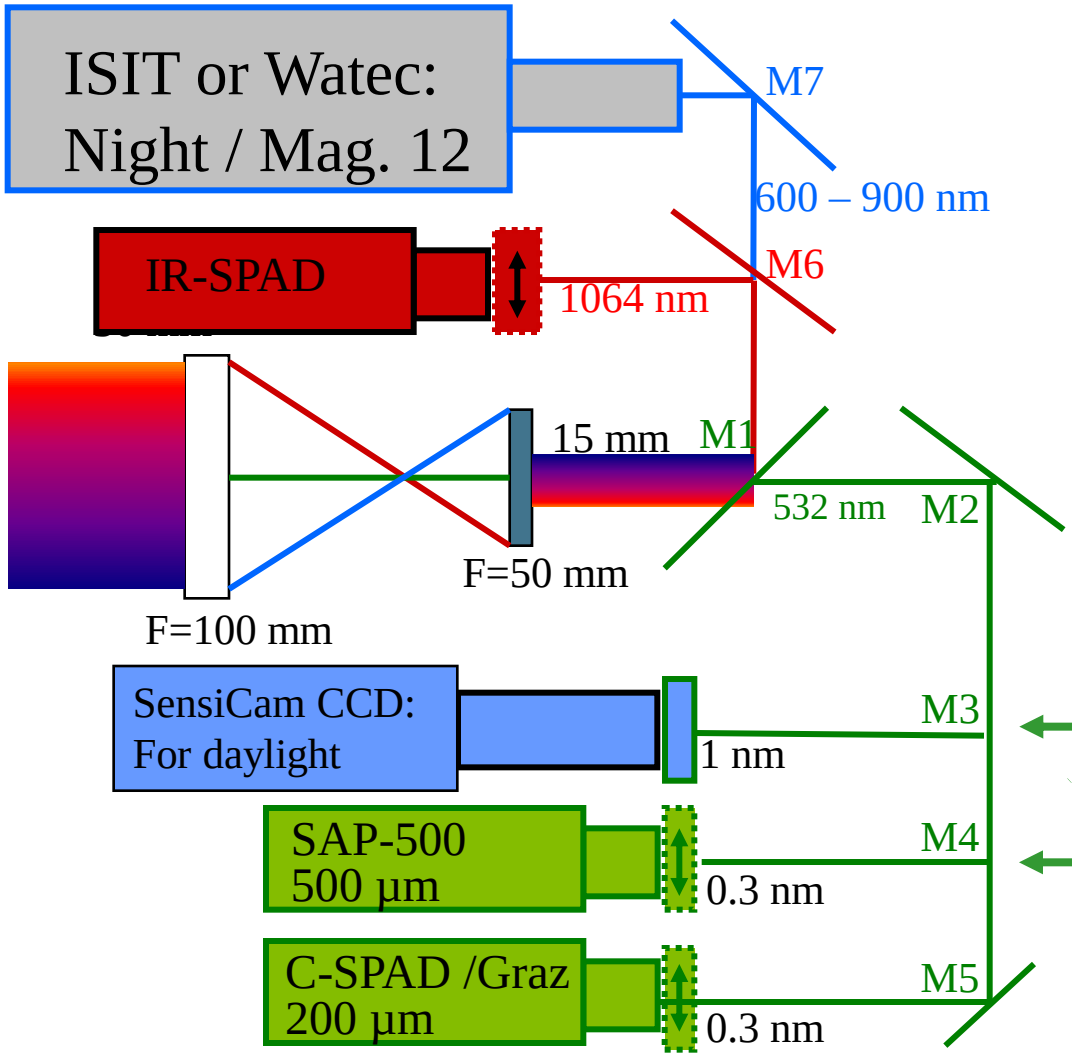
FLOAT: Needs an extended detection package => e.g. Graz Multi-Purpose Det-Pack



- Several SPADs:
  - C-SPAD: mm SLR
  - SAP-500: Space Debris
  - PGA-200-1064
- Several Cameras
  - ISIT / Night
  - SensiCam: Day
- Filters & Mirrors:
  - Remote Control (Remove)
  - Automatic Settings
- Operational since 2015

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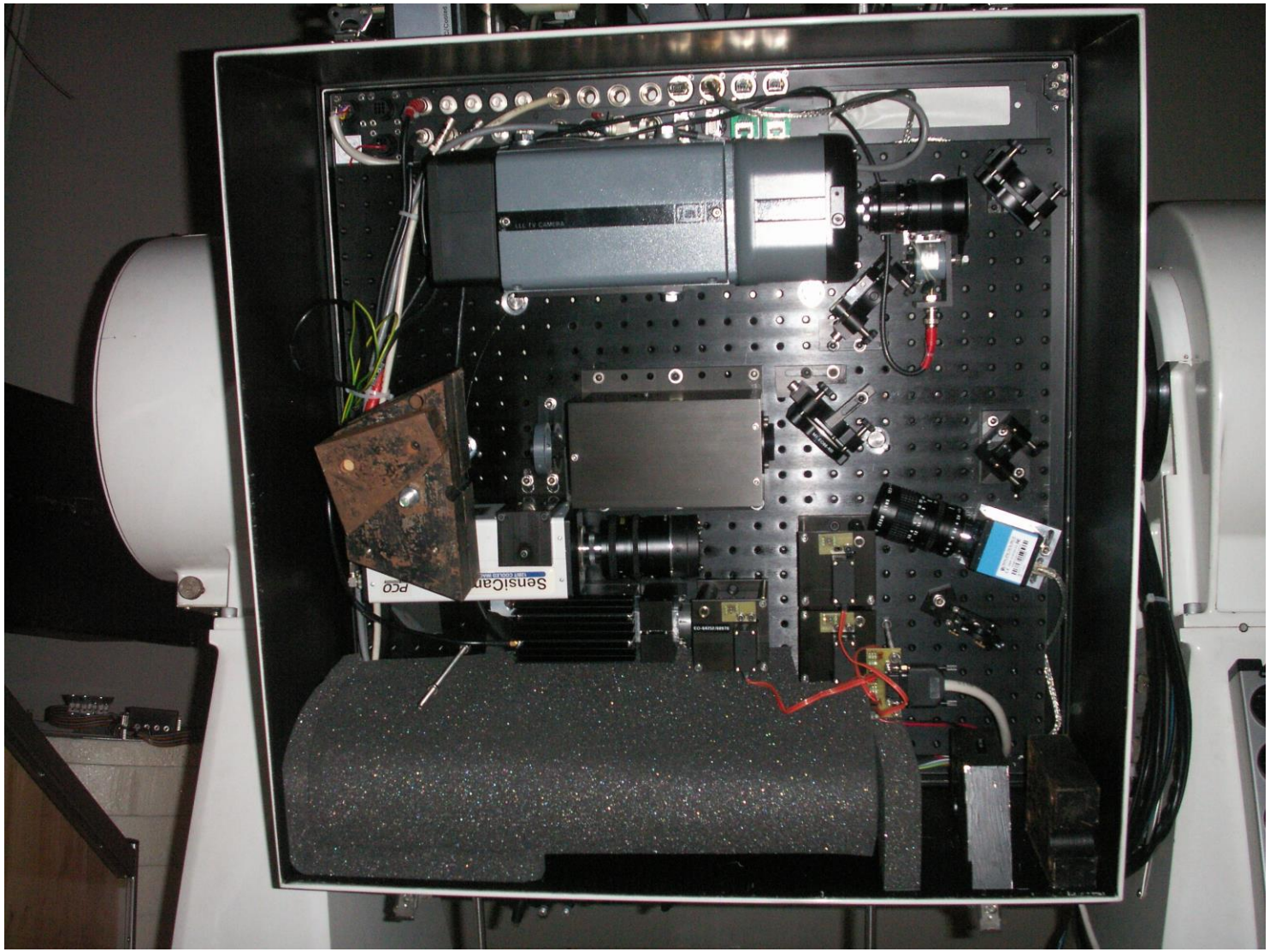
Graz: Multi-Purpose SLR Detection Package…



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Graz: Multi-Purpose SLR Detection Package…

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The box is closed, temperature controlled…

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Conclusion & Summary

The concept is very versatile:

- It allows SLR for a random mix of wavelengths and repetition rates;
- It covers all present SLR activities (mm SLR / debris / LC)
- It is open for easy add-ons, future extensions and upgrades …
- It allows for easy automatics / switching between tasks etc…
- It offers significant cost reductions ☺
- If you already HAVE a good telescope, but you are handicapped by rotating mirrors, long Coudé paths etc. – *but you want kHz:*
  => just mount a kHz laser box on your telescope …

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Thank you for your attention !