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### **Ranging the GNSS Constellation**

Laser ranging is an indispensable independent tool for validating the precise orbits determined for GPS satellites using microwave pseudorange observations since decades. SLR allowed it to identify orbit modeling issues. Including albedo radiation pressure and antenna thrust, among others, into the GPS orbit model allowed it to basically eliminate the observed SLR bias. For the first Galileo satellites SLR residuals indicated severe orbit modeling issues. Other than the rather cubic-shaped GPS satellites the Galileo satellites have an elongated shape, a fact which needs to be considered in the orbit model. In future all GNSS satellites will be equipped with Laser retro reflectors, a big challenge for the ILRS concerning tracking scenarios and observation planning. Eventually observations from co-located SLR and GNSS sensors will be routinely used for joint precise orbit determination by ILRS and IGS for GNSS.