

# How to generate S1 Burst IDs

Oliver Cartus, Urs Wegmüller, Christophe Magnard, Charles Werner,  
Gamma Remote Sensing AG

Version 5-Jan-2021

## 1. INTRODUCTION

In this document a unique burst ID (or burst number) for Sentinel-1 (S1) data acquired in the Interferometric Wide Swath (IWS) mode is defined. This S1 burst ID can be determined from the S1 data and meta-data. Corresponding bursts of repeat-pass observations have identical burst IDs.

## 2. HOW TO GENERATE S1 BURST IDS

The Sentinel-1 SLC TOPS\_par file, generated by par\_S1\_SLC when importing S1 IW or EW SLCs, assigns a unique Burst Number to each burst contained in each of the three (IW) or five (EW) sub-swaths. The Burst Number reported in the TOPS\_par parameter *burst\_asc\_node* is derived from *asc\_node\_delta*, i.e., the time passed since the beginning of the ascending node. *burst\_asc\_node* is a decimal number (e.g., 224.16) which increases in steps of 1 for consecutive bursts of the same sub-swath. The decimal fraction (e.g., .16) is quasi constant (variations are typically within a range of +/- 0.02) for multi-temporal observations from the same relative orbit/sub-swath but varies across sub-swaths and relative orbits.

For the sake of simplicity, users may prefer to identify bursts with a unique integer type-of Burst ID. Simply rounding the TOPS\_par burst parameter *burst\_asc\_node* to the next integer number is not a robust method though because of the slight variations of the Burst Number across a multi-temporal stack of observations, for instance between 244.49 and 244.51 or between 243.99 and 244.01.

As a robust alternative, it is proposed to generate the (integer) Burst ID for a given relative orbit and sub-swath by subtracting from the Burst Number a previously defined decimal burst number fraction and rounding then to the next integer number. An analysis of S1 SLCs from each of the 175 relative orbits showed that the decimal fraction can be predicted when knowing the relative orbit (also called path number or track number). The relative orbit can be calculated from the orbit number reported, for instance, in the filename of the original SLC zipfile (in red):

**S1A\_IW\_SLC\_\_1SDV\_20200222T135936\_20200222T140003\_031366\_039C2C\_F930.zip**

with:

S1A: relative orbit = ( orbit - 73 ) mod 175 +1

S1B: relative orbit = ( orbit - 202 ) mod 175 +1

Figure 1 illustrates, for the example of sub-swath IW1, the variation of the decimal fraction in the

Burst Numbers as function of the relative orbit (black dots). When unwrapping the decimal fractions (red dots), the variation as function of the relative orbit may simply be described with a linear model (rvalue=0.9999913483331611, pvalue=0.0, stderr=2.28197e-05) so that the decimal fraction for IW1 can be predicted based on the relative orbit with:

$$\text{frac}(\text{Burst Number}) = \text{frac}(0.7514975369458172 + 0.07215506045678455 * \text{rel\_orbit}) \quad (1)$$

For IW2 and IW3, the fraction could be predicted accordingly with:

IW2:

$$\text{frac}(\text{Burst Number}) = \text{frac}(0.05455566502462794 + 0.07213978952082403 * \text{rel\_orbit}) \quad (2)$$

IW3:

$$\text{frac}(\text{Burst Number}) = \text{frac}(0.4456315270935942 + 0.07213795342588447 * \text{rel\_orbit}) \quad (3)$$

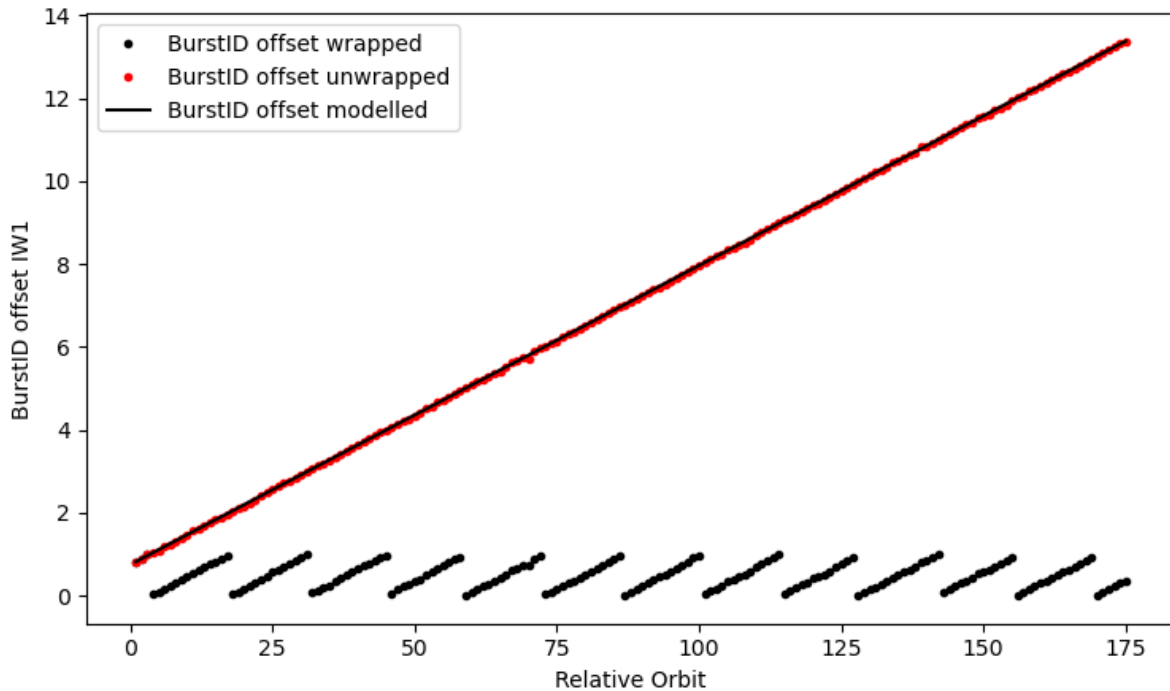


Figure 1. Decimal fraction of Burst Numbers in IW1 as function of the relative orbit (black dots). When unwrapped (red dots), a simple linear model may be used to model the variation of the fractions as function of the relative orbit (black line).

**Suggested approach for generating Burst IDs:**

In order to assign multi-temporally consistent integer type-of Burst IDs, the following approach is recommended:

- 1) calculate the decimal fraction for IW1 based on the relative orbit with Eq. (1); note that the decimal fraction is reported by the ISP program *S1\_path\_number*,
- 2) subtract the decimal fraction from the Burst Numbers in IW1 (*burst\_asc\_node* parameter in the TOPS\_par file),
- 3) round the value to the next integer.

Now for IW2 and IW3 data the value is not independently determined using a similar approach as described for IW1, but it is directly linked to the IW1 ID calculation, so that the IW1 burst with the ID X always precedes the IW2 and IW3 bursts with the same ID X. This is done by simply adding for IW2 0.3 and for IW3 0.7 to the decimal fraction obtained for IW1. So the decimal fractions of IW2 and IW3 can be larger than 1.0.